Solving Low Delta T Syndrome for Better Energy Efficiency

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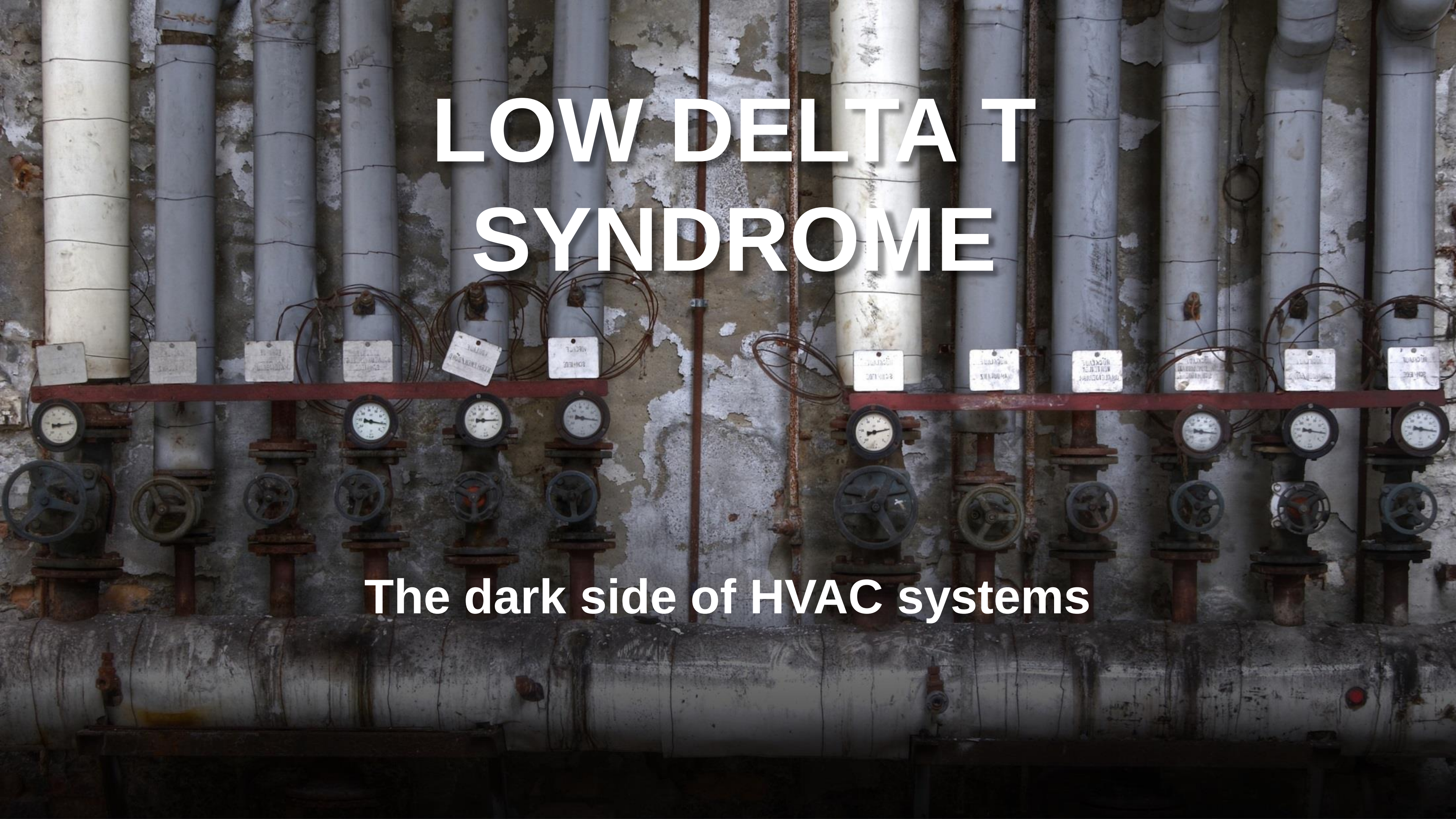
Strategy and Brand Management



LOW DELTA T SYNDROME

The dark side of HVAC systems


The Paris Agreement forces us to
limit global warming and lower
greenhouse gases

Buildings are an integral and elementary part of the global energy system

Buildings use about:

