

Advanced Control Technologies in Chilled Water systems

- Smart Devices =
- Improved Control
- Energy Savings



Smart Devices



Which Smart Device with Advanced Technology are we talking about ?

HVAC Control Valves for Chilled Water Systems.



Introducing Energy Valve 3.0

**The world's most
advanced pressure-
independent valve**



What makes the Energy Valve so different to other types of control valves ?

“If You **Can't Measure It**, You **Can't Improve It** “ *

Conventional and Pressure Independent Control valves **cannot measure.....**

1. Flow in 'real time'
2. Temperature (flow)
3. Temperature (return)
4. Delta T
5. Cooling Energy kw/h
6. Store the data (every minute) onboard itself
7. Autonomously action the data to ensure efficiency is maintained
8. Connect to the Cloud for remote data Analysis and performance reporting
9. Allow remote interrogation and control
10. Receive regular software updates

Energy Valve Overview

1 **Actuator**, Webserver, Data logger,
BACnet, Modbus, MP Bus, Cloud capability

2 **Electronic flow meter**, True Flow, wet
calibrated

3 **Temperature sensors**, Platinum based RTD
for supply and return, allowing BTU
measurement

4 **Logic**, Delta T Management, Cloud
Optimization, Power Control algorithm

**Measure, Observe, Record and Trend
Performance Data**



Improved Control

What is that ?

