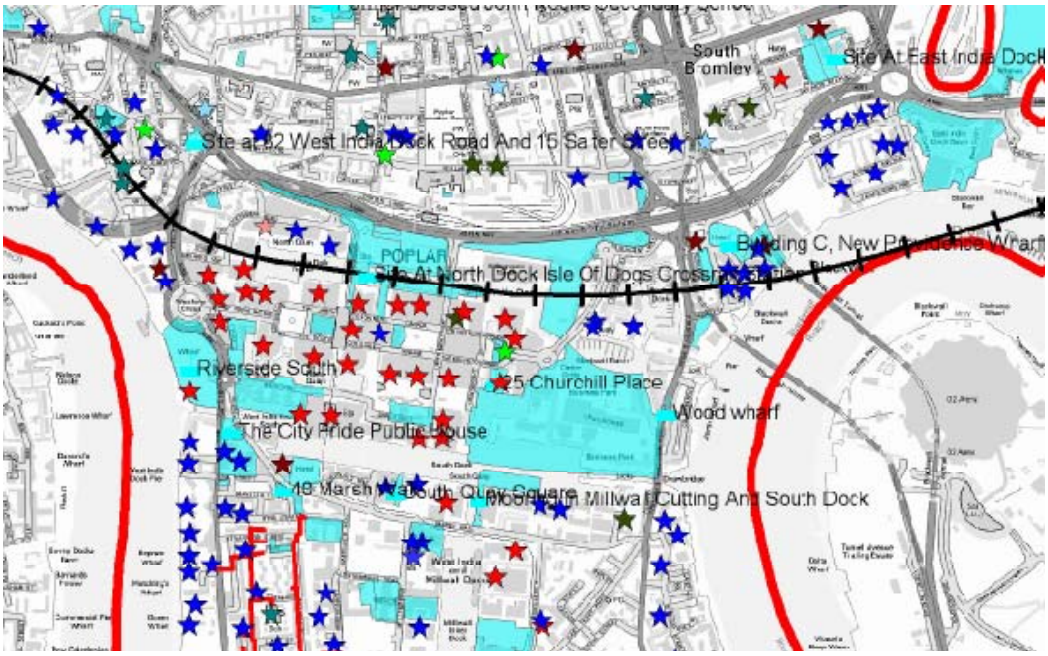
Intended for
The London Borough of Tower Hamlets

Document type
Report

Date
February 2011

THE LONDON BOROUGH OF TOWER HAMLETS
LONDON HEAT MAP STUDY



RAMBOLL

THE LONDON BOROUGH OF TOWER HAMLETS

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Description	**Heat mapping for the London Borough of Tower Hamlets.**

Ref: 08146-100

(**Front cover image: Heat map of the London Borough of Tower Hamlets**)

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APPENDICES

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1. INTRODUCTION

1.1 Background

Ramboll Energy (RE) has been commissioned by the London Borough of Tower Hamlets (LBTH) to carry out a heat mapping exercise of the Borough as part of the London Development Agency's (LDA) Decentralised Energy Master Planning (DEMaP) programme.

The LDA's Decentralised Energy and Energy Masterplanning Programme (DEMaP) has been developed to identify decentralised energy opportunities in London which will contribute to the Mayor's target of providing 25% of London's energy supply from decentralised energy sources by 2025.

In order to achieve this target, a partnership of local authorities, regional bodies and private sector stakeholders is required to plan for, develop and deliver DE projects. For example, the integration of local energy centres and heat distribution networks with sub-regional transmission networks requires co-ordination and concerted action.

The LDA, Greater London Authority (GLA) and London Councils are working together to offer a comprehensive support package to local authorities that promotes the delivery of Decentralised Energy (DE) in their boroughs and across London.

The development and implementation of DE opportunities in London is integral to local, regional and national climate change mitigation targets as defined by National Indicators 185 and 186, Carbon Reduction Commitment, Planning Policy Statement 1 on Climate Change, the London Plan and the Government's Heat and Energy Saving Strategy.

Essential to the objectives of this brief is to enable the LBTH to implement economical low carbon district heating (DH) and Cooling infrastructure and this requires planning policy to help implement.

In order to help achieve this, the LDA has made available some funding for Boroughs to gather actual energy data and identify sites with potential for DH networks within their boundaries. The LBTH was successful in securing this funding and appointed RE to carry out the work.

1.2 Scope

RE has undertaken this study on behalf of the LDA and the LBTH as part of Phase 1 (Capacity Building) support of the DEMaP Programme. The three key aims of this study are:

(a) Produce heat maps for the LBTH to identify areas of highest heat demand and the locations of existing CHP plant and energy networks.
(b) Identify potential areas for the development of further DH networks in the LBTH.
(c) Provide advice and support to the LBTH in interpreting and acting upon the results of the heat mapping through a high level implementation plan.

2. DATA GATHERING

2.1 Requirements

The brief required the data to be collected in an Excel spreadsheet template which was provided by the LDA (LDA template). The spreadsheet format has been designed to be easily updated, allowing for future revision. The spreadsheet format also allows it to be uploaded into a Geographical Information System (GIS) and used to update the London Heat Map. A summary of the template contents is shown in Table 1.

	Spreadsheet Tabs		
Information	Major Heat Loads	Major Heat Supply Plants	District Heating Networks
OXS	x	x	x
OYS	x	x	x
Object ID	x	x	x
Name	x	x	x
Address	x	x	Energy Centre Address
Postcode	x	x	Energy Centre Postcode
Ownership	x	x	x
New Development	x	x	
Typology	x	x	x
Heating supply	x		
Fuel source	x	x	x
Fuel consumption from all assets excluding CHP (MWh/year)	x	Fuel consumption from all assets including CHP (MWh/year)	Fuel consumption from all assets including CHP (MWh/year)
Fuel consumption from CHP (MWh/year)	x	Heat generation from all assets including CHP (MWh/year)	Heat generation from all assets including CHP (MWh/year)
Gross internal floor area (m2)	x		Length of trench (km)
Number of dwellings	x		Area Covered
Installed thermal capacity from all assets excluding CHP (MWth)	x	Installed thermal capacity from all assets including CHP (MWth)	Installed thermal capacity from all assets including CHP (MWth)
CHP Installed power (MWe)	x	x	x
CHP Installed thermal capacity (MWe)	x		
CO2 emissions (tCO2/year)	x	x	x
Year of Construction	x	Date of Construction	Date of Construction
Year of data collection	x	x	x
Start date	x	x	x
Completion date	x	x	x
Data Source	x	x	x
Confidentiality of data	x	x	x
Attach file	x	x	x
Borough	x	x	x
Real or estimated data?	x	x	x
Notes	x	x	x

Table 1 - Tabulated representation of the Heat Map Template

The search was focused primarily on the following building types;

- Hospitals
- Central government estate
- Local government estate (including social housing)
- Sport & leisure facilities
- Prisons
- Hotels
- Educational facilities
- Museums & art galleries
- Churches
- Private residential developments (>149 units or 9,999m^2)
- Private commercial developments (>9,999m^2)
- Other public buildings (e.g. theatres, fire stations, police stations)

2.2 Methodology

At the outset of the study it was decided to employ a web-based questionnaire to assist in the data collection exercise. The LBTH kindly provided an introductory letter, explaining the purpose of this work and introducing RE, to add authority to the process. The web-based questionnaire was created to make the data reporting easier by providing clear guidance on the requirements and to allow for missing data. This on-line database was designed to transfer the data seamlessly into the LDA template.

