

Free cooling on the Mediterranean shore: Energy efficiency upgrades at PIC

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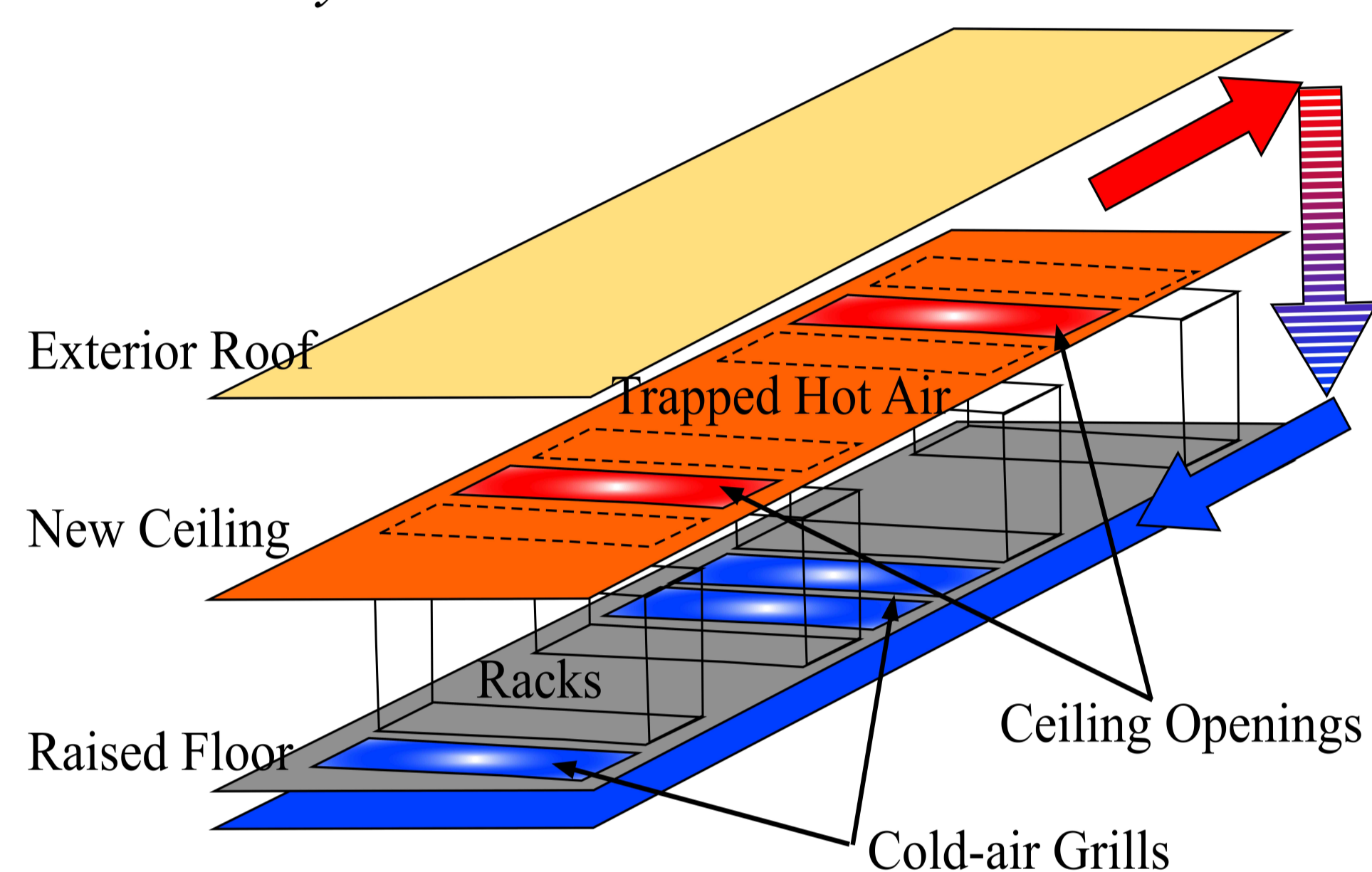
Starting points: 2010 PUE=2.3 → Renew chillers → 2012 PUE=1.7 PUE=Power Usage Effectiveness=Total Power/IT Power

Challenge: Separate hot/cold air in a high-ceiling, shared, open-plant room.

