Table 36: Indicators for monitoring the effects of measure and project implementation in oil sector

Strategic goal	Indicator	Description	The method of calculating	Value in 2016	Target / calculated value in 2023
Provision of secure supply of domestic market with petroleum products of the quality that meets the highest EU standards	Reserves-to-production ratio[1]	Indicates the availability of produced reserves at certain values of annual oil production; it is expressed in years.	R/P =produced reserves (mill. t)/ annual oil production (mil.t/year)	14.30	16.47
	Advance in crude oil refining[2]	Indicates the increase of crude oil refining depth; it is expressed in percentages.	Depth of refining (%) = Depth of refining (t) / Total input* (t) Depth of refining (t) = total input*(t)-losses (t) - own consumption (t) - residual fuel oil (t) * Total input includes: crude oil, the external semi-products that are going to refining (without natural gas) and hydrogen (obtained from a refined natural gas at a refinery)	84.89%	92% in 2020
		Indicates the increase of "white derivative" production; it is expressed in percentages.	White derivatives (%) = White derivatives * (t) / Total input (t) * White derivatives include: LPG, propylene, gasoline, (aviation gasoline, jet fuel, all gas oils, primary gasoline, aromatics (benzene, toluene)	74.10%	85.8% in 2020
	Days of establishing the mandatory stocks of crude oil and petroleum products (related	Indicates the dynamics of establishing the mandatory stocks of crude oil and petroleum products; it is expressed in days.	Days of establishing the mandatory stocks of crude oil and petroleum products = Stored reserves (t)/Needed reserves (t)/61)	13	61

Strategic goal	Indicator	Description	The method of calculating	Value in 2016	Target / calculated value in 2023
	to establishing minimum stocks equivalent to at least 61 days of consumption)				
Reduction of import dependency	Reserves-to-production ratio[1]	Indicates the availability of produced reserves at certain values of annual oil production; it is expressed in years.	R/P = produced reserves (mill. t)/ annual oil production (mil.t/year)	14.30	16.47

1) Energy indicator of sustainable development-economic dimension, source: Energy Indicators for Sustainable Development: Guidelines and Methodologies, International Atomic Energy Agency, United Nations Department of Economic and Social Affairs, International Energy Agency, Eurostat and European Environment Agency, 2005 , http://www.unosd.org/content/documents/1237Pub1222_web %20EISD.pdf; Data source: Petroleum industry of Serbia (NIS)

Note: The value of reserves in this indicator is variable parameter due to many factors such as discovery of new reservoirs, application of new technologies, as well as changes in economic conditions.

2) Energy indicator of sustainable development-economic dimension, source: NIS

3) Energy indicator of sustainable development-economic dimension, defined in accordance with the Energy Indicators for Sustainable Development: Guidelines and Methodologies, International Atomic Energy Agency, United Nations Department of Economic and Social Affairs, International Energy Agency, Eurostat and European Environment Agency, 2005 , http://www.unosd.org/content/documents/1237Pub1222_web %20EISD.pdf; Data Source: Public Enterprise Transnafta, Directorate for Commodity Reserves and Ministry of Mining and Energy.

Table 37: Activities for harmonization of national legislative framework with the EU Acquis and EC regulations

Activity	EU/EC regulation for alignment	Deadline	Responsible institutions
Adoption of Action Plan to align with Acquis on minimum stocks of crude oil and/or petroleum products	Directive 119/2009/EC	at the drafting stage	Ministry of Mining and Energy (Department of oil and gas and Department of geology and mining), Directorate of energy reserves as an entity of the Ministry of Energy and Mining
Adoption of Rulebook on deadlines, content and manner of submitting data on purchase and sale of oil, oil derivatives, biofuels and compressed natural gas, and data on the prices of petroleum products and biofuels with and without excise taxes and taxes	Council Decision 99/280/ EC and Council Regulation 2964/95	Quarter 2 - 2017	
Adoption of Regulation on a program of measures to put the mandatory stocks of oil and oil derivatives at the market when security of energy supply is threatened - Crisis Plan	Directive 119/2009/EC	Quarter 2 - 2017	
Transposition of Directive 94/22/EC in accordance with second revised National Program for the Adoption of the Acquis (NPAA), adopted in November 2016	Directive 94/22/EC	Quarter 4 - 2018	Ministry of Mining and Energy (Department of oil and gas and Department of geology and mining)
Adoption of Rulebook on business reporting for companies involved in petroleum exploration and production	Directive 2013/30/EU, articles 20-22.	Quarter 4 - 2018	Ministry of Mining and Energy (Department of oil and gas and Department of geology and mining)
Analysis of the Law on Mining and Geological Research as a basis for transposing the Directive 94/22/ EC in accordance with the second revised National Program for the Adoption of the Acquis (NPAA), adopted in November 2016	Directive 94/22/EC	2017-2018 period	Ministry of mining and energy (Department of geology and mining)

Activity	EU/EC regulation for alignment	Deadline	Responsible institutions
Adoption of secondary legislation of the Law on Mining and Geological Research for regulating issues related to the disposal and management of mining waste and the conditions, criteria and procedures for issuing permits for waste management	Directive 2006/21/EC	at the drafting stage	Ministry of Mining and Energy
Establishing or strengthening the institutional and administrative capacities for regulation implementation and for implementing the public tender for issuing and use of an authorization for prospection and production of hydrocarbons	-	2019-2021 period	Ministry of Mining and Energy (Department of geology and mining)
Establishing or strengthening the institutional structure and administrative capacities in order to monitor fulfilment of the obligations for submission the circumstances of each major accident in which are involved companies registered in its territory for petroleum exploration and/or exploitation, and on their own or through subsidiaries are performing offshore petroleum exploration or exploitation activities outside the EU territory	-	2019-2021 period	Ministry of mining and energy (Department of geology and mining)
Realization of the planned dynamics of gradually increasing the quantity of mandatory stocks of crude oil and/or petroleum products	Directive 119/2009/EC on maintaining the minimum stocks of crude oil and/or petroleum products (of 90 days of average net daily import or 61 days of average daily inland consumption, whichever of the two quantities is greater)	2021-12/31/2022	Directorate of energy reserves as an entity of the Ministry of Energy and Mining

Activity	EU/EC regulation for alignment	Deadline	Responsible institutions
Including in electronic services the procedure for issuing energy permits for construction of facilities for petroleum products production, oil and petroleum product pipeline, storage facilities for oil, derivatives, biofuels, compressed natural gas and liquefied natural gas of more than 10 m^3 in volume	-	In 2018	Ministry of Mining and Energy, Ministry of Public Administration and Local Self-Government, Chamber of Commerce and Industry of Serbia

Table 38: Activities in oil subsector - exploration and production

Measure	Activity	Deadline	Responsible entity/institution
Increase of resource base and production	The continuation of geological exploration for oil in south-eastern part of the Pannonian basin in Serbia	2017-2020/2021 period	Petroleum industry of Serbia (NIS)
	The requests for continuation of geological exploration for oil in south-eastern part of the Pannonian basin in Serbia	2020/2021-2023 period	
	Projects of geological exploration works in Bosnia and Herzegovina and at the licensed blocks in Hungary and Romania	2017-2023 period	
	Completion of "Study of the regional geological model and estimate of future prospects on oil and gas in Pannonian Basin"	Until 2018	
	Investments in concessionary rights abroad	2017-2023 period	
Realization of planned oil production by increase of oil reservoir recovery and by using the measures for lowering the production decline	Investments in geological-technical measures	2017-2023 period	NIS
	Drilling of development wells	2017-2023 period	
	Application of enhanced oil recovery methods (CO_2 injection)	2017-2023 period	
	Application of oil production stimulation methods	2017-2023 period	
Exploitation of unconventional oil resources - oil shale	Reorganization of Public enterprise for underground coal mining - Resavica - "Aleksinac mine"	-	Ministry of economy and Ministry of Mining and Energy

Crude oil production plan for 2017-2023 period is given in Table 39 [44]. It involves planned production at the currently active exploitation fields: Jermenovci, Lokve, Janosik, Velika Greda south, Elemir, Zrenjanin, Zrenjanin north, Itebej, Boka, Rusanda, Mihajlovo, Srpska Crnja, Vojvoda Stepa, Turija North, Čoka, Kikinda Varoš, Kikinda Varoš south, Kikinda Varoš north, Majdan, Mokrin, Cantavir, Kelebija, Palić, Velebit, Sirakovo, Bradarac-Maljurevac and Kasidol, as well as the planned production from discovered oil fields: Kikinda west, Iđoš, Rusanda northeast, Kikinda east, Vrbica, Podlokanj, Crna bara south, Kurjače and Obilićevo.

Table 39: Oil production plan for 2017-2023 period

Planned oil production* (t)						
2017.	2018.	2019.	2020.	2021.	2022.	2023.
858,051	762,028	669,482	627,030	589,455	565,329	533,700

*Note: The planned crude oil production from exploitation fields is defined on the basis of active approvals, and planned production from discovered fields is based at the current assumptions on the expected crude oil price in the future period.

In the territory of the Republic of Serbia, NIS company is carrying out oil geological exploration in seven approved exploration areas: in the one approved exploration area south of Sava and Danube river by 12/31/2019 and in six approved exploration areas in Vojvodina by 12/32/2020. According to provisions of the Law on Mining and Geological Research (OGRS, no. 101/15) NIS will apply for continuation of the oil geological exploration for a period of 5 years (exploratory periods 3 + 2 years).

Future projects of geological exploration will determine geological, geophysical, geochemical, laboratory and other necessary methods to be applied at prospect locations for discovering the oil reservoirs.

Project development plans, implementation of geological exploration works and other obligations imposed by law is given in Table 40 [44].

Table 40: Projects of oil geological explorations

No	Title	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	Geological exploration projects at the exploratory area of northern Banat									
	Project development			X	X			X		
	Obtaining the approval for project continuation				X			X		
	Project implementation	X	X	X	X	X	X	X	X	X
	Annual/final reports on projects	X	X	X	X/X	X	X	X/X	X	X/X
2	Geological exploration projects at the exploratory area of middle Banat									
	Project development			X	X			X		
	obtaining the approval for project continuation				X			X		
	Project implementation	X	X	X	X	X	X	X	X	X
	annual/final reports on projects	X	X	X	X/X	X	X	X/X	X	X/X

No	Title	2017	2018	2019	2020	2021	2022	2023	2024	2025
3	Geological exploration projects at the exploratory area of southern Banat									
	Project development			X	X			X		
	obtaining the approval for project continuation				X			X		
	Project implementation	X	X	X	X	X	X	X	X	X
	annual/final reports on projects	X	X	X	X/X	X	X	X/X	X	X/X
4	Geological exploration projects at the exploratory area of northern Bačka									
	Project development			X	X			X		
	obtaining the approval for project continuation				X			X		
	Project implementation	X	X	X	X	X	X	X	X	X
	annual/final reports on projects	X	X	X	X/X	X	X	X/X	X	X/X
5	Geological exploration projects at the exploratory area of southern Bačka									
	Project development			X	X			X		
	obtaining the approval for project continuation				X			X		
	Project implementation	X	X	X	X	X	X	X	X	X
	annual/final reports on projects	X	X	X	X/X	X	X	X/X	X	X/X
6	Geological exploration projects at the exploratory area of Srem									
	Project development			X	X			X		
	obtaining the approval for project continuation				X			X		
	Project implementation	X	X	X	X	X	X	X	X	X
	annual/final reports on projects	X	X	X	X/X	X	X	X/X	X	X/X
7	Geological exploration projects at the exploratory area south of Sava and Danube rivers									
	Project development		X	X		X	X			
	obtaining the approval for project continuation			X			X			
	Project implementation	X	X	X	X	X	X	X	X	
	annual/final reports on projects	X	X	X/X	X	X	X/X	X	X/X	

By 2020, at the approved exploration areas for carrying out the oil geological exploration will be implemented planned 3D seismic surveys, followed by seismic and geological interpretation for the purpose of allocation of sites for exploration drilling.

The planned number of exploratory wells that will be drilled in the territory of Serbia for 2017-2023 period is given in Table 41 [44]. Number of wells is given on the basis of the current geological exploration projects for the period from 2017 to 2020. The drilling plan for 2021-

2023 period is given according to the results achieved so far, and it will be defined by new projects.

Table 41: Number of planned exploratory wells*

Year	2017	2018	2019	2020	2021	2022	2023
Number of wells	7	8	7	8	10	11	14

*Note: Number of planned exploratory wells is based on the current assumptions of the expected crude oil price in the future period.

NIS' projects of geological exploration works in Bosnia and Herzegovina and at the licensed blocks in Hungary and Romania refers to:

- The results of hydrocarbon exploration in the territory of the Serbian Republic in Bosnia and Herzegovina that are carried out by "Jadran-Naftagas" (daughter company of NIS and Neftegazinkor) will define the dynamics of future exploration and production in this region.
- In Romania, NIS has started geological exploration activities at the six licensed blocks.
- In Hungary, NIS has started in cooperation with the Austrian RAG company geological exploration activities at two licensed blocks.

The completion of "Study of the regional geological model and estimate of future prospects on oil and gas in Pannonian Basin" with aim of analysis and interpretation of geological data collected at territory of Serbia, Hungary, Romania and Bosnia and Herzegovina for geological modelling of the Pannonian Basin and selecting the most prospected sites for future oil geological exploration, is planned for the end of 2017.

Plan of drilling wells at active exploitation fields for 2017-2023 period is given in Table 42 [44].

The values of reserves-to-production ratio (R/P) for 2017-2023 period are presented in Table 43 [44].

Table 42: Planned drilling projects in active exploitation fields for 2017-2023 period

Year	2017	2018	2019	2020	2021	2022	2023
Number of wells	30	20	20	20	20	20	20

Table 43: Reserves-to-production ratio values

Year	2017	2018	2019	2020	2021	2022	2023
R/P (years)	14.99	15.75	16.79	16.86	16.87	16.55	16.47

3. Measures in oil subsector - refining

- Continuing the modernization of the oil refinery in Pančevo

A set of activities that follows this measure is presented in Table 44.

4. Measures in oil subsector - transportation

- Construction of the First facility of petroleum product pipeline system
- The development of international cooperation for connecting the oil pipeline systems, as well as product pipeline systems

A set of activities that follows these measures is presented in Table 45.

5. Measures in oil subsector - sales

- Provision of mandatory stocks of crude oil and petroleum products according to Directive 119/2009/EC.

A set of activities that follows this measure is presented in Table 46

6. Measures for improving the energy efficiency

In table 47 are given measures and activities of NIS' Energy efficiency action plan for 2017 [44]. NIS company's Energy efficiency action plan is done on an annual basis.

Since 2008, oil refinery in Pančevo has been included in a program of comparative analysis of refinery key performance indicators according to "Solomon" methodology, where the value of energy intensity index ("EII") is monitored. The estimated EII value after implementation of "Deep refining" project is presented in the review of mentioned project [44].

7. Environmental protection measures

The environmental protection measures and activities for harmonization of NIS' operations with legislation of the Republic of Serbia and the EU legislation by 2025 are presented in Table 48 [44]. The projects and activities for environmental protection in Transnafta Public Enterprise for 2016-2023 period are given in table 49 [45].

The emission of harmful substances into the air, the amount of waste water, waste, chemicals, soil pollution and accidents, that are a source of environmental pollution, with measures taken for environmental protection that are presented by NIS on an annual basis, will be shown in the Report on Program's Strategic Environmental Assessment for 2017-2023 period.

Table 44: Activities in oil subsector - refining

Measure	Activity	Deadline	Responsible entity
The continuation of oil refinery modernization in Pančevo	The second phase of modernization of the refinery in Pančevo for improving production and increasing the energy efficiency of refining and processing plants	2017-2019 period	NIS

Table 45: Activities in oil subsector - transportation

Measure	Activity	Deadline	Responsible entity
Construction of the First facility of petroleum product pipeline system	Construction of Pančevo- Smederevo section	End of 2020	Public enterprise Transnafta
	Construction of Pančevo- Novi Sad section	End of 2022	Public enterprise Transnafta
The development of international cooperation for connecting the oil pipeline systems, as well as product pipeline systems	Agreements with interested parties in the region and wider	End of 2022	Ministry of Mining and Energy and Public enterprise Transnafta

Table 46: Activities in oil subsector - sales

Measure	Activity	Deadline	Responsible entity
The establishment of mandatory stocks of crude oil and/or petroleum products	Supply of crude oil and petroleum products	End of 2022	Ministry of Mining and Energy
	Changing the legal regulations	In 2017	Ministry of Mining and Energy and Ministry of Finance
	Provision of new storage capacities	End of 2022	Ministry of Mining and Energy, Republic Directorate for Commodity Reserves and PE Transnafta (storages under public ownership)

Table 47: NIS ' Energy Efficiency Action Plan for 2017

Name of NIS' Block	Activity	Type of energy	Energy savings	Unit	Cost savings [000 RSD]
Exploration and production	Reactive power compensation	Electrical energy	-	-	2,908
	Balancing, repair, replacement of pumping units, working in lower tariff	Electrical energy	2,771	000 kWh	23,397
	Reducing the energy consumption and costs for heating tanks and installation of energy-efficient equipment, the transition from diesel generators to TS	Electrical energy	8,462	000 kWh	74,706
	Modernization of lighting	Electrical energy	117	000 kWh	869
Refining	Reducing electricity consumption by installing the heat exchangers, by changing dimensions of the steam lines and by other operational activities	Electrical energy	13,100	000 kWh	88,065
	Investment measures for energy efficiency increasing	thermal energy	77,428	Gcal	325,707
	Organizational and technical	thermal energy	19,961	Gcal	92,457
	Investment measures for energy efficiency increasing	Fuels	25,447	toe	622,752
	Organizational and technical	Fuels	3,400	toe	80,192
Energy	Installation of more energy-efficient equipment	electrical energy	940	000 kWh	5,800

Name of NIS' Block	Activity	Type of energy	Energy savings	Unit	Cost savings [000 RSD]
	Automation and modernization of plant	electrical energy	2,427	000 kWh	17,212
	Reconstruction of a plant's segment	thermal energy	87	Gcal	803
	Automation and modernization of plant	Fuels	668	toe	20,215
Sales	Purchase of new vehicles	Fuels	62	toe	8,818
Business centres	Modernization of air conditioning	electrical energy	300	000 kWh	2,400
	Modernization of air conditioning	thermal energy	1,500	Gcal	10,800
Plant for production of "Jazak" drinking water	Modernization of lighting	electrical energy	15	000 kWh	81

Table 48: The environmental protection activities for harmonization of NIS' operations with legislation of the Republic of Serbia and the EU by 2025

Name of NIS' block	Activity	Investments (Million USD)	Deadline	Responsible entity
Refining Block				
1	Reclamation and separation of oiled and atmospheric sewage system in Pančevo oil refinery	0,05	2017-2025	NIS
2	Project for washing the ejector's gas at S-2200 (reducing SO_x emission)	1,06	2017-2025	NIS

Name of NIS' block	Activity	Investments (Million USD)	Deadline	Responsible entity
3	Installation of separator at SLOP line	1,06	2017-2025	NIS
4	Reconstruction of dispatcher' objects in Pančevo oil refinery	0,02	2017-2025	NIS
5	CEMS at S-5000	0,17	2017-2025	NIS
6	Reconstruction of system for gas detection and fire protection in furnaces	0,44	2017-2025	NIS
7	Reconstruction of FB-0805 tank	0,41	2017-2025	NIS
8	Reconstruction of FB-1109 tank	0,20	2017-2025	NIS
9	Amine gas treating with DA-2107 II at the atmospheric distillation plant according to IED directive 2010/75 / EU	2,10	2017-2025	NIS
10	Installing the "Low NOx" burners for reducing emissions at processing furnace	2,78	2017-2025	NIS
11	Redirecting of off-gas from S-5000 to the gas flare	0,10	2017-2025	NIS
12	Construction of a closed sampling system in production	0,22	2017-2025	NIS
13	Reconstruction and modernization of the Pančevo refinery port at Danube river	0,03	2017-2025	NIS
14	Modernization of installations for bitumen loading / unloading at filling stations/ railway filling stations, incineration of waste gases from the tank and installation of radar mixers and temperature probes at tanks	0,87	2017-2025	NIS
15	Adaptation of natural gas heating system at the S-9900, S-9950 and natural gas flow regulation at the S-9900	0,01	2017-2025	NIS
16	Construction of new platforms and rehabilitation of existing platforms in Pančevo and Novi Sad refineries for increasing employees' safety	0,38	2017-2025	NIS

Name of NIS' block	Activity	Investments (Million USD)	Deadline	Responsible entity
17	Arranging a location for contractors according to the plan for 2016	0,01	2017-2025	NIS
18	Flue gas exhale for furnace BA-0252	1,00	2017-2025	NIS
19	Reconstruction of the VME system	0,50	2017-2025	NIS
20	EC filter istallation at the smoke channel of the FCC plant	4,00	2017-2025	NIS
21	Reconstruction for harmonization according to rquirements of "VOC" Directive 1994/63/ EC and 2009/126 /EC	0,68	2017-2025	NIS
	Energy Block			
22	Geothermal energy projects	0,21	2017-2025	NIS
23	The thermal power plant-heating plant project in Pančevo - part of NIS	70,6	2017-2025	NIS
24	The construction of cogeneration plants	15,61	2017-2025	NIS
25	Projects of compressed natural gas (CNG)	2,27	2017-2025	NIS
26	Projects of heating system reconstruction in the Novi Sad Refinery	0,67	2017-2025	NIS
27	Adaptation of condensate recovery system	0,24	2017-2025	NIS
	Exploration and Production Block			
28	Environmental protection projects	10,27	2017-2025	NIS
	Sales block			

Name of NIS' block	Activity	Investments (Million USD)	Deadline	Responsible entity
29	Investment in technical and technological measures that have to be taken in the part of the system for handling and storing gasoline in accordance with the requirements of VOC Directive 1994/63 / EC and 2009/126 / EC	6,02	2017-2025	NIS
30	Installation of separators, piezometers and flow meters for oiled wastewater with accompanying project documentation at SSG and storages	0,92	2017-2025	NIS
31	Remediation of water intake by filter installation, reconstruction of sewer and facilities for waste water treatment in the N ovi Sad Refinery	0,40	2017-2025	NIS
32	Reconstruction and upgrading of "SND NS" sewage system	0,28	2017-2025	NIS
	Oilfield Services Block			
33	Procurement and installation of wastewater measuring devices	0,12	2017-2025	NIS
34	Construction of sewage system - NAFTAGAS Oilfield Services Block, Sangaj	0,10	2017-2025	NIS
35	Construction and equipping of storages for disposal of hazardous and non-hazardous waste (equipment for manipulation and measurement of waste, absorbents, bundwalls)	0,15	2017-2025	NIS
36	Construction of 3 new tanks for mud waste disposal	2,98	2017-2025	NIS

Table 49: Projects and activities for environmental protection in PE Transnafta for 2016-2023 period

No.	Project/Activity	Description	Investments (million RSD)	Deadline	Responsible entity
1	Report on security and accident protection plan - Crude oil terminal	Identification of hazards and review of the possible accident situation development, the analysis of consequences and prevention measures	5	2016-2023 period	PE Transnafta
2	Report on security and accident protection plan - oil product storages in Refinery	Identification of hazards and review of the possible accident situation development, the analysis of consequences and prevention measures	5	2016-2023 period	PE Transnafta
3	Environmental impact assessment with accident protection plan for "Ledinci" fuel storage	- Environmental protection measures - Description of possible significant effects of fuel storage on the environment	1	2016-2023 period	PE Transnafta
4	Environmental impact assessment with accident protection plan for "Knić", "Umac baza" and "Jeminska Stena" storages	- Environmental protection measures - Description of possible significant effects storage of fuel on the environment	3	2016-2023 period	PE Transnafta

No.	Project/Activity	Description	Investments (million RSD)	Deadline	Responsible entity
5	Environmental monitoring at the PE Transnafta facilities	- Air monitoring/ air immissions and emissions - total hydrocarbons BTX, NO_2 and CO) - Surface water monitoring for the presence of hydrocarbons of petroleum origin - Groundwater monitoring for the presence of hydrocarbons of petroleum origin - Monitoring of the water at the exit of oily water separator - hydrocarbons C10-C40 - Soil quality - Level of noise and vibration - The groundwater level	5	2016-2023 period	PE Transnafta
6	Remedial measures in the event of contamination/ accident	- The state of the environment at the site after contamination - Exploring operations - The amount and concentration of hazardous substances at the site and environmental impact - The project's solution for remediation - Control measures	21	2016-2023 period	PE Transnafta
7	Pollution preventive measures at the PE Transnafta facilities	- Engagement of authorized company for pollution prevention-constructing the protective dams on watercourses - Provision of adsorbents and protective equipment - Provision of polyethylene film for the safe disposal of contaminated waste - Selective separation of waste and safe storage	12	2016-2023 period	PE Transnafta

No.	Project/Activity	Description	Investments (million RSD)	Deadline	Responsible entity
8	Measures and activities for pollution prevention caused by an accident - Terminal and pipeline system	- Construction of the collecting manholes - Extraction of oil from soil and water using the vacuum pump - Remediation of contaminated soil and water - Terrain reclamation - Construction of piezometers	40	2016-2023 period	PE Transnafta
9	Measures and activities for pollution prevention caused by an accident -petroleum product pipeline	- Construction of the collecting manholes - Pumping the derivative from soil and water by vacuum pumps - Remediation of contaminated soil and water and permanent waste disposal - Terrain reclamation - Construction of piezometers	-	2016-2023 period	PE Transnafta
10	Measures and activities for pollution prevention caused by an accident - "Ledinci" storage	- Setting up absorbent booms and collection of spilled fuel from the water and concrete surfaces - The use of means for decommissioning and dismantling of hydrocarbon from the water surfaces - Collection of spilled fuel from the tank, catchment tanks and manholes - Cleaning the separators - Remediation of contaminated soil and permanent disposal of hazardous waste - Terrain reclamation - Construction of piezometers for groundwater monitoring	15	2016-2023 period	PE Transnafta

No.	Project/Activity	Description	Investments (million RSD)	Deadline	Responsible entity
11	Measures and activities for pollution prevention caused by an accident - Knić", "Umac baza" and "Jeminska Stena" storages	- Setting up absorbent booms and collection of spilled fuel from the water and concrete surfaces - The use of means for decommissioning and dismantling of hydrocarbon from the water surfaces - Collection of spilled fuel from the tank, catchment tanks and manholes - Cleaning the separators - Remediation of contaminated soil and permanent disposal of hazardous waste - Terrain reclamation - Construction of piezometers for groundwater monitoring	-	2016-2023. period	PE Transnafta
12	Disposal of hazardous and non-hazardous waste at the PE Transnafta facilities	- Examination of waste and determining the waste index number - Procurement of containers and barrels for selective separation and collection of waste - Adaptation of the temporary storages for waste collection at Transnafta's locations - Waste labelling and waste list managing - Disposal of hazardous and non-hazardous waste - Developing and updating the waste management plans	15	2016-2023 period	PE Transnafta

No.	Project/Activity	Description	Investments (million RSD)	Deadline	Responsible entity
13	Waste water collection and treatment, regularity control of facilities for collection, drainage and waste water treatment	- Collection of waste water - Monitoring the water tightness	10	2016-2023. period	PE Transnafta

3.4.2. The Projects in Oil Sector

3.4.2.1 Projects in Oil Refining Subsector

P.18. Strategic project "Deep refining" [44]

Table 50: Basic characteristics of the project

Technical characteristics and project description	The effects of realization based on available documentation	The value of the project and funding source
Implementation of delayed coking technology as a second phase of oil refinery modernization in Pančevo	This project will enable an increase in the depth of refining (at 92%) and increased production of white derivatives (to 85.8%), with improvement of refining process efficiency, increasing the plant's availability and maximizing the level of energy costs' optimization. Due realization of the project and other measures that are planned to be implemented in Oil Refinery Pančevo, energy intensity index ("EII", defined on the basis of the "Solomon" methodology) will be almost equal to the refineries in world that use EII as a reference index. According to macroeconomic indicators used for the project calculation, the expected average increase in profit before interest, income taxes, depreciation and amortization (i.e. EBITDA) for the period after the beginning of the project is $87 million per year.	$330 million without VAT (NIS' own funds)

Table 51: State of the project

Project	Project preparation status	Lacking planning and technical documentation
Deep refining	Feasibility study of the project is done during 2013 and 2014. Three technological solutions were considered in the study with aim of increasing the depth of refining, and delayed coking technology (DCU) has proven to be an optimal solution. In 2015, the contract between CB&I company and NIS for development of base and extended base project "Deep refining" (BDP/FEED) has been signed. During 2015, CB&I has developed a conceptual study of the project and submitted a base project (BDP). In 2016, CB&I has completed the activities on the development of the expanded base project for the construction of main and auxiliary facilities. A tender procedure has been conducted and CB&I has been selected for the implementation of EPCM project's phase. The project has two "work packages": WP1 - construction of DCU and ancillary facilities, WP2 - modernization and reconstruction of existing facilities due to changes in the refinery's operating mode.	Obtaining the missing licenses

Table 52: Dynamics for realization of activities in the period of Program's implementation

Project "Deep refining"	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Construction of DCU and ancillary facilities	NIS	x						
Modernization and reconstruction of existing facilities due to changes in the refinery's operating mode			x	x				
Testing of new refining possibilities				x				

3.4.2.2 The Projects in the Oil Subsector-Transportation

P.19. Project "Construction of the First facility of petroleum product pipeline system"

The objective of Petroleum product pipeline system construction in Serbia is provision of an economical, efficient and environmentally friendly mode of transportation of petroleum products that are produced in the oil refinery Pančevo. It represents a project of national and strategic importance since it significantly contributes to supply security [45].

