EDIFICI A ENERGIA QUASI ZERO

Centro congressi Torino Incontra, Torino 22 giugno 2011

Monitorggio dei consumi, come verificare le performance progettuali

Risultati dei progetti di ricerca IEA-ECBCS Annex 48 e IEE-SAVE project, HarmonAC.

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Introduction

– The IEA-ECBCS Annex 48 “Heat pumping and reversible air conditioning” project has examined the potential for heat pump system application in tertiary buildings: 5 italian case studies
http://www.ecbcs.org/annexes/annex48.htm

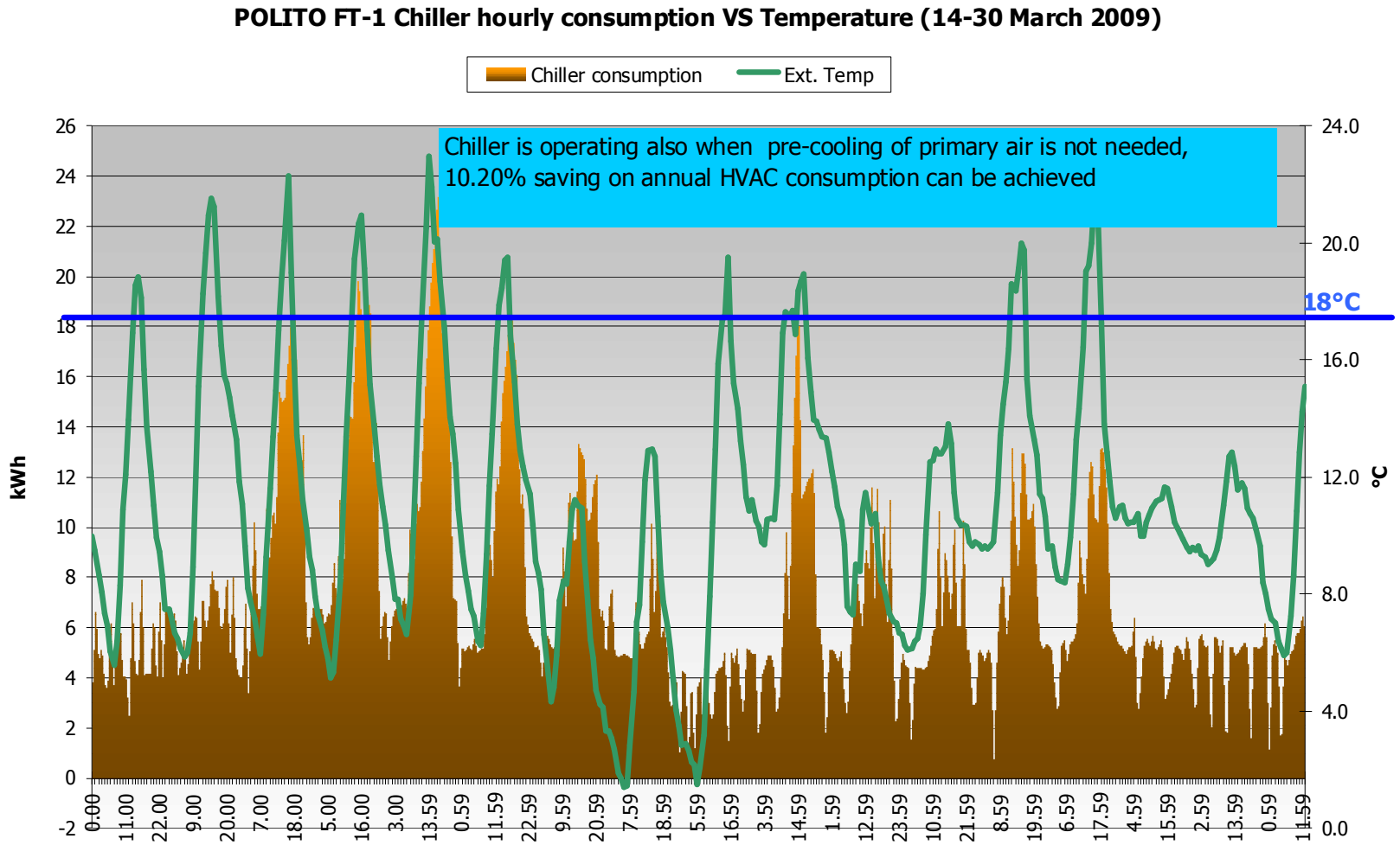
– The HarmonAC project was focused on HVAC system inspection, electric consumption data was taken: 20 italian case studies
http://www.harmonac.info/

Knowledge of HVAC system manager

The “automatic” settings represents often a problem:

- Chillers on during all the year (typical of all air system)
- Sequential heating and cooling (middle season)
- Human decisions is need to get the best performance, BMS helps, but it is not self sufficient.

Example of “automatic settings”:



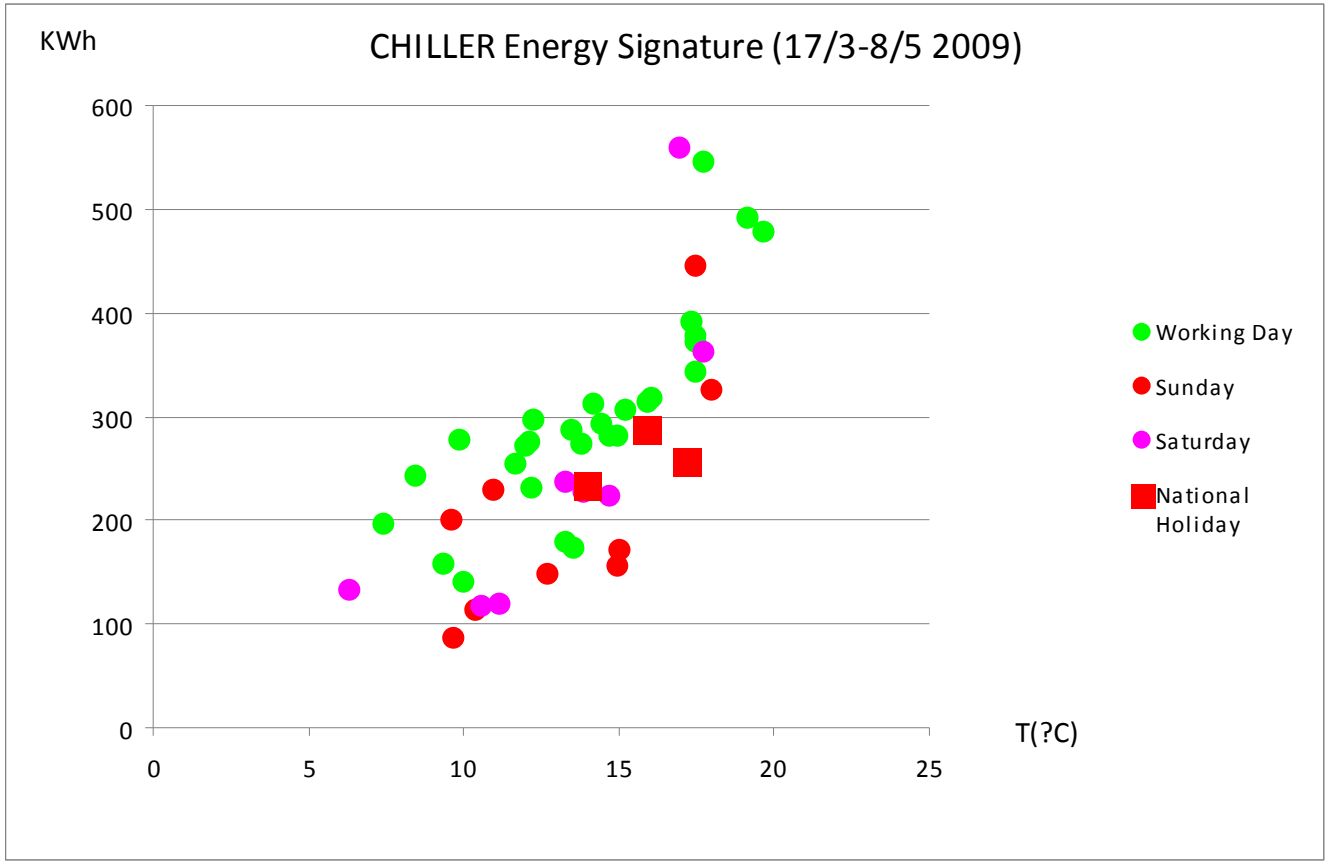
Instrumentation characteristics

Instrument	Typical values logged	Acquisition time	Memory	Cost (€)
Electrical power meter T/RH logger (stand-alone) Status logger (ON/OFF)	kW, kWh, VAh, PF °C, RH (%) On/Off status	15 minute 1 hour 1 second	1 year 6 months 8000 COV(*)	300-1000 120-250 100
(*) COV = Change of value				

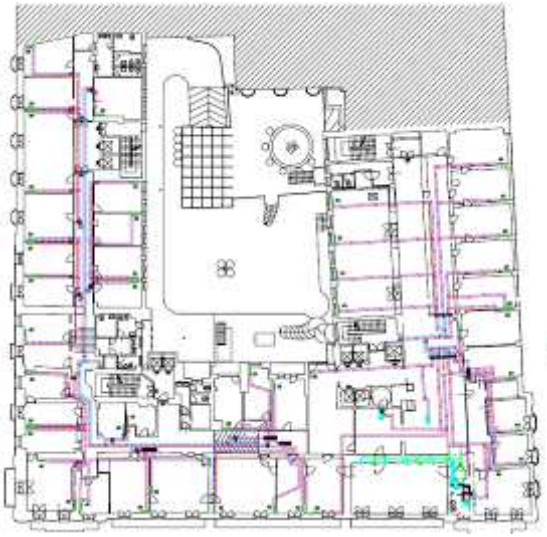
T/RH logger

Electrical power meter

Data analysis



Air-to-Air (VRF heat pump system)

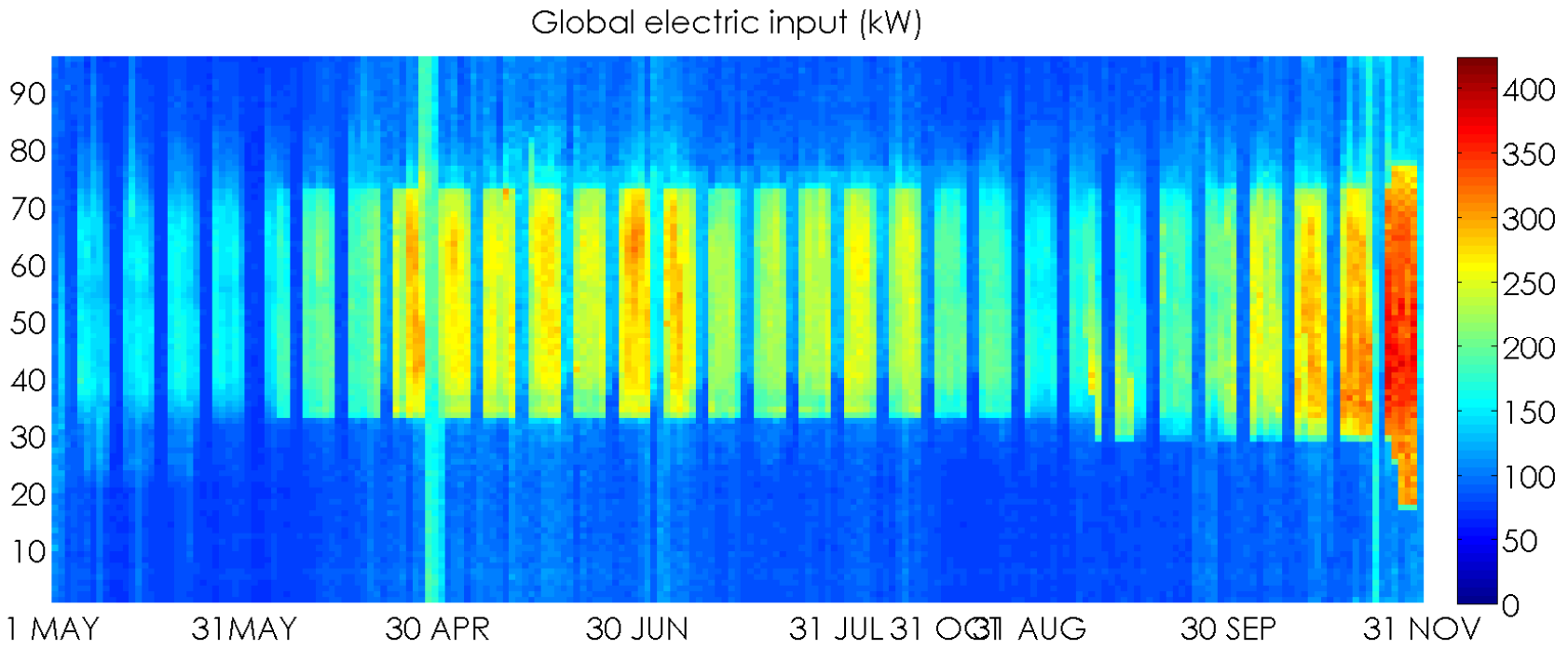


VRF system specific electric consumption (kWh/m^2)

