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Hackney Decentralised Energy Masterplan

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Contents

Glossary 5

1 Executive Summary 6

2 Understanding the Scope 10
- 2.1 Context 10
- 2.2 District heating introduction 10
- 2.3 Project scope 11

3 Relevant Studies and Policies 12
- 3.1 Previous heat mapping studies 12
- 3.2 Policy 14

4 Clustering method 16
- 4.1 Overview 16
- 4.2 Data sources 16
- 4.3 Clustering approach 17

5 Heat supply 18
- 5.1 Low carbon technologies review 18
- 5.2 Existing heat networks 23
- 5.3 Energy centre sizing 23
- 5.4 Pipe sizing 23

6 Heat mapping and cluster selection 24
- 6.1 Heat mapping 24
- 6.2 Borough wide heat map and clusters 25
- 6.3 Strategic Network 27
- 6.4 Prioritisation of clusters 28

7 Cluster overviews 29
- 7.1 Clusters taken forward 29
- 7.2 Clusters not taken forward 48

8 Retrofit 60
- 8.1 Introduction 60
- 8.2 Requirements 61
- 8.3 Example projects 62
- 8.4 The challenge of retrofit and connection to DHN 62
- 8.5 Funding opportunities 63

9 Commercial appraisal 64
- 9.1 Approach 64
- 9.2 Techno-economic model inputs 65
- 9.3 Techno-economic model results and analysis 67
- 9.4 Funding streams 71
- 9.5 Procurement strategy 72
- 9.6 Commercial structures 73

10 Conclusions and prioritisations 75
- 10.1 Key conclusions 75
- 10.2 Next steps 77

11 Risk register 78
- 11.1 Quantifying the risk 78

Appendix A - Benchmarks and assumptions 85

Appendix B - Capex schedule 87

Appendix C - Stakeholder engagement tracker 88

Glossary

Term	Definition
ASHP	Air source heat pump
BEIS	Department of Business, Energy and Industrial Strategy
CHP	Combined heat and power
DE	Decentralised energy
DEC	Display Energy Certificate
DEEP	Decentralised Energy Enabling Project
DHN	District heat network
DHW	Domestic hot water
EC	Energy centre
ECO	Energy Company Obligation
EPC	Energy Performance Certificate
GLA	Greater London Authority
GSHP	Ground source heat pump
HIU	Heat interface unit
HNDU	Heat Networks Delivery Unit
HNIP	Heat Networks Investment Project
LBH	London Borough of Hackney
LCOH	Levelised cost of heat
LTHW	Low temperature hot water
LZC	Low and zero carbon
Opex	Operational expenditure
Repex	Replacement expenditure
RHI	Renewable Heat Incentive
TEM	Techno-economic model
WSHP	Water source heat pump

1 Executive Summary

This Hackney Energy Masterplan has assessed and identified the potential for district energy to contribute to decarbonisation of the Borough. High level techno-economic assessment suggests that two clusters (~£22m) could provide investible propositions within the LBH hurdle rate (6%) with funding support whilst delivering long term carbon savings to the borough.

Role of district heating in Hackney

District heating networks have a key role to play in support of the UK's target to reduce the its greenhouse gas emissions to net zero by 2050 from 1990 levels. Hackney Council has gone beyond the UK target with its Climate Emergency declaration, committing to net zero by 2040. The Council aims to deliver strategic heat network infrastructure in the Borough as part of its overall objectives to reduce carbon emissions, help to lower energy costs and promote energy security.

The key aim of this document is to explore the potential of district heat networks in Hackney, identifying the key opportunity areas for district heating and developing a longer-term vision to support Hackney's growth and low carbon transition using decentralised energy. It will provide an evidence base for the development of district heating network schemes in Hackney, informing both policy and delivery.

Process

A number of strategic district heat network (DHN) opportunities have been identified within the London Borough of Hackney based on the outcomes of this energy masterplan (Figure 1.1). Of the eleven clusters, the following five are explored in more detail within this report to develop initial technical schemes and high level economic performance:

- Dalston
- Hackney Central
- Homerton
- Shoreditch North & Hoxton
- Woodberry Down

Techno-economic analysis is not carried out on Woodberry Down due this currently being undertaken by other consultants. The remaining four core networks could serve lower carbon heat up to 6,100 homes and a range of LBH owned and private commercial assets. Together, a saving of 74,360 tCO2e could be achieved over the lifetime of these schemes compared to gas boilers.

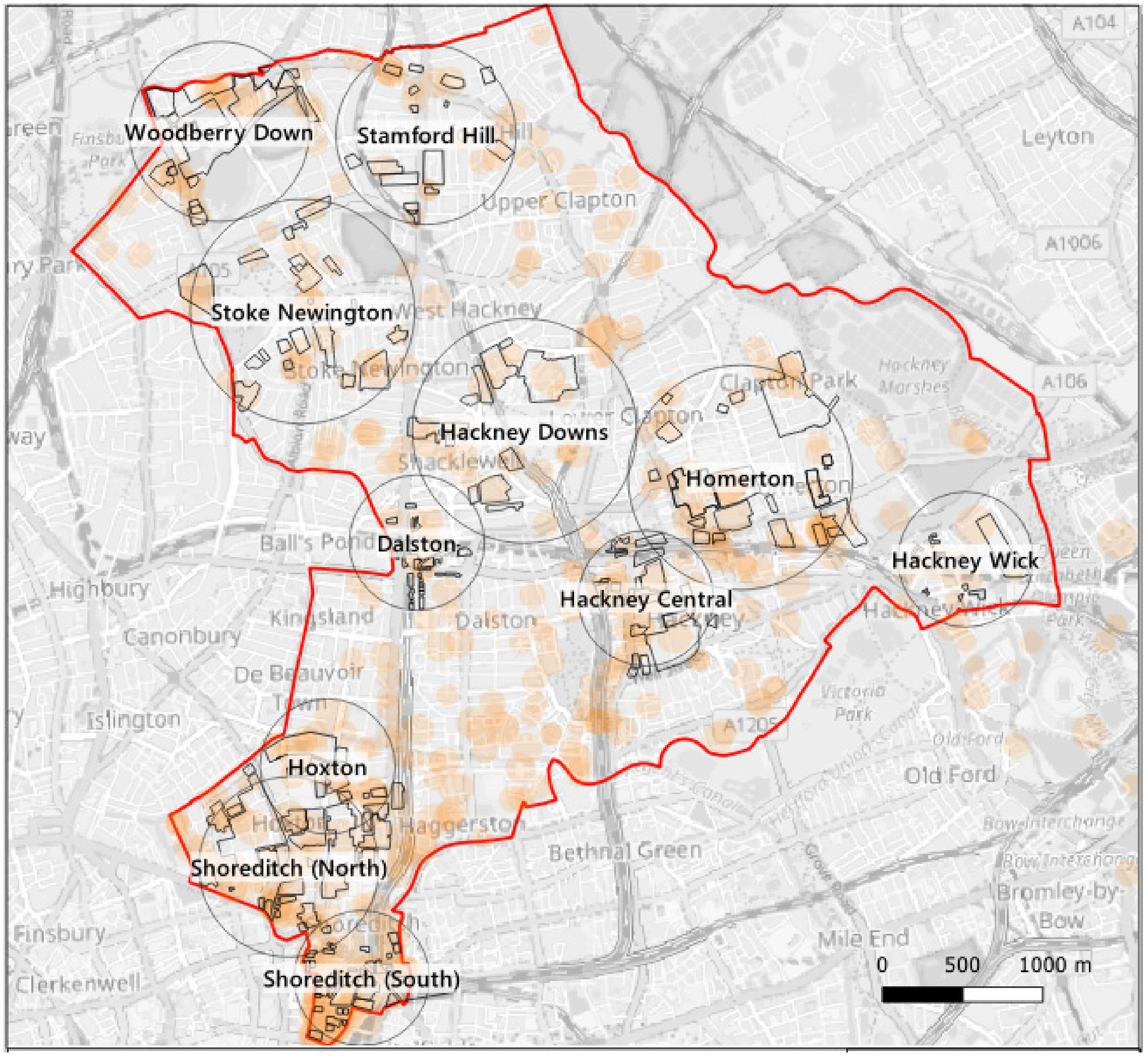


Figure 1.1: District heating clusters - all clusters

Techno-economic performance

High-level modelling suggests schemes at Shoreditch North & Hoxton and Dalston are able to achieve the LBH hurdle rate of 6% Internal Rate of Return (IRR) at 30 years with reasonable capital grant funding. A number of time critical actions have been identified at several clusters including Shoreditch North and Hoxton, Woodberry Down and Hackney Central to ensure developments are futureproofed to deliver long term decarbonised heat supply to the wider area (see overleaf). It is recommended that Hackney look to safeguard these clusters for further development and explore more detailed feasibility studies. Timings will also be critical so not to miss the opportunity to secure funding through the £320m Heat Networks Investment Project (HNIP) fund.

Table 1.1: Cluster summary

	Dalston	Hackney Central	Homerton	Shoreditch & Hoxton CHP	Shoreditch & Hoxton CHP + HP	Woodberry Down
Network:						
Annual heat demand (MWh/yr)	12,438	11,392	9,220	14,539	14,539	18,484
Heat line density (MWh/m)	3.7	7.9	14.9	5.8	5.8	6.1
No residential units on core network	1,765	895	379	3,065	3,065	550
Percentage tier 1 heat (%)	84	62	100	100	100	
Percentage public owned	5.3	67 (+33% JV)	100	60 (+40% JV)	60 (+40% JV)	100
Commercial performance:						
CAPEX (£m)	6.6	9.5	5.9	11.4	13.0	By others
LZC technology	ASHP	ASHP	ASHP	-	GSHP & WSHP	GSHP & WHSP
IRR @ 30 yrs (%) – no funding or RHI	3.9	N/A	N/A	5.0	3.6	By others
IRR @ 30 yrs (%) – with RHI	8.3	0.7	N/A	5.0	5.7	By others
IRR @ 30 yrs (%) – with 30% capex grant funding	9.5	0.6	N/A	10.1	7.9	By others
Environmental performance vs gas boilers						
DH emissions saving @ yr 10 (% tCO2e)	66	65	82	No saving	4	By others

Challenges and recommendations

A key challenge across the borough is decarbonising existing LBH housing estates which are spread across the borough. In many cases these are in densely populated areas which are typically favourable for heat networks. However, many flats are individually heated with gas boilers which presents a more complex solution in order to retrofit for heat network connection. The cost of this can impact viability, however if Hackney is to meet its 2040 target, then interventions will be required to these sites to decarbonise. A borough wide strategy is recommended to define capital budgets / programmes on existing housing stock. Key actions linked to progression of each cluster are outlined in Table 1.2.

The three clusters recommended to prioritise for the next stage of detailed feasibility are:

- Shoreditch North & Hoxton
- Hackney Central
- Woodberry Down.

Table 1.2: Key actions relating to identified clusters

Cluster	Key action
Shoreditch (North) and Hoxton	▪ Futureproof Colville Energy centre design (design commences early 2020, therefore time critical) to serve the wider area and for long-term decarbonisation ▪ Consider Detailed Feasibility Study to further explore the viability and scheme requirements
Hackney Central	▪ Futureproof 55 Morning Lane (Tesco site) energy centre design – currently at preplanning stage, therefore time critical - to serve the wider area. Engage with the design team carrying this out ▪ Consider Detailed Feasibility Study to further explore the viability and scheme requirements
Dalston	▪ Ensure that the future redevelopment of the Kingsland Shopping Centre has a planning requirement for an energy system to serve the wider area
Homerton	▪ Engage with the Hospital to understand appetite for decarbonisation, serving the wider area and any development plans for the site
Woodberry Down	▪ Engage with developers (Berkeley) and design team on integration of low carbon heat source in place of CHP ▪ Consider Detailed Feasibility Study to further explore the viability and business case for the Community Interest Company including connection to Meridian Water heat network scenario and TfL vent shaft.

Prioritised cluster summaries

Shoreditch (North) and Hoxton

The viability of this cluster is underpinned by the existing Shoreditch Heat Network and planned Colville Estate Network, which is already planned to serve the Britannia masterplan. The extension and linking of these two networks provides the opportunity to decarbonise a large number of LBH owned estates in the surrounding area.

The existing and planned networks are currently to operate with gas CHP as the low carbon heat source. Due to the decarbonisation of the grid, gas CHP can no longer deliver long term carbon savings and therefore a transition plan is required to futureproof the networks for decarbonisation. The timing is critical as Colville Estate energy centre is due to commence detailed design in early 2020 - it is recommended that LBH consider a derogation from planning to integrate lower carbon technologies from day one. The area is surrounded by low carbon heat sources including the Regents Canal (WSHP), Shoreditch Park (GSHP), large combined sewer (sewage offtake heat pump) as well as future Crossrail 2 ventilation shafts.

The majority of the LBH estates identified for connection in this cluster are heated by individual gas boilers and would therefore require fairly significant retrofit to connect to heat networks – this is discussed further in Section 8.

The scheme shows potential from the techno-economic modelling to achieve a positive IRR before funding. A big influence on this is due to much of the infrastructure costs for the energy centres and networks already being in place for the Colville and Shoreditch networks, therefore capex is mostly networks and building connections including retrofit. The scheme also benefits from electricity sales from the CHP – which in the long term would be swapped with heat pumps and may not be able to deliver the same savings.

Hackney Central

The scheme at Hackney Central is time critical as the redevelopment of the 55 Morning Lane (Tesco site) provides an opportunity to provide futureproofed space in this energy centre to serve the wider area. The core scheme focusses on capturing largely LBH properties including the Town Hall and Trelawney Estate – this cluster could therefore be a strong demonstration project both for retrofit project and also to show that LBH are committed to their carbon targets through decarbonising their own estate. There are limited secondary heat opportunities in the area and therefore low carbon plant is likely to be via ground- or air- source heat pumps.

The financial performance of the cluster is challenging, largely due to the costs of retrofitting, however, if some of these retrofit costs can` come from another capital budget (e.g. housing asset replacement fund) and/or capital funding along with RHI (or its replacement) could be obtained, then the scheme looks likely to achieve positive returns.

As a minimum, it is recommended that LBH ensure that the energy centre at the 55 Morning Lane redevelopment is futureproofed for expansion to the wider area.

Woodberry Down

Woodberry Down Estate is a large mixed-use development site with approximately 5,500 homes. At full build out, this site could have a heat demand of approximately 18 GWh/yr. Currently, planning is granted for the construction of an energy centre with a gas CHP and another consultant are undertaking the low carbon optioneering and techno-economic analysis for this site (hence its exclusion from the current report).

There is a time-critical opportunity at the energy centre, as it is currently undergoing detailed design, to futureproof the space for alternative technologies and to serve the wider area. LBH are exploring connection to the Meridian Water waste heat supply which may provide a long-term decarbonised heat source. The Piccadilly line ventilation shaft off Seven Sisters Road could also provide a suitable heat source.

Although possible extensions identified in the area mostly do not pass initial viability assessments, except for the adjacent schools, more detailed modelling is recommended to confirm this. It may be that these connections can still meet the Community Interest Company viability thresholds with these connections, particularly if supported by funding such as HNIP.

2 Understanding the Scope

2.1 Context

The London Borough of Hackney (LBH) secured Greater London Authority (GLA) Decentralised Energy Enabling Project (DEEP) funding to complete an energy masterplan of the Borough, with the aim of identifying opportunity areas for district heat network (DHN) development.

LBH have recently declared a Climate Emergency and to do ‘everything within the Council’s power’ to deliver net zero emissions across its functions by 2040. Heating demands make up over 30% of the UK’s total carbon emissions and, as the UK grid is decarbonising, is becoming a focus area in government decarbonisation objectives as traditionally heating is provided by natural gas in the UK which will not allow the UK to meet its carbon targets. It is envisaged that the outputs of this report will feed into LBH’s update to the Local Plan (LP33) which is currently being updated.

2.2 District heating introduction

In a district heating network, buildings are served with hot water through an insulated pipe network from a centralised energy centre, remote from the point of supply, generating heat (and sometimes cooling and/or electricity).

Where the heat demand density is low, for example in Hackney’s areas of low-rise housing, an individual building approach to heating tends to be most suitable – such as individual gas boilers or electric point heaters. Where heat demand density is high, district heating can be more energy efficient, reducing costs and enabling technologies with lower CO2 emissions to be connected, such as gas CHP and heat pumps, or utilisation of waste heat sources.

District heating infrastructure enables a wide spectrum of opportunity for low carbon heat by facilitating the ability to change future heat sources, without modifying building design. It allows the integration of some large heat sources that require a minimum heat output to be cost-effective. District heating can provide cost-effective and technically feasible means of achieving significant CO2 emissions savings for urban areas. However, care is needed to optimise the commercial and technical aspects of the network to minimise losses and maximise operational efficiency.

Heat networks can contribute to the Borough’s objective from its Community Strategy to:

“Become a low carbon and carbon-resilient borough realising significant improvements to air quality and reducing the urban heat island effect within the Borough”

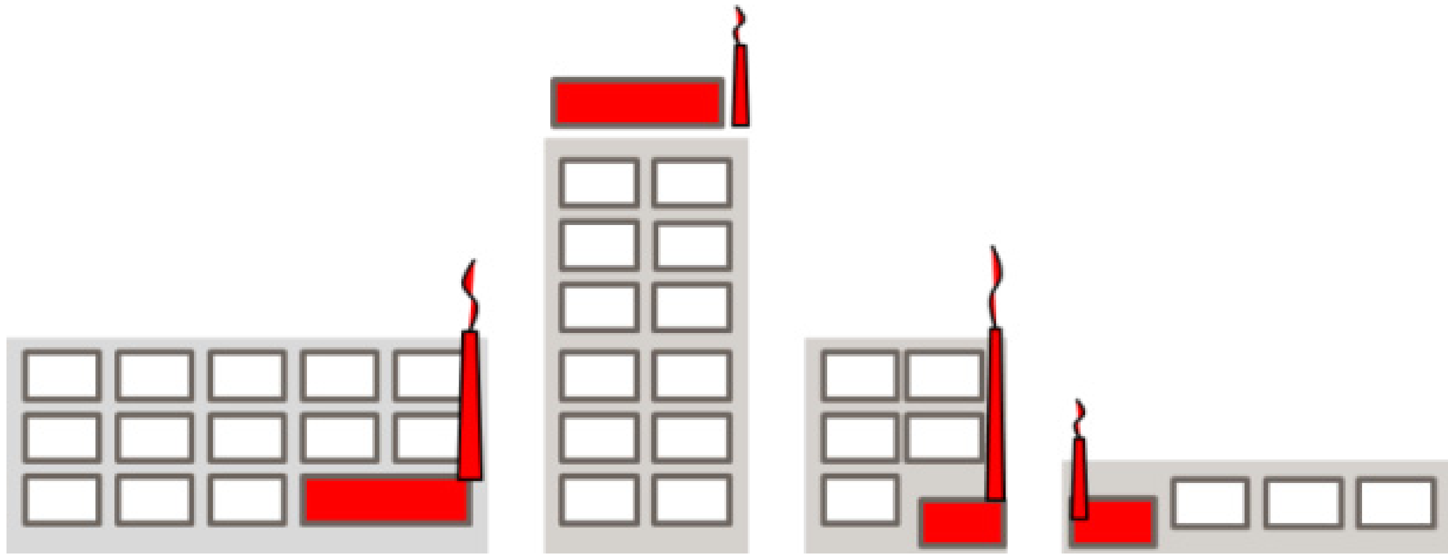


Figure 2.1: Without heat network

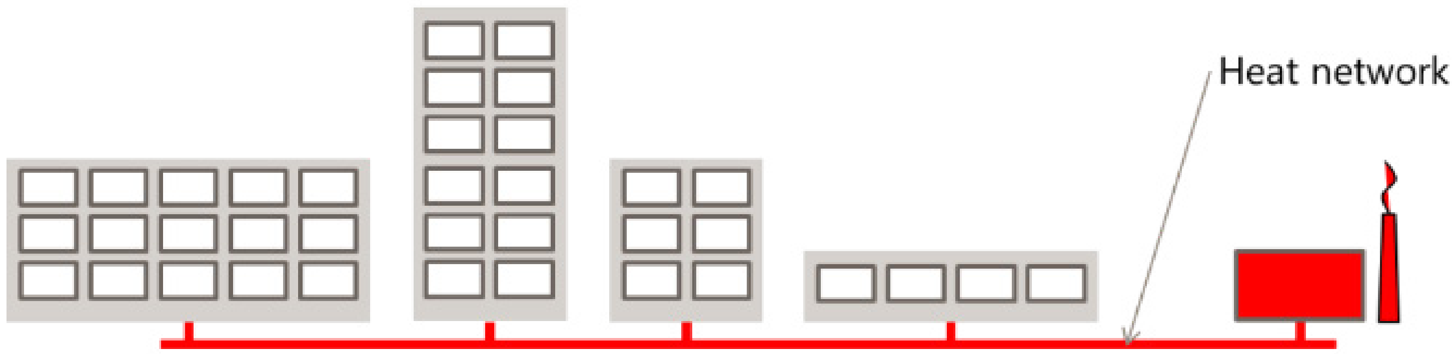


Figure 2.2: With heat network

Specific benefits of district heating networks include:

- Introduction of wider range of energy efficient technology can result in lower carbon and lower costs to consumers if implemented at scale;
- Decarbonising heat generation can be more practically feasible than fabric upgrading of individual existing buildings;
- Future proofing to ensure continued carbon savings without altering individual buildings. As newer, more energy efficient heating plant becomes commercially available, the plant within the energy centre can be replaced at the end of its commercial lifecycle;
- Energy security – an energy centre can provide fuel flexibility, as multiple types of heat generating plant can be used to deliver heat to a network. This can be based on the most efficient and cost-effective technology depending, for example, on the dynamic carbon factor of grid electricity or spark gap price between gas and electricity. A district heating network has the potential to be technology agnostic whereby the distribution of heat is not necessarily dependent on particular type of plant;
- District heating can support building compliance and local authority targets for new and existing buildings, whilst also supporting the aim to decarbonise the UK heat supply through the Climate Change Act 2008;
- Range of economic benefits, include:
- Mitigating against rising energy costs and potentially providing long term returns on investment;
  - Reducing developers' cost of compliance with Building Regulations;
  - Reducing labour and maintenance costs compared with individual systems;
  - Reducing or eliminating the need to reinforce utility networks;
  - Providing Local Authorities with an opportunity to address fuel poverty for vulnerable residential and businesses by providing lower, more affordable and stable prices.

2.3 Project scope

The approach to delivering a Decentralised Energy Masterplan for the Borough has been split into the following work packages:

- WP1: Energy mapping and masterplanning and clustering of heat loads to identify initial high-level opportunities
  - Stakeholder engagement
  - Review of existing documents
  - Energy demand assessment
- WP2: Analysis of energy supply/demand sources, energy distribution analysis and energy sales investigation
  - Low carbon and renewable energy technology supply options appraisal
  - Energy centre location and sizing
  - Energy distribution systems
  - Energy sales review
  - WP3: Financial and carbon appraisal with recommendations
  - Initial economic assessment of scheme options
  - CO2 savings and social value assessment
  - Recommended scheme options and borough-wide strategy
  - GIS mapping of scheme options, constraints and opportunities
  - Risk assessment and risk management
  - Stakeholder engagement
- WP4: Project plans for preferred solutions
- WP5: Development of a consolidated roadmap of timescales and milestones

This report is the response to Work Packages 1-3.

3 Relevant Studies and Policies

3.1 Previous heat mapping studies

Hackney Heat Mapping Study (AECOM, 2010)

In 2010, AECOM carried out a heat mapping study of Hackney as part of the London Development Agency's Decentralised Energy Master Planning programme. The aims of the project were:

- To collect actual heating energy data from as many buildings as possible within the London Borough of Hackney in order to update the London Heat Map
- To use the information collected to select a number of priority sites for further investigation into the feasibility of delivering district heating networks in the Borough

As a result of the study, a list of preferred high/medium priority sites were established (Figure 3.1) and are used as the basis to this study. This report presents an update to this study to reflect changes in the borough over the last 10 years.

Preferred sites
1. Woodberry Down (and Manor House)
10. Gascoyne Estate and Homerton Hospital
6. City Road area
4. Dalston Town Centre
5. Colville Estate and Britannia Leisure Centre
8. Hackney Central Town Centre
9. Hackney Wick
2. Kings Crescent Estate
7. St Leonard's Hospital
12. Old Hackney Hospital
13. Cranston Road
14. Haggerston West and Kingsland + Haggerston Baths
15. Regents Estate

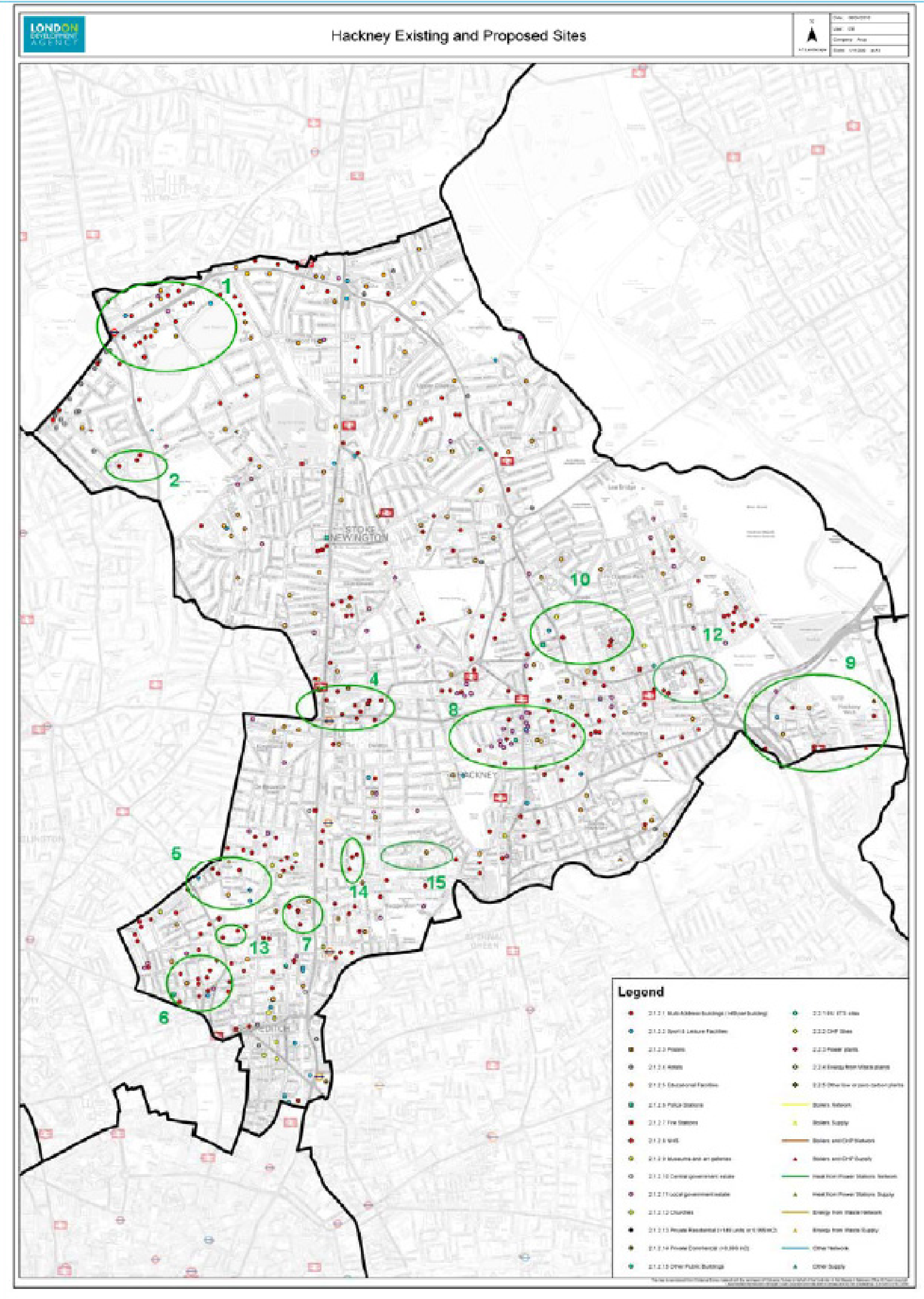


Figure 3.1: AECOM List of preferred sites for DHN

Hackney Wick and Fish Island (Arup, 2016)

This study was carried out on behalf of London Legacy Development Corporation (LLDC) to assess the opportunity for a district heat network within the Hackney Wick and Fish Island Character Areas. It was produced to support development of the SPD for the area. The study identified 25 heat loads suitable for connection to a network, including loads from both existing and planned developments.

A number of network configurations underwent techno-economic assessment:

- Network connected to Kings Yard energy centre
- Standalone network serving Hackney Wick and Fish Island
- Standalone network serving Hackney Wick
- Standalone network serving Fish Island

Only the standalone network serving Fish Island was shown as commercially viable as a private ESCo without some form of additional financial support. All other cases could be viable as a public ESCo venture, with gap funding support of between £450k and £1.1m.

Discussions with Engie during the course of this Decentralised Energy Masterplan have identified that:

- The main constraint is currently the gap funding to make the scheme commercially viable. Engie, as ESCo, is considering a HNIP application to meet this
- RIBA Stage 1 network routing carried out by AECOM
- There will be a network in the Telford Home site plus ducts in Hackney Wick station in order to get North-South connection
- Lee Valley EfW connection is still a possibility for the network but is not being explored in detail at this time
- Engie is working on own long-term decarbonisation options for the network including heat from sewage (Old Ford), vents at Pudding Mill Lane and canal source heat pumps. A key challenge to this is network temperatures to allow for integration of low carbon technologies
- There is significant capacity in the Kings Yard energy centre
- The GLA is allowing derogations for developers connecting in to the network to use SAP 2012 factors, with the anticipation that the network will decarbonise in the long term
- The scheme is dependent on LLDC loads as anchor
- A window of opportunity has been missed from some plots to connect

Figure 3.2 shows existing and proposed schemes in the area identified by Arup.

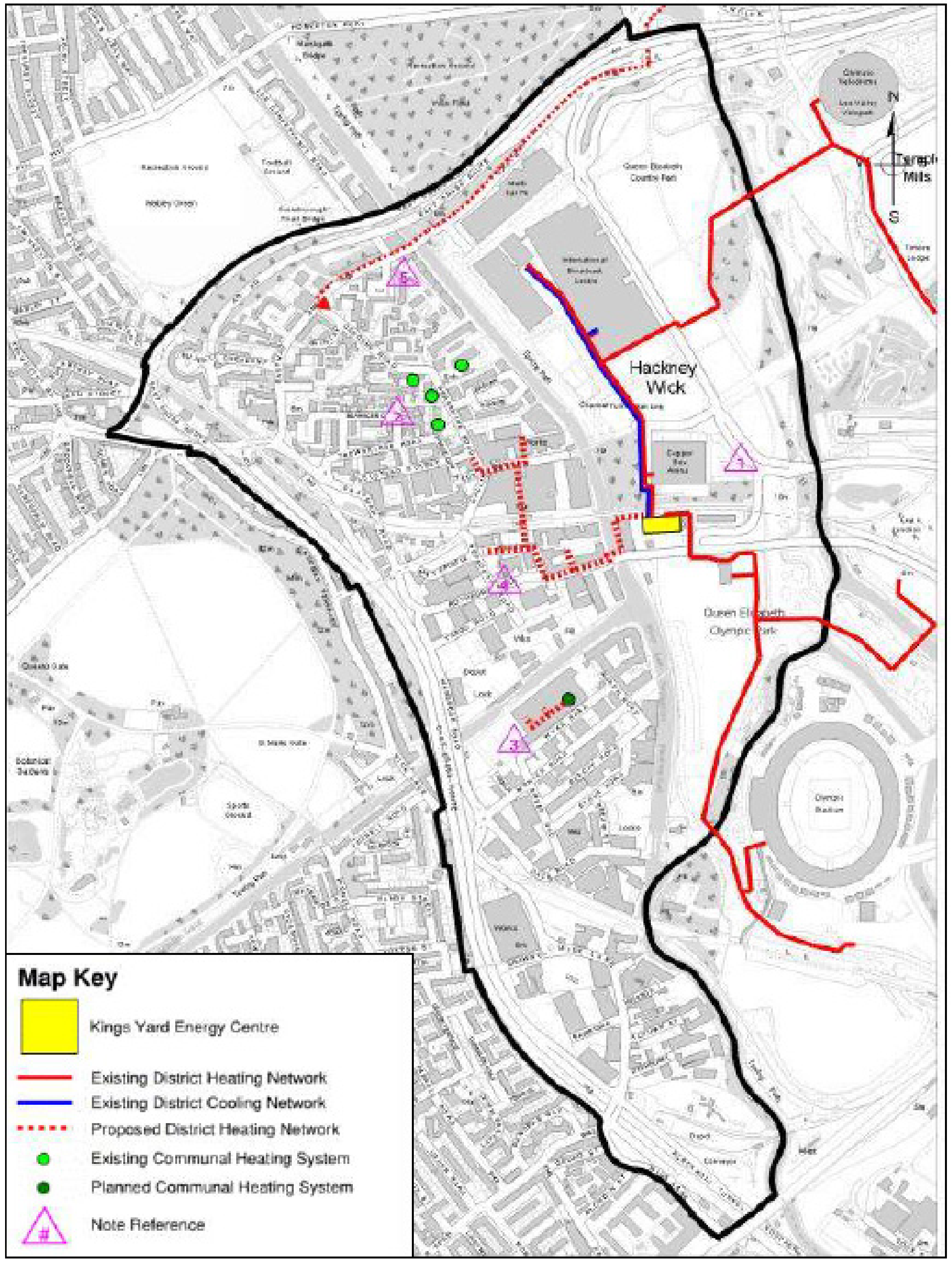


Figure 3.2: Existing and proposed DHN route in Hackney Wick and Fish Island

Powering Parks

Powering Parks is a study published in December 2019 calculating the heat potential of ground source systems in parks across Great Britain. Undertaken by Possible (previously 10:10 Climate Action), in partnership with Hackney Council, the objective of the study was to produce a high-level estimate of the ground source heat potential from the public parks and publicly accessible green space in Great Britain for heat-only schemes without inter-seasonal heat storage.

The study identified that in Hackney, there was an area of potentially suitable land in public parks of 97 ha., with a ground source heating potential of 22MW. As part of the study, a series further sites were identified in Hackney, in which proposals have been developed. These areas are:

- Abney Park Cemetery, Stoke Newington
- Clissold Park/Clissold House
- London Fields Lido and Depot
- West Reservoir, Woodberry Down
- Kingsmead Primary School/Daubeney Fields – Kings Park Ward, next to Hackney Marshes.

3.2 Policy

This chapter describes some of the national, regional and local policy context that will shape the future of district heating and decentralised energy within Hackney.

3.2.1 Local Policy

Local Plan 2033 (LP33)

Hackney's new borough-wide Local Plan, known as LP33 will be the key strategic planning document used to direct and guide development in the borough up to 2033. Following extensive consultation, a final draft plan has been produced.

Policy LP56 gives developments a clear steer to prioritise connection to decentralised energy networks and otherwise provide their own on-site networks, connectable to external networks in the future. The outputs of this study should be used to flag opportunity areas and existing networks to developers and LBH planning to ensure future opportunities are not missed.

Green Infrastructure Plan

Hackney Council has committed to developing a Green Infrastructure Plan as part of LP33, with the aim of ensuring the selection and spatial distribution of trees and plants is driven by research to improve Hackney's resilience to climate change-induced extreme weather events, such as floods and heatwaves, and contribute to fighting the Borough's poor air quality.

In addition to the above, the Green Infrastructure Plan may be relevant to the development of decentralised energy in the Borough, safeguarding open spaces where ground source heating could be connected into district networks.

UK100

Hackney Council has committed to using 100% clean energy across its full range of functions by 2050 as a signatory to the UK100, a network of local authorities focused on a full transition away from fossil fuels. The network seeks to devise ambitions plans that are cost-effective and involve local residents and businesses.

This commitment will involve changes to energy procurement and the implementation of energy efficiency measures, further to deployment of renewable energy generating technologies across the Borough.

As part of this, a carbon and energy strategic plan for the Council is also being produced.

3.2.2 Regional policy

The GLA have issued new Energy Planning Guidance applicable from January 2019. In this update planning applicants are encouraged to use updated (SAP 10) carbon emission factors to assess the expected carbon performance of a new development, ahead of their adoption into Building Regulations in 2020. The implication of this will be that gas-fired Combined Heat and Power (CHP) will not be able to provide the required savings to achieve compliance. All major developments in LBH will be referable to the GLA.

Updates to the Draft New London Plan have been published as of July 2018 following public consultation. The new hierarchy continues to promote heat networks but, as with the above, the focus shifting to lower emission heat sources such as heat pumps (rather than CHP which was previously favourable) if a building cannot connect to local existing or planned heat networks.

