- EPCG –

Elektroprivreda Crne Gore AD Nikšić

Elektroprivreda Crne Gore
AD Nikšić

Elektroprivreda Crne Gore AD Nikšić (EPCG) is a national energy company established for the purpose of carrying out energy activity, i.e. electricity generation and supply.

EPCG Vision

Leader in the economic development of Montenegro, competitiveness at the European market and active participation in new market challenges through investment in people, green energy, new technologies and capacities, maintenance and optimum use of resources and digital transformation of company.

EPCG Mission

Reliable and quality generation, electricity supply and trading in addition to full compliance with requirements and needs of our customers and other interested parties, improvement of the environmental care and high degree of corporate responsibility.

Improvement of business operations by compliance with and application of highest professional and ethical standards, responsible behaviour while performing activities in line with applicable regulations, compliance and provision of trust both in EPCG as well as in broader business environment.

Strategy

EPCG is being developed with the aim of improving the relationship with its customers, employees and other stakeholders, to meet the requirements of standards in the areas of business quality, occupational health and safety, environmental protection and social responsibility.

General objectives

Safe and reliable supply of customers with electricity; Safe and efficient generation; Increase in business efficiency and effectiveness; Satisfied customer; Increase in energy efficiency throughout all generating segments; Efficient energy management – trading with electricity and resource management; Attractive employer to accumulate human potentials; Compliance with ecological standards; Compliance with safety standards and occupational safety and health; Presence at international markets

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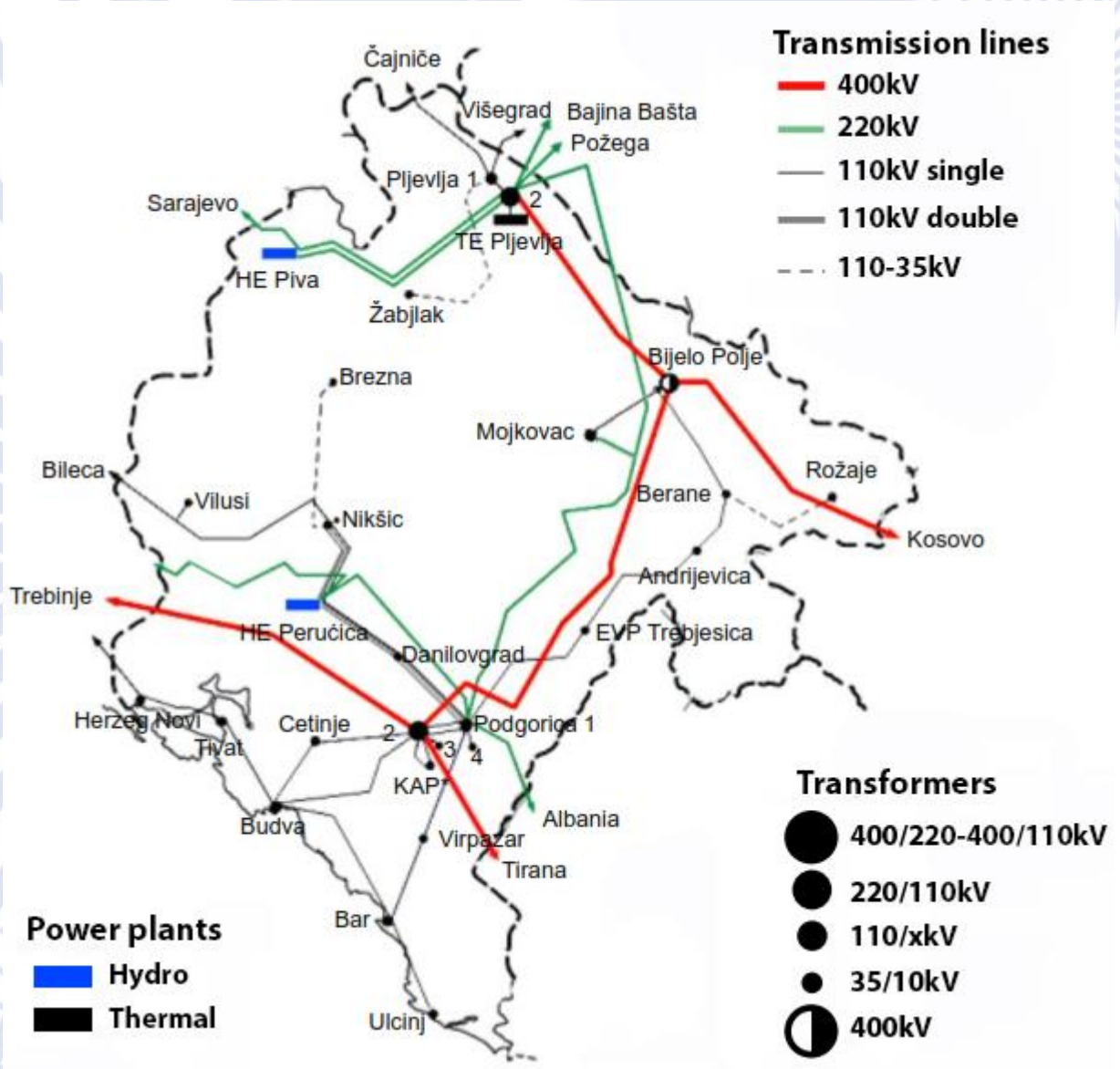
Core activity of EPCG



Production and supply of electricity are the main activities of Montenegrin Electric Enterprise AD Niksic (EPCG).

Activities carried out by the Company are the following:

- electricity generation,
- electricity supply,
- electricity trading,
- construction and maintenance of electric power facilities,
- designing and supervision, and
- other activities prescribed by the Statute of EPCG.

By carrying out core activities, EPCG ensures regular and quality supply of the customers at the demanded voltage levels - safe and stable electricity supply to the Montenegrin population and economy.

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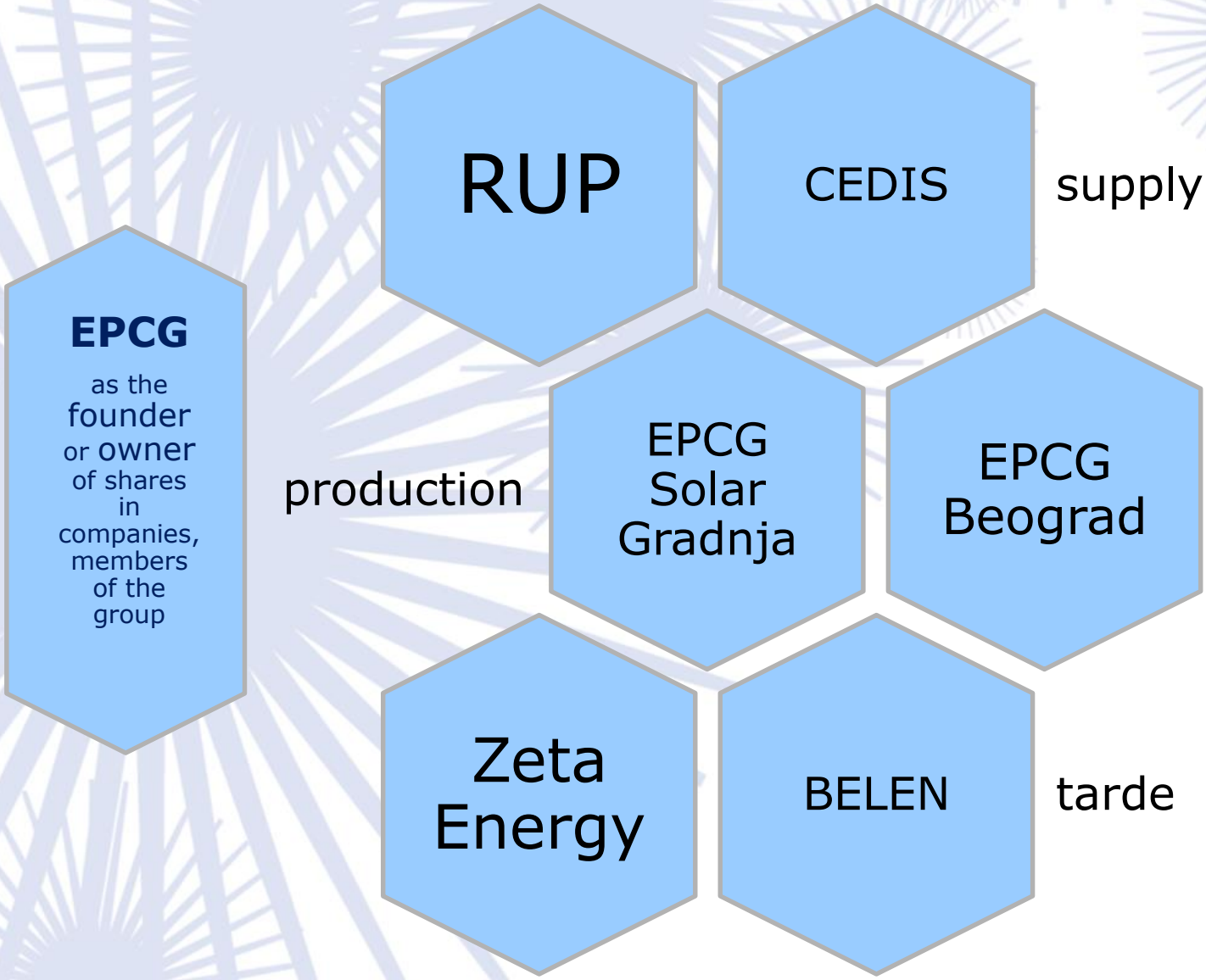
EPCG Group structure



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The strength of our power system is based on the capacity of production plants HPP "Perućica" HPP "Piva" TPP "Pljevlja".

