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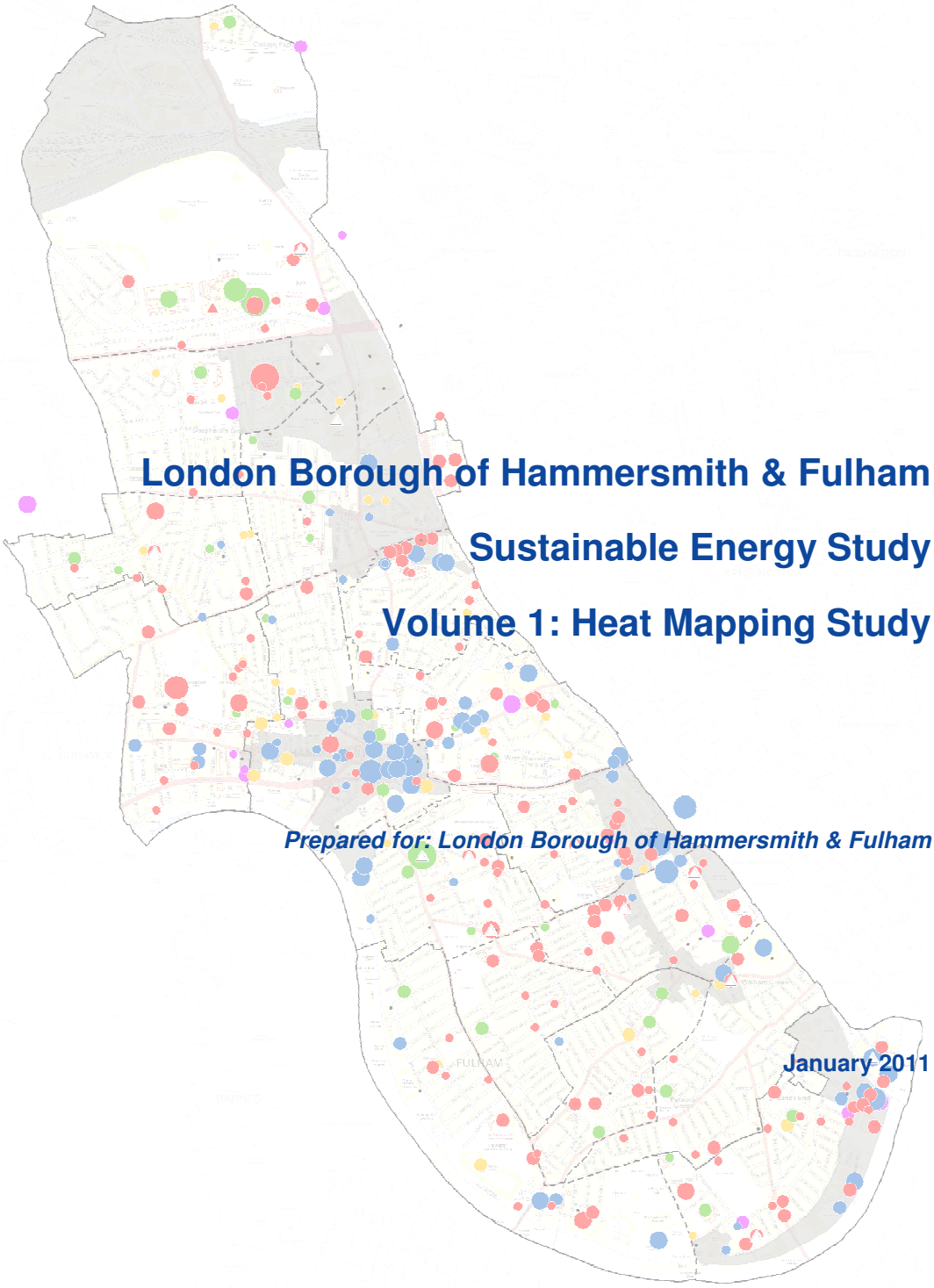

London Borough of Hammersmith & Fulham

Sustainable Energy Study

Volume 1: Heat Mapping Study

Prepared for: London Borough of Hammersmith & Fulham

January 2011

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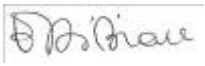
	Elena Di Biase		27/01/2011	Senior Regeneration Consultant
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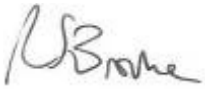
Approved by	Rory Brooke		27/01/2011	Project Director

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EXECUTIVE SUMMARY

Introduction

In its 2007 *Community Strategy* the London Borough of Hammersmith & Fulham (LBHF) sets out a vision to create a Borough of opportunity for all, with a key priority to create a cleaner, greener Borough.

In line with national and regional policy, the Council's *Proposed Submission Core Strategy* emphasises that:

> "*Our new buildings will be energy and resource efficient and much more of our waste will be sustainably managed, including identified sites in the north of the borough. All development in the borough, both buildings and infrastructure, will have been designed to support the move to a low carbon economy and take account of climate change, particularly the risk of flooding. Some major developments in the regeneration areas will be zero carbon exemplars.*"

This *Sustainable Energy Study* (the Study) aims to strengthen the Council's understanding of the potential for low carbon and renewable energy deployment in the Borough and seeks to put forward a spatial strategy for the delivery of such technologies. As a result, this Study will support the Council in its role of promoting the implementation of low carbon, decentralised and renewable energy technologies through its powers that can be applied during the Planning/Development Control process.

The Study comprises three key workstreams:

1. Delivering a heat mapping study focused around opportunities for and a road map towards the implementation of decentralised energy (DE) in LBHF;
2. Delivering a spatial strategy for low carbon, decentralised and renewable energy technologies; and
3. Undertaking an economic feasibility assessment covering the technologies discussed in the spatial strategy as well as the requirement for higher Code for Sustainable Homes Levels/BREEAM ratings.

This *Volume 1: Heat Mapping Study* reports on the findings of Workstream One. *Volume 2: Renewable Energy Spatial Strategy and Economic Feasibility* addresses the work undertaken under Workstreams Two and Three.

Approach

More than 300 priority buildings were identified when considering the existing building stock and new development proposals in the Borough. Energy consumption data was collected utilising a web-based questionnaire wherever possible and appropriate (please see Chapter 4 for a detailed account of the data collation methodology). 27 priority buildings were identified as large heat consumers, comprising: healthcare and education facilities; multi-address, private commercial and residential buildings; hotels; and Wormwood Scrubs Prison.

The energy consumption expected from the forecast development growth in the Borough's key regeneration areas of Old Oak Common and Hythe Road Area, the Wider White City Area, Hammersmith Town Centre, North Fulham (part of the Earls Court and West Kensington Opportunity Area) and South Fulham Riverside was also considered.

A framework and criteria for analysis was developed to determine the viability of DE in these areas of opportunity, based on the following criteria:

- Technical;
- Strategic;
- Financial;
- Economic; and
- Deliverability and management.

DE Opportunities in Hammersmith & Fulham

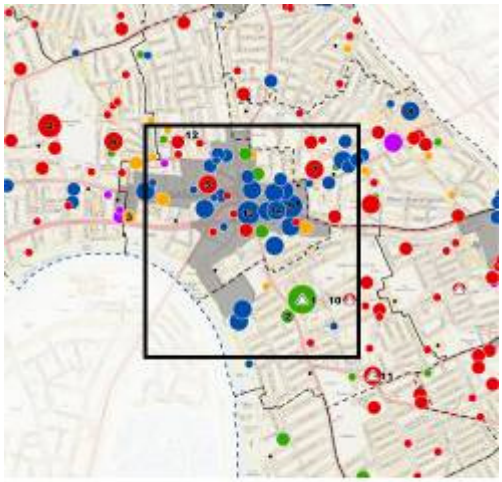
Hammersmith Town Centre offers a very good technical fit with the DE implementation objectives. The application of the optimised CHP/CCHP plant capacities (8MWe and 8.75MWe, respectively) in Hammersmith Town Centre could potentially contribute CO_2 emissions savings of approximately 64% (11ktCO_2) in this area of opportunity. This is predominantly driven by a combination of particularly favourable technical conditions, including:

- The presence of the Charing Cross and Ravenscourt Park Hospitals, which offer opportunities for energy centre provision and establishment of an anchor heat load consumer base;
- The proposed mixed use regeneration scheme at Kings Street, which includes a community energy system serving a diversity of consumer types, and the maximisation of wider economic impacts due to the required investment in infrastructure; and
- The presence of Council owned housing estates and a number of schools, which jointly improve

the commercial viability of an ESCo through their ability to act as secondary heat consumers.

The key next steps for the implementation of DE in Hammersmith Town Centre include:

- Clarifying technical parameters associated with the Charing Cross and Ravenscourt Park Hospitals;
- Reviewing relevant information on the proposed Kings Street regeneration scheme to clarify its compatibility for connection to a wider DE network and the implementation of future proofing measures (e.g. provision of safeguarded plant space for the installation of plate heat exchanger plant and circulating pumps);
- Gathering information on the existing servicing strategy at Melcombe Primary School and Godolphin & Latymer School to assess their compatibility for connection to a DE network; and
- Resolving ownership issues for the identified housing estates and reviewing information on the servicing strategies, asset replacement cycles and the availability of plant space for retrofit.



HAMMERSMITH TOWN CENTRE AREA OF OPPORTUNITY

LEGEND

1 CHARING CROSS HOSPITAL
2 MELCOMBE PRIMARY SCHOOL
3 KINGS STREET REGENERATION
4 RAVENSCOURT AND PARK HOSPITAL
5 ASHCROFT SQUARE (223 UNITS), KINGS MALL
6 FLORA GARDENS (197 UNITS)
7 LATIMER COURT (385 UNITS)
8 OLYMPIA EXHIBITION CENTRE
9 NOVOTEL
10 CHELMSFORD CLOSE
11 BAYONNE ROAD ESTATE
12 GODOLPHIN & LATYMER SCHOOL
13 BROADWAY SHOPPING CENTRE
14 THE METRO BUILDING

The ***Wider White City Area*** shows very encouraging prospects for mitigating management and delivery risks associated with DE delivery. The application of the optimised CHP plant capacity (4MWe) in the Wider White City Area could potentially contribute CO_2 emissions savings of approximately 32% (6ktCO_2) in this area of opportunity. Key elements driving the potential for implementation of a DE network in the area are:

- The presence of a public development area, including the Shepherds Bush Market and the Wood Lane Estate, which is under single ownership, resulting in favourable delivery and management conditions, offering high levels of commercial viability for ESCo procurement; and
- The presence of a large number of schools, which could act as secondary heat consumers in support of improving the commercial viability of an ESCo operating in the area.

The White City Estate, BBC Media Village, the redevelopment of the Imperial College Campus and the public development area should be considered as high priority sites for supporting the implementation of a DE network in the area, and next steps are expected to include:

- Monitoring the progress of the regeneration plans at the White City Estate to investigate opportunities for the provision of an energy centre within the scheme;
- Engage in detailed consultation with the BBC to gauge interest in a connection of the BBC Media Village to a DE network; and
- Monitoring development proposals and site allocations for the Imperial College Campus and the public development area to ensure they are compatible with the connection to a DE network.

WIDER WHITE CITY AREA OF OPPORTUNITY

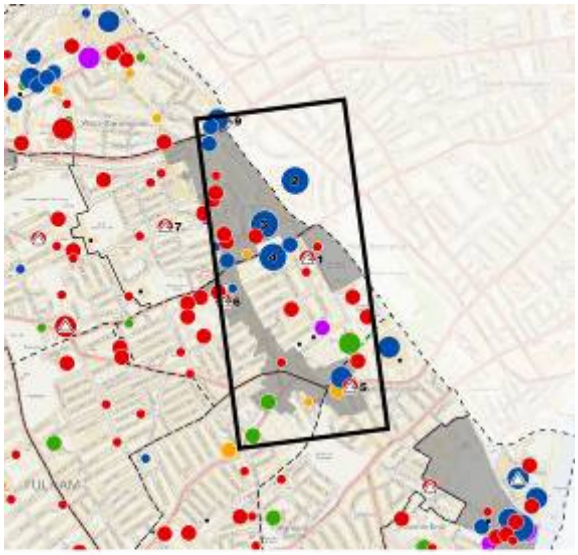
LEGEND

1 WHITE CITY ESTATE
2 HAMMERSMITH HOSPITAL
3 WESTFIELD SHOPPING CENTRE
4 WORMWOOD SCRUBS PRISON
5 PHOENIX HIGH SCHOOL
6 KEY WEST HOTEL AND SPA
7 BBC WHITE CITY
8 BBC TV CENTRE
9 CANBERRA PRIMARY SCHOOL
10 POPE JOHN PRIMARY SCHOOL
11 BURLINGTON PRIMARY SCHOOL
12 WOODMAN MEWS ESTATE
13 OLD OAK PRIMARY SCHOOL
14 IMPERIAL COLLEGE

North Fulham appears to offer robust technical characteristics for DE delivery, whilst also mitigating management and delivery risks due to the number of priority buildings that are publicly owned. There could also be opportunities to utilise/retrofit existing estate boiler houses for energy centre provision. The application of the optimised CHP/CCHP plant capacities (4MWe and 4.5MWe, respectively) in the North Fulham Area could potentially contribute CO_2 emissions savings of approximately 23% (6ktCO_2) in this area of opportunity. Key features in the regeneration area are:

- A substantial opportunity for comprehensive regeneration of the opportunity area comprising the Earls Court Exhibition Complex (with its car park in Seagrave Road), and the TfL Lillie Bridge depot and adjacent housing estates, which technically validate the application of a DE network due to an offering of high heat demand and density levels, and a sufficient diversity of consumer types;
- The presence of a range of private commercial buildings that could act as heat consumers, including the Empress State Building, the Kensington Village and the Ibis Hotel, which improve the commercial viability of an ESCo operating in the area;
- The presence of two of the existing communal heating systems/networks in the Borough, the Walham Green Court Estate (151 units), located to the south of the area, and the Star Road Estate (209 units) to the west, which support the Council's aim of encouraging any new networks to link up to the Borough's existing networks; and
- The asset replacement cycle at the Star Road Estate, the Walham Green Court Estate and the Seagrave Estate occurring between 2012 and 2014, present an opportunity for connection to a DE network or facilitate future proofing for an eventual DE network connection.

The Council should monitor development proposals for the Earls Court Exhibition Complex to ensure they are compatible with connection to a DE network, whilst also gathering further information on Council owned housing estates to understand the asset replacement cycles and servicing strategies, and the availability of plant space for boiler house retrofit and future proofing.



NORTH FULHAM AREA OF OPPORTUNITY

LEGEND

1 SEAGRAVE ESTATE (212 UNITS)
2 EARLS COURT EXHIBITION CENTRE
3 EMPRESS STATE BUILDING
4 IBIS HOTEL (504 UNITS)
5 WALHAM GREEN COURT (151 UNITS)
6 MICHAEL STEWART HOUSE (104 UNITS)
7 STAR ROAD ESTATE (209 UNITS)
8 THE LONDON ORATORY SCHOOL
9 KENSINGTON VILLAGE

Compared to 2007 figures, gas consumption in the ***South Fulham Riverside*** area of opportunity is anticipated to increase; however, it is still significantly lower than that anticipated for the previously discussed areas. The Council's vision for this area is that most sites should be developed for predominantly residential purposes. Therefore

development would need to offer communally heated solutions and put in place future proofing measures to support connection to a DE network. These future proofing measures could include energy centre provision (safeguarded plant space), and, for larger developments, committing to serve as anchor heat load consumers. With these requirements in place, driven through planning conditions, this area could be identified as being technically feasible for DE provision within the 2010-2026 DE implementation timeframe currently considered within the Study.

The heat map analysis in the ***Old Oak Common and Hythe Road Area*** indicates less favourable conditions for DE delivery. However, discussions with the Council indicate that development prospects, such as the proposals to develop a high speed rail hub (as part of the plans for High Speed Rail 2) at Old Oak Common, would support higher levels of development than currently anticipated, offering significantly improved conditions for DE delivery. A long term vision for this area is to transform it with substantial mixed use regeneration made possible principally by this rail infrastructure led development. This could provide thousands of homes, jobs and supporting facilities in a high quality environment, securing future growth for London in a very sustainable way.

Therefore, this area could be suitable for integration of DE in the future depending on the characteristics of the regeneration proposals. Based on the potential provision of a rail hub at Old Oak Common, DE should be considered as part of any masterplanning process when considering future development proposals.

It is further noted that for areas where less favourable conditions exist for DE delivery (e.g. the Old Oak Common and Hythe Road and South Fulham Riverside regeneration areas), developers should still be required to assess the opportunities for DE provision within their development proposals in accordance with both the Mayor's energy hierarchy (be lean: use less energy; be clean: supply energy efficiently, i.e. utilise CHP technology; and be green: use renewable energy sources), and heating and cooling hierarchy (i. connection to existing heating or cooling networks; ii. site wide CHP network; and iii. communal heating and cooling). This demonstrates best practice sustainable design principles

Phasing and Inter-Borough Linkages

Within the Hammersmith Town Centre area of opportunity, the King Street regeneration scheme could serve as an energy centre location when developed, compatible for connection to a wider DE network. Safeguarding of plant space for the potential expansion of plant capacity to serve other nearby heat customers would allow for future proofing of expansion capabilities. Latter phases of DE implementation could then consider the neighbouring Council owned housing estates and the Ravenscourt Park Hospital as anchor heat load consumers.

The Wider White City area of opportunity, through the public development area of Shepherds Bush Market and the Wood Lane Estate[1], offer a first phase delivery option for energy centre provision, with the further expansion of a heat supply network for the latter phases of development, i.e. the connection of the White City Estate, BBC Television Centre Complex, BBC Media Village, and BBC White City building.

Phasing for the North Fulham area of opportunity is likely to be driven by planned regeneration. The large landowners in this area offer the best delivery opportunities for energy centre provision due to the subsequent development of large heat consumers, which could act as anchor heat load consumers, and sufficient levels of density and mix of uses to support the commercial viability of an ESCo operating in the area.

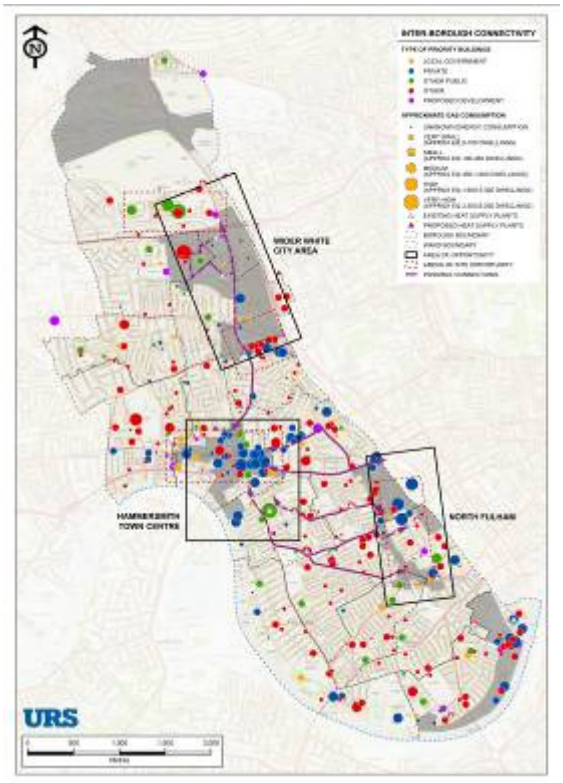
Initial or first phase DE delivery is typically driven by the identification of suitable energy centre locations that can readily overcome environmental constraints. DE network expansion and connection would organically evolve from a number of existing single-site schemes to multi-site mixed use schemes as the commercial viability of an expanded DE network improves. The timing for the connection of single-site schemes and heat consumers would be partly driven by the asset replacement cycles of the existing building stock. Any major new development within the areas of opportunity could also be compelled to connect into a DE network once it is in place. Therefore, alignment of planning policy with the finding of the heat mapping process is essential.

Over time, an area wide DE network could develop that interconnects the areas of opportunity through the multi-site mixed use schemes and the consolidation of energy production into fewer, larger, more efficient energy centres. Existing and proposed heat supply plants could offer the basis for interconnection, acting as connection nodes between the areas of site opportunity. Likely network routes should also be established and safeguarded, such as Shepherds Bush Road (likely connection route between Hammersmith Town Centre and the Wider White City areas of opportunity), and Fulham Palace Road, Lillie Road, Dawes Road, Talgarth Road and Greyhound Road (likely connection route between Hammersmith

[1] The Draft LDA *White City Area of Opportunity Energy Strategy*, June 2010, refers to the estate located to the north of the BBC Television Centre Complex as the Wood Lane Estate.

Town Centre and the North Fulham areas of opportunity) (see *Figure 6-5*).

When considering the Old Oak Common and Hythe Road and South Fulham Riverside areas of opportunity, whilst these areas were not currently shortlisted, safeguarding potential connection routes should still be considered. Scrubs Lane would be a likely connection route between Old Oak Common and Hythe Road and the Wider White City areas of opportunity. No obvious connection route is apparent between the North Fulham and South Fulham Riverside areas of opportunity due to the spatial arrangement of the priority buildings in the South Fulham Riverside area of opportunity. The priority buildings are distributed along the riverfront and any network connection routes would most likely be determined by the location of the developments seeking connection to a DE network.



Cross-Borough Linkages

Based on the identification of the heat zones in the Royal Borough of Kensington & Chelsea (RBKC), and the focus areas in the London Boroughs of Brent (LBB) and Ealing (LBE), opportunities for DE cross-borough linkages have been evaluated.

Royal Borough of Kensington & Chelsea

Earls Court (Heat Zone 5 in the RBKC) is seen as a potential bridge with LBHF's North Fulham area of opportunity. Heat Zone 5 was identified around the Earls Court Exhibition Centre and the surrounding Earls Court strategic development site, which is immediately adjacent to the North Fulham area of opportunity. Major redevelopment in the Earls Court area is planned in the long term and, since the site straddles RBKC and LBHF, a network in this region would require some degree of cross-borough working. In support of this, any planning submission for the area is likely to be subject to consent by both LBHF and RBKC, which offers a significant opportunity for cross-borough working in support of DE delivery in the North Fulham area of opportunity.

Further connectivity into the RBKC could develop through Heat Zone 6 (South Chelsea), Heat Zone 2 (Royal Hospitals) and Heat Zone 1 (Albertopolis). The *RBKC Heat Mapping Study* has identified these heat zones for DE deployment.

