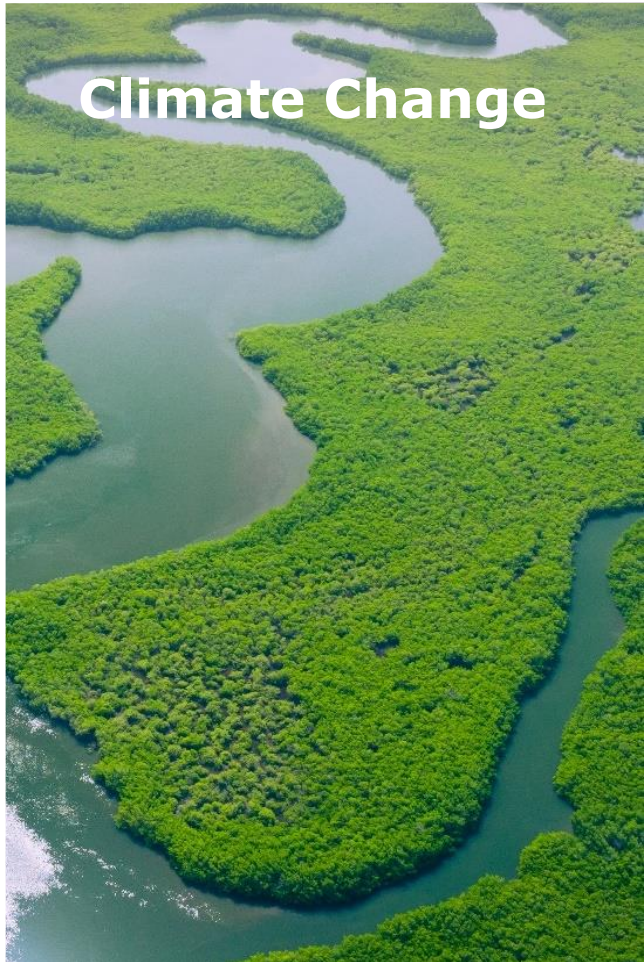
ENGINEERING TOMORROW

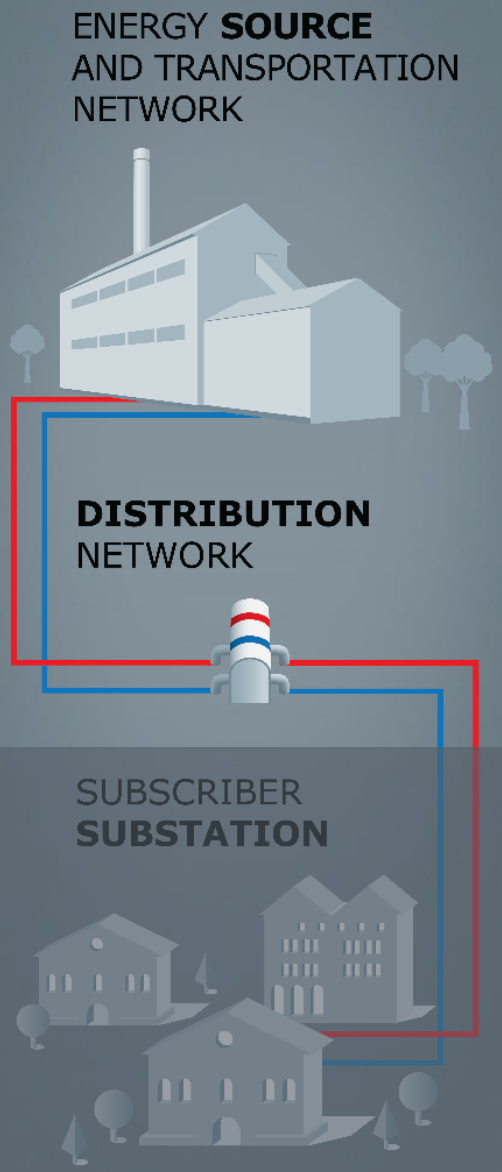
Decarbonization in urban efficiency and optimization of District Cooling systems

Pidchapad Kidkirdsang, Business Development Manager - Commercial Building, Thailand

GLOBAL MEGATRENDS

Transforming our world



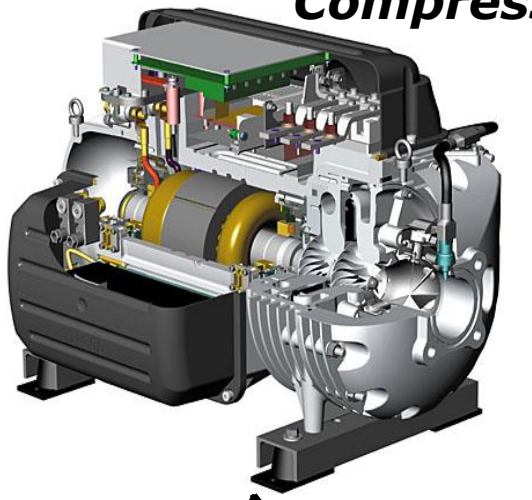


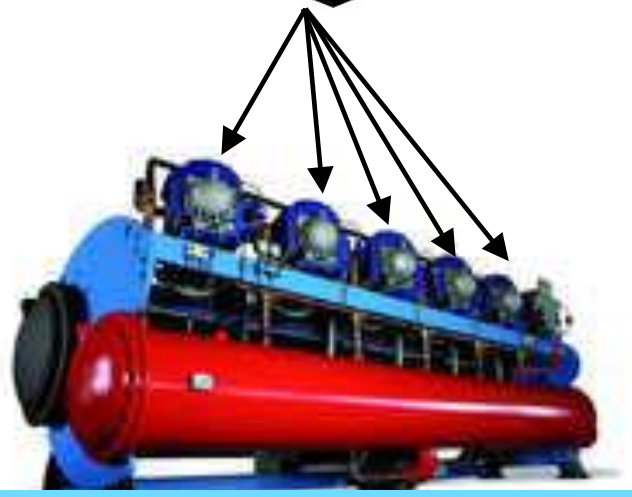
District Cooling– Topics

1) District Cooling key components
2) Addressing the biggest challenge in district cooling
3) Presenting proven case studies in solving the energy transfer & control problems.
4) System performance

1. Where Danfoss Key Components are applied?

Magnetic Levitation Compressors





+

Drives/Inverters

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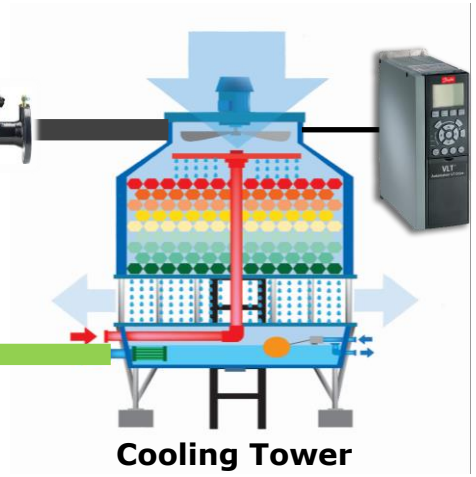
Pressure Independent Balancing & Control Valve

