PlanEnergi

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Large-scale heat pumps for district heating
Lessons learned from real applications

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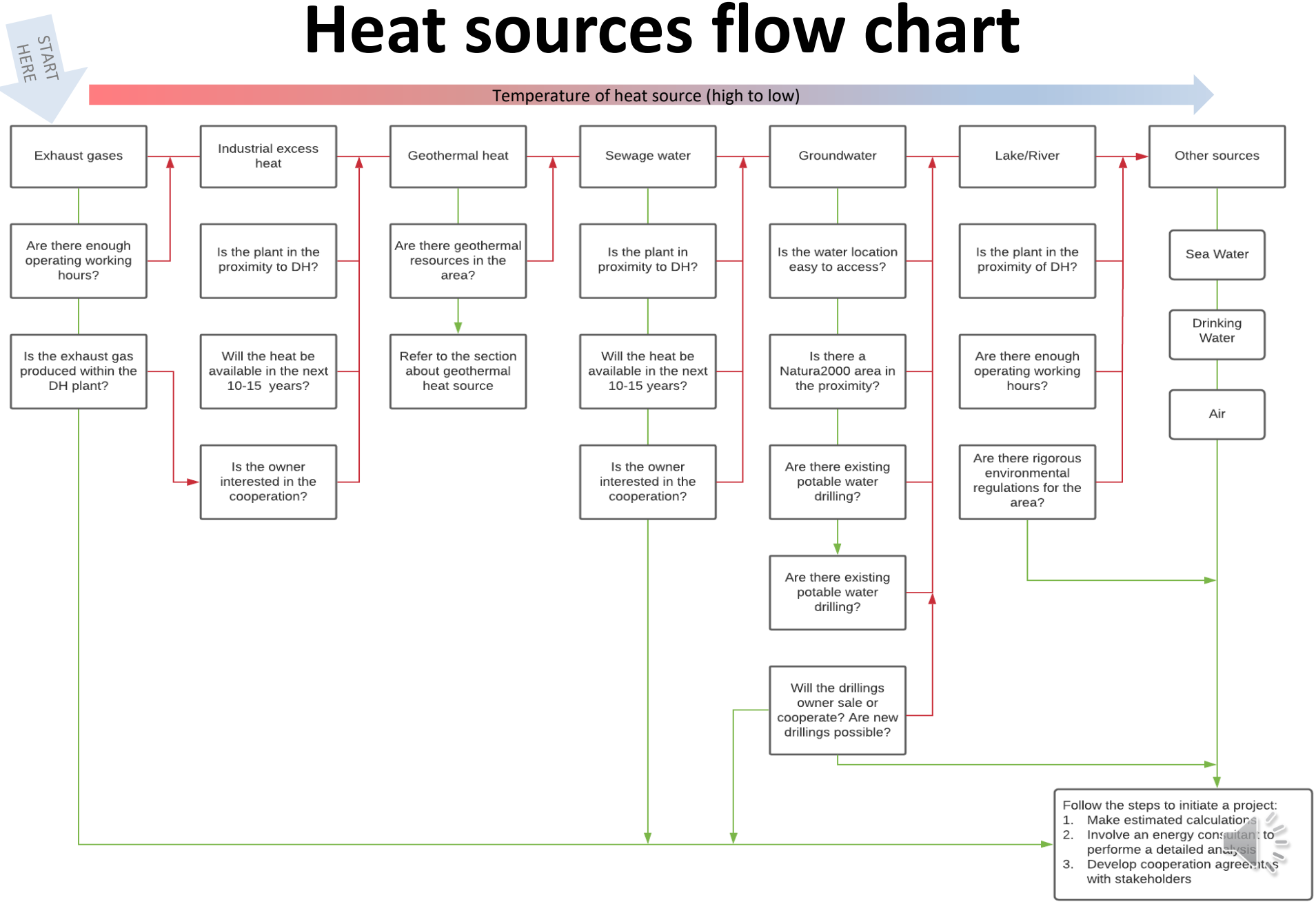
Heat sources flow chart



Economics

- With more (fluctuating) renewable electricity, the integration of electricity in heating sector becomes more relevant and beneficial for the overall system