The total installed generating capacity of power plants amounted to 874 MW, of which hydro power plants belonging to 649 MW or 74.3%, a power plant of 225 MW or 25.7%.

The strength of any power system is based on the construction and capacity of production plants, one of which is primarily expected to provide sufficient amounts of electricity, which is becoming a more difficult task. Today, when the need for energy increasing, it is not necessary to prove that the production of electricity is essential not only for the stability of the power system, but is a necessary precondition of economic development.

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Hydro power plant "Perućica"

HPP "Perućica" is the oldest large hydropower plant in Montenegro, and was put into operation in 1960. It is named after the well Perućica, which originates in the vicinity of hydroelectric power plant.

It is located in the municipality of Niksic, in northern Bjelopavlici plain, while small hydro power plants are located in the municipalities of Kolasin, Podgorica, Cetinje and Savnik.

Its installed capacity is 307 MW, and a potential annual production is about 1,300 GWh. For electricity production, HPP "Perucica" uses water catchment of river Gornja Zeta, which is water that flows into Niksic field with favorable decline in the short distance between the Niksic field and Bjelopavlici plains. Useful reservoir is 225 million water cubic meters. Catchment area of HPP "Perucica" is 850 km².

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HPP "Perucica" consists of the following facilities:

- accumulations "Krupac" and "Slano" and retention "Vrtac"
- The system of channels,
- Sedimentation,
- Compensation reservoir,
- Intake tunnel with the intake structure,
- Pipeline with three pipes under pressure,
- Power house for 8 aggregate,
- Electrical Substations of 110 kV and 220 kV,
- Supply tunnel 3323.27 m,
- Pipeline no. 3 with a diameter of 2.65 + 2.5 m.

In the machine building of HPP "Perućica", seven twin turbine-type "Pelton" generators with the horizontal properties of the total installed capacity of 307 MW were built. Five units have installed capacity of 40 MVA and two of 65 MVA. It is planned that the eighth power generator of 65 MVA to be installed.

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Hydro power plant "Piva"

HPP “Piva” is a reservoir dam facility with one of the largest concrete arch dam in the world. It was built in 1976.

Its main activity is production of electricity in peak mode, because it has the ability to start quickly and synchronize to the electric grid of 220 kV. HPP “Piva” is situated in the mountain range on the northwest of Montenegro. Due to the specific topographical features of the ground, complete installation of facilities was done below the surface.

The designer of the dam was "Energoprojekt" - Belgrade, and of underground facilities "Elektroprojekt" - Ljubljana. Model testing and geotechnical works were carried out by: Institute "Jaroslav Cherni" and "Geosonda" - Belgrade, while the main construction work was performed by "Hidrotehnika" - Belgrade.

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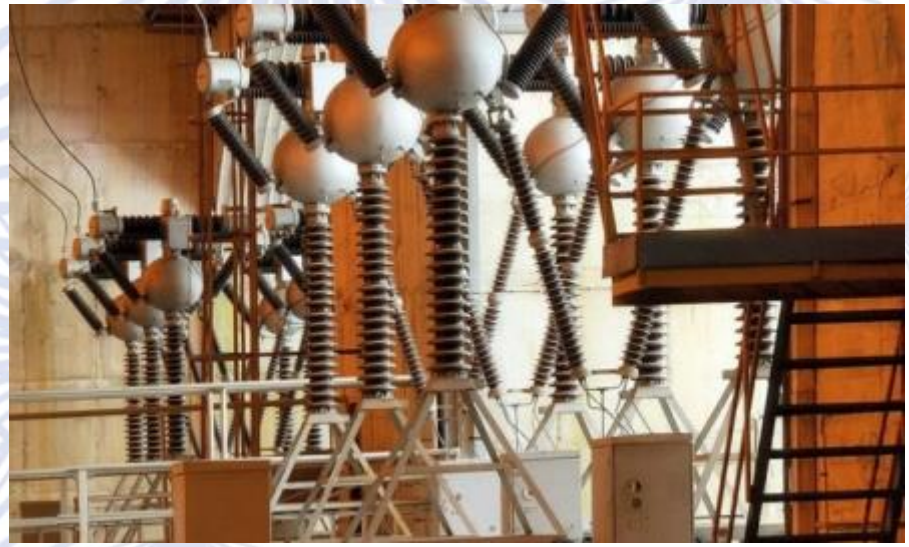

Basic technical characteristics of HPP “Piva” are:

- Installed power - 342 MW,
- The total storage capacity - 824 x 10 ³ x 10 ³ m³
- Storage capacity - 746 x 10 ³ x 10 ³ m³
- The projected annual production of electric energy - 860 GWh
- Energy accumulation value 275 GWh
- Three helical turbines with vertical shaft (250 rpm) such as "Francis"
- Three-phase generator with a vertical shaft (250 rpm) of 120 MVA
- Three-phase transformer (15,75 / 220 kV) of 120 MVA
- Structural concrete arch dam height is 220m, hydraulic height of 190m, arc length on the crown is 268,6m, long arc in level of the bed 40m
- Normal backwater elevation - 675.25m above sea level
- Minimum operating level - 595.0 m above sea level
- The maximum net head - 181.95m
- Minimum net head - 99.90 m
- Installed flow - 3x80 m³/s
- Catchment area of HPP "Piva" is 1760 km²

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Thermal power plant "Pljevlja"

TPP "Pljevlja" began operations in 1982 - the first synchronization on a network was performed on 21 October 1982..

TPP "Pljevlja" is the first Montenegrin condensation power plant designed with two blocks of 210 MW. The accumulation of water as well as all auxiliary, technical and managerial and administrative facilities (except for de-carbonization and recirculation cooling system) was made for two blocks. However, only one block was built.

Altitude at which it is built is 760 m. Height of its chimney is 250 m, so that its outlet exceeds 1000 m above sea level.

Thermal Power Plant is supplied with cooling water from the accumulation of "Otilovici", which has 18 million m^3. It is situated on the river Cehotina, and is about 8 km from the power plant with which it is connected by asphalt road. The dam has a concrete-arch and the height of 59 m.

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Important projects were carried out related to environmental and technological stabilization of objects:

Replacement of electro filter system;
Replacement of control systems and management;
Replacement of divorce 6 and 0.4 kV auxiliary consumption;
Replacement of generator excitation system and the installation of the generator switch.

For the power system of Montenegro, whose stable work significantly depends on TPP "Pljevlja", it represents the base power plant which has the greatest significance in covering constant load diagram.

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- **to develop both the interconnected energy systems** and better integrated grids as support to renewable energy sources
- to incentivize innovative technology and **modern infrastructure**
- to increase **energy efficiency and ecological design** of products
- **to decarbonise gas sector** and encourage **smart integration** in all sectors
- **to empower consumers** and support member states in combating the energy poverty
- to promote **EU energy standards** and technology on a global level
- to develop the Europe's **offshore wind power** potential fully

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- Strength of our energy system has been based on generation from HPP Perućica, HPP Piva and TPP Pljevlja
- **Our goal** – diversification of electricity generation from renewable energy sources (pridominantly from wind and solar)

	Installed capacity (MW)	Annual generation (GWh)
HPP Perućica	307	920 (max 1435, min 539)
HPP Piva	342	750 (max 1286, min 360)
TPP Pljevlja	225	1350
Small HPP Zeta Energy	6,56	18,5
Small HPP EPCG	2,46	5,5
Total	**883**	**3044**

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Montenegro – electricity generation/consumption (2017/18/19/20/21)

Electricity balancing elements	2017	2018	2019	2020	2021
	GWh	GWh	GWh	GWh	GWh
EPCG - generation	2190	3484	3011	2819	3161
Montenegro - generation	2327	3677	3265	3224	3650
Montenegro – consumption	3240	3489	3486	3302	3481

