ENVIRONMENTAL REPORT

FOR THE ROMANIAN ENERGY STRATEGY 2019-2030, WITH PERSPECTIVES FOR 2050

PROVIDER: **KVB CONSULTING & ENGINEERING SRL**

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CONTENTS

I. INTRODUCTION

This paper is the Environmental Report for the Strategic Environmental Assessment of Romanian Energy Strategy for the period 2019-2030 with perspectives for 2050, hereinafter referred to as RES 2019-2030 with perspectives for 2050. This paper was developed by SC KVB Consulting & Engineering SRL, a company registered with the[1] national register of the environmental protection study designers under no. 82 for development of: environmental report (RM), environmental impact report (RIM), environmental review (BM), site report (RA), safety report (RS) and appropriate assessment study (EA).

This Environmental Report (RM) was carried out in accordance with Annex 2 of GD 1076/2004 establishing the procedure for carrying out the environmental assessment for plans and programmes.

The Romanian Energy Strategy for the period 2019-2030 with perspectives for 2050 is promoted by the Ministry of Energy as the owner of the strategy.

The overall objective of the Strategy is the sustainable growth of the energy sector. The eight strategic objectives that structure the entire analysis and planning for the period 2019-2030 for 2050 will also contribute to the fulfilment of the general objective, respecting the national, European and global benchmarks that influence political determinations and decisions in energy field.

Romanian Energy Strategy was developed for the time horizon 2019-2030 with perspectives for 2050, taking into account Romania's international needs and obligations, as well as the optimal scenario for the development of the national energy system for this moment.

The environmental assessment procedure was started at the beginning of 2017, during the course of the procedure, emerging the necessity of updating the Energy Strategy. Thus, a first version was drafted, entitled the "Romanian Energy Strategy 2016-2030 with perspectives for 2050", published on December 19, 2016, and subsequently updated for the period 2019-2030 with perspectives for 2050. This takes into account the recent national and global changes (National Strategic Investment Programme and inclusion in the list of primary energy resources - hydropower, wind and solar energy, energy waste and geothermal energy).

Upon completion of the SEA procedure for RES 2019-2030, with the prospect of 2050, the Environmental Notice will be issued based on the Environmental Report and of the Adequate Assessment Study, which may undergo changes under the aforementioned procedure. If the RES 2019-2030 with prospects for 2050 will be modified, the competent environmental protection authority will be notified, which will decide whether a new SEA procedure will be carried out.

II. According to Order no. 1026/2009 for the preparation of environmental reports, environmental impact reports, environmental reviews, site reports, appropriate assessment studies and safety reports

[1] According to Order no. 1026/2009 for the preparation of environmental reports, environmental impact reports, environmental reviews, site reports, appropriate assessment studies and safety reports

III. METHODOLOGY OF SEA PREPARATION FOR RES 2019-2030, WITH PERSPECTIVES FOR 2050

Strategic environmental assessment is conducted in accordance with the SEA Directive [2] on the assessment of certain plans and programs on the environment and GD 1076/2004 establishing the procedure for carrying out the environmental assessment for plans and programs, which transposes the provisions of the Directive into national legislation.

The following documents should be considered in the environmental assessment procedure:

- Manual on the implementation of the environmental assessment procedure for plans and programs developed by the Ministry of Environment and Water Management and the National Environmental Protection Agency;
- Guide to the application of EIA [3]/SEA [4] /SHE [5] procedures, Beneficiary: Ministry of Environment and Forests, 2010;
- Generic Guide on Environmental Assessment for Plans and Programs, project: Strengthening institutional capacity for implementation and enforcement of the SEA Directive and the Reporting Directive, project: EuropeAid/121491/D/SER/RO, Beneficiary: Ministry of Environment and Sustainable Development, 2007;
- Guide on Environmental Assessment for Energy Development Plans and Programs, Project: Strengthening institutional capacity for implementation and enforcement of the SEA Directive and the Reporting Directive, Beneficiary: Ministry of Environment and Sustainable Development, 2007.

According to GD 1076/2004, art.3, paragraph (2), the SEA procedure involves the following steps:

- Stage of including the plan or program in the environmental assessment procedure;
- The stage of defining the draft plan or program and the execution of the environmental report;
- Stage of environmental report quality analysis.

The elaboration of this Environmental Report required the following steps:

- Environmental status analysis at national level (aspects relevant for RES 2019-2030, with perspectives for 2050) taking into account existing data and information;
- Following the characterization of the current state of the environment, a set of environmental aspects and environmental issues that are relevant for the Strategy;
- For the environmental aspects and environmental issues identified, the relevant Environmental Objectives to which the Strategy has to address are formulated;

[2] European Council's Directive 2001/42/EC
[3] EIA - environmental impact assessment;
[4] SEA - Strategic Environmental Assessment;
[5] EA - Appropriate Assessment;

- An analysis was made of the likely evolution of the state of the environment (of those environmental aspects previously identified) provided that the provisions of the Strategy are not implemented (Alternative 0);
- The environmental impacts generated by the implementation of the RES 2019-2030 with perspectives for 2050 were assessed by reviewing how the Strategy's Objectives and proposed measures contribute to achieving the relevant Environmental Objectives;
- Based on the assessment, a cumulative assessment has been developed that can provide an overview of possible future developments in the state of the environment provided that RES is implemented;
- A list of indicators proposed for the monitoring of the effects of RES on the environment has also been made;
- On the basis of the analysis carried out, a set of recommendations was proposed on the prevention, reduction and compensation of any potential adverse environmental effects associated with the implementation of RES;
- Analysis of alternatives.

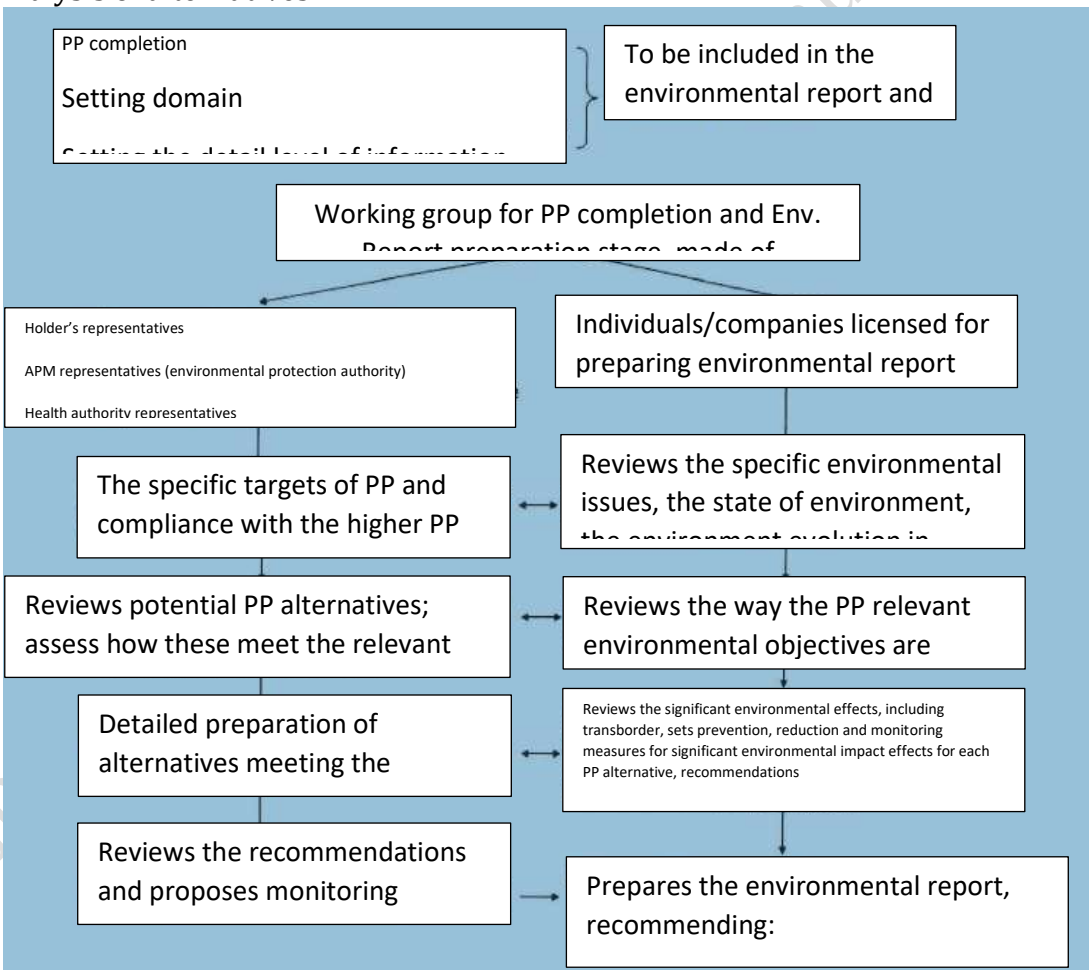

Figure 1 Steps to define and implement the Environmental Report

IV. BRIEF PRESENTATION OF RES 2019-2030 WITH PERSPECTIVES FOR 2050

III.1. INTRODUCTION

The Romanian Energy Strategy for the period 2019-2030 with perspectives for 2050 will be adopted by Government Decision in the version approved by the Ministry of Environment after the environmental assessment procedure. The first version of RES 2016-2030, with perspectives for 2050, was developed in December 2016, with the second version coming in July 2018, and in November 2018 the third version.

The completion of RES 2019-2030, with perspectives for 2050 will be achieved within the SEA Procedure, in working groups with public health authority and other public authorities interested in the effects of this strategy. The SEA procedure started with the submission to the Ministry of Environment of Notification no. 250 224/02.13.2017 [6] and 61460/14.02.2017 [7] , together with the first version of the RES 2016-2030, with perspectives for 2050 and the two calls. In May 2017, the first working group took place and the Ministry of Energy would proceed with the procurement procedure for the elaboration of the Environmental Report. On October 17, 2018, the second working group took place.

RES 2019-2030, with perspectives for 2050, also takes into account the changes that have taken place over the last years at the global and national levels, representing the document prior to the Integrated National Plan for Energy and Climate (PNESC).

This Environmental Report looks at the third version of RES 2019-2030, with perspectives for 2050 developed in November 2018.

III.2. CURRENT FACTS

Currently, at an international level, the energy market is in a transition period, from four points of view: technological, climatic, geopolitical and economic. These developments have an impact on the energy sector both at European and national level. Thus, Romania will have to adapt to these trends in international markets, but also to the geopolitical resettlements that influence strategic partnerships with both security and investment components, as well as trade and technology.

From a technological point of view, there have been a number of transformations: the use of shale hydrocarbon technology, which has led to a reversal of the world hierarchy of oil and natural gas producers; transforming the electricity sector by digitizing intelligent networks with real-time coordination; the use of electricity in transports, estimating that electric cars having a considerable weight until the end of 2030. According to the International Energy Agency (IEA), an increase of up to 30 million electric cars is expected by 2025, and by 2040 the number will increase to 150 million.

From the climatic point of view, it is intended to promote “clean energies” centred on the reduction of GHG emissions. The International Energy Agency has established, in a

[6] Registration number of the Ministry of Energy
[7] Registration number of the Ministry of Environment

document [8] elaborated in November 2016, a list of measures, as follows: introducing a global pollution price (for CO2); creating a global set of indicators of decarbonisation and increasing governments' capacity to implement the energy transition process.

From an economic point of view, there is a trend in lowering the price of natural gas and oil and a growing increase for energy. Thus, the energy sector turns into an unprofitable sector for investors. For the time horizon of 2030-2040, it is expected to replace capacities in nuclear power units for investments that took place between the 1970s and 1980s.

Romania's energy policy is developed within the changes and developments taking place internationally and at European level. Thus, Romania's energy policy must be correlated with similar documents existing at European level to ensure a single direction with the European Union's policy in the field.

RES 2019-2030, with perspectives for 2050, aims at fulfilling the main Objectives of the new energy-environment policy of the European Union, as well as the objectives undertaken by Romania.

III.3. STRUCTURE OF THE ENERGY STRATEGY OF ROMANIA FOR THE PERIOD 2019-2030 WITH PERSPECTIVES FOR 2050

The Romanian Energy Strategy for the period 2019-2030, with perspectives for 2050, is structured in 7 chapters, as follows:

I. The Energy Strategy Vision - sets out the guidelines that Romania will have to follow in order to grow in terms of energy under sustainability conditions;
II. Fundamental strategic objectives - There are eight fundamental Strategic Objectives, which look at the analysis and planning for the period 2019-2030 with perspectives for 2050;
III. Programme of strategic investments of national interest - Presentation of the next 4 major national investments for nuclear energy, thermoelectric power and hydropower;
IV. Current context - presents the perspectives of the energy evolution at international, European and national level, with the presentation of the development directions for the period 2019-2030 with perspectives for 2050;
V. Measures and actions to achieve strategic Objectives - presentation of operational Objectives and priority actions, and correlation of strategic and operational Objectives;
VI. The evolution of national energy sectors by 2030 - presents information on energy consumption by activity categories, exhaustible and renewable energy resources, investments in the energy sector, etc.;
VII. Perspectives of the Romanian energy sector between 2030 and 2050.

III.4. MAIN OBJECTIVES PROPOSED BY THE ENERGY STRATEGY OF ROMANIA FOR THE PERIOD 2019-2030 WITH PERSPECTIVES FOR 2050

The general objective of the Strategy is the sustainable growth of the energy sector. The eight strategic objectives that structure the entire analysis and planning for the period

[8] Energy, climate change and environment report

2019-2030, with perspectives for 2050 will also contribute to the fulfilment of the general objective, respecting the national, European and global benchmarks that also have an impact on the political findings and decisions in the energy field.

RES 2019-2030, with perspectives for 2050, provides for seven general objectives for which 23 strategic objectives (OS) are set:

1. OB1. Clean energy and energy efficiency:

OS.1. Mixed and balanced energy mix:

AP1a: Continue the sustainable exploitation of all the primary energy resources of the country;

AP1b: Maintaining a diversified and flexible fleet of electricity production capacities according to Romania's energy mix;

AP1c: Adopting advanced technologies in the energy sector by attracting private investment by supporting scientific research and developing strategic partnerships;

AP1d: Development of electricity production capacities with low GHG emissions - nuclear, RES, hydropower;

OS. 9. Replacement, in the horizon of 2030, of electricity production capacity that will come out of operation with new, efficient and low-emission capacities:

AP9a: Investments in new electricity generation capacities, under the constraint of achieving the energy security, competitiveness and decarbonisation objectives of the energy sector;

AP9b: Ensuring a technological neutrality framework for the development of the national energy mix;

AP9c: Ensure funding mechanisms for investment in new generation capacities without GHG emissions in economic efficiency conditions;

AP9d: Ensure funding mechanisms for completing hydro-energetic facilities with complex uses (irrigation, flood protection, water supply, etc.).

OS.10. Increasing energy efficiency across the energy value chain:

AP10a: Clearly defining the concept of "energy efficiency" in the sense that it corresponds to rising yields and reducing losses, in conditions of economic growth and consumption;

AP10b: Utilising the potential for energy efficiency in the building sector, through thermal insulation programmes in the public sector, housing blocks and communities affected by energy poverty;

AP10c: Integrated approach to the district heating sector of buildings, with the coordination of investment projects on the value chain - production, transport and efficient consumption of heat;

AP10d: Develop smart metering and smart grids;

AP10e: Implement measures to mitigate network losses and combat theft of energy.

OS.15. Reducing GHG and nitrous oxide emissions in the energy sector:

AP15a: Current activities and projects of energy companies must comply with environmental legislation and apply best international environmental protection practices;

AP15b: Further reduce emissions of pollutants into the air, water and soil, related to the energy sector;

AP15c: Supporting scientific research to decarbonise the energy sector;

AP15d: Promoting alternative fuels;

AP15e: Reducing the volume and safe storage of radioactive waste at the producer (Cernavodă NPP) and correlation with the „National medium and long-term strategory for safe management of used nuclear fuel and radioactive waste".

OS.16. Sustainable development of the national energy sector, with the protection of air, water, soil and biodiversity:

AP16a: Organize information and public debate programmes on major energy projects, taking into account the interests of local communities and national interest.

OS.17. Balanced participation in the collective effort of EU Member States to achieve RES efficiency targets and to reduce GHG emissions:

AP17a: Achievement of Romania's 2020 targets;
AP17b: Equitable participation in achieving the collective targets of the EU Member States for 2030, under the imperatives of guaranteeing energy security and the competitiveness of energy markets;

AP17c: Equal participation in the achievement of the European GHG reduction target of 80% compared to 1990 in 2050, namely to limit the climate change to 1.5-2 °C.

2. <u>OB2 Ensuring access to electricity and heat for all consumers:</u>

OS.5. Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer):

AP5a: Digitization of the national energy system in the transport, distribution and consumption segments;

AP5b: Encouraging prosumers, both domestic and industrial and agricultural, along with the development of networks and smart meters;

AP5c: Integration of distributed production systems and prosumers into the power system.

OS.10. Increasing energy efficiency across the energy value chain:

AP10a: Clearly defining the concept of "energy efficiency" in the sense that it corresponds to rising yields and reducing losses, in conditions of economic growth and consumption;

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AP10d: Develop smart metering and smart grids;

AP10e: Implement measures to mitigate network losses and combat theft of energy.

OS.11. Increased competition in domestic energy markets:

AP11a: Developing the internal gas market by increasing traded volumes and liquidity, and further linking it to the European natural gas market;

AP11b: Integration of Romanian energy markets into the single European energy market, in order to increase the regional role of Romanian stock exchanges in the trading of energy products.

OS.12. The liberalization of energy markets and their regional integration so that the energy consumer benefits from the best energy price:

AP12a: Increasing the transparency and liquidity of energy markets.

OS.19. Transparency of the administrative act, simplification of bureaucracy in the energy sector

AP19a: Reducing bureaucracy through transparency, digitization and introducing the "one-stop-shop";

AP19b: Introducing best practices on transparency and accountability in the interaction between the consumer and the administrative system;

AP19c: Introducing best practices on transparency and accountability in the interaction between the consumer and the administrative system;

AP19d: Elimination of conflicts of interest between public institutions and energy companies with state capital.

OS.22. Increasing people's access to electricity, heat and natural gas:

AP22a: Improving access to alternative energy sources through the development of distribution networks;

AP22b: Developing, from various sources of financing, micro-networks and distributed electricity generation systems, with priority for households without access to electricity;

A22c: Development of public policies at the level of the local administrative units on how to ensure the thermal energy for the communities.

3. <u>OB3 Vulnerable consumer protection and reduction of energy poverty:</u>

OS.5. Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer):

AP5a: Digitization of the national energy system in the transport, distribution and consumption segments;

AP5b: Encouraging prosumers, both domestic and industrial and agricultural, along with the development of networks and smart meters;

AP5c: Integration of distributed production systems and prosumers into the power system.

OS.12. The liberalization of energy markets and their regional integration so that the energy consumer benefits from the best energy price:

AP12a: Increasing the transparency and liquidity of energy markets.

OS.23. Reducing energy poverty and vulnerable consumer protection:

AP23a: Achieving public thermal insulation programs for communities affected by energy poverty to reduce energy losses and lower heating costs;

AP23b: Protection of the vulnerable consumer by adequate social aid, such as heating aids and the social tariff for electricity, and by public service obligations.

4. OB4 Competitive energy markets, the basis of a competitive economy:

OS.1. Mixed and balanced energy mix:

AP1a: Continue the sustainable exploitation of all the primary energy resources of the country;
AP1b: Maintaining a diversified and flexible fleet of electricity production capacities according to Romania's energy mix;
AP1c: Adopting advanced technologies in the energy sector by attracting private investment by supporting scientific research and developing strategic partnerships;
AP1d: Development of electricity production capacities with low GHG emissions - nuclear, RES, hydropower.

OS.5. Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer):

AP5a: Digitization of the national energy system in the transport, distribution and consumption segments;
AP5b: Encouraging prosumers, both domestic and industrial and agricultural, along with the development of networks and smart meters;
AP5c: Integration of distributed production systems and prosumers into the power system.

OS.9 Replacement, in the horizon of 2030, of electricity production capacity that will come out of operation with new, efficient and low-emission capacities:

AP9a: Investing in new generation capacities, under the constraint of achieving the energy security, competitiveness and decarbonisation objectives of the energy sector;
AP9b: Ensuring a technological neutrality framework for the development of the national energy mix;
AP9c: Ensure funding mechanisms for investment in new generation capacities without GHG emissions in economic efficiency conditions;
AP9d: Ensure funding mechanisms for completing hydro-energetic facilities with complex uses (irrigation, flood protection, water supply etc).

OS.10. Increasing energy efficiency across the energy value chain:

AP10a: Clearly defining the concept of "energy efficiency" in the sense that it corresponds to rising yields and reducing losses, in conditions of economic growth and consumption;
AP10b: Utilising the potential for energy efficiency in the building sector, through thermal insulation programmes in the public sector, housing blocks and communities affected by energy poverty;
AP10c: Integrated approach to the district heating sector of buildings, with the coordination of investment projects on the value chain - production, transport and efficient consumption of heat;
AP10d: Develop smart metering and smart grids;
AP10: Implement measures to mitigate network losses and combat theft of energy.

OS.11. Increased competition in domestic energy markets:

AP11a: Developing the internal gas market by increasing traded volumes and liquidity, and further linking it to the European natural gas market;
AP11b: Integration of Romanian energy markets into the single European energy market, in order to increase the regional role of Romanian stock exchanges in the trading of energy products.

OS.12. The liberalization of energy markets and their regional integration so that the energy consumer benefits from the best energy price:

AP12a: Increasing the transparency and liquidity of energy markets.

OS.13. Efficiency of the economic activities of energy companies with state capital:

AP13a: Improving the management of state-owned energy companies to increase their value in the medium and long term, without political or social considerations;
AP13b: Elimination of losses in state-owned energy companies;
AP13c: Economic optimization of asset portfolios and investment projects of state-owned energy companies.

OS.14. Economic and fiscal policies to stimulate investment in the development of RES equipment manufacturing industry, energy efficiency and electromobility:

AP14a: Capitalize national primary energy resources as much as possible in the domestic economy in order to generate an economic multiplier effect;
AP14b: Supporting scientific research and investments in the production of equipment and components for energy transition - SRE, energy efficiency and electromobility technologies.

OS.19. Transparency of the administrative act, simplification of bureaucracy in the energy sector

AP19a: Reducing bureaucracy through transparency, digitization and introducing the "one-stop-shop";
AP19b: Introducing best practices on transparency and accountability in the interaction between the consumer and the administrative system;
AP19c: Development of institutional mechanisms (such as integrity alerts); the publication of regular reports on public procurement and all sponsorship;

AP19d: Elimination of conflicts of interest between public institutions and energy companies with state capital.

5. OB5 Modernization of the energy governance system:

OS. 13. Efficiency of the economic activities of energy companies with state capital:

AP13a: Improving the management of state-owned energy companies to increase their value in the medium and long term, without political or social considerations;

AP13b: Elimination of losses in state-owned energy companies;

AP13c: Economic optimization of asset portfolios and investment projects of state-owned energy companies.

OS. 18. Separation of the status of owner and shareholder status from that of the energy market arbitrator:

AP18a: Institutional separation of the state's activity as legislator, regulator and policymaker, on the one hand, therefore, from that of holder and asset manager, on the other.

OS. 21. Improving corporate governance of state-owned companies:

AP21a: Implement the rules on corporate governance of state-owned companies and introduce mechanisms to monitor the managerial performance of these companies;

AP21b: Ensure the professionalism and transparency of the selection process of the management team with a detailed publication of the selection criteria and the interim and final results.

6. OB6 Increasing the quality of education in the field of energy and continuous training of the human resources:

OS.1. Diverse and balanced energy mix:

AP1a: Continuing the sustainable exploitation of all types of primary energy resources of the country;

AP1b: Maintaining a diverse and flexible park of the electricity production capacities according to Romania's energy mix;

AP1c: Adopting advanced technologies in the energy sector, by attracting private investments, by supporting scientific research and by developing strategic partnerships;

AP1d: Developing electricity production capacities with low GHG emissions – nuclear, SRE, hydroenergy.

OS.8. Developing Romania's strategic partnerships in the field of energy:

AP8a: Attracting the investments of leading energy companies in the field of energy from Romania;
AP8b: eveloping cooperation in the field of scientific research and know-how transfer;

AP8c: Cooperating with the authorities of the partner states for increasing the security of the infrastructure.

OS.14. Economic and fiscal policies to stimulate investment in the development of RES equipment manufacturing industry, energy efficiency and electromobility:

AP14a: *Economic and fiscal policies to stimulate investment in the development of RES equipment manufacturing industry, energy efficiency and electromobility*;
AP14b: Supporting scientific research and investments in the production of equipment and components for energy transition - SRE, energy efficiency and electromobility technologies.

OS.15. Reducing GHG and nitrous oxide emissions in the energy sector:

AP15a: Current activities and projects of energy companies must comply with environmental legislation and apply best international environmental protection practices;
AP15b: Further reduce emissions of pollutants into the air, water and soil, related to the energy sector;
AP15c: Supporting scientific research to decarbonise the energy sector.
AP15d: Promoting alternative fuels;
AP15e: Reducing the volume and safe storage of radioactive waste at the producer (Cernavodă NPP) and correlation with the „Medium and long-term national strategy for safe management of used nuclear fuel and radioactive waste".

OS.20. Supporting education and promoting scientific research; security and health at work:

AP20a: Developing higher education in the field of energy and harmonizing it with the needs of the energy sector. Partnerships with the energy industry for education and professional training;
AP20b: Supporting professional secondary education in the field of energy;
AP20c: Supporting scientific research, technological development and innovation in the field of energy; development of partnerships with the energy industry and with university centres;
AP20d: Developing the capacity to attract European and international financing sources for scientific research, by participating in international consortiums of research-development-innovation institutes;
AP20e: Continuous training programs for specialists from administration within the energy sector;
AP20f: Continuous training to prevent professional risks, protection of the health and security of workers, removing risk and accident factors.

7. <u>OB7 Romania, regional energy security provider:</u>

OS.1. Mixed and balanced energy mix:

AP1a: Continue the sustainable exploitation of all the primary energy resources of the country;
AP1b: Maintaining a diversified and flexible fleet of electricity production capacities according to Romania's energy mix;

AP1c: Adopting advanced technologies in the energy sector by attracting private investment by supporting scientific research and developing strategic partnerships;
AP1d: Development of electricity production capacities with low GHG emissions - nuclear, RES, hydropower.

OS.2. Capitalizing on new primary resource deposits to maintain a low level of energy dependence and safe operation of SEN (translation note = national energy system):

AP2a: A stimulating investment environment for the exploration and development of oil, natural gas and lignite deposits, as well as for increased recovery from mature fields;
AP2b: Ensuring on time the necessary infrastructure for market access of production from new natural gas deposits;
AP2c: Establishment of development areas for energy capacities using renewable energy sources.

OS.3. Increasing interconnection capacities of energy transmission networks:

AP3a: Establishing gridlines for energy transmission networks and setting up a specific framework for lands, permits and other measures to ensure their execution.;
AP3b: Providing funding sources for the development of bidirectional interconnection capacities and related components of national energy transmission systems;
AP3c: Coordination at regional level for timely development, financing and operation of international energy infrastructure projects;
AP3d: Harmonization of network codes and entry/exit rates into/from national energy transmission systems to facilitate regional energy flows;
AP3e: Closure of the 400-kV ring in the national electricity transmission system;
AP3f: Making new lines linking new production capacities with interconnection points;
AP3g: Rehabilitation of hydrocarbon transport systems.

OS.4. Ensuring the storage of energy and backup systems:

AP4a: Establishment of mandatory stocks of crude oil, petroleum products and natural gas;
AP4b: Developing electricity storage capacities in pumping hydroelectric systems; realization of CHEAP Tarnița-Lăpuștești;
AP4c: Develop capacities and mechanisms for integrating intermitted SRE in SEN, into electrical battery systems, including small storage capacities at the prosumer location.

OS.5. Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer):

AP5a: Digitization of the national energy system in the transport, distribution and consumption segments;
AP5b: Encouraging prosumers, both domestic and industrial and agricultural, along with the development of networks and smart meters;
AP5c: Integration of distributed production systems and prosumers into the power system.

OS.6. Protection of critical infrastructure against physical, cyber attacks and calamities:

AP6a: Implementing physical security measures for critical infrastructure against potential terrorist acts;
AP6b: Computer security of energy network control systems by strengthening protection barriers as well as through international cooperation;
AP6c: Ensure maintenance and modernization work of the power system as a whole to maintain critical safety objectives (lakes, dams, embankment, etc.);
AP6d: Operationalization of population warning/alert systems and civil defence drills.

OS.7. Pro-active participation of Romania in the European energy diplomacy initiatives:

AP7a: Romania's participation in setting up solidarity mechanisms to ensure energy security in crisis situations of energy supply;
AP7b: Romania's participation in the incipient stages of drafting European normative and strategic documents in the sense of promoting national interests;
AP7c: Increasing Romania's capacity to attract European funding for the development of strategic infrastructure projects and energy efficiency programmes;
AP7d: Diplomatic steps for the accession of Romania to the Economic Cooperation and Development Organization and involvement in the activities of the International Energy Agency.

OS.8. Developing Romania's strategic partnerships on the energy dimension:

AP8a: Attracting the investments of the leading energy companies in the Romanian energy sector;
AP8b: Developing cooperation in the field of scientific research and transfer of know-how;
AP8c: Cooperation with partner country authorities to increase infrastructure security.

OS.17. Balanced participation in the collective effort of EU Member States to achieve RES efficiency targets and to reduce GHG emissions

AP17a: Achievement of Romania's 2020 targets;
AP17b: Equitable participation in achieving the collective targets of the EU Member States for 2030, under the imperatives of guaranteeing energy security and the competitiveness of energy markets;
AP17c: Equal participation in the European GHG emission reduction by 80% compared to 1990 in 2050, namely limiting the climate change to 1.5-2 °C.

8. <u>OB8. Increasing Romania's energy contribution to regional and European markets by capitalizing on the national primary energy resources</u>

OS.1. Mixed and balanced energy mix:

AP1a: Continue the sustainable exploitation of all the primary energy resources of the country;
AP1b: Maintaining a diversified and flexible fleet of electricity production capacities according to Romania's energy mix;

AP1c: Adopting advanced technologies in the energy sector by attracting private investment by supporting scientific research and developing strategic partnerships;
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AP4c: Develop capacities and mechanisms for integrating intermitted SRE in SEN, into electrical battery systems, including small storage capacities at the prosumer location.

OS.9. Replacement, in the horizon of 2030, of electricity production capacity that will come out of operation with new, efficient and low-emission capacities:

AP9a: Investments in new electricity generation capacities, under the constraint of achieving the energy security, competitiveness and decarbonisation objectives of the energy sector;
AP9b: Ensuring a technological neutrality framework for the development of the national energy mix;

AP9c: Ensure funding mechanisms for investment in new generation capacities without GHG emissions in economic efficiency conditions;
AP9d: Ensure funding mechanisms for completing hydro-energetic facilities with complex uses (irrigation, flood protection, water supply etc).

To meet the objectives, RES 2019-2030, with perspectives for 2050, proposes a series of measures structured as follows:

1. General measures (MG) valid for all energy subsectors (mining, nuclear, production, hydrocarbons, energy from renewable sources, as well as production, transport and distribution of electric and thermal energy);
2. Specific measures: air, water, soil, biodiversity, population and human health, economic and social environment, cultural patrimony and landscape;
3. Specific measures per components: planning, impact projection and evaluation, loss of habitats, habitat alteration, habitat fragmentation, death rate, disturbance of the activity of species of community importance, monitoring and additional measures.

III.5. RELATIONSHIP WITH OTHER RELEVANT PLANS AND PROGRAMMES

The analysis presented in the table below included the performance of 17 strategies and plans/programs of direct relevance to the energy sector, identifying the correlation between them and RES 2019-2030, with perspectives for 2050. However, other strategies, plans and programmes that may be related to the RES 2019-2030, with perspectives for 2050 may be identified.

We mention that some of the plans, programs, strategies have undergone the steps of the strategic environmental evaluation procedure, some are in progress in relation to the strategic environmental evaluation procedure, while for others the strategic environmental evaluation procedure was not initiated yet

Relation of RES 2019-2030, with perspectives for 2050, with other plans and programmes

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
Strategy, plan, program for the development of SEA procedure				
1.	EU Energy Policy	2020 - 2030	It provides the following Objectives: ✓ Reducing greenhouse gas emissions by at least 40% over 1990 levels; ✓ 27% increase in the share of renewable energies in energy consumption; ✓ Improve energy efficiency by 20% in order to reach 30%; ✓ Develop interconnection of electricity grids by at least 15%.	In the RES 2019-2030, with perspectives for 2050, a GHG emission reduction target (40% for 2030 and 60% for 2040 with 1990 reference) is quantified. To increase the share of renewable energies, it is formulated in RES 2019-2030, with perspectives for 2050, a target of 37.9% of the total primary energy sources that will make up the energy mix in the year 2030. Also, to improve energy efficiency, RES 2019-2030, with perspectives for 2050, aims to increase its target from 27% to 30%. In RES 2019-2030, with perspectives for 2050, the development of interconnection of electricity networks is not quantified; specifies financial investments in these transport networks by modernizing them.
2.	Romanian National Sustainable Development Strategy 2030	2030	The Romanian National Sustainable Development Strategy 2030 sets the national framework for supporting the 2030 Agenda and for implementing a set of 17 sustainable development objectives. This supports Romania's development on three major sectors: economic, social and environment. Objective 7 "Clean and affordable energy" of the Strategy refers to the Energy Sector. This objective foresees that everybody should have energy at affordable prices, in a safe, sustainable and modern way; energy infrastructure; energetic security; access to energy, renewable energy and energetic	RES 2019-2030, with perspectives for 2050, contains the information obtained as part of Objective 7 from the Romanian National Strategy for Sustainable Development 2030, by establishing priority measures and actions. The access to energy is, according to RES 2019-2030, with perspectives for 2050, a strategic objective for which 6 operational objectives were set. The other elements are also detailed in RES 2019-2030, with perspectives for 2050, in particular: energy infrastructure; energetic security; renewable energy and energetic efficiency.

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			efficiency.	
3.	National Waste Management Strategy (SNGD)	2014-2020	The National waste policy must be consistent with the European policies in the field of waste management prevention and aim to reduce the consumption of resources and the practical hierarchization of waste. The provisions of PNGD complete the provisions of SNGD as a main approach, so that Romania becomes a recycling company and to apply a waste hierarchy for all types of waste subject to planning.	RES 2019-2030, with perspectives for 2050 supports energy from renewable sources, including waste (biomass, bioliquids, biogas, waste and gas from waste and slurry fermentation). The aim is to increase the rate of SRE and of low-carbon fuels in the field of transports, including refuse-derived fuels; the growth until 2030 of the installed power of 139 MW produced from biomass, bioliquids, biogas, waste and waste and slurry fermentation gas, compared to 126 MW in 2015; the use of waste by energetic exploitation, if these must observe the quality regulations (the installations used for the energetic exploitation of waste will be equipped with parameters that observe the targets undertaken for greenhouse gas emissions).
4.	National Waste Management Plan (PNGD)	2018-2035		
5.	Large Infrastructure Operational Program 2014-2020 (POIM 2014-2020)	2014-2020	The general objective of the POIM 2014-2020 is the development of transport infrastructure, environment, energy and risk prevention under conditions of economic growth and of protection and efficient use of natural resources. In the field of Clean Energy and Energy Efficiency under the 2014-2020 POIM, it establishes a 20% reduction in GHG emissions for the 2020 time horizon compared to the reference level recorded in 1990.	Within the 2019-2030 SER with the perspective of the year 2050, the components of clean energy and energy efficiency are developed. The main purpose of the implementation of SER 2019-2030 with the perspective of 2050 is the reduction of GHG emissions for the time horizons 2030 (up to 40%), 2040 (up to 60%) and 2050 (at least 80%) compared to reference year 1990.
6.	National Rural Development Programme (NRDP)	2014-2020	NRDP 2014 2020 pursues the efforts for rural development through the following Strategic Objectives: i) restructuring and increasing the viability of agricultural holdings;	Therefore, SER 2019-2030 with perspectives for 2050 encourages the development of projects in the field of agriculture to use energy from renewable resources, especially by waste reuse and exploitation (biomass, bioliquids, biogas, waste and waste and slurry

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			ii) ii) sustainable management of natural resources and combating climate change; iii) diversification of economic activities, job creation, improvement of infrastructure and services for improving the quality of life in rural areas, according to AP. i)The potential major impact on the environment identified in NRDP for the renewable energy and energetic efficiency components are: increasing the efficient use of energy in agriculture and in the food industry that contributes to the reduction of carbon dioxide and ammoniac emissions (low emissions and sustainable use of biomass for energetic purposes contributes to the reduction of internal production costs by reducing the energy costs and the use of energy from renewable sources); implementation of the projects focussed on low emissions and sustainable use of the biomass produced or generated by agricultural or forest waste, contributes to the development of the energetic autonomy of farms; the indirect contribution to the increase of energetic efficiency and energy savings in agriculture (a better use of technology and of the storage capacity etc.) and increasing the level of re-use and exploitation of the biomass derived from agriculture and related industries (plant remains, manure and other renewable energy sources).	fermentation gas).

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
7.	National strategy on climate change and low-carbon economic growth	2013-2020	The energy supply sector is the largest contributor to the country's carbon footprint, accounting for 58% of total greenhouse gas (GHG) emissions (excluding LULUCF [9]) and the intensity of the economy's emissions significantly exceeds the EU average. Romania's total per capita emissions have fallen significantly since their peak in the late 1980s as a co-benefit of structural transformation, a typical model for transition economies, and an increase in the share of non-emitting energy sources. Total CO2 emissions in Romania amounted to 78.7 million tonnes in 2010, accounting for a modest 2.1% of total EU emissions and 0.23% of global emissions. CO2 emissions per capita were also low, at around half of the EU average and slightly over one third of the OECD average. Strategic goals - GHG emissions reduction: a) Reducing the intensity of CO2 emissions from energy activities The intensity of CO2 emissions of the current energy mix in Romania exceeds the average of EU countries28 and could be significantly reduced compared to the least CO2-intensive Member States such as Sweden, France and Finland. This will require sustained investment in energy supply from renewable and low-carbon sources, economically viable, high	In the context of RES 2019-2030, with perspectives for 2050, the strategic investment programme of national interest aims to move towards a low greenhouse gas energy sector. Measures taken under RES 2019-2030, with perspectives for 2050 for GHG reduction: 1. Increasing the efficiency of the thermoelectric power plants will reduce the demand for primary energy needed to ensure final electricity consumption and a **significant reduction in greenhouse gas emissions**. 2. Modernization of the industrial sector. Within the RES 2019-2030, with perspectives for 2050, under the Greenhouse Gas Emission Reduction sub-chapter, Romania undertakes the reduction targets as set at EU level.

[9] Land Use, Land Use Change and Forestry

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			efficiency and low carbon technologies as well as in transport, distribution and storage infrastructure of energy, which will be able to efficiently, sustainably and consistently deliver a lower carbon dioxide energy mix to end users. b) Improved energy efficiency at end-user level, especially in buildings and industrial sectors Romania has an ambitious plan to invest in energy efficiency, especially in residential buildings and in some industrial production sectors. c) Energy accessible to economically vulnerable groups For the financial sustainability of low-carbon energy supply, fair price signals for energy efficient investments and for saving measures, it is essential to apply duly justified economic prices that adequately reflect the costs of production.	
8.	National Strategy and Action Plan for biodiversity conservation	2010-2020	The main objectives of this strategy are: -conservation of biological diversity, sustainable use of the components of biological diversity and correct and fair distribution of benefits resulting from the use of genetic resources. The main anthropic factors led to the change of the composition and ecological structure, respectively of the productive and supporting capacity of the Romanian biodiversity, so that the following threats are predominant:	RES 2019-2030, with perspectives for 2050, also contains aspects that refer to conservation of biodiversity in the context of Natura 2000 habitats. Therefore, this contains a description of the objectives that pursue the harmonization of the energetic sector with the environmental protection sector: providing the ecological flows, passages for migration of the water fauna and Natura 2000 habitats. Different targets are set for each of these objectives based on the years of reference (2020-for hydroenergetic planning to minimize the environmental impact, 205 – ensuring

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			1. Land conversion (for developing the urban, industrial, agricultural etc. infrastructure over areas that protect biodiversity); 2. Development of the infrastructure (car, railway, maritime, energy transportation etc. without measures to reduce/remove the impact on biodiversity); 3. Extension and development of human dwellings (extension of areas within city limits by affecting the elements of biodiversity – fragmentation, loss of habitat); 4. Hydrotechnical works (embankment – that can cause the loss of reproductive areas for water species etc.); 5. Over-exploitation of natural resources (uncontrolled exploitation of wood); 6. Inadequate exploitation of renewable resources (exploitation of sand and gravel from river beds – lead to the loss of habitats for water species, exploitation of mineral resources – loss of habitats – by stripping habitats etc.);	the ecological flows for hydropower areas of small sizes, 2030 – building passages for the migration of the water fauna).
9.	National Transition Plan	2020	The National Transition Plan applies to combustion plants covered by Chapter III of Directive 2010/75/EU on industrial emissions. It has been developed in line with EU requirements for air pollutants emitted from combustion plants with rated thermal inputs greater than 50 MWt which have a major impact on human health and the environment. The purpose of this PNT	RES 2019-2030, with perspectives for 2050, includes measures to reduce pollutant emissions into the atmosphere by upgrading, refurbishing large power generation units and/or completing, building new units that meet emission targets or from renewable sources.

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			(National Transition Plan - en.) is to prepare EU Member States to achieve new Objectives to reduce emissions of pollutants into the atmosphere (sulphur dioxide, nitrogen oxides and dust) by 2020,	
10.	National Management Plan updated for the national portion of the International Danube River Basin	2016-2021	The main objective of the updated National Management Plan is to reach a good ecological state for water bodies and encompasses the objectives for reaching a good ecological and chemical state for the surface water bodies, respectively a good ecological potential and a good chemical state for strong water bodies modified and artificial and of good chemical and quantitative state of underground water bodies. The updated national management plan is prepared in close connection with the social and economic development and is the starting point for the measures that respond to the impact of anthropic activities, including water management measures at the level of the basin and locally and highlights the major factors that have an impact on water management in a hydrographic basin. The necessary water saving decisions are also established as well as objectives for a sustainable, unitary, balanced and complex management of water resources.	RES 2019-2030, with perspectives for 2050, proposes measures to reduce the pressure on the water environmental factor by adopting higher levels for servitude/ecological flows and determining the habitats included in the Natura 2000 network. For large hydropower areas, the adoption of higher standards of ecological flows shall be gradual until 2030, in three stages of adjustments for fulfilling the medium European standards in the field. For small hydropower areas, the fulfilment of the medium European standards must be achieved by 2025. The water capturing works for hydropower areas must include passages for migration of the water fauna, the deadline for implementing these measures is 2030. For hydropower areas compared to Natura 2000 habitats, a series of measures were proposed whose purpose is to reduce the environmental impact.
Strategy, plan, program in progress SEA procedure				
11.	Mining Strategy of Romania	2017-2035	In February 2019, the overall objective of the mining strategy is to continue exploiting the existing ores and derived secondary	At SER 2019-2030, with perspective for 2050, the main supplier of coal (lignite) is identified as Oltenia mining tank with 15 mining perimeters. As regards the

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			resources and the research-exploitation activities and to open new ores as long as the economic efficiency can be ensured. An important aspect of this Strategy is related to the mine closing and greening activity. From an environmental perspective, Romania's Mining Strategy aims to: remedy the historical damages (to rehabilitate the decommissioned mines), to promote the management of the lands and of the natural resources with the purpose of protecting the environment, minimizing the volumes of waste and pollution and making sure that the polluters pay for greening, protecting the natural and cultural patrimony, being cautious when the environmental impact is unknown, taking into account the lifecycle of minerals upon estimating and fulfilling the mineral demand.	uranium ore this is mostly imported. These investments in the two subsectors of the mining sector will be done in compliance with the conditions imposed by the environmental legislation (GHG reduction).
12.	The National Forestry Strategy	2018-2027	The National Forestry Strategy 2018-2027 groups 5 Strategic Objectives: Strategic Objective 1 - Improving the institutional and regulatory framework for forestry activities; Strategic Objective 2 - Sustainable management of the national forest fund; Strategic Objective 3 - Increasing the competitiveness and sustainability of forest industries, bioenergy and bio-economy as a whole; Strategic Objective 4 - Develop an effective public awareness and communication system;	In the context of RES 2019-2030, with perspectives for 2050, Strategic Objective 3 will be the target for correlating these two strategies. Thus, firewood is the main form of biomass for energy purposes. Approximately 3.5 million homes out of a total of 8.5 use firewood as a source of heat. The target for 2030 is to reduce the use of wood as a source of 20% of energy compared to 2018. RES 2019-2030, with perspectives for 2050 proposes a phasing-out of firewood by implementing new housing improvements to be energy efficient (thermal insulation of homes, efficient biomass heating, which is less polluting).

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			Strategic Objective 5 - Development of scientific research and forestry education.	
Strategy, plan, program for which the SEA procedure was not initiated				
13.	RET Development Plan (transport networks)	2018-2027	The main objectives of the RET Development Plan [10] are: ✓ Informing about the current and future ability of the transport network to meet the needs of the users and the public interest, taking into account the objectives of the National Energy Strategy and Policy and the legislation in force; ✓ Correlation of conditions for correlation between OTS (carrier and system operator) and market participants in medium and long term of actions/investments that may impact on the safety performances of SEN[11]; ✓ Information on zonal opportunities for connection to the RET and the use of RET on the basis of forecasts of consumption trends and production capacities; ✓ Information on the evolution of energy-exchange capacities with neighbouring systems in the context of the European electricity market; ✓ Reserve level in SEN to ensure that demand is met with production and energy transport at the peak of consumption; ✓ The need for resources for the development of RET and their source.	In line with the RET Development Plan, RES 2019-2030, with perspectives for 2050, describes projects of common interest at European level (Project 138 Black Sea Corridor and 144 Mid Continental East Corridor Project). The transmission and system operator, Transelectrica SA, coordinates the power flows of the SEN by controlling the dispatchable production units. Although dispatching involves additional costs for manufacturers, it makes it possible to balance SEN in extreme situations. Electricity-related investments are foreseen by 2030.

[10] Electricity Transport Network
[11] National Energy System

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
14.	SN Nuclearelectrica SA Development Strategy	2015-2025	Long-term strategic objectives of SNN [12] are: ✓ Operation of nuclear units in safe and nuclear security conditions for personnel, population, environment and production assets; ✓ Maintaining the electricity production capacity for the current average level in industry (Unit 1 refurbishment); ✓ Fulfilment of major investment objectives; ✓ Improving the indicators of the company's financial performance; ✓ Ensuring safety in the supply of raw materials; ✓ Diversifying the portfolio of activities; ✓ Use of assets that currently do not generate revenue (completion of Units 3 and 4 at CNE Cernavoda)	Within RES 2019-2030, with perspectives for 2050, an increase in energy from nuclear sources is estimated from 17.4 TWh in 2030 to 23.2 TWh in 2035. Also, nuclear power is a low GHG energy source with an 18% share of the energy mix. Completion and commissioning of two nuclear units (Units 3 and 4 at CNE Cernavoda), each with an installed capacity of 720 MW, one group to be commissioned by 2030. At present, the energy from nuclear sources is 18%, reaching the target of 28% in the year 2035.
15.	National Strategy for Research, Development and Innovation	2014-2020	The National Strategy CDI 2014-2020 helped identify the areas where Romania can have significant contributions and at the same time can benefit of the results of science and of innovation in increasing competitiveness. This focusses on the following types of priorities: 1. Smart specialization priorities include defining and consolidating high competence fields in which there are real or potential comparative advantages that can have a major contribution to the GDP; 2. Publicly relevant priorities aim to	A relevant aspect for the RES 2019-2030, with perspectives for 2050 may be that the 2014-2020 research goals are to increase the level of integration in the energy field in four interdependent fields that are at the basis of the Energetic Union: energetic security, solidarity and confidence, a fully integrated European energy market; the contribution of energetic efficiency in moderating the energy demand; decarbonation of economy; research, innovation and competition.

