REPUBLIC OF SERBIA

SECURITY OF SUPPLY STATEMENT

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1. INTRODUCTION

1.1. Legislative and Regulatory Framework of the Energy Sector

The basic legal and strategic documents which regulate the operation of the energy sector and define and implement the energy policy:

- Energy Law, adopted in December 2014 (Official Gazette of the RS, no. 145/2014) [1],
- Energy Sector Development Strategy of the Republic of Serbia for the period 2015-2025 with projection up to 2030 [2], and
- Energy Balance

These documents define the general objectives in terms of security of supply of market with energy and energy sources, and certain guidelines and frameworks for the adoption of other acts that further and closer define this issue.

Energy Law, among others, regulates:

- energy policy objectives and manner of its implementation,
- conditions for reliable, secure and high quality supply of energy and energy sources for a secure customer supply,
- energy and energy sources customer protection, conditions and manner of performing energy activities,
- conditions for the construction of new energy facilities,
- status and scope of the Energy Agency of the Republic of Serbia,
- use of renewable energy sources,
- organization and functioning of the electricity, natural gas, petroleum and petroleum products markets,
- the rights and obligations of participants in the market,
- establishment of ownership on the network operator systems,
- field of heat energy as the energy industry, and its production, distribution and supply, etc.

Energy policy of the Republic of Serbia shall be diluted and implement using Energy Sector Development Strategy, Strategy Implementation Program and Energy Balance of the Republic of Serbia.

The Strategy is a document that outlines the energy policy and planning of energy sector development. Strategy is adopted by the National Assembly of the Republic of Serbia at the proposal of the Government for a period of at least 15 years. The competent Ministry prepare a report every year for the Government on the realization of the Strategy.

Strategy Implementation Program defines the conditions, manner, dynamics and measures for the implementation of the Strategy. The program is adopted by the Government, for a period of up to six years on the proposal of the Ministry in charge of energy affairs. The Ministry monitors the achievement of the Program and, if necessary, propose its adjustment to the actual needs at least every other year. The Government submits to the National Assembly an annual report on the Strategy and Programme implementation, which comprises: the results accomplished against the objectives set by the Strategy, or the Programme for the year in which the annual report on the Strategy and Programme implementation is being submitted; estimated effects of the

achieved results and their impact on the Programme in the upcoming year; a proposal of measures for a more efficient Strategy and Programme implementation; estimated needs for adjusting the Programme and possible Strategy adjustment to the actual needs. RS Government in accordance with the Strategy and Program brings national action plans that more closely define development objectives and measures for their implementation.

Energy Balance determines the annual need for energy and energy sources (expressed on a monthly basis), which is necessary to provide for the reliable, safe and quality supply of customers. It also emphasizes the rationality of energy consumption and energy optimization of resources and the required amount of energy, and energy sources, defines the required level and structure of energy stocks and spare capacity. Required contents of the energy balance are: balances of electricity, coal, oil, oil products and biofuels, natural gas, thermal energy and renewable energy. RS Government brings the Energy Balance on Ministry's proposal, by the end of December of the current year for the following year. The Ministry monitors the implementation of the Energy balance, analyze its performance in the previous year and, if necessary, propose to the Government measures to ensure its implementation.

Ministry monitors the implementation of the National Action Plan For Renewable Energy and every two years submit a report about that to the Government.

1.2. Institutional Framework Governing the Energy Sector

The institutional framework for the energy sector is determined by the Constitution, the Law on Energy and Law on Ministries [3].

In the energy sector of the Republic of Serbia, the jurisdiction primarily have:

- The Government of the Republic of Serbia,
- Ministry of Mining and Energy and
- Energy Agency of the Republic of Serbia.

The Government of the Republic of Serbia prescribes conditions for delivery and supply of electricity, oil and natural gas, as well as measures to be taken in the event of an endangered security of energy and energy sources supply due to disturbances in the power system or the energy market. The Government adopts the Preventive Action and Contingency plan, in order to ensure safety of natural gas supply. Preventive Action plan contains a risk assessment in terms of achieving security of supply, as well as measures to mitigate the identified risks related to the required transmissionation capacity in order to meet the total demand for natural gas and to secure the supply of certain groups of final customers of natural gas. The Contingency plan determines measures, energy service companies which will be responsible for ensuring the security of the transmission system and the security of supply of certain groups of end customers, the quantity and capacity of natural gas in case of general shortage of natural gas. In case of compromised security of customer supply or energy system, due to insufficient offer in the energy market or the occurrence of other extraordinary circumstances, the Government provides measures and limits the supply of electricity or natural gas. The Government can also provide special conditions for the import or export of certain types of energy, method and conditions for determination and price control, obligation to supply only certain customers or special conditions for energy activities with minimal disruption of the energy market in the region. If the safety of the supply is endangered because of the lack of oil offer in the energy and energy source market or because of the occurrence of other extraordinary circumstances, the Government can approve amendment of the limits of certain characteristics of petroleum products quality that can be put on the market of the Republic of Serbia for a period not exceeding six months.

Ministry of Mining and Energy [4] performs state administrations related to: energy, energy policy and planning of energy development in the field of electricity, natural gas, oil and oil derivatives, the energy balance of the Republic of Serbia, the oil and gas industry, strategy and policy of energy security, development of annual and medium-term programs of energy security and providing material and other conditions for the implementation of these programs, mandatory and other reserves of energy sources, safe pipe transport of gaseous and liquid hydrocarbons, manufacturing, distribution and supply of thermal energy, rational use of energy and energy efficiency, renewable energy, environmental protection and climate change in the field of energy, coordinating activities in connection with investments in the energy sector, as well as other duties specified by law.

Energy Agency of the Republic of Serbia (AERS) [5] was established in June 2005, on the basis of the Energy Law 84/04. Position, operating mode and activities of AERS are regulated by the Energy Law (Official Gazette of the RS, no. 145/2014) [1]. AERS is the only regulatory body for energy sector and was established in order to promote and direct the development of the electricity and natural gas market on the principles of non-discrimination and effective competition, through the creation of a stable regulatory framework, as well as to perform other tasks established by the mentioned law. AERS is an independent legal entity and independent from the executive authorities in performing their duties, as well as from other state agencies and organizations, legal entities and individuals engaged in the energy industry. Members of the Council are elected by the National Assembly, thus acquiring independence in decision-making from its purview.

The law regulates the tasks performed by AERS. In performing these tasks AERS take measures that, among other things, contribute to achieving the following objectives: ensuring secure supply of energy through efficient operation and sustainable development of the energy system, 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 gives approval to market and technical rules, system development plans, brings the methodology for determining the price for access to the transmission or distribution of electricity, rates of access to transmission, distribution and storage of natural gas and the cost of access to the system of oil transport pipelines and systems for the transportation of oil derivatives.

1.3. Working Group on Security of Supply

Since 2005, the competent Ministry in charge of energy sector introduced the practice of forming Working Group to review and monitor the situation regarding security of energy and fuels supply in the Republic of Serbia. The main task of the Working Group is monitoring the situation regarding reliable and optimal supply of energy market. The working group is formed by a decision issued by the Minister. Meetings are held on a monthly basis during the hole year and more often, if it is necessary, depending on the situation.

Task of the Working Group is consideration and monitoring security of energy and energy sources supply, proposing appropriate measures, preparing the basis for a report on the security of electricity and natural gas supply and proposing measures in case the compromised security of customer supply or energy system operation, due to insufficient offer on the energy market or the occurrence of other extraordinary circumstances.

Working Group members are representatives of Ministries, PE "Elektroprivreda Srbije", PE "Elektromreža Srbije", PE "Srbijagas", NIS JSC, Serbian Association of heating plants, Provincial Secretariat for Energy and Mineral Resources, Energy Administration of the Belgrade city, Energy Agency and Belgrade power plants.

Energy entities deliver Reports on activities for the Working Group meetings which contain information on the operation of the energy sector, their operating status and readiness, actual and potential problems, as well as projections for the next period (30 days).

1.4. Other Important Acts for the Functioning of the Energy Sector

1.4.1. Ordinance on Terms of Energy Supply

Ordinance on Conditions for Delivery and Supply of Electricity, (Official Gazette of the RS, no. 63/2013) [8] shall regulate more specific terms of energy supply, as well as the measures taken in case the security of energy supply has been jeopardized due to the functional disruption of the energy system or the disruption in the energy market in the Republic of Serbia, namely:

- Terms and procedure of granting approval for connection to the electric energy transmission or distribution systems,
- Measures to be undertaken in case of short-term disruptions caused by breakdowns and other unforeseen circumstances whereby safety of the energy system operation is jeopardized, as well as due to unforeseen and necessary works on maintenance of electric power facilities and required works on the expansion of the electric power system, and also other terms and measures for the purpose of supplying customers with electric energy,
- Measures to be undertaken in the case of a general electric power shortage, terms and conditions for undertaking measures and the schedule of restricting energy supply, as well as measures of energy saving and rational consumption in case of a general energy shortage,
- Terms and conditions of electricity supply suspension, as well as the rights and obligations of system operators, suppliers, or the public supplier and final customers,
- Terms and conditions for rational use of energy and energy saving,
- Method of calculation of unauthorized take-off of energy,
- Terms and conditions for the supply of electricity to customers,
- Terms and manner of fulfilling responsibilities of the supplier and public supplier.

1.4.2. Ordinance on Terms of Natural Gas Supply

Ordinance on terms of natural gas delivery and supply (Official Gazette of RS, No. 47/06, 3/10 and 48/10) [9] presents detailed terms of delivery and supply of natural gas, as well as measures to be taken in case of failing safety of natural gas delivery and supply to end-users due to disruptions in transmission or distribution system operation, or disturbances in the natural gas market in the Republic of Serbia, as follows:

- Conditions and procedure of granting approval for connection to the transmission or distribution system of natural gas,
- Measures to be taken in the event of short-term disruptions caused by failures and other unforeseen circumstances which threaten the safety of transmission, and natural gas distribution system, as well as the necessary maintenance of energy facilities and required works on the upgrade of the system, as well as other conditions and measures for supplying customers with natural gas;
- Measures to be taken in case of general shortage of natural gas, due to the circumstances referred to in Article 164 of the Law on Energy,

- Conditions and methods of the suspension of natural gas supplies,
- Conditions and rational use of energy and saving natural gas,
- Terms and methods of measures and schedule constraints of natural gas supply, as well as measures for saving and rational use in case of general shortage of natural gas,
- Conditions of supplying privileged end-users' facilities to whom cannot be suspended supply due to outstanding liabilities for delivered natural gas or in other cases,
- Method of regulating relations between the supplier and the end-user to whom cannot be suspended natural gas supply,
- Method of measuring natural gas quantities,
- Calculating method for unauthorized natural gas take over,
- End-users public information.

According to the provisions of this by-law regulation, in the case of short-term disruption of natural gas supplies, caused by breakdowns in its facilities, equipment, pipelines and installations for the transmission and distribution of natural gas, and other unforeseen circumstances which threaten the safety of transmission and distribution system, due to unforeseen reparation, reconstruction and maintenance of transmission and distribution systems as well as required system expansion works, the transmission or distribution system is required to measure the degree of a disruption, and take the necessary actions to bring the system in a safe and uninterrupted operation as well to determine the terms of use the remaining capacity of production, transmission or distribution systems and develop the plan for limiting the delivery of natural gas.

The plan for limiting the delivery of natural gas comprises of the following measures: replacement of natural gas with other energy sources, limit supplies of natural gas and the suspension of natural gas supplies.

This Regulation set forth the restrictive measures to be taken in case of general shortage of natural gas, conditions and terms of suspension of natural gas supplies, conditions and rational use of energy and saving natural gas, as well as objects of end-users to whom cannot be suspended natural gas supply and methodology for regulation of the relation between the supplier and the end-user to whom cannot be suspended natural gas supplies.

The transmission and distribution system operators and public suppliers are obliged in case of general shortage immediately inform the ministry about the occurrence of general shortage. The Ministry, on the basis of this notice as soon as possible submits a proposal to the Government for a decision on the implementation of measures under Article 164 of the Energy Law.

1.4.3. Regulations of Commodity Reserves

In the part of security of supply, the area of oil is regulated by the Law on commodity reserves which regulates the conditions for the formation, financing, deployment, use and restoration of the obligatory reserves of oil and petroleum products, provision and maintenance of space for storage, as well as the operation and management of the compulsory reserves and storage facilities on the territory of the Republic of Serbia.

2. STRUCTURE OF ENERGY SECTOR

The energy system of the Republic of Serbia is consisted of oil, natural draft, coal, power engineering sector, the sector of thermal energy and renewable energy sources. This chapter provides a brief overview of the basic data relating to the mentioned energy sectors, while a detailed description will be given in the context of specific chapters.

2.1. Crude Oil Sector

Exploitation of domestic crude oil reserves is performed within the limits of NIS a.d. (in 2015 it amounted 1.073 mil. tons, which is 37% of total needs). The Oil Industry of Serbia a.d. (NIS a.d.) is the only company in Serbia engaged in crude oil and natural gas exploration and production. Since 25th January 2009 the majority stock holder (owner) in NIS is the Russian company Gazprom Neft.

Production of petroleum products is carried out within the two refineries which are a part of NIS a.d.: Pancevo Oil Refinery and Novi Sad Oil Refinery (in 2015 domestic production of petroleum products amounted 3.041 mil. tons, which is 90.6% of total needs for petroleum products).

The only service provider - operator is JP Transnafta, which is founded on 1st October 2005, until when the service was carried out within NIS company. The business activities of transportation of crude oil through crude oil pipelines and petroleum products through product pipelines are the regulated busiess activity of general interest and is carried out by JP Transnafta by regulated prices.

Делатност промета нафте и деривата нафте укључујући и биогорива и компримовани природни гас и складиштења, карактерише велики број привредних субјеката. Издато је 20 лиценци за складиштење нафте и нафтних деривата, 41 за трговину нафтом и дериватима нафте на велико, а 462 за трговину дериватима нафте на мало. Увоз деривата нафте је слободан, а цене су тржишне. Малопродаја деривата нафте на територији Србије се обавља кроз развијену и разгранату трговачку мрежу од 1450 малопродајна објеката.

The activity of trade of crude oil and petroleum products including biofuels and compressed natural gas and storage is operated by a large number of economic entities. There are 20 licenses being issued for crude oil and petroleum products storage, also 41 for crude oil and petroleum products wholesale and 462 for crude oil and petroleum products retail trade. The import of crude oil is liberal and the prices are commercial. The retail trade of petroleum products on the territory of the Republic of Serbia is performed through the developed and outspread trade network of 1450 retail facilities.

Total consumption of petroleum products as final energy-generating product amounted 3.118 Mtoe, out of which 0.426 Mtoe was spent for non-energy purposes and 2.692 Mtoe was spent for energy purposes whereby mostly in traffic sector 76.92%, then in industry 15.31%, in agriculture was spent 4.1%, and in households about 1.58%, while the rest of consumers participate with 2.07%.

2.2. Natural gas sector

Natural gas sector comprises of:

- Exploatation of domestic natural gas reserves within Serbian oil prodiction company NIS a.d. (production in 2015 has been 586 million m3),
- Natural gas processing within gas refanery,

- Natural gas import (one direction from Russia via Ukraine and Hungary, total amount of 1.731 million m3 in 2015),
- Storage of natural gas and storage management (underground storage facility Banatski Dvor, capacity of 450 million m3 of natural gas),
- Natural gas supply,
- Natural gas transmission and transmission management (Transportgas Srbija a.d. and Yugorosgaz a.d.),
- Natural gas distribution and distribution management (34 companies).

In 2015, natural gas consumption in Serbia had following structure:

- Systems of energy transformation - 44%;
- Energy sector - 6%;
- Transmission and distribution losses <1%;
- Non-energy consumption - 5%;
- Sectors of final energy consumption - 44%.

In process of natural gas transformation in other forms of energy, highest share had district heating plants - 52%, followed by CHP plants with 18% and industrial energy plants with 13%.

The highest share within final energy consumption for energy purpose had industry (63%) followed by households with 19%, agriculture and trafic with 4% and other consumers with approximately 14% share.

2.3. Coal Sector

Coal mining in the Republic of Serbia takes place in the context of:

- Mining of PE Resavica (in 2015 it produced 0.570 million tons of coal)
- Underwater exploitation in Kovin (in 2015 it produced 0.234 million tons)
- Surface coal mining in two major mines in Kolubara (in 2015 domestic production was 28.7 million tons) and Kostolac (in 2015 production was 8.3 million tons of coal), which are located within PE EPS.

Of the total domestic production of coal, 98% comes from surface exploitation, and the rest of the underground and underwater exploitation. Domestic production mainly produces low-quality lignite, so the need for higher quality types of coal covered from imports. That is the reason why the domestic production satisfies 98.5 of the total demand for coal and the rest is imported.

Import includes import of coal shortage types of coal and coke for the needs of metallurgical complex and high-calorie coal for the industry, and the brown coal for different consumers. Total domestic coal production in 2015 amounted to 37,945 million tons, or 7.222 Mtoe, while the total amount of coal available for consumption is about 7.878 Mtoe. Of this amount for the transformation process has been spent up to 7.497 Mtoe, of which 6.836 Mtoe (91%) in thermal power plants, and the remaining of 9% in industrial power plants, heating plants, blast furnaces and coal processing.

Within the processing of coal in Vreoci, which is part of PE EPS, in 2015 was produced 311,907 tons of dry lignite.

Final consumption of coal in 2015 amounted 0.666 Ktoe of which is in sector that is no energy sector consumed 0.029 Mtoe, and in energy purposes 0.637 Mtoe. In the structure of final

consumption for energy purposes, the participation of industry is 48%, 41% of households and other sectors with 11%.

2.4. Energy Sector

Capacities for the production of electricity in the Republic of Serbia, for the most part are owned by PE EPS (99%), and their structure is:

- Thermal Power Plant (TPP), output power of these plants is 3,971 MW,
- Thermal Plant- heating plant (TP-HP), with power 249 MW,
- Hydroelectric power plant (HE) with output power of 3,010.6 MW (including small hydro plants), actually 3,045.6 MW with facilities on the territory of AP Kosovo and Metohija,
- Wind power plants, with power 0.5 MW
- Solar power plants, with power 9.29 MW
- Power plants on biogas, with power 4.87 MW,
- Industrial power plants.

In about thirty industrial enterprises there are power stations that enable production of electric and thermal energy, capacity of 250 MW, of which the largest number was not operational.

Total electricity production in 2015 was 38,300 GWh (3.293 Mtoe). The largest part of production was realized in thermal power plants (71%) and hydropower plants (28%). Thermal-heating plants and industrial power plants in total electricity production together accounted for about 1%. Import of electricity was 5,877 GWh (0.505 Mtoe), export 6,442 GWh (0.554 Mtoe), so that net gross export amounted to 565 GWh (0.049 Mtoe).

Power consumption of the energy sector in the same year amounted to 13% of the generated electricity. Losses in the transmission and distribution system amounted to 14% of the total electricity production.

Final electricity demand was 27,562 GWh (2.370 Mtoe). Electricity as final energy is consumed mostly in households (51%), then in industrial plants along with the construction sector (27%), and transport, agriculture and other consumers (22%).

In the energy sector following energy entities have a part:

- Public Enterprise Serbian Transmission PE EMS, which is involved in the transmission of electricity, transmission system operation and organization of bilateral and balancing market
- Public Enterprise PE EPS performing activities of electricity generation, electricity distribution and supply of electricity (in the free market, regulated public/guaranteed supply and backup supply)
- Other electricity generators
- Other electricity suppliers.

In Serbia is a large number of licensed electricity suppliers (at the end of 2015 there were 90, and that number is increasing). Only half perform this activity mainly in the form of cross-border traffic for transit and trade among the suppliers, including PE EPS, within Serbia. PD EPS Supply is determined by the act of the Government of the Republic of Serbia for public supply of electricity at regulated prices to customers who have a legal right.

2.5. Thermal Energy Sector

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

- Power plants within the district heating system
- Power plants
- Cogeneration facilities
- Industrial power plants
- The individual boiler rooms that are not covered by energy balance.

Centralized heat supply exists in 57 towns in Serbia, with the total installed thermal capacity of boilers 6.587 GW.

Industrial power plant are used to produce thermal energy for needs of different industrial process. Except for manufacturing processes, thermal energy produced in these power plants is also used for heating of working space. In particular industrial enterprises are power plants that provide combined heat and power generation (it is estimated that in 2015 9,580.7 TJ of heat and 371 GWh of electricity was produced).

Production of thermal energy takes place in thermal power plants and cogeneration facilities. These are the following objects in the composition of PU EPS:

- Power plant Nikola Tesla A Obrenovac for district heating (steam coal blocks)
- Power plant Kostolac A for district heating of Pozarevac and Kostolac (steam blocks for coal)
- Power plant Kolubara for district heating of Lazarevac
- Cogeneration facility Novi Sad, Zrenjanin and Sremska Mitrovica for district heating and process steam (steam blocks for the gas and liquid fuel).

Natural gas, coal, oil products and biomass are used for the production of heat in district heating plants. In 2015, in the power stations was spent 564,446 million m^3 of natural gas, 196,884 tons of coal, 93,463 tons of petroleum products and 6,576 tons of biomass.

The thermal energy production in 2015 amounted about 35,458.03 TJ or 0.847 Mtoe. The largest part of the production was achieved in industry (27%) and power stations (64%).

Distribution losses were 3,409.26 TJ, or 0.081 Mtoe and consumption of the energy sector was 1,962.38 TJ or 0.047 Mtoe. Final energy consumption in 2015 amounted to 30,086.39 TJ or 0.719 Mtoe. When it comes to this amount, in industrial plants was spent (31%) and in household (58%). Other consumers accounted for 11% of final energy.

2.6. Renewable Energy Sector

Renewable energy sector includes:

- The production of geothermal energy,
- Use of hydropower potential, solar and wind energy,
- The production of solid, liquid and gaseous biomass,
- Import and export of biomass,
- The production of electrical and thermal energy from plants using renewable energy sources.

Balance of renewable energy for 2015, included the production and consumption of electricity from large and small watercourses, geothermal energy, solid biomass (firewood, pellets, briquettes), biogas, solar energy and wind energy. In 2015, renewable energy accounted for 19.6% of the domestic production of primary energy.

Electricity production from large and small watercourses was included in the balance of the total electricity production in the Republic of Serbia and was 10,986 GWh or 0.945 Mtoe. This means that in 2015 the hydropower plants produced 29% of the total gross electricity generation.

Geothermal energy production is followed by the Statistical Office of the Republic of Serbia within their statistical surveys and in 2015 this production was 0.0056 Mtoe which is less than 1% of the total domestic production of primary energy. This data did not cover use of geothermal energy through the use of heat pumps.

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 (heating). Biomass production in 2015 in the Republic of Serbia was 1.115 Mtoe, of which the largest part of 0.855 Mtoe was consumed in households.

2.7. Energy Resources

Energy resources and potentials of the Republic of Serbia consists of fossil, conventional (coal, oil and natural gas) and unconventional fuels (oil shale), as well as renewable energy sources.

Good quality energy reserves, such as oil and gas are symbolic and make less than 1% of geological reserves, while the remaining 99% of energy reserves are various types of coal, with the largest share of lignite from over 95% of the balance reserves. Considering the total geological reserves, among the most abundant coal reserves, the presence of still unexploited oil shale, at around 9% of the total geological reserves, is observed.

Coal reserves should, according to the projections of the consumption, meet consumption requirement until the end of this century.

Oil shale reserves are significant, but the conditions for their exploitation and technology for their use has yet to be defined, given that this is an unconventional fuel.

The volume of oil and natural gas reserves will last until 2030, and further exploitation, will depend on the translation of the off-balance reserves into balance reserves, as well as on the discovery of new deposits. Thus, the geological reserves of primary energy sources still represent a significant basis.

For the renewable energy sector, with the exception of large hydropower plants, it can be said that it is in the early stage of development. Estimated total technically available potential of renewable energy sources in Serbia is 5.65 Mtoe per year. From this potential 1.054 tonnes of oil equivalent of biomass and 909 thousand tonnes of oil equivalent of hydropower is already used.

Primary production includes exploitation, or use of domestic resources of coal, crude oil, natural gas and renewable energy sources (hydro potential, geothermal energy, and biomass). In Serbia 10,795 Mtoe of primary energy was produced in 2015. This production has satisfied more than 70% of the total demand for primary energy. The structure of domestic production of primary energy is as follows: coal production amounts to 7,222 Mtoe of the total domestic production of primary energy, while the remaining part is the production of crude oil and natural gas, hydropower and wind and solar energy, the production of firewood and geothermal energy.

Total primary energy consumption in 2015 was 15,235 Mtoe. Net import dependence of Serbia in 2015 was 29%. During 2015, mostly imported energy sources were: crude oil and petroleum products 52%, natural gas 25%, coal 14% and so on.

Primary energy was used for:

- Transformation in the thermal power plants, hydropower plants, thermal power - heating plants, heating plants, industrial power plants, oil refineries, coal processing, blast furnace;
- The consumption of the energy sector (auxiliary consumption);
- Losses in transmission and distribution of energy and energy sources;
- Direct consumption by end users.

In the consumption structure for the transformation processes, dominates the consumption of coal 58%, then 26% of crude oil, petroleum products 6%, natural gas 6% and 7% of the hydropower potential. Total consumption of final energy includes energy consumed in transformation processes as well as part of the total available primary energy which is not included in the processes of transformation and are directly consumed by end users.

Total final energy consumption in Serbia in 2015 was 8.885 Mtoe of which 0.546 Mtoe was consumed for non-energy purposes, while the consumption of final energy for energy purposes was 8.338 Mtoe.

By consumption sectors, final energy was most consumed in the household sector 28%, followed by industry 21%, then traffic 20%, while other sectors accounted for 31%.

On the other hand, in the final energy consumption, energy products consumption is dominated by oil with 35% and electricity with 27%, followed by natural gas with 11%, coal with 7%, thermal energy with 8%, while renewable energy (firewood) participate with 12%.

3. ELECTRICITY

Energy Law [1] in electricity defines the energy activities related to: electricity generation, combined generation of electricity and thermal energy, electricity transmission and electricity transmission system management, electricity distribution and electricity distribution system management, power distribution and management of the closed distribution system, electricity supply and wholesale electricity supply.