Initial contact was made by telephone, where we tried to establish the relevant person(s) who would be able to provide the data required. Where successful, contact details were obtained to which the covering letter and the hyperlink to the web-based questionnaire were sent via e-mail. The link to our web-based questionnaire was included to allow the respondent to easily input the data or pass it to a more appropriate individual within the organisation. In all instances we clearly offered the opportunity for any data released to be retained as confidential in accordance with the LDA requirements.

Where it was clear that no data would be forthcoming, it was decided that we would attempt to determine the floor area of a number of buildings – concentrating on the largest by occupancy - through the use of GIS software - MapInfo. MapInfo provides the ability to measure the footprint of a building when the map is vector based. The footprint was multiplied by the number of floors of the building and when a building was found to have floors with differing areas; an average was estimated conservatively taking into account that we were seeking the Gross Internal Area (GIA). Of course this method is limited as basements and variable heights of buildings cannot be accurately taken into account, hence it should at best be considered a rough estimate.

National Indicator 185 (NI 185) has been developed by Government to measure the progress of local authorities' efforts to reduce CO_2 emissions from the relevant buildings and transport used to deliver its functions. Functions of an authority cover all their own operations and outsourced services. Each local authority reports on an annual basis. This database will help to identify all the buildings that could be included in a decentralised energy network within the authority. Additionally the energy consumption data should be considered very robust due to the requirements of reporting procedure.

The Local Land and Property Gazetteer (LLPG) is an address database held and maintained by each Local Authority. The database contains the list of addresses of all property in the authority area. The database is used to help identify buildings in the area that should be considered in the identification of priority buildings. The LLPG was not available to RE for the purposes of this study.

2.3 Identification of priority buildings

The methodology for data gathering was to target heat demand by building type as indicated in 2.1 - Requirements.

Main data collection issues are highlighted below for each type of building.

- Sport & leisure facilities
  - Heat consumption data was extracted from the borough's NI185 records.
- Prisons
  - There are no prisons in the Borough.
- Hotels
  - Large hotels (> 149 bedrooms) were identified using an internet search together with data obtained from LBTH's business database. Gas consumption for heating was approximated using CIBSE Guide F benchmarks.
- Education facilities
  - Gas consumption for schools and nurseries was extracted from the NI185 database.
  - Additional entries were identified in the business database and the colleges and universities were contacted.
- Police stations
  - 10 Police stations were identified and added to the template. From our communications with the police department we understand fuel consumption data is currently being collected centrally for all police stations. The data was not available for us to include in the maps/data collection template at the time of writing this report.
- Fire stations
  - 6 fire stations were identified within the area and were mapped with data from the London Fire Brigade.
- Hospitals
  - Gas consumption data was obtained for Royal London Hospital and London Chest Hospital through Barts and The London NHS Trust. Data was obtained for Mile End Hospital from Tower Hamlets Primary Care Trust. We understand from our investigations that the Mildmay Hospital is being redeveloped.
- Museums & art galleries
  - Buildings in this category were identified and added to map and data template, however out of the 5 organisations contacted no data was obtained.
- Central government estate
  - No central government estate was identified within the Borough.
- Local government estate
  - Data was extracted for 17 buildings from the NI185 database. In addition two buildings were obtained from existing LDA data.
- Religious institutions
  - Although 86 were identified in the business database none were added to the maps or template due to prioritising larger heat demand buildings within the other building type categories. It should be noted that coordinates are not

available in the business database as opposed to Local Land and Property Gazetteer (LLPG) database, which we could not access during the project.

- Private residential units
  - Multi-address buildings with residential units were identified through Ordnance Survey (OS) Address Point register and/or through the reference data from LDA's London Heat Map. Fuel consumption for heating and hot water was estimated using benchmark per unit.
  - 23 housing associations through 34 contacts were contacted both by RE and LBTH. This did not result in any obtained data.
  - Proposed developments were either benchmarked or, as in most cases; data was obtained from energy strategies submitted as part of the planning application.

- Private commercial units
  - Private commercial units were identified based on a variety of sources.
    - From the Business register the companies with 200+ employees were approached.
    - Websites for tall buildings and architecture.
    - Planning applications through the Borough's planning website; http://www.towerhamlets.gov.uk/lgsl/501-550/516_register_of_planning_decis.aspx
    - Real Estate Agents selling and renting properties.
    - Google Streetview, Google Earth and Bing Bird's Eye View services.
  - The Canary Wharf area was targeted due to the relatively high density of large scale developments/buildings.

- Planning applications
  - Major planning applications from 2005 and onwards were obtained from the Borough's Planning department and the developments were separated into two groups, one with smaller buildings and dwellings and one with larger. The second group was focused on and 25 sites identified (see table 2). In most cases energy strategies provided estimates of fuel consumption for heating and information regarding potential CHP's. Others were benchmarked with future projections of modelled buildings based on the information in the planning application documents.
    - First group comprised of
      - Small Scale Dwellings
      - Other Small Scale developments
      - Small Scale Offices/R&D/light industry
      - Small Scale Gen. Indus/storage/warehouse
      - Small Scale Retail distribution & servicing
      - and any other planning applications labeled as 'small'
    - Second group comprised of
      - Large Scale Offices/R&D/light industry
      - Other Large Scale developments
      - Large Scale Dwelling
      - and any other planning applications labeled as 'large'.

