Belimo Energy Valve™ at Land O'Lakes, Inc., Minnesota

Belimo Energy Valve Plays Integral Role in Land O' Lakes, Inc.'s Corporate Facility Upgrade

Founded in 1921, Land O' Lakes, Inc. is one of America's premiere member-owned cooperatives. It has 3,200 direct producer-members and 1,000 member-cooperatives that combine to serve more than 300,000 agricultural producers in more than 60 countries worldwide.

Since its inception, Land O' Lakes, Inc. has been committed to environmental stewardship – leveraging sound science and state-of-the-art technologies to improve sustainability and conserve natural resources in its many operations throughout the globe. In the spring of 2015, the company took steps to exemplify that commitment by improving energy efficiency at its corporate headquarters in Arden Hills, Minnesota.

Building type	Office Building
Project type	Renovation
Trade	HVAC
Products	Belimo Energy Valve

Facility Overview and Initial Situation

Land O' Lakes, Inc.'s corporate headquarters consists of multiple buildings, the two largest of which are a four-story, 135,000 SF office building and a two-story, 56,000 SF R&D facility / analytical research lab. Both buildings were constructed in 1980, and together they house roughly 1,100 employees.

In 2014, Land O' Lakes, Inc.'s Corporate Sustainability Group began making plans to upgrade the facilities in order to increase efficiency and reduce energy consumption. HVAC systems were a particular area of focus due to the fact that as the buildings aged, they became more difficult to cool and meet desired discharge air temperature set points (especially in the summer months). Improving occupant comfort was also a priority.

The majority of the headquarters' chilled water needs are handled by a single, closed loop that is driven by a central chilling plant. The plant features two 300-ton centrifugal chillers (600 tons total). A total of six (6) air handling units handle the cooling load for the headquarters – four (4) in the office building and two (2) in the R&D facility. When examining the operation of HVAC systems and equipment to identify areas were efficiency could be gained, Land O' Lakes, Inc. energy officials uncovered a costly issue in the AHUs' chilled water coils. Much of the time, delta T across the coils was lower than its design specifications. In addition to increasing electricity costs due to over pumping, this resulted in suboptimal heat transfer and significant inefficiency at the building level. After conducting a thorough review of piping, valves, and instrumentation, officials concluded that in order to solve the problem, various infrastructural improvements would have to be made. They then began the process of searching for a solution, which eventually led them to the Belimo Energy Valve™.

Customer Requirements: Save Energy, Improve Occupant Comfort, Enhance Operational Visibility

1. Increase delta T in chilled water coils to their design specifications and achieve energy savings through increased pumping efficiency.
2. Improve occupant comfort, particularly in the summer months.
3. Gain visibility into the operation of air handlers and chilled water coils. In recent years, the chilling plant had been unable to adequately cool the facility. Energy officials at Land O' Lakes, Inc. wanted to determine if that was due to insufficient chilling capacity or inefficiency at the building level.

The Solution: Belimo Energy Valve

In April 2015, after various meetings with Belimo Americas, Land O'Lakes, Inc. made the decision to install Belimo Energy Valves on all six (6) of the AHU's chilled water coils (AHU-1 through AHU-6). The valves replaced the 3-way pneumatic valves that were installed when the facility was originally commissioned in 1980. The project also consisted of replacing all chilled water coils in the AHUs, as well as making improvements to piping and adding new motors and variable frequency drives (VFDs) to allow for more precise control of the chilled water loop. Two (2) additional Energy Valves were also installed on hot water coils that supply the R&D facility.

Belimo's Platinum Control Contractor, NAC Mechanical and Electrical Services, performed all mechanical and electrical work on the project. This included the installation of the Energy Valves, along with all new air handler coils, VFDs, electrical motors, and modifications to pipe and electrical infrastructure.

