How to enable interregional heat exchange?

Review and analysis of best practice examples

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BACKGROUND HEAT HIGHWAY

MAIN GOALS

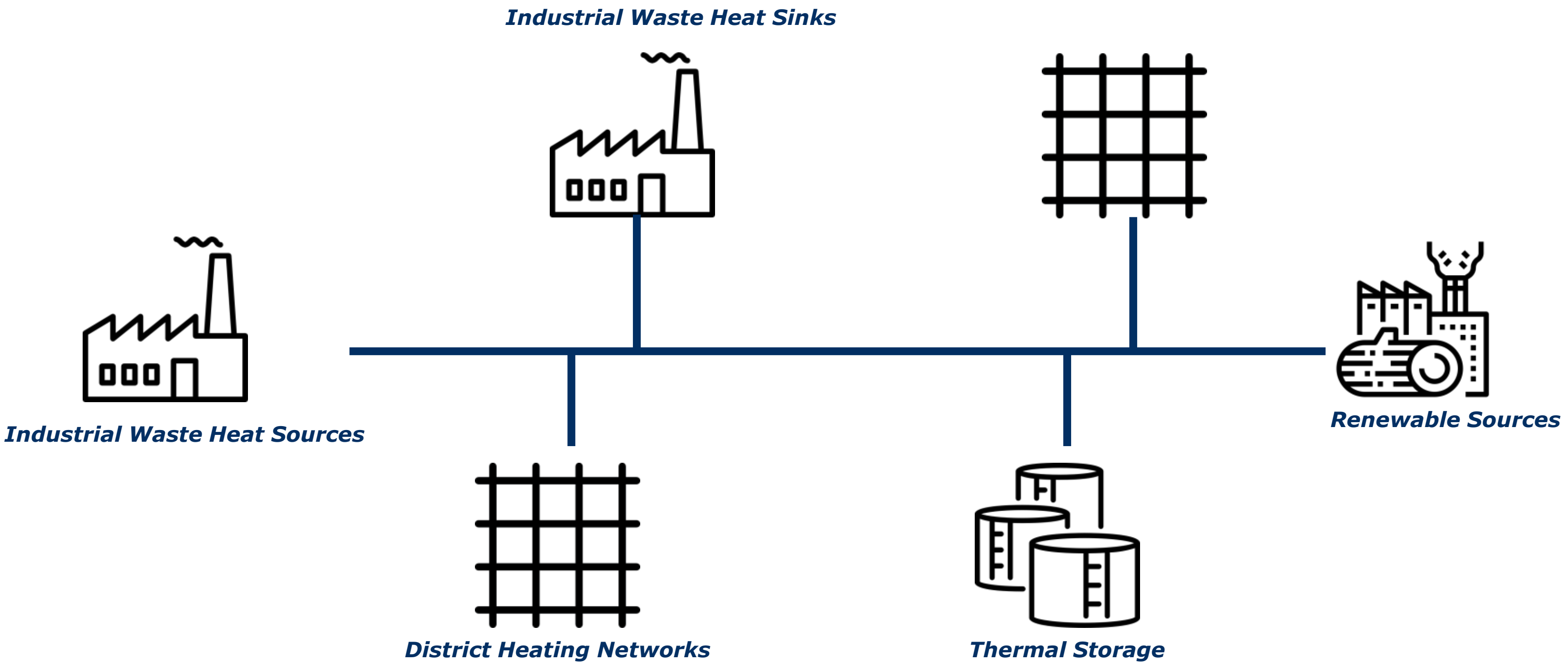
- Develop a multi-level toolbox for optimizing the operation and implementation of heat transmission networks.
- Anticipate industrial waste heat potentials from current and breakthrough (decarbonized) processes.
- Develop a prototype of a cost-effective pipe system to significantly reduce investment costs.
- Setting up a 3D simulation based "virtual demonstrator" for showcasing the feasibility despite high complexity.