[12] National Nuclear System

It. no.	Name of strategy, plan, programme	Time horizon	Summary of the document	Relationship with RES 2019-2030, with perspectives for 2050
			allocate resources to fields where technological research and development fulfils certain social needs that are concrete and pressing.	
16.	The Integrated National Plan for Energy and Climate Change (PNIESC)	2021-2030	The main National Objectives for the PNIESC are represented by: ✓ Decarbonation (GHG emissions and absorption, renewable energy); ✓ Energy efficiency; ✓ Energy security; ✓ Domestic energy market (interconnectivity of electricity grids, energy transport infrastructure, market integration, energy poverty); ✓ Research, innovation and competitiveness.	Within RES 2019-2030, with perspectives for 2050, the 5 National Objectives are included, both strategies aiming to decarbonise the national energy sector so that Romania achieves GHG targets in line with EU requirements; energy efficiency consisting mainly of investments in the energy, oil, electricity and heat sectors, but also the thermal efficiency of buildings; in the case of energy security no numerical targets were set, but only qualitative; the other two Objectives are common to the two strategies.
17.	CEF (Connecting Europe Facility) Program	-	This program ensures the financing of the project "Improvement of the navigation conditions in the common Romanian-Bulgarian sector of the Danube". The purpose of the implementation of the project has three directions, namely: developing an integrated approach on the Danube, increasing the traffic with avoiding a negative impact on the river and ecological system, improving the waterway infrastructure for the development of river transport on the Romanian-Bulgarian joint Danube sector (river km 845.5 - 375), and supporting transport and encouraging the use of inland waterway transport.	Within RES 2019-2030, with perspectives for 2050, the implementation of hydropower investment from Turnu Magurele Nicopole is mentioned, which overlaps the project "Improvement of the waterway conditions on the common Romanian-Bulgarian sector of the Danube". The impact of these two projects can be significant for habitats that are part of Natura 2000 network and other categories of protected areas in the stage of construction of two investments. The measures of prevention, reduction and compensation resulting from the adequate evaluation studies for the two investments will be taken into account.

V. RELEVANT ASPECTS OF THE ENVIRONMENT STATE

IV.1. CURRENT STATE OF THE ENVIRONMENT

The characterization of the current state of the environment was made on the basis of the data and information on the national territory available at the time of elaboration of the Environmental Report. An analysis of the current state of the environment has been carried out for each relevant environmental aspect.

Relevant environmental considerations are: air, water, soil, climate change, biodiversity, conservation and efficient use of natural resources, energy efficiency, population and human health, natural landscape, cultural aspects, sustainable transport, awareness raising on the environmental issues.

Energy production is a form of development that generates some of the most significant environmental effects, yet it is essential for human well-being.

IV.1.1 AIR

The energy sector is one of the sectors with the greatest influence on air quality, materialized by the following effects:

- Increase in greenhouse gas emissions;
- Environmental pollution with hydrocarbons;
- Air pollution from long-term storage of mining waste (uncovered dumps).

Energy activity is responsible for the presence of pollutants above 50% of methane and carbon monoxide emissions, about 70% of sulphur dioxide emissions, about 50% of nitrogen oxide emissions, about 80% of the amount of particulate matter discharged into the atmosphere and about 80% of carbon dioxide emissions.

As a Member State of the European Union and as part of the UNECE [13]/CLRTAP [14] Convention, Romania publishes annual estimates of emissions of air pollutants covered by the national emissions ceiling Directive 2001/81/EC (transposed into national legislation by GD 283/2017 for the amendment of GD 1856/2005 on national emission ceilings for certain atmospheric pollutants) and the protocols of the abovementioned Convention.

Another responsibility of the Member States is compliance with the Gothenburg Protocol emission ceilings by adopting measures to reduce the impact of anthropogenic activities on the environment. Thus, Romania has the obligation to reduce the annual limits of acidifying and eutrophying gases and ozone precursors below 918 kt for sulphur dioxide (SO2), 437 kt for nitrogen oxides (NOx), 523 kt for volatile organic compounds (NMVOCs) and 210 kt for ammonia (NH_3).

Below we will present the dynamics of the main pollutants (SO2, NOX) estimated for the period 2000-2015, as well as the presentation of the main pollutants.

[13] The Aarhus Convention;
[14] 1979 Convention on long-range transboundary air pollution, done at Geneva on 13 November 1979.

Sulphur oxides (especially SO2 - sulphur dioxide) come mainly from stationary and mobile sources by combustion of fossil fuels. Sulphur dioxide is a colourless, choking and penetrating gas which is transported over long distances by being lightly fixed to the dust particles, and in reaction with water vapour forms sulfuric acid or sulphurous acid, resulting in the occurrence of acid rain. For the 2010-2014 time horizon of the total SO_2 emissions at national level resulted from 5 industrial activities. Thus, the largest contribution was in the energy sector: about 95% of thermal power plants and other combustion plants, followed by oil and gas refineries with about 2.5%, the cement and lime industry, the production of iron and steel and non-ferrous metal smelting amounts to approximately 2.25% (Source: Report on the state of the environment in Romania for the years 2010-2016).

Figure 2 SO_2 emissions dynamics in the energy sector, relative to total emissions for the period 2000-2014 (Source: eea.europa.eu)

From the above figure it can be noticed that the SO_2 emissions both total and the energy sector, did not exceed the allocated ceilings for the reviewed period, namely 2005 and 2010. A decrease in SO_2 emissions can be noticed, however, from 2008. Also, SO2 emissions from the energy sector have the largest share of total emissions for the whole reviewed period.

Nitrogen oxides (NOx) result from combustion processes in stationary and mobile sources or from biological processes. Nitrogen monoxide is the most common nitrogen oxide resulting from the combination of nitrogen and oxygen at high temperatures. The main "supplier" of NOx emissions is the energy industry, transport, combustion in the manufacturing industry, and production processes.

For the 2010-2016 time horizon of the total NO_x emissions at national level resulted from 13 industrial activities. Thus, the largest contribution was in the energy sector: about 67% of thermal power plants and other combustion plants, followed by the cement or lime and cement industry in rotary kilns by about 13%, the phosphorous, nitrogen and potash fertilizer industry by approximately 6%, pig iron plants by about

5%, petroleum refineries and gas by about 2.5% (Source: Report on the state of the environment in Romania for the years 2010-2016*)*.

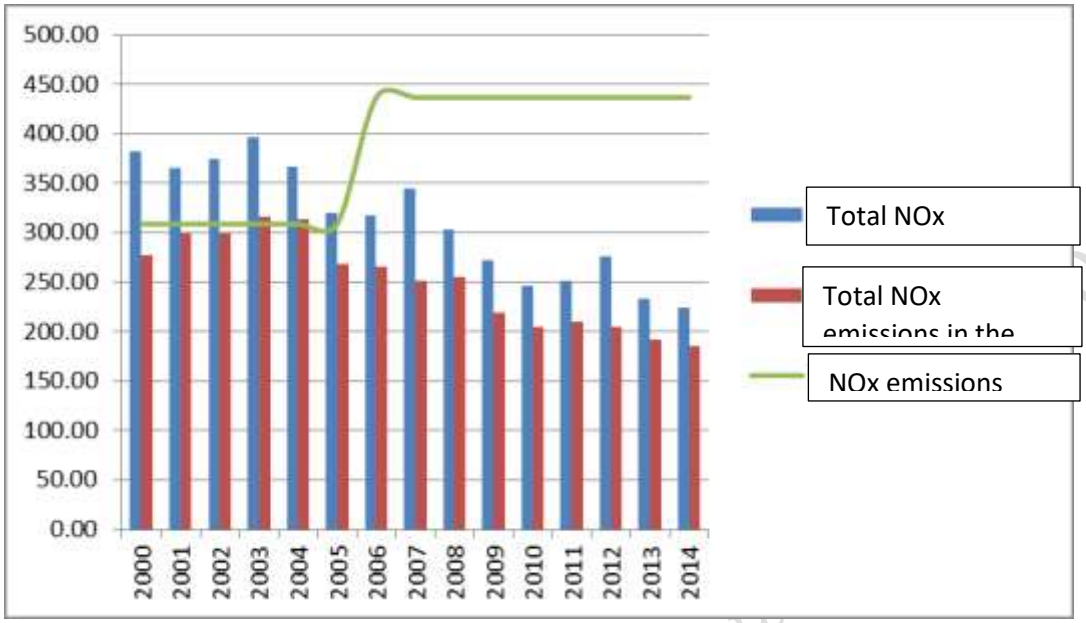


Figure 3 Dynamics of NO_x emissions from the energy sector, relative to total emissions for the period 2000-2014 (Source: eea.europa.eu)

From the above figure it can be seen that for the period under review the NOx emissions for the period 2000-2005, the total emissions exceeded the ceiling set in the Gothenburg Protocol, while those in the energy sector are below this. For the period 2006-2014, both the total and the energy sector emissions did not exceed the allocated ceilings for the reviewed time periods. For the period 2008-2014 there is a decrease in NO_x emissions from the energy sector, even if total emissions fluctuate variably.

At national level, the acidification effect of pollutants comes mainly from the energy sector, for carbon dioxide and nitrogen oxides and from agriculture for ammonia.

At 2015, emissions of most acidifying substances with the largest share come from the sectors of activity are the aluminium production with significant sulphur dioxide values, followed by the production of nitric acid with significant figures for nitrogen oxides.

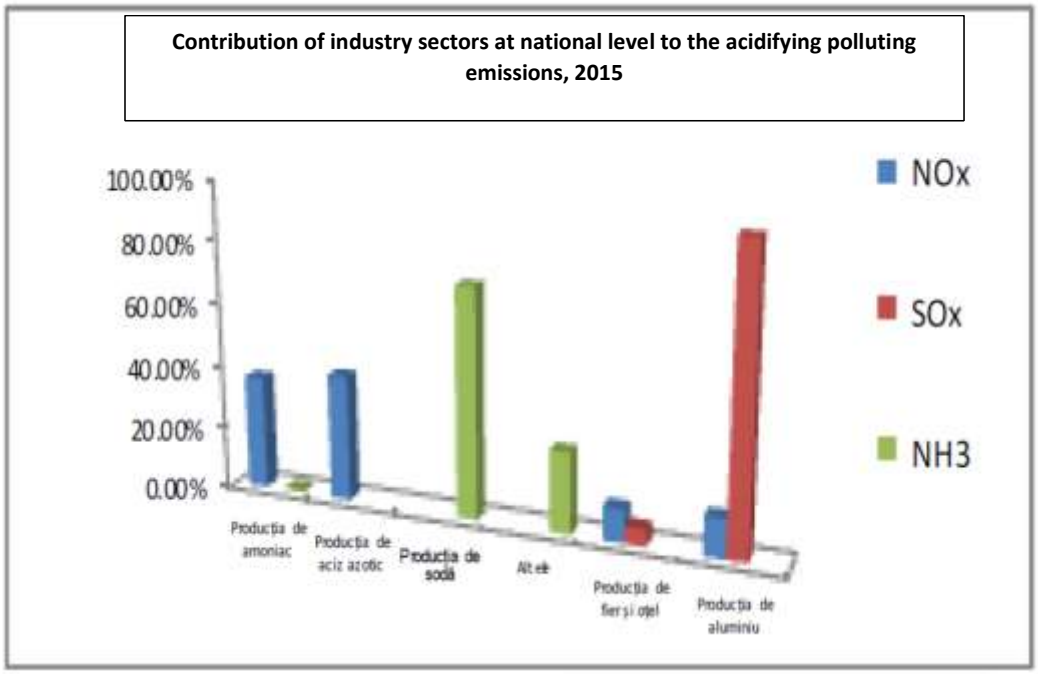


Figure 4 Contribution of industry sectors at national level to pollutant emissions with acidifying effect for 2015 (Source: Report on the state of the environment in Romania, 2016, ANPM)

Productia de amoniac – ammonia production

Productia de acid azotic – nitric acid production

Productia de soda – soda production

Altele – others

Productia de fier si otel – iron and steel production

Productia de aluminiu – aluminium production

Taking into account the 2010 ceilings and the revised Gothenburg Protocol on the reduction of air pollutant emissions, commitments to be achieved by 2020, it is noted that the evolution of acidifying pollutants at national level throughout the reviewed period follows a downward trend towards the threshold imposed in the revised Gothenburg Protocol.

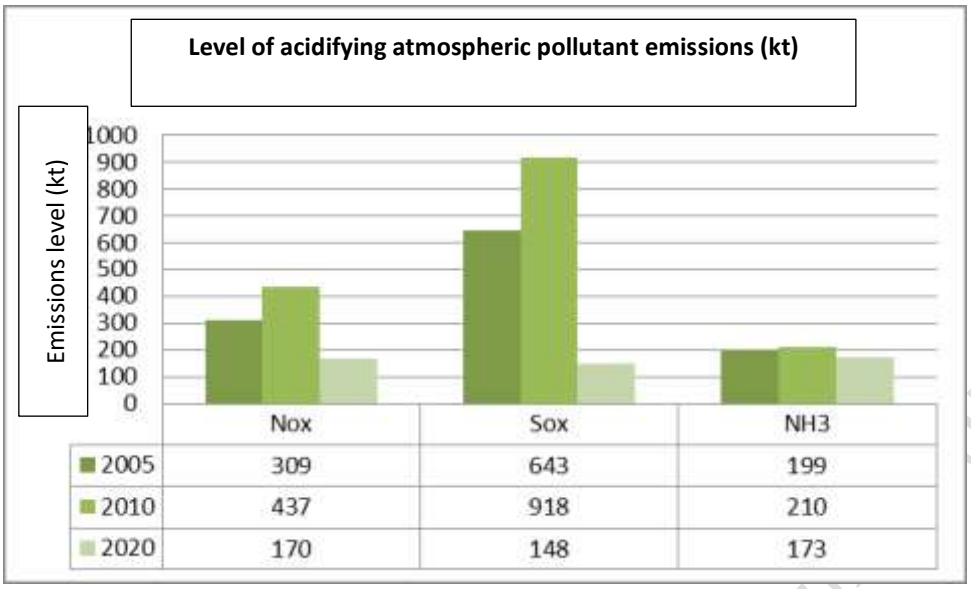


Figure 5 Emission level of atmospheric pollutants with acidifying effect according to the ceilings of the Gothenburg Protocol 2010 (Source: Report on the state of the environment in Romania, 2016, ANPM)

RES 2019-2030, with the perspectives of 2050 contains the energetic mix for 2020, 2030 and 2050, as follows:

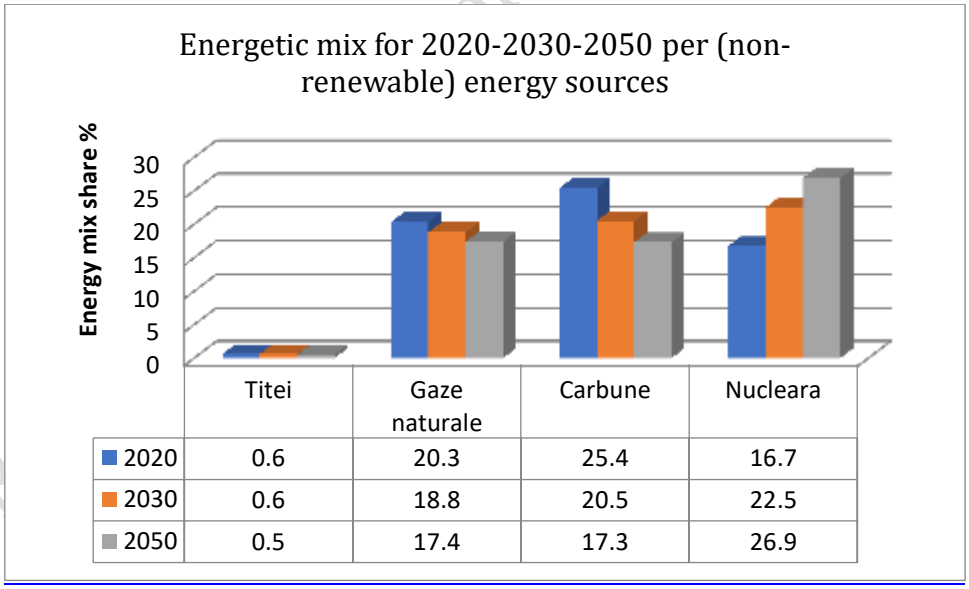
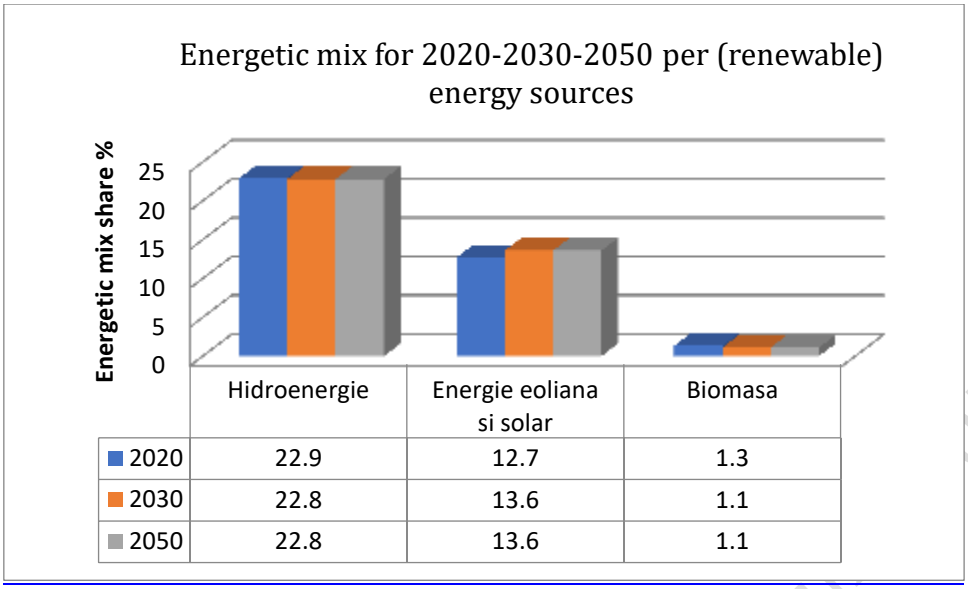


Figure 6 Energetic mix for the period 2020-2030-2050 per (non-renewable) energy source according to RES 2019-2030, with perspectives for 2050



	Hidroenergie	Energie eoliana si solar	Biomasa
2020	22.9	12.7	1.3
2030	22.8	13.6	1.1
2050	22.8	13.6	1.1

Figure 7 Energetic mix for the period 2020-2030-2050 per (renewable) energy source according to RES 2019-2030, with perspectives for 2050

According to Figure 6 that contains the energy sources and their share in the energetic mix for the 2020-2030-2050 time horizon, we notice a decrease of the share of coal in the energetic mix, which will also reduce greenhouse gas emissions. It is also noticed a decrease in the share of natural gas in the energetic mix, which will result in a reduction of the compounds (CO2, CO, No2, SO2, etc.) resulting from burning.

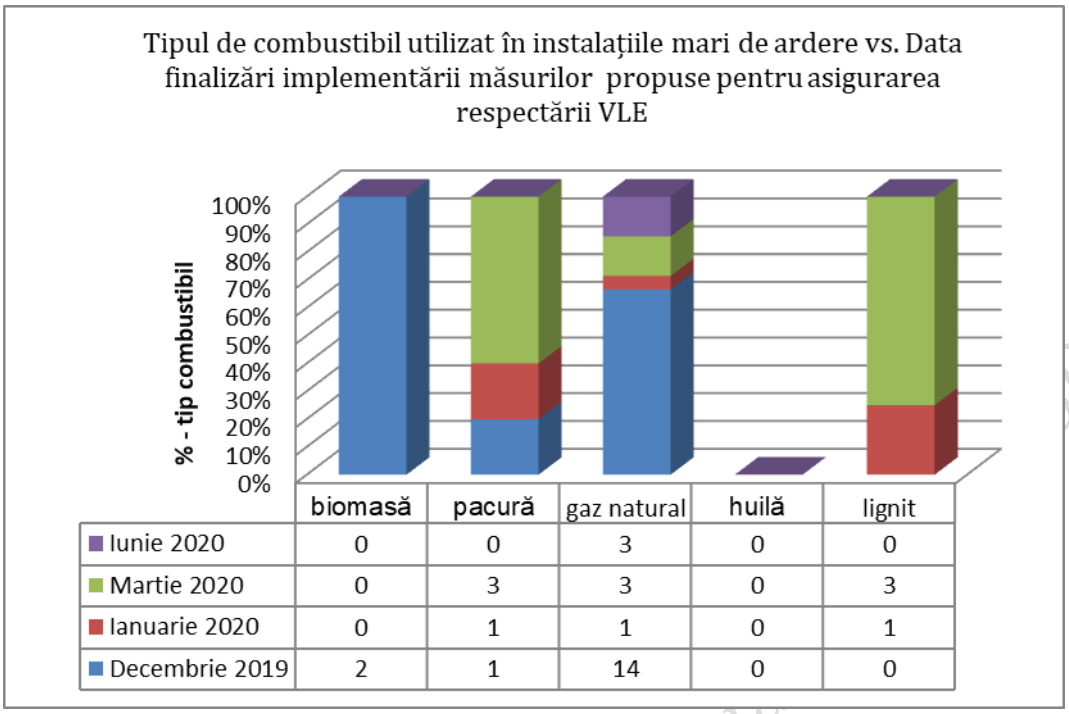
According to Figure 7 that contains the energy sources and their share in the energetic mix for the 2020-2030-2050 time horizon, it is noticed an increase of the components from renewable sources from the energetic mix for the 2020-2030 time horizon and maintaining them for the 2030-2050 time horizon.

With the National Transition Plan, in 2016 there were 33 large combustion plants covered by Chapter III of Directive 2010/75/EU on industrial emissions.

The table below lists the large combustion plants, emissions (sulphur dioxide, nitrogen oxides and dust), measures that require repair of the installations where appropriate.

The figure below presents the large combustion plants per types of fuel, in correlation with the terms of conformity as regards the date of implementation of the measures to ensure the due dates of emission (SO_2, NO_X, dusts).

Of the 49 combustion plants, only 32 of them have deadlines for implementation set. Therefore, it can be seen that for plants using as raw material hard coal, there are no deadlines of implementation and for those using lignite there are deadlines for implementation for half of them.



	biomasă	pacură	gaz natural	huilă	lignit
Iunie 2020	0	0	3	0	0
Martie 2020	0	3	3	0	3
Ianuarie 2020	0	1	1	0	1
Decembrie 2019	2	1	14	0	0

Figure 6 Types of fuels used in large combustion plants (Source: National Transition Plan)

Table 1 Emission ceilings for combustion plants by fuel type (Source: National Transition Plan)

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019	SO2	Nox	Dust	
Biomass										
S.C. C.E.T. GOVORA S.A. nr.2	200	200	200	200	50	20			Using EF combined with DGA	31 December 2019
S.C. C.E.T. GOVORA S.A. nr.3	200	200	300	250	50	20			Using EF combined with DGA	31 December 2019
Fuel oil										
CET Iasi 1 - IMA no. 2 (e.g. Dalkia Termo Iasi SA CET Iasi 1 - IMA No. 2)			400	150				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019
SC Complexul Energetic Oltenia SA SE Craiova - Craiova no. 1 (e.g. SC Complexul Energetic Craiova			400	150				Mounting and commissioning of a selective non-catalytic reduction of nitrogen		31 March 2020

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
S.E Craiova - Craiova no.1)								oxides of combustion gases (SNCR)		
SC Complexul Energetic Oltenia SA SE Rovinari no. 1 (e.g. SC Complexul Energetic Rovinari no.1)			400	150				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		31 March 2010
SC Complexul Energetic Oltenia SA SE Turceni no. 2 (e.g. SC Complexul Energetic Turceni no.2)			400	150				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		01 January 2020
S.C. C.E.T. GOVORA S.A. nr.2	400	200	400	150	50	20	Reduced-sulphur fuel; Combined techniques for	Combined techniques for NOx reduction.	Using EF combined with DGA	

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
							reducing SO2			
S.C. C.E.T. GOVORA S.A. nr.3	1700	250	450	200	50	25	Reduced-sulphur fuel; Combined techniques for reducing SO2	Combined techniques for NOx reduction.	Using EF combined with DGA	
S.C. Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva no. 2 (e.g. S.C. ELECTROCENTRALE DEVA S.A.nr. 2)	400	200	400	150	50	20				
S.C. Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva no. 3 (e.g. S.C. ELECTROCENTRALE DEVA S.A. no. 3)	400	200	400	150	50	20				
S.C.COLTERM S.A. nr.3			450	200						
S.C.COLTERM S.A. nr.4			450	200						

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
SC ROMPETROL RAFINARE SA RAFINARIA VEGA PLOIESTI				450						
Natural gas										
CET Iasi 1 - IMA no. 2 (e.g. Dalkia Termo Iasi SA CET Iasi 1 - IMA No. 2)			200	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019
CET Iasi 1 - IMA no. 2 (e.g. Dalkia Termo Iasi SA CET Iasi 1 - IMA No. 2)			200	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
S.C. Electrocentrale Galaţi no.3			200	100				Upgrading low-NOx burners to comply with the VLE imposed/fitting and/or commissioning of a selective catalytic/non-catalytic reduction system of nitrogen oxides in the combustion gases		31 December 2019
Societatea Electrocentrale Constanţa SA CT Palas no.1+4 (e.g. SC ELCEN Bucureşti SE Palas no.1+4)			300	100				Upgrading low-NOx burners to comply with the VLE imposed/fitting and/or commissioning of a selective catalytic/non-catalytic reduction		31 December 2019

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
								system of nitrogen oxides in the combustion gases		
Societatea Electrocentrale Constanţa SA CT Palas no.5 (e.g. SC ELCEN Bucureşti SE Palas no.5)			300	100				Upgrading low-NOx burners to comply with the VLE imposed/fitting and/or commissioning of a selective catalytic/non-catalytic reduction system of nitrogen oxides in the combustion gases		31 December 2019
SC Complexul Energetic Oltenia SA SE Craiova - Işalniţa (e.g. SC Complexul Energetic Craiova			200	100				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides		31 March 2020

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
SE Işalniţa)								of combustion gases (SNCR)		
SC Complexul Energetic Oltenia SA SE Craiova - Craiova no. 1 (e.g. SC Complexul Energetic Craiova S.E Craiova - Craiova no.1)			200	100				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		31 March 2020
SC Complexul Energetic Oltenia SA SE Rovinari no. 1 (e.g. SC Complexul Energetic Rovinari no.1)			200	100				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		31 March 2020
SC Complexul Energetic Oltenia SA SE Turceni no. 2 (e.g. SC Complexul Energetic Turceni			200	100				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides		01 January 2020

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
no.2)								of combustion gases (SNCR)		
S.C. C.E.T. GOVORA S.A. no.1			200	100				Combined techniques for NOx reduction		31 December 2019
S.C. C.E.T. GOVORA S.A. no.2	35	35	200	100	5	5	Reduced-sulphur fuel; Combined techniques for reducing SO2	Combined techniques for NOx reduction	Using EF combined with DGA	
S.C. C.E.T. GOVORA S.A. no.3	35	35	300	100	5	5	Reduced-sulphur fuel; Combined techniques for reducing SO2	Reduced-sulphur fuel; Combined techniques for reducing SO2	Using EF combined with DGA	
S.C. Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva no. 2 (e.g. S.C. ELECTROCENTRALE DEVA S.A.nr. 2)	35	35	200	100	5	5				

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
S.C. Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva no. 3 (e.g. S.C. ELECTROCENTRALE DEVA S.A. no. 3)		35	200	100	5	5				
S.C. ELECTROCENTRALE ORADEA S.A no. 1			200	100				Mounting and commissioning of a selective catalytic reduction (SCR) system for nitrogen oxides in combustion gases 3		31 December 2019
SNGN ROMGAZ S.A.-SPEE Iernut no. 1 (e.g. S.C ELCEN Bucuresti SE Mures No. 1)			300	100				Mounting and commissioning of a non-catalytic selective reduction system for nitrogen oxides		30 June 2020

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
SNGN ROMGAZ S.A.-SPEE Iernut no. 4 (e.g. S.C ELCEN Bucuresti SE Mures No. 4)			300	100				Mounting and commissioning of a non-catalytic selective reduction system for nitrogen oxides		30 June 2020
SNGN ROMGAZ S.A.-SPEE Iernut no. 5 (e.g. S.C ELCEN Bucuresti SE Mureş No. 5)			200	100				Mounting and commissioning of a non-catalytic selective reduction system for nitrogen oxides		30 June 2020
SC ELCEN Bucuresti CET Progresul no.1			200	100				Upgrading low-emission nitrogen oxides burners for compliance with the required VLE/fitting and commissioning of a selective catalytic/non-		31 December 2019

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
								catalytic reduction system of nitrogen oxides in the combustion gases		
SC ELCEN Bucuresti CET Sud no. 1			200	100				Upgrading low-emission nitrogen oxides burners for compliance with the required VLE/fitting and commissioning of a selective catalytic/non-catalytic reduction system of nitrogen oxides in the combustion gases		31 December 2019

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
SC ELCEN Bucuresti CET Sud no. 1			200	100				Upgrading low-emission nitrogen oxides burners for compliance with the required VLE/fitting and commissioning of a selective catalytic/non-catalytic reduction system of nitrogen oxides in the combustion gases		31 December 2019
S.C.COLTERM S.A. no.2			300	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
S.C.COLTERM S.A. no.3			300	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019
S.C.COLTERM S.A. no.2			300	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019
S.C.COLTERM S.A. no.3			300	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion		31 December 2019

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
								gases		
S.C.COLTERM S.A. no.4			300	100				Mounting and commissioning of a selective catalytic reduction system for nitrogen oxides in the combustion gases		31 December 2019
SC ROMPETROL RAFINARE SA RAFINARIA VEGA PLOIESTI			300	100				Mounting and commissioning of low-emission nitrogen oxide burners		31 December 2018
Coal										
CET Iasi 1 - IMA no. 2 (e.g. Dalkia Termo Iasi SA CET Iasi 1 - IMA No. 2)			NC	NC						
SC Veolia Energie SA Iaşi CET Iaşi 1 - IMA no .3 (e.g.			NC							

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
Dalkia Termo Iaşi SA CET Iaşi 1 - IMA no.3)										
SC Veolia Energie SA Iaşi CET Iaşi 2 - IMA no.4 (e.g. Dalkia Termo Iaşi SA CET Iaşi 2 - IMA no.4)	400	200	200	200			Installation and commissioning of a scrubber for flue gas desulphurization of the second boiler from IMA no.4, the first boiler in the desulphurisation plant being realized by the project on Axis 3 SOP Environment	Staging the air input in the furnace		
S.C. Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva no. 2 (e.g.	400	200	200	200	50	20	Flue gas desulphurisation	Low NOX burner rehabilitation	Electrofilter rehabilitation	

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
S.C.ELECTROCENTRALE DEVA S.A.no. 2)										
S.C. Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva no. 3 (e.g. S.C. ELECTROCENTRALE DEVA S.A. no. 3)	400	200	200	200	50	20	Flue gas desulphurisation	Low NOX burner rehabilitation	Electrofilter rehabilitation	
Lignite										
SC Complexul Energetic Oltenia SA SE Craiova - Işalniţa (e.g. SC Complexul Energetic Craiova SE Işalniţa)			200	200				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		31 March 2020
SC Complexul Energetic Oltenia SA SE Craiova - Craiova no. 1 (e.g. SC Complexul			200	200				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides		31 March 2020

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
Energetic Craiova S.E Craiova - Craiova no.1)								of combustion gases (SNCR)		
SC Complexul Energetic Oltenia SA SE Rovinari no. 1 (e.g. SC Complexul Energetic Rovinari no.1)			200	200				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		31 March 2020
SC Complexul Energetic Oltenia SA SE Turceni no. 2 (e.g. SC Complexul Energetic Turceni no.2)			200	200				Mounting and commissioning of a selective non-catalytic reduction of nitrogen oxides of combustion gases (SNCR)		01 January 2020
S.C. C.E.T. GOVORA S.A. no.2	400	200	200	200	50	20	Reduced-sulphur fuel; Combined techniques for reducing SO2	Combined techniques for NOx reduction.	Using EF combined with DGA	
S.C. C.E.T. GOVORA S.A. no.3	1228	250	600	200	100	25	Low sulphur fuel;	Combined techniques for NOx	Using EF combined with	

Large combustion plants/Fuel type	VLE SO_2 (mg/Nmc)		VLE NO_x (mg/Nmc)		VLE Dust (mg/Nmc)		Measures to ensure compliance with emission limit values			Date of implementation completion
	2016	2019	2016	2019	2016	2019				
							SO2	Nox	Dust	
							Combined techniques for SO2 reduction	reduction.	DGA	

IV.1.2 WATER

Environmental objectives

At European level, environmental objectives concerning water bodies are mentioned in the Framework Water Directive (FWS), being the main element of this regulation. The purpose of the Directive is to provide long-term protection, sustainable use and management of waters.

The overall environmental objectives include the following elements:

- For surface water bodies: reaching a good ecological state and a good chemical state, respectively a good ecological potential and a good chemical state for highly modified and artificial water bodies;
- For underground water bodies: reaching a good chemical state and a good quantitative state;
- Progressive reduction of pollution with priority substances and gradual termination and removal of emissions, discharges and losses of hazardous priority substances from surface waters, by implementing the necessary measures;
- "preventing or limiting" the discharge of pollutants in underground waters by adopting measures;
- Inversing the tendencies of significant and sustainable growth of the concentrations of pollutants in underground waters;
- Non-deterioration of the state of surface and underground waters (art. 4.1.(a)(i), art. 4.1.(b)(i) of DCA;
- For protected areas: fulfilling the objectives set forth by the specific law.

The current situation of surface water bodies

The following surface water categories are available at national level:

- Rivers (natural, heavily modified and artificial) – 78,905 km (cadaster rivers);
- Natural lakes – 129;
- Transitional waters – 781,37 km^2;
- Coastal waters – 571,8 km^2.

At national level, the characterization of the ecological state/ecological potential of water bodies is made on hydrographical basins by global evaluation of the analytical results obtained periodically from sampling campaigns according to the monitoring programme set.

The impact in terms of the ecological state/ecological potential of ground water bodies at national level evaluated according to the updated National Management Plan corresponding to the National part of the International Hydrographic Basin of Danube River is relevant in the context of the RES 2019-2030 objectives with perspectives for 2050, for the following objectives: Execution of a 600 MW energy group at Rovinari, Execution of a new 400MW energy group ultrasupercritical parameters at Turceni, Execution of a new 200MW CCGT energy group – Craiova II, Execution of a hydropower plant with accumulation by pumping Tarniţa-Lăpuşteşti, Execution of hydropower plants on the river Jiu 90 MW, Execution of hydropower plants on Olt river - 145 MW.

The objectives of RES 2019-2030, with perspectives for 2050 which overlap the highly modified overground water bodies are: Completion of groups 3 and 4 at Cernavoca NPP, Execution of a new energy group of 400 MW CCGT powered by gas with flexible operation Mintia, Execution of hydropower plant at Răstoliţa 35 MW, Execution of hydropower plant at Turnu Măgurele-Nicopole.

At national level, some of the existing accumulation lakes or accumulations also have a hydro-energetic role. The figure below shows the main hydroelectric accumulations.

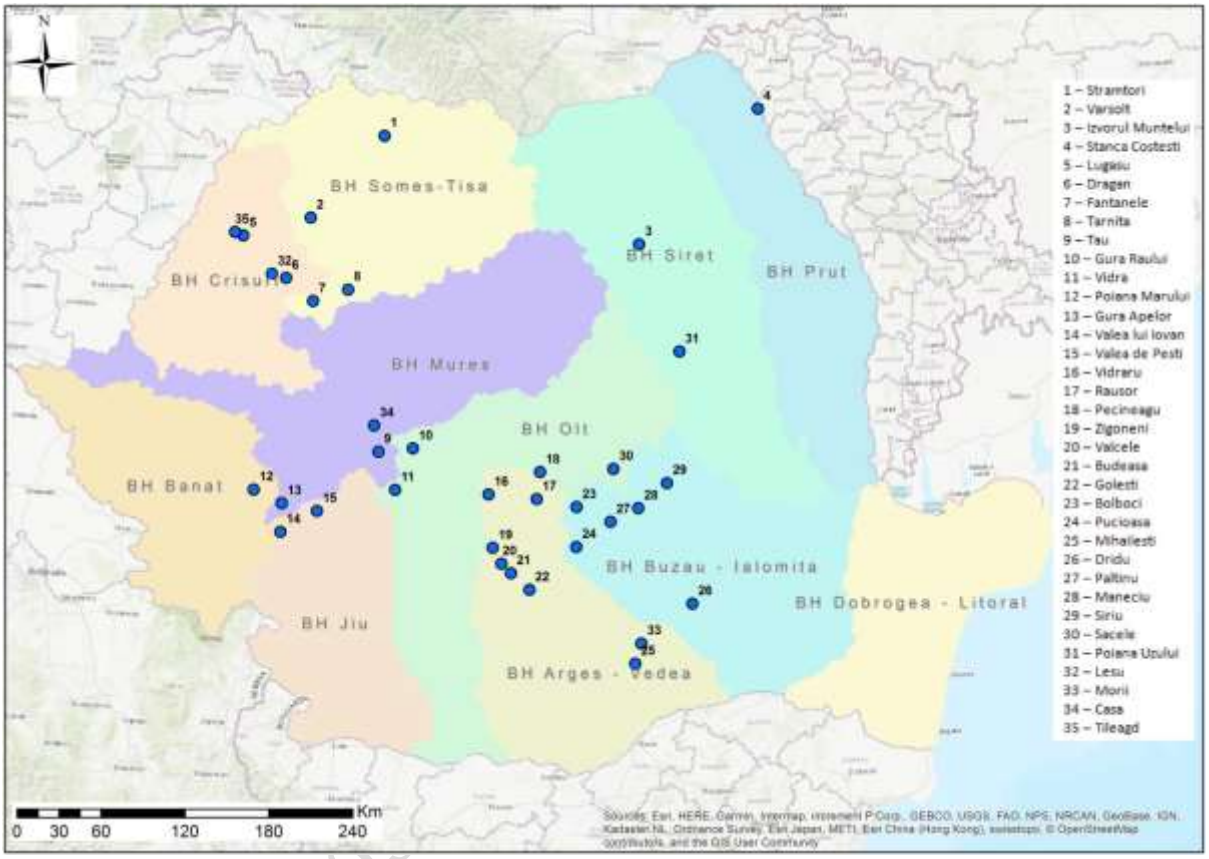


Figure 7 The localization of the main hydropower accumulation lakes at hydrographic basin level (Source: basin management plans)

We specify that the source of data is the information from the basinal management plans, respectively maps that contain the categories of overground waters. These were extracted and interpolated by the consultant's team of experts.

The source of origin of our country's surface water resources are two major categories: the Danube River and the interior rivers, including the natural lakes. In 2017, the resource for the Danube River at the entry in the country was 71429 billion cubic meters, while the natural water resource from interior rivers was a discharge volume of 29228 x 10^6 cubic meters, 28% lower than the average natural water resource from the period 2012-2016 (Figure 10).
The theoretical resource is the average annual stock consisting of all the natural surface and underground water resources, and the technically usable resource is the share of the theoretical resource that can be sampled to meet the water requirements of the economy. Their situation for the period 2012-2017 is presented in Figure 10.

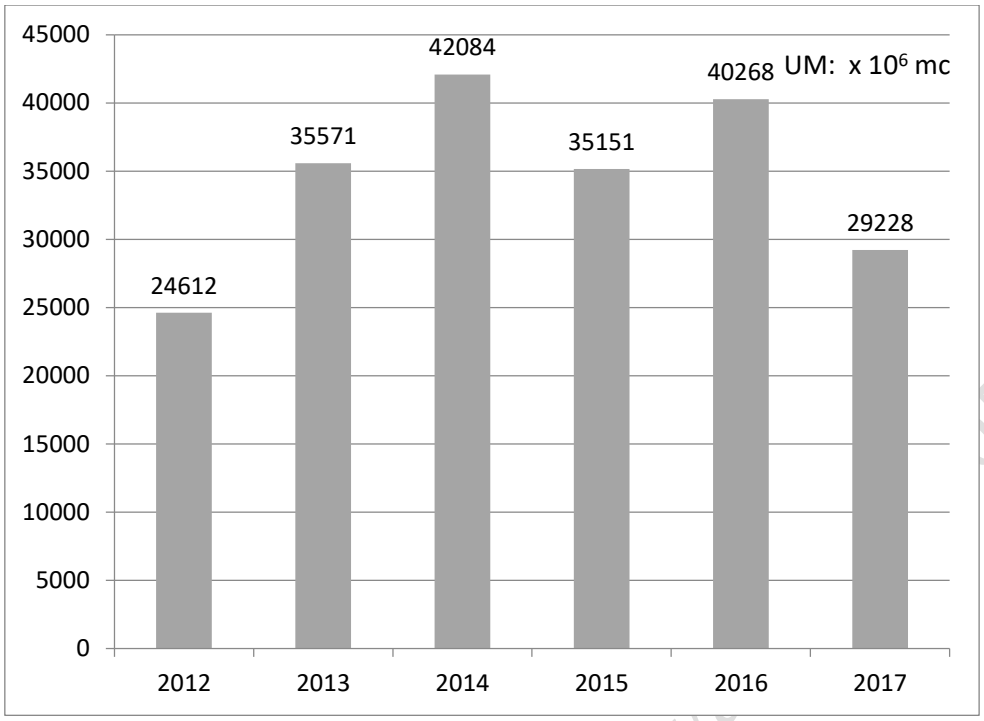


Figure 8 Natural water resource in 2017, compared to the period 2012-2016 (Source: Report on the state of the environment in Romania, ANAR)

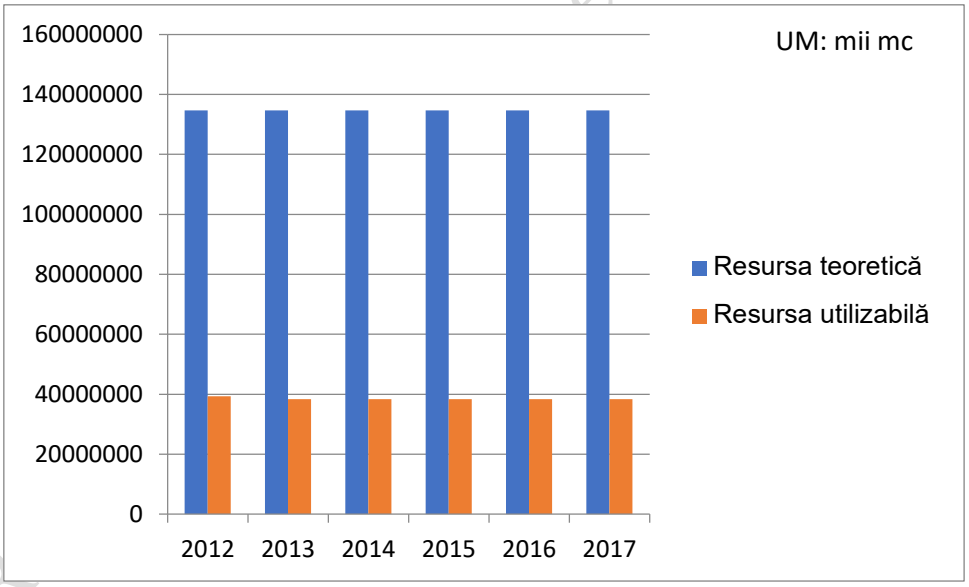


Figure 9 Natural water resource in 2017, compared to the period 2012-2016 (Source: Report on the state of the environment in Romania, ANAR)

As regards the water demand compared to the sampling of water volumes in 2017, according to the Report on the state of the environment in Romania, year 2017, the following were sampled: a quantity of 2921401 thousand cubic meters from the surface water (interior rivers and natural lakes), the demand being of 3245288 thousand cubic meters, a quantity of 646430 thousand cubic meters from the underground water, the demand being of 689566 thousand cubic meters, a quantity of 3194512 thousand cubic meters from the Danube River, the demand being of 3050420 thousand cubic meters and a quantity of 10305 thousand cubic meters from the Black Sea, the demand being of 10345 thousand cubic meters (*Figure 10*).

