ENGINEERING TOMORROW

District heating and future low energy buildings?

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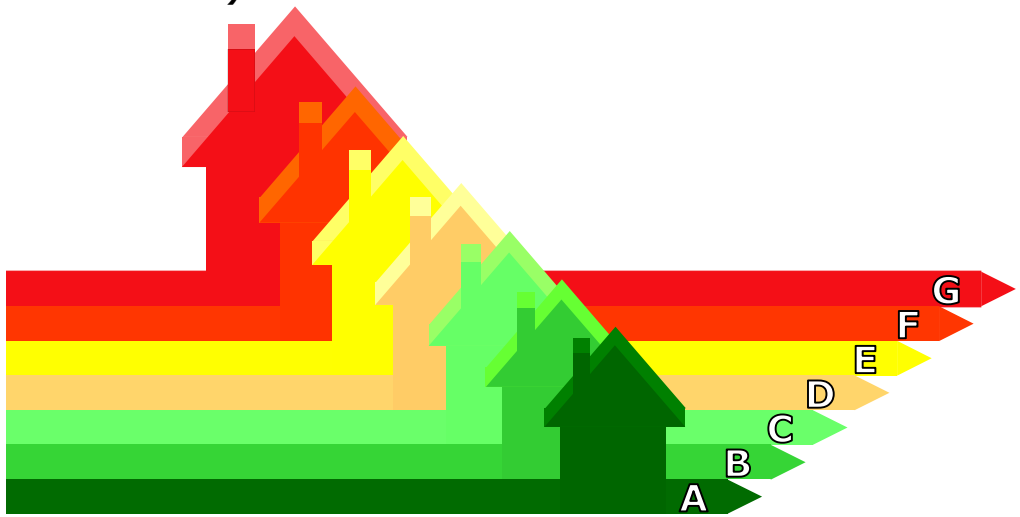
Purpose of study:

Does district heating have a future if all new buildings become low energy buildings?

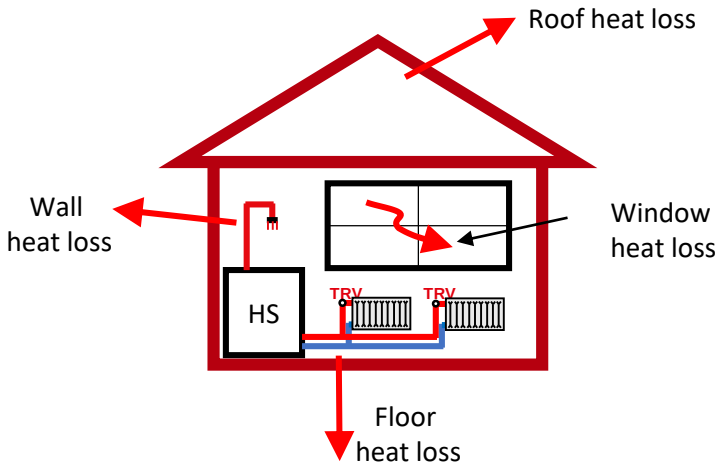
Building trends

- Buildings are changing
  - New windows
  - New doors
  - New energy efficient heating control equipment
  - Increased energy awareness
  - Increased insulation levels
  - Total renovation (tear and rebuild)