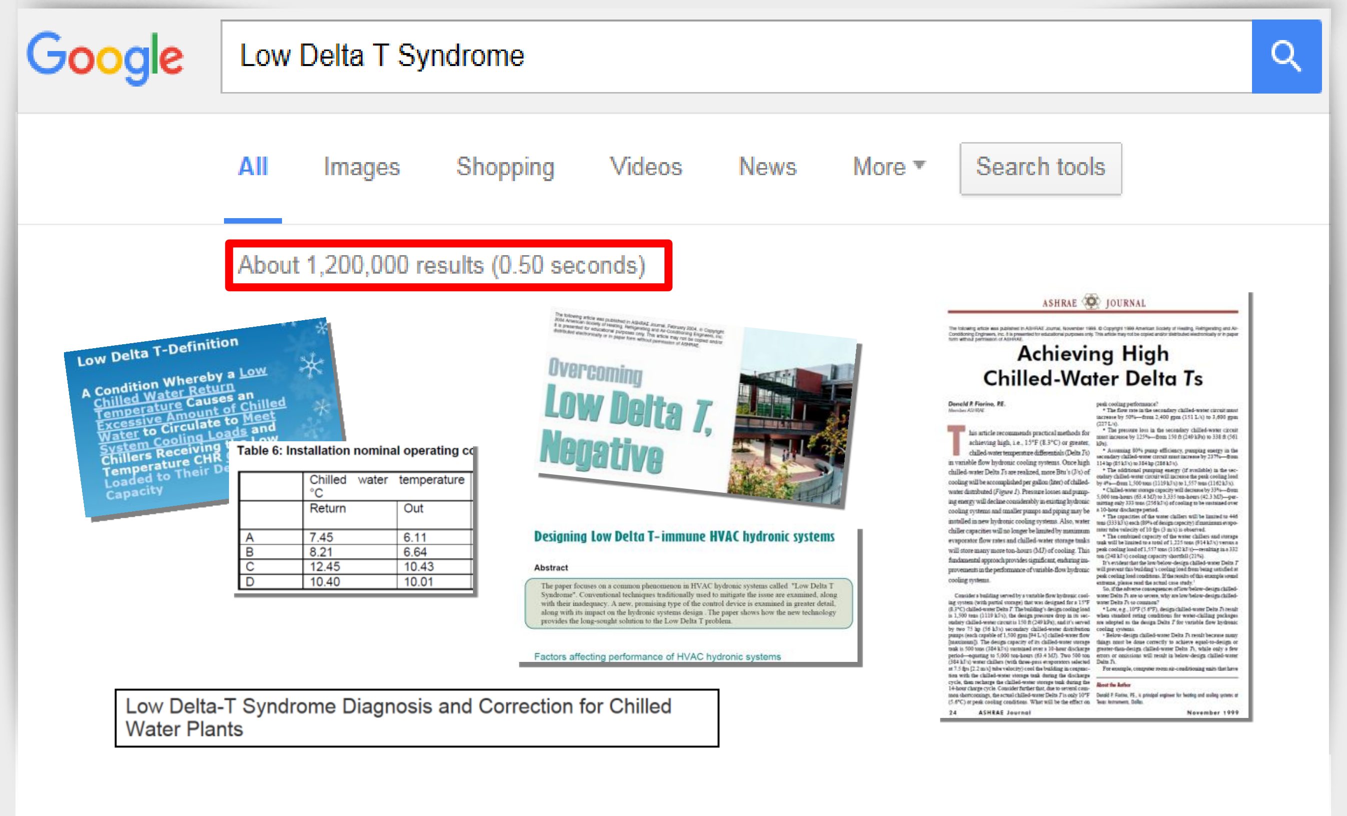
- **40% of global energy**
- **25% of global water**
- **40% of global resources**
  they emit 1/3 of GHG


For buildings to be able to realize their potential, they must first and foremost be energy efficient
According to LEED 33- 39% of a building's energy use is HVAC
Greenbuild estimates that 6% of the world's energy is used for cooling


As discovered in the Helsinki Report, buildings with central plants are far from being energy efficient
Many suffer from a condition called
Low Delta T Syndrome


Research suggests that more
than half of buildings with a
central plant are suffering
from Low Delta T Syndrome