System Efficiency Key Technologies

Danfoss Key Components in District Cooling and Building Load



Cooling Tower

	Water Pump
	Electro Magnetic Fan
	Variable Speed Drive
	Manual Balancing Valve
	Pressure Independent Balancing Control Valve
	Magnetic Levitation Compressors (Turbocor)

CHILLER

Condenser

Evaporator

Thermal Energy Storage

Primary

Secondary

HEX

FCU

Cooling Coil

AHU

2. What are the biggest challenges in District Cooling?

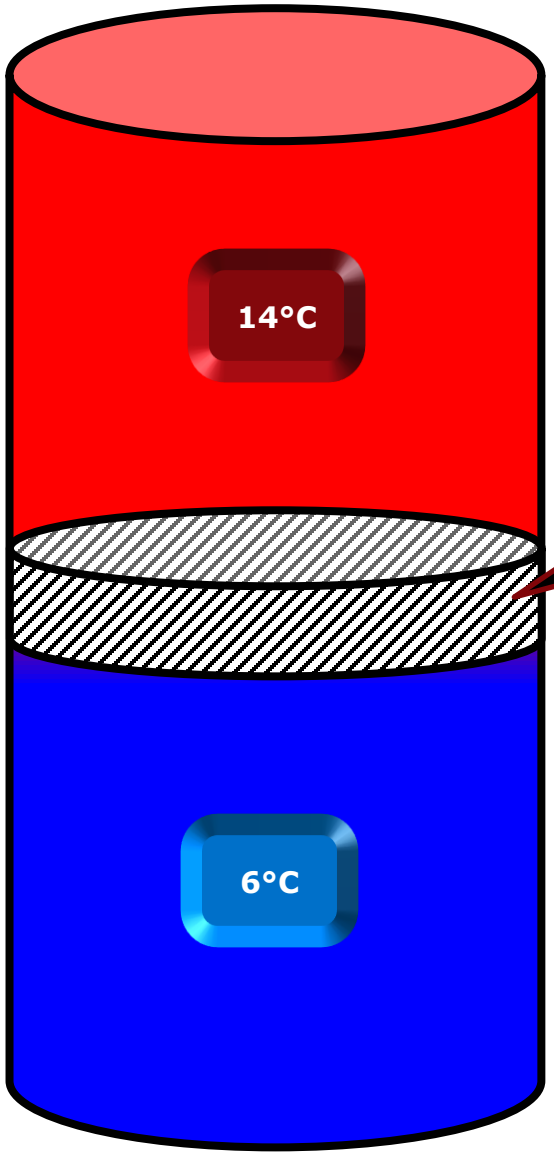
Low ΔT problem is a consequence of ...

Poor Control

- Poor hydronic balance
- Secondary side low efficiency
- Oversized control equipment and HEX
- Low return temperature – low ΔT
- Consumer behavior (low set point)

