9th International Conference on Smart Energy Systems
12-13 September 2023
#SESAAU2023

Powered by

WASTE HEAT AS A DRIVER FOR GREENFIELD HEAT NETWORKS?

PLANNING TRADE-OFFS ILLUSTRATED USING A CASE STUDY FOR ZELZATE, BELGIUM.

Aljoscha Pollmann, Dr. Ali Aydemir, Dr. Markus Fritz

This presentation is based on work carried out within the project Act!onHeat. This project received funding from the European Union's Horizon 2020 research and innovation program under grant agreement no. 101033706, for which the authors are grateful.

EU Horizon 2020 research and innovation program (GA No 101033706)

Content

- Introduction
  – Research Area
- Method
  – Data preparation
  – Scenarios
  – Indicators
- Results
  – Trade-offs

Introduction

European Union's Horizon 2020 research and innovation program

Support municipalities to start, continue or improve their strategic heating and cooling planning

Lokaal bestuur Zelzate

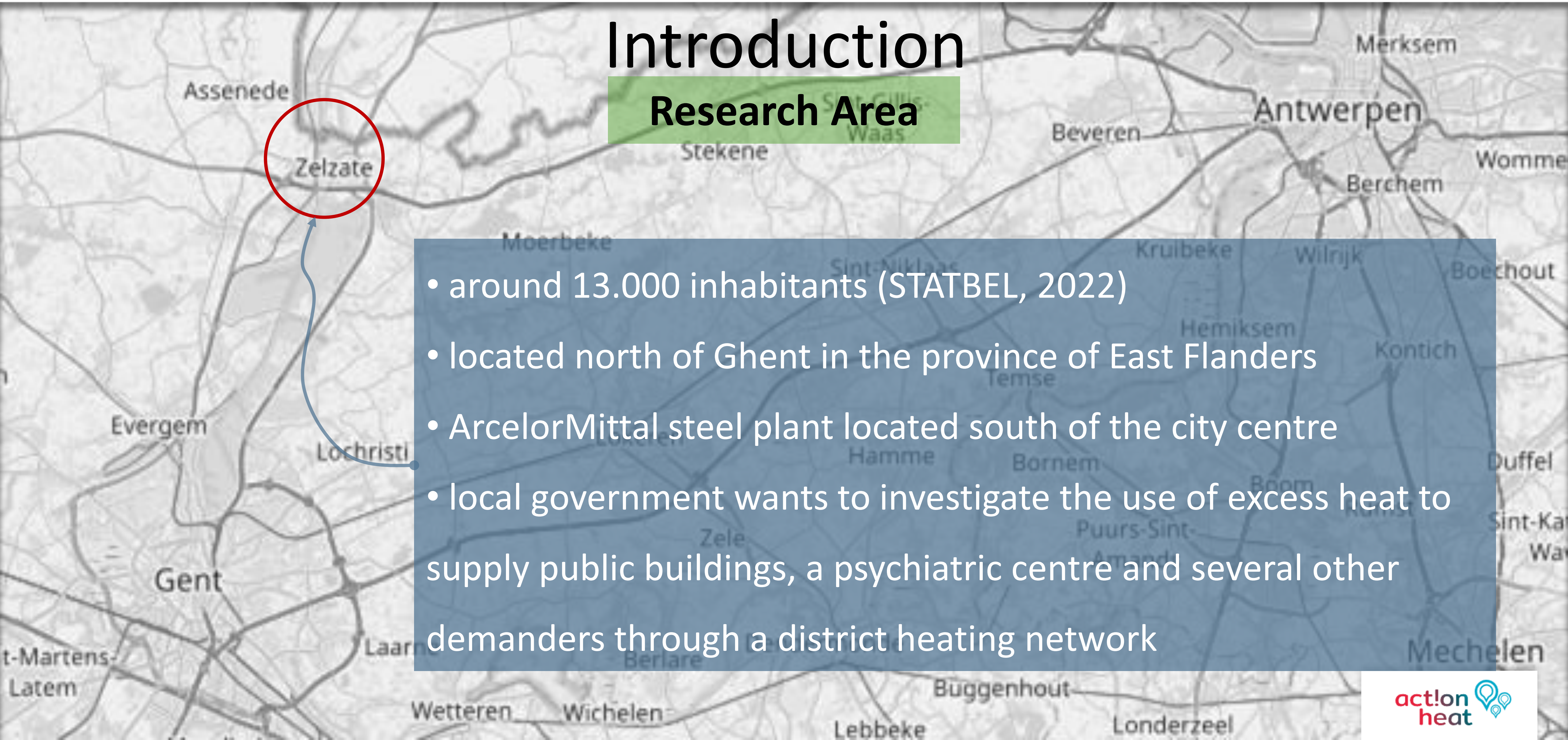
Introduction

Research Area

action heat

Introduction

Research Area

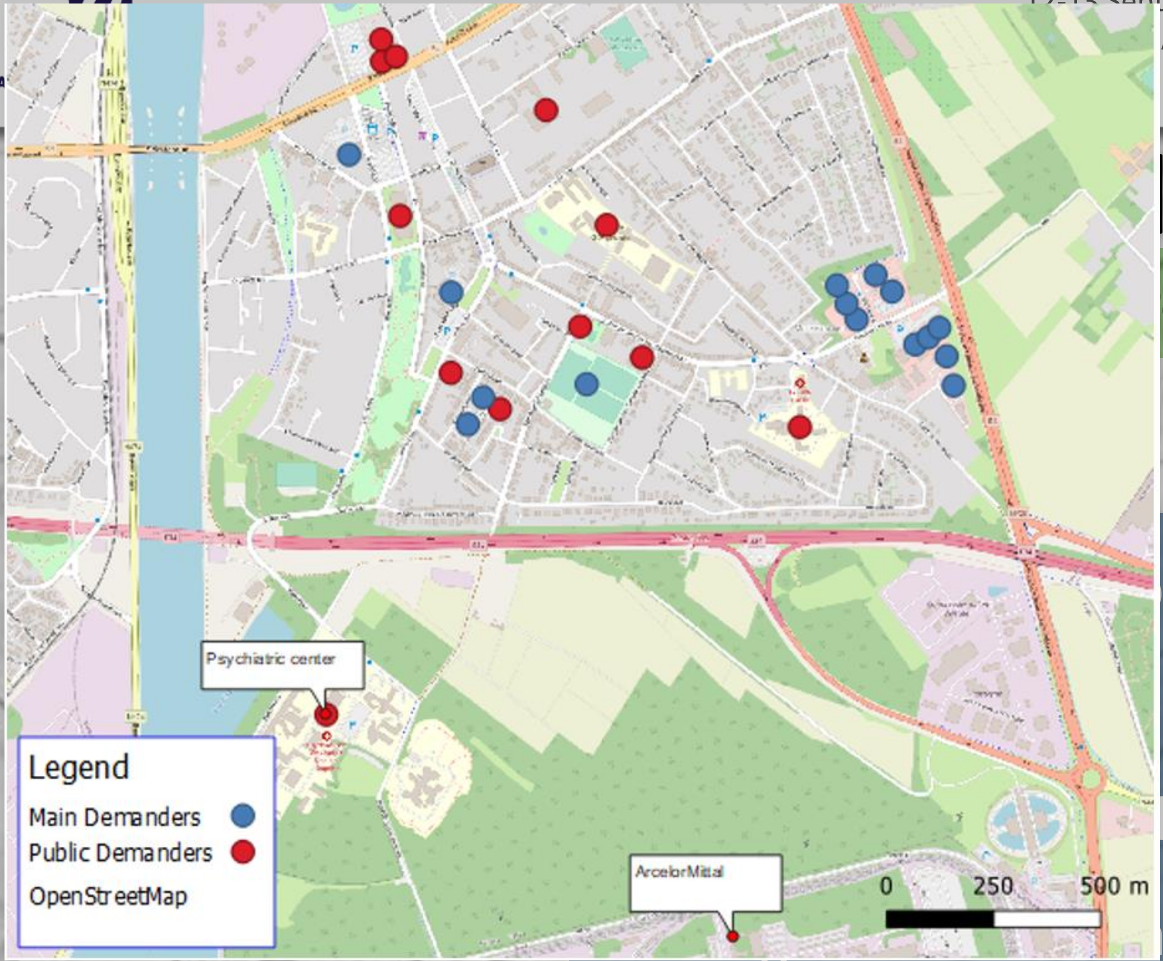


- around 13.000 inhabitants (STATBEL, 2022)
- located north of Ghent in the province of East Flanders
- ArcelorMittal steel plant located south of the city centre
- local government wants to investigate the use of excess heat to supply public buildings, a psychiatric centre and several other demanders through a district heating network

act!on heat

…luction

…ch Area



…itants (STATBEL, 2022)

