

Ovation™ for improved hydro plant management

An automation upgrade at the Avio hydroelectric power station in Italy has increased productivity and led to significant improvements in the way the plant is managed

Luigi Magnaguagno, Hydro Dolomiti Enel, Italy

Hydro Dolomiti Enel (HDE) manages 27 hydroelectric power stations in the Trento province of northern Italy. The plants vary in size from just a few hundred kW to 110 MW and feature a range of different turbines. Managing such a highly diverse fleet requires HDE to be very flexible, employing operators and engineers with differing skill sets and levels. These range from engineers able to devise and enter the process logic during the design phase, through to on-call personnel required to think quickly on their feet in the event of a malfunction or breakdown.

Such a diverse workforce requires a plant automation system that is flexible and user-friendly and has a simple user interface. Operators, in particular, need a system that enables them to understand what is happening at each plant, so they can run the plants safely and, if needed, take action to quickly resume production without calling for specialist support. The aim is to have 30 people capable of problem solving instead of just three specialists.

With these aims in mind, HDE selected Emerson's Ovation™ expert control system for the automation upgrade at its Avio hydroelectric power station.



Adjustment valve automation at Avio



Pelton turbine group with 3 MW alternator at Avio

The Avio upgrade

The Avio station is one of two plants powered by water from the Pradastua dam. A separate plant at the base of the dam takes the first hydraulic head before releasing water into the Piagù basin. From the basin, water passes through a high-pressure conduit to provide energy to drive two 3 MW turbines within the Avio plant. The two plants are designed to work either individually or in parallel, enabling production to be optimised depending on the hydraulic energy available and the amount of power the market requires.

For this project, HDE required a supplier that could offer not only state-of-the-art technology that is easy to understand and use, but also the ability to customise the system design to meet the specific needs of the power plant, helping to improve its flexibility and increasing availability.

Emerson's Ovation system offered the option of viewing operating data remotely, enabling the power station to be managed from a distance.

In addition, the Ovation system's highly developed alarm management capabilities, and the proactive way the system handles maintenance, made it ideal for hydroelectric power systems consisting of several plants spread out across a wide area.

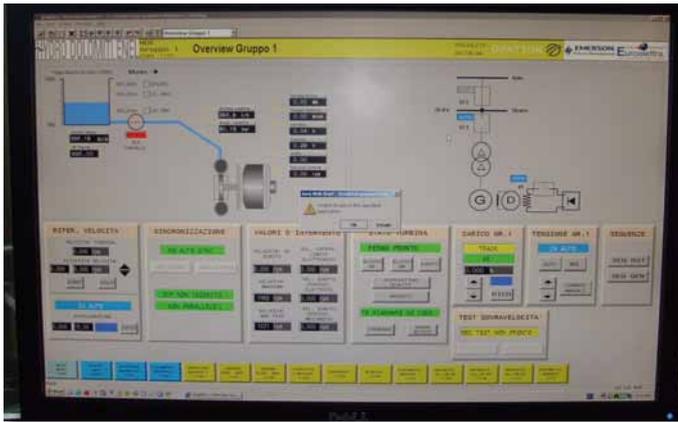
The simplicity of the Ovation system interfaces was another important factor. Operators need to be able to navigate easily and quickly to find the data they require to perform necessary procedures when an alarm has been raised. The Ovation system provides easy-to-follow sequences that make navigation simple, as well as direct and contextual access to control logic, parameters and trends.

Another consideration was the quality of support services provided by Emerson, meaning that, in practice, a problem arising even on a Sunday is resolved in just a few hours. Also, once the system was installed, Emerson did all the necessary adjustments to help improve productivity and make the generator units more stable and efficient.

Managing problems

The simplicity, efficiency, and effectiveness of the system is apparent when analysing how it manages problems that may cause the generators to malfunction. These problems, which can have a major impact on productivity, can be broken down into three types:

- Malfunctions that are caused by national grid issues. It is impossible to completely prevent this type of disruption, and in most cases the operator will have to start up the plant again. The malfunction will then clear once the grid has returned to its normal status.
- Minor problems originating within the plant, such as low oil levels in a tank or a relay that needs replacing. Here it is possible for operators to take the necessary action immediately by simply restoring the stability and function of the device.



Typical screen displays generated by the Ovation expert system at Avio

- Problems that require a structured intervention. These might be caused by a shift in process parameters (rotating equipment speed, temperature, flow rate measurements etc) that results in a failure to complete certain automation sequences.

The Ovation system can help to deal with all three types of problems, but it is with the third type that it provides the greatest advantages. A series of illustrated console displays allow the operator to visualise the process parameters and keep them under control, particularly fundamental parts of the plant. By allowing adjustment to the parameters, the Ovation system enables the specific malfunctioning device to continue to operate safely whilst maintenance is planned, limiting any potential loss of production. When the repair of a malfunctioning device cannot be delayed, rather than being forced to intervene, the operator can use the Ovation system to continue production whilst in a 'maintenance mode'.

Colour changes to the various elements of the system's display make it simple to identify situations that might lead to a turbine malfunction, and the easy-to-read user interface simplifies analysis of the causes of

malfunctions. The causes and consequences of those malfunctions are categorised using flags, enabling the operators to see at a glance what has happened and to then prioritise actions. Although alert-priority decisions are initially made during the engineering phase of the system, as the operators' experience increases it is possible to modify the priorities through simple reconfiguration of the system.

All alerts require an acknowledgement, which can be performed whether remotely or on site. The Ovation system is able to manage some alert signals without stopping production, but for more serious alerts that affect the safety of operators and equipment, the system can manage controlled turbine shut-downs.

New possibilities in plant management

The flexibility of the Ovation system has enabled HDE to meet its automation-upgrade objectives of increasing efficiency, effectiveness, and productivity. The successful implementation of the Ovation system at the Avio plant has also opened up new possibilities for HDE in terms of plant management.