



AUGUST 2022

Visit to Frederiksberg Forsyning, Denmark Introduction to Danish District Heating

ABB

Agenda

01. Introduction to Danish District Heating
02. District heating in Greater Copenhagen
03. The future challenges and development
04. Questions

— Danish Heating – History and current status

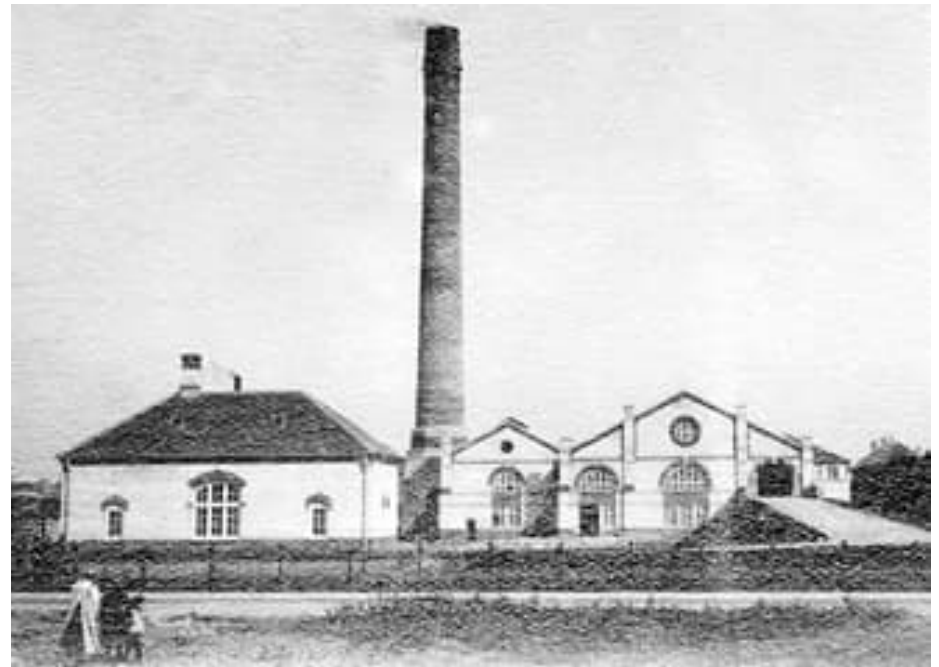
District Heating history

First DH system:

- France, heating in 13th century
- England, "hot water systems", 18-19th century
- Manhattan, US, 1882

First DH system in Denmark:

Frederiksberg, 1903



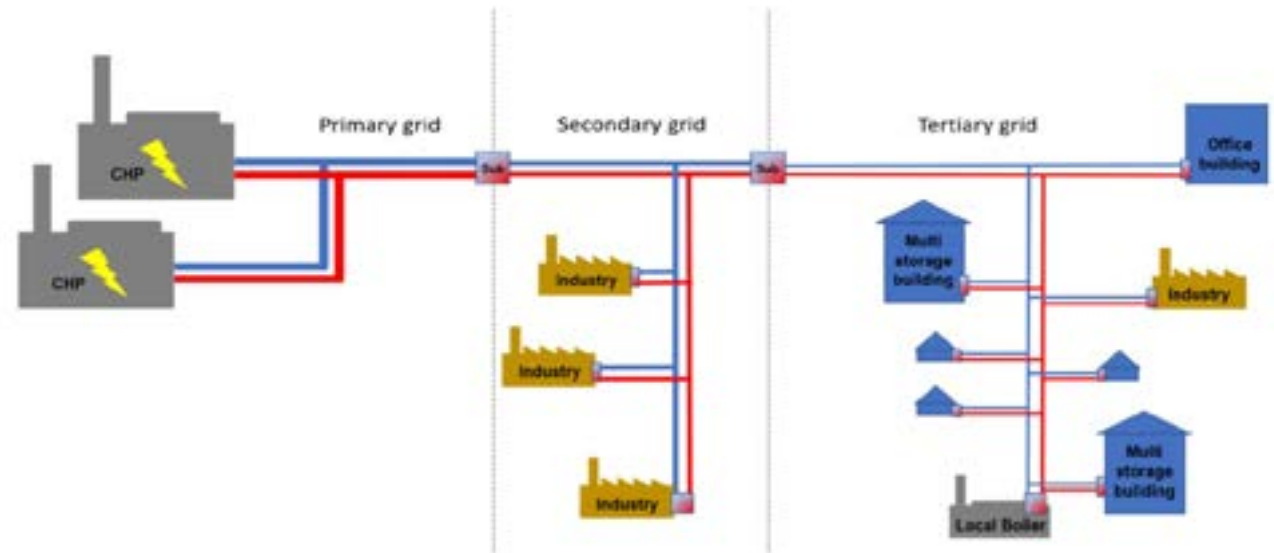
What is a District Heating system?

