



# Modifying Intensive Carbon Energy Systems (MICES)

# MICES

## Modifying Intensive Carbon Energy Systems

By

Aya H. Heggy | 4 July 2023



**London  
South Bank  
University**

EST 1892

# Agenda

**Introduction**

**Challenges**

**Research plan**

**Case studies**

**Vision**

**Conclusion**



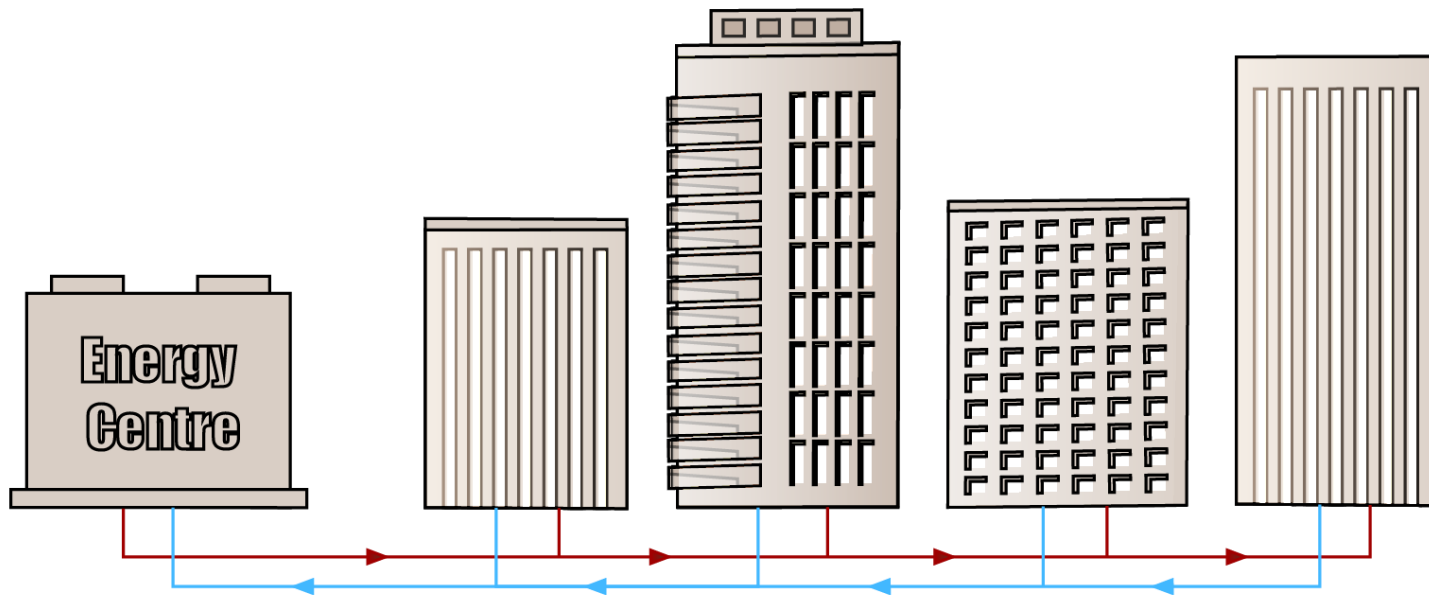
# Heat Decarbonisation



Decarbonising heat will be crucial on our path towards net-zero in 2050

# Heat Networks have a crucial role

Efficiently distributes heat from centralised source to multiple buildings...



reducing **0.7 MTCO<sub>2</sub>**

...saving **3000 GWh** of  
gas imports a year

# Heat Networks have a crucial role

**14,000**

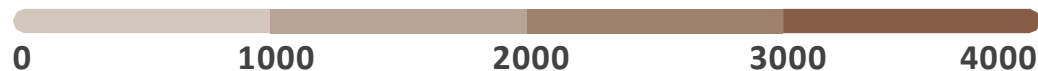
heat networks in the UK....

With **20%**  
are district schemes....

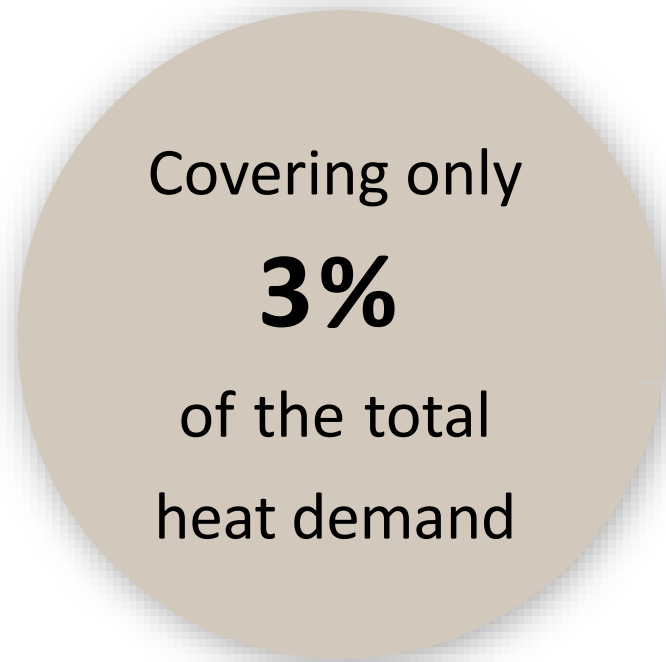
Covers only **3%**  
of the total heat demand



