Snow for Sure

Those who want to guarantee tourists good ski slopes at all times must invest in modern technology. The innovative drive solution for the high-pressure pumping systems of a snowmaking machine considerably reduces power consumption, and therefore costs, thanks to electronic pressure and speed control.

The Schmittenhöhe mountain in Austria has been a popular destination since the days of the empire. During the winter, tourists enjoy the ski area with its scenic surroundings and 77 km of slopes and 26 cable cars and ski lifts. All the slopes can be covered with artificial snow, which guarantees ideal winter sport conditions during the entire season. With the aid of 295 snow guns and 86 propeller systems, around 1.1 million m³ of snow are brought to the slopes each winter, with a maximum capacity of approximately 1.5 m³ of snow per second.

The physical principle: when cold water is atomized under high pressure via nozzles and with the aid of compressed air, crystals form that gather on the ground as snow. This works particularly well at temperatures in the range between –5°C and –10°C. “As there are increasingly fewer cold days, the ski-area operating companies have to continually invest in the efficiency of their snowmaking machines,” emphasizes Hannes Mayer, technical manager at Schmitten AG in Zell am See, which today operates 12 pumping stations. The newest pump at the water reservoir at Plettsau Kopf is 58 m long and went into operation at the end of 2010.

Efficiency at all levels

“The critical factors for us are, among other things, the high availability, high operating safety, and high sustainability of the system,” Mayer explains. In terms of sustainability, energy-efficient solutions and systems with low maintenance costs are in demand. That is why those responsible decided in favor of a converter solution in connection with 3-phase asynchronous motors to actuate the huge water pumps. Siemens Innsbruck took on the project responsibility, supplying the electrical system, measuring technology, control, and visualization.

1PQ8 motors now actuate the high-pressure pumps. They are ideal where availability and a long service life for pump drives are important and are available in the output class up to 1,000 kW. Up to 375 kW, the upper limit of validity under the new international efficiency norm, they are also available in the high-energy-efficiency class IE2 according to IEC 60034-30.

Responsible use of resources made Schmitten AG use energy-saving frequency converters for the pressure and speed control of water pumps at an early stage. The latest unit extension was with Sinamics G150 – two devices with a power-handling capability of 250 kW each, seven devices with a 400 kW capability, and one with 560 kW. The frequency converters are delivered as ready-to-use cabinets.

Their special advantages are their high reliability and control accuracy. Although they are capable of vector control without an additional encoder, an external speed sensor is used in this project. As many pumps are attached to the same feed network, the characteristic curves must be as close to identical as possible. This is obtained by exact pressure and volume flow rate control, which is only possible via external speed sensors in connection with precise pressure sensors – and thanks to which the Austrians save a considerable amount of power year in and year out.

Integrated harmonic wave compensation

Due to the many frequency converters in the power supply system and the high capacities, harmonic waves need to be compensated in Zell am See. In order to comply with the total harmonic distortion (THD) values specified by the electricity supplier, line filters are required. The Sinamics G150 with the L01 option, the so-called Line Harmonics Filter, has been available as Sinamics G150 High Power since 2010. In these devices the compen-
Sating filter is completely integrated between the control unit and the power element of the converter as a tested cabinet unit. The frequency converter switches the filter off automatically as soon as it is no longer needed. The L01 option not only saves space and cabling expenditure compared with earlier solutions with individual devices; it also helps prevent errors during installation.

Increased availability

For the production of snow that is as fine-grained as possible, the water must shoot through the nozzles with a pressure of about 20 bar. Because the station at Plettsau Kopf is at about 1,400 m above sea level and the guns at the summit are at about 2,000 m above sea level, the water pumps must generate pressure of up to 100 bar. If one unit of equipment fails, a rapid shutdown of the pumping system is necessary to avoid damage. “Such an advantageous individual shutdown was easy to realize thanks to the optional fail-safe shutdown of the Sinamics G150,” explains Harald Ruetz, project manager at Siemens in Innsbruck.

Only if an emergency stop is triggered are all aggregates disconnected from the grid. The individual shutdown considerably increases the availability of the snowmakers because in the event of a fault all unaffected pumping systems can continue to run. All in all, a highly available system was put into action with the 1PQ8 3-phase asynchronous motors and Sinamics G150 frequency converter – a system that also fulfills the user’s requirements for energy efficiency and sustainability. The conclusion of Ruetz and Mayer: “With modern technology, efficient ski-area operation can be ensured at all times – even with a cloudless sky, just as the tourists like it.”

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