Name	Address
Former Beagle House	Braham Street
Site At East India Dock Site	East India Dock Road
1 & 2 Aldgate Place	Whitechapel High, Buckle St. & Commercial Road
Site At Former Goodmans Fields At South East Junction of Leman Street And Alie Street	Leman Street
21 Wapping Lane, London	21 Wapping Lane, London
Building C, New Providence Wharf	Blackwall Way
33-35 Commercial Road	33-35 Commercial Road
Former St Andrews Hospital	Devas Street
Mooring In Millwall Cutting And South Dock	Marsh Wall
Site At North Dock Isle Of Dogs Crossrail Station	Upper Bank Street
Wood Wharf	Prestons Road
South Quay Square	1 Marsh Wall
The Bede Estate	Bow Common Lane
Holland Estate	Holland Estate, Commercial Street
News International Limited	1 Virginia Street
Riverside South	Westferry Circus
Site at 438 - 490 Mile End Road	438 - 490 Mile End Road
The Eric And Treby Estates Mile End	Treby Street
Site at 82 West India Dock Road And 15 Salter Street	West India Dock Road
Land South of Otis Street and Three Mills Lane, east of the A12 and North of the Railway Line	Land South of Otis Street and Three Mills Lane
OUTLINE PA/Ocean Estate	Ocean Estate
Former Blessed John Roche Secondary School	Former Blessed John Roche Secondary School
The City Pride Public House	15 Westferry Road
25 Churchill Place	25 Churchill Place
40 Marsh Wall	40 Marsh Wall

Table 2 - 25 Planning Applications identified in data collection exercise

2.4 Limitations of Data Collection

The time available to gather data when considering the requirements of the task created a significant challenge. The approach taken by RE to maximise the quality of the data collected will help to provide a platform from which a more detailed study can be performed in the future.

There are a number of limitations that have arisen;

- Estimated data is based upon a simple format using CIBSE Guide F which is based upon industry standard benchmark assumptions. This data will not be sufficiently sensitive to distinguish between similarly constructed buildings with very differing operation requirements.
- Actual data gathered, normally only represents – at best – the most recent 12 month cycle. Clearly this information is limited in that it represents the energy demand of a year which may not be considered a 'typical' due to the prevailing weather conditions throughout the metering period in question.
- Actual data provided by a building user/owner may not be accurate. The scope of this type of study will not be able to determine accuracy of the data.
- Metered gas consumption will often include the use of gas for demands other than heating and hot water, although it is recognised that the proportion is likely to be small.
- It is difficult to determine if electric heating forms part of the heating to a building without a detailed understanding of the services contained within the building.
- Where it has been established that electricity is used to heat buildings, it is often difficult to determine the proportion of consumption by heating and that by lighting and other appliances. In these cases benchmarking would have to be undertaken to approximate the demand by heat.
- In the case of private commercial property collecting data required the identification of the most appropriate person. It was clear from a large number of institutions that they adopt a 'no name' policy which meant that we could not contact anyone within the organisation and so data had to be benchmarked.

2.5 Energy sources and district energy networks

A search was conducted to determine known energy sources and potential energy sources in the Borough.

2.5.1 Olympic Park

The Olympic Park has two energy centres; one to the west in King's Yard and one to the east in Stratford. The largest and most significant centre – King's Yard - is located in LBTH and lies on the borders with Hackney and Newham.

The King's Yard Energy Centre primarily provides energy to the Olympic Park but its potential expansion will be key in achieving long term local low-carbon energy provision for the new buildings and communities that will develop after 2012. The intention is to use low carbon sources of energy such as biomass.

The Energy Centre has been designed, financed and built by Cofely, a subsidiary of GDF SUEZ, together with approximately 16km of DH and cooling networks. It will be operated by Cofely for 40 years.

RE met with Cofely East London Energy (CELE) – the special purpose vehicle created to operate the energy centre and to ensure the energy produced is marketed beyond the Games - to determine available capacity from the energy centre. We were advised that the energy centre has been built to contain up to 210MW of heat capacity with roughly half of this capacity having already been installed. Any future expansion of the energy centre would be done so based on economically viable demand. The energy centre is design to allow expansion through a modular arrangement. Discussions with Cofely suggested that up to 5MW of heat energy may be available in the area adjacent to Fish Island.

It is likely that, as the major pipe infrastructure from the energy centre has already been installed, any future growth will be constrained by the existing pipe sizes.

Figure 1 - King's Yard Energy Centre (courtesy of Cofely GDF Suez)

In addition to the heat availability up to 57MW of cooling has been installed but most of this has been earmarked for the local Westfield and IBC developments.

The heat network system operates at 95/55°C flow and return temperatures.

2.5.2 London Thames Gateway Heat Network

The LDA is developing a sustainable DH system. The London Thames Gateway Heat Network (LTGHN) is a hot water heat network that aims to connect diverse sources of affordable low/zero carbon heat to existing and new developments helping to create sustainable communities.

The LDA envisage sources of heat to come from existing industrial plant already in operation in the London Thames Gateway with future energy sources connecting later as they emerge and demand grows.

The whole heat network will be built in periodic stages; the timing yet to be determined but it will initially draw in the Sustainable Industries Park (SIP), Barking Town Centre. The network will be separately started in the Royal Docks area. Future phase will see the joining of the Barking Town centre network with that in the Royals and further growth of the Network East and Westerly to Stratford.

Figure 2 - LTGHN Vision Plan (courtesy of the LDA)

The planned LTGHN, however, does not intend to reach as far as the LBTH as can be seen in Figure 3 although an option is retained to run the heat network into the Borough as far as Wood Wharf which could clearly provide benefit to the areas around Canary Wharf and Barkantine.

