

Modern DHC Approaches – Danish Example

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Membership base

380 members:

- 59 members are public utilities (65 % of heat deliveries)
- 310 members are private cooperatives (33 % of heat deliveries)
- 11 private companies (3 % of heat deliveries)

Monopoly regulation applies to all

Total supply:

- DDHA members deliver **99%** of all Danish district heating. More than **108 PJ** sold
- More than 2 million households – **70,1 %** of all
- **+37.000** km of network



Danish district heating's history

1950's

- Regulation municipal utilities

1960's

- Growth on private and municipal initiative

1970's

- **Energy crisis**
- Heating Commission
- Shift to surplus heat (CHP)

1980's

- **Heat law**
- **Heat planning**
- Continued shift to CHP and other surplus heat sources
- Expansion of networks
- No more oil

1990's

- Localised CHP
- Natural gas/biomass

2000's

- Consolidation
- Looking for **sustainable heat**

2010's

- Expansion
- Renewables
- Integration

2020's – Today

- **Energy crisis**
- **Climate crisis**
- New focus on DH
- Independence from imported fuels
- High demand for transition to renewable energy



Heat Supply Act - Objective

Google translation!

Paragraph 1:

*“(1)....to promote the **most socio-economic and environmentally friendly utilization** of energy for heating buildings, supplying them with hot water and reduce the dependency of the energy system on oil.*

*(2) ...in agreement with the objectives mentioned in subsection (1), the supply of heat shall be organised with a view to **promoting the highest possible degree of cogeneration** of heat and power.*

*(3) ...also to **promote the use of energy from renewable energy sources** in heat production for use in companies' production and services.”*

Municipal role in Danish heating sector (very condensed!)

Before 2019: Planning with intent

Zoning based on lowest socio-economic cost (not consumer cost!)

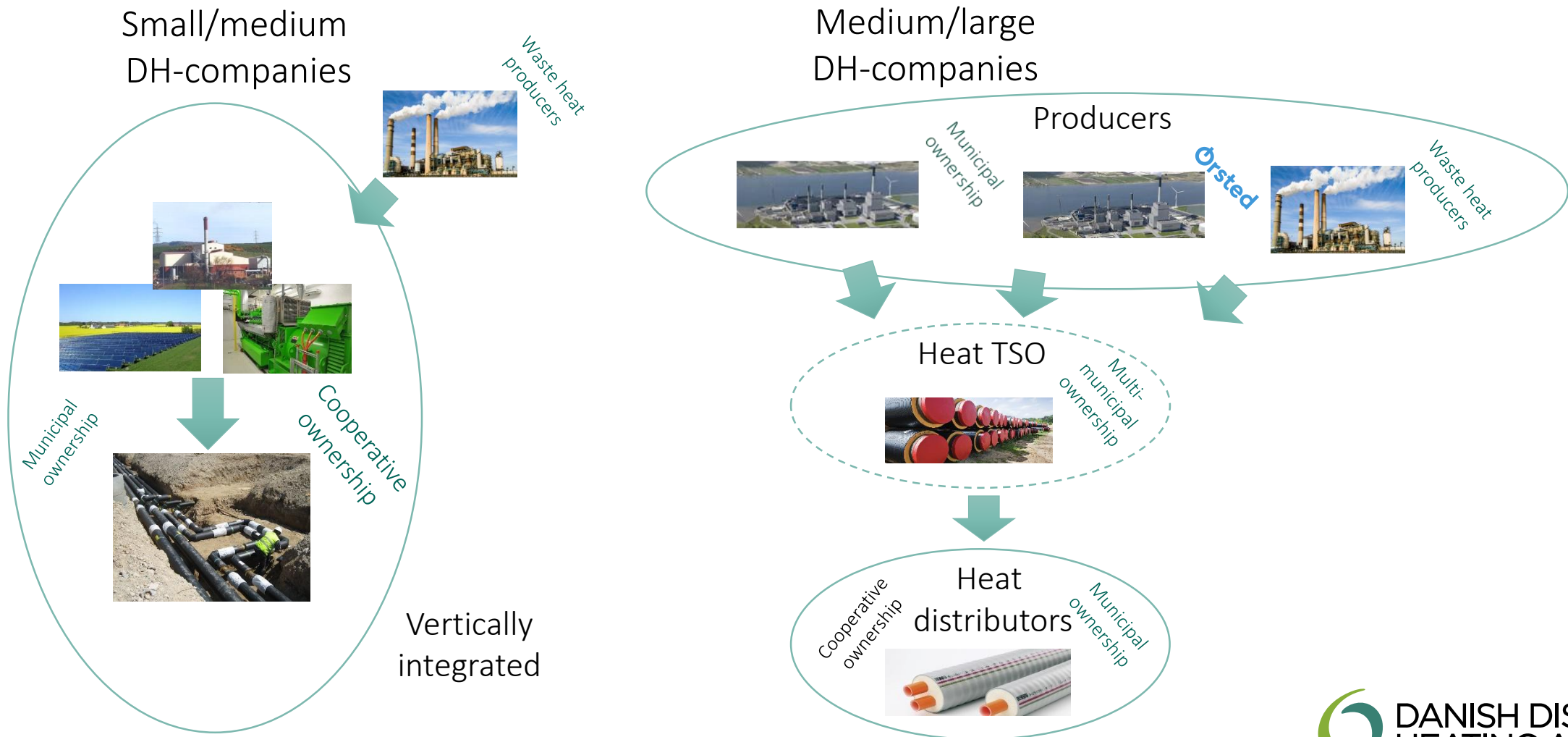
- Zones suitable for "collective supply"
 - Heat density (urban & suburban areas)
 - Availability of heat source or gas
 - District heating or natural gas
 - Request construction by utility
 - Permitting (grid and production)
 - Optionally impose obligation to connect/remains connected
 - Issue loan-guarantee (grid and production)
- Zones for individual solutions (countryside)

