Danish Energy Agency

Danish Ministry of Energy, Utilities and Climate

Strategic sector cooperation (SSC) between Turkey and Denmark: ”Efficient and Low Carbon Heating Cooling” Cost-Benefit Analyses of District Heating systems

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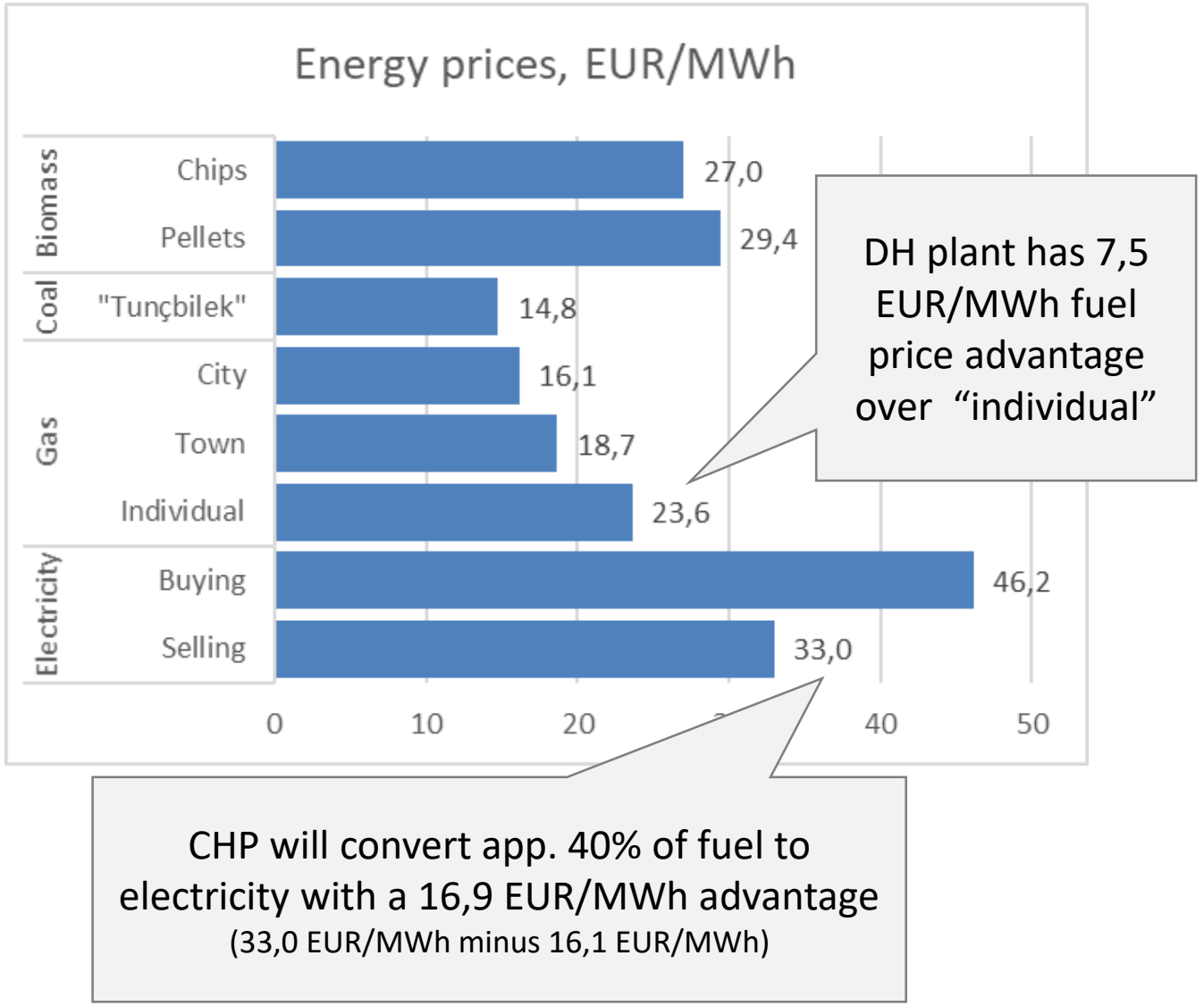
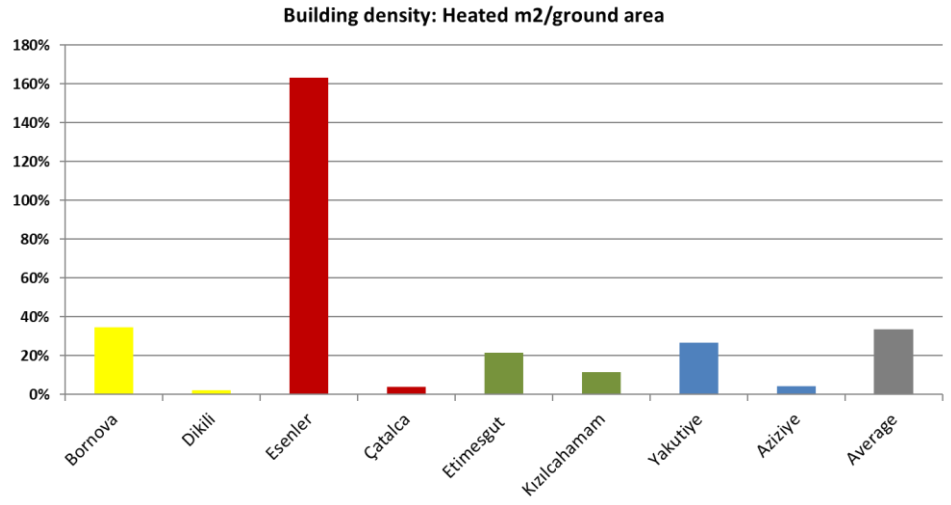
Why District Heating in Turkey?