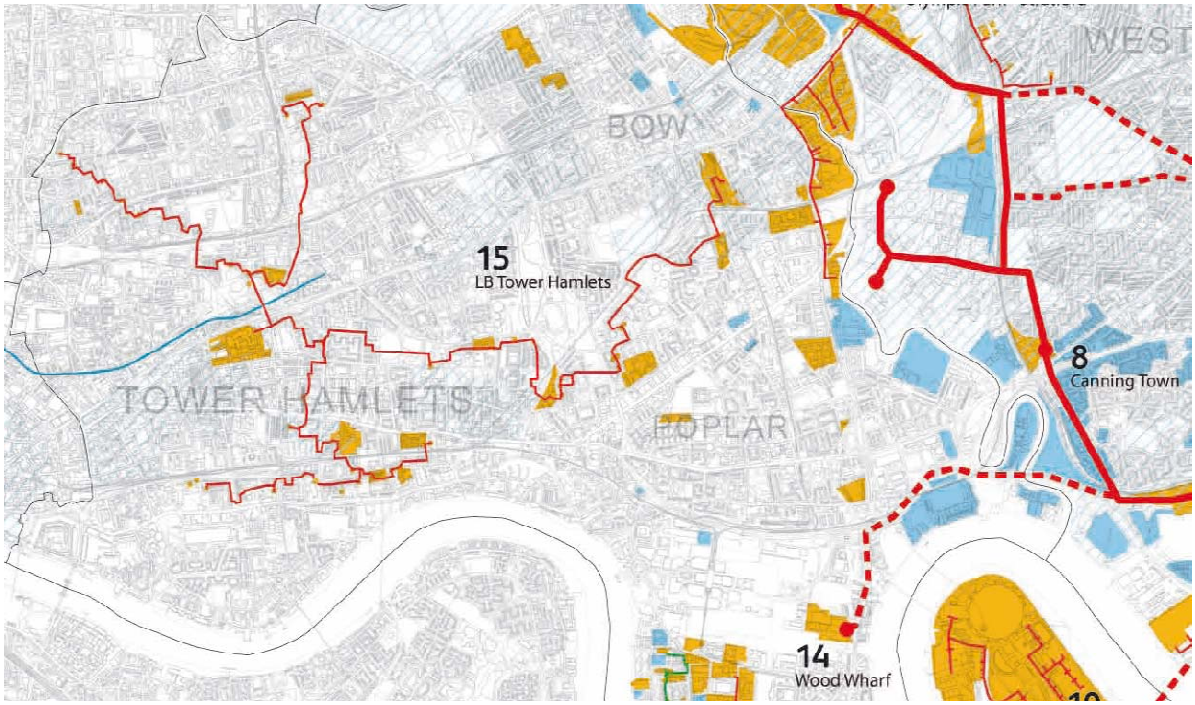

Figure 3 - Proximity of the LBTH to the LTGHN

2.5.3 Barkantine District Heating

Barkantine Heat and Power Company was originally jointly conceived by EDF Energy and LBTH Council's Energy Efficiency Unit and funded by DEFRA as a National Pathfinder scheme.

The Barkantine Energy Centre consists of a 1.3 MWe/1.6 MWth CHP gas engine, four 1.4 MW gas boilers act as back-up and standby and two 105 m^3 thermal stores.

Figure 4 - Barkantine Energy Centre
(courtesy of Cofely GDF Suez)

The thermal stores can hold 4.5 MWh of heat which is sufficient to cover up to 8 hours of heat demand across the DH Network. The DH network connected to the energy centre consists of 4 km of pre-insulated pipes and operates at approximately 90/70°C flow and return temperatures. The heat network appears to have capacity for expansion and has points of connection in the network to achieve this.

RE contacted Barkantine Heat & Power but was unable to speak to anyone regarding the potential for expanding the energy centre. RE are aware that LBTH are encouraging the expansion of the Barkantine scheme to serve local buildings but further development has yet to take place.

2.6 Local Development Framework

LBTH has produced a number of Evidence Based documents as part of their Local Development Framework (LDF) and clearly recognise the important role, planning has to play in responding to climate change. As a result they have produced a Sustainable Energy & Enhanced Biodiversity Report.

The report, amongst many initiatives, highlights the vision and need to prioritise the use of renewable energy through the use of DE. This is proposed to be achieved by developing a borough-wide heat network (Figure 5).

LBTH has identified priority areas it considers suitable for DE;

1. Fish Island/Olympics Energy Centre/ Hackney Wick /adjacent proposed development in Hackney.
2. Bromley By Bow (N & S) linked to Newham Gas works site
3. Poplar Riverside and Leven Road Gas works site
4. Blackwall Reach and Robin Hood Gardens
5. Leamouth
6. Poplar/Chrisp Street
7. Bow Common Gas Works, Limehouse Cut & St Paul's area
8. Mile End
9. Barkantine CHP network and extension, Canary Wharf, Wood Wharf, Isle of Dogs development (west) including Westferry Printing Works & Greenwich View
10. Crossharbour District Centre & Isle of Dogs develop (East)
11. The Highway (Shadwell)
12. Wapping Printing Works & Tobacco Docks
13. Aldgate & Spitalfields development
14. Banglatown & Brick Lane
15. Pritchard Road Gas works – Bethnal Green North

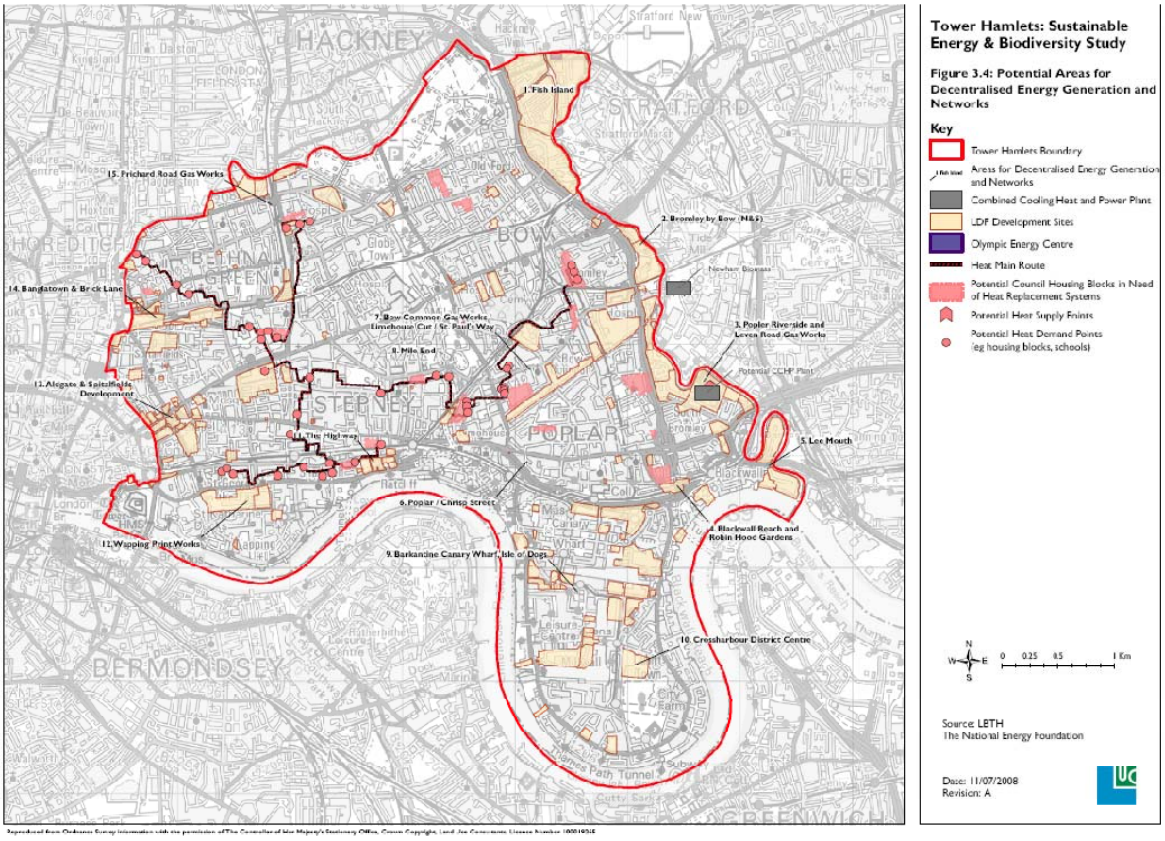

Figure 5 - Potential DE Network and LDF Development sites

LBTH has drawn up a heat network that connects some of these areas together and also addresses areas of housing that they have highlighted as needing heat systems replacement.

2.7 Benchmarking

Benchmarking of buildings was based primarily on a number of references and are summarised in Table 3 below. We have used an average annual consumption for housing based on all properties having an average floor area of 61m^2. It is considered that this will be sufficiently representative of a mix of property sizes and sufficient for estimating the energy demand over the borough.

