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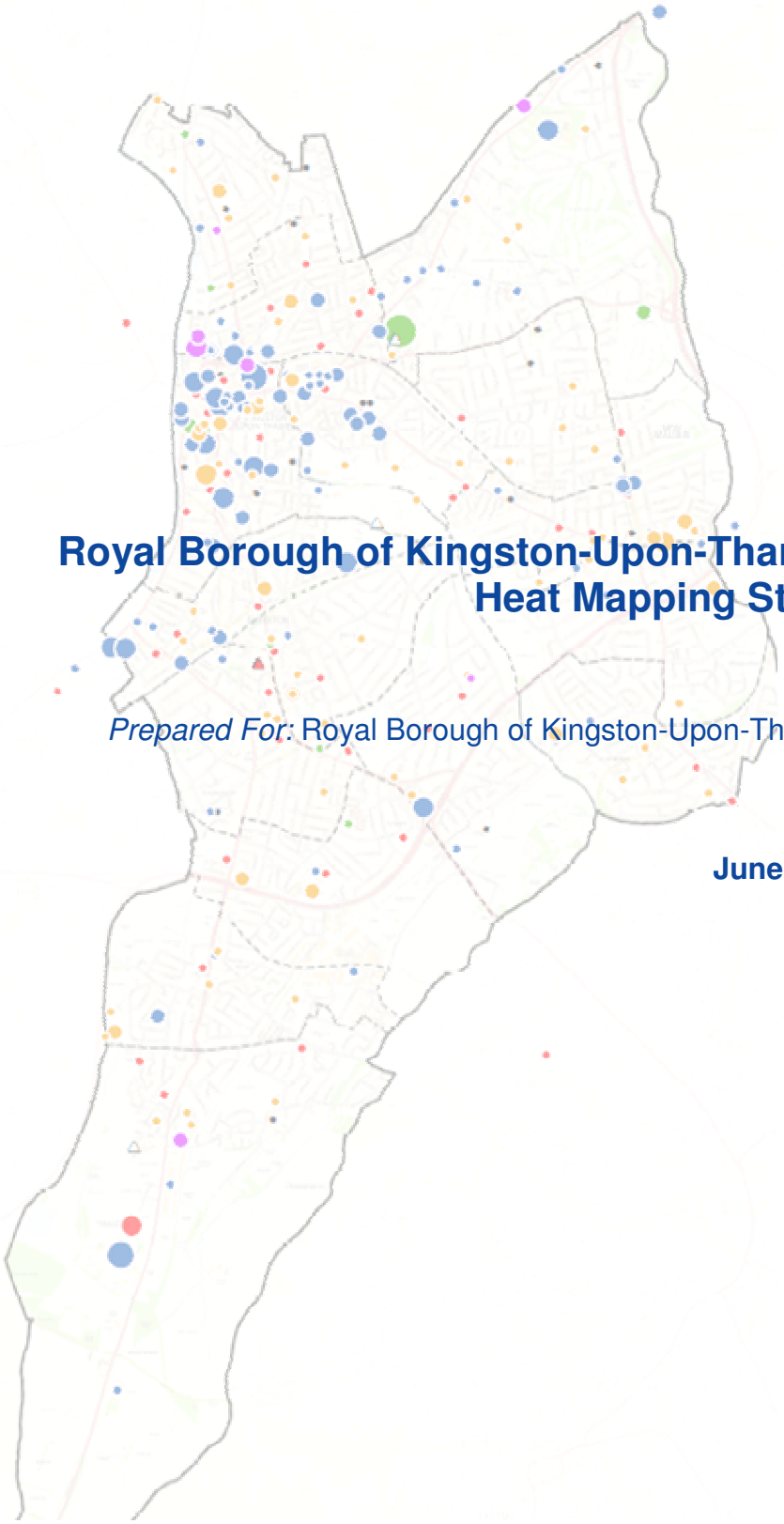

Royal Borough of Kingston-Upon-Thames
Heat Mapping Study

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1. INTRODUCTION

1.1. Purpose of the Study

One of the Mayor's top priorities for reducing London's CO_2 emissions is to reduce the capital's reliance on centralised power stations. This means increasing the use of local, low carbon energy supplies through decentralised energy systems. Accordingly, a target has been set in the Climate Change Action Plan (CCAP), to meet a quarter of London's energy from decentralised sources by 2025.

To meet this challenge, the London Development Agency (LDA) are working with London boroughs to provide energy masterplanning so they can identify where and how they can install and promote decentralised energy (DE).

There are a number of key considerations which will contribute to an evidence-based understanding of local feasibility and potential for DE. It is particularly important to understand the heat and power demands of existing buildings and existing (and possibly under-used) DE sources, as there may be opportunities to link existing and new development together.

The LDA has produced a suite of 'service packages' setting out the steps necessary to support boroughs to deliver a DE project, from concept, through to implementation. One of the 'service packages' provided by the LDA, is Heat Mapping, which involves the detailed mapping of decentralised energy data for boroughs.

Heat mapping information from boroughs is subsequently incorporated into the *London Heat Map* (Figure 1.1), an interactive platform displaying high level data on DE across London. The Heat Map has been recently developed to help address the lack of information and certainty surrounding London's heat loads. It is intended to be used by policy and decision-makers to help identify opportunities for DE in their area and to develop new decentralised energy schemes and enable the market to make informed investment decisions without risking significant development costs.

The Royal Borough of Kingston (RBK) are undertaking Phase 1 of the development of a Heat Map. This study has been carried out as part of Phase 1, to collect data relevant to the energy consumption of high energy users within the borough and help create a robust Borough Heat Map.

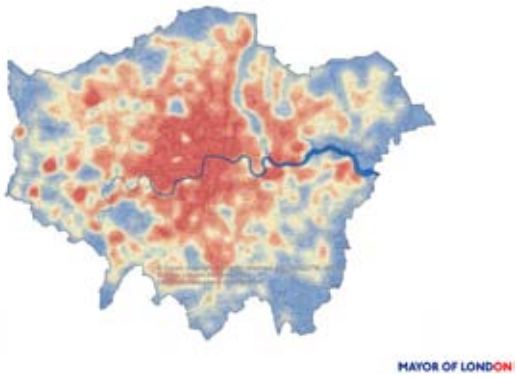


Figure 1.1: The London Heat Map

1.2. Structure of this document

The remainder of the report covers the items outlined in our proposal, and is structured as follows:

- Section 2 is a review of key international, national, regional and local policies;
- Section 3 presents a general overview of decentralised energy networks;
- Section 4 presents our methodology on the Heat Map data collection;
- Section 5 presents the analysis of the Heat Map;
- Section 6 summarises the key opportunities for Decentralised Energy in Kingston and presents a high level delivery vision;
- Section 7 identifies potential constraints and relevant recommendations;
- Section 8 summarises key recommendations and suggestions on the implementation plan and the next steps for the way forward; and
- Section 9 is a summary of this study's findings and conclusions.

2. POLICY CONTEXT

2.1. UK Climate Change Agenda

The UK Government has responded to the climate change agenda with a wide range of climate change legislation, targets and actions for Green House Gas (GHG) emission reductions. Relevant initiatives include:

- Setting a national target of 80% reduction in annual GHG emissions compared to 1990 levels by 2050, with an interim target of 34% reduction by 2020
- Establishing the world's first national Climate Change Act to tackle the threat of climate change, and
- Introducing programmes such as: the Renewables Obligation (RO); the Feed in Tariff (FIT); the Renewable Heat Incentive (RHI); and the Carbon Reduction Commitment (CRC).

Legislation is intended to support the transition to a low carbon economy – an economy that minimises environmental impact, is sustainable and limits GHG emissions. The national government's agenda is being taken forward by all the local authorities in the UK.

2.2. London's Climate Change Agenda

The Mayor of London recognises the imperative to address climate change and has set an ambitious target to achieve 60% savings in London's CO_2 emissions against 1990 levels by 2025.

In particular the Mayor supports the need to generate more of London's energy from decentralised energy sources. The CCAP specifically has a target of supplying 25% of London's energy demand through decentralised energy sources by 2025 and 50% by 2050.

'Cutting the Capital's Carbon Footprint: Delivering Decentralised Energy'[1] sets out the recommended measures needed to decentralise 25% of London's energy supply by 2025. Overseen by a group of the capital's business leaders, it makes several key recommendations, including the need for further economic incentives, projects of a sufficient scale, approaches involving the public and private sectors, the delivery of energy masterplans and the creation of a public sector centre of expertise capable of working at both the strategic and project levels.

'Powering Ahead, Delivering Low Carbon Energy for London[2] describes how delivering decentralised energy on a large scale faces commercial challenges requiring high levels of upfront capital expenditure. The report indicates that the investment environment is changing as political initiatives are beginning to create a more favourable policy framework for decentralised energy. Ensuring a positive regulatory and policy context is critical to delivering decentralised energy, as is the public sector's ability to remove delivery barriers. National policy changes, such as the introduction of Feed in Tariffs (FITs) and the extension of the Climate Change Levy (CCL) exemption for indirect sales of CHP electricity to 2023, will have a positive impact on decentralised energy delivery in London.

The document recognised the crucial role that London's boroughs are playing as facilitators – providing supportive local policies and assembling public heat demand as part of the LHM. The document includes a pipeline of potential projects, with the partners and interventions required to deliver them, produced to illustrate the scale, commercial structures and role of the public sector in unlocking current opportunities.

A list of existing and planned decentralised energy schemes in London is provided in Appendix A.

2.3. Planning Policy

Overall planning policy at the national, regional and local level places increasing emphasis on including renewable energy in schemes to obtain planning permission. In addition policy highlights the importance of low carbon energy schemes in achieving national, regional and local targets for reduced carbon emissions.

2.3.1. National Planning Policy

At the national level relevant planning policy includes PPS1 *'Delivering Sustainable Communities'*, PPS22 *'Renewable Energy'* and the companion guide to PPS22. These are intended to encourage the appropriate development of renewable energy schemes throughout the UK. This includes schemes in urban as well as rural locations, ranging in size from the domestic to the commercial scale. The documents highlight that if the targets are to be met a positive and innovative approach will be required.

The *Renewables Obligation* (RO) works by placing an obligation on UK suppliers of electricity to source an increasing proportion of their electricity from renewable sources. A green certificate called the Renewables Obligation Certificate (ROC) is issued

[1] London First, October 2008

[2] LDA, Powering Ahead - *Delivering Low Carbon Energy for London*, 2009

to all accredited generators of eligible renewable electricity generated within the UK and supplied to customers within the UK by a licensed electricity supplier.

Feed-in tariffs (FITs) are introduced for small-scale low-carbon electricity generation, up to a maximum limit of 5 megawatts (MW) capacity or 50 kilowatts (KW) in the case of fossil fuelled Combined Heat and Power (CHP). The FITs will be introduced through changes to electricity distribution and supply licences.

These provisions are intended to encourage the uptake of small-scale low-carbon energy technologies while the RO continues to be the main support mechanism for large scale renewables deployment.

As of April 2010 FITs are proposed to be applied to wind, solar PV, anaerobic digestion, biomass and biomass CHP, and non-renewable micro CHP.

Tariffs for 2010-2011 have been preset by the Department for Energy and Climate Change (DECC), as published in its Consultation on Renewable Electricity Financial Incentives 2009. Proposed tariff levels included in the Feed-in Tariffs framework are shown in Table 2.1 below.

Technology	2010-2011 Tariff (pence/kWh)
Anaerobic Digestion CHP, < 5MW electricity	11.5
Biomass CHP, < 5MW electricity	9.0
Bonus for Export	5.0

Table 2.1: Proposed FIT Tariffs

The Energy Act 2008 (Section 100) allows for the setting up of a *Renewable Heat Incentive* (RHI), which would provide financial assistance to generators of renewable heat and to some producers of renewable heat, such as producers of bio-methane. The RHI will:

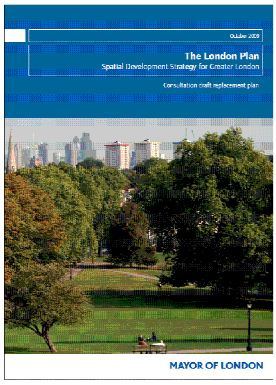
- Apply to generation of renewable heat at all scales, whether it is in households, communities or at industrial scale.
- Cover a wide range of technologies including biomass, solar hot water, air and ground source heat pumps, biomass CHP, bio-gas produced from anaerobic digestion and injection of bio-methane into the gas grid.
- Be banded so different rates of support may apply to different technologies or scales i.e. some (e.g. larger scale biomass heat) may require less support per MWh than others.

The RHI provides added (financial) incentive to the use of CHP. There is some overlap between FITs, RO and RHI which DECC are currently assessing the best way to address. However, once the RHI is implemented the heat output of CHP will be rewarded under the RHI. As an interim measure initial FITs for CHP generators include an uplift comparable to that which applies under the RO.

The *Carbon Reduction Commitment* (CRC) is an emissions trading scheme that applies to non-energy intensive organisations such as larger corporations, banks, government departments, and large local authorities to provide incentives for them to improve their energy efficiency and reduce their carbon emissions. The CRC will do this by placing a cost on emissions and by providing financial and reputational incentives for those businesses that are most successful in lowering their emissions over the course of the scheme. Those falling under the CRC will thus have to account for the emissions associated with their use of electricity, gas and certain other fuels. Those who burn gas to generate their space heating and/or hot water may be able to benefit from a temporary CRC 'windfall' through connection to a district heating network. Where a customer imports heat (whether to provide heating or cooling) from a third party, this will be zero rated for emissions under the CRC in the hands of the customer. This is so whatever means was used to generate the heat (although the third party heat supplier may fall under the CRC or other climate change regulation). Consequently, this effective "outsourcing" of emissions provides an incentive to CRC participants. However, the windfall effect will last for a maximum of one CRC phase (from 2013, each phase lasting 5 years). This will limit the value of the potential carbon incentive from an investment perspective. Thereafter, a consumer's focus will be primarily on a cost comparison between conventionally delivered heat/hot water and heat delivered through a district heating scheme.

The scheme started in April 2010 and seeks to tackle CO_2 emissions not already covered by Climate Change Agreements and the EU ETS.

2.3.2. Regional Planning Policy



In October 2009 the Mayor of London published the *Consultation Draft Replacement London Plan*. The formal publication of the replacement plan expected towards the end of 2011. The *London Plan* published in February 2008 will be in force, and will have legal status until the replacement plan is formally published. However, the Consultation Draft Replacement London Plan will be a material consideration taken into account in deciding planning applications, and will gather weight the further into the replacement process it goes.

The Consultation Draft Replacement London Plan sets out a comprehensive range of policies to underpin London's response to climate change. With regard to development proposals, the Mayor acknowledges that the early design stage is the most cost effective time to incorporate relevant design and technological measures, enabling proposals to realise their full potential to reduce carbon dioxide emissions and adapt to climate change.

The Consultation Draft Replacement London Plan sets out a comprehensive range of policies to underpin London's response to climate change. Whilst the overall thrust and direction of the document on tackling climate change is the same as the current 'London Plan', some changes from the existing policies are proposed.

Development proposals are still required to minimise their carbon dioxide emissions in accordance with the Mayor's energy hierarchy, (i.e. be lean: use less energy; be clean: supply energy efficiently; and be green: use renewable energy), and submit a detailed energy assessment to demonstrate how the minimum targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy (Policy 5.2 – Minimising carbon dioxide emissions).

Policy 5.2 also introduces new targets on reduction of carbon dioxide emissions applicable to all major proposals. The carbon dioxide reduction targets should be met on site. Where it is clearly demonstrated that the specific targets cannot be fully achieved on site, any shortfall may be provided off site or through a cash in lieu contribution to the relevant borough to be ring fenced to secure delivery of carbon dioxide savings elsewhere.

As with the current London Plan, development proposals are required to demonstrate how sustainable design standards have been integrated in the design process (Policy 5.3 – Sustainable design and construction). Major development proposals are required meet the minimum standards outlined in the Mayor's supplementary planning guidance on sustainable design and construction[3].

The Consultation Draft Replacement London Plan also supports decentralised energy. The Mayor has set a target for London to generate 25% of its heat and power requirements through the use of local, decentralised energy systems by 2025. Boroughs will be required to develop policies and proposals to identify and establish decentralised energy network opportunities, as part of their Local Development Frameworks (LDFs) (Policy 5.5 – Decentralised energy networks). The London Heat Map tool has been developed to assist boroughs and developers to identify decentralised energy opportunities in London.

Development proposals are required to evaluate the feasibility of CHP systems and the opportunity to extend the system beyond the site boundary to adjacent sites (Policy 5.6 – Decentralised energy). Major development proposals should select energy systems in accordance with the following hierarchy:

- Connection to existing heating or cooling networks
- Site wide CHP network
- Communal heating and cooling.

Where future network opportunities are identified proposals should be designed to connect to these networks.

2.3.3. Local Planning Policy

The *Core Strategy, Planning for the Future* sets out the overall planning framework for the Borough. The document includes spatial objectives and strategic policies and identifies the broad location and amount of planned development. Thematic policies are included in the Core Strategy that apply across the Borough and are supplemented by area based guidance.

The Vision for Kingston in 2026 is of a borough better equipped to deal with the increasing effects of climate change. This includes the establishment of a

[3] *Sustainable Design and Construction – Supplementary Planning Guidance*, GLA, 2006. A revised SPG will be published in 2010.

low carbon, decentralised energy network of power and heat generation in Kingston Town Centre.

Preferred Policy TP 2, *'Decentralised Energy Networks and Low Carbon Zones'* states that the Council will work with its partners and developers to evaluate and establish low carbon decentralised energy networks at the following locations:

- Kingston town centre
- District Centres (Surbiton, New Malden, Tolworth)
- Hospitals
- Hogsmill Sewage Treatment Plant
- Large employment and education sites.

Where large new developments and CHP plants or decentralised energy schemes already exist, the Council will encourage their expansion into a wider network and/or the linking in of new developments.

New developments (thresholds are still to be set) will be required to be designed so that they may be connected to decentralised energy networks.

Finally, areas suitable for designation as low carbon zones will be identified and refurbishment of existing developments will be expected to be low carbon.

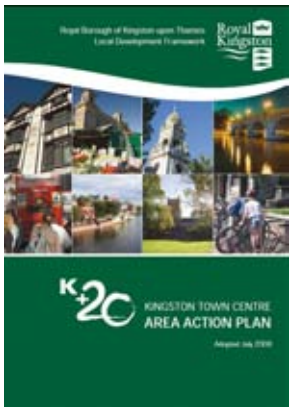
Towards the identification and development of low carbon heat network opportunities and local, low carbon energy supply opportunities the Council will work with other public and private organisations (Kingston PCT, Kingston Hospital, Kingston University, Kingston College, Thames Water, developers).

The planned regeneration and development of Kingston town centre (for mixed use development) under the 2008 Area Action Plan offers significant opportunities to establish a large scale decentralised network and will be the primary focus for such an initiative. Mixed use development on major sites within the District Centres (including Tolworth Tower, Cocks Crescent in New Malden and Surbiton Station car park) also offer opportunities.

Preferred Policy TP 3, *'Renewable and Low Carbon Energy'* , states that the Council will increase the use of renewable and low carbon energy by requiring all new development to achieve a reduction in carbon dioxide emissions by a minimum of 20% from on-site renewable or low carbon energy generation and use of decentralised energy sources, unless it can be demonstrated that such provision is not feasible or carbon reductions can be achieved in other ways, and by promoting its use in existing development.

The *Kingston Town Centre Area Action Plan (AAP)* is part of the Council's emerging Local Development Framework for the borough, as set out in the Local Development Scheme.

The Plan identifies areas suitable for major change to accommodate new development and key areas for conservation and enhancement, notably the Old Town around the Market Place and the riverside, which have significant natural and cultural heritage value.



Once the Core Strategy is adopted, the strategic policy framework for this AAP will comprise national planning guidance, the London Plan and the Core Strategy DPD.

The Plan addresses key issues and provides the spatial framework to guide future development and improvement, setting out a vision for the future, with objectives, policies and proposals to deliver it.