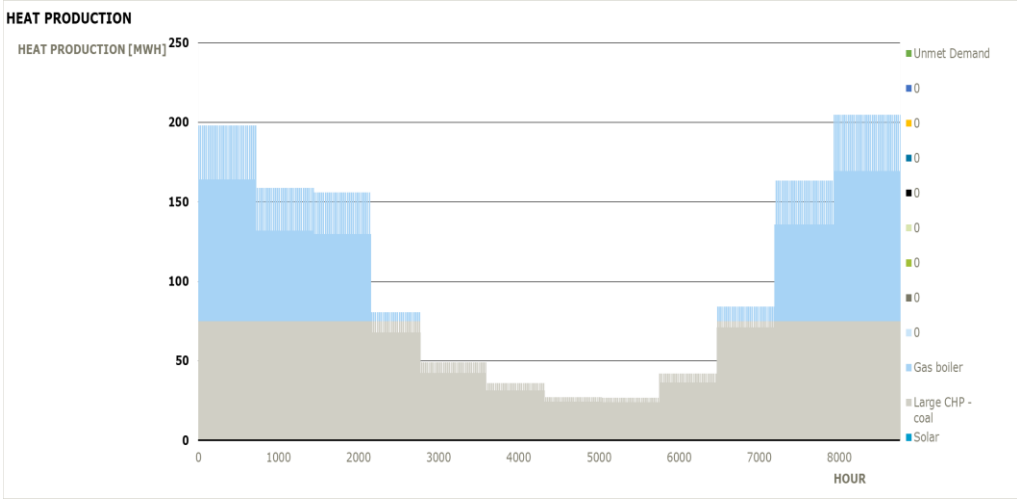
- Turkey has large untapped domestic potentials - requires large heat markets for being used:
  - Surplus heat from power plants and industries, geothermal energy, municipal waste, solar energy, biomass
- Large scale advantages with DH-production, compared with non DH
- Advantages by combining heat – and power generation in CHP plants
  - Fuel converted to high value electricity.
  - CHP plants have fuel cost advantage, comp. with non-DH supply.
- Synergies by combining district heating and district cooling
  - To be further investigated in the SSC.



