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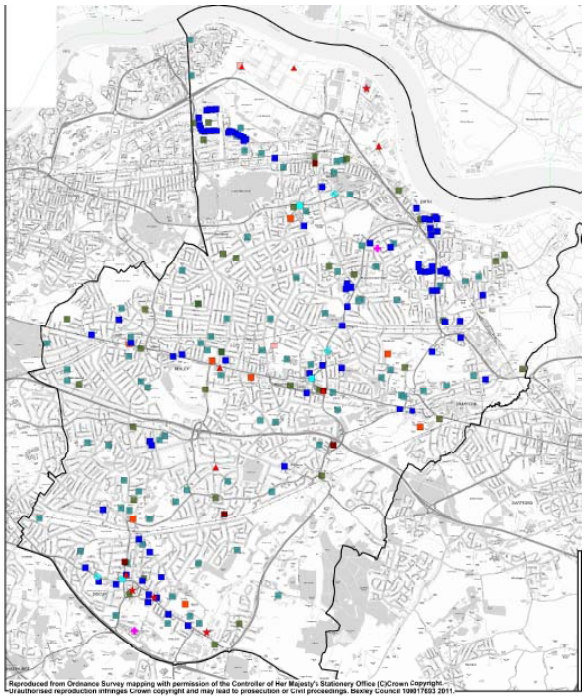
THE LONDON BOROUGH OF BEXLEY
LONDON HEAT MAP STUDY



RAMBOLL

THE LONDON BOROUGH OF BEXLEY
LONDON HEAT MAP STUDY

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Description	**Heat mapping for the London Borough of Bexley.**

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

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1. INTRODUCTION

1.1 Background

Ramboll Energy (RE) has been commissioned by the London Borough of Bexley (LBB) 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 (NI) 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 LBB 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 LBB 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 LBB 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 LBB 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 LBB.
(c) Provide advice and support to the LBB in interpreting and acting upon the results of the heat mapping through a high level implementation plan.

The scope of this work differed from previous studies undertaken by RE as part of the DEMaP program in that the data collection exercise was undertaken by LBB. We understand that the LDA determined that sufficient data had been collected in previous LLB studies to warrant the exclusion of data collection from this study. RE, therefore, has produced this report on the basis of the information provided by LBB.

2. DATA GATHERING

2.1 Requirements

The LDA requires that data is collected in an Excel spreadsheet template which they provided. 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 LDA also set out a list of buildings that should be focused on as a priority;

- 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

As it was agreed that the LBB would provide the data suitable for use in the LDA template RE provided LBB with a sample template that they could populate with their data. The result was a spreadsheet with names, coordinates, addresses and gas consumption derived from the NI185 data. RE updated some of the coordinates as they were inaccurate.

The NI185 data received from LBB contained no residential buildings, however, approximately 26 buildings had been identified by the LDA which was obtained through their existing database, as multi-address buildings each containing at least 50 residential units. These buildings had to be benchmarked as the LDA database contained no energy consumption data. RE believed that due to the nature of development, with blocks of flats often clustered together within the Borough, it would be worth including buildings with a lower number of residential units. In addition to the 26 identified by the LDA, a further 64 residential buildings each containing more than 30 units were added to the template derived from the Ordnance Survey Address Point register and subsequently benchmarked where data was not available.

RE has previously undertaken a number of Heat Mapping projects for other London Boroughs and has created a number of contacts. Although not part of the scope, in addition to the residential building mentioned above we have also been able to add;

- the gas consumption for the 3 Fire stations in the Borough.
- the gas consumption for Queen Mary's hospital
- two large hotels, education facilities and a small number of private industrial facilities.

2.3 Limitations of Data Collection

Although RE was not involved in the data collection exercise, it is important to recognise that there are a number of limitations that can arise;

- 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 whether 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.

During the process of interpreting the data we noted the following;

- LBB were only able to provide data from their NI 185 database.
- The data from private buildings, previously thought to be available, was subject to copyright and could not be used in this report.

RE did try to use Local Land and Property Gazetteer (LLPG) data to identify priority buildings for benchmarking but the LLPG data received from LBB unfortunately did not categorise building type or use, and so specific priority buildings could not be extracted to populate the maps/template.

2.4 Energy sources and district energy networks

A search was conducted to determine known energy sources and potential energy sources in the Borough. RE searched databases including; DECC Heat Map – CHP database, London Energy Partnership community heating database, LDA heat map for previous records and OFGEM CHP register.

2.4.1 London Thames Gateway Heat Network

The LDA is developing a sustainable district energy 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 phased stages; the timing yet to be determined but it will initially draw in the Sustainable Industries Park (SIP) and Barking Town Centre. The network will be started separately in the Royal Docks area. Future phases 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 1 - LTGHN Vision Plan (courtesy of the LDA)

Figure 2 indicates the proximity of LBB to the LTGHN. The LTGHN hopes to use Barking Power station as a primary source of heat energy for the network. Its vision also indicates a potential link into LBB using the Belvedere Plant as an energy source and a springboard for a network south of the Thames.