After 2019: ~~Planning with intent~~ Analyzing feasibility

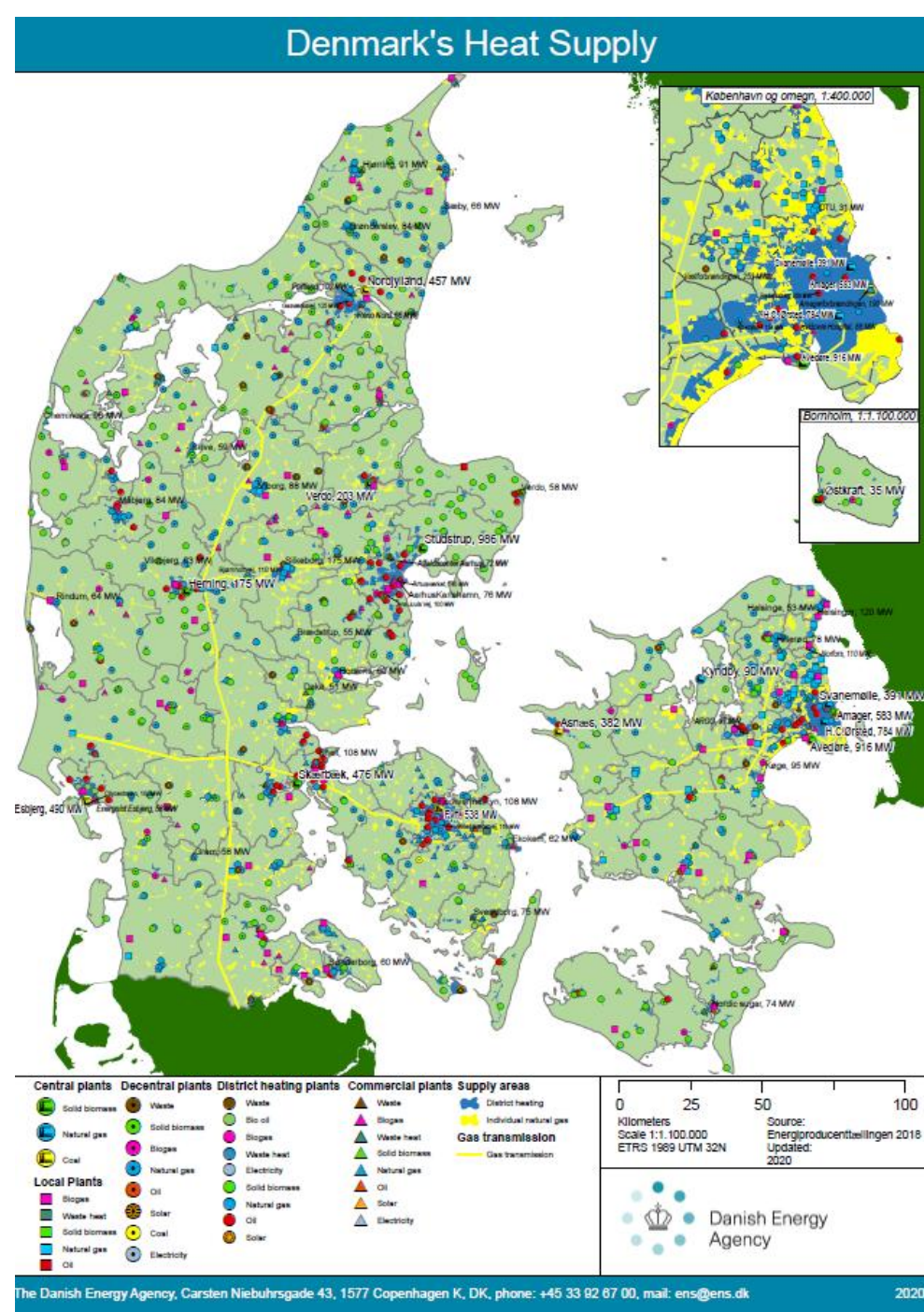
Zoning based on lowest socio-economic cost/~~not~~ consumer cost/~~technical feasibility/sustainability.....~~‡

- Zones suitable for "collective supply (DH)"
 - Heat density (urban & suburban areas)
 - Availability of heat source ~~or gas~~
 - District heating ~~or natural gas~~
 - ~~Request construction by utility~~
 - Permitting/~~Easing of permitting~~ (grid and production)
 - ~~Optionally impose compulsory connection/remains connected~~
 - Issue loan-guarantee (grid and production)
 - No support for individual heat pumps