**30%** of networks  
located in London



# The growth potential is significant



By 2050



17%

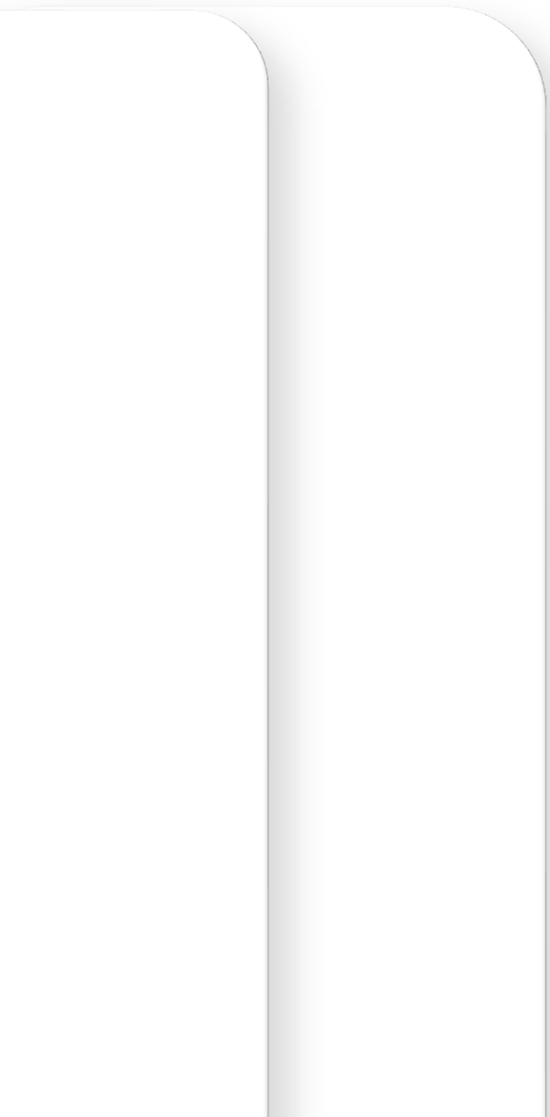
of homes



24%

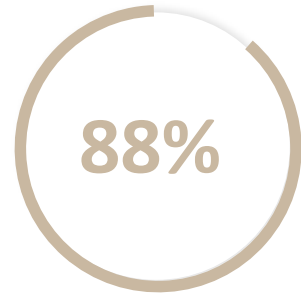
of commercial and  
public sector buildings

