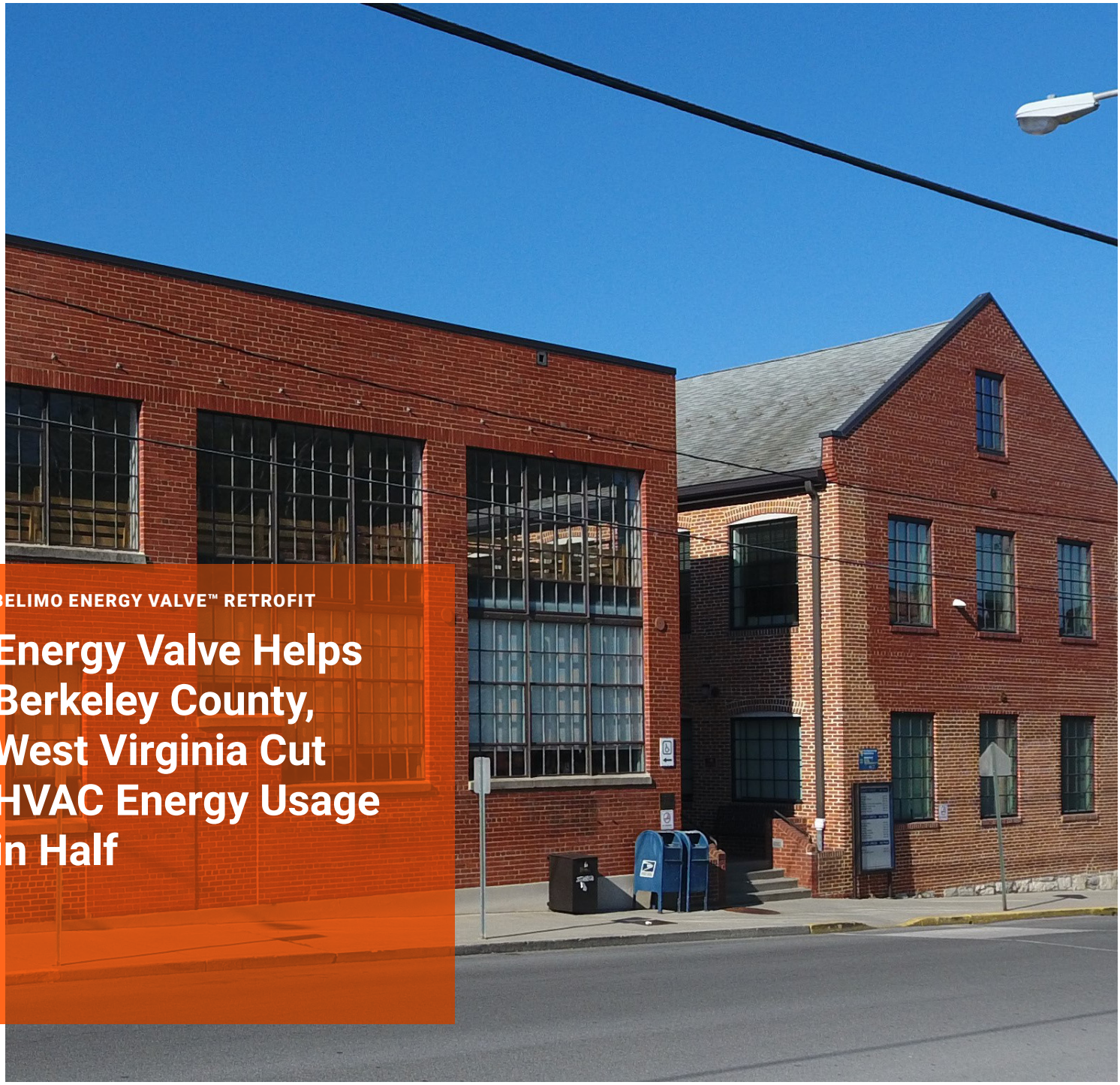


BELIMO ENERGY VALVE™ RETROFIT

Energy Valve Helps Berkeley County, West Virginia Cut HVAC Energy Usage in Half

Belimo Energy Valves Solves Low Delta T Syndrome

Built in 1910, the Dunn Building in Berkeley County, West Virginia, has a diverse history. For nearly four decades, the building operated as a woolen sock mill. It has since been used for a variety of purposes, including retail shopping center and technical college, among others. Today, it serves as administrative offices for Berkeley County. On any given day, approximately 50 people occupy the facility.