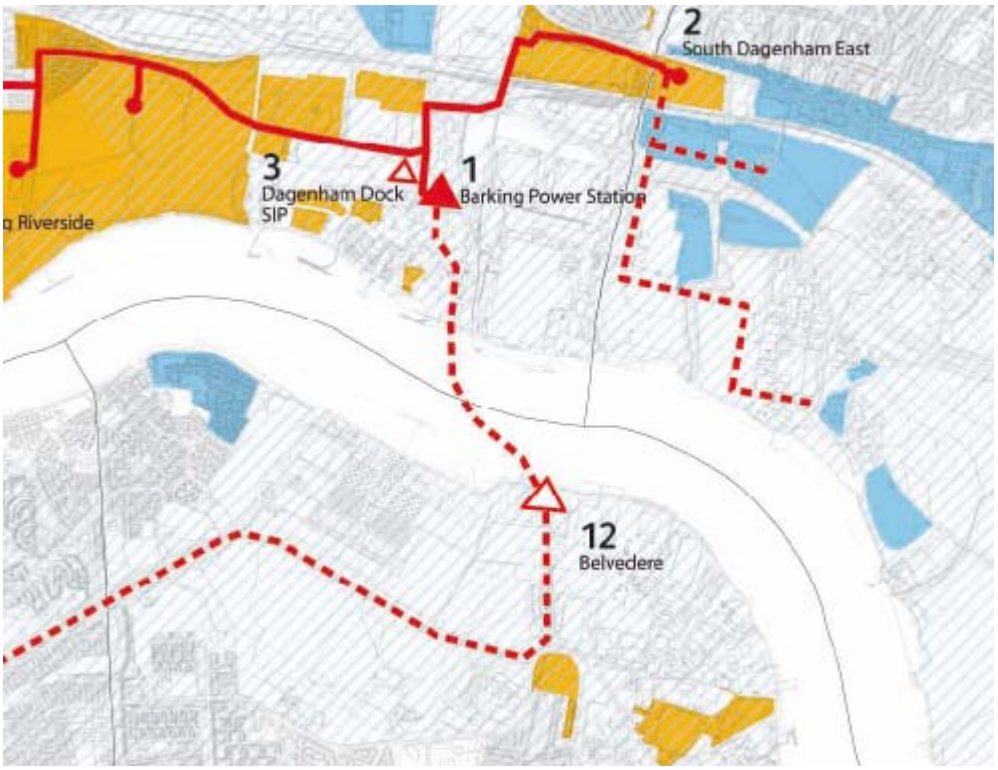


Figure 2 - Proximity of the LBB to the LTGHN (courtesy of the LDA)

2.4.2 Belvedere Waste to Energy Facility

The site of the development is located at Norman Road, Belvedere. It lies to the north of A2016 on the south bank of the River Thames. Bexleyheath is to the south and the important strategic Dartford River Crossing lies some 8km to the East.

The Waste to Energy facility based in Belvedere is a plant in construction that will process 585,000 tonnes of domestic waste per annum. The conversion of this waste is hoped to generate up to 30MW of heat energy and 72MW of electricity.

It may be possible to extract more heat than the 30MW initially indicated by Riverside Resource Recovery Ltd – a subsidiary of Cory Environmental Ltd – but this would mean a reduced electrical output.

2.4.3 Crossness Sewerage Works

On an adjacent site sits the Crossness sewerage works which treats the waste from serves Richmond upon Thames, Wandsworth, Merton, Lambeth, Southwark, Lewisham, Greenwich and parts of Sutton and Bromley.

The process of waste water treatment requires energy and the incineration of the waste sludge will help provide the energy to do this. The energy demand of the site is expected to outstrip that available from the waste, so it is not considered that they would have heat to export.

2.4.4 Archer Daniels Midland Ltd

Archer Daniel's Midland Ltd (ADM) is located in Belvedere and is a refinery for the production of edible oils and fats. The LDA data base identifies that the plant has a CHP installation rated at $8MW_e$; $4.75MW_{th}$. The scope of this project and time available meant that RE were not able to verify these figures with ADM.

2.4.5 Other CHP Installations

In addition to the large energy generating sites listed above we have from the existing LDA database been able to identify, four further CHP installations in the borough;

- The Marriott Hotel has an installation rated at 320kW electrical.
- Splash World has an installation rated at 90kW electrical.
- Riverside Baths has an installation rated at 90kW electrical.
- Lamorbey Baths has an installation rated at 90kW electrical.

These CHP installations are too small to be considered as being able to contribute to any development of a DE heat network as any heat output is likely to be consumed entirely by the host building.

2.5 London Borough of Bexley

The Borough's Investment Plan[1] identifies a number of priority areas – the projects of some have yet to be fully developed – including;

- Erith
- Slade Green
- Thamesmead
- Belvedere
- Crayford
- Bexley First

LBB has identified growth in housing as a requirement at a rate slightly above that identified in the London Plan but recognises that a funding gap exists for affordable homes. In the period leading up to 2017/18 LBB estimates that with public sector support up to 3,400 homes could be developed; of which 1,200 could be affordable. Further growth of housing has been identified at 345 homes per year until 2026.