# | Challenges



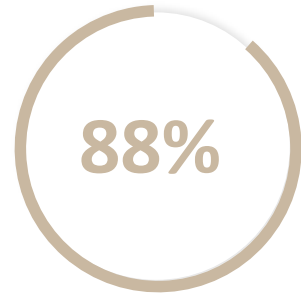


# Challenges : natural gas dependency



**of networks use gas CHP and boilers**

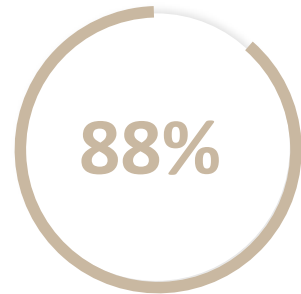
# Challenges : natural gas dependency



**of networks use gas CHP and boilers**

challenge in  
decarbonisation

# Challenges : natural gas dependency



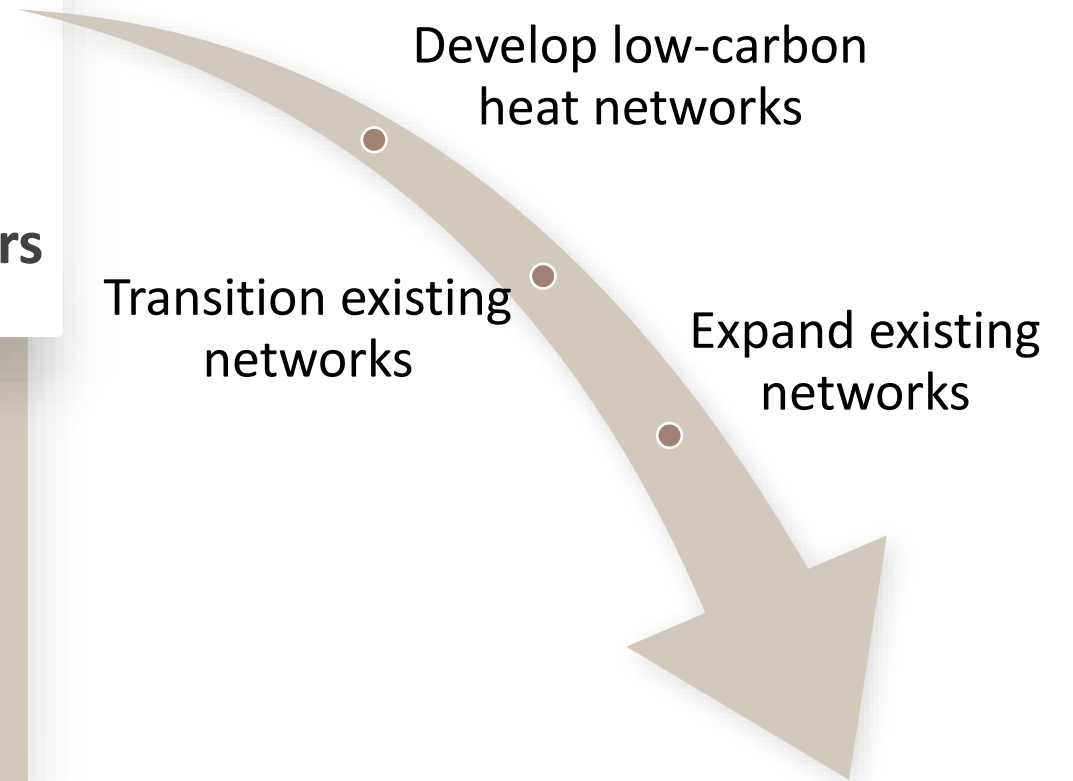
of networks use gas CHP and boilers

challenge in decarbonisation

Fuel poverty/  
compromising energy security



Crucial to achieve net-zero



2050

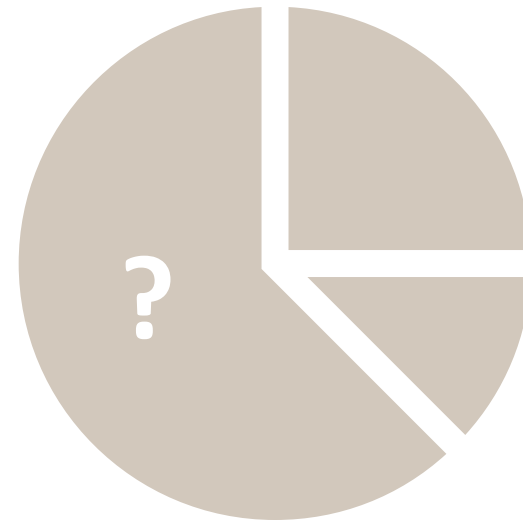
# Challenges: chaotic market

The UK heat network market is currently chaotic with incomplete and inconsistent data.

“ There are currently around **14,000** UK networks, accounting for less than **3%** of heat demand (DESNZ, 2023). ”