The RBK *Infrastructure Delivery Plan* has been prepared as part of the evidence base to inform the development of the LDF. The main aims of the Infrastructure Plan are:

- To assess the existing capacity of infrastructure provision across the borough; and
- To identify what infrastructure may be required to serve the proposed level and location of development and growth in the borough.

The study covers a range of infrastructure types including social and community, environmental and physical. For each type of infrastructure an assessment of the existing infrastructure in the borough and future need is made, using evidence from within the Council, and from infrastructure providers, and including the identification of specific areas within the borough where infrastructure may be needed.

3. DECENTRALISED ENERGY NETWORKS

3.1. District Heating as Decentralised Energy

The UK's centralised energy network is characterised by significant generation of waste heat at power stations in locations remote from concentrations of demand. There are also transmission losses associated with this system. A DE system that produces energy in the form of heat and electricity at or near the point of consumption provides the opportunity to improve utilisation of energy and reduce the carbon intensity of the energy network. In summary, decentralised energy brings a range of benefits including:

- Ability to capture the heat generated in that process and use it nearby (known as Combined Heat and Power (CHP));
- Reduce the energy lost in transmission networks;
- Increased use of renewable, carbon-neutral and low-carbon sources of fuel;
- Increased flexibility for generation to match local demand patterns for electricity and heat;
- Greater energy security for businesses that control their own generation; and
- Greater awareness of energy issues through community-based energy systems, driving a change in social attitudes and more efficient use of our energy resources.

The local benefits of implementing a DE network in a region can be summarised as follows:

- Regional organisations, businesses and individuals would benefit from improved energy security and reduced costs which would improve the competitiveness of the region;
- It will support the region to achieve a low-carbon economy;
- There would be significant investment in the region and increased employment opportunities;
- The experience gained could become an export opportunity; and
- It provides opportunities to build on regional expertise in some of the renewable or lower carbon fuel sources such as biomass or waste to energy.

There is a broad array of different technologies which can be classed as decentralised energy, including microgeneratation, such as photovoltaics, wind and hydro; however, the most common form of decentralised energy supply is community or district heating. This is where space heating and hot water is delivered to multiple occupants from a local plant via a network of insulated pipes buried in the ground. The pipe network can be installed at the same time as other services (water, drainage, etc) to minimise costs in new development. It is also possible to retrofit existing buildings and there are convincing cost/benefit arguments for supplying heat to them or industry rather than new buildings where there is low heat demand.

District heating networks served by CHP plants are considered to have the largest potential for carbon emission savings. CHP with district heating is a local decentralised community energy system that captures and utilises waste heat from power generation to maximise primary energy efficiencies. This waste heat can be distributed to buildings via district heating pipes. The electricity produced could be exported to the national grid or transported to other users over the local electricity distribution network or over a new, community owned or part owned network.

CHP with district heating has the added benefit of future-proofing a district's energy supply because it allows a range of fuels and sources of waste heat to be used, such as biomass, biogas (anaerobic digestion) or syngas (gasification), at a later stage when technologies and fuel supply chains are more mature. Furthermore, CHP has a minimal visual impact on the townscape, although the siting of urban power stations requires careful consideration, particularly if they require biomass fuel deliveries.

Local decentralised generation plants can be housed in 'energy centres' or block plant rooms and are therefore best planned at the neighbourhood masterplanning stage. Given that heat can be transmitted up to 30km with little heat loss from modern pre-insulated pipework there is also potential to capture the heat from existing power stations and connect this to new and existing developments.

As indicated in the *'Powering Ahead, Delivering Low Carbon Energy for London*[4]*,* DE schemes generally fall within three types:

Type 1 – single site schemes: where energy production is based on small or medium CHP units, typically gas-fired engines, with or without biomass boilers according to planning requirements. This system would supply a single consumer type, or a small amount of mixed use, for example serving up to around 3,000 residential units, or the equivalent load. In the past these schemes have primarily been

[4] LDA, Powering Ahead - *Delivering Low Carbon Energy for London*, 2009

developed by the public sector, but are increasingly being incorporated in planning applications for major development. An example scheme of this type is the Cranston Estate regeneration, which will connect over 500 residential units to a decentralised energy network consisting of approximately 1km of heat network piping and a natural gas CHP engine.

Type 2 – multi-site, mixed use schemes: These serve more than one site and user type. The energy production plant is based in a dedicated energy centre and would serve 3,000 to 20,000 residential units or equivalent load, along with a range of commercial, private and public sector consumers. A Type 2 example is the Southwark MUSCo (multi-utility services company), which is positioned to deliver electricity, heat, hot water, water and communications infrastructure for 9,700 residential units and 38,000m^2 of commercial space including two major urban regeneration sites: the Elephant and Castle and Aylesbury.

Type 3 – area-wide heat transmission projects: These schemes would consist of extensive heat pipe networks connecting multiple heat producers such as power stations, industrial waste heat or energy from waste facilities. They may serve 100,000 plus units and a large range of mixed public and private commercial facilities. A Type 3 example would be the London Thames Gateway Heat Network (LTGHN), led by the LDA and Communities and Local Government to develop a low-carbon district heating network in Europe's largest regeneration area. The system will incorporate heat from a number of sources, including low cost heat from Barking Power Station and heat generated by Tate & Lyle. Heat will be distributed via an extensive distribution main up to 67km long. The project's delivery is expected over a three phase period from 2010 to 2019.

3.2. District Heating and Heat Mapping

The potential of district heating networks with CHP to reduce emissions from the built environment derives from the scope to use the waste heat from electrical generation within the built environment that would otherwise be rejected from conventional centralised thermal generating plant. However, for a CHP scheme the driving factor in location is the heat load, not the electricity demand. Therefore, the benefits of district heating schemes largely depend on their deployment being carried out in the right context.

The key parameter is the heat demand density; this is reduced not only when the potential consumers are spaced further apart but also when the buildings are better insulated.

A second parameter is balanced heat demand: this type of schemes function on the principle of aggregating the heat demand of individual buildings and focus on managing the flow of heat through a set of buildings over the course of a day or year. This management of heat is based on balancing the demand profiles of different consumer types and seasonal demands for different energy services across the broad portfolio of property uses.

Specifically, different building types have different characteristic heat demand profiles. While for a domestic user peak demands might be expected between 7 to 9am and 5 to 10pm, commercial and public buildings are more likely to peak between 9 to 5pm. There are also buildings which have consistent round-the-clock demand such as hospitals. Connecting such different users produces an aggregate demand that is smoother than individual ones, meaning that heating plant can run continuously for much of the time. Therefore, this balancing of demand allows for the more efficient generation of energy and therefore increased carbon savings.

This is quite unlike the erratic or spiky demand on an individual boiler in a single house, and leads to better plant performance, less overall plant capacity to be installed and consequently, improved financial viability.

The final parameter is availability of anchor loads: the initial development of district heating systems needs to be anchored on a core of large, steady consumers, offering steady loads over the long term. Typically these will be public sector buildings such as hospitals, universities and LA facilities.

Thus, the key requirements for an area to be able to support such energy systems are:

- Sufficient energy density;
- Sufficient diversity of consumer types;

- Anchor load consumers.

The development of a heat network therefore, should be based on an analysis of the heat loads within a certain area, known as heat mapping that facilitates its evaluation against the criteria identified above. The heat mapping will result to the identification of clusters of potential heat consumers, identify the heat density, the mix of uses and the presence of anchor loads.

4. METHODOLOGY

4.1. Data Collection

During this study, data relevant to the heat requirements of high energy users (defined as priority buildings by the LDA) within the RBK were collected to help create a robust Borough Heat Map. The data collected were input into the database provided by the LDA (DeMap Database).

The DeMap Database is intended to inform the London Heat Map *(Figure 4.1)* and therefore includes three categories of heat mapping information: major heat loads (i.e. priority buildings), heat supply plants and district heating networks. Each category includes a number of data fields, classified as 'mandatory' or 'desirable', based on their importance to the Heat Map. The purpose of the data collection was to populate the relevant fields of the DeMap Database. Accordingly, our methodology consisted of the stages described in the remainder of this section.

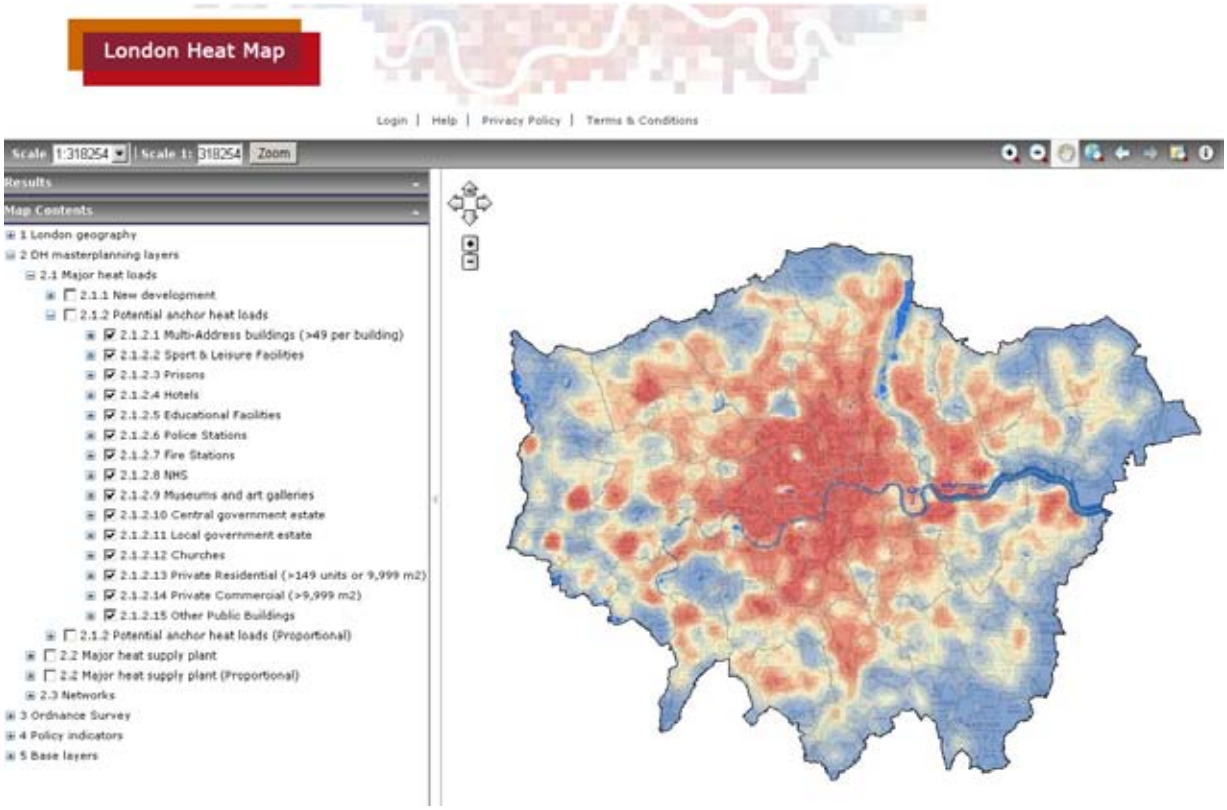


Figure 4.1: The London Heat Map

4.1.1. Identification of priority buildings

The priority buildings were divided into several categories (identified on Figure 4.1), according to the requirements of the DeMap database provided by the LDA. Buildings in the RBK identified and included in each category was cross-referenced between several sources to ensure that all major priority buildings were captured. Small-scale hotels, commercial and residential buildings were excluded from the database, in accordance with the relevant thresholds provided by the LDA. Details are provided below:

Schools
All educational buildings identified within the *UK Schools and Colleges Database* for Kingston were incorporated into the database, regardless of their scale, since no threshold was provided by the LDA. The building sizes range from small nursery schools to large university complexes.

The following sources were used to identify priority educational buildings:

- RBK DeMap Spreadsheet;

- LDA DeMap spreadsheet;
- UK Schools and Colleges Database[5];
- Kingston Address Point database; and
- Kingston Draft Infrastructure Delivery Plan.

Sports and Leisure Facilities
All sport and leisure facilities identified within the Borough were incorporated into the database, regardless their scale, ranging from small gyms to large leisure centres, such as the Chessington World of Adventures.

Gyms located within large building complexes have not been incorporated into this category to avoid duplicate entries. For example, Holmes Place Health Clubs Ltd is located on the third floor of the Bentalls Shopping Centre and the whole complex is included in the *'Private Commercial'* category.

The following sources were used to identify sports and leisure facilities:

- RBK DeMap spreadsheet;
- LDA DeMap spreadsheet;
- Kingston Draft Infrastructure Delivery Plan;
- internet sources for local listings[6]; and
- Kingston Upon Thames Council Official website[7].

Hospitals
Based on the information provided by the NHS Trust, there are currently four hospitals located in the Borough:

- The Kingston Hospital;
- The Tolworth Hospital;
- The New Victoria Hospital; and
- The Surbiton Hospital.

NHS Kingston, however, confirmed that Surbiton Hospital will soon be replaced by Surbiton Polyclinics.

The following sources were used to identify NHS hospitals within the Borough:

- RBK DeMap spreadsheet;
- LDA DeMap spreadsheet;
- Kingston Draft Infrastructure Delivery Plan; and
- NHS trust official website[8].

Police and Fire Stations
Three police stations were identified: Kingston Police Station, Surbiton Police Station and New Malden Police Community Office. Only the first two were entered in the database, as the New Malden Police Community Office is located within the CI Tower, which was included in the *'Private Commercial'* category.

The London Fire Brigade was contacted in order to confirm the number of fire stations in Kingston. The Kingston Borough Commander manages three fire stations; however, only two are located within the Borough boundaries: the Kingston Fire Station and the Surbiton Fire Station.

The following sources were used to identify police and fire stations in the Borough:

- RBK DeMap spreadsheet;
- LDA DeMap spreadsheet;
- Kingston Draft Infrastructure Delivery Plan;
- Metropolitan Police website[9];
- London Fire Brigade website[10].

Museums and Galleries
Kingston upon Thames Museum and Heritage Service was included in the database alongside with Fusionarts Studios and Dorich House. Stanley Picker Gallery was not included as it forms part of the university complex and is therefore covered under the *'educational buildings'* category. The Toilet Gallery and Penny School Gallery were not included in the database as their energy loads were not considered significant for the purposes of this study.

The following sources were used to identify museums and galleries within the Borough:

- RBK DeMap spreadsheet;
- LDA DeMap spreadsheet; and
- Kingston upon Thames Council Official website.

Local Government Buildings
Local Government and Other Public Buildings were identified through this study, while based on the conversations with the Council, there are no Central Government buildings within the Borough.

The following information was used to list the public buildings and local government buildings:

[5] http://www.schoolswebdirectory.co.uk/leasearch.php?lea=Kingston%20upon%20Thames, accessed 27/04/2010

[6] http://www.locallife.co.uk/kingstonuponthames/leisure-centres.asp, accessed 28/04/2010

[7] http://www.kingston.gov.uk/browse/leisure.htm, accessed 28/04/2010

[8] http://www.nhs.uk/, accessed 28/04/2010

[9] http://cms.met.police.uk/met/boroughs/kingston_upon_thames/index, accessed 28/04/2010

[10] http://www.london-fire.gov.uk/FireSafetyCentre_KingstonUponThamesFSC.asp, accessed 28/04/2010

- RBK spreadsheet,
- LDA spreadsheet, and
- Kingston upon Thames Council Official website.

Hotels
According to the LDA thresholds only hotels with over 99 units or 4,999m^2 should be included in the database. Based on these selection criteria six hotels were identified as priority buildings for the purposes of this study.

The following sources were used to identify the relevant hotels within the Kingston area:

- RBK DeMap spreadsheet;
- LDA DeMap spreadsheet;
- *'Miscellaneous addresses'* spreadsheet provided by RBK;
- Kingston upon Thames Council Official website;
- internet sources for local listings[11].

Churches
All churches located within the Borough boundaries were included in the database. The following sources were used to identify churches in Kingston:

- RBK DeMap spreadsheet;
- LDA DeMap spreadsheet;
- *'Miscellaneous addresses'* spreadsheet provided by RBK;
- Kingston Address Point database; and
- Kingston Draft Infrastructure Delivery Plan.

Private Commercial
According to the LDA thresholds, only developments of a gross internal floor area over 9,999m^2 should be included in the database; however, some of the important industrial parks and commercial developments were included even if they fall below the LDA threshold. These were identified based on the number of employees occupying each building or based on the viability of the development to connect to the future district heating network.

RBK's *'Business Directory'* spreadsheet, which summarises all employers within the Borough, was used to obtain the numbers of employees of the relevant businesses. All employers with over 200 employees were investigated and those with large offices, retail or industrial premises were included in the study.

All industrial parks identified by the RBK on their official website were incorporated in the database.

Additionally, all multi-tenanted buildings, occupied by more than one companies, were investigated and those with significant floor area were also included.

The sources used to identify significant Private Commercial buildings were:

- Kingston Business Directory;
- Kingston Address Point database;
- Kingston Upon Thames Council Official website.

Residential and multi-address buildings
According to the LDA, all residential developments of over 49 units should be included under the category *'Multi-Address buildings'* and all residential developments of over 149 units, or over 9,999m^2, should be included under the category *'Private Residential'.*

RBK's spreadsheet *'Flat survey'* was used to identify residential developments of over 49 units.

27 housing associations operating in Kingston were contacted directly through the phone survey conducted by URS and via e-mail by the RBK to confirm whether they manage any properties of over 49 units. Only four of them replied and their responses were incorporated into the database.

The following sources were used to identify relevant residential developments in the Borough:

- LDA DeMap spreadsheet;
- *'Flat Survey'* spreadsheet by RBK; and
- phone and e-mail research with housing contacts provided by RBK.

Table 4.1 below summarises the relevant sources that were cross-reference during this stage. Upon completion, the list of the priority buildings formed the core of the Kingston DeMap Database.

[11] http://www.4hotels.co.uk/uk/kingston-upon-thames.html, accessed 28/04/2010

www.travelodge.co.uk, accessed 28/04/2010

http://www.antoinettehotel.com/kingston.html, accessed 28/04/2010

http://www.a1tourism.com/uk/kingston-upon-thames.html, accessed 28/04/2010

Priority Building	Sources of Information											
	LBK DeMap Spreadsheet	LDA DeMap spreadsheet	UK Schools and Colleges Database	Kingston Address Point database	Kingston Draft Infrastructure Delivery Plan	Internet sources for local listings	Kingston Upon Thames Council Official website	NHS Trust Official website	*Miscellaneous addresses'* spreadsheet by LBK	Kingston Business Directory	'Flat Survey' spreadsheet by LBK	Phone and e-mail research with housing contacts provided by LBK
Schools	✓	✓	✓	✓	✓							
Sports and Leisure Facilities	✓	✓			✓	✓	✓					
Hospitals	✓	✓			✓			✓				
Police and Fire Stations	✓	✓			✓							
Museums and Galleries	✓	✓					✓					
Local Government Buildings	✓	✓										
Hotels	✓	✓				✓	✓		✓			
Churches	✓	✓		✓	✓				✓			
Commercial				✓		✓				✓		
Residential		✓		✓							✓	✓

Table 4.1: Sources of Information for priority buildings

4.1.2. Actual Data Collection

The second stage of the methodology included the collection of actual energy consumption data to populate the relevant fields of the Kingston DeMap Database. For this purpose a web-based questionnaire was created, designed to reflect the data fields of the DeMap Database. The questionnaire is attached in Appendix B.

The questionnaire was distributed to the relevant buildings identified through the previous stage. Prior to sending questionnaires, an extensive phone survey (over 150 phone calls) was conducted to locate energy or facility managers in an effort to target the correct audience and maximise the relevance of the received responses.

Twenty-seven housing associations were approached directly during the phone survey and via e-mails sent by RBK Officers. The contacted housing associations were asked to fill the web-based questionnaire for each development of over 49 units.

Fifty web-based questionnaires were sent to the relevant contacts. Data collected through the questionnaires was analysed and then integrated within the Kingston DeMap Database. A summary of the responses to the questionnaires is included in Appendix C.

4.1.3. Benchmarking

After discussions with RBK and the LDA, where actual data on the energy consumption was not possible to be collected through the web-based questionnaire, a benchmarking exercise was carried out to calculate the relevant values requested within the Kingston DeMap Database.

