
Republic of Serbia
Ministry of Energy, Development and Environmental Protection

Preparation of Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030, II Phase

Draft Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030

Consultant:
University of Belgrade - Faculty of Mining and Geology

Contract No.: 404-02-60/2012-01
Date of contract signing: 19.07.2012.

Belgrade, 14.06.2013.

Dean of
Faculty of Mining and Geology
Prof. Ivan Obradović, PhD

Employer	Ministry of Energy, Development and Environmental Protection
Subject	Preparation of Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030, II Phase
Contract	404-02-60/2012-01 dated 19.07.2012.
Study prepared by	University of Belgrade - Faculty of Mining and Geology
Dean	Prof. Ivan Obradović, PhD
Head of Work Group	Prof. Dejan Ivezić, PhD
Work Group	Ass.prof. Marija Živković, PhD Branislava Lepotić Kovačević, PhD Prof. Nenad Đajić, PhD Prof. Petar Đukić, PhD Ass.prof. Jovan Mikulović, PhD Prof. Vladimir Pavlović, PhD Prof. Dušan Danilović, PhD Prof. Dragan Ignjatović, PhD Ass.prof. Snežana Grujić, PhD Aleksandar Vučetić, dipl.ecc. Prof. Miloš Tanasijević, PhD Ass.prof. Vesna Karović Maričić, PhD Aleksandar Madžarević, MSc Miroslav Crnogorac, MSc
Head of Work Group Prof. Dejan Ivezić, PhD	Dean of Faculty of Mining and Geology Prof. Ivan Obradović, PhD

Content:

I INTRODUCTION	4
Energy sector and economic development	5
Sustainability as an sector development challenge	6
<hr/>	
II ENERGY RESOURCES AND POTENTIALS OF THE REPUBLIC OF SERBIA	8
Coal	9
Oil and natural gas	11
Oil shale	11
Renewable energy sources	13
<hr/>	
III BASIC ASSUMPTIONS REGARDING DEVELOPMENT OF ENERGY SECTOR OF THE REPUBLIC OF SERBIA	17
Energy sector in the Republic of Serbia in 2010	18
Projections of final energy consumption	23
SWOT analysis of the energy sector of the Republic of Serbia	26
<hr/>	
IV STRATEGIC PRIORITIES OF ENERGY SECTOR DEVELOPMENT IN THE REPUBLIC OF SERBIA BY 2030	29
<hr/>	
V ENERGY SECTOR DEVELOPMENT	35
Electric power system	37
District heating	46
Renewable energy sources	49
Coal	52
Oil	54
Natural gas	57
Efficient energy use	60
<hr/>	
VI LEGISLATIVE, INSTITUTIONAL AND SOCIAL AND ECONOMIC FRAMEWORK OF ENERGY SECTOR DEVELOPMENT IN THE REPUBLIC OF SERBIA	63
Impact of international assumed obligations	64
Development of institutional framework	67
Legal and market framework of subfield (law) of energy sector	68
Social and economic aspects of the foreseen development	70
Energy sector and similar fields – horizontal harmonization necessity	72
<hr/>	
VII ENERGY SECTOR DEVELOPMENT IN THE REPUBLIC OF SERBIA AFTER 2030	74
<hr/>	
Annex – Total energy balances and energy indicators	78

INTRODUCTION



At the beginning of the second decade of XXI century, economy and society of the Republic of Serbia are in very deep crisis in terms of development. At the time of long economic recession, the Republic of Serbia is challenged to make path to desired long-term energy development and define strategic preferences which are the basis for that development in future mid-term period, i.e. by 2030. Strategic reviewing and positioning of national energy sector should enable energy sector and economy of the country to overcome current crisis with lower costs as well as to take better start position for future more dynamic and quality economy growth and its sustainable development.

More precisely, Energy Sector Development Strategy in the Republic of Serbia by 2030 shall offer the road of market restructuring and technological modernization of energy sector of the Republic of Serbia in order to better prepare for the period of the growth of general demand for goods and services.

Strategic engagement in energy sector implies that processes in the economy and country, as well as in the life of citizens, are performed with lower economic costs, with higher level of social and environmental sustainability, i.e. higher standard of population with reduction of pollution and better environmental protection. In that sense, application of the Energy Law and Energy Sector Development Strategy of the Republic of Serbia should result in adequate energy, economic, environmental and social policy, which would, with adequate legislation and the country acting in accordance with the law, lead to sustainable energy system, more efficient economy and better social prosperity with sustainable balances of natural resources and pollution at the lowest possible levels.

Energy Sector and Economic Development

All analyses of key economic and technological changes in XXI century show that energy sector has been and still is the initiator and key factor of economic changes, as well as the spine of economic development during the last two and a half centuries. Global changes demand professional and long-term consideration of its future directions at national level and thus adequate management of energy sector development.

The beginning of modern technological era is connected with the key foundings in energy transformation and its concentration at the consumption point. Today, energy sector has not lost slightest significance regardless of the forecasts about reduction of importance of natural resources and also available energy potentials for technologically high-sophisticated economy, in society and economy of knowledge.

In the whole world today strategic positioning of countries, nations and companies for the access to remaining natural resources, especially mineral energy resources such as oil and gas, as well as technological competition in energy efficiency and commercial use of renewable sources (RES) are still ongoing. Only in XX century global population increased 3.7 times, while demand for final energy increased more than 30 times. It means that, together with intensive exponential growth of world population especially noticeable in the second half of XX century,

energy consumption per capita was far higher as well. Although the exponential trend of the population growth was lower at the end of century, trend of the increase of energy consumption per capita has still been growing. For three decades just at the end of XX century average total consumption of primary energy was growing at average annual rate of 2.1%, growth rate of global population was 1.6%, while growth rate of world gross domestic product (GDP) was 3%. This shows the fact that despite reduction of energy intensity, primary energy consumption is still growing faster than population.

Energy generation and consumption per capita are increased also in the countries with the fastest technological progress and highest income per consumed energy unit, thus becoming more energy efficient. According to the estimation of International Energy Agency (IEA), in the period from 2005 until 2025 it is expected that the primary energy consumption would be increased by 40%. This shows that development of energy sector has to be planned in strategic way and analyzed in detail from all aspects regarding general development, technological and economic aspects and social, environmental and other aspects as well.

It is certain that today energy represents the economy sector with the highest negative environmental impact and its dependence on conventional energy sources represents real threat for the sustainability of economic directions. Namely, the fact that the most commercial and most available energy products in the world now (coal, oil and gas) are not renewable is very important characteristic of world energy sector that influences the sustainable future, i.e. possibility of today's generations to achieve economic growth and development but not taking that possibility from future generations.

Sustainability as an Energy Sector Development Challenge

There is no doubt that energy sector was and is the sector of particular interest for the whole economy and society. If energy sector becomes stable, modern and quality organized sector this will inevitably lead to the welfare of the entire economy of the country. Vice versa, if not enough attention is paid to the energy sector from the position of strategic planning, bad position and weak perspectives of the entire economy will be inevitable.

The most likely scenario of global development assumes economy based on the **efficient use of relatively "clean" energy available from different sources**. According to all development scenarios, energy sector shall still for a long period of time, have a task to provide for economy and society significant amounts of energy and energy products, but with the tendency to reduce energy intensity, i.e. consumption per unit of monetary product.

Second requirement for energy sector is to be cleaner, i.e. to rely as much as possible on **renewable energy sources** and as little as possible on exhaustible sources.

Third requirement that shall be dominant in the future is that generation and consumption of "green" energy shall have **the lowest possible impact on environment**, water, air, land and directly also at whole food chain, biodiversity and human health.

Fourth requirement for energy sector is about **economic efficiency and energy market**. Energy is goods and its turnover and prices have to be defined by the market. Energy offer and demand significantly influence on its price, supply conditions and the events at the international level. Having in mind that energy sector has particularly high external effects (costs or benefits for indirect participants, who do not have to be direct customers, i.e. suppliers) it represents for this market necessary corrective **mechanism of internalization of externals (application of the principles that consumer/pollutant pays)**. The thing is that both ecological and other external costs have to be included in the retail price - through charges, fees, taxes, penalties or other economic and financial instruments. In external costs which are included in the price of some energy products, in the option of future energy sector, transition costs have to be included as well, i.e. substitution and technological adaptation for the use of other, by the rule more expensive energy products, when exhaustible conventional sources are completely used.

These requirements cannot be implemented without adequate legal framework, institutions and bodies that are responsible for this concept. Behavior that is energy efficient and ecologically adequate within energy sector requires non-selective application of the laws and non-discriminatory practice. Finally, position regarding energy and environment and the change of behavior of energy customers, consumers and producers that comes from the dispersion of knowledge as a key development factor of today's economy are very important.

Development of energy sector has to be **socially tolerable**, i.e. possible sudden changes at energy market cannot have much serious social impact on the majority of population in the society. Possibilities given by dynamic development of energy sector in terms of rational cost allocation and benefits at the level of country should be used. Key positive social consequences of such energy sector development are employment, life standard increase and improvement of status of human rights and possibilities to use public goods. New technological solutions, based on the market stimulations, have to be the guarantee that **more efficient, cleaner** and to a greater extent **renewable energy sector** shall be **socially sustainable** as well.

II ENERGY RESOURCES AND POTENTIALS OF THE REPUBLIC OF SERBIA



Energy resources and potentials of the Republic of Serbia include fossil, conventional (coal, oil and natural gas) and unconventional fuels (oil shale), as well as the renewable energy sources¹.

Structure of energy reserves of fossil fuels of the Republic of Serbia is presented in the Table II-1. Reserves of more quality energy products, such as oil and gas are symbolic and make less than 1% of geological reserves with high exploration level, while remaining 99% of energy reserves include various types of coals, with the highest share of lignite, over 95% in the proved reserves. Significant part of the reserves of lignite is located at the territory of the Autonomous Province (AP) of Kosovo and Metohija². Taking into consideration total geological reserves and resources, it can be noticed that besides mostly used reserves of lignite, oil shale, which make 9% of total geological reserves and resources are presented and have not been exploited yet.

Table II-1: Geological reserves and resources of fossil fuel (million toe)

Energy resource	Proved and probable geological reserves	Total geological reserves and resources
Hard Coal	2.77	4.02
Brown Coal	37.7	45.17
Brown-lignite Coal	134.25	193
Lignite	1.583 (780*)	3.698
Oil	10.14	50
Natural Gas	3.37	50
Oil shale	-	398**

* Without Kosovo and Metohija

** Kerogen – organic part of oil shale

Coal

Most significant coal deposits in the Republic of Serbia are lignite deposits (soft brown coal). Geological reserves of lignite compared to the geological reserves of all types of coal in the Republic of Serbia make 97%. Exploitable coal deposits with high exploration level, which are by its cost-effectiveness divided into the class of proved coal deposits cost-effective for exploitation and the class of probable coal deposits which currently are not cost-effective for exploitation, are given in Table II-2.

It should be noted that from the presented amounts of lignite (8.88 billion tons) about 4.5 billion is at the basin of Kosovo and Metohija, while about 4 billion tons is at the central part of the Republic of Serbia, i.e. Kolubara and Kostolac basins. Total coal reserves that can be exploited are significant and represent realistic basis for further long-term development of the energy sector in general and particularly for the electricity generation.

1 Energy sources that can be found in nature and that are completely or partially renewable, particularly energy of river flows, wind, non-accumulated solar energy, biomass, biomass derived from animals waste, geothermal energy, biofuels, biogas, synthetic gas, landfill gas, gas from facilities for the treatment of utility waters and waste waters from food and wood processing industries which do not contain hazardous materials.

2 Kosovo and Metohija is the autonomous province within the Republic of Serbia and based on the United Nations Security Council Resolution 1244 dated 10 June 1999 it is under temporary civil and military administration of the United Nations, <http://www.srbija.gov.rs/pages/article.php?id=45630>

Table II-2: Proved and probable coal reserves of the Republic of Serbia,(t)

Coal	Class	Amount
Hard	Proved	6.174.630
	Probable	2.040.780
	Total	8.215.410
Brown	Proved	90.120.540
	Probable	21.173.090
	Total	111.293.630
Brown-lignite	Proved	268.339.290
	Probable	10.713.660
	Total	279.052.950
Lignite	Proved	7.464.442.961
	Probable	1.415.974.802
	Total	8.880.417.763

Total geological reserves of coal in the Republic of Serbia are presented in Table II-3. Having in mind the high level of exploration, total geological reserves in the Republic of Serbia not including the provinces from Table II-3 correspond to the geological reserves from Table II-2. Low level of exploration at the territory of Kosovo and Metohija leads to the significant difference between balance and off-balance reserves and total geological coal reserve.

Table II-3: Total geological coal reserves of the Republic of Serbia (thousands of t)

Coal	Serbia not including AP	AP Kosovo and Metohija	AP Vojvodina	Total Serbia
Hard	8.215			8.215
Brown	111.294			111.294
Brown-lignite	536.678		8.729	545.407
Lignite	3.989.333	15.746.000	275.000	20.010.333

According to the data from balance reserves for 2010 more than 76% of total coal reserves in the Republic of Serbia are at the territory of Kosovo and Metohija basin. According to the same source, in Kolubara basin there is 14% and in Kostolac basin there are 3.3% of coal reserves. 2.7% of total amount of coal are in Sjenica and Kovin basins. Most significant lignite reserves that are exploited today within Elektroprivreda Srbije are in Kolubara and Kostolac basins.

Oil and natural gas

Basic characteristics of the status of resources and reserves of oil and natural gas in the Republic of Serbia are little scope of conventional resources and balance reserves, relatively high level of exploration and limited exploration area. In the majority of oil and gas resources relatively high coefficient is achieved resulting in natural drop in generation. By the application of new technologies and interventions on boreholes, drop in generation is temporarily stopped.

Remaining balance reserves of crude oil in the Republic of Serbia at the end of 2010 amounted to 10.14 million tons, i.e. 4.23 billion m³ of natural gas. These reserves have low exploitation quality (mature and late phase of exploitation of the existing deposits), which requires application of new technologies regarding elaboration and generation.

As the level of exploration at the territory of the Republic of Serbia is not equal and generation of crude oil and natural gas is realized only from Pannonian Basin, a new modern concept of oil and geological explorations is concentrated on the exploration of non-structural traps of tertiars and exploration of mesozoic complex and finding reserves in non-structural traps and collectors of untraditional type in Vojvodina, as well as on finding large anticline traps in zones of collapse of regional tectonic structures and near the possible roads of migration of hydrocarbon at the territory of the Republic of Serbia which has not been explored in detail. Only after the completion of detail geological explorations at the territory of central, eastern and south-east Serbia it will be possible to talk more precisely about possible potentials of this large area from the aspect of oil and natural gas reserves.

Pannonian Basin, although young in geological terms, is defined as one of the potential basins in the Europe for unconventional resources of hydrocarbon. In this regard the project for geological exploration of unconventional gas has been initiated and upon its finalization potentials of our part of Pannonian Basin will be defined more precisely in terms of unconventional resources of hydrocarbon.

Oil shale

Oil shale reserves in the Republic of Serbia are identified in the following basins: Aleksinac, Vranje, Senonski tektonski rov, Valjevo and Mionica, Zapadna Morava, Krusevac, Babusnica, Kosanica, Nis and Levač. Except Aleksinac, other basins are explored at the level of probable reserves and total of estimated reserves and resources in stated basins are about 4.8 billion t of oil shale, i.e. 400 million t of kerogen.

At Aleksinac basin higher level of exploration of the oil shale is reached and estimated reserves are probable having in mind that their processing technology is not defined, in respect to their content and technical and economic conditions of exploitation. It is estimated that there are two billion tons of potential oil shale reserves and resources in Aleksinac basin, where only field Dubrava is explored in detail and estimated reserves are with average content of organic material of 16.6 volume % and production of oil of 8,95 mass %. According to the dominant type of kerogen and level of conversion, the reserves of kerogen in Aleksinac basin are estimated at 200 million t.

The Republic of Serbia does not have balance uranium reserves, and existing off-balance reserves are relatively small and from the aspect of current level of exploration do not represent developing potential.

General conclusion regarding renewable energy sources in the Republic of Serbia is that they have not been sufficiently explored (except coal) and therefore data about them are not final. Coal reserves are such that according to the projections of consumption they meet need until the end of this century. Oil shale reserves are significant but conditions for the exploitation and technology of their use are yet to be defined having in mind that they represent unconventional fuel. Oil and natural gas reserves shall enable their production until 2030 and further exploitation shall depend on the transfer of probable reserves into proved reserves, as well as the discoveries of new reserves. Therefore, geological reserves of primary energy sources still represent significant basis for development of generation and use for the needs of development of energy sector of the Republic of Serbia.

Nevertheless, when considering time horizon and development of energy sector regarding fulfillment of consumption demands, dynamic dimension of primary energy reserves has to be taken into account, which includes the following aspects:

- Change of reserves of solid, liquid and gas fuels;
- Changes to limits on the tightening of criteria regarding environmental protection, energy sector impact on the climate changes, water management, uncontrolled and undirected urbanization and placement of infrastructure buildings within the zone and at the areas where energy resources are, i.e. areas good for exploitation of energy raw materials;
- Development of new methods and technologies of exploration, exploitation, processing, refinement or transformation, i.e. expected changes within the sphere of valorization of specific value categories in the future, which shall affect change of current limits of economically feasible exploitation of potentials.



Renewable Energy Sources

Renewable energy sources sector, except hydro energy, is in its early phase of development. Estimated total renewable energy sources potential, which is technically available in the Republic of Serbia, is estimated to 5.65 million toe per year. 1054 toe of biomass and 909 thousand toe of hydro energy of this potential is already in use. (Table II-5).

Table II-5: Overview of technical usable potential of RES (from 2012)

RES type	Available technical potential in use (million toe/per year)	Unused available technical potential (million toe/per year)	Total available technical potential (million toe / year)
BIOMASS	1,054	2,351	3,405
Agricultural biomass	0,033	1,637	1,67
Parts of agricultural species	0,033	0,99	1,023
Parts in fruit growing, wine growing and fruit processing	-	0,605	0,605
Liquid Manure	-	0,042	0,042
Wood (forest) biomass	1,021	0,509	1,53
Energy crops	-	-	not available
Biodegradable municipal waste	0	0,205	0,205
HYDRO ENERGY	0,909	0,770	1,679
For installed capacities up to 10MW	0,004	0,151	0,155
For installed capacities from 10MW to 30MW	0,020	0,102	0,122
For installed capacities over 30MW	0,885	0,517	1,402
WIND ENERGY	≈0	0,103	0,103
SOLAR ENERGY	≈0	0,240	0,240
For the electricity generation	≈0	0,046	0,046
For the production of heat energy	≈0	0,194	0,194
GEOTHERMAL	0,005	0,175	0,180
For the electricity generation	≈0	≈0	≈0
For the production of heat energy	0,005	0,175	0,180
BIODEGRADABLE WASTE PART	0	0,043	0,043
Total from all RES	1,968	3,682	5,65

Biomass represents significant energy potential of the Republic of Serbia. Biomass potential is estimated at 3.405 million toe and it makes 60.3% of total potential of RES. The largest part of this potential is biomass wood potential -1.53 million toe and agricultural biomass potential -1.67 million toe (parts in crop farming, cattle breeding, food growing, wine growing and primary fruit processing), while the potential of biodegradable municipal waste is estimated at 205 thousand of toe. Biodegradable waste (except municipal waste) includes also waste cooking oils and animal waste (slaughterhouse waste) in total amount of 0.043 million toe/per year.

Biomass potential is available at the whole territory of the Republic of Serbia. Wood biomass is mostly located in the area of the central Serbia and agricultural biomass in the area of Vojvodina. Nevertheless, while the level of use of wood (forest) biomass potential is relatively high (66.7%), agricultural biomass potential is used very little (about 2%) while the biodegradable municipal waste potential is not used at all. Biomass (especially agricultural) potential is dynamic category and in order to increase it, it is necessary to undertake adequate activities for the use of uncultivated land, and for the use of marginal land in the biomass production for energy sector purposes (energy crops).

In the Republic of Serbia there it is possible to produce both **bioethanol** and **biodiesel**. Raw materials necessary for the production of bioethanol are cereals, millet, Jerusalem artichoke (topinambour) and potato. For the biodiesel production the following oilseeds can be used: sunflower, soya, and rapeseed, as well as waste cooking oils. All stated raw materials can be taken into account as the potential for the production of biofuel only after all other needs are met. It is estimated that market surpluses of the cereals are more than million tons, but using them for the production of bioethanol is economically justifiable only in the cases when it is not possible to achieve them and in the events when it is not possible to produce bioethanol from lignocellulose biomass. Also, according to the estimations there are approximately 100.000 ha of marginal land in the Republic of Serbia that can be used for cultivation of millet and Jerusalem artichoke by which about 3 million tons of ethanol per year could be produced. Growing oilseed for the production of biodiesel could be performed at 350.000 ha by which 220.000 t of biodiesel could be produced. It is estimated that it is possible to collect about 10.000 tons of waste cooking oil per year which can be used for the production of biodiesel.

Total **hydro energy potential**, gross potential of water that flows in the rivers on the territory of the Republic of Serbia is about 25.000 GWh/per year. The largest part of hydro potential (over 70%) is concentrated only at several rivers with the potential over 1000 GWh/per year: Danube, Drina, Velika Morava, Lim and Ibar. On the other hand, it will be possible to use hydro energy potential of several rivers only partially, because of the priority that water management use has, because some rivers are planned as the sources of regional water supply systems: Toplica, Crni Timok, Rasina, Studenica, Veliki Rzav, Mlava, Lepenac and etc.

Technically usable potential in the Republic of Serbia is around 19.5 TWh/per year, out of which around 17.7 TWh/per year is at the facilities with the capacity more than 10 MW. 16 hydro power plants are built until now and average of about 10.5 TWh/ per year⁴ is produced. Total technical potential of hydro power plants with the capacity up to 10MW is estimated at around 1.800 GWh per year.

Remaining part of hydro potential and the possibility to use it shall also be determined in accordance with the non-energy sector criteria which are related to multipurpose water use and based on the political agreements on the division of hydro potential with neighboring countries. Also, having in mind that the estimated potential of small HPPs is based on the Cadaster of small hydro power plants from 1987, detailed revision of the locations shall be continued in the following period in order to make more precise list of feasible locations and create better planning basis for the use of this renewable source. Also, for the overall hydro energy sector it is necessary to consider impact of climate changes, availability to use water

4 TWENTY-YEAR-AVERAGE

flows for electricity generation. This is important both for the consideration of the expected electricity generation from the existing hydro power plants, and for the possible potential of hydro energy for the construction of new hydro power plants.

Wind energy in the Republic of Serbia can be used in the area of Kosava wind, south Banat, area of east Serbia, area of east side of Kopaonik, area of Zlaribor and Pester and at the location of mountain passes at the heights over 800m. For the clearer consideration of potential, in the following period it is necessary to continue with the specific measuring of the wind (at 50m heights and higher) for the preparation of wind atlas, as one of the conditions for the investment into capacities for the electricity generation that use wind energy.

Technically usable potential is, in the case of wind energy and solar energy, determined based on the existing technical possibilities of electric power system to accept this energy. Additional assumptions in determining the potential are that maximum variations of electricity generation from wind energy will not coincide with the maximum variations of electricity generation from solar power plants and that the maximum variation will not exceed 90% of the total installed capacities. It means that in the installed capacities it is possible to have 500 MW with current size of tertiary reserves. Having in mind maximum possibilities of generation of wind power plants with such installed capacity it can be counted on their maximum technically usable potential of 1200GWh /per year, i.e. 0.103 million toe/ per year.