The London Environment Strategy 2018 (LES) is an integrated environmental strategy for London, commissioned by the Mayor of London. It states that although predominantly gas-based CHP engines have been used in new developments across London, the carbon savings from these systems is declining as a result of the national grid electricity decarbonisation. This increasing evidence of adverse air quality impacts from CHP systems has led the Mayor to recognise the need for alternative approaches.

3.2.3 Updates to SAP factors

The Standard Assessment Procedure (SAP) is the methodology used by the Government to assess and compare the energy and environmental performance of dwellings. SAP 2012 guidance was followed by Building Regulations 2013.

An updated version, SAP 10.0 , was published for consultation in July 2018. More recently, a further updated version, SAP 10.1, has been published in October 2019 to coincide with the publication of the Government's Future Homes Standard consultation, which discusses proposed changes to Building Regulations Approved Document L1, which makes reference to SAP.

It should be noted that both SAP 10.0 and SAP 10.1 are consultation versions only and are not used for any official purpose. SAP 2012 continues to be the version used for all official purposes. The Building Research Establishment (BRE) expects a further update to SAP, SAP 10.2, to be published before it is brought into official use . Building Regulations Part L is usually updated once every four years, meaning that SAP 10 could be in use in 2020.

Amongst other changes within these new versions of SAP, carbon emissions factors have been updated for a number of key fuels including grid electricity, waste heat from power stations and heat from waste combustion boilers. These carbon factors are summarised in Table 3 1 and Figure 3.3.

The reducing electric grid carbon emission factors (greater than half of SAP2012) will make CHP unable to provide the required carbon savings to meet planning targets, as the impact of the offset from the electricity generated by the CHP unit is significantly reduced. Other electrically-led technologies or waste heat sources will need to be considered in its place whilst also considering the cost of heat to consumers. For example, direct electric has a low capital cost but high operational cost. Use of heat pumps in communal heating systems is a way to reduce long term carbon and avoid high heat prices for customers.

3.2.4 Hackney Light and Power

In an effort to speed up the decarbonisation of the borough, Hackney Council are planning to launch their own energy service company called Hackney Light and Power in early spring 2020. Although the study to date has not focused on integrating power with heating, it is a solution that could be considered as this study progresses.

Table 3.1: Carbon factor by version of SAP

	SAP 2012 version 9.92	SAP 2016	SAP 10	SAP 10.1
Mains gas	0.216	0.208	0.210	0.210
Electricity, any tariff	0.519	0.398	0.233	0.136

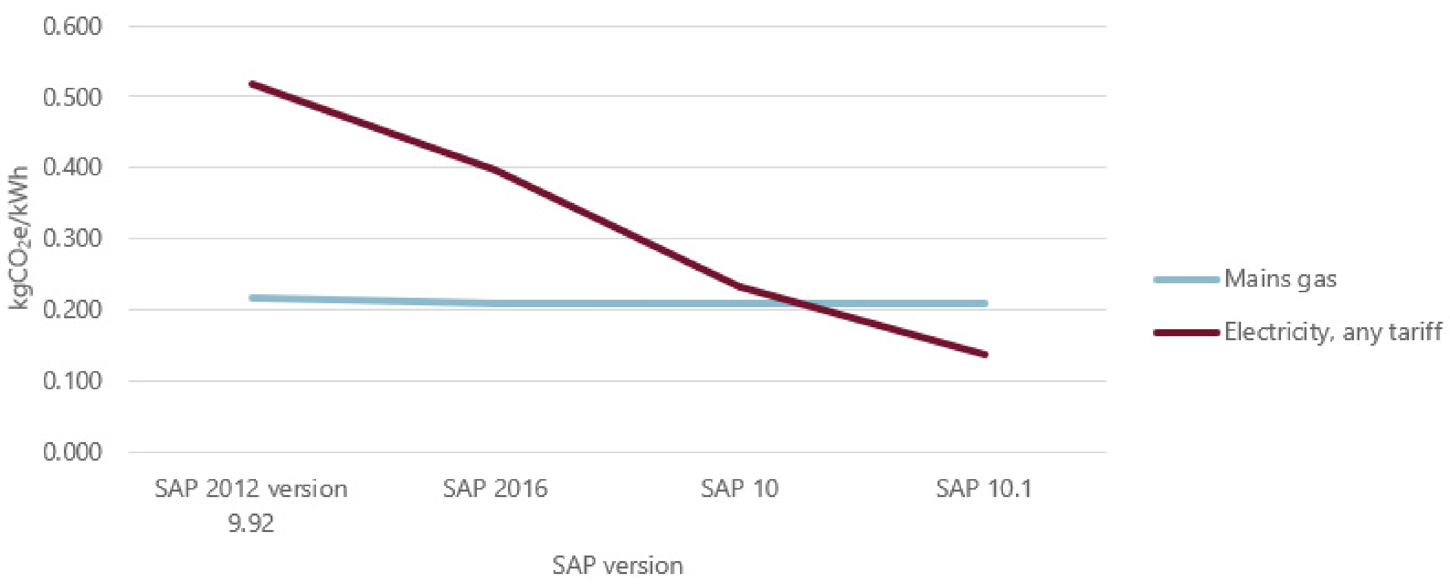


Figure 3.3: Carbon factor by version of SAP

4 Clustering method

4.1 Overview

The methodology of this study follows the development stages summarised in Figure 4.1 below.

Figure 4.1: Methodology flow diagram

4.2 Data sources

4.2.1 LBH site data

Hackney Council have provided monthly gas consumption data from 2016 to 2019 for over 300 sites across the Borough including housing, leisure facilities, libraries and schools. As the only source of actual, measured data on energy demand, this has been taken to be the most accurate data source. Values of energy consumption have been verified against benchmarks and erroneous readings discarded.

4.2.2 Load schedule data

A load schedule was developed for each identified heat load within the Borough. The load schedule includes existing developments over 50 residential units or 5,000m^2 GIA. All developments identified in pre-planning are included in the map (i.e. loads smaller than 50 units) as LBH have more control over their energy strategy and therefore have a higher potential to connect into a DHN. This is also true for LBH social housing, where all blocks are mapped.

A full description of the benchmarking process and all assumptions made are detailed in Appendix A.

- Peak heat demands: The peak loads per cluster are calculated using benchmarks (see Appendix A), with a 0.8 diversity factor applied at the energy centre
- Annual heat demands: Data from energy strategies for new developments where available, measured site gas and electricity demand, domestic and non-domestic energy certificates (DEC/EPC) and data from the previous heat mapping studies were used to estimate annual heat demands across the borough. The annual loads are benchmarked Appendix A if no load information is known
- Building heat supplies and fuel source: Where the heat supply technology for buildings in Hackney was not known (through previous heat mapping studies or consultation with stakeholders), data from the Energy Performance of Buildings Data England and Wales was used
- GIA: For existing buildings, the Gross Internal Floor Area (GIA) was taken from EPC and DEC certificates where possible, otherwise a floor area of 73m^2 was used as the Hackney residential average . Any new buildings and new development floors areas were taken from a combination of planning applications and energy strategies.
- OS grid references: The Latitude and Longitude of each site was converted from postcode data.

4.3 Clustering approach

Each development mapped in the borough has been given a tier, based on the criteria set out in Table 4.1. The tier assigned depends on the building's annual heat demand, typology, ownership and development status.

New builds have been more favourably tiered due to LBH's ability to influence energy strategy and their higher probability of connection readiness to a DHN. LBH and other publicly owned buildings have an improved tier compared to privately owned to reflect LBH's influence over refurbishment and plant replacement strategies.

Table 4.1: Heat demand tiering criteria

New development	Building ownership	Building typology	Annual heat demand (MWh/year)						
			Unknown	<250	250-500	500-1000	1000-2000	2000-5000	5000+
No	Local government	All typologies	Tier 2	Tier 3	Tier 2	Tier 1	Tier 1	Tier 1	Tier 1
	Other public	All typologies	Tier 2	Tier 3	Tier 2	Tier 1	Tier 1	Tier 1	Tier 1
	Private	All typologies	Tier 3	Tier 3	Tier 3	Tier 2	Tier 1	Tier 1	Tier 1
	Private	Multi-address buildings	Tier 3	Tier 3	Tier 3	Tier 2	Tier 2	Tier 2	Tier 2
	Other	Churches	Tier 3	Tier 3	Tier 3	Tier 3	Tier 1	Tier 1	Tier 1
	Other	Education facilities	Tier 3	Tier 3	Tier 3	Tier 2	Tier 1	Tier 1	Tier 1
Yes	Private	All typologies	Tier 2	Tier 3	Tier 2	Tier 1	Tier 1	Tier 1	Tier 1
	Private	Private residential	Tier 2	Tier 3	Tier 2	Tier 2	Tier 1	Tier 1	Tier 1
	Local government	All typologies	Tier 1	Tier 2	Tier 1	Tier 1	Tier 1	Tier 1	Tier 1
	Other public	All typologies	Tier 1	Tier 2	Tier 1	Tier 1	Tier 1	Tier 1	Tier 1

5 Heat supply

5.1 Low carbon technologies review

For each identified cluster, a central low carbon technology has been identified for technical modelling. Table 5.1 describes a range of possible low carbon technologies, explaining which have been considered as options in the cluster development.

- Green shaded cells indicate a positive impact, opportunity of advantage of using the technology
- Amber indicates a medium or neutral impact
- Red indicates potential large challenges and considerations of using particular technology

Table 5.1: Low carbon technologies review

Technology	Capital costs	Operational costs	Future energy prices	Future decarbonisation	Technology risk	Local environmental impact	Space and access	Security of supply	Further comments	Selected?
Natural gas CHP	Amber	Amber	Amber	Red	Green	Amber	Red	Amber	Widely utilised technology considered mature and attractive. Considered a transition technology to bridge between natural gas and long-term electrification.	N – no longer 'future-proofed' solution due to the rising cost of carbon compared to the future grid electricity price.
Natural gas boiler	Green	Green	Green	Red	Green	Amber	Amber	Amber	Mature, economic technology, offering a high level of flexibility and rapid heat generation.	Y – will be considered as a backup option or to meet peak demand
WSHP	Amber	Amber	Green	Green	Amber	Green	Amber	Green	Likely to become more attractive for large scale schemes as the grid decarbonises	Y – potential in River Lea Navigation, New River and Woodberry Down reservoirs
ASHP	Amber	Amber	Amber	Amber	Amber	Green	Amber	Green	Varying performance with ambient conditions, infinite supply, becoming a widely used low carbon technology	Y – particularly suitable for clusters where ground space is limited
GSHP	Red	Amber	Green	Green	Amber	Green	Amber	Green	More attractive as the grid decarbonises. Open loop requiring detailed ground survey but reliable, closed loop offering compact installation	Y – possible solution with Clissold Park, Shoreditch Park and Hackney Downs
Sewage Recovery	Red	Amber	Amber	Green	Amber	Green	Green	Amber	Emerging technology, utilising waste heat that is otherwise disposed of.	Y – waste heat available close to Colville site on Poole Street
Biomass boiler	Amber	Amber	Amber	Amber	Green	Red	Red	Red	Responds slowly to fluctuating demand, so operate more efficiently under a more constant load.	N – does not meet air quality requirements in London
Biomass CHP	Red	Amber	Amber	Amber	Red	Red	Red	Red	Small-scale biomass CHP is relatively low efficiency. Well-established at a larger scale (>10MWe).	N – high cost and fuel storage presents major constraints

Technology	Capital costs	Operational costs	Future energy prices	Future decarbonisation	Technology risk	Local environmental impact	Space and access	Security of supply	Further comments	Selected?
Biogas CHP									No active authorised landfill sites or sewerage treatment plants in the study area.	N – high cost and supply of fuel is not certain for the scale of the project
Energy from Waste									Fossil fuel and electricity price uncertainty may make EfW a more convincing proposition in the future	Y – Potential connection to Meridian water heat networknorth of the Borough
Hydrogen network									Pilot projects on-going. Potential solution for retrofitting. Not recommended trialling for this scale of deployment.	N – Technology in pilot testing (see later)

With ongoing decarbonisation of the national electricity grid, gas CHP is no longer considered a low carbon technology for district heating. Heat pumps are therefore likely to play an important role in the development of district heating going forward. Figure 5.1 shows carbon factor modelling until the year 2055; the counterfactual option representing individual gas boilers in each home/building. This modelling assumes that CHP electricity is used on-site. It demonstrates how CHP is expected to become a less attractive option in terms of CO2 emissions than the counterfactual option in the year 2032.

Table 5.2 gives an overview of key consideration of heat pmp technology as a whole. It should, however, be noted that the relative benefits of heat pumps are dependent on the heat source – usually air, water or ground.

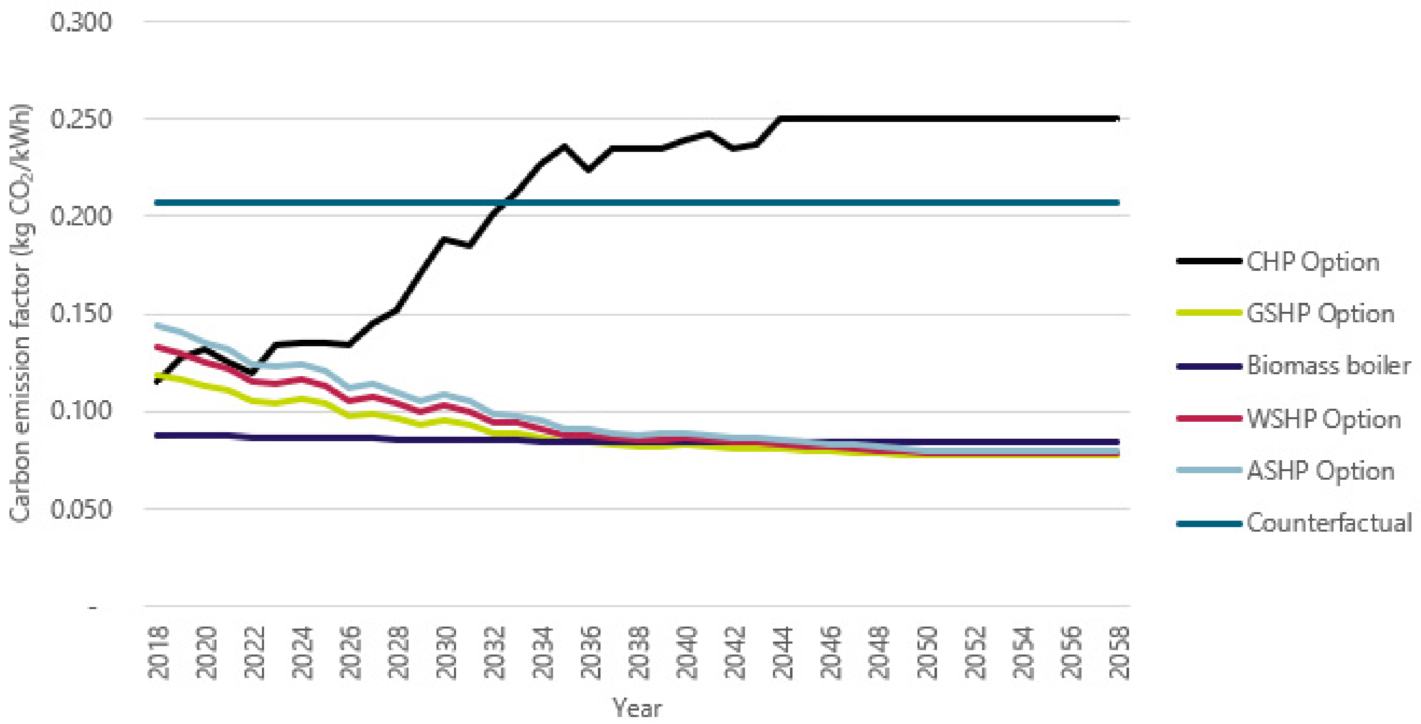


Figure 5.1: Carbon factor model to 2055 based on typical efficiencies and using BEIS projected carbon factors

Table 5.2: Heat pump technology review

Heat pumps		Comments
Capital costs	(red)	Heat pump plant is relatively low cost, but ground, water or heat recovery installation can be expensive.
Operational costs	(green)	Electricity costs are higher than gas, but this is offset by the high efficiencies for heat pump plant if connected to a constant heat source.
Future energy prices	(amber)	Grid electricity forecast to increase in cost. No electricity generation, meaning that the only revenues would be from heat sales and any Renewable Heat Incentive (RHI) payments. RHI replacement from March 2021 is currently unknown.
Future decarbonisation	(green)	Grid electricity forecast to decarbonise significantly to 2050, meaning that the heat supplied by heat pumps will reduce in carbon intensity.
Technology risk	(amber)	There is precedent for deployment at large scale in the UK and abroad, however the market in the UK for large DH heat pumps is still reaching maturity. Heat pumps are most efficient at lower temperatures than traditional heating systems and therefore interventions may be required at connections to existing buildings.
Local environmental impact	(green)	No emissions at the source of heat generation, as electricity is the fuel used rather than combustion. This avoids local air quality issues associated with heat generation, such as are experienced with combustion units like gas CHP.
Sustainability	(green)	Grid electricity projected to significantly decarbonise over the lifetime of the plant. Heat pumps also present the opportunity to connect to alternative electricity sources.
Space and access	(amber)	Spatial issues associated with GSHPs due to the need for boreholes or ground loops.
Transport	(green)	No transport requirements for fuel to site.
Security of supply	(green)	Connection to National Grid considered to be a secure supply. Could build resilience by running heat pump on locally-generated electricity, potentially also using battery storage. Implementation of heat pumps, especially in a centralised configuration is likely to require electricity grid reinforcement due to the high power demand.
Noise	(amber)	Requires consideration when locating technology
Temperature variations	(green)	Fluctuations in the source temperature may result in efficiency variations.

Hydrogen network

An alternative to installing new low carbon technologies is to inject lower carbon gases into the existing gas network. It is possible to inject the gas to varying degrees in order to reduce the carbon factor of the system. Hydrogen as an alternative fuel is being piloted in many projects across the country.

At Keele University, a project called 'HyDeploy' is testing the effect of injecting hydrogen into the gas grid up to a mix of 20% . Should the scheme be successful, there is a vision to test on a larger scale in the North East and the rest of the UK. This could lead to emission savings without major infrastructure changes.

In addition, it is possible to completely replace natural gas with hydrogen. Tests have been being carried out at a facility in Buxton for transforming the existing gas grid to 100% hydrogen. As a result of it's success, a further £6.8m has been awarded for phase 2 of the project .

Should these tests prove safe and viable, the transition to a hydrogen network could be an alternative decarbonisation solution in Hackney, particularly for the housing estates with individual boilers as appliances can likely be replaced with similar products, however conversion of gas pipework within the buildings could still create large disruption and cost.

The deployment of hydrogen networks are however in their infancy and the timescales of introduction of hydrogen at scale are unknown, with large scale trials in the UK not set to be complete till the early 2030s. Widespread use also requires the development of significant new infrastructure, including a new transmission system, hydrogen production (through renewable energy sources) and storage facilities.

Given this uncertainty this study focusses on commercially ready technologies in order to implement low carbon heat networks within the next 10 years and help Hackney achieve their climate emergency targets. That said hydrogen has the potential to play a strategic role in long term heat decarbonisation.

Secondary heat supply

This section provides some detail on secondary heat resource opportunities in the Borough. A study undertaken by Buro Happold for the GLA identified that across London, about 38% of heat demand could be met by secondary heat sources integrated with heat networks.

As described in the previous section, heat pumps are likely to be a key technology for the development of low carbon district heating going forwards. Therefore, the source for heat pumps must be carefully considered. Heat pumps operate most efficiently when the temperature of the heat source is closer to the temperature of the heat delivered. This means that heat pumps operating with an air source are least efficient in the winter, when the air temperature is much colder. It is desirable to identify heat sources with consistent year-round temperatures, such as in the ground or large waterbodies.

In addition to natural features, man-made waste heat can also be good sources for heat pump technology, such as heat rejection from cooling and refrigeration (e.g. data centres and supermarkets), and waste heat from electricity transformers.

Figure 5.2 shows key secondary heat sources across the Borough. Table 5.3 gives further details on the most significant heat sources identified for Hackney.

Table 5.3: Details of potential opportunities and constraints

Secondary Source	Location	Capacity if known	Notes
River Lea navigation	Homerton/ Hackney Wick	¬¬11.5MW	Possible for Clapton Estate. Requires liaison with the Environment Agency to determine constraints on abstraction and discharge. Using river data obtained through the NRFA, it is estimated that a capacity of approximately 11.5MW could be achieved.
Crossrail 2 – vent shafts	Shoreditch North Stamford Hill	Unknown	Proposed plans to have a vent shaft located on the North West region of Shoreditch Park and at the Morrisons site in Stamford Hill. Potential for heat recovery using an air source heat pump, similar to the operational scheme at Bunhill phase 2.
Woodberry Down West Reservoir	Woodberry Down	Unknown	The East reservoir at Woodberry Down is a nature reserve, however the West reservoir could act as a heat source/sink for heat pumps. It is understood that the West Reservoir is owned by Thames Water. The Woodberry Down re-development project is understood to be investigating this as a heat source.
Regents Canal	Hoxton	Unknown	Regents Canal is situated to the North of Hoxton, adjacent to the Colville Estate. Abstracting and discharging to the canal would require a license from the Canals and Rivers Trust, which would incur a fee. Reached out for temperature and flow data however not received.
New River	Woodberry Down/ Stoke Newington	Unknown	River to the north of the Woodberry Down development. No data found on this waterway.
London Fields Lido	West of Hackney Central		Waste heat from swimming pool (public)
Edmonton Energy from Waste Plant	Enfield	35MW	Offtake facilities from a planned Energy from Waste facility are expected to provide 35MW of heat, with an option to expand to 65MW, supplying heat to the Lea Valley Heat Network which could provide transmission of heat through Haringey and in to Hackney.
Sewage heat recovery	Likely many opportunities across the Borough,	375kW	Information was received from Thames Water for a main combined sewer in Hoxton, which runs next to the proposed Colville Energy Centre. Using data obtained from Thames Water sewage rates, it is estimated an average of capacity of 357kW can be extracted from this source.
Hackney Parks	Across the borough	~22MW	There are many parks located across the borough that could be used to utilise low grade heat via a ground source heat pump. A report published in Dec 2019 , indicates that 22MW of secondary heat could be utilised in the borough of Hackney. It is currently early stages in the study and therefore should be explored further in later stages of this project,

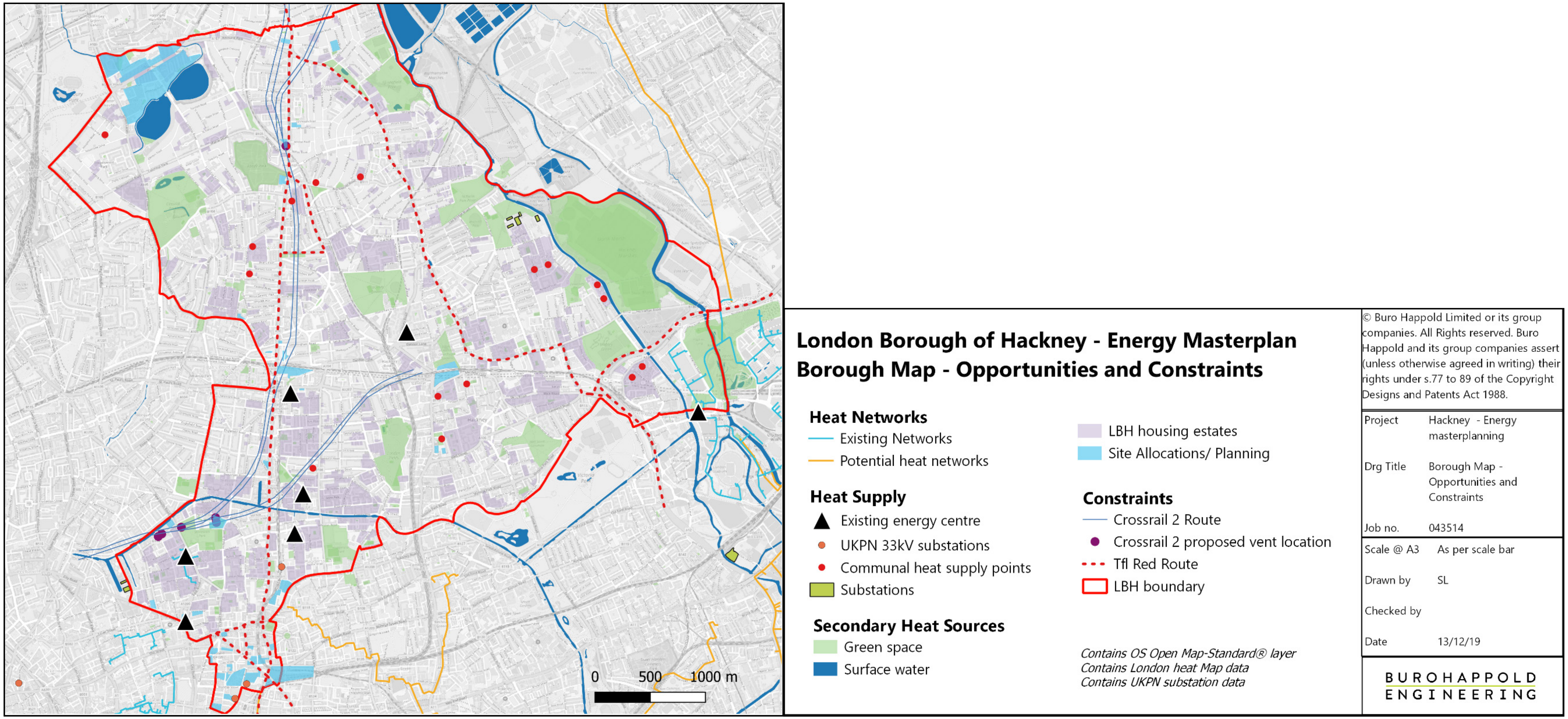


Figure 5.2: GIS map of potential opportunities and constraints in LBH

5.2 Existing heat networks

There are several heat networks operational in the borough of Hackney. These are shown in Figure 5.2.

Shoreditch

There is currently a heat network operational in the north of Shoreditch with an energy centre located in Cropley House and one in the Carole Young Community centre (Cranston Estate). The Cranston estate holds 10x 375kW gas boilers and 3x 4,700L thermal stores, however due to reaching capacity, a further 375kWe gas CHP was installed in Cropley House . The two energy centres joined forming the Shoreditch heat network. With the Shoreditch and Hoxton cluster posing a range of potential connections, expanding this network in the future would be a possibility.

Haggerston and Kingsland

SSE own two energy centres in the Haggerston and Kingsland area that are situated both north and south of the canal. The energy centres each have approximately 0.5MW of spare capacity to serve the wider area.

Citigen, Farringdon

Owned and operated by E.ON UK, Citigen supplies a huge network both heating and cooling. Although located outside the boundary of the Borough, Citigen has the potential for large expansion that could look to supply the south west of Hackney, in the Shoreditch area.

Within the energy centre located on Charterhouse Street, Farringdon, tri-generation of heating and cooling is supplied by 2no. 4.3MWe/4.1MWth CHPs (model: MWM TCG 2032 V16) alongside 3no. 3MW gas boilers and 6.3MW of absorption chillers.

In light of correspondence with E.ON Community through this Energy Masterplan study, the Citigen network has spare capacity and is interested in increasing the network expansion.

Dalston Square

Dalston Square energy centre (E8 3BQ) is another heat network operated by E.ON Community Energy. The energy centre provides low carbon heat and hot water to Dalston Square area. There is a CHP, biomass boiler, gas boilers and thermal storage totalling a capacity of 4.9 MWth .

Meridian Water heat network

The new energy recovery facility (ERF) is situated to the north east of the Hackney boundary (as shown in Figure 5.2. This site has the potential to provide 35MW of waste heat to the Meridian Water heat network, expanding to 60MW in the future . Initial discussions are in place to extend the network down to St Anns Hospital (just to the north of Woodberry Down) and potentially to the Olympic park. Woodberry Down, Stoke Newington and Stamford Hill could all benefit from this low carbon heat source.

5.3 Energy centre sizing

EnergyPro models have been developed for each of the prioritised clusters with hourly profiles developed from BuroHappold database of similar building types. Using these models Eenergy centres for each cluster have been sized accordingly to achieve a low carbon heat fraction of ~75% with thermal storage. Gas boilers are proposed for peak/back up purposes and are sizes sized to be able to achieve 100% back up for resilience.

5.4 Pipe sizing

The distribution pipe work capex costs are based on the required pipe capacity per connection and length of pipe from the GIS network routes. The required pipe capacity is based on the total peak heat load of all downstream connections, taken from the load schedule. Pipe sizing is based on a delta-T of 30K, maximum velocity 3m/s and maximum allowable pressure gradient 100Pa/m. Standard pipe dimensions ranging from 20mm-1,200mm have been used. All pipes are assumed to be hard dig to produce a conservative estimate of cost. The unit costs of pipework are based on costs from previous Buro Happold projects.

When considering futureproofing the clusters, the trunk pipework has been sized to allow for a 30% increase in capacity for supplying future connections. A breakdown of these costs can be found in Appendix B.

6 Heat mapping and cluster selection

6.1 Heat mapping

Figure 6.1 shows a process diagram of how a heat map for the Borough was developed using data from different sources.

Data sources included:

- Hackney Council
- Estates
- Site Allocations
- Meter data for public buildings
- Parks
- National Grid
- Electricity transmission network assets including power lines and primary substations
- Environment Agency
- Waterbodies
- Ministry of Housing, Communities and Local Government
- Display Energy Certificates
- Energy Performance Certificates
- Department for Business, Energy and Industrial Strategy
- Fuel poverty statistics
- Non-domestic and domestic energy consumption by MSOA/LSOA
- London Development Database
- Planning applications

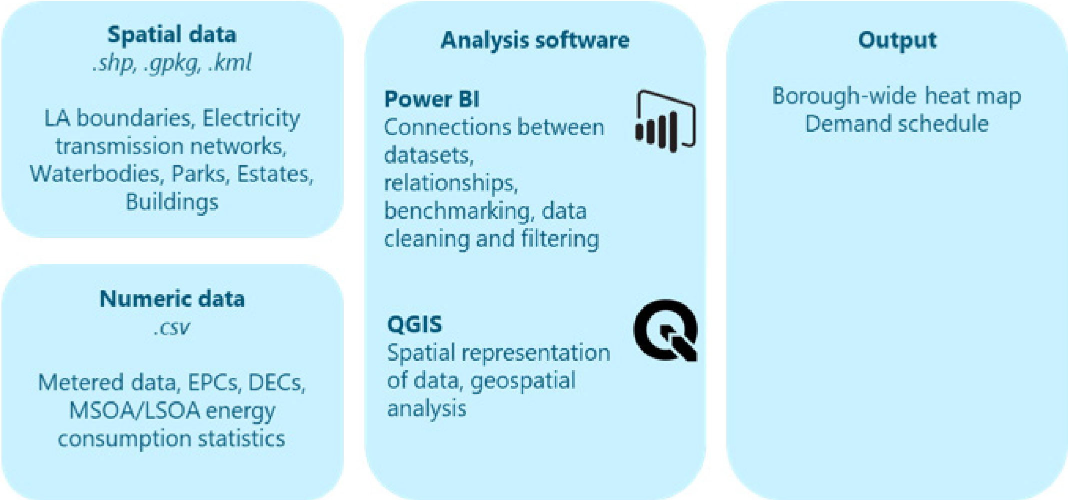


Figure 6.1: GIS process diagram

Using the data available at the building/site level, a load schedule was developed for each identified heat load in the Borough. This includes domestic and non-domestic buildings with data available – such as from DECs/EPCs, planning applications and meter data. Peak and annual heat demands were developed for each of these buildings, based on the following hierarchy:

- Meter data
- DEC reported energy consumption
- Benchmarking using DEC/EPC floor area
- Benchmarking using planning application floor area or number of residential units.

Spatial data not available at the building level is also used to inform the Borough heat map and energy masterplan, providing information on opportunities and constraints present in the area. For example - using the Output Area level of information, which is an aggregation of buildings, further intelligence is presented regarding information such as areas of high fuel poverty and overall energy demand.

The overall heat map of the Borough is shown in Figure 6.2 which was used to select clusters for further investigation of decentralised energy projects.

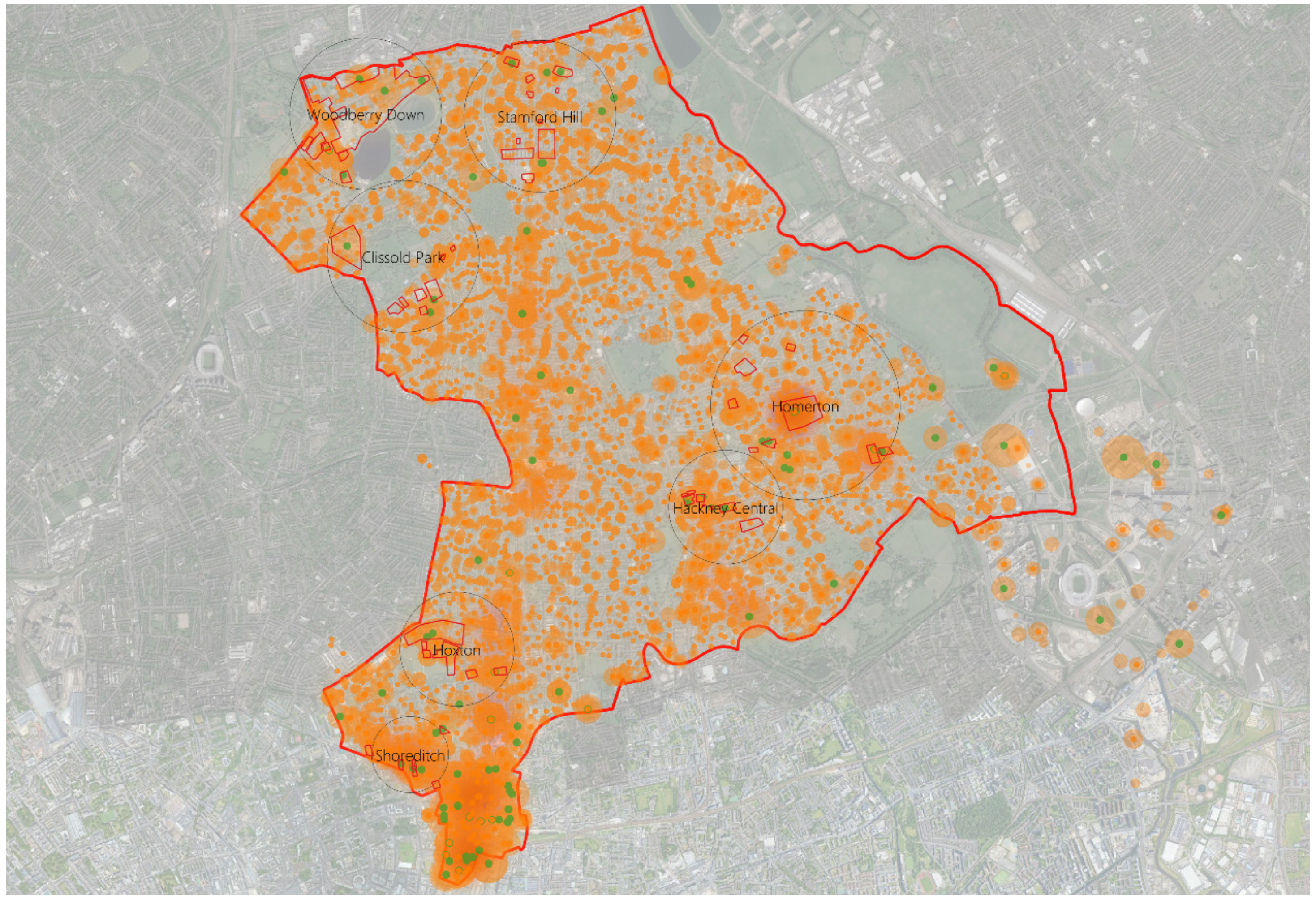


Figure 6.2: Hackney heat map (all loads)

6.2 Borough wide heat map and clusters

The borough wide heat map is shown in Figure 6.3. This includes Tier 1 and 2 loads only, with each cluster identified.

