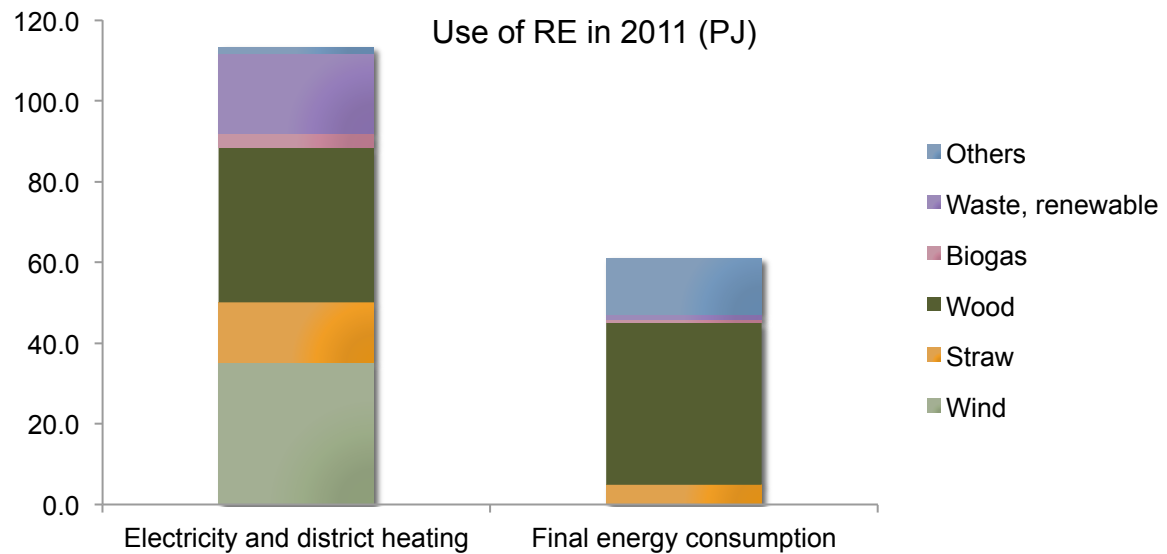
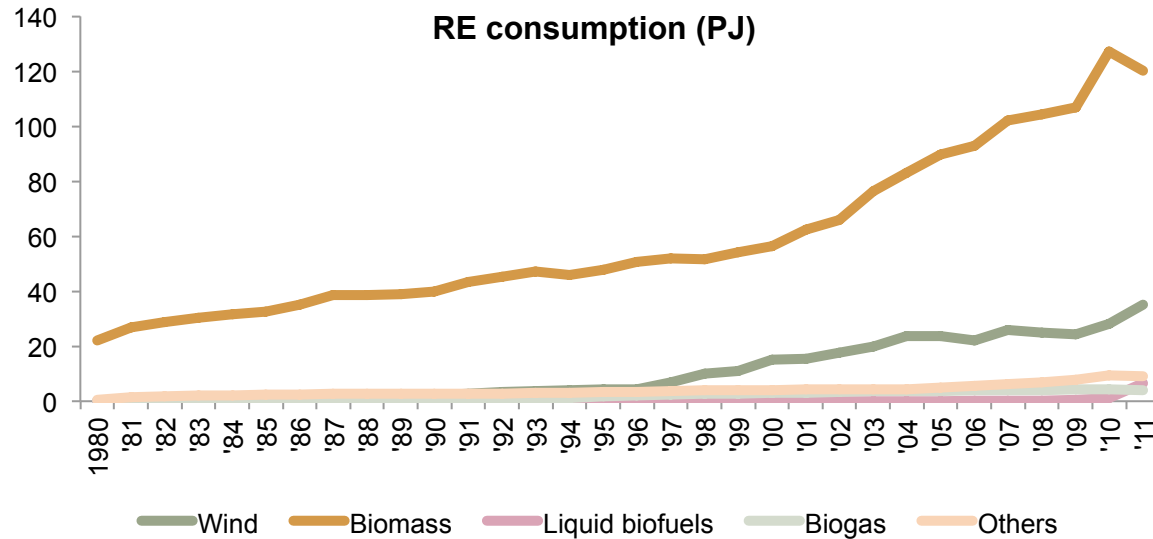