Solar energy represents energy potential of the Republic of Serbia that can be used for the generation of heating energy or electricity. On the greater part of the territory of the Republic of Serbia number of hours of the solar radiation is significantly higher than in most European countries (between 1500 and 2200 hours per year). Average intensity of solar radiation at the territory of the Republic of Serbia is from 1.1 kWh/m²/per day in the north to 1.7kWh/m²/per day in the south-during January and from 5.9 to 6.6 kWh/m²/per day – during July. Annually, average value of radiation energy is from 1200 kWh/m²/per year in the north-west Serbia to 1550 kWh/m²/per year in the south-east Serbia, while in central part it is about 1400 kWh/m²/per year.

Technically usable energy potential for the conversion of solar energy into heating energy (for the preparation of hot water and other purposes) is estimated at 0.194 million toe per year with the assumption of application of solar thermal collectors at 50% available facilities in the country. Regarding the electricity generation basic technical limitation is the possibility of electric power system to accept this energy in months during summer due to variable generation. Based on the currently available capacities of electric power system of the Republic of Serbia for the provision of tertiary reserves it was adopted that maximum technically usable capacity of solar power plants is 450MW, i.e. their technically usable potential is 540 GWh/per year (0.046 million toe/per year).

Construction of new conventional electric power capacities (coal, large HPPs) and particularly PSHPs (Bistrica and/or Djerdap 3) could significantly increase technically available potential of intermittent RES – wind and solar energy for electricity generation.

The Republic of Serbia is within the zone of favourable geothermal potential and resources. The Republic of Serbia is significantly rich with geothermal energy which involves petro thermal and hydro geothermal energy sources. The use of geothermal energy for heating and in other energy sector purposes in the Republic of Serbia is in the initial phase and it is very modest compared to the potential and resources. Geothermal potential of the Republic of Serbia is clearly indicated by the existence of many spas and natural springs with water temperatures higher than 30°C, and different level of natural wealth. Based on the existing measurements heat flow is above the average for Europe (60mW/m²) i.e. from 80 to 120mW/m². Natural and artificial springs of thermal water are identified at the territory of more than 60 municipalities. Water temperature is usually within the range up to 40 °C and only at the territory of six municipalities (Vranje, Sabac, Kursumlija, Raska, Medvedja, Apatin) water temperature is over 60°C. Average water flows from the existing springs and boreholes are at average up to 20 l/s. At several locations the water flow exceeds 50 l/s (Bogatic, Kursumlija, Pribojska Banja, Niska Banja) and only at one location the water flow is over 100 l/s (Banja Koviljaca). Total heat capacity that could be made by using all existing sources of thermal water is about 216 MWt, with generation of heat energy from 180 thousand toe. Significant but not considered geothermal potential is in the use of watered oil and gas boreholes in Vojvodina where the exploitation is completed.



**BASIC ASSUMPTIONS REGARDING
DEVELOPMENT OF THE ENERGY
SECTOR OF THE REPUBLIC OF SERBIA**



Energy Sector in the Republic of Serbia in 2010

Exploitation of domestic primary energy (coal, oil, natural gas, renewable energy sources), import of primary energy (mainly oil and natural gas), electricity and heat energy generation, exploitation and secondary processing of the coal, as well as electricity transmission and distribution to end users of final energy are performed within energy sector of the Republic of Serbia.

Energy sector of the Republic of Serbia is comprised of the following:

- **Oil sector** includes exploitation of domestic oil reserves; import, transport and processing of crude oil and petroleum products; distribution and sale/export of petroleum products.
- **Natural gas sector** includes besides gas import, exploitation of domestic reserves of natural gas their primary processing, collection, transport and distribution to end users of gas.
- **Coal sector** includes coal exploitation and processing. Coal exploitation is performed in the mines with surface coal exploitation, mines with underground coal exploitation and in the mine with underwater coal exploitation.
- **Electric power sector** includes electric power sources for electricity generation: thermal power plants, combined heat and power plants and hydro power plants, electricity transmission system used for transmission of electricity generated in the country and for the exchange with the neighboring systems, as well as the electricity distribution systems used for the supply of electricity to end customers.
- **District heating systems** exist in 57 cities in the Republic of Serbia. Additionally, in the industry energy system there are heating sources used for the production of technological steam and heat energy for the needs of production processes and for the heating of working space. At about 30 industrial companies in Serbia there are power plants that enable combined production of heat energy and electricity.

Total consumption of final energy in Serbia in 2010 was 9.696 million toe, with consumption structure divided according to sectors and energy products presented in the Diagrams III-1a and III b-2.

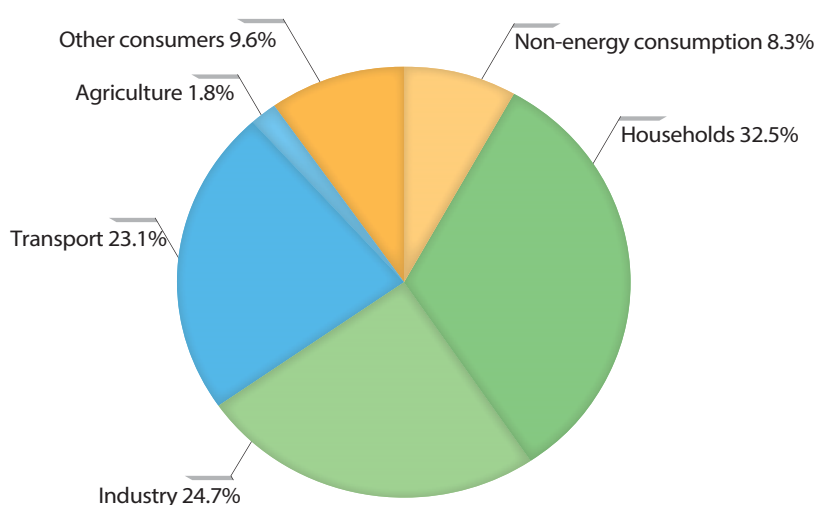


Diagram III-1a. Structure of final energy consumption in 2010 by sectors

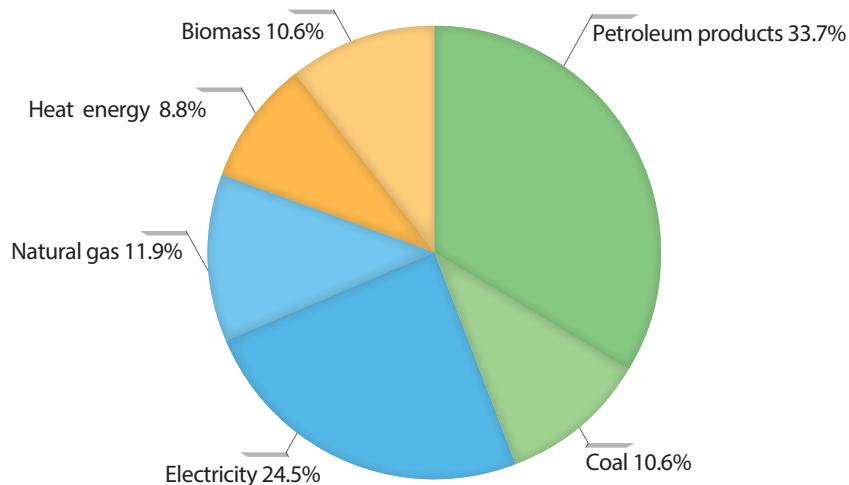


Diagram III-1b. Structure of final energy consumptions in 2010 by energy products

Primary energy consumption in the Republic of Serbia in 2010 was 15.531 million toe with the structure presented in the diagram III-2. Necessary coal amounts, which participate in the primary energy consumption with 50.7%, are secured from domestic production with over 90%. Metallurgical coke and better quality coal types are being imported. Unlike coal, about 70% of crude oil and 84.5% of natural gas are secured from import. Petroleum products (refined basic raw materials, liquefied petroleum gas, diesel) are imported, while coal and lubricants, oil fuel, kerosine and bitumen are exported.

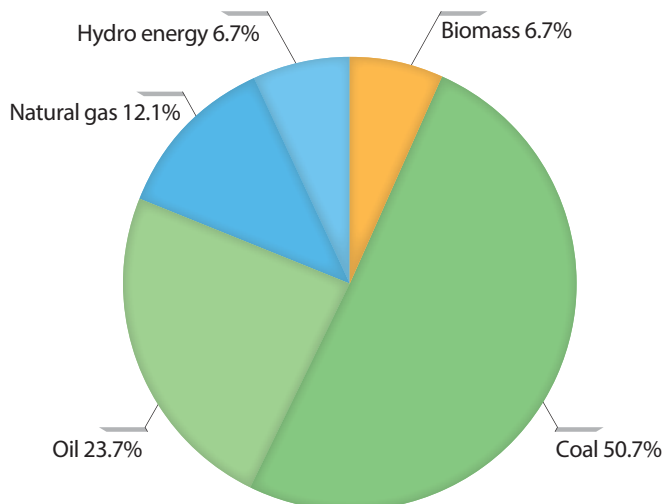


Diagram III-2. Structure of primary energy consumption in 2010

Coal consumption is dominantly connected with energy generation by transformation (about 92%) out of which the highest consumption is in thermal power plants. Structure of used energy sources for the electricity generation in 2010 is shown in the diagram III-3.

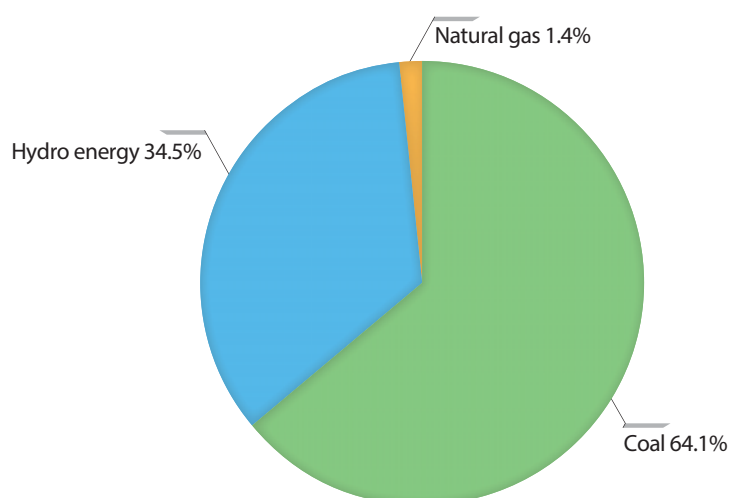


Diagram III-3. Share of energy products in electricity generation in 2010

With share of 13.3% in consumption of primary energy in 2010, the Republic of Serbia also has a significant role at regional energy market (Diagram III-4). Consumption of primary energy per capita in 2010 in the Republic of Serbia amounted to 2.14 toe (Diagram III-5) which is slightly above average regional and world consumption, but it is two times less than average consumption of OECD developed countries. The primary energy consumption per domestic product unit (reduced to the purchasing power parity) was higher by 15% than the world average and by 46% higher than in OECD member countries (Diagram III-b) in the Republic of Serbia in 2010.

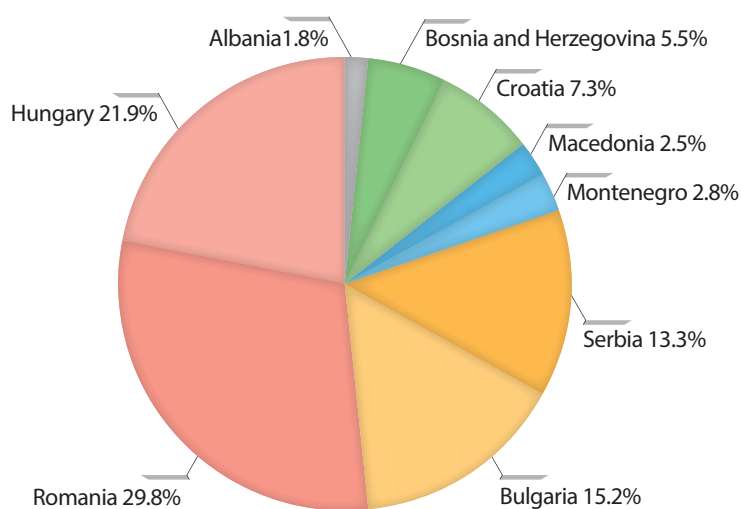


Diagram III-4. Structure of primary energy consumption in the region in 2010

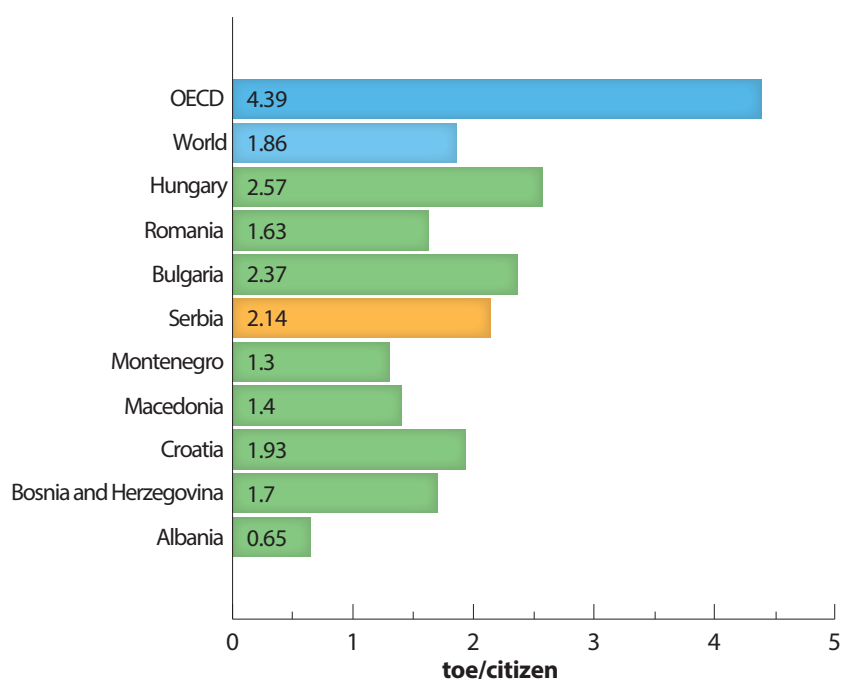


Diagram III-5. Primary energy consumption per capita in 2010

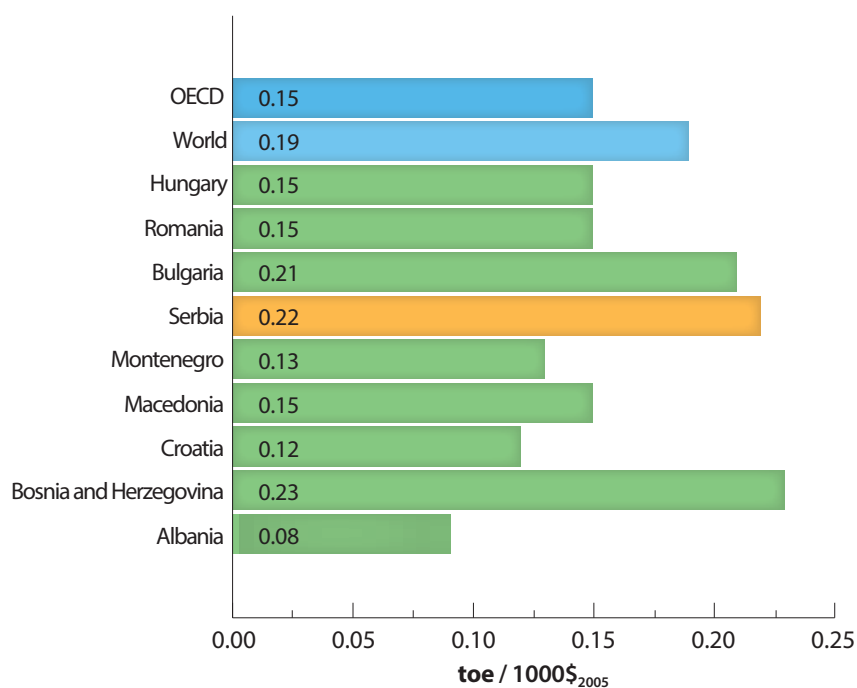


Diagram III-6. Primary energy consumption per GDP unit in 2010
(Reduced to the purchasing power parity)

Electricity generation and consumption ratio in region in 2010 is shown in Diagram III-7. Average electricity consumption per capita in the region in 2010 was 3.659kWh. The Republic of Serbia has 50% higher consumption than world average but also about two times less consumption compared to OECD member countries. (Diagram III-8)

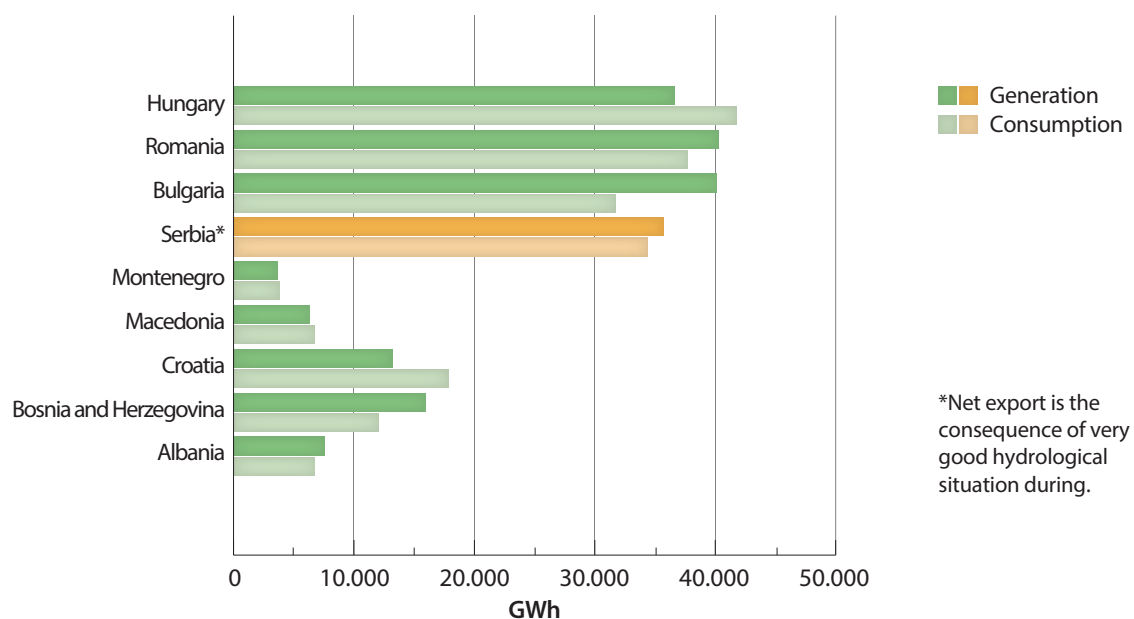


Diagram III-7. Electricity generation and consumption in the regional countries in 2010

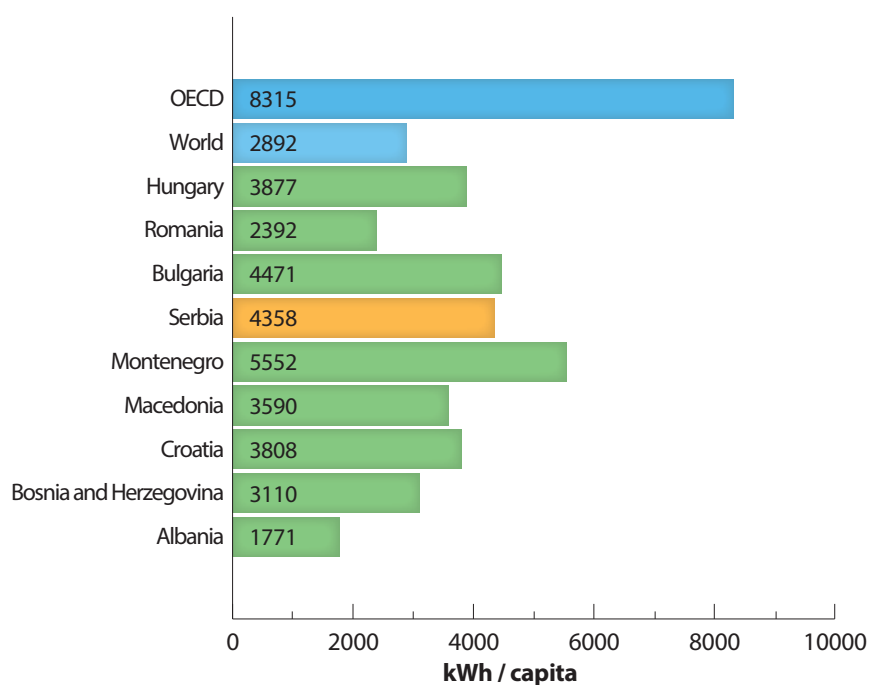


Diagram III-8. Electricity consumption per capita in regional countries in 2010

Projections of Final Energy Consumption

Consideration of energy sector development in the Republic of Serbia in the conditions of current economic crisis is not an easy task. From the economic aspect, adequate strategic documents do not exist upon which the credible estimations of development of economy of the Republic of Serbia would be based. It is generally agreed that balanced and sustainable economic development of the Republic of Serbia has to be based upon faster growth of exchangeable goods and export, particularly agriculture and industry. Development pace depends on the foreign investments, economic and political environment, macroeconomic stability, legal security, reign of law and institutions, as well as on the quality of the judiciary, level of corruption, political stability and other.

Modified projection from the strategy and policy of development of the industry of the Republic of Serbia from 2011 to 2020 are adopted for the economy development model, which as the final desired result of the industrial development in the period from 2011 until 2020 sets doubled industrial production in 2020 compared to the level from 2010 and also with significant change in the structure of industrial consumption. Given that economical fluctuation in 2011 and 2012 did not fulfill these expectations, aimed growth and figures with adequate change of industrial and economical structure have been adopted as the scenario of economy development until 2025, which means average economy growth of about 3% per year.

Results of census from 2011 are taken into account and projection of the Statistical Office of the Republic of Serbia was adopted with estimated average fertility rate, according to which further reduction of population will be continued to about 7 million in 2020, i.e. to about 6.8 million until 2030, for the needs of the preparation of demographic projections necessary for the consideration of energy consumption.

Manner and amount of energy necessary for the final consumption determine as well the further necessary development of energy transformations sector (electric power and district heating), and directly or indirectly development of generation (or the need for import) of primary energy (renewable energy sources, coal, oil and natural gas). For the needs of energy sector development planning two scenarios of final energy consumption in the period until 2030 are defined:

- Reference scenario ("business as usual") and
- Scenario with the implementation of energy efficiency measures.

The first scenario refers to the continuance of the current practice in energy consumption, while the second scenario refers to the maximum promotion of measures of energy efficiency within all phases of energy sector cycle.

In **reference scenario**, specific indicators of energy consumption (amount of energy per created GDP unit) in industry, agriculture and non-energy consumption are the same as in base 2010. Estimated growth of energy consumption in these, production sectors is connected with the estimated economy growth. For the needs of the estimation of energy consumption in the sector of transport the estimated consumption growth is 0.5% per year. For the growth of energy consumption in the sector of households and in the sector of other users, average growth rates in the period from 2001 to 2010 were adopted.