Energy consumption benchmarks for the priority buildings were sourced from CIBSE Guide F, (typical practice buildings) and the BSRIA Rules of Thumb, as agreed with the LDA. Benchmarks were chosen based on the nature of the building's function (i.e. office use, retail space, industrial space etc). The *Kingston OS Database* was then used to determine the footprint of buildings.

4.1.4. Geocoding and Address Layer Cross Reference

Using the *Kingston OS Database*, URS's GIS team carried out geocoding to identify the OXS and OYS coordinates for all priority buildings within the Kingston DeMap Database.

The *Kingston Address Layer* was then used to cross-reference the listings in the Kingston DeMap Database and ensure that all relevant buildings have been incorporated. The addresses were completed based on the Address layer, where required.

4.1.5. Existing Heat Plants

The *'London Energy Partnership's Community Heating'* database was consulted; only two existing heat plants were identified within the database and therefore, an alternate approach was adopted to locate any remainder existing heat plants in the Borough:

Based on the information collected and calculated for the Kingston DeMap Database, URS identified existing buildings or building complexes that are more likely to be powered by an energy centre. These were identified based on the following criteria:

- Energy Consumption: buildings with large energy consumption, for example the Kingston Hospital;
- Building Use: the type of use of a building may also indicate that it is served by an energy centre. For example: leisure centres, hospitals, university and college, council buildings, high-rise office buildings and large shopping centres, were considered;
- Floor Area: the building uses identified above were also filtered based on their floor area, i.e. large leisure centres were considered, whereas smaller gym facilities were less likely to be served by an energy centre.

The buildings meeting the above criteria were listed in the Table 4.2.

Energy or facility managers of the buildings or building complexes listed in Table 4.2 were contacted with an information request to determine whether these buildings do actually accommodate heat plants that are of interest in this study.

The information received indicates that most of the larger developments in Kingston are served by the gas fired boilers; some of them are provided within central energy centres, but the majority are served by individual boilers.

Based on the research three CHP sites and a sewage treatment plant were identified in Kingston and included in the DeMap database.

	Name	Address/ Description
1	Hogsmill Sewage Treatment Works	Lower March Lane, Kingston Upon Thames
2	Kingston Hospital	Galsworthy Rd, Kingston Upon Thames
3	Future Surbiton Polyclinics	Ewell Rd
4	Tolworth Hospital	Red Lion Road, Surbiton
5	New Victoria Hospital	184, Coombe Lane West, Kingston Upon Thames
6	Kingston University	Complex of buildings
7	Kingston College	Complex of buildings
8	Malden Centre	Cocks Crescent, New Malden, Surrey
9	Tolworth Recreation Centre	Fullers Way North, Tolworth, Surbiton, Surrey
10	RBK: The Kingsfisher Leisure Centre	Fairfield Rd, Kingston Upon Thames, Surrey
11	Guidhall (1,2,3)	Guildhall, High Street, Kingston Upon Thames
12	Norbiton Hall	Residential complex
13	Apex Tower	New Malden
14	CI Tower	St Georges Square
15	Tolworth Tower	Ewell Road, Surbiton, Surrey
16	Conquest House (John Lewis)	Wood Street
17	Bentall Shopping Centre	Wood Street
18	Edenwalk Shopping Centre	Alderman Judge Mall
19	Royal Quarter	Residential complex

Table 4.2: List of potential Heat Supply Plant Sites

4.1.6. DH Networks

Based on the following sources, existing district heating networks were not identified in Kingston:

- Kingston Draft Infrastructure Delivery Plan;
- An Energy Strategy for Kingston;
- Powering Ahead, Delivering Low Carbon Energy for London; and
- London Thames Gateway Heat Network (LDA).

4.1.7. Future Developments

A *'Future Developments'* spreadsheet was provided by the RBK, which included developments planned in Kingston. This spreadsheet was used as the basis for mapping the future developments and associated heat demand in the Borough.

To calculate energy demand for proposed developments, after discussions with the LDA, benchmarks from CIBSE Guide F (Good Practice) were used for non-domestic buildings, while for the domestic buildings energy demand in a range of domestic buildings compliant with Building Regulations, 2006, was used as a benchmark.

5. HEAT MAP ANALYSIS

5.1. Analysis Criteria

As described in Section 3, in addition to heat density, the operation and efficiency of a heat network is also optimised through correctly combined demand from a mix of residential, commercial and industrial land uses.

For example, residential load profiles for hot water tend to have pronounced morning and evening peaks. To maximise the benefits of a CHP system, it would need to serve enough residents and blocks, for the installation of a large thermal store (i.e. hot water tank) to meet demand at peak times, to become viable. A mix of uses alongside the residential use however, would help to create daytime loads, reducing the need for thermal storage and making CHP more viable. Uses such as larger public sector sites, commercial offices and hotels create a flatter, more consistent load profile.

Finally, the presence of anchor heat loads is another factor affecting the feasibility of district heating networks. These will be large, steady consumers of heat that are able to enter long term contracts and consequently act as cornerstones for the development of heat networks. Typically these will be public sector buildings such as hospitals, universities, Local Authority facilities, hotels or leisure centres.

The collected data was therefore analysed against the three key requirements necessary for an area to support heat networks:

- Sufficient heat density;
- Sufficient diversity of consumer types; and
- Anchor load consumers.

Accordingly, the analysis aimed to identify high heat density areas combined with the appropriate mix of uses and anchor heat loads.

In addition to the above, the location of any existing, major heat plants in the Borough is also relevant, as these provide opportunities to retrofit existing energy centres (e.g. in housing estates) to support new plant and infrastructure. Furthermore, plant space in these locations is already available and identified for relevant uses and therefore the installation of new plant facilities will encounter less resistance. Therefore, any existing power plants in the Borough are considered a potential strategic location for the installation of future energy centres for new heat networks.

5.2. Heat Map Analysis Results

The location and energy requirements of priority buildings in Kingston were mapped to relate their spatial distribution and associated heat densities to the local authority's strategic heat plan. The potential role of these buildings as loads for large and/or local scale district heating networks can then be identified.

Figure 5.1 shows the spatial distribution of the various consumer types identified in Kingston. These are represented by the priority buildings that include, as explained in the *Methodology Section*, multi-address and residential buildings, hospitals, educational buildings, fire and police stations, local government and public buildings, museums, sport and leisure facilities, hotels, churches and commercial units.

The map also shows the location of the three major existing power plants in the Borough identified through this study: the Kingston Hospital CHP, the Amy Woodgate House CHP and the Hogsmill Sewage Treatment Works waste-to-energy plant. There is also potential for a CHP plant in the Surbiton Polyclinics site, a location also indicated on *Figure 5.1*.

Finally, the key areas of change in the Borough, as defined in the Kingston Core Strategy, in Hogsmill Valley and Tolworth are highlighted.

To help visualise the heat demand and associated density of the identified consumer types, a Heat Map was created, where the priority buildings were plotted with increased size to demonstrate increased heat demand (*Figure 5.2*). The heat demand of the buildings identified through this study is associated with their gas consumption, which was determined using real-data, where available, and benchmarks. Approximate gas consumption of the priority buildings was categorised as *'very small', 'small', 'medium', 'high'*, and *'very high',* using an equivalent of dwelling gas consumption (*Figure 5.2)*.

The map on *Figure 5.3* was designed to distinguish between private (in blue), local government (in yellow), and other public buildings, such as hospitals, police and fire stations (in green). The map also shows in red buildings that do not fall into any of the above categories, such as churches. Proposed developments in the Borough are indicated in purple.

Name	Ownership	Typology	Fuel consumption from all assets excluding CHP (MWh/year)
Kingston Hospital	Other public	NHS	47029
Edenwalk Shopping Centre	Private	Private commercial (> 9,999 m2)	17617
David Lloyd gym (gym+pool)	Private	Sport & Leisure facilities	12015
Chessington World of Adventures	Private	Sport & Leisure facilities	10952
Kingston University Penrhyn Road	Private	Education facilities	8021
Tolworth Tower	Private	Private commercial (> 9,999 m2)	5077
Kingston University Kingston Hill	Private	Education facilities	5007
Cannons Health Club (gym+pool)		Sport & Leisure facilities	4872
Kingston College	Private	Education facilities	4023
Surrey County Council	Local government	Local government estate	3861
KINGSTON POWER STATION	Private	Private residential (> 149 units or 9,999 m2)	3711
John Lewis Plc	Private	Private commercial (> 9,999 m2)	3274
Kingston University Seething Wells	Private	Education facilities	3065
Apex Tower	Private	Private commercial (> 9,999 m2)	3043
Kingston University Clayhill	Private	Education facilities	3014
Kingston University Knights park	Private	Education facilities	2948
REGENTS COURT	Private	Multi-address buildings	2799
Holiday Inn Chessington	Other	Hotels (> 99 units or 4,999 m2)	2784
Marks & Spencer PLC	Private	Private commercial (> 9,999 m2)	2722
RBK: Malden Centre	Local government	Sport & Leisure facilities	2555
YMCA	Private	Hotels (> 99 units or 4,999 m2)	2264

Table 5.1: Large Heat Consumers in RBK

The buildings with the highest heat demand identified through this study (*Table 5.1*) include the Kingston Hospital, located in the north of the borough, commercial units such as shopping and leisure centres located in the Kingston Town Centre (including the Edenwalk shopping centre, John Lewis, Marks and Spencer, David Lloyd gym), Kingston University buildings in Kingston Hill, Seething Wells, Clayhill, Knights Park and Penrhyn Road, the Kingston College, the Surrey County Council buildings, the Chessington World of Adventures and the Holiday Inn Hotel, located to the south of the Borough, the Apex Tower and Malden Centre, located to the east, the Cannons Health Club, south of the Town Centre, and the Tolworth Tower.

The heat demand of schools located in the Borough was generally below 1,000MWh/year, with the exception of Coombe Boys' School in New Malden and Tolworth Girls' School with heat demands of 1,400 and 1,100 MWh/year, respectively. The Richard Challoner School in New Malden, the Tiffin's Girls' School on Richmond Road and the Southborough School in Surbiton have heat demands around 900 MWh/year. The remainder of schools have heat demands below 850 MWh/year.

Figures 5.1, 5.2 and 5.3 demonstrate that the spatial distribution and associated heat density characteristics of the priority buildings in Kingston generally conform to expectations:

- The majority of priority buildings are located within the Kingston Town Centre, including a mixture of large commercial units, such as shopping centres, department stores and hotels. Several Local Government buildings are also found in this area including the Surrey County Council, the Guildhall buildings, the Kingsfisher leisure centre, the Kingston Library and some schools. Some Kingston University buildings are also located in Kingston Town Centre.
- Directly to the south of Kingston Town Centre, in Surbiton, large heat consumers include commercial buildings, such as health clubs and hotels, while Kingston University buildings, such as Seething Wells and Clayhill are also located in this area.

- Tolworth Tower is the dominant heat consumer in central Kingston.
- The Apex and CI Towers and Malden Centre are the major heat consuming buildings towards the east of the Borough, in New Malden, an area that also includes several local authority buildings, such as housing estates, libraries, youth clubs and schools.
- To the south of the Borough, the Holiday Inn hotel and the Chessington World of Adventures are the major heat consumers. Local Authority buildings in this area include several schools and the Chessington Community College.
- The major existing heat supply plants that can act as strategic locations for the provision of energy centres, are distributed throughout the Borough. Kingston Hospital's gas-fired CHP plant, with a capacity of 1.4MWe in located to the north of the Borough. The Amy Woodgate House gas-fired CHP system has a capacity of 0.1MWe and located in Chessington. The Hogsmill Sewage Treatment Works facility incorporates a waste to energy plant with a capacity of 0.94MWe. The facility is located within the Hogsmill Valley Area of Change. Finally, there is a potential for a CHP unit being accommodated within the Surbiton Polyclinics site on Ewell Road.
- *Figure 5.3* shows in purple the location of proposed developments in the Borough, with the majority of those located to the north of the Kingston Town Centre.

This spatial and density analysis of the Heat Map indicates that the most prominent cluster of high heat demand buildings is located in the Kingston Town Centre (*Figure 5.4*). The high density of development and mix of uses identified within this area would create a continuous daytime heating load that may be well-suited for large-scale CHP supplying district heating.

Specifically, two clusters of priority buildings are identified in Kingston town Centre: North and South.

Primary energy consumers identified in the north town centre cluster (Cluster 1) include the central retail core, with large shopping centres (the Bentalls Centre, Edenwalk shopping centre) department stores (John Lewis, Marks and Spencer) and leisure centres (David Lloyd gym), local authority buildings (Guildhall, Guildhall 1 and 2), the Kingston Library, the Kingsfisher Leisure centre, the Kingston College, the Kingston Museum and Heritage Service, Travelodge chain hotels, the Kingston Police Station and residential developments (Garricks House, Stevens House).

The cluster to the south of the Kingston Town Centre (Cluster 2) includes energy consumers such as the Kingston University Buildings, the Surrey County Council buildings, several schools and a chain hotel (Antoinette Hotel).

Two clusters predominantly of residential developments are located directly to the east of Kingston Town Centre (Clusters 3 and 4). Cluster 3 includes the residential developments Clarendon House, Buick House, Norbiton Hall, School Lane and Cambridge Gardens. Tiffin School and Sports Centre are also part of Cluster 3.

Cluster 4 consists of the high-rise residential buildings Childerley, Brinkley Graveley and Madingley.

A smaller cluster has been identified to the south of the Town Centre (Cluster 5). Energy consumers include a Kingston University building, a YMCA and a leisure facility (Cannons Health Club), office spaces (DST International) and residential developments (Surbiton and Porton Court).

Cluster 6, located to the east of the Borough includes Local Government buildings, such as Hobkirk House, Causeway Centre, Malden Centre and Burlington Schools, and the CI and Apex Towers, located to the north of the cluster.

Finally, Cluster 7, to the south of the Borough, includes the Holiday Inn chain hotel, the Chessington World of Adventures, schools and the Chessington Leisure Centre.

The Kingston University Clayhill, one of the largest heat consumers in the Borough, is located between Cluster 2 and the Hogsmill Sewage Treatment Works, a key area, which, according to the Core Strategy, the Council is seeking to evaluate and establish as part of a low carbon decentralised energy network.

Although Clusters 5, 6 and 7 are spatially distributed throughout the Borough, Clusters 1 through 4 are loosely arranged in a ring formation of high heat density locations around the Kingston Town Centre that is also in close proximity to isolated large heat consumers such as the Kingston Hospital and the Kingston University in Clayhill (*Figure 5.4*). Two of the largest existing power plants in the Borough are also located in the periphery of the Town Centre Ring: the 1.4MWe CHP plant in Kingston Hospital and the waste-to-energy facility in Hogsmill Sewage Treatment Plant with a capacity of 0.94 MWe.

The buildings included in each Cluster and their respective heat demand are shown in the tables provided in Appendix D. The maps presented on Figures 5.1 through 5.4 are also provided in full scale in Appendix E.

Taking into account the results of the Heat Map analysis, the following section builds on the identified clusters and provides an evaluation of those, to identify the boundaries of the opportunity areas in Kingston and outline the vision for the deployment of Decentralised Energy in the Borough.

