ENGINEERING TOMORROW

# Digitalization in DH: Danfoss Leanheat end-to-end solutions—from innovative technology and components to optimization tools and services.

***Povilas Dambrauskas***
*Key account manager.*
*District energy.*
Danfoss Climate Solutions

ENGINEERING
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# Who is Danfoss?

# Danfoss at a glance

Worldwide sales in more than

100

countries

Three strong business segments with leading positions

**Power Solutions**

**Climate Solutions**

**Power Electronics and Drives**

Leading technology partner for our customers who want to decarbonize through energy efficiency, machine productivity, low emissions, and electrification

+42,000

Employees worldwide. People are the foundation of our business

Well on the way towards carbon-neutral global operations by 2030

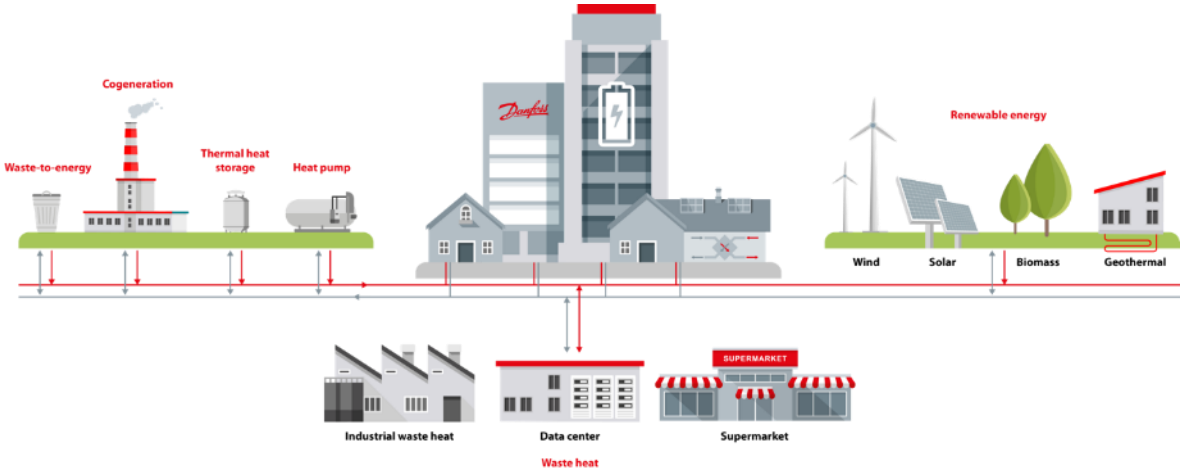
97

Factories in more than 20 countries

1933

Long track record within innovation and engineering

# **Trends** driving the district energy evolution




From single source to...

**MULTI-SOURCE**

From fossil to...

**RENEWABLES & SURPLUS ENERGY**

From high temperature to...

**LOW TEMPERATURE DISTRICT HEATING**

# **Key Challenges** in District Energy

## ΔT Optimization

Economical balance between temperature and flow

## Optimal Network Design

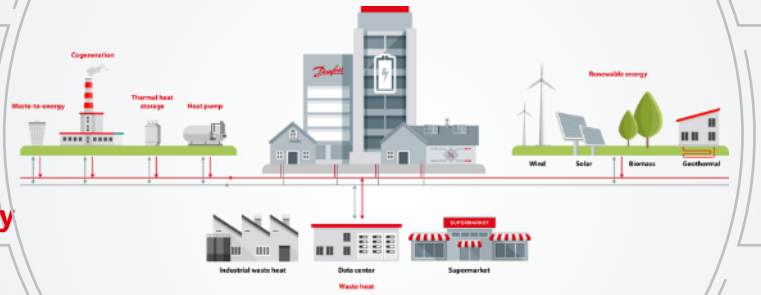
With new connections and new buildings

## Decentralization - Increased source complexity

In production: more heat sources including renewables

## Decarbonization

Legislation and environmental care / energy efficiency




## Peak energy demand

Drives up overall cost (OPEX as well CAPEX)

## Legacy SCADA

Make data integration less difficult and time consuming

## Increase focus on business models

Create attractive business environment for future

## Resilience

Secure high efficiency of operation in unexpected conditions

# **Key challenges** in district energy

**Min 1%**

**reduction of primary energy generation cost for each 3K of ΔT increase**

**Up to 17%**

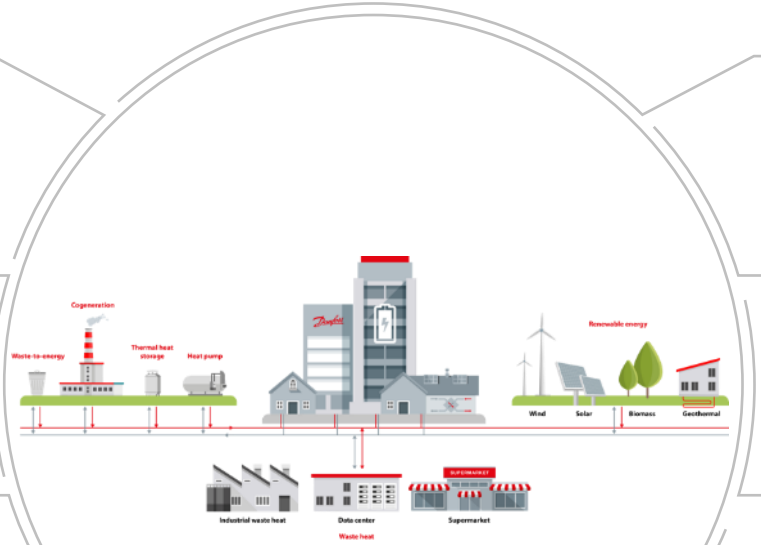
**Investment reduction (compared to traditional design)**

**Support**

**achieving 27% target based on EU renewable energy directive**

**Reduce**

**CO2 emissions in your system by optimizing energy efficiency**




**Up to 20 %**

**energy demand peak reduction**

**Up to 30%**

**enhanced work efficiency (compared to traditional SCADA)**

**Increase focus on business models**

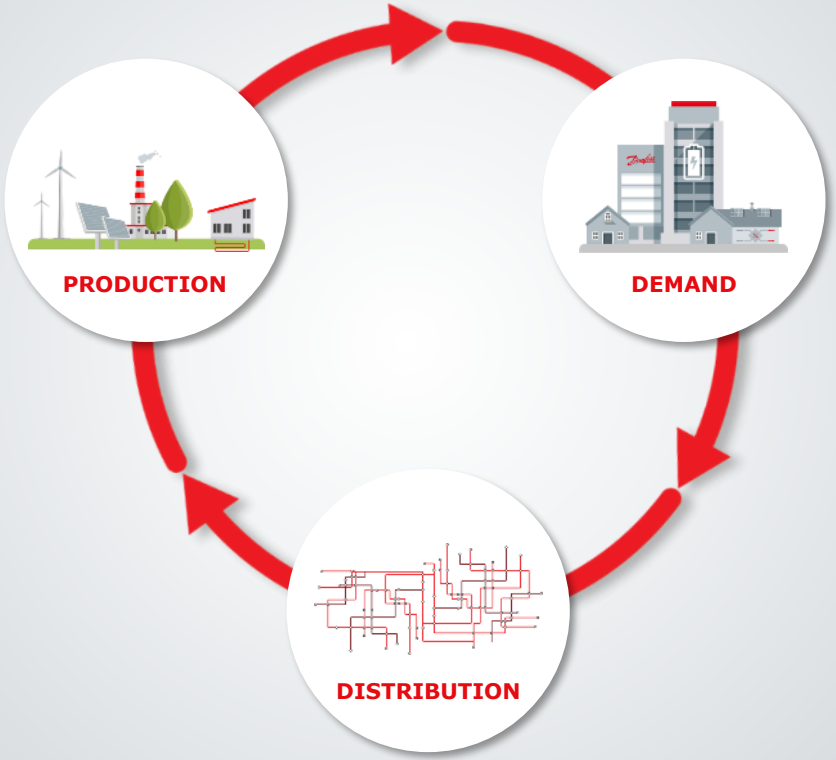
**Create attractive business environment for future**

**Ensure**

**resilience with end-to-end optimization of your system**

# Increase operational efficiency and reduce cost with smart, **end-to-end optimization**

**Danfoss Leanheat®** is an innovative suite of **end-to-end optimization solutions** that harness the power of digitalization to help users in the entire district energy network increase operational efficiencies, decrease costs, and accelerate the green transition.



# Danfoss Leanheat® **is leading the green energy transformation**

A complete portfolio of products, components, and software for end-to-end optimization.