↓

- Operation costs (by far linked to the cost of electricity) represents the majority of the LCoH, i.e. feasibility relies on electricity costs

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- Economic conditions regulated politically to incentivize heat pumps

↓

- Lowering taxes to improve feasibility =>
  - heat pump operation cheapest option regardless of carbon footprint of the electricity
  - extra costs to connect to higher grade heat source becomes less feasible

Economics

- ***"The incentive dilemma": Lowering electricity taxes to improve HP feasibility also reduces the incentive to improve COP*** *(relatively)*

- Key issue:
  - Not simply a need for electricity use, but for intelligent interaction with the electricity grid

- Upcoming:
  - More variation in tariffs to divert electricity away use from peak load hours
  - (New common CO_2 tax to promote using renewable electricity?)

Environment

Global:

- GHG emissions avoided when using RE-based electricity
- Refrigerants

Use natural refrigerants!

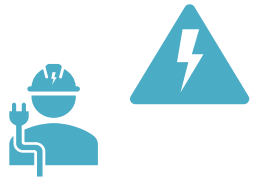
Local:

- Particle emissions avoided by replacing fuels
- Potential noise impact
- Potential impact on heat source

Noise may or may not be an issue

Electrical connection

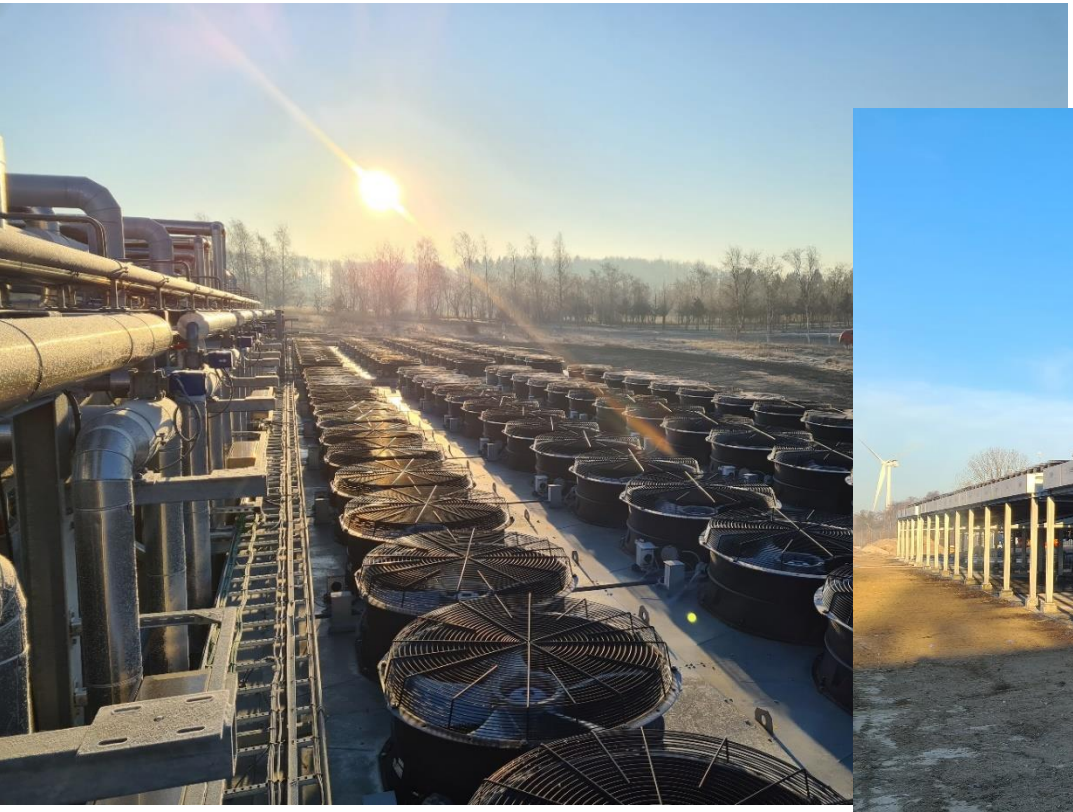
- Type of connection affects operation costs (tariffs)
  - 0.4 kV
  - At 10/0.4 transformer: 0.4 kV or **10 kV**
  - At 60/10 transformer: 10 kV or 60 kV