Today, we can see a high awareness of the Low Delta T syndrome



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

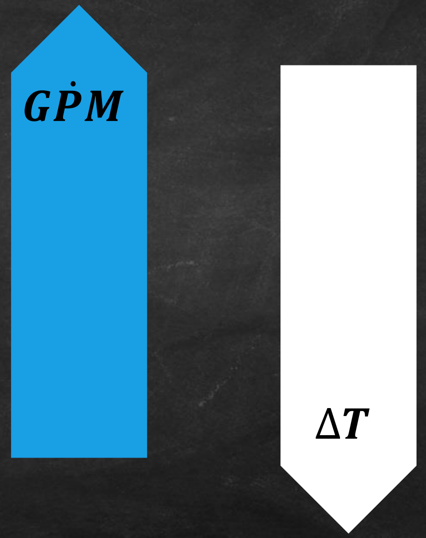
A quick lesson on Power Output

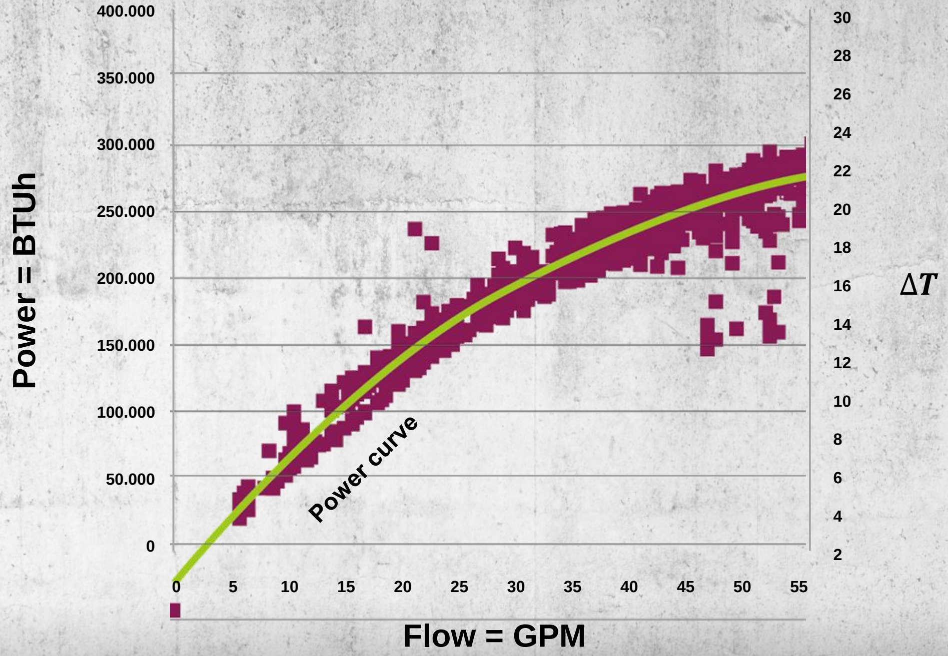
For a given/constant load on the coil, flow and Delta T are inversely proportional