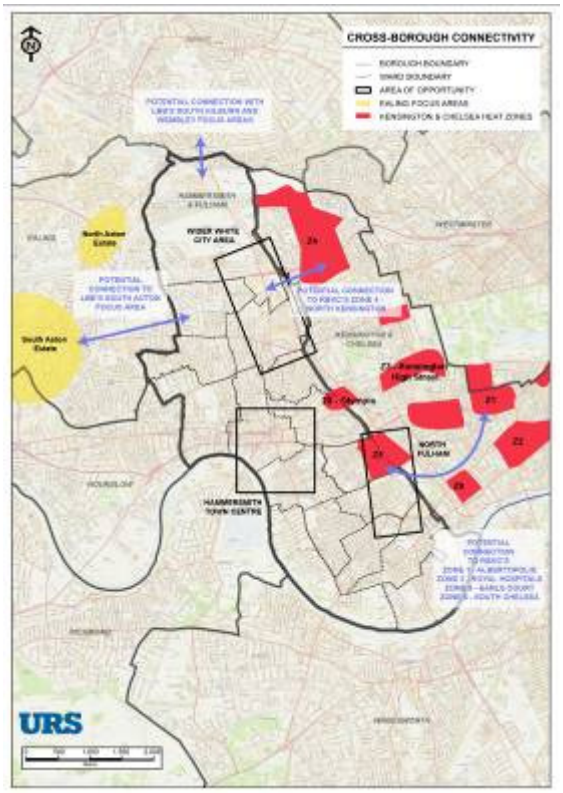
Potential for linkages between Heat Zone 4 (North Kensington) and the Wider White City area of opportunity may exist through sites identified in the *RBKC Heat Mapping Study*, such as the Burlington Danes School, located to the north of the Hammersmith Hospital, and the Woodmans Mews Estate, served by a 0.59MW central boiler.

London Borough of Ealing

The South Acton focus area is located to the north west of LBHF and to the west of the Wider White City area of opportunity. Although the distance between South Acton and the Wider White City area of opportunity poses a barrier to DE deployment, potential linkages could be established between the two areas through connection of priority buildings and new development proposals. Existing priority buildings in LBHF that could support this connectivity include the Becklow Garden Estate with 255 dwellings, and Malvern Court (62 units) served by a central gas boiler of 0.49MW.

London Borough of Brent

Due to their spatial distribution, potential connection between LBHF and LBB would need to occur through the Old Oak Common and Hythe Road Area. The Government is proposing to reinforce the rail transport infrastructure in Old Oak Common as part of the HS2 rail hub proposals (see Section 5.3.1). This is likely to support higher levels of development than currently anticipated and could offer the opportunity to support DE delivery. Connection would then be possible with the high priority focus areas of South Kilburn and Wembley in the LBB.



Next Steps

Role of the Council

To reinforce the role of the Council in support of DE delivery, LBHF could consider identifying/creating a 'DE Borough Champion' with responsibility for an inter- and cross-borough strategy for decentralised energy delivery. The 'DE Borough Champion' could be responsible for tasks such as:

- Clearly articulating the contribution decentralised energy generation and heat networks can make to meeting the Borough's CO_2 emissions savings 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 (i.e. to drive behavioural change) to help build confidence and address organisational barriers; and
- Working with other responsible bodies to ensure the integrated delivery of community infrastructure.

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.

In order to secure investment, the Council will need to use its planning powers to ensure that consumers connect to DE networks. Developers should be required to incorporate CHP, and communal heating and cooling on a site specific basis, and ensure that building services are designed to connect to wider networks in the future (future proofing).

ESCo Procurement

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. Procurement routes could include:

- Identification of a private ESCo partner: selection of a specialist CHP provider through a tender process and based on competitive dialogue; and
- Establishment of a 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; and
    - Social enterprise – new enterprise established with local authority support (to provide covenant strength) and board representation.

1. INTRODUCTION

1.1. Purpose of this Document

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 needs from decentralised sources by 2025. *The Consultation Draft Replacement London Plan* has also set a target for London to generate 25% of its heat and power requirements through the use of local, decentralised energy systems by 2025. London Boroughs will be required to embed policies and proposals within their Local Development Frameworks (LDFs) in support of establishing decentralised energy network opportunities.

To meet this challenge, the London Development Agency (LDA) is working with the London Boroughs to provide energy masterplanning to identify where and how decentralised energy (DE) can be installed and promoted.

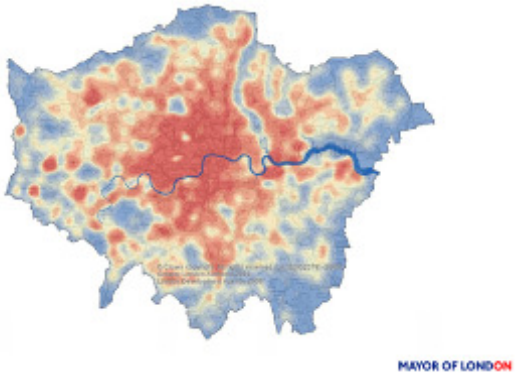
There are a number of key considerations that contribute to an evidence based understanding of local feasibility and potential for DE in the London Borough of Hammersmith & Fulham (LBHF). It is particularly important to understand the heat and power demands of existing buildings, and new and future development, and existing (and possibly under used) DE/heat generation sources, as there may be opportunities to link existing and new/future development together.

The LDA has produced a suite of 'service packages' setting out the steps necessary to support the London 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 the London Boroughs.

Heat mapping information from the London Boroughs is subsequently incorporated into the London Heat Map (*Figure 1–1*), an interactive platform displaying high level data on DE across London. The London Heat Map (LHM) 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 the London Boroughs, landowners and developers to help identify opportunities for DE in their area and to support the development of new decentralised energy schemes. It also enables the market to make informed investment decisions without risking significant development costs.

LBHF is undertaking Phase 1 of the development of a Heat Map. This Study has been carried out as part of Phase 1 in order to collect data relevant to the energy consumption of high energy users and energy demand characteristics within the Borough to support the creation of a robust Heat Map.

Figure 1-1: The London Heat Map



1.2. Structure of this Document

The remainder of the report is structured as follows:

- Chapter 2 is a review of key national, regional and local policies;
- Chapter 3 presents a general overview of DE networks;
- Chapter 4 presents our methodology on the Heat Map data collection process;
- Chapter 5 presents the analysis of the Heat Map;
- Chapter 6 discusses the key opportunities for DE in LBHF;
- Chapter 7 identifies the next steps towards the implementation of a DE network in LBHF; and
- Chapter 8 summarises the results of the work into a high level implementation plan for LBHF.

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 Greenhouse Gas (GHG) emissions cuts. Relevant initiatives include:

- Setting a national target of 80% cuts in annual GHG emissions compared to 1990 levels by 2050, with an interim target of 34% cuts by 2020;
- Establishing the world's first national Climate Change Act to tackle the threat of climate change;
- Incentive programmes, such as the: Renewables Obligation (RO); Feed-in Tariffs (FITs); Renewable Heat Incentive (RHI); and Carbon Reduction Commitment (CRC);
- A mandatory requirement for new homes to achieve a Code for Sustainable Homes (CSH) Level 4 by 2013 (currently a Code Level 3 target) and Code Level 6 (i.e. 'zero carbon') by 2016; and
- A likely requirement for new non-domestic development to achieve 'zero carbon' status by 2019.

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 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 sets a target of supplying 25% of London's energy needs through decentralised energy sources by 2025 and 50% by 2050.

Cutting the Capital's Carbon Footprint: Delivering Decentralised Energy[2] 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 strategic and project levels.

Powering Ahead, Delivering Low Carbon Energy for London[3] 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 recognises the crucial role that London's Boroughs are playing as facilitators – providing supportive local policies and assembling public heat demand data as part of the London Heat Map. The document includes a pipeline of potential projects and outlines the partners and interventions required to deliver them in order to illustrate the scale, commercial structures and role of the public sector in unlocking opportunities.

2.3. Planning Policy

Overall, planning policy at the national, regional and local level places increasing emphasis on the importance of integrating low and zero carbon energy generation in new development to obtain planning permission and help achieve national, regional and local targets for carbon emissions savings.

National Planning Policy

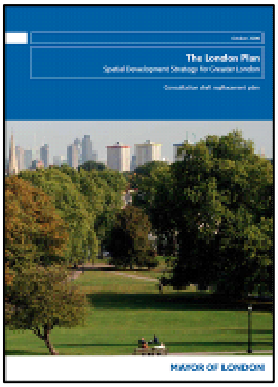
At the national level, relevant planning policy includes *PPS1 Delivering Sustainable Communities*, *Supplement to PPS1 Planning and Climate Change*, *PPS22 Renewable Energy* and the *Companion Guide to PPS22*. These encourage a contribution to achieving CO_2 emissions savings, stabilising climate change (mitigation) and taking into account the unavoidable consequences (adaptation). *PPS22* promotes the appropriate development of renewable

[2] London First, October 2008

[3] LDA, 2009

energy schemes throughout the UK. This includes schemes in urban as well as rural locations, ranging in size from domestic to commercial scale. The documents highlight that if CO_2 emissions savings targets are to be met, a positive and innovative approach will be required.

Regional Planning Policy



In October 2009 the Mayor of London published the *Consultation Draft Replacement London Plan*. The formal publication of the *Replacement London Plan* is 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 London Plan* is formally published. However, policies in the *Consultation Draft Replacement London Plan* will be a material consideration when deciding planning applications, and will gather weight as the replacement process progresses.

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 to the existing policies are proposed. 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 development proposals to realise their full potential to minimise carbon dioxide emissions and adapt to climate change.

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 savings are to be met within the framework of the energy hierarchy outlined above (Policy 5.2 – Minimising carbon dioxide emissions).

Policy 5.2 also introduces new targets on carbon dioxide emissions savings applicable to all major development proposals. The carbon dioxide emissions savings targets should be met through on site energy efficiency and passive design measures, and low and zero carbon technologies. 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 emissions 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 to meet the minimum standards outlined in the Mayor's supplementary planning guidance on sustainable design and construction[4].

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, landowners 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:

i. Connection to existing heating or cooling networks;

ii. Site wide CHP network; and

iii. Communal heating and cooling.

Where future DE network opportunities are identified, proposals should be designed to enable connection to these networks, i.e. future proofed.

Local Planning Policy

The *Unitary Development Plan (UDP) as amended in September 2007* contains the Council's 2003 planning policies, which have been extended beyond 27 September 2007.

The *UDP*, together with the *London Plan*, comprises the statutory development plan for the Borough. The Hammersmith & Fulham Local Development Framework will eventually replace the *UDP* and will provide spatial policies and site allocations, together

[4] GLA, *Sustainable Design and Construction*, *The London Plan Supplementary Planning Guidance*, 2006

with generic development management policies, for the Borough.

UDP Policy G0 on Sustainable Development outlines the Council's commitment to apply the principles of sustainable development through its planning policies. Promoting energy and resource conservation are highlighted; however, decentralised energy is not specifically addressed as part of the *UDP*.

The *Proposed Submission Core Strategy* (October 2010), has been published, together with proposed changes to the adopted Proposals Map, to allow for representations to be made before the document is submitted to the Secretary of State for Examination in Public in 2011.

The Borough Wide Strategic Policy CC1 to Reduce Carbon Emissions and Resource Use and Adapt to Climate Change Impacts requires development proposals to make the fullest possible contribution to the mitigation of and adaptation to climate change.

The Council will seek to achieve carbon dioxide emissions savings and tackle climate change by:

- Achieving carbon dioxide emissions savings from the redevelopment or reuse of buildings by ensuring development proposals minimise their energy use, make use of energy from efficient sources and use renewable energy, where feasible;
- Maximising the provision of decentralised energy networks and integrating the use of renewable energy in the proposed regeneration areas;
- Meeting the Consultation Draft Replacement London Plan targets for carbon dioxide emissions savings from new development;
- Promoting the efficient use of land and buildings, and patterns of land use that reduce the need to travel by car; and
- Requiring developments to be designed and constructed to take account of the increasing risks of flooding, drought and heat waves.

The document suggests that energy use in new development should be reduced by appropriate siting, design, landscaping and energy efficiencies within the building. Where buildings are converted or reused, improvements in energy efficiency should also be implemented. Decentralised energy schemes which produce energy close to where it is used, typically Combined Heat and Power (CHP) and Combined Cooling Heat and Power (CCHP), are more efficient than centralised electricity generation where heat and electrical power are wasted in generation and transmission, respectively. Where possible, new development should link to existing decentralised energy networks and upgrade/reinforce these networks. New decentralised energy networks should be set up in regeneration areas and other areas where major development is taking place. Energy assessments will be required to demonstrate the carbon dioxide emissions savings achieved by the proposed development. New development also needs to maximise the amount of energy generated from renewable sources in order to meet renewable energy targets for London.

With regard to the proposed regeneration sites in the borough, such as the White City Opportunity Area (WCOA) and the Earls Court and West Kensington Opportunity Area, the document states that an outstanding environmental performance will be achieved by means of low and zero carbon technologies, i.e. the establishment of a decentralised energy network, including combined heat and power technologies, and the installation of renewable energy systems.

The *Infrastructure Study* (October 2010), has been prepared as part of the evidence base to inform the development of the Local Development Framework. The Study states that the Borough's regeneration areas offer an opportunity to create CHP and district heating networks. As proposals for these areas develop, the Council will continue to formulate policy to encourage these networks and to attempt to link these with the Borough's existing communal heating networks[5].

The *Supplementary Planning Document: Energy* was produced in 2006 to provide guidance on the information the Council expects developers to provide on energy efficiency and renewable energy measures when submitting a planning application. The document supplemented the energy policies as they stood in 2006 and identifies those measures and technologies that are the most beneficial and acceptable for use in the Borough. At the time it was produced, the emphasis was on the use of small scale measures serving local needs and decentralised energy was not addressed in detail.

The Council expects developers to take account of the advice in this *SPD* in preparing planning applications, particularly for major development proposals. It also supplements the policies in the *London Plan* and, in accordance with Policy 4A.4, developers are requested to submit an energy assessment for major developments.

The energy assessment should show how the issues on energy efficiency and renewable energy

[5] The systems at Bayonne Road, Star Road and Walham Green Court Estates are referenced as the largest communal heating systems/networks in the Borough – *Infrastructure Study*, Section 2.2 Energy, October 2010

use have been considered and designed into a development, wherever appropriate. In particular, for renewable energy use, the assessment should show how the various technologies have been assessed for their feasibility on a particular site, highlighting which technology or combination of technologies is to be integrated to meet carbon dioxide emissions savings targets.

The *SPD* provides detailed advice on how energy conservation and energy efficiency should be considered in all proposals for major development proposals, including the conversion or renovation of existing buildings, as well as how to incorporate renewable energy measures, wherever feasible. In order to make the best use of these measures, developers are advised that the most cost effective time for incorporation, enabling proposals to realise their full potential to minimise carbon dioxide emissions, is at the early design stage.

Advice is provided on how to determine the suitability of renewable energy systems for particular developments, and how they can be implemented successfully.

The *White City Opportunity Area – A Framework for Development* (July 2004) was published as the first stage towards securing comprehensive regeneration of land in the WCOA and provided the basis for a masterplan. The framework is supplementary planning guidance to the *UDP* and is subject to an Opportunity Area Planning Framework[6].

According to the framework, new development proposals should embrace the principles of sustainable design and construction, and all development should incorporate significant renewable energy generation and be designed to achieve 'zero carbon' status on at least part of the area.

The *Proposed Submission Core Strategy* strengthens this position by stating that the development of privately owned land to the west and east of Wood Lane will not be acceptable unless it contributes directly to regeneration of the whole of the north of the opportunity area (that also includes the Council and RSL housing estates). This should happen through measures that include, among others, environmental improvement and measures to enhance environmental sustainability, such as implementation of decentralised energy and heat networks.

The *White City Opportunity Area Energy Strategy* (May 2010) provides the strategic framework for the development of a site wide, low carbon, decentralised energy scheme within the WCOA.

Stakeholders, such as LBHF, RBKC, Greater London Authority (GLA), Hammersmith Hospital, BBC, EDF, Wormwood Scrubs Prison, King Sturge, Westfield Group, Imperial College London, Building Schools for the Future, Land Securities and TfL, were screened to identify those which could be potential energy customers should a district heating network (DHN) be developed in the WCOA.

The report suggests that the public development area under the ownership of LBHF represents a major opportunity for catalysing the development of a DHN within the WCOA, as a single customer (the Council) with a very significant, long term and secure heat demand supports DE delivery.

The report concludes with a number of recommendations to enable the delivery of a DHN for the WCOA, such as:

- LBHF to commit to taking an active role in the development of a DE network in the area, including pledging to connect all Council owned buildings and residential properties within a feasible distance of the planned network;
- Require that any development proposals for the BBC Television Centre Complex consider the feasibility of retaining the current CHP systems to support a wider DE system;
- Take a collective approach, through the establishment of a White City (WC) District Heating Steering Group, to determine the optimum ownership and contracting structure of the scheme and agree the preferred delivery approach. The steering group would likely include all major stakeholders, including representatives from all the major developments in the main scheme area, i.e. LBHF, GLA and LDA;
- Require, via planning obligations, that the Consortium Development provide sufficient space on site for an energy centre to support a 5.6MWe CHP engine and 17MW of boiler plant capacity. This is likely to require gap funding to cover the developer's opportunity costs and is due to be investigated by the Steering Group;
- Ensure that key development proposals identified in the report connect to a DHN. Where a development is completed before the network is available, the development should be designed using technical standards established by the WC District Heating Steering Group to ensure it can connect to the network with minimum delay and modifications. Planning obligations are due to be used to ensure connections occur; and

[6] The new White City Opportunity Area Planning Framework is due to be published in early 2011. The analysis presented in this report relies upon information current at the time of preparation.

- Once development phasing has been finalised, the key stakeholders are to determine the optimum location, scale and combination of energy generation technologies to provide a reliable and low carbon supply of heat for the DHN, with the flexibility to adapt to future changes in relevant guidance and regulation.

An Energy Strategy for Earls Court is also being drafted at the time of writing, alongside a Supplementary Planning Document for the area. Both documents are expected to be published in early 2011[7].

[7] The analysis presented in this report relies upon information current at the time of preparation.

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. Transmission losses are also associated with electrical power distribution. A DE system that produces energy in the form of heat and electrical power at or near the point of use 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 waste heat from energy generation and use it nearby (CHP);
- Reduce the energy lost in transmission networks;
- Increased use of renewable and low carbon sources of fuel;
- Increased flexibility for energy generation to match local demand patterns for electricity and heat;
- Greater energy security for businesses and households that control their own energy generation; and
- Greater awareness of energy issues through community based energy systems, driving behavioural change and the more efficient use of energy resources.

The local benefits of implementing a decentralised energy network (DEN) 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 in achieving a low carbon economy;
- Offers significant investment in the region and increases employment opportunities;
- The experience gained could become a skills export opportunity; and
- It provides opportunities to build on regional expertise and skills in renewable and low carbon fuel sources such as biomass, biogas and syngas.

The most common form of decentralised energy supply considered in the UK is community or district heating in which heat is delivered to multiple buildings 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 utility services (e.g. water, drainage, telecoms, etc.) to minimise costs to new development. It is also possible to retrofit existing buildings and there are convincing cost/benefit arguments for supplying heat to existing rather than new buildings[8].

District heating networks served by CHP plant are considered to have the largest potential for carbon dioxide emission savings. CHP with district heating is a local, decentralised community energy system that captures and utilises waste heat from power generation to maximise energy utilisation efficiencies. This waste heat can be readily distributed to buildings via a pipework network. The electrical power produced could be exported to the national grid or provided to other users over a local electricity distribution network or over a new, community owned or part owned network (known as a private wire network).

CHP with district heating has the added benefit of future proofing a district's energy supply because it allows a range of fuel sources to be considered, such as biomass, biogas (from AD processes) or syngas (from gasification processes), 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 CHP energy centres requires careful consideration (see Section 6.1) and are therefore best planned at the neighbourhood masterplanning stage.

A DEN and associated energy centre can typically support a 3km pipework distribution radius; however, utilising a number of satellite top-up boiler systems/energy centres connected to the DEN at strategic locations can allow heat to be typically transmitted up to 30km from the energy centre. This is based on utilising modern pre-insulated pipework (see Section 6.1).

As indicated in the *Powering Ahead, Delivering Low Carbon Energy for London,* DE schemes generally fall under three types, briefly described below.

[8] Existing buildings are less energy efficient than new buildings as less prescriptive construction standards applied at the time of construction. This means existing buildings will have a much higher heating demand than new buildings due to improved fabric performances. As a result, supplying low carbon heat to existing buildings will result in a greater potential for achieving CO_2 emissions savings.

Type 1: Single-Site Schemes

In these schemes, energy generation is based on small or medium scale 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 equivalent load. In the past, these schemes have primarily been developed by the public sector but are increasingly being incorporated in planning applications for major developments. An example scheme of this type is the Cranston Estate regeneration site in the London Borough of Hackney, which will connect over 500 residential units to a DEN consisting of approximately 1km of distribution pipework and a natural gas CHP engine.

Type 2: Multi-Site Mixed Use Schemes

These serve more than one site and user type. The energy generation plant is based in a dedicated CHP energy centre and would serve from 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, which is positioned to supply electricity, heat, water, drainage 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 Estates.

Type 3: Area Wide Heat Transmission Projects

These schemes consist of extensive heat distribution pipework systems forming a network of connected multiple heat producers such as power stations and industrial waste heat or energy from waste (EfW) facilities. They would serve 100,000 plus residential units and a large range of mixed public and private commercial facilities. A Type 3 example is the London Thames Gateway Heat Network (LTGHN), led by the LDA and Department for Communities and Local Government (CLG). The aim is to develop a low carbon district heating network in Europe's largest regeneration area. The heat network will incorporate heat from a number of sources, including low cost heat from Barking Power Station and heat generated by Tate & Lyle's industrial facilities. Heat will be distributed via an extensive distribution pipework main up to 67km long. The project's delivery is expected to be implemented 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 carbon dioxide emissions from the built environment derives from the scope to use the waste heat from power generation that would otherwise be wasted at conventional power generation plants. The benefits of district heating schemes largely depend on deployment being carried out in the right context.

Appropriate heat demand and density levels, a correctly combined demand from a mix of residential, commercial and industrial land uses, and the presence of anchor heat load heat consumers optimise the operational efficiency of a DE network. These three technical parameters are described in detail in Sections 5.1 and 6.1.

The development of a DE network should be based on an analysis of the heat demands within a certain area, known as heat mapping, that facilitates the evaluation of the potential for DE delivery against the technical criteria identified above, as a minimum. The heat mapping process will result in: the identification of clusters of potential heat consumers, serve to identify the density characteristics, understand the mix of uses, and pin point the anchor heat load consumers[9].

[9] These will be large, steady consumers of heat that are able to enter into long term heat supply contracts and consequently act as economic cornerstones for the development of heat networks.