BIOMASS FOR HEATING IN DENMARK

Kaare Sandholt, Chief expert, China National
Renewable Energy Centre

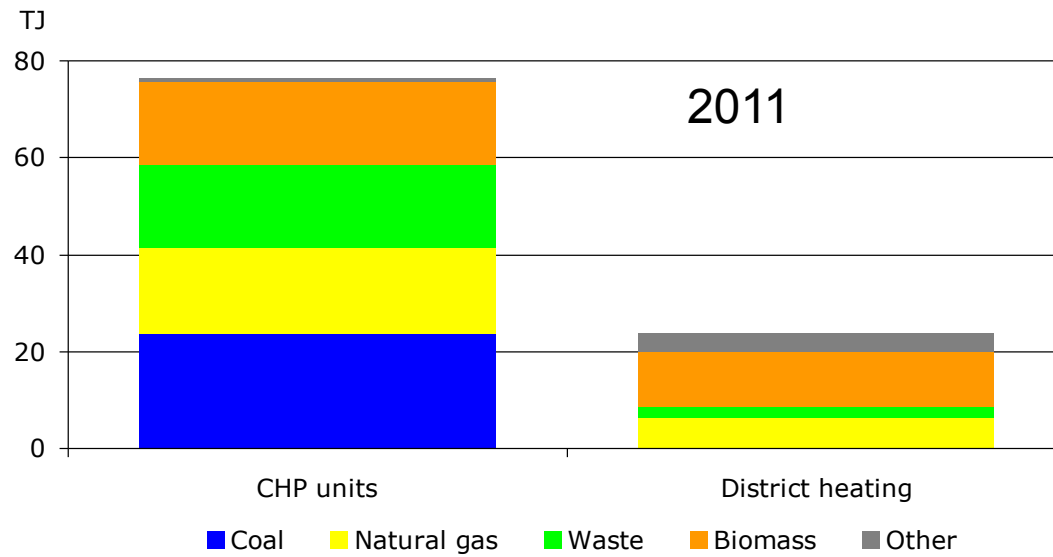
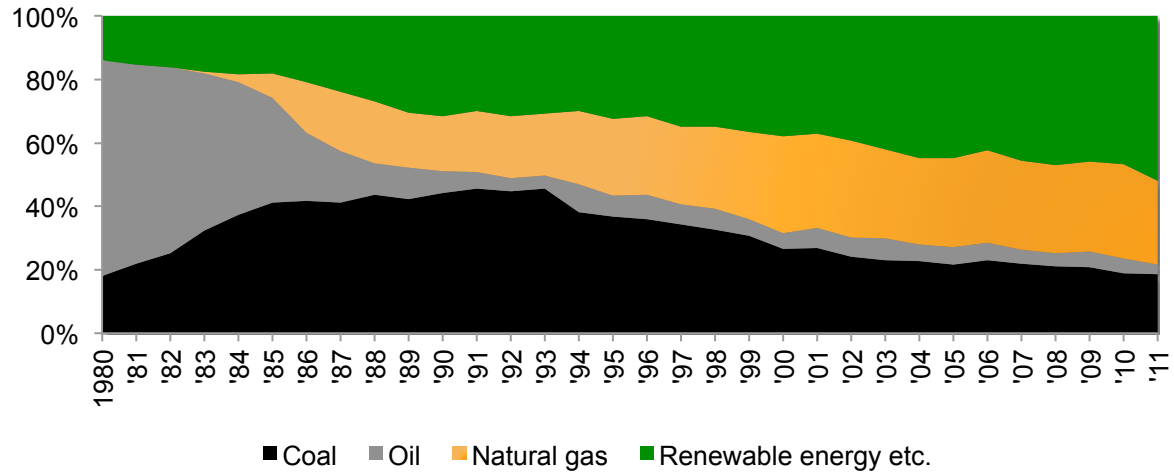
Biomass important part of Denmark energy supply

Biomass has been the dominant RE source in Denmark for three decades



Heating

Fuel consumption for district heating (%)



280 Biomass Plants in Denmark

Wood or straw:

- 200 district heating plants
- 15 CHP plants

Biogas:

- 33 CHP

Municipality Solid Waste:

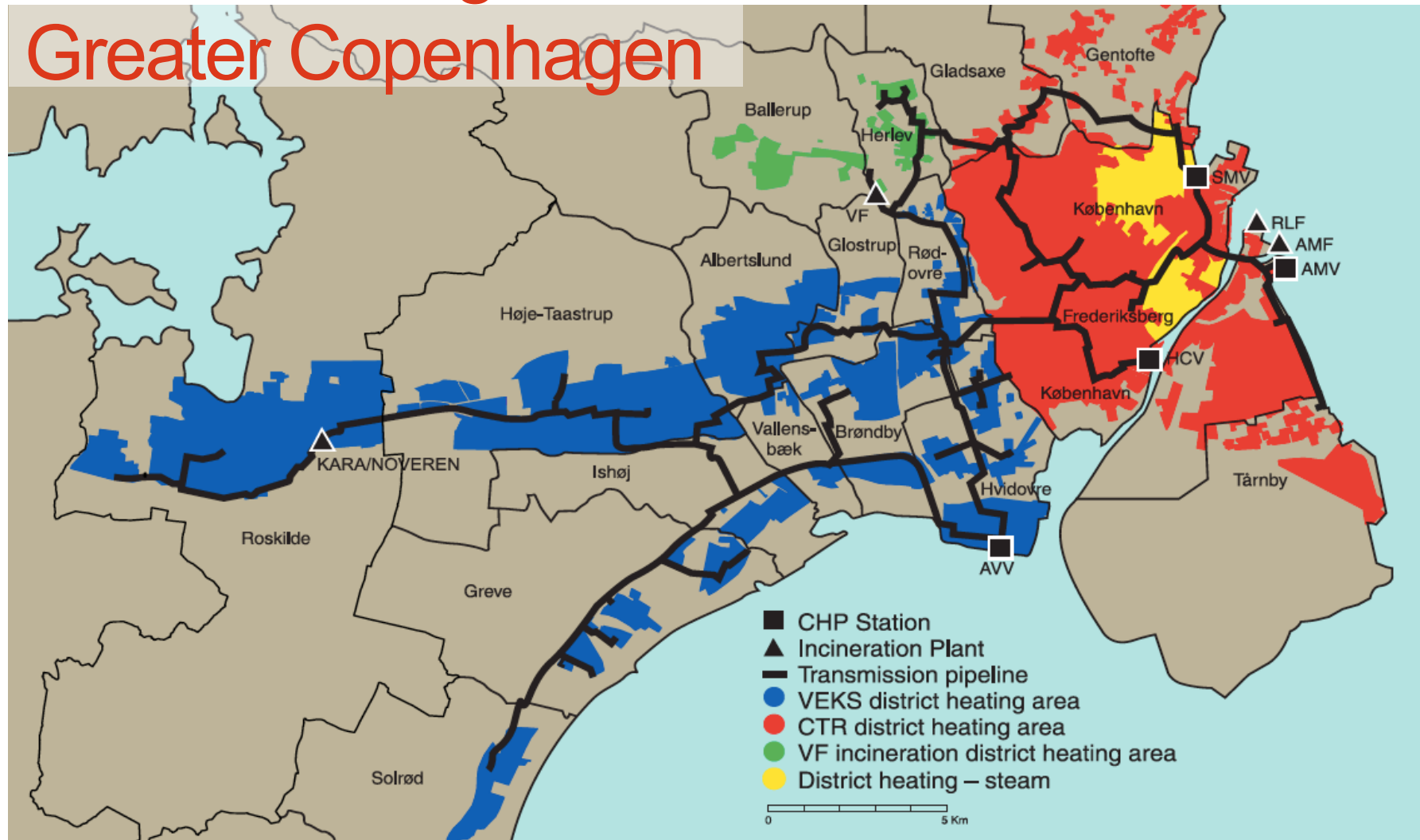
- 24 CHP plants
- 8 district heating plants



10% of the electricity consumption and 25% of the heat consumption from biomass, incl. organic waste.