● What does the 3% represent in the market?

● Heat network statistics were last recorded in 2015.



# | Research objectives

**Market  
characterisation**



**Market  
decarbonisation**



# Research objectives

## Market characterisation



Give a clear picture of the UK heat network market by categorising it into archetypes and creating a comprehensive database that has uniform language and information for each category.

## Market decarbonisation





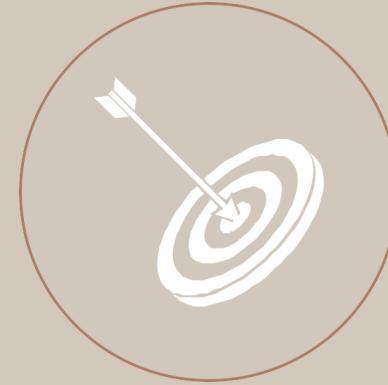
# Research objectives

## Market characterisation



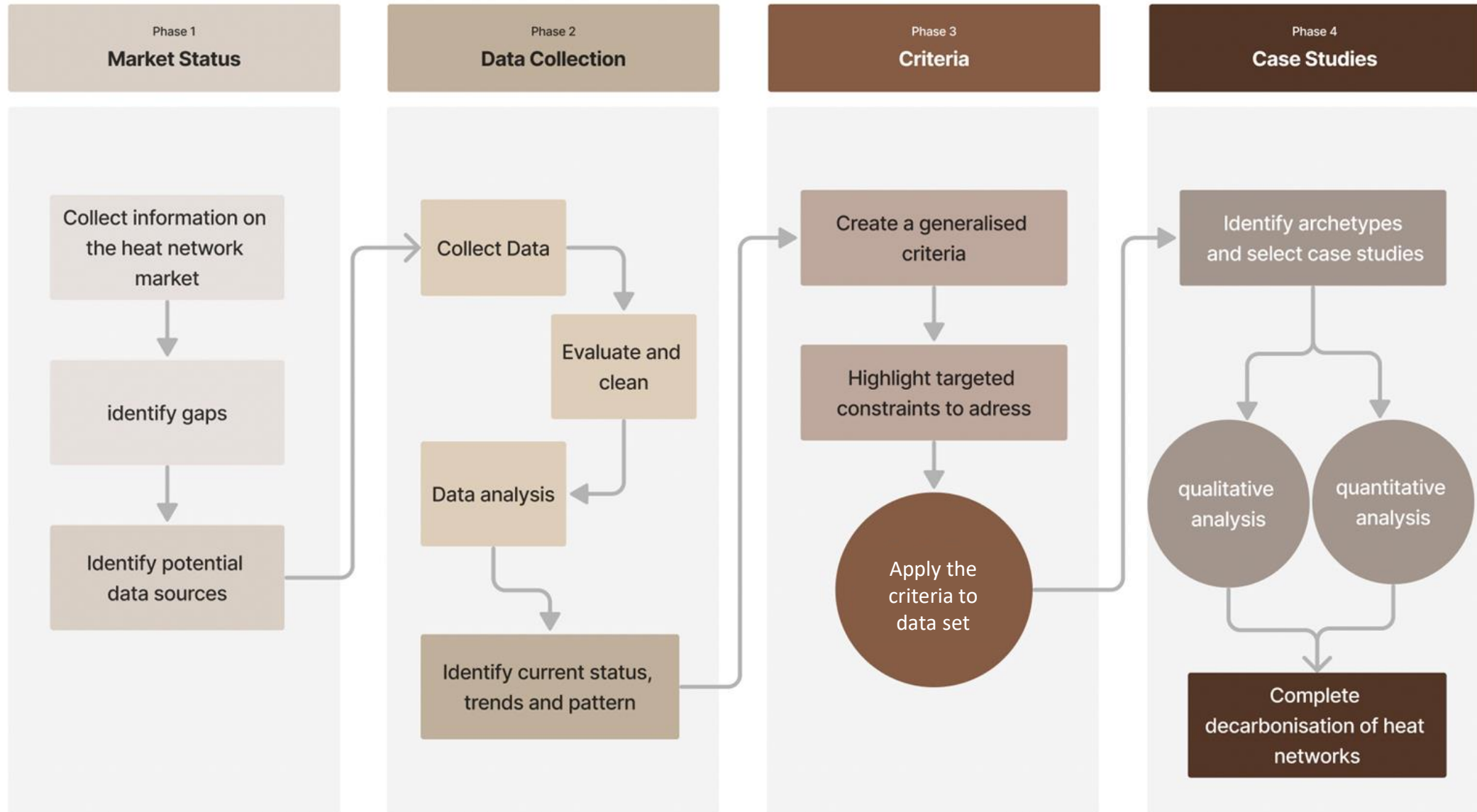
Give a clear picture of the UK heat network market by categorising it into archetypes and creating a comprehensive database that has uniform language and information for each category.