Building type	MWh per Annum		Reference
	per m2 GIA	per unit	
2 bed flat		8.165	Assuming 61 m2 per unit
Housing	0.134		2 bed flat gas consumption.
School - Primary (no pool)	0.113		GPG343
School - Secondary (no pool)	0.108		GPG343
Office	0.091		Energy Consumption Guide 019
New office modelling results part L modelling	0.068		Based on part L modelling
Future office - modelling part L 2010	0.026		Based on Part L modelling
Hotel -Luxury		17.40	CIBSE Guide F - Good Practice
Hotel - Business/Holiday		15.08	CIBSE Guide F - Good Practice

Table 3 - Benchmarking Values

3. HEAT MAP ANALYSIS

3.1 Criteria for Creating Clusters

Clusters need to be developed around the existence of one or more of the following factors;

Large heat user(s)

- Large heat users are the most crucial element of any cluster development. Ideally a number of large energy users or a number of energy users concentrated into a small area creates an ideal environment. Often (one or more) anchor loads are sought as these can provide either a secure and sizeable income stream or be seen as a landmark building that influences the thinking of others in the vicinity.

Large heat producer

- The provision of a primary energy source is also a requirement. Any successful network should seek out a local source of energy, preferably a source of waste heat. Waste heat would normally be assumed to come from a source which would normally have to “dump” heat as part of the process. Waste heat can often be secured at a price less than conventional energy sources from fossil fuel, for example. Where no such waste heat can be found, conventional sources of fossil or biomass should be sought.

Existing networks and/or new development(s)

- In some instances small heat networks may already have been developed and could form part of a new wider network; they may also contain a heat source that can be used either directly as a primary energy source or as future back-up. In most instances, however, they will have been sized to accommodate the intended load and have little capacity for expansion.
- Larger networks may also have been developed and the extent to which new networks and buildings can interlink would be subject to discussion with the operator of such a network.
- New developments can provide an ideal platform for creating a new heat network that is able to connect to a wider area. The new development can act as the anchor load and as the site of any primary energy source. This often makes the development of a wider network more viable as the initial asset provisions can be accommodated by the new development.

Public buildings(s)

- Connecting public buildings not only provides a series of potential anchor loads but also sends a very positive message to other building owners in the area. This action often provides assurance from prospective connectors, who may harbour concerns over that suitability and connectivity to a heat network.

Building Diversity

- In an ideal scenario a heat network should strive to secure a variety of buildings with differing demand profiles and heat loads. This variation helps to optimise the sizing and selection of heat network equipment. It should be noted that whilst this is desirable, it is by no means essential that this should always apply.

3.2 Cross Borough Opportunities

The LBTH is bordered by six Boroughs;

- The City of London
- LB of Hackney
- LB of Newham
- LB of Southwark
- LB of Greenwich
- LB of Lewisham

3.2.1 The City of London

The area bordering Tower Hamlets has a number of developments and, in itself, could act as a cluster and could provide an opportunity to the City of London. There are no energy centres in this area and indications are that none could be reasonably developed.

3.2.2 Hackney

The border between the LBTH and Hackney is quite extensive but the potential for DE cross-border cooperation appears limited.

Hackney Wick is close to the King's Yard Energy Centre of the Olympic Park and has been highlighted as a potential connection to this area.

3.2.3 Newham

RE was not able to determine any cross-borough opportunities in the time available for this project.

3.2.4 Southwark

The London Borough of Southwark neighbours the LBTH but is separated by the River Thames. Southwark has identified a number of opportunities in the north of the Borough but these are predominant in the area around the South Bank/Blackfriars.

The area around London Bridge and Tower Bridge, and the Tabard Gardens areas also Guy's Hospital has been identified as a potential anchor load for the London and Tower Bridge sub-areas. The Canada and Surrey Water areas have development proposals and may offer some potential if a suitable tunnel crossing can be secured but is considered outside the range of inter-connection due to the investment required for any tunnel and pipe installation.

3.2.5 Greenwich

The London Borough of Greenwich neighbours the LBTH but is separated by the River Thames.

We understand that Greenwich is actively involved in developing DE in its borough. The Greenwich Peninsula has seen development over the years with a CHP/DH system supplying energy to the Greenwich Millennium Village. Development of the remainder of the Peninsula is being planned and RE understands that DE is considered as a solution to the future energy needs.

Any potential to link LBTH with Greenwich would be subject to a river crossing that would require significant investment and a heat demand to match that investment.

3.2.6 Lewisham

The London Borough of Lewisham neighbours LBTH but is separated by the River Thames. Lewisham is home to SELCHP which could offer a significant energy source if a suitable tunnel crossing is available. SELCHP is being targeted by Lewisham, Southwark, Lambeth and potentially Greenwich as a source of low-carbon energy.

The Deptford Park area has development opportunities but it is considered that any river crossing would require significant infrastructure and thus, significant heat load to justify the investment.

3.3 Results

The results of the data collection exercise are contained in the LDA Template, attached as an appendix and summarised below.

In total RE were able to gather data from 682 buildings. Of this total, the data from 609 buildings was received through the NI 185 database from LTBH.

In addition, RE targeted a further 83 buildings (not featuring in the NI 185 database). The success of data gathering from these buildings is illustrated in Figure 6.

“No Success” indicates that neither a company nor a responsible person could be contacted. In these instances it was necessary to apply a benchmark to the building to obtain estimated heat data.

“Partial Success” indicates that we were successful in contacting a company and/or finding a responsible person or some data was received in order to benchmark, but that no consumption data was received.

“Success” indicates that we were successful in contacting a company and/or finding a responsible person and that data was received.

RE attempted to contact 23 housing associations through various sources but only 1 responded but without any data. All housing association data was benchmarked from the information held by the LDA.

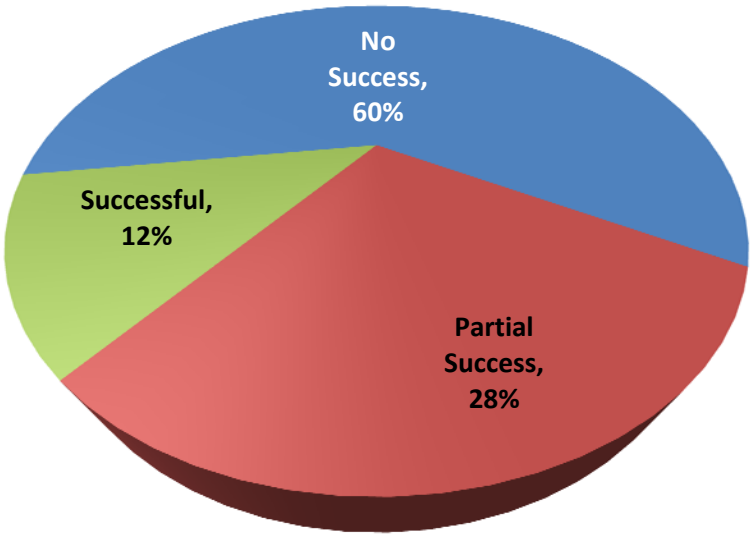

Figure 6 - Breakdown of data gathering results by success

Table 4 summarises the data collection by building type and Table 5 summarises the data by building ownership.