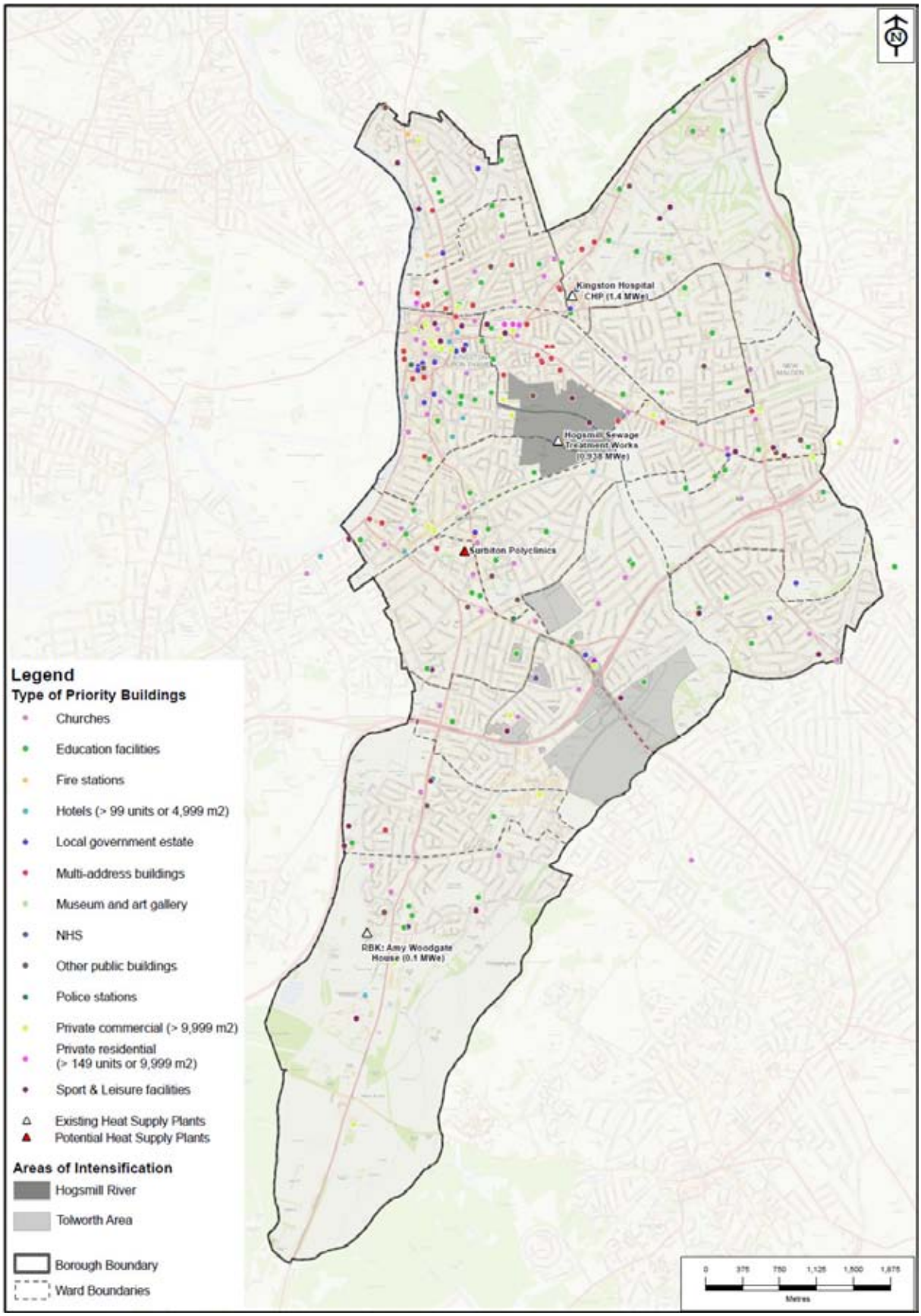


Figure 5.1: Priority Buildings in the RBK

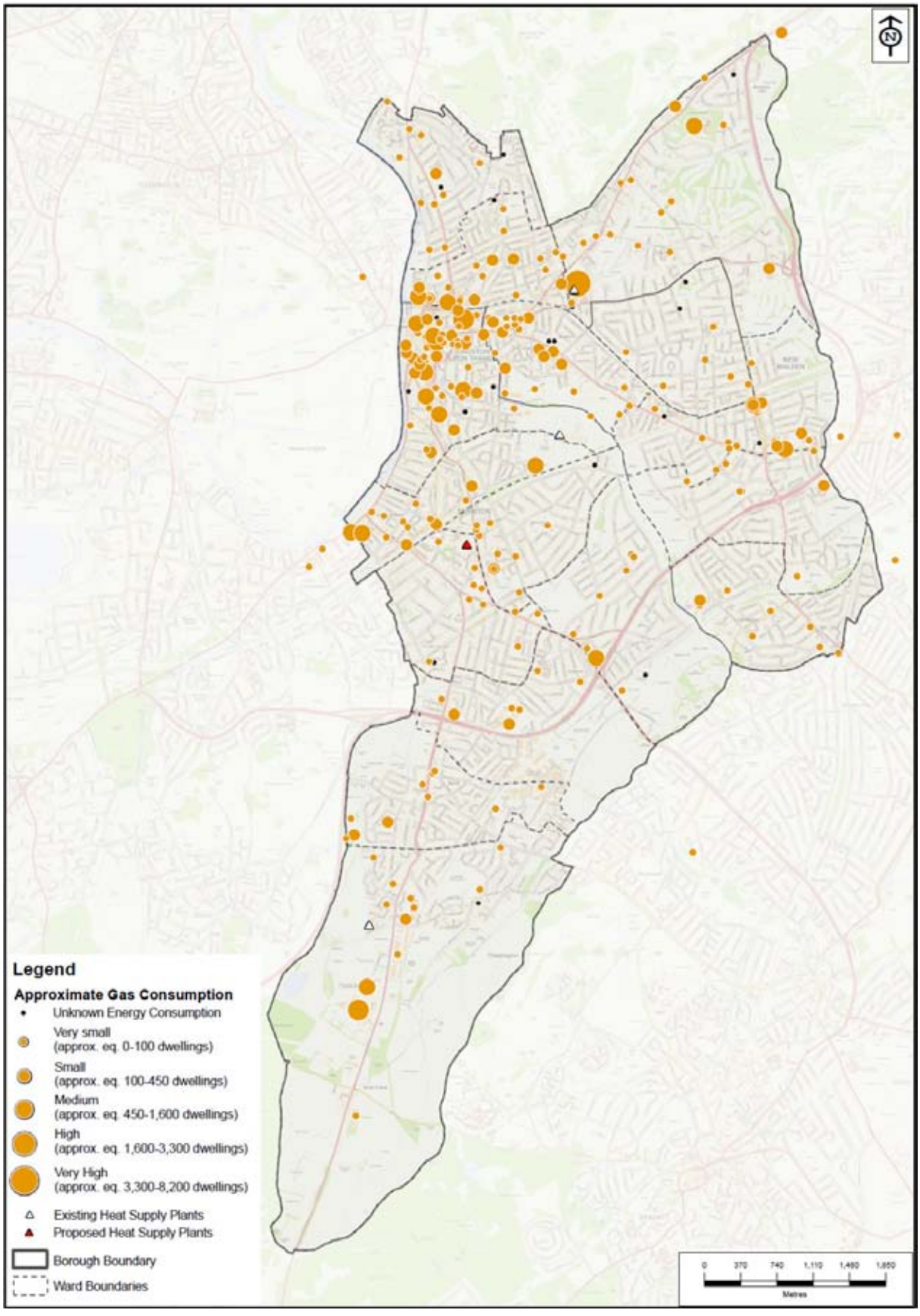


Figure 5.2: RBK Heat Map

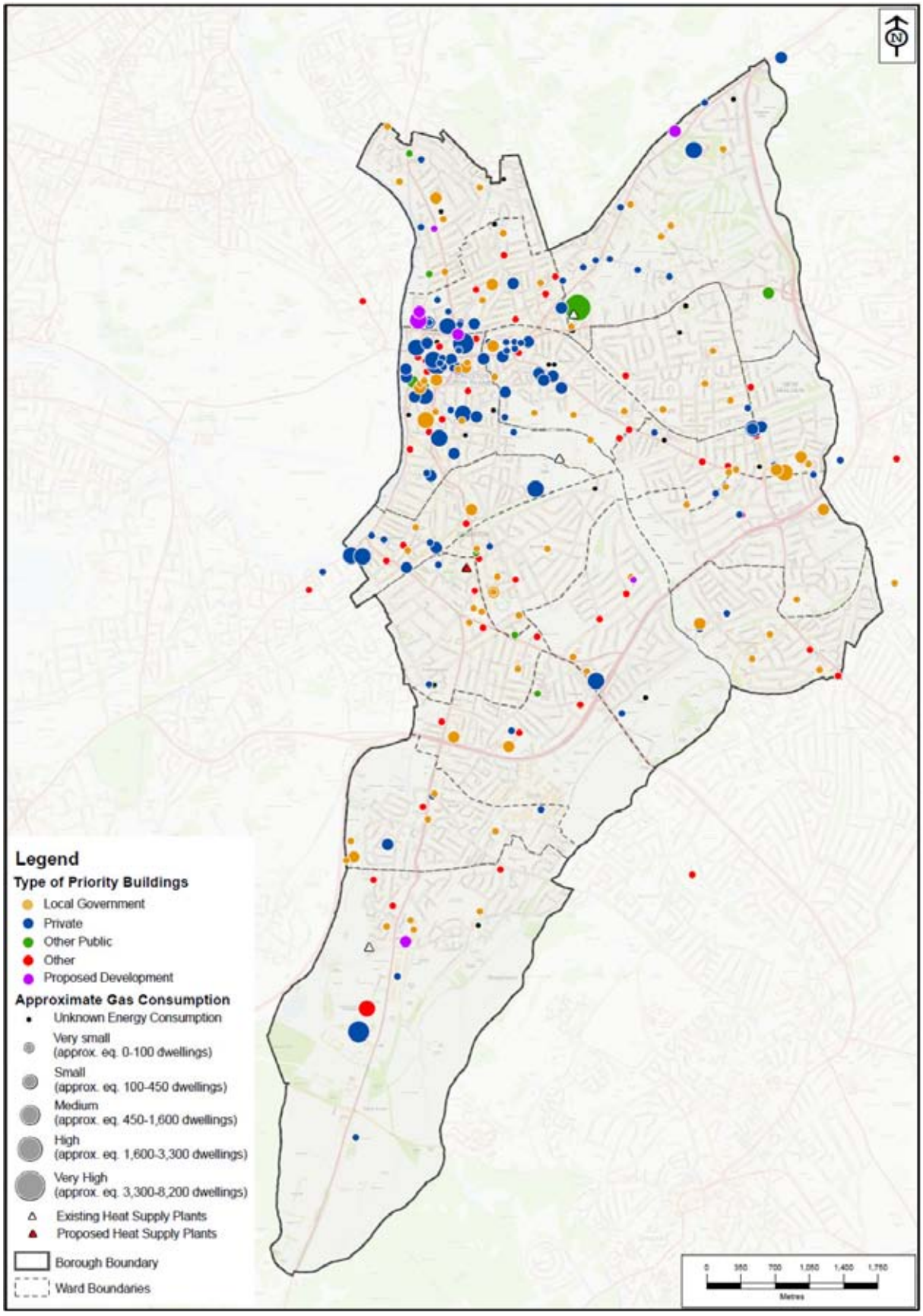


Figure 5.3: RBK Heat map and building ownership

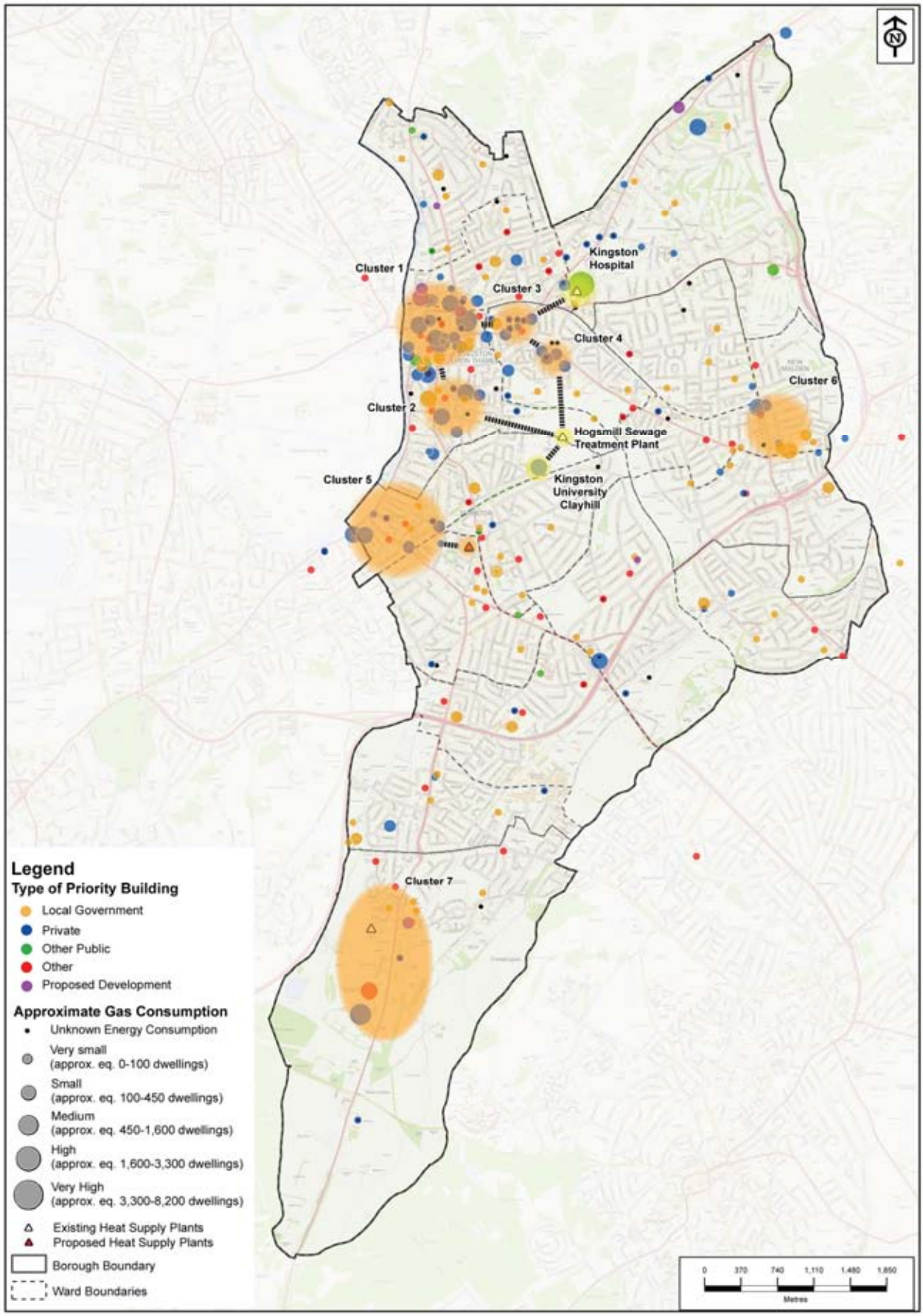


Figure 5.4: Priority Buildings Clusters

6. DELIVERY VISION

6.1. Cluster Evaluation

The Clusters identified on the Kingston Heat Map have been assessed against the three key requirements that support the deployment of decentralised energy systems:

- Sufficient heat density;
- Sufficient diversity of consumer types;
- Anchor load consumers.

In terms of physical extent, in engineering terms there are no upper limits to a heat network; however, proportionally the heat losses from the pipes will be larger the greater the distance over which heat is distributed. Moreover, the costs associated with laying the necessary pipe infrastructure, also increase with increased distances. Therefore, the proximity of potential strategic energy centre sites (strategic locations) and the consumers these will serve is an additional consideration when evaluating the Kingston Clusters.

The table below summarises the Clusters' performance against these characteristics:

Cluster Performance

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7
	Town Centre Ring						
Heat Density							
Diversity of Consumers							
Anchor Loads							
Proximity to Strategic Locations							

Performance
High
Medium
Low

The **heat density** of each cluster is indicated through the number and size of heat consumers within the cluster.

The Town Centre Ring that includes Clusters 1 through 4 (*Figure 6.1*) exhibits the highest density in terms of heat demand, with a considerable number of relatively large heat consumers concentrated in a small area. Clusters 5 through 7 exhibit lower heat density, when taking into account the number of consumers included, the distance between consumers and the heat loads associated with those.

The Town Centre Ring is also characterised by larger **diversity of consumer types**. Primary energy consumers in the north Town Centre include large shopping centres, department stores, leisure centres, Council buildings, the Kingston Library, the Kingston College, the Kingston Museum and Heritage Service, Travelodge chain hotels, the Kingston Police Station and residential developments. Cluster 2 in the south of the Town Centre, includes energy consumers such as the Kingston University Buildings, the Surrey County Council buildings, several schools and a chain hotel. Clusters 3 and 4 are dominated by residential heat consumers, whose heat load is complemented by those of the commercial developments located in the Town Centre.

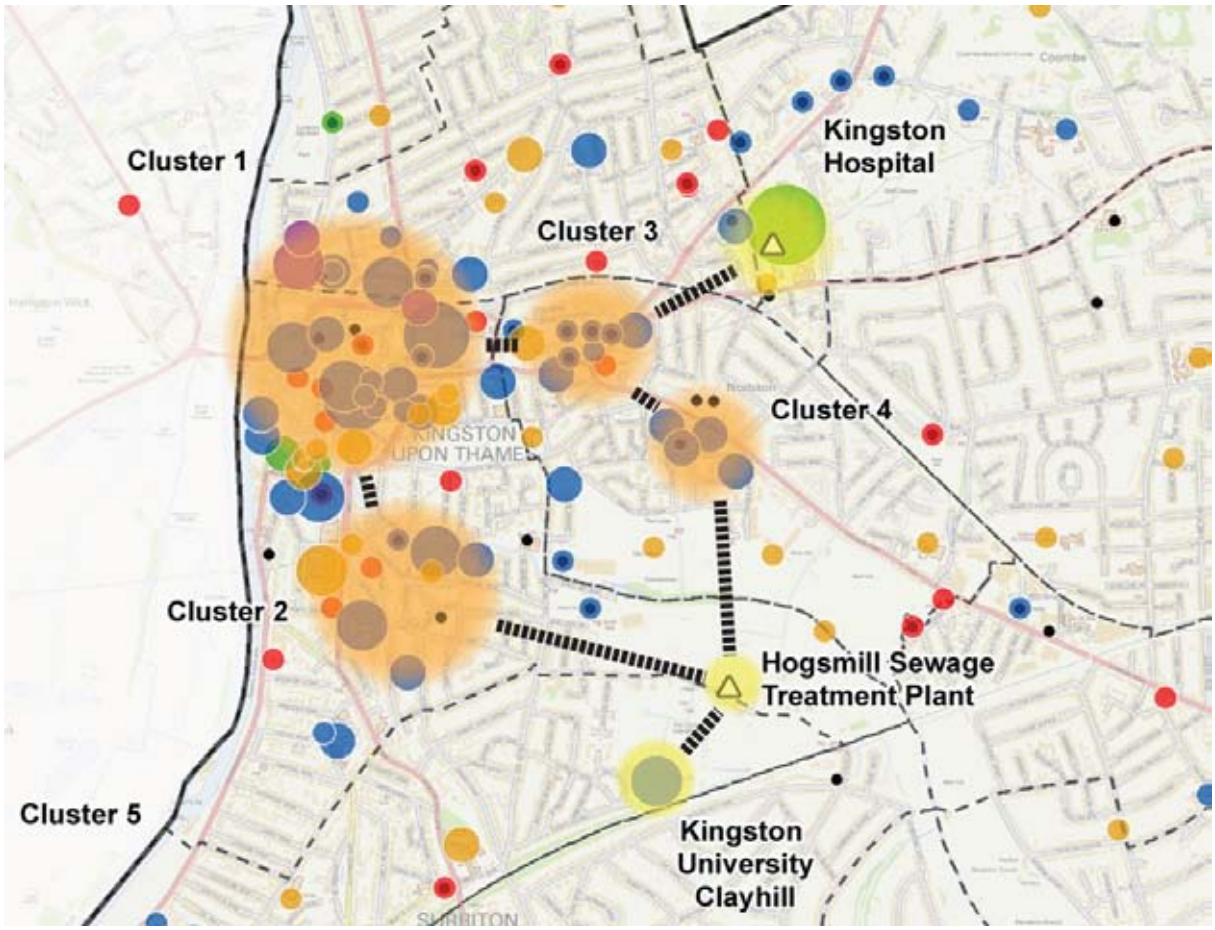


Figure 6.1: The Town Centre Ring

To the south of the Town Centre Ring, Cluster 5 also exhibits a wide diversity including a Kingston University building, a YMCA and a leisure facility, office spaces and residential developments.

Cluster 6 mostly includes Local Government buildings, including a nursing home and the CI and Apex Towers. Finally, Cluster 7, to the South of the Borough, includes the Holiday Inn chain hotel, the Chessington World of Adventures, schools and the Chessington Leisure Centre. No large residential developments have been identified within Clusters 6 and 7.

A minimum base demand is required for a decentralised system to become financially viable, which translates into a certain number of buildings that can act as **anchor loads** for the network.

The Kingston Town Centre Ring exhibits the most solid set of potential anchor loads, including large commercial consumers, the Kingston University Buildings and the Council and County Council buildings. The Kingston Hospital located in the periphery of the Ring is also a major potential anchor load.

The Kingston University in Seething Lanes and the Malden Centre could be a potential anchor loads for Clusters 5 and 6. The chain hotel in Cluster 7 could potentially offer the anchor heat demand for a future heat network.

Strategic locations with existing plants are located in the periphery of the Town Centre Ring, including the Kingston Hospital CHP and the Hogsmill Sewage Treatment Plant. The CHP plant at the Amy Woodgate House is located within Cluster 7. Finally, there is the potential for a CHP unit being accommodated within the Surbiton Polyclinics site, located at the edge of Cluster 5. Based on the findings of this study, Cluster 6 there are no sites with existing heat plants within or in the vicinity of Cluster 6.

6.2. Identification of DE Opportunities

Based on the Cluster evaluation, the concentration of density, diversity and anchor loads makes the Town Centre Ring the area with the highest potential for opportunities of decentralised energy

being developed. The provision of a low carbon, decentralised energy network of power and heat generation established in Kingston Town Centre is also in line with the aspirations of the RBK described in the Core Strategy.

One potential scenario for the deployment of an energy network in the Town Centre Ring area would be one with strategic energy centres located in the existing power plant locations in the Kingston Hospital and the Hogsmill Sewage Treatment Plant. The strategic energy centres would be supplemented by satellite energy centres in the Kingston Town Centre, where anchor loads could be chosen from a range of local authority and private commercial units. Connection of the surrounding residential developments present in the Town Centre, would contribute to smooth, 24-hour load of heat/cooling demand, which in turn provides the commercial potential and stability for the network.

This option would involve a circular shaped pipe subway route, linking up the energy centres and potential consumers. The ring network would provide a closed circuit resulting in high security supply for energy transport and offers further reliability to an end user.

The potential to utilise waste heat associated with the electricity production at the sewage treatment works facility, is a key opportunity to be investigated that would allow a future heat network to move from low carbon towards zero carbon fuel options.

In terms of phasing, the deployment of DE in the identified opportunity areas could originally be established based on single site schemes, with energy centres located in existing plant rooms or accommodated in the plant room of proposed developments, and where anchor loads could the guarantee of baseload demand. These requirements could potentially be met on sites within the Kingston Town Centre Clusters, 1 and 2. Therefore, the first phase of the network would supply a single consumer type, or a small amount of mixed use.

On a second phase the network could expand to a multi-site mixed use schemes that would evolve through the connection of a number of existing single-site schemes and neighbouring heat consumers. The timing for the connection of single-site schemes and heat consumers would be partly driven by the need to replace equipment and maintenance cycles of existing stock. Any major new developments could also be compelled to connect into the network once it is delivered. Therefore, planning policy would be a key consideration at this stage.

The presence of the relatively large scale heat producer Hogsmill Sewage Treatment plant in an area identified as priority for new development, would also offer an opportunity for the expansion of the network in Hogsmill Valley that could provide significant carbon reductions at low heat prices by connecting excess and low carbon heat sources to emerging heat loads.

Over time, a large-scale network could develop to cover the town centre ring area though the interconnection of general multi-site schemes and the consolidation of energy production into fewer larger, more efficient plants.

As discussed in more detail in the following section (*Section 7: Potential Constraints and Recommendations*), technical limitations associated with the deployment of a heat network in the Kingston Town Centre, would need to be considered at the immediate next steps to assess the feasibility of this scenario. Technical limitations would include the following:

- Identifying appropriate energy centre locations in the Kingston Town Centre, where issues such increased land values and densely populated areas pose additional constraints;
- Ensuring that the gas and electricity grids are able to support the delivery of DE schemes;
- Assessing the existing utility infrastructure provision to inform the energy centre location and capacity and potential building interconnections; and
- Assessing the existing building infrastructure and existing heating systems and the potential for retrofitting.