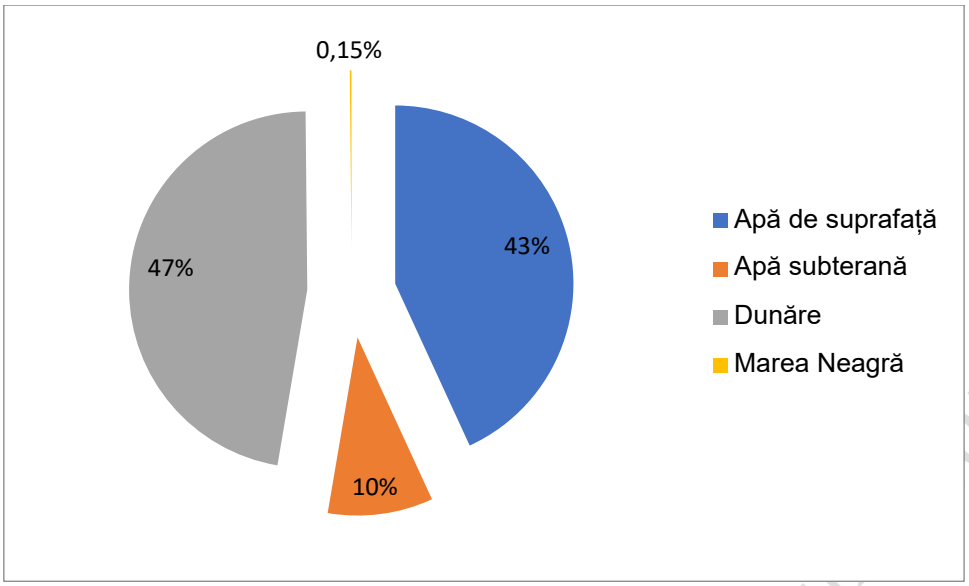


Figure 10 Quantity of water taken, expressed in percentages, in 2017 (source: Report on the state of the environment in Romania, 2017 ANPM, taken from ANAR)

The evolution of the water demand compared to the taking of water volumes is presented in Figure 13 where it is apparent that, compared to 2016, the quantity sampled in 2017 is approx. 6% higher, and compared to 2012, approx. 4% higher

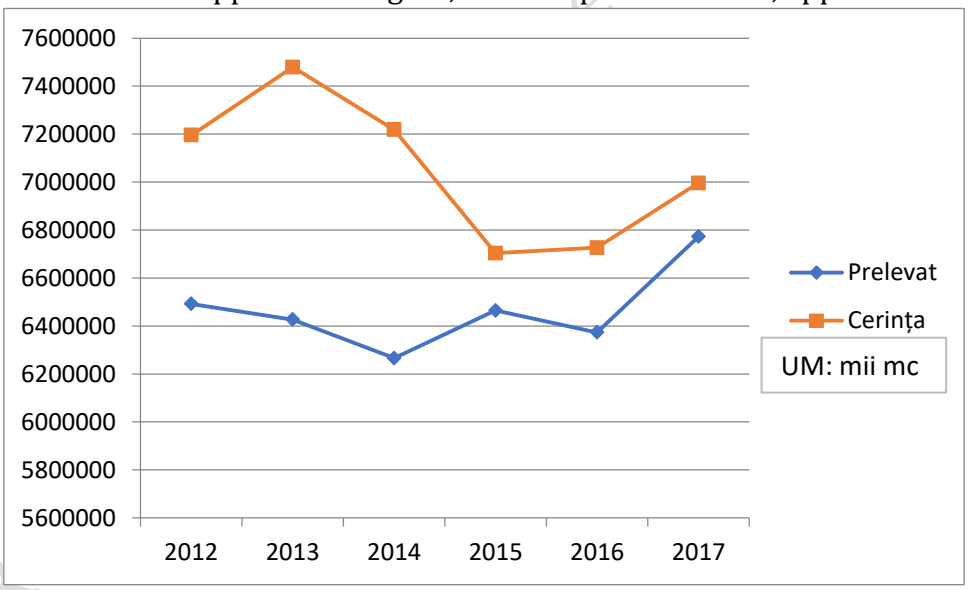
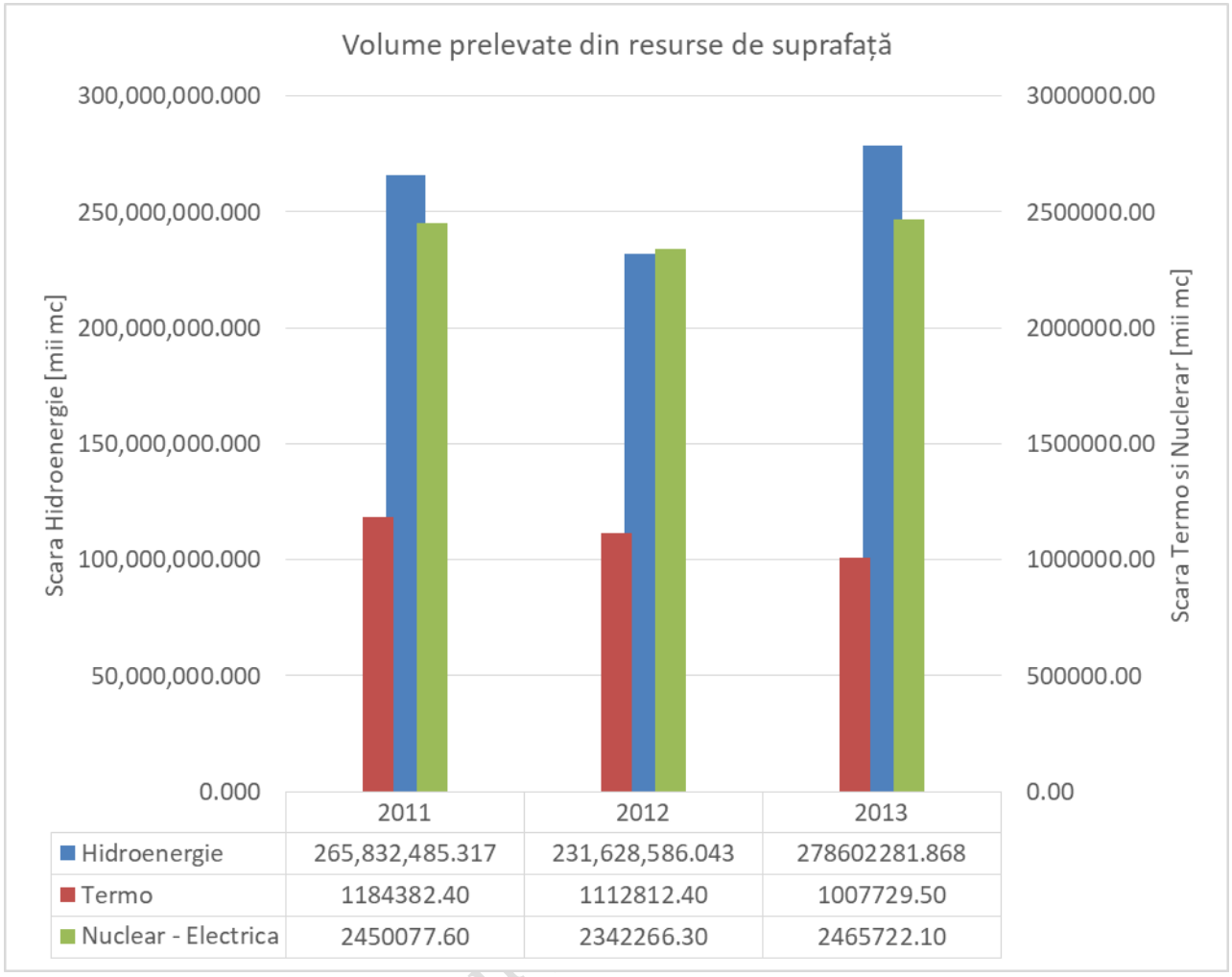


Figure 11 Evolution of the water demand compared to the sampling of water volumes (source: Report on the state of the environment in Romania, 2017 ANPM, taken from ANAR)

The sampling of water from surface sources but not only is a major way of supporting the national economy. The sectors to which the highest quantities of sampled water are allocated are the industry and agriculture preceded by the population water supply systems.



	2011	2012	2013
Hidroenergie	265,832,485.317	231,628,586.043	278602281.868
Termo	1184382.40	1112812.40	1007729.50
Nuclear - Electrica	2450077.60	2342266.30	2465722.10

Figure 12 Water taken from surface sources per types of uses (Source: Water Balance prepared by A.N. Apele Romane in the period 2011-2013, updated National Management Plan of Danube River)

According to the figure above, it can be seen that the largest quantity of water taken from surface water resources is used in hydropower. We specify that the figure above is used at two scales to view the water consumption from heating and nuclear-electrical, volumes that are insignificantly lower than for hydropower.

The ecological state and/or the ecological potential of water bodies can be affected by the hydromorphological alterations and by a high number of projects aimed at providing protection against floods, electricity production, navigation, at different states of planning and implementation that contributes to the physical alteration of water bodies.

We mention that the implementation of these projects can cause pressures that result in the deterioration of the ecological state/ecological potential of water bodies, which is confirmed or not, in the studies that are part of the environmental impact evaluation procedure.

The potentially significant hydromorphological pressures mentioned in the updated management plan in relation to the RES objectives are first of all the damming works with impact on the hydrological regime, the transportation of sediments and the migration of the biota followed by works along the river, dams, regularization works with effects in terms of the hydrological regime and the morphology of water stream beds and water intakes with effects in terms of minimum flow and biota.

A particular attention in this case will be given to the energy sector where a large quantity of water is used to cool down installations. In 2017, aside from the volume of waste water of 1890.8 million cubic meters discharged from different industrial installations, a quantity of 2905.16 million cubic meters is added, representing the cooling water resulting mainly from the energetic industry. According to EUROSTAT, the quantities of water used in the energy industry to cool down installations in the period 2004-2015 are presented in Figure 13.

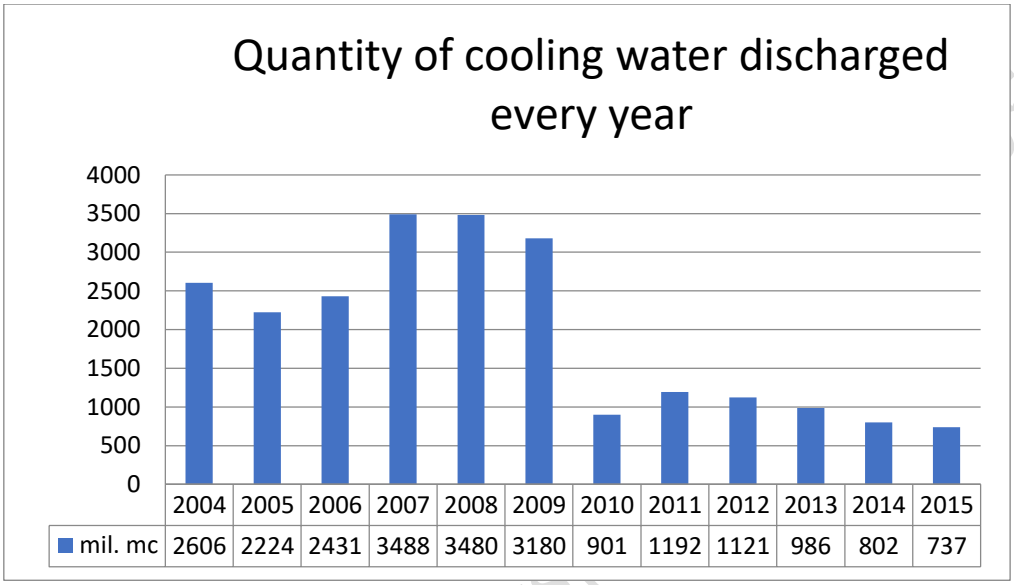


Figure 13 Quantity of water taken for cooling installations from the energetic industry (source: EUROSTAT (sursa:EUROSTAThttps://ec.europa.eu/eurostat/tgm/refreshTableAction.do?tab=table&plugin=1&pcode=ten00006&language=en)

Aside from the discharge of the water used for cooling electricity production installations, wastewater is a category of water of energetic use. The intensity of the impact depends on two main features that wastewater has: the effluent flow and the volume of polluting substances. In this context, according to the information presented in the Summary of the quality of Romanian waters in 2017[15], nationwide, thefollowing fields of economic activity were identified that have a significant contribution on building the potential of pollution:

water abstraction and processing for the population;

-chemical processing;

-electricity and thermal energy;

-metallurgical industry and car building;

- -extractive industry.

In the field of *Electricity and thermal energy* the following values registered in 2017 are important for this study:

[15] Administratia Nationala Apele Romana. Summary of the quality of Romanian waters in 2017 (excerpt) (http://www.rowater.ro/Lists/Sinteza%20de%20calitate%20a%20apelor/DispForm.aspx?ID=17&Source=http%3A%2F%2Fwww%2Erowater%2Ero%2FLists%2FSinteza%2520de%2520calitate%2520a%2520apelor%2FAllItems%2Easpx)

- a total water volume that requires treatment of 546529.59 thousand cubic meters of which 127800.46 thousand cubic meters are not treated and 151.34 thousand cubic meters are improperly treated and 418577.79 thousand cubic meters are treated properly;
- a loading with the following quantities of chemical indicators: 1316,736 t CBO5, 4313,563 t CCO-Cr, 6,572 t total nitrogen, 0,368 t total phosphorus, 320,169 t nitrides, 4,763 t nitrites, 28,585 t ammonium, 17265,571 t suspended particles, 99688,721 t fixed residue, 6561,974 t chlorinate 20954,728 t sulphates, 15005,529 t calcium, 2703,413 t magnesium, 28,248 t total iron, 0,389 t total manganese, 42,093 t sodium, 0,001 t aluminum, 0,007 t H_2S+sulphates, 0,007 t phenols;
- a loading with the following quantities of chemical indicators: 0,207 t synthetic detergents, 1886,777 t extractible substances, 0,296 t petroleum products, 0,0084 t arsenic and compounds, 0,00002 t copper, 0,00001 t cadmium and compounds, 0,001081 t mercury and compounds, 0,020947 t lead and compounds.

Underground water

142 bodies of groundwater were delineated within the country, of which 91 are used for industrial purposes, including for energy purposes. According to the Romanian Environmental Status Report 2016, 19 groundwater bodies were identified which did not achieve good chemical status due to the following parameters: nitrogen and ammonium, for which exceptions were set to achieve the Objectives by 2027. At the level of 2015, underground water bodies had a good chemical status, and 15 were under poor chemical status.

In terms of the energy sector (hydro, thermo and nuclear), the resource of underground water bodies is used to supply with water for making it drinkable or for hygienic purposes for the staff servicing the use of water.

From the data we currently have, there is no information on the amount of pollutants discharged into groundwater from the energy sector, so we are unable to quantify the effect that this sector can produce. According to the *updated National Management Plan corresponding to the National part of the International Hydrographic Basin of Danube,* nationally there are not underground water bodies that have a low quantitative state.

- **Impact on water bodies**

For the subject of this study, one shall approach the objectives targeting nuclear energy, hydroenergy and thermal energy.

- **Nuclear energy**

In this category it is included the objective *Completion of the groups 3 and 4 from C.N.E. Cernavodă.* The objective targets the existing site within C.N.E. Cernavodă and it is in progress. From the perspective of location, C.N.E. Cernavodă does not overlaps the European ecological network Nature 2000.

According to Environment agreement for the project *Continuation of the works of construction and completion of the Units 3 and 4 at C.N.E. Cernavodă*, pursuant to the results and conclusions of the report related to environment impact, of additional

documents submitted by the holder of the project between 2006-2013 and conclusions formulated in the final opinions of the states potentially affected by the project, it is stated that for each environment element one has identified and assessed the potential impacts due to the operation of the Units 3 and 4, as well as the impact cumulated for the simultaneous operation of the 4 nuclear units, not being identified a significant negative impact for normal operation.

Also, the outage of water with changed temperatures formed with the discharge of effluent from C.N.E. Cernavodă in Danube does not present negative effects if the operation of the units 3 and 4 will be made with the observance of the conditions stipulated by the Water Rights Permit no. 49/22.05.2019 related to the *Continuation of the works of construction and completion of the Units 3 and 4 at C.N.E. Cernavodă* issued by the National Administration Romanian Waters that updates the Water Rights Permits no. 12/17.03.2017, 34/19.03.2015, 54/11.04.2013 and 35/14.03.2011 of *Cernavodă Nuclear Power Plant Units 3 and 4*, county Constanța [16]. The conditions entail that the additional thermal input by discharge of effluent will be maximum 10°C on the temperature of Danube and, pursuant to crossing the mixing area, the water temperature will not exceed 35°C.

The impact on biodiversity pursuant to the discharge of cooling water was analysed in the proper study of evaluation, relying on the premise that the nuclear-electric power plant with 4 units is near some Natura 2000 sites. The stations for the special measurements on vertical (on water column) and transversal (left bank - canal – right bank) in the area of outage of water with changed temperatures were in number of 3 and, according to the summary of *Proper evaluation of environment impact of Units 3 and 4 of C.N.E. Cernavodă* – Impact on biodiversity (INCDDD, 2012), were located as follows: P1 – 700 m downstream of waterway outfall for discharge of cooling water, P2 – 1,5 km downstream of waterway outfall for discharge of cooling water and P3 – 2.5 km downstream of waterway outfall for discharge of cooling water.

The characterisation of effluent with temperatures changed discharged in Danube was quantified by Danube Delta– Tulcea[17] Institute of Research Development by performing measurements during summer (July-August 2010), autumn (September-November 2010), winter (January-March 2011) and spring (April-May 2011) and some tests in laboratory of hydrochemical and hydrobiological samples of the cooling canal of C.N.E. Cernavodă and stations established on the level of Rasova-Capidava sector, with site observations performed on the section Călăraşi-Hârşova. The conclusions resulted pursuant to the interpretation and correlation of results emphasized the following:

- During the periods characterised by the increase of river in Cernavodă by over 200 cm, mainly during summer and winter, the waters having as source the canal of discharge of cooling waters of the power plant flow on Danube on a distance of 3.5 km without mixing;
- On the contrary, during the periods when the Danube level is low in Cernavodă (under 200 cm – spring and autumn), the stratification phenomenon does no

[16] Environment Agreement for the project *Continuation of the works of construction and completion of Units 3 and 4 at C.N.E. Cernavodă*

[17] *Proper evaluation of environment impact of the Units 3 and 4 of C.N.E. Cernavodă* – Impact on biodiversity (INCDDD, 2012) – summary (http://www.mmediu.ro/beta/wp-content/uploads/2012/08/2012-08-10_centrala_cernavoda_studiuincdddrezumatromana.pdf)

longer occur, the waters mixing from the first hundreds of meters after discharging. Thus, the warm water outage presents a length of only 1.5-2 km;

- The dimensions of water outage changed are the following: variable width in the discharge area of 300-400 m reduced to approximately 50 m near the locality Şeimeni.

The potential impact was correlated with the changes that might occur in the future pursuant to commissioning the Units 3 and 4 of C.N.E. Cernavodă considering the length and width of outage of water with temperatures changed in the area of discharge of cooling waters[18]:

High levels of Danube (summer and winter)	Low levels of Danube (autumn and spring)
There is the possibility that the water layer with changed temperatures covers a length of 4.5-6.5 km*. *This depends on the increase of debit of discharged waters with the commissioning of another 2 units within C.N.E. Cernavodă, as well as the difference between the temperature of water coming from the discharge canal and the temperature of Danube waters upstream of the outfall of the canal of discharge of cooling waters.	There is the possibility that the water outage has a length of 3-3.5 km*. * This depends on the increase of debit of discharged waters and the difference between the temperature of water coming from the discharge canal of cooling waters and the temperature of Danube waters upstream of the outfall of the canal of discharge of cooling waters.

As for the width of water outage changed, with the doubling of the debit of cooling water by commissioning the units 3 and 4, it is possible that it increases up to 450 m.

- **Hydroenergy**

According to the *Report on environment condition in Romania, year 2017*[19], the following activities/pressures were discovered on the water bodies with potential impact on water bodies:

Pressure	Effects
Works of transversal retaining situated on the water body	The effects generated by this kind of works have an impact on the hydrologic regime, bed stability, transport of sediments and biota migration, causing the fragmentation/interruption of longitudinal connectivity of water body.
Works along the river	The effects generated by this kind of works have an impact on the vegetation from the flood plain, of the areas of reproduction and longitudinal river profile, sublayer and

[18] *Evaluare adecvată a impactului de mediu a Unităţilor 3 şi 4 ale C.N.E. Cernavodă* – Impactul asupra biodiversităţii (INCDDD, 2012) – rezumat (http://www.mmediu.ro/beta/wp-content/uploads/2012/08/2012-08-10_centrala_cernavoda_studiuincdddrezumatromana.pdf)

[19] Report on environment condition in Romania, year 2017 (http://www.anpm.ro/documents/12220/2209838/Raport+stare+mediu+anul+2017.pdf/12fc7560-32e3-4540-8c36-2432fe7674ae)

	biota structure, this leading to the loss of lateral connectivity.
Sampling and returns/derivations	The effects thereof influence the level of minimum flow, bed and biota stability.
Main and secondary captures	The effects caused by such works may have an impact on the downstream hydrogeomorphological regime of power plant.
Navigable canal	Effects on the stability of bed and biota.

The majority of all these pressures are hydrotechnical and mutually dependent for a good operation of an investment in the field of hydroenergy.

The production of hydroenergy and activities prior to this process presents a range of positive and negative features, although it is associated to a green, clean energy, without carbon discharges and which uses a renewable resource for the production of electricity. Pursuant to specialised studies, the following issues have been identified:

Positive	Negative
* In order to obtain hydroenergy, the driving force is the gravitational force, the water used in this process being a renewable resource (Abbasi and Abbasi, 2011);	* The retaining of waterways influences, on long term, the terrestrial ecological systems and biodiversity widely, the river flow regime, migration of aquatic bodies and it is also determining the occurrence of greenhouse gas emissions and change of ecological condition of water bodies (The Report of the World Commission on Dams, November 2000); * The process of production of hydroenergy influences the flow of rivers, the migration of aquatic bodies and the transport of nutrients and sediments (Bratrich et al, 2004); * The hydroelectric stations have major impact on all kinds of habitats identified where located, on the outfall of river in the sea for big electric stations, on the bankes of rivers where located (Abbasi and Abbasi, 2000).

As for the potential impact of big hydrotechnical constructions, as the case of the objective SER *Performance of power plant Turnu Măgurele - Nicopole 500 MW /Exeuction of hydropower plant with accumulation by pumping Tarnița-Lăpuștești/Execution of hydropower plant Răstolița 35 MW/ Execution of hydropower plant on Jiu River of 90MW/ Execution of hydropower plant on Olt River – 145 MW*, acc. to Bergkamp și colab. (2000) can be divided into three orders of impact as follows:

Impact order	Upstream effects	Downstream effects	Observations
I	*Changes of thermal	*Change of water flow	The effects are

Impact order	Upstream effects	Downstream effects	Observations
	regime of water; *Change of water quality; *Accumulation of sediments in containers.	regime; *Morphological changes; *Changes of water temperature; *Reduction of the quantity of sediments.	immediate or shortly after the start of constructions.
II	*Modification of biotic and non-biotic elements; *Changes of the structure of ecological systems, mainly aquatic; *Modification/Occurrence of misbalances on level of primary productivity, mainly on level of aquatic ecosystems.	* Modification of biotic and non-biotic elements; * Changes of the structure of ecological systems, mainly aquatic; * Modification/Occurrence of misbalances on level of primary productivity, mainly on level of aquatic ecosystems.	The second impact order is the result of modifications caused by the impacts included in the first order. This order is associated to a longer period of time, the effects being noticed few years after the construction of power plant. Bergkamp and collab. (2000) state that the main modifications are emphasized among the riparian vegetation, of the increase rate of macrophytes, plankton and periphyton.
III	*Effects on level of bodies (ichthyofauna, avifauna, invertebrate and mammals) of target ecological systems.	* Effects on level of bodies (ichthyofauna, avifauna, invertebrate and mammals) of target ecological systems; * Downstream impact appears including on the level of discharge of the river in the sea, and on the level of the sea.	The impacts included in the third order are the results of the two orders. These are obvious after a longer period of time opposite to the second order of impact, before reaching a new ecological balance.

- **Thermal energy**

The element incriminated for the potential occurrence of negative impact in case of energy coming from non-renewable sources is represented by the burning of these resources, in this case, burning of carbon and natural gas.

The effects of combustion are multiple and have, on its turn, visible secondary effects present on all levels of organisation of organised matters. The compounds generated by the burning of fossil fuels often remain in the air in the form of polluting particles or reach the ground or waterways with the acid rains that it forms. The main effects of acid rains are the acidification of water or soils and influence on growth or foliar degradation of trees, mainly on high heights.

According to the *National Strategy and Plan of Action* for Conservation of Biodiversity *2010-2020*[20], the exploitation of carbon on surface often needs the uncovering of wide areas, this causing the pollution of surface waters used in floating. For underground exploitations, the acid mine waters and containing heavy metals reach surface causing several ecological misbalances.

The potential impact associated to the production of energy from non-renewable resources, in this case by burning carbon and natural gas, must be analysed from several perspectives: impact caused by the exploitation of resources, transport of it and actual use.

For the two kinds of resources, the main potential effects in the detriment of biodiversity are the following [21]:

Exploitation	Transport	Burning
- Occurrence and aggravation of erosion; - Phonic pollution; - Atmospheric pollution; - Degradation and fragmentation of species´ habitats, manly by stubbing different areas of forest, and facilitation of entry of invasive species; - **Damage of water quality;** - Esthetical alteration of landscape; - Topography changes.	- Accentuation of the impact due to mine exploitation by increase of the concentrations of polluting emissions from mobile sources.	- Increase of atmospheric pollution concentrations due to increased emissions of carbon dioxide, nitric oxide, sulphur and methane dioxide generated by burning, affecting the health of bodies; - contribution to occurrence of photochemical smog, of acid rains and accentuation of the effects of climatic changes.

Also, the high volumes of cooling waters of the installations discharged in the surface water bodies have often a negative impact due to the occurrence of eutrophysing causing major structural modifications, including physical chemical and functional, of aquatic ecological systems.

[20] *National Strategy and Plan of Action* for Conservation of Biodiversity 2010-2020 (http://biodiversitate.mmediu.ro/implementation/legislaie/politici/strategia-nationala-si-planul-de-actiune-pentru-conservarea-biodiversitatii/)

[21] Center for Biological Diversity (https://www.biologicaldiversity.org/programs/public_lands/energy/dirty_energy_development/coal/index.html)

IV.1.3 SOIL

The quality of soils is affected by different degrees of pollution produced by different industrial activities. In the field of soil protection, pollution means any disruption that affects their quality in terms of quality and/or quantity.

The main economic sectors with a significant impact on the soil come from: mining and metallurgy (through waste processing and storage, tailing ponds and tailings dumps), chemical industry (chemical, petrochemical and drugstore waste disposal sites, sites that are abandoned), the oil industry (through soil pollution with hydrocarbons and heavy metals), old pesticide deposits and other large-scale activities (metalworking, non-compliant domestic waste dumps, military sites, woodworking industry, coal power plants , transport activities, service activities, etc.).

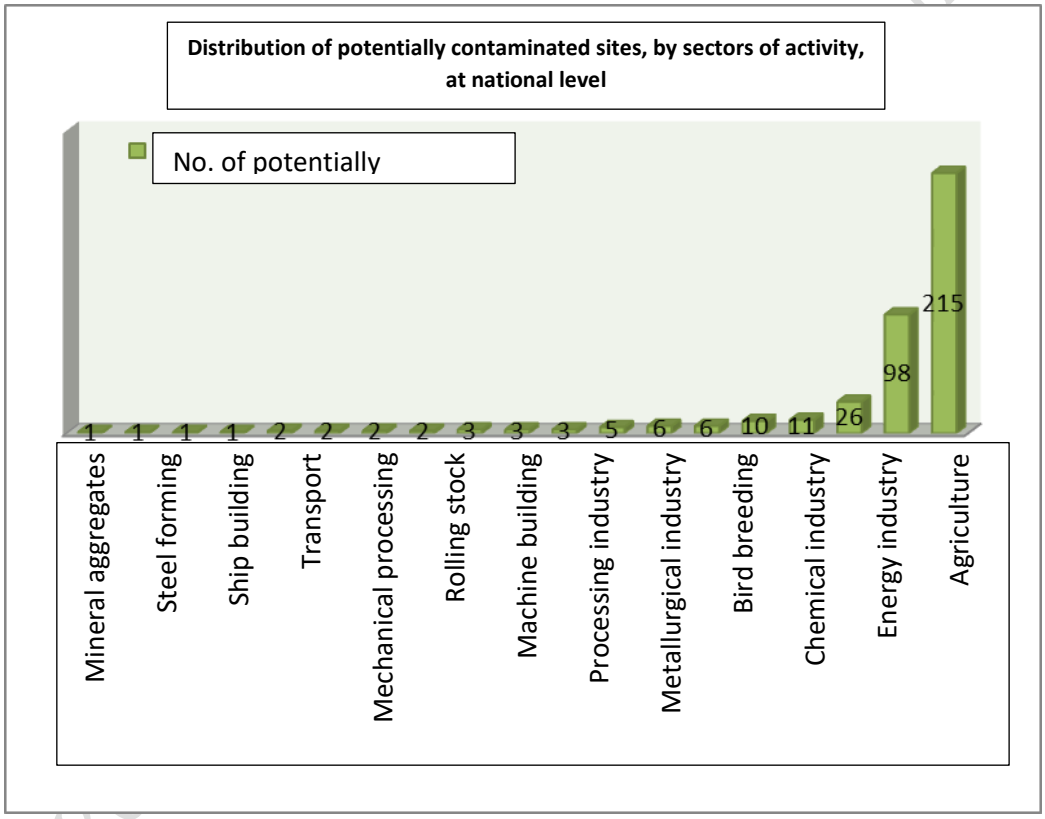


Figure 16 Distribution of potentially contaminated sites by sector at national level (Source: National Strategy and National Action Plan for the management of contaminated sites in Romania, taken from ANPM)

The information used to carry out the *distribution of potentially contaminated sites by sector at national level* was taken from the preliminary national inventory of potentially contaminated sites carried out by ANPM in 2008-2009. For these sites, there is information about the activities that have been carried out, but there is no environmental documentation for the risk assessment, i.e. the level I and/or II environmental review and/or the risk assessment report. After making these documentations, it can be determined whether the sites are contaminated or uncontaminated. From the analysis of the figure above, it can be seen that the energy industry has a number of 5 potentially contaminated sites. Also, most potentially

contaminated sites are in the oil extraction industry, 215, this being also the most widespread economic activity at national level.

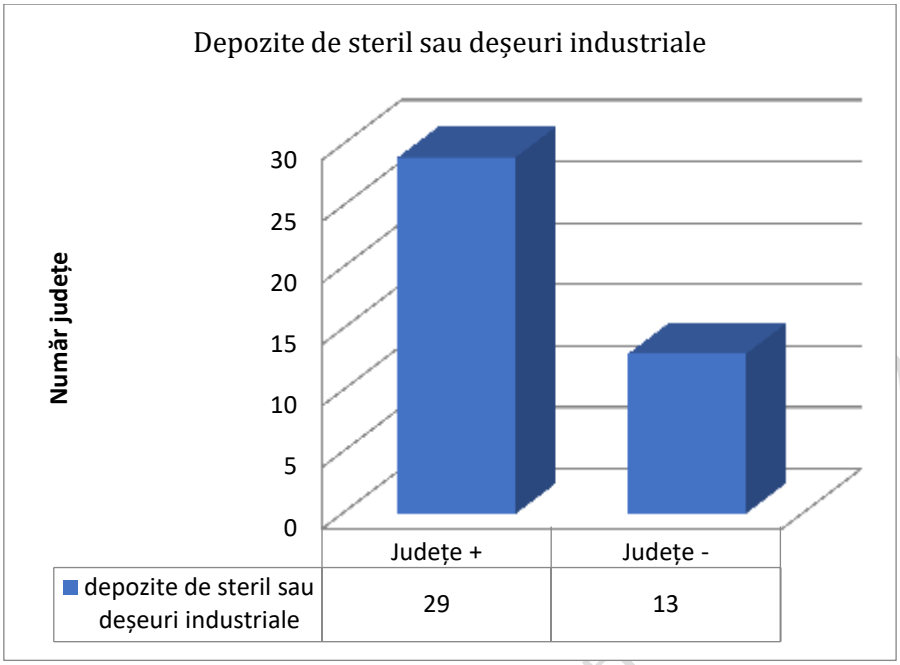
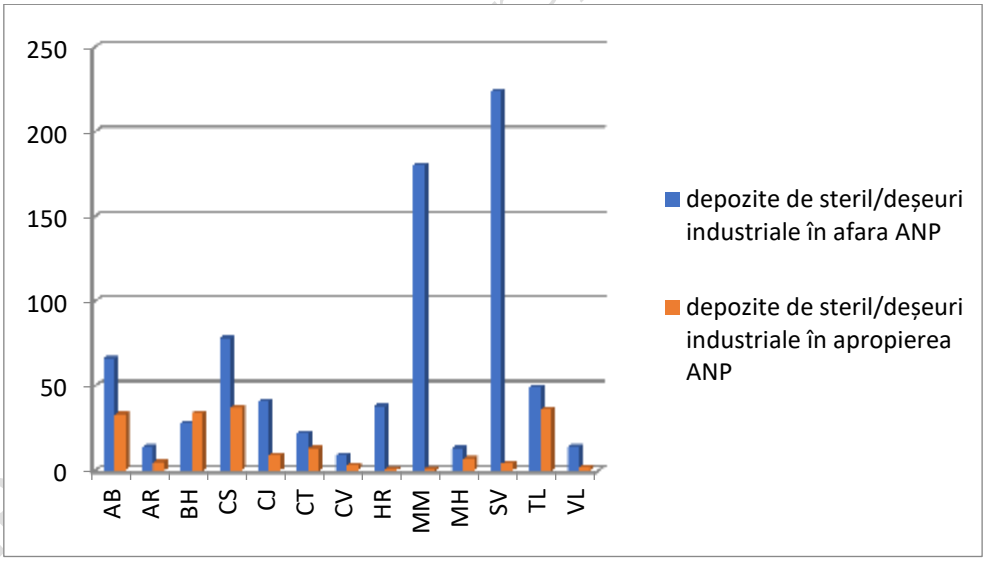


Figure 14 Representation of the counties that have deposits and/or industrial waste (Source: Ministry of Economy, Report – Inventory and visual inspection of dumps and decantation ponds in Romania, September 2017)



dump /industrial waste deposits outside ANP

dump /industrial waste deposits close to ANP

Figure 17 Representation of dump and/or industrial waste deposits in relation to natural protected areas (Source: Ministry of Economy, Report – Inventory and visual inspection of dumps and decantation ponds in Romania, September 2017)

The above figures illustrate the dump and/or industrial waste deposits at the level of counties. Figure 17 shows "counties+~, the counties where such deposits are located, and "counties-" representing counties where such deposits do not exist. Figure 18

shows counties where dump and/or industrial waste deposits are close to natural protected areas. Therefore, from a total of 29 counties with dump and/or industrial waste deposits, only 13 have such deposits located close to natural protected areas. We specify that not all dump and/or industrial waste deposits come from the energetic sector.

IV.1.4 CLIMATE CHANGE

According to the European Environment Agency, climate change corresponds to the greatest environmental threats and, implicitly, to the socio-economic framework. In the last 150 years, the average global temperature has increased by about 0.8 °C and at European level by about 1 °C. The consequences of climate change have become observable and are associated with extreme climatic events such as heat waves and droughts and floods for which intensification is expected. The impacts that these major climatic changes have and will have on biodiversity are indisputable and therefore, in order to reduce them, there is a need for a significant reduction of GHG emissions (GHG) at worldwide level.

GHGs, the main responsible for the emergence and intensification of climate change, have as major sources of emissions into the atmosphere different sectors of the economic sectors of great social and economic importance:

- combustion of fossil fuels for energy production;
- agriculture and land use, especially the changes that have taken place therein, such as deforestation;
- disposal of waste;
- use of fluorinated industrial gases (HFC - hydrofluorocarbons, PFC - perfluorocarbons and SF6 - sulphur hexafluoride).

Measures to reduce GHG emissions are a priority at the level of the European Union, committing itself to transforming the European economy into a highly energy-efficient, low-carbon economy. In this respect, the EU's main objective is to reduce GHG emissions by 80% -95% by 2050 compared to 1990 emissions. The first climate change measures were adopted by the EU in 2008, and through this package of measures three key objectives for 2020 are also identified, also referred to as *20-20-20 Objectives*, namely:

- 20% reduction in GHG emissions;
- increasing the share of energy from renewable resources by up to 20%;
- achieving a 20% improvement in energy efficiency.

At the same time, the 28 EU Member States are signatories to the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol and the Global Climate Change Paris Agreement. Following ratification by Law no. 3/02.02.2001 of the Kyoto Protocol to the United Nations Framework Convention on Climate Change adopted on 11 December 1997, Romania has undertook that it will comply with the provisions on limiting and reducing GHG emissions (carbon dioxide, methane CH4, N2O nitrous oxide, HFC hydrofluorocarbons, PFC perfluorocarbons and sulphur hexafluoride SF6) to promote sustainable development.

In the first phase of the Kyoto Protocol, Romania committed itself to reduce GHG emissions by 8% over the reference year 1989 in the period 2008-2012. Thus, according to the National Inventory of Greenhouse Gas Emissions and against the

backdrop of the decline in economic activity and energy consumption that marked the period 1989-1995, Romania managed to reduce GHG emissions by 60% compared to 2008-2012 1989 (Figure 15). It is noted that the largest contribution to the total annual GHG share is held by CO2, being 67% -69%.

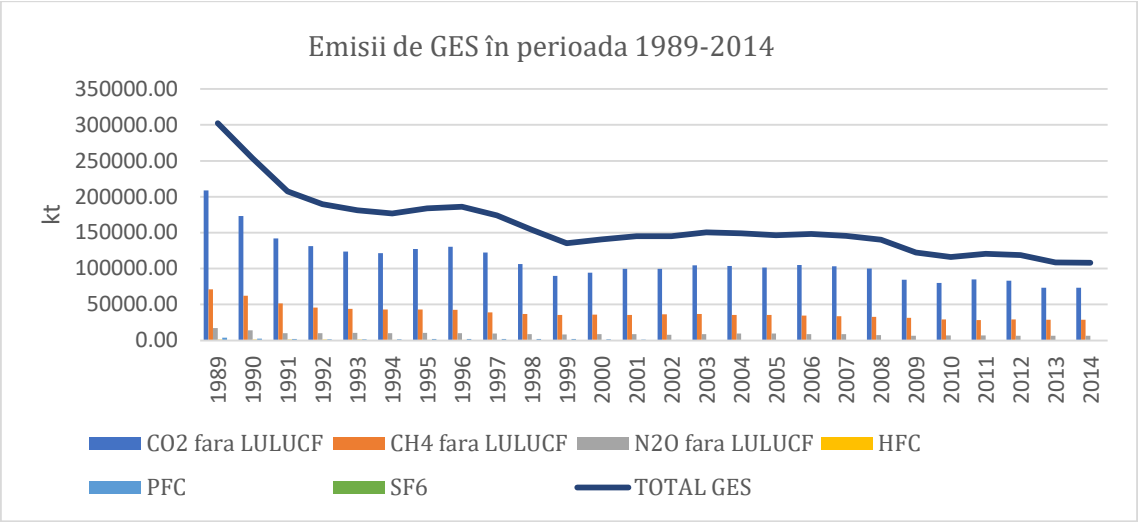


Figure 15 Dynamics of total GHG emissions at national level during 1989-2014 (source: NIR 2016)

According to *Romania's Third Biennial Report under UNFCCC 2017* , the period 2010-2015 was characterized by the maintenance of GHG emissions.

According to the information represented in Figura 16 , at the level of Romania, the energy sector is the most important economic sector and at the same time is responsible for 69.52% of the total GHG emissions in 2014. However, compared to 1989, emissions from this sector decreased by 65.32%. The second important economic sector in terms of GHG emissions is agriculture, thus contributing with 15.35% to total emissions for 2014. The reduced contribution of this economic sector is due to the reduction of the number of farms, the cultivated area and the quantities of N-based fertilizers applied lately, thus registering a reduction of 54.38% of the quantities of GHGs released annually compared to the year 1989.

The agricultural sector is preceded by that of industrial processes which, due to the decline or cessation of certain production activities, contributed with 9.89% to the total GHG emissions in 2014. The last major sector is waste, with the trend of emissions increasing, with 12.09% more than in 1989. However, the contribution of this economic sector was 5.24% of total GHG emissions in 2014.

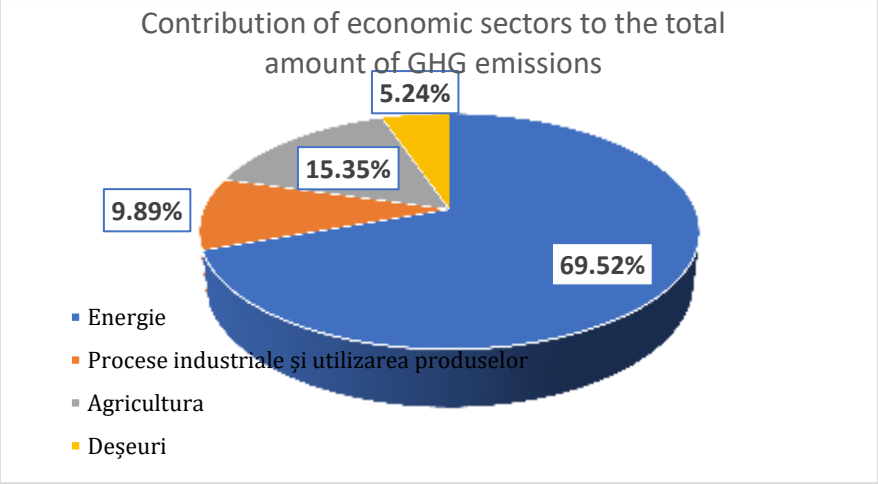


Figura 16 Contribution of the economic sectors to the total quantity of GHG emissions in 2014 in Romania (Source: NIR 2016)

Energie – energy

Procese industriale si utilizarea produselor – industrial processes and product use

Agricultura – agriculture

Deseuri - waste

The energy sector is the major anthropogenic source of GHG at national level. Its percentage contribution by type of gas is represented by Figure 17.

The main economic categories included in this sector are as follows:

- 1.A.1. Energy Industries;
- 1.a.2. Processing and Construction Industries;
- 1.a.3. Transport;
- 1.a.4. Other sectors (Commercial/Institutional, Residential, Agriculture/Forestry/Fisheries);
- 1.B. Fugitive Emissions from Fuels.

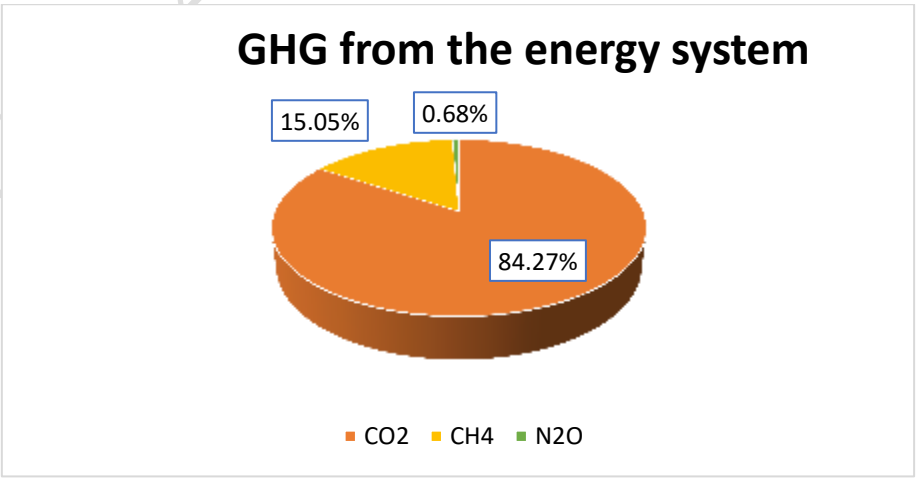
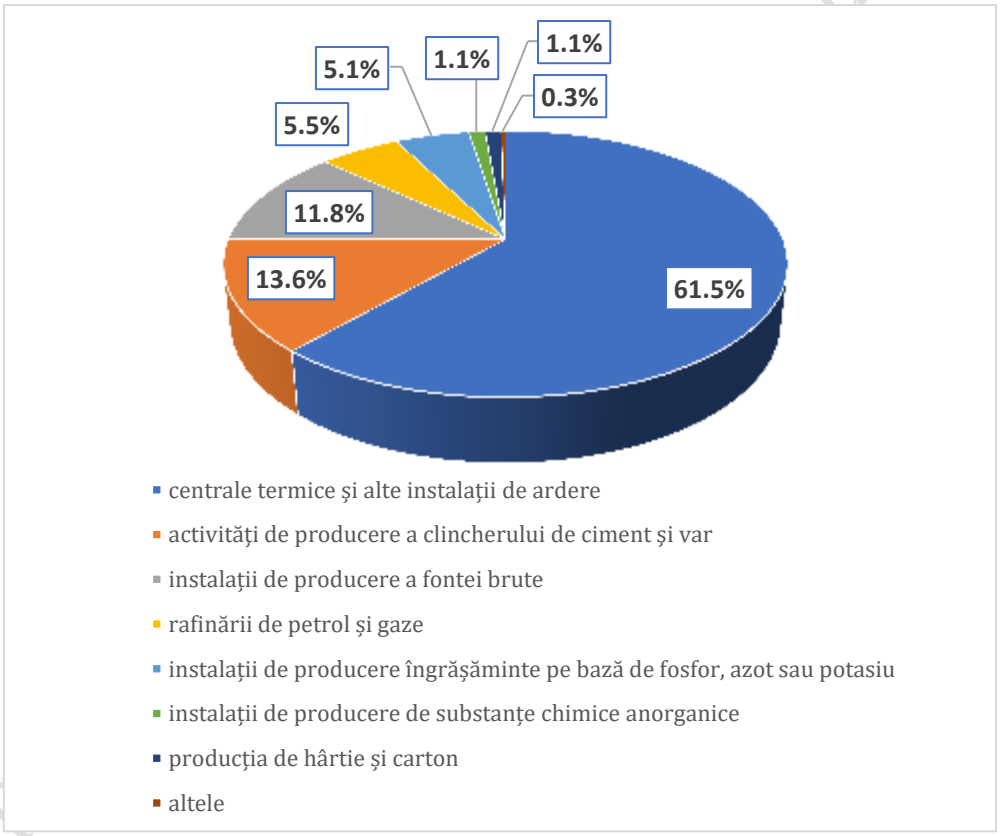


Figure 17 GHG from the energy sector in 2014 in Romania (source: NIR 2016)

The second commitment period under the Kyoto Protocol is established by *the Doha Amendment*, ratified by Law no. 251/2015 for the adoption of the Doha Amendment, adopted at Doha on 8 December 2012, to the Kyoto Protocol to the United Nations Framework Convention on Climate Change adopted on 11 December 1997, targeting the 2013-2020 period and is the stage where the EU has undertaken GHG emissions reduction by 20% over 1990. According to the Annual Report on the state of environment in Romania in 2016, the amount of CO2 released at national level was 39 704 000 tonnes, about 75% less than in 1990, coming from the following 12 industrial sectors presented in Figure 22.

With regard to greenhouse gas emissions, such as nitrogen oxides (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and sulphur dioxide (SO2) it must be said that their national trend is still decreasing and is due to the much reduced quantities of fuels used in the combustion processes in the energy sector as well as due to the reduction of the sulphur compounds from the different types of fuels.



Heating plants and other combustion plants
Cement and lime clinker production
Pig iron manufacturing plants
Oil and gas refineries
Phosphorus, nitrogen or potassium-based fertilizer manufacturing
Inorganic chemical manufacturing installations
Paper and cardboard manufacturing
Others

Figure 18 Sources of CO2 emissions in 2016 (source: Environmental status report, 2016, ANPM)

IV.1.5 BIODIVERSITY

At the level of Romania, the conservation of biodiversity is achieved through a network of protected natural areas designated due to the ecological, scientific or cultural value identified on their territory. This network consists of: 940 protected natural areas of national interest, 19 wetlands of international importance (RAMSAR sites); 3 Biosphere Reserves; 1 natural site of universal natural heritage; 606 Natura 2000 sites.

Their location at national level is represented in Protected natural areas of national interest

Natural sites of the natural universal patrimony

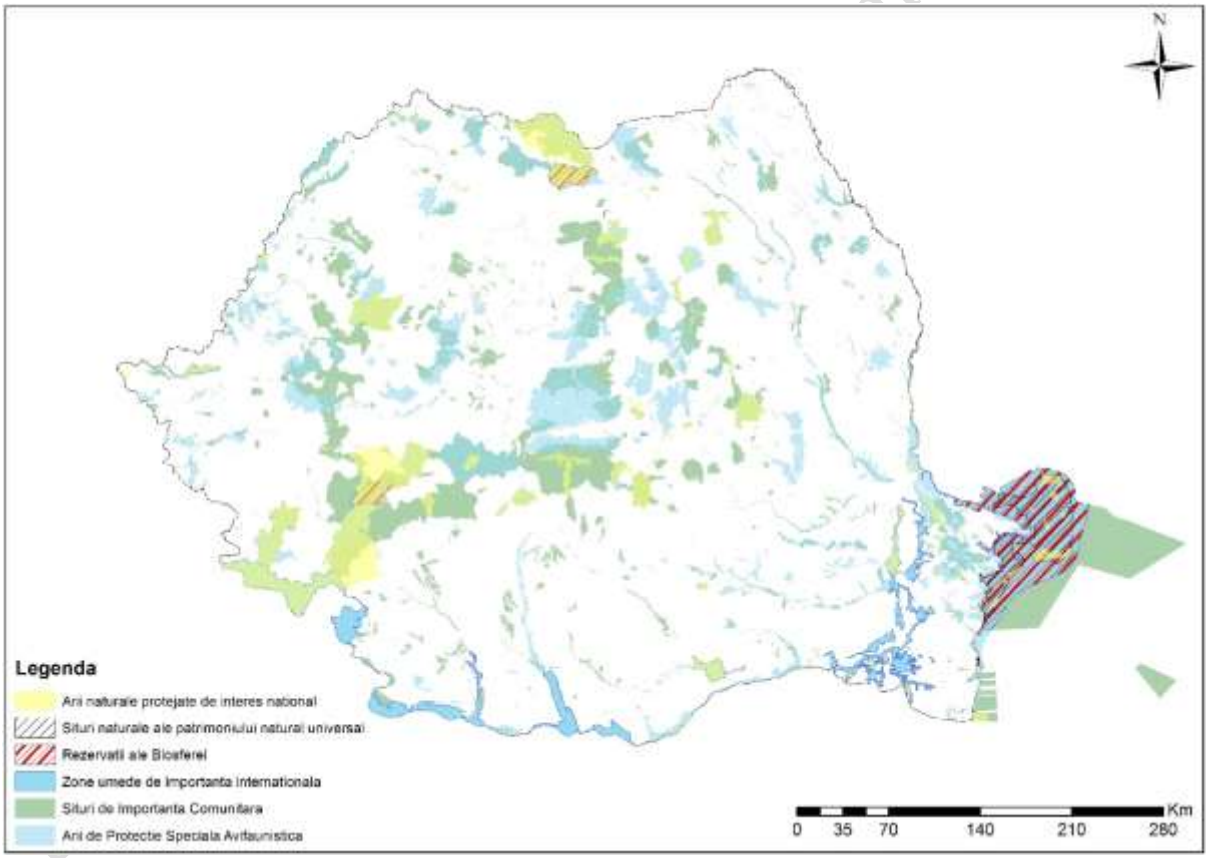
Biosphere reservations

Wetlands of international importance

Sites of Community importance

Special Protected Bird Areas

*Figure **19**.*



Protected natural areas of national interest

Natural sites of the natural universal patrimony

Biosphere reservations

Wetlands of international importance

Sites of Community importance

Special Protected Bird Areas

Figure 19 Representation of the protected natural areas on the territory of Romania

According to the National Strategy and the Action Plan on Biodiversity Conservation 2013-2020, natural and semi-natural ecosystems account for about 47% of the country's surface, 45% for agricultural ecosystems, and the remaining 8% for construction and infrastructure.