A number of maps have been produced and are attached in Appendices as follows:

- Appendix A illustrates the raw data collected by building type over the borough.
- Appendix B illustrates the building data using graduated scaled points of reference to highlight the magnitude of energy demand for a given site.
- Appendix C illustrates the data collected by building type but also showing the Masterplan and Site and Placemaking DPD sites.
- Appendix D illustrates the chosen Cluster areas (see 3.4)
- Appendix E illustrates the data collected by building owner but with planning applications identified.

It can be seen that residential property accounts for a substantial amount of energy demand as does private commercial. The private commercial load is predominantly based in the Canary Wharf area.

Type of buildings	Subtotal	Subtotal [MWh]	Floor Area [m2]	Residential Units
Multi-address buildings	331	216,682	-	26,529
Sport & Leisure facilities	12	10,345	23,640	-
Prisons	-	-	-	-
Hotels (> 99 units or 4,999 m2)	24	66,552	32,503	557
Education facilities	115	67,130	297,468	-
Police stations	10	-	-	-
Fire stations	6	710	7,126	-
NHS	15	72,526	-	-
Central government estate	-	-	-	-
Local government estate	19	4,553	49,478	-
Museums & Art Galleries	26	-	-	-
Churches	-	-	-	-
Private residential (> 149 units or 9,999 m2)	19	59,652	72,769	7,855
Private commercial (> 9,999 m2)	44	239,569	2,195,988	1,900
Other public buildings	61	10,708	42,550	-
TOTAL	**682**	**748,427**	**2,721,637**	**36,841**

Table 4 - Summary of data collection by building type

Ownership of buildings	Subtotal	Subtotal [MWh]	Floor Area [m2]	Residential Units
Central government	25	72,526	-	-
Local government	204	71,115	413,251	-
Other public	8	21,239	7,126	-
Private	445	583,547	2,301,260	36,841
Other	-	-	-	-
TOTAL	**682**	**748,427**	**2,721,637**	**36,841**

Table 5 - Summary of data collection by ownership

For the buildings in Table 4 other total key figures are shown in Table 6 below.

	Fuel Consumption [MWh]	Floor area [m2]	Dwellings [units]
Total	748,427	2,721,637	36,841

Table 6 - Key numbers totals

The collected data has been sorted to show the numbers of buildings (x-axis) that consume a level of heat energy in MWh per annum (y-axis) in Figure 7. This diagram illustrates very well the propensity for buildings to have a high demand; at least 125 of the buildings identified consume over 1,000MWh heat per annum.

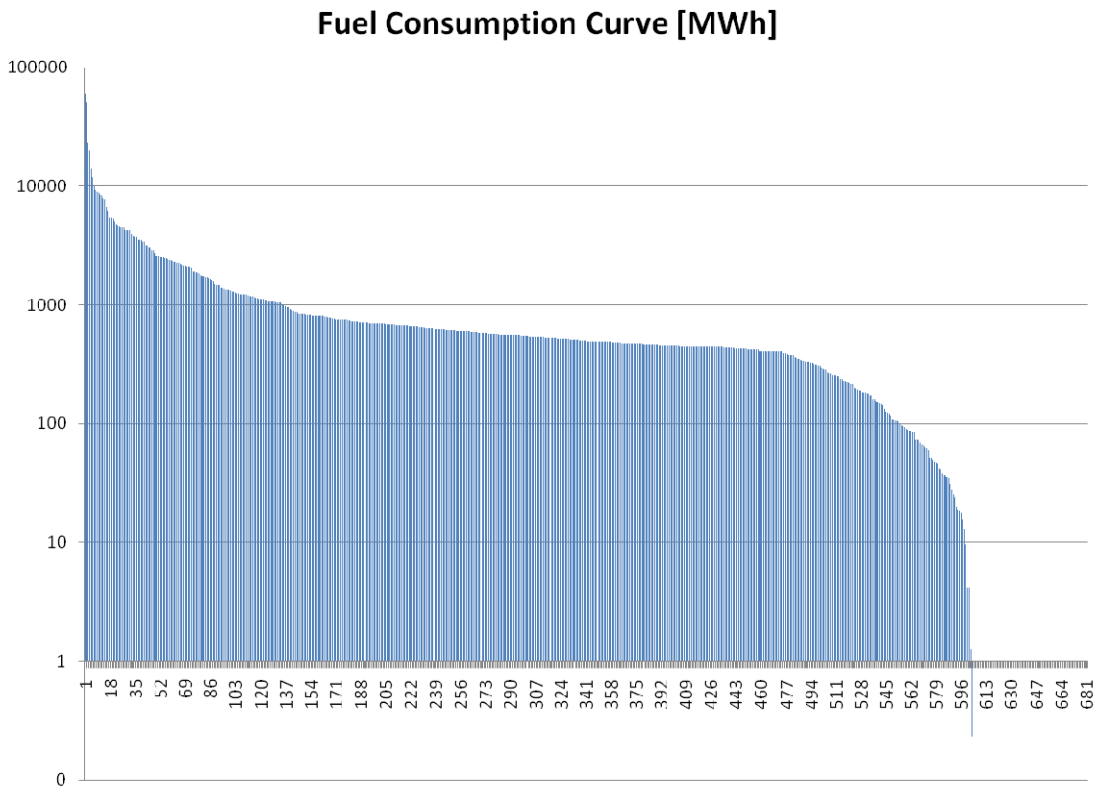

Figure 7 - Fuel Consumption Curve

3.4 Cluster areas

Whilst a number of buildings have been identified throughout the Borough, it is necessary to identify a number of smaller areas that could be focused upon to provide potential for heat network development.

With the criterion listed above (3.1) in mind, the process by which a cluster area is determined is by trying to group as many large heat users together as possible and at the same time corral as many of the smaller heat users as possible. The cluster areas are also determined by areas where an energy strategy is already in process or where planning permission is being sought or given to a larger residential and/or mixed use development.

This process may result in a cluster area crossing larger roads, railways and rivers just as it could be excluding some buildings that appear to be within reach, but it would be expected that a detailed feasibility study would determine the scope for a heat network within the areas.
The following clusters have been created and are illustrated in Appendix D.

3.4.1 Bromley by Bow

This area contains a number of multi-tenanted housing developments some of which has been identified by LBTH as needing heat system replacement. The area around Three Mill Lane has been identified in the Council's Masterplan and nearby areas has been cleared for redevelopment. The majority of buildings in this cluster area comprise housing and schools.

