

REPUBLIC OF SERBIA

SECURITY OF SUPPLY STATEMENT

2024

2026.

TABLE OF CONTENTS

1. INTRODUCTION	1
1.1. LEGISLATIVE AND REGULATORY FRAMEWORK OF THE ENERGY SECTOR IN THE REPUBLIC OF SERBIA	1
1.2. INSTITUTIONAL FRAMEWORK GOVERNING THE ENERGY SECTOR.....	4
1.3. WORKING GROUP ON SECURITY OF SUPPLY.....	6
1.4. DECREES ON THE CONDITIONS FOR THE SUPPLY OF ELECTRICITY AND NATURAL GAS, AND OTHER ACTS REGULATING ENERGY AND ENERGY SOURCES SUPPLY SECURITY IN THE REPUBLIC OF SERBIA.....	6
1.4.1. Decree on Conditions for Electricity Delivery and Supply	6
1.4.2. Decree on Energy-Vulnerable Customers.....	7
1.4.3. Decree on the Network Code on the Connection of Power Generation Units to the Grid.....	8
1.4.4. Decree on Network Code Related to the Connection of Customer Facilities to the Grid	8
1.4.5. Decree on the Network Code Related to the Connection of High Voltage Direct Current Systems to the Grid	8
1.4.6. Decree on Transmission Capacity Allocation and Congestion Management	8
1.4.7. Decree on the Incentive Fee for Eligible Electricity Producers.....	8
1.4.8. Decree on the Market Premium and Feed-in Tariff.....	9
1.4.9. Decree on the Conditions for the Delivery and Supply of Natural Gas	10
1.4.10. Decree on Establishing the Preventive Action Plan to Ensure the Security of Natural Gas Supply	11
1.4.11. Decree on Establishing the Emergency Plan to Ensure the Security of Natural Gas Supply.....	11
1.4.12. Decree on Network Code for Balancing the Natural Gas Transmission System	11
1.4.13. Decree on Network Code for Congestion Management Procedures and Publication of Data and Technical Information for Access to the Natural Gas Transmission System.....	11
1.4.14. Decree on Network Code Related to the Calculation and Allocation of Natural Gas Transmission Capacity.....	11
1.4.15. Decree on Network Code on Harmonized Tariffs for Natural Gas Transmission	12
1.4.16. Decree on Network Code for the Cooperation of Transmission System Operators and Rules for Data Exchange for the Operation of Interconnected Gas Transmission Systems	12
1.4.17. Law on Commodity Reserves	12
1.4.18. Decree on the Establishment of the Program of Measures in Case of Threats to the Security of Energy and Energy Sources Supply – Crisis Plan	12
1.4.19. Decree on Operational Reserves of Petroleum Products, Coal and Other Energy Sources	13
2. STRUCTURE OF THE ENERGY SECTOR	14
2.1. CRUDE OIL AND PETROLEUM PRODUCTS SECTOR.....	14
2.2. NATURAL GAS SECTOR	16
2.3. COAL SECTOR	17

2.4.	ELECTRICITY SECTOR.....	18
2.5.	THERMAL ENERGY SECTOR.....	18
2.6.	RENEWABLE ENERGY SECTOR	19
2.7.	ENERGY RESOURCES	20
3.	ELECTRICITY	22
3.1.	ELECTRICITY MARKET	23
3.1.1.	<i>Participants in the Electricity Market</i>	<i>24</i>
3.1.2.	<i>Bilateral Electricity Market.....</i>	<i>25</i>
3.1.3.	<i>Balancing Electricity Market.....</i>	<i>31</i>
3.1.4.	<i>Organized Electricity Market</i>	<i>33</i>
3.2.	ELECTRICITY PRODUCTION, TRANSMISSION AND DISTRIBUTION CAPACITIES.....	35
3.2.1.	<i>Electricity Production Capacities.....</i>	<i>35</i>
3.2.2.	<i>Transmission Capacities.....</i>	<i>39</i>
3.2.3.	<i>Distribution Capacities.....</i>	<i>42</i>
3.3.	SCOPE AND QUALITY OF MAINTENANCE OF PRODUCTION CAPACITIES, TRANSMISSION AND DISTRIBUTION SYSTEMS.....	43
3.3.1.	<i>Maintenance of Production Capacities</i>	<i>43</i>
3.3.2.	<i>Transmission System Maintenance.....</i>	<i>47</i>
3.3.3.	<i>Distribution System Maintenance.....</i>	<i>48</i>
3.4.	SECURITY ASSESSMENTT OF TRANSMISSION AND DISTRIBUTION SYSTEM OPERATION.....	49
3.4.1.	<i>Security Assessment of Transmission System Operation</i>	<i>49</i>
3.4.2.	<i>Assessment for Distribution System Security.....</i>	<i>51</i>
3.5.	MECHANISMS FOR CONGESTION MANAGEMENT IN TRANSMISSION AND DISTRIBUTION SYSTEMS IN ACCORDANCE WITH THE TREATY ESTABLISHING THE ENERGY COMMUNITY AND THE RULES OF EUROPEAN TRANSMISSION SYSTEM OPERATOR ASSOCIATIONS.....	52
3.5.1.	<i>Mechanisms for Congestion Management in Transmission Systems.....</i>	<i>52</i>
3.5.2.	<i>Mechanisms for Congestion Management in Distribution Systems.....</i>	<i>53</i>
3.6.	DATA ON THE MEASURES TO COVER PEAK DEMAND, AS WELL AS MEASURES TAKEN IN THE EVENT THAT ONE OR MORE SUPPLIERS DO NOT PROVIDE SUFFICIENT QUANTITIES OF ELECTRICITY	54
3.7.	DATA ON THE PROGRESS OF CONSTRUCTION OF FACILITIES FOR ELECTRICITY GENERATION, TRANSMISSION, AND DISTRIBUTION	55
3.7.1.	<i>Electricity Generation</i>	<i>55</i>
3.7.2.	<i>Transmission System</i>	<i>55</i>
3.7.3.	<i>Distribution System</i>	<i>61</i>
3.8.	DATA ON THE PLANNED CONSUMPTION AND PRODUCTION OF ELECTRICITY, AS WELL AS THE METHOD OF SECURING THE MISSING QUANTITIES FOR THE NEXT FIVE-YEAR PERIOD.....	65
3.8.1.	<i>Realized Consumption and Production</i>	<i>65</i>
3.8.2.	<i>Method of Ensuring the Missing Quantities of Electricity for the Next Five-Year Period.....</i>	<i>69</i>
3.9.	SUPPLY FORECAST FOR THE NEXT FIVE TO TEN YEARS	71
3.10.	DATA ON INVESTMENTS IN ELECTRICITY GENERATION CAPACITIES.....	72
3.11.	DEVELOPMENT PLAN AND INVESTMENTS FOR THE TRANSMISSION SYSTEM FOR THE NEXT TEN YEARS, INCLUDING THE CONSTRUCTION OF INTERCONNECTION TRANSMISSION LINES.....	76

3.12.	DEVELOPMENT AND INVESTMENT PLAN FOR THE DISTRIBUTION SYSTEM FOR THE NEXT THREE TO TEN YEARS	79
3.13.	REGIONAL, NATIONAL AND EUROPEAN GOALS OF SUSTAINABLE DEVELOPMENT, INCLUDING INTERNATIONAL PROJECTS	82
4.	NATURAL GAS.....	85
4.1.	NATURAL GAS MARKET	85
4.2.	TRANSMISSION SYSTEM.....	88
4.2.1.	<i>Assessment of the Operational Security of the Transmission System</i>	<i>89</i>
4.3.	DISTRIBUTION SYSTEM.....	90
4.3.1.	<i>Assessment of the Operational Security of the Distribution System</i>	<i>91</i>
4.4.	STORAGE OF NATURAL GAS.....	95
4.5.	SECURITY OF SUPPLY	97
4.5.1.	<i>Planned Production and Consumption of Natural Gas and Method of Ensuring Missing Quantities for the Next Five-Year Period</i>	<i>97</i>
4.5.2.	<i>Measures for Covering Peak Demand and Actions Taken in Case One or More Suppliers Fail to Provide Sufficient Quantities of Natural Gas</i>	<i>102</i>
4.5.3.	<i>Quality and Maintenance Level of Energy Facilities</i>	<i>103</i>
4.5.4.	<i>Incentive Measures for New Investment in Exploration, Production, Transmission, and Storage of Natural Gas</i>	<i>104</i>
4.5.5.	<i>Plans for the Construction of Energy Facilities to Ensure the Security of Natural Gas Supply.....</i>	<i>104</i>
4.5.6.	<i>Preventive Action Plan and Emergency Plan for Ensuring the Security of Natural Gas Supply.....</i>	<i>107</i>
5.	CRUDE OIL AND PETROLEUM PRODUCTS.....	109
5.1.	PRODUCTION, IMPORT, EXPORT AND CONSUMPTION OF CRUDE OIL AND PETROLEUM PRODUCTS.....	109
5.1.1.	<i>Crude Oil.....</i>	<i>109</i>
5.1.2.	<i>Petroleum Products.....</i>	<i>110</i>
5.2.	SECURITY OF SUPPLY OF OIL AND PETROLEUM PRODUCTS.....	114
5.2.1.	<i>Balance of Crude Oil and Petroleum Products for 2025 – Plans</i>	<i>114</i>
5.2.2.	<i>Measures Taken in Case of Threats to the Security of Oil and Petroleum Products Supply.....</i>	<i>115</i>
5.3.	TECHNICAL AND OTHER REQUIREMENTS THAT MUST BE MET BY LIQUID FUELS OF PETROLEUM ORIGIN AND LIQUEFIED PETROLEUM GAS.....	118
5.4.	DATA ON OIL INFRASTRUCTURE	119
5.4.1.	<i>The Refineries in Novi Sad and Pančevo</i>	<i>119</i>
5.4.2.	<i>Oil Pipeline Operated by Transnafta JSC.....</i>	<i>120</i>
5.4.3.	<i>Oil Pipelines Operated by NIS JSC.....</i>	<i>120</i>
5.4.4.	<i>Petroleum Product Pipelines in the Republic of Serbia</i>	<i>121</i>
5.4.5.	<i>The Terminals for Crude Oil.....</i>	<i>121</i>
5.4.6.	<i>Storage of Petroleum Products</i>	<i>121</i>
5.4.7.	<i>Fuel Supply Stations for Transport Vehicles – Number and Structure</i>	<i>122</i>
5.5.	INVESTMENT PLAN IN OIL INFRASTRUCTURE.....	122

5.5.1.	<i>Overview of the Technological Safety of the Oil System, Quality and Maintenance of Oil and Petroleum Products Transport Networks (Pipelines for Transporting Crude Oil and Petroleum Products, Terminals, and Ports)</i>	122
5.5.2.	<i>Oil Pipeline Projects</i>	125
5.5.3.	<i>Modernization and Investment Program for Refineries to Increase the Production of Petroleum Products and Improve Progress in Meeting European Union Product Quality Specifications</i>	125
5.5.4.	<i>Project implemented in the Refinery</i>	127
5.6.	CAPACITIES FOR THE IMPORT AND EXPORT OF CRUDE OIL AND PETROLEUM PRODUCTS VIA PIPELINES, TANK TRUCKS, RAILWAYS, AND WATERWAYS/PORTS	128
5.6.1.	<i>Capacities for Import and Export of Crude Oil</i>	128
5.6.2.	<i>Capacities for the Import and Export of Petroleum Products</i>	129
5.7.	OVERVIEW – GEOGRAPHICAL ORIGIN OF IMPORTED ENERGY SOURCES DEFINED IN SECTION 4 OF ANNEX B OF REGULATION (EC) NO. 1099/2008	130
6.	CONCLUSION	131
7.	LITERATURE	135

ABBREVIATIONS

AERS	- Energy Agency of the Republic of Serbia
AP	- Autonomous Province
CESEC	- Central and South Eastern Europe Connectivity
CHP	- combined heat and power plant
CSS	- connection switching station
EMS JSC	- Joint Stock Company “Elektromreža Srbije” Belgrade
DSO	- distribution system operator
ELV	- emission limit values
EnC	- Energy Community
EU	- European Union
GHG	- greenhouse gases
HPP	- hydro power plant
JSC	- joint stock company
MB	- mine basin
MG	- main gas pipeline
NERP	- National Emission Reduction Plan
OHL	- overhead line
PCI	- European Commission Projects of Common Interest
PE	- public enterprise
PECI	- Projects of Energy Community Interest
PMI	- Projects of Mutual Interest
PPS	- handover station
PSHPP	- pumped storage hydro power plant
RMC	- remote, monitoring and control system
RS	- Republic of Serbia
SCADA	- Supervisory Control and Data Acquisition
SEEPEX	- South-eastern European Power Exchange
SS	- switching station
SPP	- solar power plant
TPP	- thermal power plant
TENT	- Thermal Power Plant Nikola Tesla
TS	- transformer station
TSO	- transmission system operator

- UGSF** - underground gas storage facility
- WB6** - Western Balkan Six
- WBIF** - Western Balkan Investment Framework project list

1. INTRODUCTION

1.1. Legislative and Regulatory Framework of the Energy Sector in the Republic of Serbia

The main legal and strategic documents that regulate the operation of the energy sector and define and implement the energy policy are:

- Energy Law,
- Law on the use of Renewable Energy Sources,
- Law on Energy Efficiency and Rational use of Energy,
- Integrated National Energy and Climate Plan,
- Energy Sector Development Strategy,
- Strategy Implementation Program, and
- Energy Balance of the Republic of Serbia.

These documents define the general objectives regarding the security of supply of market with energy and energy sources, and establish guidelines and frameworks for the adoption of other acts that more specifically and in greater detail address this issue.

Energy Law (“Official Gazette of the RS”, No. 145/14, 95/18, 40/21, 35/23-other law, 62/23 and 94/2024) [1], regulates:

- Energy policy objectives and manner of their implementation,
- Conditions for reliable, secure and high-quality supply of energy and energy sources, as well as conditions for ensuring secure supply to consumers,
- Protection of energy and energy source consumers, conditions and manner of performing energy activities,
- Conditions for the construction of new energy facilities,
- Fundamentals of nuclear energy development,
- Status and scope of work of the Energy Agency of the Republic of Serbia,
- Organization and functioning of the electricity, natural gas, crude oil, and petroleum products markets,
- Rights and obligations of market participants,
- Establishment of ownership over system operator networks, and
- Production, distribution and supply of thermal energy as energy activities.

The energy policy of the Republic of Serbia is further developed and implemented through the Energy Sector Development Strategy of the Republic of Serbia (hereinafter: Strategy), the Strategy Implementation Program (hereinafter: Program), and Energy Balance of the Republic of Serbia (hereinafter: Energy Balance). The Strategy is the main document that defines energy policy and plans the development of the energy sector. The Strategy is adopted by the National Assembly of the Republic of Serbia at the proposal of the Government of the Republic of Serbia (hereinafter: Government) for a period of at least 15 years. The Ministry responsible for energy affairs prepares an annual report on the implementation of the Strategy for the needs of the Government. The Program defines the conditions, methods, schedule, and measures for the implementation of the Strategy. The Program is adopted by the Government for a period of three

years, based on the proposal of the Ministry responsible for energy affairs. The Government submits an annual report on the implementation of the Strategy and the Program to the National Assembly, which includes: the achieved results in relation to the goals set by the Strategy and Program for the year in which the annual report is submitted; an assessment of the effects of the achieved results and their impact on the Program in the following year; a proposal of measures for a more efficient implementation of the Strategy and the Program; an evaluation of the need to align the Program and possibly adjust the Strategy to meet real needs. Based on the report, the Strategy and Program are proposed to be updated in line with actual needs. In accordance with the Strategy and Program, the Government adopts national action plans that further define the development goals and measures for their implementation.

The Energy Sector Development Strategy of the Republic of Serbia until 2040, with projections until 2050, was adopted on 27 November, 2024 (“Official Gazette of the RS”, No. 94/2024) [2]. The development of the Energy Sector Development Strategy of the Republic of Serbia until 2040, with projections until 2050, and the Program for its implementation for the period 2025-2028, was prepared during 2024.

The Energy Balance determines the annual needs for energy i.e., the needs for energy sources (expressed on a monthly basis), that must be provided to ensure reliable, secure, and high-quality supply to customers. In doing so, emphasis is placed on the rational use of energy and energy sources, the optimization of sources and the required quantities of energy, as well as the required level and structure of the stocks of energy sources and spare capacities. The mandatory contents of the energy balance include: balances of electricity, coal, crude oil, oil products and biofuels, natural gas, thermal energy and renewable energy sources. The Energy Balance is adopted by the Government, upon the proposal of the Ministry responsible for energy affairs, no later than by the end of December of the current year for the following year. The Ministry responsible for energy affairs monitors the implementation of the Energy Balance, analyses its performance for the previous year, and, if necessary, proposes measures to the Government to ensure its execution.

Energy Law [1] has harmonised national regulations with the regulations of the European Union. The Energy Law prescribes obligation to prepare an Integrated National Energy and Climate Plan (INECP) in line with the obligations arising from the international agreements, which define national goals in the areas of decarbonisation regarding greenhouse gas emissions, energy from renewable sources, energy efficiency, energy security, the internal energy market, research, innovation and competitiveness. The INECP is adopted by the Government for a period of up to ten years, and the Ministry responsible for energy, in cooperation with other relevant ministries, updates the INECP every four years after its adoption. The Ministry responsible for energy drafted the INECP of the Republic of Serbia for the period from 2021 to 2030, with a vision until 2050, as part of the IPA project “Further Development of Energy Planning Capacities”, which was financed entirely by the European Union. The project was implemented by a consortium from Greece, led by the company LDK Consultants SA, in cooperation with the Centre for Renewable Energy Sources and Saving (CRES). In 2023, the INECP was subject to public consultation and public discussion, and the Government adopted it in July 2024 (“Official Gazette of the RS”, No. 70/24). The Energy Law established a legal framework for the adoption of by-laws transposing EU regulations concerning network codes in the fields of electricity and natural gas. Additionally, the law established a legal framework for determining energy projects for the construction of energy facilities as projects of special importance for the Republic of Serbia (through a special government act), and provisions on strategic energy projects were also included.

During 2024 amendments to the Energy Law [1] were adopted. The legislative amendments primarily facilitate the transposition of the Electricity Market Integration Package, which

encompasses nine EU regulations, and are also aimed at enabling the integration of electricity markets, supporting the transition to clean energy sources, and ensuring a secure and reliable supply of electricity to both citizens and businesses. The amendments aim to increase security of supply, through cooperation at the regional and European level, as well as through defined actions of the Government, the Ministry and the transmission system operator in the event of an electricity crisis. Law [1] now defines active consumers, their rights and responsibilities, as well as the conditions for establishing and operating citizen energy communities, integration of electromobility into the electricity grid and connection of public and private electric vehicle chargers to the distribution system. The ownership and management of electricity storage facilities, which is important for the integration of renewable sources into the electricity system, has been regulated, and the rules for connecting power plants to the distribution system have also been improved. For the first time, mandatory certification of installers of renewable energy systems has also been introduced. A new provision of the law allows electricity supply to end consumers to be carried out directly by the producer, based on a physical delivery power purchase agreement (PPA), which has long been a demand of the business sector and is expected to promote the development of the private sector. Further amendments also defined energy poverty, as well as measures to reduce and eliminate it. End customers are now guaranteed the right to advanced meters. The amendments to the Law [1] foresee the reintroduction of the nuclear energy sector, effectively repealing the Law on the Prohibition of Nuclear Power Plant Construction, while simultaneously regulating the main steps for the potential peaceful use of nuclear energy in Serbia. It is defined that, based on the guidelines of the International Atomic Energy Agency, the Government, upon the proposal of the Ministry responsible for energy affairs, adopts a Program for the Development of the Peaceful Use of Nuclear Energy. The professional and executive tasks related to the development of the aforementioned program, carried out by the Ministry responsible for energy affairs, have also been defined.

The legislative amendments also foresee the adoption of two new strategic documents: Hydrogen Development and Use Program and Program for the Development of Thermal Energy Production and Use. Licenses for electricity storage are also being introduced, and producers of electricity for their own needs are exempt from licensing, regardless of whether the excess energy produced is fed into the system.

Supply security has been given a significantly greater role under the amendments to Law [1]. For the purpose of ensuring the security of supply of energy and energy products, the energy entities defined under Law [1], are required to give priority to securing sufficient quantities of energy and energy products necessary for the daily life and work of citizens, as well as for the operations of business entities, and to supply them with energy and energy products in a safe, reliable, and high-quality manner, while taking into account the criterion of cost-effective delivery. To monitor the supply of energy and energy products to the domestic market, the Ministry responsible for energy affairs shall establish a special working group for the security of energy and energy products supply. Additionally, a reliability standard has been defined, as the necessary level of security of electricity supply for which generation capacities should be provided, including through a capacity provision mechanism.

During 2023 and 2024, amendments and supplements to the Law on the Use of Renewable Energy Sources (“Official Gazette of RS”, No. 40/2021, 35/2023 and 94/2024 (other law)) [4] were adopted. These amendments enable the introduction of new capacities for the production of electricity from renewable sources into the power system in a way that will not jeopardize the security of its operation. This has, in principle, resolved the issue of a large number of requests for the connection of new solar and wind power plants, whose requested connection capacity increased from 4.8 GW to 20 GW in the last two years, which is two and a half times the total capacity of all power plants in Serbia. Considering that this capacity exceeds the system's balancing capabilities, the issue was resolved by the amendments to the law, allowing the

transmission system operator (EMS JSC Belgrade) to delay the connection of power plants using variable renewable energy sources to the system if, during the transparent procedure of preparing the transmission system development plan, it is determined that there is insufficient reserve for balancing. The amendments to the Law on the Use of Renewable Energy Sources [4] also protected the guaranteed supplier (Joint Stock Company Elektroprivreda Srbije) from the financial risk of assuming balancing responsibility for all renewable energy producers. The law retained this obligation of the guaranteed supplier only for privileged producers who have entered the incentive system and for a limited period of time, while commercial projects will resolve the issue of balancing responsibility on a commercial basis.

The market premium system has been further improved in the interest of citizens, as it will allow investors to compete in auctions for incentives by not only offering the lowest price but also committing to provide additional capacity for guaranteed supply to citizens and/or direct contracts with end customers. This will ensure that green energy stays and is consumed in Serbia, rather than being exported.

Special novelties refer to the capacities of prosumers, where limits have been defined for households and other end customers in a way that balances the interests of the stability of the power system and the interests of prosumers.

Prosumers who are households will be able to install solar panels with an installed power of up to 10.8 kW, while other prosumers can install up to 150 kW, while retaining priority access to the system without balancing responsibility. In this way, the concept of prosumers is oriented towards households and small businesses, contributing to the optimization of household investments in line with real annual consumption, and encouraging prosumers to avoid using electricity for heating during periods when it is most expensive. As for large industrial consumers, they will exercise their rights to self-supply through the concept of active customers after future amendments to the Energy Law [1].

The Law on Energy Efficiency and Rational Use of Energy (“Official Gazette of RS”, No. 40/2021) [5] was not amended in 2024.

1.2. Institutional Framework Governing the Energy Sector

The institutional framework for the energy sector is determined by the Constitution, the Energy Law [1] and the Law on Ministries [6].

The following are primarily responsible for the energy sector in the Republic of Serbia:

- The Government of the Republic of Serbia,
- The Ministry responsible for energy affairs, and
- The Energy Agency of the Republic of Serbia.

The Government of the Republic of Serbia establishes the conditions for the delivery and supply of electricity, oil and natural gas to customers, as well as the measures to be taken in the event of a threatened security of energy and energy sources supply due to disturbances in the operation of the power system or energy market. The Government adopts the Preventive Action Plan and Crisis Plan, to ensure the security of natural gas supply. The Preventive Action Plan contains a risk assessment regarding the achievement of the security of supply, as well as measures to mitigate the identified risks related to the required transport capacity that would meet the total demand for natural gas and ensure the supply of specific groups of end customers. The Crisis Plan defines the measures, energy entities responsible for ensuring the security of the transmission system’s operation and the security of supply for specific groups of end customers, as well as the quantities and capacities of natural gas in case of a general shortage of natural gas. In cases where the security of supply to customers or the operation of the energy system is

threatened due to insufficient supply in the energy market or the occurrence of other emergency circumstances, the Government prescribes measures and limits the supply of electricity or natural gas, or special conditions for the import or export of certain types of energy, as well as the manner and conditions for setting and controlling prices, the obligation to supply only specific customers, or special conditions for carrying out energy activities with minimal disruption to the energy market in the region. In cases where the security of supply to customers is threatened due to insufficient availability of petroleum products offered in the energy and energy source market or because of the occurrence of other emergency circumstances, the Government may, by decree, approve the modification of limit values of specific quality characteristics of petroleum products that can be placed on the market of the Republic of Serbia for a period of up to six months.

The Ministry responsible for energy affairs performs state administration tasks related to: energy, energy policy, and planning the development of the energy sector in the areas of electricity, natural gas, crude oil and petroleum products, the energy balance of the Republic of Serbia, the oil and gas industries, preparation of proposals for acts regarding the appointment and dismissal of governance bodies, as well as other acts related to the operation and business of public enterprises and companies that perform the activities of production, distribution and supply of electricity, natural gas, i.e. crude oil and petroleum products, energy security strategy and policy, preparation of annual and medium-term energy security programs and ensuring the material and other conditions for the implementation of these programs, mandatory and other stocks of energy sources, safe pipeline transportation of gaseous and liquid hydrocarbons, the production, distribution, and supply of thermal energy, rational use of energy and energy efficiency, renewable energy sources, environmental protection and climate change in the energy sector, coordination of activities related to energy investments, as well as other tasks defined by law.

The Energy Agency of the Republic of Serbia (AERS) was established in June 2005, based on the Energy Law from 2004. The position, operating mode, and activities of AERS are defined by the Energy Law [1]. AERS is the only regulatory body in the energy sector, established to promote and guide the development of the electricity and natural gas markets based on the principles of non-discrimination and effective competition, through the creation of a stable regulatory framework, as well as performing other tasks established by the aforementioned law. AERS is an independent legal entity, independent from the executive authorities in the performance of its tasks, as well as from other state agencies and organizations, and legal and natural persons engaged in energy activities. The members of the AERS Council are elected by the National Assembly, which ensures its independence in making decisions within its scope of work.

The Law [1] outlines the tasks performed by AERS. In performing these tasks AERS takes measures that, among others, contribute to the achievement of the following goals: ensuring a secure and reliable energy supply for consumers through the efficient operation and sustainable development of energy systems, in accordance with the energy policy of the Republic of Serbia, including environmental protection and the development of renewable energy sources; the development of the electricity market in the Republic of Serbia and its integration into the regional and pan-European electricity market. Also, AERS approves market and technical rules, system development plans, adopts methodologies for determining the system access charges for transmission and distribution of electricity, prices for ancillary services, prices for access to transport, distribution, and storage of natural gas, electricity prices for guaranteed supply, prices for natural gas for public supply, prices for access to the oil transport system through pipelines, and for the transport of petroleum products, for assessing investments and risks for strategic infrastructure projects in the fields of electricity, natural gas and oil, as well as regulations concerning supplier switching, on monitoring of technical and commercial indicators, regulating the quality of electricity and natural gas supply, and preventing market abuses in the electricity and natural gas markets. Local self-government units also play a role in the implementation of energy policy, which is defined through the institutional framework of the Republic of Serbia.

Article 361 of the Energy Law [1] defines that local self-government units may establish an energy entity within their territory for performing activities related to the production of thermal energy, distribution, and supply to customers of thermal energy, whereas the founding act shall determine the conditions and manner of performing each of these activities. It is understood that the founding act must be in accordance with the Energy Law and other acts within the institutional framework of the Republic of Serbia that regulate the energy sector.

1.3. Working Group on Security of Supply

Since 2005, the relevant ministries in the field of energy have implemented the practice of forming a Working Group to discuss and monitor the situation regarding the security of energy and energy sources supply in the Republic of Serbia. The main task of the Working Group is to closely monitor the situation related to the reliable and optimal supply of the energy market. The Working Group is formed by a decision made by the Minister of Mining and Energy.

The task of the Working Group is to discuss and monitor the security of energy and energy sources supply, propose appropriate measures, prepare the bases for reports on the security of electricity and natural gas supply, and propose measures in case the security of supply to consumers or the operation of the energy system is threatened due to insufficient energy supply on the market or the occurrence of other emergency circumstances.

Working Group members are representatives of the Ministry responsible for energy affairs, Joint Stock Company Elektroprivreda Srbije (EPS JSC), Elektrodistribucija Srbije d.o.o. Beograd (Elektrodistribucija Srbije), Joint Stock Company Elektromreža Srbije Beograd (EMS JSC), Public Enterprise Srbijagas Novi Sad (PE Srbijagas), Company for the Exploration, Production, Refining, Distribution, and Trading of Crude Oil and Petroleum Products, and the Exploration and Production of Natural Gas Naftna Industrija A.D. Novi Sad (NIS JSC), Association of District Heating Plants of Serbia, Provincial Secretariat for Energy and Mineral Resources, Energy Administration of the City of Belgrade, AERS and Public Utility Company Belgrade Heating Plants, Belgrade. Energy entities submit Reports on their activities for the purpose of the Working Group meetings. These reports contain information about the operation of the energy sector, their operational status and readiness, current and potential issues, as well as projections for the upcoming period (30 days).

1.4. Decrees on the Conditions for the Supply of Electricity and Natural Gas, and Other Acts Regulating Energy and Energy Sources Supply Security in the Republic of Serbia

1.4.1. Decree on Conditions for Electricity Delivery and Supply

The Decree on Conditions for Electricity Delivery and Supply (“Official Gazette of the RS”, No. 84/2023) [7] specifies the conditions of for the delivery and supply of electricity to end customers, including the following:

- Conditions for granting approval for connection to the transmission or distribution system, conditions for changing technical conditions at the connection point and the approved capacity,
- Conditions and procedures for connecting facilities referred to in Articles 140, paragraphs 7, 8, and 9 of the Energy Law, the method and procedure for determining the list of end customers who meet the requirements for the status of a small customer,
- The point of demarcation of responsibility for the delivered electricity between the energy entity and the customer, or the producer,

- Conditions for concluding and the content of the supply contract,
- Conditions and procedure for suspending the supply or taking over electricity from end customers or producers, as well as energy-vulnerable customers,
- Rights and obligations of the transmission or distribution system operator, the supplier, and the end customer,
- Types of facilities by purpose where the supply of electricity cannot be suspended due to non-fulfilment of obligations for delivered electricity or in other cases,
- Conditions and procedure for disconnecting the end customer's or producer's facility from the system, rights of end customers or producers,
- The method of notifying the end customer or producer,
- Billing period and mandatory content of the bill for electricity delivery,
- Procedure, method, and deadlines for exercising the end customer's right to compensation due to deviations from the prescribed quality of delivery or electricity supply, and
- Other issues in accordance with the law.

1.4.2. Decree on Energy-Vulnerable Customers

The Decree on Energy-Vulnerable Customers (“Official Gazette of the RS”, No. 137/2022, 93/2023, and 116/2023) [8] is adopted in December 2022, which prescribes in detail:

- Criteria and conditions for acquiring the status of an energy-vulnerable customer,
- Content of the request for acquiring the status of an energy-vulnerable customer,
- Method of determining the fulfilment of conditions for acquiring the status of an energy-vulnerable customer,
- Issuance of a decision on acquiring that status, method of issuing and content of the decision on acquiring the status of an energy-vulnerable customer, as well as the validity period of the decision,
- Content and scope of the right to a reduction in the monthly payment obligation,
- Acquiring the status of an energy-vulnerable customer due to health conditions,
- Method of keeping records of energy-vulnerable customers,
- Method of securing funds for the protection of energy-vulnerable customers, as well as punitive provisions and other necessary issues for determining that status.

This act improves the criteria for obtaining the status of an energy-vulnerable customer in order to enable a greater number of households to qualify for a reduction in their electricity, gas or district heating bills. Through amendments to the Decree in 2023, households whose members have received an increased monetary allowance have become eligible for a reduction in their electricity, gas, or heating bills, and it is also possible to acquire the right to a bill reduction ex officio, which will be enabled through the exchange of data between the competent institutions and suppliers.

1.4.3. Decree on the Network Code on the Connection of Power Generation Units to the Grid

Decree on the Network Code on the Connection of Power Generation Units to the Grid (“Official Gazette of the RS”, No. 95/22) [9] is a new decree, adopted in August 2022, and it regulates the network rules relating to the connection of production units to the network. These network rules establish the requirements for connecting power plants, i.e. synchronous generation modules, energy park generation modules, and energy park generation modules placed on water, to the system in interconnection.

The connection requirements defined in the Decree [9] apply to new generation modules that are considered important, unless otherwise stipulated by this act.

Existing generation modules are not subject to the requirements of the Decree [9], except in special cases specified within the decree itself.

1.4.4. Decree on Network Code Related to the Connection of Customer Facilities to the Grid

The Decree on the Network Code Related to the Connection of Customer Facilities to the Grid (“Official Gazette of the RS”, No. 104/2022) [10] establishes the requirements for connecting customer facilities to the transmission system, distribution system’s facility to the transmission system, distribution systems, including closed distribution systems, and customer facility equipment used by the customer’s facility or a closed distribution system, in order to ensure demand management services for the relevant system operators and the transmission system operator.

1.4.5. Decree on the Network Code Related to the Connection of High Voltage Direct Current Systems to the Grid

The Decree on the Network Code Related to the Connection of High Voltage Direct Current Systems to the Grid (“Official Gazette of the RS”, No. 104/2022) [11] is a new decree, adopted in September 2022, and it regulates the grid rules relating to the connection of high voltage direct current systems to the grid. These grid code establishes the requirements for connecting to the high voltage direct current transmission system and unidirectionally connected power park modules.

1.4.6. Decree on Transmission Capacity Allocation and Congestion Management

The Decree on Transmission Capacity Allocation and Congestion Management (“Official Gazette of the RS”, No. 102/2024) [12] provides detailed rules governing the role of the nominated electricity market operator, the central counterparty, the transmission agent, and the transmission system operator in connection with the coupling of organized markets; the principles of financial settlement and payment; the principles of day-ahead and intraday market coupling with neighboring markets; detailed rules for transmission capacity allocation between bidding zones and congestion management in the day-ahead and intraday electricity markets; the requirements for drafting joint methodologies for determining the values of simultaneously available transmission capacities between bidding zones; the criteria for efficiency assessment; as well as the review of the method for determining bidding zones and other guidance related to transmission capacity allocation between trading zones and congestion management.

1.4.7. Decree on the Incentive Fee for Eligible Electricity Producers

The Decree on the Incentive Fee for Eligible Electricity Producers (“Official Gazette of the RS”, No. 50/2024) [13] prescribes the method of calculating, paying, and distributing funds

collected through the incentive fee for privileged producers, as well as the method of calculating, paying, collecting, and distributing additional incentive funds; the purpose and manner of allocating funds obtained from the negative market premium; and the procedures for monitoring and reporting related to incentive funds and funds obtained from the negative market premium.

1.4.8. Decree on the Market Premium and Feed-in Tariff

The Decree on the Market Premium and Feed-in Tariff (“Official Gazette of the RS”, No. 90/2024)[14] provides detailed rules on the type, manner, and conditions for acquiring, exercising, and terminating the right to a market premium; method of determining the reference market price; other elements that a public invitation must contain, conditions, deadlines and method of registering for auctions, evidence of fulfillment of the conditions from the public invitation, as well as the conditions for the formation of the Commission; starting the auction process, delivery and exchange of documents, notification, content and form of the offer, method of protecting the contents of the offer until it is opened, offer opening time, publication and form of decisions; requirements for application in the qualification phase, content and amount of the financial instrument providing security for the seriousness of the offer, bank guarantee model, conditions and method of collection of the financial instrument as collateral for the seriousness of the offer in relation to the market premium; evaluation of offers, ranking of offers, the method of filling the quota, as well as the method of proving the obligation and the minimum duration of a long-term contract with a guaranteed supplier, or by the end customer, in accordance with the offer submitted by the auction participant; requirements for application in the qualification phase, content and amount of the financial security instrument, bank guarantee model, conditions and method of collection of the financial security instrument, procedure for transfer and termination of the status of temporary eligible producer in relation to the market premium; obligations of the authorized contracting party; conditions and method of extending the status of a temporary privileged producer and resolving requests for extension of the status of a temporary producer in the event of force majeure in relation to the market premium; obligations of the temporary eligible producer regarding the market premium; method of cancellation the status of temporary privileged producer in relation to the market premium; method of acquiring, transferring and terminating the status of a privileged producer in relation to the market premium; obligations of a qualified producer, the amount of the cash deposit for the costs of removing the power plant after the end of its service life and rehabilitating the land on which the power plant was located, deadline and procedure for the removal of the power plant and land remediation in connection with the market premium; method of cancellation the status of a privileged producer in relation to the market premium; conditions under which small plants and demonstration projects can obtain a feed-in tariff, as well as the method of obtaining the status of a privileged producer for small plants and demonstration projects; method, conditions and procedure for acquiring, exercising and terminating the right to a feed-in tariff; requirements for application in the qualification phase, content and amount of the financial security instrument, bank guarantee model, conditions and method of collection of the financial security instrument, procedure for transfer and cancellation of temporary eligible producer status in relation to the feed-in tariff; conditions and method of extending the status of a temporary eligible producer and the method of deciding on a request for extending the status of a temporary producer in the event of force majeure in relation to the feed-in tariff; obligations of the temporary eligible producer regarding the feed-in tariff; method of terminating the status of temporary eligible producer in relation to the feed-in tariff; method of acquiring, transferring and cancellation the status of eligible producer in relation to the feed-in tariff; obligations of a qualified producer, the amount of the cash

deposit for the costs of removing the power plant after the end of its service life and rehabilitating the land on which the power plant was located, deadline and method for removing the power plant and rehabilitating the land in connection with the feed-in tariff; method of cancellation the status of a qualified producer in relation to the feed-in tariff.

1.4.9. Decree on the Conditions for the Delivery and Supply of Natural Gas

The Decree on the Conditions for the Delivery and Supply of Natural Gas (“Official Gazette of the RS”, Nos. 49/2022-4, 32/2023-4, 97/2023-4) [15] prescribes in detail the conditions for the supply of natural gas, as well as measures to be taken in case the security of natural gas supply to customers is threatened due to disturbances in the operation of the transmission or distribution system, or market disturbances in the territory of the Republic of Serbia, including:

- Conditions and procedures for granting approval for connection to the system and linking systems;
- Location of measurement and place of delimitation of responsibility for delivered natural gas;
- Conditions and procedures for connecting temporary facilities, construction sites, trial-run facilities, and other facilities in accordance with the law governing construction;
- Measures to be taken in case of short-term disruptions due to accidents or other unforeseen situations that threaten the security of operation of the transmission or distribution system, as well as due to unforeseen and necessary maintenance work on energy facilities or required works for system expansion;
- Measures to be taken in case of a general shortage, conditions and procedures for implementing measures, and the order of restrictions on natural gas supply, as well as energy-saving and rational consumption measures in the event of a general natural gas shortage;
- Conditions and procedures for suspending the supply of natural gas;
- Conditions and procedures for rational consumption and saving of natural gas;
- Conditions for supplying customer facilities where natural gas supply cannot be suspended due to non-fulfilment of obligations for delivered natural gas or in other cases;
- Procedures for regulating mutual relations between the supplier, system operator, and the end customer, to whom the natural gas supply cannot be suspended;
- Conditions and procedures for measuring the delivered natural gas¹;
- The range of quality, chemical composition, and other characteristics of natural gas that is taken into the system and delivered from the system;
- Procedures for billing unauthorized withdrawal of natural gas;
- Procedure, methods, and deadlines for exercising the end customer's right to compensation for deviation from the prescribed quality of supply, i.e., natural gas supply;
- Method of notifying the end customer;
- Conditions and measures for supplying natural gas to customers;
- Billing period and mandatory contents of the bill for natural gas supply;
- Content of the plan and deadlines for the installation of metering devices.

¹ The decree prescribes kWh instead of m³ as the billing unit for delivered energy.

1.4.10. Decree on Establishing the Preventive Action Plan to Ensure the Security of Natural Gas Supply

Decree on Establishing the Preventive Action Plan to Ensure the Security of Natural Gas Supply (“Official Gazette of the RS”, No. 102/2018) [16] establishes the Preventive Action Plan for Ensuring Security of Natural Gas Supply. This plan includes a risk assessment regarding the achievement of security of supply, as well as measures to mitigate the identified risks related to the required transportation capacity that would meet the overall demand for natural gas and ensure the supply of specific groups of end customers.

1.4.11. Decree on Establishing the Emergency Plan to Ensure the Security of Natural Gas Supply

The Decree on Establishing the Emergency Plan for Ensuring the Security of Natural Gas Supply (“Official Gazette of the RS”, No. 102/2018) [17] establishes the Emergency Plan for ensuring natural gas supply security.

This plan defines the criteria for declaring a crisis, crisis levels, responsible entities during a crisis, measures to be taken in the event of a crisis, and the procedures to follow in a crisis to ensure the supply of natural gas to the Republic of Serbia's market.

1.4.12. Decree on Network Code for Balancing the Natural Gas Transmission System

The Decree on Network Code for Balancing the Natural Gas Transmission System (“Official Gazette of the RS”, No. 112/2022) [18] regulates the network code related to access to the natural gas transmission network at the national, regional, and European natural gas markets, in relation to balancing rules, including rules on nomination procedures, imbalance charges, settlement processes related to daily imbalance charges, and operational balancing between gas transmission system operators.

1.4.13. Decree on Network Code for Congestion Management Procedures and Publication of Data and Technical Information for Access to the Natural Gas Transmission System

The Decree on Network Code for Congestion Management Procedures and Publication of Data and Technical Information for Access to the Natural Gas Transmission System (“Official Gazette of the RS”, No. 112/2022) [19] regulates the network code related to access to the natural gas transmission network at the national, regional and European natural gas markets, in connection with capacity calculation and capacity allocation. It establishes mechanisms for capacity allocation in transmission systems for existing and additional capacities and regulates how neighbouring transmission system operators cooperate to facilitate capacity sales, taking into account the general commercial and technical rules related to capacity allocation mechanisms. The standard capacity allocation mechanism established under this Decree includes an auction process for interconnection points and standard capacity products offered and allocated in those auctions. The Decree also regulates an alternative allocation mechanism applied to offer additional capacity.

1.4.14. Decree on Network Code Related to the Calculation and Allocation of Natural Gas Transmission Capacity

The Decree on Network Code Related to the Calculation and Allocation of Natural Gas Transmission Capacity (“Official Gazette of the RS”, No. 112/2022) [20] regulates the network code related to access to the natural gas transmission network at the national, regional, and European natural gas markets, in connection with capacity calculation and capacity allocation, i.e. capacity allocation mechanisms are established in transmission systems for existing and

additional capacities. The Decree regulates how neighbouring transmission system operators cooperate to facilitate capacity sales, taking into account the general commercial and technical rules related to capacity allocation mechanisms. The standard capacity allocation mechanism established under this Decree includes an auction process for interconnection points and standard capacity products offered and allocated in those auctions. This Decree also regulates an alternative allocation mechanism applied to offer additional capacity.

1.4.15. Decree on Network Code on Harmonized Tariffs for Natural Gas Transmission

The Decree on Network Code on Harmonized Tariffs for Natural Gas Transmission (“Official Gazette of the RS”, No. 112/2022) [21] regulates the network code related to access to the natural gas transmission network on the national, regional, and European natural gas markets, in connection with the code on harmonized tariffs for natural gas transmission. This network code includes codes for applying the methodology for determining the reference price, requirements regarding the implementation of public consultations and publishing information related to the methodology for determining the reference price, as well as codes for calculating reserve prices for standard capacity products.

1.4.16. Decree on Network Code for the Cooperation of Transmission System Operators and Rules for Data Exchange for the Operation of Interconnected Gas Transmission Systems

The Decree on Network Code for the Cooperation of Transmission System Operators and Rules for Data Exchange for the Operation of Interconnected Gas Transmission Systems (“Official Gazette of the RS” No. 112/2022) [22] regulates the rules related to access to the natural gas transmission network at the national, regional and European natural gas markets.

1.4.17. Law on Commodity Reserves

In the area of supply security, the oil sector is also regulated by the Law on Commodity Reserves (“Official Gazette of the RS”, No. 104/2013, 145/2014 - other law and 95/2018 - other law) [23], which regulates the conditions for the formation, financing, deployment, use and replenishing of mandatory stocks of oil and petroleum products, as well as the provision and maintenance of facilities for storage and safeguarding, along with the operation and management of mandatory stocks and storage facilities within the territory of the Republic of Serbia. In addition to the mentioned law, this area is also regulated by the Energy Law, which established the Energy Reserves Administration, as an administrative body within the Ministry and defined its jurisdiction. The Energy Law also mandates the establishing and storage of operational reserves of petroleum products, coal, and other energy sources.

1.4.18. Decree on the Establishment of the Program of Measures in Case of Threats to the Security of Energy and Energy Sources Supply – Crisis Plan

The Decree on the Establishment of the Program of Measures in Case of Threats to the Security of Energy and Energy Sources Supply – Emergency Plan (“Official Gazette of the RS”, No. 63/2019) [24] establishes the Emergency Plan for situations where the security of energy and energy sources supply is threatened.

This plan includes procedures and criteria for identifying disruptions in supply, as well as the responsibilities and duties of public and private entities to resolve supply disruptions and restore normal supply conditions in the market of the Republic of Serbia. The program also includes procedures for responding to an international decision to release mandatory stocks onto the market.

1.4.19. Decree on Operational Reserves of Petroleum Products, Coal and Other Energy Sources

Article 345 of the Energy Law defines that energy entities that perform the activity of production of petroleum products and trade of crude oil, petroleum products, biofuels and compressed natural gas are required to maintain operational reserves of petroleum products equal to the ten-day average amount of motor gasoline and gas oils, or the fifteen-day average amount of jet fuel, which they placed on the market of the Republic of Serbia in the previous year from their own production and imports. Energy entities involved in the production of electricity and/or the combined production of electricity and/or heat are also required to maintain operational reserves of petroleum products and/or coal in quantities sufficient to ensure at least 15 days of their average electricity and/or heat production in January, February, and March over the previous five years. The operational reserves are to be gradually established by January 1, 2028.

Operational reserves of petroleum products and coal are to be used in case of short-term disturbances on the market, caused by accidents and other unforeseen situations that threaten the secure operation of certain parts of the energy system or the entire energy system.

The Decree on Operational Reserves of Petroleum Products, Coal and Other Energy Sources (“Official Gazette of the RS”, No. 79/21) [25] prescribes the conditions and procedures for the gradual establishment, use, and replenishment of operational reserves of petroleum products, coal, and other energy sources.

2. STRUCTURE OF THE ENERGY SECTOR

The energy system of the Republic of Serbia consists of the oil, natural gas, coal, electricity, heat energy, and renewable energy sectors. This chapter provides a brief overview of key data related to the mentioned energy sectors, while a detailed description will be given in the respective chapters.

2.1. Crude Oil and Petroleum Products Sector

The exploitation of domestic oil reserves is carried out by NIS JSC. Novi Sad (in 2024 this amounted to 0.795 million tons, which is 20% of total demand). NIS JSC is the only company in the Republic of Serbia engaged in crude oil and natural gas exploration and production. Since 25th January, 2009, the majority owner of NIS JSC has been the Russian company Gazprom Neft.

The production of petroleum products is carried out at the Pančevo Oil Refinery, which is part of NIS JSC Novi Sad (in 2024, domestic production of petroleum products amounted 3.733 million tons, representing a decline compared to the previous two years).

The Energy Law, in the section on the stocks of petroleum products, defines that energy entities engaged in the production of petroleum products and trade of crude oil, petroleum products, biofuels, bioliquids, compressed natural gas, liquefied natural gas, and hydrogen, except those only engaged in the trade of compressed natural gas and/or liquefied natural gas and/or hydrogen, are required to ensure operational reserves of petroleum products, which are equal to the ten-day average amount of motor gasoline and gas oils, or the fifteen-day average amount of jet fuel, which they placed on the market of the Republic of Serbia in the previous year from their own production and imports.

The Law in the part on security of supply also addresses the report on security of supply of crude oil and petroleum products, which must include:

- Data on the production, import, export, and consumption of oil and petroleum products;
- Data related to the security of supply of oil and petroleum products;
- Technical and other requirements that liquid fuels of petroleum origin, liquefied petroleum gas, and biofuels must meet;
- Data on oil infrastructure;
- Data related to the quality and maintenance level of oil infrastructure facilities;
- Oil infrastructure investment plan;
- Overview of the sources of crude oil/petroleum product supply (including the geographical origin of imported energy sources as defined in the European energy statistics regulations);
- Data on the capacity for the import and export of crude oil and petroleum products.