Typical ownership setup in Danish district heating

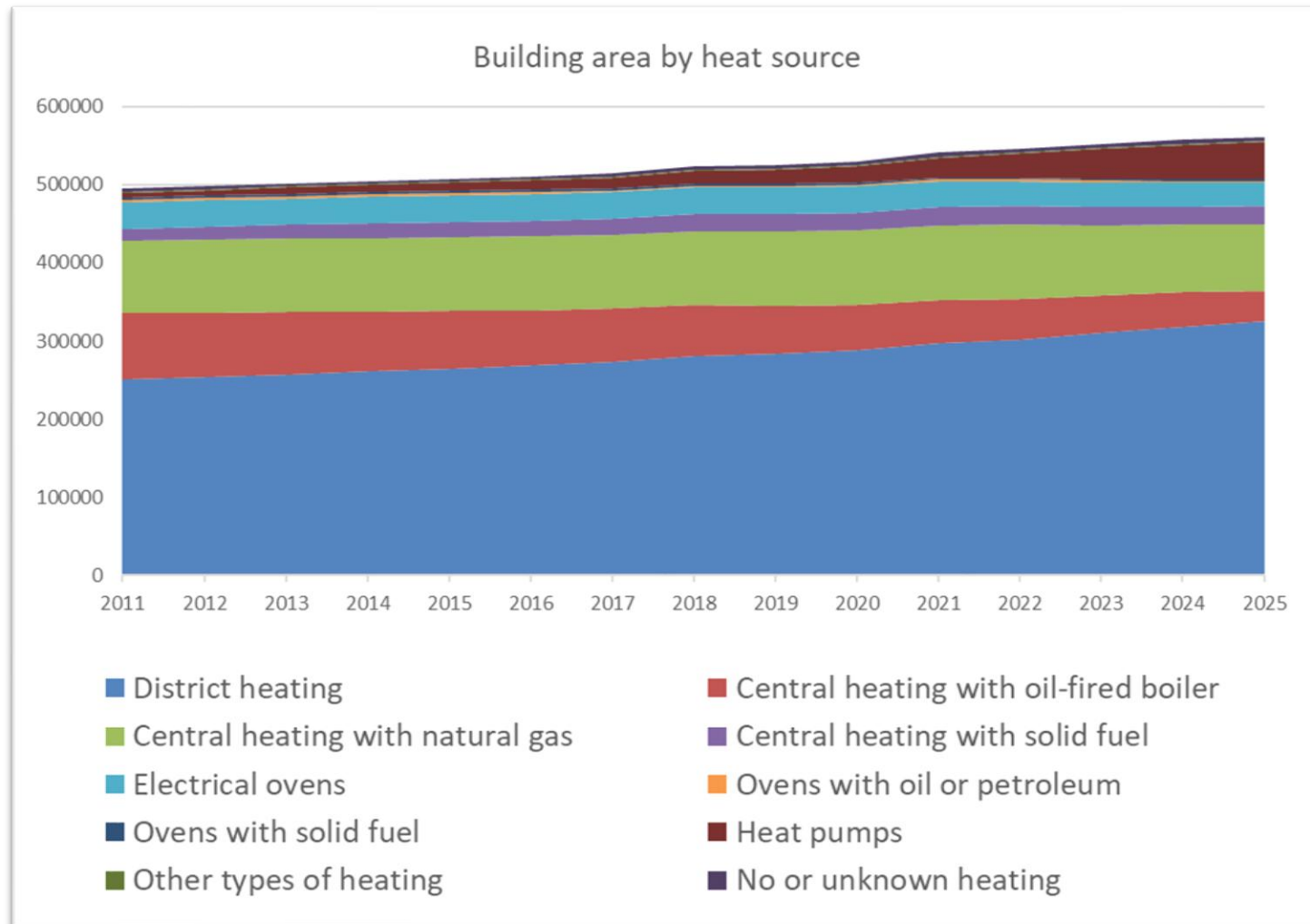


District heating everywhere!



DANISH DISTRICT
HEATING ASSOCIATION

Heated area by heating solution 2011 - 2025



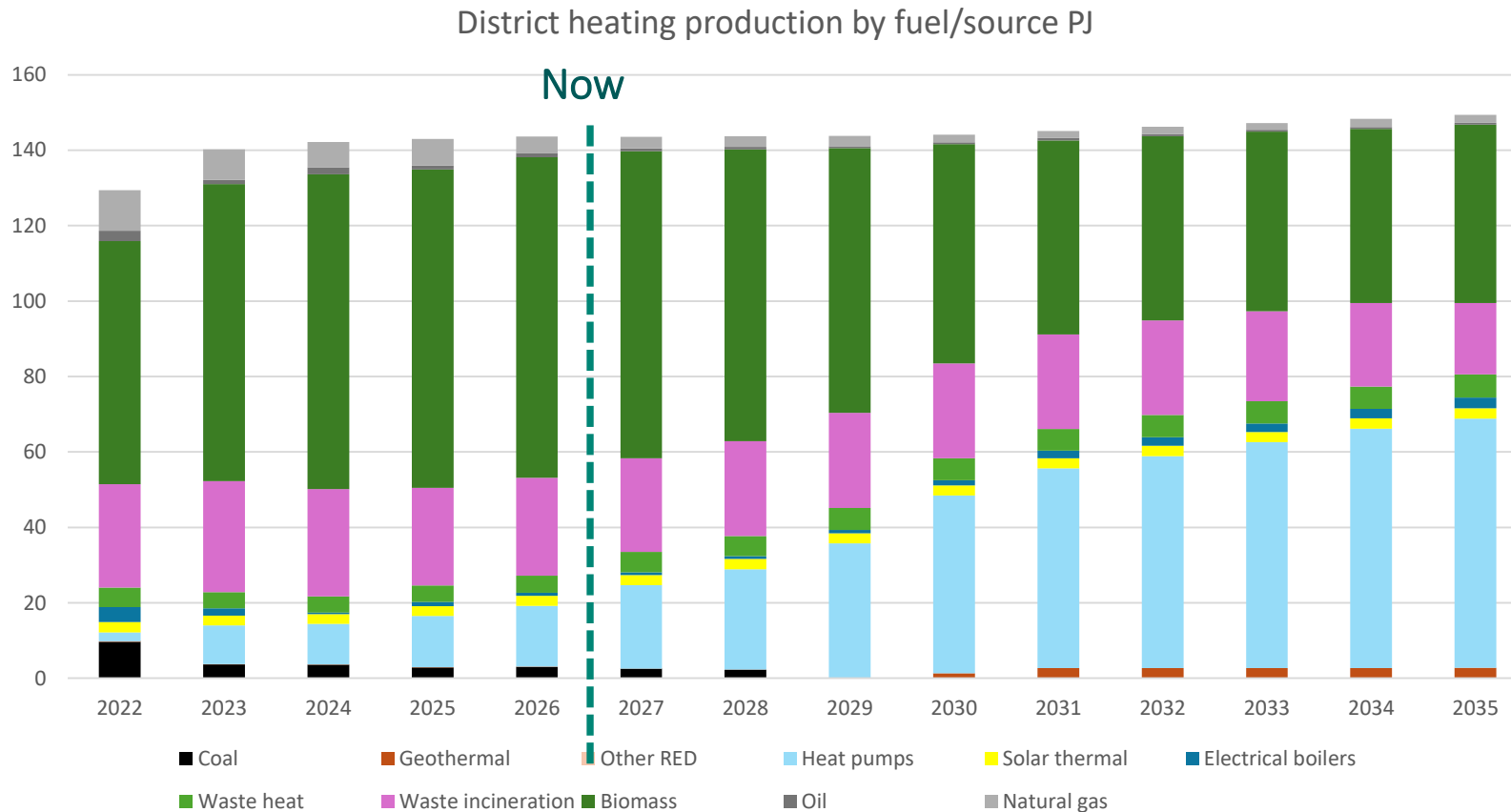
- Area heated by district heating has increased by almost 30% from 2011 – 2025
- Area with heat pumps grown 900% in same period
- District heating dominates with 58% of heated area
- 70 % of all homes heated with district heating

How do we heat Danish homes (and other buildings)?

