



Field data of CO2 integrated
refrigeration, heating and cooling
systems for supermarkets

EU GREEN WEEK 2021 PARTNER EVENT

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for healthier people and planet



Summary

- Introduction –The MultiPACK project
- Installation sites and system lay-outs
- Operations in the field
- Energy performances
- Conclusions

Introduction – the MultiPACK project



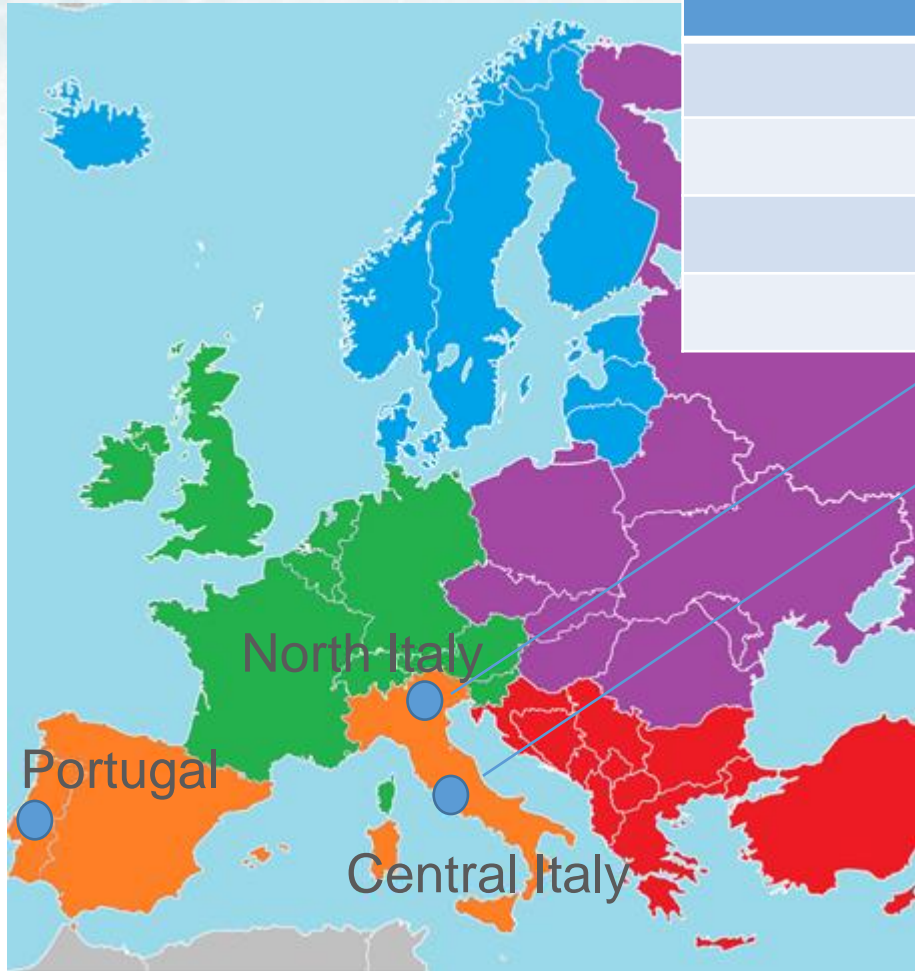
- MultiPACK: EU funded Horizon 2020 Project (Grant number 723137)
- Main goals: **increase confidence** in environmental friendly solutions, **demonstrate** the performance and efficiency of integrated cooling and heating packages based on CO₂ by **installation** and **monitoring** of 6 units

MultiPACK unit for supermarkets



- Integrated (refrigeration, heating and cooling)
- Based on Carbon Dioxide
- Suitable for Hot Climate

Installation Sites

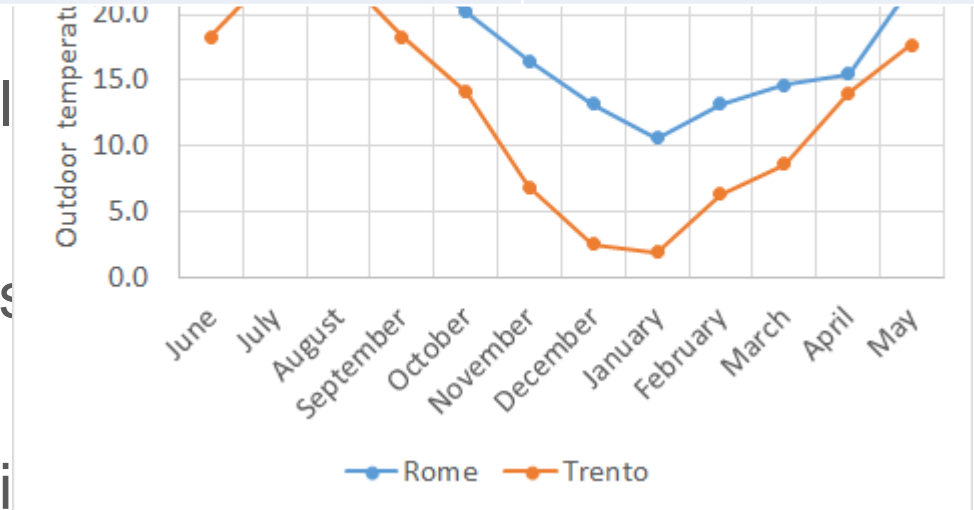


	Rome	Trento
$Q_{MT,D}$	50 kW @ -4°C	90 kW @ -4°C
$Q_{LT,D}$	19 kW @ -30°C	22 kW @ -30°C
$Q_{H,D}$	75 kW @ 10°C external temp.	200 kW @ 10°C external temp.
$Q_{AC,D}$	110 kW @ 30°C external temp.	280 kW @ 30°C external temp.

