



## Danfoss Leanheat® Building

**As a new approach to predict and optimize the heat demand, Danfoss Leanheat offers a software solution to optimize the centralized heating system of multi-family buildings. Fully automated and self-learning, Leanheat® Building provides real-time optimization, not only for substations, but for the entire clusters of the apartment buildings.**

Using Leanheat® Building solution, district heating utilities can serve customers more efficiently and with a smaller carbon footprint as a result. The system collects data from sources inside and outside the building and enables monitoring, data analysis, and remote-controlled adjustment of all parameters. By securing a stable and optimal indoor temperature and a suitable humidity level, the day-to-day comfort of residents is hugely improved.

Leanheat® Building reduces substation peak loads up to 30%. For the utility company, this means the heat demand from the customers can be met from existing peak-load capacity with less need for expensive but environmentally harmful peak-load boilers, and more sales for high-margin base-load heat.

### Tested solutions

Within the HEAT 4.0 project, Leanheat® Building was installed in 13 buildings together with TREFOR Varme and in 12 buildings together with Hillerød Førsyning.

Danfoss Leanheat used two different solutions for building heating optimization, i.e., Full Leanheat® and Leanheat® Sensorless, depending on whether indoor temperature sensors were installed in the buildings or not. During the project, Danfoss Leanheat developed an energy saving module for Sensorless Leanheat®, which allows the sensorless solution also to save energy on top of peak power optimization.

Leanheat® Building saved approximately 350MWh (7%) of the total normalized heating consumption across all 25 buildings during the 2021-2022 heating season while reducing peak power almost by 10% in buildings in Hillerød.

### Cross System Optimization

Danfoss Leanheat worked closely together with HEAT 4.0 partners on cross-system optimization - both peer-to-peer as well as peer-to-cloud-to-peer on the building optimization side.

The objective was to be able to provide aggregated flexibility and load forecast from the buildings to production and network optimization for which Danfoss Leanheat developed a Virtual Heat Storage (VHS) module during the project. Unfortunately, insufficient building mass and lack of production optimization did not allow actuating and demonstrating CSO in real-life in the networks in question within Heat 4.0.

### PARTNERS:

NIRAS (project manager), Dansk Fjernvarme, Brønderslev Forsyning, Trefor Varme, Hillerød Forsyning, Danfoss, Kingspan/Logstor, EMD International, Enfor, Neogrid Technologies, Danfoss Leanheat, NorthQ, Kamstrup DESMI, Center Denmark, DTU, and Aarhus University.



## Leanheat® Virtual Heat Storage

Leanheat® Virtual Heat Storage (VHS) combines flexibility from several buildings to one aggregated set of properties. Roughly 30% - 40% of the residential buildings' heating power can easily be controlled depending on outside temperature. VHS provides data series on the current energy storage state in the buildings, available flexibility in terms of energy and power as well as control forecasts 7-days ahead.

VHS can be integrated to a production optimization or to a middle layer, such as a HEATman Cloud. VHS is already operational in several district heating

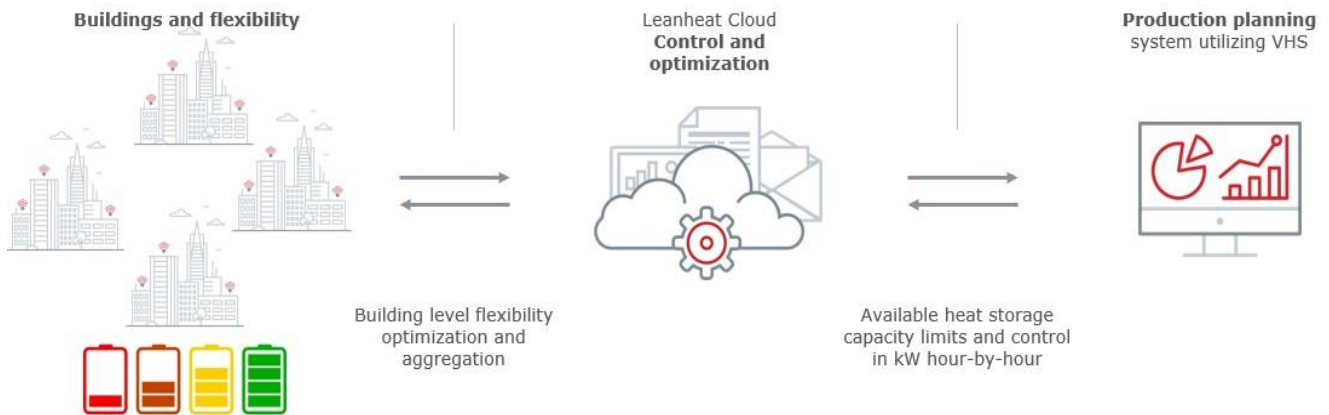
networks, and building-level optimization has been directly integrated to several different production optimization software systems since late 2021. Currently, Leanheat can confirm approximately 15-20MW of flexible heating power capacity in total during peak periods via demand response with several district heating utilities in Finland.

Leanheat® VHS integration is based on REST API, which is an industry standard and HEAT 4.0 compliant. Unfortunately, the Leanheat® VHS integration with Center Denmark was not finalized within this project.



### More about HEAT 4.0

- Leanheat Building saved on average 7% in total heat consumption and cut peak power by ~10% in 25 buildings
- Leanheat Building partnered in Cross System Services and is 'Heat 4.0 Ready'
- Improved building optimization models to better suit the Danish heating market
- Robust aggregation of flexibility in buildings via VHS to enable demand response



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