Cool-Data

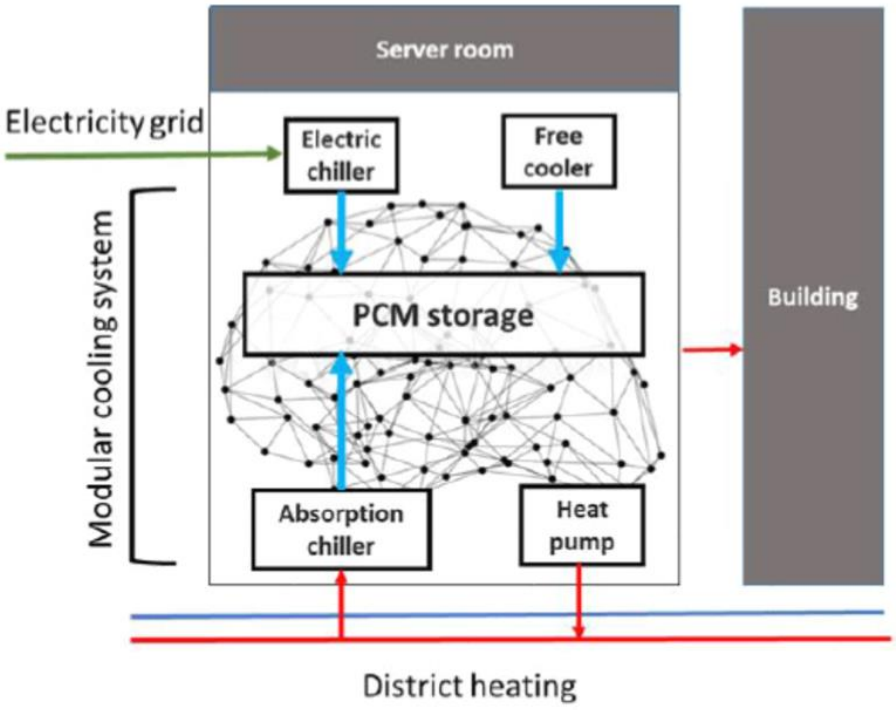

Figure 1: Cool-Data Overview

Summary of IoT case

Cool-Data develops, assesses, and implements an AI-based modular, flexible, secure, and reliable integrated cooling energy system for data centers.

With the integrated flexible solution, Cool-Data aims at significantly reducing the energy need and cost for cooling data centers and actively participates to minimizing the carbon footprint of the sector. The integrated cooling solution supports the utilization of electricity from renewable energy sources by storing surpluses in time in PCM (phase changing materials) storage units. This allows the decarbonized surplus heat generated by the data centers to be used and valorized in district heating with the help of heat pumps.

By using Artificial Intelligence and smart controllers that connect the cooling equipment and the PCM storage, a modular cooling solution capable of responding to reliability requirements in data centers and minimizing the cost for cooling is obtained. By doing so, the Cool Data project targets up to 80 % energy efficiency gains in data centers, resulting in severely limiting the current impact of this sector's growth on carbon emissions.

Moreover, Cool-Data enables UPS systems to access a new revenue as Frequency Containment Reserve in the balancing market. There is the possibility to sell UPS reserve power and storage that is not used for the data center operation as FCR while ensuring the reliable operation of the data center. The pro of operating as FCR is that prices are favorable, but the main downside is the difficulty to forecast the balance market.

Cool-Data also assess the business and environmental benefits of scaling up the solution in terms of energy efficiency, flexibility, excess heat utilisation, and CO_2 reduction.

Cool-Data is a research project funded by Innovation Fund Denmark led by DTU Compute and involving 8 partners in Denmark:

- 3 research groups: DTU Compute, DTU Civil Engineering, DTU Management
- 1 non-profit research institute: Center Denmark
- 2 Danish manufacturers: EnergyCool and Purix
- 1 air traffic controller: Naviair
- 1 Danish district heating utility: GEV

Learnings and results

A reinforcement learning algorithm was successfully developed, and it managed to keep the server rack temperature at 30 °C by using the cooling equipment in an efficient way.

A pilot storage set up using paraffin has been already studied. It consists of 8 kWh storage capacity and 115 liters of PCM. Currently, the design is being optimized further.

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FACTS ABOUT THE PROJECT

IoT Catagory: Optimize heat pump operation
Goal: Reducing the energy need and cost for cooling data centers and actively minimize the carbon footprint of the sector.
Beneficiary: Data centers
Data required: Data center cooling requirements, balancing market prices
Analysis method: energy balances and control engineering
Modelling requirements: stochastic MILP
Quality-of-Service: nearly real time
Project participants: DTU Compute, DTU Civil Engineering, DTU Management, Center Denmark, EnergyCool, Purix, Naviair, GEV
Time schedule: 01/09/2020 → 31/08/2023
Technology availability: TRL 6
Link to webpages:
https://cool-data.dtu.dk/
https://www.linkedin.com/company/cool-data/