In Serbia, the production of petroleum products is performed in the Pančevo Oil Refinery. In addition to the Pančevo Oil Refinery, liquefied petroleum gases are also produced at the NIS JSC Novi Sad stabilization unit, or at the plant for preparation of natural gas for transportation located in Elemir. Additionally, production is carried out at the units of Standard Gas LLC Novi Sad located in Odžaci (producing propane, butane, as well as pentane-hexane fraction, i.e. solvent), where imported gas condensate, a broad fraction of light hydrocarbons, is used as raw material. At the Hipol JSC Odžaci units, propane is obtained as a by-product in the process of treatment of refinery or petrochemical propylene into polymer-grade propylene. At the same location, but with different plants, production is also carried out by Energreen MTV. The production of propane-butane mixtures and autogas, based on component blending, is conducted by the company Petrol LPG at the in Smederevo unit, the company VML at the Jakovo unit, and the company Euro gas in Subotica.

The only provider of crude oil pipeline transportation services is JSC Transnafta Pančevo (formerly PE Transnafta), which was established on October 1, 2005, and prior to that, this activity was performed within NIS JSC Novi Sad. The activities of oil transportation via pipelines and the transportation of petroleum products via product pipelines are regulated activities of general interest and are carried out by Transnafta JSC at regulated prices.

The activity of trading in crude oil and petroleum products, including biofuels and compressed natural gas, as well as storage, is characterized by a large number of economic entities. A total of 25 licenses have been issued for the storage of crude oil and petroleum products, 63 for wholesale trade in crude oil and petroleum products, and 418 for retail trade in crude oil and petroleum products. The import of petroleum products is free, and prices are market-based. Retail sales of petroleum products in the territory of the Republic of Serbia are conducted through a developed and extensive retail network of approximately 1,520 retail facilities.

In Serbia, the supply of transport vehicles with compressed natural gas as a motor fuel is provided at 30 stations.

The total consumption of petroleum products as final energy sources in 2024 amounted to 3.930 Mtoe, out of which 0.608 Mtoe was consumed for non-energy purposes and 3.114 Mtoe for energy purposes, with the largest share used in the transportation sector, 79.7%, followed by industry, 12.9%, while other consumers accounted for 7.4%.

Directive 2009/28/EC [47], relating to renewable energy sources for the purposes of reducing greenhouse gas emissions, specifically regarding the mandatory content of biofuels in motor fuels, was implemented into domestic legislation starting in 2019 because, since then, the following have been adopted: Decree on the Share of Biofuels in the Market (“Official Gazette of the RS”, No. 71/2019), Rulebook on Technical and Other Requirements for Biofuels and Bioliquids (“Official Gazette of the RS”, No. 73/2019) and Decree on the Sustainability Criteria for Biofuels (“Official Gazette of the RS”, No. 83/2019). The aforementioned Directive ceased to be valid on June 30, 2021, and was replaced by Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources. At the end of 2023, a new Decree on Sustainability Criteria for Biofuels, Bioliquids and Biomass Fuels was adopted (approved on November 2 and entered into force on November 10) (“Official Gazette of the RS”, No. 96/2023) [26].

The Rulebook on Calculation of the Share of Renewable Energy Sources (“Official Gazette of the RS”, No. 2/23) [27], among other things, specifies the energy content of fuels in transportation and the method for calculating the impact of biofuels and bioliquids, and their comparable fossil fuels, on greenhouse gas emission. The National Action Plan for the Use of Renewable Energy Sources of the Republic of Serbia included the obligation to achieve a 10% share of renewable energy sources in the transport sector by 2020. The Integrated National Energy and Climate Plan of the Republic of Serbia for the period until 2030, with projections until 2050, plans a share of RES in transportation of 7% by 2030.

The Law on the use of Renewable Energy Sources (“Official Gazette of the RS”, No. 40/21, 35/23 and 94/2024-204 and other Law) [4], among other things, adopted certain provisions from the existing Energy Law [1] governing the use of biofuels and expanded them, while also providing for the adoption of appropriate by-laws that will further regulate this area.

The Decree on the Plan and Criteria for the Establishing of Mandatory Stocks of Crude Oil and Petroleum Products (“Official Gazette of the RS”, No. 48/2021), defines that crude oil for the purpose of establishing mandatory stocks shall be procured in a quality whose parameters meet the conditions set forth in the Oil Pipeline Transportation System Network Code, which, with the Agency's approval, is adopted by Transnafta, as well as that mandatory stocks can be replenished through replacement, sale, and procurement. Also, the Rulebook on Determination of the Annual

Program for the Establishing and Maintenance of Mandatory Oil Stocks for 2024 (“Official Gazette of the RS”, No. 75/2024) has been adopted.

Of importance to the Oil Sector are:

- Decree on Operational Oil Reserves (“Official Gazette of the RS”, No. 79/21),
- Rulebook on Licenses for Energy Activities and Certification (“Official Gazette of the RS”, No. 83/21),
- Set of technical regulations relating to pressure equipment,
- Rulebook on Deadlines, Content, and Method of Submitting Data on the Procurement and Sale of Oil, Petroleum Products, Biofuels, Bioliquids, Compressed Natural Gas, Liquefied Natural Gas, and Hydrogen (“Official Gazette of the RS”, No. 72/2021), which further specifies the deadlines, content, and method of submitting data by energy entities engaged in the energy activity of petroleum product production, energy activity of trading in crude oil, petroleum products, biofuels, bioliquids, compressed natural gas, liquefied natural gas and hydrogen, and the energy activity of trading in motor and other fuels at filling stations for supplying transport vehicles.

The Rulebook on Consent for the Storage and Supply of Oil, Petroleum Products, and Biofuels for Own Needs (“Official Gazette of the RS”, No. 12/16, 44/18 – other regulations, 65/2018, and 79/21) [85] further specifies the conditions for issuing, amending, and revoking consent for the storage of crude oil, petroleum products and biofuels for own needs with a total capacity exceeding five tons and for supplying own transport vehicles at their own filling stations, for which no license is issued, as well as the content of the request and the documents attached to the application for issuance.

Also, of importance is the Rulebook on Technical and Other Requirements for Liquid Fuels of Petroleum Origin (“Official Gazette of the RS”, No. 104/23 and 21/24) [86].

In 2024, the Government of the Republic of Serbia adopted a Regulation on Limiting the Price Level of Petroleum Derivatives (“Official Gazette of RS”, No. 6/24 and 29/24). This Regulation prescribes the method for determining the maximum retail prices of petroleum derivatives. In accordance with the applicable Regulation, the Ministry of Mining and Energy in 2024 adopted the Rulebook on the Calculation of the Average Wholesale Price of Petroleum Derivatives — Euro Diesel and Euro Premium BMB 95 (“Official Gazette of RS”, No. 7/24).

In 2024, the Rulebook on Determination of the Annual Program for the Establishing and Maintenance of Mandatory Oil Stocks for 2024 was adopted (“Official Gazette of the RS”, No. 75/24) [87].

By the Law on Amendments to the Energy Law (“Official Gazette of RS”, No. 94/24) [1] the scope of energy activities requiring a license has been expanded, by adding the activities of aggregation and biomethane production.

2.2. Natural gas sector

The natural gas sector encompasses:

- The exploitation of domestic natural gas reserves within NIS JSC Novi Sad (in 2024, it amounted² to 296.954 million Sm³) [33],

² Reduced cubic meter (Sm³) denotes the amount of natural gas which, at standard conditions (temperature of 15°C and pressure 1013.25 mbar), has a volume of 1 m³ and a lower calorific value of 33338.35 kJ/m³ [76]. The term "standard cubic meter (Stm³)" is used in bulletins of energy balances issued by the Statistical Office of the Republic of Serbia [32]. This term is used for natural gas which, at a temperature of 15°C and 1013.25 mbar pressure, has a lower calorific value Hd=33338 kJ/m³.

- The import of natural gas (2,525.934 million Sm³ in 2024)³,
- The storage of natural gas and operation of the natural gas storage facility (the Banatski Dvor Underground Gas Storage Facility with a capacity of 450 million m³),
- Supply of natural gas,
- Natural gas transmission and transmission system operation (Transportgas Serbia LLC Novi Sad, Yugorosgaz-Transport LLC Niš and Gastrans LLC Novi Sad),
- Natural gas distribution and system operation is performed by 31 licensed distribution system operators. There is one more energy entity that holds a license but does not perform any activities.

In 2024, natural gas consumption in the Republic of Serbia had the following structure:

- Energy production sector through transformation: 43.4%,
- Own consumption of the energy sector: 6.2%,
- Transmission and distribution losses: 1.3%,
- Final energy consumption: 49.1%.

In the transformation of natural gas into other forms of energy during 2024, the highest share was held by heating plants at 41.9%, followed by CHP at 33.1%, industrial power plants at 13.0%, and the refinery at 12.0%.

When looking at the consumption sectors in 2024, the largest share of final natural gas consumption was in the industry at 44.3%, followed by households at 28.7%, the public and commercial sector at 23.0%, transport at 2.7%, and agriculture at 1.4%.

2.3. Coal Sector

The energy reserves of the Republic of Serbia are predominantly based on coal, which is exploited within the framework of the following:

- Surface coal mining in two main mining basins, Kolubara (in 2024, production amounted to 22.182 million tons) and Kostolac (in 2024 production was 8.504 million tons of coal),
- Underground mining within PE UCE Resavica (in 2024, production was 360 thousand tons of coal), and
- Underwater coal mining in Kovin (in 2024, production was 167.282 thousand tons of coal).

Of the total domestic production of coal, 98.3% comes from surface mining, with the remaining portion coming from underground and underwater mining. Since most of the domestic production is low-quality lignite, the need for higher-quality types of coal is met through imports and coal drying plant in Vreoci. In 2024, domestic production met 90.5% of total coal needs, and the rest was obtained from imports. Coal imports mainly include deficit types of coal, primarily coke for the metallurgical complex and high-calorific coal for industrial use, followed by brown coal for general consumption. Total domestic coal production in 2024 amounted to 31.25 million tons or 5.423 Mtoe, while the total quantity of coal available for consumption was 34.54 million tons or 6.532 Mtoe. Of this quantity, 34.828 million tons or 6.465 Mtoe (99%)⁴, was used in transformation processes, of which 33.699 million tons or 5.946 Mtoe (92%) was used in thermal power plants, and the remaining 1.129 million tons or 0.519 Mtoe (8%) was used in industrial power plants, heating plants, blast furnaces, and coal processing.

Total final coal consumption in 2024 was only 0.264 million tons, or 0.118 Mtoe, of which 0.012 million tons (0.002 Mtoe) was used for non-energy purposes and 0.252 million tons (0.116 Mtoe) for energy purposes. In the structure of final consumption for energy purposes, the

³ Include amount not supply by the transport system operator.

⁴ All percentage shares in this chapter are calculated based on the coal energy balance.

share of industry was 49.2% (0.073 million tons or 0.058 Mtoe), households 47.9% (0.140 million tons or 0.057 Mtoe), and other sectors around 1.2% (0.005 million tons or 0.001 Mtoe).

2.4. Electricity Sector

The structure of electricity production capacity in the Republic of Serbia in 2024 is as follows [31]:

- Thermal power plants (TPP), with a capacity of 4,359 MW;
- Thermal power plants with district heating (TPP-DH), with a capacity of 496 MW;
- Hydro power plants (HPP), with a capacity of 3,147 MW, including small hydropower plants 129 MW;
- Wind power plants, with a capacity of 608 MW;
- Solar power plants, with a capacity of 95 MW;
- Biogas power plants, with a capacity of 43 MW;
- Biomass power plants, with a capacity of 2 MW;
- Waste-to-energy plants, with a capacity of 30 MW;
- Industrial power plants, with a capacity of 109 MW;
- CHP, with a capacity of 25 MW.

EPS JSC still manages the largest share of the mentioned capacities – their total installed power at the power plants at the end of 2024 was 7,683 MW. The total gross electricity production in 2022 was 37,489 GWh (3.223 Mtoe). The largest share of production was realized in thermal power plants (62%, or 23,220 million tons or 1.997 Mtoe) and hydro power plants (28%, or 10,512 million tons or 0.904 Mtoe). The share of production from combined heat and power plants and wind power plants is almost identical, at 4%, while all other power plants together accounted for 2% of total electricity production. Imports of electricity amounted to 6,936 GWh (0.596 Mtoe), exports were 6,416 GWh (0.552 Mtoe), resulting in a net import of 520 GWh (0.045 Mtoe) [32].

The own consumption in the electricity sector in the same year accounted for 10.56% of total electricity production (gross generation). Losses in the transmission and distribution system amounted to 10.63% of total electricity production (gross generation) [32].

The final consumption of electricity was 29,555 GWh (2.541 Mtoe). The largest share of electricity as final energy was consumed in households 13,225 GWh or 1.137 Mtoe (45%), followed by industrial plants along with the construction sector 9,927 GWh or 0.854 Mtoe (33%), and transport, agriculture, and other consumers 6,403 GWh or 0.551 Mtoe (22%) [31], [32].

In 2024, there were 11 active suppliers in the Republic of Serbia providing electricity to end customers on the free market. The dominant supplier on the free market remains EPS JSC, with a share of 98.20% of electricity sold to end customers on the free market and 99.06% of total final consumption [39].

2.5. Thermal Energy Sector

The capacities for the production of thermal energy in the Republic of Serbia are installed in:

- District heating plants, part of the district heating system,
- Thermal power plants (TPP),

- Thermal power plants with district heating (TPP-DH),
- Industrial power plants, and
- Individual boiler rooms that are not included in the energy balance.

District heating is provided in 60 cities across Serbia. The total installed thermal capacity of the own production facilities of the 55 district heating systems that are members of the Business Association “Toplane Srbije” amounted to 5,674 MWt in 2024, across a total of 259 locations. In addition, these district heating systems use an additional 877 MWt owned by other legal entities, bringing the total capacity to 6,551 MWt [29].

Industrial power plants are used to produce thermal energy for the needs of various industrial processes. In addition to the production process needs, the thermal energy produced in these power plants is also used for heating the working spaces. In certain industrial companies, there are power plants that enable the combined production of both thermal and electrical energy (it is estimated that in 2024, 8,867 TJ of thermal energy and 632,681 GWh of electricity were produced) [31], [32].

Production of thermal energy also takes place in thermal power plants and thermal power plants with district heating. These are the following facilities under EPS JSC:

- TPP Nikola Tesla A (Units A1 and A2) for district heating of Obrenovac (coal-fired steam units),
- TPP Kostolac A for district heating of Požarevac and Kostolac (coal-fired steam units),
- TPP Kolubara A for district heating of the village of Veliki Crljeni,
- TPP-DH Novi Sad, TPP-DH Zrenjanin, and TPP-DH Sremska Mitrovica for district heating systems and process steam (gas and liquid fuel-fired steam units, with a new boiler at TPP-DH Sremska Mitrovica running on biomass), and
- TO Vreoci, which supplies thermal energy to the Public Utility Company Lazarevac. Natural gas, coal, petroleum products and biomass are used for the production of heat in district heating plants.

In 2024, district heating plants consumed 519.740 million m³ of natural gas, 36,664 tons of coal, 22,653 tons of petroleum products, and 52,287 tons of biomass [32], [31].

The production of thermal energy in 2024 amounted to 33,014 TJ or 0.789 Mtoe. The largest share of production was achieved in district heating plants (56%) and industrial power plants (27%) [31], [32].

Losses in distribution amounted to 2,686 TJ, or 0.064 Mtoe, while energy sector consumption was 1,183 TJ or 0.028 Mtoe. The final consumption of thermal energy in 2024 was 29,145 TJ or 0.696 Mtoe. Of this amount, 33% was consumed in industrial plants, and 54% in households. Other consumers accounted for 13% of final consumption [31], [32].

2.6. Renewable Energy Sector

Renewable energy sector includes:

- The production of geothermal energy,
- The Use of hydropower potential, solar and wind energy,
- The production of solid, liquid and gaseous biomass,
- The Import and export of biomass,

- The production of electricity and thermal energy from plants using renewable energy sources.

The production of electricity from large and small watercourses is included in the total electricity production balance for the Republic of Serbia, and in 2024, it amounted to 10,512 GWh or 0.904 Mtoe, which means that in 2024, hydropower plants accounted for 28.04% of the total gross electricity production [31], [32].

The production of geothermal energy is monitored by the Statistical Office of the Republic of Serbia as part of its statistical surveys, and in 2024, this production amounted to 0.0016 Mtoe, (which is 0.02% of total domestic primary energy production). This data does not include the use of geothermal energy through heat pumps.

The production and consumption of solid biomass includes not only the production and consumption of firewood but also the production of pellets and briquettes for energy purposes (for heating needs). In 2024, biomass production in the Republic of Serbia amounted to 1.64 Mtoe, with the largest share, 1.432 Mtoe, consumed by households [31], [32].

2.7. Energy Resources

The energy resources and potentials of the Republic of Serbia consist of fossil fuels (coal, oil, natural gas, and oil shale), nuclear mineral raw materials, and renewable energy sources (watercourses, biomass, wind, solar, renewable hydrogen, biogas, landfill gas, gas from wastewater treatment plants, geothermal energy sources, etc.) [2].

Among fossil fuels, lignite coal basins and deposits have the greatest energy significance. The balance reserves of coal amount to approximately 2.9 billion tons, and the off-balance reserves are 1.1 billion tons. The production of both crude oil and natural gas primarily occurs in the Vojvodina region, with a small part in central Serbia. The peak production levels were reached around ten years ago, but since then, there has been a nearly constant decline. Based on the observed trend, it can be concluded that unless new, larger domestic oil and gas deposits are discovered, there will be a gradual further decline in their production in the upcoming period.

Oil shales are widely distributed in the Republic of Serbia, found at 23 locations. However, their degree of exploration and reserve assessment is generally at the hypothetical, i.e. at the level of potential reserves. Rough estimates of the potential reserves range from 8 to 10 billion tons. The potential of renewable energy sources in the Republic of Serbia consists of biomass, hydroenergy, wind energy, solar energy, and geothermal energy. The total technically available potential of these sources is estimated at 10.288 Mtoe annually, which includes 3.196 Mtoe of biomass, 2.622 Mtoe (30.5 TWh) of solar energy, 2.593 Mtoe (30.15 TWh) of wind energy, 1.547 Mtoe (18 TWh) of hydroenergy, and 0.330 Mtoe of geothermal energy [2].

Primary energy production includes the exploitation and use of domestic resources such as coal, crude oil, natural gas and renewable energy sources (hydro potential, geothermal energy, biomass, biogas, wind energy, solar energy). In 2024, Serbia produced 9.367 Mtoe of primary energy. This production has met more than 58% of the total demand for primary energy. The structure of domestic production of primary energy is as follows: coal production amounted to 5.423 Mtoe, or 58% of total domestic primary energy production, with the remaining portion coming from crude oil and natural gas production, utilization of hydropotential, wind and solar energy, firewood production, and geothermal energy.

Total domestic energy consumption in 2024 amounted to 16.229 Mtoe. Net import dependency of the Republic of Serbia in 2024 was 41.5%. The largest imports were crude oil and petroleum products, accounting for 52%, followed by natural gas at 33%, coal at 15%, and electricity at 1%.

Primary energy was used for:

- Transformations in thermal power plants, hydro power plants, thermal power plants with district heating, district heating plants, industrial power plants, oil refineries, coal processing, blast furnaces;
- Consumption in the energy sector;
- Losses in the transmission and distribution of energy and energy sources;
- Final consumption by end users.

In the structure of consumption for transformation processes, coal consumption dominates at 41%, followed by oil and petroleum products at 26%, and natural gas at 16%. Total final energy consumption includes the energy consumed from transformations, as well as the part of the total available primary energy that does not enter transformation processes but is directly consumed by end users.

Total final energy consumption in Serbia in 2024 was 10.036 Mtoe, of which 0.579 Mtoe was consumed for non-energy purposes, while the consumption of final energy for energy purposes was 9.457 Mtoe.

By consumption sectors, the largest share of final energy was used in the household sector 35.8% (3.384 Mtoe), followed by transport 28.5% (2.694 Mtoe), industry 23.6% (2.234 Mtoe), and other sectors accounting for 12.3% (1.167 Mtoe).

On the other hand, regarding energy sources used in final energy consumption, oil dominated with 33.4% (3.160 Mtoe) and electricity with 26.9% (2.541 Mtoe), followed by renewable energy sources (geothermal energy, biomass, biogas) with 17.3% (1.636 Mtoe), natural gas with 13.1% (1.243 Mtoe), thermal energy with 7.4% (0.696 Mtoe) and coal with 1.2% (0.116 Mtoe).

3. ELECTRICITY

Energy Law [1], prescribes the following energy activities in the field of electricity: electricity generation, combined generation of electricity and thermal energy, electricity transmission and electricity transmission system operation, electricity distribution and electricity distribution system operation, distribution of electricity and closed distribution system operation, electricity supply, aggregation, wholesale electricity supply, organised electricity market operation and electricity storage. Energy activities may be carried out by a public enterprise, a commercial company, another legal entity, or an entrepreneur who has a license to perform energy activities, unless otherwise specified by this law. Energy activities of general interest in the field of electricity are: electricity transmission and transmission system operation, electricity distribution and distribution system operation. Other listed energy activities are performed in accordance with market principles. Licenses for performing energy activities are issued by the AERS, and in the case of thermal energy, by the competent authority of the city/municipal administration, in accordance with the Energy Law [1] and the Rulebook on Licenses for Performing Energy Activities and Certification (“Official Gazette of the RS”, No. 87/2015, 44/2018 – other regulations, and 83/2021) [34].

A license is issued for each energy activity separately. It is issued for ten years, while for the production of electricity, combined production of electricity and thermal energy, and production of thermal energy, it is issued for 30 years (as prescribed in Article 20 of the Energy Law). An energy entity holding a license to perform energy activities may be subject to the obligation to provide public services that will ensure security of supply, regularity, quality, and pricing of supply, environmental protection, including energy efficiency, use of energy from renewable sources, and climate protection (as prescribed in Article 12 of the Energy Law).

In the field of electricity, the following energy entities operate in the Republic of Serbia:

- EMS JSC, which in 2016 changed its legal form from a public enterprise to a joint stock company and is 100% state-owned, It performs the energy activity of electricity transmission and transmission system operation. In accordance with the Law on the Management of Companies Owned by the Republic of Serbia [35], the ownership management of a joint-stock company engaged in electricity transmission and the operation of the transmission system is carried out through an independent state authority responsible for energy networks, in accordance with a special law. For this purpose, the Energy Law [1] established the Republic Commission for Energy Networks as an autonomous and independent body of the Republic of Serbia, responsible for overseeing electricity transmission system operators that carry out transmission and system management activities as a service of general interest, in accordance with the aforementioned law.
- EPS JSC, which performs the following energy activities: electricity production, electricity supply, and wholesale electricity supply, and is 100% state-owned. EPS JSC is the founder of the company EPS Trgovanje LLC Ljubljana, which engages in electricity trading. In addition to the aforementioned energy activities, EPS JSC (branch EPS Supply) also provides the public service of guaranteed and last resort supply. On April 6, 2023, the Government of Serbia adopted a decision to change the legal form of Elektroprivreda Srbije from a public enterprise to a non-public joint stock company, in which the Republic of Serbia remains the sole owner.
- In accordance with the Law on the Management of Companies Owned by the Republic of Serbia [35], the ownership management of a joint-stock company engaged in electricity transmission and the operation of the transmission system is carried out through an

independent state authority responsible for energy networks, in accordance with a special law.

- Elektro distribucija Srbije d.o.o., which performs the activity of electricity distribution and distribution system operation, and is 100% state-owned.
- In accordance with the Law on the Management of Companies Owned by the Republic of Serbia [35], the ownership management of this company is carried out through the ministry responsible for economic affairs.
- SEEPEX JSC Belgrade (SEEPEX), which operates the organized electricity market. In June 2022, the Government of the Republic of Serbia appointed SEEPEX JSC as the Nominated Electricity Market Operator (NEMO) responsible for implementing the day-ahead and intraday market coupling with neighbouring electricity markets in the Republic of Serbia.
- Operators of closed distribution systems,
- Other electricity producers,
- Other electricity suppliers,
- Electricity storage operators.

3.1. Electricity Market

By adopting the Energy Law at the end of 2014 [1], the energy sector in domestic legislation has been harmonized with the provisions of the European Union's energy legislative packages, thus initiating the process of introducing competition in the electricity sector in Serbia, in order to increase the sector's efficiency through the impact of market mechanisms in electricity generation and supply, while maintaining economic regulation of electricity transmission and distribution activities as natural monopolies.

According to the Energy Law [1], as of January 1, 2015, the right to guaranteed supply at regulated prices is available only to households and small customers. Guaranteed supply is a public service that ensures the right of households and small consumers to be supplied with electricity with prescribed characteristics throughout the territory of the Republic of Serbia at reasonable, clearly comparable, transparent, and non-discriminatory prices. End customers on the free electricity market must have a supply contract in place that regulates the rights and obligations between the supplier and the end customer. Only one full supply contract can be concluded for a single delivery point and for the same supply period. For a single delivery point, multiple supply contracts with predetermined quantities of electricity can be concluded for each billing period during the supply period. When a supply contract with predetermined quantities of electricity is concluded, the customer is obligated to sign, before the supply begins, a contract regulating balancing responsibility for their delivery points, and a system access contract with the system operator to which the end customer's facility is connected. An end customer of electricity who is not entitled to guaranteed supply and does not have a valid supply contract (for reasons specified in Article 192 of the Energy Law [1]), has the right to last resort supply for a period of up to 60 days, during which they must find a new supplier (otherwise, the system operator is obligated to suspend their electricity supply to that customer). The price of backup supply is typically higher than market electricity prices, as it is determined through a tender procedure for selecting the last resort supplier in accordance with Article 193 of the Energy Law [1], and cannot be lower than the average price of electricity on the organized market for the previous year, if the guaranteed supplier, as designated by the Government, is declared the last resort supplier.

According to the Energy Law [1], the electricity market in the Republic of Serbia includes:

- The bilateral electricity market;
- The balancing electricity market;
- The organized electricity market;
- The transmission capacity market between trading zones; and
- The ancillary services market.

According to the time of electricity trading, the electricity market can be:

- forward market;
- day-ahead market;
- intra-day market.

The electricity transmission system operator regulates and administers the electricity balancing market, the market for transmission capacities between trading zones and the market for ancillary services, while the market operator (an energy entity that performs the activity of operation of the organized electricity market) regulates and administers the organized electricity market, ensuring compliance with the principles of transparency and non-discrimination.

3.1.1. Participants in the Electricity Market

The Energy Law stipulates that participants in the electricity market may be: electricity producers, suppliers, wholesale suppliers, end customers, electricity transmission system operators, electricity distribution system operators, operators of closed distribution systems, market operators, nominated market operators, electricity storage operators and aggregators. In addition to the listed participants, other legal entities may also participate in the organized electricity market in accordance with the network code for organized market operation. Electricity market participants are required to provide the transmission or distribution system operator with all necessary data in accordance with the Energy Law [1].

The following table shows the number of active licenses for performing energy activities in the electricity sector in 2023 and 2024.

Table 1: Overview of active licenses for performing energy activities in the field of electricity in 2023 and 2024 [39]

Activity	Total number of licenses issued as of 2023	Total number of licenses issued as of 2024
Electricity production	35	40
Combined power and heat production	11	11
Electricity transmission and transmission system operation	1	1
Electricity distribution and distribution system operation	1	1
Electricity distribution and closed distribution system operation	6	6
Electricity supply	74	79
Wholesale electricity supply	84	95
Organised electricity market operation	1	1

In the territory of the Republic of Serbia, the energy activity of electricity transmission and transmission system operation is carried out by EMS JSC, while the activity of electricity distribution and distribution system operation is performed by Elektro distribucija Srbije. The Energy Law [1] prescribes obligations that these energy entities must fulfil in the process of

obtaining a license. These obligations pertain to the provisions on the unbundling and certification of the electricity transmission system operator, as well as the provisions related to the unbundling of the electricity distribution system operator, the compliance program and the compliance officer. By the decision of the AERS Council, on 8 December 2017, EMS JSC was licensed for the energy activity of transmission and transmission system operation, and on April 1, 2021, a license was issued to Elektrodistribucija Srbije for performing the activity of electricity distribution and distribution system operation.

3.1.2. Bilateral Electricity Market

The Energy Law [1] defines the bilateral electricity market as a market where electricity is directly purchased and sold between market participants based on electricity supply contracts.

An electricity supply contract specifies the quantity of electricity, the price, and the supply period.

The quantity of electricity can be:

- Pre-determined for each billing period during the supply period,
- Determined based on actual electricity consumption at the point of delivery during the supply period, and
- Determined based on actual electricity production at the point of delivery during the supply period.

In the wholesale bilateral market, participants trade electricity at free-market prices, whereas in the retail bilateral market, supply is conducted at both free-market and regulated prices. Since 2014, all consumers, except households and small consumers, are required to purchase electricity on the free market.

The activities of suppliers and wholesale suppliers in the free market are most pronounced in the area of cross-border trade, primarily for transit purposes through Serbia, which is dominant due to the central geographic position of Serbia's power system in the region with eight borders, as well as for import and export needs for end consumers.

The following tables (Table 2-Table 5) present relevant electricity market indicators in Serbia for the period 2014–2024.

Table 2: Electricity market concentration level in Serbia (2014-2015)⁵ [39]

Supplier's activity	2014				2015			
	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale [%]	Herfindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale [%]	Herfindahl-Hirschman Index - HHI	Market concentration level
Trade with PE EPS								
Sales	2,047	51	1,053	Moderately high	659	72	2,160	High
Purchase	980	39	767	Low	1,535	53	1,535	Moderately high
Trade between suppliers								
Sales	948	40	852	Low	1,349	42	852	Low
Purchase	941	26	620	Low	1,345	36	620	Low
Electricity import and export								
Import	2,925	43	893	Low	2,926	49	893	Low
Export	1,255	29	536	Low	2,306	60	536	Low
Transit								
Transit	12,774	41	815		14,092	48	815	Low

⁵ Herfindahl-Hirschman index (HHI) is defined as the sum of squares of share of a single company in the market. The lower the value, the more developed is market competition. In order to rank market concentration, following boundaries are used:

HHI < 1000 – not concentrated, 1001 < HHI < 2000 – moderately concentrated,

HHI > 2001 – highly concentrated market.

Table 3: Electricity market concentration level in Serbia (2016-2018)⁶ [39], [40]

Supplier's activity	2016					2017					2018				
	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level
		[%]	[GWh]				[%]	[GWh]				[%]	[GWh]		
Trade on organized electricity market															
Sales	533	80	425,752	3,389	High	848	62	527	1,812	Moderately high	2,318	64	1,473	1,760	Moderate
Purchase	533	72	423,169	1,985	Moderately high	848	59	496	1,446	Moderately high	2,318	41	954	985	Low
Trade between suppliers on bilateral electricity market															
Sales	5,279	57	2,836	1,883	Moderately high	4,033	36	1,454	732	Low	3,951	33	1,296	659	Low
Purchase	5,279	35	1,481	702	Low	4,033	50	2,018	1,148	Moderately high	3,951	35	1,372	688	Low
Electricity sales to end costumers on open market															
Sales	11,603	98.6	11,424	9,130	High	12,637	97	12,303	8,892	High	13,370	98	13,192	9,273	High

⁶ Herfindahl-Hirschman index (HHI) is defined as the sum of squares of share of a single company in the market. The lower the value, the more developed is market competition. In order to rank market concentration, following boundaries are used:

HHI < 1000 – not concentrated, 1001 < HHI < 2000 – moderately concentrated,

HHI > 2001 – highly concentrated market.

Table 4: Electricity market concentration level in Serbia (2019-2021)⁷ [39], [40]

Supplier's activity	2019					2020					2021				
	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level
		[%]	[GWh]				[%]	[GWh]				[%]	[GWh]		
Electricity sales to end costumers on open market															
Sales	2,528	45	1,127	1,067	Moderate	2,816	42	1,191	938	Low	3,305	48	1,580	1,007	Moderately concentrated
Purchase	2,292	41	946	1,015	Moderate	2,562	42	1,083	892	Low	3,315	33	1,090	770	Low
Trade between suppliers on bilateral electricity market															
Sales	3,938	40	1,564	823	Low	5,840	45	2,645	935	Low	6,169	35	2,034	680	Low
Purchase	3,938	38	1,513	798	Low	5,838	31	1,797	647	Low	6,169	44	2,301	997	Low
Electricity sales to end costumers on open market															
Sales	13,573	99.0	13,473	9,155	High	13,305	99	13,214	9,125	High	14,226	100	14,168	9,255	High

⁷ Herfindahl-Hirschman index (HHI) is defined as the sum of squares of share of a single company in the market. The lower the value, the more developed is market competition. In order to rank market concentration, following boundaries are used:

HHI < 1000 – not concentrated, 1001 < HHI < 2000 – moderately concentrated,

HHI > 2001 – highly concentrated market.

Table 5: Electricity market concentration level in Serbia (2022-2025)⁸ [39], [40]

Supplier's activity	2022					2023					2024				
	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level	Electricity quantity [GWh]	Share of three suppliers with the greatest trading scale		Hefindahl-Hirschman Index - HHI	Market concentration level
		[%]	[GWh]				[%]	[GWh]				[%]	[GWh]		
Electricity sales to end costumers on open market															
Sales	3,205	40	1,292	833	Low	4,682	40	1,883	829	Low	5,443	27	1,441	538	Low
Purchase	3,205	46	1,496	1,084	Moderately concentrated	4,682	36	1,660	712	Low	5,443	38	2,081	689	Low
Trade between suppliers on bilateral electricity market															
Sales	3,853	30	1,099	568	Low	4,165	53	2,230	1,443	High	5,213	52	1,436	1,243	High
Purchase	3,853	75	2,725	3,895	High	4,205	49	2,048	1,340	High	5,213	45	1,140	1,140	High
Electricity sales to end costumers on open market															
Sales	14,749	100.0	14,749	9,968	High	15,098	100	15,098	9,991	High	16,479	100	16,478	9,989	High

⁸ Herfindahl-Hirschman index (HHI) is defined as the sum of squares of share of a single company in the market. The lower the value, the more developed is market competition. In order to rank market concentration, following boundaries are used:

HHI < 1000 – not concentrated, 1001 < HHI < 2000 – moderately concentrated,

HHI > 2001 – highly concentrated market.

The market concentration level in 2024 remained at the same level as in the previous year. The trade on the bilateral market reached 5,213 GWh in 2024, which is about 25% more than in 2023, when it amounted to 4,165 GWh. This indicates a strong growth in activity in this segment, while maintaining a high level of concentration among participants. During 2024, continued growth in trade on the organized electricity market was recorded, indicating further strengthening of the liquidity and stability of the organized market. The concentration of the retail market in 2024 is very high. It amounts to as much as 98.20%. Such a high percentage is the result of the traditionally dominant position of EPS JSC in the retail market. Table 16 on the page 66 shows electricity consumption in Serbia (excluding Kosovo and Metohija) for the period 2014-2024. From the given table, it can be observed that electricity consumption in 2024 increased by 1.47% compared to 2023.

The total number of metering points for electricity delivery to customers in Serbia, excluding Kosovo and Metohija (not counting the 42 metering points for Serbian Railways facilities in the transmission system), was 3,828,463 at the end of 2024, and compared to 2023, that number increased by 0.9% [39].

In 2024, only households and small consumers purchased electricity on the regulated market. In 2024, 46.4% of the electricity consumed by final customers was delivered on the regulated market, which is 1.4% more electricity compared to 2023 (14,104 GWh in 2023, 14,302 GWh in 2024) [39].

The regulated electricity price for guaranteed supply of end customers, approved on November 1, 2023, was applied in 2024. Since 2015, all end customers have been able to purchase electricity on the free market, where 16,479 GWh of electricity was delivered in 2024, excluding electricity delivered through last-resort supply, accounting for 53.4% of total end-customer consumption. Among the customers on the free market, there were around 2,000 households (almost 3.5 times fewer than in the previous year), while the number of electricity delivery metering points increased to more than 191 thousand metering points. Out of 79 energy entities licensed to perform electricity supply activities at the end of 2024, only 11 were active on the free retail market, which is 8 more than the previous year. The dominant supplier on the free market remained EPS JSC, with a market share of 98.2% of the total electricity sold to end customers on the free market (excluding energy sold within a vertically integrated company) and a share of total sales by EPS JSC (including guaranteed, last-resort and free market supplies) of 99.06% share of total final consumption [39].

Guarantees of Origin [39]

Guarantees of origin are electronic documents that serve the sole purpose of providing evidence to the end customer that a given share or quantity of energy delivered by the supplier was produced from renewable sources.

In 2017, the Decree on the Guarantee of Origin [41] entered into force, and the Rulebook on the Method of Calculation and Presentation of the Share of All Types of Energy Sources in the Sold Electricity [42] was adopted. In December 2017, EMS JSC Belgrade adopted the Rulebook on Issuing Guarantees of Origin for the Republic of Serbia. On December 22, 2017, the Council of the Energy Agency of the Republic of Serbia approved the decision on the Fees for Issuance, Transfer, and Termination of the Validity of Guarantees of Origin, thereby fulfilling all the conditions for the start of the new market process - Issuing and Administration of Guarantees of Origin for Electricity in the Market Area of the Republic of Serbia. During 2019, EMS JSC adopted new Rulebook on Issuing Guarantees of Origin for the Republic of Serbia [43]. In March 2020, the Rulebook on Calculating the Share of Renewable Energy Sources [27] was adopted, thereby repealing the previous Rulebook [42]. In January 2023, two new documents were adopted, the Rulebook on Calculating the Share of Renewable Energy Sources [28] and the

Rulebook on the Method of Calculating and Displaying the Share of All Types of Energy Sources in Rulebook on the Method of Calculation and Presentation of the Share of All Types of Energy Sources in the Sold Electricity (“Official Gazette of the RS”, No. 2/2023) [30].

In November 2020, after fulfilling all the conditions for full membership and following the provision of necessary insurance, EMS JSC was connected to the AIB system (AIB HUB) and, thereby, both the export of guarantees of origin from the Republic of Serbia to the member countries of the Association as well as the import of guarantees of origin into the Republic of Serbia were enabled. Hereby, Serbia became the first Contracting Party of the Energy Community to join the Association of Issuing Bodies.

In 2023, the system audit conducted by the AIB was successfully completed, confirming the compliance of the system in Serbia with EU standards. Also, data migration was carried out from the previous CMO. Grexel to the new G-REX system, which further improved the technical infrastructure for working with guarantees of origin.

EMS JSC conducts the registration of participants in the system of guarantees of origin. In 2024, a total of 54 participants were registered in the Guarantee of Origin Registry, with the following structure:

- Eligible producer, supplier – 4
- Wholesale supplier – 13
- Eligible producer – 18
- Supplier – 19

The total number of issued guarantees of origin⁹ in the period from the first issued guarantee of origin (November 2018) until December 2024 is 15,510,782, while 2,509,254 guarantees of origin were issued in 2024 alone [39]. Compared to 2023, when a record 10,581,175 guarantees were issued, this number is significantly lower, which may indicate stabilization or saturation of the market. The number of imported guarantees of origin in the period from the allowed import through AIB until the end of 2024 is 632,948, of which 119,835 were imported in 2024, and 240,465 in 2023. The number of exported guarantees of origin, in the period from when exports were enabled through AIB in 2023 until the end of the year, amounts to 8,776,760, of which 1,619,349 were esported in 2024 [39].

3.1.3. Balancing Electricity Market

The balancing electricity market was established on January 1, 2013, and operates in accordance with the Energy Law [1], Electricity Market Code [38], and Electricity Transmission Grid Code [36]. The legal framework for establishing and operating the balancing electricity market is defined by the Energy Law [1], and according to this Law, the transmission system operator is responsible for system balancing. This involves the following:

- Providing balancing services in accordance with transparent, non-discriminatory, and market-based principles which will provide appropriate incentives for system users to balance their electricity generation and consumption;
- Determining the price of electricity for the needs of system balancing, in accordance with the Electricity Market Code;
- Collecting and publishing data and information in accordance with the Rules on Publication of Key Market Data [44].

⁹ They refer to 1 MWh of electricity produced.

On the balancing electricity market, the transmission system operator purchases and sells balancing energy for the purpose of balancing between electricity production, consumption and exchange in real-time, ensuring the secure operation of the electricity system and maintaining the necessary level of reserves for secondary and tertiary regulation. Pursuant to the Energy Law [1], the transmission system operator, with prior approval of AERS, shall adopt the Electricity Market Code. The Electricity Market Code shall further regulate the following: the balancing responsibility of market participants, the balancing electricity market, the calculation of imbalances for balancing groups, the financial settlement of balancing responsible parties, payment security instruments and criteria for determining the amount and period for which it is requested, the calculation of electricity for balancing purposes and ensuring the secure operation of the system, the provision of system services, as well as other matters necessary for the functioning of the electricity market [38].

In recent years, the balancing responsibility system in the Republic of Serbia has been significantly enhanced through regulatory, organizational, and technical improvements. The Energy Law, together with the Rulebook on Licensing for Performing Energy Activities and Certification, has enabled foreign companies to obtain a license for wholesale electricity supply and to acquire the right to register as balancing responsible parties. During 2022, AERS approved the adoption of new Electricity Market Code by EMS JSC, which included changes related to electricity market participants, communication with market participants, optimization of the registration of balancing responsible parties, additional regulation of the section defining the content of the Balancing Responsibility Agreement, and changes in the calculation of risk values in case of non-fulfilment of obligations. The section concerning explicit offers from market participants, as well as the calculation of financial settlements for balancing responsible parties was also modified.

During 2022, a significant number of activities marked the development of the balance responsibility market. The composition of balancing groups was changed 53 times, initiated by various contractual relationships between end customers, suppliers and BOS. JSC EMS, in accordance with contracts with PE EPS, engaged balancing entities in secondary and tertiary regulation to maintain the balance of production and consumption. Cross-border balancing has also been implemented in cooperation with CGES and NOSBiH, including the activation of emergency and tertiary energy within the settlement interval. During 2022, EMS JSC was actively involved in regional and European initiatives for coupling organized electricity markets, cross-border balancing electricity markets (as an observer in the MARI project), and the European project for a single intraday electricity market. In October 2022, EMS JSC became an operational member of the single European platform for exchange – imbalance netting (IGCC) [39].

In 2022, a new energy register for electricity market participants, NERA (New Energy Registry for Applicants), was developed and successfully launched on November 23, 2022. It is used for the administration of balancing responsibility and the composition of balancing groups [39].

In 2023, these activities continued. SMM Control Block (Serbia, Montenegro and North Macedonia) mechanism continued to function, allowing for the netting of deviations between regulatory areas. Within the IGCC platform, Serbia continued its active participation in the processes of exchange of derogations. The total engaged balancing energy across all settlement intervals in 2024 amounted to 1,051.01 GWh with a total weighted settlement price of 96.753 €/MWh, which is 3.855 €/MWh less than the previous year. Considering the direction of balancing entities engagement, the weighted settlement price was as follows [45]:

- In cases where the total balancing energy in the settlement interval was greater than zero: 146.679 €/MWh,

- In cases where the total balancing energy in the settlement interval was less than zero: 31.925 €/MWh.

The transmission system operator is also responsible for providing ancillary services necessary to ensure the safe, reliable, and stable operation of the energy system. In order to secure the required resources, including capacities and energy for primary frequency regulation, secondary and tertiary frequency and exchange power regulation, voltage regulation, and system restoration after a breakdown, EMS JSC also had a contract with EPS JSC for ancillary services in 2024. Thus, a 35 MW reserve for primary regulation was contracted in accordance with ENTSO-E requirements. The contract confirmed a range of 160 MW for secondary regulation and a positive reserve of 300 MW and a negative reserve of 150 MW for tertiary regulation. During 2024, after each outage of units exceeding 1,000 MW in interconnection, the total response of primary regulation in Serbia was tested and satisfactory results were obtained. For frequency and exchange power secondary regulation during 2024, the following hydro power plants were operational: HPP Đerdap 1, HPP Bajina Bašta, HPP Bistrica and PSHPP Bajina Bašta, with a total regulation range of 996 MW. In addition, thermal units TENT A3, A4, A5 and A6, each with a secondary regulation range of 40MW (a total of 160 MW), were also used for operation in secondary regulation. Thermal units respond significantly slower and are used for secondary regulation during periods when hydropower units are unable to operate in secondary regulation (periods of very high or very low inflows). The percentage of secured reserves during 2024 was above the target value of 95%. During 2024, the average hourly regulation error on a monthly basis was between -5.71 MWh/h and 1.15 MWh/h. The standard deviation of the regulation error was between 7.8 MWh/h and 15.5 MWh/h in 2024.

During 2024, EPS JSC satisfactorily fulfilled its contractual obligations related to the provision of tertiary reserve, while EMS JSC covered its needs for external assistance through cross-border exchange of tertiary regulatory energy (PTRE) with CGES (Transmission System Operator of Montenegro) and NOSBiH (Transmission System Operator of Bosnia and Herzegovina), based on valid PTER exchange agreements. Compared to emergency energy, cross-border tertiary regulation energy can be activated significantly faster (within 15 minutes), involves a simpler procedure, and is generally less expensive. In 2024, EMS JSC procured a total of 2,035 MWh and delivered 1,923 MWh of PTRE. Additionally, in 2024, EMS JSC procured a total of 550 MWh of emergency energy, which is procured when no other energy sources are available.

3.1.4. Organized Electricity Market

According to the Energy Law [1], the organised electricity market is an institutionally regulated relationship between supply and demand among electricity market participants, with predefined standardised products and physical delivery in the day-ahead and intraday timeframes. The activity of organised electricity market operation is carried out by the market operator, which is established by the transmission system operator in a manner and in accordance with an act of the Government.

Under the Energy Law [1], the responsibilities of the market operator include: establishing an organized electricity market, administering the organized electricity market, efficiently and functionally coupling of the electricity market in the Republic of Serbia with neighbouring electricity markets in cooperation with the transmission system operator in the Republic of Serbia, as well as transmission system operators and market operators in neighbouring countries, in accordance with internationally established principles and commitments.

On July 14, 2015, EMS JSC established SEEPEX - power exchange, formed in partnership with EPEX SPOT, France. The exchange¹⁰ began operations in February 2016. In 2024, a total of 45

¹⁰ SEEPEX activities can be followed on the website www.seepep-spot.com

participants were registered on the exchange, which is six more than in 2023, when 39 participants were registered, and 16 more than in 2022. A total of 25, 35, and 42 participants were actively engaged in trading on the organized electricity market in 2022, 2023, and 2024, respectively [40].

The benefits that SEEPEX has generated in the development of the electricity market in Serbia and the region are reflected in:

- Introduction of new products,
- Harmonization of trading and clearing processes on the organized market in accordance with best European practices,
- A transparent pricing mechanism,
- Determination and publication of a reference price,
- Financial security of transactions concluded on the organized market through a centralized clearing and financial settlement process, and
- Promotion of competition.

In previous years, SEEPEX [40] operated the organized market with standardized products on the day-ahead market. As of July 25, 2023, intraday market trading has also commenced, completing the framework for the organized electricity market in the Republic of Serbia.

In 2022, the Government of the Republic of Serbia appointed SEEPEX JSC as the Nominated Electricity Market Operator (NEMO), which is designated in the Republic of Serbia for implementing the coupling of the day-ahead and intraday organized electricity markets with neighbouring organized electricity markets. In December 2022, a corporate merger occurred between the SEEPEX JSC electricity exchange and BSP Southpool from Slovenia, resulting in the establishment of the Alpine-Adriatic Danube Electricity Exchange - ADEX. ADEX is the first regional electricity exchange with the aim of expanding operations into the Central and Southeast European region. The founders of ADEX are the transmission system operator in Slovenia (ELES), the transmission system operator in the Republic of Serbia (EMS JSC), and the exchange partner EPEX SPOT. ADEX had headquartered in Belgrade and Ljubljana until 2023.

In 2023, a fourth member joined this group - the Hungarian transmission system operator (MAVIR), with the aim of increasing spot market liquidity and simplifying trading and clearing in this part of Europe [40]. In November 2024, the ADEX Group merged with the Hungarian Power Exchange (HUPX), positioning itself as a leader in electricity trading in Central and Southeastern Europe. This merger, which was formalized on December 10, 2024, is expected to significantly improve market liquidity, while promoting efficiency and price transparency. Through this business transaction, the ADEX Group, whose headquarters have been relocated to Budapest, becomes the sole shareholder of BSP, HUPX, and SEEPEX.

