

WASTE HEAT FROM DATA CENTRES TO DISTRICT HEATING SYSTEMS

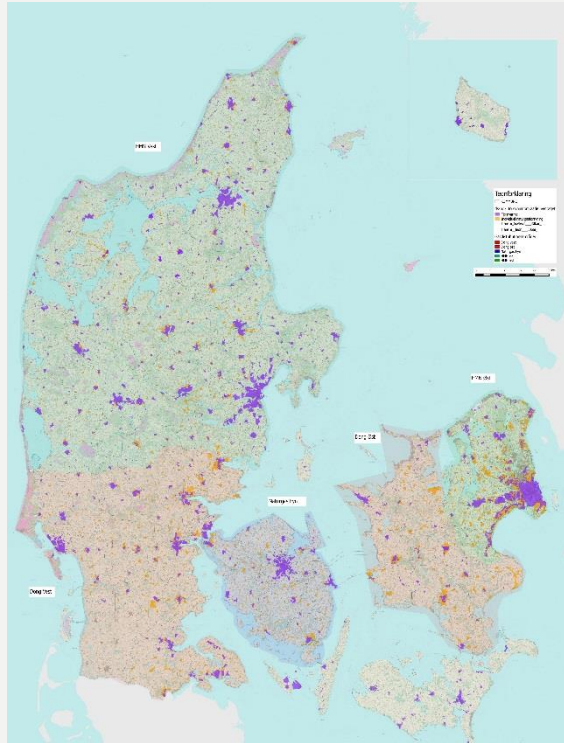
Interxion, 7th of March 2018



OUTLINE

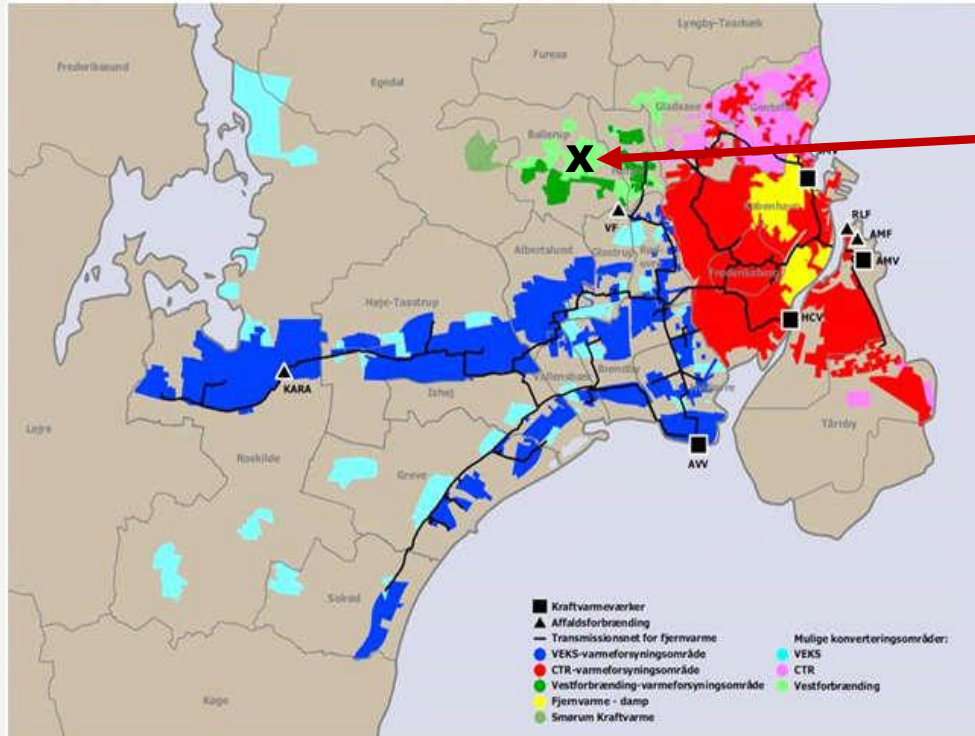
- District heating in Denmark (...and the Nordics)
- Technical concepts for waste heat utilization from data centres
- Business case example
- Expected future developments

DISTRICT HEATING SYSTEMS IN DENMARK



- An old tradition to heat houses via publicly operated heating grids (Copenhagen 1903)
- Historically focus has been utilization of waste heat from central power plants
- Today, approximately 62% of building heating is supplied from district heating grids
- Future developments (among others) look into increased utilization of power from windmills for operation of heat pumps utilizing various waste heat sources