Power Output

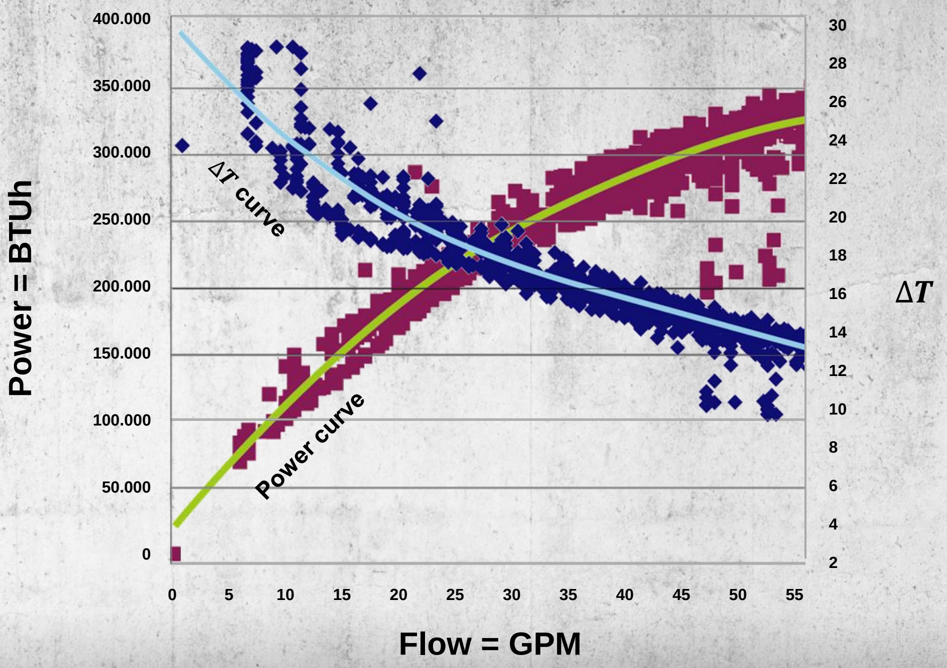
$$Q = 500 \cdot GPM \cdot \Delta T$$

$\dot{Q}$ in BTH/U and is constant

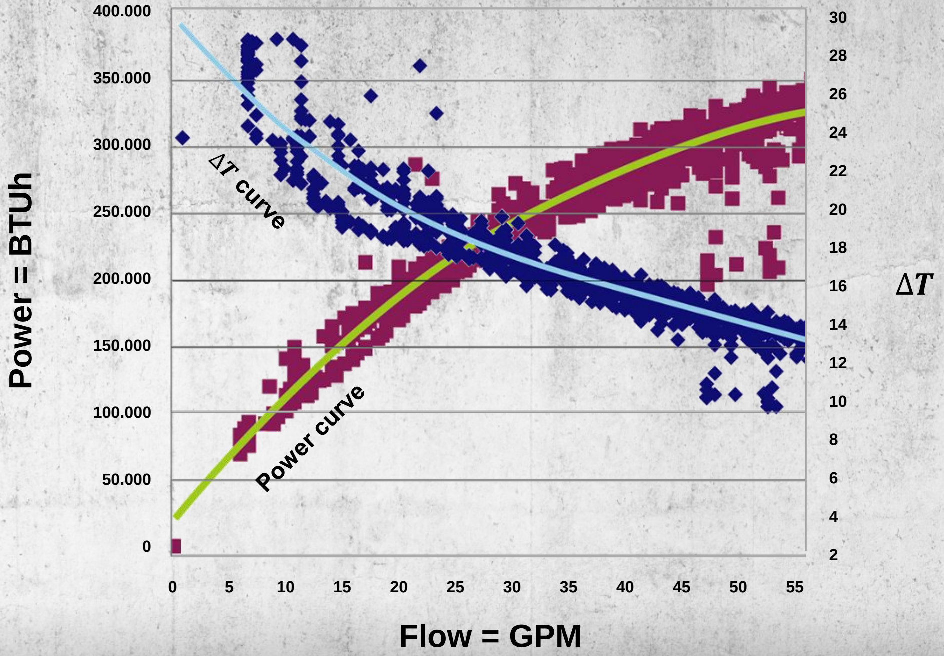




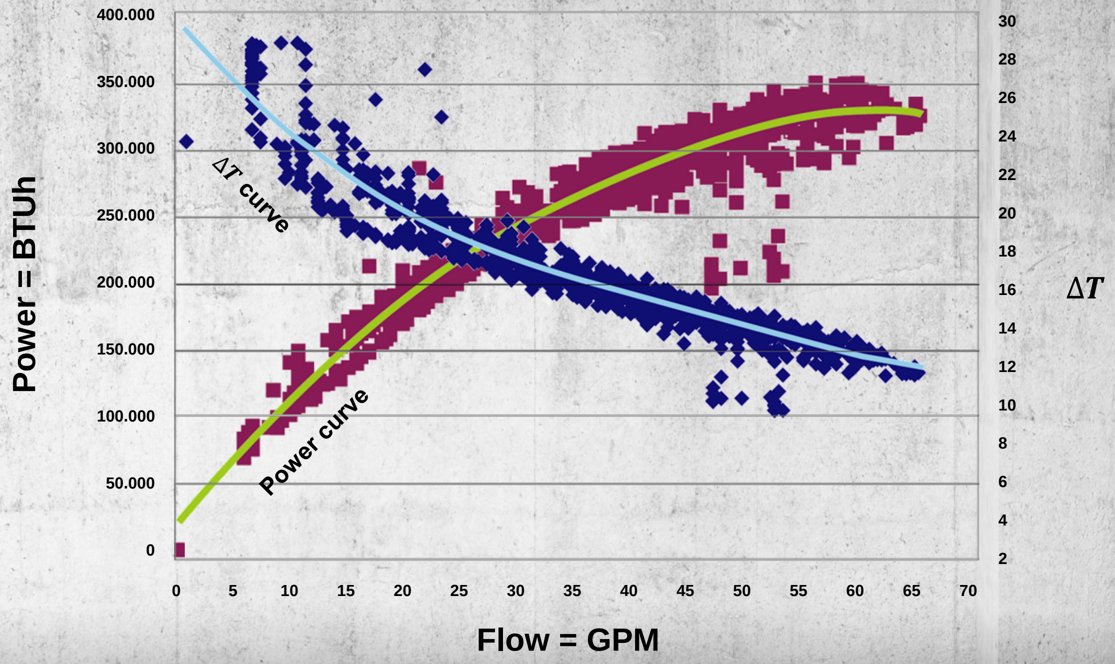
The Power output in BTUh increases with the flow



