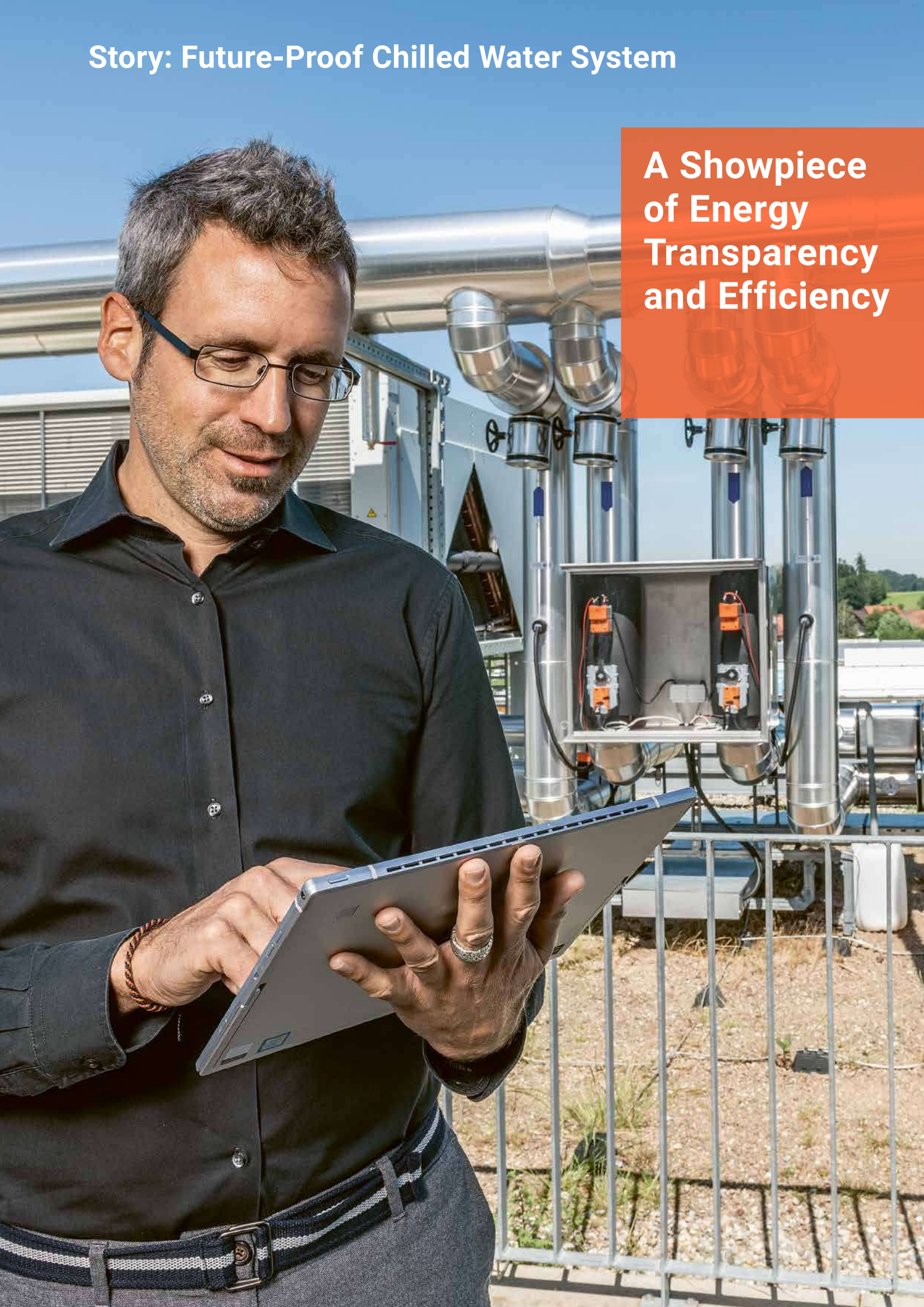
Story: Future-Proof Chilled Water System

A Showpiece of Energy Transparency and Efficiency



To optimize the HVAC system at its headquarters, Belimo went the extra mile with an innovatively designed and controlled cooling plant. It not only showcases energy-efficient HVAC field devices but also energy transparency.

In 2018, Belimo kicked off the planning of a new chilled water supply plant. Its goal was to address demanding and persistent comfort issues in the main production building in Hinwil (Switzerland) and to replace the 18-year-old plant. Simultaneously, the switch to a new building automation solution had been initiated.

Two chillers, each with a cooling capacity of 350 kW (100 cooling tons), were designed to be the heart of the new system – with the option to add a third chiller in the future. After a thorough planning phase, installation started in March 2019 as the two 3.2 ton machines were lifted onto the roof.

Providing Full Transparency

In the following phase, six Belimo Energy Valves™ were installed in the two chillers and in the four sector sub stations, where they provide transparency on two levels: where cooling energy is being generated (at the chiller level) and in which sector it is being consumed.

