

ENGINEERING
TOMORROW

Danfoss

Integrated Heating & Cooling Systems

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Danfoss Group: a global leader in energy efficiency technologies with a unique bandwidth of solutions

3 Pillars

Power Solutions
Climate Solutions
Drives

40,043

Employees

7.5€bn net sales

in more than **100** countries

95 factories

in **27** countries

Privately held

Ownership

Kim Fausing

President and CEO

Nordborg, Denmark

Headquarters

Danfoss Power Solutions



Construction



Industry



Forestry



Agriculture

Danfoss Climate Solutions



Controls



Refrigeration



District Energy



Thermal Comfort

Danfoss Drives



Industry



Food & Beverage



Automotive



HVAC

Leading by example:

Our own operations will be carbon neutral by 2030

Direct and indirect emissions
(Scope 1 + Scope 2)

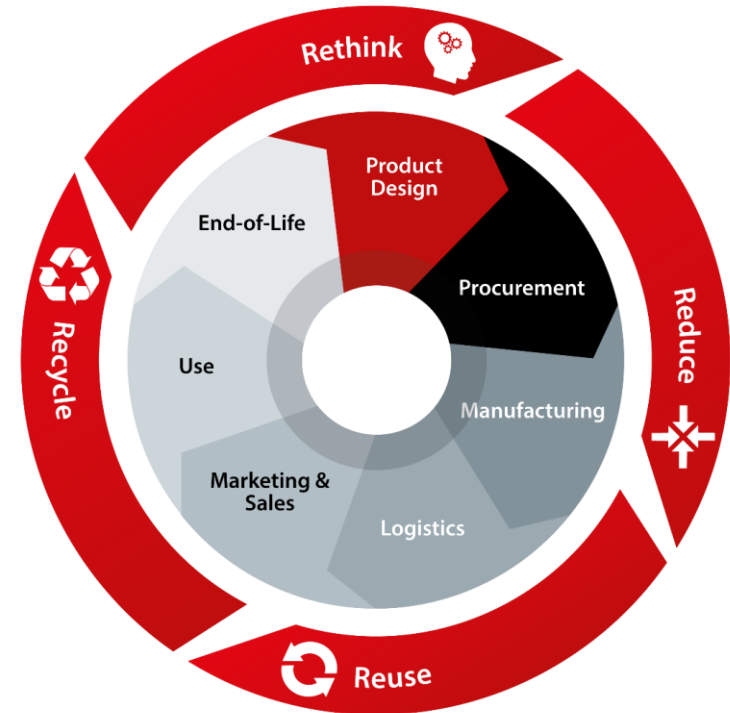


Danfoss will become **carbon neutral** with our own operations **by 2030**

Value Chain
(Scope 3)



Danfoss will reduce value chain emissions **by at least 15% by 2030**



Danfoss decarbonization targets are in line with the 1.5°C pathway and have been approved by the Science Based Targets Initiative

Example for circularity targets at Climate Solutions

- More than 80% of newly developed products are covered by the circularity approach.
- Circularity collaborations with more than 80% of top-25 customers.

The evidence is clear: the time for action is now!

The Intergovernmental Panel on Climate Change (IPCC) is the leading, international scientific body assessing climate change.

Future global climate risks



Heat stress



Water scarcity



Food security



Flood risk

“Unless there are immediate and deep emissions reductions across all sectors, 1.5°C is beyond reach.”

Source: IPCC, Sixth Assessment Report

Global policy trends reflect the urgency:

4 Top Policy Trends in > 130 countries worldwide

- > **Carbon Neutrality:** Commitments or pledges to achieve carbon neutrality by 2050 or 2060
- > **Kigali Amendment:** Transition from high Global Warming Potential (GWP) to ultra-low GWP refrigerants
- > **Renewable Energy Targets:** Commitments to increase the share of renewable energies and accelerate the phase-down of fossil fuels
- > **Minimum Energy Performance Standards (MEPS):** Minimum efficiency requirements and energy labelling for equipment and appliances

Other important trends:

- > **Embodied carbon & Circularity:** product carbon footprint, life-cycle assessment, reparability, recyclability, waste reduction, lifetime
- > **Sustainable finance models** to reduce financial risk triggered by climate change ...