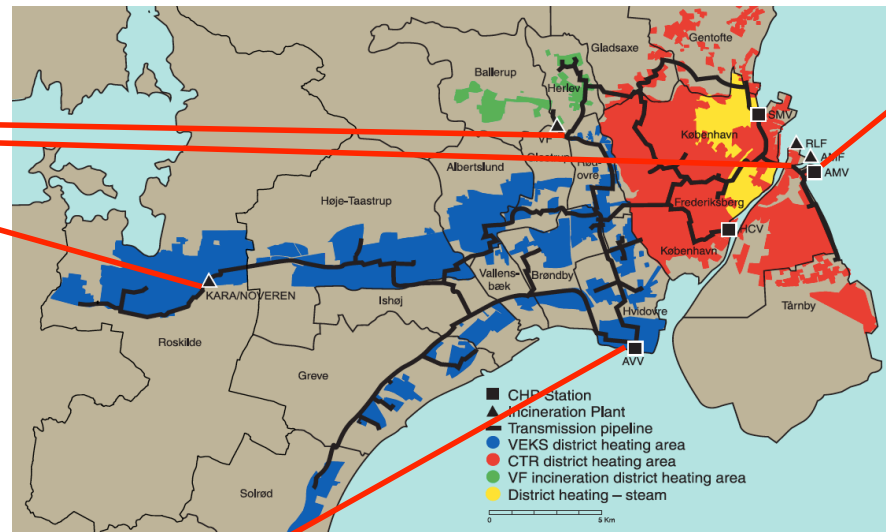


District heating in Greater Copenhagen



Biomass and waste in CHP plants

Waste incineration plants



Amagerværket

Straw pellets

Avedøreværket

Wood pellets and straw boiler

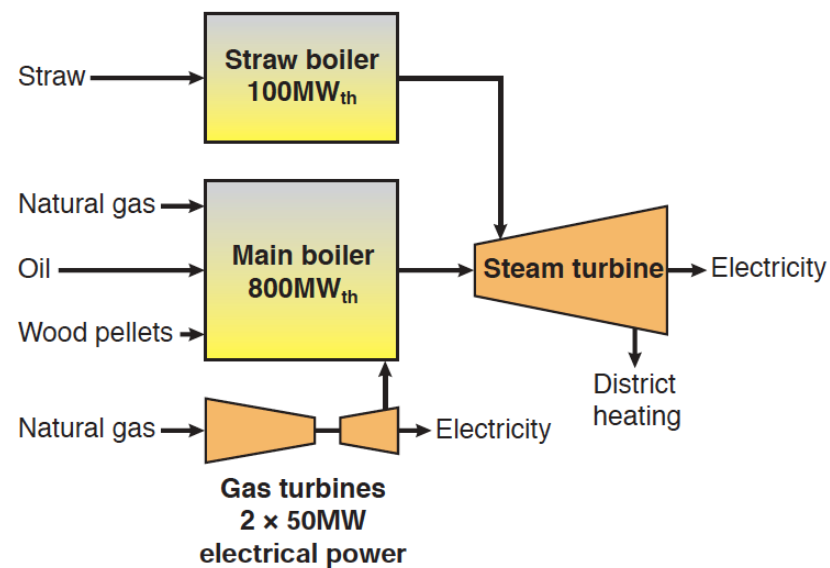


Avedøreværket unit 2

Also unit 1 will be converted from coal to wood pellets



Data for Avedøreværket (Avedøre 2)	
Commercial operation	2001
Supplier of boiler plants	FLS miljø, BWE, Vølund
Fuels	Oil, natural gas, wood pellets and straw
Consumption of wood pellets	300,000 tonnes/year
Consumption of straw	150,000 tonnes/year
Fired output	800MW
Boiler type	Benson
Firing concept	Biodust-firing/vibrating grate
Steam pressure (main boiler/straw boiler)	305/310 bar
Steam pressure (main boiler/straw boiler)	296/40kg/second
Steam temperature (main boiler/straw boiler)	582/545°C
Electricity efficiency	49 per cent
Boiler efficiency	94 per cent
Flue gas cleaning (main boiler/straw boiler)	DeNO _x -plant, electrostatic precipitator and desulphurisation plant/bag filter
Electrical power efficiency	390/275MW