Heating solution in all Danish occupied homes by number, 2026 Source: Statistics Denmark, 2025*	Detached houses	Terraced, linked or semi-detached houses	Multi-unit buildings	All homes	Industrial, public, tertiary, service etc. buildings (2025)
District heating	46,8%	71,5%	92,7%	70,4%	60,1%
Central heating/with oil	7,5%	1,0%	0,7%	3,6%	8,9%
Central heating/with N-gas	16,6%	16,8%	4,8%	11,5%	21,0%
Central heating/without oil or N-gas	7,0%	0,5%	0,2%	3,1%	2,4%
Heat pump	15,6%	5,3%	0,8%	7,6%	3,4%
Direct electric heating	5,5%	4,6%	0,6%	3,3%	2,3%
Stoves, other	0,8	0,1%	0,1%	0,4%	0,7%
Unknown	0,1%	0,3%	0,2%	0,2%	1,2%
	100,0%	100,0%	100,0%	100,0%	100,0%

*As reported by building owners to national building register. Both past changes and current trends in heating conversions may thus be underreported.

Type of energy and renewables share in Danish district heating (2017-2035)



- The share of renewable energy in the district heating supply has increased from around 60% in 2017 to 77% in 2024.
- Political aim to have fully carbon neutral heating and electricity sector by early 2030'ties

Data source: Danish Ministry of Climate, Energy and Utilities: Denmark's Energy and Climate Outlook 2024.

Current technologies in Danish district heating

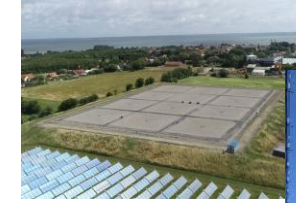
3.-4. generation network



Combined heat & power (CHP) on biomass and coal (until 2028)



Waste incineration



Solar thermal and storages



Gas & oil boilers



Biomass boilers



CHP on gas engines



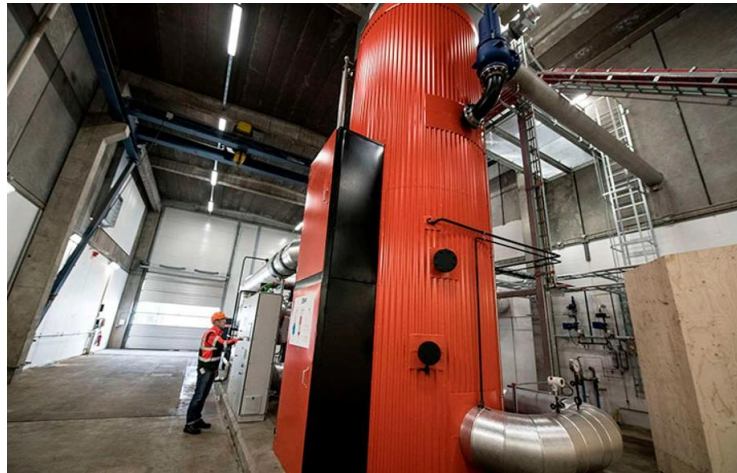
Phasing in new technologies in Danish district heating