For modulating (proportional control) it is this

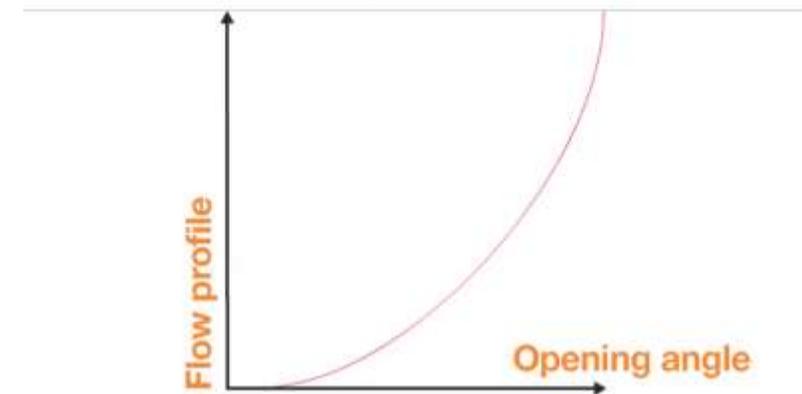


Improved Control

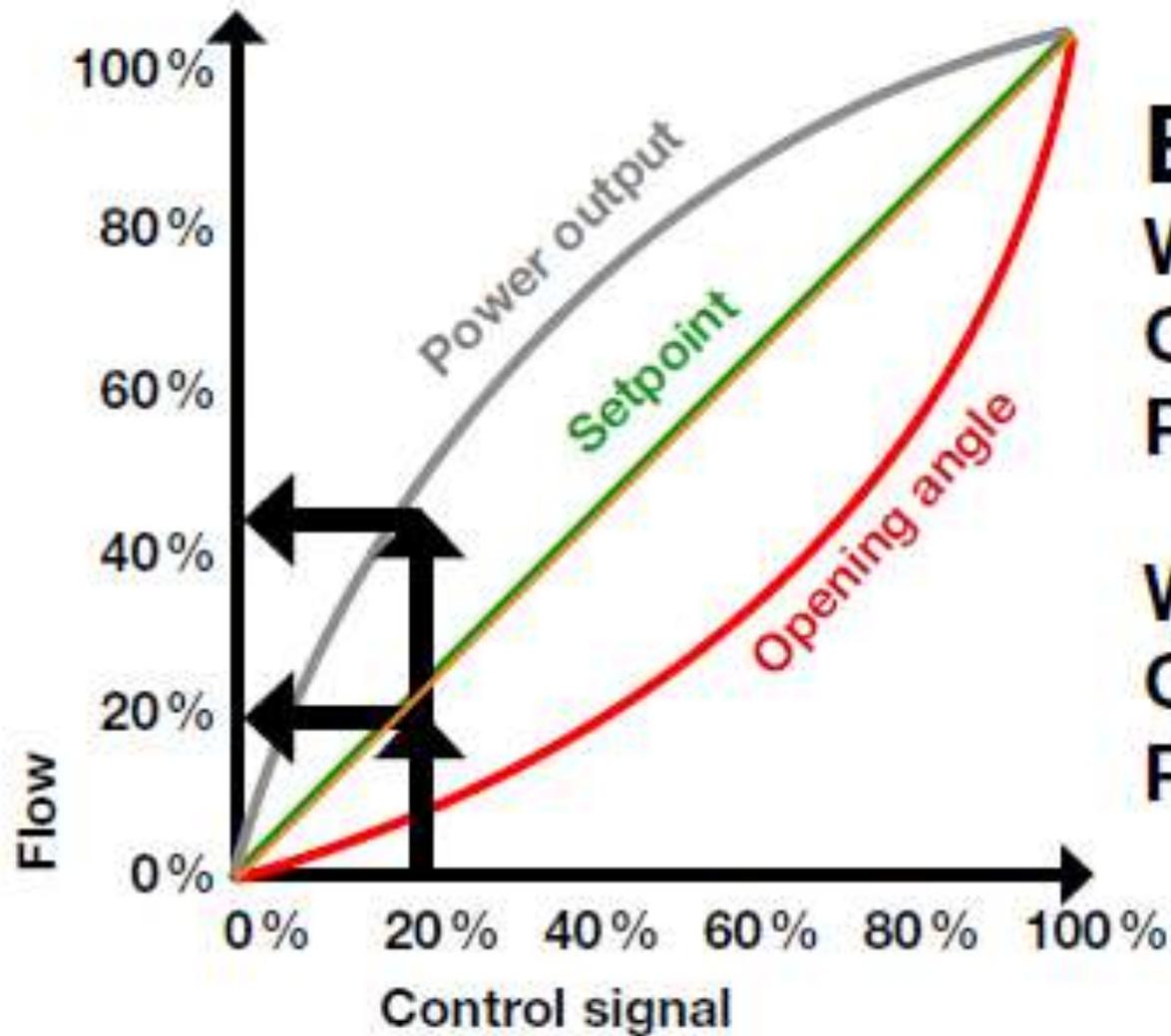
Control Ball Valve



- **Air bubble-tight closing**
 - No energy loss with zero load
- **Self Cleaning when rotating**
 - Not sensitive to water quality
- **Excellent Control**
 - Characterising disk, equal percentage curve
- **Formfit connection to Actuator**
 - Reliable Operation at any pressure situation
- **Robust, compact design**



Improved Control



Example

Without valve control:
Control signal = 20%
Power output = 45%

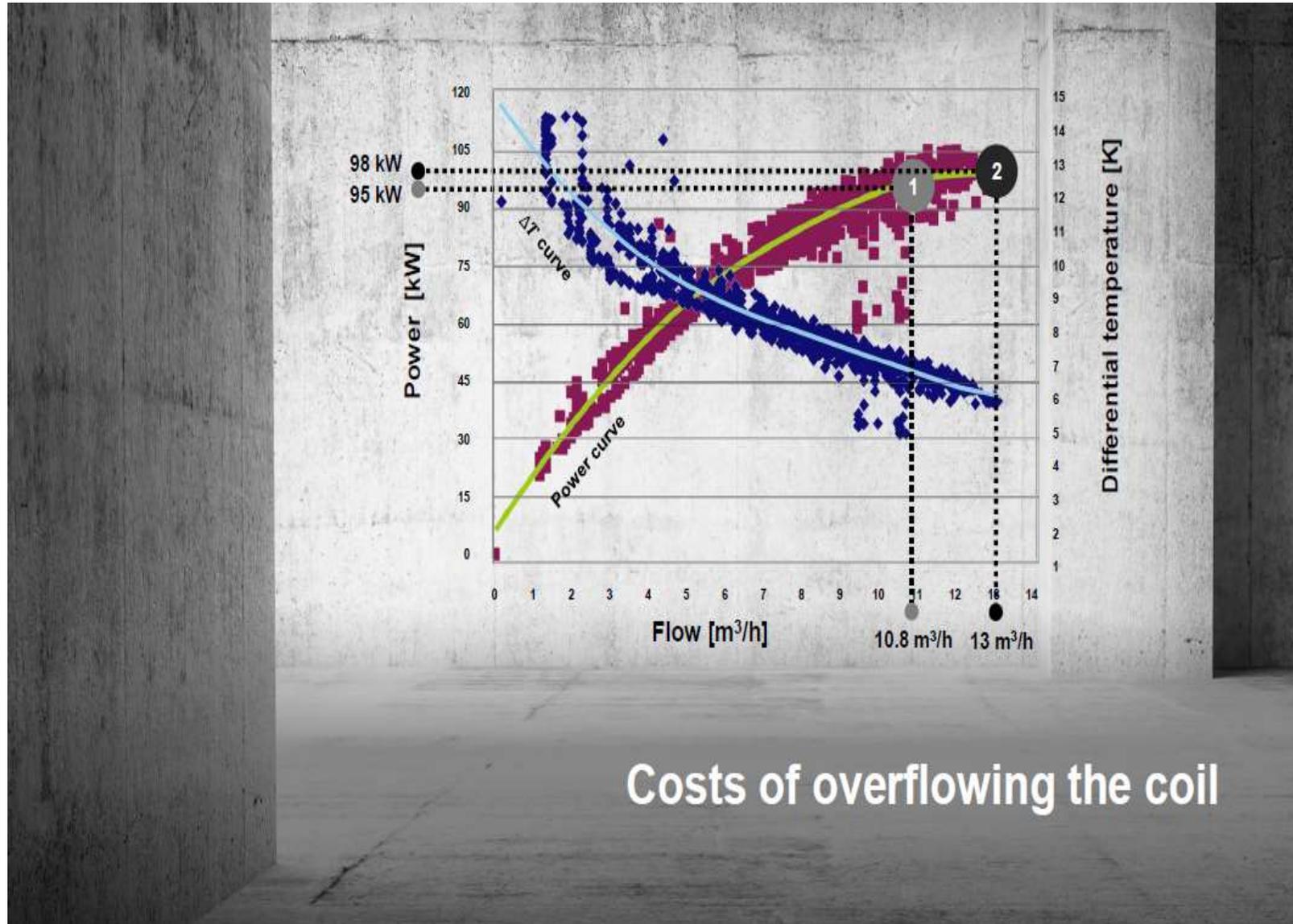
With valve control:
Control signal = 20%
Power output = 20%

Improved Control

Measure the Flow in order to prevent Overflow !