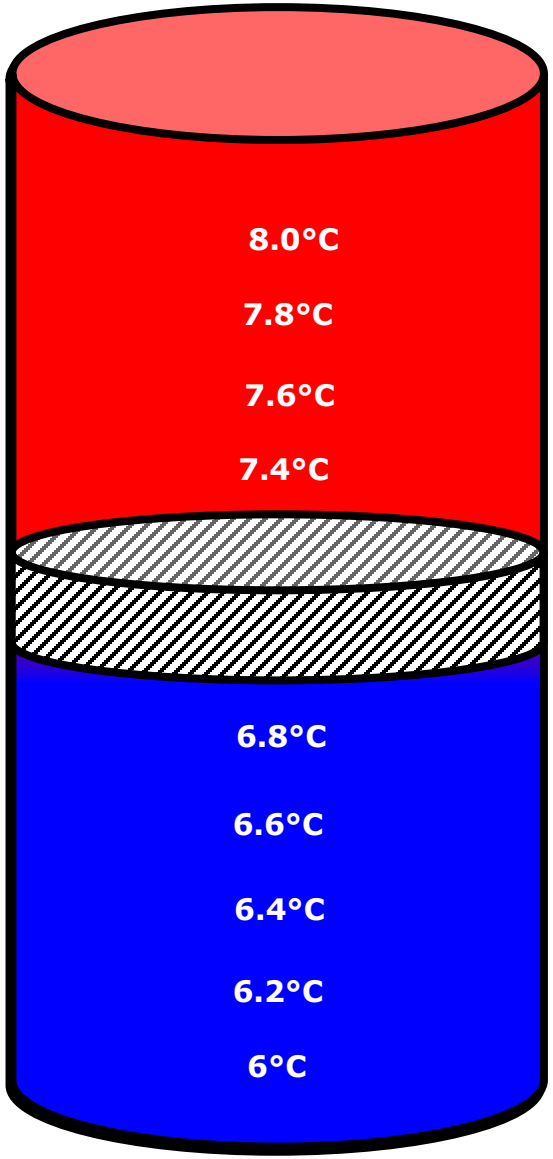
Overflows

- Delivered more energy than consumed especially on partial load

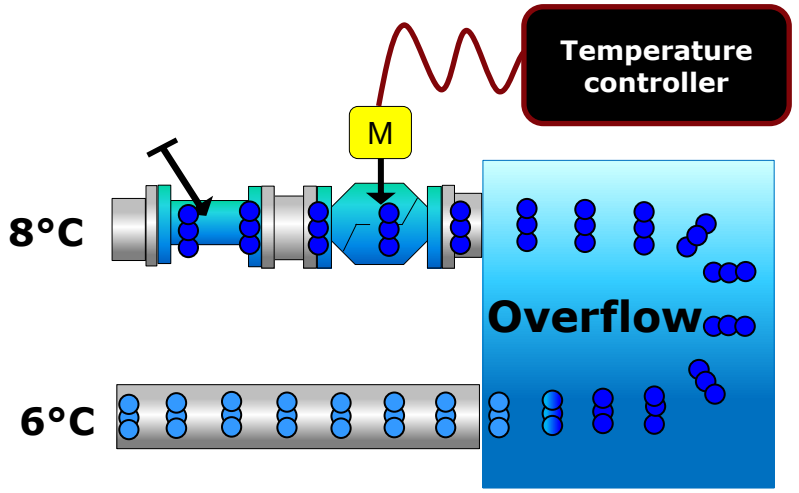


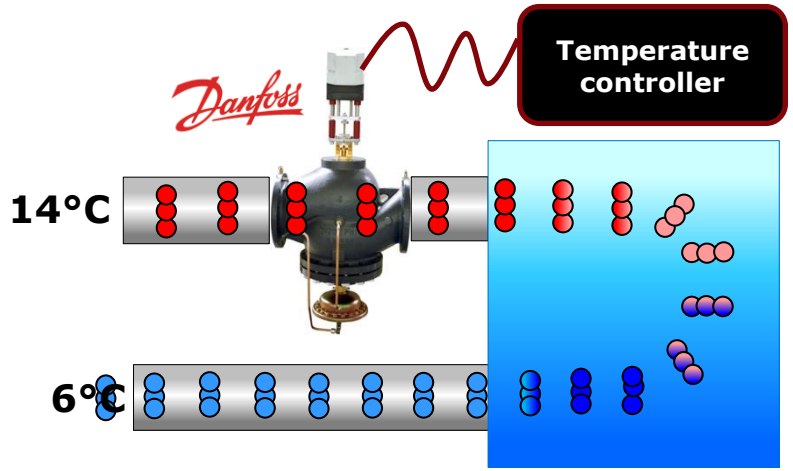
Natural thermocline layer is intact if temperature differences are wide

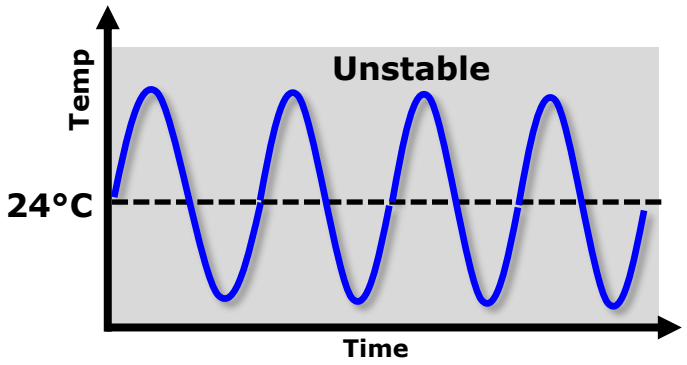
thermal mixing and losses.

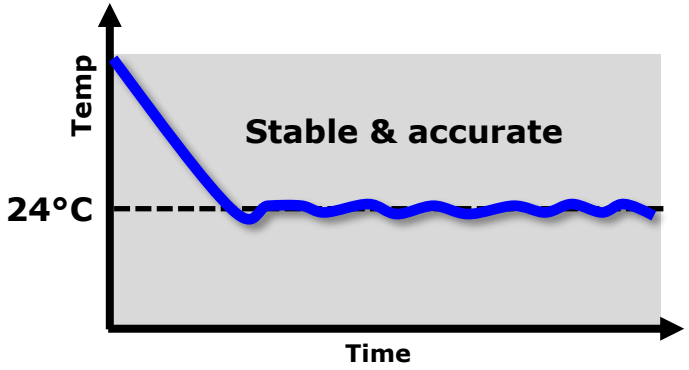


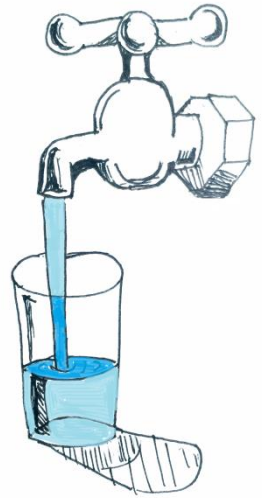
3. What are the causes of these challenges?