District Heating (DH) Definition

"Distribution of heat through a network to 1 or several buildings using hot water or steam, produced centrally, often at co-generation plants from waste heat from industry or from dedicated heating systems". Source: Eurostat

After the heat has been transferred and consumed by the customer, the water is returned to the source of heat where it is reheated and redistributed.

For maximized efficiency the temperature difference between the supply and return (Δt) should be as large as possible.



Example of a DH network with a primary, secondary and tertiary grid which is separated by substations (Sub.) and which supplies heat to different types of consumers (Source: D. Rutz)

The district heating system

Transmission and distribution pipe network



District Heating in Denmark

Oil crisis in the 1970's

The crisis, giving the kickoff to:

- Coal as fuel in the power plants
- Combined heat and power plants, CHP
- Small decentralized CHPs – often gas fires
- Waste to Energy plants
- District heating
- Natural gas from the North Sea
- Wind power
- (biogas)
- Energy saving – standards for buildings



District Heating and Combined Heat and Power plants, CHP

- +400 heat / CHP plants
- Many small village systems
- Systems being integrated in larger DH networks

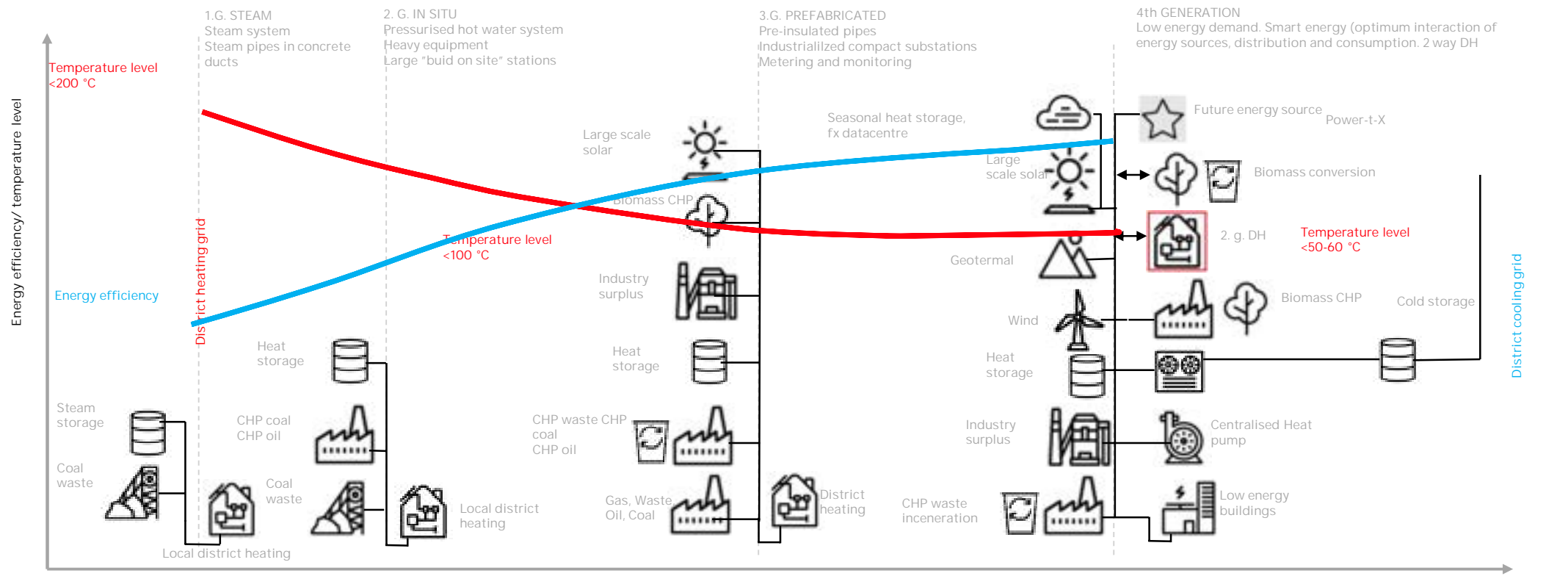
- District heating coverage +65%
- District cooling – in major cities
- 60% carbon neutral fuels for DH
- 100% carbon neutral in 2030