Energy Savings



**A 3% increase in cooling results
in a 74% increase in pumping energy**

Pump Affinity Law

$$\frac{P_2}{P_1} = \left(\frac{\dot{V}_2}{\dot{V}_1} \right)^3$$

	1	2	Δ
\dot{Q}	95	98	3%
\dot{V}	10.8	13	16%
P_{pump}	P increase = $(13/10.8)^3$		74%

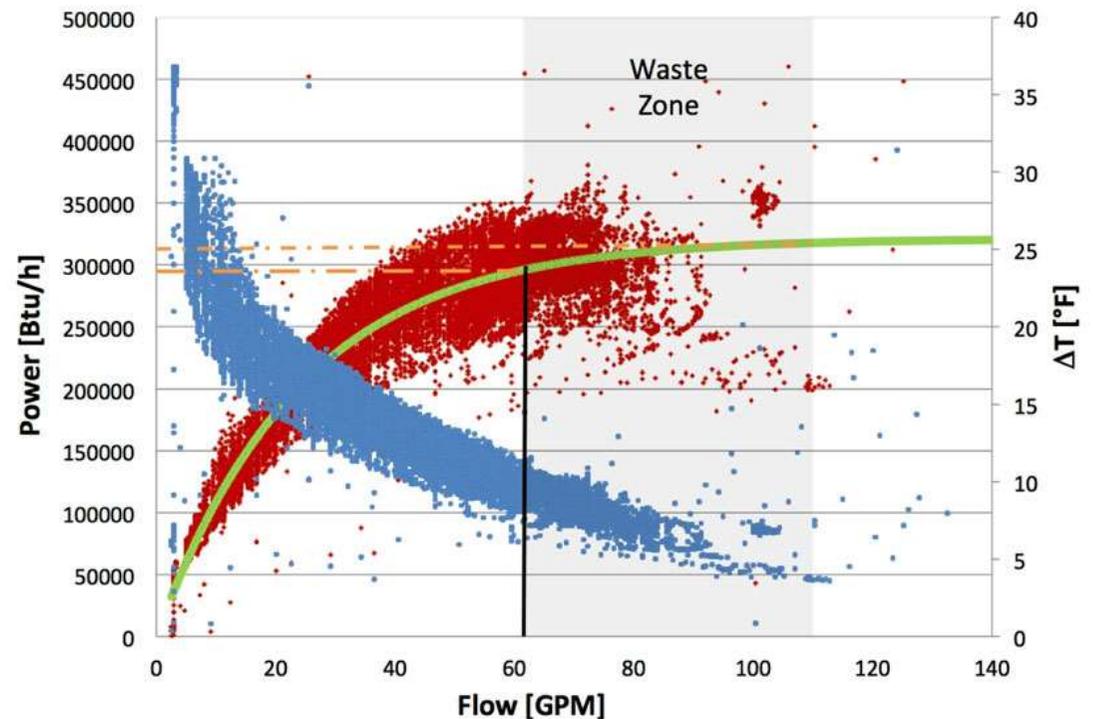
Energy Savings

“Our Technology needs to be Less Old so that we can Stay Cold”

- The Buildings Performance Institute Europe- [BPIE](#) (2017) Building automation reduces energy consumption by around 23% and 27% in residential properties.
- Advanced technology will enable even more efficient use of measured data and therefore energy in HVAC chilled water systems

Smart devices can help but where in the HVAC system should we focus ?

1. Production
2. Distribution
3. Dissipation



Energy Savings

What is...

Low Delta T Syndrome?

Low Delta T Syndrome may occur when...

coils and
valves are not
sized properly

too much
water is
delivered

coils foul and
degrade with
age or lack
proper
maintenance

water systems
are not
dynamically
balanced

How can the Energy Valve manage Low Delta T ?

Simple..... it does what other valves cannot.....it Measures, then acts using..... Advanced Technology

Energy Savings

The plant will operate in the saturation zone with a higher flow, but no added kW



Energy Savings

Low Delta T wastes energy at the coil.

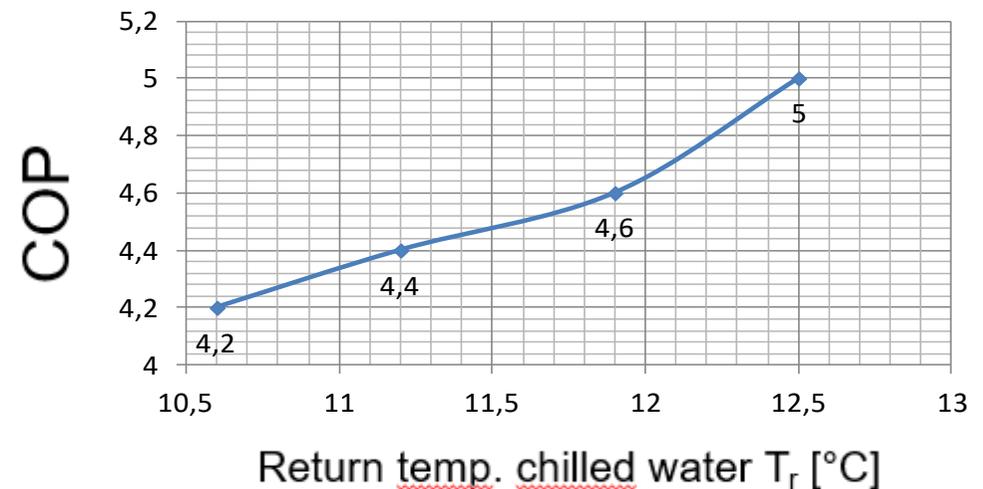
**What effect can this have on the
chiller plant?**