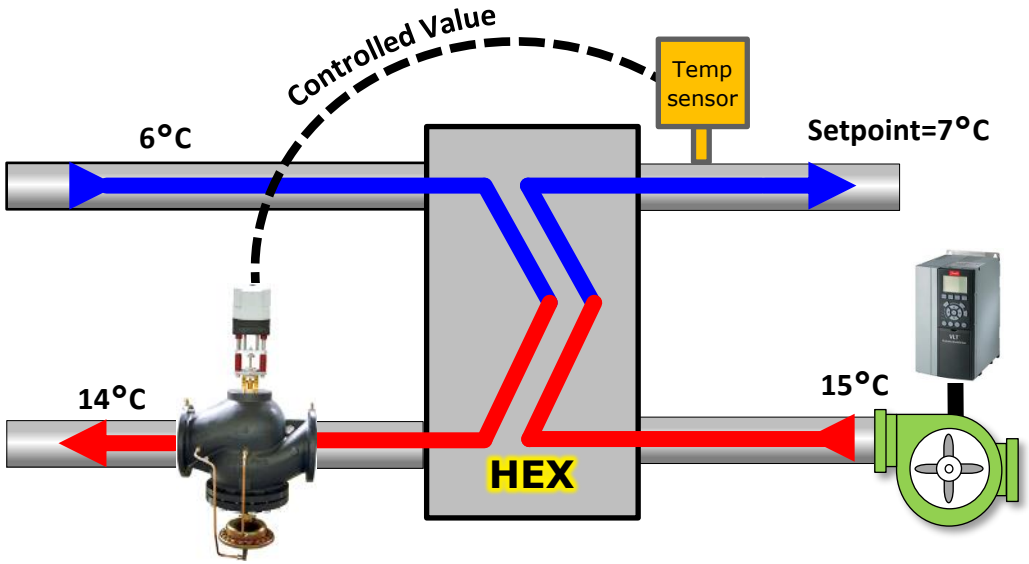


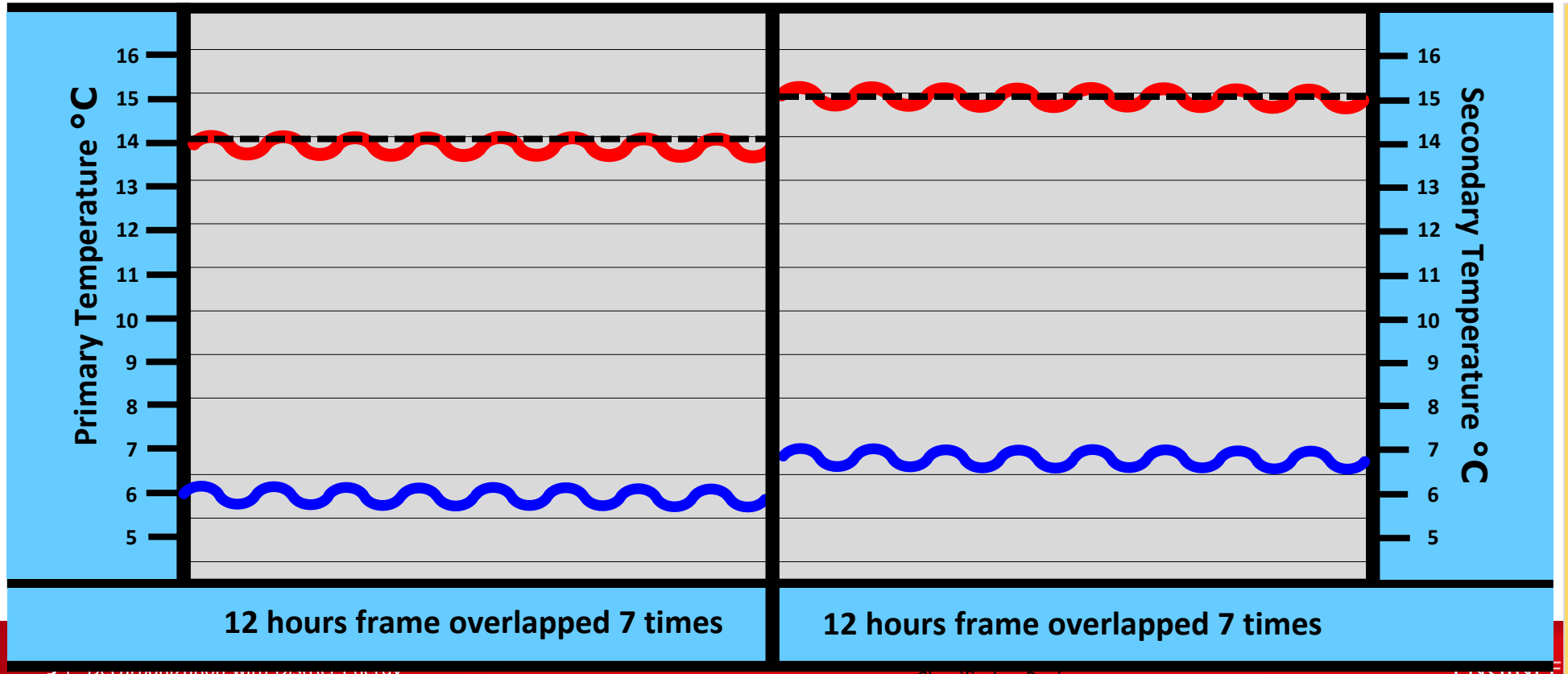


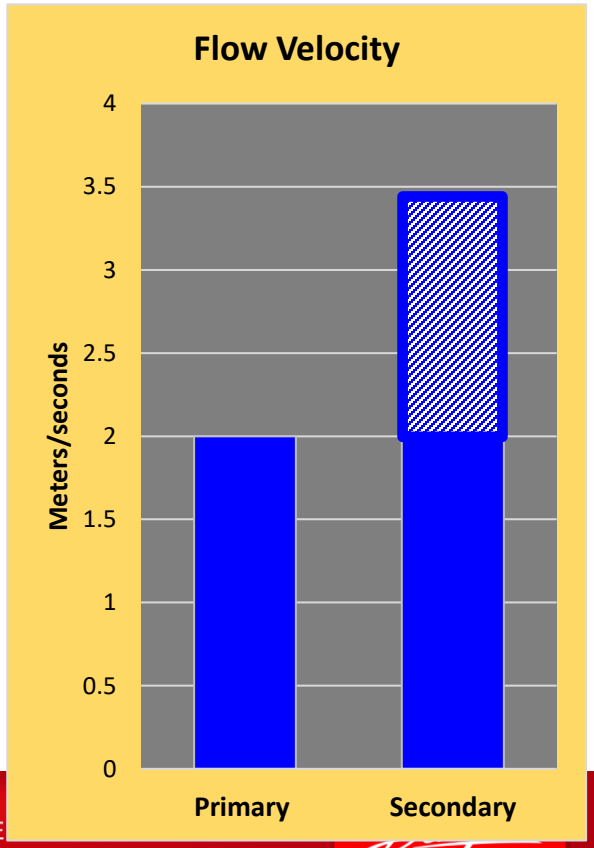


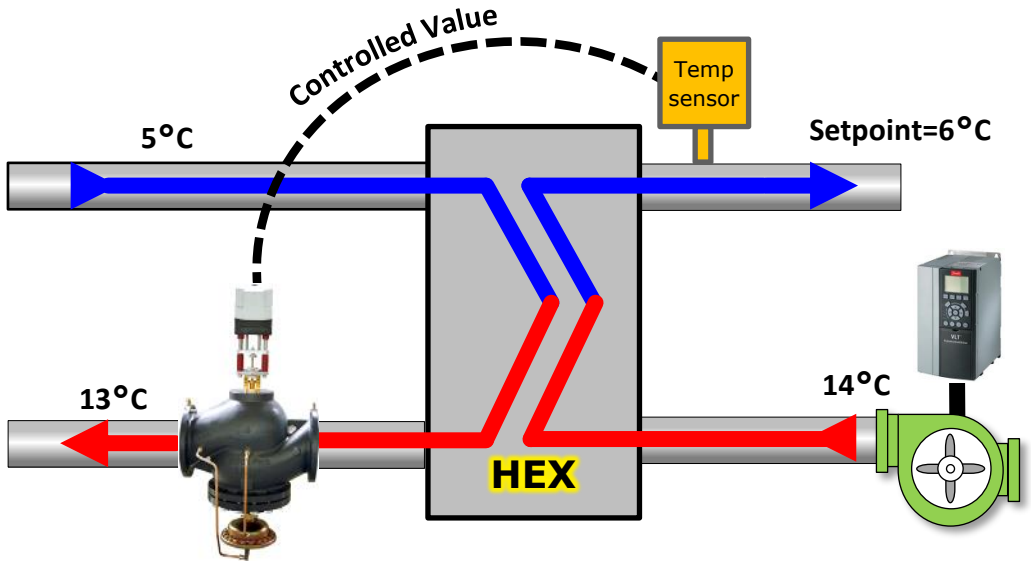


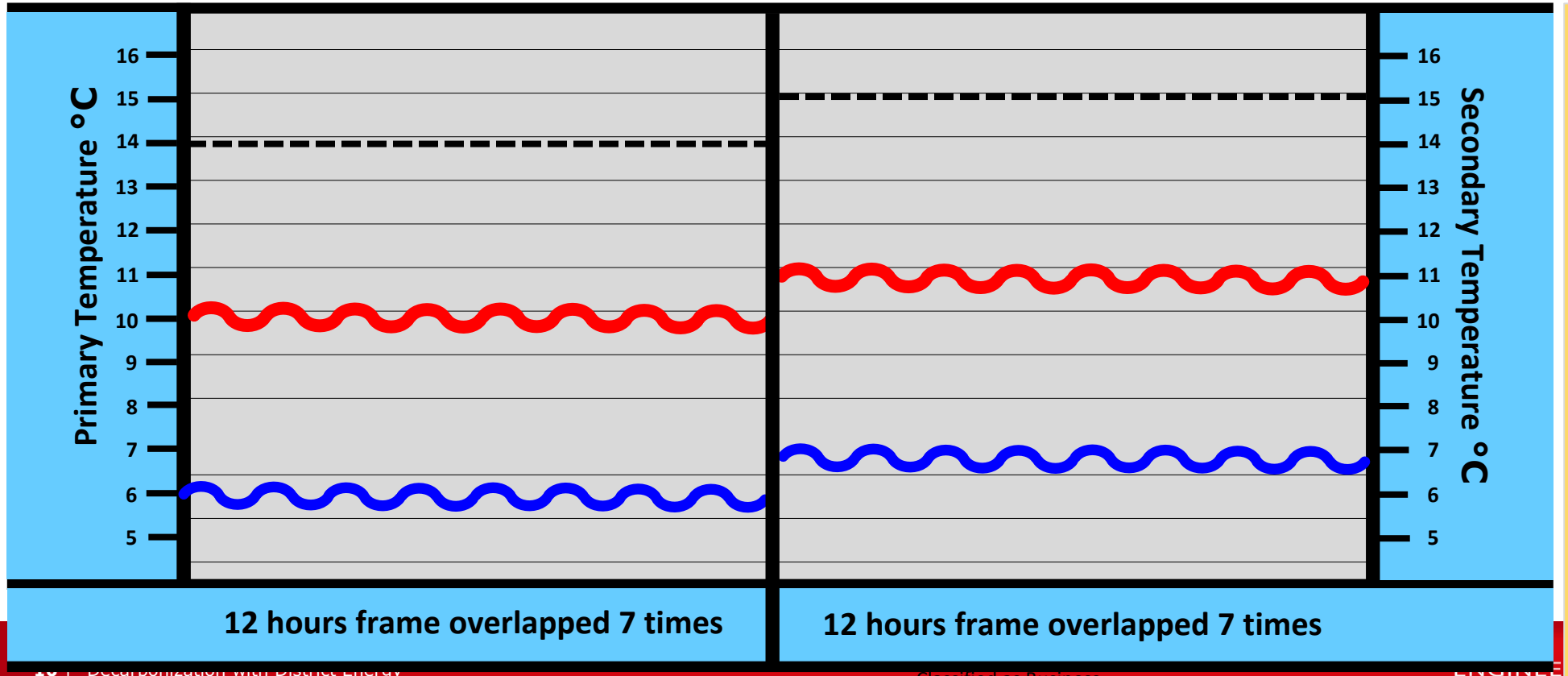