From an economic point of view, transport of petroleum product by pipeline is the most efficient way in terms of the amount of operational expenses, minimum losses during transport and it is considered as a „just-in-time" type of transportation regarding accuracy and reliability of transportation dynamics.

From the socioeconomic point of view, petroleum product transportation by pipelines can contribute to the reduction of traffic congestion, and to reduction of external costs which are compensated from the budget (numerous traffic accidents, environmental pollution, abrasion and damage of roads). Indirect social benefit, by using this type of oil product transportation in comparison to other ones, is lower energy consumption

From an environmental and safety point of view, the petroleum product pipeline system is the safest type of product transportation with the least adverse impact on the environment (the lowest emissions of carbon dioxide, nitrogen oxides, and volatile organic compounds, without noise) and at least accidents resulting in death or serious injury.

The other advantages of petroleum product pipeline system are: great transportation capacity, shorter route since the pipes can be laid in the water also, it occupies small area and very important issue is the possibility of cross-border regional connectivity that is supported by The Energy Community Treaty of Southeast Europe.

Table 53: Basic characteristics of the project "Construction of the First facility of petroleum product pipeline system"

Technical characteristics	Description	The effects of implementation on the basis of available documentation	The value of the project and funding source
The length of First facility of petroleum product pipeline is: 26.9 km +90.3km = 117.2 km. It has three terminals (shipping terminal in Pančevo, receiving terminals in Smederevo and Novi Sad)	Construction of the First Facility of the Products Pipeline System is envisaged in three phases: construction of the products pipeline connecting oil refinery in Pančevo with the existing storage tanks in Smederevo and Novi Sad; construction of new storage tanks in Pančevo and Smederevo and providing conditions for further transport. It goes from terminal in Pančevo in two directions: to the south (Smederevo) and to the north (Novi Sad). The southern direction starts with Pančevo-Smederevo section, i.e. from shipping terminal within the oil refinery in Pančevo, along the Pančevo-Kovin road to the receiving terminal in Smederevo, which is located next to the existing NIS' storage. The northern direction starts by Pančevo-Novi Sad product pipeline route that is in a zone of existing pipeline route (former Yugoslav's oil pipeline) and it connects to the receiving terminal, at the location near the oil refinery in Novi Sad.	Increasing the oil derivative supply security. More cost-effective mode of transportation at a price lower than the current 4.7 EUR/t for marine transport and up to 9 EUR/t for road transport. The energy consumption per ton of transported petroleum products will be significantly reduced and thereby increasing efficiency by about 60%. Preservation of transport infrastructure at the previous routes of supply. Environmental pollution reduction and consequently decreasing the impact on the population's health and reducing the health care costs.	30 million euros according to the preliminary project design, but it should be much lower with application of more rational technological solutions; PE Transnafta.

Table 54: Status of project

Project	Status of project preparation	Lacking planning and technical documentation
First facility of petroleum product pipeline system construction	Complete planning documentation is done; The Feasibility Study with the Basic Design and the Environmental Impact Assessment Study for Construction of the First Facility of the Products Pipeline System (Pančevo-Smederevo and Pančevo-Novi Sad sections) are completed.	The implementation project and Project for construction permit for Pančevo-Smederevo section The implementation project and Project for construction permit for Pančevo-Novi Sad section Tender documentation for construction.

Table 55: Dynamics for realization of activities in the period of Program's implementation

Project: "First facility of petroleum product pipeline system construction"	Responsible entity	2017	2018	2019	2020	2021	2022	2023
The implementation project and Project for construction permit for Pančevo-Smederevo section	PE Transnafta	x						
Resolving property and legal affairs for Pančevo-Smederevo section	PE Transnafta	x						
Preparation of tender documentation	PE Transnafta		x					
Construction	PE Transnafta			x	x			
The implementation project and Project for construction permit for Pančevo-Novi Sad section	PE Transnafta	x						
Resolving property and legal affairs for Pančevo-Smederevo section	PE Transnafta		x					
Preparation of tender documentation	PE Transnafta				x			
Construction	PE Transnafta					x	x	

3.4.2.3 Projects in Oil Subsector - Sales

P.20. Project "Establishing the mandatory stocks of crude oil and/or petroleum products"

In the Republic of Serbia, establishment of crude oil and/or petroleum product mandatory stocks (MS) is planned for 201 -12/31/2022 period, starting from stocks in 2015 that were corresponded to 9.5 days of 61 days of average daily inland consumption. [46], [47] MS will be determined for each year in the mentioned period, based on data from the previous year in an amount of 90 days of average net daily import or 61 days of average daily inland consumption, whichever of the two quantities is greater. Also, the structure of mandatory reserves will be determined for each year, where it involves petroleum products whose common share expressed in units of oil equivalent is equal to at least 75% of the total domestic consumption in previous year.

Directorate of energy reserves has formed MS in 2015 equals to 9.5 days of 61 days of average daily inland consumption and has continued to manage project for establishing the mandatory stocks of crude oil and/or petroleum products in 2016 [48].

Directorate of energy reserves is obliged to pay the excise tax on petroleum product purchase. It is necessary by amending the Law on excise taxes to provide purchase of petroleum products without excises that will directly contribute to more efficient MS forming concerning the fact of limited budget for this purpose.

In order to form MS, PE Transnafta has started revitalization of certain number of petroleum product storages that belong to the Army of Republic of Serbia. Besides that, it has started to build at the terminal in Novi Sad two crude oil storage tanks with capacity of 20,000 m^3. This construction is planned to be completed in the second half of 2017 [49]. According to that, it is necessary to change the defined MS structure since the oil stocks would be increased from 20,000 tons to about 51,000 tons, and petroleum product stocks would be reduced.

Also, Republican Directorate for Commodity Reserves (RDCR) plans to increase storage capacities by the construction of new storage tanks [50].

Data on the available storage capacities under the public ownership and ownership of public enterprise (RDCR and PE Transnafta) and dynamics of their increase in order to form MS are presented in table 56. In tab. 57 is given the dynamics of project for establishing the mandatory stocks of crude oil and/or petroleum products.

Based on the analysis, it was found that lack of storage volume for forming the MS is about 155,000 tons amounting to 20.4 days of average daily consumption. The problem of insufficient storage capacity can be solved by using the existing available storage capacities in the Republic of Serbia (that are not used currently), by the construction of new storage capacities under public ownership, by the construction of new storage capacities through public-private partnership and contractual rights for purchasing the certain quantities of petroleum products.

For establishment of mandatory stocks, that includes the provision of new storage capacities, purchase of petroleum products, storage costs and other necessary expenses (insurance, quality control, etc.), it is necessary to provide about 650 million Euros.

Table 56: Available storage capacities under public ownership and public enterprise ownership

Year	2016	2017	2018	2019	2020	2021	2022	2023
PE Transnafta, tons	45,600	92,400	103,200	114,600	121,656	121,656	121,656	121,656
RDCR, tons	115,739	115,739	115,739	154,939	170,939	186,939	186,939	186,939
Total capacity, tons	161,339	208,139	218,939	269,539	292,595	308,595	308,595	308,595
MS, days	21.2	27.4	28.8	35.5	38.5	40.6	40.6	40.6
The planned dynamics for MS establishing, days	17	23	31	39	47	54	61	61

Table 57: Dynamics for realization of activities in the period of Program's implementation

Project: "Establishing the mandatory stocks"	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Supply of oil and petroleum products	Ministry of Mining and Energy	x	x	x	x	x	x	
Amending the Law on Excise Taxes	Ministry of Finance	x						
Redefining the existing structure of MS	Ministry of Mining and Energy	x	x					
Provision of new storage capacities	Ministry of Mining and Energy, Republic Directorate for Commodity Reserves (RDCR) and PE Transnafta (storages under public ownership)	x	x	x	x	x	x	

3.4.2.4 The Possibility of Exploiting and Refining the Oil Shale

The estimated reserves of oil shale in the Republic of Serbia are about 4.8 billion tons. The reserves of oil shale are found in the following basins: Aleksinac, Vranje, Senonian Tectonic Trench, Valjevo-Mionica, Western Morava, Kruševac, Babušnica, Kosanica, Niš and Levač. In the Aleksinac basin, a higher degree of exploration of oil shale has been achieved in comparison to the other basins, and the potential reserves of oil shale in Aleksinac reservoir are estimated at around two billion tons.

In 2012, the study on estimate of productive oil shale reserves for Public enterprise for underground coal mining Resavica - "Aleksinac mine" has been done. It is determined that reserves of Dubrava field are 352,759,195 tons where the oil yield ranges from 9.9% to 12.5%. PE Resavica - "Aleksinac mine" has an exploitation permit No. 04-783/ 2.

There are more interested parties in the oil shale exploitation. The cost- effective exploitation of oil shale from Aleksinac basin is directly related to the crude oil price. According to the analysis, the beginning, as well as an implementing the exploitation, is conditioned by the price of crude oil on the world market from 70 to 80 $/barrel. Oil shale can be effectively used for the production of synthetic oil (by extraction), that can be used as a fuel or upgraded by refining to petroleum products, while the residual part of extracted oil shale could be used for electricity production.

From the standpoint of environmental impact, the project is acceptable since there is no need for disposal of extracted oil shale. It will be used for electricity and heat production. The oil shale ash, that is by-product from oil shale combustion, could be used as a raw material in the construction industry. By using the modern technologies, gas emissions would be reduced, while all waste water would be subjected to treatment in the treating facility.

The exploitation and refining of oil shale has multiple positive effects such as:

- valorisation of unused mineral resources;
- an increase in domestic oil production;
- production of electricity and heat;
- the progress of undeveloped region in Serbia;
- new jobs and
- direct impact on GDP growth.

Regarding the current state of the PE Resavica - "Aleksinac mines" it is necessary to take appropriate measures and actions in terms of company's financial consolidations. This can be achieved through the reorganization of the company that would provide an opportunity for finding a strategic partner or for privatization. Due this present situation, dynamics for implementation of activities in the period of Program's implementation cannot be defined.

3.5. Sector of Natural Gas

Achieving the strategic objectives in the natural gas sector should be obtained by implementation of measures and realization of projects, which have been selected and defined based on an impact that they have on one or more strategic goals. Complex measures include regulatory, organizational, technical and other activities. Their joint realization, with engineering demanding and investment intensive project activities, should synergistically contribute to achievement of the objectives of the Strategy. The adopted strategic objectives in the natural gas sector are:

- Ensuring security of supply of the national natural gas market,
- Establishing national and regional natural gas market,
- Diversification of sources and routes of natural gas supply.

The level of realization of strategic objectives will be monitored by indicators presented in Table 58.

3.5.1. Measures for the Natural Gas Sector

Measures in the field of natural gas that are primarily directed toward accomplishing the strategic objectives. Measures include, as follows:

1. **Harmonization of legislation with obligations arisen from a membership in the Energy Community**; A set of activities related to this measure includes adoption of plans and instructions related to ensuring secure supply of natural gas, conditions for access to the networks for the transmission of natural gas, as well as adoption of a new legal framework related to exploration and exploitation of hydrocarbons, and rules on reporting, for companies that perform research and exploitation of oil and natural gas. Also, for ensuring the certification process of the transmission system, it is necessary to adopt changes on the Law on Ministries, the Law on Government, the Law on Public Utilities and the Law on Commercial Companies.
2. **Improvement of regulatory and technical conditions for the operation of gas infrastructure**; The key activities within this measure are adoption of rules for the operation of transmission system, revision and improvement of the methodology for determining the price for accessing to natural gas distribution system, equipping of transmission pipeline system with measurement and data acquisition systems necessary for the operation and development of the natural gas market, as well as taking over measuring devices and metering and regulating stations in facilities of existing consumers or producers by the distribution systems operators.
3. **Planning of gas infrastructure development**; This measure refers to adoption of ten-year development plans, for transmission and storage capacities, as well as five-year plans for distribution systems development, and research and preparation of documentation for the future development of gas infrastructure.
4. **Reorganization of the natural gas distribution sector**; This measure includes a range of activities aimed at development of the national natural gas market. This should be achieved by regulatory and other incentives for enlargement of the existing distribution companies or their integration with communal utilities, aimed to accomplish their financial sustainability.
5. **Realization of planned natural gas production in the Republic of Serbia**; This measure includes a set of technical-technological and organizational activities aimed at achieving optimal natural gas production, which significantly contributes to the security of the supply of the domestic market. The plan for the production of gas dissolved in petroleum and free gas for the period up to 2023 is given in.

A particular set of measures is related to the improvement of energy efficiency of production, transmission and distribution of natural gas. These measures have a positive effect on the functioning of the entire natural gas sector, and include:

- Improving efficiency of oil and natural gas production,
- Maintenance and rehabilitation of the transmission system,
- Maintenance and rehabilitation of the distribution system.

The listed measures, along with related activities, envisaged deadlines for adoption, institutions responsible for implementation and indicators for monitoring are presented in Table 60-Table 63.

Table 58: Indicators for monitoring the effects of the implementation of measures and the realization of projects in the natural gas sector

Strategic goal	Indicator	Description	Method for calculating
Ensuring a secure supply of the national natural gas market	(N-1) index of the system availability [52]	The indicator determines daily operational flexibility of the gas system, and the system's ability to respond to consumers` demands in extreme conditions.	N-1 = (technical capacity of entering points + maximal technical production capability + maximal storage technical deliverability + maximal technical LNG facility capacity- technical capacity of the single largest gas infrastructure)/ Maximal daily gas demand with a statistical probability of occurrence once in 20 years x 100%
Establishment of national and regional natural gas market	Level of market openness [40]	The indicator shows the level of liberalization of the natural gas market, and refers to the amount of natural gas which is sold on open gas market.	Ratio of amounts of natural gas sold on an open market, and the overall consumption of natural gas x 100%
Diversification of sources and routes for natural gas supply	Import Route Diversification (IRD) [53]	The index determines import diversification of supply routes, and depends on available capacities of interconnections.	Sum of squares of percentage shares of interconnections and percentage shares of delivery from LNG terminals in overall supply. Lower value of the index means greater diversification of supply routes.

Table 59: Plan of natural gas production in the period 2017-2023 (in thousands of m^3)

Planned natural gas production						
2017	2018	2019	2020	2021	2022	2023
516,632	469,781	429,924	397,369	364,912	343,522	322,353

Table 60: Measures for ensuring a secure supply of the national natural gas market

Strategic goal:	**Ensuring a secure supply of the national natural gas market**			
Measure	**Activity**	**Deadline for adoption of the regulation**	**Responsible entity**	**Indicator of the activity**
Harmonization of legislation with obligations arisen from a membership in the Energy Community	Adoption of the Preventive action plan for safeguarding the security of natural gas supply	III quarter 2017.	Ministry in charge of mining and energy (Sector for oil and gas)	Adopted plan harmonized with Regulation 994/2010
	Adoption of the Crisis plan for safeguarding the security of natural gas supply	III quarter 2017.	Ministry in charge of mining and energy (Sector for oil and gas)	Adopted plan harmonized with Regulation 994/2010
	Transposition of the Directive 94/22/EU in accordance with the revised Second National Program for the Adoption of the EU Acquis (NPAA), adopted in November 2016	IV quarter 2018.	Ministry in charge of mining and energy (Sector for oil and gas, Sector for mining and geology)	Transposed the Directive 94/22/EC in accordance with the revised Second National Program for the Adoption of the EU Acquis
	Adoption of the Regulation on reporting for companies that conduct research and exploitation of oil and gas	IV quarter 2018.	Ministry in charge of Mining and Energy (Sector for oil and gas, Sector for mining and geology)	Adopted regulation harmonized with the Directive 2013/30/EU - articles 20-22.

Strategic goal:	**Ensuring a secure supply of the national natural gas market**			
Measure	**Activity**	**Deadline for adoption of the regulation**	**Responsible entity**	**Indicator of the activity**
Planning the development of gas infrastructure	Adoption of a ten-year plan for the development of the transmission system (to be adopted every year)	2017-2023.	Transmission system operators - TSO (Transportgas Srbija d.o.o and „Yugorosgaz-Transport" d.o.o.), AERS	Obtained the approval from AERS
	Adoption of a ten-year plan for the development of natural gas storage (to be adopted every year)	2017-2023.	Storage operator	Document delivered to AERS
	Adoption of plans for development of distribution systems (to be made every year for a period of five years)	2017-2023.	Distribution system operators (DSO)	Publicly available document
Improvement of regulatory and technical conditions for the operation of gas infrastructure	Adoption of Natural gas transmission system code	II quarter 2017.	TSO - Transportgas Srbija, AERS	Obtained the approval from AERS
	Inclusion of the procedure for issuing energy permits for the construction of facilities for natural gas transmission, facilities for natural gas distribution, storage facilities for natural gas and direct gas pipelines in electronic services E-portals	2018.	Ministry in charge of mining and energy, Ministry in charge of public administration and units of local self-government, Serbian Chamber of Commerce	Introduced new electronic service on E-portal

Table 61: Measures for establishing national and regional natural gas market

Strategic goal:	**Establishing national and regional natural gas market**			
Measure	**Activity**	**Deadline for adoption of the regulation**	**Responsible entity**	**Indicator of the activity**
Harmonization of legislation with obligations arisen from a membership in the Energy Community	Adoption of the Decree on conditions of natural gas delivery and supply	IV quarter 2017	Ministry in charge of mining and energy (Sector for oil and gas)	Adopted Decree harmonized with the Directive 2009/73/EU, the Decree 715/2009 and the Decree 994/2010
Providing a legal framework for carrying out the certification process of the transmission system	Amendment of the Law on Ministries, the Law on Government, the Law on Public Enterprises and the Law on Commercial Companies	2018.	Government of the Republic of Serbia, National Assembly of the Republic of Serbia, Ministry in charge of mining and energy	Conducted certification procedures and obtained certification of the operator of the transmission system from AERS
Improvement of regulatory and technical conditions for the operation of gas infrastructure	Revision and improvement of Natural gas transmission and distribution connection charging methodology	2020.	AERS	Adopted innovative methodology that promotes economy of scale and encourage efficiency in operation of distribution companies

Strategic goal:	**Establishing national and regional natural gas market**			
Measure	**Activity**	**Deadline for adoption of the regulation**	**Responsible entity**	**Indicator of the activity**
	Gas transmission system equipping with metering and data collection devices (measuring equipment, measuring and operational platform, SCADA) necessary for the functioning and development of the gas market	2020.	TSO - Transportgas Srbija	Share of exits from transmission system equipped with metering and data collection devices (current state: 34% in the system TSO - Transportgas Serbia and 100% in the system of TSO - Yugorosgaz-Transport)
	Adoption of plans for takeover metering devices and metering and regulating stations, in the facilities of existing customers or producers	Until 2020	DSOs	Adopted plans for takeover, by the founders of the distribution companies
Reorganization of the natural gas distribution sector	Analysis of business performance and recommendation of measures for the consolidation of distribution sector and reorganization of distribution companies with negative financial balances	2018-2021.	Ministry in charge of mining and energy, units of local self-government	Adopted reorganization plans by the founders of distribution companies

Table 62: Measures for diversification of sources and routes for natural gas supply

Strategic goal:	**Diversification of sources and routes for natural gas supply**			
Measure	**Activity**	**Deadline for adoption of the regulation**	**Responsible entity**	**Indicator of the activity**
Planning the gas infrastructure development	Feasibility studies for construction of main gas pipelines to the borders with Romania, Croatia, Montenegro, Macedonia and Bosnia and Herzegovina	2020-2023	TSO (PE Srbijagas) Ministry in charge of mining and energy	Feasibility studies completed
	Feasibility studies for construction of compressor stations	2020-2023	TSO (PE Srbijagas) Ministry in charge of mining and energy	Feasibility studies completed
	Geological Research and Feasibility Study for the underground gas storage Itebej	2018-2021	TSO (PE Srbijagas) Ministry in charge of mining and energy	Feasibility study completed
	Geological Research and Feasibility Study for the underground gas storage Tilva	2020-2023	TSO (PE Srbijagas) Ministry in charge of mining and energy	Feasibility study completed

Table 63: Measures aimed at improving energy efficiency of production, transmission and distribution of natural gas, environmental protection and at reducing the impact on climate change

Measure	Activity	Deadline for adoption of the regulation	Responsible entity	Indicator for energy efficiency monitoring	Indicator for environment and climate change monitoring
Improvement of oil and natural gas production processes	Introduction of more efficient technologies and optimization of oil and natural gas production processes	2017-2023	NIS	Specific consumption of natural gas for oil and natural gas production: In 2015: 66.67 m^3/toe (Statistical Office of the Republic of Serbia, Total energy balance in 2015)	Specific amount of natural gas flared in oil and natural gas production processes [m^3/toe]
Maintenance and rehabilitation of the transmission system including revitalization of compression station	Diagnostics of the existing transmission infrastructure, replacement of critical sections and preventive maintenance of equipment and installations	2017-2023.	Transmission system operators	Losses in transmission (as a percentage of total transmitted gas): In 2015: 0.32% (AERS, Report for 2015.) Preferred value in 2023: 0.3%	Emitted amount of natural gas in transmission network: In 2015: 8 million m^3 (AERS, Report for 2015.)
Maintenance and rehabilitation of the distribution systems	Diagnostics of the existing distribution infrastructure, replacement of critical sections and preventive maintenance of equipment and installations	2017-2023.	Distribution systems operators	Losses in distribution (as a percentage of total distributed gas): In 2015: 0.57% in total, in some distribution system significantly higher (AERS, Report for 2015.) Preferred value in 2023: < 0.5% in total, < 2% for the each distribution system	Emitted amount of natural gas in distribution networks: 2015: 8 million m^3 (AERS, Report for 2015.)

3.5.2. Projects in the Natural Gas Sector

P.21. Gas interconnection project Serbia - Bulgaria, the main gas pipeline MG-10 Niš - Dimitrovgrad (border with Bulgaria)

The interconnection project Serbia - Bulgaria is listed at the Single list of infrastructure projects in energy, the Priority list of energy projects (PECI list), the List of projects of common interest (P list) and at the List of projects for gas connection of Middle Eastern and South Eastern Europe (CESEC list).

Table 64:Main characteristics of the project

Technical characteristics	Description	The effects of realization based on available documentation	The value of the project and funding source
Main single gas pipeline; length 109 km, diameter DN 700, technical capacity 1.8 billion m^3/year, maximum operating pressure 55 bar	Main pipeline MG-10 Niš - Dimitrovgrad is an infrastructural basis for the establishment of gas interconnection with Bulgaria. Primary technical elements are: pipeline, facilities and associated infrastructure. An integral part of the pipeline are: - 2 overtaking stations - in a location near the state border and within the existing pipeline junction point "Niš 2". - 6 block stations - 2 pipeline inspection gauge within overtaking stations - 4 main metering and regulating stations (MMRS) as follows: MMRS "Niš 2" with a capacity of 30,000 m^3/h, MMRS "Bela Palanka 2" capacity of 3,000 m^3/h, MMRS "Pirot" capacity of 35,000 m^3/h, MMRS "Dimitrovgrad" capacity of 7,000 m^3/h - Devices for cathodic protection of the pipeline - Devices and equipment for the remote control and monitoring of facilities	Securing a new supply route. Increase of available natural gas quantity from import for 38% (from 12.96 million m^3/day to 17.89 million m^3/day). Compared to the maximum daily imported quantity of natural gas, in the period 2011-2015 for the consumers in Serbia (11.2 million m^3/day), the interconnection provides 44% of import needs.	85.5 million € Pre-accession EU funds, credit and the Budget of the Republic of Serbia

Table 65: Impact of the project on the achievement of strategic goals

Strategic goal	Description	The value of the indicator after realization of the project	Change compared to 2015
Ensuring a secure supply of the national natural gas market	Significantly improves; Additional entrance to natural gas network increases the security of supply, reliability of the system and creates a possibility for importing natural gas from other sources.	(N-1) = 64.3%	+86%
Establishment of national and regional natural gas market	Improves; Provides a possibility for reducing transit costs and development of distribution network in eastern and southern Serbia. It is prerequisite for the establishment of regional natural gas market. Potentially increases number of market participants.	-	-
Diversification of sources and routes for natural gas supply	Significantly improves; Introduces a new route of supply. Provides a new route for supply from Russia or from other supply sources (Azerbaijan, LNG from terminals in Greece etc.).	IRD = 6007	-39.9%

Table 66: State of the project

Project	Project preparation status	Lacking planning and technical documentation
Main gas pipeline MG-10 Niš - Dimitrovgrad (border with Bulgaria)	Spatial plan for special purpose area with elements of detailed regulation was completed.	Conceptual design, Location conditions, Feasibility study, Preliminary design, Study on environmental impact assessment, Project for building permit, Building permit, Project for construction, Project of the constructed facility (as-built design) in accordance with the requirements of the Law on Planning and Construction, Energy permits in accordance with Energy Law, the tender documents for construction.

