

## Back into Future

### Retrofitting running water generators by BENNING Electric Machines department

**Smart energy is leading the way in the energy supply of tomorrow. E.ON relies on renewable energy and thus helps to ensure that energy is clean and remains securely available. E.ON relies on a competent and experienced partner for the repair of hydropower generators: BENNING.**

Hydropower is a modern classic among renewables. It is one of the cleanest and most efficient energy sources in the world. The ever-present supply of water, machine efficiencies of over 90% and robust technology make hydropower plants reliable endurance runners that continuously contribute to powering the grid.

E.ON operates 212 hydroelectric power plants in Europe with a total capacity of 6.1 million kW. Of these, 19 are run-of-river power stations along the Danube and Inn.

#### Using existing resources

In addition to pioneering innovative projects in the field of tidal and wave power plants, E.ON also requires constant maintenance and optimisation of existing hydroelectric plants. These life extending maintenance projects preserve the environment and nature whilst not causing any pollution.

The history of many systems goes back to the 1920s when they were considered to be masterpieces of engineering. One of these systems is the Kachlet run-of-river power station on the Danube river, 2,230.5 kilometres above Passau.

Built in 1927 by Rhein-Main-Donau AG (RMD), it was the largest hydroelectric power plant in the world at its launch. In its 144-m-long powerhouse, 8 Kaplan turbines each drive one of the huge generators with a stator bore diameter of 7,000 mm.

With a total performance of 53.7 MW, about 300 million kWh of electricity is generated per year. This corresponds to the annual electricity consumption of a city with a population of 250,000. →

*View into the power room: Each of the stator housings weighs 46.3 t, each rotor 69.3 t*



*The power plant Kachlet is the most productive and second oldest power plant of the Rhein-Main-Donau AG. It is remotely controlled by the E.ON Kraftwerke GmbH's central control station in Landshut.*



Preparations for diagnostics and fingerprint measurements on the generators



Professional insertion of the 600 coils in detail



Assembly of coils on-site. The service technician stands in the 7000 mm wide groove of the stator

### Recent overhaul six decades ago

In the 1960s Rhein-Main-Donau AG replaced the previously installed propeller turbines with Kaplan turbines to increase the output of the power station. The generators, however, date from 1927 and were last overhauled around 60 years ago.

With increasing age the risk of failure understandably also increases. In 2014, RMD decided that the four generators would undergo a retrofit to ensure feed-in availability in the future whilst significantly prolonging the life of the plant. Each of the "slow runners" has a nominal voltage of 6.3 kV and a capacity of 8,500 kVA at only 75 revolutions per minute. The total weight of the stator and rotor is about 110 tons.

### Proven and flexible partner

In its search for a company that combines efficiency, planning expertise and high qual-

ity execution, E.ON chose BENNING to manage the repairs.

BENNING has decades of experience in the construction, reconstruction and maintenance of electric motors for a variety of industries, having been involved in the repair of generators and motors since 1938. These include the steel and aluminium processing,

### Far from being old

Compared to coal or gas power, the Kachlet hydroelectric power station reduces CO<sub>2</sub> emissions by approximately 210,000 tons per year. This corresponds to the CO<sub>2</sub> emissions of about 96,000 cars (145 g CO<sub>2</sub> /km). To generate a comparable amount of power, it would be necessary to cover 1,350 football pitches with solar panels - or to build a wind farm with 130 wind turbines.

mining, oil, gas, petrochemical, railway and energy production industries.

BENNING had already previously carried out repair work for the energy supplier's hydropower generators. In particular, the high degree of flexibility in the implementation phase, without cutting back on occupational safety and quality, impressed the customer.

### Efficiency and quality

In addition to these references, E.ON was impressed by the economic efficiency of the offer and in September 2014 it awarded BENNING the contract to renovate the four hydropower generators.

To minimise downtime and the consequent loss of power generated, all generators were to be modernised one after the other in a very short time. The BENNING project team fulfilled this requirement with the first new generator put back into operation on schedule.

To do this, service teams at BENNING in Bocholt, who are equipped with the latest equipment in-house, wound 600 new coils and inserted them in the grooves of the 7,000 mm stator. Technical know-how, craftsmanship and the use of state-of-the-art materials and insulation were used to ensure the longevity of the modernised plant. The constant availability of project managers as contacts on-site ensured rapid processes and optimal communication between the operator and repairs, thereby minimising delays or downtime.

### Rapid construction progress

Before the start of the expansion measures, the BENNING diagnostic team performed fingerprint measurements on the generator. After going back into operation, another measurement of the thermal limits, electrical load characteristics, vibration and noise analyses will confirm the success of the generator repair work.

### Back in the future

Currently repairing the fourth generator, work in the powerhouse is planned to be completed by July 2016. The Kachlet hydropower station will then have reached its maximum feed-in power levels again and will continue to reliably contribute to the "green energy revolution" - after nearly 100 years of operation. The high-quality services provided by the BENNING Electric Machines department played their part in this. ▣

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