SEEPEX offers two standardized products on the day ahead market- single hour products (Single Contract Orders) and block orders (Block Orders). Single hour offers allow up to 256 price/quantity combinations for each hour of the following day. The lower price limit for buy and sell orders is 0.0 €/MWh, and the upper limit is 4,000 €/MWh [40]. Quantities (which can be positive for buying, negative for selling, or equal to zero if no bid is submitted in a given hour) must be entered within these price limits. The block product was introduced on March 22, 2017, enabling participants to submit orders for one or more delivery periods, with at least one hour of delivery for the day-ahead market. Block orders are used by linking multiple hours, which do not have to be consecutive, according to the “all-or-nothing” principle, meaning the offer is accepted for all hours or completely rejected. Within a block, it is possible to input different quantities of electricity for each hour, but offers for purchase and sale cannot be mixed in a single block. In

other words, a block defines trading in only one direction - either purchase or sale. A single price is offered for the entire block, which is compared to the weighted price of the hours included in the offer. If the price is favourable, the block is executed; otherwise, it is fully rejected. With the introduction of “curtailable” blocks on December 15, 2021, the possibilities for block offers were expanded by relaxing the “all-or-nothing” rule by defining a Minimum Acceptance Ratio (MAR) which the bidder is willing to accept [39].

Average electricity prices on the organized electricity market in Serbia in 2024 were 101.76 €/MWh (base price) and 103.45 €/MWh (peak price) [46].

The total amount of electricity traded on SEEPEX in 2024 was 5,540.26 GWh of which 5,432.87 GWh on the day-ahead market and 107.39 GWh on the intra-day market [46]. The share of electricity traded on the power exchange compared to the electricity delivered to all electricity end consumers increased from 15.5% in 2023 to 16.5% in 2024. The share of the exchange in comparison to the electricity supplied to end consumers supplied on the free market (free retail market) in 2024 was 30.8%. On the wholesale market, the exchange's share was 19.76%, where the wholesale market includes the bilateral market (the purchase and sale of electricity between electricity suppliers) and the purchase, i.e. sale of electricity on the electricity exchange (organized market).

In 2024, the highest monthly trading volume on the exchange was achieved in October, totalling 544.5 GWh, while the daily maximum was reached on October 9 with a trading volume of 23,957 MWh. The lowest monthly trading volume was in January, amounting to 320.9 GWh, which is 3% higher than the minimum month of the previous year. The highest hourly price was 899.97 €/MWh, which was recorded on September 3 at twentieth hour. The average base price for the year was 101.76 €/MWh, which is 1.6% lower than the previous year (103.46 €/MWh) [46].

3.2. Electricity Production, Transmission and Distribution Capacities

3.2.1. Electricity Production Capacities

3.2.1.1. Conventional sources of electricity production

The total power at the interface of the power plants in 2024 in the Republic of Serbia is shown in Table 6. In addition to the mentioned power plants, wind, solar, biogas, biomass, waste-to-energy, high-efficiency CHP plants using natural gas, and boiler plants have been connected to the power system of the Republic of Serbia. For the first time, prosumers are also included in the electricity balance.

Table 6: Net production capacities in Republic of Serbia from 2014 to 2024 [31]

Technology	Net production capacity [MW]										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Thermal power plant (coal)	3,877	4,032	4,012	4,052	4,079	4,079	4,079	4,079	4,079	4,051	4,359
Combined heat and power plants (gas, fuel oil)	297	297	297	297	297	297	297	496	496	496	496
Hydro power plants	2,966	2,985	2,965	3,008	3,043	3,058	3,084	3,101	3,105	3,149	3,147
Small power plants	61	66	71	82	95	103	108	125	128	131	129
Wind power plants	1	1	17	25	226	398	398	398	399	514	608
Solar power plants	6	9	10	10	11	11	12	12	13	43	95
Biogas power plants	5	5	10	13	16	23	29	36	39	36	43
Biomass power plants						2	2	2	2	2	2
Waste power plants							1	1	1	30	30
Industrial power plants	87	90	93	93	93	92	92	92	108	109	109
CHP high-efficiency cogeneration on natural gas	11	11	21	21	21	26	25	25	26	25	25
Prosumers									9	40	84
Total	7,249	7,430	7,426	7,520	7,785	7,988	8,019	8,244	8,277	8,494	8,999

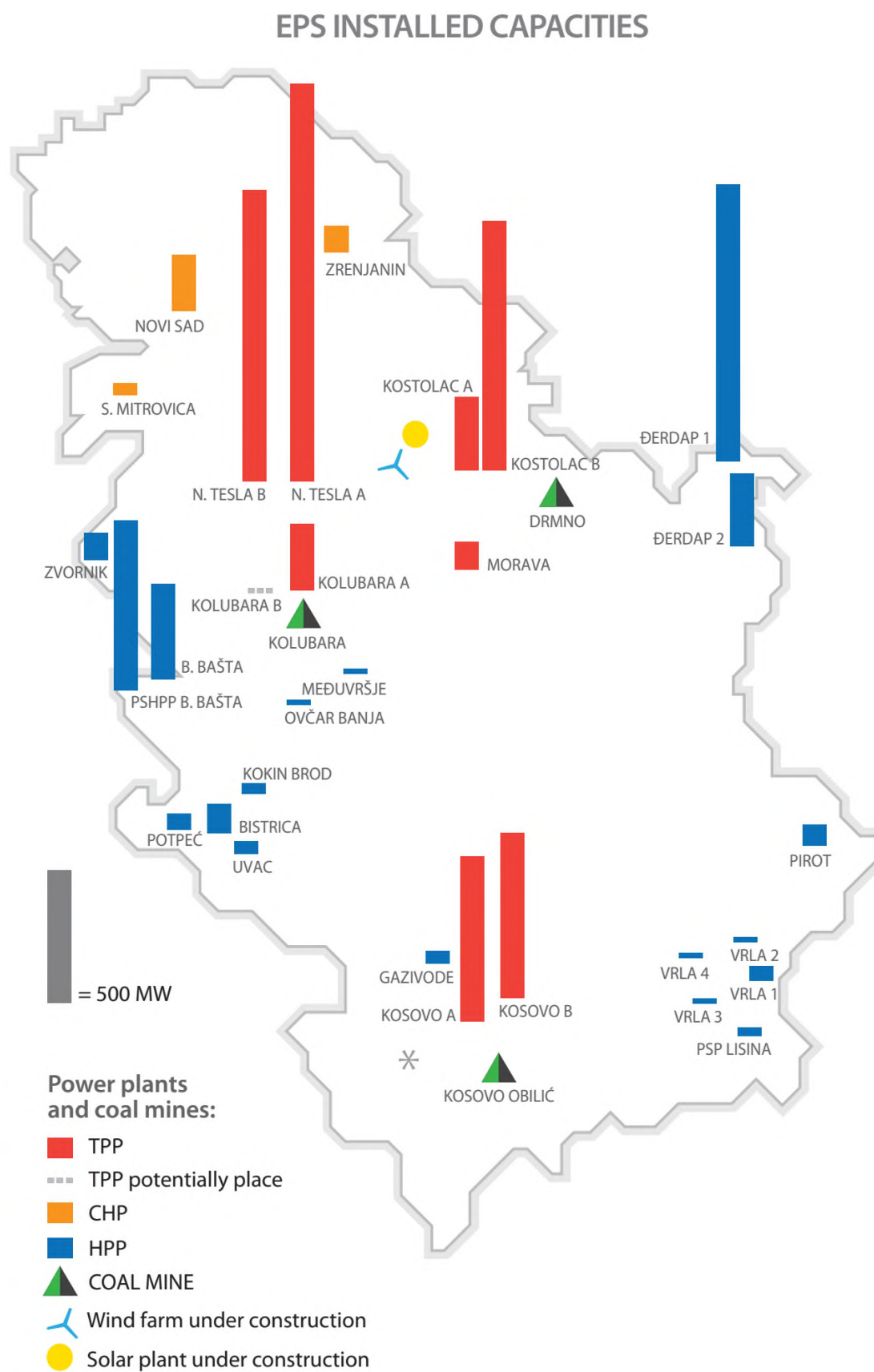
The participation of thermal power plants (TPP) and combined heat and thermal power plants with district heating (TPP-DH) is around 55%, hydro power plants (HPP) 37%, including one pumped-storage hydro power plant with a capacity of 2x307 MW, which, in addition to its significant energy contribution, is also very important for system operation, and around 8% of installed capacities come from other energy sources.

In addition to EPS JSC, which is the largest and dominant electricity producer, at the end of 2024, 39 energy entities held a license for electricity generation, bringing the total to 40 energy entities (with EPS JSC). Furthermore, 11 energy entities held a license for combined electricity and heat generation, including 10 additional entities, operating small generation facilities connected to the distribution network. During 2024, the Pupin wind farm, with an installed capacity of 95 MW, was connected to the transmission network, so that at the end of 2024, the total installed capacity of other producers connected to the transmission network was 804 MW, of which 574 MW in wind power plants and 230 MW in combined heat and power plants. By the end of 2024, a total of 392 small power plants from other producers, with a combined installed capacity of 315 MW, were connected to the distribution network [39].

Among all licensed independent producers, the largest are: GAZPROM ENERGOHOLDING SERBIA TPP-DH PANČEVO, with a combined heat and power plant of 196 MW installed capacity; ELECTRAWINDS K-WIND LLC with the Kovačica wind farm of 104.5 MW; MK-FINTEL WIND AD with the Košava wind farm of 69 MW; Elicio Ali VE LLC with the Alibunar wind farm of 42 MW; NIS (Naftna Industrija Srbije) JSC with a total of 11.94 MW installed across 9 facilities; Vetropark Kula LLC with a wind farm of 9.9 MW; PUC Novi Sad District Heating Company with combined production of 9.98 MW; ELICIO MALI WF LLC with a wind farm in Alibunar of 8 MW, and NOVO SELO POWER LLC with the Lebane-Novo Selo solar power plant of 8 MW installed capacity [39].

The construction of new production capacities is necessary to replace existing ones, which, due to outdated technology, cannot meet environmental protection requirements, as well as to cover any potential increase in electricity consumption.

Figure 1: Production capacities EPS JSC¹¹



¹¹ As of June 1999, EPS JSC does not operate its facilities on the territory of Kosovo and Metohija.

3.2.1.2. Renewable energy sources

Pursuant to Article 20 of the Law on the Ratification of the Energy Community Treaty (“Official Gazette of RS”, No. 62/2006), the Republic of Serbia has undertaken the obligation to implement European Directives in the field of renewable energy sources - Directive 2001/77/EC on the promotion of electricity from renewable energy sources and Directive 2003/30/EC on the promotion of biofuels or other fuels produced from renewable energy sources for transport. These Directives have been gradually replaced since 2009, and in January 2012, they were repealed by the new Directive 2009/28/EC of the European Parliament and Council of April 23, 2009, on the promotion of the use of energy from renewable sources, with amendments and subsequent repeal of Directives 2001/77/EC and 2003/30/EC. In accordance with Directive 2009/28/E3 [47] and the Decision of the Ministerial Council of the European Community of October 18, 2012 (D/2012/04/MC-EnZ), a very ambitious target was set for the Republic of Serbia, which aims for 27% renewable energy sources in its gross final energy consumption by 2020 and 10% share of energy produced from renewable energy sources in transport by 2020. The same Decision defines that the National Renewable Energy Action Plan of the Republic of Serbia should be prepared in accordance with the adopted template for the preparation of this document (Decision 2009/548/EC). In the meantime, Directive 2018/2001 EU (RED II) entered into force (in December 2018), with implementation starting on July 1, 2021. In October 2023, a new Directive (EU) 2023/2413 [48], was adopted, amending the previously mentioned Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources, the Supplementary Regulation 2019/807, and Commission Implementing Regulation No. 2022/996. Directive [48] establishes a common framework for the promotion of energy from renewable sources and sets a binding EU target for the total share of energy from renewable sources in gross final energy consumption in the EU by 2030. It also establishes rules on financial support for electricity from renewable sources, on own consumption of such electricity, on the use of energy from renewable sources in the heating and cooling sector, and in the transport sector, on regional cooperation between member states and between member states and third countries, on guarantees of origin, on administrative procedures, and on information and training. As part of the EU's “Fit for 55” package, a legislative package aimed at aligning the EU's policies on climate, energy, land use, transport, and taxation, with the goal of reducing greenhouse gas emissions by 55% by 2030 (compared to 1990 levels), this Directive has been reformed to set an overall binding target for a share of renewable energy of at least 42.5% in the EU energy mix by 2030, while targeting a share of 45%. Among the most important updates to the Directive are new provisions on bioenergy, aimed at preventing the degradation of carbon sinks and loss of biodiversity in accordance with existing practices.

The Republic of Serbia in 2013 adopted the National Renewable Energy Action Plan [49] as a framework for the promotion of energy produced from renewable sources and set mandatory national targets for the share of energy from renewable energy sources which defined the method for achieving the binding national target. These targets have been redefined in the new Integrated National Energy and Climate Plan of the Republic of Serbia until 2030, with the projections until 2050 (INECP) [60].

In accordance with the above, and in order to increase the use of renewable sources, in 2013 the Republic of Serbia joined the countries that subsidize the production of electricity from renewable sources and introduced the most widespread model for incentivizing electricity production using renewable sources – incentive purchase price (the “feed-in” tariffs) with a guaranteed electricity purchase period of 12 years. According to the Law on the Use of Renewable Sources [4], the systems for incentivizing the production of electricity from renewable sources have been modified and these are now implemented through a system of market premiums and a system of feed-in tariffs. These systems pertain to the electricity price, balancing responsibility, the right to priority access to the system, and other incentives

prescribed by law. In this context, the feed-in tariff is a form of operational state aid granted as an incentivized purchase price, guaranteed per kWh for the electricity delivered to the power grid during the incentivized period. However, it can only be granted to small plants and demonstration projects, in accordance with this law and other by-laws. The market premium is an incentive for the production of electricity, through which the state protects the producer from market price fluctuations relative to the price offered by the producer at auction by paying the difference between the auction price and the market price. If market prices are higher than the price offered by the producer at the auction, the producer will pay the difference to the state. The reference market price for calculating the market premium is the price of electricity on the day-ahead organized electricity market on the Serbian power exchange (SEEPEx). The incentivized period lasts 15 years, starting from the first payment of the incentive. In order to stimulate investments in the production of renewable energy sources, the first auctions for the allocation of incentives in the form of market premiums were successfully conducted in 2023. A total of 425.2 MW of new capacity was allocated (400 MW for wind power plants and 25.2 MW for solar power plants) in a transparent and professional manner. The total capacity of the power plants that received incentives is 716.99 MW (some power plants applied for incentives with part of the capacity). The total investment value of the power plants that applied for the auction is around €1.2 billion.

In November 2024, the Ministry of Mining and Energy launched the second round of auctions for the allocation of market premiums. In accordance with the Regulation on the Quota in the Market Premium System for Solar Power Plants (“Official Gazette of the Republic of Serbia”, No. 90/2024), the quota for solar power plants (with approved capacities of 500 kW and above) is set at 124.8 MW, while under the Regulation on the Quota in the Market Premium System for Wind Power Plants (“Official Gazette of the Republic of Serbia”, No. 90/2024), the quota for wind power plants (with approved capacities of 3 MW and above) is set at 300 MW.

This is only part of the implementation of the Plan of the Incentive System for the Use of Renewable Energy Sources for the Period 2023-2025 [50], which foresees the total allocation of incentives for the construction of 1.3 GW of renewable energy projects.

The quantities of electricity produced from the most significant renewable sources from 2014 to 2024 are shown in Table 7.

Table 7: Electricity production from the most significant renewable sources from 2014 to 2024 [31], [32]

Renewable energy sources	Electricity [GWh]										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Hydro power plants	11,617	10,783	11,520	9,752	11,393	10,198	9,749	11,984	9,274	13,080	10,512
Solar power plants	6	11.45	12.43	13.14	13.04	13.55	13.261	13.52	15.86	46.66	162.68
Wind power plants	0.37	0.42	25.91	48.45	150.42	898.21	975.63	1,085	949	1,068	1,355
Total	11,623.4	10,794.9	11,558.3	9,813.6	11,556.6	11,110	10,737.5	13,082.3	10,239.6	14,195.1	12,028.9

3.2.2. Transmission Capacities

The transmission electricity grid of the Republic of Serbia includes the 220 kV and 400 kV voltage levels, as well as parts of the 110 kV network (Figure 2), in accordance with the provisions of the Energy Law [1].

The 400 kV OHLs connect the largest and most important production and consumption centres in Serbia, and, primarily through this voltage level, the entire power system of Serbia is interconnected with the power systems of the neighbouring countries, enabling international electricity trade. The transmission system of Serbia is part of the Pan-European electricity

transmission system. It is interconnected by transmission lines with eight countries in the region, ensuring the transmission of electricity from the northeast to the southwest of Europe [45].

The transmission system of the Republic of Serbia is connected to neighbouring power systems via 20 interconnecting transmission lines with voltages of 400, 220 and 110 kV. In addition to the OHLs and facilities, the transmission system also includes other ancillary systems (telecommunication system, remote control system, own consumption, etc.), all of which together make the transmission system one of the most complex infrastructure systems.

Table 8 and Table 9 present data on the transformer stations and transmission lines that belong to EMS JSC.

Compared to 2023, there was no increase in capacity, i.e. the installed power of the plants in the EMS JSC transmission system, but the number of distribution plants increased by two.

The difference in the length of the high-voltage lines in 2024 compared to 2023 is 36.49 km.

The handover process of 110 kV transmission lines and cables between EMS JSC and EPS JSC, initiated in 2013 in accordance with the Law, is still ongoing. The procedure for the transfer of the remaining 110 kV transmission lines and cable circuits, still owned by the DSO, has been ongoing and is expected to be completed in 2025.

During 2024, the following was completed: the takeover of the 110 kV OHL No. 1247 TS Lazarevac – TS Ljig and OHL No. 1227 TS Jagodina – TS Jagodina 4, introduction of OHL No. 150 in CSS Crni Vrh 1, OHL No. 177/2 in CSS Crni Vrh, OHL No. 122B in Crni Vrh 1, OHL No. 1007 in CSS Zrenjanin, OHL No. 177/2 and OHL No. 150 were aligned with the new open pit mines at the Cerovo Cementacija and Cerovo Primarno, and the relocation of the OHL No. 1103/2 from TS Ada to the pole 50 was completed in the order to connect new 110 kV OHL TS Ada – TS Kikinda 2 to the TS Ada.

The total number of plants increased by two compared to 2023, due to the commissioning of the CSS 110 kV Crni Vrh 1 and the CSS 110 kV Zrenjanin.

Figure 2: Map of EMS JSC transmission network [45]

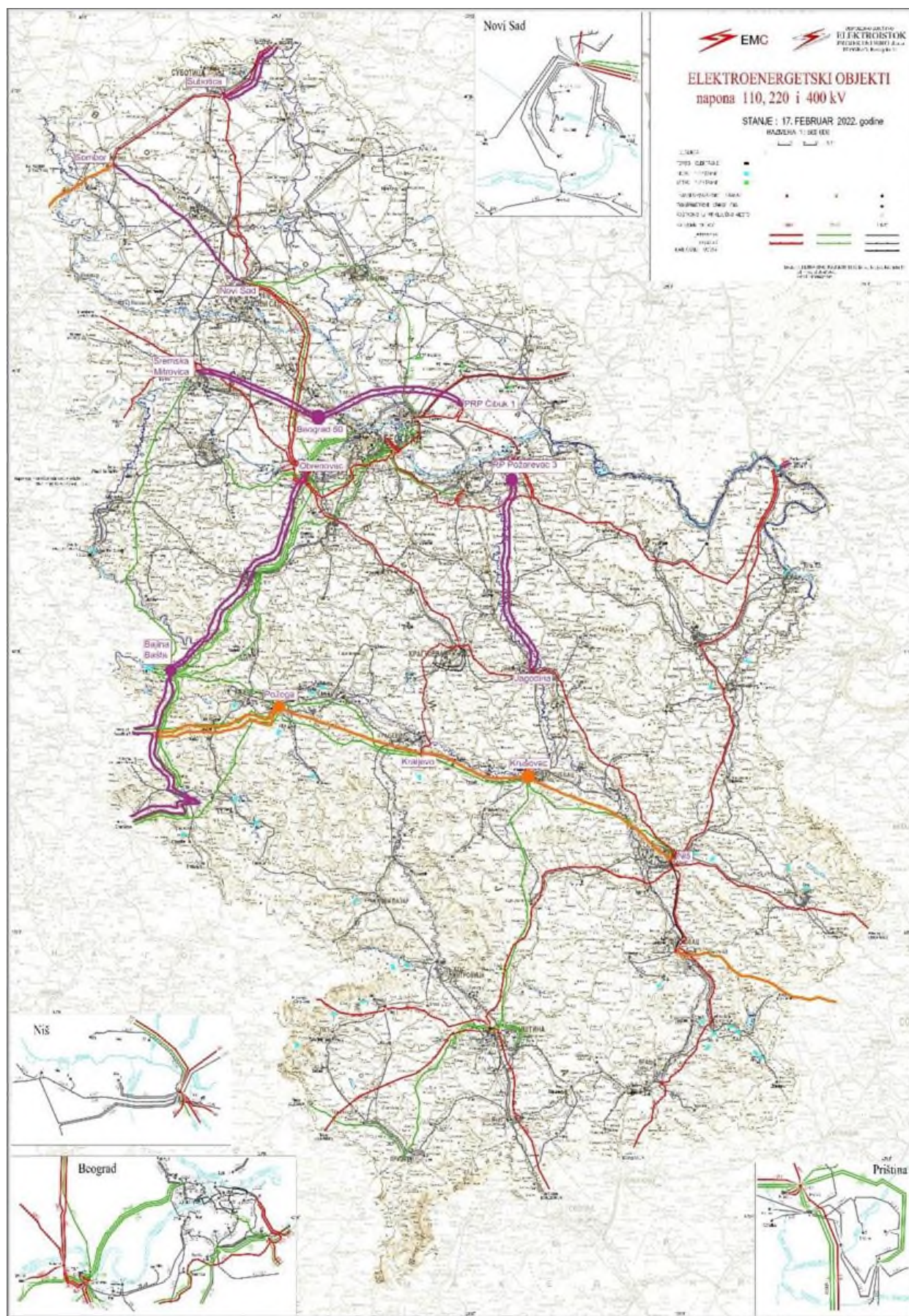


Table 8: Overview of EMS JSC transformer stations, for 2023 and 2024 [45]

Facilities owned by EMS JSC		2023	2024
400/x kV	Number of fascilities	22	22
	Number of transformers	32	32
220/x kV	Number of fascilities	14	14
	Number of transformers	28	28
110/x kV	Number of fascilities	13	15
	Number of transformers	16	16
Total	Number of fascilities	49	51
	Number of transformers	76	76

Table 9: Overview of EMS JSC power lines, for 2023 and 2024 [45]

Power lines owned by EMS JSC		2023	2024
400 kV	Number of OHL	40	40
	Length of OHL [km]	1,871.28	1,871.28
220 kV	Number of OHL	47	47
	Length of OHL [km]	1,768.64	1,768.64
110 kV	Number of OHL	391	397
	Length of OHL [km]	6,178.86	6,215.35
110 kV	Number of OHL	14	14
	Length of OHL [km]	54.51	54.51
< 110 kV*	Number of OHL	11	11
	Length of OHL [km]	205.28	205.28
Total	Number of OHL	503	509
	Length of OHL [km]	10,078.57	10,115.10

*110 kV lines operating at a voltage of 35 kV

3.2.3. Distribution Capacities

The distribution electricity network of the Republic of Serbia includes 35 kV, 20 kV, 10 kV and 0.4 kV voltage levels and 110/x kV transformer stations, in accordance with the provisions of the Energy Law [1].

At the end of 2024, Elektrodistribucija Srbije owned 36,934 transformer stations with a total installed capacity of 31,965 MVA and 168,047 km of distribution lines of all voltage levels, the structure of which for 2023 and 2024 is given in Table 10 and Table 11.

The change in capacity in 2024 compared to 2023 is reflected in an increase in the number of transformer stations by 182, while the installed capacity increased by 250 MVA. An additional 759 km of lines were also built (all at a voltage level of 20 kV or lower).

Table 10: Overview of Elektrodistribucija Srbije transformer stations¹², for 2023 and 2024 [51]

Facilities		2023	2024
110/x kV	No. of SSs	201	202
	S _r [MVA]	11,142	11,242
35/x kV	No. of SSs	583	581
	S _r [MVA]	6,646	6,681
20/0.4 kV	No. of SSs	9,169	9,252
	S _r [MVA]	3,546	3,604
10/0.4 kV	No. of SSs	26,799	26,899
	S _r [MVA]	10,381	10,439
Total	No. of SSs	36,752	36,934
	S_r [MVA]	31,715	31,965

Table 11: Overview of Elektrodistribucija Srbije power lines, for 2023 and 2024 [51]

Power lines [km]	2023	2024
110 kV	-	-
35 kV	6,956	6,976
20 kV	10,870	10,947
10 kV	34,417	34,529
0.4 kV	115,045	115,595
Total	167,288	168,047

3.3. Scope and Quality of Maintenance of Production Capacities, Transmission and Distribution Systems

3.3.1. Maintenance of Production Capacities

The program for maintenance for electricity and heat production plants in 2024, in the composition of the EPS JSC, included the following activities: routine maintenance (planned - preventive and corrective - emergency maintenance), standard overhaul maintenance and investment maintenance (modernization of equipment, efficiency improvement, extending the operational life of plants, increasing installed capacity, environmental programs and other).

The objectives of routine maintenance in 2024 were focused on intensive work to continuously assess and monitor the condition of the plants through regular preventive inspections and various diagnostic methods.

Maintenance of TPPs and TPP-DHs

Standard maintenance is an annual planned downtime which typically lasts from 3 to 6 weeks. During standard maintenance, repairs and refurbishments are carried out on worn-out components, as well as the replacement of parts that are expected to fail before the next maintenance. In 2024, standard overhauls were carried out for up to 30 days on the following units:

- TPP Nikola Tesla A: units A2, A4 and A6,
- TPP Nikola Tesla B: units B1 and B2,

¹² Sr - installed capacity

- TPP Kolubara: units A3 and A5,
- TPP Morava: unit A1,
- TPP Kostolac: units A2, B2 and B3,
- TPP-DH Novi Sad: units A1 and A2, and
- TPP-DH Zrenjanin: unit A1.

In 2024, the following extended overhauls, lasting from 30 to 60 days, were carried out on units:

- TPP Nikola Tesla A: unit A2 and
- TPP Kostolac: units A1 and B1.

Capital overhaul is a planned downtime of a production facility after 35,000 to 50,000 hours of operation. This maintenance includes the replacement of parts and assemblies that are estimated to not last until the next capital overhaul, and the replacement of which would require a prolonged downtime with significant and extensive dismantling/assembly work. During capital overhauls, in addition to activities aimed to extend the operational life of the plant and improve its operational characteristics, the installation of modern systems has become increasingly important in order to meet environmental protection requirements. The duration of the overhaul itself depends on the scope and complexity of the necessary, planned works, and the interval between two capital overhaul periods is determined based on the manufacturer's recommendation and the results of inspections conducted during annual checks.

In 2024, capital overhaul of the turbine was realized on unit A2 at TENT A and on unit B1 at TPP Kostolac. There were no planned overhauls on the units A1 and A2 at TPP Kolubara in 2024, so enhanced routine maintenance of the plant was carried out. Data on outages for 2023 and 2024 are presented in the following table, as well as their comparison.

Table 12: The number of outages of thermal units in EPS JSC for 2023 and 2024 [52], [53]

Outages/Year		2023		2024		Number of outages in 2024 compared with 2023	
		TPP	TPP-DH	TPP	TPP-DH	TPP	TPP-DH
Boiler pipe system		119	3	123	4	4	1
Turbine facility		19	4	22	1	3	-3
Technological and electrical protection		18	2	13	5	-5	3
Power facility		2	0	4	0	2	0
Other		7	0	12	0	5	0
Σ without suppression		165	9	174	10	9	1
Reserve shutdown		44	8	35	3	-9	-5
Σ TOTAL		209	17	209	13	0	-4
Forced outages	Number	165	9	174	10	9	1
	Forced outages rate Ki (%)	6.5	n/a	6.2	9.9	-0.3	n/a
	Equivalent forced outages rate EK _i (%)	24.8	n/a	29.7	38.6	4.9	n/a

As can be seen from the table above, the total number of outages in 2023 and 2024 did not vary much. The total number of outages, excluding suppression, increased from 174 to 184, which is an increase of 6%, but considering that this number was 167 in 2022 (177 in 2021), it can be concluded that these changes are not of particular importance. Compared to 2023, number of outages caused by problems in boiler pipe system was increased by 5 in 2024, which represents an increase of 4%. The number of reserve shutdown suppressions decreased by 14, while the number of outages in the turbine plant during 2024 remained unchanged compared to 2023. The number of outages due to technological and electrical protections decreased by 2, while the number of outages in power plants increased by 2. In the “other” category, there were 5 more outages in 2024 than in 2023.

For the next maintenance season, it will be necessary to plan procurements and works that will reduce the number of unplanned shutdowns.

Other activities in the overhaul of the thermal power sector during 2024:

- After the standard overhaul of unit A1 in TENT A, the so-called preparation for the extended winter season due to turbine repair was implemented in the period from September 20, 2024. to January 18, 2025.
- All planned repair works on unit A2 in TENT A have been completed. The most significant works include the revitalization of the TSP housing and the housing of medium-pressure safety valves, as well as the factory overhaul of the elements of the TSP flow section.
- The extended overhaul of unit A3 in TENT A has been postponed to February 2025, while maintenance (preparation for the winter season) was carried out during 2024.
- Standard repair works were carried out on all other units in TENT A, TENT B and TPP Morava.
- Three standard overhauls were conducted on the units of TPP Kostolac, since the planned replacement of the rotor blades of the turbine power unit (TNP) on the unit A1 at TPP Kostolac was postponed to 2025.
- At unit A1 in the TPP Kostolac, unit maintenance (preparation for the winter season) was carried out for 9 days, from October 8 to October 17, 2024.
- At unit B1 in the TPP Kostolac TPP, a major overhaul of the turbogenerator, boiler piping system, secondary measures to reduce nitrogen oxide emissions, as well as the suspension of the steam pipeline, was carried out.
- Standard repairs were carried out on the units of Pannonian TPP-DH (both units in Novi Sad and the unit in Zrenjanin). The modernization of the turbine plant control unit at TPP-DH Zrenjanin, planned for 2024, has been postponed to 2025.

The data are taken from the official annual report of EPS JSC on the implementation of the maintenance program of EPS JSC power plants for 2024 [53]. The data on the forced outage factor and the equivalent forced outage factor were taken from the Annual Report on the Operation of Production Capacities for 2024 [54].

Hydro sector

EPS JSC operates 49 conventional hydro-generators, one pumping stations with two pumps and two reversible hydro-generators. All these units are organized into a total of 16 hydropower plants (including one reversible) and one pumped storage plant, through the branches of HPP Đerdap and HPP Drinsko Limske. An overview of hydropower plants by branches with their associated installed capacities at the power plant interface is provided in Table 13.

Table 13: Overview of hydro power plants by branches in the Republic of Serbia¹³[56]

Branch/HPP	Aggregates	Pn (net production capacity) [MW]
HPP Đerdap - Kladovo		1,619.0
Đerdap I	A 1-A 6	1,140.0
Đerdap II	A 1-A 10	270.0
Vrla I	A 1-A 4	51.0
Vrla II	A 1-A 2	23.8
Vrla III	A 1-A 2	29.4
Vrla IV	A 1-A 2	24.8
Pirot	A 1-A 2	80.0
Drinsko -Limske HPP		1,387.8
Bajina Bašta	A 1-A 4	420.0
Bajina Bašta PSHPP	A 1-A 2	614.0
Zvomik	A 1-A 4	125.6
Ovčar Banja	A 1-A 2	8.2
Međuvršje	A 1-A 2	9.0
Potpeć	A 1-A 3	51.0
Bistrica	A 1-A 2	102.0
Kokin Brod	A 1-A 2	22.0
Uvac	A 1	36.0
Small HPPs	-	17.9
HPP EPS JSC		3,024.7

The most significant investments in 2024:

- Revitalization of units in PSHPP Bajina Bašta. The revitalization works of the first unit were completed on January 6, 2025. The revitalization of the second unit will be carried out between March 2025 and March 2026. The revitalization is not intended to increase the power of the unit, but rather the main goal is to extend its service life, i.e. install equipment for the next 40-year operating cycle, as well as further reliable production and provision of the above-mentioned services to the system.
- The revitalization of the ship lock at HPP Đerdap 2 has been completed. All revitalization works of electromechanical equipment have been completed at the HPP Đerdap 2. The value of the works amounts to 29 million EUR, and they were carried out under a contract concluded between the Ministry of Construction, Transport and Infrastructure (the investment holder) and DSD Noell GmbH, Germany, the consortium leader. Financing was provided 60% through an EIB loan, while the remaining 40% was secured from the CEF Fund (Connecting Europe Facility Fund).
- Revitalization of 10 units in Vlasinske HPPs. The subject of the reconstruction includes the generating units, the associated and auxiliary electromechanical systems of the units, and the hydromechanical equipment at the HPP Vrla 1, HPP Vrla 2, HPP Vrla 3, and HPP Vrla 4. The main goal of the reconstruction is to ensure reliable and safe operation of the Vlasina HPPs in the next 30-year exploitation period. Tender documentation has been prepared in accordance with EBRD rules, and the procurement process is ongoing.

¹³ Conventional hydro units and two pumped storage hydro units, not including the third unit which was a station transformer at the HPP Međuvršje.

It is expected that by the end of 2025 contracts will be signed for the main works, supervision, and the modernization of the aggregate control system.

During 2024, capital overhauls were carried out on the units of HPP Đerdap 2 A1 (109 days) and HPP Đerdap 2 A2 (94 days).

As for the other hydro generators, a relatively large number of inspections and standard overhauls were carried out. During 2024, a total of 74 outages occurred, of which 50 outages occurred in the branch of HPP Đerdap, while the remaining 24 outages occurred in the branch of Drinsko – Limske HPPs. Unplanned outages at HPP Đerdap 2, lasting 3 days each, occurred due to failure in the kinematics of the directional unit, on unit A1, and due to the repair of a leak in the turbine seal, on unit A2. The outages on units A3 and A6 in HPP Đerdap 1 were caused by a failure in the turbine regulator, while the cause of the failure on unit A2 was a leakage of the shaft seal. A short outage on unit A1 at the HPP Vrla 3 occurred due to a failure of the regulating pump, while the outage on unit A3 at the HPP Zvornik was caused by the loss of SF6 gas in the circuit breaker. Unit A2 at the HPP Kokin Brod experienced a 3-day outage due to a cooler rupture, as well as a short outage on the same unit caused by a failure of the control valve. Of particular note are the outages at: unit A2 at HPP Potpeć due to a single-phase ground fault in the stator winding that lasted 31 days, then at unit B at HPP Vrla 2 for 6 days due to the operation of the ground fault protection, which caused repair works on the generator stator; and on unit A2 at the HPP Ovčar Banja, where works lasted 5 days due to a failure of the shaft sealing.

Production, processing and transportation of coal

As for the overhauls within the branches for coal production, processing and transportation, the implementation of a total of 19 overburden systems, 7 coal production systems and 3 coal processing lines is planned for the 2024. These overhauls were completed, except for the BTO overburden system, where the overhaul was not completed on one overburden system (out of the planned 19).

3.3.2. Transmission System Maintenance

The Energy Law [1] stipulates the obligation of the Transmission System Operator to ensure the safe and reliable transmission of electricity, which therefore implies adequate maintenance.

During 2024, as in previous years, the focus of work on OHLs was on regular maintenance, inspections and overhauls.

On the 110, 220 and 400 kV OHLs, 98.94% in 2024 of the total number of planned audits was performed. A total of 7,027.96 km of OHLs of all voltage levels were overhauled (major construction and reconstruction works on transmission lines are presented in chapter 3.2.2).

The operational readiness of transformer stations and high-voltage equipment during 2022 and 2024 was at a satisfactory level. The following events had the greatest impact on the operational readiness in 2024:

- Lack of human resources and high engagement rates on connection projects;
- Outage of T3 in TS Srbobran due to the operation of the Buchholz relay. After oil sampling, electrical tests were performed and it was concluded that the transformer was unfit for further operation and its replacement was initiated. Transportation was organized by the transporter, design works were carried out by Elektroistok - Projektni biro Ltd, as well as works on replacement which is performed by ELEKTROISTOK - Izgradnja Ltd. A standby transformer from the TS Požega, manufactured by ENERGOINVEST, type RT20 with a rated power of 20 MVA and a voltage ratio of 110/36.75/10.5 kV, was installed; The power transformer T1 with a voltage ratio of 220/115/10.5 kV and a rated

power of 150 MVA at the TS Valjevo 3 was unavailable due to a failure of the 10 kV cable termination, which caused an interruption of the substation's auxiliary power supply. Replacement of all three cable terminations was organized, the cable was tested, and the transformer was returned to service. On July 8, 2024, transformer T4 at the TS Belgrade 5 tripped due to the operation of the restricted ground fault protection. The following day, the damaged conductor insulator was replaced and the transformer in question was checked, after which it was returned to operation;

- During an annual overhaul at the TS TENT A substation facility (for own consumption) at TRP T1 110 kV, a mechanical failure was detected in the Minel PS1231 switch from 1987. The switch drive mechanism has been replaced. A complete replacement of the circuit breaker and busbar disconnecter is planned for this year.
- Operation of the differential protection caused the outage of transformer TR1, manufactured by Siemens (2008), at the TS Zrenjanin 2. The outage occurred due to a flashover on the neptun junction of the tertiary winding caused by an animal (a marten). The damaged neptun junction was replaced with a new one.
- At TS Valjevo 3, an insulating plate on the neptune junction caught fire. Transformer TR1 Minel (1985) was not affected by the fire but was disconnected. The fire damaged the neptune junction and the conductors between the transformer and the tertiary housing. The arresters in the neptune junction have been replaced with new ones.

The good operational readiness of the transformer stations was contributed by: high-quality preventive and corrective maintenance of high voltage equipment, routine inspections, checks, overhauls, as well as reconstructions of transformer stations.

In 2024, the 400/x, 220/x and 110/x kV transformers, as planned, were overhauled. In addition to the planned works, during 2024, there were also significant efforts focused on corrective and emergency actions to address the identified deficiencies. Major works on high-voltage equipment and substations during 2024 include:

- Replacement of circuit breakers and bus bar disconnectors for both systems of the 220 kV main bus bars at TRP No. B05, as well as the cooling cabinet and current transformer for REF protection on transformer T2 at the TS 220/110/10 kV Šabac 3.
- At the TS TENT A substation facility (for own consumption), the circuit breakers and disconnectors in OHLs fileds 121/2 and 121/3 were replaced.

3.3.3. *Distribution System Maintenance*

During 2024, all activities related to the maintenance of electric power facilities were carried out in accordance with the plans of Elektro distribucija Srbije. The focus of the work was on routine maintenance, overhauls, inspections, and the replacement of measuring devices. Completed overhaul works in 2024:

- The planned number of preventive inspections was completed, except for a very small number that were not carried out due to the impossibility of de-energizing and adverse weather conditions. The total number of preventive inspections carried out at all voltage levels during 2024 was 73,063, of which: 2,986 at TS 110/x kV, 5,414 at the 35 kV voltage level, 44,528 at medium voltage (10 and 20 kV), and 20,138 at low voltage.
- The planned preventive overhauls were carried out with high quality, except for a small number which were not realized due to the inability to disconnect the system and adverse weather conditions. The total number of preventive repairs completed at all voltage levels

during 2024 was 27,542. Of these: 869 at TS 110/x kV, 1,827 at the 35 kV voltage level, 11,282 at medium voltage (10 and 20 kV), and 13,564 at low voltage.

- Corrective overhauls, i.e. interventions represent the removal of a defect in the building or part of the building. They represent a priority in the maintenance of electric power facilities and all planned works are postponed if there is a need to urgently eliminate the malfunction. This is why it happens that due to a large number of corrective repairs (which by their nature cannot be planned), regular maintenance (preventive audits and repairs) has to be postponed for some future period. The total number of corrective repairs (interventions, i.e. repaired defects) at all voltage levels during 2024 was 79,997. Of these: 423 at TS 110/x kV, 939 at voltage level 35 kV, 11,747 at medium voltage (10 and 20 kV) and 66,888 at low voltage.
- A total of 7,051 dilapidated impregnated columns were replaced with concrete ones.
- A total of 834.50 km of AlFe conductors were replaced with SKS.
- A total of 273,912 single-phase and three-phase meters, as well as measuring groups, were replaced.

Significant investment in the automation of the distribution system at all voltage levels in recent years has led to a substantial increase in the number of facilities and elements of the distribution system included in the remote monitoring and control systems (RMC). The automation process advanced the most at the TS 110/x kV, as the most significant elements of the distribution system. Out of a total of 210 facilities in this category, 199 have been integrated into the RMC. As for the 35/x kV TSs and switching stations, out of a total of 650, 453 have been included in the RMC. The process of automating the elements of the remaining part of the distribution system of Elektro distribucija Srbije is also underway, and currently, 2,496 different elements/facilities (TS 20(10)/0.4 kV, reclosers and bus bar sectionings) have been integrated into the RMC, distributed across the network's depth.

3.4. Security Assessmentt of Transmission and Distribution System Operation

The main guideline in the planning and construction of the transmission and distribution network is to ensure the “n-1” criteria, according to which the failure of any element of the transmission and/or distribution system (line or transformer) does not lead to the disruption of the normal operation of the transmission and/or distribution system, nor to a reduction in the supply of electricity to customers. Radially supplied system users in which this criterion is not met are predominantly located in rural and mountainous areas at the distribution level.

3.4.1. Security Assessment of Transmission System Operation

Indicators of continuity of supply in the transmission network, which are monitored and calculated, are as follows:

- Power outage [MW] – total power loss at all measurement points where supply was interrupted,
- ENS [MWh] – total unsupplied, representing the total amount of unsupplied electrical energy during all interruptions,
- ENS [%] – a share of unsupplied electricity in the total supplied electricity,
- AIT [min] – average duration of supply interruptions in minutes, which represents the quotient of unsupplied electricity and average power.

Table 14 presents the values of the continuity of supply indicators in the transmission network for the period 2014–2024.

Table 14: Indicators of supply continuity in the transmission network [39] ¹⁴

Year	Interruptions	Power failure [MW]	ENS [MWh]	ENS [%]	AIT [min]
2014	Planned	115	110	0,0003	2,07
	Unplanned	1.905	3.496	0,0104	57,25
	Total	2.020	3.605	0,0107	59,32
2015	Planned	359	1.543	0,0046	26,57
	Unplanned	2.292	1.659	0,0049	26,35
	Total	2.351	3.202	0,0095	52,92
2016	Planned	167	547	0,0016	9,61
	Unplanned	1.693	1.317	0,0039	21,32
	Total	1.860	1.864	0,0055	30,93
2017	Planned	306	1.496	0,0044	24,76
	Unplanned	1.980	1.418	0,0042	24,04
	Total	2.286	2.914	0,0086	48,79
2018	Planned	350	1.552	0,0024	27,30
	Unplanned	1.059	826	0,0013	13,42
	Total	1.409	2.378	0,0037	40,72
2019	Planned	429	1,065	0.0032	17,93
	Unplanned	832	595	0.0017	9,25
	Total	1,261	1,660	0.0049	27,18
2020	Planned	676	1,162	0.0035	20,70
	Unplanned	2,856	978	0.0029	15,84
	Total	3,535	2,140	0.0064	36,54
2021	Planned	495	1,340	0.0039	22,34
	Unplanned	1,147	1,038	0.0041	15,92
	Total	1,642	2,378	0.0080	38,26
2022	Planned	925	1,034	0.0030	17,45
	Unplanned	791	819	0.0024	13,14
	Total	1,716	1,853	0.0054	30,59
2023	Planned	13,771	1,150	0.0034	18,33
	Unplanned	13,042	2,293	0.0068	37,38
	Total	26,813	3,443	0.0103	55,71
2024	Planned	522	560	0.0017	9,22
	Unplanned	1,067	1,036	0.0031	15,99
	Total	1,589	1,596	0.0047	25,21

Compared to 2023, in 2024 the indicators for unplanned outages are significantly better, both in terms of total unsupplied (ENS) and power outages. Based on the data on the causes of interruptions, it is evident that force majeure, in 2024, significantly reduced from 63.11% in 2023 to only 4.50% in 2024. However, outages caused by another energy entity increased from 15.87% in 2023 to 50.35% in 2024.

¹⁴ NOTE: In 2021, the methodology for calculating continuity indicators and power outages was changed compared to previous years, i.e., pumped storage hydropower plants and energy storage systems are now considered separately when operating in the mode of absorbing electricity from the transmission system..

In 2024, due to unplanned events, a total of 1,036.48 MWh of electricity was not delivered. EMS JSC was responsible for 460.92 MWh, or 44.47% of unsupplied energy. The planned ENS, for which EMS JSC was responsible, was 300 MWh, which means that the amount of unsupplied electricity in 2024 exceeded the planned limit. The most significant events that contributed to exceeding the planned values occurred in March, May, November and December. The major causes of interruptions within the responsibility of EMS JSC were transient faults on OHLs (11.98%), permanent faults on OHLs (66.22%), and permanent faults in the plant (14.22%). Other transmission system users were responsible for 521.87 MWh or 50.33%. In addition to the above, 559.7 MWh was not delivered as a result of the planned works, resulting in a total of 1,596.18 MWh of unsupplied electrical energy in 2024, when combined with unplanned supply interruptions. In 2024, the average duration of planned interruptions was 9.22 minutes, and for unplanned interruptions, it was 15.99 minutes, while the portion related to EMS JSC was 7.22 minutes. The total average interruption time in 2024 was 25.21 minutes [45]. For 2024, the planned value of the AIT parameter under the responsibility of EMS JSC was 5.0 minutes, so it is concluded that the average value of the delivery interruption for which EMS JSC is responsible exceeded the planned value. Unplanned interruptions caused by the transmission system operator, due to disruptions in the transmission system that occurred during 2024, and which led to the interruption in the operation of production capacities, were as follows: on January 30, 2024 due to a circuit breaker failure on the 110 kV OHL No. 1110/2 TS Nova Varoš – HPP Uvac in TS Nova Varoš, there was an asymmetric load in the network, and due to the untimely reaction of the EMS JSC dispatcher, a production module in the HPP Uvac failed (at the time of the outage, production was 28.28 MW); on October 22, 2024, due to a transient fault on the 110 kV busbar system No. 1 in the SS 110 kV Đerdap 2, there is a failure of the generation modules G1, G2, G3, G4, G5, G6, G7, G8 and G10 (at the time of the outage HPP Đerdap 2 produced a total of 225 MW).

3.4.2. *Assessment for Distribution System Security*

The continuity of supply in the distribution network is evaluated based on the following indicators:

- SAIFI [number of interruptions/user] – the average frequency of supply interruptions per user, calculated as a quotient of the cumulative number of interruptions and the total number of users and
- SAIDI [min/user] – the average duration of interruptions in minutes per user, calculated as the quotient of the cumulative duration of supply interruption per user and the total number of users.

Table 15 presents the continuity of supply indicators in the distribution system for the period 2014-2024.

Table 15: Indicators of continuity of supply in the distribution system [39], [51]¹⁵

SAIFI (number of interruptions/user)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total	10,53	9,25	8,11	8,38	7,99	8,14	8,20	8,27	6,93	7,92	6,34
Unplanned	8,09	6,73	6,05	6,42	6	6,29	6,61	6,57	5,33	6,42	4,95
Planned	2,44	2,52	2,06	1,97	1,99	1,85	1,6	1,7	1,6	1,49	1,38
SAIDI (min/user)	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Total	1,283	1,029	810	917	811	789	804	892	617	851	705
Unplanned	850	542	458	578	441	486	547	616	349	590	427
Planned	433	487	352	338	370	302	257	276	268	261	278

Regarding the indicators of the continuity of electricity supply, at the level of Serbia as a whole, there was an overall improvement in the SAIFI and SAIDI indicators in 2024. The average frequency of unplanned interruptions decreased from 6.42 to 4.95 interruptions per user, while the average duration of unplanned interruptions per user decreased by 163 minutes, from 590 to 427 minutes. The average frequency of planned interruptions also decreased from 1.49 to 1.38 interruptions per user, while the average duration of planned interruptions per user increased by 17 minutes (6.5%), from 261 to 278 minutes.

3.5. Mechanisms for Congestion Management in Transmission and Distribution Systems in Accordance with the Treaty Establishing the Energy Community and the Rules of European Transmission System Operator Associations

3.5.1. Mechanisms for Congestion Management in Transmission Systems

Congestion in the transmission system is a phenomenon when there is a greater demand for transmission capacity on the market than what is offered. Such situations occur in cases when there is a greater demand for a given direction and period during a capacity auction than the available transmission capacity [45].