Of the 35 hydropower accumulating lakes represented in Figure 79 , the section IV.1.2 , 13 are located on SPA territory and 12 on SCI territory. Taking into account the fact that most of the two types of areas are overlapping, the total number of hydropower accumulation lakes on the territory of Natura 2000 sites in Romania is 19.

The proposed investments to be made by 2030, in line with the objectives of the RES 2019-2030, with perspectives for 2050 on the development of the energy sector, are as follows:

1. Completion of Groups 3 and 4 from Cernavoda nuclear power plant;
2. Achievement of the pumping accumulation hydro power plant from Tarniţa-Lăpuştești;
3. Achieving the 600 MW Group from Rovinari.

The potential impact they will have on biodiversity is reflected on the one hand in the location on the territory of protected natural areas or at a certain distance from them, and on the other hand on the activities deriving from the implementation of projects, as follows:

- the realization of the pumping accumulation hydropower plant from Tarniţa-Lăpuştești could have a negative impact, (increase of the noise level affecting the species of fauna of conservation, fragmentation of the habitats for water species by creating dams – the lack of migration passages for the water fauna, reduction of the water flow for sustaining species of water flora and fauna), directly or indirectly, on the species and habitats of community interest present on the territory of the following protected natural areas within the location of the project: ROSCI0263 Valea Ierii, ROSCI0427 Pajiştile de Liteni-Savadisla, by alteration, fragmentation or loss of habitats and implicitly of the species protected by sites; measures of prevention, reduction and compensation; restricting the use machines and vehicles and manual execution of works in areas or in period when species of fauna are vulnerable; creating fauna migration opportunities; ensuring biological corridors/passages for the movement of fauna; carrying out construction works outside the mating season of protected animals identified in the area of such works.
- the realization of a new 400 MW energy group at Turceni could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the territory of the protected natural area ROSCI0045 Jiu Corridor in the vicinity of the location of the project; please note that this project will be located on the existing site or in the immediate vicinity; measures of prevention, reduction and compensation; restricting the use of machines and vehicles and manual execution of works in areas or in period when species of fauna are vulnerable; monitoring indicators from the discharged water in the natural receiver (Jiu River)during the period of construction and use;
- the realization of a new 400 MW CCCGT energy group on gas with flexible operation Mintia could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the territory of the

protected natural area ROSCI0373 Mureş River between Brănişca and Ilia located near the location of the project; please note that this project will be located on the existing site or in the immediate vicinity; measures of prevention, reduction and compensation; restricting the use of machines and vehicles and manual execution of works in areas or in period when species of fauna are vulnerable; monitoring indicators from the discharged water in the natural receiver (Mureş River), during the period of construction and use;

- the realization of the hydroelectric power plant 35 MW Rostoliţa could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the protected natural areas ROSPA0133 Calimani Mountains located near project site and ROSCI0019 Călimani-Gurghiu by alteration, fragmentation or loss of habitats and implicitly of specifies protected by sites, located inside the area where the project is located; the following measures of conservation are proposed for maintaining the species and habitats: maintaining the current groundwater level by forbidding works that have an impact on the groundwater, maintaining the habitats not allowing cutting works or replacing the species from that habitat with other species; execution of works during the period of construction and use (maintenance) outside the periods when a series of groups of bodies of conservative interest are in the period of chicken reproduction and/or raising;
- the realization of hydroelectric power stations on the Jiu River 90 MW could have a negative impact, directly or indirectly, on the species and habitats of the community located on the territory of the natural protected area ROSCI0063 Defileul Jiu located within the area where the project is located, by alteration, fragmentation or loss of habitats and implicitly of the species protected by sites; measures of prevention, reduction and compensation; restricting the use machines and vehicles and manual execution of works in areas or in period when species of fauna are vulnerable; creating fauna migration opportunities; ensuring biological corridors/passages for the movement of fauna; carrying out construction works outside the mating season of protected animals identified in the area of such works.
- the achievement of the hydroelectric power plants 145 MW on the Olt River could have a negative impact, directly or indirectly, on the species and habitats of the community present on the protected natural areas ROSCI0085 Frumopasa, ROSPA0043 Frumoasa, ROSCI0112 Făgăraş Mountains, ROSCI0304 Hârtibaciu de Sud-est and ROSCI0132 Olt Mijlociu-Cibin-Hârtibaciu near the location of the project; by alteration, fragmentation or loss of habitats and implicitly of the species protected by sites; measures of prevention, reduction and compensation; restricting the use machines and vehicles and manual execution of works in areas or in period when species of fauna are vulnerable; creating fauna migration opportunities; ensuring biological corridors/passages for the movement of fauna; carrying out construction works outside the mating season of protected animals identified in the area of such works.
- the realization of the 500 MW power plant Turnu Magurele - Nicopole could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the protected natural areas RORM0012 Suhaia, ROSCI0044 Corabia-Turnu Magurele, located inside the area where the project is placed, and ROSCI0039 Ciuperceni-Desa, ROSCI0044 Corabia-Turnu Magurele,

ROSCI0045 Jiu Corridor, ROSCI0173 Stârmina Forest, ROSCI0206 Portile de Fier, ROSCI0299 Dunărea la Gârla Mare- Maglavit, ROSCI0306 Jiana, ROSPA0011 Blahniţa, ROSPA0013 Calafat-Ciuperceni-Danube, ROSPA0023 Jiu-Danube confluence, ROSPA00024 Olt-Danube confluence, ROSPA0026 Danube-Baziaş-Portile de Fier course, ROSPA0046 Gruia-Gârla Mare, ROSPA0074 Maglavit, ROSPA0080 Almăjului-Locvei Mountains, ROSPA0135 Nisipurile de la Dăbuleni near the location of the project; by alteration, fragmentation or loss of habitats and implicitly of the species protected by sites; measures of prevention, reduction and compensation; restricting the use machines and vehicles and manual execution of works in areas or in period when species of fauna are vulnerable; creating fauna migration opportunities; ensuring biological corridors/passages for the movement of fauna; carrying out construction works outside the mating season of protected animals identified in the area of such works;

- the realization of the new 400 kV Gutinas-Smârdan LEA (overhead power line - en.) could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the protected natural areas ROSCI0162 Lunca Siretului Inferior and ROSPA0071 Lunca Siretului Inferior inside the area where the project is located;
- the realization of the new 400 kV Cernavoda-Stâlpu LEA may have a negative impact, directly or indirectly, on the species and habitats of community interest present on the protected natural areas ROSPA0012 Bratul Borcea, ROSCI0290 Ialomiţa Corridor, ROSPA0120 Kogălniceanu-Gura Ialomiţei, ROSPA0006 Balta Tătaru inside the area where the project is located;
- the realization of the new 400 kV LEA Portile de Fier - Anina-Reşiţa could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the territory of protected natural areas ROSCI0206 Portile de Fier, ROSCI0198 Mehedinţi Plateau, ROSCI0069 Domogled-Valea Cernei, ROSCI0226 Semenic-Cheile Caraşului, ROSCI0031 Nerei-Beusniţa Gorges, ROSPA0080 Almăjului-Locvei Mountains, ROSPA0086 Semenic Mountains - Carasului Gorges, ROSPA0020 Nerei-Beusnita Gorges located inside the area where the project is located;
- the realization of the LEA 400 kV Resita (Romania) - Pancevo (Serbia) could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the protected natural area ROSCI0226 Semenic-Caraşului Gorges located inside the area where the project is located;
- the realization of a 400-kV crossover of the 220 kV dc LEA Reşiţa-Timişoara-Săcălaz-Arad could have a negative impact, directly or indirectly, on the species and habitats of community interest present on the territory of the protected natural area ROSCI0277 Becicherecu Mic, ROSCI0109 Lunca Timişului, ROSPA01258 Lunca Timişului, ROSPA0047 Hunedoara Timişană within the area the project is located.

We mention that for implementing the aforesaid projects, the measures of prevention, reduction and compensation mentioned in this study will be take into account and then in the environmental impact evaluation procedure to identify other forms of impact, more detailed for each taxonomic group identified in the habitat of the project.

IV.1.6 LANDSCAPE

According to Government Emergency Ordinance no. 57/2007 on the regime of natural protected areas, conservation of natural habitats, wild flora and fauna, approved with amendments and additions by Law no. 49/2011, the landscape is defined as "the area perceived by the population as having specific characteristics resulting from the action and interaction of natural and/or human factors". The importance of the landscape is underlined by Law no. 451/2002 for the ratification of the European Landscape Convention, adopted in Florence on October 20, 2000, according to which the landscape is an important part of the quality of life that contributes to the formation of local cultures and is at the same time the basic component of the European natural and cultural patrimony that participates in the consolidation of the identity of Europe.

Landscape degradation is closely related to the degradation of biological diversity conservation status. The National Strategy and the Action Plan for the Conservation of Biodiversity 2013-2020 emphasize that the main anthropogenic elements that have induced the modification of the composition and functions of the ecological systems, including the productive and support capacity of the biodiversity in Romania derive from the Objectives of the socio-economic development strategies, as well as from the means used for their implementation in the period 1950-1989.

The visual impact is generated by a series of anthropic actions, including:

- Conversion of natural and semi-natural ecological systems into agricultural production systems;
- Increased industrialization due to the development of production infrastructure in large units. The industrial sectors concerned are ferrous and non-ferrous metallurgy, chemical and petrochemical industry, machine building. The impact on the landscape in this case is indirect due to increased consumption of non-renewable mineral and energy resources, a major contribution to air, surface and groundwater or soil pollution;
- Overexploitation of forests, with direct consequences on the structure and functions of ecosystems, generating ecological imbalances especially at the level of the river basins in the mountain area;
- Realization of extensive hydro-technical works for the accumulation of water;
- Increasing electricity production capacity in the context of increasing population needs and continuing urbanization that brings inferior coal consumption and the exploitation and expansion of surface mining activities by expanding the areas occupied by non-certified tailings dumps and increasing the distribution infrastructure of electricity by increasing the number of overhead power lines (LEA), both of which contribute to the qualitative degradation of the landscape;
- Urban development, especially urban population growth, leads to the deterioration of the urban landscape by diminishing the area of green spaces or by building on them, cutting trees or by inefficient waste and wastewater collection and treatment measures;
- Developing transport infrastructure by fragmenting natural habitats and, implicitly, landscapes;
- Overexploitation of renewable and non-renewable natural resources to feed production processes, especially those in the energy sector.

IV.1.7 CULTURAL ASPECTS

Section III - PROTECTED AREAS of the National Territorial Planning (PATN) approved by Law no. 5 of March 6, 2000, provides the list of heritage values of national interest (historical monuments of particular national value). Its composition is presented in Table 2.

Table 2 List of heritage values of national interest (historical monuments of particular national value) and their number according to Section III - PROTECTED AREAS of PATN

Architectural monuments and ensembles	Archaeological monuments and sites
• Citadels: 35 • Lordly courtyards in ruin: 5 • Fortified churches - citadels: 22 • Castles, mansions, palaces: 28 • Towers: 11 • Urban civil buildings: 70 • Urban settlements: 20 • Wooden churches: 81 • Outdoor ethnographic museums: 7 • Rupestral churches: 6 • Churches and monasteries: 197 • Industrial architecture; communication facilities: 13 • Monuments of folk architecture (village dwellings): 15 • Traditional rural ensembles: 7	• Paleolithic sites: 6 • Neolithic and Eneolithic settlements: 11 • Bronze Age settlements and necropolis: 6 • Fortifications and settlements of the first Iron Age (hallstattien): 9 • Dacian fortifications: 35 • Necropolis and sacred areas - the Iron Age: 8 • Castles and related civil settlements; Roman-Byzantine fortifications: 33 • Antique cities: 10 • Edifices: 6 • Medieval monuments identified on the basis of archaeological research: 15 • Archaeological reservations containing sites with long-term habitat levels - settlements and necropolises: 6

According to the Strategy for National Culture and Heritage 2016-2022, the total number of historical monuments in Romania in 2015 was 30,136, more than half of them being represented by architectural monuments Figure). Monuments are also classified into two major categories: monuments of national interest (6,875) and monuments of local interest (23,261).

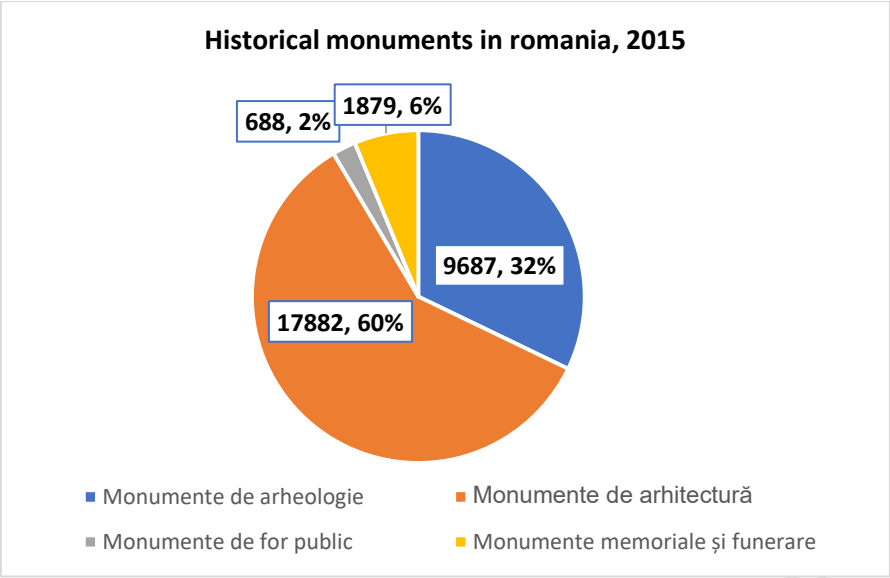


Figure 23 The total number of historical monuments at national level, by types of monuments (Source: Strategy for National Culture and Heritage 2016-2022)

According to the lists of historical monuments (2015) related to each county, their localization at national level is represented in Figure . Of the total number of monuments, 38% are located in Bucharest and Cluj, Iasi, Dâmboviţa, Prahova, Sibiu, Arges and Mureş counties.

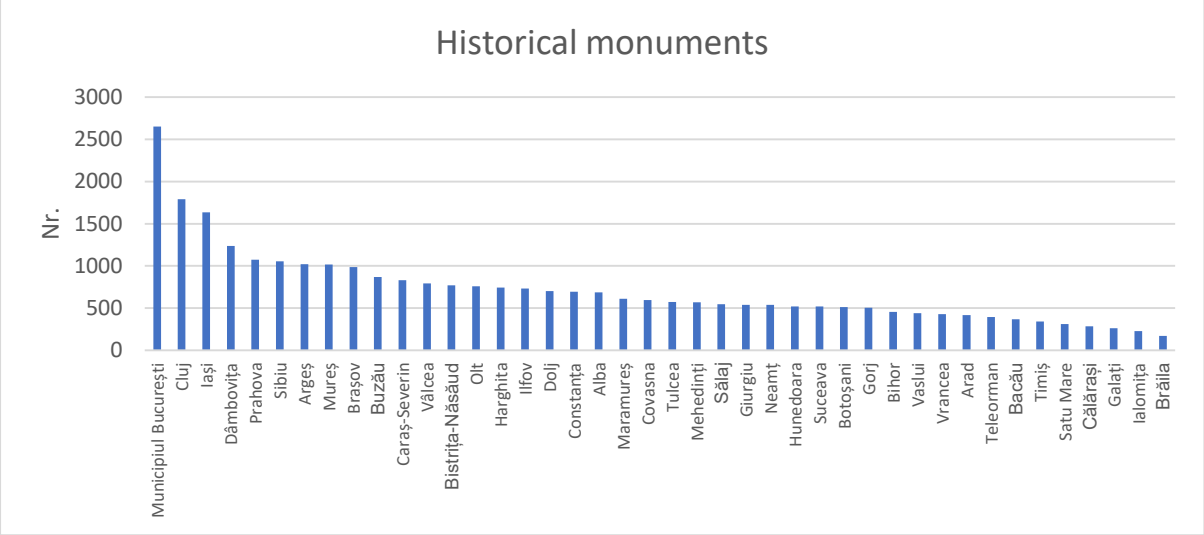


Figure 24 The number of historical monuments in the counties of Romania, 2015 (source: Ministry of Culture)

The state of preservation of historical monuments is presented in the framework of the National Culture and Heritage Strategy 2016-2022 as follows: for 43% of them the situation is unknown, 38% have a poor conservation status, 16% have a medium conservation status, good and very good, and 3% are in pre-collapse and collapse.

The objectives presented in RES 2019-2030, with the perspectives of 2050, are not located in the vicinity of historical monuments, the closest is located at approx. 2 km from the project "execution of the hydropower plant Turnu-Magurele – Nicopole 500

MW" (TR-I-s-A-14229 Archaeological site from Turnu Magurele, "Turnu" point – TURNU MAGURELE municipality – "Turnu", at 3 km SW of the city, close to the Danube - XIV-XIX sector, Medieval Era)[22]. Regarding the way the energy sector affects the state of historical monuments, there are no studies or data to highlight the relationship between them or the potential impact this economic sector has.

IV.1.8 CONSERVATION OF NATURAL RESOURCES

Preserving natural capital and ensuring the support of socio-economic development over the longest time is the goal of sustainable development. Among the components of the natural capital and the other components of the ecosphere there are interdependence relationships, any structural change, whether minor or major, producing immediate functional imbalances or, in some cases, after a certain period of time.

The most affected components are those that are indirectly indispensable to humans and have a wide range of uses. The most used non-renewable natural resources, the raw materials in the case of energy production, are oil, natural gas, coal.

According to the National Institute of Statistics, the primary energy resources by categories and quantities expressed in thousands of tonnes of oil equivalent are represented in FigurE ***20*** 26 and FigurE ***21***27 . In all cases, there is a decline in resource stocks, amid the decline in economic activity and energy consumption that marked the 1989-1995 period and the restructuring of the economic sectors over the last period of time.

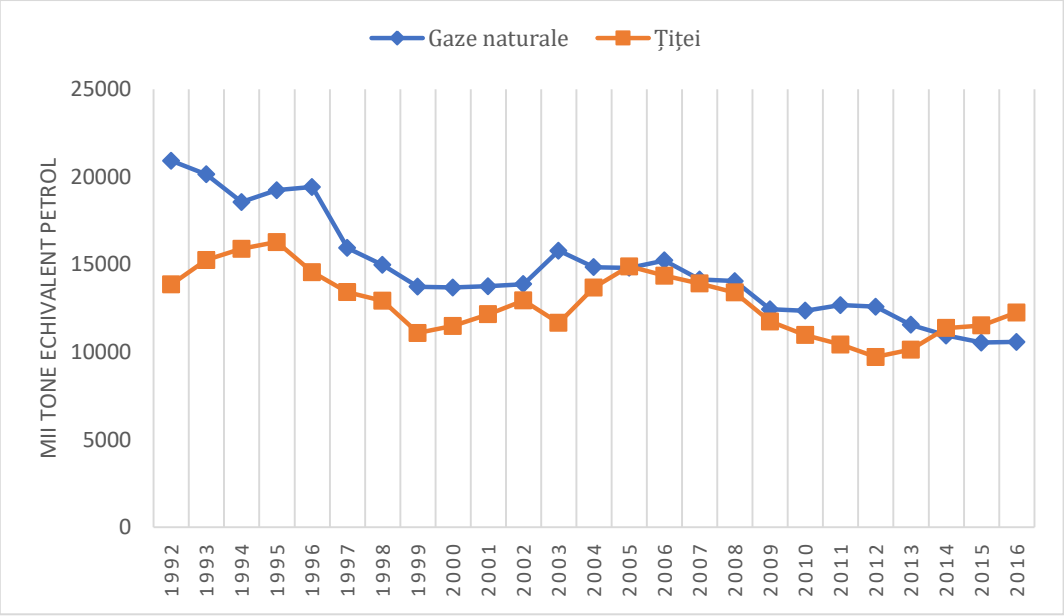


FigurE 20 The evolution of the quantities of primary energy resources (natural gas, crude oil) during the period 1992-2016 at national level (source: Tempo, INS)

[22] According to the List of historical monuments 2015 – Teleorman County, Ministry of Culture (https://patrimoniu.gov.ro/images/lmi-2015/LMI-TR.pdf)

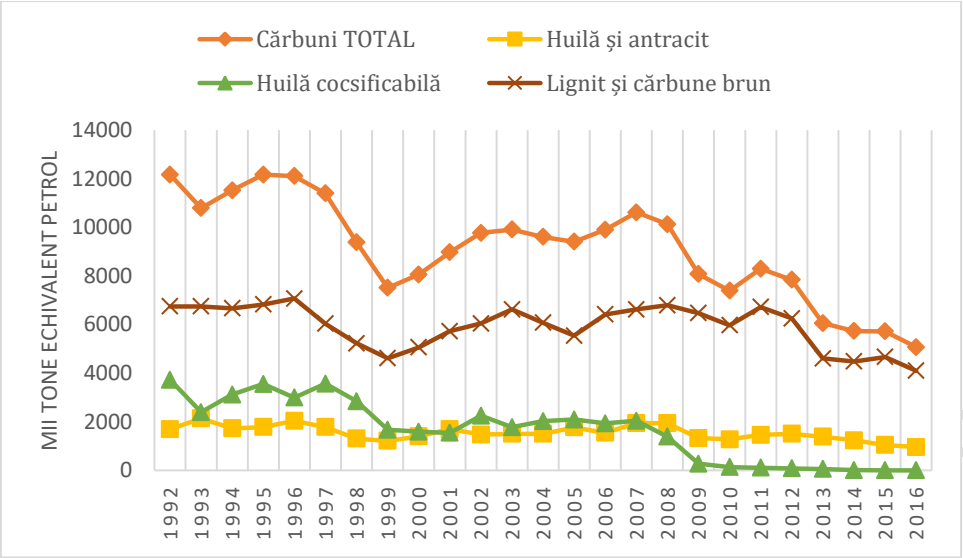


FigurE 21 The evolution of primary energy resources (coal) in the period 1992-2016 at national level (source: Tempo, INS)

Carbuni total – total coal
Huila cocsificabila – coking pit coal
Huila si antracit – pit coal and anthracite
Lignit si carbine brun – lignite and brown coal

At national level, total energy consumption corresponds to around 7.8% of total resources (Figure ***22***). Regarding the production of thermoelectric energy, the specific consumption of fuel by categories of resources is represented in Figure 23 where it can be seen a decrease for the period 1992-2016. Specific consumption is expressed in *kilograms of oil equivalent per 1000 kWh* , the decrease in coal, gas and oil being the result of the implementation of policies to make primary resource use more efficient.

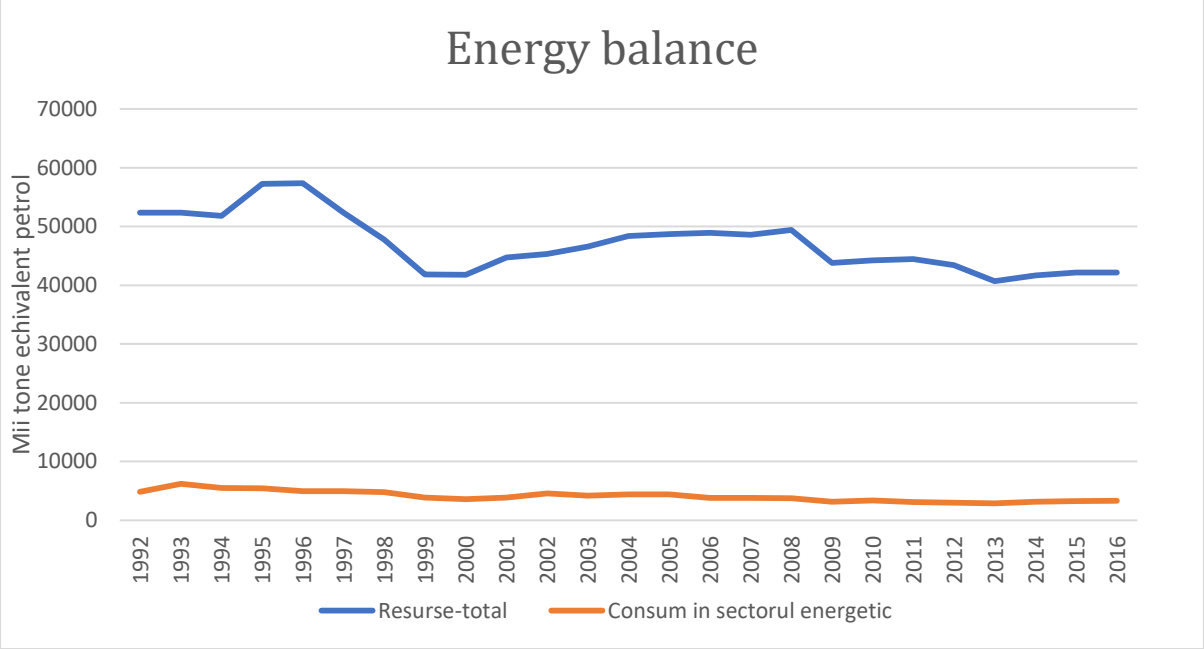


Figure 22 Consumption corresponding to the energy sector in relation to the total resources at national level, 1992-1996 (source: Tempo, INS)

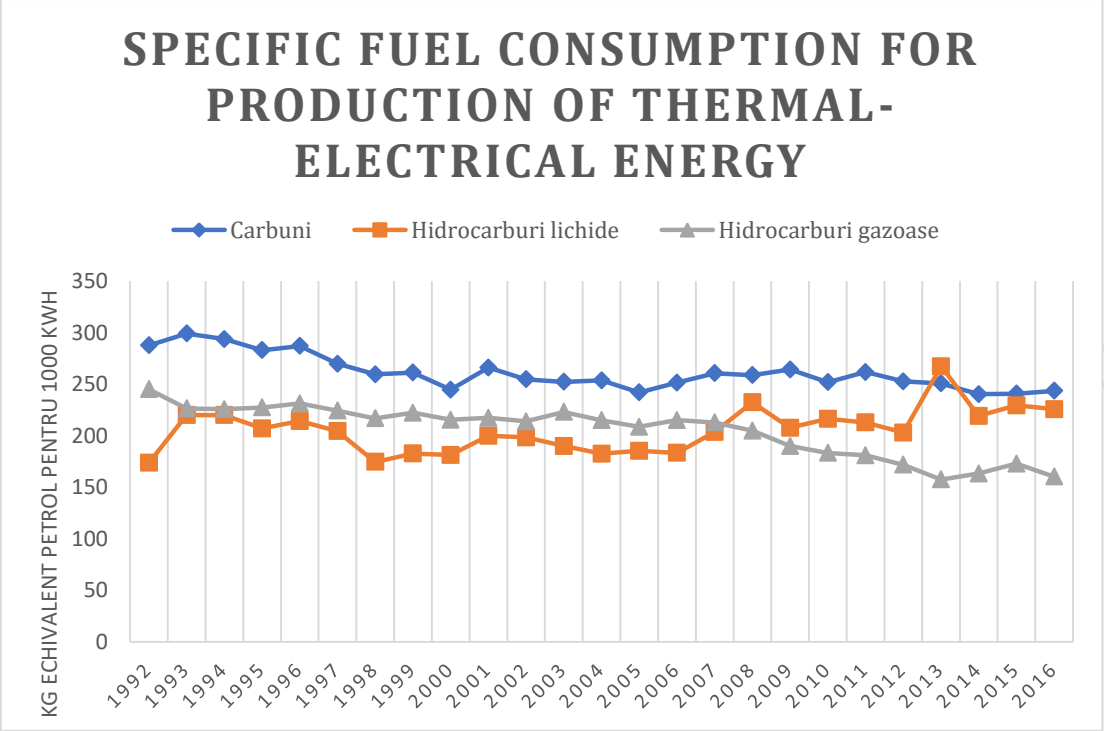


Figure 23 Specific fuel consumption for the thermoelectric power generation at national level in the period 1992-2016 (source: Tempo, INS)

Carbuni – coal
Hidrocaburi lichide – liquid hydrocarbons
Hidrocarburi gazoase – gas hydrocarbons

At the level of 2016, the thermoelectric energy production process had the following natural resources as raw material, represented in **Error! Reference source not found.** . Coal is the main resource, the quantity used in 2016 being 3.7% less than in 1992. A contribution of 36% to the total quantity of fuel used for the production of thermoelectric energy is given by the natural gas, which used quantities decreased by 44.5% in 2016 compared to 1992. Fuel with the lowest percentages used in the thermoelectric energy production are liquid hydrocarbons (1%) and reusable energy and other fuels (4%).

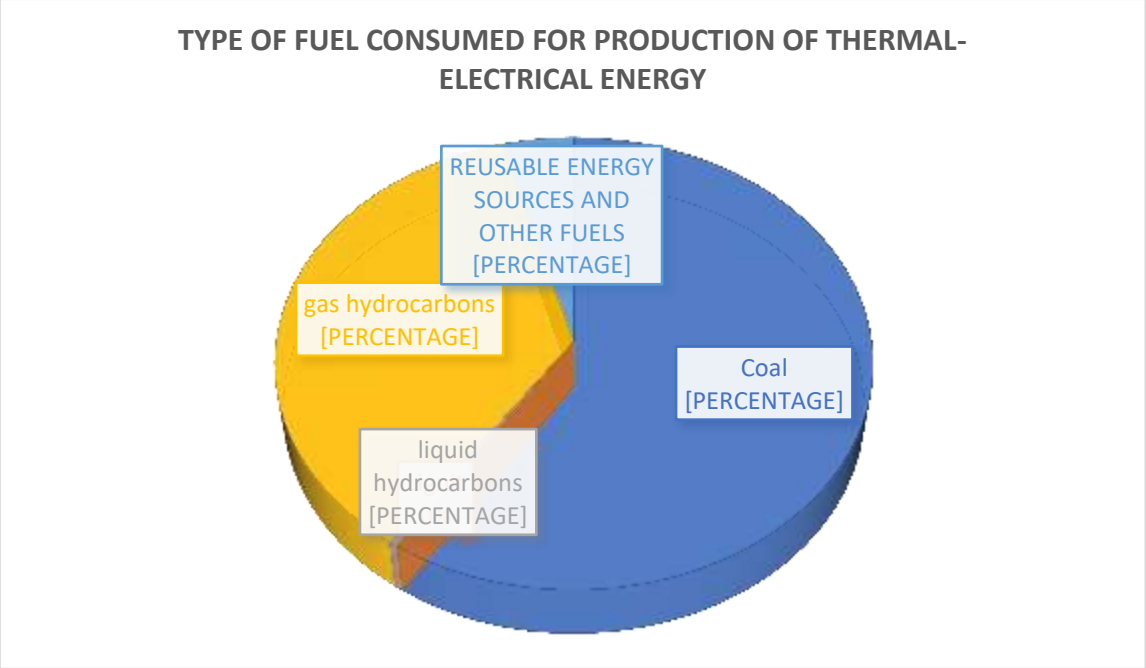


Figure 24 The type of fuel consumed in the thermoelectric power production in 2016 (source: Tempo, INS)

Regarding renewable energy resources, it should be noted that they have an important energy potential at national level. The evolution of the amounts of energy from such sources is represented by Figure 25.

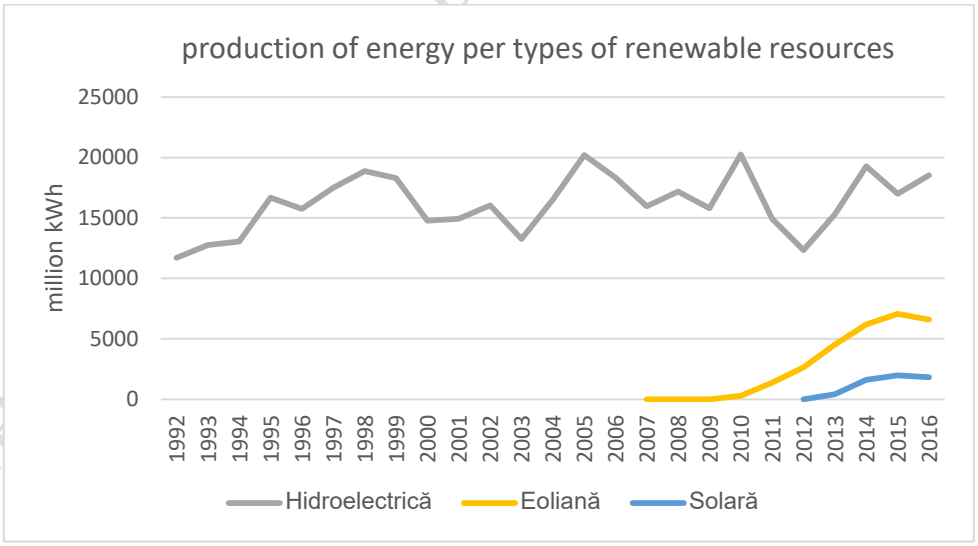


Figure 25 The evolution of electricity production from renewable sources at national level in the period 1992-2016 (source: Tempo, INS)

According to the data provided by the National Institute of Statistics, most renewable energy in Romania is produced in the hydro-energetic field. Water, the main source in hydro power, is also used by other industries or economic sectors, as follows: electricity production (46%), water capturing, treatment and distribution (22%), agriculture, forestry, fish farming (17%), manufacturing industry (14%) and other activities (1%).

Wind energy is another type of renewable energy source. This energy branch has witnessed global growth over the last decade, with installed capacity rising exponentially from year to year.

Another source of energy is geothermal energy, exploited especially in the resorts. Geothermal power plants use the heat of the earth to convert water into vapours, and they have a turbine that produces electricity. The national exploitable reserve is about 167 thousand toe/year of low enthalpy resources, of which about 30 thousand toe/year is currently being used. The total installed capacity in Romania is 320 MWh (for a reference temperature of 300 °C).

IV.1.9 WASTE

Industrial waste presents the highest annual quantities compared to other types of waste produced, such as municipal waste or agricultural waste. They can be classified into hazardous and non-hazardous waste and, depending on the resulting process, can be classified as follows:

- Wastes from the extractive sector (field connected to the energetic sector), in this category including mining tailings or quarries;
- Waste from thermal processes carried out in the production of thermal energy/thermal power plants, in this category having mainly the ashes;
- Wastes from the metallurgical industry, such as slag and ash, dust, refractory materials, cores or crumbs;
- Ferrous or non-ferrous metal waste;
- Industrial sludges.

According to the Environment state report for the year 2016, the evolution of the non-hazardous waste quantities from the main economic activities during 2011-2015 is represented in Figure 32 where it can be seen that the production, transport and distribution of electricity and heat, gas and water represent the sector with the largest quantities of waste generated annually. From the preliminary data of the report, the amount of waste from this sector in the year 2015 was 7,444.84 thousand tonnes, 12% more than in 2011.

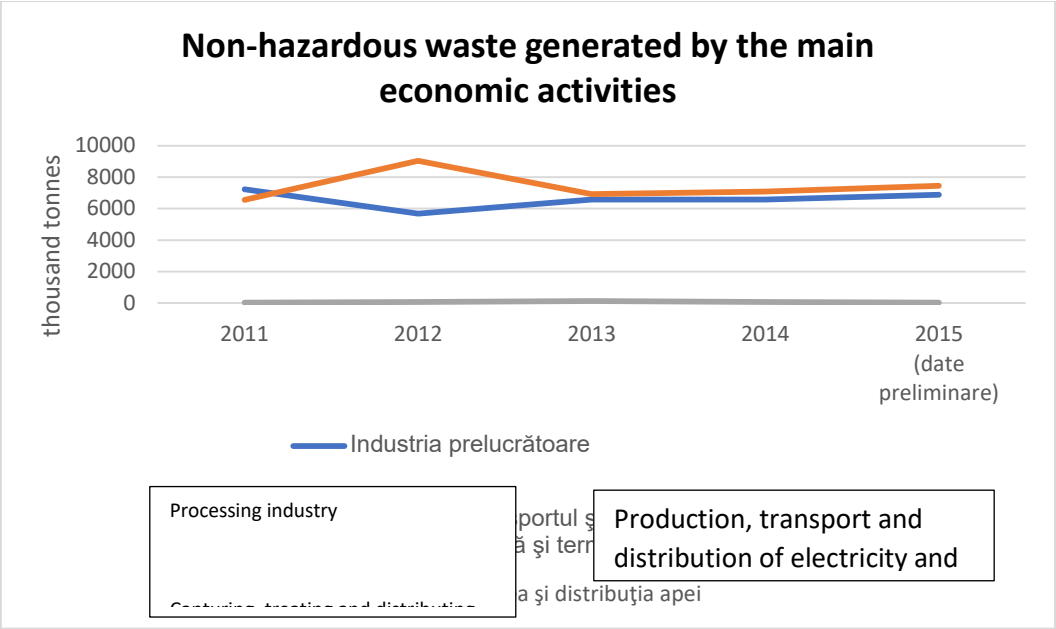


Figure 32 Evolution of the quantities of non-hazardous waste generated by the main economic activities during 2011-2015 at national level (Source: Environmental status report, 2016, ANPM)

The situation of the quantities of hazardous waste generated by the main economic branches is represented by Figure . The mining sector is remarkable by the largest quantities of hazardous waste generated during the period 2013-2015. The quantity of 343.37 thousand tonnes corresponding to 2015 is about 68% higher than that generated in 2011. The extractive industry is followed by the crude oil processing industry and coal coking industry for which, according to national data, a decrease in the amount of hazardous waste generated during the period 2011-2015 has been observed. Thus, the quantity of waste from the crude oil processing industry and the coking of coal in 2015 is 64.89 thousand tonnes, 55.3% less than that generated in 2011.

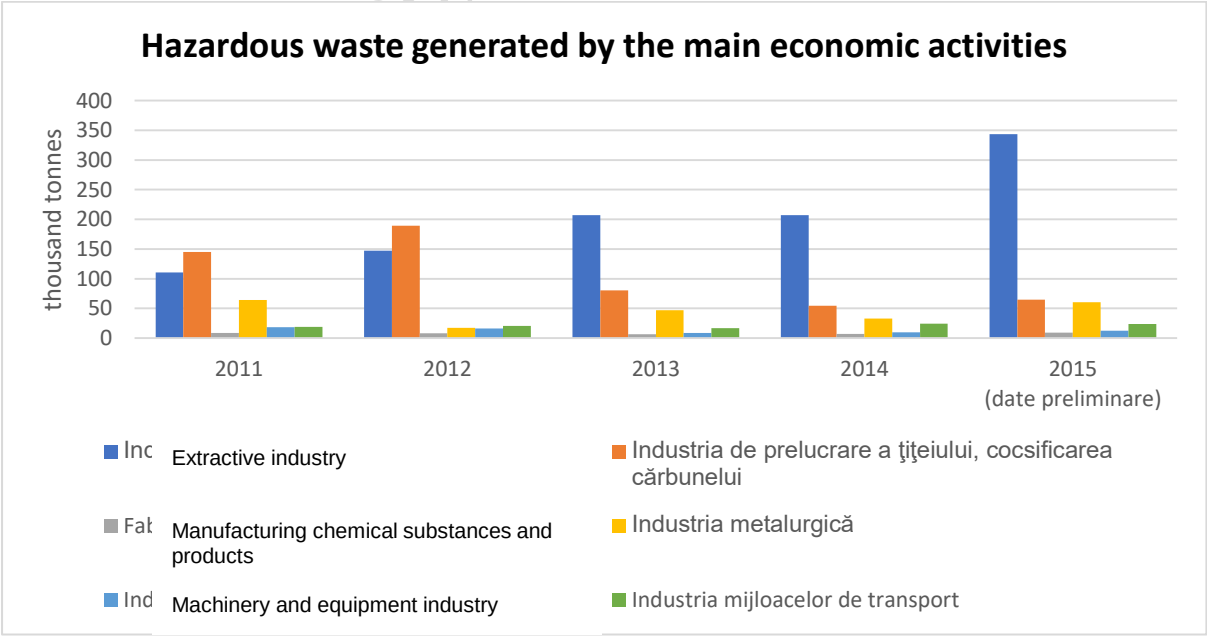


Figure 33 Evolution of the quantities of hazardous waste generated by the main economic activities during 2011-2015 at national level (Source: Environmental status report, 2016, ANPM)

In order to efficiently manage waste from the economic sectors, the European Union has adopted a series of policies[23] aimed at reducing the impact of waste on the environment and health, as well as improving energy efficiency. The main long-term objective implemented at EU level is to reduce the amount of waste generated and, where this may not be avoided, to use it as a resource to achieve higher levels of recycling and safe disposal.

According to the National Waste Management Plan (PNGD), non-hazardous industrial waste management is carried out in own facilities for recovery or disposal, as well as in authorized installations to which the transport is carried out either by authorized collectors or by generators. The situation of authorized economic operators for the recovery of industrial non-hazardous waste in the year 2016 is presented in Figure 3.

Figure 3 Number of authorized economic operators for the recovery of non-hazardous industrial waste at the level of 2016 by development regions (Source: PNGD 2018)

Development region	Number of authorized operators for the recovery of industrial non-hazardous waste
N-E	126
S-E	197
S	116
S-W	76
W	48
N-W	174
Centre	142
Bucharest - Ilfov	7
TOTAL	**886**

The evolution of the quantities of industrial waste generated, recovered and disposed of in the period 2010-2014, with the main source of provenance from the manufacturing and thermal processes, is presented in Figure . It is noted that most of the waste from the processing industry is being recovered and that most of the waste resulting from the production and supply of energy is eliminated.

[23] Europe Strategy 2020 and the Seventh action program for the environment, a legislative package on the climate and energy for 2030

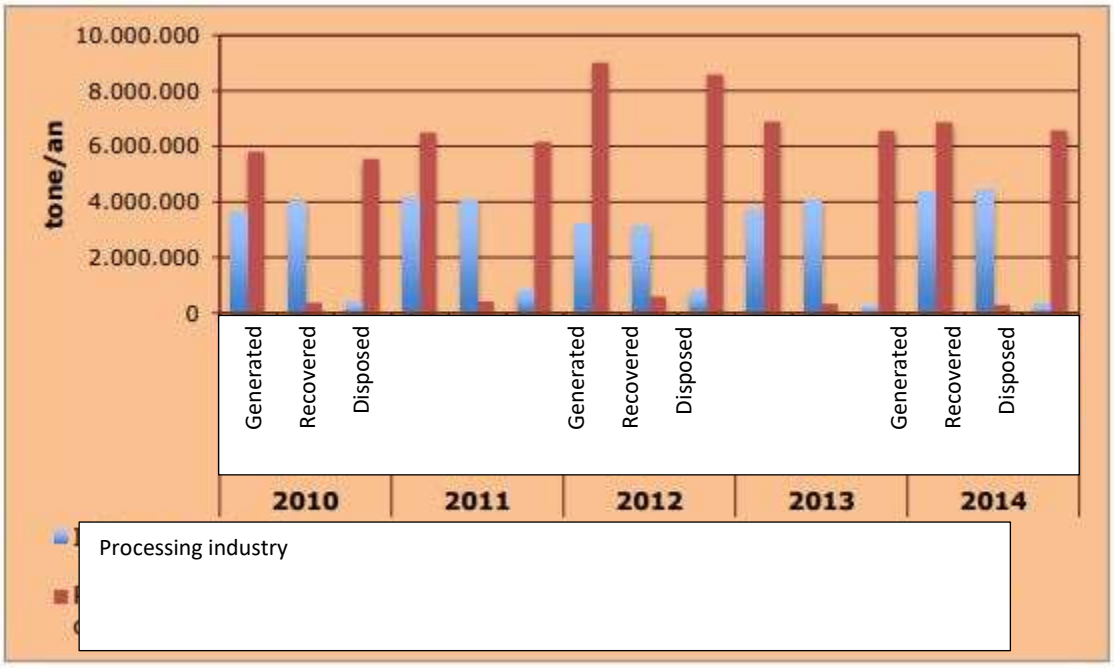


Figure 34 Generation, recovery and disposal of industrial waste in the period 2010-2014 at national level (image taken from PNGD, 2018; data source: ANPM)

Of the total amount of the recovered non-hazardous industrial waste, the highest share is energy-used waste (R1 - mainly used as a fuel or other energy source) and recycling/recovery of organic substances (R3). In both recovery cases mentioned above, the main category of wastes is the waste from wood processing (sawdust, shavings, chips, chipboard and veneer). In their case, energy recovery is achieved by using as fuel in thermal power plants.

Concerning the category of waste resulting from the production of electric and thermal energy, only about 4% (300.851 tonnes) of the total quantity was recovered in 2014. Of the total amount recovered, approximately 76% was recovered by operation R12 (the exchange of waste for exposure to any of the R1-R10 operations). In the case of hearth ash and fly ash (codes 10 01 01 and 10 01 02), the recovery operation was R5 (recycling/recovery of other inorganic materials), and in the case of wastes from gas scrubbing (code 10 01 19) the recovery operation used was R1 (energy recovery). The share of capitalization operations is represented in Figure Figure .

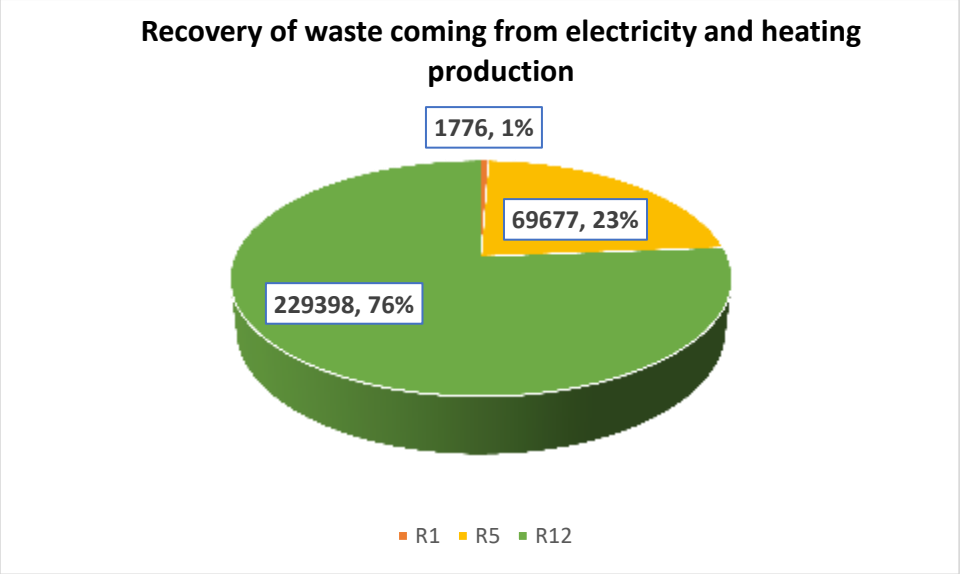


Figure 35 The share of the quantities of waste from the production of electricity and thermal energy utilized by recovery operations R1, R5 and R12 (source: PNGD 2018)

IV.1.10 POPULATION AND HUMAN HEALTH

According to the data obtained through the Tempo database of the National Institute of Statistics, the Romanian population registered a decrease of approximately 9.7% in 2018 (19,523,621 inhabitants) compared to 2003 (21,627,509 inhabitants) (Figure 26), due largely to emigration that has led to an aging population and a significant increase in the annual death toll.