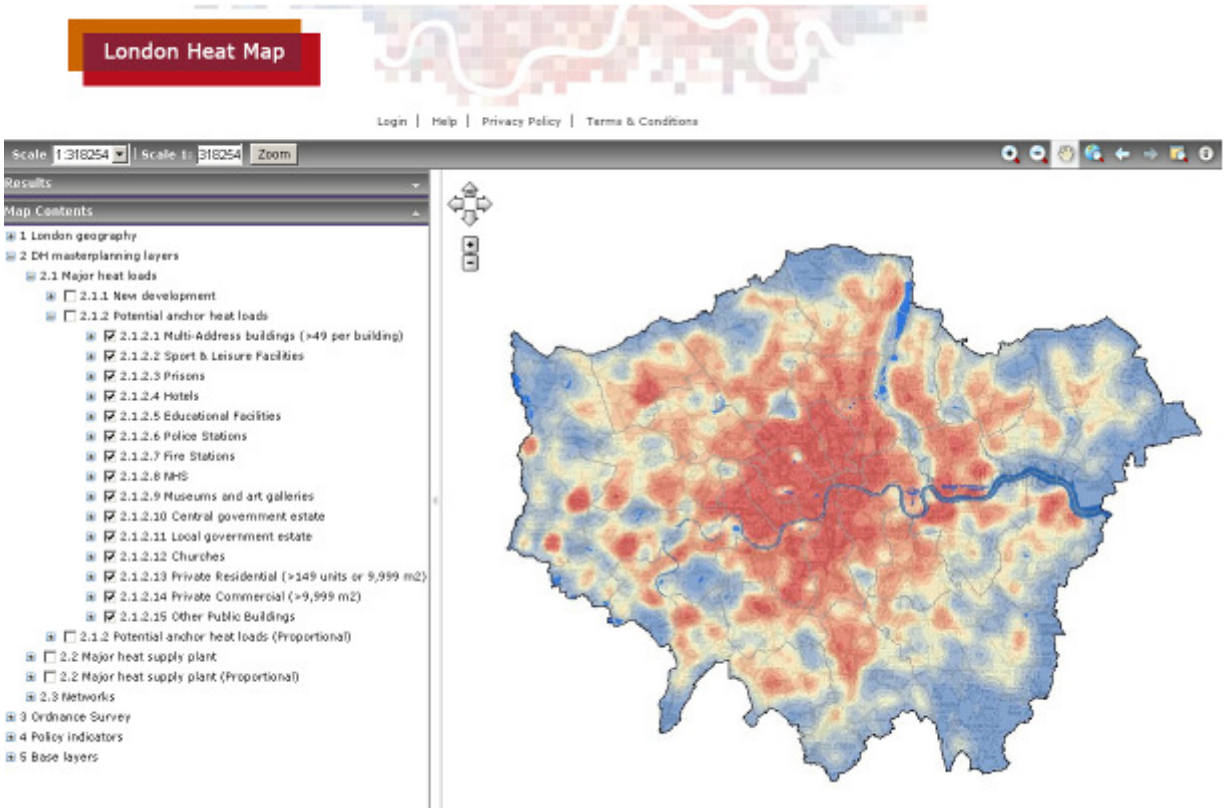
4. METHODOLOGY

4.1. Introduction

Data relevant to the heat requirements of high energy users (defined as priority buildings by the LDA) within LBHF were collected to help create a robust Heat Map for the Borough. The data collected was input into the DEMaP Database format provided by the LDA.

The DEMaP Database is intended to inform the interactive LHM (*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 within the LHM. The purpose of the data collection was to populate the relevant fields of the DEMaP Database. The heat mapping methodology consisted of the stages are described below.

Figure 4-1: London Heat Map Interactive Portal



4.2. Identification of Priority Buildings

The priority buildings were divided into several categories (identified in *Figure 4-1*) in accordance with the requirements of the DEMaP Database. Buildings in LBHF identified and included in each category were cross-referenced between several sources to ensure that all 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.

The index of priority buildings produced by cross-referencing all available sources was then supplemented by desk-based analysis of the GIS data. GIS information was processed based on the building classification categories and building size. This ensured that the largest buildings within the Borough were captured in the database.

Details on the data collection sources for each priority building are provided below:

Schools

All educational buildings identified within the *UK Schools and Colleges Database* for LBHF and those identified on the LBHF website were incorporated into the database, regardless of their scale as no threshold was provided by the LDA. The building sizes range from small nursery schools to larger education complexes.

The following sources were used to identify priority educational buildings:

- Display Energy Certificates (DECs);
- LDA DEMaP Database current at the time of analysis;
- UK Schools and Colleges Database[10];
- LBHF website[11]; and
- LBHF GIS data: Address Layer 2 and MasterMap.

Sports and Leisure Facilities

All sport and leisure facilities identified within the Borough were incorporated into the database, regardless of their scale, ranging from small gyms to large leisure centres.

Gyms located within large building complexes have not been incorporated into this category to avoid duplicate entries.

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

- Hammersmith & Fulham Assets Register;
- LBHF Leisure Centres listings;
- LBHF website;
- LBHF *Infrastructure Study* (October 2010);
- LBHF GIS data: Address Layer 2 and MasterMap;
- LDA DEMaP Database current at the time of analysis; and
- Internet sources for local listings.

Hospitals

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

- Hammersmith Hospital; and
- Charing Cross Hospital.

Ravenscourt Park Hospital, listed in the current DEMaP Database, was found to be currently non-operational; however, after discussions with the Council, it was determined that the hospital is likely to be re-opened in the near future. Therefore this priority building has been included in the heat mapping analysis.

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

- LBHF Hospitals listings;
- LDA DEMaP Database current at the time of analysis;
- LBHF GIS data: Address Layer 2 and MasterMap;
- LBHF *Infrastructure Study* (October 2010); and
- NHS trust official website[12].

Police and Fire Stations

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

- LBHF *Infrastructure Study* (October 2010);
- LBHF GIS data: Address Layer 2 and MasterMap;
- LDA DEMaP Database current at the time of analysis;
- Metropolitan Police website[13], and
- London Fire Brigade website[14].

Museums and Galleries

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

- LBHF Museums and Galleries listings;
- LBHF GIS data: Address Layer 2 and MasterMap;
- LBHF website; and
- LDA DEMaP Database current at the time of analysis.

Local Government and Other Public Buildings

Local Government and Other Public Buildings were identified. Based on conversations with the Council,

[10] http://www.schoolswebdirectory.co.uk, accessed September 2010

[11] http://www.lbhf.gov.uk, accessed September 2010

[12] http://www.nhs.uk/, accessed September 2010

[13] http://cms.met.police.uk, accessed September 2010

[14] http://www.london-fire.gov.uk, accessed September 2010

it was established that there are no Central Government buildings in the Borough.

The following information was used to list the public buildings and Local Government buildings:

- NI 185 data;
- Hammersmith & Fulham Assets Register;
- DECs;
- LBHF public buildings energy data;
- LBHF GIS data: Address Layer 2 and MasterMap;
- LBHF *Infrastructure Study* (October 2010); and
- LDA DEMaP Database current at the time of analysis.

Hotels

According to the LDA thresholds, only hotels with over 99 bedrooms 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 Borough:

- LBHF website;
- LBHF GIS data: Address Layer 2 and MasterMap;
- Internet sources for local listings; and
- LDA DEMaP Database current at the time of analysis.

Churches

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

- LBHF GIS data: Address Layer 2 and MasterMap;
- LBHF Churches and Places of Worship listings;
- LBHF *Infrastructure Study* (October 2010); and
- LDA DEMaP Database current at the time of analysis.

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 though they fell 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 a DE network.

LBHF's *Largest Employers 2009* spreadsheet, which summarises all employers within the Borough, was used to obtain the numbers of employees of the applicable businesses. All employers with over 200 employees were investigated and those with large offices, retail or industrial premises were included in the Study.

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

In summary, the sources used to identify significant Private Commercial buildings were:

- *Office/B1 Developments in Hammersmith & Fulham* (2008);
- *Land use changes in Hammersmith & Fulham 1992 – 2007* (September 2009);
- LBHF *Largest Employers 2009* spreadsheet;
- LBHF GIS data: Address Layer 2 and MasterMap; and
- LDA DEMaP Database current at the time of analysis.

Residential and multi-address buildings

According to the LDA, public residential, housing association and council estate residential developments of over 49 units should be included under the category 'Multi-address buildings'. Private residential developments of over 149 units, or over 9,999m^2, should be included under the category 'Private residential'.

Housing associations were contacted directly by LBHF to confirm whether they manage any properties of over 49 units. In this case, they were requested to complete a questionnaire (see Section 4.3) for every such property.

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

- *Ward Profiles*, Councillors Briefings (2006);
- LBHF spreadsheet, *Proposed Housing Boiler Replacements 2010+*;
- LBHF document, *Addresses served by communal heating systems*;
- LBHF document and associated correspondence, *Communal heating systems*;
- LBHF spreadsheet, *Housing Gas Bills Overview 2010-07-31*;
- LBHF spreadsheet, *Housing League Table of Consumption Cost 2010-07-31*;
- LBHF spreadsheet, *Flats and Mansions in Orange Sack collection*;

- LBHF spreadsheet, *Riverside Housing Developments since 1980*;
- LBHF GIS data: Address Layer 2 and MasterMap; and
- LDA DEMaP Database current at the time of analysis.

4.3. Actual Energy Consumption Data

The second stage of the methodology entailed the collection of actual energy consumption data to populate the relevant fields of the 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 A.

The questionnaire was distributed to the relevant priority buildings identified through the previous stage. Prior to sending the questionnaires, an extensive phone survey (over 600 phone calls) was conducted to identity energy/facility managers in an effort to target the correct audience and maximise the relevance of the received responses. An email was then sent to the identified energy/facility managers providing a weblink to the questionnaire. Where no response was received, the energy/facility manager was contacted a second time after a reasonable period by phone to follow up.

100 web-based questionnaires were sent to the relevant contacts, of which 35 were returned. 15 responses related to privately owned facilities (42.9%) and 14 publicly owned (40%), with the remaining six falling in the 'other' category (including for instance churches and charities). A summary of the type of facilities for which responses were provided is shown in *Figure 4-2*.

The majority of facilities for which responses were received provide space heating and/or domestic hot water heating via individual boilers, with centralised gas boiler systems being the second most common source of heat supply. This is illustrated in *Figure 4-3*.

Figure 4-2: Questionnaire Responses, Type of Building

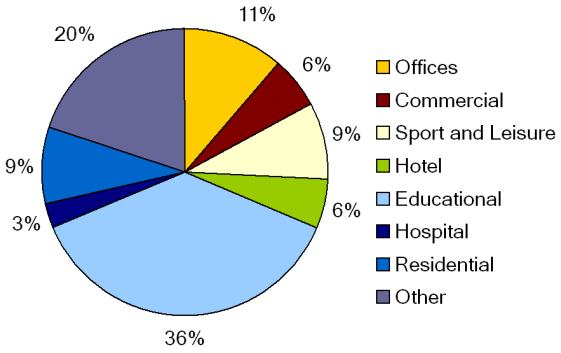
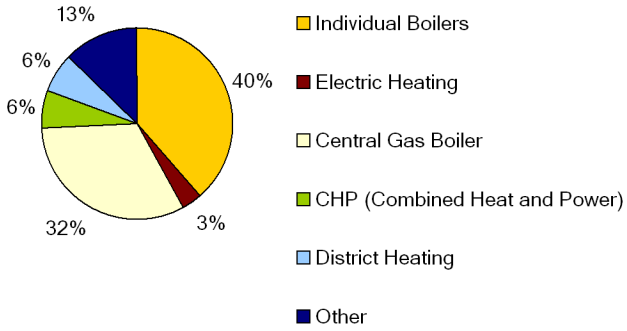


Figure 4-3: Questionnaire Responses, Source of Space Heating/Domestic Hot Water



Although the actual energy consumption data collection process involved a series of phone calls that resulted in approximately 100 questionnaires being sent to priority buildings, only 35% of these were completed. This amounts to approximately 10% of the total existing priority buildings identified in the Borough. Although this response seems low, it was considered reasonable within the scope of this Study, especially when taking into account constraints identified throughout the Study, such as the difficulty in identifying relevant energy/facility managers or other contacts with access to appropriate data. Additionally, some organisations had no incentive to provide their energy consumption information, especially in cases where such data was considered confidential. Some organisations were not able to respond within the timeframe of the engagement stage, and in some cases energy records were collected and managed centrally at the head office for which contact information was not provided within the timeframe of the Study.

Finally, in addition to the questionnaires, actual energy consumption data for public buildings was also collected through Display Energy Certificate (DEC) and NI 185 data. The combination of these

sources resulted in gathering actual energy consumption data for 84 buildings, representing approximately 23% of the total existing priority buildings identified in the Borough.

This generally demonstrates a good performance under the collation of actual energy consumption information.

Data collected through the questionnaires was analysed and then integrated into the DEMaP Database.

4.4. Benchmarking

Where actual energy consumption data was not available, a benchmarking exercise was carried out using LDA approved conventions to calculate the relevant input values requested within the DEMaP Database.

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

Benchmarks for residential buildings were sourced after consulting the following articles/publications:

- *CE309 – Sustainable refurbishment, Energy Saving Trust*, 2010 edition;
- *Energy efficient modernisation of housing: A UK Case Study*, Leeds Metropolitan University;
- *Phase 1 technical and energy modelling guidance notes v1.0*, CLG, August 2009;
- *Domestic Retrofitting Strategies in the UK: Effectiveness versus Affordability*, Architectural Association Graduate School, September 2006; and
- *Extreme low carbon dwelling refurbishment*, BSRIA, February 2010.

Where no actual information was available on building areas, these were estimated using the X and Y coordinates of the priority buildings and the Virtual London Building Heights GIS data.

4.5. Existing Heat Plants

To identify existing heat plants in the Borough, the following databases were consulted:

- London Energy Partnership's Community Heating Database;
- DECC CHP Database;
- The UK Heat Map; and
- OFGEM CHP Database.

After consultation with the LDA, in addition to major heat supply plants, central boilers above 500kW were also included in this category. Information provided by LBHF on addresses served by communal heating systems was used to identify the number and type of installed boilers.

In addition to the above, based on the information collected and calculated for the DEMaP Database, URS identified existing buildings or building complexes that are more likely to be powered by communal heating systems. These were identified based on the following criteria:

- Energy Consumption: buildings with a large energy consumption;
- 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, colleges, Council buildings, high-rise office buildings and large shopping centres, were considered; and
- 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.

Energy/facility managers of the buildings that met the above criteria were contacted with an information request to determine whether the identified buildings actually accommodate communal heat plant.

4.6. DH Networks

Based on the following sources, no existing district heating networks were identified in LBHF:

- London Energy Partnership's Community Heating Database;
- *Powering Ahead, Delivering Low Carbon Energy for London*; and
- London Thames Gateway Heat Network (LDA).

According to the *Infrastructure Study* (October 2010), the three largest or most relevant community heating systems/networks serving housing estates are located at Bayonne Road, Star Road and Walham Green Court Estates[15]. The energy centres at these locations were captured in the current DEMaP Database; however insufficient information was available relevant to the network coverage area

[15] *Infrastructure Study*, Section 2.2 Energy, October 2010

and, therefore, were not included in the LBHF extended DEMaP Database.

4.7. New Development

Output from the London Development Database (LDD) from 2005 to 2010 was used to list the new (proposed) developments in the Borough. These were filtered based on the LDA size thresholds (i.e. residential developments of more than 49 units, commercial spaces of more than 9,999m^2 and hotels of more than 99 bedrooms).

Energy strategies, where available, were used to source data on anticipated fuel consumption. For the remaining proposed developments, benchmarks from *CIBSE Guide F* (good practice) were used for non-domestic buildings, whilst for the domestic buildings, energy demand in a range of domestic buildings compliant with Part L1A of Building Regulations, 2006, was used as a benchmark.

4.8. Future Development

The housing trajectory up to 2026 was provided by LBHF to inform the estimates of future heat consumption.

In line with the *Proposed Submission Core Strategy*, the trajectory has been provided for the Borough's key regeneration areas:

- Old Oak Common and Hythe Road Area;
- Wider White City Area;
- Hammersmith Town Centre;
- North Fulham (part of the Earls Court and West Kensington Opportunity Area); and
- South Fulham Riverside.

Firstly, a baseline energy consumption position was established by using the Department for Business, Innovation and Skills (BIS) metered gas and electricity consumption data (2007). The BIS energy consumption data was analysed in combination with MasterMap topography data to demonstrate the actual heat demand/gas consumption characteristics (kWh/year) of LBHF based on a 250m x 250m grid format.

The growth trajectories were then developed by the Council as part of the LDF process using the best available information at the time of the Study, and have been used to provide an indication of the suitability of the identified areas for the integration of a DE network. These have been provided for the five key regeneration areas and a residual 'other' category covering the remainder of the Borough, and are presented in *Table 4-1*. For each time period, energy consumption benchmarks were sourced and applied to the Council's trajectory[16] to obtain future consumption estimates incorporating the proposed step changes in Building Regulations[17]. It should be noted that for the purpose of this Study, the estimated reduction in energy consumption incorporates not only regulated energy uses, but also those resulting from non-regulated energy uses.

The resulting growth consumption figures were finally added to the BIS 2007 baseline figures to provide future total energy consumption up to 2026 (i.e. 2007 baseline consumption plus consumption growth by period).

[16] For residential and non-residential uses – *Supporting Regional Spatial Strategy Policy 39 (e)*, which includes benchmark energy consumptions (in kWh/m^2); Source: BRE, CP Energy Ltd, NaREC, and NEA: *Supporting Regional Spatial Strategy Policy 39 (e), Simplified Guidance Supporting Major Developments to Have Embedded Within Them a Proportion of On Site Generated Renewable Energy*

Energy consumption for hotels – *CIBSE Guide F*, *Energy Efficiency in Buildings*, January 2004

[17] Part L 2010 Building Regulations will be applicable for buildings built between 2010 and 2013. Part L 2010 of the Building Regulations requires a 25% improvement in CO_2 emissions over Part L 2006. For the purposes of this study, only improvement associated with energy efficiency measures were considered to estimate the corrected energy consumption in 2010-2013, disregarding any improvement achieved through low and zero carbon technologies as this does not reduce the actual energy demand of a building. The improvements for the upcoming periods (i.e. 2013-2016, 2016-2019 and 2019-2026) were estimated similarly.

Table 4-1: Regeneration Areas, Housing Trajectories, Additional Number of units/bedrooms / Area [m^2] by Period

	Wider White City Area	2010-2013	2014-2016	2016-2019	2020-2026
units	Residential	300	750	900	1,800
m^2	Commercial	0	0	60,000	60,000
m^2	Industrial	0	0	0	0
bedrooms	Hotel	0	0	0	250
m^2	Retail	2,400	23,800	22,500	23,900
m^2	Leisure	5,000	0	0	5,000

	North Fulham	2010-2013	2014-2016	2016-2019	2020-2026
units	Residential	750	750	750	1,000
m^2	Commercial	0	50,000	50,000	50,000
m^2	Industrial	0	0	0	0
bedrooms	Hotel	0	0	250	0
m^2	Retail	1,200	4,800	8,000	6,000
m^2	Leisure	0	0	1,000	5,000

	Hammersmith Town Centre	2010-2013	2014-2016	2016-2019	2020-2026
units	Residential	500	700	0	0
m^2	Commercial	50,000	50,000	40,000	40,000
m^2	Industrial	0	0	0	0
bedrooms	Hotel	0	250	0	0
m^2	Retail	1,500	10,400	22,200	33,900
m^2	Leisure	0	0	0	0

	South Fulham Riverside	2010-2013	2014-2016	2016-2019	2020-2026
units	Residential	600	600	400	300
m^2	Commercial	0	0	0	0
m^2	Industrial	0	0	0	0
bedrooms	Hotel	0	0	0	0
m^2	Retail	4,000	0	0	0
m^2	Leisure	0	0	1,000	0

	Old Oak Common and Hythe Road Area	2010-2013	2014-2016	2016-2019	2020-2026
units	Residential	0	0	0	1,600
m^2	Commercial	0	0	0	0
m^2	Industrial	0	0	0	0
bedrooms	Hotel	0	0	0	0
m^2	Retail	0	0	0	0
m^2	Leisure	0	0	0	0

	Other	2010-2013	2014-2016	2016-2019	2020-2026
units	Residential	1,100	100	0	0
m^2	Commercial	0	0	0	0
m^2	Industrial	0	0	0	0
bedrooms	Hotel	0	0	0	0
m^2	Retail	0	0	0	0
m^2	Leisure	0	0	0	0

5. HEAT MAP RESULTS

5.1. Introduction

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

In this chapter, an analysis focused on technical considerations is presented, structured in two stages:

- Firstly, existing conditions are discussed by analysing heat map results for existing priority buildings and new development proposals (i.e. pipeline development), to shortlist areas that present short/medium term opportunities for DE; and
- Secondly, future development incorporating longer term development proposals and policies will be considered to highlight how current opportunities for DE can be made more robust and how new opportunities can be fostered in areas where DE does not appear suitable in the short/medium term.

In the following sections, the framework underpinning the technical analysis is set out. Further, the results of the two stage technical analysis are presented.

5.2. Framework for Analysis

Heat Demand and Density Levels

The presence of adequate heat demand and density levels is essential in supporting the viability of a DE network.

Density levels are reduced when the potential heat consumers are spaced further apart, whilst heat demand is also reduced when buildings are better insulated (i.e. when considering new and future development).

Historically, densities above 50 dwellings per hectare, e.g. a development of flats (> than 149 dwellings), have been used to determine when a district heating scheme should be implemented, based on economic parameters.[18]

[18] Energy Saving Trust, *CE299 The applicability of district heating for new dwellings*, September 2008

Diversity of Consumer Types

A balanced/consistent heat demand is also crucial. DE 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 heat demand profiles/characteristics. For example, domestic applications offer peak heating demands typically between 7 to 9am and 5 to 10pm (domestic hot water led demand), whilst commercial and public buildings are more likely to peak at 6 to 7am (due to boiler start up functions) with a fairly consistent, low level heating demand throughout the day depending on occupancy levels (space heating led demand). There are also buildings which have consistent round-the-clock demand such as hospitals and leisure centres (process heating led demand). Connecting such different users produces an aggregate demand that offers smoother, more consistent heat demand characteristics than individual buildings, meaning heating plant can run significantly longer at the design output capacity. Therefore, this balancing of demand allows for the more efficient generation of energy and therefore optimised carbon dioxide emissions savings. This is quite unlike the erratic or spiky heat demand on an individual boiler in a home, and leads to a better DE plant performance and operational efficiency, the ability to install an optimised (reduced) plant capacity and, consequently, improved financial viability.

Anchor Heat Load Consumers

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 into long term heat supply contracts and consequently act as economic cornerstones for the development of heat networks. Typically these will be public sector buildings such as hospitals, universities, Council facilities (including housing estates and offices), or hotels and leisure centres.