**Leanheat® Production**

**Leanheat® Network**

**Leanheat® Monitor**

**Leanheat® Building**

**Heat exchangers, line components**

**Motorized valves**

iNET

**Self acting diff. pressure controls**

iSET

**Substations**

**Intelligent controllers**

**Heat meters**

**eTRV**

**ASV**

# **Danfoss Leanheat®** software suite & services
# End-to-end energy optimization solutions

| **Leanheat® Production** (LHP) | **Leanheat® Network** (LHN) | **Leanheat® Monitor** (LHM) | **Leanheat® Building** (LHB) | |
|---|---|---|---|---|
| Load forecasting | Network design | Monitoring and control | Peak load optimization | Customer engagement |
| Data Driven temperature optimization | Online visualization of network operation | Easy data integration, extraction and interpretation | Energy optimization | Return temperature optimization |
| Production optimization | Hydraulic supply temperature optimization | Integrate devices with different protocols | | |
| Production planning | Pressure optimization | | | |

Data API HUB

AI Engine

**Primary Side**
(Planning, Network operation, Production)

**Secondary Side**
(Buildings)

# Leanheat Monitor

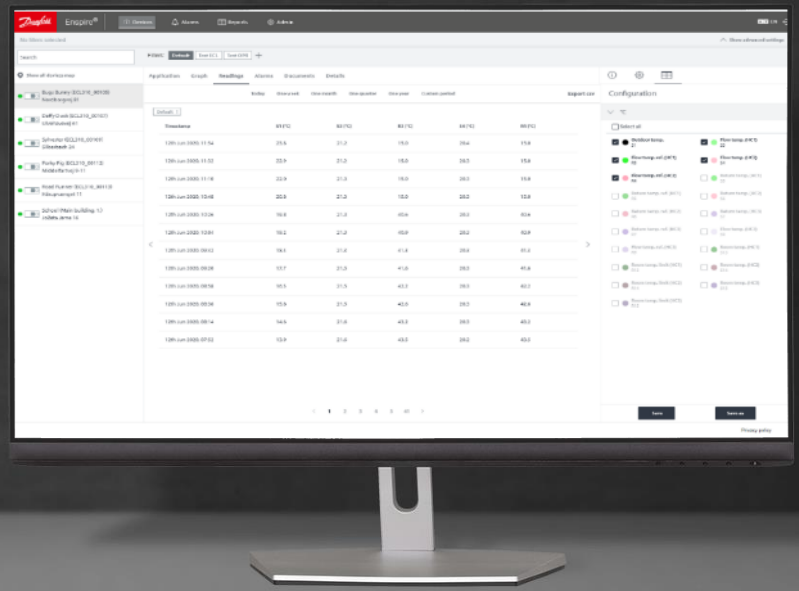
Titan™ by Danfoss

# Leanheat® Monitor

## Improve and control operational management

Leanheat® Monitor—an advanced software tool for **remote monitoring**, **control** and **optimization** of your district heating:

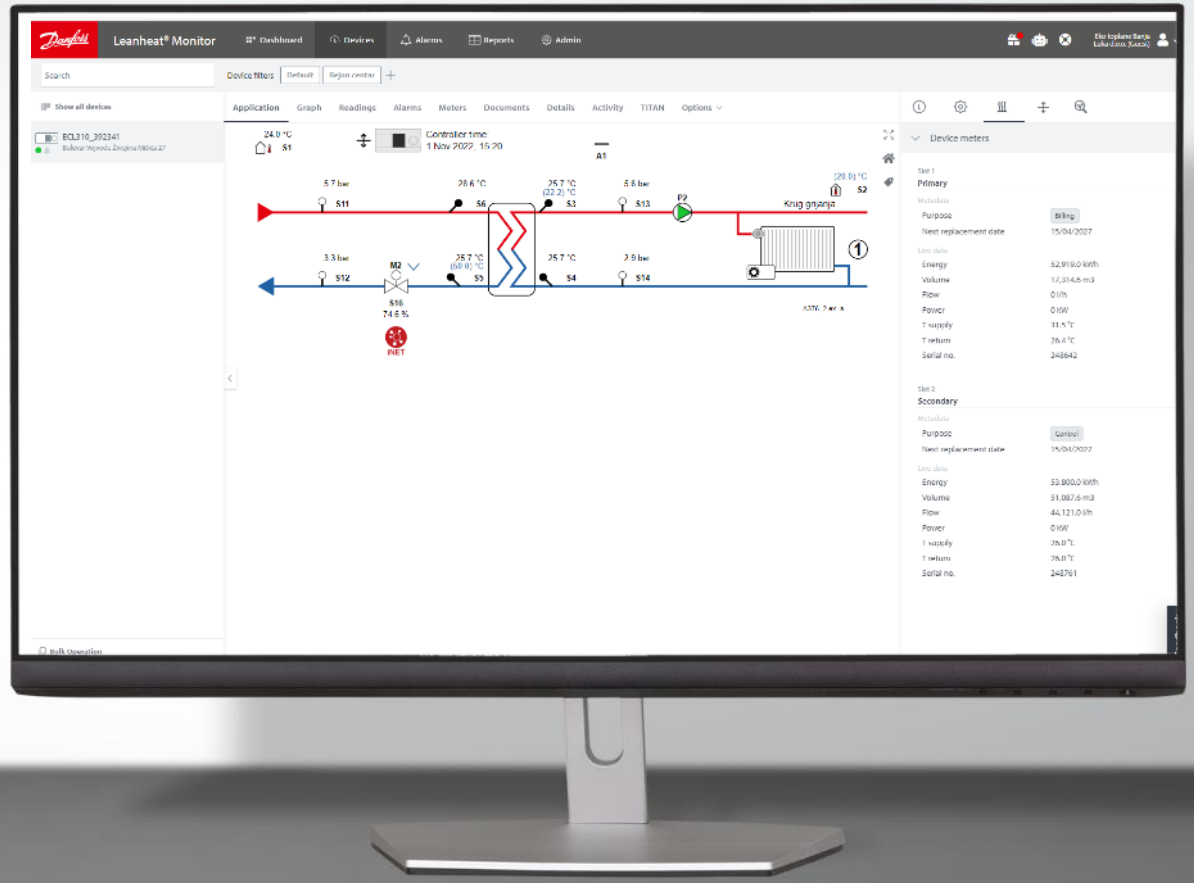
- Open, connected, and transparent
- Modern, web-based solution
- Customized for district energy
- Lowered investment and predictable operation costs



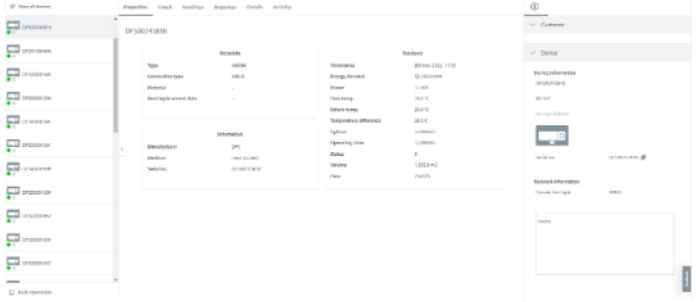
*Development overview*

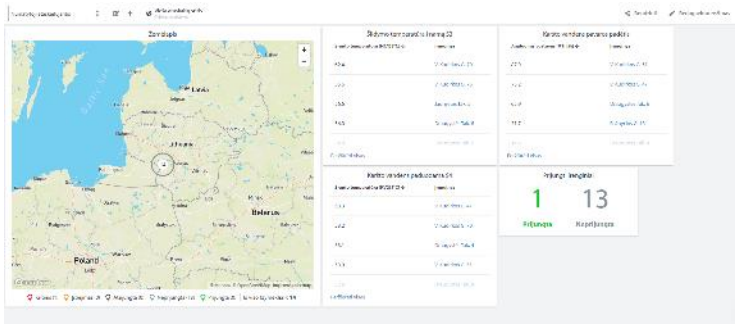
# Smart substations support your commissioning phase

- Substation Commissioning
- The tool offers three commissioning procedures to be used during initial substation commissioning:
- Setup Danfoss recommended controller parameters for specific application and design conditions
- Calculate and deploy Danfoss optimized PI parameters for the control loop
- Automatic remote setting of Maximal flow or Differential pressure.
- The tool also provides a commissioning report generator