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EPCG
- New RES projects -

	Field	Name of the investment/project/process	Value	MW
001	SPP	Solar 3000+ 500+	30.000.000,00	30,00
002	SPP	Solar 5000+	70.000.000,00	70,00
003	SPP	Solar 10000+	85.000.000,00	100,00
004	SPP	Slano dam, Vrtac dam	4.000.000,00	4,00
005	SPP	SPP Krupac	20.000.000,00	25,00
006	SPP	SPP Vilusi-Banjani EPCG	20.000.000,00	25,00
007	SPP	Slano – floating SPP	30.000.000,00	50,00
008	SPP	Briska Gora	200.000.000,00	250,00
009	SPP	Velje Brdo	50.000.000,00	50,00
010	SPP	SPP Marking 1 EPCG	60.000.000,00	75,00
011	SPP	SPP Marking 2 OTHERS		
	SPP	Solar power plants	569.000.000,00	679,00
021	WPP	Gvozd	60.000.000,00	54,00
022	WPP	WPP Marking 1 EPCG	100.000.000,00	100,00
023	WPP	WPP Marking 2 OTHERS	50.000.000,00	50,00
	WPP	Wind power plants	210.000.000,00	204,00
030	HPP	Reconstruction Perućica 5,6,7	33.000.000,00	
031	HPP	8. generator	23.000.000,00	58,50
032	HPP	Water regulation of Nikšićko Polje	24.000.000,00	
033	HPP	Liverovići - Gračanica	7.000.000,00	0,00
034	HPP	mHPP in Perućica system	3.000.000,00	
035	mHpp	mHPP on Slano lake and mHPP Rošca	12.000.000,00	12,00
036	HPP	Komarnica	250.000.000,00	172,00
037	HPP	Kruševo	120.000.000,00	90,00
038	HPP	HPP Piva	2.000.000,00	
039	HPP	Potential Bilećko lake		
040	HPP	HPP Boka-Sutorina,	300.000.000,00	250,00
041	HPP-SPP	Skadarsko lake	300.000.000,00	250,00
	HPP	Hidro power plant	1.074.000.000,00	832,50
050	TPP	Reconstruction TPP Pljevlja	54.000.000,00	
051	TPP	Reconstruction of boiler	15.000.000,00	
052	TPP	Heating of Pljevlja	2.500.000,00	
053	mHPP	Otilovići	2.000.000,00	3,00
054	TPP	Maljevac	17.300.000,00	
055	TPP	Pljevlja- Kaseta	2.700.000,00	
	TPP	Termo power plant	93.500.000,00	3,00
060	GPP	Gas power plant Bar, Kap, Pljevlja	250.000.000,00	400,00
	GPP	Gas power plant	250.000.000,00	400,00
		TOTAL	**2.196.500.000,00**	**2.118,50**

- **Reconstruction and modernisation of existing HPPs**
  - HPP Perućica – 307 MW
  - HPP Piva – 342 MW

***Depends on dynamic of connection to the grid**

****Preliminary assessment**

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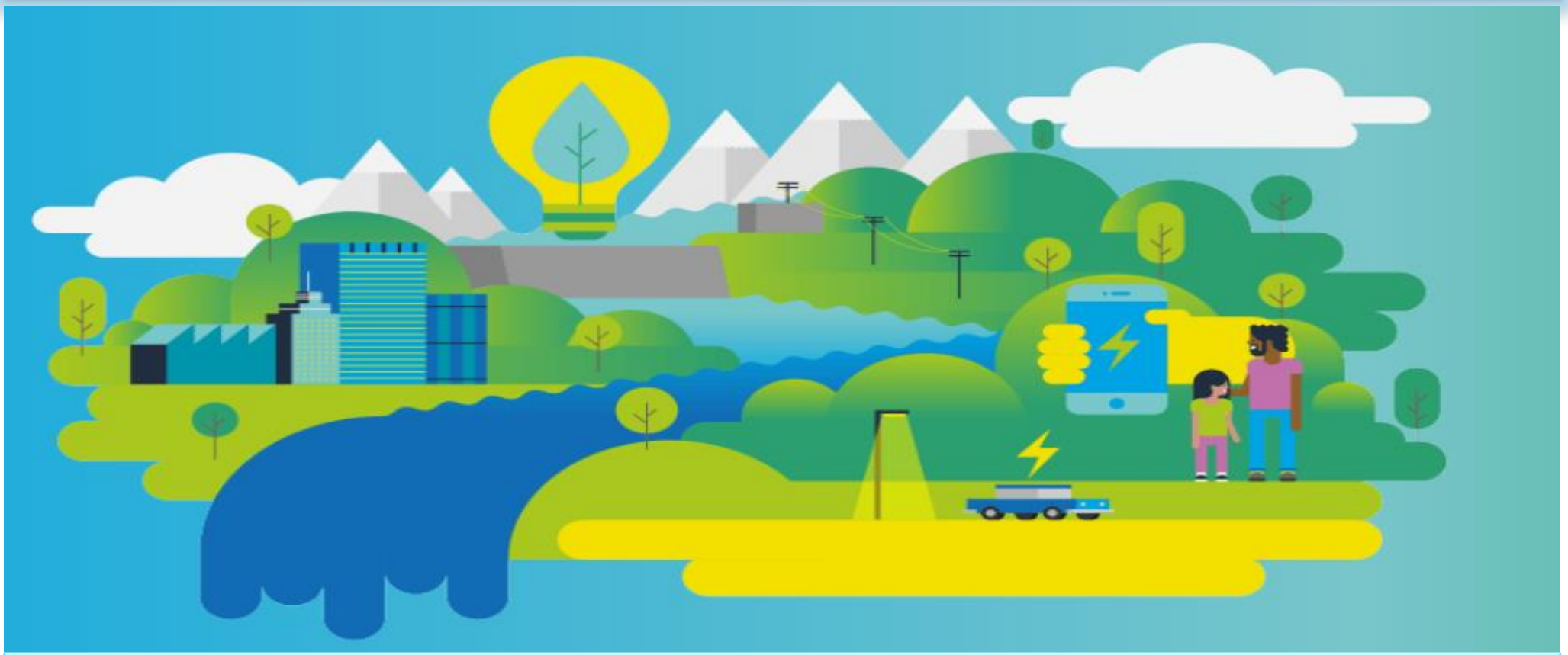
International Hydropower Association - IHA



- Being a national power company and having the category of up to 2,000 MW of installed hydropower capacity in its portfolio Elektroprivreda Crne Gore AD Nikšić became a Silver member of the International Hydropower Association on December 3, 2020.

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- Promotion of a principle of sustainability in the hydropower sector and its role and importance in RES systems
- Combat against climate changes and achievement of Paris Agreement objectives

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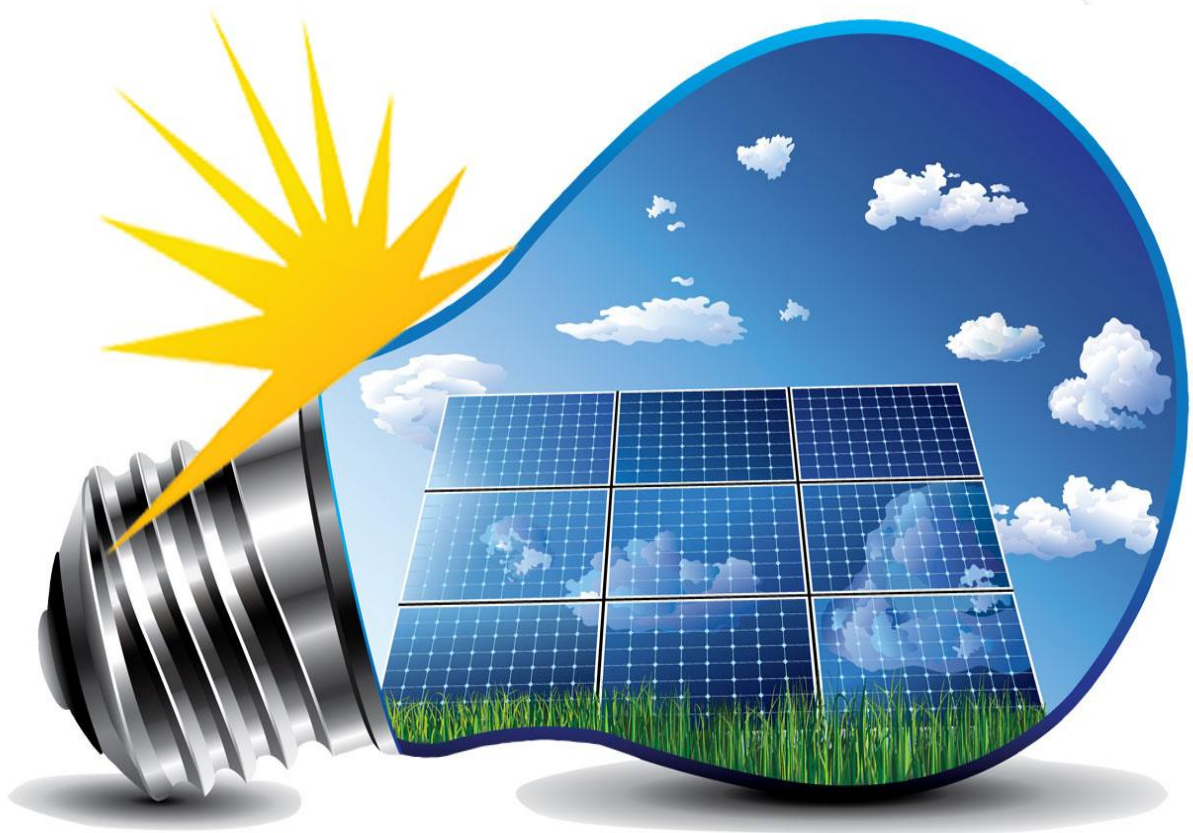
SOLAR POWER PLANTS

- Solar 3000+ i 500+
- Solar 5000 +
- Solar 10000+
- SPP dam Slano
- SPP dam Vrtac
- SPP Obala Krupac
- SPP Slano- floating
- SPP Velje Brdo
- SPP Briska Gora
- SPP Vilusi I
- SPP Dragalj/Vilusi II



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PROJECT 3000+ and 500+
28.6 MW 44 GWh

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SOLAR 3000+ and 500+

- This project envisages installation of 3000 solar systems on rooftops of residential structures and 500 solar systems on rooftops of facilities owned by legal persons.
- EPCG signed the *Agreement on joint financing and implementation of Solari 3000+ and Solari 500+ Project* with ECO FUND, whereby ECO FUND is to subsidise the project, i.e. the end users with a subsidy amounting to 20% of the total value of the solar system

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SOLAR 3000+ and 500+

Solari 3000 + and 500+ Project shall be fully funded with a EUR 30 M (VAT included) loan from a selected financial institution in accordance with the tender for submission of bids for financing the mentioned investment launched by EPCG

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SOLAR 5000+

- Installed power 70 MW.
- Estimated production 105 GWh.
- Investment value EUR 70 mil.