Delta T decreases as the flow to load ratio decreases

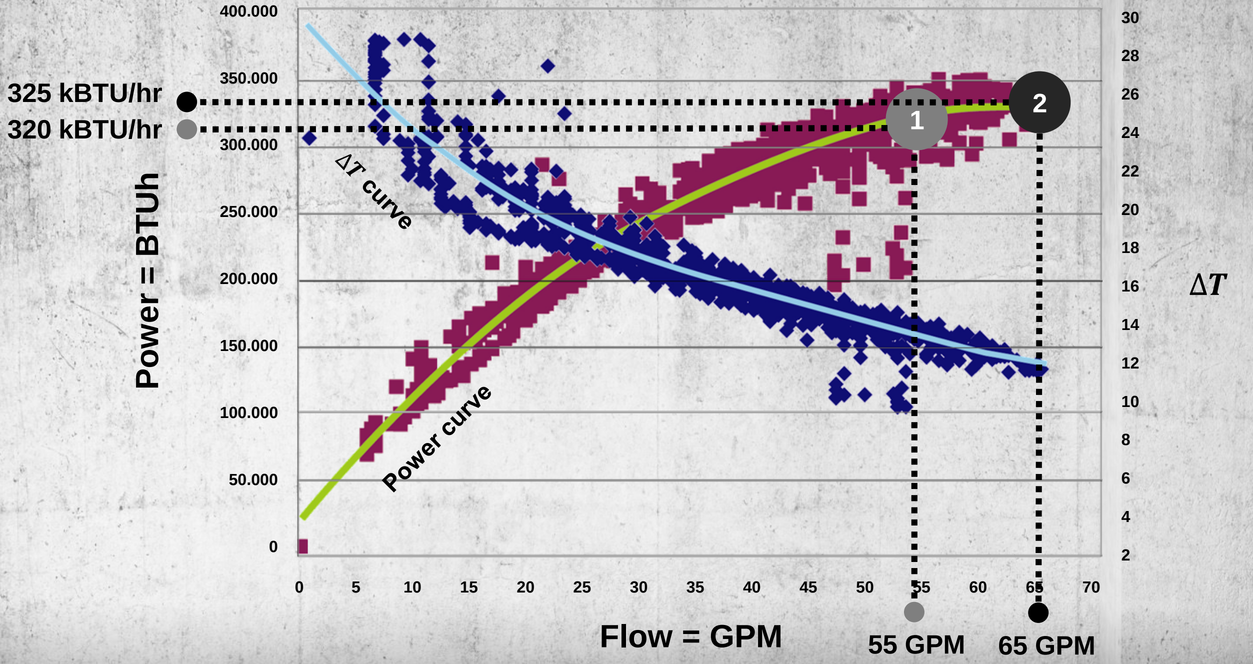


What happens when the coil receives more flow than is needed?



What happens when the coil receives more flow than is needed?

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



Costs of overflowing the coil

The energy required to increase the flow can be calculated using the Pump Affinity Law

$$\frac{HP_2}{HP_1} = \left(\frac{GPM_2}{GPM_1}\right)^3$$

HP_1: power needed for GPM_1

HP_2: power needed for higher GPM_2

GPM_1: flow in gallons per minute

GPM_2: flow in gallons per minute

According to the Pump Affinity Law: power is proportional to the cube of the flow

$$\frac{HP_2}{HP_1} = \left(\frac{GPM_2}{GPM_1}\right)^3$$

	1	2	Δ
BTUh	320,000	325,000	1.6%
GPM	55	65	16%
PUMP HP	HP increase = $(65/55)^3$		65%

A 1.6% increase in cooling results in a 65% increase in pumping energy

Pump Affinity Law

$$\frac{HP_2}{HP_1} = \left(\frac{GPM_2}{GPM_1}\right)^3$$

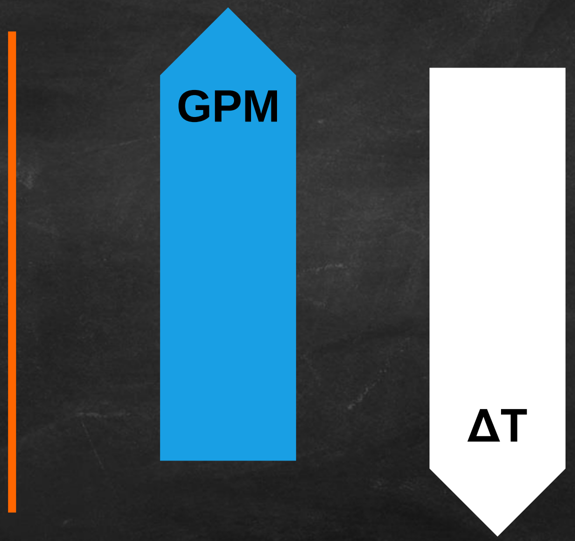
	1	2	Δ
BTUh	320,000	325,000	1.6%
GPM	55	65	16%
PUMP HP	HP increase = $(65/55)^3$		65%

Low Delta T wastes energy at the coil.