Carbon
Neutrality

Refrigerant
Transition

Renewable
Energies

MEPS

Europe has made its choice:

Binding commitment to halve greenhouse gas emissions by 2030, be carbon neutral by 2050

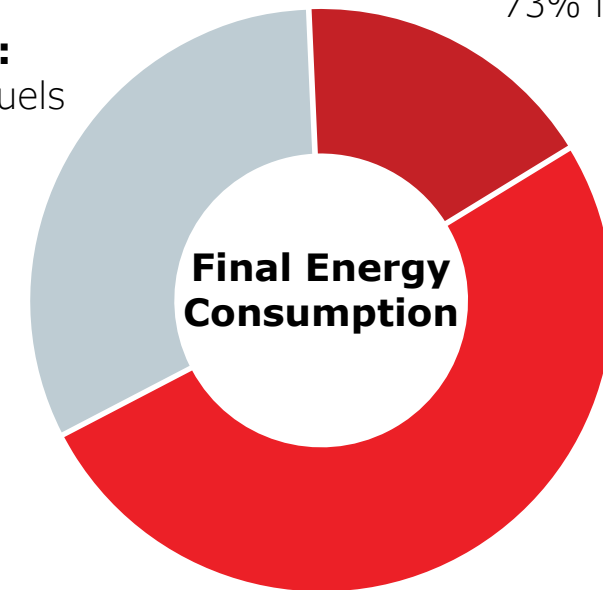
Heating and Cooling account for half of the total final energy use in the world, most of it based on fossil fuels

This includes heating and cooling in **buildings, industrial processes, etc.**

The EU, Member States and numerous cities & regions have committed to decarbonisation

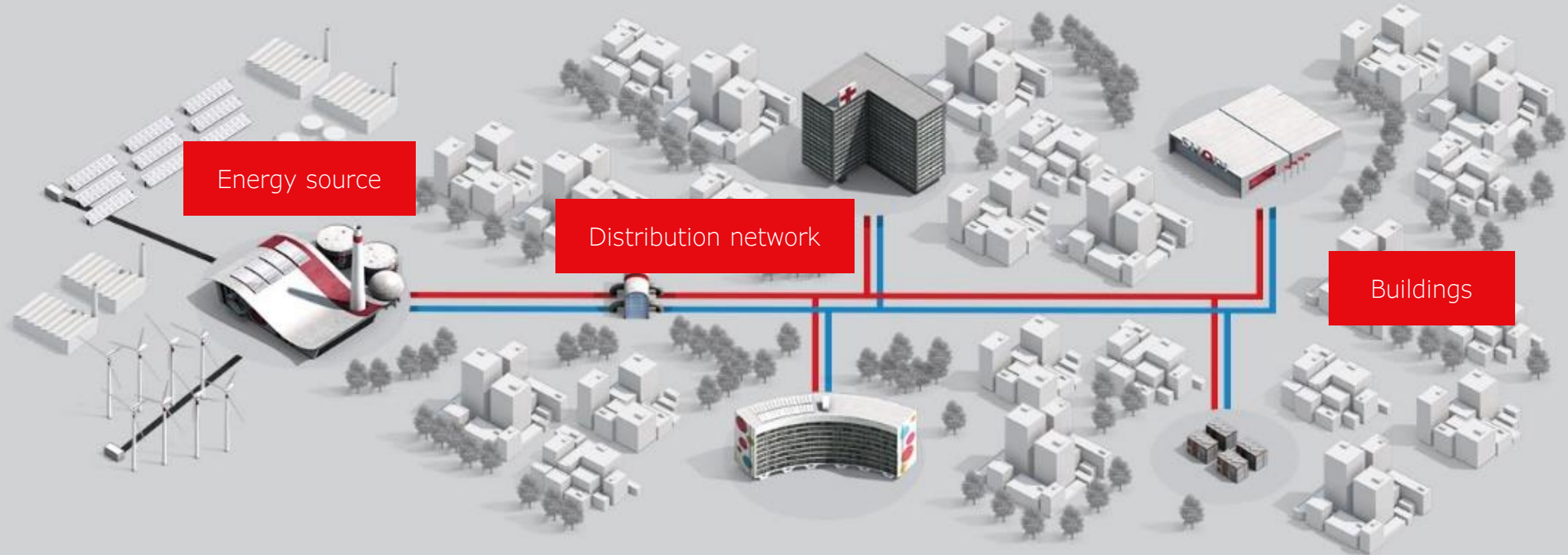
- Phase-down of fossil fuels in district heating
- Bans of fossil fuel boilers in at least 11 EU countries
- Carbon pricing on heating fuels
- Mandatory heat maps
- Mandatory waste heat recovery in certain countries ...