Redevelopment has taken place over recent years which may render the existing heating systems redundant if connected to a heat network.

Within this Focus Area 24 buildings/connections have been identified.

3.4.2 Stepney

Queen Mary University of London University could provide a basis for local area network with commercial developments to help create anchor loads straddling Mile End Rd. Other major loads include London Independent Hospital, Stepney Green College and Mile End Hospital.

There is significant housing (Ocean Estate) around the area of Shandy Park.

Within this Focus Area 33 buildings/connections have been identified.

3.4.3 Aldgate / Whitechapel

The Royal London Hospital could provide a basis for an energy centre and heat network. The Aldgate/ Leman St /Alie St area development, identified in the Council's Masterplan may offer significant potential for both an energy load and an energy centre site.

If developed strategically links could be made with Stepney and/or Wapping but significant rail infrastructure divides the area.

Within this Focus Area 82 buildings/connections have been identified.

3.4.4 Mile End

Mile End Leisure centre could be the anchor load and site for an energy centre. Housing dominates this area with a good concentration of housing around Wellington Way, Eric Estate, Terby Estate and The Bede Estate. It should be noted that this area is subject to redevelopment plans.

Within this Focus Area 22 buildings/connections have been identified.

3.4.5 Wapping

News International is a major commercial player that could become a significant heat consumer or even be able to contribute to energy provision. A number of multi-tenanted buildings populate this area and a number of local authority buildings but they are evenly distributed and none offer significant energy demands.

Within this Focus Area 52 buildings/connections have been identified.

3.4.6 Bethnal Green

The London Chest Hospital could act as basis for an energy centre and heat network. Significant housing around and Old Ford Rd and Mace St would suggest this has potential for creating a heat network. The area to the north of Hackney Road has been identified in the Council's Site and Placemekaing DPD which, depending on time and type of development, could tie in with the housing on Old Bethnal Green Rd.

Within this Focus Area 34 buildings/connections have been identified.

3.4.7 Blackwall

There is a mix of commercial, housing and hotels in a relatively small area. The combined buildings offer a high heat load density but have significant road and rail (DLR) infrastructure dividing the area. The presence of small wharfs may hinder growth of a network in this area.

Within this Focus Area 28 buildings/connections have been identified.

3.4.8 Canary Wharf

Extensive existing commercial developments would make ideal loads for a network in this area. Clearly the buildings in this area may well employ localised CHP which may impede the development of a network in this area. Opportunities exist for a network, however, when these CHP units come to the end of their working life.

Within this Focus Area 51 buildings/connections have been identified.

Table 7 summarises the estimated heat demands and loads for each of the Focus Areas.

Focus Area	Estimated heat demand (MWh/yr)	Estimated Max. Heat Load (MW)
1. Bromley by Bow	18,471	7.7
2. Stepney	45,276	18.9
3. Aldgate/Whitechapel	101,753	42.4
4. Mile End	16,156	19.2
5. Wapping	40,684	17.0
6. Bethnal Green	21,580	9.0
7. Blackwall	41,030	17.1
8. Canary Wharf	257,445	107.3
TOTAL HEAT DEMAND	**542,395**	**226.0**

Table 7 - Cluster Area heat demands and loads for potential DH network(s)

4. SAMPLE HEAT NETWORK

4.1 Pre-conditions

The outline of the DH network considered in this assessment is based on the conditions described below.

The flow and return temperatures have been chosen as 90ºC and 50ºC. The distribution network is recommended as being pressure rated at 10 bar. A maximum pressure of 10 bar, a static pressure of 1.5 bar and a pressure difference of 1 bar at the end-user installations has also been assumed for the hydraulic optimisation.

The necessary pipe dimensions are estimated by using the software package “SYSTEM RORNET”, which is a simulation programme for hydraulic and thermal analysis of DH networks. SYSTEM RORNET (SR) calculates the optimum diameters of the pipes based on knowledge about temperature difference between flow and return, pressure levels, costs for piping and the maximum velocity in the pipes. SR is a software package specifically developed by RE for DH and cooling network optimisation and is considered a leading industry software package.

4.2 Heat Loads and Diversity

Heat loads are used for network dimensioning and are calculated based on the annual heat demand.

In a DH network the branch supplying a single consumer is designed for the consumers peak load demand. A distribution pipe supplying several consumers is not designed for supplying all the consumers with their peak load demand at the same time; the individual peak load demands will not occur at the same time due to diversity. Therefore, the peak load demand of each consumer has to be multiplied by a diversity factor to find the heat load that the distribution pipe should be designed for.

The estimated annual heat consumptions in Table 8 are turned into maximum heat loads using a yearly utilisation time and taking diversification in the system into account.

The rounded heat demands and network heat loads for the scheme are shown in Table 8.

Modelled Area	Estimated heat consumption (MWh / Annum)	Max. Heat Load (MW)
Blackwall 18 consumers	27,555 MWh	7 MW

Table 8 - Rounded heat demands and loads estimated for the potential DH network.

4.3 Network Layout

A network layout has been developed for illustrative purposes and is shown as an output from RE’s System Rornet software Figure 10 and overlaid on a map (in red dotted) Figure 9.

As we have not yet identified an energy centre, we have assumed a notional position for the purposes of this exercise that ultimately may not be achievable.

The total length of the network is approximately 1.5 km. The largest pipe dimension is DN200. The energy centre would be located north of the network.