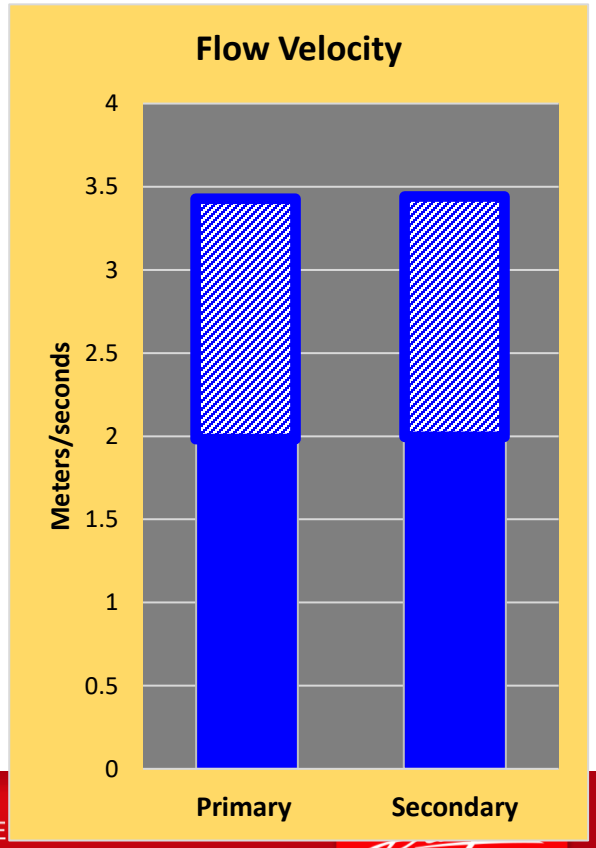


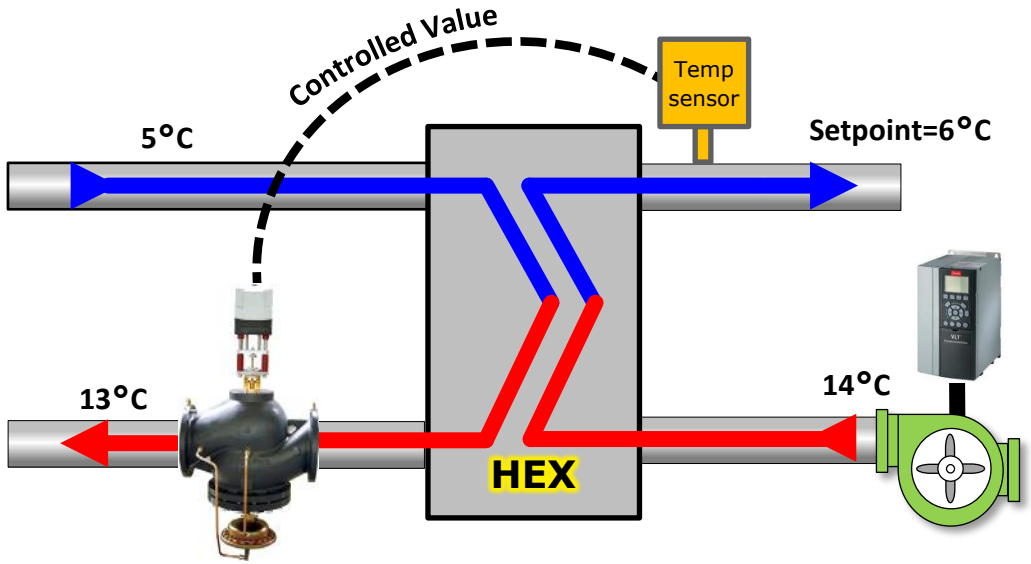


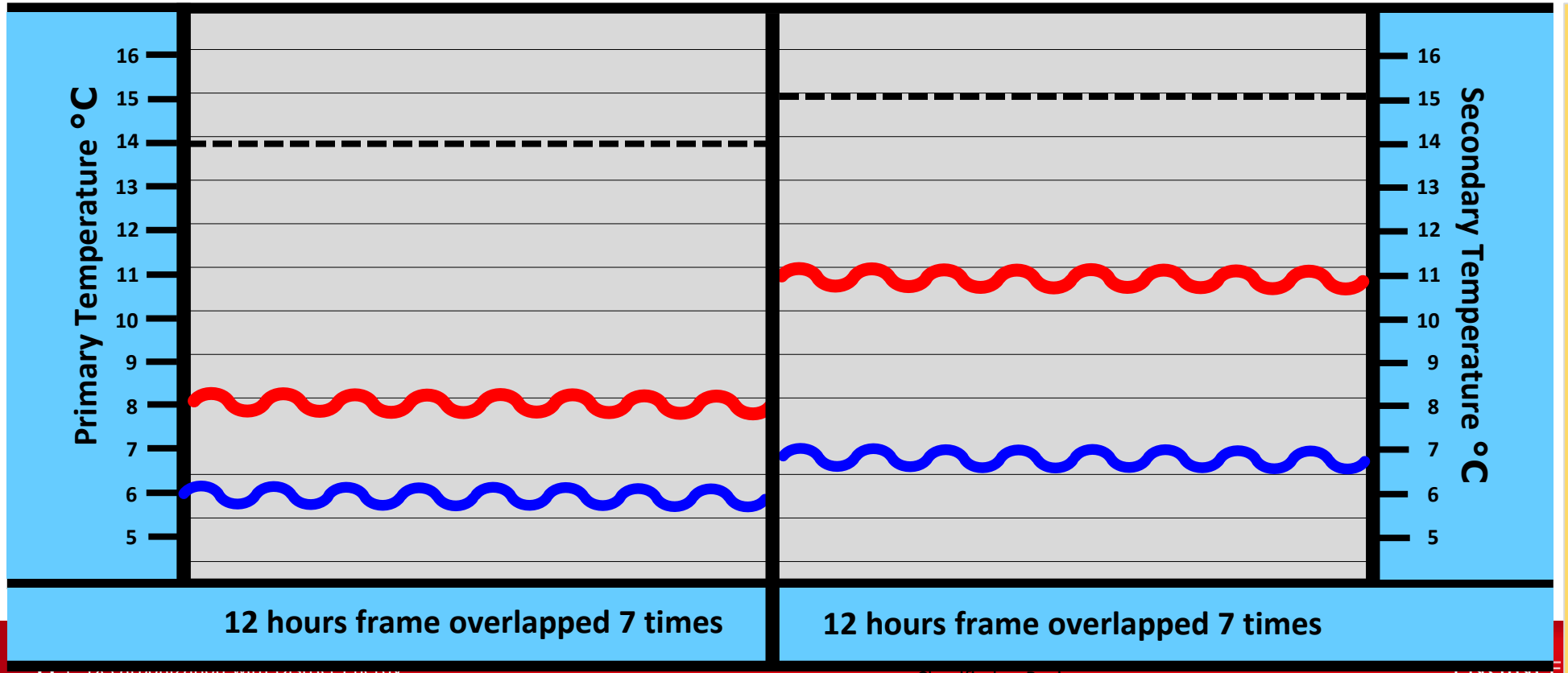


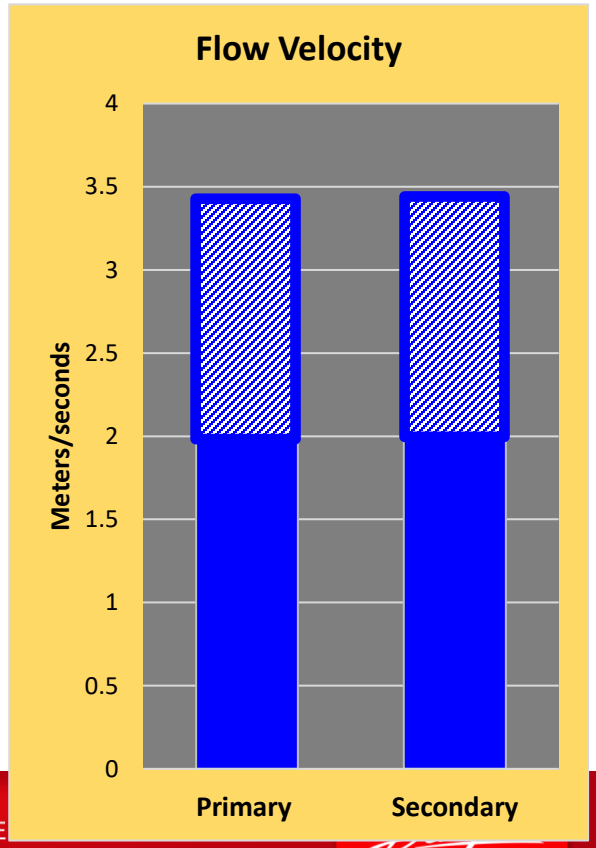

Controlled Value
Temp sensor
5°C
Setpoint=6°C
13°C
14°C
HEX


Primary Temperature °C
16
15
14
13
12
11
10
9
8
7
6
5
Secondary Temperature °C
12 hours frame overlapped 7 times
12 hours frame overlapped 7 times