Season	Annual	Heating Oct-Apr	Cooling May-Sep
2005 - 2006	65	47	18
2006 - 2007	48	35	13
2007 - 2008	49	37	12

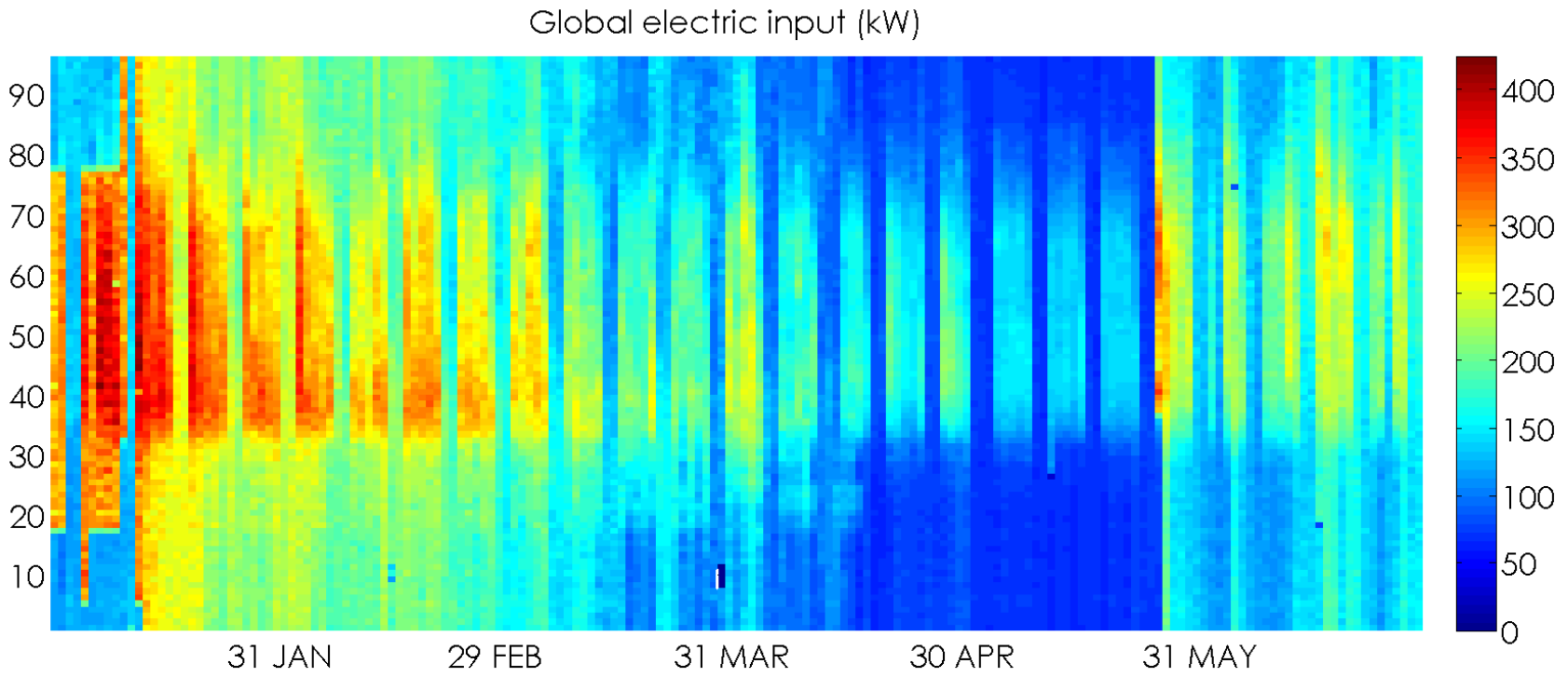
Carpet plot of electric consumption (global income):

- HVAC schedule set correctly
- Some problem on late afternoon: some system remains ON

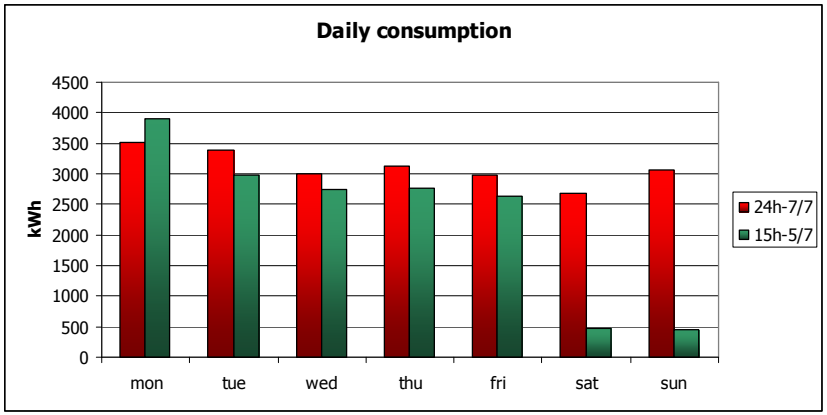


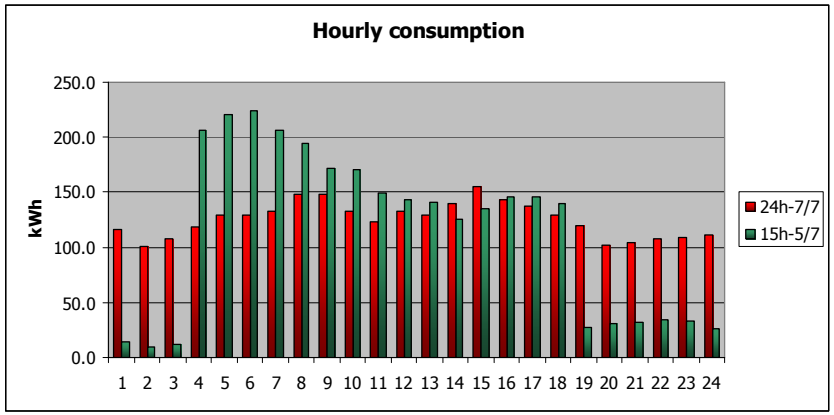
Carpet plot of electric consumption (global income):