Figure 1. More than 400 DH and CHP plants cover the country of Denmark and the most dominant type by far is the decentralised CHP plant.



Increasing complexity

District heating generations



The district heating system in Greater Copenhagen

District Heating system in the Greater Copenhagen area

Heat suppliers:

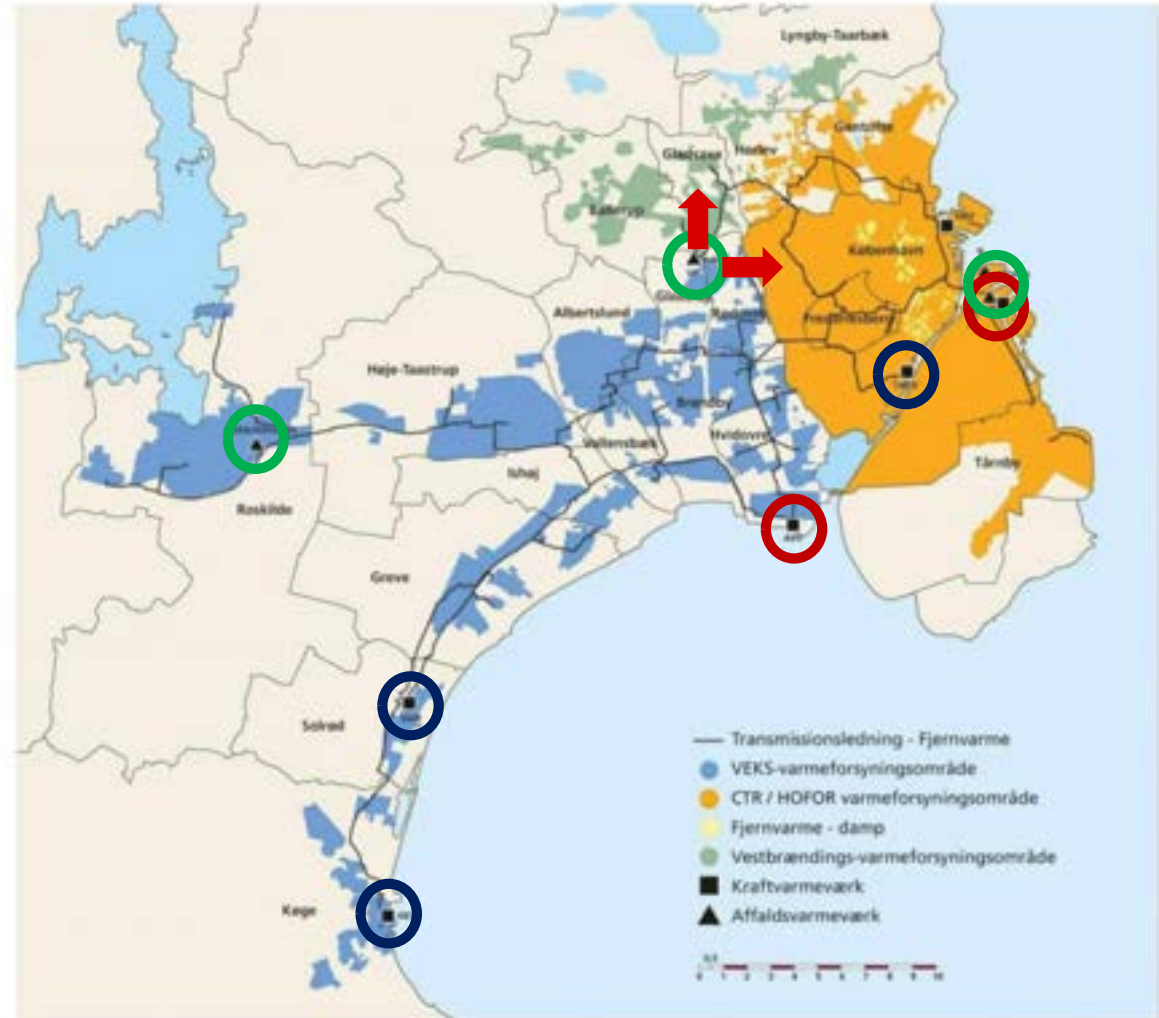
- Ørsted Bioenergy PP
- HOFOR (Copenhagen Utility)
- Waste-to-Energy:
Vestforbrænding, ARC, Argo
- CTR & VEKS:
Small CHPs + biogas engine, heat pumps,
electric boilers, peak load boilers