With respect to human health, labour force issues will be further reviewed, with reference to the number of people employed in the sectors of production, transport and distribution of heat and electricity, gas and hot water, their evolution, and with reference to job accidents and occupational diseases reported annually.

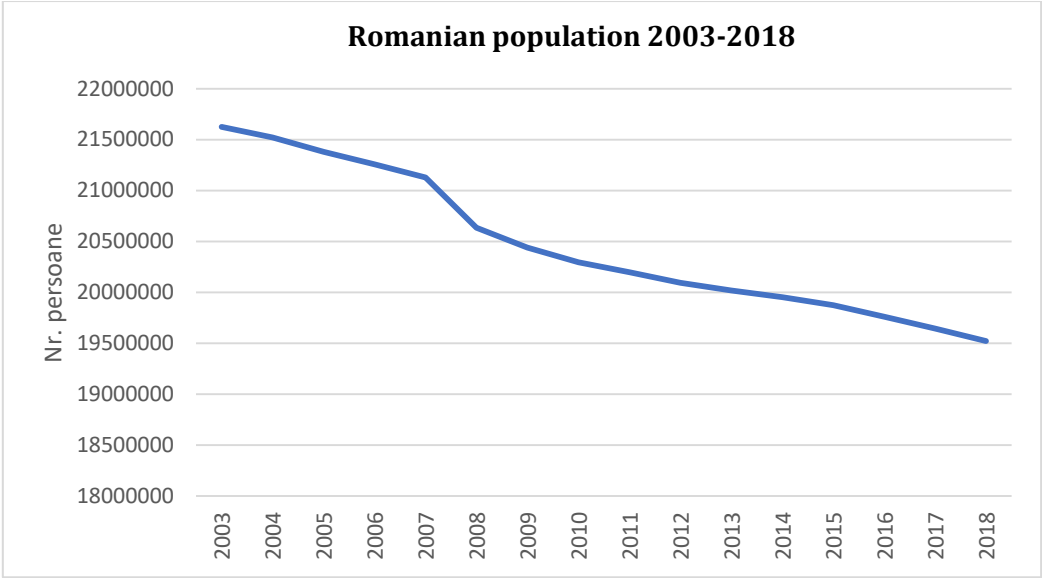


Figure 26 Evolution of the number of inhabitants in Romania during 2003-2018 (source: Tempo, INS)

Of the total number of working-age population, in the year 2016 there were reported 1957 employees in the industry, of which about 87.77% in the manufacturing sector, 6.68% employed in the field of water distribution, sanitation, waste management , including decontamination activities, 2.78% in the production and supply of electricity and heat, gas, hot water and air conditioning and 2.77% in the extractive industry (Figure). Compared to 2008, the number of persons working in the industry decreased by 1.23%.

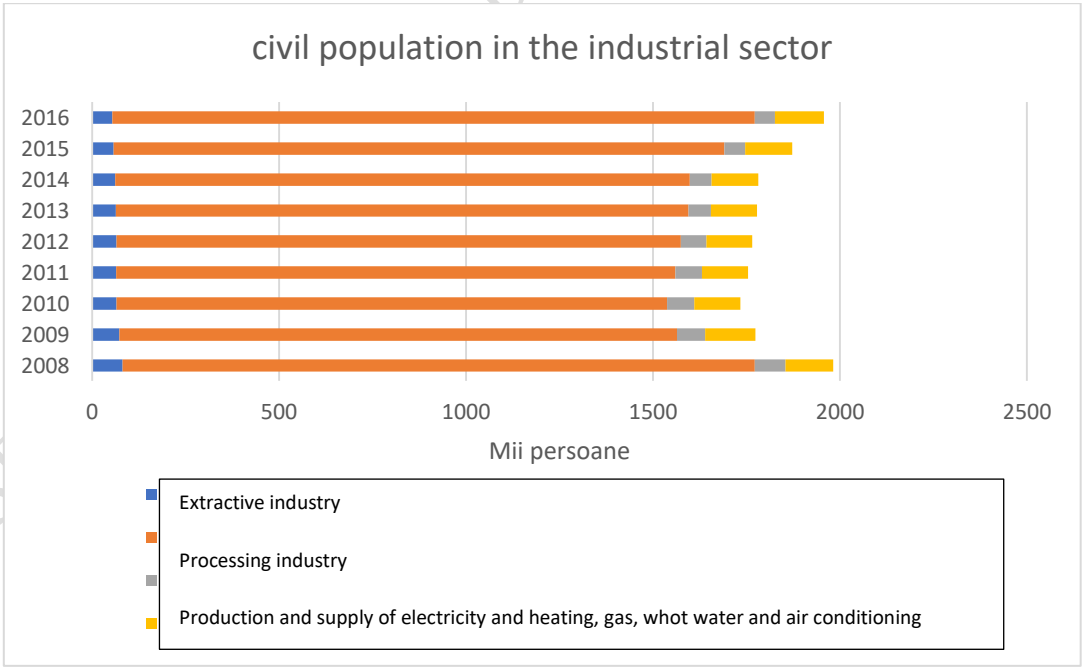


Figure 36 Evolution of the number of employees in the main industrial branches in Romania (source: Tempo, INS)

According to the National Occupational Safety and Health Strategy for the period 2017-2020, occupational diseases reported annually at national level continue to be below the values stated by other EU Member States. The trend of occupational diseases (BP) for the period 2012-2017 is declining. The first place in terms of structure of morbidity in 2014 and 2016 is BP (professional diseases - en.) caused by overloading the locomotor system. In the case of lung diseases, their number decreased, but occupied a major place in the years 2012, 2013 and 2015 in the morbidity structure.

Rap The Report on Professional Morbidity in Romania for 2017 highlights the evolution of BP cases from 2005-2017 (Figure 38).

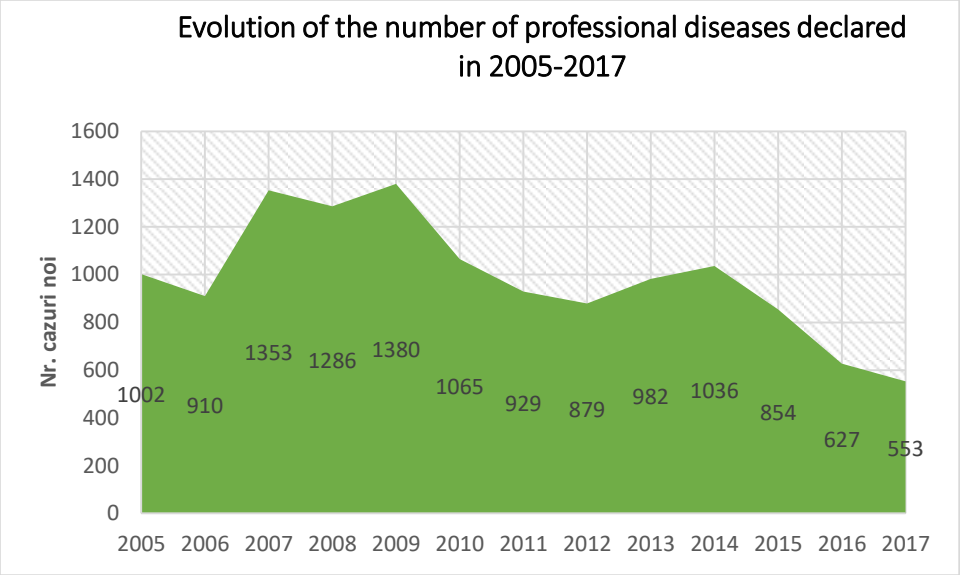


Figure 38 The Evolution of Occupational Diseases in Romania, 2005-2017 (source: Annual Report - Professional Morbidity in Romania 2017, National Institute of Public Health – National Centre for Monitoring the Risks from the Community Environment)

Thus, we can see a downward trend in BP cases due to the evolutionary trend of the industry at national level, the changes in the profile and distribution of the workforce, the evolution of unemployment, or other specific issues where the evolution of the technologies used in different economic sectors can also be included. Out of the 553 new BP cases registered in 2017, 71 belong to the mining profession in the underground and 21 to the mining machinist profession.

The reported situation of BP per counties for the year 2017 (Figure 39) indicates that the main counties affected in this respect, with over 20 cases annually, are Hunedoara, Olt, Mures, Maramures, Suceava, Dolj and Bucharest. Also, the following 9 counties have not declared new cases of BP for 2017: Braila, Covasna, Giurgiu, Ialomita, Satu Mare, Teleorman, Timis, Tulcea, Vrancea.

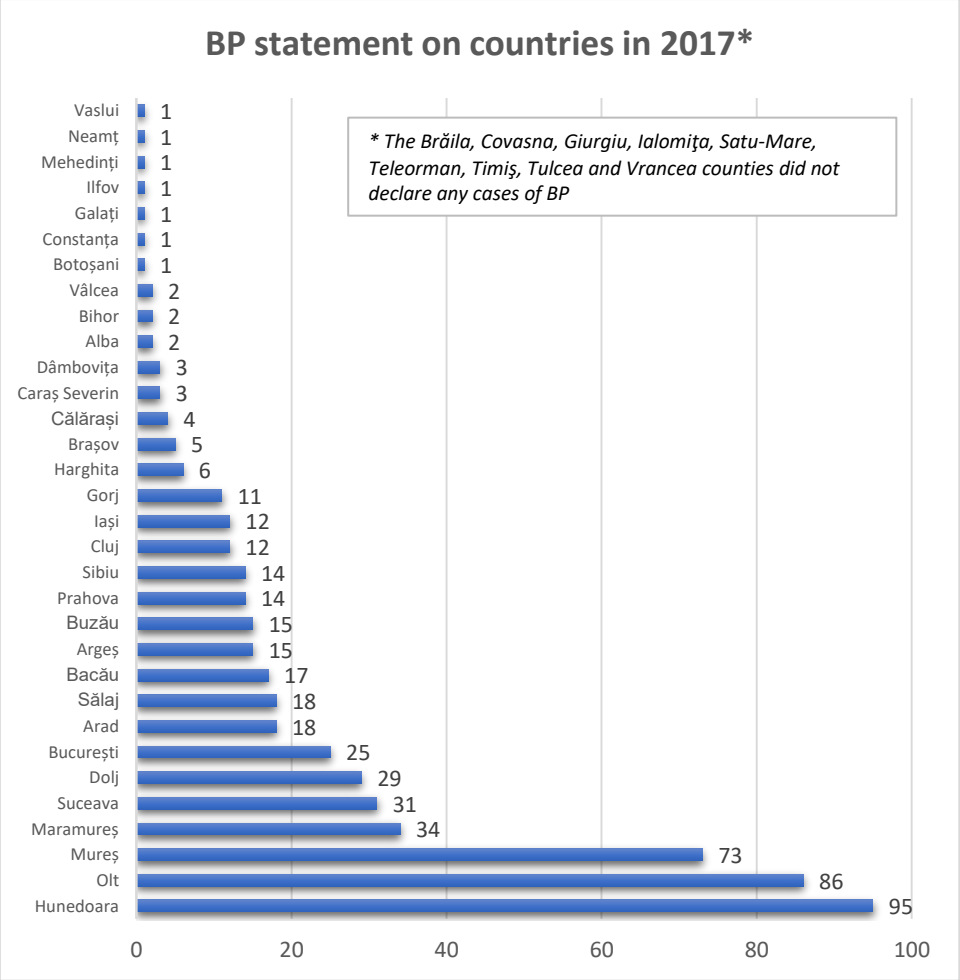


Figure 39 Situation of the number of cases of occupational diseases in Romania at the level of 2017 (source: Annual Report - Professional Morbidity in Romania 2017, National Institute of Public Health – National Centre for Monitoring the Risks from the Community Environment)

Concerning the number of accidents at work, according to the data provided by the Labour Inspectorate, in 2017 the number of fatal injured persons was 225 i.e. 3.6% of the total number of injured persons and about 2% less than the number of injured persons seen in 2013 (Table 4).

Table 4 Number of people injured at work in 2013-2017 at national level (source: Occupational injuries statement 2013-2017, Labour Inspection)

Year	Total injured persons at work	Fatalities at work
2013	4319	323
2014	4277	319
2015	4908	323
2016	4961	225
2017	4804	172

Of these, according to the National Institute of Statistics, most of the collective labour accidents belong to the manufacturing, construction and transport and storage sectors.

Concerning the mining and the production and supply of electric and thermal energy, gas and hot water, the number of collective labour accidents is very low, while in the 2008-2016 analysis period there were 8 cases in the extractive industry and only 2 cases in the supply of electricity and heat, gas and hot water (Figure 27).

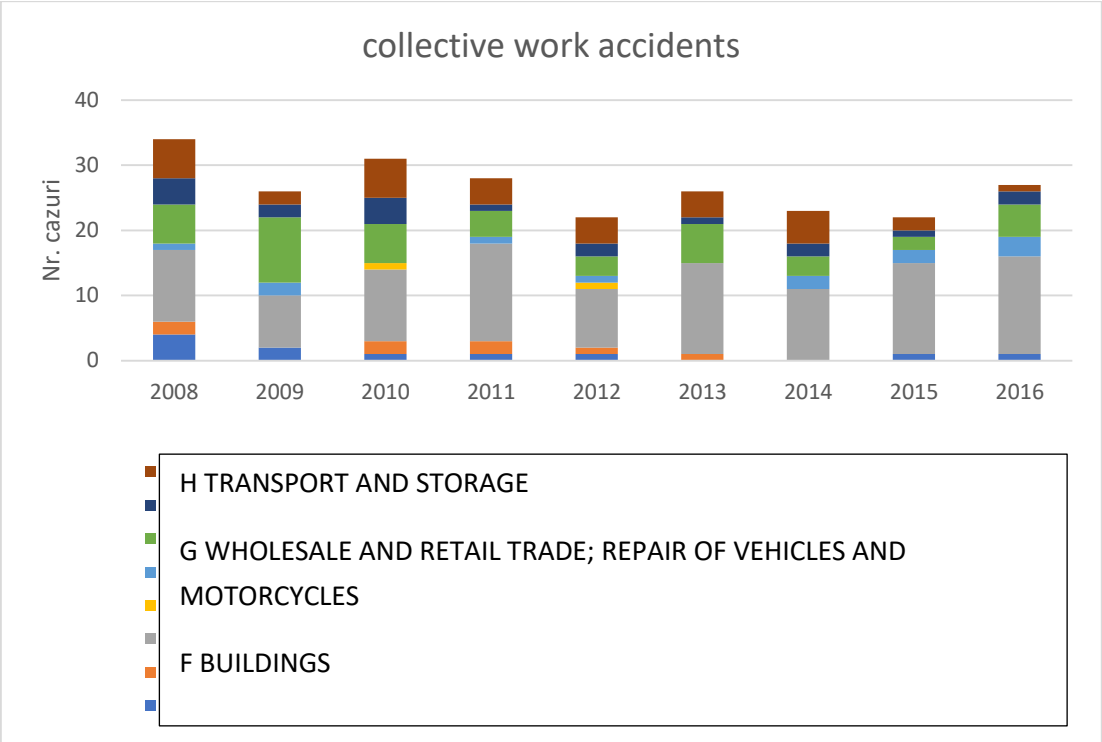


Figure 27 Evolution of the number of collective labour accidents at national level, by main economic sectors, for the period 2008-2016 (source: Tempo, INS)

IV.1.11 TRANSPORT

This chapter will address, on the one hand, the transport of natural resources necessary for the energy and electricity industry and, on the other hand, freight and passenger transport.

Transport of electricity and natural resources needed to produce energy

Electricity transport at national level is managed by the National Power Grid Company Compania Națională de Transport al Energiei Electrice Transelectrica. Electricity transport is carried out through the Power Transport Network (RET), which is made up of power substations and lines. RET is represented in Figure .

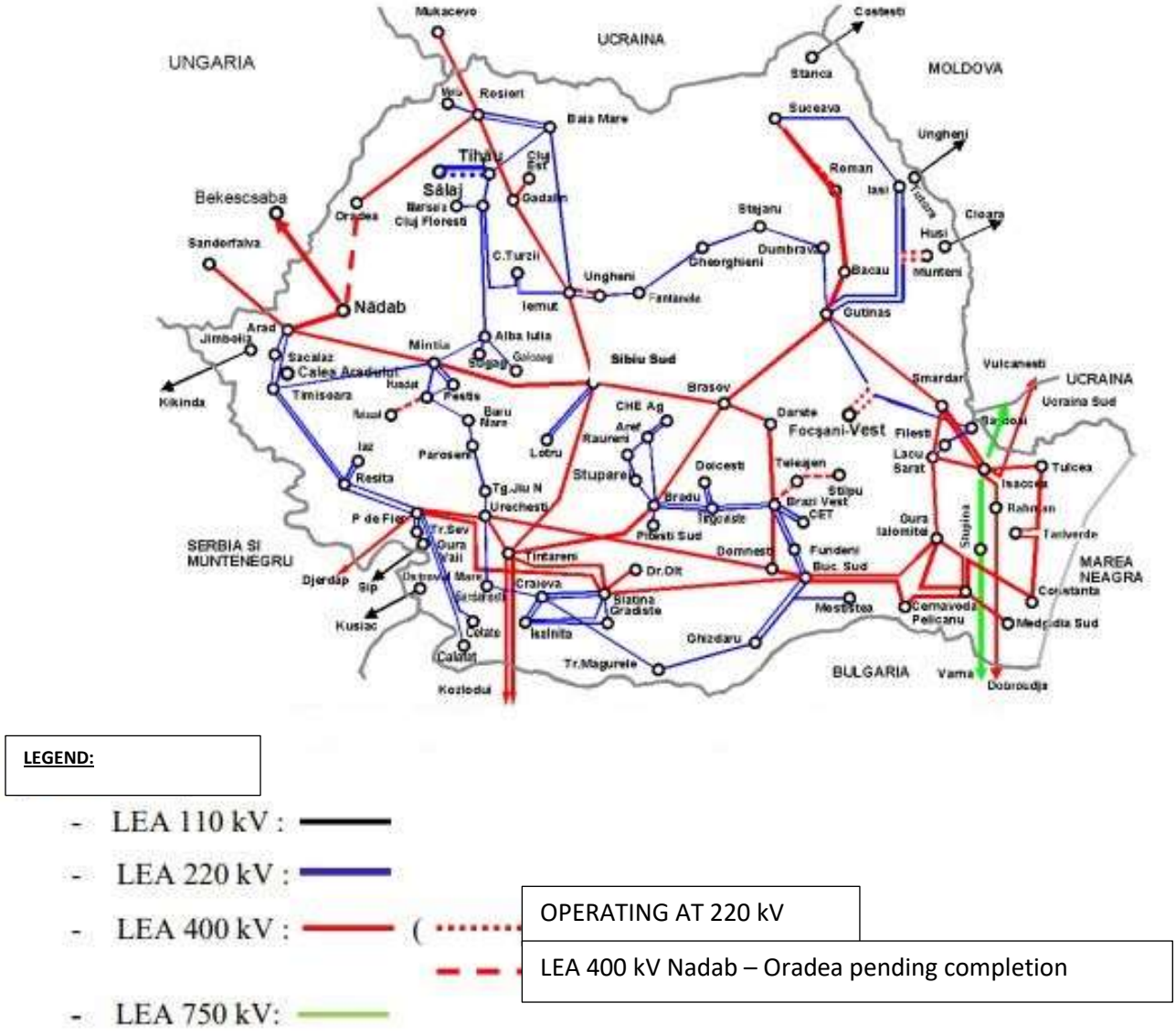


Figure 41 The Power Transport Network (source: RET Development Plan for the period 2018-2027)

The volume of installations managed by Transelectrica SA consists of:

- 81 power stations: 1 station of 750 kV, 38 stations of 400 kV and 42 stations of 220 kV;
- 8834,4 km overhead power lines (LEA), out of which: 3,1 km 750 kV, 4915,2 km 400 kV, 3875,6 km 220 kV, 40,4 km 110 kV. Of these, 486.2 km are interconnection lines;
- 216 major transformation units totalling 38058 MVA as follows: 2x1250 MVA, 2x500 MVA, 22x400 MVA, 31x250 MVA, 81x200 MVA, 1x100 MVA, 2x63 MVA, 9x40 MVA, 24x25 MVA, 1x20 MVA, 32x16 MVA, 9x10 MVA.

The second type of transport covered by this sector is the transport of the natural resources needed to produce energy. Its representative data will be presented in the final version of the Report along with those related to freight and passenger transport.

For improving the railway infrastructure for ensuring a sustainable, social, environmental development and the energetic efficiency and safety of transportation for the period 2017-2023, the rehabilitation of 8 railway sections, as mentioned in POIM 2014-2020 is proposed. Therefore, for the railway transportation infrastructure sector, passenger and goods, measures are proposed to help reduce the environmental impact: modernization/rehabilitation of the rolling stock park; greening works of the railway lines; modernization/rehabilitation of railway engines and wagons so that the noise level is low; providing systems for recovering petroleum residues.

IV.1.12 ENERGY EFFICIENCY

Energy efficiency is directly related to energy intensity, both of which are defining dimensions for sustainable economic and energy development, implicit for RES.

Energy intensity is the ratio between gross domestic consumption and primary energy or final energy consumption and gross domestic product (GDP) at constant prices. This size depends on the structure of the economy and the industry and reflects the added value they create in making a product. Romania has and continues to have the highest value for energy intensity at European level, meaning that it produces energy at high costs and consumes it inefficiently.

According to the RES, data for 2015 show that Romania's energy intensity was 218 toe/mil. € 2013, 75% higher than the European average, however, relative to the purchasing average, is slightly below the European average. For 2030, it is estimated that the energy intensity for Romania will decrease by 30% to 153 toe/mil. € 2013, this level being still 65% higher than the European average.

Energy efficiency is any measure that results in the provision of a service to a final consumer with a reduction in the energy used. Energy efficiency or inefficiency reflects the level of proximity/distance from accepted international standards in the final use of energy.

According to the data included in the National Energy Efficiency Action Plan, the evolution of the final electricity consumption per capita and the final energy intensity during the period 2007-2012 show a growth trend, reaching a value of approximately 2120 kWh, value about 2.6 times lower than the EU average in 2011 (5502 kWh/site).

Table 5 Evolution of electricity indicators in the period 2007-2012 (source: National Action Plan in the field of Energy Efficiency)

	YEAR					
	2007	**2008**	**2009**	**2010**	**2011**	**2012**
Final consumption of electricity per capita (kWh/inhabitant)	1961	2034	1846	2040	2120	2109
Final electricity intensity (kWh/1000 Euro 2005)	447.6	425.7	410.2	455.7	460.6	454.2
Share of electricity consumption in final energy consumption (%)	14.3	14.4	14.5	15.6	16.1	16.0

IV.2. THE EVOLUTION OF THE ENVIRONMENT PROVIDED THAT THE ENERGETIC STRATEGY OF ROMANIA FOR THE PERIOD 2019-2030 WITH PERSPECTIVES FOR 2050 IS NOT IMPLEMENTED

According to the legislative requirements, i.e. Art. 5 and Anx. I-b of the SEA Directive and Art. 15 of GD no. 1076/2004, these are a mandatory requirement for the analysis of the state of the environment provided that the Romania's National Strategy 2019-2030 with perspectives for 2050 is not implemented.

The purpose of this analysis is to evaluate how RES 2019-2030, with perspectives for 2050, responds to the needs and requirements of the state of the environment on the territory of Romania and its future tendencies.

The analysis of Alternative 0 (that of non-implementation of RES 2019-2030, with perspectives for 2050) was made on the basis of specialized studies and reports and existing assessment methods regarding the state of the environment and the trends of its evolution.

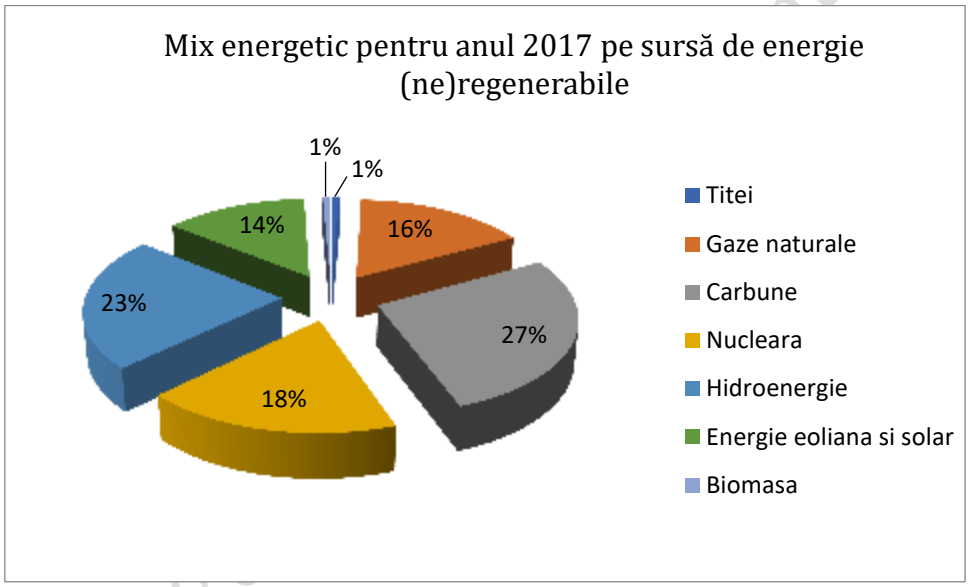


Figure 42 Energetic mix for 2017 per (non)renewable energy source according to RES 2019-2030, with perspectives for 2050

The above figure shows the energetic mix for 2017 per types of energy sources. In the context of non-implementation of RES 2019-2030 with perspectives for 2050, this energetic mix may become stagnant in terms of the share of the types of non-renewable sources.

The analysis is structured per relevant environmental issues on the basis of which the state of the environment was characterized.

The implementation scenario of Alternative "0" implies the non-implementation of RES 2019-2030, with perspectives for 2050. With regard to this hypothesis, the following points can be made:

- No new investments will be proposed in the energetic sector, therefore the current conditions of greenhouse gas emissions, particulate matters, nitrogen and sulphur oxides etc. will be maintained;

- RES 2019-2030, with perspectives for 2050, ensures the proposal of new projects with state-of-the-art technologies (overcritical and ultraovercritical parameters after 2035) for energy production from coal; non-implementation of new projects, namely those that use coal as energy source, its share would be maintained in the energetic mix, which would make the GES emissions stagnant etc. (see **Error! Reference source not found.**, **Error! Reference source not found.**, **Error! Reference source not found.**);
- Increasing and then maintaining the energetic mix from renewable sources (hydropower, wind energy, solar energy and/or biomass); without these provisions, the European and national targets set would not be reached (20% reduction for 2020, respectively 80%-95% for 2050 compared to the reference year 1990), the use of ineffective funds by implementation of global and/or regional decisions, non-implementation of the objectives from RES 2019-2030, with perspectives for 2050, to reduce the environmental impact of the energetic sector.

Table 6 Evolution of the state of the environment in the case of non-implementation of RES 2019-2030, with perspectives for 2050

Relevant environmental aspects	Possible evolution of the state of the environment provided that RES 2019-2030, with perspectives for 2050 is not implemented
Air	The failure to implement RES 2019-2030, with perspectives for 2050 means that the energy sector will remain the main generator of atmospheric pollutants, not contributing to the reduction of GHG emissions; the level of modernization of installations[24] will be very slow, maintaining the tendencies of stagnation of pollutant emissions in the atmosphere.
Water	The level of investments for economic operators that want to invest in microhydropower plants will remain low; after the implementation of RES 2019-2030, with perspectives for 2050, this will not be supported; A possible insignificant evolution of the growth of the level of improvement of the chemical and ecological state of surface waters in areas where coal is still used.
Soil	By minor streamlining at objectives that use coal, the polluted land areas will increase due to the non-implementation of the measures of decontamination of sites, where necessary.
Climate changes	Maintaining GHG emissions at the current level in the context of non-streamlining coal installations; the risk that Romania is subject to an infringement procedure for breaching the GHG emission threshold.
Biodiversity	Affecting habitats and species by the alteration, fragmentation and loss thereof in the absence of concrete measures in protected areas of conservative interest.
Landscape	The failure to integrate industrial objectives in the landscape by becoming closer to residential areas, reducing green spaces and by improper management of the waste resulting from the energetic sectors, mainly from the sectors that use coal.
Cultural aspects	The lack of an integrated vision regarding the identification and location of cultural heritage Objectives towards areas vulnerable to energy pollution

[24] Execution of a new energetic group of 400 MW ultraovercritical parameters at Turceni and execution of the 600MW group in Rovinari with overcritical parameters

Relevant environmental aspects	Possible evolution of the state of the environment provided that RES 2019-2030, with perspectives for 2050 is not implemented
	will prevent the development of measures to protect them.
Conservation of natural resources	Supporting coal-based energy subsectors (renewable resources) and ensuring policies for exploitation of sustainably renewable resources.
Waste	Maintaining a low level of energy exploitation of waste from activities from the energy sector; this will not allow the management and reduction of the quantity of waste (targets proposed in other waste-related strategic documents[25]
Population and human health	The current degree of connection to the energy sources will be maintained; the energy inefficiency level for buildings will be maintained in the absence of plans for preventing thermal energy loss from buildings. The number of professional illnesses, the number of accidents and the number of persons exposed to high concentrations of pollutants shall be maintained.
Transport	Lack of interconnection of energy transmission systems with neighbouring countries; GHG targets will not be met by not applying low-carbon fuels to the transport sector;
Energy efficiency	The failure to implement the provisions of the Directive on the energy efficiency of buildings Absence of financial measures for energy efficiency increase projects and programmes

[25] NWMP – National Waste Management Plan and NWMS – National Waste Management Strategy

VI. THE ENVIRONMENTAL CHARACTERISTICS OF THE AREAS LIKELY TO BE AFFECTED SIGNIFICANTLY BY THE IMPLEMENTATION OF RES 2019-2030 WITH PERSPECTIVES FOR 2050

RES 2019-2030, with perspectives for 2050, covers the framework for implementing the categories of investments proposed across the national territory for developing the energy sector with as low as possible damages to the natural environment.

The categories of investments proposed by RES 2019-2030, with perspectives for 2050 are: modernization and execution of the electricity production capacities in coal and natural gas-powered thermal power plants; execution and completion of the electricity production capacities in hydropower plants; completion of the electricity production capacities in the nuclear sector; extending investments from the electricity transportation subsector.

In the analysis of the environmental characteristics of the areas likely to be significantly affected, only the categories of investments that might have a negative environmental impact were taken into account.

Table 7 Environmental characteristics of the areas likely to be significantly affected in relation to the types of investments within RES 2019-2030, with perspectives for 2050

Crt. no.	Type of proposed investment	Environmental characteristics of areas likely to be significantly affected
1	Modernization and execution of the electricity production capacities in coal and natural gas-powered thermal power plants	The quality of air, water and soil may be affected during the period of the construction works. For the period of operation, the implementation of the project will help reduce GHG emissions by applying the overcritical parameters; The sources of impact with small/medium effects on the environment, for the stage of operation, are: surface mining, industrial and commercial areas, soil pollution with solid waste.
2	Execution and completion of electricity production capacities in hydropower plants	The quality of air, water and soil may be affected during the period of the construction works for this type of investments. Biodiversity may be affected during the period of the construction works by the fragmentation and alteration of habitats. This may also suffer losses during the period of implementation of these types of investments, there is a risk that the habitat of certain water species is severely affected by the alteration of the hydrogeomorphological functions. The sources of impact with a possible high

Crt. no.	Type of proposed investment	Environmental characteristics of areas likely to be significantly affected
		negative effect are sand and gravel quarries needed for the period of execution of investments. The sources of impact that have a possible medium/small negative effect are: artificial planting, roads, hunting, traps, poisoning, poaching.
3	Extension of investments from the electricity transportation sub-sector	Investments from the energy transportation sector may damage especially biodiversity, by deforestation of areas of habitat for OHL (overhead lines) and/or fragmentation and/or loss of species of avifauna. The quality of air, water and soil can be affected by the stage of construction.

A series of projects were identified which are part of the 3 types of investments proposed, in particular: for 5 of them, the forms of impact and the measures of reduction have already been established through already issued environmental approvals, for 7 others the location is known at this time (it will be modernized or streamlined on the place of the current energy objectives), and for two others the exact location will be defined in the environmental impact evaluation procedure.

The areas likely to be affected are sensitive areas inside or in the vicinity of natural protected areas by new types of investments. Also, other environmental aspects are liekly to be affected: water, soil and air.

Depending on the type, scope and location of the works proposed, the implementation of these projects might affect: natural habitats and wild species of flora and fauna; riparian areas and water uses from areas located downstream of the location of projects, in the case of works that take into account regularizations of the banks of water streams, bank defences, embankment. The decision to implement projects on a certain site is made by selecting alterative waters that allow the achievement of the purpose set with the lowest environmental costs and by considering the adequate measures of reduction and compensation (if necessary) of the effects based on the size of the impact generated, including the full (structural and functional) recovery of the ecological systems affected.

In Chapter XI, the measures for avoiding/reducing the potential effects of the implementation of RES 2019-2030, with perspectives for 2050, are presented.

VII. EXISTING RELEVANT ENVIRONMENTAL ISSUES FOR RES 2019-2030 WITH PERSPECTIVES FOR 2050

In the present paper, chapter IV.1 Current state of the environment by environmental components, presented the current state of the environment at national level. In this chapter there are selected the main environmental issues of direct relevance to RES 2019-2030, with perspectives for 2050.

Table 8 Existing environmental issues relevant to RES 2019-2030, with perspectives for 2050

Relevant environmental aspects	Relevant environmental aspects for RES 2019-2030, with perspectives for 2050
Air	Existence of areas that are critical[26] in terms of air pollution due to activities in the energy sector (sulphur oxides, nitrogen oxides); Existence of a significant number of thermal power Objectives, which are not upgraded with emission reduction installations, mainly sulphur oxides, nitrogen and carbon compounds;
Water	Alteration of surface water courses through the development of different hydropower constructions; The tendency of loading surface water with organic substances, particulate matter from power plants, which have not undergone a modernization process;
Soil	The presence of contaminated areas around the energy sector sites (land near the coal-fired power plants); The presence of areas contaminated with petroleum products and saltwater from the extraction of crude oil; Non-decontamination of historically polluted sites in the energy sector;
Climate changes	High emissions of greenhouse gases from energy sector activities;
Biodiversity	Incorrect location of entities in the energy sector in relation to protected natural areas; Absence of cumulative assessments of the impact of each energy sub-sector, and lack of cumulative assessments of the agglomeration of some Energy Objectives in restricted areas; Inappropriate ecological reconstruction work that would not allow the restoration of natural habitats;
Landscape	Natural landscape degradation due to the construction of new Energy Objectives;
Cultural aspects	Degradation of areas of cultural interest due to the construction of new Energy Objectives;
Conservation of natural resources	Exploitation of non-renewable resources at an alert pace.
Waste	Uncontrolled disposal of all types of waste;
Population and human health	High number of units in the energy sector with impact on human health;
Transport	Lack of infrastructure for the development of electric transport;
Energy efficiency	Lack of infrastructure for waste recovery in order to reduce the exploitation of exhaustible natural resources.

[26] The coal basin of Oltenia region.

VIII. ENVIRONMENTAL PROTECTION OBJECTIVES ESTABLISHED AT THE NATIONAL, COMMUNITY, OR INTERNATIONAL LEVEL WHICH ARE RELEVANT FOR THE ENERGY STRATEGY

In order to evaluate the environmental impacts generated by the implementation of RES 2019-2030, with perspectives for 2050, a series of relevant Objectives have been selected and reviewed, directly related to:

- The environmental aspects indicated in Annex 2 of GD no. 1076/2004;
- Environmental issues relevant to RES 2019-2030, with perspectives for 2050, as a result of reviewing the current state of the environment;
- Objectives and measures proposed through RES 2019-2030, with perspectives for 2050.

Table 9 Environmental aspects and environmental Objectives proposed under RES 2019-2030, with perspectives for 2050

Environmental aspects	Proposed environmental objectives
Air	**OM.1** Improving air quality by reducing emissions from energy sector activities;
Water (surface and underground)	**OM.2** Improving water quality by reducing emissions from energy sector activities; **OM.3** Maintaining the ecological status of running waters (Water Framework Directive);
Soil	**OM.4** Limitation and reduction of point soil pollution; **OM.5** Maintaining the ecological status of the soil;
Climate changes	**OM.6** Decrease in greenhouse gas emissions from the energy sector to meet EU targets;
Biodiversity	**OM.7** Conservation of habitats and species of flora and fauna of community importance; **OM.8** Maintaining the national network of protected natural areas;
Landscape	**OM.9** Protection and conservation of the natural landscape;
Cultural aspects	**OM.10** Preservation and conservation of cultural heritage; **OM.11** Preservation and conservation of local traditions and customs;
Conservation of natural resources	**OM.12** Reducing the exploitation of depleting resources and facilitating the use of renewable resources;
Waste	**OM.13** Reducing the amount of waste generated and increasing recycling/recovery for all types of waste;
Population and human health	**OM.14** Decrease of emissions of pollutants from the environment that might improve the health state of the population and implicitly improve the standard of living
	OM.15 Use of clean (efficient) technologies that generate as few as possible risks for the staff from the industrial facilities;
Transport	**OM.16** Facilitation of infrastructure for the provision of electric transport; **OM.17** Ensure transport conditions to meet EU targets;
Energy efficiency	**OM.18** Improving energy efficiency and sustainable use of resources to produce energy.

IX. POTENTIAL SIGNIFICANT EFFECTS ON THE ENVIRONMENT

VIII.1. ASSESSMENT METHODOLOGY

This chapter of the Environmental Report presents the assessment of compatibility between the 23 strategic objectives of the development of the national energy sector (5 strategic objectives for OB1, 9 strategic objectives for OB2, 9 strategic objectives for OB3, 6 strategic objectives for OB4, 3 strategic objectives for OB5, 6 strategic objectives for OB6 and 3 strategic objectives for OB7) and their compatibility with the relevant environmental objectives proposed in the Strategic Environmental Assessment procedure.

The evaluation of the Energy Strategy was carried out at the level of the sub-sectors that make up the energy sector, as well as of the measures proposed for the implementation of the Strategy. The environmental assessment was carried out by reviewing how these measures contribute to achieving the relevant environmental objectives.

Determination of potential significant environmental effects was made taking into account the criteria presented in Annex no. 1 and GD 1076/2004.

The scoring system below was used for evaluation.

Table 10 Quantification of the impacts generated by the implementation of the measures under RES 2019-2030, with perspectives for 2050 on the relevant environmental objectives

Value	Rationale
+3	Significant positive effect on the relevant environmental objective
+2	Direct positive effect on the relevant environmental objective
+1	Positive indirect/reduced effect on the relevant environmental objective
0	No effect/the effect may not be evaluated
-1	Indirect/reduced negative effect on the relevant environmental objective
-2	Direct negative impact on the relevant environmental objective
-3	Significant negative effect on the relevant environmental objective

VIII.2. THE CONCEPTUAL FRAMEWORK USED FOR THE EVALUATION OF THE ENERGY STRATEGY

At present, the national energy market is subject to technological, economic, geopolitical and climate transformations in a trend with global and European changes. In this context, Romania needs to anticipate and position itself on international trends as well as on geopolitical realignments that influence strategic partnerships.

The main coordinates of the conceptual framework used in the energy strategy assessment are as follows:

1. **Correct identification and implementation of environmental liabilities** in the energy sector (including historical debts: contaminated sites, terrestrial areas and water bodies requiring ecological rehabilitation or reconstruction);
2. **Reducing environmental** extensions related to the operation of current energy capacities (reducing atmospheric pollutant emissions, reducing water

consumption, collecting and properly cleaning discharged wastewater, reducing quantities and increasing waste recovery);

3. **Promoting those new energy projects that provide the lowest environmental** impact (do not affect species or habitats subject to conservation, have measures to prevent, mitigate or compensate for adverse effects);
4. **Increasing the share of use of renewable resources in energy production**;
5. **Increasing energy efficiency** across all segments (from exploitation to consumption).

Table 11 Description of the main pressures on the environment generated by the energy sector

Component	Main environmental issues	Indirect and cumulative effects	Main solutions	Other required measures
Exploitation of fossil fuels	Exhaustion of non-renewable resources	Exploitation of geological resources is also done with affecting other resources (largely renewable part) at surface (soil, surface water, biological components)	Continuous growth of degree of use of renewable resources (hydro, wind, solar, biomass)	Remedial and compensation of damage to the environment (mainly on biological components)
Processing of raw materials with their transformation into electricity, fuels and propellants	High levels of environmental externalities (emissions of air pollutants, waste, modification of habitats) that affect different environmental components (e.g. soil and underground water pollution with oil products)	Affecting the health of all the species including a of the human population. Changes in structure and operation of ecological systems (capacity of the systems to adapt to entries, accumulations and transformations of pollutants).	Refurbishment of facilities and equipment used for transport, processing and distribution.	Including externalities of environment in the price of energy
Consumption of energy products	High levels of environmental externalities given the increase of consumption of energy	Fragmentation/destruction of habitats due to development of infrastructure	Increase of energy efficiency, rationalizing consumption and promoting non-polluting transport, heating solutions, etc.	Increase the degree of information, awareness and involvement of consumers in reducing consumption of energy.

VIII.3. ENVIRONMENTAL EFFECTS BY THE IMPLEMENTATION OF THE ENERGY STRATEGY

The following is the evaluation matrix in which compatibility has been identified, coded as follows: "+" (if the targets are compatible), "-" (if the targets are not compatible), "/" (when there were found other factors that do not depend on the two target types), "=" the targets were found to be the same). When it was found that there was no compatibility, no sign of the above was used.

Table 12 The matrix to assess the compatibility of the objectives under RES 2019-2030, with perspectives for 2050 with relevant environmental objectives

		OM1 Air	OM2 Water	OM3 Water	OM4 Soil	OM5 Soil	OM6 Climate changes	OM7 Biodiversity	OM8 Biodiversity	OM9 Landscape	OM10 Cultural aspects	OM11 Cultural aspects	OM12 Conservation of natural resources	OM13 Wastes	OM14 Population and human health	OM15 Population and human health	OM16 Transport	OM17 Transport	OM17 Energy efficiency
Clean energy and energetic efficiency	**OB1**																		
Diverse and balanced energy mix	OS1	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Replacement, in the horizon of 2030, of electricity production capacity that will come out of operation with new, efficient and low-emission capacities	OS9	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Increasing the energetic efficiency across the entire value chain of the energy sector	OS10	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	=
Reduction of GHG and NOx emissions in the energy sector	OS15	=	/	/	/	/	=	/	/	/	-	-	/	/	+	+	/	/	/
Sustainable development of the national energy sector, with the protection of air, water, soil and biodiversity	OS16	+	+	+	+	+	+	+	+	/	-	-	+	+	+	+	+	+	/
Balanced participation in the collective effort of EU Member States to achieve RES efficiency targets and to reduce GHG emissions	OS17	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-
Ensuring access to electricity and heat for all consumers	**OB2**																		
Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the	OS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+

		OM1 Air	OM2 Water	OM3 Water	OM4 Soil	OM5 Soil	OM6 Climate changes	OM7 Biodiversity	OM8 Biodiversity	OM9 Landscape	OM10 Cultural aspects	OM11 Cultural aspects	OM12 Conservation of natural resources	OM13 Wastes	OM14 Population and human health	OM15 Population and human health	OM16 Transport	OM17 Transport	OM17 Energy efficiency
category of active consumers (prosumer):																			
Increasing energy efficiency across the energy value chain	OS10	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	=
Increasing competition in domestic energy markets	OS11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liberalization of energy markets and their regional integration so that the energy consumer benefits from the best energy price	OS12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Transparency of the administrative act, simplification of bureaucracy in the energy sector:	OS19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Increasing people's access to electricity, heat and natural gas:	OS22	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+
Vulnerable consumer protection and reduction of energy poverty	**OB3**																		
Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer)	OS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Liberalization of energy markets and their regional integration so that the energy consumer benefits from the best energy price	OS12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Reducing energy poverty and protecting the vulnerable consumer	OS23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+

		OM1 Air	OM2 Water	OM3 Water	OM4 Soil	OM5 Soil	OM6 Climate changes	OM7 Biodiversity	OM8 Biodiversity	OM9 Landscape	OM10 Cultural aspects	OM11 Cultural aspects	OM12 Conservation of natural resources	OM13 Wastes	OM14 Population and human health	OM15 Population and human health	OM16 Transport	OM17 Transport	OM17 Energy efficiency
Competitive energy markets, the basis of a competitive economy	**OB4**																		
Diverse and balanced energy mix	OS1	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer)	OS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Replacement, in the horizon of 2030, of electricity production capacity that will come out of operation with new, efficient and low-emission capacities	OS9	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Increasing energy efficiency across the energy value chain	OS10	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	=
Increasing competition in domestic energy markets	OS11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Liberalization of energy markets and their regional integration so that the energy consumer benefits from the best energy price	OS12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Efficiency of the economic activities of energy companies with state capital	OS13	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+
Economic and fiscal policies to stimulate investment in the development of SRE equipment manufacturing industry, energy efficiency and electromobility	OS14	/	/	/	/	/	/	/	/	/	/	/	/	+	/	/	+	+	+

		OM1 Air	OM2 Water	OM3 Water	OM4 Soil	OM5 Soil	OM6 Climate changes	OM7 Biodiversity	OM8 Biodiversity	OM9 Landscape	OM10 Cultural aspects	OM11 Cultural aspects	OM12 Conservation of natural resources	OM13 Wastes	OM14 Population and human health	OM15 Population and human health	OM16 Transport	OM17 Transport	OM17 Energy efficiency
Transparency of the administrative act, simplification of bureaucracy in the energy sector	OS19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Modernizing the energy governance system	**OB5**																		
Efficiency of the economic activities of energy companies with state capital	OS13	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+
Separation of the status of owner and shareholder status from that of the energy market arbitrator	OS18	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Improving corporate governance of state-owned companies	OS21	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Increasing the quality of education in the field of energy and continuous training of the human resource	**OB6**																		
Diverse and balanced energy mix	OS1	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Development of Romania's strategic partnerships on the energy dimension	OS8	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Economic and fiscal policies to stimulate investment in the development of SRE equipment manufacturing industry, energy efficiency and electromobility	OS14	/	/	/	/	/	/	/	/	/	/	/	/	+	/	/	+	+	+
Reduction of GHG and NOx emissions in the energy sector	OS15	=	/	/	/	/	=	/	/	/	-	-	/	/	+	+	/	/	/

		OM1 Air	OM2 Water	OM3 Water	OM4 Soil	OM5 Soil	OM6 Climate changes	OM7 Biodiversity	OM8 Biodiversity	OM9 Landscape	OM10 Cultural aspects	OM11 Cultural aspects	OM12 Conservation of natural resources	OM13 Wastes	OM14 Population and human health	OM15 Population and human health	OM16 Transport	OM17 Transport	OM17 Energy efficiency
Supporting education and promoting scientific research; security and health at work	OS20	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Romania, regional provider of energetic security:	**OB7**																		
Diverse and balanced energy mix	OS1	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Capitalizing on new primary resource deposits to maintain a low level of energy dependence and safe operation of SEN	OS2	+	+	+	+	+	+	+	+	+	/	/	=	+	+	+	+	+	/
Increasing interconnection capacities of energy transmission networks	OS3	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+	+	+
Ensure the storage of energy and backup systems	OS4	+	+	+	+	+	+	+	+	/	/	/	+	+	/	/	+	+	+
Increasing the flexibility of the national energy system through digitization, intelligent networks and developing the category of active consumers (prosumer)	OS5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+
Protection of critical infrastructure against physical, cyber attacks and calamities	OS6	+	+	+	+	+	+	+	+	+	+	/	+	+	+	+	+	+	/
Pro-active participation of Romania in the European energy diplomacy initiatives	OS7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Development of Romania's strategic partnerships on the energy dimension	OS8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Balanced participation in the collective	OS17	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-

		OM1 Air	OM2 Water	OM3 Water	OM4 Soil	OM5 Soil	OM6 Climate changes	OM7 Biodiversity	OM8 Biodiversity	OM9 Landscape	OM10 Cultural aspects	OM11 Cultural aspects	OM12 Conservation of natural resources	OM13 Wastes	OM14 Population and human health	OM15 Population and human health	OM16 Transport	OM17 Transport	OM17 Energy efficiency
effort of EU Member States to achieve RES efficiency targets and to reduce GHG emissions																			
Increasing Romania's energy contribution to regional and European markets by capitalizing on national primary energy resources	**OB8**																		
Mix energetic diversificat și echilibrat	OS1	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+
Capitalizing on new primary resource deposits to maintain a low level of energy dependence and safe operation of SEN	OS2	+	+	+	+	+	+	+	+	+	/	/	=	+	+	+	+	+	/
Increasing interconnection capacities of energy transmission networks	OS3	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	+	+	+
Ensure the storage of energy and backup systems	OS4	+	+	+	+	+	+	+	+	/	/	/	+	+	/	/	+	+	+
Replacement, in the horizon of 2030, of electricity production capacity that will come out of operation with new, efficient and low-emission capacities	OS9	+	+	+	+	+	+	+	+	+	/	/	+	+	+	+	+	+	+

Evaluation of sub-sectors under RES 2019-2030, with perspectives for 2050

Energy production is a form of development that generates some of the most significant potential effects on the environment, yet it is essential for human well-being. Each type of energy source raises a different range of environmental issues, but by conserving and rational use of resources and by applying specific measures to avoid, reduce and compensate, it is possible to reduce the adverse effects.