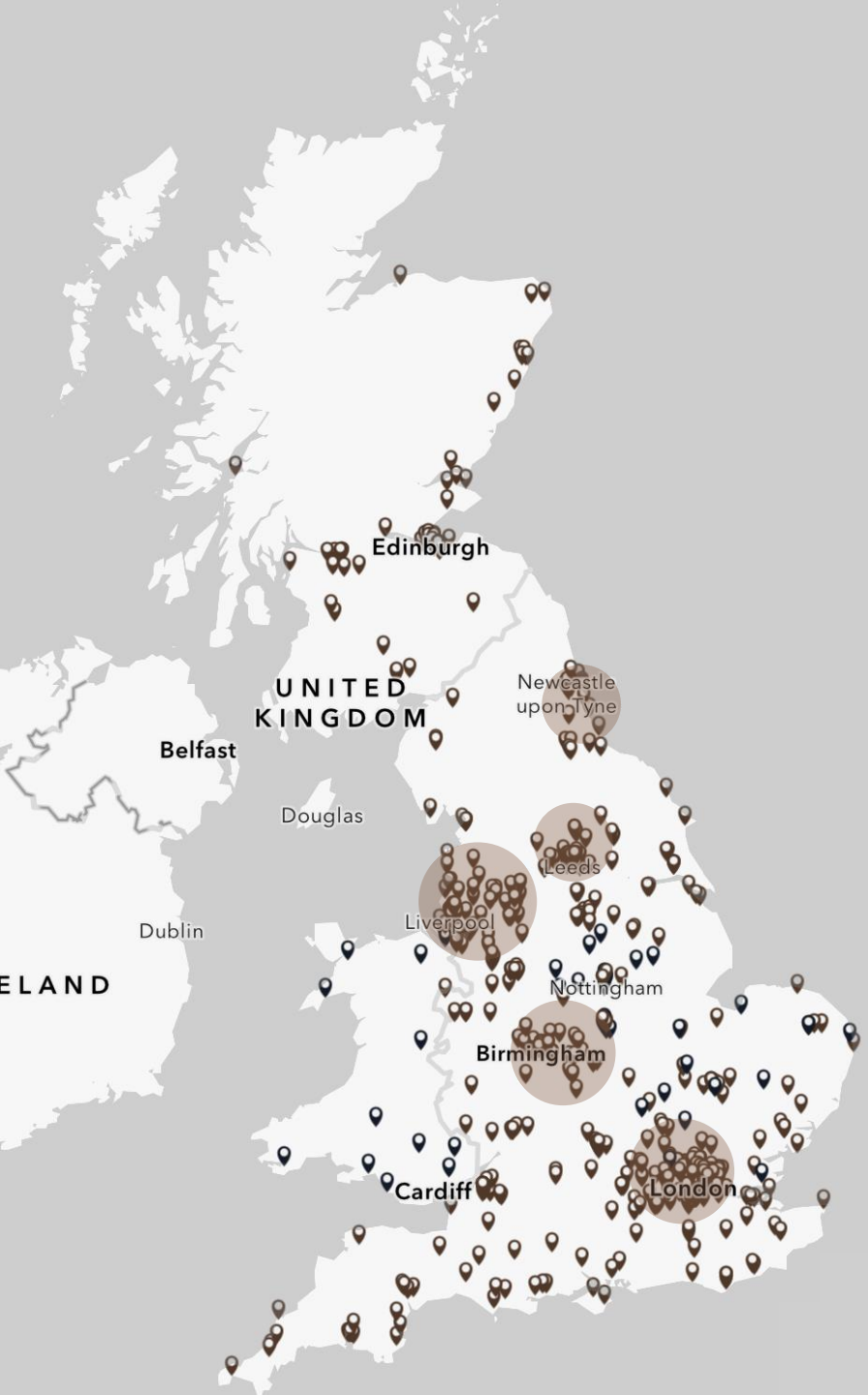
## Market decarbonisation



Explore technical and non-technical options for decarbonising existing gas-intensive networks in the UK, focusing on the main archetypes within the market.