Energy activities of public interest, are carried out in accordance with this Law wich regulates the status of public companies. In the area of electricity those are: electricity transmission and transmission system management, electricity distribution and distribution system management.

An energy-related activity can be performed by a public enterprise, business entity or other legal entity or entrepreneur having a license for performing the energy-related activity, unless otherwise prescribed by this Law.

To perform these energy-related activities, all domestic and foreign entities must obtain a permit, ie license issued by the Energy Agency of the Republic of Serbia. The license is an administrative act on fulfilment of conditions stipulated by the Energy Law [1] and the Regulation on conditions related to expert personnel and the manner of issuing and revocation of licenses for performing energy activities.

License is issued for each energy activity separately. It is issued for ten years, and for the production of electricity, the combined production of electricity and thermal energy and thermal energy production for 30 years.

The basic structure of the electricity sector was established in 2005 upon the adoption of the Energy Law in 2004 [20], by unbundling and internal reorganisation of a common vertically integrated Public Enterprise "Elektroprivreda Srbije" (EPS) and establishment of Public Enterprise "Elektromreže Srbije" (EMS).

Public enterprises EMS and EPS were established on July 1, 2005 by the decision of the Government of the Republic of Serbia and both of them are 100% owned by the Republic of Serbia.

The Public Enterprise "Elektroprivreda Srbije" (EPS) is an energy entity involved in the activity of electricity production, combined power and heat energy production, electricity distribution and electricity distribution system management, electricity supply.

Within the PE EPS exist "EPS Distribucija" Ltd. Belgrade, PD "EPS - Snabdevanje" Ltd. Belgrade was established to perform activities of electricity supply including public (guaranteed) supply, PD "EPS Trgovanje" Ltd. Ljubljana with the position of foreign legal persons as well as companies in accordance with the provisions of the Brussels Agreement of August 2015.

Public Enterprise "Elektromreža Srbije" ensure secure and reliable power transmission, efficient control of the power system interconnected with the power systems of other countries, optimum and sustainable development of the transmission system aimed at satisfying the needs of customers and of the entire society, ensuring the functioning and development of the Serbian electricity market as well as its integration in the regional and European power markets.

Public Enterprise "Elektromreža Srbije", as the transmission system operator regulates and administers balanced electricity market, while SEEPEX as a market operator, regulates and administers the organized electricity market, respecting the principles of transparency and non-discrimination.

3.1. Electricity Market

The opening of the electricity market in the Republic of Serbia was conducted in stages:

- From 1 January 2013, end customers connected to the transmission network no longer had right to be supplied at regulated prices and had to buy electricity on the open electricity market;
- From 1 January 2014, end customers connected to the distribution system (except households and small consumers), no longer had right be to supplied at regulated prices and had to buy electricity on the open electricity market;
- From 1 January 2015 households and small electricity customers, in accordance with the law have the right to freely choose their suppliers on the market, as well as right to a public (guaranteed) supply if they do not choose another supplier.

Whereas:

- end customer is a legal or natural person or entrepreneur purchasing electricity or natural gas for its own needs;
- small electricity customers are end customers (legal persons and entrepreneurs) with fewer than 50 employees and a total annual revenue of up to EUR 10 million in dinar counter value, whose all facilities are connected to the electricity distribution system with the voltage level lower than 1 kV, and whose electricity consumption in the previous year was not higher than 30,000 kWh;
- guaranteed supply is a public service ensuring the right of households and small customers to the supply of electricity having prescribed characteristics in the territory of the Republic of Serbia, at reasonable, clearly comparable, transparent and non-discriminatory prices;

Pursuant to the provisions of the Energy Law, the end buyer which is not entitled to guaranteed supply, has the right to a backup supply in the event of: in case of bankruptcy or liquidation of the supplier that had supplied the customer until then, in case of termination or revocation of the license held by the supplier that had supplied the customer until then and if the customer has not found a new supplier upon termination of the agreement on supply with the previous one. The last resort supply is made automatically and may not last longer than 60 consecutive days. After the expiration of this period, if the end customer does not find a new supplier, the system operator shall suspend electricity supply to that customer.

On the basis of the conducted public tender procedure, the Government designates the supplier to perform last resort supply. The public tender procedure is conducted by the Ministry. In case that the last resort supplier is not selected, the Government shall designate a supplier that will temporarily perform the last resort supply, for a period not longer than six months, during which a new tender shall be announced and finalized. In case that the last resort supplier is not selected in the repeated tender procedure, the Government shall designate a guaranteed supplier that will perform the last resort supply, for a period not longer than a year. Currently, this role is performed by PE "Elektroprivreda Srbije" The price at which the guaranteed supplier shall carry out last resort supply may not be lower than the average price of electricity in the organised market for the previous year.

3.1.1. Participants in the Electricity Market

Energy Law [1] stipulates that players in the electricity market may be: an electricity producer, a supplier, a public supplier, the final customer, the electricity transmission system, the electricity distribution system operator and the market operator. The organised electricity market

participants may also be other legal persons, in accordance with the rules on the organised market operation. Electricity market players are obligated to submit all necessary data to the transmission, i.e. distribution system operator pursuant to the rules on transmission system operations [25], distribution system operations [26] and market code [27].

Table 1: Active licensess in electricity sector in year 2015 [5]

Activity	Active licenses
Electricity production	7
Combined power and heat production	3
Electricity transmission and transmission system operation	1
Elecricity distribution and distribution system operation	1
Electricity supply	82
Wholesale electricity supply	6
Ogranised electricity market operation	1

According to the Energy Law [1], the electricity market includes: bilateral, balance and the organized electricity market.

3.1.2. Bilateral Electricity Market

A bilateral electricity market is the market on which electricity is directly purchased and sold among the market participants on the basis of agreements on electricity supply (Energy Law [1]).

The agreement on electricity supply particularly defines the amount of electricity, the price and the period of supply.

The amount of electricity may be:

- determined in advance for each accounting period during the period of supply,
- determined on the basis of the recorded electricity consumption at the point of takeover during the supply period, and
- determined on the basis of the recorded electricity production at the point of takeover during the supply period.

Table 2 presents the relevant indicators of electricity market concentration in Serbia in 2013 and 2014.

Table 2: Electricity market concentration level in Serbia (2013 - 2014) [23]

Trade activity	2013			2014		
	Electricity amount [GWh]	The share of three suppliers with the highest trading volume [%]	The level of market concentration	Electricity amount [GWh]	The share of three suppliers with the highest trading volume [%]	The level of market concentration
Trading with EPS						
Sales to EPS	4	100	High	2,047	51	Moderately high
Purchase from EPS	3,297	54	Moderately high	980	39	Low
Trade between suppliers						
Sales	1,143	63	High	948	40	Low
Purchase	1,298	54	Moderately high	941	26	Low
Import and export of electricity						
Import	486	46	Moderately high	2,925	43	Low
Export	3,672	52	Moderately high	1,255	29	Low
Transit						
Transit	8,328	57		12,774	41	

At the end of 2014, from 39 active suppliers 6 suppliers occurs among the three dominant in each of the activities. The level of market concentration has decreased compared to 2013 in all the activities of the supplier, as well as in the activities of PE EPS. Table presents typical examples. When it comes to the purchase from PE EPS, the level of market concentration fell from moderately high in 2013 to a low concentration in 2014. Also in case of trade between suppliers in terms of sales, the level of market concentration fell from high in 2013 to a low in 2014 and purchase from a moderately high concentration to low. These processes are largely conditioned by the energy atypical year for PE EPS which in 2014 bought larger quantities of electricity from other suppliers, caused by big issues in the work of production capacity in the thermal sector caused by natural disasters in this year.

Table 3 presents the electricity consumption in Serbia (without APKM) in the period from 2013 to 2015. The consumption of end users of electricity in 2014 compared to 2013 was reduced around 2.8%. Electricity consumption decrease trend, observed in the period before 2013, has been maintained. However, in 2015 according to the balance electricity consumption is expected to increase. For now, there are no available data on the achievement.

Total number of metering points for customer delivery in Serbia without APKM (without metering points of facilities within Železnice Srbije/Serbian Railroad – 22 in total) at the end of 2014 amounted to 3,605,448. Compared to 2013, the number was increased by 0.7% (3,580,579) [23].

Table 3: Electricity consumption structure in the period 2013 – 2015 (GWh) [4]

Sector	2013	2014	2015
Industry and Construction	7,079	7,156	7,519
Transport	478	336	354
Households	14,146	13,802	14,192
Public and commercial activities	4,899	4,566	5,182
Agriculture	301	298	314
Final consumption	**26,903**	**26,158**	**27,562**

3.1.3. Balancing Electricity Market

Energy Law [1] provides that on the balancing electricity market the transmission system operator purchases electricity from and sell it to the balance electricity market participants for the purpose of balancing and ensuring the safe system operation. The price of electricity for the needs of system balancing and ensuring its safe operation is determined based on the market principle, in accordance with the rules on the market operation. The share in the balance market is regulated by an agreement concluded between the transmission system operator and an electricity market participant, in accordance with the rules on the electricity market operation.

Pursuant to Energy Law, the transmission system operator, with the prior approval of the Agency [5], shall adopt the Rules of Operation of the electricity market. The rules on the electricity market operation shall regulate in more detail: balance responsibility of market participants, balance electricity market, calculation of balance group deviations, calculation of financial offsets between balance responsible parties, the payment security instrument and criteria for determining the amount and the period for which it is required, calculation of electricity needed for balancing and ensuring safe system operation, the method for providing system services and other matters necessary for the electricity market functioning.

PE EMS, as the transmission system operator, is responsible for balancing the system and securing of system services in the electricity system in the Republic of Serbia [22].

Balancing is performed on the basis of the Rules of operation of transmission system and the "Contract for the provision of system services, procurement and delivery of emergency and balancing electricity" through activation of secondary control and issuance of orders for the tertiary control, based on the priority list of order of engagement [25]. Tertiary control is activated by the order of engagement of production capacities which the transmission system operator (EMS) used to be provided with by EPS.

From the aspect of frequency containment process in interconnection Continental Europe, ENTSO-E annually determines the primary reserve of active power for each control area. For 2015, PE EMS has provided 45 MW of necessary primary reserve. Frequency restoration implies the impact on the reference inputs of the primary regulators in order to eliminate stationary deviation of frequency and power exchange deviations in interconnection.

Required active power reserve in frequency restoration for control area is 160 MW, while on the other hand the total available frequency restoration reserve in PE EMS control area is 1,036 MW (of which 876 MW in hydro power plants and 160 MW in thermal power plants), so it can be concluded that PE EMS should not have problems in securing frequency restoration reserve in the coming five-year period.

Reserve replacement is a process that is superimposed on the frequency containment process and frequency restoration process in order to release the extent of frequency restoration.

The minimum amount of reserve replacement according to the Rules of Procedure of the transmission system is:

- 450 MW for positive reserve, at least 300 MW from production units in the control area of PE EMS;
- 150 MW for negative reserve from production units in the control area of PE EMS (production decrease, or consumption increase).

Assessing the possibility of contracting reserve replacement in the coming five-year period, taking into account the production adaptation, it cannot be said that PE EMS will be able to procure the entire reserve replacement within its control area.

Depending on the total developments on the electricity market, PE EMS may come in a situation where the small part of reserve replacement is purchases outside its control area. In this regard, work has begun to develop a procedure that will allow, in a first step, members of SMM block (PE EMS, MEPSO, and CGES) to exchange the reserve replacement.

Emergency exchanges used to take place in accordance with the contract EMS made with neighbouring transmission system operators.

3.1.4. Organized Electricity Market

Pursuant to Energy Law [1], the market operator shall pursue the activity of organizing and administering the organized electricity market and its connecting with organized electricity markets of other countries. Energy Law [1] prescribes that the Government shall closely regulate the organization and work of market operators, conditions and methods of operation of participants on the organized electricity market and other conditions which ensure the functioning of electricity market in accordance with the law.

The same law provides the market operator shall be responsible for the establishment of the organised electricity market, administering of the organised electricity market, efficient and functional connection 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 of neighbouring countries, in accordance with internationally defined principles and undertaken obligations.

3.1.5. SEEPEX

In July 2015, joint stock company SEEPEX [28] was founded, which will operate an organized electricity market (stock exchange) in Serbia. SEEPEX was formed as a partnership between Serbian transmission system operators PE "Elektromereža Srbije" (EMS) and European power exchange EPEX SPOT. The operational start of Serbian day-ahead electricity market is expected in mid-February 2016, under the condition of ensuring adequate readiness of the participants, and the fulfillment of the remaining regulatory issues for joining the SEEPEX.

3.2. Production, Transmission and Distribution Capacities

3.2.1. Production Capacities

3.2.1.1. Conventional Energy Sources

The total net installed capacity of the power plants in Serbia amounts to 7,291 MW. Within PE EPS, in lignite-fired thermal power plants, the installed capacity amounts to 3,971 MW, in hydro power plants 2,964 MW, in natural gas- fired or heat oil-fired thermal power plants 249 MW and in 13 small hydro power plants – 20 MW (Table 4). The lignite used in thermal power plants is produced in open pits which belong to PE EPS.

Table 4: Electricity generation capacities from 2013 to 2015[1] [4]

Technology	Installed power [MW]		
	2013	2014	2015
Hydro power plants	2,884	2,884	2,963.7
Thermal power plants (coal)	3,827	3,846	3,971
Combined heat and power plants (gas, fuel oil)	277	249	249
Small PE EPS power plants	20	20	20.88
All plants that are not owned by PE EPS, but PE EPS buys electricity from them			51.88
HP Gazivode			35
Total instaled capacity	**7,008**	**6,999**	**7,291**

The share of the capacities within thermal power plants (TPP) and combined heat and power plants (CHPs) amounts to 60%, while the hydro power plants (HPPs), including small HPPs cover 40%. There is also one pumped-storage hydro power plant among HPPs of PE EPS with 2x307 MW capacity which is very important for system operation, apart from covering an important energy share.

Production capacities, during the year 2013 and 2014, were organised in five daughter companies of PE EPS which hold the license for electricity generation: Hidroelektrane Đerdap llc, Drinsko-limske hidroelektrane llc, Panonske termoelektrane-toplane llc, Termoelektrane Nikola Tesla llc and Termoelektrane i kopovi Kostolac llc. Small hydro power plants owned by PE EPS were within companies for electricity distribution Elektrosrbija llc and Jugoistok llc. During 2015, the reorganization of PE EPS was carried out, and further status change of merger of subsidiary companies for the production of electricity and coal PE EPS.

[1] Small hydropower plants have installed power up to 10 MVA.

The construction of new production units is needed in order to replace the existing ones, which, due to outdated technology cannot meet the requirements of environmental protection, as well as to cover the possible increase in electricity consumption (which is predicted despite the negative trend of recent years).

3.2.1.2. Renewable Energy Sources

Pursuant to the Article 20 of the Energy Community Treaty (Official Gazette of the RS, no. 62/06) the Republic of Serbia accepted the commitment to apply European Directives in the field of renewable energy sources (hereinafter referred to as RES) - Directive 2001/77/EC for the promotion of electricity from renewable energy sources and the Directive 2003/30/EC for the promotion of biofuels or other fuels produced from renewable energy sources for transport. Since 2009 mentioned Directives were gradually replaced and in January 2012 they were repealed by a new Directive 2009/28/EC of the European Parliament and Council, dated 23 April 2009, on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

In accordance with the Directive 2009/28/EC [33] and the Decision of the Council of Ministers of the European Community dtd. 18 October 2012 (D/2012/04/MC-EnC) a very ambitious binding target was set for the Republic of Serbia, amounting to 27 % renewable energy sources in final gross energy consumption in 2020. At the same time, it was defined that the National Action Plan for renewable energy sources of the Republic of Serbia should be prepared, in compliance with the adopted template for the preparation of this document (Decision 2009/548/EC).

The Republic of Serbia has adopted the National Renewable Energy Action Plan [34] as a framework for the promotion of energy produced from renewable sources and has set mandatory national targets for the share of energy from renewable energy sources which defined the way of achieving binding national target.

Pursuant to the abovementioned and in order to increase the use of renewable sources, Republic of Serbia joined the countries that subsidize the production of electricity from renewable sources and introduced the most widespread model - stimulated fixed redemption price (the "feed-in" tariffs) with the guaranteed electricity takeover of 12 years.

Incentive measures can be used by energy entities that have acquired the status of a privileged producer within the meaning of the Energy Law. The privileged producer is entitled to incentive measures by concluding a contract on purchase of electricity with a guaranteed supplier.

The Government, at the proposal of the ministry responsible for energy affairs, adopts regulations that detail the conditions and procedure of acquisition, duration and termination of the status of privileged producer of electricity from renewable energy sources, the maximum capacity of all power plants using wind and solar energy that will get status of privileged producer, content and other elements of the contract on purchase of electricity. In accordance with the Energy Law Ministry monitors the implementation of the National Action Plan and submits the annual report to the Government (hereinafter: the Report). Also, in accordance with Article 15 of the Decision of the Ministerial Council of the Energy Community (D/2012/04/MC-EnC) signatories to the Treaty establishing the EnC submit report to the EnC Secretariat on progress in the promotion and use of energy from renewable sources every two years. The first report was made in 2014 (Official Gazette of the RS, no. 8/15) and contains data for year 2012 and 2013. The share of renewable energy in gross final energy consumption in 2013 was 19.10% and in 2014 20.1%.

The quantities of electricity taken over from renewable sources from 2013 to 2015 are shown in Table 5.

Table 5: Electricity taken from renewable sources (2013 – 2015)[2] [4]

Renewable energy sources	Electricity [MWh]		
	2013	2014	2015
Hydro power plants	10,853,000	11,617,008	10,798,358
(Small hydro power plants)	68,762.7	198,335.9	187,777.8
Biomass power plants	18,698.3	20,650.5	20,543.2
Solar energy	1,501	6,000	8,869.4
Wind energy	547	371.5	355.5
Total	**10,873,746.3**	**11,644,029.9**	**10,828,125.9**

3.2.2. Transmission Capacities

PE "Elektromreža Srbije" was established by the Decision of the Republic of Serbia. It performs electricity transmission and management of the transmission network as the transmission system operator pursuant to the Energy Law with obtained license.

Main activities of the Public Enterprise "Elektromreža Srbije" are:

- Electric energy transmission,
- Transmission system control,
- Organization and administration of balance electricity market.

Transmission system of Republic of Serbia includes 220 and 400 kV network and one part of 110 kV network.

Transmission lines 400 kV connect the largest and most important centres of production and consumption in Serbia. Mainly over this voltage level, whole power system of Serbia is interconnected with power systems of the neighbouring countries, allowing international trade of electricity. Transmission system makes Serbia part of a pan-European system for the transmission of electricity. Over interconnection lines Republic of Serbia is directly connected with eight countries and provides the transmission of electricity from north to south, from east to west and from the northeast to the southwest of Europe [22].

Transmission system of PE EMS is connected with the neighbouring power systems via twenty-two 400, 220 and 110 kV interconnection lines [22]. In addition to transmission lines and power plants transmission system includes other supporting systems (telecommunication system, remote control system, power consumption, etc.). All of this makes transmission system one of the most complex infrastructure systems.

The electricity transmission system of the Republic of Serbia which PE EMS is responsible for, is shown in Table 6.

[2] Small hydropower plants have installed power up to 10 MVA.

Table 6: PE EMS substations [36]

Facilities owned by PE EMS		2013	2014	2015
400/x kV	Number of facilities	16	17	18
	Number of transformators	23	24	29
220/x kV	Number of facilities	14	14	14
	Number of transformators	31	31	30
110/x kV	Number of facilities	6	6	6
	Number of transformators	13	13	14
400 kV	Number of facilities	3	3	3
110 kV	Number of facilities	4	4	4
Total	**Number of facilities**	**43**	**44**	**45**
	Number of transformators	**67**	**68**	**73**

Table 7: PE EMS transmission lines [36]

Lines owned by PE EMS		2013	2014	2015
400 kV	Number of OHL (km)	32	33	34
	Length of OHL(km)	1,613.72	1,613.66	1,630.04
220 kV	Number of OHL (km)	48	48	46
	Length of OHL(km)	1,884.47	1,884.47	1,845.51
110 kV	Number of OHL (km)	332	341	353
	Length of OHL(km)	5,578.68	5,641.47	5,785.78
	Number of cable (km)	2	2	2
	Length of cable(km)	6	6	6
Total	Number of lines (km)	**414**	**424**	**435**
	Length of lines (km)	**9,082.87**	**9,145.60**	**9,267.33**

3.2.3. Distribution Capacities

In accordance with the statutory amendments provided by the Reorganization program of "Elektroprivreda Srbije", to which the Government of Serbia gave its assent on November 27, 2014, the parent company Public Enterprise "Elektroprivreda Srbije" from July 1st is the founder of the subsidiary "EPS Distribucija" consisting of current companies "Elektrovojvodina", "Elektrodistribucija Beograd", "Elektrosrbija", "Jugoistok" and "Centar".

In Table 8, number and installed power of transformers of substations in distribution network is provided. Table 9 shows the structure of distribution lines in distribution network during the years 2013, 2014 and 2015.

Within the "EPS Distribucija" there are 34,657 transformer stations with a total installed power of 29,248 MVA and 159,852 km of distribution lines of all voltage levels. The process of taking ownership of the transformer station 110/x kV/kV from PE EMS ended in 2014, for 52 of the 53 stations for which the takeover process was initiated. Companies for distribution of electricity are now committed to maintain these facilities.

Most of the 110 kV overhead lines has been transferred into the ownership of PE EMS during the establishment of this enterprise in 2005. Some 110 kV overhead lines, which worked on the 35 kV voltage remained in the ownership of PE EPS, but over time their number decreased, so basically in 2015 there are no more such power lines owned by PE EPS, as can be seen from Table 9. In accordance with the Energy Law all underground cables are submitted to PE EMS and this process is ongoing.

Table 8: PE EPS substations [37]

Facilities owned by PE EMS		2013	2014	2015
110/10 kV	Number of facilities	27	28	26
	Instaled power [MVA]	1,615.0	1,677.5	1,583.0
110/20 kV	Number of facilities	49	49	49
	Instaled power [MVA]	2,608.0	2,671.5	2,734.5
110/35 kV	Number of facilities	68	75	75
	Instaled power [MVA]	3,314.0	4,070	4,063
110/X/Y kV	Number of facilities	33	34	34
	Instaled power [MVA]	1,939.0	1,969	1,981
35/10 kV	Number of facilities	589	589	587
	Instaled power [MVA]	6,313.4	6,313	6,273
10/0,4 kV	Number of facilities	25,542	27,535	25,682
	Instaled power [MVA]	9,434.6	11,209.2	9,488.4
20/0,4 kV	Number of facilities	8,044	8,126	8,204
	Instaled power [MVA]	3,051.8	3,086.8	3,125.5
Total	**Number of facilities**	**34,352**	**36,436**	**34,657**
	Instaled power [MVA]	**28,276**	**30,997**	**29,248**

Table 9: PE EPS transmission lines [37]

Lines owned by PE EPS		2013	2014	2015
110 kV	OHL (km)	150.70	150.67	2.06
	Cable (km)	31.60	31.60	31.60
	Total (km)	183.30	150.67	34.66
35 kV	OHL (km)	5,862.65	5,830.92	5,822.71
	Cable (km)	981.19	999.48	992.37
	Total (km)	6,843.84	6,830.40	6,815.08
20 kV	OHL (km)	6,333.93	6,441.34	6,481.82
	Cable (km)	2,718.68	2,809.85	2,906.07
	Total (km)	9,052.61	9,251.19	9,387.88
10 kV	OHL (km)	23,625.22	24,082.66	24,215.39
	Cable (km)	6,904.98	8,266.26	8,480.94
	Total (km)	30,530.20	32,348.92	32,696.33
0,4 kV	OHL (km)	92,515.16	94,628.98	95,102.87
	Cable (km)	12,885.65	15,299.23	15,814.87
	Total (km)	105,400.82	109,928.20	110,917.74
Total	**OHL (km)**	**128,487.66**	**131,134.56**	**131,624.84**
	Cable (km)	**23,522.10**	**27,406.42**	**28,225.85**
	Total (km)	**152,009.76**	**158,540.98**	**159,850.68**

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

3.3.1. Production Maintenance

Determining the required scope and dynamics of the maintenance, starts from the overview of overall state of the plant, analysis and assessment of the degree of realization of the repair and renovation program from the previous period, as well as routine maintenance, the possibilities of providing financial resources and the time required for the preparation and implementation of

planned activities, as well as the necessity to satisfy as much as possible electricity demand for the supply and sale purpose from its own capacities [38].

Maintenance program of electricity and heat production plant in 2013 and 2014 included the following activities: planning - preventive and corrective or emergency maintenance, and overhaul (investment maintenance).

Through regular ongoing maintenance, cyclic maintenance with a larger scope of work in the so-called "Capital overhaul", as well as the corresponding investment activities in the existing equipment (the "additional investments") satisfactory level of availability of equipment and facilities is achieved.

Maintenance program of power plants, besides other, included following main activities: reconstruction with the extension of the lifetime of block A1 in TPP "TENT" and block B1 in TPP "Kostolac", capital overhaul of block A1 in TPP "TENT", reconstruction with the extension of the lifetime of block A5 in HPP "Đerdap 1", as well as capital overhaul of blocks A1 and A2 in HPP "Đerdap 2".

Power plants maintenance program, among others, included the following main activities. Reconstruction of block no. 3 in TENT A, with the extension of its working life. Overhaul was carried out in 2014 and with a little delay completed during 2015. Major reconstruction of block no. 1 in TPP Kostolac B was also completed. Overhaul was completed in 2014 and in the first quarter of 2015 observed defects were eliminated. Major overhaul of block no. 2 in TENT A was carried out in 2015 (started and finished in the same year). In the area of hydropower the most important event was the revitalization of the aggregate number. 4 in HPP Djerdap 1, which was completed in 2013. That same year, in October, fourth unit in HPP "Bajina Basta" was commissioned, signifying the end of revitalization of this HPP. Also throughout 2014 and part of 2015 revitalization of block no. 5 in HPP Djerdap 1 was carried out.

