

# PROJECT NARRATIVE



## System Description

**Product Type:** Ovation

**Plant size (MW):**

HPP Globocica (42 MW)

HPP Spilje (70 MW)

HPP Tikves (92 MW)

Mavrovo Cascade (total 182 MW):

HPPs Vrutok, Vrben, Raven

**Location:** Macedonia

**Plant Type:** Hydro

**Application:** HPP

**Initiation:** 2001

**Ship:** 2002 - 2004

### Major System Components:

- Ovation controllers
- Ovation workstations
- Unit & plant control
- HV substation control
- Optimization solutions
- Electric metering systems
- Electrical protections
- LV auxiliaries
- Black-start unit

### DCS I/O Point Count (total):

- HPP Vrutok: 3767
- HPP Vrben: 1866
- HPP Raven: 2281
- HPP Tikvesh: 2912
- HPP Globocica: 1736
- HPP Spilje: 2430



Emerson revamped six power plants at Elektrostopanstvo na Makedonija – ELEM, including Globocica, Spilje, and Tikvesh, as well as three in the Mavrovo Cascade, Vrutok, Raven, and Vreben.

## **ELEKTROSTOPANSTVO NA MAKEDONIJA – ELEM Globocica, Spilje, Tikvesh, Vrutok, Raven, and Vreben Hydroelectric Power Plants Located in the Republic of Macedonia**

Hydro power plants represent about 30% of the installed generation base in the Republic of Macedonia. To combat peak electricity demand and enhance the country's biggest hydropower plants, Elektrostopanstvo na Makedonija (ELEM), a state-owned power company located in Macedonia, conducted a massive hydropower refurbishment program. The program consisted of several project packages and was financed by the World Bank. One of the packages included modernization of instrumentation and control.

With heavy competition from companies like ABB/Koncar, Alstom, VA Tech Hydro, and Voith Siemens, Emerson Process Management was chosen to implement the project. Emerson handled project planning, engineering, coordination, and management, as well as equipment design and integration of six power plants, which comprise of Globocica, Spilje, and Tikvesh plants, as well as three additional plants in the Mavrovo Cascade: Vrutok, Raven, and Vreben. After the upgrade, Macedonia was able to sell its energy to the European market while supplying its own resources.

### **Control System and Instrumentation**

Ovation replaced the existing, conventional control systems, including: individual indicators, recorders, switches and push buttons. The new systems implement redundant Ovation Controllers (one per each unit), plus additional controllers for switchyard control and data acquisition. An Ovation Network for each plant provides high-speed (100MB) data transmission.

Turbine governors, voltage regulators, PLCs, and other third party sub-systems are connected to Ovation with bi-directional wired or radio communication.

All Ovation control systems communicate online with the National Dispatch Center (NDC) in Skopje, sending actual status data for the units and receiving new load demand signals. The link with NDC implements ICCP protocol.

## Electrical Protection

All existing obsolete protection relays were replaced with microprocessor-based protection relays. The relays are attached to a serial link with Modbus protocol and connected to Ovation.

The project included electrical protections for:

- Substations 110 kV at HPP Vrutok, HPP Tihvesh, HPP Spilje, HPP Globocica
- Substation 220 kV at HPP Vrutok
- Substations 35 kV in HPP Vrutok, HPP Spilje, HPP Globocica, HPP Raven and HPP Vrben
- 4 units at HPP Vrutok
- 4 units at HPP Tikvesh
- 3 units at HPP Spilje
- 2 units at HPP Globocica
- 3 units at HPP Raven
- 2 units at HPP Vrben.

The complete scope of deliveries and services included:

- Complete protection panels (hardware and firmware)
- Design including schematic diagrams of AC and DC circuits, calculations of faults currents and calculations of protection setting values
- Programming and commissioning tools
- Factory tests
- Installation
- Start and commissioning

## Low Voltage Auxiliaries

The low voltage auxiliaries equipment installed at each of the hydro power plants included:

- 220V AC Control Boards, UPS
- 220V DC Control Boards, Batteries, Rectifiers, Chargers
- 48V DC Control Boards, Batteries, Rectifiers, Chargers.

## Installation and Integration Process

The six-plant project was completed at the end of 2004. The installation and integration process followed detailed project schedules developed by ELEM and Emerson for each plant.

Project implementation started in 2001 with the most complex application at HPP Vrutok, including:

- Process control, monitoring and optimizing
- Radio communication to dams, gates and surge chambers
- FO communication to HPP Vrben and HPP Raven
- Links to third-party Turbine Governors and Voltage Regulators
- Synchronizers
- Electric metering system
- Electrical protections
- LV auxiliaries
- Modernization of black-start unit
- Communication to NDC