1. "Feasibility Study: Rehabilitation of Transmission Network",

   Ordered by: Kreditanstalt fűr Wiederaufbau (KfW), Germany
   Realized by: DECON (Deutsche Energie-Consult Ingenieurgesellsch), Germany
   Dr Radu T.Krohne
   Dr Gerd-Henning Vogel

   BEA Consulting, Germany
   Jűrgen Kampa

   Institute "Nikola Tesla", Power Systems Department
   Srđo Mrđa, MSc.
   Dragan Popović, PhD.
   Đorđe Dobrijević, MSc.
   Emilija Turković, MSc.

   Public Utility "Elektroprivreda Srbije"
   Branka Ribar, MSc.

   Public Utility "Elektroistok"
   Nešo Mijušković, PhD.

   The object of this study was to identify facilities in Serbian transmission network which should be rehabilitated in forthcoming period and also to rank their priority against minimum of investments in order to:

   - provide efficient transmission of electrical energy from the source to the consumers and to prepare power system for entering liberalized electricity market;
   - upgrade availability of some of the facilities in Serbian power system and to provide the optimal dispatching, with reduction of load shedding and elimination of the blackouts;
   - minimize technical looses in transmission network;
   - make easier power system reintegration to the UCTE;

   The study contains two parts. The first part of the study is related to load forecasting (until the year of 2010.) and forming transmission network database as a base for the realization of the second part of the study, where detailed analyses of the network's conditions has been performed. The first part of the study is also related to detailed analyses of characteristics and conditions of individual facilities in Serbian transmission network, characteristics and structure of the demand as well as plenty of economic and demographic factors which are of interest for the forecasting.

   In the second part of the study, analyses of future transmission network functioning (in 2001, 2006 and 2011) have been performed. Analyses involved load flow calculations, static and dynamic security of Serbian transmission network, calculation of the short circuit currents and analyses of primary frequency regulation. According to the results of those analyses, quantification of expected reconnection of the first and the second UCTE synchronized zone effects has been done, as well as the valorization of the effects of new transmission network elements planned incorporation. In the end conclusions and suggestions for the rehabilitation are given.

   Size of Project: 300 pages
   Finished in: 2002.

2. "Forming database for 400, 220, 110 and 35 kV networks of EPS and connection with programs for development planning and network (distribution and transmission) exploitation",

   Ordered by: Public Utility "Elektroprivreda Srbije", Belgrade
   Project Manager: Đorđe Dobrijević, MSc.
   Associates: Branislav Petković, MSc.

   In this study, database of transmission network of EPS has been formed. Database contains all needed data about lines, transformers and generators, which are necessary for the load flow calculations. Also, this database is connected to database of 15 minutes loads, which enables automatic updating loads for all system nodes for the chosen 15 minutes period. This database is connected to programs DLF/OPF and CLF/OPF, too. Program DLF/OPF reads all needed data form database, calculates load flows and writes results to database, which enables user-friendly searching of output results. Program CLF/OPF has

bidirectional data exchange with database (input data for the CLF/OPF can be written in the database, and data from database can also be written directly to the CLF/OPF input file).

Finished in: 2001.

3. "Improvement of applicative software for static security analysis and it's connection to the software for short term operational planning of EPS's power system",

   Ordered by: Public Utility "Elektroprivreda Srbije", Belgrade
   Project Manager: Đorđe Dobrijević, MSc.
   Associates: Dragan Popović, PhD.
   Branislav Petković, MSc.

   In this study, first of all, further improvements of analyses of static security for EPS have been performed. Relevant methodological and software basics have been given in the previous study which was ordered by EPS. EPS already developed software for short term operational planning. Improved software for security analysis is connected with this software. Appropriate user interface for this programs have been developed in ORACLE environment. Software for security analysis is using part of data which are needed for the operation of load flow software (DLF-OPF), which have already been developed for the EPS. These programs are operating within their own ORACLE database. Therefore, existing DLF-OPF software have been adopted according to the needs of applicative software for static security analysis by both introducing new and extending existing tables in the database.

   Special database was developed for the data which have not been enclosed by existing databases for operational planning and load flow software, which are necessary for the operation of applicative software for static security analysis.

   Also, two user interfaces have been made: one of them (STATICW) for bidirectional data interchange between database and applicative software for static security analysis (STATIC), which is developed by Electrical Engineering Institute "Nikola Tesla" (furthermore, topological network check and calculation of outside equivalent are performing in this software) and the other (GRAFICKIEDITOR) for bidirectional data interchange between database and graphic editor, which is developed by EPS. Thereby, network topology can be changed by using graphic editor, and also output data can be searched.

   After initialization, procedure for static security analysis is performed, and output results are stored to the database where user can check and analyze them, by using appropriate forms.

   Both programs have been realized as dialogue applications, written in Microsoft Visual C/C++, by using MFC (Microsoft Foundation Classes). For the data interchange with the database ORACLE Pro*C/C++ tool have been used. All parameters needed for the operation of these programs can be entered from the command line. After that, program is executing demanded operation. If during the operation an error occurs, problem is reported, and program operation continues or stops, depending on error.

   Size of Project: 253 pages
   Finished in: 2002.

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

   Ordered by: Public Utility "Elektrosrbija", Kraljevo
   Project Manager: Saša Minić, MSc.
   Associates: Gordana Radović, MSc.
   Maja Turković, MSc.
   Ivan Jovanović, MSc.
   Srđo Mrđa, MSc.

   Analysis of network's present condition (phase 1 of the Project) and load forecast (phase 2 of the Project) have been accomplished based on data from the year of 1997. 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 (Valjevo, Topola). Initial network size: ~570 MV/LV substations. Population: ~109000.

   Size of Project: 181 pages
   Finished in: 2002.