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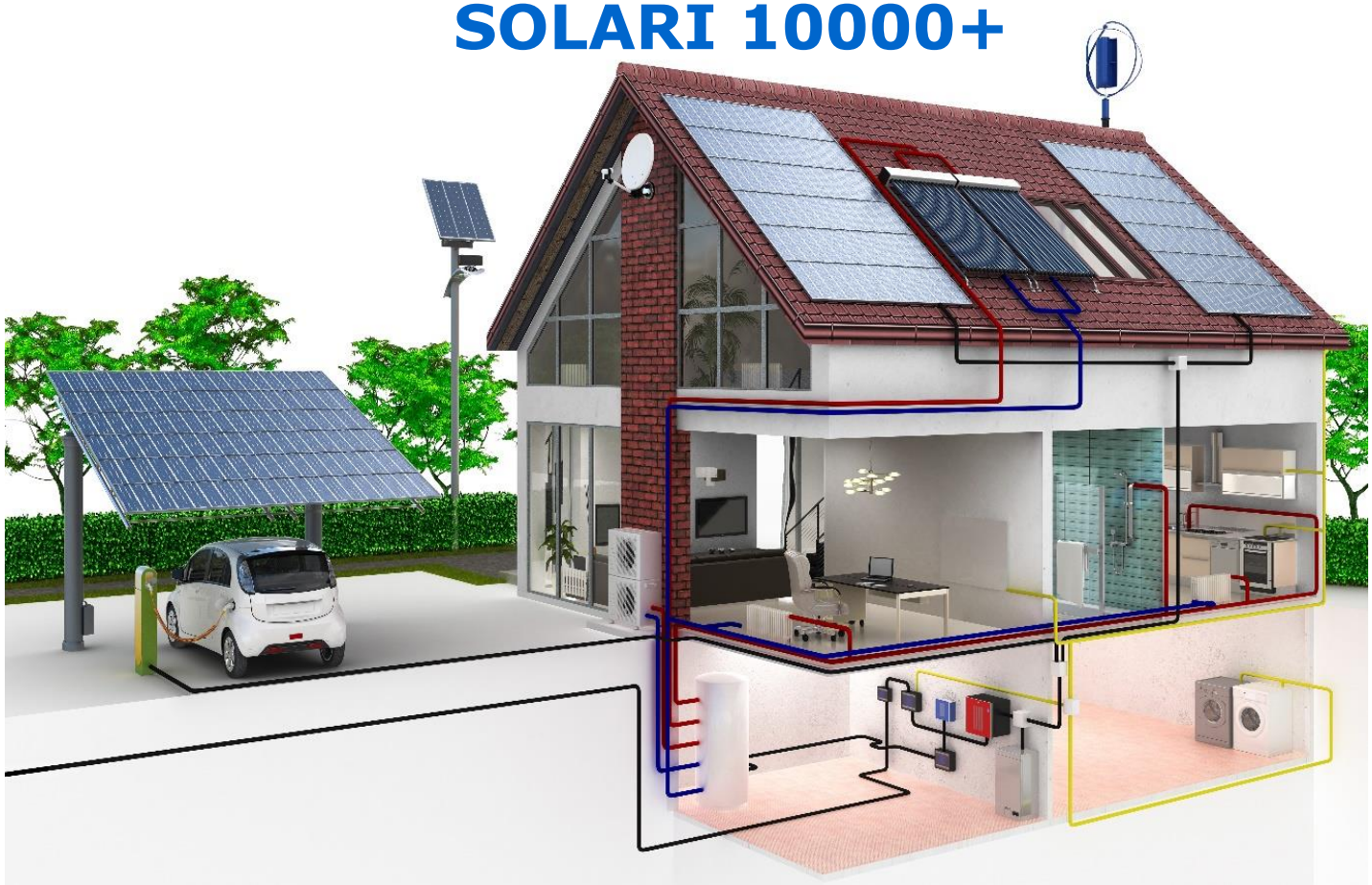
SOLARI 10000+



The project envisages the installation of 10,000+ solar systems on the rooftops.

- The installed capacity cca 85 MW.
- Estimated production 110,5 GWh.
- The total value of the investment EUR 90 mil.
- The project is nominated on the SPP list 2021/22 for financing from European funds.

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SPP SLANO DAM

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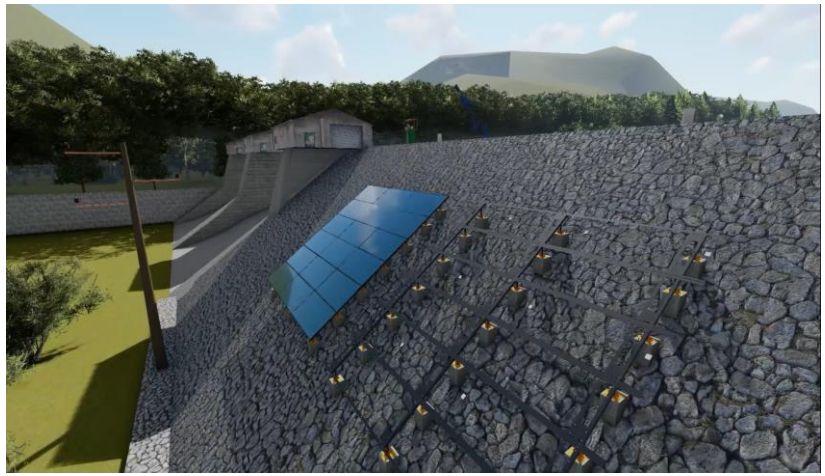
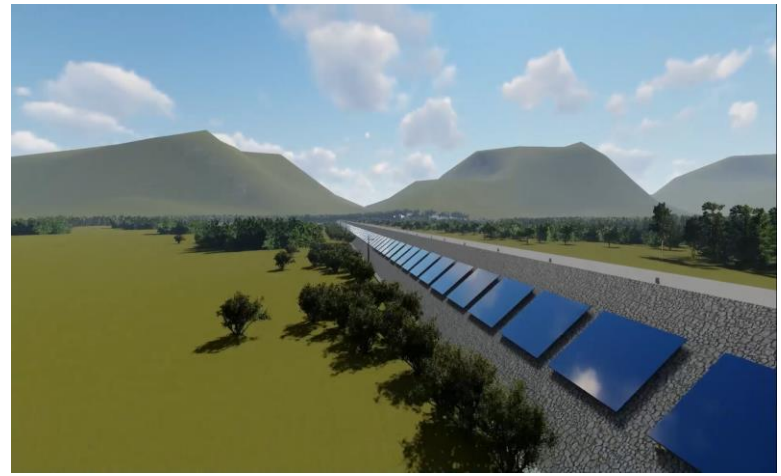
SPP VRTAC DAM





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SPP Slano – floating solar

- Multiple international companies expressed their interest
- Up to 33.6 MW

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SPP Briska Gora

- Planned site for SPP Briska Gora – Briska Gora, the Municipality of Ulcinj
- Consortium EPCG, Fortum Corporation Finland and Sterling&Wilson India
- Construction of the power plant by phases:
  - *Phase I – 50 MW, estimated annual generation 90 GWh (18 months)*
  - *Phase II – 200 MW, estimated annual generation 360 GWh (36 months)*
- Total investment value is cca. EUR 210 M

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SPP Velje Brdo

- Site location study "Velje Brdo – solar power plant" Podgorica
- *Total installed capacity of the solar power plant:*
  - *Phase I – 50MW*
  - *Phase II – 100MW*
- *Committee for initiation of activities tied to construction of SPP at the location of Velje brdo – development of the tender documents for long-term lease of state-owned land*

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Defining SPP sites

- Core objective- analyis of the territory of municipalities Nikšić, Podgorica and Cetinje as well as defining the potential locations for development of electricity generation from PV solar systems
- Criteria:
  - Physical (orientation, land category, reconstrution of the access road or construction of a new one, etc.)
  - Social (ownership of the site, visibility and availability to the end of promoting RES use, etc.)
- SPP Vilusi I 30 MW
- SPP Dragalj/Vilusi II 80 MW
- SPP Čevo 100 MW