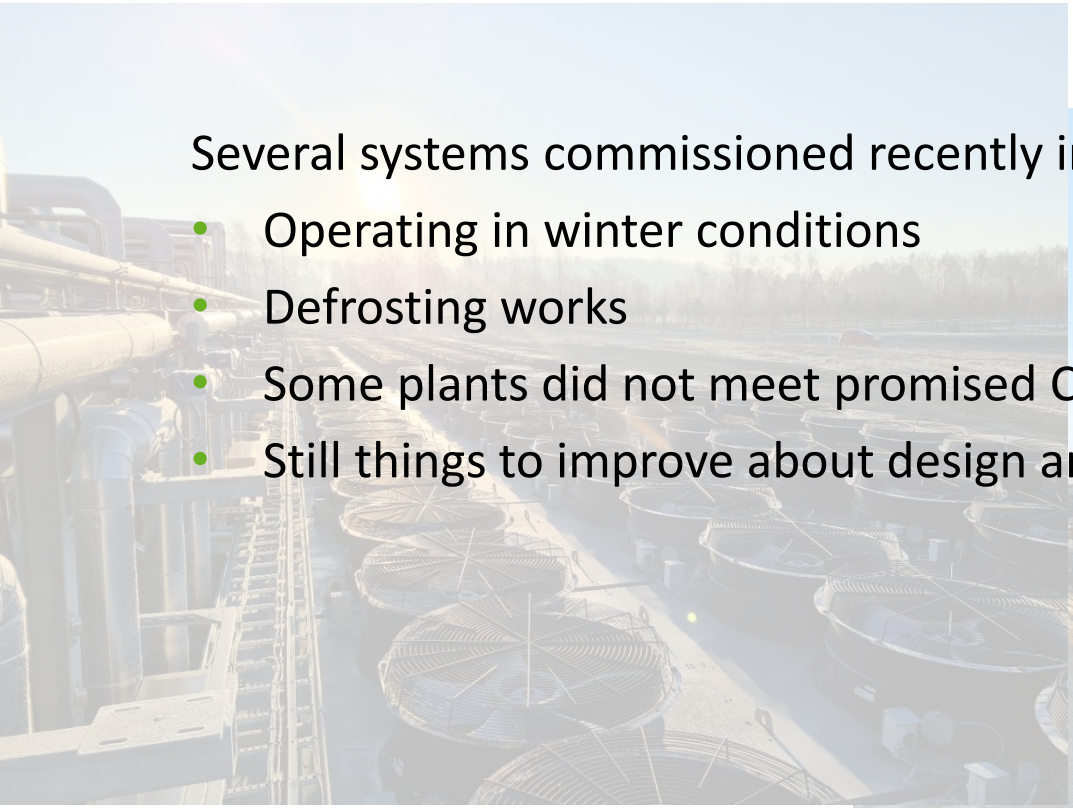
- Many systems presently connected with “cut-off option” to save connection fee