Since taking sole ownership of the Dunn Building in the late 1990s, Berkeley County officials have initiated multiple capital improvement projects aimed at lowering costs and increasing energy efficiency. The most recent upgrade took place in 2019 when the county contracted Maryland-based Boland Trane to perform a complete overhaul of the building's heating and cooling systems. For the project, Boland replaced a number of outdated system components with state-of-the-art energy-conserving technologies – one of which was the Belimo Energy Valve™.

TYPE OF BUILDING
Office Building

PROJECT
Retrofit

SECTOR
Government

PRODUCTS
Belimo Energy Valve™

BELIMO

Valve Technology Improves HVAC Building Performance

Project Overview

The Dunn Building's primary motivation for the upgrade project was to 1) decrease HVAC energy consumption/costs and 2) improve occupant comfort. Boland Trane's solution for achieving these goals was two-fold. The first objective was to improve the efficiency in which hot and chilled water were produced. The second was to optimize the manner in which they were utilized to meet the building's heating and cooling load.

To address the production of hot water, Boland Trane replaced four 1.7 million BTU hot water boilers, which were installed in the 1970s, with one 6 million BTU high-efficiency modular boiler. A new 250-ton air-cooled Trane helical rotary chiller was also installed for cooling, along with an ice plant and associated storage.

Although the previous chiller was only 12 years old, it was in a state of disrepair – with half of its compressor modules inoperable. However, despite its condition, a system evaluation revealed that it was not the primary root cause of the building's poor performance. Like many older facilities, the Dunn Building suffered from low Delta T syndrome (i.e., inefficient heat transfer across coils) caused by overpumping of the chilled water system. This contributed to short cycling of the chiller's compressors. It also increased the building's electricity usage.

To maximize energy efficiency and prevent the new chiller from meeting the same fate as the old one, Berkley County and Boland Trane determined that additional system upgrades would have to be made beyond the installation of the new boilers and chiller plant. More specifically, the low Delta T problem would have to be addressed. For this, they turned to the Belimo Energy Valve.

"The Energy Valve revealed a critical flaw in the building's cooling system, which was that the supply and return line risers had been mislabeled and thus incorrectly installed on roughly a third of the building's air handlers."

Jim Bauer, Account Executive, Boland Trane

Solution and Savings

The Energy Valve is an IoT-based pressure independent control valve that utilizes advanced cloud-based analytics to leverage captured system data to its full potential -- providing savings and efficient operation. Utilizing its built-in Power Control and Delta T Manager logics, the valve measures flow and temperature to monitor coil performance and energy consumption.

The Delta T setpoint in the valve can be matched to the design Delta T of the coil. As the temperature sensors start to realize a lower differential temperature across the coil, the valve begins to close and flow decreases, allowing for more efficient heat exchange and elimination of overflow. When Delta T begins to stabilize, the valve increases flow back through the coil, thus maintaining optimal heat transfer.

In total, 87 Energy Valves were installed across the Dunn Building (replacing old 3-way valves) – 42 each on both the heating and cooling coils in FCU and 3 on the cooling coils in existing AHU. During commissioning, the built-in diagnostic capabilities of the valves indicated that a flow problem existed. It was first suspected that the valves were installed backwards. However, further evaluation revealed that in fact the supply and return lines to a number of air handlers were incorrectly piped.