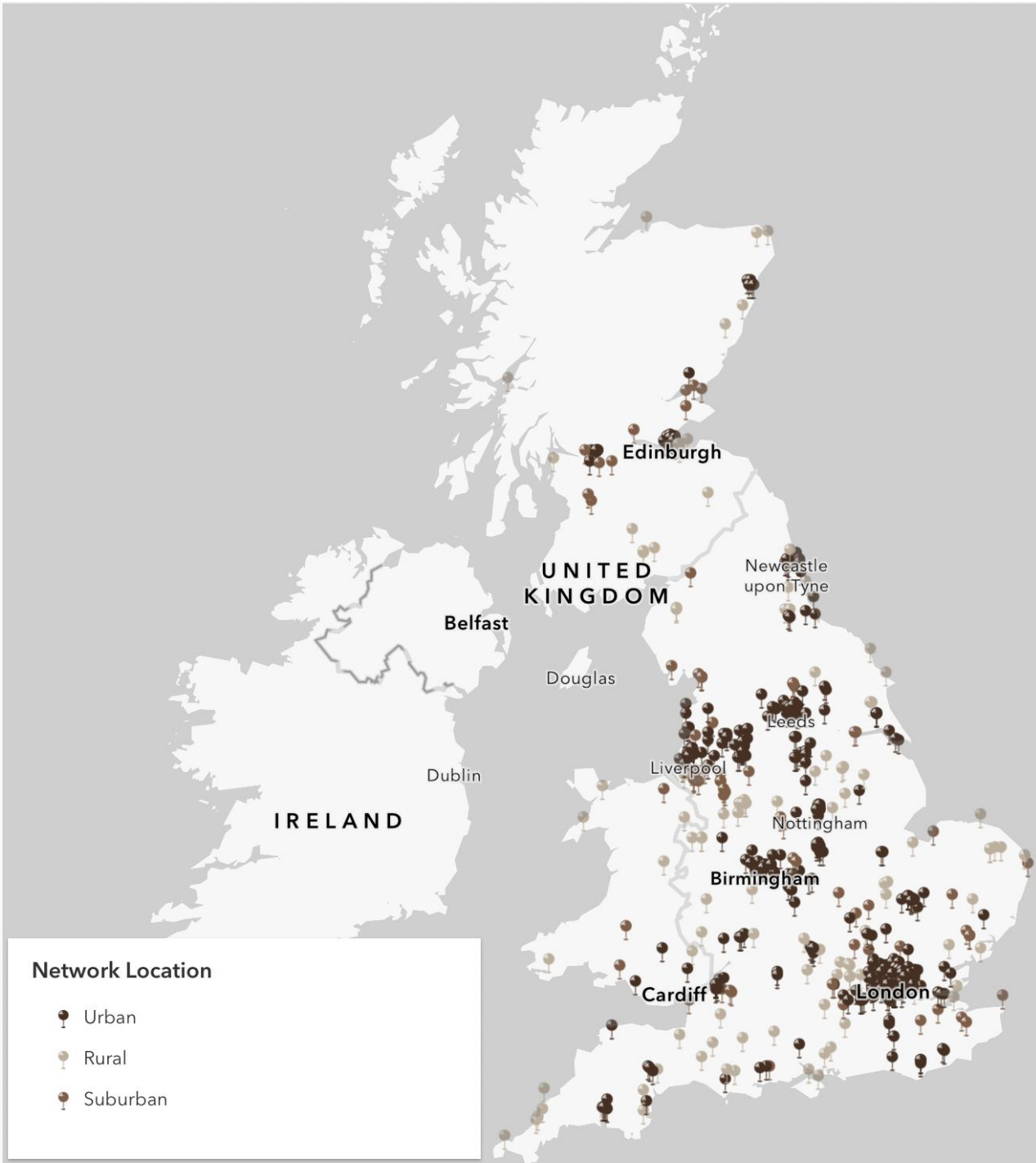
# Research plan



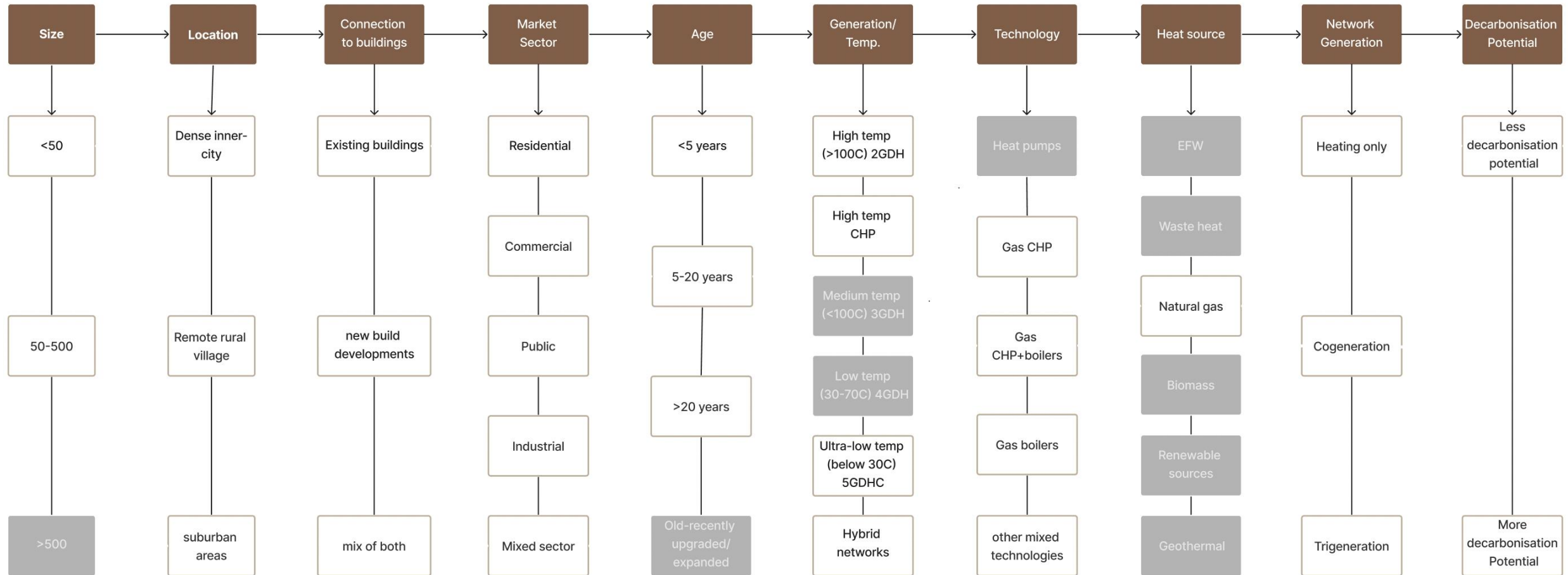


## A sample of 940 heat networks

London; 460	Midlands; 86	North West; 86	
	South West; 60	Scotland; 54	East of England; 49
	South East; 54	Yorkshire and Humber; 42	North East; 37
			Wales; 12