Table 67: Dynamics for realization of activities in the period of Program implementation

Project: Main gas pipeline MG-10 Niš - Dimitrovgrad (border with Bulgaria)	Responsible entity	2017.	2018.	2019.	2020.	2021.	2022.	2023.
Exploration works	PE Srbijagas	x						
Conceptual design and location permit	PE Srbijagas	x						
Study on impact assessment on environment and society	PE Srbijagas	x						
Resolving property issues	Ministry in charge of mining and energy, PE Srbijagas	x						
Preliminary design and feasibility study	PE Srbijagas	x						
Energy permit	Ministry in charge of mining and energy,	x						
Project for building permit and building permit	PE Srbijagas		x					
Preparation of tender documents	Ministry of Finance - Sector for contracting and financing programs from EU funds (CFCU), PE Srbijagas		x	x				
Project for construction	PE Srbijagas			x	x			
Construction	-				x	x		

P.22. Gas interconnection project Serbia - Croatia, main gas pipeline MG 08 Gospođinci (Futog) - Sotin (Croatian border)

The interconnection project Serbia - Croatia is listed at the Single list of infrastructure projects in energy, the Priority list of energy projects (PECI list), the list of projects of common interest (P list) and at the List of projects for gas connection of Middle Eastern and South Eastern Europe (CESEC list).

Table 68: Main characteristics of the project

Technical characteristics	Description	The effects of realization based on available documentation	The value of the project and funding source
Main single pipe gas pipeline; length 95 km, diameter DN 600, capacity 1.5 billion m^3/year, nominal pressure 75 bar	Main pipeline MG 08 Gospođinci (Futog) - Sotin is an infrastructural basis for the establishment of gas interconnection with Croatia. Primary technical elements are: pipeline, facilities and associated infrastructure. An integral part of the pipeline are: - Overtaking station and pipeline inspection gauge at the location near the state border, - Block stations, - Devices for catholic protection of the pipeline, - Devices and equipment for the remote control and monitoring of facilities.	Securing a new supply route. Increase of available natural gas quantity from import for 31% (from 12.96 million m^3/day to 17.06 million m^3/day). Compared to the maximum daily imported quantity of natural gas, in the period 2011-2015 for the consumers in Serbia (11.2 million m^3/day), the interconnection provides 37% of import needs	85.5 million € (Data source: PE Srbijagas) Pre-accession EU funds, the Budget of the Republic of Serbia and other sources of funding

Note: During elaboration of the interconnection project Serbia - Croatia, in cooperation with the Croatian side, the beginning of the network is adopted to be in Gospođinci. This caused increase of the pipeline length that caused the difference in the value of the project presented above, and the value presented in the Single list of infrastructure projects in the energy sector (Table 129 on page 213).

Table 69: Impact of the project on the achievement of strategic goals

Strategic goal	Description	The value of the indicator after realization of the project	Change compared to 2015
Ensuring a secure supply of the national natural gas market	Significantly improves; Additional entrance to natural gas network increases the security of supply, reliability of the system and creates a possibility for importing natural gas from other sources.	(N-1) = 58.9%	+70.9%
Establishment of national and regional natural gas market	Improves; Provides a possibility for reducing transit costs. It is prerequisite for the establishment of regional natural gas market. Potentially increases number of market participants.	-	-
Diversification of sources and routes for natural gas supply	Improves; Provides a possibility for alternative supply of Algerian gas from Italy, via Croatia, or from a future LNG terminal in Croatia (anticipated capacity of 5-6 m^3 billion/year).	IRD = 6,348	-36.5%

Table 70: State of the project

Project	Project preparation status	Lacking planning and technical documentation
MG 08 Gospođinci (Futog) - Sotin (Croatian border)	The route at the level of the general design	Spatial plan for the special purpose area, Conceptual design, Location conditions, Feasibility study, Preliminary design, Study on environmental impact assessment, Project for building permit, Building permit, Project for construction, Project of the Constructed Facility (As-built Design) in accordance with the requirements of the Law on Planning and Construction, Energy permits in accordance with Energy Law, the tender documents for construction.

Table 71: Dynamics for realization of activities in the period of Program implementation

Project: MG 08 Gospođinci (Futog) - Sotin (Croatian border)	Responsible entity	2017.	2018.	2019.	2020.	2021.	2022.	2023.
Preparation of planning documents	PE Srbijagas						x	
Exploration works							x	
Conceptual design and location permit								x
Study on impact assessment on environment and society								x
Resolving property issues						x	x	x
Preliminary design and feasibility study								x
Energy permit								x
Project for building permit and building permit								x
Preparation of tender documents								x
Main project								x
Construction	-							

P.23. Gas interconnection project Serbia - Romania, pipeline Mokrin - Arad (border with Romania)

The project of gas interconnection Serbia - Romania is on the Single list of infrastructure projects in the energy sector.

Table 72: Main characteristics of the project

Technical characteristics	Description	The effects of realization based on available documentation	The value of the project and funding source
Main single gas pipeline; length 6 km, diameter DN 600, technical capacity 1.6 billion m^3/year, maximum operating pressure 50 bar	Main gas pipeline Mokrin -Arad is an infrastructural basis for the establishment of gas interconnection with Romania. Primary technical elements are: pipeline, facilities and associated infrastructure. An integral part of the pipeline are: - Overtaking station and 2 pipeline inspection gauges - Block stations - Devices for cathodic protection of the pipeline - Devices and equipment for the remote control and monitoring of facilities	Securing a new supply route. Increase of available natural gas quantity from import for 34% (from 12.96 million m^3/day to 17.34 million m^3/day). Compared to the maximum daily imported quantity of natural gas, in the period 2011-2015 for the consumers in Serbia (11.2 million m^3/day), the interconnection provides 39% of import needs.	Estimated value of the project 85 million € (Data source: Market report: Serbia natural gas sector: prospects, market structure and strategy, 22 August 2016, EY) Part in Serbia 6 million € (Data source: PE Srbijagas) EU pre-accession funds, the Budget of the Republic of Serbia and other sources of funding

Note: In the conceptual development (consideration) of the project interconnection Serbia - Romania, in cooperation with the Romanian side, a metering station is envisaged on the territory of the Republic of Serbia, what caused the difference of the value given above and the value given in the Single list of infrastructure projects in the energy sector (Table 129 on page 213).

Table 73: Impact of the project on the achievement of strategic goals

Strategic goal	Description	The value of the indicator after realization of the project	Change compared to 2015
Ensuring a secure supply of the national natural gas market	Significantly improves; Additional entrance to natural gas network increases the security of supply, reliability of the system and creates a possibility for importing natural gas from other sources. Significant disburdening of the basic main pipeline Horgoš - Batajnica.	(N-1) = 60.6%	+76%
Establishment of national and regional natural gas market	Improves; Provides a possibility for reducing transit costs. It is prerequisite for the establishment of regional natural gas market. Potentially increases number of market participants. Provides a possibility for the inclusion of existing and future gas storages in the regional natural gas market.	-	-
Diversification of sources and routes for natural gas supply	Improves; Particularly in the case of realization of transcontinental project for natural gas supply over Romania.	IRD = 6,224	-37.7%

Table 74: State of the project

Project	Project preparation status	Lacking planning and technical documentation
Gas interconnection project Serbia - Romania, pipeline Mokrin - Arad (border with Romania)	The route at the level of the general design	Spatial plan for the special purpose area, Conceptual design, Location conditions, Feasibility study, Preliminary design, Study on environmental impact assessment, Project for building permit, Building permit, Project for construction, Project of the Constructed Facility (As-built Design) in accordance with the requirements of the Law on Planning and Construction, Energy permits in accordance with Energy Law, the tender documents for construction

Table 75: Dynamics for realization of activities in the period of Program implementation

Project: Gas interconnection Serbia - Romania	Responsible entity	2017.	2018.	2019.	2020.	2021.	2022.	2023.
Preparation of planning documents	PE Srbijagas						x	
Exploration works								x
Conceptual design and location permit								x
Study on impact assessment on environment and society								x
Resolving property issues								x
Preliminary design and feasibility study								x
Energy permit								x
Project for building permit and building permit								
Preparation of tender documents								
Main project								
Construction								
	-							

P.24. Project for increasing the capacity of Underground storage Banatski Dvor

Table 76: Main characteristics of the project

Technical characteristics	Description	The effects of realization based on available documentation	The value of the project and funding source
Increasing the technical capacity of the storage to 800-1,000 million m^3, with withdrawal capacity up to 10 million m^3/day	Upgrade of the underground gas storage in Banatski Dvor from current capacity of 450 million m^3, to capacity of 800 to 1 billion m^3 with maximum technical capacity of production of 9.96 million m^3/day (415,000 m^3/h) and maximum technical capacity of injection of 5.52 million m^3/day (230,000 m^3/h).	Doubling of natural gas amount available from underground storage (from 5 million m^3/day to 10 million m^3/day). Compared to the maximum daily imported quantity of natural gas, in the period 2011-2015 for the consumers in Serbia (11.2 million m^3/day), the additional capacity provides 44.6% of needs.	65 million € Project finance (Data source: PE Srbijagas)

Table 77: Impact of the project on the achievement of strategic goals

Strategic goal	Description	The value of the indicator after realization of the project	Change compared to 2015
Ensuring a secure supply of the national natural gas market	Significantly improves; Available amounts of natural gas in occurrence of maximum daily consumption are significantly increased by project realization.	(N-1) = 66.6%	+93.3%
Establishment of national and regional natural gas market	Improves; Additional storage capacities, with envisaged interconnections, provides a possibility for use in the regional gas market.	-	-
Diversification of sources and routes for natural gas supply	Without impact	-	-

Table 78: State of the project

Project	Project preparation status	Lacking planning and technical documentation
Increasing the capacity of underground storage Banatski Dvor	At the level of the general design	Spatial plan for the special purpose area, preliminary project, location conditions, feasibility study, preliminary design, study on environmental impact assessment, project for building permit, building permit, project for construction, Project of the Constructed Facility (As-built Design) in accordance with the requirements of the Law on planning and construction, energy permits in accordance with Energy law, the tender documents for construction.

Table 79: Dynamics for realization of activities in the period of Program implementation

Project: Increasing the capacity of underground storage Banatski Dvor	Responsible entity	2017.	2018.	2019.	2020.	2021.	2022.	2023.
Exploration works	Storage operator (Natural Gas Underground Storage "Banatski Dvor" doo Novi Sad)				x			
Conceptual design and location permit						x	x	
Study on impact assessment on environment and society						x	x	
Resolving property issues						x	x	
Preliminary design and feasibility study							x	
Energy permit							x	
Project for building permit and building permit							x	
Preparation of tender documents							x	
Main project							x	
Construction	-						x	x
							x	x

P.25. Construction of main, delivery and distribution pipelines

Table 80: Main characteristics of projects (Data sources: documentation of PE Srbijagas and Yugorosgaz a.d., Market report: Serbia natural gas sector: prospects, market structure and strategy, 22 August 2016, EY)

Technical characteristics		Description	The effects of realization based on available documentation	The value of the project and funding source
Construction of transmission network (in 2015: the length of transmission network - 2,423 km, the number of main metering and regulating stations on transmission system exit - 269)	Main pipeline RG 11-02	Main single line pipeline RG 11-02 Leskovac - Vladičin Han - Vranje; length 70.7 km, diameter 323.9 mm, maximal operation pressure 50 bar, 6 block stations, 3 main metering and regulating stations (MMRS "Vlasotince" 5,000 m³/h, MMRS "Vladičin Han/Surdulica" 5,000 m³/h, MMRS "Vranje" 10,000 m³/h)	Extension of the national transmission network to south part of Serbia, in municipalities Vlasotince, Vladičin Han, Surdulica and the city of Vranje, provision of opportunities for further development of gas system toward Bujanovac and Preševo, as well as for interconnection with natural gas network of the Republic of Macedonia	15.6 million US$ is the value of complete RG 11-02 pipeline project. Until 2023, planned investments are 7.8 million US$ (projects, resolving of property relations and purchase of equipment and pipes, construction of pipeline from pipeline junction point (PJC) Niš to PJC Vladičin Han) Own resources of Yugorosgaz a.d.
	Main pipeline MG 01/II Itebej - Beograd Jug	Main single line pipeline; app. length 130 km and diameter 610 mm	Increasing dependability of national transmission network operation; Unload of Kikinda - Pančevo pipeline; Creation of opportunities for better functioning of national natural gas market	65.1 million € Own resources of PE Srbijagas, Budget of the Republic of Serbia
	Main pipeline Batajnica - Velika Plana - Niš	Main pipeline; length 116+161 km and diameter DN 700	Increasing dependability of national transmission network operation; Connection of pipeline Niš - Dimitrovgrad to Batajnica; Creation of opportunities for better functioning of national natural gas market	91.7 + 115.7 million € Own resources of PE Srbijagas, Budget of the Republic of Serbia
	Delivery pipeline RG 09-04/2 Aleksandrovac - Tutin	Delivery pipeline; operation pressure -up to 50 bar, length app. 121 km and diameter 323.9 mm	Development of transmission network of the Republic of Serbia and construction of distribution networks at municipalities along pipeline route (Brus- Kopaonik, Raška, Novi Pazar, Tutin).	53 million € Own resources of PE Srbijagas, Budget of the Republic of Serbia
	Delivery pipeline Mokrin - UGS Banatski Dvor	Delivery pipeline; operation pressure -up to 50 bar, length 50 km and diameter DN 600	Connection of UGS Banatski Dvor to pipeline from Romania; Creation of opportunities for better functioning of national natural gas market	30 million € Own resources of PE Srbijagas, Budget of the Republic of Serbia
Construction of distribution networks (in 2015: length of distribution network - 16,532 km, number of active connections/delivery points - 262,506)		Maximum operating pressures in distribution networks are 16 bar and 4 bar; Pipelines are constructed of steel and PE pipes with different diameters	Reduction of electricity consumption in households; substitution of using liquid fuels (heavy fuel oil, fuel oil) in district heating systems and industry; Increasing of efficiency of primary energy use by implementation of more efficiency technologies (CHP, condensing boilers etc.).	245 million € Own resources of DSOs, Budget of the Republic of Serbia

Table 81: Impact of the project on the achievement of strategic goals

Strategic goal	Description
Ensuring a secure supply of the national natural gas market	Improves; Construction of pipeline Itebej-Belgrade South increases security of supply of the area of Belgrade and Central Serbia.
Establishment of national and regional natural gas market	Significantly improves; Infrastructure preconditions (transmission system) are created for natural gas consumption in South, South-western and Central Serbia. Construction of new and extension of existing distribution networks enable increasing of natural gas consumption and development of natural gas market.
Diversification of sources and routes for natural gas supply	Without impact

Table 82: State of the project

Project	Project preparation status	Lacking planning and technical documentation
Construction of main, delivery and distribution pipelines	Depending on the project: Conceptual design, location conditions, feasibility study, preliminary design, study on environmental impact assessment, project for building permit, building permit, project for construction, Project of the Constructed Facility (As-built Design) in accordance with the requirements of the Law on planning and construction, energy permits in accordance with Energy law, the tender documents for construction.	Depending on the project: Conceptual design, location conditions, feasibility study, preliminary design, study on environmental impact assessment, project for building permit, building permit, project for construction, Project of the Constructed Facility (As-built Design) in accordance with the requirements of the Law on planning and construction, energy permits in accordance with Energy law, the tender documents for construction.

Table 83: Dynamics for realization of activities in the period of Program implementation

Project: Construction of main, delivery and distribution pipelines	Responsible entity	2017.	2018.	2019.	2020.	2021.	2022.	2023.
Conceptual design and location permit	PE Srbijagas, Yugorosgaz a.d., DSOs	x	x	x	x	x	x	x
Study on impact assessment on environment and society		x	x	x	x			
Resolving property issues		x	x	x	x	x	x	x
Preliminary design and feasibility study		x	x	x	x			
Energy permit		x	x	x	x			
Project for building permit and building permit		x	x	x	x	x	x	x
Preparation of tender documents		x	x	x	x	x	x	x
Main project		x	x	x	x	x	x	x
Construction	-	x	x	x	x	x	x	x

3.5.3. Sub-sector of Environmental Protection in the Sector of Natural Gas

Natural gas is an energy source with significant environmental advantages over other fossil fuels. The emission of nitrogen oxides from combustion of natural gas is much lower compared to coal, liquid fuels and biomass, and there is virtually no emissions of particles and oxides of sulfur. The carbon dioxide emission coefficient for natural gas is significantly lower than all other fossil fuels.

Direct environmental protection measures in the natural gas sector relate to the reduction of the amount of natural gas burnt on the torch during the production of oil and natural gas, and which it emits during transport and distribution. These measures, the activities that accompany them, the deadlines for execution, the responsible entities, as well as the indicators for their monitoring are listed in Table 84.

Table 84: Measures to improve environmental protection and reduce the impact on climate change in the production, transport and distribution of natural gas

Measure	Activity	Deadline for execution	Responsible institutions	Indicator for monitoring environmental impacts and climate change
Improving the process of oil and natural gas production	Introducing more efficient technologies and optimizing the production of oil and natural gas	2017-2023	NIS	The specific amount of natural gas burnt on torches in the production of oil and natural gas [m^3/ten]
Maintenance and rehabilitation of the transport system, including revitalization of the compressor station	Diagnostics of the existing transport infrastructure, replacement of critical parts and investment maintenance of equipment and installations	2017-2023	TSO	Emitted quantity of natural gas: 2015: 8 million m^3 (AERS, Report for 2015)
Maintenance and rehabilitation of the distribution system	Diagnostics of the existing distribution infrastructure, replacement of critical parts and investment maintenance of equipment and installations	2017-2023	DSO	Emitted quantity of natural gas: 2015: 8 million m^3 (AERS, Report for 2015)

3.6. Sector of Coal

Energy strategy in coal sector defines following strategic targets:

- Safe and reliable supply of coal firing power plants and
- Securing of sufficient amounts of coal for final consumption and generation of heat energy.

Table 85: Electricity generation balance in coal firing power plants and coal for production, according to referent scenario and scenario with applied energy efficiency measures

No.	Position	Year			
		2015	2020	2025	2030
(1)	(2)	(3)	(4)	(5)	(6)
1.	Referent scenario				
1.1.	Electricity generation in thermal power plants (in GWh)	26,679	23,865	25,563	27,284
1.2.	Coal for electricity generation (in1000 t)	38,772	34,203	34,946	37,711
2.	Scenario with applied energy efficiency measures				
2.1.	Electricity generation in thermal power plants (in GWh)	26,621	24,283	25,481	27,284
2.2.	Coal for electricity generation (in 1000 t)	38,772	34,203	34,946	37,706

This chapter provides detailed description of parameters for monitoring completion of individual targets.

Indicator no. 1

Target: Securing of sufficient amounts of coal for final consumption and generation of heat energy

Indicator: Ratio between domestic coal production and coal required for final consumption and transformation in heating plants; Indicator shows that there is capability to meet requirements for coal in these areas of domestic production. This indicator is not including the fact that there is domestic production of high quality coal in small amounts (anthracite, hard coal, etc.). It is calculated as a ratio of energy value of produced coal and sum of final energy and energy required for transformation in heating and combined plants.

Year 2015

Domestic coal production:

PEU mines	595,284 t,	17,000 kJ/kg
Underwater mine	225,000 t,	9,000 kJ/kg
EPS		(7,500 kJ/kg)
drying	548,752 t	
industry	231,921 t	
heating plants	211,197 t	
Final consumption:	27,984 TJ	
Heating plants:	2,732 TJ	
Combined plants (excluding blast furnace gas):	2,845 TJ	
Consumption:	33,561 TJ	
Value of indicator:	**0.58 (58%)**	

Target value of indicator in: 0.75.

Indicator no. 2

Target: Safe and reliable supply of coal firing power plants

Indicator: Ratio of effective and theoretical production rate of EBS (Excavator-Belt conveyor-Stacker) system. This indicator shows utilization of installed production rate of equipment. Second indicator is ratio between achieved operational time of EBS system and theoretical time. This indicator shows time utilization of equipment. Indicators are given separately for coal and overburden.

Table 86: Values of indicators for coal and overburden in 2015

Basin	Open pit mine	Time utilization	Production rate utilization
Kolubara	Field B/C	0.24	0.24
	Field D	0.45	0.32
	Veliki Crljeni	0.46	0.36
	Tamnava West Field	0.22	0.38
	Total	**0.31**	**0.34**
Kostolac	Drmno	0.31	0.31
	Total	**0.31**	**0.31**
EPS	**Total**	**0.31**	**0.33**

Table 87: Values of indicators for overburden in 2015

Basin	Open pit mine	Time utilization	Production rate utilization
Kolubara	Field B/C	0.43	0.28
	Field D	0.34	0.36
	Veliki Crljeni	0.62	0.37
	Tamnava West Field	0.37	0.43
	Total	**0.38**	**0.36**
Kostolac	Drmno	0.44	0.49
	Total	**0.44**	**0.49**
EPS	**Total**	**0.40**	**0.40**

Target value of indicator in 2023: To achieve planed production it is necessary to increase value of production rate utilization indicator to 0.5, thus creating conditions for more efficient time utilization and rationalization of work-force (precondition to halt operation of the systems during weekends).

Indicator no. 3

Target: Achievement of production rate utilization on coal and overburden, for the purpose of safe supply of fuel to power plants.

Indicator: Ratio of achieved and planned production of overburden and coal at open pit mines; This indicator shows the level of achieving required production rate of coal and overburden, for the purpose of safe supply of thermal power plants.

Table 88: Achieved indicators on coal production in 2015

Basin	Open pit	Coal production plan, t	Achieved coal production, t	Indicator
Kolubara	Field B/C	3,300,000	1,296,938	0.39
	Field D	11,382,000	12,298,460	1.08
	Veliki Crljeni	3,500,000	3,673,013	1.04
	Tamnava West Field	10,100,000	11,419,040	1.13
	Total	**28,282,000**	**28,687,451**	1.01
Kostolac	Drmno	8,499,000	8,341,640	0.98
	Total	**8,499,000**	**8,341,640**	0.98
EPS	**Total**	**36,781,000**	**37,029,091**	1.00

Table 89: Achieved indicators on overburden production in 2015

Basin	Open pit	Overburden production plan, m^3	Achieved overburden production, m^3	Indicator
Kolubara	Field B/C	10,000,000	7,713,293	0.77
	Field D	21,000,000	16,461,944	0.78
	Veliki Crljeni	1,550,000	1,643,653	1.06
	Tamnava West Field	23,000,000	21,479,029	0.93
	Total	**55,550,000**	**47,297,919**	0.85
Kostolac	Drmno	42,000,000	36,897,434	0.87
	Total	**42,000,000**	**36,897,434**	0.87
EPS	**Total**	**97,550,000**	**84,195,353**	0.86

Indicators are showing drawbacks in excavation of overburden by 15%, which can cause inability to produce required amount of coal in long term. Amount of overburden must be corresponding to the strip ratio. Ratio of produced overburden of 84,195,353 m^3 and coal of 37,029,091 t (2.27), is not suitable to current strip ratio.

Target value of indicator in 2023: Overburden indictor should be 1.0, with plan suitable to coal production and strip ratio for the current year.

Indicator no. 4

Target: Optimization and concentration of underground coal production

Indicator: Ratio of spent and planned investments shows level of completion of planned projects. Optimization and concentration of underground coal production also shows potential threats due to lower production caused by lack of investment.

Year 2015

Planned investment: 998,213,000 РСД

Spent investment: 324,063,770 РСД

Value of indicator: **0.32 (32%)**

Target value of indicator in 2023: 0.90

Indicator no. 5

Target: More intensive exploration of coal deposits across the whole area of Republic of Serbia

Indicator: Ratio of completed and planned explorations is showing degree of completion of planned project "More intensive exploration of coal deposits across the whole area of Republic of Serbia" and suggests to potential threats due to lack of quality data caused by reduced level of investments.

Example for JPPEU, same methodology is applied for the other subjects (EPS):

Year 2016

Planned explorations: 5,190.0 m

Completed explorations: 650.8 m

Value of indicator: **0.12 (12%)**

Target value of indicator in2023: 0.90

Indicator no. 6

Target: More intensive exploration of coal deposits across the whole area of Republic of Serbia

Indicator: Ratio of reserves category A+B and total reserves ($A+B+C_1$). Indicator shows level of deposit exploration, regarding reliable and quality estimation of coal reserves.

Kolubara basin:

Reserves of A category: 64,882,090 t

Reserves of B category: 1,127,278,570 t

Reserves of C_1 category: 913,064,140 t

Indicator: Reserves $(A+B)/(A+B+C_1) = 0.566$

Open pit mine Drmno:

Reserves of A category: 0 t

Reserves of B category: 238,675,082 t

Reserves of C_1 category: 159,310,462 t

Indicator: Reserves $(A+B)/(A+B+C_1) = 0.599$

Public Company for Underground Coal Mining (JPPEU):

Reserves of A category: 3,888,810 t

Reserves of B category: 436,106,730 t

Reserves of C_1 category: 595,356,870 t

Indicator: Reserves $(A+B)/(A+B+C_1) = 0.739$

Target value of indicator in2023: 0.60

Indicator no. 7

Target: Introduction of Coal quality management system

Indicator: Number of train shipments with coal of insufficient quality - delivered with lower calorific value (below 6,500 kJ/kg), with higher calorific value (over 7,500 kJ/kg) and total number of train shipments.

Example for PK Tamnava West Field

Year 2015

Number of train shipments:	9,891
Number of shipments with insufficient quality:	
- shipments with quality lower than 6,500 kJ/kg	1,106
- shipments with quality higher than 7,500 kJ/kg	2,606
Value of indicator:	**0.375**

Indicator shows large number of train shipments with insufficient coal quality, mainly with quality higher than required.

Target value of indicator in2023: 0.20

3.6.1. List of Measures in Coal Sector

Strategic actions as given in Strategy are:

- More intensive exploration of coal deposits across the whole area of Republic of Serbia
- Opening of replacement capacities for existing open pit mines which will stop the production and opening of open pit mines as suppliers for new thermal power plants.
- Optimization and concentration of underground coal production.
- Introduction of coal quality management system.

Beside these strategic actions, which define projects to be executed, following table provides activities for harmonization of national legal framework with legislation of EU and Energy Community in coal sector.

