

HPP BOSKOV MOST



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HPP Boskov Most is complex hydro energy system which includes entire usage of hydro potential of Mala Reka respectively its tributaries Tresonce, Rosoki, Lazaropole River, Valovnica, Garska, Zvoncica and Belesnica which catchment area is situated in the west part of Republic of North Macedonia.

The hydro power plant Boskov Most with the supply and drainage facilities and powerhouse building is located in the west areas of North Macedonia, near the town of Debar. Near the plant passes the Republic highway Skopje-Debar-Ohrid.



It is a typical derivation plant. The waters of the river Mala Reka are , as it inflows in the river Radika 10 km upstream from the inflow of Radika into the river Crn Drim.

Pilot provision has been made for construction of a dam and forming of an accumulation (lake), intakes of all streams of Mala Reka river basin, derivation canals, tunnel, pipeline and powerhouse building.

The dam will be constructed at the river Jadovska Reka inflow in the river Tresonecka Reka, below the Tresonce village.

The dam is 31,80 m. high and provides a useful storage area of $546 \times 10^3 \text{ m}^3$ which represents water storage for several days.

The tunnel length is of 8750m and $D=3,3$ m. The tunnel passes on the right side of the river Mala Reka through the mountain called Vranje Krasta. On the right side there is the intake and the supply of the river Rosoki. All the other intakes: river Garaska, Valovnica, Lazaropolska, Zvoncica, Belesnica and the supply canals with total length of 10.698 m, pass on the left side of the river Mala Reka through taps Gari and Tresonce, are joined into the supply tunnel.

The supply tunnel is terminated with surge tank with circular section (profile). The waters from the surge tank through steel penstock are led to the generators in the powerhouse. The generators will be built in the power house with Francis turbine, 2 x 35,75 MW.

For this project Main Design for 45 MW rated power was prepared by HEP-Skopje in 1983 as well as Feasibility Study, prepared by Paul C. Rizzo Ass, USA and financed by TDA in 2002. The preliminary design for 68 MW rated power was prepared by HEP-Skopje and Energoprojekt-Belgrade in 2005.

JSC ESM is Investor of project HPP Boskov Most, using own financial sources and EBRD loan.

Preparations for the implementation of HPP "Boskov Most" began in 2010 when the European Bank for Reconstruction and Development (EBRD) hired consultants by the company "Poyry" from Switzerland and one independent consultant to support the ESM and EBRD to prepare a project for financing.

The value of the project and the financing structure was determined with the set parameters, as well as the procurement and individual participation in financing from EBRD and JSC ESM and on 10.11.2011 loan agreement was signed with EBRD worth 65 million euros, which determined the financing of the project.

In November 2011, international public announcement was published and Consortium Stucky - AF Consult was selected for consulting services including design and supervision.

HPP Boskov Most project will be realized in four parts:

- Civil works- dam construction, roads, intakes and remaining infrastructure, headrace tunnel, surge tank, powerhouse building and remaining facilities.
- Electromechanical equipment - supply and installation of major equipment, turbines, generators and transformers.
- Connection to the grid refers to equipment and work required to connect the building with high-voltage grid.
- Construction of 110 kV Transmission line from SS Boskov Most to Kicevo region.

Hydrological data

There is a relatively large data bank regarding the measured and calculated flows for HPP Boskov Most. For the 1946 to 1960 time frame, the existing data bank consists of measurements on the Radika River at a location downstream of the site, and since 1960, a monitoring station with continuous recording capability was placed on the Mala Reka, next to the project site. A series of simultaneous measurements were performed on each stream intake location and dam site, in order to define the correlation between the flows in the catchments area, and according to the calculations the natural available flow is 5,21 m³/s. For the purpose of this project verification of hydrological basis was made by the consulting company "Poyry" from Switzerland in 2015.

Environmental aspects

According to the EBRD's operational policies and associated with this project, JSC ESM for that purpose undertook several commitments to environmental protection and the impact of the project on it. So far for the project HPP Boskov Most are prepared following documents: ESIA – Environmental impact assessment study, annual report for bio-monitoring and environmental monitoring is prepared, Aquatic Biodiversity Study is prepared which identified and proposed measures on minimum acceptable environmental flows, Report for mitigation on the environment and in the final stages of preparing is a Landscape management plan.