Energy Savings

Plant	Manufacturer Chiller Plant Efficiency Coefficient*	Average Chiller Plant Efficiency Coefficient*	Actual Delta T [F]
A (Office)	4.26	2.02	2.4
B (Museum)	4.78	2.87	2.8
C (Bank)	3.15	2.14	3.6
D (Office)	3.87	0.84	0.7

◆ Higher Efficiency Coefficient reflects higher plant efficiency

Effect of a reduction in the return water temp. on COP

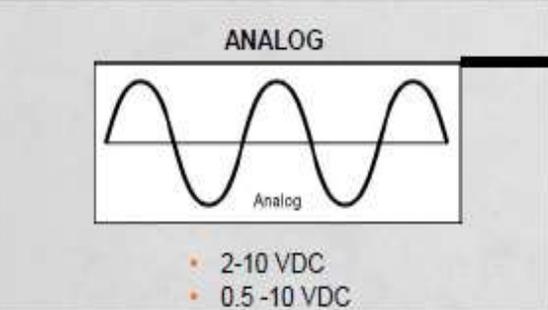


Energy Savings



Enhanced Communication

More than any other actuator on the market



New and improved features



**Improved Delta T
Management**



Ultra Sonic Flowmeter



Glycol Monitoring



**New Web
Interfaces**



**Cloud-Based
Services**



Energy Valve 3.0 Cloud Services

Multiple benefits providing advanced optimization



OPTIMIZATION OF
DELTA T AND
FLOW SETTINGS



PERFORMANCE
REPORT



ONLINE
SUPPORT



SOFTWARE
UPDATES



INCREASE
WARRANTY TO
7 YEARS



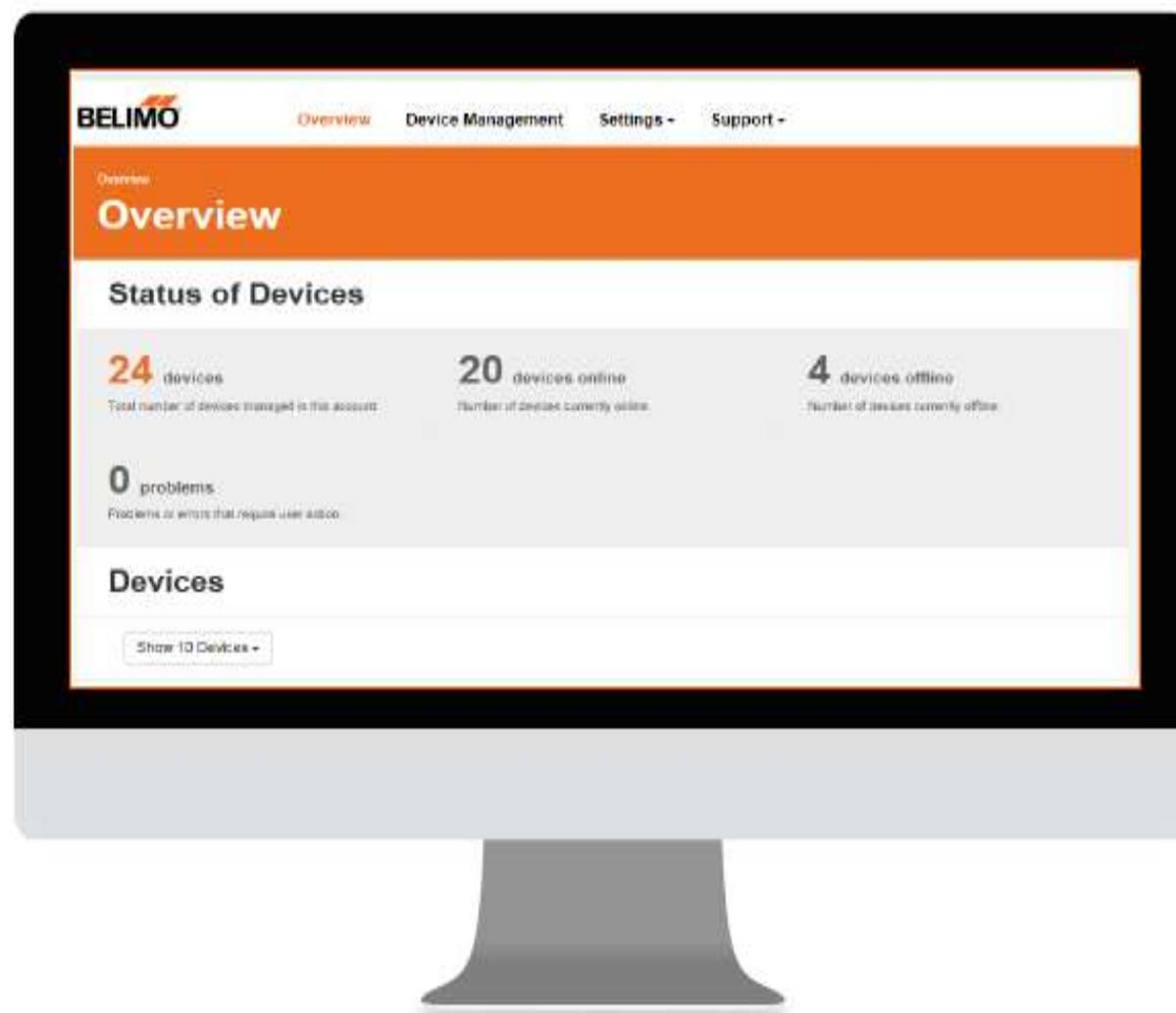
LIFETIME
DATA
ACCESS



BELIMO ONLINE SUPPORT



- Real time troubleshooting reduces downtime
- Fast response time
- Direct connection to Belimo experts