Table 90: Activities for harmonization of national legal framework with legislation of EU and Energy Community in coal sector

Item	EU regulation to be harmonized with	Deadline	Responsible institutions
- Establishment of rules for State subsidy to coal industry, for purpose to contribute to restructuring of coal industry. Rules will take into account social and regional aspects of restructuring and requirements of maintaining it, such as precaution measures, minimal amount of domestic coal production, as a guarantee to access the reserves. - Establishment of meanings and limitation of opportunities for State aid to coal industry, as well as goals to access coal reserves, reduction of aid and targets for reducing exceptional expenses. - Definition of situations, limitations and conditions for aid to be considered as acceptable, regarding functioning of unified market. - Defines the scale of the aid and conditions for public access and transparency which must be met by companies - aid receivers, as well as procedures for assigning and control of the aid, including the role of European Commission in these processes. - Introduction of good management components into utilization of natural resources of coal. - Reporting to the Commission, which further on reports to the European Parliament. Activities are important regarding aspects for improving competitiveness of unified market and the environment, as well as efficiency of resource production.	2010/787/EU: Council Decision of 10 December 2010 on State aid to facilitate the closure of uncompetitive coal mines	Second revision of National program for acceptance of EU Acquis for period 2016-2018, accepted by the RoS Govt. on 17th November 2016, with conclusion 05 no. 337-10957/2016-2, which accepts Second revised National program for acceptance of EU Acquis (NPAA) in Chapter 3.8.2 State aid and planned measures for this period. Regarding harmonization of legislation in area of State aid, ministry authorized for finance set December 2017 as provisional deadline for harmonization of this decision with Act on rules for assigning State aid.	Ministry authorized for finance

3.6.2. List of Projects in the Coal Sector

P.26. More intensive exploration of coal deposits across the whole area of Republic of Serbia

Kolubara basin

Single area of eastern part of Kolubara coal basin

Reference for coal exploration is [54]. Since coal production at open cast mines Field D and Field C will be finished in 2020 and 2025 respectively, smaller scale multipurpose explorations are planned, including geological exploration at mine Field C related to recovery of internal waste dump. Due to insufficient exploration level, and in accordance to mine planning of open cast mine Field E, this project includes geological exploration to be completed within 4 years, starting on 2016. List of planned works and dynamics, by open cast mines, are given in following tables.

Table 91: Dynamics of geological exploration on mine Field C, related to recovery of internal waste dump

No.	Item	Dynamics
1	Field works	2016
2	Laboratory works	2016

Table 92: Dynamics of geological exploration on mine Field C

No.	Item	Dynamics
1	Exploration drilling	2016
2	Geological works	2017
3	Hydrogeological works	2017
4	Laboratory works	2017

Table 93: Dynamics of geological exploration on mine Field D

No.	Item	Dynamics
1	Exploration drilling	2016
2	Geological works	2017
3	Laboratory works	2017

Table 94: Dynamics of geological exploration on mine Field E

No.	Item	Dynamics
1	Multipurpose exploration works - Exploration drilling, 31,000 m - Other works	2016, 2017 and 2018
2	Exploration works	2016, 2017 and 2018
3	Geotechnical exploration works	2016, 2017 and 2018
4	Hydrogeological exploration works	2016, 2017 and 2018

Small scale multipurpose geological explorations are planned at the mine Field E, until the end of the production, at level of 200,000 to 250,000 € per annum, which can be used for elaboration of five year reports.

Field G

Due to high level of coal reserves of A and B category in Field G of 100%, this mine is well explored. Opposing to coal, exploration of clearly existing non-ferrous concomitant mineral resources within the deposit are completely neglected. Plan is to perform geological explorations until 2018 to 2022, at latest. Dynamics of geological explorations in period 2018-2022 are given in Table 95.

Table 95: Dynamics of geological exploration at mine Field G, in period 2018-2022

Works	2018	2019	2020	2021	2022
Multipurpose exploration works	x	x	x	x	x
Geological exploration works	x	x	x	x	x
Geotechnical works	x	x	x	x	x
Hydrogeological works	x				x

There will be no detailed geological exploration at mine Field G until the end of coal production.

Tamnava West Field

Geological explorations are planned in such manner to be performed in front of the mining operations, at least for the period to secure all the parameters required for in-time and reliable geological interpretation of the deposit and unhindered planning and overburden and coal excavation. These are given in Table 96.

Table 96: Dynamics of geological exploration at deposit Tamnava West Field

Works	2018	2019	2020
Multipurpose exploration works	x	x	x
Geological exploration works	x	x	x
Geotechnical works	x	x	x
Hydrogeological works	x	x	x

Investment of 300,000 € are completed during 2015 as part of previous plan, aside of afore mentioned geological explorations for period 2018-2020. Until the end of production, small scale explorations are planned in periods 2022-2026 and 2029-2033, at level of 400,000 €, i.e. 80,000 € per annum in planned period of 5 years, which can be used for elaboration of five years reports.

Table 97: Planned investments for geological explorations of Tamnava deposit

Works	Amount (€)
Multipurpose exploration works	573,653
Geological exploration works	323,518
Geotechnical works	55,856
Hydrogeological works	43,227
Total	**996,255**

Dynamics and cumulative investments in planned detailed geological explorations by years are given in Table 98.

Table 98: Investment dynamics into geological explorations

Works	2018	2019	2020	Total (€)
Multipurpose exploration works	194,913	190,827	187,914	573,653
Geological exploration works	107,278	101,205	115,035	323,518
Geotechnical works	25,480	14,629	15,747	55,856
Hydrogeological works	15,289	18,308	9,630	43,227
Total	**342,959**	**324,969**	**328,327**	**996,255**

Field Radljevo

Due to insufficient exploration level and in accordance to opening dynamics of Radljevo open pit mine, project is planning geological exploration which should be completed within 4 years, starting on 2016. Dynamics of geological explorations in period 2016-2019 are given in Table 99.

Table 99: Dynamics of geological exploration at Radljevo deposit

Works	2016	2017	2018	2019
Multipurpose exploration works	x	x	x	x
Geological exploration works	x	x	x	x
Geophysical exploration works	x	x	x	x
Geotechnical works	x	x	x	x
Hydrogeological works	x	x	x	x

Geological explorations until the end of production at Radljevo open pit mine are planned in such manner to be performed in front of the mining operations, at least for the period to secure all the parameters required for in-time and reliable geological interpretation of the deposit and unhindered planning and overburden and coal excavation. Therefore, it is necessary to complete the geological exploration on period 2023-2028, similar in size and scope to those planned for period 2016-2019. Dynamics of geological explorations in period 2023-2028 are given in Table 100.

Table 100: Dynamics of geological exploration at Radljevo mine in period 2023-2027

Works	2023	2024	2025	2026	2027
Multipurpose exploration works	x	x	x	x	x
Geological exploration works	x	x	x	x	x
Geophysical exploration works	x	x	x	x	x
Geotechnical works	x	x	x	x	x
Hydrogeological works	x	x	x	x	x

Small scale explorations are planned until the end of coal production, in periods 2030-2034, 2037-2041 and 2043-2047. Planned investments in these explorations are 500,000 €, i.e. 100,000 € per annum in planning period of 5 years which can be used for elaboration of 5 years reports. Presented dynamics of geological explorations, for each operational deposit in planned period until 2025 i.e. 2050, are planned in such manner to be performed in front of the mining operations, at least for the period to secure all the parameters required for in-time and reliable geological interpretation of the deposit and unhindered planning and overburden and coal excavation.

Table 101: List of geological works and exploration costs (€) at Radljevo deposit by types in period 2016-2019

Works	2016	2017	2018	2019	Total (€)
Multipurpose exploration works	509,659	540,459	723,854	265,311	2,039,283
Geological exploration works	900,379	696,886	933,064	261,711	2,792,040
Geophysical exploration works	172,703	229,450	167,792	268,339	838,284
Geotechnical works	182,361	154,817	129,583	84,706	551,467
Hydrogeological works	204,859	402,937	116,824	242,896	967,516
Total	**1,969,961**	**2,024,548**	**2,071,118**	**1,122,963**	**7,188,589**

Table 102: Investment (€) in geological exploration in eastern part of Kolubara basin

No.	Item	Total investment in period2015-2049	Investment in period2015-2020	Investment in period2021-2049
1	**Geological exploration**			
1.1	Exploration related to recovery of internal waste dump of Field C	80,000	80,000	0
1.2	Geological exploration at Field C	440,000	440,000	0
1.3	Geological exploration at Field D	480,000	480,000	0
1.4	Geological exploration at Field E	7,530,000	5,280,000	2,250,000
1.4.1	Multipurpose exploration works	4,280,000	2,030,000	2,250,000
1.4.2	Exploration works	1,450,000	1,450,000	0
1.4.3	Geotechnical works	450,000	450,000	0
1.4.4	Hydrogeological works	1,350,000	1,350,000	0
2	Designing	2,500,000	1,500,000	1,000,000
	Total	**11,030,000**	**7,780,000**	**3,250,000**

Coal reserves

Kolubara coal basin

Overall minable reserves in Kolubara basin, at the end of 2015, are 2,105,224,800 t of coal, while total non-balanced reserves are 2,645,574,081 t of coal. Reserves in mining fields in Kolubara coal basin are given in Table 103.

Table 103: Overview of coal reserves in Kolubara coal basin

Deposit	Category	Balanced reserves (t)	Non-balanced reserves (t)	Geological reserves (t)
Field C old Fields B and C	A	7,355,290	3,260,760	10,616,040
	B	33,704,980	3,959,420	37,664,400
	A+B	**41,060,260**	**7,220,180**	**48,280,440**
Field D	A	34,276,560	43,875,950	78,152,510
	B	-	24,053,510	24,053,551
	A+B	**34,276,560**	**67,929,460**	**102,206,020**
Field E	B	146,207,300	27,620,050	173,827,350
	C_1	150,720,140	104,349,620	255,069,760
	B+C_1	**296,927,440**	**131,969,670**	**428,897,110**
Field F	B	464,559,700	-	464,559,700
	C_1	181,600,500	-	181,600,500
	B+C_1	**646,160,200**	-	**646,160,200**
Field G	A	21,873,290	25,728,230	47,601,520
	B	14,393,170	40,105,680	54,498,850
	A+B	**36,266,460**	**65,833,910**	**102,100,370**
Field Veliki Crljeni	A	1,376,950	15,460,220	16,837,170
	C_1	-	49,973,480	49,973,480
	A+C_1	**1,376,950**	**65,433,700**	**66,810,650**
Tamnava - West Field	A	-	26,147,790	26,147,790
	Б	56,283,760	11,121,600	67,405,360
	C_1	245,021,530	44,675,650	289,697,180
	A+Б+C_1	**301,305,29**	**81,945,040**	**383,250,330**
Field Radljevo	B	223,472,020	30,557,550	254,029,570
	Ц	169,743,800	47,179,910	216,923,710
	Б+C_1	**393,215,820**	**77,737,460**	**470,953,280**
	C_2	potential, estimated		191,363,430
Field Šopić - Lazarevac	B	109,712,900	-	109,712,900
	C_1	-	19,331,500	19,331,500
	Б+C_1	**109,712,900**	**19,331,500**	**129,044,400**
	C_2	potential, estimated		127,172,300
Field Zvizdar	B	78,944,740	-	78,944,740
	C_1	165,978,170	22,948,320	188,926,500
	Б+C_1	**244,922,910**	**22,948,320**	**267,871,240**
TOTAL RB KOLUBARA	A	64,882,090	114,472,950	179,355,030
	B	1,127,278,570	137,417,810	1,264,696,421
	C_1	913,064,140	288,458,480	1,201,522,630
	A+B+C_1	**2,105,224,800**	**540,349,240**	**2,645,574,081**
	C_2	**potential, estimated**		**318,535,730**

Kostolac coal basin

Overall minable reserves in Kostolac coal basin, at active mine Drmno, are 300 million tonnes of coal, while some 400 million tonnes of coal are balanced in western part of the basin.

Effectiveness of coal exploration at Drmno is best represented by the amount of reserves of B and C_1 categories of 643×10^6 t (with balanced reserves of 398×10^6 t and non-balanced of 245×10^6 t), including potential reserves of C_2 category, estimated at 164×10^6 t. Reserves of category B are around 55% of total explored reserves, while remaining 45% are of C_1 category. Balanced reserves are 61% of overall explored reserves, while non-balanced are remaining 39%.

B category reserves of $190x10^6$ t are 65% out of total minable reserves of $293x10^6$ t, while C_1 category reserves of $103x10^6$ t are 35%.

Effectiveness of coal exploration at western part of Kostolac basin is best represented by the amount of reserves of B and C_1 categories of $603x10^6$ t (with balanced reserves of $408x10^6$ t and non-balanced of $195x10^6$ t), including potential reserves of C_2 category, estimated at $36x10^6$ t. Reserves of category B are around 25% of total explored reserves, while 39% are of C_1 category. Balanced reserves are 63% of overall explored reserves, while non-balanced are remaining 37%. Conceptual contours of open pit mine total minable reserves of coal are $355x10^6$ t.

Total geological reserves of Kostolac basin are 1,643,802,637 t, where balanced B+C_1 category of reserves are 881,702,050 t, non-balanced B+C_1 category of reserves are 522,298,897 t and potential reserves of C_2 category are 239,801, 690 t of coal.

Active open pit mines

Balanced reserves of B+C1 category in Drmno deposit, according to Book of coal reserves in Drmno deposit (2013) on 31st March 2013, are 397,985,545 t and 245,271,819 t of non-balanced reserves of same category.

Designed open pit mines

Geological reserves of coal in Klenovik deposit, according to Book of coal reserves (2010) on 31st December 2010, are 8,595,000 t of B category and all of those are non-balanced. Balanced reserves of B+C1 category in Ćirikovac deposit, according to Book of coal reserves (2010) on 30th June 2010, are 75,505,300 t. According to the same reference there are 74,012,568 t of non-balanced reserves of B+C_1 category and estimated, potential reserves of C_2 category of 162,414,100 t of coal.

Potential open pit mines

According to the Book of reserves (2014) (not verified), balanced reserves of B+C_1 category in western part of Kostolac basin are 408,211,206 t, with 194,419,510 t of non-balanced reserves of same category, as well as 35,886,110 t of potential C_2 reserves. All of these reserves are within conceptual contours of designed open pit mines, while 208,671,468 t are outside of these contours. Afore mentioned reserves are balanced are balanced in Book of resources and reserves of coal, while the coal in third coal seam was not included. However, it should be mentioned that reserves in third coal seam are estimated in this reference at level of 1,024,000,000 t.

Overview of geological and minable coal reserves according to existing documentation

Overview of geological and minable coal reserves according to existing documentation for active, designed and potential open pit mines is given in Table 104.

As already mentioned, Kostolac basin has one active open pit mine in Drmno, designed mines are Klenovik and Ćirikovac, while potential open pit mines are Dubravica and Jagodica in western part of Kostolac basin.

Analysis of balanced reserves in Books of reserves for all four deposits in Kostolac basin, shows that balanced reserves are part of geological reserves of category B and C_1 which are fulfilling limiting criteria for mining (minimal thickness, minimal quality, etc.), without any objects on top of them with large value and whose extraction is economically viable, while non-balanced reserves are those whose extraction is not viable in relation to justifying afore mentioned limiting mining conditions.

Potential reserves are those reserves which are not explored at sufficient level, and as such are categorized in C_2 and D_1 categories. Minable reserves are balanced reserves, reduced by minable losses.

Table 104: Overview of coal reserves in Kostolac coal basin

Deposit	Category	Balanced reserves (t)	Non-balanced reserves (t)	Geological reserves (t)
Drmno	A			
	B	238,675,082	112,382,957	351,058,039
	C_1	159,310,462	132,888,861	292,199,323
	A +B+C_1	397,985,544	245,271,818	643,257,364
	C_2			
	Total	**643,257,364**		
		Minable reserves: 292,938,852		
Klenovnik	A			
	B		8,595,000	
	C_1			
	A +B+C_1			
	C_2			
	Total	**8,595,000**		
		Minable reserves: 0		
Ćirikovac	A			
	B	54,403,038	63,233,168	121,636,207
	C_1	19,102,261	8,779,400	27,881,661
	A +B+C_1	75,505,299	74,012,568	149,517,868
	C_2			162,414,100
	Total	**461,449,836**		
		Minable reserves: 0		
Western Kostolac	A			
	B	161,576,217	13,742,976	175,319,193
	C_1	246,634,989	180,506,190	427,141,179
	A +B+C_1	408,211,206	194,249,166	602,460,372
	C_2			208,671,468
	Total	**811,131,840**		
		Minable reserves: 408,211,206		
TOTAL KOSTOLAC	A	454,654,337	197,954,101	648,013,439
	B	425,047,712	322,174,451	747,222,073
	C_1	879,702,049	520,128,552	1,395,235,604
	A +B+C_1			371,085,568
	C_2	454,654,337	197,954,101	648,013,439
	Total	**1,766,321,172**		
		Minable reserves: 701,150,058		

Having in mind that Books on reserves are including analyses of balancing reserves mainly on conceptual solutions of open pit mining, reserves in Klenovnik and Ćirikovac deposit must be considered with some scepticism, by taking into account that limiting conditions of mining are changing both in space and in time. However, it should be mentioned that coal reserves in Klenovnik deposit are non-balanced and that this mine is permanently closed, and that reserves in Ćirikovac deposit are balanced, non-balanced and potential and that this mine is only temporarily closed.

Anyhow, it should be noted that Kostolac basin is a single coal deposit, which is artificially divided into existing fields. Regarding this aspect and for the purpose of better coal recovery, basin also can be considered as eastern, central and western part. At the moment, mining operations are taking place in the eastern part of the basin at open pit mine Drmno. Inactive mines Klenovnik and Ćirikovac are located in the central part of the basin, while activities in the

western part of the deposit were limited only to geological explorations. According to the Books of reserves, central part of Kostolac basin has 75 million tonnes of balanced reserves (Ćirikovac deposit), over 82 million tonnes of coal in non-balanced reserves (Klenovnik and Ćirikovac deposits), and over 160 million tonnes of potential reserves in Ćirikovac deposit. Therefore, it is necessary to perform detailed analysis, with suitable study, all potential solutions for valorisation both balanced and non-balanced and potential reserves of coal in this part of the basin, including connecting central and western part of the basin, for the purpose of exploitation and optimal recovery of reserves.

Planned explorations at Drmno deposit should be completed within five years cycles, meaning that field and laboratory works should be done in four years period while the fifth year includes development and approval of Book of reserves.

List of geological works and costs for exploration, by types, in single time cycle is given in Table 105.

Table 105: Overview of exploration cost in single time cycle

Works	Amount (€)
Multipurpose exploration works	1,500,000
Geological exploration works	1,000,000
Geotechnical exploration works	200,000
Hydrogeological exploration works	1,300,000
Total	**4,000,000**

Planned scope of geological explorations until the end of coal production at Drmno deposit will be completed in 8 five-year cycles with overall costs of 32,000,000 €. Cost of one five year cycle is 4,000,000 €, i.e. 800,000 € per annum. Exploration works are performed according to dynamics of coal mining, regarding recategorization of balanced reserves into higher rank of category.

Public Company for Underground Coal Mining (JPPEU)

Coal reserves of mines in JPPEU, on 31st December 2015, are approximately 600,000,000 t of coal, where most of these are brown coal-lignite and lignite types.

Table 106: Review of coal reserves in mines of JPPEU

Type	Balanced reserves (t)	Non-balanced reserves (t)	Total (t)
Hard coal	5,766,350	1,704,290	7,470,640
Brown coal	79,761,340	21,366,760	101,128,100
Brown-lignite coal	330,864,180	12,673,460	343,507,640
Lignite	178,995,000	3,184,000	182,179,000
Total	595,356,870	38,928,510	634,285,380

Kovin coal basin

Kovin basin (protected and not-protected parts) has verified reserves at level of 271 million tonnes of coal (5 million in not-protected part and 266 million in protected part).

Total geological reserves for Kovin coal deposit in protected part, fields A and B (Book of coal reserves in Kovin deposits, fields A and B, 2015) are 308,894,622 t, comprised of 167,206,129 t of B category and 141,688,493 t of C1 category. Balanced reserves included B and C1 category

of reserves above level of 0 m. Non-balanced reserves below this level are 42,786,864 t of coal. Total verified balanced reserves for protected part in fields A and B are 266,107,758 t of B+C_1 category, where 165,575,751 t are B category and 100,532,007 t are C_1 category. Quality parameters of this coal reserves are: moisture 42.83%, ash 20.42%, S total 1.05%, S in ash 0.64%, S combustible 0.59%, coke 33.46%, C-fix 17.88%, volatiles 23.33%, combustible 39.63%, lower calorific value 8,914 kJ/kg, upper calorific value 10,120 kJ/kg. Mining losses are 15%, meaning that minable reserves in the deposit are 226,107,758 t of coal. Coal quality is around 9,000 kJ/kg.

Total reserves in non-protected part of field A are somewhat over 5,000,000 t of coal, with calorific value around 9,000 kJ/kg and S content of 0.48%. Aside of coal, reserves of graver are verified at amount of 5,200,000 m^3.

At the moment, Kovin project is a potential project, which depends on findings of feasibility study for mine and thermal power plant. Project includes construction of new lignite mine and thermal power plant with installed capacity of 700 MW, in the Kovin municipality. Lignite mine will utilize underwater coal mining technology, which is already present in existing mine with smaller production rate (Rudnik Kovin a.d.) and it will be located in protected part on left bank of River Danube, in Kovin municipality, south of Gaj settlement and west of Dubovac settlement.

This project includes:

- Development of coal mine in protected part of Kovin deposit (fields A and B) in Kovin, with planned production of 6 million tonnes per annum, for underwater mining of 266 million tonnes of balanced coal reserves. Planned investments into the mine are 260 million €.
- Construction of thermal power plant with provisional power of 700 MW, according to all EU standards applicable to large boilers. Planned investments into the power plant are 900 million €m while expected annual production rate is 490 GWh of electricity.
- Expected life of the mine and the power plant is over 35 years.

Required technical documentation for obtaining approvals for mining and energy license for thermal power plant is expected in recent future. This documentation is Feasibility study for development of mine and Feasibility study for construction of thermal power plant. Both documents will be developed in accordance to Serbian legislation. Upon completion of feasibility studies more detailed data will be available regarding this project, which at this moment are not defined. Expected parameters to be established by these feasibility studies are related to:

- number of units-blocks of the thermal power plant;
- actual location of the power plant;
- actual power of the power plant;
- equipment for excavation of overburden and waste;
- equipment for excavation of coal;
- price of coal;
- price of electricity;
- diversity and dynamics of selling the coal and electricity;
- actual budget and investments;
- investment return period;
- other issues important for preparation and realization of Kovin project.

As planned, coal exploitation should start on 2023. However, having in mind remaining period, already developed documentation, as well as existing experience with underwater mining, it is unlikely that coal mining and electricity generation will start on 2023.

Štavalj - Sjenica basin

Sjenica coal basin has minable reserves of 117 million tonnes of coal, with average calorific value of 15,000 kJ/kg and S content of 0.98%. Štavalj mine is located in western Serbia, near state border to Montenegro. Mining at this location started in 1965.

Prefeasibility study for construction of thermal power plant and mine at Štavalj (DMT GmbH - Montan Consulting Germany, Faculty of Mining and Geology, University of Belgrade Serbia, SES TLMAČE Slovakia) was developed in 2007. Study analysed construction of 320 MW power plant. Planned investment for power plant are 375 million €, with additional 20 million € for connection to the grid. Overall investment into the mine are estimated at level of 90 million €, while overall investment into the mine throughout its operational life of 40 years are 391 million € (31 m€ for infrastructure, 357 m€ for equipment and 10 m€ in construction).

Required production rate of mine is 2.3 million t of coal per annum (including 60,000 t for wholesale).

It is necessary to carry out activities for further analysis of the available parameters, given the potential construction of the mines and thermal power capacities.

P.27. Opening of replacement capacities for existing open cast mines which will stop production and opening of open cast mines dedicated to new thermal power plants

Opening of new mines, i.e. expansion of existing mines, as well as opening of replacement ones for existing open pit mines which will stop production, including mines dedicated to new thermal power plants are considered for Kostolac, Kolubara, Kovin and Sjenica coal basins.

Single considered project for **Kostolac coal basin** was increased production rate of Drmno open pit mine from 9 to 12 million tonnes of coal per annum, due to construction of new block TPP Kostolac B3, with 350 MW power.

Considered projects in **Kolubara coal basin** included increase production rate of Field C in relation to opening of Field E, opening of Field E as a replacement for Field C and Field D mines, opening of Field G as a replacement for open pit mine Veliki Crljeni, and opening of open pit mine Radljevo in relation to equalizing coal quality and in later stage as a replacement for Tamnava West field mine. In case of requirement for increase of production rate, Radljevo mine can increase its production rate for possible new power plant.

Considered project for **Kovin basin** was opening of new underwater mine for supplying the coal to new thermal power plant, with installed power of 700 MW.

Sjenica basin is included with project of new 320 MW power plant, which requires coal supply from the Štavalj underground mine, at level of 2.3 million t per annum.

Table 107: Main properties and outcomes of project "Completion of investment development and increased production rate of Drmno mine

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Infrastructure and traffic routes 9 mt	3,900,000 € (EPS resource)	Completion of investment development of Drmno mine for 9,000,000 tpa of coal, including production rate increase to 12,000,000 tpa of coal, enables safe supply of existing plants TPP Kostolac A and TPP Kostolac B with installed power of 1,007 MW, as well as supply of planned TPP Kostolac B3 (350 MW) with average coal quality of 9,800 kJ/kg. Total investments are around 350,000,000 €, while production rate of 12,000,000 tpa will be available since 2020.	Execution of project for production rate increase of Drmno mine enables continuity of electricity production, including supply of necessary amounts of coal for new block TPP Kostolac B3. Based on overall reserves of coal at Drmno mine overall electricity production of 200,000 GWh is feasible. Economic flow of the project provides Internal rate of return of: **IRR=10.42%** Economic flow of the project also provided calculation of net present value with discount rate of 8% at level of: **NPV**=107,017,210 € **NPV per t of coal**=0.39 €/t Acquisition of new ECS system with frequency regulation on drives (8 drive stations) and capability of velocity change in relation to production rate. Energy savings will be on level of 10% to 30%, i.e. savings of 540,000 kWh on annual level for system.
Revitalization of existing equipment at Drmno mine	13,500,000 € (EPS resource)		
Acquisition of new and completion of existing conveyors for rate of 9 million t	55,500,000 € (EPS resource)		
Acquisition of auxiliary mechanization	8,000,000 € (EPS resource)		
Coal quality management	5,000,000 € (EPS resource)		
Equipment for production rate increase to 12,000,000 tpa	120,000,000 € (SMEK credit and EPS resource)		
Technology change of ECS and ECC systems	59,000,000 € (EPS resource)		
Drainage-dewatering	80,000,000 € (EPS resource)		

Table 108: Missing planning and technical documentation

Project	Status of project preparation	Missing planning and technical documentation
Completion of investment development and production rate increase at Drmno mine	Finished feasibility study and Main mining project	Project of exploitation, Equipment assembly projects for 5 ECS systems

Table 109 Dynamics of activities within the referent period of Program

Project: Completion of investment development and production rate increase at Drmno mine	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Project documentation	EPS	x						
Preparation of technical documentation		x						
Approvals and acceptances by ministries and institutions		x	x					
Infrastructure and traffic routes 9 mt		x						
Revitalization of existing equipment at Drmno mine		x	x					
Acquisition of new and completion of existing conveyors		x	x	x				
Acquisition of auxiliary mechanization								
Coal quality management		x	x	x				
Power supply and communication								
Equipment for production rate increase to 12,000,000 tpa		x	x	x				
Technology change of ECS and ECC systems			x					
Drainage-dewatering		x	x	x	x	x	x	x
Excavation of overburden		x	x	x	x	x	x	x
Excavation of coal		x	x	x	x	x	x	x

Risks: Public procurements for work and services, completion of Chinese credit, stability of internal waste dump, acquisition of new equipment, realization of drainage system

Kolubara coal basin

Considered projects in **Kolubara coal basin** included increase production rate of Field C in relation to opening of Field E, opening of Field E as a replacement for Field C and Field D mines, opening of Field G as a replacement for open pit mine Veliki Crljeni, and opening of open pit mine Radljevo in relation to equalizing coal quality and in later stage as a replacement for Tamnava West field mine. In case of requirement for increase of production rate, Radljevo mine can increase its production rate for possible new power plant.