Transport:
97% fossil fuels



Heating & Cooling:
90% fossil fuels

The entire system needs to be optimised to decarbonize heating and cooling



**Sustainable
energy carriers**



**Efficient distribution
and integration**

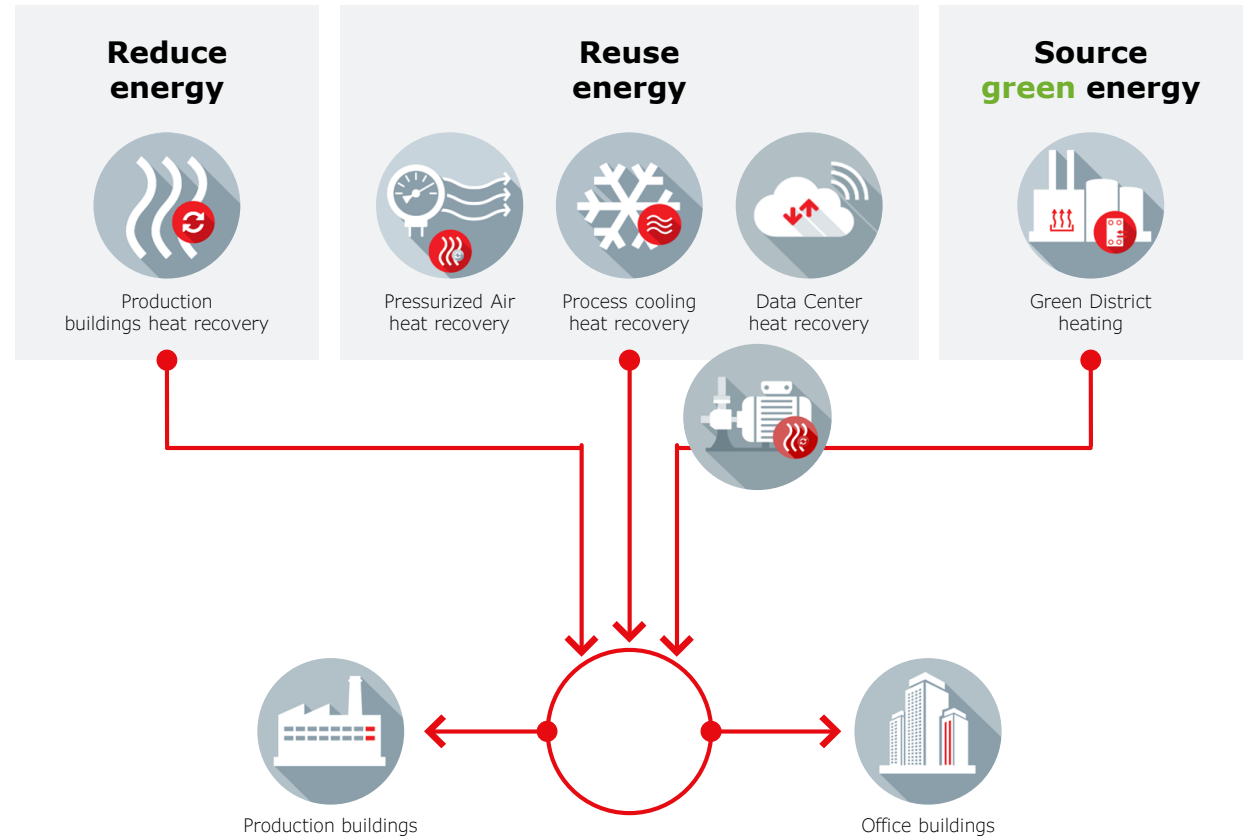
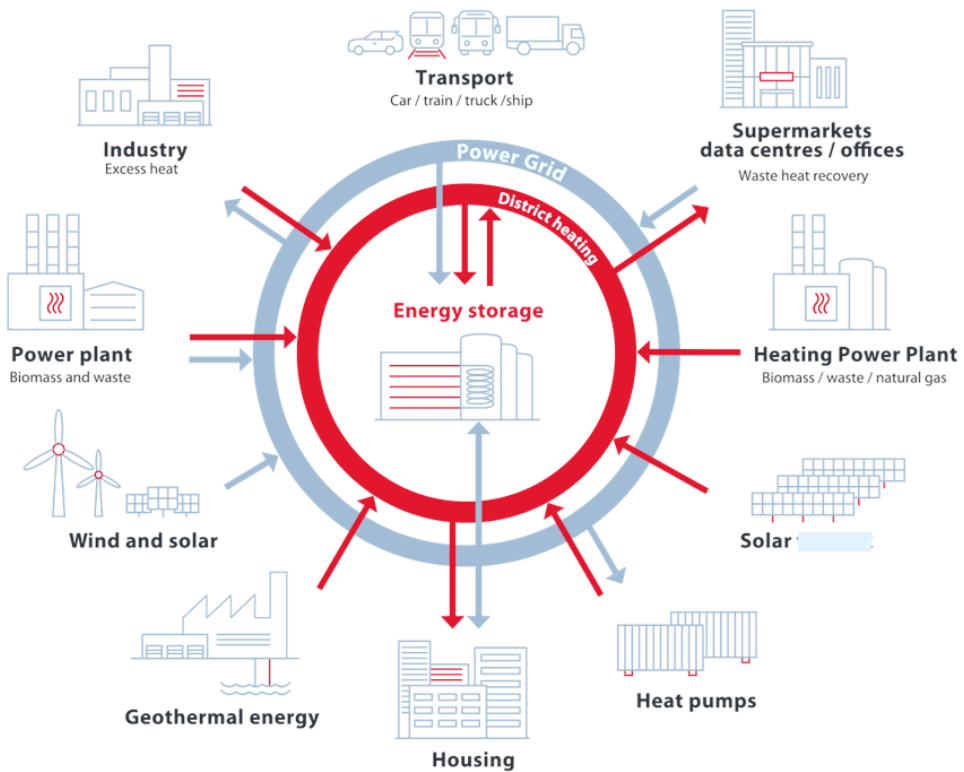