# Case Studies: selection criteria



Criteria

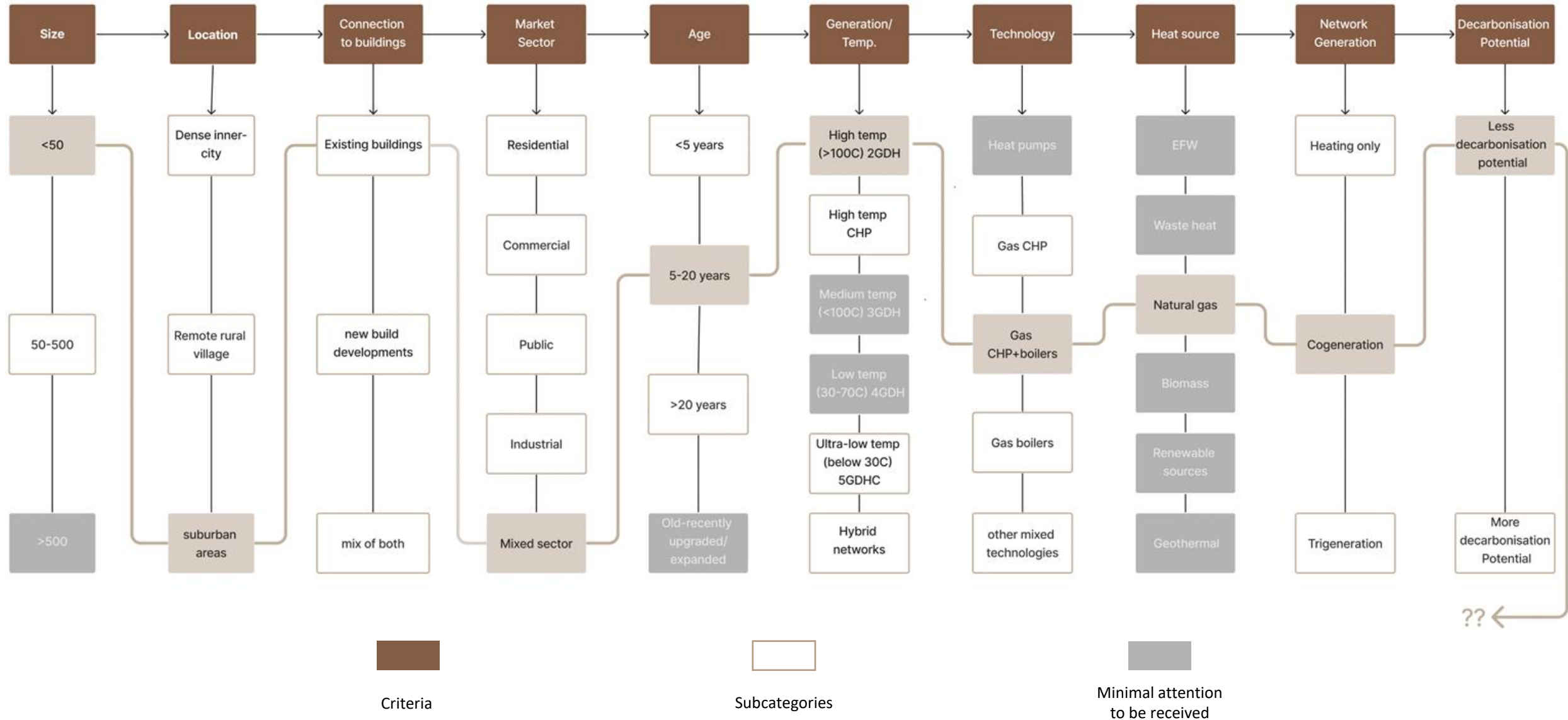


Subcategories



Minimal attention  
to be received

# Case Studies: selection criteria





# Case Studies: objectives

1.

Eliminate fossil fuel CHP  
and boilers used in heat  
networks

---

2.

Maximise energy efficiency  
while reducing carbon  
emissions

---

3.

Optimise feasibility and  
economic viability of  
decarbonisation  
technologies

---

# Case Studies: methodology



Define parameters, assumptions and interventions



Run the baseline case studies and adjust assumptions

# Case Studies: methodology



Define parameters, assumptions and interventions



Run the baseline case studies and adjust assumptions



Run the baseline case studies with interventions

# Case Studies: methodology



Define parameters, assumptions and interventions



Run the baseline case studies and adjust assumptions



Run the baseline case studies with interventions

Heat pumps

Waste heat potential

Renewable sources

Energy storage systems

Fuel substitution

# Case Studies: methodology



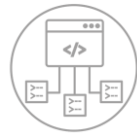
Define parameters, assumptions and interventions



