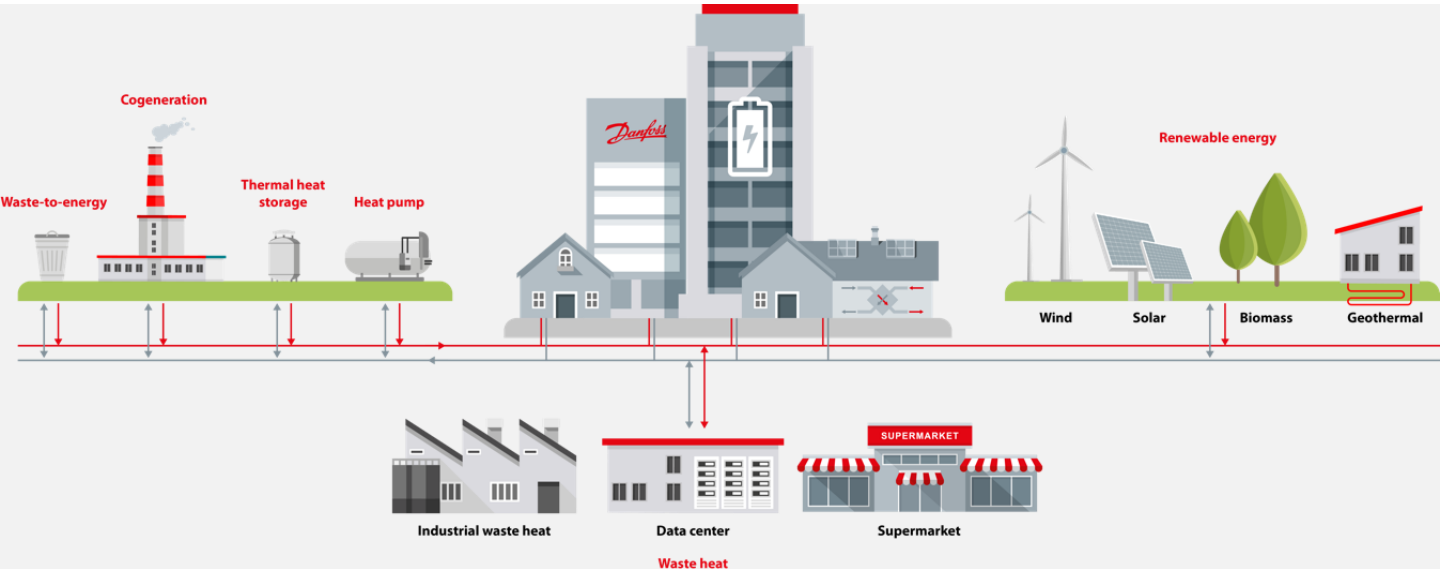


Sustainable Energy Systems – Powered by digitalization

"*The greenest energy is the energy we don't use*", this is the doctrine, Danfoss complies to running its business as well as in creating solutions for clients. Climate Solution technologies support the transition to a decarbonized, digital, and more sustainable tomorrow by providing a broad portfolio of energy-efficient solutions which improve energy performance in buildings, reduce food loss, and make our cities cleaner.

We can prove reliable solutions to meet many of the climate, urbanization, and food challenges. Driven by the power of an electrified society and fueled by the opportunities of going digital, Danfoss is dedicated to engineering solutions that can unleash the potential of tomorrow. This is how we engineer tomorrow and build a better future.

Digitalization supports Integration of Renewables and Waste Heat into Sustainable Energy Systems
The request for greener and more efficient energy systems challenges the energy sector in several ways:

- a shift from single-source to multi-source energy supply,
- replacing fossil fuels by renewable energy sources
- a supply of industry excess heat into the system.

Supplies from renewables, particularly solar and wind, tend to fluctuate much more than traditional fuel. These changes call for highly flexible systems that run efficiently with low temperatures and can easily be extended with new energy sources and new supply areas. This is what we call District Energy 4.0.

Stable End-to-End System from Supply to Demand
Digitalization enables state-of-the-art control of temperature and flows, inter-connecting production plants, distribution network, buildings, and individual homes in real-time balancing of supply and demand. Digitalization uses data from sensors and energy meters in all parts of the network to analyze and predict heating/cooling demand and production. Digitalization allows optimization of the system and enables remote control. Digitalization paves the way for predictive maintenance, improving the reliability, uptime, and service life of the system.