Avoid cold-air starvation in closed cold aisles. Careful: Tape robots in same space.

Solution: 400 m² modular ceiling with openings above hot aisles. Slat curtains guide hot air through openings, trapping it above ceiling. Few pillars, so ceiling hangs from roof beams.

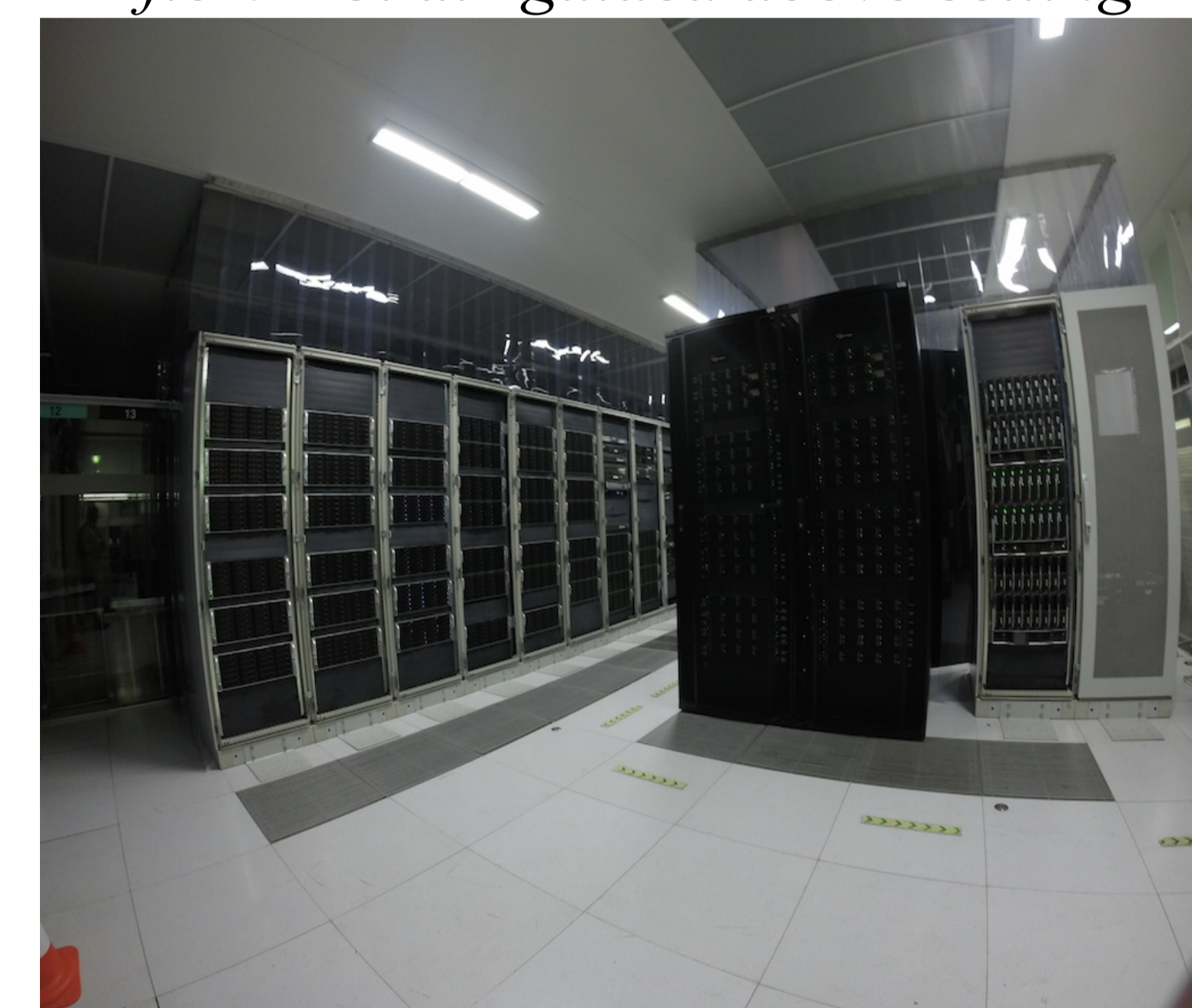
Vertically stacked hot air containment scheme



Before: Hot and cold air mix



After: Hot air guided above ceiling



Opportunity: Expand cooling capacity and improve efficiency with a free-cooling system

Solution: Indirect free-cooling system based on industrial components.