# LHM for heat meters data collections



# Leanheat™- how it works?

ECL 310

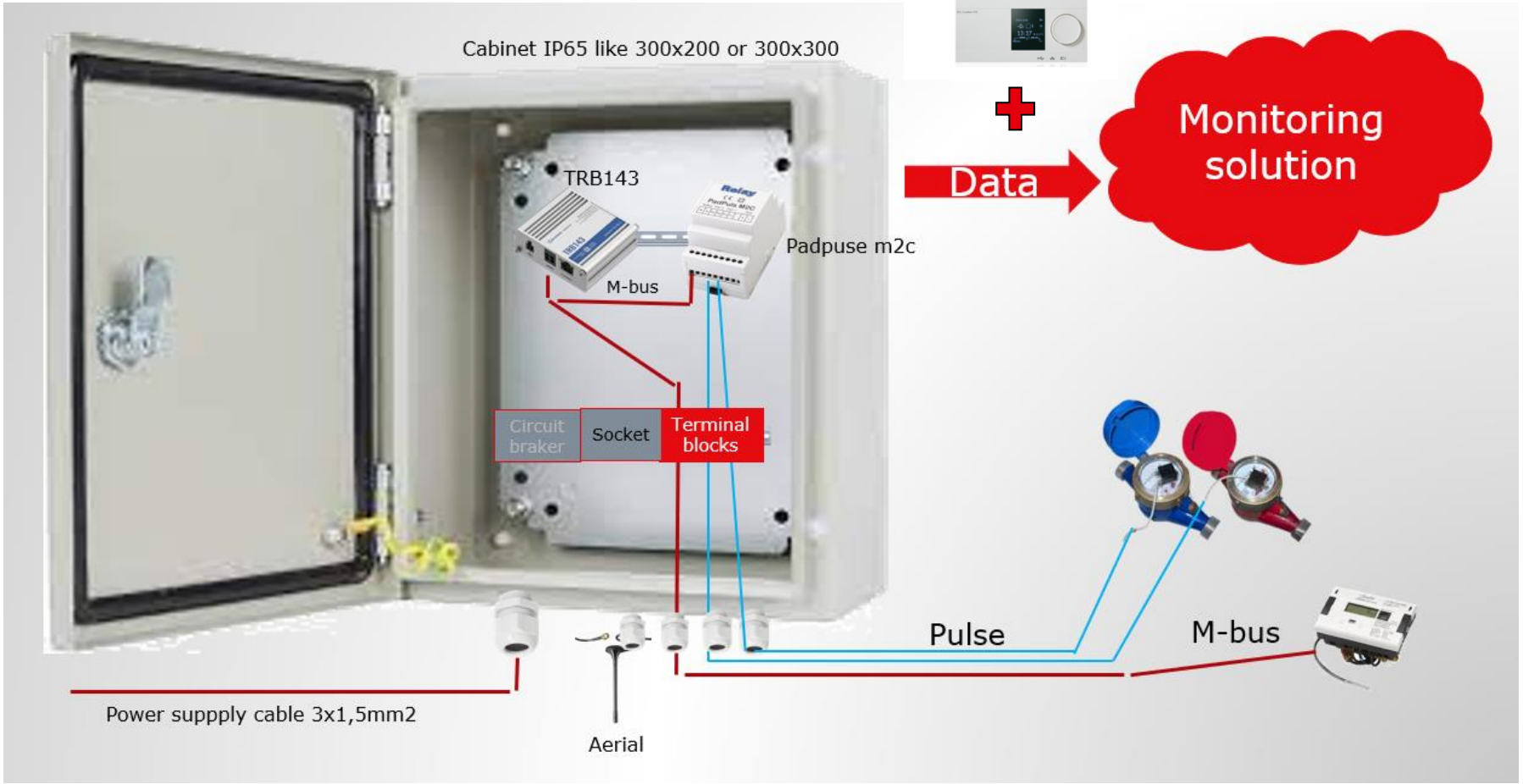


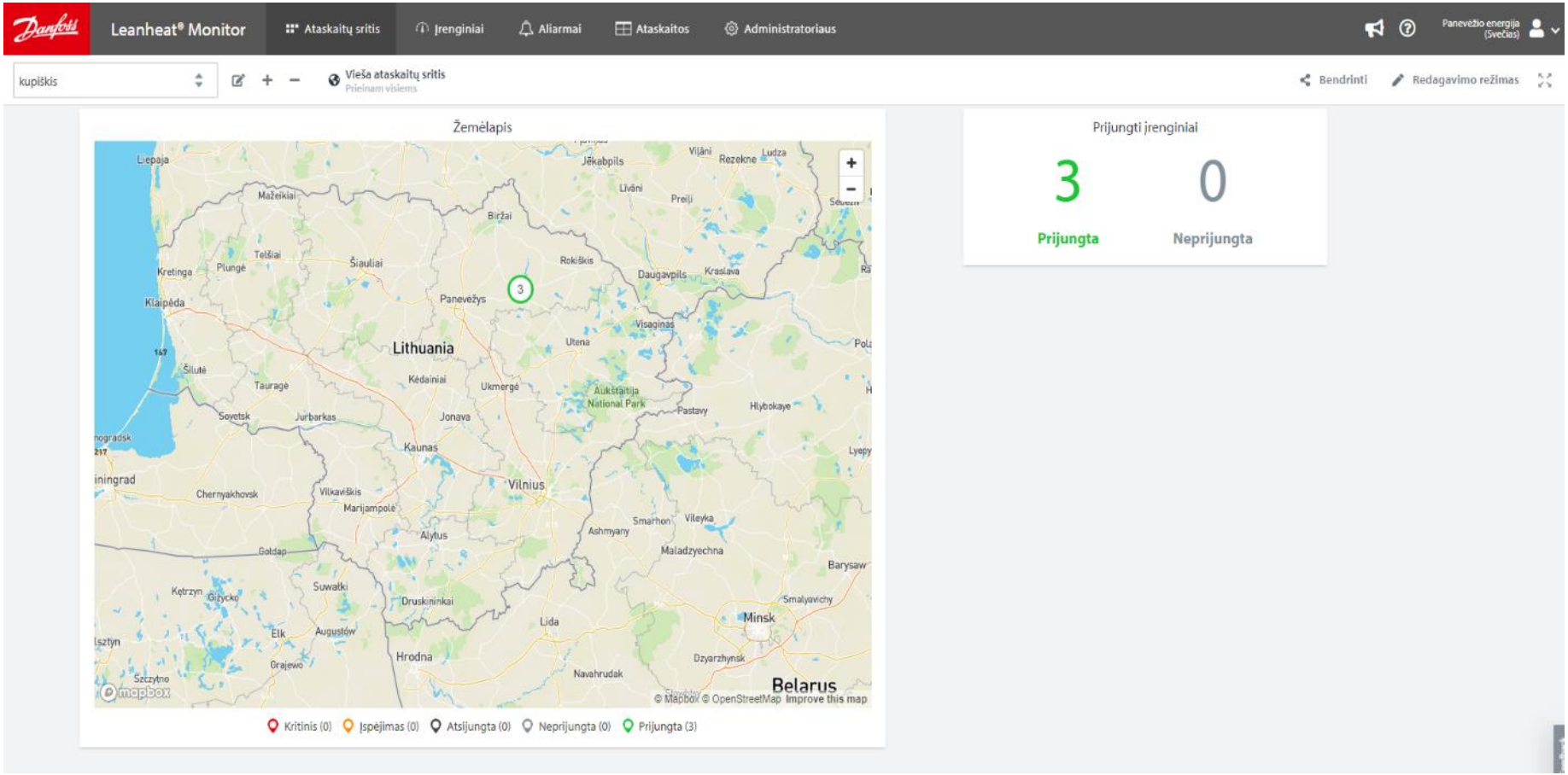
Ethernet connection

ECL 210

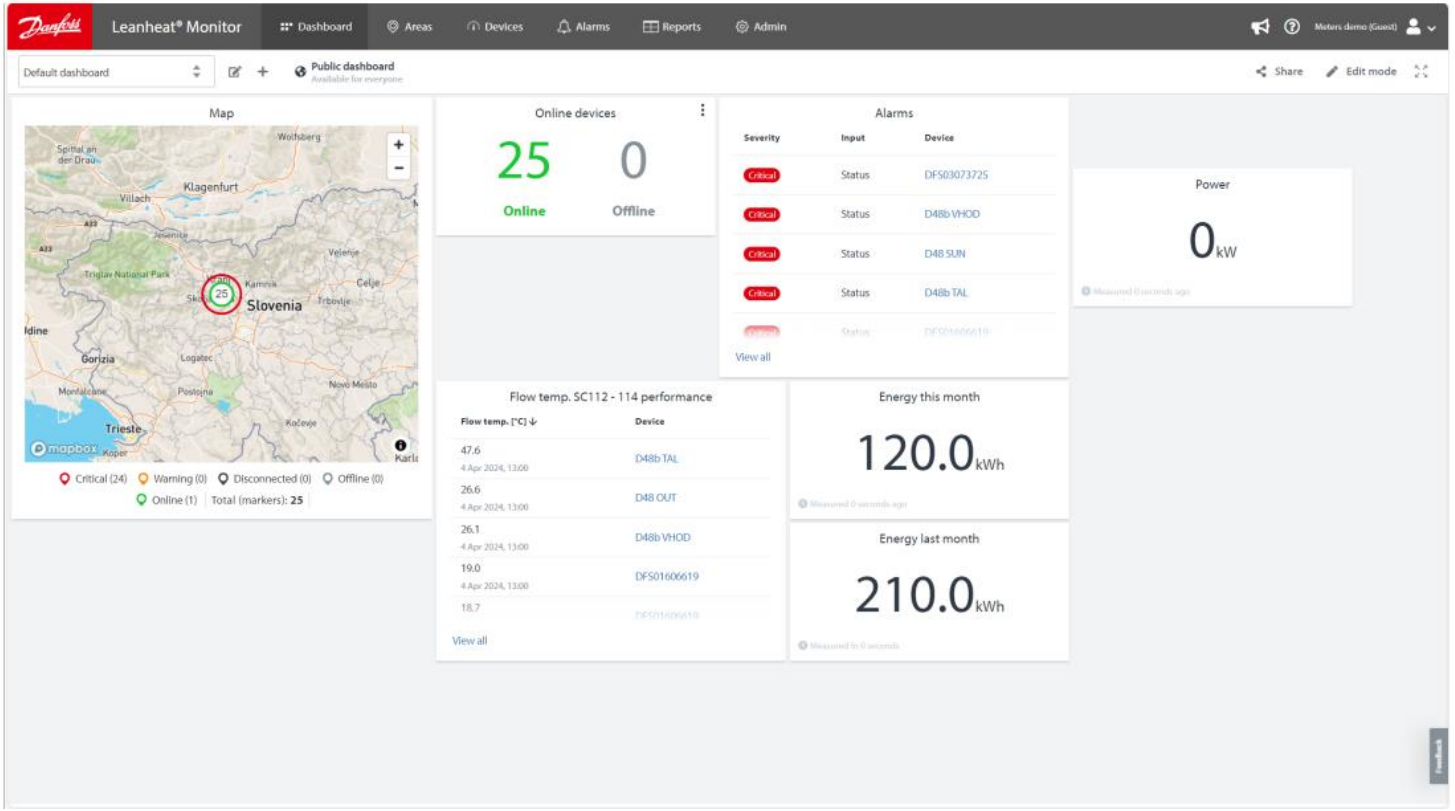

LeanHeat

ECL 310