Scenario with energy efficiency (EE) measures application is adjusted compared to the Reference, because it foresees the application of measures with the aim to reduce the consumption of final energy in accordance with the obligations from the Energy Community Treaty and Directive 2006/32/EC on energy efficiency regarding final consumption and energy services. These measures primarily are related to the household, commercial and public-service sector, industry sector and transportation sector and lead to 9% saving in final consumption in 2018 compared to the Reference scenario. Consequently, the result is relative reduction of energy consumption (reduction in relation to the GDP unit) in production and service sectors (industry, agriculture, public and commercial sector, civil engineering), while in the sectors of transport and households there should also be absolute reduction of consumption compared to the base year.

Final energy consumption projections according to these two scenarios are compared in the Diagram III-9. Compared to the base 2010 the increase amounts to 10.1% in reference, i.e. 1% in scenario with measures EE by 2020, i.e. 18% and 6.8% by 2025 (compared to the base year). Difference in final consumption according to these two scenarios in 2020 amounts to 920 thousand toe, which promotes energy efficiency into “new energy source” and gives strong base that overall energy policy becomes concentrated on the fact that the consumption of final energy in the Republic of Serbia leads to the Scenario with the application of energy efficiency measures. Therefore, regardless of the fact that the economy development of the country shall, with foreseen reindustrialization, certainly lead to the increased necessities for energy, by the intensive application of measures and activities for the energy efficiency increase it is necessary to secure that indicators of energy efficiency (reduced to monetary and natural values) lead to average values as in the countries in European Union (EU).

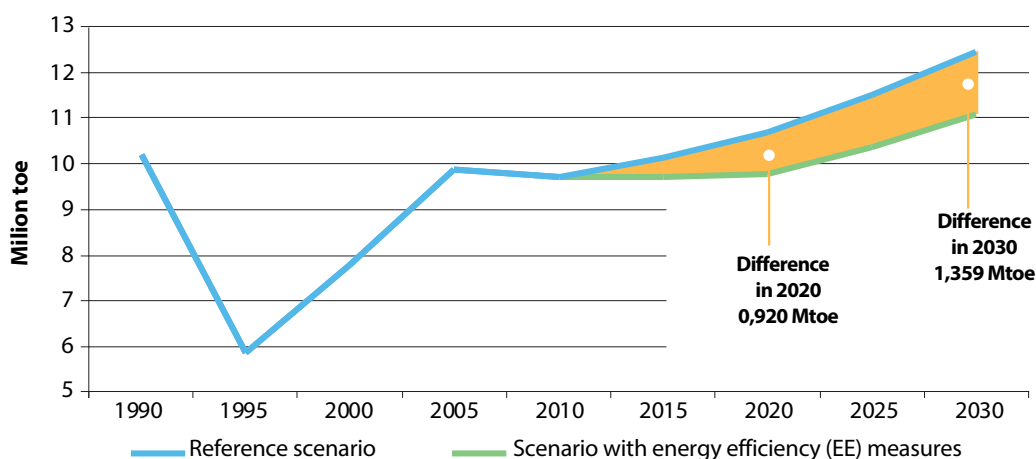


Diagram III-9: Projection of final energy consumption

According to the sectors (Table III-1), economy development of the country leads to the increase of share of production sectors (industry, agriculture, non-energy consumption) in both scenarios. Foreseen increase of the share of these sectors is from 34.8% in 2010 to about 40% in 2025. Trend is such that in 2030 the final consumption in these sectors would be about 40%. In the same period the share of households sector should be reduced by about 5%, and traffic by about 2-3%.

Table III-1: Final energy consumption by sectors (thousand toe)

Sector	Reference scenario					Scenario with application of EE measures			
	2010	2015	2020	2025	2030	2015	2020	2025	2030
Households	3148,0	3193,1	3226,5	3284,3	3349,5	3136,9	3129,0	3121,2	3113,4
Industry	2393,0	2560,4	2826,9	3277,1	3799,1	2409,9	2467,1	2891,1	3388,0
Civil engineering	7,0	7,9	8,9	10,4	12,2	7,9	8,9	10,4	12,2
Transport	2239,0	2329,2	2388,1	2448,4	2510,2	2206,7	2143,4	2081,9	2022,2
Agriculture	175,0	184,9	203,9	232,5	264,9	184,9	203,9	232,5	264,9
Other customers	934,0	979,9	1024,8	1077,0	1132,0	867,5	805,9	855,5	908,1
Non-energy sector	800,0	882,0	997,9	1168,1	1367,3	882,0	997,9	1168,1	1367,3
TOTAL	9696,0	10.137,4	10.676,9	11.497,9	12.435,1	9.695,8	9.756,1	10.360,8	11.076,2

In both scenarios the increase of RES share in the gross final consumption to 27% by 2020 as well as the adequate change in the structure of energy products use in some sectors are foreseen (Table III-2). In the industry sector the change of the structure of used energy products is conditioned by the expected change of industry structure. In the sector of households and other customers (public and commercial sector) the lower use of coal and petroleum products as well as the electricity for heating needs and increase of consumption of renewable energy sources, heat and natural gas are foreseen. The change of structure within the transport sector refers primarily to the higher use of biofuel which should by 2020 participate with 10% in final consumption in the traffic sector.

Electricity consumption by 2025/2030 in both scenarios is growing. In reference scenario it constantly grows during the whole period, in accordance with the historical trend that it follows, while in the Scenario with the energy efficiency measures, these measures stop that trend by 2020. After that, regardless of the further presence of energy efficiency measures, increase of electricity consumption, due to the growth of economy activities in absolute amount, exceeds the saving based on the energy efficiency measures.

Table III-2: Final energy consumption according to the energy products (thousand toe)

Energy products	Reference scenario					Scenario with the application of EE measures			
	2010	2015	2020	2025	2030	2015	2020	2025	2030
Biofuels	-	22,6	231,3	237,2	243,1	21,4	207,5	201,5	195,6
Petroleum products	3.268,0	3.410,4	3.368,8	3595,6	3.853,1	3.258,5	3.083,0	3.200,4	3.348,7
Coal	1.025,0	996,7	989,6	1013,8	1.046,3	918,5	837,2	881,7	934,9
Electricity	2.371,0	2.482,4	2.512,7	2644,4	2.799,4	2.317,0	2.254,1	2.360,7	2.490,7
Natural gas	1.150,0	1.321,7	1.540,9	1796,0	2.088,0	1.320,0	1.418,0	1.659,0	1.934,9
Heating energy	852,0	841,1	864,1	956,2	1.058,1	803,4	786,9	857,1	936,2
RES for heating needs	5,7	24,3	65,6	70,1	75,1	23,2	64,6	68,7	73,1
Biomass	1.025,0	1.038,2	1.104,0	1184,6	1.272,1	1.033,8	1.104,9	1.131,8	1.162,1
TOTAL	9696,0	10.137,4	10.676,9	11.497,9	12.435,1	9.695,8	9.756,1	10.360,8	11.076,2

SWOT Analysis of the Energy Sector of the Republic of Serbia

SWOT analysis, by definition, represents good way to consider chances or obstacles for implementation of any project, through compared presentation of basic advantages, weaknesses, chances and threats. The Strategy of Energy Sector Development of the Republic of Serbia enables identification of all key, positive or negative factors, that could affect the achievement of objectives, overview of everything that could help the realization of the Strategy, as well as the factors that could lead to the delay and problems, whether internal weaknesses or extreme limitations.

Following table includes many factors, circumstances and facts which affect, both positively and negatively (as incentives and obstacles) the realization of the Strategy of Energy Sector Development in the Republic of Serbia. Many of the stated factors are given as the indicators which direct to the strategic and operational objectives of development of some energy sector fields, in order that the strategy, programs of its realization, action plans and other activities which are directed to its implementation (legal solutions, decrees and above all energy sector policy and practice) could be adjusted to the facts that are given in SWOT analysis.

Table III-1: SWOT analyses of the status and possibilities of the energy sector in the Serbia

ADVANTAGES (existing)	WEAKNESSES (internal)
<ul style="list-style-type: none"> • Tradition and experiences in the previous development of energy sector in the Republic of Serbia <ul style="list-style-type: none"> • Quality employees and qualified work force in the energy sector; • Rehabilitation of the sector reached in the first decade of XXI century; • Available resources and potentials <ul style="list-style-type: none"> • Coal; • Renewable energy sources potential; • Potential of increase of energy efficiency in generation, transmission and consumption; • Geographical position of transmission system between the regions with energy surpluses and regions with electricity deficiency; • Geographical position of potential regional hub for electricity trading, transportation and storage capacities of natural gas. • Energy infrastructural systems are technically relatively preserved <ul style="list-style-type: none"> • Development of electricity system and its regional connectivity; • Technical characters of transmission system in accordance with requirements of European 	<ul style="list-style-type: none"> • High external energy dependency <ul style="list-style-type: none"> • Unfavorable structure of domestic conventional energy sources; • Low level of investments in the researches of energy potentials; • Insufficient use of renewable energy sources; • Non- economic prices of energy and disparity of prices of energy and energy products • Low level of electricity and natural gas collection • Irrational use of energy <ul style="list-style-type: none"> • Insufficient use of highly efficient technology for energy generation and consumption; • High specific energy consumption per unit of gross domestic product; • High specific energy consumption per unit of product in industry; • Low quality and unfavorable structure of traffic in energy sense; • Irrational use of electricity for heating purposes; • Insufficient use of natural gas in households and commercial sector; • Low share of RES in consumption;

<ul style="list-style-type: none"> association transmission system operator (ENTSO-E); • Significant level of the development of transport and distribution gas pipeline system; • Development of district heating system; • Ratification and effectiveness of the Energy Community Treaty, by which the Republic of Serbia became part of connected European energy market • Signing of the Stabilization and Association Agreement between Serbia and EU 	<ul style="list-style-type: none"> • Lack of standards and regulations in energy sector; • Technological obsolescence of the existing and lack of new energy sector capacities <ul style="list-style-type: none"> • Minimum cogeneration of electricity and heating energy; • High technological and other losses in energy distribution; • Limited funds for the investments in energy capacities • Technological lag of domestic industry in the construction of energy facilities and infrastructure; • Non efficiency of public energy utilities; • Legacy of devastation of natural space and over pollution of water, air and land caused by energy sector • Law level of usage of technologies with low level of emissions of harmful substances in all parts of energy cycle • Development of internal and regional electricity and natural gas market • Lack of strategy of economy and social development of the country • Non-transparency of energy policy making • Non-development and inadequacy of energy statistics • Lengthy and complex procedures to obtain permits and licenses
OPPORTUNITIES (development potentials)	THREATS (to development)
<ul style="list-style-type: none"> • Integration of the Republic of Serbia into EU-fulfillment of obligations undertaken by the accession the Energy Community Treaty <ul style="list-style-type: none"> • Higher use of renewable energy sources; • Organization of the system of minimum mandatory oil stocks and petroleum products; • Modernization of refineries in accordance with the EU standards; • Increase of the possibilities and scope of public-private partnership in the energy field; • Increase of total economic competence of energy systems <ul style="list-style-type: none"> • More intensive use of pre-accession funds of EU in the energy sector; 	<ul style="list-style-type: none"> • Actual crisis flows of energy products in the world and possibilities of new energy “shocks” • New sudden increases of demand for energy products in the world or creation of crisis focuses which would lead to the growth of energy products’ prices (particularly of the oil and natural gas) • Global differences in opinion regarding the policy of climate changes and strategies of “cleaner” energy sector • Deepening of social and economic crisis, poverty increase, indebtedness and slow economy development of the country • Lag for the changes in energy sector policy in the region due to the unsolved social and political issues

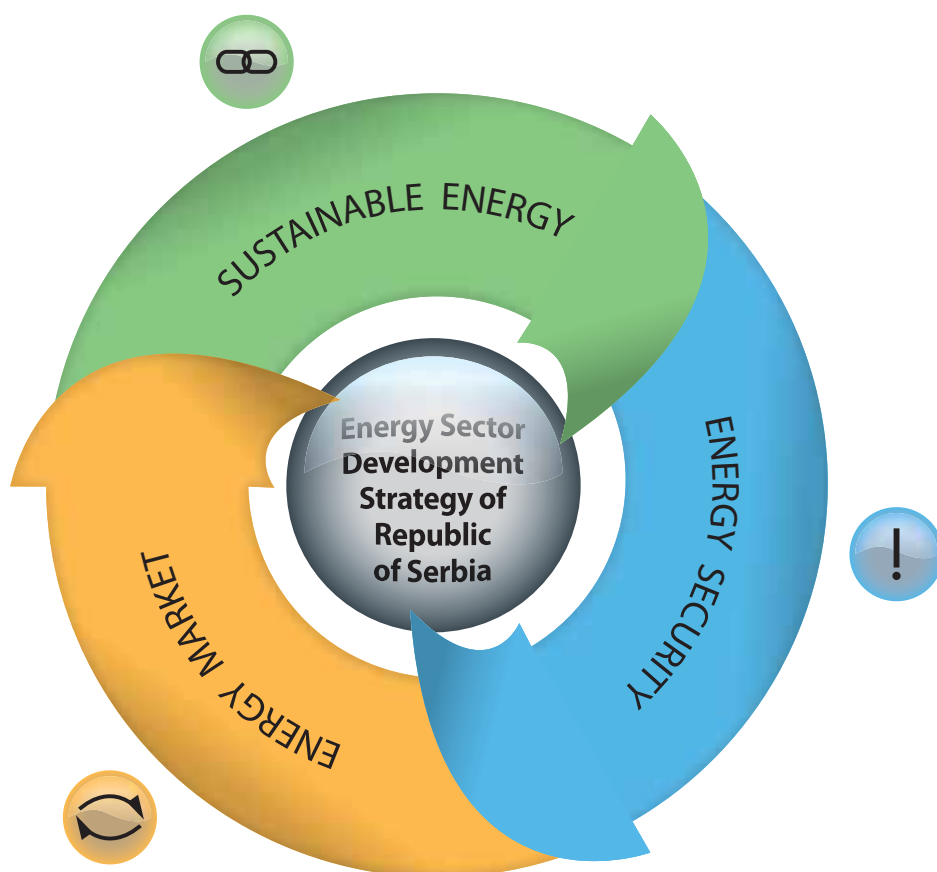
-
- More efficient business operation of public energy utilities and other economy entities in the energy field;
 - Attraction of foreign partners, banks and investors in the safe and long-term investment in Serbian energy system; ;
 - Increase of competition and competitiveness in energy sector;
 - Development of electricity and natural gas market in the country and region;;
 - Increase of legal security of investments;
 - **Improvement of energy efficiency**
 - Use of energy efficient technologies in overall energy cycle;
 - Introduction of energy management in public, commercial and industrial sector;
 - Operation of ESCO company;
 - Modernization and rehabilitation of energy network and facilities;
 - **Introduction of the principles of cleaner generation in energy sector;**
 - Sustainable use of renewable energy sources;
 - Construction of new coal-fired thermal power plants harmonized with EU standards;
 - More intensive use of natural gas in households and commercial sector;
 - Construction of natural gas or biogas-fired facilities for combined generation of electricity and heating energy
 - **Construction of South Stream gas pipeline**
 - **Construction of gas interconnections with gas pipeline systems of neighboring countries**
 - **Extension of the existing and construction of new capacities for the storage of natural gas**
 - **Construction of new capacities for electricity transmission**
 - **Construction of new systems for the transportation and storage of oil and products**
 - **Unfavorable demographic trends and ageing of population**
 - **Political opportunism and unreadiness for depoliticization and professionalization of energy sector**
 - Absence of political will to conduct consistent market reforms in energy sector;
 - Retention of principles of “social prices” of energy;
 - **Lag and slow technology development of energy system, due to unfavorable economic position**
 - Insufficient investments in renovation, modernization and construction of energy facilities and infrastructure;
 - Reduction of reliability of energy facilities and equipment due to their age and insufficient maintenance;
 - **Standards and regulations are not harmonized with EU regulations, i.e. they are not applied**
 - **Unfavorable impact of the climate change on energy sector**

IV




STRATEGIC PRIORITIES OF ENERGY SECTOR DEVELOPMENT IN THE REPUBLIC OF SERBIA BY 2030



Energy sector is one of the most intensive investment branches of economy. It has multiple impacts on economic results of production, as well as on the entire technological basis of the society and represents one of the basics of overall development of each country. Secure energy supply, its availability under transparent and non-discriminatory conditions, generation and use in accordance with principles of sustainable development are preconditions for successful functioning of each society, for the increase of competitiveness of national economy and finally for the welfare of the citizens. This is particularly important during current economic crisis in which the Republic of Serbia is.



Provision of energy security, energy market development and overall transition towards sustainable energy sector are imposed as key priorities of energy sector development in the Republic of Serbia, i.e. principles based on which the energy sector policy by 2030 should be developed.

 ENERGY SECURITY	<ul style="list-style-type: none"> • Reliable, safe, efficient and quality supply of energy and energy products • Setting up conditions for reliable and safe operation and sustainable development of energy systems and energy sector in general
 ENERGY MARKET	<ul style="list-style-type: none"> • Competitiveness on electricity market based on non-discrimination, publicity and transparency • Protection of energy and energy products customers • Development of electricity and natural gas market and their connection with the unique energy market of EU • More intense connection of energy system of the Republic of Serbia with energy systems of other countries, especially neighboring countries
 SUSTAINABLE ENERGY	<ul style="list-style-type: none"> • Provision of conditions for energy efficiency improvement in energy activities and energy consumption • Creating economic and financial conditions for increase of share of energy from renewable energy sources, as well as for combined production of electric and heat energy • Creating institutional, financial and technical assumptions for using new energy sources • Promotion of condition and environmental protection system in all fields of energy activities • Establishing more favorable legal, institutional and logistic conditions for more dynamic investment into energy sector

Provision of energy security

Sufficient and adequate energy offer, i.e. safe, reliable and quality energy supply is a precondition of economic and social development. Import energy dependency of the Republic of Serbia (33,5% in 2010) compared to the majority of European countries is not high, but is highly present in oil sector, petroleum products, and natural gas. Delay in the construction of new electric power facilities may also lead to the Republic of Serbia becoming more significant importer of electricity in the following years. Expected reindustrialization and the increase of industry production which is expected after the crisis, would probably lead to the same, but more emphasized outcome.

Thus in addition to promotion of saving and rational use of energy, as national values and principles, it is necessary to provide appropriate oil and natural gas stocks, perform diversification of directions and sources of supply with these energy products and to initiate construction of new electricity generation facilities that will use coal with significantly higher energy efficiency and valorize potentials of renewable energy sources. Beside provision of an open and connected domestic energy market with regional and European market and with efficient energy transit and cross-border cooperation these activities should provide balanced development of energy sector and long-term energy security in the country.



Energy market development

Internal- national energy market

Creation and development of energy market is a key assumption for economically sustainable development of the energy of the Republic of Serbia. That means establishment of energy market based on the principles of competition, publicity and free initiative of energy entities. This should provide customers' free choice related to energy and energy products supply, by which their price should depend more on offer and demand. However, principled and transparent manner of gradual, but certain establishment of appropriate price parity, that is based on including full amount of environmental charges and costs in the energy price shall remain the permanent task of energy policy. This internal regulatory framework, with regional market liberalization, would provide regional integration of national market.

Regional energy market

The Republic of Serbia accepted, signed and ratified Energy Community Treaty. By that it set regional energy market establishment as one of its priorities and its integration into energy market of the European Union. Such market should provide significant investment into sector and to contribute to the development of economy and stability of country and region. Market functioning should be based on implementation of relevant legal framework and acquis communautaire of the European Union in energy field, but also environmental field, competition, renewable energy sources use and energy efficiency. Energy security of relatively small and import-dependending economy is far easier to achieve in the conditions of harmonized principles of energy market functioning in the region and wider, by creating unique and open energy market.

Developed national and regional market opens the possibilities for significantly higher investing into sector and contributes the development of economy and country stability. Construction of South Stream gas pipeline, and new electricity and gas interconnections shall place the Republic of Serbia as significant transit country.

For efficient functioning of internal and regional energy market the work on further construction and modernization of electricity and gas infrastructure is necessary. It is necessary to perform regional connection of gas pipeline system and finalize gasification of Serbia, and in the field of electricity permanently work on rehabilitation of existing and construction of new transmission and distribution capacities.

Development of energy sector in the Republic of Serbia should be such that it has a minimum impact on environment. However, energy sector of Serbia shall have to be based on the market and economically efficient, enough to generate own development but also to represent the generator and safe basis for country development.



Transition towards sustainable energy sector

Applying energy efficiency measures, renewable energy sources use, environmental protection and reduction of impact on climate changes are key elements of transition towards sustainable development of energy sector in the Republic of Serbia.

Having in mind current situation in efficiency of production, transformation, transport and consumption of energy in the Republic of Serbia, application of measures and procedures for the increase of energy efficiency has the capacity of “new, domestic energy source” and imposes as long term element of functioning and the foundation for development of all energy sectors. Taking into consideration energy potentials and resources, energy production in the first half of this century in the Republic of Serbia shall be directed towards using locally available renewable energy sources and application of technologies of “clean coal”. Impact of energy production and facilities on environment with the lowest possible emission of green house gas shall become a crucial criterion for the evaluation of energy technologies and possible directions of energy sector development, by which the norms related to environmental protection shall become stricter.

Transition towards more efficient, cleaner and renewable energy has to be based on market price of energy from conventional sources (that include costs of environmental protection) on one hand and on adequate incentives and stimulations on the other. Application of appropriate technological standards, education and better informing, combined with economic instruments and incentives for saving, increase of energy efficiency and higher usage of renewable energy is an integral part of overall strategy of sustainable energy sector.

Achieving sustainable energy sector development of the Republic of Serbia in the period until 2030 in accordance with possibilities of economy and society and reaching targeted goals requires that further development of energy sector in the Republic of Serbia is based on the activities that include:

- More intense research of energy potentials;
- Energy market development, applying the principles of competition, transparency and non-discrimination;
- Construction of new energy capacities, i.e. rehabilitation and modernization of existing;
- Comprehensive and coordinated approach for rationalization of energy consumption and overall increase of energy efficiency;
- Creation of adequate regulatory and organizational conditions, and simplify and accelerate procedures for obtaining approvals and permits;
- More intense use of renewable energy sources, by which promotion of renewable energy sources should be included in energy plans of cities and local communities as part of local energy strategies;
- Reorganization and restructuring of companies in energy sector:
 - Creating economic, organizational and legal conditions that public enterprises of energy industry may successfully operate on the market individually and become capable to provide higher share of own assets for the needs of development, environmental protection and area reclamation,

-
- Introducing principles of corporate management in public enterprises;
 - Considering options of synergetic connection of enterprises that manage network infrastructure systems (oil, gas, electricity);
 - Further compliance of existing regulations with regulations and standards of the EU, with mutual compliance and development of national regulation in order to:
 - Provide compliance of technical regulation and the regulations as a support for safe, secure and unambiguous technical management of energy infrastructure;
 - Provide permanent protection of area over reservoirs of raw energy materials, hydro reservoirs and energy corridors from further construction;
 - Oblige investors to always use the best available technology within investment programs when constructing energy and other facilities, so that the optimal use of available energy, energy efficiency and environmental protection are provided.