**Efficient energy use
at application level
(buildings, industry, etc.)**

Integration of energy sources and sectors

Connecting energy demand and energy supply

Sector integration



Zooming in on Critical Facility Cooling / Heat Recovery Systems:

Best Bet for Baseload Heat Recovery Heat Source



01

Critical facility cooling & heat recovery $\sim 20^{\circ}\text{C}+$

02

Geothermal and comfort cooling $\sim 10-20^{\circ}\text{C}$

03

Ambient air/water & refrigeration $\sim <10^{\circ}\text{C}$

An important part of the solution – System performance

$$\text{TER} = \frac{\text{Heating} + \text{Cooling Capacity}}{\text{Power Input}}$$

$$\text{TER} = \frac{500\text{kW Cooling} + 618\text{kW Heating}}{118\text{kW power draw}} = 9.5 \text{ COP}$$



Distributed application benefit:

- 01 | Chiller cooling
- 02 | Heat pump heating



"Symbiosis System" – Total Efficiency Ratio



From cooling or heating to "moving heat"



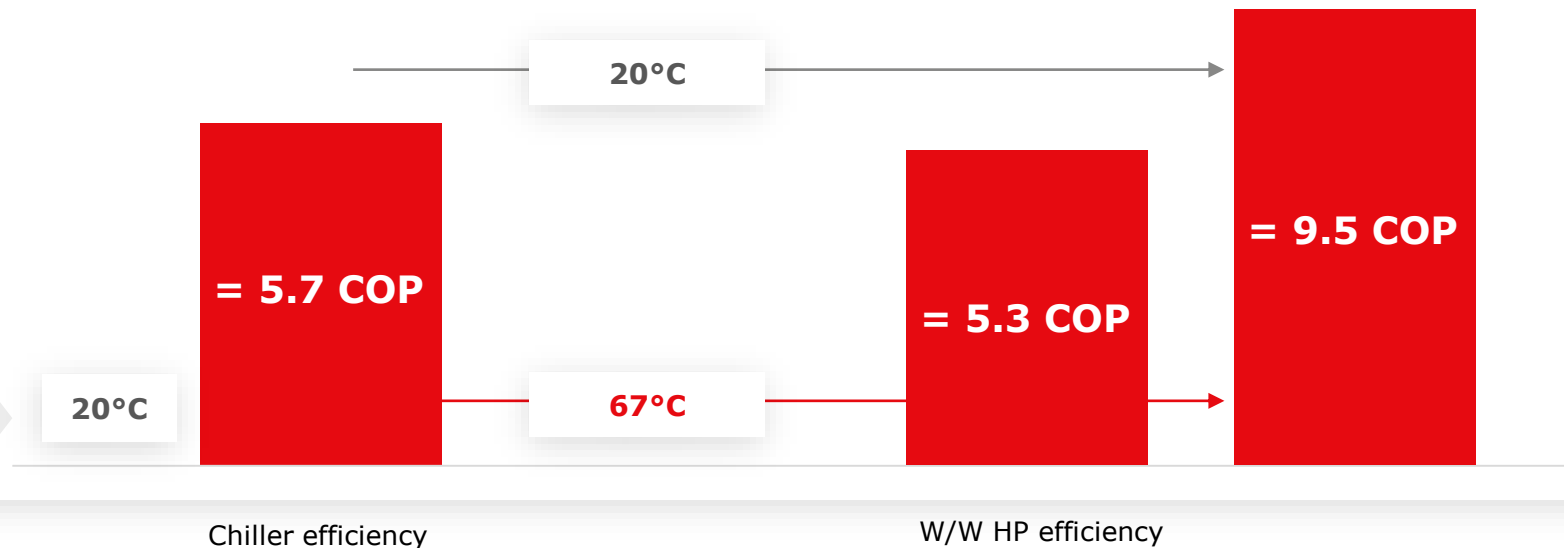
Recovery capacity limitations eliminated with district heating