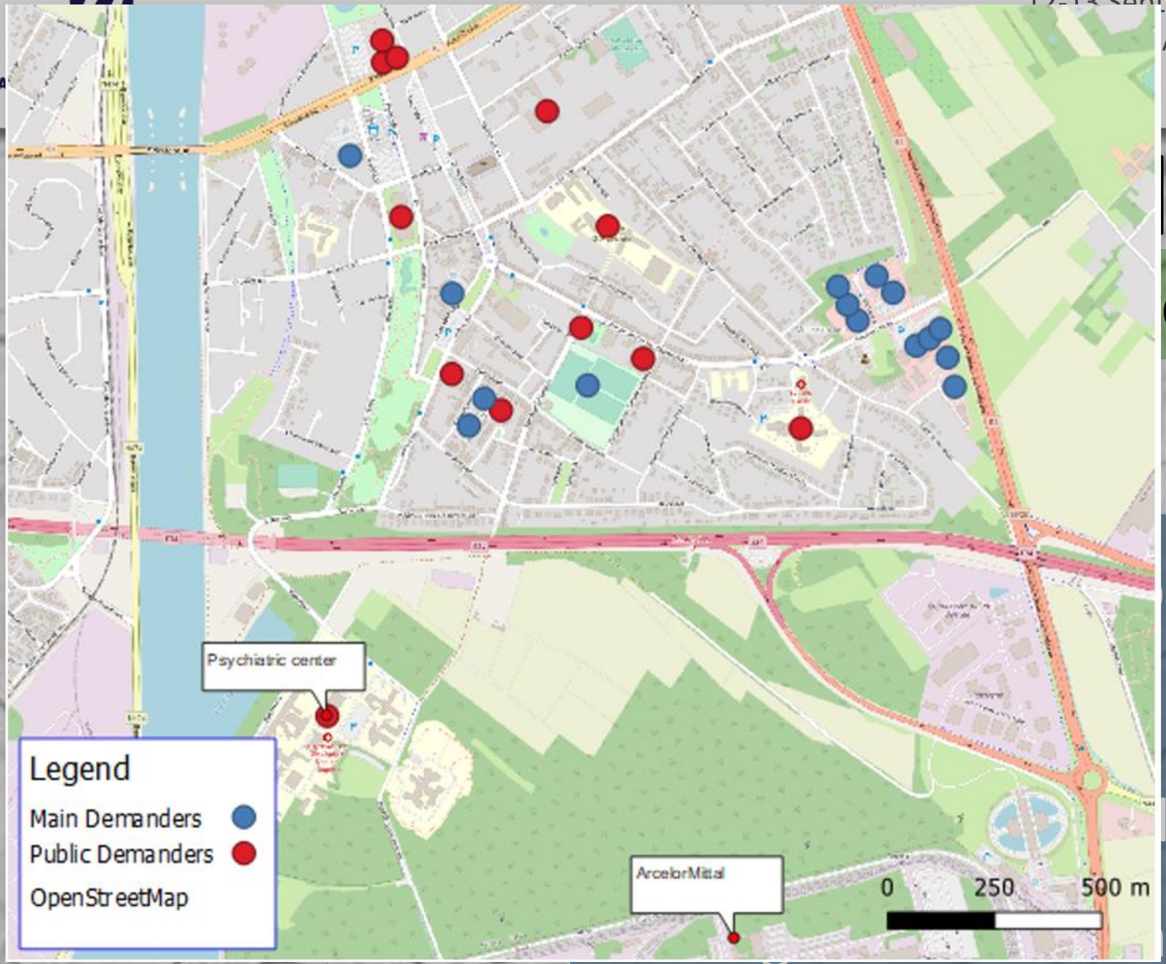
…nt in the province of East Flanders

…lant located south of the city centre

…nts to investigate the use of excess heat to supply public buildings, a psychiatric centre and several other demanders through a district heating network