It is necessary for these activities to be followed by appropriate organizational and other measures based on:

- Raising capacities of financial organization for financing measures of energy efficiency, i.e. for financing development of production and placement of best available technology and energy equipment;
- Development of innovative mechanisms of financing sector of energy services (ESCO concept and other) ;
- Promote development of domestic industry so that it follows foreseen development of energy sector
- Careful analysis of climate changes impact on energy sector in the Republic of Serbia and adopting adequate adaptation plans;
- Systematic increase of the capacities of scientific and educational institutions for the work in energy sector;
- Complete and timely informing public about the situation in the sector;
- Education and raising consciousness on possibilities and effects of savings, rational consumption and energy substitution, as preconditions for sustainable development of entire development of society and country.

All stated goals, activities and measures are in accordance with the policy of the EU in the energy sector and fully in accordance with goals of future Regional Energy Strategy of Energy Community, that assume the creation of competitive, integrated energy market, attracting investments into energy sector and providing safe and sustainable energy supply. However, they are mostly harmonized with the need of economic development and technological modernization, i.e. sustainable economy and social development of the Republic of Serbia. In that sense these goals are harmonized with the National Strategy of Sustainable Development as a document important for harmonization of all sector, development, economic and social and environmental goals of society.

V

ENERGY SECTORS DEVELOPMENT



Elaboration of energy policy per energy sectors represents integration of defined goals and priorities in the assumed scenario of energy sector development, so that for each sector strategic goals and priority activities/actions are defined.

Projections of energy sector development for the period 2025/2030 and adequate balance indicators (Annex) were made for two scenarios of changes in final energy consumption. Reference scenario refers to the follow up of previous practice in energy consumption, while Scenario with measures of energy efficiency refers to the maximum promotion of energy efficiency measures in all phases of energy cycle. Although development of electric power industry and remote heating system, renewable energy sources, oil, coal and natural gas sector, was foreseen in such manner to satisfy foreseen, future needs for both scenarios, energy policy which this Strategy promotes and its sector elaboration is focused on transition to the scenario with energy efficiency measures. Energy sector, by the construction of new economic, ecological and socially sustainable forms, should become not only the follower but the driver of industry development of the Republic of Serbia.

Of course, while considering suggested scenarios and according to them and the development of certain energy sectors it should be born in mind that each long-term strategy for energy development contains a certain level of uncertainty, due to the change of parameters relevant for development: industry development rate, energy price, new technologies for the usage of conventional fuels and RES, changes in investments necessary for the development of certain projects etc. Therefore it is necessary within implementation period of this Strategy to permanently reevaluate sector goals, planned activities and their implementation, and if necessary, to adjust it to specific needs, conditions and possibilities.

Electric power system

Strategic goals

- Provision of secure electricity supply from domestic market;
- Electricity market development on national and regional level
- Increase of transmission capacities / corridors in the Republic of Serbia that have regional and Pan-European importance
- Reduction of losses in distribution networks
- Creating possibilities for net export of electricity.

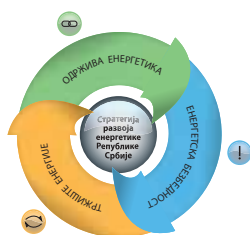
Current situation:

- Increase of net import of electricity
- Age and inefficiency of existing production capacities
- Dominant participation of coal in electricity generation
- Process of market liberalization started with strong influence of "social" component
- Low and inadequate electricity price

Strategic actions

- Rehabilitation of existing electric power facilities:
 - Adjusting current thermal and energy production capacities to responsibilities assumed based on the membership in Energy Community,
 - Rehabilitation and modernization of existing hydro power plants
- Construction of new production plants using conventional fuels
- Increase of generation from RES (hydro energy, wind, biomass, solar energy)
- Rehabilitation of existing and construction of new transmission capacities,
- Modernization and construction of distribution systems
- Market liberalization in accordance with Energy Law and market electricity price setting
- Reorganization of sector for efficient work of energy utilities and attracting investments
- Enabling and development of capacities of energy machine building industry for larger participation in the construction of electric power facilities and infrastructure

Priority activities:



Reconstruction of thermal power plants in accordance with Directive on Large Combustion Plant



Construction of new coal-fired thermal energy units of 700MW capacity until 2025 (350 MW until 2020)



Construction of PSHPP Bistrica



Construction of natural gas fired CHP around 450 MW capacity until 2020



Construction of transmission and distribution infrastructure



Development of electricity system is crucial for the development of the complete energy system of the Republic of Serbia. It is determined by the following important facts and relatively certain assumptions:

- Average age of practically total installed production capacity in thermal and hydro power plants of JP EPS is over 25 years;
- Increase of the electricity consumption compared to base year in reference scenario is around 5,7% until 2020, i.e. 10,5% until 2025 and 16,3% until 2030 (Diagram V-1);

- Application of Directive 2001/80/EC on limitation of emissions of pollutants from large combustion plants is mandatory;
- Application of Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) for new projects is mandatory;
- Mandatory participation of RES is 27% in gross final consumption until 2020¹;
- Minimum efficiency of the new production capacities shall be stipulated by the Law on Efficient Use of the Energy.

These challenges for electric energy system of the Republic of Serbia may be overcome and system made sustainable provided that the following is secured:

1. Application of the entire set of energy efficiency measures stipulated by the Law on Efficient Use of the Energy and which lead to rationalization of electricity consumption and important reduction of electricity losses in transportation and distribution.

2. Rehabilitation of the existing electric power production capacities and the construction of new capacities by which the main goal of generation sector related to secure, safe and quality supply of domestic electricity market, is achieved.

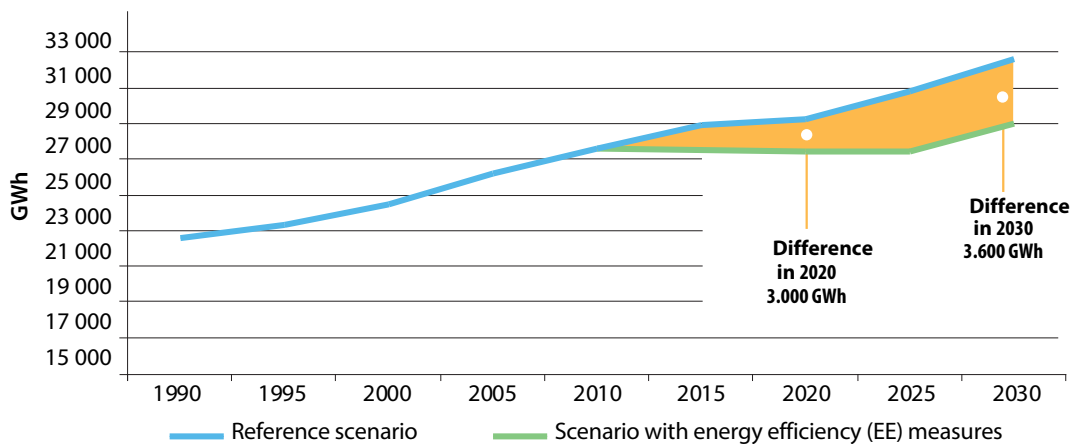


Diagram V-1: Projection of electricity consumption

Generation capacities

The level and the manner of rehabilitation of the existing thermal energy capacities are conditioned by the application of the Directive on Large Combustion Plants. This Directive stipulates the reduction of emission of SO₂, NO_x and particles from thermal units with thermal input equal or greater than 50 MW, regardless of the type of the fuel by the end of 2017. With the aim of conducting this Directive in new thermal facilities and those that are in the process of rehabilitation, units for desulfurization, denitrification of flue gases as well as electrostatic precipitators of high efficiency shall be installed.

¹ Stipulated by Directive 2009/28/EC

Application of this Directive demands significant investments (around EUR 634.5 million) into modernization and environmental improvement of thermal units over 300 MW capacity (Units TENT A3-A6, TENT B1-B2, Kostolac B1-B2 of total installed capacity of 3.160 MW and average annual production of around 19.000 GWh). Having in mind how important these units are for electric power and also total energy security of the country it is absolutely necessary to provide their modernization in defined deadlines in order not to be decommissioned.

As for thermal energy units below 300 MW capacity (TENT A1 and A2, Kostolac A1 and A2, Morava, Kolubara, Panonske Elektrane) their average age is 45 years and average energy efficiency below 30%. Successive decommissioning of those units is envisaged for the period from 2018 to 2024 and their functioning in that period shall be provided and defined by the National Emission Reduction Plan or other flexible mechanisms stipulated by the Directive on Large Combustion Plants.

Average annual production of units envisaged for decommissioning is around 6000 GWh so that for providing safe supply of all customers in the country, regardless of metrological and hydrological conditions in the country and region, it is necessary to introduce new generation units into the system with significantly higher energy efficiency (over 40%). Therefore and in terms of construction dynamics different scenarios of electric power sector development are possible and the whole series of projects of EPS and other investors (Table V-1) is in different phase of preparation and elaboration.

Table V-1: Potential projects for the construction of new production capacities in electric energy sector

Project name	Installed capacity	Estimated time necessary for project implementation	Approximate investment value
TENT B3	750 MW	4-6 years	1.600.000.000 €
TPP Колубара B	2 x 375 MW	6 years	1.500.000.000 €
TPP Kostolac B3	350 MW	4 years	450.000.000 €
TPP Novi Kovin	2 x 350 MW	6 years	1.330.000.000 €
TPP Stavalj	300 MW	5 years	650.000.000 € - 750.000.000 €****
CHP Novi Sad	340 MWe	2-3 years	400.000.000 €
Natural gas fired CHP	860 MWe *	4 године (phase implementation)	1.500.000.000 €
HPP Velika Morava	147,7 MW**	3-7 years (phase implementation)	360.000.000 €
HPP Ibar***	117 MW**	2-7 years (phase implementation)	300.000.000 €
HPP Middle Drina***	321 MW**	5-9 years (phase implementation)	819.000.000 €
PSHPP Bistrica	4 x 170 MW	5 years	560.000.000 €
PSHPP Djerdap3(I phase)	2 x 300 MW	5 years	400.000.000 €
Small HPP	387 MW	6 years (191 locations)	500.000.000 €

* Total capacity of more CHPs (Pančevo, Beograd, Niš and other)

**Total capacity of more cascade HPPs

*** With the Law that confirms agreement between the Government of the Republic of Serbia and the Government of the Republic of Italy on cooperation in the field of energy, joint implementation of these projects is defined.

****including investment in coal mine

Criteria for selection of facilities will allow, in the period covered by the Strategy, to provide a reliable supply of electricity at the lowest cost and least impact on the environment, as well as support the development economic sectors related to energy.

Taking into consideration the necessary electricity generation from RES the projection of the construction of new production capacities that provide covering domestic needs according to the Referent (more demanding) scenario is given on diagram V-2. Projection of production from new and existing plants is given on diagram V-3. Implementation of some additional capacities according to table IV-2 or realization of lower electricity consumption, according to the scenario with application of energy efficiency measures with envisaged capacities, also opens the possibility for electricity export.

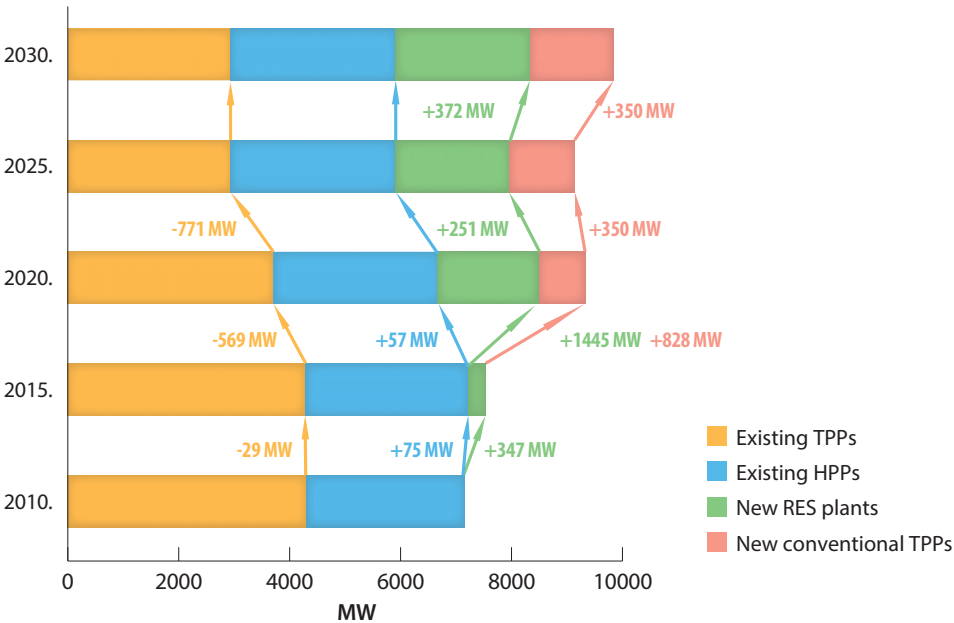


Diagram V-2: Production capacities in the period until 2025/2030

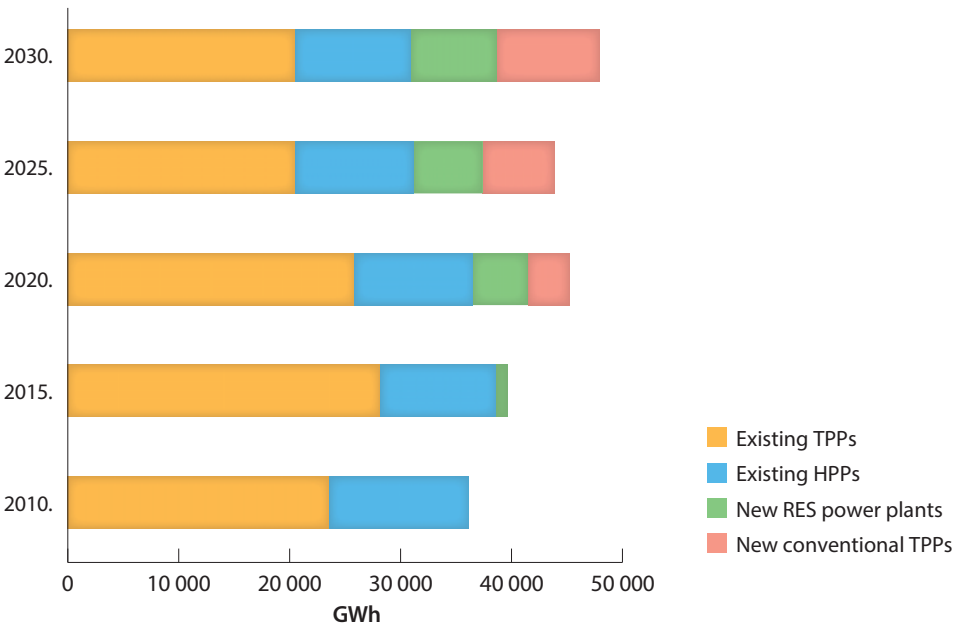


Diagram V-3: Projection of electricity generation

Regarding the envisaged construction of new thermal power units, aiming at increase of flexibility of electric power system, efficient measures for consumption management shall be introduced in order to reduce unequal consumption diagram and increase participation of base energy in consumption profile.

Increase of system flexibility is specifically important, having in mind the envisaged significant construction of new capacities based on the usage of intermittent RES (wind farms and solar power plants). For capacity balancing in the system in the conditions of great participation of thermal energy facilities, the construction of new pumped storage hydro power plants is necessary. In addition to the increase of balance power in the system, the construction of new pumped storage hydro power plants (Bistrica and/or Djerdap III), along with the existing, would provide maintaining the necessary level of system stability also in the event of large thermal units outage. For the needs of the Republic of Serbia and development of RES, it is necessary to have one PSHPP on the network around 2020, while the need for the other PSHPP shall be defined depending on the regional circumstances regarding the construction of new RES units and/or nuclear power plants. Strategic importance of PSHPPs is such that it is necessary to provide that the Republic of Serbia is the major owner of them.

Transmission and distribution

Development of transmission capacities includes rehabilitation of existing and the construction of new transmission capacities in order to achieve balanced, sustainable and timely development of transmission system, with the aim to include new conventional and renewable energy sources.

Three groups of projects have strategic and development importance on national, regional and Pan-European level in the period until 2025, i.e. 2030:

- **Strengthening internal transmission capacities as well as the capacities of regional corridor through transmission network, 400 kV voltage level of the Republic of Serbia in the direction northeast-southwest.**

Transmission system of the Republic of Serbia, owing to its geographic position, represents the connection between all electric power systems in the South-East Europe region. Transmission system of the Republic of Serbia is connected with the transmission systems of eight neighbouring countries. The aim of this group of projects is to strengthen the internal transmission capacities and to replace the obsolete network of 220 kV voltage level in the western Serbia region, as well as to strengthen the transmission capacity of one of the busiest corridor of the South-East Europe region (taking into consideration planned underwater connections between Italy and Montenegro primarily, as well as possibly Italy and Croatia). This group of projects shall enable transmission of energy from eastern part of SE Europe, as well as Moldova, Turkey and Ukraine towards southwestern part of the region and further towards the west Europe. It is comprised of three projects:

1. New interconnective transmission line between the Republic of Serbia and Romania (double 400 kV transmission line between Rešica (Romania) and Pančevo (Serbia) with new substation 400/110 kV in Vršac that is connected to this transmission line),
2. Upgrading network of west Serbia to a voltage level of 400 kV (double 400 kV transmission line between Obrenovac and Bajina Bašta with upgrading substation in Valjevo to 400 kV voltage level and connecting to mentioned transmission line),
3. New 400 kV interconnection between the Republic of Serbia, Montenegro and Bosnia and Herzegovina.

- **Strengthening internal transmission capacities as well as capacities of regional corridor over transmission network, 400 kV voltage level of the Republic of Serbia in direction east-west**

Goal of this group of projects is to strengthen internal transmission capacities and replace network of 220 kV voltage level in Central Serbia. This group of projects shall provide transmission of energy from eastern part of southeast Europe and from Moldova, Turkey and Ukraine towards southwest part of the region, as well as further towards Western Europe. It includes the construction of new network of 400 kV voltage level from Niš to Bajina Bašta and Bistrica with upgrading of existing 220 kV substations in central Serbia to 400 kV and strengthening capacities of existing 400 kV interconnection towards Bulgaria.

- **Strengthening transmission capacities of strategic directions in network of voltage level 110 kV**

The purpose of this group of projects is to raise reliability of transmission system and safe supply of customers, connection of new production capacities as well as connection of transmission and distribution system. The following are listed as the most important one:

1. Double transmission line of 110 kV between Kraljevo and Novi Pazar (is the solution for safe supply of Raška area and area in the north of Kosovo and Metohija)
2. Transmission line 110 kV between Veliko Gradište and Bela Crkva (is the solution safe supply of area of south Banat and provides connection of future wind farms in Banat region)

Distribution network development includes the construction of missing substations and lines, primarily of voltage level 110 and 35 kV and reconstruction and modernization of existing substations (replacement of obsolete energy equipment, raising capacities, automation of plant elements and other) and existing network of lower voltage levels (35, 20, 10 and 0,4 kV). By these measures the reduction of (currently very high) losses in distribution network shall be achieved and their efficiency shall increase, higher level of system operation security and better quality of electricity customers supply shall be provided.

Strategically important project in electricity distribution sector is the replacement of existing metering devices with modern digital metering devices that shall provide implementing so called «smart metering», which implies metering and acquisition of all relevant amounts of consumption, i.e. remote reading, remote disconnection, consumption management, etc. By 2030 the replacement of around 3 million meters is expected. Related to distribution system, it is necessary to undertake other steps related to introduction of so called «smart grid» concept. Distribution network automation within “smart grid” concept implies introduction of systems and SCADA application for remote monitoring and management of the existing and future switching elements in distribution network. Apart from its contribution to the reduction of losses in distribution system, this is important for possibility to connect new electricity generators from RES to distribution network. That shall require distribution companies to become active participants in managing their part of the system.

Electricity market

Conditions for market liberalization in electricity sector exist since 2008 when obligation of public supply of all electricity customers that were not connected to distribution system ceased to exist. By that around 10% of the market was opened. From the beginning of 2014 additional 30-35% of the market shall be opened, since only households and small electricity customers will remain in the public supply system (at regulated prices). From January 1, 2015, the market shall be completely opened, so that the household could freely select electricity supplier on the market.

It is expected that price liberalization shall lead to price competition, which will lead to certain price increase, but with such a structure that shall cover balanced costs, including external costs. It means that, in that event, the «social component», by which the standard of the citizens is unjustifiably protected at the cost of energy, would be removed from electricity price, by which significantly more funds would remain for investments in technological development and «green energy». To achieve economically balanced level it is necessary to plan permanent actual growth of regulated electricity price so that it could be achieved in relatively short period (2-3 years).

Eliminating state influence on electricity price regulation and elimination of „social“ component and regulated price system in total, shall on the one hand, at least in first moment, lead to the increase of production costs and services in those industry areas that are more dependent on electricity. However, basically this should motivate application of energy efficiency measures and consumption management, as well as to represent stimulus for using other energy sources as replacement, and where economically justifiable, to lead to own electricity generation. Regarding the concept of electricity market, pursuant to the provisions of Energy Community Treaty, it can be expected that, once this market becomes fully operational, electricity prices will be at the level of prices in the neighboring countries.

This scenario is acceptable from the position of long term supply security and quality of business operation of this activity. Operational costs of public supplier business operation would have to include operational internal and external generation costs, costs of capital and appropriate rates of return, which would provide adequate maintenance and overhaul of existing infrastructure, as well as timely investment in the development and construction of infrastructure.

Challenges of development

In the process of accession to the EU electricity sector of the Republic of Serbia will face mandatory and financially challenging costs of CO₂ emission. Namely, the Republic of Serbia as developing country (in the status of non-Annex I member of Kyoto Protocol) does not have international obligations for now (including the obligations towards the EU legislation) to reduce the greenhouse gas emission (GHG), but most probably at the moment of accession to the EU, shall have the obligation to assume limiting/reducing GHG emission. Projected change in the structure of energy products for electricity generation (significant share of RES and natural gas), decommissioning of old and inefficient plants, commissioning new, more efficient lignite-fired thermal power plants and loss reduction in distribution and transmission shall lead to significantly lower specific emission of GHG from this sector (Diagram V-4). However, still high share of lignite in generation shall require significant preparation of companies in sector for implementation of the EU Emission Trading Scheme.

