

HYDRAULIC SYSTEMS OPTIMISATION

20.04.2016

Dorian Vlaeminck
Export & Business development



TRANE®

*Cooling and Heating
Systems and Services*



A word about the company...



- Operating in every major geographic region
- Nearly 45,000 employees
- 50+ manufacturing facilities globally
- Strategic brands are n°1 or n°2 in their respective market
 - HVAC brand
 - Close to 25,000 employees worldwide



One of our air conditioning Units is installed every Minute of every day

A Technology Leader

27 Factories Worldwide

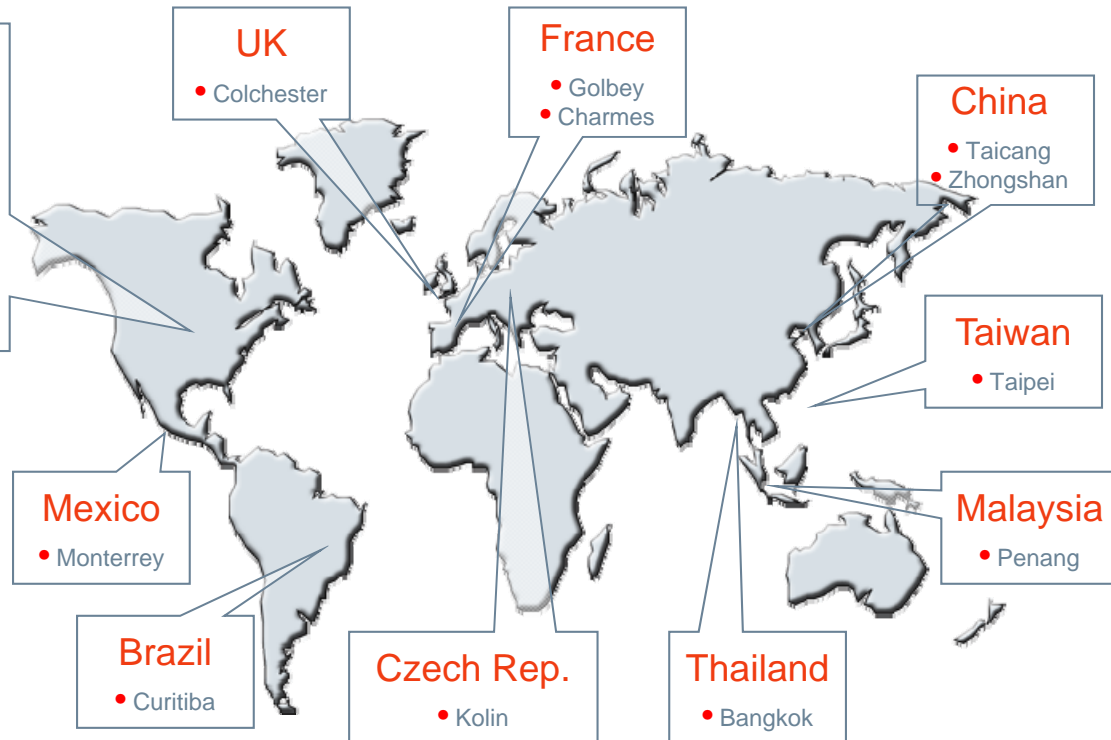
U.S.A.

- La Crosse, WI
- Rushville, IN
- St. Paul, MN
- Trenton, NJ
- Pueblo, CO
- Charlotte, NC
- Lexington, KY
- Vidalia, GA
- Macon, GA
- Forsyth, GA
- Ft. Smith, AR
- Clarksville, TN
- Tyler, TX
- Waco, TX
- Springhill, LA
- Lynn Haven, FL
- Columbia, SC

A technology leader



- 8 research and design centers around the world
- 21 engineering hubs around the world
- More than 1 100 engineers and 35 PhDs pioneering new technologies



Vertical market solutions

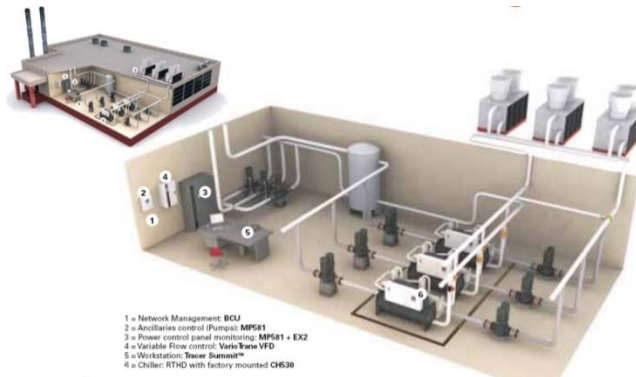
Commercial building



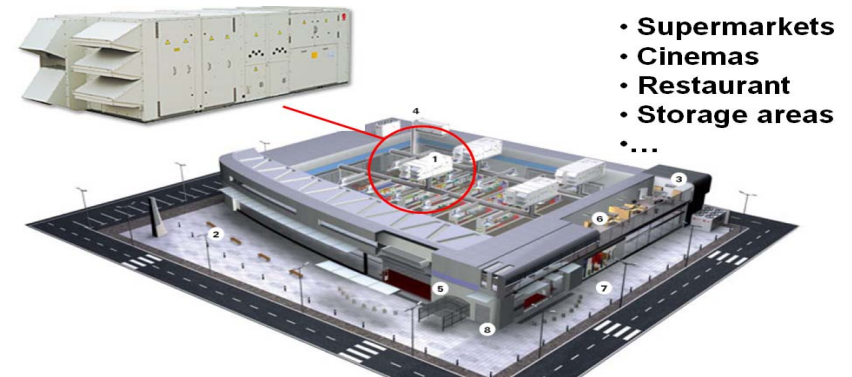
Lodging / Hotels



Industry



Retail



One provider



Trane Worldwide references

Statue of
Liberty,
USA



Bank of China,
China



Burj
Khalifa,
UAE



Palm Island, UAE



Kremlin, Russia



Quai d'Orsay Museum, France



Belgian references

Industry : GSK, UCB, Baxter, Solvay, Sabca, Audi, AGC Glaverbel, ...