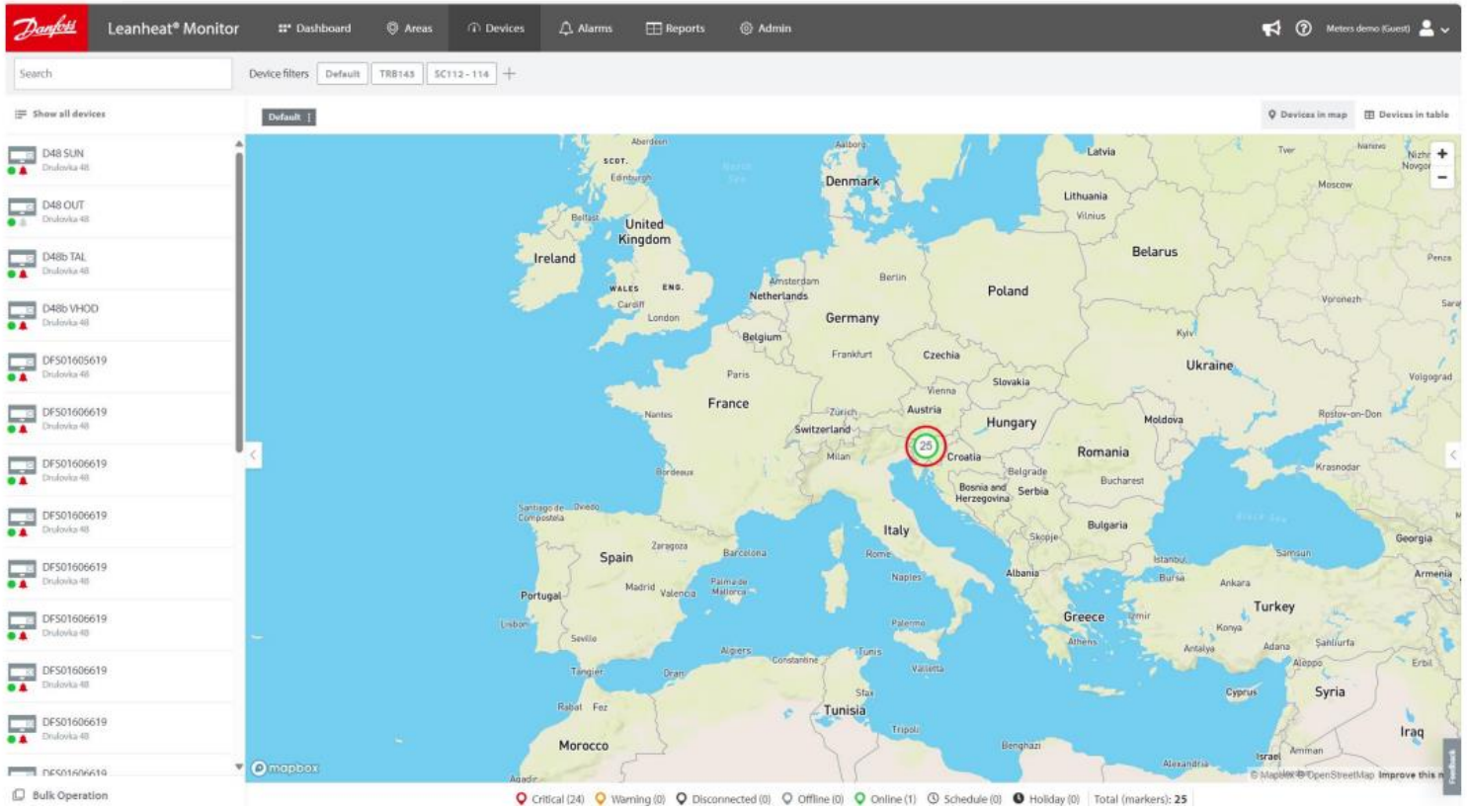




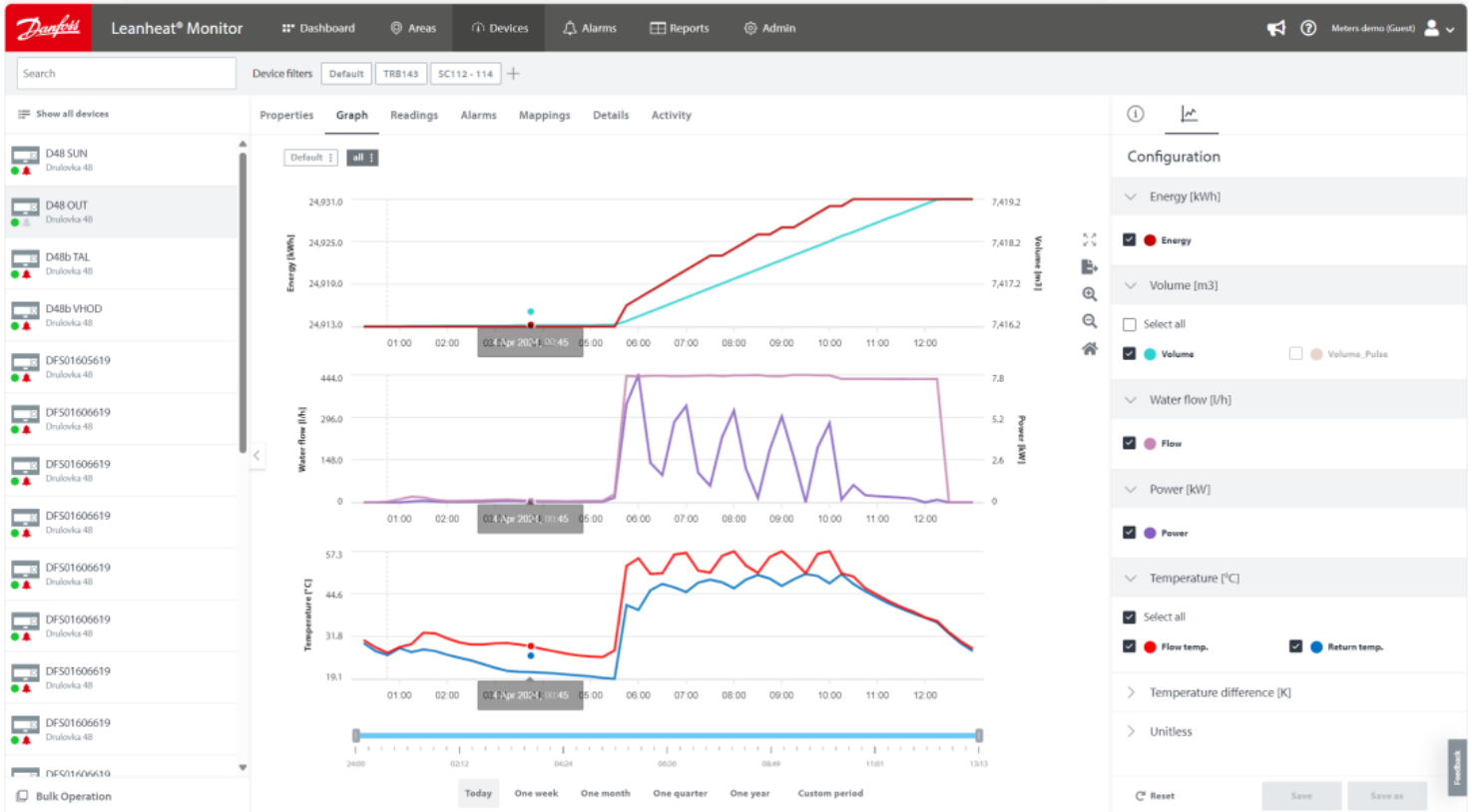
# Leanheat Monitor Metering Dashboard



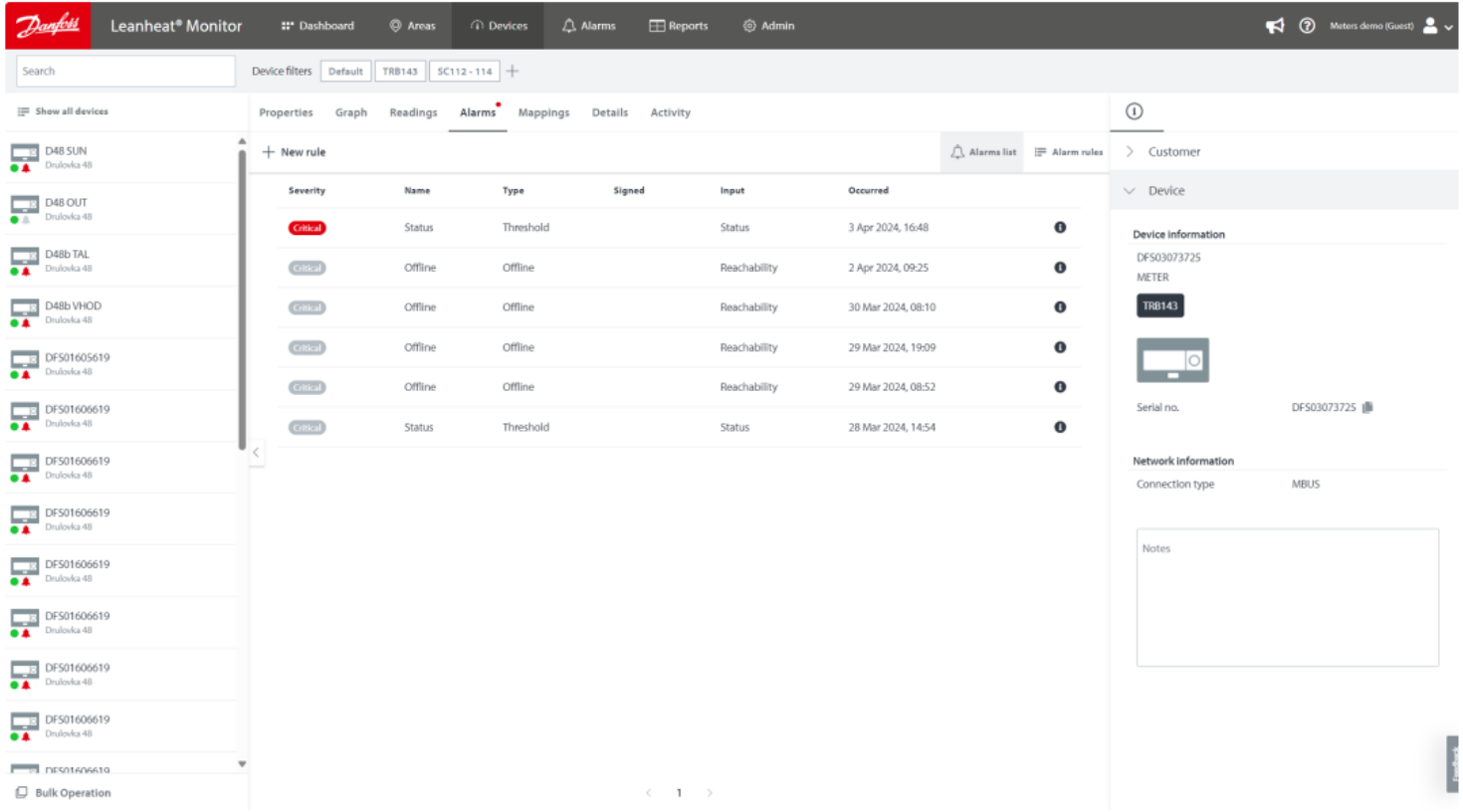
# Leanheat Monitor Metering Devices



# Leanheat Monitor Metering Graph



# Leanheat Monitor Metering
# Alarms



# Leanheat Building

# Leanheat® Building

## Better indoor climate with less energy and maintenance costs

Leanheat® Building is an **AI solution**, using IoT technology to enables **energy savings, smart heating control & maintenance for buildings**