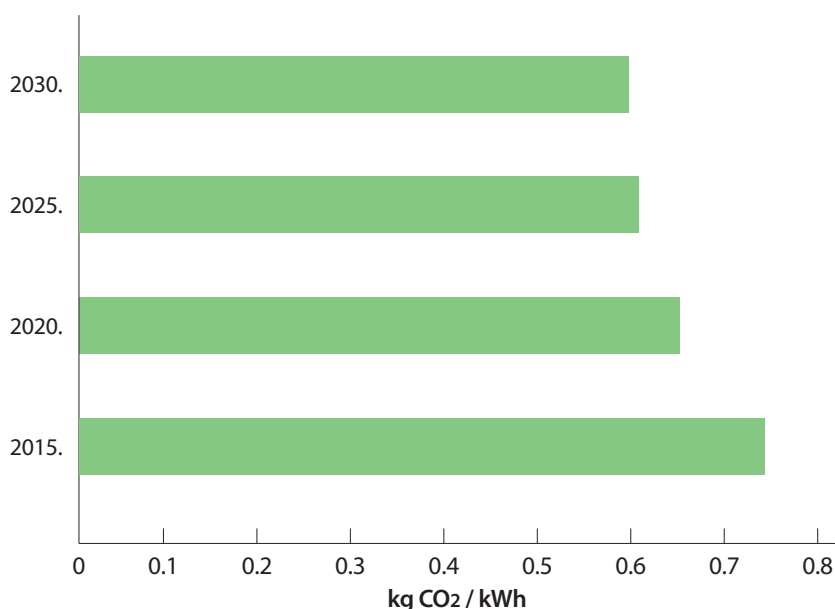


Diagram V-4: Change of specific CO₂ emission

For the development of electricity sector significant funds are necessary (Table V-2). Joint ventures with foreign partners are form of investment envisaged for bigger part of considered projects (except investments into transmission network where the Republic of Serbia has 100% shares). Thereby it is strategically important to insist on introducing the best available technologies - as for increase of efficiency of energy transformation, the same for rational management of natural resources with strict protection of domestic interest and following EU norms related to environmental protection

Table V-2: Investments into systems for electricity generation, transmission and distribution, (million EUR)

Year	until 2020	until 2025	until 2030
Modernization of existing thermal power plants according to the LCP Directive	634*	-	-
Modernization of existing hydro power plants	200	100	100
Construction of new conventional thermal power plants	1.100	500	500
Construction of PSHPP	360	300	300
Construction of new RES capacities	2.323	520	750
Investments into transmission system	200	170	-
Investments into distribution system	500	250	250
Cumulative investment (million Euros)	5.317	7.157	9.057

*modernization shall be performed in accordance with the deadline for Directive implementation

The Republic of Serbia has to find a way to participate in implementation of energy projects at Kosovo and Metohija. It is important for what is already constructed there, as well as for future use of own resources.

As for possibility to use nuclear energy, for which the Law that prohibits the construction of nuclear power plants² is still valid, transferred based on the succession with SFRY, currently there is no regulatory or administrative framework which would regulate the construction and operation of nuclear power plants. Also, there are no scientific or expert human resources that would monitor the construction and operation of these plants, and educating human resources needed for nuclear energy was terminated. Similar situation is in administrative and regulatory and scientific and expert terms and with the treatment of highly radioactive waste and spent nuclear fuel. Also, it should also be noted, that this is the case of energy based on import fuels. However, the construction of nuclear power plants should not be excluded as an option, having in mind the environmental limitations for the existing generation and future needs. Estimation is that 10-15 years from the moment of abolishing the Law that prohibits the construction of nuclear power plants, would be the minimum period to overcome all listed problems and deficiencies, until the beginning of possible operation of such plant in the Republic of Serbia.

2 Law that prohibits the construction of nuclear power plants in FRY, Official Gazette of FRY, 2/95

District heating

Strategic goals

- Providing heat for safe supply of households and industry by strictly following environmental protection norms
- Increase of energy efficiency in generation, transport, distribution and heat use
- Higher use of RES
- Sustainable business operation of heat producers

Current situation:

- System is based solely on fossil fuels (48% natural gas, 23% coal and 29% liquid fuel)
- Average age of infrastructure is over 25 years
- High specific energy consumption
- Absence of market, inconsistent and inadequate manner of lump sum collection for heat

Strategic actions

- Continuous modernization of the existing district heating systems
- Establishing and applying unique tariff system for heat production, distribution and supply
- Institutional connection of systems
- Extension of the existing district heating
- Promotion of change of energy products and their more efficient usage
 - Reducing share of liquid fuel and coal,
 - Higher usage of biomass (possible co-combustion in existing coal-fired heating plants),
 - Use of municipal waste,
 - Higher usage of sanitary hot water,
 - Combined production of electricity and heat,
- Capacity increase of local self-governments regarding market regulation

Priority activities:

Reduction of energy losses in networks



Introducing measurements of heat consumption at end users and collection according to supplied energy



District heating in the Republic of Serbia exists in 57 cities/ municipalities, and their total nominal installed capacity is 6,700 MW. Average age of heating sources, heating substations and hot water distribution network is over 25 years. Rehabilitation and modernization of these systems, by renewal of heat source equipment, replacement of obsolete elements within distribution networks, as well as continuous promotion of the equipment of heating substation represents the constant priority of this sector. For the purpose of more efficient realization of these activities and general development municipal energy on the territory of the Republic of Serbia, it is necessary to consider the possibility to institutionally connect these systems in order to achieve synergic effect in their joint and harmonized development.

When performing rehabilitation of the existing facilities for heat supply or possible construction of new facilities the best available technology shall be applied, whose energy efficiency fulfills criteria that shall be stipulated by the Law on Efficient Use of Energy, and

which will strictly follow the legislation in the field of environmental protection. Turning to cleaner energy sources in this sector and technological modernization of district heating is an imperative, having in mind that the biggest part of existing heating sources is located in the highly populated urban environments. Special attention shall be given to reconstruction of district heating in cities whose heating plants dominantly use coal (Kragujevac, Kruševac, Bor, Leskovac and other), as well as the cities which are supplied by heat from thermal power plants planned for decommissioning (Obrenovac, Požarevac, Lazarevac). It is necessary to provide that safe supply of heat in these cities is not threatened during reconstruction/ decommissioning of existing thermal sources.

Targeted change of energy products structure in this sector is envisaging reduction of coal and liquid fuel share (heavy fuel oil and fuel oil), and increase of biomass and natural gas share (Diagram IV-5). It is necessary in addition to mentioned requirements related to environmental protection and for providing targeted RES share of 27% in gross final consumption until 2020, but also because the EU Emission Trading Scheme refers to this sector.

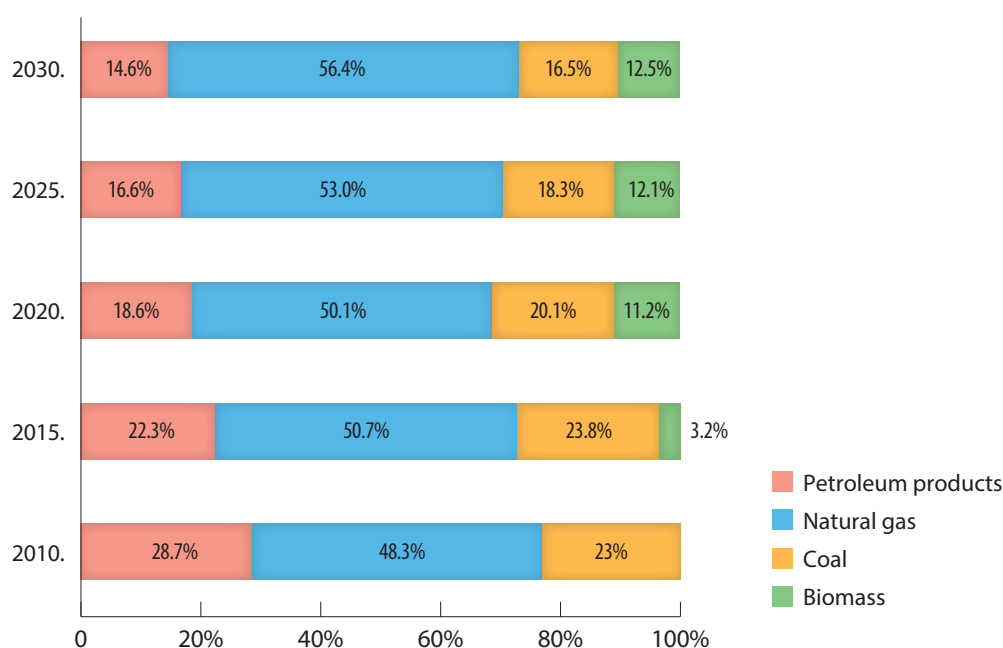


Diagram V-5: Projected changes in the structure of fuel for heat production

Compared to developed countries of EU, in the Republic of Serbia the number of apartments that are connected to district heating is still low, so in this sense it is possible to enlarge the consumption area, especially in highly urban environments. In order to achieve that 40% of the households in the cities with district heating (average countries of the EU with similar climate conditions) be connected to the network, in the period until 2025 it will be necessary to connect around 100.000 new households.

Development of urban areas and construction of energy efficient facilities, i.e. energy reconstruction of existing with collection of heating according to the consumption for each dwelling unit, with the possibility of regulated transmission of heating in substation

and on each heater, should lead to very significant reduction of final consumption of heat. Realized saving could be the energy available for new customers.

Since the termination (direct or hidden) of subsidizing of thermal energy sector may be expected, at the same time with electricity market establishment, it is necessary to take into consideration with all modernization activities, the possibility to transform existing heat sources into combined heat and power plants (CHP). It is assumed that the market price of electricity and heat could cover initially higher investment into these capacities, and additional possibilities for their economically justifiable operation should be looked for in development of distribution of sanitary hot water, and with development of economy and by trigeneration. Possibilities for combined electricity and heat production are numerous and may use different energy products (coal, natural gas, RES and other). From the point of view of local industry development, facilities that use locally available resources may be used (biomass, municipal waste, geothermal energy and coal) and simultaneously supply more settlements/cities. In case of small mines with underground exploitation (east Serbia) this could be a solution for their profitability. One of the possibilities is using combined heat plants located outside the city and heating pipelines that supply cities and settlements nearby, with thorough analysis of cost-efficiency and environmental impact.

Implementation of Strategy requires the establishment of the system for precise measuring and collection of supplied heat in the Republic of Serbia by 2015, regardless of the entity of production, distribution or consumption. The existing system of paying the lump sum for heat ("according to the square meter of heating area") is economically unacceptable, technologically demotivational and socially unfair and basically prevents the application of measures for promotion of energy efficiency and rationalization in energy consumption. In order to raise consciousness of heat customers in the country and direct them to rational heat consumption and realization of savings it is additionally necessary to create unique, national tariff system for heat production, distribution and supply. Using cost model for heat price setting its customers could unambiguously and clearly understand costs that incurred in heat production, distribution and supply, and producers and distributors would be motivated for significant application of energy efficiency measures and overall efficient business operation.

Estimation of financial funds necessary for the development of this sector is given in Table V-3. Development of relevant natural gas-fired CHP plants is seen as an investment in energy sector. Estimation is around EUR 220 million that would be necessary to invest in this sector until 2020, the biggest part in reconstruction and modernization of the system.

Table V-3: Investments into systems for heat production and distribution (million EUR)

Year	By 2020.	By 2025.	By 2030.
Reconstruction, modernization and construction of heat sources	85	45	65
Rehabilitation of distribution network	95	45	65
Rehabilitation of heating substations	40	25	30
Cumulative investment (million Euros)	220	335	495

Renewable energy sources

Strategic goals

- Increase of energy production from RES for the purpose of reduction of import and improving energy security

Current situation:

- Existing share of RES in gross final consumption 20,1%
- The largest part of current usage of RES refers to traditional way of using biomass and large hydro power plant
- Introduced «feed-in» tariffs

Strategic actions

- Adoption and implementation of National Action Plans for RES
- Defining national objectives for using RES per sectors and monitoring implementation:
 - Using RES for electricity generation
 - Using RES in heating plants and final consumption
 - Change of use of fossil fuels (coal, heavy fuel oil, fuel oil and natural gas) for heating
 - Change of use of electricity for production of sanitary hot water
 - Introducing RES in sector of building sector (primarily in public sector)
 - Using RES in traffic
- Development of distribution network for connection of smaller electricity generators
- Production and application of equipment and technologies that shall provide more efficient use of energy from RES
- Informing and education of public

Priority activities:

Implementation of Action Plan for RES by 2020



Potentials of renewable energy sources of the Republic of Serbia are significant and estimated at 5.65 million toe per annum. From this, more than 60% is biomass potential, whose usage is currently estimated at around 30% of available potentials. Available technical hydro potential has a share of 30% of total RES potential. More than a half of this has already been used. From other RES currently only use of geothermal energy is partially monitored and balanced

With ratification of Energy Community Treaty the Republic of Serbia also assumed obligations from Directives 2009/28/EC on the promotion of the use of energy from renewable sources and on promotion of use of bio fuel or other fuel from renewable energy sources for transport. For larger use of renewable sources the Republic of Serbia joined countries that subsidize electricity generation from renewable sources and introduced the widely used model- feed-in tariff with the period of guaranteed supply of electricity of 12 years.

The Republic of Serbia adopted the National Action Plan for RES as a framework for promotion of energy generated from renewable energy sources and set mandatory national goals for share of renewable energy in gross final consumption of energy (27%) as well as the share of energy from renewable sources in transport (10%) by 2020.

In order to achieve adopted national goals installation of larger capacities is envisaged for electricity generation by using wind, biomass and sun (Diagram V-6), as well higher share of RES in heat production (Diagram V-5). Targeted projection of RES use for electricity and heat generation and direct use in final consumption is given on Diagram V-7. By this the targeted share of RES in gross final consumption 2020 is achieved, by which over 50% of estimated RES potential.

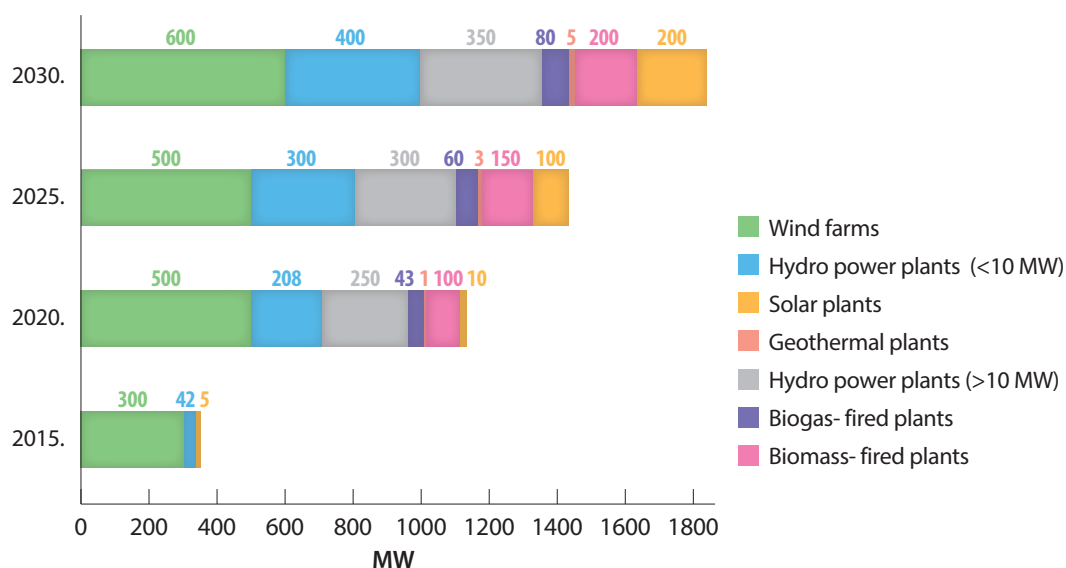


Diagram V-6: Projection of the construction of plants for electricity generation using RES ³

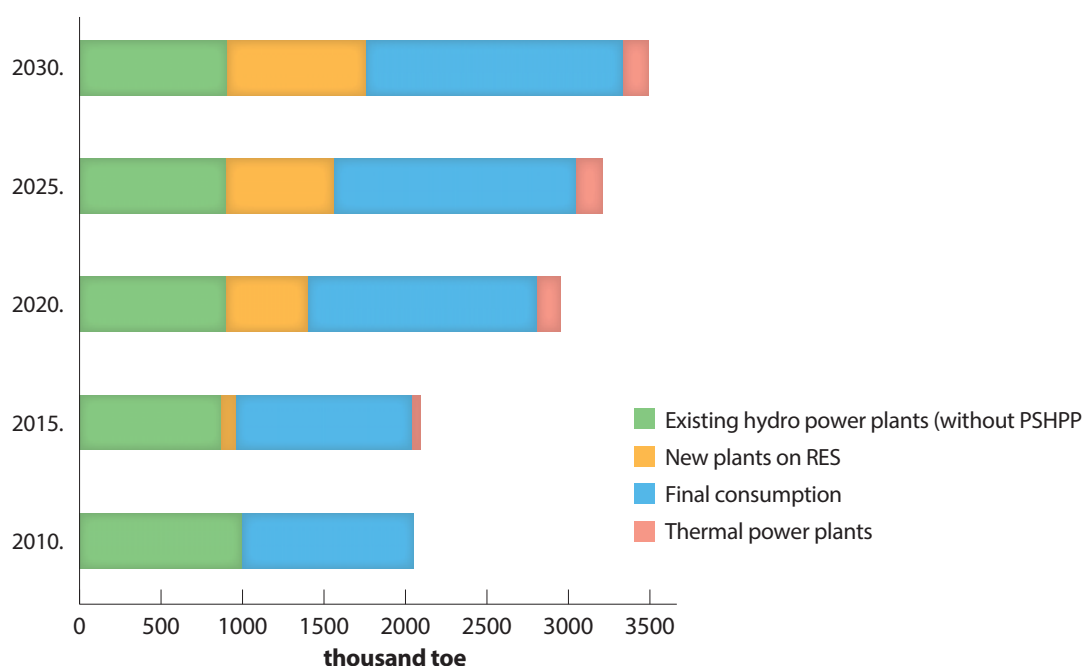


Diagram V-7: Projection of energy use from renewable energy sources

To achieve this very ambitious, mandatory share of RES in gross final consumption, it is of paramount importance to achieve goals related to energy efficiency (in accordance with Directive 2006/32/EC). Each deviation from envisaged energy savings would mean higher energy gross consumption than planned, and with that also more capacities for energy generation from RES would be needed. Also, having in mind that the participation of foreign partner is foreseen for several projects of construction of large hydro power plants and wind farms and export of „green“ energy, detailed analysis of project from the standpoint of

³ In the period until 2020 harmonized with Action Plan for renewable energy sources

energy system possibilities is necessary, long-term interest of the Republic of Serbia and their impact on mandatory national goals for energy share from renewable energy sources in total gross final energy consumption.

Depending on the energy consumption in traffic sector, for the fulfillment of obligations from Directive on RES production of bio fuels between 210 and 250 thousand toe should be provided until 2020. The Republic of Serbia currently has capacities for production of bio fuels from biomass of first generation, which do not fulfill conditions regarding GHG emissions and could not contribute to achieving mandatory share of 10% 2020. Having in mind that currently there are no facilities for the production of bio fuels from biomass of second generation, the absence of legal regulation in this field and very short period for achieving this very demanding goal, the Republic of Serbia has to plan the import of bio fuel. Therefore it is necessary to stimulate the production of bio fuels in the country. Estimation is that for the construction of bio refinery for the production of up to 200, 1 tonne of bio ethanol (second generation of bio fuels) it would be necessary to invest from 100 to 120 million €.

Funds for stimulation of electricity generation from renewable sources are provided by electricity price increase by which the costs of stimulation are transferred to end users. In the process of monitoring implementation of the Strategy depending on goals realization, and also the development of technologies for RES use, it is possible to adjust feed-in tariffs, and if it shows that additional stimulation is necessary, additional funds shall be provided by direct support, either monetary, or by tax allowances and by bonuses that producers of non-renewable energy have to pay as a type of compensation for causing pollution. In particular, it is necessary to consider the possibility to introduce incentives for using RES for fulfilling heat demands.

Coal

Strategic goals

- Secure supply of coal for thermal power plants
- Provision of necessary amount of coal for final consumption and for heat production

Current situation:

- Age of plants and equipment and the need for rehabilitation
- Problems with expropriation of land for further development of open-cast mines
- Underground coal exploitation is not profitable and functions with the help of state

Strategic actions

- Intensifying investigations of coal deposits on the territory of Serbia,
- Opening replacement capacities for existing open cast mines which stop operating and opening mines that shall be used for new thermal capacities,
- Optimization and concentration of coal production from underground exploitation in profitable facilities
- Introduction of coal quality management system.

Priority activities:

Opening new open cast mines in Kolubara basin



Extension of capacities at open cast mine Drmno



Determined and potential stocks of lignite in Kolubara, Kostolac and other basins⁴ are such that they can fully and in long-term fulfill the growing demands for safe supply of existing rehabilitated and new thermal power plants. Diagram V-8 shows the necessary amount of coal for that purpose, as well as for use in final consumption and for the production of heat.

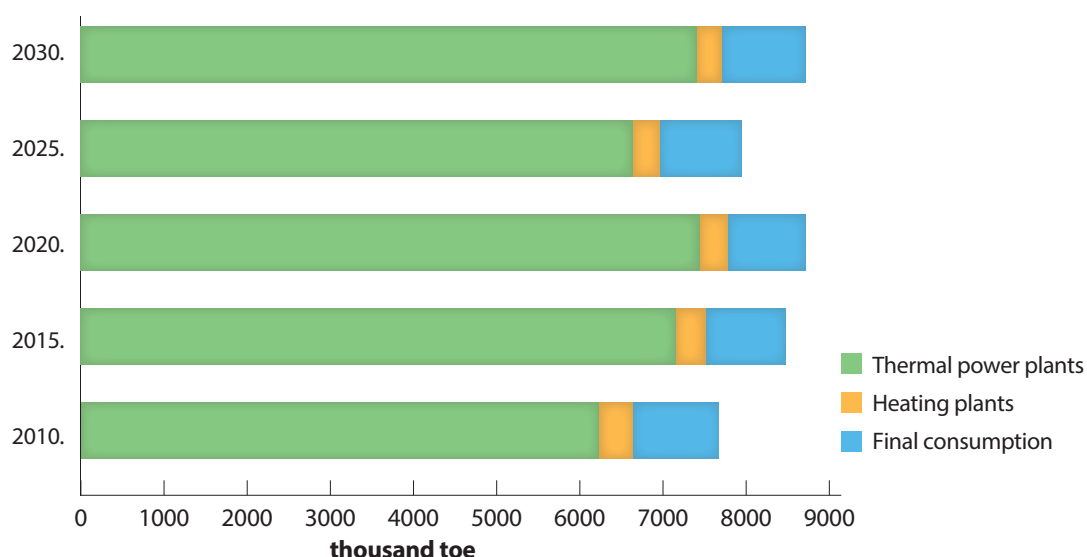


Diagram V-8: Projection of primary coal consumption (Reference scenario)

⁴ From July 1 1999, Electric Power Industry of Serbia does not manage its capacities at the territory of AP Kosovo and Metohija

For the purpose of continuation of operation of the existing and foreseen new thermal capacities, opening of new open cast mines is necessary. Projects which must be realized in order to provide continuous operation of the existing thermal energy units are in Kolubara mine basin connected to the investments into existing mines (Tamnava – West Field, Fields C and D, relocation of Vreoci village, total investment of € 470 million), opening of open cast mine Field E, as the replacement mine for mine Field D (€ 532 million investment) and opening of open cast mine Field G as the replacement for mine Veliki Crljeni (€ 161 million investment).

Opening of open cast mine Radljevo (value of investment is € 600 million for 6 year period of implementation and achievement of projected production of 13 million tonnes of coal per year, i.e. € 1,232 million until the end of exploitation) is strategically connected to the construction of TPP Kolubara B and TENT B3, as well as to the further development of Kolubara mine basin, and in that sense, dynamic harmonization of implementation of these projects is necessary.

Gradual increase of coal production is possible in Kostolac basin from open cast mine Drmno (unfinished investments for achievement of 9 million tonnes of coal capacity are € 100 million, and additional € 130 million is necessary for achievement of the capacity of 12 million tonnes of coal per year) and in long-term perspective also the activation of production on other open cast mines (Ćirikovac, west part of Kostolac basin) which depends on the construction of production capacities in this basin.

Capacity of Kovin basin can provide continuous supply of around 700 MW thermal capacity, but that requires investment into mine sector of around € 500 million.