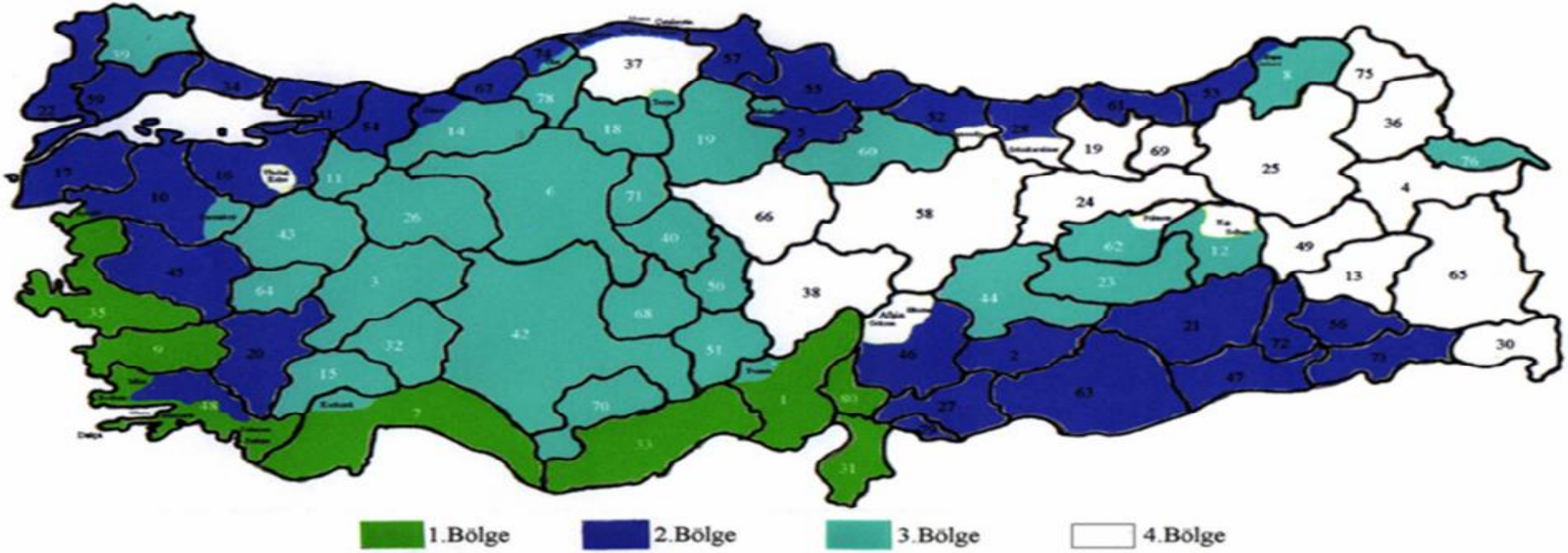
Why not District Heating?

- District Heating network is costly to build, especially in less dense areas
- If low heat demand, then lower revenues for payback of investment
- Large variation between summer and winter demand is bad for plant utilisation - peak load plants and heat storage facilities needed.





