District Heating in Denmark

Brussels, 10 December 2019

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EGP - Programme

Cooperation between Danish Ministry of Foreign affairs and Danish Energy Agency

Purpose:
exchanging experience with the energy transition in selected sectors

Bilateral cooperation with current focus on 5 countries:
Germany
UK
US
South Korea
Netherlands: District Heating & Energy Efficiency in Buildings
DH in Denmark – The past

• First system from 1903 (Frederiksberg)
  By-product of waste disposal

• Development pre-1970’s
  Mainly driven by cooperatives Growth from 4-30%

• Post 1970’s Oil Crisis
  centralised planning
  Focus: Energy Security, Energy efficiency, CHP
  Large expansion in number of networks and coverage
DH in Denmark – Past to present

From cities to nationwide CHP coverage
Current Status - Numbers

• Approximately 2.7 million homes in DK
• 2/3 of all homes covered
• 50% of heat demand
• DH 17% of Denmark’s final energy demand
• 33,000 km. district heating pipes (trench) all over Denmark
• Direct Employment - 2,000 persons. (10,900 persons incl. suppliers)
• Much larger coverage in Big cities. Eg. Copenhagen around 98%
Current Status - ownership

Municipally owned:
  Before 2002: DH Integrated in municipalities
  After 2002: new rules separated accounting between municipalities and DH companies. Most municipalities separated energy companies entirely but kept ownership

Consumer owned companies

Few commercial companies
Current Status - Regulation 1

Municipally owned:

Same regulation for all types of ownership:

- Cheap loans
- Socio-economic viable investments
- Transparent pricing
- Possible compulsory connection

Only necessary costs are allowed + certain profit allowed by regulator
Current Status - Regulation 2

Necessary costs:
- Energy (mostly fuels)
- Administration and salaries
- Return on Investment if external financing
- Taxes and other obligations like energy savings
- Feasibility studies

Works well in a not for profit context
Current Status - Regulation 3

Municipal approval of projects based on central guides and rules

DH Companies have to document socio-economic feasibility based on central calculation methodology and assumptions

Municipalities examines whether proposals are in accordance with methodology
Current Status - expansion

Trend:
Few new networks
Expansion of existing networks, conversion from gas and merging companies

Example Copenhagen
• 19 municipalities
• 25 DH companies
• 500,000 end users
• Expansion around CPH
• Gradual lowering of temperature in existing system
Current Status - production

The graph illustrates the production status from 1990 to 2017, showing contributions from various units:
- Large-scale CHP units
- Small-scale CHP units
- District heating units
- Autoproducers, CHP
- Autoproducers, heat only
Current Status - Heat sources
Green transition

DH plays important role as excellent facilitator
DH is fuel agnostic
Once the system is there, the source can be changed

In DK Energy sources already changed

Oil $\rightarrow$ Coal (CHP)

Coal $\rightarrow$ waste
Biomass
Solar Thermal
Industrial residual heat
industrial heat pumps
electrification
Green transition

Example Solar thermal
Around 1/4 of DH companies have solar thermal in their mix
Total capacity passed 1 GW this year
Often combined with storage
Seasonal storage
Green transition

Hydrogen in District Heating – Case from Fredericia

Plans launched for 20MW Electrolyser By Shell Denmark and Everfuel
Long term plans upgrade to 1 GW electrolyser
Shell refinery already delivering residual heat to DH system
Only 65-70% conversion to hydrogen
Loss as heat to be used in DH
Electrolysing process at 85 degrees