The flood wave that occurred on 15 May 2014, made a strong impact on the progress of the maintenance program. The scope of regular maintenance has been reduced in favour of rehabilitation works of the flood. For some aggregates and blocks start of the overhauls was delayed, and for some it was shortened. Works on the revitalization of blocks B1 in TPP "Kostolac B" were not interrupted [39].

3.3.2. Transmission System Maintenance

Energy Law stipulates the obligation of the system operator to ensure safe and reliable transmission of electrical energy, which therefore implies adequate maintenance.

In 2013, in accordance with the Energy Law, handover of ownership of the TS 110/x kV between PE EMS and PE EPS was performed.

The most important work in 2013 is reconstruction of the transmission lines 186A and 186B/1/2 and their connection with the TS FAS, therefore securing a double supply of TS FAS.

Some other major works in 2014 on transmission lines include work on the reconstruction of transmission line 186AB, on section TS Kragujevac 2, TS Kragujevac 8, TS Crvena Zastava, as well as works on unravelling transmission lines and their connection with TS Vranje 4 (transmission lines 461 and 462, 1219/2, and 1190) [37].

Year 2014 from the standpoint of operation and maintenance of transmission lines was one of the most unfavourable, given that three all different climatic phenomena (floods and landslides, storm winds and the simultaneous occurrence of snow, ice and wind), led to large losses and damages on transmission lines.

In mid-May months of 2014, as a result of large amounts of rainfall, numerous landslides on transmission lines in western Serbia were activated, which threaten the operation of transmission lines and safe supply of customers. Landslides were activated on the 220 kV transmission lines no. 209/1 TS Bajina Bašta - TS Sremska Mitrovica 2 and 110 kV transmission lines no.106A/2 TS Valjevo 3 - TS Loznica and 106B/2 TS Valjevo 3 - TS Osečina, transmission line 1116 TS Krupanj - TS Osečina and transmission line 1176 TS Krupanj - TS Ljubovija. Due to changes in the flow of the river West Morava 110 kV transmission lines no. 1183 TS G. Milanovac - TS Čačak 3 and 1167B/2 TS Kraljevo 5 - EVP Kraljevo were directly endangered. Damage repairs of these lines included the reconstruction and relocation of power lines with construction of new pillars on safer terrain.

At the end of June 2014 storm wind, on the terrain stretching from Lazarevac to Smederevo, damaged and broke down pillars on five 110 kV transmission lines: 120/1 TE Kolubara - TS Lazarevac, 3 pillars fell down, 120/1 TS Lazarevac - EVP Slovac, 2 pillars fell down, 123/1 TE Kolubara - TS Aranđelovac, 1 pillar fell down, 157 TS Aranđelovac - TS Mladenovac, 4 pillars fell down, 1223 TS Smederevo 3 - TS Smederevska Palanka, 2 pillars fell down. These disasters have caused a power outage in the TS Lazarevac at 110 kV voltage level. Rapid intervention of PE EMS transmission line teams, after less than 2 days, transmission line 120/2 was re-energized which regain power to TS Lazarevac. During the month of July final repairs on lines 120/1 and 1223 were done, and then in August final repairs on the remaining three lines: 120/1, 123/1 and 157 were performed.

Very bad climatic conditions with huge amounts of ice that was deposited on the conductors, protective ropes and pillars, as well as the long duration of these conditions, caused damage and broke down pillars on 110 kV lines no.122AB TS Bor 1 - TS Petrovac, no. 193/1 TS Knjaževac - TS Svrljig and line 1204 TS Boljevac - TS Zaječar 2, as well as damage to the pillars on the 400 kV OHL no. 403 TS Bor 2 - TS Nis 2 and 110 kV OHL no. 148/2 TS Bor 2 - TS Zaječar 2.

Operational readiness of transformers and high-voltage equipment during 2013-2015 was at a good level despite the unfavourable weather conditions and floodings in 2014. In September 2014, there was a fault in the transformer T1 220/110 kV in TS Beograd 3, so this transformer was replaced by a new, spare transformer with an increase in capacity of 50 MVA, and was put into operation on 15 of December 2014. Unfavourable weather conditions in November in Eastern Serbia did not jeopardize the work of transformer stations in the area and there were no failures and faults on high voltage equipment.

Reconstruction of the TS 220/110 kV Beograd 3, TS 400/220 kV Obrenovac, TS 220/110/35 kV Beograd 5 and 400 kV switchyard facility Drmno was continued. In 2014 planned reconstruction of the 110 kV field in TS Leskovac 2, as well as preparation for the construction of the second 400/110 kV transformer in this substation was completed. In 2014, after a long period of time, a newly constructed substation was put into operation. In November, in accordance with the contractual obligations and on schedule TS 400/110 kV Vranje 4 was placed into trial operation, thus significantly improving the safety of the transmission system and reliability of the supply in the region.

3.3.3. Distribution System Maintenance

One of the most significant activity in 2013 was the mentioned takeover of 53 TS 110/X kV. In 2014 defecation of the state of the undertaken TS was performed and list of priorities for rehabilitation was formed. During 2015, for eight selected most critical TS technical documentation for rehabilitation was done. For five of these 8 TS funds were provided through the World Bank loan. These TS 110/X kV are Petrovac 1, Šabac 1, Aleksinac, Gornji Milanovac and Lešnica.

Also, in the period of 2013-2015 regular overhauls were performed on all TS of all voltage levels, as well as on the transmission lines of all voltage levels within the distribution system of PE EPS. Special emphasis is on year 2014 when the distribution system on three occasions, was threatened by natural disasters. May floods, snow and strong wind gusts in the area of Elektrosrbija Kraljevo and big storm that hit eastern Serbia in the December. In all these situations by extraordinary engagement of many teams in the field all failures and effects of the storm were eliminated. During 2015 plan of the reconstruction of individual transmission lines which will be implemented in the coming period was made.

3.4. Security Assessment of Transmission and Distribution System Operation

3.4.1. Security Assessment of Transmission System Operation

Indicators of discontinuity of delivery in the transmission network which are monitored and calculated are the following [23]:

- Power failure – undelivered power [MW] – total failed power on all measuring points where supply was interrupted,
- ENS [MWh] – total undelivered electricity which amounts to total undelivered electricity during all interruptions,
- ENS [%] – a share of undelivered electricity in total delivered electricity,
- AIT [min] – average interruption duration in minutes, a quotient of undelivered electricity and average power.

The main guideline in the construction of the transmission and distribution network is the "n-1" criteria, according to which failure of any transmission line does not lead to a reduction in the supply of electric power to customers. Customers "antenna" type in which this criteria is not fulfilled, are mostly in rural and mountainous areas at the distribution level.

Indicators of discontinuity in delivery within the transmission network calculated in such a manner for the period 2013 - 2014 are given in Table 10. At the time of reporting data for the year 2015 were not available yet.

Table 10: Indicators of discontinuity in delivery within the transmission network in the period 2013 – 2014 [23]

Interruptions		Power failure – undelivered power [MW]	ENS [MWh]	ENS [%]
2013	Planned	161	618	0.002
	Unplanned	1,770	747	0.002
	Total	1,931	1,365	0.004
2014	Planned	115	110	0.0003
	Unplanned	1,905	3,496	0.0104
	Total	2,020	3,605	0.0107
2014	Planned	359	1,543	0.0046
	Unplanned	2,292	1,659	0.0049
	Total	2,651	3,202	0.0095

The number of power failures and cases of undelivered electricity quantities due to unplanned interruptions in 2013 was drastically decreased, relative to the data from the previous period, as a result of investment in the maintenance and development of the transmission network, as well as

improving the management of the transmission system. However, in 2014 due to extreme weather conditions, especially icy rains, which caused great damage to the transmission and distribution system, there was an increase of power failures and cases of undelivered electricity quantities due to unplanned interruptions [23]. Table 10 shows significant increase in energy not delivered due to unplanned outages in 2015 compared to 2013 (2014 is uncharacteristic for the known extreme natural disasters). The reason for this is primarily a great disturbance in TS Beograd 5 (September 2015) when during the construction, outage of the whole substation occured. Also some other significant resons are disorders caused by extreme storms in western Serbia during the month of March (snow, ice rain, wind) as well as well as long-term interruption of TS Ljubovija due to the failure of radial power line 1176 (March 2015), which was taken from the DSO in December 2014.

In comparasion to the previous period, there was a reduction of average duration of unplanned interruption in 2013. It amounted to 11.57 minutes. Average duration of the planned interruption was still on the 2012 level and it amounted to 9.57 minutes. There was a great increase of average duration of unplanned interruption in 2014. It amounted to 54.6 minutes and this is the highest value in the past six years. Average duration of the planned interruption was considerably reduced if compared to previous years and it amounted to 1.72 minutes. Values of unplanned interruption indicators were affected by force major, i.e. natural disasters. The decrease in the share of interruptions of unknown origin indicates that there has been an improvement in the field of identification of interruption cause. In 2015, average duration of unplanned outage was 26.32 minutes and of planned outage 26.57 minutes. Total average time of supply interruption in 2015 was 52.89 minutes.

When considered transmission system of the Republic of Serbia, the largest amount of undelivered energy occurs as a result failure on the 110 kV line. This fact is a result of conception of 110 kV network, which comparison to the network of 400 and 220 kV that have a significantly smaller number of alternative sources of supply in case of failure on the 110 kV lines.

3.4.2. Security of Distribution System Operation

The indicators for the estimation of discontinuity of delivery in the distribution network are the following [23]:

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

In **Table 11** presents indicators of continuity of supply in the distribution system for the period 2013-2015.

Table 11: indicators of continuity of supply in the distribution system

SAIFI	2013	2014	2015
Total	8.78	10.38	9.02
Unplanned	6.45	7.98	6.55
Planned	2.34	2.40	2.47
SAIDI	**2013**	**2014**	**2015**
Total	723.72	1288.50	1097.46
Unplanned	400.90	852.05	534.60
Planned	322.83	436.44	562.86

There was considerable improvement with continuity indicators for unplanned interruptions in the distribution grid in 2013 in Serbia. The average frequency of unplanned interruptions was reduced by 1 interruption per customer, while the average duration of unplanned interruptions was decreased by almost 200 minutes per customer, which represents a huge improvement in comparison to 2012. This may indicate improvements in the activities of distribution companies in development planning and grid maintenance, distribution system management and interruptions management. However, it may also be the result of much favourable meteorological circumstances and more stable electricity consumption in 2013 than in 2012.

Compared to 2013, there was a significant worsening in Serbia in 2014. The average frequency of unplanned interruptions was increased by 2 interruptions per customer, while the average duration of unplanned interruptions was increased by almost 400 minutes per customer, which represents a huge deterioration in comparison to 2013. This still does not indicate the reduction of the activities of distribution companies. It is the result of extremely unfavourable meteorological circumstances. However, once the interruptions caused by weather, the indicators values are still much higher than those in the European Union member states, and, therefore, it is necessary to take further measures in order to reduce the number of supply interruptions and reduce their duration. The average frequency and duration of planned interruptions were still on the high level in comparison to international practice.

The share of certain interruption causes within the number and duration of unplanned interruptions changed considerably during the year 2014 in comparison to 2013. The share of vis major was increased significantly since the indicators valued increased considerably due to the May floods in Serbia. The percentage rate of other causes in coefficients is generally speaking the same, but it must be highlighted that the share of "unknown causes" and "other" amounted to half the 2013 values. Better identification of interruption causes is necessary in order applied adequate measures to eliminate the cause of the interruption and reduction of their number and duration.

Data from 2015 shows that after a difficult 2014, things are normalizing and that the indicators of continuity of supply in the category of unplanned outages are significantly better and close to the values in 2013. Bearing in mind the extent of necessary remediation, higher indicators from unplanned outages categories are expected, and during 2016 their decline and return to values from 2014 is expected.

3.5. Mechanisms of Congestion Management in Transmission and Distribution Systems

3.5.1. Mechanisms of Congestion Management in Transmission Systems

Congestion in a transmission system is the phenomenon when on the market there is a bigger demand for transmission capacity than offered. That is, it is the situation during the auction of capacities when the total value of required capacities on a border, for a given direction and for a given auction period exceeds the value of available transmission capacity [22].

Allocation of cross-border transmission capacity is a mechanism for eliminating congestion between control areas of the neighbouring transmission system operators. At the border of the control area, PE EMS allocation of cross-border transmission capacity is performed in the form of explicit auctions (a market method through public tender for the allocation of available transmission capacity for a predefined border, direction and time period), by two types of auctions [22]:

- Joint auctions in which the transmission system operator allocates all available cross-border transmission capacity to two control areas,
- PE EMS as Serbian Transmission System and Market Operator organizes yearly, monthly and weekly auctions for 50% of the total available cross-border transfer capacity on borders with Albania, Montenegro and Macedonia. Neighbouring TSO organizes auctions for 50% of the total available cross-border transfer capacity.

In 2015 on EMS borders of control area the situation is as follows [22]:

- From year 2013. joint auctions for transmission capacity allocation are organized on Serbia - Bosnia & Herzegovina border. Annual and monthly auctions are organized by PE EMS and daily auctions and intraday allocations are organized by NOSBIH.
- From year 2013. joint auctions for transmission capacity allocation are organized on Serbia - Romania border. Yearly and monthly auctions are organized by EMS and daily and intraday auctions are organized by TRANSELECTRICA.
- From year 2014. joint auctions for transmission capacity allocation are organized on Serbia - Bulgaria border. Annual and monthly auctions are organized by ESO (Bulgarian transmission system operator) and daily auctions are organized by EMS.
- From year 2011. joint auctions for transmission capacity allocation are organized on Serbia - Hungary border. Yearly and monthly auctions are organized by MAVIR (Hungarian transmission system operator). Daily auctions and intraday capacity allocations are organized by EMS.
- From year 2014. joint auctions for transmission capacity allocation are organized on Serbia - Croatia border. Annual and monthly auctions are organized by HOPS (Croatian transmission system operator) and daily and intraday auctions are organized by EMS.

3.5.2. Mechanisms for Congestion Management in Distribution Systems

Congestion in a distribution system means that during the electricity transfer by distribution system in a given work mode, an overload of a branch distribution network occurs (of a line or transformer) or impairment of voltage limitations in nodes (busbar in transformer stations, forks in lines or at the final customers).

Congestion management in distribution system includes the following actions to relieve the overloaded branches or remove the impairment of voltage limitations:

- Change of distribution grid topology,

- Cancellation of planned and suspension of ongoing works,
- Regulation of voltage transformers on transformation 110/X kV,
- Temporary pre-adjustment of protection, when it is not allowed to reach values that can damage elements of the distribution system,
- 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 generally works as a radial one. Alternative power directions are used when the need arises.

Activities related to the automation and modernization of distribution network is described in detail in chapter 3.7.3

3.6. Measures for Covering Peak Demand and Insufficient Amount of Provided Electricity

In case of endangered safety of supply to end customers due to insufficient supply in the market or the occurrence of other extraordinary circumstances, the Government shall prescribe the measures for restriction of electricity supply, or special conditions for 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-related activities with the minimum disturbance of the energy market in the region (Energy Law [1]).

In order to cover peak consumption, in the event that 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:

- Include the contract on system services,
- Include contracts on energy in cases of accidents,
- Draw up daily plans of EPS work,
- Balance the system in real time.

In order to provide system services, the public enterprise EMS with users of the transmission system made the contract for the provision of ancillary services, which includes primary reserve, secondary reserve, the third reserve, capacity for voltage regulation and capacity for establishment of transmission system after the collapse.

The amount of reserves is regulated by the Rules of operation of transmission system [25], based on the technical requirements in force in the interconnection Continental Europe. Details regarding the values of frequency containment reserve, frequency restoration reserve and reserve replacemet are given in chapter 3.1.3.

By drawing up a daily work plan of electric energy system, the transmission system operator shall combine data of market players and then consider whether the suppliers have provided sufficient level of energy to supply the contractual reserve capacities based on their own demand forecasts. If this is not the case, the transmission system operator shall take the necessary measures, i.e. plan to engage the reserve capacities in the balancing mechanism or shall use the emergency power supply.

Balancing of electric energy system in real time is carried out through the activation of secondary and tertiary reserves. In this way, a balance is achieved between production, consumption and agreed cross-border exchanges in electricity. In addition to the contractual amount of spare capacities, the balancing mechanism includes all production capacities not engaged by the work plan, but which are available for production. If the country capacities are not enough to cover the consumption, the energy transmission system operator shall activate the emergency energy.

There are times when in spite of all measures, the required amount of electrical energy cannot be provided. In these cases, voltage reductions can be implemented in distribution system, which can reduce the consumption by up to 150 MW. If that is not enough, the transmission system operator shall start limitation of electricity supply. The size of interconnection, as well as good connections with neighbouring transmission systems, make space for the national transmission system operator to be in a lower deficit for a shorter period of time.

3.7. Realization of Planned Construction of New Generation, Transmission and Distribution Facilities

3.7.1. Generation

The only new capacity production in 2013-2015 which was implemented in public enterprise EPS, is an additional aggregate in hydro power plant Međuvršje. The power of this engine is 600 kW, a forecasted annual production is 1.7 GWh. When it comes to the major projects, the preparations for the block no. 3 in thermal power plant Kostolac B, of 350 MW, were carried out. By the end of 2015, the construction has not started.

3.7.2. Transmission

Core activity of the Investments department in 2013 - 2015 was the organisation and management of investment construction of new transmission facilities and refurbishment of the existing ones (high-voltage substations and high voltage transmission lines), and/ or other subsystems in PE EMS as well as expansion, refurbishment and modernisation of the existing subsystems [36].

The most important final operations in this period are:

- Finished SS 400/110 kV Vranje 4 along with connecting 400 kV, 110 kV and 35 kV lines,
- Finished SS 400/110 kV Beograd 20 with connecting 400 kV and 110 kV overhead lines,
- The denouement of 110 kV lines at SS Beograd 20,
- Replacement work of entire high-voltage equipment in SS 220/110 kV Beograd 3 is finished.

Among other investment projects that are in progress, the most important investment and strategic projects for PE EMS [37]) that are stand out are:

- Actions and replacement work of SS 400/110 kV Kragujevac 2 - two 110 kV feeders for directions of FAS were equipped,
- Adaptation work at SS 400/220 kV Obrenovac,
- Preparatory actions on installation of power transformer T3 at SS 400/220 kV Obrenovac, reconstruction SS 220/110 kV Kraljevo 3 - eplacement of transformers T1,

- Preparatory actions on extension and reconstruction of SS 400/220/110 kV Kraljevo 3 and SS 400/220/35 kV Bajina Bašta,
- Actions and work on reconstruction of SS 400/110 kV Bor 2 and 400 kV Đerdap 1,
- OHL 400 kV no. 451 SS Beograd 8 – SS Pančevo 2 – Romania border,
- OHL 400 kV no. 451 SS Beograd 8 – SS Pančevo 2, introduction into SS Beograd 20,
- OHL 400 kV no. 451 SS Beograd 8 – SS Pančevo 2, Danube crossing,
- Preparatory actions on construction of OHL 400 kV SS Kragujevac 2 – SS Kraljevo 3,
- Preparatory actions on construction 110 kV lines and introduction 400 kV line into SS Srbobran and introduction 400 kV line into SS Smederevo 3,
- Preparatory actions on construction of OHL 2x400 kV - connection BiH, CG and RS,
- Reconstruction work at SS 220/110/35 kV Beograd 5,
- Actions and work on installation of protection and control systems at the SS 220/35 kV Bajina Bašta,
- Preparatory actions and purchase of equipment from the package EIB C and own funds for construction SS 220/110 kV Bistrica, reconstruction SS 220/110/35 kV Srbobran, reconstruction SS 220/110/35 kV Kruševac1 and reconstruction SS 220/110 kV Smederevo 3,
- 2x2x110 kV overhead line SS Kragujevac 1 – SS Kragujevac 8,
- OHL 220 kV no. 253/1 SS Beograd 8 – HIP Pačevo, Danube crossing,
- OHL 110 kV Majdanpek – Mosna,
- Preparatory actions on construction of OHL 110 kV Bela Crkva – Veliko Gradište,
- Preparatory actions on construction of OHL 110 kV SS Novi Sad 5 – SS Novi Sad 7,
- Actions and work on replacing a part of equipment at 110 kV plant off SS 400/110kV Leskovac 2,
- Preparatory actions on construction the central oil holdings at SS Srbobran,
- Preparatory actions on OHL 110 kV no.1127 connection to SS Kraljevo 6 (Ribnica),
- Preparatory actions on construction of OHL 2x110 kV SS Niš 2 – SS Niš 6 (Ratko Pavlović),
- Preparatory actions on construction of OHL 110 kV Ada – Kikinda 2, OHL 2x110 kV no. 104/5 Inđija – Stara Pazova, introduction into SS Krnješevci, OHL 110 kV no. 1127 introduction into SS Kraljevo 6, OHL (KB) 2x110 kV Niš 2 – Niš 6,
- Preparatory actions on constructions of cable lines for supplying Belgrade Waterfront.

3.7.3. Distribution

In line with the new Energy Law, distribution system operator is obliged to adopt network development plans, harmonised with the transmission system development plan and connection applications.

In order to increase the security of energy supply investment investment activities as well as other activities were aiming at the completion of initiated investments and new investments in network expansion, revitalisation or replacement of existing old-fashioned equipment in the distribution network, especially transformer stations 110/x kV/kV transferred from PE EMS as

well as other measures in terms of modernisation of operations and business activities. A plan for transfer of metering devices, switchboards, connection lines, installation and equipment in the switchboard and other devices within the connection in the facilities of existing customers or producers is an integral part of the plan.

In 2014, distribution systems were affected by great damage due to freezing rain and floods and considerable efforts were made so as to remove the damage. The following works were either completed or initiated within the distribution systems:

- on overhead and cable lines (Table 9, page 21):
  - Construction and reconstruction of a set of lines within the distribution network,
  - Construction of low voltage network, in line with local growth in electricity consumption and transmission capacities development as well as with the need to up upgrade quality of supply.
- on substations (Table 8, page 21):
  - Reconstruction and expansion of capacities was done on a certain number of existing substations,
  - In 2014, the legal procedure of transfer of 52 of 53 transformer stations which were transferred from PE EMS in 2013 was completed. Therefore, taking into consideration the status of equipment, their reconstruction and modernisation is planned in the following ten-year period.
- metering and management:
  - Upgrade of metering devices and further development and introduction of remote reading system has not been done to the expected scale primarily due to delayed tenders launch which prevented mainly launching more numerous procurement procedures for new electricity meters.

The replacement of meters in the distribution companies with more modern models is planned. PE EPS is preparing a project on the modernisation of the system for electricity distribution and supply so as to provide monitoring, protection and automates optimisation of the work of all system parts and installations between system users, power plants, network and connected facilities. However, there is great delay in project realization. In 2013, a feasibility study on meters replacement was done again so as to continue the procedure of metering equipment procurement. In 2014, a tender for the realization of a modern metering system, remote metering and metering data processing was launched and finished.

Smart grids and measurement systems will enable high reliability and quality level of delivered electricity (chapter 3.4.2). They will stimulate better consumption management and more dynamic electricity market, as well as considerate reduction of technical and commercial losses.

With the investment activities in 2014 (increased grid capacity, replacement of invalid meters, dislocation of metering points), better control over electricity theft and increasing of the collection rate, the distribution system operators initiated the trend of reduction of energy loss in grids. However, that activities was not sufficient and they did not match the level of losses and the need to cut the losses to an acceptable level in technical terms.

3.8. Planned Electricity Consumption and Production / Method of Providing the Missing Quantities in the next Five-Years Period

3.8.1. Realized Consumption and Production

Unlike to 2013 when maximum production was achieved, almost 37.5 TWh, which is around 30% higher than in 2000, in 2014, there was reduction of production due to limited exploitation of coal necessary for the operation of thermal power plants as a result of floods in May 2014, so the power plants produce around 23% less electricity than in the previous year. Hydropower production was above average. Cogeneration plants are operated in accordance with the needs for heating during the winter season and produced significantly less electricity than in 2013.

Production in hydro power plants was above the average level combined heat and power plants operated in line with the heat demand during the winter season and they produced considerably lower quantities than in 2013. Production from small power plants connected to the distribution grid is relatively small but their production in 2014 was 2.5 times higher than in 2013. This fact, in addition to the connection of new power plants to the distribution grid and in addition to favourable hydrological conditions is also the consequence of the unbundling of transmission and distribution grid. Therefore, the total annual production of hydro power plants "Ovčar banja" and "Međuvršje" was included in the production of power plants connected to the distribution system which was not the case before [23].

Beside the import of PE EPS which amounted to 246 GWh of electricity in 2014, based on the available data, it is estimated that other suppliers imported around 2,623 GWh in Serbia, i.e. in total 2,869 GWh were imported. The import of electricity was increased 4.4 times in comparison to 2013 in order to meet customers' demand in Serbia. This was due to the inability of thermal power plants to operate due to coal shortage.

Table 12 presents data on total electricity production and consumption in the Republic of Serbia from 2013 to 2015.

Table 12: Balance of Electricity from 2013 to 2015 [4]

	2013 [GWh]	2014 [GWh]	2015 [GWh]
Gross production	**39,876.66**	**34,060.57**	**38,300.37**
Hydro power plants	10,852.39	11,617.01	10,798.36
Thermal power plants	28,620,345	22,073	27,000.77
Combined heat and power plants	201.88	75.19	120.67
Other power plants	202	295.37	401.11
Total import (including transit)	**4,077**	**7,007.52**	**5,877.36**
Total export (including transit)	**6,614.36**	**5,445.09**	**6,442.25**
Transmission network losses	**1,013**	**947.82**	**947.13**
Distribution network losses	**4,486.60**	**4,215.10**	**4,357.97**
Consumption in the energy sector including own use of TPP and HPP	**4,937.03**	**4,301.82**	**4,868.74**
Hydro power plants	60.42	90.47	84.25
Pump	1,007,253	897.54	944.91
Термоелектране	2,580.80	2,017.18	2,524.29
Combined heat and power plants	41.56	21.69	29.51
Industrial plants	25	32	41
District heating plants	170	80	80
Oil and gas production	234	82	82
Refineries		236	236
Coal mines	604	541	541
Coal transformation	214	217	217
Other		87	89
Energy available for final consumption	**26,902.66**	**26,158.26**	**27,561.64**

3.8.2. Method of Providing the Missing Quantities in the next Five-Years Period

According to the Energy Development Strategy of Serbia [2],the increase in electricity consumption is scheduled compared to the base year (2010) about 5.7% bz 2020. and 10.5% by 2025 and 16.3% by 2030.