•HVAC control system lost schedule settings: 24h/day 7days/week

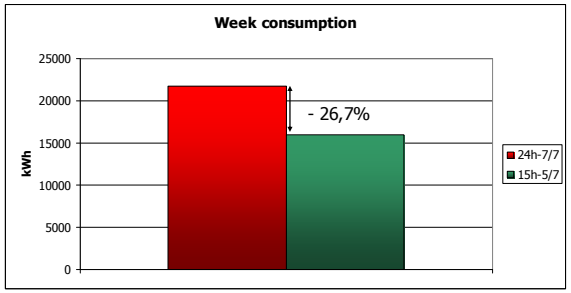


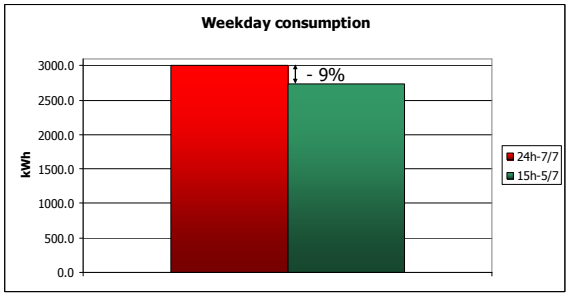
Daily and hourly electric energy demand of VRF system with different schedules