In this section, the various sub-sectors that make up the energy sector are evaluated.

The mining sub-sector (lignite, coal, uranium)

The current situation:

The current situation is presented briefly within RES 2019-2030, with perspectives for 2050, as follows:

- coal production in 2017 was 5164.7 thousand toe, representing about 15% of the energy mix;
- lignite resources: 690 mil. Tonnes - 28-year reserve period;
- coal resources: 232 mil. Tonnes - 290-year reserve period;
- uranium resources: no data available (specific available data in the enclosed annex);
- the production of lignite is mainly made from 15 perimeters of exploitation in the Oltenia coal basin;

Identify externalities/environmental obligations:

Environmental obligations are not clearly identified, but several solutions are proposed to keep the energy source within the national energy mix as follows:

- lignite-based energy production is feasible to the extent that it manages to remain competitive in the electricity mix and to meet its environmental obligations;
- it is proposed to develop new capacities equipped with CO2 capture, transport and geological disposal (CSC) technology;

Identifying targets for 2020, 2030 and 2050:

According to the information from the RES 2019-2030, with perspectives for 2050, coal-fired power generation tends to grow until the 2030 horizon, and then drops in line with the decline in coal reserves.

1. For 2020 - the construction of new lignite thermoelectric power plants with supercritical parameters;
2. For 2020, coal-fired power generation will be 17.5 TWh (27.5% of the share of energy resources in electricity production) compared to 17.3 TWh (25.4% of the share of energy resources in electricity production) at the level of the year 2017;
3. For 2025 - coal-fired power generation will be 17.8 TWh (24.7% of the share of energy resources in electricity production) compared to 17.3 TWh (27.5% of the share of energy resources in electricity production) at the level of 2017;

4. For 2030 - coal-fired power generation will be 18.8 TWh (20.5% of the share of energy resources in electricity production) compared to 17.3 TWh (27.5% of the share of energy resources in electricity production) at the level of 2017;
5. For the year 2035 - coal-based electricity production will be 14.9 TWh (18% of the share of energy resources in electricity production) compared to 17.3 TWh (27.5% of the share of energy resources in electricity production) at the level 2017;
6. For the year 2035 - the construction of new lignite thermoelectric plants provided with CO2 capture, transport and geological disposal (CCS) technology.
7. For the years 2040 - 2050 - coal-based electricity production will be 14.9 TWh (18% of the share of energy resources in electricity production) compared to 17.3 TWh (27.5% of the share of energy resources in electricity production) at level 2017.

Identify major projects (potential significant effects):

Within RES 2019-2030, with perspectives for 2050, projects are presented which are based on coal as raw material:

- ✓ Achieving a new 600 MW power plant at Rovinari - super-critical parameters;

Raw material, lignite, to be used under the above-mentioned objective will be extracted from quarries in the immediate vicinity of the investment objective.

- ✓ Realization of a new 400 MW power plant in Turceni - ultra super-critical parameters;

A few potential negative effects identified in this procedure will be presented:

- ❖ Affecting some large land areas for the extraction of coal used as raw material in the two above mentioned objectives, including the irreversible alteration of natural habitats;
- ❖ High atmospheric emissions of dusts and/or particulate matter with direct effects on the health of the population and/or natural vegetation in the vicinity;
- ❖ Changing local hydrogeological and hydrological conditions that may have remote effects;
- ❖ Possible pollution of surface water (with particulate matter), groundwater and soil/subsoil.

Identify innovative/sustainable solutions:

RES 2019-2030, with perspectives for 2050, promotes the use of new technologies equipped with ultra-super-critical and super-critical parameters that lead to high efficiency, operating flexibility and specific low GHG emissions.

Hydrocarbons sub-sector (crude oil and natural gas)

The current situation:

Within RES 2019-2030, with perspectives for 2050, succinct data on hydrocarbon exploitation perimeters, their production etc. are presented, as follows:

- the crude oil production in the year 2017 was 11,175.9 thousand toe, representing about 32.6% of the energy mix;
- natural gas production in 2017 was 9,282.1 thousand toe, representing about 27% of the energy mix;
- the exploitation of hydrocarbons is currently made in 400 oil and natural gas fields, as follows: OMV Petrom operates over 200 commercial oil and natural gas fields with over 7000 active wells and more than 700 facilities and has 7 fixed platforms in the Black Sea;
- Romgaz operates on 8 perimeters of exploration, development, exploitation;
- natural gas resources: 726.8 mil. Tonnes - 69-year reserve period;
- crude oil resources: 229.2 mil. Tonnes - 67-year reserve period.

Identify externalities/environmental obligations:

The following measures of prevention and reduction to reduce the potential environmental impact of the hydrocarbon sector were proposed:

- Avoiding the implementation of projects that might result in the alteration of the chemical state of water bodies and of the their ecological potential/state;
- Analysis of the opportunity of changing the categories of use of the lands for implementing projects so that the activities in the area are not affected;
- Rehabilitation of the locations of working points soon after completing the construction works;
- Restricting the use of machines and vehicles and manual execution of works in areas or when species of fauna are vulnerable.

Identifying targets for 2020, 2030 and 2050:

According to the information from RES 2019-2030, with perspectives for 2050, crude oil (petroleum) energy production is linear, with small inflections depending on market requirements. In the case of the production of natural gas-based energy, this tends to increase for the time horizon specified in the RES. Here below are examples of energy production with crude oil (petroleum) and natural gas:

1. For 2020, the production of hydrocarbon-based (oil) electricity will be 0.4 TWh (0.6% of the share of energy resources in electricity production) compared to 0.4 TWh (0.7% of the share of energy resources in electricity production) at the level of 2017;
2. For 2020, the production of electricity with natural gas will be 14 TWh (20.3% of the share of energy resources in electricity production) compared to 10.2 TWh (16.3% of the share of energy resources in electricity production) at the level 2017;
3. For the period 2025-2050, the production of hydrocarbon-based (oil) electricity will be 0.4 TWh (0.6-0.5% of the share of energy resources in the electricity production) compared to 0.4 TWh (0.7% of the share of energy resources in production of electric power) at the level of 2017;
4. For the period 2025 - 2035 - the production of electricity with natural gas will be 14.5 TWh (20.1 - 17.5% of the share of energy resources in the electricity

production) compared to 10.2 TWh (16.3% of the share of energy resources in production of electric power) at the level of 2017;

5. For the period 2040 - 2050 - the production of electricity with natural gas will be 15 TWh (17.8 - 17.4% of the share of energy resources in the electricity production) compared to 10.2 TWh (16.3% of the share of energy resources in production of electric power) at the level of 2017.

Identify major projects (potential significant effects):

Within RES 2019-2030, with perspectives for 2050, projects are presented which are based on natural gas as raw material:

- ✓ Realization of a new 200 MW CCGT-Craiova II Group, on gas with flexible operation including the storage of energy resources in the Ghercești underground deposit;
- ✓ Realization of a new group of 400 MW CCGT on gas with flexible operation at Mintia;

On the basis of the presented elements significant negative effects associated with future mining projects from the sector of natural gas can be identified, mentioning a possible alteration of the chemical/ecological state of water bodies. Also, please note that the two projects will be carried out on the site or in the immediate vicinity of the current energy objectives.

The following measures of prevention and reduction to reduce the potential environmental impact of the hydrocarbon sector were proposed:

- ❖ Avoiding the implementation of projects that may cause the alteration of the chemical state of water bodies and their ecological state/potential;
- ❖ Analysing the opportunity of changing categories of use of lands for implementing certain projects so that the activities in the area are not affected;
- ❖ Rehabilitation of the sites of working points soon after the construction works are completed;
- ❖ Restricting the use of machines and vehicles and manual execution of works in areas or when species of fauna are vulnerable.

Identify innovative/sustainable solutions:

Prospecting new perimeters of exploitation through own investment programs and by implementing programs for modernization and retrofitting of obsolete installations.

Renewable energy sub-sector (hydropower, wind, solar, geothermal, biomass)

The current situation:

The current situation in the renewable energy subsector is presented in the RES 2019-2030, with perspectives for 2050, as follows:

- ❖ the production of hydroelectric power, nuclear power, solar energy and electricity from import in 2017 was 5,203.8 thousand toe, representing about 15.2% of the energy mix;

- Hydro-energy: Romania's hydro-energetic potential is ensured on the one hand by the inland waters with a production of 51.6 TWh/year and on the other by the Danube river (the Romanian part) with a production of 18.4 TWh/year;
- wind energy: there are presented areas that offer opportunities for energetic use (Dobrogea, areas in Bărăgan and Moldova) and the context of the development of this sector on the energy production market;
- solar energy: it is used for energy purposes in two directions: on the one hand in the individual system of domestic hot water supply and heating of buildings, and on the other hand the production of electricity in photovoltaic systems. Areas with maximum potential are: Dobrogea, eastern Baragan and southern Oltenia;
- biomass (which may be in the form of bioliquids, biogas, waste and waste and slurry fermentation gas, fire wood); the main form of energy biomass is represented by firewood used as a heating system in individual dwellings;
- the presentation of the production of energy from renewable sources (biomass, biofuels, biogas, waste and waste and slurry fermentation gas, fire wood, energy recovery waste) will have an upward trend, with firewood consumption decreasing by 20% in the year 2030, and the consumption of biofuels will increase by 4.1 TWh/year;
- at the level of 2017, the energy production from the aforementioned sources was 126 MW;
- geothermal energy: the main exploitation perimeters located in western Transylvania, on restricted areas in northern Bucharest and Râmnicu Vâlcea, and around Ţăndărei locality are presented. It is also suggested that this type of renewable resource is not feasible in cost-benefit ratio.

<u>Identify externalities/environmental obligations:</u>

For the production of energy from renewable sources in RES 2019-2030, with perspectives for 2050, several directions have been drawn in terms of the environment as follows:

- hydro power: establishment of auxiliary flows and establishment of Natura 2000 sites that have reduced annual useful water use by about 20% compared to 1990 levels; for large hydropower planning, the gradual adoption of higher standards for ecological flows shall comply with the law, to fulfil the average European standards in the field.
- harmonization with European environmental policies;
- wind energy: limitations imposed by the Natura 2000 ecological network, but also flight lanes for migratory bird populations;
- solar energy: the establishment of the Natura 2000 network that has restricted areas for the installation of new photovoltaic parks.

<u>Identifying targets for 2020, 2030 and 2050:</u>

According to the information from RES 2019-2030, with perspectives for 2050, the production of renewable energy has an upward trend, as can be seen from the presentation of the proposed targets as follows:

1. For 2020, renewable electricity (water) production will be 15.8 TWh (22.9% of the share of energy resources in electricity production) compared to 14.4 TWh (23% of the share of energy resources in electricity production) at the level of 2017;
2. For the year 2020 - the production of renewable electricity (wind and solar) will be 8.8TWh (12.7% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017;
3. For the period 2020-2050 - the production of renewable energy (biomass) will be 0.9 TWh (1.3% of the share of energy resources in the electricity production) compared to 0.4 TWh (0.7% of the share of energy resources in the production of electricity) at the level of 2017;
4. For the year 2025 - the production of renewable energy (water) will be 17.5 TWh (24.3% of the share of energy resources in electricity production) compared to 14.4 TWh (23% of the share of energy resources in electricity production) at the level of 2017;
5. For the year 2025 - the production of renewable electricity (wind and solar) will be 9.6 TWh (13.3% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017;
6. For the period 2030-2050, the production of renewable electricity (water) will be 17.6 TWh (22.8-20.5% of the share of energy resources in electricity production) compared to 14.4 TWh (23% of the share of energy resources in electricity production) at the level of 2017;
7. For the year 2030 - the production of renewable electricity (wind and solar) will be 10.5 TWh (13.6% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017;
8. For the year 2035 - the production of renewable electricity (wind and solar) will be 11.4 TWh (13.7% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017;
9. For the year 2040 - the production of renewable electricity (wind and solar) will be 12.3 TWh (14.6% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017;
10. For the year 2045 - the production of renewable electricity (wind and solar) will be 13.1 TWh (15.4% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017;
11. For the year 2050, the production of renewable electricity (wind and solar) will be 14 TWh (16.3% of the share of energy resources in electricity production) compared to 8.5 TWh (13.5% of the share of energy resources in the production of electricity) at the level of 2017.

<u>Identify major projects (potential significant effects):</u>

According to RES 2019-2030, with perspectives for 2050, the hydro power field has been proposed for most of the projects, some of them in advanced stages of realization:

- ✓ Achieving the pumped-accumulation hydroelectric power plant with Tarniţa-Lăpuşteşti;
- ✓ Realization of hydroelectric power plant Turnu Magurele -Nicopole, 500 MW;
- ✓ Realization of hydroelectric power plant Răstoliţa – 35 MW;
- ✓ Realization of hydropower plants on the Jiu River – 90 MW;
- ✓ Realization of hydropower plants on the Olt River (in the defile area) – 145 MW.

After the analysis, the potential significant effects on the environment were established, in terms of the biodiversity environmental factor by the alteration, fragmentation and then the possible loss of habitats for projects intersecting protected natural areas. Among the most well-known potentially significant negative effects, it could be on aquatic and riverside ecosystems by decreasing water flow on rivers.

Identify innovative/sustainable solutions:

In order to ensure energy from renewable resources and in particular hydropower, new investment opportunities and the modernization of the plants are sought, both for the observance of the environmental protection norms and for the replacement of the existing ones, as the life span for most hydro power plants is near the end.

According to RES 2019-2030 with the perspectives of 2050, under the waste of energy use section it is proposed to recover waste from the mechanical processing of the following fractions: dry fraction (approx. 20%), recyclable fraction (approx. 25%), wet-organic fraction (approx. 30%), dry-organic fraction (approx. 25%). Therefore, according to Directive 2008/98/EC[27] and to the principle of circular economy, around 55% of these waste, representing the recyclable fraction and dry-organic fraction, must be recovered not incinerated. The dry-organic fraction yields: gas (that can be injected in the existing natural gas network), GNC[28] (used for vehicles powered by this type of fuel). The remaining 45% of waste, representing the dry and dry-organic fractions, is a waste that, if properly processed, becomes an alternative fuel that can reach values of the heating power of up to 2 times the value of the calorific power of lignite. The dry fraction and dry-organic fraction combine to obtain a solid alternative fuel (SSF – Secondary Solid Fuel).

Secondary solid fuel (SSF) is already produced in EU countries according to the national regulations that transposed in the specific laws the provisions of the European Directive 2008/98/EC. SSF is defined as a reliable alternative to „replacing conventional fuels for achieving the environmental and economic objectives affecting the climate, increasing the use of renewable energy sources through a sustainable use for energetic purposes". The European Directive 2008/98/EC accepts the use of SSF as fuel in the following situations:

- ❖ coal-powered power plants with groups of unitary powers higher than 50 MW;
- ❖ cement factories with a production capacity of more than 500 t/day clinker.

The European Union rates „neutral" emissions from power plants that use SSF as fuel added instead of fossil fuels, thus reducing CO2 emissions.

[27] Directive 2008/98/EC on waste and repealing certain directives

28 GNC- Compressed Natural Gas

The use of SSF will also have immediate benefits by reducing the bill paid by economic agents for CO2 Certificates.

Nuclear energy sub-sector

The current situation:

Under RES 2019-2030, with perspectives for 2050, no detailed information is provided on the nuclear sector in the context of electricity generation.

Identify externalities/environmental obligations:

No environmental obligations have been identified with regard to the production of nuclear energy.

Identifying targets for 2020, 2030 and 2050:

According to RES 2019-2030, with perspectives for 2050, there were identified targets with an upward trend in the context of energy production, as follows:

1. For 2020, electricity production from nuclear sources will be 11.5 TWh (16.7% of the share of energy resources in electricity production) compared to 11.5 TWh (18.3% of the share of energy resources in electricity production) in the year 2017;
2. For 2025, electricity production from nuclear sources will be 11.4 TWh (15.8% of the share of energy resources in electricity production) compared to 11.5 TWh (18.3% of the share of energy resources in electricity production) in the year 2017;
3. For 2030, electricity production from nuclear sources will be 17.4 TWh (22.5% of the share of energy resources in electricity production) compared to 11.5 TWh (18.3% of the share of energy resources in electricity production) in the year 2017;
4. For the period 2035-2050 - the production of electricity from nuclear sources will be 23.2 TWh (28-26.9% of the share of energy resources in the electricity production) compared to 11.5 TWh (18.3% of the share of energy resources in electricity production) at the level of 2017.

Identify major projects (potential significant effects):

The only project promoted by RES 2019-2030, with perspectives for 2050, is the

- ✓ Completion of groups 3 and 4 at Cernavoda NPP.

Please note that there are no potential significant negative effects of the project implementation.

Identify innovative/sustainable solutions:

The technology used in the nuclear field is CANDU (Canadian).

Electricity transport subsector

The current situation:

The current situation presented in the framework of RES 2019-2030, with perspectives for 2050, regarding the transport of electricity, is presented as follows:

- transport, storage, distribution and natural gas market in Romania through the National Transport System (SNT) linking production points to consumers. This is done by TRANSGAZ;
- The storage of natural gas is done in 7 storages, of which 6 storages are owned by ROMGAZ and the 7th by ENGIE;
- the transmission of electricity is carried out by Transelectrica - a system and transport operator who intends to develop the regions of the national territory where RET (transmission network) is deficient, increase the cross-border interconnection capacity and evacuate of the power from the concentration areas to the regions/areas of consumption.

Identify externalities/environmental obligations:

Under RES 2019-2030, with perspectives for 2050, no environmental obligations have been identified.

The potential significant negative impacts consist of deforestation (exploitation corridors) for the stage of construction of OHL. In order to compensate for this type of intervention, other land areas can be planted in agreement with the forestry departments from these localities.

Identifying targets for 2020, 2030 and 2050:

No targets are set for the transport, retention and storage of electricity under RES 2019-2030, with perspectives for 2050.

Identify major projects (potential significant effects):

Within RES 2019-2030, with perspectives for 2050, there are presented a series of projects targeting the transport of energy:

- ✓ The components of the "138 Black Sea Corridor" project with the following investments:
  - New 400 kV dc LEA between the existing stations Cernavodă and Stâlpu with an incoming/outgoing circuit at the 400 kV Gura Ialomiţei station;
  - The new 400 kV dc LEA (with an equipped circuit) between existing stations Smârdan and Gutinaş;
  - Expansion of the 220/110 kV Stâlpu station by building the 400/110 kV station.
- ✓ The components of the "144 Mid Continental East Corridor" project with the following investments:
  - New 400 kV dc LEA between existing stations Resita (Romania) and Pancevo (Serbia);

- New 400 kV s.c. LEA to existing station 400 kV Portile de Fier and the new 400 kV station Resita;
- Switching to 400 kV at 220 kV dc LEA Reşiţa-Timişoara-Săcălaz-Arad;
- Expansion of the 220/110 kV Resita station by building the new 400/220/110 kV Resita station;
- Replacement of the 220/110 kV Timisoara station by construction of the new 400/220/110 kV station.

Some of the energy transport projects have obtained environmental agreements through which there have been identified a number of potentially significant negative effects, as follows:

- For the "new 400 kV dc LEA (with equipped circuit) between existing stations Smârdan and Gutinaş", there were identified the following:

Of the length of 138 km of LEA, about 3.483 km cross forest lands, on the territory of which, in the stage of ecological construction and reconstruction, a 54 m wide corridor will be gutted, resulting in the area of 18.8084 ha of deforested land, from which:

- On the territory of Bacău County - 8.6086 ha of deciduous forest, of which 0.2731 ha is on the territory of ROSCI0162 Lunca Siretului Inferior;
- On the territory of Vrancea County - 5.6778 ha of deciduous forest and on a distance of 575 m LEA intersects a plantation of walnut and acacia with the height of the specimens of 3 - 6 m;
- On the territory of Galati County - 4.5219 hectares of deciduous forest, of which 0.1080 ha of poplar planting in the form of a curtain in the Cosmesti area, an area where the territories ROSCI0162 and ROSPA0071 Lunca Siretului Inferior overlap territorially.

- For the "new 400 kV dc LEA between existing stations Cernavodă and Stâlpu, with an input/output circuit at the 400 kV Gura Ialomiţei station" the following were identified:

In order to realize the 400 kV Cernavodă - Stâlpu LEA and to connect to Gura Ialomiţei station, it is necessary: to remove from the forest area the surface of 65129 sq. m., of which 1837 sq. m permanent occupation and 63292 sq. m temporary occupation; deforesting an area of 64920 sq. m. of which 1837 sq. m. permanent deforestation and 63083 sq. m. temporary deforestation; deforesting an area of 0.0598 ha (598 sqm) from ROSCI0022 Canaralele Dunarii.

The areas of corridors will be mostly replanted with the same species that will be deforested.

Total deforested areas are the areas to be occupied by the pillars, and the temporarily deforested areas are those necessary for the construction of work and safety corridors. The surfaces necessary for the corridors are to be mostly repopulated with species similar to the deforested ones.

With the exception of the Danube meadow areas and the Borcea branch, the LEA route avoids areas with forests.

In the crossing area of ROSCI0290 Ialomita Corridor, there are no meadow forests but only grassy vegetation.

In the maintenance phase of the 400 kV Cernavoda-Stalpu LEA, no deforestation will be carried out, but only tree dressing, to avoid reaching the active conductors by the high canopys or extending the trees into the passageways and safety corridors. Only those trees and shrubs that pose a real danger of falling over electric lines or supporting posts during storms will be cut.

- For the project "LEA 400 kV Porţile de Fier - Anina – Reşiţa" we identified the following:

The total area required for the project through deforestation is 148.1270 ha. Of this, 80.4370 ha (54.3%) are located on the surface of protected natural areas as follows:

- ROSCI0206 Porţile de Fier 0.0325%;
- ROSCI0198 Platoul Mehedinţi 0.0189%;
- ROSCI0069 Domogled - Valea Cernei (RN Iardaşiţa) 0.0012%;
- ROSCI0226 Semenic - Cheile Caraşului 0.0069%;
- ROSCI0031 Cheile Nerei-Beuşniţa 0.0662%;
- ROSPA0080 Munţii Almăjului - Locvei 0.0345%;
- ROSPA0086 Munţii Semenic - Cheile Caraşului 0.0071%;
- ROSPA0020 Cheile Nerei - Beuşniţa 0.0618%.

- For the "new 400 kV dc LEA" between existing stations Resita (Romania) and Pancevo (Serbia)" measures are envisaged to reduce the impact on the protected area.

Identify innovative/sustainable solutions:

The ongoing projects will implement the best available technologies in the field.

Thermal energy sub-sector

The current situation:

The current situation in RES 2019-2030, with perspectives for 2050, for the thermal energy sector is presented below:

- the segment of buildings and services represents 45% of the total energy consumption in Romania, while residential heating accounts for 78% of energy consumption and cooling only 1%;
- thermal energy for the industrial sector has declined considerably against the decline in economic activity;
- thermal energy is generated through CET (cogeneration power plants).

Identify externalities/environmental obligations:

Under RES 2019-2030, with perspectives for 2050, no environmental obligations have been identified.

Discontinuation of SACETs due to the restraint of industrial activity and due to the financial impossibility of achieving environmental investments.

Identifying targets for 2020, 2030 and 2050:

No targets have been identified for the target period of RES 2019-2030, with perspectives for 2050.

Identify major projects (potential significant effects):

Under RES 2019-2030, with perspectives for 2050, no major projects in the thermal energy sector were identified.

Also, no significant negative effects were identified.

Identify innovative/sustainable solutions:

Using solar panels and geothermal energy or heat pumps can build houses that will have low energy (almost zero) energy consumption or positive energy balance (energy plus).

Funding for the implementation of thermal insulation programmes for buildings.

X. ADEQUATE EVALUATION OF THE POTENTIAL EFFECTS OF THE IMPLEMENTATION OF THE ENERGY STRATEGY ON THE PROTECTED NATURAL AREAS OF COMMUNITY INTEREST

IX.1. INTRODUCTION

In order to meet the requirements of the Habitats (Directive 92/43 EEC) and Birds Directive (Directive 2009/147/EC), Romania has designated 606 Natura 2000 sites, namely 435 SCIs (Sites of Community Importance) and 171 SPAs (Special Protection Bird Areas).

These sites are part of the Natura 2000 European Ecological Network, a a biodiversity conservation tool applied at EU level, based on two directives: Council Directive 92/43 EEC on the conservation of natural habitats and of wild fauna and flora adopted on 21 May 1992 and Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, transposed by the Emergency Ordinance of the Government no. 57/2007 on the regime of natural protected areas, conservation of natural habitats, wild flora and fauna, approved with amendments and additions by Law no. 49/2011. These areas account for about a quarter of the country's total area.

IX.2 CURRENT SITUATION

The identification of Natura 2000 sites potentially affected by the implementation of the projects foreseen in the *Romanian Energy Strategy 2019-2030, with prospects for 2050*, was carried out by an analysis in which the following data were used:

- Proposed projects in the energy sector, i.e. in the two subsectors: energy production and transport. Their placement was made using geospatial information vectored by the Provider pursuant to the Beneficiary's indications. In the case of LEA targets, information from environmental agreements was used;
- The boundaries of the protected natural areas and Natura 2000 sites in Romania in shp format (updated on 29.08.2017), available on the website of the Ministry of Environment [29];
- Standard Forms of Natura 2000 sites in Romania (updated on 29.08.2017), available on the website of the Ministry of Environment [30].

The analysis was carried out through two approaches:

- Identifying the specific elements of the RES objectives intersecting Natura 2000 sites;
- Identify objectives that do not intersect Natura 2000 sites but which are located less than 1 km away from them.

[29] http://www.mmediu.ro/articol/date-gis/434
[30] http://www.mmediu.ro/articol/natura-2000/435

We specify that for a few objectives for which no concrete data on their location and on the areas of the land temporarily or permanently occupied by their realization were available. This is due to the strategic stages of the objectives. From this point of view, the projects were classified as follows:

- projects that target existing sites and will be deployed within them, these being the only projects that have a concrete location;
- projects for which spatial location was made by different methods: 1) By georeferencing and digitizing existing images with project location [31].

IX.3. MAJOR PROJECTS INCLUDED IN RES

The proposed investments to be made by 2030, in line with the objectives of the RES 2019-2030, with perspectives for 2050 on the development of the energy sector, are as follows:

Figure 13 Objectives identified and targeted by Romania's Energy Strategy 2019-2030, with perspectives for 2050

It. no.	Objectives RES 2019-2030, with perspectives for 2050
Producere energie	
1	Completion of groups 3 and 4 at Cernavoda nuclear power plant
2	Realization of a new 600 MW power plant in Rovinari
3	Realization of a new energy group of 400 MW with ultra supercritical parameters in Turceni
4	Realization of a new 200 MW CCGT - Craiova II energy group, on gas, with flexible operation, including energy storage in the underground storage facility Ghercești
5	Realization of a new 400 MW MWG CCGT energy group on gas, with flexible operation, at Mintia
6	Realization of a hydroelectric power plant with accumulation by pumping at Tarniţa-Lăpuştești
7	Realization of a hydroelectric power station at Turnu Magurele - Nicopole 500 MW
8	Realization of a hydroelectric power plant 35 MW at Rostoliţa
9	Realization of hydropower plants on the Jiu River 90 MW
10	Realization of hydropower plants on the Olt River - 145 MW
Energy transport	
11	The new 400 kV dc LEA (with an equipped circuit) between existing stations Smârdan and Gutinaş
12	New 400 kV dc LEA between the existing Cernavodă and Stâlpu stations with an inlet/outlet at the 400 kV Gura Ialomiţei station

[31] For the objective *Execution of the hydroelectric power plant with accumulation by pumping at Tarniţa-Lăpuştești, t*he location of the project was found by georeferencing the image concerning the location of the project HidroTarniţa, at the Beneficiary's instructions (http://www.hidrotarnita.ro/localizare/)

It. no.	Objectives RES 2019-2030, with perspectives for 2050
13	Expansion of the 220/110 kV Stâlpu station by building the 400/110 kV station
14	LEA 400 kV Porţile de Fier - Anina - Reşiţa
15	New 400 kV dc LEA between existing stations Resita (Romania) and Pancevo (Serbia)
16	Switching to 400 kV of LEA 220 kV dc Reşiţa-Timişoara-Săcălaz-Arad
17	Expansion of the 220/110 kV Resita station by building the new 400/220/110 kV Resita station;
18	Replacement of the 220/110 kV Timisoara station by construction of the new 400/220/110 kV station.

Their location and the procedure for locating each unit will be shown in the following figures.

ENERGY PRODUCTION:

- *Completion of groups 3 and 4 at Cernavoda nuclear power plant*

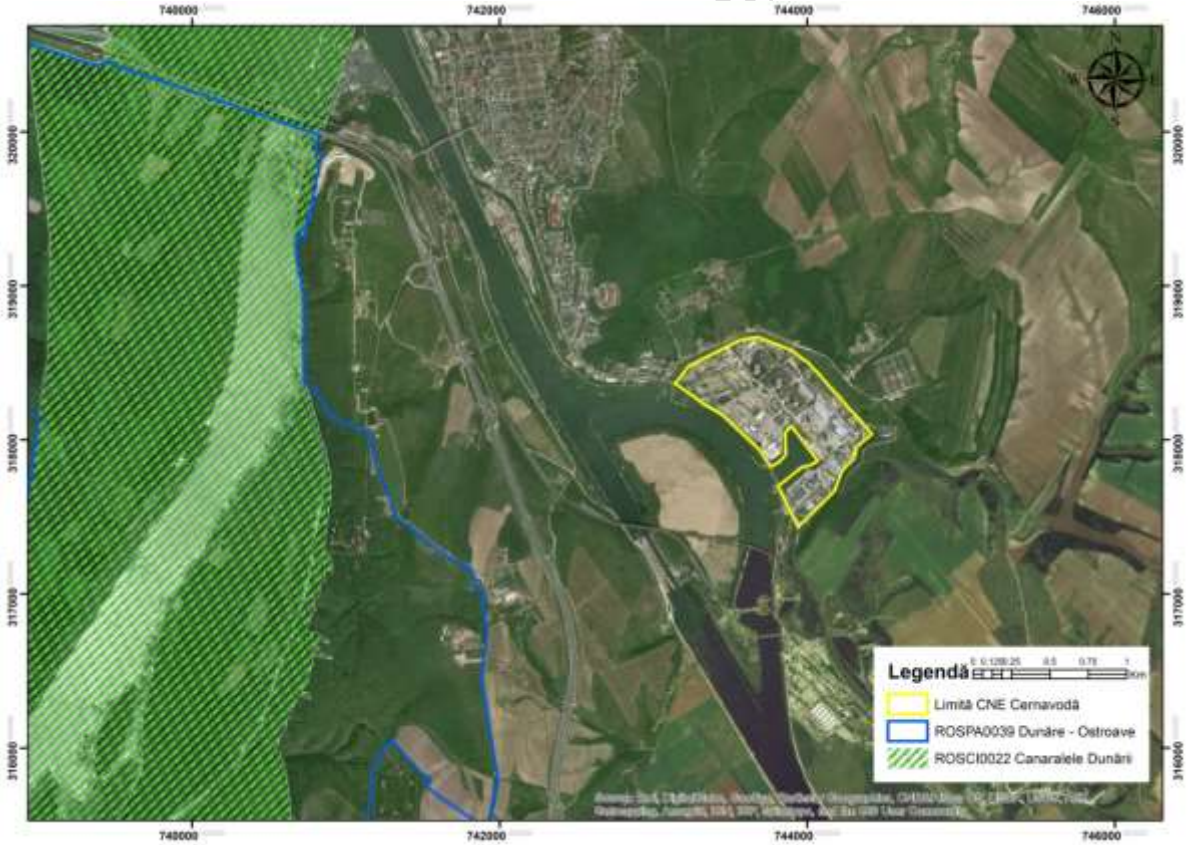


Figure 28 Locating the objective "Completion of Groups 3 and 4 at Cernavoda NPP"

The location of the objective was made taking into account the fact that it refers to the existing site of Cernavoda NPP that does not intersect Natura 2000 sites.

We mention that the Environmental Approval for "Completion of groups 3 and 4 at Cernavoda NPP" was given by Government Decision no. 737/25.09.2013.

The impact on biodiversity of the discharge of cooling water was analysed in an adequate evaluation study, starting from the premise that a nuclear power plant with 4 units is close to Natura 2000 sites. According to the summary to the Adequate evaluation of the environmental impact of Units 43 and 4 of Cernavoda NPP – Impact on biodiversity (INCDDD, 2012) there are 3 stations where special vertical measurements (on water column) and transversal measurements (left bank-canal-right bank) are made in the water shortage are with modified temperatures, located at the following coordinates: P1=700 m downstream the mouth of the cooling water discharge canal, P2 = 1.5 km downstream the mouth of the cooling water discharge canal and P3 – 2.5 km downstream the mouth of the cooling water discharge canal.

Among the most important conclusions of *Proper evaluation of environment impact of the Units 3 and 4 of C.N.E. Cernavodă,* according to environment agreement, we mention:

- The impact of the projects of units 3 and 4 is insignificant, the simultaneous operation of 4 nuclear units in C.N.E. Cernavodă not impairing the favourable maintenance status of habitats and species, including those of community interest present on the territories of the closest sites Nature 2000 (ROSCI0022 Canaralele Dunării, ROSPA0002 Allah Bair-Capidava and ROSPA0017 Canaralele de la Hârşova);
- No significant negative impact on the evolution of flora and fauna in the area has been identified in the area of influence of the project due to the discharges of technological warm water in Danube;
- In case of accident, the documentation of evaluation of impact on environment includes operation procedures, measures of intervention of the staff of nuclear power plant, and other authorities in charge;
- One has analysed the effects on natural succession and composition of reofil phytoplankton from Danube, on the conservation of the species of community interest (plants, invertebra, fish, amphibians, reptiles, birds, mammals) emphasized that the impact would be insignificant among them.

The potential impact was correlated with the changes that might occur in the future pursuant to commissioning the Units 3 and 4 of C.N.E. Cernavodă considering the length and width of outage of water with temperatures changed in the area of discharge of cooling waters[32]:

High levels of Danube (summer and winter)	Low levels of Danube (autumn and spring)
There is the possibility that the water layer with changed temperatures covers	There is the possibility that the water outage has a length of 3-3.5 km*.

[32] Adequate evaluation of the environmental impact of Units 3 and 4 of Cernavoda NPP– Impact on biodiversity (INCDDD, 2012) – summary (http://www.mmediu.ro/beta/wpcontent/uploads/2012/08/2012-08-10_centrala_cernavoda_studiuincdddrezumatromana.pdf)

a length of 4.5-6.5 km*.

*This depends on the increase of debit of discharged waters with the commissioning of another 2 units within C.N.E. Cernavodă, as well as the difference between the temperature of water coming from the discharge channel and the temperature of Danube waters upstream of the outfall of the channel of discharge of cooling waters.

* This depends on the increase of debit of discharged waters and the difference between the temperature of water coming from the discharge channel of cooling waters and the temperature of Danube waters upstream of the outfall of the channel of discharge of cooling waters.

- *Realization of a new 600 MW power plant in Rovinari*

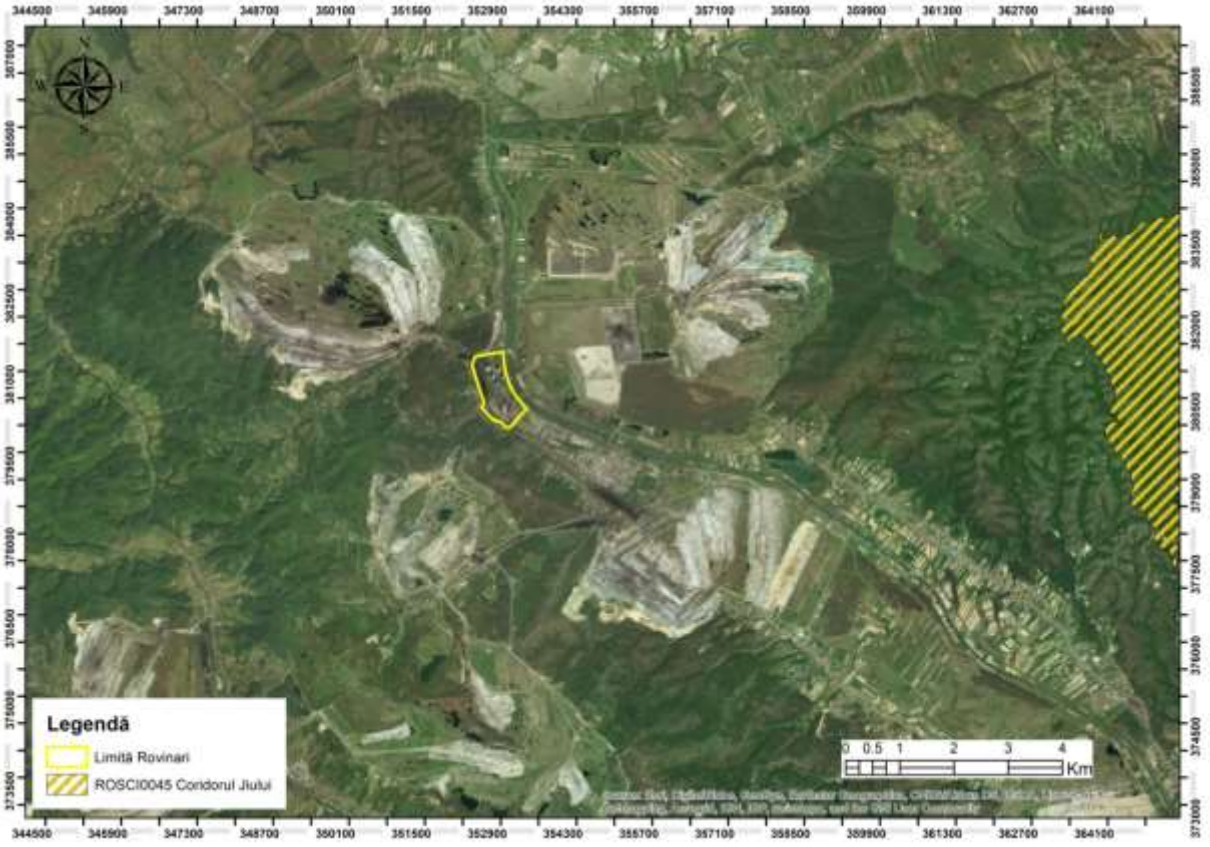


Figure 29 Locating the "Realization of a new 600 MW power plant in Rovinari"

The objective concerns the existing site that does not intersect Natura 2000 sites. According to RES 2019-2030, with perspectives for 2050, the 600 MW new energy group in the Rovinari area, expected to be commissioned in early 2021, will use as the basic fuel the lignite supplied from the quarries in the immediate vicinity of the investment objective.

The project was adopted in September 2015 based on the Feasibility Study and the Assessment report on the contribution in kind of the company Complexul Energetic

Oltenis SA. It will be developed in the southern part of the energetic complex on a total area of 141,885 sqm[33]

We also mention that the current Complex Energetic from Rovinari has the Integrated Environmental Permit no. 07/25.09.2018 issued by Gorj Environmental Protection Agency.

The potential impact associated to the production of energy from non-renewable resources, in this case by burning carbon and natural gas, must be analysed from several perspectives: impact caused by the exploitation of resources, transport of it and actual use.

For the two kinds of resources, the main potential effects in the detriment of biodiversity are the following [34]:

Exploitation	Transport	Burning
- Occurrence and aggravation of erosion; - Phonic pollution; - Atmospheric pollution; - Degradation and fragmentation of species´ habitats, manly by stubbing different areas of forest, and facilitation of entry of invasive species; - **Damage of water quality;** - Esthetical alteration of landscape; - Topography changes.	- Accentuation of the impact due to mine exploitation by increase of the concentrations of polluting emissions from mobile sources.	- Increase of atmospheric pollution concentrations due to increased emissions of carbon dioxide, nitric oxide, sulphur and methane dioxide generated by burning, affecting the health of bodies; - contribution to occurrence of photochemical smog, of acid rains and accentuation of the effects of climatic changes.

[33] According to notice no. 130289/02.07.2019 registered with the Ministry of Energy (a notice sent by the Company Complexul Energetic Oltenis SA).

[34] Center for Biological Diversity (https://www.biologicaldiversity.org/programs/public_lands/energy/dirty_energy_development/coal/index.html)

- *Realization of a new energy group of 400 MW with ultra supercritical parameters in Turceni*

Figure 30 Localization of the "Realization of a new energy group of 400 MW with ultra super critical parameters in Turceni"

The location of the objective was made taking into account that it targets the existing site. We consider it necessary to emphasize that the 400 MW Turceni new energy group with ultra super critical parameters, based on the latest European emissions technologies for pollutants, will contribute to the reduction of CO2 emissions through the highest level of energy efficiency.

We specify that the current Branch of Turceni Power Plant holds the Integrated Environmental Permit no. 1/10.03.2014, valid until 10.03.2024 issued by the Gorj Environmental Protection Agency.

The site is located less than 1 km from the site ROSCI0045 Jiu Corridor.

The potential impact associated to the production of energy from non-renewable resources, in this case by burning carbon and natural gas, must be analysed from several perspectives: impact caused by the exploitation of resources, transport of it and actual use.

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[35] Center for Biological Diversity (https://www.biologicaldiversity.org/programs/public_lands/energy/dirty_energy_development/coal/index.html)

- *Realization of a new 200 MW CCGT - Craiova II energy group, on gas, with flexible operation, including energy storage in the underground storage facility Ghercești*

Figure 31 Localization of the objective "Realization of a new 200 MW CCGT - Craiova II energy group, on gas, with flexible operation, including energy storage in the underground storage facility Ghercești"

The objective "Realization of a new 200 MW CCGT - Craiova II energy group, on gas, with flexible operation, including energy storage in the underground storage facility Ghercești" targets the existing site of the Craiova II thermal power plant and the existing underground storage site in Ghercești. They do not overlap with the Natura 2000 network.

We mention that, for the current activity of Craiova II Power Plant Branch, Dolj Environmental Protection Agency has issued the Integrated Environmental Permit no. 74/07.07.2016.

- *Realization of a new 400 MW MWG CCGT energy group on gas, with flexible operation, at Mintia*

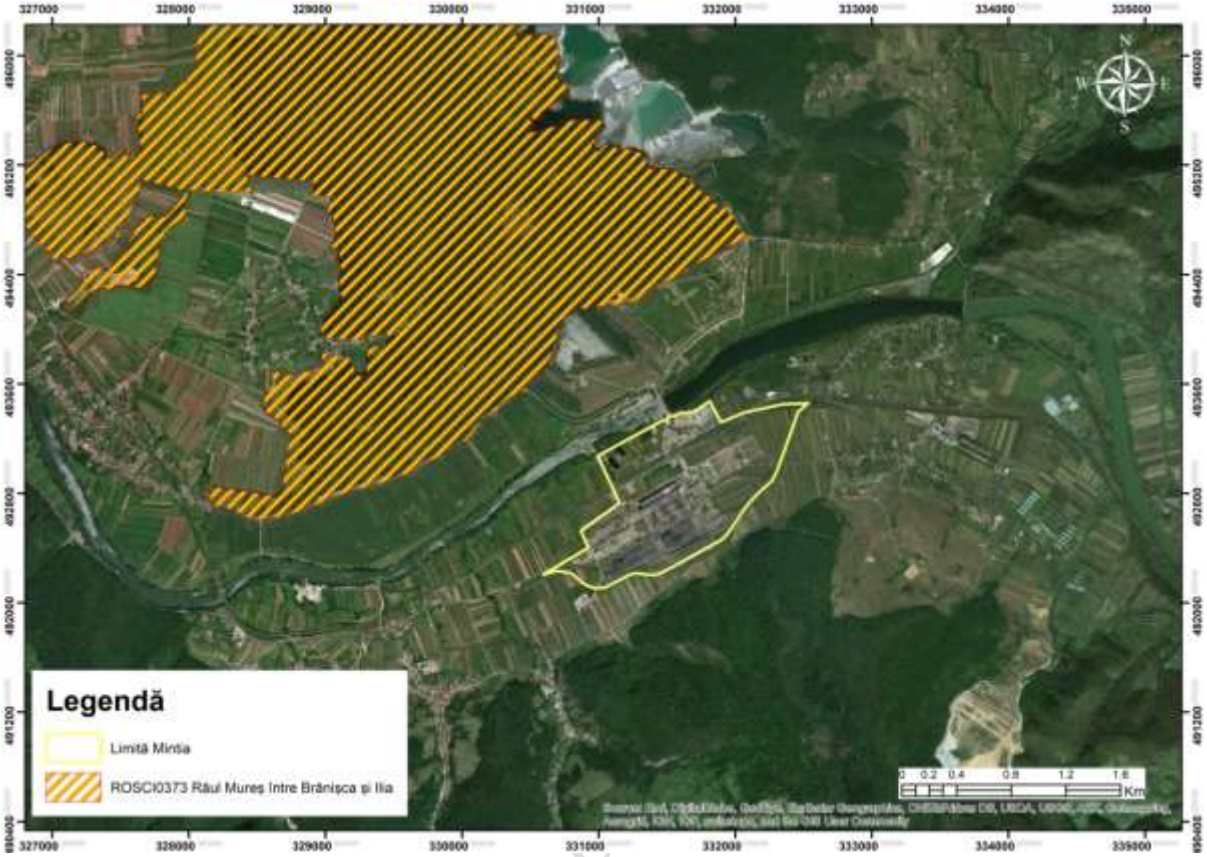

Figure 32 Locating the objective "Realization of a new 400 MW MWG CCGT energy group on gas, with flexible operation, at Mintia"

This objective relates to the existing site and the transition of the two functional groups on coal to gas. The main advantage of the objective is to clearly reduce the amount of pollutant emissions, especially particulate matter (PM_{10} and PM2.5).

According to the information supplied by Societatea Complexul Energetic Hunedoara SA[36], the site of the objective proposed will be in the vicinity of Group no. 6 on a minimum area of 1.3 ha. The choice of the site was made on the basis of 4 (pre)feasibility studies made by foreign entities and by national entities. Finally, it was opted for the Japanese project whose feasibility study was drawn up by Kansai Electric Power and ROMGAZ Project with the pre-feasibility study drawn up by ISPE. Therefore, the objective proposed will meet the following requirements: a capacity of 350MWc 43Gcal/h, powered by methane gas, state-of-art technology and ensuring the high efficiency operation, high operating flexibility, ensuring the continuity and safe supply of electricity and heat, observing the environmental law and economy from the point of view of the cost of the life cycle.

