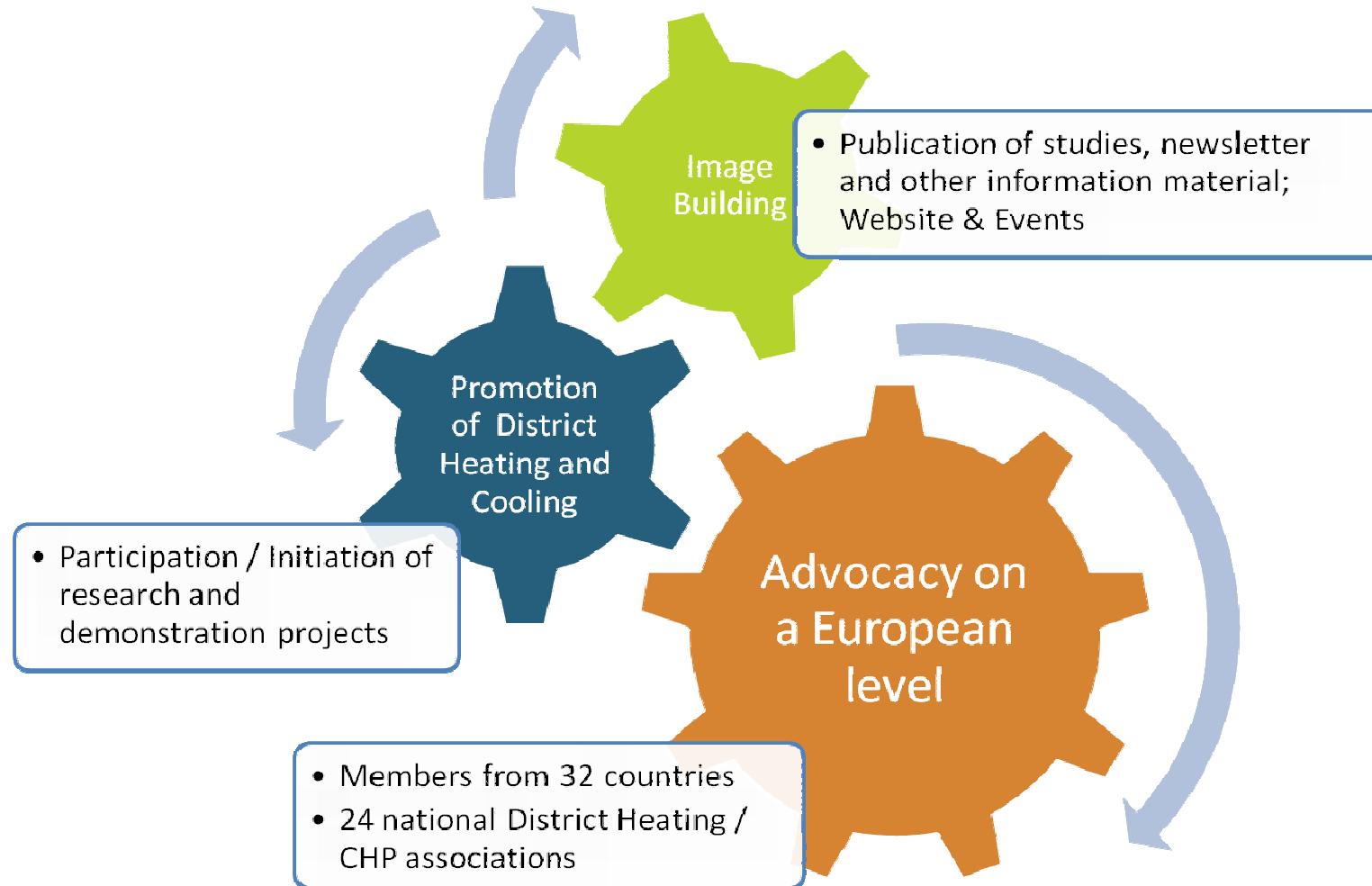


Overall energy efficiency in chilled water plant



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Introduction

A growing demand for air-conditioning

A central requirement : Energy Efficiency

Energy Efficiency raises two questions:

- Measure and control the efficiency of existing systems
- Develop ever more energy efficient systems

A common issue:

- **How to measure effective energy efficiency of a chilled water production system ?**



Existing Indicators...