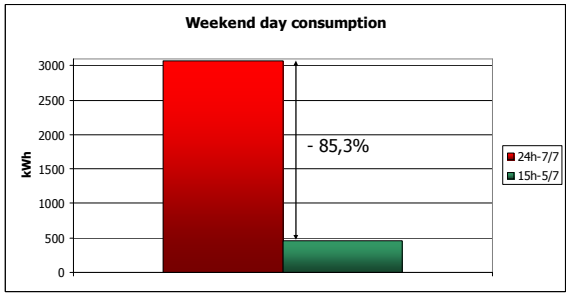




Energy saving achieved with modified operation scheduling





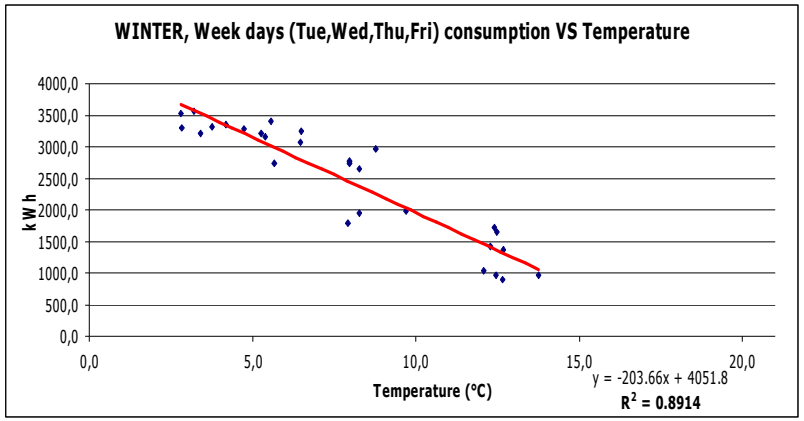


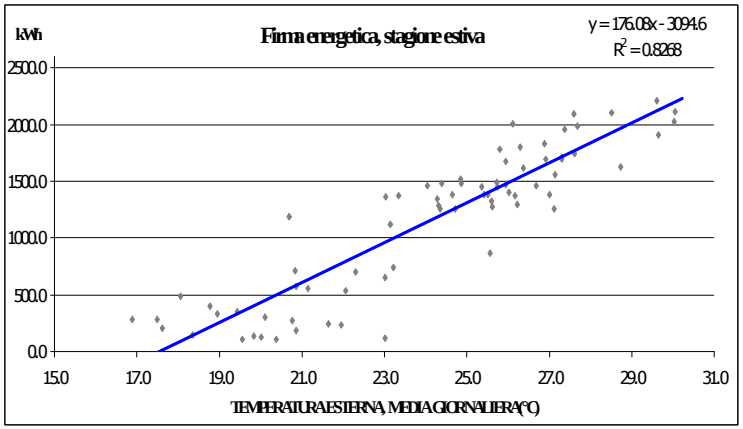
Weekly saving -26.7%

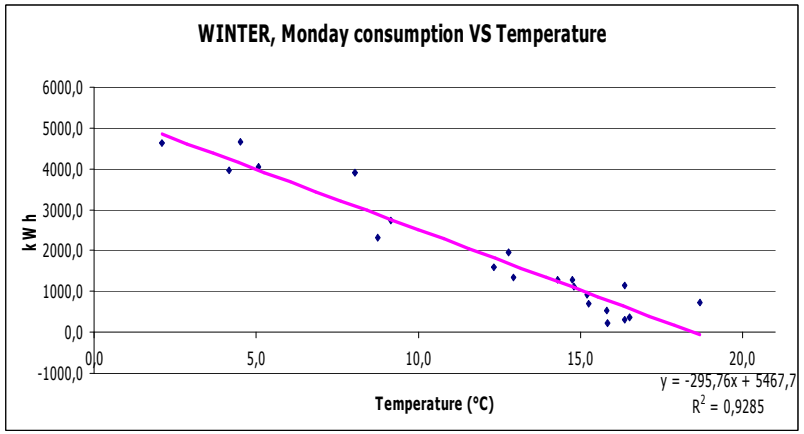
Workday saving -9%

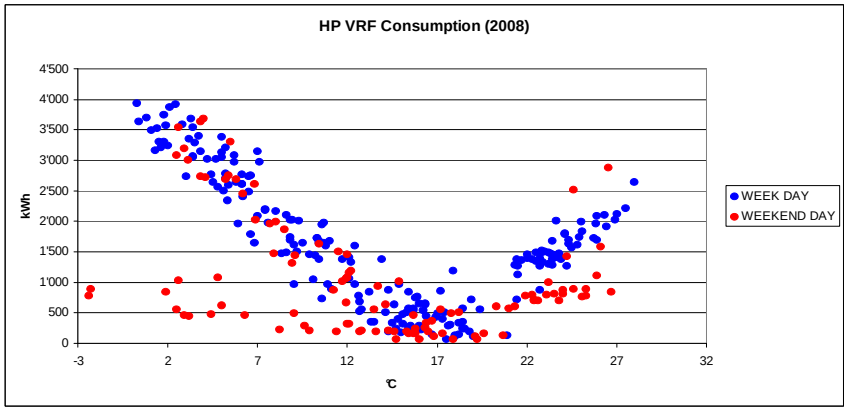
Weekend saving -85.3%

Energy signatures of electric consumption (VRF external units)