The heat mapping method identified 11 potential areas for DHN development:

1. Woodberry Down
2. Stamford Hill
3. Stoke Newington
4. Hackney Downs
5. Dalston
6. Homerton
7. Hackney Central
8. Hackney Wick
9. Hoxton
10. Shoreditch North
11. Shoreditch South

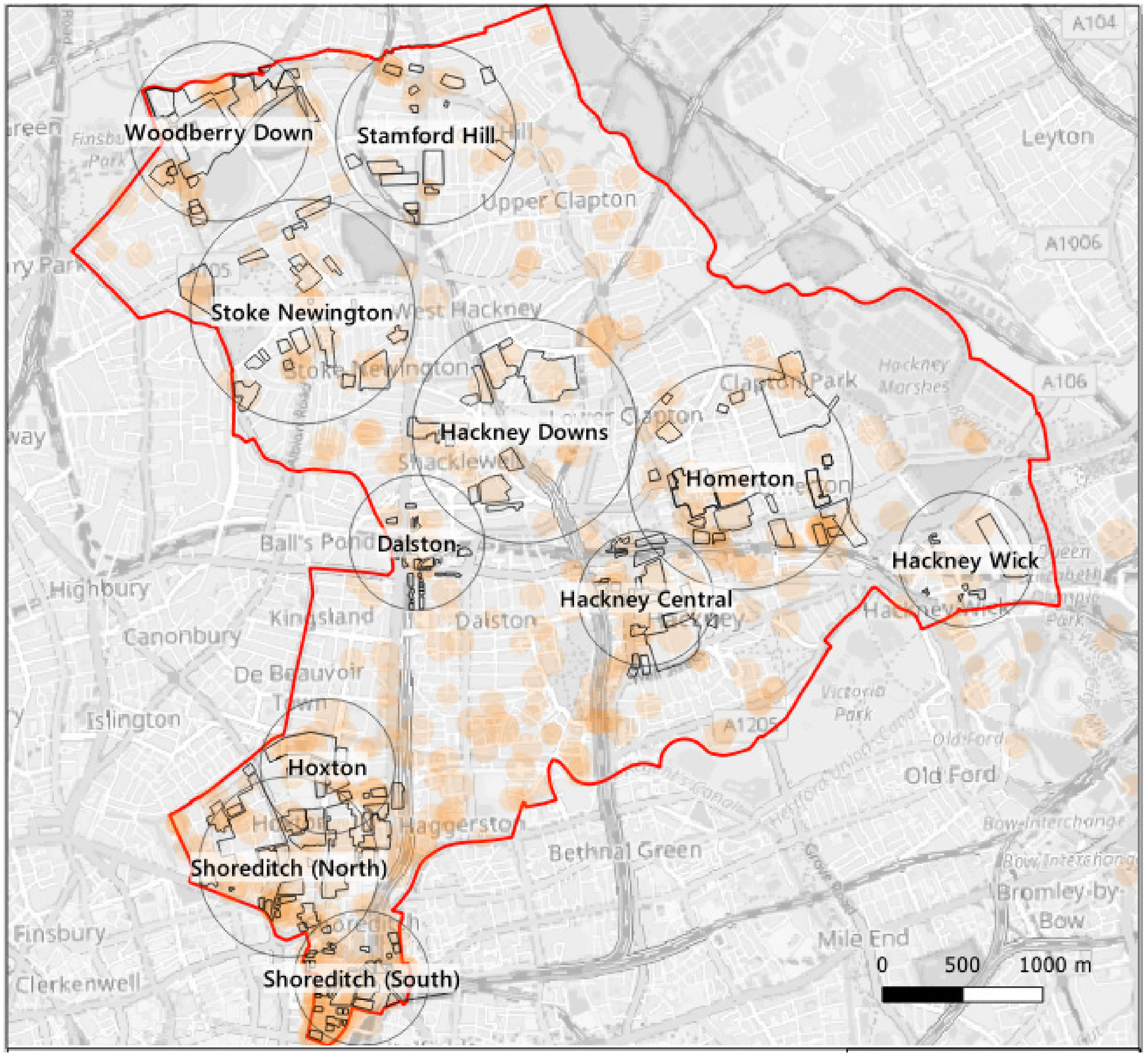


Figure 6.3: Map of identified clusters

Once the prioritised clusters were identified, the main cooling loads were plotted (Figure 6.4). The darker regions highlight the largest cooling loads, whilst the lighter regions identify much smaller loads. For reference, the largest load identified in the Hackney Wick area, requires 8,228 MWh/yr. The largest cooling load in Shoreditch South is 4,147 MWh/yr. It is likely this is due to the largest commercial presence in both of these locations.

The cooling demand is considered when selecting prioritised clusters which have a large commercial area, however heat demand is taken as a priority for this scope.

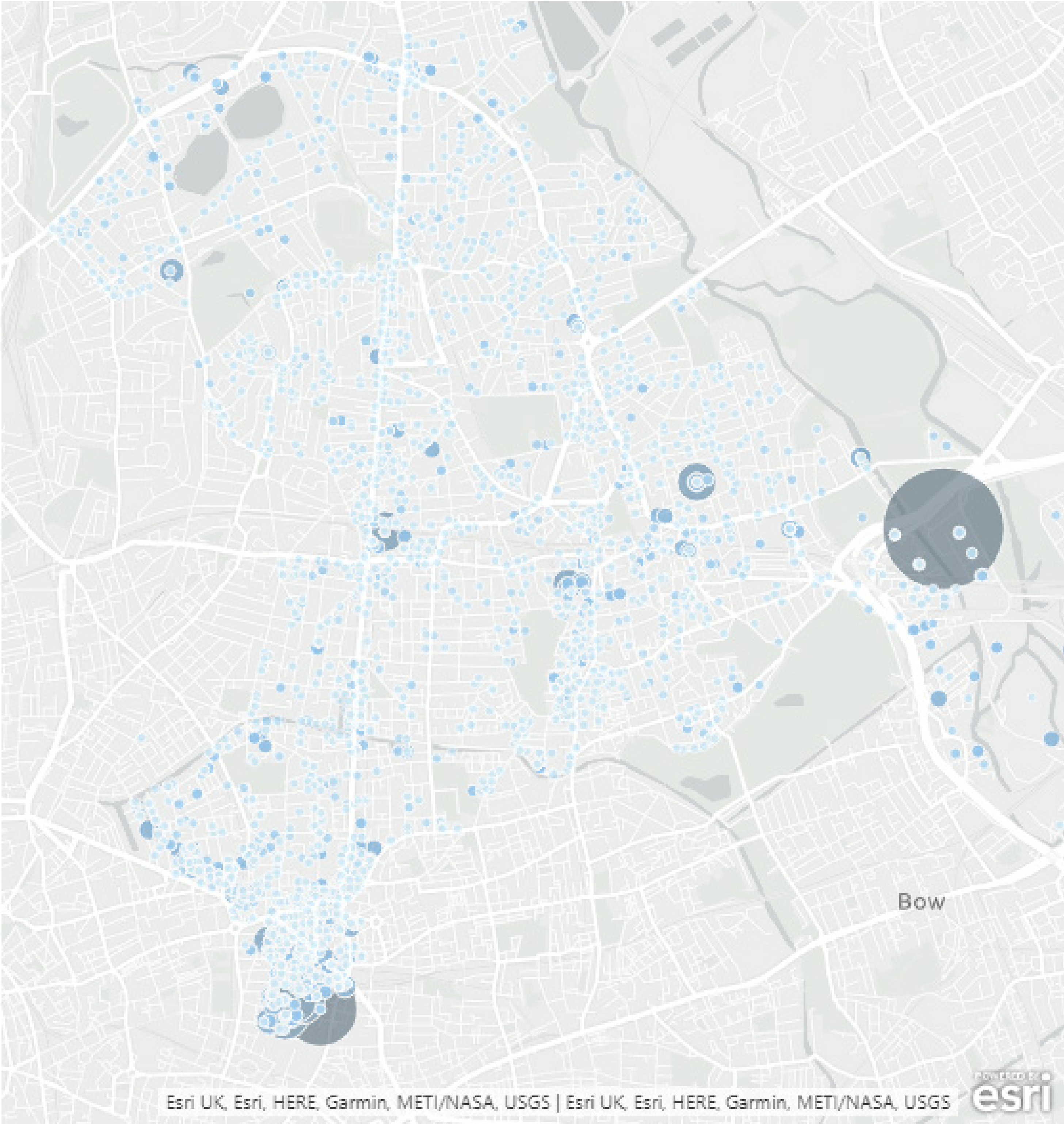


Figure 6.4: Borough wide cooling load map (dark circles - highest load, light circles – lowest load)

6.3 Strategic Network

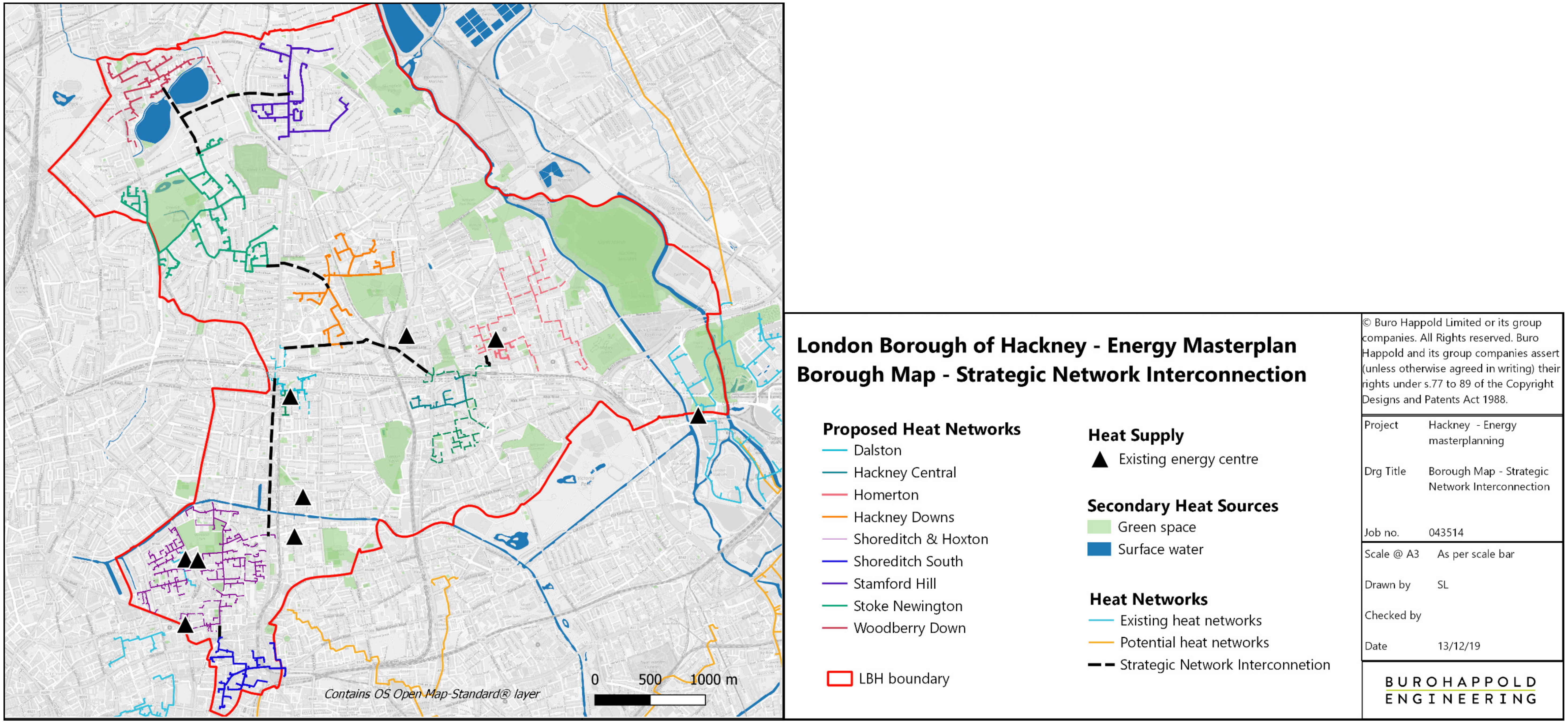


Figure 6.5: -curve showing future vision of borough wide heat network

6.4 Prioritisation of clusters

The following section gives an overview of initial high-level analysis of each of the identified cluster areas however these clusters were shortlisted to five to develop further for high level technical and commercial testing.

The following criteria was considered when selecting these five clusters.

Technical: heat load, typology, heat density, phasing

Financial: ownership, network length, potential for expansion, existing LZC technology, fuel poverty

Deliverability: proposed refurbishments, new buildings, timescales for phasing, physical constraints (road and rail).

Each cluster is described in further detail in the following sections.

	Highest (best) ranking
	Lowest (worst) ranking
	High Impact (negative)
	Moderate Impact
	Low Impact

Table 6.1: Cluster prioritisation matrix

	Annual heat demand (MWh/year)	Heat density (kWh/m²)	Tier 1 heat demand (%)	Public sector heat demand (%)	Households in fuel poverty* (%)	Development timing	Technical complexity	Rank (equal category weighting, 1 is best opportunity)
Dalston								5
Hackney Central								3
~~Hackney Downs~~								9
~~Hackney Wick~~								6
Homerton								4
Hoxton/ Shoreditch North								2
~~Shoreditch (South)~~								7
~~Stamford Hill~~								8
~~Stoke Newington~~								10
Woodberry Down								1

7 Cluster overviews

This section provides a brief overview of each of the clusters chosen in this study, providing an insight into the current and future development in the area, including sites identified for connection to decentralised energy systems.

7.1 Clusters taken forward

The following clusters were taken forward for more detailed analysis, including energy centre technology sizing, techno-economic analysis and more detailed consideration of commercial arrangements and stakeholder engagement.

7.1.1 Shoreditch (North) & Hoxton

Figure 7.1 overleaf shows the potential network route for the combined Shoreditch North and Hoxton cluster. The cluster incorporates the new developments of Colville and Britannia and existing housing estates. Currently, there is an existing heat network operational south west of Shoreditch Park which when combined with the planned Colville Energy Centre, demonstrates high potential for network expansion.

Table 7.1 outlines the key metrics for the Shoreditch and Hoxton cluster.

Table 7.1: Shoreditch North and Hoxton cluster core network metrics

Metric	Unit	Core Network
Heat Demand	MWh/yr	14,539
Network Length	m	2,490
Heat Line Density	MWh/m	5.84
Peak Load	MW	11.0
Percentage of heat load public sector	%	60 (40% JV)
Percentage Heat load Tier 1	%	100
Energy Centre Technology	-	Currently gas CHP at Colville and Shoreditch networks. Future; heat pumps using secondary source heat (sewage and Shoreditch park)

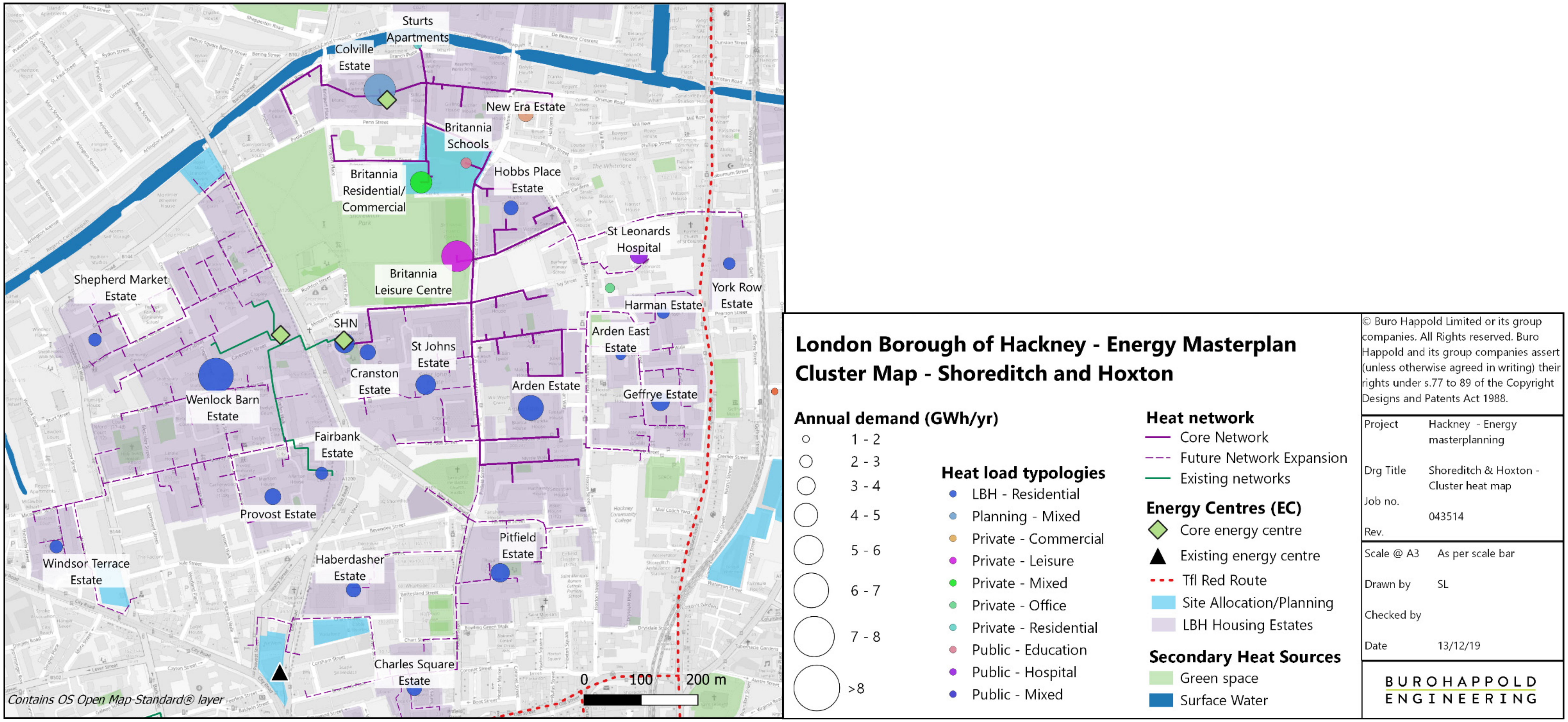


Figure 7.1: Shoreditch and Hoxton cluster network route

Proposed connections

The heat loads associated with the Shoreditch North and Hoxton cluster are summarised in Table 7.2. Although this cluster is largely dominated by social housing estates, there are two prominent developments that are ongoing; Colville Estate and Britannia. These developments provide the basis of the assessment with the housing estates acting as an extension to the current network plans.

Table 7.2: Shoreditch North & Hoxton cluster connections

Site	Description	Heat Supply	Heat Load (MWh/yr)	Tier	Source of Demand	Ownership	Status	No. units/ GIA(m²)
Colville Estate	Proposed re-development of Colville Estate	Gas CHP & boilers	3,803	1	Buro Happold project	JV	In progress	Up to 884 residential units
Britannia Leisure Centre	Redevelopment of Britannia Leisure Centre	Connected to Colville EC	3,681	1	Buro Happold project	JV	Planning granted	12,009 m²
New Era Development	Proposed redevelopment of existing estate	Individual gas boilers	714	1	Buro Happold benchmarks	Private	Pre-Planning	199 residential units and 344m² retail
Hobbs Place Estate	Existing housing estate	Individual boilers – Clinger court communal boiler	613	1	LBH estates database & benchmarks	Public	Existing	175 properties
Arden Estate	Existing housing estate	Individual boilers –Caliban Tower communal boiler	2,380	1	LBH estates database & benchmarks	Public	Existing	680 properties
Britannia Development	Proposed new development with school and residential units	Connected to Colville EC	1,957	1	Buro Happold project	JV	Planning granted	Up to 481 residential units/ up to 400m² commercial, 15,005 m² Secondary school and 491 m² Early Years Centre
Shoreditch Heat Network (SHN)	Existing heat network	Cranston and Cropley EC – CHP and boilers	1.391	1	LBH gas data	Public	Existing	464 residential units across Cranston, Wenlock Barn and Fairbank estates.

Energy centre location and technology

There are currently plans for an energy centre to be constructed within the Colville Estate (as shown in Figure 7.1) containing 9MWth of gas boilers and a 1MWth CHP – this capacity includes some futureproofing to serve the wider area. The energy centre has planning for CHP and is due to commence design in early 2020 – there is an opportunity to reconsider the chosen technology here or ensure that the installed CHP capacity is phased to avoid locking into a full CHP scheme for the next 15 years (assumed engine lifetime).

In addition, there is the existing Shoreditch heat network (SHN) that is supplied by two energy centres; Cranston energy centre and Cropley energy centre. The former was extended after it reached capacity to include a CHP that was installed at the Cropley location. This network currently supplies 464 homes spread across Cranston Estate, Fairbank Estate and Wenlock Barn Estate. Between the two sites there are 10no. 350kW gas boilers, 1no. 375kWe CHP and 3no. 4,700L thermal stores. A combination of all three sites results in a total capacity of approximately 14MW. The Energy Manager for this scheme at LBH has indicated that there is spare capacity within the existing plant, and additional space within the energy centre for further capacity.

The summary of thpiee plant across the energy centres is outlined in Table 7.3.

Table 7.3: Summary of energy centre plant for Shoreditch and Hoxton cluster

Shoreditch	Unit	Value
Low carbon heat technology	-	Proposed: GSHP and sewage heat recovery Planned: Gas CHP
Low carbon heat supply capacity	MW	760 kW Heat Pumps 700kW CHP at Colville
Thermal store capacity	m3	88 (SHN and Colville)
Gas boiler capacity	MW	12.5 (existing and planning)
% yearly supply from low carbon heat	%	72.5 (inc. CHP)

Low carbon potential

Although natural gas supplies the existing and proposed plant at both sites, there are several secondary heat sources that could be used in substitution.

1. To the north of the cluster lies Regents canal which is understood to be used for cooling national grid transmission lines; this heat could potentially be recovered using a water source heat pump before the water is returned to the canal and fed into the Colville energy centre. Alternatively, direct heat recovery could be considered from the canal. When in correspondence with Islington Council, it is understood that there is an abstraction fee payable to Canal and Rivers Trust which has impacted viability when previously explored.
2. In the centre of the cluster lies Shoreditch park which covers a total area of 7.1 hectares. It is ideally positioned for integrating waste heat recovered via ground source heat pumps into either energy centre location. This area may be favourable for open loop GSHP solutions according to the BGS map .
3. A trunk sewer network situated on Poole St is estimated to have an average capacity recovery of 357kW based on modelled flow data from Thames Water. Flows would need monitoring for verification.

It is recommended that once the existing CHP located at Cropley energy centre reaches end of life, the equivalent capacity be replaced with a GSHP in the park. Likewise, at Colville, a previous study by Buro Happold considered a phased approach for the energy centre to install a smaller CHP of approximately 700kW with space for an alternative technology or additional CHP; the remaining capacity could be supplied from sewer network heat recovery option or other heat pump solution.

Retrofit

Operating temperatures are a major constraint when connecting to existing council housing. Currently the majority of housing estates in the cluster are supplied by individual gas boilers and therefore would require retrofit to transition to a heat network. Currently, there are 464 properties connected to the Shoreditch heat network and a further 114 communally heated units in Arden and Hobbs Place estates. When considering a retrofit solution, it is important to assess the percentage of leasehold ownership. A higher leasehold percentage may make the logistics of retrofitting more difficult. A high level retrofit estimate has been carried out for all housing estates in the core and future networks. The costs outlined in Table 7.4 are based on a 'new systems retrofit' and would not include building passive improvements.

Table 7.4: Estimated cost of retrofit for housing estates in Shoreditch & Hoxton cluster

Housing Estate	No. Properties	Leasehold (%)	Estimated cost of retrofit
Arden Estate	680	30.6	£5,100,000
Hobbs Place Estate	175	20.0	£1,312,500
Shepherd Market Estate	10	13.7	£75,000
Wenlock Barn Estate	1345	29.8	£10,087,500
Windsor Terrace Estate	132	48.5	£990,000
Provost Estate	242	25.2	£1,815,000
Fairbank Estate	118	29.6	£885,000
Haberdasher Estate	183	30.6	£1,372,500
Charles Square Estate	198	31.3	£1,485,000
Pitfield Estate	344	25.3	£2,580,000
Arden East Estate	59	0	£442,500
Harman Estate	115	24.3	£862,500
St John's Estate	121	31.3	£907,500
Existing communal heating	578		- £4,312,500
Estimated Total CAPEX			£23.6m

Network expansion

In order to futureproof this proposal, expansion to future loads are assessed and outlined in Table 7.5. It is apparent that connecting to the adjacent estates has the potential to more than double the annual demand on the network. As a result, it may be necessary to connect to additional energy centres in the vicinity such as Kingsland and Haggerston or the Bunhill network or identifying locations for additional energy centres.

Table 7.5: Potential future loads - Shoreditch & Hoxton

Future Site	Heat Load (MWh/yr)	Reason for exclusion from core scheme
Shepherd Market Estate	459	Distance from proposed network, contains no communally heated properties therefore large retrofit cost
Wenlock Barn Estate	4,708	Largest estate in the cluster, retrofit cost would be too high. Too ambitious for first retrofit demonstration
Windsor Terrace Estate	462	Long distance from proposed network, line density would be very low
Provost Estate	847	No existing communal heating. Would require retrofit
Fairbank Estate	413	No existing communal heating. Would require retrofit and comparatively small load
Haberdasher Estate	641	No existing communal heating, low line density and large retrofit cost
Charles Square Estate	693	Long distance from proposed network, line density would be very low
Pitfield Estate	1,204	Large heat demand with no communal heating, high retrofit cost.
Arden East Estate	207	No existing communal heating
Harman Estate	403	LBH owned housing estate
St Johns Estate	1,397	LBH owned housing estate
Shoreditch Fire Station	302	Long distance from the proposed development, line density is low
St Leonards Hospital	3,211	Currently uncertain of future plans for this site – possible development
Total future heat load	14,947	

Opportunities and constraints

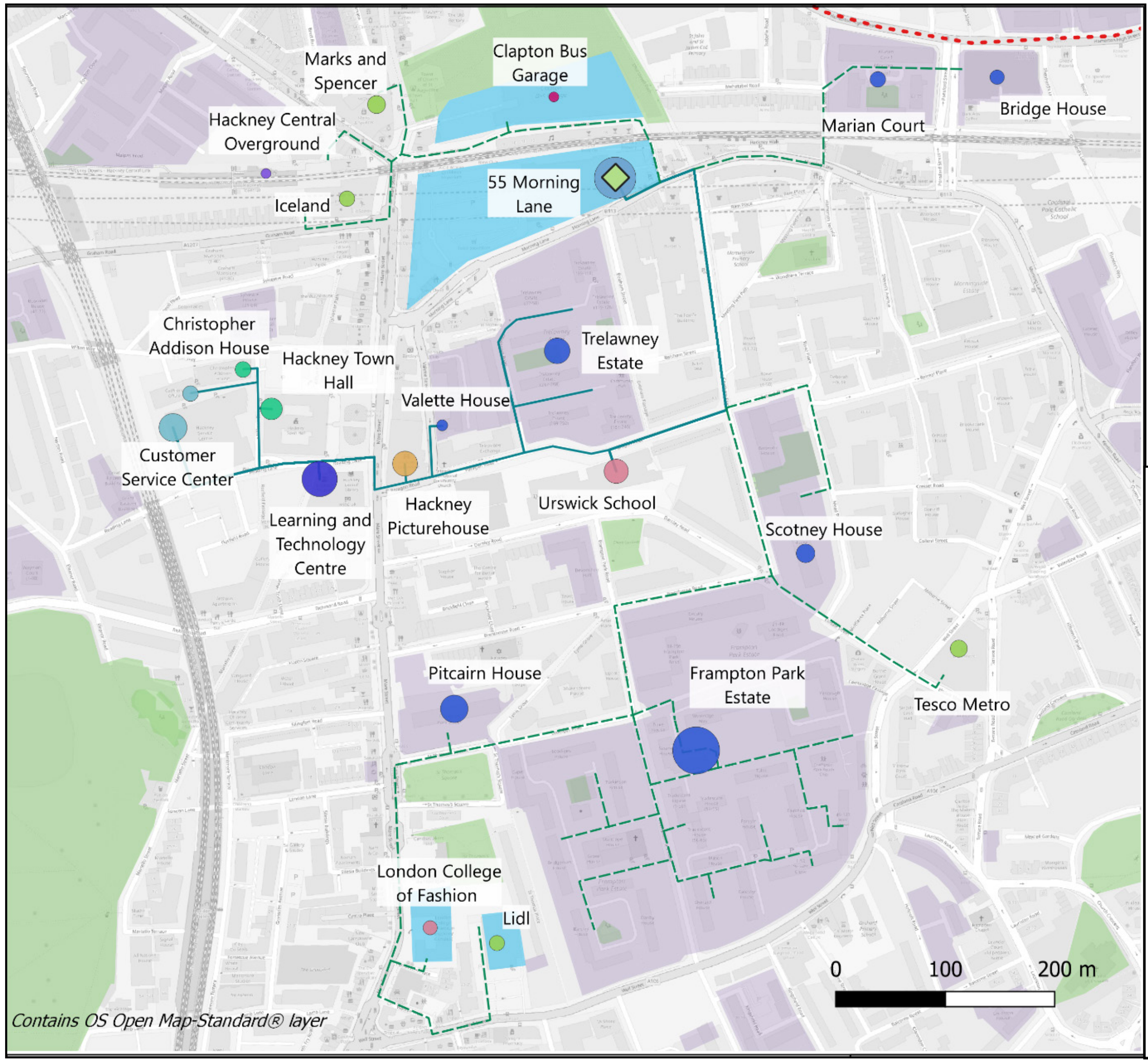
Opportunities
▪ Planned/Existing DHN - Colville estate is installing a heat network and energy centre which could serve a wider area. In addition, the existing Shoreditch heat network has spare capacity to serve the wider area
▪ Secondary Heat Sources - Regents canal, Shoreditch park and waste heat from sewage enables various low carbon heat sources to be utilised via heat pumps in order to future decarbonise the heat network.
▪ Future Network Expansion - Close proximity to the Bunhill heat networks which are interested in expanding futher. Possible St Leonards Hospital redevelopment
▪ LBH owned housing - there is a large number of LBH housing estates in the area presenting a large heat demand under council ownership and influence
▪ Future Expansion Potential - Possibility to connect to other public owned estates, hopsitals, and education sites, with the potential of an additional 14MWh/yr of heat demand.
▪ Shoreditch Park Consultation - Shoreditch Park improvement consultation carried out end 2019 with plans expected early 2020. Could be coordinated with GSHP installation.
Constraints
▪ Operating Temperatures - The development of Colville and Britannia poses the challenge of connecting new developments of lower operating temperatures to existing social housing estates that operate at much higher temperatures
▪ Retrofit - as the majority of the connections/future are individually heated social housing estates, a wide spread retrofit must be carried out in order to make the properties connection ready
▪ Existing Colville Planning - currently the Colville site has plans for a gas CHP which will mean an increase in emissions compared to gas boilers over the lifetime of the scheme
▪ Conservation Area - Areas of this cluster fall within a conservation area and will require additional consulation prior to laying DHN pipework.
▪ Existing SHN heat prices - it is understood from verbal communications that the existing charges for heat on the SHN are in the region of 2p/kWh . This rate is significantly less than market prices and may make achieving a profitable network challenging.
▪ Leashold Ownership - Difficulties arise for retrofit when a large percentage of the connections are leasehold.

7.1.2 Hackney Central

Hackney Central lies in the heart of the borough with Crossrail 2 set to pass through in the future. Current planning for the mixed-use site at 55 Morning Lane 'Tesco Site' has the potential to require a demand of almost 4 GWh/yr where an energy centre is required by planning. It is proposed to futureproof this energy centre for capacity to serve the existing housing estates and commercial buildings in the wider area. Table 7.6 outlines the key metric for the Hackney Central.

Table 7.6: Hackney Central cluster core network metrics

Metric	Unit	Value
Heat Demand	MWh/yr	11,390
Network Length	M	1,448
Heat Line Density	MWh/m	7.9
Peak Load	MW	11.9
Percentage of heat load public owned	%	67 (33% JV)
Percentage Heat load Tier 1	%	62
Energy Centre Technology	-	Air Source Heat Pumps



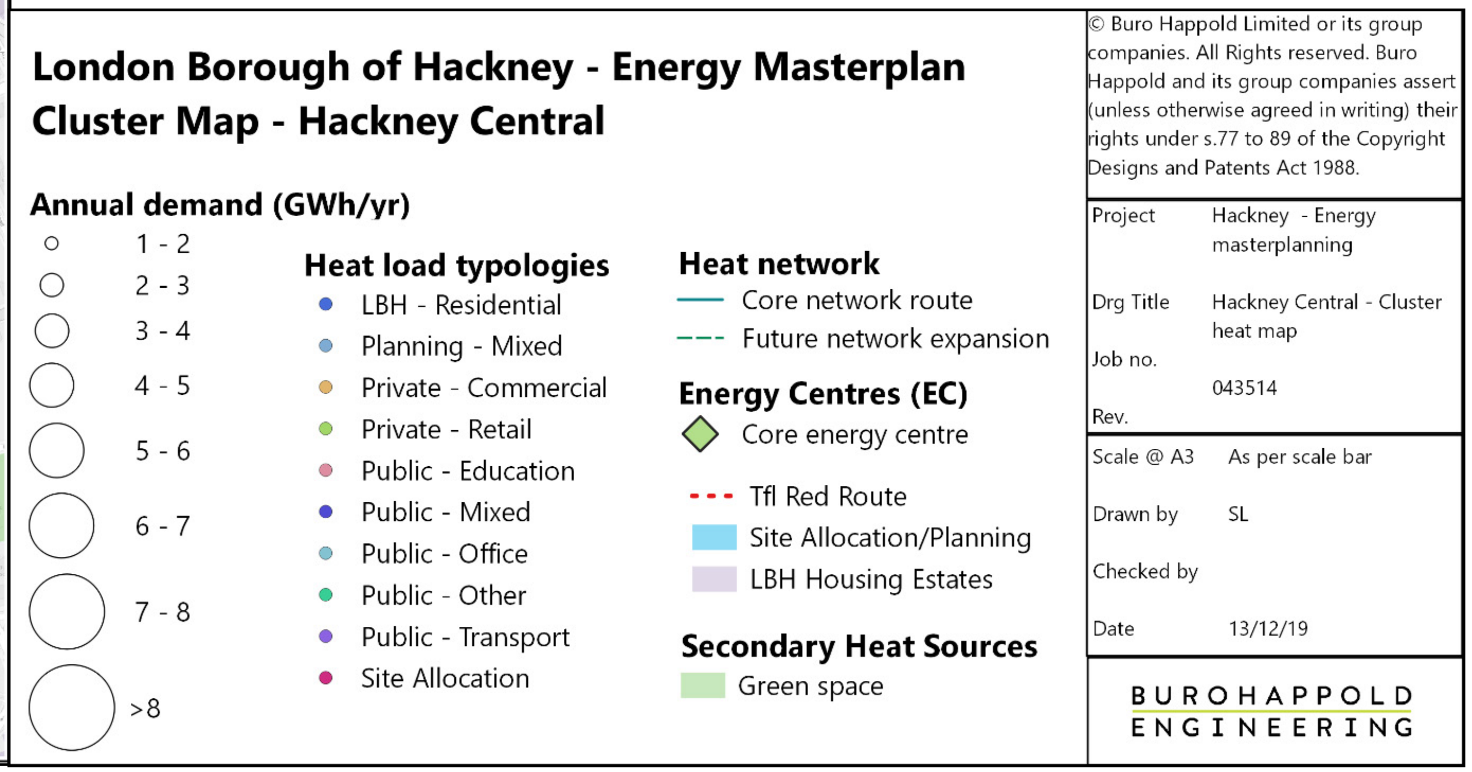


Figure 7.2: Hackney Central network route

Proposed connections

Table 7.7: Hackney Central cluster connections

Site	Description	Heat Supply	Heat Load (MWh/yr)	Cooling Load (MWh/yr)	Tier	Source Energy Data	Ownership	Status	No. units/ GIA(m²)
Tesco Site - 55 Morning Lane	Proposed redevelopment site	Proposed ASHP with gas boilers	3,785	3522	1	Buro Happold benchmarks	JV with Hackney	Pre-planning	37,000m² retail 43,000m² residential (558 units) totalling 80,000 m²
Trelawney Estate	Existing housing estate	Individual Gas boilers	1,019	N/a	1	LBH Estate Database & benchmarks	Public	Existing	291 residential units
Valette House	Existing housing	Communal Gas Boiler	110	N/a	3	LBH Estate Database & benchmarks	Public	Existing	46 residential units
Urswick School	Existing school	Gas Boilers	888	275	1	Non-domestic EPC	Public	Existing	7294m²
Hackney Picturehouse	Existing Cinema	Natural Gas	947	N/a	2	Non-domestic EPC	Private	Existing	5764m²
Hackney Town Hall	Town Hall	Natural Gas	675	742	1	Non-domestic EPC	Public	Existing	8553m²
1 Reading Lane	Mixed Use	Natural Gas	2,157	N/a	1	Non-domestic EPC	Public	Existing	8627m²
Hackney Service Centre	Existing council offices	Natural gas	1,267	1.328	1	Non-domestic EPC	Public	Existing	15,436m²
Christopher Addison House	Existing council offices	Natural Gas	279	287	2	Non-domestic EPC	Public	Existing	3332m²
Permit Office	Existing council offices	Natural Gas	265	269	2	Non-domestic EPC	Public	Existing	3125m²

Low carbon potential

Although there is limited potential for secondary heat recovery in the region, there are several existing CHP and communal boiler sites. Pembury Circus and Homerton University Hospital are situated to the north of the cluster, both of which have spare capacity to serve the wider area. Pitcairn House and Scotney House have communal boilers that serve each site respectively. London Lido is situated to the west of the cluster whereby waste heat could be recovered from the swimming pool.