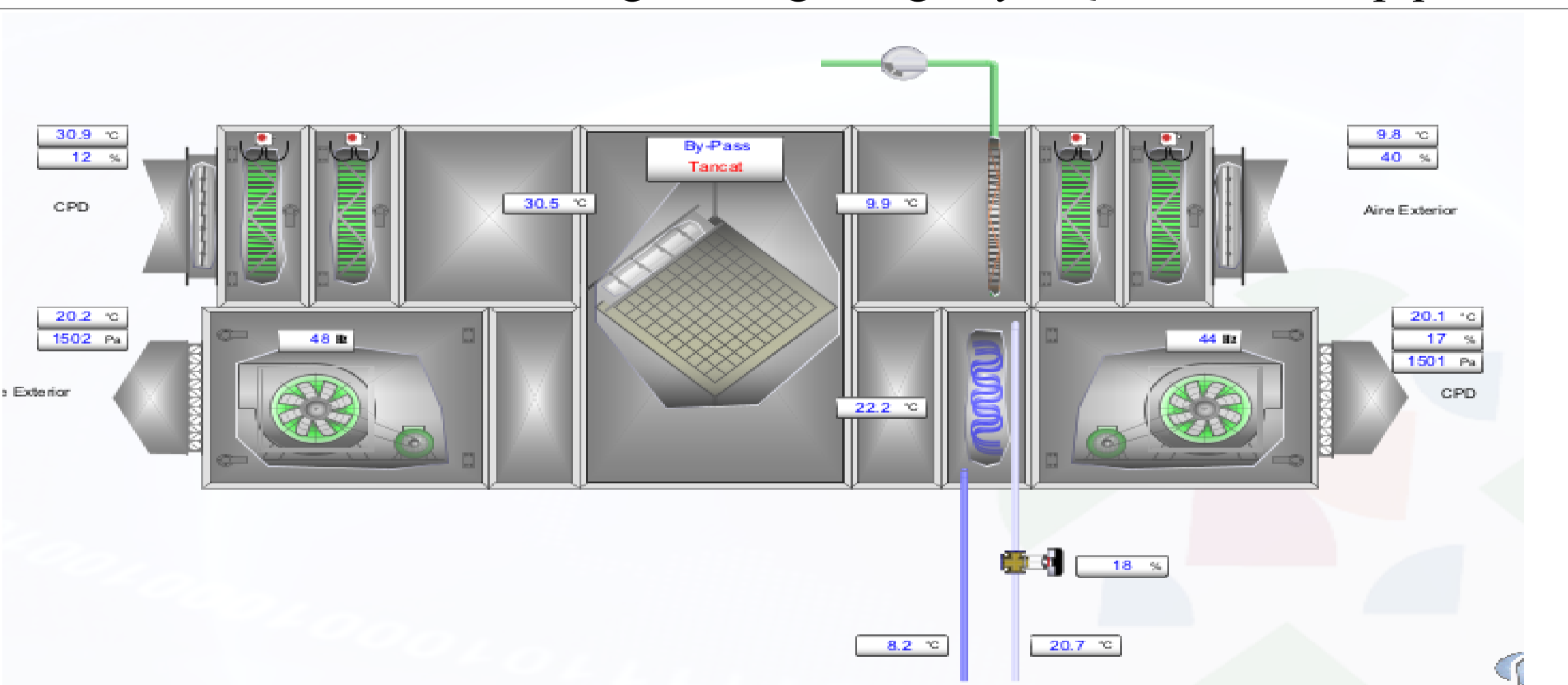
- Exterior Air Loop separated from Datacenter Air Loop
- Air-to-Air Heat Exchanger with Adiabatic and Chilled Water Assist

