REPUBLIC OF SERBIA
MINISTRY OF MINING AND ENERGY

REPORT ON THE STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT FOR THE ENERGY DEVELOPMENT STRATEGY OF THE REPUBLIC OF SERBIA UP TO 2040 WITH PROJECTIONS UP TO 2050

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- Draft -

Belgrade, July 2024

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INTRODUCTORY NOTES

Strategic Environmental Assessment is conducted with the aim of ensuring the protection and improvement of the environment by integrating basic principles of environmental protection into the process of preparation, development and adoption, in this case, of the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050. Strategic Environmental Assessment is an instrument which serves to describe, evaluate and assess possible significant impacts of planned solutions on the environment that may occur in the implementation of the aforementioned Strategy.

The Report on SEA for the Energy Development Strategy of the Republic of Serbia, in addition to evaluating potentially significant impacts on the environment, should also prescribe appropriate measures for prevention, minimisation, mitigation, remediation or compensation of adverse impacts on the environment and human health. Application of SEA opens up the opportunity to observe spatial changes and respects the needs of the subject environment. All activities envisaged by the Strategy are critically considered therein, observing them from the aspect of environmental impacts, after which a decision is made whether the Strategy will be implemented and under which conditions, i.e., what protection and monitoring measures will be set forth.

Conducting the Strategic Environmental Assessment is based on the following basic postulates:

- inclusion of strategic analysis in the Strategy development process as early as possible, but certainly before final decisions are made;
- examining the environmental effects of alternative solutions, which will help determine how plans and programmes can reduce environmental risk;
- raising to a higher level the obligation of the Strategy to establish, implement and monitor measures to prevent and limit negative environmental impacts;
- the scope of the analysis of possible ecological effects should be in accordance with the scale of the expected effects;
- transparency of the process of creating the Strategy increases and enables the achievement of a wider consensus on the goals and solutions of the strategic document in the area of environmental protection;
- in order to analyse the environmental effects, existing mechanisms are used, performance of the analysis evaluated, and recommendations for the protection of environmental elements and space given, including preparation of the report with relevant results.

It is important to point out that the Strategic Environmental Assessment integrates socio-economic and physical segments of the environment, it connects, analyses and evaluates the activities of different spheres of interest and directs the policy document towards solutions that are primarily of interest to the environment.

The Strategic Environmental Assessment will comprehensively, spatially, temporally and strategically integrate environmental aspects into the overview of impacts of all development priorities and goals in the field of energy. Based on the evaluation, it will be possible to choose the most favourable variant solution and create a unique integrated Energy Development Strategy, in accordance with the concept of sustainable development, where

conservation of nature and the environment stands among most important conditions for quality life in the future.

The subject SEA must be coordinated with other strategic impact assessments, as well as with environmental protection plans and programmemes, and is conducted pursuant to the procedure prescribed by the Law on Strategic Environmental Impact Assessment (Official Gazette of RS, No. 135/ 2004 and 88/10). This primarily refers to the Draft SEA for the Integrated National Energy and Climate Plan of the Republic of Serbia for the period up to 2030 with a vision up to 2050.

Numerous sectoral studies, strategic environmental impact assessments for strategic and planning documents and projects from different areas of development were used in the preparation of this Report. Detailed analyses of already existing data and data time series were conducted, all with the aim of obtaining the most comprehensive, complete and high-quality assessment of the impact of strategic activities on the environment, and regulation of protection measures.

The SEA Report was prepared based on the **Decision on the preparation of strategic environmental impact assessment for the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050**, which was adopted by the Ministry of Mining and Energy (number: 312-01-977/ 2021-11, dated 7 October 2021).

The Decision on the preparation of strategic environmental impact assessment for the Energy Development Strategy was published in the Official Gazette (Official Gazette of RS, No. 97/2021), pursuant to the Law on Strategic Environmental Impact Assessment.

For the purposes of preparing the subject SEA, the Ministry of Mining and Energy, as Contracting Authority of the SEA, contracted the University of Belgrade – Faculty of Geography through public procurement procedure published under number 13/21, Lot 2. The Contract on the preparation of the subject SEA was signed with the Faculty of Geography, which was registered under number: 404-02-65/4/2021-08, dated 5 July 2021 (at the Ministry), and under number: 727, dated 5 July 2021 (at the Faculty).

Pursuant to Article 1, the subject of the Contract is preparation of the Report on the Strategic Emvironmental Impact Assessment for the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050, in compliance with the Terms of Reference defined by the Ministry, relevant legal legislation, as well as regulations, norms and standards in place for this type of work. The Report is to be prepared in high quality, respecting the rules of profession.

One of the advantages of the preparation of the SEA Report is that the activities in preparation of the Report follow the procedure of adopting the Energy Development Strategy of the Republic of Serbia, thus enabling an early review of development projects and timely provision of potential suggestions aimed at protecting and improving the environment.

1. STARTING POINTS FOR THE SEA

The SEA Report is the basic document of the strategic envionmental impact assessment process, i.e., of the SEA results. The scope and level of detail of the SEA Report is adapted to the scope of the specific plan or programme, in this case of the Energy Development Strategy, with the fact that it should contain clear and precise guidelines and measures from the aspect of spatial and environmental protection.

The starting points for the strategic environmental impact assessment, pursuant to Article 13 of the Law on Strategic Environmental Impact Assessment, include the following:

- brief overview of the content and objectives of the Strategy and linkages with other plans and programmes;
- overview of the current state and quality of the environment in the area to which the report refers;
- environmental characteristics in areas likely to be significantly impacted;
- considered issues and problems of environmental protection in the Strategy, and presentation of the reasons for omitting certain issues and problems from the assessment procedure;
- overview of the prepared variant solutions related to environmental protection in the Strategy, including variant solution of non-implementation of the Strategy and most favourable variant solution from the aspect of environmental protection;
- results of previous consultations with relevant authorities and organisations of importance from the aspect of objectives and goals, and assessment of potential impacts of the strategic assessment.

Presentation of variant solutions and comparison of variant solutions, as well as presentation of the reasons for choosing the most favourable solution will be processed and presented in Chapter 3 of the SEA Report.

1.1 Overview of subjects, contents and goals of the Strategy and linkages to other documents

1.1.1. Subject of the Strategy

Energy has a great influence on population, economy, environment and the state, and that is why energy transition is a historically significant challenge for decision makers. The essence of energy policy in general consists in the fact that it should provide the economy and the population with the possibility of energy consumption in the amount that corresponds to their needs, with high level of cost-effectiveness and without risk to the health of population, climate parameters and environmental sustainability.

The Republic of Serbia has accepted the path of energy transition, which entails numerous economic, social, geospatial and ecological implications at different levels, from local, to regional and national ones. It changes the structure of the entire energy system of Serbia,

from the exploitation of domestic primary energy sources, import of primary energy (oil and natural gas in particular), production of electricity and thermal energy, production and processing of coal, to the transmission network of energy and energy products.

As stated in the Strategy, Serbia's energy sector is facing fundamental structural changes that are conditioned by both global and national circumstances, namely economic, technological and environmental changes and internationally and nationally accepted development goals.

When talking about the energy sector, international position of the Republic of Serbia is conditioned by the membership in the Energy Community, the Stabilisation and Association Agreement with the European Union, and the acquisition of candidate status for the EU membership, and opening of accession negotiations on the EU membership. By signing the Sofia Declaration on the Green Agenda for the Western Balkans, Serbia committed itself to conducting a strict climate policy and reforming the energy and transport sectors. In addition, by becoming a member of the Energy Community, our country committed itself to the implementation of relevant legal framework and the EU acquis in the fields of energy, climate, environmental protection, use of renewable energy sources, and energy efficiency.

By signing the Paris Climate Agreement in 2015 and ratifying it in the National Assembly in 2017, Serbia accepted to actively work in the direction of reducing greenhouse gas emissions, and assumed the obligation to develop National Energy and Climate Plans that will define the goals for decarbonisation, increasing the share of RES, and energy efficiency improvements.

In the development of the Strategy and the relevant SEA, an approach of integral and continuous planning was applied, with an emphasis on the search for sustainability measures through integration of realistic goals and potentials in the field of energy on the one hand, and the goals and needs of environmental protection, quality of life of residents, and socio-economic development on the other.

The main strategic priority is decarbonisation of the energy sector, and the use of renewable energy sources, i.e., the application of clean technologies is highlighted as an important development potential, which in the context of environmental protection gives the Strategy particular importance.

1.1.2. Contents of the Strategy

Development of the Strategy is based on the terms of reference and a comprehensive overview of the energy sector in the Republic of Serbia. The content of the Energy Development Strategy is:

INTRODUCTORY CONSIDERATIONS

ENERGY SYSTEM OF THE REPUBLIC OF SERBIA

Achievement of the main strategic goals from the Energy Development Strategy of the Republic of Serbia until 2025, with projections until 2030
Characteristics of energy production and consumption in the Republic of Serbia
Energy resources of the Republic of Serbia and assessment of the possibilities of their use

DEVELOPMENT OF THE ENERGY SECTOR OF THE REPUBLIC OF SERBIA UP TO 2040
Development vision and goals
Development scenarios

DEVELOPMENT OF ENERGY SECTORS UNTIL 2040
Electric power sector
Thermal energy sector
Renewable energy sources
Energy efficiency
Natural gas
Oil
Coal
Hydrogen in energy transition
Nuclear energy

FRAMEWORK AND ASSESSMENT OF THE IMPACT OF POSSIBLE CHANGES OF THE INTERNATIONAL POSITION OF SERBIA AND THE INTEGRATION PROCESSES ON ENERGY DEVELOPMENT

ANALYSIS OF THE EFFECTS OF IMPLEMENTING THE STRATEGY
Macroeconomic indicators
Regional development
Technological and scientific research development and innovation
Social dimension of the new Energy Strategy

ENERGY SECTOR OF THE REPUBLIC OF SERBIA AFTER 2040

1.1.3. Overview of development of the energy sector in the Strategy

Development of the energy sector of the Republic of Serbia comprises the following:

1. **Electric power sector** includes power sources – thermal power plants, thermal power plants-heating plants, hydro power plants, solar power plants, wind farms, gas and biogas power plants, industrial power plants, electricity transmission system, through which the electricity produced in the country is transmitted and exchanged with neighbouring systems, electricity distribution systems for the delivery of electricity to consumers, supply to consumers, as well as the electricity market.

The electric power sector is the bearer of most significant and greatest changes in the new Energy Development Strategy compared to all other fields of energy. Decarbonisation of the energy sector is closely related to the phase-out of electricity production using fossil fuels, especially coal, as the largest emitter of carbon dioxide. Strategic commitment includes integration of RES, especially production facilities that use solar and wind energy, into the production system.

<u>Thermal power plants</u>

It is necessary to phase out electricity production using fossil fuels because of decarbonisation process, but due to the security of supply, operational dynamics of thermal

power plants will depend on energy security. Some blocks will remain in line with their performance, a number of them will operate on reduced power, and in the later period will be either in stand-by regime, or completely closed.

The existing thermal blocks A1 and A2 in TENT A need to be revitalised, as well as both blocks in TPP Kostolac A (including investments in primary and secondary measures to reduce emissions of nitrogen oxides, reduction of emissions of sulphur dioxide and particulate matters, as well as waste water treatment). In the period up to 2030, the remaining four blocks in TPP Kolubara A will be disconnected from the grid, while for TPP Morava it will be considered whether to put it in cold stand-by or to close it.

Out of the new thermal capacities, only block B3 of TPP Kostolac B should remain on the grid, and according to the project documentation, the power of this block is 350 MW at the grid threshold.

Gas power plants

Capacities of gas power plants in the Republic of Serbia currently include Pannonian TPP-HP (297 MW) and TPP-HP Pančevo (188 MW), but it is necessary to build new capacities since Pannonian TPP-HP is planned to be disconnected from the grid (Block 2 will remain in stand-by regime with maximum power of 120 MW). That is why the construction of gas power plant in Novi Sad (350 MW of electricity and 100 MW of thermal energy) is planned and of a gas power plant nearby Niš (150 MW of electricity, and 100 MW of thermal energy).

Hydro power plants

Revitalisation of a number of aggregates is planned for the period up to 2030, starting from 2025, when successive revitalisation of all 10 aggregates in HPP Đerdap 2 will begin, with an increase in power of 5 MW per aggregate. In addition, three revitalised aggregates in HPP Potpeć and four aggregates in Vlasinske HPPs are planned, with increase in power of 6 MW and 8 MW, respectively, as well as both aggregates in HPP Bistrica. Total additional power expected from these revitalisations amounts to 77.7 MW (47.7 MW by the end of 2030). In addition to revitalisation, a construction of a new aggregate in HPP Potpeć (G4) is also planned for this period, installed capacity of which will be 14 MW.

Revitalisation of the remaining 6 aggregates in HPP Đerdap 2 is planned for the period after 2030, whereby expected power increase will amount to 30 MW. In the period 2030-2040, the goal is to use hydro potential of the Drina River (HPP Buk Bijela, HPP Foča and HPP Paunci will be connected to the grid by 2032 – the Republic of Serbia participates in this project with 51%, so the expected installed power amounts to about 92 MW), and also to exploit hydro potential of the Ibar (121MW) and Morava (146MW) Rivers.

Construction of the PSHPP Bistrica (628 MW of installed power) is planned as one of the priorities until 2032, which would be the most significant regulation resource in addition to the PSHPP Bajina Bašta. Construction of PSHPP Đerdap 3, with total estimated installed capacity of 1,800 MW is planned until 2040.

Renewable Energy Sources

When it comes to renewable energy sources, it is expected that minimal total installed power of wind power plants and solar power plants in 2030 will reach 3.5 GW, which is a significant increase in the share of RES in total electricity production. The estimated installed power in wind power plants is about 1.77 GW, and 1.73 GW in solar power plants. By 2040, minimal total installed capacity of constructed wind power plants and solar power plants is expected to be 10.97 GW (installed power of 3.16 GW in wind power plants, and 7.37 GW in solar power plants). Territory of the Republic is suitable for the use of geothermal heat pumps. It is estimated that heat pumps with a total power of about 7 GW could be installed in individual heating systems.

2. **Thermal energy sector**. There are 60 district heating systems in the Republic of Serbia. In addition, industrial energy system contains heat sources that are used for the production of technological steam and heat energy for production processes and heating of the working areas, while cogeneration of heat and electricity is carried out in power plants in dozens of industrial installations.

By rehabilitating the existing distribution system, replacing worn-out sections with the installation of pre-insulated pipes, which aims to reduce losses, the sector can create significant potential for the increased connections of new customers. The estimation says that number of connections to the district heating system can increase by 15 to 25% in the period until 2040, compared to the current situation. Moreover, strict implementation of the billing system according to the measured consumption of heat energy will lead to more efficient use of heat energy.

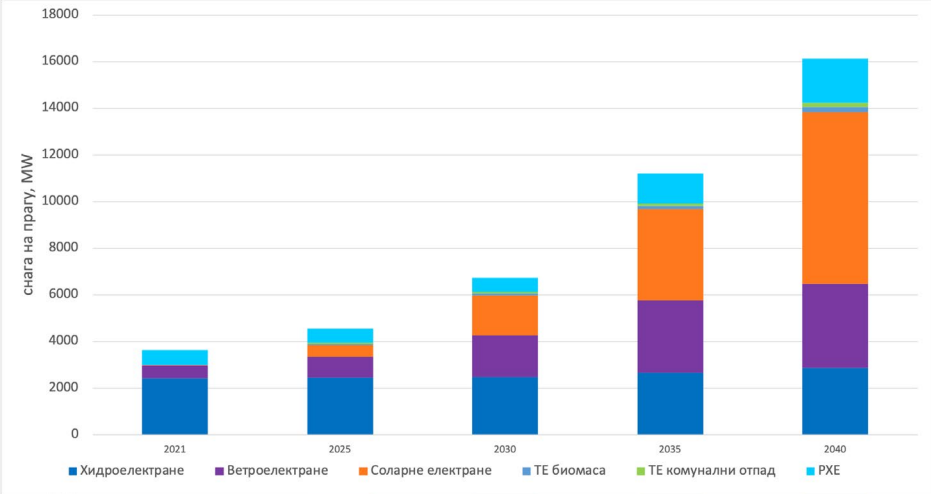
Phasing out individual solid and liquid fuel burners, and switching consumers to district heating from centralised systems with highly efficient energy production from gaseous fuels, would significantly reduce local pollution.

3. **Renewable energy sources sector**. The Republic of Serbia has significant RES potential for the production of electricity and heat, as well as for use in transport.

The basic assumption of the energy transition and the focus of the Strategy is more intensified production of electricity from the wind and solar power. This is the basis for gradual decarbonisation of the power sector, along with the use of hydro power potential.

When it comes to biomass, the focus should be primarily on biogas from agricultural and industrial production, as well as from municipal waste, landfill gas, etc. In addition to energy importance, the planned installations are also of great importance from the aspect of resolving environmental problems.

The minimal capacities for the production of electricity from renewable sources by year are presented in the figure below.



RES capacities for the production of electricity until 2040[1]

(left, vertical: threshold power, MW, row from left to right: HPPs, wind power plants, solar power plants, TP from biomass, TP from municipal waste, PSHPP)

The increase in the use of RES for the production of electricity will be accompanied by a significantly higher use of RES for the production of thermal energy. Decarbonisation of the power sector enables the application of heat pumps in heating plants, households and the public and commercial sector to gain its proper meaning. In order for the effect of their application to be maximal, it is necessary to insist on using geothermal potential of hydro-petrogeothermal sources at shallower levels.

During the projected period, wood biomass has retained a dominant share among RES for the production of thermal energy. Using potentials from agricultural production, municipal waste, etc. can be effectively achieved by building biogas plants for the production of electricity and/or thermal energy. It is reasonable to expect the use of biogas in industrial plants, as well as in public and commercial sectors.

4. **Energy efficiency.** Strategic commitment to the implementation of energy efficiency measures is a basic prerequisite for a successful transition towards a secure and environmentally acceptable form of energy and energy supply.

Energy consumption in households accounts for more than one-third of the final energy consumption in the Republic of Serbia. In this sector, more than 70% of energy is used for space heating and preparation of hot water. For this reason, a key factor in improving energy efficiency in households should be measures such as energy rehabilitation of buildings (reconstruction/renovation of facades, installation/replacement of insulation, replacement of windows, etc.), and implementation of more efficient heating systems.

The Strategy proposes banning and completely phasing out of coal for heating purposes in urban areas by 2040, and switching to more efficient devices for biomass and application of other heating technologies (heat pumps).

Improving energy efficiency in the public and commercial sectors is one of the essential prerequisites for successful promotion of energy efficiency. For the improvement of energy efficiency and energy savings in the industry, application of energy management system is of

[1] PSHPPs are not conventional production capacities, but are used as capacities for balance reserves.

utmost importance. In the agricultural sector, in addition to the application of new technologies and machinery, a great potential for improving energy efficiency lies in the production and exploitation of biomass for the production of electricity and heat. Increasing energy efficiency in transport sector is seen in the development of infrastructure for supplying vehicles with environmentally acceptable types of alternative fuels (biofuels and biomethane), renewal of the fleet, greater use of railway transport, and the development of intermodal transport.

5. **Natural gas sector**. This sector includes exploitation, collection and primary processing of domestic natural gas reserves, import of natural gas, transport and distribution of natural gas, as well as supply of natural gas, are carried out within the sector.

Dependence of the Republic of Serbia on imports is very high in this sector (78.6% in 2021). In recent years, there have been no significant discoveries of new natural gas deposits, most gas fields are in the final stage of exploitation, and domestic natural gas production is declining.

Continuation of the current trend in energy consumption leads to the consumption of natural gas of about 4 billion m^3 in 2040. In the scenario of intensive decarbonisation of the energy sector and more intensive use of RES for electricity production, consumption of natural gas decreases to about 3 billion m^3/year by 2040.

Mandatory reserves of natural gas are made to ensure full supply of consumers in the Republic of Serbia even in case for three months of consumption in the winter period interruption in the supply of natural gas from other transport systems, and the needed size of storage capacities of the Republic of Serbia ranges between 1 and 1.5 billion m^3. In addition, regular maintenance, further construction and improvement of transport system is a prerequisite for secure supply of natural gas to consumers. In parallel with the expansion of transport system, it is necessary to further develop distribution system, and to create conditions for greater use of natural gas in mass consumption.

6. **Oil sector**. This sector includes exploitation of domestic oil reserves, import, transport and processing of crude oil and oil derivatives, distribution and sale/export of oil derivatives.

The Republic of Serbia is a highly import-dependent country when it comes to this sector (75.5% in 2021), with a relatively low share of its own oil production in total demand. Domestic production of crude oil reached its maximum level in 2013, after which it has been recording a constant natural decline. The expected electrification and change in the structure of consumption in the transport sector after 2030 will lead to a significant drop in oil consumption.

Developments in the field of transport of oil derivatives in the future period implies activity on the strategic-development project of building a product pipeline through the Republic of Serbia. In order to increase the security of crude oil supply, during the implementation period of this Strategy, it is necessary to build an oil pipeline towards Hungary and ensure a connection with the Družba international oil pipeline.

A possibility for reducing import dependence is, in addition to the production of biofuels, the use of oil shale for oil production. Further modernisation process of the oil refinery in Pančevo includes reconstruction of the catalytic cracking plant, and construction of a plant for the production of high-octane gasoline components.

One of the priorities in this sector is to provide storage capacities in the Republic of Serbia by 2027 in order to ensure storage capacities for mandatory reserves of oil and oil derivatives in the amount corresponding to 90 days of net imports, or 61 days of internal consumption.

7. **Coal sector**. It includes coal exploitation (open, ground and underwater) and processing.

Currently, the electricity supply of the Republic of Serbia depends to a large extent on the secure supply of coal. In the previous period, coal production in the Republic of Serbia amounted to 37-38 million tons of lignite, about 400 thousand tons of coal from underground exploitation, and 400 thousand tons of coal from underwater exploitation (Kovin). One part of surface mines (Drmno, Tamnava Zapadno Polje) is in full exploitation, but the planned investments have not yet been realised. Part of the mines is in the investment construction phase – replacement capacities (Field E, Radljevo), and only part of the planned investments have been realised.

The planned decrease in electricity production from thermal energy capacities will lead to a gradual decrease in coal production. After 2040, coal should not be used in households, public and commercial sectors, as well as in district heating systems. It is estimated that the need for brown/dried coal will be halved by 2040 compared to 2021.

The process of energy transition implies a sort of uncertainty, so the remaining coal reserves should acquire a strategic character and a reserve that could enable rapid start of production in crisis situations.

8. **Hydrogen in energy transition.** The Republic of Serbia should timely adjust its energy policy for the production and use of hydrogen.

The industrial production of hydrogen is based on two processes. Natural gas reforming is currently the most economically advantageous, most efficient and most common method of hydrogen production. The efficiency of reforming is 65–85%, but carbon dioxide is emitted during this process. The so-called “green” hydrogen, which is produced in electrolysis of water using electricity produced from renewable energy sources, is considered an environmentally clean fuel from the point of view of carbon dioxide emissions. The degree of usefulness of obtaining hydrogen by electrolysis of water is about 70%. The possibilities of using hydrogen and its importance in the process of transition and decarbonisation of the energy sector are great, and when the full use of hydrogen will come to life depends on a whole range of factors – availability of electricity from RES and the costs of producing “green” hydrogen, the costs of developing transport infrastructure, safety in use, etc.

As priorities in the field of hydrogen transition, the following can be singled out: harmonization of legal regulations, strengthening of human resources and capacities for efficient production, transport, storage and use of hydrogen, as well as strengthening of scientific research potential in the field of hydrogen technologies. It is expected that in the

period after 2040, green hydrogen production and storage technologies will be available and commercially available to a significant extent

9. **Nuclear energy.** The Law on the Prohibition of the Construction of Nuclear Power Plants is in force in the Republic of Serbia.