Available	Nominal COP / EER :	performance energy indicators as defined by manufacturers based on nominal working conditions
	ESEER / SEER :	Nominative performance energy indicators taking into account partial loading rates (seasonal)

to be compared with real measures

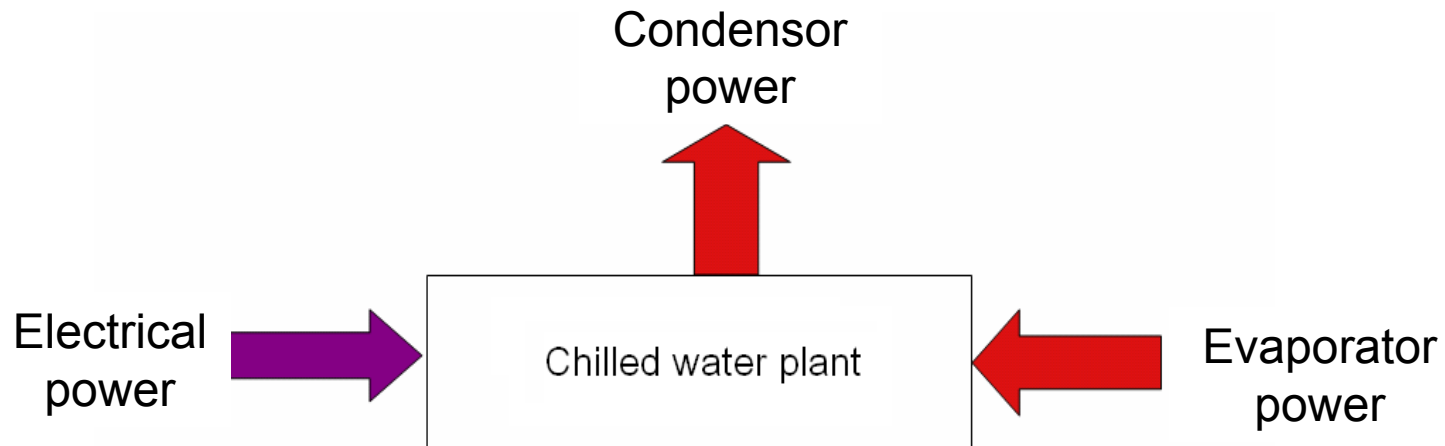
Measured COP / EER : Cooling energy produced along the year, compared to **all** energy used in production system

Problem is... lack of measures !