Transmission companies:

- CTR
- VEKS

District heating companies

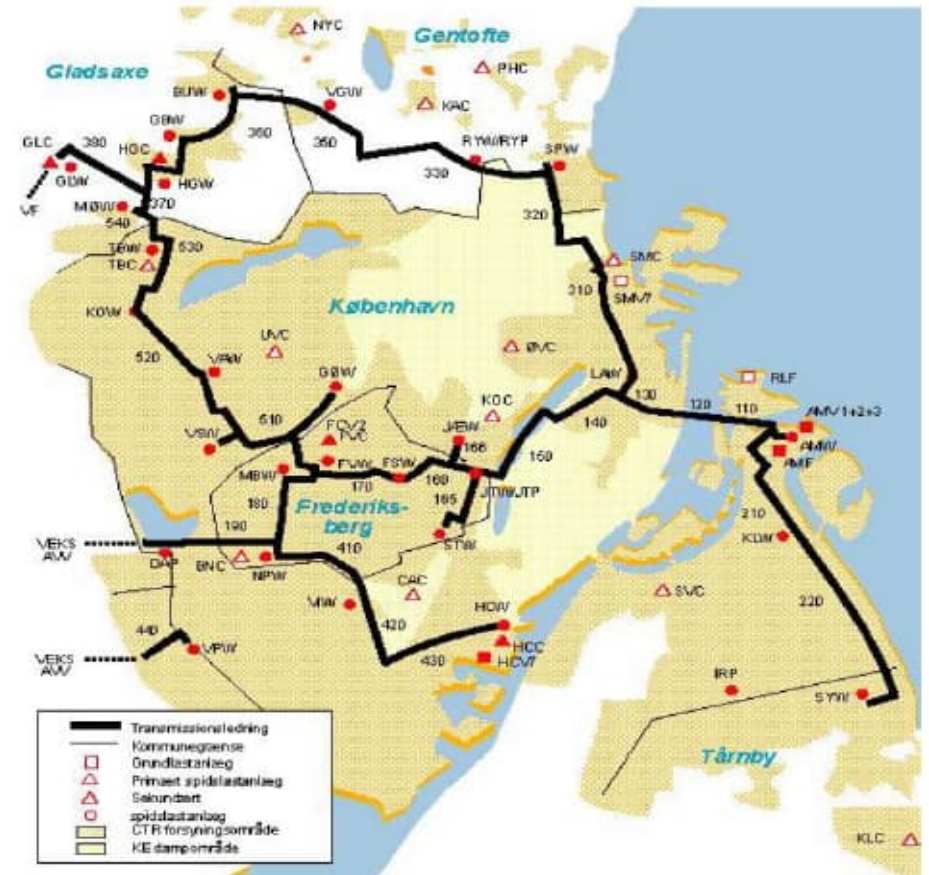
