

1. "Rationalization of the own electrical energy consumption in Thermal Power Plant Kostolac "B" - the 1st. phase: Energy analysis of own consumption, loads and losses and selection of measures for the rationalization",

Ordered by: Public Utility "Thermal Power Plant Kostolac", Kostolac  
Project Manager: Miloje Kostić, PhD.  
Associates: Saša Minić, MSc.  
Ana Šaranović, MSc.

Thermal Power Plant Kostolac "B" has two aggregates (2x345 MW). Its own consumption is about 10% of the plant's power (about 70 MW) as well as about 10% of total produced electrical energy. 6 kV asynchronous motors participate with about 85% and 0.4 kV asynchronous motors participate with about 10% in the Thermal Power Plant's own consumption. The first phase of this project was the study that contains 3 chapters:

1. Energy analysis of own consumption and loads, based on estimations and/or calculations of total losses in 6 kV and 0.4 kV asynchronous motors, and the structure of losses.
2. Selection of measures for the rationalization according to the analysis specified in previous thesis. For the rationalization of plant's own consumption (that is, of the electromotive drive), following measures have been chosen:
  - Identification of the optimal voltage values within  $U_n \pm 5\%$ , for the 6 kV network;
  - Selection of the consumers with economically justified reactive power compensation;
  - Application of asynchronous drives with the speed regulation for chosen drives and,
  - Individual energy rationalizations for 6 kV network, 6/0.4 kV transformers and motors.
3. The savings attained by rationalization of plant's own consumption have been estimated to about 1% (1.5 million kWh per year).

Size of Project: 50 pages  
Finished in: 2004.

2. "Improvement and practical application of the software for automated calculations of marginal transfer capacities of the interconnections",

Ordered by: Public Utility "Elektroprivreda Srbije", Belgrade  
Project Manager: Dragan Popović, PhD.  
Associates: Đorđe Dobrijević, MSc.  
Ana Petrić, MSc.  
Saša Minić, MSc.  
Andreja Rašić, MSc.

This study consists of five tomes. The first tome contains relevant methodological and practical aspects of the automated calculations of the marginal transfer capacities. The second tome gives detailed description of program STATICW, which is in charge of bidirectional data conversion between ORACLE database and program STATIC, whose purposes are security analyses and transmission capacities calculation. The third tome gives detailed description of program KONVERTOVANJEFORMATA, which is used for bidirectional data conversion between ORACLE database and ASCII files that contains data in UCTE and PTI formats. In the fourth tome is the user manual, with documentation for the overall software, which incorporates following programs: STATIC, STATICW and KONVERTOVANJEFORMATA in ORACLE environment. At the end, the fifth tome implies all needed documentation related to ORACLE database (logic relation model and description of database physical project).

Size of Project: 431 pages  
Finished in: 2004.

3. "Standard asynchronous motors for two voltage levels as energy efficient motors (EEM)",

Ordered by: Serbian Ministry of Science and Environment Protection  
Project Manager: Miloje Kostić, PhD.  
Associates: Žarko Janda, PhD.  
Sekula Ištvan, MSc.  
Lajoš Miškolci, MSc.

Main objective of this study was to research and check practicability and adequacy of usage asynchronous motors for two voltage levels (two stator winding connections) as energy efficient motors (EEM). As a result of the research, appropriate series of asynchronous motors should be defined. The study has been realized according to program task that comprehended 5 phases of the research, which were carried out

through 8 activities defined in program task. Based on research results, new series of asynchronous motors for two voltage levels as energy efficient motors has been defined: powers from 1 to 30 kW and (possibly) from 37 to 75 kW.

Results of this project can be used for rewinding asynchronous motors: damaged stator winding should be replaced with two separate half windings, whose terminals should be connected to  $\Delta$  connection if average value of loads is less than 80% of the nominal load. It was estimated that this solution is applicable for about 70 - 80% of repaired motors, which would improve their energy characteristics. If this solution is applied to motors whose total power is 60-70 MW per year, savings of active power could be about 1 MW and for reactive power even 10 Mvar, which means that active and reactive energy savings could be 3000 MWh and 30000 Mvarh.

Size of Project: 50 pages

Finished in: 2004.

4. "Distribution network further development and medium voltage level selection for the area of Public Utility "Elektrosrbija" Kraljevo - Distributive area of Loznica",

Ordered by: Public Utility "Elektrosrbija", Kraljevo

Project Manager: Saša Minić, MSc.