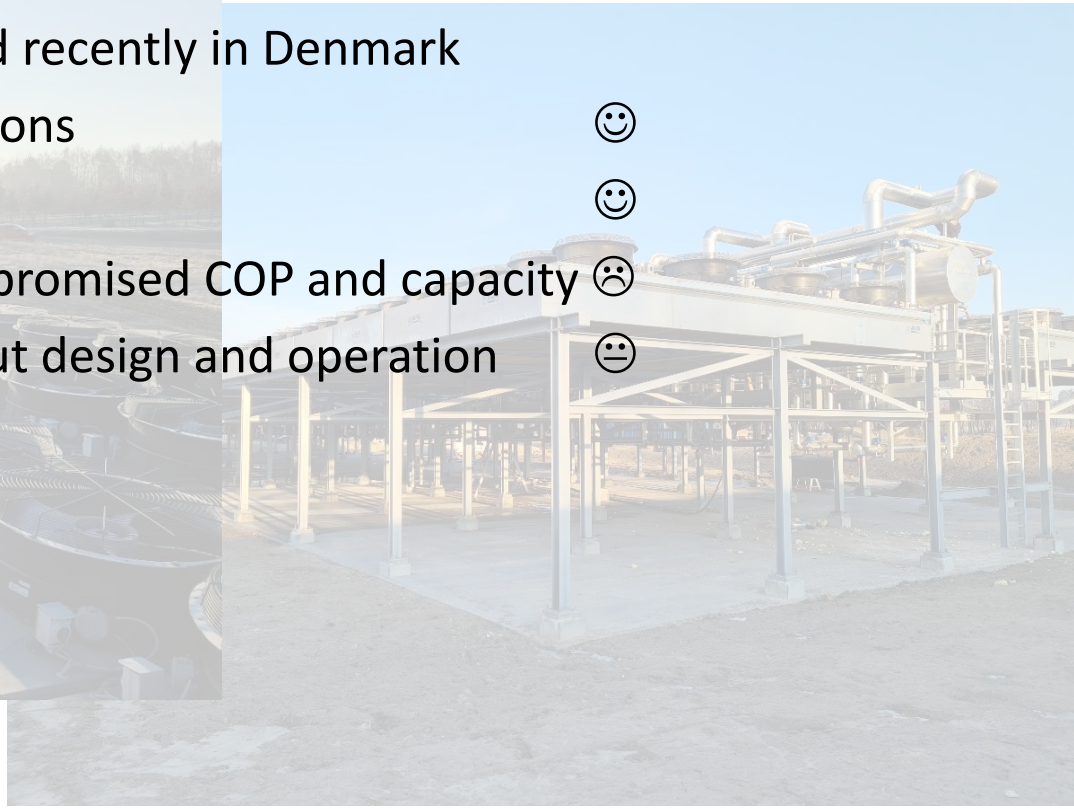
- New situation for DSOs

Using cold winter air to heat homes



Using cold winter air to heat homes





Several systems commissioned recently in Denmark

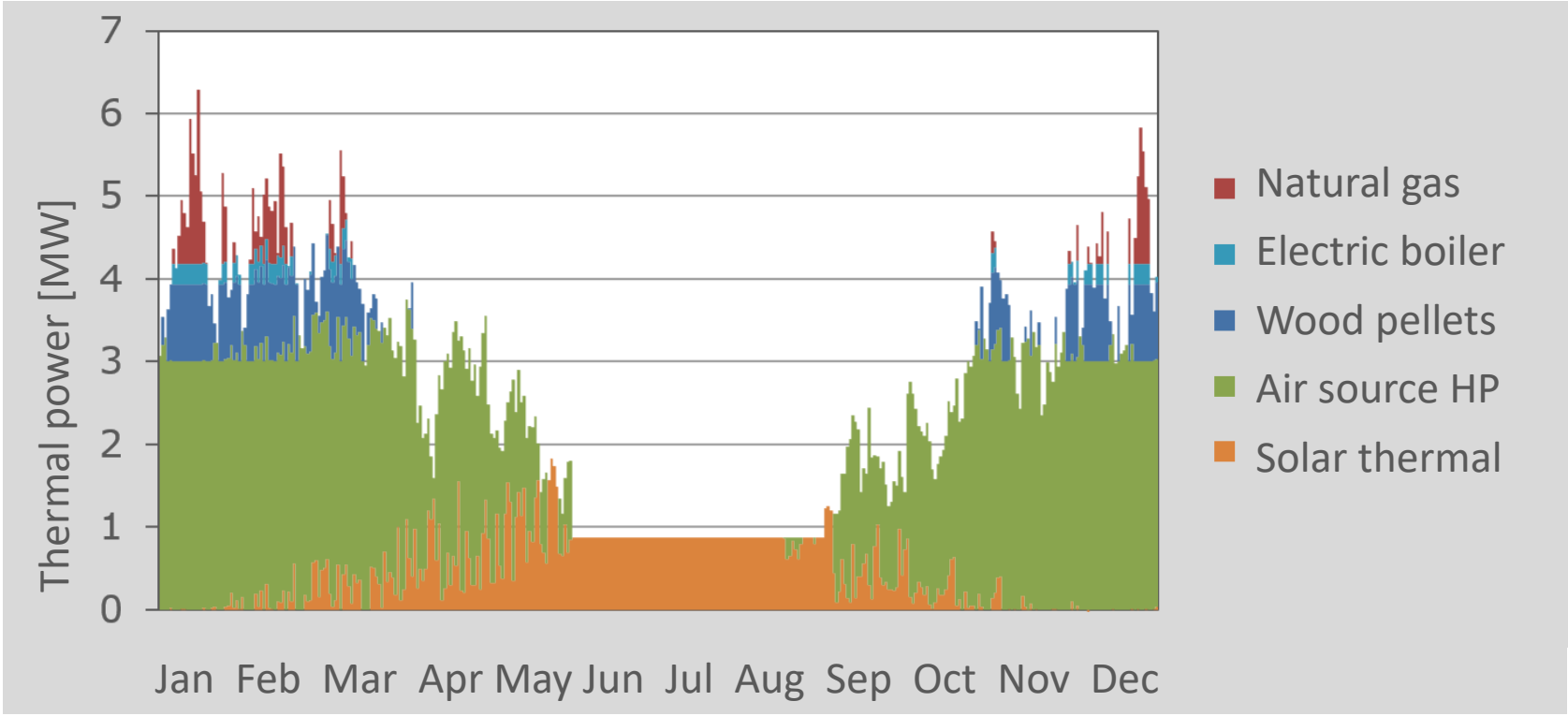
- Operating in winter conditions ☺
- Defrosting works ☺
- Some plants did not meet promised COP and capacity ☹
- Still things to improve about design and operation 😐