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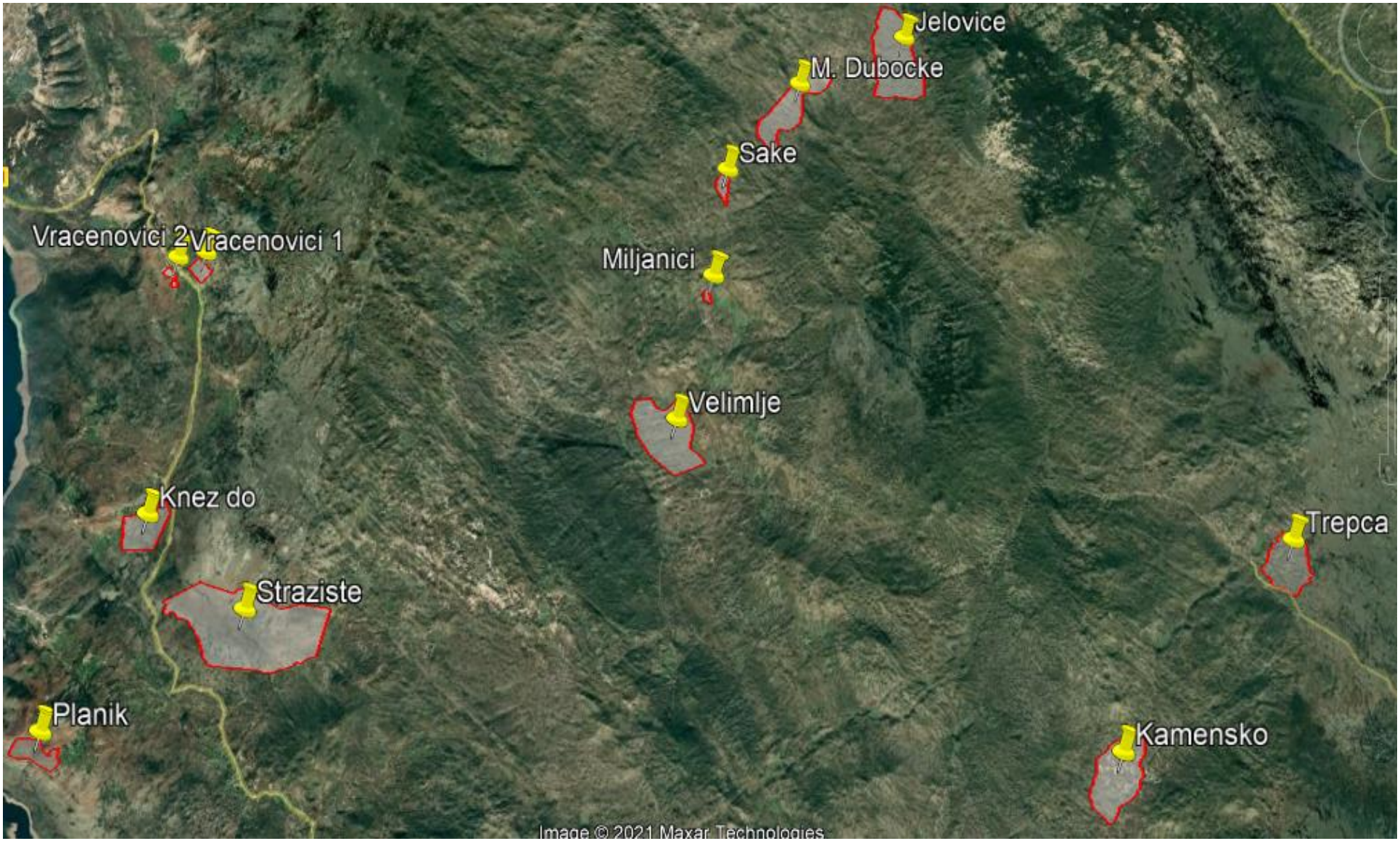
Unified locations for solar power plants_Kameno more_Nikšić



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WPP Gvozd

13 wind turbines, 54.6 MW, 150 GWh/g

- *together with construction of standard plateaus for installation of wind turbines and foundations on which to install wind generator poles*

Total investment value is cca. EUR 61 M

EBRD – Mandate Letter

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WPP Gvozd

Phase construction and commissioning

- The total of 13 wind turbines in addition to construction of standard plateaus for installation of wind turbines and foundations on which to install wind turbine poles
- 110/33 kV "Gvozd" transformer station on the project site
- Rehabilitation of 110/33 kV "Krnovo" transformer station
- Construction of a single line 110 kV TS "Gvozd" – TS "Krnovo", 3,125 m long
- Construction of 110 kV single line TS "Gvozd" – TS "Nikšić", 14,730 m long
- Rehabilitation of 110/35 kV "Nikšić" transformer station

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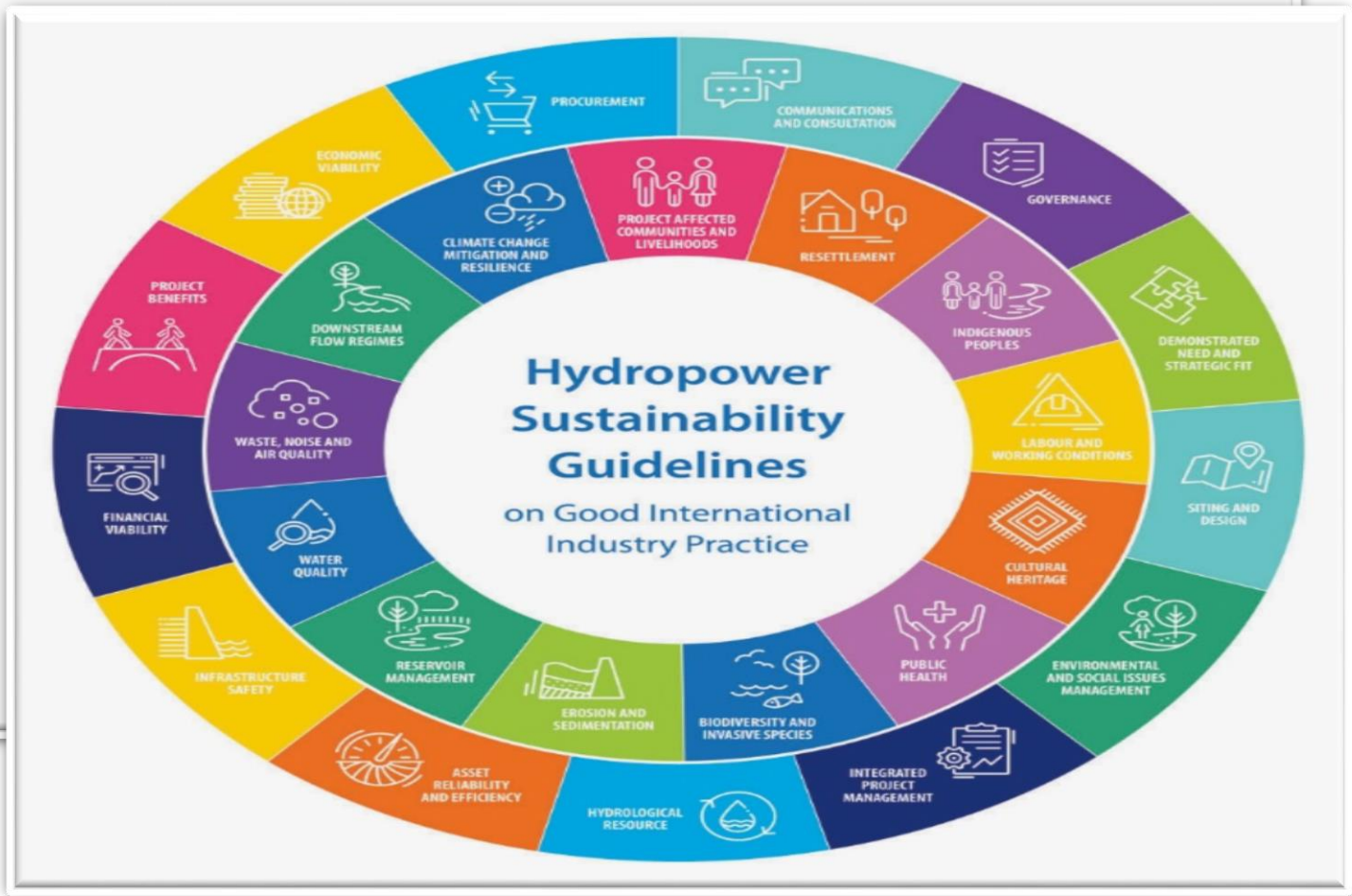
HYDRO POWER PLANTS

- Reconstruction and modernisation of HPP Piva –Phase II
- Reconstruction and modernisation of HPP Perućica– Phase II
- HPP Perućica – unit U8
- HPP Komarnica
- HPP Kruševo
- HPP Boka