Associates: Ana Šaranović, MSc.  
Gordana Radović, MSc.  
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Branislav Čupić, MSc.  
Andreja Rašić, MSc.  
Tijana Janjić, MSc.

Analysis of network's present condition (phase 1 of the Project) and load forecast updating (phase 2 of the Project) have been accomplished based on data from the year of 2002. Long-term directions (year of 2020) of network development (phase 3 of the Project) have been formed and dilemmas, which should be clarified by detailed analysis of network development variants, have been clearly segregated. Variants of network development have been formed and analyzed, both without (phase 4 of the Project) and with (phase 5 of the Project) appliance of 20 kV voltage, and the most economical plan, which fulfills previously defined criteria, has been suggested. Network has been considered in respect of adjacent distributive areas (Šabac, Valjevo). Initial network size: ~740 MV/LV substations. Population: ~155000.

Size of Project: 500 pages

Finished in: 2004.

5. "Study of long-term prospective 110 kV, 35 kV and rural 10 kV networks development for the area of "Elektromorava" Požarevac",

Ordered by: Public Utility "Elektroprivreda Srbije", Belgrade

Project Manager: Srdo Mrda, MSc.

Associates: Dušan Muškatirović, MSc.  
Saša Minić, MSc.  
Ana Šaranović, MSc.  
Nada Obradović, MSc.  
Branislav Čupić, MSc.  
Ivan Stanisavljević, MSc.  
Andreja Rašić, MSc.

The objective of this study is development of prospective 110 kV and 35 kV networks, and also for rural 10 kV network in the area of "Elektromorava" Požarevac for the period 2002 to 2020. The study includes analyses of energy consumption development for the period up to the year of 2000 as well as load and energy consumption forecast until the year of 2020. Detailed analyses of 110 kV, 35 kV and 10 kV networks present condition (including physical state of networks, load of elements, voltage conditions and losses) have been accomplished.

Based on those analyses, results of load forecasting, techno-economical analyses and comparison of possible development variants, the most prosperous solution of distributive network further development in the considered area for the period up to the year of 2020 has been suggested.

Size of Project: 564 pages

Finished in: 2004.

6. "Perspectives of the part of 220 kV network - Analysis of solution for substation 220/110 kV Beograd 3",

Ordered by: Public Utility "Elektroprivreda Srbije", Belgrade

Project Manager: Srđo Mrđa, MSc.

Associates: Saša Minić, MSc.

Nada Obradović, MSc.

Ana Šaranović, MSc.

Tanja Đokić, MSc.

Ivan Stanisavljević, MSc.

In this study detailed technical and economy analyses of possibility and reason for replacing existing transformation 220/110 kV with 400/110 kV in Beograd 3 substation has been given. This analysis has been carried out with respect to age of existing 220 kV equipment, necessity of replacing it with new ones, age of 220 kV lines, which are connected to Beograd 3 and investments for their revitalization. Possible variants for connecting Beograd 3 to 400 kV have been considered from the aspect of the urban planning. According to this analysis and techno-economical comparisons, the conclusion was that final decision should be postponed after additional analyses considering whole transmission network of Serbia.

Size of Project: 37 pages

Finished in: 2004.

7. "Rationalization of the own electrical energy consumption in Thermal Power Plant Kolubara",

Ordered by: Public Utility "Thermal Power Plant Nikola Tesla", Obrenovac, Public Utility "Thermal Power Plant Kolubara", Obrenovac

Project Manager: Miloje Kostić, PhD.

Associates: Saša Minić, MSc.

Ana Šaranović, MSc.

Thermal Power Plant "Kolubara" has six aggregates whose total power is 271 MW:

- old part with five aggregates (4x32 MW + 65 MW);

- new part with one aggregate (110 MW);

Its own consumption is about 10% of the plant's power (about 27 MW) as well as about 10% of total produced electrical energy. 6 kV asynchronous motors participate with about 85% and 0.4 kV asynchronous motors participate with about 10% in the thermal plant's own consumption. Within this study in the first phase the study "Energy analysis of own consumption and selection of proceedings for the rationalization" was made.

It contains 3 chapters:

1. Energy analysis of own consumption and loads, based on estimations and/or calculations of total losses in 6 kV and 0.4 kV asynchronous motors, and the structure of losses.
2. Selection of measures for the rationalization according to the analysis specified in previous thesis. For the rationalization of plant's own consumption (that is, of the electromotive drive), following measures have been chosen:
  - Identification of the optimal voltage values within  $U_n \pm 5\%$ , for the 6 kV network;
  - Selection of the consumers with economically justified reactive power compensation;
  - Application of asynchronous drives with the speed regulation for chosen drives and,
  - Individual energy rationalizations for 6 kV network, 6/0.4 kV transformers and motors.
3. The savings attained by rationalization of plant's own consumption have been estimated to about 1% (630000 kWh per year).

