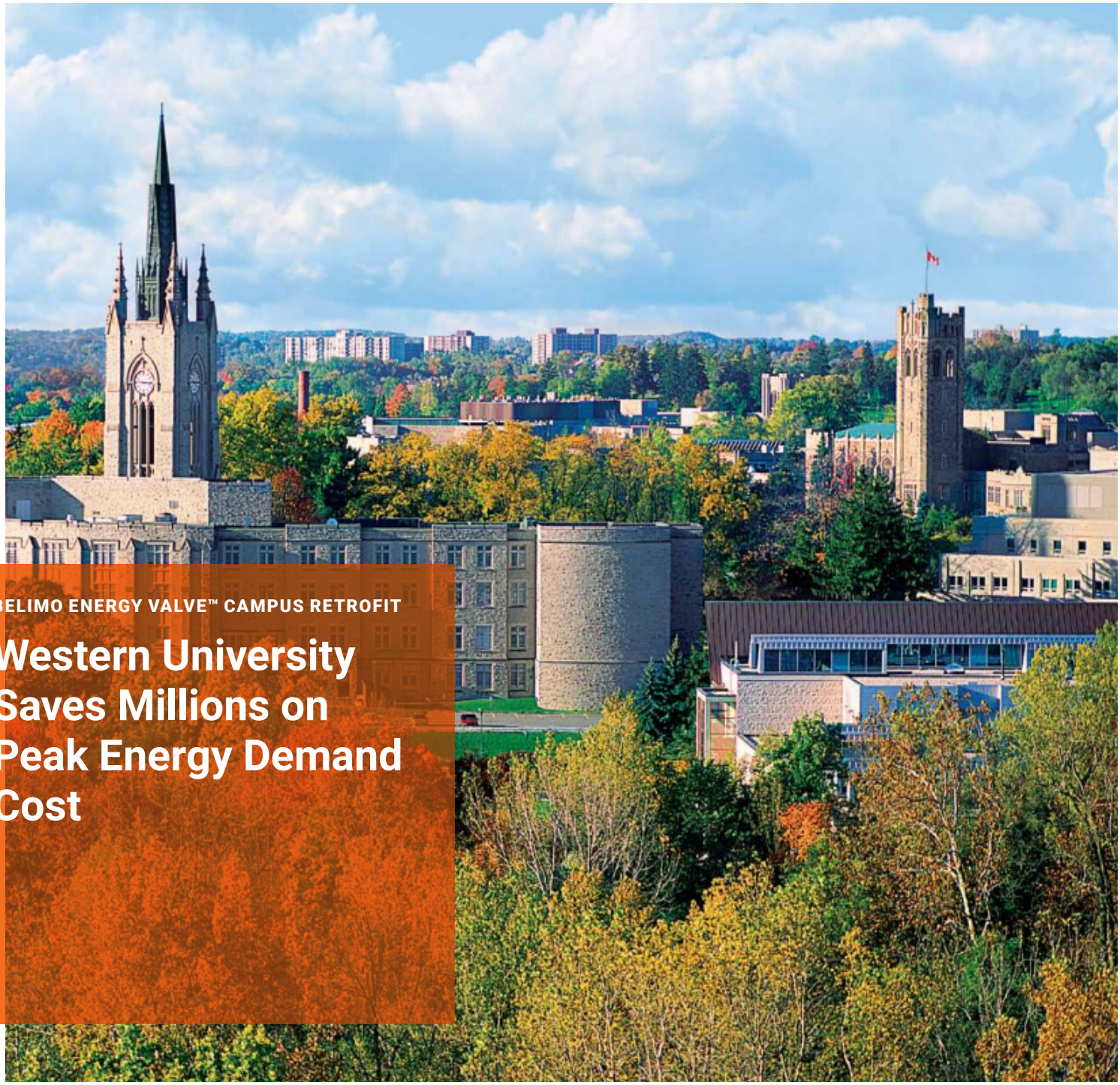

BELIMO ENERGY VALVE™ CAMPUS RETROFIT

Western University Saves Millions on Peak Energy Demand Cost

Belimo Energy Valve with Delta T Manager Improves Cooling Efficiency and Occupant Comfort