What effect can this have on the chiller plant?

At the chiller, flow and Delta T are inversely proportional

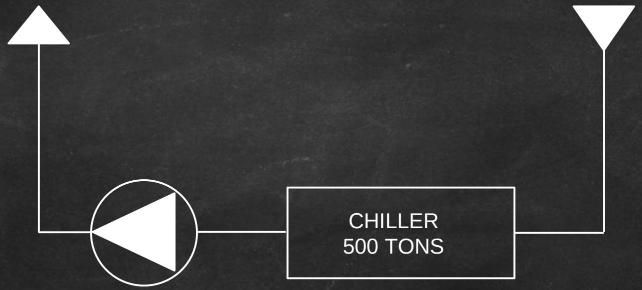
$$GPM = \frac{Tons \cdot 24}{\Delta T}$$



Tons: Load at the chiller

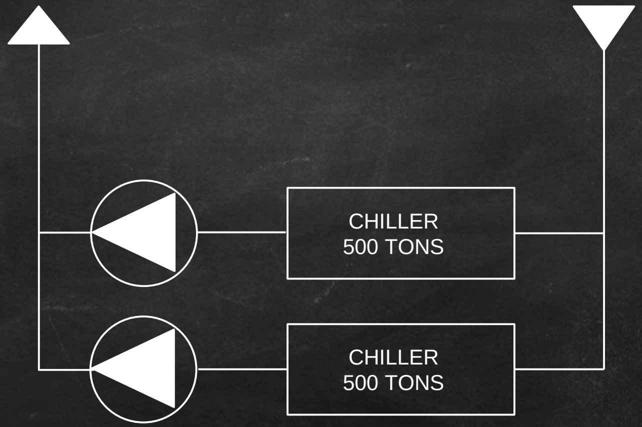
Example: At a design Delta T of 12 this 500 ton chiller will run at 100% capacity

$$GPM = \frac{500 \cdot 24}{12} = 1000$$



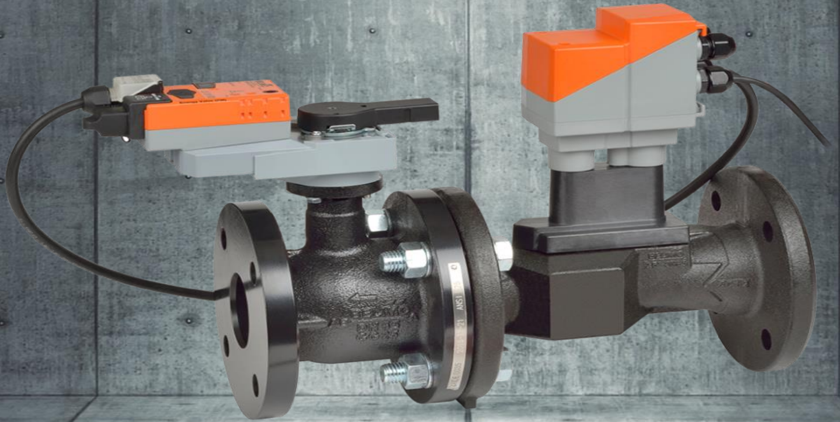
Example: If the Delta T were to drop to 8 with the same 500 ton load, a second chiller will need to be staged on due to the additional flow

$$GPM = \frac{500 \cdot 24}{8} = 1500$$



If the Delta T could be maintained as designed, the central plant would operate much more efficiently

Solving Low Delta T Syndrome with **Belimo Energy Valve**



Success Story
Massachusetts Institute of Technology (MIT)

Average Delta T rose from 6 F to 12 F, reducing chilled water flow by

49%

If implemented campus wide annual savings were estimated to be as high as

$1.5 million

Success Story
Nanyang Technical University, Singapore

The peak chilled water flow through the cooling coil was reduced from 25 l/s to 18 l/s