Instrumentation and measures on a series of chilled water production systems

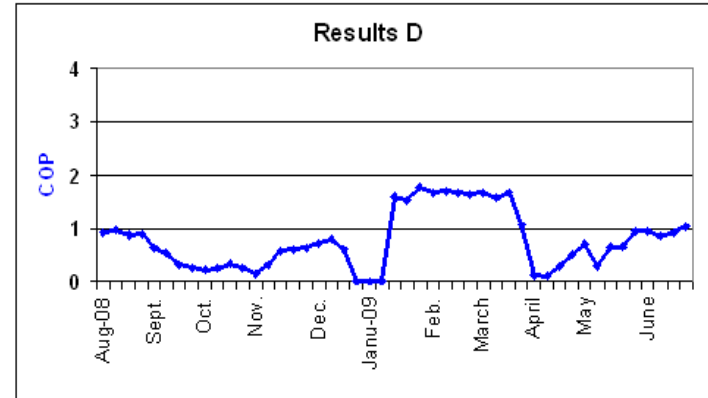
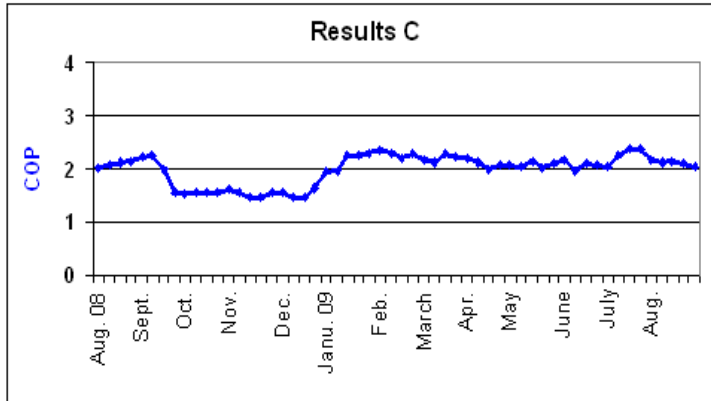
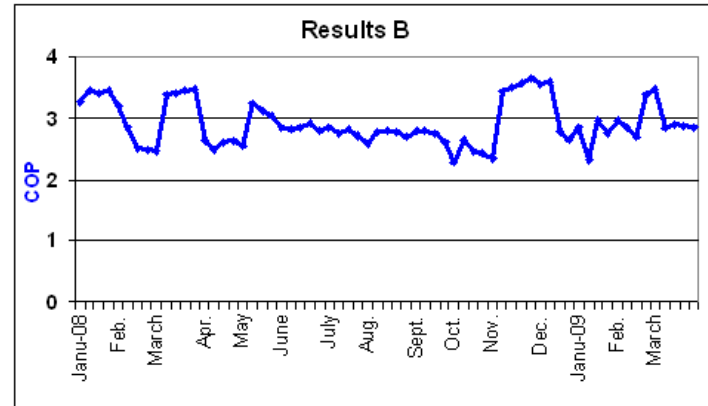
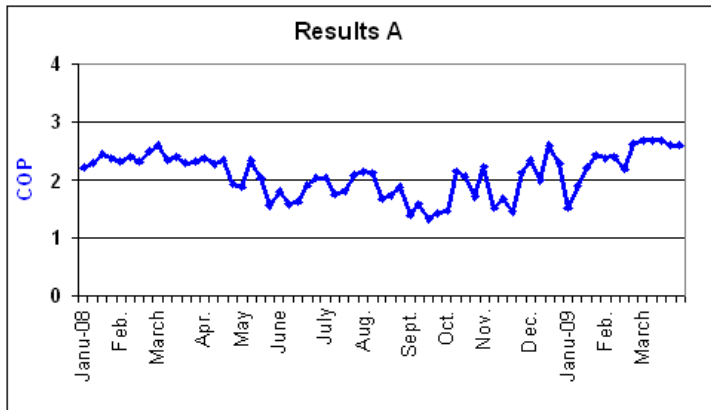
- **10 chilled water plants**
 - 7 in Paris (France), 4 in Helsinki (Finland), 1 in Gothenburg (Sweden)
 - Performance measurements carried out over a long period of time (minimum one year)
- **Range of cooling power**
 - 400 to 1500 kW
- **Measurements equipments (per instrumented plant)**
 - Data acquiritors
 - Flow meters
 - Watt meters
 - Temperature sensors