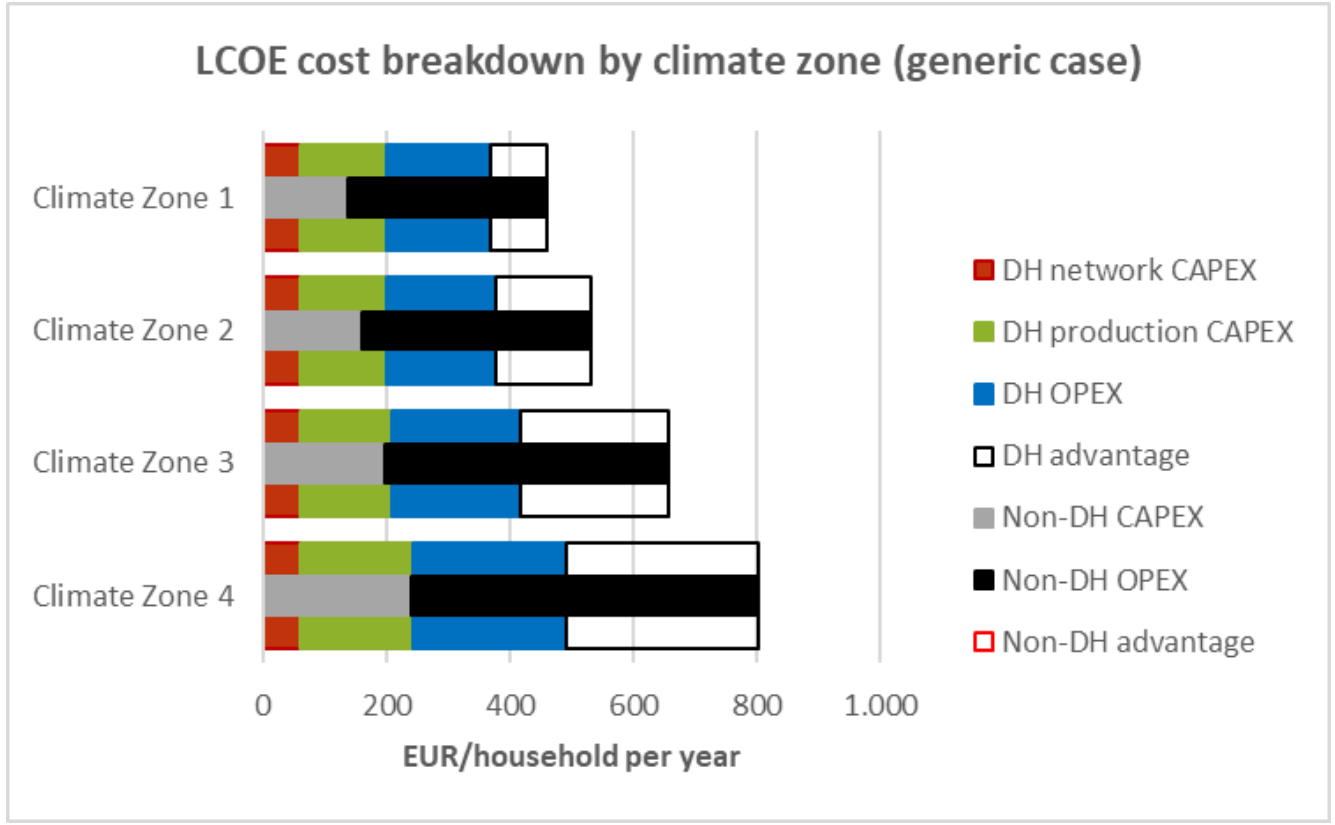
Four climate zones: Izmir (zone 1), Istanbul (zone 2), Ankara (zone 3) and Erzurum (zone 4)



What is the impact of different climate zones?

- Given the same network size and building density, warmer climate zones reduce the demand - and the revenue
- Less potential for paying back investments in plants and networks
- Generally, climate zones have important influence on DH advantage

*) LCOE: Levelised Costs of Energy



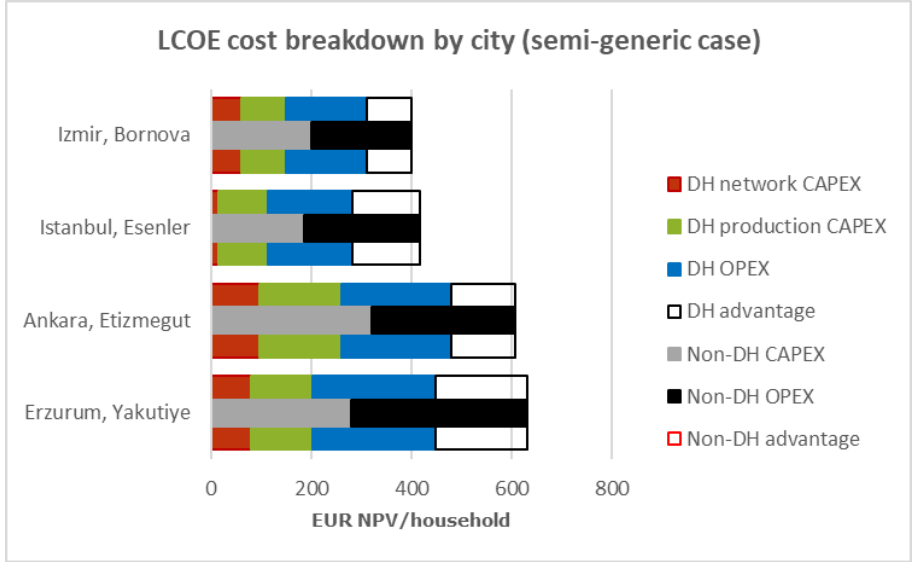
What is the impact of building density?