Configurations

With a range of heat production units, it is relevant

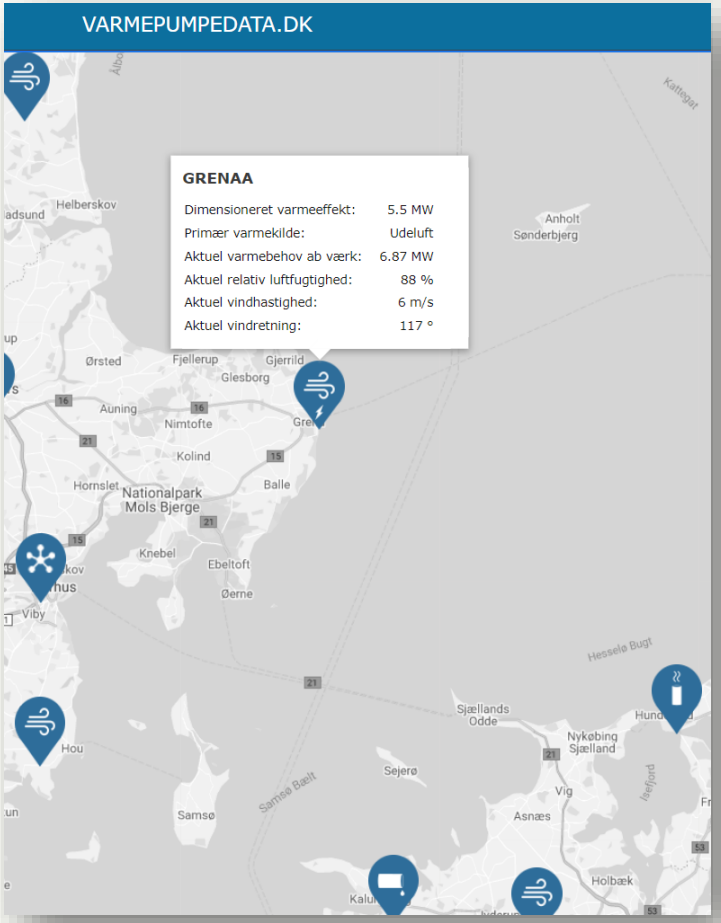
- a) to construct the system to enable flexibility
- b) to consider the operation strategy optimizing the assets *and* total system

Example:



Lessons leaned & new lessons

- Ongoing process of optimizing solutions
- Fact sheets released later in 2021 – check planenergi.dk/ts3
- Data gathering on heatpumpdata.eu
  - In Danish *varmepumpedata.dk*. English version coming soon
  - Overview of Danish large-scale HP in DH
  - Real time and historical data of HP operation (temperatures, COP etc.)
  - Developed over time with more and more systems added



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