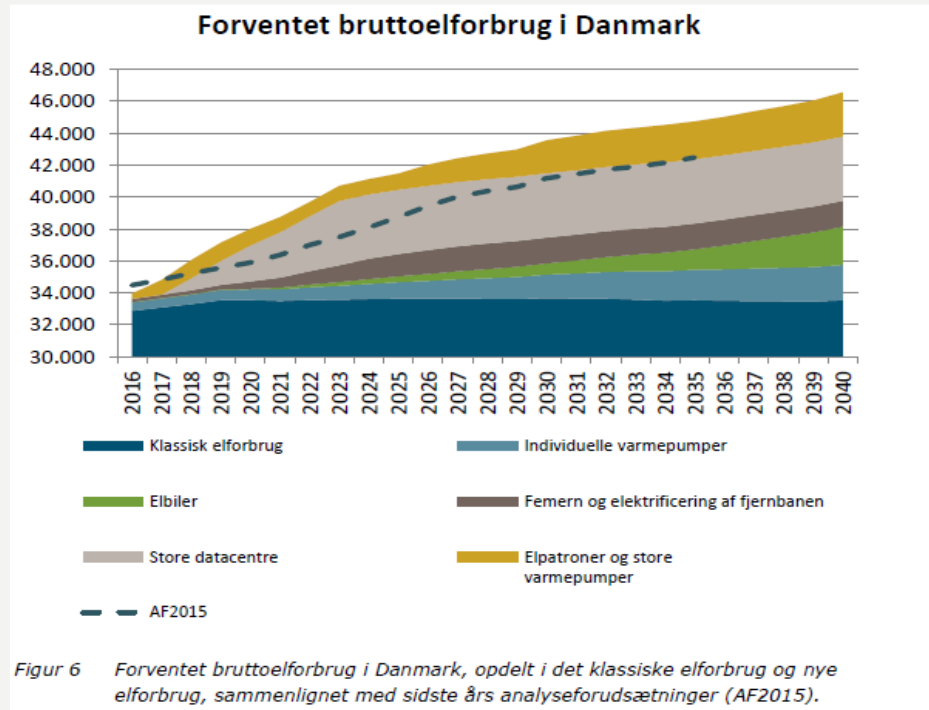
THE COPENHAGEN REGION:



Interxion

The interconnected district heating grids in the Copenhagen Region is to become carbon neutral by 2025

POWER CONSUMPTION IN DENMARK



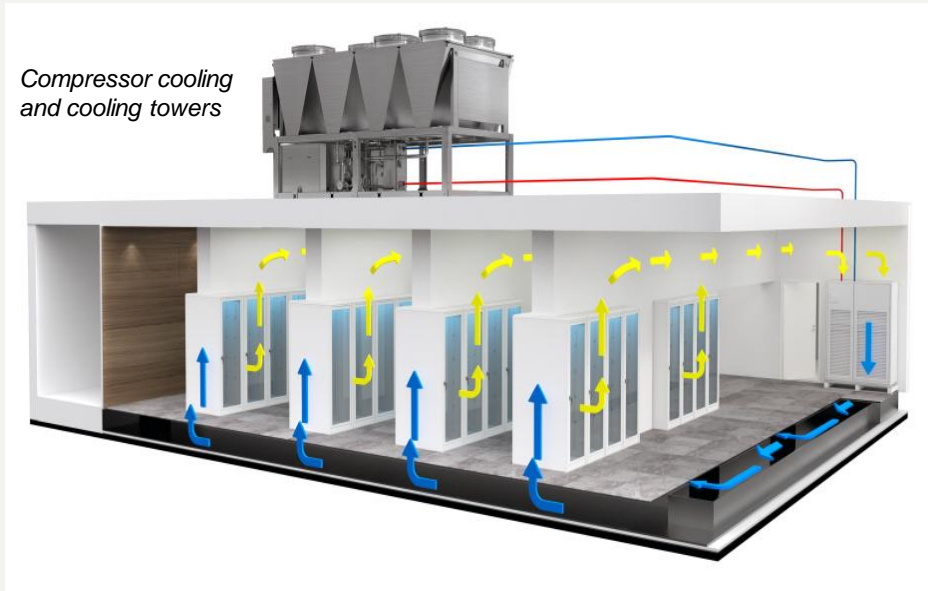
- Datacentres are expected to use approx. 10% of total electricity consumption in Denmark by 2025



- Strong political focus on how to integrate data centres in the future energy system

