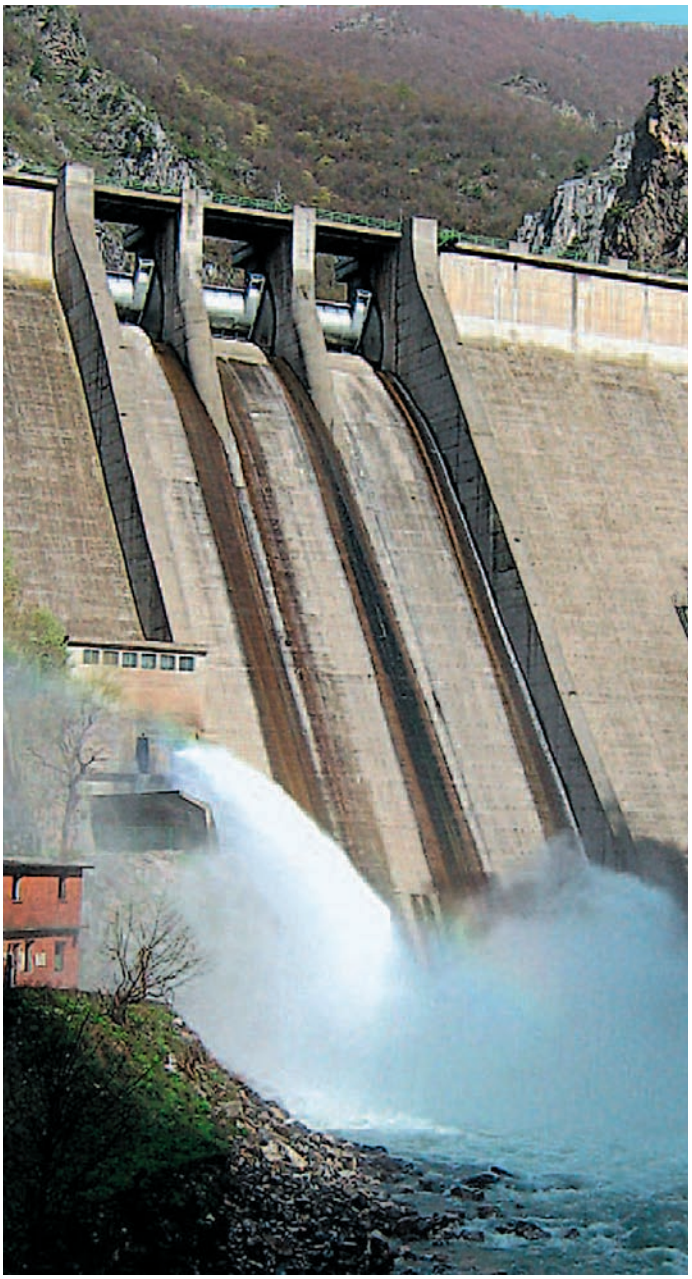
Project Brief

Compact 800
State-of-the-art Power Station Control

In February 2006, ABB Bulgaria EOOD signed a contract with the national electricity supply company of Bulgaria, NEK EAD, for the design, manufacture, delivery, installation, and commissioning of new excitation, medium-voltage switchgear, and control equipment for two hydro-electric power generators at the purchaser's Vacha II power station. The contract was awarded to ABB as a result of an open tender round against stiff competition from all the big names in power generation and control.

Only eight months later, comfortably ahead of schedule, the station was put back in operation and the customer noticeably pleased.



The Vacha II hydro-electric power station is part of what the customer calls "the Dospat – Vacha Cascade", a complex multitiered chain of power stations, the purpose of which is to extract a maximum of power from the natural resource the river system is while paying due attention to nature preservation.

Originally, the Vacha II station was commissioned in 1973 with two vertical Francis-turbine/generator sets, each with a generating capacity of 3.5 MW. The station is fed from the Krichim Dam through a pipeline it shares with another station in the cascade.

The project presented ABB Bulgaria with plenty of engineering challenges that stemmed from the overall mission: to integrate Vacha II smoothly into the cascade while maximizing yield, and minimizing the need for human attention. (One aspect of the latter requirement was that the station had to be operable remotely.)

Eight months later, ABB's project team had the customer's word that they had succeeded admirably.

Overview of the Vacha II power station, Plovdiv, Bulgaria.

ABB's scope of supply can be divided into the following subsystems:

New Control System

The relay-logic control system for the generating sets has been replaced with a new computer-based control system: ABB's Compact 800 System. This system in turn consists of the following:

- Two aggregate controllers, AC 800M plus accompanying S800 I/O, whose software implementation of the required controls has enabled a far more precise, sophisticated and smooth control of the generating sets than before.

  These controllers communicate with the relay protection equipment of the generators over Profibus DP field buses, eliminating the need for discrete wiring that would have necessitated far more cabling.

  Each aggregate controller has a color touch panel for local operation.

- One station controller, also AC 800M + S800 I/O, for the handling of shared station functionality.

- One operator workstation, Compact HMI 800, for visualization and human operation of the processes involved.

All controllers and the operator workstation are interconnected by an optical Ethernet communications network.

New Excitation System

The existing electromechanical excitation systems have been replaced by new static thyristor-based systems: ABB's Unitrol F. The electrical braking function has been implemented neatly in software across the Unitrol-embedded controllers and the aggregate controllers.

New synchronization units have been installed, based on ABB Synchrotact 4, facilitating precise automatic and manual synchronization of the generators with the electric power grid.

New Medium-voltage Switchgear

New 6.3kV MV switchgear has been installed: ABB's UniGear ZS1, with built-in digital protection as well as remote control and communication functionality. The switchgear has a small footprint, which enabled installation in the available space without alterations to the building.

New Auxiliary Equipment

New low-voltage switchgear, ABB's MNS Light, with withdrawable units, has been installed to cater for the overall

”Success doesn’t just happen”

▶ One of the two 3.5 MW Francis-turbine/generator sets of Vacha II. Together they typically produce 11.4 GWh of electricity a year.

▶▶ Overview of the control equipment installation in the machine room after the upgrade.

▶ The new 6.3 kV ABB UniGear ZS1 switchgear is equipped with digital protection as well as fieldbus communication and control.

▶▶ While ABB Bulgaria was putting their equipment into the machine room, the customer’s (NEK EAD’s) own construction department erected this new 110 kV outdoor switchgear.

needs of the station, including supply and control of the aggregate governors. A dry MV transformer has also been installed.

All equipment installed is of the latest designs, offering faster synchronization, more accurate load balancing, and more sophisticated (including remote) control.

– This kind of project, involving many different engineering disciplines suits us down to the ground, says Kolyo Stoilov, ABB Bulgaria’s manager of the Vacha II modernization project. “We have a broad palette of electrical and control equipment on offer and we are well stocked with local engineering, installation and support resources. Now, that simplifies life for our customers and enables us to provide next-door support for our installations for as long as our customers need it.”

NEK EAD seem to be of similar mind; for quite some time after completion of the project they ran a press release with the following message on their website (translated excerpt here only):

Due to excellent cooperation between the experts of ABB Bulgaria and NEK EAD, the [Vacha II] modernization project was completed successfully by the end of November 2006, within a record term of 8 months. Vacha II HPP has been commissioned for regular operation, the upgrade promising reliable operation far into the future.

– Success doesn’t just happen, Stoilov points out. “That’s something you have to work at on all levels and in all phases. That’s what we did also in the case of Vacha II and that’s why we were successful.”

The Vacha II power station is controlled by three ABB AC800M/S800 I/O sets like these. One is for overall station control and the other two are for turbine+generator control.

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