PROCESS INSTRUMENTATION

Saving energy and enhancing environmental sustainability at a top university in Asia

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The challenge

At one of the most prestigious universities in Asia, the main campus comprises a large number of buildings clustered within an area less than 2 km^2 (1.2 mi^2). Because the university was built more than a century ago, many facilities on the campus were never fitted with the proper instrumentation for energy measurement, making it difficult or impossible to monitor the performance of most HVAC systems, including the cooling system.

In order to balance their chiller load and optimize energy consumption, the university sought flowmeters capable of measuring both energy and volumetric flow at 80 different installation points. The need for energy measurement was especially great since the energy flow for chilled water will differ significantly as temperature changes, even though the volumetric flow will remain the same. Keeping the chilled water supply temperature (CHWST) lower than necessary causes a chiller to operate in a less efficient region of its performance curve, while raising the CHWST one degree Fahrenheit reduces chiller energy consumption by approximately 2%.

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The case at a glance

Region: Asia

Industry: HVAC

Customer: University campus

Challenge: Install high-accuracy flowmeters at 80 installation points to balance chiller load and optimize **energy consumption**

Product: SITRANS FST020 paired with SITRANS FUE950

Main benefits

- Non-intrusive sensors with no flow interruption required
- Consistently high accuracy of ±0.5-1% of flow rate
- Measures very low and even zero flow rates
- Very cost-efficient solution

Knowing the correct energy flow at each measuring point and the consumption pattern of each user would make it possible for the university to adjust the number of chillers being used and the CHWST of each one on a regular basis to maximize efficiency and savings.

Whichever flowmeters were chosen would need to perform several vital functions at a very high rate of accuracy. First, they would be used to calculate the BTU and volumetric flow rate of chilled water at the chiller plant. The meters would then communicate the measured supply/return temperatures and flow rates to the existing Building Management System (BMS), enabling the system to make more accurate operational decisions regarding the number of chillers that should be switched on or off to fulfill the current cooling demand and the proper running sequence of chillers, pumps and cooling towers to ensure even wear and tear on the equipment. The flowmeters would also need to measure the BTU of chilled water within the air handling units on each floor of the campus buildings, allowing the university to bill individual tenants for their energy consumption.

The solution

All of the chilled water pipelines at the university were already in service, and the cooling system was required to operate year-round due to the region's hot and humid climate. As a result, the project committee did not want to consider any flow technology that would require cutting the pipes or otherwise stopping the flow. The committee eventually concluded that clamp-on ultrasonic flowmeters would be the best fit for several reasons:

- Non-intrusive sensors that can be externally mounted with no cutting necessary, resulting in simplified installation and very minimal maintenance
- Consistently high accuracy of ±0.5-1% of flow rate
- Capable of measuring low and even zero flow rates, a tremendous advantage over conventional mechanical flowmeters

The university had previously acquired 400 electromagnetic flowmeters and 400 energy calculators from Siemens and was pleased with the product performance as well as the pre-sales and after-sales service provided. They were also familiar with Siemens' reputation as a pioneer in clamp-on ultrasonic technology. As a result, the project committee took a careful look at the performance records of Siemens clamp-on energy meters in similar applications at other universities, and what they discovered was that several dozen elite universities throughout the United States have been using these meters for years to optimize chiller load, line balance and efficiency. The customers have seen significant increases in energy savings since integrating Siemens flowmeters into their applications.

Siemens presented the university with two options that met the stated objectives. The first was the SITRANS FUE1010 energy flowmeter with built-in energy calculation software and clamp-on or insert RTDs to provide energy readings in both metric and imperial units. The second was the more basic SITRANS FST020 flowmeter paired with the SITRANS FUE950 energy calculator, which uses volumetric flow data from the SITRANS FST020 and temperature readings from included insert RTDs to calculate energy flow. The first option offered the convenience of an all-in-one solution, while the second was available at a lower overall cost. Siemens now offers the option of the FS220 (replacing the previous FST020) with either the FUE950 as described in this paper or the FEC920 Thermal Energy Calculator with additional functionality over the FUE950.

After carefully weighing the benefits, the university elected to purchase 80 SITRANS FST020 clamp-on flowmeters and 80 SITRANS FUE950 energy calculators. The instruments now work in conjunction to communicate accurate and reliable flow, energy and temperature readings to the BMS via the M-Bus protocol. Remaining aware of exact energy consumption levels at different campus locations throughout the day and night has allowed the university to optimize the performance of its cooling system, resulting in considerable energy savings, reduced greenhouse gas emissions and an improved bottom line.

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