Large scale heat pumps – largest 3 x 44 MW

- Sea/sewage water
- Waste heat
- Ambient heat
- Geothermal



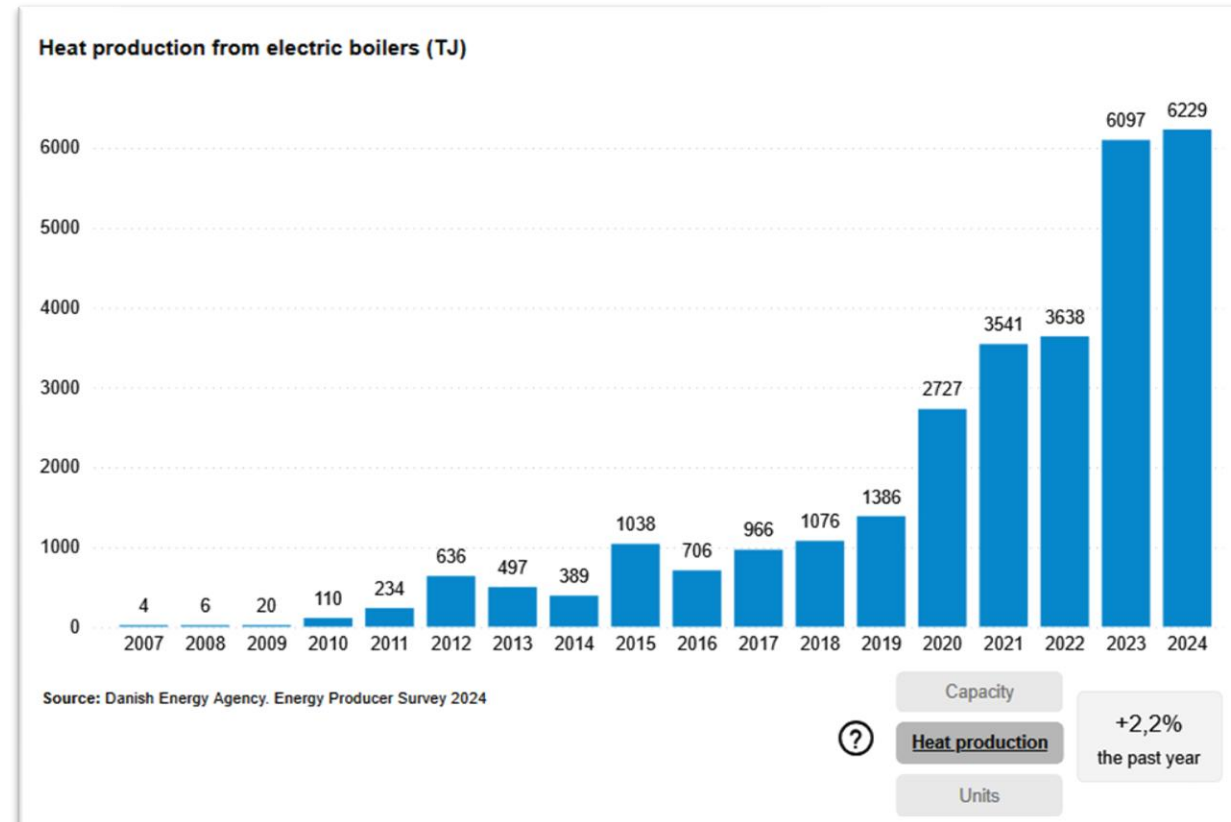
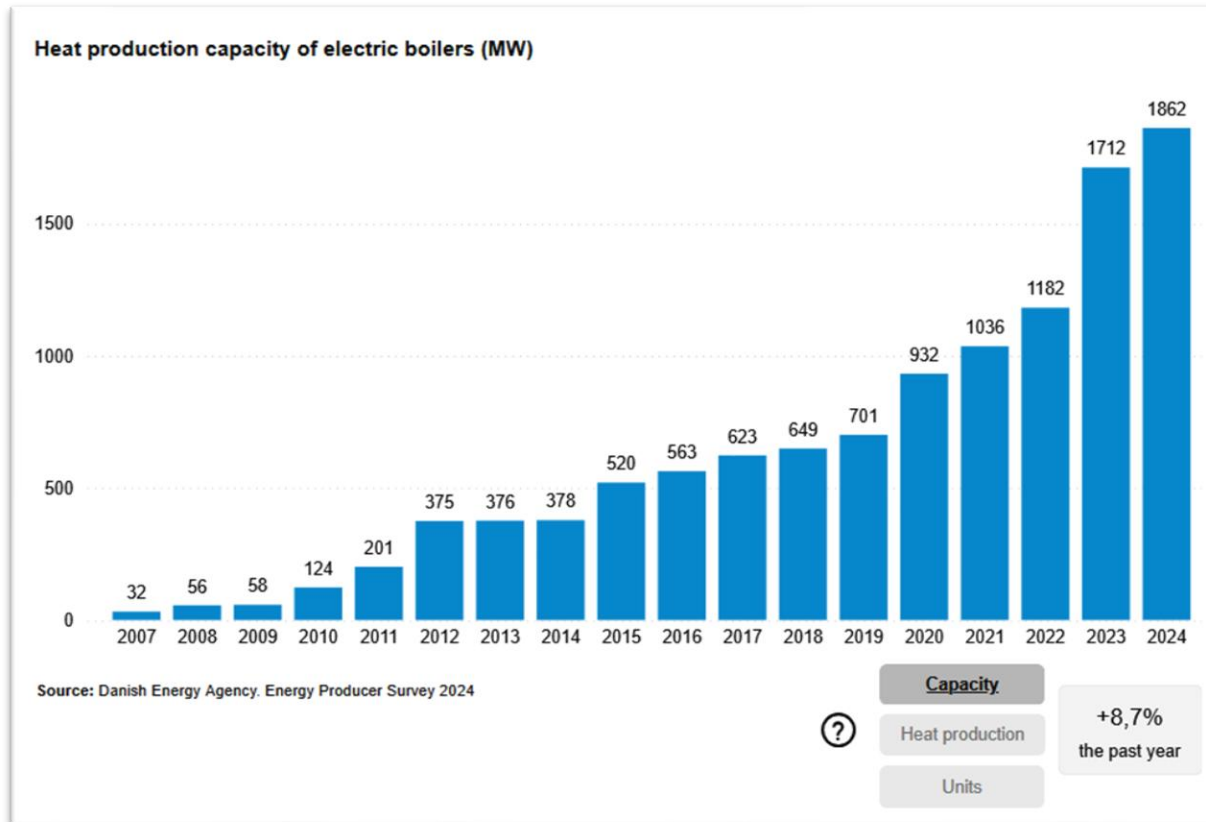
Electrical boilers – largest 80 MW