When it comes to underground coal exploitation, it is strategically necessary to connect stocks of these mines for thermal capacities. New investments (of about € 330 million) can initiate the use of exploitable stocks of around 155 million tonnes of coal. In that case, it is possible to produce and place (thermal capacities and broad consumption) around 3 million tonnes of commercial coal, with production costs which would have to be under EUR 2/GJ.

Underground coal exploitation restructured in such manner could economically exist independently and supply customers as the equivalent of one TPP of about 300 MW and one CHP of 50 to 100 MW.

Oil

Strategic goals

- Provision of secure supply of domestic market with petroleum products of the quality that meets the highest EU standards
- Reduction of import dependency
- Provision of new directions of supply of crude oil

Current situation::

- High import dependency
- Dominant import from one direction
- NIS is a joint stock company with majority share of the foreign partner

Strategic actions

- Provision of mandatory stocks of oil and petroleum products (reconstruction of the existing and construction of new storage capacities)
- Research with the aim of finding new reservoirs
- Maintaining the highest possible level of production of crude oil in the country
- Modernization of refining process
- Provision of more efficient transport of derivatives via oil products pipeline system
- Competition in the sector with the aim of achieving the most favorable prices for customers

Priority activities:

Reconstruction of the existing and construction of new storage capacities



Increase of the level of refining process



According to all considered scenarios of energy development up to 2030, increase of consumption of petroleum products is expected, but in the amount that the capacity of oil refinery in Pančevo of 4.7 million tonnes per year can meet the needs in balance, even if it does not come to foreseen production of biofuel (Diagram V-9).

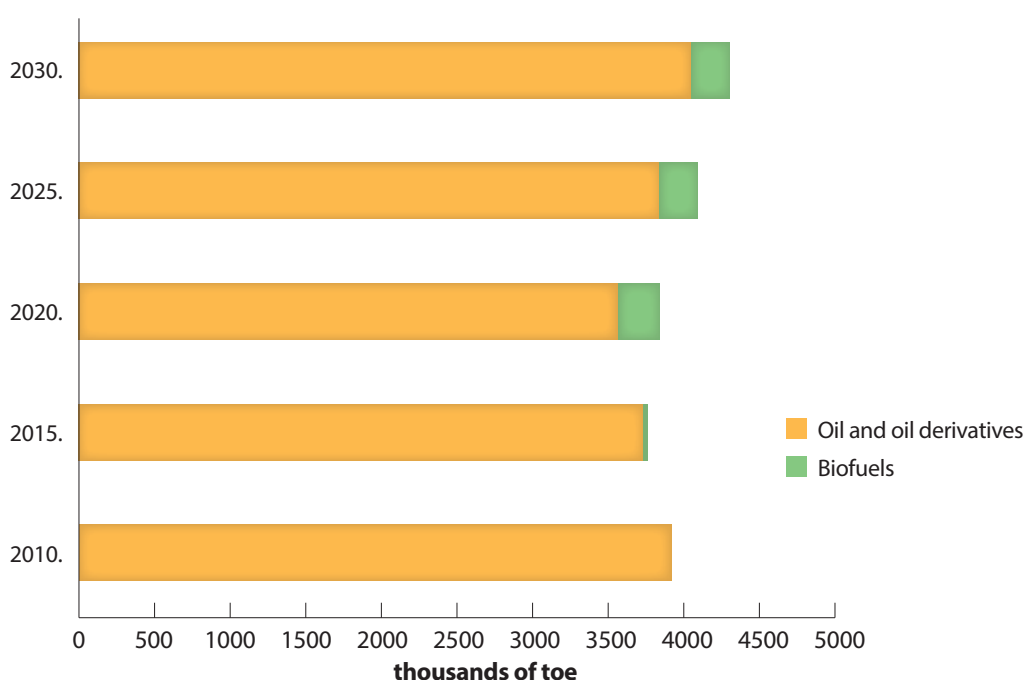


Diagram V-9: Projection of liquid fuels consumption (Reference scenario)

After privatization of NIS, Russian company Gazprom Neft became its majority shareholder, therefore it fully controls subsectors of research and production of oil and natural gas and oil processing and in good deal it also controls turnover of products (with around 68% share in wholesale and 35% share in retail of products). That is why it is necessary to promote the enlargement of the number of the participants and market competition in this sector.

Oil and petroleum products market in the Republic of Serbia is free, and price regulation refers only to transport via oil pipelines and foreseen oil products pipelines which represent natural monopoly. Oil market in the Republic of Serbia shall in the following period also be determined first of all with the price of this power product at the global market, which even though is difficult to predict has long-term growing trend.

The Republic of Serbia in the oil sector is highly import dependant country with relatively small participation of own production of oil in total demand and dominant import from one direction of supply. Prices of petroleum products are therefore directly conditioned with the changes of price of Ural oil and it is necessary to consider the possibility of providing new directions of crude oil supply.

In the following period, main activities in research and oil production subsector shall be directed towards mitigation of the reduction of crude oil production. When the fall was stopped in 2006 and 2007 production in the country started to grow and reached its maximum in 2012, first of all thanks to additional interventions at bore holes. It was planned to compensate the fall in production with the discoveries from new reservoirs. In that sense, realization of new research projects has started and reconstruction and modernization of production systems shall increase their energy efficiency. The goal is to have at least half of the amount for processing from the production in the country and concessional production. The fact is that if it does not come to discovery of new oil reservoirs and natural gas, in the period up to 2030 gradual reduction and possibly the end of production of these energy products in the country could occur.

One of the possibilities for the reduction of import dependency is, beside biofuel production, the use of oil shale for oil production. For the full consideration of this potential, it is primarily necessary to undertake all required activities for the complete consideration of geological, mining, processing and economic aspects of their exploitation and processing, with thorough analysis of ecological effects.

Modernization of refineries in Pančevo and Novi Sad in a manner that would provide that all fuels in the country up to 2015 shall meet relevant EU standards is a strategic priority. In Refinery in Pančevo the increase of the level of processing is necessary and in both refineries it is necessary to implement projects related to increase of energy efficiency and environmental protection. For achieving full cost-effectiveness of processing in refinery Pančevo it is necessary to have more intensive cooperation with HIP Petrohemija, with additional investments.

Required and expected development of oil sector entails provision of regular supply and increase of security of oil and petroleum products supply in accordance with forecasted trend of further growth of consumption of these energy products. So far, in the Republic of Serbia,

beside goods reserves, there are only commercial reserves of the companies. The condition of the existence of mandatory oil and petroleum products reserves (according to Directive 2009/119/ EC), which should be separated from the operational and in the amount equivalent to 90 days of net import or 61 days of internal consumption (according to higher value), storage capacities in the Republic of Serbia do not meet.

Mandatory reserves (in the form of crude oil, derivatives or contracts on the right of purchase of certain amounts of oil and petroleum products) shall be formed in the period from 2013 to 2022. Total amounts of mandatory reserves in 2022 should be around million m³. It is necessary to also form military oil and petroleum products reserves.

Development in the field of transport of oil and petroleum products in the future period primarily entails activity regarding strategic and development project of construction of oil products pipeline system through the Republic of Serbia. That shall enable significant reduction of loss of motor fuels (from 0.15 to 0.2% to 0,02%) compared to existing manner of transport of motor fuels from refineries to distribution centers (by trucks, tank cars and barges).

Beside this project, it is necessary to also consider revitalization of oil products pipeline Pančevo-Temišvar, and in the case of success of NIS's research in Romania, the construction of oil pipeline which would transport produced oil to the refinery in Pančevo is possible. The idea of construction of Pan-European Oil Pipeline in current circumstances is not real, but it should not be entirely rejected due to economic, ecological and strategic importance of transport of Caspian and Russian oil to the territory of the countries of south-east and central Europe.

Further development of oil sector of the Republic of Serbia shall in great deal depend on the activity of foreign, majority owner of NIS, as well as on the activity of other participants at oil market (JP Transnafta, Lukoil Srbija, MOL, OMV, etc.). In table V-4 estimation of funds required for achievement of subsectors' goals and their realization until 2025 is presented.

Table V-4: Estimation of investments into oil sector

Subsector	Activities	Investment (million EUR)
Research and production of oil and natural gas	Research in the country and region with the aim of finding new reservoirs. Application of new technologies and methods of exploitation	800
Oil refining processing	Increase of the level of processing and further modernization of refineries in Pančevo and Novi Sad	750
Petroleum products turnover	Modernization of gas stations and construction of new ones. Construction of new reservoir capacities Modernization of loading station Procurement of modern means of transport	160
Oil and petroleum products transport	Project of construction of oil products pipeline through the Republic of Serbia	170

Natural Gas

Strategic goals

- Provision of secure supply of domestic market with natural gas
- Establishment of domestic and regional market of natural gas

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

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 for combined generation of electricity and heat in industry and larger cities
- Participation in international projects of natural gas supply
- Regional connecting

Priority activities:

Construction of South Stream gas pipeline



Establishment of at least two regional interconnections until 2020



Completion of the gasification of Serbia



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 price of oil 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-calorie gases is significant (with increased content of CO₂, 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 specifically constructed for its use (e.g. MSK Kikinda), i.e. to find new direct customers.

Transport system of natural gas in the Republic of Serbia is line system with only one entrance with the 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 costs 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.

For gas sector of the Republic of Serbia, implementation of South Stream gas pipeline is of great importance. This transnational gas pipeline should enable secure natural gas supply of Europe and the whole region in the future period. The beginning of the operation of gas pipeline was planned for the end of 2015. Total investment only for South Stream gas pipeline in the Republic of Serbia (not including new storages) should be around EUR 1.7 billion. With the expected transit towards Hungary, Bosnia and Herzegovina and Croatia of about 40 billion m³ of natural gas until 2020, the Republic of Serbia becomes important energy and transit area in Europe and regional gas hub with significant revenue from transit. What is very important for the Republic of Serbia is that the foreseen amount for domestic consumption from this gas pipeline is 3.9 billion m³. Taking into consideration that amount and expected lower transport costs compared to current ones, redistribution of the routes of gas supply can be expected.

Implementation of interconnection with countries from the region and gas South Stream pipeline shall enable larger use of natural gas for combined production of heat energy and electricity. Beside primary use in industry, the construction of gas-fired power plants with combined cycle should be considered in larger industrial centers as well (Novi Sad, Beograd, Niš, Kragujevac, Pančevo, Loznica etc.). These power plants can have important role in balance mechanism during integration of renewable sources, as well as important regional significance upon the establishment of regional electricity market. It is necessary to consider the problem of synchronized operation of Underground Gas Storage "Banatski Dvor" (and possible construction and operation of new underground storages) with electric power system for their operation.

Beside the extension of the capacity of storage "Banatski Dvor" up to the capacity of 800 million m³, there is the possibility of construction of the whole system of storages in the Republic of Serbia - in Vojvodina (Itebej, Mokrin etc.) and central part of the country (Ostrovo and other surrounding locations) with the total capacity estimated at 2.5 to 3 billion m³ of natural gas, and whose feasibility of construction is necessary to analyze within the increase of domestic consumption and development of regional gas market. Construction of gas storages would additionally contribute to energy security of the country.

Implementation of South Stream project should provide significant revenues from transit. In that sense, there is the space to mitigate large natural gas price fluctuations to some extent based on that additional revenue, depending directly from short-term fluctuations at international market, i.e. from global price of oil. In that manner, the increase of the share of consumption of natural gas at domestic market would be stimulated, which would also have positive ecological effects. Therefore, projection of consumption of

natural gas until 2030 can have long-term growing trend (Diagram V-10), although foreseen amounts are significantly lower than those provided by South Stream and the existing interconnection with Hungary. In order to valorize available amounts it is necessary to also consider the possibility of possible construction of gas-fired power plants, whose production would primarily be used for export.

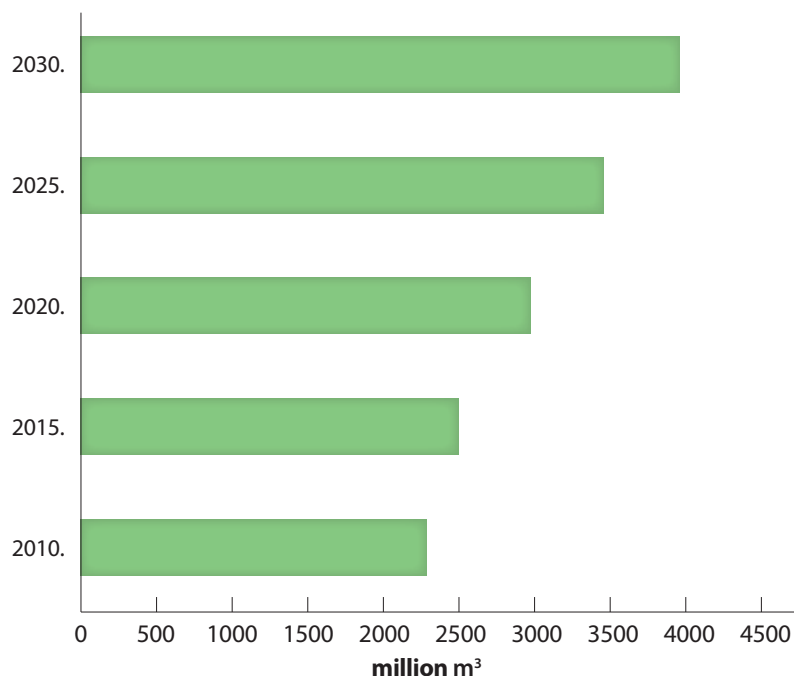


Diagram V-10: Projected consumption of natural gas until 2030 (Reference scenario)

The estimation of required investments in natural gas sector is given in Table V-5. It shows that the sum of investments into gas infrastructure in the Republic of Serbia until 2020 should be over EUR 2.4 billion.

Table V-5: Estimate of investment into natural gas sector

Project	Investment (million euros)		
	up to 2020	up to 2025	up to 2030
South Stream gas pipeline	1.700	-	-
Interconnection with regional countries	120	60	20
New gas storages	100	100	100
Completion of gasification of the Republic of Serbia and revitalization of the existing gas system	500	500	200
Cumulative investment (million euros)	2.420	3.080	3.400

Efficient Energy Use

Strategic goals

- Increase of energy efficiency in all sectors of consumption

Current situation:

- Energy indicators for 2010:
 - Energy intensity: 0,452 kg oe/€2005₂₀₀₅
 - Ratio of primary energy consumption and GDP corrected compared to parity of purchasing power: 0,223 kg oe/\$₂₀₀₅
 - Primary energy consumption per capita: 2.140 kg oe

Strategic actions

- Continuous application of Law on Efficient Use of the Energy
- Adoption and implementation of National Action Plans for Energy Efficiency
 - defining the national saving goals (in total and per sectors) and monitoring of implementation
- Use of combined production of electricity and heat in industry
- Introduction of energy management system
- Increase of capacity of energy statistics
- Informing and education of the public

Priority activities:

Energy reconstruction in building sector



Introduction of energy management in public sector



Energy future of the country shall largely depend on the amount and manner of consumption of energy. Existing indicators of energy consumption compared to the value of GDP have the values comparable to countries in the region, but significantly above average values for EU countries, regardless of the fact that the consumption of energy per capita is lower than average in EU (diagram V-11). Economic development of the country, with the foreseen reindustrialization shall certainly lead to increased energy needs, but more intense application of measures and procedures for energy efficiency increase is required to provide that energy intensity indicators (reduced to monetary and natural values) tend to reach average values in EU countries.

Experience of EU countries show that more significant results in application of measures and technologies for energy efficiency increase require strong state support. In that sense, Law on Efficient Use of the Energy represents basis for support to these activities through forming adequate regulatory and financial framework. In order to achieve optimal scenario of energy development, defining national goals of saving shall be continued by adopting National Action Plans for Energy Efficiency with clearly defined measures and activities in most significant sectors of consumption (households, public and commercial sector, industry and transport).

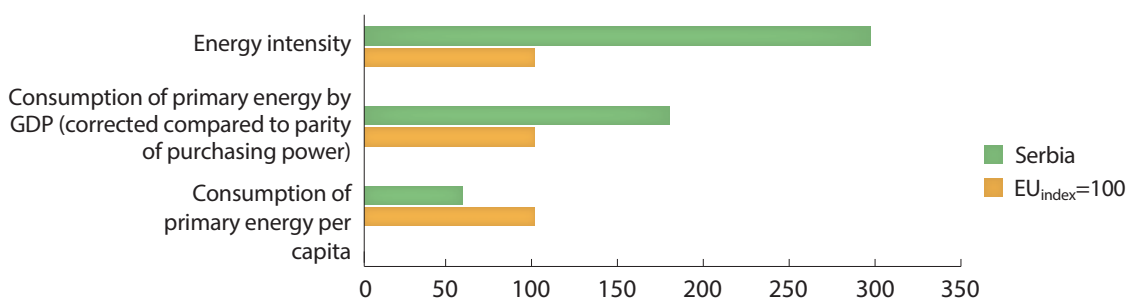


Diagram V-11: Ratio of energy indicators for the Republic of Serbia and EU in 2010

Development of National Action Plans shall be achieved through three-year-long programs of energy saving which shall be adopted by the participants of energy management system from public sector and economy. Programs shall contain clear activity plans for introduction of energy efficient products, processes and technologies, monitoring of achieved results, as well as the resources for their achievement. Adequate informing of end users of energy characteristics of household appliances and precise responsibility of the suppliers and distributors, as well as the additional conditions related to eco design, shall contribute to selection of energy products which are more efficient by end users and thus contribute to achievement of the planned goal.

With the aim of improvement of energy efficiency in the building sector Law on Planning and Construction shall be followed consistently as well as the supporting regulations, regarding determination of allowed energy characteristics of the buildings and energy certification. In that manner significant energy saving shall be achieved during the construction of new and reconstruction of the existing buildings. Overall application of measures of energy efficiency to the existing housing stock in the Republic of Serbia has the potential of saving around 16% of the consumption of final energy and opens the market necessary for its recovery worth several billion euros.

Improvement of energy efficiency in transport partly refers to renewal of vehicle fleet in all sectors, increase of energy efficiency in rail transport, highway traffic and air traffic, but also to multisector harmonization and development of traffic infrastructure, promotion and improvement of public transportation etc.

In industry, reduction of energy consumption is possible by 15-25%, compared to reference scenario, in the period up to 2025 based on the improvement of combustion processes, by use of waste heat from energy facilities and production processes, by replacement of the existing electric motors, by regulating processes of energy use and introduction of measures and procedures of energy management.

Having in mind multidisciplinary activities and measures for improvement of energy efficiency, coordinated work of several different state and local institutions and organizations is necessary, also different companies, but citizens as well. Although the leading role in these activities as well as the coordination and connection of tax, housing and spatial planning policy with the aim of increasing energy efficiency and rationalization of energy consumption shall have the Ministry competent for energy activities, it is necessary to provide and raise the level of capacity in this field at all levels.

Investments required for transition of the Republic of Serbia towards the system of lower final energy consumption are very high for its economic state. However, they are justified because they reduce import dependency, through lower costs they contribute to competitiveness of the economy, reduce costs of environmental protection and directly and indirectly contribute to better standard of the citizens. Also, investments into energy efficiency reduce the need for investment in other energy sectors in long-term, i.e. they leave space for produced energy to be used in

more rational and cost-efficient manner. Beside that, market of energy services which shall be opened in case of this transition shall represent strong generator of economic development because it affects large number of other industries. Budget fund stipulated by the Law on Efficient Use of the Energy is significant and necessary financial support to this transition.

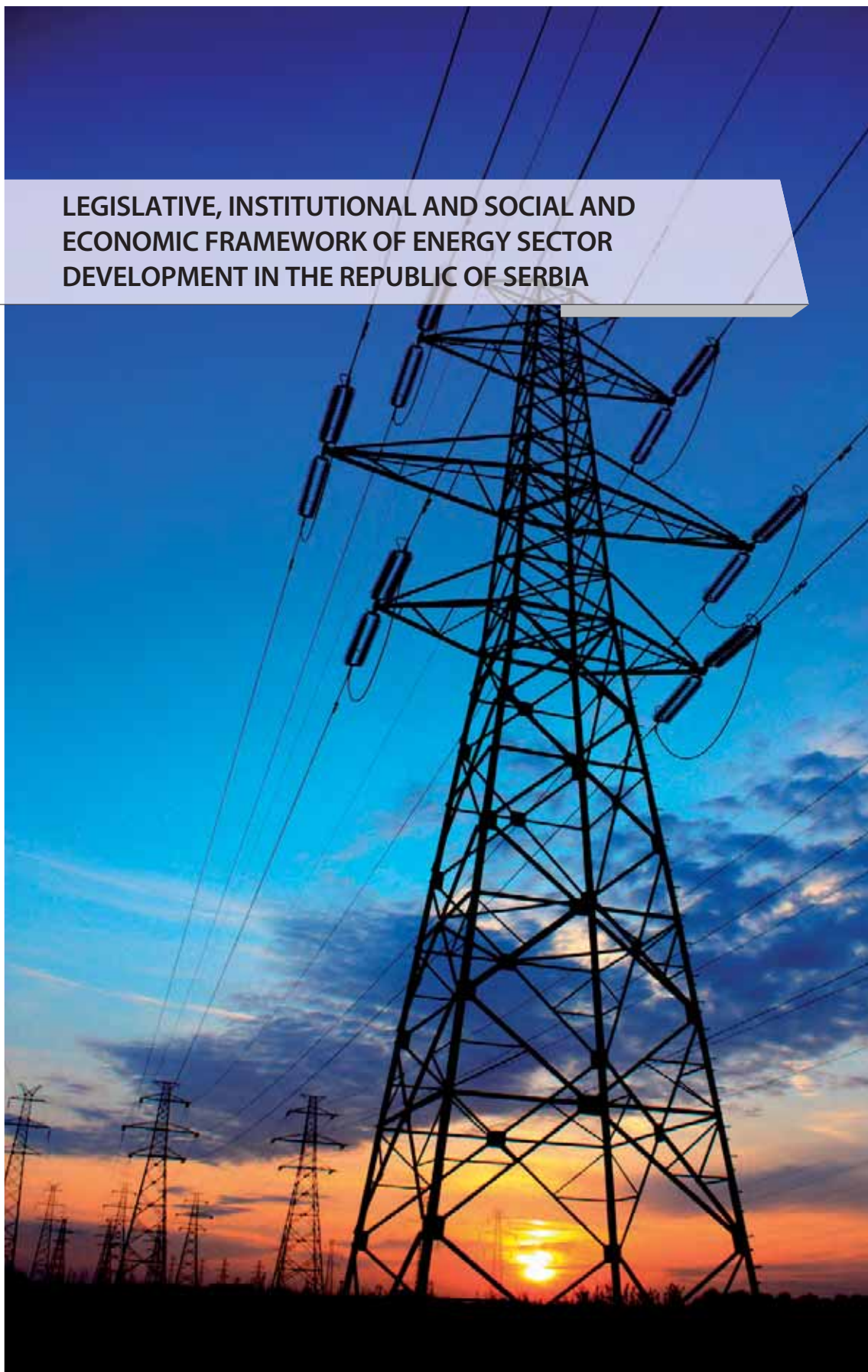
Legal obligations of the preparation of energy balances at the level of units of local self-governments and other entities in energy management system must be consistently enforced and the Ministry responsible for energy sector shall establish quality information system for monitoring of functioning of energy management system and evaluation and verification of the achieved energy savings.

