

The first research related to remote monitoring and control of the facilities in the electric power industry began in 1963 in the Institute Mihailo Pupin at the initiative of Belgrade Power Distribution Company (EDB). The aim of this research was to develop technologically modern and powerful system, which would be a solid ground for upgrading the control process at all electric power industry' levels: energy generation, transmission and distribution.

This first systems developed as a result of research in this area were called ATLAS, later becoming the brand beyond the borders of our country. The research in this area was financed partially from our own funds and to some extent by the Ministry of Science of the Republic of Serbia. In the mid-nineties, relying on their own expertise and taking similar foreign products as a model, the Institute's specialists developed the SCADA (Supervisory Control and Data Acquisition) program, the VIEW software package which, together with the ATLAS family hardware program (process computers, PLC equipment and data loggers), forms part of all segments of the Serbian Electric Power System.

Three decades after the first application of computers in the field of remote control, in 2004 IMP-Automation and Control started with the implementation of VIEW Power System - DCS (Distributed Control System) which nowadays represents the backbone of the system for control of thermal and hydro power plant operation. For supervision, management, statistics, data and events archiving and their analysis the software package POWER VIEW 6000 is used.



DCS IN THERMAL POWER PLANT OPERATION

The main characteristics of the View T-Power solution, used in thermal power plants are:

- Integration with new ALSTOM TGC turbine control systems (Morava Thermal Power Plant, the Nikola Tesla Thermal Power Plant A4)
- Integration of old turbine control systems (Kostolac Thermal Power Plant-B2)
- Integration of new electro filtering systems (Nikola Tesla Thermal Power Plant-A4, A2, A1)
- PLC system standards, IEC 61131 series
- Communication between the generator electrical protection system and the 6kV plant (Nikola Tesla-A4, A2, Kostolac-B2)
- K-200 turbine control by direct regulation commands on the turbine control engine.

The up-to-date equipment incorporated into DCS allows more reliable supervision, improved regulation and a higher automation level in block control. In addition, higher security and reliability of operation, process optimisation, enhanced operation efficiency and flexibility, shorter start-up and shut-down times, faster fault location as well as easier and faster fault elimination are provided. These advantages result in reduced plant operation costs which make the block more economical and the required modernization investment fully justifiable. It should be mentioned that a thermal block being out of operation for just a single day makes a loss in the amount of 100.000 Euro. Computerized supervision and archiving of all generator data as well as simple numerical and schematic presentation of trends changing in a particular time period represent a reliable ground for determining the length of the remaining lifecycle of the vital, highly loaded, components of the main block equipment. In this way the adjustment of plant operating modes and generation parameters of the block load and the extent of the necessary repair works and maintenance costs is determined increasing the overall security of the plant.

The investment made so far in the repair of the blocks of Serbia's thermal power plants has increased the capacity of old blocks by almost 400 MW. Thanks to constant investments, the Nikola Tesla thermal power plants increased its production from 15.3 to more than 18 billion kilowatt hours (kWh) of electrical energy in the period 2000-2007. In the period 2004-2009, the Electric Power Industry of Serbia (EPS), during the ongoing capital repairs of TPP "Morava" (125 MW), blocks in TE "Nikola Tesla A" (210-320 MW), and "Kostolac B", "TE-TO Novi Sad", entrusted us to perform the reconstruction of the control system in these thermal power plants. Thanks to these tasks the systems developed at the Institute represent the backbone of the electrical system in Serbia. The huge technological breakthrough was achieved and the team of experts was completed, capable of performing similar tasks with high quality standards and in this way putting the Institute Mihailo Pupin in the same line with large multinational companies producing and delivering DCS systems. We are especially proud of the quality and reliability of our devices that are in the very top and are our best recommendation for the further penetration of markets around the world.



