Case study for district heating in Genk area

DHC+ Summer School Group Project
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Goals

1. Minimize use of non-renewable primary energy sources:
   - Elimination of CO_2 emissions
   - Integration of waste heat
2. Establish an anchor location for DHC in Genk area:
   - "First" grid from which extensions can grow
   - Raising awareness and acceptance in the local community for future DHC projects
3. Plan for economic and societal feasibility within the Belgian context
   - "It's a small step for mankind, but a big step for Belgians" ☺

Genk-South

Genk city center:
commercial, residential

1. Use excess heat that is currently wasted

2. Connect new development areas to DH from the start

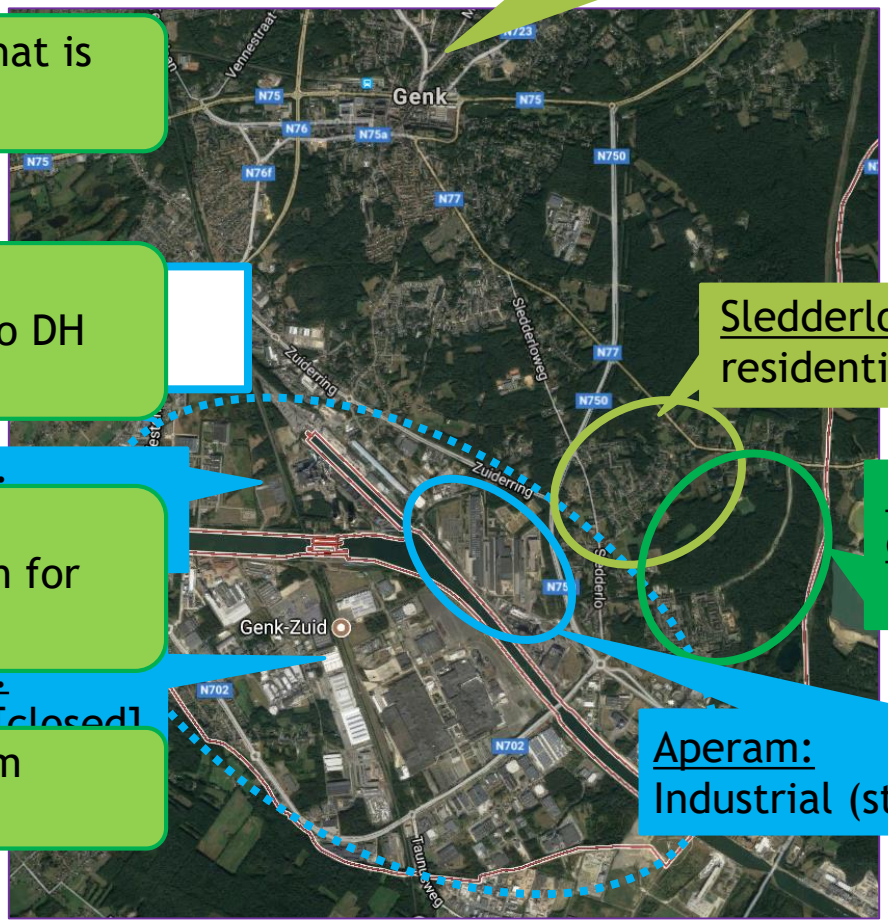
Sledderlo:
residential

Nieuw-Sledderlo (new development area):
residential

3. Integrate existing buildings and/or plan for future transition

Aperam:
Industrial (steel manufacturing)