The Belimo Energy Valve (EV) has the capability of operating as either a pressure dependent or pressure independent control valve. The mode of operation can be changed through the valve's built-in web-based user interface (UI). Belimo's patented Power Control and Delta T Manager™ can also be enabled or disabled through the UI and allows the valve to achieve a user-defined delta T setpoint. The intent at Land O' Lakes, Inc. was to operate the Energy Valves in Flow Control Mode (pressure independent) with Delta T Manager enabled.

By installing the Energy Valves and making various infrastructural improvements to buildings, Land O' Lakes, Inc. officials aimed to return water at or near the design temperature of the chillers. In doing so, the amount of flow required to provide cooling to the building would be substantially reduced and energy consumption at the central chilled water plant could be decreased. Officials also sought to utilize the diagnostic capabilities of the Energy Valve to increase visibility into the operation of the cooling system, and more specifically, to determine the specific tonnage per air handler.

Results:

Over the course of 31 days, the operation of the chilled water Energy Valves was monitored and data was recorded in an effort to quantify their effect on the chilled water system.

Flow savings in the table below are based on calculating the difference between actual flow and projected flow. Actual flow is measured by the built in flow meter. Projected flow is determined by calculating the flow based on valve position requested by the DDC system versus actual valve position.

To summarize, the data collected from the six (6) Belimo Energy Valves included in this study indicates a potential flow savings of 6,210,964 gallons of pumped water over the time period from June 14, 2015 to August 24, 2015 Measurements also show that the valves have increased delta T closer to the design specifications of the chilled water plant, resulting in optimal heat transfer and more efficient chiller operation. In previous years, the lowest discharge air temperature that could be achieved at the facility was approximately 58°F (14.5°C). After the Energy Valves were installed, discharge air temperature as low as 52°F (11°C) was observed.

Overall, the installation of the Energy Valves, coupled with various infrastructural improvements to building cooling systems, helped Land O' Lakes, Inc. cut kilowatt usage in July and August of 2015 by roughly 15% when compared to the same months the previous year.

The hot water Energy Valves installed at the R&D facility will be monitored throughout the upcoming heating season (winter 2015 – 2016) and data will be recorded in order to quantify their impact on energy savings as well.

AHU Unit Tag	Projected Flow Savings (gallons)
AHU - 1	1,745, 078
AHU - 2	276,171
AHU - 3	554,269
AHU - 4	1,689,298
AHU - 5	1,679,956
AHU - 6	266,192
Projected Flow Savings Total	**6,210,964**

Benefits:

- Increased pumping efficiency and reduced energy consumption. Land O' Lakes, Inc. was able to achieve an average of 15 percent less kilowatt usage in July and August of 2015 as compared to the same months in 2014.
- The electrical and mechanical contractor, NAC Mechanical and Electrical Services was able to secure a rebate for the project. This rebate was based off of the installation of the Energy Valves, new VFDs, air handler coils, electric motors, and modifications made to necessary pipe and electrical infrastructure.
- Used feedback data from Energy Valve to control pumps with VFDs, allowing for more precise control of the chilled water loop without sacrificing the AHUs call for cooling during occupied times.
- Diagnostic capabilities allowed for visibility into individual building's and cooling coil performance, which helped make projections regarding future energy consumption.

Energy Valve Features and Capabilities:

- Efficient regulation of flow and heat exchanger output and monitoring of delta T.
- Automated, hydraulic compensation through continuous flow rate measurement.
- Energy monitoring via web server and BACnet IP, BACnet MS/TP or MP-Bus®. The built-in web server collects up to 13 months of data that can be downloaded to external tools for further optimization.
- Temperature range: 14°F to 248°F (-10°C to 120°C).
- 11 nominal diameters from DN15 to DN150 (1/2-inch to 6-inch).

Conclusion:

Land O' Lakes, Inc. is examining plans to add a 153,000 SF expansion to their headquarters in Arden Hills, Minnesota. Although the plan is still in its early stages, if the project is approved, Belimo Energy Valves will be flat spec'd throughout the facility (where applicable). The valves may also be used at a facility in California in order to improve the chilled water system that provides cooling to both employees and livestock.

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