The Republic of Serbia does not have balance reserves of nuclear raw materials, and there is no regulatory and administrative framework that would regulate the construction and operation of nuclear power plants. From the aspect of main development goals and priorities of energy development, nuclear energy could significantly contribute to decarbonisation and increasing the competitiveness of the energy sector. From the aspect of GHG and local pollutants emissions, nuclear energy is a clean energy source, it is based almost entirely on imported technology and on imported fuels. Nowadays, small modular reactors – nuclear fission reactors with an electric power of 300 MW – are being intensively developed.

The Strategy does not take into account the use of nuclear energy for energy purposes in the energy development projections until 2040. Possible construction and commissioning of such installation can be considered after 2045, which is stated as a possibility and option in INEKP, which would then have implications on respective energy balances in the power, natural gas and renewable energy sectors. It is necessary to initiate public discussions that would include security, legal, organisational, scientific research, engineering and all other aspects of the use of nuclear technology, along with preparation of a multidisciplinary study to assess the impacts of introduction of nuclear energy on economic and social development of the Republic of Serbia, as well as environmental impacts of this technology.

1.1.4. General objective and specific goals of the Strategy

General objective of the Strategy is to ensure a secure and affordable supply of energy and energy products to the population and the economy, with progressive reduction of greenhouse gas emissions and other negative impacts on the environment and human health.

The Strategy defines general **priorities** of energy development and the principles needed for the development of energy policy of the Republic of Serbia, as follows:

- *Energy security,* which includes security of supply and reduction of import dependence;
- *Decarbonisation,* which means reducing the impact on the environment and greenhouse gas emissions, increasing energy efficiency and greater use of RES;
- *Economic competitiveness of the energy sector,* which implies a developed energy market, new jobs in energy, research and development and affordability of energy and energy products.

The listed priorities are mutually connected and inter-dependent, and permeate all areas of energy.

Specific development goals, by energy sector, are defined as:

<u>Electricity sector</u>

- Secure supply of electricity to the domestic market,

- Continuous reduction of greenhouse gas emissions,
- Increasing the use of RES,
- Maintaining energy independence.

Heating energy sector
- Secure and efficient supply of thermal energy,
- Increasing the use of RES,
- Long-term sustainable operations of energy entities,
- Harmonisation of institutional framework and improvement of the regulatory one.

RES sector
- Greater use of RES for electricity production,
- Greater use of RES for heat production,
- Greater use of RES in transport,

Energy efficiency
- Improvement of energy efficiency in all consumption sectors.

Natural gas sector
- Secure supply with demanded quantities,
- Development of the natural gas market,
- Diversification of sources and directions of supply.

Oil sector
- Ensuring a secure supply of oil and oil derivatives.

Coal sector
- Secure and reliable supply of thermal energy capacities,
- Provision of coal in the required quantity and quality for final consumption and for the production of heat energy.

Achieving the general objective and specific goals, as well as the stated energy policy priorities in the coming period, implies significant changes in all energy sectors. The Energy Development Strategy defined that change in the energy sector of the Republic of Serbia, in the context of the proposed vision and development goals, should be treated as a chance for development and changes in the entire economy:

- Structural changes in industry and transition from energy-intensive to less energy-intensive industrial programmes and branches of industry; in the event of gradual increase in energy prices, the production costs of energy-intensive industries will be higher, which would have to lead to the implementation of energy efficiency measures, but also to changes in production programmes and technologies.
- Further growth of the service sector; energy transition in the service sector encourages smart technical solutions, generates savings in consumption and more efficient use of energy, reduces material costs, and thus contributes to decoupling of economic growth and energy consumption growth.
- Investments in renewable energy; incentives from the EU Green Deal and other domestic and foreign funding sources will contribute to the creation of new “green” jobs in energy, as well as in energy-related systems.

1.1.5. Linkages with other strategic and planning documents

The strategy is linked to numerous policy documents (strategies and programmes), which have either already been adopted, or are being drafted. The most important documents are presented below in the SEA.

The National Plan for the Reduction of Emissions of Major Polluting Substances from Old Large Combustion Plants (Official Gazette of the RS, No. 10/20) was adopted with the aim of reducing emissions of pollutants into the air from large combustion plants whose total input installed thermal power equals to 50 MW or higher. The National Emission Reduction Plan (NERP) is the intention of the Republic of Serbia to reduce emissions of pollutants from the existing large combustion plants. The NERP, pursuant to Article 5 of the Decision on the Implementation of the LCP Directive, is valid until 31 December 2027. By that date at the latest, large combustion plants covered by the NERP will comply with the emission limit values defined in Part 1, Annex V of the Industrial Emissions Directive (IED)[2], which have been transposed into national legislation. The goal of the NERP is to reduce total annual emissions of sulphur dioxide (SO_2), nitrogen oxides (NOx) and particulate matter from old large combustion plants covered by the NERP. Achieving this goal is ensured by establishing maximum emissions for SO_2, NOx and particulate matter. The NERP, which was submitted to the Energy Community Secretariat, included thermal power plants and combustion plants within refineries, which is in accordance with the definition of "network energy" in accordance with the Treaty on the Establishment of the Energy Community. The NERP does not apply to combustion plants that will use the "opt-out" mechanism (life-limited plants). Combustion plants covered by the NERP must comply with the annual maximum emissions specified in the NERP annexes.

The Fourth Action Plan for Energy Efficiency of the Republic of Serbia was prepared for the period until 31 December 2021. The Report particularly contains the achieved results of final energy savings, the status of implementation of certain measures defined within the 3rd Action Plan for Energy Efficiency (APEE), goals for final energy savings in 2020 and 2021, measures to achieve them, as well as the status of implementation of measures defined by Directive 2012/27/EU on energy efficiency, taken over by the Energy Community by virtue of the Decision of the Ministerial Council (D/2015/08/MC-EnC). In this reporting period, energy savings were achieved based on the implementation of the Energy Management System, both in public and commercial sectors, and in industry.

The Low-Carbon Development Strategy of the Republic of Serbia for the period from 2023 to 2030 with projections up to 2050 (Official Gazette of the RS, No. 46/23) regulates in detail the measures and activities in accordance with the obligations of the Republic of Serbia under the Paris Agreement and the United Nations Framework Convention on Climate Change, which enable a significant shift of Serbian economy towards a low-carbon and climate-adaptive economy. The main objective is to present possibilities and recommend desirable options for harmonizing the GHG emission levels from Serbia with those in the EU, in an economically acceptable and socially just way. For the aforementioned purposes, and in order to evaluate different mitigation options, six scenarios were developed for GHG

[2] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control.

emissions, while the Strategy determines the path to 2030 and proposes a range of possibilities until 2050. The action plan, which is an integral part of the Strategy, assesses the possibilities and proposes desirable measures and actions to achieve the vision and goals of the Strategy. The strategy also identifies adaptation options relevant to reducing GHG emissions and mitigation measures. The strategy recognises the risks of climate change for sustainable development of the Republic of Serbia and defines goals that take into account adaptation to changed climate conditions.

The National Action Plan for the Use of Renewable Energy Sources (Official Gazette of RS, No. 53/2013) is a document that sets the objective and goals for use of renewable energy sources until 2020, as well as the way to achieve them. It aims, *inter alia*, to encourage investment in the field of renewable energy sources. The drafting of the National Plan resulted from the international obligation that the Republic of Serbia undertook in 2006 with the Law on the Ratification of the Treaty on the Establishment of the Energy Community. The National Action Plan sets national targets for the share of energy from renewable energy sources in transport, electricity and heating and cooling sectors by 2020, taking into account the effects of energy efficiency measures in gross final energy consumption. Also, the Action Plan envisaged adequate measures to be taken to achieve national goals, including cooperation between local, provincial and national authorities, as well as the possibility of implementing joint cooperation projects between the Contracting Parties of the Energy Community to achieve their binding goals.

The National Strategy for the Sustainable Use of Natural Resources and Goods (Official Gazette of RS, No. 33/2012) singles out numerous practical policies that include several sectors, which have an impact on the use of natural resources such as energy and minerals, i.e., mineral policy, policies related to water, biodiversity, soil protection, urban environment, economic policy, fiscal policy, transport and agriculture. The Strategy for the Sustainable Use of Natural Resources and Goods creates a long-term framework for practical policy of several sectors for sustainable use of natural resources. It analyses current bases of natural resources of the Republic of Serbia, ways of managing natural resources, and a series of practical policy goals and instruments for implementation in the next decade and beyond. The Strategy establishes a link between the use of resources and the negative impact of resource use on the environment, and identifies where certain actions need to be taken in order to overcome the problems. The goal of the National Strategy is to promote sustainable economic development through efficient use of natural resources, while simultaneously reducing negative impacts on the environment.

The Industrial Strategy of the Republic of Serbia for the period from 2021 to 2030 (Official Gazette of RS, No. 35/20) aims to increase competitiveness of the industry. The Strategy reads, *inter alia*, that application of linear economic model in the Republic of Serbia has resulted in significant losses in the flow of raw materials, materials and products, which leads to irrational use of resources. One of the specific goals (specific goal 5) refers to transformation of industry from a linear to a circular model. Manufacturing industry (especially food processing industry), construction, and primary agriculture have been identified as sectors that have the greatest potential for applying circular economy concept in the Republic of Serbia. In the Action Plan for the Implementation of the Strategy (Official Gazette of the RS, No. 37/21), three measures (seven activities) had been defined within specific goal 5 to be implemented in the next three years: 1. Promotion of circular economy and education of companies; 2. Encouraging investments in circular and low-carbon economy

solutions as generators of growth; 3. Encouraging more efficient use of material resources and energy efficiency in industrial processes.

The Water Management Strategy of the Republic of Serbia until 2034 (Official Gazette of RS, No. 3/2017) is a unique document that defines long-term water management policy, i.e., directions for sustainable action in the field of water use, water protection, regulation of watercourses and protection against harmful effects of water. Water sector reforms will be implemented based on this document in order to reach necessary standards in water management, including organisational adaptation and systemic strengthening of professional and institutional capacities at the national, regional and local levels. At the same time, the framework set by this Strategy must be respected when developing strategies and plans for spatial planning, environmental protection and other areas that depend on water or have an impact on water. Analyses and development projections cover the period up to 2034. In this period, a significant improvement of the situation in the water sector is expected compared to the existing one. This improvement will take place in accordance with social and economic possibilities of the country, while respecting the standards of the European Union in the field of water.

Agriculture and Rural Development Strategy of the Republic of Serbia for the period 2014-2024 (Official Gazette of RS, No. 85/2014) is a basic and long-term strategic document that defines the objectives, priorities and frameworks of political and institutional reforms in the field of agriculture and rural development. Conservation and improvement of the fertility of agricultural land, as well as creation of efficient land resource management system, are some of the priorities of agricultural policy. To that end, operational goals of the Strategy were defined. Appropriate political framework and incentive programmes contribute to greater responsibility and more rational use of natural resources, as well as to more active participation in the implementation of activities related to environmental issues. The Strategy envisages operational goals for the implementation of priority areas related to the protection and improvement of the state of the environment and conservation of natural resources.

The Strategy of Sustainable Urban Development of the Republic of Serbia until 2030 (Official Gazette of RS, No. 47/19) is a key instrument for achieving sustainable urban development by applying integrated approach. Five strategic directions of urban development were defined (sustainable economic development, arrangement of urban settlements, social well-being, quality of the environment, and management of urban development). The feature of this Strategy is its clear connection with the spatial aspect and differentiation into levels and domains of national and local action.

The Waste Management Programme of the Republic of Serbia for the period 2022-2031 (Official Gazette of RS, No. 12/22) is a strategic document that defines objectives and goals for the improvement of waste management system and basic principles that should guide all stakeholders in the waste management system to achieve those goals in the Republic of Serbia in the period 2022-2031. Implementation of this Programme, in addition to reducing harmful impact on the environment and climate change, should enable achievement of prerequisites for use of waste in circular economy.

Circular Economy Development Programme in the Republic of Serbia for the period 2022-2024 (Official Gazette of the RS, No. 137/22) is a policy document whose general objective is the creation of a stimulating environment for the development of circular economy in order to support green transition in the Republic of Serbia. The Programme

covers the most important areas of importance for circular economy: waste management; water management; renewable energy sources and energy efficiency; chemical management; instruments in the field of environmental protection; economic policy; innovation and awareness raising. The Programme contains the Action Plan for a period of three years, wherein the activities for achieving the measures and goals established by the said Programme are defined.

The Air Protection Programme in the Republic of Serbia for the period from 2022 to 2030 with Action Plan (Official Gazette of the RS, No. 140/22). The overall objective of the Programme is to reduce harmful effects on health due to exposure to poor quality air by 2030, compared to 2015, by reducing exposure to air pollution, at the same time enabling the Republic of Serbia to comply with the regulatory limits prescribed in the European Union for air pollution, and limiting harmful impacts on ecosystems. Specific goals defined by the Programme include: 1) Reduction of SO_2 emissions by 92% and $PM_{2.5}$ by 58.3% from the energy sector (including transport and individual combustion plants) by 2030 compared to 2015; 2) Reduction of emissions of pollutants and heavy metals into the air from industrial processes and product use through compliance with BAT AELs; 3) Reduction of NH_3 emissions from agricultural sector by 20.5% compared to 2015; and 4) Promotion of transition to clean air for all.

Policy documents in preparation

The Programme for Adaptation to Changed Climate Conditions, a document that will provide for measures to increase resilience to climate change in order to maintain and potentially improve the well-being of people, economy and environment in the Republic of Serbia. The Programme aims to provide capacities for improving timely provision of information to the public about weather and climate conditions and climate hazards in order to increase preparedness of individuals, entrepreneurs, and employers. At the same time, the Programme enables implementation of adaptation measures to the changed climate conditions (adaptation) that have been identified as most urgent ones in order to prevent a multiple increase in damages and losses resulting from the impact of climate change. The Programme also ensures implementation of interventions related to direct defence against climate hazards where it is not possible to mitigate the impacts, implementation of measures that enable initiation and maintenance of adaptation processes in the future in a sustainable manner, as well as implementation of measures that enable rapid application of new scientific knowledge in the adaptation process. The Programme is a part of the first pillar of the Environmental Protection Strategy – Green Agenda, which includes the areas of decarbonisation, climate action, energy and mobility, elaborating the measures and activities in the area of adaptation to changed climate conditions. The Programme provides information on climate change and its impacts even after the expiry of the Programme, on the needs for further development of multidimensional processes of adaptation, including pointing out the gaps in knowledge and information necessary for further sustainable development in changed climate conditions.

The Environmental Protection Strategy – Green Agenda for Serbia for the period 2024 - 2033 is a comprehensive framework in the area of the environment, based on the principles of justification, efficiency and sustainability. This Strategy is dedicated to sustainable development, development of green economy, protection of natural resources, reduction of pollution, and improvement of the quality of life of all citizens. Key aspects of the Strategy include improving the legal and institutional framework for environmental protection, strengthening the economy based on low-carbon development, stimulating innovation and

developing “green” technologies, in order to stimulate green economic growth and create new green jobs. The Republic of Serbia is becoming an active participant in the fight against climate change. Investments in renewable energy sources, energy efficiency, environmental protection and waste recycling create new industries and jobs, contributing to economic growth and development. Digitisation also plays a very important role. It is necessary to ensure even more efficient mechanisms of information, education and participation of citizens in decision-making processes. Improving the environmental protection financing system remains a challenge.
The structure of the Strategy corresponds to the structure of the Green Agenda, and includes all areas through the five pillars of the Green Agenda, as follows:

1. Climate change and emissions reduction: with a focus on reducing GHG emissions and adapting to changing climate conditions, using renewable energy sources, energy efficiency and reducing dependence on fossil fuels.
2. Circular economy: with a focus on industrial symbiosis, waste recovery, responsible recycling, sustainable production, innovation, eco-design, green public procurement and efficient use of resources.
3. Protection of biodiversity and ecosystems: protection and sustainable management of natural resources, including sustainable management and protection of forests, protected areas and animal species.
4. Reduction of environmental pollution: improvement of air, water and soil quality, reduction of industrial pollution and risk management, management of chemicals, reduction of noise in the environment, ionizing and non-ionizing radiation.
5. Sustainable food systems and rural development: impact of agriculture on the environment, food safety, sustainable food production, organic food, use of specific chemicals (pesticides and fertilisers).

The Integrated National Energy and Climate Plan of the Republic of Serbia (INECP) **for the period up to 2030 with a vision up to 2050**. The Plan is a comprehensive strategic document that defines all necessary measures that the Republic of Serbia intends to take to achieve a series of strategic goals towards low-carbon development. The INECP serves as a basis for defining long-term energy and climate policy. The main policy priorities for each dimension of the INECP are:

1. **Decarbonisation** is a specific area related to the goal of demonstrating a country’s commitment to climate action and decarbonisation of the economy, with a particular focus on increased use of renewable energy sources and reduction of greenhouse gas emissions.
    a. **Greenhouse Gas (GHG) Emissions –** a separate sub-area related to the objective of demonstrating a country’s commitment to reducing emissions from the energy sector, as well as emissions from non-energy sectors.
    b. **Renewable Energy Sources (RES) –** a sub-area related to the objective of demonstrating a country’s commitment to encouraging the use of renewable energy sources and to the strengthening of greater application of RES-based technologies.
2. **Energy efficiency** – a sub-area related to the objective to demonstrate a country’s commitment to improving energy efficiency in all sectors.
3. **Energy security**, a specific area related to the objective to demonstrate a country’s commitment to diversification of energy sources and to ensuring security of supply through solidarity and cooperation between the EU and the contracting parties of the Energy Community.

4. The **internal energy market**, a specific area related to the objective to demonstrate a country's commitment to creating a fully integrated and functional market, which enables free flow of energy through the Energy Community and the European Union through adequate infrastructure and without technical or regulatory barriers.
5. **Research, Innovation and Competitiveness,** a specific area related to the objective to demonstrate a country's commitment to supporting the development of low-carbon and clean energy technologies.

Achieving the goals from INECP will contribute to a healthier environment, more secure energy supply with more green energy, as well as energy independence and efficient and economical management of decarbonisation process.

The Spatial Plan of the Republic of Serbia for the period until 2035 is the main planning document for spatial planning and development in the Republic of Serbia, which defines long-term strategic framework for directing and managing spatial development. Implementation and elaboration of the long-term strategy, conception and planning solutions of SPRS in the development planning documents, public policies, spatial and urban plans, will enable the achievement of national goals and strategic commitments of spatial development. Harmonisation of national, regional and local interests and development priorities will be carried out through preparation of regional and local level planning documents, within which planning solutions and priorities will be additionally elaborated in accordance with SPRS guidelines. The *general objective* of the spatial development of energy and energy infrastructure is the secure supply of energy to consumers and energy transition, which implies the protection of energy potentials, increasing the use of renewable energy sources, research into new energy sources, a more efficient energy system (energy production, distribution and consumption), and optimal spatial distribution of energy installations and energy infrastructure, while ensuring environmental protection and public health. *Specific goals* of energy development are: 1. rationalisation of research, production and consumption of conventional fuels and greater use of renewable energy sources; 2. reducing losses and increasing energy efficiency, production, transportation, transmission, distribution and use of energy; 3. improving the energy efficiency of structures, utility systems, devices for energy use and local production energy capacities; 4. reduction of negative impacts on the environment and public health, which implies modernisation of energy facilities, including revitalisation and technological improvement of environmental protection, in order to achieve EU standards, norms defined by international agreements and ratified/complementary legislation in Serbia and appropriate alignment with national regulations on climate change; 5. harmonising the development of the electric power network with the use of RES; and 6. establishment of a comprehensive and coordinated approach to rationalisation of energy consumption and overall increase of energy efficiency in the construction, transport and industry sectors and in communal services.

1.2. Considered issues and problems of nature and environment protection and reasons for omitting certain issues from the SEA procedure

The criteria for determining the possibility of significant environmental impacts of plans and programmes are defined in Annex I of the Law on Strategic Environmental Impact Assessment. These criteria are based on characteristics of relevant plans/programmes, and on characteristics of impacts.

In the SEA Report, key environmental problems were identified based on strategic and planning documentation, relevant reports and data. The creation of the relevant SEA is approached with the aim of including the goals and criteria of environmental protection in the process of preparation, selection of variants, and implementation of the Energy Development Strategy.

When it comes to the Energy Development Strategy for which the SEA is being developed, it is particularly important to identify environmental problems in the areas under direct influence of energy installations and activities, and to analyse possible implications of said activities on the quality of the environment, in particular on:

- the quality of main environmental media: air, water, soil,
- natural values (especially protected natural goods),
- cultural and historical heritage,
- waste generation and treatment,
- population health,
- social development,
- economic development,
- technological development.

Considering the planned strategic activities and priorities of the Strategy, potential consequences of the mining sector, thermal power plants and hydropower plants on the environment were especially considered in the SEA, because the mentioned activities imply dominant influence of the energy sector on environmental media. Although these activities are prioritised, all strategic guidelines defined by the Strategy were analysed from the ecological and socio-economic aspects, including the environmental impacts of the use of renewable energy sources.

Certain questions from the area of environmental protection were not valid for consideration in the SEA because they are not part of the project-technical documentation, but of the strategic one. In the specific case, it can about the absence of a more detailed assessment of the impact of individual facilities and activities in the energy sector, because for such an analysis the Strategy did not provide appropriate level of detail. It will be possible to reach such a level of detail when drafting documentation at a lower hierarchical level, i.e., for each planned energy facility. In this context, strategic assessment will be predominantly based on the assessment of trends in the environment arising as a consequence of individual energy activities, or as a consequence of the interaction of several energy activities (cumulative and synergistic impacts).

1.3. Prior consultations with relevant authorities and organisations

During the preparation of the *Decision on the development of a strategic environmental impact assessment for the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050*, consultations were held with relevant institutions. The request for the opinion on the draft Decision on the development of a SEA was sent to all relevant institutions, and such cooperation resulted in the final text of the Decision on the SEA, which was he basis for the subject SEA procedure to start.

Drafting of the Energy Development Strategy and implementation of the SEA will include consultations with representatives of relevant authorities and organisations, pursuant to

Article 11 of the Law on Strategic Environmental Impact Assessment. Once the SEA Report drafted, public consultations and a presentation of the SEA will be organised, and interested parties, competent authorities and the public can take part therein, and their opinions will be taken into account during the preparation of the final version of the Report.

Moreover, drafting of the Energy Development Strategy and SEA included collection of data, conditions and opinions from competent authorities and organisations, which were taken into account when designing strategic guidelines and their evaluation from the aspect of environmental protection.

The Ministry of Mining and Energy established a Working Group composed of numerous representatives of relevant institutions and large companies from the public and private sectors, as well as of civil society organisations. The decision-making process, preceded by presentations and discussions, was carried out at the meetings of the Working Group, which were held regularly, where progress reports regarding the document development were adopted.

The entire process of development and preparation of the Energy Development Strategy and the SEA Report was coordinated by the Ministry of Mining and Energy, as the leading institution in the preparation of documents and key beneficiary of the above-mentioned project.

2. CURRENT STATE AND QUALITY OF ENVIRONMENT IN THE AREA COVERED BY THE REPORT

When preparing the Strategic Environmental Impact Assessment, it was necessary to provide an overview of the current state and quality of the environment in the area covered by the Report, because characteristics of the current state were the basis for any research of environmental issues in a specific area. The main characteristics of the current state for the purposes of this research were defined based on the results of environmental measurements carried out by authorised organisations, existing planning documents, conducted studies and available professional and scientific literature.

The state of the environment in Serbia is characterised by various factors, the most important of which are the presence of urban, mining-energy and industrial areas that put pressure on the environment and space, and have, as a consequence, the quality of the environment being threatened.

Due to a specific nature of the Strategic Environmental Impact Assessment, the first part of this Chapter provides an overview of the current state and quality of the environment at the level of the Republic of Serbia, followed by an overview of environmental media exposed to the influence of energy sectors and activities.

2.1. Current state and quality of environment

2.1.1. Air quality

Air quality in the Republic of Serbia can be assessed as unsatisfactory and is one of the most pressing environmental problems. In addition to urban centres and their peri-urban zones, air quality is impaired in the areas of mining and larger thermal energy and industrial installations, as well as on transport corridors. The most common causes of air pollution are low energy efficiency, use of low-quality fuel, lack of gas scrubbing facilities and outdated technology, as well as incompliance with standards on air pollutant emissions and parameters of the waste gases state, as well as competences of the state and local self-government units, which are not clearly delimited.