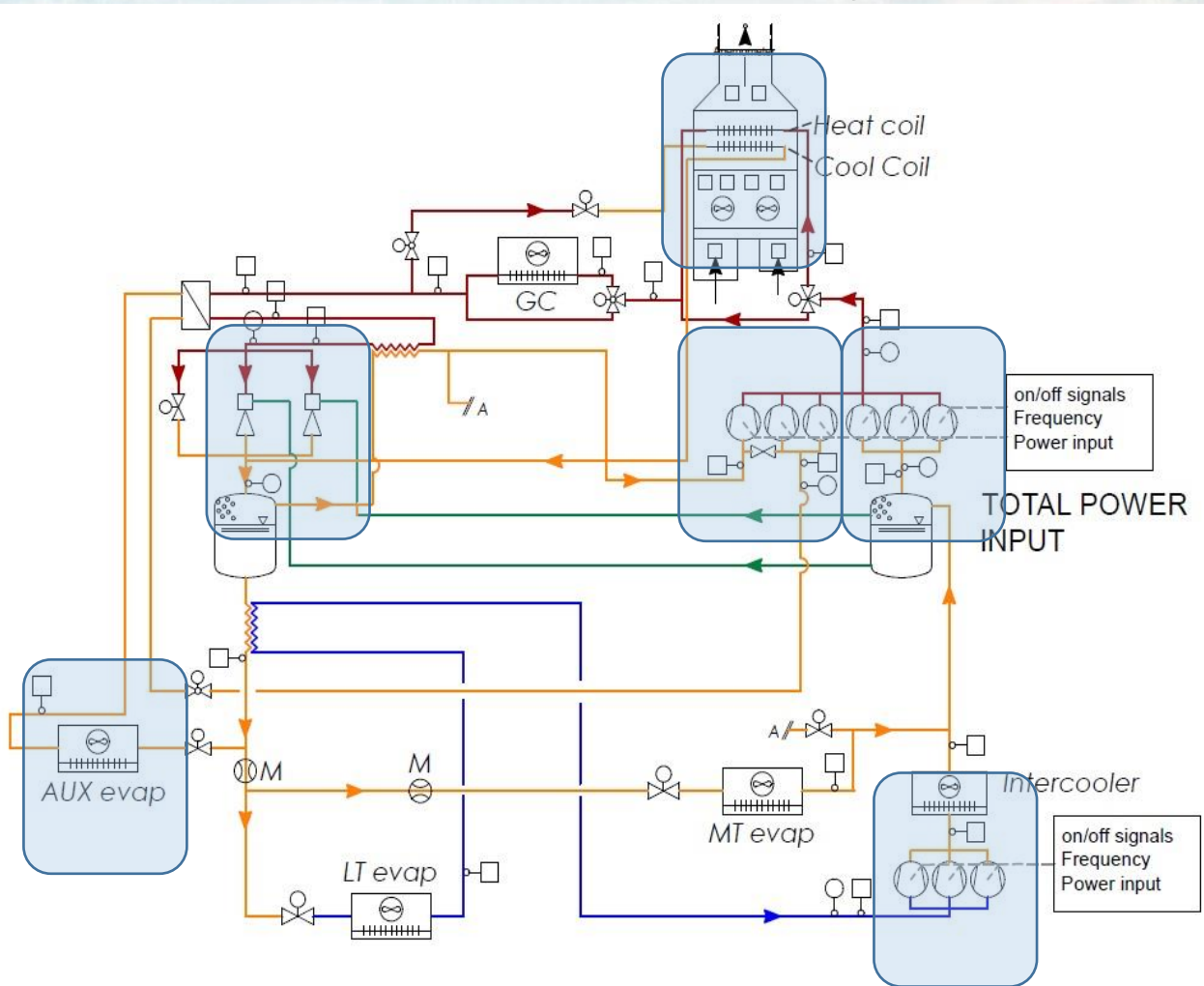
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The Central Italy site- Rome