Field G

Open pit mine Field G is opened as a replacement for mine Veliki Crljeni. Designed production rate is 5,000,000 tpa of coal.

Following sub-projects must be completed in order to start the open pit mine Field G as a replacement for mine Veliki Crljeni:

- Relocation of River Kolubara in 2nd phase in total length of 2.6 km;
- Relocation of River Peštan in length of 1.8 km;
- Relocation of regional road M22 Belgrade-Gornji Milanovac (Ibarska magistrala) in length of 7.24 km;
- Relocation of 110 kV high voltage power line (2 pieces into one double line);
- Relocation of 35 kV high voltage power line (5 pieces);
- Relocation of settling ponds and facility for waste water treatment in Kolubara Prerada;
- Relocation of springs and water intakes;
- Acquisition of new equipment (self-propelled conveyor, 3 belt conveyors B=1,600 mm and 2 distribution stations);
- Revitalization and modernization of existing main equipment;
- Acquisition of new auxiliary mechanization.

Table 110: Main properties and outcomes of project "Opening of open pit mine Field G"

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Relocation of River Kolubara in 2nd phase in total length of 2.6 km	10,460,000 € (EPS resource)	Open pit mine Field G is a replacement for Veliki Crljeni mine. Field G will secure sufficient coal for safe supply of TPP Nikola Tesla. Planned production rate is 5,000,000 tpa of coal with calorific value of 8,150 kJ/kg. Coal of this quality enables blending with lower quality coal from Tamnava West Field and Radljevo mines, thus making possible to utilize large amounts of coal with poorer quality making better recovery of deposit and increase its potential. Total investments are 60,605,585 €. Start of overburden production is in 2017, and start of coal production is in 2018.	Execution of opening of Field G mine enables continuity of electricity production. Based on overall reserves of coal at Field G mine overall electricity production of 30,000 GWh is feasible. Economic flow of the project provides Internal rate of return of: **IRR=14.86%** Economic flow of the project also provided calculation of net present value with discount rate of 8% at level of: **NPV**=21,634,494 € **NPV per t of coal**=0.60 €/t This open pit mine will use old equipment therefor no additional outcomes regarding energy efficiency will occur.
Relocation of River Peštan in length of 1.8 km	1,370,000 € (EPS resource)		
Relocation of regional road M22 in length of 7.24 km	5,850,000 € (EPS resource)		
Relocation of 110 kV power line and relocation of 35 kV power line (5 pieces)	2,000,000 € (EPS resource)		
Relocation of springs and water intakes	4,220,000 € (EPS resource)		
Relocation of settling ponds and facility for waste water treatment in Kolubara Prerada	5,000,000 € (EPS resource)		
Acquisition of new main and auxiliary equipment	29,500,000 € (EPS resource)		
Revitalization and modernization of existing main equipment	15,000,000 € (EPS resource and maintenance resource)		
Investment overburden	2,100,000 € (EPS resource)		

Table 111: Missing planning and technical documentation

Project	Status of project preparation	Missing planning and technical documentation
Opening of open pit mine Field G	Project documentation completely developed	Spatial plan is on approval.

Table 112: Dynamics of activities within the referent period of Program

Project: Opening of open pit mine Field G	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Project documentation	EPS	x						
Preparation of technical documentation		x						
Environmental and social impact assessment		x						
Approvals and acceptances by ministries and institutions		x						
Relocation of River Kolubara in 2nd phase in total length of 2.6 km		x						
Relocation of regional road M22 in length of 7.24 km		x	x	x				
Relocation of springs and water intakes			x	x				
Relocation of 110 kV power line and relocation of 35 kV power line		x	x					
Relocation of settling ponds and facility for waste water treatment		x						
Acquisition of new main and auxiliary equipment		x	x					
Revitalization and modernization of existing main equipment		x						
Excavation of overburden		x	x	x	x	x	x	x
Excavation of coal			x	x	x	x	x	x

Risks: Public procurements for work and services, relocation of infrastructure (rivers, roads, etc.)

Field C

Investments in open pit mine Field C are in function of achieving design production rate and opening of open pit mine Field E which is replacement for mine Field D. Designed production rate (according to new Additional project which is used for approval procedure) starts with 3,000,000 tpa in 2017, following with 4,000,000 tpa in successive years until 2030.

Following sub-projects must be completed in order to start the open pit mine Field E as a replacement for mine Field D:

- Acquisition of ECS system, with production rate of 6,600 m^3/h (bucket wheel excavator, belt conveyors B=2,000 mm with 4 drive stations and length of 5,000 m and stacker for capacity of 8,800 m^3/h);
- Recovery of internal waste dump and start of dumping in the area of former mines Field A and Glina.

Field E

Open pit mine Field E is a replacement for mine Field D. Designed production rate is 12,000,000 tpa of coal. Following sub-projects must be completed in order to start the open pit mine Field E as a replacement for mine Field D:

- Acquisition of ECS system, with production rate of 6,600 m^3/h (bucket wheel excavator, belt conveyors B=2,000 mm and stacker for capacity of 8,800 m^3/h);
- Acquisition of haulage equipment and equipment for selective excavation;
- Revitalization of existing equipment;
- Acquisition of auxiliary equipment;
- Construction of retention dams and regulation of River Peštan;
- Construction of infrastructure (assembly lot, workshops, etc.);
- Relocation of roads;
- Land acquisition.

Table 113: Main properties and outcomes of project "Opening of open pit mine Field E (completion of investment development of Field C)"

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Relocation of infrastructure	41,230,000 € (EPS resource)	Open pit mine Field E, as replacement for mines Field D and Field C, will secure sufficient coal supply to TPP Nikola Tesla. Planned production rate increase on Field C to 6,000,000 tpa with mining at NW part of Field D at rate of 6,000,000 tpa to 11,000,000 tpa (until 2020) and mining of 1,300,000 tpa to 5,000,000 tpa from roof seam of Field E with equipment from mine Field D. Mining at Field E is planned for 2025. Total production rate is 12,000,000 tpa (5,000,000 tpa roof seam and 7,000,000 tpa main seam). Total investments are 235,200,000 €, with additional 510,214,000 € until the end of the life of the mine, i.e. total of 745,214,000 €. Planned production rate is 11,000,000 tpa.	Execution of opening of Field E mine enables continuity of electricity production. Based on overall reserves of coal at Field E mine overall electricity production of 190,000 GWh is feasible. Economic flow of the project provides Internal rate of return of: **IRR=11.42%** Economic flow of the project also provided calculation of net present value with discount rate of 8% at level of: **NPV**=170,495,911.15 € **NPV per t of coal**=0.41 €/t Acquisition of new ECS system with frequency regulation on drives (4 drive stations) and capability of velocity change in relation to production rate. Energy savings will be on level of 10% to 30%, i.e. savings of 300,000 kWh on annual level for system. Later on, two additional systems are acquired.
Relocation of settlements	9,340,000 € (EPS resource)		
Construction of infrastructure	7,200,000 € (EPS resource)		
Field C new equipment (ECS system)	79,000,000 € (EBRD bank)		
Equipment for Field D south wing (roof seam of Field E)	80,400,000 € (EPS resource)		
Field E (equipment until 2020)	3,500,000 € (EPS resource)		
Drainage-dewatering	15,000,000 € (EPS resource)		
Geological exploration	7,780,000 € (EPS resource)		
Acquisition of new auxiliary equipment	34,000,000 € (EPS resource)		

Table 114: Missing planning and technical documentation

Project	Status of project preparation	Missing planning and technical documentation
Opening of open pit mine Field E	Completed feasibility study and Main mining project	Renewal of Feasibility study, Main mining project for mine Field E, Environmental impact assessment.

Table 115: Dynamics of activities within the referent period of Program

Project: Opening of open pit mine Field E	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Project documentation	EPS	x	x					
Preparation of technical documentation		x	x					
Approvals and acceptances by ministries and institutions			x	x				
Relocation of infrastructure			x	x				
Relocation of settlements		x	x					
Construction of infrastructure			x	x	x	x	x	x
Field C new equipment (ECS system)			x	x	x			
Equipment for Field D south wing (roof seam of Field E)		x						
Field E (equipment until 2020)			x	x	x			
Drainage-dewatering			x	x	x			
Geological exploration		x	x	x	x	x	x	x
Excavation of overburden (including Field C)			x	x	x	x	x	x
Excavation of coal (including Field C)		x	x	x	x	x	x	x

Risks: Public procurements for work and services, recovery of mining benches and internal waste dump of Field C and Field D, relocation of infrastructure, financing

Field Radljevo

Open pit mine Radljevo is opened as additional capacity in western part of Kolubara basin, for purpose of equalizing coal quality. In western part of Kolubara basin coal series contains numerous dirt intrusions and coal is with highly variable quality. In order to equalize coal quality and utilize low quality reserves, coal from mine Radljevo will be blended with coal from mine Tamnava west field and mine Field G. In this case, production rate on Field G will be reduced and high quality reserves will preserved for homogenization. In case of construction of new power plant, production rate of Radljevo mine will be increased. Approval procedure is on-going at the moment for mining in this mine, which will be followed with acquisition of approvals for development of mines and execution of mining activities. Following sub-projects must be completed to open mine Radljevo:

- Land acquisition;
- Relocation of infrastructure;
- Acquisition of new and auxiliary equipment;
- Acquisition of ECS system, with production rate of 6600 m^3/h (bucket wheel excavator, belt conveyors B=2000 mm with 4 drive stations and length of 5000 m and stacker for capacity of 8800 m^3/h);
- Acquisition of used system with production rate of 4100 m3/h;
- Acquisition of 2 coal systems with production rate of 4100 m3/h;
- Acquisition of stacker for inter-burden;
- Acquisition of haulage equipment;
- Acquisition of drainage-dewatering equipment;
- Construction of infrastructure;
- Relocation of roads.

Table 116: Main properties and outcomes of project "Opening of open pit mine Radljevo"

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Land acquisition and infrastructure	17,500,000 € (EPS resource)	Opening of Radljevo mine will compensate lack of production in western part of Kolubara basin with simultaneous reduction of production rate at Field G, thus preserving required coal quality for combustion in TPPs. Coal series in Radljevo mine has numerous dirt intrusions, thus reducing coal quality and making it more difficult for use in power plants. Blending of this coal with one from Field G will result in coal of sufficient quality and in same time enable recovery of reserves with poorer quality. In case of new power plants, production rate on Radljevo mine can be increased easily. Investments for production rate of 6,000,000 tpa of coal are 640,000,000 €. Start of production is planned for 2021. Total investments until 2023 are around 245,000,000 € and until the end of operational life are 640,000,000 €.	Execution of opening of Radljevo mine enables continuity of electricity production, and production rate can be easily increased in case of construction of new TPP. Economic flow of the project provides Internal rate of return of: **IRR=11.76%** Economic flow of the project also provided calculation of net present value with discount rate of 8% at level of: **NPV**=129,731,120 € **Avg. net profit** = 6.92 €/t **NPV per t of coal**=0.54 €/t Acquisition of new ECS system with frequency regulation on drives and capability of velocity change in relation to production rate. Energy savings will be on level of 10% to 30%, i.e. savings of 540,000 kWh on annual level for system.
Investment overburden	10,500,000 € (EPS resource)		
Main equipment	142,500,000 € (EPS resource)		
Auxiliary equipment	6,760,000 € (EPS resource)		
Power supply	4,590,000 € (EPS resource)		
Coal quality management system	5,500,000 € (EPS resource)		
Drainage-dewatering	10,190,000 € (EPS resource)		
Geological exploration	8,300,000 € (EPS resource)		

Table 117: Missing planning and technical documentation

Project	Status of project preparation	Missing planning and technical documentation
Opening of open pit mine Radljevo	Completed feasibility study and Main mining project	Approval procedure for Spatial plan Fire protection project

Table 118: Dynamics of activities within the referent period of Program

Project: Opening of open pit mine Radljevo	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Project documentation	EPS	x						
Approvals and acceptances by ministries and institutions		x	x					
Land acquisition and infrastructure		x	x	x	x	x	x	x
Investment overburden								
Acquisition of used excavator and stacker		x	x					
Main equipment			x	x	x	x	x	x
Auxiliary equipment			x		x	x	x	x
Power supply								
Coal quality management system			x	x			x	
Drainage-dewatering			x	x	x	x	x	
Geological exploration		x	x	x	x	x	x	x
Excavation of overburden			x	x	x	x	x	x
Excavation of coal						x	x	x

Risks: Public procurements for work and services, investments

Tamnava west field

To complete investment development of Tamnava west field it is necessary to acquire stacker and belt conveyor for inter-burden (with capacity of 12,000 m^3/h), bucket wheel excavator and self-propelled conveyor (capacity 4,500 m^3/h), as well as finalizing construction of crushing facility and development of second SUP line and introduction of coal quality management system. Also it is necessary to perform refurbishment and modernization of equipment damaged in flood, and to solve the issue of remaining mud in relation to waste dump stability.

Table 119: Main properties and outcomes of project "Finalizing investment development of Tamnava west field mine"

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Construction of roads Paljuvi-Jabučje, Jabučje-Skobalj, Jabučje-Viš and hydro facilities	2,750,000 € (EPS resource)	Finalizing investment development of Tamnava west field mine is final stage of investment cycle in this mine, which started in 1986. Mine achieved designed production rate but investments are not completed. Beside this, catastrophic flood in 2014 made great damage to the mine. These investments are including missing equipment (mainly for inter-burden, coal transport, finalizing stock yard and introduction of coal quality management system), as well as refurbishment and modernization of flooded equipment and acquisition of new equipment. Finalizing investment cycle are creating conditions for supplying sufficient amount of coal to TPP Nikola Tesla. Planned production rate is 14,000,000 tpa until 2018, followed by 11,000,000 tpa of coal with quality of 7,000 kJ/kg. Total investment until 2025 is 250,000,000 €, and until the end of operational life 351, 389,540 €.	Execution of finalizing investment development of Tamnava west field mine project enables continuity of electricity production. Based on overall reserves of coal at Tamnava west field mine overall electricity production of 180,000 GWh is feasible. Economic flow of the project provides Internal rate of return of: **IRR=35.57%** Economic flow of the project also provided calculation of net present value with discount rate of 8% at level of: **NPV**=519,305,043.35 € **Avg. net profit** = 8.44 €/t **NPV per t of coal**=1.95 €/t Old and flooded equipment is completely modernized with new electric equipment. Energy savings 10% to 30%.
Land acquisition and relocation of Skobalj settlement	31,000,000 € (EPS resource)		
Construction of new stock yard and introduction of coal quality management system	54,400,000 € (KfW bank)		
Stacker for inter-burden (12,000 m^3/h)	18,700,000 € (KfW bank)		
New bucket wheel excavator (4500 m^3/h) and transfer belt conveyor	24,500,000 € (EPS resource)		
Refurbishment and modernization of equipment damaged in flood.	29,500,000 € (EPS resource, World Bank)		
Belt conveyors for inter-burden and coal	30,300,000 (EPS resource)		
Acquisition of auxiliary equipment	15,400,000 € (EPS resource)		
Drainage-dewatering	15,000,000 € (EPS resource)		

Table 120: Missing planning and technical documentation

Project	Status of project preparation	Missing planning and technical documentation
Finalizing investment development of Tamnava west field mine	Complete project documentation is finalized	Special purpose plan for land acquisition and relocation of Skobalj settlement

Table 121: Dynamics of activities within the referent period of Program

Project: Finalizing investment development of Tamnava west field mine	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Construction of roads Paljuvi-Jabučje, Jabučje-Skobalj, Jabučje-Viš and hydro facilities	EPS	x						
Land acquisition and relocation of Skobalj settlement		x	x					
Construction of new stock yard and introduction of coal quality management system		x	x					
Stacker for inter-burden (12,000 m^3/h)		x	x					
New bucket wheel excavator (4,500 m^3/h) and transfer belt conveyor			x	x	x			
Refurbishment and modernization of equipment damaged in flood.		x	x	x				
Belt conveyors for inter-burden and coal		x	x					
Acquisition of auxiliary equipment		x	x					
Excavation of overburden		x	x	x	x	x	x	x
Excavation of coal		x	x	x	x	x	x	x

Risks: Public procurements for work and services, Recovery of internal waste dump from consequences of 2014 flood

P.28. Optimization and concentration of underground coal production

JPPEU Resavica is a single company, with status of public company and 100% owned by Republic of Serbia. Main activity of the company is coal production. Mining takes place in 9 parts of the company and these are:

- Anthracite mine "Vrška Čuka", Avramica
- Ibarski hard coal mines, Baljevac
- Brown coal mine "Rembas", Resavica,
- Brown coal mine "Bogovina", Bogovina
- Brown coal mine "Soko", Soko Banja
- Brown coal mine "Jasenovac", Krepoljin
- Brown coal mine "Štavalj", Štavalj
- Lignite mine "Lubnica", Lubnica
- Aleksinac mine, contracting services in other mines.

Beside main activity of underground mining, company also operates one open pit mine Progorelica and one boron underground mine Pobrđski potok.

Overall production of all mines is around 550,000 tpa, while planned production for 2017 is 580,000 tpa.

- Anthracite mine "Vrška Čuka", Avramica, - 5,000 t
- Ibarski hard coal mines, Baljevac - 125,000 t
- Brown coal mine "Rembas", Resavica, - 175,000 t
- Brown coal mine "Bogovina", Bogovina - 15,000 t
- Brown coal mine "Soko", Soko Banja - 90,000 t
- Brown coal mine "Jasenovac", Krepoljin - 42,000 t
- Brown coal mine "Štavalj", Štavalj - 85,000 t
- Lignite mine "Lubnica", Lubnica - 45,000 t

Program for restructuring of Public Company for Underground Coal Mining is currently being developed. This Program will start as soon as it is approved by the Government of Republic of Serbia. Program will define which mines will be closed due to lack of coal reserves and poor economic performances which are showing no trend in improving income. Also, Program will define mines with resource potential, as well as capabilities to increase income with investments.

Plan is to increase production of coal to 600,000-700,000 tpa after optimization and concentration of coal production. Precondition is to finalize investment in Soko mine (investment in equipment and new technology), thus creating conditions for higher production rate in this mine.

Higher production rate in Štavalj mine is related to construction of new thermal power plant, due to lack of the coal market in this region of Serbia.

Even higher production rates are feasible, but only after opening underground mines in Ćirikovac and Poljana deposits.

There is a possibility of opening new coal deposits, with previously prepared investment documentation that will take into account all necessary parameters on the basis of which it can be concluded whether there is economic justification for opening them.

P.29. Introduction of coal quality management system

Serious problems are caused in thermal power plants because of large variations of delivered coal quality. Problems are mainly reflected through:

- Output power of power plants declines below nominal level due to poor quality of coal;
- Coal with low calorific value causes low efficiency of boilers and consumption of larger amounts of coal per produced MWh;
- Low calorific value of coal could cause problems with maintaining heat energy pressure and steam in boilers, resulting in consuming (expensive) oil fuel;
- Low calorific value of coal requires higher utilization of crushers to secure higher intake of coal into boiler, resulting in larger electricity consumption.

Beside advantages with easier combustion in power plants, coal homogenization enables mining of reserves with lower quality (which are blended on the open pit mine or stock yard with coal of better quality), thus resulting in higher recovery of the deposit. Also, coal homogenization has advantages related to environment protection (mainly by elimination of coal self-combustion at the stock yards).

Coal quality is the main cause for partial failures, which are resulting in lower productivity of power plants by 5%, meaning 180 MW lower power in production. Losses due to partial failures in power plants are 1200 GWh, all caused with insufficient coal quality. Introduction of homogenization (coal quality management) will eliminate around 30% of total losses (or reduction of 370 GWh) and save up to 9,000,000 € per year.

Coal quality management system will be introduced at three locations, therefore three sub-projects are defined:

1. Introduction of coal quality management system in western part of Kolubara basin (open pit mines Tamnava west field and Field G, later on Radljevo);
2. Introduction of coal quality management system in eastern part of Kolubara basin (first Fields C and D, and later on Field E);
3. Introduction of coal quality management system in Drmno mine - Kostolac.

These three sub-projects are on various level of development:

1. **Introduction of coal quality management system in western part of Kolubara basin**: complete investment documentation is finished, active public procurement procedure, selected contractor and currently at stage of base and detailed engineering. Complete finish of project is expected at the end of 2017. Value of investment is 54.4 million €, financed by KfW bank, bank donations and EPS resources.
2. **Introduction of coal quality management system in eastern part of Kolubara basin**: currently is in stage of development of technical and tendering documentation. Completion of documentation is expected during 2017. Expected schedule of the project depends on suggested solutions in documentation, but the project will be probably introduced in stages, with utilization of existing facilities in "Kolubara Prerada" until its closure, and later on with construction of new coal stock yard and crushing facility in the area of Vreoci village, which will be relocated. Planned amount is around 90,000,000 €, financed from EPS resources.
3. **Introduction of coal quality management system in Drmno mine - Kostolac**: Completed technical and tendering documentation, tendering procedure is expected during 2017. Expected finish is 2018. Planned amount is 5,225,230 €, financed from EPS resources.

Table 122: Main properties and outcomes of project "Introduction of coal quality management system"

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Introduction of coal quality management system in western part of Kolubara basin	54,400,000 € KfW bank	Equalizing coal quality for optimal combustion in power plants. Utilizing low quality coal by blending with high quality coal, thus increasing recovery of the deposits. Higher efficiency of power plants. Reduced consumption of oil fuel in TPPs. Reduced pollution at stock yards caused by self-combustion of low quality coal.	Coal homogenization project at Tamnava mine secures increase energy efficiency in power generation at TPP Nikola Tesla, extends the operational life of available reserves in deposit and reduces total cost of electricity generation. Economic evaluation was done separately for Tamnava mine and TPP Nikola Tesla B. Achieved internal rate of return for mine is: **IRR = 8%** and for power plant is: **IRR = 238%**
Introduction of coal quality management system in Drmno mine - Kostolac	5,225,230 € EPS resource		Coal homogenization project at Drmno mine secures increase energy efficiency in power generation at TPP Kostolac, extends the operational life of available reserves in deposit and reduces total cost of electricity generation. Economic flow of the project provides Internal rate of return of: **IRR=57.3%** and it is very high for mining project, but it objectively depicts all the benefits of coal homogenization, which generates 410,000 t of coal for combustion in TPP n value sense. This means that period for investment return is 1.8 years, after starting coal homogenization. Economic flow of the project also provided calculation of net present value with discount rate of 8% at level of: **NPV=2,037.5 million RSD**
Introduction of coal quality management system in eastern part of Kolubara basin	90,000,000 € EPS resource		Project is in development stage. Research of BCG indicated that some 30% of total losses in TPP or 370 GWh can be eliminated by coal homogenization, which equals to 9.2 million € per year.

Table 123: Missing planning and technical documentation

Project	Status of project preparation	Missing planning and technical documentation
Introduction of coal quality management system	Introduction of coal quality management system in western part of Kolubara basin is in implementation stage. Finalizing engineering and activities on stock yard started. Completion of works - beginning of 2018. Introduction of coal quality management system in Drmno mine is in tendering preparation for selection of contractor. Introduction of coal quality management system in eastern part of Kolubara basin is in development stage.	Study "Introduction of coal quality management system in eastern part of Kolubara basin" is in development.

Table 124: Dynamics of activities within the referent period of Program

Project: Introduction of coal quality management system	Responsible entity	2017	2018	2019	2020	2021	2022	2023
Introduction of coal quality management system in western part of Kolubara basin project realization	EPS	x	x					
Introduction of coal quality management system in Drmno mine-project realization		x	x	x				
Tendering procedure		x						
Acquisition and assembly of equipment at Drmno mine			x	x				
System running-in			x	x				
Introduction of coal quality management system in eastern part of Kolubara basin-project realization		x	x	x	x			
Finalizing of Feasibility study		x						
Tendering procedure			x					
Acquisition and assembly of equipment at Drmno mine			x	x	x			
System running-in				x	x			

Risks: Public procurements for work and services, exploration works of poor quality

P.30. Introduction of new organization at EPS's open pit mines for purpose of work improvement and higher efficiency of EPS open pit mines

EPS, with assistance of Boston Consulting Group, defined set of required measures to improved efficiency and profitability of coal production, and at same time to maintain competitive price of electricity on world market and to reduce business costs. The purpose of these measures is to ensure safe supply of coal with sufficient quality to power plants. Main defined targets are:

- improvement of occupational safety;
- increasing utilization of mining machinery to level existing in central Europe;
- increasing automation level on production systems, for purpose of safer work and reduced number of workers;
- implementation of homogenization and coal quality management on all open pit mines;
- better planning and execution of land acquisition;
- more efficient utilization of available working hours (pauses, work on holidays and Sundays);
- improvement of maintenance system.

Priorities were defined, and expected profit in four year period is 235,000,000 €. This will create funding for new investments and opening of replacement mines.