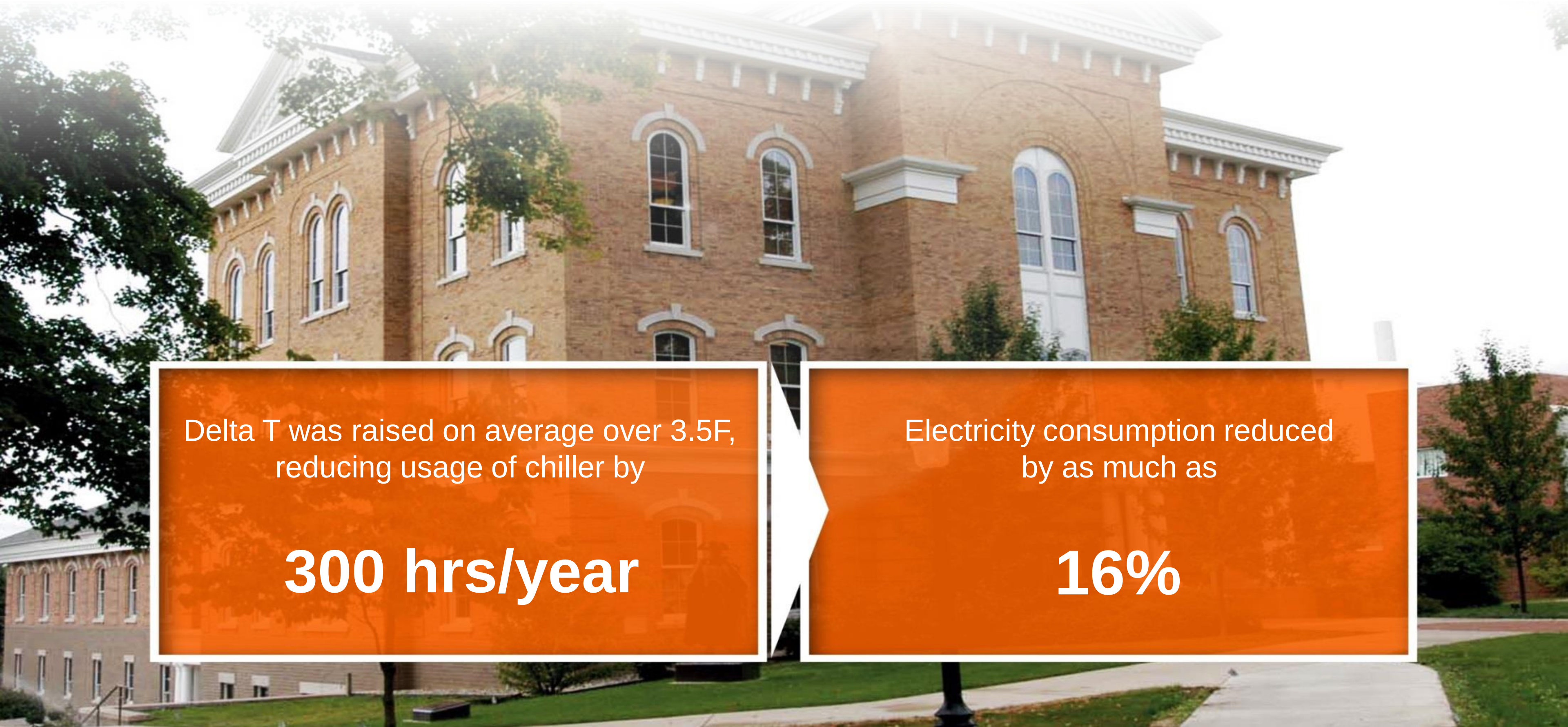
18.4% reduction in average day-time flow