The site is located less than 1 km away from the site ROSCI0373 Mureș River between Brănișca and Ilia.

[36] According to Notice no. 130293/02.07.2019 sent by Societatea Complex Eneregtic Hunedoara to the Ministry of Energy.

- *Realization of hydroelectric power station with pumping accumulation (CHEAP) Tarniţa-Lăpuşteşti*

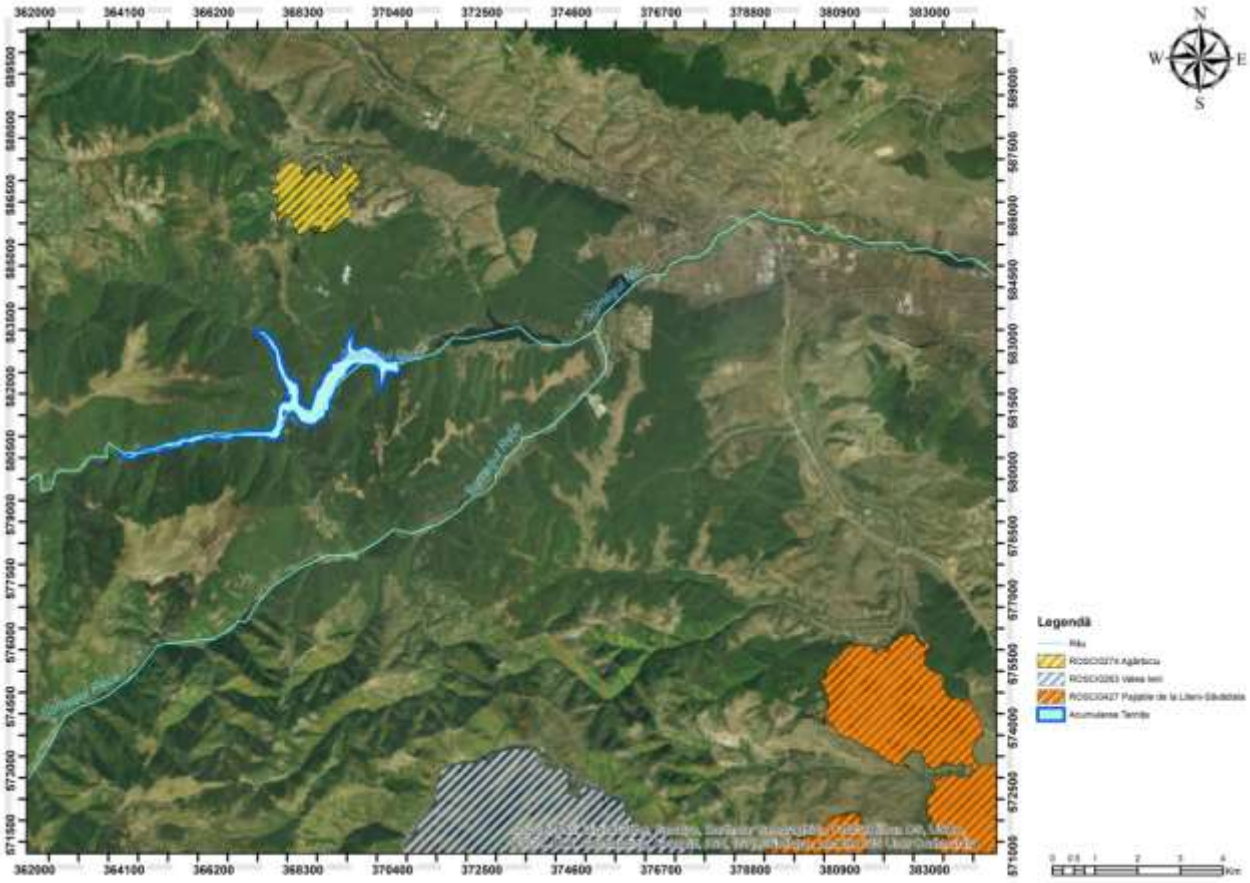

Figure 33 Localization of the objective "Realization of hydroelectric power station with pumping accumulation (CHEAP) Tarniţa-Lăpuşteşti"

The Tarniţa-Lăpuşteşti CHEAP placement will be carried out in the Someşul Cald river basin, on the valley of Somesul Cald river, in the left slope adjacent to the existing Tarniţa accumulation, on the administrative territory of the Raşca, Căpuşu Mare, Mărişel and Gilau communes including the Dângăul Mare, Dealu Mare, Lăpuşteşti, Someşul Cald, mostly in their outlying area [37].

The delineation of the area targeted by this objective was achieved by georeferencing the project location image taken from the project web page. Thus, after the limit of the project was obtained, two Natura 2000 sites, namely ROSCI0263 Valea Ierii and ROSCI0427 Pajiştile de la Liteni-Săvădisla, were intersected.

Although it is associated to a green, clean energy, without carbon discharges and which uses a renewable resource for the production of electricity. Pursuant to specialised studies, the following issues have been identified:

Positive	Negative
➢ *In order to obtain hydroenergy, the driving force is the gravitational force, the water used	*The retaining of waterways influences, on long term, the terrestrial ecological

[37] Source: http://www.hidrotarnita.ro/localizare/

in this process being a renewable resource (Abbasi and Abbasi, 2011);

- *Hydroenergy does not affect the air quality and, implicitly, does not pollute the air we are breathing, as it is not a source of atmospheric emissions (Yüksel, 2010);
- *Considering that hydroenergy replaces part of power production by burning of fossil fuels, it may be stated that it positively influences the issue of occurrence of smog and acid rains (Abbasi and Abbasi, 2011; Yüksel, 2010).

systems and biodiversity widely, the river flow regime, migration of aquatic bodies and it is also determining the occurrence of greenhouse gas emissions and change of ecological condition of water bodies (The Report of the World Commission on Dams, November 2000);

*The process of production of hydroenergy influences the flow of rivers, the migration of aquatic bodies and the transport of nutrients and sediments (Bratrich et al, 2004);

*The hydroelectric stations have major impact on all kinds of habitats identified where located, on the outfall of river in the sea for big electric stations, on the bankes of rivers where located (Abbasi and Abbasi, 2000).

History of the CHEAP Tarniţa-Lăpuşteşti project [38]:

- ✓ 1975-1985: ISPH makes tests, location studies and scheme studies for a standard CHEAP project;
- ✓ 1985-1988: Chosing the current location (existence of the inferior lake and of the consumption center);
- ✓ 1988-1994: The requests of offer are requested and analyzed for the main energy equipment of CHEAP Tarniţa-Lăpuşteşti, received from international leading competitors in the field such as Ansaldo GIE (Italy), Toshiba (Japan), Alsthom-Neyrpic (France), Hitachi (Japan), Mitsubishi (Japan);
- ✓ 1993: I.S.P.H. and GEOTEC performs the Geotechnical and hydrogeological study; I.S.P.H. performs the Economic evaluation study for CHEAP functions in NPG; I.S.P.H. performs the Pre-feasibility study for CHEAP Tarniţa – Lăpuşteşti, the variant of 4 x 250 MW; The study was endorsed by the Ministry of Environment;
- ✓ 1994: I.S.P.H. performs the Feasibiluty study for the Water-Pumping Accumulation Power Plant (CHEAP) Tarniţa – Lăpuşteşti, the 4 x 250 MW variant;
- ✓ 1995: Drawing up documentation studies regarding the energy equipment and the exploitation; Drawing up Technical Specifications for equipments;
- ✓ 1999-2000: The Specialized Institute of Electric Power Development Co. (E.P.D.C.) of Japan was created, based on a grant by the Japanese government, a study based on the technical data from previous documentation drawn up by I.S.P.H., a study drawn up together with Toshiba;

[38] Datele furnizate sunt în conformitate cu Studiu de fundamentare – Centrala cu Acumulare prin Pompaj Tarnița- Lăpuștești, Anexa 1 elaborat de de către Comisia Națională de Strategiei și Prognoză, București, 2019;

- ✓ 2003: I.S.C.E. and I.S.P.H. conducted a pre-feasibility study for building a CHEAP at Tarnița – Lăpuștești where the variant of three groups of 330MW each was analyzed;
- ✓ 2007: The consultant IPA/ Verbund/ Poyry develops a feasibility study within the SEEREM programme of the World Bank of 2005, financed by BIRD. The analysis if based on the prior solutions and the equipment plan proposed by I.S.P.H. and E.P.D.C., with small useful changes of the objective;
- ✓ 2008: I.S.P.H. updated the feasibility study with the provisions of the Government Decision 28/2008 (on the content of feasibility studies for projects financed from public funds);
- ✓ 2009: the Romanian Government approved a Memorandum for execution of the investment objective Water-Pumping Accumulation Hydropower Plant at Tarnița-Lăpuștești, a memorandum that is not currently valid;
- ✓ 2010: A consultant (consortium) was hired to prepare the investors attracting process, the leader being Deloitte Consultanta S.R.L. The consortium was also made up of the Romanian Commercial Bank and HydroChina ZhongNan, and the subcontractors were Mușat&Asociații Sparl, Herbert Smith, Knight Piesold and Tempo Advertising. In February 2014, the contract concluded with this consortium expired and was not extended by the parties;
- ✓ 2013: The Romanian Government approved several memoranda for realizing the investment objective Water-Pumping Accumulation Hydropower Plant of Tarnița-Lăpuștești, a benchmark being the Memorandum of 4 September 2013, the Memorandum of 16 October 2013 and the Memorandum of 31 July 2014. In November, based on the provisions of the Memoranda approved by the Government, the project company HIDRO TARNIȚA S.A. was founded to implement the Project; According to the Memorandum of 4 September 2013, the project company Hidro Tarniţa SA was founded initially with a shareholding consisting of Romanian energy companies and whose purpose was to attract foreign investors through a competitive procedure. The project company was founded by Electrica SA and Complexul Energetic Hunedoara SA (companies in which the state was the sole shareholder) with a share capital of 2 million euro. Subsequently, after the division of the company Electrica SA and of other capital operations among shareholders, the share capital of the company Hidro Tarniţa SA was held 99.358% by Societatea de Administrare a Participaţiilor Statului în Energie (SAPE SA) and 0.642% by Complexul Energetic Hunedoara SA;
- ✓ 2014: In March, I.S.P.H. updated the Feasibility Study drawn up in 2008 from the point of view of the technical solutions, the requirements from the approvals held and the cost estimates. In July, HIDROELECTRICA S.A. sold to HIDRO TARNIȚA S.A. the current investment consisting of the technical, economic documentation and of other kind, drawn up for grounding, promoting, approving, authorizing, assigning and performing the project as well as the permits and approvals obtained for the project with the transfer agreement of Hidroelectrica;
- ✓ 2015-2018: The project company Hidro Tarniţa SA developed specific activities for prepation of documentation, approvals, authorizations and regulatory acts

required for implementing the project, the value of these activities being added to the current investment acquired in 2014 from Hidroelectrica SA. On 31.12.2018, the account value of current investments registered at the assets of the project company Hidro Tarniţa SA, for current investments „CHEAP Tarniţa – Lăpuşteşti" is of 13,278,628.47 lei.

A comparison of the relevant studies for the project CHEAP Tarniţa –Lăpusteşti:

Description	**SF EPDC 1999 4x250 MW**	**SF ISCE-2003 4x250MW**	**SF ISPH 2008 4x250MW**	**SF ISPH 2014 4x250 MW**
Comparison	SF EPDC Japan	SF ISCE	SF ISPH 2008	SF ISPH 2014
The best location	Tarniţa-Lăpuşteşti	Tarniţa-Lăpuşteşti	Tarniţa-Lăpuşteşti	Tarniţa-Lăpuşteşti
Installed power (MW)	1000	1000	1000	1000
Equipping reversible turbines	Francis	Francis	Francis	Francis
Pumping cycle	weekly	weekly	weekly	weekly
Upper tank Lăpuşteşti –mNNR quota	1085	1085	1085	1085
Lower tank Tarniţa –mNNR quota	521,5	521,5	521,5	521,5
Higher tank height	45	45	40	40
Dam-mNNR quota	1088	1088	1086,5	1086,5
Storage capacity –mil.mc	10	10	10	10
Plug–type' polygonal '-pc	1	1	1	2
Underground plant (m)	L=157, l=22, H=45	L=120, l=23, H=47	L=120, l=23, H=48	L=120, l=23, H=48
Transformer room	L=126, l=15, H=20	L=117, l=19, H=25	L=117, l=19, H=48	L=117, l=19, H=48
High pressure gallery–ml	1100	1100	1100	2 fire x 1100
High pressure gallery diameter -ml	6	6	6	4.3
Escape gallery -ml	2x1350	2x1350	2x1350	2x1350
Escape gallery diameter -ml	6,2	6,2	6,2	6,2

- *Realization of a hydroelectric power station at Turnu Magurele - Nicopole 500 MW*

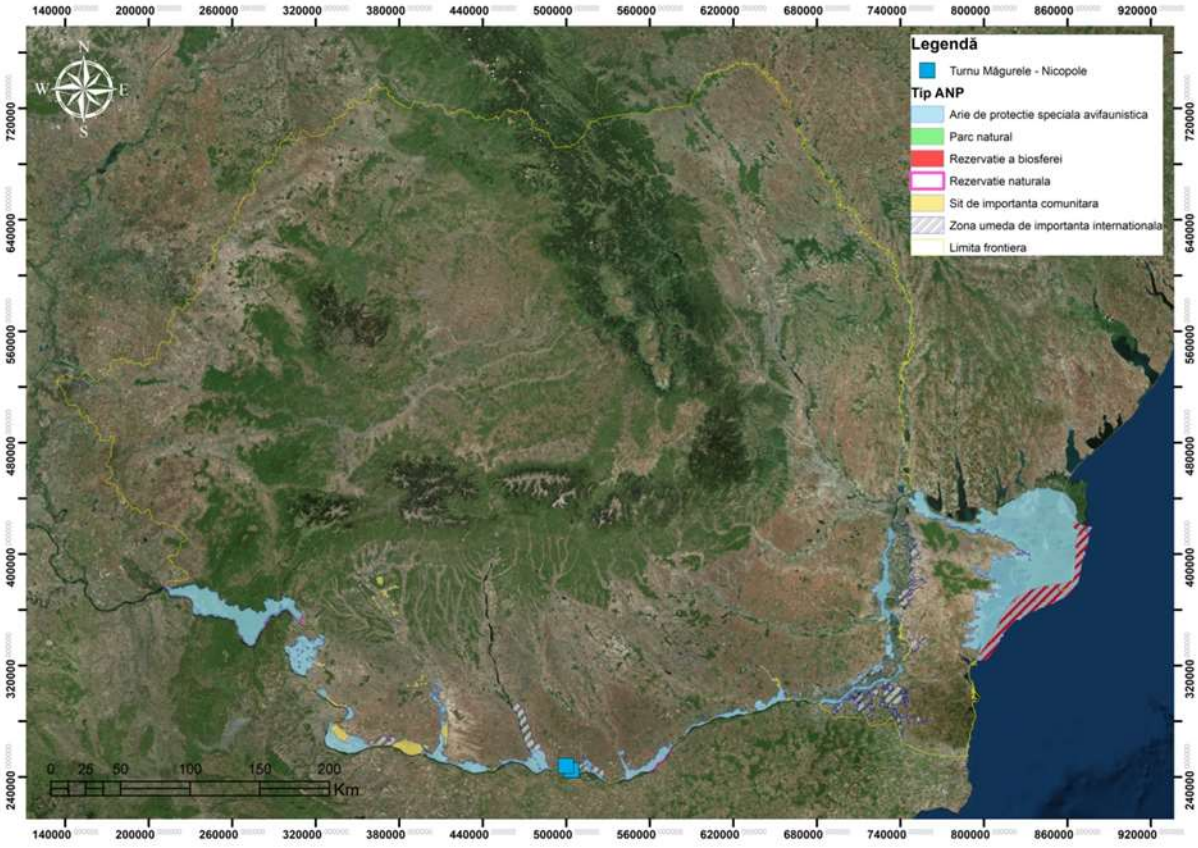

Figure 34 Location of the objective "Realization of a hydroelectric power station at Turnu Magurele - Nicopole 500 MW"

In the case of this objective, Natura 2000 sites intersected or potentially affected by its implementation have been obtained by setting up buffer zones according to the methodology discussed and presented in Section III.2. The hydroelectric power plant area overlaps with the protected natural areas ROSCI0044 Corabia-Turnu Magurele and with RORMS0012 Suhaia.

According to the correspondence between the Ministry of Energy and the National Commission of Strategy and Prognosis, for the objective „Execution of a power plant at Turnu Măgurele - Nicopole 500 MW" the substantiation study was not initiated, there there are no technical or location data available.

As a strategic objective of a very large scale involving regularization works carried out all over the Danube, but whose specific location is not known, Natura 2000 sites whose vulnerabilities are increased have been obtained by creating a buffer zone (50 m) that targeted the Romanian riverbank area. Following the analysis, the following protected natural areas Natura 2000 were intersected (Table 14) to which are added 8 nature reserves of national interest, including a natural park (the Natural Park Portile de Fier with Ramsar site status, Balta Nera-Dunăre, Gura Văii-Vârciorova, Dealul Varanic, Cazanele Mari and Cazanele Mici, Locul fosilifer Şviniţa, Cracul Crusii, Faţa Virului) and 7 natural reserves of international interest - Ramsar sites (National Park Porţile de Fier, Bistreţ, Confluenţa Olt-Dunăre, Suhaia, Blahniţa, Calafat-Ciuperceni-Dunăre and Confluenţa Jiu-Dunăre).

Table 14 Natura 2000 sites potentially affected by the achievement of the objective "Realization of a hydroelectric power station at Turnu Magurele - Nicopole 500 MW"

Code	Name	Type of natural protected area
ROMAB0003	Rezervaţia Biosferei Delta Dunarii	Biosphere reserve
RONPA0014	Parcul Natural Porţile de Fier	Natural park
RONPA0017	Parcul Natural Balta Mică a Brăilei	Natural park
RONPA0316	Balta Nera - Dunăre	Natural reserve
RONPA0614	Gura Vaii - Vârciorova	Natural reserve
RONPA0625	Dealul Varanic	Natural reserve
RONPA0626	Cazanele Mari şi Cazanele Mici	Natural reserve
RONPA0627	Locul fosilifer Şviniţa	Natural reserve
RONPA0641	Cracul Crucii	Natural reserve
RONPA0642	Faţa Virului	Natural reserve
RONPA0898	Ostrovul Gâsca	Natural reserve
RONPA0942	Cama - Dinu - Păsărica	Natural reserve
RORMS0001	Delta Dunării	Wetland of international importance
RORMS0002	Parcul Natural Balta Mică a Brăilei	Wetland of international importance
RORMS0006	Parcul Natural Porţile de Fier	Wetland of international importance
RORMS0009	Bistreţ	Wetland of international importance
RORMS0011	Confluenţa Olt - Dunăre	Wetland of international importance
RORMS0012	Suhaia	Wetland of international importance
RORMS0013	Blahniţa	Wetland of international importance
RORMS0014	Braţul Borcea	Wetland of international importance
RORMS0015	Calafat - Ciuperceni - Dunăre	Wetland of international importance
RORMS0016	Canaralele de la Hârşova	Wetland of international importance
RORMS0017	Ostroavele Dunării - Bucgeac - Iortmac	Wetland of international importance
RORMS0018	Confluenţa Jiu - Dunăre	Wetland of international importance
RORMS0019	Dunărea Veche - Braţul Măcin	Wetland of international importance
ROSCI0006	Balta Mică a Brăilei	Site of Community importance
ROSCI0022	Canaralele Dunării	Site of Community importance
ROSCI0039	Ciuperceni - Desa	Site of Community importance
ROSCI0044	Corabia - Turnu Măgurele	Site of Community importance

Code	Name	Type of natural protected area
ROSCI0045	Coridorul Jiului	Site of Community importance
ROSCI0065	Delta Dunării	Site of Community importance
ROSCI0088	Gura Vedei - Şaica - Slobozia	Site of Community importance
ROSCI0131	Oltenița - Mostiștea - Chiciu	Site of Community importance
ROSCI0173	Padurea Stârmina	Site of Community importance
ROSCI0206	Porţile de Fier	Site of Community importance
ROSCI0278	Bordușani - Borcea	Site of Community importance
ROSCI0299	Dunărea la Gârla Mare - Maglavit	Site of Community importance
ROSCI0306	Jiana	Site of Community importance
ROSCI0319	Mlaştina de la Feteşti	Site of Community importance
ROSPA0005	Balta Mică a Brăilei	Important bird protection area
ROSPA0011	Blahnița	Important bird protection area
ROSPA0012	Braţul Borcea	Important bird protection area
ROSPA0013	Calafat - Ciuperceni - Dunăre	Important bird protection area
ROSPA0017	Canaralele de la Hârşova	Important bird protection area
ROSPA0021	Ciocăneşti - Dunăre	Important bird protection area
ROSPA0023	Confluența Jiu - Dunăre	Important bird protection area
ROSPA0024	Confluența Olt - Dunăre	Important bird protection area
ROSPA0026	Cursul Dunării - Baziaş - Porţile de Fier	Important bird protection area
ROSPA0031	Delta Dunării şi Complexul Razim - Sinoie	Important bird protection area
ROSPA0038	Dunăre - Oltenița	Important bird protection area
ROSPA0039	Dunăre - Ostroave	Important bird protection area
ROSPA0046	Gruia - Gârla Mare	Important bird protection area
ROSPA0074	Maglavit	Important bird protection area
ROSPA0080	Munţii Almăjului - Locvei	Important bird protection area
ROSPA0090	Ostrovu Lung - Gostinu	Important bird protection area
ROSPA0102	Suhaia	Important bird protection area
ROSPA0108	Vedea - Dunăre	Important bird protection area
ROSPA0135	Nisipurile de la Dăbuleni	Important bird protection area
ROSPA0136	Oltenița - Ulmeni	Important bird protection area

According to the National Strategy and the Action Plan for Biodiversity Conservation 2010-2020, the impact of large hydrotechnical buildings (in Romania, the ones from Porţile de Fier) was and still is negative for the species of migrating fish or that need to move upstream during reproduction. In the case of sturgeons, the numbers have dropped to half because of this. At the same time, embankments destroyed the areas used during reproduction for species of fresh water fish (e.g. the carp that prefers shallow, transparent and warm waters. For this species, the numbers decreased with 10%). This strategy also mentions the impact of hydrotechnical buildings from the premises of harbours. In their case, because of the discharge of large quantities of sediments in the coastal waters, entire bental associations, habitats for ecologically and economically valuable species dissappeared.

Based on the information regarding the potential impact from upstream and downstream of large hydrotechnical constructions mentioned above, the forecast on the number of natural protected areas that might be threatened was completed with the identification of 59 whose structure or functions are likely to be affected, as mentioned in Table 15.

Table 15 Natura 2000 sites of Bulgaria and Hungary, possibly affected by the implementation of the project „Execution of a hydropower plant of 500 MW at Turnu Măgurele - Nicopole"

item no.	Country	Code Natura 2000	Natura 2000	Type	Item no.	Country	Code Natura 2000	Name Natura 2000	Type
1	Bulgaria	BG0002104	Tsibarsko Blato	SPA	22	Bulgaria	BG0000334	Ostrov	SCI
2	Bulgaria	BG0002091	Ostrov Lakat	SPA	23	Bulgaria	BG0000241	Srebarna	SCI
3	Bulgaria	BG0002074	Nikopolsko plato	SPA	24	Bulgaria	BG0000241	Srebarna	SPA
4	Bulgaria	BG0002065	Blato Malak Preslavets	SPA	25	Bulgaria	BG0000232	Ostrov Pozharevo	SCI
5	Bulgaria	BG0002064	Garvansko blato	SPA	26	Bulgaria	BG0000232	Batin	SCI
6	Bulgaria	BG0002030	Kompleks Kalimok	SPA	27	Bulgaria	BG0000199	Tsibar	SCI
7	Bulgaria	BG0002025	Lomovete	SPA	28	Bulgaria	BG0000181	Reka Vit	SCI
8	Bulgaria	BG0002024	Ribarnitsi Mechka	SPA	29	Bulgaria	BG0000377	Kalimok - Brashlen	SCI
9	Bulgaria	BG0002018	Ostrov Vardim	SPA	30	Hungary	HUDI20039	Pilis és Visegrádi-hegység	SCI
10	Bulgaria	BG0002017	Kompleks Belenski ostrovi	SPA	31	Hungary	HUDI20034	Duna és ártere	SCI
11	Bulgaria	BG0002009	Zlatiyata	SPA	32	Hungary	HUDI20008	Börzsöny	SCI
12	Bulgaria	BG0000614	Reka Ogosta	SCI	33	Hungary	HUDI10002	Börzsöny és Visegrádi-hegység	SPA

item no.	Country	Code Natura 2000	Natura 2000	Type	Item no.	Country	Code Natura 2000	Name Natura 2000	Type
13	Bulgaria	BG0000610	Reka Yantra	SCI	34	Hungary	HUDD1004	Béda-Karapancsa	SPA
14	Bulgaria	BG0000608	Lomovete	SCI	35	Hungary	HUDD20032	Gemenc	SCI
15	Bulgaria	BG0000576	Svishtovska gora	SCI	36	Hungary	HUDD20023	Tolnai Duna	SCI
16	Bulgaria	BG0000534	Ostrov Chayka	SCI	37	Hungary	HUDD20045	Béda-Karapancsa	SCI
17	Bulgaria	BG0000530	Pozharevo - Garvan	SCI	38	Hungary	HUDD20032	Gemenc	SCI
18	Bulgaria	BG0000529	Marten - Ryahovo	SCI					
19	Bulgaria	BG0000528	Ostrovska step - Vadin	SCI					
20	Bulgaria	BG0000396	Persina	SCI					
21	Bulgaria	BG0000335	Karaboaz	SCI					

- *Realization of a hydroelectric power plant 35 MW at 35 MW*

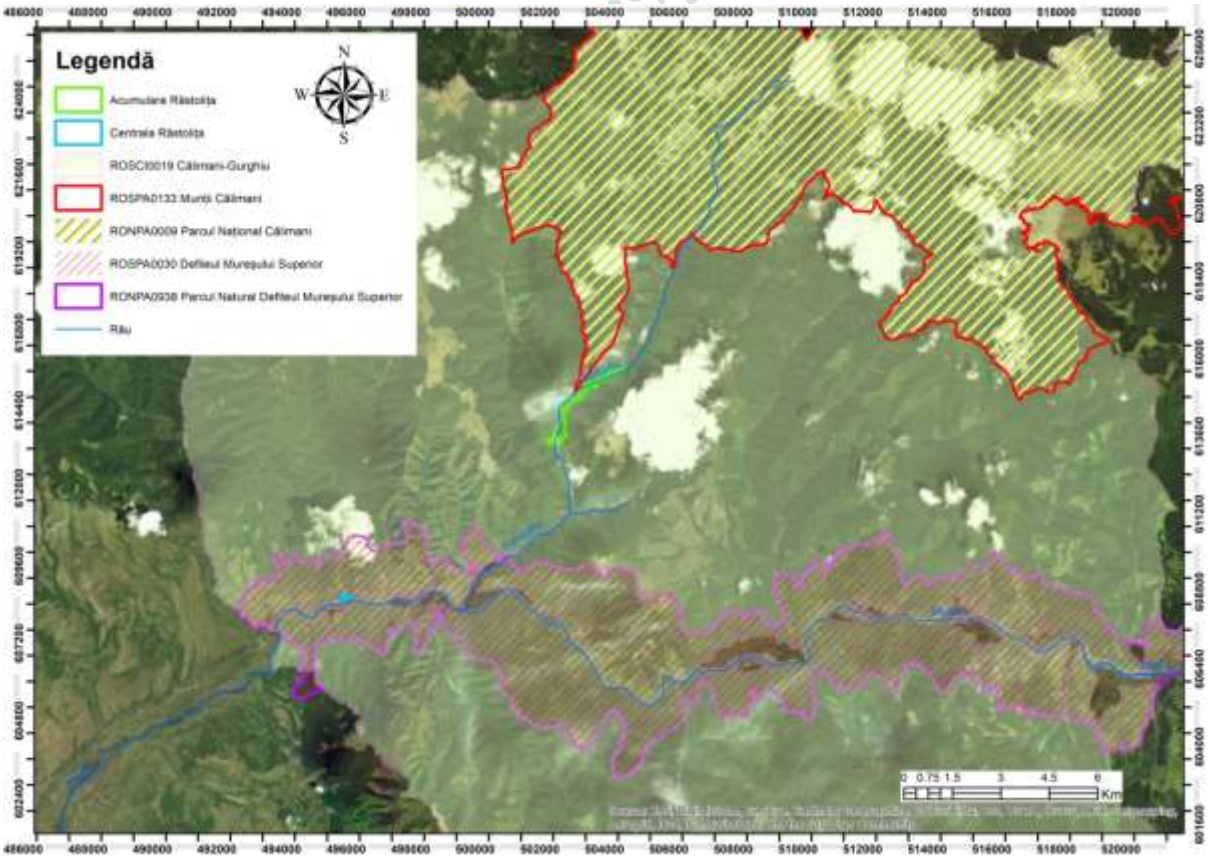

Figure 35 Localization of the project "Realization of a hydroelectric power plant 35 MW at Rostolița"

The location of the project was made using the indications given by the Beneficiary. Based on these, a polygon vector was built, which delimits the Rostolița accumulation zone. Also, on the basis of satellite images, the land area was identified, at which the temporary and permanent areas where the works were started were identified.

For the previous objective there are regulatory acts in the field of environmental protection and water protection issued by the competent institutions[39] for the works performed, as follows:

- ✓ Environmental permit no. 12/07.11.1990 on PE „Hydropower Fitting Răstolița";
- ✓ Water management permit no. 39/07.06.1990 "On protection against floods for the social camp ACTH – Tarnița located in Lunca Gării- Răstolița, Mures County";
- ✓ Approval note no. 5956/02.10.1990 flows concluded at Tg. Mures Waters Division;
- ✓ Water management permit no. 16/16.04.1992 for the work "Regularization of river Mures in the area of Vălenii de Munte" Mures County;
- ✓ Water management permit no. 363/30.03.2012 for the investment "Regularization downstream the dam– AHE Răstolița. Răstolița Dam".

The accumulation of Rostolita completely overlaps the Natura 2000 site ROSCI0019 Călimani-Gurghiu and is also located at the limit of ROSPA0133 Călimani Mountains overlapped on the natural reservation RONPA0009 Călimani National Park.

Although it is associated to a green, clean energy, without carbon discharges and which uses a renewable resource for the production of electricity. Pursuant to specialised studies, the following issues have been identified:

Positive	Negative
➢ *In order to obtain hydroenergy, the driving force is the gravitational force, the water used in this process being a renewable resource (Abbasi and Abbasi, 2011); ➢ *Hydroenergy does not affect the air quality and, implicitly, does not pollute the air we are breathing, as it is not a source of atmospheric emissions (Yüksel, 2010); ➢ *Considering that hydroenergy replaces part of power production by burning of fossil fuels, it may be stated that it positively influences the issue of occurrence of smog and acid rains (Abbasi and Abbasi, 2011; Yüksel, 2010).	*The retaining of waterways influences, on long term, the terrestrial ecological systems and biodiversity widely, the river flow regime, migration of aquatic bodies and it is also determining the occurrence of greenhouse gas emissions and change of ecological condition of water bodies (The Report of the World Commission on Dams, November 2000); *The process of production of hydroenergy influences the flow of rivers, the migration of aquatic bodies and the transport of nutrients and sediments (Bratrich et al, 2004); *The hydroelectric stations have major impact on all kinds of habitats identified where located, on the outfall of river in the sea for big electric stations, on the banks of rivers where located (Abbasi

[39] According to notice no. 74905.1 of 01.07.2019 sent by SPEEH Hidroelectrica SA to the Ministry of Energy.

and Abbasi, 2000).

According to the notice mentioned under the investment objective „Realizing the hydropower plant of 35MW at Răstolița", the following works shall be performed divided per objectives, as follows:

- ✓ Stage I- minimum energy quota of 720mdM
- ✓ Objective I - Răstolița Dam: procurement and mounting of AMC dam; lighting installations and wave-breaking guardrail on a dam canopy; dam downstream regularization works; closing the water deviation gallery; cleaning the lake basin; completing the C+M works at MHC located on the circuit of empying the gallery of the dam; completing the mounting works at the bottom emptying plug; completing the electrical works at the bottom emptying;
- ✓ Objective II – Main culvert: arranging the valve house platform, energy socket at the quota of 765,50 mdM; completing the C+M works at the socket valve house (flat valve and cofferdam); supplying the consumers of the platform socket socket valve house;
- ✓ Objective III – Pressure node: mounting a butterfly valve activating installation; exterior design works at the pressure node platform; completing the C+M works at the butterfly valve house;
- ✓ Objective IV –Răstolița Plant: completing the interior and exterior design works; completing the execution of the dewatering, fire extinguishing, ventilation systems; completing the auxiliary installations (mechanical part) of HA1 and HA2; acquiring and mounting the equipment for the primary and secondary electrical part; supply of consumers, plant-based services;
- ✓ Objective V –110 kV station: completing the works of mounting the electrical part at the cable household; completing the connection works for 110kV with the Power station of SDEE Transilvania Sud;
- ✓ Objective VI – Clearing tank:completing the works of mounting healting activation of the discharge valves at the bottom of the basin;
- ✓ Objective VIII – West Branch of culvert and secondary intakes: execution of works for realizing the secondary intakes for the West branch at Vișa, Gălăoaia Mare and Gălăoaia Mică;
- ✓ Infrastructure works: execution of lake contour road and execution of the connecting road between the dam canopy and the intake valve room; execution of fitting and environmental protection works;
- ✓ Stage II - final quota 760 mdM:
- ✓ Objective I –Răstolița Dam: completing the raising of the dam at the final quota; completion of the large water discharger at the final quota;
- ✓ Objective VII – West Branch culvert and secondary intakes: execution of works for execution of secondary intakes Bradu and Ilva Mare; excavation and concrete works of the east branch culvert;
- ✓ Objective VIII – West Branch culvert and secondary intakes: execution of works for execution of secondary intakes Bistra; excavation and concrete works at the Bistra – Gălăoaia Mare culvert;
- ✓ Infrastructure works: execution of fitting and environmental protection works.

- *Realization of hydropower plants on the Jiu 90 M*

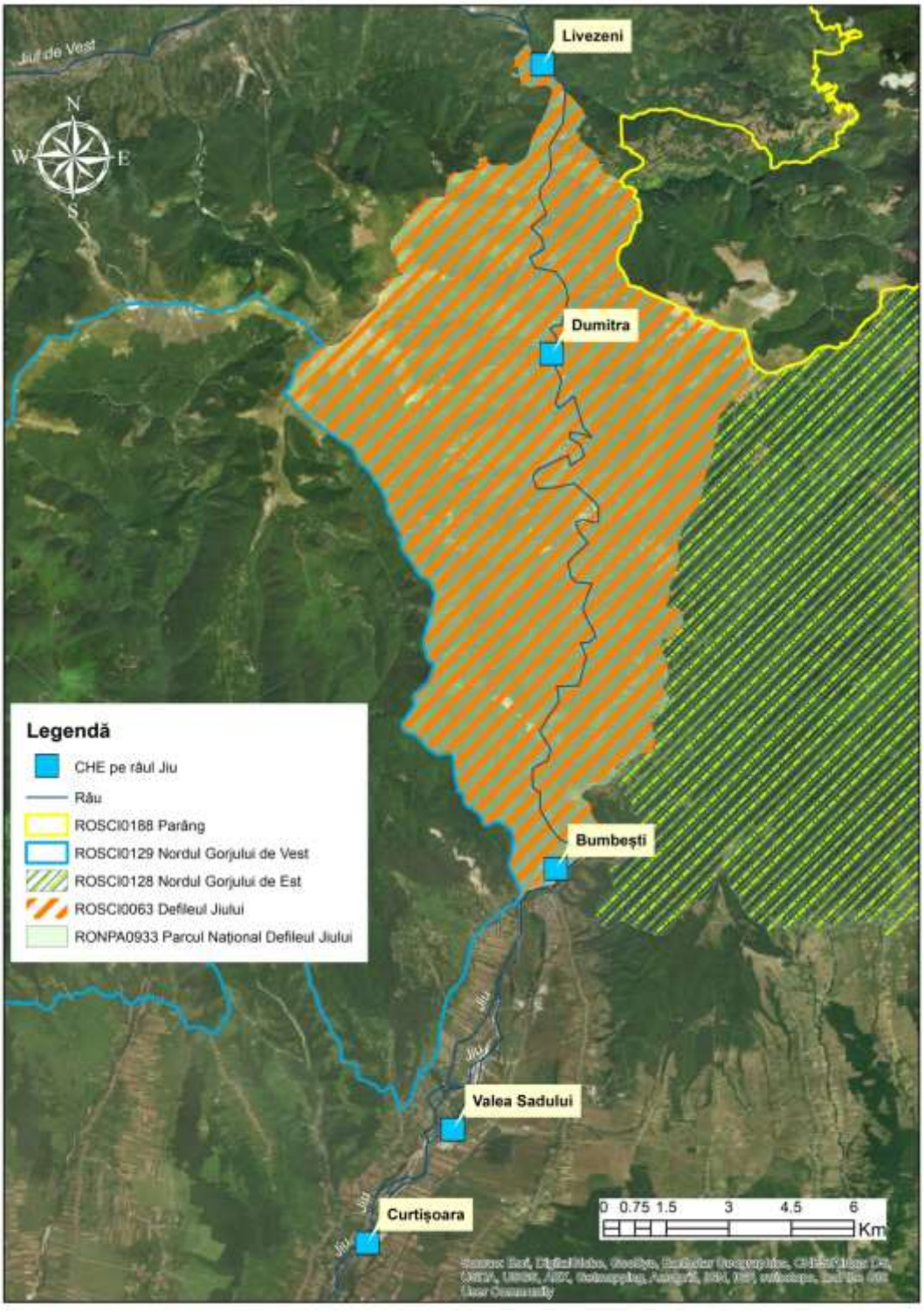

Figura 36 Localizarea obiectivului "Realizare centrale hidroelectrice pe râul Jiu 90 MW"

The objective of the RES "Realization of hydropower plants on the Jiu 90 MW" aims at the realization of 5 hydropower plants represented in Figura ***36***51 : Livezeni, Dumitra, Bumbești, Valea Sadului and Curtișoara. Of these, Livezeni, Dumitra and Bumbești are 85% completed and are located within or near the Natura 2000 site ROSCI0063 Jiu Gorge overlapped with the National Park Defileul Jiului (see Figur3 37 , Figure 38 ,

Figure 39). Valea Sadului and Curtişoara are built 100% and do not overlap or are not close to any Natura 2000 site.

Figur3 37 Localization of the objective "Realization of hydroelectric power stations on the Jiu 90 MW" - detail Livezeni

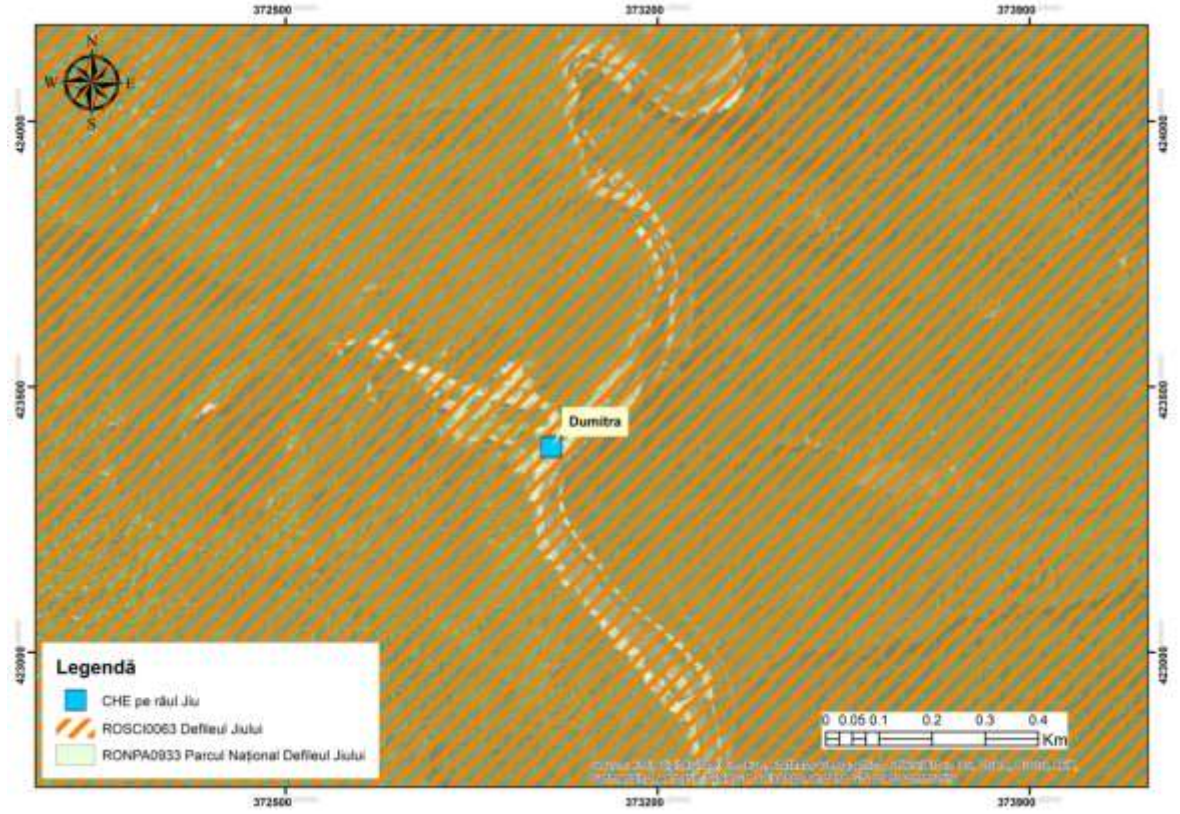

Figure 38 Localization of the objective "Realization of hydroelectric power plants on the Jiu 90 MW" - detail Dumitra

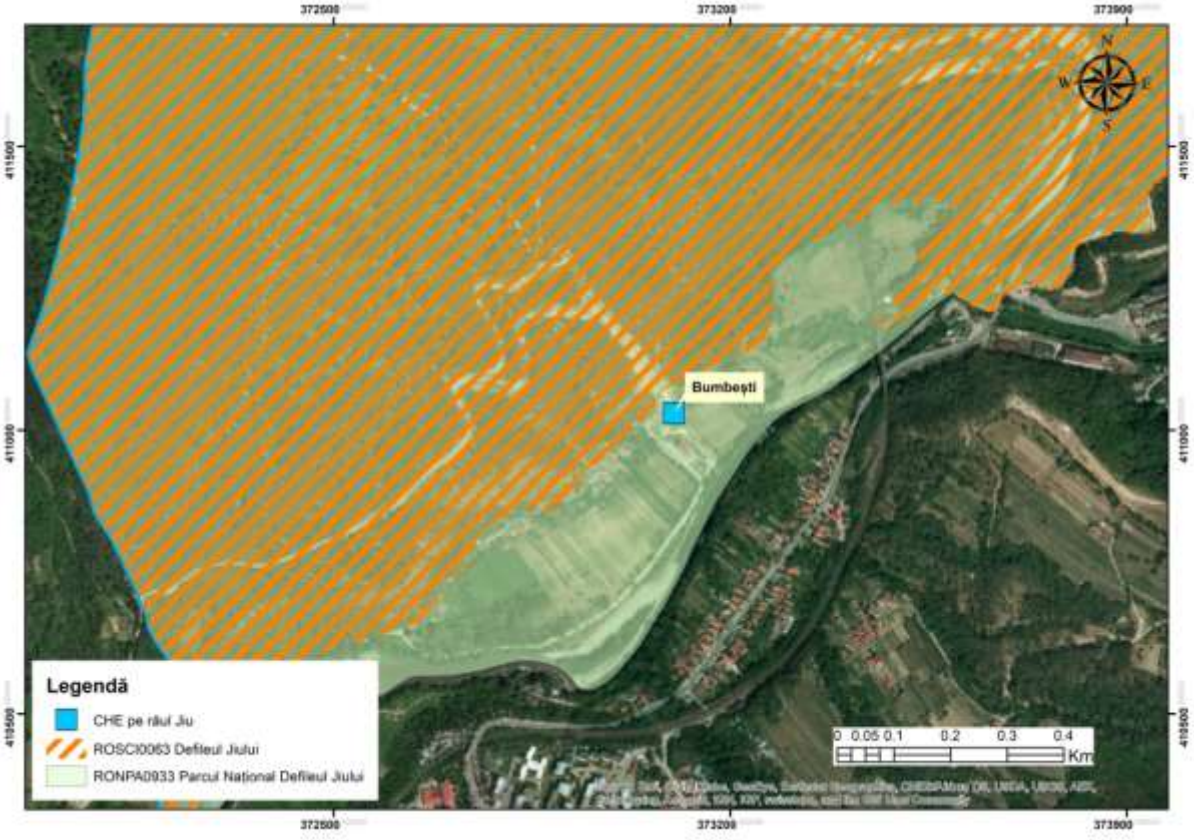

Figure 39 Localization of the objective "Realization of hydroelectric power plants on the Jiu 90 MW" - detail Bumbești

Although it is associated to a green, clean energy, without carbon discharges and which uses a renewable resource for the production of electricity. Pursuant to specialised studies, the following issues have been identified:

Positive	Negative
➢ *In order to obtain hydroenergy, the driving force is the gravitational force, the water used in this process being a renewable resource (Abbasi and Abbasi, 2011); ➢ *Hydroenergy does not affect the air quality and, implicitly, does not pollute the air we are breathing, as it is not a source of atmospheric emissions (Yüksel, 2010); ➢ *Considering that hydroenergy replaces part of power production by burning of fossil fuels, it may be stated that it positively influences the issue of occurrence of smog and acid rains (Abbasi and Abbasi, 2011; Yüksel, 2010).	*The retaining of waterways influences, on long term, the terrestrial ecological systems and biodiversity widely, the river flow regime, migration of aquatic bodies and it is also determining the occurrence of greenhouse gas emissions and change of ecological condition of water bodies (The Report of the World Commission on Dams, November 2000); *The process of production of hydroenergy influences the flow of rivers, the migration of aquatic bodies and the transport of nutrients and sediments (Bratrich et al, 2004); *The hydroelectric stations have major impact on all kinds of habitats identified where located, on the outfall of river in the sea for big electric stations, on the bankes of rivers where located (Abbasi and Abbasi, 2000).

For the objective mentioned, there are regulatory acts in the field of environmental protection and water protection issued by competent institutions[40] for the following works:

- ✓ Environmental permit no. GJ -51 of 18.04.2003 on „Hydropower arrangement of Jiu River at the Livezeni-Bumbeşti section";
- ✓ Water management permit no. 188/14.02.2003 on „Hydropower arrangement of Jiu River at the Livezeni-Bumbeşti section ";
- ✓ Amending water management permit no. 410/15.08.2005 on „Hydropower arrangement of Jiu River at the Livezeni-Bumbeşti section ".