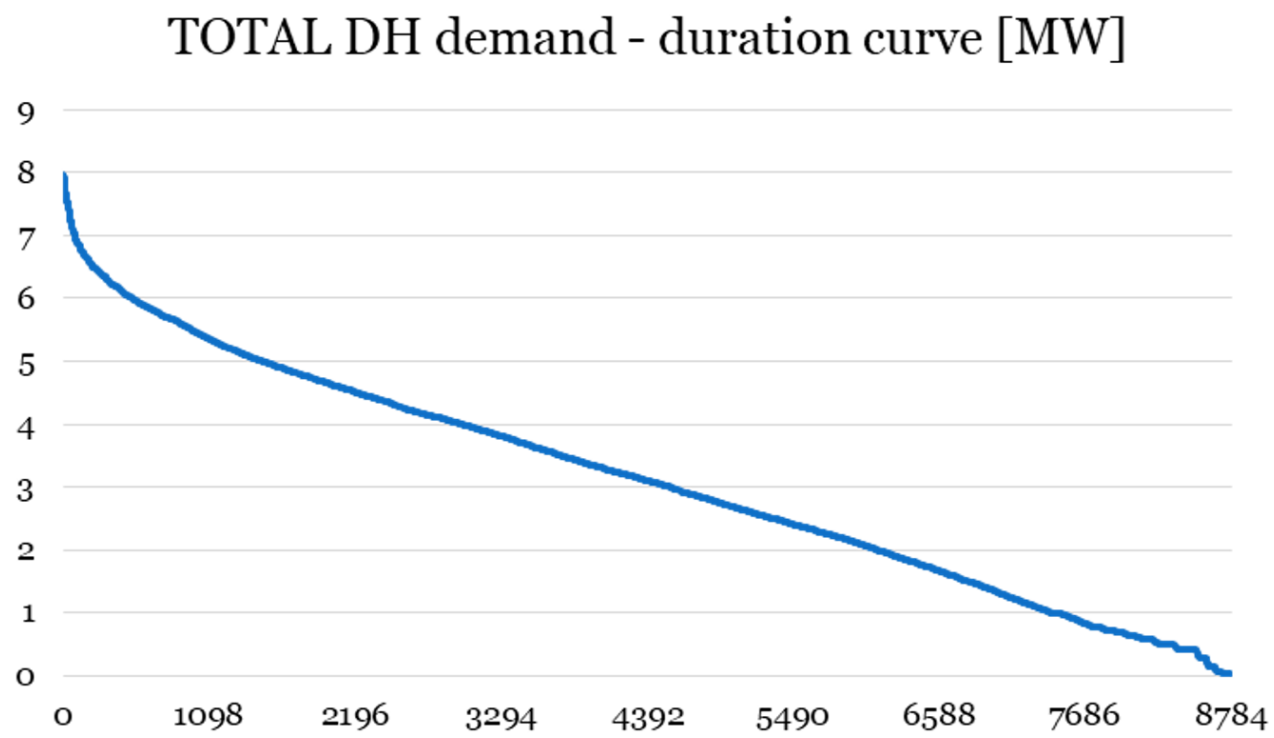
4. Integrate long-term thermal storage



Current situation in Sledderloo/Genk-South

- Residential housing district built in 50's
- New-Sledderloo: social district built in the 70's
- Groot-Sledderlo: new residential area in 2010
- New area will be built: LO2020