Booster system

Parallel compression

Two-phase ejectors

AHU for direct heating/cooling

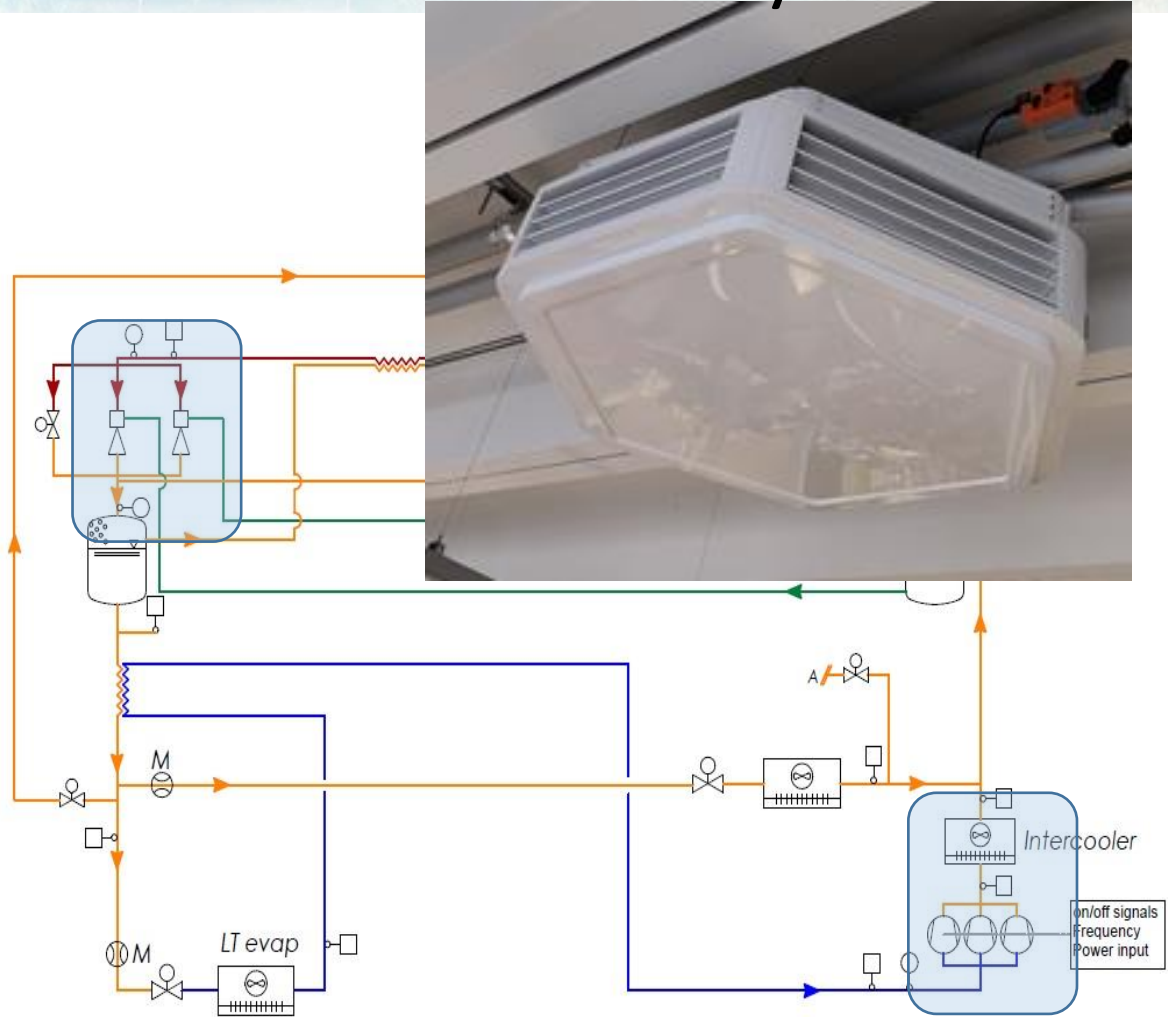
HP functionality/outdoor evaporator

Temperature, pressure sensors

Mass flow meters

Power meters

The North Italy site - Trento



Booster system

Parallel compression

Two-phase ejectors

Distributed indoor coils for direct heating/cooling inside the shopping area + AHU