According to the notice mentioned under the investment objective „Hydropower arrangement of Jiu River at the Livezeni-Bumbeşti section " the following works shall be performed:

- ✓ Livezeni Dam: arrangement of the technological platform, arrangement of the Livezeni lake basin, AMC – completing the mounting works; staircase for migration of the fish fauna;
- ✓ MHC Livezeni: form layer – completing the roof; interior and exterior finishing; interior installations;
- ✓ Livezeni – Dumitra Culvert: arrangement of Livezeni platform and access road; arrangement of Murga Mică platform;

[40] Idem [40]

- ✓ CHE Dumitra: floors, finishes, metal fittings, exterior arrangements, platforms, fencing and gullies; bridge over the calming basin – asphalting and guardrails;
- ✓ Dumitra intervention block: earthworks, resistance structure; brickwork; floors; roof; plating and finishes; installations and lightning pole;
- ✓ Dumitra- Bumbeşti Culvert: marks and finishes Valea Rea downstream; marks and finishes Bratcu upstream; injections Bratcu upstream 2+400 – 3+000, Valea Rea window intersection, Bratcu window intersection; concreting the Valea Rea intersection plug; concreting the Bumbesti castle intersection plug; Bratcu well injections; concreting the Bratcu sealed gate;
- ✓ Bumbeşti pressure node: valve room- concreting, architecture, installations and AMC, mounting equipments; forced pipe; completing the mounting works, AMC;
- ✓ Bumbeşti HPP: masonry, floors, finishes, joinery and metal structures, installations and lighting rod, mounting equipments, exterior fittings, platforms, fencing and gullies, concreting the calming basin, 110kV station – earthworks and construction;
- ✓ Bumbeşti intervention block: floor, plates and finishes; completing installations;
- ✓ Bumbeşti escape canal: upstream concreting;
- ✓ Jiu intake: stage II deviation, stage II excavations, concreting, staircase for fish fauna migration; mounting equipments, Jiu intake pipe – sections II, III and IV; embankment protection;
- ✓ Dumitra intake: excavations, fillings, embankment protection; concreting the calming basin, mounting equipments;
- ✓ Road to HPP: form layer;
- ✓ Road to Dumitra HPP: infrastructure, form layer;
- ✓ Jiu access road: embankment protection, foot bridges, form layer;
- ✓ Access road over the M2 peak at Bumbesti HPP: form layer, gullies.

We specify that for the aforesaid works, SPEEH Hidroelectrica SA is currently conducting the environmental impact evaluation.

- *Realization of hydroelectric power plants on the Olt River 145 MW*

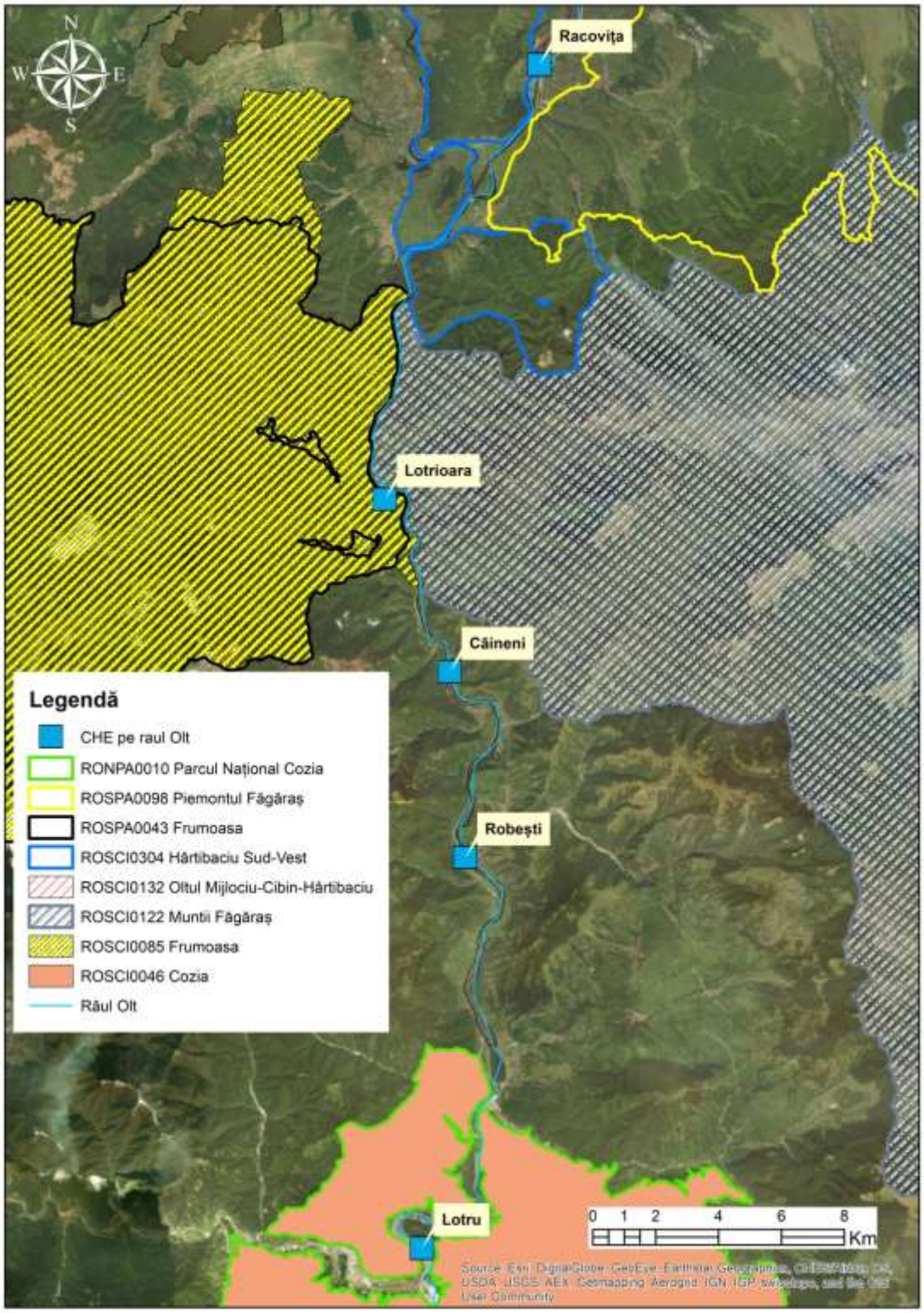

Figure 40 Localization of the objective "Realization of hydroelectric power plants on the Olt river 145 MW"

The objective targets 5 hydropower plants located on the Olt River: Racovița, Lotrioara, Câineni, Robești and Lotru (Figure ***40***). All five plants are 100% built and do not directly intersect Natura 2000 sites but are less than 1km away from the following: ROSCI0304

Hârtibaciu Sud-Vest, ROSCI0132 Oltul Mijlociu-Cibin-Hârtibaciu, ROSPA0043 Frumoasa, ROSCI0085 Frumoasa and ROSCI0122 Făgăraș Mountains (Figure 41, Figure 42, Figure 43, Figure 44, Figure 45).

Figure 41 Localization of the objective "Realization of hydroelectric power plants on the Olt 145 MW" - detail Racoviţa

Figure 42 Localization of the objective "Realization of hydroelectric power plants on the Olt 145 MW" - detail Lotrioara

Figure 43 Localization of the objective "Realization of hydroelectric power plants on the Olt River 145 MW" - detail Câineni

Figure 44 Localization of the objective "Realization of hydroelectric power plants on the Olt river 145 MW" - detail Robești

Figure 45 Localization of the objective "Realization of hydroelectric power plants on the Olt river 145 MW" - detail Lotru

Although it is associated to a green, clean energy, without carbon discharges and which uses a renewable resource for the production of electricity. Pursuant to specialised studies, the following issues have been identified:

Positive	Negative
➢ *In order to obtain hydroenergy, the driving force is the gravitational force, the water used in this process being a renewable resource (Abbasi and Abbasi, 2011); ➢ *Hydroenergy does not affect the air quality and, implicitly, does not pollute the air we are breathing, as it is not a source of atmospheric emissions (Yüksel, 2010); ➢ *Considering that hydroenergy replaces part of power production by burning of fossil fuels, it may be stated that it positively influences the issue of occurrence of smog and acid rains (Abbasi and Abbasi, 2011; Yüksel, 2010).	*The retaining of waterways influences, on long term, the terrestrial ecological systems and biodiversity widely, the river flow regime, migration of aquatic bodies and it is also determining the occurrence of greenhouse gas emissions and change of ecological condition of water bodies (The Report of the World Commission on Dams, November 2000); *The process of production of hydroenergy influences the flow of rivers, the migration of aquatic bodies and the transport of nutrients and sediments (Bratrich et al, 2004); *The hydroelectric stations have major impact on all kinds of habitats identified where located, on the outfall of river in

the sea for big electric stations, on the bankes of rivers where located (Abbasi and Abbasi, 2000).

For the objective mentioned, there are regulatory acts in the field of environmental protection and water protection issued by competent institutions[41] for the following works:

- ✓ Authorization for execution of works no. 65/06.08.1990 issued by the Prefecture of Sibiu County in the locality of Avrig-Racovița, for the investment objective, step Racovita HPP and step Lotrioara HPP;
- ✓ Authorization for execution of works no. 83/17.04.1990 issued by the Prefecture of Sibiu County in the locality of Câineni-Racovița, issued by the Prefecture of Sibiu County in the locality of Racovita HPP and step Cornetu HPP;
- ✓ Authorization for execution of works no. 98/26.05.1989 issued by the People's Council of Valcea County in the locality Câineni-Robești, for the investment objective, step Robesti HPP and step Caineni HPP;
- ✓ Environmental permit no. SB 10 din 27.05.2005 issued by Sibiu Environmental protection authority for PATZ of the investment objective – Hydroenergetic arrangement on Olt River on the Avrig – Cornetu section;
- ✓ Water Management Permit no. 87/03.05.2015, privind Plan de Amenajare a Teritoriului Zonal – Avig, Tălmaciu, Racovița, Turnu Roșu, Câineni – Județele Sibiu și Vâlcea. Amenajarea hidroenergetică pe râul Olt Superior Cornetu – Avrig.
- ✓ Authorization for execution of works no 15/11.12.2018, issued by the Town hall of Turnu Roșu Commune, Sibiu County, for the objective Execution of debusing works at Sebes creek (railway bridge protection)

According to the aforesaid notice under the investment objective „Hydropower arrangement of Jiu River at the Livezeni-Bumbești section" the following works shall be performed:

- ✓ <u>Robești falling step</u>

99% of the works completed. The plant is operational since 2012. The remainder is: acquiring the land for arrangement (by applying Law Legii 255/2010); execution of OHL N110KV Robești-Sibiu Sud, for evacuating the power of Robești, Câineni and Lotrioara plants. Operating license – all valid permits.

- ✓ <u>Racovița falling step</u>

95% of the works completed: Execution of the Final Takeover. It can operate at a capacity of max. 60%, due to the restrictions given by the securization of railway bridges that crosses the escape canap. The rest of the works for reaching the NNR upstream quotaŞ 373,5 mdMB**

- DMD upstream of Bradu bridge 3rd tranche
- DMS 3rd tranche
- closing Mârșa and Avrig creeks
- protection of Mârșa and Avrig railway bridges

Required works for reaching the final escape quota:

- debusing of Sebes creek

[41] Ibidem [40]

- demolition of downstream road bridge
- deepening and widening the escape canal: Stage I: downstream quota 362 mdMB, Stage II: upstream quota 358 md

*According to the solution for protecting the downstream railway bridges.

**The execution of the remaining works is mandatory in order to achieve the indicators set.

The acquisition of lands continues only by applying Law 225/2010 on public utility expropriation, the need of approving the expropriation corridor for completing the works.

In the course of licensing. The procedures for obtaining the Water Management Permit and the Environmental Permit were initiated.

✓ Falling step at Câineni

20% of the works were completed. The works were suspended in 2012.

The remaining works for completing the investment:

Câineni discharge dam:

- concreting the superstructure of the dam;
- arrangement of the dam-plant canopy;
- concreting the wall downstream the left shore of the missing sections (2 sections);
- concreting the wall upstream the right shore of the missing sections (3 sections);
- concreting the missing energy dissipation teeth (3 pcs).

Hydropower plant:

- concreting the infrastructure (approx. 50%) and the entire superstructure;
- calming basin of approx. 20%.

Left and right shore dams:

- the left shore dam completely: fillings, surface and deep sealing, counter-canal;
- the left shore dam completely: fillings, surface and deep sealing, counter-canal (of which a small part adjacent to the node is performed (service platform, 200m Kelly screen, 2 countercanal foundation sections.

Escape and high water canal:

- excavations of approx. 60% of its length;
- concrete protections on the left shore.

Access roads and bridges on the site – completely

Site organization – 50% reconditioning.

The permits were obtained from the Custodians of Natura 2000 Sites.

On 11.06.2019, the Project of the Decision of the Stage of Classification was posted. The continuous procedure by issuing the Guide according to Law no. 292/2018. The issuing of the Environmental permit is subject to obtaining the SGA Permit.

✓ Lotrioara falling step

1% of the works were completed.

- NH execution building – it is entirely on the left shore close to the railway;
- The outlet dam – the first blades of the foundation from the two outlet fields placed on the left shore (openings 3 and 4) were concrete and the separating pile (on the middle of the outlet dam);
- Technological and social organization – a concrete platform is left;
- Permits were obtained from the Custodians of Natura 2000 Sites;
- On 11.06.2019, the Draft of the Decision for the Stage of Classification, continuous procedure with the release of the Guide acc. to Law no. 292/2018 was posted.

The issuing of the Environmental permit is subject to obtaining the SGA Permit.

ENERGY TRANSPORT

RES 2019-2030, with perspectives for 2050, targets the following projects for the development of energy transport infrastructure:

- The new 400 kV dc LEA (with an equipped circuit) between existing stations Smârdan and Gutinaş
- New 400 kV dc LEA between the existing Cernavodă and Stâlpu stations with an inlet/outlet at the 400 kV Gura Ialomiţei station
- Expansion of the 220/110 kV Stâlpu station by building the 400/110 kV station
- LEA 400 kV Porţile de Fier - Anina - Reşiţa
- New 400 kV dc LEA between existing stations Resita (Romania) and Pancevo (Serbia)
- Switching to 400 kV of LEA 220 kV dc Reşiţa-Timişoara-Săcălaz-Arad
- Expansion of the 220/110 kV Resita station by building the new 400/220/110 kV Resita station;
- Replacement of the 220/110 kV Timisoara station by construction of the new 400/220/110 kV station.

✓ **<u>l 138 „Black Sea Corridor" project</u>**

The „Black Sea Corridor" project is part of the electricity corridor: "North-South interconnections for electricity from Central Europe and South-East Europe ("NSI East Electricity") and its role is to consolidate the electricity transport corridor along the Black sea coast (Romania-Bulgaria) and between the coast and the rest of Europe. The components of the project are:

➢ **New OHL of 400 kV d.c. between the existing stations at Cernavodă and Stâlpu, with an entry/exit circuit in 400 kV Gura Ialomiţei station.**

The works consist of two sections of 400 kV OHL with double circuit:

- section I 400 kV double circuit Cernavodă – Gura Ialomiţei;
- section II 400 kV Gura Ialomiţei – Stîlpu, completed with 400kV line panels with simple circuit that allow the execution of connections to Gura Ialomitei Station, according to the investment requirements.

Cernavodă – Stâlpu Overhead line (OHL), of approx. 160 km will be built as a double circuit line, an entry-exit circuit in Gura Ialomitei station, and the second circuit will be continuous to Stalpu Station.

- **Stage:** works acquisition procedure –the complaint filed by a biddrer is in the course of settlement;
- **Regulatory acts obtained:** the Government Decision of expropriation no. 805/08.11.2017 and the updated Environmental permit of 23.04.2019 were obtained;
- **Location:** the route of the overhead power line is outside the built-up area of 34 communes in Constanta, Ialomita and Buzau counties and will cross the river Danube and Borcea branch.

➢ **Upgrading the 220/110/20 kV station at Stâlpuşi building the 400 kV Station at Stâlpu.**

- **Stage:** in the course of procurement execution of works – tender evaluation;
- **Regulatory acts obtained**: not applicable;
- **Location:** 220/110/20 kV Stâlpu power transformer station is located in Stalpu commune, Buzau County.

➢ **New 400 kV d.c. OHL (with an equipped circuit) between the existing stations Smârdan and Gutinaş;**

- **The works consist of** building a new line that will comprise two separate sections: underground electrical line section (in cable) 440 kV between the 400 kV Gutinaş Station and terminal pillar no. 1 of approx. 2.0 km and a section of 400kV OHL BETWEEN THE PILLAR NO> 445 of Smardan section, with a length of approx. 138 km. For connecting this OHL, Gutinas station and Smardan station must be extended with two line cells.
- **Stage: design in progress;**
- **Regulatory acts to be obtained:**
  - Under initiation the revision of the Environmental Permit for obtaining the Government Decision for removal from the forest fund;
  - The interministerial circuit for approving the Government Decision of transfer of the right of administration of lands from the public patrimony of the state on the OHL route was initiated;
  - Under preparation the documentation for obtaining the Government Decision for removal from the farming circuit;
  - The funding agreement is negotiated after the funding request was approved within the Large Infrastructure Operational Programme in April 2019;
- **Regulatory acts obtained: GD no. 840/22.09.2017 of expropriation was obtained;**
  - Location: LEA 400 kV d.c. Gutinaş - Smârdan shall be located on 26 administrative territories belonging to Bacău (5 UAT), Vrancea (5 UAT) and Galaţi (16 UAT) counties, length of the line: 140km;

✓ **<u>144 „Mid Continental East Corridor" Project</u>**

The „Mid Continental East Corridor" Project is part of the priority electricity corridor: "North-South interconnections for electricity from Central Europe and South-East Europe ("NSI East Electricity") and leads to an increase of the exchange capacity on the borders between Romania – Hungary – Serbia. This intensidies the North-South European corridor from North-East Europe towards South-East Europe through

Romania, allowing a stronger integration of the markets and enhancing the security of consumption supply in South-East Europe.
The components of the project are:

- **New 400 kV d.c. OHL between the existing stations in Reşiţa (Romania) and Pancevo (Serbia);**
  - **Investment objective completed in 30.03.2018.**

- **New 400 kV s.c. OHL at existing station of 200 kV Porţile de Fier and the new 400 kV Reşiţa station;**
- **The passage to 400 kV of 220 kV d.c. Reşiţa – Timişoara – Săcălaz – Arad OHL;**
- **The extension of 220/110 kV Reşiţa station by building the new 400/220/110 kV Reşiţa station.**
- **Streamlining the 220/110 kV Timişoara station and execution of the new 400/220/110 kV station.**

Stage I: Extension of 400 kV Porţile de Fier Station; 400 kV Porţile de Fier – Reşiţa OHL; 400 kV Reşiţa Station;

The works comprise:

Extension of 400 kV Porţile de Fier station consisting of equipping a OHL cell at Porţile de Fier Station and replacing the command, control and protection system from 400/220 kV Porţile de Fier station;

- **Stage:** investment objective completed in 2016;

Execution of a new 400 kV Porţile de Fier – Anina OHL, rehabilitation of 400 kV Anina – Reşiţa OHL;

- **Study:** execution of works;
- **Regulatory acts obtained:** HG de expropriere nr. 917/2016, HG de fond forestier nr. 353/2019 şi Environmental permit no. 6/21.11.2013;
- **Location:** The works shall be made in 13 UATs; 10 UATs in Caras-Severin county and 3 UATs in Mehedinti county;

Execution of 400/220/110 kV Reşiţa station by execution of a new 400kV station and streamlining the old 220/110 kV station;

- **Study:** execution of current works as part of the secondary equipment and associated services and in the bidding – bid evaluation procedure for supply of the primary equipment and related services;
- **Regulatory acts obtained:** since the works for execution of the new 400kV station and streamlining the old 220/110 kV Reşiţa station require the acquisition of an additional land, because 400/220/110 kV Reşiţa Station cannot fit into the site of the existing 220/110 kV station, GD no. 934/2016 for approving the site and launching the expropriation of private properties was obtained;
- **Location:** Soceni locality, National Road DN 58 Reşiţa – Caransebeş;

Stage II: 400 kV D.C. Reşiţa – Timişoara – Săcălaz OHL + 400 kV Timişoara station, 110 kV Timişoara station;

The works consist of:

Execution of 400 kV double-circuit OHL at Reşiţa – Timişoara, Reşiţa – Săcălaz

- **Stage:** in the course of design;
- **Regulatory acts obtained:** in the course of obtaining the Environmental permit;
- Location: the works shall be carried out in Caras-Severin and Timis counties;

Streamlining 220/110 kV Timişoara station and execution of 400 kV Timişoara station

- **Stage:** execution of works in progress;
- **Regulatory acts obtained:** not applicable;
- **Location:** Calea Moşniţei, nr. 40, Timisoara Municipality.

Stage III: 400 kV d.c. Timi;oara – Săcălaz – Arad OHL + 400/110 kV Săcălaz Station + Extension of 400 kV Arad Station;

The works consist of:

Execution of the 400 kV Timişoara – Săcălaz – Arad OHL section;

- **Stage:** the design services for execution of FS, TD+TS are in progress;
- **Regulatory acts obtained:** after completing the design, the stage of obtaining the Environmental permit shall begin
- **Location:** the works shall be conducted in Timis and Arad counties.

400 kV Săcălaz station and streamlining 110 kV Săcălaz station;

- **Stage:**the technical specifications for the acquisition of the design services are being drafted.
- **Regulatory acts obtained:** after completing the design, the stage of obtaining the Environmental permit shall begin.
- **Location:** DN 59A Timişoara-Jimbolia la km 4.

Extension of 400 kV Arad station and streamlining 110 kV Arad Station;

- **Stage:** the Technical Specifications for acquiring the design services are being prepared.
- **Regulatory acts obtained:** after completing the design, the stage of obtaining the Environmental permit shall begin.
- **Location:** DJ 709 Arad - Şiria km 1.

The locations are shown in Figure 61 based on the environmental permits and the layout plans provided by the Beneficiary.

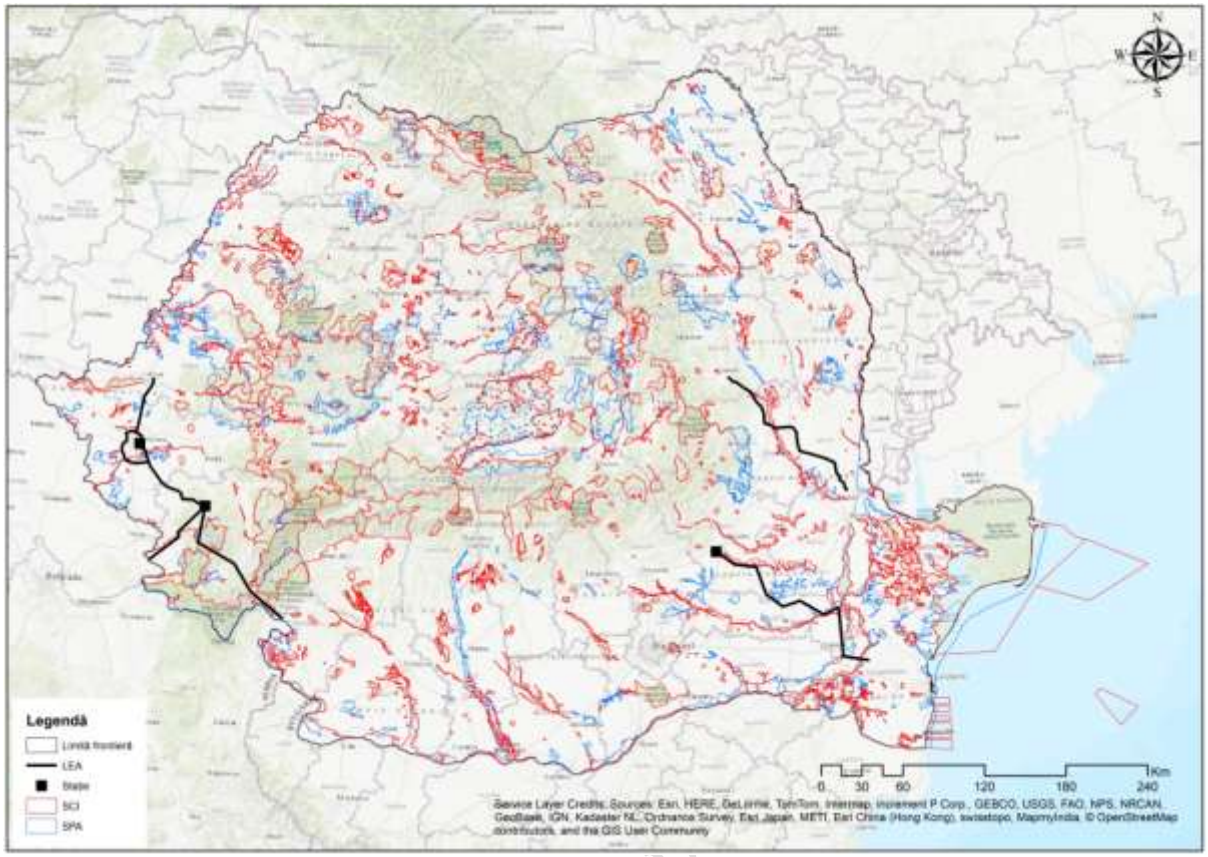

Figura 46 Objectives under RES 2019-2030, with perspectives for 2050, in the field of energy transport

IX.4. PROJECTS REGARDING THE USE OF RENEWABLE RESOURCES

Within RES 2019-2030, with perspectives for 2050, a series of projects are used, which make use of renewable resources as raw material, namely water:

- Realization of hydroelectric power plant with accumulation by pumping Tarniţa-Lăpuşteşti;
- Realization of hydroelectric power plant Turnu Magurele - Nicopole 500 MW;
- Realization of hydroelectric power plant 35 MW Rostoliţa;
- Realization of hydroelectric power plants on the Jiu River 90 MW;
- Realization of hydroelectric power plants on the Olt River - 145 MW.

They have been dealt with in the previous chapters of this Environmental Report.

XI. POTENTIAL SIGNIFICANT EFFECTS ON THE ENVIRONMENT, INCLUDING ON HEALTH, IN A TRANSBOUNDARY CONTEXT

In terms of the effects on the environment and human health in a transboundary context, measures that mainly target the construction of hydropower plants on the border rivers (Turnu Magurele Nicopole hydroelectric power plant), the construction of nuclear power stations, the realization of the energy transmission lines (LEA) are of relevance. Potential adverse effects that may arise in the implementation of such projects have been described in previous sections.

With regard to such projects proposed in the RES, most of them will be developed in partnership with the neighbouring states (Turnu Magurele-Nicopolis hydroelectric power plant, 400 kV LEA between existing stations Resita Romania - Pancevo Serbia, etc.), thus that significant effects on the environment or on human health in a transboundary context were identified at this time, which would require consultation with neighbouring countries, mainly consisting of the alteration, fragmentation and possible loss of protected fauna and flora in the natural protected areas located along the Danube, in Romania and in Bulgaria for Turnu Magurele-Nicopolis hydroelectric power plant.

For the realization of Units 3 and 4 of Cernavoda nuclear power plant, according to the information available on the website of the Ministry of Environment (http://www.mmediu.ro/protectia_mediului/centrala_cernavoda.htm), it obtained the Environmental Agreement in 2013. Under this procedure, based on the provisions of the Espoo Convention, notifications were sent to states potentially affected by the implementation of the project, namely Bulgaria, Ukraine, Republic of Moldova, Hungary and Austria.

As regards the potential effects on the health of the population, for new projects, in a national and cross-border context, the legal provisions of the Order of the Ministry of Health no. 119/2014 amended and supplemented by MH Ordr 994/2018 will be taken into account.

Potential significant environmental impacts can be obtained after consultations with the countries involved in the implementation of the two projects, namely Bulgaria (for the hydroelectric power plant Turnu Magurele-Nicopole) and Serbia (for the hydroelectric power plant Turnu Magurele-Nicopole and the realization of the new 400 kV LEA between the existing stations Resita Romania - Pancevo Serbia).

XII. PROPOSED MEASURES TO PREVENT, REDUCE AND COMPENSATE AS COMPLETE AS POSSIBLE ANY ADVERSE EFFECTS ON THE ENVIRONMENT THROUGH IMPLEMENTATION OF THE STRATEGY

XI.1. GENERAL CONSIDERATIONS

The establishment of measures to prevent, reduce and compensate for the significant environmental effects resulting from the implementation of the plan is a provision of Government Decision 1076/2004 on establishing the reduction of the environmental assessment for plans and programmes. It should be noted that the level of the RES 2019-2030, with perspectives for 2050 and of the Strategic Environmental Assessment, respectively, does not allow for a detailed identification of all the effects due to the implementation of the Strategy.

Preventing and minimizing as fully as possible any adverse effects on the environment can be achieved by considering environmental assessment at all stages of the Strategy's preparation and implementation, namely:

- The strategic environmental assessment will be considered in the development and implementation of the lower rank plans that will fall under the provisions of the Strategy;
- The proposed projects to be carried out with an impact on the environment will have to be assessed in terms of their environmental impact, a process that will be carried out in accordance with the requirements of the national legislation in force. This will identify: environmental impacts in the project area, best available techniques and solutions for the proposed activities, measures to prevent, reduce and compensate the negative environmental impacts generated by the projects concerned, measures to monitor the environmental effects of project implementation;
- With impact assessments, cumulative assessment is required. The cumulative impact can be the result of a series of situations associated with the interaction between similar development projects or the accumulation of different effects in a given area. Thus, the impact assessment carried out at the project level is not sufficient to identify the wide range of cumulative effects on the environment generated both by existing pressures and by new energy projects;
- Impact assessments for the projects promoted by the Strategy will be based on actual, reliable data, including through field measurements and will be obtained by processing such data on the initial environmental status of the project area. This will make it possible to make the best decisions, including the subsequent monitoring of the effects from project implementation.

XI.2. MEASURES PROPOSED TO PREVENT, REDUCE AND COMPENSATE ANY NEGATIVE ENVIRONMENTAL IMPACT

General measures related to the implementation of certain types of investments:

- MG1 – Sequencing the construction works for projects in the same area or located in adjacent areas and correlating the measures for prevention, reduction, compensation (if necessary) with those identified after the evaluations for other strategies, plans and programs;
- MG2 – Approaching all the matters concerning the stage of construction during the evaluations of the environmental impact starting from the location of the site organization up to the areas of deforestation (if they are indispensable for the project), quarries and/or gravel pits that willbe opened to obtain raw materials, construction of technological roads, utilities;
- MG3 –Avoiding the placement of projects inside or in the immediate vicinity of natural protected areas; if this cannot be avoided, to establish proper measures according to the management plans of protected areas or by applying measures for avoiding, reducing, compensating the major environmental effects established during the adequate evaluation procedure;
- MG4 –Execution of environment management plans for projects so that the environmental performance can be assessed during this entire period (stage of design, construction and operation.

The specific measures recommended for preventing and reducing certain negative environmental effects in relation to the relevant environment issues described in the table below:

Table 16 Specific measures proposed for RES SER 2019-2030, with perspectives for 2050

Crt. no.	Environmental aspect	Specific measures recommended to prevent and reduce certain negative impacts on the environment	
1.	Air	MS1	Choosing locations so that the distances of transportation are minimal.
		MS2	Avoiding sensitive areas in relation to air quality, when the projects are localized that involves high emissions of atmospheric pollutants, during construction or inthe stage of operation
		MS3	Adaptation of the design solutions by considering the climatic changes;
2.	Water	MS4	Excluding areas subject to flooding for the sites targeted by the project; if this is unavoidable, the necessary measures of protection against floods will be included in the project;
		MS5	Avoiding the implementation of projects that may cause an alteration of the chemical state of water bodies and of their ecological potential/state;
		MS6	Choosing the location of a project by taking into account all the uses of the water downstream of the area of implementation, existing, under execution or included in certain plans or programs (e.g. drinking water sources, industrial water sources, irigations);
3.	Sol	MS7	Limiting the land areas temporarily occupied (during the construction works);
		MS8	Analysing the opportunity of changing the categories of use of lands for implementing certain projects so that they are not affected by the activities carried out in that area;

Crt. no.	Environmental aspect	Specific measures recommended to prevent and reduce certain negative impacts on the environment	
		MS9	Rehabilitation of the sites of working points soon after the construction works are completed
4.	Biodiversity	MS10	Restricting the use of machines and vehicles and manual execution of works in areas or when species of fauna are vulnerable;
		MS11	Creating opportunities for fauna migration;
		MS12	Providing biological corridors/passages for the movement of the fauna;
		MS13	Execution of construction works outside the season of reproduction of protected animals identified in the area of works;
5.	Population and human health	MS14	Implementation of programs for monitoring the air quality, water quality and noise in the areas where the projects may cause discomfort and risk to the population, during construction and during operation for adopting the adequate measures for reducing the impact on human health;
		MS15	Reducing the noise pressure level in residential areas close to the future objectives that may cause a potential discomfort to the population;
		MS16	For new projects, the location of high voltage lines must be taken into consideration, by observing the provisions of ANRE Order 49/2017, for human protection purposes;
		MS17	Reduction of the risks on the health of workers by technical measures (using new, efficient and reliable machines/equipment) and organizational measurements ;
6.	Economic and social environment	MS18	Preparation and implementation of traffic management plans during the construction works (in case of works for infrastructures);
		MS19	Implementation of non-structural measures of preventing the risk of floods;
		MS20	Avoiding interferences with various infrastructures through the coordination of the projects in the same area;
7.	Cultural patrimony and landscape	MS21	Including in projects measures to protect the cultural, architectural objectives
		MS22	Choosing sites for projects making sure that the impact on areas with special visibility from recreational, touristic, residential areas is minimal.

XIII. EXPLANATION OF THE REASONS FOR THE SELECTION OF CHOSEN VARIANTS

XII.1. EVALUATION OF RES VARIANTS

In RES 2019-2030, with perspectives for 2050, there are not explicitly presented more alternatives that have been considered and for which reviews have been made in a differentiated manner. This Environmental Report has taken into account the alternative "0" and the alternative presented in the Strategy.

The effects of non-implementation of RES 2019-2030, with perspectives for 2050, can be found in the present environmental report, in chapter IV.2.

By implementing RES 2019-2030, with perspectives for 2050, meeting the targets for reducing the greenhouse gas effects will be achieved, investments will be made in the energy objectives that are approaching the end of the operating period. A number of such beneficial measures are to be found in RES 2019-2030, with perspectives for 2050, and are also presented in this document.

Regarding the difficulties encountered in the processing of the required information, a major limitation of the activities proposed in the strategic environmental assessment is represented by the low quantitative and qualitative level of the database and information belonging to the public domain. In this regard, we note that the main difficulties encountered are determined by:

- The quality of the available data. For the same data set, there are contradictions between environmental status reports or between them and other sources of information (e.g.: INS);
- Lack of spatial data on the status of the different environmental components;
- The still low level of availability of data on the spatial location of habitats and populations of species with a conservative concern;
- The lack of detailed forecasts of electricity generation by source and technology types, which would have allowed for a more detailed analysis of the environmental costs associated with the implementation of the strategy.

XIV. MEASURES TAKEN INTO ACCOUNT TO MONITORING THE SIGNIFICANT EFFECTS OF IMPLEMENTATION OF RES 2019-2030, WITH PERSPECTIVES FOR 2050

As in the case of prevention, reduction and compensation measures, in the light of the requirements of GD 1076/2004, this section should describe the measures for monitoring the significant environmental impacts generated by the implementation of the RES 2019-2030, with perspectives for 2050.

The implementation of a monitoring programme will help identify unforeseen adverse effects as well as appropriate remedial actions.

Thus, the following aspects have been considered in proposing a comprehensive and effective environmental monitoring system generated by the implementation of the Strategy:

- ✓ A program to monitor the environmental effects of RES 2019-2030, with perspectives for 2050, as a whole, and not just on components, is necessary to assess its impact, prevent potential significant effects and establish timely measures to mitigate adverse effects;
- ✓ The monitoring program must be comprehensive, simple and efficient, requiring a low consumption of resources, but allowing for the most accurate knowledge of the quality of the environment in the reviewed area;
- ✓ The proposed monitoring system is related to the relevant environmental objectives established in the SEA working group. The monitoring system will thus not only make it possible to assess the impact of the Strategy's implementation on the environment but also on how these relevant environmental objectives are achieved;
- ✓ Taking into account the fact that there are a significant number of authorities and institutions involved in the energy sector, the Strategy holder will be able to benefit from much of the data needed for the monitoring indicators, its main responsibility being to centralize and adequately present the indicators. As far as possible, it was tried to propose a set of indicators for which no additional efforts are required, being selected on the basis of the competences and responsibilities of the competent authorities.

The objectives of the monitoring program are:

- ✓ Validation of the conclusions of the assessment: the existence of a correspondence with the nature, probability and magnitude of the environmental effects with the SEA predictions;
- ✓ Allow verification of how the proposed measures have been implemented to compensate adverse effects and optimize benefits;

Identifying the need for changes to the Strategy to reduce environmental impact or optimize benefits.

We have tried to formulate impact indicators that characterize the effects of strategy implementation, not just its results.

Table 17 Indicators for monitoring and controlling the environmental effects in the context of RES 2019-2030, with perspectives for 2050

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
Aer	**OM.1** Improving air quality by reducing emissions from energy sector activities;	Emissions of pollutants in the atmosphere (COx, NOx, SO_2, particulate matter, heavy metals, COV, HAP) that appear during the period of construction of the projects proposed by RES 2019-2030 with perspectives for 2050	Quarterly measurements in the stage of execution; Half-yearly measurements in the stage of operation;	By implementing projects in the stage of execution, it is possible that emissions of pollutants have values that exceed the admissible limits established by the law on the quality of the air, but in the stage of operation they register a significant decrease compared to the current situation, through the implementation of non-polluting technologies (overcritical parameters and ultra overcritical paramters in the case of power plants);	Ministry of Energy through the subordinated structures, as Beneficiary; Competent environmental protection authority;
Water (surface and underground)	**OM.2** Improving water quality by reducing emissions from energy sector activities;	The volume of discharged wastewater and the concentration of pollutants (heavy metals, CBO_5, CCOCr, petroleum products etc.) in natural receivers; Changes to the hydro-geo-morphological regime associated to the energy sector -	Quarterly, in the stage of execution of works, for the projects proposed by RES 2019-2030, with	Maintaining the admitted limit values for discharge of wastewaters natural emissary - NTPA001; Changes may appear in	Ministry of Energy through the subordinated structures, as Beneficiary;

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
		number of water streams/lakes on which hydropower facilities are built, number of temporary works inthe bed in the stage of execution;	perspectives for 2050, by taking water samples from the discharge points wastewater/water possible pollutted; Half-yearly, inthe stage of operation, for the projects proposed by RES 2019-2030, with perspectives for 2050, by taking samples of water from wastewater discharge points;	the morphology of the minor bed, in the discharge dynamics because of the works for construction of hydropower facilities;	Competent environmental protection authority; Competent authority in the field of waters;
	OM.3 Maintaining the ecological status of running waters (Water Framework Directive)		În perioada de proiectare și execuție;		
Soil	**OM.4** Limitation and reduction of point soil	Pollutants in ambient air (COx, NOx, SO2, particulate matter, heavy metals, COV, HAP) resulting in the period of	Quarterly measurements in the stage of	The evolution of pollutants in the ambient air can lead to an	Ministry of Energy through the

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
	pollution **OM.5** Maintaining the ecological status of the soil	construction of the projects proposed by RES 2019-2030 with perspectives for 2050; Number of accidental pollutions registered and affected areas (by the proposed proposed by RES 2019-2030, with perspectives for 2050); The quantity and type of substances that caused the accidental pollution;	execution; Half-yearly measurements in the stage of operation; Annually, in the stage of execution and in the stage of operation.	estimate of the evolution of the quality of soil; This indicator is relative, the number of accidental pollutions does not fully depend on the design of the investments proposed by the Strategy, these can also be caused by human errors, means of transport etc.	subordinated structures, as Beneficiary; Competent environmental protection authority;
Climate changes	**OM.6** Decrease in greenhouse gas emissions from the energy sector to meet EU targets;	Greenhouse gas emissions (CH_4, N_2O, NO_X, CO, CO_2, NMVOC) in relation to the objectives using coal as raw material; The number of incidents caused by extreme weather conditions (floods, low/high temperatures etc. land slides in the project area);	Quarterly measurements in the stage of execution; Half-yearly measurements in the stage of operation; Annually;	The fulfilment of this objective depends more on facilitating the sale of alternative fuels, the development of the alternative fuel infrastructure, improving the operating technology of thermal power objectives; To be compared with the situation prior to the implementation of the project	Ministry of Energy through the subordinated structures, as Beneficiary; Competent environmental protection authority;

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
Biodiversity	**OM.7** Conservation of habitats and species of flora and fauna of community importance; **OM.8** Maintaining the national network of protected natural areas;	Natura 2000 habitats inside the sites of community importance lost /altered as a result of the implementation of the projects from RES 2019-2030, with perspectives for 2050; The areas of Natura 2000 habitats (ha) inside the sites of community importance reversible affected by construction works for the projects from RES 2019-2030, with perspectives for 2050; The death rate of species of fauna/flora of community importance inside Natura 2000 sites resulting from the operation of the projects from RES 2019-2030, with perspectives for 2050 (affected numbers); Number of protected areas intersected by the projects proposed by RES 2019-2030, with perspectives for 2050;	In the stage of execution and in the stage of operation by monitoring programmes covering different stages from the biological cycle, according to each class of organism	Localization of the projects (those for which the site was not established yet) will avoid as much as possible to cross natural protected areas or where this is not possible the occupation rate must be minimal and not affect the habitats; In the case of those located in natural protected areas, compensation measures will be proposed depending on the occupied area and the species of flora and fauna encountered in those areas;	Ministry of Energy through the subordinated structures, as Beneficiary; Competent environmental protection authority;
Landscape	**OM.9** Protection and conservation of the natural landscape;	The areas of protected areas affected (ha) by the projects proposed by RES 2019-2030 with perspectives for 2050 in relation to the total area of Natura 2000 network; All the landscape transformations that could appear as a result of the projects	In the stage of execution and in the stage of operation by specific annual measurements; In the stage of	The land areas permanently occupied by the projects proposed by RES SER 2019-2030 with persepctives for 2050; In the stage of execution and in the stage of	Ministry of Energy through the subordinated structures, as Beneficiary; Competetn
Cultural aspects	**OM.10** Preservation and conservation of				

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
	cultural heritage	proposed by RES 2019-2030 with perspectives for 2050 (land areas occupied permanently and temporarily, grubbed up, stripped areas, number of decommissioned buildings); The number of acheological areas opened on various sections of the investments proposed after discovering archeological sites etc.;	design, measures will be taken to limit the negative impact on the habitats Natura 2000 that will be applied in the stage of execution and in the stage of operation. If the implementation of measures does not have the expected results, these will be adjusted at all times to the onsite situation. At the completion of the execution, the habitats will be rehabilitated, also by compensatory measures;	operation by specific annual measurements, in the stage of design, measures will be taken to limit the negative impact on the Natura 2000 habitats that will be implemented in the stage of execution and inthe stage of operation. If the implementation of the measures does not have the expected results, these will be adjusted at all times to the onsite situation. At the completion of the execution, the habitats will be rehabilitated, including by compensatory measures;	environmental protection authority; pentru Competent authority in the field of evaluation of the national cultural patrimony;
	OM.11 Preservation and		During the period of execution of		

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
	conservation of local traditions and customs;		construction works;		
Conservation of natural resources	**OM.12** Reducing the exploitation of depleting resources and facilitating the use of renewage resources	The quantity of alternative fuels used (tonnes equivalent petroleum product)	Annually	In the stage of design, measures can be taken to equip the installations using depleting resources with technologies/installations that can also use alternative fuels; The data will be compared to those from the period before the implementation of projects;	Ministry of Energy through the subordinated structures, as Beneficiary;
Waste	**OM.13** Reducing the amount of waste generated and increasing recycling/recovery for all types of waste;	The amount of waste generated, (tonnes/year – for the projects proposed by RES 2019-2030 with perspectives for 2050 in relation to the built area; The amount of waste reused or recovered by recycling (tonnes/year) – for the projects proposed by RES 2019-2030 with perspectives for 2050 in relation to the built area	Quarterly, in the period of execution and annually in the period of operation.	The amount of waste generated during the period of execution and during the period of operation will be reported;	Ministry of Energy through the subordinated structures, as Beneficiary; Competent environmental protection authority;
Population and	**OM.14** Decrease	The number of accidents that occurred and	Annually	Measures to protect the	Ministry of

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
human health	of emissions of pollutants from the environment that might improve the health state of the population and implicitly improve the standard of living; **OM.15** Use of clean (efficient) technologies that generate as few as possible risks for the staff from the industrial facilities;	the number of persons prejudiced by the implementation of the projects proposed by RES 2019-2030, with perspectives for 2050; The number of persons that may be exposed to high concentrations of pollutants in the ambient air from the area by the implementation of the project; The number of professional illnesses and illnesses related to the profession that might result from the implementation of the projects;		population against the risks associated to the thermal power objectives willbe taken in the stage of design, measures that will be implemented by contractors. It is estimated the reduction of the number of accidents in the energy sector; The data will be compared with the reference scenario;	Energy through the subordinated structures, as Beneficiary; Territorial Labour Inspectorate Competent Health Authority ;
Transport	**OM. 16** Facilitation of infrastructure for the provision of electric transport; **OM.17** Ensure transport conditions to meet EU targets;	The number of vehicles using non-polluting fuels;	Annually	-	Competent authority in the field of transport;

Environmental aspects	Relevant environmental objectives for RES 2019-2030, with perspectives for 2050	Monitoring indicators	Frequency	Description	Responsible
Energy efficiency	**OM.18** Improving energy efficiency and substainable use of resources to produce energy	Number of projects of modernization/rehabilitation/streamlining proposed by RES 2019-2030 with perspectives for 2050	Annually	-	Ministry of Energy through the subordinated units, as Beneficiary;

XV. NON-TECHNICAL SUMMARY

This report presents the conclusions of the Strategic Environmental Assessment for the Romanian Energy Strategy for the period 2019-2030 with perspectives for 2050.

The environmental report was prepared in accordance with the content requirements of Annex no. 2 of the Government Decision no. 1076/2004 "on establishing the procedure for carrying out the environmental assessment for plans and programmes".

Strategic environmental assessment is a process of reviewing a strategy, plan or programme that has attempted to address all environmental issues in the energy industry, has identified solutions to reduce it and avoids creating new environmental problems through its objectives and the proposed new measures.

Romania's Energy Strategy 2019-2030, with perspectives for 2050, is a document promoted by the Ministry of Energy. The energy sector includes all activities related to the exploitation of coal, natural gas, crude oil, the exploitation of renewable resources (wind power, water energy, solar energy, geothermal energy, biomass), the production of electricity and hot water by burning fossil fuels or other technologies, transportation of raw materials, energy and hot water.

Through RES 2019-2030, with perspectives for 2050, the following were identified: the evolution trend of energy consumption; energy capabilities to be rehabilitated/built to provide the necessary energy, transport and distribution; measures necessary to provide the necessary human resources; the necessary steps to comply with the requirements of environmental protection legislation; the measures needed to increase energy efficiency (maintaining energy production with less resource consumption and diminishing losses).

SRES 2019-2030, with perspectives for 2050, does not present more alternatives that can be considered for assessing impacts on human health and the environment. Two environmental alternatives have been taken into account in this Environmental Report: the non-implementation of RES 2019-2030, with perspectives for 2050, which would lead to the non-implementation of the environmental targets imposed by the Community environmental protection legislation and the alternative presented in the Strategy, which implies compliance with some commitments and the achievement of targets set by Community legislation, making new investments or upgrading of those already existing in the field of electricity generation.

Implementing the strategy will also generate positive and negative effects. On the whole, we can assume that the share of positive effects is much higher out of the total potential effects identified.

Negative effects are mainly associated with the proposed measures of expansion and building of new energy capacities, mainly: construction of new hydropower plants. The environmental component for which the most potential negative impacts have been identified is biodiversity (mainly conservation of natural habitats and wild flora and fauna species).

Positive effects are mainly associated with measures of mitigation/removal of

environmental issues in the energy sector. Most positive effects are associated with measures to reduce pollutant emissions in the air and increase energy efficiency.

The energy sector is currently based on the exploitation of natural resources (depleting or renewable). How this sector will manage to maintain and consolidate the sustainability (by reducing the use of depleting resources, increasing the use of renewable resources and increasing energy efficiency) is the direct measure of its sustainability. With some reservations about the potential negative impacts identified (which can be prevented/removed by implementing appropriate measures) we can conclude that this form of the Energy Strategy proposes a significant change in the national energy policy that creates the prerequisites for the sustainable development of this sector.