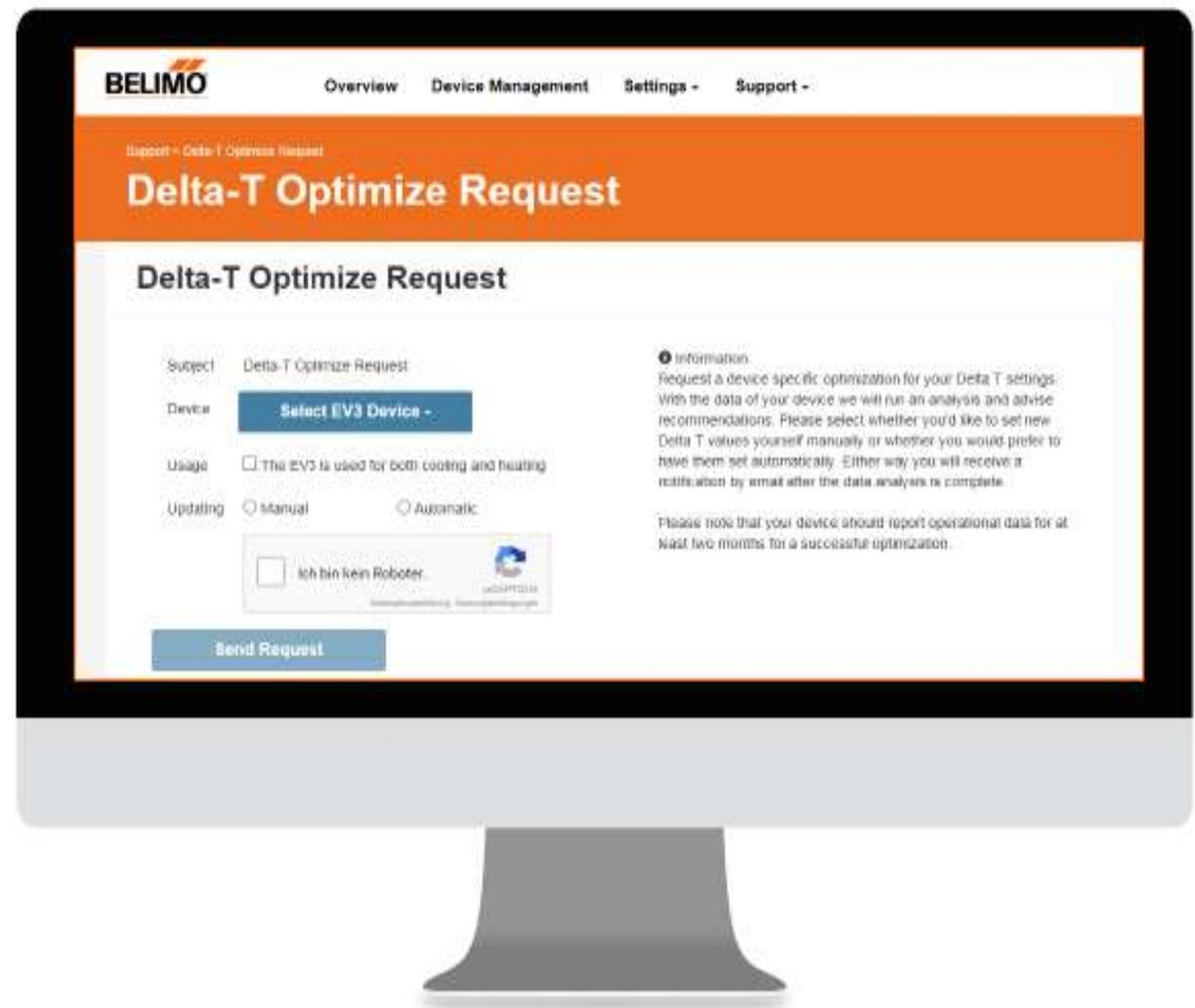




OPTIMIZATION OF DELTA T AND FLOW SETTINGS



- Better performance and system stability
- Ensures effective use of the Delta T Manager
- Cost savings through efficient operation
- Notification of any system changes