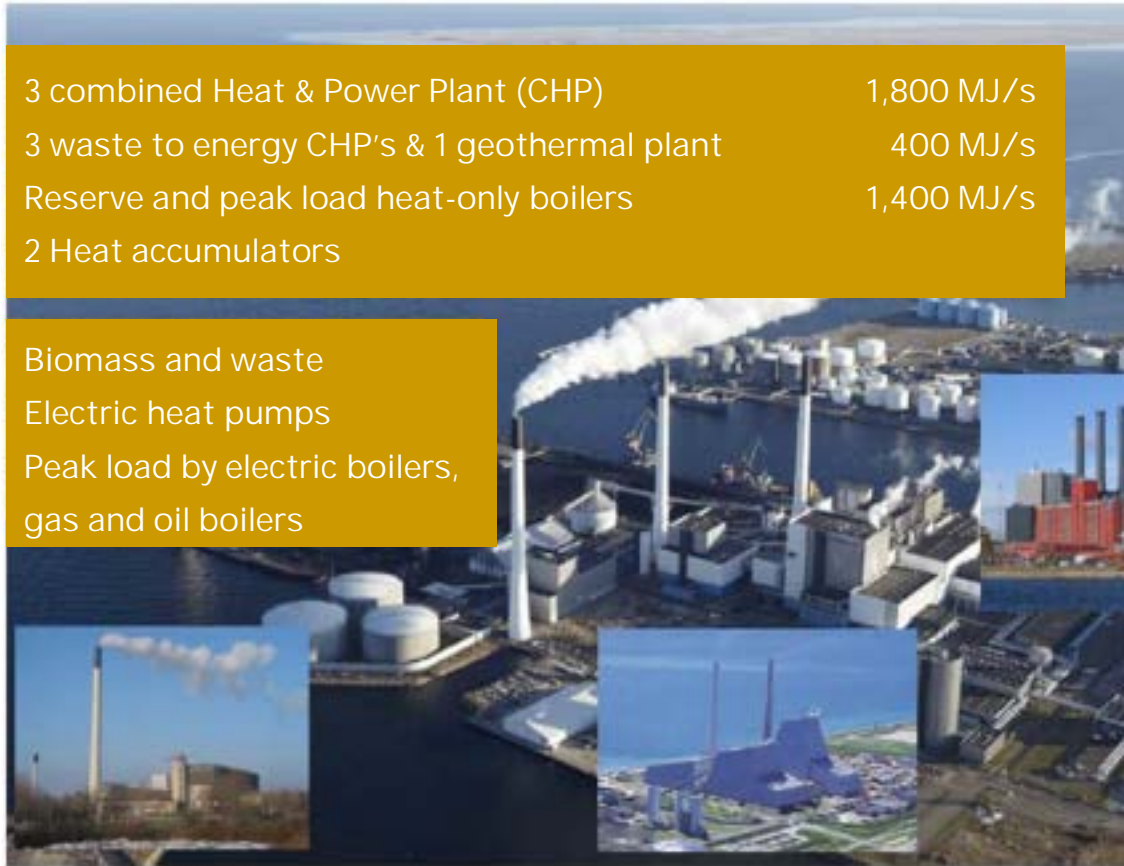
- Heat distribution and end customers