The allocation of cross-border transmission capacity is a mechanism for eliminating congestion between the control areas of the neighbouring transmission system operators. At the borders of its control area, EMS JSC allocates cross-border transmission capacity in the form of explicit auctions (via a market mechanism through a public auction to allocate available transmission capacity for predefined borders, directions, and time periods). There are two types of auctions [45]:

- Joint auctions in which the transmission system operator allocates the total available capacity between two control areas,
- EMS JSC, as the transmission system and electricity market operator in Serbia, is responsible for organizing annual, monthly, weekly, and daily auctions for 50% of the total available cross-border transmission capacity. The neighbouring TSO organizes auctions for 50% of the available capacity.

During 2024, EMS JSC conducted the allocation of cross-border transmission capacity at the borders of its control area in the following manner [45]:

- Since 2015, a joint allocation of rights to use available transmission capacities has been organized at the Serbia – Bosnia and Herzegovina border. EMS JSC organized annual and monthly auctions, while daily auctions and intraday allocations were conducted by NOSBiH (the transmission system operator in Bosnia and Herzegovina).

¹⁵ Data for 2014 are taken from AERS documentation, and from 2015 to 2024 from Electro distribucija Srbije documentation.

- Since 2013, a joint allocation of rights to use available transmission capacities has been organized at the Serbia – Romania border. In 2024, EMS JSC organized daily auctions, while annual and monthly auctions, as well as intraday allocations of cross-border transmission capacity, were conducted by the Romanian transmission system operator CNTEE Transelectrica S.A.
- Since 2014, a joint allocation of rights to use available transmission capacities has been organized at the Serbia – Bulgaria border. In 2024, annual, monthly and daily auctions were organized by the allocation office JAO S.A. (Joint Allocation Office S.A. from Luxembourg), and EMS JSC was responsible for conducting the intraday allocation of cross-border transmission capacity.
- In 2017, EMS JSC became a user of the services provided by JAO S.A., the office for coordinated capacity auctions. Since 2018, the coordinated cross-border transmission capacity auctions on the Serbia-Croatia border have been conducted by JAO S.A., on the Serbia-Bulgaria border since 2019, and on the Serbian-Hungarian border since 2024.
- Since 2011, a joint allocation of rights to use available transmission capacities has been organized at the Serbia–Hungary border. In 2024, EMS JSC was responsible for conducting the intraday allocation of cross-border transmission capacity, while Joint Allocation Office S.A. was responsible for organizing annual, monthly and daily auctions.
- Since 2014 a joint allocation of rights to use available transmission capacities has been organized at the Serbia – Croatia border. Annual, monthly and daily auctions were organized by the allocation office JAO S.A. (Joint Allocation Office S.A.) from Luxembourg, while EMS JSC conducted the intraday auctions. Since 2017, a joint allocation of rights to use available transmission capacities has been organized at the Serbia – North Macedonia border. EMS JSC was responsible for organizing daily auctions, as well as for conducting the intraday allocation of cross-border transmission capacity. The annual and monthly auctions were organized by MEPSO (the Macedonian transmission system operator).
- Since 2020, a joint allocation of rights to use available transmission capacities has been organized at the Serbia–Montenegro border. In 2024, EMS JSC was responsible for organizing annual and monthly explicit auctions, while daily auctions and intraday allocations were organized by CGES (the Montenegrin transmission system operator).

3.5.2. *Mechanisms for Congestion Management in Distribution Systems*

Congestion in the distribution system occurs when distribution network elements (lines and transformers) are overloaded and when there is a violation of both minimum and maximum voltage limits in the distribution network.

Managing congestion in the distribution network, to eliminate the causes of congestion, includes the following activities:

- Change of distribution grid topology,
- Cancellation of planned and suspension of ongoing works,
- Regulation of voltage with transformers 110/x kV,
- Temporary pre-adjustment of protection, which allows an increase in power line transfer capacity,
- Coordinated implementation of management actions with neighbouring distribution systems operators in order to restore normal operation,

- Limitation of production of the power plants that are connected to the distribution system.

Note: The distribution system of the voltage level less than 110 kV works as a radial one. Alternative power directions are used when the need arises.

3.6. Data on the Measures to Cover Peak Demand, as well as Measures Taken in the Event That One or More Suppliers Do Not Provide Sufficient Quantities of Electricity

The Energy Law [1] stipulates that in case of threat to the security of supply to end customers due to insufficient supply in the market or the occurrence of other emergency circumstances, the Government shall impose measures to restrict electricity supply, or establish special conditions for the import or export of electricity, the manner and conditions for the formation and control of prices, the obligation of supply exclusively to particular users, or special conditions for performing energy activities with minimal disruption to the energy market in the region. In the event of a general shortage of electricity, measures are taken to restrict the supply of electricity, as well as measures for energy conservation and rational electricity consumption. To cover peak consumption, if one or more suppliers do not provide enough electricity, the transmission system operator is obliged to provide the missing amount of electricity. The transmission system operator shall take the following actions:

- Conclusion of the Agreement for providing system services, procurement, and delivery of electricity for compensation programs in the control area of the Republic of Serbia towards the European interconnection,
- Conclusion of Contracts on the supply of electricity in emergency modes,
- Preparation of daily operational plans for the transmission system based on the daily plans of balancing groups,
- System balancing in real-time.

In order to ensure system services, EMS JSC concludes contracts with transmission system users for the provision of ancillary services, which include primary reserve, secondary reserve, tertiary reserve, voltage regulation capacities, and capacities for restoring the transmission system after a blackout.

The amount of reserves is regulated by the Transmission Grid Code [36], based on the technical requirements of the 'Continental Europe' interconnection. Details regarding the values of primary, secondary, and tertiary reserves are provided in Chapter 3.1.3.

The transmission system operator prepares the Daily Operational Plan of the transmission system based on the available transmission capacities between each trading zone in both directions, accepted daily operational plans of balancing groups, forecasted electricity consumption, forecasted technical losses in the transmission system, planned amounts of primary, secondary and tertiary reserves, as well as the availability of generation modules and energy storage facilities, i.e. balancing entities. Based on this Daily Plan, and in accordance with the interconnection network code, the transmission system operator conducts appropriate analyses to determine whether all prerequisites for the normal operation of the system are met. If these analyses show that the reported daily operational plans of the balancing groups ensure the conditions for normal operation, the transmission system operator takes appropriate measures, in accordance with the Transmission Grid Code [36].

Balancing the electricity system in real-time is achieved through the activation of secondary and tertiary reserves. In this way, balance is maintained between production, consumption, and agreed cross-border electricity exchanges. In addition to the contracted reserve capacity, the

balancing mechanism includes all production capacities that are not engaged in the operational plan but are available for production. If the internal capacities are insufficient to cover consumption, the electricity transmission system operator shall procure emergency energy.

Sometimes, despite all the measures taken, the required amount of electricity cannot be secured. In the event of a shortage of active power in the transmission system, reactive power deficiency in the system, or voltage collapse, overloading of network elements at 400 kV, 220 kV and 110 kV, or any other disturbance that threatens to disrupt the normal operation of the transmission system, voltage reductions may be applied through the implementation of the Transmission System Protection Plan against voltage collapse, i.e. by limiting the supply of electricity in the entire system or in specific parts of the system by applying the Electricity Supply Restriction Plans, provided that all possible measures have been taken to avoid applying the aforementioned plans. In that case, the responsible control centre of the transmission system operator decides which type of plan to implement, in accordance with the Transmission Grid Code [36]. The size of the interconnection, as well as the good connectivity with neighbouring transmission systems, allows the transmission system operator to compensate for the deficit in the shortest possible time.

3.7. Data on the Progress of Construction of Facilities for Electricity Generation, Transmission, and Distribution

3.7.1. Electricity Generation

The overview of all electricity generation capacities in the Republic of Serbia is provided in Chapter 3.2.1 (Table 6). In 2024, total installed capacity increased, primarily in thermal power plants and wind farms. The largest change resulted from the commissioning of the newly constructed B3 unit at the TPP Kostolac B, which increased the total generation capacity by 350 MW. The capacities of the wind farms increased by 94.4 MW, while solar power plants recorded a significant proportional rise in installed capacity, from 42.8 MW to 95.2 MW.

Prosumers have more than doubled their installed capacity, now reaching 84.2 MW.

No major changes were recorded for other types of power plants.

3.7.2. Transmission System

The Energy Law [1] stipulates that the transmission system operator is obligated to prepare and submit to AERS for approval, every two years, a ten-year Transmission System Development Plan of the Republic of Serbia, as well as an annual three-year Investment Plan for the transmission system. In 2023, EMS JSC submitted to AERS the proposed Transmission System Development Plan of the Republic of Serbia for the period 2023-2032, which AERS, in accordance with the Law, placed on public consultation from 4 July to 5 August 2023. AERS granted its approval for this plan on March 28, 2024. During 2024, EMS JSC submitted to AERS the proposed Investment Plan for the transmission system of the Republic of Serbia for the period 2024-2026. AERS approved this plan on December 6, 2024. At the end of 2024, a draft Transmission System Development Plan of the Republic of Serbia for the period 2025-2034 was prepared, as well as a draft Investment Plan for the transmission system for the period 2025-2027. These drafts will be presented to the Technical Council Board in March 2025, after which they will be submitted to the Shareholders' Assembly of EMS JSC, and subsequently forwarded to AERS for approval.

The main investment activities in 2024 related to the implementation and management of construction, extension, reconstruction, and modernization projects concerning existing facilities of the EMS JSC transmission system.

With respect to investment projects for high-voltage transmission lines, two HV line facilities were energized in 2024, while intensive work continued on 13 projects [45]:

- Completed high-voltage transmission line facilities in 2024:
 1. Interconnection OHL 2x400 kV TS Pančevo 2 - TS Rešica;
 2. 110 kV OHL No. 1270 TS Bela Crkva - TS Veliko Gradište;
- Projects required to ensure reliable supply for the new demand expected in the Surčin area, both due to the inevitable industrial expansion and major developments such as the construction of the National Football Stadium with all accompanying facilities. In addition, the need for these projects is further emphasized by the fact that Belgrade has been selected as the host of the world exhibition EXPO 2027, where the stable supply of facilities built for this event will depend directly on the implementation of the following projects:
 1. 2×110 kV connection OHL for TS 110/35 kV Belgrade 44 (Surčin) – Reconstruction works at the Euro Asia Trade location in Novi Beograd have been completed. To date, piles and foundations have been constructed for around 60% of the new OHL route, out of a total of 31 towers up to TS Surčin. Contract annexes have been signed with the contractor for works related to the railway crossing, and an agreement on financing the works has been signed between EMS and MCTI. MCTI has provided EMS with all required documentation, and the amended Construction Permit was issued on September 13, 2024. In early October 2024, works began on relocating the 220 kV OHL due to the construction of the new railway line for EXPO 2027, and all required piles for tower foundations were completed. The execution design has been finalized. Completion of works is expected in 2025.
 2. 2×110 kV connection cable for TS 110/10 kV Belgrade 58 (National Stadium) – At the end of December 2024, a public procurement procedure was launched for selecting the contractor and associated equipment supplier. Contracting is expected by the end of February/March 2025. The harmonized request for obtaining the Construction Permit was submitted on January 15, 2025.
 3. Reconstruction of OHL 110 kV No. 104/1 and 104/2 TS Belgrade 5 - TS Belgrade 2 into a double-circuit line – Verification of the route by the designers has been completed. Information on location requirements was received in mid-June. An application for location conditions was submitted on August 6, 2024, and the process of obtaining conditions from the relevant public utility companies is ongoing. Public interest has been granted. Publication of the public procurement is planned for early April 2025, with contract signing expected in early June 2025. Start of works is planned for late June or early July 2025, and completion of the entire Phase 1 project is expected by December 2026.
- Investment OHL projects with intensive construction activities during 2024:
 1. Approximately 98% of works have been completed on the construction of the new 2×110 kV OHL TS Kraljevo 3 - TS Novi Pazar 1, with a total length of 63.578 km, for which 223 steel lattice towers were planned at the start of construction in 2022.
 2. Construction of the completely new OHL 110 kV No. 142/1 TS Srbobran - TS Bečej began in 2022 and continued through 2023 and 2024. Approximately 87% of works have been completed.

3. All works on the 110 kV OHL TS Ivanjica - TS Guča have been completed, except for electromechanical works in the connection spans to TS Ivanjica and TS Guča, where EDS needs to complete the OHL bays.
4. More than 90% of works initiated at the end of 2022 have been completed on the construction of the 110 kV OHL No. 1269 TS Ada - TS Kikinda 2.
5. All construction works have been completed and final testing is underway prior to commissioning of the 110 kV cable No. 1286 TS Obrenovac A - TENT Obrenovac A substation (for own consumption).
6. A public procurement procedure was conducted, the execution design was completed, and preparatory activities were carried out for the reconstruction of sections of OHL No. 151/2 and 151/3.
7. Approximately 31% of works have been completed on the 220 kV line rearrangement and the connection of OHL 110 kV No. 117/1 TS Beograd 2 - TS Belgrade 35 into TS Belgrade 3.
8. All foundation works that did not require OHL outages have been completed, and 60% of foundations have been completed for the reconstruction of OHL 116/1 Sevojno - Kosjerić.
9. Approximately 25% of works have been completed on the reconstruction of the 110 kV OHL 113/1 Niš 2 - Niš 1.
10. A construction permit has been obtained, a public procurement procedure carried out, and part of the equipment procured for the construction and rehabilitation of the mixed line TS Novi Sad 3 - TS Inđija 2.
11. Approximately 85% of civil works have been completed on the extension of OHL 110 kV No. 1104 TS Pančevo 2 - Pančevo 3 with connection to TS Pančevo 6.

In 2024, work was fully completed on high-voltage substation investment projects involving the reconstruction of the SS 400 kV, 220 kV and 110 kV at TS Pančevo 2, as well as the adaptation of 110 kV bays at SS Đerdap 2. The remaining activities are presented below:

- During 2024, the following activities were initiated:
 1. TS 400/110 kV Kragujevac 2 – reconstruction of auxiliary power supply and construction works on relay houses with cable ducts; tender documentation prepared and procurement launched for reconstruction of the SS 400 kV and 110 kV;
 2. SS 110 kV Đerdap 2 – construction and adaptation of 110 kV bays required for the integration of the OHL from CSS Nikine Vode;
 3. TS 220/110 kV Valjevo 3 - construction of the pit and foundations and installation of the new transformer T2 (220/110 kV – 250 MVA);
 4. TS 400/110 kV Vranje 4 – procurement of a 200 MVar variable shunt reactor contracted and technical documentation harmonized;
 5. TS 400/110 kV Bor 2 – contracted works for reconstruction of the remaining part of the SS 400 kV (junction field and two OHL fields construction permit obtained and works contracted (including a design annex) for equipping the 110 kV bay E02 for integration of the line from CSS Bor 4;
 6. CSS 110 kV Košava – contracted works for equipping the 110 kV bay E04 for integration of the OHL from TS Alibunar;

7. CSS 110 kV Bor 4 – contracted works (including a design annex) for equipping two 110 kV bays E02 and E07 for integration of OHL from TS Bor 2 and TS Zaječar 2;
 8. TS 400/220 kV Obrenovac – installation of transformer T4 (220/110 kV – 150 MVA);
 9. TS 110/35/6 kV TENT A substation (for own consumption) – equipping bay E04 for the 110 kV cable to TS Obrenovac;
 10. TS 400/220/110 kV Novi Sad 3 – onstruction permit obtained and works contracted (with a design annex) for equipping the 110 kV bay E15 for the introduction of OHL 217/1 from TS Obrenovac;
 11. TS 400/220/110 kV Pančevo 2 – reconstruction of the SS 20 kV, tender documentation prepared and procurement launched for reconstruction of the control building and internal roads;
 12. TS 220/110/35 kV Belgrade 5 – contracted works for reconstruction of the two 110 kV OHL bays E08 and E10.
- During 2024, the following parts of high-voltage facilities were commissioned for trial operation:
 1. At TS 400/220/110 kV Pančevo 2, in the SS 400 kV, reconstruction of the busbars was completed, as well as reconstruction of transformer T1 (400/220 kV - 300 MVA) with the associated bay C01, and transformer T3 (400/220 kV - 400 MVA) with the associated bay C06. In the SS 220 kV, reconstruction of transformer bay D02 (T3) was completed, while in the SS 110 kV, reconstruction of transformer bay E09 (T1) was finalized.
 2. At TS 400/110 kV Bor 2, in the SS 400 kV, the reconstruction of the main busbar system was completed and the system was transferred into the main busbar system 1. Reconstruction of transformer T1 (400/110 kV – 300 MVA) with its associated bay C05 was also completed. In the SS 110 kV, reconstruction of transformer bay E03 (T1) was finalized, thereby completing the full reconstruction of the SS 110 kV.
 3. At SS 400 kV Đerdap 1, the construction of new cable channels was completed, along with a completely new auxiliary power supply and backup supply system at 0.4 kV from TS Obala. A new SCADA system was installed, and the reconstruction of OHL bays for the HPP Đerdap 1 generator-transformer units was completed: OHL 457 - Unit 1, OHL 458 - Unit 2, and OHL 459 - Unit 3.
 4. At TS 400/110 kV Srbobran, reconstruction of the control-operation building was completed, as well as reconstruction of the 20 kV medium-voltage switchgear.
 5. At SS 110 kV Đerdap 2, construction of the new bus coupler bay E13 was completed, as well as reconstruction of the old bus coupler bay E04 into OHL bays for OHL 1186, and reconstruction of OHL bay E02 for the integration of the line from the direction of Nikine Vode.

During 2024, significant progress was achieved on the projects within the Trans-Balkan Corridor initiative [45]:

- Section 3 - 2×400 kV TS Obrenovac - TS Bajina Bašta, including the voltage level upgrade in TS Bajina Bašta to 400 kV.
Subproject of Section 3 of the Trans-Balkan Corridor - OHL 2×400 kV Bajina Bašta - Obrenovac (Lot 1) – The pre-qualification procedure for selecting the contractor has been

completed. The tender documentation for the second phase of the qualification procedure has been finalized and approved, and submitted to the qualified bidders with a deadline for bid submission set for October 3, 2024. A pre-bid meeting and site visits with the bidders were held. Two bids were received and opened, and their evaluation was carried out. A pre-award meeting was held, and contract signing with the top-ranked bidder is forthcoming. Signing of the contract with the contractor will take place in the first quarter of 2025, as the approval of the evaluation report by the KfW Bank took longer than expected.

Subproject of Section 3 of the Trans-Balkan Corridor - Construction of the SS 400 kV at TS Bajina Bašta (Lot 2) – Due to insufficient competition, the pre-qualification procedure was repeated and completed, and the evaluation report was approved. The tender documentation for the second phase of the qualification procedure has been finalized and approved, and submitted to the qualified bidders. A pre-bid meeting was held on October 14, 2024. Site visits with bidders were held on October 15, 2024 at TS Obrenovac and on October 16, 2024 at TS Bajina Bašta. The deadline for bid submission was extended to December 2, 2024 due to procedural deadlines related to clarifications of the tender documentation. A public opening of the two submitted bids was conducted, and their evaluation is currently in progress.

- Section 4 - Interconnection OHL 2×400 kV between Serbia, Bosnia and Herzegovina, and Montenegro. The additional WBIF investment grant in the amount of €2,480,000 for Section IV was not approved. The Board of Directors decided on 29 July 2024 that the funds from the unapproved additional grant would instead be secured through an additional loan in the amount of €35,000,000 for Sections III and IV together. The tender for the consultant was published, and the opening of bids for consultancy services on the project was carried out on July 8, 2024. The complete technical and financial evaluation report was approved by the bank. A contract for consultancy services was signed with JV Dornier Power & Heat GmbH and Colenco Ltd Skopje on January 3, 2025. - Field surveys, including all required fieldwork necessary for the preparation of the biodiversity study, have been completed by the engaged consulting firm Geonatura. Following comments from the competent ministry, the Environmental Impact Assessment Study was revised and submitted for approval.

In addition to the construction works on the Trans-Balkan Corridor, as a project of national and strategic importance, EMS JSC also worked during 2024 on the implementation of another major project - the BeoGrid2025 project – TS Belgrade 50 with the associated rearrangement of the SS 400 kV and 110 kV and the 2×400 kV OHL TS Belgrade 50 - PRP Čibuk 1, on which significant progress was likewise achieved during 2024:

- TS Belgrade 50: An amendment to the location conditions has been obtained. Public interest has been granted, and the parcelation project has been confirmed by the competent Secretariat. The IPP procedure is in progress. The final positive report on the IDP and the Feasibility Study has been issued by the Revision Commission of the competent ministry. All PGD volumes with accompanying studies have been completed, and compliance with the comments of the technical control is currently being checked. The Environmental Impact Study and the Waste Management Plan have been prepared and submitted to the competent ministry for approval. Procurement procedures for civil works and part of the equipment have been initiated. Preparation of technical specifications for the remaining equipment and for electromechanical installation works is forthcoming.
- OHL No. 450: Public interest has been granted. The IPP procedure is in progress. The final positive report of the Revision Commission of the competent ministry on the IDP

and the Feasibility Study has been obtained, but certain measures must be incorporated at the PGD level. The PGD has been prepared, a meeting of the PGD Technical Committee has been held, comments have been harmonized, and project corrections are underway. The competent ministry has issued a decision that preparation of an Environmental Impact Assessment Study is not required. All procurement procedures for works and equipment have been launched.

- OHL 110 kV: Feasibility Studies with IDP have been completed for OHL 104/8 and OHL 1178AB and submitted to the Revision Commission of the competent ministry for approval. Requests for environmental impact assessment have been prepared for all 110 kV OHLs. Longitudinal profiles for OHL 104/8 and OHL 1178AB have been delivered, and the ITC has been completed. Tower location staking for all 110 kV OHLs has been carried out, and the preparation of expropriation studies is underway.
- Cable 2×110 kV TS Belgrade 50 - TS Belgrade 49: Public procurement of works under the “turnkey” system has been launched.
- OHL 2×400 kV TS Belgrade 50 – CSS Čibuk 1: Route harmonization in the area of the Stari Banovci military complex has been completed and amended location conditions have been obtained. Preparation of longitudinal profiles is in progress.

In 2022, works began on the project Increasing Transmission Capacity in the Bor Region, for which the Government of the Republic of Serbia adopted a conclusion designating it as a project of special importance for the Republic of Serbia. This project includes the construction of TS 400/110 kV Bor 6 and the construction of 400 kV OHLs. Preparation of project-technical documentation for the TS and OHL is in progress. EMS JSC has revised and harmonized with the Client the IDR for the 400 kV OHLs and the IDP for the TS, which was a prerequisite for initiating equipment procurement activities for the TS. Handover of all tower locations for the introduction of OHL 400 kV No. 402 and No. 403 into TS Bor 6 has been completed, as well as the tower locations for the introduction of one branch of OHL 400 kV No. 401/2 into TS Bor 6. Most HV equipment, as well as the complete relay protection and local control equipment, has been received. The Special Purpose Area Spatial Plan has been adopted and published in the Official Gazette of the Republic of Serbia.

On December 9, 2024, EMS JSC submitted to the Government of the Republic of Serbia a Proposal for a Conclusion recognizing the “Pannonian Electricity Transmission Corridor” as a project involving the construction of facilities of special importance for the Republic of Serbia. On July 2, 2024, field assessment activities began, including meetings with representatives of the Hungarian transmission system operator (MAVIR), for defining the border crossing point of the future interconnection OHL. The border crossing point has been agreed with MAVIR. Harmonization of the text of the joint agreement with MAVIR regarding the implementation of the interconnection OHL is in progress. Procurement for the preparation of the Special Purpose Area Spatial Plan has been initiated, and the tender has been published. Two submitted bids have been opened, and their evaluation is ongoing. Requests for the issuance of preliminary conditions from Public Authority Holders for the OHL 2×400 kV TS Subotica 3 - TS Šandorfalva have been submitted, and most conditions have already been obtained. This project was included on the Projects of Mutual Interest (PMI list) prepared by the European Commission in November 2023. In November 2024, the project was submitted as a candidate for inclusion on the next such list, to be finalized during 2025.

Once the necessary conditions are met (verification of OHL routes and facility locations), EMS JSC will submit a request for the project “Central Balkan Corridor – Phase 1” to be designated as a project of special importance for the Republic of Serbia. On October 16, 2024, a Loan Agreement related to Phase 1 of the Central Balkan Corridor project was signed between the

Saudi Fund for Development and the Republic of Serbia. In addition, in April 2024, the development of the Preliminary Feasibility Study for the entire Central Balkan Corridor was initiated. Completion of this study is expected in spring 2025.

During 2024, EMS JSC issued, upon the requests of future system users, connection and interconnection acts for connecting facilities to the transmission system.

In the process of connecting facilities to the transmission system, the following activities were carried out during 2024:

- A new 110 kV OHL bay No. D101 at TS 110/20 kV Ada was commissioned for trial operation (OHL 110 kV No. 1103/2 TS Senta - TS Ada was connected);
- A new 110 kV OHL bay No. 1270 at TS Veliko Gradište was commissioned for trial operation (OHL 110 kV No. 1270 TS Bela Crkva - TS Veliko Gradište was connected);
- The fully reconstructed TS 110/35/20/6 kV Šabac 1 has been connected to the transmission system;
- Power transformers commissioned for trial operation:
 - 110/35/10 kV at TS 110/35/10 kV Kruševac 4;
 - 110/35/10 kV at TS 110/35/10 kV Leskovac 1;
 - 110/35/10 kV at TS 110/35/10 kV Mladenovac;
 - 110/35/10 kV at TS 110/35/10 kV Ivanjica;
 - 110/35 kV at TS 110/35 kV Valjevo 1;
 - 110/35 kV at TS 110/35 kV Zaječar 2.

As part of the investment activities related to obtaining the necessary permits during 2024, Construction Permits, i.e., Decisions on Work Approval, were issued for a total of eight facilities. Five facilities received Location Conditions [45].

Within the investment projects in the field of automation, activities were carried out primarily related to relay protection and local control systems, as well as the implementation of optical network infrastructure in power system facilities.

Through these completed investment activities, together with the investments planned for implementation in the 400 kV and 110 kV networks, as well as the daily activities at the level of operational management, EMS JSC continued its efforts in 2024 to reduce energy losses in the network.

3.7.3. Distribution System

The distribution system operator, in accordance with the Energy Law [1], is obligated to prepare and submit to the Energy Agency of the Republic of Serbia (AERS) for approval, every two years, a development plan for the distribution system for the upcoming ten-year period. This plan should be aligned with the transmission system development plan and the requirements for connection to the distribution system. In addition to the development plan, the distribution system operator is also obligated to adopt and submit annually to AERS for approval an investment plan for the distribution system for the period of up to three years, also in alignment with the transmission system investment plan.

Elektro distribucija Srbije submitted to AERS in 2023 the proposed Distribution System Development Plan of the Republic of Serbia for the period 2023–2032, and AERS granted its approval to this plan on July 4, 2024. In the same year, Elektro distribucija Srbije submitted to

AERS the proposed Distribution System Investment Plan of the Republic of Serbia for the period 2023–2025, and AERS granted its approval on July 4, 2024. Subsequently, on December 19, 2024, Elektrodistribucija Srbije submitted to AERS the proposed Distribution System Investment Plan of the Republic of Serbia for the period 2024–2026, which is currently under consideration for approval.

During the reporting period, in addition to the reconstruction works on TS 110/x kV (see Chapter 3.3.3), reconstruction, adaptation and extension of existing facilities were also carried out in the distribution network, aiming to increase system capacity and reliability, as well as to improve the security of supply for end-users. The most important investment activities in 2024 include:

- The complete reconstruction of TS 110/35 kV Šabac 1 was finalized, and the substation is in operation.
- Equipping of the second 110 kV transformer bay at TS 110/20/10 kV Novi Pazar 2, including the connection of the 40 MVA power transformer to the same busbar system as the first transformer (reserve function in case one transformer trips). In the second phase, after the reconstruction of TS NP1 is completed, a new MV facility will be built and both transformers connected to voltage simultaneously.
- All works at TS 35/10 kV Divčibare, including the substation and both 35 kV incoming lines, have been completed. The Use Permit procedure is in progress.
- Construction of TS 35/10 kV Velika Župa, including the associated OHL connection, has been completed. The substation is in operation and the Use Permit has been issued.
- Construction of TS 35/10 kV Mrčajevci and the associated 35 kV cable has been completed. The substation is in operation, the Use Permit and the final report of the internal technical inspection committee are being processed.
- The development of project documentation for the construction of the 35 kV cable line extension from the TS 110/35 kV Užice 2 was completed.
- Equipping of the 110 kV OHL bay at TS 110/35 kV Ivanjica. The IDR has been completed, Location Conditions received, the IDP prepared, and comments submitted by the Working Group are being resolved in coordination with the designer.
- Construction of TS 110/35/20 kV Zrenjanin 1 at the location of the existing TS 110/35 kV- reconstruction of the SS 110 kV, extension by one transformer bay and installation of a 110/20 kV 31.5 MVA transformer, construction of a new building for the SS 20 kV and SS 35 kV, installation of new SS 20 kV and SS 35 and complete auxiliary systems. Works are ongoing.
- At TS 110/20 kV Ada adaptation works were underway, the part related to stage I of phase I was completed.
- Adaptation works in TS 35/10 kV Liman, including reconstruction of the existing 35/10 kV substation and formation of a new SS 20 kV to convert the station into 35/20 kV, are ongoing.
- Construction of the new TS 110/20 kV Kać, 2×31.5 MVA. Design and equipment procurement are in progress.
- Construction of the new TS 110/20 kV Pančevo 6, 31.5 MVA. Design and equipment procurement are in progress.
- In TS 110/35 kV Beograd 6, reconstruction of the SS 110 kV and 35 kV, protection, control, auxiliary supply, and associated civil works is ongoing. Part of the building for the installation of the new 35 kV SS has been completed. The 110 kV GIS is in operation.

- In TS 110/35 kV Belgrade 10, reconstruction of the SS 110 kV and 35 kV, protection, control, auxiliary supply, and associated civil works is ongoing. The 35 kV switchgear building has been completed; 35 kV cubicles have been installed and connected.
- Construction of the new TS 110/35 kV Belgrade 42 (Grocka), 2×31.5 MVA. Civil works on foundations for equipment supports, transformer foundations and the control building are in progress.
- Replacement of existing 35 kV underground cables. Works are ongoing on the lines Belgrade 6 - Viline vode and Belgrade 6 - Karaburma. The route towards TS Viline vode has been completed.
- Construction of the new TS 110/35 kV Belgrade 44 Surčin, 2×31.5 MVA. Major equipment has been procured and the Construction Permit has been obtained.
- Construction of the new TS 110/10 kV Belgrade 58 - National Stadium, 2×40 MVA. Major equipment has been procured and the Construction Permit obtained.
- Reconstruction of TS 110/35 kV Aleksinac and power increase. The internal technical inspection for Phase 1 is ongoing. Commissioning of this phase is planned for April 2025, after which Phase 2 of construction will proceed.
- Construction of TS 35/10 kV Prokuplje 5, 2x8MVA. Final works are ongoing and documentation is being prepared for the internal technical inspection.
- Construction of TS 35/10 kV Zaječar IV, 2x8MVA. Works are completed; internal technical inspection is ongoing.
- Construction of a double 35 kV cable from TS 110/35 kV Zaječar 2 to TS 35/10 kV Zaječar IV, total length 3,265 m. A 1 km section of the cable has been installed.
- Construction and reconstruction of underground and overhead 35 kV lines in the territory of DP Kragujevac. Construction of 35 kV underground cables is ongoing.
- TS 110/35 kV Veliko Gradište, Phases I and II: works on equipping the OHL bay for the planned 110 kV OHL Bela Crkva - TS 110/35 kV Veliko Gradište (OHL 110 kV - E03) have been completed. Works on the existing OHL to TS Rudnik 3 (OHL 110 kV - E04) within TS Veliko Gradište are ongoing.
- Final works are ongoing on the construction of the new SS 35 kV in TS 35/10 kV Požarevac 2, required to relocate the existing SS 35 kV (at the request of Coca-Cola - Bambi).

Regarding the construction of power facilities and connections required under the Conclusions of the Government of the Republic of Serbia, the activities carried out during 2024 were as follows:

- Minth Šabac. Works are ongoing.
- Industrial Zone Valjevo (TS 35/10 kV Valjevo 12 with associated 35 kV lines and facilities required for connecting the factories). Works are ongoing. Works on TS Valjevo 12 are in the final stage,, project documentation is being prepared for the 35 kV connection lines. Both factories have been connected.
- TS 35/10 kV Autoput - construction. Works are ongoing. The Construction Permit has been issued, work application is pending.
- TS 35/10 kV Milićevo Selo with connecting OHL – power facilities at 35 kV - a project of special importance for the Republic - This refers to the construction of power infrastructure required for connecting the E-763 motorway section Preljina – Požega. The Decision has been issued, harmonization of the PZI is in progress.

- TS 35/10 kV Pakovraće with associated OHL - power facilities at 35 kV - projects of special importance for the Republic. This refers to the construction of power infrastructure required for connecting the E-763 motorway section Preljina - Požega. Works at the substation are in the final stage, the permitting procedure for the 35 kV connection lines is ongoing.
- TS 35/10 kV Krstac with connecting OHL - power facilities at 35 kV - projects of special importance for the Republic. This refers to the construction of power infrastructure required for connecting the E-763 motorway section Preljina - Požega. Construction works have been completed, the substation is energized and in trial operation. The Use Permit procedure is in progress.
- Industrial Zone Šid (TS 110/20 kV Šid) for factory connection purposes. The project includes equipping four 20 kV cubicles for the needs of the “Thermowool” factory and supply of the local load. Works are ongoing.

In accordance with the Energy Law [1] stipulates that Elektrodistibucija Srbije, in addition to the development and investment plan, every year, should also adopt a plan for taking over metering devices, metering distribution cabinets, installations and equipment in metering distribution cabinets, connection lines and other devices that are part of connections in the facilities of existing customers, i.e. producers. The taking of metering devices, metering distribution cabinets, and connection lines into the ownership of the distribution system operator should result in better maintenance, control, and replacement with more modern equipment, with the aim to increase the accuracy of measurements and reduce electricity losses in the distribution system, which is in the interest of both end customers and distribution system operator. According to the Energy Law (Article 404) [1], prior to the amendments made in 2021, it was stipulated that all the aforementioned devices should be taken over by Elektrodistibucija Srbije by the end of 2020 at the latest. Elektrodistibucija Srbije did not fulfil this legal obligation, but with amendments to the Energy Law from 2021, this deadline was extended until the end of 2024. Even after the expiration of this extended period, Elektrodistibucija Srbije has not fulfilled this obligation, but continues to carry out activities related to the takeover of metering points, which are performed directly at the metering location in communication with the distribution system user. The takeover of metering devices and installations at the metering points of existing electricity customers is performed by relocating the metering point, in accordance with the technical requirements defined by the Distribution System Grid Code [37], and by applying the current internal Procedure, which defines the process, activity owners, and required documentation for the takeover of metering points and the replacement of existing metering devices with new ones. The number of metering points and connections taken over in 2024 amounts to 55,991, while the minimum number of metering point takeovers planned for the next three-year period is as follows: in 2025: 328,531; in 2026: 439,139; in 2027: 50,967. Elektrodistibucija Srbije has defined as its primary goal the improvement of the metering system for users whose facilities are connected to the medium-voltage network, as well as for users whose facilities are connected to the low voltage network, where active and reactive energy and monthly maximum power are measured. In 2024, the percentage of installed smart meters at customers on all voltage levels is 18.76%, while this percentage for producers is 100.00%. Advanced grids and metering systems will enable greater reliability and quality of electricity supply, better consumption management, and a more dynamic market, as well as a significant reduction in technical and commercial losses of electricity [39].

In 2024, there was a reduction in losses in the distribution network, which, compared to losses in 2023, decreased by 0.48% and amount to 10.37% of the electricity taken into the distribution system. Loss reduction activities must be intensified in the coming period, as it is necessary to

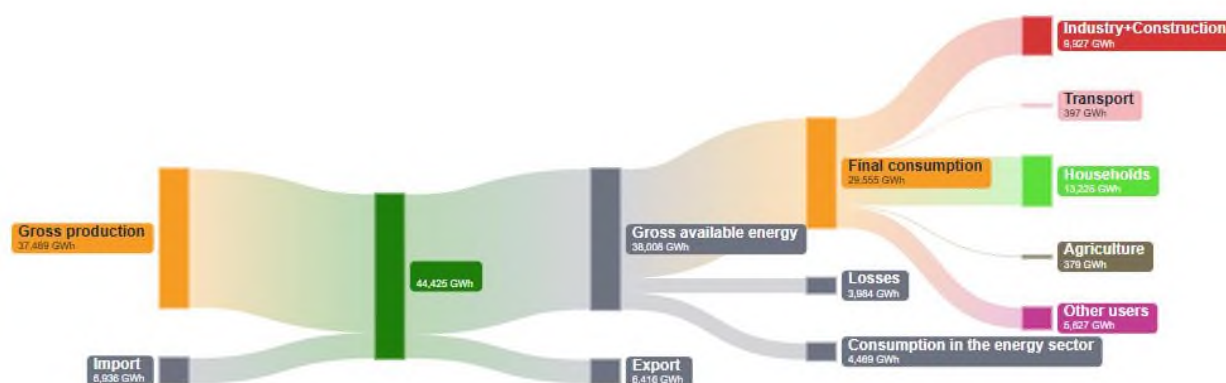
reduce losses to a technically acceptable level as soon as possible. In 2024, regular activities to control metering devices were carried out at only 19.8% of the planned locations [39].

3.8. Data on the Planned Consumption and Production of Electricity, as well as the Method of Securing the Missing Quantities for the Next Five-Year Period

3.8.1. Realized Consumption and Production

The next Figure 3 shows a (simplified) electricity flow diagram, which visually and quantitatively presents the balance for 2024, while the detailed electricity balance in the Republic of Serbia for the period from 2014 to 2024 is shown in Table 16.

Figure 3: Energy (Sankey) diagram of the electricity balance for 2024



Data for the realized electricity balance for 2024 [31], [32], show certain differences compared to the balances of previous years, primarily in the structure of generated energy.

After an increase in production at hydro power plants in 2018, there was a decrease in this production in 2019 and 2020, while in 2021, when the hydrology was exceptionally favourable, production exceeded the values from 2018. This was followed by a significant decrease in production at hydropower plants in 2022, when hydropower plants produced 9,274 GWh, which is 22.61% less compared to the previous year, 2021. Nevertheless, hydrology was exceptional in 2023, and the hydro sector contributed to the total electricity production with 13,080 GWh, which is a record in the last decade. Then, during 2024, hydro power plant production fell to 10,512 GWh, meaning that hydro power plants produced 19.63% less compared to 2023.

The gross electricity production from thermal power plants in 2024, according to [32], amounted to 23,220 GWh (61.94% of total production in 2024), which is a slight difference (more precisely, 1.2% less) compared to 2023, when it was 23,502 GWh (58.71% of total production in 2023). During 2024, the units of the TENT Branch achieved amounting to 14,981.3 GWh, which represents 99.7 of the planned value. The units of the TPP Kostolac achieved production at the interface of the power plant in 2024, amounting to 6,292.8 GWh, which represents 99.2% of last year's production (97.3% planned value) Overall, in 2024 thermal power plants produced slightly less electricity than in 2023 (by 5.3%) and 2022 (by 1%).

Table 16: Balance of Electricity from 2014 to 2024 [31], [32]

	2014 [GWh]	2015 [GWh]	2016 [GWh]	2017 [GWh]	2018 [GWh]	2019 [GWh]	2020 [GWh]	2021 [GWh]	2022 [GWh]	2023 [GWh]	2024 [GWh]
Gross production	34,061	38,299	39,343	37,043	37,426	37,600	37,956	38,235	35,510	40,028	37,489
Hydro power plants	11,617	10,783	11,520	9,752	11,393	10,198	9,749	11,984	9,274	13,080	10,512
Small HPPs			241	223			318				
Thermal power plants	22,073	27,133	27,191	26,414	24,975	25,546	26,429	23,734	23,460	23,502	23,220
CHP	75	53	140	291	351	474	317	893	1,331	1,850	1,608
Other	295	330	491	585	707	1,382	1,462	1,625	1,445	1,596	2,149
Total import (including transit)	7,008	6,303	5,068	6,549	6,400	5,417	5,070	6,984	8,447	5,174	6,936
Total export (including transit)	5,445	7,221	6,990	5,724	6,284	5,341	5,675	6,333	5,696	7,364	6,416
Losses	5,163	5,169	4,808	4,806	4,532	4,332	4,385	4,481	4,182	4,129	3,984
Consumption in the energy sector	4,302	5,138	5,280	5,270	3,898	4,252	4,009	4,253	4,027	4,005	3,958
Hydro power plants	90	86	91	82	86	92	76	90	83	94	87
Used for Pump storage	898	1,090	1,029	938							
Thermal power plants	2,017	2,529	2,565	2,586	2,466	2,855	2,525	2,662	2,453	2,415	2,392
CHP	22	18	25	42	51	58	42	96	113	105	89
Autoproducers	32	26	33	37	42	30	39	35	32	37	55
District heating plants	80	97	218	193	171	163	187	202	170	173	171
Oil and gas extraction	82	93	91	87	89	93	89	85	86	90	90
Refineries	236	257	243	255	261	240	273	287	319	326	308
Coal mines	541	570	600	590	603	596	649	663	650	643	629
Coal transformation	217	282	313	366	40	38	39	37	32	33	30
Other	87	90	72	94	90	87	89	96	89	89	87
Energy available for final consumption	26,158	27,073	27,333	27,792	28,047	27,994	27,881	29,200	28,981	28,733	29,555
Final energy consumption	26,158	27,073	27,333	27,792	28,047	27,994	27,881	29,200	28,981	28,733	29,555
Industry+Construction	7,156	7,423	7,731	7,861	8,734	8,783	8,617	9,380	9,551	9,628	9,927
Transport	336	351	352	358	375	375	358	384	391	394	397
Households	13,802	14,062	13,931	14,165	13,415	13,340	13,718	13,877	13,379	13,008	13,225
Agriculture	298	317	314	319	341	342	331	358	365	367	379
Other users	4,566	4,920	5,005	5,089	5,183	5,154	4,856	5,201	5,295	5,336	5,627

The total operating time of thermal power plant units at full capacity was slightly reduced, while unplanned outages decreased and planned outages slightly increased compared to 2023. Operationally available units of the thermal power plants spent somewhat longer periods in cold reserve and significantly longer in hot reserve, while there were no outages due to coal shortages.

The volume of electricity generation from thermal power plants depends on the optimization of business profitability achieved by EPS JSC through the purchase of solar-generated electricity on the market at lower prices, on the overhaul schedules of increasingly aging capacities, as well as on the obligation to gradually reduce coal-fired generation in accordance with the National Emission Reduction Plan for major pollutants originating from old large combustion plants.

Electricity production in the TPP-DH plants in 2024 reached 1,608 GWh, i.e. 13.08% less was produced compared to production in 2023.

The production in the so-called “other power plants” category, which include renewable energy sources, cogeneration plants using natural gas, and industrial power plants, in 2024, recorded an increase of 553 GWh, so during this year production amounted to 2,149 GWh (5.73% of total production in 2024), which is 34.65% more than in 2023 (when production was 1,596 GWh) (3.99% of total production in 2023).

When it comes to total electricity production in 2024, it can be noted that production from HPPs significantly decreased compared to the previous year, which was hydrologically very favorable in terms of energy. Production from thermal power plants showed a slight decline compared to the previous year, whereby the share of thermal power plants in total electricity production also

decreased by a certain percentage (more precisely, by 3.23%, when considering gross production). Production from new renewable sources and other power plants was higher in 2024 compared to 2023. TPP-DHs were also very successful in 2024. As a result of all the factors mentioned above, the total gross electricity production in the Republic of Serbia in 2024 amounted to 37,489 GWh, which is 2,539 GWh less compared to 2023 (Table 16).

Regarding the planned electricity generation in the Republic of Serbia, the projections are provided in the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050 [2] and in the Integrated National Energy and Climate Plan of the Republic of Serbia for the period up to 2030, with a vision until 2050 [60]. Both documents consider the reference (BAU) scenario, which represents the continuation of current practices, and Scenario S, the desired development scenario, which envisages lower emissions of harmful gases and higher production from renewable energy sources¹⁶. The projection is presented in the following table (Table 17).

Table 17: Projection of electricity production in the Republic of Serbia [2]

Gross production of electricity [GWh]							
Scenario S				Reference scenario			
2030	2035	2040	2050	2030	2035	2040	2050
40,866.7	44,863.9	48,794.8	62,806.7	45,996.7	48,447.1	51,267.4	54,474.9

The current share of electricity produced from fossil fuels is around 66%. According to the Integrated National Energy and Climate Plan, this share is expected to decrease in favor of the contribution of renewable energy sources. Thus, already in 2030 this share should decline to 55%, in 2040 to 40%, and by 2050 it should be only 6% (Scenario S). If future energy development continues according to the reference (BAU) scenario, the share of electricity generation from fossil fuels will remain more or less constant, ranging between 62% and 72% of total gross production.

Final consumption in 2023 experienced a slight increase of 2.86% compared to 2023, totalling 29,555 GWh [31]. Consumption increased in all sectors, with the largest increase recorded in the industry and construction sector (299 GWh), as well as the “other consumers” sector (291 GWh). Specifically, final consumption in the industry and construction sector in 2024 amounted to 9,927 GWh (which is 299 GWh more than the previous year), electricity consumption in the transport sector amounted to 397 GWh (3 GWh more than in 2023) in the household sector 13,225 GWh (217 GWh more than previous year), in the agricultural sector 379 GWh (12 GWh more than in 2023), and in the “other consumers” sector 5,627 GWh (291 GWh more than previous year).

When it comes to the forecast of electricity consumption, it is also presented in Energy Development Strategy [2] and in the Integrated National Energy and Climate Plan of the Republic of Serbia for the period up to 2030, with a vision until 2050 [60]. The differences between the scenarios are noticeable, as the reference scenario (BAU) implies higher final consumption, primarily due to lower implementation of energy efficiency measures.

¹⁶ Strictly speaking, there is also a third scenario, the S-N scenario, which is based on Scenario S, with the additional introduction of nuclear sources into the energy portfolio of the Republic of Serbia after 2040; however, it will not be considered in this document.

Table 18: Forecast of final electricity consumption in the Republic of Serbia [2]

Final consumption of electricity [GWh]							
Scenario S				Reference scenario			
2030	2035	2040	2050	2030	2035	2040	2050
31,974.4	35,751.8	38,203.4	48,492.4	34,860.9	36,657.8	38,830.2	41,781.9

The total import of electricity in 2024 increased significantly and amounted to 6,936.17 GWh, which is 1,761.98 GWh more than the import in 2023, while the total export in 2024 amounted to 6,416.31 GWh (947.63 GWh less than the export in 2023).

When it comes to the purchase and sale of electricity that EPS JSC performs for the purposes of optimization and balancing, the situation in the previous period was variable. After an increase in electricity sales in 2021, which amounted to 1,709 GWh, there was a significant decrease in sales in 2022, which fell to just 151 GWh, and already during 2023, sales had increased to 1,652 GWh. In 2024, electricity sales on the wholesale market fell to 903 GWh. Electricity purchases in 2022 increased by 1,865 GWh compared to previous year, i.e. 3,278 GWh was purchased, while in 2023, purchases were 723 GWh (a decrease of 2,555 GWh compared to 2022) [55]. In 2024, EPS JSC purchased 2,701 GWh on the wholesale market [56], which means that the difference between purchased and sold electricity amounted to 1,798 GWh., In 2024, the Kolubara mining basin achieved a realization of 22,18 million tons, which is 5,598 million tons less compared to 2023. Electricity production at the TENT A and TENT B power plants in 2024 was 14,402 GWh, which is approximately 1.4% less compared to 2023, when it reached 14,611 GWh.

A decline in coal production is also noticeable in Kostolac. In 2024, it was 8.54 million tons, representing a decrease compared to 2023, when production amounted to 9.23 million tons.

The problems that affected the reduction in coal production during 2024 compared to 2023 include:

- Coal production at TE-KO Kostolac in Q3 was limited due to the maximum capacity and optimization of the stockpiles, resulting from rescheduling of the start date of unit B3 at TPP Kostolac B,
- Towards the end of the year, outages occurred due to failures of the excavators used for coal extraction: Excavator 800, Excavator 400, Excavator 710(u), and Excavator 8,
- Advancement of the Drmno mining complex to the north and increasing technological difficulties in coal excavation, and
- Shortage of personnel in all specialties in production.