KEY FACTS

Expected duration: 03/21 – 02/24

Project volume: € 2,500,000

DEFINITION
HEAT TRANSMISSION NETWORKS



BEST PRACTISE EXAMPLES*

Source: Google - MyMaps

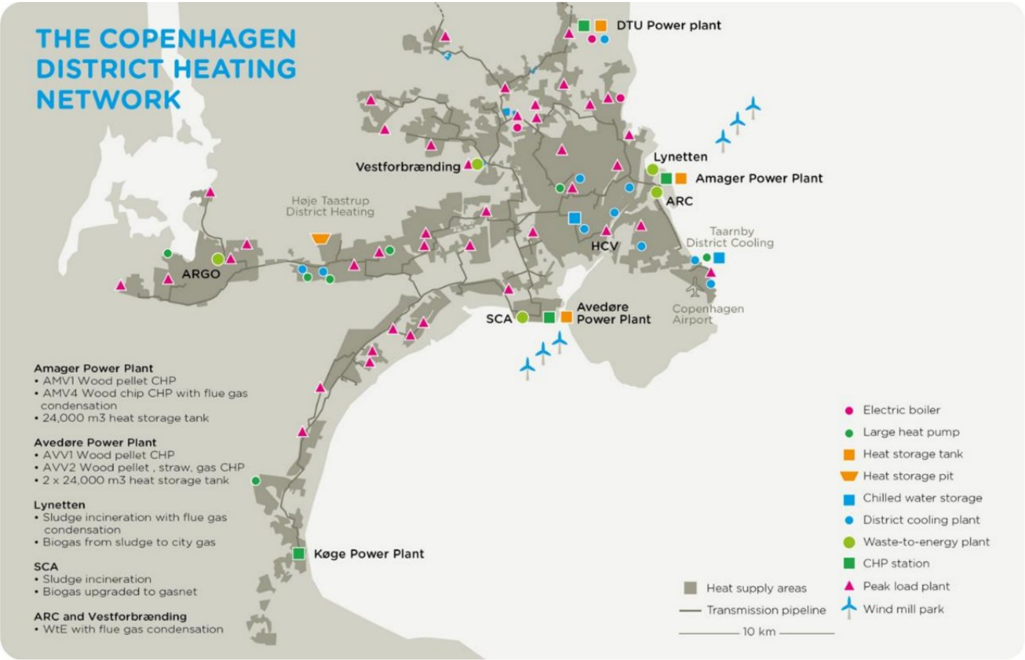
Long heat transmission network

Heat transmission pipe
Unidirectional transport
(one source/one sink)

**Non-exhaustive list*

EXAMPLE
GREATER COPENHAGEN DHN

- 180 km transmission network
- 3 operators
- 21 connected DHN
- Heat supply: ~ 8500 GWh/a
    - Biomass CHP
    - Waste incineration
    - Peak load boiler
    - Industrial waste heat
    - Thermal storages
- Targets
    - CO2-neutral by 2025
    - Realization of 4GDH



https://dbdh.dk/wp-content/uploads/SoG_WhitePaper_DistrictEnergy_210x297_DE_V03_WEB.pdf
https://www.cibsejournal.com/technical/europes-hottest-city/

Gudmundsson, O. und Dyrelund, A.: District Energy – the resilient energy infrastructure. URL: https://www.iea-ebc.org/Data/Sites/4/media/events/2020-10/presentations/2.4--gudmundsson--district-energy-resilience.pdf

EXAMPLE
INNSBRUCK – WATTENS

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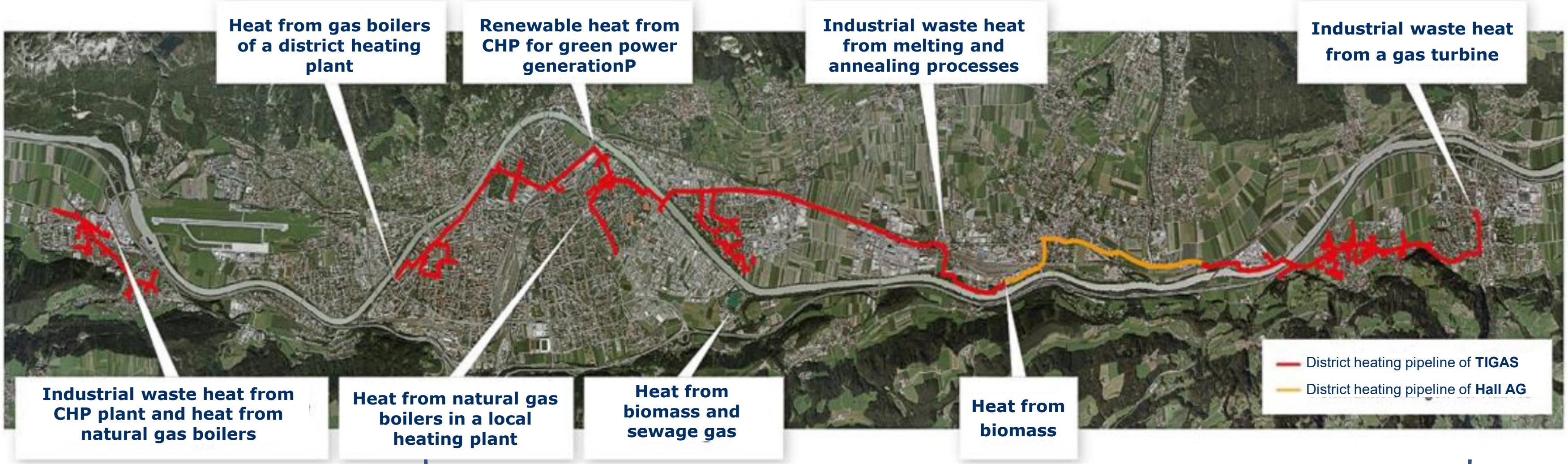
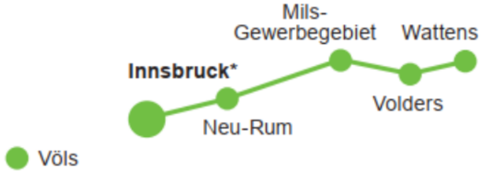