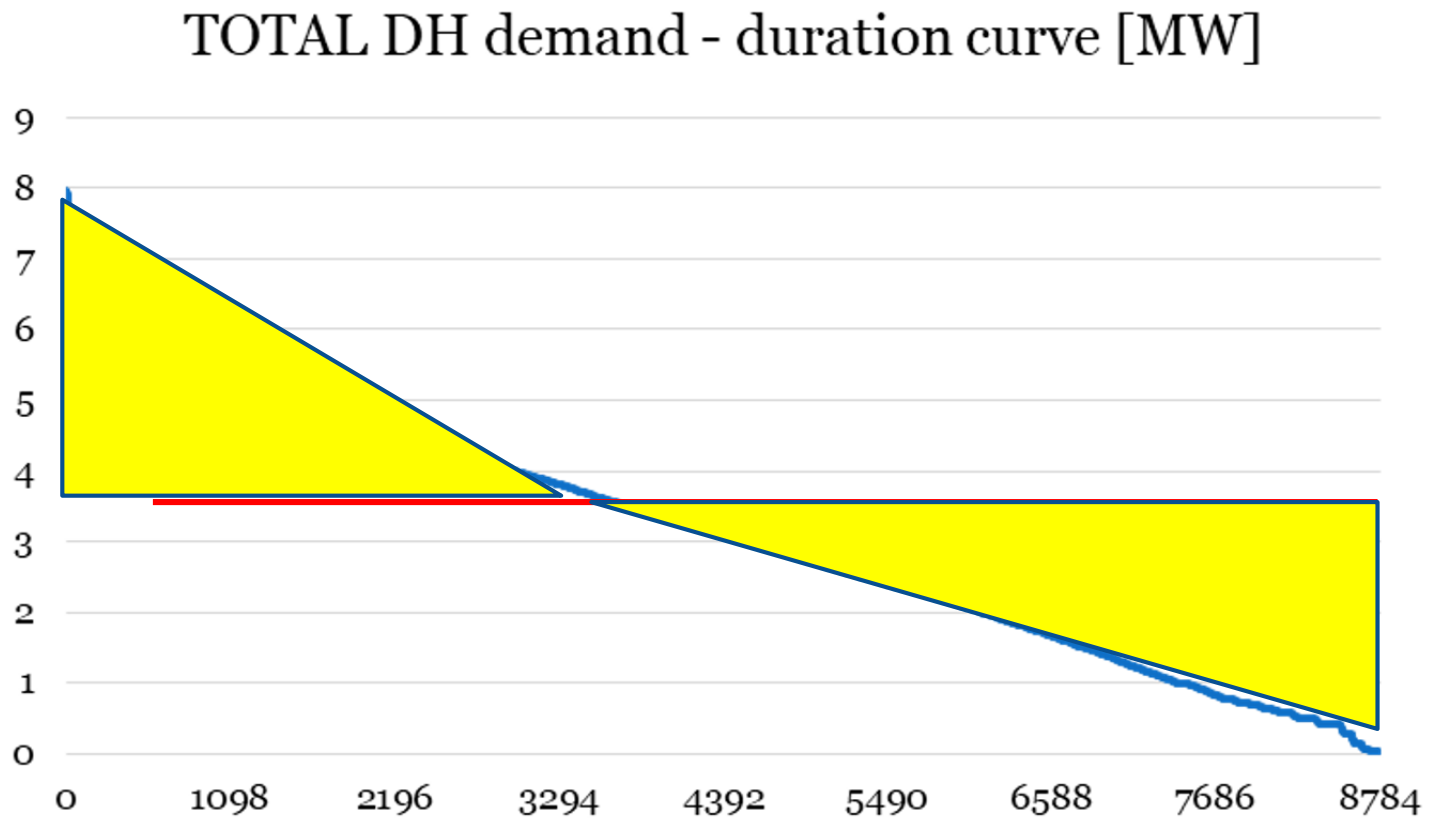
Heat demand analysis



Annual heat demand:
23.9 GWh
Peak heat demand:
6.9 MW

DHC network planning

- Heat sources:

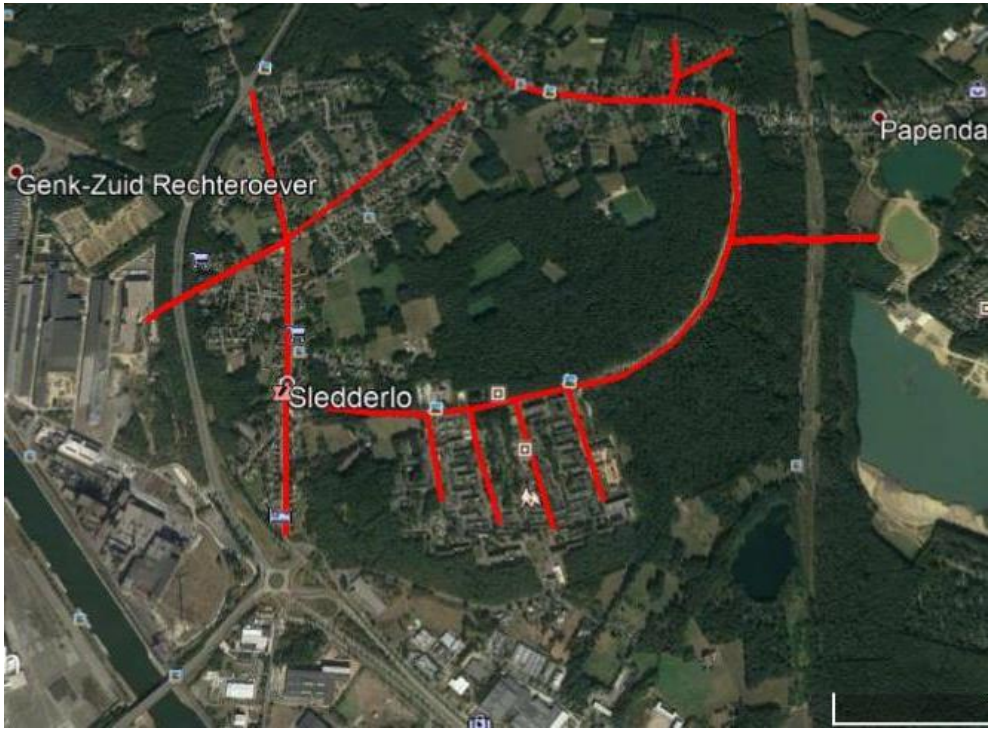


Seasonal heat storage assessment

- 0.3 km^2 lake area
- Necessary storage volume: 150,000 m^3
- Depth needed ~5 m
- Current depth of lake est. 3m → can be increased by digging deeper and use it to build a dam around the lake