The overburden excavation in the Branch of MB Kolubara in 2024 amounted to 59.57 million m³ [59], which is 10.59% less compared to the same period in the previous year. In the Branch of TEKOSTOLAC, the overburden excavation in 2024 was 44.15 million m³, which is 16.05% more compared to the 2023, when it was 38.05 million m³. In 2024, 0,20 million m³ less of overburden was excavated compared to 2023.

At the end of 2024, the situation at the TPP Kostolac B stockpiles was about 258,7 thousand tons higher compared to 2023. The stock at the TPP Kolubara stockpile at the end of 2024 was 46.71 thousand tons, which is 54.87 thousand tons less than in previous year, while at TPP Morava, at the end of 2024, the stock at the stockpile amounted to 146.78 thousand tons, amounting to a reduction of 20.58 thousand tons compared to 2023. At the end of 2024, the total stockpile levels were higher than in 2023.

After reaching a peak of 1.59 t/MWh in 2018, the specific coal consumption slightly decreased over the next two years to 1.58 t/MWh and 1.57 t/MWh. However, in 2021, specific coal consumption reached a new peak of 1.64 t/MWh and remained at that level in 2022, while in 2023, the specific coal consumption decreased to 1.57 t/MWh. During 2024, the average specific coal consumption amounted to 1.59 t/MWh, which is slightly higher than the previous year, but still lower compared to 2021 and 2022. Also, the achieved specific coal consumption matches the planned value, which is a result of the PPM rebalance adopted in October 2024. Fuel oil consumption in 2024 reached 91,037 tons, which is 10% higher than in the previous year, 2023, but still lower compared to 2022, when it amounted to 103,512 tons. Specific fuel oil consumption increased by approximately 13% compared to 2023, rising from 4.22 t/GWh to 4.78 t/GWh. During 2024, power plants owned by EPS JSC produced a total of 31,861 GWh of electricity. This value is the second lowest annual production since 2010 (the only year that was lower was 2022, when 31,130 GWh was produced). The realized production fulfilled the plan by 100.1%, which is 47.7 GWh more than the planned values. Compared to 2023, the achieved production is lower by 2,859.1 GWh, or 8.2%. Lower production in 2024 was partly a result of the extremely poor hydrological situation. Hydro power plants achieved production of 10,245.4 GWh, which met the plan by 102.7%, but was at the same time 19.1% less than the energy produced a year earlier. Although the new unit B3 at TPP Kostolac started operating in 2024, coal thermal power plants produced 21,274.1 GWh, which is 1% below the planned value and 261.1 GWh less than in 2023. The Pannonian TPP-CHPs produced 341.6 GWh in 2024, which is 97.8% of the planned production. Compared to 2023, production from the TPP-CHPs amounted to 65%.

Prices of Electricity for Commercial Supply

The prices at which EPS JSC sells electricity for commercial supply, i.e. to customers who, in accordance with the Energy Law, purchase electricity on the open market, are formed based on market-based principles. Considering the disruptions in the open electricity market that occurred during 2021 and in order to protect business entities, the Government of the Republic of Serbia has, since October 2021, adopted conclusions recommending that EPS JSC conclude electricity supply contracts with commercial supply customers at a unified price.

Thus, in April 2023, the Government of the Republic of Serbia adopted new conclusions recommending to EPS JSC to conclude electricity supply contracts with end customers on commercial supply at a uniform price of 110.81 EUR/MWh, with the application period from May 1 to October 31, 2023.

In October 2023, the Government of the Republic of Serbia adopted conclusions recommending that EPS JSC supply end customers on commercial supply at a uniform price of 119.67 EUR/MWh, and supply end customers who are users of public funds for metering points of public lighting, provided that, during the period from October 1, 2022, to March 31, 2023, they reduced their electricity consumption by at least 5% compared to the equivalent period of the previous year, at a uniform price of 104.79 EUR/MWh, with the application period from November 1, 2023 to April 30, 2024. Since the beginning of May 2024, the supply of electricity to customers on a commercial basis has been carried out at contracted prices, which are determined based on movements in prices on reference electricity exchanges, i.e., according to market principles.

3.8.2. Method of Ensuring the Missing Quantities of Electricity for the Next Five-Year Period

The most significant changes in the upcoming period are expected in the way electricity will be produced in the future and the restructuring of production capacities. Decarbonisation is closely linked to the gradual phase-out of electricity production using fossil fuels, as the largest emitter of CO₂. The Integrated National Energy and Climate Plan of the Republic of Serbia for the

period from 2021 to 2030 [60] defines the goals that the Republic of Serbia needs to achieve in terms of reducing greenhouse gases and introducing renewable (intermittent) energy sources (RES) into its production portfolio.

Accordingly, the construction of several significant renewable energy production capacities is planned. It is expected that electricity from RES will increase to 17,750 GWh by 2030 (compared to 13,075 GWh in 2021). It is important to note that a significant contribution to the achievement of this goal is also expected from the private sector. Within EPS JSC, there are projects that are at a significant stage of maturity. During 2024, the construction of the Kostolac wind farm was intensified (with an installed capacity of 66 MW and an estimated annual production of 167 GWh), and the SPP Petka (installed capacity of 9.75 MW). Also, the implementation of the project for the construction of large-capacity self-balancing solar power plants was launched, with a total installed capacity of 1 GW and battery energy storage systems with a total installed capacity of 200 MW. By 2030, the construction of the HPP Kolubara (installed capacity 78.6 MW, annual production 116 GWh), as well as the HPP Morava (installed capacity 31.8 MW, annual production 56 GWh), is planned. Additionally, by 2030, the construction of wind farms owned by private investors with a total installed capacity of up to 500 MW is planned. In the field of hydropower, a new pumped storage hydro power plant (PSHPP Bistrica with an installed capacity of 661 MW) is being introduced, along with the revitalization of the existing hydropower plants. This includes extending their operational lifetime, increasing efficiency, and, in many cases, increasing installed capacity. By 2030, the revitalization of Vlasinske HPP, HPP Potpeć (along with the construction of the fourth unit) is planned, as well as the adaptation and investment maintenance of the HPP Bistrica. By 2035, the first phase of the pumped storage hydropower plant Đerdap 3, is expected to begin operation. Additionally, the project for the construction of the Buk Bijela, Foča, and Paunci hydropower plants is also in preparation, with a planned capacity of the Upper Drina hydropower system of up to 212 MW (HPP Buk Bijela 114.4 MW, HPP Foča 53.6 MW, and HPP Paunci 43.2 MW) and an average annual production of around 705 GWh. In addition to pumped storage hydropower plants, the construction of gas-steam power plants is also planned, with their dominant role, in addition to heat energy production through cogeneration, being to balance the electricity system. In this regard, the installation of gas-fired power plants on the territory of Republic of Serbia is planned, with installed capacities about 620 MW.

In this way, the requirements of the energy transition towards a higher share of RES will be met without jeopardizing the stability of the system. Additionally, necessary investments in primary and secondary environmental protection measures are planned to ensure the sustainable use of thermal capacities within the electricity generation capacity mix, with the aim of preserving base load energy that does not create import dependence for the country. By 2030, the implementation of projects for the revitalization of TENT A1 and A2 units, with the introduction of the system of primary and secondary reduction of NO_x, as well as the construction of desulfurization plants connected to the system for the transportation of ash, slag, and gypsum at these units, is planned. Units TEKO A1 and A2 are scheduled for adaptation, which would ensure the reliable operation of the system with the aim of securing the capacity needed to support the security of supply in the Republic of Serbia, as well as the uninterrupted delivery of thermal energy during the winter period for the district heating of the city of Požarevac. Alternatively, depending on the available financial resources, the adaptation may be replaced by revitalization.

The replacement of the boiler plant at TEKO B1 is planned to be completed by the end of 2026, with the goal of achieving the designed boiler parameters and reducing nitrogen oxide emissions below 170 mg/Nm³ when operating with primary and secondary measures at maximum boiler production. Additionally, for TEKO B1, the reconstruction of the ash removal system under the boiler and the reconstruction of the cold flue gas channel are planned, while for TEKO B2, a nitrogen oxide reduction plant is planned, along with the delivery and installation of tanks with

pumps for selective non-catalytic reduction. A joint water supply system reconstruction will be carried out for TEKOB1 and B2, including the plant for the preparation and transportation of ash and slag. Among future projects related to TENT A and B, a capital overhaul for TENT A6 and TENT B2, the construction of four ash disposal sites for TENT A, as well as the completion of the construction of the desulfurization plant for TENT units A3-A6 and for TENT B. During 2024, the newly built unit B3 at the TPP Kostolac B was put into operation. By commissioning unit B3, EPS has increased the total power of its production capacities by 350 MW, which is a significant additional security for the electricity sector of the Republic of Serbia.

3.9. Supply Forecast for the Next Five to Ten Years

The national transmission system operator, in cooperation with the relevant state institutions, is responsible for ensuring the security of electricity supply.

The security of electricity supply involves ensuring the necessary amounts of electricity, as well as the technical capability of the transmission and distribution systems to deliver it to end customers.

Until 2016, ENTSO-E applied a deterministic approach to assessment of adequacy - SO&AF (Scenario Outlook and Adequacy Forecast), provided an adequacy evaluation of the system for several characteristic, but chronologically unrelated hours. Given the new challenges posed by the transformation of the power system with a significant share of generation from intermittent renewable energy sources, the need for a new and improved method to analyse the operation of the electricity system and assess its adequacy emerged.

Therefore, in 2016, a new methodology for medium-term adequacy analysis at the European level was adopted - MAF (Mid Term Adequacy Forecast), which was renamed in 2021 to ERAA (European Resource Adequacy Assessment). The new methodology is based on a probabilistic approach to modelling and analysing the adequacy of the European electricity system. The goal of the new method is to assess the risks related to security of supply, as well as the need for flexibility over the next ten-year period. With this in mind, EMS JSC changed the methodology for analysing the adequacy of Serbia's generation system and determining the risks to supply consumers.

In the adequacy analyses of production, existing operational limitations of the power system are taken into account, considering a large number (over 700) of possible situations characterized by different levels of production from renewable sources, hydro and thermal power plant production, and varying consumption levels due to different climatic conditions (wind speed, sunshine, or temperature), hydrology and thermal unit outages [61].

The main results of these analyses are indicators of the level of risk in meeting the system's total consumption, expressed through probabilistic production adequacy indicators:

- ENS (Energy Not Supplied) (MWh/year) – represents the level of unsupplied electricity from the production system to consumers, due to higher consumption levels than the available production and available imports during a certain period of the year.
- LOLE (Loss Of Load Expectation) (h/year) – represents the number of hours during the year when unsupplied electricity occurs.

For the analysis of the adequacy of production using the probabilistic method, conducted during the development of the Transmission System Development Plan [61], two possible scenarios were defined:

- Realistic - according to the expected development of the power system that is close to the scenario defined in the ENTSO-E ERAA2021 analysis, and

- Alternative - with deviations from the expected development of the power system in order to simulate more critical regimes (higher level of consumption and lower level of available generation capacities).

Table 19: Results of adequacy analysis for realistic and alternative scenarios in 2025 and 2030 [61]

Period	2025	
Scenario	ENS [MWh] AVG	LOLE [h] AVG
Realistic	0	0
Alternative	0	0
Periodo	2030	
Scenario	ENS [MWh] AVG	LOLE [h] AVG
Realistic	0	0
Alternative	0	0

Based on the calculated probabilistic indicators of production adequacy (Table 19), it can be concluded that in 2025 and 2030, there will be no issues with the adequacy of production capacities of the Republic of Serbia (excluding AP Kosovo and Metohija). In both development scenarios, there will be no unsupplied electricity (ENS) nor hours in which the supply of electricity is interrupted (LOLE).

Amendments to the Energy Law [1] during 2024 introduced a new parameter regarding the monitoring of supply security. This concerns the reliability standard, defined as the required level of electricity supply security, for which adequate generation capacities must be ensured, including through the capacity assurance mechanism. It is determined based on the value of expected unserved electrical energy and the value of expected unsatisfied demand, in accordance with the methodology of the European Network of Transmission System Operators for Electricity (ENTSO-E), which is approved by ACER, taking into account the value of unserved energy and the costs of introducing new generation capacities and controllable consumption facilities across all market timeframes. Capacity assurance mechanisms cannot be applied unless the reliability standard has been established.

Upon the proposal of AERS, the Ministry responsible for mining and energy determines the reliability standard in the report on supply security [1].

3.10. Data on Investments in Electricity Generation Capacities

As a signatory of the Energy Community Treaty, the Republic of Serbia committed to, among other things, implementing the provisions of the Large Combustion Plants Directive 2001/80/EC in accordance with the deadlines defined in the Treaty, specifically by January 1, 2018.

The Directive applies to combustion plants with a capacity of 50 MWth or greater (all thermal power plants within EPS JSC fall into the category of large combustion plants, as they have a capacity greater than 50 MWth). The goal of the Directive is to reduce emissions of pollutants into the air originating from large combustion plants.

The Ministerial Council of the Energy Community adopted two following two Decisions on October 23, 2013:

- Decision D/2013/05MC-EnC on the implementation of LCP directive and
- Decision D/2013/06/MC-EnC on the Introduction of the Industrial Emissions Directive.

Decision D/2013/05/MC-EnC enabled the contracting parties of the Energy Community Treaty to use two mechanisms for implementing the Large Combustion Plants Directive, as defined within the Directive itself. These mechanisms are as follows:

- The implementation of the National Emission Reduction Plan (NERP) from January 1, 2018, to December 31, 2027. The goal of implementing the NERP is to ensure that, by December 31, 2027, emissions from existing combustion plants comply with the Emission Limit Values (ELVs) defined by the Industrial Emissions Directive, and
- Implementation of the limited operation mechanism, also known as the “opt-out” mechanism (20,000 operating hours between 2018 and the end of 2023). After the opt-out period expires, the plant either shuts down or must comply with the Emission Limit Values for new plants as defined by the Industrial Emissions Directive.

For the Republic of Serbia, the NERP was adopted by the Government in February 2020 [62].

According to the new Strategy [2], by 2030, thermal capacities whose further operation would not be possible or justified, taking into account the age of the machines themselves and other techno-economic parameters, will be withdrawn from the grid. This applies to the remaining four units in the TPP Kolubara A, while two options will be considered for the TPP Morava: placing in reserve shutdown or withdrawal. The aforementioned withdrawals will not significantly affect the amount of electricity produced in the electricity system of the Republic of Serbia, but they must be dynamically coordinated with the commissioning of new production facilities, so as not to jeopardize energy security. In doing so, care should also be taken to ensure the provision of thermal energy for those district heating systems that directly depend on the operation of individual units. The Integrated National Energy and Climate Plan of the Republic of Serbia [60] envisages the decommissioning of the TPP Morava and units A3 and A5 of the TPP Kolubara until 2030.

In line with the commitments under the Energy Community Treaty, efforts to improve environmental protection in the electricity generation sector from fossil fuels aim to reduce emissions of sulphur dioxide, nitrogen oxides, and particulate matter to the prescribed emission limit values as defined by the Regulation on Emission Limit Values for Pollutants in the Air from Combustion Plants (“Official Gazette of the RS”, No. 6/2016, 67/2021) [63]. Reducing emissions to the prescribed limit values is part of the National Emission Reduction Plan (NERP), in line with Ministerial Council Decision E3 D/2013/05/MC-EnC and D/2013/06/MC-EnC. The implementation of the NERP is planned for the period from January 1, 2018 to December 31, 2027. However, these environmental commitments have two significant downsides. First, they are very expensive and mainly require foreign technology, and second, they lead to an increase in electricity consumption for internal needs, thereby reducing the available energy for the market and available capacity at the transmission interface. According to available technical data, the own consumption of the desulfurization plants will impact the increase in the own consumption of the units that remain in operation by 5-6% of the installed capacity (which is about 188 to 226 MW) and energy, or approximately 1.1 TWh annually. This is further supported by the completed project at TPP Kostolac B, where the installation of two additional transformers with a capacity of 2x25 MVA was necessary to meet the operational needs of the desulfurization plant.

The construction of the Obrenovac (TENT A) - Novi Beograd district heating pipeline is a project whose implementation also leads to a reduction in the capacity for electricity production. The first works on this project began more than 20 years ago, but were soon suspended, and the hot water pipes were removed. However, the plan is back on track and work is currently underway at three locations in parallel. The estimated value of project is about €200 million. The goal of this project is to reduce the consumption of fuel oil and coal used by Belgrade's power

plants as input energy sources. Heated water from TENT A will be transferred via the heating pipeline to the Heating Plant Novi Beograd, where it will be further heated using gas to meet the peak demand of the system. However, an electricity perspective, this represents a further reduction in electricity generation capacity, but also an obligation for EPS JSC to prepare all units at TENT A for heating mode. This involves the reconstruction of the turbine units TENT A3-A6, including the design, delivery of equipment, and dismantling-installation activities related to adapting these turbines for the heating needs of Belgrade.

EPS JSC has plans for other projects at TENT A and TENT B in the upcoming period, such as the capital overhaul of TENT A6 in 2026, replacement of the ash and slag transport system in TENT A, project for the construction of a desulfurization plant for TENT B, whose implementation is expected by the end of 2025, as well as the second phase of the revitalization of the TENT B2 unit in 2026.

Large-scale projects are also planned for the Kostolac A and Kostolac B thermal power plants. TEKOA1 and A2 units are expected to undergo adaptation, which would enable reliable system operation with the aim of ensuring capacity to support security of supply in the Republic of Serbia, as well as uninterrupted delivery of thermal energy in the winter period for district heating of the city of Požarevac. Alternatively, depending on available funds, adaptation may be replaced by revitalization. The capital overhaul of TEKOB1 was carried out during 2024, as planned.

In 2021, the steam-gas power plant TPP-DH Pančevo with a capacity of 200 MW in condensing mode became operational, and since then, it has successfully contributed to the stability of the electricity system. In the near future, the construction of two more gas-fired power plants, with a total electrical capacity of 620 MW and thermal capacity of 250 MW, is planned.

From 2012 until the end of 2020, a total of eight wind power plants with a total installed capacity of 398 MW were built within the incentive scheme, and they have the status of privileged producers (Devreč 1 with 0.5 MW, Kula with 9.9 MW, La Piccolina with 6.6 MW, Malibunar with 8 MW, Kovačica with 104.5 MW, Alibunar with 42 MW, Čibuk with 158.46 MW and Košava with 68 MW). Although the incentive system was modified, interest from potential investors in this field has not decreased. By the end of 2024, 571.7 MW from wind power plants were connected to the transmission network, which is an increase of about 95 MW compared to the previous year, 2023, when this capacity was 477.3 MW.

On December 20, 2023, EMS JSC started the first interval for preparing Connection Studies following the adoption of the Decree on the Conditions for Delivery and Supply of Electricity, the Connection Code, the new Transmission System Network Code, and the procedure for connecting facilities to the transmission system. Contracts were signed with applicants for 51 facilities with a total capacity of 7,649.99 MW), including 18 applications for the connection of wind farms (with a total capacity of 3,239.76 MW).

During 2024, the installed capacity of solar power plants in the Republic of Serbia more than doubled, remained relatively small (95 MW, see Table 7), without any larger capacity connected to the transmission network. EMS JSC has signed agreements for the preparation of Connection Studies with 24 investors interested in constructing larger solar power plants, with a total capacity exceeding 3 GW (3,278.5 MW).

In accordance with the defined deadlines, the Studies were delivered to all applicants by April 30, 2024. Of the facilities to which the Connection Studies were delivered, 28 facilities (of which 13 are solar and 13 are wind power plants) concluded connection contracts.

The next interval began on September 1, 2024 and lasted until December 31, 2024. Contracts were concluded with applicants for 18 facilities and 4 facilities of a strategic partner, of which 14¹⁷ requests for the connection of solar power plants, with a total capacity of 1,793.03 MW.

As the current procedure essentially recognizes only the serious intentions of investors, this suggests that a significant wind power capacity can be expected in the production portfolio of our power system in the near future. Several wind farms are currently under construction, and their connection to the grid is expected within the next one to two years.

Regarding hydropower plants, the main intention for upcoming next period is to preserve all existing capacities, with revitalizations and potential capacity increases, followed by the expansion of existing plants and the construction of new capacities. By 2030, the revitalization of all ten units at the HPP Đerdap 2 is planned. Revitalization with capacity increase is also planned for the units at the HPP Potpeć and Vlasinske HPPs. For the HPP Bistrica, revitalization is planned but without any capacity increase. Among the new units in existing hydropower plants, the construction of a fourth unit at the HPP Potpeć is planned. During 2026, the implementation of a very important project to build the PSHPP Bistrica should begin, the goals of which are primarily the ability to store energy and participate in balancing the electricity system.

The construction of new hydropower capacities is planned for the period after 2030, primarily focusing on utilizing the hydro potential of the Drina, Ibar, and Morava rivers. The first major project that could be completed in the next ten years, in cooperation with Bosnia and Herzegovina, is the construction of the Upper Drina hydropower system, which includes three new hydropower plants – HPP Buk Bijela, HPP Foča, and HPP Paunci. The total installed capacity will be up to 212 MW, and with the participation of EPS JSC in this project of 51%, the expected annual production that the Republic of Serbia can count will be around 350 GWh. The construction of hydropower plants on the Ibar river (121 MW) is also planned, with an expected annual production of approximately 455 GWh.

In addition to the aforementioned wind, solar and hydropower plants, which are particularly important for achieving the goals related to the share of renewable energy sources, the realization of the construction of the new unit B3 at the TPP Kostolac B is of exceptional importance. This will contribute to increasing the regulatory reserve and positively affect the stability of the Republic of Serbia's electricity system, as well as ensuring a reliable and secure energy supply to end customers. The installed capacity of the new unit is 350 MW, while the estimated annual production is 2,200 GWh. This unit was put into trial operation in 2024, and by the end of the calendar year it produced 966.9 MWh, which is about 90% of the planned value. The acquisition of appropriate usage permits is underway. The project also includes the expansion of the Drmno open cast mine (Phase II – Section II), which involves increasing coal production from 9 to 12 million tons per year. The TPP Kostolac B3 unit meets all environmental protection standards prescribed by the laws of the Republic of Serbia.

In addition to construction of new capacities, during 2024 the revitalization of a large number of hydropower units continued, as well as the overhauls of thermal units (detailed in Chapter 3.3.1).

In the area of electricity generation, a number of environmental protection projects were also implemented, as well as projects aimed at ensuring a secure and uninterrupted coal supply and the rational management of natural resources, while reducing atmospheric pollution [65]:

- In TENT A, the Flue Gas Desulfurization (FGD) plant for units A3-A6 was put into trial operation in 2024. As part of the completion of the construction of this plant, a plant for the treatment of wastewater generated by the FGD process was also put into operation.

¹⁷ Data from 4 facilities of the strategic partner were taken into account, for which studies are prepared independently of the interval, but during the specific period, studies for these facilities were conducted in parallel with the ongoing interval.

- The project for the construction of a FGD plant for units B1 and B2 at the TENT B is divided into 4 phases. The construction of the flue gas desulfurization plant is expected to reduce the concentration of sulfur dioxide from both units to a level of 130 milligrams per cubic meter. The first phase includes the construction of the limestone and gypsum system, the second phase includes the construction of the absorber system and chimney, the third phase includes the construction of the flue gas ducts and the installation of booster fans, and the fourth phase includes the construction of bridges to carry pipelines and electrical cables. At the end of 2024, the realization of the completed works on the project is 91.10%.
- In the previous period, primary measures were introduced to reduce nitrogen oxide emissions at units A3, A4 and A5 in TENT A and at unit B1 in TENT B with the aim of reducing nitrogen oxide emissions below 200 mg/Nm³. The guarantee tests of the low-nitrogen burners, test “B” on unit B1, were successfully carried out in July 2023. The plan is to introduce primary measures to reduce nitrogen oxides in the coming period at unit A6 in TENT A, as well as at unit B2 in TENT B.
- In TENT B, construction of a wastewater treatment plant continued during 2024. At unit B1 of the TPP “Kostolac B”, as part of the revitalization of the unit, new burners were installed in 2014 with the aim of reducing nitrogen oxide emissions below 200 mg/Nm³. During 2019, a nitrogen oxide reduction system was installed at the TPP “Kostolac B”, on unit B2. During 2022, guarantee tests were carried out for the reduction of nitrogen oxides by applying primary measures at unit B2. In 2023, the construction of the ammonia-water reservoir, along with the associated equipment for the secondary measure of reducing nitrogen oxide emissions from units B1 and B2, was completed. The implementation of this measure took place during the capital overhaul in 2024. During 2024, equipment for the secondary measures of reducing nitrogen oxide emissions through the dosing of ammonia-water was also installed, ensuring that emissions comply with the limit value of 200 mg/Nm³ prescribed by the EU Industrial Emissions Directive.

Investments in the mining sector will be primarily directed toward increasing and sustaining coal production, as well as overburden removal at the Radljevo North, Field E and Drmno mining complex, which are expected to become the key coal production sites within the Kolubara mining basin and the TEKO Kostolac in the future. The main investment projects will be directed toward the construction of new dewatering facilities and the procurement of new mining equipment, with the aim of raising production to the higher planned level. The objectives of these investments are primarily to increase production capacities for supplying the thermal power plants, to improve the reliability of mining equipment operation, and to ensure long-term exploitation.

3.11. Development Plan and Investments for the Transmission System for the Next Ten Years, Including the Construction of Interconnection Transmission Lines

The development of transmission capacities includes the reconstruction of existing and the construction of new transmission capacities to achieve a balanced, sustainable, and timely development of the transmission system, with the goal of enabling the connection of new conventional and renewable sources, as well as facilities of other users of the transmission system.

Two groups of projects in the field of electricity transmission are of strategic and developmental importance at the national, regional and pan-European level until 2032. The first group consists of interconnection projects, or strengthening the connections of the transmission system of the Republic of Serbia with neighbouring transmission systems, and further integration of the transmission system of the Republic of Serbia into the regional interconnection. The second

group consists of projects for the further development and reconstruction of the internal transmission network in order to ensure secure power supply to users of the transmission system and the placement of the produced electricity [61].

The first group of projects includes the “Trans-Balkan Corridor” project, which is in the implementation phase and has a predominantly regional character, as well as the “Pannonian Corridor” project, which is in the study phase [3].

The “Trans-Balkan Corridor” project is listed on the Single Pipeline List of Infrastructure Projects, the Priority List of Energy Infrastructure Projects (PECI List), the List of Projects of Common Interest (PCI List) (section Resica - Pančevo), the List of Projects under the Investment Framework of the Western Balkans (WBIF List), the List of Projects under the Western Balkans 6 Initiative (WB6 list) (section Kragujevac 2 - Kraljevo 3 and the expansion of TS Kraljevo 3), and the List of Projects under the CESEC Initiative, and it consists of two phases [3].

The “Trans-Balkan Corridor - Phase 1” project consists of four sections that have been included in the investment plan of EMS JSC:

- Construction of a double circuit OHL from 400 kV TS Pančevo 2 - TS Rešica - 68.3 km, €27.36 million (own funds of EMS JSC). The project was completed in 2017, and since 2024, a new interconnection transmission line between Serbia and Romania has been in operation;
- Construction of a 400 kV OHL from TS Kragujevac 2 - TS Kraljevo 3 with an increase of voltage level at TS Kraljevo 3 to 400 kV and equipping one overhead line field at the TS Kragujevac 2 - 60 km, €27.5 million (€6.468 million grant through WBIF, €15 million KfW loan, and own funds of EMS JSC). The project was completed in 2022;
- Construction of a double circuit 400 kV OHL from TS Obrenovac - TS Bajina Bašta with an increase of voltage level at TS Bajina Bašta to 400 kV - 109 km, €89.98 million (EU pre-accession funds). The planned commissioning of the OHL is in 2027;
- Construction of a double circuit interconnecting 2x400 kV OHL Serbia - Bosnia and Herzegovina - Montenegro - 83.3 km, €53.2 million (EU pre-accession funds). Construction is expected to begin in the first quarter of 2026, with the planned completion of works and commissioning scheduled for early 2028.

The “Trans-Balkan Corridor - Phase 2” project includes several projects that are in the development phase:

- CSE Corridor Project – In 2021, EMS JSC applied for and received grant funds within the 25th round of WBIF technical assistance for the preparation of a Feasibility Study with an Environmental and Social Impact Assessment (ESIA). In 2022, the Feasibility Study was completed, which included a techno-economic analysis. EMS JSC has revised and accelerated the implementation schedule of the BeoGrid2025 project to ensure backup power supply for the EXPO2027 project. On July 29, 2024, an Initiative was submitted to the Ministry of Energy for amending the Government of the Republic of Serbia’s Conclusion dated December 2, 2021, including a detailed justification for the increased financial requirements. The planned completion of the design and technical documentation necessary for obtaining construction permits is scheduled for the end of 2024, while the tendering for the execution of works is planned for 2025.
- Central Balkan Corridor Project – In 2021, the preparation of a bilateral study was paused by mutual agreement between the Bulgarian TSO and EMS JSC. This project was nominated for the PCI list in early 2021, and after receiving feedback from the European Commission, work on the aforementioned study will continue. The technical solution for the site selection of Phase I of this project has been completed. Once conditions are met,

EMS JSC will submit a request for the designation of this project as a project of special importance for the Republic of Serbia. On October 16, 2024, a Loan Agreement was signed between the Saudi Fund for Development and the Republic of Serbia, regarding the Phase I project of the Central Balkan Corridor. In addition, in April 2024, the preparation of a Pre-Feasibility Study for the entire Central Balkan Corridor was launched. This study is expected to be completed in the spring of 2025.

- 400 kV OHL between Serbia and Croatia – The planned commissioning of the transmission line is after 2032 (prior to that, there is no system need for it).

The Pannonian Corridor project is intended to enable in the transmission capacity of electricity across the Balkan Peninsula, in a north-south direction, which will contribute to the integration of the electricity market and increase the reliability of power supply to consumers in Bačka and Srem. Also, this project is expected to contribute to the easier integration of renewable energy sources in these areas. The project consists of two phases:

- Phase I - construction of a new double circuit 400 kV OHL from TS Subotica 3 - Serbia - state border between Serbia and Hungary,
- Phase II - reconstruction of TS Subotica 3, construction of a new double circuit 400 kV OHL from TS Sombor 3 - TS Novi Sad 3, and construction of a new double circuit 400 kV OHL from TS Sremska Mitrovica 2 - TS Beograd 50.

In the first half of 2023, the bilateral interconnection study between the Hungarian transmission system operator (MAVIR) and EMS JSC was completed. This project was included in the PMI project list published in November 2023. The planned completion of the project and commissioning is expected for 2028 (Phase I - interconnecting OHL), and for 2030 (Phase II - internal reinforcement of the grid).

Regarding the 110 kV interconnecting OHLs, the commissioning of the OHL connecting TS Ljubovija and the nearest transformer station in Bosnia and Herzegovina – TS Srebrenica is expected in 2027, while the construction of the OHL between Tutin and the future transformer station in Rožaje (Montenegro) is expected after 2032.

The second group of projects includes projects for the development of the internal transmission network, i.e. projects for the construction and reconstruction of facilities and 400, 220 and 110 kV lines, projects for the connection of transmission and distribution systems, and projects for connecting the facilities of electricity prosumers.

A Regional Voltage Regulation Study has been developed, which proposed the installation of devices for reactive power compensation in the WB6 (Western Balkans six) region. The study showed that addressing the issue of excessively high voltage in parts of the 400 kV network will be facilitated by the project for the installation of a variable shunt reactor at the TS 400/110 kV TS Vranje 4. Since this is just one of the investments needed to resolve voltage-related issues, EMS JSC has also initiated the preparation of a study which will define the optimal locations for installing devices for reactive power compensation. The planned completion year of the project is 2026. Other projects for the development of the internal electricity infrastructure will allow for increased transmission capacities, development of the electricity market, improved reliability of the transmission system, and enhanced security of supply to consumers, as well as greater possibilities for connecting new conventional and renewable sources of electricity. With regard to the 400 kV and 220 kV voltage level networks, the strategic commitment of EMS JSC is the gradual phase-out of the 220 kV network, or its upgrade to the 400 kV voltage level, which will be largely implemented within the Transbalkan Corridor project. It is planned to preserve the 220 kV transmission corridors and utilize the existing routes as much as possible for future 400 kV and 110 kV OHLs. Regarding the development of the 110 kV transmission network, the planned projects will provide solutions for existing areas where the security of electricity supply

has not been met, particularly in radially fed areas. The development of the 110 kV network is particularly important for aligning with the distribution system development plan, enabling the realization of projects for connecting transmission and distribution system facilities.

3.12. Development and Investment Plan for the Distribution System for the Next Three to Ten Years

The main function of the planned projects in the field of electricity distribution is to increase the stability of the system and the reliability of power facilities, ensuring the quality of electricity supply to all users in accordance with the Distribution System Grid Code [37], increasing existing capacities, which enable the connection of new consumers, reducing technical and non-technical losses, reducing maintenance costs by installing equipment and materials with new technological solutions, reducing operating costs through modernization and automation, maximizing the utilization of available capacity throughout its lifetime, and improving environmental conditions by installing environmentally friendly materials and constructing facilities in accordance with environmental requirements [64].

With the aim of achieving the stated strategic objectives, the implementation of two groups of projects has been planned: projects for the construction and reconstruction of power facilities, and the Advanced Distribution Network Management Project [2].

The first group of projects includes the construction and reconstruction of TS 110/x kV, TS 35/x kV, and 35 and 10(20) kV lines, as well as projects for the replacement of old and construction of new TS 10(20)/0.4 kV substations. By increasing the capacity of the distribution network, seamless connection of new consumers will be enabled, the quality of electrical supply will be improved through a reduction in the number and duration of outages, voltage conditions at the distribution system users will be enhanced, operational stability will be increased, and the reliability of power facilities will be strengthened. These projects also envisage the replacement of old transformers with new ones with reduced losses, which will further contribute to reducing technical losses of electricity. Installing equipment and materials with new technological solutions will reduce maintenance costs, and will also create an opportunity to install more environmentally friendly materials.

A large number of projects for the construction and reconstruction of power plants are planned for the coming period. Many facilities are at the end of their service life, especially the TS 110/35 kV taken over from EMS JSC, but the pace of their reconstruction depends on the available funds. Delays in planned investments in these facilities generally occur because funds are redirected to other facilities that are assigned higher priority during the year (e.g., supplying power to electrical energy facilities of importance for the Republic of Serbia, etc.). The criterion “Providing power supply to a new zone” is applied as a priority mainly after the declaration of projects of importance for the Republic of Serbia, i.e. the adoption of a Conclusion of the Government of the Republic of Serbia recommending EDS LCC to construct and reconstruct facilities using its own funds. Priority projects for the construction and reconstruction of the distribution network:

- The construction of new TS 110/35 kV Belgrade 44 – Surčin and TS 110/10 kV Belgrade 58 – National Stadium, the 10 kV network configuration, and the CSS 10 kV are planned for the period 2024–2026, funded by the budget of the Republic of Serbia, to supply the EXPO Center and the National Stadium. The planned value of the project is €50 million.
- The construction of the new TS 110/10 kV BIO4 Campus, the 10 kV network configuration, and the CSS 10 kV is planned for the period 2025–2026, funded by the budget of the Republic of Serbia, to supply the BIO4 Campus complex. The planned value of the project is €21 million.

- Improvement of the electricity distribution system - Replacement of wooden impregnated poles with concrete poles, including the replacement of conductors. The project involves replacing worn-out wooden impregnated poles, which are in very poor condition, with new concrete poles. In addition, the existing conductors will be replaced with modern conductors of higher capacity. Replacements will be carried out in the most vulnerable areas, identified through monitoring network outage trends. The planned value of the project is €52.5 million.
- The reconstruction of 25 substations 110/x kV will include the installation of electrical equipment, as well as the associated construction works, in the scope specified by the technical documentation. The project is intended to ensure improved reliability of the distribution network, a reduction in the number and duration of outages for end-users, a decrease in losses within the distribution network, and a reduction of the overall maintenance costs of substations. The planned value of the project is €47.5 million.
- The reconstruction of 26 substations 35/x kV will include the installation of electrical equipment, as well as the associated construction works, in the scope specified by the technical documentation. The project is intended to ensure improved reliability of the distribution network, a reduction in the number and duration of outages for end-users, a decrease in losses within the distribution network, and a reduction of the overall maintenance costs of substations. The planned value of the project is €18.2 million.

The advanced distribution network management project includes the automation of the medium-voltage network, the replacement of electromechanical meters with smart meters, and the implementation of an integrated system for remote monitoring, diagnostics, and management of the low-voltage distribution network. The objective is to improve the existing distribution network management system in the coming period and to lay the foundations for the implementation of new technological solutions.

The priority projects are as follows:

- Automation of Medium – Voltage Network - The scope of the project includes the construction of new and the reconstruction of existing 35/x kV substations, the delivery and installation of new ring main unit switching equipment at existing X/0.4 kV substations, the delivery and installation of new remotely controlled switching devices in the medium-voltage network, the delivery and installation of telecommunications and ADMS systems for the analysis, planning, monitoring, and control of medium-voltage distribution network elements; and the delivery and installation of the Advanced Distribution Management System. The objective of the project is to improve the reliability of consumer supply, shorten outage durations, protect particularly sensitive customers (public services, hospitals, process industries sensitive to supply interruptions), increase the level of operational flexibility of the medium-voltage network, and enhance the utilization of existing equipment by equalizing the annual load curve through remote load control and, accordingly, by changing the manner of supplying that load using remote-control systems within the medium-voltage network.

In November 2020, an Agreement was signed in Belgrade between the Government of the Republic of Serbia and the Government of the French Republic on cooperation in the implementation of priority projects in the Republic of Serbia, which also provides for cooperation in the implementation of the project “Automation of Medium – Voltage Network”. In December 2022, a Contract was signed between EDS and EDF – International Networks for joint assistance in the management and implementation of the project. A Commercial Contract was signed in June 2023 between EDS and Schneider Electric for the implementation of the Medium - Voltage Distribution Network Automation Project in Serbia (the Contract has entered into force). A contract for a

commercial loan was signed with DB on June 21, 2024. A direct loan agreement was signed with the French Treasury (BPI) on June 13, 2024. The Government Conclusion of the Republic of Serbia (GRS) for both loans was adopted at the GRS session held on June 13, 2024. An Annex to the Contract between EDS and SE was signed to extend the deadline for completing the documentation for the effectiveness of the Main Works Contract, setting the final deadline for document completion to September 30, 2024 (it was adopted at the GRS session on June 27, 2024). Other activities arising from the Government Conclusion, the law, and previously assumed obligations are also ongoing. The planned value of the project is €320 million.

- Replacement of electromechanical meters with smart meters - Project for the development of the distribution network, and the procurement and installation of electricity metering and billing systems (EDS Metering) (EBRD and EIB loans). The project is divided into two separate phases (phase 1A - EBRD loan: €40M; WBIF grant: €7.84M) and (phase 1B - EIB loan: up to €80M). On September 14, 2021, a loan agreement was signed with the EBRD for the financing of phase 1A of the project. In the first phase (1A), the implementation of a centralized IT AMM MDM system is planned, as well as the introduction of smart meters. It is expected that a total of 200,000 smart meters will be installed in three Serbian cities: Kraljevo (30,000 units), Čačak (30,000 units), and Niš (140,000 units). The Smart Metering project will serve as the core of the future unified remote meter reading system. After the implementation of both phases of the project, it is expected that approximately 600,000 additional high-consumption meters will be added to the remote meter reading system.

The most important goal of this project is to reduce non-technical losses in the distribution network.

- Planned takeover, relocation of metering points and modernization - Works on the relocation of metering points and the replacement of metering devices (meters and metering groups) in the consumer areas of DP Novi Sad, DP Belgrade, DP Kraljevo, DP Niš, and DP Kragujevac (subsidized by the Republic of Serbia) began in 2023 and have continued throughout 2024. The project envisages the replacement of 470,305 metering devices (including the replacement of 49,094 metering groups across the country, 317,000 high-consumption meters in DP Belgrade, 65,411 high-consumption meters in DP Novi Sad, and 38,300 relocations of metering points) on the territory of the Republic of Serbia. The metering device replacement project will simultaneously establish the conditions for remote measurement, management, and control of production and consumption through advanced metering infrastructure (AMI) with a meter data management (MDM) system, which is directly in line with EU Directives 2019/943 and 2019/944, promoting the installation of smart meters and the development of smart meter reading systems. The total number of measuring devices replaced so far is 344,452. In 2023, a total of 103,076 metering devices were replaced, of which 24,342 were metering groups, 77,202 meters from the general consumption category, and 1,532 relocated metering points. As of July 14, 2024, 241,376 metering devices were replaced, of which the share of metering groups was 21,073, the share of meters from general consumption category was 208,505, while 11,798 metering points were relocated.
- The consolidation and expansion of existing ICT systems for remote meter reading is intended to support the aforementioned development projects as well as previously implemented remote meter reading systems. This includes the standardization of software solutions and their consolidation onto a single centralized platform for all advanced metering systems, along with the implementation of new functionalities in the AMI/MDM ICT system. The implementation of these advanced metering systems would

provide benefits in terms of greater automation of meter reading, improved meter accuracy, reduction of losses, enhanced customer relations through daily (or more frequent) readings, faster and easier adjustment of tariffs and other measurement parameters, reduced reading costs, quicker readings, and faster connection and disconnection of consumers, among others.

In addition to the aforementioned activities in the distribution part of the system, in the period 2025-2027, special attention will be paid to the continued implementation of environmental protection measures that prevent or minimize the impact of company activities on the environment. The activities envisaged in the Business Program, to the necessary extent, also comply with the requirements of EU legislation in the field of environmental protection. Significant obligations are also imposed by the necessity of cooperation with international institutions, primarily financial ones, which require compliance with European Union regulations.

The protection plan at the level of “Elektro distribucija Srbije” LCC Belgrade also includes the development of new technologies and solutions, as well as some tasks related to the fulfillment of legal obligations.

In 2025, activities related to the storage and shipment of used transformer and motor oil for processing are planned to continue. Activities are also planned to address issues related to the remediation and replacement of transformers filled with PCB oils, in accordance with legal obligations. The project for sampling and testing oil for the presence of PCBs in power facilities, as well as the decontamination of PCB-contaminated 20/x and 10/x kV transformers, will continue. This also includes soil testing for oil contamination at high-risk sites and locations of previous (historical) soil pollution, along with remediation (clean-up) services for contaminated soil. If soil monitoring detects contamination, soil remediation will be organized in accordance with the treatment methods available within the territory of the Republic of Serbia.

Environmental protection controls are also planned in all parts of “Elektro distribucija Srbije” LCC Belgrade, timely updating of documentation, as well as harmonization of internal procedures and instructions with the applicable legal regulations of the Republic of Serbia.

Also, further activities are planned to improve the environment and protect the soil, and to prepare technical documentation for the rehabilitation of the 110/x kV and 35/10 kV substations.

3.13. Regional, National and European Goals of Sustainable Development, Including International Projects

Republic of Serbia has adopted, signed and ratified the Treaty establishing the Energy Community [66]. Thus, it has defined the establishment of a regional electricity market and its integration into the European Union energy market as one of its priorities. Such a market should ensure significant investments in this sector and contribute to the economic development and stability of the country and the region. The functioning of the market must be regulated by the legal framework and actions of European Union in the fields of electricity, environmental protection, competition, the use of renewable energy sources, and energy efficiency.

In addition to domestic laws and strategic documents, the goals and directions for the development of the energy sector in the Republic of Serbia are also defined by internationally assumed obligations.

The ratification of the Paris Agreement¹⁸ has a significant impact on the energy sector of the Republic of Serbia. This agreement was adopted at the 21st Session of the Conference of the

¹⁸ Law on the Ratification of the Paris Agreement, “Official Gazette of the Republic of Serbia - International Treaties”, No. 4 of May 30, 2017.

Parties to the UN Framework Convention on Climate Change, held in Paris at the end of 2015. The agreement was reached “in the context of sustainable development and efforts to eradicate poverty”, and aims to strengthen the global response to the threat of climate change.

In 2019, the European Union adopted the regulatory package “Clean Energy for All Europeans” with the aim of fulfilling the obligations under the Paris Agreement - defining and achieving climate and energy targets until 2030 (a reduction of GHG emissions by at least 40% compared to 1990 levels, increasing the share of renewable energy to 32%, and improving energy efficiency by 32.5%) and establishing a single energy market within the EU. Under this package, the European Union introduced an obligation for its member states to develop National Energy and Climate Plans that define national targets for reducing GHG emissions, increasing the share of renewable energy, and improving energy efficiency.

Additionally, in 2020, the EU, as part of a political initiative called the “European Green Deal”, further adjusted the decarbonisation target. In order for Europe to become a carbon-neutral continent by 2050, a target of a 55% reduction in GHG emissions by 2030 compared to 1990 levels was adopted. Within the framework of the “European Green Deal”, the European Union defined the “Green Agenda for the Western Balkans”, which the Republic of Serbia agreed to at the regional summit in Sofia in November 2020.

By signing the Sofia Declaration on the Green Agenda for the Western Balkans, the Republic of Serbia has committed to working together with the EU towards the goal of making Europe a climate-neutral continent by 2050, through the introduction of strict climate policies and reforms in the energy and transport sectors.

The Republic of Serbia has undertaken the obligation to develop a National Energy and Climate Plan, which will define decarbonisation targets, the increase of the share of RES, and improvements in energy efficiency for the period until 2030, with projections until 2050. The drafting of this document began in March 2021 and was completed in December 2023. The NECP was adopted in July 2024. In November 2024, the National Assembly of the Republic of Serbia adopted the Development Strategy of the Republic of Serbia until 2040 with projections until 2050 (“Official Gazette of RS”, No. 94/2024) [2], as the basic act that establishes energy policy and plans development in the energy sector.

In this regard, following the energy transition trends defined by the plan, a series of documents were adopted to define the formal legal frameworks as well as the substantive ways of functioning of the transmission and distribution systems under the new conditions. Some of these include the Law on Energy [1], the Law on the Use of Renewable Energy Sources [4], the Decree on the Network Code on the Connection of Power Generation Units to the Grid [9], the Code for Connecting Facilities to the Transmission System, the Decree on the Allocation of Transmission Capacity and Congestion Management [12], Regulation on the Incentive Fee for Privileged Electricity Producers [13], Regulation on the Market Premium and Feed-in Tariff [14], the Decree on the Criteria, Conditions, and Methods for Calculating Claims and Obligations between Prosumers and Suppliers [67].

National and regional projects whose implementation is in progress or planned in the medium term period (more details about each project in Chapters 3.10, 3.11 and 3.12):

- The “Trans-Balkan Corridor– Phase 1” project consists of four sections that are included in the investment plan of EMS JSC, two of which have already been completed. The estimated value of the Phase 1 is approximately €143 million.
- The BeoGrid2025 project (as part of the North CSE Corridor project), which includes the construction of TS Belgrade 50 with the corresponding layout of 400 kV and 110 kV OHLs, as well as the construction of the 2x400 kV OHL TS Belgrade 50 - CSS Čibuk 1. The estimated investment value is €205 million.

- Projects for the construction of new wind farms in the Republic of Serbia. The projects are being implemented by EPS JSC and several private investors and are of strategic importance for the Republic of Serbia in achieving the goals set for the share of renewable energy sources in the gross final energy consumption of the Republic of Serbia. The capacities planned for construction by 2040 amount to 3.2 GW, and the total estimated value of investments is around €4,480 million [2].
- Projects for the construction of new solar power plants in the Republic of Serbia. The projects are being implemented by EPS JSC and several private investors and are of strategic importance for the Republic of Serbia in achieving the goals set for the share of renewable energy in the gross final energy consumption of the Republic of Serbia. The capacities planned for construction by 2040 amount to 7.3 GW, and the total estimated value of investments is around €8,760 million [2].
- The “Smart Metering” project. The estimated investment value is €505 million.
- The “Automation of the Medium-Voltage Distribution Network” project. The estimated investment value is approximately €320 million.
- The project of construction of PSHPP Bistrica with an installed capacity of 628 MW. The estimated investment value is approximately €1,100 million.
- Construction of the Upper Drina Hydroelectric System (HES). The estimated investment value is approximately €529 million, of which EPS JSC's share is €265 million.

Potential national and regional projects whose implementation is not expected before 2030:

- The project for the construction of HPP Ibar, with an installed capacity of 121 MW. This project is significant because it will enable the employment of the local population, improve infrastructure (new projects), increase the use of renewable energy sources in accordance with European Union standards, and raise the social standard. The estimated investment is around €350 million.
- The project for the construction of PSHPP Đerdap 3, with an installed capacity of 1,800 MW. The estimated investment for the Phase I of the project is about €2,632 million [103].