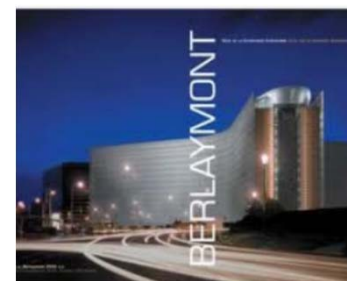
Baxter



Hotels : Radisson, Hôtel Amigo, Novotel, Ibis, Crown Plaza, ...



European & International organisation : Parlement Européen, Berlaymont, NATO/OTAN, commission, ...



Belgian references

Bank : Banque Nationale Belge, BNP Paribas, KBC, Belfius, ING, ...



Hospitals : UZ Gent, UZ Leuven, UZ Jette, ...



Stores : Media Markt, Decathlon, Cora, ...



and many more ...

TODAY'S AGENDA

I. Introduction

- a. Importance of system thinking

II. Practical case study

- a. How to best address the “free cooling opportunity”
- b. Preferentially-loaded heat-recovery chiller or how to better benefit of combined heat and cooling demand
- c. The variable primary flow serial system

III. Conclusion

I. Introduction

Importance of systems thinking...

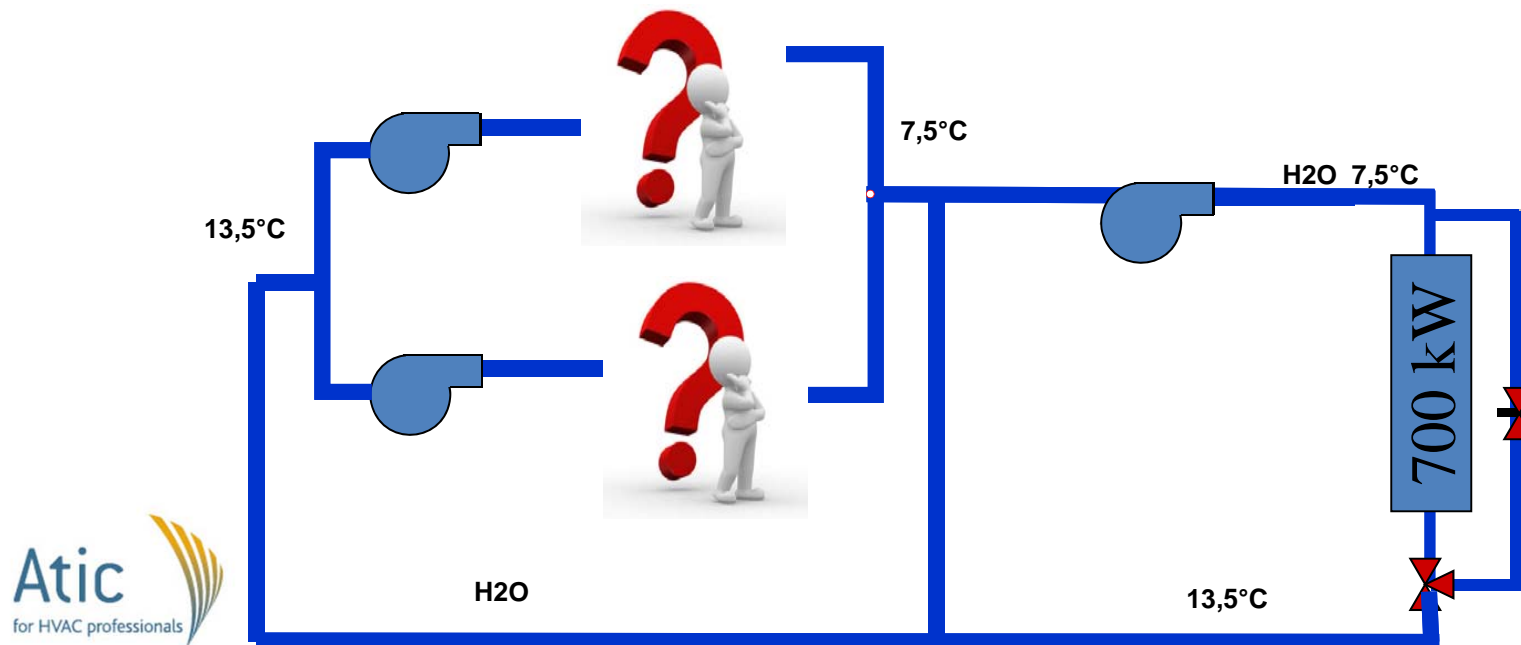
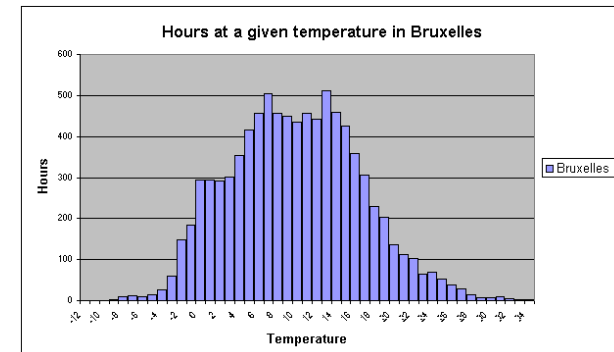
- The final bill includes more than the electrical consumption of the Chiller only
- From Chiller EER (ESEER) to global system efficiency
- Many system optimisation methods may be considered

