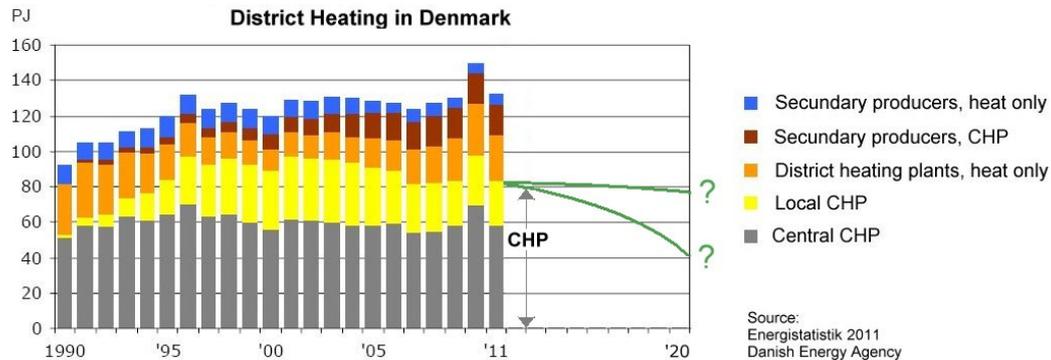


# Scenarios for Analysis of Combined Heat and Power

## Summary



1. Combined heat and power (CHP) can cover about half the Danish demand for space heating. The annual production has been increasing until the turn of the century to about 100 PJ. CHP units can be operated at thermal efficiencies about 90%.
2. Since then the increasing production of wind energy in Denmark has caused decreasing production of electricity from the CHP units and correspondingly lower revenue. Some central power plants have already been closed or mothballed. The local CHP production has fallen from about 40 PJ to about 20 PJ in 2011.
3. In 2020 50% wind energy and 4 % photovoltaic energy (PV) are expected to cover the traditional electricity demand. Efficient supply of both the remaining 46% electrical demand and the district heating demand will be a challenge.
4. Four scenarios for the external conditions of Danish CHP production in 2020 have been developed for the Danish District Heating Association:
  - a. "European shortage of electricity" due to a nuclear disaster and subsequent massive closure of nuclear power plants. The increased demand for electricity will encourage maintenance the present capacity of Danish CHP units.
  - b. "Electricity Import" due to closure of most Danish CHP plants and capacity arrangements supporting power plants in the neighbouring countries.
  - c. "Coal stop". A political decision prevents the use of coal in Danish power plants before 2020.
  - d. "Competition on equal terms". EU introduces a common European capacity market before 2020.
5. Analyses of the four scenarios have demonstrated the risk of a random development of the future energy infrastructure. The result can be an incoherent infrastructure, unless a balanced capacity is maintained by a determined control of the frameworks for the electricity and heating sectors.
6. Under the present conditions the most likely CHP production level in 2020 seems to be about 40 PJ or 40% of the level at the turn of the century.
7. A future stable supply of electricity will require reserve capacity from either Danish or foreign sources for practically all installed wind power. Imported electricity will not necessarily be cheaper or cleaner than electricity from Danish power plants.
8. The CHP systems can utilize overflow from wind power and provide an essential part of the necessary reserves for the power system. This flexibility will be conditioned by sufficient CHP production capacity.
9. Capacity payments in harmony with capacity arrangements in the neighbouring countries will be vital elements in maintaining a suitable central and local CHP capacity in Denmark.