Flow Velocity
Meters/seconds
4
3.5
3
2.5
2
1.5
1
0.5
0
Primary
Secondary

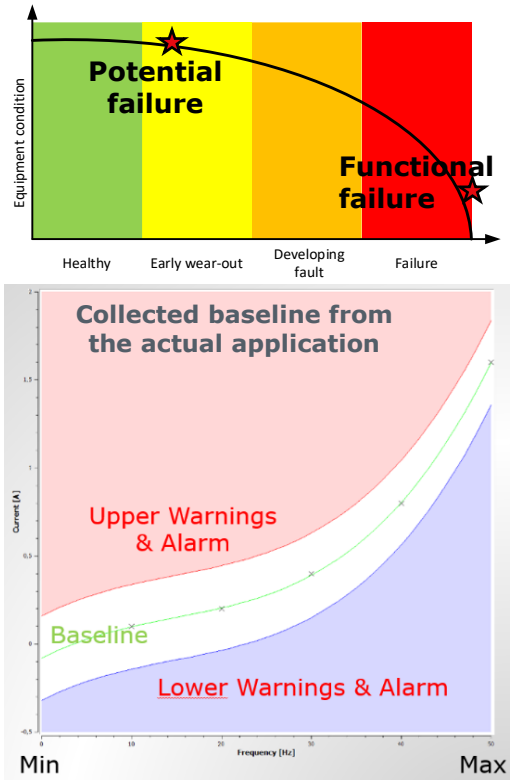






VLT ® intelligence – condition-based monitoring

Early warnings with notification

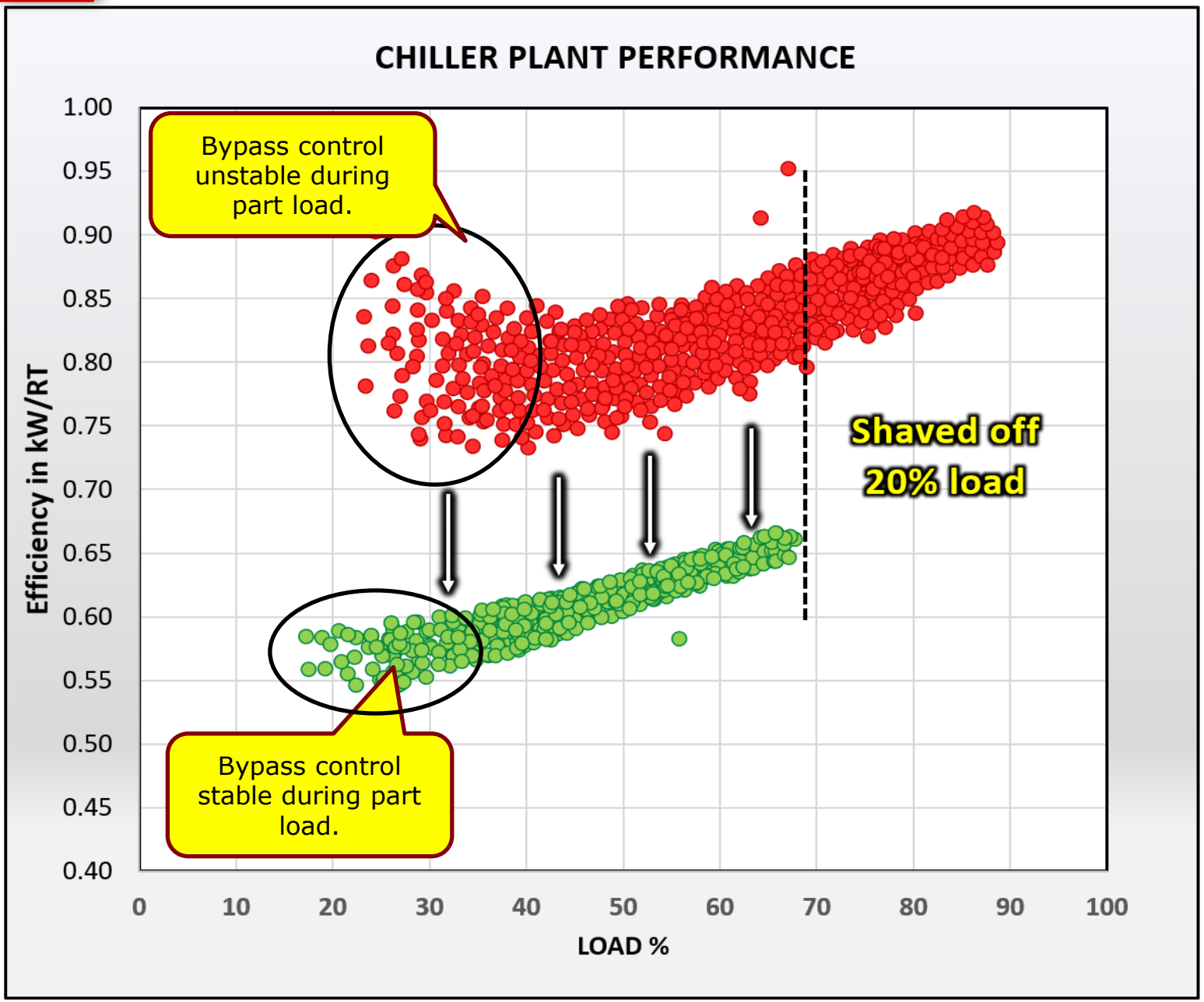


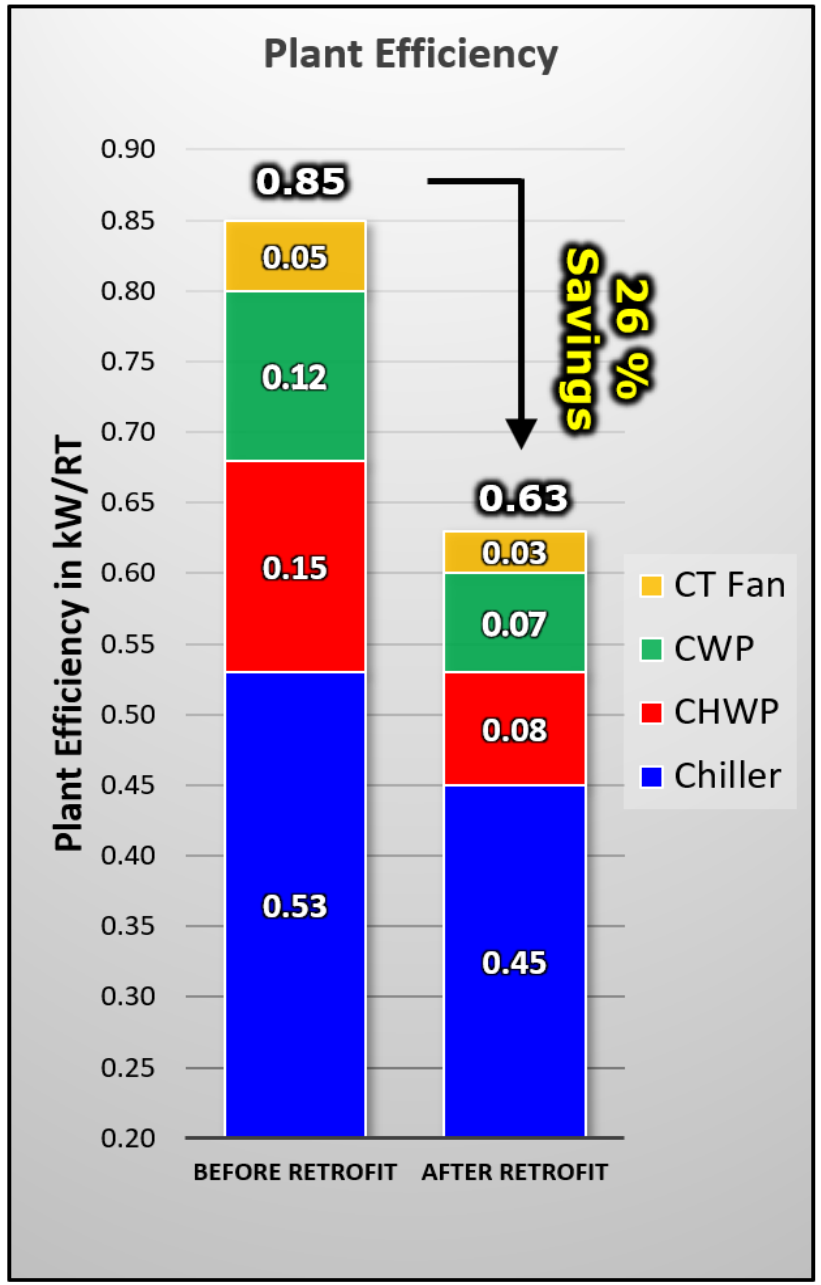
HVAC Drive
FC 102
Built-in
CBM.