Impact of energy renovation on the cost of heating

Heat demand → Capacity demand → Investment cost



Impact of energy renovation on the cost of **individual** heating

Heat demand

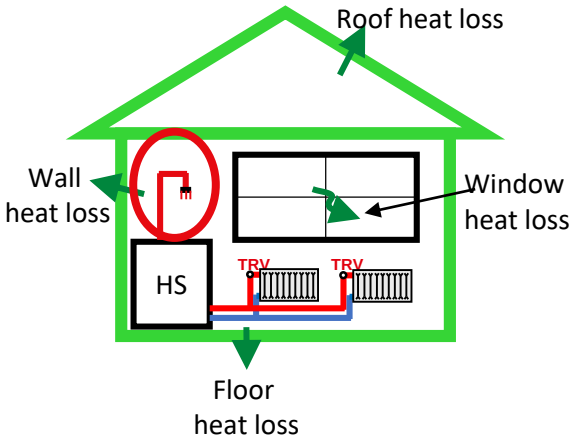
Capacity demand

Investment cost

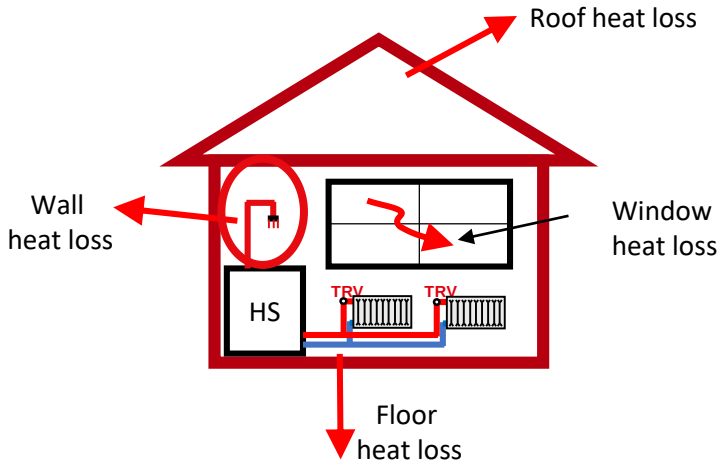
Reduced heat demand
=
Reduced fuel consumption
=
Reduced cost of heat

Capacity demand is dominated by domestic hot water demand
=
Limited impact

Investment cost is **"lightly"** dependent on the capacity



New



Impact of energy renovation on the cost of **district** heating

Heat demand

Capacity demand

Substation cost

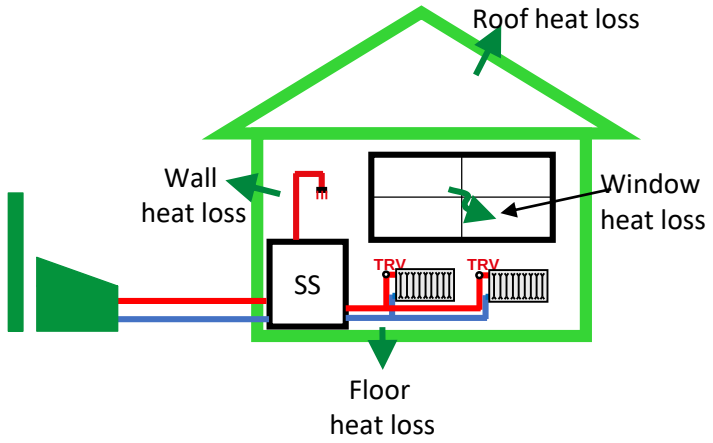
Distribution cost

Heat plant cost

Reduced heat demand
=
Reduced fuel consumption
=
Reduced cost of heat

Since DHW demand is aggregated in DH any reduction of space heating capacity demand can be addressed at heat plant
=
Big impact

Heat plant investment cost is **strongly** dependent on the capacity



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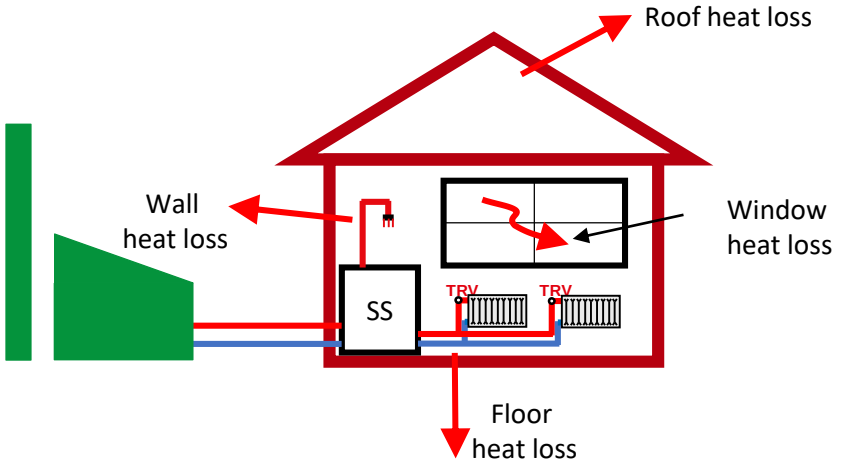
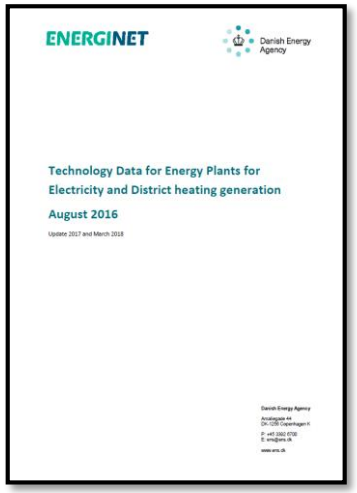
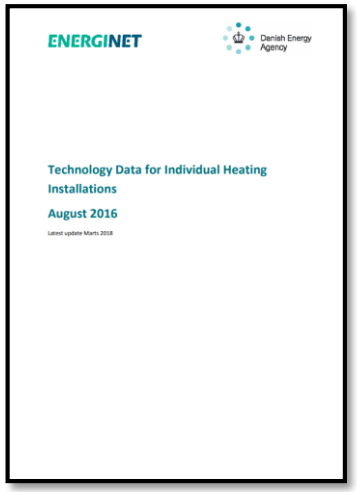
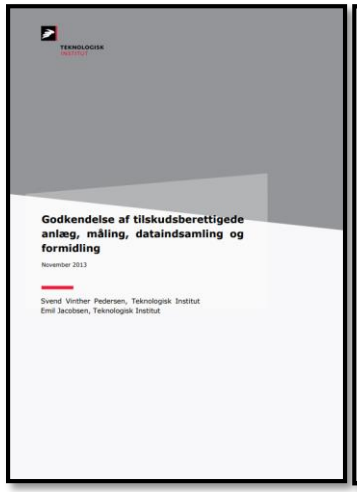