Smart Devices



BELIMO ENERGY VALVE™



IMPORT DATA

DATA RANGE
 From: 11/1/2016 4:40 AM
 To: 12/1/2016 4:00 AM

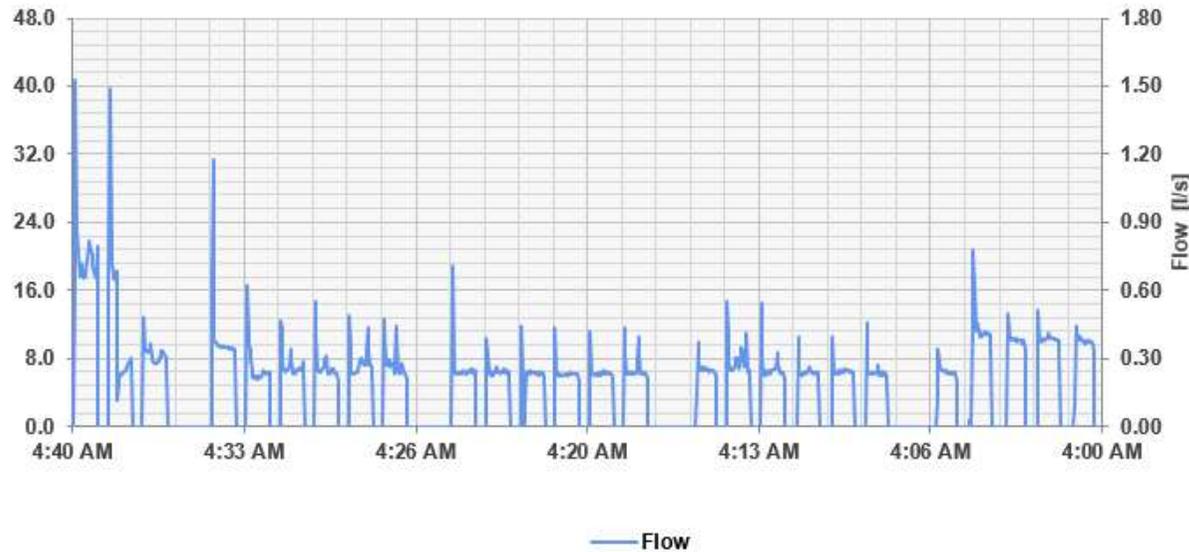
SELECT STARTTIME
 11/1/2016 4:40 AM

SELECT DURATION

Ten Mins	Full Time Period
One Hour	
Six Hours	
One Day	
Six Days	

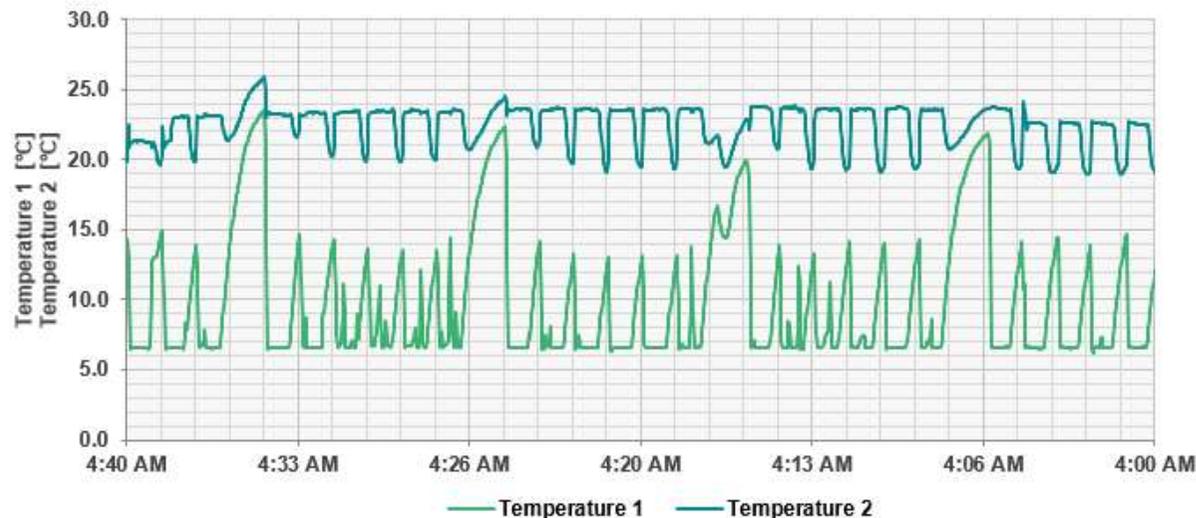
SELECT PLOT

- relative flow
- flow
- relative power
- power
- actuator position
- setpoint DDC
- energy cooling
- energy heating
- dT-Manager
- temperatur 1
- temperatur 2
- dT
- dT-Limiting value



◀ Previous Time Period

Next Time Period ▶



CUSTOMER
 Customer name
 Valve location

VALVE SIZE
 76.1GPM - 2", 288l/min - DN50

ACTIVATED OPTIONS
 Snapshot taken at
 November 1, 2016 4:45 AM

Control Mode	Flow control
Override	Auto
dT-Manager	inactive
Installation position	Return Flow
Setpoint DDC	0.000 [%]
Total Flow	464,749 [l]
dT Average	12.58 [°C]
Energy	28,756 [kBTU]

TIME ZONE
 UTC +04:00
 (Standard Time)