Clusters 5 through 7 exhibit some of the immediate characteristics for the implementation of DE networks; however, according to the results of this study, the lack of the appropriate combination of key characteristics, would mean that more detailed analysis, combined with growth projections, development potential and an estimate of the future anticipated heat demand, would be needed to supplement the assessment of opportunities for DE networks in those areas.

These high-level findings identify a number of key DE opportunities in Kingston Town Centre, where the possibility of heat network may be the preferred solution; however, the technical limitations identified would need to be further investigated through more detailed assessments of the technical, financial and legal feasibility of these opportunities. This will identify infrastructure routes and constraints, test operational scenarios and CHP sizes identify anchor loads and key organization / resources to lead the project.

6.3. DE Opportunities and Areas of Change

As indicated in the Core Strategy document and shown on *Figure 5.1,* Tolworth and parts of the

Hogsmill Valley are areas, where change will be promoted to benefit local and wider needs.

Hogsmill Valley is a key area, which, according to the Core Strategy, the Council is seeking to evaluate and establish as part of a low carbon decentralised energy network, and according to the findings of this study, there is actual opportunity to achieve this.

As shown on *Figures 5.2 through 5.4*, the Hogsmill Sewage Treatment Works is located within the Hogsmill Valley opportunity area, while the Kingston University Clayhill, one of the largest heat consumers in the Borough, is located at the edge of this area, between Cluster 2 and the sewage treatment facility. As indicated in previous sections, the Hogsmill Sewage Treatment Works is considered a strategic location for the deployment of DE opportunities in the Borough with potential to capture any waste heat associated with the sewage treatment plant and utilise it to provide heat to surrounding properties that will form part of the heat network. Proposed developments that fall within this area of change could also be required to connect to the potential network, increasing the viability of the scheme.

The deployment of a DE network within this area would also take advantage of the Council-owned waste site at Villiers Road (UDP Site Proposal 26), that has been identified as a potential area for redevelopment as a waste facility. Opportunities for waste-to-energy facilities could therefore be investigated within the context of DE. The Villiers Road Site has also been identified with the *'South London Waste Plan, Potential Sites and Policies'*[12] as Site Number 6, with an area of 1.86 hectares and has been characterised as having potential for re-development with no identified constraints.

Tolworth is also a regeneration area, where the Council will promote social and economic development and environmental enhancement over the next ten years, as indicated in the '*Tolworth Project Draft Strategy*'[13]. According to local policy documents and discussions with planning officers, major development proposals are expected to materialise in this area. Some examples include the Former Government Offices, Toby Jug PH and Marshall House sites that are awaiting redevelopment. The government offices site is allocated for residential and community uses, with a hotel, offices and transport interchange on the Kingston Road frontage. The site is the largest allocated site for new housing in the borough with a housing capacity estimated at up to 400 dwellings. Another site is the Jubilee Way/ Kingston Road corner, allocated for a hotel on the Kingston Road frontage and for indoor and outdoor sport/recreation including a swimming pool and indoor sports hall.

Although major future regeneration is planned for this area, the current heat loads identified through this study (*Figures 5.2 and 5.3*) were not dense enough to classify Tolworth as a potential cluster. As shown on the maps, in terms of heat density, this area is currently dominated by Tolworth Tower, with the remainder of the buildings in the vicinity being classified as only small heat consumers. In addition, although regeneration sites are identified in local policy documents, the Heat Map, has not been designed to include this type of sites, as it is not possible to obtain heat demand data for speculative areas.

Therefore, although through the information collected as part of this study, Tolworth is not clearly identified as an opportunity area, the growth projections for this district would be very relevant in estimating the future anticipated heat demand, and potentially re-assess the opportunity for a local heat network.

[12] *South London Waste Plan, Potential Sites and Policies, Consultation Policies, 20th July to 16th October 2009*
[13] *Tolworth Project, Draft Strategy, November 2009*

7. POTENTIAL CONSTRAINTS AND RECOMMENDATIONS

7.1. Spatial Constraints

Although the heat density, diversity and anchor loads make the Town Centre an ideal location for a district heating network, high land values may mean that generation technologies with a large space requirement (e.g. biomass) may be less suitable.

RBK should consider a range of options for finding suitable, affordable sites for energy centres, including use of their own land assets. Locations with existing/redundant plant space provision should be investigated. Opportunities to extend the existing plant space provision in the key heat plant locations identified at Kingston Hospital, the Hogsmill Sewage Treatment plant and the Amy Woodgate House, also offers benefits of possible reduced capital expenditure, and therefore the these locations are considered strategic for the deployment of DE networks in Kingston.

Opportunities could be sought to locate energy centres on lower value allocated land such as industrial areas.

7.2. Technical Constraints

In addition to locational, technical constraints need to be considered, relevant to linking a network to existing utilities, infrastructure and systems.

For example, gas-fired CHP plant could offer a cost effective DE delivery option, with benefits including comparatively low capital expenditure, known and reliable technologies and products, and favourable operating expenditure. For a gas-fired CHP scenario to be implemented, however, the gas National Grid needs to be able to respond to and support the delivery of the identified DE schemes.

Furthermore, a large scale gas-fired CHP plant would generally require gas compression systems for efficient operation, imposing additional capital expenditure, both in terms of equipment and plant space requirements. It also has an impact on potential energy centre locations operating gas fired CHP plant. Therefore, locations in close proximity to the medium pressure gas mains are more likely to support the financial viability of DE projects because of potential reduced capital expenditure for grid connection and mitigation of grid reinforcement costs.

Electricity generated by CHP plant will be sold in most cases to the grid due to the complexity of the electricity supply regulations. At larger capacities (circa 20MWe) it is essential that the electricity grid distribution infrastructure be rated at 33kV to support export. This has an impact on potential energy centres – locations in close proximity to existing or planned 33kV substations are more likely to support the financial viability of DE projects due to likely reduced capital expenditure for grid connection and mitigation of grid reinforcement costs.

Therefore, after assessing the potential building clusters in the Kingston Town Centre Ring that could support a DE network, the existing utility infrastructure provision and its rated capacities must be considered, before determining the technical constraints on the energy centre location and capacity. These parameters can be determined through statutory searches.

A comprehensive DE network will require extensive laying of new pipes and/or use of any existing and new tunnels infrastructure. Both approaches typically involve significant constraints and costs.

Laying pipes often faces problems with finding sub-surface space as much of this space under roads is already congested with utilities infrastructure. There are also issues with difficulties of maintenance and repair and consequent traffic disruption. A constraint in investigating and planning possible pipe routes is the lack of a centralised, easily accessible and useable database on existing buried utilities infrastructure.

Constraints that need to be considered in the potential use of existing infrastructure include:

- There appears to be a lack of a centrally compiled database of existing infrastructure, including location, status, ownership, capacity and condition. This makes assessment of the potential to use existing infrastructure difficult and also creates problems ensuring that new infrastructure is not obstructed by existing infrastructure.
- Utilities companies are generally reluctant to share spare space in their existing infrastructure. There is often a lack of awareness that there are acceptable design and management solutions to sharing tunnel space.
- Creating relevant pipe infrastructure is likely to cross many land ownerships and requires relevant statutory powers. It is therefore essential that either the public sector uses its relevant compulsory purchase powers and/or it is partnered with a utility provider with relevant powers.

Compiling better information on existing utilities and existing networks and plans for capital improvements and expansion, is therefore a key step towards assessing the feasibility of DE networks in Kingston.

A common issue with linking DE networks into existing infrastructure is that such buildings will have

their own heating systems already in place and these will be at varying stages in their maintenance and asset replacement cycles, thus potentially dissipating/delaying potential demand. For example, during the course of this study it was found that one of the largest residential developments identified in the Borough, the Royal Quarter, with approximately 450 flats, is served by individual boilers, rather than a community heating system.

7.3. Environmental Constraints

Environmental constraints can also be a significant limiting factor on the potential locations and nature of DE energy centres. Key issues often revolve around noise and air quality impacts on near-by sensitive receptors and local political and resident perceptions that energy centres are bad neighbour activities.

Biofuel and waste powered energy centres, such as the Hogsmill Sewage Treatment Plant are particularly problematic. Potentially acceptable solutions include use of abatement technologies, sound insulation and increased chimney heights to help disperse pollutants. Single, large scale energy centre schemes lend themselves better at mitigating air quality issues, as abatement technologies are only financially viable at large scale capacities.

Therefore, a range of potential energy centre technologies and scales with differing environmental impacts should be considered. As well as considering solutions such as the waste-to-energy plant in Hogsmill Sewage Treatment Plant, consideration should be given to technologies with lower environmental impacts, such as gas fired centres.

A thorough search should be carried out for sites with environmentally acceptable impacts, and desirable characteristics such as the presence of adequate buffer zones between sites and the nearest residential (or other sensitive) properties/receptors, or sites that are not immediately surrounded by tall buildings as this will impact on chimney heights. Typically, the chimney height will need to be greater than the adjacent building(s) to ensure air quality impacts are minimal.

Finally, sensitive, well thought-through stakeholder engagement and consultation can help gain buy in and bring about behavioural change that will support acceptance of why a shift is required in the way energy is supplied and the acceptability of proposed energy centres.

7.4. Financial Constraints

In terms of financial constraints, a barrier to DE delivery is the significant capital expenditure outlay and associated risk to put in place the necessary infrastructure and the export of low carbon electricity to the grid. Such investment is deemed a high risk option by most companies and investors. One way to de-risk the investment and provide more revenue forecast certainty is the identification and securing core/anchor DE customers.

Finally, smaller scale systems tend to have lower efficiencies, while the relative transaction costs to establish them may be higher. This is due factors such as the fact that development costs to establish a DE network are similar when a certain scale has been reached. Any investment requires initial feasibility work and these costs do not vary significantly with the project size. In contrast larger scale projects may be able to offer economies of scale and increased efficiency, including in costs per tonne of carbon saved.

8. IMPLEMENTATION PLAN: NEXT STEPS

According to the LDA and the *'DEMaP Support Package to Boroughs'*, there are 3 phases towards the implementation of decentralised energy opportunities:

- Capacity building;
- Feasibility and Delivery Route; and
- Project Definition and Delivery.

These are described in detail on Table 8.1.

Phase 1, characterised by the LDA as 'Capacity Building' stage, includes the following sub-stages:

- Heat Mapping;
- Political Support and Commitment;
- Strategies and Policies; and
- Budget Commitment.

The Royal Borough of Kingston are currently undertaking the first stage of Phase 1, Heat Mapping. The remainder of this section focuses on key recommendations on how the RBK could follow up on the Heat Mapping undertaken as part of this study, to complete Phase 1.

8.1. Political Support and Commitment

The process of developing DE projects is a major undertaking requiring clear political commitment and leadership and significant allocation of up-front and on-going resources. The support of senior, influential decision makers is fundamental to progressing the DE opportunities into the next stage, as is the commitment from the Borough relevant authority. Therefore, the Council needs to assume the leading role in facilitating (and initiating) projects, committing reasonably significant resources to up-front feasibility and project development work.

In gaining support, the RBK can utilise the opportunity represented by the increasing interest in climate change and resource management issues, which has caused and increased focus on energy management and carbon savings. The opportunities regarding installation of community infrastructure (in both new and existing developments) in Kingston may offer significant reductions in CO_2 emissions and also energy security.

To reinforce the leading role of the Council, RBK could identify/create a central "Borough champion" with responsibility for a cross-borough strategy for decentralised energy and resourced adequately to meet this challenge. The Borough Champion would be responsible for tasks such as:

- Clearly articulating the contribution decentralised energy generation and heat networks can make to meet the Borough's energy targets.
- Overcoming barriers to the roll out of decentralised energy and heat networks.
- Supporting necessary changes/adjustments to ensure an effective planning system is in place.
- Engaging relevant stakeholders through workshops and forums.
- Encouraging members of the Local Strategic Partnership, housing associations and other public sector partners (schools, hospitals, leisure centres etc) to consider DE options.
- Supporting targeted awareness raising campaigns, information and demonstrations to help build confidence and address organisational barriers.
- Working with other responsible bodies to ensure the integrated delivery of community infrastructure.

Phase 1 Capacity Building		
Heat Mapping	**Political Support and Commitment**	**Strategies and Policies**
o Identify key 'anchor' heat loads (existing and proposed) o Identify existing and proposed heat networks o Gather energy consumption, energy supply assets and associated data from local stakeholders/building owners/borough officers o Define boundary of DE project/opportunity area	o Gain the support and commitment of senior, influential decision makers to progressing the DE opportunities further Secure DE in strategy documents	o Identify all relevant strategies that can be utilised to facilitate the implementation of DE in the borough and ensure that all policies are worded accordingly (e.g. waste, housing, energy, planning, LDF Core Strategy, OAPF, AAP, LAA, SPG, etc)
Phase 2 **Feasibility and Delivery Route**		
Feasibility Study	**Delivery Route / Procurement Strategy Options**	
o Identify infrastructure routes and constraints o Test a number of operational scenarios and CHP sizes for different clusters o Identify 'catalyst' consumers for core cluster/scheme o Engage key stakeholders to explain possible contractual routes to implementation and gauge appetite towards risk o Identify lead organisation(s) to pull together group of like minded parties with heat loads to pledge o Drawings showing buildings, plant locations and distribution infrastructure o Summary CO2 savings o Detailed recommendation for preferred technical option	o Develop capital and operating costs and revenues for different options and run whole life cost model o Identify preferred scheme(s) to take forward based on agreed metric e.g. £/tCO2, IRR etc	
Phase 3 **Project Definition and Delivery**		
Business and Financial Plan	**Procurement**	**Legal**
o Identify sources of funding o Develop project risk matrix o Agree which parties are to be included in the scheme o Develop heads of terms or MOU	o Decide on procurement process o Prepare reference design & output specification o Verify pipework routes o Validate capital cost forecast o Validate Opex & revenue forecasts o Develop financial model and prepare business plan o Obtain internal approval	o MoUs for local authority and external stakeholders o Explore leasehold/freehold issues o Draft contracts (sale/purchase of heat/electricity and associated services) o Explore tariff options

Table 8.1: DE Deployment Implementation Stages

Stakeholder engagement should be one of the key actions to be undertaken by the DE Borough Champion. This will help gain buy-in and bring about behavioural change that will support the deployment of DE networks, as well as identify the potential anchor loads.

The key stakeholders identified through this study are presented in Table 8.2. A first step towards the stakeholder consultation was carried out during the course of this study, utilising a web-based questionnaire (Appendix F). Although the responses received were not enough to allow for a statistical analysis, the questionnaire designed to assess the potential stakeholders understanding of the benefits provided by the deployment of a DE network, could help identify the key issues to be discussed during workshops with stakeholders, as one of the immediate next steps.

The consultation process should also aim to supplement data collected through this study for the creation of the Heat Map. For example, private sector buildings should be encouraged to publish their energy consumption information, for example when their next boiler refit/major refurbishment is due or when their energy supply contract is next up for renewal. This information could be added on the DeMap Database to enhance the accuracy of the heat loads, especially in cases where benchmarks were used.

Another immediate action of the DE Champion would be a more detailed assessment of the waste-to-energy plant in the Hogsmill Sewage Treatment Works and the CHP plant at the Kingston Hospital. Specifically, it should be determined what the potential capacity of these existing schemes is for supplying additional/any heat load. Further to this, there is a significant distance between the Hogsmill sewage treatment plant and the Kingston Town Centre, therefore the potential for identifying consumers mid-way between the two, would significantly increase the viability of a potential installation at this location. The area around the sewage treatment plant is defined by Kingston Council as an area of intensification, therefore there may be additional opportunities to be investigated, in terms of new developments planned adjacent to this site that could take advantage of the waste heat.

At later stages of the DE programme, the DE Borough Champion would mature to a DE Committee, to assume responsibilities, such as:

- Managing the procurement process.
- Using relevant powers to secure sites, access and possibly to some degree regulation of infrastructure.
- Committing to changing estate management processes and investment cycles to link in their own property assets as anchor customers for DE networks. There may also be a need to commit certain of a local authorities own resources.

8.2. Strategies and Policies

In order to secure investment, Local Authorities will need to use their planning powers to ensure that consumers connect to heating networks. Developers can be required to incorporate CHP and district heating on a site specific basis or to ensure that building services are designed to connect to wider networks in future.

Key here is the development of a planning policy where all early development is compelled to connect into the network once delivered as well as identifying existing stock.

Different phases of future development may be carried out by different developers, particularly if there is a horizontal mix of uses. To ensure that developments are 'future-proofed' for connection to district heating, each phase should be designed to be compatible with and optimise the overall operation of district heating. For example, new blocks of residential development should be specified with space heating systems that are supplied by communal boilers so they can be connected to a district heating network in the future.

Common standards and requirements for future-proofing should form part of strategic heat planning guidance as set out in local policy documents and/or relevant AAPs and Development Briefs. This approach has been adopted by the London Borough of Barking and Dagenham which is seeking to develop a town centre district heating network.

The publication of an energy options map by the Borough would also significantly increase the chances of project success by providing the necessary information to help stakeholders identify anchor loads that allow effective balancing of supply and demand. Specific targets could also be placed within key council strategies.

As indicated in the previous sections, public sector or local authority buildings provide excellent anchor load potential. These buildings should be encouraged to connect to planned heating networks at next available opportunity, i.e. at time of next boiler refit or when energy supply contract comes up for renewal. For example, after discussions with RBK officers the Cambridge Road Estate was identified as being of potential interest in offering an opportunity for connection to a DE network. Due to the thresholds defined by the LDA on the data collection during the Heat Mapping, Cambridge Estate was not identified as part of the Heat Map; therefore the potential for this development to form part of the DE vision for the Borough could be the subject of an additional study that would assess its

characteristics and determine the technical feasibility for connection to a future DE network.

A requirement for public sector buildings to join a local heat network when one is available would deliver potential anchor load and therefore reduce the financial risk. Consideration should also be given to planned networks when determining the location of new public sector buildings.

Major Heat Consumers and Potential Stakeholders	Contact Name
Kingston University London	
The New Victoria Hospital	
Eden Walk Shopping, Kingston Upon Thames	
Tolworth Hospital	
The Malden Centre, DC Leisure Management Kingston Ltd	
Tolworth Recreation Centre, DC Leisure Management Kingston Ltd	
Kingsfisher Recreation Centre, DC Leisure Management Kingston Ltd	
Guildhall Complex, Royal Borough of Kingston Upon Thames	
Norbiton Hall, BIRKENHEAD AVENUE, Kingston Upon Thames	
CI Tower, New Malden	I
Apex Tower, New Malden	
John Lewis, PLC	-
Kingston College	
Kingston Hospital NHS Trust	-
Chessington World of Adventures, Merlin Entairtainments	-
Bentall Centre	-
Tolworth Tower	
Royal Quarter, Kings Way, Kingston Upon Thames	

Table 8.2: Major Heat Consumers and Potential Stakeholders in RBK

8.3. Budget Commitment

During this stage, RBK would need to secure budget to carry out options appraisal for DE projects and develop an implementation programme.

Given the caveats on the cost and viability of energy planning requirements set out in PPS22 and the Supplement to PPS1 on Planning and Climate Change, a local authority's position can be strengthened if there is an Energy Services Company (ESCo) partner to invest in the infrastructure, offsetting the capital costs and mitigating the risk for developers.

8.3.1. Energy Services Companies (ESCos)

A variety of different community-owned, privately financed or public-private partnership delivery structures have been developed to finance decentralised energy systems. These structures are generically termed Energy Service Companies (ESCos). ESCos usually install, finance and manage community energy systems and therefore provide an efficient and comparatively lower risk approach to CHP installation management.

ESCo providers can consist of large scale utility providers such as E.on, and other specialist ESCo providers such as Dalkia Utilities (Pimlico District Heating Undertaking), and Thameswey Energy Limited (Woking town centre district heating/cooling

and private wire scheme). *Table 8.3* presents a list of potential ESCOs and relevant contacts. Successful community energy projects require high level support from local authorities to help promote the project with planners, developers, communities and utility providers. Critically, the borough would need to act as either a partner or a key customer (by utilising public sector buildings to provide guaranteed custom) for ESCos.