Two electrical meters measure the power consumption of the two chillers and compare this data to their thermal output. The resulting COP measurement (Coefficient of Performance, see box on page 87) is the leading key performance indicator for gauging energy efficiency of the cooling system. "If it was not for the Belimo Energy Valves™, we probably would never have found out at such an early stage that the two identical chillers were not performing equally," says Marco Manfredi, Global Real Estate Manager at Belimo (see photo above). By directly comparing their COP, Manfredi could work together with the contractor to single out and consequently fix a parameter that differed in the two chillers' factory settings.

The Belimo Energy Valves™ also provided the necessary transparency and dynamic hydronic balancing at the sector level to efficiently address the comfort issues in the building. Allowing Manfredi to read out significant real-time values was essential for the system's efficient operation and optimization. "By independently regulating the flow based on the required volumetric flow, the Belimo Energy Valve™ not only increases energy efficiency, it also creates transparency as power and energy consumption can be read and compared in each sector," explains Manfredi.

If substantial differences in performance between the sectors occur, the cause can be singled out and, if necessary, a system malfunction can be corrected. And in the event that something does not work as planned, historical data can be used for evaluation.

The hydronic system is designed as a variable primary flow (VPF) system, adapting the primary flow according to the cooling demand of the building sectors. The two Turbocor chillers control the supply temperature in a modulating manner. "Thanks to the Belimo Energy Valves™, the flows of the two chillers and the four sub stations are balanced and adapted at all times to the load situations," says Manfredi.

Sensors Maximize Efficiency

In addition to the Belimo Energy Valves™, Belimo sensors were installed in many of the system's components. They continuously monitor system values and report them to the control system. The sensors for continuous temperature measurement at the evaporator input and output were designed to offer precise and robust measurement as well as easy mounting. All data can be visualized and monitored through the Belimo Building Management System in real time. The system also allows full remote access and control of the HVAC systems and triggers alarms if it detects any incorrect situations.

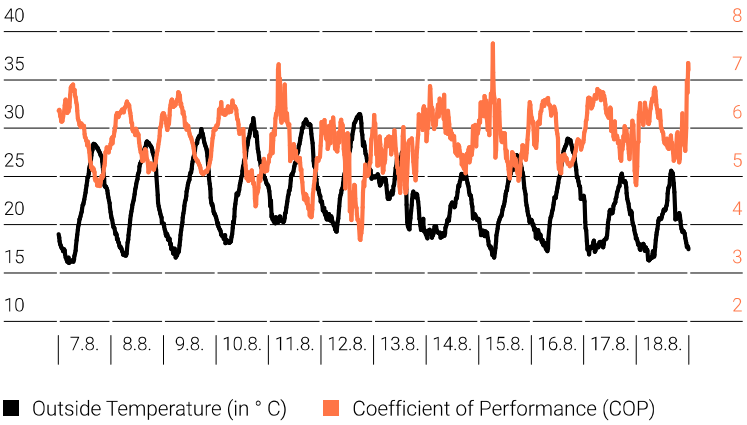
A great deal of thought went into designing the installation and control, ensuring to be as energy efficient as possible. The cooling energy produced is distributed to the four sub stations with heat exchangers (one per sector) via a 140 meter (460 foot) long pipeline equipped with a twin pump installation and Belimo butterfly valves.

The primary and secondary circuit is separated by plate heat exchangers. 3000 liters (793 gallons) of water storage are connected to the system, temporarily storing cooling energy. "The storage allows the chillers to operate more efficiently as longer and continuous operating times are possible, instead of operating on a short-term and intermittent basis," says Manfredi.

The cooling energy is used in every sector for ventilation and air-conditioning systems, as well as for the thermally-activated building systems (TABS). TABS are an energy-efficient, innovative solution for cooling and heating buildings. They use the building mass, in particular the concrete, as energy storage, cooling the zone as chilled

Data of the Chilled Water System at Belimo Hinwil (per Machine)

- Highly efficient, air-cooled chilled water system for outdoor installation
- Cooling capacity of chillers: 2 × 350 kW
- Dimensions: 3.2 tons; 2.5 × 4.0 × 2.2 meters (H × W × D)/ (8 x 13 x 7 feet)
- Total power consumption of chiller and compressor: 100 kW
- Energy efficiency ratio: 100.5 kW/kW
- EUROVENT class: A
- Refrigerant: Water/glycol mixture 70/30 percent
- Operating temperature: 11/17 °C (52/63 °F)
- Delta T: 6 °K (43 °F)
- Variable primary flow (VPF): Ranging from 40 m³/h to 115 m³/h



Belimo Energy Valves™ Provide Transparent COP Monitoring

The graph above depicts the measured Coefficient of Performance (COP) – a KPI for energy efficiency of the chilled water system – in comparison with the outside temperature in degrees Celsius during twelve summer days in August 2020. This level of transparency and real-time tracking of KPIs is only possible thanks to the Belimo Energy Valves™ installed.

ceilings do by radiation from the ceiling. Selecting chillers with modulating Turbocor compressors also significantly contributes to greater energy efficiency. The compressors' shafts are designed to be "supported" by a magnetic field, which makes them extremely quiet and allow variable speed.

In August 2019, work on the new system was finally completed, and the first fresh breeze of new cooling comfort provided relief amidst the heat of the summer.