[1] Bexley Investment Plan

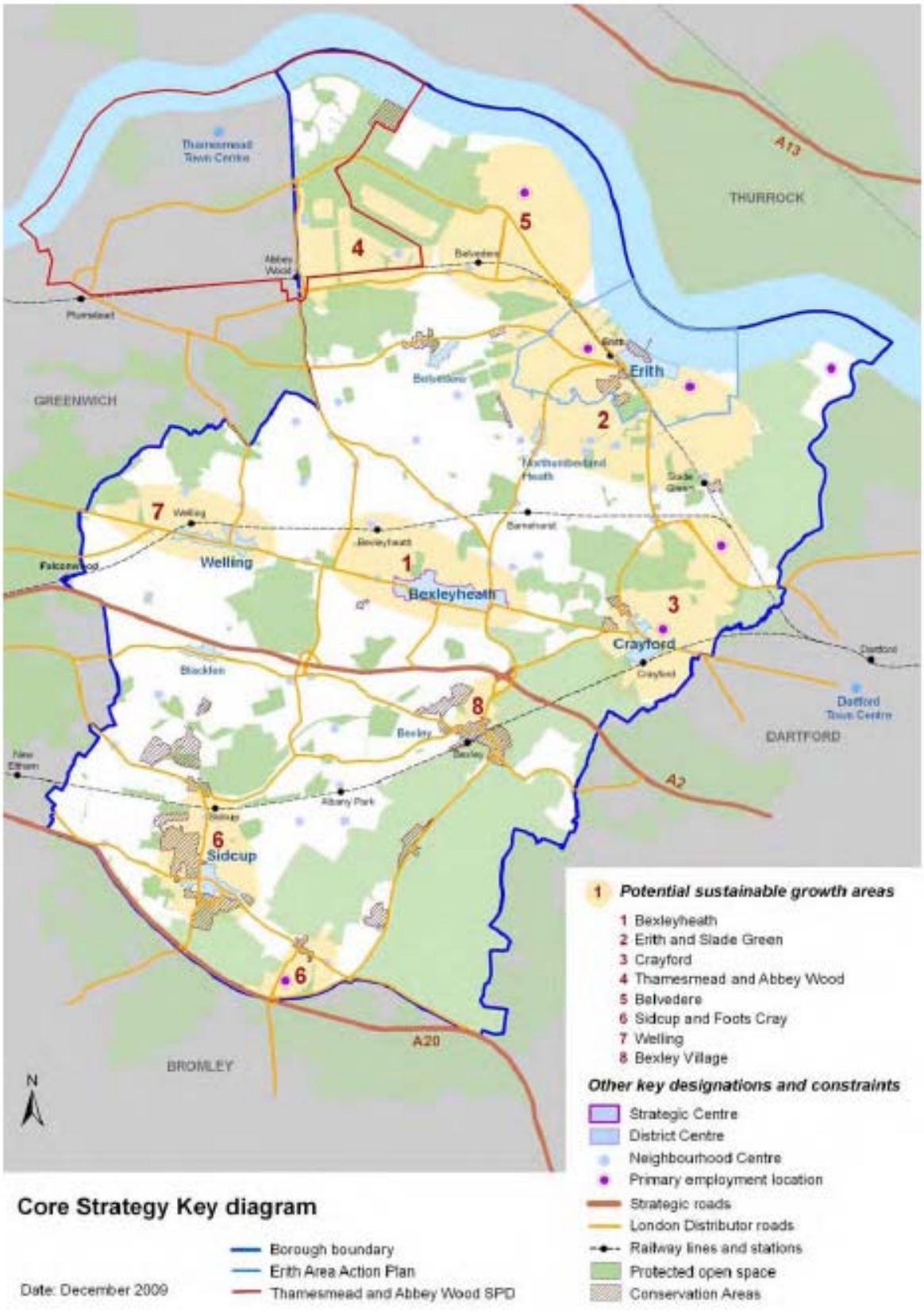


Figure 3 – LBB Core Strategy

2.5.1 Erith

Erith is located in the north of the Borough adjacent to the River Thames. Despite the decline in activity in the area there have been a number of new developments in the area that has helped to stimulate growth.

The Town Centre has many flats owned by local housing associations. The Council owns much of the land which can offer the opportunity for development using DE.

Priority projects identified by the Council include the Erith Western Gateway – an area between the station and the Town Centre. 350 residential units form part of the proposal to generate the area. The redevelopment would also include a number of mixed used commercial developments.

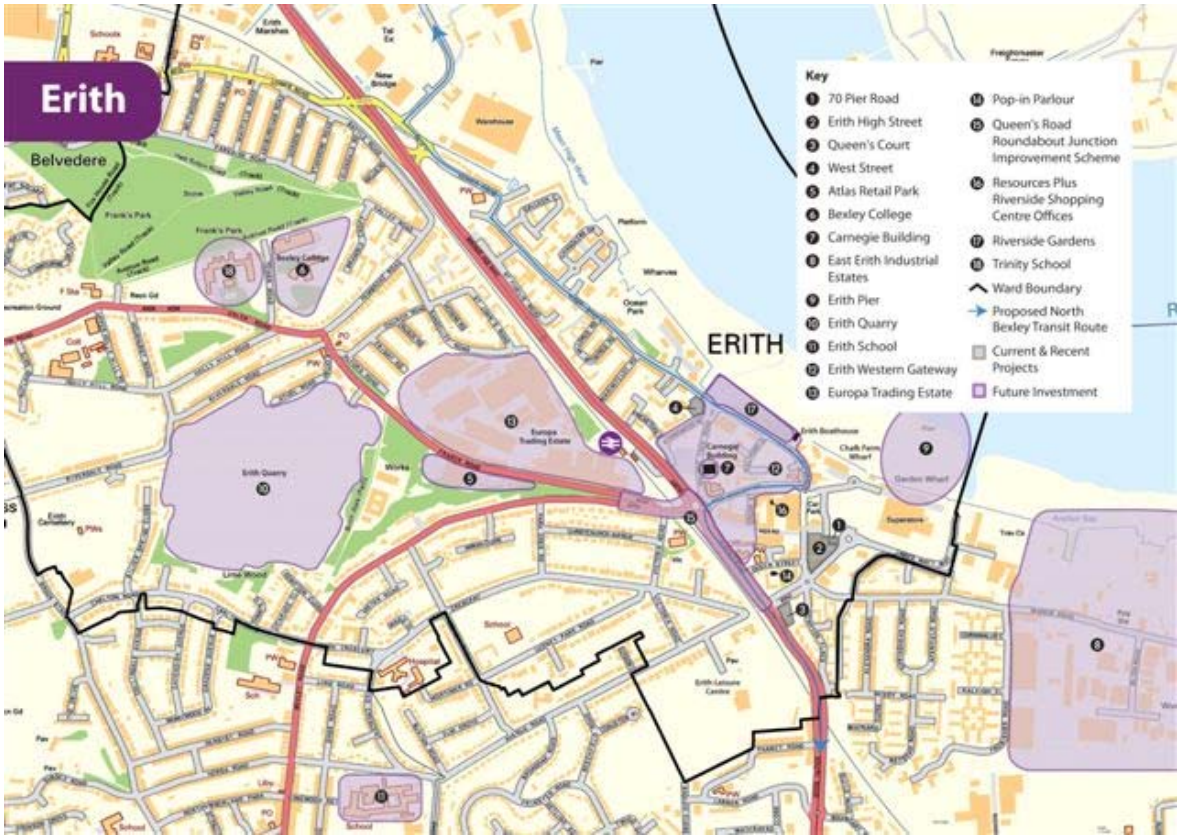


Figure 4 – Erith Investment Plan

2.5.2 Slade Green

Slade Green lies immediately to the south-east of Erith and is similarly in the Thames Gateway – an area identified for special regeneration measures. This area is also identified by LBB as having declined and suffering from some degree of deprivation. The industrial legacy has caused environmental impacts on land that could be used to redevelop the area.

