

Precise control

Emerson Process Management has installed its Ovation expert control system at Unit 1 of the newly commissioned Dnestrovskaya pumped storage power plant, an important source of renewable and reliable power in Ukraine

Alexei Etkin of Emerson Process Management explains how precise control of a new hydroelectric scheme on the Dniester River is providing much needed flexibility for the Ukraine's power generation network

THE Ukraine was the first of the Former Soviet Union countries to introduce a competitive electricity market in the mid 90's. According to a 2007 report by the Centre for Social and Economic Research (CASE) in the Ukraine, the companies that took over the responsibility for generation inherited outdated assets. Their report states "Despite the fact that currently the Ukraine is a net exporter of electricity, the production capacities in the electricity sector are outdated: 95 per cent of power units have worked out their useful life; the residual life of thermal power plants is 5-7 years. This poses a problem for the future electricity supply in Ukraine."

The report goes on to say that, "In December 2006 the First Vice-Premier Andriy Klyuev announced that the government is going to initiate a reconstruction programme for the energy sphere of Ukraine with about US\$7.3 billion of investment. The funding sources are planned to be taken as loans from banks. The first stage of the programme is expected to be launched in February 2007."

The total capacity of all Ukrainian power plants in 2007 was 52GW, including 33.5GW (64.4%) at thermal plants, 13.8GW (26.5%) at nuclear plants and 4.7GW (9.0%) at hydroelectric plants. This situation meant that there was a lack of manoeuvrability.

DNESTROVSKAYA PROJECT

The Ukraine has been investing in additional hydro power capacity as it introduces much needed flexibility into its ageing system. One of these projects is the Dnestrovskaya pumped storage plant on the Dnyéstr River, just downstream of Novodnestrovsk in the

Ukraine. The Dnyéstr River rises in Ukraine, near Drohobych close to the border with Poland, and flows toward the Black Sea. The plant was commissioned in December 2009 by UkrHydroEnergo Open Joint Stock Company (OJSC), a non-profit public organisation which brings together individuals and companies operating in hydro power in the Ukraine.

The task of the Dnestrovskaya project is to regulate peak loads in the electricity supply system, participate in frequency regulation, and provide emergency power reserves. The plant has seven 421MW units and, when all units are operational, will have a total capacity of 2947MW, making Dnestrovskaya the largest pumped storage plant in Europe.

The control system on the plant has been supplied as a turn-key project by Emerson Process Management in partnership with Ukrainian Joint-Stock Company Enpaselectro and included the supply of an Ovation expert control system along with the associated project management, engineering, installation supervision, start-up and commissioning services.

Emerson was selected for this project because of its industry expertise and considerable experience in providing control systems for hydro power plants in the region. Support was to be provided by Emerson's local hydro expert team, its engineering centre in Chelyabinsk, Russia and hydro specialists in Warsaw and St. Petersburg.

Other projects that Emerson has worked on include a pumped storage plant in the north of Poland (which comprises four reversible hydro units of 716MW) and a large hydroelectric scheme located on the Volga River in Russia. This large and complex project comprises around 60 units with a total output of 5GW.

OVATION SYSTEM AND SCADA

The Ovation system incorporates state-of-the-art networks, controllers, I/O, databases, and workstations with the latest software to produce the most efficient control technology. Ovation provides a multitude of options specialised for hydroelectric plants, including hardware and software for local unit control, emergency hydroelectric units, LV auxiliaries, metering systems, and HV substations. Ovation provides state-of-the-art programming features, alarming capabilities, engineering tools, and data collection within its standard software applications.

The Emerson system manages 2,500 I/O points and monitors and controls all major equipment and processes, including the Turboatom hydraulic turbine, Electrotyazhmash pump turbine generator, lubrication and cooling, drain and leakage systems, temperature monitoring systems, auxiliary equipment and main electrical system. Ovation also interfaces to the turbine governor, vibration system and excitation system.

The Ovation system provides basic control schemes for each unit, including the pump and turbine operations. The system also provides all transition regimes as well as providing control for an emergency shutdown.

The system management level consists of workstations for use by the operators and executive and technical staff. There are also workstations for engineering management, system database and data historian, and anti-virus protection.