Run the baseline case studies and adjust assumptions



Run the baseline case studies with interventions



Options Appraisal

# Case Studies: methodology



Define parameters, assumptions and interventions



Run the baseline case studies and adjust assumptions



Run the baseline case studies with interventions



Options Appraisal

CapEx and OpEx

Carbon emissions savings

Resilience/ Adaptability

Expansion potential

Potential implication assessment



# Case Studies: methodology



Define parameters, assumptions and interventions



Run the baseline case studies and adjust assumptions



Run the baseline case studies with interventions



Options Appraisal



Results and insights

# Vision

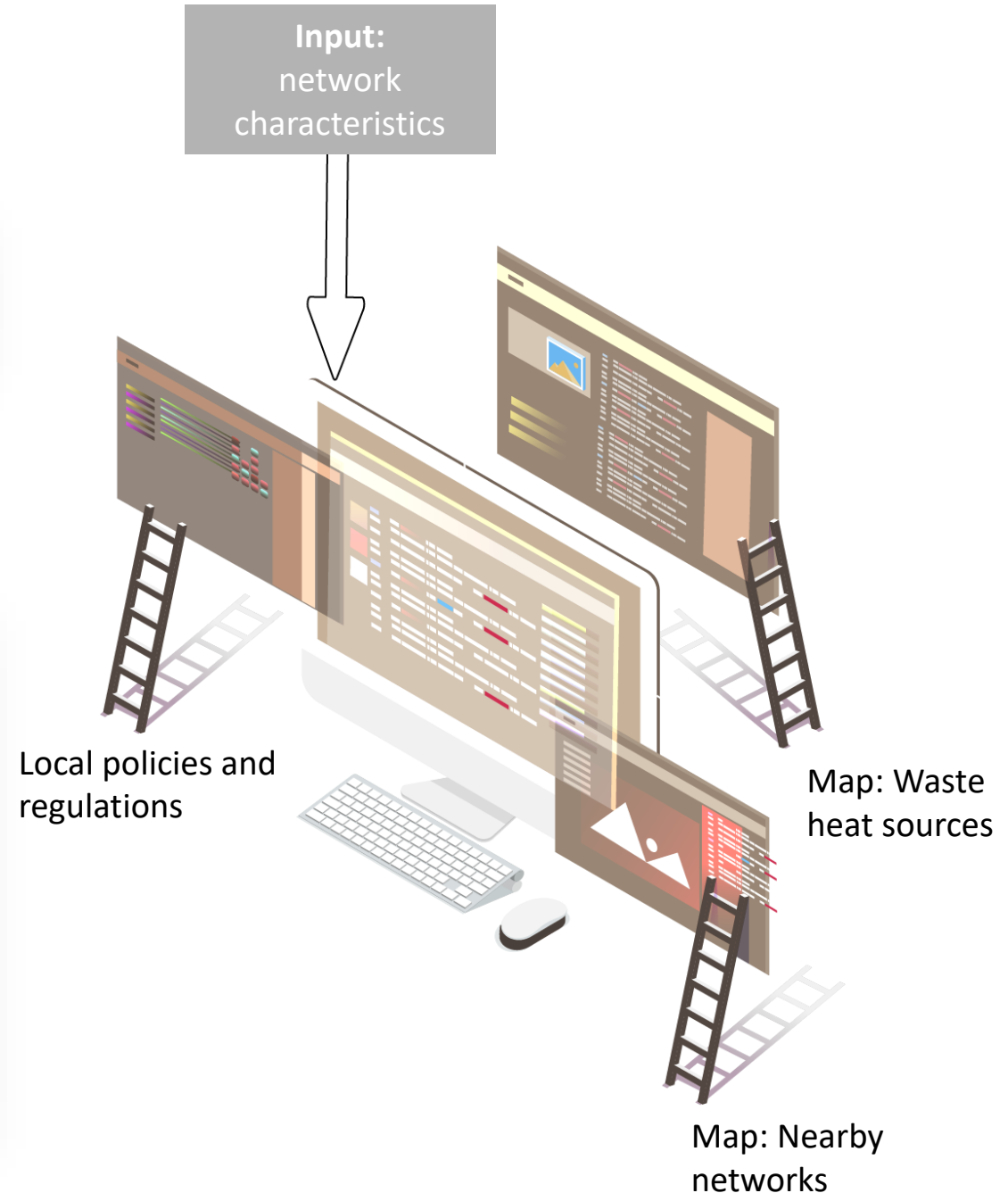


Results and insights

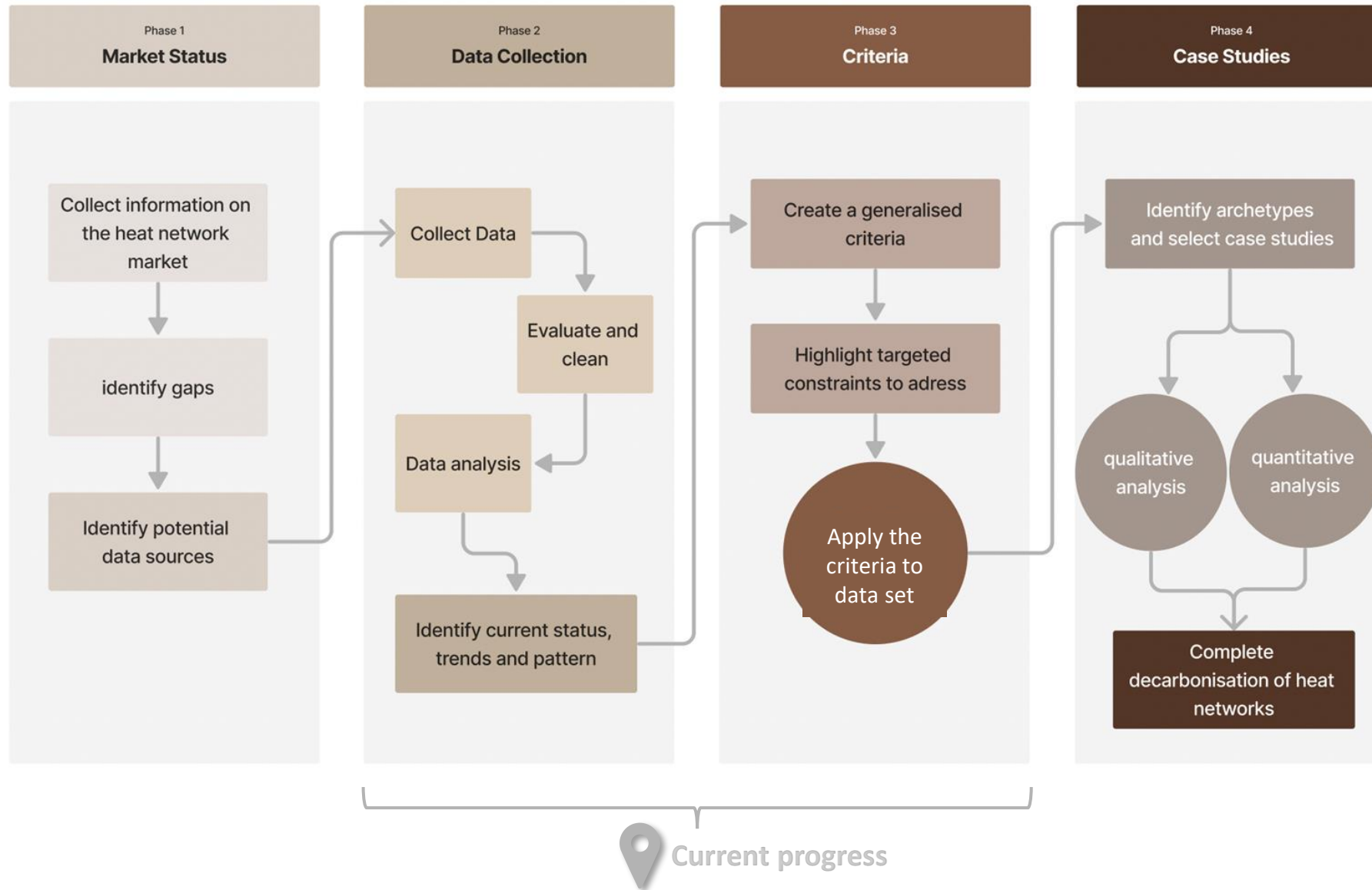


HN decarbonisation database

- An online platform that guides users through a series of questions about their heat network
- Subcategorise the market into main archetypes
- Provides a comprehensive guide on potential decarbonisation of heat networks using project insights



# Current progress



| THANK YOU

Aya H. Heggy

[Heggya2@lsbu.ac.uk](mailto:Heggya2@lsbu.ac.uk)



**London  
South Bank  
University**

EST 1892