Siemens PTI’s feasibility study results proven in pilot project: Smart grid project implementation based on Siemens PTI master plan in Russia.

In 2014 Siemens PTI had the privilege to support Bashkirian Power Grid Company (JSC BESK), Bashkirenergo, with the development of a modernization plan for the electrical network of the city of Ufa, capital of the Bashkortosan Republic in Russia¹. At this year’s CIRED conference in Madrid in June, Bashkirenergo published a report on the “experience of smartgrid implementation in electric system of Ufa city for optimization of the distributive electric system operation expenses”².

In the report Bashkirenergo refers to measures of the pilot project initiated in May 2014 after receiving Siemens PTI’s study results, which included the renovation and automation of distribution and transformer substations and the installation of an intelligent power metering system in the pilot region.

During the pilot project, Bashkirenergo experienced a “significant contribution to electric system reliability improvement and minimization of emergencies” through the recommended grid optimization measures and connecting new prosumers, achieving a decrease in commercial power losses by 96.3%. Because the “results of the successful pilot project confirm that estimations that were made in (Siemens PTI’s) feasibility study were correct”, Bashkirenergo is now replicating the pilot proven solutions in the entire Ufa city electric system.

¹ Power Technology, Modernization of the Ufa City Distribution Network, Siemens PTI Delivers Smart Grid Master Plan, Issue T19, April 2015
² CIRED19 paper no. 1919 from Dmitry Sharovatov, BESK JSC, et al.

Figure 1: Power losses for different regions
Against this background, the scope of the study was to define suitable measures to increase security and quality of power supply in order to ensure the economic efficiency of new Smart Grid technologies integrated into the network as well as to decrease the high technical and non-technical power losses in the power system. Therefore, the following questions were raised in the course of the investigation of the Ufa city electricity network, looking at voltage levels 110 kV, 35 kV, 10 kV, 6 kV and 0.4 kV:

- What is the situation of the network infrastructure today?
- What are the critical issues that have to be solved?
- Which technical solutions can be implemented to solve existing and future problems?
- Which of these measures are also economically feasible?
- How does the roadmap for implementation of the solutions until 2020 look like?

Answering these questions, Siemens PTI analyzed different conventional and innovative automation, measurement and monitoring technologies and solutions, and developed a smart grid master plan:

The network structure was found to be very complex with partly inefficient supply paths, redundancies and protection concepts. There were several long feeders whose operating voltage was beyond acceptable limits, while communication infrastructure in the MV network was not clear and the level of automation was very low and locally restricted. From the weak point analysis of the present network, possibilities for improvement were identified and different scenarios regarding network structure and automation concept were developed, also considering future load increase, requirements on reliability performance, commercial losses and economics. The reference scenario (Sc 0) and Scenario 1 used the existing topology, but different measures for automation, monitoring and metering. Scenario 2 and Scenario 3 further include improvements on network structure. For each scenario a bill of quantities of primary and secondary level equipment was created.

Subsequently, a techno-economical evaluation of the necessary measures leading to the developed scenarios was carried out and the necessary measures were identified. For the evaluation, capital and operational expenditures, technical and commercial losses, net present value and return of investment were investigated. Assessment of the individual measures showed that optimization of network structure using 6 kV and 10 kV equipment and GIS technology as well as network automation using feeder condition monitoring, digital power meters and partially remote-control of transformer stations lead to a positive return of investment after 10 years.
Figure 3: Techno-economic evaluation of different measures.

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