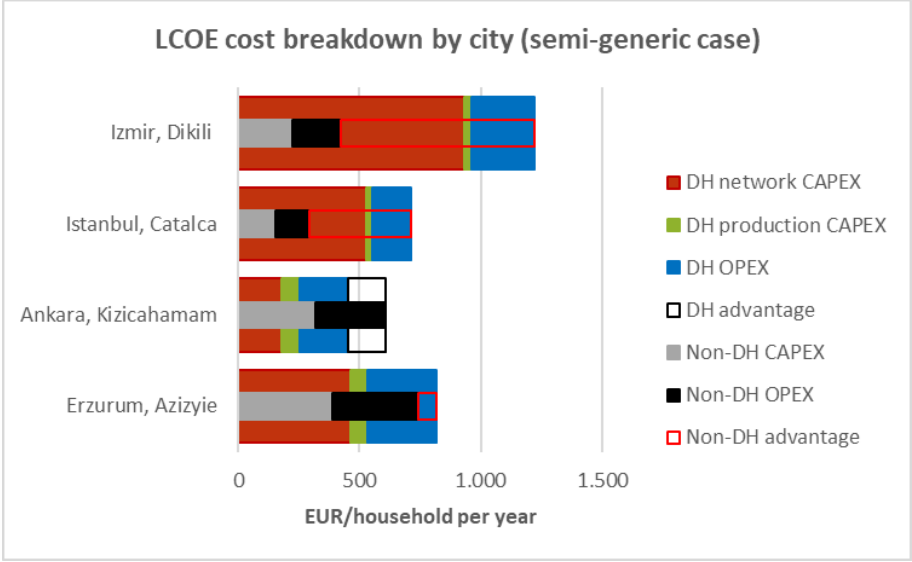
High building density (e.g. Esenler (CZ 2) with 169%) results in very low DH network costs.

- DH network is in these cases typically a smaller share of costs (<20%).

Low or very low building density may destroy the feasibility of DH, as network costs will increase.

