Press

Grist to the valve manufacturer's mill

Wind and solar power are hot topics at the moment, but hydropower is currently still the most important source of renewable energy in Europe. In Africa they are also working on securing more supply. The hydroelectric power station of the Grand Inga Dam, for example, which will be built this year and could supply half of the African continent with 40,000 megawatts of energy. Other continents and countries are also changing with the tide.

The Grand Inga Dam on the river Conga is considered Africa's mega energy project par excellence. A capacity of 4.8 gigawatts has been projected for the end of the first phase (2025). Once the dam is completed it is expected to produce 40 gigawatts. This will make the Grand Inga in the Congo almost twice as large as the world's largest dam, the Three Gorges Dam in China, which has an annual output equivalent to 30 nuclear power plants.

62 billion euros for the Grand Inga Dam

62 Billion euros will be invested in the Grand Inga Dam, which is located 150 kilometres off the mouth of the river Congo. The area is considered extremely suitable for energy production because of the steep slope. In order to realise the dam project, the entire river will have to pass through an adjoining valley and be dammed up to 200 metres high.

The project is not without controversy. Critics warn of the ecological consequences of such a massive intervention. Major flood plains could dry up and in other places valuable natural areas will be flooded.

If the plans remain unchanged, 2.5 gigawatts of the first phase total of 4.8 gigawatt power will initially go to South Africa. The newly developing country has a rapid growing economy for which it needs abundant energy.

Nevertheless all people and industry in Africa are said to benefit from this project. Over 300 million people do not have sufficient access to water and experts predict that the droughts will only continue to increase.

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Valve World 2016 CONFERENCE

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Water Crisis and Energy Transition

More run-of-the-river stations, conventional dams, pumped-storage power plants, tide power stations, as well as plants that use the water's kinetic energy can help alleviate the global water shortage and contribute significantly to the energy revolution in developing countries. From a technical aspect valves are of course crucial for the flow control, especially shut-off valves.

The Austrian Federal Railways (ÖBB) for example, use hydroelectric power plants as an energy source. The railway-owned power plants are medium and high pressure works with heads ranging from 182 metres to 795 metres.

"The water flows from the reservoir and inlet structure over coarse and fine screens to the inlet shut-off devices," states the national railway company. It then flows through a pipeline to a surge tank. "From the surge tank, the water is guided past shut-off and emergency devices through the penstock –pressure pipeline or pressure shaft – to the power plant." This is where the water is distributed through piping and shut-off devices, such as ball valves, to the individual turbines. Here the water transfers its energy to the turbine wheels and flows out of the power plant as tailwater or outflow.

The turbines drive single phase synchronised generators to produce the single-phase AC. This alternating current is spread over block transformers and a high voltage switch gear to the power supply network, explains the ÖBB.

Different Typesof Sealing

Multiple types of valves are used in hydroelectric power plants depending on the water quantity, head, and work site. Most common are butterfly valves, spherical valves, cone valves, or ring gates.

Butterfly valves are required in hydroelectric power plants with a low and medium pressure range in order to ensure high quality sealing and rapid opening and closing.

Spherical valves are mainly used in high pressure applications. Control valves are used in water treatment, distribution systems, as well as hydroelectric power plants.

To avoid operating failure, equipment manufacturers must find all sorts of solutions. For example, the pressure at the intake can cause auto-oscillation, which can damage the penstock. A timely, automated detection of such auto-oscillation can prevent hazards. “By opening or closing a seal the oscillating system is de-tuned and damages due to auto-oscillation can be prevented,” explains Andritz Hydro. This function can either be performed fully automatically or manually after an alarm.

Lots of operational transitions

At the hydropower plant Cerro Del Aguila in Peru – a high pressure application – “a substantial improvement” of approximately 15% was recently achieved in the valve head losses by utilising Computational Fluid Dynamics (CFD) calculation programs and by taking existing model test results from the standard valve disc geometry as a basis.