Realized the consumption in 2015 is significantly lower than projected, so the forecast itself will be the subject of revision in the future.

Some of power plants will be withdrawn from operation, due to old age and inability to meet the requirements of environmental protection. This fact points to the problem of providing electrical energy in the future.

According to [2], construction of a large number of hydro power plants, thermal power plants - district heating plants is planned. On the other hand, an increasing part of needs for electrical energy in the future can be covered by renewable energy sources.

Modernizations and rehabilitations of existing facilities will enable their higher flexibility and increasing the production of electricity (chapter 3.3.1).

It is expected that aforementioned activities will provide satisfying future electricity needs in the medium term.

3.9. Forecast Security of Electricity Supply in the Republic of Serbia in the next Five to Fifteen Years

The National transmission system operator is obliged to guarantee with relevant state institutions the security of electricity supply to customers. The security of supply is defined as electric energy system abilities to meet consumption needs. For security assessment of production in the Republic of Serbia PE EMS uses a modified methodology of association ENTSO-E, while for making long-term security reports it is using SO&AF - *Scenario Outlook and Adequacy Forecast method*.

Regulation (EC) No. 714/2009 [73] defines, the obligation of SO & AF report every two years, but for the practical needs, this report is produced each year. It is a follower of previous reports: UCTE System Adequacy Forecast (UCTE System Adequacy Forecast) and ETSO adequacy of energy systems (ETSO Power System Adequacy).

The integration of a large number of generating capacity in the category of renewable energy sources, end of process for forming the internal electricity market at EU level, new technologies for energy storage, and the response of demand side management and constant changes in energy policies require permanent modification ENTSO-E methodology for the assessment of conformity production and consumption of electricity in the short and longer term. One of the main changes compared to the classic method of conformity assessment of production and consumption, which is valorized by the moment of maximum consumption in the power system, is the need to consider other scenarios of electricity consumption because of the unpredictable production of some types of renewable energy sources, actually loading of transmission system at selected times other than the moment of maximum load. At this point a safety assessment is carried out in two typical cases:

- Winter maximum and
- The summer maximum.

These typical cases of load forecast are part of the ten-year plans of the member of ENTSO-E, which is updated every year. Similarly, using two scenarios of electricity generation (formed by the method of bottom-up) in order to better evaluated the extent of uncertainty in the prediction of future production capacity and evaluate the risk of security of supply in the forecasting period: scenario A - "conservative" and scenario B - "scenario of best estimation" that individually prepare transmission system operators based on the plans of electricity producers who are planning connection to the transmission system.

Scenario A includes additional investments in production capacities, which are considered certain (already being implemented construction or in which the purchase of equipment can not fail). As for the phasing out of production capacity, most likely the plan of release will be adopted, which is not only based on the official data of individual producers, but also takes into account information about the age of some production facilities.

For the load forecasts in this scenario the best national estimate available to the transmission system operator is adopted, taking into account the maximum expected rise in consumption based on available development plans of electrical networks.

Scenario B, in addition to production capacity covered by scenario A, includes the planned investment on production capacity, which can be considered sufficiently probable according to the belief of the transmission system. Also, if there is no official information on the exit of a unit from the system, the scenario B consider it available in the forecasting period (at the old production capacity is calculated on the extension of life expectancy). The load is predicted in the same manner as in scenario A. For scenario B, during forecasts of new production capacity, it is necessary to take into account the national targets for the participation of renewable energy

sources, as well as stimulating measures that work in this direction. However, the transmission system operator has to make a realistic forecast of future production capacity, even if defined national goals were not met. In the context of the assessment of conformity of production and consumption of electricity gives the estimate of transmission capacity for export and import of electricity.

A scenario function is to assess the lack of capacity in production at a national (and European) level in order to satisfy future consumption. B scenario function is to assess whether the expected level of investment in production capacity are sufficient to meet future consumption.

Of course, in order to adequately assess the possibility of meeting the projected consumption with the planned production, need for the reserve production, expected outages and repairs of production units, capacity in which the forecasting period can not be used for various other reasons must be taken into account.

In assessing the compliance of the production capacities, tables in a predefined format (such shown in Table 14 and Table 15 relating to the period of 2016-2025 for the Republic of Serbia) need to be filled. The method of calculating the individual components is given in the table. Future production can meet future consumption if the remaining capacity (at number 26) is larger than the reference margin adequacy of production (at number 29).

Based on the data presented in Table 14 and Table 15 following can be concluded:

- In the "conservative" scenario of building the production capacities, future production capacity will not be sufficient to meet forecasted system consumption (in the winter season 2025);
- If planned construction of new generating capacities is realized in the following amounts ("best estimate scenario"): 320 MW by 2020 in thermal capacities, an additional 188 MW in capacities of gas power plants compared to what is already certain, additional 266 MW capacities in hydropower plants (104 MW by 2020 and 162 MW by 2025) as well as an additional 285 MW in capacities of wind power plants (273 MW by 2020 and 12 MW by 2025) compared to what is already certain, and, if planned closure of thermal generating capacities amounting to 20 MW is postponed (or adequate substitution for capacities coming out of service implemented), futer production capacities will be sufficient to meet forecasted transmission system consumption.

Capacities for the import and export of electricity are sufficient to secure missing amount of energy in the case of scenario A. Deficit in electricity production by 2025 is expected in the scenario A only in the winter season during the regime of maximum consumption. In the summer season with an appropriate overhauls plan of production blocks, it can be ensured that there is no deficit in the production of electricity needed to provide power to the forecasted consumption.

Table 13: Indicators of compliance of production and consumption of electricity in scenario A - "conservative" for the Republic of Serbia [74]

	2016		2020		2025	
National Power Data (GW)	**January 19:00 pm**	**July 19:00 pm**	**January 19:00 pm**	**July 19:00 pm**	**January 19:00 pm**	**July 19:00 pm**
1. Nuclear Power	0.00	0.00	0.00	0.00	0.00	0.00
2. Fossil Fuels (3+4+5+6)	5.39	5.39	5.37	5.37	5.09	5.09
3. Lignite	5.08	5.08	4.95	4.95	4.67	4.67
4. Hard Coal	0.00	0.00	0.00	0.00	0.00	0.00
5. Gas	0.31	0.31	0.42	0.42	0.42	0.42
6. Oil	0.00	0.00	0.00	0.00	0.00	0.00
7. Mixed Fuels	0.00	0.00	0.00	0.00	0.00	0.00
8. Renewable Energy Sources (other than hydro) (9+12+13)	0.00	0.00	0.30	0.30	0.57	0.57
9. Wind (10+11)	0.00	0.00	0.28	0.28	0.55	0.55
10. of which onshore	0.00	0.00	0.28	0.28	0.55	0.55
11 of which offshore	0.00	0.00	0.00	0.00	0.00	0.00
12. Solar	0.00	0.00	0.02	0.02	0.02	0.02
13. Biomass	0.00	0.00	0.00	0.00	0.00	0.00
14. Hydro power (total)	2.92	2.92	3.09	3.09	3.09	3.09
15. of which renewable hydro generation	2.32	2.32	2.08	2.08	2.08	2.08
16. Not Clearly Identifiable Energy Sources	0.00	0.00	0.00	0.00	0.00	0.00
17. Net generating Capacity ((1+2+7+8+14))	8.31	8.31	8.75	8.75	8.74	8.74
18. Non-Usable Capacity	0.29	0.19	0.38	0.29	0.64	0.56
19. Maintenance and Overhauls	0.17	1.30	0.00	1.26	0.00	1.57
20. Outages	0.45	0.37	0.47	0.38	0.44	0.33
21. System Service Reserve	0.46	0.46	0.46	0.46	0.46	0.46
22. Unavailable Capacity (18+19+20+21)	1.38	2.32	1.31	2.40	1.55	2.93
23. Reliable Available Capacity (17-22)	6.93	5.98	7.44	6.35	7.19	5.81
24. Load	6.72	4.25	7.15	4.52	7.55	4.78
25. Load Management	0.00	0.00	0.00	0.00	0.00	0.00
26. Remaining Capacity (23-24+25)	0.22	1.74	0.29	1.83	-0.36	1.03
27. Spare Capacity	0.00	0.00	0.00	0.00	0.00	0.00
28. Margin Against Seasonal Peak Load	0.10	0.60	0.11	0.64	0.12	0.68
29. Adequacy Reference Margin (27+28)	0.10	0.60	0.11	0.64	0.12	0.68
30. Simultaneous Importable Capacity for Adequacy	3.25	2.92	4.25	3.72	4.85	4.22
31. Simultaneous Exportable Capacity for Adequacy	3.06	2.68	4.06	3.48	4.66	3.98

Table 14: Indicators of compliance of production and consumption of electricity in scenario B - "best estimate scenario" of the Republic of Serbia [74]

	2016		2020		2025	
National Power Data (GW)	January 19:00 pm	July 19:00 pm	January 19:00 pm	July 19:00 pm	January 19:00 pm	July 19:00 pm
1. Nuclear Power	0.00	0.00	0.00	0.00	0.00	0.00
2. Fossil Fuels (3+4+5+6)	5.39	5.39	5.88	5.88	5.57	5.57
3. Lignite	5.08	5.08	5.27	5.27	4.97	4.97
4. Hard Coal	0.00	0.00	0.00	0.00	0.00	0.00
5. Gas	0.31	0.31	0.61	0.61	0.61	0.61
6. Oil	0.00	0.00	0.00	0.00	0.00	0.00
7. Mixed Fuels	0.00	0.00	0.00	0.00	0.00	0.00
8. Renewable Energy Sources (other than hydro) (9+12+13)	0.00	0.00	0.57	0.57	0.85	0.85
9. Wind (10+11)	0.00	0.00	0.55	0.55	0.83	0.83
10. of which onshore	0.00	0.00	0.55	0.55	0.83	0.83
11 of which offshore	0.00	0.00	0.00	0.00	0.00	0.00
12. Solar	0.00	0.00	0.02	0.02	0.02	0.02
13. Biomass	0.00	0.00	0.00	0.00	0.00	0.00
14. Hydro power (total)	2.92	2.92	3.19	3.19	3.35	3.35
15. of which renewable hydro generation	2.32	2.32	2.19	2.19	2.35	2.35
16. Not Clearly Identifiable Energy Sources	0.00	0.00	0.00	0.00	0.00	0.00
17. Net generating Capacity ((1+2+7+8+14))	8.31	8.31	9.63	9.63	9.78	9.78
18. Non-Usable Capacity	0.29	0.19	0.64	0.56	0.92	0.85
19. Maintenance and Overhauls	0.17	1.30	0.00	1.29	0.00	1.59
20. Outages	0.45	0.37	0.51	0.43	0.48	0.38
21. System Service Reserve	0.46	0.46	0.46	0.46	0.46	0.46
22. Unavailable Capacity (18+19+20+21)	1.38	2.32	1.61	2.74	1.86	3.28
23. Reliable Available Capacity (17-22)	6.93	5.98	8.02	6.89	7.92	6.50
24. Load	6.72	4.25	7.15	4.52	7.55	4.78
25. Load Management	0.00	0.00	0.00	0.00	0.00	0.00
26. Remaining Capacity (23-24+25)	0.22	1.74	0.87	2.37	0.36	1.72
27. Spare Capacity	0.00	0.00	0.00	0.00	0.00	0.00
28. Margin Against Seasonal Peak Load	0.10	0.60	0.11	0.64	0.12	0.68
29. Adequacy Reference Margin (27+28)	0.10	0.60	0.11	0.64	0.12	0.68
30. Simultaneous Importable Capacity for Adequacy	3.25	2.92	4.25	3.72	4.85	4.22
31. Simultaneous Exportable Capacity for Adequacy	3.06	2.68	4.06	3.48	4.66	3.98

3.10. Investments in Capacity for the Production of Electricity

The level and method of rehabilitation of the existing thermal power capacity is determined by Directive of large combustion plants.

As a signatory to the Treaty of establishment of the Energy Community Republic of Serbia obliged, among other things, to implement the regulations of the Large Combustion Plants Directive 2001/80/EC in accordance with the deadlines defined by the Treaty itself, that is, until 01.01.2018.

The Directive applies to facilities for combustion power with power greater or equal to 50 MWth (all thermal power plant within PU EPS are in category of large combustion plants, and have a capacity of more than 50 MWth). The Directive aim is to reduce emissions of air pollutants from large combustion plants.

Minister's Council of the Energy Community adopted on 23 October 2013, following decisions:

- Decision D/2013/05MC-EnC EnC for the rules of implementation of the Large Combustion Plants (Decision D / 2013 / 05MC-EnC LCP Directive on implementing rules)
- Decision D2013/06/MC-EnC for the introduction of the Industrial Emissions Directive 2010/75 / EC (Decision D / 2013/06 / MC-EnC on the Introduction of the Industrial Emissions Directive).

Decision D/2013/05 MC-Es of the rules for implementing the Directive on large combustion plants enabled the states that singed the Treaty for establishment the Energy Community, the use of two mechanisms for implementation of the Directive on large combustion plants, which are defined in the Directive itself, in the following way:

- Use of the National Plan for the Reduction of emissions - NERP in the period from 01.01.2018. to 12.31.2027. Application of NERP aims that by the end of 2027. emissions from the existing combustion plants reach the emission's limit values - GVE defined in Directive on industrial emissions
- The application of the mechanism for limited operation of the plant, so called. "Opt-out" mechanism (20,000 hours in the period from 2018 to 2024). After the expiry of the period provided by "opt-out", the plant is either cancelled, or must be comply with the GVE for new plants based on the Directive on industrial emissions (the most stringent GVE).

The Republic of Serbia is on 31.12.2015. to the Energy Community Secretariat submitted a preliminary national plan for the reduction of emissions and a preliminary list of plants that will use the "opt-out" mechanism. It is planned that in the period of 9 months from the time of submission of NERP, the Energy Community Secretariat carry out an analysis and, if it is necessary, indicate the necessary corrections of NERP-a.

This directive provides the reduction of emissions of SO_2, NO_X and particles from combustion plants with a thermal input which is equal to or greater than 50 MW, regardless of the type of fuel by the end of 2023. In order to implement this directive in new thermal power plants and those that can be revitalized, it should install desulphurization, flue gas denitrification as well as high efficiency electrostatic precipitators [2].

Implementation of this directive requires significant investments. According to the Strategy [2] these funds are approximately 634.5 million € for the modernisation and environmental protection measures for thermal power plants exceeding 300 MW of power (blocks TENT A3-

A6, TENT B1-B2, Kostolac B1 - B2 total installed capacity of 3,160 MW and average annual production of about 19,000 GWh).

Considering the importance of these capacities for power, but also the overall energy security of the country it is absolutely necessary to provide their modernization on time to avoid their forced withdrawal.

As for thermal power plants that are below 300 MW (TENT A1 and A2, Kostolac A1 and A2, Morava, Kolubara, the Pannonian power plants) they are on average 45 years and with average energy efficiency below 30%. Successive withdrawal of some small blocks is scheduled for the period from 2018 to 2024, using the mechanism of a limited number of working hours (opt-out), while for the particular small blocks it is scheduled that in the period from 2018-2027 they be included by the National Plan for the reduction of emissions.

Average annual production of blocks predicted for retreat is around 6,000 GWh, so for the provision of security of supply to all consumers in the country, regardless of meteorological and hydrological situation in the country and the region, it is necessary to introduce in the system the new production units with significantly greater energy efficiency (over 40%). In that sense, as well as in terms of the dynamics of the construction different scenarios of development of power sector are possible and the whole range of projects of PE EPS and other investors in varying levels of preparation and elaboration.

Criteria for the selection of objects will allow, for the period until 2025 (with projections to 2030), ensuring a reliable supply of electricity at the lowest cost and the least impact on the environment, as well as the development of industry branches related with the energy sector.

According to the planned construction of new thermal power plants and in order to increase the flexibility of the electricity system, effective measures for energy management will be introduced, for reducing the irregularity of consumption diagrams and increase the participation of the base energy in consumption profile.

Increasing the flexibility of the system has the particular importance, considering the predicted significant construction of new facilities based on the use of intermittent renewable energy sources (wind farms and solar power plants). For balancing power in the system in terms of the high participation of thermal power plants, it is necessary to build new reversible hydro power plant. In addition to increasing the balancing power in the system, construction of new reversible hydro power plant (Bistrica and/or Djerdap 3), with the existing one, would enable maintaining the required level of system stability, and in the event of a large thermal power plants block outage. For the purposes of the Republic of Serbia and the development of renewable energy in it, it is necessary that one reversible hydro power plant be in the system around 2020, while the need for a second one will be defined depending on the regional events in the construction of new renewable energy capacity and / or nuclear power plants.

3.11. Development Plan and Investments in Transmission System for the next Three to Fifteen Years

Development of transmission capacity includes the revitalization of existing and construction of new transmission capacity in purpose to achieve balanced and sustainable development of the transmission system, with the aim of connecting new conventional and renewable energy sources.

Three groups of project [2] have strategic and developmental importance to national, regional and pan-European level, in the period up to 2025, actually 2030.

The first group is strengthening internal transmission capacity and the capacity of regional corridors through the transmission network of 400 kV voltage level of the Republic of Serbia in the direction northeast - southwest.

The transmission system of the Republic of Serbia, thanks to its geographical position, presents the link between all of electric power systems in South Eastern Europe. The transmission system of the Republic of Serbia is connected with transmission systems of eight neighbouring countries. The aim of this group of projects is reinforcement of internal transmission capacity, and replacement of old network 220 kV voltage level in the region of western Serbia, as well as strengthening the transmission capacity of one of the most congested corridor in the region of Southeast Europe (taking into account the planned submarine connection between the Republic of Italy and Montenegro, as well as Republic of Italy and the Republic of Croatia). This group of projects will allow the transfer of energy from the eastern part of South East Europe, as well as from the Republic of Moldova, the Republic of Turkey and Ukraine to the south-western part of the region and further to Western Europe. It is consisted of four projects:

- The new interconnection line between Serbia and Romania (two 400 kV overhead transmission line between Resita (Romania) and Pancevo (Serbia) with a new substation 400/110 kV in Vrsac, which is connected to this transmission line).
- Conversion of western Serbia network to 400 kV voltage level (construction of a 400 kV in Bajina Basta, the double 400 kV line between Obrenovac and Bajina Basta and reconstruction of substation in Valjevo at 400 kV and connecting to mentioned transmission line).
- The new 400 kV interconnection line between the Republic of Serbia, Montenegro and Bosnia and Herzegovina.
- The new 400 kV interconnection line between the Republic of Serbia and Hungary.

Second group is reinforcement the internal transmission capacity and the capacity of regional corridors through the transmission network, 400 kV network level, in the Republic of Serbia in the east - west direction (forming a 400 kV connection Bajina Basta - Kraljevo - Kragujevac, with the reconstruction of substation in Kraljevo to 400 kV) .

The purpose of this group of projects is reinforcement the internal transmission capacity and replacement of 220 kV voltage level in central Serbia. This group of projects will also enable the transfer of energy from the eastern part of South-East Europe and the Republic of Moldova, the Republic of Turkey and Ukraine to the south-western part of the region, and further to Western Europe. It includes the construction of new networks 400 kV from Nis to Bajina Basta and Bistrica, along with constructing the existing 220 kV substations, in central Serbia, 400 kV and reinforcement the capacity of the existing 400 kV interconnection with the Republic of Bulgaria.

The third group predicts reinforcement the transmission capacity of the strategic directions in the 110 kV voltage level.

The purpose of this group of projects is to increase the reliability of the transmission system and the security of supplying, connections of new production capacities as well as connecting transmission and distribution system. The most important are:

- The double 110 kV feeder between Kraljevo and Novi Pazar (solves safe supply of Raska area and northern part of Kosovo and Metohija)
- Feeder 110 kV between Veliko Gradiste and Bela Crkva (solves the supplying of South Banat region and enables connection of future wind farms in the region of Banat).

3.12. Investment and Development Plan of the Distribution System for the next Three to Five Years

Development of distribution network includes construction of missing substations and feeders, especially voltage level of 110 kV and 35 kV and reconstruction and modernization of existing substations (replacement of old equipment, increasing capacity, automation of elements, etc.). And construction of the existing network of lower voltage levels (35 , 20, 10, and 0.4 kV). These measures will contribute to reducing the losses in the distribution systems, which are currently very high, and increasing their efficiency. They will achieve a greater level of reliability of the system and provide a better quality of supply for customers [2].

During 2016. and 2017, based on prepared tender documentation and provided funding, a complete revitalization of substations: Petrovac 1, Šabac, Aleksinac, Gornji Milanovac and Lešnica will be completed. This process will be continued with other substations that will prepare documentation in 2016 and 2017. For now, the plan is to revitalize TS Niš 1, Belgrade 2 and Zrenjanin.

Strategically important project in the electricity distribution sector is replacement of existing measuring devices with modern digital measuring devices that will enable the implementation of so-called. *smart metering*, which involves measuring the acquisition of all relevant options for the consumption, namely remote sensing, remote shutdown, power management, etc. Up to 2030 it is expected to replace about three million meters. When it comes to the distribution system, it is necessary to take other steps regarding to the introduction of the so-called. *smart gri*d concept. Automation of the distribution network within the smart grid concept involves the introduction of the system and SCADA applications for remote monitoring and controlling of existing and future switching elements in the distribution network. This will contribute to reduction of losses in the distribution system, and it is important because of the possibility of connecting to the distribution network new producers of electricity from renewable energy sources. This will require that distributions become active participants in managing their part of the system.

Future measures that should also contribute to the reduction of electricity losses in distribution networks are:

- construction of new network facilities, transmission lines and substations,
- taking over measuring devices, measurement switch panels, installations and equipment, connecting cables and other devices that are part of the connections of existing customers and bringing them to a state in accordance with the technical regulations and rules of operation of the distribution system,
- purchase and installation of new meters for most customers electricity (realized mainly through the project of modernization of metering system),
- modernization of the system of measurements with remote reading and load control (the project is under progress),
- improving technical and business system of billing and payment of,
- activation of existing and installation of new devices for reactive power compensation and
- reinforcement of cooperation with state authorities in order to reduct illegal consumption of electricity.

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

The Republic of Serbia has adopted, signed and ratified the Treaty establishing the Energy Community [41]. Thus, it has set as one of its priorities the establishment of a regional energy

market and its integration into the energy market of the European Union (EU). Such a market should provide significant investment in the sector and contribute to the economic development and stability of the country and the region. Functioning of the market must be based on implementation of the relevant legal framework and the EU acquis in the field of energy, but also environmental protection, competition, use of renewable energy and energy efficiency. The construction of new electricity and gas interconnections will position the Republic of Serbia as an important energy transit country. Full implementation of the EU acquis within the prescribed timeline is one of minimal prerequisites and a legal requirement [2].

All national objectives, activities and measures in the energy sector are fully consistent with objectives of the regional energy strategy and the EU strategy, which presume the creation of a competitive, integrated energy market, attracting of investments in the energy sector and ensuring a secure and sustainable energy supply. If we are to single out the key elements to sustainable development in Serbian energy, they are as follows: energy efficiency, renewable energy and the environment and the reduction of the impact on climate change.

It should be noted that the Energy Law [1] stipulates that all competent authorities in the Republic of Serbia have the obligation to cooperate with the competent authorities of other countries in order to establish liberal regional and pan-European market. In addition, the Energy Law defines three basic documents that are closer to elaborate and implement the energy policy of the Republic of Serbia: Energy Sector Development Strategy [2], Strategy Implementation Programme and Energy Balance. New Energy Sector Development Strategy of the Republic of Serbia was adopted in 2015. The next step in further improving the energy policy is a regular annual reporting to the National Assembly on the degree of implementation of the Energy Strategy and the Strategy Implementation Programme which will be adopted during 2016, and through which further need for updating the Strategy and the Strategy Implementation Programme and their alignment with real needs will be proposed.

In order to develop the regional market and its integration in energy market of the European Union, several important activities of the Republic of Serbia [4] can be mentioned:

- The project of building a 400 kV voltage level system for the transmission of electric energy "Trans - Balkan corridor" is a project of the highest national and regional interest, which also allows the transnational transmission of electricity over long distances with minimal losses, bringing together markets of Eastern and Western Europe, ensuring safe and stable supply of domestic consumers, with sufficient quantity and quality of electricity. The project was primarily designed in order to ensure national energy stability of the Republic of Serbia and to replace worn-out lower voltage level network (220 kV) with system with many times greater capacity and higher voltage level. With its geographical position and planned investment in new interconnections, system also presents, a kind of connection between East and the West, connecting the two aforementioned electricity markets, which will lead to a remarkable increase in the general profit of the entire region of South East Europe and beyond. The project opens up the possibility for the power system of the Republic of Serbia to use its geographical location and potential, and that in the near future take over the role of a regional leader in the field of electric power, which will certainly continue to lead to an indirect effect on the economic and social development of the Republic of Serbia [22].
- In 2013, the Energy Community Secretariat (EnZ) has announced a competition for a list of Projects of Energy Community Interest (PECI lists) from the sectors of electricity, natural gas and oil. The projects that encourage integration and market opening, security and continuity of supply and ensure cross-border co-benefits to more countries. The aim of the PECI list is to identify the projects that will have priority in funding. Of the 35

projects approved, 13 projects were adopted in the Republic of Serbia (11 from the electricity sector and 2 in the gas sector).

- Adriatic-Ionian Initiative, which is based on the EU Strategy was launched in 2000 and involves eight countries: four EU Member States (Greece, Croatia, Italy and Slovenia) and four countries that are not EU member states (Bosnia and Herzegovina, Albania, Montenegro and Serbia). The EU Strategy for the Adriatic-Ionian region (EUSAIR) is built on four thematic pillars: blue growth, connecting the region, environmental quality and sustainable tourism. Serbia, together with Italy coordinates the pillar - Connecting the region (transport and energy). The main objectives of the Adriatic-Ionian Initiative are to promote economic growth and prosperity in the region, competitiveness and cohesion, protection of the sea environment and ecosystem, as well as coastal and inland areas. All of the above should contribute to better integration into the EU, both Member States and potential candidate countries throughout the region.