Table 125: Main properties and outcomes of project "Improving efficiency of EPS's open pit mines"

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Improved efficiency of Prerada	-	Improving efficiency of drying process. Increase the price of heat energy and reducing subsidies to local community. Terminate internal railway..	Reduction of workers by 250; Reduced costs by 8,000,000 €; Increased income by 12,000,000 €
Increasing automation level in mines	one-time investment of ~10M€ and annual investments of 0.7 M€ per annum EPS resource	There are 96 drive stations in Kolubara, with over 1,000 workers. All manually controlled stations should be improved to remote controlled stations, except those planned for replacement in 2018 (Field E).	Reduction of workers by 560; Reduced costs by 5,000,000-6,000,000 €;
Increasing utilization of mining machinery	-	Replacement of old/outdated auxiliary mechanization, to increase availability. Improve land acquisition to ensure proper conditions for excavators. Construct roads to improve efficiency of auxiliary equipment and reduce travelling time through mines. Improve planning and maintenance execution.	Reduced costs by 15,000,000-25,000,000 €;
Improvement of capital maintenance through aggregate replacement of parts	15,000,000 € EPS resource	Reduce time for capital investment with higher aggregate replacement of parts. Invest into replacement of parts/components and their renewal and transport to location before failure of the system.	Reduced costs by 10,000,000-15,000,000 €;
System operation during break of the crew	-	System operation during pause. Pay the crews to work instead to have a break. Alternative is to use reserves to organize replacement crews to operate systems during the break of the original crew.	Reduced costs by 10,000,000-15,000,000 €;

Technical properties	Value of project and source of finance	Description of outcomes	Valorised averaged annual outcomes according to available documentation
Reducing the number of drivers	6,000,000 € EPS resource	Current road conditions are causing necessity to have assigned drivers to transport staff across the mines. Better roads on the mines will reduce requirements for drivers. Shift staff will drive the vehicles to their stations.	Reduction of workers by 200; Reduced costs by 2,000,000-3,000,000 €; Net savings 10,000,000 € in period of 6 years.
Reducing the cost of electricity through reactive power compensation	500,000 € EPS resource	Reducing costs of electricity through compensation of reactive energy. Solution is suggested in project "More rational utilization of energy through compensation of reactive energy in Kolubara", developed by Electro-technical Institute Nikola Tesla	Savings due to reduced extensive use of reactive energy by 230,000 € per annum (reduced consumption of reactive energy by 75,000,000 kvarh per annum); Savings due to reduced losses at level of 70,000 € per annum (reduced losses of active energy by 1,600,000 kWh per annum).
Reducing the cost of external services	-	Conduct detailed analysis of causes for higher costs and identify unnecessary increases in scope of given services. Secure competitive selection process for this type of services. Reduction of external services.	Reduced costs by 1,000,000-5,000,000 €;
Centralization and optimization of warehouse management	-	Implement centralized warehouse management in single unit/sector. Unify items catalogue. Supervise work orders and reserved materials/items. Consider to organize only one or two warehouses for accepting items.	Reduced costs by 1,000,000-5,000,000 €;

3.6.3. Sub-sector of Environmental Protection in Coal Sector

Main environmental protection aspects in coal sector (required environment impact assessments and prevention measures for not allowed environmental impact) in the area of coal mining, beside all the legislation listed in chapter 1, are additionally stipulated by Law on Mining and Geological Exploration (Official Gazette RoS, no. 101/2015). Projects listed in this chapter are mainly dedicated to reduced negative impact of coal exploitation on the environment.

One of the on-going projects is commissioning of new Excavator-Conveyor-Stacker (ECS) system in Kolubara basin, as a part of the project "Improve mining technology in MB Kolubara to increase thermo power plants efficiency and to reduce its environmental impact ", which is under credit of EBRD and KfW banks at level of 140 million €.

Purpose of this project is to secure reliable and continuous supply of coal, rational management of natural resources, including reduced pollution of ambient air, surrounding thermal power plants using coal from Kolubara basin. Project has technological importance, regarding environmental impact through harmful substances as well as social importance. Therefore, state-of-the-art environment protection measures are applied, in order to minimize impact of the equipment on the existing environmental condition. Special attention was given to spot and linear noise and dust emitters, for the purpose of elimination of their impact on the environment and neighbouring population.

Regarding noise protection, all requirements are met defined by standard "Acoustics - description of measuring and assessment of noise in the environment" - part 1 "Basic values and assessment procedures" standard SRPS ISO 1996-1 and part 2 "Establishment of noise levels in the environment" standard SRPS ISO 1996-2, which are identical to standards ISO 1996-1 and ISO 1996-2 2007 "Act on noise indicators, limiting values, methods for assessment of noise indicators, disturbances and harmful effects of noise in the environment" (Official Gazette RoS, no. 75/10) requirements of Action plan for environment protection (ESAP from Project on improving condition of environment in Kolubara basin) and Policy of environment protection and social policy of EBRD from 2008. Maximal level of noise after commissioning will concur to "Act on noise indicators, limiting values, methods for assessment of noise indicators, disturbances and harmful effect of noise in the environment".

For zone 4 "Business-residential areas, trading-residential areas and playgrounds", according to this Act, defined maximal level of noise during daytime is 60 dBA, and for night-time is 50 dBA. Most recent measures are applied for noise suppression, caused by surface mining technology, which are also used on open pit mines in Germany. Equipment used in the process has reduced noise level (rollers on belt conveyors with balance G 16, enclosure of belt conveyor drive stations, etc.).

Concerning protection from impact of suspended particles, all conditions are in accordance to limits, tolerance values and limit of tolerance as defined by "Decision of Government of Republic of Serbia on conditions for monitoring and requirements of air quality (Official Gazette RoS, no. 11/2010) and requirements of Action plan for environment protection (ESAP from Project on improving condition of environment in Kolubara basin) and Policy of environment protection and social policy of EBRD from 2008. This Directive if in complete compliance to norms provided in EU Directive 2008/50/EC (Directive 2008/50/EC on ambient air quality and cleaner air for Europe, Official Journal of the European Union L 152/31 11.6.2008). Air pollution is measured by monitoring and measuring concentration of suspended particles (PM10, PM2.5) in air, taking samples and their analysis. This area also included most recent methods for dust suppression (installed water sprinklers on all transfer points of material, starting at excavating point, over belt conveyors to the stacking). Dust suppression is also performed along the roads around this system.

Same approach will be used on new ECS system (VI ECS system) at open pit mine Drmno. Also, all new systems operating in EPS mines will utilize this system for environment protection.

Reclamation projects of degraded terrain was completed for all open pit mines of EPS, and these will be activated as soon as conditions on internal waste dumps allow (Remark: According to the Law on Mining and Geological Exploration, part of the Main mining project and Additional mining project are Technical projects on reclamation, which are executed once the conditions allows within the mine).

Monitoring of surface water quality released into recipients as a part of drainage, is taking place on all open pit mines. Also, control of ground water quality is organized through wells.

3.7. Sector of Energy Efficiency in Energy Consumption

Energy efficiency in area of final energy consumption and energy sources is regulated by two laws: Energy Law ("Official Gazette of the Republic of Serbia", no. 145/2014) and the Efficient Use of Energy Law ("Official Gazette" no. 25/2013) in Serbia. Through these two laws the requirements of Directive 2006/32/EC about energy efficiency of final consumption and energy services (ESD) have been transposed. In the meantime Directive ESD was replaces by a new-formed Directive 2012/27/EU about Energy Efficiency Directive (EED), whose obligatory implementation, for the signatories of the Contract of Energy community establishment, starts at the end of 2017, in accordance to the decision of the Ministerial Council (D/2015/08/MC -ENC) from October 2015. Decision defines out the terms and requirements for the performance of particular EED regulations which are different in regards to the members of the EU. Even though direct adjustment with new Directive has not been made yet, the aforementioned laws, primarily the Efficient Use of Energy Law ("Official Gazette" no. 25/2013), are largely compliant with its regulations.

In addition to these laws, the area of energy efficiency in the building sector is regulated by the Law on Planning and Construction ("Official Gazette of the Republic of Serbia", no. 72/2009, 81/2009 - corr., 64/2010 - decision, 24/2011, 121/2012, 42/2013 - decision, 50/2013 - decision, 98/2013 - decision, 132/2014 and 145/2014) and related Delegated legislation: Regulations on energy efficiency of building construction ("Official Gazette of the Republic of Serbia" No. . 61/2011) and the Regulations on the conditions, content and manner of issuing certificates of energy performance of buildings ("Official Gazette of the Republic of Serbia", no. 69/2012).

Action plan for energy efficiency is the document used to plan and implement energy efficiency improvements in accordance with Article 7 of the Efficient Use of Energy Law in Serbia. The 3rd action plan for energy efficiency for the period from 2016 to 2018 ("Official Gazette of the Republic of Serbia", no. 1/17) (3rd APEE) was adopted by the Government in late 2016. 3rd APEE was prepared in a format that is defined by Energy Community, in accordance with the requirements of Directive 2006/32/EC, but also included a number of elements concerning the future implementation of Directive 2012/27/EU. 3rd APEE comprises: (1) national savings goals for the period of 2016-2018.(2) Measures for the efficient use of energy, activities, responsible for activities, deadlines and evaluation of the expected results of each of the measures to achieve the set goals, (3) financial, legal and other instruments envisaged for implementation of the planned measures and activities, and (4) Ratings the degree of realization of the planned energy savings goal from the previous Action plan (for the period 2010-2015).

3.7.1. The Goals in the Area of Energy Efficiency and Indicators of Their Implementation

From the point of defining the goals it is important to have in mind the fact that the goals by 2018 are defined by the signatories of the Contract of Energy community establishment and in accordance with Directive 2006/32/EC, as final energy savings of 9% in the period from 2010 to 2018. By Directive 2012/27/EU, the European Union adopted the goal that energy consumption in the EU in 2020 must not exceed 1474 million toe of primary energy, i.e., 1078 million toe of final energy. For some State Members the individual goals are not defined in the Directive, but it is recommended that countries review their national goals in order to fit in a common goal. As part of the implementation of this Directive, by the signatories of the Contract of Energy community establishment, energy consumption that does not exceed 187 million toe of primary energy, i.e., 133 million toe of final energy is defined as the goal. Pursuant to this goal, the indicative target of the Republic of Serbia is that primary energy consumption does not exceed 17,981 million toe of primary energy and final energy consumption does not exceed 13,103 million toe of final energy for energy purposes in 2020. Defined values are greater than the projected ones according to the reference scenario, and in particular according to the scenario with the implementation of energy efficiency measures of the energy strategy. Also, data about the implementation of the energy balance in 2015, show that the realization of both, the

consumption of primary energy (15,051 million toe), and the final energy consumption (8,776 million toe, which includes 617 thousand toe for non-energy and 8,159 million toe for energy purposes) is significantly below the projected consumption according to both designed scenarios so Serbia will strive to maintain the trend of achieving savings of final energy consumption at the level of 1% compared to 2008. A significantly higher level of reserves exists in terms of final energy consumption than in terms of primary energy. Namely, there is space for average annual growth of 3.6% in primary energy consumption and, the average growth of 9.9% for total final energy consumption for energy purposes in the period up to 2020.

Projected reduce of greenhouse gases emissions caused by an increase in energy efficiency in the energy consumption has been calculated using the following emission factors that are multiplied by energy sources for final consumption: for heating plant - 0.287 tCO_2/MWh of the produced heat energy (emission factor with which it is calculated in the Energy Strategy), for the electrical energy - 1.099 tCO_2/MWh (combined emission factor for the production of electric energy in the electric power system of Serbia - national emission factors for 2017), 2,954 tCO_2/toe for oil derivate (an emission factor with which is calculated in the Energy Strategy),101 $kgCO_2$/TJ for coal and 56.1 $kgCO_2$/TJ for natural gas (Source for last two: IPCC Guidelines for National Greenhouse Gas Inventories - Stationary Combustion, their values are used in the Energy Strategy as well). Calculation of projected net reduction in emissions of greenhouse gases due to increased energy efficiency in energy consumption was made on the basis of differences in the consumption of two scenarios of the Energy Strategy: reference scenario and scenario with implementation of energy efficiency measures. Projected net reduction in emissions of greenhouse gases due to the implementation of energy efficiency measures amounts 6,669.548 Gg CO_2eq in 2030. It accounts for about 81% of the intended national specified contribution for 2030.

Since the fall of final energy consumption is greater than the fall in consumption of primary energy it is obvious that measures that have been implemented to improve energy efficiency at the level of final consumption produced significant results. On the other hand, measures in the sectors of transformation, transmission and distribution of energy were not identified in the previous action plans. Greater enforcement of energy efficiency measures in these sectors is expected as a result of the implementation of Delegated legislation of the efficient use of energy Law, primarily Rulebook and the Regulations that prescribe minimum energy efficiency requirements for new and reconstructed facilities for the generation, transmission and distribution of electricity and heat. Measures of energy efficiency in energy transformation, transmission and distribution are subject of chapters that analyse the specific areas within the Program. The measures and activities relating to final energy consumption are mainly discusses in this chapter.

According to Directive 2006/32/EC and by Decision 2009/05/MS-EnC Ministerial Council of the Energy Community of 18th December 2009, signatories of the Contract of Energy community establishment are committed to achieve savings goal of 9% of final energy consumption in the period of nine years starting in 2010. The reference year for the Republic of Serbia in respect of which the percentage of savings is accounted is 2008, because of the reason that at the time of the Decision implementation the most accurate available data on energy consumption are taken from the Energy Balance for the year of 2008. The planned target that was established for the first time in the framework of the First Action Plan for Energy Efficiency of the Republic of Serbia for the period from 2010 to 2012, was confirmed through the 3rd APEE as expected savings of 752.4 thousand toe by 2018. According to the analysis in the 3rd APEE, the savings of 308.3 thousand toe was achieved by 2014, and projected savings up to 2015 amounts 370 thousand toe. Value of savings are not projected for 2016 and 2017, but only the final saving for 2018. Having in mind that the energy management system is only just established and that its most significant effect can be expected in 2018, and that a similar conclusion can be applied to the implementation of efficient of tires in road vehicles and the marking and monitoring of fuel quality, the assumed savings per year in order to realize the set

goal is formed within Program. The default implementation is formed based on the assumption that the savings on mentioned categories will occur only in 2018, and that the ratio between savings per year will be 0.8: 1: 1.2. Indicators of final energy consumption saving goal achievement by years of realization of the 3rd APEE are shown in the following table.

Table 126: Indicators of realization of goal of final energy savings achievement per year, based on measures of energy efficiency improvement in the period 2016-2018.

Year	2016.	2017.	2018.
Final energy savings (thousands of toe)	448	545.5	752.4

During the creation of the 4th and 5th APEE analyse of the effects of the implementation of measures in order to achieve the goals defined in the 3rd APEE will be done. During the creation of 4th and 5th APEE the goals for the period 2019-2023. years will be also determined.

The implementation of two measurable goals in terms of energy efficiency, which realization is obligatory, was imposed to Serbia by Directive 2012/27/EU. Thus, under Article 5 EED requires from State Members annual renovation of the central government's buildings, which area is 3% of the total area of all buildings of the central government, with the aim of implementing measures in order to improve energy efficiency. The above decision of the Ministerial Council, for the countries that are signatories of the Contract of Energy community establishment, defines their obligation to improve energy efficiency in the 1% of the heated / cooled area of buildings which are owned and used by the central governments. In that way the building achieve the least energy properties defined by Article 4 of Directive 2010/31/EU. Signatories of the Contract of Energy community establishment have the obligation to establish and make publicly available an inventory of heated / cooled central government's buildings with a total area greater than 500 m^2 by the January 1st of 2017 and, starting from 2019, with an area of more than 250 m^2. After that they need to realize this goal according to the formed inventory. Realization of the goal should be started in 2018. It should be noted that the reconstruction of buildings of central government should be part of the wider renovation Strategy that is part of the measures that should be taken in order to meet the requirements of Article 4 of Directive 2012/27/EU. Serbia has begun with the activities on the preparation of this strategy by participation in the "TABULA" project which primary goal was the categorization of the building by the year of construction, construction style and energy demand for heating. The secondary goal was determination of energy efficiency measures in residential sector. Participation in the project is enabled the assessment and the categorization of the housing stock in Serbia. Renovation strategy should include all the buildings: residential, commercial and public. Implementation of the project as well as activities in order of establishment an inventory of the central government buildings was helped by GIZ.

Countries that are signatories of the Contract of Energy community establishment are obliged, by the transposition of Article 7 of Directive 2012/27/EU, to achieve cumulative savings during the period of 2017-2020 in the amount of 7% of the average final energy consumption for energy purposes (according to the definition of the Republic Institute for Statistics) in the period 2013-2015. The consumption of energy in transport can be exempt from this amount. Same obligatory schemes, related to distributors and retail companies that sell energy, are established in order to achieve this goal. By these schemes distributors or retail companies are becoming obligatory parties that ensure achievement of the mentioned savings in final energy consumption. The goal, elaborated in detail through the directive, is realized through the achievement of new savings each year, starting from January 1st in 2017. The savings amount to 0.7% of annual energy sales to final customers of all energy distributors or retail companies that sell energy to the extent that is an average of the last three year in the period prior to 1 January 2016. While doing so, the sale of energy in the transport sector, in terms of volume, may be partially or entirely dispensed from the calculation. The Directive gives the possibility to realize this savings by establishing an obligatory scheme for the energy efficiency, as defined in paragraph 1 of the article, or by applying the alternative measure, defined in paragraph 9, in accordance with paragraphs 10 and

11 of this article. While doing so, the amount of savings can be further reduced if savings has been already achieved by the other measures in the sector of transformation, distribution and transmission, including efficient infrastructure of district heating and cooling, and if the measures that has already been implemented, starting from 2008, are taken into account. The largest reduction in the required savings in that case can be 25% of the calculated value. Paragraph 2 of Article 7 defines that the savings calculated with a reduction of 25% of the calculated value can be allocated per year. In that way Member State have obligation to achieve savings of 0.5% in 2017, an additional 0.5% in 2018, and then an additional 0.7% in 2019 and 0.7% in 2020. On the other hand, the cumulative value of energy that needs to be saved, if the reduction of 25% is calculated, is lower for 7.25% from the value which is calculated by using the savings per year defined by paragraph 2 of Article 7 of the Directive.

Given that, based on the energy balance for 2013 and 2014 and based on the previous data of the Republic Institute for Statistics for 2015, the final consumption of energy for energy purposes, with the exception of traffic, respectively were: 6,437.6 thousand toe, 5,758.8 and 6,123.3 thousand toe, the average value of consumption in relation to which the required savings has been accounted is 6,106.5 thousand toe. Indicators of possible realization of the implementation of Article 7 of Directive 2012/27/EU according to the schedule defined in paragraph 2 of Article 7 are given in the following table per year (second row). However, establishing a mandatory scheme for energy efficiency requires a series of coordinated preparatory activities that would be implemented in Serbia during 2017 and 2018. That is why it should be kept in mind that, if this is determinate to be the best or one of the options for implementing Article 7 of the Directive, implementation can start earliest in 2019. In this sense, the table shows the revised indicators of the implementation of the member 7. The Directive 2012/27/EC, assuming that implementation is realized only by applying obligatory scheme for the energy efficiency in the Republic of Serbia.

If it is assumed that investments in measures of energy efficiency incensement are proportion to annual savings achieved through the implementation of these measures, it is of great importance to start as soon as possible with the implementation of measures in order to achieve the goals defined in Article 7 of Directive 2012/27/EU. If the implementation of energy efficiency measures for achievement of savings, that are prescribed by Article 7 of Directive 2012/27/EU, could be implemented throughout the every year in the period 2017-2020. and in the manner suggested in paragraph 2 Article 7 of Directive, (second row in Table 127) it can be shown that the total investments would be approximately 36% less than the amount required for investment assuming that implementation is realized only by applying obligatory scheme for the energy efficiency started from 2019 (third row in the Table 127). These values clearly indicate the necessity of beginning with the implementation of other measures for improvement of energy efficiency in order to achieve the required cumulative savings defined in Article 7 as soon as possible (primarily by providing larger and more stable revenues for the work of the Budget Fund for energy efficiency).

Table 127: Indicators of two possible ways for realization of the implementation of Article 7 from Directive 2012/27/EU

Year	2017.	2018.	2019.	2020.	Cumulative
Projected annual savings in final energy consumption excluding transport if realization starts in 2017 (thousand toe)	30.5	61	103.7	146.4	341.9
Revised annual savings in final energy consumption excluding transport if realization starts in 2017 (thousand toe)			114	227.9	341.9

Note: Cumulative savings that Republic of Serbia needs to achieve, considering the possibility of reducing by 25%, if savings has been already achieved by the other measures in the sector of transformation, distribution and transmission, including efficient infrastructure of district heating and cooling, and if the measures that has already been implemented starting from 2008 are taken into account, is lower than the value shown in the table and amounts 320.6 thousand toe.

One of the tools available to encourage the implementation of measures of improvement of energy efficiency is the Budget Fund for energy efficiency. As part of the Budget Fund, 160 million RSD is defined for the implementation of energy efficiency projects in local governments in 2016. These funds are small and insufficient for the implementation of all planned energy efficiency projects. For example, only for implementation of measures to improve the energy efficiency of buildings in the public and commercial sector (JK1 measure, planned for implementation in the 3rd APEE) the necessary funds are estimated at 58 million € per year. One of the possible mechanisms for increasing the means of the Fund is the introduction of fees for energy and energy sources. The means of approximately 9 million € annually could be provided, by introduction of feeds for energy and the energy sources (oil products and natural gas) in the amount of 0.015 price RSD/kWh at an early phase. This activity should be carried out as early as possible, preferably already in 2017, in order to realize savings prescribed by Article 7 of Directive 2012/27/EU with the lowest investment. Along with this means, Budget Fund collects funds from donations (organizations and funds) which are subsequently distributed to the users. Due to the limited means, the Budget Fund has, defining the funding for projects related to local governments only. The cycle of projects for local governments is time-consuming, since it presupposes the adoption of financing program for the year, issuing of public calls, selection of projects, implementation of public procurement procedures (in some cases, local governments had to make a change in budget and in procurement plan for the current year) and realization of the defined work. Consequently, it is necessary that Budget Fund has the resources to carry out a new public call for each year, as well as to finance the implementation of approved and contracted projects from the previous one. In addition to the incensement of the volume of projects financing in the public sector, increasing the Fund's resources is necessary and in order to enable implementation of projects of energy efficiency in other sectors of energy consumption. It is necessary to strengthen the capacity of the Ministry in charge of mining and energy to carry out activities of Budget Fund, considering that the Fund represents only a budget line, and that all works are performed by employees of the Ministry in charge of mining and energy.

Using the means from the Budget Fund is defined by the Rulebook of the conditions for distribution and use of the Budget Fund funds for improving the energy efficiency of the Republic of Serbia and the criteria for exemption from performing an energy overview ("Official Gazette" no. 15/16). This act defines who can be a user of the Budget Fund - legal and natural persons registered or with residence on the territory of the Republic of Serbia, with an emphasis on the users: (1) The local self-government units that are in the devastated areas in accordance with the regional development law, as well as other local self-government units, and (2) the household sector (individuals, buildings council). All procedures for the allocation of funds are accurately elaborated in the mentioned Rulebook, whereby it should be noted:

- a uniform use of Budget Fund funds is provided for the units of local self-government with the limit that only one project of a local self-government unit can be financed per year,
- defined criteria for project selection (maximization of relations between savings and investment, the share of own funds, payback period) are provided the maximum effects of the usage of resources,
- the measures of energy efficiency, which are the subject of financing, and in accordance with the measures of 3rd APEE are defined

It is necessary to provide significantly greater resources for operation of the Budget Fund in order to achieve realization of the goals in the area of energy efficiency by 2023. It is necessary

to develop other mechanisms for financing the Budget Fund (the introduction of fees on energy and energy sources), which are possible in accordance with the its legal status in the period of 2917-2019. It is also necessary to analyse the possible improvement of its operation through potential amending of its legal status and to establish a mechanism for the returning of the fund (revolving fund).

In accordance with the possibilities provided by the Law on Efficient Use of Energy ("Official Gazette of the Republic of Serbia", no. 25/2013), it is recommended that local self-government units establish budget funds at the local level to improve energy efficiency in a manner similar to the Budget Fund of the Republic of Serbia.

3.7.2. Overview of Measures and Activities for Their Implementation in the Area of Energy Efficiency

The list of measures in the area of energy efficiency was defined based on the 3rd APEE. In the measures of the Program, that will be implemented in the period 2018, the measures which are elements of this plan, but not yet implemented, have been added.

In addition to these measures, particular attention was paid to implementing measures required of Directive 2012/27/EU, which are not recognized as an element of the plan (e.g. The establishment of schemes of obligations in terms of energy efficiency) as well as activities on monitoring of the results of nearly applied measures implementation (such as the introduction of the energy management system). Periodical creation of new action plan for energy efficiency (4th - for the period from 2019 to 2021, and the 5th - for the period 2022-2024.) are considered as a special measures also. These action plans are documents that will include analysis of the effects of existing measures and list of new measures that should be implemented in the period of the Program realization.

The Efficient Use of Energy Law predicts the introduction of energy management at the local level, in the industrial sector and in the area of building, which is especially highlighted as a measure that should bring significant savings. The Law also prescribes the implementation of mandatory energy overview at system obliged entities within the prescribed period of time (one to five years for system obliged entities in the industrial sector, and once in ten years for the system obliged entities in the area of building construction). This system predicts a scheme to establish a system of training and licensing certified energy managers and energy advisors who will report to the competent Ministry through mandatory annual reports (energy managers) and implement mandatory energy overviews (energy advisers) The plan is to establish a system of energy managers in the first quarter of 2017, with the first reports of energy managers to the Ministry in charge of mining and energy sector expected in late March 2017. Energy management system is considered as the basic measure for improving energy efficiency in all sectors of energy consumption and therefore it is specified as a special measure in the review of measures even though it is the part of the measures that should be implemented in the 3rd APEE.

Overview of measures in the area of energy efficiency, which should be implemented during the implementation of Program, is given in the following table. Activities for the implementation of measures that are estimated from 3rd APEE are described in detail in the plan and therefore they are not re-homing in the Program (it is only pointed out that their description is given in the 3rd APEE.

Table 128: Overview of measures in the area of energy efficiency that will be implemented during the period of Program implementation

Name of measure	Description of the activities for the implementation of measures	Measures implementers	The targeted final consumption	Duration	Indicator of the implementation of measure
The measures predicted in the 3rd Action Plan for Energy Efficiency of the Republic of Serbia for the period 2016-2018.	Implementation of activities defined through the 3rd action plan for energy efficiency.	Ministry in charge of mining and energy, other entities predicted by individual measures within the 3rd APEE	All sectors	2017 -2018.	Saving of 752, .4 thousand toe by 2018.
The introduction and operation of energy management (SEM) in the public, commercial and industry sector	Identification of SEM obliged entities through the collection of reports on energy consumption in accordance with the Regulation on determining the limits of annual consumption of energy ("Official Gazette of the Republic of Serbia", no. 18/2016) Training and licensing of persons to perform the job of energy manager (EM) and energy advisor (EC) The appointment of energy managers by system obliged entities in accordance with the regulations that governing this area Finishing of the legal framework and its further improvement Preparation of programs and plans by SEM obliged entities Implementation energy efficiency improvement measures in order to achieve the goals of primary energy savings as defined by Regulation on establishing the limits of annual consumption of energy ("Official Gazette of the Republic of Serbia", no. 18/2016) Reporting to the Ministry through the established web application and database for monitoring Regular implementation of energy overview in the terms set by the law of the EKE. Implementation of projects that promote the implementation of SEM to the obliged entities and other institutions.	Ministry in charge of mining and energy, training organizations SEM obliged entities	Energy use in buildings, municipal services, large industrial systems and other final consumption	2017 - 2023. (and continues after the end of this period)	Saving of 49.9 thousand toe by 2018.