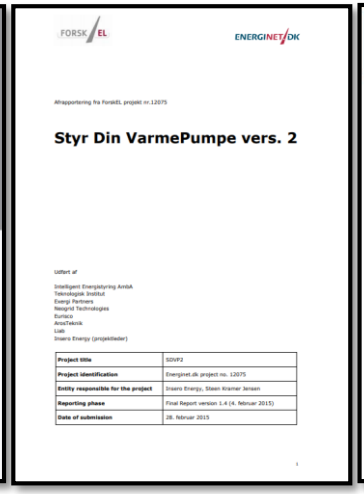
Information sources

- **Baseline data source:**
  - *Danish Energy Agency technology catalogues*
- **Experience from the field:**
  - Danish Technology Institute
    - Reports on heat pumps
  - Danish Gas Technology Center
    - Report on individual gas boilers
  - District heating project experience









Your Output is Only as Good as Your Inputs

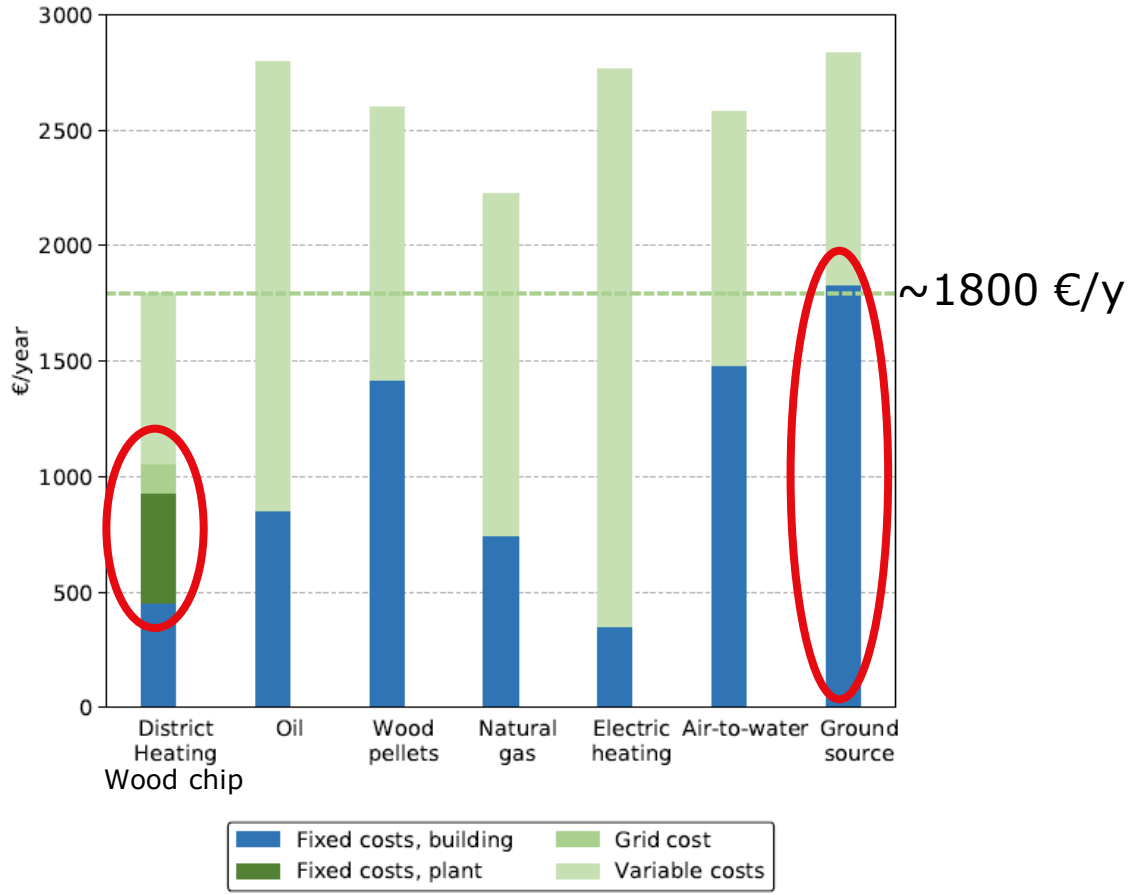
Area under investigation

- Neighborhood of Fredericia, Denmark
  - 1.800 consumers
- New district heating network
- System design:
  - 4th generation district heating