Digitalization is Opening Unleashed Opportunities in Future Energy Systems Efficiency
By partnering in research and development activities, such as HEAT 4.0, we explore digitalization in our core areas of temperature, flow, and pressure control by using:

- Internet of Things to gather and evaluate real-time data,
- Artificial Intelligence to predict energy consumption to continuously optimize operation and match consumption with supply at any time, as well as
- Augmented reality to support installation, inspection, and maintenance of facilities.

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.

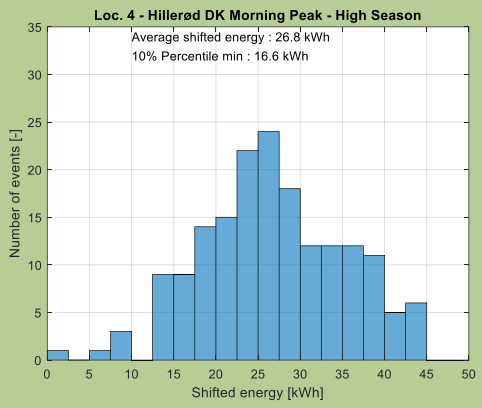
Insights on domestic hot water consumption for multi-flat buildings

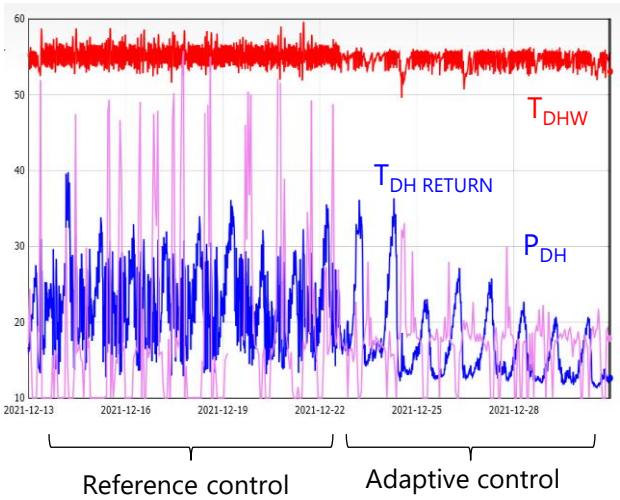
When talking energy optimization and load flexibility of buildings connected to district heating systems, the focus has traditionally mainly been on the space heating systems.

However, in larger buildings - storage tank-based domestic hot water systems are often installed. These storage tanks offer opportunities for load shifting and peak load management.

Results from this project have given detailed insights into domestic hot water load pattern in 5 multi-flat buildings and form the basis for investigating the potential for smart control e.g. by load shift.

Looking at the capacity, one more interesting result of the project is, that the load shift potential for domestic hot water systems is just as relevant to activate equivalent to the case for the heating system.





More about HEAT 4.0

- Deep insight to domestic hot water tapping profiles for various buildings
- Developed, tested and verified new adaptive control strategies for domestic hot water storage tank systems
- Reduction of the district heating return temperature of 2-4 centigrade for the service of domestic hot water
- Based on analysis, load shift potential from domestic hot water tanks are relevant to develop further.

Adaptive control strategy for domestic hot water storage tank

Requirements for improved energy efficiency and increased utilization of renewable energy sources as well as waste heat, the district heating supply temperature in the network will inevitably be reduced where it is possible. A low district heating return temperature is necessary to support this future trend.

An adaptive domestic hot water tank-control principle was developed and tested in five multi-apartment buildings.

The developed control strategy is compared to a standard reference control strategy in terms of maximum capacity demand and district heating return temperature. Results of the project are novel control methods that prove to support the lowering of the district heating return temperature from these installations by 2-4 centigrade, which is very significant. Besides this, a reduction of the peak capacity demand is obtained, and the number of high-load peaks is reduced.

Get in touch with us:

Jan Eric Thorsen
jet@danfoss.com
+45 3058 0444

Atli Benonysson
atli.benonysson@danfoss.com
+45 29495044

www.HEATman.dk