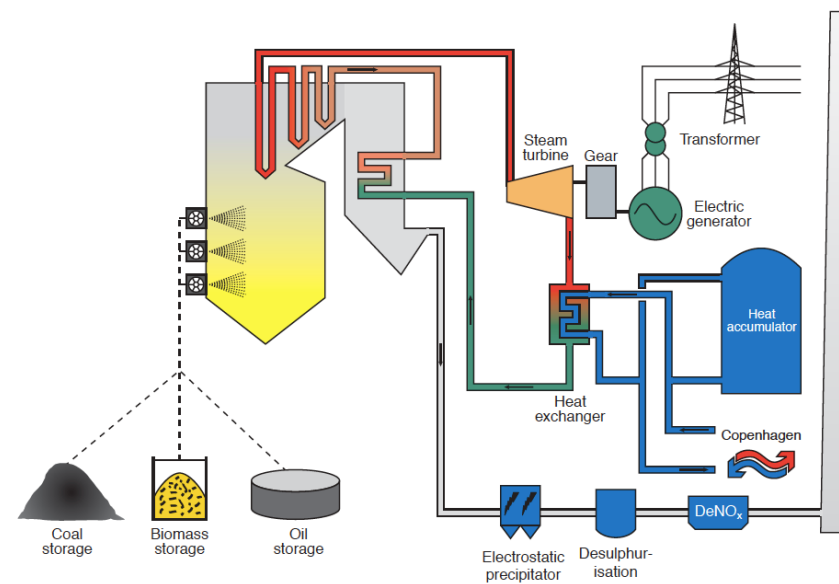
Amagerværket unit 1

Also unit 3 will be converted to pellets



Data for Amagerværkets unit 1

Commercial operation	1971/2009
Supplier of boiler plants	Burmeister og Wain Energy
Fuels	Coal, oil, wood pellets and straw pellets
Consumption of fuel	150,000 tonnes/year
Fired output	350MW
Boiler type	Benson
Firing concept	Dust-firing
Steam pressure	185 bar
Steam volume	139kg/second
Steam temperature	562°C
Electricity efficiency	23 per cent
Boiler efficiency	95 per cent
Flue gas cleaning	Desulphurisation plant and deNO _x plant
Electrical power efficiency	80MW
District heating output	250MJ/second