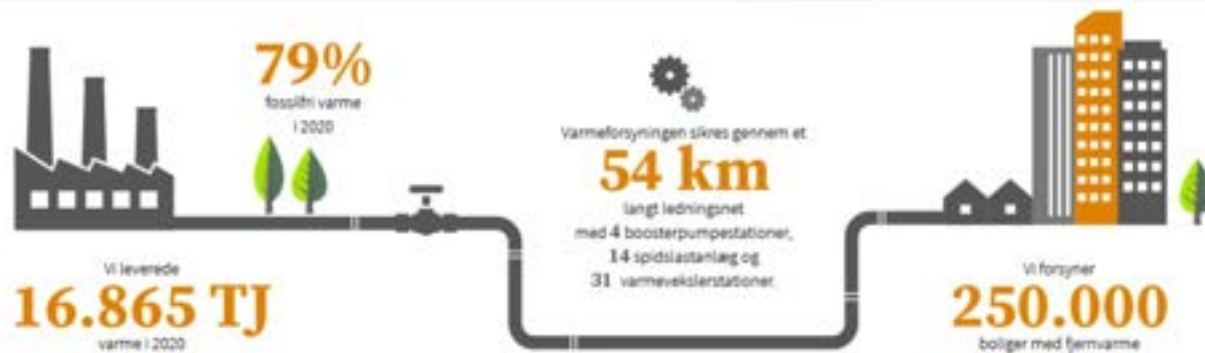
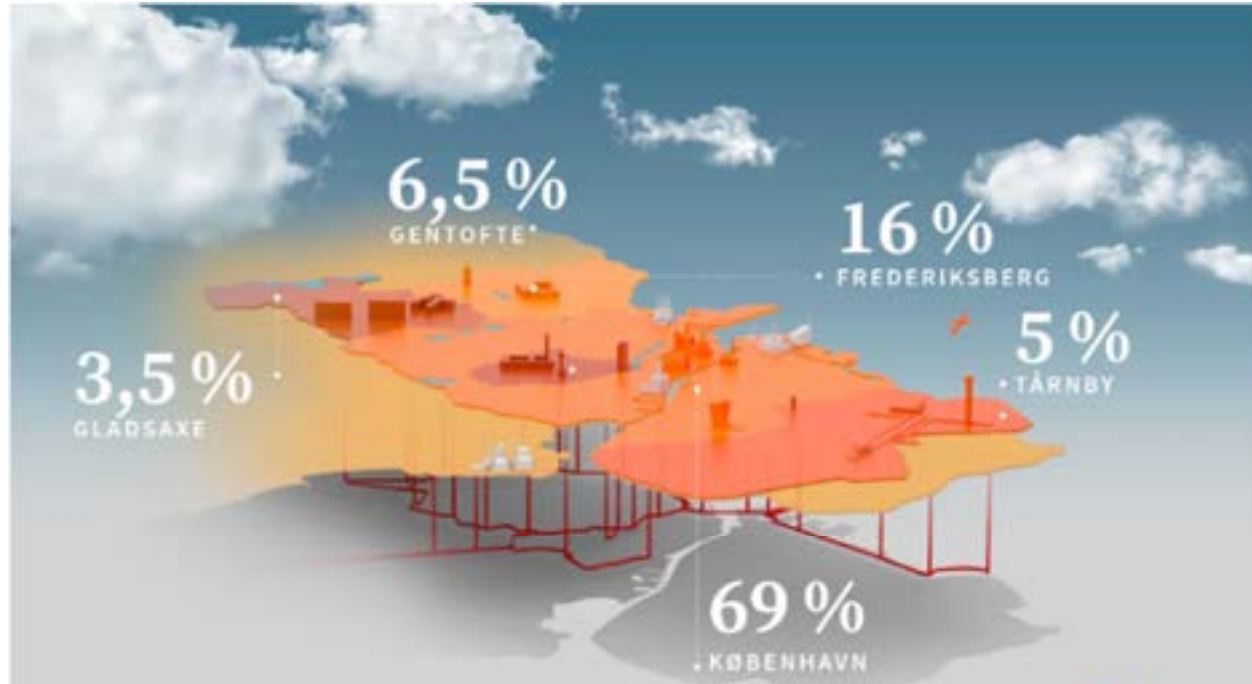
The Copenhagen district heating system and heat sources