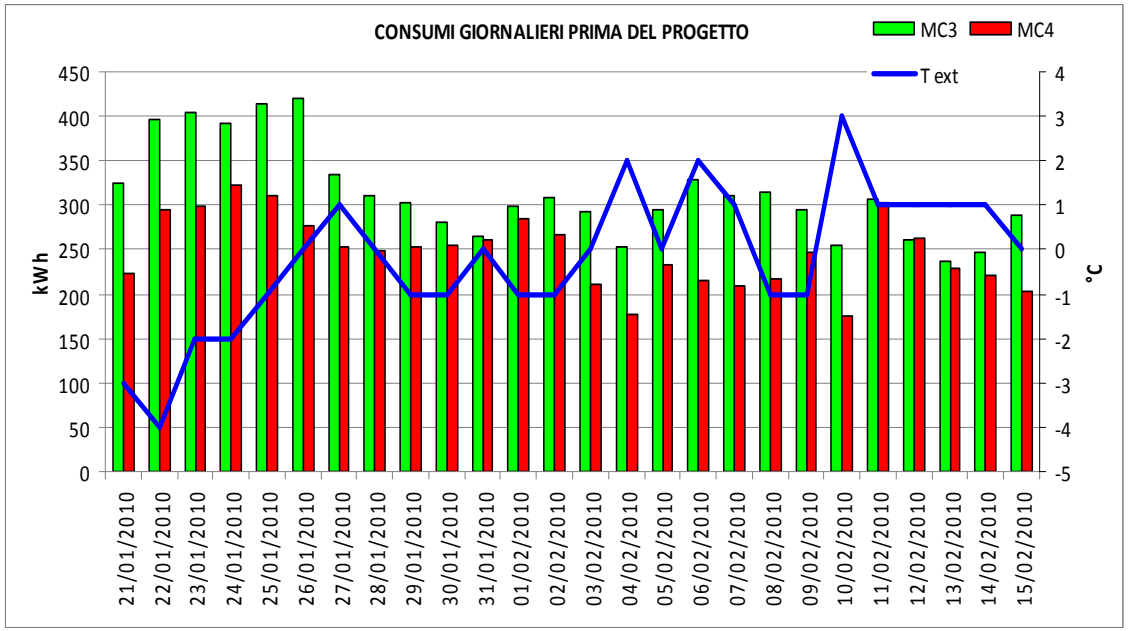






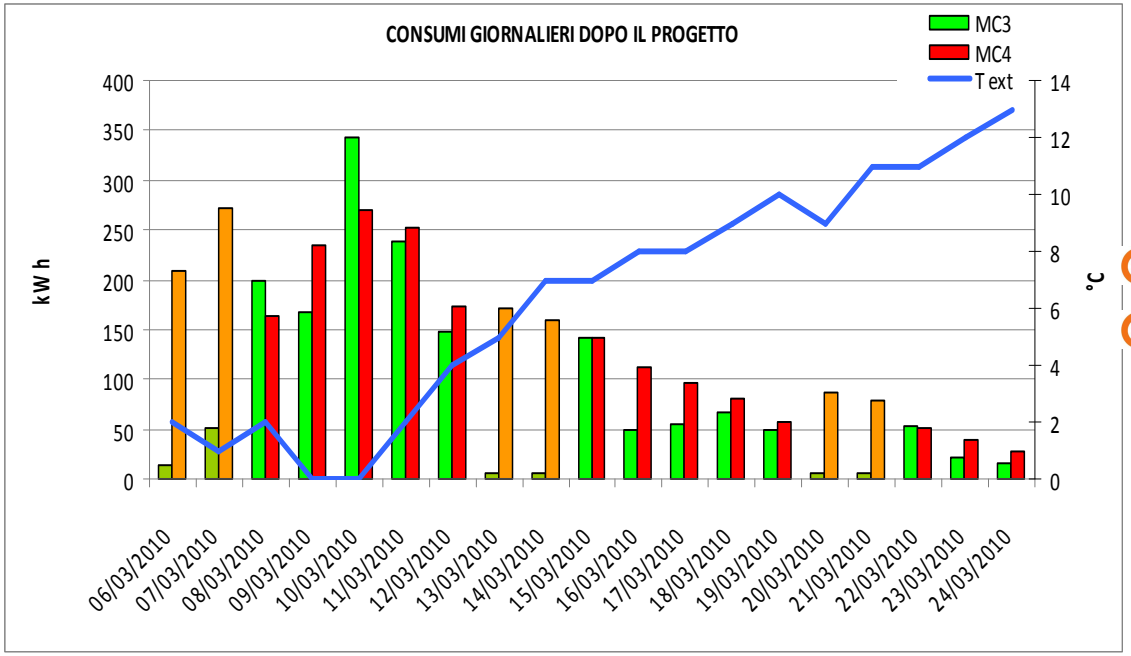


Consumption Data before the control improvement



- MC3 nord side
- MC4 sud side

Consumption Data after the control improvement

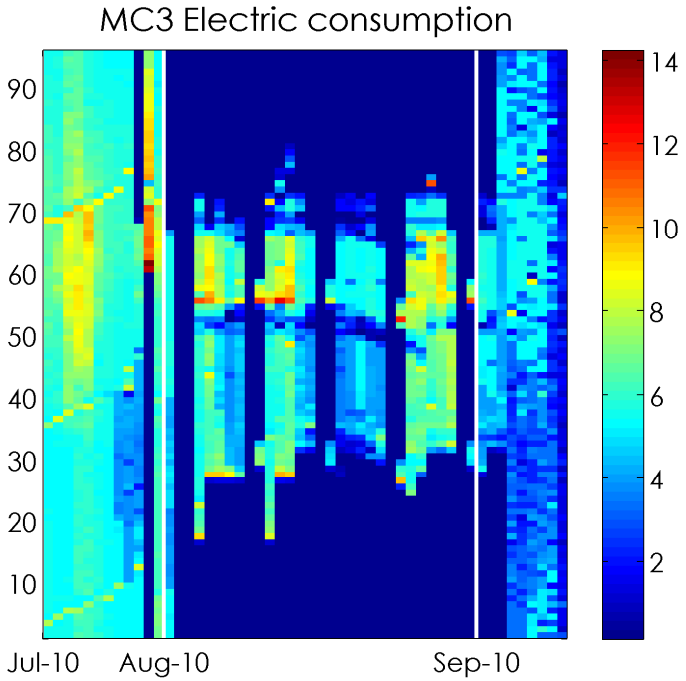


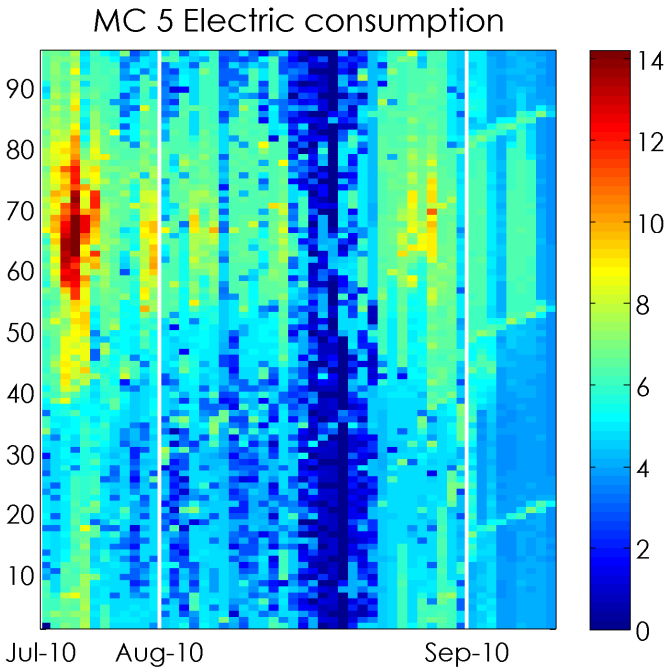
- MC3 nord side
- MC4 sud side

Consumption difference

- Work days: - 20%
- Week end: - 83%

Overall savings: 30%

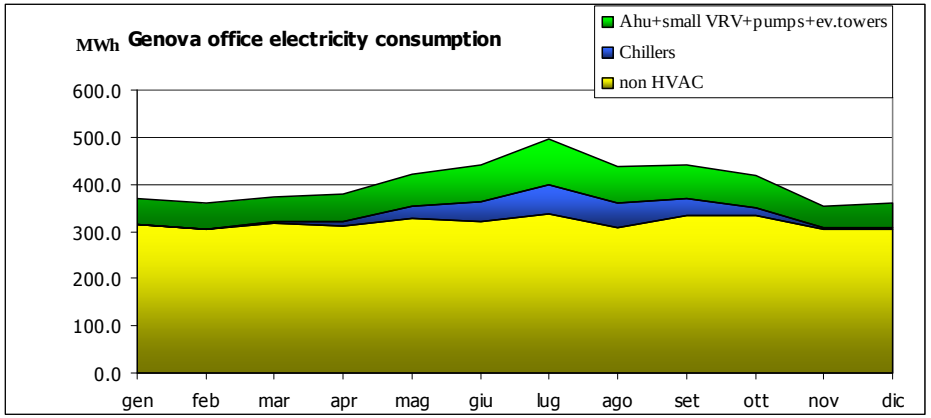


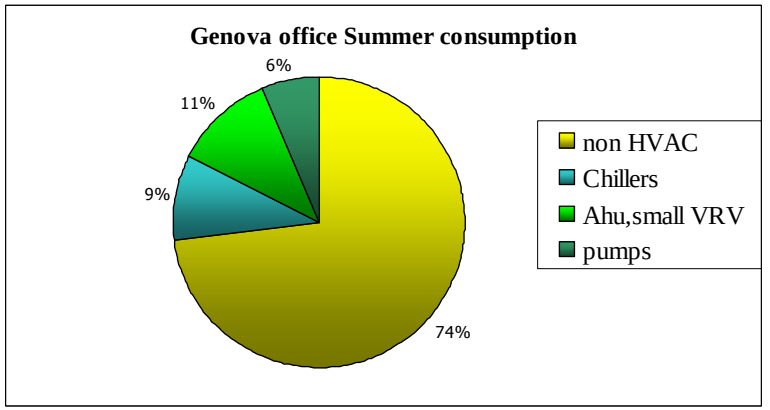


System Commissioning

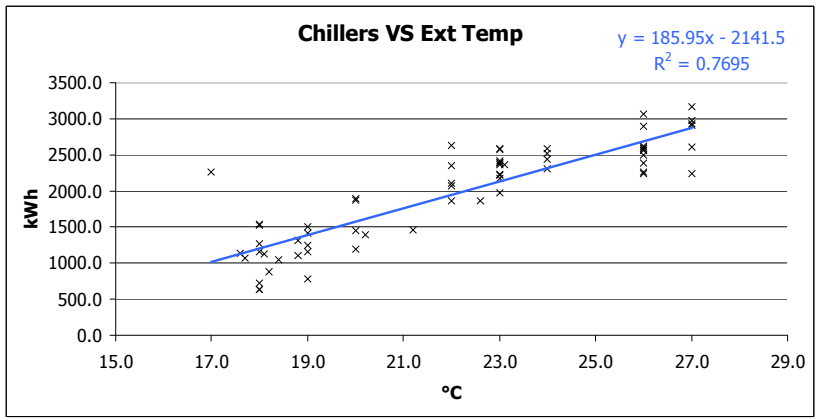
- Contractual specification of the commissioning procedure (responsibilities of the various subjects, required documents, technical aspects)
- *Initial commissioning* (starting from system delivery)
- *On-going commissioning* → monitoring (guaranteed performance in time)