Engagement with the energy consultants at the 55 Morning Lane site suggests the most likely energy strategy for the development will be ASHP and boilers and this could be increased to serve the wider area. Given the large commercial area which is likely to require year-round cooling there is also the potential for heat recovery from the cooling system (cooling loads have been estimated and are presented in the load table).

Energy centre location and technology

The development of the 55 Morning Lane site provides an ideal location for an energy centre to supply the wider area. Due to the status of planning, it is possible to recommend the installation of a 1.5MW ASHP with 12MW peak/back up gas boilers to supply heat to the network. This plant configuration would achieve a low carbon heat fraction of 75%.

Table 7.8: Summary of energy centre plant for Hackney Central cluster

Hackney Central	Unit	Value
Low carbon heat technology	-	Proposed: ASHP
Low carbon heat supply capacity	MW	1.5
Thermal store capacity	m^3	55
Gas boiler capacity	MW	12
% yearly supply from low carbon heat	%	75

Retrofit

One of the major constraints for connecting existing buildings to the new development at 55 morning lane is the variation in operating temperatures. To overcome this challenge a 'new systems retrofit' estimated has been calculated in Table 7.9.

Table 7.9: Estimated retrofit costs for LBH estates in Hackney Central cluster

Housing Estate	No. Properties	Leaseholder (%)	Estimated cost of retrofit
Trelawney Estate	291	25.1	£2,182,500
Frampton Park	1136	21.6	£8,520,000
Total retrofit CAPEX			£10.7m

Network expansion

Should the retrofit demonstration be successful, there is the potential to expand the network into the wider area. Figure 7.2 shows the possible extensions including LBH owned Frampton Park estate and LP33 site allocations.

Table 7.10 shows the additional heat load associated with expanding the network.

Due to the proximity to the Pembury Circus (Peabody) energy centre and Homerton University Hospital, connecting the heat network to the wider area could be a viable option. The large Pembury Estate (Peabody) could also be connected but requires significant retrofit.

Table 7.10: Future connections for Hackney Central cluster

Future Site	Heat Load (MWh/yr)	Description
Marks and Spencer	396	Low line density from EC, site allocation for future potential
Hackney Central Overground	87	Low line density from EC, site allocation for future potential
Clapton Bus Garage	-	Potential for large development, no plans yet but included in site allocation (SALP)
Frampton Park Estate	3,976	LBH owned housing estate, 1136 units. Too large to connect in the core network due to extensive retrofit required
Tesco Metro	342	Low line density from EC, site allocation for future potential
London College of Fashion	201	Low line density from EC, site allocation for future potential
Lidl	248	Low line density from EC, site allocation for future potential
Marian Court	1,121	Existing development requiring further retrofit. Ready for demolition
Iceland	260	Low line density from energy centre
Bridge House	385	Under construction, would present increased complexity with operating temperatures. 194 residential units (2012/1731)
Total future head demand	7,016	

Opportunities and constraints

Opportunities
▪ Timing (Futureproof development site) - 55 Morning Lane is undergoing planning for a large mixed use development which is likely to be the location of an energy centre. The site can be futureproofed by the surrounding expansion potential and decarbonise through the use of an ASHP and heat recovery from cooling load
▪ Future Expansion Potential - Possibility to connect to Frampton Park Estate and other site allocations in the future. Proximity to the existing Pembury Circus energy centre and the Homerton Universtiy Hospital which have spare capacity to serve the wider area
▪ Retrofit Demonstration - Trelawney Estate can act as a retrofit demonstration for the surrounding area/borough in the necessary transition for exisiting social housing.
▪ LP33 public realm improvements- draft Local Plan identifies a number of Potential public realm improvements which could be coordinated with heat network installation
Constraints
▪ Operating Temperatures / Retrofit - The development at 55 Morning Lane will provide low operating temperatures which may cause difficulty with the existing buildings in the rest of the cluster which will require retrofit to achieve the same temperatures. This is likely to be costly in order for the buildings to be connection ready.
▪ Commercial Performance - This cluster does not have an existing energy centre or heat network to extend and would therefore require a large CAPEX to build the scheme. To obtain a positive IRR, funding is required. Some 3rd party stakeholders who may be difficult to secure connection.
▪ Conservation Area - Areas of this cluster fall within a conservation area and will require additional consulation prior to laying DHN pipework.

7.1.3 Homerton

The initial cluster is developed around the Homerton University Hospital which provides the largest anchor heat load in the Borough. Currently, the hospital does not supply the wider area but is has been suggested it has some spare boiler capacity to do so. Banister House is located to the south of the hospital consisting of 379 flats that are heated via individual gas boilers. As the Borough transitions to a low carbon future, it is essential to address these housing estates and the necessary retrofit required to do so.

Table 7.11: Homerton core cluster metrics

Metric	Unit	Value
Heat Demand	MWh/yr	9,220
Network Length	m	617
Heat Line Density	MWh/m	14.9
Peak Load	kW	3.6
Percentage of heat load public owned	%	100
Percentage Heat load Tier 1	%	100
Energy Centre Technology	-	Existing gas CHP and boilers – proposed ASHP

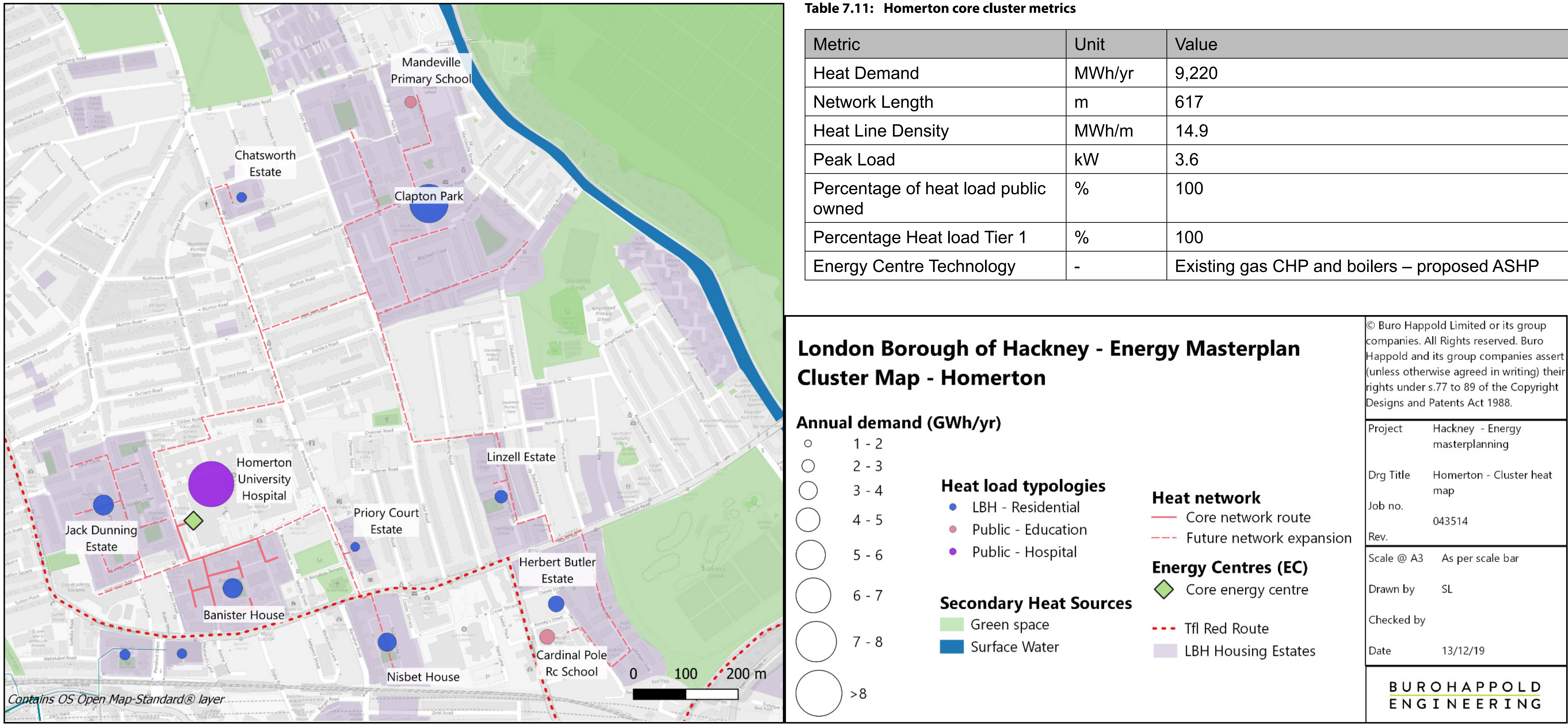


Figure 7.3: Homerton cluster network route

Proposed connections

Figure 7.3 shows the proposed network route for the Homerton cluster, connecting to Banister House estate. Homerton University Hospital presents the largest heat demand in the Borough of almost 8MWh/yr. The hospital is surrounded by residential estates, most of which being heated via individual gas boilers. Banister house consists of 379 flats across several low-rise blocks. Key metrics associated with the connections in this cluster are outlined in Table 7.12.

Low carbon potential

Air source heat pump. Daubeney Fields and the River Lea Navigation are located to the east of the cluster whereby a GSHP and WHSP respectively could be explored.

Energy centre location and technology

The existing energy centre in Homerton University Hospital contains 1no. 310kWe gas CHP, 2no. 3.5MWth winter gas boilers and 1no. 2.5MWth summer gas boiler. Currently, the CHP and 1no. 3.5MW gas boiler is generally able to meet the hospital demand over the winter leaving approximately 5MW of spare capacity to serve the wider area. A future 200kWe CHP is planned for installation in the near future – the assumptions for the technical development of this cluster is that this is swapped for a 750kW ASHP, large enough to serve the Banister House estate and the hospital. An ASHP combined with the existing CHP could achieve a heat fraction of 75% whilst supporting the decarbonisation of the hospital.

All energy centre plant associated with the Homerton scheme is outlined in Table 7.13.

Table 7.13: Summary of energy centre plant for Homerton cluster – core network

Homerton	Unit	Value
Low carbon heat technology	-	Proposed: ASHP
Existing: Gas CHP		
Low carbon heat supply capacity	MW	0.75
Thermal store capacity	m³	40
Gas boiler capacity	MW	9.5 (existing)
% yearly supply from low carbon heat	%	75

Retrofit

An estimated cost for the retrofit of the housing estates in Homerton are outlined in Table 7.14.

Table 7.14: Estimated retrofit costs for LBH estates in Homerton cluster

Housing Estate	No. Properties	Leaseholder (%)	Estimated cost of retrofit
Banister House	379	31.1	2,842,500
Jack Dunning Estate	418	31.6	3,135,000
Clapton Park	~700	19.4	5,250,000
Priory Court Estate	48	58.3	360,000
Linzell Estate	96	31.3	720,000
Nisbet House	327	24.2	2,452,500
Herbert Butler Estate	229	42.8	1,717,500
Total retrofit CAPEX			£16.5m

Table 7.12: Homerton core cluster connections

Site	Description	Heat Supply	Heat Load (MWh/yr)	Cooling Load (MWhh/yr)	Tier	Source energy data	Ownership	Status	No. units/ GIA(m²)
Homerton University Hospital	Existing Hospital	Gas CHP and boilers	7,890	1,894	1	Non-domestic DEC	Public	Existing	28,806m²
Banister House Estate	Existing housing estate	Individual Gas boilers	1,327	N/a	1	LBH estate database & benchmarks	Public	Existing	379 residential units

Network expansion

Homerton contains many LBH owned housing estates alongside the City Academy that could contribute to the future expansion of the network. These are outlined in Table 7.15 and would add approximately 13GWh/yr to the network. All future connections are publicly owned, reducing the commercial constraint when connecting.

For wide scale expansion, Hackney Central is situated to the south west of the hospital across the TfL red route. Although this is a constraint, Hackney Central has the potential to add approximately 17MWh/yr will future connections. Pembury Circus energy centre is located to the west of the cluster which has a 70kWe CHP and 4MW gas boilers. Kings Yard energy centre in Hackney Wick is located to the south east of the cluster whereby future connection could be a possibility for wide spread distribution.

Table 7.15: Future connections for Homerton cluster

Future Site	Heat Load (MWh/yr)	Description
Jack Dunning Estate	1,463	LBH housing estate – 418 units
Clapton Park	5,680	Large retrofit requirement and approximate 1km of pipework to reach the estate from the energy centre ~ 700 units
Priory Court Estate	168	LBH housing estate – 48 units
Linzell Estate	448	LBH housing estate – 96 units
Nisbet House	1,144	Requires crossing TfL red route – South of Homerton, 327 units
Herbert Butler Estate	801	LBH housing estate – 229 units
City Academy	2,561	Estimated demand from planning
Total heat demand	12,925	

Opportunities and constraints

Opportunities

- Spare Plant Capacity- there is currently a gas CHP and 3no. gas boilers installed at Homerton Hospital. Although the gas CHP is used for both heat and private wire, there is ~3.5MW spare boiler capacity that can be used to supply the wider area
- Future Expansion Potential - Possibility to connect to nearby LBH owned housing estates and local schools plus Hackney Central cluster and Kings Yard EC in Hackney Wick.
- Public Ownership - 100% of the proposed core and future connection are publically owned and therefore more influence for connection
- Low Carbon Potential - Homerton Hospital has the potential space for an ASHP, whilst the adjacent River Lea Navigation and Daubeney Fields could be utilised via a WHSP and GSHP repectively. This could not only provide low carbon heat to the surrounding area but support the decarbonisation of the hospital
- LP33 - draft Local Plan identifies a number of estates with ‘potential for improvement’ including Banister House and also proposed ‘potential public realm improvements’ including the red route which may be able to be cordinated towith network installation to open up expansion opportunities.

Constraints

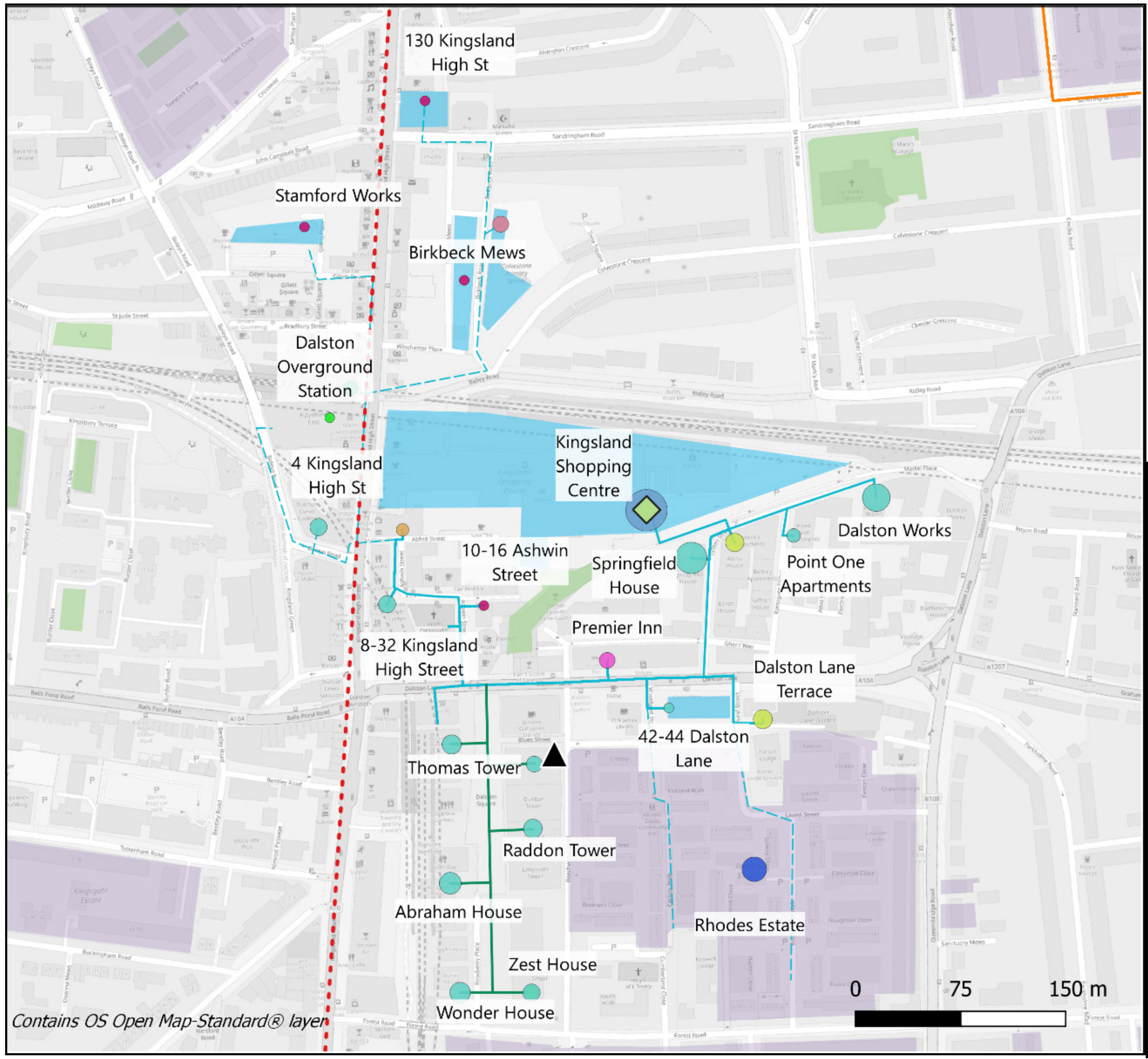
- Retrofit - all connections are existing and therefore will require a degree of retrofit to improve the building efficiency. This will incur a large CAPEX which impacts the performance of any scheme.
- Commercial arrangements - in order to use the hospital assets and provide the hospital with low carbon heat, there must be buy in for decarbonisation and commercial arrangements from the hospital. A challenge is likely to be finding suitable metrics for low carbon heat sales to compete with current CHP
- TfL Red Route - location of the TfL red route makes it difficult to expand the network to the south of the cluster and Hackney Central.

7.1.4 Dalston

The Dalston area action plan (AAP) was released in 2013 where several sites were identified as being areas in need of development. Since, many of these sites have been redeveloped and are operating on communal heating systems. Kingsland shopping centre is a key site that has been identified for redevelopment, currently covering 26,000sqm . To date, this site is in pre-planning stages with the view to construct an energy centre to supply the heating to site. Given the stage of the development and the existing communal heating within the area, the redevelopment of this site presents an opportunity to decarbonise the Dalston area.

Table 7.16: Dalston cluster metrics

Metric	Unit	Value
Heat Demand	MWh/yr	12,438
Network Length	m	3322
Heat Line Density	MWh/m	3.7
Peak Load	MW	9.5
Percentage of heat load public owned	%	5.3
Percentage Heat load Tier 1	%	84
Energy Centre Technology	-	ASHP located at Kingsland Shopping Centre. Potential for heat recovery chillers from supermarket / retail spaces.



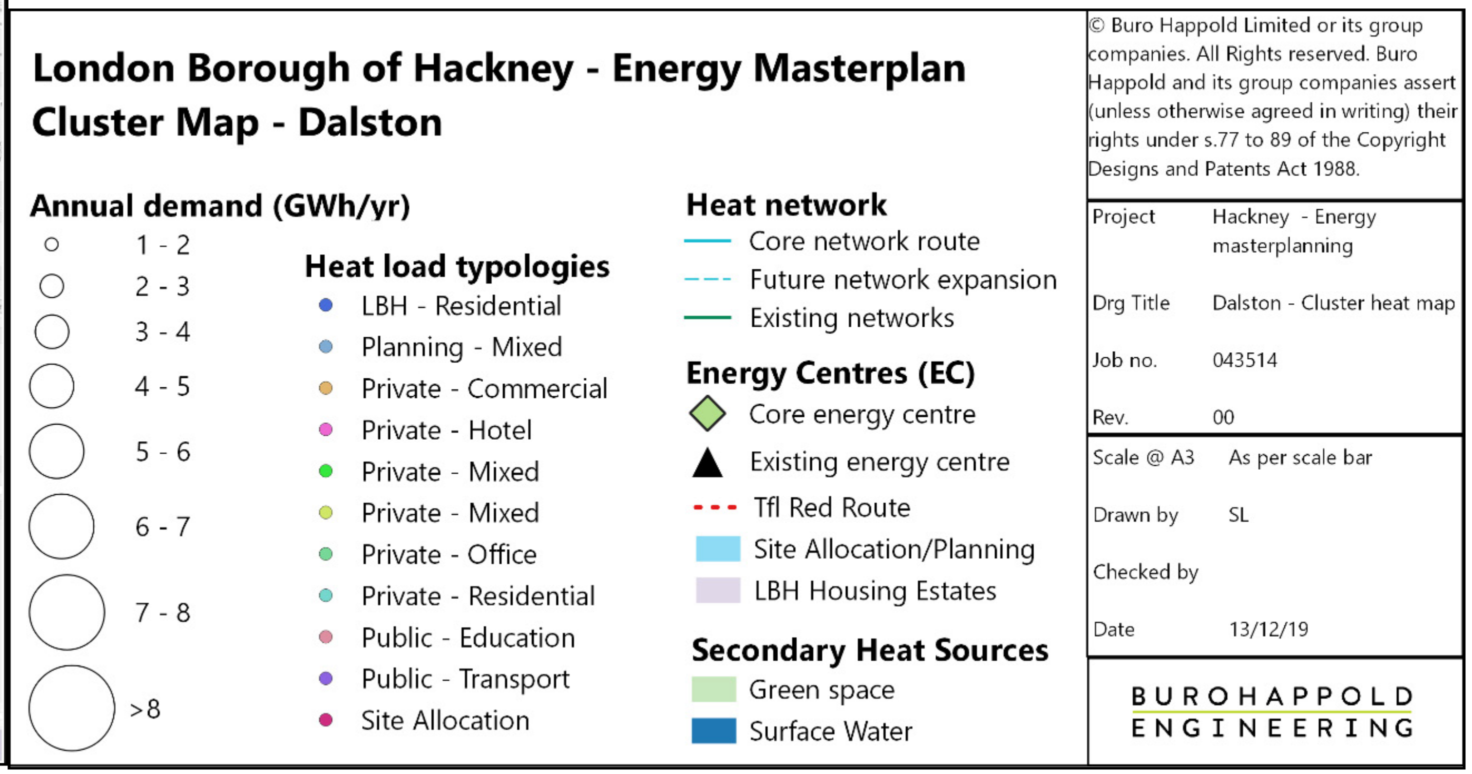


Figure 7.4: Dalston cluster network route

Proposed connections

The Kingsland Shopping Centre development provides the greatest anchor load of approximately 2 GWh/yr for the core connections that are outlined in Table 7.17. Although most of the proposed connections are communally heated, they are also privately owned with recently installed plant and in some cases a concession agreement (Dalston Square). This poses a challenge when connecting to the network and co-ordinating plant replacement.

Table 7.17: Dalston cluster connections

Site	Description	Heat Supply	Heat Load (MWh/yr)	Tier	Heat demand data source	Ownership	Status	No. units/ GIA(m²)
Kingsland Shopping Centre	Proposed re-development of existing shopping centre	Proposing ASHP	3,057	1	Buro Happold benchmarks	Private	Pre-planning	646 residential units, reprovisioned Sainsburys of 50,418 sqft GIA, 89,356 sqft GIA retail, 22,873 GIA sqft workspace, 20,172 sqft GIA office and 23,756 sqft GIA D1 space.
8-32 , Kingsland High Street	New build mixed use buildings	Individual gas boilers	350	3	London heat map	Private	Existing	49 residential units with retail
32-34 Kingsland High Street	Existing build, site allocation	Individual gas boilers	144	3	London development database	Private	Existing	Retail, Food and Drink
Springfield House	Existing residential	Individual gas boilers	1,672	1	Domestic EPC	Private	Existing	91 units
Point One Apartments	Existing residential	Community heating + Solar water heating	182	3	Buro Happold Benchmarks	Private	Existing	55 units
Dalston Works	Redeveloped residential	Site-wide communal heating (gas boilers)	1,230	1	Planning documents	Private	Existing	121 units, 2,253 m² B1, 99m² retail, 236m² B1/A1/A3 space
Dalston Lane Terrace	Redeveloped residential	Communal heating – site wide	468	3	Planning documents	Private	Existing	44 residential units, 1029m² commercial space
Premier Inn	Hotel	Gas boilers	280	3	Buro Happold Benchmarks	Private	Existing	3410 m²
Holy Trinity Primary School	Primary School	Mains gas	172	3	Non-domestic EPC	Public	Existing	1208 m²
Dalston Square	Communally heated residential development	Gas CHP, gas boiler, biomass boiler – Communal heating	4,457	1	Domestic EPC and Benchmarks	Private	Existing	653 residential units, approx. 1800m² retail/comm.
Kinetica Apartments	Mixed use residential and office	Community scheme – mains gas	426	3	Domestic EPC	Private	Existing	56 residential units, approx. 1650m² office/comm.

Low carbon potential

Many of the existing sites operate communal gas boilers or small-scale gas CHP. With the decarbonisation of the grid, CHPs are becoming less attractive and feasible. To transition Dalston to a low carbon future away from natural gas, alternative technologies need to be considered. As seen in Figure 7.4, there are limited heat sources e.g. no large green spaces or surface water or waste heat sources, therefore an air source heat pump is the deemed the most likely low carbon solution. Given the proposed retail addition there could be opportunity for heat recovery from cooling systems at the Kingsland Shopping Centre redevelopment.

Energy centre location and technology

The proposed energy centre will be located at the Kingsland shopping centre development site where a 1.5MW air source heat pump and 9.5MW peak/back up gas boilers would serve the core network. It is assumed that the network would operate in place of the Dalston Square CHP, which is likely to be close to replacement by the introduction of any wider network in this area. Therefore, the new plant will also supply this additional heat load. Thermal storage will be installed to increase the heat fraction obtained by the heat pump to 74%.

Table 7.18: Summary of energy centre plant for Dalston cluster

Dalston	Unit	Value
Low carbon heat technology	-	Proposed: ASHP
Low carbon heat supply capacity	MW	1.5
Thermal store capacity	m3	85
Gas boiler capacity	MW	9.5
% yearly supply from low carbon heat	%	74

Network expansion

In the immediate vicinity, there are some site allocations, existing and new developments which could connect in the long term. These future connections are outlined in Table 7.19.

For wide scale expansion, Hackney Downs is to the north of the cluster where a large number of LBH owned housing estates are located. To the south is De Beauvoir Town and Hoxton. There is currently planning for a district heating network in Colville Estate.

Table 7.19: Future connections for Dalston cluster

Future Site	Heat Load (MWh/yr)	Description
4 Kingsland High St	353	Requires crossing of the TfL red route. 56 residential units
51-57 Kingsland High St	985	Requires crossing of the TfL red route. 98 residential units
130 Kingsland High St	11	Site Allocation with no confirmed planning
Stamford Works	-	Site Allocation with no confirmed planning
Birkbeck Mews	-	Site Allocation with no confirmed planning
Rhodes Estate	927	LBH Housing Estate. 265 residential units requiring retrofit – 15.9% leasehold ownership
Total heat demand		

Opportunities and constraints

Opportunities
■ Futureproof developement site - Kingsland Shopping Centre is undergoing planning for a large mixed use development which is likely to be the location of an energy centre in the next 5-15 years. Space should be allocated to futureproof to serve the surrounding area
■ Existing Communal Heating - a large majority of the proposed connections in Dalston are currently communally heated either by an onsite boiler/CHP or connected to Dalston Square energy centre. This makes connecting to a larger network much more simple and reduces the need for building retrofit. Engaging with existing developments sooner rather than later to ensure that a network is in their long term low carbon transition plan would be prudent so that they could connect in the future.
■ Commercial Performance - as a larger percentage of the core pipework is exisiting at Dalston square, and the reduced need for retrofit, the scheme presents a postive IRR without funding.
■ Crossrail 2 - should Crossrail 2 proceed to pass through Dalston, there is likely to be population growth and increasing heat load density in this area
Constraints
■ Private Ownership - a large proportion of the connections are privately owned which makes securing a co-ordinated scheme and plant replacement more difficult.
■ Low Carbon Potential - there are very few secondary heat sources in the surrounding area making ASHP the only obvious decarbonisation option for this scheme
■ E.ON ESCo Agreement - Dalston Square is already under an E.ON consession

7.1.5 Woodberry Down

Woodberry Down Estate is a large mixed-use development site with approximately 5,500 homes. At full build out, this site could have a heat demand of approximately 18 GWh/yr. Currently, planning is granted for the construction of an energy centre with a gas CHP as shown in Figure 7.5. Hodkinson's are undertaking the low carbon optioneering and techno-economic analysis for this site and therefore this has been excluded in the scope for this cluster.

Within this section, an overview of the low carbon alternatives and the initial feasibility of additional connections are explored.

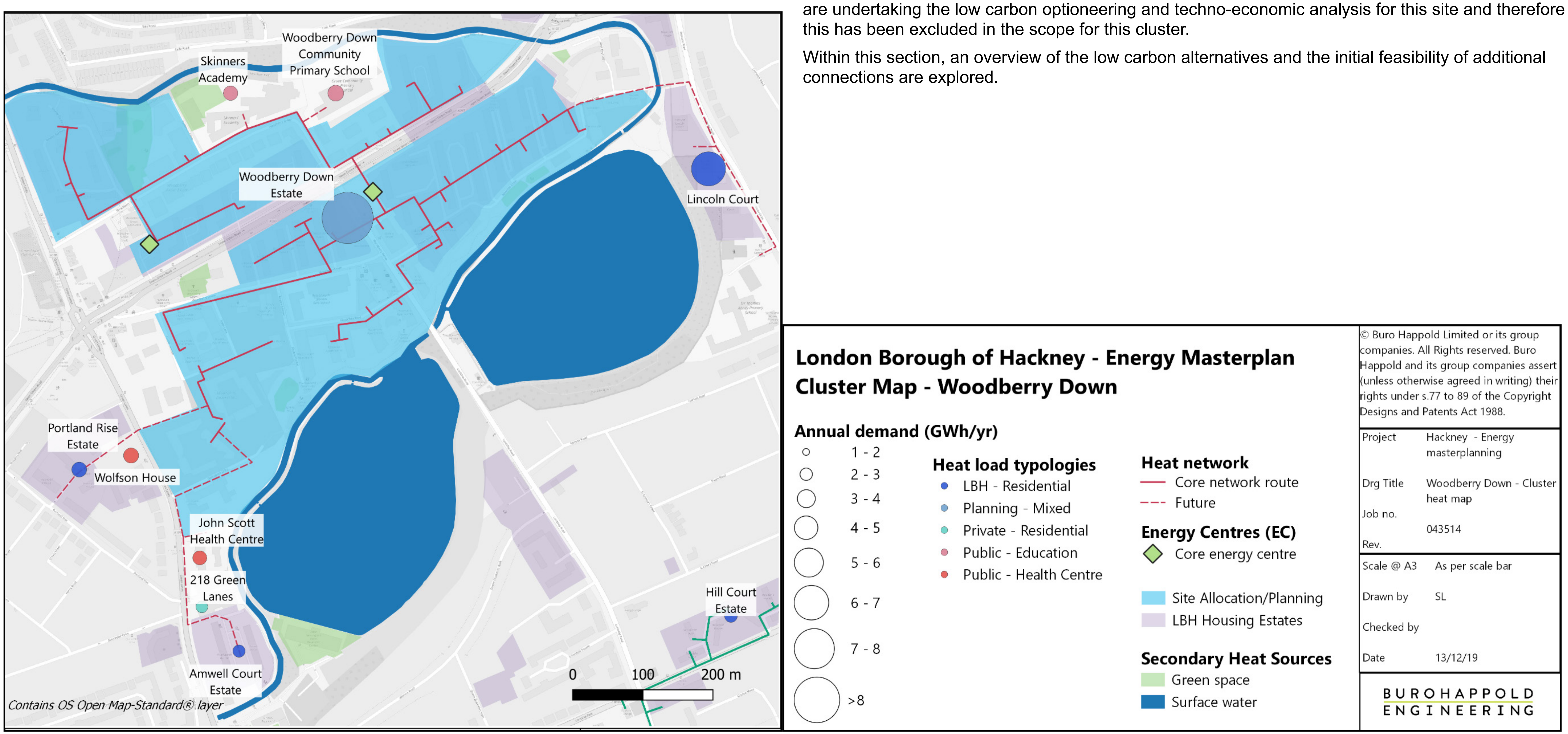


Figure 7.5: Woodberry Down network route

Future Connections

Table 7 20 outlines the possible connections to the Woodberry Down development. In total, these connections have the potential to add an additional 3.8 GWh/yr. A line density of above 5 MWh/yr /m of pipework is typically used as an initial benchmark for viability for network extensions; the table below shows that most of these sites, except for the adjacent schools are too far away from the main network to pass these initial tests, however LBH or private developers may see larger benefits for connection such as to tackle fuel poverty (e.g. where direct electric heating is installed) or for decarbonisation where plant replacement is due. The Woodberry Down development itself is fairly dense itself and therefore likely has a much larger line density. The Community Infrastructure Company in charge of the energy centre / network may also wish to connect the wider community despite the reduction of overall line density. If there is continued growth of the area around the Woodberry Down redevelopment then these metrics will be expected to improve.

Alternative heat supply

The New River runs to the north and the south of the development site with the potential for abstraction for a water source heat pump. There are two reservoirs in close proximity to the site. The east reservoir is classified as a nature reserve and therefore cannot be used for abstraction. The west reservoir is understood to be LBH owned and leased the Greenwich Leisure (GLL) and could be used as a secondary heat source.

To the north of Woodberry Down is the planned energy recovery facility with the potential to supply 22GWh/yr of heat to the surrounding area via the Meridian Water heat network. Hackney, Energetik and Haringey have had a number of exploratory meetings to discuss a pipe extension from Enfield to Haringey and on to Hackney. This is an ambitious cross borough opportunity and there are plans to approach HNIP for a joint HNIP/funding application. Currently, Haringey is expected to require 10MW supply to support Broadwater Farm, Tottenham North, Wood Green and Tottenham Hale . A similar sized supply would likely be required to provide a baseload supply to Woodberry Down with future proofing to serve the Stamford Hill and Clissold Park areas of the borough.

Table 7.20: Potential future connections for Woodberry Down

Future Connection	Annual heat Demand (MWh/ yr)	Ownership	Line density (MWh/ yr/m)	Opportunity	Constraints	Heat method	Retrofit?
Lincoln Court	4,516	Public	1.3	LBH owned, currently communally heated after retrofit	Long pipework required, main road of piping	Communal heating	No
Portland Rise Estate	682.5	Public	3.4	LBH owned	Busy road, high operating temperatures	Gas Boilers	Yes
218 Green Lanes	381.5	Private	2.1	Communally heated, new build lower temp	Busy road, privately owned development	Communal – Gas CHP	No
John Scott Health Centre	584.2	Public	2.9	NHS, public owned	Busy road, older building – higher operating temps	Gas Boilers	-
Skinners Academy	627.5	Public	48.8	New build, likely lower operating temperature	Timing network with plant replacement	Gas Boilers	No
Woodberry Down Community Primary School	804.7	Public	27.7	Public school	High operating temperature requires building improvement	Gas Boilers	Yes

Network Expansion

Stoke Newington is located to the south and Stamford Hill to the east of the cluster. These clusters were not prioritised in the initial stages due to low heat density and various constraints. Woodberry Down has the potential to expand the network and connect up to these areas, supplying low carbon heat (as shown in Figure 7.6).

Stamford Hill is an area challenged by fuel poverty and would benefit greatly from a heat network in the area. There is a Morrisons supermarket where waste heat could be recovered from refrigeration. It is also the located of a proposed cross rail 2 vent shaft where heat could be recovered. In order to connect to a heat network, retrofit works would be required for the housing estates that are operating inefficiently. It is recommended that further consultation be carried out regarding crossing the TfL red route that dissects the cluster.

Stoke Newington has a large heat demand but is challenged by the distance between connections. Clissold leisure centre provides the largest anchor load in the cluster of 3,429 MWh/yr .