Energy sector is the largest emitter of greenhouse gases in Serbia, accounting for 80.6% of total emissions, of which the most important subsector is the energy industry, which includes public production of electricity and thermal energy, refineries and fuel production (accounting for 70% of emissions from the energy sector, and 56% of total national emissions). Fossil fuels are dominating ones in consumption, with 87.9%.

According to the data of the Environmental Protection Agency, production of electricity and thermal energy was, with share of 91%, dominant source of *sulphur oxide* emissions in 2021. The most significant contribution to total amount of emitted sulphur oxides also in the multi-annual period of observation, from 1990-2020 comes from the “Production and distribution of energy” (Figure 1).

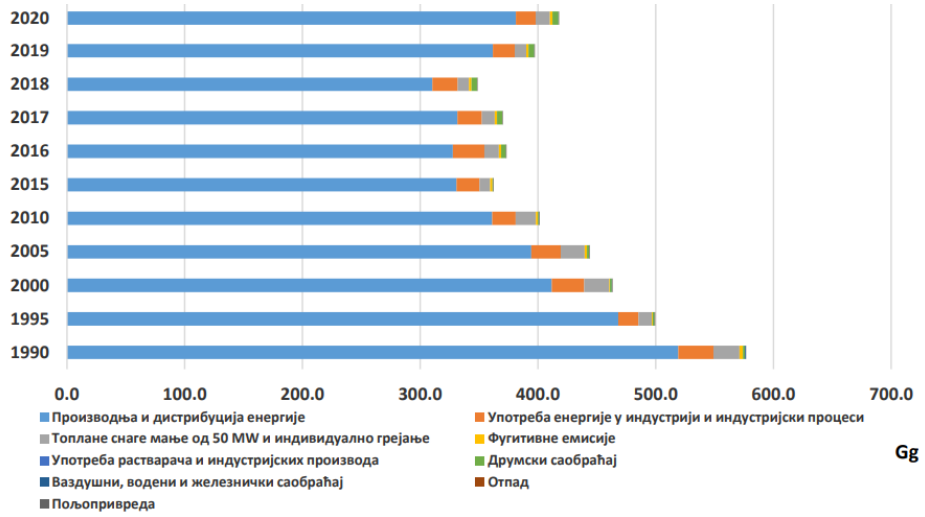


Figure 1: Sulphur oxide emissions as per sector in the period between 1990 and 2020, expressed in thousands of tons

Source: Serbian Environment Protection Agency, 2022

(columns, from left to right: Production and distribution of energy, Heating plants with power less than 50 MW and individual combustion plants; Use of solvents and industrial products; Air, water and railway transport; Agriculture; Use of energy in industry and industrial processes; Fugitive emissions; Road transport; Waste)

Electricity and thermal energy production sector also had the largest share in total emissions of *nitrogen oxides*, 42%, with road transport in second place with a slightly smaller contribution of 38%. Observed in the multi-annual period, from 1990-2020, the most significant contribution to total amount of emitted nitrogen oxides came from the "Production and distribution of energy" and "Road transport" (Figure 2).

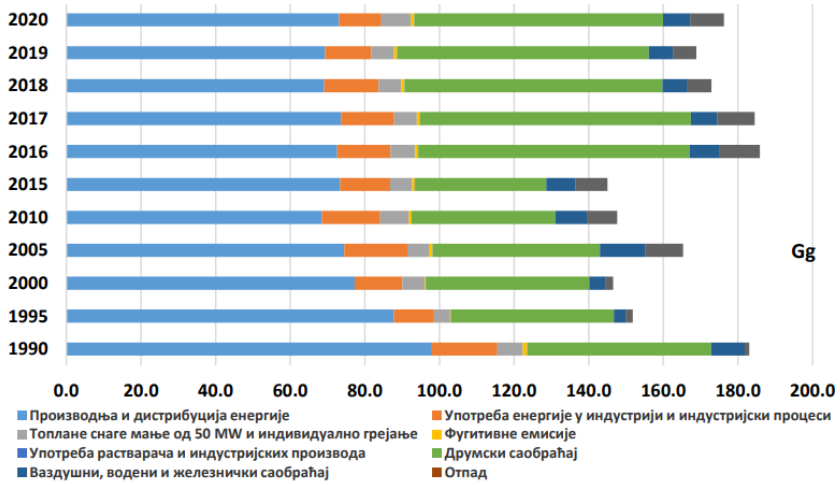


Figure 2: Nitrogen oxide emissions as per sector in the period between 1990 and 2020, expressed in thousands of tons

Source: Serbian Environment Protection Agency, 2022

(columns, from left to right: Production and distribution of energy, Heating plants with power less than 50 MW and individual combustion plants; Use of solvents and industrial products; Air, water and railway transport; Use of energy in industry and industrial processes; Fugitive emissions; Road transport; Waste)

Particulate matters (dust, smoke, smog) are released into the environment to the greatest extent in the process of burning fuel in energy, transport and industrial production, but also in manure management. During 2021, dominant share of PM_{10} emissions, about 64%, came from heating plants with a capacity of less than 50 MW and individual combustion plants. The influence of heating plants with a power of less than 50 MW and individual combustion plants on the total emissions of $PM_{2.5}$ was extremely large, and amounted to 80%. In the

multi-annual period of observation (for the period 1990-2020), the emission of particulate matters came predominantly from the above-mentioned sectors (Figure 3).

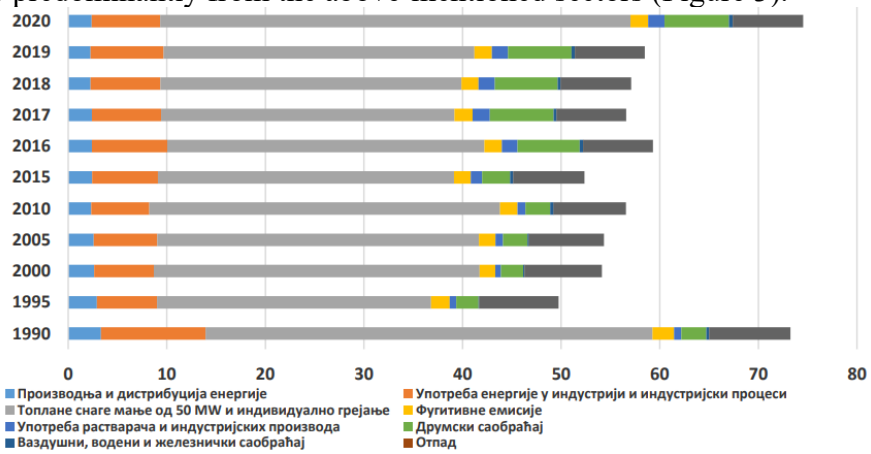


Figure 3: Particulate matters emissions as per sector in the period between 1990 and 2020, expressed in thousands of tons

Source: Serbian Environment Protection Agency, 2022

(columns, from left to right: Production and distribution of energy, Heating plants with power less than 50 MW and individual combustion plants; Use of solvents and industrial products; Air, water and railway transport; Use of energy in industry and industrial processes; Fugitive emissions; Road transport; Waste)

The analysis of pollutant emissions confirmed the dominant share of thermal energy plants in the emitted quantities of sulphur oxides in 2021, and it was established that total emissions of this pollutant was 285.77 Gg, while total emission of nitrogen oxides amounted to 42.96 Gg. The largest emitted amounts of this pollutant came from thermal power plants, mineral and chemical industry (Figure 4). Total emissions of particulate matters was 8.66 kt in 2021. The most significant emitted quantities (90.73%) came from thermal energy plants from the energy sector (Figure 5).

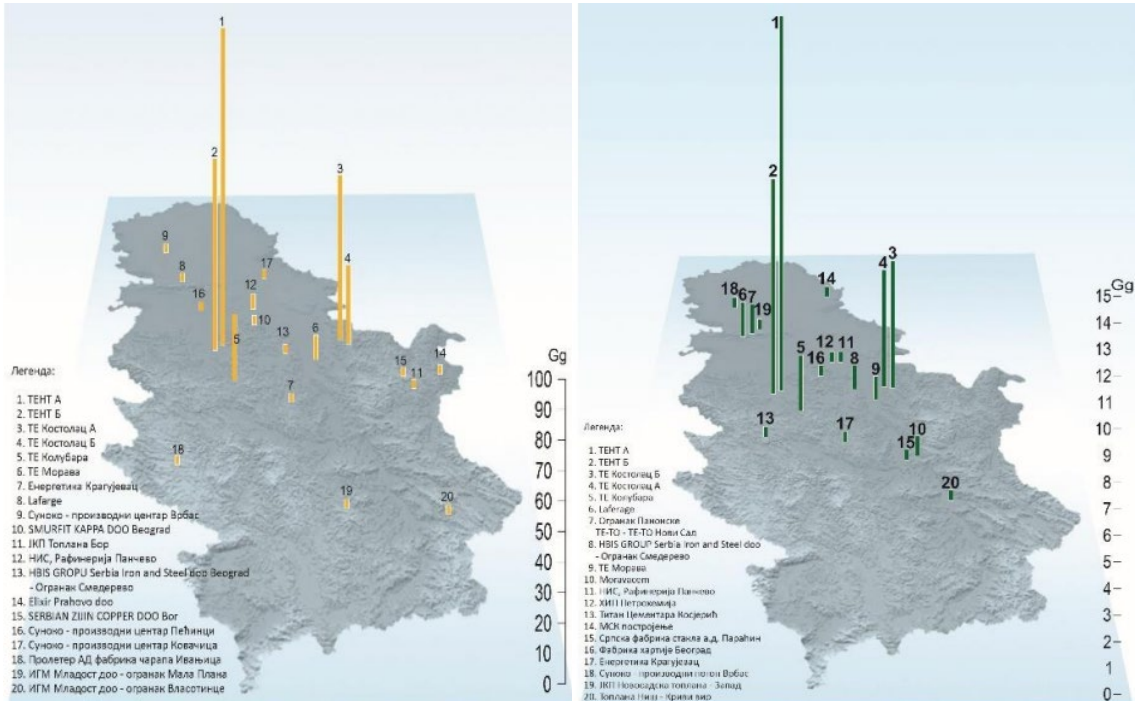


Figure 4: 20 most significant emitters of sulphur dioxide (left) and 20 most significant emitters of nitrogen oxides (right) in the Republic of Serbia

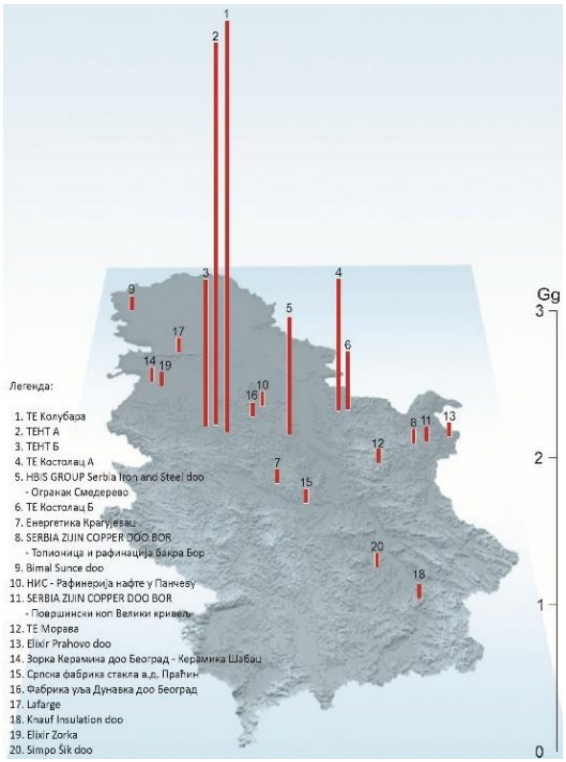


Figure 5: 20 most significant emitters of particulate matters in the Republic of Serbia
Source: Serbian Environment Protection Agency, 2022

According to data from 2021, 20 cities in Serbia recorded excessively polluted air – Belgrade, Bor, Niš, Pančevo, Kosjerić, Smederevo, Užice, Valjevo, Novi Pazar, Subotica, Novi Sad, Loznica, Čačak, Kraljevo, Zaječar, Kragujevac, Paraćin (Popovac), Sremska Mitrovica, Sombor and Zrenjanin (Figure 6).

		КАТЕГОРИЈЕ КВАЛИТЕТА ВАЗДУХА				
		2017	2018	2019	2020	2021
ЗОНЕ	**СРБИЈА**	I	I	I	I	I
	Град Крагујевац	III	III	I	III	III
	Град Краљево	III	III	III	III	III
	Град Зајечар			III	III	III
	Град Ваљево	III	III	III	III	III
	Град Нови Пазар				III	III
	Град Параћин		I	I	III	III
	Град Чачак					III
	Град Лозница					III
	Војводина	I	I	I	I	I
	Град Ср. Митровица	I	III	I *	I	III
	Град Суботица	III	III	III	III	III
	Град Зрењанин			I	III	III
	Град Сомбор					III
АГЛОМЕРАЦИЈЕ	Нови Сад	I	I	III	I	III
	Београд	III	III	III	III	III
	Панчево	III	III	III	III	III
	Смедерево		III	III	III	III
	Бор	I	I	III	III	III
	Косјерић		III	III	III	III
	Ужице	III	III	III	III	III
	Ниш	III	III	III	III	III

Figure 6: Air quality trend as per zones, agglomerations and cities, 2017-2021
Source: Serbian Environment Protection Agency, 2022

(from left to right: AIR QUALITY CATEGORIES; (left, vertical) ZONES; AGGLOMERATIONS; Serbia: City of Kragujevac, City of Kraljevo, City of Zaječar, City of Valjevo, City of Novi Pazar, City of Paraćin, City of Čačak, City of Loznica; Vojvodina: City of Sremska Mitrovica, City of Subotica, City of Zrenjanin, City of Sombor; (the rest belong to agglomerations: Novi Sad, Belgrade, Pančevo, Smederevo, Bor, Kosjerić, Užice, Niš)

2.1.2. Water quality

Current state of water quality in Serbia is still at an unsatisfactory level. The main sources of water pollution in Serbia are untreated industrial and urban waste water, drainage water from agriculture, leachate from landfills, as well as pollution related to river navigation and the operation of thermal power plants.

The SWQI[3] analysis was conducted at 45 measuring points with continual sampling between 1990 and 2020. An insignificant trend was found in the Sava River Basin, while an increasing (positive) trend was found in the Danube and Morava River Basins, as well as in the entire territory of the Republic of Serbia. Median SWQI values range from 80 to 90, which corresponds to "good" and "very good" quality (Figure 8). Poor quality, according to the SWQI parameter, was found at five (11%) measurement sites: Bačko Gradište (DTD Channel), Vrbica (Zlatica), Hetin (Stari Begej), Bački Breg (Plazović) and Ristovac (South Morava). There is an unfavourable (declining) trend at four (9%) measuring points.

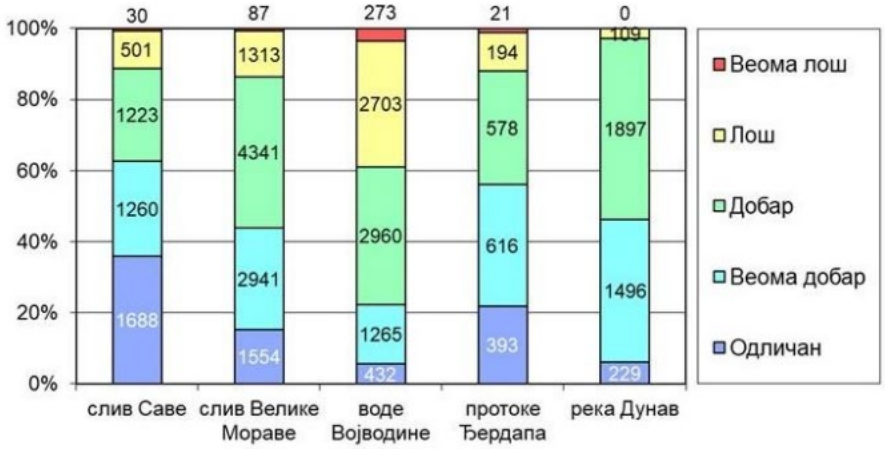


Figure 8. Serbian Water Quality Index, 1998-2020
Source: Serbian Environment Protection Agency, 2021
(right column: very poor, poor, good, very good, excellent; from left to right below: The Sava Basin, The Velika Morava Basin, Water of Vojvodina, Watercourses of Đerdap, The Danube)

Untreated urban and industrial waste water is a specific problem. Total amount of wastewater discharged into public sewage systems in 2021 recorded an increase of 2.7% compared to 2020, i.e., 4.2% compared to 2017, while the amount of wastewater discharged into septic tanks in 2021 year was by 8.7% higher than in 2020. According to the latest data from 2020, the percentage of population covered by waste water treatment was very small, only 15.02% (Figure 9). Severnobački County had the most treated waste water by all types of treatment,

[3] Serbian Water Quality Index (SWQI) provides a measure of the condition of surface waters in terms of the general quality of surface waters without taking priority and hazardous substances into account. The index measures nine parameters of physico-chemical quality (water temperature, pH value, electrical conductivity, percentage of oxygen saturation, BOD-5, suspended matter, total oxidised nitrogen (nitrates + nitrites), orthophosphates and ammonium) and one parameter of microbiological water quality (the most likely number coliform germs) and

discharged into waste water disposal systems in 2020 (96.6%). Srednjobanatski, Belgrade, Braničevski, Jablanički, Zlatiborski, Toplički and Nišavski Counties had no treated waste water in the same period. Only 26 cities and municipalities have urban waste water treatment plants in operation (with two under reconstruction, and five in trial operation), of which a small number operate according to design criteria, while the remaining ones operate with efficiency far below the designed one. Only five local government units have a tertiary treatment plants. A small number of industrial facilities do the pretreatment of technological waste water before discharging it into the recipient.

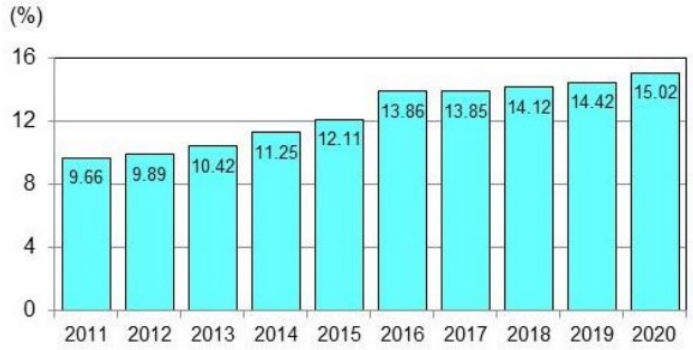


Figure 9: Population covered by waste water treatment in percentages
Source: Serbian Environment Protection Agency, 2022

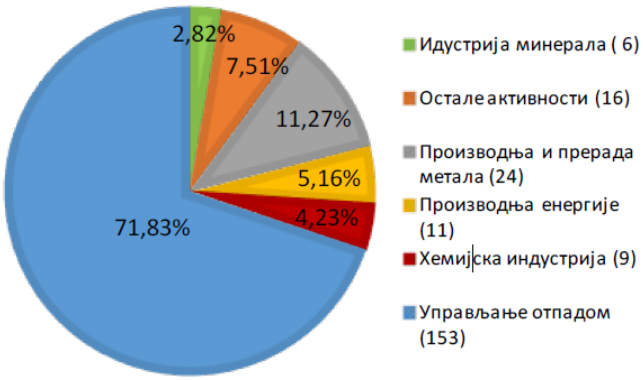
The state of sewage systems and the number of inhabitants connected to public water supply systems is currently at an unsatisfactory level. The population not connected to public sewage mostly uses septic tanks to evacuate their waste water, which is a big problem, while a smaller part uses dry systems and inadequate installations for evacuating waste water. Currently, 65.9% of the population is connected to public sewerage (2020), of which the highest percentage is in Belgrade (86.1%), Šumadijski (77%) and Moravički Counties (71.7%), while the lowest percentage is in Zapadnobački (32%) and Nišavki (34.7%) Counties, where majority of population is connected to septic tanks (Report on the State of the Environment of the RS, 2022).

2.1.3. Soil quality

The quality of soil in Serbia is affected by both natural and anthropogenic factors. The main sources of deterioration of soil quality are erosion, reduction of organic matter, soil structure, soil acidification, soil pollution from industrial activity, mining and energy, excessive use of chemicals in agriculture, compaction of agricultural soil, and waste management. Based on the analysis of the content and distribution of potentially harmful and dangerous elements in the soil, several ecologically endangered spots (hot spots) have been identified.

In 2020, 213 sites were identified in the territory of the Republic of Serbia in 2020 as potentially contaminated and contaminated ones. With regard to concentration and types of pollutants in the soil, proximity of vulnerable structures, activities at the location, size of the complex, and the estimated scope of remediation works, all locations where soil pollution had been confirmed were classified into 4 groups. Group 4th (highly polluted soil) includes large industrial establishments where rehabilitation and remediation is needed: Mining and Smelter Complex Bor, Prva petoletka Trstenik, Železara Smederevo, Chemical Industry Zorka Subotica, PKS Latex Čačak, and Chemical industry Viskoza Loznica.

Municipal landfills had the largest share of localised soil pollution with 71.83%, followed by metal production and processing with 11.27%, energy production and chemical industry (Graph 1).



Graph 1: Share of main localised sources of soil pollution in total number of identified sites (%) – state from 2020
Source: Serbian Environment Protection Agency, 2021

(Mineral industry (6), Other activities (16), Metal production and processing (24), Energy production (11), Chemical industry (9), Waste management (153))

Intensive urbanisation, industrial development, traffic and agricultural activity also led to soil pollution with large amounts of waste materials that could not be broken down in self-treatment processes. Examination of soil quality in certain urban areas (Belgrade, Pančevo, Kruševac, Čačak, Smederevo, Novi Pazar and Surdulica) indicated that those areas were under strong human influence. In those localities, metals were the most common polluting substances, with limit values or remediation values of certain elements exceeded.

Soil degradation is particularly pronounced in the areas of exploitation of mineral raw materials, especially in open pit mines. Based on the Report of the Ministry of Mining and Energy, data on degraded areas and disposed tailings from major mining companies in the Republic of Serbia that have significant pollution are presented below (Table 1).

Company	Soil degraded with excavation (ha)	Soil degraded due to disposal of tailings (ha)
Electric Power Industry of Serbia	158.77	0.00
CRH Serbia	1.37	1.63
Concern Pharmacom, Lece Mine	0.00	20.10
Serbia Zijin Copper Bor	20.10	58.68
Jugo-Kaolin	1.19	1.60
Bosil-Metal		0.30
PE for underground exploitation of coal	13.92	2.69
Total	**195.35**	**85.00**

Table 1: Data on degraded sites and soil degraded due to tailings disposal from major mining companies in the Republic of Serbia
Source: Serbian Environment Protection Agency, 2021

Agricultural land

The used agricultural land in the Republic of Serbia includes 3,475,894 ha. Monitoring the structure of used agricultural land in 2021 shows that largest share was arable land and gardens with 2,615,194 ha, i.e., 74.59%. Meadows and pastures occupy a total of 665,984 ha, or 18.99%, orchards 182,084 ha, which makes 5.19%, vineyards 20,113 ha, or 0.57%, other permanent plantings and nurseries occupy 2,273 ha, while yards occupy 20,427 ha. In the period from 2019, there was an increase in the area under arable land and gardens. The total area under meadows and pastures has been decreasing since 2018, the area under vineyards has not changed since 2019, while the area under orchards decreased in 2021 compared to 2020. Looking at the regions, the most used agricultural land is in Vojvodina, followed by the region of Šumadija and Western Serbia.

Two-thirds of the agricultural land is in areas where crop cultivation is possible for more than 200 days a year due to favourable distribution of rainfall. About 45% of agricultural land is the one suitable for cultivation without significant restrictions, while the rest is agricultural land mostly not suitable for cultivation, or can be cultivated with significant restrictions. Change in land use is also one of the major threats to global land. In our country, there is a declining trend for pastures, due to devastation of livestock production and great need for arable land. Ploughing of pastures results in increased soil erosion, as well as loss of biodiversity. Pastures, as well as mixed agricultural areas, are occupied due to urban development and infrastructure construction, taking into account transport of energy and energy sources.