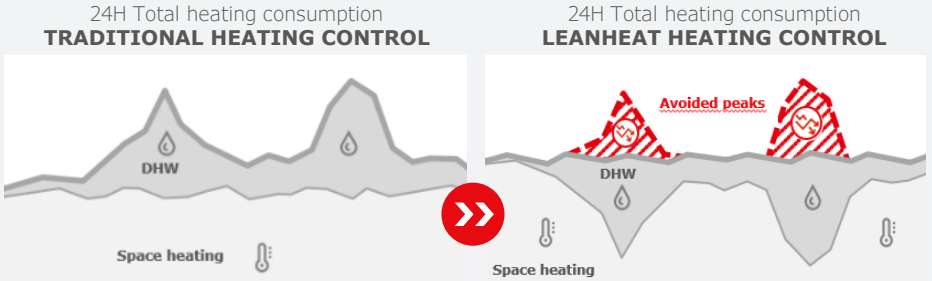
Save energy by **7%** on average

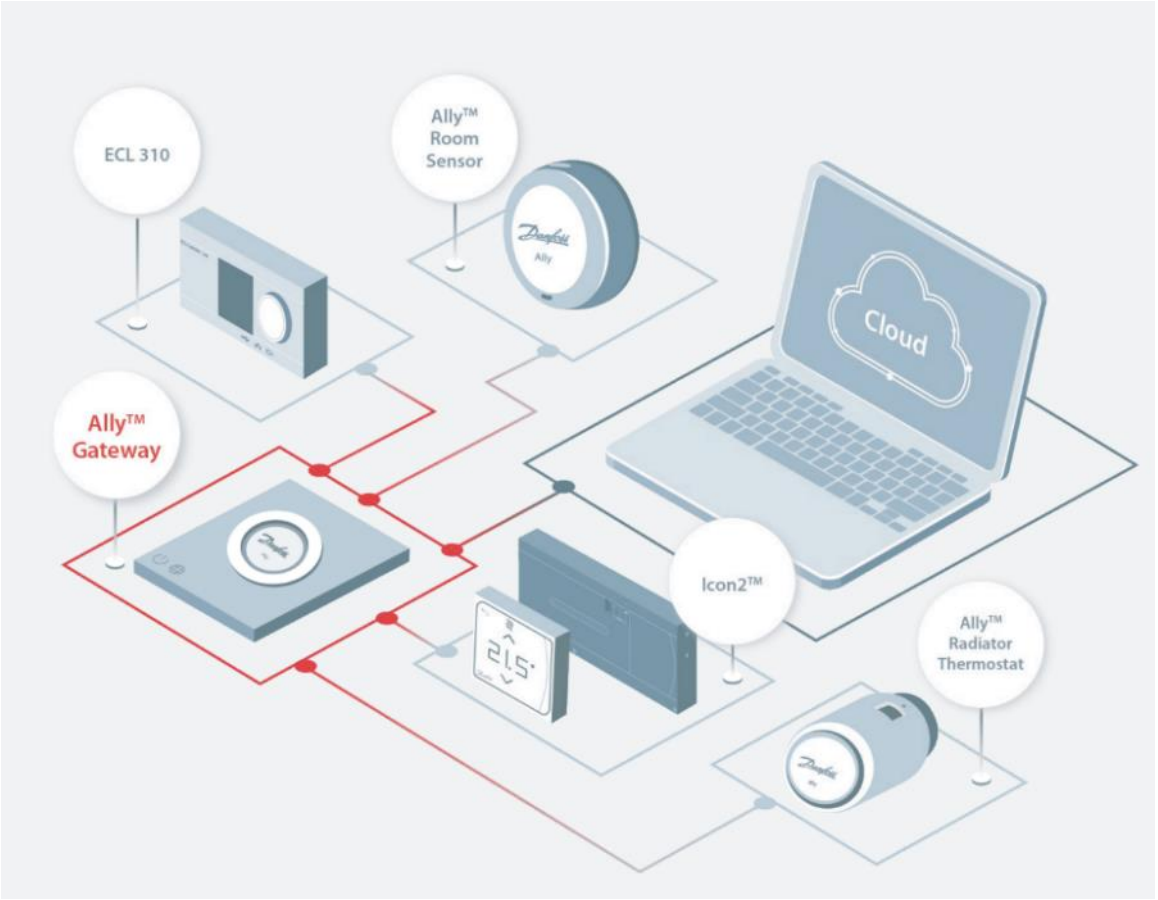
Cut peak power by **20%**

**Optimal indoor** conditions for tenants

Leanheat® Building saves 5-10 % of energy in apartment buildings while maintaining indoor comfort

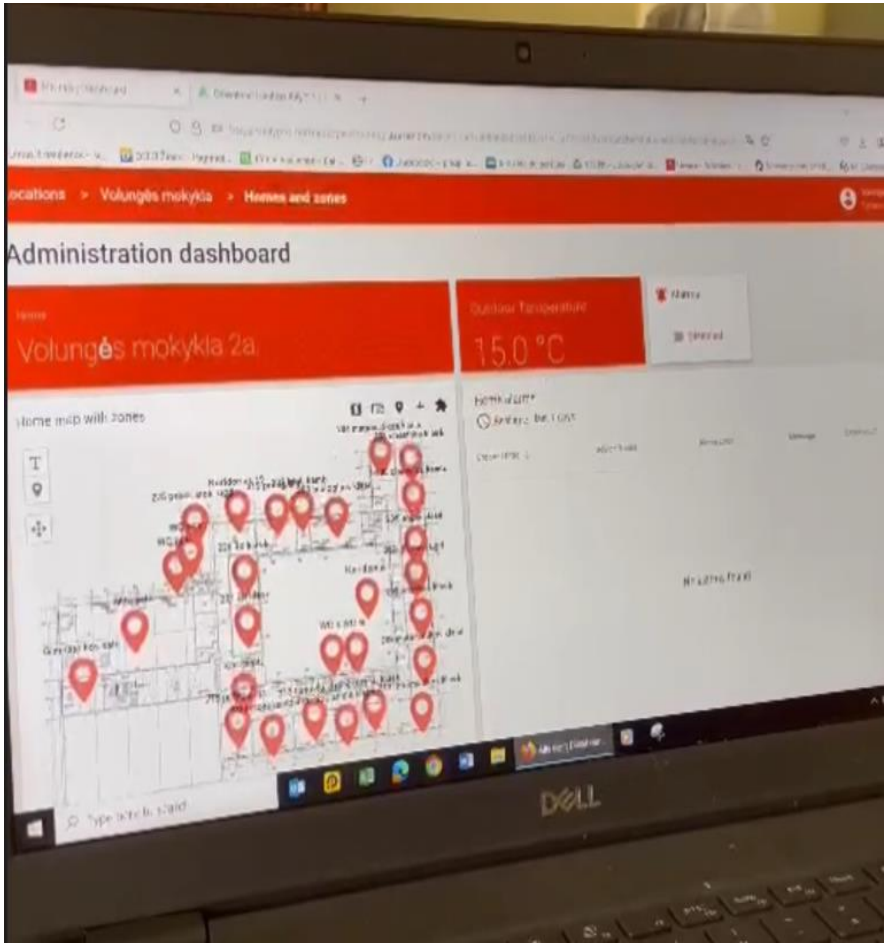
Peak Power Optimization is based on prediction and adaptation

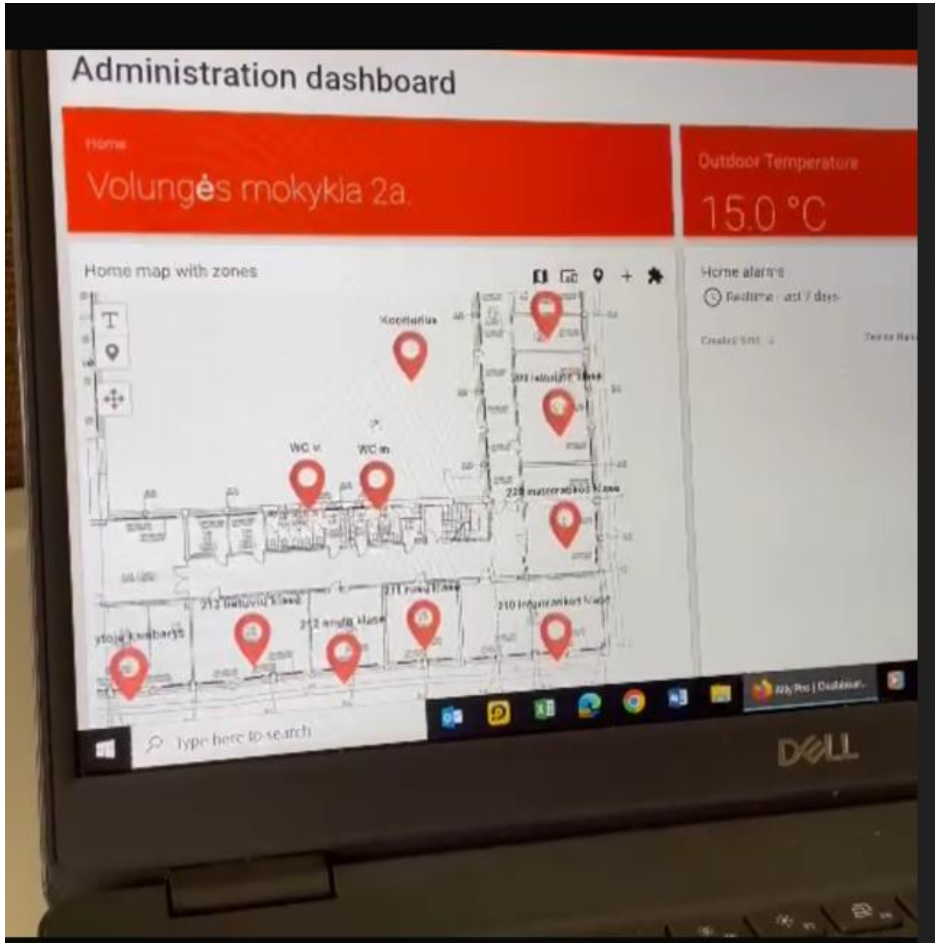






Danfoss Ally™ Compatible



# Leanheat® Network

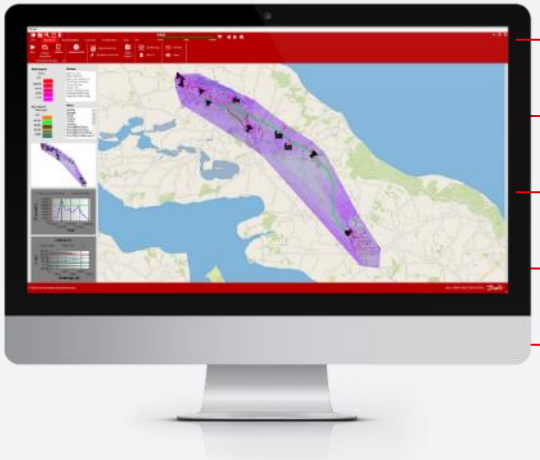
## Design and operate your heat distribution optimally