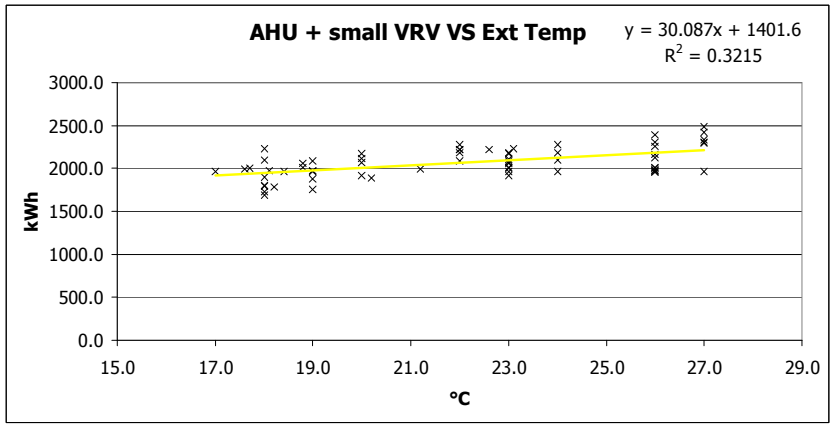
Electrical uses breakdown based on annual monitoring



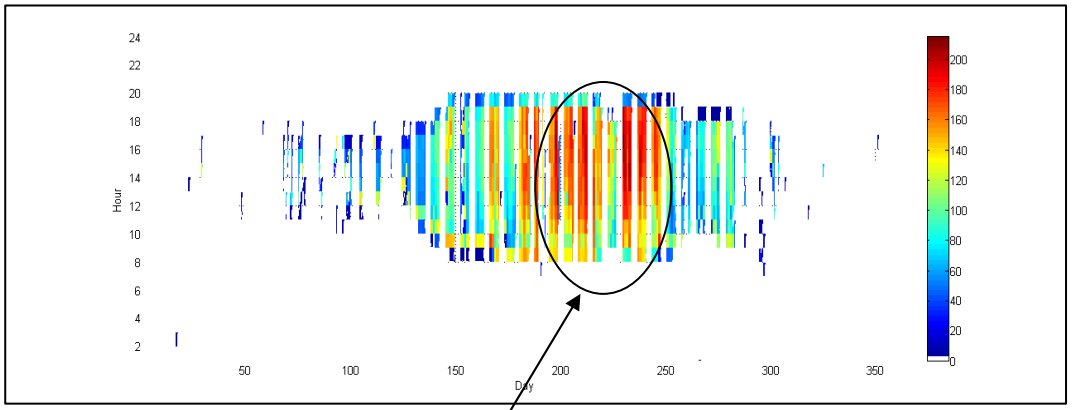


Energy signatures: electric consumption vs. outdoor temperature

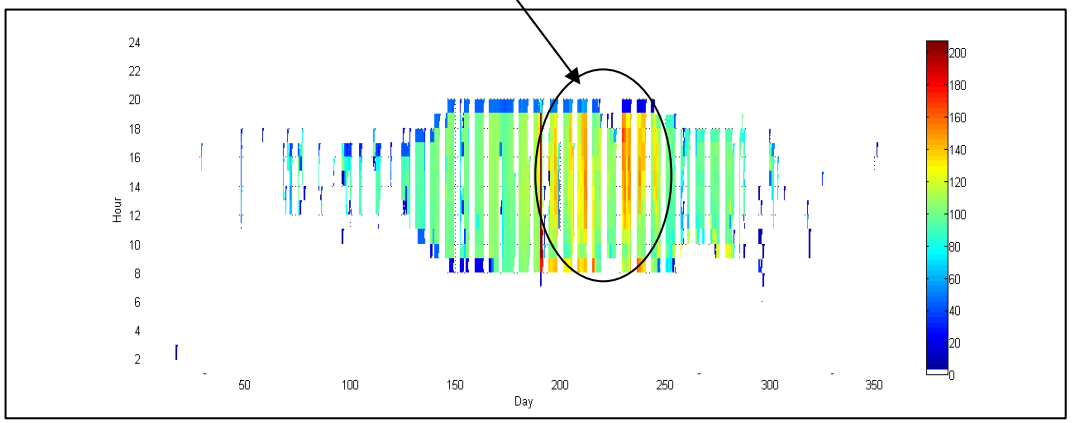




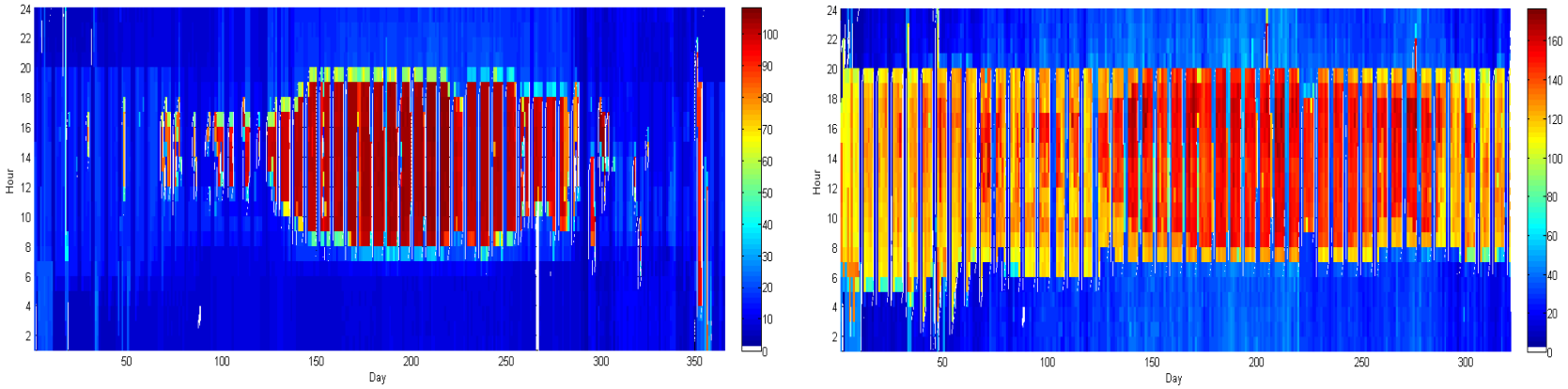
Carpet plots of electric consumption of two water-condensed chillers