2025 Goals for Copenhagen

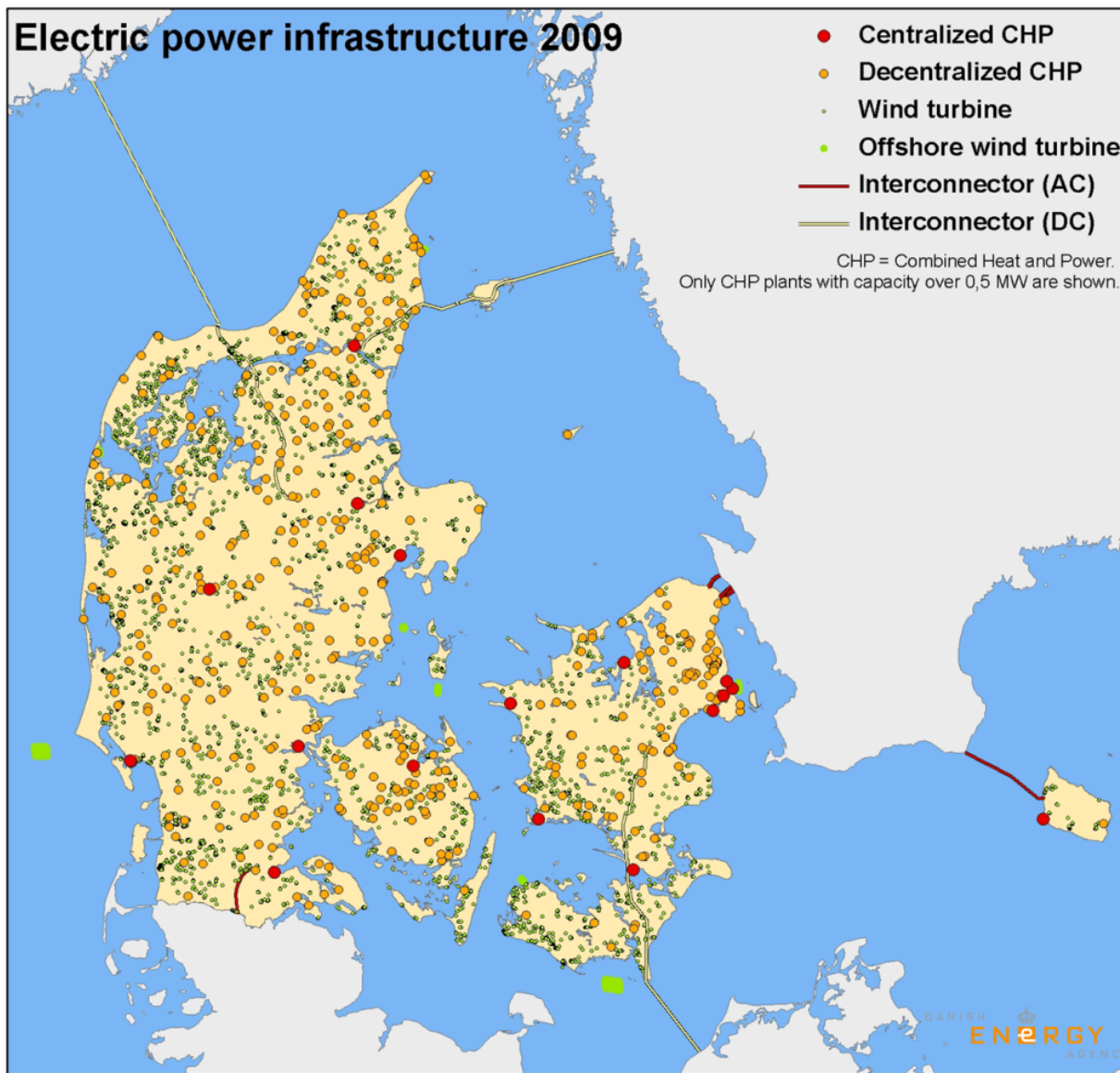
Carbon neutral by 2050

MAJOR GOALS FOR 2025

- // DISTRICT HEATING IN COPENHAGEN IS CARBON NEUTRAL.
- // ELECTRICITY PRODUCTION IS BASED ON WIND AND BIOMASS AND EXCEEDS TOTAL ELECTRICITY CONSUMPTION IN COPENHAGEN.
- // PLASTIC WASTE FROM HOUSEHOLDS AND BUSINESSES IS SEPARATED.
- // BIOGASIFICATION OF ORGANIC WASTE.

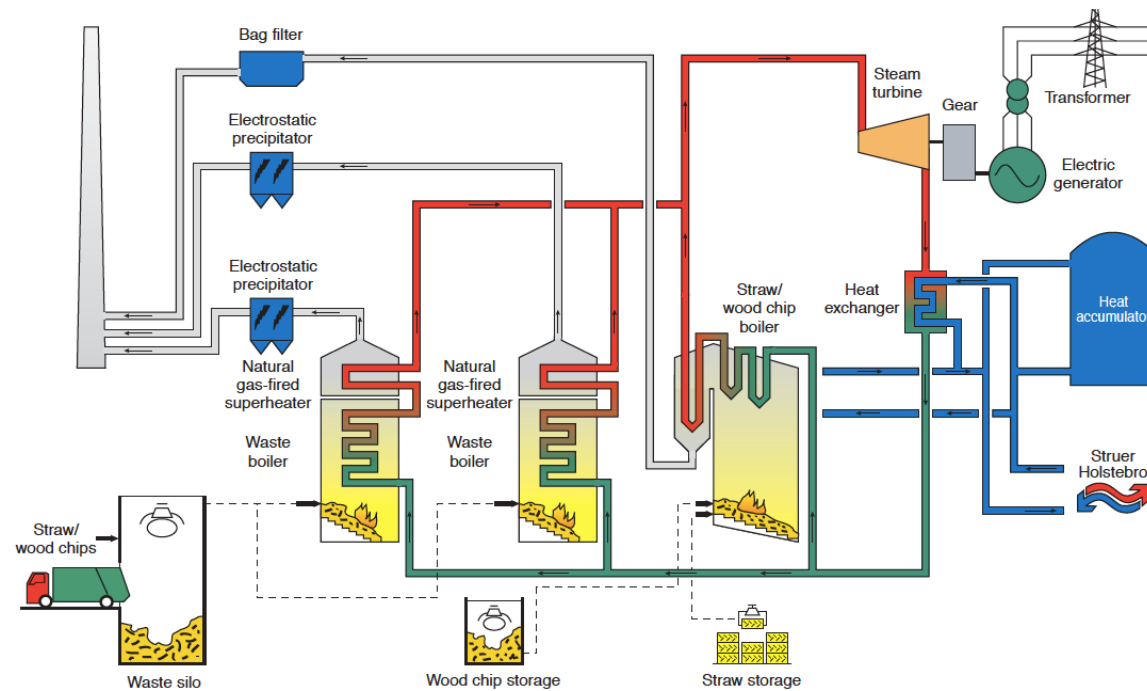
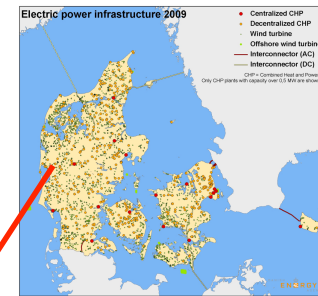