Existing Heat Plants

The location of any existing heat plants (as defined by the LDA) in the Borough is also relevant, as these provide opportunities to retrofit existing plant rooms/boiler houses (e.g. in housing estates) to support new plant and infrastructure. Furthermore, plant space in these locations is already available and identified for relevant use and therefore the installation of new plant facilities will encounter fewer barriers. Any existing heat plant offering in the Borough is assessed against identified strategic

locations for the installation of future energy centres for new heat networks.

Where small community heating systems/networks have already been developed, such as the Bayonne Road, Star Road and Walham Green Court Estates, these could form part of a new wider heat network. They may also contain a heat source that can be used either directly as a primary energy source or as future back-up provision. Small district heating networks, however, may have been sized to accommodate the intended load and have little capacity for expansion and therefore site specific feasibility studies may be required.

New and Future Development

Finally, new and future development can provide an ideal platform for creating a new district heating network that is able to connect to a wider area. A new development can act as the anchor heat load and as the site of any primary energy source/centre. This often makes the development of a wider network more viable as the initial asset provision (energy centre, plant and infrastructure) can be accommodated by the new development, particularly the upfront capital expenditure.

5.3. Stage 1: Existing and New Development

The location and energy requirements of existing and new priority buildings were mapped to relate their spatial distribution and associated heat demand and density levels to an emerging strategic Heat Map for the Borough. The potential role of these buildings as loads for large and/or local scale district heating networks can then be identified.

The priority buildings (existing and new) with the highest heat demand identified through this Study are presented in *Table 5-1.*

Table 5-1: Large Heat Consumers in LBHF

Name	Ownership	Typology	Fuel consumption (MWh/year)[19]
THE HAMMERSMITH HOSPITALS NHS TRUST	Other public	NHS	46,500
CHARING CROSS HOSPITAL	Other public	NHS	44,000
White City Estate – includes 35 blocks (2,027 units)	Other	Multi-address buildings	32,444
Ravenscourt Park Hospital	Other	Other public buildings	15,565
Imperial College of Science, Technology & Medicine	Other public	Private commercial (> 9,999m^2)	13,808
Earls Court Exhibition Centre	Private	Private commercial (> 9,999m^2)	13,556
Imperial Wharf (1,665 units)	Private	Private residential (> 149 units or 9,999m^2)	10,629
Broadway Shopping Centre – Office (including Coca-Cola)	Private	Private commercial (> 9,999m^2)	10,418
Empress State Building	Private	Private commercial (> 9,999m^2)	10,146
Ibis Hotel	Private	Hotels (> 99 units or 4,999m^2)	9,354
Novotel (Accor UK)	Private	Hotels (> 99 units or 4,999m^2)	9,172
W12 Shopping Centre	Private	Private commercial (> 9,999m^2)	7,369
Olympia Exhibition Centre	Private	Private commercial (> 9,999m^2)	7,181
PROPOSED – Imperial Wharf (1,007 units)	Private	Private residential (> 149 units or 9,999m^2)	6,429
Millennium and Copthorne Hotels	Private	Hotels (> 99 units or 4,999 ^{2})	5,401
SULIVAN COURT (433 units)	Other	Multi-address buildings	5,265
The Ark	Private	Private commercial (> 9,999m^2)	5,162
PROPOSED – Hammersmith Hospital	Other public	NHS	5,013
THE LONDON ORATORY SCHOOL	Other public	Education facilities	4,927
H M PRISON WORMWOOD SCRUBS	Other public	Prisons	4,920
PROPOSED – Site on Corner of Lyons Walk and	Private	Hotels (> 99 units or 4,999m^2)	4,807

[19] From all assets excluding CHP

Name	Ownership	Typology	Fuel consumption (MWh/year)[19]
Hammersmith Road			
LATYMER COURT (385 units)	Other	Multi-address buildings	4,682
Fulham Broadway Retail Centre (including Fulham Broadway Methodist Church)	Private	Private commercial (> 9,999m^2)	4,608
Chelsea Harbour (The Belvedere) (362 units)	Private	Private residential (> 149 units or 9,999m^2)	4,402
Bayonne Road Estate (334 units), multiple buildings	Other	Multi-address buildings	4,061
Westfield Shopping Centre (includes Marks and Spencer Plc, Debenhams, Next Retail Ltd, House of Frasier)	Private	Private commercial (> 9,999m^2)	4,000
Imperial College Campus, Woodlands	Other public	Education facilities	3,350

Figure 5-1 overleaf illustrates the spatial distribution of the various consumer types identified in the Borough. These are represented by the priority buildings that include, as explained in Chapter 4, multi-address and residential buildings, hospitals, educational buildings, fire and police stations, local government and public buildings, museums and galleries, sport and leisure facilities, hotels, churches and commercial units/buildings.

The map also shows the location of existing heat plants in the Borough, including the existing CHP units at the Conrad Hotel, the proposed CHP unit at the Hammersmith Hospital, and the largest community heating systems/networks, such as the Bayonne Road, Star Road and Walham Green Court Estates.

Finally, the key regeneration areas in the Borough, as defined in the *Proposed Submission Core Strategy* (October 2010), are highlighted on the map:

- Old Oak Common and Hythe Road Area;
- Wider White City Area;
- Hammersmith Town Centre;
- North Fulham; and
- South Fulham Riverside.

To help visualise the heat demand and associated spatial characteristics of the identified consumer types, a Heat Map has been created where the priority buildings were plotted in *Figure 5-2* with increased size to demonstrate increased heat demand. The heat demand of the priority buildings is linked through their gas consumption, which was determined using actual energy consumption data where available, and supported by a benchmarking approach where data was unavailable. Approximate gas consumption of the priority buildings was categorised as *'very small', 'small', 'medium', 'high'*, and *'very high',* using the gas consumption of an equivalent quantity of dwellings.

Figure 5-2 also distinguishes 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. New development buildings in the Borough are indicated in purple.

Figure 5-1 and Figure 5-2 demonstrate the spatial distribution and associated heat demand characteristics of the priority buildings (existing and new) in LBHF.

Figure 5-1: Priority Buildings in LBHF

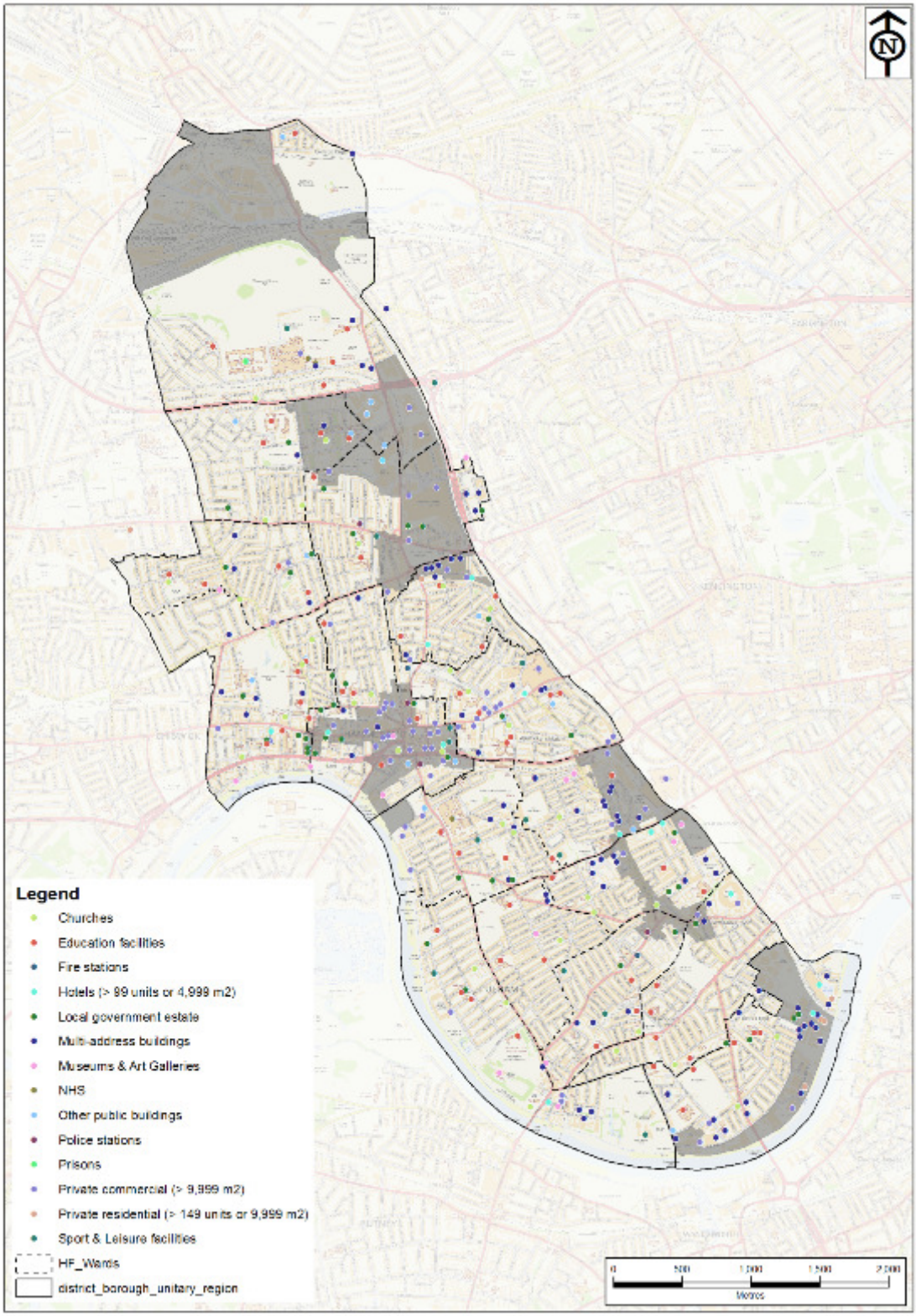
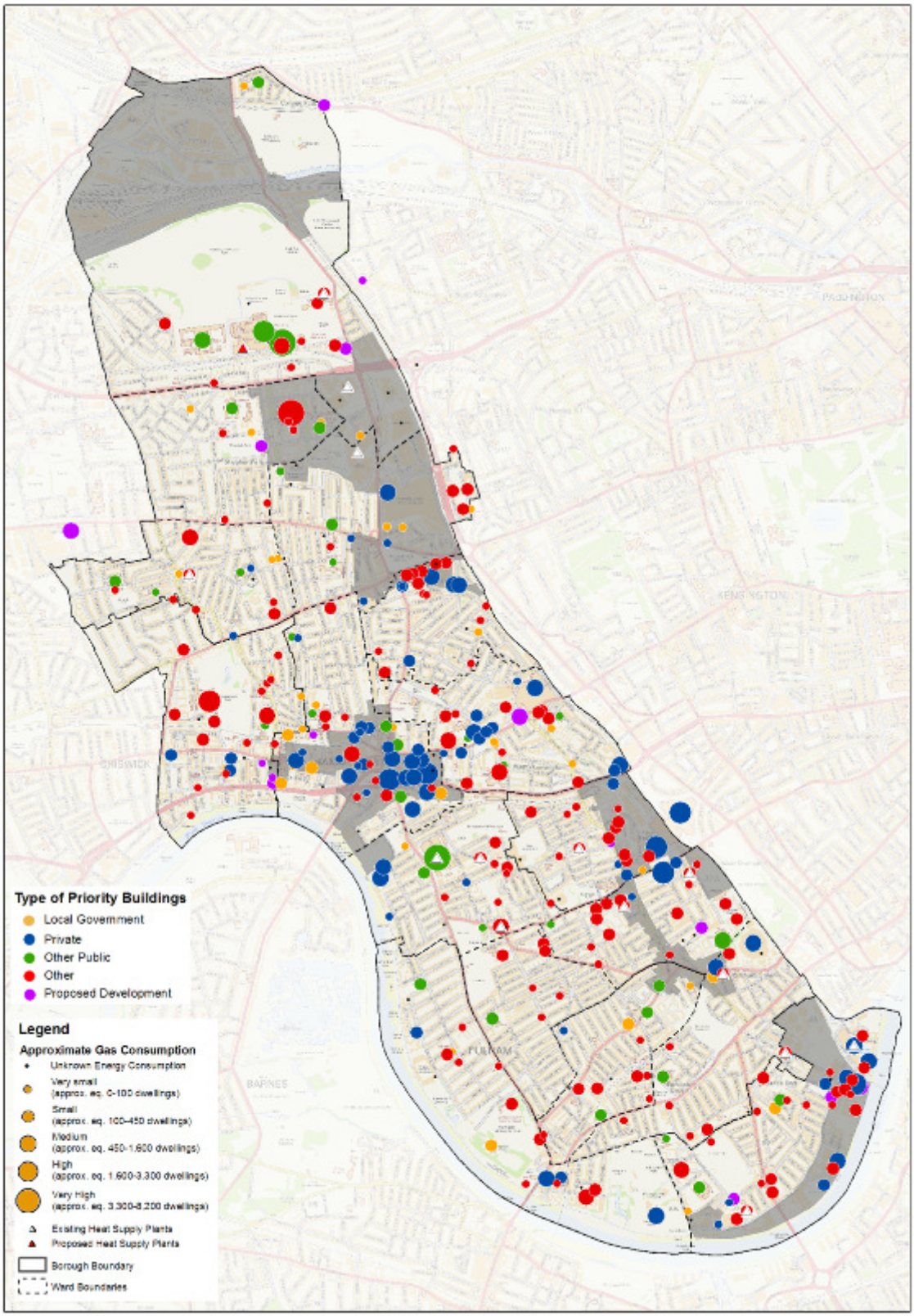


Figure 5-2: Heat Demand Characteristics of the Priority Buildings in LBHF



5.3.1. Evidence from Heat Map Analysis

Based on an analysis of the spatial and heat demand (or heat map) characteristics of the relevant existing buildings and new development proposals in accordance with the criteria outlined in Section 5.1, four key areas of opportunity are initially identified for the deployment of DE within the Borough largely coinciding with the following regeneration areas:

- Hammersmith Town Centre;
- Wider White City Area;
- South Fulham Riverside; and
- North Fulham.

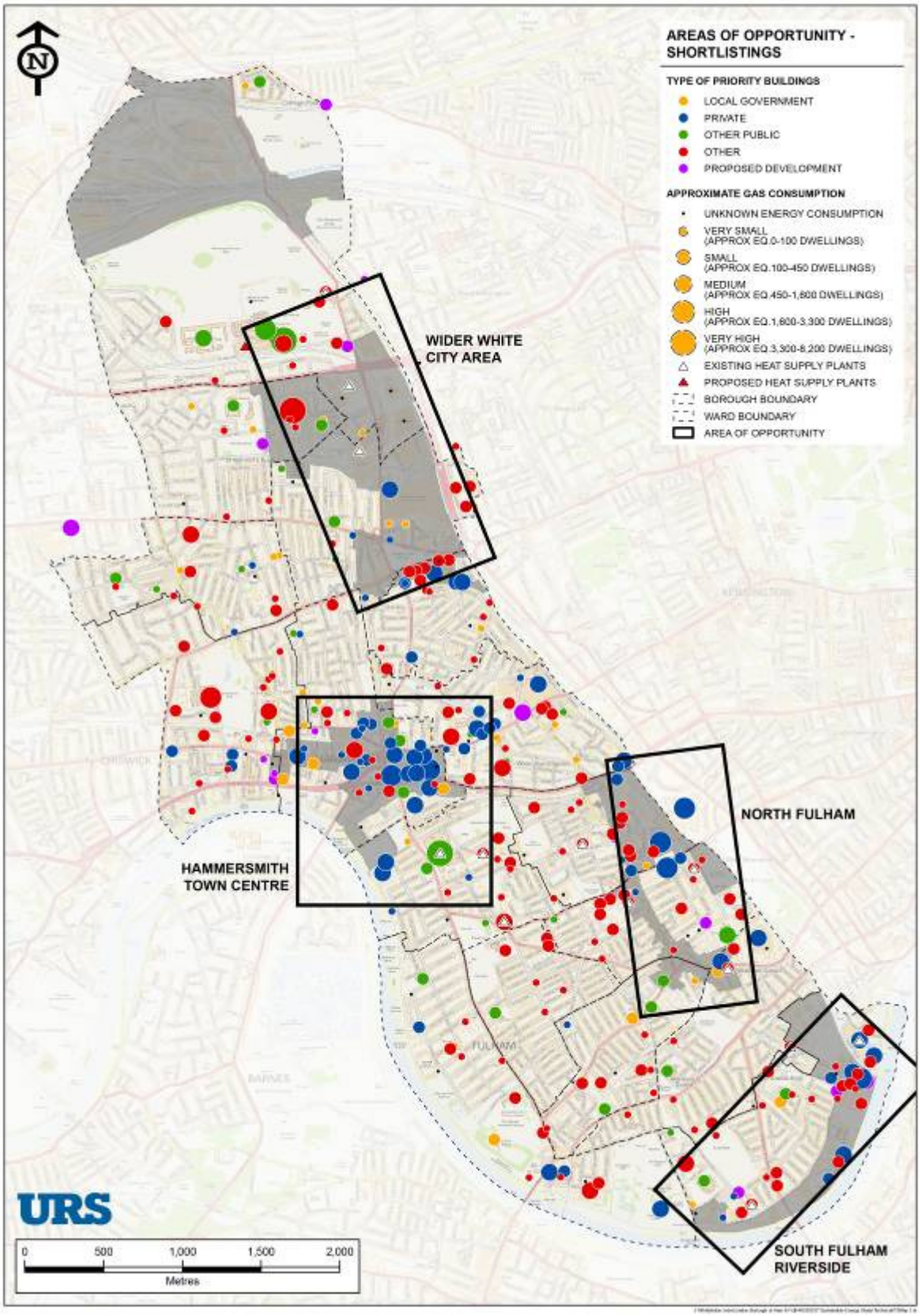
This is generally in line with the Borough's vision to maximise the provision of DE networks and the integration of renewable energy technologies in the proposed regeneration areas. The outline of the shortlisted DE areas of opportunity is shown in *Figure 5-3,* and the priority buildings and their associated heat demand that fall within each shortlisted area of opportunity are presented in Appendix C.

Although the spatial and heat demand analysis of existing priority buildings and new development proposals in the Old Oak Common and Hythe Road regeneration area indicate less favourable conditions for DE delivery, discussions with the Council indicate that pipeline development prospects, such as the proposals to develop a high speed rail hub (as part of the plans for a high speed rail line – High Speed 2) at Old Oak Common would support higher levels of development than currently anticipated, offering significantly improved conditions for DE delivery.

Therefore, as per Section 5.4, future development in all the five key regeneration areas is considered to assess whether future opportunities for DE delivery are likely to emerge from policy designations and longer term development proposals. Particular attention will be given to identify the necessary parameters that could occur/be introduced to support the implementation of DE in areas omitted from the in depth analysis carried out in Chapter 6.

It is further noted that for areas where less favourable conditions exist for DE delivery (e.g. the Old Oak Common and Hythe Road regeneration area), developers should still be required to assess the opportunities for DE provision within their development proposals in accordance with both the Mayor's energy hierarchy (be lean: use less energy; be clean: supply energy efficiently, i.e. utilise CHP technologies; and be green: use renewable energy sources), and heating and cooling hierarchy (i. connection to existing heating or cooling networks; ii. site wide CHP network; and iii. communal heating and cooling). This demonstrates best practice sustainable design principles.

Figure 5-3: Shortlisted DE Areas of Opportunity



Hammersmith Town Centre

The priority buildings in this area include a number of major heat consumers such as the Charing Cross Hospital and the Broadway Shopping Centre. The Town Centre exhibits high heat demand characteristics, with a considerable number of relatively large heat consumers concentrated in a small area (high density levels). In particular, the centre of this zone features a cluster of large consumers within a radius of 300 metres. The centre of the cluster includes mostly commercial office and retail buildings, with surrounding public and Council buildings.

This density of development and high heat demand characteristics, combined with an appropriate mix of uses, such as hotels and shopping centres alongside large residential developments (e.g. Latimer Court, Ashcroft Square, etc.), and the Charing Cross Hospital could create economic run time conditions (> 5,000 hours per year) that are well suited for medium to large scale CHP plant supplying a district heating network.

Additionally, the Charing Cross Hospital and the Broadway Shopping Centre, and the public and Council buildings offer improved viability for a DE network as anchor heat load consumers, improving both the operation and financial merits of a CHP led district heating network.

New developments are also present in this area, including the King Street regeneration scheme that will include the new Council offices, and commercial and residential floor space. According to the *Proposed Submission Core Strategy*, development sites are also present in close proximity to Ashcroft Square, one of the largest housing estates, and the Kings Mall Shopping Centre, adding to the diversity of consumer types, and heat demand and density levels for the area.

Wider White City Area

This part of the Borough forms part of the White City Opportunity Area (WCOA), one of the 28 opportunity areas identified within the *London Plan* for which the LDA has prepared an Opportunity Area Planning Framework and associated *WCOA Energy Strategy* assessing the potential heat demand and the viability of decentralised energy (see Section 2.3).

Large and diverse heat consumers are distributed throughout this area of opportunity, such as the White City Estate, BBC Television Centre Complex, BBC Media Village, Phoenix High School, Westfield Shopping Centre and the K West Hotel and Spa. Hammersmith Hospital is located to the north of this zone and is scheduled to house two new CHP units, each rated at 1MWe.

New development in the area includes the extension of the Westfield Shopping Centre that will potentially add an additional 60,000m^2 of commercial floorspace and 2,500m^2 of residential provision immediately to the north east of the Westfield site.

Redevelopment of part of the Imperial College Campus, Woodlands, will comprise the erection of postgraduate student accommodation buildings comprising 606 units, 9 residential units (Class C3) and 120m^2 GEA of Class D1 floorspace, plus ancillary facilities, access, parking, cycle storage, ancillary plant, landscaping and public realm provision. CHP plant is proposed with a capacity of 533kWth/200kWe, including 40m^2 of solar PV panels.

Although major heat consumers are present, this area exhibits lower density levels when compared to Hammersmith Town Centre, mostly due to an increased distance between heat consumers, but also in the number of heat consumers/priority buildings and their associated heat demands.

Existing energy centres in this area include those at the BBC Television Centre Complex and Media Village.

Generally, the WCOA has already been identified as capable of accommodating significant commercial and residential development as a catalyst for regeneration, and as such is an area of strategic importance.

The investigation carried out as part of the *WCOA Energy Strategy* proposed a distributed energy scheme based around gas fired CHP and some renewable heat. Electricity generated by the CHP plant would be sold to the grid and the heat distributed to customers via a district heating network. Public and private developments have been identified as suitable areas to establish a core district heating network, which can subsequently expand to supply and interconnect with other parts of the WCOA. These locations are characterised by high heat demand and density levels, with short distances between heat consumers and having similar regeneration timescales.