II. Practical case study

a. The free cooling opportunity

CASE

- 700 kW cooling load (with stand-by)
- Needed 8760 hours a year, in Brussels
- Objective: optimise overall efficiency

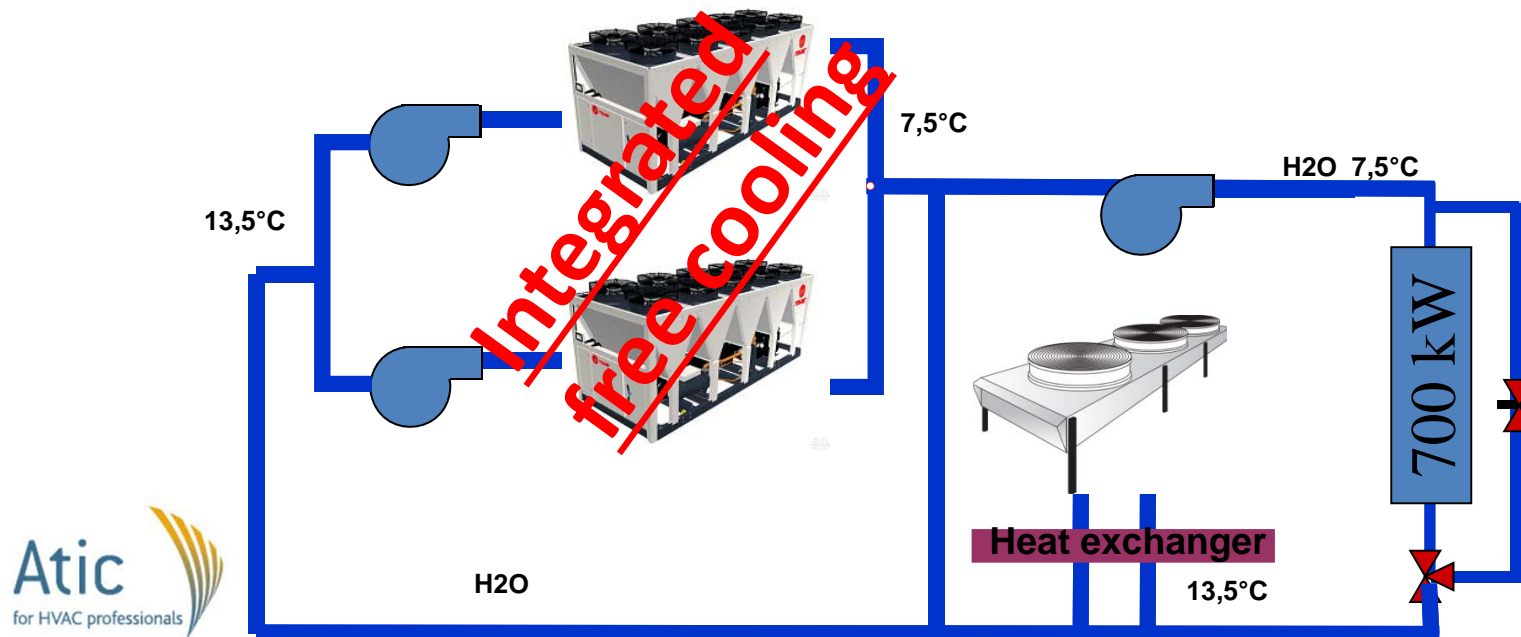


II. Practical case study

a. The free cooling opportunity

SOLUTIONS

1. Standard 700 kW air cooled chiller option
2. Standard chiller + free cooling through dry cooler
3. Chillers with integrated Free Cooling