Table 7.21: Heat demand of Stamford Hill and Stoke Newington

Future expansion	Annual heat demand (MWh/yr)	Line density to cluster (MWh/m)	Source
Stoke Newington	14,270	21.6	DEC data and Buro Happold benchmarks
Stamford Hill	13,380	13.1	EPC/DEC data
Total heat demand	27,650		

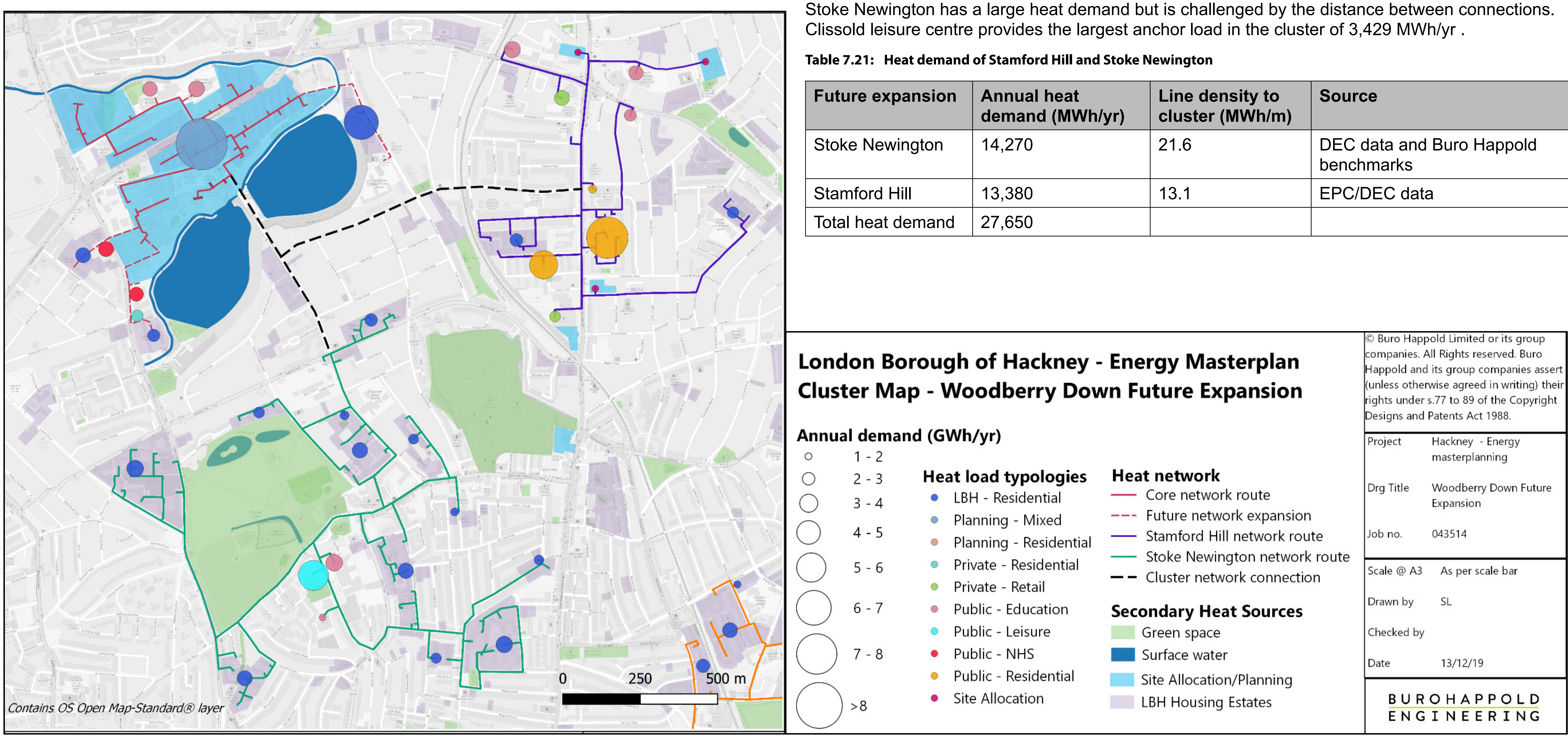
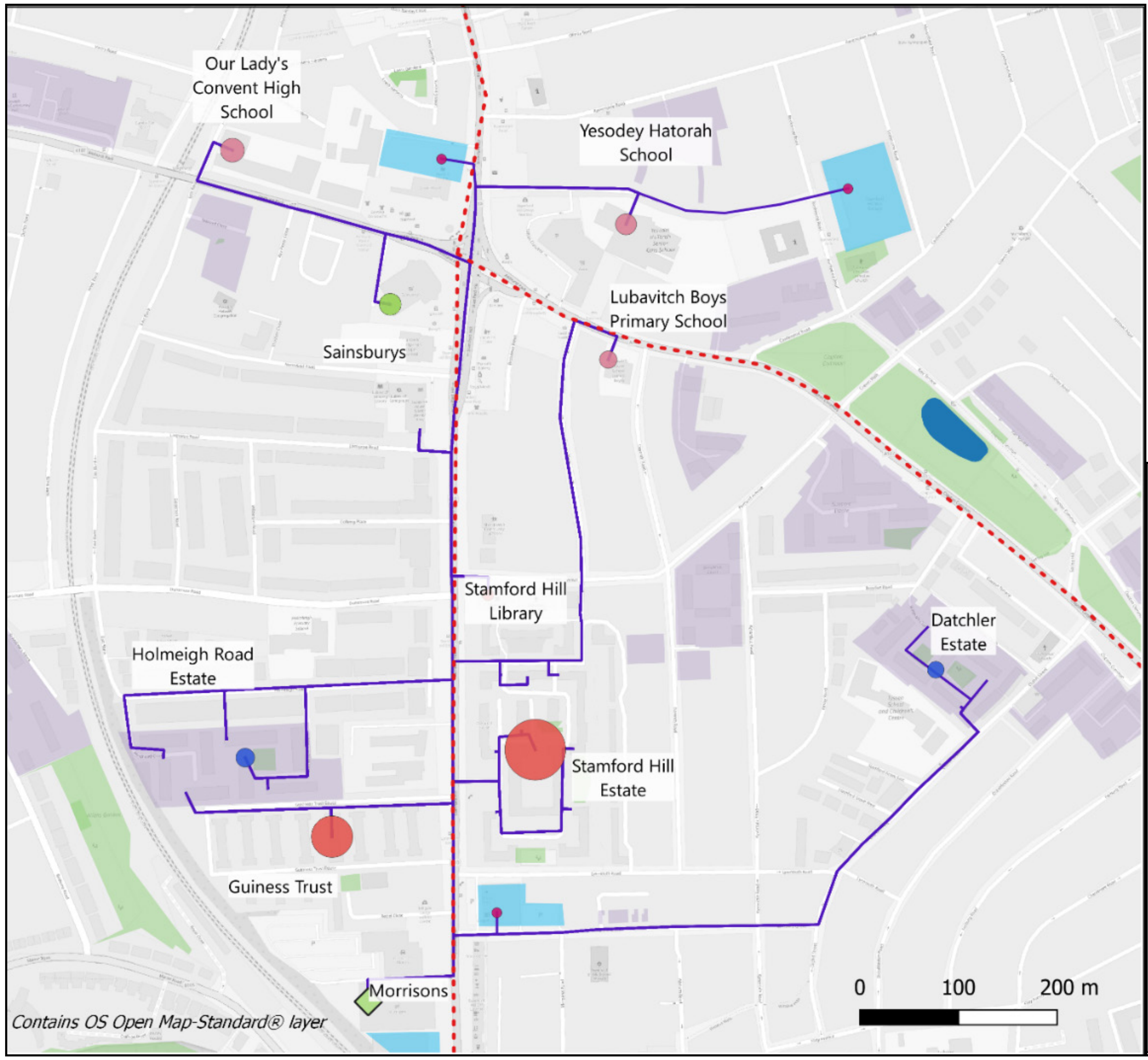


Figure 7.6: Potential expansion of Woodberry Down cluster to Stoke Newington and Stamford Hill

7.2 Clusters not taken forward

This section provides an overview of clusters not taken forward for detailed modelling. An overview of why these clusters were identified as areas for decentralised energy projects is given.

Despite these clusters not being analysed in detail, there may still be opportunities in these areas – and low carbon energy projects in each will still need to be investigated if Hackney is to meet its net zero carbon goal.



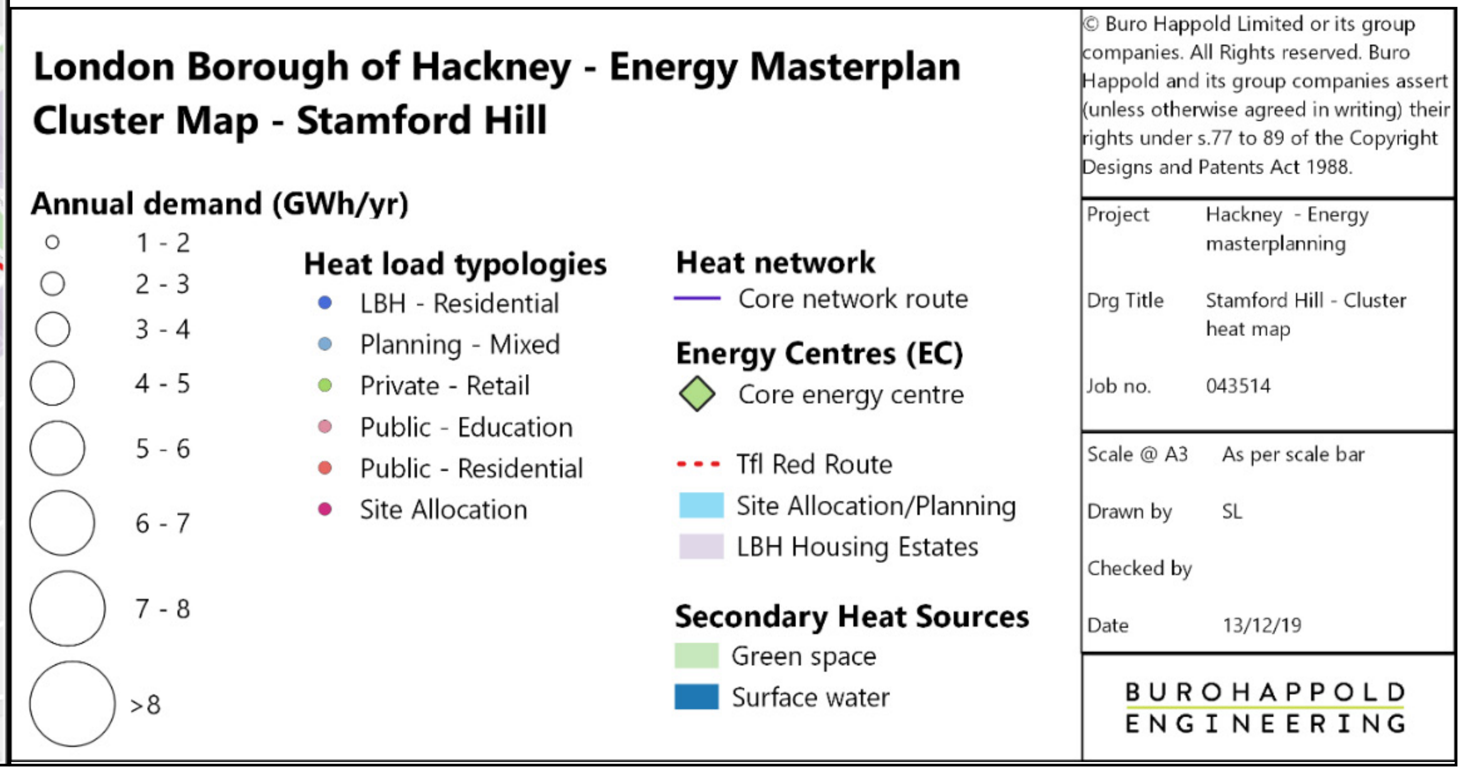


Figure 7.7: Stamford Hill network route

7.2.1 Stamford Hill

Stamford Hill was initially picked out as a cluster of interest for decentralised energy projects due to the area's high fuel poverty – the highest in Hackney. Well-planned decentralised energy projects such as district heating could therefore play a part in fuel poverty alleviation.

Table 7.22: Stamford Hill network metrics

Metric	Unit	Whole network
Heat Demand	MWh/yr	14,100
Heat Density	kWh/km²	33
Percentage of heat load public sector	%	88%
Percentage Heat load Tier 1	%	83%
Energy Centre Technology	-	Heat pump – sources include waste heat from proposed Crossrail 2 vent shaft and rejected heat from refrigeration at Sainsbury's supermarket.

Proposed connections

Table 7.23 summarises key metrics for the proposed connections.

Table 7.23: Stamford Hill cluster connections

Site	Heat load (MWh/year)	Tier	Source of Demand	Ownership	Status
Stamford Hill Library	140	3	DEC	Public	Existing
Sandford Court	182	3	Buro Happold benchmarks	Public	Existing
Lubavitch Boys' Primary School	250	2	DEC	Public	Existing
Datchler Estae	322	2	Buro Happold benchmarks	Public	Existing
Lubavitch House	362	3	Buro Happold benchmarks	Private	Existing
Holmleigh Road Estate	451	2	Buro Happold benchmarks	Public	Existing
Yesodey Hatorah School	611	1	Buro Happold benchmarks	Public	Existing
Sainsbury's	674	2	Buro Happold benchmarks	Private	Existing
Morrisons	722	2	Buro Happold benchmarks	Private	Existing
Our Lady's Convent High School	852	1	Buro Happold benchmarks	Public	Existing
Guinness Trust	2,870	1	Buro Happold benchmarks	Public	Existing
Stamford Hill Estate	6,660	1	Buro Happold benchmarks	Public	Existing

Opportunities and constraints

Opportunities
▪ Emerging Area Action Plan - Policy framework for the area currently being developed could be supportive of decentralised energy projects
▪ Fuel poverty - Stamford Hill is an area of high fuel poverty. Therefore decentralised energy has a role to play in fuel poverty alleviation
▪ Heat recovery opportunities - Crossrail 2 is proposed to run through Stamford Hill, with a vent shaft located just south of the Morrison's site
Constraints
▪ TfL red route - The A10 Stamford Hill bisects the cluster and will be a barrier to installing district heat pipework to connect the significant heat loads either side of the road
▪ Retrofit - due to the large number of social housing estates in teh cluster, wide spread retrofit is required which will be costly

7.2.2 Hackney Downs

This cluster centres around a series of social housing estates around Hackney Downs. It was not taken forward for detailed modelling at this stage due to the low heat density of the identified network, however the high proportion of public sector housing could make this area an opportunity for a demonstrator project of domestic retrofit and low carbon residential heating.

Table 7.24: Hackney Downs network metrics

Metric	Unit	Whole network
Heat Demand	MWh/yr	5,575
Heat Density	kWh/km²	10
Percentage of heat load public sector	%	100
Percentage Heat load Tier 1	%	76.7
Energy Centre Technology	-	Heat pump – Hackney Downs could be a major resource for ground source heating in the area.

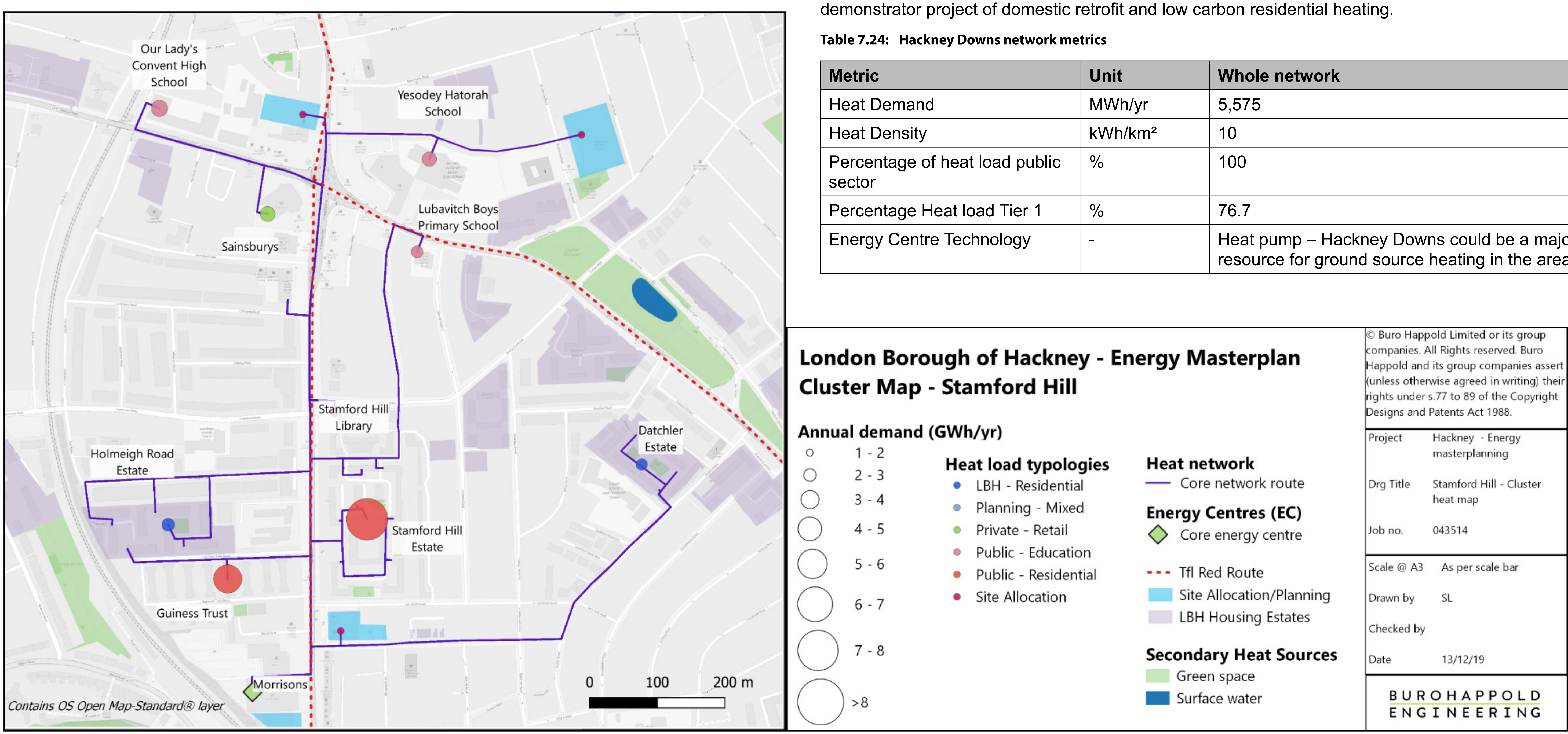


Figure 7.8: Hackney Downs network route

Proposed connections

Table 7.25 summarises the proposed connections in the scheme.

The communal system for the older part of the Nightingale Estate is currently running an old CHP, and Buro Happold have been informed that there are currently operational issues with it. Planning permission has been granted for the next stage, but this is currently on hold due to potential structural issues with a podium structure on the site. Should a survey indicate that the podium structure is insufficient to support the proposed development, this phase of development is likely required to have major redesign, requiring another planning submission.

Table 7.25: Proposed connections for Hackney Downs cluster

Site	Description	Heat Supply	Heat Load (MWh/yr)	Tier	Source Energy Data	Ownership	Status	No. units/ GIA(m²)
Nightingale Estate	New Build development – under construction	Communal Heating (CHP)	1,375	1	Energy strategy and benchmarks	Public	Under construction	400 resi units, 232sqm retail/café, 453sqm (D1) and 62.4sqm office
Benthal Court	LBH Housing Estate	Individual gas boilers	105	3	LBH Estate Database & benchmarks	Public	Existing	30 residential units
Landfield Estate	LBH Housing Estate	Individual gas boilers	697	1	LBH Estate Database & benchmarks	Public	Existing	199 residential units
The Beckers	LBH Housing Estate	Individual gas boilers	518	1	LBH Estate Database & benchmarks	Public	Existing	148 residential units
Morris Blitz Court	LBH Housing Estate	Individual gas boilers	175	3	LBH Estate Database & benchmarks	Public	Existing	50 residential units
Shacklewell Properties	LBH Housing Estate	Individual gas boilers	245	3	LBH Estate Database & benchmarks	Public	Existing	70 residential units
Somerford Estate	LBH Housing Estate	Individual gas boilers	207	3	LBH Estate Database & benchmarks	Public	Existing	140 residential units
April Street	LBH Housing Estate	Individual gas boilers	119	3	LBH Estate Database & benchmarks	Public	Existing	34 residential units
Downs Estate	LBH Housing Estate	Individual gas boilers	735	1	LBH Estate Database & benchmarks	Public	Existing	210 residential units
Mountford Estate	LBH Housing Estate	Individual gas boilers	578	1	LBH Estate Database & benchmarks	Public	Existing	165 residential units
Montague Estate	LBH Housing Estate	Individual gas boilers	182	3	LBH Estate Database & benchmarks	Public	Existing	52 residential units
Abersham Road Estate	LBH Housing Estate	Individual gas boilers	151	3	LBH Estate Database & benchmarks	Public	Existing	43 residential units

Opportunities and constraints

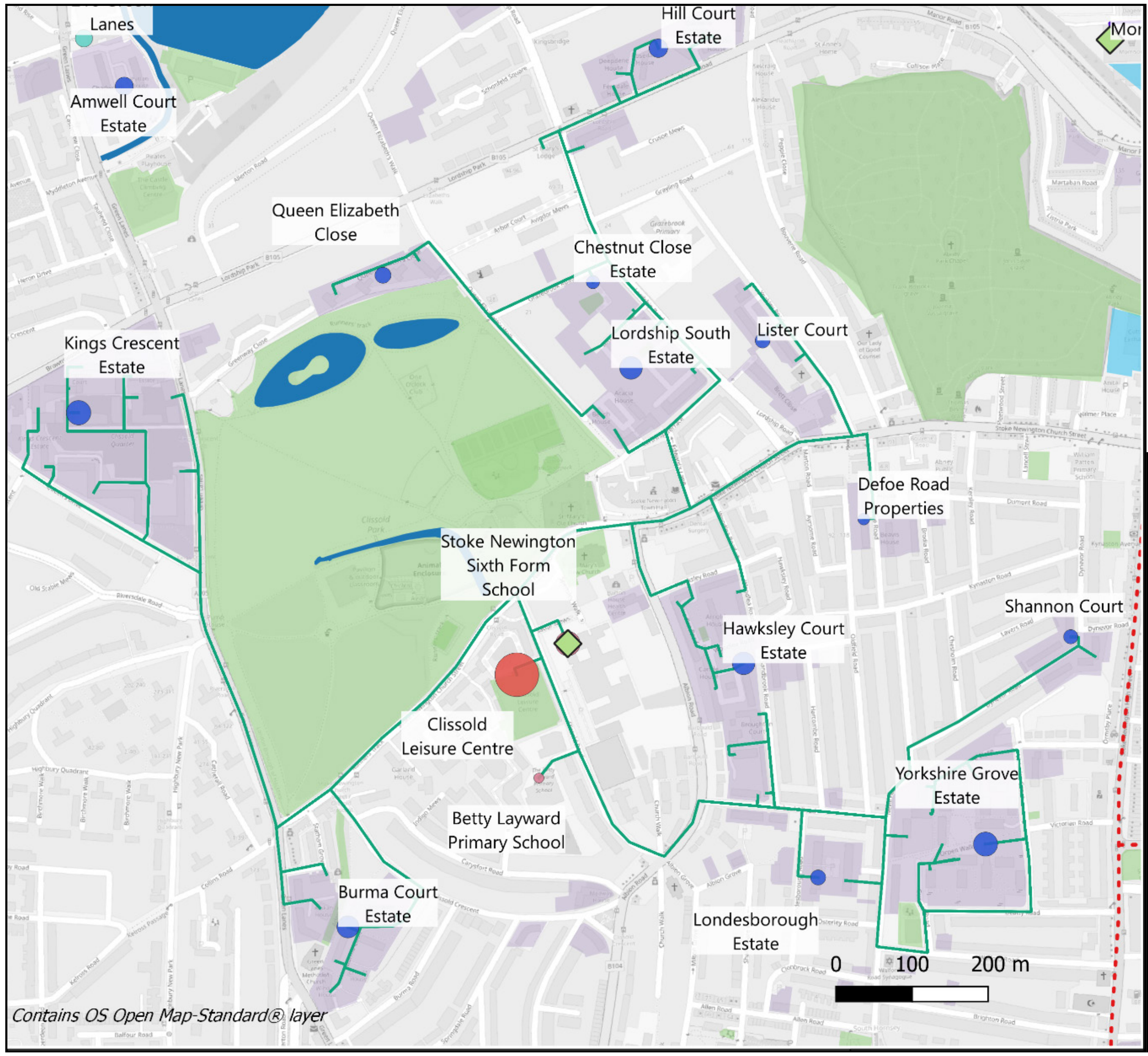
Opportunities
▪ Nightingale Estate - all of the connections are LBH housing estates which reduces the complexity of connecting to a network
▪ Public sector - all of the connections are LBH housing estates which reduces the complexity of connecting to a network
▪ Ground source heat resource - Hackney Downs could be a major resource for a low-carbon ground energy system.
▪ Clapton redevelopment - possible development just to the east in Clapton
Constraints
▪ Retrofit - due to the large number of social housing estates in the cluster, wide spread retrofit is required which will be costly
▪ Line Density - to connect to the housing estates in the cluster, extensive pipework is required to connect the network with uncomparable load. Along with the retrofit costs, this cluster will be very costly

7.2.3 Stoke Newington

The area around Clissold Park in Stoke Newington has been identified as an opportunity area, having a high concentration of social housing located close to other public sector buildings including the Clissold Leisure Centre, Betty Layward Primary School and Stoke Newington Library. The network wasn't taken forward for further analysis at this time due to the low heat density, but the decarbonisation of the public sector buildings is expected to be a priority for Hackney Council in order to deliver against its Climate Emergency targets. The cluster is also located close to the boundary with Islington, presenting an opportunity for long-term investigation of a decentralised energy across both Councils.

Table 7.26: Stoke Newington network metrics

Metric	Unit	Whole network
Heat Demand	MWh/yr	7,843
Heat Density	kWh/km²	9
Percentage of heat load public sector	%	100?%
Percentage Heat load Tier 1	%	73.4%
Energy Centre Technology	-	Heat pump – Clissold Park could be a major resource for ground source heating in the area.



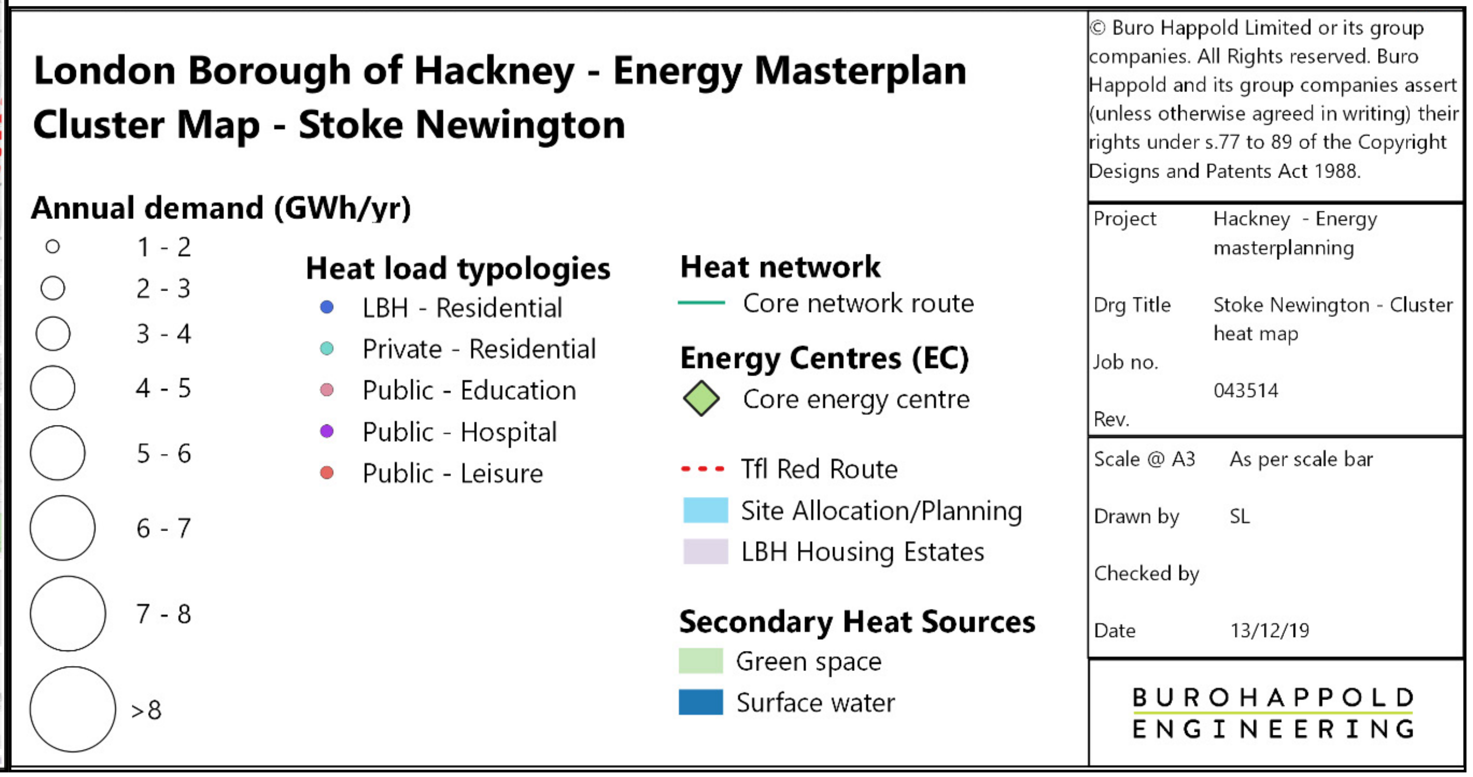


Figure 7.9: Stoke Newington network route

Proposed connections

Table 7.27 shows the proposed connections.

Opportunities and constraints

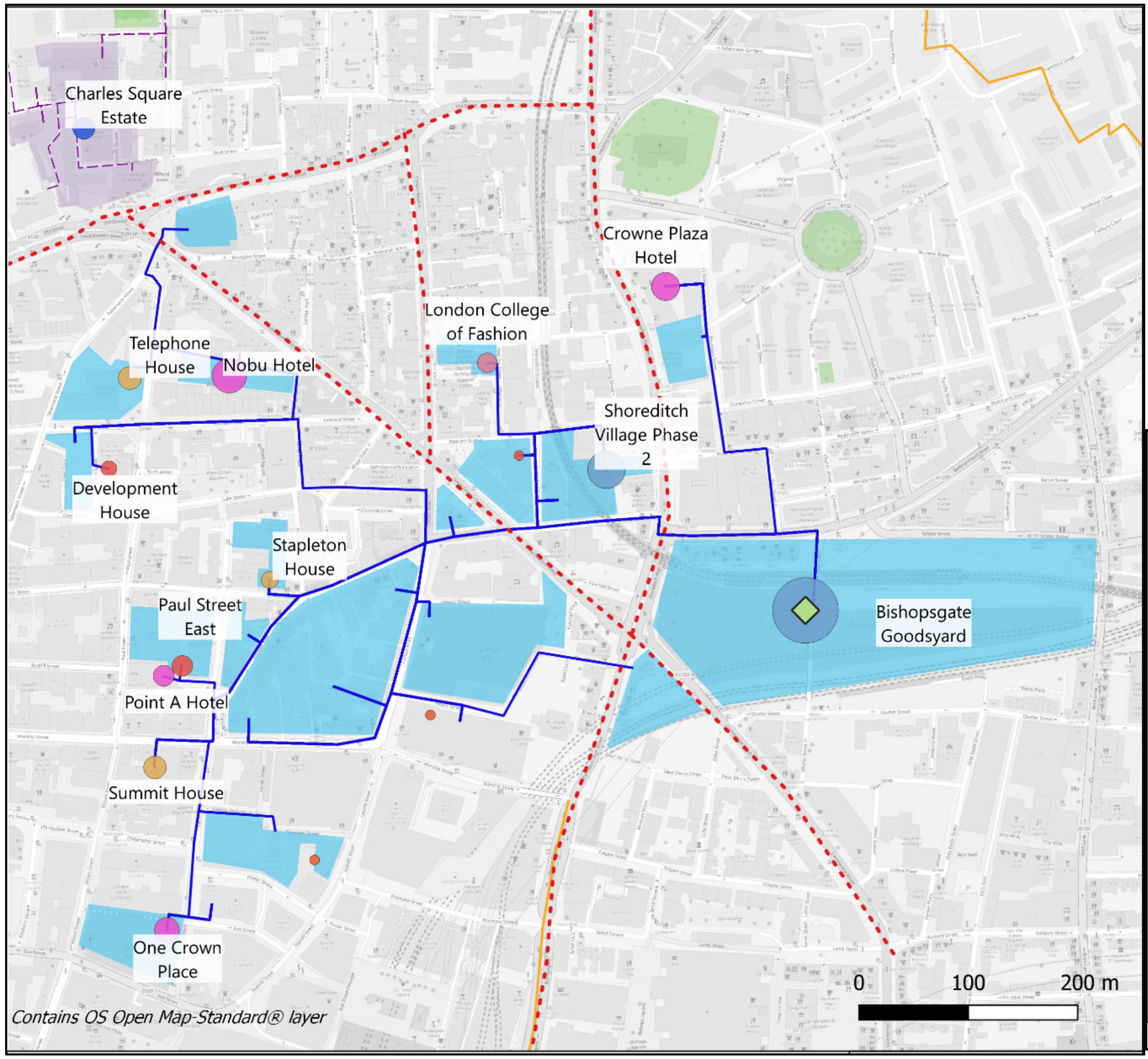
Opportunities
▪ Public sector - all of the connections are public sector, which reduces the complexity of connecting to a network.
▪ Ground source heat resource - Clissold Park could be a major resource for a low-carbon ground energy system.
Constraints
▪ Retrofit - due to the large number of social housing estates in the cluster, wide spread retrofit is required which will be costly.
▪ Line Density - to connect to the housing estates in the cluster, extensive pipework is required to connect the network with uncomparable load. Along with the retrofit costs, this cluster will be very costly.

Table 7.27: Proposed connections for Stoke Newington cluster

Site	Heat Load (MWh/yr)	Tier	Source Energy Data	Ownership	Status	No. units/ GIA(m²)
Manor Road Properties	123	3	LBH Estate Database & benchmarks	Public	Existing	35 residential units
Defoe Road Properties	126	3	LBH Estate Database & benchmarks	Public	Existing	36 residential units
Chestnut Close Estate	168	3	LBH Estate Database & benchmarks	Public	Existing	48 residential units
Shannon Court	207	3	LBH Estate Database & benchmarks	Public	Existing	59 residential units
Lister Court	231	3	LBH Estate Database & benchmarks	Public	Existing	66 residential units
Londesborough Estate	245	3	LBH Estate Database & benchmarks	Public	Existing	70 residential units
Betty Layward Primary School	253	2	DEC	Public	Existing	2227 m²
Queen Elizabeth Close	291	2	LBH Estate Database & benchmarks	Public	Existing	83 residential units
Hill Court Estate	441	2	LBH Estate Database & benchmarks	Public	Existing	126 residential units
Burma Court Estate	704	1	LBH Estate Database & benchmarks	Public	Existing	201 residential units
Hawksley Court Estate	746	1	LBH Estate Database & benchmarks	Public	Existing	213 residential units
Lordship South Estate	749	1	LBH Estate Database & benchmarks	Public	Existing	214 residential units
Stoke Newington School & Sixth Form	855	1	DEC	Public	Existing	12,067 m²
Yorkshire Grove Estate	879	1	LBH Estate Database & benchmarks	Public	Existing	251 residential units
Clissold Leisure Centre	911	1	Non-domestic EPC	Public	Existing	5658 m²
Kings Crescent Estate	914	1	LBH Estate Database & benchmarks	Public	Existing	261 residential units

7.2.4 Shoreditch (South)

Shoreditch was identified as a cluster as it is one of the most heat dense areas in the Borough, with high rise buildings and major ongoing development. The proposed network incorporates a series of important sites including existing and future mixed-use schemes. However, the area does not have any major public sector buildings to act as anchor loads for district heating. This makes getting any network off the ground very challenging. The planned Bishopsgate development however poses an opportunity to integrate an energy centre to serve the wider area.