4. NATURAL GAS

In the field of natural gas, the Energy Law [1] specifies the following energy activities: transmission and natural gas transmission system operation, natural gas storage, and natural gas storage facility operation, natural gas distribution and natural gas distribution system operation, natural gas supply, wholesale natural gas supply, and public natural gas supply.

Regulated energy activities include natural gas transmission and natural gas transmission system operation, natural gas storage and natural gas storage facility operation, natural gas distribution and natural gas distribution system operation, and public natural gas supply. The energy activities of natural gas supply and wholesale natural gas supply are subject to market principles.

AERS is the competent body that regulates the price of natural gas for public supply, determines the price of access to the natural gas transmission system, determines the price of access to the natural gas distribution system, and determines the price of access to natural gas storage. Energy entities that perform regulated energy activities calculate regulated prices and adopt price acts, which they submit to AERS for approval.

The determination of activities of general interest in the energy sector, as well as the obligations of public supply, is regulated by the Energy Law [1].

The Energy Law [1] defines energy activities of general interest in the natural gas sector, which are: transmission and natural gas transmission system operation, natural gas storage and natural gas storage facility operation, natural gas distribution and natural gas distribution system operation, and public natural gas supply.

The Commission for Energy Networks of the Republic of Serbia was established by the Law on Amendments to the Energy Law (“Official Gazette of RS”, No. 62/2023), as an independent and autonomous body of the Republic of Serbia, responsible for the control of natural gas transmission system operators whose founder is the Republic of Serbia and which carry out natural gas transmission and natural gas transmission system operation as activities of general interest, in accordance with the Energy Law [1].

With the adoption of the Energy Law in December 2014 [1], the Third Energy Package of directives in the field of natural gas was transposed into the legislation of the Republic of Serbia. Since January 1, 2015, all final customers of natural gas have the right to freely choose their supplier on the market.

To ensure the security of supply of end consumers, it is stipulated that households and small customers, whose all facilities are connected to the natural gas distribution system, and who do not choose another supplier, are entitled to public supply at regulated prices. Small natural gas customers are end customers whose annual natural gas consumption is up to 100,000 m³ (1,026,000 kWh), and whose all facilities are connected to the natural gas distribution system.

The right to last resort supply, for a period not exceeding 60 days, is granted to the end customer of natural gas who does not have the right to public supply in the case of bankruptcy or liquidation of the supplier who had been supplying them, the cessation or revocation of the license of the supplier who had been supplying them, or who has not found a new supplier after the termination of the supply contract with the previous one, unless the termination of the contract was due to the customer's failure to meet payment obligations. The government has designated PE Srbijagas Novi Sad as the supplier responsible for the last resort supply.

4.1. Natural Gas Market

The natural gas market in the Republic of Serbia operates as a bilateral market. Natural gas market participants in 2024 were as follows: producer (NIS JSC Novi Sad), suppliers (58

companies, while 23 active), public suppliers (31 companies), end customers (360,156 on regulated supply and 1,264 on the free market), transmission system operators - Transportgas Serbia LLC Novi Sad” (Transportgas Serbia)¹⁹, Yugorosgaz-Transport LLC Niš (Yugorosgaz-Transport)²⁰, and Gastrans LLC Novi Sad (Gastrans)²¹, distribution system operators (31 active companies; one company did not perform the activity) and the storage operator - UGSF Banatski Dvor. During 2024, 6 suppliers obtained a license for the wholesale supply of natural gas, so that at the end of 2024, there were 11, but these suppliers were not active during 2024 [39].

Access to the natural gas transmission network in the national, regional, and European natural gas markets is regulated by decrees, which include:

- Balancing rules, including rules on nomination procedures, imbalance charges, settlement processes related to daily imbalance charges, and operational balancing between gas transmission system operators [18],
- Procedures for managing congestion and the publication of data and technical information for accessing the natural gas transmission system [19],
- Calculation and allocation of natural gas transmission capacity [20],
- Harmonised tariffs for natural gas transmission [21],
- Interoperability between transmission system operators and data exchange rules for the operation of interconnected gas transmission systems [22].

The Transmission Network Code [68]-[71] stipulates the manner in which the transmission system operator performs the tasks of organizing and administering the natural gas market, as well as the framework that more specifically regulates the rights and obligations of market participants.

In wholesale trading, two companies were involved in 2024: PE Srbijagas Novi Sad and the natural gas producer NIS JSC Novi Sad. These two companies sold gas to other suppliers, with only PE Srbijagas acting as the supplier of public suppliers, selling natural gas to all public suppliers.

The majority of natural gas is sold on the free market - in 2024, 2,008 million m³ (20,605.93 GWh) or 81% of total supply. Last-resort supply was used by four customers (3.4 million m³ or 34.9 GWh). The share of households and small customers (whose annual natural gas consumption is up to 100,000 m³ and whose all facilities are connected to the natural gas distribution system) on the retail market was 19% (471 million m³ or 4,836 GWh) [39]. Analysis of the trend of natural gas sales structure on the retail market (Table 20) shows that since the market liberalization in 2015, the ratio of sales on the free and regulated markets has remained approximately constant (85%:15%). In the 2019-2024 period, there was a slight increase in the share of sales on the regulated market. Table 20 does not show the consumption of NIS JSC Novi Sad from its own production (171 million m³ or 1,758 GWh), as it was not subject to market trading.

¹⁹ Since October 2020, the transmission system operator Transportgas Serbia LLC has fully taken over the activities of natural gas transmission and natural gas transmission system operation, but during 2024 it did not obtain a licence to perform this activity. The Republic of Serbia is the sole member of Transportgas Serbia LLC, holding a 100% share. The Council of the Energy Agency of the Republic of Serbia, at its 325th regular session held on March 21, 2025, decided to issue a certificate as an independent system operator to Transportgas Srbija d.o.o. [34].

²⁰ The Council of the Energy Agency of the Republic of Serbia (AERS), in accordance with the Energy Law and AERS acts, adopted a Decision at the meeting on July 15, 2019, whereby Yugorosgaz-Transport LLC Niš is revoked the certificate issued by the Agency's Decision of June 20, 2017 [34].

²¹ Gastrans LLC was certified as an independent natural gas transmission operator on February 21, 2020. The AERS Council confirmed at its meeting on March 31, 2022, that Gastrans LLC Novi Sad submitted all the required evidence to the Agency, confirming that it independently operates and manages the constructed transmission system, which is necessary for holding the certificate as an independent transmission operator. [34].

Supplier switch was performed at one metering point in 2024 on the transmission system of Jugorosgaz-Transport LLC [39].

At the distribution level, suppliers were switched at 51 metering points in 7 DSO, with a consumption of 20.9 million m³, accounting for 1.16% of the natural gas delivered from distribution systems, or 0.84% of total market consumption (without NIS JSC Novi Sad own production) [39]. The valid Rules on Supplier Switching have been in effect since 2015, and since then, valid data on supplier switching has been available (Table 20). It can be concluded that the volume of supplier switching, both in terms of numbers and quantities, is negligible.

Table 20: Natural gas sales in the period from 2012 to 2024, in million m³ [39]

		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Open market	mill. m ³	324	649	804	1,514	1,712	1,917	1,881	1,751	1,853	2,184	2,091	2,021	2,008
	%	16.2	34.3	40.6	85.3	85.6	85.4	85.4	84.1	82.9	82.7	81.9	81.5	81%
Regulated market	mill. m ³	1,680	1,243	1,178	261	289	329	321	332	382	456	461	458	471
	%	83.8	65.7	59.4	14.7	14.4	14.6	14.6	15.9	17.1	17.3	18.1	18.5	19%
Supplier switching in transmission system	mill. m ³	-	-	-	95	-	-	148	-	-	-	-	-	-
	%	-	-	-	19.8	-	-	16.6	-	-	-	-	-	-
	Metering points	-	-	-	3	-	-	1	-	-	-	-	-	1
Supplier switching in distribution system	mill. m ³	-	-	-	4	74	21	24.8	7.4	3.6	1.4	2.3	3.6	20.9
	%	-	-	-	0.3	5.1	0.9	1.7	0.51	0.16	0.05	0.09	0.14	1.16
	Metering points				10	22	85	57	207	17	31	25	45	51

The natural gas market in the Republic of Serbia includes both domestic gas and imported gas. When it comes to imported gas, the Republic of Serbia primarily secures imports from Russia based on a long-term contract, and, if needed, also from other sources under short-term contracts. The long-term contract between Gazprom Export DOO and Jugorosgaz AD Belgrade for the supply of Russian natural gas to the Republic of Serbia was signed in March 2013²². Under this Contract, Jugorosgaz JSC Belgrade is responsible for delivering Russian natural gas to the Republic of Serbia. The contract guarantees a delivery of 2 billion Sm³ of natural gas per year. Additional quantities of natural gas can be taken through daily contracted quantities (about 6 million Sm³) with price adjustments.

The contract defines the method for determining the price of the delivered natural gas (based on the so-called ‘oil-linked pricing formula’) and the supply regime. The supply regime covers the taking of nominated available quantities of natural gas.

Natural gas can also be delivered to the Republic of Serbia via the pipeline Dimitrovgrad – Niš. At the end of 2023, a contract was signed for the delivery of up to 400 million m³ of natural gas from Azerbaijan via this route until 2026, with the possibility to increase this amount to one billion m³ per year. Contracted supply regime, until the end of 2025, was 200,000 m³/day during the winter period, and 100,000 m³/day during the summer period. Subsequently, a guaranteed quantity of one million m³ per day from this direction was agreed for the period from 1st of November 2025 to 31st of March 2026 [31].

²² This contract was valid until the end of May 2025, and was extended by an annex until September 30, 2025.

4.2. Transmission system

The natural gas transmission system consists of a network of gas pipelines with a design pressure exceeding 16 bar, except for the feeder gas pipelines, as well as compressor stations, block valve stations, metering-regulating and metering stations at all points of delivery from the transmission system, other energy facilities, electronic communication and information systems, and other infrastructure necessary for natural gas transmission, including line pack (hereinafter: natural gas transmission system).

At the end of 2024, the length of the transmission system in Serbia was 3,133 km. The length of the transmission system in northern and central Serbia, on which Transportgas Serbia LLC operates, is 2,606 km (83.2%). The transmission system operated by Yugorosgaz-Transport LLC has a length of 125 km (4%) and is located in the southeastern part of Serbia. Gastrans LLC performs transmission activities on 402 km (12.8%) of the gas pipeline from the Bulgaria-Serbia border to the Serbia-Hungary border.

Table 21: Table of transmission network length in the Republic of Serbia from 2011 to 2024 [39]

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Length of network [km]	2,396	2,466	2,473	2,498	2,498	2,498	2,534	2,539	2,539	2,539	3,005	3,028	3,130	3,133

The main technical characteristics of the transmission systems of Transportgas Serbia, Yugorosgaz-Transport and Gastrans are shown in Table 22.

Table 22: Main technical characteristics of the transmission systems of Transportgas Serbia, Yugorosgaz-Transport, and Gastrans [39]

Technical characteristics of the transmission system	Transportgas Serbia LLC	Yugorosgaz-Transport LLC	Gastrans LLC
Capacity (mil. m ³ /day)	≈ 23,9 (245)	≈ 2,2 (23)	≈ 34,60 (355)
Pressure (bar)	16–75	16–55	66–75
Length [km]	2.606	125	402
Nominal diameters (mm)	DN 150–DN 750	DN 168–DN 530	DN 1200
Number of compressor stations	1	-	1
Compressor station, power, (MW)	4,4	-	19,287
Number of entry points into the transmission system:	15	2	1
1.From another transmission system	5 (Horgoš, Karadjordjevo brdo, Pancevo, Gospodjinci, Dimitrovgrad)	2 (Pojate, Trupale)	1 (near Zajecar)
2.From production fields	9	-	-
3.From the underground storage	1	-	-
Number of exit points from the transmission system	251	6	4
Metering and regulating stations at the exit points of the transmission system.	246	6	0
Transfer stations	3	-	4

Technical characteristics of the transmission system	Transportgas Serbia LLC	Yugorosgaz-Transport LLC	Gastrans LLC
Exit to the Yugorosgaz-Transport transmission system	2	-	-
Exit to the Transportgas Serbia transmission system	-	-	3
Interconnector towards Bosnia and Herzegovina	1	-	-
Interconnector towards Hungary	-	-	1
Natural gas storage	1	-	-

Transmission system operators are required to ensure the automatic collection and processing of data on natural gas flows, with a collection interval of 24 hours or less, for all delivery points from the transmission system. Such metering and data acquisition equipment is necessary for the functioning and development of the market. By the end of 2022, it was installed at all delivery points in the system operated by Yugorosgaz-Transport and Gastrans, as well as at 88% of the total number of exit points from the transmission system of Transportgas Serbia. It should be noted that appropriate metering equipment has been installed at exit points with higher volumes of natural gas, so the share of natural gas volumes measured in the Transportgas Serbia system stands at 99% of the annual measured volumes.

The Republic of Serbia has five interconnections with the gas pipeline systems of neighbouring countries, operated by:

- Transportgas Serbia LLC has three interconnections [72], [104]:
 - Hungary (Kiskundorozsma) - Serbia - entry point with a technical capacity of 13.85 mil. m³/day,
 - Serbia - Bosnia and Herzegovina (Zvornik) - exit point with a technical capacity of 2 mil. m³/day,
 - Republic of Bulgaria (Kalotina/Dimitrovgrad) – Republic of Serbia – bidirectional interconnection with a technical capacity of 5.1 million m³/day²³;
- Gastrans LLC has two interconnections²⁴:
 - Bulgaria - Serbia (Zajecar) - entry point with a technical capacity of 35.7 mil. m³/day (calculated using 366,731,712 kWh/day),

Serbia – Hungary (Kiskundorozsma) - exit point with a technical capacity of 23.9 mil. m³/day (calculated using 245,765,598 kWh/day).

4.2.1. Assessment of the Operational Security of the Transmission System

The assessment of the operational security of the transmission system is carried out based on delivery and supply quality indicators for natural gas, which are systematically collected in the same manner by energy entities in accordance with the Rules on Monitoring Technical and Commercial Indicators and Regulating Quality of Electricity and Natural Gas Delivery and Supply [73] are reported to AERS once a year.

²³To achieve the full technical capacity, it is necessary to construct the Trupale regulating station (reducing the pressure to 50 bar) and to reconstruct the Pojate metering and regulating station (the current maximum capacity is 4.8 million m³/day). It is also necessary to sign an operating agreement between the TSOs Transportgas Serbia LLC and Yugorosgaz-Transport LLC [104].

²⁴ <https://gastrans.rs/transparentnost/kratak-opis-gasovoda-i-tacaka-interkonekcije-sa-nazivima-oso/>

The security of the transmission system operation is monitored through the number and duration of interruptions in the delivery of natural gas in the transmission system. Interruptions are categorized as planned, unplanned, and force majeure interruptions.

Table 23 shows interruptions in the Transportgas Serbia transmission system from 2015 to 2024. During the same period, there were no interruptions in the transmission system operated by Yugorosgaz-Transport.

The interruptions during 2024 were mostly planned and occurred primarily due to investment works involving the replacement of a large number of sectional valves (around 68 units). In 2024, there was also one unplanned emergency interruption, lasting about 9 hours, caused by a malfunction of the gas equipment on the pipeline supplying the main metering and regulation station Bačka Topola.

Table 23: Interruptions in the transmission system by cause [39]

TSO Transportgas Serbia	Interruption causes					
	Planned interruptions		Unplanned interruptions		Force majeure	
	Number	Duration (min)	Number	Duration (min)	Number	Duration (min)
2015	0	0	5	36	0	0
2016	7	2,649	0	0	0	0
2017	15	10,980	2	720	0	0
2018	7	5,460	0	0	0	0
2019	11	118	2	79	0	0
2020	3	1,890	0	0	0	0
2021	48	42,630	0	0	0	0
2022	55	42,660	0	0	0	0
2023	28	23,430	1	1,749	0	0
2024	18	58,470	1	540	0	0

4.3. Distribution system

The natural gas distribution system consists of a network of pipelines, regulation, metering-regulation, and metering stations at all delivery points from the distribution system, other energy facilities, electronic communication, information, and other infrastructure necessary for the distribution of natural gas with a maximum operating pressure equal to or less than 16 bar, including line pack.

According to the Energy Law [1], the distribution of natural gas is a regulated activity.

In 2024, 31 distribution system operators in Serbia were engaged in the distribution and operation of the natural gas distribution system. There is one more licensed distribution system operator that has not yet started operations. Since 2013, the length of the distribution network in the Republic of Serbia has increased by 55.5%. In 2024, the increase was 994 km, or 4.2%, creating conditions for connecting new customers [39]. In 2024, the largest percentage increase in network length was in the DSO Interklima (7.2%), followed by DSO Yugorosgaz (6.33%) and DSO Srbijagas (6.1%). PE Srbijagas operates on 63.93% of the total distribution network in the Republic of Serbia.

There was no change in the network length for 14 DSOs in 2024 [39]. The number of connections increased by 5.9% in 2024 compared to the previous year [39].

The length of the distribution gas pipeline and the number of active connections is shown in Table 24.

Table 24: Length of the distribution gas pipeline in the period 2013-2024 [39]

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Length [km]	15,839	16,363	16,532	16,653	16,961	18,422	19,286	19,833	20,831	22,172	23,639	24,633
Number of active connections	261,000	261,000	262,500	267,000	270,626	276,518	282,997	293,523	306,815	324,925	342,840	362,983

4.3.1. Assessment of the Operational Security of the Distribution System

The assessment of the operational security of the distribution system is carried out based on delivery and supply quality indicators for natural gas, which are systematically collected in the same manner by energy entities in accordance with the Rules on Monitoring Technical and Commercial Indicators and Regulating the Quality of Electricity and Natural Gas Delivery and Supply [73], and are reported to AERS annually. According to the AERS 2024 Annual Report [39], data were provided from 362,983 delivery points, i.e., 100% of delivery points.

The operational security of distribution systems is assessed based on the reliability parameters of these systems - the number and duration of interruptions in the delivery of natural gas. These parameters are monitored separately for planned and unplanned supply interruptions. Based on the parameters mentioned above, indicators of supply continuity are calculated [73]:

- SAIFI [number of interruptions/user] - average frequency of interruptions in the delivery of natural gas per user; It is calculated as the ratio of the cumulative number of interruptions in the delivery of natural gas to the total number of users;
- SAIDI [min/user] - average duration of interruptions in the delivery of natural gas per user; It is calculated as the ratio of the cumulative duration of all interruptions in the delivery of natural gas to the total number of users.

Table 25 and Table 26 present the summary reliability parameters of the distribution systems and the summary supply continuity indicators for the period 2015–2024, which relate to unplanned and planned interruptions in supply. The data is categorized according to the causes of interruptions, and the maximum values of the SAIFI and SAIDI indicators recorded in individual distribution systems are also provided.

Table 25: Unplanned interruptions in distribution systems - Summary indicators [39]

Interruption cause	Year	Number of interruptions	SAIFI	Maximum reached SAIFI	SAIDI	Maximum reached SAIDI
			Number of interruptions per user		min/user	
Delivery reduction from upstream system	2015	0	0	0	0	0
	2016	6	0	0.12	0.10	34.14
	2017	0	0	0	0	0
	2018	0	0	0	0	0
	2019	0	0	0	0	0
	2020	1	0	0	0	0
	2021	2	0.01	0.98	6.06	886.14
	2022	0	0	0	0	0

Interruption cause	Year	Number of interruptions	SAIFI	Maximum reached SAIFI	SAIDI	Maximum reached SAIDI
			Number of interruptions per user		min/user	
	2023	0	0	0	0	0
	2024	5	0	0.01	0.34	0.78
Gas leak	2015	58	0.02	0.11	1.70	10.15
	2016	84	0.04	2.00	6.3	15.85
	2017	37	0.02	0.13	3.33	23.71
	2018	39	0.01	0.07	1.15	9.44
	2019	27	0.01	0.21	1.71	18.09
	2020	68	0.06	0.14	22.22	53.07
	2021	55	0.05	0.42	20.27	43.36
	2022	22	0.01	0.21	4.18	264.32
	2023	48	0.11	0.42	39.19	84.13
	2024	51	0.02	0.06	6.76	14.88
Third-party	2015	219	0	0.15	0.09	75.88
	2016	183	0.02	0.54	3.86	710.00
	2017	259	0.03	0.04	3.80	16.44
	2018	230	0.06	1.00	9.37	154.62
	2019	185	0.03	2.00	6.16	360
	2020	272	0.02	0.1	5.34	11.25
	2021	253	0.03	0.42	6.65	50.19
	2022	402	0.03	0.71	15.94	85.71
	2023	93	0.01	0.13	6.85	151.61
	2024	177	0.02	0.98	8.17	1,062.00
Inadequate network capacity	2015	0	0	0	0	0
	2016	0	0	0	0	0
	2017	0	0	0	0	0
	2018	0	0	0	0	0
	2019	0	0	0	0	0
	2020	0	0	0	0	0
	2021	0	0	0	0	0
	2022	0	0	0	0	0
	2023	0	0	0	0	0
	2024	0	0	0	0	0
Other reasons	2015	0	0	0	0	0
	2016	0	0	0	0	0.07
	2017	3	0.01	0.3	3.79	168.14
	2018	1	0.00	0	0.02	0.18
	2019	0	0	0	0	0
	2020	4	0.01	0.2	3.89	9.57
	2021	0	0	0	0	4.39
	2022	1	0	0.04	0	4.29
	2023	0	0	0	0	0
	2024	0	0	0	0	0
Total	2015	277	0.02	0.15	1.79	75.88
	2016	273	0.06	2.00	10.26	710.00
	2017	299	0.06	0.3	10.92	168.14
	2018	270	0.07	1.07	10.54	164.24
	2019	212	0.04	2.21	7.87	378.09

Interruption cause	Year	Number of interruptions	SAIFI	Maximum reached SAIFI	SAIDI	Maximum reached SAIDI
			Number of interruptions per user		min/user	
	2020	345	0.09	0.44	31.45	73.89
	2021	310	0.09	1.51	33.25	984.08
	2022	425	0.04	0.96	20.12	354.32
	2023	141	0.13	0.55	46.06	235.74
	2024	233	0.04	1.05	15.28	1,077.66

The main causes of unplanned interruptions in 2024 were “Gas Leak” and “Third-Party”. “Inadequate network capacity” and “Other reason” were not indicated as causes of the interruption. In 2024, the SAIFI and SAIDI indicators for the unplanned interruption type “Gas leakage” show significantly lower values compared to the previous two years. Interruptions caused by “Third parties” have high values both in number and in duration, indicating the need for better coordination with other utility services. The total number of unplanned interruptions in 2024 (233) is at the level of the multi-year average, as are the average SAIFI and SAIDI values. However, the maximum achieved SAIDI in 2024 has the worst value in the analyzed period 2015–2024.

Table 26: Planned interruptions in distribution systems - Summary indicators [39]

Interruption cause	Year	Number of interruptions	SAIFI	Maximum reached SAIFI	SAIDI	Maximum reached SAIDI
			Number of interruptions per user		min/user	
Cause on the connected system	2015	0	0	0	0	0
	2016	5	0	0.03	0.21	6.98
	2017	4	0.04	1.62	12.93	873.20
	2018	2	0.02	0.09	15.31	61.03
	2019	10	0.12	0.4	108.33	370.47
	2020	54	0.13	0.32	63.06	155.06
	2021	102	0.13	1.97	72.23	1,830.98
	2022	41	0.08	2.00	79.58	990.00
	2023	77	0.03	0.08	32.32	76.62
	2024	39	0.04	1.00	14.17	1,320.00
Administrative interruption	2015	0	0	0	0	0.16
	2016	2	0	0.55	0.04	0.65
	2017	5	0.03	0.3	14.81	127.62
	2018	2	0.01	0.46	0	0
	2019	2	0.02	0.06	9.12	31.2
	2020	18	0.02	0.05	8.51	20.91
	2021	1	0	0.03	0.28	7.00
	2022	1	0.04	1.00	42.48	1,080.00
	2023	21	0.06	1.04	41.30	1,050.81
	2024	1	0	0.48	0.05	200.87
Operator-caused interruption	2015	22	0.03	1.00	4.38	540.00
	2016	27	0.11	0.31	104.85	631.92
	2017	51	0.040	1.00	14.72	360.00
	2018	62	0.06	1.00	27.36	540.00
	2019	18	0.05	1.00	20.77	540.00

Interruption cause	Year	Number of interruptions	SAIFI	Maximum reached SAIFI	SAIDI	Maximum reached SAIDI
			Number of interruptions per user		min/user	
	2020	91	0.09	0.34	22.36	56.64
	2021	174	0.29	1.00	93.98	600.00
	2022	72	0.1	1.88	21.18	360.00
	2023	94	0.11	0.57	26.87	308.56
	2024	168	0.23	0.52	75.09	170.77
Uncategorized interruption	2015	32	0.02	0.11	1.80	12.30
	2016	32	0.01	0.11	1.57	12.13
	2017	44	0.004	0.03	2.02	16.55
	2018	74	0.02	0.17	3.43	28.37
	2019	2	0.01	0.81	7.4	509.92
	2020	1	0	0.03	0.01	3.4
	2021	0	0	0	0	0
	2022	2	0	0.02	0.17	6.14
	2023	0	0	0	0	0
	2024	1	0	1.00	2.77	600.00
Total	2015	54	0.05	1.00	6.18	540.00
	2016	66	0.12	0.55	106.67	631.92
	2017	104	0.11	1.62	44.49	873.20
	2018	140	0.11	1.72	46.11	629.4
	2019	32	0.19	2.27	145.62	1,451.59
	2020	164	0.24	0.74	93.94	236.01
	2021	277	0.42	3.00	166.48	2,437.98
	2022	116	0.21	4.90	143.42	2,436.14
	2023	192	0.20	1.69	100.49	1,435.99
	2024	209	0.27	3.00	92.09	2,291.64

For planned interruptions in 2024, there was generally an increase in indicator values compared to the previous year, and the values are close to those from 2021, when the maximum values of all indicators were recorded. The SAIDI indicator for interruptions of the type “Cause on the connected system” and “Uncategorized interruption” shows a very high maximum value. The difference between the average and maximum indicator values indicates significant inconsistency in the operational reliability of individual distribution systems, and highlights the need for those systems with substantially higher values to undertake appropriate measures to eliminate the causes, primarily unplanned interruptions.

Table 27 presents the summary reliability indicators of the operation of distribution systems for the period 2015–2024. From Table 27, it can be observed that the number of supply interruptions continuously increased throughout the considered period up to 2021 (except for 2019), while in 2024 the number of interruptions is slightly lower. The value of the SAIFI indicator is at the average level for the last three years, while the SAIDI indicator belongs to the lower range for the entire period under review.

Table 27: Reliability indicators of the operation of distribution systems – summary [39]

Type of interruptions	Year	Number of interruptions	SAIFI [interruptions/user]	SAIDI [min/user]
Planned	2015	277	0.02	1.79
	2016	66	0.12	106.67
	2017	104	0.11	44.49
	2018	140	0.11	46.11
	2019	32	0.19	145.62
	2020	164	0.24	93.94
	2021	277	0.42	166.48
	2022	116	0.21	143.42
	2023	192	0.2	100.49
	2024	209	0.04	15.28
Unplanned	2015	54	0.05	6.33
	2016	273	0.06	10.26
	2017	299	0.06	10.92
	2018	270	0.07	10.54
	2019	212	0.04	7.87
	2020	345	0.09	31.45
	2021	310	0.09	33.25
	2022	425	0.04	20.12
	2023	141	0.13	46.06
	2024	233	0.27	92.09
Total	2015	331	0.07	8.12
	2016	339	0.18	116.93
	2017	403	0.17	55.41
	2018	410	0.18	56.65
	2019	244	0.23	153.5
	2020	512	0.33	125.4
	2021	587	0.51	199.74
	2022	541	0.25	163.54
	2023	333	0.33	146.55
	2024	442	0.31	107.37

4.4. Storage of Natural Gas

The Banatski Dvor underground gas storage facility was commissioned in November 2011 and is located on the site of an exhausted gas deposit with a capacity of 3.3 billion m³ of natural gas. Gazprom Export LLC and PE Srbijagas are the owners of this storage facility [74]. The total area of the storage is approximately 54 km². The working volume of the storage is 450 million m³ of natural gas.

The underground gas storage (UGS) facility has 30 wells, varying in purpose, equipment, and construction time. Out of the total number, 17 wells are used for natural gas injection and

withdrawal, 2 are used for injection of formation water, and 11 wells are used for monitoring the condition of the reservoir. The gas injection/ production line is equipped with gas purification devices (separators, filters), measuring and safety equipment, as well as equipment for gas drying and glycol regeneration. The compressor station consists of two compressor units (gas engine, compressor, and cooler). The compressors are two-stage, with an inlet pressure of 30-35 bar and an outlet pressure of up to 150 bar. The 2.5 MW compressor unit was commissioned in 2006, while the 3.5 MW unit has been in operation since November 2010.

The maximum daily withdrawal capacity from the storage is 5 million m³/day and is determined by the capacity of the gas drying line. The maximal technical injection capacity is 2.7 million m³/day and is determined maximum capacity of the two compressor units in parallel operation. There is no backup compressor capacity in the event of a failure of any of the compressor units.

The operational history of the storage facility from 2012 to 2024 is provided in Table 28.

Table 28: Operational history of the UGSF Banatski Dvor 2012-2024 (million m³) [39]

UGS mill.m3	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Injected	389	342	284	228	197	240	273	315	296	229.7	506	238	248
Withdrawn	161	268	353	113	254	227	270	112	300	509	116	95	286.5
Own consumption	-	7	5	3	3	3	3	4.4	3.5	3.3	7.3	3.7	2.8
Delivered to transmission system	-	266	352	113	254	227	299	112	300	509	116	95	286.5
Cushion gas (at the end of year)	353	530	530	530	530	530	530	530	530	530	530	530	530
Commercial gas (at the end of year)	328	402	333	448	391	404	375	572	401	192	582	724	684.5
Maximal daily injection ²⁵	2.48	2.5	2.7	2.4	2.6	2.4	2.6	2.7	2.7	2.7	2.7	2.5	2.8
Maximal daily withdrawal	3.94	4.2	4.2	2.8	4.95	5.1	5	4.9	4.9	5.0	5.0	4.4	248

The table shows that during 2024; the underground storage facility operated with injection and withdrawal volumes that were at the level of the multi-year average. A slightly higher withdrawal compared to the amount of injected gas meant that there was less gas at the end of 2024 than at the end of 2023, but this is certainly a quantity that is at the upper limit of the storage capacity. For the needs of the Republic of Serbia, storage capacities were also leased in the Republic of Hungary. On this basis, at the end of 2024, 101.8 million m³ of natural gas were available in the UGS.

The Banatski Dvor UGS is connected to the transmission system via the bidirectional gas pipeline Gospodinci - Banatski Dvor. The key data for this gas pipeline are as follows:

- Length: 42.5 km,
- Nominal diameter: DN 500,

²⁵ The technical capacity of the storage is determined at 20°C and a pressure of 1.01325 bar, while the values for the maximum withdrawn and injected quantities are determined at a temperature of 15°C and a pressure of 1.01325 bar, adjusted to a lower calorific value of Q_n = 33,338.35 kJ/m³.

- Maximum operating pressure: $p_{\max}=75$ bar,
- Maximum gas flow:
 - When withdrawing from UGSF Banatski Dvor: $Q = 415,000 \text{ m}^3/\text{h}$ (10 million m^3/day) and
 - When injecting into UGSF Banatski Dvor: $Q = 230,000 \text{ m}^3/\text{h}$ (5.5 million m^3/day).

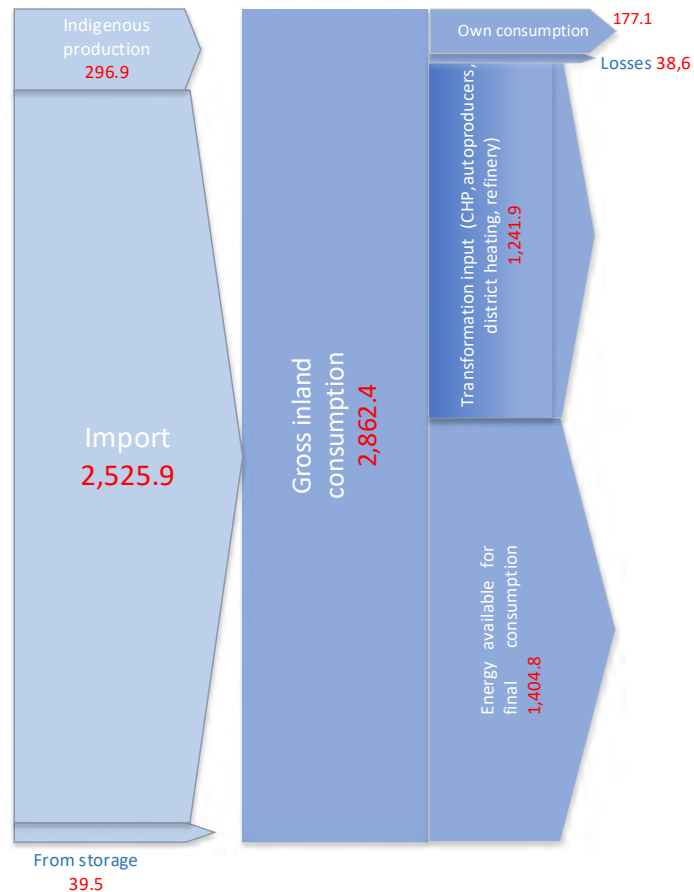
Currently, the technical capacity of the Banatski Dvor UGS is sufficient to provide the required amount of natural gas for the normal supply of consumers in the Republic of Serbia in the event of a 30-day disruption in supply from imports. However, 13.7% of the gas would be lacking to meet all the needs in the case of a disruption lasting 90 days [75]. Naturally, these results should be taken conditionally, as the daily (and hourly) withdrawal capacity from the storage is limited, so in the case of higher consumption, it cannot be fully met (regardless of the available gas in the storage). Also, this analysis is valid only for one winter period. In the event of a permanent disruption in supply from import routes, and without an alternative supply route, the underground storage would not be able to be replenished, which would impact gas supply during the following year.

The plan is to expand the capacity of the underground storage (second phase of development) to 750 million m^3 of natural gas.

4.5. Security of Supply

4.5.1. Planned Production and Consumption of Natural Gas and Method of Ensuring Missing Quantities for the Next Five-Year Period

In 2024, natural gas was the third most used primary energy source, after coal and oil. Its share in total primary energy consumption amounted to 15.73% [33]. Compared to consumption recorded in 2023, total primary supply of natural gas in 2024 was about 1% higher, reaching 2,862.4 million m^3 , which continues the long-term trend of increasing consumption. Final consumption increased by about 5% compared to 2023, while energy consumption for transformation processes slightly decreased relative to 2023. Natural gas consumption for electricity generation decreased by 12.8% compared to 2023, amounting to 411.4 million m^3 . A slight increase in consumption was recorded in industry and district heating plants, while the largest increase was observed in households (10.4%) and in the public and commercial sector (6%). The achieved household natural gas consumption of 403.1 million m^3 represents the highest recorded consumption in households in the period 2010–2024. A detailed overview of the natural gas supply and consumption structure in 2024 is presented in Figure 4, while the natural gas energy balance for the period 2010–2024 is shown in Table 29.

Figure 4: Structure of natural gas supply and consumption in 2024, in millions of Sm³, [33]**Table 29: Energy balance of natural gas for the period 2010–2024, in thousands of Sm³ [31], [32], [33], [76]**

Year:	2010	2015	2019	2020	2021	2022	2023	2024
Production	387,183	572,502	438,615	408,532	362,124	327,891	312,848	296,954
Import	1,967,753	1,740,221	2,262,610	2,135,585	2,365,051	2,969,595	2,645,490	2,525,934
Storage	0	-114,511	-197,967	100,087	280,046	-389,777	-52,154	39,516
Available for consumption	2,327,593	2,198,212	2,503,258	2,644,204	3,007,221	2,907,709	2,906,184	2,862,404
Transformation input	805,480	885,174	953,057	1,006,607	1,240,228	1,255,001	1,314,005	1,241,895
TPP-DH	95,173	20,064	149,637	93,990	272,322	395,738	469,811	411,418
Industrial power plants	203,910	164,998	166,099	193,940	197,585	173,749	177,288	161,180
District heating plants	506,397	563,451	497,046	570,589	598,937	498,184	515,812	519,740
Refineries	-	136,661	140,275	148,088	171,384	187,330	151,093	149,557
Own consumption in the energy sector	60,274	209,707	210,465	226,955	240,988	216,273	189,330	177,101
Losses	20,943	11,433	20,570	16,064	21,113	13,498	10,347	38,585
Final	1,440,896	1,091,898	1,319,166	1,394,578	1,504,875	1,422,937	1,392,502	1,404,823

Year:	2010	2015	2019	2020	2021	2022	2023	2024
consumption								
Non-Energy consumption	271,435	157,658	169,746	188,194	133,454	-	-	-
Energy consumption	1,169,461	934,240	1,149,420	1,206,384	1,371,421	1,422,937	1,392,502	1,404,823
<i>Industry</i>	759,313	543,083	622,175	614,720	595,216	625,867	607,006	621,859
<i>Transport</i>	12,623	11,204	13,532	27,569	29,665	30,223	29,577	38,005
<i>Households</i>	270,412	189,822	255,165	302,982	371,659	377,293	369,223	403,134
<i>Agriculture</i>	18,330	20,713	24,488	20,862	25,757	25,393	24,85	19,098
<i>Public and commercial sector</i>	108,783	169,418	234,060	240,521	349,124	364,161	361,85	322,727

Natural gas production in the Republic of Serbia is carried out predominantly in the territory of Vojvodina. The sole producer of natural gas is NIS JRC Novi Sad, which is responsible for exploration, production, processing, distribution, and trade of oil and oil derivatives, as well as for natural gas exploration and production.

Total natural gas production in 2024 amounted to 296.9 million Sm³, which is about 5.7% less than in 2023. This decrease in production represents the expected continuation of a long-term trend. In the coming period, a further decline in domestic production is anticipated, as the deposits are characterized by a high depletion rate, the volume of conventional resources and recoverable reserves is small, while the level of exploration is relatively high. Projections of natural gas production in the Republic of Serbia up to 2050 are presented in Table 30.

Table 30: Projections of natural gas production in the Republic of Serbia, in thousands of m³ [2]

Year	2025	2030	2035	2040	2045	2050
Production	372.0	473.5	388.7	312.8	236.3	171.6

The NIS JSC also includes the Oil and Gas Preparation and Transport Plant in Elemir, whose main activity is the preparation of domestic natural gas for transportation and the production of components for liquefied petroleum gas and natural gasoline. After preparation, which ensures the required quality, the produced natural gas is delivered at 9 points into the transmission system (97.7% of the produced volume), while the remaining portion is delivered at 4 points into the distribution system [39]. The quantity of gas delivered into the transmission and distribution systems in 2024 was 176.6 million m³, which is 11.2% less than in 2023 [39]. After significant growth in 2011 and 2012, natural gas production has been continuously declining since 2013. Domestic production achieved in 2024 was sufficient to meet 10.4% of total demand.

Most natural gas was supplied through imports from the Russian Federation under a long-term contract. For customers in Serbia, natural gas from Gazprom is procured by the company Yugorosgaz a.d. The shareholders of this company are Gazprom with 50%, JP Srbijagas with 25%, and Central ME Energy and Gas, Vienna, with 25%. Imports of natural gas from the Russian Federation under the long-term contract amounted to 2,103 million m³ in 2024 and were delivered from the direction of Bulgaria via the GASTRANS LLC transmission system. In addition to imports under the long-term and other contracts for natural gas from the Russian Federation, PE Srbijagas purchased natural gas from one additional supplier in 2024, and these volumes were taken over from the Bulgarian transmission system [39].

Projections of future natural gas consumption are presented in the Energy Development Strategy of the Republic of Serbia until 2040 with projections until 2050 [2] and in the Integrated National Energy and Climate Plan of the Republic of Serbia for the period until 2030 with a vision until 2050 [60]. Two scenarios of natural gas consumption were considered: the Reference Scenario (BAU), which represents the continuation of existing practices, and Scenario S, the desired development scenario, which assumes a more intensive implementation of energy efficiency measures and the use of renewable energy sources. Both scenarios foresee an increase in gas consumption - both in the transformation sector (new cogeneration plants and increased use of natural gas in district heating plants and heating plants) and in the final energy consumption sector (Table 31). The greatest difference between the two scenarios is in final energy consumption, which is significantly lower in Scenario S due to the intensive introduction of RES and the implementation of energy efficiency measures, especially in the building sector, as well as the greater use of electricity and hydrogen in industry. Given the increase in consumption in the period 2021–2024, it can be concluded that gas consumption is following a trend that aligns with the projections of both scenarios until 2030.

Table 31: Projections of natural gas consumption, in thousand Sm³ [2]

	Scenario S				Reference scenario			
	2030	2035	2040	2050	2030	2035	2040	2050
Transformation input	1,468.6	1,245.3	1,463.6	1,520.0	1,330.8	1,373.7	1,433.7	1,603.8
Final Energy Consumption	1,239.2	1,345.2	1,358.2	1,462.7	1,482.6	1,840.5	2,092.0	2,650.0
Non-Energy Consumption	849.8	342.8	371.4	400.0	316.5	352.1	386.6	435.4
Total Primay Energy Supply	3,619.5	3,133.5	3,382.8	3,560.3	3,512.0	3,967.2	4,185.7	4,811.7

In 2023, Transportgas Serbia carried out an assessment of the total natural gas volumes transported through the pipeline system from 2022 to 2031, as part of the development of the Gas Transmission System Development Plan for 2022-2031, including an investment plan for 2022-2024 [72]. In this document, the estimates of transported volumes for the needs of DSO and end consumers connected to the transmission system were based on historical data for the period 2017-2021, as well as a survey of DSO and end consumers connected to the transmission system and the projections from the Energy sector development strategy of the Republic of Serbia for the period 2015-2025 with projections until 2030²⁶. The data in Table 32 refer to the period from 2024 onward and are aligned with the gas transmission projections from the Yugorosgaz-Transport System Development Plan [77].

Table 32: Estimate of total transported volumes of natural gas through the pipeline system for the period 2024–2031, in millions of Sm³ [72], [77]

Year	2024	2025	2026	2027	2028	2029	2030	2031
Total transmission including cross border transmission	4,151.5	4,424.6	4,755.8	5,577	6,030.5	6,385.3	6,821.4	7,634.4
Transfer station PPS Bačko Novo Selo	-	-	-	600	800	900	1.000	1.500
Interconnection Serbia - Bosnia and Herzegovina	200	300	330	400	500	600	900	1.200

²⁶ This document is no longer valid.

Year	2024	2025	2026	2027	2028	2029	2030	2031
PPS Pojate	78.2	81.7	85.4	87.5	90.1	92.8	95.6	98.4
PPS Zvornik	290	294	296	298	300	304	308	310
Distributors	1,950	2,008	2,068	2,130	2,194	2,259	2,291	2,297
End consumers connected to the transmission system	1,140	1,174	1,209	1,245	1,282	1,320	1,325	1,333
UGSF Banatski Dvor	318	400	600	650	700	750	750	750
For transportation to natural gas producers	162	152	152	151.4	148	142	135	129
Own consumption	2.5	3	3	3	3	3	3	3
Losses in the transmission system	10.8	11.9	12.4	12.1	13.4	14.5	13.8	14

The natural gas energy sector in Europe has been characterized by dramatic changes in recent years. The war conflict in Ukraine since February 2022, followed by the suspension of the “Nord Stream 2” project, the shutdown of the “Nord Stream 1”, restrictions on volumes, and operational issues with pipelines through Ukraine and the Yamal gas pipeline, have entirely called into question the supply of natural gas to a large part of the European market from Russia. Gas supply to the European market from the Russian Federation via the so-called Southern Gas Corridor (through Turkey, Bulgaria, and Serbia to Hungary) is currently proceeding without disruption, but it cannot be guaranteed that this will remain the case in the future. On the other hand, the policy of the European Union after following the outbreak of the conflict in Ukraine has moved toward an intensive abandonment of natural gas as an energy source, particularly gas originating from Russia. Undoubtedly, these developments will significantly influence the future natural gas consumption in the Republic of Serbia.

Assuming that there is no physical disruption (for any reason) in the supply of natural gas from Bulgaria, it can generally be stated that natural gas consumption in the coming period will depend on the price parity between natural gas and other energy sources, as well as on developments in the electricity system of the Republic of Serbia and the need to compensate for electricity production from coal with natural gas. Additionally, natural gas could play a significant role in balancing renewable energy sources. Events involving large industrial systems, which are major consumers of natural gas (e.g., Azotara Pančevo, MSK Kikinda), could have a significant impact on natural gas consumption. Other factors include the implementation of projects such as the supply of Belgrade with thermal energy via a heat pipeline from the TPP Nikola Tesla A, the implementation of energy efficiency measures in industry and general consumption, etc.

What is certain is that, unless there is a drastic change in the structure and intensity of natural gas consumption, given the expected decline in domestic natural gas production, further increases in import dependence can be expected.

From the engineering point of view, additional missing quantities of natural gas in the future could be acquired through imports from the Russian Federation via Bulgaria, via the constructed interconnector from the border of Bulgaria and Serbia to the border of Hungary and Serbia (the gas pipeline on which Gastrans LLC carries out gas transmission and transmission system operation activities).

Besides, via an interconnector with Bulgaria (gas pipeline Niš-Dimitrovgrad), there is also the possibility to supply from Azerbaijan, LNG terminals in Greece, the Russian Federation, etc. To

fully realize the technical capacity of this supply direction, it is necessary to construct the Trupale regulating station and reconstruct the Pojate metering and regulating station. It is also necessary to sign an operating agreement between the TSOs Transportgas Serbia LLC and Yugorosgaz-Transport LLC [104].

Alternative options include supply from the Horgoš direction, from European LNG terminals (by leasing appropriate transmission capacities), or purchasing available natural gas on the European market.

4.5.2. Measures for Covering Peak Demand and Actions Taken in Case One or More Suppliers Fail to Provide Sufficient Quantities of Natural Gas

The adopted Transmission Network Codes [68]-[71] provide detailed regulations on situations related to capacity allocation, congestion management, and handling disruptions in the transmission system.

In the case of the peak demand, when the total requested capacities for entry/exit during a specific time period exceed the available capacities for allocation, the transmission system operator allocates capacity to each applicant proportionally to their requested capacity. Additionally, the transmission system operator has the right to restrict or interrupt interruptible capacity at entry/exit points if, upon receiving nominations for the next gas day, it determines that the nominated quantities of natural gas for the following day exceed the technical capacity for a specific entry/exit point. The transmission system operator limits interruptible capacity to minimize the number of interruptions, taking into account the volume of the missing capacity, the frequency and duration of interruptions in the previous period, and the overall integrity of the transmission system.

The situation in which one or more suppliers fail to provide sufficient quantities of natural gas is treated under the Transmission Network Code as a Market Disruption, i.e. as a situation in which the security of supply to end customers is threatened due to a general shortage of natural gas or other extraordinary circumstances which, due to the insufficient supply on the natural gas market, lead to a drop in pressure in the transmission system and jeopardize its operation. The transmission system operator, based on the gas consumption restriction plan, implements measures to restrict the supply of natural gas in case of a general shortage, following a decision by the Government to implement such measures. If a Customer²⁷ refuses to implement the gas supply restriction plan, the transmission system operator shall limit or interrupt the supply of natural gas to the Customer. The transmission system operator is obligated to timely inform Customers and relevant authorities about planned and anticipated disruptions and interruptions in the natural gas supply except in cases where immediate action is necessary to ensure the safe and uninterrupted operation of part or the entirety of the transmission system.

Detailed instructions for handling these and other situations that influence or can influence the normal functioning of the natural gas market in the Republic of Serbia and/or jeopardize supply security are provided in the Emergency Plan for Ensuring the Security of Natural Gas Supply [17].

Experiences from previous crises (e.g., the interruption of gas supply in 2009, the sanctions of the international community in the 1990s) indicate that in such situations, it is necessary to require fuel switches for end-users who have such options, considering the environmental effects caused by gas supply interruption of industrial users, and necessary coordination with other energy systems (primarily electric power system).

²⁷An energy entity, a natural gas producer, or an end customer who has concluded a contract on natural gas transmission.