National and regional projects of power plants for producing electricity [2]:

- Project of power plant Nikola Tesla B3 of 750 MW. The main objective of this project is to respond to the growing demand for electricity in Serbia and the region. Estimated value of the investment is up to 1.6 billion €.
- Thermal power plant Kolubara B installed power 2x375 MW. It is expected that in the coming years existing thermal power plants, that work on lignite, be rebuilt before the end of their technical life. Together with renewable energy, thermal power plants that work on lignite can achieve the objectives of the European Union with the aim of preserving the environment, along with security and competitiveness. Investment estimated value is 1.5 billion €.
- Project for power plant Kostolac B3 (installed capacity 350 MW), with widening current mine, accordance with EU standards for environmental protection. Placement power of the block B3 in Elektromrežu Srbije will be perform using the existing substation 400 kV located close of the new block. The estimated investment is around 716 million $, and the estimated time for construction is 4 years. In December 2014, the Government of the Republic of Serbia has signed an agreement with the EXIM Bank of China for a loan under preferential terms for the second phase of the project package Kostolac B. Currently is working on the preparation of project documentation. The beginning of the preparatory work is planned for October 2016 [21].
- Project for thermal power plant Novi Kovin installed capacity of 2x350 MW. The estimated investment is about 1.33 billion €.
- Project for power plant with installed capacity of 300 MW Štavalj. The estimated investment is around 700 million €.
- Project for power - heating plant Novi Sad installed capacity of 340 MW. The new unit is part of the existing power plant Novi Sad for the production of electricity and heat. The estimated investment is around 400 million €.
- Project for power - gas plant (Pancevo, Belgrade, Nis, etc.), installed capacity of 860 MW. The estimated investment is about 1.5 billion.
- Hydro power plant Velika Morava with installed capacity 147.7 MW. The estimated investment is around 360 million €.
- Hydro power plant Ibar with installed capacity of 117 MW. This project is significant because it will enable the employment of local population and improve infrastructure (new projects), increase the use of renewable energy sources in compliance with EU

standards and the increase of social standards. The estimated investment is around 300 million €.

- Hydro power project Srednja Drina with installed capacity of 321 MW. The estimated investment is around 819 million €.
- Project for reversible hydro power plant Bistrica with installed capacity 4x170 MW. The new plant will be part of the system of the Lim hydroelectric power plants. The estimated investment is around 560 million €.
- Project for reversible hydroelectric Djerdap 3 with installed capacity 2x300 MW. The estimated investment is around 400 million €.
- Projects for construction of small hydropower plants in 191 locations with total installed capacity of 387 MW. The estimated investment is around 500 million €.

4. NATURAL GAS

Energy Law stipulates conditions whereby an energy-related activity can be performed by a public enterprise, business entity or other legal entity or entrepreneur who is registered and having a license for performing the energy-related activity, unless otherwise prescribed by this Law.

Energy-related activities in natural gas sector are: natural gas transmission and transmission system management, natural gas warehousing and natural gas warehouse management, natural gas distribution and natural gas distribution system management, natural gas supply and public natural gas supply.

Regulated energy-related activities are: natural gas transmission and transmission system management, natural gas warehousing and natural gas warehouse management, natural gas distribution and natural gas distribution system management and public natural gas supply. Energy-related activity of natural gas supply is subjected to market principles.

Energy Agency of Republic of Serbia is competent body performing price regulation of natural gas for public supply, determine the price of access to the natural gas transmission system, determine price of access to the natural gas distribution system, and price of access to the natural gas storage facility. Energy subjects performing regulated energy-related activities determine regulated prices and issue document on prices to the Agency for approval.

The Law on Public Enterprises regulates activities of public interest in several business activities one of which is energy-related activity. The Energy Law regulates activities of public interest in energy sector, as well as obligations of the public supply.

The Energy Law defines energy-related activities of public interest in the field of natural gas, as follows: natural gas transmission and transmission system management, natural gas warehousing and natural gas warehouse management, natural gas distribution and natural gas distribution system management, natural gas supply and public natural gas supply.

The Republic of Serbia signed the Treaty of Energy Community establishing, and is committed itself to apply the Acquis Communautaire in the field of natural gas.

The adoption of the Energy Law in December 2014 transposed in the legislation of the Republic of Serbia the third energy package directives in the field of natural gas.

The Energy Law stipulates that from January 1st 2015 all final customers of natural gas can freely choose their suppliers on the market.

In order to ensure security of supply of end consumers it is stipulated that households and small customers whose all facilities/objects are connected to the natural gas distribution system, if they do not choose another supplier, are entitled to public supply at regulated prices. Small consumers of natural gas are the final customers whose annual consumption of natural gas are less than 100,000 m^3 and whose facilities/objects are all connected to the natural gas distribution system. In addition to JP Srbijagas another 32 energy entities have a license to perform activities of public service.

The right to last resort supply of maximum duration of 60 consecutive days, has the end consumer of natural gas, which is not eligible for public supply in the case of bankruptcy or liquidation of the supplier, previously supplied above mentioned consumer; after the termination or revocation of the license of the supplier who had previously supplied customer; it has not found a new supplier after the termination of the supply contract with the previous supplier, unless the contract termination is the consequence of the non-payment obligation of the buyer. The government according to the public tender procedure assigned public company JP Srbijagas for supplier who will perform the last resort supply.

According to the public tender the government assigned JP Srbijagas as a supplier for public suppliers of natural gas. The Energy Law stipulates that until the establishment of a competitive natural gas market in the Republic of Serbia the government, according to the public tender procedure, determines the supplier which will supply natural gas public suppliers, at their request, under the same conditions and at the same prices.

4.1. Natural gas market

Natural gas buying and selling takes place in the market, and it is based on the contract on the sale of natural gas between market participants. The contract on the sale of natural gas determines the amount of natural gas (can be in advance agreed for each accounting period during the supply period or determined on the basis of actual consumption by the consumer at the delivery point during the supply period, in the case of full supply sale) price and supply period.

Natural gas market participants are:

- Natural gas producer (1);
- Natural gas supplier (60);
- Public natural gas supplier (33);
- Supplier of public suppliers (1);
- End customer (around 262.600);
- Transmission system operator (2);
- Distribution system operator (34) and
- Natural gas storage facility operator (1).

The Republic of Serbia uses natural gas from domestic sources as well as imported gas. The largest deposits of natural gas are located in Vojvodina (Elemir, Kikinda, Plandište, Mokrin, Novo Miloševo, Ada, Čantavir, Martonoš, Međa, Itebej, Banatski Dvor, etc.). The capacity of these sites is sufficient to meet between 20 and 25% of the current needs of the Republic of Serbia for natural gas. The only company in Serbia engaged in the exploration and production of natural gas is the Serbian Oil Company (AD NIS). As a part of AD NIS there is gas refinery in Elemir, whose main activity is processing of domestic natural gas for safe transportation and production of liquefied petroleum gas and light gasoline fraction (C5+). The rest of needs for natural gas Republic of Serbia imports from Russia on the basis of long-term contracts as well as from other sources under other agreements.

The final consumers of natural gas have the right to choose supplier on the market, and this took effect for households on January 1st 2015. The supply of natural gas to end customers can perform an energy entity that has a license to perform activities of supply or public supply in accordance with the Energy Law. The supply of natural gas to the end customers can perform an energy entity dealing with natural gas distribution if it meets the requirement that the number of connections to its system is its less than 100,000. Public supplier is determined by the Government. Households and small customers whose all facilities/objects are connected to the natural gas distribution system are entitled to public supply if they do not choose another supplier. The public supplier buys natural gas on bilateral or organized market. Until the establishment of a competitive natural gas market in the Republic of Serbia, the Government, according to the public tender procedure, assigns the supplier that supplies public suppliers of natural gas, at their request, under the same conditions and at the same prices.

The right to last resort supply in the period of market opening has the final customer of natural gas who is not entitled to public supply in the case of bankruptcy or liquidation of the supplier,

previously supplied above mentioned consumer; after the termination or revocation of the license of the supplier who had previously supplied customer; it has not found a new supplier after the termination of the supply contract with the previous supplier, unless the contract termination is the consequence of the non-payment obligation of the buyer. The duration of last resort supply can be maximum 60 consecutive days The government according to the public tender procedure assigned public company JP Srbijagas for supplier who will perform the last resort supply.

The activity of natural gas transmission and natural gas transmission system management performs the natural gas transmission system operator (TSO). TSO also perform the activities of organizing and administering the natural gas market and perform business operations in accordance with the principles of objectivity, transparency and non-discrimination, observing conditions prescribed by Energy law and its by-law regulations.

TSO may not purchase or sale natural gas, except in the case of providing necessary natural gas quantities for the first system filling, own natural gas consumption, system balancing and compensation of losses in the transmission system.

TSO is responsible for: safe and reliable operation of the transmission system and quality of natural gas delivery; safe operation of the natural gas transmission system; transmission system management in the manner that will ensure safety of natural gas delivery; development that will ensure long-term capability of the transmission system to fulfil rational requirements for natural gas transmission; coordinated operation of the transmission system with other transmission, i.e. distribution systems and natural gas storage facility; system balancing; non-discriminatory access to the transmission system; accuracy and reliability of natural gas measurement at the points of takeover, into and from the transmission system; arranging and administering the natural gas market.

TSO is obliged to: maintain and develop the transmission system; pass rules on the transmission system operation; adopt a transmission system development plan every year for a period of at least ten years and harmonise it with the plan of development of connected systems and with requests for the connection of storage facilities, producers and customers; adopt the program of measures and prepare the annual report (submit it to the Agency for approval); procure natural gas for the purpose of ensuring safe operation of the system and for the compensation of losses in the transmission system, based on the principles of minimum costs, transparency and non-discrimination; purchase and sell natural gas for the purpose of system balancing, i.e. balancing of the amount of natural gas taken over, for the needs of users, by the transmission system at the point of entry and delivered from the transmission system at the output point, based on the principles of minimum costs, transparency and non-discrimination; use line-pack for the purpose of system balancing, ensuring system operation safety and compensation of losses in the transmission system; balance the system based on the principles of minimum costs, transparency and non-discrimination; take the prescribed safety measures when using the transmission system and other capacities in the function of the transmission system; decide on the price of access to the transmission system pursuant to this Law; determine the price of natural gas for the needs of system balancing in accordance with regulations on the transmission system operation; not discriminate any transmission system users or groups of users, and particularly not favour energy entities associated with it; provide information to transmission system users for the efficient system access based on the principles of transparency and non-discrimination; ensure confidentiality of commercially sensitive information obtained during performing the activity and publish information that may ensure advantage in the market in a non-discriminatory manner; collect and publish data and information necessary for the fulfilment of prescribed obligations in terms of transparency and supervision of the natural gas market, in accordance with the rules on the natural gas transmission system operation; submit to the end customer or its supplier, upon a request of the end customer, the data on natural gas consumption in the facilities

of that customer, in the form and according to the procedure on operation of TSO; determine technical and technological conditions for connecting facilities, devices and plants into a single system; supervise the safety of delivery and supply and submit data for a report on safety of supply to the Ministry; take measures for an increase in energy efficiency and environmental protection; exchange information necessary for the safe and secure system functioning with other system operators; cooperate with other system operators and other relevant stakeholders, aiming at establishment of the regional natural gas market and market liberalization; submit to the Agency the data and documents on prices of non-standard services to which the Agency shall give its consent and which shall be published on the system operator's website, and regulate other matters necessary for the transmission system operation and natural gas market functioning.

The transmission system operator should keep records of transactions in the natural gas market, in a manner and according to the procedure stipulated by the rules on the natural gas transmission system operation.

The activity of natural gas distribution and natural gas distribution system management performs the natural gas distribution system operator (DSO), with rights and obligations stipulated by Energy Law.

DSO performs business operations in accordance with the principles of objectivity, transparency and non-discrimination, observing conditions prescribed by Energy law and its by-law regulations.

DSO is responsible for: safe and reliable operation of the distribution system and quality of natural gas delivery; safe operation of the natural gas distribution system; development ensuring long-term capability of the distribution system to fulfil the needs for natural gas distribution in an economically justified manner; construction of connection to the distribution system; providing information to energy entities and distribution system users that is necessary for the efficient access to the distributions system, based on principles of transparency and non-discrimination; non-discriminatory access to the distribution system; distribution system management in the manner that will ensure safety of natural gas delivery; accuracy and reliability of delivered natural gas measurement.

DSO is obliged to: maintain and develop the distribution system; pass the rules on the distribution system operation; adopt a distribution system development plan every year for a period of at least five years, harmonized with the development plan of connected systems and requests for connection; adopt the program of measures and prepare the annual report (submit it to the Agency for approval); submit the data for the report on safety of supply to the Ministry; issue a decision on the price of access to the distribution system pursuant to Energy Law; publish the prices of connection in accordance with the methodology prescribed by Energy Agency; adopt the plan for reduction of losses in the system if the losses exceed the technically justifiable level; procure natural gas for the compensation of losses in the distribution network, based on the principles of minimum costs, transparency and non-discrimination; not discriminate any distribution system users or groups of users, and particularly not favor energy entities associated with it; provide information to distribution system users for the efficient access to the system, based on the principles of transparency and non-discrimination; ensure confidentiality of commercially sensitive information obtained during performing the activity and publish information that may ensure advantage in the market in a non-discriminatory manner; verify and submit to the transmission system operator the data necessary for administering of the natural gas market, in accordance with the rules on transmission system operation; take prescribed safety measures while using the distribution system; exchange information necessary for the safe and secure system functioning with other system operators; submit to the Agency the data and documents concerning rules of natural gas distribution system operation; take measures for an

increase in energy efficiency and environmental protection; and deal with other matters necessary for the distribution system operation and market functioning.

The natural gas distribution system operator may neither purchase nor sell natural gas, except for the purpose of ensuring its own natural gas consumption and for losses in the distribution system.

The activity of natural gas storage and natural gas storage facility management performs the natural gas storage facility operator (SFO).

SFO performs business operations in accordance with the principles of objectivity, transparency and non-discrimination, observing conditions prescribed by the Energy Law and by-law regulations.

SFO is responsible for safety and reliability of natural gas injection and extrusion; safe operation of the natural gas storage facility; non-discriminatory access to the storage facility; storage facility management.

SFO is obliged to: maintain and develop the storage facility; take the prescribed safety measures; pass the rules on the storage facility operation; adopt a natural gas storage facility development plan every year for a period of at least ten years and harmonize it with the plan of development of connected systems and with requests for the connection of storage facilities and facilities of producers and customers; adopt the non-discriminatory behavior Program, designate the person responsible for supervision of implementation of this program, and prepare the annual report and submit it to the Agency for approval; manage the facility operation; submit the data for the report on safety of supply to the Ministry; publish the data on available capacities; purchase natural gas for its own consumption and the compensation of losses, based on the principles of minimum costs, transparency and non-discrimination; decide on the price of access to the storage facility pursuant to Energy Law; not discriminate any storage facility users or groups of users, and particularly not favor energy entities associated with it; provide information to storage facility users for the efficient access to the storage facility, based on the principles of transparency and non-discrimination; harmonize the operation and exchange data necessary for the safe and reliable storage facility operation with the transmission system operator; submit to the Agency the data concerning rules of natural gas storage facility system operation; provide the transmission system operator with the data of significance for the natural gas market functioning; ensure confidentiality of commercially sensitive information obtained during performing the activity and publish information that may ensure advantage in the market in a non-discriminatory manner; take measures for an increase in energy efficiency and environmental protection; regulate other matters necessary for the storage facility operation.

The natural gas storage facility operator may neither purchase nor sell natural gas, except for the purpose of ensuring its own natural gas consumption and for compensation of losses in the natural gas storage facility.

Natural gas market participants regulate their balance responsibility by concluding an agreement on transmission, thus regulating the financial responsibility for the difference between the quantity of natural gas delivered at input points of the transmission system and the quantity taken over at output points of the transmission, i.e. distribution system, for the accounting period. TSO is responsible for the establishment and implementation of balance responsibility of market participants and for keeping the registry of balance responsibility, in accordance with regulations on the transmission system operation and rules on a change of supplier. The supplier is balance responsible for the points of takeover of the end customer that purchases natural gas pursuant to the agreement on sale with the full supply. The data needed for keeping the registry of balance responsibility for the points of takeover in the distribution system is provided by DSO, which should submit them to the TSO. TSO has to provide natural gas for balancing and maintenance

of safe system operation, from market participants, by the use of natural gas from the storage facility, as well as from the line-pack.

The natural gas market, in addition to gas trade for public suppliers, was based also on bilateral contracts between producers and suppliers. During 2015 at the natural gas market the two companies were traded.

The biggest impact on the natural gas market had the fluctuation of the purchase price as well as the exchange rate of US $. Gas prices are highly influenced by the price of transit through Hungary, which is higher than the current price for domestic users in Hungary, as well as the users from the Croatia and Romania. Prices of natural gas transmission in Hungary were established as a long-term contract between Hungarian and Serbian transmission system operators, independent from the Hungarian Energy Regulatory Authority. This contract expires in 2016, when it will be necessary to reset the terms and eventually achieve more favorable conditions comparing to existing agreement.

In 2014, 60 customers were buying gas on the free market. They were delivered 804 million m^3, including 317 million m^3 of natural gas that is spent in Serbian Oil Company (NIS) for its own production, i.e. 41% of the total amount of gas delivered to end customers [23].

In 2014, customers connected to the transmission system, which were obliged to purchase natural gas on the free market, practically bought all of the supplied quantities of natural gas sold on the free market. In the distribution system, there is only one buyer buying natural gas on the free market and in an amount of 2 million m^3, or 0.2% of the quantity sold on the free market.

In 2014, three vendors met the needs of the customers and delivered more than 30 million m^3 and 23 distributors sold less than 10 million m^3.

Srbijagas sold largest portion of natural gas, i.e. 1,310 million m^3 or about 66% of the total amount in 2014. After Srbijagas, the highest sales had the Novi Sad-Gas with 57 million m^3 i.e. about 2.9% and Yugorosgaz with 42 million m^3 of gas, or 2.1% of the total amount in 2014 [23].

In Table 15 is presented natural gas balance for the period 2013-2015

Table 15: Natural gas balance for the period 2013-2015, [42], [43], [44]

Year	2013	2014	2015[*1]
(million m^3)			
Total primary production	531.188	557.179	586.304
Total imported	1,887.422	1,394.574	1,731.094
Stock balance	-72.6	68.8	27.9
Energy sector consumption	773.846	856.098	875.62[*2]
Energy sector own use	159.937	183.560	165.603
Total loss (transmission and distribution)	16.356	18.344	12.176
Energy for final consumption	1395.871	962.552	1,291.899

Source Energy balance of Republic of Serbia

[*1] - assessment for 2015 based on the data available from IMIS database

[*2] - projections from the Energy Balance of the Republic of Serbia for 2015 [44]

The origin of imported natural gas in 2014 and 2015 were from the Russian Federation, while in 2013 a portion (38.7%) of imported quantities of natural gas came from other sources.

In 2014, there was 31% less consumed natural gas than the amount in 2013. Consumption decreased in households by 18% in heating plants by 3.4% and in industry by 52.3%. Decrease of consumption for households and heating plants is the result of higher average temperatures during the winter months. In some cases in households, there was substitution of natural gas with other energy sources due to favorable price. In 2015 there were 34% more natural gas consumption than it was in 2014.

The household sector consumes approximately 9-10% of the total available quantity of natural gas, and in heating plants that is 24%, while for the industry and other consumers remains 66-67%. Considering only sector of final energy consumption the structure is as follows: households - 20%, industry (consumption of natural gas for energy and non-energy use) - 62%, while the public and commercial sector, transport and agriculture accounts for 18%.

The operators of the transmission system, carrying out the transmission and the management of transmission system are PC Transportgas Srbija ltd, Novi Sad and Yugorosgas-transport ltd, Niš. Company Yugorosgaz imports natural gas from Gazprom in Moscow for customers in Serbia.

Through the gas pipeline system of the Republic of Serbia is also carried out transit of natural gas to consumers in Bosnia and Herzegovina. Trasnport is done from the entrance to the gas pipeline system Srbijagas at Horgos to the exit at Zvornik. [23]

Table 16 gives data on the quantity of natural gas within the transmission system for the period 2013 to 2015.

Table 16: Quantities of natural gas within the transmission system for the period 2013 to 2015

(million m^3)	2013	2014	2015*
Domestic production taken into transmission system	451	453	451
Taken from Hungary for Serbia	1,823	1,468	1,628
Taken from Hungary for BiH	194	185	218
Total taken	2,468	2,106	2,297
From storage	266	353	253
Transported	2,734	2,459	2,550

* Projection

For distribution of natural gas and distribution management system there are 34 licensed operators, most notably PC Srbijagas and Yugorosgaz, while the remaining 32 companies are owned by local government, or they are part of mixed or privately owned companies. PC Srbijagas, Novi Sad and Yugorosgaz doo, Nis, perform operation of transmission and transmission management systems for natural gas.

The largest distributor of natural gas is PC Srbijagas. Its distribution system includes a gas pipeline (operating on pressure of 6 to 16 bar) with length of over 600 km of pipelines and low pressure pipelines (up to 6 bar pressure), whose length is 6.033 km. The average age of the system is 10 years. PC Srbijagas distributes natural gas to the end users (households and commercial/production companies) in 57 municipalities in Serbia. The total number of households connected to the gas distribution network is over 90,000.

Number of consumer's connections in 2014 increased by 188 compared to 2013 and at the end of 2014 was 261,203, where 248,975 or 95.3% are households' connectors. That means that only 10% of all households in Serbia have access to gas.

Part of the natural gas is supplied from distribution system of JP Srbijagas to the other distributors. Only a small portion of natural gas is provided from the production of (NIS AD) directly connected to the distribution system. The table below shows the amount of natural gas taken into the system for distribution of natural gas and distributed in the previous period (2013-2015). Table 17 gives the balance of gas within the distribution system in the period 2013-2015.

Table 17: Balance of natural gas within distributed system in the period 2013-2015

(million m^3)	2013	2014	2015*
Total distributed	1,362.79	1,288.43	877.19
Taken from transmission system	1,258.1	1,197.85	819.87
From distribution systems	87.4	76.71	49.21
Directly from natural gas production	17.162	13.6	6.65
Losses	13.29 (1%)	12.42 (1%)	1.99(0.23%)

* Period from January to September 2015, the source IMIS base of MoME

For the storage operation and natural gas storage management there is one registered company Podzemno skladište Banatski Dvor doo Novi Sad (storage operator).

Banatski Dvor is an abended gas reservoir located 22 km from Zrenjanin and 44 km of main gas hub in Gospodjinci. Underground gas storage Banatski Dvor started its operation in November 2011. The owner and operator is a joint venture founded by PC Srbijagas (49%) and Gazprom Germania (51%).

This gas storage is very important for ensuring a secure supply of natural gas in Serbia. In 2014, the maximum technical inlet capacity was 2.7 million m^3 / day; the maximum technical production capacity of warehouses was 4.5 million m^3 / day. Concerning the maximal production capacities, the maximum daily inlet quantities in 2014 were 2.7 million m^3 / day and the maximum daily produced quantities amounted to 4.2 million m^3 / day.

From the transmission system in the storage were handed over 288 million m^3, and withdrawn to transmission system 352 million m^3 of natural gas. At the end of 2014, the stock was 333 million m^3 of commercial gas.

Bi-directional pipeline Gospođinci - Banatski Dvor enables the smooth and full connectivity of the underground gas storage facility to the transmission system.

4.2. Transport System

A natural gas transmission system is a network for natural gas transmission comprising a network of pipelines with design pressure exceeding 16 bar, except for supply gas pipelines, as well as compressor stations, block stations, metering and regulating stations, and metering stations at all points of delivery from the transmission system, other energy entities, electronic communications and information system. and other infrastructure necessary for natural gas transmission, including line-pack (hereinafter: the natural gas transmission system).

At the end of 2014, the length of the transmission system of Transportgas Srbija was 2,298 km in northern and central Serbia, and the transmission system of company Yugorosgaz-

transport ad was 125 km in the south-eastern part of Serbia. Transportgas Srbija owns 95% of the transport gas pipeline network, and Yugorosgaz-transport ad over the remaining 5%. Table 18 provides an overview of the length of the gas pipeline transmission system in Serbia. From the table it can be noticed that the tendency of constant increase in the length of the network is maintained in 2015, but exact information was not available.

Table 18: Overview of the length of the gas pipeline transmission system in Serbia

Year	2012	2013	2014
Length (km)	2,391	2,398	2,423

Approximately 5 million or 70% of Serbia's population lives in an area that has an existing natural gas transmission network, which provides potential for further development of the natural gas distribution system and the rise in natural gas consumption.

Basic technical characteristics of transmission systems Transportgas Srbija and Yugorosgaz-transport ad are given in Table 19.

Table 19: Basic technical characteristics of transmission systems in Serbia

Technical description of transmission system	Transportgas Srbija	Yugorosgaz-transport a.d.
Capacity (M m^3 per day)	≈ 18	≈ 2.2
Pressure (bar)	16-50	16-55
Length (km)	2,298	125
Nominal diameter (mm)	DN 150 – DN 750	DN 168 – DN 530
Average age of the transmission system	25	10
Compressor stations	1	-
Power rate of compressor stations (MW)	4,4	-
The total number of connection entries into the transmission system	12	1
1. Other transmission system	1 (Horgoš)	1
2. Domestic production fields	10	-
3. Underground storage	1	-
Number of connections in transmission system	168	5
Stations for measurement and regulation (at exit of the transmission system)	165	5
Delivery station	2	-
Exit to the transmission system of Yugorosgaz	1	-
Interconnection to the BiH	1	-
Connection to the underground storage facility	1	-

* Source PC Srbijagas. http://www.srbijagas.com/o-preduzecu/delatnost/transport/transport-prirodnog-gasa.67.html

The Republic of Serbia has two interconnections with other external pipeline systems (one entry and exit point), such as gas pipelines:

- Hungary - Serbia (Kiškundorožma) - entry point

- Serbia - Bosnia and Herzegovina (Zvornik) - exit point

Both the interconnection are the integral part of the transmission system of PC Transportgas Srbija, while the transmission system Yugorosgaz-transport ad has no gas pipeline connecting the transmission systems in neighboring countries.