Section 6.4 discusses opportunities for potential connectivity between the Wider White City Area with suitable/sites schemes in the Royal Borough of Kensington & Chelsea (RBKC).

North Fulham

This area of opportunity includes Fulham Town Centre and the Earls Court and West Kensington Opportunity Area. Private heat consumers dominate, including the Empress State Building, the Ibis Hotel, Kensington Village, and a number of large residential developments, such as the Seagrave Estate and Michael Stewart House. It exhibits a good mix of consumer types located within relatively close proximity, demonstrating good density levels. These buildings also exhibit a heat

demand large enough to support their application as potential anchor heat load consumers.

The Study also identified existing energy centres within this area, including the largest community heating systems/networks in the Borough serving the Bayonne Road, Star Road and Walham Green Court Estates.

According to information provided by the Council, the energy centres (boiler houses) in Walham Green Court, Michael Stewart House and Seagrave Estate are due for boiler replacement between 2012 and 2014. The potential for deploying a DE network within this area should take into account this asset replacement cycle, since the timing for connection of single-site schemes is generally driven by the need to replace equipment that has reached its end-of-life. The existing boiler houses also offer further advantages in terms of acting as preferred energy centre locations that can provide heat beyond the estate requirements, with an improved potential to tie into a larger district heating network.

Three more energy centres serving Council housing estates are located directly to the west of the North Fulham area of opportunity, and towards the south of Hammersmith Town Centre (the Star Road Estate, Bayonne Road Estate and Chelmsford Close). Again, with boiler replacement programmes outlined between 2013 and 2014, the Star Road Estate and Bayonne Road Estate could also be considered for potential connection to a DE network anchored to either the Hammersmith Town Centre or the North Fulham areas of opportunity.

South Fulham Riverside

This area includes mostly large hotels (e.g. Wyndham Grant Hotel, the Belvedere and Jury's Inn Chelsea, etc.) and major residential developments such as the Imperial Wharf, Sullivan Court and Chelsea Harbour.

A number of these priority buildings are clustered to the east of this zone within a relatively small area (i.e. within a radius of 150 to 200m). The remainder of priority buildings are distributed throughout the extent of this zone predominantly along the riverfront.

Public buildings within this zone include some schools and a community centre, but the heat demands associated with these buildings are not large enough to support anchor heat load provision. Furthermore, the community centre identified (Sands End Community Centre) is being considered for potential sale by the Council. In terms of new development, discussions with the Council indicate that the redevelopment of a Sainsbury's superstore at Townmead Road (Sands End development site) will provide a total of 9,395m^2 gross retail floorspace, 472 residential homes and a number of other commercial uses. The new scheme is anticipated to include a 413kWe CHP and 200m^2 of solar PV panels.

Three energy centres are located in this area: the CHP at Wyndham Grant Hotel, and two community boiler systems serving the Philpot Square and Manor Court Estates.

Old Oak Common and Hythe Road Area

This area in the north of the Borough (to the north of Wormwood Scrubs and Little Wormwood Scrubs) includes a variety of industrial uses, car sales, waste management and railway uses, and has the largest remaining concentration of industrial type premises in the Borough. Accordingly, the priority building heat map (*Figure 5-2*) did not identify any major heat consumers in this area. The Council are promoting Old Oak Sidings and the former North Pole Eurostar depot as a location for a major rail interchange/hub between the proposed High Speed 2 (HS2) rail line, Crossrail, the Great Western line, and West and North London lines, subject to the Government confirming that there should be such an interchange (see Section 5.3.1).

Discussions with the Council indicate that the long term vision for this area is to transform it with substantial mixed use regeneration made possible principally by this rail infrastructure development. This could provide thousands of homes, jobs and supporting facilities in a high quality environment, securing future growth for London in a very sustainable way.

Therefore this area could be suitable for integration of DE in the future, depending on the characteristics of the regeneration scheme. Based on the potential provision of an HS2 rail hub at Old Oak Common, DE should be considered as part of any masterplanning process when considering future development proposals.

5.3.2. Evidence from Baseline Combined Gas Consumption[20]

In addition to the priority buildings heat map, *Figure 5-4* demonstrates the spatial distribution of the Borough's baseline gas consumption based on BIS metered gas consumption data for 2007. Observations of the gas consumption map generally conform to findings of the priority buildings heat map (*Figure 5–2*), as follows:

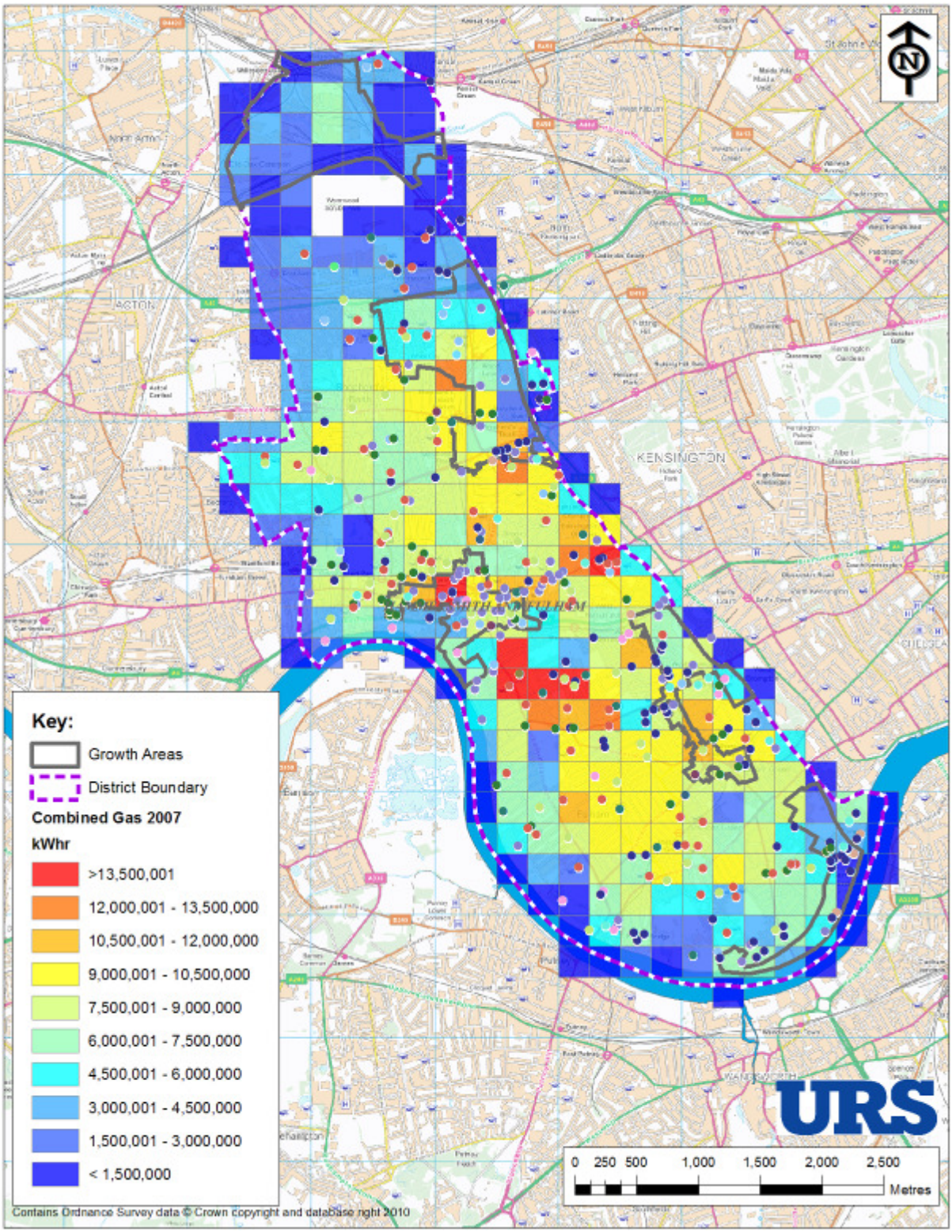
- The largest area of high gas consumption (shown in red and orange on *Figure 5-4*) is

[20] It should be noted that gas consumption data is utilised to represent proxy heat demand characteristics for the purposes of the study. Additionally, combined gas consumption refers to the gas consumption associated with both residential and non-domestic buildings.

found in Hammersmith Town Centre, aligning with the density and heat demand characteristics observed in the priority buildings heat map (*Figure 5-2*);

- An area of medium gas consumption (in yellow) is shown to the south of Hammersmith Town Centre, an area mostly characterised by low density residential use. This illustrates the predominance of domestic led heat demand in parts of the Borough. The priority buildings heat map has captured some of the largest Council estates in this area (e.g. Bayonne Road, Chelmsford Close, Muscal House, etc.). Whilst these high density residential buildings lend themselves to the implementation of a DE network, this zone has not been identified as part of the potential area of opportunity for DE due to the high cost of connecting the predominantly low density housing to a district heating network (connection costs are estimated in the order of £8,000 per terraced home);
- Similarly, a pocket of medium-high gas consumption is shown to the east of Hammersmith Town Centre, mainly characterised by terraced residential housing and some Council estates (e.g. West Kensington Estate, Argyll Mansions and Palace Mansions);
- Pockets of medium-high gas consumption are also shown to the south and central part of the Wider White City and North Fulham areas of opportunity, generally in agreement with the clusters of priority buildings identified in these zones;
- The gas consumption in the South Fulham Riverside area of opportunity is shown to be lower than that of any of the areas of opportunity identified through the priority buildings exercise, a fact that may be attributed to the larger distances between priority buildings. Although with future development, further heat demand could be introduced, making a DE system more viable; and
- As anticipated, gas consumption in the Old Oak Common and Hythe Road Area is currently low, although, should proposed rail infrastructure investment go ahead in Old Oak Common, further heat demand would be introduced, making a DE system more viable.

Figure 5-4: Heat Map, BIS Baseline Combined Gas Consumption, 2007



Source: URS calculations based on BIS data

5.4. Stage 2: Future Development in the Regeneration Areas

Figure 5-5 shows the metered gas consumption forecast for the Borough up to 2026.

Future demand methodology and results

As discussed in Section 5.3.2, 2007 BIS metered gas consumption data was used to provide a baseline of the spatial heat demand characteristics across the Borough. The borough wide figures are presented in *Table 5-2*.

Table 5-2: Baseline Borough-Wide Energy Consumption Summary (kWh)

	Electricity	Gas
Residential	298,526,372	1,110,061,275
Non-domestic	221,074,576	598,033,871
Total	**519,600,948**	**1,708,095,146**

Source: BIS 2007

Having established the Borough baseline, additional growth in gas consumption has also been estimated, taking account of the proposed step changes in Building Regulations and the associated improvements in energy efficiency requirements. The results of this exercise are illustrated for the key regeneration areas in *Table 5-3*.

Table 5-3: Key Regeneration Area, Forecast Gas Consumption Estimates, kWh/year by Period

Wider White City Area	2010-2013	2014-2016	2016-2019	2020-2026
Residential	1,678,096	3,962,170	4,474,922	8,949,843
Commercial	0	0	1,752,819	1,752,819
Industrial	0	0	0	0
Hotel	0	0	0	2,289,839
Retail	55,576	520,508	463,131	491,948
Leisure	879,525	0	0	781,800

North Fulham	2010-2013	2014-2016	2016-2019	2020-2026
Residential	4,195,239	3,962,170	3,729,101	4,972,135
Commercial	0	1,551,976	1,460,683	1,460,683
Industrial	0	0	0	0
Hotel	0	0	2,289,839	0
Retail	27,788	104,976	164,669	123,502
Leisure	0	0	156,360	781,800

Hammersmith Town Centre	2010-2013	2014-2016	2016-2019	2020-2026
Residential	2,796,826	3,698,026	0	0
Commercial	1,643,268	1,551,976	1,168,546	1,168,546
Industrial	0	0	0	0
Hotel	0	2,432,954	0	0
Retail	34,735	227,449	456,956	697,784
Leisure	0	0	0	0

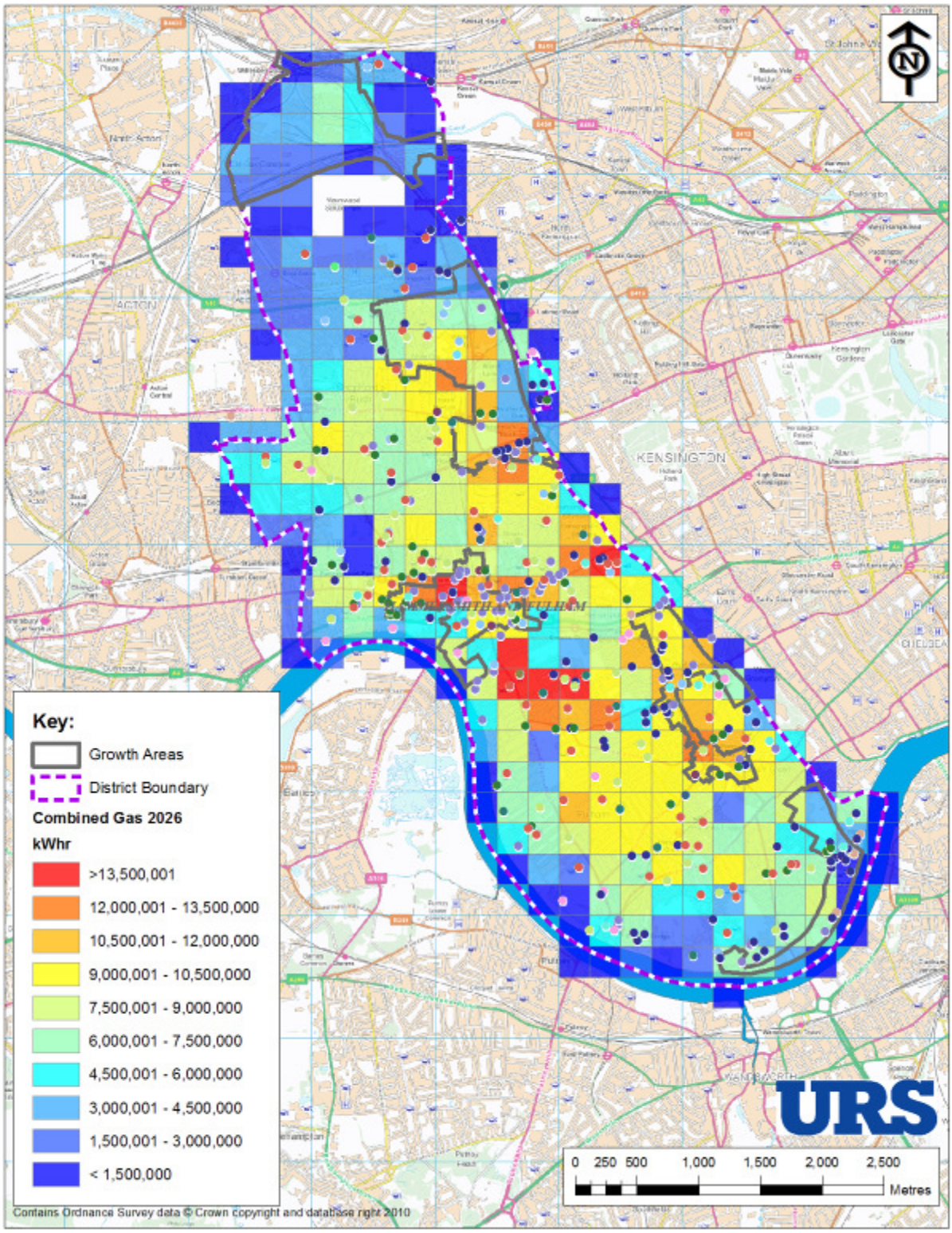
South Fulham Riverside	2010-2013	2014-2016	2016-2019	2020-2026
Residential	3,356,191	3,169,736	1,988,854	1,491,641
Commercial	0	0	0	0
Industrial	0	0	0	0
Hotel	0	0	0	0
Retail	92,626	0	0	0
Leisure	0	0	156,360	0

Old Oak Common and Hythe Road Area	2010-2013	2014-2016	2016-2019	2020-2026
Residential	0	0	0	7,955,416
Commercial	0	0	0	0
Industrial	0	0	0	0
Hotel	0	0	0	0
Retail	0	0	0	0
Leisure	0	0	0	0

Other	2010-2013	2014-2016	2016-2019	2020-2026
Residential	6,153,017	528,289	0	0
Commercial	0	0	0	0
Industrial	0	0	0	0
Hotel	0	0	0	0
Retail	0	0	0	0
Leisure	0	0	0	0

Source: URS Calculations

Figure 5-5: Heat Map, Forecast Combined Gas Consumption, 2026



Source: URS calculations based on BIS and LBHF data

5.5. Baseline and Forecast Gas Consumption Comparison

The following figures are presented to graphically compare the baseline 2007 and forecast 2026 gas consumption characteristics of the shortlisted DE areas of opportunity (based on *Figure 5-3*). *Table 4-1* and *Table 5-3* present the development growth projections and forecast gas consumption figures for the regeneration areas in LBHF, respectively.

By comparing the gas consumption growth in the shortlisted DE areas of opportunity, it can be seen that only a marginal growth/change in gas consumption is demonstrated. This is due to the following:

- Typically, the existing building stock will make up approx. 85% of the building stock in 2026, i.e. the forecast gas consumption for 2026 is predominantly made up by the existing building stock (or 2007 baseline); and
- The new and forecast building stock will offer significant improvements in energy efficiency performance, driven by the predicted step changes in Building Regulations and the Code for Sustainable Homes Level requirements when considering residential development. The 'zero carbon' housing trajectory from 2016 onwards and the 'zero carbon' non-domestic development trajectory from 2019 onwards, means that the heat demand (or gas consumption) of the new and forecast building stock will be significantly less than the less energy efficient existing building stock. This has a significant impact on the forecast gas consumption growth in the regeneration areas considered.

Figure 5–6: Hammersmith Town Centre Comparative Gas Consumption

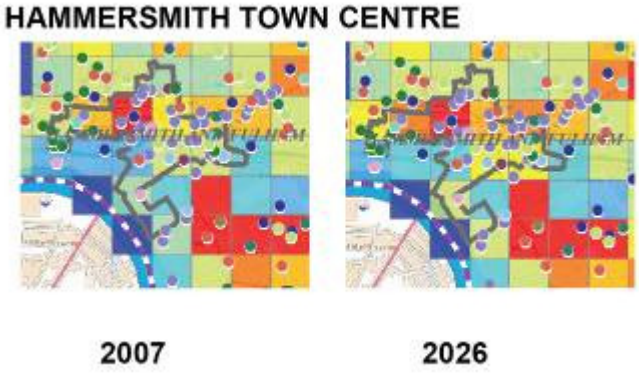


Figure 5–7: Wider White City Area Comparative Gas Consumption

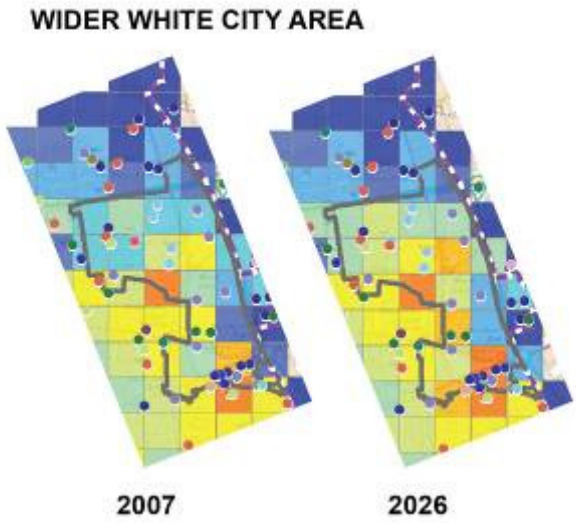


Figure 5–8: North Fulham Comparative Gas Consumption

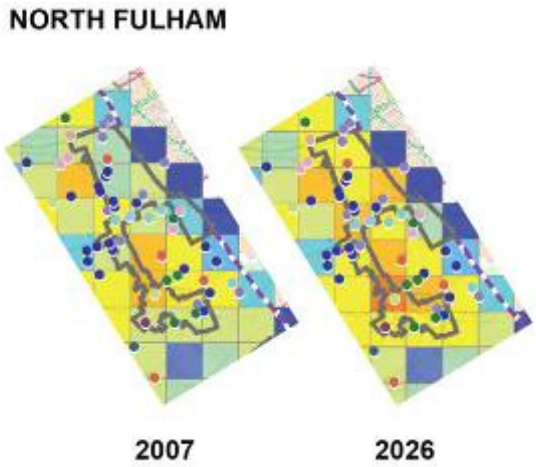
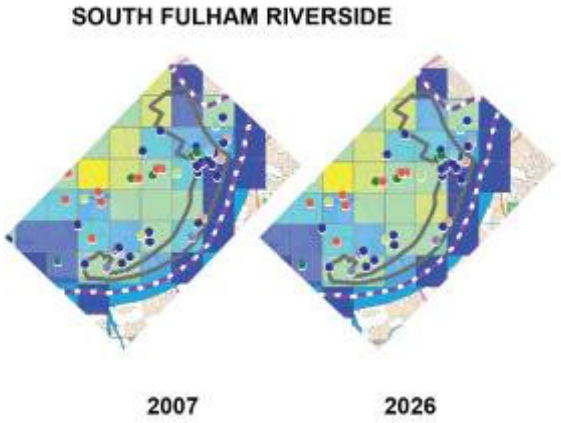


Figure 5–9: South Fulham Riverside Comparative Gas Consumption



5.6. Summary

The future demand projections for the five regeneration areas were based on the Council's development vision for these areas, as described in the *Proposed Submission Core Strategy*. This supplemented the heat mapping analysis of existing and new development to further validate the shortlisted DE areas of opportunity.

When reviewing both data sets, Hammersmith Town Centre, and the Wider White City and North Fulham areas of opportunity immediately exhibit favourable characteristics for DE network deployment, both in terms of current (existing and new) and future heat demand. Therefore these three areas are deemed to be of high priority for the deployment of DE and a wider analysis extending to non-technical considerations is presented in the following chapter, alongside the potential for inter-borough and cross-borough connectivity.

A number of existing large heat consumers has been identified in the South Fulham Riverside area of opportunity; however, current heat mapping (spatial) characteristics limit the potential for DE provision in the immediate future. New and future development would need to offer communally heated solutions and put in place future proofing measures to support connection to a DE network. These future proofing measures could include energy centre provision (safeguarded plant space), and, for larger developments, committing to serve as anchor heat load consumers. With these requirements in place, driven through planning conditions, this area could be identified as being technically feasible for DE provision within the 2010-2026 DE implementation timeframe currently considered within the Study. An analysis of expected future development up to 2026 and discussions with the Council indicate that opportunities for DE may arise in the future through the anticipated regeneration that will include residential developments and new shopping facilities to meet the local needs.

