

# STUDY OF LONG-TERM OVERVIEW OF EMS AND TRANSMISSION NETWORK ON THE TIME HORIZON UNTIL 2035

## The goal of the project

### Expected project results

The transmission network of EMS is relatively old and it is necessary to consider, in addition to the needs for the development of the transmission network, also the need for reconstruction of existing transmission network facilities or if it is necessary to decommission them, to look for new solutions.

The result of this project is a Study that will:

1. Enable EMS to optimally consider the needs for construction, adaptation, extension and reconstruction of transmission network facilities;
2. Provide variant solutions in a form in accordance with the Law on Planning and Construction and acceptable for the preparation of the Feasibility Study;
3. Give solutions to the problem of radially powered transformer stations;
4. Show "ID card" of all existing facilities.

## Methodology of the Study

The preparation of the Study can generally be divided into six groups of activities:

1. Collection and systematization of data and substrates;
2. Analysis of the current state of the network and identification of critical points in the network and the possibility of solving burning problems;
3. Forecast of energy consumption and peak power and their distribution by points in the system;
4. Consideration of the target solutions in the network and variants which will be discussed in detail;
5. Detailed elaboration of variant solutions and formation of proposals of optimal variants by work packages;
6. Development of a database with ID cards of network elements suitable for further application in the planning and development of individual projects.

## Analysis, forecast and planning of the network

### Analysis of the existing situation:

- Forming a transmission system model for maximum winter and summer load and minimum load;
- Identification of usual power plant engagements for different regimes;
- Analysis of normal network operation in defined modes and formation of proposed measures for possible improvement;
- Analysis of "n-1" criteria of security and analysis of "n-2" criteria according to the defined list of outages.

### Demand forecast:

- Forming projections of total electricity and power consumption at the level of Serbia based on the previous period using different statistical models;
- Systematization and grouping of settlements according to supply substations 110/X kV and 35/X kV;
- Analysis of spatial plans and assessment of their impact on economic development growth rates by groups of settlements and supply TS 110/X kV and 35/X kV;
- Forecast of total electricity consumption in different categories of consumption and consumption by groups of settlements and supply TS 110/X kV and 35/X kV.

### Formation of target solutions and elaboration of network development year by year:

- Analysis of the required capacities of the 400 kV network for the needs of transmission of the forecasted power and substitution of the 220 kV network planned for shutdown, taking into account the planned power transits;
- Formation of variant solutions of new 400 kV lines that include proposals for potential routes;
- Identification of necessary additional capacities in the transformation of 400/110 kV or 400/220 kV, optimal locations for possible new TS and their optimal connection to 400 kV voltage and reconfiguration at a lower voltage level;
- Analysis of the availability of 110 kV lines in the perspective period, the need for a new 110/X kV substation and the development of variant 110 kV network solutions.

## Serbian transmission network

The transmission network is divided into 6 work packages:

1. Work package 1 - consumption area of south-western Serbia;
2. Work package 2 - consumption area of south-eastern Serbia;
3. Work package 3 - consumption area of west-ern Serbia;
4. Work package 4 - consumption area of central and eastern Serbia;
5. Work package 5 - consumption area of Bel-grade, part of Srem, Danube region behind Belgrade and southern Banat;
6. Work package 6 - consumption area of Srem, northern Banat and Bačka.

## References

1. Methodology and criteria for transmission network planning, Electrical Engineering Institute Nikola Tesla, Belgrade, 2000.IECC-2012
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3. Rules of the Transmission System Operator, Belgrade, December 2017
4. Realization of the electricity balance of electricity distribution companies in Serbia, Public company Electric Power Industry of Serbia, Belgrade
5. Report on electricity flows on the transmission system of the Republic of Serbia
6. Program for the realization of the Energy Development Strategy of the Republic of Serbia until 2025 with projections until 2030 for the period from 2017 to 2023, Belgrade, 2017