Although the expansion of agricultural land and intensification of agricultural production have brought great benefits to the country's development, the same factors have had profound negative impacts on biodiversity and ecosystem services. Even though it is expected that use of agricultural land will continue to change and expand with population growth and climate change, many existing agricultural regions are under stress of water scarcity, soil degradation, and increased climate extremes. These stresses will require careful changes in land use management to sustain agricultural production.

Forest land

The estimated area under forests in the Republic of Serbia amounts to about 88,361 km^2, which is approximately 30.9% of the territory of the Republic of Serbia (Table 2)[4]. Draft Spatial Plan of the Republic of Serbia envisages an increase in areas under forest to an optimal 41% of the territory, i.e., to at least 32% by 2035, as well as an increase in the area under trees and forests in urban areas as important factors in the resilience of urban centres to climate change. State forests are managed by public companies "Srbijašume" and "Vojvodinašume", public companies of national parks, the Faculty of Forestry of the University of Belgrade, JP "Forests of Goč", military institutions, public water management companies, agricultural husbandries and others.

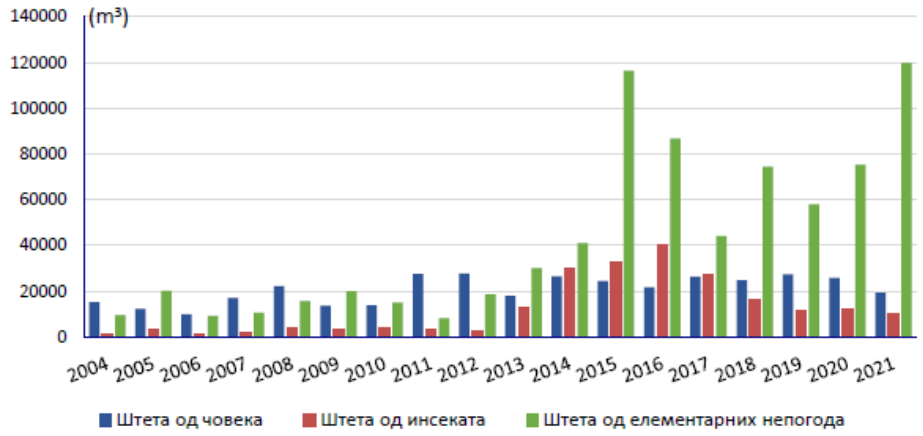
[4] According to the National Forest Inventory

Area	Total area (km^2)	Forest area (km^2)	Forestation %
Republic of Serbia	**88,361**	**27,334**	**30.9**
Serbia – North	24,728	2,048	8.3
City of Belgrade – entire area	3,222	508	15.7
Vojvodina	21,506	1,540	7.1
Serbia – South	63,616	25,286	39.8
Šumadija and Western Serbia	26,775	10,020	37.4
Southern and Eastern Serbia	228,208	10,456	40.3

Table 2: Forest coverage
Source: Draft Spatial Plan of the Republic of Serbia 2023-2035

State-owned forests account for 47%, while privately-owned forests account for 53% (of the total covered area). Forests of high origin (restored from seeds) cover the area of 25.4%, forests of shoot origin (restored from offshoots or sprouts) 68.1%, cultures (raised by sowing seeds or, more often, planting seedlings) 5.1%, and plantations (intensive poplar plantations) 1.3%. Unvegetated land, shrubbery, bushes and deciduous forests cover about 3,824 km^2 (data from the Draft Spatial Plan of RS 2021-2035).

The agents that cause damage in forests are of biotic, abiotic and anthropogenic nature. Biotic agents include insects and diseases, wildlife and livestock grazing in the forest. Abiotic agents include fire, storm, wind, snow, drought, mudflows and avalanches. Anthropogenic agents include illegal logging or other forest damages caused by logging that reduce the health and vitality of forest ecosystems. During 2021, the intensity of damage from natural disasters in state forests increased by about 60% compared to the previous year. About 19,000 cubic meters of wood were illegally cut in state-owned forests, mostly in the region of southern and eastern Serbia. The damage caused by insects was the same as in 2020, but there is a trend of decreasing damage in the past four years. The damage caused by natural disasters has been increasing since 2018, and recorded the highest value of almost 120,000m^3 in the period since 2004 (Graph 2). The pressure on forests is also increased by intensive touristic and recreational activities that cause forest fires, pollution and destruction through air pollution, traffic or livestock grazing.



Graph 2: Damages caused in state-owned forests as per agent
Source: Serbian Environment Protection Agency, 2022

(damages caused by humans, damages caused by insects, damages caused by natural disasters)

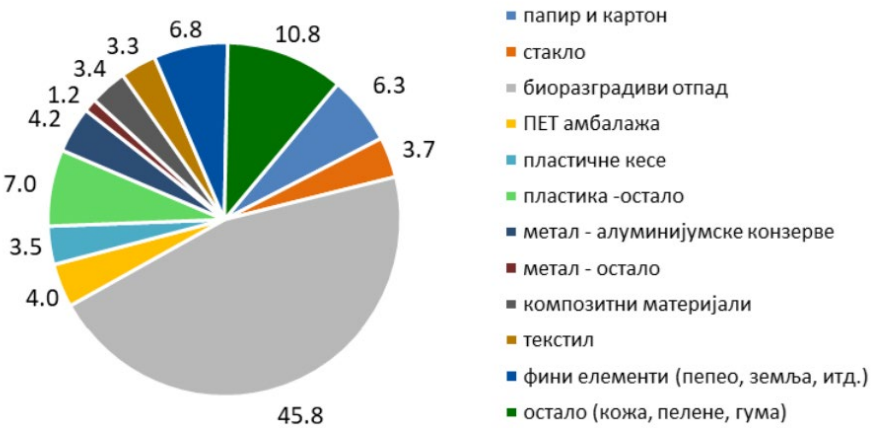
Forest fires are among most significant forms of damage in forests. Unlike controlled forest burning, which can lead to an increase in species biodiversity, uncontrolled forest fires have very negative consequences for the ecosystem, such as desertification, erosion, water loss. During 2021, 10,100 m^3 of wood volume burned, which was almost three times more than in 2020. Compared to the previous year, when forest fires affected an area of about 180 ha, the area affected by fire in 2021 was 572 ha, which is almost three times the burned area than the previous year. The problem of forest fires and damage to forests from natural disasters is becoming more and more actualised by climate change, i.e., alternating dry and rainy periods. Also, direct damages in the lost wood mass are no longer as important as the loss of general beneficial functions of forests after a fire (hydrological, protective, climatic, hygienic-health, touristic-recreational, etc.).

2.1.4. Waste management

Current situation in the area of waste management in the Republic of Serbia is at an unsatisfactory level. The existing system is characterised by insufficient coverage of the population with organised waste collection system, transport and disposal, poor condition and full capacity of the existing landfills, inadequate disposal and handling with hazardous and special waste streams, as well as a still low percentage of recycling.

According to the data of the Environmental Protection Agency in 2021, the average coverage of waste collection was 88% of the population, a total of 2.87 million tons was generated, of which 2.48 million tons were collected and landfilled. The degree of recycling, despite the constant slight increase, was still very low and amounted to only 16.8% of the total collected waste.

Morphological composition of municipal waste in 2021 (Graph 3) indicates the highest share of biodegradable waste with 45.8%. Types of waste that are significantly less common are: paper and cardboard, fine fraction and others (leather, diapers, rubber, etc.).



Graph 3: Morphological structure of waste in Serbia, 2021
Source: Serbian Environment Protection Agency, 2022

(paper and cardboard, glass, biodegradable waste, PET packaging, plastic bags, plastic – other, metal – metal cans, metal – other, composite materials, textile, fine fraction (ash, soil, etc., other (leather, diapers, rubber)

So far, 12 sanitary landfills have been built in the Republic of Serbia, ten of which are regional, and two are local ones. Table 3 indicates the amount of waste deposited at sanitary landfills in the period 2016-2021. In the observed period, an increase in the amount of waste disposed of at regional landfills was observed, especially in 2021 with the opening of RSL Vinča.

SANITARY LANDFILL	Quantities of generated waste					
	2016	**2017**	**2018**	**2019**	**2020**	**2021**
RSL "Duboko" Užice	77,930	75,295	79,764	82,214	83,541	87,905
RSL "Vrbak" Lapovo	49,749	41,266	35,264	68,166	57,396	50,404
RSL Kikinda	50,903	50,411	55,056	50,231	37,478	29,717
RSL "Gigoš" Jagodina	74,113	62,893	61,660	75,360	69,042	75,835
RSL "Željkovac – D2" Leskovac	63,380	69,255	71,102	71,369	82,953	77,388
RSL "Muntina padina" Pirot	31,685	29,987	28,456	30,903	30,654	33,918
RSL "Jarak" Sremska Mitrovica	48,126	50,912	51,080	55,369	56,680	58,574
RSL Pančevo	34,093	25,815	25,358	28,562	76,225	41,817
RSL Subotica	/	/	/	4,056	27,382	27,978
SL "Meteris" Vranje	19,890	16,841	17,247	20,087	21,946	23,504
SL "Vujan" Gornji Milanovac	13,628	15,203	14,655	14,580	15,361	15,095
RSL "Vinča Beograd"						327,980
Total	**463,497**	**437,878**	**439,642**	**500,897**	**558,568**	**850,115**

Table 3: Quantities of waste disposed of in sanitary landfills, 2016-2021
Source: Serbian Environment Protection Agency, 2022

The lack of infrastructure for the treatment and disposal of *hazardous waste* is a particular problem. There is not sufficient capacity to store hazardous waste, with only limited capacities for physical-chemical treatment and disposal of hazardous waste.

Large amounts of ash, slag and dust are generated in boilers within thermal energy plants, which, together with fly ash from coal, reach the amount of 7.04 million tons, i.e., they make up 79% of the total amount of generated industrial waste (Report on the state of environment of RS, 2022). Other types of waste originating from thermal processes also have significant share in this type of waste: unprocessed slag and waste from slag processing from the iron and steel industry, calcium-based solid waste created in the gas desulphurisation process. This is followed by quantities of solidified and other wastes from waste treatment plants, excavation and soil generated in construction activities, glass, plastic and wood containing hazardous substances and sludge from washing, cleaning, peeling, centrifugation and separation.

When talking only about *hazardous waste*, the Agency received reports on the way of handling 49,249 t or 80%. The largest share of the amount of hazardous waste disposed of is sludge and filter cakes from the gas treatment process, which contain hazardous substances. Significant amounts of hazardous waste sent to recycling treatment include separately collected electrolyte from batteries and accumulators, solid particles from the casting process of non-ferrous metals and waste containing oils. Solid wastes from gas treatment processes containing hazardous substances and hazardous components removed from discarded equipment make the largest amounts of hazardous waste reported by waste generators as being exported. The existing infrastructure for *special waste streams* treatment is insufficient. The existing infrastructure for medical waste management in Serbia consists of a network of central and local treatment sites, located within healthcare institutions. These include

treatment of waste subject to special requirements due to the prevention of infection, and comprise sterilisation in devices for low-temperature treatment of a part of medical waste, which can then be landfilled, disinfection/sterilisation of infectious waste and sharp objects, and crushing/grinding of sterilised waste. Open-type facilities for animal waste treatment that apply basic processing methods are located in Sombor (the closure of this facility is planned), Ćuprija and Inđija. There are several facilities for the mechanical treatment of cables, for use of copper and other metals, as well as for treatment of waste electric and electronic equipment.

Dumpsites are a special problem in the Republic of Serbia. These sites do not receive large quantities of waste, but waste disposed of there is often hazardous one from households or agriculture (plant protection products packaging, animal carcasses, etc.). The real problem is actually their number, where a total of 3,044 dumpsites were reported (as of 25 May 2022), of which local self-government units reported 2,641 and citizens 403.

2.1.5. Noise

Noise belongs to the group of polluting energies in the environment. Noise in the Republic of Serbia most commonly originates from traffic and industrial plants, and the problem in urban areas is also noise from local sources, that is, catering and craft shops, etc. In 2021, the Environmental Protection Agency received data from five agglomerations of the Republic of Serbia (56 measuring points), while 42 LGUs (393 measuring points) also held valid data. After analysing the data, it can be concluded that highest percentage of total noise indicator Lden ranged between 60 and 64 dB, while the highest percentage of the night noise indicator Lnight ranged between 51 and 55 dB, as well as 55 to 60 dB, and the percentage exceeding 70 dB was negligible. If five agglomerations (56 measuring points) are observed, independently of other urban areas in the territory of the Republic of Serbia where monitoring is carried out, it can be concluded that highest percentage of total noise indicator Lden is in the range of 60-64 dB, while the highest percentage of the night noise indicator Lnight it is in the range of 56-60 dB, while the percentage exceeding 70 dB is also negligible.

Strategic noise maps contain data on existing and estimated noise levels, which are presented by noise indicators and are made for agglomerations (more than 100,000 inhabitants), for main roads (average annual flow of more than 3,000,000 vehicles), main railways (flow of more than 30,000 trains) and major airports (more than 50,000 operations per year), and are reviewed every five years. So far, strategic noise maps have been prepared for the City of Niš, all main roads in the Republic of Serbia (843 km), main railways with an average annual traffic of more than 30,000 trains (railway number 101: Belgrade – Šid – Tovarnik, total length of 16 km; railway number 106: Belgrade Centre – Pančevo – Vršac – State border (Stamora Moravita), total length 12 km; railway number 110: Belgrade Centre – New Belgrade, total length 3 km). Data analysis indicates that the largest number of inhabitants, 58,900 of them, are exposed to total noise indicator Lden, which is less than 55 dB, while 58,100 inhabitants are exposed to the values of the night noise indicator Lnight, which is less than 45 dB. Strategic noise maps are being developed for the City of Novi Sad, while strategic noise maps have not yet been created for the Cities of Belgrade, Subotica, Kragujevac and the Belgrade airport.

Action plans for protection against environmental noise are significant plans because they contain measures to protect against noise and its effects in the environment, as well as

measures to reduce noise in cases when limit values are exceeded. Public company "Roads of Serbia" has prepared action plans for noise protection based on SNM prepared for 843 km of the state road network.

2.1.6. Most affected areas – hotspots

Taking into account the current environmental quality in the territory of the Republic of Serbia, a total of 4 categories have been distinguished – areas of polluted and degraded environment, areas of endangered environment, areas of environmental quality and areas of very high quality environment[5]. Areas of polluted and degraded environment include sites with exceeded limit values, urban areas, areas of open lignite pits, tailings, regional landfills, thermal power plants, highway corridors, watercourses of 4th class and "out of the class". Such areas have a negative impact on humans, flora and fauna, and on quality of life. For this category, solutions and determinations to be provided should be such to prevent further degradation and reduce the effects of limiting development. It is necessary to rehabilitate and revitalise degraded and endangered ecosystems and rehabilitate other consequences of pollution, with the aim of creating a better quality environment.

According to the preliminary list of installations for which integrated permit is mandatory (until 2022), energy sector includes 30 operators, metal production and processing industry 22 operators, mineral industry 25 operators, chemical industry 11 operators, waste management 13 operators, and 119 operators in the category of other activities (industrial production installations, food processing installations, installations for disposal and recycling of animal carcasses and animal waste, etc.). That makes a total of 220 installations for which an IPPC operating permit is mandatory.

2.2. Environmental media exposed to the impact of energy sector

2.2.1. Air quality

Kolubara coal exploitation complex. The areas of open pit mines are characterised by excessive emissions of dust into the air, as well as of harmful gases, such as nitrogen oxides, carbon monoxide, sulphur dioxide and volatile organic compounds. There are increased values of particulates and settling solid particles in the ambient air. The problem is also the emission of floating particles and sediments. In 2022, air quality parameters were measured (PM_{10}, $PM_{2.5}$, SO_2, $NO/NO_2/NOx$, CO, O_3), and it was found at the measurement points of Vodovod Medoševac and Baroševac that limit values for concentration of PM_{10} was exceeded in 13 out of 15 periods (measurement point Baroševac) and 14 out of 15 periods at the measurement point (Vodovod Medoševac), while one measurement indicated the value exceeding 100 μg/Nm^3. Open pit mines and ash dumps, as well as their surroundings, are characterised by increased emissions of particulates and settling particles, like in e.g., Medoševac and Junkovac. The presence of heavy metals: nickel, chromium, cadmium, manganese, lead, etc., was found in particulates and settling substances. Concentration values of nickel, chromium, and manganese occasionally exceed the set MACs. Vreoci record the so-called pollution with specific pollutant, such as: acrolein, phenol, formaldehyde and organic nitrogen and sulphur compounds (unpleasant odours). Emissions of these substances come from "Suva separacija", "Sušara" ("dry separation" and "drying plant") and WWTP,

[5] Spatial classification of environmental quality according to the Spatial Plan of the Republic of Serbia 2023-2035.

and their concentrations periodically significantly exceed the prescribed ILVs. Flue gases are scrubbed in the electrostatic plant and are released into the air through the 80m high stack.

Kostolac-Kovin coal exploitation complex. The open pit exploitation of coal in the Kostolac Complex has caused numerous negative impacts on all environmental media. Air quality is impaired by the emission of particulate matters and exhaust gases from the mining loading, transport and auxiliary engines, comprising emissions of the following gases: carbon monoxide, carbon dioxide, nitrogen oxides, sulphur dioxide, acrolein and others. The ash and slag landfill "Srednje Kostolačko ostrvo" is a secondary source of particle emissions, due to the scattering of ash particles, especially during strong winds, thus endangering the settlements of Kostolac, Kostolac selo, Klenovnik, Drmno and Petka.

Bor-Majdanpek coal exploitation complex. The biggest problem of air pollution in the process of disposal of flotation tailings is the emission of dust from dams on the flotation tailing ponds. Concentration and density of the resulting dust cloud, which is dispersed in the air, depends on the degree of humidity of the tailings, atmospheric conditions (relative air humidity and wind speed). As a major source of dust, flotation tailing ponds threaten the surrounding villages and agricultural land, thereby limiting agricultural production and harming the health of residents. Excessive dust emission results from the technology of implementing the dams on flotation tailing ponds, failure to implement reclamation measures of dams on flotation tailing ponds, and the absence of sanitary protection zones. The copper smelter plants emits large amounts of sulphur dioxide and arsenic emissions. Air quality monitoring is carried out with inadequate and outdated equipment, which does not ensure immediate intervention in case of environmental accidents. Dominating emission of dust into the air in the open pit zones is laden with harmful gases such as nitrogen oxides, carbon monoxide, sulphur dioxide and volatile organic compounds.

Thermal Power Plants "TENT A", "TENT B", "Kolubara A" and "Morava". The content of total sulphur in the Kolubara lignite used for combustion in the TENT is about 0.5%. Flue gases containing carbon dioxide, sulphur dioxide, nitrogen oxides and particulate matters are released into the air through stacks after the scrubbing, separation of particulate matters in electrostatic precipitators: TENT A – 150 m (blocks A1, A2 and A3) and 220 m (blocks A4, A5 and A6); TENT B – 280 m (blocks B1 and B2); Kolubara A – 105 m (boiler K1), 105 m (boilers K3, K4 and K5) and 130 m (block A5, K6) and TPP Morava – 105 m. Given the existing technologies of boiler operation, there are high values and occasional exceeding of emission limit values. Significant contribution also comes from other local sources of pollution, such as traffic, household combustion plants, industrial plants, coal mining, dust from landfills, etc. Flue gases contain harmful substances, the most significant of which are CO_2, SO_2, NOx, CO and particulate matters (fly ash). According to the Report on the state of the environment of PE EPIS for 2022, total emissions of particulate matters within the Nikola Tesla plant in 2022 amounted to 4,863.36 t, sulphur dioxide 224,530.12 t, nitrogen dioxide 24,724.63 t, and carbon dioxide 18,794,175.86 t.
Negative impact of thermal power plants on the environment is also reflected in the inevitable process of disposal of ash and slag in landfills within the installation complex. In addition to the impact on water pollution, landfills are a surface source of air pollution with ash particles. Due to the unfavourable physico-chemical characteristics of ash and the current method of ash disposal in open landfills, aeolian erosion of ash occurs in dry and windy weather. In order to reduce negative impacts of ash landfills on the environment, PE EPIS implements a number of measures, such as spraying and wetting of surfaces, biological protection. Ash landfills contribute to cumulative pollution. The main polluting substances emitted by TPP

"Kolubara A" into the air are: sulphur, nitrogen and carbon oxides, solid ash particles and slag, coal particles. In 2022, there was a much smaller amount of ash spreading from the ash landfill in "TPP Morava", because ash wetting system was installed on the inactive Cassette 7, which was in operation during the summer period, especially during the period of strong winds. Water mirror on the active Cassette 8 had an optimal surface in accordance with technical conditions. Up to now, electrostatic precipitators have been reconstructed in all units in TPP "Nikola Tesla" A and TPP "Nikola Tesla" B (B1 and B2), as well as unit A5 in TPP "Kolubara A", while electrostatic precipitator in TPP "Morava" was reconstructed within the overhaul in 2016 in order to achieve the output concentration of particulate matters of 50 mg/Nm^3. Installation of a flue gas desulphurisation plant for units A3-A6 in TPP "Nikola Tesla A" and units B1-B2 in TPP "Nikola Tesla B" is underway, and construction of the plant is expected to reduce concentration of sulphur dioxide from both units to a level of 130 mg/m^3. In the previous period, primary measures were introduced to reduce the emission of nitrogen oxides on Blocks A3, A4 and A5 in TENT A and on Block B1 in TENT B, with the aim of reducing the emission of nitrogen oxides below 200 mg/m^3.

Thermal Power Plants "Kostolac A" and "Kostolac B". TPPs "Kostolac A" and "Kostolac B" emit different types of harmful substances that affect air pollution. The most harmful effect is sulphur dioxide, which, together with nitrogen oxides, leads to the appearance of acid rain, negatively affects human health, flora and fauna, as well as materials (accelerates corrosion). In addition to these, carbon dioxide, nitrogen oxides, carbon monoxide and ash particles are emitted into the air from "Srednje Kostolačko ostrvo" is a secondary source of air pollution, because strong winds often cause scattering of ash particles and excessive air and soil pollution in the immediate vicinity. The landfill is scheduled for closure and recultivation.
Total sulphur content in the Kostolac lignite used for combustion in the TPP-Mine "Kostolac" complex is about 1.3%. Flue gases containing sulphur dioxide, nitrogen oxides, carbon dioxide and particulate matters are released into the air after purification and separation of particulate matters in electrostatic precipitators. Air quality is monitored within the plant for internal purposes. The content of total suspended particles (TSP), sulphur oxides (SO_2), particulate matters (PM_{10}), soot and heavy metals (Pb, Cd, As and Ni) are measured regularly. According to the Report on the state of the environment of PE EPIS in 2022, a total of 7,103,610.69 t of carbon dioxide, 78,251.84 t of sulphur dioxide, 1,261.53 t of particulate matters, 7,620.19 t of nitrogen dioxide and 2,957.42 t of carbon monoxide were emitted. Due to large emissions, reconstruction of the electrostatic precipitator for the emission of particulate matters was carried out on all blocks of the "Kostolac" thermal power plant. At the end of 2016, a desulphurisation plant was built, as well as a new stack with two pipes (each block, B1 and B2, has its own pipe). Also, in 2014, new burners were installed at block B1 in TPP-Mine B as part of the block revitalisation, with the aim of reducing the emission of nitrogen oxides below 200 mg/Nm³. Measurement results indicate significant reduction in the emission of nitrogen oxides. Implementation of a project to introduce secondary measures to reduce nitrogen oxides in TPP-Mine B2 is underway.