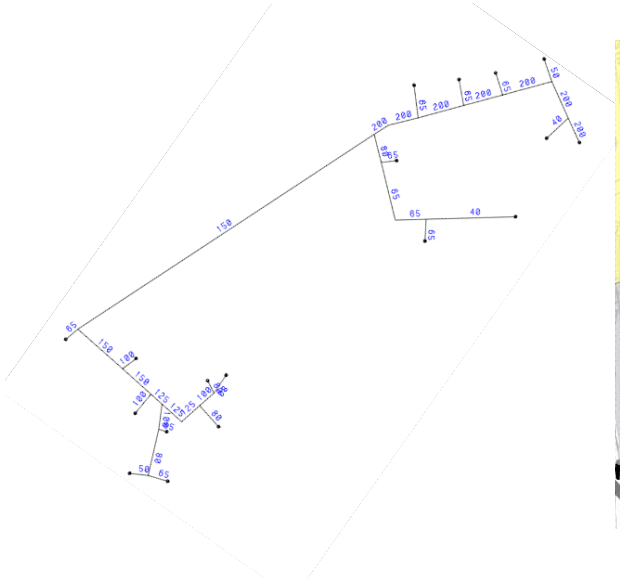

Figure 9 - System Rornet Output

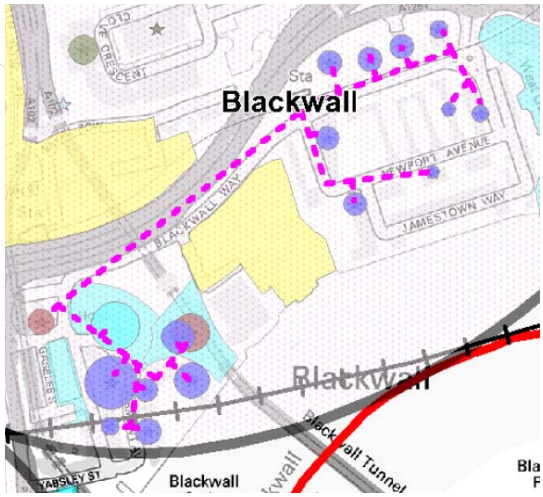

Figure 8 - Pipe layout on plan

4.4 Heat Loss from the Network

The network heat loss has been estimated based on the proposed pipe dimensions, the flow and return temperatures and the assumption that the surrounding soil is at 10 °C. The heat loss in a full load situation is found to be around 73 kW which gives a heat loss of about 580 MWh per annum or 2.1% of total energy generated. The measure of heat losses will vary throughout the year as demand rises and falls with the seasons.

4.5 DH Main Network Cost Estimate

The ‘Blackwall’ network costs have been estimated at £1.4 million. This excludes the cost of the energy centre and any modifications required by buildings to connect to the heat network. The cost does reflect hard dig civil work but excludes significant traffic control that would be applicable to very dense urban areas.

5. IMPLEMENTATION PLAN

Following the identification of the DE opportunities it is important to develop a high level Implementation Plan that helps LBTH to set out the steps to progress the identified opportunities. For each opportunity, key components have been identified that will help drive forward any proposal such as where an energy strategy is already in process or where planning permission is being sought or given to a larger residential and/or mixed use development; this should also include the requirement for further study. Identified barriers have been included to highlight issues that may hinder the development of an opportunity. Identifying the next steps, key dates for action and responsible persons within the Borough have not been completed within the time available for the report. LBTH have indicated that this work will be concluded after this Report has been concluded.

	DE Opportunity	Priority	Notes	Planning Status	Barriers	Next Steps	Key dates	Responsible person
	(Identified by location, name of development, scheme name or other)	(High, Medium or Low based on highest potential for delivery)	(Basis of assessment of delivery potential)	(Planning permission granted, outline application, detailed application, etc)	(Potential barriers for delivery of opportunity identified)	(Next steps for LA to facilitate delivery of opportunity identified)	(If action is not taken by this date the potential for delivery of the scheme may be reduced)	(Person responsible for taking action)
1	Bromley by Bow	Medium	A number of multi-tenanted housing some of which identified by LBTH as needing heat system replacement. Area around Three Mill Lane.	Site of former St Andrews Hospital.	Programme length			
				Three Mill Lane site area	A12 may create barrier to pipe expansion			
					TfL road restrictions			
				Areas identified in Site and Placemaking DPD				
2	Stepney	High	Queen Mary University of London hospital could provide a basis for local area network. Significant housing (Ocean Estate) and commercial developments to help create anchor loads straddling Mile End Rd		Availability of hospital assets; longevity.	Engage Hospital trust		
					TfL road restrictions?			

3	Aldgate/Whitechapel	High	The Royal London Hospital could provide a basis for an energy centre and heat network. Significant housing developments		Availability of hospital assets; longevity.	Engage Hospital trust		
				The area has been identified as a significant area for development under Masterplan.	Uptake of scheme by new developments	Local policy framed to encourage connection by new developments		
				Leman St/Alie St site				
					TfL road restrictions			
4	Mile End	High	Mile End Leisure centre could be the anchor load and site of an energy centre. Good concentration of housing around Wellington Way, Eric Estate, Terby Estate and The Bede Estate		No individual significant heat loads present			
				Areas identified in Site and Placemaking DPD				
					Longevity of estates buildings			
5	Wapping	Medium	A number of multi-tenanted buildings. A number of LA buildings could act as anchors		No individual significant heat loads present			
					Areas of water course may inhibit scope of network			
6	Bethnal Green	High	The London Chest Hospital could act as basis for an energy centre and heat network. Significant housing around Old Bethnal Green Rd and Old For d Rd		Rail network divides area			
				Areas identified in Site and Placemaking DPD				
						Engage Hospital trust		
7	Blackwall	Medium	Significant commercial developments		A1261 and DLR infrastructure			
				Areas identified in Site and Placemaking DPD				

					Housing developments relatively new.			
					Potential for water course to disrupt pipe routes			
8	Canary Wharf	High	Extensive existing commercial developments adjacent to East India dock Rd		Likely to be self-served with small-scale CHP	Create interest group in area with building owners		

6. SUMMARY AND CONCLUSIONS

Eight Focus Areas were identified in this study and ranked in the following order; the numbers refer to the numbers in the implementation plan in Section 5 above.

2. Stepney - High
4. Mile End - High
3. Aldgate/ Whitechapel - High
6. Bethnal Green - High
7. Blackwall - High
8. Canary Wharf - Medium
1. Bromley by Bow - Medium
5. Wapping – Medium

We have tried to rank these but they all have merits and constraints that differ. Most sites have very good potential for developing DE in the form of heat networks.

When implementing DE there are a number of good practices and recommendations in relation to the design and installation that have been developed over the years.

This study is a very early high level assessment of the potential network locations. The next phase should be to complete a more detailed feasibility study of the preferred schemes as a whole.

- A detailed and more in-depth study would examine the heat demands and their connection to a DH system in more detail. Due to the varying sizes of the DH networks considered in this study and to fully consider the potential for a Borough-wide approach, a more detailed study needs to consider the transmission/distribution network approach as to what will be the best technical solution in combination with the viability of the scheme.

- The investment is potential significant and a more detailed study should look at phasing the implementation of the heat networks and look at reducing the investment risk.

- A detailed cost analysis and viability calculation based on whole life cost should be carried out on each network.

It is likely that even following a detailed feasibility study that a number of questions and uncertainties will remain. These should be thoroughly investigated and/or determined directly.

The detailed specification for the installation and maintenance of the DH network is something worth considering as early as possible in the project process. This helps to gain greater certainty for both the capital and operating costs.

RE recommends that;

- Feasibility studies should be undertaken for each of the recommended Focus Areas potential heat networks.

- A study should be undertaken to determine what other buildings, not identified within the scope of this study, could form part of the core heat networks and to collect the heat data from these buildings.

- For each heat network an additional investigation should be undertaken to consider the network and the heat production facility in more detail.

- In light of the developing heat networks, a study should be undertaken to determine how the heat energy demands for the Borough can be met, particularly from low carbon

sources. Consideration should be given to determining an overarching energy plan with all neighbouring Boroughs.