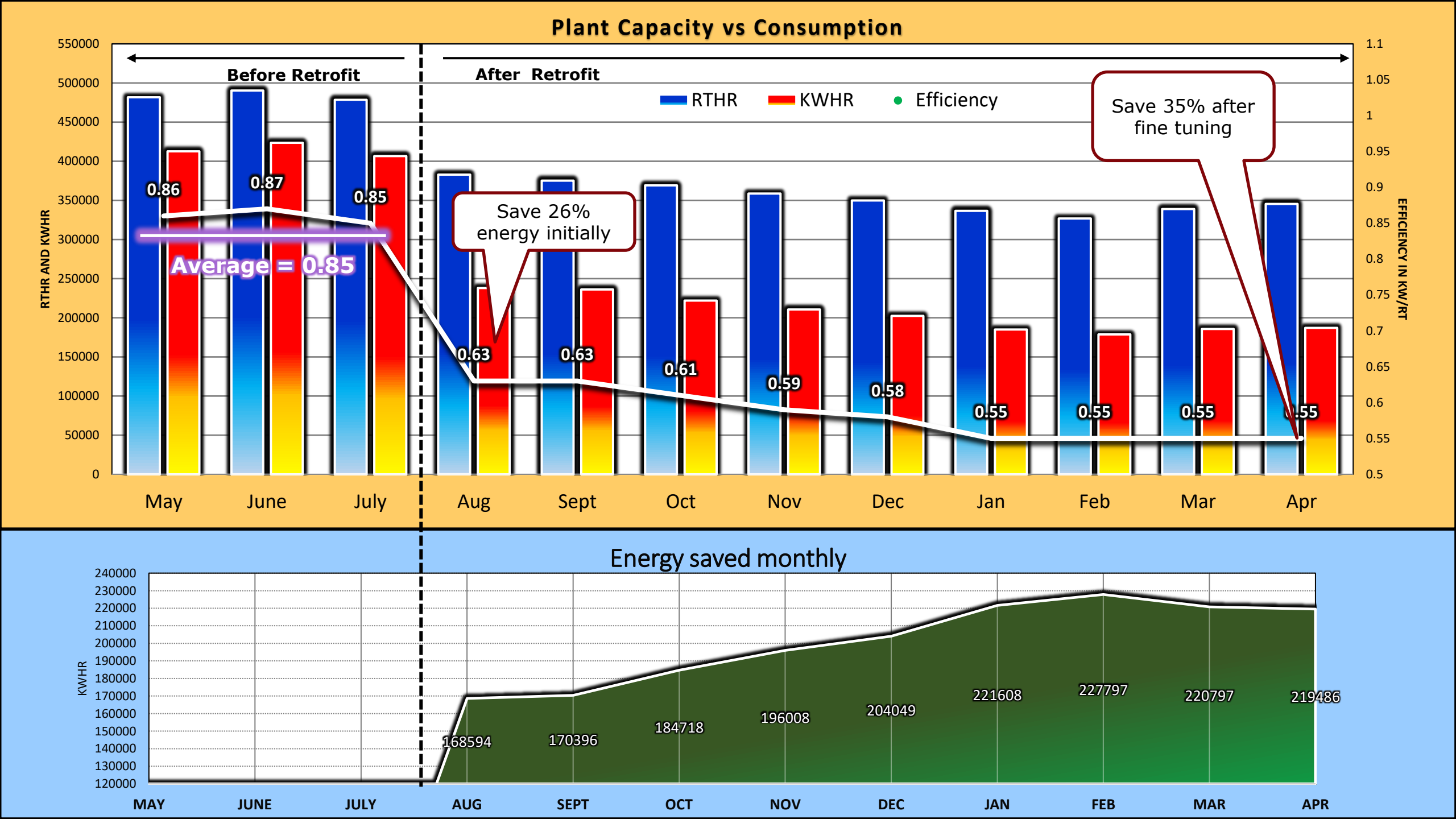
Sensor Inputs
- Vibration
- Pressure
- … free selection

Ventilation motor
- Load Condition
- Motor Winding

4. System Performance

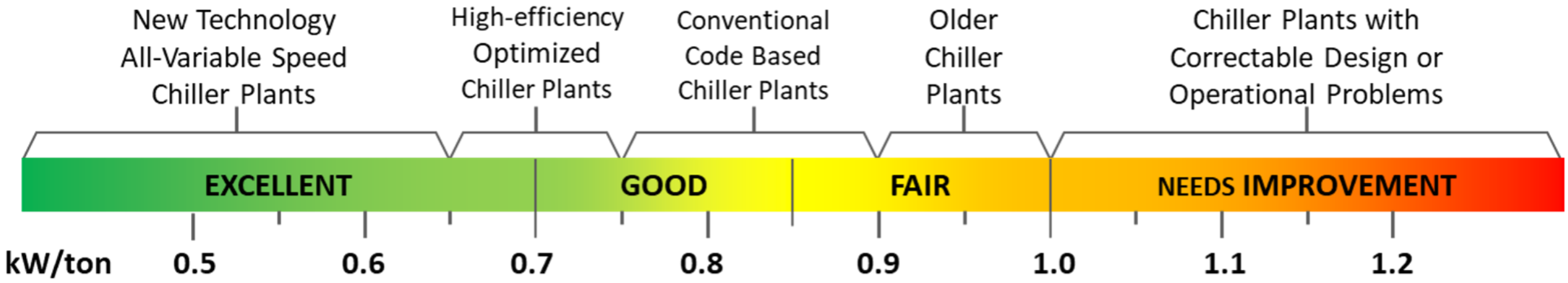





Plant Capacity vs Consumption
Before Retrofit
After Retrofit
RTHR
KWHR
Efficiency
Save 35% after fine tuning
Save 26% energy initially
Average = 0.85
0.86
0.87
0.85
0.63
0.63
0.61
0.59
0.58
0.55
0.55
0.55
0.55
RTHR AND KWHR
EFFICIENCY IN KW/RT
550000
500000
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
1.1
1.05
1
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
May
June
July
Aug
Sept
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Energy saved monthly
KWHR
240000
230000
220000
210000
200000
190000
180000
170000
160000
150000
140000
130000
120000
168594
170396
184718
196008
204049
221608
227797
220797
219486
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APR

Chiller Plant Efficiency Benchmark

Plant performance



ASHRAE chiller plant efficiency benchmark

ENGINEERING
TOMORROW

Email: pidchapad.k@danfoss.com
Mobile: 065 7289717