ESCo	Contact details
1. Cofely	Simon Matthews T: 01332 360738 E: simon.matthews@cofely_gdfsuez.com
2. E.on	Steve Vizor
3. Dalkia	Tony Orton T: 01617 491921
4. Inexus	Sarah Tomlinson Ocean Park House East Tyndall Street Cardiff CF24 5GT T: 08450 556196
5. SSE Utility Solutions	Charles Farley M: 07767 852458 E: charles.farley@sse.com

Table 8.3: Potential ESCos

The term ESCo refers to a wide range of different energy supply arrangements. Essentially, an ESCo acts like a utility provider but instead of supplying gas, heat is supplied. Typically, in order for an ESCo to be viable, the tariff structure for heat supply must meet or better that for gas supply, i.e. the unit price for heat is equivalent or better than the unit price for gas. Currently, the supply of heat is not regulated, unlike gas and electricity, therefore the local authority is tasked to ensure that any ESCo provider can offer full security of supply at equivalent costs to that of the conventional grid.

Another aspect of a CHP network is the supply of electricity to customers through a private wire scheme (i.e. unconnected to the national grid). This is very attractive to ESCos as the tariff structure improves the financial viability of decentralised energy systems. Similarly, the local authority is tasked to ensure that any ESCo provider can offer full security of supply at equivalent costs to that of the conventional grid.

Businesses and homes (public and private) connected to district heating/cooling and private wire schemes would experience no significant operational differences than if connected to conventional utility providers. The same security of supply would apply, meaning that the customer would not need to provide on site plant to back-up a loss of heat or electricity supply. The ESCo would be required to provide back-up and top-up boiler plant as part of the energy centre plant provision, ensuring that should the CHP plant fail or be subject to operational downtime for preventative and reactive maintenance, the heat supply would not be affected. Similarly, as is the case of the Woking town centre private wire scheme, a third party connection would be established with EDF such that full electricity back-up is always available. This also ensures that the customer can maintain their right to switch electricity suppliers should the ESCo tariff exceed conventional grid tariffs and motivates ESCo's to maintain competitive tariffs.

In addition to the energy supply, an ESCo may provide finance for the provision of end services (heat, power and comfort), the expertise to maintain the equipment, and advise to residents/occupants in the correct operation of equipment and appliances.

8.3.2. ESCOs Procurement

The majority of existing local authority CHP schemes have been developed in partnership with an ESCo. An ESCo can be created by the Council on its own or can be created as a joint venture with a private sector partner. As described above, an ESCo would typically provide capital finance, project

design, construction, management, fuel purchasing, plant operation, maintenance, and long-term replacement and risk management. The Council would have a contract with the ESCo for the supply of heat and power and through this sell the energy to its heat customers in the usual way.

There are a number of different routes to procurement of an ESCo partner, and it is generally recommended that selection and involvement of suitable partners takes place as early on in the development process as possible. As indicated in the '*Community Energy: Urban Planning for a Low Carbon Future*[14] procurement routes could include:

- Identification of private ESCo partner: Selection of a specialist CHP provider through a tender process and based on competitive dialogue;
- Establishment of new standalone ESCo: The establishment of a special purpose vehicle with a standalone business plan. Options could include:
  - Public/ private partnership: Local authority partnership with a private sector CHP partner
  - Social enterprise: New enterprise established with local authority support (to provide covenant strength) and board representation.

A report by the London Energy Partnership[15] has highlighted the role that Local Authorities can play in helping to establish ESCos, their powers to facilitate new infrastructure and the legal scope of their ability to participate in new ventures.

The Danish consumer-owned ESCo model could be particularly relevant to the UK situation, addressing as it does many of the concerns raised by developers and energy consumers such as accountability for a monopoly supply. This model could be established as a social enterprise with local authority support, potentially using Community Interest Company or Industrial & Provident Society legal structures.

In order to make progress a step change is needed not just in strategic policy and planning, but in the scale of investment being made. Local authorities are significant purchasers of energy services in their local areas. They have the ability to act as a catalyst for energy projects, with the potential for their portfolio of buildings to provide baseloads and long-term supply contracts as anchors for community energy projects.

[14] Community Energy: Urban Planning for a Low Carbon Future, TCPA & CHPA, 2008
[15] London Energy Partnership, *Making ESCOs work - Guidance and advice on setting up and delivering an ESCO, Brodies LLP,* February 2007

8.4. The route to the Feasibility Studies Stage

The high-level findings outlined in this report identify a number of opportunities and benefits for developing a decentralised energy network in Kingston. After completing the Capacity Building stage through the steps identified in this section, the study would continue to conduct a more detailed assessment of the technical, financial and legal feasibility, such as identifying infrastructure routes and constraints, testing operational scenarios and CHP sizes and identifying anchor loads. The key issues to be examined at the feasibility stage would be:

- Test a number of operational scenarios and CHP sizes for different clusters and identify a core cluster(s)/scheme(s);
- Identify anchor load consumers for core cluster(s)/scheme(s);
- Intensify engagement with key stakeholders to explain possible contractual routes to implementation and gauge appetite towards risk;
- Identify possible locations for DE plant to serve the core cluster(s)/scheme(s);
- Identify infrastructure routes and constraints (for example check existing services in buildings for engineering compatibility and space, identify routes for pipework including existing tunnels, basements etc);
- Estimate thermal baseload and phasing of load growth to develop an annual load duration curve and determine the likely scale of CHP plant;
- Produce drawings/sketches showing buildings, plant locations and distribution infrastructure;
- Summarise CO_2 savings;
- Prepare a detailed recommendation for preferred technical option;
- Estimate capital cost, energy sales, operating costs & any funding gap; and
- Consider implementation & procurement.

Therefore, a set of feasibility studies would be needed to evaluate the feasibility of a comprehensive decentralised energy network to serve the needs of Kingston.

9. SUMMARY AND CONCLUSIONS

This study aimed to assist the Royal Borough of Kingston Upon Thames towards developing a Heat Map of the Borough. This will form part of their strategic heat plan to support the evidence-based understanding of local feasibility and potential for DE, by identifying areas of viable heat density, highlighting buildings that could create a baseload requirement for energy and adjacent areas which could be connected.

The heat density of an area is important because higher heat load densities offer better returns and investment costs are lower. The mix of uses also dictates the appropriate context as well as the existence of anchor heat loads that can improve the commercial viability of a decentralised energy scheme.

The heat demand data collected through the first phase of this study was therefore plotted on a GIS-based format to create a Heat Map and facilitate an analysis against the three key requirements necessary for an area to support heat networks:

- Sufficient heat density;
- Sufficient diversity of consumer types; and
- Anchor load consumers.

Accordingly, an analysis was carried out aiming to identify high heat density areas combined with the appropriate mix of uses and anchor heat loads that resulted in the identification of seven Clusters of buildings in the Borough.

The Clusters were further evaluated against the above criteria and based on this assessment, Clusters 1 through 4, loosely arranged in a ring formation of high heat density locations around the Kingston Town Centre, exhibited the highest concentration of density, diversity and anchor loads. In close proximity to the ring formation are also isolated large heat consumers such as the Kingston Hospital and the Kingston University in Clayhill (*Figure 5.4*). Two of the largest existing power plants in the Borough are also located in the periphery of the Town Centre Ring: the 1.4MWe CHP plant in Kingston Hospital and the waste-to-energy facility in Hogsmill Sewage Treatment Plant with a capacity of 0.94 MWe.

According to the results of this analysis, the Town Centre Ring area was identified as having the highest potential for opportunities of decentralised energy being developed. The provision of a low carbon, decentralised energy network of power and heat generation established in Kingston Town Centre was also in line with the aspirations of the RBK described in the Core Strategy.

The potential to utilise waste heat associated with the electricity production at the sewage treatment works facility, has also been identified as a key opportunity to be investigated that would allow a future heat network to move from low carbon towards zero carbon fuel options.

This study also outlined technical and environmental limitations associated with the deployment of a heat network in the Kingston Town Centre, which would need to be considered at the immediate next steps to assess the feasibility of this scenario. The deployment of a DE network will therefore require a combination of:

- Cost effective development of district heating networks;
- Strategic heat planning to coordinate network development and requirements through planning to connect to networks; and
- Mechanisms for financing new projects.

One of the key recommendations included in the final sections of this study indicates that the local authority needs to play a key role in facilitating and the delivery of a DE project in the identified opportunity areas. This can be achieved through promoting changes in strategic policy and planning, and in the scale of investment being made through partnership in Energy Service Companies (ESCOs).

Local authorities are generally significant purchasers of energy services in their local areas. Therefore, they have the ability to act as a catalyst for energy projects, with the potential for their portfolio of buildings to provide baseloads and long-term supply contracts as anchors for community energy projects.

This study concludes with specific recommendations on how the RBK can proceed to complete the first Phase of the DeMap programme, building the necessary resource and knowledge capacity to allow transition to the next phase of the feasibility studies, where the technical and financial feasibility of the DE opportunities will be assessed.

Appendix A – Existing and planned decentralised energy schemes in London

Existing Decentralised Energy Schemes

Scheme	*Location*	*Description*
Citigen	City of London	The system produces approximately 60,000MWh of heat (including output from auxiliary boilers), 32,000MWh of electricity, and 30,000MWh of chilled water per year. It serves a number of City of London buildings including Guildhall, the Barbican Arts Centre, the Guildhall School of Music and Drama, the Museum of London and London Central Markets (Smithfield) as well as other major commercial customers. Citigen has expressed an interest in expansion and the delivery of services for heating, cooling and power to additional consumers/customers, and would consider connection to other energy centres. However, operational and financial viability issues have played a part in preventing investment in further significant infrastructure delivery and expansion, impacting on the feasibility of proposed DE schemes (see Islington South Cluster B) and new development in the vicinity who are seeking to establish a commercially viable heat supply contract to meet regional and local DE policy requirements and aspirations.
Bloomsbury Heat and Power & Gower Street Heat and Power	Camden	Owned/operated by Utilicom (now Cofely District Energy Ltd), this centre currently generates approximately 58,000MWh of heat and 33,000MWh of electrical power, and serves 450,000m^2 of educational and research facilities. Clients include the University College London (UCL) main campus, School of Oriental and African Studies (SOAS), Institute of Education, Birbeck College and various other colleges of the University of London. According to discussions with Harold Garner and Celeste Giusti of the LB Camden there are plans for major expansion and incorporation of other UCL and UCH buildings.
Whitehall & Pimlico	Westminster	The Pimlico and Whitehall district heating schemes are both over 50 years old, and each recently underwent a major retrofit for CHP plant operation. The Whitehall district heating scheme (owned/operated by Cofely District Heating Ltd) provides heat to 23 Government office buildings, amounting to 270,000m^2 of floor space. The PDHU (Pimlico District Heating Undertaking) scheme is owned/operated by City West Homes (formerly the Housing Department of the City of Westminster) and currently serves 3,250 residential units on the Churchill Gardens Estate, around 50 commercial premises (mainly small shops, pubs etc), two schools and a health centre. According to discussions with Joe Baker of the LB Westminster and Peter North of the LDA, opportunities are being investigated to support interconnection between the PDHU and Whitehall district heating schemes. DECC and LDA are contributing £3.5M to support this interconnection, which will be led by Pimlico. The LDA is actively seeking to complete negotiations between the network operators and establish a route for network expansion and connection of additional heat supply customers in the Victoria area.
South East London CHP (SELCHP)	Lewisham	SELCHP is owned/operated by Veolia Environmental Services. The scheme is designed to handle up to 420,000 tonnes per year of municipal solid waste (MSW), which can generate the equivalent energy consumption of 48,000 homes. Electrical power is exported but the surplus heat is not currently utilised. Based on discussions with Bob Fiddik of the LB Southwark, the SELCHP energy waste management plant in Livesey is planned to send fuel to SELCHP. 50% of the excess heat produced will then be utilised to heat estates (around 2,000 residential units) around Southwark Park saving an estimated 8,000 tonnes of CO_2/year. The project is planned to begin by February 2011 at the latest.

Scheme	*Location*	*Description*
		There is further potential to provide heat to the Canada Water development. However no vehicle for delivery is in place.
Barkantine Combined Heat and Power	Tower Hamlets	The Barkantine Heat and Power Company (BHPC) supplies 8,000MWh of heat and exports 5,500MWh of power per year. This scheme is a retrofit community energy network using CHP plant to service over 700 residential units on an East London estate, a nearby leisure centre/swimming pool and the local primary school. The LDA is currently liaising with a Canary Wharf users group with regard to the development of DE networks in the area and a future link to a longer term heat network from Newham. The redevelopment of the Westferry Printing Works and industrial premises at Greenwich View site could contribute to the provision of heat and power for this area along with the expansion of the Barkantine CHP plant.

Planned Decentralised Energy Schemes

Scheme	*Location*	*Characteristics*
Islington South Cluster A (Delhi-Outram / Bemerton)	Islington	South Cluster A includes Caledonian Road Pool, Bemerton Estate and Delhi Outram Estate. Two possible energy centre locations have already been identified. The anticipated CHP capacity is 1,416kW$_e$. According to discussions with Lucy Padfield of the LB Islington, South Clusters A is less advanced than South Cluster B in term of DE procurement. This is due to limited success in negotiating a heat supply contract between King's Cross Central (Metropolitan/Argent) and LB Islington.
Islington South Cluster B (City University)	Islington	South Cluster B includes the Ironmonger Road Baths, Finsbury Leisure Centre, Stafford Cripps Estate, City University (Northampton Square), Kings Square Estate, Brunswick Estate and Finsbury Estate. The main City University boiler plant room at Northampton Square has the potential for expansion through an adjacent store .This anticipated CHP capacity is 6,800kW$_e$. According to discussions with Lucy Padfield of the LB Islington, South Cluster B has secured funding of £2.3M through the LDA. However, the viability of the DE procurement route is still dependent on the success of the negotiations with Citigen for a commercially viable heat supply contact (see Citigen).
Euston Road District Heating Scheme	Camden	The proposed district heating scheme has a planned CHP capacity of 2-3MW$_e$. It would serve existing council housing estates, nearby public buildings and a number of other commercial buildings, with the potential to connect to the proposed King's Cross Central scheme, expanding along Euston Road. The area-wide district heating network will extend from Regent's Park in the west to Caledonian Road in the east. Existing buildings in this area which could potentially be connected to such a scheme, including local authority housing, are: the British Library, Camden Civic Offices and Town Hall, the Wellcome Buildings and Regents Place. Peter North of the LDA has indicated that negotiations are advancing for establishing a DHN that will connect multiple buildings but due to complex legal matters associated with the large number of stakeholders involved in the proposals, it is taking a considerable amount of time to finalise a suitable financial model that will ensure a feasible long term operation.
South Bank Employers Group	Lambeth	The LDA has funded the South Bank Employers Group (SBEG), in conjunction with South Bank University, to look at the potential for an extensive decentralised energy scheme across London's South Bank. The scheme would connect major energy users to a district heating network. Existing public and private buildings such as St Thomas' Hospital, the South Bank Arts complex and Shell buildings are all possible heat customers, as well as a number of planned high density mixed use developments.
Cranston Estate Retrofit	Hackney	The scheme will connect over 500 residential units to a decentralised energy network consisting of approximately 1km of heat network piping and a natural gas CHP engine. The residential units are split over three estates within Shoreditch: Cranston, Wenlock and Thaxted.
King's Cross Central	Camden	As part of Argent's redevelopment of King's Cross Central (KXC) with London and Continental Railways and DHL, a decentralised energy system will be delivered and principally powered by gas fired CHP and boiler plant, with supplementary biomass boiler and a fuel cell plant. It will serve the newly developed site and also has the potential to connect with other nearby users.
Broadgate Estates	Hackney	British Land is investigating site-wide opportunities for reducing carbon dioxide emissions at Broadgate Estates. An assessment indicated that a gas-fired Combined Cooling Heating and Power plant (CCHP), i.e. the provision of absorption chiller plant linked to

Scheme	*Location*	*Characteristics*
		CHP, would offer the most cost effective energy supply option for reducing carbon dioxide emissions.
Elephant & Castle / Southwark MUSCo	Southwark	The Elephant & Castle / Southwark MUSCo (Multiple Utilities Services Company) decentralised energy scheme is intended to deliver electricity, heat and hot water for 9,700 residential units and 38,000m2 of commercial space, including the two major urban regeneration sites: the Elephant & Castle and Aylesbury. The Elephant and Castle regeneration scheme will consist of approximately 160,000m2 of residential, mixed use and culture/leisure developments, of which around 20% have already received planning consent.
Battersea Power Station	Wandsworth	The GLA has prepared an OAPF for the VNEB OA. Battersea Power Station is included in the VNEB OA Energy Masterplan and is identified as a key energy supply provider for the proposed OA DHN. The LDA has taken a keen interest in this development and will look to pursue the export of heat from the Battersea Power Station to support the OAPF energy ambitions. The VNEB OAPF Energy Masterplan recommends that the Battersea Power Station energy centre design will incorporate a connection to Pimlico in order facilitate a cross-river heat supply. Pimlico is already connected to Battersea Power Station via existing 300mm diameter district heating pipework installed in a tunnel beneath the River Thames. The pipework is owned by PDHU (Pimlico District Heating Undertaking). Whilst there may be a conflict in exporting heat to Pimlico and the proposed OA DHN, the development of these areas will be subject to a longer lead in time than the currently anticipated interconnection of Pimlico and Whitehall to establish a Victoria wide DHN.
The London Thames Gateway Development Corporation (LTGDC)		The London Thames Gateway Development Corporation (LTGDC) are developing an affordable, low carbon district heating network to distribute heat from a wide variety of low carbon sources to communities, offices and industry in the london Thames Gateway, Europe's largest regeneration area. The project, the largest enviosned for London to date, will make a substantial contribution to reducing the carbon footprint of London'd energy supply. The London Thames Gateway Heat Network (LTGHN) will have the potential to connect up to 120,000 homes and properties through 67km of network, which will save almost 100,000 tonnes of CO2 emissions each year. The fist customer could be supplied by 2011. Appraising the LDA's plans set out in the LTGHN Vision Map and their implications for the CoL it can be seen that the planned district heating networks in the LB of Tower Hamlets could provide a link between the LTGHN transmission line (Olympic Park transmission line) to a CoL decentralised energy network (DEN). The LTGHN Vision Map also sets out a development timeline demonstrating a continued growth in the LTGHN westward from 2015 onwards in order to connect Citigen, Pimlico District Heating Undertaking and Whitehall, and their environs. The current Decentralised Energy and Pipe Subway Study (DEPSS) is being undertaken by the CoL and its partners, which includes the LDA. The outcomes from the DEPSS will support and help to put in place the appropriate delivery mechanisms to support the westward growth of the LTGHN in conjunction with potential tunnel and DE infrastructure in the CoL, this demonstrate alignment with the LDA's plans for the provision of a London wide DEN.

Appendix B – Data collection questionnaire

Royal Borough of Kingston Heat Mapping Study

1. Introduction

On behalf of the Royal Borough of Kingston Upon Thames Council and the London Development Agency, URS Corporation Limited are carrying out a heat mapping study. As part of the study, we need to collate energy consumption data for high energy users within the borough to understand where there are pockets of high energy consumption which may be suitable for a district heating system.

Your building has been identified as a potential high energy user and one which could benefit in future from a local network. We would like to request data on the building energy consumption to help create a robust borough heat map.We would therefore greatly appreciate your time in completing the following questionnaire as precisely as possible.

If you would like to contact the Council to discuss this project please contact:

Nia Prys-Williams
Climate Change Officer, Royal Borough of Kingston upon Thames
0208 547 5766
nia.prys-williams@rbk.kingston.gov.uk

The Council will be holding stakeholder events in the near future to brief local business and partners about district heating systems and introduce the findings of the heat map.