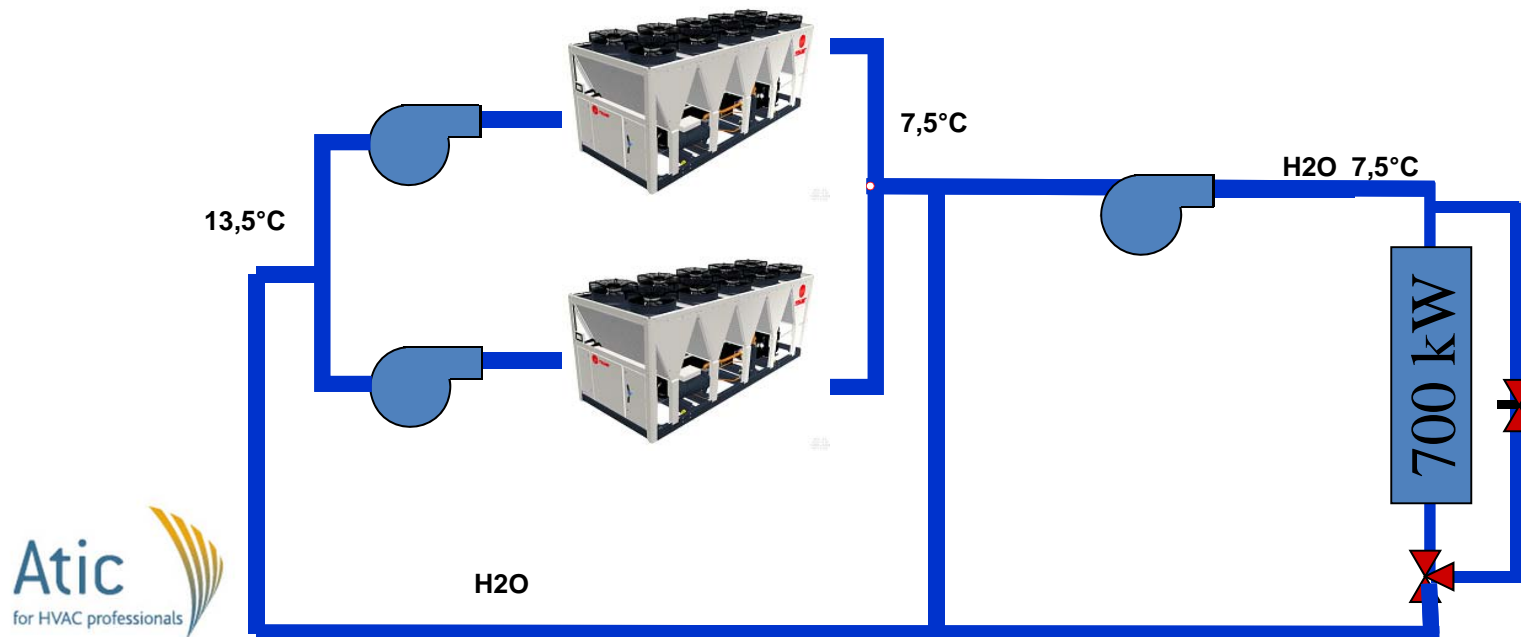


II. Practical case study

a. The free cooling opportunity

1) Standard 700 kW air cooled chiller

- TRANE RTAF SE x2
- Chiller runs even when temperatures decreases
- Relevancy to include a VFD if both units run all year long at partial load. Swing (with vfd) chiller example may be interesting.

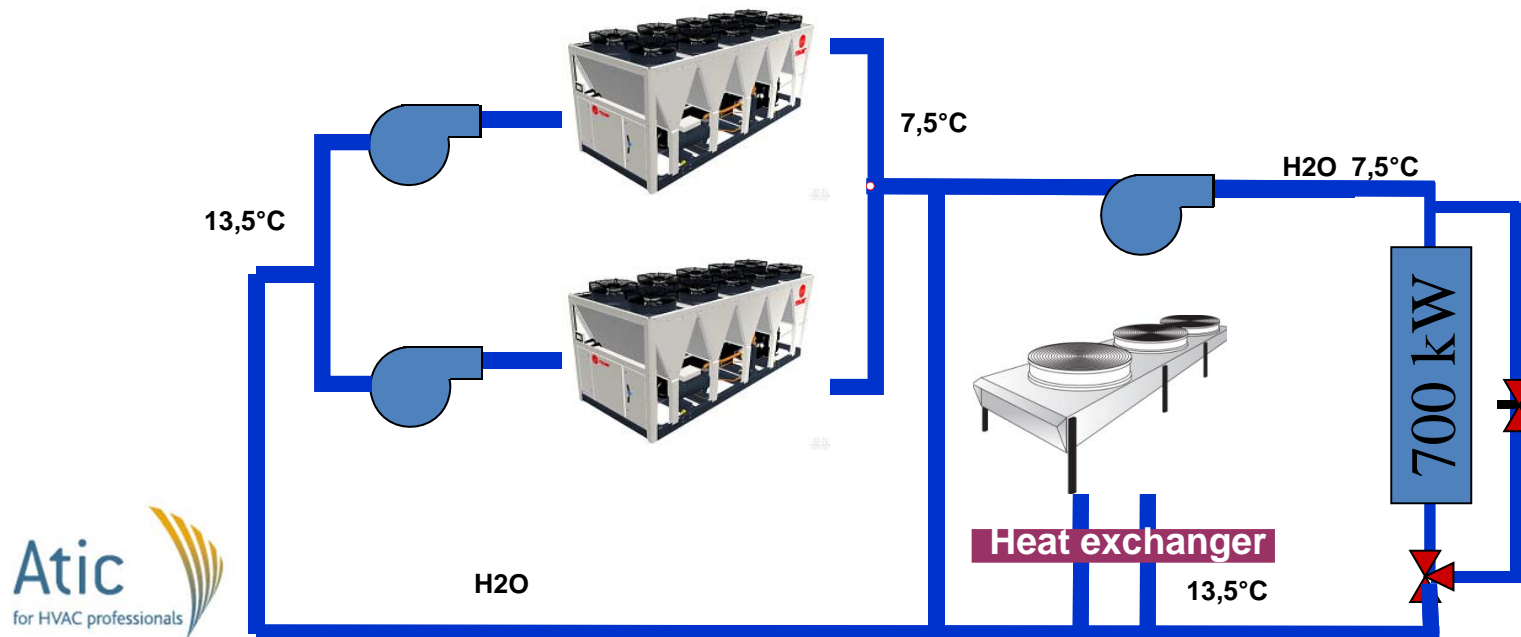


II. Practical case study

a. The free cooling opportunity

2) Standard chiller + free cooling through dry cooler

- TRANE RTAF x 2 + Dry cooler
- No chiller use up to 4°C outdoor ambient (... % of the time)
- Flexibility of the size of Dry cooler installed