4.5.3. *Quality and Maintenance Level of Energy Facilities*

The maintenance of the transmission system and other energy infrastructure under the jurisdiction of Transportgas Serbia is carried out in accordance with the Rulebook on Technical Conditions for Undisturbed and Safe Gas Transport via Gas Pipelines of Pressure Exceeding 16 bar [78] and the Transmission Network Code for natural gas [68], approved by the AERS Council, as well as the Guidelines for the Maintenance of Gas Pipeline Facilities of Transportgas Serbia. The rules define the conditions required to ensure proper maintenance during the design and construction phases of gas stations, as well as the complete procedure for adopting and implementing maintenance programs for the upcoming gas year. The maintenance program specifies the entries/exits that will be affected by the planned maintenance, the time period in which the capacities at entries/exits will be reduced due to maintenance, the level of reduction in available capacity and a description of the works to be carried out that affect the reduction of transmission capacity, and includes works on connection to the system, testing, repair, replacement, re-commissioning, development and expansion of the system, as well as preparatory and final works required for maintenance. The maintenance program for the transmission system of “Transportgas Srbija” for 2024²⁸ did not include works on technical maintenance that could limit the transmission of natural gas through the system. The works included the replacement of sectional valves with actuators.

From the security of supply point of view, proper maintenance of the transmission system, which was successively built, is of key importance. More than half of this network is over 40 years old, and the age of some sections is over 50 years (Table 33). Based on the work carried out so far on the repair of damage to gas pipelines, it was established that external damage was mainly caused by corrosion on the pipe (due to damage to the insulation on the pipe, poor installation of insulation on the pipe, etc.), while internal damage is characteristic of gas pipelines transporting domestic gas. Repairs have been carried out on most of the more important sections [72].

Transportgas Serbia plans to test the gas pipeline with the so-called “Intelligent” or “Smart” Pipeline Pigging Services over a length of 1,200 km. The obtained test results will accurately define the percentage and location of damage to the gas pipeline and will enable quick and efficient repair of damage by reconstructing the affected sections. This activity also includes determining the condition of the existing high-pressure main gas pipelines from Horgoš to Niš (approximately 500 km long), which should be the basis for a techno-economic assessment of the feasibility of upgrading and modernizing this section, or the possible construction of a new parallel gas pipeline [2].

In addition to the pipeline itself, other elements of the transport system under the jurisdiction of Transportgas Srbija also require modernization. It is necessary to replace valves at block stations, cleaning boxes, connection valves at branches and inlet valves at the facilities of the main metering and regulation stations. In addition, the main metering and regulation stations themselves require detailed reconstruction (replacement of worn-out regulation, safety, shut-off valves and measuring equipment, improvement of measuring systems, improvement of gas filtration, etc.).

²⁸ <https://www.transportgas-srbija.rs/za-korisnike/planirana-odrzavanja>

Table 33: Age of the Transportgas Srbija LCC transmission system (the situation in 2022) [72]

Age	Over 50 years	40-50	30-40	20-30	10-20	1-10	Total
Length [km]	286.5	1,145.1	306.7	214.2	287.6	260.9	2,501.1
Share [%]	11.45	45.78	12.26	8.57	11.50	10.43	100

The transmission system and other energy infrastructure under the jurisdiction of Yugoenergija-Transport are maintained according to the Guidelines for Gas Installations Maintenance and the adopted maintenance program for the upcoming gas year, in line with the Transmission Network Code [70], approved by the AERS Council. The maintenance program includes monthly, quarterly, semi-annual, and annual inspections of specific installations, followed by appropriate interventions as needed.

The maintenance of the gas pipeline under the jurisdiction of Gastrans LLC is conducted according to the Natural Gas Transmission Network Code [71] and the Technical Maintenance Program for the period 2021–2023 for the transmission gas pipeline (interconnector) “Border of Bulgaria - Border of Hungary”. Gastrans LLC has engaged a specialized company to perform services and works related to the technical maintenance and overhaul of facilities within the transmission gas pipeline (interconnector) “Border Bulgaria-Border Hungary” (the pipeline’s linear section, main and backup dispatching centers, and the Velia Plana compressor station). The specialized company conducts planned regular technical maintenance and overhauls and, if necessary, unplanned (emergency and non-emergency) maintenance and overhauls, providing monthly reports on these activities.

The maintenance of distribution systems is carried out in accordance with the Rulebook on Technical Conditions for Undisturbed and Safe Gas Transport via Gas Pipelines of Pressure exceeding 16 bar [79] and the Distribution Network Code, which each distribution system operator submits to AERS for approval²⁹. According to the code, each distribution system operator adopts a Maintenance Program for the upcoming gas year no later than May 1, taking into account, to the extent possible, proposals from users and operators of interconnected distribution systems. The maintenance program includes works that impact the reduction of distribution capacity, such as connection works to the distribution system, testing, repairs, replacements, recommissioning, system development and expansion, as well as preparatory and concluding works necessary for maintenance.

4.5.4. Incentive Measures for New Investment in Exploration, Production, Transmission, and Storage of Natural Gas

In the Republic of Serbia, there are currently no specific incentive measures for new investments in the exploration, production, transmission, and storage of natural gas.

4.5.5. Plans for the Construction of Energy Facilities to Ensure the Security of Natural Gas Supply

The security of natural gas supply refers to ensuring and timely delivery of the required quantities of natural gas to consumers. Security of supply is improved through the diversification of supply sources and routes, as well as the construction of gas storage facilities. The (N-1) indicator is used as a measure to assess the supply security of the system. This indicator reflects

²⁹ <https://www.aers.rs/pravila-o-radu-distributivnog-sistema-1>

the daily operational flexibility of the gas pipeline system and its ability to meet consumption demands under extreme conditions. It is calculated as follows:

$$(N - 1) = \frac{E_{pm} + P_m + S_m - I_m}{D_{max}} \times 100 [\%]$$

where:

- D_{max} - is the total daily gas demand on the day of the maximum gas demand, which statistically occurs once every 20 years [Sm^3/day],
- E_{pm} - is the sum of the technical capacities of all entry points from other transmission systems [Sm^3/day],
- P_m - is the technical production capacity (total) [Sm^3/day],
- S_m - is the maximum technical capacity of the entry from the underground natural gas storage [Sm^3/day],
- I_m - is the technical capacity of the largest entry into the transport system [Sm^3/day].

A gas pipeline system is considered to be satisfactory in terms of infrastructure and security of supply if the entry capacities into the transmission system are such that they meet the total natural gas requirements even in the case of an interruption of the single largest infrastructure entry into the transmission system, during a day with exceptionally high natural gas demand, statistically occurring once every 20 years. This corresponds to (N-1) indicator values greater than 100%.

For the gas pipeline system of the Republic of Serbia, the values of input parameters required for calculating the (N-1) indicator in 2024, are as follows:

$E_{pm} = 55.05$ million Sm^3/day (technical capacity of the Horgoš entry point - 13.85 million Sm^3/day , and two entry points from Bulgaria: near Zaječar – 35.7 million Sm^3/day and near Dimitrovgrad – 5.5 million Sm^3/day) [72],

$P_m = 1.573$ million Sm^3/day [72],

$S_m = 5.0$ million Sm^3/day (UGSF Banatski Dvor),

$I_m = 35.7$ million Sm^3/day (technical capacity of the entry point from Bulgaria)³⁰,

$D_{max} = 17.744$ million Sm^3/day (achieved on January 19th, 2017) [72].

The calculated value of the (N-1) indicator for 2023 is $(N-1) = 146\%$, and the infrastructure standard is met.

Key planned infrastructure energy facilities (interconnections, storage facilities, transmission system) whose construction significantly contributes to ensuring and enhancing supply security are [72], [80], [103]:

Expansion of the Underground Gas Storage Facility Banatski Dvor project

This project envisages the expansion of the underground natural gas storage facility in Banatski Dvor from its current capacity to a capacity of 750 million m^3 , with a maximum technical withdrawal capacity of 10 million m^3/day (415,000 m^3/h) and a maximum technical injection capacity of 5.8 million m^3/day (242,000 m^3/h). The complete design for the construction of the UGS Banatski Dvor was prepared as a supplementary mining project. A construction permit has been issued. Additional wells are being drilled. The purchase of compressors and other equipment and the commissioning of the expanded storage facility are expected in 2026.

Gas interconnection Serbia - Romania, the Mokrin – Arad Gas Pipeline (border with Romania) project

Transmission systems are connected by DN600 pipelines with a nominal pressure of 63 bar. The length of the gas pipeline is about 85 km in Romania and 13.1 km in Serbia. Expected annual capacity of this pipeline is in the range of 1,600 to 2,500 million Sm^3 .

³⁰ <https://gastrans.rs/transparentnost/kratak-opis-gasovoda-i-tacaka-interkonekcije-sa-nazivima-oso/>

The additional entry point of natural gas into the network increases supply security, enhances the reliability of system operation (by relieving the Horgoš-Batajnica main route), and opens the possibility for acquiring Romanian natural gas or gas from the BRUA gas pipeline.

Additionally, on the territory of Serbia, it is necessary to build a section with a nominal pressure of 63 bar, 3.3 km long, to the point of connection with the future gas pipeline for the Banatski Dvor and Belgrade gas pipelines (Nakovo junction point). At the Nakovo junction point, it is planned to build the control MS45, the beginning of the section for the Banatski Dvor gas pipeline, as well as relocate the beginning of the MG-03 gas pipeline, with a cleaning station and MRS46. The section from the Nakovo junction point to the connection with the current MG-03 gas pipeline is 10.2 km long, with a diameter of DN600 and a nominal pressure of 50 bar.

The completion of the construction of this interconnection is planned for 2027.

Gas Interconnection Project Republic of Serbia - Republic of North Macedonia (MG 14 GRČ Orljane - Leskovac – Vranje - Border with the Republic of North Macedonia - Section Vranje-border with Macedonia)

This project would connect the gas pipeline systems of the Republic of Serbia and the Republic of North Macedonia, which would be implemented on the Serbian side by building a DN500 gas pipeline from Vranje to the border with the Republic of North Macedonia, with a length of approximately 47 km. In order to ensure the conditions for the construction of the Serbia-North Macedonia interconnector in terms of the required capacity, it is necessary to work synchronously on the construction of the Orljane-Leskovac-Vranje gas transmission pipeline. In accordance with the new strategy for the development of the European gas pipeline network, the pipeline should also enable the transport of hydrogen (“Hydrogen ready”). The planned technical capacity of the gas pipeline from the direction of Macedonia is 1.5 billion m³/year. Through the project implementation, the security of supply would be increased, and alternative supply directions would be enabled. The construction of this pipeline would contribute to the diversification of gas supply routes and would enable connection to the TAP³¹ and TANAP³² gas pipelines through other national gas systems.

The completion of the construction of this interconnection is planned for 2028.

Gas Interconnection Republic of Serbia - Republic of Croatia

The national gas transmission systems of Serbia and Croatia are not interconnected. This fact leads to the impossibility of achieving the strategic goals of the European Union, which include the development of a gas market that will be operationally and fully integrated to ensure the security of gas supply. It is planned to connect the gas transmission systems of Serbia and Croatia with a gas pipeline with a diameter of DN600, with a nominal pressure of 74 bar. The length of the territory of Serbia is 95 km, from the Gospodjinci junction point to the border crossing point near Bačko Novo Selo. The projected completion year of this interconnection is 2031.

Gas interconnection Serbia – Bosnia and Herzegovina

The national gas transmission systems of Serbia and Bosnia and Herzegovina are connected by a DN400 gas pipeline with a nominal pressure of 50 bar. This pipeline also supplies western Serbia (Šabac, Loznica) and has a limited capacity.

³¹ Trans Adriatic Pipeline (TAP), 878 km long, connects Turkey, Greece, Albania and Italy, is in operation since 2020.

³² The TANAP gas pipeline (Trans-Anatolian Natural Gas Pipeline) spans the territory of Turkey and connects the TAP gas pipeline with the so-called Shah Deniz pipeline. It enables the supply of natural gas from Azerbaijan.

Therefore, the construction of a DN500 gas transmission pipeline with a nominal pressure of 50 bar, a length of 90 km on the territory of Serbia, with a 12 km branch to Loznica, is planned. The pipeline route is from the point of connection to the MG-04/2 gas pipeline near Indija to the border crossing point near Novo Selo. A metering station is planned at the end of the pipeline on the territory of the Republic of Serbia. The projected completion year of this interconnection is 2030.

Transmission gas pipeline Mokrin-UGS Banatski Dvor-UGS Itebej-Pančevo- Belgrade south

To create a backup supply route and create the possibility of directly connecting the Banatski Dvor gas storage facility with the largest consumers in Pančevo and Belgrade, as well as to enable the full use of the interconnection with Romania, it is necessary to build a gas pipeline from the future Nakovo hub on the gas pipeline to Romania via the Banatski Dvor and Pančevo underground storage facilities to a location south of Belgrade, in the Zuca region. It is necessary to build a transport gas pipeline with a diameter of DN600, a design pressure of 63 bar, and a length of 150 km. The construction of this gas pipeline would create conditions for connecting possible future gas storage facilities in Itebej, Tilva and Čestereg to the transport system. The projected completion year of this gas pipeline is 2029.

4.5.6. Preventive Action Plan and Emergency Plan for Ensuring the Security of Natural Gas Supply

The Government adopted the Preventive Action Plan for Ensuring the Security of Natural Gas Supply [16] and the Emergency Plan for Safeguarding the Security of Natural Gas Supply [17] in 2018.

The Preventive Action Plan for Safeguarding the Security of Natural Gas Supply includes risk assessment in terms of achieving security of supply, as well as measures to mitigate the identified risks that refer to the necessary transmission capacity to meet the total demand for natural gas and to provide supplies to certain groups of final customers of natural gas. The Preventive Action Plan was prepared following Article 315 of the Law on Energy [1] and in accordance with Article 5 of Regulation (EU) No. 994/2010 of the European Parliament and the Council of 20th October 2010 concerning measures to safeguard the security of gas supply and repealing the Council Directive 2004/67/EC³³ [82]. The Preventive Action Plan included risk assessment prescribed by Article 9 of Regulation (EU) No. 994/2010, preventive measures for eliminating defined risks, and the responsibilities of the Competent Authorities and energy entities concerning safeguarding the security of natural gas supply.

For safeguarding secure supply, the main identified risks are related to the natural gas supply disruption scenario at the Horgoš entrance and supply disruption from the Banatski Dvor underground storage.

To mitigate identified risks and ensure a safe gas supply, the following measures and activities are determined by the Preventive Action Plan:

- establishing interconnections with the countries in the region, construction of a new direction of natural gas supply, expansion and construction of new storage capacities, as well as realization of other projects that influence the reduction of consumption of natural gas in accordance with the Energy Strategy [2] and the Regulation on the establishment

³³ This Directive is no longer valid and has been replaced by Directive (EU) No. 1938/2017 of the European Parliament and the Council [100], and the Energy Community transposed this regulation with the Decisions of the Ministerial Council of the Energy Community 2021/15/MS-EZ and 2022/01/MC-EZ [101], [102]. Therefore, new Preventive Action Plan and Emergency Plan are adopted in 2025 to ensure the security of the natural gas supply.

of the Program for the implementation of the Energy Development Strategy of the Republic of Serbia by 2025 with projections until 2030 for the period from 2017 to 2023 [3];

- establishment of operational reserves of energy products in accordance with Article 345 of the Law [1];
- ensuring required natural gas reserves in accordance with Article 346 of the Law [1];
- establishing regional cooperation in crises.

The Emergency Plan for Safeguarding of Security of Natural Gas Supply to ensure the security of natural gas supply which identifies measures and energy entities that will be in charge of ensuring the security of the transmission system operation and the security of supply of certain groups of end customers, the volumes and capacity of natural gas in case of a general shortage of natural gas.

The Emergency Plan is prepared in accordance with Article 315 of the Energy Law and in accordance with Article 10 of Regulation (EU) No. 994/2010 and it is based on three defined levels of crisis that occur due to the natural gas shortage:

- Level 1 - Early Warning: when there is concrete, serious and reliable information that an event may occur, which is likely to result in significant deterioration of the supply situation and is likely to lead to Level 2 or Level 3 being triggered.
- Level 2 - Alert Level: when a supply disruption or exceptionally high gas demand occurs, which results in significant deterioration of the supply situation, but the market is still able to manage that disruption or demand without the need to resort to non-market measures.
- Level 3 - Emergency Level: a situation of exceptionally high gas demand, significant supply disruption or other significant deterioration of supply and if all relevant market measures have been implemented but the supply of gas is insufficient to meet the remaining gas demand so that non-market measures have to be additionally introduced with a view, in particular, to safeguard supplies of gas to protected customers.

The Emergency Action Plan has defined the roles and responsibilities of energy entities in the natural gas sector, industrial consumers, as well as their interaction with relevant authorities. Also, the competence of responsible institutions (the Government, the Ministry in charge for the energy issues, the Special Working Group established by the Ministry, Directorate for Commodity Reserves of the Republic of Serbia) and companies (Transportgas Srbija, natural gas suppliers, Public Enterprise Elektroprivreda Srbije, JSC Elektromreža Srbije, major natural gas customers, natural gas transmission, i.e. distribution system operators, natural gas storage facility operator and energy entities engaged in the production of electricity and/or combined production of power and/or heat) have been determined. This plan defined detailed procedures that should be carried out for each level of crises, including schemes of information flows. Mechanisms for cooperation with other countries for each level of crises are determined, obligations for gas companies related to reporting for each level of crises and the list of predefined activities for securing gas supply in the event of crises are defined.

5. CRUDE OIL AND PETROLEUM PRODUCTS

Pursuant to the Energy Law [1] licensed energy activities in the petroleum and biofuel sector are:

- Production of petroleum products,
- Transportation of crude oil via oil pipelines,
- Transportation of petroleum products via product pipelines,
- Trade in crude oil, petroleum products, biofuels, bio-liquids, and compressed natural gas, liquefied natural gas, and hydrogen,
- Trade in motor and other fuels at fuel supply stations,
- Storage of crude oil, petroleum products, biofuels,
- Blending of biofuels with petroleum-based fuels,
- Blending of bio-liquids with petroleum-based fuels,
- Trade in fuels for vessels,
- Trade in fuels outside stations for the supply of means of transport,
- Filling of containers with liquefied petroleum gas, compressed and liquefied natural gas.

Energy activities can be performed by a public enterprise, a business entity, i.e. any legal entity or entrepreneur who holds a license for conducting energy activities.

Transportation of crude oil via oil pipelines and the transportation of petroleum products via product pipelines are energy activities which are defined as activities of general interest by the Energy Law. They are carried out in accordance with this law and the law governing the status of public enterprises. Other listed energy activities are conducted in accordance with market principles.

Pursuant to the Energy Law, no license is required for energy activities related to the transportation of crude oil, petroleum products, and biofuels, as well as other forms of transportation; however, this activity is crucial for the topic of supply security and will be addressed in the text below.

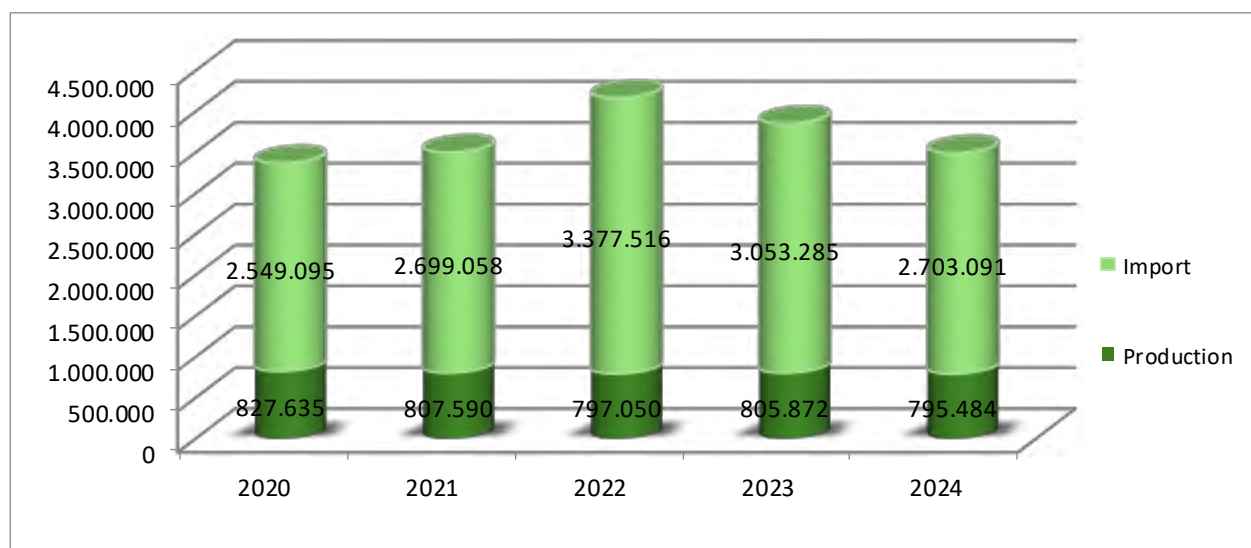
5.1. Production, Import, Export and Consumption of Crude Oil and Petroleum Products

5.1.1. Crude Oil

The quantities of crude oil that are required for refining purposes are secured through imports (over 70%), with a slightly smaller share coming from production at 64 domestic oil/gas fields and around 866 oil production wells. The largest number of oil fields are located in the Vojvodina region, in the Bačka area (Velebit, Turija), Northern Banat (Kikinda), Central Banat (Zrenjanin), and Southern Banat (Jermenovci, Janošik), as well as from the oil fields in the Stig region around Požarevac (Sirakovo, Bradarac, Maljurevac) [81].

Crude oil production and refining in Serbia is carried out solely by NIS JSC Novi Sad, which in recent years has also been the only entity in the Republic of Serbia responsible for imports.

Additionally, NIS A.D. Novi Sad holds a concession for a block in Angola, where approximately 4.2 million tons of crude oil have been produced since 1985. The oil produced in Angola (around 30,000 tons) does not enter the Energy Balance [32].

Figure 5: Comparative overview of crude oil production and imports (in tons) over the last five years [31]

Crude oil (in tons)	2020	2021	2022	2023	2024
Production	827,635	807,590	797,050	805,872	795,484
Import	2,549,095	2,699,058	3,377,516	3,053,285	2,703,091
Total	3,376,730	3,506,648	4,174,566	3,859,157	3,497,575

Domestic crude oil production (Figure 5) saw a decline in 2024, while the missing quantities were secured through imports, which amounted to 2,703,091 tons in 2024 and 3,053,285 tons in 2023. The energy balance for 2025 foresees a production of 820,000 tons [31].

Imported crude oil is mostly transported via oil pipeline, with the transportation and operation of the pipeline system carried out by Transnafta JSC. The pipeline enters the Republic of Serbia near Bačko Novo Selo from Croatia, as a continuation of the Adriatic Oil Pipeline, which starts in Omišalj (Krk Island, Republic of Croatia), continues to Novi Sad, and then to Pančevo. Other forms of crude oil transportation, such as by rail or river, are not prevalent. In previous years, around 200,000 tons were transported by rail tankers from Romania.

Crude oil produced from domestic fields is transported from gathering and dispatch stations via oil pipelines to the Novi Sad Oil Refinery and then further refined at the Pančevo Oil Refinery. A certain percentage (<10%) is transported by tank trucks to the Pančevo Refinery.

5.1.2. Petroleum Products

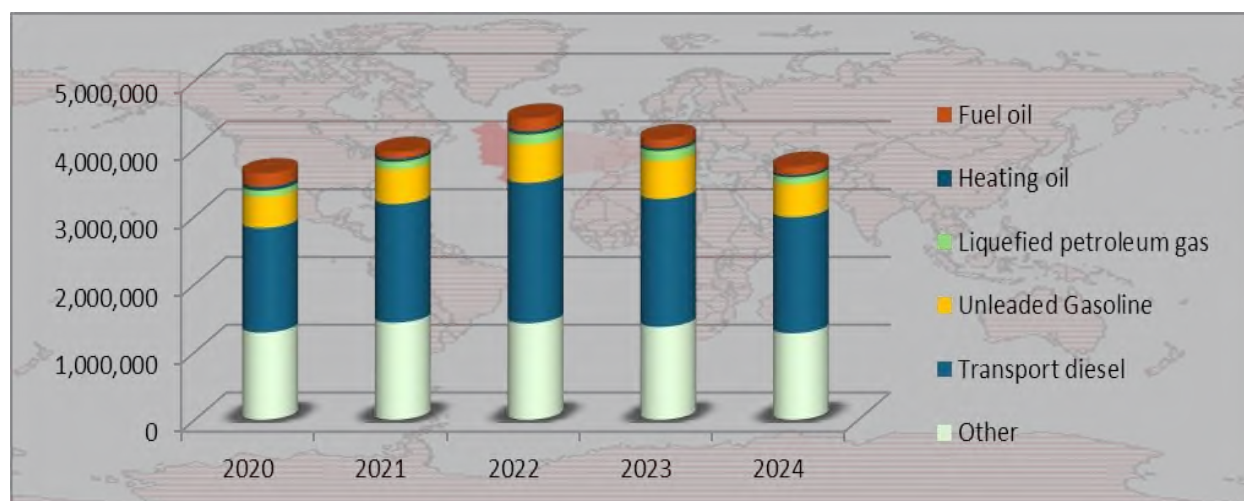
The supply of petroleum products is provided through imports and domestic refining of crude oil, which is refined at the Pančevo Oil Refinery. The Pančevo Oil Refinery, as part of NIS JSC Novi Sad, is the sole facility responsible for crude oil refining, while natural gas products and natural gas condensate are produced at the Elemir Gas Refinery and at the facilities of the former Hipol JSC, now Standard Gas LLC Novi Sad” (Standard Gas) [39].

The quantities of produced petroleum products in 2024 (Figure 6) amounted to 3,733,335 tons, which represents an decrease of 10.81% compared to 2023. In 2024, the Pančevo Oil Refinery

decreased production of liquefied petroleum gas by 26.03% and heating oil by 5.78% compared to 2023. In 2024, the production of petroleum products was about 9.75% lower [31].

The petroleum products produced at the Pančevo Oil Refinery are transported by rail tank cars, river vessels (river tankers, barges, self-propelled barges) and tank trucks. Transportation of petroleum products via product pipelines is not carried out, as there is no established product pipeline network.

Figure 6: Production of petroleum products (in tons) – comparative overview for the period 2020-2024 [31]

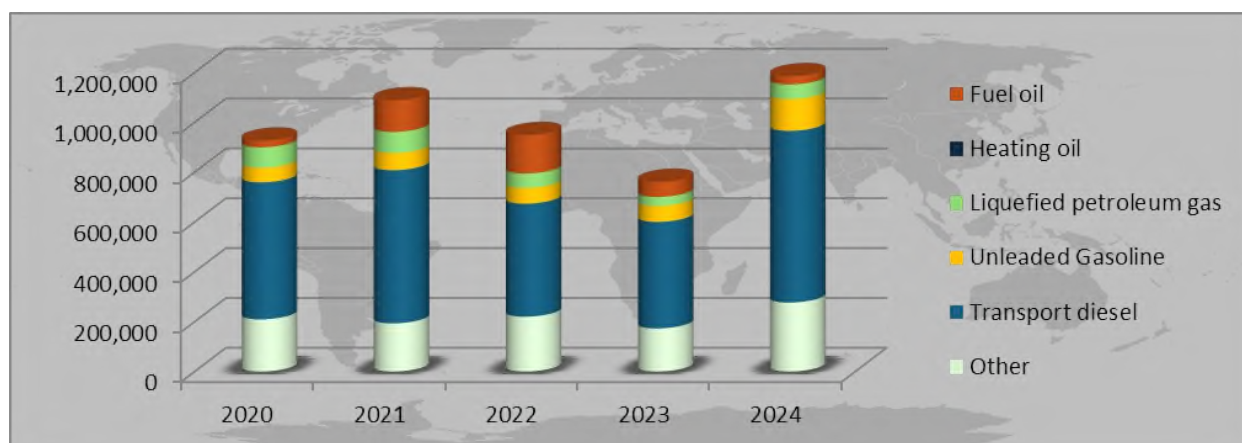


Production of petroleum products (in tons)	2020	2021	2022	2023	2024
Transport Diesel	1,543,221	1,751,629	2,070,634	1,888,221	1,714,636
Unleaded Gasoline	451,377	504,957	563,125	559,018	475,825
Liquide petroleum gas	99,610	116,729	150,797	149,679	110,724
Heating oil	50,736	42,958	45,767	39,036	32,731
Fuel oil	202,725	99,500	188,081	129,572	122,088
Other products	1,288,045	1,433,797	1,425,151	1,371,294	1,277,331
Total	3,635,714	3,949,570	4,443,555	4,136,820	3,733,335

In 2024, a incline in imports was recorded (Figure 7) and the imported quantity of petroleum products was 1,185,069 tons. Notably, in 2024, there was a significant import was made as a result of the long-term capital repairs at the Pančevo Refinery.

Motor fuels in 2024 saw a increase in imports by about 65.84%. Analysing the structure of imported petroleum products, it appears that the largest import was of Eurodiesel, imported primarily from Hungary, Bulgaria and Romania. Gasoline was imported from Hungary, Austria and Romania [31].

The imported quantities are transported by river vessels (barges, river tankers) via the Danube and Sava rivers, by rail tank cars, and a certain quantity by tank trucks.

Figure 7: Import of petroleum products – comparative overview for the period 2020-2024 [31]

Import of petroleum products (in tons)	2020	2021	2022	2023	2024
Transport Diesel	549,469	614,320	453,322	427,428	688,836
Unleaded Gasoline	58,416	68,675	62,701	63,684	127,089
Liquide petroleum gas	82,069	85,047	58,293	36,467	59,024
Heating oil	0	0	0	0	29
Fuel oil	26,383	126,578	153,873	59,837	32,496
Other products	210,306	194,165	220,919	173,747	277,595
Total	926,643	1,088,785	949,108	761,163	1,185,069

In 2024, there was a increase in the export of petroleum products (Figure 8) with the quantity reaching 709,479 tons, which represents a incline of 20.89%. Notably, there was a significant grow in the export of motor fuels in 2024 compared to 2023. In 2024, the total export of motor fuels from the Republic of Serbia amounted to 332,434 tons, which is 5.57% more compared to previous year. The most exported product was diesel, with 207,786 tons, which is a increase of 39.59% compared to the previous year, followed by gasoline with 101,730 tons, which decreased by 25%. At the same time, liquefied petroleum gas saw a decline in export by 24.63%. Among other petroleum products, the export of bitumen was significant, amounting to 52,190 tons. In 2024, the incline in exports of petroleum products continued, with a increase of around 20,89% compared to 2023 [31].

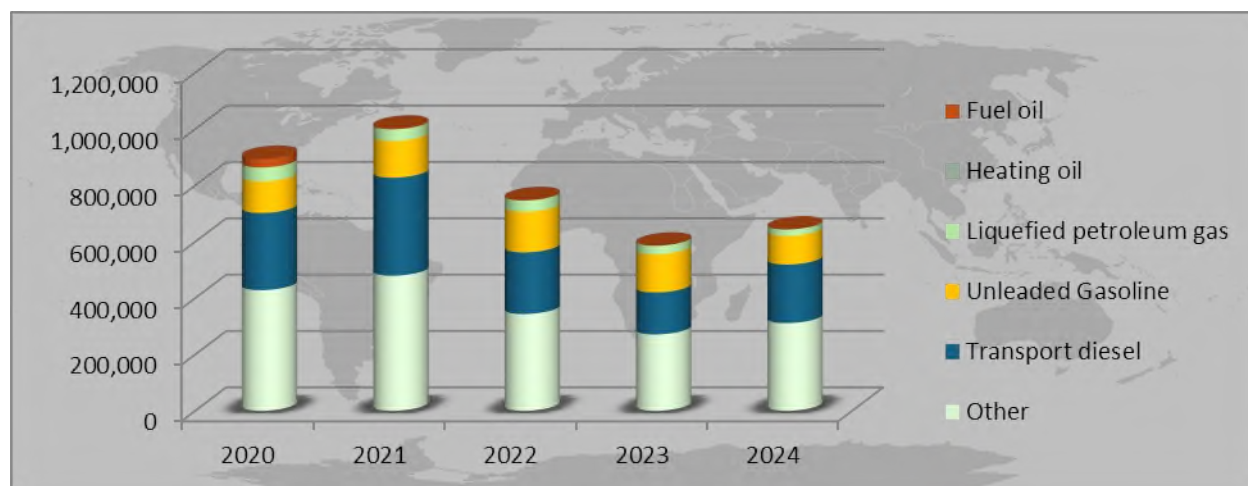
In June 2022, the Government of the Republic of Serbia adopted a Decision on the Temporary Ban on the Export of Eurodiesel EN 590 ("Official Gazette of the RS", No. 73/2022), which was initially set for 7 days but was extended multiple times, and from November 2022, it was extended to heating oil.

The export of petroleum products is performed through the sale of diesel fuel at bunker stations at four locations on the Danube River: Veliko Gradište, Novi Sad and Prahovo. In mid-2015, NIS JSC put into operation the Belgrade bunker station for supplying ships in domestic and international transport. A bunker station was also built in Smederevo, but it is used only for supplying domestic vessels. During 2024, a total of 3,693 tons of diesel fuel were placed on the market at the bunker stations, compared to 4,215 tons in the previous year [31].

In May 2018, amendments to the Law on Navigation and Ports on Inland Waterways were adopted, which clearly regulated the area of bunker stations for supplying ships.

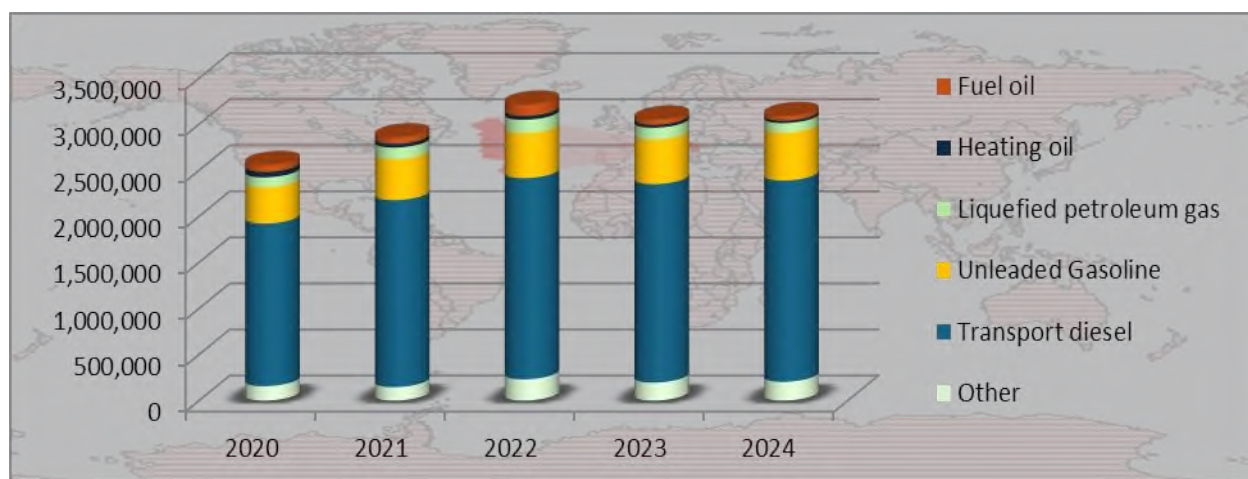
According to the Law on Navigation and Ports on Inland Waterways (“Official Gazette of the RS”, Nos. 73/10, 121/12, 18/15, 96/15 - other law, 92/16, 104/16 - other law, 113 /17 - other law, 41/18, 95/18 - other law, and 37/19 - other law, 9/2020 and 52/2021), it is foreseen that shippers, port operators, and the Directorate for Inland Waterways should align their operations with the provisions of this law by December 31, 2018, at the latest. By the end of 2022, most companies storing petroleum products in tanks at river terminals had aligned their operations with the applicable regulations in an appropriate manner. The companies Sibir Invest from Požarevac and NIS hold licenses for the fuel trade for vessels. Both companies have bunker stations in Veliki Gradište on the Danube River, while NIS also owns a bunker station in Prahovo.

Figure 8: Export of petroleum products – comparative overview for the period 2020-2024 [31]



Export of petroleum products (in tons)	2020	2021	2022	2023	2024
Transport Diesel	273,619	347,740	218,676	148,859	207,786
Unleaded Gasoline	112,025	130,177	144,069	135,635	101,730
Liquide petroleum gas	49,657	41,795	40,272	30,408	22,918
Heating oil	0	0	0	0	0
Fuel oil	30,582	2,572	1,350	100	65
Other products	429,183	480,374	344,274	271,864	312,045
Total	895,066	1,002,658	748,641	586,866	709,479

Final energy consumption for 2024 (Figure 9) was at a level of 3,090,868 tons (an increase of 1.29% compared to 2023), while in 2023, it was approximately 5% lower compared to 2022. In the structure of final consumption of petroleum products for 2024, the industry accounts for 11%, transport for 79%, and other sectors for 10% [31].

Figure 9: Comparative overview of final consumption of petroleum products (in tons) for the period 2020-2024 [31]

Consumption of petroleum products (in tons)	2020	2021	2022	2023	2024
Transport Diesel	1,765,554	2,030,438	2,184,378	2,154,931	2,185,054
Unleaded Gasoline	394,533	442,966	489,670	483,292	519,300
Liquid petroleum gas	107,450	127,488	144,366	128,966	105,164
Heating oil	58,437	39,859	41,301	31,949	26,466
Fuel oil	76,786	71,923	124,510	55,517	49,601
Other products	157,840	147,586	232,165	196,827	205,283
Total	2,560,600	2,860,260	3,216,390	3,051,482	3,090,868

Note: The values displayed for the production, import, export, and consumption of oil and petroleum products for 2024 represent estimated data, as final figures were not available during the preparation of the document.

5.2. Security of Supply of Oil and Petroleum Products

5.2.1. Balance of Crude Oil and Petroleum Products for 2025 – Plans

The balance of crude oil, petroleum products, and biofuels includes the production, import and export of crude oil, the refining of crude oil in refineries, as well as production, import, export and consumption of petroleum products and stock levels.

The Energy Balance of the Republic of Serbia for 2025 [31] is defined to the greatest extent in accordance with the implementation and estimates by the end of 2024. The exact quantities of all energy sources can only be seen at the end of 2025.

In line with the Energy Balance [31] the supply of crude oil and semi-finished products for refining will be ensured from domestic production in the amount of 0.820 million tons (20%), while the required quantity of crude oil and semi-finished products will be secured through imports, totalling 3.214 million tons (80% of total needs).

The refining of both domestic and imported crude oil from stocks, as well as the refining feedstocks (semi - finished products), will be carried out at the Pančevo Oil Refinery.

In 2025, the refining of crude oil and semi-finished products is planned in an amount of 4.182 million tons [31].

Considering the total demand for petroleum products in 2025, including the planned domestic production of petroleum products, the shortfall of 0.8 million tons will be covered by imports.

In 2025, the export of petroleum products is also planned at 0.615 million tons. The final consumption of petroleum products in 2025 is planned at 3.637 million tons, of which 0.561 million tons is for non - energy purposes, and 3.076 million tons is planned for energy purposes. In the structure of this final consumption of petroleum products for 2025, industry accounts for 11.7%, transport for 82% and other sectors for 6.3%.

In the long-term, the consumption of petroleum products is planned in accordance with the Strategy [2].

Table 34: Projection of consumption until 2030 [2]

Consumption	Product	Unit	Period (year)		
			2020	2025	2030
Primary energy consumption	Crude oil and semi-finished products	thousand toe	3,822	4,049	4,312
Final consumption	Petroleum products	thousand toe	3,368.8	3,595.6	3,853.1

5.2.2. Measures Taken in Case of Threats to the Security of Oil and Petroleum Products Supply

In the area of supply security, the oil sector is regulated by the Law on Commodity Reserves [23], which stipulates the conditions for the establishing, financing, deployment, use and replenishment of mandatory stocks of crude oil and petroleum products, provision and maintenance of facilities for storage and stockholding, as well as the operation and management of mandatory stocks and storage facilities on the territory of the Republic of Serbia. It is also regulated by the Energy Law, which established the Energy Reserves Administration as a government body within the Ministry responsible for energy affairs, tasked with carrying out executive and expert tasks related to mandatory stocks of crude oil and petroleum products, as well as mandatory stocks of natural gas.

Based on the Law on Commodity Reserves, the Government of the Republic of Serbia adopted a Decree on Establishing the Program of Measures in Case of Threats to the Security of Energy and Energy Sources Supply – Crisis Plan (“Official Gazette of RS”, No. 63/2019) in 2019. The Crisis Plan outlines procedures and criteria for identifying supply disruptions, the responsibilities and accountability of public and private entities to address these supply disruptions, and the procedures normalizing the energy market supply in the Republic of Serbia. The program also includes actions in case of an international decision to release mandatory stocks onto the market.

In accordance with the Law on Commodity Reserves, long-term, medium-term, and short-term programs for the formation of mandatory reserves have been adopted [23].

The Directorate for Commodity Reserves of the Republic of Serbia, in accordance with the Law, stores mandatory petroleum product stocks in its tanks, manages the construction of new and the reconstruction of existing storage capacities of the Directorate, which are financed from the budget of the Republic of Serbia [31].

At the Petroleum Products Storage Facility in Smederevo, the Energy Reserves Administration has financed the construction of 4 tanks, each with a capacity of 20,000 m³, for the storage of

petroleum products since 2020. The issuance of operating permits and the commissioning of these tanks is expected to take place in December 2025. The total potential storage capacity is 80,000 m³ for the storage of 66,000 tons of mandatory petroleum product stocks of the Republic of Serbia, which will increase the total stocks by 8 days based on the number of days of average daily domestic consumption. However, the completion of construction works, the project remains in the phase of harmonization and integration into a unified management system, alongside technical acceptance procedures and the issuance of an operating permit. Pursuant to the latest annexes, December 31, 2025 has been established as the deadline for finalizing all works and securing the required permits, thereby enabling the tanks to assume their intended functional purpose.

The Energy Reserves Administration also conducts an annual selection of contractors for the qualitative and quantitative analysis of petroleum products, as well as the selection of an insurance company for insuring goods in storage.

In May 2021, the Government of the Republic of Serbia adopted the Action Plan for the establishing and maintenance of mandatory stocks of crude oil and petroleum products from June 2021 to December 2026.

This Action Plan was developed to meet the requirement to submit an action plan to the European Union, while simultaneously describing a specific plan for the establishment and maintenance of mandatory oil stocks in accordance with Directive 2009/119/EC on minimum stocks of oil and petroleum products.

The Action Plan describes: the existing legal framework and remaining legislative harmonization necessary for full transposition of the Directive, the competent authority fully responsible for the establishment of Serbia's mandatory oil stocks in accordance with the Directive, financing of storage for Serbia's mandatory oil stocks, the estimated minimum storage obligations under the Directive, necessary data collection and reporting for the purposes of the Directive, the composition of mandatory stocks which will be defined over time, specifications for the quality of liquid fuels to be stored as mandatory stocks, the amount of storage capacity needed for mandatory stocks, including the currently available amounts in both public and private facilities, the planned timeline for the establishing of emergency stocks (procurement schedule, additional capacity requirements, procurement policy and investment in capacities, financing), organizational structure and emergency response planning, and the schedule for the implementation of the Action Plan.

During 2024, mandatory reserves were augmented by 1,024 tons of Euro diesel relative to 2023, reaching the equivalent of 41 days of average daily net imports, corresponding to a mandatory reserve level of 308,255 tons.

By 2027, it is planned to increase the mandatory stocks of oil and petroleum products to the level of 61 days of average daily domestic consumption, or 534,600 tons of crude oil equivalent, as outlined in the 2021 Action Plan.

At the end of 2023, the mandatory stocks of oil and petroleum products were formed at the level of 38 days of average daily domestic consumption, amounting to 257,231 tons of physically stored goods in the Republic of Serbia and 50,000 tons in “tickets” – option contracts.

At the end of 2024, mandatory stocks of oil and petroleum products were formed for 41 days of average daily domestic consumption. According to the type of petroleum product, the Republic of Serbia physically disposes of the following quantities:

- Euro diesel – 128,257.852 tons
- BMB – 14,541.150 tons

- Jet fuel (JET) – 3,864.113 tons
- Fuel oil – 25,496.205 tons
- Crude oil – 86,096.313 tons
- Tickets – 50,000,000 tons

In accordance with the adopted Rulebook on Determination of the Annual Program for the Establishing and Maintenance of Mandatory Stocks of Oil and Petroleum Products (“Official Gazette of the RS”, No. 75/2024) [87] for 2024, it was planned for 2024 that the number of days would increase to 42.

From March to September 2023, a draft study for a public-private partnership agreement was developed, titled “Financing, Construction, Maintenance, and Operation of Storage Terminals for Mandatory Stocks of Oil and Petroleum Products in the Republic of Serbia”, for the construction of storage capacities of 680,000 m³ to store 575,000 tons of mandatory stocks of oil and petroleum products. According to the developed study, the construction of 20 storage tanks with capacities ranging from 10,000 to 60,000 m³ for the storage of mandatory mandatory stocks of oil and petroleum products was planned. Also, according to the PPP Study, during the first three years, construction and storage of mandatory reserves will be carried out, and after that, for the next 15 years, the storage space will be leased by the Energy Reserves Administration, whereas after the full 18 years, the entire infrastructure and storage space will be transferred to the ownership of the Republic of Serbia. In December 2023, the draft study was submitted to the Commission for Public-Private Partnership for further action within their jurisdiction.

By implementing the PPP project, the Republic of Serbia would fulfil its obligation to establish mandatory stocks of oil and petroleum products at a level higher than 61 days of average daily domestic consumption.

The Law also defines that energy entities that carry out the activity of production of petroleum products and trade in oil, petroleum products, biofuels, and compressed natural gas are required to ensure operational reserves of petroleum products equal to the ten-day average amount of motor gasoline and gas oils, i.e. the fifteen-day average amount of jet fuel, which they placed on the market of the Republic of Serbia in the previous year from their own production and import. Energy entities engaged in the production of electricity and/or combined production of electricity and/or heat energy are required to ensure operational reserves of petroleum products and/or coal in a quantity that will allow for at least 15 days of their average production of electricity and/or thermal power in January, February and March over the previous five years. Energy entities engaged in the activity of thermal power production from petroleum products and/or coal for supplying tariff customers with thermal power are required to ensure operational reserves of petroleum products and/or coal in a quantity that will allow for at least 15 days of their average thermal power production in January, February and March over the previous five years. Operational reserves will be formed gradually until January 1, 2028.

Operational reserves of petroleum products coal are used in the event of short-term market disruptions, caused by accidents and other unforeseen situations that threaten the security of operation of certain parts of the energy system or the energy system as a whole.

The Law on Energy also stipulates that in the event of a threat to the security of supply to customers due to insufficient supply of energy and energy sources on the market or the occurrence of other emergency circumstances, the Government may approve, by act, changes to the limit values of certain quality characteristics of petroleum products that can be placed on the market of the Republic of Serbia for a period of up to six months. The measures may last as long as the circumstances that caused them persist, or until the consequences arising from those circumstances are resolved [1].

5.3. Technical and other Requirements that Must be Met by Liquid Fuels of Petroleum Origin and Liquefied Petroleum Gas

According to Article 337 of the Energy Law [1], petroleum products and biofuels placed on the market must meet the conditions set out in regulations on the quality of liquid petroleum fuels and biofuels, regulations on environmental protection, and technical and other regulations related to the trade of petroleum products and biofuels [83] and [84].

The technical and other requirements for liquid fuels of petroleum origin used as fuels for internal combustion engines and as energy fuels placed on the market of the Republic of Serbia, as well as the method of assessing compliance of liquid fuels is prescribed by the Rulebook on Technical and other Requirements for Liquid Fuels of Petroleum Origin (“Official Gazette of the RS”, No. 104/23, 21/24, 94/24, 106/24, 101/25) [86].

In 2020, the Ministry of Mining and Energy of Serbia adopted the Rulebook on Technical and Other Requirements for Liquid Fuels of Petroleum Origin (“Official Gazette of the RS”, No. 150/2020 and 127/21), which provides for the reduction of sulphur content in fuel oils from a maximum of three percent to no more than one percent, effective from January 1, 2021.

This Rulebook also reduced the sulphur content in fuel for machinery and tractors, thereby fully aligning with Directive 98/70/EC on the quality of diesel and motor gasoline.

Through these alignments, as well as the introduction of monitoring the quality of petroleum products on the market in Serbia, the use of high-quality petroleum-based fuels has been enabled, which contributes to reducing air pollution not only from the transportation sector but also from industry, construction, and agriculture.

The market introduction of leaded gasoline is prohibited, the quality of unleaded motor gasoline must meet all the requirements of the SRPS EN 228 standard, and the quality of diesel fuel must meet all the requirements of the SRPS EN 590 standard (with the exception of gas oil 0.1 used for starting tractors, machinery, and railway vehicles, as well as vessels with diesel engines, whose maximum sulphur content is 0.10% (m/m)).