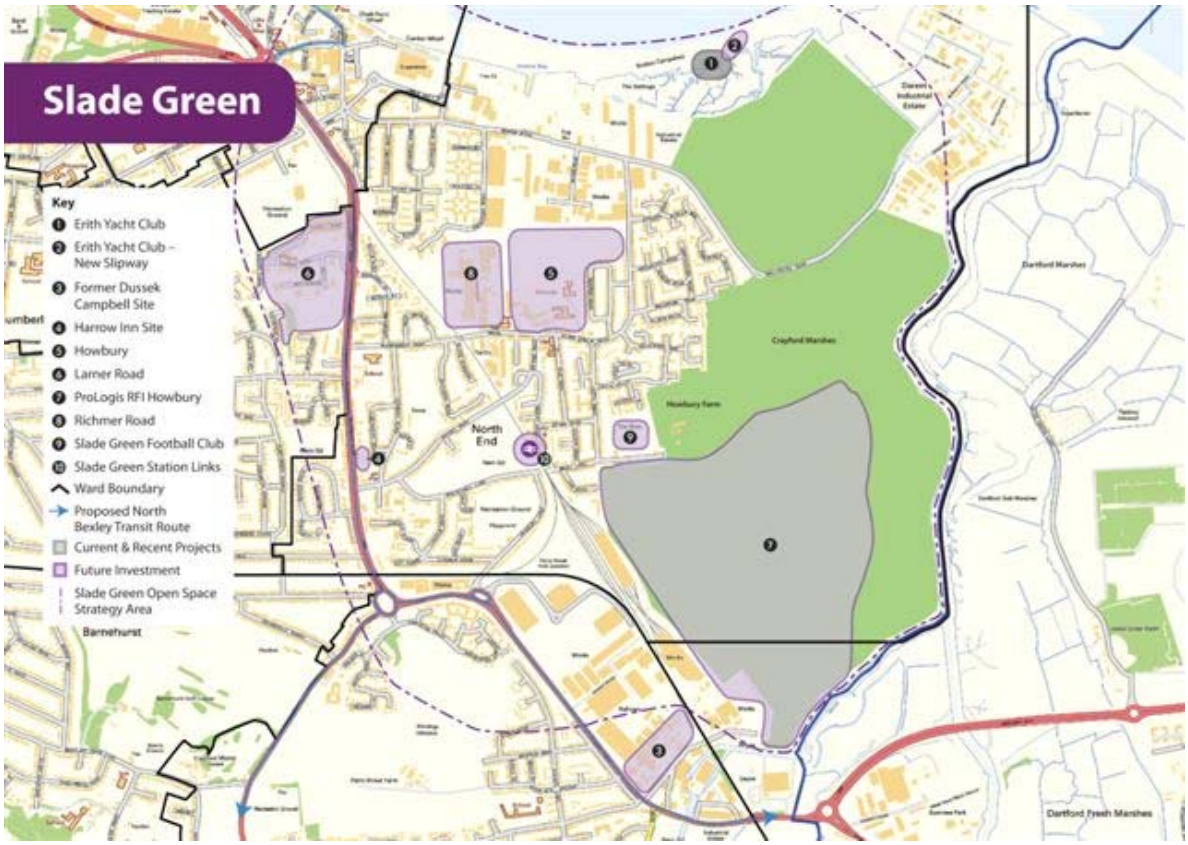


Figure 5 – Slade Green Investment Plan

LBB has identified two key priority projects - Larner Road Estate Renewal and Howbury Centre Site.

The Larner Road Estate comprises mainly of seven 14 storey tower blocks and one lower block. It has been subject to significant renovation but the financial burden of maintaining the estate is considered too high. The proposal is to replace the estate with a mixture of flats, maisonettes and houses.

Howbury Centre Site is an area of vacant land and a number of buildings that once formed a secondary school and is now occupied by the Council. This area has been identified as offering space for a new development of housing and local community buildings.

2.5.3 Thamesmead

Thamesmead is located in the north of the Borough and fronts onto the Thames. It also is an area shared between LBB and London Borough of Greenwich (LBG). This area also suffers from levels of multiple deprivation.

A strong partnership including LBB, LBG, the HCA and local housing partnerships has produced a joint Supplementary Planning document and a delivery plan for the area.

Priority projects include;

Southmere Village (formerly Tavey Bridge) which has commenced and is planned phased delivery will see completion in 2018. This includes the refurbishment, demolition and new building of residential properties and community infrastructure.

Parkview is identified for public realm and community infrastructure improvements.

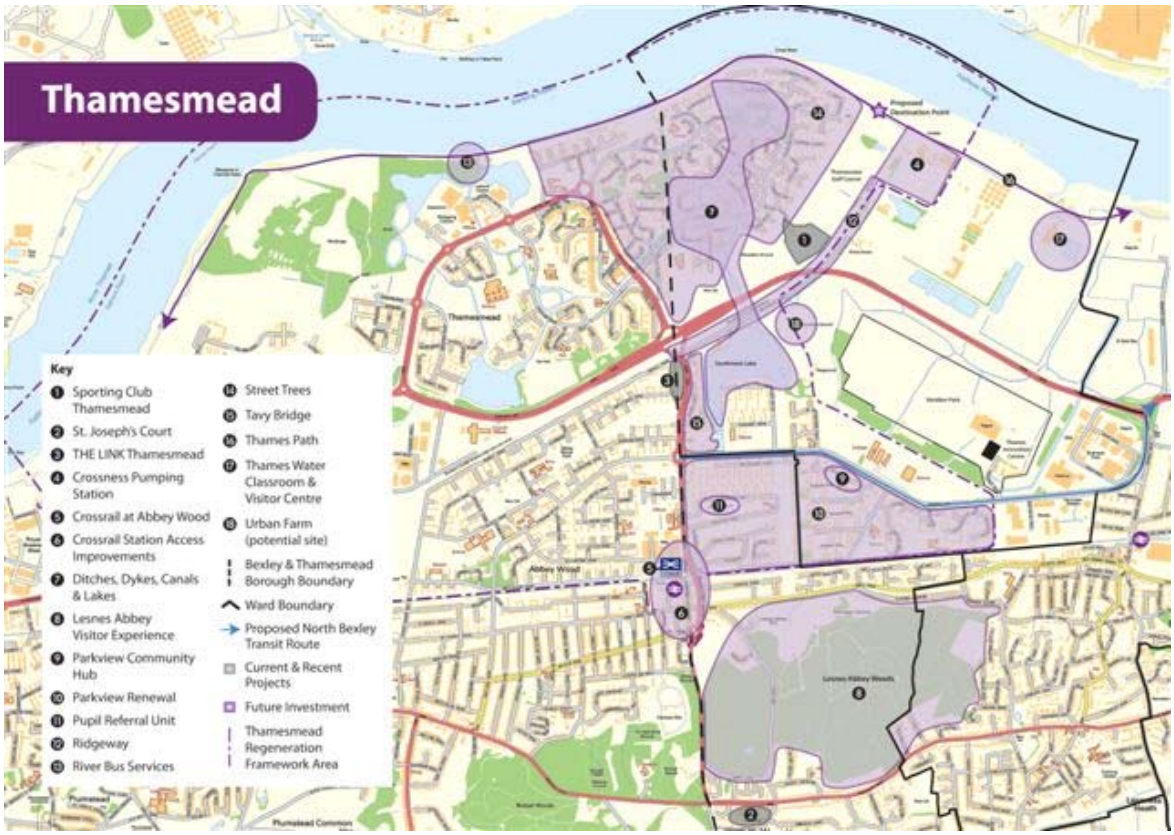


Figure 6 – Thamesmead Investment Plan

2.5.4 Belvedere

Belvedere Employment area is one of London's largest industrial employment areas but has suffered from decline and is subject to localised flooding and land contamination issues.