Although currently anticipated development in the Old Oak Common and Hythe Road Area is not predicted to reach levels in the 2026 timeframe that could readily support DE delivery, as more detailed plans come forward it is possible that sites having a sufficient diversity of consumer types will come forward in support of rail infrastructure reinforcement projects (e.g. the HS2 rail hub), offering sufficient heat demand and density levels for future DE systems.

Although the South Fulham Riverside and Old Oak Common and Hythe Road areas are not currently considered to be of high priority for DE delivery, future development trends and development types could offer the opportunity to pursue DE provision.

For both of these areas, the next steps to continue gauging the viability of DE implementation are outlined in Chapter 7, alongside the Implementation Plan in Chapter 8.

Below is a brief description of the results of the technical analysis for each regeneration area.

Hammersmith Town Centre

Higher gas demand is anticipated in Hammersmith Town Centre, which is in line with the Council's vision to encourage the regeneration and redevelopment of this zone, and the provision of a wide range of major retail, employment, local government services, leisure, arts, entertainment, and community facilities. Furthermore, it is anticipated that Hammersmith Town Centre's major location advantages will encourage office development and secure more modern accommodation. The King Street regeneration scheme is a good example of the vision for the future of Hammersmith Town Centre, aiming to regenerate the area around the existing Hammersmith Town Hall and include 320 new homes alongside new Council office buildings and commercial areas.

Wider White City Area

Increased gas demand is anticipated in the Wider White City Area where regeneration will be focused on the development of land east of Wood Lane, partial development of the BBC Television Centre Complex and encouraging the regeneration of the White City and adjacent estates. It will also involve improvements to, and developments within, the historic Shepherds Bush town centre, including a regenerated market area that provides an enhanced focus and destination in the western part of the town centre.

North Fulham

North Fulham exhibits increased gas demand as the Council envisages that there is a substantial opportunity for major regeneration based on a comprehensive approach to the Earls Court and West Kensington Opportunity Area, comprising the Earls Court Exhibition Complex (with its car park in Seagrave Road), the TfL Lillie Bridge depot and adjacent housing estates. As a residential led mixed use scheme, this area has the potential to become a major new neighbourhood for the Borough and West London, providing significant new housing and employment opportunities. The Council is also seeking phased regeneration over 20 years of the existing West Kensington, Gibbs Green and Clem Attlee Estates.

6. SPATIAL OPPORTUNITIES FOR DECENTRALISED ENERGY

6.1. Framework and Criteria for Analysis

Chapter 5 identifies three areas of highest priority in the short to medium term for the implementation of DE based on an assessment of existing priority buildings, and new and forecast development against technical and spatial criteria for DE delivery.

These areas are further assessed in this chapter against a wider range of criteria adapted from the HM Treasury Five Case Model, offering a practice guide for programme and policy evaluation. The criteria applied to the shortlisted DE areas of opportunity are listed and described below.

Technical

Sufficient heat demand and density levels

The heat demand and density characteristics of priority building clusters must achieve appropriate levels when assessing the ability of these clusters (or areas of opportunity) to support development of and connection to a district heating network.

In terms of physical extent, i.e. network coverage, there are upper limits to the coverage of a district heating network based on CHP energy centre provision. Where a district heating network is served by a single energy centre with no satellite energy centre support, the extent of the network typically reaches a 3km radius. This 'rule of thumb' is determined by pipework heat losses and the operational temperature of the network. The greater the network coverage area, the higher the operational network temperature will need to be to facilitate the correct heat supply temperature to the connected heat consumers.

Where networks exceed this typical 3km coverage area, local top-up boiler systems/satellite energy centres will be required to maintain the correct operational network temperature, potentially increasing the reach of a network to up to 30km.

Moreover, the costs associated with laying the necessary pipework infrastructure also increase with increased distances. Therefore, the proximity of potential strategic energy centre sites (strategic locations) and connected consumers is a crucial consideration in the evaluation of opportunities for DE.

Sufficient diversity of consumer types

Correctly combined demand from a mix of residential, commercial and industrial land uses would optimise the operation of a DE network.

For example, residential load profiles for domestic hot water tend to have pronounced morning and evening peaks (see Section 5.2). To maximise the benefits of a CHP system, the installation of a large thermal store (i.e. hot water storage tanks) will be required to meet the peak time demands in order to support economic plant capacities and run times. A mix of uses alongside the residential use, however, would help to create daytime loads, reducing the need for thermal storage capacity and help to improve CHP operational viability. Use of larger public sector sites (e.g. Council offices and housing estates), commercial offices and hotels creates a more consistent and robust load profile.

Anchor heat load consumers

An anchor heat load may be defined as a large, steady consumer of heat that will form the core of a DE network. This would be a site well suited to CHP with high and relatively constant heat (and ideally electrical) demand.

Other potential anchor heat load consumers include sites with existing CHP/community plant installations or buildings already linked via a district heating network.

Public sector sites (e.g. Council offices and housing estates) are preferred as they typically present lower commercial risk and may be able to 'drive' the viability of a DE network. This is, in part, due to Council's being able to enter into longer term heat supply contracts with ESCos, ensuring commercial viability for Energy Services Companies (ESCos)[21].

Technical constraints

Existing buildings that are served by electrically driven heating systems (e.g. Variable Refrigerant Flow – VRF – fan coil unit systems, electric panel heaters, point-of-use domestic hot water systems, etc.) cannot generally support connection to a district heating network without major plant refurbishment and structural modifications. This would pose a significant cost burden on building owners and operators.

[21] The term ESCo refers to a wide range of different energy supply arrangements, under which an ESCo acts like a utility provider but instead of supplying gas, heat is supplied. ESCos usually install, finance and manage community energy systems and therefore provide an efficient and comparatively lower risk approach to CHP installation and management.

See Section 7.4.1 for a more extensive discussion on ESCos and their potential role in LBHF.

Existing buildings that have central heating systems already in place (e.g. four-pipe fan coil unit systems, wet radiator systems, central calorifier systems for domestic hot water, etc.) offer a better potential for a district heating connection but are still constrained by asset replacement programmes, whereby sufficient funds would only become available at the end of the life of the plant to support plant upgrade or a potential district heating connection.

A number of other technical constraints will need to be considered at more advanced planning stages to ensure the viability of proposed DE schemes[22]. Investigating these issues at such an early stage of analysis is difficult, e.g. more advanced and detailed plans would be required to undertake specific statutory searches to identify existing utilities networks.

In Chapter 7, potential ways of overcoming such limitations are identified to progress the implementation of DE networks in the Borough.

Environmental constraints

These may include air quality and noise impacts on nearby sensitive receptors that can affect resident perceptions on CHP energy centres. Environmental impacts largely depend on the scale and technology used for an energy centre and therefore further consideration should be given to such issues on a case-by-case basis.

Environmental impacts can generally be mitigated with proper design and use of best available technologies.

In Chapter 7, further specific analysis is identified for later stages of the implementation process.

Strategic

Local, regional and national strategic fit

DE schemes in the areas of opportunity contribute to meeting climate change and energy security policy objectives at the Borough, London-wide and national levels.

Financial

Financial risk

DE schemes in areas with a high number of different landowners, particularly if private, are likely to be more financially risky than those in areas with a more concentrated land ownership or where large anchor heat consumers exist, e.g. public sector buildings. When ownership is fragmented, particularly across private stakeholders, financial incentives are likely to be required.

Cost implications

Insufficient heat demand and density levels, absence of an adequate mix of consumer types and the lack of anchor heat load consumers are all likely to result in higher capital and operational costs, and greater levels of commercial risk for DE schemes. Any specific technical or environmental constraint can be expected to have a similar effect.

With regards to CHP, engine capacity is a key consideration to assess the likely commercial viability of the scheme for ESCos. Economies of scale me mean a higher cost per kilogram of CO_2 saved (£/kgCO_2 saved) as engine capacities decrease is likely to reduce the viability of a DE network.

Also, variations in the total capital and operational expenditure among the range of emerging opportunities could mean that higher cost options are less likely to be financially viable. This element will be considered when a spatial strategy for renewable energy in the Borough is developed.

The Volume II report of this *Sustainable Energy Study* will discuss in more detail example costs of medium to large scale CHP systems and associated infrastructure.

Funding opportunities

Limited opportunities to access a range of public funding sources or subsidies are likely to limit the potential for implementing DE schemes.

If the level of new and future development in an area is high, and led by a limited number of stakeholders, then greater opportunities arise for the Council to negotiate with developers to introduce a DE network or contribute funding towards the retrofit of existing properties to support connection.

The Volume II report of this *Sustainable Energy Study* will discuss in more detail the potential for regional, national and European funding opportunities.

Economic

Wider economic benefits

Economic impacts from the implementation of DE networks are likely to affect a range of stakeholders,

[22] These include, among others:

- Whether the National Grid is likely to be able to respond to and support the delivery of the identified DE schemes (e.g. a gas fired CHP plant), i.e. ensure sufficient grid infrastructure/assets are in place to support the export of electricity to the grid;
- Whether any proposed large-scale, gas fired CHP plant is appropriately located in close proximity to a medium pressure gas mains, as this is more likely to support the financial viability of DE projects due to the requirement for gas infrastructure reinforcement and gas compression plant; and
- Whether a proposed DE scheme is located in an area that is congested with existing utilities infrastructure, affecting network distribution.

including: utilities companies, developers, residents and businesses in the Borough, the Council itself, and the wider London/national economies. Of particular importance are general benefits to individual building and business owners (outlined below), as these constitute a possible leverage to raise interest and reduce deliverability risks.

At a later stage, when feasibility studies are undertaken, additional consideration should also be given to utilities and traffic disruption costs that are avoided.

The benefits to business, and building owners and occupiers who connect to a decentralised energy network will be specific to the individual building or business, depending on its size and requirements. The general benefits can be summarised as follows:

- Lowering of carbon dioxide emissions through the use of CHP will have a positive reflection on the value of the owner's building portfolio and overall corporate social responsibility targets;
- Potentially released boiler plant space, which can be utilised for other purposes. Heat exchanger plant can be accommodated within a smaller plant space than the boiler plant removed;
- Potential savings on boiler maintenance. There will be savings on maintenance costs when redundant boilers are removed. Boiler maintenance costs are generally £1,500 pa per boiler; and
- Savings on boiler replacement. The costs of new boiler plant may be in the order of £25,000.

Savings on boiler replacement and maintenance are also direct benefits for residents and tenants, In addition, wider economic benefits for these groups include:

- Fuel poverty alleviation;
- Increased heat supply security; and
- Opportunity for behavioural change through raising awareness of an individual's energy consumption.

Contribution to CO_2 emissions savings targets

The implementation of DE schemes can contribute to meeting the local, regional and national carbon dioxide emissions savings targets. The predominant drivers are at a regional level. The Mayor's *Climate Change Action Plan* (*CCAP*) sets out a target to provide 25% of London's energy needs through decentralised energy sources by 2025. In addition to this, the Mayor's *Energy Strategy* sets out a commitment to achieve 60% saving in London's CO_2 emissions by 2025.

Deliverability and management

Delivery opportunities

Existing energy centres offer an opportunity for the deployment of DE networks, particularly if maintenance and asset replacement cycles are aligned with new and future development in the area.

Delivery risks

The presence of a high number of different priority buildings in different ownership is likely to result in a higher delivery risk, requiring commitment from a range of stakeholders. For this reason, the presence of anchor heat load consumers, and particularly public sector consumers, is likely to reduce the delivery risk.

The commercial viability for ESCos to operate DE networks in the areas of opportunity and the Borough as a whole is a key consideration, which will be driven by the other factors discussed under Section 6.1.

Political risks

Potential environmental constraints and negative public perceptions on specific DE schemes may mean that the Council needs to actively engage with local residents, businesses and developers to ensure they support the Council's drive for DE in the Borough. Stakeholder engagement would allow benefits to be disseminated such that any particular issues raised are addressed effectively.

Management

Generally, the greater the number of players in a partnership, the more complex and difficult it is to pursue and achieve objectives. However, this needs to be balanced with the advantages of involving key organisations. At this stage, an assessment of potential implications for the management of a DE network is limited by the strategic nature of the options discussed.

In addition to undertaking the design, finance and build of a decentralised energy system, an ESCo is also well placed to undertake the operation and management of the system. Once the energy centre and infrastructure has been established, an ESCo can ensure continuity of the fuel supply chain, operation and maintenance. Depending on the contract terms, ESCos can also manage metering and billing.

In Chapter 7, further specific analysis is identified for later stages of the implementation process.

6.2. Results

Under each area of opportunity, specific sites, categorised against the priority buildings categories highlighted in *Figure 5-2*, i.e. Local Government, Private, Other Public, Other and Proposed

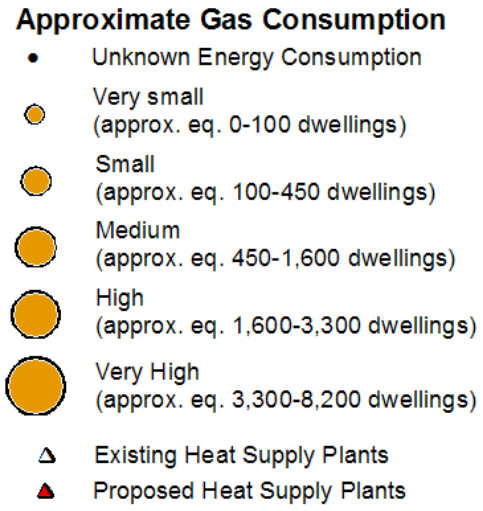
Development, are discussed in further detail to support the framework (see Section 6.1) findings.

At this stage of heat mapping, technical considerations are a key driver of the analysis, due to the standard DEMaP scope of works, which emphasises the technical assessment of priority buildings. The implications of the technical characteristics of the areas considered, in terms of strategic fit, financial and economic impacts, and deliverability and management, have also been incorporated in the framework for analysis. They are also given consideration in the final chapters of this report when the Next Steps for the delivery of DE are identified and the Implementation Plan is outlined.

Below are the results of the analysis for each of the shortlisted DE areas for opportunities. Area specific maps illustrate priority buildings in each area, namely:

- Private (in blue);
- Local government (in yellow);
- Other public buildings, such as hospitals, police and fire stations (in green);
- Buildings that do not fall into any of the above categories, such as churches (in red); and
- New developments in the Borough are indicated in purple.

As in *Figure 5-2*, the heat demand of the priority buildings identified through this Study is associated with their gas consumption (as a proxy to heat demand), categorised as *'very small'*, *'small'*, *'medium'*, *'high'*, and *'very high'*, using the gas consumption of an equivalent quantity of dwellings as indicated in the legend below.



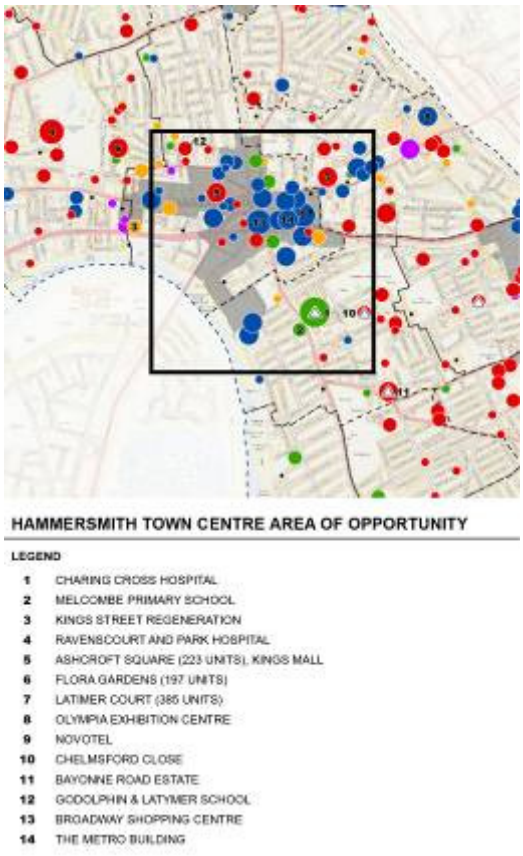
Hammersmith Town Centre

Specific sites

The specific sites identified under the priority buildings categories are:

- Other Public:
  1. Charing Cross Hospital, and
  2. Melcombe Primary School.
- Proposed Development:
  1. King Street regeneration scheme.
- Other:
  1. Ravenscourt Park Hospital;
  2. Stamford Court Estate;
  3. Park Court Estate;
  4. Kings Court Estate;
  5. Flora Gardens Estate; and
  6. Godolphin and Latymer School.
- Private:
  1. Novotel Hotel;
  2. Broadway Shopping Centre;
  3. Kings Mall; and
  4. Metro Building.

Figure 6-1: Hammersmith Town Centre Area of Opportunity



Technical

The Charing Cross Hospital, located to the south of this area, presents a notable opportunity for the deployment of DE as it could reliably serve as an anchor heat load consumer. Based on information collected, the hospital is currently served by gas central boilers and would, therefore, theoretically be compatible with connection to a DE network.

Potential constraints that would need to be investigated include the asset replacement cycle for the boiler plant and whether an opportunity exists to replace the plant with a CHP engine, i.e. support the provision of an energy centre.

The distance from the hospital to other heat consumers should also be assessed to determine the appropriate network coverage.

The Ravenscourt Park Hospital located to the north of the King Street regeneration scheme is currently not operational but, according to discussions with the Council, it is anticipated to re-open. Depending on the current servicing strategy and asset replacement cycles, and with an estimated heat demand of 15,000MWh/year, the hospital could reliably serve as an anchor heat load consumer.

The Melcombe Primary School is located to the west of the Charing Cross Hospital. It has an internal floor area of approximately 2,500m^2, has an estimated heat demand of 700MWh per year and could function as a secondary heat consumer to a potential DE network anchored to the Charing Cross Hospital. Currently, heating is provided by two gas fired boilers, with a separate boiler for domestic hot water services (with storage). This demonstrates compatibility with connecting to a DE system.

The Godolphin and Latymer School, located to the north of the Town Centre area, has an estimated heat demand of approximately 1,100MWh per year and demonstrates compatibility with connecting to a DE system. A potential barrier identified, however, is the distance of the school from larger heat consumers that may act as anchor heat load consumers.

The King Street regeneration scheme is located just to the west of this area of opportunity and is currently at the planning application stage. The scheme proposes the redevelopment of the land adjacent to the existing Hammersmith Town Hall to create a new mixed use campus of retail and residential accommodation, together with a new Civic Square and associated public realm. The development comprises:

- New Civic Square with the existing listed Town Hall as the focus;
- Creation of a single civic campus with the listed Town Hall as a centrepiece through the creation of a new Civic Office directly linked to the existing Town Hall and providing a public one-stop-shop facility at the main entrance level;
- Retail units fronting the new square and a community food retail unit fronting King Street; and
- 320 new residential dwellings arranged in three distinct residential zones (north, south and east).

A community energy system will be implemented with a single energy centre providing heating and electricity to the whole development (employing a 220kWe gas fired CHP unit). Works are anticipated to start on site in 2012. The need for the CHP system to be designed and installed to allow future connection of other nearby sites has been highlighted as part of the planning process. The proposed energy centre is therefore compatible for connection to a wider district heating network and could ensure that enough plant space is allocated for a potential expansion of the CHP system to serve other nearby heat consumers.

There are a number of housing estates in close proximity to the Ravenscourt Park Hospital, such as the Stamford Court Estate (due for boiler replacement in 2013-14) consisting of 127 units, the Park Court Estate consisting of 63 units, the Kings

Court Estate consisting of 128 units, and the Flora Gardens Estate consisting of 197 units. The heat demand and density level characteristics of the housing estates, and their ability to act as anchor heat load consumers (although only the latter is Council owned), supports the technical viability of both DE network connection and energy centre provision (retrofit of existing boiler houses).

Hammersmith Town Centre also includes several private commercial buildings, such as the Novotel Hotel, Broadway Shopping Centre, Kings Mall and Metro Building, that could act as heat consumers, and provide the diversity of consumer types necessary to balance the heat demand profile and increase the feasibility of a DE network.

CHP/CCHP capacity considerations

An in depth energy demand profiling analysis, utilising the baseline BIS metered gas and electricity consumption data (2007) and the forecast energy consumption assessment (2026) associated with Hammersmith Town Centre, results in the determination of the following CHP/CCHP capacities:

- Optimum CHP capacity – 8MWe; and
- Optimum CCHP capacity – 8.75MWe.

The predicted annual CO_2 emissions savings associated with the operation of the CHP/CCHP plant is:

- CHP – 11,055 tonnes CO_2 emissions savings per year; and
- CCHP – 11,332 tonnes CO_2 emissions savings per year.

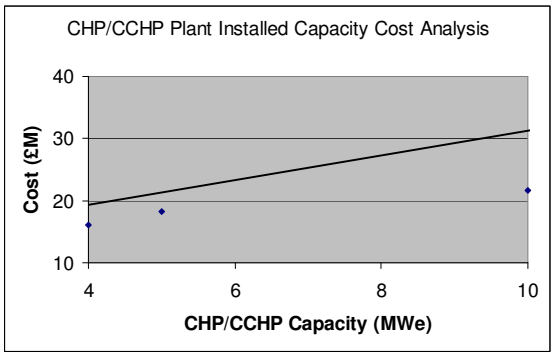
Strategic

Generally, the area of opportunity and specific sites identified offer a strategic fit at local, regional and national levels.

Financial

Figure 6-2 below demonstrates the trend in cost vs. installed capacity of CHP/CCHP plant. This relates to the procurement and installation costs of the CHP engine(s) and the energy centre build costs only.

Figure 6-2: CHP/CCHP Installed Capacity Cost Analysis Graph[23]



Based on *Figure 6-1*, the estimated CHP/CCHP plant capacity (8MWe and 8.75MWe, respectively) indicates installed costs ranging from circa £27m – £29m.

The cost per kilogram of CO_2 emissions saved[24] associated with the CHP and CCHP is as follows:

- CHP– £2.44/kgCO_2 saved or £2,442.36/tonne CO_2 saved; and
- CCHP– £2.56/kgCO_2 saved or £2,559.19/tonne CO_2 saved.

Cost implications for CHP and CCHP begin to diverge when infrastructure costs are considered. CHP plant will support a district heating network consisting of flow and return pipework with a typical pipework diameter of circa 600mm (including pipework insulation), which equates to a circa $2m^2$ cross-sectional area (in terms of trenching requirements) to support distribution. CCHP plant supports both district heating and cooling networks. The typical diameter of cooling distribution pipework is in the order of 1000mm with an associated trench cross-sectional area requirement of $4m^2$. This has significant cost implications with regards to trenching works, particularly where utilities congestion is prevalent. The most cost effective approach is to support the distribution of a district heating network with local cooling plant being provided at the priority buildings that require comfort cooling.