Change Units

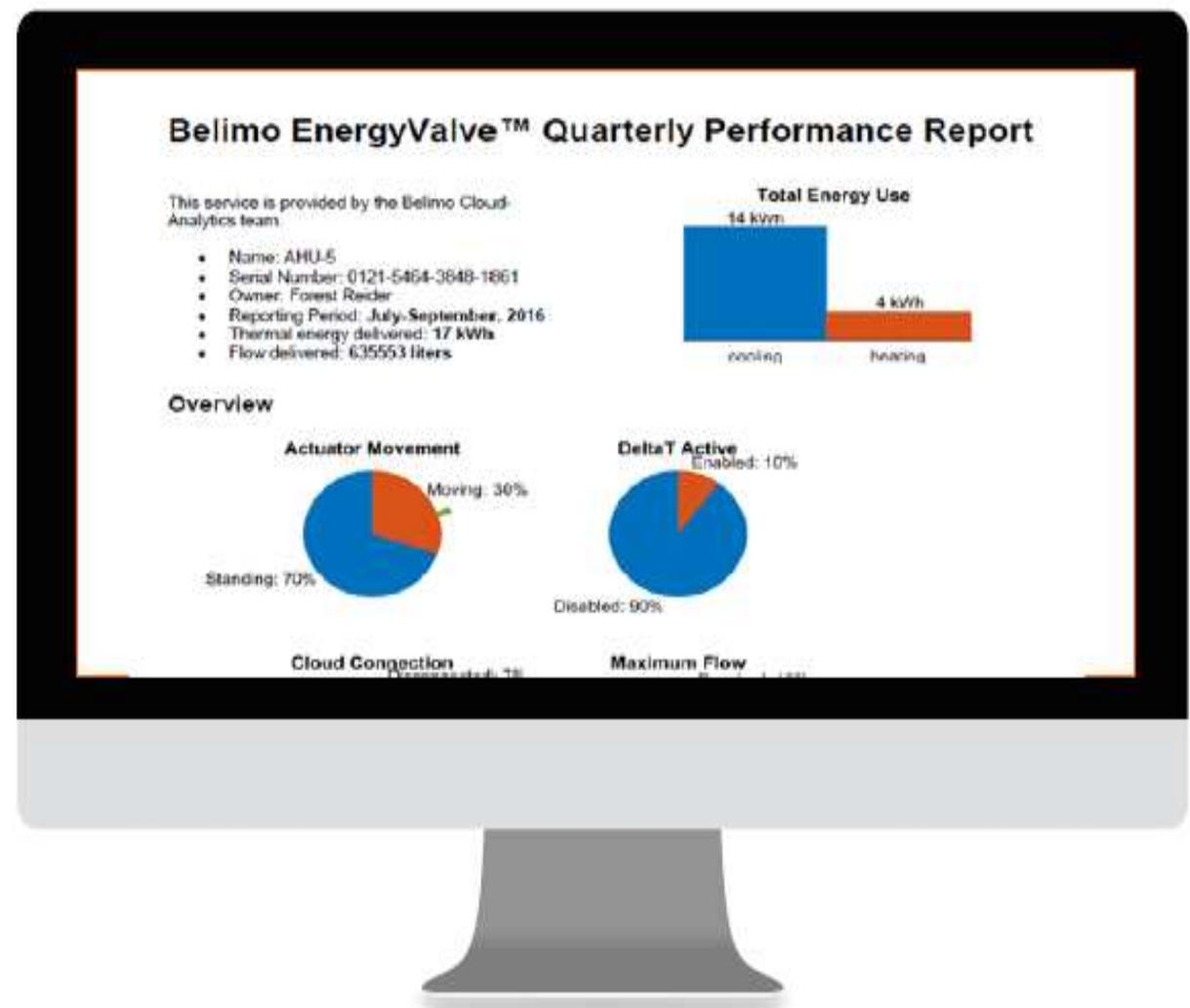




PERFORMANCE REPORTING



- Automatically generated performance and commissioning report with key insights
- Allow for predictive maintenance of coil performance and easy ROI analysis
- Important KPI data for system transparency



Success Story

Massachusetts Institute of Technology (MIT)

BELIMO

Average Delta T rose from
6.15°F to 12.14°F, reducing
chilled water flow by

49%

Annual savings were
estimated to be as high as

\$1.5 million

Case Study

MIT University - Boston, MA

Results

- Aug 9 - Oct 9, 2010
 $\Delta T = 6.15 F$
- Aug 9 - Oct 9, 2011
 $\Delta T = 12.14 F$

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IMPROVING CAMPUS CHILLED WATER SYSTEMS WITH INTELLIGENT CONTROL VALVES: A FIELD STUDY

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ABSTRACT

The degradation of the temperature difference between supply and return flow, known as ΔT degradation, in chilled water systems has been widely observed and documented over the last 25 years. High pumping energy consumption as well as reduced efficiency of the



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ABSTRACT

The degradation of the temperature difference between supply and return flow, known as ΔT degradation, in chilled water systems has been widely observed and documented over the last 25 years. High pumping energy consumption as well as reduced efficiency of the chillers operating under part-load conditions, lead to a decrease of overall system efficiency of chilled water plants. This article describes a field study conducted on two university campuses in Massachusetts and Colorado during the cooling season of 2011. The purpose of this experimental study was to alleviate ΔT degradation problems on both campuses through the use of intelligent pressure-independent control valves, and to quantify the improvements achieved. The MA field results revealed that the intelligent control valves when coupled with a ΔT management strategy have allowed the campus to serve additional cooling load on its campus with the same distribution and central plant system.

Keywords: chilled water plants; delta T degradation; energy efficiency; building retrofits;

INTRODUCTION

The degradation of the temperature difference between supply and return flow, known as ΔT degradation, in *chilled water systems* has been widely observed and documented over the last 25 years. While commonly the problem of decreasing waterside temperature difference is reported, the real problem is the corresponding increase in water flow rate. Especially under part-load conditions, when the mass flow rate relative to the cooling load increases, an additional chiller and cooling tower need to be brought online to maintain the flow requirements even though the cooling capacity limits of the chillers have not yet been reached. Both, high pumping energy consumption as well as reduced efficiency of the chillers operating under part-load conditions, lead to a decrease of overall system efficiency of chilled water plants.