Informing and education of the public about the need for the improvement of energy efficiency and possibilities of the use of renewable energy sources is very important prerequisite for the desired change towards more rational energy consumption and selection of energy products, use of more efficient devices and technologies. It is important to create the consciousness in the society about the value of energy and the need for its rational use. State shall make public sector to serve as an example of the application of prescribed measures of energy efficiency. At all levels of education, teaching process shall include topics related to energy efficiency and rational energy use, promotion of "clean" and more efficient technologies while using conventional fuels, higher use of RES, environmental protection in energy sector etc. Implementation of all these activities shall be defined with specific Communication Strategy in the Field of Energy Efficiency.

The most important condition regarding energy efficiency remains forming of energy market and market forming of price of energy. Without adequate price policy it is not possible to achieve desired changes in final consumption. The price is the most simple and the most direct manner of directing energy consumption into desired direction.

Special attention shall be paid to electricity price and it shall be brought to such a level and in such relation towards prices of other energy products, that on one hand it shall demotivate its irrational use, especially for heating, and that on the other hand it shall promote the use of other energy products (RES and natural gas) or procedures (heating pumps) for that purpose. Also, measuring with possibility of regulation of heating energy and collection according to supplied energy, with corresponding price of heating energy shall lead to its more rational consumption in final consumption. Development of energy services market, public-private partnership (ESCO) and other mechanisms of financial support for energy efficiency measures gain complete meaning only in such circumstances.

**LEGISLATIVE, INSTITUTIONAL AND SOCIAL AND
ECONOMIC FRAMEWORK OF ENERGY SECTOR
DEVELOPMENT IN THE REPUBLIC OF SERBIA**



Basic goals of energy sector development of the Republic of Serbia are energy security, establishment of energy market and functioning of the sector in accordance with the principles of sustainable development, and legal and institutional framework, as well as possible directions of their development in the light of activity of Energy Community and process of accession to European Union should enable achievement of those goals.

Development of legal norms in energy sector in the Republic of Serbia, according to internationally assumed obligations, should be directed towards the harmonization with regulations of European Union and implementation of goals and regulations of European Union in practice¹. Some harmonization and possible exceptions in the stated process shall be necessary due to following other internationally assumed obligations. This process includes the whole system of legal norms in the field of energy, starting from acts of regulation and regulation of energy market, regulations regarding interactively connected fields of environment, traffic, use of public good. Horizontal and vertical harmonization of all regulations of legal system is condition for achieving goals stipulated by energy policy and energy sector development strategy, given in provisions of normative acts. Although very similar in their basic principles of functioning, energy sectors have a great deal of characteristics which require separate regulations. They more clearly determine specific legal relations of certain field of energy sector and at the same time enable flexibility of specific regulations, in order to direct development of the subject being regulated.

Development of legal and institutional framework of energy sector shall contribute directing energy sector into direction of raising energy efficiency, use of renewable energy sources and establishment of unique national energy market integrated into energy market of Energy Community, which shall in the future enable further integration into energy market of European Union. Beside that, it must be taken into account that research and development in the field of energy are not based on isolated technologies, but are incorporated in time and content into processes of development of other sectors with the aim of sustainable society development.

Decisions on energy facilities and technologies related to energy thus should be adopted with full awareness of advantages/disadvantages which they bring: instability/stability, high risk/low risk, economically sustainable/supported by the state, as well as the participation of the public in all segments of decision making on their application. Decision making in the field of energy sector on construction of certain facilities is particularly complex process, having in mind the fact that it can have consequences which would affect social and economic and ecologic systems for several decades.

Impact of Internationally Assumed Obligations

Strategic direction of development of energy sector in the Republic of Serbia, beside domestic strategic acts, is also determined by internationally assumed obligations.

Particularly important is membership in Energy Community and accession to European Union. Energy Community Treaty is the first contract between the Republic of Serbia and

¹ Regulations from the text were valid on day 31.07.2013

European Union, by which the Republic of Serbia assumed obligation of implementation of European Union regulations (table VI-1). This Treaty became effective in 2006.

Energy market of Energy Community includes electricity and natural gas market. At the end of 2008, this market was extended to oil and petroleum products market, and this possibility was also left for liquefied natural gas, hydrogen and other forms of energy transmitted by the networks.

Significance of Energy Community Treaty is confirmed by ratification of Stabilization and Association Agreement in 2008. In this Agreement the necessity of cooperation of the Republic of Serbia and European Union for the development of Community acquis and integration of the Republic of Serbia into energy market of the European Union is emphasized.

It is necessary to point out that this Strategy is harmonized with common strategic energy framework being developed at the level of Energy Community. Similar process is achieved within Regional Cooperation Council Secretariat, which beside the field of energy includes other fields of economy.




Agreement between the Government of the Republic of Serbia and Government of Russian Federation on cooperation in the field of oil and gas industry from 2008 significantly determined direction of the development of oil and gas industry, because based on it, agreements on sale of majority packages of shares of NIS a.d. and construction of part of future South Stream gas pipeline at the territory of the Republic of Serbia and natural gas storage "Banatski Dvor" were signed. This agreement increased the security of natural gas supply, as well as petroleum products in great deal, but at the same time foreign partner was introduced into that process.

At the global level, negotiations on mechanism for implementation of United Nations Framework Convention on Climate Change (UNFCCC) for period after 2012 are ongoing. Negotiating process should lead to adoption of new international and legal document, which shall succeed Kyoto protocol. The Republic of Serbia is a member of the Convention and signed Kyoto protocol and participation in negotiating process shall enable it to accept and apply agreements which shall be the result of these negotiations. It can be expected that new agreements or protocols shall affect EU regulations on climate change and reduction of emissions, which shall significantly affect the change of structure of energy cycle and its infrastructure.

In the field of use of hydro capacities for the generation of electricity and provision of use of transmission electric power capacities, at the end of 2012, Agreement between Government of the Republic of Serbia and Government of the Republic of Italy from 2011 on cooperation in the energy sector which arranges the cooperation between these two countries was ratified.

However, beside the regulations adopted by European Union, there are also regulations with the wider international character, which are also considered integral part of European legal framework. In other words, it is expected that the Republic of Serbia as candidate country for membership in European Union considers and applies these international standards as well, to introduce them into its internal legal system and provide their application. This especially refers to certain regulations and conventions of the United Nations or European organizations which

Table VI-1: EU regulations for which obligation of implementation is assumed, in accordance with Energy Community Treaty

<p>Energy security</p> 	<p>Directive 2005/89/EC concerning measures to safeguard security of electricity supply and infrastructure investment</p> <p>Directive 2004/67/EC concerning measures to safeguard security of natural gas supply</p> <p>Directive 2009/119/EC imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products</p>
<p>Energy market</p> 	<p>Directive 2009/72/EC concerning common rules for the internal market in electricity</p> <p>Regulation 714/2009 on conditions for access to the network for cross-border exchanges in electricity</p> <p>Directive 2009/73/EC concerning common rules for the internal market in natural gas</p> <p>Regulation 715/2009 on conditions for access to the natural gas transmission networks</p>
<p>Sustainable energy sector</p> 	<p>a) Energy Efficiency</p> <p>Directive 2006/32/E3 on energy end-use efficiency and energy services</p> <p>Directive 2010/30/EU on the indication by labeling and standard product information of the consumption of energy and other resources by energy-related products</p> <p>Directive 2010/31/EU on energy performance of buildings</p> <p>b) Renewable Energy Sources</p> <p>Directive 2009/28/EC on the promotion of the use of energy from renewable sources</p> <p>c) Environmental Protection</p> <p>Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment</p> <p>Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from large combustion plants (LCP Directive)</p> <p>Directive 1999/32/EC relating to a reduction in the sulphur content of certain liquid fuels</p> <p>Directive 79/409/EEC on conservation of wild birds</p>

have wider membership than the direct membership of European Union. This includes the Energy Charter Treaty, then Organization for Economic Co-operation and Development, International Energy Agency, the World Trade Organization and other similar organizations. Complete application of provisions of World Trade Organization impends in further process of accession to European Union and the World Trade Organization itself. Special attention should be paid to standards and conventions which appeared during years of work of United Nation Economic Commission for Europe. These standards and conventions are mostly accepted by all member states of European Union and are incorporated into its regulations. Beside implementation of European Union regulations, what awaits the Republic of Serbia is adoption and application of these international standards, contracts and conventions.

Development of Institutional Framework

Ministry competent for energy sector is responsible for creation and implementation of energy policy and development of legal framework within energy sector law of the Republic of Serbia. It is competent and responsible for implementation of legal norms of European Union in the energy sector into legal system of the Republic of Serbia. This shall ensure that it shall be sufficiently enabled to follow the application of certain legal norms in practice and to analyze effects of their application. Permanent increase of the capacity of this ministry, in the manner that it meets the needs and supports development of energy sector is of the highest importance.

For optimal development of energy sector in accordance with requirements of modern society, it is necessary to improve significantly educational, professional and scientific and research potential of the country. Forming of Energy Institute of Serbia as the specialized organization for continuous analysis of condition and planning of development of the whole energy system and certain energy sectors, would enable concentration of science and research and professional potential in the country and represent support to state authorities, local self-governments, companies and other legal entities in solving the problems related to energy sector and its strategic development.

Coordination of Ministry competent for energy sector and Ministry competent for science and education shall affect education system in the country and development of strategic scientific programs and projects, which would follow and be support to foreseen development of energy sector, energy technologies and related legal and economic fields.

Energy Agency was, in accordance with implementation of provisions of EU Second Energy Package, established as an independent regulatory body with competence in the field of electricity, natural gas, oil and petroleum products and heating energy generated in power plants with combined generation. This agency has competences which are harmonized with provisions of EU regulations. The position of Energy Agency requires its continuous staff recruitment for the purpose of performance of independent regulation of energy sector activities of general interest in the conditions of open energy market, in accordance with adopted strategic and legislative framework

i.e. provisions of EU Third Package regulations in the energy sector which shall be implemented into domestic regulations.

For the overall insight of the Government into energy reality of the country and the condition of energy entities and energy customers, energy statistic system shall be improved. Keeping energy statistics in the Statistical Office of the Republic of Serbia is not complete and equipped with required legal framework for gathering, processing and publishing of data. It is necessary to develop legal framework in which obligation of data provision, protection of the secrecy of data source, as well as the sanction for non-performance of this obligation is determined. It is necessary, in coordination between Ministry competent for energy sector, Statistical Office of the Republic of Serbia, energy entities and energy customers in the Republic of Serbia, to establish unique system of gathering, processing and verification of data on energy production and consumption (per sub-fields of energy) in accordance with EUROSTAT/IEA system of determination and presentation of national energy data and indicators.

Beside stated institutions, professional associations, chambers of commerce, institutions and bodies competent for standardization, as well as other institutions which have the role in creating legal and other relations in the field of energy and in raising level of professional knowledge in this sector are also important for development of energy sector in the Republic of Serbia. Legal framework of energy sector development should provide that, if legal, economic and social relations require that, other institutions are also organized which shall enable development, functioning and opening of energy market, as well as the whole field of energy sector in technical, legal and economic, educational, scientific and social sense. Transparency and availability of information, as well as public registers kept by certain institutions should be provided for third parties.

Legal and Market Framework of Subfield (Law) of Energy Sector

In the field of electric power system harmonization with EU regulations in the field of Second Package² of regulations and partly in the field of Third Package³ of regulations in the field of energy which shall be fully implemented in 2015 has been done. Since the deadline for harmonization with Third Package of Regulations has not expired yet, harmonization of these norms shall be done in prescribed period.

2 Directive 2003/54/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in electricity and repealing Directive 96/92/EC, Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC, Regulation (EC) 1228/2003 of the European Parliament and of the Council of 26 June 2003 on conditions for access to the network for cross-border exchanges in electricity, Regulation (EC) 1775/2005 of the European Parliament and of the Council of 28 September 2005 on conditions for access to natural gas transmission networks, Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC.

3 Directive 2009/72/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in electricity and repealing Directive 2003/54/EC, Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC, Regulation (EC) 714/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the network for cross-border exchanges in electricity and repealing Regulation (EC) 1228/2003, Regulation (EC) 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to natural gas transmission network and repealing Regulation (EC) 1775/2005, Regulation (EC) 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators.

Energy Law stipulates accounting, functional and legal unbundling of energy entities which perform several energy activities. Accounting as well as legal unbundling of electricity generation and customer supply from energy networks management shall be provided. From 01 October 2012, Energy Agency of the Republic of Serbia gives consent for the prices of services and energy. Electricity market opening shall be achieved by the dynamics foreseen by Energy Law until 01 January 2015.

In the natural gas field, obligation of unbundling energy entities per activities has not been completely achieved. Accounting unbundling of transportation and distribution system shall be conducted, as well as functional and legal unbundling. Even though there is high level of transposition of the Second Package of regulations in the natural gas field, it is not fully achieved in practice, primarily regarding covering of costs and right of disposition of means from the collection of prices of transportation and distribution services and sold natural gas. Accounting and legal unbundling of customer supply with natural gas from gas pipeline management shall be provided as well. Also there are implemented elements of Third Package of EU regulations (license issuance and recognition of different activities in the field of network energy and natural gas supply, etc.) but, as in the field of electricity, required harmonization is necessary in the prescribed deadline. Separate question regarding implementation of the Third Package is the Agreement in the field of oil and gas industry with the Russian Federation, since in the text of the Agreement itself as well as in long-term contracts concluded based on it there are elements which could make implementation of EU regulations more difficult. Market opening in natural gas is defined by Energy Law, according to dynamics until 01 January 2015.

In the field of oil and petroleum products, Directive 2009/119/ EC⁴ of European Union regarding establishing system of mandatory minimum stocks of oil and petroleum products has not been implemented so far, but that goal is set and implementation of the systems of these reserves should be achieved by 01 January 2023. Special regulations shall also regulate the need of existence of operational stocks at the market. Oil and petroleum products market is opened. Regulations determining the quality of liquid fuels of oil origin are harmonized with EU regulations regarding defining quality of benzene and diesel. In the following period the quality of other liquid fuels of oil origin shall be harmonized with EU regulations on quality. Petroleum products quality monitoring system has been established and shall be harmonized with petroleum products quality monitoring system stipulated by EU regulations. First, the system of petroleum products labeling shall be introduced, and after that petroleum products quality monitoring system shall be fully implemented according to EU regulations. Biofuels status shall be regulated in more detail in order to make its production and consumption more attractive in the direction of achieving energy policy goals.

In the field of heat energy, market is locally organized. Since it is the case of energy activities of general (local) interest, performance of these activities is regulated by the Law on Communal Activities and Energy Law. Harmonization of these two laws

⁴ Council Directive 2009/119/EC of 14 September 2009 imposing an obligation on Member States to maintain minimum stocks of crude oil and/or petroleum products

(unbundling of energy activity – production of heat energy from other public and utility activities and unbundling of supply from distribution of heat energy) and determination of separate prices of production, distribution and supply of heat energy is prerequisite for establishment of competitiveness at local market in heat energy.

In the field of energy production from renewable sources, incentives and feed-in tariffs of electricity purchasing price are determined in the Republic of Serbia. In Energy Law there is a basis for defining incentive for heating energy production from renewable sources which should be used for introduction of incentive mechanisms for higher use of available RES. Obligations in the field of renewable energy sources determined within Energy Community, require systemic additional regulation of legal framework in this field which shall significantly affect the structure of energy market regarding the increase of use of renewable sources. Separate law should stipulate mechanisms of exchange of rights in the field of renewable energy sources and achieved obligations of increase of their use within Energy Community, as well as with EU Member States.

Law on Efficient Use of Energy provides legal basis for creating policy of rational use of energy, energy management system introduction, operation of ESCO companies, energy efficiency level labeling of the products which affect energy consumption, setting minimum requirements of energy efficiency in production, transmission and distribution of electricity and heat energy and transport and distribution of natural gas, as well as for financing and introduction of incentives and other measures in this field. With Law on Planning and Construction and its by-laws, which stipulates energy efficiency in the field of buildings construction, Law on Efficient Use of Energy sets basis for establishment of mechanisms for fulfilling obligation of energy efficiency increase in total energy cycle, as well as the mechanisms for monitoring this increase. With the aim of achieving goals of these regulations by-laws shall be adopted which shall regulate energy labeling of household appliances, which is the obligation from Energy Community process, as well as the technical regulations which shall set standards of energy efficiency.

Social and Economic Aspects of the Foreseen Development

Energy sector is the field of industry which is very important for total economic, social and ecological development of the country and as such has special relation with the society. Key basis of this Strategy is that energy development must be for the purpose of economic growth. Energy sector development should contribute to faster growth of the existing industries and activities and to enable development of new production and service activities. Significant investment assumed by the proposed development shall serve as accelerator of economic growth of the whole country, and new technologies and modern business organization that those investments carry

with them shall enable significantly more efficient economy and quality economic growth which in the long-term provides conditions for higher employment, increase of standard and better conditions for living.

The concept of Strategy is such that its realization is not possible if the price of energy and energy products, primarily electricity, remains the instrument of “non-energy” policy. Namely, depreciation of real prices of any form of final energy, under the influence of the state, at the republic or local level, with the motive to keep economic stability and social sustainability in the conditions of general growth of prices and fall of standard, is unacceptable measure of energy policy. It is contrary to the principles of market economy and is highly demotivating for rationalization of costs in energy production, transmission and distribution, regular collection of supplied energy as well as restructuring of public sector, i.e. the concept of sustainable energy sector.

New paradigm of social and economic development shall have to take into consideration energy set on market basis. First of all this refers to the budget of the Republic of Serbia and public enterprises should gradually be liberated from the cost of maintaining low energy prices, which as the final result has the increase of budget deficit. If we add to this that the foreseen investments should significantly improve energy efficiency in energy production, transmission and consumption it is clear that all this should lead to significant reduction of material and energy intensity of the economy of the Republic of Serbia.

Big infrastructure projects which shall be realized in electric power system, energy mining, construction of gas line infrastructure and oil sector shall require use of state-of-art technical and technological achievements. This could be basis for creation of modern domestic supporting industry for the purpose of efficient transfer of the modern global knowledge and experience first in construction and later in maintenance of new facilities and equipment. Also, it should be insisted upon development of commercial scientific and research sector in order to create sustainable sector capable of transfer of innovations and knowledge to other sectors of economy and society through these large projects. Having in mind the foreseen importance of RES sector, applied research and economy development should be directed towards production of equipment and facilities for its use, especially biomass and hydro energy. Relatively smaller capacities of these production units are ideal for development of small and medium companies.

Insisting upon measures of energy efficiency in final energy consumption has multiple effect. It directly affects energy, and therefore also economically more efficient functioning of industry and traffic sectors, and in the sector of building construction beside impulse to civil engineering and industry of refractory it additionally opens completely new energy services market.

The Strategy also promotes the use of different, locally available energy potentials. Ecologically sustainable coal use and/or RES for insufficiently developed

areas, especially South and East, as well as the parts of West Serbia, represents the opportunity for their faster development.

It has already been emphasized that energy sector development in the Republic of Serbia has high social dimension and that therefore the changes in energy sector must be socially acceptable and sustainable. For sustainability of foreseen changes in energy sector it is necessary to establish adequate social dialogue, as well as the principle of harmonizing social and economic relations within energy companies, at the level of society between employer, unions and state, but also at the level of solidarity with electricity vulnerable customers. For sensitive and vulnerable groups of customers the state provided adequate treatment and introduced measures which improve the position of vulnerable customers.

It is the fact that large structural changes which are inevitable in energy sector can especially affect employees with lower degree of education, as well the sensitive groups and certain geographic areas. In order to mitigate those consequences measures for improvement of flexibility of work force at labour market shall be applied, as well as additional training, retraining, to reduce negative social outputs of the application of structural changes in energy sector.

Energy Sector and Similar Fields – Horizontal Harmonization Necessity

Environmental right has strong influence on energy sector. Special field of regulations in European Union are regulations about reduction of climate change effects. With the aim of preventive prevention of negative effects of energy sector on the environment, and establishing obligation of fee for pollution and removal of harmful consequences, legal norms and principles on environmental protection necessity became integral part of the law of energy sector. Directive 2001/80/EC on the limitation of emissions into the air from large combustion plants⁴ has strong impact on the development of energy sector of the Republic of Serbia, because it refers to fulfilling the obligation regarding reduction of the emission of SO₂, NO_x and particulate matters from thermal power plants and other industrial plants to the prescribed significantly lower levels. This directive and Directives (2008/1/EC and 2010/75/EU⁵), which shall replace it in the future, shall largely affect the possibility of use of technologies in the existing production energy facilities. When it comes to new facilities, new standards of emissions reduction shall be applied at the stage of facility planning, but in certain cases of the existing facilities, it can lead to their decommissioning. Reduction of the content of sulphur in liquid fuels of oil origin will be achieved from the middle of 2013.

⁴ Of the European Parliament and of the Council of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants (LCPD).

⁵ Directive 2008/1/EC of the European Parliament and of the Council of 15 January 2008 concerning integrated pollution prevention and control (IPPC directive) and Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (recast) (IED).

Even though Aarhus Convention was ratified, it was not fully implemented into legal system, because provisions on public participation in first phases of decision-making on certain projects have not been adopted, and the existing ones are not always being implemented adequately. Public participation in decision-making on certain projects is particularly important in early phases of the project, when all options are opened, and prior to final decisions are made. It is important so as the public could participate in decision-making on allocation of “public good”. In this segment, the field of spatial and urban planning may determine decisions in energy sector, so it is necessary to achieve adequate public participation in the earliest phases of documents.

Principle of competition in European Union, as the basic principle of functioning of unique market is achieved through two different aspects of competition: 1) competition between the existing participants at the market, which is provided with the rules regarding mutual relations of those participants and rules which extend and deepen the market, i.e. guarantee the possibility of participation at the markets of all member states (by using cross-border capacities of electricity and gas network, as well as in other ways) and 2) possibility of entering the market, achieved by the obligation of the states to make such a system of license issuance (for the construction of new facilities and achievement of required rights) which enables equal and simple entrance into the industry to the new participants. Regarding creation of competitive energy market, provisions on prohibition of misuse of monopoly and dominant position are particularly important, as well as the provisions of state (but also non-state) assistance.

State assistance in the Republic of Serbia is particularly sensitive institutional and legal issue, since many energy entities are public enterprises. It is necessary to ensure that public enterprises follow the competition right, because only in that manner and with following the principle of transparency, energy market can function, economically and technologically efficient, respecting the rights of customers as well.

The right of use of “public good” is not regulated in detail in our country especially regarding connection between the term of environment and operationalization of the issue of use and protection of “public good”. This particularly refers to “right to healthy environment” and “right to competitive market” as “public good”, but also to the use of natural resources. Issues of defining “public good” in the Republic of Serbia are not completely clearly materially defined. Provisions of certain regulations even give different content to terms from the category of “public goods” so that clear definition of terms “public good” and private ownership are necessary for development of energy sector, as well as precise manner of definition of use of “public good”.

Energy sector development, through allocation of costs and benefits, is opposite to poverty rate. Legal framework for energy sector and institutional conditions established by it should be organized in such a manner that they lead to reduction of poverty, through higher employment level, increase of standard of living and more complete use of “public goods”.

Sustainable development in energy sector is globally oriented towards the policy of fight against climate changes, but is actually directed towards the balance between goals of economic development, achieving right to energy, as part of human rights, and rights to healthy environment.