4.3. Distribution System

A natural gas distribution system is a distribution network of natural gas comprising a network of pipelines, regulation, metering and regulation, and metering stations at all points of delivery from the distribution system, other energy facilities, electronic communications, information and other infrastructure necessary for distribution of natural gas with maximum operating pressure that is equal or lower than 16 bar, including line-pack.

In the period between 2010 and 2014 the length of the distribution network increased by 12.6% - 16,363 km (without connections), thereby creating the conditions for connection of new customers. The largest part of the increase in the length of the network in 2014 was within PC Srbijagas distribution system. PC Srbijagas now owns about 46% of the total distribution network. Table 20 shows the change in length of the distribution network for the period 2013 to 2015.

Table 20: The length of the distribution network

Year	2013	2014	2015
Length (km)	15,839	16,363	16,968*1

* 1 - projection for spreading of distributive network for natural gas according to the available data for period 2011-2014

The number of active connections (delivery points) in distribution networks is approximately 261 thousand. License authorizing the operators for distribution of natural gas in the Republic of Serbia owns 60 companies. The largest distributor is Srbijagas with 82,081 active connections and 7,514,449 meters of distribution networks (date: 31.12.2014).

4.4. Storage of Natural Gas

Basic technical characteristics of the underground gas storage "Banatski Dvor" is given in Table 21

Table 21: Technical characteristics of gas storage

Operating volume of gas storage	450 million m^3
Stored gas in gas pillow	530 million m^3
Maximum inlet capacity of the storage	2,8 million m^3/day
Maximal production capacity of gas storage	4,5 million m^3day
Length of pipe connection	42,5 km
Nominal diameter of pipeline	DN 500
Maximal operating pressure of gas pipeline	75 bar

Source IMIS data base of MoME

In 2014, the Council of Energy Agency adopted the methodology for determining the price for access to the natural gas storage.

4.5. Security of Supply

4.5.1. Planned Production and Consumption of Natural Gas and Security of Supply the Missing Amount for the Period 2015 – 2020

Based on Energy Balance for Republic of Serbia for 2015 primary production of natural gas amounted 586.304 million m^3, which is in the level of production in 2014. Total quantity of imported natural gas was 1,731.094 million m^3.

The capacity of production, storage and transmission networks are as follows:

- Domestic production capacity ≈ 1.3 million m^3 / day;
- Injection of gas into underground natural gas storage - 2.2 to 2.4 million m^3/day;
- Production of underground storage - from 4 to 4.5 million m^3/day;
- Import up to 10 million m^3/day.

Table 15 gives the natural gas balance for the period 2013-2015. Final consumption structure is given in the Table 22.

Table 22: Natural gas consumption per sectors of final energy consumption in 2013 - 2015 [42]-[44]

Sectors of final energy consumption	**2013**	**2014**	**2015***
Households	219.086	179.000	221.507
Industry and building (energy consumption)	865.884	485.459	724.779
Transport	4.674	8.833	8.091
Public and commercial services	139.815	142.801	160.531
Agriculture	32.047	32.207	36.443

* Projection for 2015

Plans for future consumption of natural gas by 2030 (Reference Scenario) **[2]** is shown in Table 18.

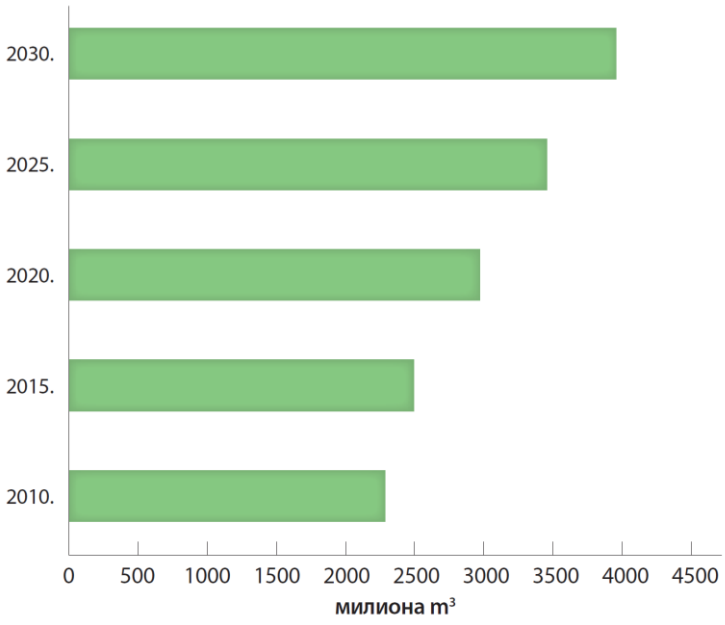

Figure 1: Projected consumption by 2030 [2]

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

Natural gas is energy product with significant technical and ecological advantages compared to other conventional fuels, and in that sense it should provide significant contribution to more efficient and ecologically acceptable use of energy. However, natural gas is dominantly imported energy product and its price is now connected to the change of oil price at global market. More significant exploitation of unconventional gas in Europe (possibly in the Republic of Serbia as well), supply of significant amounts of liquefied natural gas or opening of new directions of European market supply could possibly lead to drop of the price of natural gas in the future.

Indigenous production of natural gas currently meets about 20% domestic consumption with expected trend of decrease, and in balance reserves, the presence of low-calorific gases is significant (with increased content of CO_2, nitrogen, etc.) which are not adequate for direct connection to gas system. In order to fully use this potential it is necessary to undertake activities on securing placement of this gas in plants technologically upgraded for such purpose (e.g. MSK Kikinda), i.e. to find new direct customers.

Transmission system of natural gas in the Republic of Serbia is line system with only one entrance with limited capacity, which is unfavorable both from the point of view of energy security and market development. Domestic natural gas market is in its scope small and loaded with different technical and financial issues (nonexistence of gas line network in all parts of the country, extreme seasonal disparity in consumption, high cost of transit economically unfavorable conditions of procurement on European market, huge current debts towards suppliers, large number of relatively small distribution systems, etc.).

This is why sector development primarily requires provision of gas line infrastructure in all parts of the country and provision of interconnection with countries in the region (Bulgaria, Romania, Croatia, Macedonia...). In that way, the possibility of supply to natural gas market would be opened from other directions of supply as well, and idea of natural gas market from Energy Community Treaty would be realized.

According to [2] there are several strategic goals and actions for natural gas sector development (Table 23).

Table 23: Strategic goals and actions for energy security supply in gas sector

<table>
<tr><td>Strategic goals:
- Provision of secure supply of domestic market with natural gas;
- Establishment of domestic and regional market of natural gas;
- Diversification of sources and lines of natural gas supply.</td><td rowspan="2">Strategic actions:
- Research in the country with the aim of finding new reservoirs of natural gas including unconventional gas)
- Use of natural gas as the replacement for electricity consumption for heating needs;
- Use of combined generation of electricity and heat in industry and large cities;
- Participation in international projects of natural gas supply;
- Regional connecting.</td></tr>
<tr><td>Current situation:
- One direction of supply with technical limitation of import ;
- Gas storage meets current level of consumption;
- Inadequate sale price of natural gas in the field of public supply.</td></tr>
</table>

Priority activities are:

- New direction of supply of natural gas;
- Establishment of at least two regional interconnection by 2020;
- Continuing in gasification of Republic of Serbia.

Of great importance for the natural gas sector development would be the realization of natural gas pipeline that allows new direction of natural gas supply, thus enhancing the security of natural gas supply of the entire region in the future. The realization of interconnection with neighboring countries and setting a new direction of natural gas supply will enable significant use of natural gas for combined production of heat and electricity, in the transport sector (compressed natural gas) and others. The combined production of heat and electricity (CHP) in addition to the primary application in industrial companies should be considered as well as in major industrial centers (Novi Sad, Belgrade, Nis, Kragujevac, Pancevo, Loznica, etc.). These power plants can have an important role in balancing mechanism in the integration of renewable energy sources, as well as important regional significance after establishment of the regional electricity market.

On July 10th 2015 Serbia signed a Memorandum of understanding on a common approach, which refers to the diversification and security of supply of natural gas (Central and Eastern Europe Countries Initiative for connectivity in the field of natural gas supply - CESEC), (hereinafter referred to as the Memorandum). This document highlighted the following:

Most countries in the CESEC region (Member States and Energy Community Contracting Parties) have limited gas source diversity due to historical lock-in to long term gas supply contracts from a single supplier; missing links to alternative sources; missing or inefficient use of interconnections within the region; and legacy transit regimes with legal and technical characteristics potentially resulting in market foreclosure.

Most countries in the region have not taken the necessary concerted actions over the past decade to remedy the situation.

The countries of the CESEC region agree that diversification of supply for the region can principally come from:

- Reverse flows via existing pipelines;
- New indigenous on- and offshore resources;
- LNG;
- The Southern Gas Corridor sources;
- Bringing these possible new sources to the market also requires the development or better use of interconnection, regasification and storage infrastructure.

It is highlighted the fact that new pipeline infrastructure will benefit the situation of CESEC countries, since there will be at least three sources of natural gas supply, thus directly affect the diversification and security of supply of natural gas sources. It is prepared the list of priority projects and action plan of project implementation, i.e. it is defined the financial sources of above mention projects.

The present Energy Community CESEC Report prepared by the Energy Community Secretariat focuses on the interconnector Bulgaria-Serbia, as one of only two CESEC priority projects where a Contracting Party is involved. While the Trans Adriatic Pipeline (TAP) is also labelled as a CESEC priority project, it has been considered as “decided” on the basis of existing transmission and supply contracts.

The project Gas Interconnection Bulgaria/Serbia (IBS) predicts construction of natural gas pipeline (170 km of length, of which 62 km is on Bulgarian and 108 km on Serbian side of the border), that will connect Bulgarian capital Sofia with Serbian city Niš via Dimitrovgrad. The pipeline's capacity is initially planned at 1800 million m^3/year, with an option to increase the volumes up to 4500 million m^3/year. The line will be reversible with a pipe diameter 700 mm and working pressure of 55 bar, thus enabling access to underground storage facilities on both sides - in Serbia and in Bulgaria.

The total expected investment amounts to 115 million EUR (with EU assistance, Bulgaria has already secured financing for its part of the gas pipeline in the amount of 48 million EUR, where Serbia is still seeking to secure EU pre-accession funds (IPA) for the construction of the Serbian part of the project). The Serbian government set aside approximately 7.4 million EUR for permitting and land purchase, but the largest amount of funding, approx. 65 million EUR for the construction of the pipeline in Serbia, still remains to be secured. Up to the present Feasibility study with elements of environmental and social impact assessment was completed. The spatial plan was prepared for public consultation, and it is ongoing activity. Conceptual design should be finalized by April 2016, but it is essential to provide financing, which depends on several key players (PC Srbijagas, The Goverment of Republic of Serbia, EU funds). Construction permit for the Serbian part of the pipeline is foreseen for September 2017, and the construction works could start in February 2018 and finish in October 2019.

Currently in existing gas storage can be injected 450 million m^3. According to investment plans the underground gas storage facility should be expand on 1 to 1.2 billion m^3 of gas annually. This amount of gas would be enough to settle the semi-annual need of imported natural gas (this amount is equivalent to the energy needs of priority consumers - heating plants, schools, hospitals and kindergartens and supply of the population for two heating seasons). If we take into account the domestic production of natural gas, available amount of natural gas would be sufficient to meet the needs for six months of winter.

The investment in the modernization of underground gas storage, which does not include the construction of associated gas pipeline is approximately 65 million Euros.

The development plans for expansion of underground gas storage capacity predict possible construction of a new underground gas storage in Itebej, in order to achieve the capacities that would cover not only the domestic demand for natural gas, but would also allow the supply of the neighboring countries.

With an investment of 160 to 170 million Euros, Serbia would have the capacity for storage of natural gas of two billion m^3 of natural gas. Feasibility study has shown that this solution is much more favorable from a financial point of view then setting a new gas pipeline.

Near gas storage Banatski Dvor there are three reservoirs - "Tilva", "Međa" and "Mokrin". The capacity of potential underground storage system in Vojvodina is estimated at additional 2.5 to 3 billion cubic meters.

Taking into account the current situation in terms of the geopolitical situation, one possible scenario is that there is an interruption of natural gas delivered to EU countries via Ukraine. About 15% of natural gas to the EU goes through the territory of Ukraine. Russia delivers to European countries about 160 billion cubic meters of natural gas annually. Due to the configuration of the natural gas transmission system possible scenario is that Ukraine suspends transit of Russian gas to Europe. The construction of gas storage facilities would further contribute to the energy security of the country.

4.5.3. The Quality Level of Maintenance of Energy Facilities

According to the Energy Law each energy entity performing energy-related activities concerning natural gas transmission and transmission system management, natural gas warehousing and natural gas warehouse management, natural gas distribution and natural gas distribution system management is obliged to use and maintain energy facilities according to the law that regulates pipeline transmission, technical and other regulations concerning subjected activities, fire explosion protection, as well as environmental protection regulated by law and other by-law regulation.

Natural gas transmission system operator and distribution system operator performs control of inner gas installations within the facility/object of end consumer, in accordance to the law that regulates pipeline transport.

End consumer is obliged to provide maintenance of inner gas installations within its facility/object by entrusting that task to third party (company or other legal entity or entrepreneur) that meets the requirements in accordance to the law regulating pipeline transport.

PC Srbijagas in 2011 for the first time performed the testing of main gas pipeline by pig to determine the current state of the pipeline. In total, about 1,100 km of main gas pipelines of high and medium pressure. The investigation showed that the pipelines are in a relatively good condition. In line with current European practice, such an examination should be carried out every 10 years. In that manner, Srbijagas plans the following trial in 2021.

According to data from JP Srbijagas in the period 2013-2015 maintenance of the supply, transmission and distribution of gas was in good compliance with the maintenance plans of the company.

4.5.4. Measures to be Taken in Case of Insufficient Natural Gas Quantities and Conditions of Supply and Delivery of Natural Gas / Security of Supply and Measures in Case of Disturbances in the Energy System or Market Disruption

In the period 2013-2015, special Working group for assessment and monitoring the situation regarding the security of energy supply (WG) had several sessions, where there were discussed the following topics:

- The safety and reliability of the energy system due to the political situation in Ukraine and possible difficulties in natural gas security supply;
- Analysis of readiness of the energy system, taking into account two scenarios: a short-term (period from March to October 2014) and long-term (period March 2014 to April 2015) interruption of natural gas supply.

It was discussed and analyzed scenarios with different levels of reduction of natural gas supplies from Russia via Hungary as well as the complete cut-off the natural gas supplies coming from Russia, with the supply of natural gas from domestic sources and defined reserves in underground gas storage Banatski Dvor. Comparing short-term and long-term scenarios differing in the period for which the analyze was done the consumption of natural gas (in the case of short-term scenarios district heating systems were exempted as consumers of natural gas, while in the analysis with long-term scenarios it was taken into consideration the period relating to the heating season 2014/2015), the difference of missing quantities of natural gas for partial suspension of natural gas supply amounts from 2.5 to 3 times, or in the case of full suspension of natural gas supplies 2.6 times.

The consequence of missing quantities of natural gas is certainly increased consumption of electricity, and in this case it is necessary to provide additional quantities of electricity from imports. When considering the long-term scenario and shortage of gas imported from Russia, the

main measures to be carried out within the heating plants (district heating systems), where it is feasible, is the substitution of natural gas with the alternative fuel (liquid fuel-oil).

Import of additional quantities of electricity has financial consequences, while the substitution of gaseous fuels with alternative liquid fuels besides the financial consequences have an adverse outcome - the question of securing sufficient quantities of liquid fuel from domestic sources (refineries), as well as the issue of logistics for the supply and storage of this fuel.

The WG has proposed short-term measures to be undertaken as preventive measures:

- Increasing the amount of natural gas injected into underground storage facility Banatski Dvor;
- Perform the analysis of financial feasibility of the above mentioned measure and the possibility of making the available storage capacity and the amount of natural gas from a part of underground storage unit Banaski Dvor that controls the Russian partner (Gazpromeksport);
- Perform the feasibility study of directing the entire domestic production of natural gas to priority consumers (households, schools, hospitals, TSO, DSO, district heating systems and agricultural producers).

In cases of significant restrictions or cut off the natural gas supplies during the summer (March - October 2014) WG proposed the use of the following measures:

- Preparation of restriction plan for delivery of natural gas to industrial consumers and other customers, excluding priority customer groups; it is necessary to take into account the preservation of the quantity of natural gas in underground storage facility Banatski Dvor at the beginning of the heating season, which is defined by the energy balance of the country;
- Involvement of all capacities of Oil Refinery Pančevo in order to provide a sufficient amount of liquid fuels (fuel oil).

In the case of significant restriction or cut off in the supply of natural gas during the heating season (March 2014 - April 2015) WG proposed the use of the following measures:

- Preparation and adoption of restriction plan of delivery of natural gas to industrial consumers and other customers/buyers except for priority groups of customers (households, schools, hospitals, TSO, DSO, district heating systems and agricultural producers) and large customers which should be ensured the supply of natural gas;
- Options and additional costs of providing liquid fuel from production plants NIS Gazprom Neft for district heating systems as of March 2015;
- Involvement of all capacities of Oil Refinery Pancevo in order to provide a sufficient amount of liquid fuel, with a mandatory assessment of the logistics supply for priority customers;
- Assess the possibility of providing natural gas from other sources (Central Europe);
- Consideration of possible alternative route supply of natural gas from Russia (if this is not possible via the pipeline from Ukraine);
- Ascertain and assess the option (quantity and surcharges) of natural gas storage in Hungary.

In the context of the security of natural gas supply WG has defined long-term measures related to:

a) **Storage of natural gas** - increasing the storage capacity in the country - increasing the capacity of the underground storage facility Banatski Dvor and construction of new underground gas storage facility (Itebej)

b) **Construction of new gas interconnectors** - gas pipeline Niš - Dimitrovgrad (the project on the priority list for investments in infrastructure systems for natural gas - PECI List)
c) **District heating systems** – conduct the feasibility study of reconstruction the heating plants firing only gaseous fuel as the primary fuel and allow the use of alternative fuels (liquid fuels); conduct the analysis of possibilities of using biomass in heating plants.

In May 2014 the Republic of Serbia has suffered major natural disaster (floods) during which the lower parts of natural gas transmission and distribution systems were damaged. In this context, one part of the Report of the Government on the natural disaster that has been submitted to the National Assembly, covered the overview of the damage of natural gas pipeline transmission and distribution systems, medium pressure (pipelines and equipment elements), measures and actions taken to prevent possible damage of these systems, as well as an overview of activities and measures that were necessary for repairing the damage caused by floods, with an assessment of the necessary financial resources. All systems in the shortest period were repaired and put into to the proper and functional status in order to continue and normalize supply of natural gas.

In 2014, a Stress test for the Republic of Serbia has been prepared, at the request of the EU Directorate for Energy and the Energy Community in the framework of which there were presented possible scenarios in the case of reduced supply or a sudden interruption/cut-off in the supply of natural gas.

4.5.5. Incentives for New Investment in Exploration, Production, Transmission and Storage of Natural Gas

New infrastructural facilities of the gas pipeline system, i.e. interconnectors or natural gas storage facilities may, upon a request, be exempted from the application of the principle of transparency and non-discrimination, under the following conditions:

- That investments in the new infrastructural facility increase competitiveness in the market and safety of supply;
- That the risk of investments in new infrastructural facilities is such that the investments will not occur unless the exemption is approved;
- That the new infrastructural facilities are owned by a natural or legal person that performs business operations within another legal person separated from the system operator within which the new infrastructural facilities will be constructed;
- That users of the new infrastructural facility bear the expenses of the facility exploitation;
- That the exemption does not prevent competition, efficient functioning of the internal natural gas market and efficient operation of the regulated system to which the new infrastructural facilities are connected.

The act of exemption can be also applied in the case of a considerable increase of the capacity of existing infrastructural facilities and modification of this infrastructure ensuring development of new sources of natural gas supply.

In case of interconnections, act of exemption could be applied after exchange of opinion with other countries that are included within interconnection commissioning.

Table 24 to the Table 27 present the on-going investments as well as planned for the future development of transmission and distribution systems, systems for storage of natural gas, as well as planned investments in interconnection projects. Table 28 gives an overview of other strategic projects proposed by PC Srbijagas, and estimate of investment into natural gas sector is presented in Table 29.

Table 24: Natural gas transmission system development – On-going investments

Item	Investment
1	High pressure distribution pipeline Osipaonica – Požarevac
2	High pressure distribution pipeline Aleksandrovac – Brus – Kopaonik – Raška – Novi Pazar – Tutin
3	Main station for measurement and regulation Župa
4	Main station for measurement and regulation Brus
5	Main station for measurement and regulation Kopaonik
6	Main station for measurement and regulation Raška
7	Main station for measurement and regulation Novi Pazar
8	Main station for measurement and regulation Tutin
9	High pressure distribution pipeline Bačka Palanka – Obrovac – Bač, Main station for measurement and regulation Obrovac and Main station for measurement and regulation Bač
10	Main station for measurement and regulation Obrovac
11	Main station for measurement and regulation Bač
12	High pressure distribution pipeline RG 08-17 Paljevsko polje – Kosjerić and Main station for measurement and regulation Kosjerić
13	High pressure distribution pipeline in Bačko Dobro Polje

Table 25: Natural gas transmission system development – Planned investments

Item	Investment	Technical description
1	High pressure distribution pipeline Šid	Pipeline nominal diameter DN 250; Lenght 42 km
2	Main station for measurement and regulation Šid	Capacity Q = 21,000 Sm^3/h
3	Main station for measurement and regulation Kukujevci	Capacity Q = 9,000 Sm^3/h
4	High pressure distribution pipeline Titel	Pipeline nominal diameter DN 100; Length 6.5 km
5	Main station for measurement and regulation Vilovo	Capacity Q = 9,500 Sm^3/h
6	High pressure distribution pipeline Kljajićevo	Pipeline nominal diameter DN150 Length 9.5 km,
7	Main station for measurement and regulation Kljajićevo	Capacity Q = 13,500 Sm^3/h
8	High pressure distribution pipeline PSG Itebej – Pančevo – Beograd Jug	Pipeline nominal diameter DN 600; Length 130 km
9	Main station for measurement and regulation Kovačica	Capacity Q = 35,700 Sm^3/h
10	Main station for measurement and regulation Beograd jug	Capacity Q = 23,000 Sm^3/h
11	High pressure distribution pipeline Bela Crkva	Pipeline nominal diameter DN200 Length 34 km
12	Main station for measurement and regulation Bela Crkva	Capacity Q = 18,000 Sm^3/h
13	MSK Kikinda chemical company – domestic natural gas from Elemir	Pipeline nominal diameter DN300, Length 40 km

When it comes to the development of the distribution system it should be noted that the realization of 30 investments in municipalities and cities across Serbia (Kragujevac, Krusevac, Smederevo, etc.) is in progress.

Table 26: Interconnection projects – Planned investments

Item	Investment	Technical description
1	Interconnection to Bulgaria	Nominal pipe diameter DN 600; Length 109 km
2	Interconnection to Romania	Nominal pipe diameter DN 600; Length 6 km

Table 27: Natural gas underground storage – Planned investments

Item	Investment	Technical description
1	Capacity upgrade in natural gas storage in B.Dvor[*1]	Capacity 1.000.000.000 m^3
2	Building new natural gas storage in Itebej	Capacity 1.000.000.000 m^3

[*1] – Underground gas storage Banatski Dvor – current capacity of gas storage is 450 million m^3 (under standard conditions). Current number of wells is 18. According to signed Memorandum, there are plans for increasing gas storage capacity up to 1 billion m^3 (under standard conditions). The Study on capacity increasing of underground gas storage Banatski Dvor will give the answers regarding the necessary number of gas wells for supplying the newly defined gas storage capacity.

Table 28: Other strategic projects

Item	Investment	Technical description
1	LNG terminal in Pančevo port	
2	Introduction of CHP plants	Novi Sad (450 MWe + 300 MWt), Beograd (400 MWe + 200 MWt), Pančevo (200 MWe + 100 MWt) and Niš (400 MWe + 200 MWt)

Table 29: Estimate of investment into natural gas sector [2]

Project	Investment (million Euro)		
	up to 2020.	up to 2025.	up to 2030.
New line for interconnection for natural gas supply		-	2.000
Interconnection with regional countries	120	60	20
New gas storage capacities	70	100	40
Completion of gasification of the Republic of Serbia and revitalization of the existing natural gas system	500	500	200
Cumulative investment (million Euro)	690	1,380	3,640

5. CRUDE OIL AND PETROLEUM PRODUCTS

In accordance with the Energy Law, licensed energy activities in the petroleum and biofuel sector are:

- Production of petroleum products
- Transport of oil through pipelines
- Transport of petroleum products through petroleum product pipelines
- Trade in oil, petroleum products, biofuels and compressed natural gas
- Trade in motor and other fuels at the stations for supplying fuel into vehicles
- Storage of oil, petroleum products, biofuels and compressed natural oil
- Production of biofuels
- Blending of biofuels with fuels of oil origin.

The energy activity may be performed by public company, business entity, i.e. any legal entity or entrepreneur which is in the possession of license for energy activity performance.

Transportation of crude oil through oil pipelines and petroleum products through product pipelines represent the energy activities which are defined as the activities of general interest by the Energy Law. They are carried out in accordance with this law and the law regulating the position of public companies. The rest of the above said energy activities are performed in compliance with the market principles.

5.1. Production, import, export an consumption of crude oil and petroleum products

5.1.1. Crude Oil

The necessary amount of processed crude oil is provided from import (over 50%) and a smaller part from domestic production from 53 oil fields and about 650 oil production wells. The largest number of oil fields is located in Vojvodina, in the region of Bačka (Velebit, Turija), of North Banat (Kikinda), of Central Banat (Zrenjanin) and South Banat (Jermenovci, Janošik) including oil fields in the region of Stig around Požarevac (Sirakovo, Bradarac, Maljurevac) [54].