Pannonian TPP-HP (Novi Sad, Zrenjanin, Sremska Mitrovica). Air quality is deteriorated by the emission of sulphur and nitrogen oxides and dusty substances created in the operation of thermal power and heating plants. In 2022, a total of 473,909,630 t of carbon dioxide, 1,602,544 t of nitrogen dioxide, 4,550 t of particulate matters and 4,214 t of sulphur dioxide were emitted from the Pannonian TPP-HP (Report on the state of the environment of PE EPIS for 2022, 2023). Flue gases containing these substances are discharged through stacks at the height: TPP-HP Novi Sad – 160 m; TPP-HP Zrenjanin – 160 m, and TPP-HP

Sremska Mitrovica – concrete stack 105 m and 77.5 m brick stack. Since 2011, no measurements of emissions of pollutants into the air have been conducted at TPP-HP Zrenjanin.

Hydro Power Plants "Đerdap" (HPP Đerdap 1, HPP Đerdap 2), HPP "Pirot" and "Vlasinske HPPs". Based on legal regulations in the field of air protection, the emission of polluting substances in the air from a stationary source of pollution (heating plant, Boiler 1 and Boiler 2) intended for heating of Đerdap 1 HPP facility has been measured. The tested parameters include: mass flow of carbon monoxide, nitrogen oxides expressed as nitrogen dioxide, mass flow of nitrogen oxides expressed as nitrogen dioxide, sulphur oxides expressed as sulphur dioxide, and mass flow of sulphur oxides expressed as sulphur dioxide. Based on the results of measurements in stationary sources of pollution, Operating boiler 1 and Operating boiler 2 are in compliance with the requirements prescribed by the Regulation on limit values of emissions of polluting substances into the air from combustion facilities.

Oil Refineries Pančevo and Novi Sad. Negative impacts are manifested through free evaporation of benzene, toluene, etc. from tanks and decanting plants for light liquid derivatives and pyrolytic gasoline. Negative impacts on air quality are also reflected in the waste water treatment plant from the Refinery, where water surface releases easily volatile hydrocarbons, benzene, toluene, xylene, as well as sulphides, sulphonates and mercaptans, as well as through point/process sources that emit pollutants (nitrogen oxides, sulphur dioxide, carbon monoxide, etc.). All emitters are regularly monitored. Emissions are in accordance with the prescribed ELVs.
Air quality monitoring within the Oil Refinery is carried out as part of regular monitoring conducted at the territory of the City of Pančevo, at the nearest representative profile of "Vojlovica", where emissions of sulphur dioxide (SO_2), BTX (benzene, toluene, xylene), and particulate matters (PM_{10} and $PM_{2.5}$) are monitored. Measurement of concentrations of $PM_{2.5}$ started in 2019, and a trend of increasing concentration is observed – for the past four years, concentration of $PM_{2.5}$ has been above the LVs. Exceeding of limit and occasionally of tolerance values for PM_{10} at the measurement point "Vojlovica" are recorded (Report on the state of the environment of the City of Pančevo 2018, 2019, 2020, 2021, 2022). In 2020, maximum daily concentration of 348μg/m^3 was recorded, and the highest number of exceedances of LVs was in 2021 (75), while highest number of exceedances of LVs in 2018 was 21. Concentrations of benzene, toluene and xylene are also regularly monitored at the same measurement point "Vojlovica". Analysing the results of average annual concentrations of benzene in the air since 2009, it was concluded that there is no exceedance of the LVs at annual level (Report on the state of the environment of the City of Pančevo 2022). At the "Vojlovica" measurement point, average annual value has been increasing since 2017, and it reached 4.01 μg/m^3 in 2022.
Within the "Novi Sad" Oil Refinery, the main source of pollutants is the boiler room for the production of technological steam, which is used natural gases, but no emission limit values are exceeded.

2.2.2. Water quality

Kolubara coal exploitation complex. Surface and ground waters are exposed to intense pollution from large concentrated polluters from the complex, as well as from diffuse polluters composed of numerous smaller discharges of waste water into the recipient. Water from the pre-drainage and drainage systems within the "Površinski kopovi" ("open pit mines") is technological part of the coal exploitation system. Water pumped out (mine waste

water) from these systems is discharged, without pre-treatment, via sedimentation tanks into nearby recipients, as follows: from “Polje E” Baroševac into the Peštan and Turija Rivers, Medoševac into the Peštan River; from “Tamnava Zapadno polje” to the Kolubara River, and from “Polje G” to the Kolubara River. Technological processes for refinement and processing of Kolubara lignite generate waste water from wet separation, drying plant, heating plant – chemical preparation of boiler water and sanitary water treated at the waste water treatment plant, which is discharged into the channel and transported to the Kolubara River. The Report on the state of the environment of PE EPIS for 2022 states that discharge of treated water from the wastewater treatment plant does not negatively affect the quality of the recipient, i.e., of the Kolubara River, and that there are no significant changes in the river water quality.

Kostolac-Kovin coal exploitation complex. Water from the drainage system of the “Drmno” mine is mainly drained to the cooling water pool of the “Kostolac” B thermal power plant, and a smaller part is discharged into the Mlava River. Water from the drainage system of the “Ćirikovac” mine is accumulated in a reservoir near the mine. Quantities of water for OPM “Klenovnik” are small and are not measured. Ground water in the vicinity of the ash landfill is characterised by increased mineralisation (increased water hardness, sulphate content, etc.) and increased content of solid substances, fats, oils, and α and β radioactive emitters.

Bor-Majdanpek complex. Water around the Bor open pit mine is characterised by high concentrations of dissolved heavy metals of copper, zinc and iron. Atmospheric waters that reach deep into the pit through various cracks, channels and rock tunnels, are rich in copper solution, as they dissolve the surrounding ore while washing it off, collect at the bottom of the pit, and together with water from atmospheric precipitation from the Bor open pit mine that accumulates at the bottom of the pit, are fed into the Jama mine, where they are mixed with its internal waste water, then pumped out by the means of large pumps to the surface for further copper processing. Part of that water is further processed, and this is the cheapest way to obtain copper as there is no additional digging and the use of heavy machinery. Several breaches of LVs defined by the regulations for heavy metals (mainly copper and nickel) and for particulate matters were registered in Borska, Kriveljska and Bela Reka Rivers (copper concentration up to 16 mg/l, while the limit is 0.1 mg/l). Bringing in large amounts of sulphates, arsenic and heavy metals, they endanger settlements on the banks of subterranean rivers in Serbia and Bulgaria and affect water quality of the Danube.

Thermal Power Plants “TENT A”, “TENT B”, “Kolubara A” and “Morava”. According to the Report on the state of the environment of PE EPIS, the results of water quality tests in 2022 indicated the following exceedances:

- exceeded LVs for arsenic were found in the drainage waste water from the landfill (in three samples of the new, and one sample of the old drainage channel (TENT A));
- exceeded LVs for arsenic were found in the in the overflow waste water from the landfill (TENT A and TE Kolubara (all four sampling series));
- In the second quarter of the testing, the Sava River was classified into class 3 downstream of TENT A compared to the upstream for the parameter of particulate matters, one exceedance of LVs for sulphate was recorded, and change in the temperature regime of the Sava upstream and downstream of TENT A in one sample;
- testing of the quality of the Turia River as a recipient – exceedance of LVs in three samples downstream (2nd, 3rd and 4th series); Kolubara River – two samples downstream (3rd and 4th series) above LVs, exceeded LVs for sulphate in 3rd sampling series.

Waste water treatment plant at TENT A was built in 2016. Waste water treatment is carried out in several plants located within a 3 km radius at the TENT A site. In each of them, treatment is carried out on different types of waste water (waste water at the points of discharge into the river, on the profiles upstream and downstream of the point of discharge of waste water, and ground water in the vicinity of the ash and slag landfills) generated in thermal power plant and contaminated by coal, mazut, oil, then sanitary water, as well as waste water generated in the process of flue gas desulphurisation.
Monitoring of the impact of the ash and slag landfill on quality of ground water is carried out by testing the water quality in piezometers and village wells located in the vicinity of the ash landfill. When it comes to maximum permitted concentrations in piezometers, increased concentration of copper, tin, and mineral oils (in individual piezometers) was recorded at the TENT A location. As for samples taken from village wells at TENT A and TENT B locations, the most frequent exceedances related mainly to the parameters of oxygen saturation, iron, turbidity, as well as for microbiological parameter. Since concentration of manganese in the overflow and drainage waters of ash landfills is low, the occurrence of increased manganese concentration in the waters of certain rural wells is a consequence of outstanding presence of this element in the soil. In addition, concentration of nitrates in the water of village wells (agricultural activities) is sometimes increased, and microbiological inappropriateness was recorded in the vicinity of the TENT B ash landfill by tests in the "zero state" (Report on the state of the environment of PE EPIS for 2022, 2023). Microbiological analysis of water from village wells indicated the presence of coliform bacteria, which is a consequence of the proximity of septic tanks and stables.

Thermal Power Plants "Kostolac A" and "Kostolac B". Water captured and used for cooling in the condensers is discharged through the reverse channel into the Danube River – TPP "Kostolac" A, i.e., the Mlava River – TPP "Kostolac" B. Sanitary waste water from the "Kostolac B" thermal power plant is discharged directly or indirectly into the Mlava River after mechanical-biological treatment in aerobic conditions in treatment devices. Within this plant, the construction, i.e., commissioning of the waste water treatment plant, which consists of several units that treat sanitary, oily and waste water contaminated with mazut, as well as waste water from HPV and ODG, has almost been completed. Ground water quality was examined in 2022 at 18 piezometers. The results indicate exceedances of the MACs in one or more piezometers for the concentration of sulphate, arsenic, zinc, ammonia, nitrite, nitrate, and lead. Remedial values were occasionally exceeded for the content of arsenic, zinc and lead.

Pannonian TPP-HP (Novi Sad, Zrenjanin, Sremska Mitrovica). Within TPP-HP Novi Sad, reverse cooling water and all other technological waste water (water from the demineralisation process and oily water after primary and secondary treatment) are discharged into the Danube River after the treatment. Since 2012, sanitary sewage and atmospheric sewage water have been discharged into the city waste water collector. The Danube River is classified as a 2nd class watercourse, and in 2022 there were no exceedances in the samples of waste water and recipients (Report on the state of the environment of PE EPIS for 2022, 2023).
Waste water within the TPP-HP Zrenjanin (from chemical cleaning of the boiler plant, washing and passivation of the water tract and oily water) is discharged after the treatment into the Aleksandrovački channel, which is classified in the 4th category, and then from the channel into the Begej River, which is of the 2nd category. According to the report from 2022, the results of waste water measurement within TPP-HP Zrenjanin in the 1st and 2nd quarters

indicate suspended substances before and after the outlet, as well as BOD_5, ammonium ion, nitrites, dissolved oxygen, with no exceedance of LVs in the 4th quarter.
Reverse cooling water from TPP-HP Sremska Mitrovica is discharged into the Sava River, which is classified as a 2nd class watercourse. Part of the waste water is not discharged directly into the recipient, but after the treatment in waste water treatment plants (plants for the treatment of oily and turbid water and plant for the treatment of muddy water) and from the neutralisation pool of the plant for chemical preparation, the water is transported through the network of waste technological waste and treated water, and discharged through the control – water measuring drain into the municipal industrial-sewage collector. Sanitary-faecal waste water, after being treated in the sanitary-faecal water treatment plant, is discharged into the municipal industrial-sewerage collector through the pipeline network. In the third quarter of waste water testing in 2022, the parameters for BOD_5 in the sample of the last drain before the outlet to the Sava River exceed the LVs. Testing of the quality of the recipient in the 2nd and 3rd quarters indicate incompliance with the 2nd class of the Sava watercourse for BOD_5, while in the 4th quarter, the sample corresponded to the prescribed quality class. Two periodic tests of ground water in 2022 indicated that installation's activities had no impact on ground water (Report on the state of the environment of PE EPIS for 2022, 2023).

Hydro Power Plants "Đerdap" (HPP Đerdap 1, HPP Đerdap 2), HPP "Pirot" and "Vlasinske HPPs". Regular monitoring of water quality is extremely important for the functioning of hydro power plants. Three samples are taken from the power plants of the HPP Đerdap, i.e., a sample of waste water at the point of discharge, a sample of surface water upstream of the plant, and a sample of surface water downstream of the plant. The following parameters are tested: MPN coliform bacteria, dissolved O_2, particulate matter, COD, BOD_5, pH value and total oils and fats. Based on the obtained results for waste water (from the sewage system – before the outlet), as well as for surface water upstream and downstream, it can be confirmed that the tested parameters meet the prescribed values. Physical and chemical parameters meet limit values of polluting substances for water class 2 (HP Pirot), i.e., water classes 1 and 2 for HPP Vlasina.
Technical water is mainly cooling water that is used to cool turbines, and as such is discharged into the Danube. Cooling water contains small amounts of oil. The sources of waste water at the main and auxiliary power plant of HPP "Đerdap 2" are sanitary units and cooling systems of aggregates and block-transformers. HPP "Pirot" annually discharges about 200 m^3 of sanitary waste water into the municipal sewage system. Depending on the time of the aggregate operation, about 330,000 m^3 of technical water is discharged annually on average. Technical water is mostly cooling water that is used to cool generators and aggregate bearings, and as such is discharged into the drainage channel. Due to the cooling water pressure, which is higher than the oil pressure, there is a low probability that significant amounts of oil get into the water. A smaller part of technical water, about 10,000 m^3, is seepage water that is collected in the power plant and also pumped into the drainage channel. At "HPP Vlasinska", about 6.5x106 m^3 of water from the cooling systems, as well as about $60x10^3$ m^3 of sanitary water, are on average discharged annually. This water is discharged in the outflow water of power plants, without pre-treatment.

Drina-Lim Hydro Power Plants. The state of the quality of waste water and surface water from all power plants in the "Drina-Lim HPP" is monitored every year, and the results of the analyses are published in the annual reports of PE EPIS. Eleven samples are taken from the HPP "Bajina Bašta", 12 samples from HPP "Limska", 6 samples from HPP "Elektromorava" and 3 samples from HPP "Zvornik", a follows: sample of waste water; sample of surface

water upstream of the plant and a sample of surface water downstream of the plant. The following parameters are tested: MPN coliform bacteria, dissolved O_2, particulate matter, COD, BOD_5, pH value and total oils and fats. The rivers of Drina, Zapadna Morava, Uvac and Lim belong to the prescribed 2nd quality class.

Small HPPs (EPS has 14 MHPs under its jurisdiction, of which 6 were in operation in 2022: HPP Sićevo, HPP Sokolovica, HPP Gamzigrad, HPP Prvonek, HPP Raška and HPP Turica). Due to their size and construction, small hydro power plants of the RES branch do not generate waste water. Measurements of technical and sanitary water are not carried out, so no water quality control was carried out in the RES branch in 2022 either. The identified negative impacts in water downstream the dams are mainly twofold: with a very low water level (low throughput), which is conditioned by annual climatic and meteorological conditions, and on the contrary, when there are very large inflows, efforts are made to transfer hydro energy with the greatest degree of utilisation through planning of electricity production.

Oil Refineries Pančevo and Novi Sad. Monitoring of waste water quality (atmospheric and technological waste water) is regularly carried out in the Pančevo and Novi Sad oil refineries. All oily waste water from the Pančevo Oil Refinery is primarily treated at the API separator (impermeable concrete basin, consisting of two chambers). According to the principle of gravity separation, oily substances and mechanical impurities are separated, while the reduction of concentration of all other polluting substances is achieved by additional waste water treatment at the WWTP HIPP. The separated layer of oil phase on the surface is collected by means of a skimmer, and is transferred by pumps to tanks for the storage of oil phase, wherefrom it is reversed for further processing. The overflow water is further treated through coalescing filters, and then pumped from the receiving basin for further processing in the WWTP HIPP. The precipitate separated from the chambers of the API separator is handed over to the operator for further treatment. Regarding the state of ground water quality, parameters that exceed remediation values are total petroleum hydrocarbons (TPH) and one exceedance each of Ni and Hg, according to the NIS data.

2.2.3. Soil quality

Kolubara coal exploitation complex. This area is characterised by soil degradation due to the intensive exploitation of coal in surface mines, disposal of tailings and ash, which leads to the formation of soils of the lowest quality class, deposols and technogenic soils. The Report on the state of the environment of PE EPIS for 2022 states that during 2022 no soil quality tests were carried out due to the absence of legal obligation according to which monitoring is carried out every year, especially since MAC and remediation values of the tested heavy metals were not exceeded in the measurements which had been carried out continuously in previous years. However, according to the Report for 2019, excesses of some or most metals could be observed – chromium, arsenic, nickel, and zinc. Other negative types of coal exploitation are reflected in devastation of landscape, destruction of agricultural cover, erosion, change in land use, impact on biodiversity, loss of habitat for certain species of flora and fauna species, and impact on human health.

Kostolac-Kovin coal exploitation complex. Soil pollution is most intense in the immediate vicinity of the open pit mines, thermal power plants, slag and ash landfills, as a result of direct contamination with harmful particles, waste water and harmful gases. Monitoring of emissions of substances that affect soil quality is carried out every year. The results showed

that the total content of mercury (Hg) and nickel (Ni) was above the maximum limit values for heavy metals in almost all analysed samples. Breaching of LVs was also recorded for the content of chromium (Cr), copper (Cu), as well as for the content of cadmium (Cd). The content of cadmium (Cd) was higher than the maximum limit value in 31.6% of the samples, the content of chromium (Cr) is higher than the MAC value in 10.5% and copper (Cu) in 10.5% of the analysed samples. Other analysed parameters were within the allowed values.

Bor-Majdanpek complex. Many years of exploitation and processing of copper ore in the vicinity of Bor resulted in degraded soil by depositing a large amount of mining waste and the presence of mine water therein. Also, long-term mining operations have led to the occupation of agricultural and construction land, and devastation of the pedological layer has completely degraded agricultural land in some places. Large emissions of sulphur dioxide from metallurgical processes caused acidification of the soil, disturbance of vegetation and erosion. According to the report of the Environmental Protection Agency (2020), a total of 20.10 ha of land was degraded by excavation within Serbia Zijin Copper Bor, while 58.68 ha of land was degraded by disposal of tailings within this complex.

Thermal Power Plants "TENT A", "TENT B", "Kolubara A" and "Morava". Negative impact of thermal power plants on soil quality is reflected, among other things, in the inevitable process of disposal of ash and slag in landfills within the complex. Secondary contamination occurs under the influence of unfavourable weather conditions through the deposition of gases and floating particles. The acidity of the soil is different, which can be associated with different deposits of acid gases at different distances from their sources. Soil quality tests and the content of total and accessible forms of heavy metals and pollutants in the soil are carried out, as well as the control of the chemical composition and water quality in the melioration channels in the vicinity of the thermal power plants. During 2022, concentration of heavy metals and other toxic elements in the soil was measured and exceedances were recorded for chromium, nickel, zinc and mercury (for TENT A and B, TPP Kolubara, TPP Morava), arsenic (for TENT A and B, TPP Kolubara), copper (TENT B, TPP Kolubara, TPP Morava), cadmium (TENT B, TPP Kolubara, TPP Morava), and lead (TPP Kolubara, TPP Morava).

Thermal Power Plants "Kostolac A" and "Kostolac B". The soil is most degraded in the vicinity of the ash and slag landfills. Annual soil quality tests and of the content of total and accessible forms of heavy metals and substances that affect soil quality are conducted in the vicinity of the "Kostolac" TPP-Mine in order to monitor the impact of ash and slag landfills on the soil. The content of heavy metals and other toxic elements in the soil ranged within normal concentrations and below the remediation values for: nickel, copper, mercury, zinc, lead, chromium, arsenic (Report on the state of the environment of PE EPIS for 2022, 2023).

Pannonian TPP-HP (Novi Sad, Zrenjanin, Sremska Mitrovica). In 2022, soil quality tests were carried out for the purposes of preparing certain studies. The results of physical and chemical tests indicate that the soil in the immediate vicinity of the oil tubs and pits, as well as in the immediate vicinity of fuel oil tanks at the locations of TPP-HP Novi Sad, Zrenjanin and Sremska Mitrovica, is not contaminated with arsenic and metals such as chromium, nickel, lead, copper, zinc, cadmium, mercury and cobalt, nor is it contaminated with organic pollutants and aromatic hydrocarbons (benzene, xylene, toluene and ethylbenzene).

Oil Refineries Pančevo and Novi Sad. Based on the available data from the soil quality test conducted at the location of the ORP and the pier (80 samples from a depth of 50 cm), it was

concluded that in 2022 there was no exceedance of remediation values of the monitored parameters. Soil quality tests were conducted in 2018 in the preparation of EIA study for the project[6], where a total of twenty-eight samples were tested at depths of 0.5, 2, 4 and 7 m. The obtained results demonstrated that concentration of mercury was higher than prescribed LVs in 11 wells, concentration of nickel in 10, of vanadium in 5, while concentration of copper in 2 samples.

2.2.4. Waste management

Kolubara coal exploitation complex. Waste management operations in the area of the Kolubara Basin within the OU "Površinski kopovi" ("open pit mines"), OU "Prerada" ("processing") and OU "Metal" are carried out by the Service for Waste and Hazardous Materials. Based on data on generated waste for the 2022 from MC Kolubara (Report on the state of the environment of PE EPIS for 2022, 2023), some of the most generated types of waste[7] were singled out: scraping and processing of ferrous and non-ferrous metals, mineral non-chlorinated motor oils, oils for gearboxes and lubrication, oily water from the oil/water separator, other emulsions (waste emulsions, machine emulsions and halogen-free solutions, waste sludge from the washing lines, packaging containing substance residues or contaminated with dangerous substances, waste tires (transport steel cord tape, sealing rubber, wipers, roll rings), copper, bronze and brass (copper, copper strips, copper lacquered wire, copper coils with insulation, scrap tin bronze, scrap aluminium bronze), iron and steel.

Kostolac-Kovin coal exploitation complex. According to the data from the Report on the state of the environment of PE EPIS for 2022[8], the largest amounts of waste generated in 2022 (for the Branch TPP-Mine "Kostolac" (parts of the branch OPM "Drmno" and OPM "Ćirikovac") were composed of: iron and steel, waste mineral non-chlorinated hydraulic oil, waste mineral non-chlorinated engine oil for gearboxes and lubrication, lead batteries, copper cables, etc.

Thermal Power Plants "TENT A", "TENT B", "Kolubara A" and "Morava". Waste generated in regular operation of plants and overhaul activities is deposited in storages for temporary disposal at each of the locations of the TENT branch. A large part of the collected waste, classified as hazardous or non-hazardous, in order to reduce negative impact on the environment, is being sold, assigned or handed over to a third party with compensation, i.e., for waste disposal. The construction of storages for temporary waste disposal is planned for all four locations of the TENT branch, in accordance with the new legal requirements. According to the Report on the state of environment of PE EPIS for 2022, the most dominant category of waste is ash, slag and dust from the boiler, followed by mixed construction and demolition waste, as well as iron and steel.

Thermal Power Plants "Kostolac A" and "Kostolac B". Waste management within the TPP-Mine Kostolac is most significant from the aspect of generation of ash and slag, but also of other categories of waste generated within the regular operation of thermal energy

[6] Environmental impact assessment study of the project "Reconstruction of existing facilities in manipulation and installation of new equipment in order to adapt the system for the deep processing plant in the Pančevo Oil Refinery" (2018). Global Process Engineering a.d., NIS a.d. Novi Sad.
[7] Official nomenclature of the Rulebook on categories, testing and classification of waste (Official Gazette of RS, No. 56/2010 and 93/2019).
[8] The Rulebook on categories, testing and classification of waste (Official Gazette of RS, No. 56/2010 and 93/2019)

capacities. The ash generated in technological process of burning lignite in boilers of TPP Kostolac B is stored in a silo and sold dry to interested customers for use as raw material in construction industry, based on the contracts on sale of ash, and the rest is disposed of at the ash and slag landfill of OPM Ćirikovac. Based on the insight into the Report on the state of environment of PE EPIS for 2022, it was determined that largest amounts of generated waste were coal fly ash and calcium-based solid waste from flue gas desulphurisation process.

Pannonian TPP-HP (Novi Sad, Zrenjanin, Sremska Mitrovica). According to data from 2022, the largest types of waste generated within the operation of Pannonian TPP-HP installations were waste ash from biomass boilers, sludge from water decarbonisation, waste mineral wool, iron and steel.