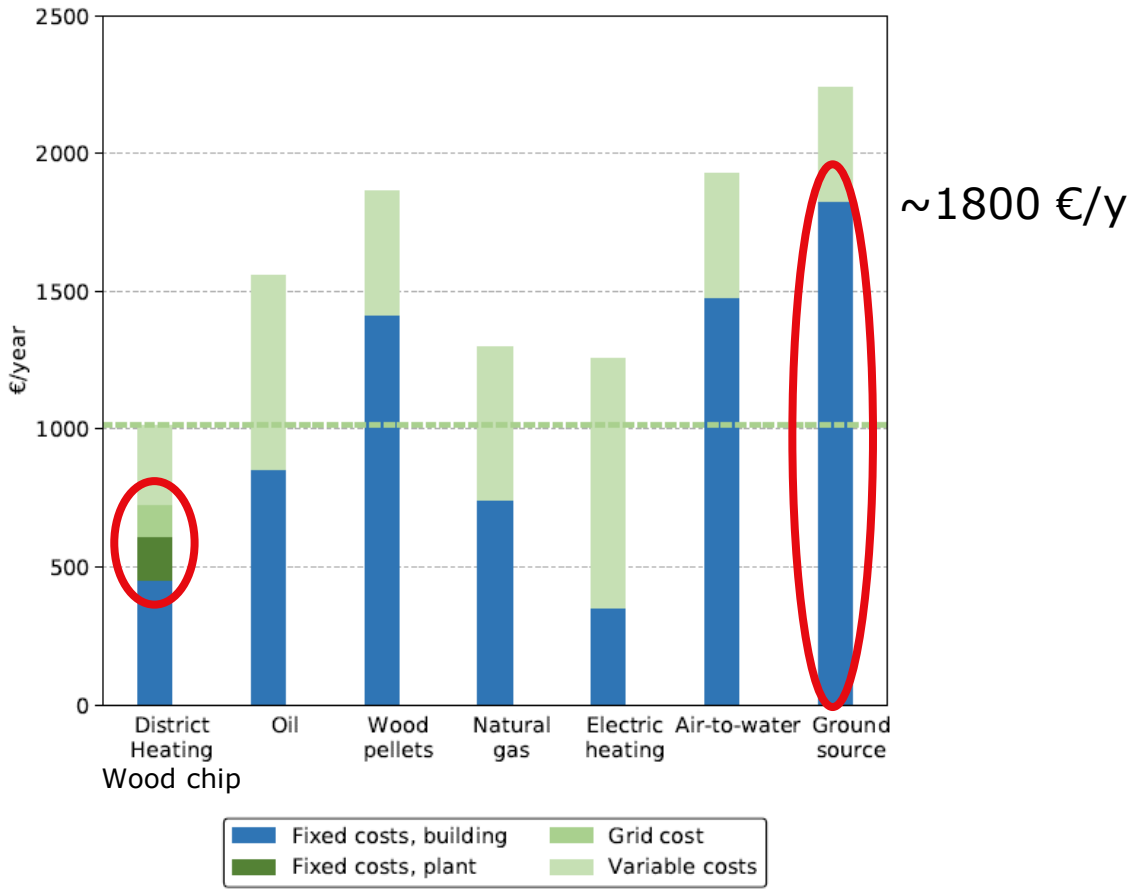
Cost comparison

- New district heating vs individual heating solutions

- Traditional single family building
  - Heat demand of 13,8 MWh per year



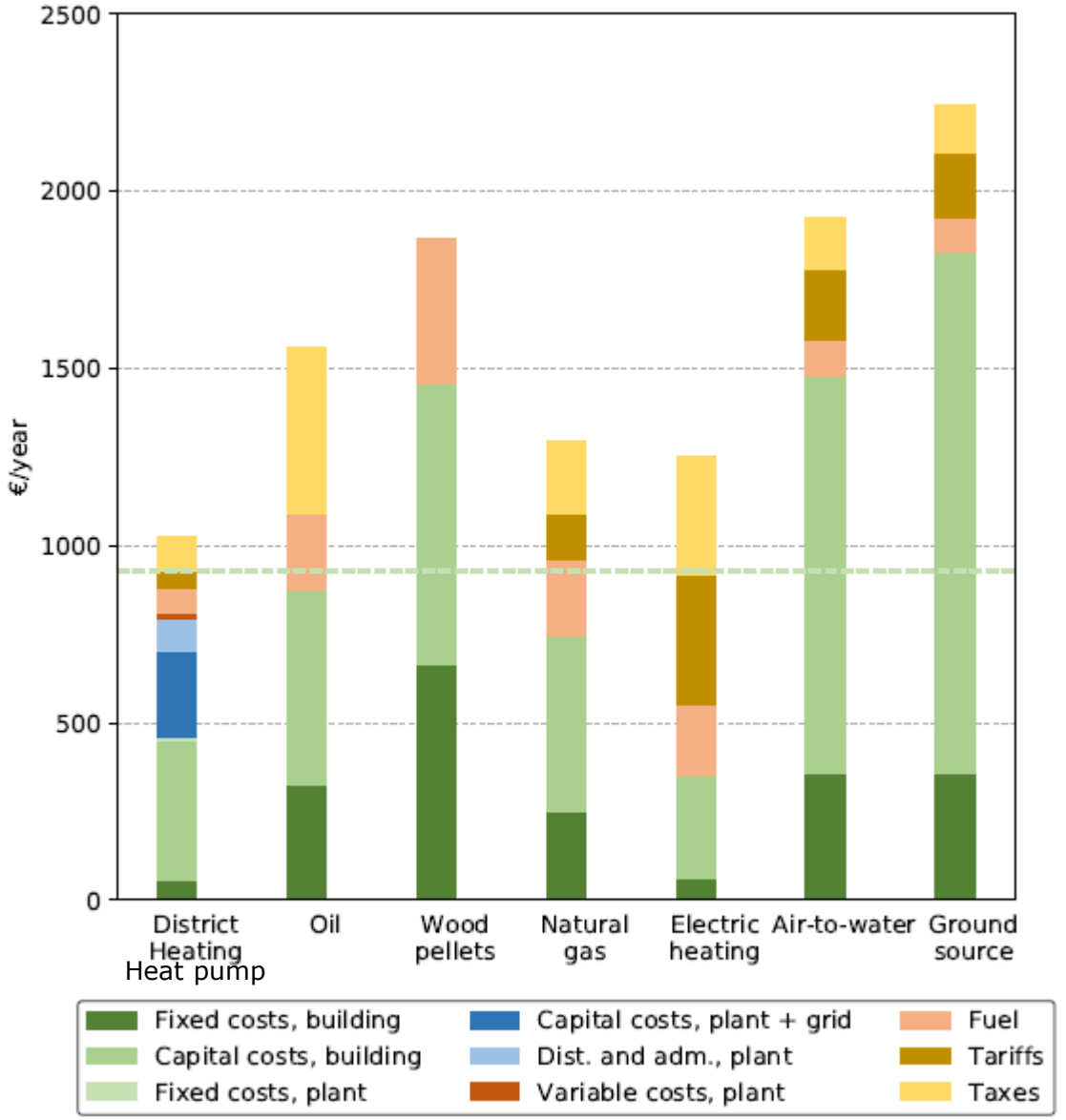
- Low energy single family building
  - Heat demand of 4,9 MWh per year



Cost comparison

- New district heating vs individual heating solutions

- Identical analysis but district heating heat source changed to a centralized heat pump
- Low energy single family building
  - Heat demand of 4,9 MWh per year
- The affordability of district heating in Denmark **is not** a tax issue!



District heating
- Multi-heat source operation

- Smart district heating systems have it in common that they apply multiple and different heat sources, spread around the distribution network

- Benefits include:
  - Maximum security of supply in terms of availability as well as delivery
  - Ability to optimize in relation to:
    - Renewable energy
    - Economics
    - GHG emissions
    - …
  - In combination with thermal storages district heating can absorb endless amount of surplus renewable power

Thank you for your attention

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