Other CHP plants



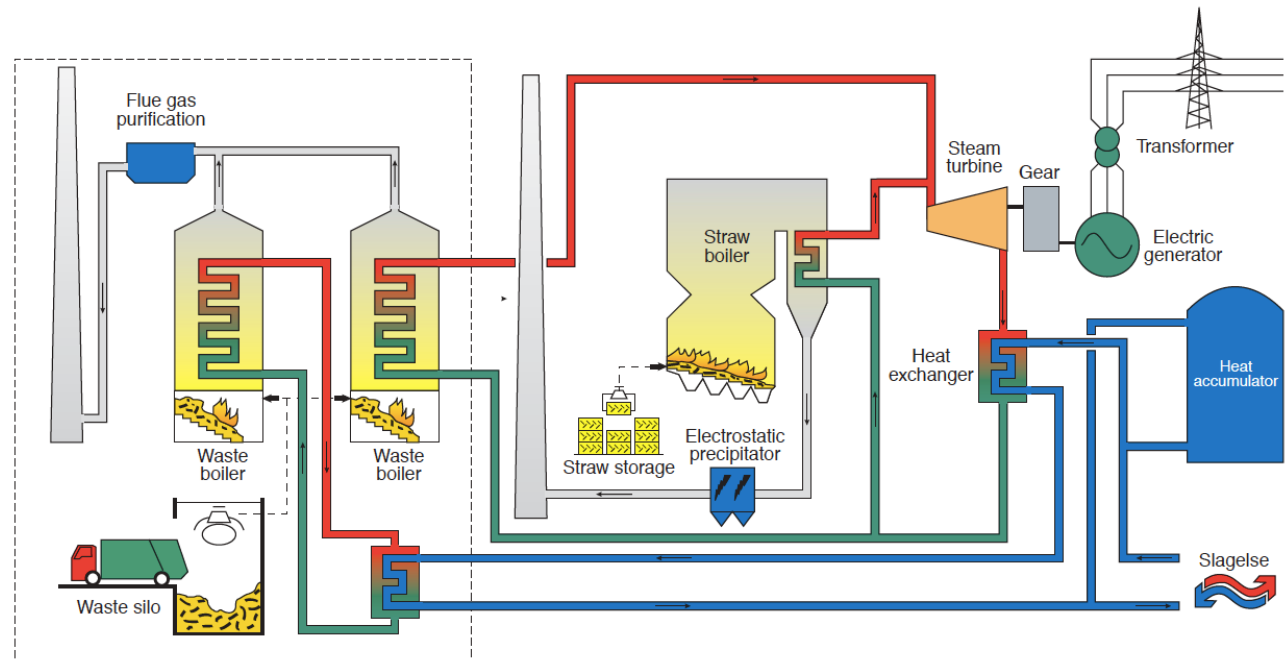
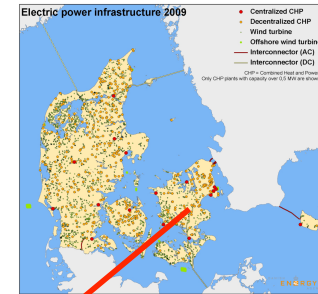
Måbjerg

Waste – Wood chips and Straw



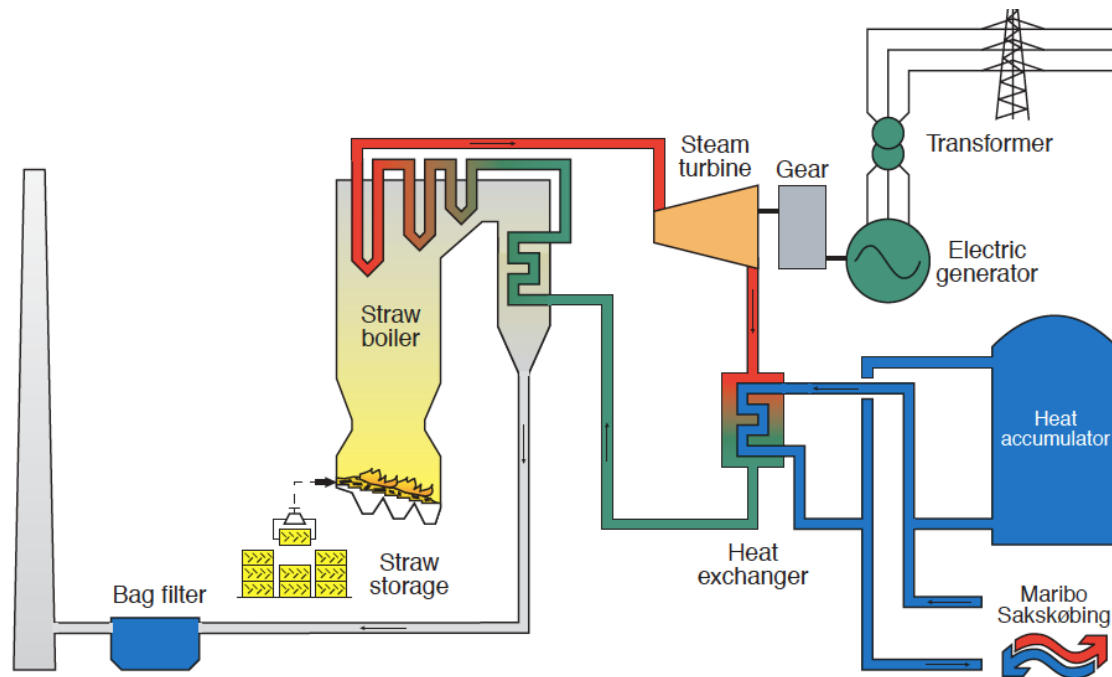
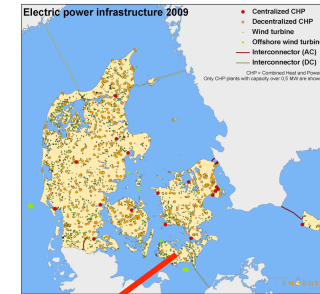
Slagelse