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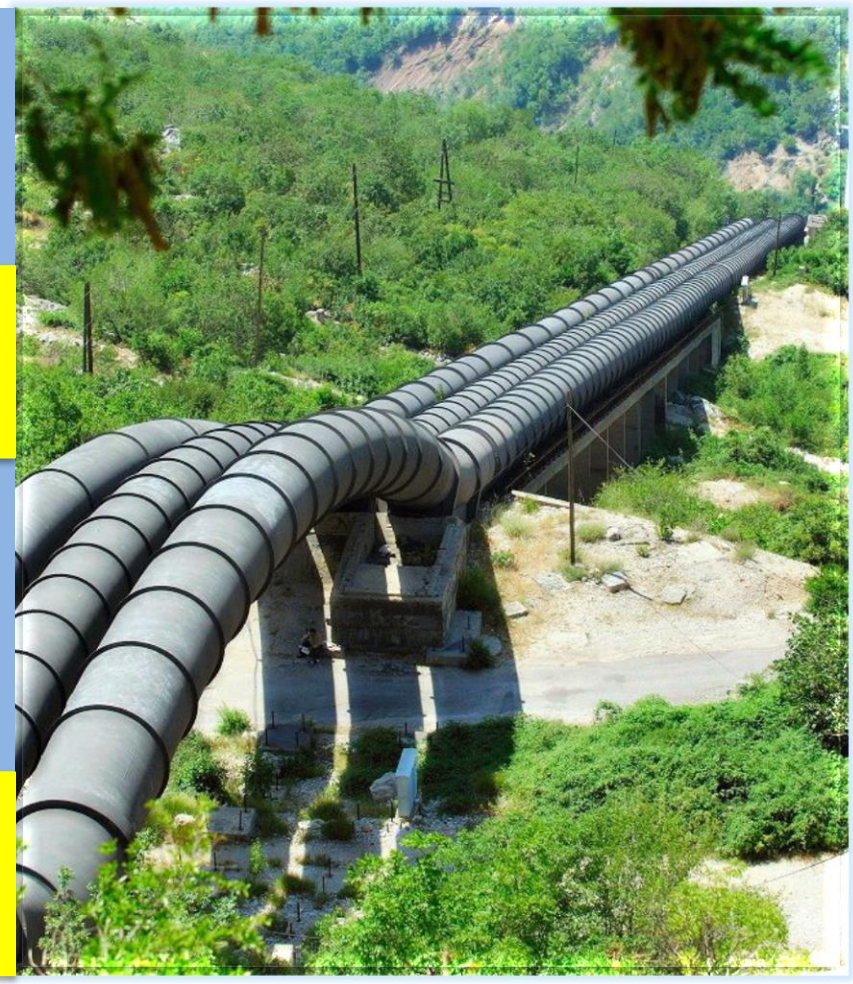
Project on reconstruction and modernisation of HPP Perućica – installation of U8

58.5 MW

- *Installation of the eight unit (U8) – Increase in total installed capacity of HPP Perućica from 307MW to 365.5 MW.*

The value of total investment is cca. EUR 24M

- *KfW Bank gave an indicative offer.*



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Project on reconstruction and modernisation of HPP Perućica – Phase II

Reconstruction and modernisation of

- *Hydromechanical and electrical equipment of units U5, U6 and U7*
- *Equipment for hydrology-hydraulic measurements*
- *Hightening and recovery of Opačica and Moštanica canals*
- *Installation of the integrated IT system at the plant's level*
- *Reconstruction and modernisation of the system's structures*

EPCG signed cca. EUR 33 M worth Loan Agreement with the KfW bank on September 18, 2019 for the needs of the project financing

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Water regulation of NK Polje

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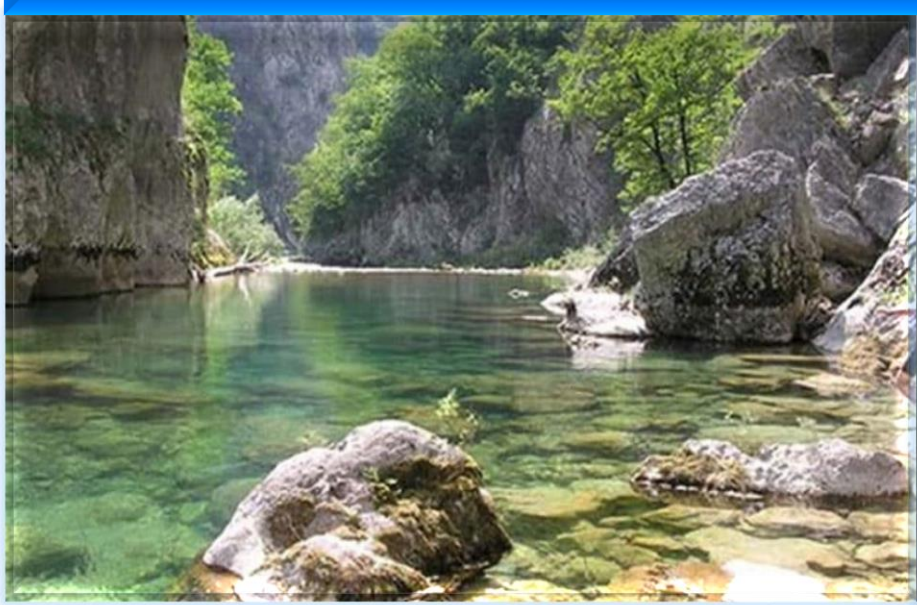
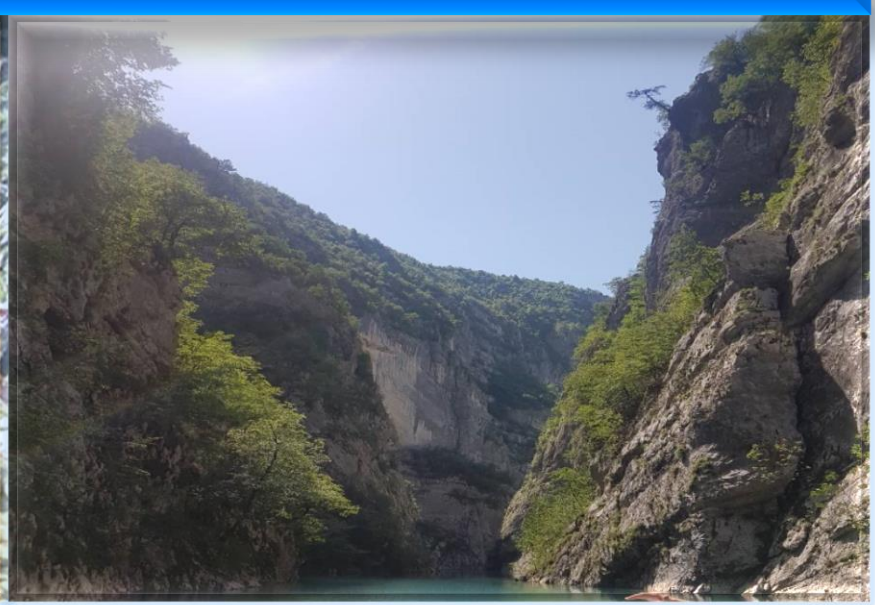
HPP Komarnica

On October 6, 2020 the European Commission adopted a comprehensive economic and investment plan for the Western Balkans in order to establish a long-term economic recovery of the region, support a green and digital transition, regional integration and convergence with the European Union.

The European Commission identified, in the energy sector under the so-called Flagship-4-RENEWABLE ENERGY, four specific projects to be supported, including the Project on construction of HPP Komarnica.





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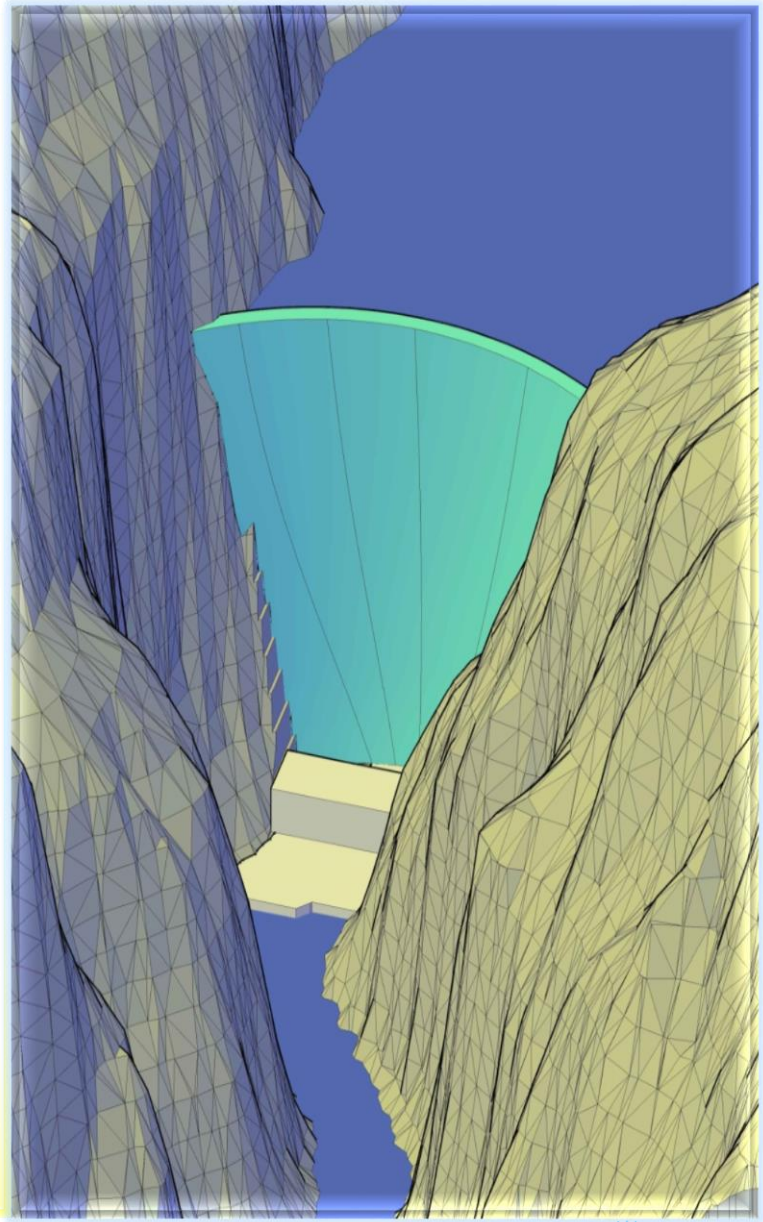
Technical features of HPP Komarnica

A concrete arch dam, with powerhouse at the toe of the dam, frontal spillway with gates and outlet tunnel in the left abutment of rock mass.