Hydro Power Plants "Đerdap" (HPP Đerdap 1, HPP Đerdap 2), HPP "Pirot" and "Vlasinske HPPs". Municipal waste and floating waste collected from the surface of the water and grids before hydro aggregates at the entrance building of HPP "Đerdap 1" are regularly disposed of at the landfill near Davidovac. The landfill is regulated and equipped in accordance with current regulations. Waste is collected at source, at HPP Đerdap 2, and transported to the plateau of the central warehouse in Kusjak, which is located within HPP Đerdap 2. Hazardous waste is also stored in the storage for hazardous materials in Kusjak. The storage area itself and the surrounding area is regulated in accordance with current regulations. Oil treatment is done in the treatment plant at the main power plant. Treated oil is used again, as long as it has satisfactory properties, and waste residue is collected and deposited in the storage for hazardous waste and handed over to authorised institutions for further treatment. At HPP "Pirot", according to the quantities generated, only some types of waste are separated in an organised manner, while other types of non-hazardous waste are disposed of at municipal landfills. Waste oils and liquids are collected and stored in the storage for oil and lubricant until they are taken over by authorised companies. Within the HPP "Vlasina", waste is disposed of at a temporary, partially regulated landfill near the central workshop at HPP Vrla 3. Hazardous waste, transformer and turbine oil are stored in a properly organised storage.

Drina-Lim Hydro Power Plants. Waste within the Drina-Lim hydro power plants is mainly generated in the process of hydro power plant maintenance. Generated waste is stored within the facilities of the hydro power plants and handed over to the authorised operators. The types of waste generated in 2022 include lead batteries, fluorescent tubes and electrical hazardous waste.

Small HPPs (there are 14 SHPPs under the EPIS competence, six of which were in operation in 2022: HPP Sićevo, HPP Sokolovica, HPP Gamzigrad, HPP Prvonek, HPP Raška and HPP Turica). No waste is generated in the process of production and ongoing maintenance of small hydropower plants in operation. During the the reconstruction of a part of the power plant, the part of the equipment created after the demolition is properly stored.

Oil Refineries Pančevo and Novi Sad. Industrial hazardous waste is temporarily stored at the Pančevo Oil Refinery in the temporary hazardous waste atorage facility on Avenue F. The warehouse has a concrete base, as well as with the so-called catch pit that would, in the event of a spill, retain and accept the spilled waste. The storage is not covered, it is fenced, marked, locked and under constant surveillance. Hazardous waste is packed in plastic or metal packaging depending on the type of waste, and the waste is labelled. The subject waste is handed over to the operator authorised for waste collection, transport and treatment. According to the relevant law, every delivery and taking over is accompanied by documents

on the movement of hazardous waste, which are properly filled out and archived. Non-hazardous waste is temporarily stored in Block 16 in ORP. The warehouse is fenced, locked and under constant surveillance.

2.2.5. Noise

Kolubara coal exploitation complex. The sources of noise in "Kolubara-Prerada" originate from the following plants: Heating plant, Drying plant, Dry separation, Wet separation, as well as noise originating from railway industrial traffic, freight road traffic and the cable car. Noise is generated both during the processing and transport of mined and processed coal. The measuring points for environmental noise are: "Baroševac" and "Strana" in Baroševac; "Naselje Radljevo" and "Kalenić". The results of the measurements indicate that the highest exceedances of day and night noise levels are at the measurement point Baroševac. In Vreoci, there is a significant intensity of noise caused by freight traffic.

Kostolac-Kovin coal exploitation complex. Increased noise is possible in all phases of exploitation in open pit lignite mines. The noise most often comes from mining machines for excavation, transport and auxiliary work. During the measurement of environment noise, it was established that noise level does not exceed the permitted level of external noise for day and night, and the noise measurement was carried out in 2022 at the measurement point in the village of Drmno on the west side of the mine, next to the crushing plant; measuring point near the village of Bradarac on the southern side of the mine, and measuring point on the northeastern side of the mine near the village of Kličevac.

Thermal Power Plants "TENT A", "TENT B", "Kolubara A" and "Morava". Noise in the process of electricity production in thermal power plants is caused by the operation of the following facilities: mills, turbines, flue gas fans, and occasionally when the block (boiler) operation mode is interrupted, the noise comes from the safety valves switching on, which lasts up to 1 minute at most. Environmental noise was measured in 2022 in the TENT branch plants. There was a registered exceedance of the permitted noise level during a 15-minute measurement at two measurement points in the night measurement period, while no measurement point recorded exceedance in the 24-hour measurement regime. At the TENT B location, the permitted noise level was exceeded at two measuring points in the 15-minute measurement both in the daytime and nighttime measurement periods, while exceedances were recorded in the nighttime measurement period at only two measurement points. During the 24-hour measurement at TENT B, the exceedance was recorded only at one measurement point, in the nearest residential area, during the night measurement period.

Thermal Power Plants "Kostolac A" and "Kostolac B". Noise measurement at the location of thermal power plants during 2022 was carried out at six measurement points, and at two measurement points at open pit mines. Measurements were made at the following measuring points: TPP-MINE A – "Prim" Kostolac; TPP-MINE A – "Laser-Balkan"; TPP-MINE A – Kostolac Pristanište-luka; TPP-MINE B – Drmno village; TPP-MINE B – Jezero TPP B, TPP-MINE B – Viminacium. The measurement results did not indicate exceedance of maximum limit values (LV) of 65 dB during the day, and 55 dB for the night period, bearing in mind that local self-government unit did not conduct acoustic zoning[9].

[9] Local self-government of the City Municipalities of Kostolac and Požarevac recently carried out acoustic zoning of the area in compliance with the Law on Environmental Noise Protection (Official Gazette of RS, No. 96/21).

Pannonian TPP-HP (Novi Sad, Zrenjanin, Sremska Mitrovica). At the end of 2022, environmental noise was measured within the Pannonian TPP – HP. The results of sampling at 4 measuring points did not indicate that the permitted noise levels were exceeded. Most of the source devices are stationary ones, and fans for introducing fresh air into the boiler were observed as the most significant sources of noise in these thermal power and heating plants. Based on the measured values, it can be concluded that TPP-HP has no effect on buildings in the residential area.

Hydro Power Plants "Đerdap" (HPP Đerdap 1, HPP Đerdap 2), HPP "Pirot" and "Vlasinske HPPs". Noise measurement is not conducted in the vicinity of electric power facilities that are part of HPP "Đerdap" due to the fact that facilities are dislocated from the settlements and as such do not endanger the environment.

Drina-Lim Hydro Power Plants. Measurements of environmental noise levels are not conducted around electric power facilities, because they are dislocated from settlements and as such are not a risk factor for the environment from this aspect.

2.2.6. Environmental impact of oil and gas exploitation

The most significant environmental impacts of oil and gas exploitation are related to drilling operations (mud generation), storage and transportation of crude oil. When exploring oil and gas wells, there is a potential risk of contaminating the aquifer with a layer that is saturated with oil or hydrocarbons. Ground water protection is ensured by technical equipment of the well. The exploration and production of oil and gas entails the inevitable loss of land, and since the largest reserves are in the area of Vojvodina, which is both agricultural and lowland region, agricultural land is often lost. In the test phase of the well, it is estimated that around 3 ha of agricultural land will be occupied. If the well is negative, it is liquidated and land is reclaimed. In the case of a positive well, a minimum of 10m x 10m is taken for a borehole. The waste generated during the drilling process is the operational fluid (drill-in fluid), which is deposited in special tanks and reused on new wells. At certain locations of the wells, which are no longer productive, technological preparation and deposition of stratum water in the reservoirs is carried out.

2.2.7. Impact of wind farms on birds and bats

One of the greatest negative impacts of wind turbines is the impact on birds and bats. During the preparation of the EIA study for the Kovačica, Čibuk, Košava and Alibunar 1 wind farms, it was found that certain species are under impact, as a result of which mitigation measures are being taken to improve the identified effects associated with the operation, but also stages during the construction of turbines. For example, for the Kovačica wind farm[10], a high level of concern was assessed for bird species: harrier, steppe falcon and kestrel, and 18 species of bats that are considered strictly protected; for the "Čibuk 1" wind park[11], due to the proximity of the Deliblatska Peščara Special Nature Reserve, located at 1.5 km, the EIA found that it will have impact on nesting, wintering and migrating of birds, while for the wind farm

[10] EIA Study for the envisaged wind farm Kovačica (2013).

[11] EIA study of the infrastructure complex project of the wind generator field "Čibuk" in Mramork, municipality of Kovin (2012). "InCity" d.o.o. Vetroelektrane Balkana d.o.o. Provincial Secretariat for Urban Planning, Construction and Environmental Protection. Novi Sad.

"Alibunar 1"[12] high level of ecological concern was assessed for the steppe falcon and medium (moderate) level for white stork, European honey buzzard, short-toed snake eagle, field harrier, meadow harrier, lesser spotted eagle, Eastern imperial eagle, booted eagle, kestrel, grey kestrel, falcon, crane, field lark, city swallow and raven.

2.2.8. Impact of solar power plants on changes in land use and visual-aesthetic experience

According to previous research, changes in land use and occupation thereof, along with the visual-aesthetic experience of the landscape, are certainly the two categories that are most susceptible to negative effects of photovoltaic power plants. Change in land use is mainly related to terrain levelling (levelling of surfaces and filling depressions), soil compaction and removal of the surface layer of soil (during the construction of access roads and transformer stations). Also, the required areas for the installation of a photovoltaic power plant vary depending on the geographical location, installed power, chosen technology and the technical solution for installing the panels (fixed panels or those with a mechanism for tracking the movement of the Sun). A photovoltaic power plant with the installed capacity of 1 MW requires approximately 1.7 ha to 2 ha of land. Topography of the terrain and vegetation have direct impact on the visibility of the photovoltaic power plant (those installed on flat terrain and surrounded by forest and other vegetation have a greater potential to reduce the visual-aesthetic impact).

[12] Environmental impact assessment study of the construction of an energy facility for the production of electricity at the "Alibunar 1" wind farm in Banat (2014). EcoLogica Urbo. "WindVision Windfarm A" d.o.o. Kragujevac.

3. GENERAL AND SPECIFIC GOALS OF THE SEA AND SELECTION OF INDICATORS

In order to effectively prepare the SEA Report and evaluate strategic guidelines (development projects), it is extremely important to adequately define the goals and indicators of the environment, i.e., of sustainable development.

Pursuant to Article 14 of the Law on Strategic Environmental Impact Assessment, general objectives and specific goals of the SEA are defined on the basis of requirements and objectives regarding environmental protection in other plans and programmes, environmental protection objectives determined at the level of the Republic and at the international level, collected data on the state of the environment and significant issues, problems and proposals regarding environmental protection in the relevant plan or programme. Based on the defined goals, appropriate indicators are selected to be used in the strategic assessment.

3.1. General objectives and specific goals of the SEA

The general objectives of the Strategic Assessment were prepared based on the state of the environment, strategic issues of environmental protection of importance for the Republic, and goals and requirements in the field of environmental protection from the relevant national sectoral strategic documents.

Based on the requirements and objectives regarding environmental protection specified in the plans and strategies, **general objectives** of the SEA are defined, which predominantly relate to the following areas of the environment:

- protection of main environmental media (air, water, soil),
- sustainable use of natural values,
- conservation of biodiversity, geodiversity and landscape improvement,
- rational use of mineral and energy resources,
- improvement of waste management.

In addition to the area of the environment, general objectives also refer to the protection of cultural and historical heritage, then the population, public health, socio-economic development, as well as to strengthening of institutional capacities for environmental protection.

In order to achieve general objectives, the SEA defines **specific goals** in certain areas of protection. Specific goals are concrete, partly quantified statement of the general objectives given in the form of guidelines for change and actions with the help of which these changes will be achieved. They should provide decision-making subjects with a clear picture of the essential impacts of the Energy Development Strategy on the environment, on the basis of which it is possible to make decisions that serve the purpose of environmental protection and the achievement of the main sustainable development goals.

The SEA specific goals form methodological benchmark through which the effects of the Strategy on the environment are checked, that is, the expected trends in the environment that are expected as a result of the application of the defined strategic guidelines.

3.2. Selection of indicators

Selection of indicators within SEA procedure was made on the basis of the Rulebook on the National list of environmental protection indicators (Official Gazette of RS, No. 37/2011). This set of indicators is based on the concept of "cause-effect-response". "Cause" indicators denote human activities, processes and relationships that affect the environment, "effect" indicators denote the state of the environment, while "response" indicators define political options and other reactions in order to change the "effects" for the environment. The set of indicators reflects the principles and goals of sustainable development.

Indicators are very suitable for measuring and evaluating strategic directions from the aspect of possible damages in the environment and for determining which adverse impacts should be reduced or eliminated. They are an instrument for systematic identification, evaluation and monitoring of the state, development and conditions of the environment, and for the assessment of effects.

The selection of indicators listed in the following table is in accordance with the planned and initiated development projects in the field of energy development, their possible impacts on the quality of the environment and socio-economic characteristics, and will serve for the evaluation of development projects.

Each specific objective of the SEA is assigned one or more indicators (31 in total).

The selection of indicators is aligned with the planning concept and predictions about possible impacts on the quality of the environment. The indicators will serve for the evaluation of strategic guidelines, on one hand, and for monitoring the state of the environment during the implementation of the Energy Development Strategy, on the other.

Table. Selection of general and specific goals of the SEA and selection of relevant indicators

SEA heading	General SEA goals	Specific SEA goals	Indicators
AIR	Protection of air and reduction of impacts on climate change	- Reduce the level of air pollutants	- Emission of acidifying gases (NOx, NH_3 and SO_2) (kt/year) - Frequency of exceeding the daily limit values of SO_2, NO_2, PM_{10} and O_3 (number of days in a year) - Emission of greenhouse gases (CO_2, N_2O, CH_4, SF_6, HFC, PFC) (Gg CO_2eq/year and Gg/year)
WATER	Protection and conservation of water quality	- Reduce pollution of surface and ground water - Mitigate the impact of energy facilities on hydrological regime	- BOD and COD in watercourses that are influenced by energy facilities and activities - Temperature change in watercourses - Change in water quality class (%) - Reused and recycled water as a result of energy sector activities (m^3)
LAND	Protection and sustainable use of land	- - Protection of forest and agicutlural land	- Change in the area of forest land (%) - Change in the area of agricultural land (%) - Management of contaminated sites (number of sites expressed numerically, share expressed in %, rehabilitation and remediation costs expressed in RSD) - Share of degraded areas as a result of energy-related activities (%)
NATURAL VALUES	Protection, conservation and improvement of landscapes, natural values and biodiveristy	- Protection of landscape - Protection of natural goods, biodiversity and geodiversity	- Share of recultivated areas in the total area of degraded land (%) - Change in surfaces of protected areas (%, ha) - Number of energy facilities that affect change of landscape - Area of protected natural areas which can be affected by energy sector activities (ha)
CULTURAL-HISTORICAL GOODS	Protection of cultural and historical heritage	- Protection of cultural and historical facilities and archeological sites	- The number and importance of protected immovable cultural assets that may be influenced by the energy sector

WASTE	Improved waste management	- Improved collection, transport, storage, treatment, reuse and disposal of waste	- Total amount of waste generated in the energy sector (t/year) - Quantities of separated, reused and disposed waste (t/year) - Quantities of special waste streams in the energy sector (t/year)
PUBLIC HEALTH	Protection and improvement of public health	- Reduce the impact of energy sector on human health	- Percentage of population exposed to increased air pollution (%) - Frequency of respiratory diseases (%) in the vicinity of energy facilities - Exposure of population to the effects of development projects in the energy field
SOCIAL DEVELOPMENT	Social cohesion	- Improve life quality of population	- Increase in energy efficiency of residential buildings (%) - Number of displaced households as a result of activities in the energy sector
INSTITUTIONAL DEVELOPMENT	Strengthening institutional capacities for environmental protection	- Institutional development and investment into environmental protection	- Investments and current expenses (thousands of dinars) - Development of the environmental protection management system
ECONOMIC DEVELOPMENT	Fostering economic development	- Stable economic development - Fostering employment of local population	- Employees in the energy sector with income above the RS average (%) - Reduction in the number of the unemployed as a result of employment in the energy sector (%) - Number of development programmemes for environmental protection in the energy sector
TECHNOLOGICAL DEVELOPMENT	Application of modern technologies and use of resources	- Rational use of energy resources - Application of BAT and modern innovative solutions	- Final energy consumption per capita - Share of renewable energy sources in total energy consumption

Table. Markings of the specific SEA goals

No.	SEA specific goals
1.	Reduce the level of air pollutants
2.	Reduce pollution of surface and ground water
3.	Mitigate the impact of energy facilities on hydrological regime
4.	Protection of forest and agricultural land
5.	Protection of landscape
6.	Protection of natural goods, biodiversity and geodiversity
7.	Protection of cultural and historical facilities and archaeological sites
8.	Improved collection, transport, storage, treatment, reuse and disposal of waste
9.	Reduce the impact of energy sector on human health
10.	Improve life quality of population
11.	Institutional development and investment into environmental protection
12.	Stable economic development
13.	Fostering employment of local population
14.	Rational use of energy resources
15.	Application of BAT and modern innovative solutions

4. ASSESSMENT OF POSSIBLE ENVIRONMENTAL IMPACTS

As already pointed out, one of the tasks of making a strategic environmental impact assessment is to assess potential negative impacts of development projects on the quality of environment. However, as the Energy Development Strategy will be a framework for the development of the energy sector of the Republic of Serbia with complex impacts on the environment (both positive and negative ones), the main goal of the SEA is to identify these impacts in relation to the defined SEA goals.

Pursuant to Article 15 of the Law on Strategic Environmental Impact Assessment, the assessment of possible impacts of the plan/programme on the environment contains the following elements:

- presentation of the estimated impacts of variant solutions of the plan and programme favourable from the point of view of environmental protection with a description of measures to prevent and limit negative, i.e., to increase positive impacts on the environment;
- comparison of variant solutions and presentation of the reasons for choosing the most favourable solution;
- presentation of the estimated impacts of the plan and programme on the environment with a description of measures to prevent and limit negative, or increase positive impacts on the environment;
- the way in which environmental factors were taken into account during the impact assessment, including data on: air, water, soil, climate, ionizing and non-ionizing radiation, noise and vibration, plant and animal life, habitats and biodiversity; protected natural assets; population, public health, cities and other settlements, cultural and historical heritage, infrastructural, industrial and other structures, or other created values;
- the way in which the impact characteristics were taken into account during the assessment: probability, intensity, complexity/reversibility, time dimension (duration, frequency, repetition), spatial dimension (location, geographical area, number of exposed inhabitants, transboundary nature of the impact), cumulative and synergistic nature of the impact.

In compliance with the Law, by applying the method of multi-criteria impact assessment, this chapter addressed impact assessment of those strategic guidelines (development projects) which are classified as priorities on one hand, and of those which may have a significant impact on the environment on the other.

4.1. Impact assessment of variant solutions

The Law on Strategic Environmental Impact Assessment does not prescribe what the variant solutions of the Strategy that are subject to strategic impact assessment are, but in practice at least two variants are usually considered:

1) variant of not adopting and implementing the Strategy,
2) option to adopt and implement the Strategy.

Variant solutions of the subject Strategy mean different scenarios of energy development through consideration of the possibility of using certain resources in space for specific purposes and activities. Therefore, the adoption or non-adoption of the strategic document is not the subject of analysis, so SEA will not deal with elaboration of variants of implementing the Strategy and of not implementing the Strategy and continuing the current energy development trends.

In the Strategy, for the purposes of sectoral elaboration and implementation of the set strategic goals, two possible scenarios of the energy development of the Republic of Serbia until 2040 were considered in detail, as follows:

- **The BaU scenario** (Business as Usual) refers to the continuation of current practices in energy production and consumption. The BaU scenario is not a desirable energy development scenario, but in the process of strategic planning it is usually used for referencing, i.e., monitoring progress in the implementation of certain activities or the application of various measures through the intensity and structure of consumption or the use of certain forms of energy;
- **Scenario S** stands for the energy development that this Strategy promotes. Changes in the intensity and structure of energy production and consumption according to the trajectories defined by Scenario S ensure achievement of energy development goals of the Republic of Serbia by 2040. All measures and activities proposed by the Strategy essentially aim at the transformation of the energy sector according to this scenario.

For the above-mentioned reasons, the strategic impact assessment will deal only with variant solutions, i.e., scenarios envisaged by the Strategy:

1. variant A – reference scenario BaU,
2. variant B – scenario S.

It should be noted that the non-adoption or non-implementation of the Strategy and the continuation of current trends does not in any case represent the BaU scenario of the Strategy itself, but a process which, in addition to contradicting the previous Strategy, also contradicts the regulations in the field of environmental protection and internationally adopted obligations, which makes it unsustainable.

Table. Brief overview of variant impacts

Development area	Variants	Development trends
Electric energy system	BaU scenario	According to this scenario, there will be further growth in electricity consumption, which will lead to increased consumption of fossil fuels, increase in the emission of air pollutants, as well as the risk of increased dependence on the import of energy sources and electricity.
	S scenario	Shutdown of thermal blocks and their placement in cold stand-by regime, entry into operation of new modern thermal capacities, construction of two pumped-storage hydro power plants, construction of two gas power plants, as well as strengthening the capacities of transmission and distribution system and infrastructure will directly lead to a reduction of negative environmental impact, reducing the share of coal in electricity production, and lowering import dependence.

Development area	Variants	Development trends
District heating system	BaU scenario	Dominant use of fossil fuels for obtaining thermal energy would be maintained, which causes significant emissions into the air, losses in distribution systems – heat pipelines.
	S scenario	Construction, reconstruction and revitalisation of production and distribution systems would reduce energy losses in the network, significantly reduce energy consumption, which will indirectly lead to a reduced negative impact on the environment.
Renewable energy sources	BaU scenario	Continuation of the slow introduction of renewable energy sources in the production of electricity and heat.
	S scenario	Increasing energy production from renewable energy sources, especially in the wind and solar sector, will lead to a large number of positive effects in terms of reduced import energy dependence, less environmental pollution and development of local economies.
Coal	BaU scenario	Slow improvement of exploitation systems, which will lead to lower exploitation efficiency, greater environmental pollution, closure of certain underground mines, etc.
	S scenario	Continuation of investment construction of open pit mines and completion of the investment cycle in existing mines will ensure a reliable supply of the power system with a reduced environmental impact, greater efficiency of the system, and stable reserve of coal in the event of major energy crises.
Oil	BaU scenario	According to this scenario, the trend of high import dependence will continue, and the existing method of processing will have a large impact on the main environmental media.
	S scenario	Construction of storage capacities, construction of sections of oil pipelines and modernisation of oil refinery will lead to an increase in the security of supply of market with oil derivatives, modernisation of oil processing and production of better quality fuels, thereby reducing the environmental impacts.
Natural gas	BaU scenario	According to this scenario, current practice of using natural gas would continue, but due to inadequate supply system as well as the price, there would be a decrease in household use. Environmental effects of using gas in relation to other energy sources give positive results.
	S scenario	Increasing the capacity for natural gas storage, implementation of additional interconnections of gas pipeline systems with better maintenance and further development of the distribution system will lead to more efficient use of natural gas, reduced lignite consumption and thus a reduction in pollutant emissions into the air.
Efficient use of energy	BaU scenario	Continuation of inefficient use of energy and high energy consumption per unit of product in all sectors of the economy, as well as increased expenses of households for electricity bills.
	S scenario	Better energy efficiency in all sectors of final energy consumption (households, public and commercial sectors, industry, agriculture and transport), as well as renewal of the construction fund will lead to the encouragement of energy

Development area	Variants	Development trends
		management and the increase in the employment of highly educated experts.
Legal framework	BaU scenario	Continued compliance of domestic legislation with EU regulations will lead to the improvement of the management system in energy sector and harmonisation of the area of energy with regulations from the area of environmental protection.
	S scenario	This scenario also envisages drafting and adoption of legal acts in the area of energy and environmental protection, as well as harmonisation with international regulations, so there is no big difference compared to the previous scenario.
Institutional development	BaU scenario	Established institutional framework is satisfactory for the implementation of EU legal norms, there would be a danger of slower improvement of staffing and technical capacities.
	S scenario	Significant improvement of educational, professional and scientific research potential due to available EU funds would enable faster human capacities development in competent authorities, state institutions at all levels, and the civil society sector, which will generate direct benefits in the area of energy and environmental protection.
Socio-economic development	BaU scenario	In this scenario, the real costs will not be acceptable on the market due to insufficiently efficient production and the need to invest in the rehabilitation of space and reconstruction of technologies, which will result in the stagnation of development of the energy sector and quality of life of citizens.
	S scenario	Harmonisation of energy prices with energy policy and the principle of social acceptability is done in responsible manner, more dynamic technical-technological development and innovation, knowledge transfer, which would, along with just energy transition, lead to a transition to new technologies and processes in the energy sector, are envisaged. Also, insisting on energy efficiency measures will have a multiple effect, because it leads to a more rational use of non-renewable and renewable energy resources and introduction of cleaner technologies in the energy sector.