Combined straw and waste incineration CHP plant



Maribo-Sakskøbing

Straw fired CHP plant



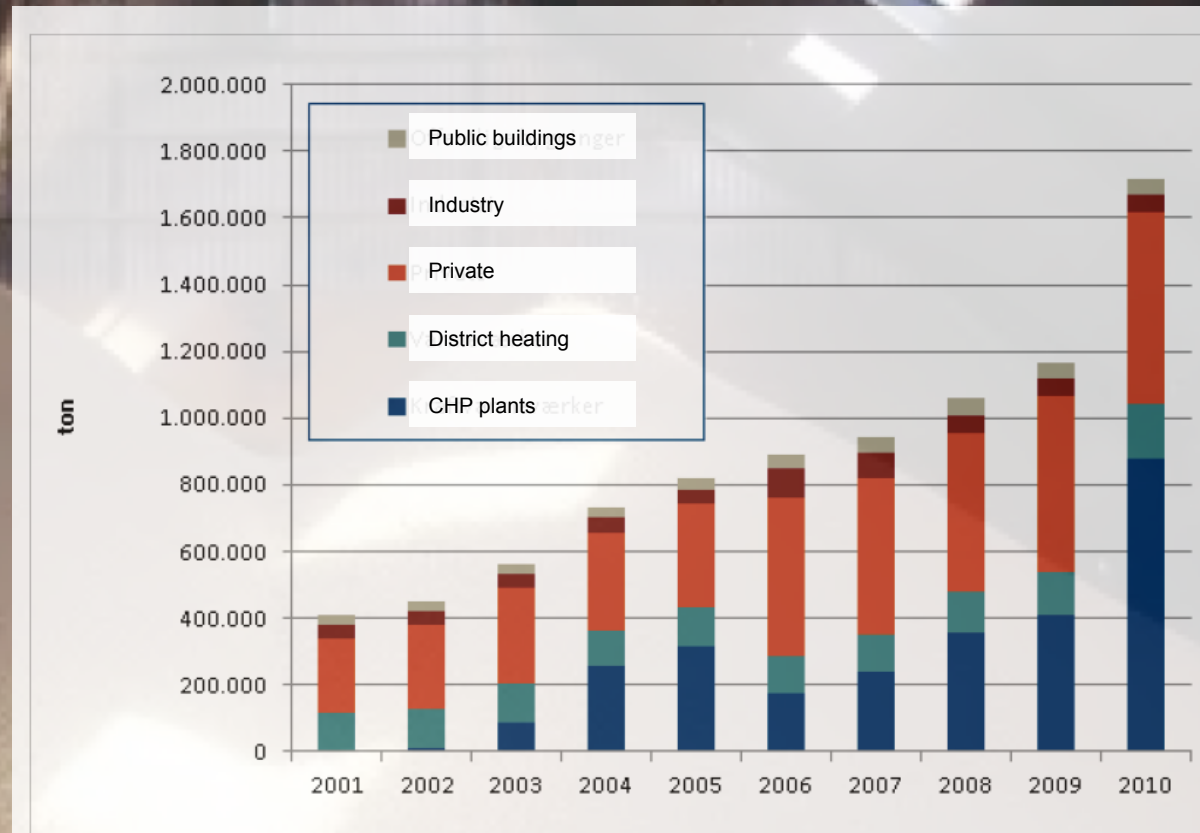
District heating

Straw fired boiler in Thorsager



Wood pellets

Private heating is a big market for wood pellets in Denmark



Wrap up

- Denmark has a long history in efficient use of biomass for energy purposes
- CHP – district heating and private use of wood pellets are the main use of biomass in Denmark
- Biomass is an important part of the Danish strategy for non-fossil energy system in 2050
- The technologies are transferable to other countries