LBB have a vision that sees the manufacturing base continue but recognise the need for diversification.

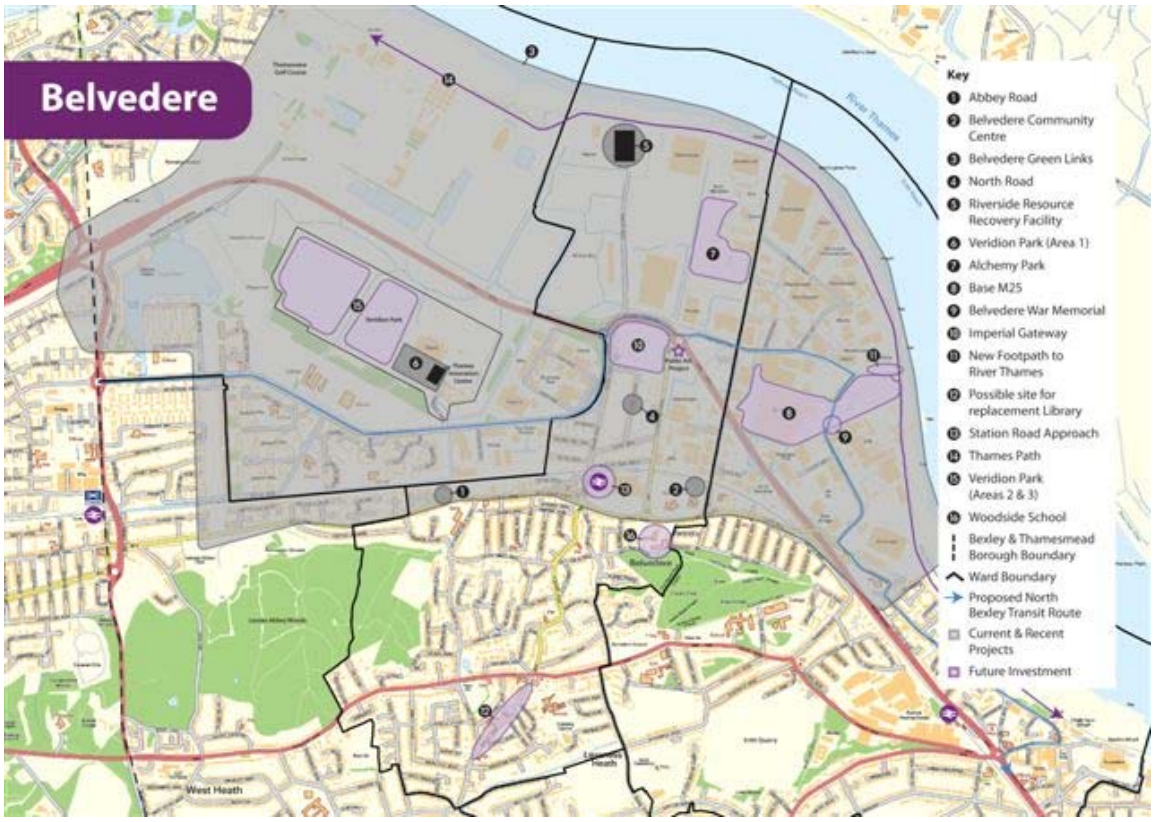


Figure 7 – Belvedere Investment Plan

2.5.5 Crayford

Crayford is located in the south-east of the Borough and has developed into a retail centre. The area has gained benefit from more recent redevelopment. The Council hope to use public funding to improve public realm facilities in the hope that this will help secure additional private investment to the area.

Along with the improvements to the public realm, the original plans to include the redevelopment of the town hall site, a new library and community facility, new clinic/health centre, and high quality housing, has been replaced with a proposal for a first phase of 144 rented and intermediate affordable homes that are HCA funded. A future phase will be considered at a later date.

