

Role of District Energy in Decentralization of Energy Supply in Denmark



October 2019



Power Supply System, Denmark



National Energy Planning

- 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 \rightarrow 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



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
 - o (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



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 мw_{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)





Energy Planning tools and examples

+ DHAT

- <u>https://ens.dk/en/our-responsibilities/global-cooperation/district-heating-assessment-tool-dhat</u>
- + Hotmaps
- <u>https://www.hotmaps-project.eu/</u>
- Planning and designing Energy Production Plants
- <u>https://www.emd.dk/software/</u>, EnergyPro, WindPro

PlanEnergi

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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





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
 - <u>www.heatroadmap.eu</u>



Samsoe Island Strategic Energy Planning



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**: <u>YouTube direct video</u>: 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 m³ 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)