Name of measure	Description of the activities for the implementation of measures	Measures implementers	The targeted final consumption	Duration	Indicator of the implementation of measure
The transposition of Directive 2012/27/EU	Revision of the Efficient use of energy Law and other regulations of importance for the full transposition of the Directive	Ministry in charge of mining and energy and other institutions in charge of regulations that should be revised	All sectors of consumption	2017-2019.	Published amendments of the Efficient use of energy Law
Implementation of the requirements of Article 7 of Directive 2012/27/EU	Consideration and selection of the best modalities for the implementation of Article 7, with the support of EMRD REEP project Adoption of relevant regulation for the implementation of Article 7. Preparatory activities of obliged entities of implementation of Article 7. Implementation of the Article 7 according to the selected mode	Ministry in charge of mining and energy, public companies, suppliers, distributors	Households, public and commercial sector, street lighting and agriculture	2017 - 2020.	Saving of 320.6 thousand toe by 2020.
Implementation of the requirements of Article 4 of Directive 2012/27/EU	- Establishment of the list of central government buildings; - Identification of the minimum requirements that must be fulfilled by the central government building towards the requirements of Article 5 of Directive - Develop a plan for renovation of central government buildings in accordance with the requirements of Directive 2012/27/EU - Implementation of the plan formed for the renovation of central government buildings	Ministry in charge of mining and energy, Ministry in charge of Construction, Transport and Infrastructure	Public sector	2017 - 2023.	Adopted program of rehabilitation of central government buildings and reports on its implementation.

Name of measure	Description of the activities for the implementation of measures	Measures implementers	The targeted final consumption	Duration	Indicator of the implementation of measure
The completion of the legal framework for energy efficiency in buildings	Determining the cost-optimal levels of energy efficiency in buildings Inclusion of all forms of energy and thermo technical systems in building certification Develop a plan for meeting the requirements in terms of buildings with zero energy consumption Revise of the regulation on energy efficiency in buildings (the Regulations on energy efficiency of buildings construction - "Official Gazette of the Republic of Serbia", no. 61/2011 and the Regulations on the conditions, content and manner of issuing certificates of energy performance of buildings - "Official Gazette of the Republic of Serbia" No. . 69/2012), which was adopted on the basis of the Law of planning and construction ("Official Gazette of the Republic of Serbia", no. 72/2009, 81/2009 - corr., 64/2010 - decision, 24/2011, 121/2012, 42/2013 - decision, 50/2013 - decision, 98/2013 - decision, 132/2014 and 145/2014)	Ministry in charge of Construction, Transport and Infrastructure	The building sector	2017-2020	The revised regulation
Preparing the 4th Action Plan for Energy Efficiency of the Republic of Serbia for the period 2019-2021.	Preparation of the data and basses for 4th APEE; Analysis of the implemented measures and forming the goals of 4th APEE; - Creation of 4th APEE;	Ministry in charge of mining and energy	All sectors	2017-2018.	4th. APEE Adopted
Preparing the 5th Action Plan for Energy Efficiency of the Republic of Serbia for the period 2022-2024.	Preparation of the data and basses for 5th APEE; Analysis of the implemented measures and forming the goals of 5th APEE; - Creation of 5th APEE;	Ministry in charge of mining and energy	All sectors	2020-2021.	5th. APEE Adopted

Name of measure	Description of the activities for the implementation of measures	Measures implementers	The targeted final consumption	Duration	Indicator of the implementation of measure
Strengthening the technical and administrative capacity of the Ministry in charge of mining and energy in area of energy efficiency	- Reception of new staff; - Training for new staff;	Ministry in charge of mining and energy, Ministry in charge of finance	No impact	2017-2018.	new experts employed in the Department for Energy Efficiency
Establishment of sustainable ways of financing energy efficiency projects	- Consideration of options for improving the work of the Budget Fund for improving energy efficiency in existing legal requirements or with the change of secondary legislation; - Provision of higher revenues for the operation of the Budget Fund through donations, fees or other suitable mechanisms; - Financing of projects to improve energy efficiency by favourable loans from international financial institutions; - Selection of the optimal modalities of the operation of the Budget Fund that would give the best results, with a focus on the possibility that the funds invested in measures to improve energy efficiency back into the Budget Fund and the establishment of the necessary amendments to the proposal laws and regulations relevant to the work of the Fund;	Ministry in charge of mining and energy, Ministry in charge of finance, public companies for electricity distribution	Households, public and commercial sector	2017 - 2023.	Number of projects implemented from the funds of the Budget Fund

4. DETERMINATION OF PROJECT PRIORITIES

In order to collect information on strategic infrastructure projects in the energy sector and treatment of individual projects on a harmonized manner, as well as the optimal way of investors finding for individual projects, the Government of the Republic of Serbia has formed Single Project Pipeline in the Field of Energy. For the purpose of the project selection process, which significantly contribute to the achievement of the strategic objectives, the prioritization of these projects, as well as the assessment of the readiness (maturity) of the project realization, the Government of the Republic of Serbia has formed a specific Methodology for Selection and Prioritization of Infrastructure Projects [59] and the Guidelines for its implementation [60]. This methodology was applied for the assessment of projects that are subject of the Program and were not part of the Single list, for future inclusion on this list. Proposition of amendments to the Single list is displayed in the Table 129. The list does not include projects in the field of mining. During the year 2018, revision of the Single list will be conducted and new project ranking will be completed based on scoring.

Selection and analysis of projects that are subject of the Program was carried out on the basis of the strategic objectives defined in the Energy Strategy. During the process of priorities determination according to the Methodology [59] it is estimated that some strategic objectives were underestimated in the assessment system as defined in the Strategic Relevance Assessment Criteria in the Energy Sector [61]. In this sense the assessment system and parameters for assessment has been redefined, as well as the weighting factors of particular score in order to adequately comprehend the impact of projects to the realization of the goals defined by the Energy Strategy. The new scores are determined in the range 1-5, and the weighting factors are in the range 1-3. Overview of new scores by individual effects of projects, as well as the aggregated score is given in Table 130.

In Table 130 are particularly emphasized projects that are part of the Single Project Pipeline in the Field of Energy and projects of international importance lists: Energy Community Priority Infrastructure Projects list (PECI and PMI), European Commission Projects of Common Interest list (PCI), Western Balkans Investment Framework projects list (WBIF), Central and South Eastern Europe Gas Connectivity project list (CESEC), Western Balkans 6 initiative projects list (WB6) and group of projects that were allocated funds under several rounds of bilateral negotiations between the Government of the Federal Republic of Germany and the Government of the Republic of Serbia.

Table 131 presents projects rankings considered as part of the Program in accordance with the scores from the Table 130, where for each project is given the following set of information: responsible entity, a brief description of the project, a brief overview of the strategic priorities of the energy strategy to which the project contributes, preparedness of planning and technical documentation for implementation, information about provided funds to finance the project, a review of project realization main risks, project cost and implementation period during realization of the Program. Presented list can be subjected to change according to eventual change of the Program. There is a requirement of two-year reporting of the Program realization which can produce change of the Program in accordance with the Energy Law ("Official Gazette of the Republic of Serbia", no. 145/2014).

Table 129: Amended Single Project Pipeline in the field of energy which includes projects from Program (without projects in mining sector and in RES sector which are realized by private investors)

- Projects in the Program which are not part of the Single Project Pipeline in the Field of Energy

- Projects included in the Program and are already part of the Single Project Pipeline in the Field of Energy

- Projects for which funding is provided or the provision of financing is in progress, i.e., it is certain that funding will be provided

Project Rank	Project Name	Project Value	Period of Realization	Maximal Number of Points Based on Strategic Relevance	Group Based on Gap Assessment Report (i.e., assessments from the Program for projects in the Program)
1	Project "Improvement of metering infrastructure" - P.5	80 million €	2017-2022.	119	A, B
2	Project "Construction of the First facility of petroleum product pipeline system" - P.19	30 million €	2017-2022.	119	B
3	The project of construction a new thermo-block in TPP Kostolac B3 - P.1	715.6 million $	2017-2020.	110	A
4	Supply of thermal energy for city of Belgrade from the TPP Nikola Tesla A, via heat pipeline with capacity of 600 MW of heat energy - P.10	165 million €	2017-2023.	110	B

5	The project for construction of new substations 110/X kV in order to increase security of supply and increase the efficiency of electricity distribution - P.8	115.1 million €	2017-2023.	105	A, B, C, D (depending on relevant subproject of substation construction)
6	Construction of main, delivery and distribution pipelines - P.25	378 million €	2017-2023.	100	A, B, C, D (depending on relevant subproject of pipeline construction)
7	Promotion of renewable energies - developing the biomass market in Serbia, Component II (part of the project of transition to boilers on biomass - P.16)	80 million €	2017-2021.	95	A, B, C, D (depending on relevant subproject of transition of boiler to biomass)
8	Trans-Balkan corridor - phase 1 - new double 400 kV OHL Pančevo (Serbia) - Resita (Romania), new double 400 kV OHL Obrenovac (Serbia) - Bajina Bašta (Serbia) and regional 400 kV interconnection RS-BA-ME (The "Trans-Balkan corridor" project - phase 1 - P.2 - sections 1, 2 and 4)	126.6 million €	2017-2023.	90	2b
9	Storage capacity for mandatory stocks of crude oil and/or petroleum products (the project "Establishing the mandatory stocks of crude oil and/or petroleum products" - P.20)	12 million €	2017-2022.	90	1b
10	Thermal rehabilitation of public buildings - improving energy efficiency in the City of Belgrade	7.685 million €	not defined	90	2a

11	Trans-Balkan corridor - Internal line - New 400 kV OHL between TS Kragujevac (Serbia) - TS Kraljevo (Serbia) with the upgrade of TS Kraljevo (Serbia) to 400 kV voltage level (The "Trans-Balkan corridor" project - phase 1 - P.2 - section 3)	29.6 million €	2017-2023.	86	1b
12	Gas Interconnector Serbia Bulgaria - gas transmission pipeline on the Serbian territory (gas interconnection project Serbia - Bulgaria, the main gas pipeline MG-10 Niš - Dimitrovgrad (border with Bulgaria) - P.21)	85.5 million €	2017-2019.	86	2b
13	Gas Interconnector Serbia Croatia - gas transmission pipeline on the Serbian territory (gas interconnection project Serbia - Croatia, main gas pipeline MG 08 Gospođinci (Futog) - Sotin (Croatian border) - P.22)	32 million €	2021-2023.	86	2b
14	Gas Interconnector Serbia Romania - gas transmission pipeline system between the Republic of Serbia and the Republic of Romania (Gas interconnection project Serbia - Romania, pipeline Mokrin - Arad (border with Romania) - P.23)	2.5 million €	2022-2023.	86	2b
15	Renewable energy project - Wind and Solar Park Kostolac (part of the project for the construction of new wind power plants at the territory of the Republic of Serbia awarded with the temporary status of privileged producers with power up to 500 MW - P.15)	105 million €	2017-2020.	86	2b
16	Implementation of energy efficiency measures in Belgrade (LEEN)	11 million €	not defined	86	2a
17	The project of utilization of geothermal energy-Bogatić	2.7 million €	not defined	86	2b
18	SO_2 and NOx emission reduction at the Nikola Tesla A1 TPP (part of the project of environmental protection in the sector of the electricity production from EPS's power plants- P.9)	36 million €	not defined	86	2a

19	SO_2 and NOx emission reduction at the Nikola Tesla A2 TPP (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	36 million €	not defined	86	2a
20	SO_2 emission reduction at the TPP Kostolac A, unit A2 (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	49* million €	2022-2023.	86	2a
21	NOx emission reduction at the TPP Kostolac A, unit A2 (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	15 million €	2022.	86	2a
22	NOx emission reduction at the Nikola Tesla A6 TPP (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	10 million €	2020-2021.	86	2a
23	NOx emission reduction at the Nikola Tesla B1 TPP (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	14.5 million €	2019-2020.	86	2a
24	NOx emission reduction at the Nikola Tesla B2 TPP (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	14.5 million €	2022-2023.	86	2a
25	NOx emission reduction at the TPP Kostolac B, unit B2 (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	17 million €	2018-2019.	86	2a
26	SO_2 and NOx emission reduction at the TPP Kostolac A, unit A1 (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	27 million €	not defined	86	2a

27	Construction of waste water treatment plant (WWTP) at: - TPP Kostolac A, - HPP Đerdap (8 locations) - HPP Drinsko-Limske (8 locations) (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	18 million €	not defined	86	2a
28	Thermal rehabilitation of public buildings - improving energy efficiency in the City of Kragujevac	4.89 million €	not defined	86	2a
29	CHP Energy Plant that use communal waste as fuel in Šabac	30 million €	not defined	86	2b
30	Strategic project "Deep refining" - P.18	330 million $	2017-2019.	86	B
31	SO_2 emission reduction at the Nikola Tesla B1 and B2 TPP - flue gas desulphurization - (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	146 million €	2021-2022.	81	2a
32	Underground Gas Storage Itebej	85 million €	not defined	81	2b
33	Trans-Balkan corridor Internal line - Single circuit 400 kV OHL TS Bajina Bašta - TS Kraljevo - phase II (The "Trans-Balkan corridor" project - phase 2 - P.2 - section 1)	36.7 million €	not defined	81	2b
34	Thermal rehabilitation of public buildings - improving energy efficiency in the City of Zrenjanin	7.2 million €	not defined	81	2a
35	Thermal rehabilitation of public buildings - improving energy efficiency in the City of Subotica	3.1 million €	not defined	81	2a
36	Gas Interconnector Serbia FYROM - Section on Serbian territory	8.5 million €	not defined	81	2a
37	Project for increasing the capacity of Underground storage Banatski Dvor - P.24	65 million €	2020-2023.	81	C

38	Gas Interconnector Serbia Montenegro - Section Niš (Doljevac) - Priština	50 million €	not defined	76	2b
39	Asbestos elimination and substitution from all energy and coal production and distribution facilities	5 million €	not defined	76	2a
40	Promotion of renewable energies - developing the biomass market in Serbia, Component I (part of the project of transition to boilers on biomass - P.16)	20 million €	2017-2021.	76	2a/2b
41	The project of reconstruction of 110 kV power lines in order to increase security of supply and increase the efficiency of the transmission of electricity at 110 kV voltage level - P.3	28 million €	2017-2023.	76	A, B, C, (depending on relevant subproject of power line reconstruction)
42	Biomass fired boiler house 2x1.25MW construction in the settlement Tivol in Ruma	1.6 million €	not defined	76	2b
43	Thermal rehabilitation of public buildings efficiency in the City of Smederevo (115 buildings)	46 million €	not defined	76	2a
44	Construction of waste and hazardous waste storage facility with infrastructure for: - TPP Nikola Tesla A and B - TPP Kostolac A and B - TPP Kolubara A - TPP Morava - HPP Drinsko-Limske (8 locations) - HPP Đerdap (8 locations) (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	27 million €	not defined	76	2b

45	Construction of waste and hazardous waste storage facility with infrastructure for EPS distribution branches (20 locations)	50 million €	not defined	76	2b
46	Biomass CHP Energy Plant in Šabac	17 million €	not defined	76	2b
47	The project reinforcement of overhead and underground (cable) 110 kV power lines in order to increase security of supply and increase the efficiency of the transmission of electricity at 110 kV voltage level - P.4	20.9 million €	2017-2021.	71	A, B, (depending on relevant subproject of power line reconstruction)
48	Project "Distribution network automation" - P.6	10.5 million €	2017-2023.	71	A, B (subproject depending on the automation that is being implemented)
49	New biomass fired CHP boiler house 4.0 MW construction in Pećinci	9 million €	not defined	71	2b
50	New ash handling system at TPP Nikola Tesla A (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	55 million €	2020-2021.	67	2a
51	Adaptation of the landfill according to EU Landfill Directive: - TPP Nikola Tesla A, - TPP Nikola Tesla B, - TPP Kolubara A, - TPP Morava (part of the project of environmental protection in the sector of the electricity production from EPS's power plants - P.9)	55 million €	not defined	67	2a
52	Enhancing of energy efficiency and usage of RES in primary schools and public buildings in the City of Kraljevo area	1 million €	not defined	67	2a

* Incorrectly stated value of the project "SO2 emission reduction at the TPP Kostolac A, unit A2" of 4 million € in the Single Project Pipeline in the Field of Energy. It is a material error that will be corrected in the updated Single Project Pipeline in the Field of Energy.

Remarks: Number of points for projects that are included in the Program is calculated by weighting the number of points calculated on the basis of the Strategic Relevance Assessment Criteria in the Energy Sector [61] with the same weight as for Single Project Pipeline in the Field of Energy.

Definition of groups based on the Gap Assessment Report:

Group 1 - prepared for tender process and implementation of investment:

Group 1a - projects with complete technical documentation, ready for preparation or implementation of the tender procedure;

Group 1b - projects with technical documentation in preparing process and after the technical documentation preparation ready for tender procedure.

Group 2 - prepared for preparation of technical documentation:

Group 2a - projects completed planning documentation and accompanying prerequisites for resolving property issues;

Group 2b - projects with gaps in spatial planning documents and unfulfilled preconditions for resolving of property issues.

Definition of project maturity for implementation in accordance with the assessment method is defined in the Questionnaire [62]. Scores are descriptive, uppercase letters A-D and their meaning is as follows:

A - prepared to call a tender procedure for construction works,

B - prepared for preparation of missing technical documentation,

C - minor shortcomings need to be addressed prior to the preparation of technical documentation,

D - significant shortcomings need to be addressed before preparation.

Projects that consist of several subprojects can contain different score values of the maturity of projects for implementation which relate to the different subprojects within the project.

Table 130: Prioritization of projects in accordance with recognized indicators of objectives achievement from the Energy Development Strategy of the Republic of Serbia

Rank	Order Number	Project Name	Number of Residents Representing Increased Security of Supply or Quality of Delivered Energy Products	Import Dependence Reduction and Creation of Conditions for Net Exports of Energy and Energy Products	Renewable Energy Sources	The Development of Energy Markets and Improvement of Competition	Projects of Regional and Broader Significance	Energy Efficiency	Environmental Protection	The Diversification of Routes and Sources of Supply	The Maturity of the Project for Implementation	The Fulfilment of International Obligations	Total
		Weighting Factor	3	3	3	1	1	2	3	2	3	1	
1	P.15	Project for the construction of new wind power plants at the territory of the Republic of Serbia awarded with the temporary status of privileged producers with power up to 500 MW	2	3	5	5	1	1	5	4	5	5	81
2	P.27	Opening of replacement capacities for existing open cast mines which will stop production and opening of open cast mines dedicated to new thermal power plants	5	5	1	1	1	4	1	2	5	1	66
3	P.29	Introduction of coal quality management system	3	3	1	1	1	4	4	2	5	3	65
4	P.18	Strategic project "Deep refining"	5	1	1	1	1	5	3	1	5	5	64
5	P.5	Project "Improvement of metering infrastructure"	5	1	1	5	1	5	1	1	5	3	60
6	P.2	The "Trans-Balkan corridor" project	3	1	1	5	5	5	1	4	4	1	59
7	P.21	Gas interconnection project Serbia - Bulgaria, the main gas pipeline MG-10 Niš - Dimitrovgrad (border with Bulgaria)	2	1	1	5	3	2	2	5	4	3	55
8	P.10	Supply of thermal energy for city of Belgrade from the TPP Nikola Tesla A, via heat pipeline with capacity of 600 MW of heat energy	3	3	1	2	1	3	3	3	2	3	54
9	P.16	The project of transition to boilers on biomass (Germany - RS)	1	1	5	2	1	3	3	3	2	3	54
10	P.19	Project "Construction of the First facility of petroleum product pipeline system"	1	1	1	1	5	4	5	1	4	1	53

Rank	Order Number	Project Name	Number of Residents Representing Increased Security of Supply or Quality of Delivered Energy Products	Import Dependence Reduction and Creation of Conditions for Net Exports of Energy and Energy Products	Renewable Energy Sources	The Development of Energy Markets and Improvement of Competition	Projects of Regional and Broader Significance	Energy Efficiency	Environmental Protection	The Diversification of Routes and Sources of Supply	The Maturity of the Project for Implementation	The Fulfilment of International Obligations	Total
		Weighting Factor	3	3	3	1	1	2	3	2	3	1	
11	P.9	The project of environmental protection in the sector of the electricity production from EPS's power plants	1	3	1	3	1	1	5	1	3	4	51
12	P.30	Introduction of new organization at EPS's open pit mines for purpose of work improvement and higher efficiency of EPS's open pit mines	4	2	1	1	1	3	2	2	3	3	51
13	P.1	The project of construction a new thermo-block in TPP Kostolac B3	2	3	1	1	1	4	2	1	4	1	49
14	P.24	Project for increasing the capacity of Underground storage Banatski Dvor	4	1	1	2	3	2	2	2	3	1	47
15	P.26	More intensive exploration of coal deposits across the whole area of Republic of Serbia	3	2	1	1	1	1	2	2	4	1	45
16	P.7	The project of reconstruction of 110/X kV substations at the end of their life cycle in order to increase security of supply and increase the efficiency of electricity distribution at 110 kV voltage level	4	1	1	1	1	2	1	1	4	1	42
17	P.23	Gas interconnection project Serbia - Romania, pipeline Mokrin - Arad (border with Romania)	2	1	1	5	3	2	2	4	1	1	42
18	P.25	Construction of main, delivery and distribution pipelines	3	1	1	2	1	3	2	1	3	1	42
19	P.28	Optimization and concentration of underground coal production	1	1	1	1	1	2	3	1	4	3	41
20	P.20	Project "Establishing the mandatory stocks of crude oil and/or petroleum products"	5	1	1	3	1	1	1	1	1	5	40

Rank	Order Number	Project Name	Number of Residents Representing Increased Security of Supply or Quality of Delivered Energy Products	Import Dependence Reduction and Creation of Conditions for Net Exports of Energy and Energy Products	Renewable Energy Sources	The Development of Energy Markets and Improvement of Competition	Projects of Regional and Broader Significance	Energy Efficiency	Environmental Protection	The Diversification of Routes and Sources of Supply	The Maturity of the Project for Implementation	The Fulfilment of International Obligations	Total
		Weighting Factor	3	3	3	1	1	2	3	2	3	1	
21	P.22	Gas interconnection project Serbia - Croatia, main gas pipeline MG 08 Gospođinci (Futog) - Sotin (Croatian border)	2	1	1	5	3	2	2	3	1	1	40
22	P.8	The project for construction of new substations 110/X kV in order to increase security of supply and increase the efficiency of electricity distribution	2	1	1	1	1	3	1	1	3	1	35
23	P.3	The project of reconstruction of 110 kV power lines in order to increase security of supply and increase the efficiency of the transmission of electricity at 110 kV voltage level	2	1	1	2	1	2	1	1	3	1	34
24	P.6	Project "Distribution network automation"	1	1	1	1	1	1	1	1	5	1	34
25	P.4	The project reinforcement of overhead and underground (cable) 110 kV power lines in order to increase security of supply and increase the efficiency of the transmission of electricity at 110 kV voltage level	1	1	1	2	1	3	1	1	3	1	33

Remarks: Shaded fields represent projects for which funding is provided or the provision of financing is in progress, i.e., it is certain that funding will be provided.

Abbreviations: SPPFE - Single Project Pipeline in the Field of Energy

PECI - Projects of Energy Community Interest

PMI - Projects of Mutual Interest

PCI - European Commission Projects of Common Interest

WBIF - Western Balkans Investment Framework projects list

CESEC - Central and South Eastern Europe Gas Connectivity projects list

WB6 - Western Balkans 6 Initiative projects list

Germany - RS - group of projects that were allocated funds under several rounds of bilateral negotiations between the Government of the Federal Republic of Germany and the Government of the Republic of Serbia.

Table 131: Rank list of projects in accordance with recognized indicators of objectives achievement from the Energy Development Strategy of the Republic of Serbia, with explanations of individual contributions to strategic priorities and objectives and recognized advantages and disadvantages of projects