Founded in 1878, Western University in London, Ontario, is widely regarded as one of Canada's premier collegiate institutions with an on-campus population to approximately 40,000 students, faculty, and staff. The main campus comprises 481 hectares [1189 acres] of Gothic-style buildings and a mix of state-of-the-art, LEED-certified structures. With overall utility costs that average over CAD 20 million, Western's facilities team devotes considerable time and resources to improve energy efficiency and sustainability. One recent endeavor improved the performance of its chiller plant operations. By replacing their network of air handling unit (AHU) control valves with 223 Belimo Energy Valves, Western was able to optimize Delta T, advance overall system performance, and increase occupant comfort. Simultaneously, peak energy demand costs were reduced by CAD 6.5 million over three years.

TYPE OF BUILDING
University

PROJECT
Retrofit and Upgrade

SECTOR
Education

PRODUCTS
Belimo Energy Valve

BELIMO

Energy Valve Innovation Tackles Cooling System Imbalances

Facilities and Project Overview

Western University's campus has grown to more than 90 buildings. Two chiller plants located at the north and south ends of the property that serve separate loops manage the extensive campus cooling system. As cooling needs increased over the years, the two plants have expanded to include nine centrifugal chillers that serve a variety of classrooms, residences, eateries, kitchens, art galleries, meeting areas, research laboratories, and exercise facilities. The chilled water supply to each building came from a traditional primary-secondary-tertiary pumping system. Each building had at least one decoupler bridge (common pipe) between the secondary and tertiary loops, with a bridge valve controlled to achieve a return water setpoint of 13°C [55°F].

As the infrastructure grew, the imbalance within the cooling system increased significantly, leading to inefficient plant performance, high pumping cost and occupant discomfort in different locations. Buildings close to the plants were receiving too much chilled water flow, while those further along the loops were not receiving enough. Over time, pumps were added to help increase pressure at the plant whenever a building was not receiving enough flow, without success.

Project Requirements

Cooling inefficiencies had been a long-standing issue at the campus. At the south end, the facilities team added variable frequency drives to boost water pressure to reach the buildings located uphill. However, this exacerbated the problem and caused water balancing issues.

"We finally realized we were doing it backward. We had to accept that boosting the pressure at the plant wasn't going to work - we needed to do valve work instead," said Dan Larkin, HVAC Controls System Specialist, Physical Plant and Capital Planning Services at Western University. "Every building had at least one bridge valve pouring water into the building and back out, often bypassing the AHU coils and leading to a huge waste of energy. The plan was to modify the return water piping to eliminate the decoupler bridges and valves, so the chilled water has to flow through the AHU coil. In that way, only the chilled water that is needed goes into the buildings and returns to the plants, allowing the chillers to operate more efficiently."

After Larkin learned about the Belimo Energy Valve capabilities, he immediately knew it was the right solution for retrofitting the chilled water system. Western established a budget, brought on an Energy Manager, and applied for some incentives. "After installing Belimo Energy valves, we immediately saw a reduction in pumping energy," added Larkin. "Since then, the Energy Valve is the specified standard for any future upgrades or expansions."

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Energy Savings Solution —
Belimo Energy Valve with the Delta T Manager

The Belimo Energy Valve is an award-winning pressure independent valve that helps organizations reduce energy consumption and operating costs throughout their facilities. It measures and manages coil heat transfer by using an embedded electronic flow meter, along with supply and return water temperature sensors.

The Energy Valve with Delta T Manager incorporates many features and capabilities, including cloud-based analytics, patented glycol monitoring functionality, remote assistance, automated Delta T setpoint analysis and optimization, along with a comprehensive communication platform for integration to the Building Automation System (BAS).

Following their initial success with the Energy Valve retrofit, the facilities team at Western began leveraging the Delta T Manager feature to realize additional energy savings and improve occupant comfort. After installing the valves, the initial testing showed significant improvements in Delta T and flow reduction. However, they still had issues cooling all areas on peak demand days.