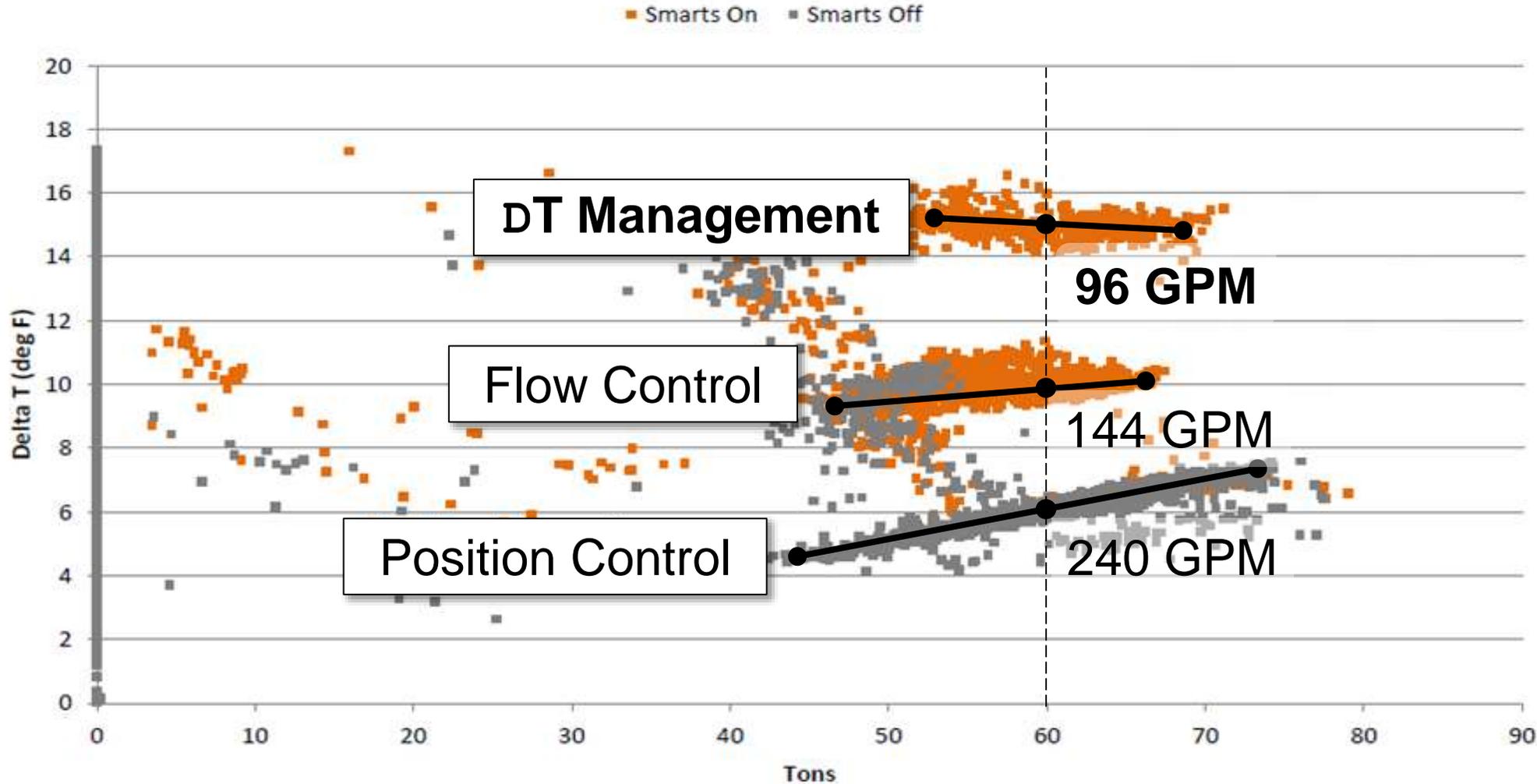
Summary

- Delta T – doubled
- Flows - cut in half
- Improved chiller efficiency
- Energy savings – est. 1.5M USD p.a
- Enhanced transparency
- Trending data now available
- Enhanced maintenance
- Continuous commissioning

Case Study

Large Tech Company in North Carolina

Delta T vs. Tons - B500 AHU3



University of Dubai highlights features that led to LEED Gold certification

Investment in HVAC technologies have paved the way for LEED Gold certification, says representative

By Hannah Jo Uy | Assistant Editor



acknowledged the contribution of the Belimo Energy Valve in helping the Dubai University building achieve LEED Gold rating. "Having enhanced visibility into both performance, and energy use was of great value, and made possible by the use of Belimo Energy Valves in our campus chilled water system," he said. "We now have ideal room temperatures and optimal energy use, utilising smart control technologies."

Conclusion



- **Smart Devices are here and available now**
- **You can save energy using them on your new build project**
- **You can retro-fit smart solutions into your existing building**
- **You will improve system performance using them**
- **You do not need to accept Low Delta T**
- **You can Measure effectively to Control effectively**
- **System visibility – hard data – no more guessing**
- **Belimo Cloud Account = ongoing support for your project**

For more information and access to useful tools and resources, please see

energyvalve.com

Thank You for Your Attention !

