

Thermal Energy Storages

for cooling applications optimization

based on Artificial Intelligence algorithms



Contact : jeremie.fricker@engie.com

Operators of cooling district networks have a complex role

They constantly must provide the cooling capacity to meet the cooling needs for each client while minimizing operational costs, energy consumption and CO2 emissions.

Thermal Energy Storage (TES) like chilled water storage or ice storage, is regularly mentioned as a way to improve safety and generate operational savings. But these potential savings could be achieved if the TES is well designed and managed.

TES Design Optimization

Algorithms test several technologies, sizes and control strategies to help engineers to design their TES, based on:

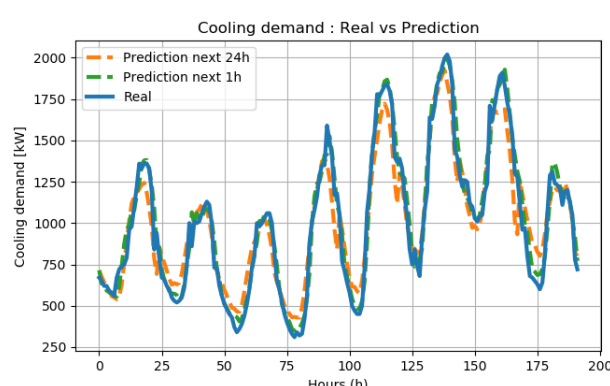
- ➔ Cooling plant general parameters
- ➔ Electricity prices
- ➔ Equipment model
- ➔ Energy balance
- ➔ Cooling profile loads

The results of these high-speed simulations (1-year simulation time ~ 7 minutes of computation time) are displayed in graphs to compare the solutions and finally to assist in decision-making.

Cooling demand forecast

Cooling demand prediction based on:

- ➔ Long Short-Term Memory networks
- ➔ 1-year of historical data



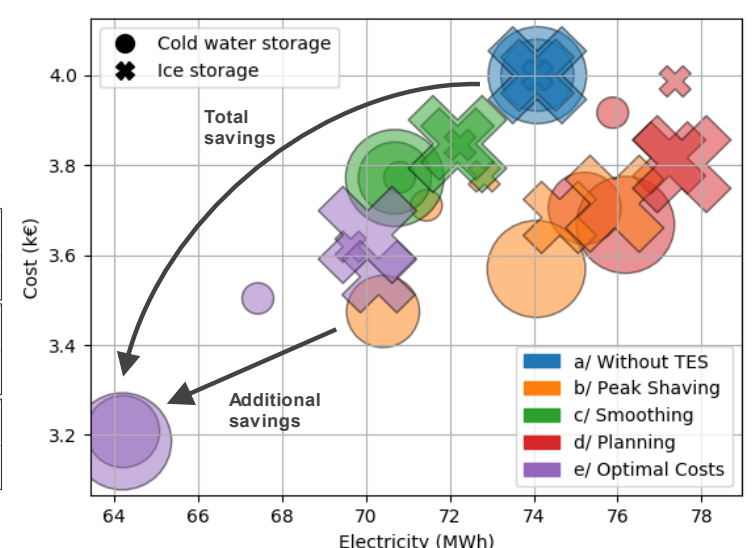
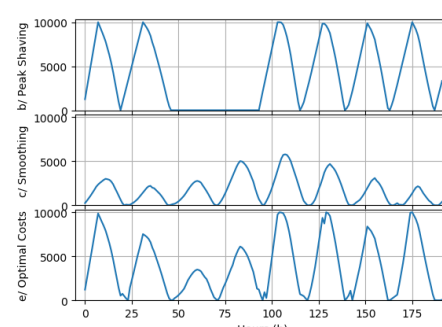
Good results for short-term (1h) and middle-term prediction (24h)

Is it possible to further optimize TES usage?

The predicted cooling demand profile is now an input for an optimization algorithm. This is implemented to find out the best daily charge and discharge curve of the TES with the aim to minimize:

- ➔ operational costs
- ➔ electricity consumption

In this case : optimal TES usage strategy, which brings additional savings, is a mix between smoothing and peak shaving



These algorithms answer to issues of finding out the best design and production strategy for TES

Even if R&D improvements are possible by getting better accuracy or reducing calculation time, the current real challenge is to integrate these methods into our operational processes to do predictive management of our cooling plants as a decision making tool for operators.