Royal Borough of Kingston Heat Mapping Study

2. Company Information

*** 1. Company/Organisation Name:**

2. Facility ownership *(choose as appropriate)*:

*** 3. Type of Facility *(choose as appropriate)*:**

- ◯ Multi-address Building
- ◯ Hospital
- ◯ Sport and Leisure
- ◯ Commercial
- ◯ Hotel
- ◯ Residential
- ◯ Educational
- ◯ Other (please specify)

4. Building Area (m^2):

5. Number of Dwellings *(if applicable)*:

*** 6. Your name:**

7. Your position:

*** 8. E-mail:**

9. Telephone number:

10. Core nature of business:

Royal Borough of Kingston Heat Mapping Study

3. Study Questions

Please add in your answers to the questions below, providing explanations as necessary.

*** 1. Is the building's/facility's heating/hot water supplied by:**

- [ ] District Heating
- [ ] Central Gas Boilers
- [ ] Individual Boilers
- [ ] Electric Heating
- [ ] CHP (Combined Heat and Power)
- [ ] Don't know
- [ ] Other (please explain)

*** 2. Choose the appropriate fuel source for the building's/facility's heating/hot water:**

- ◯ Natural gas
- ◯ Electricity
- ◯ Oil
- ◯ Biofuel
- ◯ LPG
- ◯ Don't know
- ◯ Other (please specify)

*** 3. What was the building's/facility's total fuel consumption for heating/hot water for the previous year (MWh/year) (e.g. gas bill)?**

4. What was the building's/facility's total fuel consumption for electricity for the previous year (MWh/year) (e.g. electricity bill)?

5. What was the building's/facility's annual carbon footprint (tonnes CO_2/year)

Appendix C – Summary of responses to the data collection questionnaire

1. Company/Organisation Name:

	Response Count
	18
answered question	**18**
skipped question	**4**

2. Facility ownership *(choose as appropriate)*:

	Response Percent	Response Count
Central Government	0.0%	0
Local Government	**33.3%**	**6**
Other Public	16.7%	3
Private	27.8%	5
Other	22.2%	4
answered question		**18**
skipped question		**4**

3. Type of Facility *(choose as appropriate)*:

	Response Percent	Response Count
Multi-address Building	5.6%	1
Sport and Leisure	11.1%	2
Hotel	0.0%	0
Educational	**44.4%**	**8**
Hospital	0.0%	0
Commercial	5.6%	1
Residential	5.6%	1
Other (please specify)	27.8%	5
answered question		**18**
skipped question		**4**

4. Building Area (m^2):

	Response Count
	12
answered question	**12**
skipped question	**10**

5. Number of Dwellings *(if applicable)*:

	Response Count
	6
answered question	**6**
skipped question	**16**

6. Your name:	
	Response Count
	18
answered question	**18**
skipped question	**4**

7. Your position:	
	Response Count
	17
answered question	**17**
skipped question	**5**

8. E-mail:	
	Response Count
	18
answered question	**18**
skipped question	**4**

9. Telephone number:	
	Response Count
	17
answered question	**17**
skipped question	**5**

10. Core nature of business:	
	Response Count
	16
answered question	**16**
skipped question	**6**

11. Is the building's/facility's heating/hot water supplied by:		
	Response Percent	Response Count
District Heating	10.0%	1
Central Gas Boilers	**70.0%**	**7**
Individual Boilers	10.0%	1
Electric Heating	10.0%	1
CHP (Combined Heat and Power)	0.0%	0
Don't know	10.0%	1
Other (please explain)	0.0%	0
answered question		**10**
skipped question		**12**

12. Choose the appropriate fuel source for the building's/facility's heating/hot water:

	Response Percent	Response Count
Natural gas	**80.0%**	**8**
Electricity	10.0%	1
Oil	10.0%	1
Biofuel	0.0%	0
LPG	0.0%	0
Don't know	0.0%	0
Other (please specify)	0.0%	0
answered question		**10**
skipped question		**12**

13. What was the building's/facility's total fuel consumption for heating/hot water for the previous year (MWh/year) (e.g. gas bill)?

	Response Count
	10
answered question	**10**
skipped question	**12**

14. What was the building's/facility's total fuel consumption for electricity for the previous year (MWh/year) (e.g. electricity bill)?

	Response Count
	8
answered question	**8**
skipped question	**14**

15. What was the building's/facility's annual carbon footprint (tonnes CO_2/year)	
	Response Count
	3
answered question	**3**
skipped question	**19**

Appendix D – Priority Buildings per Cluster

Cluster 1

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
EDUCARE SMALL SCHOOL	EDUCARE SMALL SCHOOL	KT2 6DZ	Private	No	Education facilities		Natural gas	61.868	0	LDA/ Benchmark
KINGSTON GRAMMAR SCHOOL	KINGSTON GRAMMAR SCHOOL	KT2 6PY	Private	No	Education facilities		Natural gas	841.58	0	LDA/Benchmark
AVANTE COURT	THE BITTOMS	KT1 2AN	Private	No	Multi-address buildings		Natural gas	1080.592	86	Benchmark
Kingston College	Kingston Hall Road, Kingston upon Thames	KT1 2AQ	Private	No	Education facilities	Central Boilers	Natural gas	4023.271	0	RBK
Kingston College	55 Richmond Road, Kingston upon Thames	KT2 5BP	Private	No	Education facilities	Central Boilers	Natural gas	529.218	0	RBK
Kingston Police Station, Metropolitan Police	5-7, High St, Kingston Upon Thames, Surrey	KT1 1LB	Other public	No	Police stations		Natural gas	891.978	0	Benchmark
Fusionaarts Studios	53 Eden Street, Kingston upon Thames	KT1 1BW	Private	No	Museum and art gallery		Natural gas	27.755	0	LDA/Benchmark
Kingston Upon Thames Museum And Heritage Service	Fairfield Road, Kingston upon Thames	KT1 2PS	Private	No	Museum and art gallery		Natural gas	555.612	0	Benchmark
Guildhall (Civic Office)	Guildhall, High Street, Kingston Upon Thames	KT1 1EU	Local government	No	Local government estate	Individual boilers	Natural gas	519.97	0	RBK & Questionnaire
Guildhall 1 (Civic Office)	Guildhall, High Street, Kingston Upon Thames	KT1 1EU	Local government	No	Local government estate	Individual boilers	Natural gas	445.837	0	RBK & Questionnaire
Guildhall 2 (Civic Office)	Guildhall, High Street, Kingston Upon Thames	KT1 1EU	Local government	No	Local government estate	Individual boilers	Natural gas	939.602	0	RBK & Questionnaire
RBK: Kingston Library	Fairfield Road, Kingston upon Thames	KT1 2PS?	Local government	No	Local government estate		Natural gas	179.658	0	RBK
Schools Library Service	Fairfield East, Kingston Upon Thames	KT1 2PT	Local government	No	Local government estate	Individual boilers	Mixed source	52.677	0	LDA
HM Revenue & Customs	3 Brook Street ,Kingston upon Thames	KT1 2NH	Local government	No	Local government estate		Natural gas	738.585	0	LDA/Benchmark
County Court	St. James Road, Kingston	KT1 2AD	Other public	No	Other public buildings		Natural gas	147.55	0	RBK
TRAVELODGE Kingston Upon Thames	21-23, Old London Rd, Kingston Upon Thames	KT2 6ND	Private	No	Hotels (> 99 units or 4,999 m2)			0	0	
TRAVELODGE Kingston Upon Thames Central	International House, Wheatfield Way, Kingston Upon Thames Central, Kingston Upon	KT1 2PD	Private	No	Hotels (> 99 units or 4,999 m2)		Natural gas	1911.68	0	Benchmark
BRIGHT HOUSE (William Sutton Homes)	KINGSTON HALL ROAD	KT1 2AQ	Other	No	Multi-address buildings	Electric heating	Electricity	0	54	Questionnaire
ALL SAINTS CHURCH	Market Place, Kingston Upon Thames, Surrey	KT1 1JP	Other	No	Churches		Natural gas	187.13	0	Benchmark
UNITED REFORMED CHURCH	Richard Mayo Hall, Eden St, Kingston Upon Thames, Surrey	KT1 1HZ	Other	No	Churches		Natural gas	120.876	0	Benchmark
JOHN BUNYAN BAPTIST CHURCH	26, Cromwell Rd, Kingston Upon Thames, Surrey	KT2 6RE	Other	No	Churches		Natural gas	33.82	0	Benchmark
Kings Church Kingston	36a Ground Floor, Parman House, Fife Rd, Kingston Upon Thames, Surrey	KT1 1SU	Other	No	Churches			0	0	
Bramber House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5BU	Private	No	Multi-address buildings		Natural gas	713.482	64	Benchmark
Hedingham House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5AE	Private	No	Multi-address buildings		Natural gas	869.556	78	Benchmark
Alexander House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5BY	Private	No	Multi-address buildings		Natural gas	501.667	45	Benchmark
Carisbrooke house	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5BS	Private	No	Multi-address buildings		Natural gas	390.185	35	Benchmark

Cluster 1

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
Dartmouth House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5BJ	Private	No	Multi-address buildings		Natural gas	735.778	66	Benchmark
Earlsfield House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5BG	Private	No	Multi-address buildings		Natural gas	680.037	61	Benchmark
Falmouth House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5AH	Private	No	Multi-address buildings		Natural gas	512.815	46	Benchmark
Garland House	ROYAL QUARTER,7 Kings Way, Kingston Upon Thames	KT2 5AF	Private	No	Multi-address buildings		Natural gas	590.852	53	Benchmark
GARRICKS HOUSE	WADBROOK STREET	KT1 1AZ	Private	No	Multi-address buildings		Natural gas	1627.058	110	
RBK: The Kingsfisher Leisure Centre	Fairfield Rd, Kingston Upon Thames, Surrey	KT1 2PY	Local government	No	Sport & Leisure facilities			1586.744	0	RBK
Curves	59, Eden Street, Kingston Upon Thames, Surrey	KT1 1DH	Private	No	Sport & Leisure facilities		Natural gas	517.487	0	LDA/ Benchmark
David Lloyd gym (gym+pool)	The Rotunda Clarence Street, Kingston upon Thames, Surrey	KT1 1QJ	Private	No	Sport & Leisure facilities		Natural gas	12014.796	0	LDA/Benchmark
The Bentalls Centre	Wood Street, Kingston upon Thames	KT1 1TR	Private	No	Private commercial (> 9,999 m2)			1063.653	0	RBK
Primark	76 Eden Street	KT1 1DJ	Private	No	Private commercial (> 9,999 m2)		Natural gas	140.392	0	Benchmark
John Lewis Plc	Wood Street	KT1 1TE	Private	No	Private commercial (> 9,999 m2)		Natural gas	3274.424	0	
AON Warranty Group, Combined House	15 Wheatfield Way	KT1 2PA	Private	No	Private commercial (> 9,999 m2)		Natural gas	149.075	0	Benchmark
Marks & Spencer PLC	26 & 69 Clarence Street	KT1 1NU	Private	No	Private commercial (> 9,999 m2)		Natural gas	2722.022	0	Benchmark
Edenwalk Shopping Centre	Alderman Judge Mall	KT1 1BS	Private	No	Private commercial (> 9,999 m2)	Central Boilers	Natural gas	17617	0	Questionnaire
Canbury Park Business Area	Elm Crescent	KT2 6HJ	Private	No	Private commercial (> 9,999 m2)			0	0	
KINGSTON BAPTIST CHURCH	Union Street, Kingston Upon Thames	KT1 1RP	Other	No	Churches		Natural gas	40.262	0	Benchmark
REGENTS COURT	SOPWITH WAY	KT2 5AQ	Private	No	Multi-address buildings		Natural gas	2799.331	132	Benchmark
SIGREST SQUARE	SIGREST SQUARE, Kingston Upon Thames	KT2 6JT	Private	No	Multi-address buildings		Natural gas	1003.904	87	Benchmark
Stevens House	JEROME PLACE	KT1 1HT	Private	No	Multi-address buildings		Natural gas	1126.864	82	Benchmark
Lock' n Store ltd	12 SKERNE ROAD, KINGSTON UPON THAMES	KT2 5AD	Private	Yes	Multi-address buildings			589.85	124	ISIS and LDD
Quebec House	QUEBEC HOUSE CROMWELL ROAD, KINGSTON UPON THAMES	KT2 5EB	Private	Yes	Multi-address buildings			838.851	129	ISIS and LDD
KINGSTON POWER STATION	SKERNE ROAD, KINGSTON UPON THAMES	KT2 5	Private	Yes	Private residential (> 149 units or 9,999 m2)			3711.25	389	ISIS and LDD
EARLSFIELD HOUSE	FLAT 1 SEVEN KINGS WAY ROYAL QUARTER KINGSTON UPON THAMES	KT2 5BG	Private	No	Multi-address buildings			0	60	
Holmes Place Health Clubs Ltd	Bentalls Shopping Centre, Wood Street, Kingston upon Thames	KT1 1TP		No	Sport & Leisure facilities			0	0	

Cluster 2

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
St John's CofE Primary School	Portland Road, Kingston upon Thames	KT1 2SG	Local government	No	Education facilities		Natural gas	202.723	0	RBK
BEDELFORD SCHOOL	BEDELSFORD SCHOOL	KT1 2QZ	Private	No	Education facilities	Other	Oil	0	0	Questionnaire
Kingston University Knights park	Grange Road, Kingston upon Thames	KT1 2QJ	Private	No	Education facilities	Central Boilers	Natural gas	2948.224	0	RBK
Kingston University Penrhyn Road	Penrhyn Road, Kingston upon Thames	KT1 2EE	Private	No	Education facilities	Central Boilers	Natural gas	8021.192	0	RBK
Kingston University Middle Mill	Portland Road, Kingston upon Thames	KT1 2SJ	Private	No	Education facilities	Central Boilers	Natural gas	921.726	0	RBK
Surrey County Council	County Hall, Penrhyn Road, Kingston	KT1 2DN	Local government	No	Local government estate		Natural gas	3860.863	0	RBK
Surrey County Council	Western House, 7 Penrhyn Rd, Kingston	KT1 2BT	Local government	No	Local government estate		Natural gas	108.324	0	RBK
Antoinette Hotels Kingston	Beaufort Road, Kingston Upon Thames	KT1 2TQ	Private	No	Hotels (> 99 units or 4,999 m2)		Natural gas	1856	0	Benchmark
THE KOREAN CHURCH LONDON	37, Grove Crescent, Kingston Upon Thames, Surrey	KT1 2DG	Other	No	Churches		Natural gas	86.351	0	Benchmark
FIRST CHURCH OF CHRIST SCIENTIST	12, Penrhyn Road, Kingston Upon Thames, Surrey	KT1 2ED	Other	No	Churches		Natural gas	35.221	0	Benchmark
SPRING GROVE HOTEL	BLOOMFIELD ROAD, KINGSTON UPON THAMES	KT1 2SF	Private	No	Hotels (> 99 units or 4,999 m2)			0	0	

Cluster 3

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
Tiffin School, Kingston upon Thames	Queen Elizabeth Road	KT2 6RL	Local government	No	Education facilities		Natural gas	850.651	0	RBK
ST. PETERS CHURCH	London Rd, Kingston Upon Thames, Surrey	KT2 6QL	Other	No	Churches		Natural gas	90.79	0	Benchmark
Tiffin Sports Centre	Queen Elizabeth Road, Kingston upon Thames	KT2 6RL	Private	No	Sport & Leisure facilities			0	0	LDA
1 Line Pilates	Chichester House 145a, London Road, Kingston	KT2 6NH	Private	No	Sport & Leisure facilities			0	0	LDA
Bausch & Lomb House	106-114 London Road	KT2 6TN	Private	No	Private commercial (> 9,999 m2)		Natural gas	722.471	0	Benchmark
Clarendon House	147 London Road	KT2 6NH	Private	No	Private commercial (> 9,999 m2)		Natural gas	345.992	0	Benchmark
BUICK HOUSE	London Rd, Kingston Upon Thames, Surrey	KT2 6QS	Private	No	Multi-address buildings		Natural gas	616.167	53	Benchmark
NORBITON HALL	BIRKENHEAD AVENUE, Kingston Upon Thames	KT2 6RT	Private	No	Private residential (> 149 units or 9,999 m2)			0	192	
Cambrgidge Gardens	CAMBRIDGE GARDENS, Kingston Upon Thames	KT1 3NR	Private	No	Private residential (> 149 units or 9,999 m2)			0	167	
School Lane	SCHOOL LANE, Kingston Upon Thames, Surrey	KT1 4DF	Private	No	Private residential (> 149 units or 9,999 m2)			0	136	

Cluster 4

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
CHILDERLEY	BURRITT ROAD	KT1 3HW	Private	No	Multi-address buildings		Natural gas	604.506	60	Benchmark
BRINKLEY	BURRITT ROAD	KT1 3HU	Private	No	Multi-address buildings		Natural gas	662.093	61	Benchmark
GRAVELEY	WILLINGHAM WAY	KT1 3HY	Private	No	Multi-address buildings		Natural gas	605	60	Benchmark
MADINGLEY	ST PETERS ROAD	KT1 3JG	Private	No	Multi-address buildings		Natural gas	662	61	Benchmark
Cambridge Gardens	17 CAMBRIDGE GARDENS KINGSTON UPON THAMES	KT1 3NL	Private	No	Multi-address buildings			0	93	
Cambridge Gardens	105 CAMBRIDGE GARDENS KINGSTON UPON THAMES	KT1 3NP	Private	No	Multi-address buildings			0	56	
Sports Centre				No	Sport & Leisure facilities			0	0	

Cluster 5

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
Maple Infants' School	Maple Road, Surbiton	KT6 4AL	Local government	No	Education facilities		Natural gas	150.536	0	RBK
St Andrew's and St Mark's CofE Junior School	Maple Road, Surbiton	KT6 4AL	Local government	No	Education facilities		Natural gas	183.988	0	RBK
Kingston University Seething Wells	Portsmouth Road, Surbiton,	KT6 5PJ	Private	No	Education facilities	Central Boilers	Natural gas	3065.243	0	RBK
YMCA	49 Victoria Road, Surbiton, Surrey	KT6 4NG	Private	No	Hotels (> 99 units or 4,999 m2)		Natural gas	2264.32	0	Benchmark
ST. ANDREWS CHURCH	St. Andrews Rd, Surbiton, Surrey	KT6 4DT	Other	No	Churches		Natural gas	117.921	0	Benchmark
GLENBUCK COURT	GLENBUCK ROAD	KT6 6BX	Private	No	Multi-address buildings		Natural gas	344.168	65	
Cannons Health Club (gym+pool)	Simpson Way, Surbiton	KT6 4ER	Private	No	Sport & Leisure facilities		Natural gas	4872.207	0	Benchmark
DST International	DST House, St Marks Hill	KT6 4QD	Private	No	Private commercial (> 9,999 m2)		Natural gas	1140.671	0	Benchmark
Co-Operative Funeral Services Group Ltd	10 St James Road	KT6 4QJ	Private	No	Private commercial (> 9,999 m2)			0	0	
SURBITON BAPTIST CHURCH	Balaclava Road, Surbiton	KT6 5PW	Other	No	Churches		Natural gas	5.441	0	Benchmark
SURBITON COURT	Court 1, 2 and 3, ST ANDREWS SQUARE	KT6 4EB	Private	No	Multi-address buildings			0	112	
PORTON COURT	BRIGHTON ROAD, Surbiton	KT6 4HY	Private	No	Multi-address buildings		Natural gas	300.306	56	Benchmark