3 combined Heat & Power Plant (CHP)	1,800 MJ/s
3 waste to energy CHP's & 1 geothermal plant	400 MJ/s
Reserve and peak load heat-only boilers	1,400 MJ/s
2 Heat accumulators	

Biomass and waste
 Electric heat pumps
 Peak load by electric boilers,
 gas and oil boilers



CTR – the DH transmission company



The future energy and district heating trends

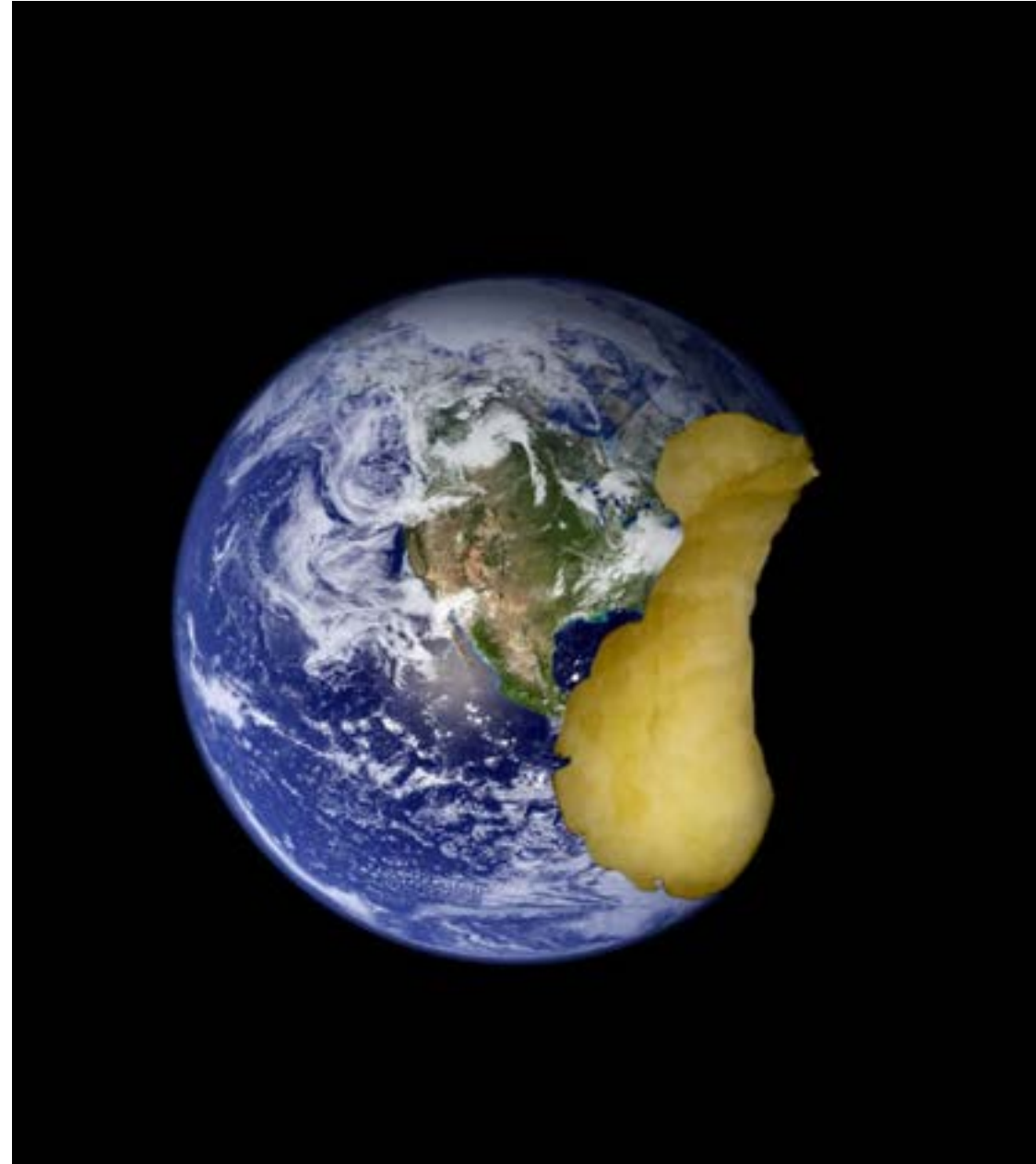
Earth resources and energy consumption

- Heating and Cooling accounts for 50% of global energy consumption
- Heat contributes 40% to 50 % of global CO₂ emissions (Heat for industry + buildings)
- Cities account for over 70 % of global energy use

IEA, Renewables Analysis, 2019

International District Energy Associations

- Heat for Copenhagen – Carbon neutral in 2025
- Denmark's carbon emission reduced by 70% in 2030



New Energies like Power-to-X Heat will be delivered 'as the wind blows'

Heating becomes 'electrical fueled'

Drivers:

- Climate targets
- Heat conversion from gas to DH

- Electric heat pumps
- Electric boilers
- Surplus heat from PtX
(1 GW electric input → 400 MW heat)
- Surplus heat from Carbon Capture
- Surplus heat from data centers, industry
- Heat from geothermal



50% of EU's wind power in the North Sea

Today:

- DK today, +50% el power from wind and solar
- Currently approx. 15 GW in the North Sea

Future ambitions:

- Energy islands
- Target before 2050: 150 GW wind power
- Off shore wind turbines – 10,000



Questions and answers

A photograph of a person in a red sweater raising their hand in a classroom or meeting. In the background, a man in a suit is standing near a whiteboard, and other people are seated, looking towards the front. The scene is brightly lit, likely by large windows.

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