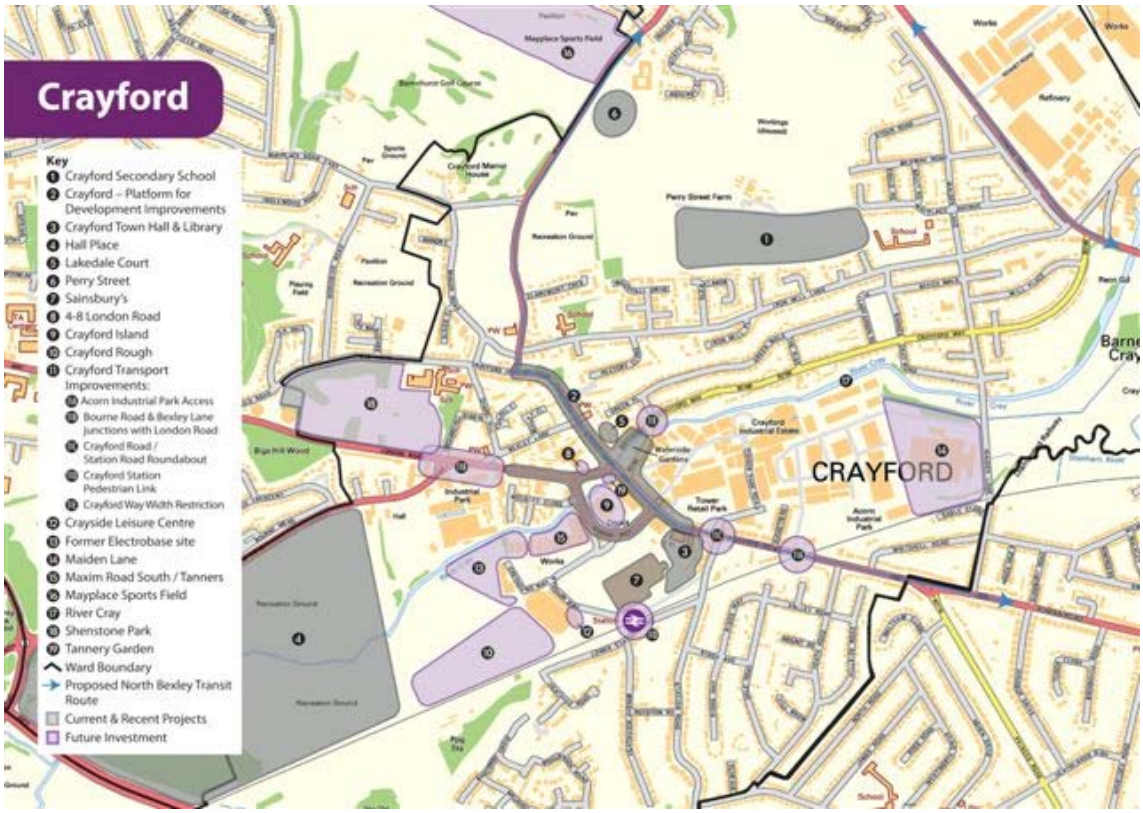


Figure 8 – Crayford Investment Plan

2.6 Benchmarking

Benchmarking of buildings was based primarily on a number of references and are summarised in Table 2 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.
Office	0.091		Energy Consumption Guide 019
Distribution centre	0.034		
Grocery store	0.200		CIBSE Guide F - Good Practice
Secondary school / Academy	0.108		CIBSE Guide F - Good Practice
Hotel - Business/Holiday		15.08	CIBSE Guide F - Good Practice

Table 2 - 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 LBB is bordered by four Boroughs;

- The London Borough of Barking & Dagenham
- The London Borough of Havering

- The London Borough of Bromley
- The London Borough of Greenwich

3.2.1 London Borough of Barking & Dagenham (LBBD)

The LBBD has developed an energy strategy for the borough which identifies the use of low carbon CHP and district heating as an energy provider. The LBBD is home the Barking Power station which has been identified as a potential energy source for the LTGHN (see 2.4.1).

Barking Town Centre has been chosen by the Mayor of London as one of four 'energy action areas' across the city to showcase a range of sustainable energy technologies and techniques. LBBD has investigated several options for heat networks in the Town Centre and has developed an Energy Action Area Implementation plan[2].

Barking Riverside is a major new development in the south of the Borough; bordering the Thames. It is being developed to enhance sustainable living which may include the use of district heating. This area has also been identified as a major heat load for the LTGHN.

Any heat network opportunities in the Borough are likely to stem from the Barking Power Station or local renewable initiatives. The potential for linking to any such opportunities is considered low as a river crossing would be required and this would require significant investment and a heat demand to match that investment.

3.2.2 London Borough of Havering (LBH)

The LBH as developed an energy strategy[3] that recognises the use of CHP and district heating but we were unable to determine whether the LBH has plans to develop any heat networks in the south of the Borough.

Any potential for linking to any such opportunities is considered low as a river crossing would be required and this would require significant investment and a heat demand to match that investment.

3.2.3 London Borough of Bromley (LBBr)

RE were unable to determine what initiatives or opportunities were available from LBBr.

[2] Barking Town Centre Implementation Plan, August 2006

[3] The London Borough of Havering's Sustainable Energy Strategy, December 2006

3.2.4 London Borough of Greenwich (LBG)

LBB and LBG are working together on a number of joint initiatives one of which is to develop the Thamesmead and Abbey Wood areas indeed a joint Supplementary Planning Document was adopted in 2009 with Greenwich for Thamesmead and Abbey Wood.
LBB is working with the HCA and LBG to build on the Supplementary Planning Document through a Master planning exercise - a Strategic Regeneration Framework Thamesmead - the first phase is planned for south Thamesmead.

We also understand that LBG is actively involved in developing DE in other parts of 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. This area is of course some distance from LBB and is not considered as a potential opportunity area.

3.3 Results

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

Table 3 summarises the data collection by building type and Table 4 summarises the data by building ownership.

The low figures for energy consumption for the Sports & Leisure Facilities, in Table 3, are due to the lack of data available.

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 and by Cluster
- Appendix D illustrates the layout of the sample network

Type of buildings	Subtotal	Subtotal [MWh]	Floor Area [m2]	Residential Units
Multi-address buildings	90	35,575	-	4,357
Sport & Leisure facilities	8	42	-	-
Prisons	-	-	-	-
Hotels (> 99 units or 4,999 m2)	5	3,755	-	-
Education facilities	85	42,557	231,679	-
Police stations	3	-	-	-
Fire stations	3	215	-	-
NHS	2	5,980	45,308	-
Central government estate	1	1,456	16,000	-
Local government estate	38	10,217	55,383	-
Museums & Art Galleries	2	-	-	-
Churches	-	-	-	-
Private residential (> 149 units or 9,999 m2)	-	-	-	-
Private commercial (> 9,999 m2)	4	2,443	40,782	-
Other public buildings	-	-	-	-
TOTAL	**241**	**102,239**	**389,152**	**4,357**

Table 3 - Summary of data collection by building type

Ownership of buildings	Subtotal	Subtotal [MWh]	Floor Area [m2]	Residential Units
Central government	9	7,651	61,308	-
Local government	110	51,137	271,516	-
Other public	-	-	-	-
Private	122	43,452	56,328	4,357
Other	-	-	-	-
TOTAL	**241**	**102,239**	**389,152**	**4,357**

Table 4 - Summary of data collection by ownership

In Figure 9 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).