Leanheat® Network is a **thermo-hydraulic modeling tool**, develop specifically for use in district energy systems to support the **planning, design and operational processes**

**Overall CAPEX and OPEX decrease**

**Energy** and **cost savings**

Ensure **optimal** and **stable distribution**



Calculation of optimal hydraulic parameters

Temperature, flow and pressure at any point

Composition of production sources at any point

What-if analysis for daily operating challenges

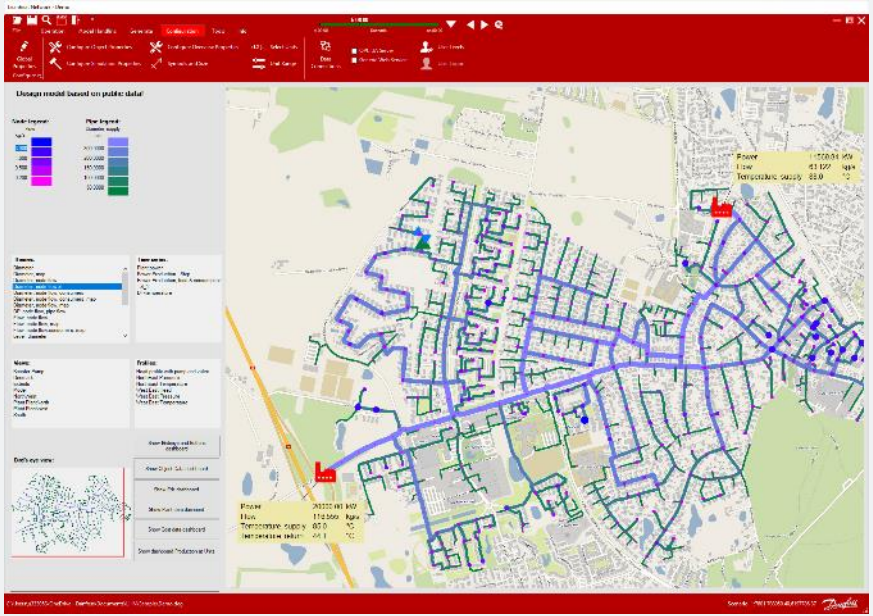
Simulation of future conditions

Up to **17%** investment reduction

Up to **10%** heat loss reduction due to a lower supply temperature

# Leanheat® Network **Designer**

**LEANHEAT® NETWORK** | HYDRAULIC ANALYSIS | FEATURES | HIGHLIGHTS

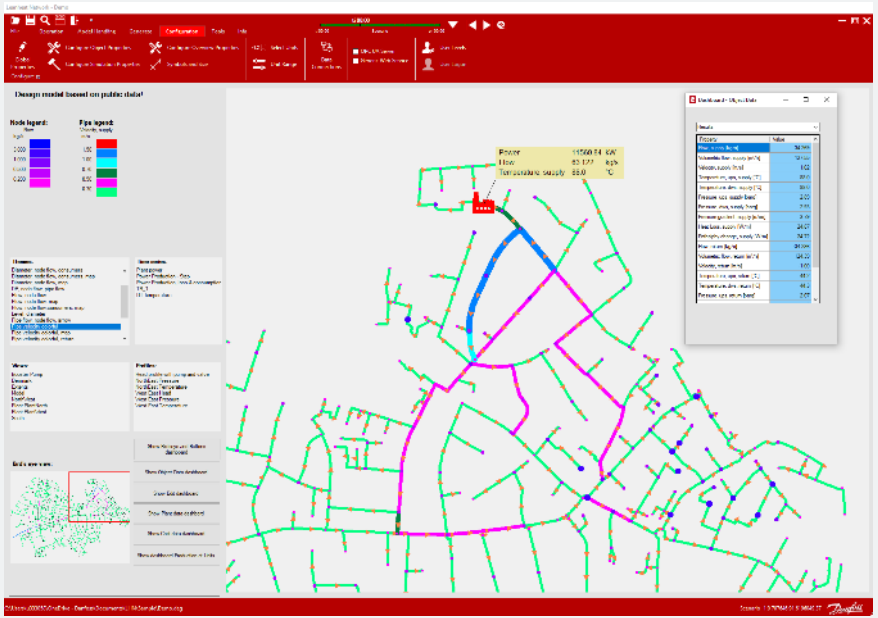


## Leanheat® Network as a planning/support tool

- Optimization of expansions, refurbishments and new connections
- Analysis of impact of expansion, refurbishments and new connections on the rest of the network
- Development of contingency plans
- Database of knowledge about network
- Understand the difference in different alternatives with respect to pressures, temperatures, flows and costs
- Dynamic temperature calculation

# Leanheat® Network **Designer**

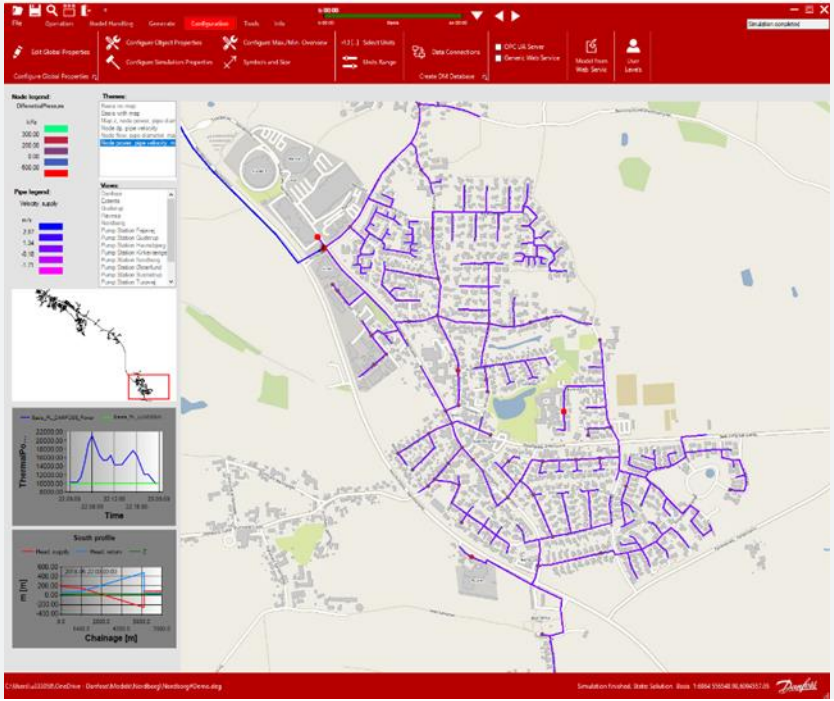
LEANHEAT® NETWORK | **HYDRAULIC ANALYSIS** | FEATURES | HIGHLIGHTS



- What-if analysis
  - What happens if we add new sources?
  - What happens if we add a new area?
  - Do we have any violation of design conditions?
  - Do we have bottlenecks in system?
  - Will a pump or valve solve a problem?
- Validating operation and sizing of accumulators
- Hydraulic and thermal simulations of state (pressure, flow and temperature) in district heating/cooling networks

# Leanheat® Network **Online**

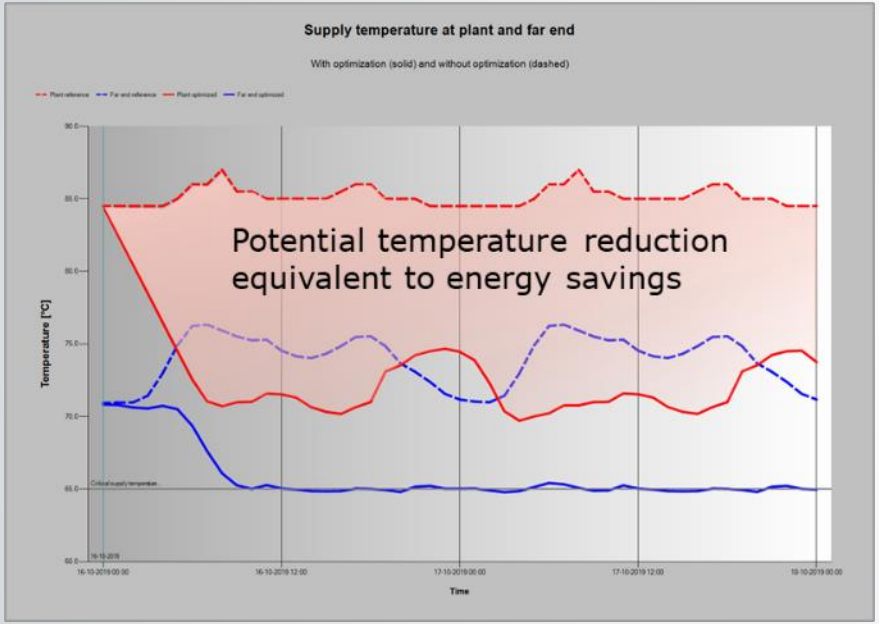
**ONLINE** | FEATURES | HIGHLIGHTS



- Digital twin
- Overview of dynamic state of pipeline network, e.g. pressure, flow and temperature including state of devices.
- Possibility to follow the operational state back in time, now and in the near future
- Possibility to see the consequences of any interaction into the network. E.g. what happens when a valve is being closed, a pump started, or changes are made in the production
- Unlimited access to real and virtual measuring points throughout the whole network
- Operators will understand what happens in network