References:

TPP "Morava" – Svilajnac

The reconstruction of the measurement and control system performed by IMP-Automation &Control Ltd. in 2004. covered: a complete replacement of control consoles and synoptic tables in the control room by the state-of-the-art solution with computers with TFT monitors, video-beam projectors and the appropriate system and applications software; delivery of 12 PLC units from the Institute's production program for acquisition and local processing of over 4000 digital data and about 80 regulation loops; development and implementation of control algorithms in cooperation with EPS's technology experts. The solution implemented also includes the remote supervisory monitoring function allowing the plant managers to obtain, at any moment, a precise in-sight of system parameter values using the NETWIEW Web application. System operation is monitored on a large number of screens housed in the control room from which dispatchers control plant operation on the basis of 960 measurement and 1900 signal indications by using View T-Power system.

Thermal Power Plants "Nikola Tesla"- Obrenovac

All blocks in the thermal power plant were modernized in the 2005-2008 period: the A2 block, 210 MW power, was completed for 4 months in 2005, the A1 block, 210MW, in 2006, the A4 block, 308 MW, in 2007, and the A6 block, the largest one, 320 MW power, in 2008. A multidisciplinary team comprising the Thermal Power Plant's and the Institute's experts planned, designed and realized an extremely demanding and complex assignment of blocks control in a record time and with exceptional financial savings estimated to about 70% of the global market price.

Thermal Power Plant "Kostolac B"

Thermal power plant blocks in 'Thermal Power Plants and Mines Kostolac' with the total available capacity of 921 MW, account for 11 percent of the total available capacity of Serbia's electric power system. The reconstruction of control system in 348,5 MW B1 thermal power plant was completed in 2008 and the works on the reconstruction of control in B2 thermal power plant were started and completed in 2009.

Combined Thermal-Heating Power Plant Novi Sad

The Combined Thermal-Heating Power Plant in Novi Sad forms part of the Panonian Power Plants Company and produces the electrical energy, heating energy for the heating of Novi Sad and the technological steam for the Petroleum Refinery. In the technical sense, this is a plant with cross links between three boilers and two turbines, without a classical block system, what provides considerable operation flexibility and reliability. Natural gas and crude oil are used to fuel the plant. This plant's rated power is near 208 MW and the generator produces 245 MW. The reconstruction of the combined thermal-heating power plant in Novi Sad is planned to be realized as a combined cycle with up-to-date technical solutions. The control of boiler 3 was modernized in 2008. The modernization of 2 turbines and 2 transformers was completed in 2009.

DCS IN HYDRO POWER PLANT OPERATION

Constant efforts on improvement of computer controlled hydro power plant operation led to the hydropower system View H-Power, with the following main features:

- Generator and block transformer control and protection systems
- Integration with new turbine governor systems LMZ Russia (Djerdap 2)
- Integration of old turbine governor systems (HPP Vrla 1).
- Integration of new generator thermal protection systems (Djerdap 2)
- PLC systems standards, IEC 61131series
- Redundant control and protection systems
- Integration into the central hydro power plant control system
- Integration with AK1703 ACP (SAT Automation – VAtech) systems.

View H-Power provides an increased volume of information, new reliable sensors and multiple (redundant) supervision of quantities provide an operator with a timely warning of the violation of some process parameter values, protecting, thus, the equipment from higher wear rates and undesirable defects. All this ensures a longer equipment lifecycle.

Visual presentation functions are adapted to the needs of operating personnel and permit easy on-line monitoring of existing generator status. Archiving functions provide the possibilities of analysing equipment and personnel operation as well as diagnostics of problems, if they arise during exploitation.



References:

"Djerdap" power plants with 1.328 MW installed power provide about 15% of the power of EPS power plants and 20% of the total Serbia's electrical energy generation. They consist of "Djerdap 1" Hydro Power Plant (HPP), "Djerdap 2" HPP, "Piroć" HPP and "Vlasina" HPP.

The Contract signed between the IMP – Automation & Control Ltd and the Public Enterprise for Hydro Power Production "Djerdap" involved the delivery of equipment and spare parts required to modernize the control boards of generator units and the block transformer in the "Djerdap 2" extra HPP.

This was the first job of modernization of hydro power plant which has given the opportunity to the Institute's experts to find the best solution for the control and management of future hydro power plant operations.