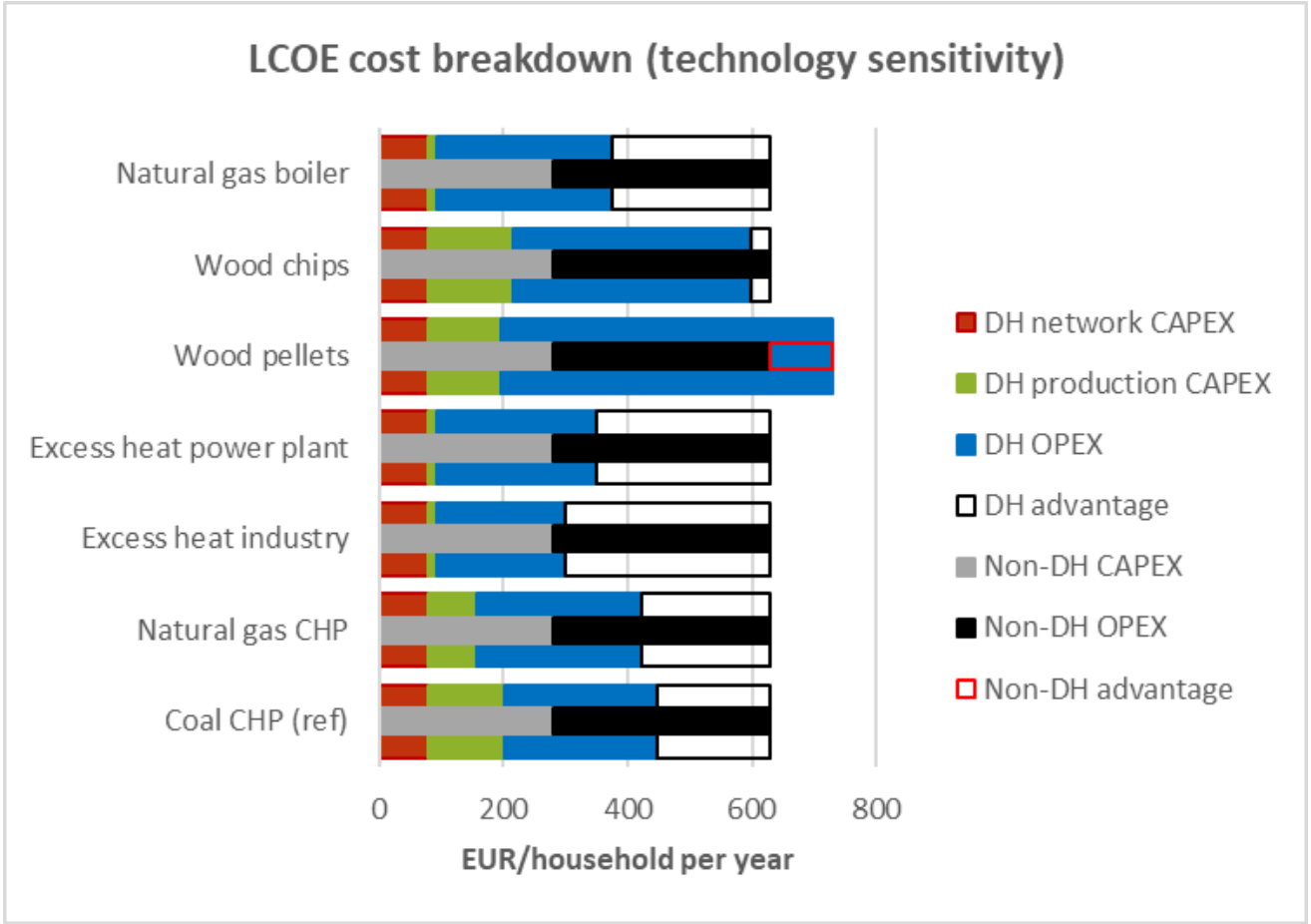
- E.g. Kizicahamam with building density 10% results in a small advantage, but below that (e.g. Dikili <5%), DH can be very disadvantageous, because of spiralling network costs.