Looking at the assessment of the impact of variant solutions in relation to the objectives of the SEA, the following can be stated:

- variant A – reference scenario BaU, is actually based on the continuation of the so far implemented practice, which will lead to negative implications for the main environmental media, as well as for socio-economic development of the Republic. This variant does not exclude implementation of development projects that have positive impacts on the quality of the environment, but the dynamics of positive trends in the area would not be appropriate;

- variant B – scenario S, implies implementation of a series of measures in accordance with the obligations from the Treaty on the Establishment of the Energy Community, i.e., phasing out of thermal power blocks and increase in the share of renewable energy sources, as well as increase in energy efficiency. As a result of the mentioned

measures, there will inevitably be positive impacts on the quality of the environment and the socio-economic development of the Republic of Serbia.

Based on the above results, it can be concluded that variant B (Scenario S) is significantly more favourable than variant A (Scenario BaU).

4.2. Evaluation of characteristics and significance of impacts

Evaluation of significance of impact is assessed in relation to the size (intensity) of the impact and the spatial scale on which the impact can be realised. The impacts, or effects, of planning solutions, according to the size of the changes, are evaluated with numbers from -3 (negative impacts) to +3 (positive impacts).

Table. Criteria for the assessment of the impact scale

Impact scale	Marking	Description
Critical	**- - -**	Sigificantly burdens spatial capacity
High	**- -**	Damages the environment to a greater extent
Low	**-**	Damages the environment to a lesser extent
No impact	**0**	No direct/unclear envronmental impact
Positive	**+**	Smaller positive changes in the environment
Favourable	**++**	Favourable changes in environment quality
Very favourable	**+++**	Changes significantly improve life quality

Table. Criteria for valuation of spatial range of the impact

Impact scale	Marking	Description
Internaltional	**I**	Possible transboundary impacts
National	**N**	Possible national impact
Regional	**R**	Possible regional impact
Local	**L**	Possible local impact

Table. Assessment of the impact probability scale

Probability	Marking	Description
100%	**HP**	Highly probable
more than 50%	**P**	Probable
less than 50%	**Ps**	Possible
less than 1%	**NP**	Not probable

Additional criteria can be derived according to the duration of the impact, i.e., of the effects, as temporary-occasional (TO) and long-term (LT) effects.

Table. Development priorities in the Strategy that is subject of the present SEA

Sector from the Strategy	Priority activities
Electric energy system	1. Revitalisation of the existing thermal blocks A1 and A2 in TENT A and both blocks in TE Kostolac A. Withdrawal from the network of the remaining four blocks in TPP Kolubara A (until 2030) and consideration of placing TPP Morava in cold stand-by regime or shutdown
	2. Construction of PSHPP "Bistrica" (628 MW) until 2032 and PSHPP "Đerdap 3" (1.800 MW) until 2040
	3. Construction of a gas power plant in Novi Sad (350 MW of electricity and 100 MW of thermal energy) by 2030 and a gas power plant in Niš (150 MW of electricity and 100 MW of thermal energy)
	4. Strengthening the capacity of the transmission and distribution systems and infrastructure
District heating system	5. Construction, reconstruction and revitalisation of production and distribution systems in order to reduce energy losses in the network
	6. Extension of the system for measuring thermal energy consumption by end consumers and implementation of billing according to consumption
Renewable energy sources	7. Increasing the share of RES (especially wind and solar) in the production of electricity and thermal energy. In 2030 minimal total installed power 3.5 GW, minimal total power 10.97 GW in 2040
Coal	8. Continuation of the investment construction of replacement capacities (open pit mines Polje E, Radljevo)
	9. Completion of the investment cycle of the existing surface mines (Tamnava zapadno polje, Drmno, Zapadni Kostolac)
Oil	10. Construction of storage capacities for mandatory reserves of the oil and the oil derivates (until 2026)
	11. Construction of oil pipeline towards Hungary and ensuring a connection with the international Družba oil pipeline as well as the construction of the pipeline system
	12. Modernisation and increasing efficiency of the oil refinery in Pančevo (increasing the product portfolio)
Natural gas	13. Increasing natural gas storage capacity (extension of UGS "Banatski Dvor" to 750 million m^3 and construction of UGS "Itebej")
	14. Ensuring the possibility of natural gas supply by realising additional interconnections with neighbouring transport systems
	15. Construction, regular maintenance and improvement of the transport system and further development of the distribution system
Efficient use of energy	16. Energy renovation of the construction fund and encouragement of the energy management system in the public sector
	17. Improvement of energy efficiency in all sectors of final energy consumption – households, public-commercial sector, industry, agriculture and transport
Legal framework	18. Drafting and adoption of legal acts in the field of energy and harmonisation with international regulations and obligations

Sector from the Strategy	Priority activities
Institutional development	19. Strengthening the institutional and organisational framework for the implementation of EU legal norms
	20. Improvement of staff capacities – educational, professional and scientific research potential of the country
Socio-economic development	21. Energy development as a function of economic growth
	22. Harmonisation of energy and electricity prices with energy policy and principles of market economy and social tolerance
	23. More dynamic technical-technological and scientific-research development and innovation, transfer of knowledge and technology in the field of energy
	24. Just energy transition, social acceptability and sustainability of restructuring measures, transition to new technologies and processes in the energy sector

The assessment of the intensity of the impact, spatial scale of the impact and the probability of impact on the environment and elements of sustainable development are given in the following tables:

Revitalisation of the existing thermal blocks A1 and A2 in TENT A and both blocks in TE Kostolac A. Withdrawal from the network of the remaining four blocks in TPP Kolubara A (until 2030) and consideration of placing TPP Morava in cold stand-by regime or shutdown			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	+++	R	HP
2. Reduce pollution of surface and ground water	+++	R	P
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	++	L	P
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	+	L	P
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	+	L	P
9. Reduce the impact of energy sector on human health	++	R	P
10. Improve life quality of population	+	L	Ps
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+	L	Ps
13. Fostering employment of local population	0		
14. Rational use of energy resources	-	L	P
15. Application of BAT and modern innovative solutions	+++	R	HP

IS – intensity scale, SS – spatial scale, P – probability

Construction of PSHPP "Bistrica" (628 MW) until 2032 and PSHPP "Đerdap 3" (1,800 MW) until 2040			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	---	I	NP
4. Protection of forest and agricultural land	--	I	NP
5. Protection of landscape	--	I	NP
6. Protection of natural goods, biodiversity and geodiversity	--	N	NP
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	I	Ps
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	N	HP
13. Fostering employment of local population	++	L	P
14. Rational use of energy resources	+++	N	HP

15. Application of BAT and modern innovative solutions	+++	N	P

Construction of a gas power plant in Novi Sad (350 MW of electricity and 100 MW of thermal energy) by 2030 and a gas power plant in Niš (150 MW of electricity and 100 MW of thermal energy)			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	+	L	P
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	-	L	Ps
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	L	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	L	HP
13. Fostering employment of local population	+	L	P
14. Rational use of energy resources	++	L	HP
15. Application of BAT and modern innovative solutions	+	L	P

Strengthening the capacity of the transmission and distribution systems and infrastructure			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	-	N	Ps
5. Protection of landscape	-	L	Ps
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	HP
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	N	P
13. Fostering employment of local population	+	L	Ps
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	0		

Construction, reconstruction and revitalisation of production and distribution systems in order to reduce energy losses in the network			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	N	Ps
13. Fostering employment of local population	0		
14. Rational use of energy resources	0		

15. Application of BAT and modern innovative solutions	0		

Extension of the system for measuring thermal energy consumption by end consumers and implementation of billing according to consumption			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	HP
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	0		
13. Fostering employment of local population	0		
14. Rational use of energy resources	+	N	HP
15. Application of BAT and modern innovative solutions	0		

Increasing the share of RES (especially wind and solar) in the production of electricity and thermal energy. In 2030 minimal total installed power 3.5 GW, i.e. minimal total power 10.97 GW in 2040			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	+++	N	HP
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	--	I	Ps
4. Protection of forest and agricultural land	-	L	P
5. Protection of landscape	-	L	NP
6. Protection of natural goods, biodiversity and geodiversity	--	I	Ps
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	++	L	P
9. Reduce the impact of energy sector on human health	+	L	Ps
10. Improve life quality of population	+	N	Ps
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+	N	Ps
13. Fostering employment of local population	+	N	P
14. Rational use of energy resources	+++	N	P
15. Application of BAT and modern innovative solutions	++	N	P

Continuation of the investment construction of replacement capacities (open pit mines Polje E, Radljevo)			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	--	L	Ps
2. Reduce pollution of surface and ground water	---	R	NP
3. Mitigate the impact of energy facilities on hydrological regime	--	R	NP
4. Protection of forest and agricultural land	---	L	NP
5. Protection of landscape	---	L	NP
6. Protection of natural goods, biodiversity and geodiversity	--	L	Ps
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	-	L	Ps
9. Reduce the impact of energy sector on human health	-	L	NP
10. Improve life quality of population	-	L	Ps
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	L	P
13. Fostering employment of local population	++	L	P
14. Rational use of energy resources	--	N	Ps

15. Application of BAT and modern innovative solutions	--	N	Ps

Completion of the investment cycle of the existing surface mines (Tamnava zapadno polje, Drmno, Zapadni Kostolac)			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	--	L	Ps
2. Reduce pollution of surface and ground water	---	R	NP
3. Mitigate the impact of energy facilities on hydrological regime	--	R	NP
4. Protection of forest and agricultural land	---	L	NP
5. Protection of landscape	---	L	NP
6. Protection of natural goods, biodiversity and geodiversity	--	L	M
7. Protection of cultural and historical facilities and archaeological sites	---	N	NP
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	-	L	Ps
9. Reduce the impact of energy sector on human health	-	L	NP
10. Improve life quality of population	-	L	Ps
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	L	P
13. Fostering employment of local population	++	L	P
14. Rational use of energy resources	--	N	Ps
15. Application of BAT and modern innovative solutions	--	N	Ps

Construction of storage capacities for mandatory reserves of the oil and the oil derivates (until 2026)			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	-	L	Ps
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	-	L	P
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	L	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+	N	HP
13. Fostering employment of local population	+	L	Ps
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	0		

Construction of oil pipeline towards Hungary and ensuring a connection with the international Družba oil pipeline as well as the construction of the pipeline system			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	++	H	B
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	-	Л	B
5. Protection of landscape	-	Л	B
6. Protection of natural goods, biodiversity and geodiversity	-	Л	B
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	+	Л	M
10. Improve life quality of population	+	Л	B
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+++	H	BB
13. Fostering employment of local population	+	Л	M
14. Rational use of energy resources	+	P	B

15. Application of BAT and modern innovative solutions	0		

Modernisation and increasing efficiency of the oil refinery in Pančevo (increasing the product portfolio)			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	-	L	P
2. Reduce pollution of surface and ground water	-	L	P
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	0		
13. Fostering employment of local population	+	L	NP
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	++	N	P

Increasing natural gas storage capacity (extension of UGS "Banatski Dvor" to 750 million m3 and construction of UGS "Itebej")			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	++	N	Ps
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	-	L	Ps
5. Protection of landscape	-	L	Ps
6. Protection of natural goods, biodiversity and geodiversity	-	L	Ps
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+++	N	P
13. Fostering employment of local population	++	N	Ps
14. Rational use of energy resources	+	N	HP
15. Application of BAT and modern innovative solutions	0		

Ensuring the possibility of natural gas supply by realising additional interconnections with neighbouring transport systems			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	-	L	NP
5. Protection of landscape	-	L	NP
6. Protection of natural goods, biodiversity and geodiversity	-	L	NP
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	R	Ps
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	R	P
13. Fostering employment of local population	+	L	NP

14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	0		

Construction, regular maintenance and improvement of the transport system and further development of the distribution system			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	++	N	HP
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	+	L	Ps
10. Improve life quality of population	+	L	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+	L	HP
13. Fostering employment of local population	+	L	Ps
14. Rational use of energy resources	+	N	P
15. Application of BAT and modern innovative solutions	0		
Energy renovation of the construction fund and encouragement of the energy management system in the public sector			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	++	N	P
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	+	L	NP
10. Improve life quality of population	+	L	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	0		
13. Fostering employment of local population	+	L	NP
14. Rational use of energy resources	+	L	Ps
15. Application of BAT and modern innovative solutions	0		

Improvement of energy efficiency in all sectors of final energy consumption – households, public-commercial sector, industry, agriculture and transport			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	+	N	HP
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	+	N	Ps
12. Stable economic development	++	N	P
13. Fostering employment of local population	0		
14. Rational use of energy resources	+	N	P

15. Application of BAT and modern innovative solutions	0		

Drafting and adoption of legal acts in the field of energy and harmonisation with international regulations and obligations			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	+++	N	P
2. Reduce pollution of surface and ground water	+++	N	P
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	++	N	P
9. Reduce the impact of energy sector on human health	+	N	Ps
10. Improve life quality of population	+	N	Ps
11. Institutional development and investment into environmental protection	++	L	P
12. Stable economic development	+	N	P
13. Fostering employment of local population	0		
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	0		

Strengthening the institutional and organisational framework for the implementation of EU legal norms			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	+++	N	P
2. Reduce pollution of surface and ground water	+++	N	P
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	++	N	Ps
9. Reduce the impact of energy sector on human health	+	N	NP
10. Improve life quality of population	+	N	Ps
11. Institutional development and investment into environmental protection	++	L	HP
12. Stable economic development	+	N	Ps
13. Fostering employment of local population	0		
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	0		

Improvement of staff capacities – educational, professional and scientific research potential of the country			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	+	N	Ps
12. Stable economic development	+	N	Ps
13. Fostering employment of local population	0		
14. Rational use of energy resources	+	N	Ps

15. Application of BAT and modern innovative solutions	0		

Energy development as a function of economic growth			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+++	N	HP
13. Fostering employment of local population	0		
14. Rational use of energy resources	+	N	P
15. Application of BAT and modern innovative solutions	+	N	Ps

Harmonisation of energy and electricity prices with energy policy and principles of market economy and social tolerance			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	-	N	NP
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	++	N	P
13. Fostering employment of local population	0		
14. Rational use of energy resources	+	N	Ps
15. Application of BAT and modern innovative solutions	0		

More dynamic technical-technological and scientific-research development and innovation, transfer of knowledge and technology in the field of energy			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	+	N	Ps
9. Reduce the impact of energy sector on human health	+	N	Ps
10. Improve life quality of population	+	N	P
11. Institutional development and investment into environmental protection	0		
12. Stable economic development	+++	N	HP

13. Fostering employment of local population	0		
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	++	N	P

Just energy transition, social acceptability and sustainability of restructuring measures, transition to new technologies and processes in the energy sector			
Specific goals	**IS**	**SS**	**P**
1. Reduce the level of air pollutants	0		
2. Reduce pollution of surface and ground water	0		
3. Mitigate the impact of energy facilities on hydrological regime	0		
4. Protection of forest and agricultural land	0		
5. Protection of landscape	0		
6. Protection of natural goods, biodiversity and geodiversity	0		
7. Protection of cultural and historical facilities and archaeological sites	0		
8. Improved collection, transport, storage, treatment, reuse and disposal of waste	0		
9. Reduce the impact of energy sector on human health	0		
10. Improve life quality of population	+	N	Ps
11. Institutional development and investment into environmental protection	+	N	P
12. Stable economic development	0		
13. Fostering employment of local population	0		
14. Rational use of energy resources	0		
15. Application of BAT and modern innovative solutions	0		

4.3. Summary of important impacts of the Strategy

Based on the evaluation of possible impacts, it can be concluded that implementation of the Energy Development Strategy will have a considerable number of strategically significant positive impacts and a smaller number of negative implications in space and the environment. Most of the negative impacts are of a local character in terms of spatial dispersion of impacts.

By shutting down thermal power blocks and placing them in cold stand-by status, significant improvements in the quality of the environment are expected in terms of reducing the emission of harmful substances into the air and negative impacts on water quality. Introduction of modern technologies in thermal power plants will contribute to this. Also, the entry of new thermal power blocks is expected to have positive impacts in the context of encouraging economic development and reducing dependence on energy imports. By increasing the share of renewable energy sources in the production of electricity and heat, positive impacts are expected on the reduction of the emission of harmful substances into the air by increasing, that is, by introducing clean technologies in the energy production process. Construction of the planned two PSHPPs (Bistrica and Đerdap 3) would have a positive impact on stimulating economic development, reducing dependence on energy imports and increasing the use of RES. Implementation of energy efficiency measures will have a positive effect on encouraging economic development. By building additional interconnections (gas pipelines) and product pipelines (oil pipelines), increasing gas storage capacity and building storage capacity for oil derivatives will have a positive impact in terms of encouraging economic development, especially along the corridors of planned regional systems and in the areas of storage capacity. Energy renovation of the building stock and the improvement of energy efficiency can be expected to have positive effects on the reduction of the emission of harmful substances into the air as a result of the reduced need for energy in public sector buildings and individual buildings and households.

Investment construction of replacement capacities and existing surface mines can have significant negative impacts on the quality of air, water (groundwater pollution) and soil,

changes in the appearance of landscape, biodiversity and social implications. Negative implications of renewable energy sources can arise as a consequence of certain projects on some natural resources and biodiversity (wind power plants on ornithofauna and chiropterofauna), as well as landscape change. Certain negative impacts are expected from the construction of the PSHPP Bistrica and the construction of the PSHPP Đerdap 3, the construction of which would have a negative impact on hydrological regime of the subject watercourses, biodiversity and ichthyofauna, a possible change in the use of agricultural and forest land, as well as a landscape change.

4.4. Cumulative and synergistic effects

Pursuant to the Law on Strategic Environmental Impact Assessment (Article 15), strategic assessment should also include the assessment of cumulative and synergistic effects. Significant effects can arise as a result of the interaction between numerous minor impacts of existing facilities and activities and various planned activities in one area.

Cumulative effects occur when individual sectoral solutions do not have a significant impact, while several individual effects together can have a significant effect. In the case of the Strategy, these are certainly large projects in transport sector and industry in areas of intensive energy. Synergistic effects arise from the interaction of individual impacts that produce an overall effect that is greater than the simple sum of individual impacts.

Strategic guidelines in the sectors of energy, district heating system, RES, coal, oil and natural gas, as well as increasing energy efficiency, cumulatively contribute to the health of the population by reducing the emission of pollutants into the environment. Positive cumulative effects for reducing the population's exposure to polluted air are achieved through reconstruction and shut down of thermal power blocks, greater use of renewable energy sources, construction of gas power plants and the continuation of gasification of settlements. An indirect effect will be realised by modernisation of the oil refinery, which will enable use of better quality fuel in traffic. Application of more modern technologies in thermal power plants and in the production of oil derivatives, as well as the increased use of RES and gasification, will contribute to the reduction of soil pollution as a result of the reduction of polluting substances from the air that settle on the ground. The aforementioned development projects in the energy sector will contribute to socio-economic development in various aspects (economic growth, employment in the energy sector, etc.).

At open pit mines where completion of the investment cycle is expected, or at those which will function as replacement capacities, after the shutdown of thermal power blocks and putting them into cold stand-by status, as well as the operation of modernised thermal power blocks, there will be no major exceedances of immission limit values. Bearing in mind that there are other sources of particle emission in these sites (traffic, industrial plants and households), it is possible, due to the cumulative effect, to exceed the ILVs in less favourable meteorological conditions. The emission of SO_2 and NOx from the thermal power block, after the reconstruction in accordance with the directive on combustion plants, will not exceed the emission limit values, but these pollutants will potentially exceed the limit values due to the cumulative effect resulting from the emissions from other sources. The entry of new thermal power blocks into operation, along with the existing capacities, until the shutdown of the existing thermal power blocks, could cumulatively and indirectly affect soil pollution. The increase in the area in the coal sector will affect the decrease in the area of agricultural land. Negative impacts on the landscape and biodiversity are expected from the construction of

hydro power plants and wind power plants. The correction of market prices for electricity with other price increases can cumulatively contribute to the initial (short-term) negative impact on the living standard of the population.

4.5. Description of measures for the prevention and reduction of negative and increase of positive environmental impacts

Environmental protection implies compliance with all general environmental and nature protection measures, as well as regulations established by law. To that end, on the basis of the analysed state of the environment and on the basis of the estimated possible negative impacts, protection measures are defined.

Protection measures aim to reduce the impacts on the environment that will be a consequence of the implementation of development projects within the limits of acceptability, with the aim of preventing threats to the environment and human health. They also serve to ensure that positive influences maintain such a trend. Protection measures enable development and prevent conflicts, which is the function of achieving of sustainable development goals.

Bearing in mind the comprehensiveness of the Energy Development Strategy and the large number of development projects from all areas, only strategically significant and framework measures for preventing and limiting negative impacts on the environment will be given as protection measures. Some of the development projects will be implemented through planning documentation, project documentation or direct implementation, so that there is room for concrete measures depending on specific development project and the conditions that are current at that moment.

General guidelines and safeguards can be defined as:

- Strict implementation of legal regulations related to environmental protection and implementation of assumed international obligations related to the energy sector and environmental protection sector;
- Alignment and adjustment of the legislation of the Republic of Serbia with the EU legislation;
- Application of environmentally acceptable technologies and materials in the implementation of development projects in order to meet emission limit values of pollutants;
- In order to protect the air, it is necessary to undertake complex and appropriate protection measures during the planned exploitation of mineral raw materials, especially coal, with the mandatory use of the best available technologies;
- It is necessary to ensure an accelerated reduction of GHG emissions from plants that hold GHG emissions permits;
- Improving the quality of water in watercourses, primarily through the construction and more efficient operation of wastewater treatment plants in energy facilities;
- Mandatory conservation of surface and ground water quality in accordance with the prescribed class;
- Waste water from the production process must be treated to the prescribed level in accordance with relevant legal regulations before being discharged into the recipient;
- In the case of construction of a new hydrotechnical infrastructure and the expansion of the existing one, all necessary measures should be foreseen in order to prevent significant impacts on the aquatic environment due to pollution or changes in the hydrographic network;

- Implementation of special programmes for examining the condition and quality of land at locations of special interest to the Republic of Serbia;
- Improving the process of identification, assessment, remediation and monitoring of contaminated sites in order to protect human health and the environment;
- Carry out remediation of contaminated mining and energy sites, which implies: implementation of decontamination and remediation procedure of hotspots – contaminated sites, recultivation and remediation of the sites most damaged by the exploitation of mineral resources, and remediation and rehabilitation of polluted watercourses;
- Encouraging the improvement of energy efficiency and increasing the use of cogeneration and RES in the district heating and cooling system in households;
- Encouraging, promoting and implementing energy efficiency projects and using the best available techniques (BAT);
- Optimisation of the national network for monitoring the quality of the environment and the impact of climate change;
- Further expansion of the network for monitoring the quality of environmental factors, as well as the number of monitoring parameters, given that often only basic parameters are collected;
- Increasing the capacity for monitoring meteorological parameters, parameters related to soil and water;
- Implementation of systematic monitoring of the state and quality of land at the state and local level;
- Monitoring and inventory of the state of natural habitats (priority in protected natural assets), as well as the creation of a digital map of habitat types in accordance with the EUNIS classification (European Nature Information System);
- Raising capacity by organising training courses and increasing the number of employees in monitoring institutions;
- Improvement of the information system and the national register of sources of environmental pollution;
- Implementation of communication, education and support activities for the implementation of the INSPIRE Directive and the activities of the National Geospatial Data Infrastructure;
- Strengthening institutions through the development and implementation of programmes for professional development;
- Improving the process of information exchange and consultation between state administration bodies, public companies and local self-governments;
- Improvement of environmental reporting, communication and dissemination systems;
- Raising the capacity of interested parties and exercising the right to participate in decision-making processes on environmental issues;
- Support for further development of formal and informal education for the environment.