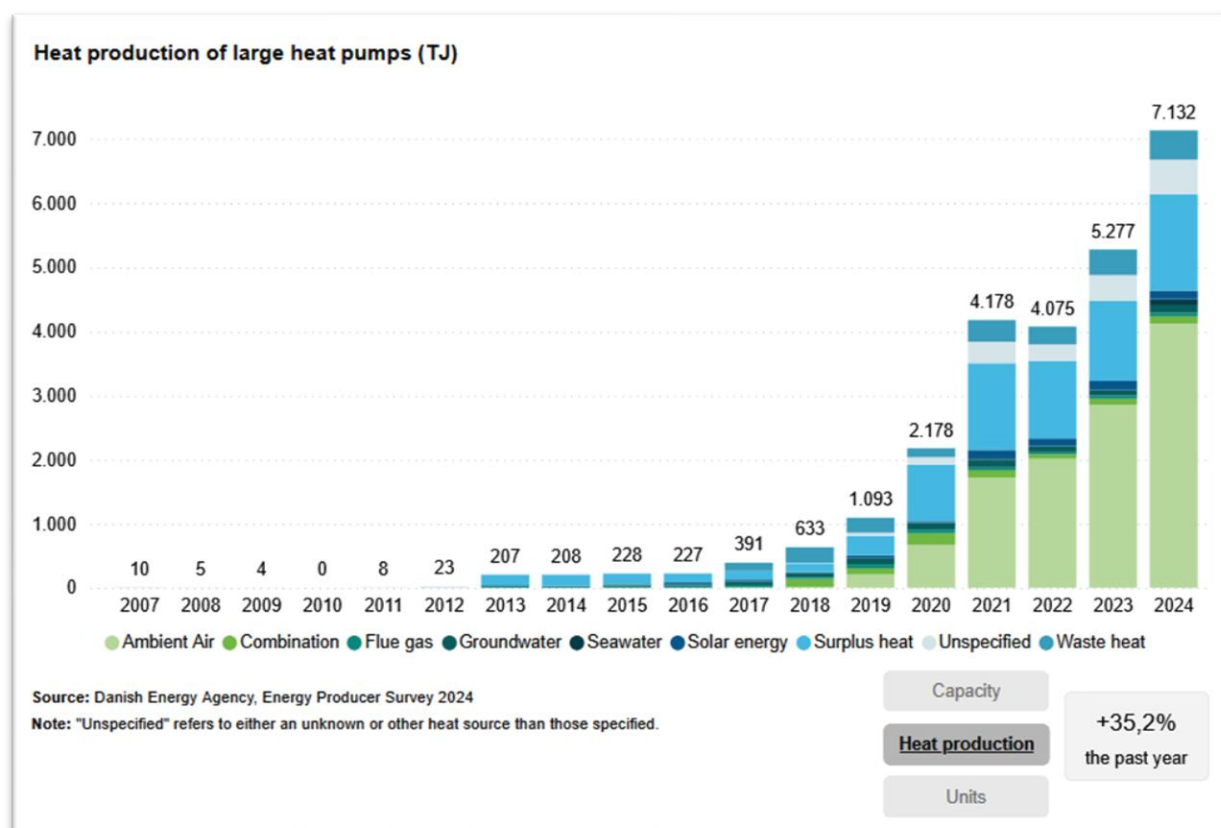
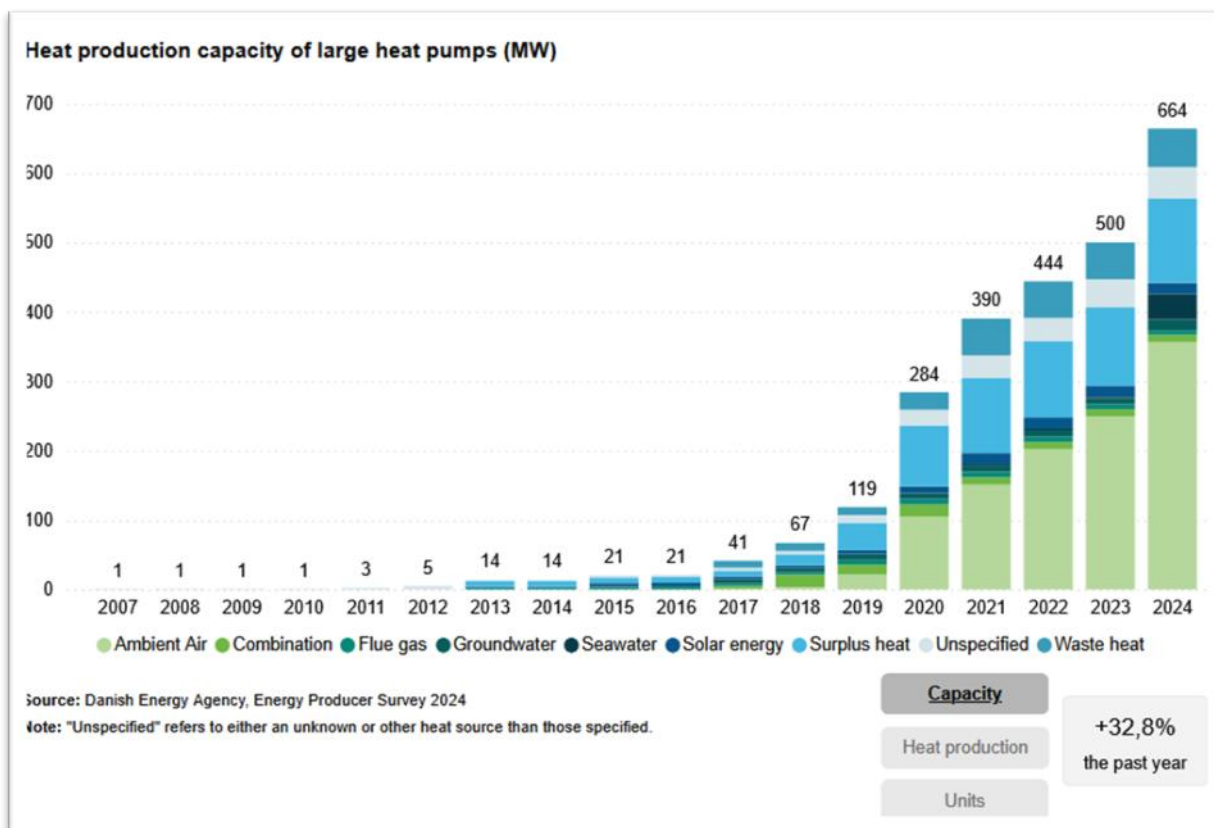
Geothermal – largest 110 MW



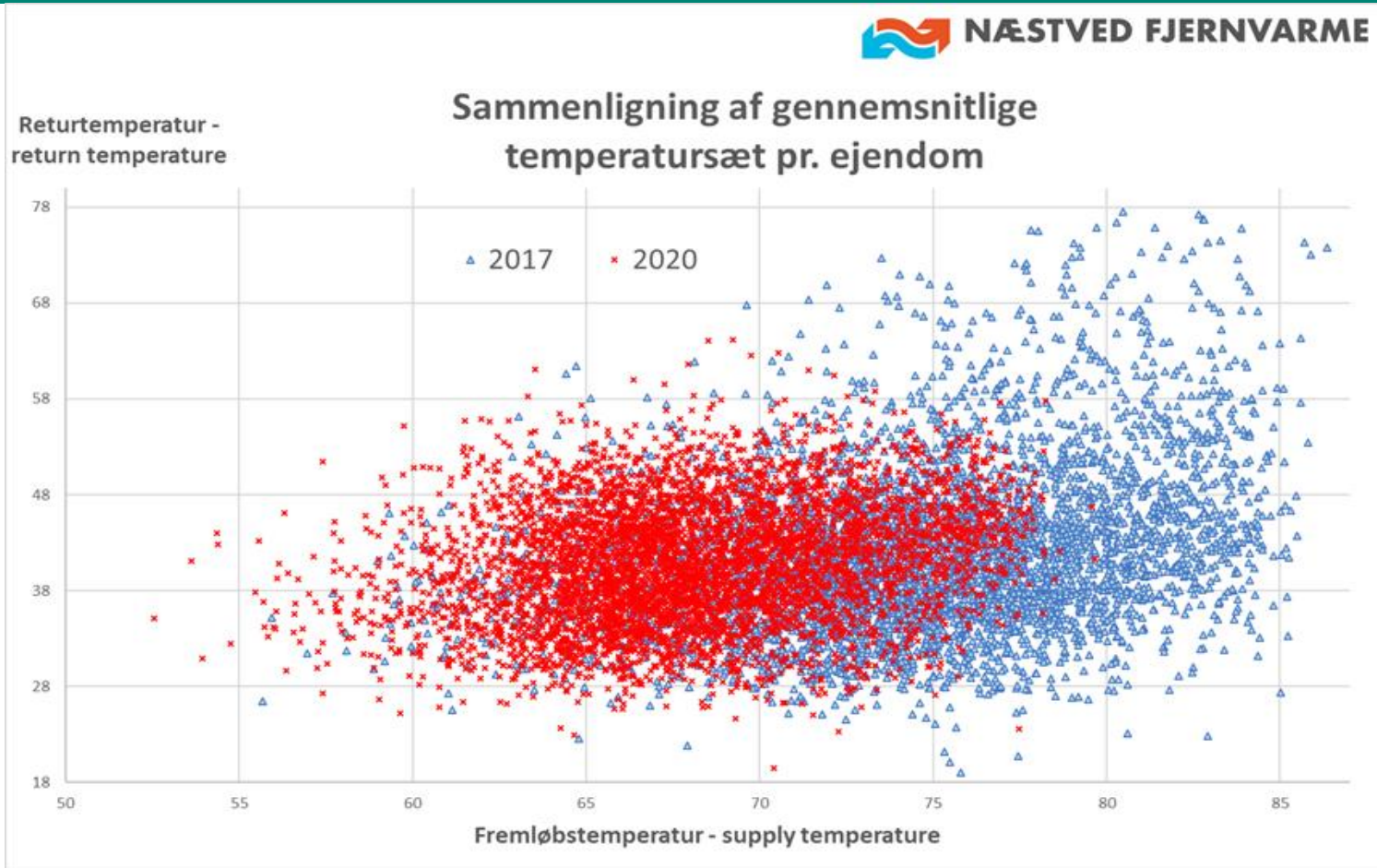
Electrification of district heating – electrical boilers