luction

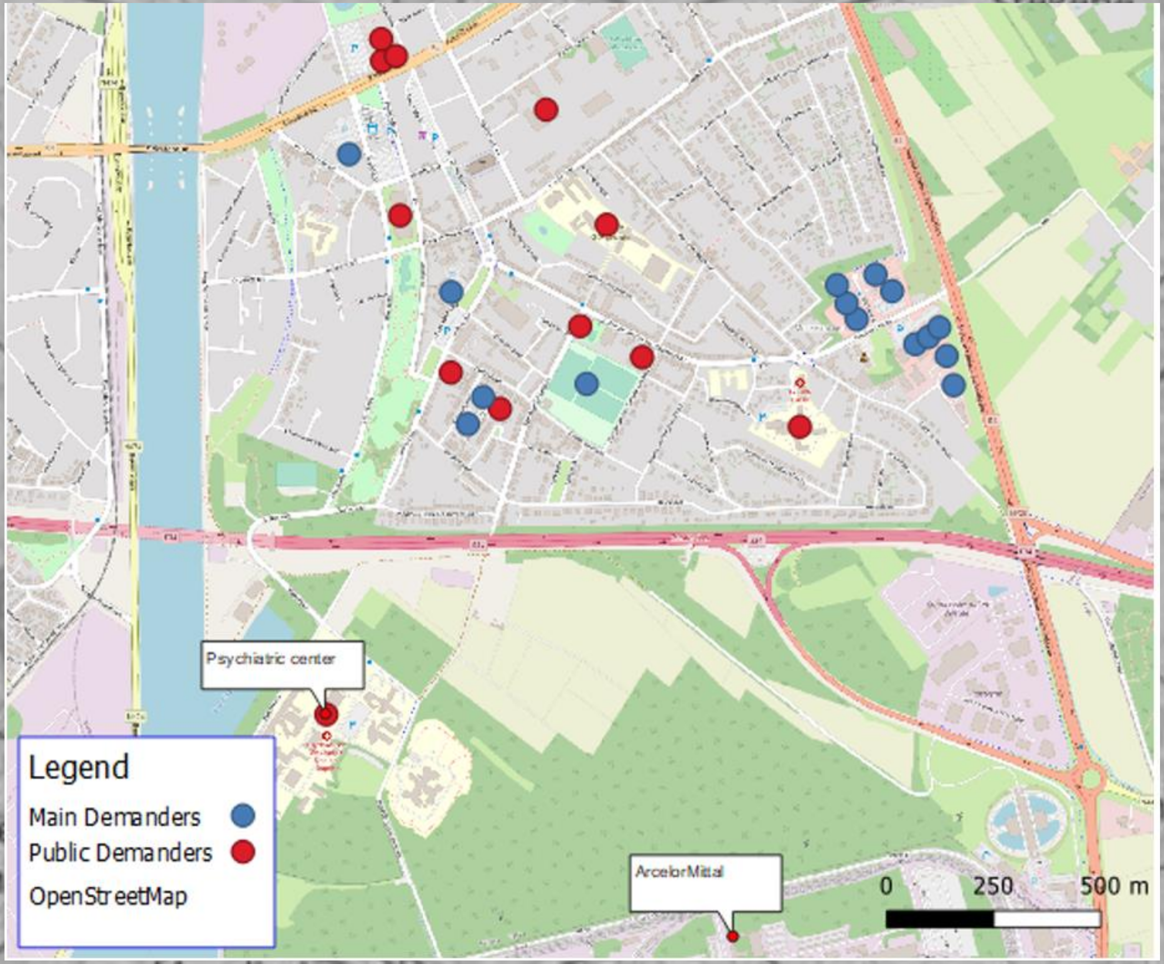
ch Area



- itants (STATBEL, 2022)
- nt in the province of East Flanders
- lant located south of the city centre
- nts to investigate the use of excess heat to supply public buildings, a psychiatric centre and several other demanders through a district heating network

Introduction

Research Area



Key planning decisions:

Should it be constructed to fully utilize waste heat?

Maximize project NPV?

Connect as many buildings as possible?

Methods

THERMOS

www.thermos-project.eu

Methods

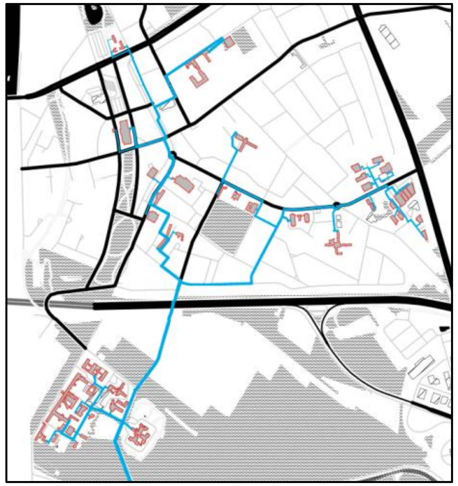
Data preparation

Plausibility Check Zelzate Centre			
Data	Estimation Model	Result (mwh/yr)	Accuracy
Reference Demand	-	53,788.00	100.00%
OSM Only	2D	98,150.00	182.48%
OSM + LIDAR	3D	37,090.00	68.96%
GIS Only	2D	98,160.00	182.49%
GIS + LIDAR	3D	65,020.00	120.88%
GIS Filtered + LIDAR	3D	53,350.00	99.19%