5. GUIDELINES FOR THE DEVELOPMENT OF SEAs AT LOWER HIERARCHICAL LEVELS AND EIAs

Compliant with Article 16 of the Law on Strategic Environmental Impact Assessment, the SEA Report contains detailed guidelines for plans or programmes at lower hierarchical levels, which include defining the need for strategic assessments and assessments of the impact of projects on the environment, which determine aspects of environmental protection and other issues of importance for environmental impact assessment of plans and programmes of a lower hierarchical level.

The development of the Energy Development Strategy will be carried out by the Programme for the Implementation of the Energy Development Strategy of the Republic of Serbia, for which it will be necessary to create a Strategic Environmental Impact Assessment in order to assess the impact of activities at a more detailed location level and with elements of technical and technological nature.

In addition to the above, for all capital energy installations planned by the Strategy: pumped-storage hydro power plants, hydro power plants, planned cogeneration plants, large-capacity transmission and distribution networks, oil and gas storages, product pipelines, etc., it is necessary to prepare appropriate planning documents for which it is necessary to prepare a Strategic Environmental Impact Assessment. Moreover, preparation of planning documents is also required for energy facilities that use renewable energy sources and are grouped in the same area and whose spatial impact exceeds local level, and preparation of a Strategic Environmental Impact Assessment is foreseen wherever there may be cumulative and synergistic impacts.

Study on Environmental Impact Assessment may be required at the level of project-technical documentation for individual energy facilities planned by the Strategy, pursuant to the provisions of the Law on Environmental Impact Assessment (Official Gazette of RS, No. 135/04 and 36/09). The project proponent is, in compliance with Article 8 of the aforementioned Law, obliged to address the authority competent for environmental protection with a Request to determine the need to prepare an Environmental Impact Assessment Study for individual projects, in accordance with the Law on Environmental Protection (Official Gazette of RS, No. 135/04, 36/09 and 72/09 – 43/11 – Constitutional Court, 14/16, 76/18 and 95/18 – state law), Rulebook on content studies on environmental impact assessment (Official Gazette of RS, No. 69/2005), and the Regulation on determining the List of projects for which an impact assessment is mandatory and the List of projects for which an environmental impact assessment can be requested (Official Gazette of RS, No. 114/08).

6. MONITORING PROGRAMME FOR THE STRATEGY IMPLEMENTATION

The programme for monitoring the state of the environment – monitoring system is an important prerequisite for achieving the goals in the field of nature and environmental protection, i.e., the SEA goals in the implementation of the Energy Development Strategy. The task of monitoring is to show the changes in the environment that may arise from the implementation of the Development Strategy, to propose possible measures to reduce or mitigate negative effects if they occur, and collect basic information on the quality of elements for reports on the state of the environment and other strategic and planning documents that require the preparation of a SEA.

Pursuant to Article 17 of the Law on Strategic Environmental Impact Assessment, the environmental monitoring programme for the implementation of the Strategy contains:
- description of the objectives of the plan and programme;
- indicators for monitoring the state of the environment;
- rights and obligations of competent authorities;
- action in the event of accidental situations.

Pursuant to the Law on Environmental Protection (Official Gazette of RS, No. 135/04, 36/09, 72/09, 43/11 – decision of the Constitutional Court, 14/16, 76/18, 95/18), the Republic, Autonomous Province, local self-government units shall ensure continuous control and monitoring of the state of the environment in accordance with this and special laws within their jurisdiction established by the Law. The Government of the RS adopts the monitoring programme based on special laws for a period of two years for the territory of the Republic, and the local self-government unit adopts a programme for monitoring the state of the environment in its territory, which must be harmonised with the aforementioned Government programme.

6.1. Description of the Strategy objectives and goals

The description of the objectives of the Energy Development Strategy, both general and specific, is detailed in the chapter on the *Starting points of the strategic assessment* in the introductory part of the SEA Report.

The vision proposed and promoted by the Strategy is for the Republic of Serbia to be energy secure in 2050 and for its energy sector to be carbon neutral. In accordance with the vision, the *general objective* is defined: ensuring a safe and affordable supply of energy and energy products for the population and the economy, with a progressive reduction of greenhouse gas emissions and other negative impacts on the environment and human health.

The strategy sets *specific development goals* by energy sector, defined as:

- Secure supply of electricity to the domestic market,
- Continuous reduction of greenhouse gas emissions,
- Increasing the use of renewable energy sources,
- Maintaining energy independence,
- Safe and efficient supply of thermal energy,

- Long-term sustainable operations of energy entities,
- Harmonisation of the institutional and improvement of the regulatory framework,
- Greater use of RES for the production of electricity and heat,
- Greater use of renewable energy sources in traffic,
- Involvement of citizens in the energy transition through the "prosumer" concept,
- Improvement of energy efficiency in all consumption sectors,
- Development of the natural gas market,
- Diversification of sources and directions of supply,
- Ensuring a secure supply of oil and oil derivatives that meet EU standards,
- Secure and reliable supply of thermal energy capacities,
- Provision of coal in the required quantity and quality for final consumption and for the production of thermal energy.

The basic task of drafting the Environmental Monitoring Programme is to ensure, *inter alia*, timely response and warning to possible negative processes, as well as a more complete insight into the state of environmental elements. This especially applies to localities where energy facilities exist or are planned.

Pursuant to Article 69 of the Law on Environmental Protection, the objectives of the Environmental Monitoring Programme would be:

- providing monitoring,
- defining the content and method of monitoring,
- determination of authorised organisations for monitoring,
- defining the monitoring of polluters,
- establishing an information system and defining the method of data delivery,
- introducing the obligation to report on the state of the environment according to the prescribed content of the report on the state of the environment.

It is important to point out that monitoring is carried out by monitoring the values of indicators, that is, by monitoring negative impacts on the environment, the state of the environment, measures and activities undertaken in order to reduce negative impacts and raise the level of environmental quality.

6.2. Indicators for environmental monitoring

Monitoring is carried out by systematic measurement, testing and assessment of indicators of the state and pollution of the environment, which includes monitoring of natural factors, i.e., changes in the state and characteristics of the environment, including cross-border monitoring, namely: air, water, soil, forests, biodiversity, flora and fauna, climate elements, ozone layer, ionizing and non-ionizing radiation, noise, waste, early warning of accidents with monitoring and assessment of the development of environmental pollution, as well as obligations assumed from international agreements.

The following table shows the indicators that provide information or describe phenomena in the area of the environment by SEA headings.

SEA heading	Indicators

AIR	- Emission of acidifying gases (NOx, NH_3 and SO_2) (kt/year) - Frequency of exceeding the daily limit values of SO_2, NO_2, PM_{10} and O_3 (number of days in a year) - Emission of greenhouse gases (CO_2, N_2O, CH_4, SF_6, HFC, PFC) (Gg CO_2eq/year and Gg/year)
WATER	- BOD and COD in watercourses that are influenced by energy facilities and activities - Temperature change in watercourses - Change in water quality class (%) - Reused and recycled water as a result of energy sector activities (m^3)
LAND	- Change in the area of forest land (%) - Change in the area of agricultural land (%) - Management of contaminated sites (number of sites expressed numerically, share expressed in %, rehabilitation and remediation costs expressed in RSD) - Share of degraded areas as a result of energy-related activities (%)
NATURAL VALUES	- Share of recultivated areas in the total area of degraded land (%) - Change in surfaces of protected areas (%, ha) - Number of energy facilities that affect change of landscape - Area of protected natural areas which can be affected by energy sector activities (ha)
CULTURAL-HISTORICAL GOODS	- The number and importance of protected immovable cultural assets that may be influenced by the energy sector
WASTE	- Total amount of waste generated in the energy sector (t/year) - Quantities of separated, reused and disposed waste (t/year) - Quantities of special waste streams in the energy sector (t/year)
PUBLIC HEALTH	- Percentage of population exposed to increased air pollution (%) - Frequency of respiratory diseases (%) in the vicinity of energy facilities - Exposure of population to the effects of development projects in the energy field
SOCIAL DEVELOPMENT	- Increase in energy efficiency of residential buildings (%) - Number of displaced households as a result of activities in the energy sector
INSTITUTIONAL DEVELOPMENT	- Investments and current expenses (thousands of dinars) - Development of the environmental protection management system
ECONOMIC DEVELOPMENT	- Employees in the energy sector with income above the RS average (%) - Reduction in the number of the unemployed as a result of employment in the energy sector (%) - Number of development programmemes for environmental protection in the energy sector
TECHNOLOGICAL DEVELOPMENT	- Final energy consumption per capita - Share of renewable energy sources in total energy consumption

The criteria for determining the number and distribution of measuring points, the network of measuring points, the scope and frequency of measurements, classification of monitored phenomena, working methodology and indicators of environmental pollution and their monitoring, deadlines and the method of data submission, are defined by the Government of the RS by virtue of special laws.

In accordance with legal regulations, regular sampling and reading or laboratory analysis of samples are carried out in a certain time interval and then, based on the defined limit values, the impact on the examined environmental factors is determined.

Air quality monitoring is achieved by systemically measuring concentrations of pollutants in the air, monitoring and researching the impact of air quality on the environment and reporting on the results of measurement, monitoring and research. The Law on Air Protection (Official Gazette of the RS, No. 36/09, 10/13 and 26/21) and the Regulation on monitoring conditions and air quality requirements (Official Gazette of the RS, No. 11/10, 75 /10 and 63/13), guidelines for research, monitoring and determination of the general state of air pollution in populated areas and unpopulated areas are provided. On the basis of the performed analyses, the state and trends are determined, on the basis of which appropriate air protection measures are taken.

Surface water quality monitoring is carried out in accordance with the Regulation on limit values of pollutants in surface and underground waters and sediment and deadlines for reaching them (Official Gazette of RS, No. 50/2012), Regulation on limit values of priority and priority hazardous substances that pollute surface waters and deadlines for their achievement (Official Gazette of RS, No. 24/2014) and the Rulebook on parameters of the ecological and chemical status of surface waters and parameters of the chemical and quantitative status of groundwater (Official Gazette of RS, No. 74 /2011).

Ground water monitoring is carried out in accordance with the Regulation on limit values of polluting substances in surface and underground waters and sediment and deadlines for reaching them (Official Gazette of the RS, No. 50/12) and the Regulation on limit values of polluting, harmful and dangerous substances in land (Official Gazette of RS, No. 30/2018).

Waste water quality monitoring is carried out in accordance with the Regulation on limit values for the emission of pollutants into water and deadlines for their achievement (Official Gazette of RS, No. 67/2011, 48/2012 and 1/2016) and in accordance with the Rulebook on the method and conditions for measuring the quantity and testing the quality of waste water and the content of the report on the performed measurements (Official Gazette of RS, No. 33/2016).

Soil monitoring is carried out according to the Law on Soil Protection (Official Gazette of RS, No. 112/15) and in accordance with the Regulation on limit values of polluting, harmful and hazardous substances in the soil (Official Gazette of the RS, No. 30/2018).

Noise monitoring is carried out in accordance with the Law on Protection from Noise in the Environment (Official Gazette of RS, No. 36/09, 88/10 and 96/21), the Rulebook on noise measurement methods, content and scope of environmental noise measurement reports (Official Gazette of the RS, No. 139/22) and the Regulation on noise indicators, limit values, methods for evaluating noise indicators, disturbance and harmful effects of environmental noise (Official Gazette of RS, No. 75/10).

Waste monitoring shall be carried out in accordance with the Law on Waste Management (Official Gazette of the RS, No. 36/2009, 88/2010 and 14/2016), the Rulebook on the form of the document on the movement of waste and the instructions for filling it in (Official Gazette of RS, No. 72/09, 114/13) and the Rulebook on the form of the document on the movement of

hazardous waste, the form of the preliminary notification, the method of their delivery and the instructions for filling them in (Official Gazette of the RS, No. 17/2017).

6.3. Rights and duties of competent authorities

When it comes to the rights and duties of competent authorities in connection with environmental monitoring, they emanate from the Law on Environmental Protection, i.e., Articles 69-78 of the Law. According to the mentioned articles, the rights and duties of competent authorities are:

1. The Government adopts a monitoring programme for a period of two years,
2. Local self-government unit adopts a monitoring programme on its territory, which must be in accordance with the Government's programme,
3. The Republic and the local self-government unit provide financial resources for monitoring,
4. The Government determines the criteria for determining the number of places and the layout of measuring places, the network of measuring places, the scope and frequency of measurements, the classification of monitored phenomena, the work methodology and indicators of environmental pollution and their monitoring, deadlines and the method of data submission.
5. Monitoring can only be performed by an authorised organisation. The Ministry prescribes more detailed conditions that must be met by an authorised organisation and designates an authorised organisation after previously obtaining the consent of the minister responsible for a certain area.
6. The Government determines the types of emissions and other phenomena that are the subject of pollutant monitoring, the methodology of measurement, taking samples, the method of recording, deadlines for submitting and storing data,
7. State authorities, i.e. organisations and local self-government, authorised organisations and polluters are obliged to submit monitoring data to the Environmental Protection Agency in the prescribed manner,
8. The Government prescribes in more detail the content and way of managing the information system, methodology, structure, common bases, categories and levels of data collection, as well as the content of information about which the public is regularly and mandatorily informed,
9. The information system is run by the Environmental Protection Agency,
10. The Minister prescribes the methodology for the creation of an integral cadastre of pollutants, as well as the type, methods, classification and deadlines for submitting data,
11. Once a year, the Government submits to the National Assembly a report on the state of the environment in the Republic,
12. The competent body of local self-government submits a report to the assembly on the state of the environment in its territory once every two years.
13. Reports on the state of the environment are published in the official gazettes of the Republic and local self-government units.

State authorities, local self-government units and authorised and other organisations shall regularly, timely, fully and objectively inform the public about the state of the environment, i.e., about phenomena monitored within the framework of immission and emission monitoring, as well as warning measures or the development of pollution that may pose a danger to human life and health, in accordance with the Law on Environmental Protection and

other regulations. Also, the public has the right to access prescribed registers or records containing information and data in accordance with this law.

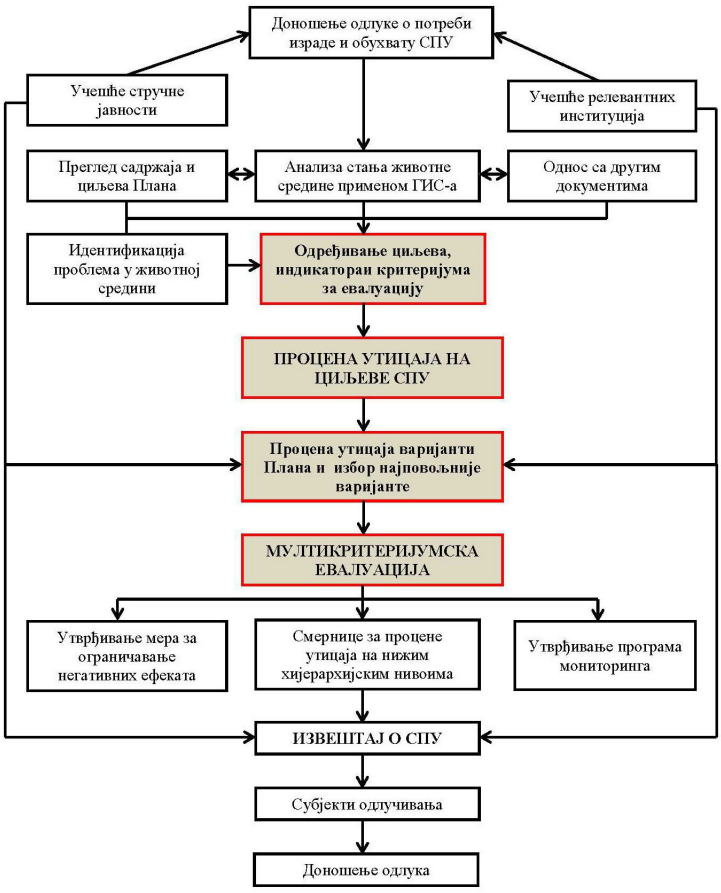
7. METHODOLOGY USED IN THE DEVELOPMENT OF SEA

7.1. Methodolgy for the development of SEA

The content of the strategic environmental impact assessment and the methodological framework for its preparation and procedures are defined by the Law on Strategic Environmental Impact Assessment and the Law on Environmental Protection.

For the preparation of the Strategic Assessment in this particular case, a methodology based on multi-criteria expert evaluation of planning solutions was applied in relation to the defined goals of the SEA and associated indicators, as a basis for the valorisation of space for further sustainable development.

The Energy Development Strategy has explored and defined the goals that need to be achieved, as well as the measures that need to be taken in order to move faster towards the decarbonisation of the energy sector and the economy as a whole. Objectives, goals, measures and activities are defined for the energy sector as a whole, but also for each area of energy separately, taking into account the integrated development of individual energy sub-sectors, as well as the sectors of the economy with which they are connected. In relation to the set objectives and development projects of the Strategy, specific goals of the SEA have been set and indicators for assessing the impact of strategic solutions on environmental elements, socio-economic development and institutional framework defined.



When it comes to methodological framework, the SEA was developed with prior analysis of the starting point in accordance with the Law on Strategic Environmental Impact Assessment, with special reference to the current state of the environment in the territory of the Republic of Serbia. Also, special attention was paid to environmental media in areas where capital systems of the energy sector are present. After that, variant solutions (scenarios) and strategic guidelines (development projects) were evaluated in relation to defined goals and indicators. Based on the results of the evaluation, guidelines for environmental protection and environmental monitoring during the implementation of the Energy Development Strategy were defined.

7.2. Challenges in the development of SEA

Lack of data for the analysis of the current state of the environment presented certain difficulties in the preparation of the SEA. Existing available data published by relevant state institutions in the form of annual reports have not been updated and refer to the period of a year or more ago, and do not include all environmental parameters that would contribute to a more comprehensive assessment of the state of the environment.

A systemic problem, which does not apply to this SEA only, but to all strategic assessments that are made for plans, programmes and strategies, is the absence of a system of environmental assessment indicators that would correspond to the strategic planning process, i.e., which could be used in the SEA process with high reliability. The situation is similar with the criteria for evaluating the selected indicators.

The basis for the drafting of the SEA Report was draft Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050.

8. DECISION-MAKING PROCESS

Bearing in mind strategic framework of the document and the importance of possible impacts of the proposed Energy Development Strategy on the environment, socio-economic development and human health, it is extremely important to ensure adequate and transparent involvement of all interested parties in the decision-making process on environmental protection issues.

Article 18 of the Law on Strategic Environmental Impact Assessment prescribes participation of relevant authorities and organisations, who can provide their opinion within 30 days.

Before submitting the request for approval of the SEA Report, the authority responsible for the preparation of the Strategy shall ensure public participation in the consideration of the SEA Report. The authority responsible for the preparation of the Strategy informs the public about the method and deadlines for reviewing the contents of the Report and for providing the opinions, as well as the time and place of the public hearing in compliance with the Law.

Participation of competent authorities and organisations is ensured in writing and through presentations and consultations in all stages of drafting and consideration of the SEA. Participation of the interested public and the non-governmental sector is ensured through means of public information and within the framework of the public presentation of the SEA, and all objections and comments are also submitted in writing.

The authority responsible for the preparation of the Strategy prepares a Report on the participation of interested authorities and organisations and the public, which contains all opinions on the SEA, as well as opinions expressed during public presentation and public discussion. The SEA Report is submitted together with the report on expert opinions and public discussion to the authority responsible for environmental protection for evaluation. The authority responsible for environmental protection gives its consent to the SEA Report within 30 days from the day of receipt of the request for evaluation.

9. CONCLUSIONS OF THE REPORT ON STRATEGIC ENVIRONMENTAL IMPACT ASSESSMENT

The Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050, for which the Strategic Environmental Impact Assessment is being prepared, is the main document that defines energy policy and plans the development in the energy sector. Strategic environmental impact assessment is an instrument that should integrate the goals and principles of sustainable development into the Strategy, taking into account the need to avoid or limit negative impacts on the environment and socio-economic development of the Republic of Serbia.

Decarbonisation of the energy sector is of key importance for the energy security of the Republic of Serbia. The strategy follows the path along which the reform of the energy sector will take place and the process of energy transition will be implemented. Key determinants of that path are significantly greater use of renewable energy sources and more intensive application of energy efficiency measures.

The goal of the Strategic Environmental Impact Assessment Report for the subject Energy Development Strategy was to assess potential significant impacts of development projects on the quality of the environment and the socio-economic aspect of development, as well as to prescribe appropriate measures to reduce negative impacts.

The Strategic Environmental Impact Assessment of the Energy Development Strategy of the Republic of Serbia analysed current state of the environment with special reference to areas threatened by energy activities. The importance and characteristics of the Strategy were also analysed, the impact of the planned priority development projects and other issues and challenges of environmental protection were assessed. In that process, a strategic approach was dominantly applied, which looks at trends that may arise as a result of activities in the energy sector, as well as development scenarios in the energy sector.

In addition, from the aspect of environmental protection and economy in the energy sector, two scenarios were evaluated. As a result, there is a need to insist on the implementation of Scenario S (in which the proposed measures and activities are essentially aimed at transformation of the energy sector and changes in the intensity and structure of energy production and consumption), which within the SEA was assessed as significantly more favourable than Scenario BaU, which refers to the continuation of current practices in energy production and consumption.

As part of the Strategic Environmental Impact Assessment, 15 specific goals and 31 indicators were defined to assess sustainability of the Strategy. The selection of indicators is aligned with the planning concept and predictions about possible impacts on the quality of the environment. In addition, specific goals will serve for the evaluation of development projects and indicators for monitoring the state of the environment during the implementation of the Energy Development Strategy. The multi-criteria evaluation process included 24 development projects planned by the Strategy, which were evaluated based on the criteria of size of impact, spatial scale of possible impacts and probability of impact.

The Strategic Environmental Impact Assessment included development of matrices for multi-criteria evaluation of defined development projects in relation to defined special goals and

indicators. This was followed by the assessment of possible cumulative and synergistic effects of the development projects.

The results of the assessment pointed to the fact that the implementation of the Strategy generates a number of strategically significant positive implications in space and the environment and potentially several negative impacts on environmental media.

Bearing in mind the comprehensiveness of the Energy Development Strategy and a large number of development projects from all areas, strategically significant and framework protection measures were proposed in order to prevent and limit negative impacts on the environment. Defined protection measures create a prerequisite for the implementation of development projects to be decided on the basis of a whole series of procedures that can be used to determine and quantitatively express the expected changes in the environment in the event of their implementation.

Some of the development projects will be implemented through planning documentation, project documentation or in direct implementation, so that was left to specify the measures depending on the individual development project and the conditions in place at that moment.

Additional support for the efficiency of the defined strategic protection measures is provided by a system of monitoring the state of the environment, which is realised by systematic measurement, examination and assessment of indicators of the state and pollution of the environment, which includes the monitoring of natural factors, i.e., changes in the state and characteristics of the environment, as defined by the SEA.

The applied methodology for the preparation of the SEA is described in the previous chapter and is in accordance with the assumptions defined in the Law on Strategic Environmental Impact Assessment, which determined the content of the Report.

Summarising all the above, the conclusion of the Strategic Environmental Impact Assessment Report is that the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050 can be considered acceptable from the perspective of possible environmental impacts with the implementation of defined environmental protection measures, monitoring and elaboration of instruments for the protection of development projects at lower hierarchical levels.