Electrification of district heating – heat pumps



Cases – temperature optimisation and ΔT



Næstved DH – sale 225 GWh/y, data from 5.500 heat-meters and direct contact to worst performing installations:

- Supply from 85,3° C to 73,7° C
- Return from 48,0° C to 43,9° C
- Higher efficiency at WtE
- Saved 5 GWh
- CO₂-reduction 627t

ENFOR

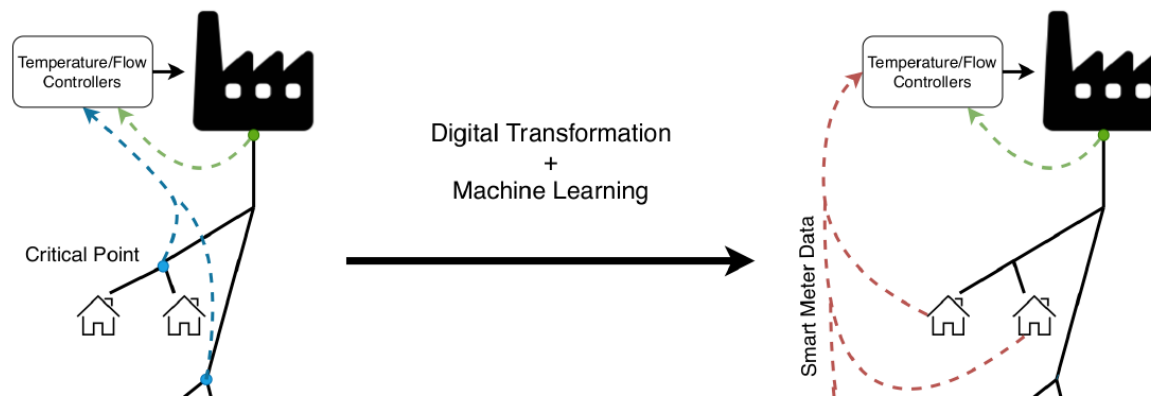


Cases – temperature surveillance with metering data

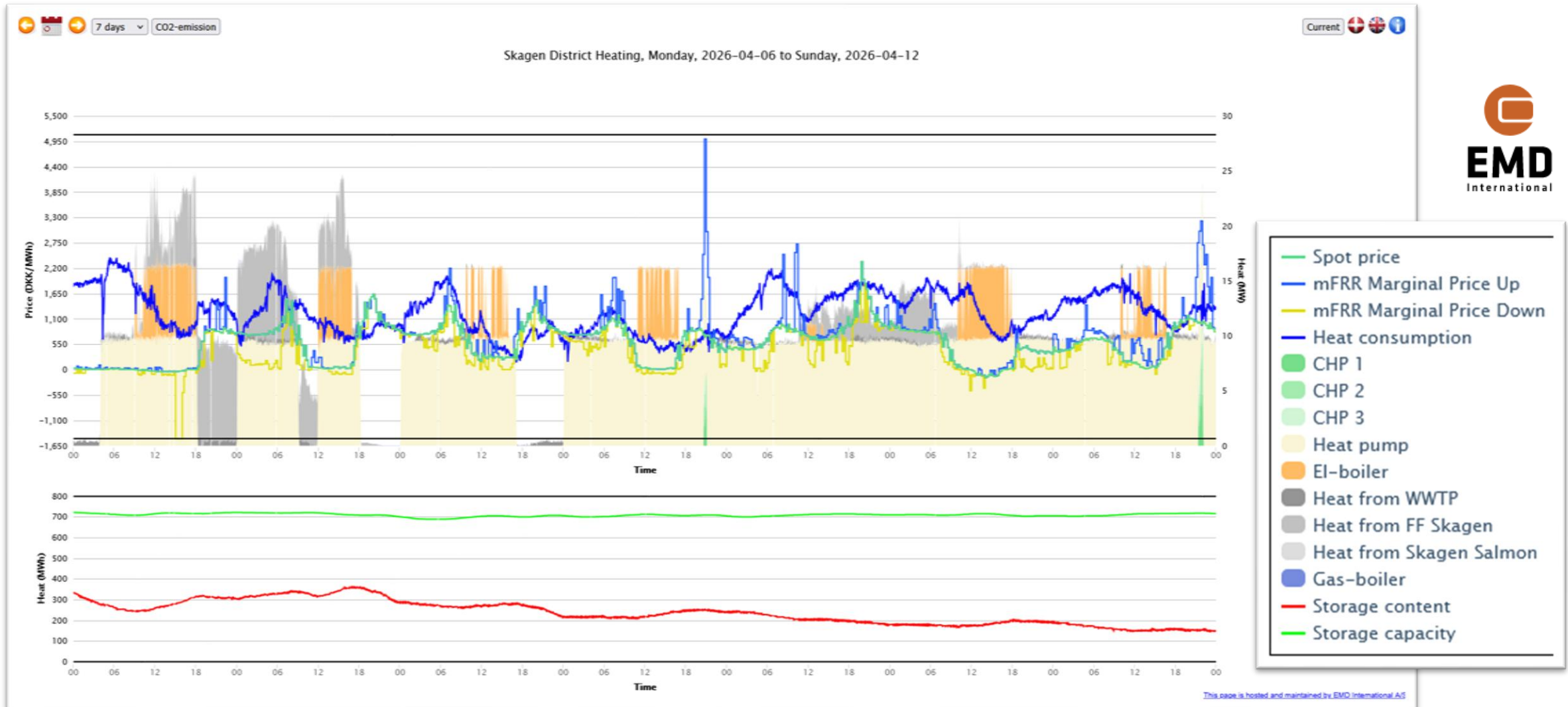


Replacing the netpoint sensors at the critical point using meter data

- Use readings from end-user to create a **artificial critical temperature** for a distribution of houses in the network
- **Replacement** of critical netpoint sensors
- **Dynamic location** of netpoints