Methods

Technical Scenarios

Main demanders



- Only main demanders as shown on previous map are connected to the network

Line densification

- Main demanders plus all buildings along the connecting pipes are part of the network

Full extent

- All buildings within the center of Zelzate are connected to the network

Methods

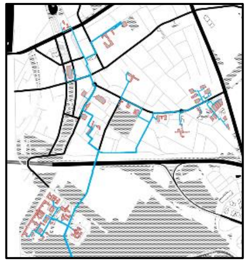
Indicators

Energy costs	
Total heat distribution costs	c/kwh

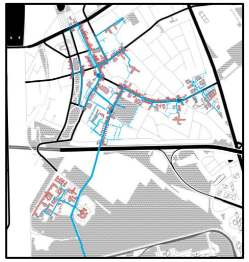
Efficiency	
Demand covered by district heating network	%
Excess heat share within district heating network	%
Heat losses	%

Environmental impact	
Avoided emissions	t CO²

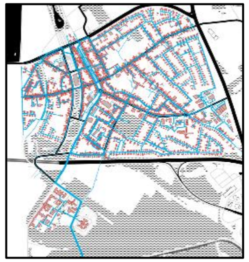
Results



Main demanders



Line densification



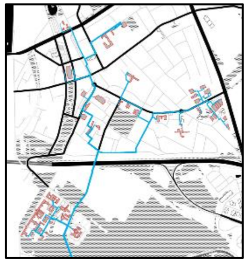
Full extent

	Main demanders	Line densification	Full extent
Energy costs			
Total heat distribution costs	lowest	second lowest	highest
Efficiency			
Demand covered by district heating network	lowest	second highest	highest
Excess heat share within district heating network	highest	highest	lowest
Heat losses	second lowest	lowest	highest
Environmental impact			
Avoided emissions	lowest	second highest	highest

Results

Trade-offs

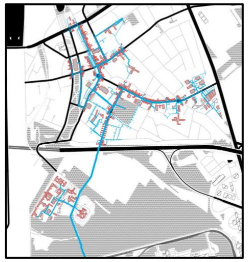
Main demanders



- Requires the least amount of construction work.
- Has the lowest capital cost.
- Operates with reasonable heat losses and low operating distribution costs.

- Limited contribution to greenhouse gas reduction targets.
- Inaccessible to homeowners wishing to decarbonise their heat supply.
- Risk of lock-in effects.

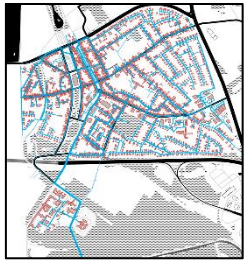
Line densification



- Most cost effective as it operates with reasonable heat losses and low operating distribution costs while requiring medium sized construction work.

- Risk of lock-in effects
- Inaccessible to homeowners away from the connecting pipes.

Full extent



- Highest contribution to emission reduction targets.
- Can be accessible to any homeowner.
- Eliminates the risk of lock-in effects.

- Has the highest heat losses of the three approaches.
- Requires the most construction work of the three approaches.
- Has the highest capital costs of the three approaches.

Conclusion

- All technical solutions have their specific technical advantages and disadvantages
- However, the local circumstances, actors, goals and commitments determine the acceptance of certain trade-offs
- Trade offs for the community are e.g:
    - High DH share
    - Low DH share
- Overall market perception of all actors (e.g. DH operators, homeowners) determines the individual decisions in development and planning
- Market uncertainty and the assessment of the markets determine the planning and decision-making of the DH operator as well as other market participants
- Especially important in view of uncertain data and external circumstances (e.g. inflation, energy prices, political agendas)

Limitations

- Our approach is only focused on the mentioned indicators, a more universal approach could lead to different conclusions and reveal other opportunities
- Purely economic assessment is limited and technical assessments should be combined with market surveys to identify local uncertainties and needs in advance

AALBORG UNIVERSITY
DENMARK

energy CLUSTER DENMARK

Powered by

Aljoscha Pollmann, Dr. Ali Aydemir, Dr. Markus Fritz

EU Horizon 2020 research and innovation program (GA No 101033706)