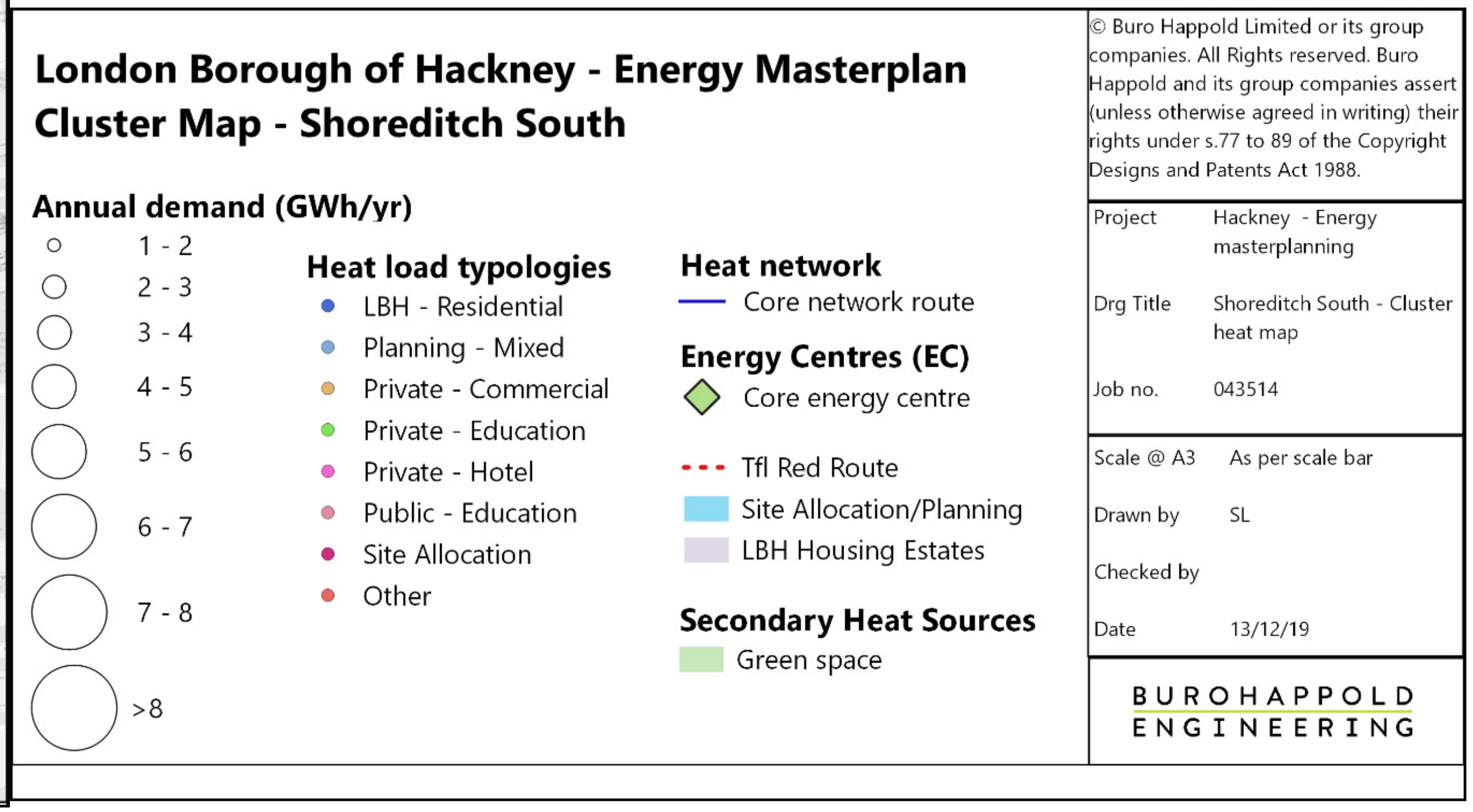


Figure 7.10: Shoreditch South network route

Upon analysis of the Shoreditch area, it was agreed with LBH to omit it from further study in this masterplan due to the complex 3rd party engagement required – with a preference to focus on opportunities within LBH control. The major physical constraints in the area are that cluster is bounded by two TfL red routes around Old Street.

Table 7.28: Shoreditch (South) network metrics

Metric	Unit	Whole network
Heat Demand	MWh/yr	20,274
Heat Density	kWh/km²	74
Percentage of heat load public sector	%	0%
Percentage Heat load Tier 1	%	79%
Energy Centre Technology	-	Air source heat pump, ground source heat pump, connection to other existing district heating schemes such as Bunhill and Citigen.

Proposed connections

Table 7.29 outlines the potential connections identified for the Shoreditch south cluster.

The majority of sites within this area are included in the site allocation local plan (SALP) and therefore expected to undergo renovation or redevelopment. Bishopsgate Goods Yard is the largest development site with a potential load of 7,786 MWh/yr and construction of multiple energy centres.

Table 7.29: Proposed connections for Shoreditch South cluster

Site	Description	Heat Supply	Heat Load (MWh/yr)	Cooling load (MWh/yr)	Tier	Source of Demand	Ownership	Status	No. units/ GIA(m²)
One Crown Place	Offices with planning for extension	Proposed CHP and gas boilers	1,674	1,333	1	Planning Energy Statement	Private	Existing	Flexible office space with 247 residential units, 32 bed hotel. TFA 23,913 m². Planning (2015/0877) granted in 2015
Bishopsgate Goodsyard	Planned development site for mixed use	Proposed multiple energy centres – each with CHP	7,786	6,597	1	Planning Energy Strategy	Private	Pre-Planning	Up to 1,356 residential units, with ~ 69,300m² non- residential space (2014/2425)
Shoreditch Village Phase 2	Planning granted	ASHP and PV	364	787	3	Energy strategy	Private	Planning	1,199 sqm retail, 6,703sqm office, 1,017sqm mixed (2017/0598)
Principal Place development	Planning granted	Proposed gas boilers (look to connect to bishopsgate goodsyard when built)	4,185	6,820	1	Planning documents & benchmarks	Private	Planning approved	Total of 329 resi units, 76,530 sqm (B1) office space, 2,506sqm retail space (2011/0698)
London College of Fashion	Education building	Gas Boiler	522	133	2	Non- domestic EPC	Private	Existing	3412 m²
Telephone House	Offices	Grid supplied electricity	787	-	2	Non- domestic EPC	Private	Existing	Unknown GIA
Development House	Planning granted for development of 10 storey office block	Proposed communal gas boilers	271	322	3	Energy Strategy and benchmarks	Private	Planning granted 2017/4694	c. 76,650 sq ft flexible office space
Stapleton House	Offices	Grid supplied electricity	342	209	3	London Development Database	Private	Existing	2430 m²
Crowne Plaza Hotel	Hotel	Gas boilers	1,294	696	1	Non- domestic EPC	Private	Existing	8926 m²
Nobu Hotel	Hotel	Grid supplied electricity	1,087	585	1	Non- domestic EPC	Private	Existing	7500 m²
Summit House	Offices	Gas boilers	755	817	2	Non- domestic EPC	Private	Existing	9500 m²
Paul Street East	Student Residential	Grid supplied electricity	593	-	2	Non- domestic EPC	Private	Existing	4905 m²
Point A Hotel	Private Hotel	Gas boilers	614	331	2	Non- domestic EPC	Private	Existing	4241 m²

Technology options

Shoreditch South is a very constrained area, presenting very few low carbon sources and therefore air-source or ground-source heat pump solutions are likely most suitable. The combination of simultaneous cooling loads in the area lends itself well to an energy sharing system – either through a 2-pipe ambient loop system or centralised energy sharing system with a more conventional 4-pipe system (separate heating and cooling networks).

The site is also located close to existing heat networks. To the west are Citigen and Bunhill heat networks, both of which are interested in further expansion of the network. The Citigen network also includes cooling.

A potential solution for this cluster would be to connect to the Citigen heat network supplied from Charterhouse Street, Farringdon. Here, there are 2no. 4.3MWe CHPs, 3no. 3MWth gas boilers, 3no. 1.1MW LV electric chillers, 1no. 3MW HV electric chiller and 320m3 thermal storage. This network is operated by E.ON UK with approximately 9MW heating resilience and the ability to expand. It is understood that they are investigating expansion and long-term decarbonisation.

Funding will be required to cross the City Road red route in order to connect to the Bunhill district heat network. The cost indicated by Islington Council for this is in the region of £1m, based on previous discussions with TfL.

Next steps

As the Bishopsgate development is likely to be a major load and is in pre-planning stage, it is recommended that LBH engage with the developers to ensure that their energy strategy is providing a long-term low carbon strategy, including reviewing the potential for energy sharing. In addition, LBH should encourage future proofing the proposed energy centre development to serve the wider area.

Sites outlined in the SALP 2016 show that the area will mean the addition of more high-rise buildings, most of which will be privately owned. LBH should ensure that these developments are futureproofed for heating/cooling network connection.

Opportunities and Constraints

Opportunities
▪ Future network expansion - Close proximity to the Bunhill and Citigen heat networks which are interested in expanding futher
▪ Future load potential - The upcoming development at Goodsyard will provide a major anchor load and basis for a heat network in the future. The mixed use site that is undergoing planning, could see a heat demand up to 7,786 MWh/yr and could provide space for an energy centre to serve the wider area.
▪ SALP 2016 suggests the area is likely to see increased development density.
▪ Energy sharing - The mix of development means simultaneous heating/cooling is expected. Energy sharing (e.g. capturing waste heat) between buildings can maximise system efficiencies.
Constraints
▪ Private ownership - With the majority of connections being privately owned, significant stakeholder engagement is required to secure a scheme and co-ordinate plant replacement
▪ TfL Red Route - Two TfL red routes intersect through the cluster making the network crossings likely difficult and costly.
▪ Connection readiness - There are several site allocations in this cluster meaning although there is potential for many connection ready buildings, this is unlikely to be in the near future.

7.2.5 Hackney Wick

The previous Hackney Wick and Fish Island feasibility study identified potential for a network in the Hackney Wick area, which has also been picked up as a cluster through this Energy Masterplan.

See Chapter 3 for an update of how the scheme is being developed here in section 5.2

Table 7.30: Hackney Wick network metrics

Metric	Unit	Whole network
Heat Demand	MWh/yr	18,180
Heat Density	kWh/km²	38
Percentage of heat load public sector	%	3%
Percentage Heat load Tier 1	%	89%
Energy Centre Technology	-	Heat pumps – water source, ground source, air source. Connection to Kings Yard energy centre – CHP, biomass, potential connection to Meridian Water heat network

Figure 7.11: Hackney Wick and Fish Island network route

Proposed connections

Table 7.31: Hackney Wick proposed connections

Site	Heat Load (MWh/yr)	Tier	Source Energy Data	Ownership	Status
Trowbridge Day Centre	272	2	DEC	Public	Existing
Gainsborough Primary School	335	2	DEC	Public	Existing
51 Wallis Road	575	1	EPC	Private	Existing
Here East	12,646	1	EPC	Private	Existing
Corsley Way	0.225	3	EPC	Public	Existing
Southmoor Way	446	2	EPC	Public	Existing
Osborne Road	1,680	1	EPC	Public	Existing
Daintry Way	330	2	EPC	Public	Existing
Eastwick Phase 1	1,237	1	EPC	Private	Existing
80-84 & 88 Wallis Road	328	3	EPC	Private	Existing
75-89 Wallis Road	328	3	EPC	Private	Existing

Opportunities and constraints

Opportunities
▪ Future network expansion - Close proximity to the Olympic Park heat network which is interested in expanding futher
Constraints
▪ LLDC Planning control - Until planning control is handed back to Hackney Council, there is limited opportunity for the Council's involvement in setting up decentralised energy in the area.

8 Retrofit

8.1 Introduction

Decarbonising existing building stock is a challenge across the UK. District heating, as an active technology, will play some part in decarbonisation. Buildings connecting to district heating where they have previously been using individual systems such as gas boilers will require retrofit in order to install a district heating plate heat exchanger or heat interface unit. There are a large number of LBH Estates, spread across the borough. The majority are individually heated with gas boilers and all will require some form of intervention to meet carbon targets (see Figure 8.1).

Passive interventions should also be considered as part of a holistic approach to decarbonisation through retrofit of existing building stock. Improving fabric performance of buildings reduces heat demand, resulting in alleviation of fuel poverty and improved thermal comfort for building occupants. The scope of this study does not include passive interventions; however, cluster analysis does recommend some example projects which Hackney Council could consider as demonstrator projects for holistic retrofit, especially to the Hackney Homes owned building stock.

Suitability of buildings retrofit for heat networks should be assessed on a case by case basis considering proximity to heat networks, technical constraints and commercial constraints.

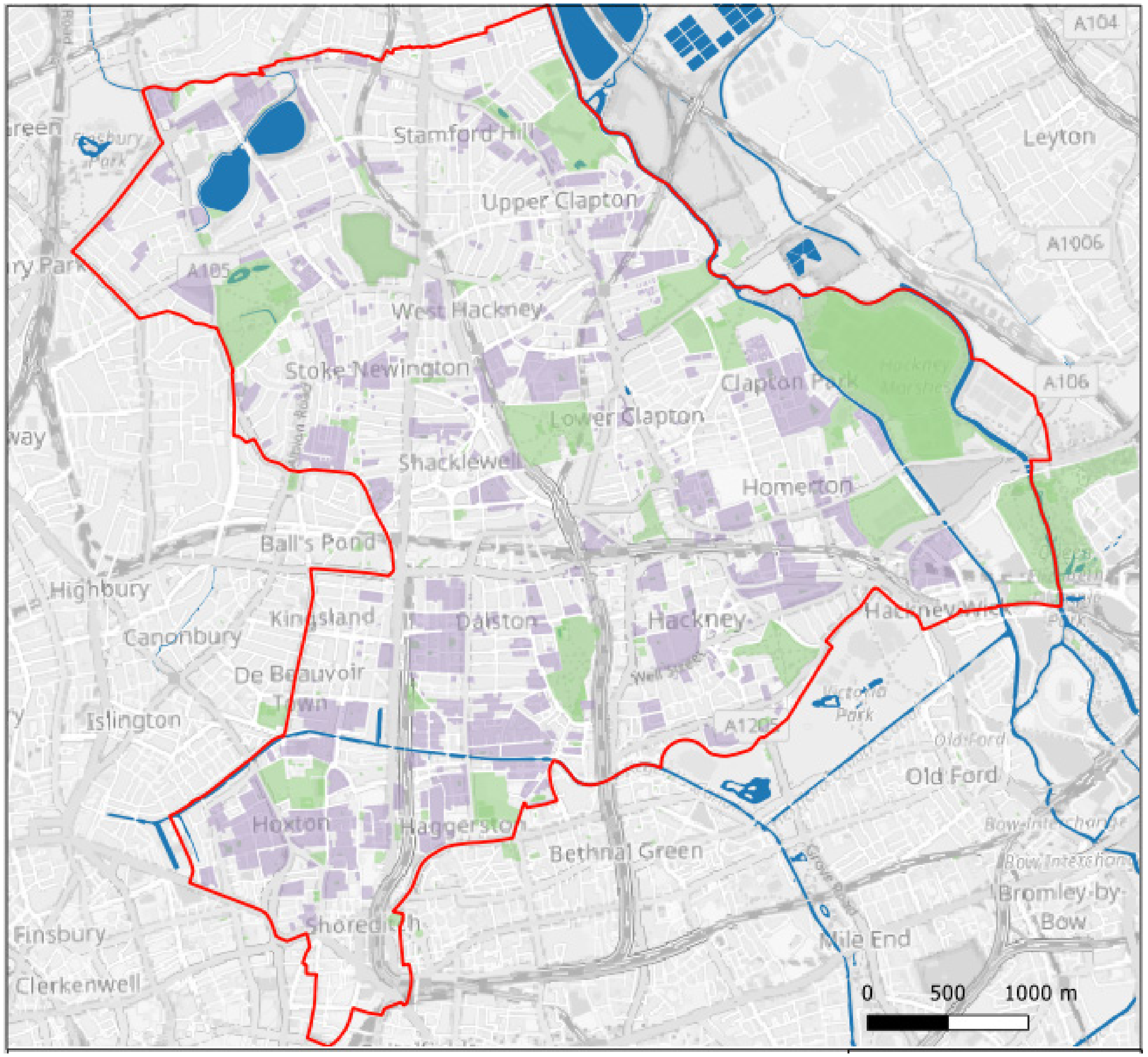


Figure 8.1: Map showing number of LBH housing estates (purple: LBH housing estates)

8.2 Requirements

With district heating operating most efficiently at lower temperatures, which also enable the use of lower carbon technologies such as heat pumps, retrofit is expected to be required across a range of buildings across Hackney as part of the deployment of decentralised energy systems. Existing systems may operate at a nominal temperature regime of 82/71°C, whereas heat pump systems operate most efficiently at 70°C flow temperature or lower, resulting in lower heat output from existing radiators, which can cause thermal comfort issues. Therefore, radiators may need to be replaced with larger units.

Buro Happold undertook a study for the GLA in 2016 investigating the technical requirements and costs associated with connecting existing non-communally heated buildings in London to district heating networks. One approach is to apply a 'New Systems Retrofit' approach which ensures the building is connection ready, as illustrated in Figure 8.3.

The cost of a 'New systems retrofit' was calculated to be around £7.5k per unit (once adjusted for inflation) including the HIU, new radiators, new pipework, high level of insulation and removal of existing systems. This is assuming that pipework runs on the external façade of the building, as internally run pipework is likely to be more complex and costly.

Per m², the lowest cost typologies for conversion to district heating from gas are the low-rise low efficiency flats (£66/m²), followed by all high-rise flat typologies (£76/m²), the purpose-built flats (£84/m²) and houses (£87/m²). In absolute terms, the high-rise flat is the lowest cost (£4600/unit), followed by the low-rise converted flats (£5100/unit), then the low rise purpose-built flat (£6780/unit) and the house (£6850/unit).

The comparative average conversion costs for electric heated domestic properties are £6850 for the house, £5650 for low rise flats and £4600 for high rise flat conversions. The principal difference between costs for gas heated and electrically heated properties is the installation of the new wet heating system and associated heat emitters.

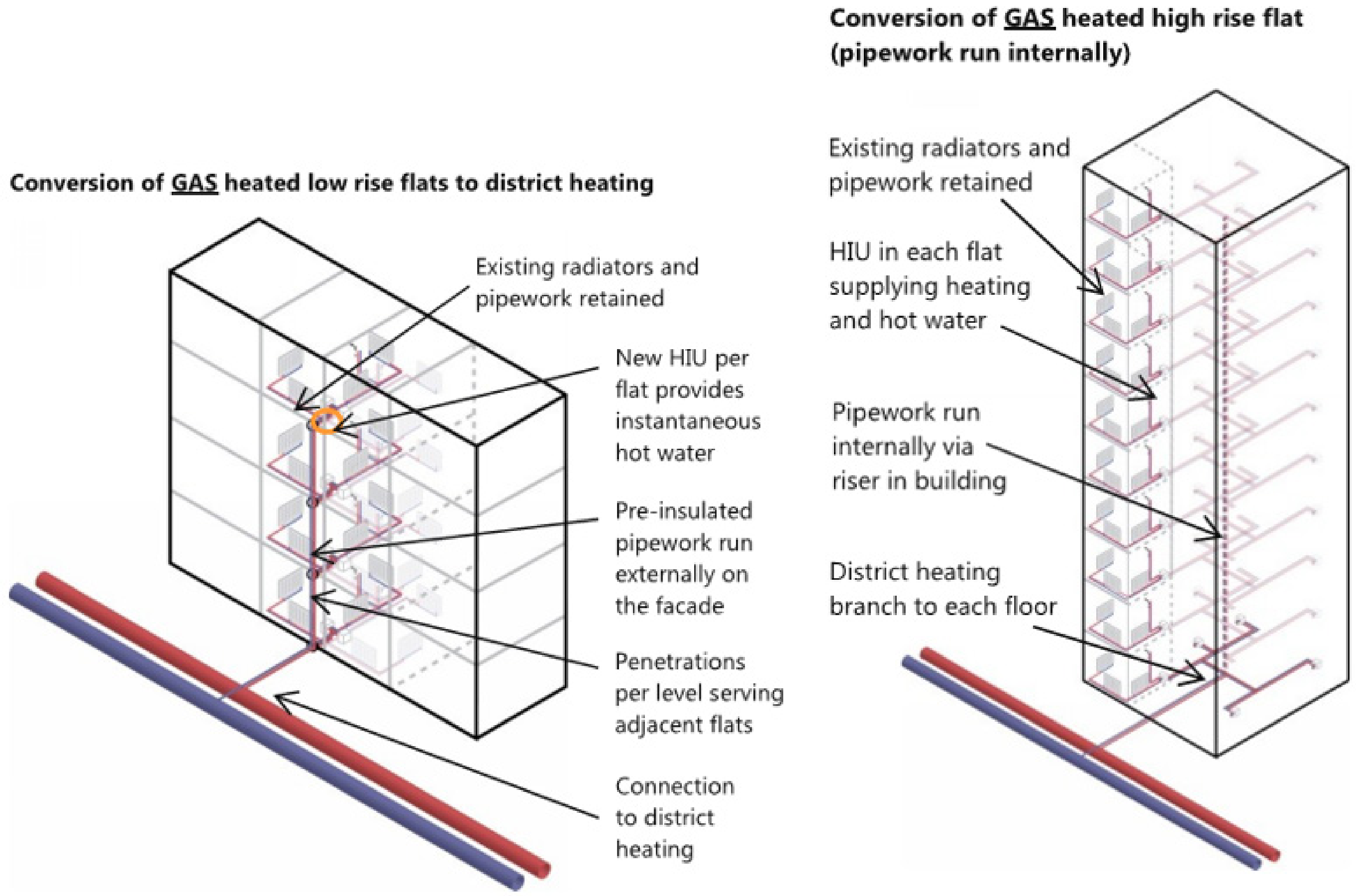


Figure 8.2: Retrofitting low rise and high-rise flats for a district heating network

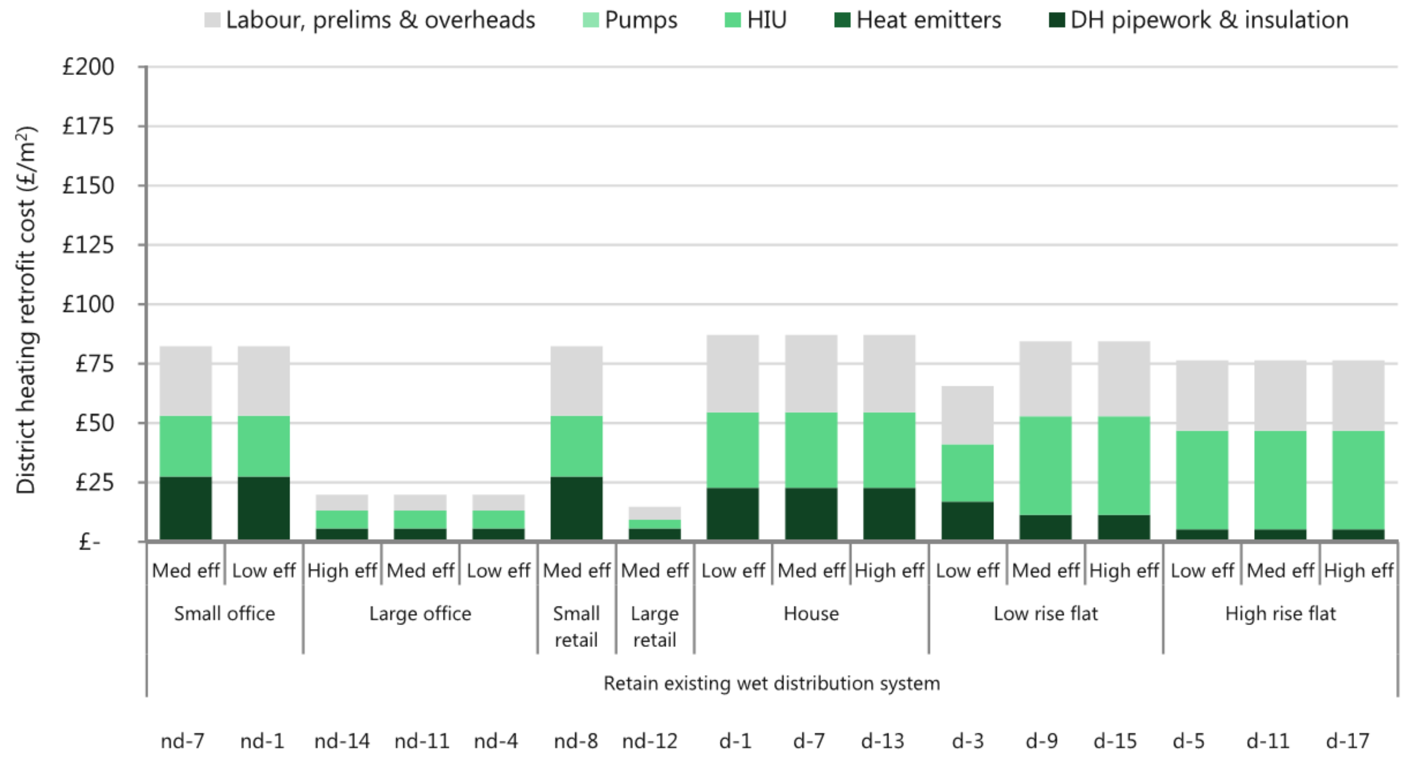


Figure 8.3: District heating retrofit costs by typology - gas conversion (Buro Happold, 2016)

8.3 Example projects

The Trelawney Estate in the Hackney Central cluster is proposed as a demonstration site for retrofitting potential due to its location adjacent to the 55 Morning Lane (Tesco) redevelopment site. Figure 8.4 shows a satellite image of the estate, demonstrating the varying height elements. It can be seen that there are five low rise residential buildings alongside three high rise.

According to the domestic energy certificates, all flats within the estate have gas boilers and radiator circuits with either cavity wall or solid brick. Both cases assume no insulation. All flats have been built with double glazing window. There are approximately 290 flats in Trelawney Estate totalling in the region of £2.2m for a 'new systems' retrofit for DHN connection.

The Frampton Park Estate is a larger estate with potential for retrofit. It includes buildings with varying degrees of efficiency; some with solid brick no insulation, some with cavity wall with insulation and some system built with insulation. Although it is a larger site, some of the properties are part way to being 'new systems' ready and therefore could be a potential for future connection.

In the event that the retrofit of Trelawney was successful, Frampton Park Estate is situated to the south of the Hackney Central cluster with a heat demand of 3,980 MWh/yr and could support expansion of that cluster.

Figure 8.4: Trelawney estate (myhackney.org)

8.4 The challenge of retrofit and connection to DHN

There are a number of constraining factors to connect these types of buildings to heat networks. These include:

- lLaseholders – in many cases leaseholders are not obliged to connect to the heat network as this is considered a change from existing leases. The number of leaseholders in a block, if not willing to connect, could damage the viability of retrofitting of a block. See ownership details for core connections below

LBH Estate	Cluster	No. units	Ownership % Hackney	Ownership % Leaseholders
Trelawney Estate	Hackney Central	291	75	25
Valette House	Hackney Central	46	65	35
Banister House	Homerton	379	69	31
Hobbs Place Estate	Shoreditch & Hoxton	175	80	20
Arden Estate	Shoreditch & Hoxton	680	69	31

- Energy efficiency / design temperatures – heat networks will ideally run at lower temperatures than traditional systems and therefore interventions are likely required in flats (e.g. new radiators and/or building fabric improvements)
- Cost – the additional cost of retrofit can challenge the viability of a heat network scheme. It may be that there is already capital budget in other pots which can be applied to these sorts of projects e.g. boiler replacements or planned refurbishments.

8.5 Funding opportunities

Retrofit Accelerator – Homes

With the support of the European Regional Development Fund (ERDF), the retrofit accelerator will aim to transition London's existing inefficient homes into low carbon homes by investing £3.6m of funding into the project. In order to futureproof these buildings, decarbonisation measures such as high-spec insulation and installation of solar PV will be implemented.

Key aims of the Retrofit Accelerator include:

- Improving the energy efficiency of existing buildings in collaboration with local boroughs and housing estates.
- Commence work on 1,600 whole house retrofits in the next three years
- Reduce the CO2 emissions associated with poorly performing buildings by over 4,000 tonnes per year
- Make funding available and low-cost finance for energy efficiency improvements.

RE:FIT – Public buildings

RE:FIT is on the of the pillars of the Mayor of London's strategic approach to climate change mitigation in London. The programme's ambition is to reach 40% of the public buildings in the city by 2025, representing an investment of £400m.

Mayor of London's Energy Efficiency Fund (MEEF)

The MEEF is a £500m investment fund established by the GLA with funding from the European Commission, seeking to provide flexible and competitive finance to enable, accelerate or enhance viable low carbon projects across London. MEEF can support energy efficiency, decentralised energy and renewable energy generation projects including innovative technologies such as energy storage and low carbon data centres. It can fund up to 100% of the capital cost of a project but can also part-fund large scale regeneration projects with low-carbon credentials.

In addition to capital funding, MEEF also has technical support funding that can be made available to support a project's business case, accelerating the due diligence process.

9 Commercial appraisal

9.1 Approach

The selected clusters were commercially assessed with a techno-economic appraisal, which estimates the return on investment over the lifetime of the project using a number of inputs. The model calculates the energy consumption of the network, the capital expenditure, operational expenditure, replacement expenditure and income from heat sales over the lifetime of the project. A sensitivity analysis was then performed to test the schemes with various levels of capital grant funding, Renewable Heat Incentive funding and heat sales price reduction. The process is summarised in Figure 9.1.

The three main financial outputs calculated are:

- Internal rate of return – the discount rate at which the project NPV is equal to zero at the end of the project lifetime
- Net present value – the cumulative present value of net project cash flow over a period of time
- Discounted payback – payback with positive net project cash flow taking into account the time value of money.

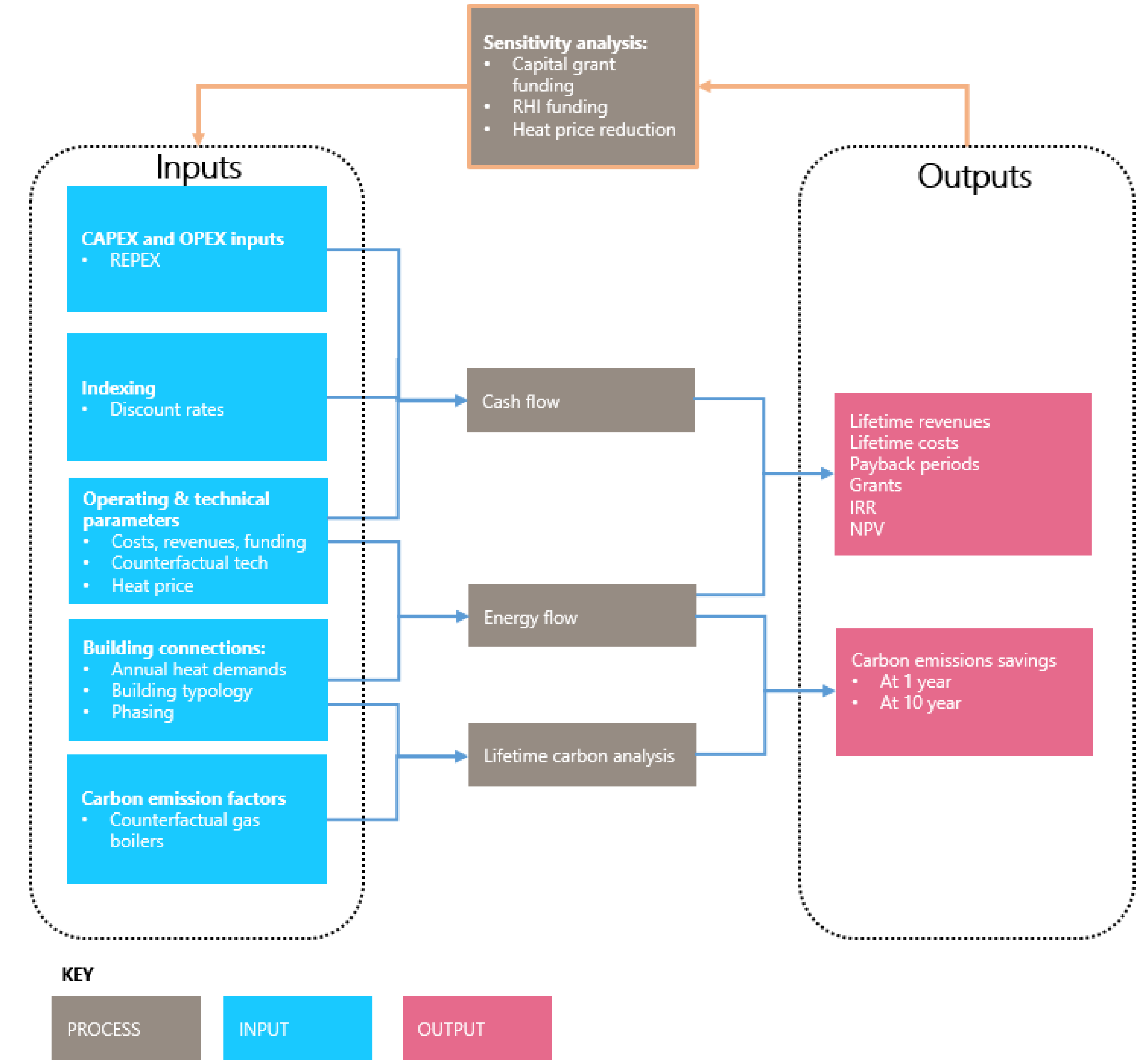


Figure 9.1: Techno-economic model process summary

9.2 Techno-economic model inputs

9.2.1 Capital costs

Capital costs for each of the core schemes for the clusters have been developed from consultation with manufacturers, industry reference data and previous Buro Happold experience of similar projects. A summary of the capex cost for each cluster are shown in Table 9.1. It should be noted that these costs are summarised, and a full breakdown can be found in Appendix B.

The distribution pipework costs are based on the required pipe capacity per connection length of pipe from the GIS core network routes shown in Section 7. For Dalston and Shoreditch & Hoxton clusters where there is any existing heat network infrastructure, this is excluded from the capex costs. Where there is a proposed network route and energy centre for the Colville and Britannia developments, this is also excluded from the capex exercise as it is assumed this cost will be embedded in the development already as construction is underway. All proposed pipework has been sized with a 30% increased capacity for future expansion. Additional pipework has been included for the heat pump option at Shoreditch & Hoxton which explains the discrepancy between the DHN costs.

A cost for retrofitting existing buildings is included within the CAPEX, depending on the type of existing heating system. The cost of the residential heat interface unit (HIU) is included in this capex and is subsequently included in the REPEX costs for lifetime replacement. Any existing boilers to be adopted by the proposed networks have allowances for replacement costs in the model through the lifetime of the scheme.

Table 9.1: Summary of CAPEX cost estimates – core schemes

Cluster – core schemes	Energy centre + LZC heat source (£m)	DH Network (£m)	Heating system retrofit (£m)	Total CAPEX (£m)
Dalston	4.2	1.5	0.9	6.6
Hackney Central	4.5	2.8	2.5	9.5
Homerton	2.4	0.8	3.3	5.9
Shoreditch & Hoxton CHP + Heat Pump	2.7	3.9	6.4	13.0
Shoreditch & Hoxton (existing CHP)	1.7	3.3	6.4	11.4

9.2.2 Opex, Repex & Business costs

Operational (OPEX), replacement (REPEX) and business costs were applied to each cluster, based on the rates shown in Table 9.2. The lifetime costs are summarised in Table 9.3.

The OPEX costs associated with Homerton University hospital are excluded as it is assumed this cost remains with the ownership of the plant at the hospital.

Table 9.2: OPEX, REPEX and Business rates

Description	Rate	Unit	Reference
OPEX: Heat supply equipment			
Air source heat pump	0.25	p/kWh	Previous Buro Happold project
Ground source heat pump	1.0	p/kWh	Previous Buro Happold project
Water source heat pump	1.0	p/kWh	Previous Buro Happold project
Gas CHP	0.7	p/kWh	Quote from Edina
Gas boiler	0.25	p/kWh	Previous Buro Happold project/ DECC
OPEX: Network and connection equipment			
Plate heat exchangers	0.90	p/kWh	
District network	0.04	p/kWh	25
Business rates			
Staff costs	1.22	p/kWh	25 (except Homerton where a lower sales price was set due to the operation)
Business costs	0.70	p/kWh	25
REPEX expenditure			
% REPEX cost incurred	80%	% of heat supply CAPEX	Assumed. Repex is applied to the key items of plant e.g. low carbon plant, boilers, HIUs, and PHE

Table 9.3: Summary of lifetime OPEX, REPEX and business costs

Cluster	Total lifetime (30yrs) OPEX costs (£m)	Total lifetime (30yrs) REPEX costs (£m)	Total lifetime (30yrs) business costs (£m)
Dalston	2.9	4.2	5.0
Hackney Central	2.7	2.9	4.7
Homerton	1.1	1.3	1.2
Shoreditch & Hoxton CHP	4.3	5.9	6.0
Shoreditch & Hoxton CHP+ HP	7.1	5.0	6.0

9.2.3 Heat sales price

The heat tariffs for DHN projects are often difficult to determine as it comes down to a number of factors. The cost of heat for the DH case must be equal to or lower than the Business as Usual (BAU) case to make DH a viable option. The retail cost could then potentially be reduced depending on financial performance of the scheme, to pass on savings to residents and LBH.

The assumed heat prices for residential and commercial connections are shown in Table 9.4, split into standing charge and variable rate. Both rates are based on an average of several Heat Trust registered operational projects and quotes for schemes in London obtained by Buro Happold.