Heat pump functionality /outdoor evaporator

Temperature, pressure sensors

Mass flow meters

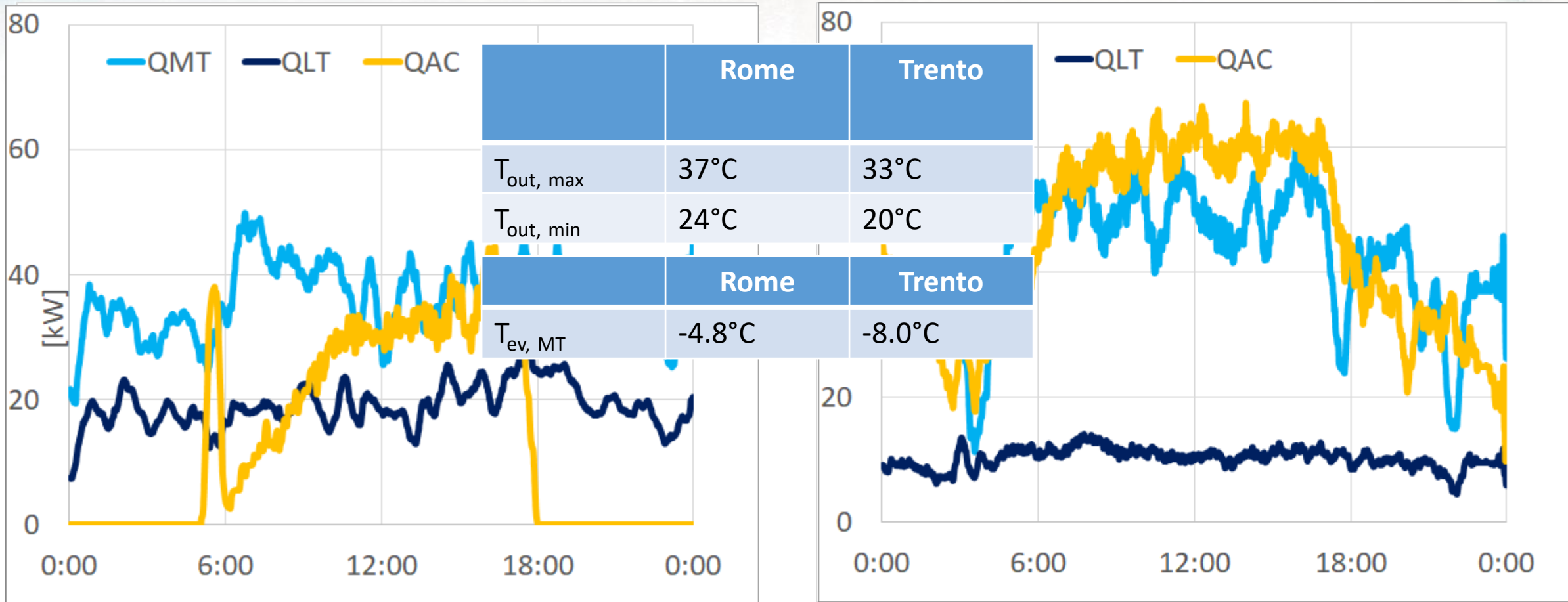
Power meters

The operating conditions - summer

Summer (13th August)