The Energy Law [1] stipulates that in the event of a threat to the security of supply to customers due to insufficient supply of energy and energy sources on the market or the occurrence of other emergency circumstances, the Government may approve, by act, changes to the limit values of certain quality characteristics of petroleum products that can be placed on the market of the Republic of Serbia for a period of up to six months. The measures may last as long as the circumstances that caused them persist, or until the consequences arising from those circumstances are resolved.

Amendments to the Energy Law in 2012 established the legal basis for the mandatory marking of petroleum products, aiming to reduce the illegal market of petroleum products, and since December 1, 2013 the Decree on Marking of Petroleum Products (“Official Gazette of the RS”, No. 51/15, 5/17, and 115/22) [88] has been in force.

The Energy Law of 2014 established the legal basis for monitoring the quality of petroleum products in accordance with SRPS EN 14274 standard, and since December 1, 2015, the Decree on Monitoring of Petroleum Products and Biofuels Quality (“Official Gazette of the RS”, No. 97/15, 5/17, 8/17 – correction, 119/17, 102/18, 8/23, and 60/23) [89] has been in force.

The monitoring of the quality of petroleum products is carried out in accordance with the Annual Program for Monitoring the Quality of Petroleum Products, which is an integral part of the Rulebook on the Content and Method of Implementing the Annual Program for Monitoring the Quality of Petroleum Products and Biofuels. The mentioned rulebook for the current year, in accordance with the Decree, is adopted by the Minister in charge of energy affairs no later than

March 31 of the current year. From 1 January of the current year until the adoption of the Annual Monitoring Program, the Annual Monitoring Program adopted for the previous calendar year is applied.

The introduction of marking and monitoring the quality of petroleum products and biofuels has significantly contributed to reducing the illegal market, increasing revenues from excise duties and taxes in the budget of the Republic of Serbia, protecting consumers, and fulfilling internationally assumed obligations regarding the implementation of Directives 2016/802/EC (which replaced the Directive 1999/32/EC) and 98/70/EC.

5.4. Data on Oil Infrastructure

5.4.1. The Refineries in Novi Sad and Pančevo

The refining of crude oil in the Republic of Serbia is carried out at the Pančevo Oil Refinery, part of the NIS JSC Novi Sad company.

The Pančevo Oil Refinery, located in Pančevo, began operations in 1968 with the commissioning of its first primary processing complex with a capacity of 1.32 MTY. With the launch of the second primary processing unit in 1978, it reached its designed capacity of 4.8 MTY. The engineering for this unit was developed by the French company CFI/Lummus.

Situated in Pančevo near the Danube River, the refinery is approximately 2.5 km from the river and about 15 km from Belgrade, covering an area of about 160 hectares. It is connected to its own jetty on the Danube via a pipeline.

Crude oil can be delivered to the refinery by pipeline, water vessels, rail tank cars and tank trucks. Thanks to its refining capabilities, the Pančevo Oil Refinery can process practically all types of crude oil and produce fuels - liquefied petroleum gas, motor gasoline, diesel fuel, jet fuel, heating oil, as well as bitumen and petrochemical products. The refinery operates at over 60% capacity utilization and has a storage capacity of 700,000 m³. Since 2014, in addition to imported crude oil, it also processes all domestically produced crude oil, with a total processing volume of approximately 3.5 MTY [90].

The dispatch of petroleum products from the Pančevo Oil Refinery is carried out using river vessels, tank trucks and rail tank cars, while HIP-Petrohemija is supplied via product pipelines.

In the immediate vicinity of the Pančevo Oil Refinery there is “HIP-Petrohemija Pančevo JSC” (Petrohemija JSC), which includes a Pyrolysis Gasoline Unit for ethylene production, known as the “Ethylene Plant.” Since 2023, it has been majority-owned by NIS JSC Novi Sad.

The Refinery provides most of the raw materials for this plant, with pyrolysis gasoline, which is rich in aromatic hydrocarbons (especially benzene), being returned to the refinery. Straight-run naphtha from the refinery to Petrohemija JSC, and pyrolysis gasoline from Petrohemija JSC to the refinery, are transported via internal product pipelines.

Through continuous modernization in recent years, the refinery has expanded its primary and secondary capacities. The construction of a new refinery unit has been completed, enabling increased production of liquefied petroleum gas (LPG), all types of gasoline, and diesel fuels.

Direct investment in environmental projects in recent years has exceeded €150 million, leading to a constant trend of reducing pollutant emissions from the refinery's units, as well as a decreasing trend in the presence of pollutants in the ambient air of Pančevo and its surroundings.

The Pančevo Oil Refinery is the first energy plant in the Republic of Serbia to have fulfilled the requirements for an Integrated Pollution Prevention and Control (IPPC) permit in 2017. This was achieved through the submission of an Action Plan and a Program of Measures to adapt the

operation of the existing plant to the prescribed conditions. The IPPC permit confirms that the refinery will continue to invest in environmental protection while conducting its activities.

Novi Sad Oil Refinery comprises a complex of refining and auxiliary factory units for refining of crude oil and petroleum products, along with storage, transport, handling facilities, research laboratories, and other associated structures. It is located in the industrial zone of Novi Sad, adjacent to the Danube River and the DTD navigable canal. The refinery was put into operation in 1968, with a designed processing capacity of 2.5 MTY.

The Novi Sad Oil Refinery has been in a state of conservation, processing facilities non-operational since 2013. Since March 2016, its tank storage capacities have been primarily used for storing petroleum products and crude oil.

This refinery no longer processes crude oil, the entire complex has been converted into a storage terminal for crude oil and petroleum products.

5.4.2. Oil Pipeline Operated by Transnafta JSC

Transnafta performs the energy activity of transportation and transportation system operation, supplying crude oil to the refineries in Novi Sad and Pančevo. The oil pipeline with a total length of 154 km stretches from the border with the Republic of Croatia on the Danube River, passing through Novi Sad to Pančevo. The oil pipeline connects with JANAF's system, which begins at the port of Omišalj on the island of Krk in Croatia, and after the Sisak refinery, their last block valve station Sotin, before it crosses the Danube River into Serbia. The first block valve station is in Bačko Novo Selo, and the pipeline continues through Transnafta JSC's terminal to the Pančevo Oil Refinery (via Transnafta JSC's measuring station). Imported crude oil is transported through along the entire length, while domestic oil is transported via domestic section from Novi Sad to Pančevo. The oil pipeline infrastructure includes: a terminal in Novi Sad with a technological storage capacity of 10,000 m³ and a pumping station, eight block valve stations along the pipeline, a measuring station near the Pančevo Oil Refinery, a cathodic protection system, and a pipeline supervisory and control system.

The oil pipeline route is divided into two sections:

- DN-1 (Bačko Novo Selo - Novi Sad, 63.3 km long, diameter 660 mm, ANSI 300 pressure class, transportation capacity 9 MTPA, 1,000 m³/h) with 38 watercourse crossings, 20 road crossings, six railway crossings, three embankments, two wetlands and five pipelines;
- DN-2 (Novi Sad – Pančevo, 91 km long, diameter 457 mm, ANSI 400 pressure class, transport capacity 6 MTG) with 95 watercourse crossings, 17 road crossings, four railway crossings, six embankments, and three pipelines.

The total average transport volume is approximately 3 million tons/year [91].

5.4.3. Oil Pipelines Operated by NIS JSC

For the transportation of domestic crude oil to the terminal in Novi Sad, pipelines operated by NIS AD Novi Sad are in use, transporting crude oil from dispatch stations. These include the pipeline from the "Kikinda Field" dispatch station to the Elemir dispatch station, 42.9 km in length; the pipeline from the Elemir dispatch station to the Novi Sad Refinery, 39.5 km in length, with a diameter of 257.4 mm, used to transport "Kikinda"-type oil; and the pipeline from the Nadrljan dispatch station to the Novi Sad Refinery, 86.4 km in length, with a diameter of 203.3 mm and a capacity of 0.5 MTPA [81].

5.4.4. Petroleum Product Pipelines in the Republic of Serbia

There is no infrastructure for transporting petroleum products via pipelines in the Republic of Serbia. Technically, product pipelines exist only between the petrochemical complex and the Pančevo Oil Refinery for transporting semi-finished products, as well as the product pipelines of Petrohemija AD used to transport ethylene and propylene to the Romanian border and further to Solventul in Romania.

The total length of the pipelines is approximately 65 km within the Republic of Serbia and around 50 km in Romania. The system consists of two parallel product pipelines: an ethylene pipeline with a diameter of 168.3 mm and a propylene pipeline with a diameter of 114.3 mm, which is currently out of service.

5.4.5. The Terminals for Crude Oil

Crude oil storage tanks are located along the oil pipeline route, specifically at the terminals of Transnafta JSC in Novi Sad and at the Novi Sad Terminal within the NIS storage terminal and the Pancevo Refinery, owned by NIS JSC Novi Sad.

Transnafta Terminal is equipped with four crude oil storage tanks, each with a capacity of 10,000 m³, along with two additional tanks of 20,000 m³ each designated for the storage of mandatory crude oil stocks.

NIS JSC Novi Sad at the Terminal at the Novi Sad Terminal within the Refinery has tanks with a capacity of about 140,000 m³ for crude oil storage. All crude oil tanks have been reconstructed in the last four years. Also, at the dispatching stations Kikinda Field, Tisa and Nadrljan, there are storage tanks for transporting domestic crude oil with a capacity of over 70,000 m³ [81].

At the Pančevo Refinery, there are storage tanks for technological processes with a total capacity of about 700,000 m³ [81].

5.4.6. Storage of Petroleum Products

The storage capacities in the Republic of Serbia are operated by the Directorate for Commodity Reserves of the Republic of Serbia (about 180,000 m³), Transnafta JSC (about 74,000 m³), as well as companies that carry out energy activities, such as the storage of oil, petroleum products, and biofuels and the trade of oil, petroleum products, biofuels, bioliquids, compressed natural gas, liquefied natural gas and hydrogen.

In 2024, there were a total 30 licenses for the storage of crude oil and petroleum products.

Among the entities with licensed storage tanks for oil and petroleum products, the company with the largest capacity is NIS JSC Novi Sad (more than 100,000 m³), followed by Transnafta JSC, Euro KB Rent, Mitani oil, MOL Serbia, and Naftachem. These four entities together accounted for about 80% of the total licensed storage capacity in 2024 [92].

In 2024, there were a total of 64 licenses wholesale trade in crude oil and petroleum products, which is identical to the previous year.

Among the entities with licensed storage tanks for trading crude oil and petroleum products, the company with by far the largest capacity is NIS JSC Novi Sad. Next are Transnafta JSC, Lukoil, Naftachem, Mitani oil, EKO Dunav, Miletić Petrol, Speed LLC VML, which, together with NIS JSC Novi Sad, hold about 90% of the total licensed capacity [92]. Significant capacities for liquefied petroleum gases are also held by Petrol LPG in Smederevo and Standard Gas, Energreen MTV, and HI Hipol JSC in Odžaci.

5.4.7. Fuel Supply Stations for Transport Vehicles – Number and Structure

The trade of motor and other fuels at fuel supply stations for transport vehicles is considered retail trade under the regulations governing the field of trade. The retail trade of petroleum products in Serbia is conducted by companies owned by both domestic and foreign entities, whose subsidiaries are registered in Serbia.

In 2024, the number of licensed business entities engaged in retail trade amounted to 421, which is an decrease of 12 compared to 2023, when the number was 433 [39].

In 2024, six licenses were granted for fuel trading outside vehicle supply stations, 30 licenses for the filling of containers with liquefied petroleum gas, compressed and liquefied natural gas, and two licenses for the trading of fuels intended for vessels.

According to data from the Ministry responsible for trade, the total number of fuel supply stations for transport vehicles (petrol stations) in Serbia at the end of 2024 was 1,520, with the following breakdown: 327 NIS JSC Novi Sad (21.5%), Lukoil 112 (7.4%), Knez Petrol 114 (7.5%), OMV 64 (4.2%), EKO 60 (3.9%), MOL 57 (3.7%), Art Petrol 30 (1.9%), Euro Petrol 25 (1.6%), Radun Avia 24 (1,6%), Mihajlovic LLC 23 (1.5%) [94].

The largest number of petrol stations (57%) are located in urban areas, followed by rural areas (19%), main roads (16%), while only 8% are located on highways.

The six companies with the highest number of petrol stations are: NIS JSC, Lukoil Serbia, Knez Petrol, OMV Serbia, EKO Serbia, Mol by the end of 2024, they collectively owned 734 petrol stations [94].

Other petrol stations, which represent nearly 50% are owned or leased by a large number of licensed entities that own one or several petrol stations and are not included in the analysis.

5.5. Investment Plan in Oil Infrastructure

5.5.1. Overview of the Technological Safety of the Oil System, Quality and Maintenance of Oil and Petroleum Products Transport Networks (Pipelines for Transporting Crude Oil and Petroleum Products, Terminals, and Ports)

In accordance with Article 324 of the Energy Law [1], energy entities engaged in energy activities of the transportation of oil by pipelines, transportation of petroleum products by product pipelines, storage of oil, petroleum products, and biofuels, wholesale trade in fuels for the supply of vessels, retail trade in fuels for the supply of vessels, and biofuel production, are required to use and maintain energy facilities in accordance with technical and other regulations related to the activities they perform, as well as with the conditions for fire and explosion protection, environmental protection as defined by law and other regulations.

The Rulebook on Technical Conditions for Uninterrupted and Safe Transportation via Crude Oil and Petroleum Products Pipelines (“Official Gazette of the RS”, No. 37/13) [93] specifies, among other things, the conditions for: pressure regulation and safety measures to prevent exceeding the permissible working pressure, marking the route of the oil pipeline and product pipelines, safety zones for oil pipeline and product pipelines, populated buildings, structures, and infrastructure facilities within the safety zone of oil pipelines and product pipelines and operational zones, hazardous zones, and corrosion protection of oil pipelines and product pipelines, conditions and methods for remote monitoring and control, conditions for designing, installing, and maintaining electrical equipment and installations in hazardous zones, conditions and methods for testing oil pipelines and product pipelines during construction, but prior to commissioning, conditions and methods for the use and operation of oil pipelines and product pipelines, as well as their maintenance during operation, repairing and emergency events,

conditions and methods for protection against corrosion and leakage of oil pipelines and product pipelines; inspection and maintenance of safety devices, and conditions and methods for protecting oil pipelines and product pipelines, or their associated above-ground equipment, installations, and structures from unauthorized use or damage.

The Transnafta JSC oil pipeline from the Croatian border to Pančevo is equipped with an installed SCADA system for remote control of valves at block valve stations along the route of 154.3 km. Additionally, a Motorola Moscad leak detection system has been implemented, which detects even the smallest leaks in a short time. A wireless remote control system has also been installed in case of a disruption to the laid optical cable, which is the primary means of communication transmission. Each block valve station is equipped with video surveillance with motion detection and alarms sent to the main dispatch centre at the Novi Sad Terminal.

Every five years, the pipeline's condition is assessed by sending an intelligent inspection scraper (pig), which provides a report on the pipeline's condition, identifying locations of damage, the extent of the damage, and the remaining lifespan of the pipeline, all in accordance with European standards related to oil pipeline integrity.

In 2023, Transnafta conducted a survey of the section from the Novi Sad Terminal to the Pančevo Refinery, and in 2024, the rehabilitation of critical areas was carried out according to the received inspection report. In 2021, the section from the Croatian border to Novi Sad was inspected, and in 2022, the critical areas were rehabilitated.

Periodic surveys of the riverbeds of the Danube and Tisa rivers are also conducted at locations where the pipelines cross watercourses, in order to enable preventive action and prevent accidents. During 2024, a survey of the riverbed of the Danube was carried out.

Article 327 of the Energy Law [1] defines that the energy entity carrying out the activity of transporting oil via pipelines or transporting petroleum products via product pipelines shall adopt the Network Code for the Operation of the System for Transport of Crude Oil via Oil Pipelines, or Network Code for the Operation of the System for Transport of Petroleum Products via Product Pipelines, which shall include, in particular: technical conditions for the safe operation of system, procedures in case of accidents and crises, or interruptions in transportation, rules for accessing the system for transport of oil or petroleum products, requirements regarding the quality of oil or petroleum products being delivered for transportation, rules for measurement with the defined necessary measuring equipment, and other transportation conditions.

Transnafta applies the valid document, the Network Code for the Operation of the Oil Pipeline transportation system [95] which prescribes all activities aimed at ensuring the safe and secure transportation and storage of crude oil.

On the pipeline route from the dispatching station in Elemir to the Novi Sad Oil Refinery, the Krohne system of leak detection has been implemented, along with the installation of a measurement system at the refinery system interface, enabling real-time monitoring of all flow parameters.

In 2020, the relocation of a section of the pipeline route in the area of the highway and the industrial zone of Novi Sad was completed. After connecting the new section of the route to the existing system, an intelligent pigging inspection of the pipelines leading to the Transnafta Terminal will be conducted.

Transnafta has successively cleaned the technological and storage tanks at the Novi Sad Terminal, carried out their repair, and restored them to excellent operational condition.

Cleaning is carried out every 10 years, during which tank inspections and repairs of any potential damage are performed. Laser calibration with the creation of volume tables is conducted every

five years, in accordance with the Decree on Types of Measuring Instruments Subject to Legal Control (“Official Gazette of the Republic of Serbia”, No. 37/2021, 84/2022) [96].

In 2017, Transnafta reconstructed the handling pipelines at the Novi Sad Terminal.

In 2024, reconstruction activities commenced on the pumping station responsible for transporting crude oil from the Novi Sad Terminal to the Pančevo Refinery.

During the reporting period, there were no disruptions in the transport of crude oil through the oil pipeline and the reconstruction works at the pumping station did not affect the supply to the refinery. Transnafta has two working and one backup pump within the pumping station, and accordingly ensures a secure, uninterrupted supply throughout the year.

The activity of the transport of petroleum products via product pipelines is not conducted, because there are no functional product pipelines constructed within the territory of the Republic of Serbia.

Transnafta has initiated the development of project and technical documentation to implement the Product Pipeline System through Serbia. This project would include the construction of a pipeline stretching from Sombor, through Novi Sad, Pančevo, Smederevo, and Jagodina, to Niš, with a branch from Pančevo to Belgrade. Additionally, the project envisions the construction of Terminals at the specified locations. This would enable safer and more secure transport with minimal environmental impact. The total length of the product pipeline would be 402 km, with a capacity of 4.3 MTA. By the end of 2020, geodetic and hydrological-psamological surveys were completed. The next step involves the development of the construction design for the Pančevo – Smederevo section. The conceptual design includes sophisticated equipment for remote control, monitoring, and leak detection. The implementation activities of the project are presently suspended pending the alignment of dispatch capacities from the Pančevo refinery.

At the terminals and storage facilities of NIS JSC Novi Sad and other licensed entities for petroleum product storage and wholesale, the loading system has been modified to implement bottom-loading. This is implemented in order to prevent evaporative losses and reduce environmental pollution. Additionally, vapour recovery units (VRUs) are being installed in gasoline loading systems to capture and recover vapours [81].

Port activities are defined by the Law on Navigation and Ports on Inland Waterways (“Official Gazette of the Republic of Serbia”, No. 73/10, 121/12, 18/15, 96/15 – other Law, 92/16, 104/16 - other Law, 113/17 - other Law and 41/18, 95/18- other Law, and 37/2019- other Law, and 9/2020 and 52/2021) [97]. There are 1,364 km of navigable rivers and canals in the Republic of Serbia. The transport of petroleum products via waterways is primarily conducted on the Danube and Sava rivers, with receipt and dispatch of petroleum products taking place at locations such as Bezdan, Novi Sad, Sremski Karlovci, Pančevo, Smederevo, and Prahovo, where modern terminals have been constructed in compliance with all safety regulations and environmental protection measures (protective barriers, skimmers).

The river fleet engaged in transport must meet safety requirements in accordance with the Regulation on the Transport of Dangerous Goods by Inland Waterways and the Obligations of Participants in the Transport of Dangerous Goods in Emergency Situations (“Official Gazette of the Republic of Serbia”, No. 125/2014). In inland waterway transport, the transportation of dangerous goods is carried out by vessels marked in accordance with the provisions of the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways ADN (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways) (“Official Gazette of the RS” - International Treaties, No. 8 / 2017-1 from September 4, 2017).

5.5.2. Oil Pipeline Projects

The implementation of the new oil pipeline project Hungary – Republic of Serbia is underway, based on the signed Memorandum of Understanding between Hungary and the Republic of Serbia, with the expected completion deadline by the end of 2027.

In 2024, the Spatial Plan for the area of special purpose of the oil pipeline infrastructure corridor from the Hungarian border to Novi Sad was adopted. The preparation of project-technical documentation has begun in accordance with the Law on Planning and Construction, and by the end of the year the necessary geomechanical works along the pipeline route were carried out, as well as the Conceptual Design, the Feasibility Study with the Conceptual Project, and the elaborates for the protection of immovable cultural heritage.

5.5.3. Modernization and Investment Program for Refineries to Increase the Production of Petroleum Products and Improve Progress in Meeting European Union Product Quality Specifications

As part of the Pančevo Refinery modernization project, over €800 million have been invested since 2009.

The investment program, which included the modernization of production capacities and technological reconstruction of the processing complex, aimed at increasing product quality to Euro-5 standards and protecting the environment, has been largely realized. Over €60 million have been invested in environmental projects so far, in parallel with the development of production modernization. Thanks to the modernization, NIS JSC Novi Sad will fully meet the needs of the domestic market for fuels with 10 ppm sulphur and unleaded gasoline.

The implementation of the Mild Hydrocracking and Hydrodesulphurization (MHC&DHT) complex at the Pančevo Refinery has enabled NIS JSC Novi Sad to fully transition to the production of environmentally clean fuels – unleaded motor gasoline and Euro diesel with a sulphur content not exceeding 10 ppm.

With the opening of the new MHC&DHT complex, which includes units for mild hydrocracking and hydro processing, in late 2012, the production of the highest quality petroleum products meeting Euro 5 standards began. This investment successfully completed the first phase of modernization and started a new era of refinery processing, which continued in 2017 with the opening of the delayed coking unit as part of the “Deep Processing” project. This project brings the refinery into a new phase of development and further modernization of refinery processing.

The long-term strategic plans of NIS, which take into account the development of the technological scheme and changes in the petroleum products market, foresee a refining depth and yield of light products at 96% and 82.6%, respectively, while simultaneously improving and increasing the efficiency of the refining process, increasing the availability of units, and maximizing energy cost optimization levels.

During 2024, for the most part, was on the overhaul of the Pančevo Oil Refinery process plants. This overhaul is so far the largest one in the history of the Refinery in terms of volume and complexity, given the modernization and increase in the number of production plants.

In addition to being specific in terms of its scope, this is the overhaul with the largest budget and the largest number of contractors so far. Before the overhaul, the company amped up production of petroleum products to create the necessary reserves for an uninterrupted supply to the market.

During 2024, the Refining Block processed 3.6 million tonnes of raw materials.

Capital overhaul which was carried out at the Pančevo Oil Refinery was a most complex and most challenging one in the Refinery’s history, considering modernisation and higher number of

production units. The overhaul and investment projects were worth over €95 million, and, in addition to NIS employees, over 2,000 contractors were engaged.

In terms of completed works, the overhaul covered 34 reactors and absorbers, whereat 850 m³ of catalyst was replaced, 245 pressure vessels were repaired, as well as 47 compressors and pumps, 298 heat exchangers, 1,457 pipelines, 243 air coolers, and 16 tube furnaces. As regards activities, most process units underwent scheduled overhauls and investment works, whereat 12 investment projects were executed, including a significant number of investments maintenance projects. The completed works facilitated improvement of operational reliability, industrial safety and energy efficiency in Pančevo Oil Refinery.

Pančevo Oil Refinery obtained a new integrated permit (IPPC), which is a confirmation of the integrated approach to pollution prevention control, and also includes the obligations of minimizing the consumption of raw materials and energy, preventing or reducing emissions to air, water, and land, and managing waste in a manner that does not endanger human health and the environment.

This permit implies that the production process in the Refinery is largely compliant with the highest domestic and European standards in the field of environmental protection.

The permit is also an obligation of Pančevo Oil Refinery to continue with a responsible management in the implementation of all its activities and significant investments in the field of environmental protection, with the application of the best available techniques.

During previous periods, investments in energy efficiency projects had benefits such as the reduction of greenhouse gas emissions.

One of the key investment projects in the company – Industrial Railway Reconstruction Project in Pančevo Oil Refinery is underway. This project covers replacement of complete substructure and superstructure of existing railtracks and construction of five new ones, thus facilitating the full capacity of the switching yard for receipt and dispatch of trains.

The importance of the Refinery railway lays in the fact that, on an annual basis, using this means of transportation, 14,000 rail cars were dispatched, carrying 750,000 tons of petroleum products. The reasons for launching the reconstruction project include ensuring legal compliance of the technical condition of the industrial railway, then implementation of measures prescribed by the HSE Action Plan, remedying deficiencies in the field pf safety, minimising the risk of accidents, and also increasing the permissible axle load of the industrial railway. The main works were started in the first quarter of 2024.

In 2024, the implementation of a large investment project in the Refining Block is underway - “Reconstruction of the fire protection system and installation of a central foam extract distribution system and provision of fire protection water for stable fire protection systems in the Pančevo Oil Refinery”. This investment was approved in the middle of last year and the implementation is divided into three stages, where each unit would be built and put into operation in phases.

The perspective of “blue” hydrogen production at the Pančevo Oil Refinery was presented at the conference in Turin, held in July, 2024, dedicated to promoting innovation, research and technical achievements in the field of energy sector transformation at the “SPE Europe Energy Conference & Exhibition”. The result of the project would have a significant positive impact on the environment by reducing the carbon footprint of the refinery, with the monetization of low-carbon fuels such as blue hydrogen.

The Rulebook on Monitoring and Reporting on the Greenhouse Gas Emissions came into force in our country at the beginning of 2024. It defines in more detail the method of monitoring,

calculation and verification of the GHG emissions, as well as the obligation for operators to obtain the GHG emissions permits for their plants.

The goal is to reduce these emissions from the industrial sector in the long term and to accelerate the decarbonization of the economy, which is one of the important pillars of the green agenda. Companies and operators were obliged to submit the Applications for GHG Emissions Permits with the accompanying documentation to the Ministry of Environmental Protection by July 5 this year.

Prepared the GHG Emissions Monitoring Plans for all plants and accompanying documentation within the legally prescribed deadline. After reviewing the submitted documentation, the Ministry of Environmental Protection of the Republic of Serbia issued a Decision on the Issuance of the Greenhouse Gas Emissions Permit.

During 2024, the Refining Block continuously carried out the activities for finding new and maximizing the existing technical, technological and organizational measures for increasing efficiency and reducing costs.

In 2024, the effect of measures for the increase of efficiency was realized in the amount of about RSD 1.5 billion. A set of additional (Upside) measures was developed, aimed primarily at savings in energy consumption

5.5.4. Project implemented in the Refinery

The implementation of projects aimed at increasing the efficiency and reliability of the Pancevo Oil Refinery is underway:

- “Reconstruction of the FCC plant, construction of the ETBE plant” – The Provincial Secretariat in Novi Sad gave its consent for the Environmental Impact Assessment Study and the Waste Management Plan, while the Audit Committee gave its consent for the Preliminary Design.

Thus, the conditions for applying for the Construction Permit were met. In July, the consent for the Construction Permit for the preparatory works was obtained from the Provincial Secretariat in Novi Sad. The decision was made to continue the implementation of the project through several smaller investment projects, all of which will aim at increasing the reliability of the FCC operation, which will enable the production of propylene in the amount sufficient for the selected production capacity of 140,000 t/h of the polypropylene production plant in HIPP.

- “Project for the Replacement of Steam turbines” – the project was approved in its entirety, the Contract on the Delivery of Equipment and Services was implemented, the equipment was installed and commissioned in May 2024.
- “Project for the Reconstruction of the Industrial Track in Pančevo Oil Refinery” – The project was approved in its entirety, the Contract on the Delivery of Equipment and Services was signed, the implementation is ongoing. Project stage A was implemented in June 2024. Works on the stage B implementation are ongoing.
- “Project for the Installation of the System for Automatic Dosing and Adding of Markers and Additives to Motor Fuels at the Pančevo Oil Refinery Truck Loading Facility” the project was approved in its entirety, the Contract on the Delivery of Equipment and Services. Construction and installation works are completed and the functional test is being conducted.

- “Project for the Reconstruction of the Fire Protection System at Pančevo Oil Refinery” – The Provincial Secretariat in Novi Sad has approved the Environmental Impact Assessment Study, the Waste Management Plan, and the Audit Commission has approved the Preliminary Design. A request for a Construction Permit was submitted in early November 2024. Contractors have been selected and contracts for hydraulic and civil engineering works, mechanical and assembly works, and E&I works have been signed. Ordering of equipment and materials and preparation of a work plan are underway.
- “Reconstruction of Laboratory Building” – works on the construction of the foundation are ongoing. Almost the entire furniture was delivered.
- “Replacement of the Cyclone on the DC-2302 Regenerator of the FCC Plant” – works were fully completed during the major overhaul and the equipment was put into operation.
- “Reconstruction of the N2 Substation” – works were fully completed during the major overhaul and the equipment was put into operation.

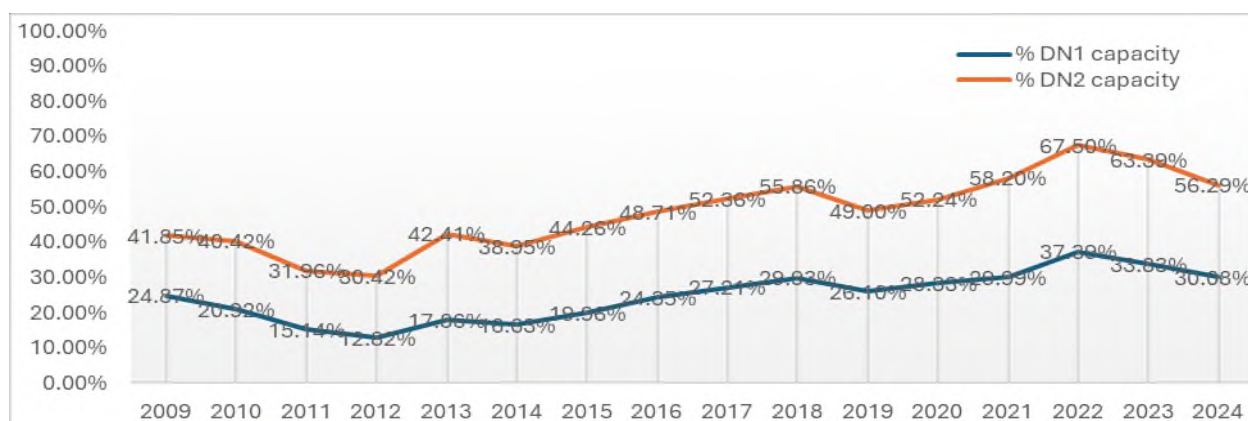
5.6. Capacities for the Import and Export of Crude Oil And Petroleum Products via Pipelines, Tank Trucks, Railways, and Waterways/Ports

According to data from the Energy Balance for 2024 [98], the transport of petroleum products in the Republic of Serbia is carried out by rail, inland waterways and road transport. From the Refinery to terminal facilities, transport is primarily carried out by rail and water, while transport to end customers is performed by road transport. Currently available capacities for these types of transport meet the needs for the transportation of petroleum products. The only provider of crude oil pipeline transport services in the Republic of Serbia is Transnafta JSC Pančevo. The activities of this company is oil pipeline transport across the entire territory of the Republic of Serbia.

5.6.1. Capacities for Import and Export of Crude Oil

The available capacity for the import of crude oil via pipelines is not fully utilized. Currently, the capacity of the pipeline operated by Transnafta, which amounts to nine million tons annually (MTA), is being used at about 30%. Since the Novi Sad Oil Refinery is no longer operational, for which a capacity of 3 MTA was reserved, the capacity of the pipeline route towards Pančevo, with a capacity of 6 MTA, is being used at less than 60%. There is no possibility for export or reversible transport via existing oil pipelines, nor are there any other constructed pipelines that could be used for the export of domestically produced oil via pipeline transport. In 2024, 2,707,373.27 tons of crude oil were imported [91].

Figure 10: Percentage of oil pipeline capacity utilization for the period 2009-2024



An alternative to pipeline import of significant quantities of crude oil is the import by vessels the Danube from Constanța. However, there are several factors that affect the inefficiency of this mode of transport. The main reason is the navigation restriction of the Danube in the area of the Đerdap hydroelectric power plants, as well as the lack of capacity in the river fleet that could deliver the necessary amount of crude oil within the optimal time frame to meet the planned refinery processing needs [81].

The condition and load-bearing capacity of the railway tracks in the Republic of Serbia is a limiting factor for significant application in crude oil imports.

Domestic crude oil is delivered via oil pipelines and tank trucks from the dispatch stations to the Novi Sad Oil Refinery, and then further dispatched to the Pančevo Refinery. Due to its poor rheological properties for transportation, Velebit crude oil must be blended with either imported or domestic crude oil with better rheological properties. Only after this blending, and once the conditions prescribed in the document “Network Code for the Operation of the Crude Oil Pipeline Transport System” are met, can it be transported to the Pančevo Refinery.

Technically, there is the possibility of transporting domestically produced crude oil by vessels from dispatch stations to the refinery. The largest dispatch stations of NIS JSC Novi Sad, Nadrljan, and Elemir have jetties and the capability to dispatch crude oil by barges, but this form of transport is not implemented in regular oil pipeline operations [81].

Crude oil transport by tank trucks is only carried out from domestic oil fields (Turija, Idoš, the fields of South Banat, and Stig) and from collection stations that are not connected by pipelines with dispatch stations previously mentioned. These are amounts that do not exceed 10% of the total production. With the closure of the Novi Sad Oil Refinery, crude oil from the Turija oil field is dispatched to the NIS Novi Sad terminal (Novi Sad Oil Refinery), where it is blended with imported oil due to its unfavourable rheological properties, and then transported by pipeline to the Pančevo Oil Refinery [81].

5.6.2. Capacities for the Import and Export of Petroleum Products

There is a significant number of licensed entities on the market that import petroleum products by rail, tank trucks, and river vessels (tankers and tank barges), either owned or leased by them.

The import of petroleum products by rail is mostly carried out using rail tank cars owned by NIS JSC or Standard Logistic, while the import by vessels, besides NIS JSC Novi Sad, is performed by several business entities with their own fleet (Speed LLC, Naftachem LLC, Kazuk LLC, Ladjar Kupra, Rubicon Shipping, Dunav Oil Trans, Judra LLC, Ladjar Transport LLC, Euro Gas Subotica, MB Gas Oil, Mario MilTrans LLC) [81].

Based on the database of the Ministry of Construction, Transport and Infrastructure – Directorate for Determining of Vessels, about 42 floating units are available, with a total capacity for the import and export of petroleum products of about 72,000 tons.

NIS JSC Novi Sad has reduced imports through the modernization of the Pančevo Oil Refinery and achieving petroleum product quality at the European level, while the leading importers remain Mol Serbia and Lukoil.

The export of petroleum products is primarily carried out by NIS JSC Novi Sad, using rail transport with rail tank cars, tank barges, and tank trucks.

5.7. Overview – Geographical Origin of Imported Energy Sources Defined in Section 4 of Annex B of Regulation (EC) No. 1099/200

Oils and lubricants, as well as liquefied petroleum gas, are the energy sources imported from the largest number of different countries. This is a result of a large number of licensed business entities and the minimally necessary technical storage capacities, which are not a limiting factor in the market and do not prevent competition.

The straight-run naphtha is sourced from Romania, while motor gasoline is primarily imported from Hungary and Romania. This is due to the presence of large international companies such as OMV and MOL in the market. Hungary is also the country from which the largest number of energy sources are imported, with a percentage of 26.88%, slightly lower than in 2023 (32.64%) [31].

Diesel fuels are imported from more diverse regions compared to gasoline: Hungary, Romania, Bulgaria, Croatia, and Slovakia. Paraffin, bitumen, petroleum coke, and lubricants come from a wider range of locations [31].

Most market participants in wholesale gasoline trade are supplied from domestic sources, unlike previous years when the majority of market participants sourced this petroleum product from imports [31].

Compared to 2023, in 2024 the trend of decreasing the number of countries from which significant quantities of petroleum products are imported has continued. Hungary, Romania, Bulgaria, Croatia, and Slovakia are the countries from which about 80% of petroleum products are imported.

6. CONCLUSION

Gross electricity production in the Republic of Serbia in 2024 amounted to 37,489 GWh, which is 6.5% lower than in 2023. Thermal power plants achieved a 5.25% decrease in production compared to 2023, and due to poor hydrology, hydroelectric power plants produced 13.5% less energy than a year earlier. Wind power plants recorded an increase in production, by almost 27% compared to a year earlier (1,354.06 GWh in 2024, 1,067.94 GWh compared to 2023), as well as solar power plants, which produced 3.5 times more energy in 2024 (162.68 GWh) compared to 2023 (46.56 GWh).

The gross production of electricity from thermal power plants in 2024 was 23,220 GWh (61.94% of total production in 2024), which is 5.25% compared to production in 2023. The volume of electricity generation from thermal power plants depends on the optimization of business profitability achieved by EPS AD through the purchase of solar-generated electricity on the market at lower prices, on the overhaul schedule of increasingly aging capacities, as well as on the obligation to gradually reduce coal-fired production in accordance with the National Emission Reduction Plan for major pollutants originating from old large combustion plants

During 2024, the units of the TENT Branch achieved t, amounting to 14,981.3 GWh. One of the reasons for the reduced production was the capital overhaul of the TENT A2 unit. The units of the TPP Kostolac, during 2024, achieved production at the power plant interface in the amount of 6,292.8 GWh, which is slightly lower than in 2023, when it amounted to 6,343.3 GWh. It is important to note here that during 2024, a major overhaul was carried out on unit B1, but also that the new unit B3 entered operation, which mitigated the consequences of the aforementioned overhaul.

What is important to emphasize is that the thermal power plants achieved 99% of the planned generation. Based on an analysis of historical data, it can be concluded that the thermal power plant units spent significantly more time in cold reserve compared to previous years. For example, in 2019, when electricity generation from thermal power plants was 2.3 GWh higher than in 2024, the average time spent in cold reserve amounted to 173 hours, while in 2024 it reached as much as 681 hours. Furthermore, in 2019 only the units in TPP Kolubara and TPP Morava were placed in cold reserve during certain periods of the year, whereas in 2024. only 3 units³⁴ out of the total 18 units were placed in cold reserve.

When it comes to the purchase and sale of electricity that EPS JSC realizes for the purposes of optimizing and balancing the balance, the situation was previously variable and this is mainly due to theunpredictable hydrological conditions, the reliability and overhauls of domestic thermal capacities, price volatility on powerexchanges, seasonally more favorable prices from solar power plants, and the pace of renewable energy source integration mentioned . In 2023, sales increased sharply compared to the previous year, 2022, and amounted to 1,652 GWh (corresponding to an increase of 1,510 GWh), only to decline again in 2024, to 903 GWh. On the other hand, electricity purchases in 2023 amounted to 723 GWh (2,555 GWh less was purchased compared to 2022), while in 2024 EPS JSC purchased 2,701 GWh on the stock exchange. Amendments and supplements to EPS JSC plans also envisaged higher electricity purchases compared to the adopted Three-Year Business Plan, taking into account the movement of electricity prices on the market and the reduction in coal imports [105].

As for the fulfillment of the plan in terms of maintaining production capacities, in 2024, a major overhaul of the turbine was carried out on block A2 in TENT A and on block B1 in TE Kostolac.

³⁴ Units TEK0 A1, TEK0 B1 and TEK0 B2.

No overhaul was planned for blocks TE Kolubara A1 and TE Kolubara A2 in 2024, so increased current maintenance of the plant was carried out.

Total investments of EPS AD during 2024 amounted to approximately 654.5 billion dinars [106], which is about 26% more than the investments in 2023 (51.9 billion dinars).

In the reporting period, the company EMS JSC operated successfully. As many as 98.94% of the total number of planned inspections were carried out on the 110, 220 and 400 kV transmission lines. A total of 7,027.96 km of transmission lines of all voltage levels were overhauled, which is a very good result. The operational readiness of transformer stations and high-voltage equipment during 2024 was at a satisfactory level. All planned 400/x, 220/x and 110/x kV transformers were overhauled, and in addition to the planned work, during 2024 there were also engagements on corrective and interventional elimination of emerging deficiencies.

In 2024, the main investment activities in the transmission network were related to the implementation and management of investment construction projects, extensions, reconstruction and modernization of existing transmission system facilities. Good interconnection and good maintenance of the transmission system contributed to the greatest extent to the implementation of the necessary additional import of electricity and maintaining the system in safe and reliable operation. It can be considered that EMS JSC successfully fulfilled its role within the EES, which is also shown by the fact that in 2024 the average duration of outages was significantly reduced compared to the previous year, so the duration of planned outages was 9.22 minutes (18.33 minutes in 2023), and unplanned 15.99 minutes (37.88 minutes in 2023).

The total value of EMS JSC investments in 2024 amounted to approximately 9.7 billion RSD [107] which is about 15% more than the investments in 2023 (8.48 billion dinars). Further investment plans of EMS JSC, for the next 3-5 years, primarily include projects for the construction of electricity infrastructure that will enable increased transmission capacities, market development at the national level, increased reliability of the transmission system and security of supply to consumers, and increased possibilities for connecting new conventional and renewable sources of electricity.

As for the distribution system, during 2024, all activities related to the maintenance of power facilities were carried out in accordance with the plans of Elektro distribucija Srbije. The focus of the work was on regular maintenance, repairs and audits. In terms of the indicators of continuity of electricity supply, an improvement in the SAIFI and SAIDI indicators was registered at the level of Serbia in 2024. The average frequency of unplanned outages decreased from 6.42 outages in 2023 to 4.95 outages per user in 2024, while the average duration of unplanned outages per user decreased by 93 minutes. The average frequency of planned outages decreased from 1.49 to 1.38 outages per user, while the average duration of planned outages per user increased by 17 minutes.

In 2024, the number of requests for acquiring the status of a customer-producer and requests for connection of electricity-generating facilities intensified, which is reflected in the amount of energy they produced (3 requests more than a year earlier). This is very positive from the aspect of electricity production and the share of renewable sources, but Elektro distribucija Srbije notes that in order to resolve all the above requests, an increase in the number of employees in the relevant departments is necessary, in order to contribute to the faster processing of received requests.

During 2024, the total investments of “Elektro distribucija Srbije” totaled approximately 38 billion dinars which is about 67% more than the investments in 2023 (around 23 billion dinars) [108]..

When it comes to natural gas, the Republic of Serbia is a country highly dependent on imports. Domestic production of natural gas is on a declining trend, given that most gas fields are in the

final stages of exploitation, and that there have been no significant discoveries of new natural gas deposits in recent years.

After the highest recorded consumption in the Republic of Serbia in 2021, which was 3 billion m³, in 2024, annual natural gas consumption was slightly lower, amounting to around 2.86 billion m³. However, this value is still significantly higher compared to earlier periods, and 1% higher than consumption in 2023. In the consumption structure, natural gas consumption for electricity generation is 12.8% lower than in 2023. A slight increase in consumption was recorded in industry and heating plants, while the largest increase in consumption was recorded in households (10.4%) and in the public and commercial sector (6%). Consumption in the household sector of 403 million m³ is the highest ever recorded in this sector.

After the start of operation of the interconnection gas pipeline from the Bulgarian-Serbian border to the Serbian-Hungarian border in 2021, at the end of 2023, the interconnection gas pipeline with the Republic of Bulgaria also began operation. This has further improved the infrastructure standard for supply (N-1) at the level of the Republic of Serbia, reaching 146%. This interconnection opens the Serbian natural gas market for supply from the direction of Azerbaijan and LNG terminal in Greece. In this way, and with the possibility of receiving natural gas from other directions and at the Horgoš point of entry, the opportunity for significant diversification of supply sources has been opened. However, to use the full capacity of the interconnection gas pipeline with the Republic of Bulgaria, it is necessary to construct the additional infrastructure (Trupale regulating station, Pojate metering and regulating station, etc.).

Given the very complex geopolitical relations, it is necessary to continue to work on increasing the diversification of supply sources and the construction of new interconnections (with Romania, North Macedonia, Croatia, etc.). In addition, in order to ensure gas for the market's needs and in case of emergencies, disruptions in supply from the largest import routes, it is crucial to implement the project for the expansion of the UGSF Banatski Dvor.

From the point of view of security of supply, it is necessary to intensify activities on assessing the condition and performing preventive maintenance of the transmission system, especially the oldest parts of the system under the responsibility of Transportgas Serbia LLC. Testing of transmission pipelines with the so-called "Intelligent" or "Smart" Pipeline Pigging Services should be done over a length of 1,200 km. The obtained test results will accurately define the percentage and location of damage to the gas pipeline and will enable quick and efficient repair of damage by reconstructing the affected sections. The determination of the condition of the existing high-pressure main gas pipelines from Horgoš to Niš (approximately 500 km long) should be the basis for a techno-economic assessment of the feasibility of upgrading and modernizing this section, or the possible construction of a new parallel gas pipeline.

In the case of distribution systems, the gas supply and delivery quality indicators (SAIFI and SAIDI) for 2024 have values close to the averages of the last ten years. However, the differences between the average and the maximum values indicate a significant disparity in the dependability of some distribution systems. Therefore, it is necessary for distribution systems in which significantly higher indicator values occur to take adequate measures to eliminate the causes, primarily unplanned interruptions. Through preventive activities, inspections and corrective maintenance, it is necessary to significantly improve their operational reliability and security.

When it comes to crude oil and petroleum products, the implementation of the new Action Plan and the establishment of the system of mandatory stocks of the Republic of Serbia, along with the filling schedule for storage facilities, are aimed at increasing supply security.

Every year, the Energy Reserves Administration ensures the acquisition of new quantities of petroleum products, as well as contracts for rights to option purchases, in accordance with the Law on Commodity Reserves and Directive 2009/119/EC. It is necessary to implement the

planned schedule for establishing mandatory stocks with the aim to ensure quantities for 90 days of imports or 61 days of average daily consumption of petroleum products in the Republic of Serbia.

Considering that by 2024, the amount equivalent to 42 days of average daily consumption has been secured, significant procurement will be required in the coming period to meet the projected quota within the defined timeframe.

Compared to the previous period, the capacity for storing mandatory stocks of the Republic of Serbia in public ownership has been increased, and new quantities of petroleum products have been stored. At the same time, active work is being done on the reconstruction of the existing and the construction of new storage capacities at existing terminals, as well as exploring alternative financing modalities for the construction of completely new storage capacities.

The declining trend in crude oil production in the country, which requires an increase in imports and greater dependence of the Republic of Serbia on imported quantities, is still ongoing.

The negative trend in crude oil production in the country can be partially halted by investing significant funds in the exploration and exploitation of new oil deposits, both in terms of geographic locations and deeper layers of existing deposits. In addition, secondary and tertiary recovery methods, in line with the latest global trends in this field, can be introduced into the production process.

The construction of a product pipeline network through the implementation of the “Product Pipeline System through Serbia” project and its connection with neighbouring countries would enable safe and secure transportation as well as a sufficient supply of petroleum products at all times.

The existing import capacities (road, rail, and water) are not sufficient to fully supply the market in the event of a disruption in supply

In considering the use of railways for the supply of crude oil from new directions, it was concluded that the existing infrastructure does not meet the needs for potential supply routes.

Addressing the existing issues in railway infrastructure by constructing new or reconstructing existing railways and increasing axle load capacity would enable the transportation of larger quantities of petroleum products by rail, both for imports and exports, which would significantly improve the security to the market of the Republic of Serbia with these energy sources.

The issue of having only one supply route for crude oil still remains. This is part of the pipeline infrastructure of the former Yugoslav oil pipeline, which is managed by Transnafta JSC.

Securing a new pipeline supply route for crude oil imports in the coming period is of importance, as the establishment of new interconnections would provide the Republic of Serbia with significant flexibility both in terms of quantities and types of oil. In this regard, the project for the construction of the Hungary–Republic of Serbia oil pipeline is particularly important, with the preparation of project-technical documentation in its final phase. A spatial plan for the special-purpose area has been adopted, public interest has been declared, and the resolution of property and legal relations along the pipeline route is to follow.

During the reporting period, there was no disruption in crude oil supply relative to the planned energy balance. Nevertheless, with the introduction of sanctions on Russian-origin oil, the supply of the Pančevo Oil Refinery became more difficult, as only a limited range of crude oils of lower quality was imported from the market.

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