Annual pumping energy reduced
76,700-90,500 kWh

Annual cooling energy reduced
175,000 – 220,000 kWh

SUCCESS STORY

Hillsdale College Mossey - Library & Delp Hall



Delta T was raised on average over 3.5F, reducing usage of chiller by

300 hrs/year

Electricity consumption reduced by as much as

16%

The Energy Valve is an innovative solution recognized by the HVAC industry

ACME 2016
Winner of Innovation Award

Acrex 2015
Winner of award of excellence

ControlTrends 2014
Energy Saving Product of theYear

ControlTrends 2012
Best commercial product of the year

2015 Energy Show
Best Energy Efficient Product

2017 AHR Innovation Award
Finalist in the Category of Building Automation

2014 AHR Innovation Award
Winner in the Category of Building Automation

2013 Building Efficiency Award
Best energy efficient automation product

BCIA Awards 2013
Technical Innovation of the Year

HVR Awards 2012
Air-conditioning product of the year

Shanghai Energy IAC 2014
Golden Key Award

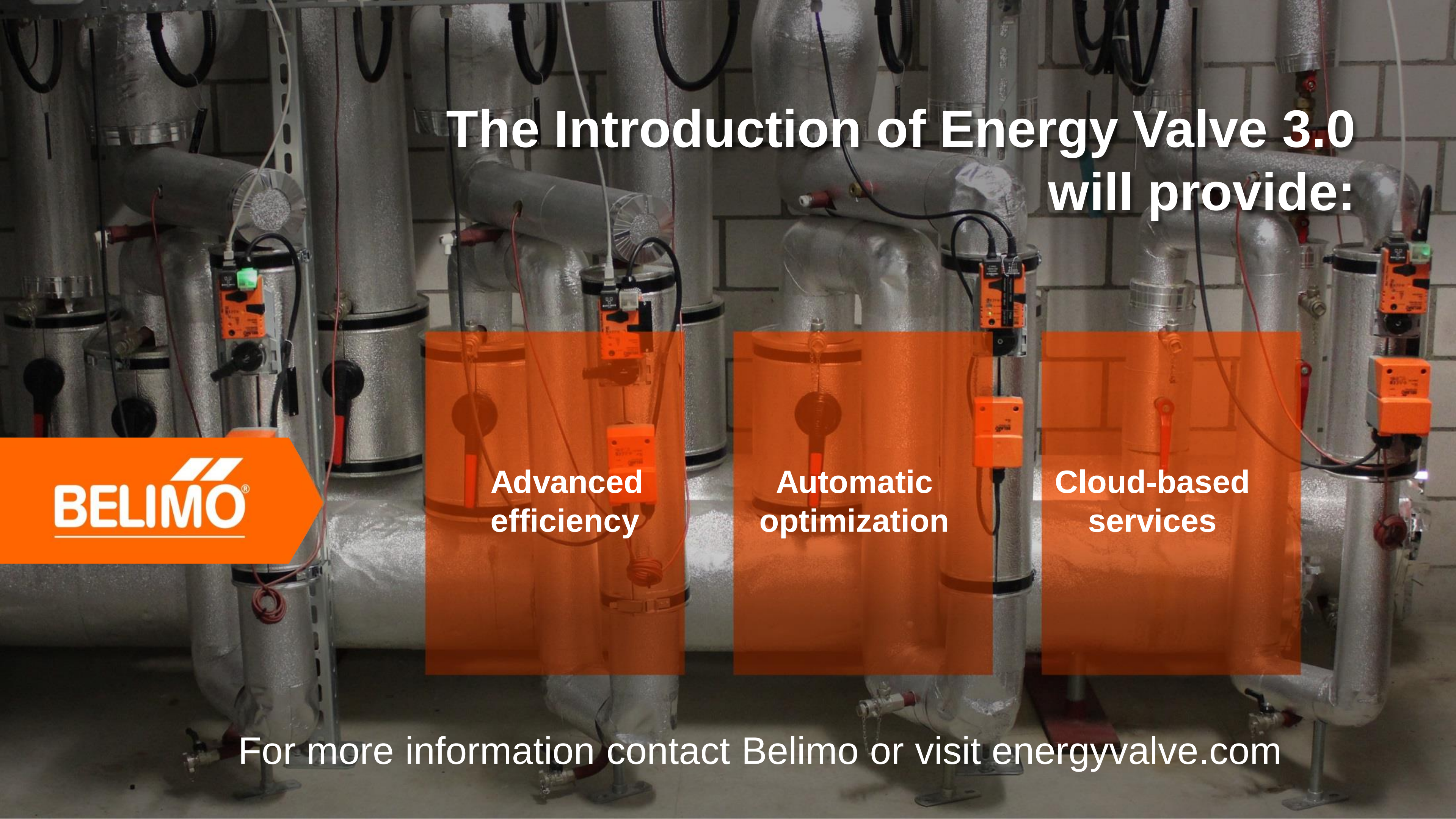
interclima + elec
Silver Trophy

Silver Trophy Award 2013
Winner of Energy Smart Automation Award


To achieve higher energy efficiency in buildings a change of mind set is needed.

A building revolution is needed to meet the requirements from the Paris protocol and the Helsinki report

Closing the performance gap of central plants, will lead to the demanded efficient energy usage


The Introduction of Energy Valve 3.0
will provide:
BELIMO
Advanced efficiency
Automatic optimization
Cloud-based services
For more information contact Belimo or visit energyvalve.com

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

energyvalve.com

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