Air-Cooled Chiller



Symbiosis System



Heat Pump System Design Summary >140 projects

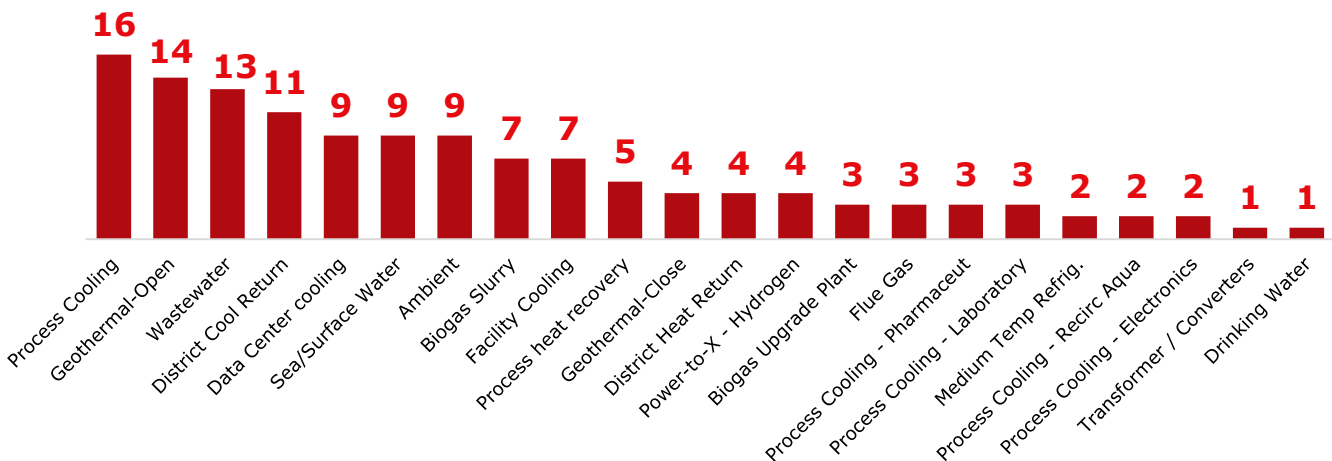
Heat Sources



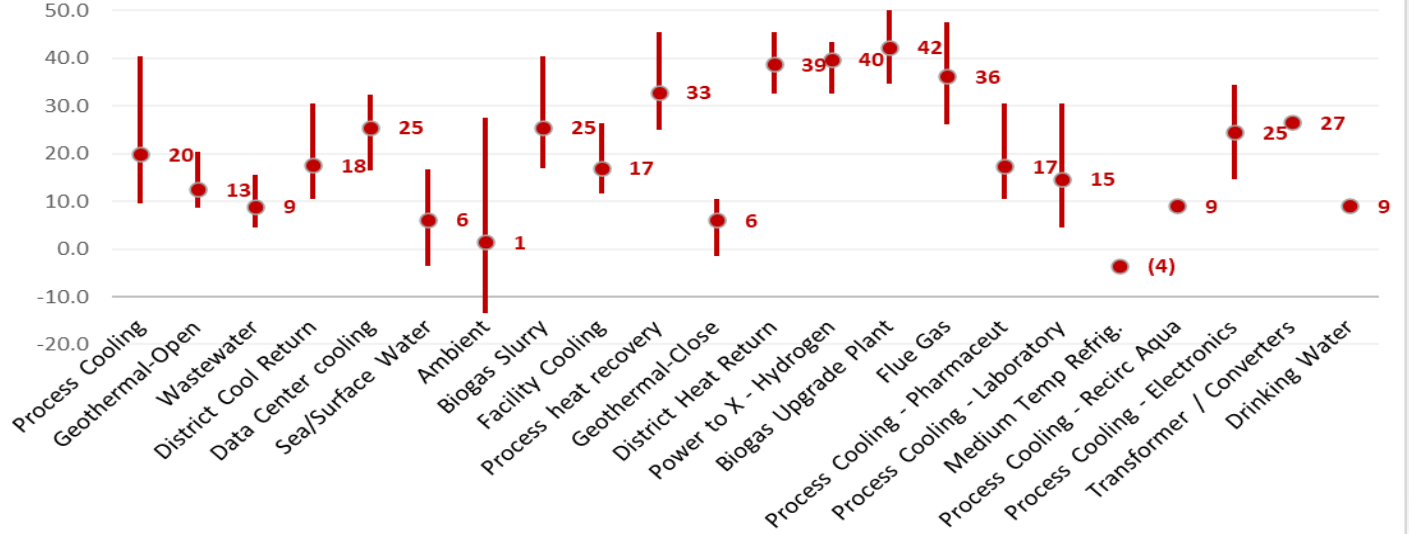
The most prevalent heat recovery heat sources

- Process, Wastewater, district and data center cooling = 44%
- Geothermal total = 14%
- Biogas total = 8%
- Target the most consistent availability and highest temperature heat sources
- To drive...
 - highest operating hours
 - best efficiency
 - lowest resulting heat price

Opportunities by Heat Source (# of projects)