- Reference project: Vojens (Denmark) → 200,000 m^3

Network layout



- Total trench length: 8.1 km
- Linear heat density: 2.9 MWh/m/y
- Linear heat power density: 0.85 kW/m
- Network temperatures: 70°C/50°C

Accompanying measures

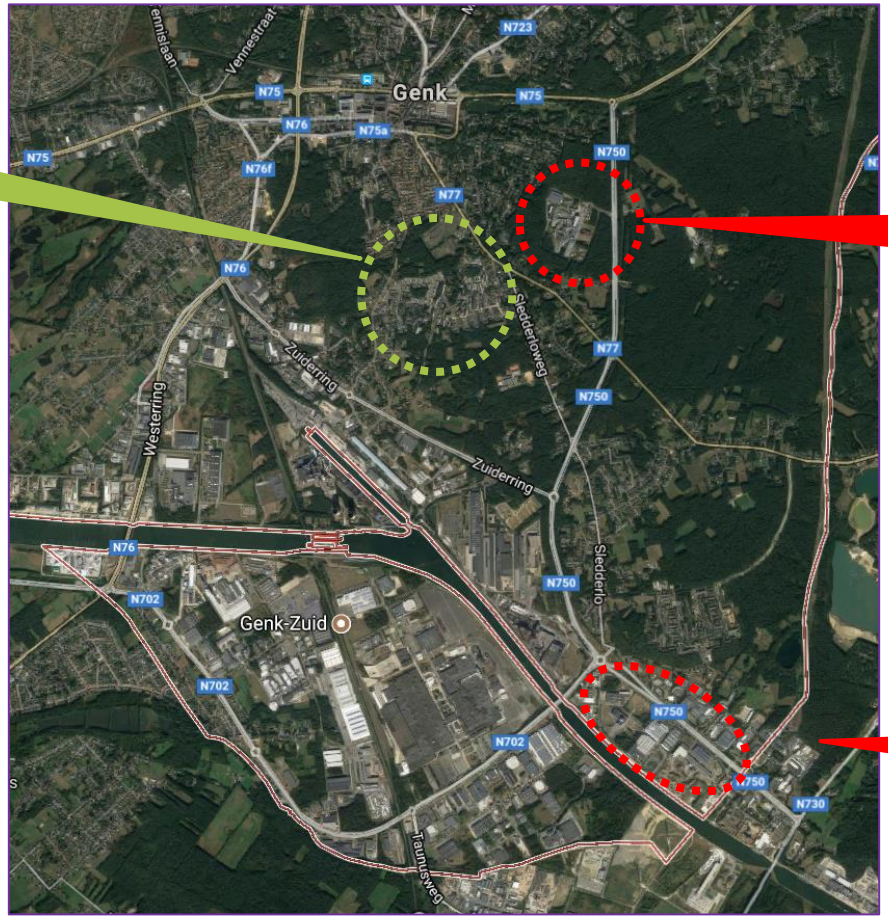
1. Consumer incentivation to reduce heat demand and supply temperature:
   - Subsidize investments in insulation improvements and heating system replacements
   - Neighbourhood competitions
   - Provide real-time monitoring applications

Cost analysis

			Fixed cost	Variable cost
Waste heat - HEX	4	MW	60.000	3.000
Natural gas boiler	8	MW	800.000	12.000
Thermal storage capacity - HEX	4	MW	60.000	3.000
Thermal storage size	150.000	m3	12.000.000	84.000
Grid	16.323	m	16.323.102	
NG boiler specific price - investment	100.000	€/MW		
NG boiler specific price - variable	1.500	€/MW		
HEX investment cost	15.000	€/MW		
HEX variable cost	5%	of investment		
TES investment	80	€/m3		
TES variable	0,70%	of investment		
NG price	40	€/MWh		
Heat price	44	€/MWh		
Total yearly revenue	1.062.427	€		
Payback period	30,45	years		

Future expansion

Kolderbos: residential



Ziekenhuis Oost-Limburg: regional hospital

Industrial area

Conclusions

- Primary energy savings: 20,4 GWh
- CO_2 emission savings: 0,0024 t-CO_2/MWh (90% reduction)
- Pay-back time: ~30 years