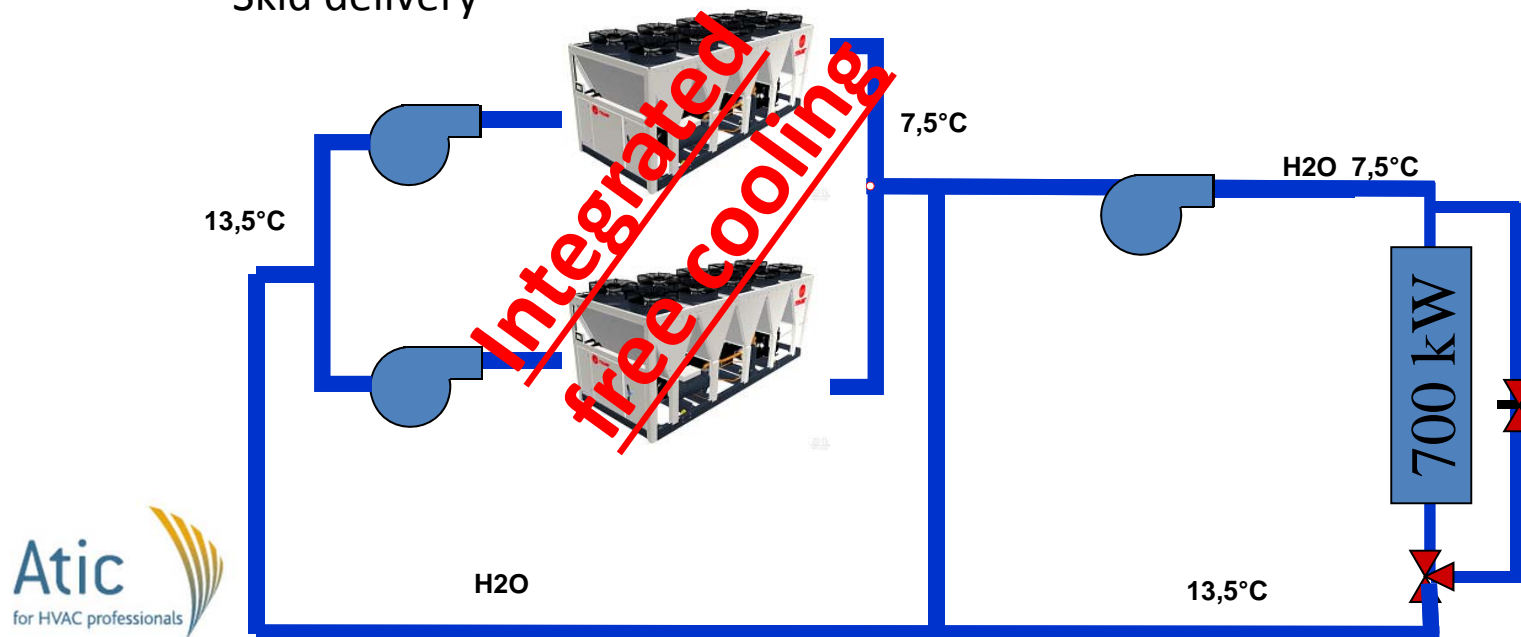


II. Practical case study

a. The free cooling opportunity

3) Chillers with integrated Free Cooling

- TRANE RTAF x total free cooling option
- No compressor use up to 4°C outdoor ambient (... % of the time)
- Lower footprint
- In between energy bill (you can't dimension the "dry cooler")
- Skid delivery

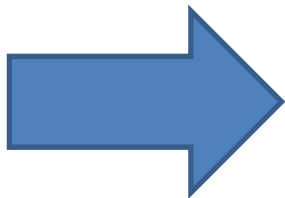


II. Practical case study

a. The free cooling opportunity

Summary

Solution	Capex	Electricity gains	Ease of installation	Footprint
Sol. 1 (std chiller)	+++	+	+++	+++
Sol. 2 (std + dry)	++	++++	+	+
Sol. 3 (int. FC)	++	++	++	+++



Depending on the case, conditions and load profile, different solution may be the most relevant in terms of investments and related ROI



Questions?

II. Practical case study

b. Heat recovery opportunity

Why heat recovery

- Economics
 - First cost versus ROI
 - Subsidies or tax incentives
- Environmental
 - Total energy use and indirect Co2 emissions reduction
 - In line with “corporate responsibilities” and improved brand image
- Compliance
 - With emissions limitations (Kyoto protocol, ...)
 - Achieved level optimization on environmental assessment methodologies (BREEAM, LEED, HQE, ...)

II. Practical case study

b. Heat recovery opportunity

When should it be considered

- Heating and cooling is needed at the same time
- Data centers
- Heating of building perimeter when interior is cooled
- Process applications
- Hotels
- Hospitals
- ...