Cooperative scheme: Each stage lowers air temperature as much as possible

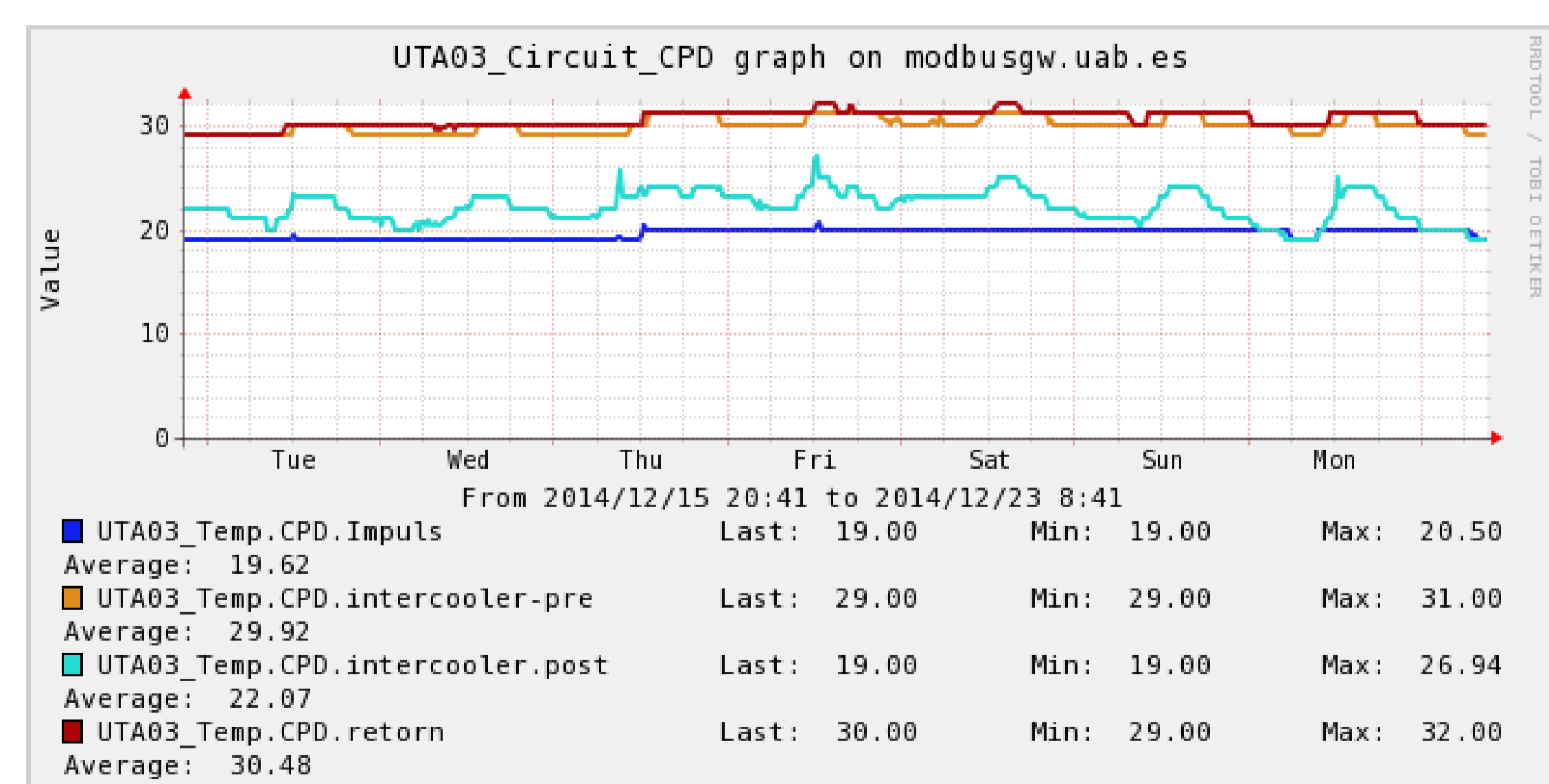


Work done with PIC and UAB data centers running. Downtime: 8 hours.

Equipment by Tecnivel, S.L. www.tecnivel.es
Installation by Agefred, S.L. www.agefred.es
Engineering design by PQC, S.L. www.pqc.es



Integration: ModBus gateway to Nagios/Ganglia



Results: (steady operation since Dec. 2014)

- Seasonal PUE: 1.3 → Yearly Avg. ~ 1.4-1.5
- Investment will be recovered in < 4 years
- Non-constrained cold aisle air flow allows increase of cold air delivery temperature from 13°C to 21°C
 - Better compatibility with free-cooling scheme
 - Additional savings by raising chilled water temp.

Note: Additional efficiency has been achieved by introduction of an Insulated Gate Bipolar Transistor UPS in April 2015.

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