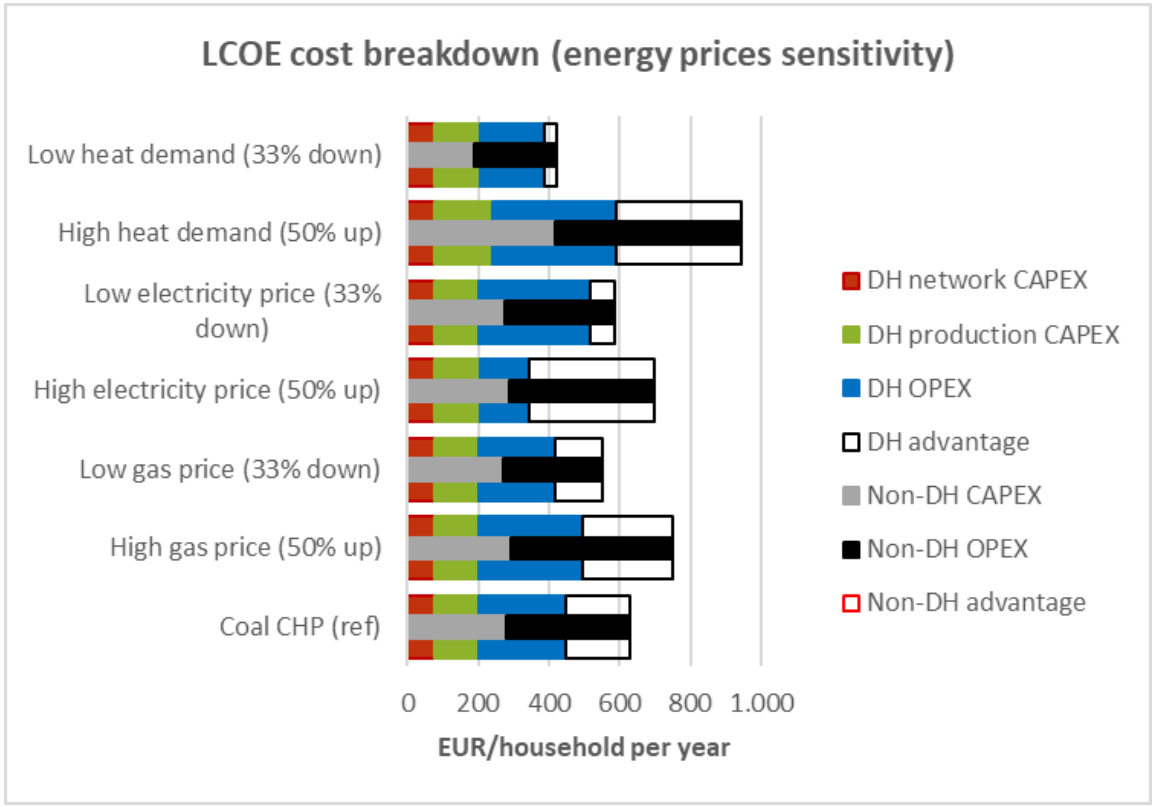
What else impacts DH feasibility? (1)

- Surplus heat / excess heat
  - Surplus heat can be quite advantageous, as most investments have already been paid
- Fuel costs and technology costs
  - Higher fuel costs for natural gas than for coal are balanced by lower technology costs for NG CHP than for coal CHP
  - High fuels costs for biomass (assumed here) and high technology costs results in high LCOE.



What else impacts DH feasibility? (2)

- Heat demand is important
  - E.g. inclusion of space heating and hot tap water improves feasibility
- Fuel – and electricty prices
  - Electricity prices are important to DH because of the CHP advantage
  - In general, fuel prices does not affect DH feasibility much, since coal, gas and electricity prices often follow each other when comparing DH and non DH – options.



Conclusions: Where to build District Heating – and how much?

- Prefer building in densely populated areas, above 10-15% floor to ground area
- Prefer colder climate zones
- Prefer locations with possibilities for cheap heat, e.g. surplus heat from power plants or industries
- First estimates suggests that 20% of households may be advantageously to be connected to District Heating
  - This estimate is scope for further work

DH-percentages and climate conditions

➢ District Heating Percentage in Chosen Countries:

- %50-60 Denmark, Finland, Sweeden
- %10-50 Croatia, Litvania ve Romania
- %3-15 France, Germany, Italy and Norway
- > %1 Spain, UK, Turkey

Cities	Heating Degree Days (HDD)*	Average HDDs with reference to 33 years Meteorological Data **
Oslo	4714	**Ardahan – 5128** **Erzurum – 4640**
Kopenhag	3720	**Van – 3465**
Berlin	3296	**Yozgat – 3360** **Sivas – 3352**
London	2800	**Afyon – 2736** **Ankara – 2599**

* European Insulation Manufacturers Association, Ecofys VII - U-values for Better Energy Performance of Buildings Report, Annex I p. 67.
** Bayram, M. ve Yeşilata, B. (2015), Isıtma ve Soğutma Derece Gün Sayılarının Entegrasyonu, IX. Ulusal Tesisat Mühendisliği Kongresi.

Thank you for your attention!

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