The Ovation system also controls the 330kV substation. Unifying control under Ovation results in integrated control, which not only enhances unit-wide compatibility, but also contributes to improved unit stability, responsiveness and operating efficiencies; tighter overall control of plant operations; and a more streamlined view of key plant parameters.

Structurally, the Ovation system consists of operation level equipment (network equipment and workstations) and control level equipment (input/output modules and controllers). To provide staggered commissioning of the various devices in the pumped storage plant, the management system is separated into three independent subsystems with individual controllers. These comprise a common station level control subsystem, unit level control subsystem, and 330kV switchgear control subsystem.

Each subsystem includes a dedicated Ovation controller, a local user station and control panels with input/output modules. The system uses a powerful Ovation controller, working in a multi-task regime. The controller executes simple or complex modulating and sequential control strategies, performs data acquisition functions, and interfaces to various I/O sub-systems. Each controller has the capability to originate up to 32,000 I/O points. Ovation optimises multi-network communication traffic and the global management system oversees the dedicated controllers and high-reliability peripheral input/output modules.

All components of the Ovation system have a redundant connection to the main 100-Mbit/second Fast Ethernet network. This network ensures that all data sources broadcast their data on the network and the receivers (for example, user stations or other controllers) "see" all available data from all these sources. Ovation's SCADA architecture provides tools to transfer important data between generating sites and the UkrHydroEnergo (UHE) and National Dispatch Centres.

Workstations for operations, technical and executive staff provide information on the current condition of the equipment and are designed for direct process management. Engineers can use the stations for system configuration, introduction of applied programmes, algorithm introduction, and changes to control sheets and workstation screens. They are password protected to restrict access to authorised personnel only, and anti-virus software is installed to protect against virus attacks.

The Ovation Process Historian provides mass storage and retrieval of process data, alarms and operator actions for the control system. Information on the status of all computer and intelligent field devices is stored in a database and the historian server allows up to 20,000 measurable and accounting parameters to be scanned and archived. The historian is optimised to organise vast amounts of real-time process data and present meaningful information to all users, including operators, engineers, and maintenance personnel.



Emerson's Ovation system monitors and controls all major equipment and processes at the Dnestrovskaya pumped storage power plant (PSP)

SUMMARY

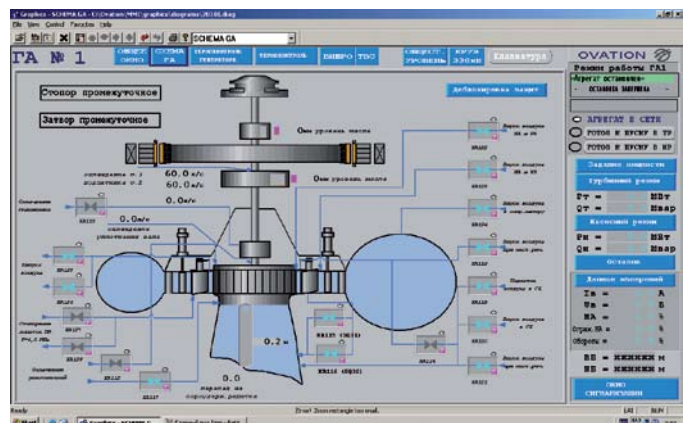
"We have found Emerson to be a reliable partner," said Yuri Bondarenko, chairman of the board, Enpaselectro JSC, the primary contractor for supply and installation of a protection and control system for Dnestrovskaya Unit 1. "Based on their ability to accomplish this comprehensive scope of work, combined with their advanced technologies, we hope to continue our successful relationship with Emerson."

Using Emerson's PlantWeb digital plant architecture with the Ovation expert control system at Dnestrovskaya has created a simple and easily understandable hardware and software platform for the operator interface.

The use of controllers, information networks and operator station functions, and applications within a truly distributed architecture, has greatly increased the reliability of the control system, and allowed the diagnostic systems to simplify system service as far as possible.

The pumped storage plant's control system integrates all the technological processes of an electrical power station, provides staff with accurate information, and guarantees continuous centralised access to all technological parameters through the Ovation workstation. This approach allows up-to-date and accurate decisions to be taken during operation, and quick reaction to events arising within the boundaries of any management mechanism. **IWP & DC**

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Ovation operator workstation with graphic display showing Unit Control