Cluster 6

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
Burlington Infant and Nursery School	Burlington Road, New Malden	KT3 4LT	Local government	No	Education facilities		Natural gas	261.96	0	RBK
Burlington Junior School	Burlington Road, New Malden	KT3 4LT	Local government	No	Education facilities		Natural gas	261.96	0	RBK
Apex Tower	New Malden	KT3 4DQ	Private	No	Private commercial (> 9,999 m2)		Natural gas	3042.768	0	Benchmark
RBK: Hobkirk House	109 Blagdon Road, New Malden	KT3 4BD?	Local government	No	Other public buildings		Natural gas	758.571	0	RBK
RBK: Causeway Centre/Crescent Resource Centre	Cocks Crescent, New Malden, Surrey	KT3 4TA?	Local government	No	Other public buildings		Natural gas	597.208	0	RBK
NEW MALDEN METHODIST CHURCH	49, High St, New Malden, Surrey	KT3 4BY	Other	No	Churches		Natural gas	132.261	0	Benchmark
CHARTER COURT	LINDEN GROVE	KT3 3BL	Private	No	Multi-address buildings		Natural gas	1141.907	88	RBK/ Benchmark
RBK: Malden Centre	Cocks Crescent, New Malden, Surrey	KT3 4TA	Local government	No	Sport & Leisure facilities		Natural gas	2554.783	0	RBK
Topnotch	23-25, Blagdon Road, New Malden	KT3 4AH	Private	No	Sport & Leisure facilities		Natural gas	35.979	0	LDA/ Benchmark
C I Tower	St Georges Square	KT3 4JA	Private	No	Private commercial (> 9,999 m2)		Natural gas	1361.476	0	Benchmark
Northrop Grumman/ Litton Marine Systems	118 Burlington Road	KT3 4NR	Private	No	Private commercial (> 9,999 m2)		Natural gas	347.25	0	Benchmark
Richard Challoner School		KT3	Local government	No	Education facilities			775	0	Borough Heat Loads

Cluster 7

Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption	Number of dwellings	Data Source
Ellingham Primary School	Ellingham Road, Chessington	KT9 2JA	Local government	No	Education facilities		Natural gas	201.481	0	RBK
Chessington Community College	Garrison Lane Chessington	KT9 2JS	Local government	No	Education facilities		Natural gas	435.985	0	RBK
St Philip's School	Harrow Close, Chessington	KT9 2HR	Local government	No	Education facilities		Natural gas	254.768	0	RBK
RBK: Amy Woodgate House	Nigel Fisher Way, Chessington	KT9 2SN	Local government	No	Other public buildings	Assets including CHP	Natural gas	523.32	0	RBK
Chessington Sports & Leisure Centre	Garrison Lane, Chessington, Surrey	KT9 2JS	Local government	No	Sport & Leisure facilities			253.649	0	RBK
Chessington World of Adventures	Leatherhead Road, Chessington	KT9 2HS	Local government	No	Sport & Leisure facilities	Central Boilers	Natural gas	10951.517	0	RBK
Barwell Business Park	Leatherhead Road	KT9 2NY	Private	No	Private commercial (> 9,999 m2)			0	0	
Holiday Inn Chessington	Leatherhead Road, Chessington	KT9 2NE	Other	No	Hotels (> 99 units or 4,999 m2)		Natural gas	2784	0	Benchmark
ST. CATHERINE OF SIENNA RC CHURCH	Leatherhead Road, Chessington	KT9 2HY	Other	No	Churches		Natural gas	72.314	0	Benchmark
CHESSINGTON COMMUNITY COLLEGE	GARRISON LANE, CHESSINGTON	KT9 2JS	Other public	Yes	Education facilities			922.836	0	ISIS and LDD

Appendix E – Full scale maps

Kingston Hospital
CHP (1.4 MWe)

Hogsmill Sewage
Treatment Works
(0.938 MWe)

Surbiton Polyclinics

RBK: Amy Woodgate
House (0.1 MWe)

Legend

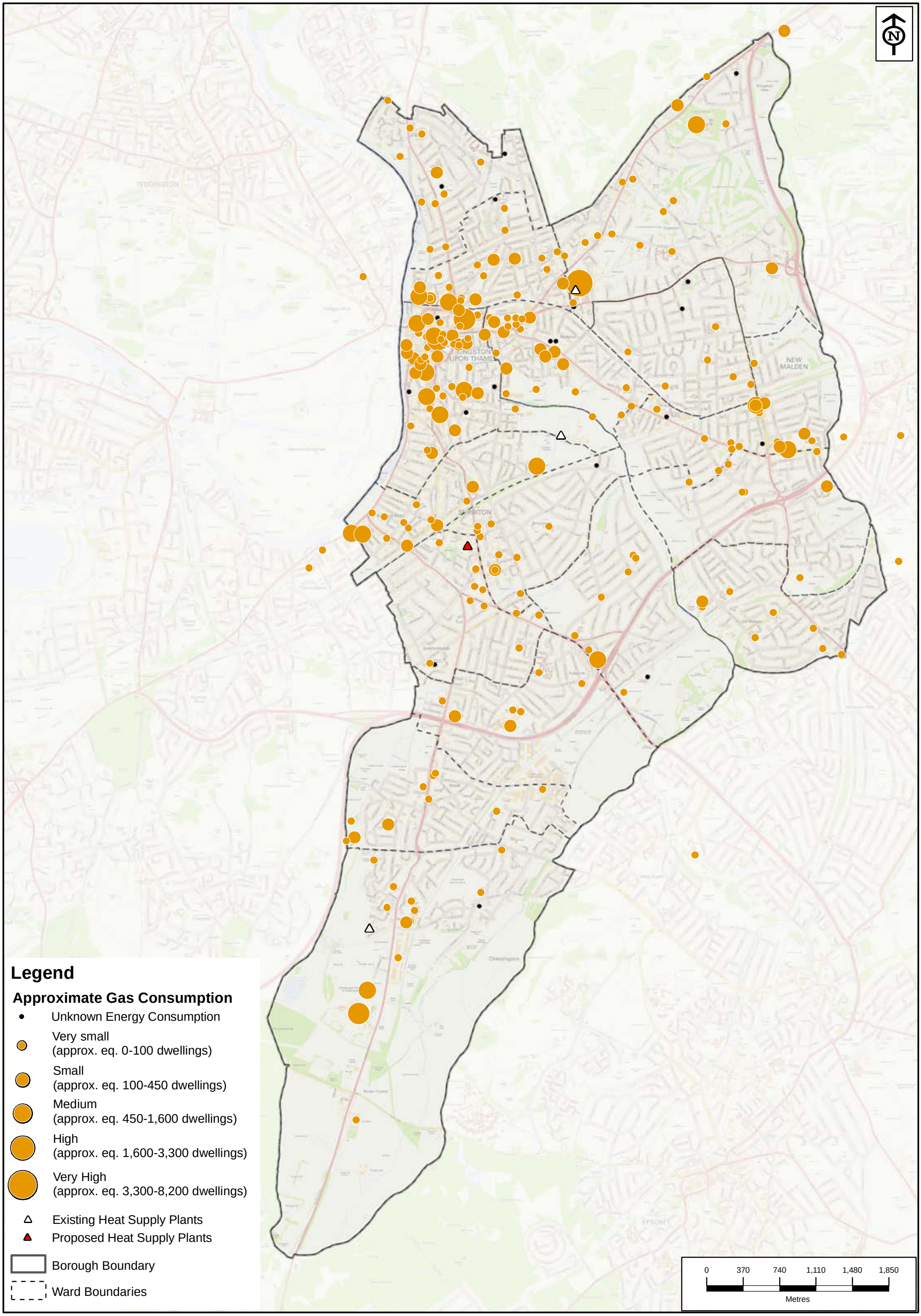
Type of Priority Buildings

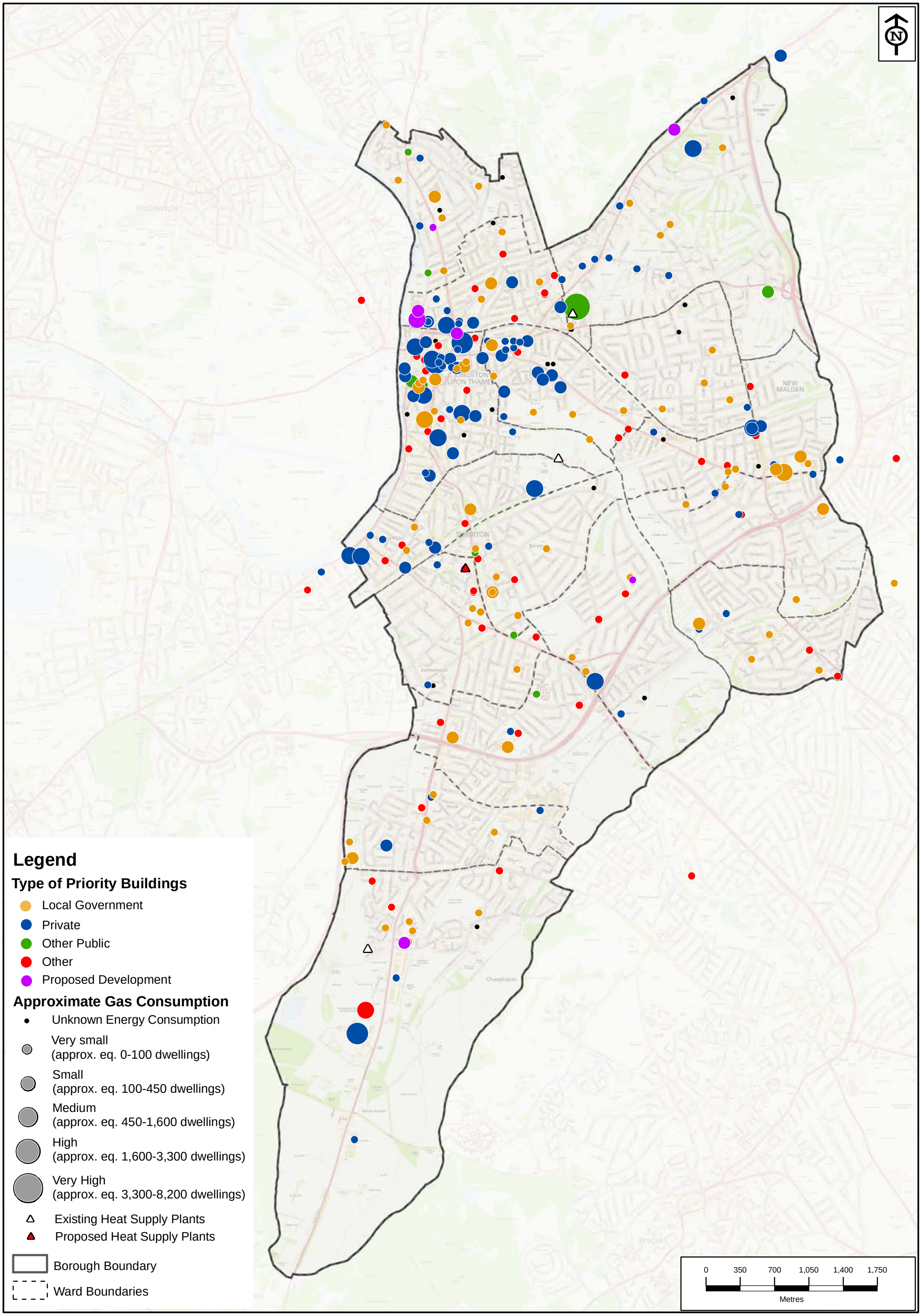
- Churches
- Education facilities
- Fire stations
- Hotels (> 99 units or 4,999 m2)
- Local government estate
- Multi-address buildings
- Museum and art gallery
- NHS
- Other public buildings
- Police stations
- Private commercial (> 9,999 m2)
- Private residential (> 149 units or 9,999 m2)
- Sport & Leisure facilities
- Existing Heat Supply Plants
- Potential Heat Supply Plants

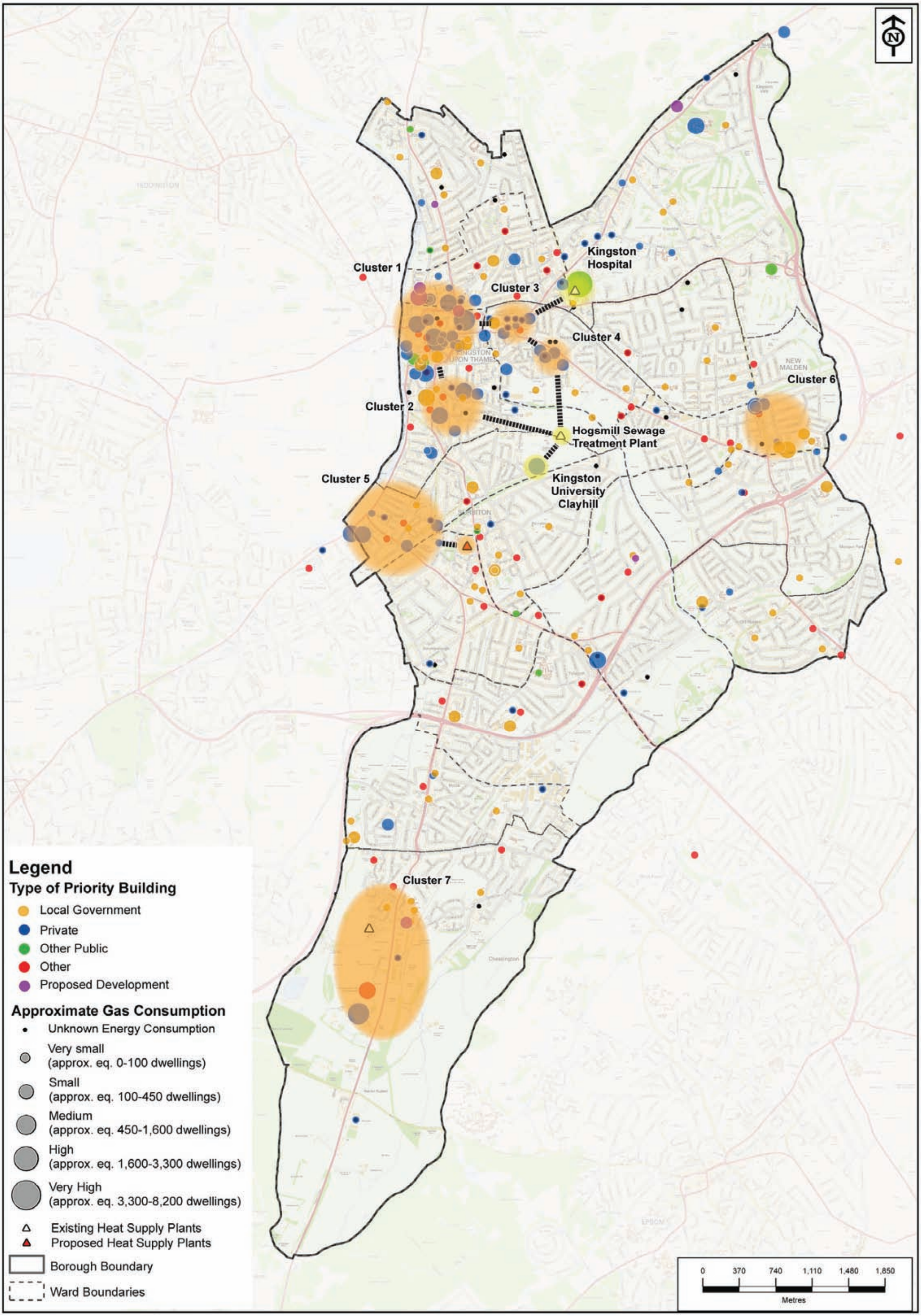
Areas of Intensification

- Hogsmill River
- Tolworth Area
- Borough Boundary
- Ward Boundaries

0 375 750 1,125 1,500 1,875
Metres


Legend
Approximate Gas Consumption
Unknown Energy Consumption
Very small
(approx. eq. 0-100 dwellings)
Small
(approx. eq. 100-450 dwellings)
Medium
(approx. eq. 450-1,600 dwellings)
High
(approx. eq. 1,600-3,300 dwellings)
Very High
(approx. eq. 3,300-8,200 dwellings)
Existing Heat Supply Plants
Proposed Heat Supply Plants
Borough Boundary
Ward Boundaries
0
370
740
1,110
1,480
1,850
Metres


N
Legend
Type of Priority Buildings
Local Government
Private
Other Public
Other
Proposed Development
Approximate Gas Consumption
Unknown Energy Consumption
Very small
(approx. eq. 0-100 dwellings)
Small
(approx. eq. 100-450 dwellings)
Medium
(approx. eq. 450-1,600 dwellings)
High
(approx. eq. 1,600-3,300 dwellings)
Very High
(approx. eq. 3,300-8,200 dwellings)
Existing Heat Supply Plants
Proposed Heat Supply Plants
Borough Boundary
Ward Boundaries
0
350
700
1,050
1,400
1,750
Metres


Cluster 1
Cluster 2
Cluster 3
Cluster 4
Cluster 5
Cluster 6
Cluster 7
Kingston Hospital
Hogsmill Sewage Treatment Plant
Kingston University Clayhill
Legend
Type of Priority Building
Local Government
Private
Other Public
Other
Proposed Development
Approximate Gas Consumption
Unknown Energy Consumption
Very small (approx. eq. 0-100 dwellings)
Small (approx. eq. 100-450 dwellings)
Medium (approx. eq. 450-1,600 dwellings)
High (approx. eq. 1,600-3,300 dwellings)
Very High (approx. eq. 3,300-8,200 dwellings)
Existing Heat Supply Plants
Proposed Heat Supply Plants
Borough Boundary
Ward Boundaries
0
370
740
1,110
1,480
1,850
Metres

Appendix F – Stakeholder questionnaire

Royal Borough of Kingston Stakeholder Questionnaire

1. Introduction

On behalf of the Royal Borough of Kingston Upon Thames Council and the London Development Agency, URS Corporation Limited are carrying out a heat mapping study. The purpose of the study is to collate energy consumption data for high energy users within the borough and understand where there are pockets of high energy consumption which may be suitable for a district heating system.

Your building has been identified as a potential high energy user and one which could benefit in future from a local network. We would like therefore to request your opinion and views relevant to heat networks and would greatly appreciate your time in completing the following questionnaire as precisely as possible.

If you would like to contact the Council to discuss this project please contact:

Nia Prys-Williams Climate Change Officer, Royal Borough of Kingston upon Thames
0208 547 5766
nia.prys-williams@rbk.kingston.gov.uk

The Council will be holding stakeholder events in the near future to brief local business and partners about district heating systems and introduce the findings of the heat map.

Royal Borough of Kingston Stakeholder Questionnaire

2. Company Information

Please tell us a little bit about you and your Company

*** 1. Company/Organisation Name:**

2. Facility ownership (choose as appropriate):

- ◯ Central Government
- ◯ Local Government
- ◯ Other (please specify)
- ◯ Other Public
- ◯ Private

*** 3. Type of Facility:**

- ◯ Multi-address Building
- ◯ Sport and Leisure
- ◯ Hotel
- ◯ Educational
- ◯ Hospital
- ◯ Commercial
- ◯ Residential

Other (please specify)

*** 4. Your name:**

5. Your position:

*** 6. E-mail :**

7. Telephone number:

8. Core nature of business:

Royal Borough of Kingston Stakeholder Questionnaire

3. Study Questions

Please type in your answers to the questions below, expanding if necessary.

*** 1. Do you believe that a shift in the energy supply service from centralised to decentralised energy to your building would offer environmental benefits?**

- ◯ Yes
- ◯ No

*** 2. Do you see these benefits will improve your company/organization image, sustainability credentials and add economic benefits?**

- ◯ Yes
- ◯ No

*** 3. Are you potentially interested in the development and/or connection to a district heating networks (DHN) covering the Royal Borough of Kingston?**

- ◯ Yes
- ◯ No

4. What incentives would help you to facilitate a connection to a District Heating Network?

- ☐ Grants
- ☐ Carbon emissions' reductions
- ☐ Technical assistance and financial information
- ☐ Reduction in taxes

*** 5. What would be an acceptable connection cost based on the building size, distance from the DHN infrastructure, etc.?**

- ◯ Cost range 1 - £5,000-£10,000
- ◯ Cost range 2 - £10,000-£20,000
- ◯ Cost range 3 - £20,000-£30,000
- ◯ Cost range 4 – over £30,000

*** 6. Is the current building services installation in your building easily adaptable for connection to a DHN? (an example of adaptable building services is gas fired boiler plant serving central domestic hot water calorifiers and low temperature hot water heating circuits for space heating (e.g. wet heating systems)).**

- ◯ Yes
- ◯ No

*** 7. Would the building services need to be partly/completely refurbished to facilitate connection?**

- ◯ No refurbishment needed
- ◯ Partial refurbishment needed
- ◯ Complete refurbishment needed

8. What other issues (i.e. not already covered in your answers to the above questions) do you anticipate will need to be resolved to successfully take forward a viable decentralised energy scheme?

*** 9. What additional information would you like to see to help you assess the opportunity and develop proposals?**