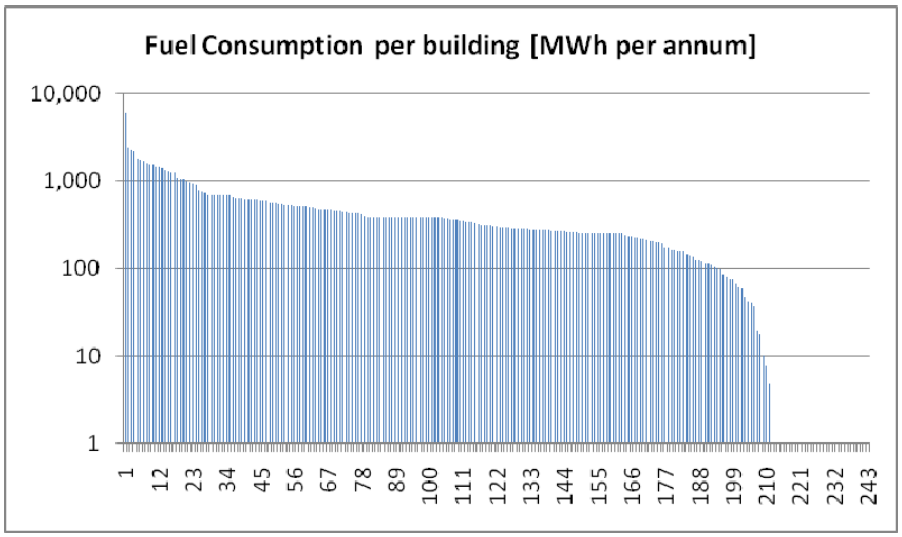


Figure 9 - Fuel Consumption Curve

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.

Five cluster areas have been identified using the described approach and are detailed below and illustrated in Appendix C. In general the identified Clusters match the areas identified by LBB in both the Core Strategy and the Investment Plan. Crayford was an area that we did not highlight but this is more as a result of having a limited scope than there being any realistic opportunities for DE in this area.

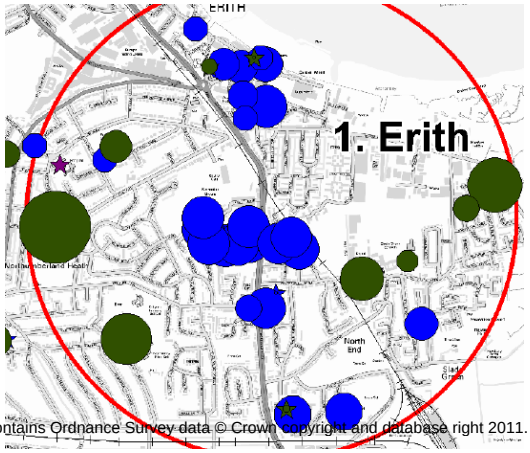
The CHP installations identified in 2.4.5 above are illustrated on the Cluster maps as small red triangles.

The scope of the work limited the data available to us and predominantly excluded private commercial properties. The Clusters will, therefore, not necessarily be representative of the full potential for the cluster or indeed for the Borough.

Table 5 summarises the data findings for the five Cluster areas identified.

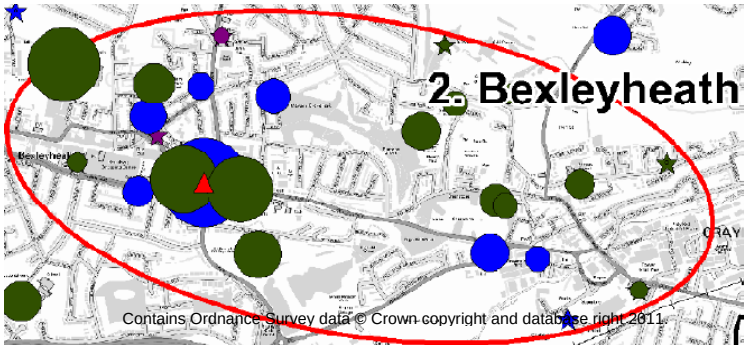
3.4.1 Erith

The Erith Cluster is a combination of Erith and Slade Green. The major centres of energy being centred on the Erith Western Gateway (Erith) and Larner Road Estate (Slade Green) areas. These two centres offer good potential to develop heat networks.



3.4.2 Bexleyheath

The area around the Broadway Shopping Centre could offer potential for a heat network. The surrounding area has a number of commercial and retail buildings that are relatively close together, providing a core of buildings from which to develop a heat network.

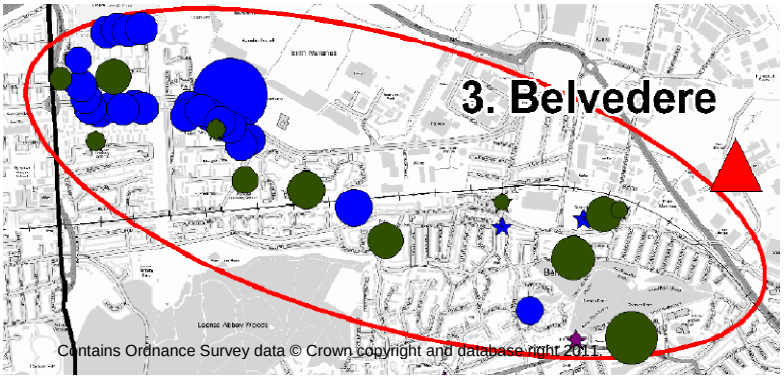


3.4.3 Belvedere

Belvedere Cluster contains the south-western areas of Belvedere, the north-western area of Erith and east Thamesmead.

Of particular interest is eastern Thamesmead area including Southmere Village, Park View and Lesnes where there is particular potential for heat networks in both the existing housing and any future development that may occur in this area.

This of course the cluster area bordering the Belvedere Waste to Energy Facility which is marked by the red triangle.



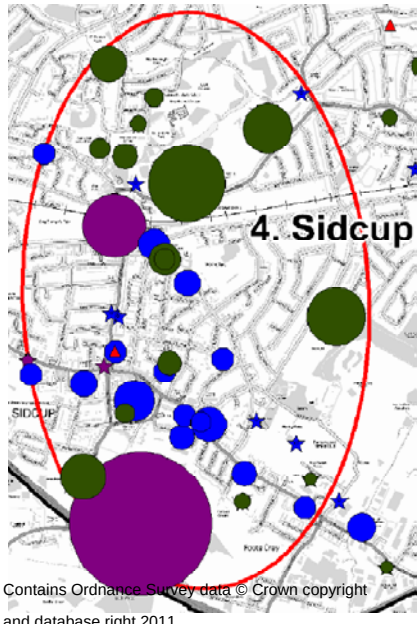
Our assessment of the main Belvedere area has been limited due to the scope of this study.

3.4.4 Sidcup

The Queen Mary Hospital is a significant load but it is relatively distanced from other potential load in the south of the Cluster. There are a number of schools in the north of the Cluster from which to base a heat network but these also are isolated from other notable heat loads.