Rome

Trento

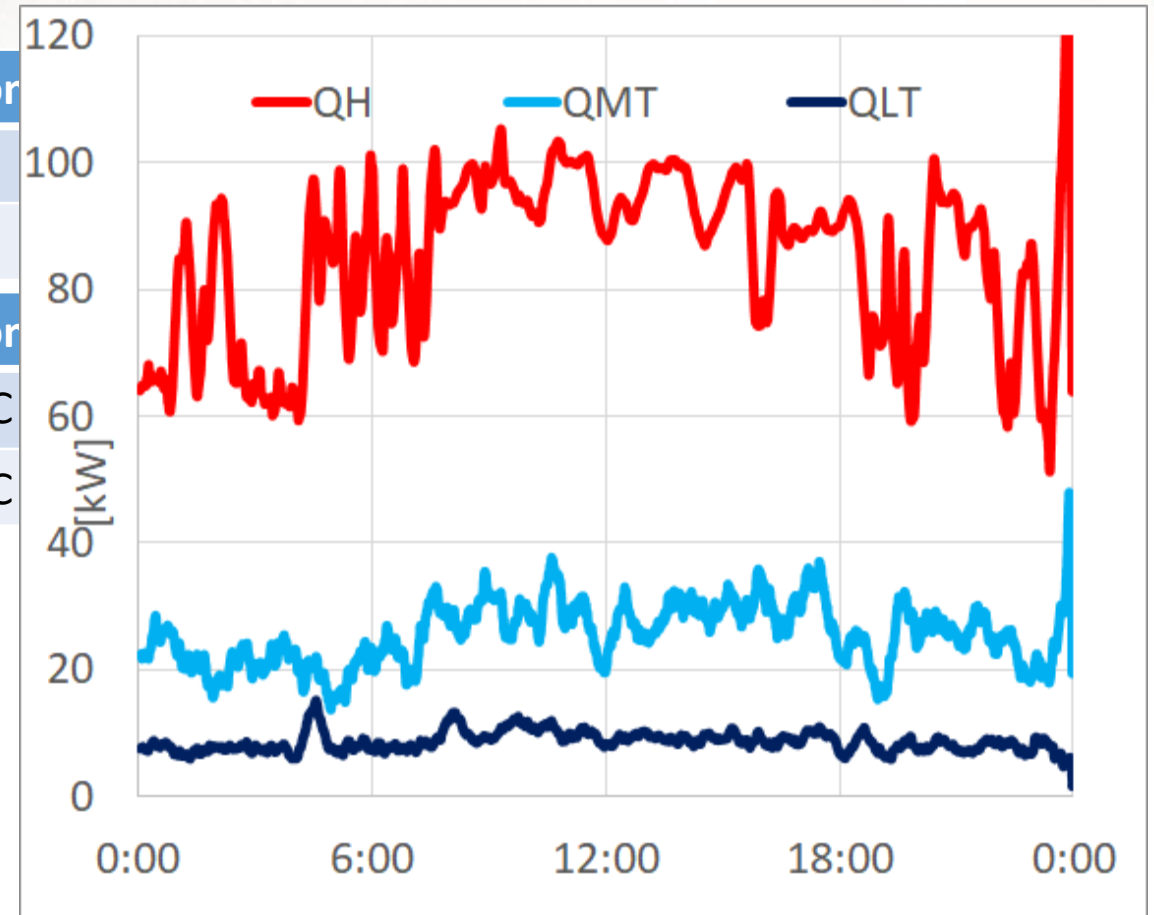
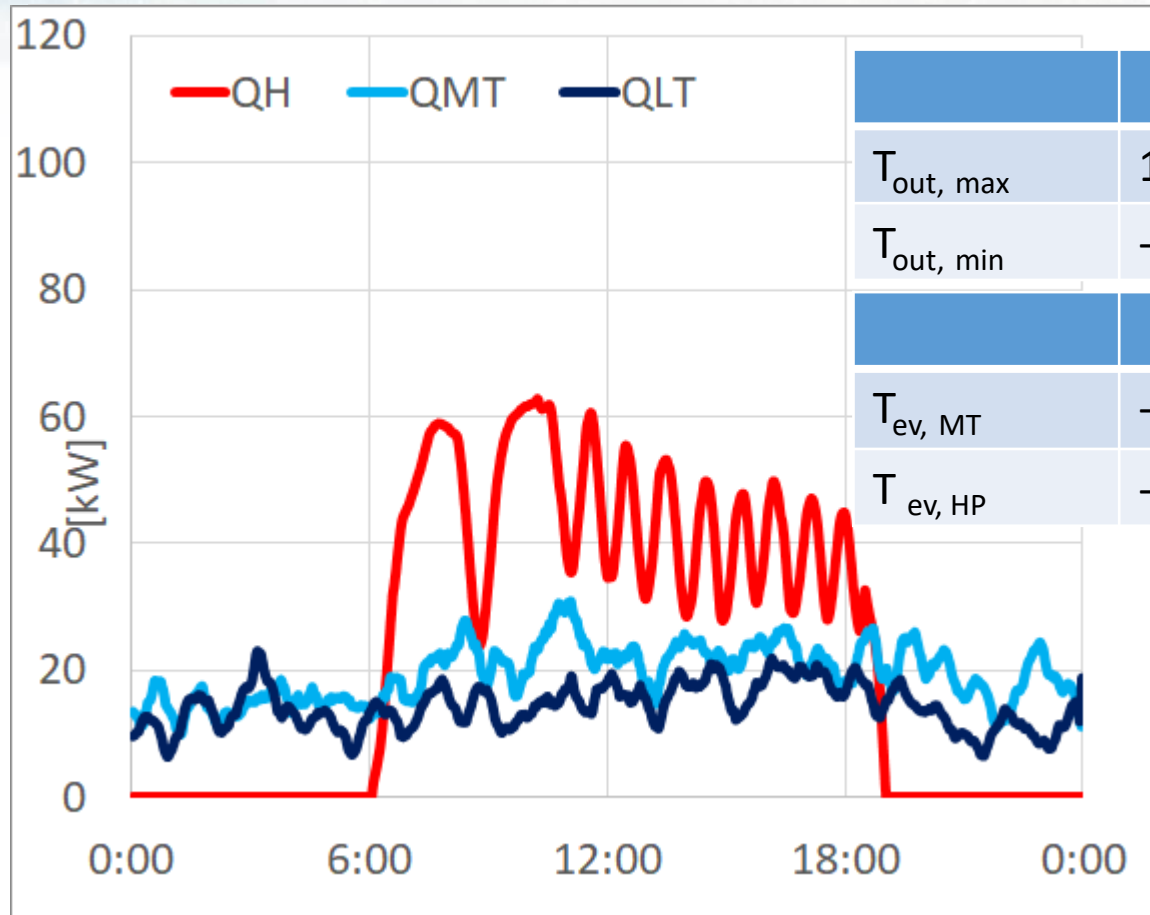