The production and processing of crude oil in Serbia is carried out by Oil Industry of Serbia (NIS a.d.) and in recent years it is the only responsible for import in the Serbian market.

Oil Industry of Serbia also owns the concession on a single block in Angola where is produced about 4,2 million tonnes of crude oil from 1985 to today. (NIS). The oil produced in Angola is not included in the Energy Balance of the Republic of Serbia [44].

Domestic production of crude oil shows a slight decrease while at the same time the missing quantities are provided by incerease of import which amounted 1,796,353 tonnes in 2015. All imported crude oil is only transported through oil pipeline of Transnafta that enters Serbia from Croatia near Bačko Novo Selo as a continuation of the Adriatic oil pipeline that begins in Omisalj (in the north - west of the island of Krk in Croatia), continues to Novi Sad and then to Pančevo. The other aspects of the transport of crude oil such as rail and waterways transports are not represented. In previous years a specified amount of about 200,000 tonnes was shipped via rail tankers from Romania.

The oil produced from domestic oil reservoirs is shipped from gathering stations through oil pipelines to Refinery of Novi Sad and further on refining to Refinery in Pančevo, and certain percentage (<10%) is transported by road tankers to Refinery in Pančevo.

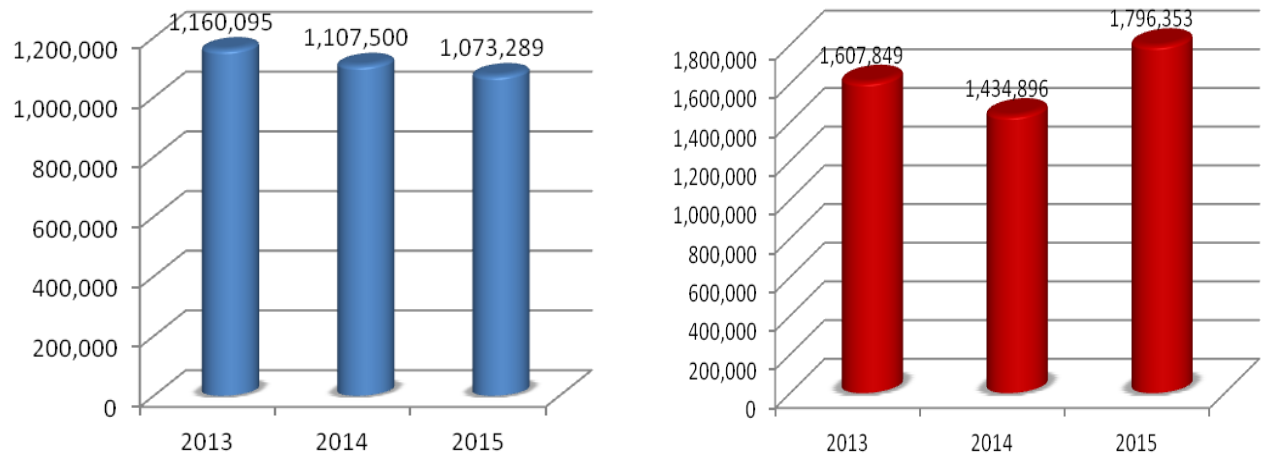

Figure 2: Comparative review of production and import of crude oil (in tonnes) in the last three years [4]

5.1.2. Derivatives of Crude Oil

The supply of petroleum products is carried out from import and from domestic processing of crude oil, obtained from the Refinery of Pančevo. The Refinery of Pančevo within NIS a.d. does processing of crude oil, while the liquefied petroleum gas is produced in the installations of former Hipol Odžaci now "Standard gas" [5].

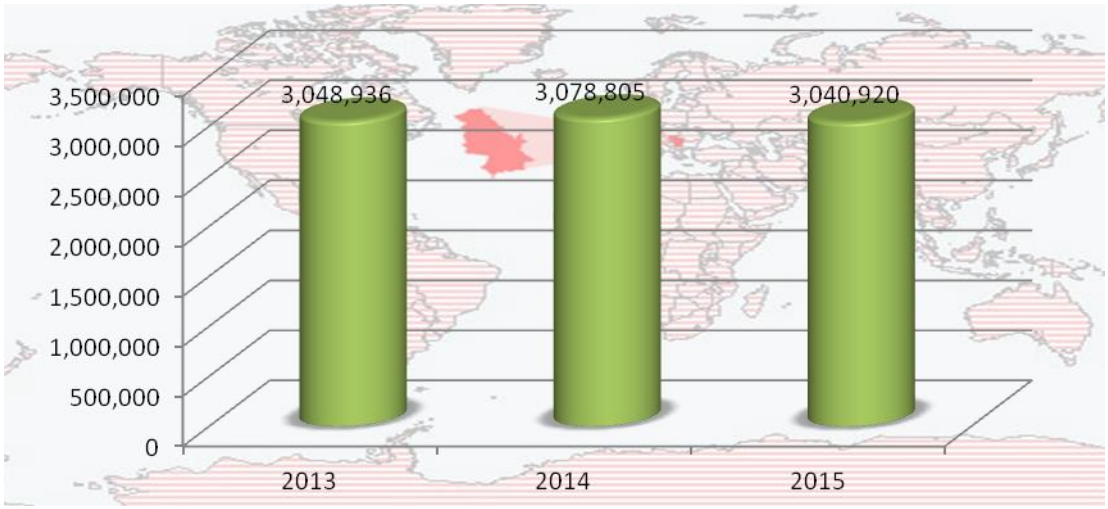

Figure 3: Production of petroleum products – comparative review of 2013 to 2015

The quantities of produced petroleum products in 2015 in the amount of 3,040,920 tonnes are presented as the estimation. Compared to 2013, in 2014 the Refinery of Pančevo increased the processing of jet fuel by 48% [4].

The derivatives produced in the Refinery of Pančevo are shipped by using rail tankers, watercrafts (river tankers, barges, hovercrafts) and road tankers. The transport of petroleum products through petroleum product pipelines does not work because there is no built petroleum product pipelines network.

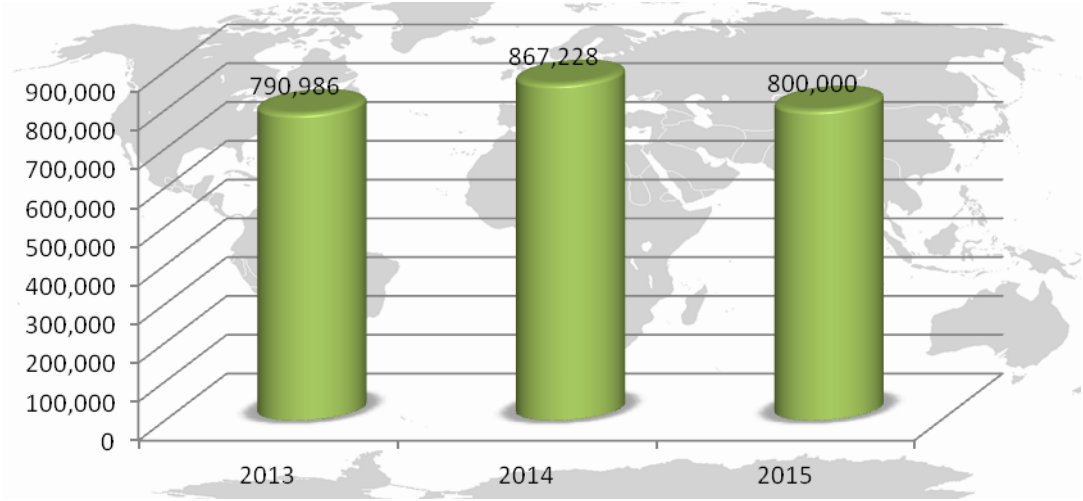

Figure 4: The import of petroleum products (in tonnes) – comparative review of 2013 to 2015

In 2015 the trend of petroleum products import continued and estimated at the extent of 800,000 tonnes.

Analyzing the structure of imported derivatives it results that the highest amount of imported products is the amount of euro diesel imported mostly from Hungary, Bulgaria and Romania. The gasoline has been imported from Hungary, Austria and Romania [4].

Regarding to the supply of derivatives from import, all the amounts are delivered by vessels (barges, river tankers) along the rivers of the Danube and Sava, then by rail tankers and the rest by road tankers.

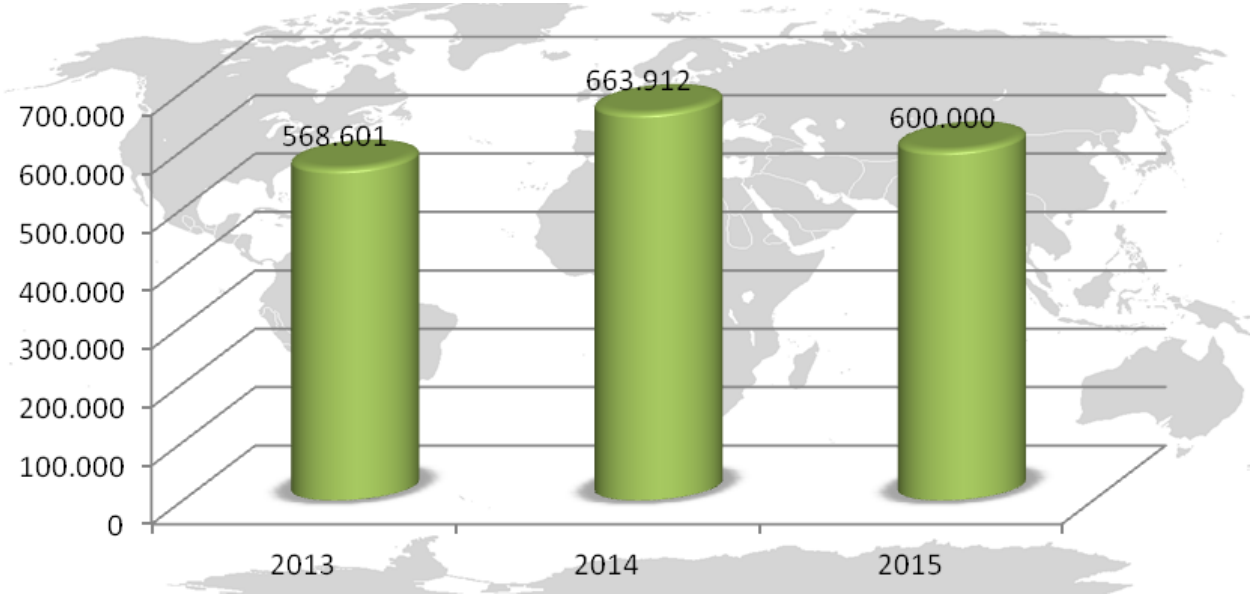

Figure 5: Export of petroleum products (in tonnes) –comparative overview for the period 2013 - 2015

In 2015 the trend of petroleum products export continued and is estimated at the extent of 600,000 tonnes. The increase of motor fuels export is paticularly important. In 2014 the Republic of Serbia's total export was 195,328 tonnes of motor fuel, which is almost 76.4% more than previous year. The most common was the petrol with 119,607 tonnes, followed by diesel with 59,328 tonnes. From other petroleum products export of bitumen is significant with 18,0617 tonnes [4]. This trend continued also in 2015.

The export of petroleum products is performed by placement of diesel fuel in the bunker stations at three locations along the river Danube: Novi Sad, Veliko Gradište and Prahovo. In Smederevo there is also a bunker station built for supplying of only domestic vessels in the country. On bunker stations there were placed on the market 15,336 diesel fuel while in previous year 9,470, which is an increase of 61.9% [4].

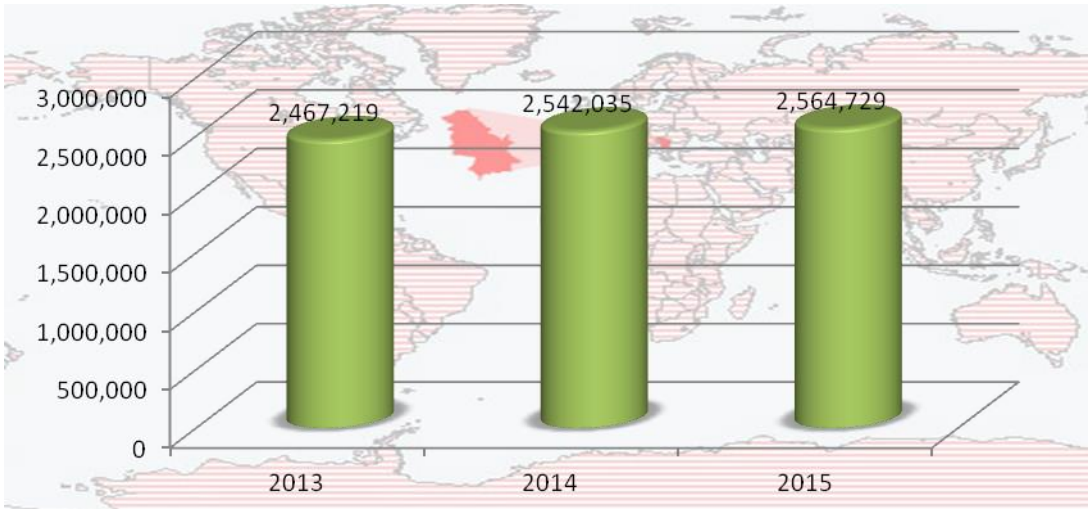

Figure 6: Consumption of petroleum products (in tonnes) - Comparative review for the period 2013 - 2015 [4]

According to the assessments for 2015, final consumption for energy purposes does not diverge from the consumption in 2014 and shows the slight increase. In this structure of final consumption of petroleum products for 2015, the industry participates with 17%, the transport with 72% and other sectors with 11% [44].

5.2. Security of supply of oil and petroleum products

5.2.1. Balance of Oil and Petroleum Products for – Plans

The balance of crude oil, petroleum products and biofuels includes production, import and export of crude oil, refining of crude oil in refineries, and production, import, export and consumption of petroleum products

Energy balance of the Republic of Serbia for 2016 [44] is mostly determined in accordance with the realization and assessment by the end of 2105. The exact amount of all energy products can be seen only at the end of 2016.

According to the information specified above, in 2016 the supply of crude oil and semi-finished products for processing in refineries will be provided from domestic production in the amount of 1,047 million tonnes (32%), while from the import it will be provided an additional amount of required crude oil and semi - finished products in the amount of 2,280 million tonnes (68% of total needs) [44].

The processing of domestic and imported crude oil from the stock as well as components for processing (semi - finished products) will be carried out in Pančevo Refinery.

In 2016, the processing of crude oil and semi-finished products is planned in an amount of 3,428 million tonnes while the domestic production of petroleum products is planned in the amount of 3.354 million tonnes [44].

In the structure of planned oil production the largest part will belong to a production of diesel with 34%, then production of petrol with 14.8%, heating oil 10.69%, liquefied petroleum gas 5.5% and other products 35% [44].

Having in mind the overall need for petroleum products in 2016, including the planned domestic production of petroleum products, the rest of the required amount of about 0.8 million tonnes will be supply from the import [44].

In 2016 it is planned to export 0.6 million tonnes of petroleum products. The final consumption of petroleum products in 2016 is planned to be about 3,298 million tonnes, of which 0,462 million tonnes are for non - energy purposes, while 2,836 million tonnes are for energy purposes. In this structure of final consumption of petroleum products for 2016, the industry participates with 15%, the transport with 77% and other sectors with 8% [44].

In a long-term framework the consumption of peroleum products is planned in compliance with the Energy Development Strategy of the Republic of Serbia.

Table 30: P rojection of consumption to 2030 [2]

Consumption	Product	unit	Period (year)		
			2020	2025	2030
Primary energy Consuption	Crude oil and semi-finished products	thousands tons of oil equivalent	3,822	4,049	4,312
Final Consuption	Petroleum products	thousands tons of oil equivalent	3,368.8	3,595.6	3,853.1

5.2.2. Measures to be taken in case the security of oil and petroleum products supply is threatened

Concerning the security of supply, the area of oil is regulated by the Law on commodity reserves [17] which regulates the conditions for the formation, financing, disposition, use and renewing of the oil and oil derivatives emergency stocks, provision and maintenance of storage, as well as the operation and management of the emergency stocks and storage facilities on the territory of the Republic of Serbia.

By adopting the new Law on commodity reserves, in relation to the oil and oil derivatives emergency stocks, at the Ministry of Mining and Energy the Administration of energy generating products was formed and the long-term, medium-term and short-term programs of emergency stocks formation were made [17].

At the end of 2015, the Administration of energy generating products of the Ministry of Mining and Energy for the purpose of forming emergency stocks purchased the crude oil (16,000 tonnes) and stored it in Transnafta tanks at the Terminal Novi Sad, 10,000 tonnes of euro diesel and stored in the Republic Directorate for Commodity Reserves tanks in Smederevo, 5,000 tonnes of heating oil - low sulfur - special NSG-S stored in Novi Sad (Refinery Novi Sad) and 3,000 tonnes of petrol stored in the Republic Directorate for Commodity Reserves tanks in Požega. Also, the 14,000 tonnes of euro diesel was procured and stored in PE Transnafta tanks in Ledinci storage [4].

Republic Directorate for Commodity Reserves in accordance with the Law store the emergency stocks of oil derivatives in their tanks, managed the construction of new and reconstruction of existing storage capacity of the Directorate, which is financed from the budget of the Republic of Serbia.

In 2015 the Administration of energy generating products was realized option agreements for oil derivative purchase in accordance with the Law on commodity reserves and Directive 2009/119 / EC [19]. In accordance with the long-term plan of emergency stocks formation for 2015, the emergency stocks for 9.5 days of average net consumption were established [4].

The Energy Law prescribes that in case of customers security of supply is threatened due to insufficient supply in the energy market or the occurrence of other extraordinary circumstances, the government can issue the document to approve the change of limit values of certain characteristics of the quality of oil derivatives that can be put on the market in the Republic of Serbia for the period of maximum six months. Measures may last until the circumstances for which they were prescribed continue, or until the consequences of such circumstances are last for [1].

The law determines that the Energy entities performing the activity of oil derivatives production and oil, oil derivatives, biofuels and compressed natural gas trade are obliged to provide the operational reserves of oil derivatives that are equal at least to 15 days of its average selling in the previous year. The operational reserves of oil derivatives and coal used in the case of short-term disruptions in the market, caused by breakdowns and other unforeseen circumstances that endanger the safety of operation of individual parts of the energy system or the energy system in whole [1].

5.3. Technical and other Requirements that Liquid Fuels of Oil Origin and Liquefied Oil Gas Must Fulfil

According to Article 337 of the Energy Act [1], petroleum products and biofuels set on the market have to complete the conditions arranged by the regulations for quality of liquid petroleum fuels and biofuels, by the regulations for protection of the environment and other regulations related to the market of petroleum products and biofuels [47], [48], [49].

Technical and other requirements for liquid fuels of oil origin used as motor fuels for the internal combustion engines and energy fuels which are the subject of trade on the market of the Republic of Serbia as well as the method of conformity assessment of liquid fuels are regulated by the ‘Rulebook on Technical and other Requirements for Liquid Fuels of Oil Origin’ (Official Gazette RS, no. 111/15)

Since enacting of the ’Rulebook on Technical and other Requirements for Liquid Fuels of Oil Origin’ in 2012 the significant progress in conformity of the quality of fuels with the European requirements has been achieved. Trade of leaded gasoline is forbidden on the market, the quality of unleaded motor gasoline must fulfil all requirements of SRPS EN 228 Standard and the quality of diesel fuel must fulfil all requirements of SRPS EH 590 Standard (with the exception of gas oil 0.1 for starting of tractor engines, working machines and railway vehicles, as well as the vessels with diesel engines, which contain sulphur of maximum 0.10% (m/m)).

The law [1] prescribes that in case when there is a security risk of supplying customers because of insufficient supply on the market of energy and fuels or in case of other extraordinary circumstances, the Government can approve with the amendment the modification of limits for some quality characteristics of petroleum products that could be put on the market of the Republic of Serbia for a maximum period of 6 months. The extents could last as long as the circumstances for which they are prescribed, concerning the duration of consequences.

With the modifications of the Energy Act from 2012, the legal basis for compulsory marking of petroleum products is established, with the purpose of reduction of illegal petroleum products market and since 1st December 2013 the Act on Marking of Petroleum Products (Official Gazette, no. 46/2013) is being applied.

The legal base for monitoring of petroleum products quality is determined by the EnergyLaw from 2014 which is in accordance with SRPS EN 14274 Standard and since 1st December 2015 the Act on Monitoring of Petroleum Products and Biofuels Quality (Official Gazette, no. 97/2015) is being applied.

Implementation of marking and monitoring of petroleum products and biofuels quality had the significant contribution in reduction of illegal market, the income growth from excises and taxes in the budget of the Republic of Serbia, in consumers' protection, as well as the fulfillment of internationally undertaken obligations regarding implementation of the Directives 1999/32/EZ and 98/70/EZ.

5.4. Data on Oil Infrastructure

5.4.1. The Refineries in Novi Sad and Pancevo

Crude oil refining in the Republic of Serbia is carried out in two refineries, which are belonging to NIS a.d. (Oil Industry Serbia a.d.).

The Refinery in Novi Sad presents a complex of refining and auxiliary factory plants for refining of oil and petroleum products, tank, transport - manipulative, research and laboratory facility and other accompanying facilities. It is located in the industrial zone of Novi Sad, located directly on the Danube and the navigable DTD channel. The refinery was put into operation in 1968, with designed capacity of refining 3 MTA.

In recent years, the refinery mostly processed the domestic oil of Velebit type using production capacity of only 0.5 MTA.

The refinery is scheduled for reconstruction in order to move to production of base oils with annual production of 180,000 tonnes of base oils, designed by Chevron Lummus Global. As a raw material it would be used naphthenic domestic oil of type 'Velebit' and hydrocracking heavy residues from processing in the refinery in Pancevo. The planned reconstruction is supposed to start in 2013 but until today the works have not been started.

The Refinery of Pancevo in Pancevo has been put into operation in 1968 by launching the first complex of plants with primary processing capacity of 1.32 MTA and with the release of other secondary plants in 1969; the refinery reached the design capacity of 4.8 MTA. Engineering for this plant was prepared by company SFI / Lummus France.

Located in Pancevo, near the Danube River at distance of about 2.5 km and at distance of about 15 km from Belgrade on the surface of about 160 hectares. The pipeline connection is connected to its own harbor on the Danube.

The crude oil is transported to the oil refinery by pipeline, waterways, rail tankers and road tankers. Thanks to its refining capabilities, NIS Oil Refinery Pancevo can practically process all types of crude oil and produce fuels - petrol, diesel fuel, jet fuel and heating oil. The capacity utilization is over 60% and storage facility has a capacity of 700,000 m^3. Since 2014, all domestic and imported crude oil is processing with a total processing of about 3 MTA [55].

Shipping products from the Refinery in Pancevo are transported by barges, road and rail tankers.

Adjacent to NIS Pancevo Oil Refinery there is "HIP-Petrohemija", which consists of plant for pyrolysis of primary petrol to produce ethylene, factory "Ethylene".

The Refinery provides most of the raw material for this plant, so the pyrolysis petrol which returns to the Refinery is very rich in aromatic hydrocarbons, especially in benzene. The crude primary petrol from Refinery to Petrohemija and the pyrolysis petrol from Petrohemija to Refinery are transported through petroleum products pipelines.

In recent years the constant modernization of the Refinery has expanded its primary and secondary capacities.

The location of NIS Pancevo Oil Refinery is very good, from the standpoint of the market and traffic capabilities; however, on the grounds of environmental protection in Pancevo and the environment, the key drawback is the wind rose, which greatly contributes to the increase of pollutants and unpleasant effects on the population of the Town of Pancevo and surrounding villages.

5.4.2. Oil Pipeline Managed by Transnafta

PE 'Transnafta' performs the energy activity of transportation and management of transportation system. "Transnafta" performs the energy activity of general interest, supplying the refineries in Novi Sad and Pancevo with crude oil. The pipeline with a total length of 154 km stretches from the Croatian border on the Danube river through Novi Sad and Pancevo. The pipeline continues to JANAF, which departs from the port of Omisalj on the island of Krk in Croatia and across the Sisak Refinery, their last block stations Sotin and river Danube enters Serbia. The first block station is in Backo Novo Selo, and the pipeline via terminals "Transnafta" with the Oil Refinery Novi Sad extends until the Pancevo Oil Refinery (via measuring station of "Transnafta"). The imported crude oil is transported through all stations along the route, and the domestic oil trough local route from Novi Sad to Pancevo. The pipeline infrastructure is represented by: terminal in Novi Sad with a storage capacity of 4 x 10,000 m^3 and a pumping station, eight block stations along the pipeline, measuring station with Oil Refinery in Pancevo, cathodic protection system and supervisory control system of oil pipelines.

The oil pipeline is divided into two sections:

- DN-1 (Backo Novo Selo - Novi Sad, a length of 63.3 km in diameter of 660 mm, pressure classes ANSI 300 transportation capacity 9 MTA, 1000 m^3/h.) with 38 crossings of watercourses, 20 road crossings, 6 railway crossings, 3 dams, 2 swamps and 5 pipelines.
- DN-2 (Novi Sad - Pancevo, a length of 91 km in diameter of 457 mm, pressure classes ANSI 400, transport capacity 6 MTA) with 95 crossings of watercourses, 17 road crossings, 4 railway crossings, 6 dams and 3 pipelines.

Total average volume of transport - approximately 2.5 million tonnes/year [56].

5.4.3. Oil Pipelines Managed by NIS a.d.

For domestic transport of crude oil to the Refinery in Novi Sad, the oil pipelines which are managed by NIS and by which the crude oil is transported from the dispatching stations are in function. It's about the oil pipeline from the delivery station " Kikinda Field " to the delivery station in Elemir in a length of 42.9 km, a pipeline from the delivery station in Elemir to Novi Sad Refinery in a length of 39.5 km with a diameter of 257.4 mm, which is used for delivery of oil type "Kikinda" as well as the pipeline from the delivery station "Nadrljan" to Novi Sad Refinery in a length of 86.4 km, a diameter of 203.3 mm and with a capacity of 0.5 MTA [54].