The High Street may offer additional loads but these are likely to be predominantly commercial which we have not been able to determine within the scope of this study.

The potential of this area may be overstated by the presence of the large hospital heat load.



3.4.5 Welling

Welling has a number of schools identified but these are positioned away from Welling High St where they may be further opportunities for heat load from commercial and retail developments not able to be identified within the scope of this study.

Cluster	Estimated heat demand (MWh/yr)	Estimated Max. Heat Load (MW)
1. Erith	18,296	12.2
2. Bexleyheath	12,054	8.0
3. Belvedere	15,450	10.3
4. Sidcup	22,736	15.2
5. Welling	6,659	4.4
TOTAL HEAT DEMAND	**75,194**	**50.1**

Table 5 – Summary table of Cluster Data

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 assumed as being pressure rated at 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 5 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 5.

Modelled Area	Estimated heat consumption (MWh / Annum)	Max. Heat Load (MW)
Belvedere	**10,814**	**5.2**

Table 6 - Rounded heat demand and load for the potential district heating 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 pink Figure 11 - Network layout on plan.

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

The total length of the network is approximately 2.3 km. The largest pipe dimension is DN150.

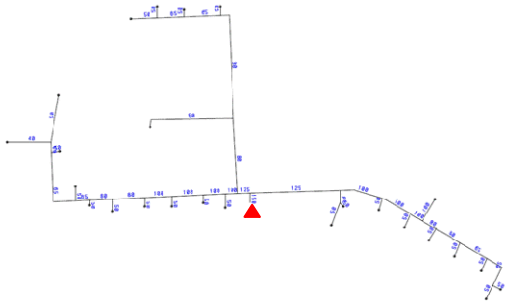


Figure 10 - System Rornet output

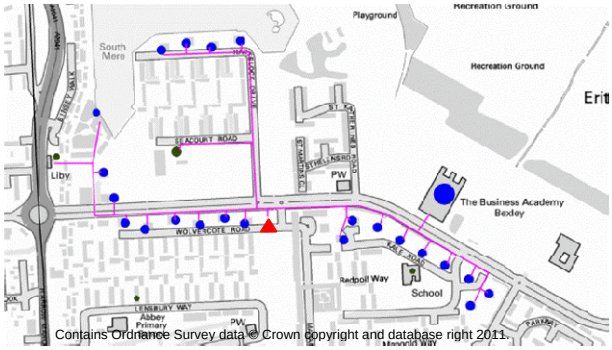


Figure 11 - Network layout on plan

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 76 kW which gives a heat loss of about 600 MWh per annum or 5.3% 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 ‘Belvedere’ network costs have been estimated at £1.6 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 management that would be applicable to traffic sensitive streets.

5. IMPLEMENTATION PLAN

	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	Erith	Medium	Erith Western Gateway, Larner Road and Howbury developments all offer opportunities to develop heat networks. Old Linpac site, adjacent to Howbury – possible housing site for 400- 600 homes	Erith Western Gateway Development Framework Supplementary Planning Document consultation draft produced February 2011. Development partner sought for first phase of Erith Western Gateway project.	Lack of available funding	Planning application expected in summer 2011 for Howbury for 380 homes		Sunny Ee London Borough Bexley(LBB) for Erith Western Gateway Laurence Pinturault (LBB) for Howbury
				Larner Road and Howbury are at pre application stage	Howbury site viability			Caroline Field Orbit Housing association for Larner Road
					Uncertainty over development decisions			
					Surrounding low density buildings			
					Rail network bisects the cluster			
2	Bexleyheath	Medium	The Broadway Shopping Centre area could provide the basis of a heat network					

					Lack of available funding			
3	Belvedere	Medium/High	Southmere Village, Parkview and Lesnes areas offer excellent potential for heat network. Potential to link to other sites such as Imperial Gateway and Pirelli.	Outline Planning Permission granted for Southmere village. This is a phased development. Phases 1 and 2 virtually complete	Uncertainty over development decisions	Extend engagement with LBG to investigate localized heat network for Thamesmead area		Galleons Housing Association
					Surrounding low density buildings			
					Rail network bisects the cluster			
4	Sidcup	Low	Queen Mary Hospital is a significant load in the south of the Cluster and there are a number of schools in the north of the Cluster from which to base a heat network		Surrounding low density buildings			
					Rail network bisects the cluster			
5	Welling	Low	Welling School, Bexley Grammar and Danson Primary Schools offer potential for anchor loads.		Surrounding low density buildings			
					Rail network bisects the cluster			

6. SUMMARY AND CONCLUSIONS

The time available to undertake this study coupled with the relatively low data available meant that the resultant heat maps are not fully representative of the actual energy demand of the Borough.

Five areas of potential "heat clusters" were identified and ranked for priority in the following order;

3. Belvedere
1. Erith
2. Bexleyheath
5. Sidcup
4. Welling

The 'Belvedere Cluster' particularly the eastern fringes of the Thamesmead area offers significant potential for a DE scheme in the form of a heat network and should be considered for greater scrutiny. This should be in the form of a further in-depth study working alongside LBG. This study should seek to identify further potential heat loads and undertake a feasibility study into implementing a local DE scheme.

The LBB has a significant heat source in the new Belvedere waste to energy plant; soon to be commissioned. A previous study investigated the potential for using heat energy from the plant but this was based on a wide area that covered the northern area of the borough and also significant parts of LBG. A study we propose should consider the potential development of a more discrete network in the areas of Erith and Belvedere, which may be more manageable for an initial DE initiative. Future aspiration could look at a larger capture area.

This study progressed in the absence of data from a significant amount of buildings. The priority for any future work would be to collect the data not obtained within the scope of this study. The clusters should be then reassessed for their potential and possibly determine other areas that may offer opportunity.

This study is a very early high level assessment of the potential network locations. Once the borough has been thoroughly assessed, 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 potential heat networks considered in this study and to fully consider the potential for a Borough-wide approach.

In summary, RE recommends that LBB;

- ***Complete the data collection for the borough at least in terms of estimating potential heat demand throughout the borough.***
- ***Re-assess the potential areas of opportunity.***
- ***Engage with LBG to undertake a detailed feasibility of the potential for a DE scheme in the Thamesmead area.***
- ***Investigate the potential for a DE scheme in the Erith and Belvedere areas using heat energy from the new Belvedere waste to energy plant.***