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

   Ordered by: Public Utility "Elektrosrbija", Kraljevo
   Project Manager: Saša Minić, MSc.
   Associates: Gordana Radović, MSc.
   Maja Turković, MSc.
   Ivan Jovanović, MSc.
   Srđo Mrđa, MSc.

   Analysis of network's present condition (phase 1 of the Project) and load forecast (phase 2 of the Project) have been accomplished based on data from the year of 1997. 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 (Lazarevac, Šabac, Loznica). Initial network size: ~640 MV/LV substations. Population: ~156000.

   Size of Project: 395 pages
   Finished in: 2002.

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

   Ordered by: Public Utility "Elektrosrbija", Kraljevo
   Project Manager: Saša Minić, MSc.
   Associates: Maja Turković, MSc.
   Ivan Jovanović, MSc.
   Gordana Radović, MSc.

   Analysis of network's present condition (phase 1 of the Project) and load forecast (phase 2 of the Project) have been accomplished based on data from the year of 1997. 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, with appliance of 20 kV voltage (phase 4 of the Project), and the most economical plan, which fulfills previously defined criteria, has been suggested. Network has been considered in respect of adjacent distributive areas (Kraljevo, Trstenik, Kruševac). Initial network size: ~160 MV/LV substations. Population: ~29000.

   Size of Project: 72 pages
   Finished in: 2002.

7. "Study of the reconstruction of 10 kV electrical energy supply of draw-wells at the left and right bank of the Sava river (improvement of electrical energy supplying reliability and quality)",

   Ordered by: Directorate for urban terrain and city of Belgrade architecture
   Project Manager: Srđo Mrđa, MSc.
   Associates: Saša Minić, MSc.
   Miloje Kostić, PhD.
   Ana Šaranović, MSc.
   Nada Obradović, MSc.
   Branislav Ćupić, MSc.
   Branko Mandić

   In this study 110, 35 and 10 kV networks, which are used for supplying the facilities of Belgrade water supply company - BVK, located at the left and right bank of the Sava river, have been analyzed. Proceedings for improving security of existing supplying facilities have been suggested, as well as solutions for connecting new facilities to the network. Also, the solution which enables more economical and more safely supply of BVK facilities at the right bank of Sava river, from the "Beograd 32 - Vodovod" 110/35 kV transformer substation has been presented. The study has been accepted, and BVK started the realization of the solutions suggested.

   Size of Project: 70 pages
   Finished in: 2002.

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

   Ordered by: Public Utility "Elektrosrbija", Kraljevo
   Project Manager: Saša Minić, MSc.
   Associates: Gordana Radović, MSc.
   Nada Obradović, MSc.
   Ana Šaranović, MSc.
   Branislav Ćupić, 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 2000. 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, with appliance of 20 kV voltage (phase 4 of the Project), and the most economical plan, which fulfills previously defined criteria, has been suggested. Network has been considered in respect of adjacent distributive areas (Trstenik, Ćuprija, Kruševac). Initial network size: ~590 MV/LV substations. Population: ~131000.

   Size of Project: 224 pages
   Finished in: 2002.

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

   Ordered by: Public Utility "Elektrosrbija", Kraljevo
   Project Manager: Saša Minić, MSc.
   Associates: Ana Šaranović, MSc.
   Gordana Radović, MSc.
   Nada Obradović, MSc.
   Branislav Ćupić, 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 2000. 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, with appliance of 20 kV voltage (phase 4 of the Project), and the most economical plan, which fulfills previously defined criteria, has been suggested. Network has been considered in respect of adjacent distributive areas (Topola). Initial network size: ~230 MV/LV substations. Population: ~45000.

   Size of Project: 99 pages
   Finished in: 2002.

10. "Study of long-term prospective 110 kV and 35 kV networks development for the area of "Elektrotimok" Zaječar",

    Ordered by: Public Utility "Elektroprivreda Srbije", Belgrade
    Project Manager: Srđo Mrđa, MSc.
    Associates: Dušan Muškatirović, MSc.
    Saša Minić, MSc.
    Ana Šaranović, MSc.
    Nada Obradović, MSc.
    Branislav Ćupić, MSc.

    The objective of this study is development of prospective 110 kV and 35 kV network for the area of "Elektrotimok" Zaječar for the period 2000-2020. The first part of the study includes analyses of loads and electrical energy consumption for the period up to the year of 2000, as well as load and energy consumption forecast until the year of 2020, by quinquennial stages (2000 - 2005 - 2010 - 2015 - 2020).

    In the second part of the study, analyses of 110 kV, 35 kV and 10 kV networks present condition have been performed and then, based on those analysis and load forecasting results from the first part of the study, possible solutions have been considered and suggestions for 110 kV and 35 kV network development have been given, up to the year of 2020, by stages.

    Size of Project: 386 pages
    Finished in: 2002.

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

    Ordered by: Public Utility "Elektrosrbija", Kraljevo
    Project Manager: Saša Minić, MSc.
    Associates: Ana Šaranović, MSc.
    Nada Obradović, MSc.
    Branislav Ćupić, MSc.
    Gordana Radović, 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 2000. 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 (Aranđelovac, Čačak). Initial network size: ~200 MV/LV substations. Population: ~33000.

    Size of Project: 176 pages
    Finished in: 2002.

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

    Ordered by: Public Utility "Elektrosrbija", Kraljevo
    Project Manager: Saša Minić, MSc.
    Associates: Ana Šaranović, MSc.
    Nada Obradović, MSc.
    Branislav Ćupić, MSc.
    Gordana Radović, 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 2000. 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 (Ćuprija, Kruševac). Initial network size: ~250 MV/LV substations. Population: ~63000.

    Size of Project: 232 pages
    Finished in: 2002.