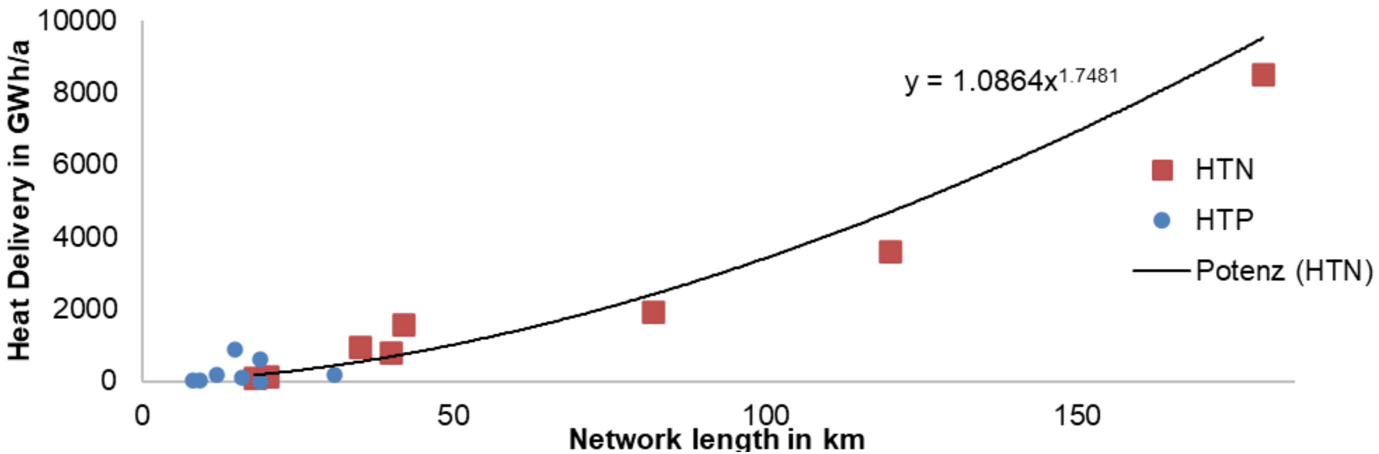
Ca. 16 km



* with Partner IKB

Source: https://eventmaker.at/uploads/16600/downloads/11_hilber_vortrag.pdf
Translated to English

QUANTITATIVE ANALYSIS



Parameter	Average	HTN	HTP
Distance in km	32	62	22
Capacity in MW_{th}	221	482	164
Heat delivery in GWh_{th}/a	1422	2302	264
Specific investment cost in €/m	725	816	699
Linear power density in MW/km	8.8	11	8.4
Linear heat density in MWh/m×a	21	24	16

QUALITATIVE ANALYSIS*

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Strengths

- Optimal integration of regionally available heat sources
- Heat delivery to remote customers
- Reduced dependencies, increased system resilience

Weaknesses

- High CAPEX
- High complexity
- High system inertia (e.g. temperature changes)

Opportunities

- Suitable land for (seasonal) heat storage
- Establishment of heat market
- Increased large-scale utilization of alternative heat sources

Threats

- Challenging investment decisions
- Utilization rates as a key parameter may vary greatly

**Only key aspects are shown*

CONCLUSION AND NEXT STEPS

- HTNs can
  - …include seasonal storages, backup boilers…
  - …reduce supply risks
  - …lead to price stability
- Interest in HTN is increasing
  - Rising gas prices
  - Best-practise examples
- Further investigation the case study "Inn Valley"*

*see also: Nicolas Marx, Stefan Reuter, Ralf-Roman Schmidt: Decarbonizing the heating supply via regional district heating networks - Status-Quo for a case study in Tyrol; 8th International Conference on Smart Energy Systems, 13th – 14th of September 2022, Aalborg, Denmark

Thank you for your attention!

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