The negative environmental impacts that would occur during the construction of the facilities will be established, monitored and will be taken appropriate measures to mitigate and avoid the negative environmental impacts from HPP "Boskov Most".

Electricity Production

HPP Boskov Most is designed to operate as near to rated capacity on the peak electricity demand hours. The plant will operate for at least five hours daily during the summer period and during the rest of the year the engaged capacity will vary according to the

hydrological conditions. According to the analyses performed in the Preliminary design HPP Boskov Most will annually generate 117 GWh.

Construction Cost

According to the calculations in the Feasibility Study, estimated cost of the plant construction amounts 143,9 millions EUR, and:

Consultant/Supervision	6.400.000 EUR
Main civil works	87.000.000 EUR
Equipment	22.000.000 EUR
Other works	28.500.000 EUR
Total:	143.900.000 EUR

Implementation period

In accordance with the previously defined dynamics in the design documentation, construction is projected at 4 years.

Expected benefits

The following effects are achieved with this project:

1. **It increases the installed capacity** of JSC ESM for 71,50 MW and annual production of additional 117 GWh.
2. **Production of peak load electricity of about 117 GWh** to cover daily peaks that means reduced export and opportunities to create market product in an open electricity market.
3. The hydro system with this HPP finalizes **the Crn Drim confluence**.
4. The construction will increase the share of renewables in the production of JSC ESM. Republic of North Macedonia has committed to the European Union to meet the objectives of 20% production from renewable sources in the energy balance, a goal set and supported by all relevant institutions in Republic of North Macedonia.

Technical characteristics of HPP Boskov Most according Basic design developed by Stucky - AF Consult from Switzerland:

1. HYDROLOGICAL CHARACTERISTICS	
AVERAGE AVAILABLE WATER FLOW	5.75 m ³ /s
AVERAGE PRODUCTION PER YEAR	117 GWh
2. HYDROTECHNICAL CHARACTERISTICS	
2.1 WATER STORAGE (Dam Lake)	
TOTAL VOLUME	1.996 x 10 ³ m ³
USEFUL VOLUME	546 x 10 ³ m ³
MAX. LEVEL	989,90 maSL
MIN. LEVEL	984.00 maSL
2.2 DAM	
DAM TYPE	Rock filled
DESIGNED HEIGHT	31.80 m
HEIGHT MEASURED FROM THE LOWEST FOUNDATION	45,70 m
DAM VOLUME	160.380 m ³
2.3 EVACUATION FACILITIES	
2.3.1 OVERFLOW	
TYPE	Shaft
CAPACITY	300.00 m ³ /s
2.3.2 BOTTOM OUTLET	
TYPE	pipeline
PIPELINE DIAMETER	3,50 m
PIPELINE LENGHT	80 m
2.4 SUPPLY FACILITY	
CAPACITY	22.00 m ³ /s
DIMENSION	3.00 m

3. ENERGY PARAMETERS

NUMBER OF GENERATOR UNITS	2
RATED FLOW	22 m ³ /s
RATED FLOW PER TURBINE	11 m ³ /s
RATED POWER	71,50 MW
VOLTAGE LEVEL	110 kV

4. ELECTROMECHANICAL PARAMETERS

4.1 TURBINE

TYPE	Francis
RATED POWER PER TURBINE	35,75 MW
NUMBER OF REVOLUTIONS	750 rpm
RATED FLOW PER TURBINE	11 m ³ /s

4.2 GENERATOR

TYPE	3 phase-synchron
RATED POWER	40 MVA
VOLTAGE LEVEL	10.5±5% kV
NUMBER OF REVOLUTIONS	750 rpm

4.3 TRANSFORMER

RATED POWER	40 MVA
TRANSITION RATIO	10.5/115.5 kV

4.4 SWITCHYARD

10 kV SWITCHYARD COMPRISING
 2 TRANSFORMER AND
 3 LONGDISTANCE POWER LINE FIELDS

Figure 1: HPP Boskov Most site on Google maps