II. Practical case study

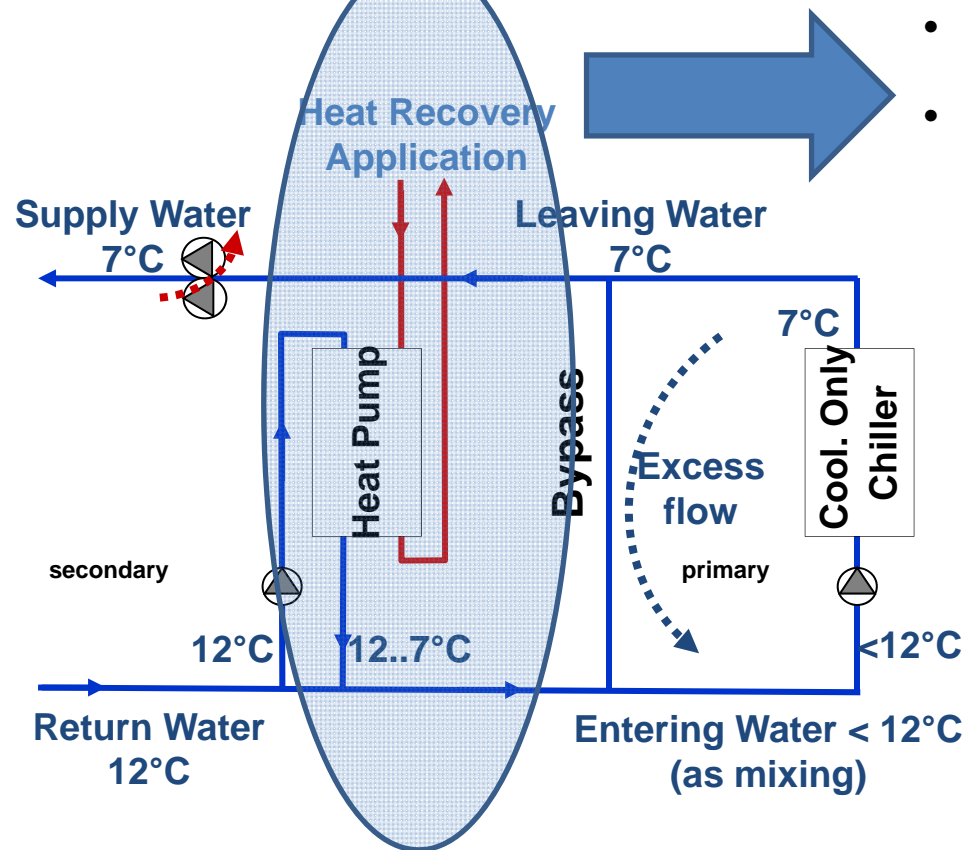
b. Heat recovery opportunity

The available options

- Heat recovery integrated in the refrigerant loop (partial or total heat recovery chillers)
- Airside heat recovery (Plate Heat Exchangers, Heat Wheels, coil loops, ...)
- The system approach: heat recovery water/water chiller in a chiller plant

