

Refurbishment of the instrumentation at Atatürk and Karakaya

M. Widmer, Rittmeyer Ltd, Switzerland

After 17 and 22 years of operation respectively, the two largest hydroelectric plants in Turkey, Atatürk and Karakaya, both on the Euphrates river, are undergoing a major refurbishment of the instrumentation, automation and process control equipment. This article describes the work being carried out, and the benefits for both installations.

A contract for the replacement of all existing flow measurement systems at Atatürk and Karakaya, as well as the refurbishment of all the water level and gate position measurement equipment, was recently awarded to Rittmeyer of Switzerland. The refurbishment will not only ensure reliable and accurate measurements in the future, but also offers the customer, EUAS, additional functional-

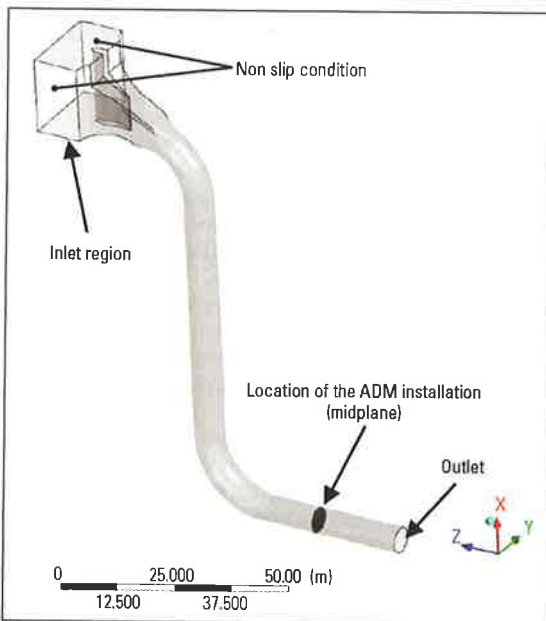
ity. At Atatürk, each of the eight penstocks will be equipped with two four-path acoustic discharge measurement systems (ADM). One ADM is installed after the intake gate, and the other before the turbine. The upper system will be used for over velocity measurement and penstock protection, and the lower system for penstock protection and turbine efficiency measurement, according to IEC 41.

All holes are drilled and tapped using a magnet base drilling machine (see photos, left). As can be seen in the pictures, the ultrasonic sensors are mounted externally. This allows for easy replacement of a defective sensor, even under pressurized penstock conditions.

At Karakaya, the two bends between the intake and measuring section (see Fig. 1) are responsible for a highly disturbed velocity profile. To achieve the best possible accuracy, Rittmeyer used computational fluid dynamics (CFD) for the numerical simulation of the flow in the measuring and upstream section (see Fig. 2). The simulation itself was carried out by Prof. T. Staubli of Lucerne University of Applied Sciences and Arts, Switzerland. As a result of the simulation, an 8-

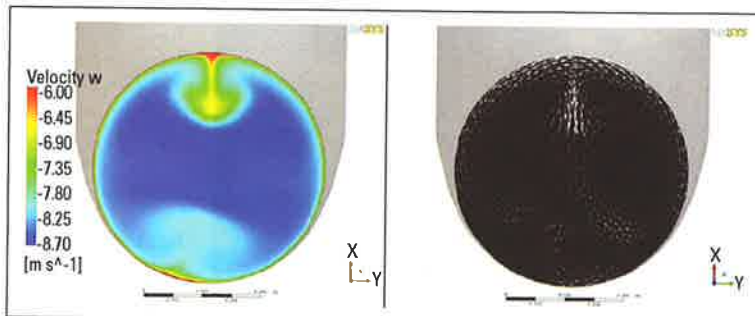


Above: Centre punching of a sensor position (left); tapping of sensor hole (left); and, installed transducer (right).



Right: Fig. 1. Geometry of the CFD simulation at Karakaya.

Below: Fig. 2. Axial velocity distribution (left) and secondary flow (right) at nominal discharge.



Penstocks at the Atatürk plant.



General view of the Karakaya dam and hydro plant.



Taking measurements with the theodolite.

path installation with two crossed planes was proposed. The position of the sensors and the weight of the individual paths are specifically optimized. Four of the six penstocks will be equipped with internally mounted sensors. This became necessary because the non-embedded penstock section is not long enough for an externally mounted sensor installation. At both powerplants a total station theodolite is used to determine the exact shape of the conduit within the measurement section (see photo above). This is also used to determine the final sensor positions.

The combination of Rittmeyer's long-term experience, the extensively field-tested Risonic 2000 ADM system, CFD and theodolite survey guarantees the best possible result. For Karakaya, the measurement error has been estimated to be less than 1 per cent.

For the gate position measurement, existing mechanical accessories will be re-used. The exchange of the shaft encoder as such will be an easy task, as the most important dimensions of the old device have been retained. The same applies to the hydrostatic level measurement equipment. Only the processing unit and the pressure sensor will be replaced. All the hydrostatic accessories will be re-used. This guarantees a smooth transition from the existing to the new system, and also guarantees a minimal outage for the customer. With the new quartz resonator pressure sensor an accuracy of 0.015 per cent will be achieved.

One of the main challenges associated with this project is the coordination of the workforce, as both powerplants need to remain in continuous operation.

Rittmeyer staffs the project with people from Swiss headquarters and a team from its subsidiary in Croatia, and also receives additional support from its Turkish partner.

The whole refurbishment project is scheduled for completion at the end of 2009. ◇

Martin Widmer graduated in Electrical Engineering from the Technical College in Zug, Switzerland, and obtained his Executive MBA at the Kaleidos University of Applied Science in Zürich, Switzerland. Between 2000 and 2004, he worked as Area Sales Manager for Western Europe in the field of power transmission and distribution at Siemens Switzerland. Since 2005 he has been Head of Sales for the Asia-Pacific region at Rittmeyer Ltd.

Rittmeyer Ltd, PO Box 464, Inwilerriedstrasse 57,
CH-6341 Baar, Switzerland.



M. Widmer