- Normal water level elevation: **811 m.a.s.l.**
- Reservoir capacity: **227 mil. m3**
- Dam heigth: **171 m**
- Installed discharge: **130+8 m3/s**
- Generators capacity: **2 x 81 MW+ 9.9 MW**
- Maximum capacity: **171,9 MW**
- Annual generation: **213 GWh**
- Investment value: **260 – 290 M EUR**



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HPP Komarnica

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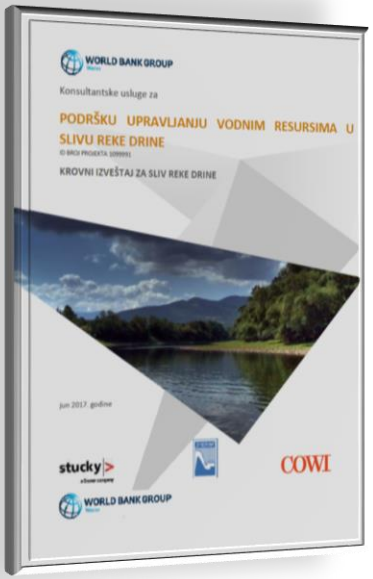
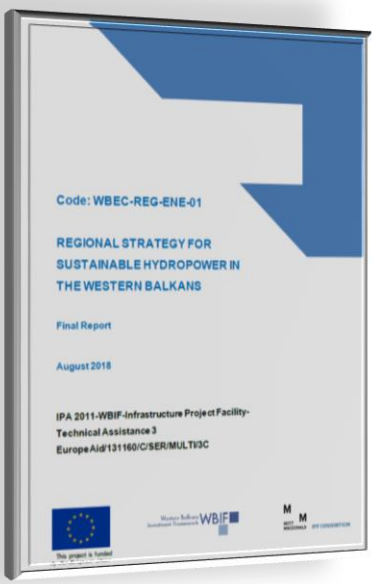
HPP Kruševo





HPP Kruševo was analysed as part of the World Bank's project Support to Water Resources Management in the Drina River Basin: COWI AS (Norway), STUCKY LTD (Switzerland) and "Jaroslav Černi" Water Institute (Serbia) (2016)

HPP Kruševo was also analysed as part of the documents Regional Strategy for Sustainable Hydropower in the Western Balkans - Western Balkans Investment Framework: Mott Macdonald and IPF Consortium, (2017)

Tabela 4: Osnovne osobine HE predloženih optimalnim scenarijom za Crnu Goru

HE	"Komarnica"	"Otilovići"	"Kruševo"
Reka	Piva/Komarnica	Ćehotina	Piva
Rastojanje	km 50+000 (Piva)		
Q_{av} (m^3/s)	21,6	4,15	75,8
Tip/Visina brane (m)		Lučna betonska (postojeća)	Kamena - betonsko gravitaciona / 68
Ukupni kapacitet akumulacije / aktivni kapacitet (mil. m^3)	176	59	25.4/18
Tip elektrane	Nije protočna	Protočna (105m duga)	Nije protočna
Inst. kapacitet (MW)	170	2.961	120
Srednja godišnja proizvodnja el. energije (GWh)	220,5	11,73	267,4
Investicioni troškovi (mil. evra)*	322	4	166

HPP KRUŠEVO (downstream profile)

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Project on reconstruction and modernisation of HPP Piva – Phase II

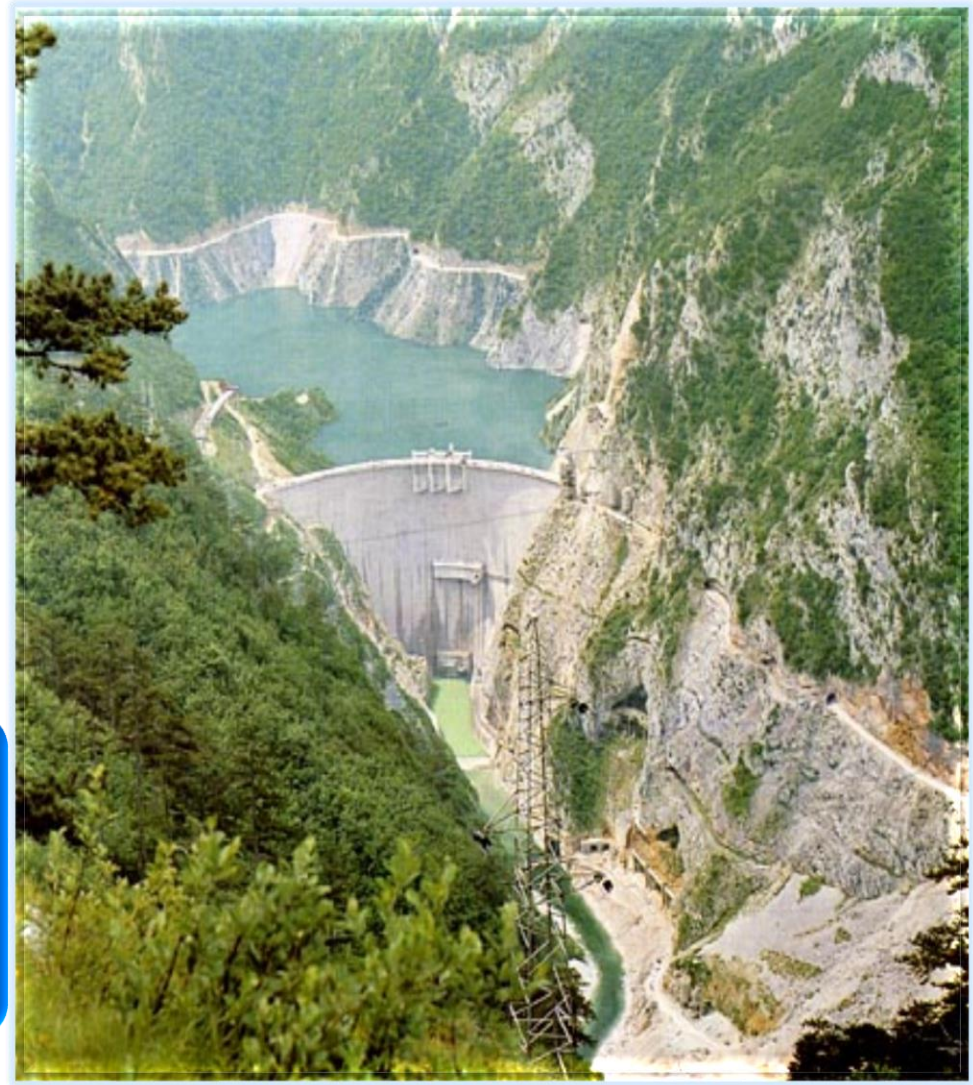
Reconstruction of hydromechanical and electrical equipment of units U1, U2, and U3 and auxiliary power supply;

Completion of works in 2022

Loan Agreement signed with KfW *(EUR 16 M worth loan)*

EPCG signed a Contract with the Contractor JV Litostroj Power from Slovenia and ABB from Italy in July 2018.