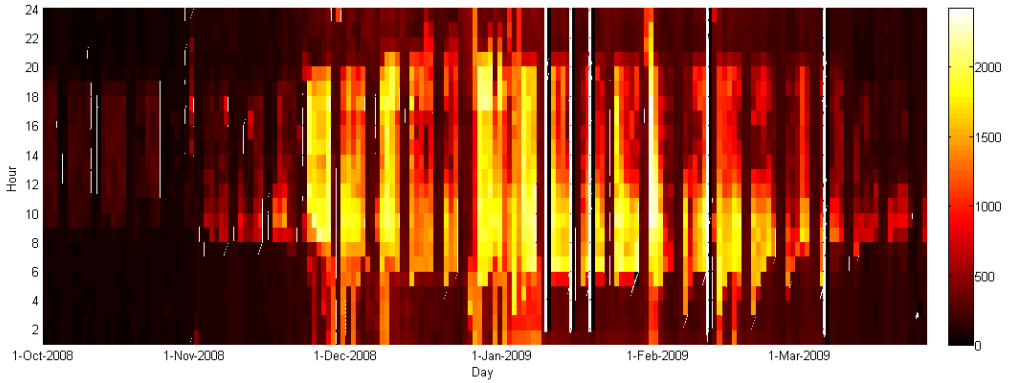
Different power of the two units under high load conditions



Carpet plots of electric consumption of pumps (left) and AHUs (right)



Carpet plot of thermal energy at secondary side of district heating HX

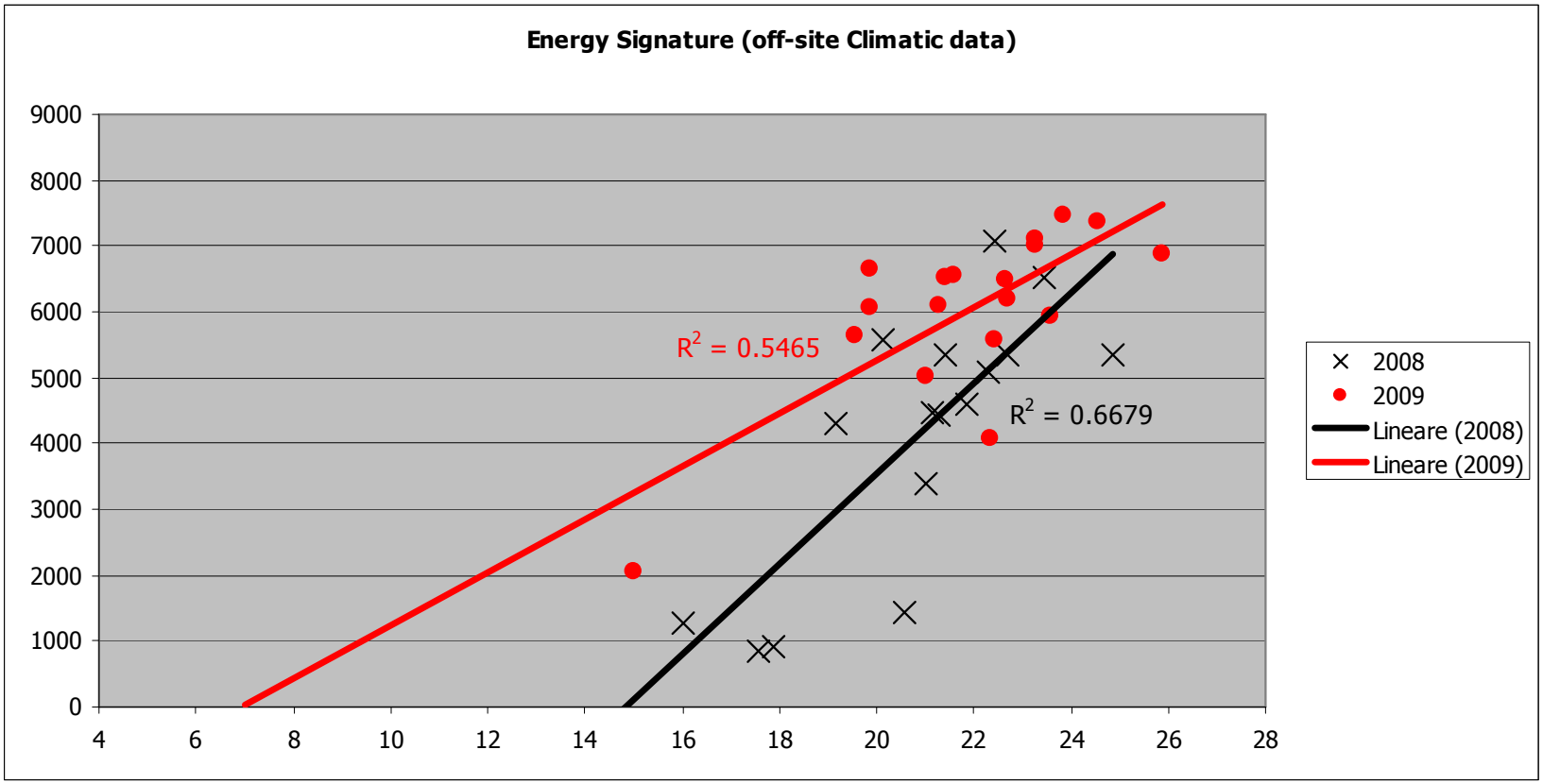


Conclusions

- Sophisticated systems require an accurate initial start-up and a qualified operation and maintenance
- Commissioning procedures (initial and on-going) are essential in order to achieve the expected results
- Monitored data should be stored and processed in a suitable way
- 20% energy savings in electric consumption may be easily achieved with current technologies: this would yield a 1% reduction in the European electric demand

Conclusions

- Energy savings are definitely hard to simulate…



GRAZIE PER L'ATTENZIONE!

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