II. Practical case study

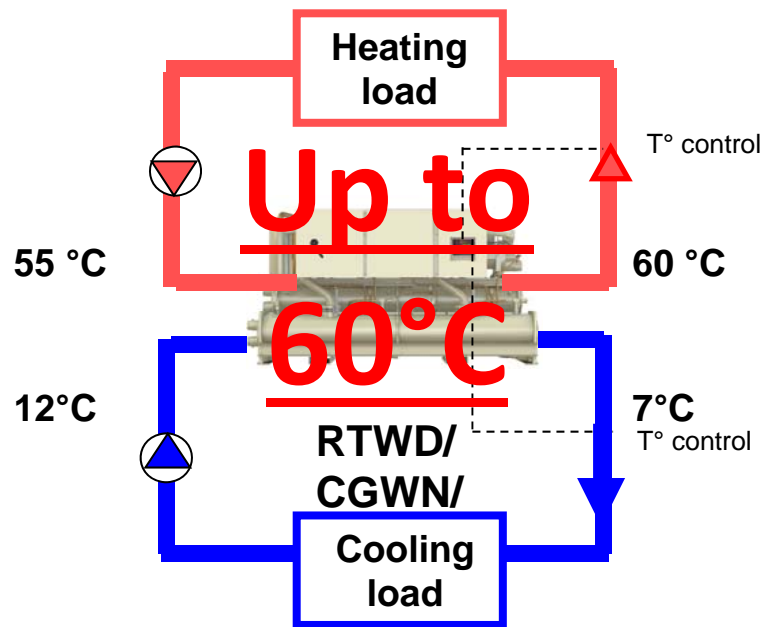
b. Heat recovery opportunity



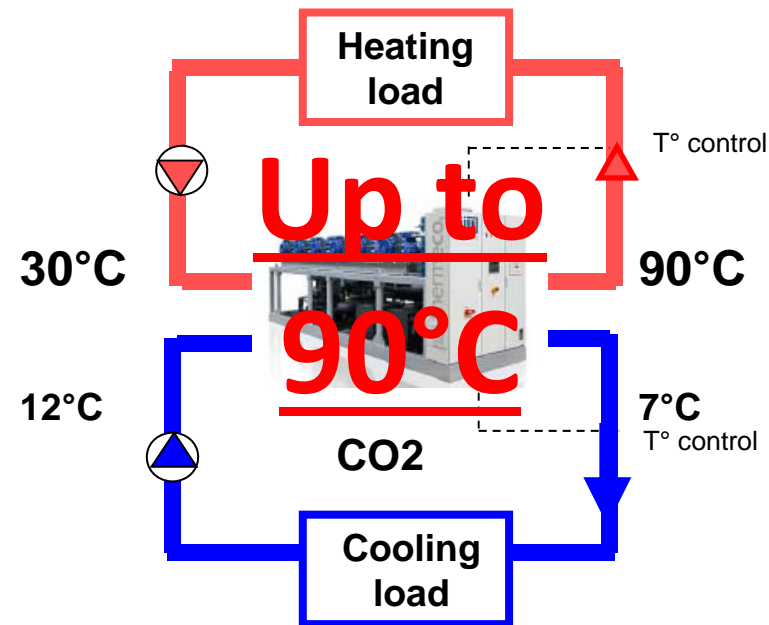
- Regular w/water heat pump (up to 60°C hot water supply)
- CO2 units (over 90°C hot water temperature)

II. Practical case study

b. Heat recovery opportunity



R134a Refrigerant



CO2 Refrigerant



Questions?

II. Practical case study

c. The variable primary flow serial system

Case study: Office building in Paris :

- 2 chillers 500 kW, base load 200 kW with max load of 1000 kW @ 35°C
- 500 terminal units
- 2 Fresh air Air Handling Units (AHUs)