"The Energy Valve revealed a critical flaw in the building's cooling system, which was that the supply and return line risers had been mislabeled and thus incorrectly installed on roughly a third of the building's air handlers", said Jim Bauer, Account Executive at Boland Trane. "This mistake from the previous contractor occurred nearly 12 years prior to the upgrade project and was significantly hindering the building's efficiency and performance. Had we not installed the Energy Valves, it is unlikely the problem would have been discovered."

The Energy Valves had an immediate impact on the cooling efficiency of the building. Delta T across the coils increased by an average of 8°F (from 4 to 12°F). By correcting the coils' flow and operating them at design specifications, the valves eliminated over-pumping. Boland Trane also installed variable frequency drives (VFDs) on all air handlers and fan coil units to enable single-zone variable air volume (VAV) control. Together, with the installation of the ice plant and storage, these upgrades resulted in a 50% reduction in the Dunn Building's energy usage. The Energy Star rating of the building also increased by 19 points – from 74 to 93.

"In addition to the energy-saving benefits, the diagnostic and data gathering capabilities of the Energy Valve provide visibility into building performance down to the individual fan coils and air handlers", added Bauer. "We pull all of the data from the valves and the building automation systems into our Applied Building Insights Platform. We then use the insights to identify opportunities for efficiency improvements and continuous optimization every quarter. This was the first Energy Valve application for Boland Trane, but it has already made it onto our Top-5 list of energy conservation measures (ECM)."

BELIMO ENERGY VALVE

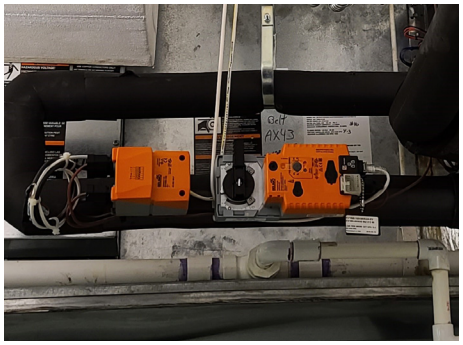
The Belimo Energy Valve is an IoT cloud-connected pressure independent valve that monitors coil performance and energy consumption while maintaining Delta T.

- Patented Power Control and Delta T Manager logic monitors coil performance and optimizes the available energy of the coil by maintaining the Delta T.
- Glycol monitoring ensures glycol content meets design needs to provide optimum efficiency and safe operation.
- Cloud analytics provide recommended Delta T and flow setpoints which can be updated remotely
- Dynamic coil performance illustrates the operation of the coil in real time accurately providing transparency of power degradation and other operational issues.
- Expansive communication platform includes Cloud, BACnet MSTP and BACnet IP, Modbus, RTU and TCP/IP, Belimo MP-Bus, and one analog feedback signal for valve flow, power, temperature or position.

Customer Satisfaction

Berkley County and Boland Trane are currently in discussions for other capital improvement projects where the Belimo Energy Valve could be used.

"The difference in terms of occupant comfort and climate control before and after the upgrade project is night and day", said Gary Wine, Deputy County Administrator for Berkeley Country. "The changes made by Boland Trane have drastically reduced our energy bills. The Belimo Energy Valve has been a big part of that. We absolutely expect it to play a role in our efforts to improve the efficiency and sustainability of our buildings going forward."



CUSTOMER BENEFITS

- **Reduced Energy Consumption** - Operating at design specifications, the Energy Valves increased Delta T and eliminated overpumping, which immediately impacted the building's cooling efficiency. The Energy Star rating of the building also increased.

- **Increased Performance** - The Energy Valve revealed a critical flaw in the building's cooling system. The supply and return line risers had been incorrectly installed on a third of the building's air handlers. The mistake occurred nearly 12 years before and significantly hindering the building's efficiency and performance.

- **Enhanced Visibility** - With the Energy Valves cloud connectivity, the diagnostic and data gathered provide building performance down to the individual fan coils and air handlers. The Energy Valves continuously monitors and compares against other valves operating under similar conditions. Quarterly energy reports provide data on trends, energy, and performance KPIs.

CS_21 – 01.2021 – Subject to technical modifications

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