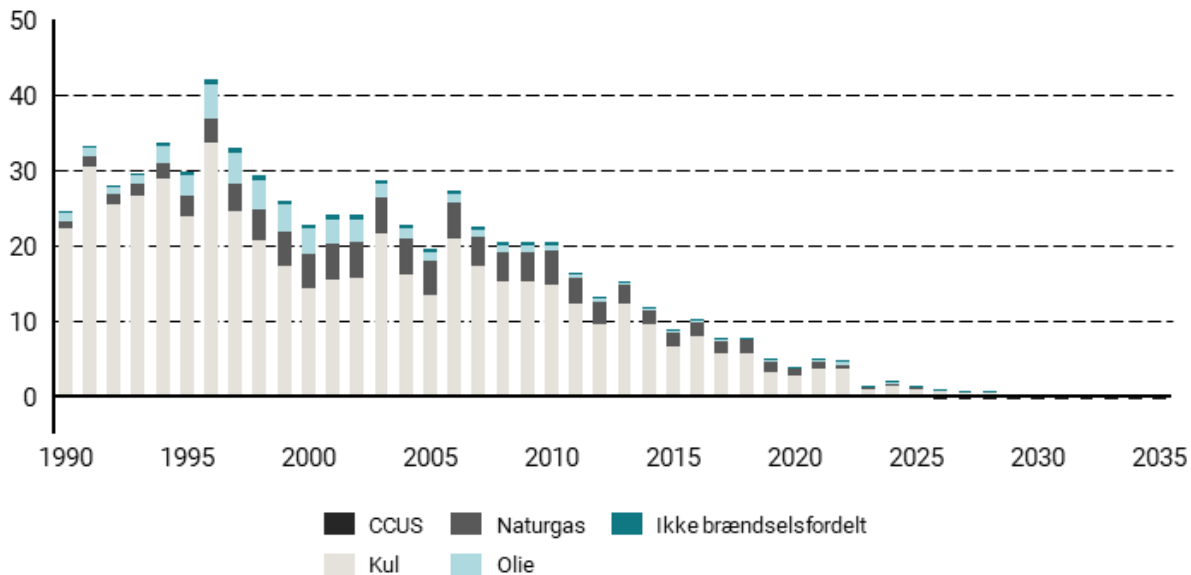


Cases – production optimisation and the electricity market

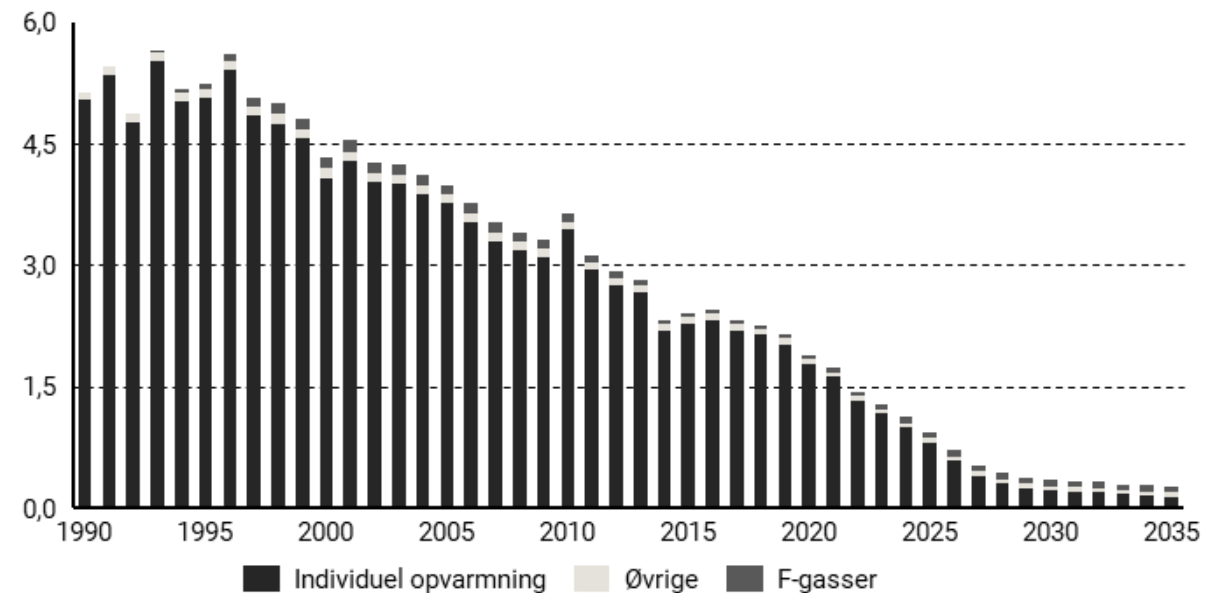


Projected CO₂-emissions

CO₂-emissions from district heating and electricity



CO₂-emissions from households





Learnings

- A burning platform helps!
- As does extensive consumer ownership in energy sector
- Planning with intent and obligations works...
- ...if consumers offered ample protection
- Energy taxation and solid financing also helps
- Focus on the long term is good...
- ...but challenged by modern short-term-ism
- Extensive, modern well-maintained 3-4 gen distribution network...
- ...adapting to next-gen heat-generation coming in
- Digitalisation drives efficiency

Questions?