The operating conditions - winter

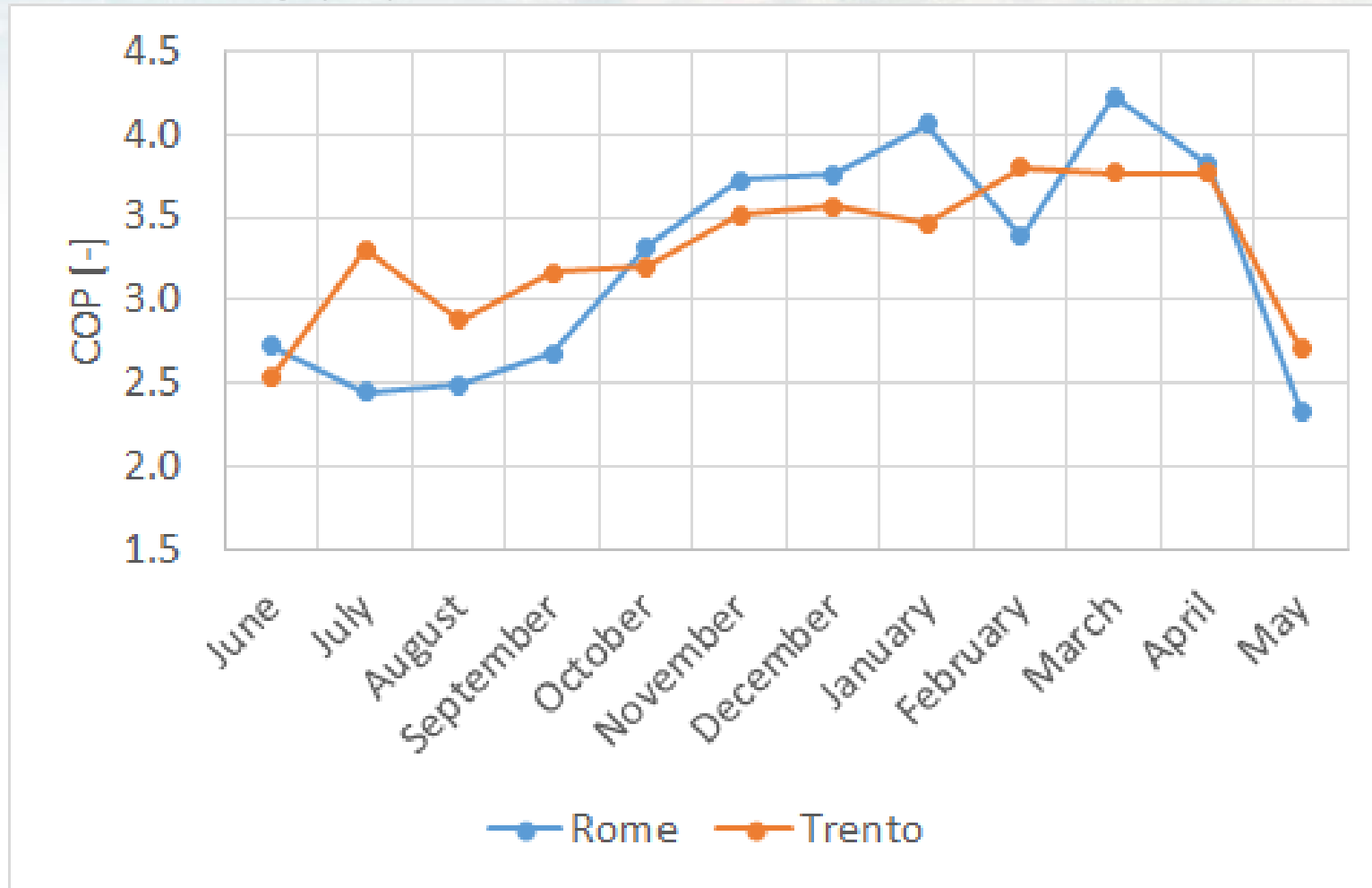
Winter (15th January)