Source Temperature Average/Range



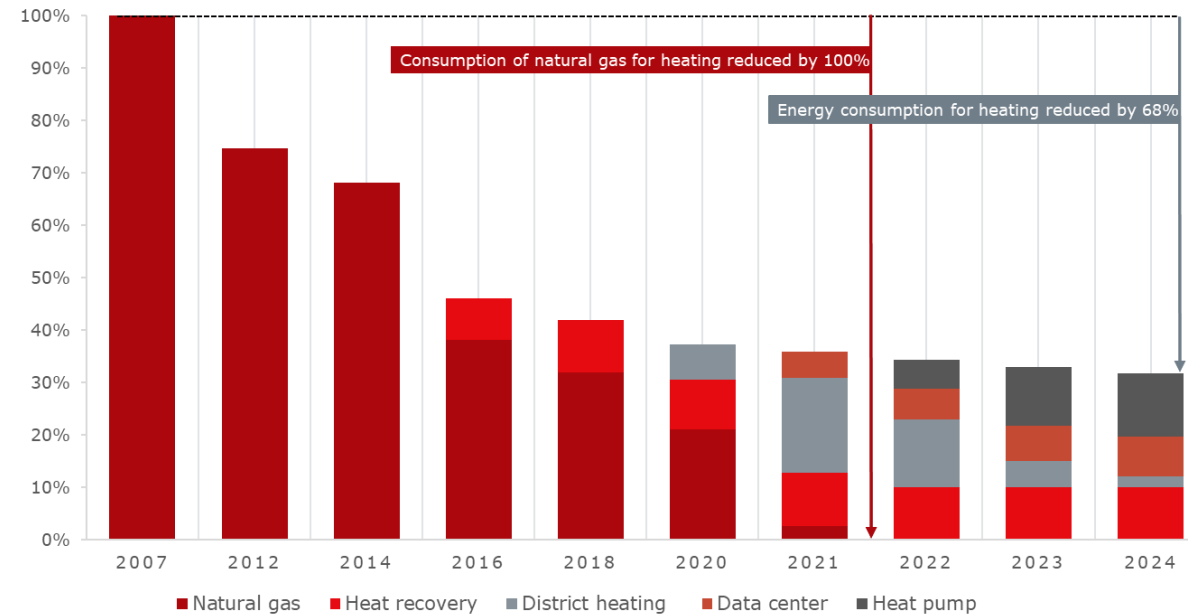
At the forefront: The Nordborg campus

Electricity

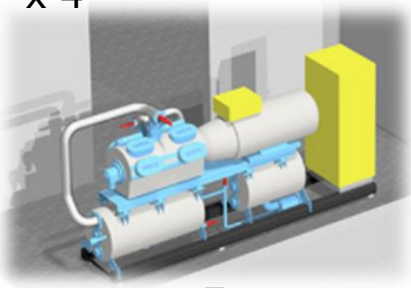
- Consumption 2020: 50 GWh - solar plant produced 2.2 GWh
- **100% green electricity from February 2021:**
 - Green energy from wind turbines (Horns Rev 2)
 - Covers all Danfoss sites in Denmark and Germany

Heating

- Consumption in 2020: 31 GWh - reduced by 68% since 2007
- **100% green heating by 2022:**
 - 20% covered by heat recovered from cooling of processes
 - 20% covered by heat recovered from the Danfoss data center
 - 60% covered by green district energy



Danfoss Heat Pumps
x 4



Danfoss Data Center



Danfoss Supermarket



Danfoss P2X Station



Compressed Air



Danfoss
Heat Exchange Station



Nordborg City

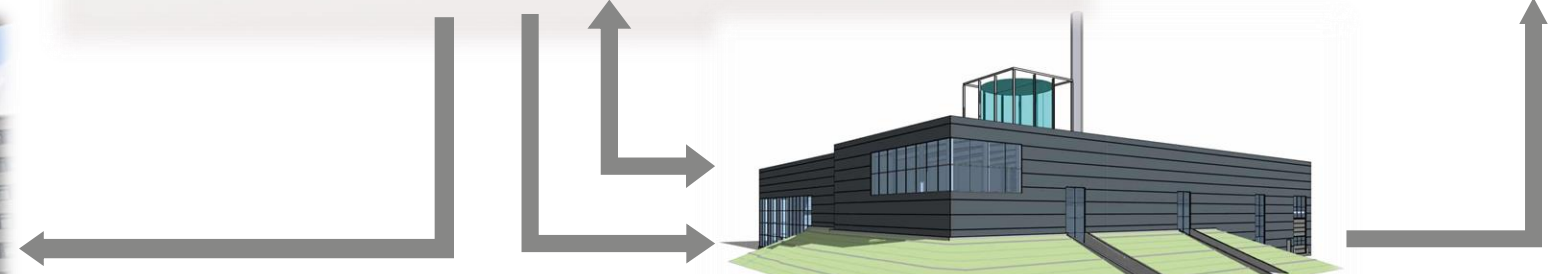
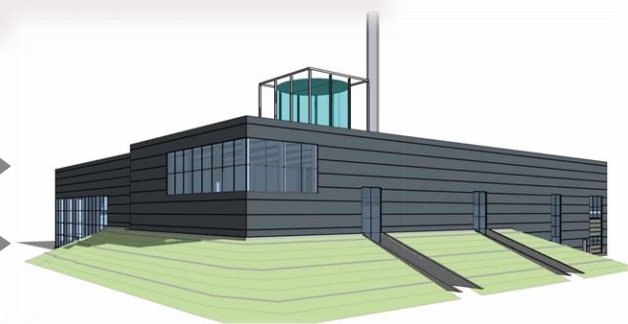


Danfoss Integrated Energy System

Danfoss Headquarters



Nordals District Heating Plant



Contact us

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