VII

ENERGY SECTOR DEVELOPMENT IN THE REPUBLIC OF SERBIA AFTER 2030



European Commission in the end of 2011 issued Communication "Energy Roadmap 2050". By this document of the program character, Commission proposed transformation of energy sector with reduction of greenhouse gas emissions until 2050 to 80 to 95% below level of emission in 1990. Challenges on the road to achieving that goal are considered in the document, regarding primarily provision of security of energy supply and sustaining competitiveness of European economy.

Adopted strategic priorities, and based on them proposed goals of development of certain energy sectors with corresponding development of legislative and institutional framework, represent good basis for accession of the Republic of Serbia to this European road.

Foreseen level of increasing energy efficiency final energy consumption should on one hand lead to very significant reduction of energy consumption per unit of gross domestic product, and on the other hand, to direct whole economy and society into sustainable development direction in a manner that growth of economic activity is not directly related to intensity of energy consumption.

Foreseen development of use of renewable energy sources according to considered scenarios until 2030 should in a way widely introduce technologies of their use into Serbian energy sector, but in the Serbian society as a whole as well. Because as the use of renewable energy sources in electric power system(except hydro power plants) is at the beginning, so in the sector of final energy consumption the use of these energy sources (except for the traditional manner of use of wood for heating) is at the moment negligible. It is very important to create critical mass of required employees, design and construction companies which shall be able to follow and promote increase of use of RES even in the period up to middle of the century in the following mid-term period in the Republic of Serbia.

For the reduction of greenhouse gas emissions at the level of announcement "Energy Roadmap 2050", according to currently commercially available technologies beside more intense level of application of energy efficiency measures and introduction of RES, it would be necessary to introduce nuclear plants into energy sector of the Republic of Serbia as well. However, period up to middle of this century is long and we can expect even more significant break of technologies which are now at the level of experimental plants or even just theoretical elaboration (production and use of hydrogen, fuel cells, nuclear fusion etc.). Development of the technologies of use of "clean coal" including storage of CO₂ could be very important for the Republic of Serbia, having in mind the available stocks of lignite.

According to the verified stocks of oil and natural gas in base year, and if there are no significant findings, it can be expected that exploitation of these energy products in the country shall be almost completely or completely finished by 2030. The most significant domestic power product at that moment remains coal with stocks which according to projected level of consumption should be enough for exploitation even after 2050. From the other it can be counted upon available oil shale and RES. European Commission proposed phase and long-term realization of energy production from "clean coal" in highly efficient thermal power plants with technologies for CO₂ capture and storage. Use of "clean coal" should be realized in three phases. In the first phase, which is practically already reached in developed EU countries, revitalization of existing and construction of new thermal power plants with higher efficiency is performed, reduced emission of CO₂, SO₂, NO_x and particulate matter. In the second phase thermal power plants with 50% efficiency level are being designed and constructed, and finally, in the third phase after 2030 technologies of separation and disposal of CO₂ are being used in industry. This would be scenario which could be used for development of domestic energy sector. In this way, with continuous modernization of thermal power plants, much higher efficiency of their operation and separating and disposal of CO₂, coal could play important role in providing security of energy supply in the Republic of Serbia even after 2050.

List of used abbreviations

GDP – gross domestic product

GHG – greenhouse gas

EUROSTAT – European Statistical Office

EPS – Electric Power Industry of Serbia

ESCO – Energy Service Companies

EU – European Union

IEA – International Energy Agency

PE – public enterprise

kg oe – kilograms of oil equivalent

NPP – nuclear power plant

OECD – Organisation for Economic Co-operation and Development

RES – renewable energy sources

toe – tonne of oil equivalent

TENT – thermal power plant “Nikola Tesla”

tce – tonne of coal equivalent

TPP – thermal power plant

CHP – combined heat and power

UN – United Nations

UNFCCC – United Nations Framework Convention on Climate Change

HPP – hydro power plant

CCS technology – coal capture and storage technology

CHP – combined heat and power

Annex – Cumulative Energy Balances and Energy Indicators

Cumulative Energy Balance of the Republic of Serbia – realization 2010

Republic of Serbia (excluding KIM) 2010	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	7228	940	-	308	1022	5	1036	-	-	10539
Import	766	2010	1313	1567	-	-	1	483	-	6140
Export	37	4	372	-	-	-	3	-509	-	927
International air bunkers	-	-	-44	-	-	-	-	-	-	-44
Stocks change	-204	117	-60	-22	-	-	-8	-	-	-177
Total available energy	7751	3064	837	1853	1022	5	1026	-26	-	15531
Power products for transformations	7124	3064	345	638	1022	0	1	0	0	12194
Thermal power plants	6258	-	-	-	-	-	-	-	-	6258
Hydro power plants	-	-	-	-	1022	-	-	-	-	1022
Combined heat and power (CHP)	-	-	17	76	-	-	-	-	-	93
Autoproducers	197	-	174	162	-	-	-	-	-	528
Heating energy production	66	-	122	400	-	-	1	-	-	589
Rafineries	-	3064	-	-	-	-	-	-	-	3064
Blast furnace	410	-	-	-	-	-	-	-	-	410
Coal processing	198	-	-	-	-	-	-	-	-	198
Other	-	-	-32	-	-	-	-	-	-	32
Transformed energy production	453	0	3009	0	0	0	0	3218	946	7626
Thermal power plants	-	-	-	-	-	-	-	2150	42	2192
Hydro power plants	-	-	-	-	-	-	-	1022	-	1022
Combined heat and power (CHP)	-	-	-	-	-	-	-	21	33	54
Autoproducers	-	-	-	-	-	-	-	25	351	376
Heating energy production	-	-	-	-	-	-	-	-	520	520
Rafineries	219	-	3009	-	-	-	-	-	-	3009
Blast furnace	234	-	-	-	-	-	-	-	-	219
Coal processing	-	-	-	-	-	-	-	-	-	234
Own consumption in energy sector	-	-	198	5	-	-	-	303	25	574
Transmission and distribution losses	55	-	35	17	-	-	-	518	69	694
Total final consumption	1025	-	3268	1150	-	5	1025	2371	852	9696
Non-energy consumption	26	-	567	216	-	-	-	-	-	809
Final energy consumption	1000	-	2704	931	-	5	1025	2370	852	8889
Industry	420	-	322	604	-	-	40	627	380	2393
Traffic	-	-	2210	10	-	-	-	19	-	2239
Households	297	-	31	215	-	-	965	1259	381	3148
Agriculture	2	-	43	87	-	3	1	39	-	175
Other customers	281	-	98	15	-	2	19	426	92	984

Projection of Energy Balance of the Republic of Serbia for 2015 (Reference scenario)

Republic of Serbia (excluding KIM) 2015	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	8415	900	-	421	833	9	1076	-	-	11654
Import	417	2864	653	1567	-	103*	-	535	0	6139
Export	-43	-	-368	-	-	-	-	-690	-	-1101
Total available energy	8789	3764	285	1988	833	112	1076	-154	0	16693
Energy production by transformation	-7793	-3764	3345	-639	-833	-65	-38	3378	1004	-5404
Thermal power plants	-7403	-	-	-	-	-	-	2480	-	-4923
Hydro power plants	-	-	-	-	-833	-	-	833	-	0
Combined heat and power (CHP)	-	-	-122	-53	-	-	-	-	27	-148
Heating energy production	-351	-	-258	-587	-	-	-38	-	977	-257
Rafineries	-	-3764	3726	-	-	-	-	-	-	-38
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-38	-	-	-	-	-	-	-	-	-38
RES (excluding hydro energy and biomass)	-	-	-	-	-	-65	-	65	-	0
Bio fuel production	-	-	-	-	-	-	-	-	-	-
Own consumption in energy sector	-	-	-219	-	-	-	-	-303	-70	-592
Transmission and distribution losses	-	-	-	-27	-	-	-	-438	-93	-559
Total final consumption	997	0	3411	1322	0	47	1038	2483	841	10138
Non-energy consumption	28	-	619	236	-	-	-	-	-	883
Final energy consumption	968	0	2792	1086	0	47	1038	2483	841	9255
Industry	437	-	340	712	-	-	54	691	326	2560
Civil Engineering	4	-	3	-	-	-	0	-	0	8
Traffic	-	-	2276	12	-	23	-	20	-	2329
Households	282	-	32	243	-	10	938	1283	406	3193
Agriculture	-	-	43	83	-	4	18	37	-	185
Other customers	246	-	99	36	-	11	28	452	109	980

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2020 (Reference scenario)

Republic of Serbia (excluding KIM) 2020	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	8562	600	-	320	1040	249	2087	-	-	12858
Import	439	2994	629	2041	-	81*	-	586	-	6770
Export	-43	-	-369	-	-	-	-	-1237	-	-1649
Total available energy	8958	3594	259	2361	1040	330	2087	-651	0	17979
Energy production by transformation	-7969	-3594	3323	-788	-1040	-33	-983	3803	1030	-6251
Thermal power plants	-7600	-	-	-	-	-	-73	2479	-	-5194
Hydro power plants	-	-	-	-	-1040	-	-	1040	-	0
Combined heat and power (CHP)	-	-	-	-156	-	-	-169	150	130	-45
Heating energy production	-329	-	-234	-632	-	-	-141	-	900	-437
Rafineries	-	-3594	3557	-	-	-	-	-	-	-36
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-39	-	-	-	-	-	-	-	-	-39
RES (excluding hydro energy and biomass)	-	-	-	-	-	-183	-	135	-	-48
Bio fuel production	-	-	-	-	-	150	-601	-	-	-451
Own consumption in energy sector	-	-	-214	-	-	-	-	-297	-70	-581
Transmission and distribution losses	-	-	-	-31	-	-	-	-343	-96	-470
Total final consumption	990	0	3368	1541	0	297	1104	2513	864	10677
Non-energy consumption	32	-	699	266	-	-	-	-	-	997
Final energy consumption	958	0	2669	1275	0	297	1104	2513	864	9679
Industry	483	-	376	841	-	-	57	763	307	2827
Civil Engineering	5	-	4	-	-	-	0	-	0	9
Traffic	-	-	2125	12	-	231	-	20	-	2388
Households	265	-	32	272	-	32	976	1220	429	3227
Agriculture	-	-	47	91	-	5	20	41	-	204
Other customers	205	-	86	60	-	29	50	468	127	1025

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2025 (Reference scenario)

Republic of Serbia (excluding KIM) 2025	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	7673	450	-	239	1087	298	2291	-	-	12038
Import	475	3384	620	2520	-	87*	-	606	-	7692
Export	-43	-	-367	-	-	-	-	-966	-	-1376
Total available energy	8105	3834	253	2759	1087	385	2291	-360	0	18354
Energy production by transformation	-7092	-3834	3571	-927	-1087	-77	-1106	3677	1132	-5743
Thermal power plants	-6744	-	-	-	-	-	-101	2228	-	-4618
Hydro power plants	-	-	-	-	-1087	-	-	1087	-	0
Combined heat and power (CHP)	-	-	-	-198	-	-	-253	203	181	-67
Heating energy production	-323	-	-224	-729	-	-	-151	-	952	-475
Rafineries	-	-3834	3795	-	-	-	-	-	-	-39
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-24	-	-	-	-	-	-	-	-	-24
RES (excluding hydro energy and biomass)	-	-	-	-	-	-228	-	158	-	-69
Bio fuel production	-	-	-	-	-	150	-601	-	-	-451
Own consumption in energy sector	-	-	-227	-	-	-	-	-312	-70	-609
Transmission and distribution losses	-	-	-	-37	-	-	-	-361	-106	-504
Total final consumption	1014	0	3596	1796	0	307	1185	2644	956	11498
Non-energy consumption	38	-	819	312	-	-	-	-	-	1169
Final energy consumption	-	0	2777	1484	0	307	1185	2644	956	10330
Industry	559	-	435	982	-	-	64	885	352	3277
Civil Engineering	5	-	4	-	-	-	1	-	0	10
Traffic	-	-	2178	12	-	237	-	21	-	2448
Households	250	-	33	302	-	34	1022	1187	457	3284
Agriculture	-	-	54	103	-	6	23	47	-	233
Other customers	162	-	72	85	-	30	75	506	148	1077

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2030 (Reference scenario)

Republic of Serbia (excluding KIM) 2030	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	8216	350	-	160	1120	374	2497	-	-	12717
Import	517	3758	607	3002	-	93*	-	603	-	8580
Export	-43	-	-367	-	-	-	-	-1101	-	-1511
Total available energy	8691	4108	240	3162	1120	467	2496	-498	0	19786
Energy production by transformation	-7644	-4108	3854	-1031	-1120	-150	-1224	4009	1245	-6168
Thermal power plants	-7305	-	-	-	-	-	-135	2453	-	-4986
Hydro power plants	-	-	-	-	-1120	-	-	1120	-	0
Combined heat and power (CHP)	-	-	-	-193	-	-	-338	230	212	-88
Heating energy production	-312	-	-210	-839	-	-	-151	-	1033	-478
Rafineries	-	-4108	4065	-	-	-	-	-	-	-44
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-27	-	-	-	-	-	-	-	-	-27
RES (excluding hydro energy and biomass)	-	-	-	-	-	-300	-	206	-	-93
Bio fuel production	-	-	-	-	-	150	-601	-	-	-451
Own consumption in energy sector	-	-	-242	-	-	-	-	-330	-70	-642
Transmission and distribution losses	-	-	-	-43	-	-	-	-382	-118	-542
Total final consumption	1046	0	3853	2088	0	318	1272	2799	1058	12435
Non-energy consumption	44	-	958	365	-	-	-	-	-	1367
Final energy consumption	1002	0	2895	1723	0	318	1272	2799	1058	11068
Industry	649	-	505	1147	-	-	72	1025	402	3799
Civil Engineering	6	-	5	-	-	-	1	-	0	12
Traffic	-	-	2233	12	-	243	-	21	-	2510
Households	235	-	34	335	-	36	1072	1154	486	3350
Agriculture	-	-	62	116	-	8	26	54	-	265
Other customers	113	-	57	113	-	32	102	546	170	1132

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2015 (Scenario with energy efficiency measures application)

Republic of Serbia (excluding KIM) 2015	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	8337	900	-	395	829	8	1072	-	-	11541
Import	286	2701	642	1567	-	102*	-	530	-	5828
Export	0	-	-369	-	-	-	-	-898	-	-1267
Total available energy	8623	3601	272	1962	829	110	1072	-368	0	16101
Energy production by transformation	-7704	-3601	3195	-615	-829	-65	-38	3377	962	-5318
Thermal power plants	-7403	-	-	-	-	-	-	2416	-	-4988
Hydro power plants	-	-	-	-	-829	-	-	829	-	0
Combined heat and power (CHP)	-	-	-122	-53	-	-	-	66	27	-81
Heating energy production	-264	-	-247	-562	-	-	-38	-	935	-176
Rafineries	-	-3601	3565	-	-	-	-	-	-	-36
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-37	-	-	-	-	-	-	-	-	-37
RES (excluding hydro energy and biomass)	-	-	-	-	-	-65	-	65	-	0
Bio fuel production	-	-	-	-	-	-	-	-	-	-
Own consumption in energy sector	-	-	-209	-	-	-	-	-283	-70	-562
Transmission and distribution losses	-	-	-	-27	-	-	-	-409	-89	-525
Total final consumption	919	0	3258	1320	0	45	1034	2317	803	9696
Non-energy consumption	28	-	618	236	-	-	-	-	-	882
Final energy consumption	890	0	2640	1085	0	45	1034	2317	803	8814
Industry	411	-	320	657	-	-	51	651	321	2410
Civil Engineering	4	-	3	-	-	-	0	-	0	8
Traffic	-	-	2156	11	-	21	-	19	-	2207
Households	258	-	31	301	-	10	940	1211	386	3137
Agriculture	-	-	43	83	-	4	18	37	-	185
Other customers	218	-	87	32	-	10	25	400	97	868

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2020 (Scenario with energy efficiency measures application)

Republic of Serbia (excluding KIM) 2020	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	8417	600	-	320	1010	248	2088	-	-	12683
Import	409	2687	607	1785	-	58*	-	548	-	6094
Export	-43	-	-368	-	-	-	-	-1468	-	-1879
Total available energy	8783	3287	239	2105	1010	306	2088	-920	0	16898
Energy production by transformation	-7946	-3287	3039	-658	-1010	-33	-983	3748	944	-6187
Thermal power plants	-7600	-	-	-	-	-	-73	2498	-	-5174
Hydro power plants	-	-	-	-	-1010	-	-	1010	-	0
Combined heat and power (CHP)	-	-	-	-79	-	-	-169	105	99	-44
Heating energy production	-309	-	-215	-580	-	-	-141	-	845	-400
Rafineries	-	-3287	3254	-	-	-	-	-	-	-33
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-38	-	-	-	-	-	-	-	-	-38
RES (excluding hydro energy and biomass)	-	-	-	-	-	-183	-	135	-	-48
Bio fuel production	-	-	-	-	-	150	-601	-	-	-451
Own consumption in energy sector	-	-	-195	-	-	-	-	-266	-70	-531
Transmission and distribution losses	-	-	-	-29	-	-	-	-307	-87	-424
Total final consumption	837	0	3083	1418	0	272	1105	2254	787	9756
Non-energy consumption	32	-	700	266	-	-	-	-	-	998
Final energy consumption	805	0	2384	1152	0	272	1105	2254	787	8758
Industry	420	-	327	709	-	-	50	666	295	2467
Civil Engineering	5	-	4	-	-	-	0	-	0	9
Traffic	-	-	1907	11	-	208	-	18	-	2143
Households	219	-	31	295	-	34	995	1164	391	3129
Agriculture	-	-	47	91	-	5	20	41	-	204
Other customers	162	-	68	47	-	26	39	365	100	806

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2025 (Scenario with energy efficiency measures application)

Republic of Serbia (excluding KiM) 2025	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	7547	450	-	239	1064	296	2239	-	-	11834
Import	443	2960	596	2248	-	52*	-	576	-	6875
Export	-43	-	-368	-	-	-	-	-1248	-	-1659
Total available energy	7947	3410	228	2487	1064	348	2238	-672	0	17049
Energy production by transformation	-7066	-3410	3173	-794	-1064	-77	-1106	3633	1022	-5689
Thermal power plants	-6744	-	-	-	-	-	-101	2243	-	-4603
Hydro power plants	-	-	-	-	-1064	-	-	1064	-	0
Combined heat and power (CHP)	-	-	-	-137	-	-	-253	168	156	-66
Heating energy production	-299	-	-203	-658	-	-	-151	-	866	-444
Rafineries	-	-3410	3375	-	-	-	-	-	-	-34
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-22	-	-	-	-	-	-	-	-	-22
RES (excluding hydro energy and biomass)	-	-	-	-	-	-228	-	158	-	-69
Bio fuel production	-	-	-	-	-	150	-601	-	-	-451
Own consumption in energy sector	-	-	-200	-	-	-	-	-279	-70	-549
Transmission and distribution losses	-	-	-	-34	-	-	-	-322	-95	-451
Total final consumption	882	0	3200	1659	0	270	1132	2361	857	10360
Non-energy consumption	38	-	818	312	-	-	-	-	-	1168
Final energy consumption	844	0	2382	1347	0	270	1132	2361	857	9193
Industry	492	-	383	838	-	-	56	780	342	2891
Civil Engineering	5	-	4	-	-	-	1	-	0	10
Traffic	-	-	1852	10	-	202	-	18	-	2082
Households	219	-	31	329	-	35	993	1117	398	3121
Agriculture	-	-	54	103	-	6	23	47	-	233
Other customers	129	-	57	68	-	27	59	398	117	856

* showed import refers to biofuels import

Projection of Energy Balance of the Republic of Serbia for 2030 (Scenario with energy efficiency measures application)

Republic of Serbia (excluding KIM) 2030	Coal	Crude oil, half-products	Petroleum products	Natural gas	Hydro energy	Renewable energy sources	Biomass	Electricity	Heat	Total (1000 toe)
Primary energy production	8111	350	-	160	1088	372	2386	-	-	12467
Import	483	3215	581	2673	-	46*	-	564	-	7562
Export	-43	-	-366	-	-	-	-	-1390	-	-1799
Total available energy	8551	3565	215	2833	1088	418	2386	-827	0	18230
Energy production by transformation	-7616	-3565	3342	-858	-1088	-150	-1224	3951	1110	-6099
Thermal power plants	-7305	-	-	-	-	-	-135	2474	-	-4966
Hydro power plants	-	-	-	-	-1088	-	-	1088	-	0
Combined heat and power (CHP)	-	-	-	-111	-	-	-338	183	180	-87
Heating energy production	-287	-	-187	-747	-	-	-151	-	930	-442
Rafineries	-	-3565	3529	-	-	-	-	-	-	-36
Blast furnace	0	-	-	-	-	-	-	-	-	0
Coal processing	-25	-	-	-	-	-	-	-	-	-25
RES (excluding hydro energy and biomass)	-	-	-	-	-	-300	-	206	-	-93
Bio fuel production	-	-	-	-	-	150	-601	-	-	-451
Own consumption in energy sector	-	-	-208	-	-	-	-	-294	-70	-571
Transmission and distribution losses	-	-	-	-40	-	-	-	-340	-104	-483
Total final consumption	935	0	3349	1935	0	269	1162	2491	936	11076
Non-energy consumption	44	-	959	365	-	-	-	-	-	1368
Final energy consumption	891	0	2390	1570	0	269	1162	2491	936	9709
Industry	576	-	448	991	-	-	64	915	395	3388
Civil Engineering	6	-	5	-	-	-	1	-	0	12
Traffic	-	-	1799	10	-	196	-	17	-	2022
Households	218	-	31	362	-	36	990	1071	405	3113
Agriculture	-	-	62	116	-	8	26	54	-	265
Other customers	91	-	45	91	-	29	82	434	136	908

* showed import refers to biofuels import

Energy Indicators

Primary energy consumption per unit of GDP (toe/1000€₂₀₁₀)

Year	Reference scenario	Scenario with energy efficiency measures application
2010	0,464	0,464
2015	0,453	0,446
2020	0,436	0,419
2025	0,373	0,353
2030	0,344	0,324

Final energy consumption per unit of GDP (toe/1000€₂₀₁₀)

Year	Reference scenario	Scenario with energy efficiency measures application
2010	0,291	0,291
2015	0,280	0,268
2020	0,261	0,238
2025	0,239	0,216
2030	0,221	0,197

Primary energy consumption per capita (toe/capita)

Year	Reference scenario	Scenario with energy efficiency measures application
2010	2,172	2,172
2015	2,319	2,279
2020	2,563	2,458
2025	2,603	2,471
2030	2,858	2,693

Emission of CO₂ connected to energy sector (million tones of CO₂ek)

Year	Reference scenario	Scenario with energy efficiency measures application
2010	42,66	42,66
2015	47,67	47,05
2020	48,08	46,05
2025	44,87	42,52
2030	48,1	45,38

Emission of CO₂ per unit of GDP (kg CO₂ek/€₁₀₀₀)

Year	Reference scenario	Scenario with energy efficiency measures application
2010	1,27	1,27
2015	1,32	1,3
2020	1,17	1,12
2025	0,94	0,88
2030	0,86	0,81

Emission of CO₂ per primary energy (tone of CO₂ek/toe)

Year	Reference scenario	Scenario with energy efficiency measures application
2010	2,74	2,74
2015	2,969	2,915
2020	2,802	2,684
2025	2,647	2,509
2030	2,643	2,493