Rome

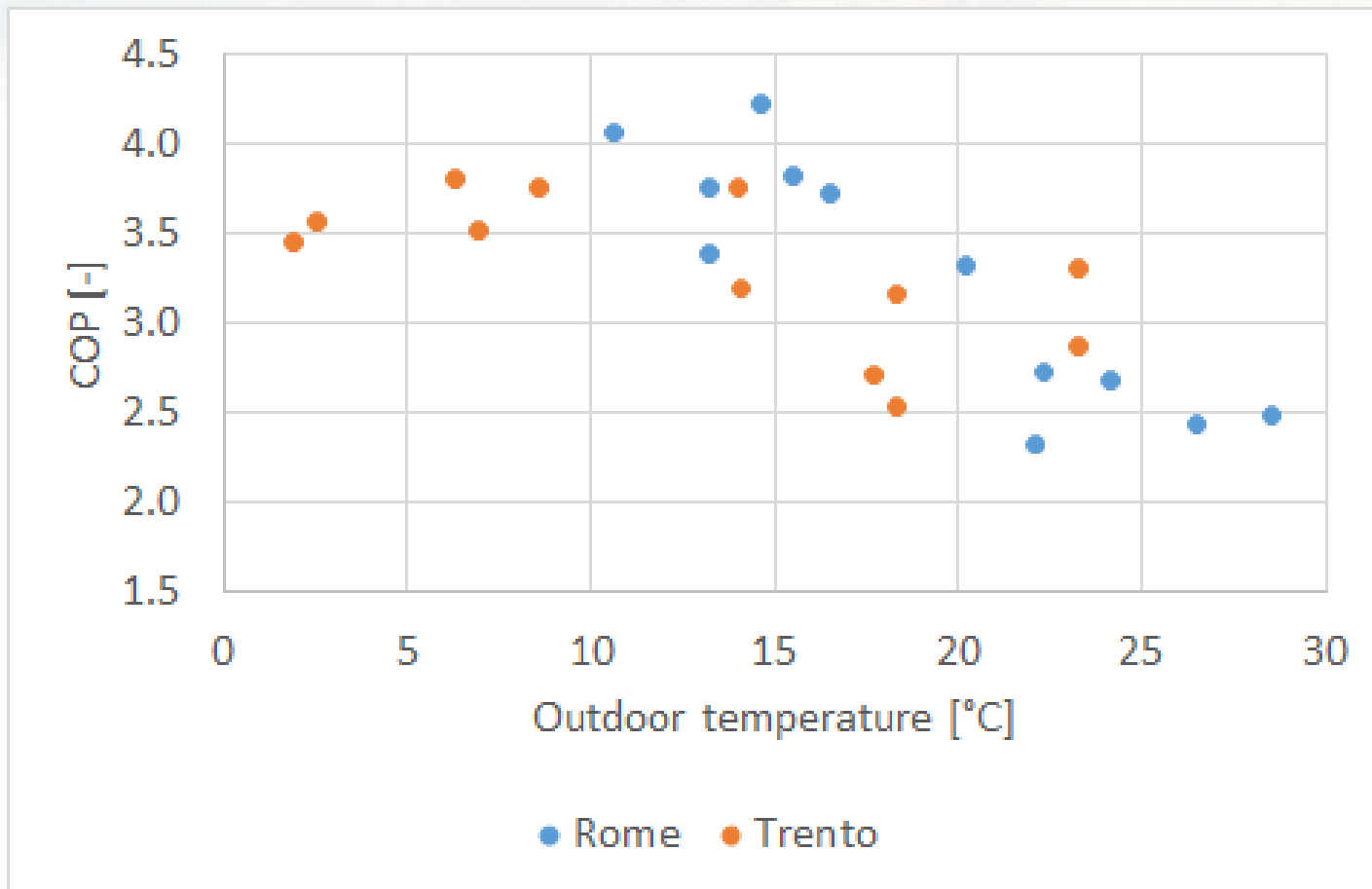
Trento



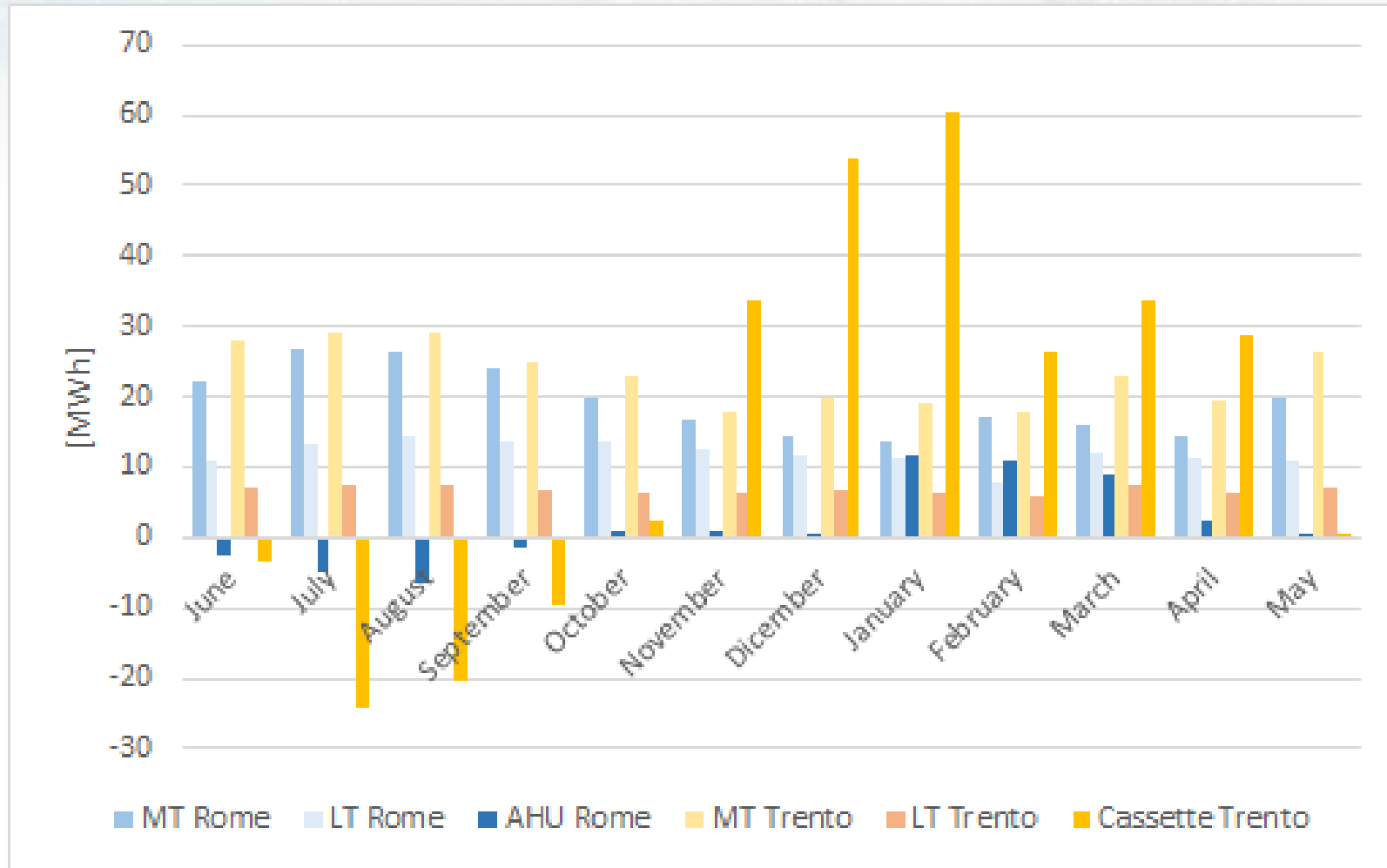
The energy performance



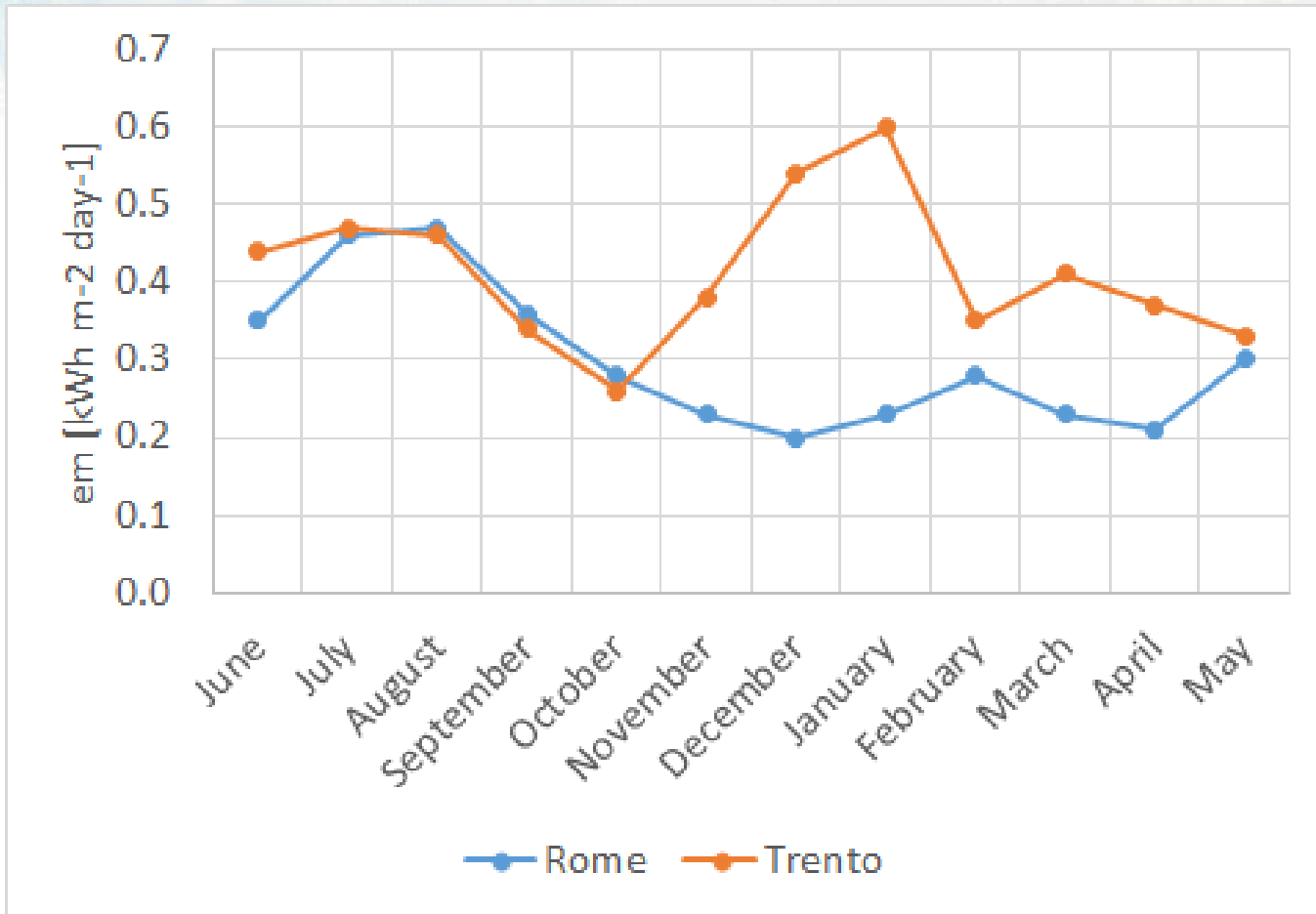
The energy performance



The energy performance



The energy performance



Annual specific energy consumption for HVAC&R (including GC fans)

Rome:

111 kWh m⁻²year⁻¹

85 kWh kWh m⁻²year⁻¹

Trento:

146 kWh m⁻²year⁻¹

116 kWh m⁻²year⁻¹

Conclusions and future work

- Two integrated systems for supermarkets have been installed in Italy within the project MultiPACK
- Installation sites, outdoor conditions, operations, loads and load ratios are different
- Systems are fully monitored
- Full collection of data allows for analysis of operating conditions and energy performances all year long
- Specific energy consumption is presented as KPI
- Next step: benchmarking with traditional solutions



Thank you!

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