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A successful cooperation between a power company, a turbine manufacturer and a university

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Abstract

Renewable energy is in demand. Refurbishment of old hydro plants will increase lifetime, reliability and efficiency, resulting in a large increase in production, hence contributing to the increasing energy demand in a cost-effective way. Due to the changing nature of the energy markets, research is still needed. Some power producing companies experience crack problems with their runners, due to dynamic loads on the runner blades. High head splitter blade runners have caused problems over a longer period time.

Statkraft is the largest producer of renewable energy in Europe, with more the 12.3 GW installed hydro power only in Norway. Statkraft has hydro power plants ranging from newly built to more than 100 years old. The company has invested important efforts nationally to upgrade and refurbish its production facilities according to modern HSE and project management routines. Statkraft's approach has been to determine a 20-year plan focusing their efforts on increasing lifetime, while simultaneously ensuring increased reliability, efficiency and cost/benefit efficient maintenance. Statkraft has organized its projects as "Bundle Buy Projects", including several power plants in each call for tender. Since 2003, one Pelton Bundle Buy with a total of 18 runners and two Francis Bundle Buys with a total of 12 runners have been completed or are coming close to completion. Future planned bundle buys include 4 Francis packages, 2 Kaplan packages and one Pelton package, all to be started between now and 2014. In total, more than 230 units will be refurbished during this period. The 20-year plan which is covering the period from now until 2020, will include even more units than the aforementioned 230 units. These large-scale projects will result in a substantial increase of efficiency, reliability and life time, and sometimes an increase in rated power. The total production increase for the whole portfolio in Pelton Bundle Buy number 1 was on average 3.6%.

The largest plant in Francis Bundle Buy 2 was the Tokke power plant, consisting of 4 units of 110MW each under a nominal head of 377 meters. When Statkraft decided to refurbish this plant, they involved the only neutral test laboratory in Norway, which is the Waterpower Laboratory at the Norwegian University of Science and Technology (NTNU). After the tender process, ANDRITZ HYDRO was chosen as the supplier of the runner for the Francis Bundle Buy 2. Then, an opportunity for a research cooperation opened up. NTNU and Statkraft were both interested in research regarding the dynamic loads in high-head Francis turbines.

To win the tender process, hydraulic and mechanical performances play vital roles. The efficiency offered, but also the weight of the runner, are key elements, which determine the power company's choice of supplier. As an effort to strengthen its position on the hydro market, ANDRITZ HYDRO is willing to improve further their ability to design safe runners with top efficiency. In this regard, the understanding of the dynamic forces under which a runner is subjected, is of greatest importance. With this objective, ANDRITZ HYDRO joined Statkraft and NTNU in this collaborative research project.

The collaborative project "Pressure Pulsations in Francis Turbines" was launched.