[23] Benchmark CHP/CCHP plant installed cost analysis provided by Cost Consultant, Turner & Townsend.

[24] It should be noted that the cost analysis outlined, based on a £ per kgCO_2 saved, is a simple cost analysis metric. A full Net Present Value (NPV) analysis would be required to offer a more robust cost analysis. This NPV analysis would be undertaken during the proceeding stages of the heat mapping process during the DE feasibility and implementation stages.

Economic

The application of the optimised CHP/CCHP plant capacities (8MWe and 8.75MWe, respectively) in Hammersmith Town Centre could potentially contribute CO_2 emissions savings of approximately 64% (11ktCO_2) in this area of opportunity[25].

Deliverability and management

The implications of a mix of private, social (RSL), and Council ownership of the identified housing estates would need to be assessed further. Their connection to a potential DE network offers delivery opportunities and minimises delivery risk when considering ESCo viability.

Summary

In addition to establishing an anchor heat load consumer base, the Charing Cross and Ravenscourt Park Hospitals offer opportunities for energy centre provision. Existing boiler houses could provide the necessary space for energy centre provision through appropriate retrofitting to support new plant and infrastructure. Therefore, installing a CHP within an existing plant space/boiler house that is already available and identified for relevant use offers practical advantages and can also minimise public perception impacts.

The King Street regeneration scheme offers a mix of uses, demonstrating a diversity of consumer types. It offers wider economic impacts as infrastructure investment is supported. Delivery and management issues risks are minimal as this scheme offers commercial viability and reduced financial risks for prospective ESCos.

The housing estates identified offer delivery opportunities whilst mitigating delivery risks, as the associated heat demand and density levels significantly improve the commercial viability of an ESCo.

The Melcombe Primary School, by acting as a secondary heat consumer, again offers a means of improving the commercial viability of an ESCo operating in Hammersmith Town Centre.

[25] The percentage CO_2 emissions savings analysis is based on the *London Energy and Greenhouse Gas Emissions Inventory* (*LEGGI*), which provides the carbon dioxide emissions associated with domestic, and commercial and industrial buildings on a 1km by 1km grid basis in Greater London. The most appropriate grid square location is utilised to determine the potential CO_2 emissions savings from the application of the optimised CHP/CCHP plant capacities within that area, i.e. the Hammersmith Town Centre, Wider White City and North Fulham areas.

The *LEGGI* data selected is based on the predicted 2015 CO_2 emissions figures for the Borough. This is the furthest projected CO_2 emissions figures available for the Borough and was selected as it represents the closest values for comparison with respect to the 2026 timeframe.

The specific sites identified within Hammersmith Town Centre offer a strategic fit within existing regulatory frameworks for energy and CO_2 emissions mitigation. CO_2 emissions savings in the order of 11,000 tonnes per year could be achieved through the implementation of a DE network, contributing to a 64% savings in the area's projected 2015 CO_2 emissions. This begins to demonstrate alignment with national, regional and local carbon reduction targets.

The optimum CHP/CCHP capacities assessed for the Hammersmith Town Centre area of opportunity offer a robust £/kgCO_2 saved metric. The provision of CHP plant and an associated district heating network offer a more cost effective solution when considering infrastructure provision and distribution.

Holistically, this area of opportunity is considered to offer a very good fit with the DE implementation objectives, particularly when considering the technical parameters.

Wider White City Area

Specific sites

The specific sites identified under the Priority Buildings categories are:

- Other Public:
  1. Wormwood Scrubs Prison;
  2. Hammersmith Hospital;
  3. Phoenix High School;
  4. BBC Media Village;
  5. BBC Television Centre;
  6. BBC White City; and
  7. Canberra Primary School.
- Proposed Development:
  1. Shepherds Bush Market and the Wood Lane Estate public development area.
- Other:
  1. White City Estate;
  2. Pope John School;
  3. Burlington Danes School; and
  4. Old Oak Primary School.
- Private:
  1. Westfield Shopping Centre.

Figure 6-3: Wider White City Area of Opportunity

Technical

Site appraisal

Certain sites within this area of opportunity are already identified within the *WCOA Energy Strategy* prepared by the LDA. Therefore more detailed information is available for this area of opportunity in terms of the potential they exhibit for connection to a DE network.

The White City Estate encompasses 35 blocks with approximately 2,000 units. The *Proposed Submission Core Strategy* identifies the potential for estate regeneration in the future; however, this has not been studied in detail. In the event that estate redevelopment is undertaken, including the community uses, there might be a possibility for some land to be used to house an energy centre.

The BBC Media Village is served by an energy centre. The site is expected to remain in its current form for the long term with no current plans for plant replacement or refurbishment.

According to the *WCOA Energy Strategy*, the majority of the existing BBC Television Centre Complex is serviced from a central energy centre. Over the coming years, these facilities will either be consolidated into the BBC Media Village or moved off site (primarily to the new site in Salford). This move was originally scheduled for 2012, but the BBC now believes that it may be 2015 before the move is complete.

The BBC White City building sits directly next to the BBC Media Village. All heat to the building is supplied via central plant within the building.

To the north of the BBC White City building, in the north east corner of the White City regeneration area, redevelopment of part of the Imperial College Campus, Woodlands, is proposed, which will comprise the erection of postgraduate student accommodation buildings comprising 606 units, 9 residential units (Class C3) and 120m^2 GEA of Class D1 floorspace, plus ancillary facilities, access, parking, cycle storage, ancillary plant, landscaping and public realm provision. CHP plant is proposed with a capacity of 533kWth/200kWe, including 40m^2 of solar PV panels.

Hammersmith Hospital is located to the north of this area of opportunity and is currently in the process of upgrading its heat generation and distribution systems across the site. It is anticipated that the two 1MWe gas fired CHP engines soon to be operational at the hospital will supply 60-70% of the site's heat demand.

In terms of the potential for Hammersmith Hospital to connect to a district heating network, a number of potential technical constraints have been identified. The proposed CHP engines have been sized to meet all expected loads in the medium term development plan and no spare capacity is expected on site. In the summer there may be some potential for exporting heat to a DE network to enable an increase in the CHP load factor but it is recognised that the cost of pipework infrastructure would have to be justified by the sale of relatively small amounts of heat in the summer. This is therefore unlikely to be viable. The opportunity to house additional CHP plant at the hospital was discussed but this was not found to be possible.

Based on the results of the analysis undertaken as part of the *WCOA Energy Strategy*, the hospital was not considered to be suitable for consideration as either a potential heat consumer or low carbon heat supplier at this stage.

Phoenix High School is located to the west of the White City Estate. The school is due to be redeveloped: approval has been given for the construction of a new 6th form block which will include a CHP system. Redevelopment is planned for some time between 2012 and 2014. Given the significant heating demand potential and the existing centralised heating plant, the school could be considered as a secondary heat consumer within this area of opportunity.

Canberra Primary School and Pope John School are also conveniently located in close proximity to the east and south of the White City Estate, respectively. Although smaller in terms of floor area than Phoenix High School, with an approximate, respective floorspace of 2,800m^2 and 1,800m^2, these schools would also offer an opportunity for connection to a DE network that may emerge from the regeneration opportunities in the White City Estate.

Another large school in the area includes the Burlington Danes School, located to the north of Hammersmith Hospital, with a floorspace of approximately 11,000m^2. The school is also in close proximity to the Woodmans Mews Estate, served by a 0.59MW central boiler system. Constraints identified with these sites relate to the distance of these priority buildings from a potential network in the area, taking into account that Hammersmith Hospital, located in close proximity, has not been found suitable for DE consideration at this stage. However, these sites are further discussed in Section 6.4 Cross-Borough Linkages due to their close proximity to RBKC.

The Wormwood Scrubs Prison is located to the north of the area. The current heating system was installed in around 1985 and is likely to be replaced within the next two years. As such, the prison could potentially serve as an anchor heat load consumer.

The Old Oak Primary School has a floorspace of approximately 4,600m^2 and is located close to the Wormwood Scrubs Prison. Potential barriers to connecting the school to a future DE network, in addition to investigating the compatibility of existing infrastructure, include its location and distance from the centre of the WCOA. Connection would likely only be possible once the prison has been included in the network in order to support the infrastructure investment requirements.

Heating to the existing Westfield Shopping Centre is provided via a centralised boiler system. This would, in theory, be compatible with connection to a district heating network. Westfield have also submitted a pre-application outlining the possible provision of 60,000m^2 of retail and 2,500 residential units immediately to the north east of the Westfield site. If implemented, this proposal could support DE provision for both sites through an energy centre that could also connect and supply heat and power to the existing Westfield Shopping Centre.

The area to the south of the existing Westfield Shopping Centre is predominantly characterised by low density, small independent commercial and residential properties which will typically have individual heating systems of varying ages and types. As such they would be uneconomic to connect to a DE network. These properties are likely to be better suited to retrofit initiatives.

Based on the investigation carried out as part of the *WCOA Energy Strategy*, a distributed energy scheme was proposed based around gas fired CHP and some renewable heat. Electricity generated by the CHP plant would be sold to the grid and heat distributed to customers via a district heating network. Public and private developments have been identified as suitable areas to establish a core district heating network, which can subsequently expand to supply and interconnect with other parts of the WCOA. These locations are characterised by high energy demand and density levels, along with short distances between heat consumers and similar regeneration timescales.

Finally, the *WCOA Energy Strategy* also identified three potential locations for the development of energy supply infrastructure to interface with the proposed district heating network. The potential locations are:

- The Consortium Development Site;
- The existing BBC Television Centre Complex; and
- The White City Estate area.

CHP/CCHP capacity considerations

An in depth energy demand profiling analysis, utilising the baseline BIS metered gas and electricity consumption data (2007), and the forecast energy consumption assessment (2026) associated with the Wider White City Area, results in the determination of the following CHP capacities:

- Optimum CHP capacity – 4MWe.

CCHP is determined not to be feasible as the predominant land use type forecast for development in the area of opportunity is residential led, i.e. domestic heating demand will predominate (see Table 5.3).

The predicted annual CO_2 emissions savings associated with the operation of the CHP plant is:

- CHP– 6,118 tonnes CO_2 emissions savings per year.

Strategic

Generally, the area of opportunity and specific sites identified offer a strategic fit at local, regional and national levels.

Financial

Based on *Figure 6-2*, the estimated CHP plant capacity indicates installed costs of circa £19m.

The cost per kilogram of CO_2 emissions saved associated with the CHP is then as follows:

- CHP– £3.11/kgCO_2 saved or £3,105.57/tonne CO_2 saved.

This conforms to expectations, i.e. economies of scale – the larger capacity CHP in Hammersmith

Town Centre offers more cost effective carbon emissions savings than in the Wider White City Area[26].

Smaller scale systems have lower efficiencies, whilst the relative transaction costs to establish them may be higher. This is due the fact that development costs to establish a decentralised energy network are similar when a certain scale has been reached (within the MWe range). Transaction costs of smaller projects can be disproportionately high as these are often inelastic with respect to project size. Any investment requires initial feasibility work and these costs do not vary significantly with the project size.

Larger schemes also have improved economics over the long term; economies of scale dictate that capital and maintenance costs per unit output fall with increasing scale, resulting in smaller total investment to supply a given amount of energy.

Economic

The application of the optimised CHP plant capacity (4MWe) in the Wider White City Area could potentially contribute CO_2 emissions savings of approximately 32% (6ktCO_2) in this area of opportunity.

Deliverability and management

Whilst the BBC Media Village is set to operate in its current form for the long term, it has been identified as forming a potential part of a wider DE system as it could be connected into a DE scheme at the time of plant replacement/retrofit. This serves to minimise delivery risk and improves the viability of long term ESCo procurement.

There are currently no known plans for the BBC Television Centre Complex after the BBC leave; however, it seems likely that the site will be developed within the timeframe of the WCOA and, given its location, any planned distributed energy systems in these areas should take account of the fact that an additional large load may arise at some point after 2015.

The BBC White City building has the potential to be integrated into a DE network even though new, central condensing boiler plant is due to be installed within the next year. By designing in flexibility for future connection to a district heating network, the building can be DE ready. Future proofing measures could take the form of capped connections to the primary heating pipework, and safeguarded plant space to support the provision of plate heat exchanger plant and associated circulation pumps.

With an estimated heat consumption of circa 3,350MWh and a centralised servicing strategy, the redevelopment of part of the Imperial College Campus offers the opportunity to connect to a district heating network as a secondary heat consumer. Additionally, should the redevelopment be future proofed to support energy centre provision (e.g. safeguarded plant space to support the provision of additional CHP plant capacity), the redevelopment could offer heat export to surrounding heat consumers and potential multi-site connectivity with the BBC White City building and the BBC Media Village, both of which have energy centre provision.

According to the *WCOA Energy Strategy*, the Wormwood Scrubs Prison is seeking to drive carbon dioxide emissions savings with tighter targets being imposed every year. For this reason, the prison is looking for opportunities to improve its carbon footprint and could potentially be interested in a DE based solution to achieve this ambition.

However, a delivery constraint identified for the prison is the need for high levels of resilience required to maintain security integrity. This is translated in a need to maintain the current modular system of individual boilers within each building/wing, in parallel with connecting to a DE network. This would significantly impact on the commercial viability of the proposal to connect. The *WCOA Energy Strategy* has not, therefore, considered the prison to be a potential heat consumer but recommended that its role is further explored as and when more detailed proposals for DE schemes within this area of opportunity are developed. The distance of the prison from the core WCOA regeneration areas is a factor in determining the economic benefit and would have to be considered in more detail.

The energy centre plant of Westfield Shopping Centre was installed in 2008 and is not expected for replacement until around 2028. Westfield is open to the principle of purchasing heat from a district heating network and is doing so for their Stratford City development. Therefore, the potential should be explored again when the systems are replaced.

An additional consideration is the proposed extension of the Westfield Shopping Centre to the north east of the current Westfield site. Delivery and management advantages are seen as this proposed extension could offer opportunities to supply low carbon heat and electricity to the existing Westfield Shopping Centre.

The public development area, including the White City Estate, is largely under the ownership of the

[26] However, it should be noted that the CHP/CCHP capacities indicated in the shortlisted DE areas of opportunity still demonstrate cost effectiveness, i.e. appear to offer a robust £ per kgCO_2 emissions saved metric. A detailed NPV analysis is required to fully assess the financial viability of any DE system proposals. This NPV analysis would be undertaken during the proceeding stages of the heat mapping process, during the DE feasibility and implementation stages.

Council. As such it represents a major opportunity for catalysing the development of a DE scheme within the area. The area, offering a single customer (the Council) with a very significant and secure heat demand that will remain well into the future, is crucial for attracting private sector interest and funding to the scheme.

Summary

Generally the Wider White City Area of opportunity and the specific sites identified offer significant delivery opportunities whilst mitigating delivery risks.

As the public development area, including the White City Estate, is largely owned by the Council, delivery and management factors are favourable, with high levels of commercial viability for ESCo procurement.

The Phoenix High School, by acting as a secondary heat consumer, again offers a means of improving the commercial viability of an ESCo operating in the area of opportunity.

The specific sites identified within the Wider White City area of opportunity offer a strategic fit within existing regulatory frameworks for energy and CO_2 emissions mitigation. CO_2 emissions savings in the order of 6,000 tonnes per year could be achieved through the implementation of a DE network, contributing to a 32% savings in the area's projected 2015 CO_2 emissions. This begins to demonstrate alignment with national, regional and local carbon reduction targets.

The optimum CHP capacity assessed still offers a robust £/kgCO_2 metric when considering economies of scale.

Holistically, this area of opportunity is considered to offer a very good fit with the DE implementation objectives, particularly when considering the delivery and management parameters.

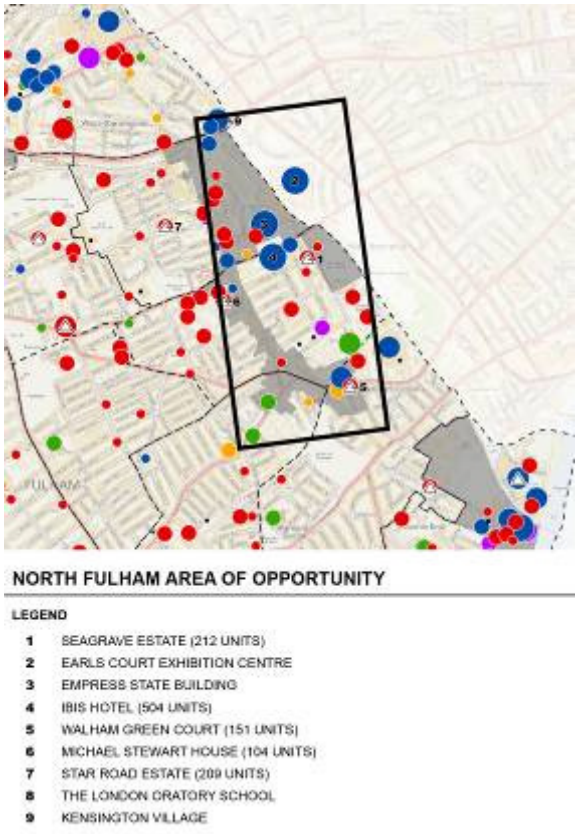
North Fulham

Specific sites

The specific sites identified under the Priority Buildings categories are:

- Other:
  1. The London Oratory School;
  2. Walham Green Court Estate;
  3. Star Road Estate;
  4. Seagrave Estate; and
  5. Michael Stewart House Estate.
- Private:
  1. Earls Court Exhibition Complex;
  2. Empress State Building;
  3. Ibis Hotel; and
  4. Kensington Village

Figure 6-4: North Fulham Area of Opportunity



Technical

Site appraisal

9.5ha of land in this area of opportunity, owned by Transport for London (TfL) and Capital & Counties (owners of Earls Court & Olympia), is likely to become available for development from 2012 with the expected closure of the Earls Court Exhibition Complex. The Earls Court car park in Seagrave Road (2.5ha) is also due for redevelopment.

There is a substantial opportunity for major regeneration based on a comprehensive redevelopment approach to the Earls Court Exhibition Complex (with its car park in Seagrave Road), and the TfL Lillie Bridge depot and adjacent housing estates. Information in the *Proposed Submission Core Strategy* suggests that the scheme would be a residential led mixed use scheme. This area has the potential to technically validate the application of a DE network due to a sufficient diversity of consumer types.

Private commercial buildings in this area that could act as heat consumers include: the Empress State Building, Kensington Village and the Ibis Hotel. Similar to the private buildings identified in the

Hammersmith Town Centre area of opportunity, these stakeholders should be consulted to gauge their interest for connection to a DE network, as well as to determine technical feasibility in terms of current servicing strategy and asset replacement cycles.

This area of opportunity includes two of the largest existing communal heating systems/networks in the Borough[27], the Walham Green Court Estate (151 units) located to the south of the area, and Star Road Estate (209 units) to the west. According to the *Infrastructure Study*, the Council will continue to formulate policy to encourage any new networks to link up the borough's existing communal heating systems/networks.

There are two boiler rooms at the Star Road Estate, housing boilers with a total capacity of 2.61MW. One of the boiler systems is scheduled for replacement in 2013-14. The Walham Green Court Estate central boiler system (1.63MW) is scheduled for replacement in 2012-2013. Information on boiler system replacement is based on the Council's proposed programme for renewal/upgrade of communal heating at various sites. However, this programme is subject to funding availability.

Individual boilers are being replaced/upgraded under the Decent Homes programme only where they near the end of their life expectancy (15 years) or are no longer serviceable.

The Seagrave Estate (121 units) is centrally located in the North Fulham area of opportunity. The estate is served by a central boiler system (1.06MW) due for replacement between 2012 and 2014, and therefore represents an opportunity for connection to a DE network. The Michael Stewart House Estate (104 units) is also located in this area and houses a central boiler system of 0.7MW.

These housing estates offer appropriate heat demand and density level characteristics, and their ability to act as anchor heat load consumers supports the technical viability of both DE network connection and energy centre provision (retrofit of existing boiler houses). Installing CHP plant within an existing, retrofitted boiler house offers operational and cost advantages.

Another opportunity site is the London Oratory School located to the south. It has an internal floor area of 16,000m^2 and an estimated gas demand of 5,000MWh/year. The school's existing heating infrastructure and compatibility for connection to a DE network would need to be investigated further.

CHP/CCHP capacity considerations

An in depth energy demand profiling analysis, utilising the baseline BIS metered gas and electricity consumption data (2007), and the forecast energy consumption assessment (2026) associated with the North Fulham area of opportunity, results in the determination of the following CHP/CCHP capacities:

- Optimum CHP capacity – 4MWe; and
- Optimum CCHP capacity – 4.5MWe.

The predicted annual CO_2 emissions savings associated with the operation of the CHP/CCHP plant is:

- CHP– 5,980 tonnes CO_2 emissions savings per year; and
- CCHP – 6,152 tonnes CO_2 emissions savings per year.

Strategic

Generally, the area of opportunity and specific sites identified offer a strategic fit at local, regional and national levels.

Financial

Based on *Figure 6-2*, the estimated CHP/CCHP plant capacity (4MWe and 4.5MWe, respectively) indicates installed costs ranging from circa £19m – £20m.

The cost per kilogram of CO_2 saved associated with the CHP and CCHP is then as follows:

- CHP– £3.18/kgCO_2 saved or £3,177.26/tonne CO_2 saved, and
- CCHP– £3.25/kgCO_2 saved or £3,251.04/tonne CO_2 saved.

Economic

The application of the optimised CHP/CCHP plant capacities (4MWe and 4.5MWe, respectively) in the Wider White City Area could potentially contribute CO_2 emissions savings of approximately 23% (6ktCO_2) in this area of opportunity.

Deliverability and management

The presence of a manageable number of large landowners (e.g. TfL, Capital & Counties and the Council when considering the housing estates) is likely to result in reduced levels of delivery risk, as a commitment from a limited range of stakeholders to consider DE connection/implementation in the context of the regeneration opportunities can be more easily achieved.

Summary

The housing estates identified offer a good performance under technical considerations: appropriate heat demand and density level characteristics, and their ability to act as anchor heat load consumers; and minimisation of environmental constraints and public perception risks due to the opportunity to utilise/retrofit existing boiler houses for energy centre provision. In addition, as the housing estates are under single

[27] *Infrastructure Study*, Section 2.2 Energy, October 2010

ownership, delivery and management factors are favourable, with high levels of commercial viability for ESCo procurement.

The predominance of large landowners within this area of opportunity offers a reduced delivery risk.

The specific sites identified within the North Fulham area of opportunity offer a strategic fit within existing regulatory frameworks for energy and CO_2 emissions mitigation. CO_2 emissions savings in the order of 6,000 tonnes per year could be achieved through the implementation of a DE network, contributing to a 23% savings in the area's projected 2015 CO_2 emissions. This begins to demonstrate alignment with national, regional and local carbon reduction targets.