Methods used for measuring

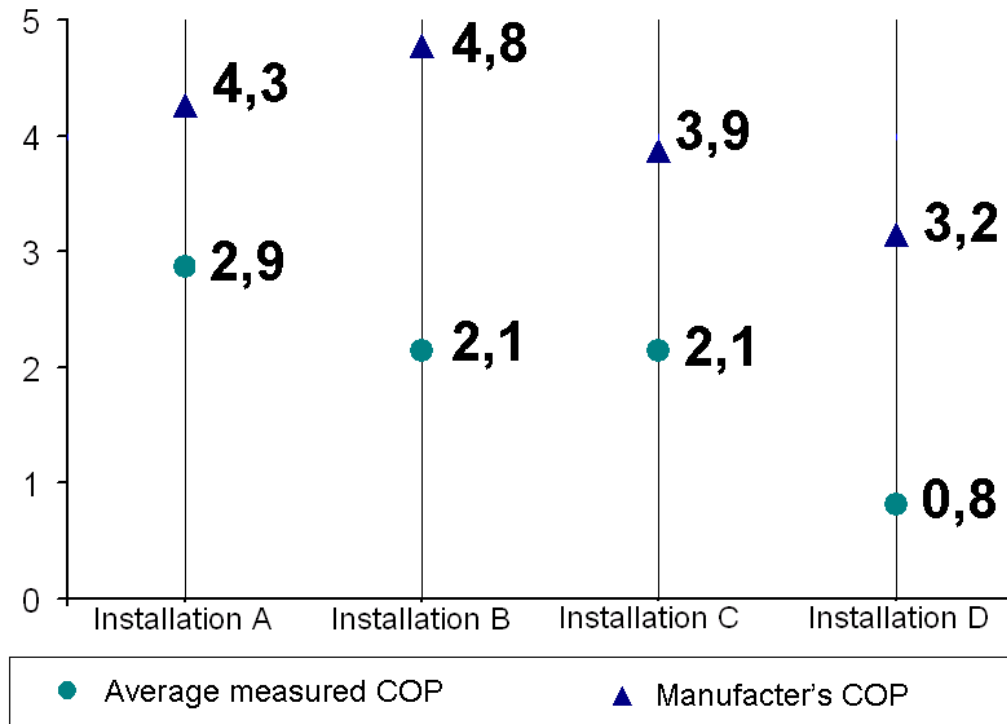


- Measurement of all electrical consumption of each machine
- Measurement of all thermic power exchanged
- Recording of values every 10 minutes

Some measurements...



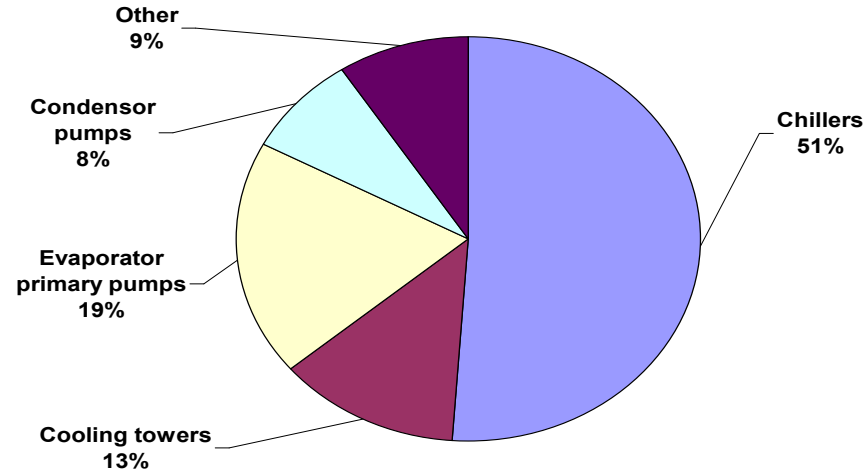
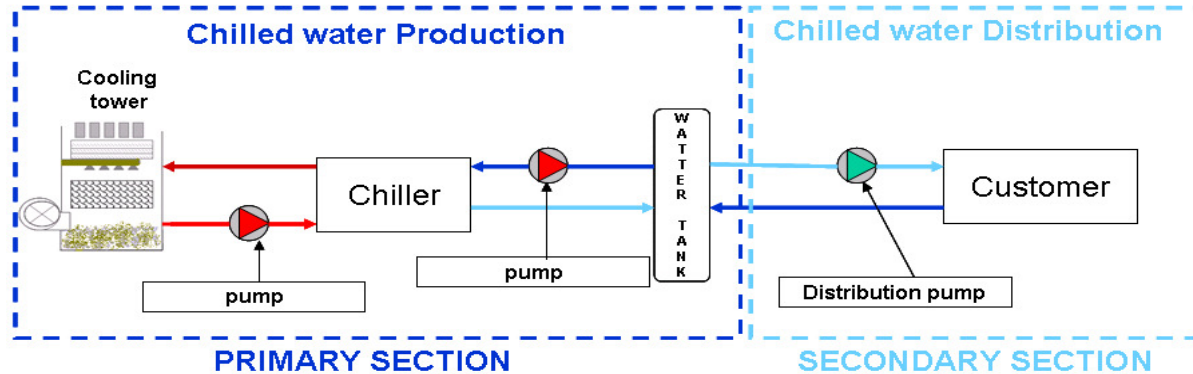
Synthetic results