Value of the Contract is EUR 10.3M



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Next Step

Development of the HPP Kruševo Study

The core objective of the Study: consideration of all the conditions to exploit hydropower potential of the Piva River downstream from HPP Piva and the commitment to choose the most favourable option

The Study comprises two options:

1. Option - analysis of the upstream and the downstream profile

2. Option - analysis of the upstream profile only (discard the downstream profile)

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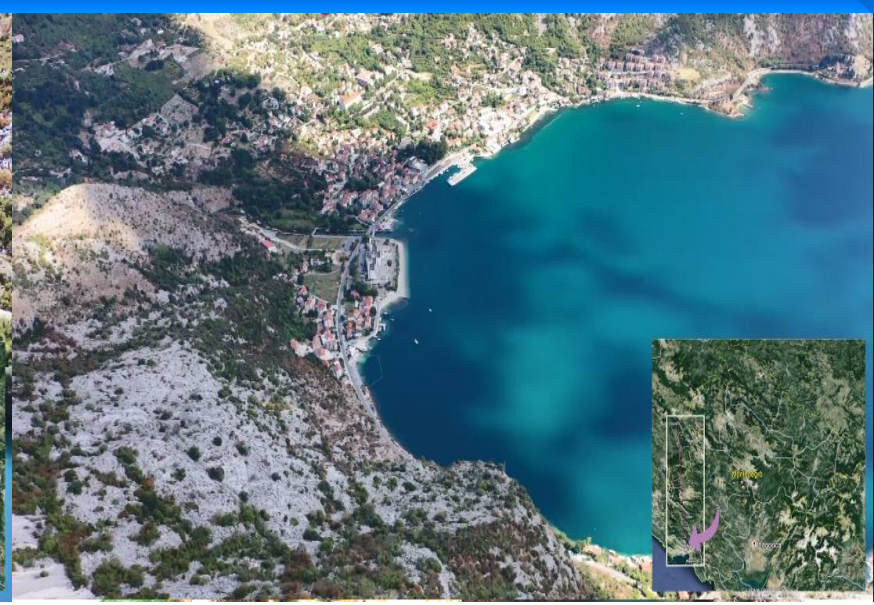
HE Boka-Sutorina

Potpisan je Memorandum o razumijevanju između Elektroprivrede Republike Srpske i Elektroprivrede Crne Gore, gdje je iskazana nesumnjiva namjera da sa Mješovitim Holdingom ,,Elektroprivreda Republike Srpske", stupi u transakciju u vezi zajedničke realizacije energetskog Projekta – HE Boka-Sutorina. Realizacijom predmetnog projekta bi se stvorili uslovi za unapređenje saradnje u cilju povećanja efikasnosti i profitabilnosti oba elektroenergetska sistema, kao i obezbjeđenje zajedničke valorizacije vodnog potencijala u energetske svrhe i za poboljšanje vodosnabdjevanja dijela Crnogorskog primorja.

Instalisana snaga 250 MW. Vrijednost projekta EUR 300 M.



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HPP Boka-Sutorina

(Potential routes)

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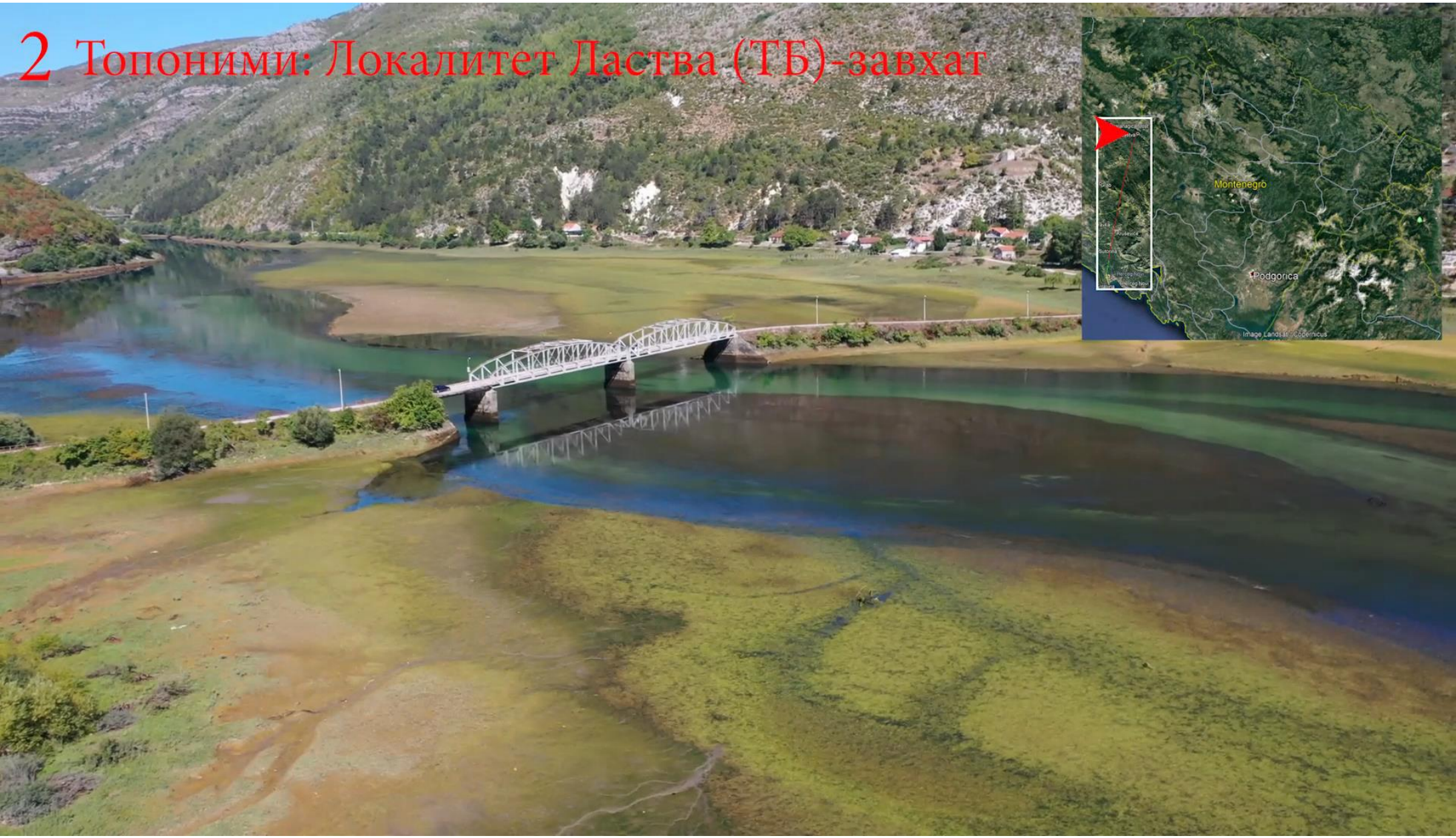
HPP Boka-Sutorina

(video)



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Reversible
HPP Skadarsko lake

The location of the mechanical building of the reversible hydropower plant is proposed on the western shore of Lake Skadar near the settlement of Donji Murići. Lake Skadar would be the lower reservoir of the proposed reversible hydropower plant. The upper reservoir is proposed to be an artificial reservoir, which would be built in a natural basin above the lake at a distance of 2.5 km from the machine building at an altitude of about 600 m. The machine building would be connected to the upper reservoir with a diversion tunnel about 2.3 km long.

Installed power 250 MW. The value of the project is EUR 300 M.

Proposed location of RHPP Skadarako Lake infrastructure

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Reversible
HPP Skadarsko lake

- Skadar lake is a huge water reservoir, as the largest lake in the Balkans and one of the largest lakes in Europe. Lake Skadar is a crypto-depression, which is mainly supplied with water by Morača river, and water flows from it towards the Adriatic Sea via Bojana river. Depending on the ratio of inflow and outflow of water, the surface of Skadar lake varies from 530 to 370 km2. About two-thirds of the lake's surface belongs to the Republic of Montenegro, and one-third to the Republic of Albania. The average depth of Lake Skadar is 6 meters, and in some parts, where the bottom is below sea level, it reaches a depth of up to 60 meters. The volume of water in Skadar lake is 1890·106 m3. The altitude of the surface of Skadar lake is variable and varies between 5 and 9 m.
- The water potential of Skadar lake has been analyzed in various studies for the purposes of: water supply, fishing, agricultural and tourist activities, but the possibility of using this natural resource for energy purposes has not been analyzed.

The infrastructure of the regional water supply system which supplies the Montenegrin coast

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GAS

Gas-fired PP BAR

Installed capacity 50 MW

Project value - € 30M

Gas-fired PP KAP

Installed capacity 150 MW

Project value - € 90M

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Initiative for coal regions in transition in the Western Balkans and Ukraine

The Initiative for coal regions in transition in the Western Balkans and Ukraine was launched in December 2020 and aims to help countries and regions rationalize coal consumption by striving for a carbon-neutral economy, while ensuring that this transition is just, i.e. it does not jeopardize the economic-social status of the country. It will deliver support to coal regions in EU neighbouring countries - Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, Serbia, and Ukraine. It is managed by the European Commission and 6 international partners: the World Bank (WB), the Energy Community Secretariat, the European Bank for Reconstruction and Development (EBRD), the European Investment Bank (EIB), Poland's National Fund for Environment Protection and Water Management and the College of Europe in Natolin.

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In focus - NECP

- In order to fulfill the EU's energy and climate goals for 2030, the EU member states are required to prepare ten-year national energy and climate plans (NECP) for the period 2021-2030.
- The national plans outline how the EU member states intend to address issues related to the following five ares: energy efficiency, renewable energy sources, greenhouse gass emissions reductions, interconnections, research and innovation.
- Montenegro's NECP is being prepared with support of GIZ, Fraunhofer and the Energy Community.

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THANK YOU FOR YOUR ATTENTION!

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Elektroprivreda Crne Gore
AD Nikšić