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
1	P.15	Project for the construction of new wind power plants at the territory of the Republic of Serbia awarded with the temporary status of privileged producers with power up to 500 MW	81	1. Responsible Entity: Private investors, EPS 2. Project Description: The project includes the construction of seven new wind farms of various forces that will provide a total annual production of 1,303 GWh, which makes that renewable sources provide a significant 1.2% of gross final energy consumption of the Republic of Serbia. The project implements more private investors and it is of strategic importance for the Republic of Serbia for achieving the objectives defined for the share of renewable energy in gross final energy consumption of the Republic of Serbia. 3. The Strategic Relevance: The project contributes to ensuring security of electrical energy supply, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: For most subprojects technical documentation is prepared, or in the final stages. Construction of the first wind farms is expected to begin during 2017. 5. Sources of Funding: Situation with the sources of financing of these facilities is not known.	706 million €	2017-2020.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
2	P.27	Opening of replacement capacities for existing open cast mines which will stop production and opening of open cast mines dedicated to new thermal power plants	69	1. Responsible Entity: EPS 2. Project Description: The project contributes to a safe and reliable supply of new and existing coal thermal electricity capacity. It consists of several subprojects whereby, in the period of implementation of the Program going to be realized an increase in capacity of opencast Drmno in Kostolac basins from existing 9 to 12 million tons of coal per year due to the construction of a new block of the Kostolac B3 350 MW power plant, while in Kolubara basin: increasing the capacity of the fields C in the function of opening of the E, opening of the field E as replacement capacity to open pit mine field C and the field D, opening of open pit mine field G as replacement capacity to open pit mine Veliki Crljeni, as well as opening of pit mine Radljevo in order to unify the quality of coal and at a later stage as replacement capacity to open pit mine Tamnava west field. 3. The Strategic Relevance: The project contributes to ensuring security of electricity supply, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: For some subprojects technical documentation has been prepared, while foe other subproject is in preparation. 5. Sources of Funding: Sources of financing were contracted for individual subprojects and for others are in the planning stage.	1,125 million €	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
3	P.29	Introduction of coal quality management system	65	1. Responsible Entity: EPS 2. Project Description: The project contributes to increasing the productivity of plants by 5%, which means an increase in power production to 180 MW, reducing losses of 370 GWh, opportunities low quality coal exploitation and environmental protection (preventing self-combustion of coal disposed in landfills). Project consists of three subprojects that are in various stages of execution. During the implementation of a subproject, is carried out the preparation of documents for the realization of the next subprojects, with implementation of experiences, and thus facilitates the financing will. 3. The Strategic Relevance: The project contributes to ensuring security of electrical electricity, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: For two subprojects technical documentation is prepared, while for the third stage is in the preparation. 5. Sources of Funding: For two subprojects are provided sources of funding and not yet for the third subproject.	150 million €	2017-2020.
4	P.18	Strategic project "Deep refining"	64	1. Responsible Entity: NIS 2. Project Description: This project will enable an increase in the depth of processing (at 92%) and increased production of white products (to 85.8%), while improving and increasing the efficiency of the treatment process, increasing plant availability and maximize levels of optimization of energy costs in the Oil Refinery Pančevo. After the level of energy intensity it will be equated with the world's leading refineries. 3. The Strategic Relevance: The project contributes to ensuring security of supply of petroleum products, petroleum products market development and transition to sustainable energy. 4. Preparedness of Documentation: The project is in the final stage of preparation before implementation - necessary permits need to be provided. 5. Sources of Funding: Funding for the project was secured from own funds and NIS.	330 million $	2017-2019.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
5	P.5	Project "Improvement of metering infrastructure"	60	1. Responsible Entity: EPS 2. Project Description: The objective of the project is the replacement of worn-out measuring infrastructure and implementation of modern systems for remote reading and load management, and information systems that allow the use of the data collected. The project is being implemented in phases, through the replacement of electric meters and implementing the system in areas where it is carried out prior preparation and recording of the existing situation. 3. The Strategic Relevance: The project contributes to ensuring security of electricity and the development of the electricity market. 4. Preparedness of Documentation: The project is implemented in stages, wherein the documentation has been prepared for the rapid implementation of the first stage. Remaining technical documentation will be prepared during the implementation of the first stage, in order to incorporate experience gained in the first stage implementation. 5. Sources of Funding: Funding for the project was provided.	80 million €	2017-2022.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
6	P.2	The "Trans-Balkan corridor" project - phase 1	59	1. Responsible Entity: EMS 2. Project Description: Project, which consists of two phases in which is being implemented more subprojects of building new 400 kV power lines (in the 1st stage four sections is carried out) and connecting and switching substations, enables an increase in transmission capacity of the transmission network of Serbia, the replacement of worn-out 220 kV network, easier connection of production and storage capacities of electricity and better integration of the electricity market. 3. The Strategic Relevance: The project contributes to ensuring security of electrical electricity, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: Project is being implemented in phases, whereby certain sections are being built, some are pending the provision of the necessary permits, for some is on-going preparation of spatial planning and technical documentation, and for some this development has yet to begin, which makes it possible to facilitate the possibility of financing and implementation of the project itself. 5. Sources of Funding: Funding is provided for the first section, which is under construction (EMS own funds). For the second section, also provided additional funding through WBIF and credit. For others funding sources are not yet secured. It is also applied for investment grant WBIF and approval pending.	156.2 million €	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
7	P.21	Gas interconnection project Serbia - Bulgaria, the main gas pipeline MG-10 Niš - Dimitrovgrad (border with Bulgaria)	55	1. Responsible Entity: PE Srbijagas 2. Project Description: Main gas pipeline MG-10 Niš - Dimitrovgrad represents the infrastructural basis for the establishment of a gas interconnection with Bulgaria. Primary technical elements of the gas pipeline are pipeline (a single pipe pipeline 109 km in length with a diameter of DN 700, technical capacity of 1.8 billion m^3/year and maximum working pressure of 55 bar), facilities and associated infrastructure. 3. The Strategic Relevance: Project contributes to the security of gas supply and gas market development. 4. Preparedness of Documentation: Planning and technical documentation for the implementation is not fully prepared. 5. Sources of Funding: Sources of funding are not provided, but the project is submitted for funding through the national IPA 2017 Improvement and approval of the Action document is in progress.	85.5 million €	2017-2020.
8	P.10	Supply of thermal energy for city of Belgrade from the TPP Nikola Tesla A, via heat pipeline with capacity of 600 MW of heat energy	54	1. Responsible Entity: PUC "Beogradske elektrane", EPS 2. Project Description: The projected capacity of 600 MWt heating pipeline provide heat for more than 50% of the consumption of heating plant Novi Beograd. A complementary project is to connect the large and more efficient heating plants (Novi Beograd, Dunav, Konjarnik ...) into a single system for supplying consumers as well as installation of the thermal energy storage system. District heating system Belgrade will be potentially supplied with 600 MWt from blocks A3 to A6 TENT-A, which will decrease available power of TENT A approximately 150 MWe. 3. The Strategic Relevance: The project contributes to ensuring security of supply of thermal energy, the development of the energy market and the transition to sustainable energy. 4. Preparedness of Documentation: Planning and technical documentation for the implementation is not fully prepared 5. Sources of Funding: Sources of funding are not provided.	165 million €	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
9	P.16	The project of transition to boilers on biomass	54	1. Responsible Entity: PUC "Beogradske elektrane" 2. Project Description: Several projects prepare to introduce biomass or geothermal in use as fuel in heating plants, with expected total power of 105 MW and an annual output of 21,000 toe. These objectives will be implemented through the activities within the project "Promotion of renewable energies - developing the biomass market in Serbia", as well as through individual commercial projects. 3. The Strategic Relevance: The project contributes to ensuring security of supply of thermal energy, the development of the energy market and the transition to sustainable energy. 4. Preparedness of Documentation: Projects are in the initial stage from the aspect of the preparation of the spatial planning and technical documentation. 5. Sources of Funding: Sources of funding are partially secured for boilers involved in the project "Promotion of renewable energies - developing the biomass market in Serbia".	100 million €	2017-2021.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
10	P.19	Project "Construction of the First facility of petroleum product pipeline system"	53	1. Responsible Entity: PE Transnafta 2. Project Description: Construction of the First Facility of the Products Pipeline System is envisaged in three phases: construction of a product pipeline linking the oil refinery in Pančevo and existing storage tanks in Smederevo and Novi Sad, construction of new storage tanks in Pančevo and Smederevo and providing conditions for further transportation. The starting point is the terminal in Pančevo, from which branch off two directions: south - to Smederevo (26.9 km) and the north - to Novi Sad (90.3 km). Building a system of product pipeline through Serbia is to provide an economical, efficient and environmentally favourable manner of transport petroleum products produced by the oil refinery in Pančevo. 3. The Strategic Relevance: The project contributes to ensuring security of supply of petroleum products and the transition to a sustainable energy. 4. Preparedness of Documentation: Planning documentation is complete, and Feasibility Study with the Basic Design and Environmental Impact Assessment for the construction of the first facility of the products pipeline system (section Pančevo - Smederevo and Pančevo - Novi Sad) is carried out. 5. Sources of Funding: Funding for the project was secured from the Transnafta funds.	30 million €	2017-2022.
11	P.9	The project of environmental protection in the sector of the electricity production from EPS's power plants	51	1. Responsible Entity: EPS 2. Project Description: The project includes thirteen subprojects intended for reduction in emissions of harmful gases SO_2 and NOx, their reduction in permissible limits, resolving the problem of ash handling, waste storage and treatment of waste water in locations of particular generating capacity in EPS. 3. The Strategic Relevance: The project contributes to ensuring security of electrical electricity, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: For some sub-projects planning and technical documentation is prepared, while for some is in the preparation phase. 5. Sources of Funding: Funding for the project has not been provided.	484.5 million €	2018-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
12	P.30	Introduction of new organization at EPS's open pit mines for purpose of work improvement and higher efficiency of EPS's open pit mines	51	1. Responsible Entity: EPS 2. Project Description: EPS with the consulting firm Boston Consulting Group defined a set of necessary measures in order to coal production to be efficient and profitable, the price of energy produced competitive in the world market and to reduce operating costs all in order to secure supply of power plant coal of appropriate quality. There have been defined nine subprojects to be implemented within the project. 3. The Strategic Relevance: The project contributes to ensuring security of electrical electricity, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: This project is in its initial implementation stage. 5. Sources of Funding: Funds for financing will be provided from own resources of EPS.	33.6 million €	2017-2020.
13	P.1	The project of construction a new thermo-block in TPP Kostolac B3	49	1. Responsible Entity: EPS 2. Project Description: The project of building a new block in Kostolac B3 includes the construction of the third block of 350 MW in TPP Kostolac B, whose annual production will be 2,200 GWh and expansion of open pit mine Drmno, i.e. increase of coal production from 9 to 12 million tons per year. 3. The Strategic Relevance: The project contributes to ensuring security of electrical electricity, the development of the electricity market and the transition to sustainable energy. 4. Preparedness of Documentation: Preliminary design is completed and approved by the National Review Committee in 2014. Amendment of preliminary design is in progress, due to the changed conditions by the Chinese partner. The drafting and review of the Project for building permit is in progress. 5. Sources of Funding: For this project, the source of funding is provided: 85% of the loan of Chinese EXIM Bank, and 15% from EPS own funds.	715.6 million $	2017-2020.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
14	P.24	Project for increasing the capacity of Underground storage Banatski Dvor	47	1. Responsible Entity: Natural gas storage operator (Underground gas storage Banatski dvor Ltd. Novi Sad) 2. Project Description: Project includes the extension of underground storage of natural gas in Banatski Dvor from the current capacity of 450 million m^3 to the capacity of 800 million - 1 billion m^3 with a maximum technical production capacity of 9.96 million m^3/day (415,000 m^3/h) and the maximum technical and injection capacity of 5.52 million m^3/day (230,000 m^3/h). 3. The Strategic Relevance: Project contributes to ensuring the security of natural gas supply. 4. Preparedness of Documentation: Extending underground storage capacity is at the level of general design, which means that planning and technical documentation for implementation has yet to be formed. 5. Sources of Funding: Funding for the project has not been provided.	65 million €	2020-2023.
15	P.26	More intensive exploration of coal deposits across the whole area of Republic of Serbia	45	1. Responsible Entity: EPS 2. Project Description: The project includes exploration of coal deposits, which will in the future provide replacement capacity for exploitation. Intensification of exploration provides reliable information for further planning of coal mining and thermal power capacity planning. 3. The Strategic Relevance: The project contributes to ensuring security of energy supply. 4. Preparedness of Documentation: This project is at a mature stage of implementation, and it is only necessary to intensify further activities. The funds are planned to the existing documentation. 5. Sources of Funding: For the individual stages sources of funding are provided, and for the others are in the planning stage. The project is financed from own resources of EPS.	12.6 million €	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
16	P.7	The project of reconstruction of 110/X kV substations at the end of their life cycle in order to increase security of supply and increase the efficiency of electricity distribution at 110 kV voltage level	42	1. Responsible Entity: EPS 2. Project Description: The project includes reconstruction of 34 substations 110/X kV, which are at the end of their life cycle, with the total installed capacity in the planning period 2,638 MVA. This involves the replacement of old equipment and adjustment capacity of substation to existing and prospective conditions in the distribution network. It is mainly about the objects that are older than 40 years, whose position in the network is significantly altered compared to the moment of their entry into operation. 3. The Strategic Relevance: The project contributes to ensuring security of energy supply. 4. Preparedness of Documentation: The project is implemented in stages, wherein the documentation has been prepared for the realization of the first phase. Remaining technical documentation will be prepared during the implementation of the first phase, in order to incorporated experience gained in the implementation. 5. Sources of Funding: For the first phase (five substations) sources of funding are provided - World Bank loan, while for the others have not been provided.	80.4 million €	2017-2023.
17	P.23	Gas interconnection project Serbia - Romania, pipeline Mokrin - Arad (border with Romania)	42	1. Responsible Entity: PE Srbijagas 2. Project Description: Main gas pipeline Mokrin - Arad represents the infrastructural basis for the establishment of a gas interconnection with Romania. The primary technical elements of the gas pipeline is pipeline (one-pipe pipeline 6 km in length with a diameter DN 600, technical capacity of 1.6 billion m^3/year and maximum operating pressure of 50 bar), the facilities that are an integral part of the pipeline and supporting infrastructure. 3. The Strategic Relevance: The project contributes to the security of gas supply and gas market development. 4. Preparedness of Documentation: Planning and technical documentation for the implementation is not fully prepared. 5. Sources of Funding: Funding for the project has not been provided.	6 million €	2022-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
18	P.25	Construction of main, delivery and distribution pipelines	42	1. Responsible Entity: PE Srbijagas, Yugorosgaz ad., Distribution system operators 2. Project Description: Within the framework of the project is planned to construct two main pipeline (Leskovac - Vladičin Han - Vranje, 70.7 km in length and Itebej - Beograd Jug 130 km in length), distribution pipeline (Aleksandrovac - Tutin 121 km in length) as well as distribution pipelines depending on the gas market development. 3. The Strategic Relevance: The project contributes to the security of gas supply and gas market development. 4. Preparedness of Documentation: Planning and technical documentation for the implementation is not fully prepared. 5. Sources of Funding: Funding for the project has not been provided.	378 million €	2017-2023.
19	P.28	Optimization and concentration of underground coal production	41	1. Responsible Entity: PE for Underground Coal Mining Resavica 2. Project Description: For a Public Enterprise for Underground Coal Mining Resavica reorganization program is currently drafting, whose implementation will start immediately after the harmonization and adoption by the Government of the Republic of Serbia. This program will define in more detail which mines is going to be close considering the reserves that are largely at the end of exploitation and because the economic indicators do not show the trend of revenue growth. Mines that have raw potential and the possibility that with the investment achieve the trend of revenue growth are going to be defined. 3. The Strategic Relevance: The project contributes to ensuring security of supply of coal and electricity and the transition to sustainable energy. 4. Preparedness of Documentation: This project is in the initial stage of the realization with well-defined periods of implementation of certain activities. 5. Sources of Funding: Funding for the project was provided in part by the Budget of the Republic of Serbia, partly from the company own funds and partly has not yet been provided.	not defined	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
20	P.20	Project "Establishing the mandatory stocks of crude oil and/or petroleum products"	40	1. Responsible Entity: Ministry in charge of mining and energy 2. Project Description: The project arose from the need to form mandatory reserves of oil and petroleum products in the period 2015 - 31.12.2022., starting from the reserves in a quantity for 9.5 days in the year of 2015 up to the quantity of average consumption in sixty-one day period or in quantity that is equal to the ninety days net import (depending on which of them is the greater). The structure of mandatory reserves will be determined for each year and will be represented by oil derivatives whose common representation, expressed in crude oil equivalent, is equal to at least 75% of the total domestic consumption from the previous year. The project encompasses revitalization of certain number of derivatives storages that belong to the Military of Serbia, as well as the construction of new storages by PE Transnafta and the Republic Directorate for Commodity Reserves. 3. The Strategic Relevance: The project contributes to ensuring security of supply of oil and petroleum products. 4. Preparedness of Documentation: This project is in the initial stage of the realization with well-defined periods of implementation of certain activities. 5. Sources of Funding: Funding for the project was provided in part by the Budget of the Republic of Serbia, partly from the PE Transnafta own funds and the Republic Directorate for Commodity Reserves and partly has not yet been provided	12 million €	2017-2022.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
21	P.22	Gas interconnection project Serbia - Croatia, main gas pipeline MG 08 Gospođinci (Futog) - Sotin (Croatian border)	40	1. Responsible Entity: PE Srbijagas 2. Project Description: Main gas pipeline MG-08 Gospođinci (Futog) - Sotin represents the infrastructural basis for the establishment of a gas interconnection with the Republic of Croatia. The primary technical elements of the gas pipeline is pipeline (95 km in length with a diameter of DN600, technical capacity of 1.5 billion m^3/year and maximum operating pressure of 75 bar), the facilities that are an integral part of the pipeline and the supporting infrastructure. 3. The Strategic Relevance: The project contributes to the security of gas supply and gas market development. 4. Preparedness of Documentation: Planning and technical documentation for the implementation is not fully prepared. 5. Sources of Funding: Funding for the project has not been provided.	32 mil. €	2021-2023.
22	P.8	The project for construction of new substations 110/X kV in order to increase security of supply and increase the efficiency of electricity distribution	35	1. Responsible Entity: EPS 2. Project Description: The project encompasses the construction of the 35 new substations 110/X kV, with total installed power of 1,789 MVA in the planning period. These substations take the function of previously uneconomically loaded medium voltage network, solve the problem of unsecure power supply from the existing substations 110/X kV and 35/X kV, problems of high losses and poor voltage conditions in the medium voltage network. Construction of a new substations 110/X kV has been intensified in the last 5-10 years. 3. The Strategic Relevance: The project contributes to ensuring security of electricity supply and the transition to sustainable energy. 4. Preparedness of Documentation: The project is implemented in stages, wherein the documentation has been prepared for the realization of the first stage. Remaining technical documentation will be prepared during the implementation of the first stage, in order to incorporate experience gained in the implementation. 5. Sources of Funding: Sources of funding are only partially provided from EPS own funds.	115.1 million €	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
23	P.3	The project of reconstruction of 110 kV power lines in order to increase security of supply and increase the efficiency of the transmission of electricity at 110 kV voltage level	34	1. Responsible Entity: EMS 2. Project Description: Over 2 000 km of overhead power lines in 110 kV transmission network was built more than 50 years ago. The project encompasses gradual reconstruction of power lines, starting from the lines which are in particularly bad condition and also have an important function in the network. It is anticipated annual reconstruction of 40 km of power lines. 3. The Strategic Relevance: The project contributes to ensuring security of electricity supply and the transition to sustainable energy. 4. Preparedness of Documentation: The project is being implemented in phases, with some sections in phase of reconstruction, some in process of provision of the necessary permits, some in process of preparation of spatial planning and technical documentation, and for some this development has yet to begin, which makes it possible to facilitate the possibility of financing and implementation of the project itself. Bearing in mind that this project is financed from EMS own funds, the project should not have problems with financing. 5. Sources of Funding: Sources of funding are provided from EMS own funds.	28 million €	2017-2023.
24	P.6	Project "Distribution network automation"	34	1. Responsible Entity: EPS 2. Project Description: The subject of the project is the automation of medium-voltage networks through the installation of equipment for remote monitoring and control of 1,050 points in the network and automation of 35/X kV substations through the installation of SCADA system. 3. The Strategic Relevance: The project contributes to ensuring security of energy supply. 4. Preparedness of Documentation: The project is implemented in stages, wherein the documentation has been prepared for the rapid implementation of first stages. Remaining technical documentation will be prepared during the implementation of the first phase, in order to incorporate gained experience. 5. Sources of Funding: Sources of funding are provided from EPS own funds.	10.5 million €	2017-2023.

Rank	Order Number	Project Name	Number of points	Basic Information Regarding Project	Project Value	Period of Realization
25	P.4	The project reinforcement of overhead and underground (cable) 110 kV power lines in order to increase security of supply and increase the efficiency of the transmission of electricity at 110 kV voltage level	33	1. Responsible Entity: EMS 2. Project Description: The project includes the implementation of six subprojects for construction of new transmission lines and cable lines of 110 kV which provides two-sided power supply of so far radially fed 110/X kV substations. At the same time it has been provided economical power transfer across some 110 kV lines. 3. The Strategic Relevance: The project contributes to ensuring security of electricity supply and the transition to sustainable energy. 4. Preparedness of Documentation: The project is being implemented in phases, with some sections in phase of reconstruction, some in process of provision of the necessary permits, some in process of preparation of spatial planning and technical documentation, and for some this development has yet to begin, which makes it possible to facilitate the possibility of financing and implementation of the project itself. Bearing in mind that this project is financed from EMS own funds, the project should not have problems with financing. 5. Sources of Funding: Sources of funding are provided from EMS own funds.	20.9 million €	2017-2021.

5. LITERATURE

[1] Energy Law, "Official Gazette of the Republic of Serbia", no. 145/2014

[2] Energy Development Strategy of the Republic of Serbia until 2025 with projections to 2030, "Official Gazette of the Republic of Serbia", no. 101/2015

[3] Law on Efficient Use of Energy, "Official Gazette of the Republic of Serbia", no. 25/2013

[4] The Third Action Plan for Energy Efficiency of the Republic of Serbia until 2018, "Official Gazette of the Republic of Serbia", no. 1/2017

[5] National Action Plan for renewable energy sources in the Republic of Serbia, "Official Gazette of the Republic of Serbia", no. 53/2013

[6] Action Plan for Implementation of National Strategy for Sustainable Development, "Official Gazette of the Republic of Serbia", no. 62/2011

[7] National program for integration of Serbia into the European Union, the document adopted by the Government of the Republic of Serbia 09.10.2008., http://www.parlament.gov.rs/aktivnosti/evropske-integracije/dokumenta.1015.html, accessed in February 2017

[8] Law on Environmental Protection, "Official Gazette of the Republic of Serbia", no. 135/2004, 36/2009, 36/2009, sec. law, 72/2009, sec. law, 43/2011, the decision of the Constitutional Court and 14/2016

[9] Law on Soil Protection, "Official Gazette of the Republic of Serbia", no. 112/2015

[10] Water Law, "Official Gazette of the Republic of Serbia", no. 30/2010 and 93/2012

[11] Law on the Protection of Environmental Noise, "Official Gazette of the Republic of Serbia", no. 112/2015

[12] Law on Protection against Non-ionizing Radiation, "Official Gazette of the Republic of Serbia", no. 36/2009

[13] Law on Waste Management, "Official Gazette of the Republic of Serbia", no. 36/2009, 88/2010 and 14/2016

[14] Law on Air Protection, "Official Gazette of the Republic of Serbia", no. 36/2009 and No. 10/2013

[15] Law on Strategic Environmental Impact Assessment, "Official Gazette of the Republic of Serbia", no. 135/2004 and No. 88/2010

[16] Law on Environmental Impact Assessment, "Official Gazette of the Republic of Serbia", no. 135/2004 and No. 36/2009

[17] Law on Integrated Prevention and Control of Environmental Pollution, "Official Gazette of the Republic of Serbia", no. 135/2004 and No. 25/2015

[18] Law on Chemicals, "Official Gazette of the Republic of Serbia", no. 36/2009, 88/2010, 92/2011, 93/2012 and 25/2015

[19] Law on Nature Protection, "Official Gazette of the Republic of Serbia", no. 36/2009, 88/2010, 91/2010 - correction and 14/2016

[20] (Law on ratification of the Treaty establishing the Energy Community between the European Community and the Republic of Albania, Bulgaria, Bosnia and Herzegovina, the Republic of Croatia, the former Yugoslav Republic of Macedonia, Republic of Montenegro, Romania, Serbia and the United Nations Interim Administration Mission in Kosovo in accordance with United Nations Security Council Resolution 1244, "Official Gazette of the Republic of Serbia", no. 62/2006

[21] First Biennial Update Report to the United Nations Framework Convention on Climate Change, Ministry of Agriculture and Environmental Protection, Belgrade, February 2016

[22] Intended Nationally Determined Contribution of the Republic of Serbia, United Nations Framwork Convention on Climate Changes, http://www4.unfccc.int/submissions/INDC/Published%20Documents/Serbia/1/Republic_of_Serbia.pdf

[23] Regulation on limit values of air emissions from combustion plants, "Official Gazette of the Republic of Serbia", no. 6/2016

[24] Western Balkan Sustainability Charter, 4 July 2016, Paris

[25] Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC Text with EEA relevance, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040:en:PDF

[26] Planning and Construction Law, "Official Gazette of the Republic of Serbia", no. 72/2009, 81/2009 - correction, 64/2010 - the decision of the Constitutional Court, 24/2011, 121/2012, 42/2013 - the decision of the CC, 50/2013 - the decision of the CC, 98/2013 - the decision of the CC, 132/2014 and 145/2014

[27] Law on Utility Services, "Official Gazette of the Republic of Serbia", no. 88/2011 and 104/2016

[28] Law on Public Enterprises, "Official Gazette of the Republic of Serbia", no. 15/2016

[29] Companies Law, "Official Gazette of the Republic of Serbia", no. 36/2011, 99/2011, 83/2014 - sec. law and 5/2015

[30] Law on Public-Private Partnership and Concessions, "Official Gazette of the Republic of Serbia", no. 88/2011, 15/2016 and 104/2016

[31] Law on Local Self-Government, „"Official Gazette of the Republic of Serbia", no. 129/2007 and 83/2014 - sec. law

[32] Public Procurement Law, "Official Gazette of the Republic of Serbia", no. 124/2012, 14/2015 and 68/2015

[33] Law on Housing And Maintenance of Buildings, "Official Gazette of the Republic of Serbia", no. 44/95, 46/98, 1/2001 - the decision of the Constitutional Court, 101/2005 - sec. law, 27/2011 - the decision of the CC and 88/2011

[34] Regulation of the Measurements of Air Pollutant Emissions from Stationary Sources of Pollution, "Official Gazette of the Republic of Serbia", no. 05/2016

[35] Regulation on Types of Activities and Facilities for which Integrated Permit is Issued, "Official Gazette of the Republic of Serbia", no. 84/2005

[36] National List of Environmental Indicators, 1. Air and Climate Change, NLEI 1.8 Emissions of greenhouse gases, http://indicator.sepa.gov.rs/pretraga/indikatori/svefind/1bf6f054ac764d2a97ade52b6ec89f32, accessed in February 2017.

[37] Regulation on the Rules for Granting State Aid, "Official Gazette of the Republic of Serbia", no. 13/2010, 100/2011, 91/2012, 37/2013 and 97/2013

[38] SHARES Tool Manual, Version 2015.61110, European Commission, Eurostat, Directorate E: Sectorial and regional statistics, Unit E.5: Energy, http://ec.europa.eu/eurostat/web/energy/data/shares

[39] Report on Security of Supply for the period 2013-2015, The Ministry of Mining and Energy, 2016.

[40] Report on the Work of Energy Agency of the Republic of Serbia for 2015, Belgrade, May 2016.

[41] Sustainable Development Report, NIS a.d, 2015.

[42] Pre-Feasibility Studies on 4 Biomass plants for District Heating Companies in Serbia, iC consulenten Ziviltechniker GesmbH, done for the Ministry of Mining and Energy and KfW Entwicklungsbank, 21. 10. 2015.

[43] European Integration Office, National Programme for Adoption of the Acquis, September, 2016.

[44] NIS a.d. Documentation, Novi Sad, 2016.

[45] PE Transnafta, Construction of the First Facility of the Products Pipeline System, 2016.

[46] Ministry of Mining and Energy, the Long-term plan for the gradual formation and maintenance of mandatory stocks of crude oil and petroleum products, 2015.

[47] Ministry of Mining and Energy, the Medium-term plan for formation and maintenance of mandatory stocks of crude oil and petroleum products for period 2015-2017, 2015.

[48] Ministry of Mining and Energy, Directorate for Energy Reserves, 2016.

[49] PE Transnafta, Storage capacity information, 2016.

[50] Republican Directorate for Commodity Reserves, Storage capacity information, 2016.

[51] NIS a.d, Energy Block, Conceptual design for the exploitation of oil shale in the Aleksinac basin area.

[52] Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC Text with EEA relevance, http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32010R0994

[53] European Network of Transmission System Operators for Gas, Ten Year Network Development Plan, Annex F - Methodology, http://www.entsog.eu/publications/tyndp

[54] The Long-term Exploitation of Coal in Coal-bearing Basins of EPS until 2025 with a Projection to 2050, Centre for surface mining and Geoing, Belgrade, 2016.

[55] Law on Mining and Geological Surveys, "Official Gazette of the Republic of Serbia", no. 101/2015

[56] Rulebook on Energy Efficiency in Buildings, "Official Gazette of the Republic of Serbia", no. 61/2011

[57] Rulebook on the Conditions, Content and Manner of Issuance of Certificates of Energy Performance of Buildings, "Official Gazette of the Republic of Serbia", no. 69/2012

[58] Regulation on Establishing Limit Values of Annual Energy Consumption, "Official Gazette of the Republic of Serbia", no. 18/2016

[59] Methodology for Selection and Prioritization of Infrastructure Projects, http://www.ppf5.rs/wp-content/uploads/2014/03/Project_prioritisation_methodology.pdf, accessed in February 2017.

[60] Guidelines for Implementing the Methodology for Selection and Prioritisation of Infrastructure Projects, http://www.ppf5.rs/wp-content/uploads/2014/03/Guidance_document_on_methodology_implementation.pdf, accessed in February 2017.

[61] Strategic Relevance Assessment Criteria in the Energy Sector, http://www.ppf5.rs/wp-content/uploads/2014/03/Strategic_Relevance_Assessment_Criteria_Energy.pdf, accessed in February 2017.

[62] Project Gap Assessment Questionnaire in the Energy Sector, http://www.ppf5.rs/wp-content/uploads/2014/03/GAP_questionnaire_energy.pdf, accessed in February 2017.