Strong disparity between measurements carried out and chillers nominal performances

All indicators tell the truth... but not the same truth

Distribution of electrical energy consumption

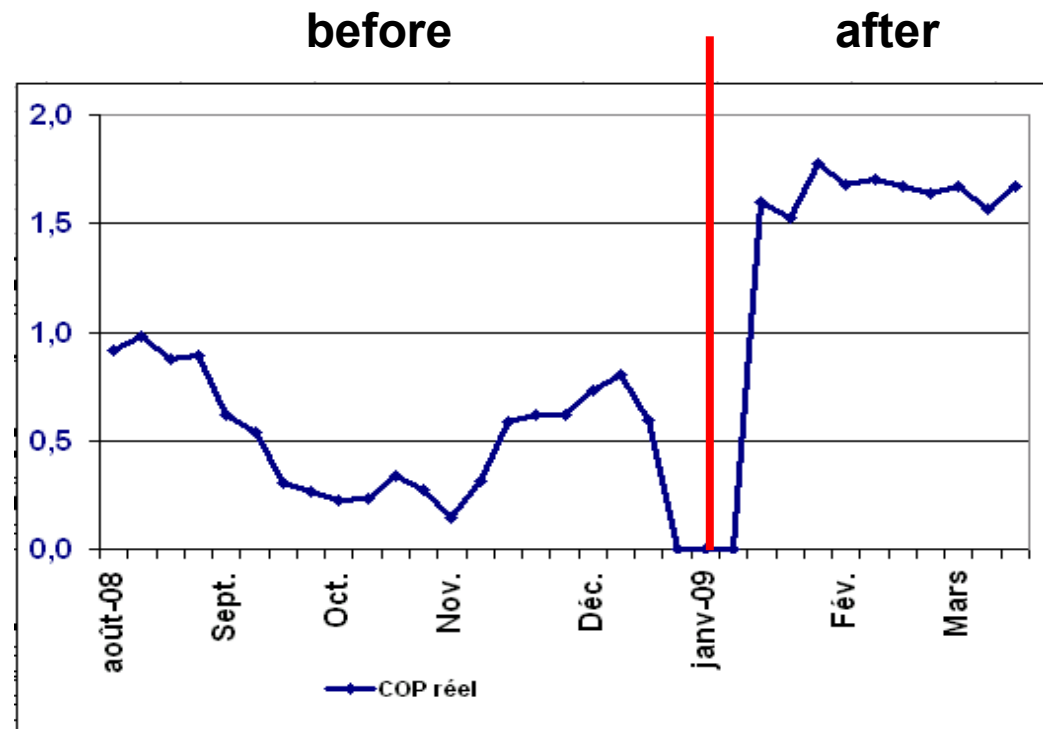


Chillers : only 51% of the total energy consumption

Example of badly run installation

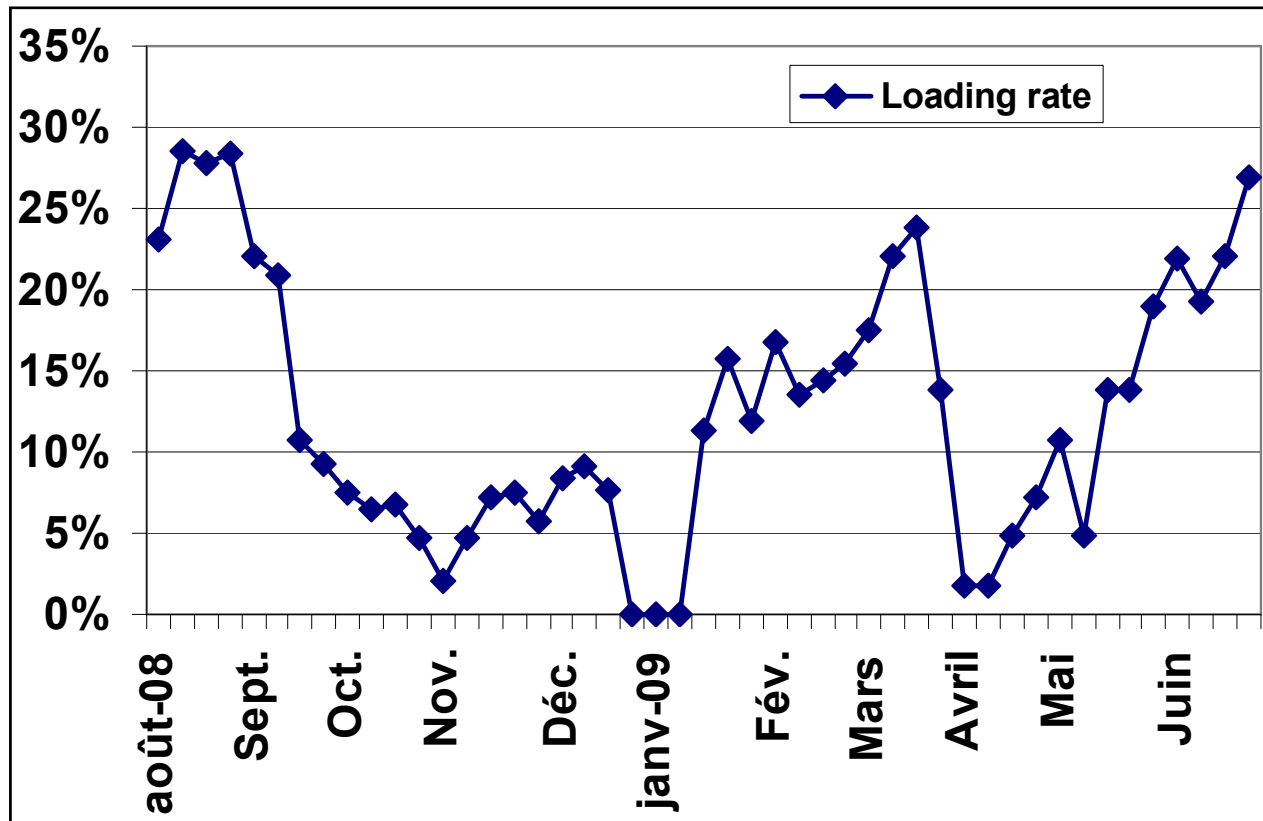
Modification of the regulated value

- T°condensor before January = 34°C
- T°condensor after January = 21°C



**Without instruments and measure analyses :
Production system is not optimized**

Example of badly run installation (D)



The average loading rates per machine is very low
=> low performance + more consumption on auxiliaries

Conclusions

- Real Energy Efficiency calculation: requires measurements carried out over a long period of time (min 1 year)
- Lack of measurement instruments on most of the installations
- Large impact of operating patterns on effective performances
- Chillers represent only 50 % of the global consumption



Energy efficiency requires instrumentation, measurements and accurate operations

Thank you for your attention...

& don't miss **District Cooling Workshop
Tomorrow - 10:45 AM - Room 12**



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