# Leanheat® Network **Temperature Optimization**

TEMPERATURE OPTIMIZATION | HEAT LOSS REDUCTION | **HIGHLIGHTS**



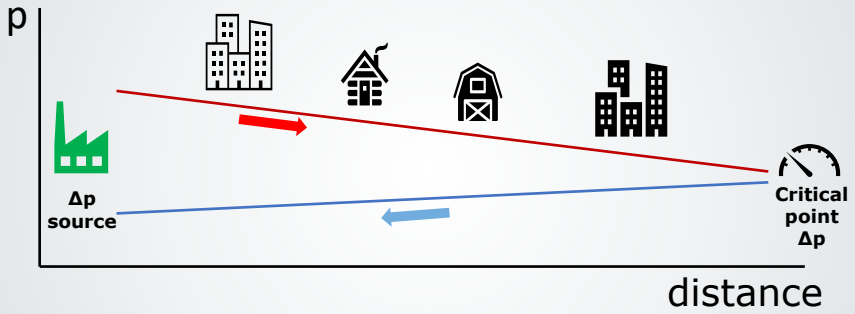

- Reduce the annual supply temperature by app. 6 to 8°C
- Reduce existing pipeline network loss by app. 8 to 10%
- Reduce the production cost up to 2%
- Minimize pressure and temperature fluctuations in the network
- Considerable energy savings. Minimize carbon emission and protect environment
- Reduce maintenance and support of pipeline network

# Leanheat® Network
## Pressure optimization

### Pump costs reduction

- Reduces pumping costs to minimum
- Calculates the optimal pump setpoints for main pumps and booster pumps allowing sufficient differential pressures to all clients
- Securing design pressures in selected points not is violated
- Takes new operational conditions into account coming from SCADA or load forecast
- Stability in operation

**Diff. pressure* network diagram**




Pumping costs saving potential by adjustment of Δp at actual critical point in real-time

*Differential pressure = Supply pressure – return pressure

# Leanheat Production

# Leanheat® Production

## Leverage data to maximize energy efficiency.

Leanheat® Production is an advanced software tool for forecasting, planning, and optimizing district energy production and distribution. The future-proof software helps adjust, reduce, and optimize energy consumption.

- **Load forecasting** predicts exact in-network heat consumption
- **Production optimization** saves between 1 – 3% on fuel costs annually
- **Temperature optimization** reduces heat loss by 5 – 10%
- **Low ROI** between 0-5 – 2 years

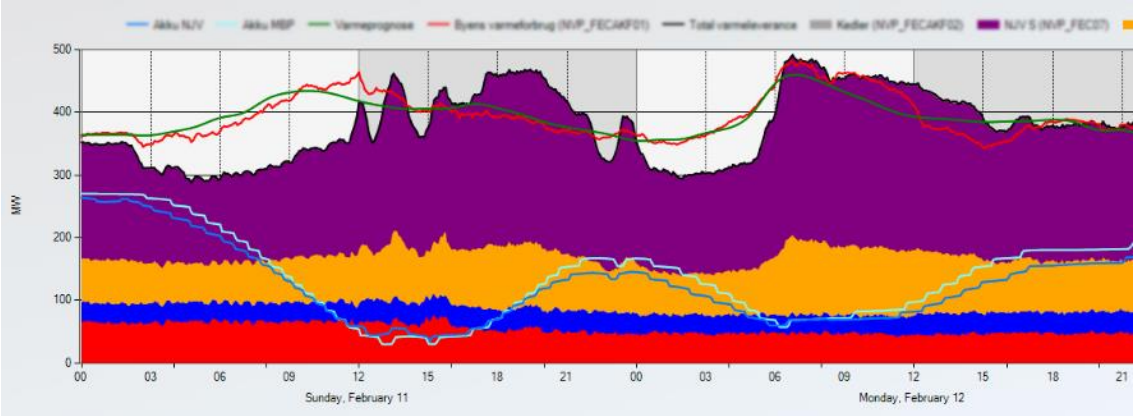
**Improved reliability, uptime, service life**

# Leanheat® Production

## Achieve more with optimization and planning

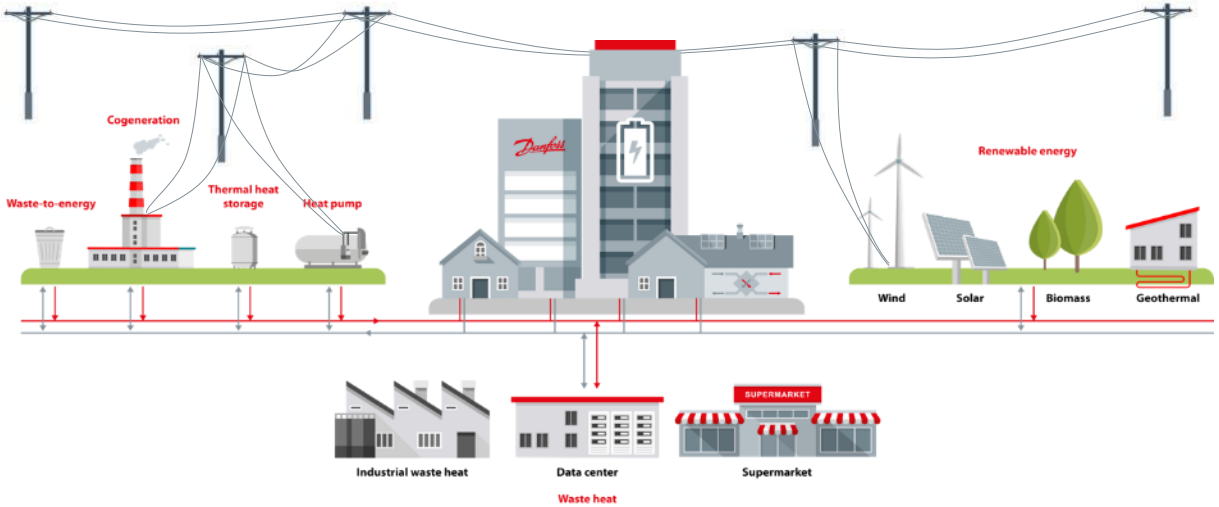
Leanheat® Production supports the operation staff in the daily operation to:

| | | | | | |
|---|---|---|---|---|---|
| **Reduce loss** in the district energy network | Suggest the most **economical operating schedule** | Collect all the **relevant data** | Achieve **time savings** in daily operations | Ensure the best possible **price on energy** during security of supply | **Develop** and maintain **the skills** of operating staff |



# Leanheat® Production **optimization**

**CONCEPT** | FEATURES | REQUIREMENTS | HIGHLIGHTS




Calculation of most economical heat schedule

**HEAT PRODUCTION SCHEDULING**

+

Electricity market planning and reporting

**ELECTRICITY PRODUCTION SCHEDULING**

=

Overall production optimization

**COMBINED OPTIMIZATION OF HEAT AND ELECTRICITY PRODUCTION**

# Leanheat® Production **optimization**

CONCEPT | **FEATURES** | REQUIREMENTS | HIGHLIGHTS

- Apply individual forecasts per heating zone
- Precise overview over the heat demand
- Predict energy in heat storage
- Support the planning of power and heat production
- Fully automated process that can run as a service

# **Danfoss Leanheat®** software suite & services
# End-to-end energy optimization solutions

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| Production planning | Pressure optimization | | | |

Data API HUB

**AI Engine**

**Primary Side**
(Planning, Network operation, Production)

**Secondary Side**
(Buildings)

Danfoss Heating, **your partner**
for district energy solutions.


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