

# Development prospects for small low-temperature district heating networks

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### HeatConsult engineering company

- Main designer of District Heating and District Cooling networks in Estonia
- DH networks up to DN1200
- 75 km on DH pipelines engineering during last 3 years
- *netSim* for hydraulic calculations, *sisKMR* for static calculations





### **District heating in Tallinn, Estonia**

- DH network from 1956
- Length: 430 km
- 40% pre-insulated pipes, other in concrete channels
- Age of DH network: 24,6 years
- Heat losses: 13,8%
- Temperature graphic: 130 °C / 70 °C





## Real object – Kopli, Tallinn, Estonia







### HEAT

### Data of region

- 2 development stages (from 2019 until 2026)
- Flat houses, shop, kindergarten, school
- 925 flats, 90 000 m<sup>2</sup>
- Floor heating + hot water
- Heating capacity *ca* 5 MW
- District heating network:
  - 1.stage: 1 140 m
  - 2.stage: 1 166 m





### Heating source and network options

- 1. Connection to Tallinn district heating network
  - Investments from DH operator for connection
  - Network graphic 95 °C / 55 °C
- 2. Local gas boiler house
  - Separate building
  - Network graphic 60 °C / 35 °C (or 80 °C / 40 °C)
- 3. Local gas boiler house + sea water heat pump
  - Separate buildings
  - Network graphic 60 °C / 35 °C



### Investments

- 1. Connection to Tallinn district heating network: 730 000 EUR
  - Investments for connection: 110 000 EUR
  - Investments for DH network (2 stages): 620 000 EUR
- 2. Local gas boiler house: 1 020 000
  - Investments for gas boiler house: 400 000 EUR
  - Investments for DH network (2 stages): 620 000 EUR
- 3. Local gas boiler house + sea water heat pump: 2 200 000 EUR
  - Investments for gas boiler house + pump: 1 580 000 EUR
  - Investments for DH network (2 stages): 620 000 EUR



### **District heating network design**





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### Heat losses for different DH network

- 1. Initial data for calculations
  - Heating period 260 days / year
  - Hot water every day
  - Average air temperature for heating period: -1,5 °C
  - Average air temperature for non heating period: 14 °C
  - Depth of district heating pipelines: 1m from the ground
  - Pipe material: pre-insulated steel
- 2. Results
  - 95 °C / 55 °C: 913 MWh / year
  - 80 °C / 40 °C: 762 MWh / year
  - 60 °C / 35 °C: 653 MWh / year



### Heat pump calculations

- Annual amount of heat: 17173 MWh / year
- SCOP: 4,04
- Lifetime: 20 years
- Primary energy factor (electricity): 2,0
- Cost of heat production without investments: 18,05 EUR / MWh
- Cost of heat production with investments: 26,59 EUR / MWh
- District heating price in Tallinn (fixed by Competition Authority): 56,65 EUR / MWh



### **Heat pump calculations**

- Connection to Tallinn district heating network
  - Natural gas consumption: 20 096 MWh
  - Primary energy: 20 096 MWh
  - CO<sub>2</sub> emission: 4 039 t
- 2. Local gas boiler house

1.

- Natural gas consumption: 19 928 MWh
- Primary energy: 19 928 MWh
- CO<sub>2</sub> emission: 4 005 t
- 3. Local gas boiler house + sea water heat pump
  - Natural gas consumption: 5 229 MWh
  - Electricity consumption: 3 248 MWh
  - Primary energy: 11 724 MWh
  - CO<sub>2</sub> emission: 4 948 t





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## **Expectation / Reality**









### **Performed solution**

- Local gas boiler house
  - Temperature in DH network 80 °C / 40 °C (pipelines are dimensioned for 60 °C / 35 °C)
    - *"We do not want to be the first developer with 4DH in Estonia"*
- Lobby from gas boiler house manufacturers
- Lack of time for calculations / heat pump solution





### Hope for 2.stage project

- District heating
  network with graphic
  60 / 35
  - Implementation of
    - sea water heat pump
- Gas boiler house as
  peak load source





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