The second phase included:

- Projects of concrete measures for reducing own electrical energy consumption;

- Realization of projected measures for reducing own electrical energy consumption;

Realization of this project resulted with savings that exceeded projected savings for about 50% - based on quarterly appliance of suggested proceedings, amount of realized savings is about 250000 kWh. Expected savings that will be reached as a result of applying suggested proceedings are estimated to 1000000 kWh per year.

Size of Project: 50 pages

Finished in: 2004.

8. "Distribution network further development and medium voltage level selection for the area of Public Utility "Elektrosrbija" Kraljevo - Distributive area of Novi Pazar",

Ordered by: Public Utility "Elektrosrbija", Kraljevo

Project Manager: Saša Minić, MSc.

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Branislav Čupić, MSc.  
Ana Šaranović, MSc.

Analysis of network's present condition (phase 1 of the Project) and load forecast updating (phase 2 of the Project) have been accomplished based on data from the year of 2002. Long-term directions (year of 2020) of network development (phase 3 of the Project) have been formed and dilemmas, which should be clarified by detailed analysis of network development variants, have been clearly segregated. Variants of network development have been formed and analyzed, both without (phase 4 of the Project) and with (phase 5 of the Project) appliance of 20 kV voltage, and the most economical plan, which fulfills previously defined criteria, has been suggested. Network has been considered in respect of adjacent distributive areas (Raška, Sjenica). Initial network size: ~420 MV/LV substations. Population: ~115000.

Size of Project: 252 pages

Finished in: 2004.

9. "Public Utility Elektrosrbija as an energy-technological and business complex",

Ordered by: Public Utility "Elektrosrbija", Kraljevo

Project Manager: Saša Minić, MSc.

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Nada Obradović, MSc.  
Branislav Čupić, MSc.  
Ana Šaranović, MSc.

The purpose of this project was to mark all integrative elements that merge Public Utility "Elektrosrbija" Kraljevo into an energy-technological and business complex. First, 110 kV and 35 kV network connections were specified. Functions, which were transferred from utility's parts to directorate level are specially analyzed: distribution network management system, maintenance repair functions, informational system integration (and as a special segment telecommunication infrastructure), development and investment functions, administrative and financial functions and supervision and surveillance functions.

In the end, Public Utility "Elektrosrbija" Kraljevo mergence was generally evaluated.

Size of Project: 20 pages

Finished in: 2004.

10. "Research of more economical medium voltage distribution network operation possibilities",

Ordered by: Serbian Ministry of Science and Environment Protection

Project Manager: Vladica Mijailović, PhD.

Associates: Saša Minić, MSc.  
Rade Drča, MSc.  
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Branislav Čupić, MSc.

Project realization consists of several phases:

- Data preparation and updating;
- Optimal reconfiguration algorithm development, graphical user-interface software development with algorithm incorporated, and data preparation for software usage;
- Actual distribution network operation analysis, research of possibilities for more economical reconfiguration and voltage regulation;
- Analysis of urgent, very profitable investments for bottlenecks clearing up;
- Analysis of research results appliance;

Presented results show that expected annual effects of optimal network operation measures are about 6 millions EUR. Properties of presented optimal reconfiguration algorithm are considerable speed and quality

results. Average profitability rate of urgent distribution network investments presented in Project is 23%. Estimated value of very profitable distribution network investments in Serbia is about 25 millions EUR.

Size of Project: 16 pages

Finished in: 2004.

11. "Evaluation of transmission capacity and ancillary services in conditions of open electricity market",

Ordered by: Serbian Ministry of Science and Environment Protection

Project Manager: Dragan Popović, PhD.

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Andreja Rašić, MSc.

Maja Turković, MSc.

Jovan Nahman, PhD.

Nešo Mijušković, PhD.

The basic objective of this Project was to develop the automatic cross-border transmission capacity assessment (NTC-Net Transfer Capacity) of interconnections in conditions of open electricity market.

It is based on advanced methodology for NTC calculation, using all its favorable properties, respecting the latest definitions, criteria, standards, procedures and practice of European Transmission System Operators (ETSO). The possibilities of developed approach were demonstrated on example of existing electrical power interconnection in Balkans.

Size of Project: 16 pages

Finished in: 2004.