“We realized we weren’t using the technology of the Energy Valve the way we needed to,” said Heather Hyde, Associate Director, Facilities Engineering at Western University. “Since then, we have been able to take full advantage of the Delta T Manager’s functionality.” In one example, the AHU coil Delta T improved to 5.7°C (10.3°F) while the flow decreased from 431 GPM to 142 GPM, with no sacrifice in room comfort.

The valves are programmed to operate based on Delta T and flow control parameters. Hyde added, “Now, we can optimize the heat transfer of the coil, which is a valuable capability we never had before.” With the Energy Valve Delta T Manager, Western was able to optimize the AHU coil performance and improve the efficiency of the chilled water plants with a 32% overall reduction in chilled water flow. The campus Delta T improved from 4.1°C to 5.3°C [7.3°F to 9.5°F], and minimally impacted the AHU supply air temperature, which increased from 13.73°C to 14.29°C [56.7°F to 57.7°F] on average.

The Belimo Energy Valve is a pressure independent valve that monitors coil performance and energy consumption while maintaining Delta T. The Energy Valve’s core features and benefits include:

- **Delta T Management** - Belimo Delta T Manager™ algorithm reduces pumping and chiller/boiler operating costs by increasing chilled water loop efficiency and mitigating low Delta T syndrome.

- **Energy Monitoring** - The Energy Valve’s integrated energy meter provides accurate coil performance data. The data helps to verify system performance during commissioning and acts as a baseline standard for system performance over time. This feature helps achieve LEED points through Energy and Atmosphere within credits 1 and 5.

- **BACnet connectivity** - Over the BAS improves system transparency to reduce maintenance costs.

Energy Valve Reduces Costs and Maintenance Requirements

Valve data is accessible to the Western's Building Automation System over BACnet IP. The communication capability allows the facility manager to view the actuators embedded webpage and change settings when needed. The webpage graphics provide visual key performance indicators of each coil to simplify maintenance and troubleshooting. Larkin stated, "Now we can identify cooling problems at the AHU instead of having to look at a building or half the campus."

Analysis of the Energy Valve data supported the elimination of dozens of tertiary pumps, thereby reducing costs and maintenance requirements. "We need fewer pumps, have lowered our capital costs ,and improved occupant comfort in all buildings," Larkin added. "And we haven't had to add more chillers because we are no longer circulating unused chilled water into the return pipes."

The energy savings have been noteworthy. Overall, the project lowered chilled water consumption by 32% year over year while significantly reducing utility peak demand charges by CAD 2.1 million in the first year, CAD 2 million in the second year, and CAD 2.5 million in the third year. Less water flow translates into better heat transfer performance and less pumping power. Since the initial implementation, Western University continued monitoring the coil temperatures and flow as part of its ongoing effort to identify real-time performance issues and energy savings opportunities.

"An added benefit is that facility operations can extend demand management days into the fall when the students return," Hyde said. "Before the installation of Energy Valves, we could only reduce chiller capacity over the summer's hottest days to minimize energy usage. Now we can continue demand management into September even with a fully occupied campus because the valves are so efficient in getting chilled water to where it needs to be."

CUSTOMER BENEFITS

- **Plant efficiency gains from effective chilled water distribution** – By replacing bridge valves with Energy Valves, Western was able to eliminate dozens of pumps, reduce the amount of chilled water needed to cool buildings, and set aside the need for additional chillers.
- **Visualization of coil performance simplifies maintenance** – With BACnet IP communication, facility managers have complete access to the Energy Valve's built-in web server for real-time monitoring of the valve's operation to identify cooling problems at the AHU. Remote adjustment of settings optimizes coil heat transfer and flow for all buildings.
- **Improved occupant comfort** – Switching to the Energy Valve has been instrumental in balancing the cooling system and enhancing the well-being of the occupants, regardless of their elevation or distance from the chiller plant.

EN – 10.2019 – Subject to technical modifications

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