- The standing charge is a flat rate paid to the DHN operator for connection to the network. For heat network pricings, this is usually based on the avoided costs of connecting into the DHN compared to the counterfactual of gas boilers.
- The variable rate is the price paid per unit of heat consumed by each customer – again usually based on the fuel cost to deliver a kWh of heat compared to the counterfactual. E.g. cost of gas per kWh divided by the boiler efficiency.

The heat price at this stage is indicative and subject to change. There is currently no regulatory body for the supply of heat from DHNs however the heat pricing strategy will need to comply with the Heat Network (Metering and Billing) Regulations 2014 . All schemes Buro Happold have based the heat price are based on are Heat Trust compliant - in-lieu of official regulation for heat networks the Heat Trust is a not for profit company focussed on customer protection for the district heating sector.

Table 9.4: Heat price – residential and commercial

	Variable rate (p/kWh)	Standing charge – resi (£/yr)	Standing charge – commercial (£/kW)
Residential	5.6	328	-
Commercial (Bulk)	4.2	-	24

It should be noted that the performances of the schemes are typically very sensitive to heat price. It is understood from conversations that Shoreditch Heat Network is charging residents a much lower rate (possibly as low as 2p/kWh) for their heat and therefore the network is likely operating at a loss – expansion of this cluster may be challenging at these current tariffs, the modelling has been carried out at those tariffs presented in the above table.

9.2.3.1 Carbon emissions inputs

The carbon emissions of the proposed schemes were analysed using average carbon equivalent factors for UK grid electricity and gas from BIES. A carbon equivalent emissions factor is the mass of carbon dioxide (CO2), methane and nitrous oxide emitted for each unit of energy consumed (kgCO2e/kWh). BEIS produce annual projections of these factors for the UK. Figure 9.2 shows the electricity carbon factor is forecast to decrease significantly in the next 30 years due to increased uptake of renewable energy generation on the grid. These are modelled following the BEIS indexed grid average consumption-based (commercial/public sector) values. The grid gas emission factor remains constant over the 30-year lifetime at 0.184kgCO2e/kWh (the 2018 BEIS gross calorific value factor).

The DHN emissions are compared against the counterfactual case (individual gas boilers) to determine relative carbon savings. The difference between each cluster's energy centre emissions and the counterfactual case equates to the scheme carbon saving.

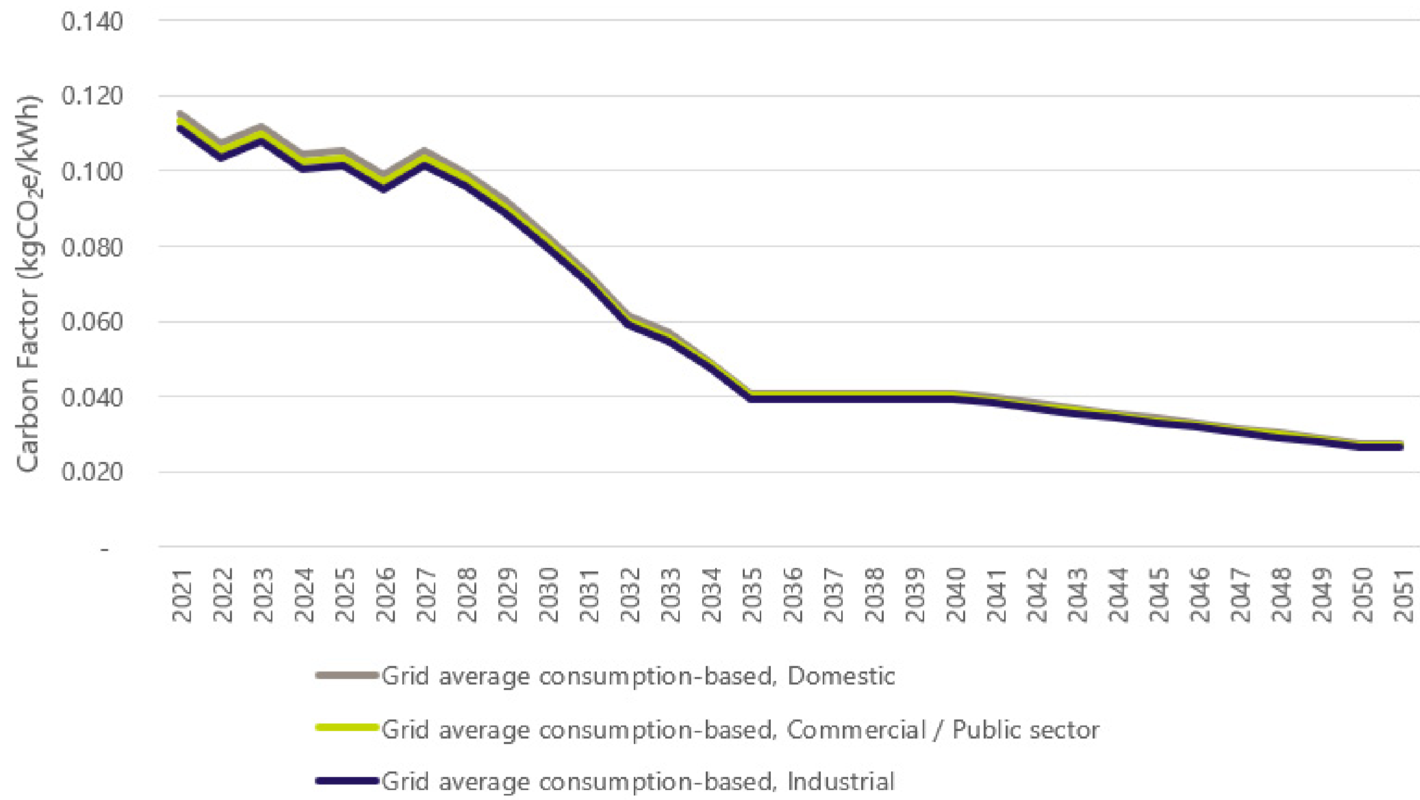


Figure 9.2: BEIS indexed grid electricity carbon factors (2019)

9.3 Techno-economic model results and analysis

9.3.1 Results summary

The results from the techno-economic model (TEM) are summarised in Table 9.5. The results show that Dalston and Shoreditch & Hoxton clusters will achieve a positive payback within a 30-year scheme (assuming a discount rate of 3.5%). This is based on the conservative approach of assuming no capital funding or RHI payments. It should be noted that for Dalston and Hackney Central, a connection charge is included for the new developments at 55 Morning Lane and Kingsland Shopping Centre. Hackney Central and Homerton schemes result in both a negative payback and IRR and would therefore require significant capital funding to meet minimum hurdle rates. See section 7.5 for available funding streams.

Note that LBH Finance team have indicated a minimum IRR hurdle rate of 6% for typical investments and therefore all these schemes would require additional financial support to achieve this IRR over a 30-year period.

Table 9.5: TEM results summary

Option	Low carbon technology	NPV @ 10 years	NPV @ 30 years	IRR @ 30 years	Capital costs	DH emissions saving @ year 1	DH emissions saving @ year 10	Energy centre lifetime emissions (over 30 years)
Unit		£m	£m	%	£m	%	%	tCO2e
Dalston	ASHP	-3.2	0.59	4.2	6.6	62	66	26,620
Hackney Central	ASHP	-7.7	-5.7	N/A	9.5	61	65	25,580
Homerton	ASHP	-5.3	-4.4	N/A	5.9	77	82	4,900
Shoreditch & Hoxton	CHP	-4.9	2.07	5.0	11.4	-13.7	-59	188,820
Shoreditch & Hoxton	GSHP, WSHP & CHP	-6.8	0.17	3.6	13.0	20	4	105,475

9.3.2 Cluster results

Figure 9.3 and Figure 9.4 show examples of the cash flows for the Shoreditch and Hoxton (CHP and HP) and Hackney Central (ASHP) clusters respectively. A positive NPV is achieved after 30 years by implementing the combined CHP and heat pump solution for Shoreditch and Hoxton.

Hackney Central fails to reach a positive NPV at 30 years. This could be contributed by the capex of a new energy centre and plant. In addition, the majority of connections are commercial and therefore tend to present a large peak, but lower annual demand compared to other clusters eg. Dalston.

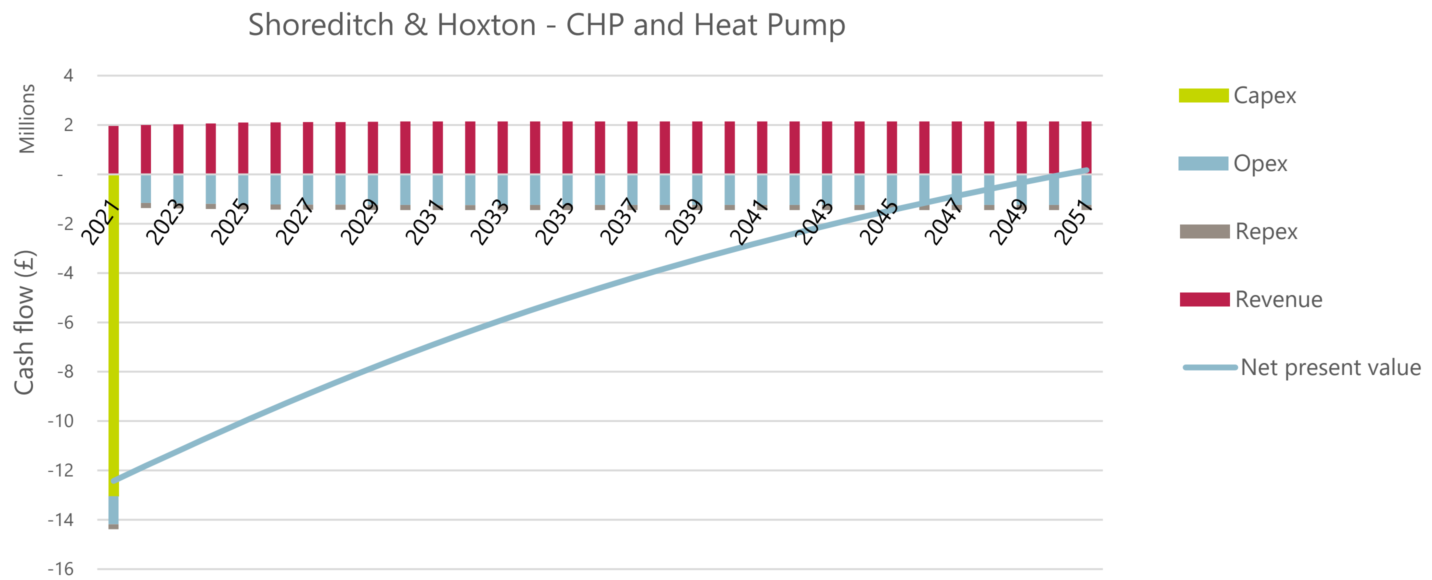


Figure 9.3: Base case cash flow and NPV – Shoreditch and Hoxton cluster

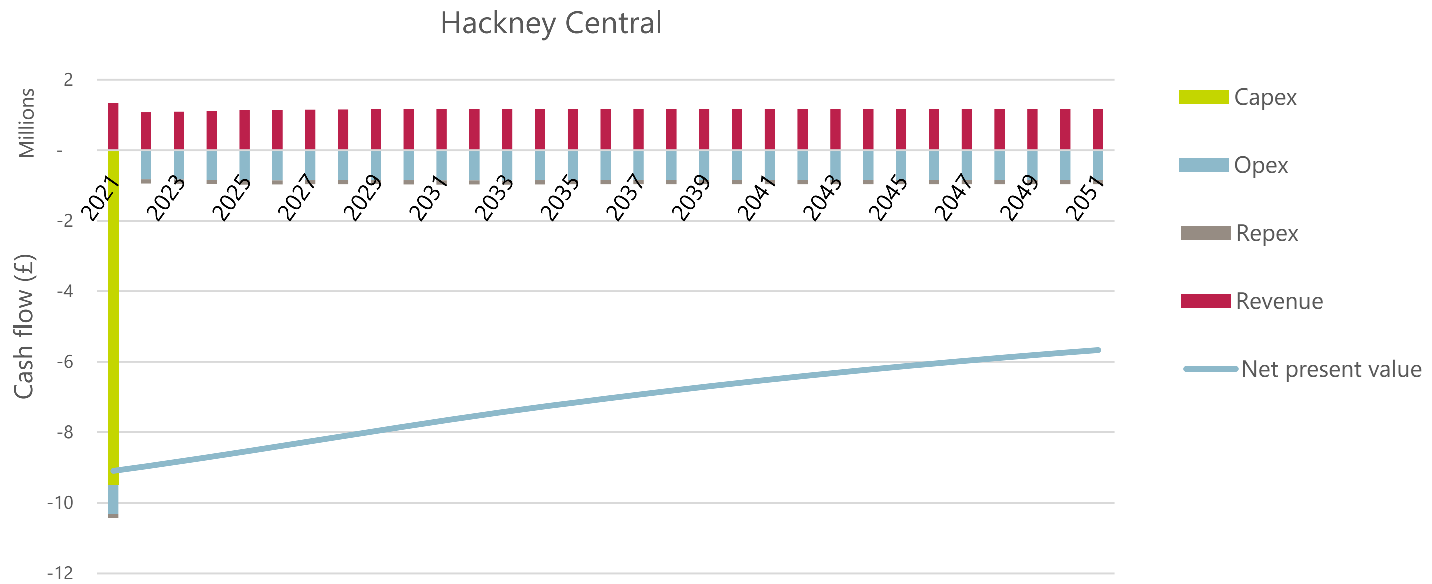


Figure 9.4: Base case cash flow and NPV – Hackney Central cluster

9.3.3 Sensitivity Analysis

Four key sensitivities have been investigated to understand the impact on commercial performance:

- RHI funding
- Variable heat price
- Capex funding
- Retrofit capex.

RHI funding

RHI funding has the potential to increase the commercial appeal of a scheme by raising the IRR. As this funding ends in 2021, it is important to understand the commercial performance without the funding. Table 9.6 outlines the NPV and IRR for each scheme with RHI and without RHI. This comparison can be clearly seen in Figure 9.5.

Without RHI, Dalston and both Shoreditch and Hoxton schemes achieve a positive IRR. RHI cannot be obtained for the CHP option, therefore the IRR does not improve. The increase for the Shoreditch and Hoxton heat pump option still contains a CHP and therefore the increase is not as high as the Dalston scheme.

RHI funding enables Hackney Central to achieve a positive IRR, although it is still unlikely to meet hurdles rates for investment. RHI is not sufficient to make the Homerton scheme commercially feasible.

Table 9.6: NPV and IRR with and without RHI

Cluster	NPV @ 30 years without RHI	NPV @ 30 years with RHI	IRR @ 30 years without RHI	IRR @ 30 years with RHI
Dalston	0.6	4.1	4.2%	8.6%
Hackney Central	-5.7	-2.4	N/A	1.0%
Homerton	-4.4	-2.6	N/A	N/A
Shoreditch & Hoxton CHP	2.1	-	5.0%	-
Shoreditch & Hoxton CHP + HP	0.17	3.4	3.6%	5.7%

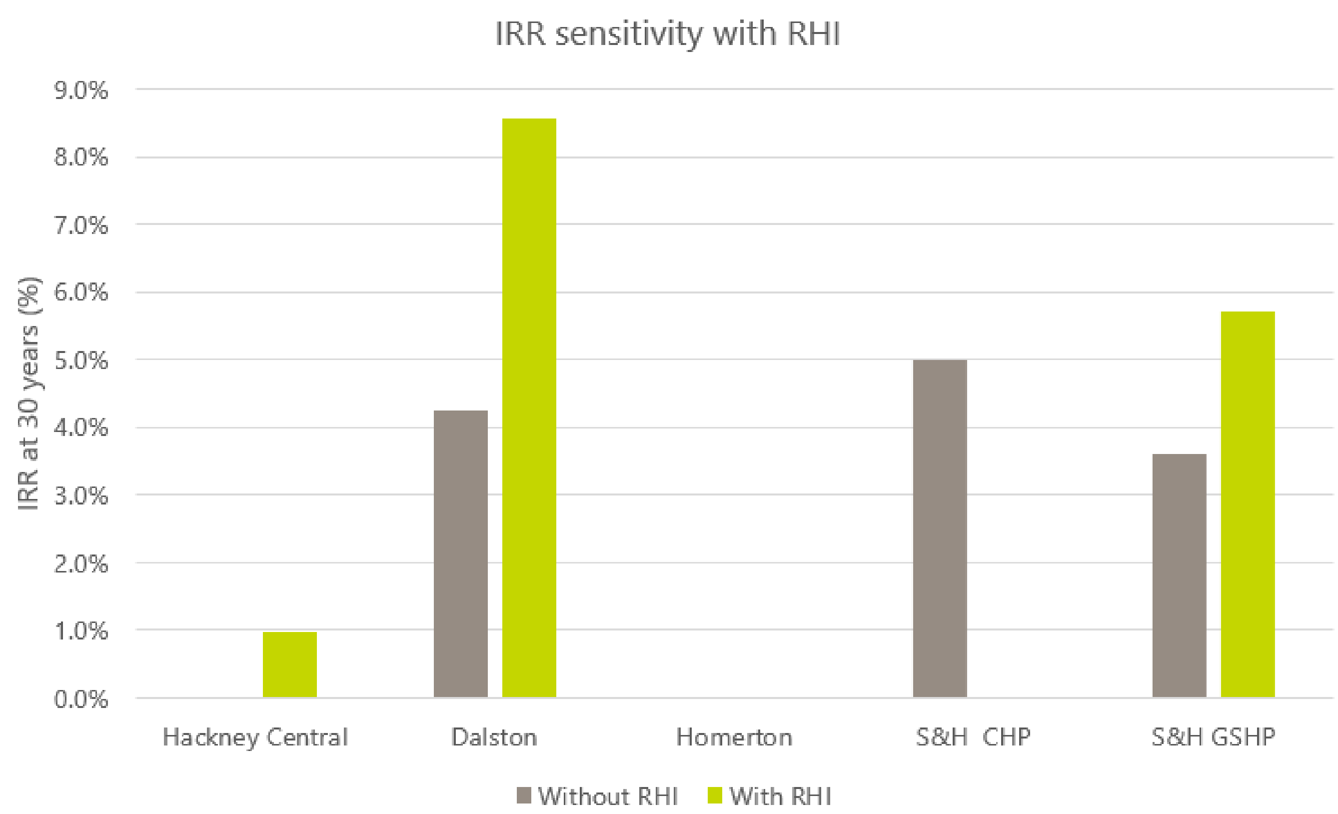


Figure 9.5: Sensitivity of RHI funding on IRR at 30 years

Variable heat price

Figure 9.6 shows the scheme sensitivity to varying the heat price. The ASHP option for Dalston generates the greatest IRR of 9.1% after 30 years. A 10% decrease in heat price from the base case approximately halves the IRR that is achieved, showing a strong sensitivity.

The gas CHP at Shoreditch and Hoxton demonstrates the least sensitivity to the heat price. The scheme is able to achieve a positive IRR even at a 20% decrease in heat price.

Changing the heat price does not enable the Homerton scheme to become commercially viable.

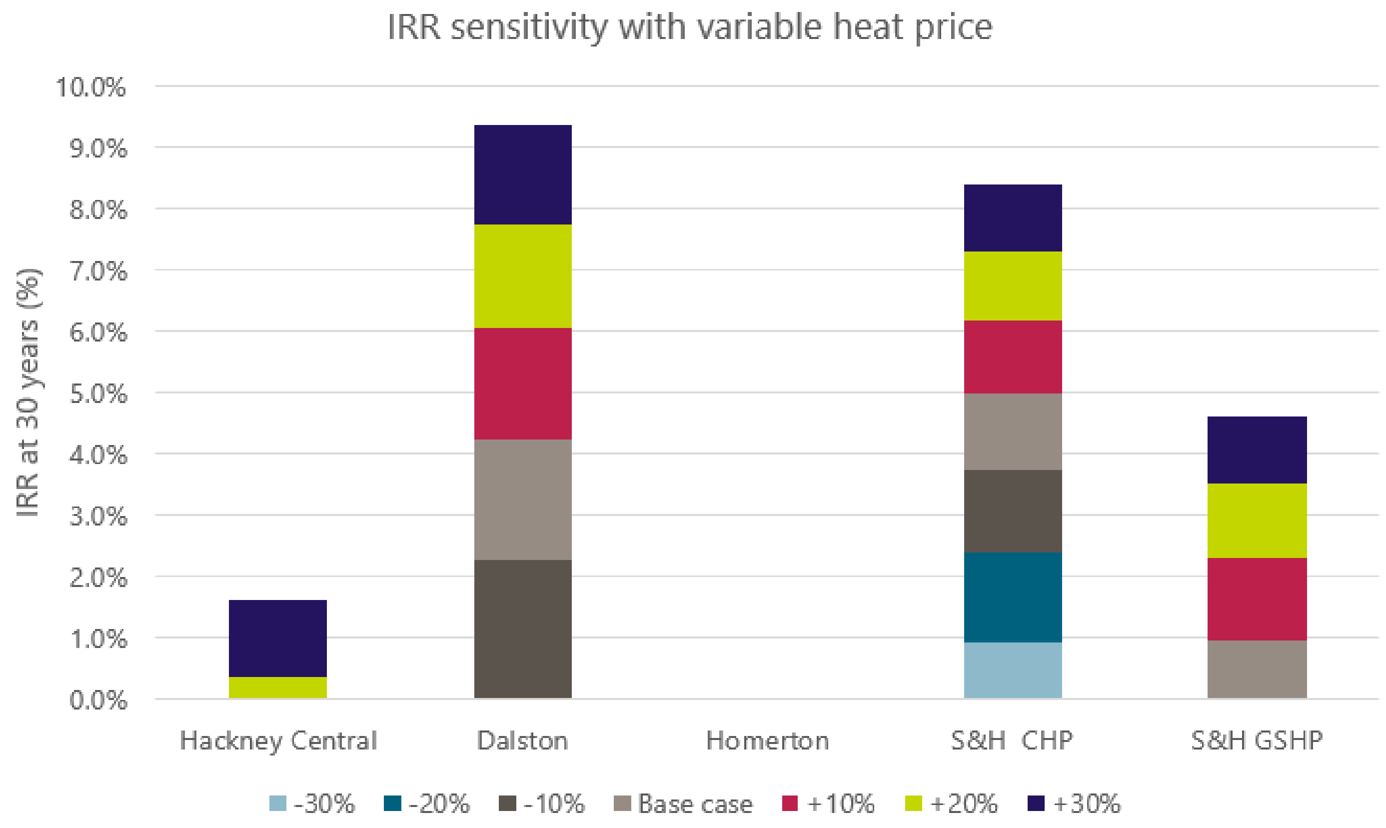


Figure 9.6: IRR sensitivity with variable heat price at 30 years

Retrofit capex

In all schemes, retrofit is a necessary requirement prior to connecting to a heat network. The associated capex could significantly affect the commercial performance of the scheme if funding is not provided. A sensitivity is carried out to understand the impact of the isolated retrofit costs. Figure 9.7 demonstrates that even if the retrofit costs were covered by an alternative funding stream, Hackney Central and Homerton schemes fail to produce a positive IRR after 30 years.

Capex funding

The final sensitivity tested was the addition of capital funding. A funding of 30% was tested against the base case of no funding. The results are presented in Figure 9.8. In the base case, only Dalston and the Shoreditch and Hoxton schemes produce a positive IRR. With funding, Hackney Central marginally produces a positive IRR and further funding may be able to improve performance. In both scenarios, the Homerton scheme fails to demonstrate a successful business case.

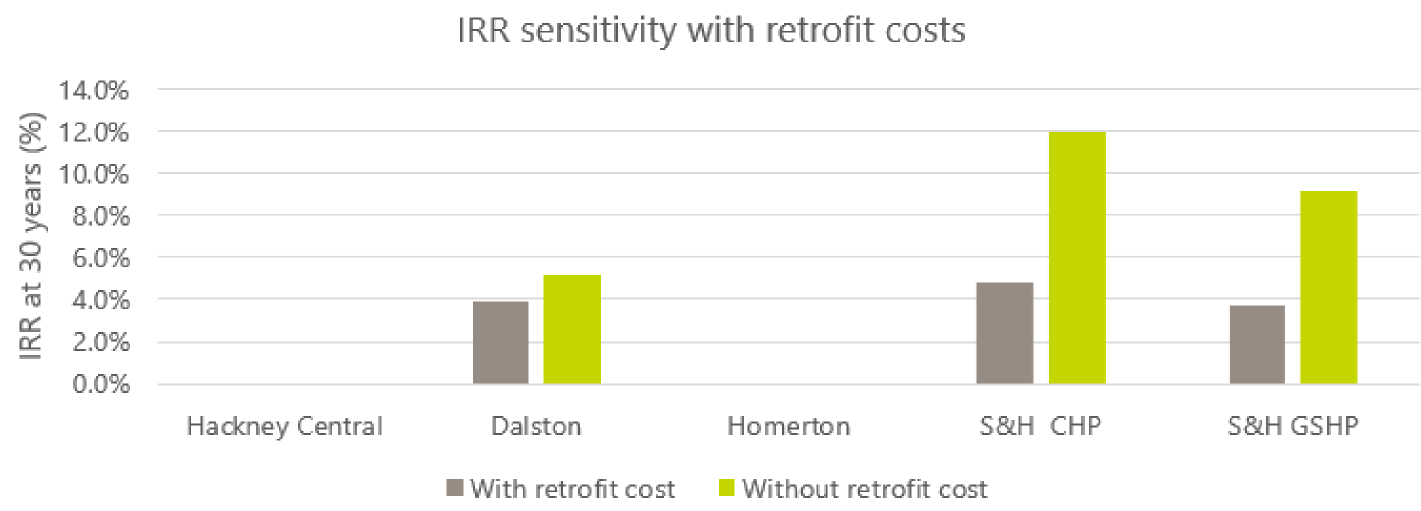


Figure 9.7: IRR sensitivity with retrofit costs at 30 years

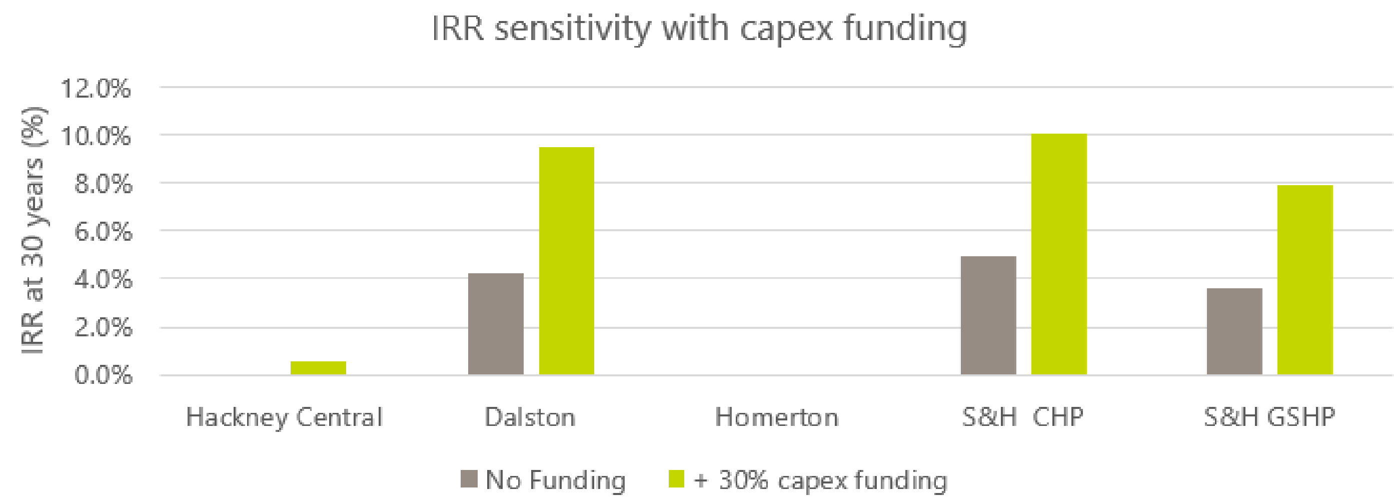


Figure 9.8: IRR sensitivity with 30% capex grant funding at 30 years

9.3.4 Carbon results analysis

Figure 9.9 shows the projected carbon savings of each cluster over 30 years compared to the counterfactual case of gas boilers in each connection. The counterfactual of existing CHP in SHN, Dalston and Homerton clusters would mean that the overall savings for these would likely be larger than presented herein. The carbon savings over scheme lifetimes have been calculated using the BEIS energy and emissions projections .

All clusters except Shoreditch & Hoxton achieve significant carbon savings over the 30-year period. By reducing the size of the CHP at Colville energy centre to approximately 700kWth and installing a GSHP and sewage heat recovery, emissions are reduced over 30 years compared with the counterfactual. For the full CHP solution, there is a 63% increase in emissions. At the end of the lifetime of the CHP (typically 15 years) it would be recommended to replace with an alternative heat pump solution to deliver more significant savings.

As a result of primarily operating on heat pumps, Hackney Central and Dalston achieve the highest emissions savings compared to the counterfactual. Homerton emissions remain relatively constant as the ASHP provides low carbon heat but is counteracted by the running of the CHP.

The carbon emissions savings are predicted to increase throughout the schemes lifetime up until around the year 2040, at which point they level out. This trend is strongly linked to the carbon factor of the grid electricity used to power the heat pumps (described in Section 9.2.3.1) which shows the carbon intensity of the electricity grid declining over time.

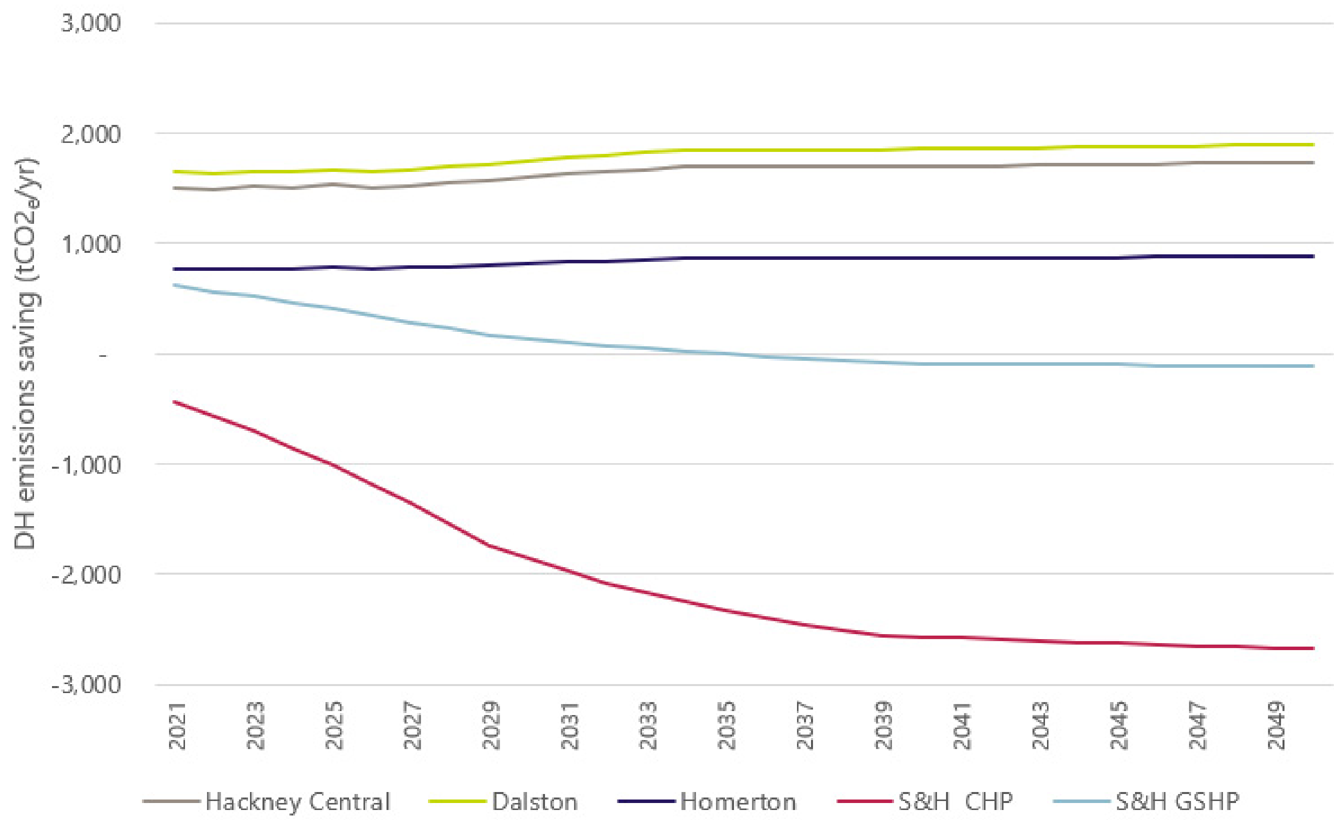


Figure 9.9: Energy centre emissions savings vs counterfactual

9.4 Funding streams

RHI funding

The Renewable Heat Incentive (RHI) is a government funding stream that provides financial incentive to increase the uptake of renewable heat within England, Scotland and Wales. Eligible installations receive quarterly payments over 20 years (non-domestic only). The RHI rate varies depending on the technology used and payments are made on a £/kWh of renewable heat generated basis .

All the schemes presented meet the eligibility criteria for the non-domestic RHI tariff. However, the scheme is due to end on the 31st of March 2021, therefore revenue from this funding stream is not included within the techno-economic model. A sensitivity analysis was carried out to see the effect on IRR if it were included.

HNIP funding

The Heat Networks Delivery Unit (HNDU) was set up to address the barriers to market faced by local authorities (LAs) for DHN project development. The HNDU provides grant funding and guidance to LAs through the early stages of heat network development, as is currently used on the energy master plan to fund a percentage of the study fee.

For the later stages of DHN development, the Heat Networks Investment Project (HNIP) can provide capital investment to support with the associated costs of construction, operation and maintenance of a DHN. The scheme will provide £320 million of capital funding to gap fund heat network projects in England and Wales . The BEIS typical project development lifecycle and HNDU and HNIP funding timeline is shown below.

To be eligible for HNIP funding the scheme must deliver a minimum of 2GWh/yr of heat. The network must also meet one of the following heat source requirements :

- 75% of the heat from CHP (which can include non-renewable fuel source)
- 50% of the heat from a renewable source
- 50% of the heat from any combination of renewable or recovered heat and non-renewable fuelled CHP.

ECO funding

The Energy Company Obligation (ECO) is a government energy efficiency scheme to reduction carbon emissions and reduce fuel poverty. This funding stream is aimed at retrofitting old, inefficient housing. The main eligibility criteria is dwellings with an EPC rating of E or below.

GLA DEEP funding

The Decentralised Energy Enabling Project (DEEP) supports London boroughs to develop decentralised energy (DE) projects, including heat networks. It can give technical, financial and commercial advisory help for large energy projects. The predecessor to DEEP, the DEPDU (Decentralised Energy Project Delivery Unit), has supported 13 decentralised energy projects to market; worth a total of £100 million in investment potential.

The project can fund all work (excluding capital) related to DE projects from an early stage of energy master planning, through to feasibility, business case, procurement and commercialisation.