5.4.4. Petroleum Product Pipelines in the Republic of Serbia

The infrastructure for the transport of petroleum products through pipelines in the Republic of Serbia does not exist. Technically speaking, the product pipelines exist only between Petrochemical complex and Refinery Pancevo for transport of semi-products and the product pipelines through which were transported ethylene and propylene to the Romanian border and further to Solventum in Romania.

The total length of the pipeline is about 65 km in the Republic of Serbia and about 50 km through Romania and it consists of two parallel product pipelines: Ethylene in a diameter of 168.3 mm and Propylene in a diameter of 114.3 mm, which is not in function at the moment.

Transnafta has initiated the project System of product pipelines through Serbia. The concept of product pipeline system means that the fully supply of the market of Serbia and partly supplying of peripheral areas of surrounding countries (Croatia, Hungary, Bulgaria) is carried out from the Pancevo Refinery. Starting from Pancevo as a center of supply of derivatives, the product pipeline system routes branch out to Novi Sad, Sombor, Belgrade and Nis, over Smederevo and Jagodina. In these cities, there would be located the terminals with appropriate storage capacities, pumping stations (secondary and main pumps) and with measuring points for commercially measurement of received and delivered quantity of motor fuel. Each of the terminals will be equipped with a plant for collection of volatile hydrocarbon and aromatic components from the storage tank.

Transnafta performed all the planning and design of technical documentation Feasibility Study and Preliminary Design and Assessment of environmental impact for the route section Pancevo - Novi Sad and Pancevo - Smederevo.

The design of the construction project for the construction of one part of section Pancevo-Smederevo is in progress and for the year 2016 the detailed design will be done for the section Pancevo - Novi Sad. The construction of this section gives the possibility to transport products from Pancevo to Novi Sad, and covers the market with terminals in Novi Sad because the Refinery Novi Sad is not operational.

5.4.5. The Terminals for Crude Oil

Crude oil storage tanks are located on the route of the crude oil pipeline, more precisely at terminals of Transnafta in Novi Sad and at the Terminal Novi Sad within the Refinery Novi Sad and Oil Refinery Pancevo owned by NIS a.d.

Transnafta Terminal has four tanks for crude oil, in volume of 10,000 m^3 each, out of which two are in the function of transport and two are intended for storage.

Petroleum Industry of Serbia at the Terminal in Novi Sad Refinery has storage tanks capacity of over 140,000 m^3 for storage of crude oil. The largest part of the tank has been reconstructed in the last three years. Also on dispatching stations Kikinda Field, Tisa and Nadrljan there are storage tanks in the function of local transport of crude oil in the capacity of over 70,000 m^3 [54].

In Oil Refinery Pancevo there are storage tanks for technological processes of total capacity of about 700,000 m^3 [54].

5.4.6. Storage of Petroleum Products

The storage capacities in the Republic of Serbia are in dispose of Republic Directorate for Commodity Reserves (approx. 180.000 m^3) Public Entrprise 'Transnafta' Pancevo (approx. 37.000 m^3) as well as the companies performing the energy activity of crude oil, petroleum products and biofuels storage and trade of crude oil, petroleum products, biofuels and compressed natural gas.

In 2015 there were in total 21 licenses for storage of crude oil, petroleum products and biofuels.

Among the companies that are in dispose of licensed storage tanks for storage of crude oil and petroleum products, the largest capacities has NIS a.d. It is followed by Lukoil, Panonske Novi Sad and PE "Transnafta". These four entities represented in total about 80% of entirely licensed storage capacities in 2013 [58].

In 2015 there were in total 41 licenses for trade of crude oil, petroleum products, biofuels and compressed natural gas.

Among the companies that are in dispose of licensed storage tanks for trade of crude oil and petroleum products, far the largest capacities are in dispose of NIS ad. It is then followed by PE "Transnafta", Lukoil, Naftachem and Jet oil, which together with NIS a.d. own approx. 90% of total licensed capacities [58].

5.4.7. Stations for Motor Fuels Supply of Vehicles - Number and Locations of Petrol Stations

Motor fuels and other fuels trade at stations for supply of means of transportation is the retail trade in terms of regulations by which the trade section is regulated.

Retail sale of petroleum products in Serbia is performed by companies in ownership by domestic and foreign companies, which dependent entities are registered in Serbia.

In 2015, the number of licensed business entities which are engaged in retail sale is 463 [5].

Based on data from the study of the Oil Industry of Serbia the total number of stations (BS) in Serbia at the end of 2014 was 1,186. Except NIS a.d. as the owner of the largest number of stations, there are other stations Serbia Lukoil, OMV Serbia, MOL Serbia, Eko Serbia, Knez Petrol, Petrobart - AVIA and Energo petrol.

The five companies with the largest number of stations: NIS, Lukoil Serbia, EKO Serbia, Serbia OMV and MOL Serbia, at the end of 2014 had 602 stations [59].

Other stations which represent almost 50% are owned or leased by a large number of licensed entities that have from one to several stations and are not included in the analysis.

5.5. Program of Modernization and Investment of Refineries

The program of modernization of Refinery Pancevo envisaged the total price of the project in the amount of 547 million euros, of which 396 million goes to construction of hydrocracking complex, the rest of 151 million euros is foreseen for the projects of ecological significance - the construction of plants for the production of hydrogen in Oil Refinery Pancevo, as well as the modernization and construction of industrial infrastructure of Refinery [54].

The project was initiated by signing a contract with engineering company CBI & Lummus, in September 2009. The start of construction is planned for the June 2010 and ending in late 2012.

The investment program, which included the modernization of production capacities and technological reconstruction of the processing complex, in order to increase product quality up to the standard Euro - 5 as well as the environmental protection was implemented to the fullest extent. Until now it has been invested into environmental projects for about 60 million euros, in parallel with the development of modernization of production. Thanks to the modernization, NIS a.d. will fully satisfy needs of the domestic market for fuels with 10 ppm S and unleaded petrol.

The realization of the complex for mild hydrocracking and hydro (complex MHC / DHT) in Refinery Pancevo, enabled the NIS to completely switch to the production of ecologically clean fuel - unleaded petrol and euro diesel with a sulfur content not exceeding 10 ppm.

At the end of April in the refinery, it is successfully completed the project of closed sampling system. This investment, worth around two million euros has ecological significance, because samples that are taken do not come into contact with the atmosphere, which is a significant contribution to environmental protection.

During 2015 it will be accessed to the continuation of realization of project "Coking", which is the second phase of modernization of the refining complex, with the aim of completing the desulphurisation process in refinery capacities.

Overview of the Technological Security of Oil System, the Quality and Maintenance of Oil and Petroleum Products

According to the Article 324 of the Energy Law [1] energy entities who realizes the energy activities of oil transport through oil pipelines, the transport of petroleum products, storage of oil, petroleum products and biofuels, the wholesale of fuels for the supply of vessels, the retail sale of fuels for the supply of vessels and biofuel production, are obliged to use and to maintain energy plants in accordance to the technical regulations and standards relating to the activity they perform, as well as the protection from fire and explosion, environmental protection determined by law and other regulations.

In 2013 a Rulebook on Technical Conditions for Undisturbed and Safe Transport through oil and petroleum products pipelines (Official Gazette of the RS, no. 37/2013) came into effect.

The conditions prescribed by this regulation are: pressure regulation and safety measures against exceeding the allowed working pressure, marking the route of the pipeline and product pipeline, the protective zone of oil and product pipelines, inhabited buildings, spaces and infrastructural objects in the protected zone of oil and product pipelines and work area, dangerous zones and corrosion protection of oil and product pipelines, conditions and mode of remote monitoring and management, conditions of design, installation and maintenance of electrical equipment and installations in dangerous areas, the requirements and testing of pipelines and product pipelines during the construction and before they are put into operation, the conditions and modes of use and handling of oil and product pipelines and their maintenance during operation, repairing and extraordinary events, conditions and modes of corrosion protection and of leaking of oil and product pipelines; examination and maintenance of security devices, conditions and method for protecting the oil and product pipelines, and protecting of their related overground devices, plants and spaces from unauthorized use or damage.

The pipeline Transnafta from the Croatian border to Pancevo has an installed SCADA system for remote control of vents on the block stations along the route of 154.3 km. It is also established a system for the detection of leaks Motorola MOSCAD by which the slightest leak is detected for a short period of time. In 2014, a system for wireless remote control in case of interruption of optical cable which represents a basic vision for electronic communications is installed. In the main dispatching center in Terminal Novi Sad, a video surveillance with motion detection and alarm is installed in each block station.

Every five years the recording of status of pipeline performs by passing the intelligent inspection device (pig) on the basis of which it receives a report of the status of pipeline located on damaged places, the degree of damage and the remaining service life of pipelines, all in accordance with European standards relating to the integrity of the pipeline.

There have been carried out periodically recording of riverbed of rivers Danube and Tisa in place where pipeline crosses through watercourses to ensure preventive response and to prevent accidents.

The Article 327 of the Energy Law [1] defines that the energy entity carrying out the transport through oil pipeline or transport of petroleum products through product pipelines establishes the Rules of Procedure of the system for transport through oil pipelines and the Rules of Procedure of the system for transport of petroleum products through pipelines, which include, in particular: technical conditions for the safe operation of system, procedures in case of disaster and critical situations, or interruption of transport, the rules on access to the system for transport of oil and petroleum products, requirements regarding the quality of oil and petroleum products which are

given for transport, rules on measurement with defined necessary measuring devices and other transport conditions.

Transnafta applies valid document Rules of the transport system [61] which defines all activities in order to provide safe and secure transport and storage of crude oil.

During 2013 - 2014, on the route of an oil pipeline from the dispatching station Nadrljan to the Novi Sad refinery, NIS conducted a survey of the status of pipeline with intelligent pig and from the dispatching station "Kikinda Field" to the dispatching stations in Elemir and from Elemir to Refinery Novi Sad. After receiving reports, the reparation of critical places of the oil pipeline was done with the aim of extending the service life and preventing the accidents.

On the route of the pipeline from the dispatching station in Elemir to Refinery Novi Sad, the system of leak detection Krohne is implemented, and also the installation for system's measuring at the entrance to the refinery system by which all parameters of flow are received in a real time.

Transnafta is successively cleared the technological and storage tanks at the Terminal Novi Sad, recovering them and bringing in excellent working order.

The cleaning is performed every 10 years and in that period testing of tanks and reparation of any damage are done as well as the laser measuring with drafting of volume tables is conducted every 5 years, all in accordance with the Rules on types of criteria that is required verification and intervals of their periodic verification (Official Gazette of the RS, no. 49/2010 and 110/2013) [62].

The activity of the transport of products through product pipelines is not done because there are no functional product pipelines built on the territory of the Republic of Serbia.

Transnafta initiated the drafting of technical documentation in order to implement the project System of product pipeline through Serbia, which would include the construction of a pipeline from Sombor, through Novi Sad, Pančevo, Smederevo and Jagodina to Niš with a branch from Pancevo to Belgrade. Also, the project envisages the construction of the terminal at specified locations. This would achieve a safer and more secure transport with minimal impact on the environment. The total length of oil product amounted to 402 km with a capacity of 4.3 MTA. The Project for construction of route Pancevo - Smederevo is currently in progress. The preliminary design includes sophisticated equipment for remote control and monitoring and leak detection.

At terminals and warehouses of NIS and other licensed entities for petroleum products storage and wholesale the substitution of pouring of the charging system is performing to avoid evaporative losses and to reduce environmental pollution. Also, the systems for the filling of petrol will be installed for condensate recovery units (VRU units) [54].

The port activity is defined by the Law on Amendments to the Law on Navigation and Ports on Inland Waters (Official Gazette of the RS, no. 18/2015) [63]. In the Republic of Serbia there are 1.364 km of navigable rivers and channels. Transport of derivatives by waterways is done mainly on rivers Danube and Sava and the reception and dispatch of products is done at locations Bezdan, Novi Sad, Sremski Karlovci, Pancevo, Smederevo and Prahovo where a modern ports are built respecting all regulations and safety measures in terms of environmental protection (protective dams, skimmers).

River fleet engaged in transport must realize the requirements in terms of security in accordance with the Regulations on the manner of transport of dangerous goods in water transport and obligations of the participants in the transport of dangerous goods by extraordinary events (Official Gazette of the RS, no. 125/2014). Water traffic in the transport of dangerous goods is done by boat which is celebrated in accordance with 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).

5.6. Capacities for Import and Export of Crude Oil and Petroleum products

According to the data from the Energy Balance of the Republic of Serbia for 2014 [64], the transport of petroleum products in the Republic of Serbia is carried out by rail, shipping and road transport. From Refinery to terminal plants it is mainly performed by railway and ship transport, and to final customers by road transport. Currently available capacities of specified types of transport satisfy all needs for transport of products. The only provider of pipeline transport of crude oil in the Republic of Serbia is "Transnafta". The activity of this company is oil pipeline transport through the Republic of Serbia.

5.6.1. Capacities for Import and Export of Crude Oil

The available capacities for import of crude oil are not fully used and the capacity of the oil pipeline, which manages Transnafta and which amounts 9 MTA is currently using less than 30%. There is no possibility to export and reversible transport through existing pipelines and there are not built other pipelines that could carry out the export of manufactured domestic oil via oil pipeline transport. In 2015,was imported 1,796,353 tonnes of crude oil [44].

An alternative to pipeline importing of significant quantities of crude oil represents the import by barges on the Danube from Konstanca, but there are several factors for the inefficiency of this mode of transport. The main reason is the restriction of mobility of Danube in Djerdap hydroelectric power plants and the absence of river fleet capacity which could deliver at the optimal time the necessary amount of crude oil according to the planning needs of the processing [54].

NIS imported by railway from Romania (Arad and Timisoara) a certain amount of crude oil (about 220,000 tonnes) in previous period. The condition and capacity of railway tracks in Serbia represents a limiting factor for significant applications in imports of crude oil [54].

Domestic crude oil is transported by pipeline from the dispatching stations to Refinery Novi Sad and after completing the storage capacity in the refinery or Transnafta Terminal, the shipping continues to the Refinery Pancevo. Oil - type Velebit due to its bad rheological transport properties must be mixed with imported crude oil, and only by bringing to the conditions prescribed by the rules of the transmission system of Transnafta can be transported to the Refinery Pancevo. This type of transport always requires a certain amount of crude oil available in the Refinery Novi Sad for the purposes of blending with Velebit.

When it comes to the waterways transport of domestic crude oil there is a possibility for transport of domestic crude oil by pipelines from the dispatching station to the refinery. The biggest dispatching stations of NIS Nadrljan and Elemir have the possibility of shipping of crude oil through barges but that mode of transport in the regular work of the pipeline is not implemented [54].

The transport of crude oil by tanks is only carried out from domestic oil fields (Turija fields of South Banat and Stig) from collecting stations that are not connected by pipelines with delivery stations previously mentioned. These are amounts that do not exceed 10% of total production. When the Refinery Novi Sad stopped working, the crude oil from the oil field Turija is shipped to the Refinery Pancevo by tank trucks, as due to its unfavorable rheological properties can not be transported by pipeline [54].

5.6.2. Capacities for the Import and Export of Petroleum Products

On the market a significant number of licensed entities who import derivatives by rail, car tanks, river vessels (river tankers, barges and self - propelled tanks) in its property or leasing.

The import of petroleum products by rail mostly is carried out by rail tankers in property of NIS or Standard Logistic while the import by vessels, except NIS a.d. and "JRB" is performed by several companies with their own fleet (Speed Ltd., Naftachem Ltd., Kazuk Ltd., Ladjar Kupra, Rubikon Shipping, Dunav Oil Trans, Judra Ltd, Ladjar Transport Ltd, Euro Gas Subotica, MB Gas Oil, Mario MilTrans Ltd. [54].

With the modernization of Refinery in Pancevo and achieving of products quality on European level, NIS a.d. has reduced the import while Intermol and Lukoil stayed the leaders of import.

NIS mainly does the export of petroleum products by rail transport using rail tankers, by waterways using barges and by road transport using truck tanks.

5.7. Overview - Geographical Origin of Imported Fuels

Based on the available data of Ministry of Mining and Energy which is composed from database that is filled by entrepreneurs [67] as the data that the ministry receives from the Customs Administration, and in accordance with the classification of Section 4 of Anex B of Regulation (EZ) No. 1099/2008 an overview of geographic origin of imported fuels is made.

From the table below it is seen that LPG is a fuel which is imported from a lot of different countries and a consequence is in a large number of licensed entrepreneurs as well as the minimum of necessary technical capacities for its storage, which is not the limiting factor in the market and do not prevent competition.

In 2015, the crude oil and refined gas are only imported from Russia.

The primary petrol is from Bosnia and Herzegovina, while the motor gasolines are mostly imported from Hungary, Austria and Bulgaria and because of that we have many big international companies such as OMV, Mol, Lukoil. We imports from Hungary the largest amounts of fuels [4].

Diesel fuels are imported from different areas opposed to gasolines: Hungary, Romania, Austria, Greece, Slovenia and Bulgaria. The paraffins, bitumens, petroleum coke and lubricants include different spectrum of products [4].

Most of the market participants is provided by euro diesel from the domestic resources, opposed to previous year when the only supply was from the import [4].

Table 31: Table of geographic origin of imported fuels [4]

		Crude oil	Refinery gas (not liquefied)	LPG	Naphtha	Motor gasoline	Kerosene type jet fuel	Gas/diesel oil (distillate fuel oil)	White spirit and SBP	Lubricants	Bitumen	Paraffin waxes	Petroleum coke	Other products
AL	Albania										●			
AT	Austria			●		●		●	●		●	●		●
BA	Bosnia and Hercegovina			●	●			●			●	●		
BE	Belgium			●					●					
BG	Bulgaria			●				●				●		
BY	Belarus			●										
CH	Switzerland			●										
CN	China											●		
CZ	Czech Republik			●										
DE	Germany			●					●	●				
ES	Spain												●	
FR	France											●		●
GB	Great Britain								●		●			
GR	Greece			●				●		●	●	●		
HR	Croatia			●				●					●	●
HU	Hungary			●		●		●	●	●	●	●	●	
IN	India									●				
IT	Italy			●					●	●			●	
MK	Republic of Macedonia			●			●							
NL	Netherlands			●					●	●				
PL	Poland			●								●		●
RO	Romania			●		●		●					●	
RU	Russian Federation	●	●	●							●	●		
SI	Slovenia			●				●	●			●	●	
SK	Slovakia												●	
TR	Turkey									●		●		
UA	Ukraine			●										

6. CONCLUSION

From the previous analysis, basic conclusion can be carried out, that the security of energy supply in the Republic of Serbia is at the entirely satisfactory level. This area is regulated by the Energy Law and a number of by-laws documents, which were adopted in the period between 2013-2015. The Energy Development Strategy of the Republic of Serbia, for the period until 2025 and with projections to 2030, was adopted at the end of the year 2015. This has generated a reliable coordinates for future activities in the field of energy, with uncertainty and dependence of future events and disturbances being reduced.

In the electrical power sector, there has been a clear trend of more intensive construction and use of renewable energy capacity. It observed that this trend is present in both private entrepreneurs and state-owned companies within PE EPS. For now, leading projects are those in the field of small hydropower plants and the use of solar energy. Also, all conditions for a more intensive use of wind power are fulfilled now, and therefore the first wind farms in Serbia are to be expected very soon. Furthermore, significant improvements in the use of biomass are expected (several plants of this kind already exist and they are privately-held), as well as in the construction and implementation of other renewable energy sources.

The state-owned company PE EPS has been elaborating on a series of major projects for the future. All these activities are in line with the Energy Development Strategy of the Republic of Serbia, and some of the projects are planned to be implemented with partners. Given the uncertainty about interest of partners for certain projects, as well as in financing some of the future projects, there is a redundancy in terms of the number of projects for the next 15 year period. For all projects, project documentation is being developed, and the decision about which will be implemented will depend also on market conditions. So far, Republic of Serbia has been characterized by very good grid interconnection with all its neighbours. However, as the report shows PE EMS undertakes a series of activities, which will lead to a significant expansion of capacity for import, export and flow of electricity through Serbia.

When it comes to natural gas, expanding the capacity of underground storage Banatski Dvor and its replenishment were of vital importance in the last period. Locations for new warehouses are being considered, whereby the realization of such projects would be of regional importance. Uncertainty regarding the implementation of transnational projects (such as the South Stream), requires that options for different routes of supply should be considered in the future, as well as different sources of natural gas supply.

Natural declining trend in domestic production of crude oil was detected, and it will affect, together with reduced investment regarding research and opening of new oil storages, the shortfall in domestic crude oil processing. Missing quantities will be compensated by increased import, and this trend will have a significant effect to the planned processing capacity of crude oil for the production of base oils, where the domestic oil of type Velebit is the main raw material.

Some crisis situations from previous years are revolved for natural disasters, and distortions in the market of some energy sources. At these challenges competent national authorities react with short-term measures, but also by establishing guidelines for the formation of long-term measures. Thus, for example, in the case of extensive flood which happened during may 2014 numerous electrical facilities were directly threatened. The reaction to this natural disaster was multilayered and included activities vertically, starting from the Government through the relevant ministries, public enterprises, etc. The first measure was the declaration of emergency, which is for the prevention of serious consequence immediately engage all available resources in the state, including the army and police resources. At the same time, within each PE and lower organizational units were formed special headquarters with 24 hours on duty and permanent

monitoring of the situation and making decisions in real time. During the flood, and taking into account the intensity of disasters, the emphasis was on natural defense of the most important objects (for example TENT A in Obrenovac), primarily by building additional dams. Due to the inability to produce electricity in a number of facilities, one of necessary short-term measures included license for off-balance sheet required amount of electricity. Next measure was the import of certain quantities of coal for the undisturbed operation of thermal power plants, since the consequences of the floods was the hardest at surface coal seam and their elimination has lasted the longest. This measure was implemented within PE EPS and can be treated as a medium-term measure. In this types of measures were also includes detail reduction of consequences which were lasted for several months on the coal seam. The long-term measures included updating, but also complement of plans for the protection of such intense rain and flooding attack. It is expected that these measures become part of the standard management system management in the companies and utilities in which this is not done yet.

It is more and more frequent appearance of the flume winds that have implications for knockdown the parts of electric feeders on distribution, even the transmission level. Certainly, as an urgent short-term measure is fast replacing broken poles and raising network and as the medium measure can be specified timely inventory management as a response to emergencies, and the long-term measure may be considered change of type columns on a given route, which are more resistant to storms, or just relocation and redesign of the route.

One of the typical problems are iced rains, which in combination with the low temperature causes great problems to the overhead electricity network, especially at lower voltages and in mountainous areas. Therefore, intervention in such cases is very difficult and can take for several days. Experience shows that serious consequences in repeated situations can be in some way reduced by partial replanning of the network and strengthening the network of lower voltage levels.

Generally, when it comes to electricity, Serbia is in great part energy secure and independent. Production capacity meets the needs of consumption and the total sum is surpass. The import of electricity is realized in the winter to cover consumption peaks, but during the year surplus electricity produced are exported. At the same time, exports in the last ten years exceeds import. Short-term disruptions in production can not significantly change this good image. In the case of extremely strong winter Serbia has the capability, thanks to good interconnection lines with neighboring countries to import electricity from various supply routes. In fact, it can be said that a very good interconnection networks represent only the realization of the former decisions and long-term measures to reduce the risk of a shortage of electricity. There are situations when some neighboring countries, due to their own difficulties in the supply of electricity, close their borders to energy output, actually, suspend active construction contracts which the electricity leaves their country. This is one of the risk factors that exist, although not very strong due to the low energy dependence of Serbia in terms of electricity and relatively small imports.

Risks that once occurred earlier were economic and trade sanctions which Serbia has been exposed. They are prevented adequate maintenance, primarily vital equipment production capacity, which is imported character. In the medium and long term this is a very endangered reliable production of electricity. However, the last 20 years, there were no such risks.

The main risk when it comes to the natural gas supply is that the dominant gas is provided from a source end and by one line of supply. There have been times when there were breaks of supply in this way, without affecting Serbia. Short-term measures are intervention purchase of gas from neighboring countries, as well as the substitution of this fuel to other energy sources (to the maximum extent possible). Medium-term measures are the construction and expansion of the capacity of underground gas storage facilities and their filling (it is achieved remarkable result in recent years which can be seen from the report). Long-term measures are the inclusion in

international projects for new supply routes and new sources of natural gas. In the absence of such projects and the expectation, Serbia took part in regional projects. One of these is (horizontal) regional integration with countries in the region which should reduce the risk of shortages of natural gas in the coming period due to new market distortion due to problems on the main lines of supply. In addition, the realization of such regional-linking will prove to be useful in the case of realization of one of the major projects in the future.

Any disturbance in the market of natural gas or electricity is reflected in the increasing demand for heating oil by large power consumers, which must be provided by operational or mandatory reserves of this energy source. For now this issue is determined by the Law on commodity reserves, and in the future will be further established through the regulations of new laws.

When crude oil is concerned, the situation is similar to natural gas. There is only one way of supply and one pipeline. This is the part of the pipeline route of the former JANAF, and in the past there was no threat to the supply of crude oil. In case of disruptions of supply in this direction, for whatever reason, it is clear that it have to increase imports of finished petroleum products. However, in the long run this is not a solution, it is clear that the provision of new supply routes for import of crude oil through the pipeline is of great importance in the future, in order to have flexibility in this regard.

Construction and implementation of oil pipeline network through Serbia, and connection with the neighbouring countries, will allow secure and safe transport and presence of sufficient quantity of oil products at any time.

Solving the existing problems of the railway infrastructure through the construction of new or reconstruction of existing railway tracks and increasing the axle load-carrying capacity, will give the possibility of product transportation by rail, for the purpose of both import and export.

Reconstruction of existing and construction of new storage facilities for the mandatory reserves should ensure availability of products in the optimal period for the entire territory of the Republic of Serbia.

Finally, it can be concluded that at this moment, despite the many unknowns caused by political instability in the world and numerous wars taking place in the strategic energy-rich areas, the situation in Serbia in terms of energy security is at a satisfactory level.

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