Because of the high number of daily transitions in hydroelectric power plants, valves are highly stressed during operation and rules must be adhered to when selecting a valve. Suitable valves, regular maintenance, and, when necessary, overhauling are a must.

High quality products are requested from plant engineers and valve manufacturers on every continent. Especially since the potential is often far from being exhausted. Some continents, for example Africa, are becoming more conscious. The Lauca hydroelectric facility, under construction on Angola’s River Cuanza is due to start operation in 2017. The facility will boast two turbines. Andritz Hydro received the corresponding order, which lies in the lower three-digit million euro range. The order includes six Francis turbines, each with an output of 340 megawatts, as well as generators and additional equipment.

India and Nepal have lots of hydropower potential

India also has a large reserve of energy through hydropower. Nevertheless, of the potential 150,000 megawatt hours, only a quarter is being utilised. Time to act: The Indian government intends to increase the share of hydropower in the energy mix from the current 25 to 40 percent in the medium term. By doing so, they hope to lessen the number of blackouts and improve the stability of the supply network. This gave Voith India the chance to land a lucrative contract for the hydropower plant in

Omkareshwar. Voith installed eight Francis turbines, including generator busducts and auxiliary systems. Each unit has a capacity of 65 megawatts.

Even Nepal has a huge potential for hydropower (40,000 MW). For the Rasuwaghadi plant in Nepal Voith will supply a complete water-to-wire solution including three 37 MW vertical Francis turbines, the generators as well as automation systems and balance-of-plant equipment. The project is located in the North of Nepal, around 150 kilometres from the capital Kathmandu.

First Tidal Lagoon Hydroelectric Power Station

An unusual order worth approximately 250 million euros was awarded to Andritz Hydro. The world's first tidal lagoon hydropower project is being built in Swansea Bay, Wales, UK. It is expected to supply more than 155,000 households with electricity. Unlike other tidal power plants, no natural bay or estuary is separated from the open sea, but instead a man-made, harbour type structure will close off a tidal sea area, creating an energy-generating lagoon.

As the sea outside the breakwater rises and is held back a head is created and once a sufficient head height is reached sluice gates are opened and water flows into the lagoon through 16 turbines to generate electricity. This process then occurs in reverse on the ebb tide, as sea levels start to fall and a tidal head is created by holding water back within the lagoon.

The plant will contribute significantly towards UK's carbon emission reduction targets with over 236,000 tons of $CO2$ saved each year. Andritz Hydro will manufacture the electromechanical equipment for the plant, for which completion is expected in the beginning of 2019 at the earliest.

Slightly surprising is hydropower's current capacity. It makes up approximately 80 percent of renewable energy and covers 20 percent of the energy generated worldwide. What makes it so attractive is that it is the most researched and advanced renewable energy. Besides this, hydropower plants are extremely efficient and provide power whenever necessary – a stability wind power and photovoltaics, for example, can't offer.

Unexhausted potential

“Hydropower’s potential is far from exhausted. It is therefore high time this technology moves back into the focus of the energy policy,” says Heike Bergmann, member of the Management Board of Voith Hydro Germany. A Voith commissioned survey by the opinion research institute TNS Emnid surveyed 600 experts from Germany, Austria, Switzerland, Norway, and Sweden seems to confirm this assessment. Sixty-three percent of the experts believe there is a lot of unexhausted potential for hydropower in Norway, forty-six percent in Germany, forty-two percent in Austria and Switzerland, and thirty-seven percent in Sweden.

In Germany only 7,000 of around 50,000 dams or weirs are equipped with hydropower plants. Experts believe that only one-third of the possible investments account for modernisation, reactivation and new construction. Therefore, there is still room for plant engineers, valve manufacturers, and suppliers to go with the flow.

Latest innovations within the valve industry can be seen at Valve World Expo, taking place at Messe Düsseldorf from November, 29 to December, 1, 2016.

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