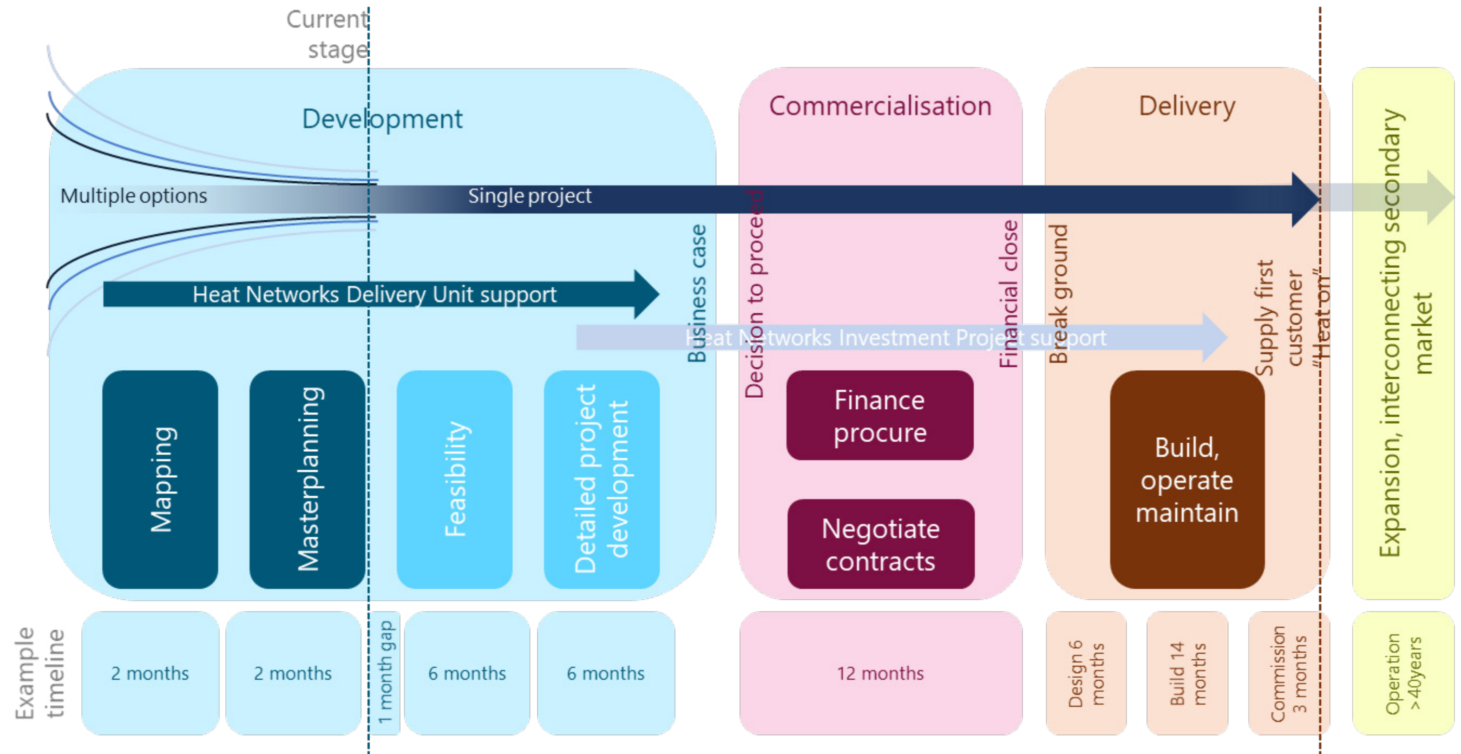


Figure 9.10: HNDU and HNIP funding timeline

MEEF funding

The Mayor's Energy Efficiency Fund (MEEF) provides flexible and competitive finance as well as other funding options to aid delivery of new low carbon technology, over an investment period of 20 years. This is part funded by the GLA through the European Regional Development Fund (ERDF).

MEEF can support energy efficiency, decentralised energy, and renewable energy generation projects, including innovative technologies . Key metrics include:

- £500m fund size
- Invest across the capital structure, with rates as low as 1.5% for up to 20 years
- £2m of technical support funding available to support a projects business case.

Carbon offset fund

Where the London Plan carbon reduction targets for new developments cannot be met (due to technical or commercial feasibility), developers must contribute to a carbon offset fund which will go towards funding the off-site CO2 reduction measures.

To date, the financial contribution for all major developments (above 10 residential units or GIA of over 1,000m²),is based on the product of an established price (currently set at £60/tonne per year) and the shortfall in CO2 tonnes saved below the minimum threshold over 30 years. However, in light of the recent local plan updates , all developments (major and minor) will now be required to offset at a cost of £95/tonne where targets are not met. The revenue received by LBH from this is ring fenced for off-site carbon emission reduction and sequestering projects within the borough. There may therefore be opportunity to secure some of this funding stream for the development of a district heat network.

9.5 Procurement strategy

The procurement strategy for any of the proposed schemes needs to address all works and services required to deliver the project, considering risk allocation and mitigation.

Successful delivery of a project will require careful identification, description, design and installation of the scheme followed by effective operation. The responsibility for ensuring an efficient affordable system changes during the implementation of the project (initially being with Council officers, then technical advisors, then the contractors' designers, installers and operators) and care needs to be taken to ensure the efficiency of the project remains intact.

Alternative procurement routes have been considered and are illustrated in Figure 9.11 ranging from self-delivery where LBH retains most risk through to DBFOT (Design, Build, Finance, Operate, Transfer) where LBH passes as much risk as possible to a third party. The final route selected will depend on risks associated with the project. In general, a risk is best allocated to the party most able to manage it, however this transfer can come at a cost.

Balancing LBH's limited experience of delivering district heating networks on the one hand with the desire to make sure the system is economic viable for the Council and future tenants, it is likely that the preferred procurement route would be DBOM or separate DB and OM procurement. Bringing together Design & Build with Operation & Maintenance mitigates the risk of value engineering of design adversely impacting operating costs. This is particularly important for infrastructure projects with a life in excess of 50 years where short-term savings in capital cost can be more than offset by higher operating costs over the project life.

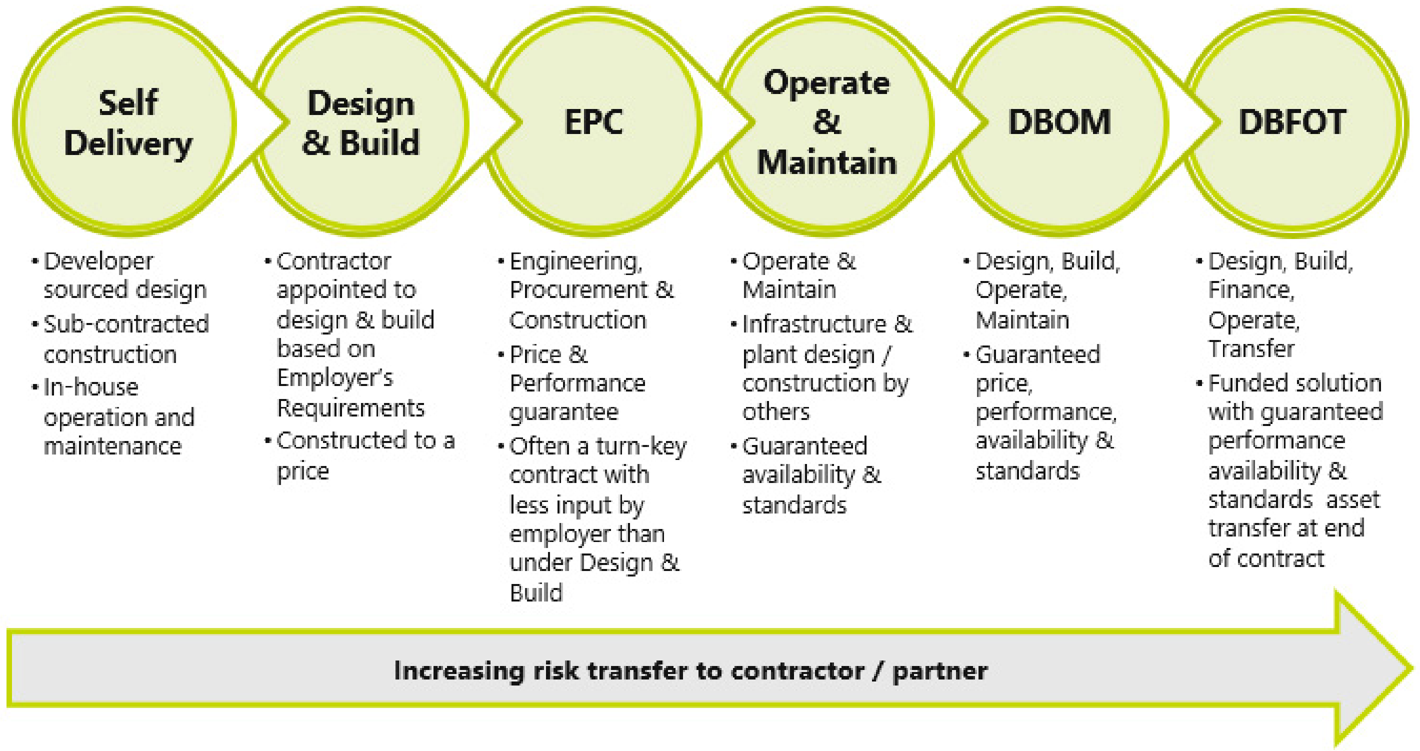


Figure 9.11: Procurement options

9.6 Commercial structures

The commercial case for any district energy project in the Borough should demonstrate that the scheme will have a viable procurement and contractual strategy that provides a sustainable basis for the long-term operation of the system.

Objectives

A commercial strategy needs to ensure that the project delivers an optimal return while aligning with the Council's drivers for low carbon development. As such it needs to consider the commercial arrangements between principal parties including Hackney Council, any potential funders / investors, contractors, suppliers and customers.

Key roles to be allocated for the development of a district heat network are given in Table 9.7. The allocation of these roles is dependent on the allocation of risks, ability to fund and requirements for participation and control.

From discussions with Hackney Council to date it is evident that creating a low carbon system and sustainable economic model are highest priorities for the scheme. There is however some tension between these objectives as low carbon technologies can be more expensive to procure and maintain.

Options available

In further development of scheme options, Hackney Council will decide what formal role they will take in the design, installation, commissioning and long-term operation of the system. If no private sector involvement is possible (e.g. due to lack of commercial performance for private sector involvement) or desired, then LBH can choose to self-deliver and operate the network. LBH has access to low cost finance through the Public Works Loan Board and other funding streams discussed within this report and could benefit from the revenue generation of the scheme.

The commercial structure options are outlined in Table 9.8. This table, provided in Code of Practice Heat Networks (CIBSE), shows that the system can be broken down as required.

Table 9.7: Key roles associated with a DEN

Role	Explanation
Property developer	Often has a limited engagement with a decentralised energy project and is mainly concerned with delivery of a real estate project including compliance with planning conditions and net floor area for revenue generation.
Asset owner	The party that owns the physical assets, such as the generation technology and associated infrastructure.
Operator	Responsible for the technical operation of the energy scheme.
Retailer	The party responsible for the retailing of energy, i.e. purchasing it from the generator, arranging transportation to the consumer and sale to the consumer.

Table 9.8: Ownership and operation options (Heat Networks Code of Practice CP1)

Option	Energy centre		Heat network		Heat supply
	Own	Operate	Own	Operate	
A	PSCo	PSCo	PSCo	PSCo	PSCo
B1	LA	LA	LA	LA	LA
B2	LA	PSCo	LA	PSCo	LA
C	SPV	SPV	SPV	SPV	SPV
D1	PSCo	PSCo	LA	LA	PSCo
D2	PSCo	PSCo	LA	LA	LA
D3	PSCo	PSCo	SPV	SPV	PSCo
E1	LA	LA	PSCo	PSCo	PSCo
E2	LA	LA	PSCo	PSCo	LA
F	COCo	COCo	COCo	COCo	COCo
LA – Local Authority PSCo – private sector company SPV – public-private special purpose vehicle COCo – community owned company					

The possible structures that are valid for the schemes discussed in this report are summarised in Table 9.9.

Table 9.9: Potential commercial structures

Commercial structure	Description
Private ESCo	Common approach whereby a private ESCo company installs, owns and operates the district heating network and acts as the energy service provider. Where the scheme is likely to be attractive to a private ESCo, this can remove any burden of operation and maintenance from the Council.
Council owned (direct involvement)	LBH undertakes delivery and operation of the project in its entirety. This will include sourcing all necessary funds, undertaking procurement, and owning and operating the scheme including acting as heat supplier to end customers. Any capacity the Council does not have in house would be contracted to third parties, e.g. through operating and maintenance contracts with equipment suppliers, and billing and metering with a dedicated company. The Council gains more strategic control, but also takes on more risk.
Council owned (DBOM)	If there is not appetite for the Council to operate the network directly, this can be done via a Design, Build, Operate and Maintain (DBOM) contract in which a private entity is responsible for design and construction as well as long term operation and maintenance. The public sector secures the project's financing and retains the operating revenue risk and any surplus operating revenue.
LBH Joint Venture	LBH enters into a formal agreement with a third party for supply of funding and / or operational and technical expertise. A Joint Venture can bring significant benefit by bringing expertise in the sector by managing delivery and operation however there needs to be a clear benefit to all JV partners.

The fundamental issue facing local authorities should they invest directly in the district heating scheme, is what the relationship is with the private sector.

The evaluation of the options usually revolves around a number of considerations:

Table 9.10: Considerations for Council involvement

Consideration	Explanation
Control vs. risk	The tensions between the desire for control over project outcomes and the willingness to take on project risk.
Commercial attractiveness	The rate of return the project will actually support and whether this will be acceptable to the private sector.
Cost of raising capital	The recognition that the cost of raising capital for the private sector is generally greater than for the public sector which, on a capital-intensive project, has a major impact on viability and ultimately on cost of heat supply.
Availability of capital	The availability of capital to both public and private sector is limited but is also closely linked to the degree of risk involved and the organisations' understanding of the risks involved.

The amount of control that Hackney Council or the various stakeholders have over the scheme may be important in achieving their overall objectives. Similarly, drivers to participate may not be sufficiently strong to ensure agreements for connection are reached. For private sector developers it is likely that some form of compulsion will be required to ensure connection, through planning conditions which require this and safeguard infrastructure and heating system types to enable future connection.

In relation to the preferred project vehicle, particularly whether or not to set up a separate operating company (Special Purpose Vehicle), it is recommended that legal advice is obtained during the initial stages of design development prior to proceeding. Issues such as State Aid, legal authority for LBH to undertake various activities, continued stakeholder engagement, impacts of the Landlord and Tenant Act, flexibility, and implications for an exit strategy will need to be considered. Where a JV was taken it is likely that establishment of an SPV would be the preferred route.

10 Conclusions and prioritisations

10.1 Key conclusions

This energy master plan updated the previous heat mapping studies within LBH and identified eleven promising areas for DHN development within the borough. These areas were quantitatively assessed based on their heat density, ownership, potential for expansion, refurbishment timescales and physical constraints. From this initial assessment, the most promising clusters were taken forward for more detailed technical design, environmental assessment and commercial analysis.

The clusters were ranked based on a mixture of key quantitative and qualitative outputs:

Table 10.1: Cluster summary

	Dalston	Hackney Central	Homerton	Shoreditch & Hoxton CHP	Shoreditch & Hoxton CHP + HP	Woodberry Down
Network:						
Annual heat demand (MWh/yr)	12,438	11,392	9,220	14,539	14,539	18,484
Heat line density (MWh/m)	3.7	7.9	14.9	5.8	5.8	6.1
No residential units on core network	1,765	895	379	3,065	3,065	550
Percentage tier 1 heat (%)	84	62	100	100	100	
Percentage public owned	5.3	67 (+33% JV)	100	60 (+40% JV)	60 (+40% JV)	100
Commercial performance:						
CAPEX (£m)	6.6	9.5	5.9	11.4	13.0	By others
LZC technology	ASHP	ASHP	ASHP	-	GSHP & WSHP	GSHP & WSHP
IRR @ 30 yrs (%) – no funding or RHI	3.9	N/A	N/A	5.0	3.6	By others
IRR @ 30 yrs (%) – with RHI	8.3	0.7	N/A	5.0	5.7	By others
IRR @ 30 yrs (%) – with 30% capex grant funding	9.5	0.6	N/A	10.1	7.9	By others
Environmental performance:						
DH emissions saving @ yr 10 (% tCO2e)	66	65	82	-82	4	By others

The key outcomes of the clusters are described below:

Shoreditch (North) and Hoxton

The viability of this cluster is underpinned by the existing Shoreditch Heat Network and planned Colville Estate Energy Centre, which is already planned to serve the Britannia masterplan. The extension and linking of these 2 networks provides the opportunity to decarbonise a large number of LBH owned estates in the surrounding area.

The existing and planned networks are currently to operate with gas CHP as the low carbon heat source. Due to the decarbonisation of the grid, gas CHP can no longer deliver long term carbon savings and therefore a transition plan is required to futureproof the networks for decarbonisation. The timing is critical as Colville Estate energy centre is due to commence detailed design in early 2020 - it is recommended that LBH consider a derogation from planning to integrate lower carbon technologies from day one. The area is surrounded by low carbon heat sources including the Regents Canal (WSHP), Shoreditch Park (GSHP), large combined sewer (sewage offtake heat pump) as well as future Crossrail 2 ventilation shafts.

The scheme shows potential from the techno-economic modelling to achieve a positive IRR before funding. A big influence on this is due to much of the infrastructure costs for the energy centres and networks already being in place for the Colville and Shoreditch networks, therefore capex is mostly networks and building connections including retrofit. The scheme also benefits from electricity sales from the CHP – which in the long term would be swapped with heat pumps and may not be able to deliver the same savings.

Hackney Central

The scheme at Hackney Central is time critical as the redevelopment of the 55 Morning Lane (Tesco site) provides an opportunity to provide futureproofed space in this energy centre to serve the wider area. The core scheme focusses on capturing largely LBH properties including the Town Hall and Trelawney Estate – this cluster could therefore be a strong demonstration project both for retrofit project and also to show that LBH are committed to their carbon targets through decarbonising their own estate. There are limited secondary heat opportunities in the area and therefore low carbon plant is likely to be via ground- or air- source heat pumps.

The financial performance of the cluster is challenging, largely due to the costs of retrofitting, however, if some of these retrofit costs can come from another capital budget (e.g. housing asset replacement fund) and/or capital funding along with RHI (or its replacement) could be obtained, then the scheme looks likely to achieve positive returns.

As a minimum, it is recommended that LBH ensure that the energy centre at the 55 Morning Lane redevelopment is futureproofed for expansion to the wider area.

Homerton

Homerton hospital is the largest individual heat load in the borough. The hospital is currently heated via gas boilers and a small gas CHP. The hospital are considering installing an additional CHP unit and also have some spare boiler capacity which they have indicated they would consider supplying outside of the hospital boundary. There are a number of Hackney owned housing estates in the area which the Local Plan LP33 identifies as with “potential for improvement”.

An ASHP alternative to the new CHP was investigated at this cluster, to serve the Banister House estate and Hospital. The economic performance of the scheme is poor without significant funding, due to the retrofit requirements. Commercial arrangement with hospital needs to come to agreement on mutually beneficial heat sales price and may need to consider other drivers for network – e.g. carbon reduction, fuel poverty alleviation – in order to make the scheme work.

There is the opportunity for expansion to the wider area including Hackney Housing estates and the Hackney Central cluster, there could also be heat supply connections to the Kings Yard Energy Centre and/or River Lea in the scheme expansion.

Initial discussions with the Hospital are recommended to understand appetite for decarbonisation and any development plans for the site.

Dalston

The Dalston cluster is the best performing in the techno-economic modelling. The trigger point for this development is the site allocation for redevelopment of Kingsland Shopping Centre. LBH should look to ensure that the development reserves space for a larger energy centre. There are limited secondary heat opportunities and therefore low carbon plant is likely to be via ground- or air- source heat pumps.

The major challenge for the cluster is that most of the developments to be connected are existing privately owned developments with their own communal systems – although this makes them easier to integrate, this level of 3rd party engagement may be challenging to secure connections in the short term.

If Crossrail 2 is realised it is likely that this will become a key growth area for the borough.

Woodberry Down

Woodberry Down Estate is a large mixed-use development site with approximately 5,500 homes. At full build out, this site could have a heat demand of approximately 18 GWh/yr. Currently, planning is granted for the construction of an energy centre with a gas CHP and another consultant are undertaking the low carbon optioneering and techno-economic analysis for this site.

There is a time-critical opportunity at the energy centre, as it is currently undergoing design, to futureproof for alternative technologies and to serve the wider area. LBH are exploring connection to the Meridian Water waste heat supply which may provide a long-term decarbonisation supply. The existing TfL ventilation shaft off Seven Sisters Road may also be able to provide secondary heat supply.

Although possible extensions identified in the area mostly do not pass initial viability assessments, except for the adjacent schools, more detailed modelling is recommended to confirm this. It may be that these connections can still meet the Community Interest Company viability thresholds with these connections, particularly if supported by funding such as HNIP.

A separate study is underway to review alternative low carbon solutions at the Woodberry Down estate and potential extensions – this will form a separate report.

10.2 Next steps

This report outlines the outcomes of work package three – energy masterplanning of the London Borough of Hackney. The three identified clusters of potential are now recommended for detailed feasibility. To conclude this stage of work, the following actions are to be completed:

- Project briefs to present business case
- Consolidated roadmap
- Explore opportunities for LBH to integrate findings into GIS system
- LBH to incorporate finding into updates of the Local policy

LBH to consider funding for further exploratory schemes:

- Develop strategy for LBH estate decarbonisation investigate asset replacement plans to identify any of the LBH estate which may be due for plant replacement / refurbishment and therefore could trigger retrofit for heat network connections
- Develop consistent heat pricing strategy across all communal heating systems / networks operated by LBH

Progression of any given cluster would require the following steps:

- Detailed feasibility
- Detailed Project Development including Outline Business Case
- Procurement and Full Business Case.

Key actions and interdependencies for individual clusters:

Cluster	Key action
Shoreditch (North) and Hoxton	▪ Futureproof Colville Energy centre design (design commences early 2020, therefore time critical) to serve the wider area and for long-term decarbonisation ▪ Consider Detailed Feasibility Study to further explore the viability and scheme requirements
Hackney Central	▪ Futureproof 55 Morning Lane (Tesco site) energy centre design – currently at preplanning stage, therefore time critical - to serve the wider area. Engage with the design team carrying this out ▪ Consider Detailed Feasibility Study to further explore the viability and scheme requirements
Dalston	▪ Ensure that the future redevelopment of the Kingsland Shopping Centre has a planning requirement for an energy system to serve the wider area
Homerton	▪ Engage with the Hospital to understand appetite for decarbonisation, serving the wider area and any development plans for the site
Woodberry Down	▪ Engage with developers (Berkeley) and design team on integration of low carbon heat source in place of CHP ▪ Consider Detailed Feasibility Study to further explore the viability and business case for the Community Interest Company including Meridian Water heat network connection scenario and TfL vent shaft

11 Risk register

DHNs require collaboration with multiple stakeholders which introduces complexity during development, from feasibility stage through to operation. This introduces inherent risks that need to be overcome, particularly surrounding ownership structures and heat supply regulations. The risks relating to developing a DHN in Hackney have been identified at ranked based on their likelihood and potential impact to the progression of the scheme. Some risks are applicable to all the identified clusters.

The risks have been split into the following categories:

- Technical
- Business case
- Planning Consents, Permitting and Environment
- Stakeholders
- Construction and procurement
- Operation and maintenance.

11.1 Quantifying the risk

Scores are developed on a scale from 1 to 5.

- 1 indicates an unlikely event, or a mild level of severity
- 5 indicates a likely event, or a severe consequence of such an event

The risks are quantified based on their impact and probability of occurring. The impact of the risk is the outcome that may occur if the risk is not properly managed. Mitigating measures are suggested to reduce the impact and probability of each risk. Table 11.1 shows the matrix used to assess the risk. The product of impact and probability dictates the overall risk level and is presented both pre and post mitigation in Table 11.2.

Table 11.1: Risk rankine matrix

Risk Ranking		Probability				
		1	2	3	4	5
Impact	1	1	2	3	4	5
	2	2	4	6	8	10
	3	3	6	9	12	15
	4	4	8	12	16	20
	5	5	10	15	20	25

Table 11.2: Risk register

Table 11.3: Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
1	Technical								
1.1	Heat consumption estimates vary vs actual consumption. If heat loads do not materialise the scheme may become difficult to operate economically	4	3	12	Heat demand confidence level included in feasibility study. Demands are derived from existing building data where possible. Recommend to lock non-LBH customers into long term contracts where possible (e.g. in planning agreements for new builds)	Buro Happold / LBH	3	2	6
1.2	Existing developments install renewed boiler plants; reducing the incentive for connection to DHN	4	2	8	Maintain communication with stakeholders identified in feasibility study to discuss alternative strategies in case of plant failure and update existing plant replacement strategies. Ensure LBH are aware of any planned upgrades to building secondary systems to ensure DHN connection capability. Suggest to defer any replacements where possible and use funds for DHN connection. New development connections to be ensured through planning policy	LBH	4	1	4

Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
1.3	Heat load insufficient to justify running of LZC plant during the summer	4	3	12	Obtain hourly heat profiles where possible. Current sizing based on typical hourly heat loads profiles for clusters to ensure sufficient base load. Measure heat loads over long period of time for best possible design information. Provide large thermal store or heat pump modulation for lower summer loads	LBH	3	2	6
1.4	LZC technology availability - if the plant does not achieve the required availability it may impact running costs and carbon emissions. Significant plant failure may leave customers without heat	5	3	15	Transfer risk to operation and maintenance contractor via guaranteed minimum availability contract provisions and penalties. Back-up boilers (or alternative) provided for resilience and fuel flexibility	LBH	2	2	4

Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
1.5	Large heat network distribution losses may lead to substantial loss in value if heat network is not adequately designed or insulated	3	2	6	Transfer risk to O&M contractor - specify high performance as per CP1 guidance and ensure detailed approval, inspection, testing and acceptance process including penalties for under performance. Minimise route lengths where possible in route proving process at detailed feasibility	LBH	3	1	3
1.6	Ground source heat potential not certain	5	2	10	Consult relevant literature as to ground conditions in London/ Hackney area (e.g. British Geological Survey maps and existing borehole data). There are many successful closed and open loop GSHP installations throughout the London area but a detailed ground survey is recommended once a suitable scheme is developed	Buro Happold	3	2	6

Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
1.7	Lack of capacity to supply electricity required for heat pumps or natural gas for peaking boilers	4	3	12	Check utility plans to indicate if there are power cables in the area near to EC locations. Get indicative connection quote from gas/power provider to suggest fee for connection. Connection cost allowance included in techno-economic model	Buro Happold	4	2	8
2	**Business case**								
2.1	Funding								
2.1.1	Failure to identify funding sources adequate to meet the capital costs of the scheme. Scheme performance reliant on grant funding	5	3	15	Continuous engagement with the GLA to ensure schemes meet requirements for HNIP funding. CP1 and HNDU checklists will be carried out to ensure scheme compliance. Do not proceed if adequate funding cannot be secured	LBH	2	2	4
2.1.2	Lack of interest from commercial developers	5	3	15	Establish what IRR/ NPV values would attract commercial investment through soft market testing	Buro Happold	4	2	8
2.2	Capital costs								
2.2.1	Budget overspend due to poor cost controls	4	2	8	Undertake design reviews with relevant stakeholders. Consider procurement via a contractors to cover energy centre and networks	LBH	2	2	4
2.2.2	Budget underestimated due to unforeseen issues	5	3	15	10% contingency added to cost estimates	LBH	4	2	8
2.2.3	Cost increases due to connection works at each block	5	3	15	Engage with planned developments to ensure secondary systems are connection ready to DHN. Cost of secondary system retrofit already estimated in CAPEX, however surveys of each connection required is needed for detailed costing.	LBH	3	2	6
2.3	Revenues								
2.3.1	Resulting cost of heat too high for residents	5	2	10	LBH required to provide additional capital funding over and above loan value in order to reduce heat cost. However, this will affect the schemes revenue performance. Tight control on scheme costs is required through detailed development	LBH	4	1	4

Item ref.	Risk description	Pre-mitigation Impact (I) 1-5	Pre-mitigation Probability (P) (1-5)	Pre-mitigation Risk level (I*P)	Mitigation measure	Lead by	Post-mitigation Impact (I) 1-5	Post-mitigation Probability (P) (1-5)	Post-mitigation Risk level (I*P)
2.3.2	Uncertainty around access to the Renewable Heat Incentive (RHI) after March 2021	4	3	12	Access to RHI funding is ending in March 2021. It is not currently known if this will be replaced by a similar funding stream. Ensure schemes are viable without RHI funding – current base modelling at EMP stage excludes RHI.	LBH	1	3	3
2.3.3	Information not forthcoming from potential heat consumers to include in the study	2	2	4	Customers are largely LBH owned or planned developments. Metered data should be used where available	LBH	2	1	2
2.3.4	Changes to energy taxes could impose costs on the energy business	3	2	6	Any increase in tax will be transferred to customer - include change of law provision in heat contracts that adjusts charges to reflect new taxes	LBH	2	2	4
2.3.5	Occupancy risk - takes longer to build up heat demand than anticipated	3	2	6	Difficult to mitigate as dependent on housing market	LBH	3	2	6
3	**Stakeholders**								
3.1	TFL oppose street-works or propose onerous requirements	4	2	8	LBH to manage TFL interface through normal channels with assistance from LBH Highways	LBH	3	2	6
3.2	Private developments not interested in connecting to DHN	5	3	15	Early engagement with developers, improved planning policy to include connection obligation. Ensure scheme is viable that is not reliant on developments who are not obliged to connect.	LBH	3	2	6
3.3	Failure to gain resident support for the scheme	4	2	8	Structure proposal to make it attractive to residents and ensure a communications plan is enacted for local residents. Ensure residents are no worse off and bring savings where possible through the cost of heat	LBH	4	1	4
3.4	LBH lack of expertise to carry project forward	4	3	12	External project manager recommended to lead the scheme. Operation and maintenance can be contracted out	LBH	3	1	3

Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
3.5	Low support from within LBH council	5	3	15	Identify a "champion" from within council to take project forward and increase awareness. LBH to manage ongoing discussions with Buro Happold input.	LBH	4	2	8
3.6	Thames Water not interested in connection to sewer network	4	3	12	Early engagement with TW has already been carried out, who have expressed interest in the scheme. Continued engagement at all stages of DHN development is required.	LBH	4	2	8
3.7	LBH's ability to invest in the 'leg work' in setting up a DHN	4	2	8	Involve relevant LBH internal departments from project outset to raise awareness of project. Apply for funding/support from GLA/BEIS	LBH	2	2	4
3.8	Third party negotiations (Thames Water, Crematorium)	4	3	12	Early stakeholder involvement in proposed schemes once identified. Discussions with third parties as to acceptable IRRs	LBH	3	2	6
3.9	Homerton Hospital not interested in supplying heat to the wider network	5	3	15	Early engagement to assess likelihood. LBH to negotiate price of heat	LBH	5	2	10
4	**Planning consents, permitting and environment**								
4.1	Failure to obtain planning permission for energy centre	5	2	10	LBH to manage planning concerns going forward through engagement with local stakeholders and the planning team. Option to house ECs below ground, however this would incur increase civils cost – alternative locations to be considered.	LBH	5	1	5
4.2	High noise levels from energy centre	4	3	12	Acoustic impact managed through using proven compliant heat pumps and noise insulating casing	LBH	3	2	6

Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
4.3	High level of visual impact from energy centre	3	2	6	Flues from the gas boilers may cause concern in built up areas. Long term energy centre façade concept to be created for communication to planning team to ensure clarity of the intent. Where possible, flues integrated into building development to reduce visual impacts	LBH	2	1	2
4.4	Planning permission required for heat network	3	2	6	LBH to confirm whether permitted development rights cover installation of heating pipework in the public highways	LBH	2	2	4
4.5	Air quality issues increase cost or result in restriction on operation of energy centre	4	2	8	Air quality impact managed by ensuring flues extend to a higher level than the surrounding buildings. Early consultation with planning team advised. De-risk by installing high efficiency gas boilers	LBH	3	2	6
4.6	Failure to negotiate use of land for energy centre	4	3	12	Engagement with landowners.	LBH	2	2	4
4.7	Homerton University contracts for power/gas. Existing service contracts may limit options for extending heat supply to wider network	3	3	9	Early engagement with the hospital NHS Trust. Get key dates of planned heating system refurbishments and ensure stakeholders are aware of plans for DHN in the area. Ensure planned site network is compatible with wider DHN connection	LBH	3	2	6
4.8	Failure to obtain planning permission for WSHP	5	3	15	Early engagement with the Environment Agency (EA) on acceptable discharge temperatures and flow rates. Not currently aware of a minimum discharge temperature into rivers set by the EA	LBH	5	1	5
5	**Construction and procurement**								
5.1	Access to properties for installation not possible in timely manner	2	2	4	LBH housing team to manage risk in conjunction with contractor. DHN scope to end at the meter at block plate heat exchanger	LBH	2	1	2

Item ref.	Risk description	Pre-mitigation			Mitigation measure	Lead by	Post-mitigation		
		Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)			Impact (I) 1-5	Probability (P) (1-5)	Risk level (I*P)
5.2	Asbestos present in existing plant rooms	3	3	9	Obtain asbestos information from stakeholders and LBH and factor into construction programme. Higher risk in town centre due to larger proportion of older building stock	LBH	2	2	4
5.4	Contract choice inappropriate and prevents project aims from being delivered	5	3	15	Review contract choice as part of development of business case. Ensure wide engagement in bid process to attract range of contractors	LBH	4	2	8
5.5	Redevelopment time windows missed	4	4	16	Early and continued engagement with all major stakeholders identified to ensure they are aware of the EMP project and potential to connect into a DHN. Promotion of work from within LBH and across the borough so that future developers are aware of proposed scheme	LBH	4	3	12
6	**Operation and maintenance**								
6.1	Heat delivery failure	5	4	20	Design resilience into system including redundancy for pumping, boilers etc. Make plans and procedures for emergency boiler hire for connection at building level.	LBH	3	1	3
6.2	Lack of clarity over the department with LBH who is responsible for operation and maintenance	3	2	6	LBH to make a clear statement of responsibility as part of internal business case. Particularly important for schemes where energy is being supplied by third party (Homerton University Hospital)	LBH	2	2	4
6.3	High losses in primary or secondary network negate cost savings and create inefficient system	4	3	12	Commissioning and ongoing monitoring conducted to ensure performance is achieved	LBH	3	2	6

Appendix A Benchmarks and assumptions

Key metrics			
Metric	**Value**	**Unit**	**Reference**
Discount factor	3.5	%	Green Book
DH standing losses	10	%	CP1 Heat networks
Parasitic pumping power	2	%	Buro Happold project experience
Scheme lifetime	30	years	Assumed
Testing and commissioning	3	%	Assumed
Prelims	8	%	Assumed
Design fees	5	%	Assumed
Contingency	20	%	Assumed
Average floor area	73	m²	From Hackney Council

Table 11.4: Peak demand benchmarks and references

Typology	Benchmark (W/m²)	Diversified DHW benchmark (W/m²)	SH benchmark (W/m²)	Reference
Office	70	56	60	BSRIA 2011
Leisure	40	32	12	Buro Happold past project
Retail	100	80	92	BSRIA 2011
School	87	69	73	BSRIA 2011 Education
Hotel	70	56	14	BSRIA 2011 Residential, slightly increased to account for higher hot water demand
Premier Inn	70	56	14	BSRIA 2011 Residential, slightly increased to account for higher hot water demand
Hospital	40	32	25	Buro Happold past project
Community	87	69	75	BSRIA 2011 Education
Industrial	80	64	76	BSRIA 2011
Student	87	69	73	BSRIA 2011 Education

Table 11.5: Annual demand benchmarks and references

Typology	Benchmark (kWh/m²)	Benchmark Source
Office	38	Carbon Buzz-metered data- Woodland Trust Headquarters - 38kWh/m²
Residential	48	Internal source using SAP 2013 Regs SWL fabric (U values: Wall 0.18, Glazing 1.4) fans and Individual Boiler - Residential, small mid floor end apartment: 2013 lean
Leisure	84	Internal source modelling for multi-use building (Comparable to Coleford Community Centre from Carbon Buzz
Retail	49	Building Energy Efficiency Survey (2016) - retail sector, lower quartile
Hotel	82	Carbon Buzz - Bermondsey Square Hotel
Student	24	Internal source
Community	24	Internal source

Appendix B Capex schedule

Table 11.6: CAPEX breakdown for each cluster

	Dalston	Hackney Central	Homerton	S&H CHP	S&H CHP&HP
Energy plant	£1.65m	£1.75	£0.63m	£-	£0.84m
Energy centre	£1.82m	£1.89	£1.05m	£1.11m	£1.32m
DHN	£1.51m	£2.78m	£0.84m	£3.29m	£3.90m
Heating systems	£0.78m	£0.54m	£0.12m	£0.56m	£0.56m
Retrofit	£0.86m	£2.53m	£3.29m	£6.42m	£6.42m
Total (£m)	6.6	9.5	5.9	11.4	13.0

Appendix C Stakeholder engagement tracker

Table 11.7: List of key stakeholders contacted

Organisation	Department	Name
Hackney Council	Project Manager	Andrew Amoah
	Sustainability	Luisa Brotas
	Energy	Mary Aladegbola
	Housing	Zoe Collins
	Estate Management	David Mitchell
	Regeneration	Suzanne Johnson
	M&E manager	Rob Jack
	Interim Director of Housing Services	David Padfield
	Energy Company	Lucja Paulinska
	Energy Manager	Angela Okoh
	Woodberry Down PM	Nicola Hudson
WSP	Energy	Jacob Cox
GLA	GLA rep	Daniel Barratt
E.ON UK	Control Room Manager	Leke Oluwole
	Business Development Manager	Mark Cavill
Engie	Business Development Manager	Lorcan McAlindon
SSE	Business Development Manager	Giles Newton
Peabody	Sustainability Manager	Chit Chong
Thames Water	Waste Water	Dejan Vernon
Transport for London	Crossrail 2	Michael Johnson
London Legacy	Olympic Park DHN	Alex Savine
Homerton Hospital NHS	Environmental Sustainability Manager	Graham Snowling

0043514 Hackney Decentralised Energy Masterplan

FINAL REPORT

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