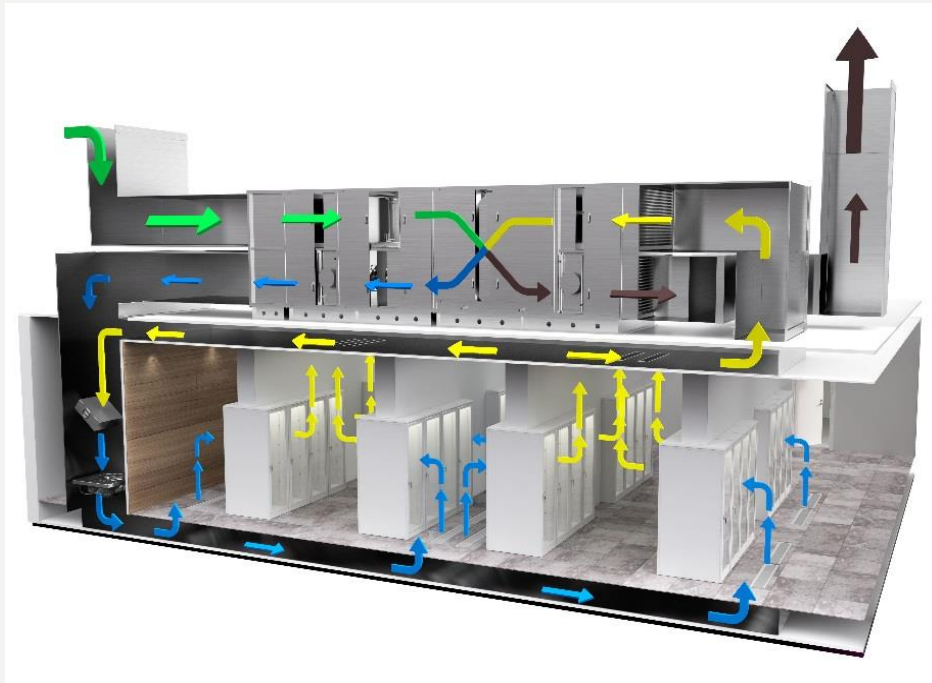
TECHNICAL CONCEPTS

COOLING - TYPICAL DATA CENTRES



- Circulating air is cooled via cooling systems:
 - Compressors
 - Cooling towers
- In Denmark, cooling towers can deliver necessary cold water approx. 2,500 hours/year
- Waste heat is available in hot water and is easy to utilize via heat pump

COOLING – HYPER SCALE DATACENTRES



- Cooling supplied by circulating ambient air directly through data centre...
- ...or via heat exchanging circulating air with ambient air
- Waste heat is available in exhaust channels venting warm air to the surroundings
- Heat exchangers and heat pumps must be applied to utilize heat

BUSINESS CASE EXAMPLE

EXAMPLE - HEAT PUMP FOR DISTRICT HEATING

- Waste heat is available in datacentre circulating water at approximately 20C
- Simple to utilize waste heat via heat pump
- Yearly heat export: 32,6 GWh
- Production time: 6550 hrs
 - 9 months "cold" period
 - No export during summer
- Heat pump COP ~ 3,5
 - Expected to increase due to gradually reduced DH-temperatures and gradually increased cooling water temp.

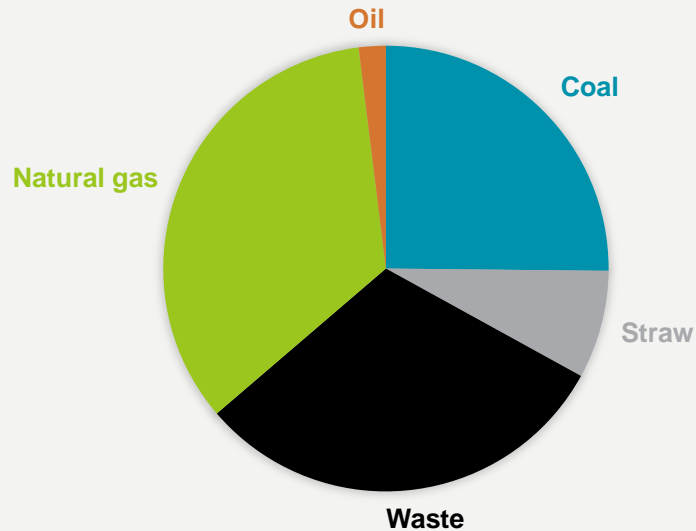
BUSINESS CASE EXAMPLE

- Investment: 3,200,000 €
- Grant: 1,130,000 €
- Annual heat sales: 1,260,000 €
- Maintenance: 20,000 €
- Annual earning: 375,000 € (after payment of net extra electricity consumption)
- Payback: 4.2 years

- Total heat export corresponds to heat demand of 1,800 households*

(*Dansk Fjernvarme)

SUSTAINABILITY*



EXAMPLE OF FUEL MIX IN DISTRICT HEATING SYSTEM IN MAJOR CITY

- Large variations in CO₂-emissions from one district heating grid to another
- During winter period, CO₂-emissions from operation of power plants is higher than during summer periods



- Datacentre will reduce CO₂-emissions in CPH-region by eliminating use of fossil fuels in power plant operation

EXPECTED DEVELOPMENTS

- Legislation (Ecodesign) will have impact on future data centres
 - Wider ranges of temperatures and humidity of circulating air/waste heat are expected
- The business case for data centres with heat pumps will improve:
 - Temperatures in district heating will develop to be in favour of waste heat
 - New taxation schemes will favour waste heat utilization (?)
- The future electricity system in the Nordics will become carbon neutral
 - Heat pumps and waste heat utilization will be a cornerstone in district heating supply
- Still - you have to calculate and plan carefully!
 - Quote: "I had never expected it to be so difficult to give something away for free"

Thanks for your attention



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