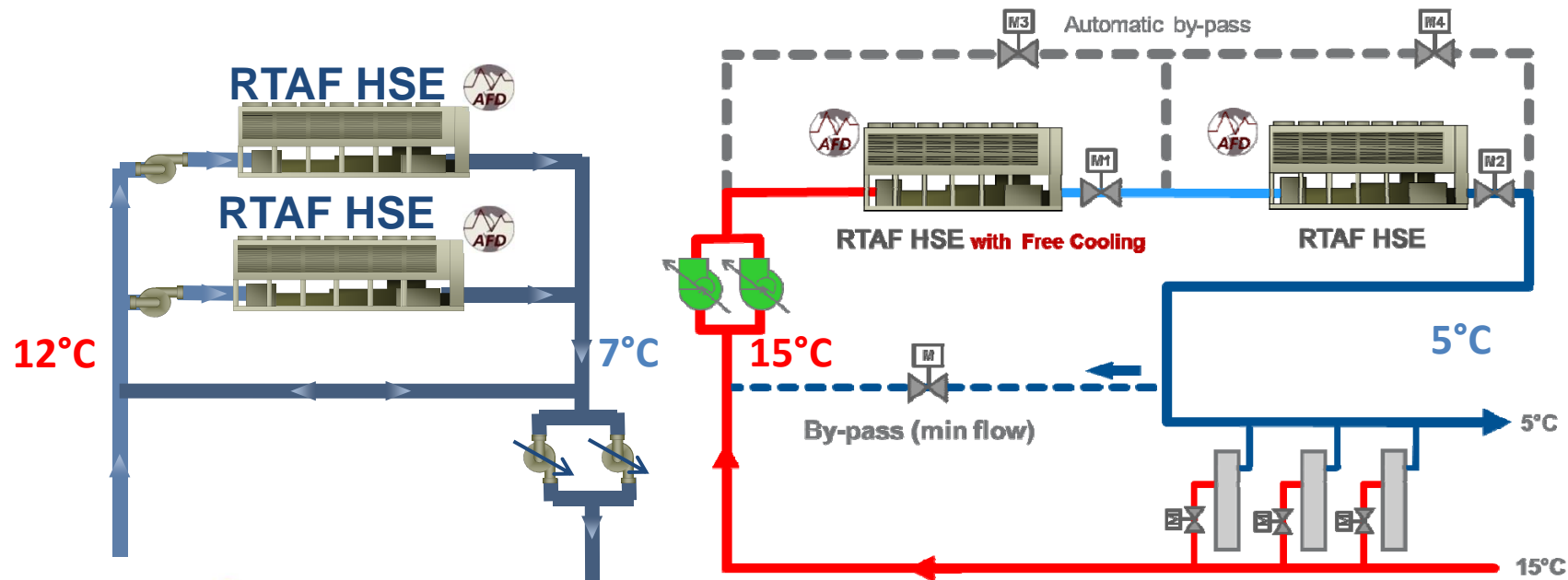


II. Practical case study

c. The variable primary flow serial system

Two system approaches compared

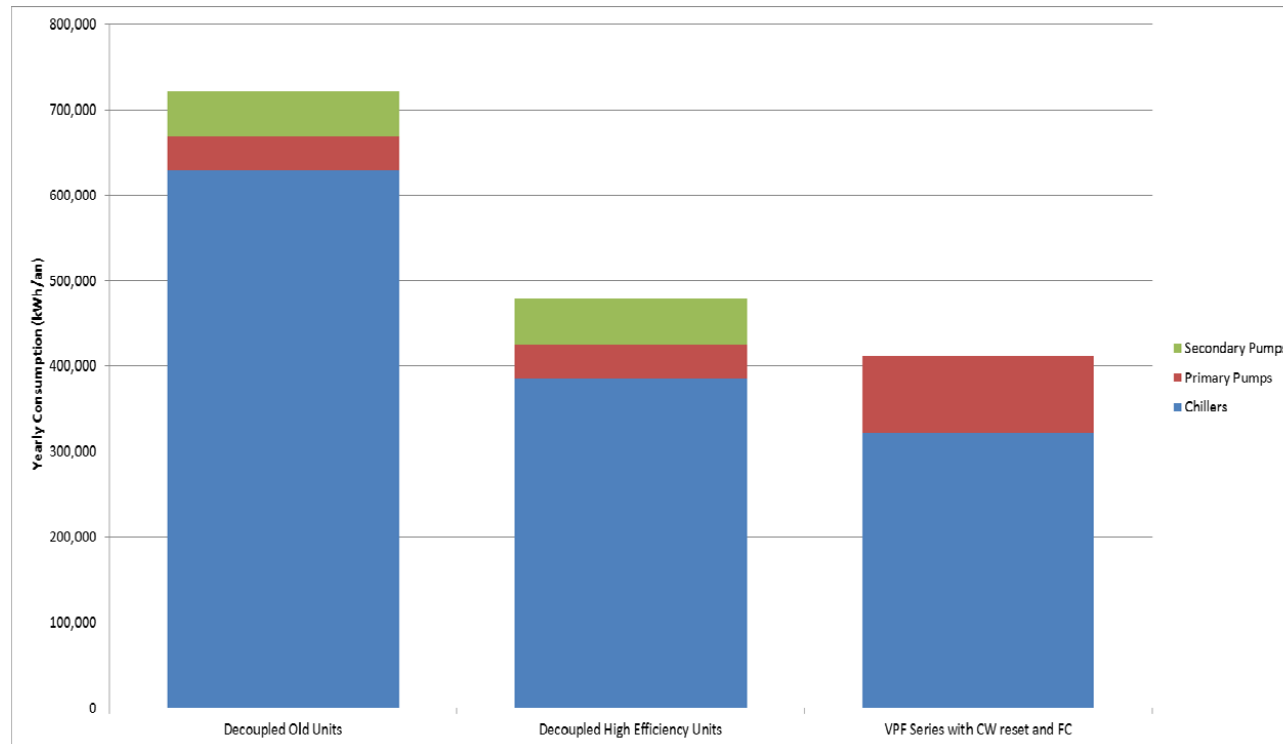
- Classical decoupled system
- Adapted system with larger delta T° + VPF + free cooling



II. Practical case study

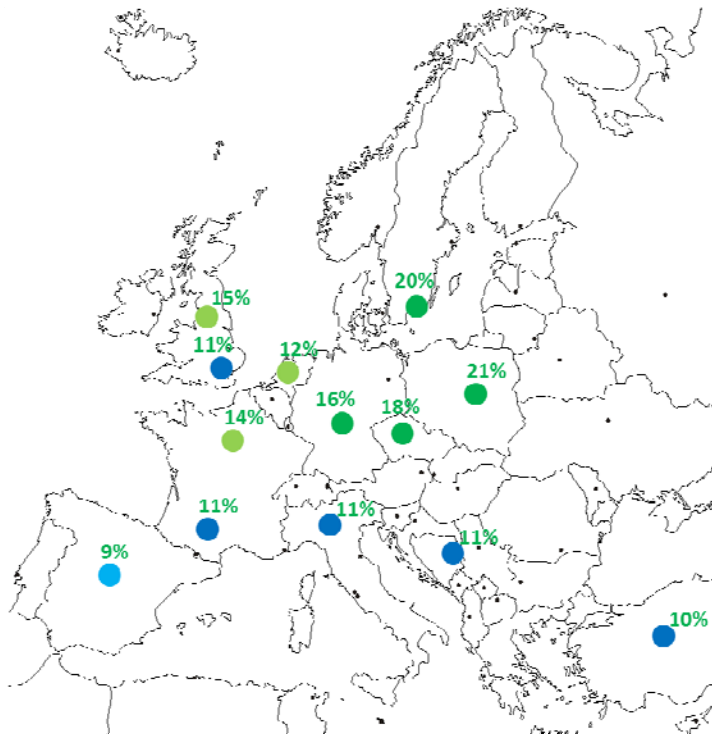
c. The variable primary flow serial system

Performance comparison



II. Practical case study

c. The variable primary flow serial system Typical additional savings in Europe



**Trane solutions vs
decoupled system with
high efficiency units**
**5.500 – 9.500 €/year
(0,10 €/kWh)**

II. Practical case study

c. The variable primary flow serial system

Additionally, to optimize overall system efficiency..

Tracer Chiller Plant Control (CPC)



Pre-engineered software application that coordinates multiple chillers and ancillary equipment for optimal efficiency and plant reliability.

Reliable plant control

Easy to understand and use

Maximize energy savings

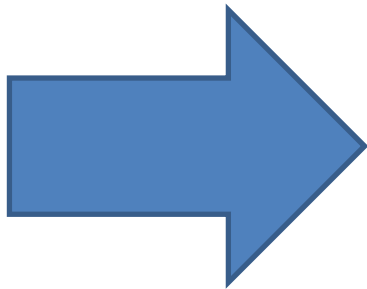
Minimize operating costs



Questions?

III. Conclusion

- One size fits all solution doesn't exist
- Each system and solution has to be defined according to the key aspects of the cooling system
- All variables have to be taken into account



**Highly efficient equipment is essential
but has to be integrated within a well
thought overall system**

Thank you !



Questions?