Role of District Energy in Decentralization of Energy Supply in Denmark
Power Supply System, Denmark
Green Fuels + CHP as technology

- Heat planning promoted green solutions by administrative decrees in 1990-1998:
  - New and existing district heating supplies should be Combined Heat and Power plants, if recommended by feasibility study. Very energy efficient technology
  - From oil and coal → natural gas and biomass
- CHP contributed ¾ of new power capacity from 1990-97.
- Municipality as Heat planning authority in the 1990’s and today. Strong national guidelines for local decisions.
- Conversion to electrical based energy system 2010-2030
Organisation/local ownership

Large cities (originally power plants):
Owned by large energy companies.
Centralized CHP (production only).
Transmission usually unbundled.

Smaller centres (originally DH plants/CHP) during the 1980s an -90s:
Usually joint production and distribution.
Owned by municipalities or local consumers.

Transmission:
Typically owned by municipalities.
Energy Planning – local/regionally

- **A: Zero line – Data Collection, where are we?**
  - Energy consumption – power, heat, fuels, transport
  - Energy ressources – fuels, renewable energy, excess heat

- **B: Setting targets – where do we want to go**
  - Environmental – CO₂, NOx, particles
  - Economical – import, local supplies

- **C: Planning – How do we do?**

- **D: Corrective activities**
  - Follow-up – standardized data collection
Local Energy Planning
District energy in long-term planning of urban development

- Planning of DHC as for other infrastructures
  - (Power, water, sewage, gas)
- Planning of urban development
  - Location of residential and commercial areas
  - Location of energy production plants
  - Facilities with excess heat
- Design and requirements for new buildings adapted to DHC
  - Low-energy not zero-energy
  - Prepared for low-temperature
Heat Supply Zones

- First Heat Supply Act introduced supply zones all over Denmark. Secures economy of scale and optimal use of capacity. Preliminary zones in 80’s, finally established in 90’s.

World Bank citation: Supply zones can make DH compete with individual heating to the benefit of lower consumer prices
Power supply system 2019

October 11th – high wind-production

- **Større værker over 100 MW**: 830 MW
- **Mindre anlæg under 100 MW**: 605 MW
- **Vindmøller**: 3.844 MW
- **Solekceller**: 171 MW
- **Nettoudvækst import**: -656 MW
- **Eltfordrags**: 4.795 MW
- **CO2-udlæsning**: 79 G/KWH
- **Total produktion**: 5.450 MW
Power supply system 2019

October 16th. low wind-production
Integrated local energy plant, example

• **Braedstrup Total Energy**
  - Heat production ( – Power production
  - Heat Storage – function as power balancing unit
  - Power consumption

**Production facilities**

- Solar collector area of approx. 18,600 m²
- Borehole heat storage (BTES) of approx. 19,000 m³ heated soil (~ 8,000 m³ of water equivalent)
- Tank storages (2,000 m³ + 5,500 m³ ~ 400 MWh)
- Electric HeatPump (6 MW_{th})
- Electric Heat Only Boiler (10 MW)
- Natural gas CHP (2x 3,7 MW_{electr.}  2 x 4 MW_{th})
- Natural gas Boilers (13,5 MW_{th})

October 2019
Energy Planning tools and examples

- DHAT

- Hotmaps
  - https://www.hotmaps-project.eu/

- Planning and designing Energy Production Plants
  - https://www.emd.dk/software/, EnergyPro, WindPro
Thank you for your attention
PlanEnergi – Company Presentation

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History

• Idea: Creating an independent consulting firm to supply competent advice concerning all forms of renewable energy and energy efficiency solutions.

• Established in 1983.

• Purpose:
  “To promote the use of resource-saving and environment protective systems. The objective will be furthered through commercial and information activity within renewable energy, rational exploitation of energy and energy planning as well as information activities”.

• Independent consultancy.

• Non-profit fund (a self governing business institution).

• 40 employees.
Business area

• PlanEnergi specialises in the development and creation of customised environmental solutions within renewable energy, rational energy use and energy planning.

• Main work areas:
  • Energy planning – Heating, cooling, transportation, industrial
  • District heating based on renewable energy
    solar thermal, seasonal storage, heat pumps, biogas, biomass, industrial waste heat etc.
  • Combined Heat and Power, heat only production and district heating networks
  • Combined heat and cooling, district cooling
  • Biogas – planning, design, project planning and general consultancy
  • Wind – planning, mapping, installation pattern and EIA with visualisations
  • Technology development
    • Power to heat/heat to power, H₂, Methanization, Energy Storage technology
Locations

- Offices in
  - Skoerping
  - Aarhus
  - Copenhagen

- Location of tasks...
Locations

• Subsidies
  • PCE - PlanCommunityEnergy
  • Samsoe Energy Academy (DK)
  • ISEP (JP)
  • PlanEnergi (DK)

• Location of tasks...
  • Japan
  • Asia
References – International activities
References

Energy planning locally... ...and in large scale e.g.

- Heat Roadmap Europe:
  - DH not only relevant for northern Europe.
  - Mix: DH + HP + heat savings.
  - We should implement heat savings until the price of sustainable supply is less than the marginal price of additional savings
  - [www.heatroadmap.eu](http://www.heatroadmap.eu)
References, selected items

Solar District Heating – SDH and seasonal Storage

Long Term Storage and Solar District Heating
Marstal DH, Dronninglund DH (front page picture), H.Taastrup, Tibet, Austria, France

District Heating Heat Pumps (selections)

- **Broager**: 4 MW$_{th}$, heat source: ground water, combined with solar heating and gasfired CHP
- **Roedkaersbro**: 1,6 MW$_{th}$, heat source: waste water from diary. Combined with CHP (Natural and biogas)
- **Stoevring CHP Plant**: [YouTube direct video](#): 8,7 MW$_{th}$, heat source: ambient air.
- 2 Mycom Electric driven compressors

Biomass

- **Oester Hornum**: 3,1 MW Heat Only Boiler for straw,
- **Gelsted**: 4 MW, Heat only boiler for wood chips
- **Vegger Biogas Plant**: 5,000,000 m$^3$ biogas/ year. – CHP and heating for DH and Diary
Dronninglund SDH

• 35,000 m² solar panel
• 60,000 m³ seasonal storage (water pond 5-90 °C)