The optimum CHP/CCHP capacity assessed still offers a robust £/kgCO_2 metric when considering economies of scale. It should be noted, however, that the provision of CHP plant and an associated district heating network offers a more cost effective solution when considering infrastructure provision and distribution (see the financial considerations discussed under the Hammersmith Town Centre area of opportunity).

Holistically, this area of opportunity is considered to offer a very good fit with the DE implementation objectives, particularly when considering the technical, and delivery and management parameters.

6.3. Inter-Borough Linkages

Figure 6-5 illustrates the indicative inter-borough connectivity when considering the spatial implementation of decentralised energy between the identified areas of opportunity.

Based on the evaluation of the shortlisted DE areas of opportunity, the concentration of demand and density, diversity and anchor heat loads, and other framework factors, such as delivery and management, financial, etc, it has been demonstrated that Hammersmith Town Centre (technically led), the Wider White City area (delivery and management led), and North Fulham (technically, and delivery and management led) offer the highest potential for decentralised energy development/implementation.

Within each area of opportunity, areas of site opportunity are further illustrated based on the site appraisal. The areas of site opportunity display a good performance against the framework criteria (see Section 6.1).

In terms of phasing, the deployment of DE in the identified areas of opportunity could originally be established based on single-site schemes, with energy centres located in existing plant rooms/boiler houses or accommodated in the plant room of proposed developments, and where anchor heat load consumers could guarantee a baseload demand.

Within Hammersmith Town Centre, the King Street regeneration scheme could serve as an energy centre location when developed, compatible for connection to a wider district heating network. Safeguarding of plant space for the potential expansion of the energy centre to serve other nearby heat consumers would allow for future proofing of expansion capabilities. Latter phases of DE implementation could then consider the neighbouring Council owned housing estates and the Ravenscourt Park Hospital as additional anchor heat load consumers.

The Wider White City Area, through the public development area of Shepherds Bush Market and the Wood Lane Estate[28], offer a first phase delivery option for energy centre provision, with the further expansion of a heat supply network for the latter phases of development, i.e. the connection of the White City Estate, BBC Television Centre Complex, the BBC Media Village, and BBC White City building.

Phasing for the North Fulham area of opportunity is likely to be driven by planned regeneration. The large landowners in this area offer the best delivery opportunities for energy centre provision due to the subsequent development of large heat consumers, which could act as anchor heat load consumers, and sufficient levels of density and mix of uses to support the commercial viability of an ESCo operating in the area.

Initial or first phase DE delivery is typically driven by the identification of suitable energy centre locations that can readily overcome environmental constraints. DE network expansion and connection would organically evolve from a number of existing single-site schemes to multi-site mixed use schemes as the commercial viability of an expanded DE network improves. The timing for the connection of single-site schemes and heat consumers would be partly driven by the asset replacement cycles of the existing building stock. Any major new development within the areas of opportunity could also be compelled to connect into a DE network once it is in place. Therefore, alignment of planning policy with the finding of the heat mapping process is essential.

Over time, an area wide DE network could develop that interconnects the areas of opportunity though

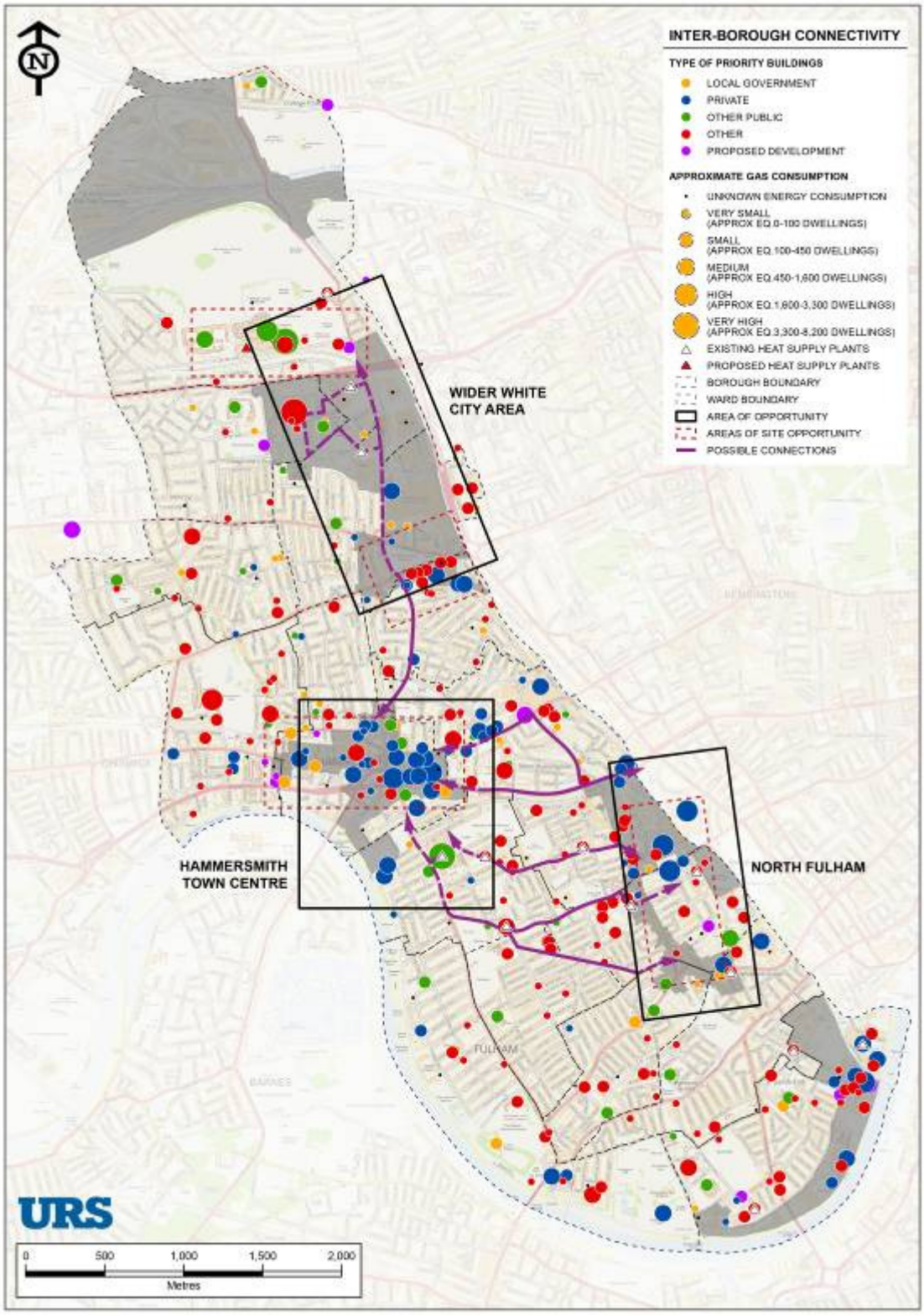
[28] The Draft *White City Area of Opportunity Energy Strategy*, LDA, June 2010, refers to the estate located to the north of the BBC Television Centre Complex as the Wood Lane Estate.

the multi-site mixed use schemes and the consolidation of energy production into fewer, larger, more efficient energy centres. Existing and proposed heat supply plants could offer the basis for interconnection, acting as connection nodes between the areas of site opportunity. Likely network routes should also be established and safeguarded, such as Shepherds Bush Road (likely connection route between Hammersmith Town Centre and the Wider White City areas of opportunity), and Fulham Palace Road, Lillie Road, Dawes Road, Talgarth Road and Greyhound Road (likely connection route between Hammersmith Town Centre and the North Fulham areas of opportunity) (see *Figure 6-5*).

When considering the Old Oak Common and Hythe Road and South Fulham Riverside areas of opportunity, whilst these areas were not shortlisted, safeguarding potential connection routes should still be considered. Scrubs Lane would be a likely connection route between Old Oak Common and Hythe Road and the Wider White City areas of opportunity. No obvious connection route is apparent between the North Fulham and South Fulham Riverside areas of opportunity due to the spatial arrangement of the priority buildings in the South Fulham Riverside area of opportunity. The priority buildings are distributed along the riverfront and any network connection routes would most likely be determined by the location of the developments seeking connection to a DE network.

As discussed in more detail in Chapter 7, limitations associated with the deployment of a DE network in the Borough are considered for immediate next steps to assess the feasibility of this overall spatial DE delivery scenario.

Figure 6-5: Inter-Borough Connectivity



6.4. Cross-Borough Linkages

Based on the identification of the shortlisted DE areas of opportunity in the Royal Borough of Kensington & Chelsea (RBKC)[29], and the London Boroughs of Brent (LBB)[30] and Ealing (LBE)[31] (determined through their respective heat mapping studies), an evaluation of opportunities for DE cross-borough linkages is presented in this section.

Cross-borough linkages can increase the viability of certain DE proposals, for example, by boosting the concentration of head demand and density levels, and offering a greater number of anchor heat load consumers that are in close proximity, even if not within the boundaries of LBHF.

Royal Borough of Kensington & Chelsea

The *RBKC Heat Mapping Study* identified ten areas where the potential exists for the deployment of DE:

- Zone 1 – Albertopolis;
- Zone 2 – Royal Hospitals;
- Zone 3 – Kensington High Street;
- Zone 4 – North Kensington;
- Zone 5 – Earls Court;
- Zone 6 – South Chelsea;
- Zone 7 – Brompton Road;
- Zone 8 – Olympia;
- Zone 9 – Cromwell Road; and
- Zone 10 – Notting Hill Gate.

The areas were assessed against a set of criteria and ranked in order of priority. Zones 1, 2, 4, 5 and 6 were found to have the highest potential for the implementation of DE.

The potential for connectivity between these Zones and the areas of opportunity for DE in LBHF is evaluated based on their spatial distribution.

Zone 1 includes the three large museums on Exhibition Road: the Natural History Museum, Victoria and Albert Museum, and the Science Museum. The Natural History Museum has an existing gas fired CCHP system and exports both heat and electricity to the adjacent Victoria and Albert Museum via district heating pipework and a private wire electrical connection, respectively. The Science Museum has a standalone gas fired CHP system.

Immediately north of the three museums is the main Imperial College campus and the Royal Albert Hall, though both sites are located just outside the boundary of RBKC in Westminster City Council (WCC). Imperial College has a very high heat demand (gas consumption of 81,400MWh in 2004/05, nearly three times the combined total of the identified museums) and has an existing 3.9MWe gas fired CHP unit.

The Royal Albert Hall has a moderate heat demand (gas consumption of 3,500MWh in 2004/05) and demonstrates an erratic heat demand profile given the fluctuating usage of the building. Other loads that could be connected to a DE network in this zone include several medium size hotels, a school and Brompton Oratory, a large church adjacent to the Victoria and Albert Museum.

All sites in this Zone are existing buildings with no significant new/future development planned. The *RBKC Heat Mapping Study* concluded that there may be an opportunity for the existing small DE network connecting the Natural History Museum and Victoria and Albert Museum to be expanded, and a larger DE network to be developed in the short term.

Zone 5 – Earls Court is seen as a potential bridge between Zone 1 and LBHF's North Fulham area of opportunity. Zone 5 was identified around the Earls Court Exhibition Centre and the surrounding Earls Court strategic development site, which is immediately adjacent to the North Fulham area of opportunity. Major redevelopment in the Earls Court area is planned in the long term and since the site straddles RBKC and LBHF, a network in this region would require some degree of cross-borough working. However, due to any planning submission for the area being subject to consent by both LBHF and RBKC, there is a significant opportunity for cross-borough working in support of DE delivery for the area of opportunity.

Zone 2 lies directly to the south of Zone 1 and is centred on two medium size specialist hospitals, the Royal Brompton (approximately 350 beds) and the Royal Marsden (approximately 270 beds). Neither hospital has a CHP plant at present. Other possible 'additional loads' in this zone include Chelsea Old Town Hall, Chelsea fire station, Holy Trinity school, several hotels and various residential buildings.

The Chelsea and Westminster Hospital (Zone 6) is also characterised by a high heat demand and is not known to have an existing CHP plant. Zone 6 is located in close proximity to LBHF, between the southern part of the North Fulham area of

[29] Entec, *Royal Borough of Kensington & Chelsea*, *Heat Mapping Study*, *Final Report*, May 2010

[30] Rambol, *London Heat Map Study for the London Borough of Brent*, May 2010

[31] Rambol, *London Heat Map Study for the London Borough of Ealing*, May 2010

opportunity and Zone 2, increasing the potential for cross-borough connectivity.

Zone 4, in the north of RBKC, lies to the north east of the Wider White City area of opportunity and is characterised by considerable long term regeneration and new development plans. The area offers the opportunity for a residential led DE network. The main strategic sites earmarked for development are Kensal Gasworks and the areas surrounding the existing North Kensington Sports Centre, with a smaller site at Wornington Green.

There are also various existing areas of social housing (including a number of tower blocks) which may benefit from a DE network. St Charles Hospital has also been identified as a good starting point from which a network could be developed, although the suitability for CHP was not investigated.

The *RBKC Heating Mapping Study* indicated it may be appropriate to develop smaller independent schemes in these areas, before linking these at a later date. This conclusion follows the approach discussed in Section 6.3, i.e. DE network expansion and connection would organically evolve to include multi-site mixed use schemes through a number of existing single-site schemes and neighbouring heat consumers.

Potential for linkages between Zone 4 and the Wider White City area of opportunity may exist through sites identified in this Study, such as the Burlington Danes School, located to the north of the Hammersmith Hospital, and the Woodmans Mews Estate, served by a 0.59MW central boiler. These sites are in close proximity to the St Charles Hospital in RBKC.

Zone 8 – Olympia, although of lower DE priority, has also been identified as one worth pursuing. This small zone is based around the Olympia Exhibition Centre and Hilton London Olympia. It could also incorporate a number of other smaller hotels, all of which are in very close proximity to each other. Few other large developments or existing sites were identified in the vicinity. Although no immediate area of opportunity was identified in LBHF in appropriate proximity to the Olympia Exhibition Centre, this area demonstrated a pocket of medium-high gas consumption. The area was found to be mainly characterised by terraced residential housing and some Council estate blocks (i.e. West Kensington Estate, Argyll Mansions and Palace Mansions).

London Borough of Ealing

Towards the north west of LBHF, the *London Heat Map Study for LBE* also identified eight focus areas which were ranked based on their potential to support a DE network:

- South Acton – High;
- Ealing Metropolitan Centre/Green Man Lane – High;
- Copley Estate – Medium/High;
- Farrier Rd/Union Rd – Medium/High;
- Ealing Hospital/Hanwell – Medium;
- Southall – Low;
- Greenford Rd – Low; and
- North Acton – Low.

South Acton is located to the north west of LBHF and to the west of the Wider White City area of opportunity. The *London Heat Map Study for LBE* indicates that a DE network in this area could be initiated by two new developments: Arcadia and Dickens Yard, which are large mixed-use developments with proposed community heating systems. Arcadia is to have a 90kWe CHP system. In the future, this network could encompass the Ealing Council building and other premises in the vicinity, as identified on the heat map.

A community heating scheme is proposed for the development at Green Man Lane. This network could be linked to the Ealing Metropolitan Centre network described above and then extend further west to connect Cambridge Yard and Ealing Hospital.

Although the distance between South Acton and the Wider White City area of opportunity is significant, potential linkages could be established between the two areas through connection of proposed and existing developments. Existing priority buildings in LBHF that could support this connectivity include the Becklow Garden Estate with 255 dwellings and Malvern Court (62 units) served by a central gas boiler of 0.49MW.

London Borough of Brent

The *London Heat Map Study for the LBB* identified eight focus areas that could develop heat networks, ranking them in order of priority;

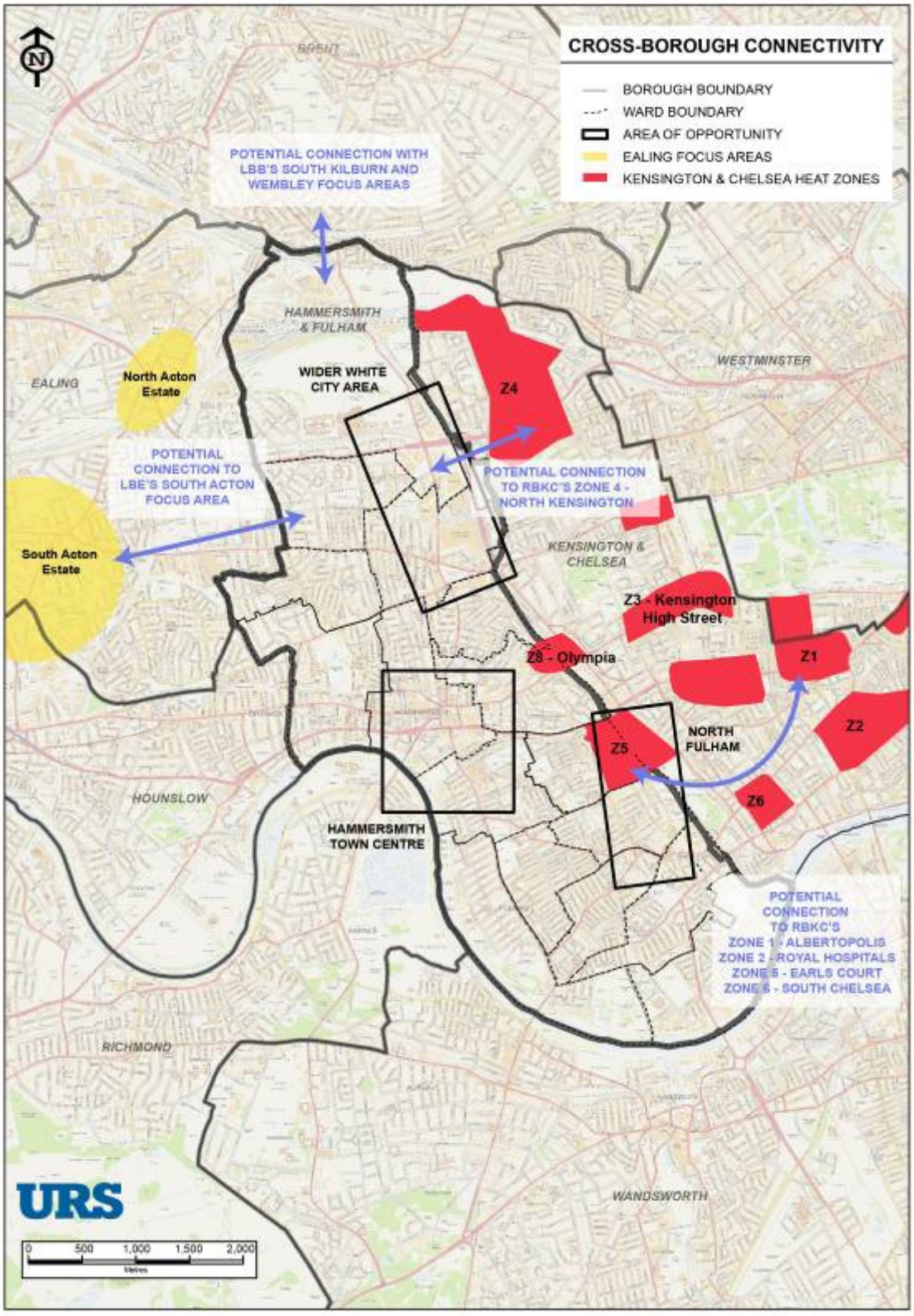
- South Kilburn – High;
- Wembley – High;
- Wembley Central – Medium/High;
- Northwick Park Hospital – Medium;
- Alperton – Medium;
- Church End – Medium;
- Burnt Oak/Colindale – Medium; and
- Park Royal – Low.

Due to their spatial distribution, potential connection between LBHF and LBB would need to occur through the Old Oak Common and Hythe Road

Area. The Government is proposing to reinforce the rail transport infrastructure in Old Oak Common as part of the HS2 rail hub proposals (see Section 5.3.1). This is likely to support higher levels of development than currently anticipated and offer the opportunity to support DE delivery. Connection would then be possible to the highest priority DE areas of South Kilburn and Wembley.

Figure 6-6 below spatially demonstrates the cross-borough connectivity options.

Figure 6-6: Cross-Borough Connectivity



7. NEXT STEPS

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

- Capacity building;
- Feasibility and delivery route; and
- Project definition and delivery.

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

- Heat mapping;
- Political support and commitment;
- Strategies and policies; and
- Budget commitment.

LBHF is currently undertaking the first stage of Phase 1, Heat mapping. The remainder of this chapter focuses on key recommendations on how the Council could follow up on the heat mapping work undertaken as part of this Study in order to complete Phase 1.

7.1. 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 LBHF. After completing the 'Capacity building' stage through the steps identified in this chapter, the Study could 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 heat load consumers. 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 core clusters/schemes;
- Identify anchor heat load consumers for core clusters/schemes;
- 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 clusters/schemes;
- 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 options;
- Estimate capital cost, energy sales, operating costs and any funding gap; and
- Consider implementation and 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 LBHF.

Building on the strategic criteria adopted in Section 6.1, the following considerations should be noted when furthering the work towards the implementation of DE networks in the Borough:

Technical and Environmental Considerations

Technical limitations that should be considered include the following:

- Identifying appropriate energy centre locations;
- 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.

In respect to the existing utility infrastructure provision, 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. Constraints that need to be considered in the potential use of existing infrastructure are:

- 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, e.g. tunnel space; and
- 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.

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

With regards to specific environmental constraints, potentially acceptable solutions include the use of emissions 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 generally only financially viable at large scale capacities.

A range of potential energy centre technologies and scales should be considered, with the aim of mitigating any impacts to an acceptable level. Consideration should be given to technologies with lower environmental impacts, such as gas fired CHP/CCHP plant.

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.

Financial Considerations

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 distribution infrastructure. 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 of core/anchor heat load consumers.

Smaller scale systems tend to have lower efficiencies, while the relative transaction costs to establish them may be higher. This is due to the fact that development costs associated with establishing a DE network are similar when a certain scale has been reached (MW capacity range). 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 improved costs per tonne of carbon dioxide emissions saved.

Deliverability and Management Considerations

In order to gain a comprehensive understanding of the management implications of any proposed DE network, the following will need to be explored with the client stakeholder group and beyond:

- What value each stakeholder attributes to participating in delivery of a DE network?
- What value each sees in potentially having access to a heat network?
- What potential value each sees in participating in delivery of heat generation, distribution or supply?
- What demand for energy centres or infrastructure or heat could they commit to, along which distribution routes or in which location, if the terms were right?
- What price range would make schemes attractive? and
- What resource (financial, technical, land, other) could they offer, if the terms were right?

A preliminary indication of interest has been gauged by means of a stakeholder consultation exercise that the Council has started as part of this heat mapping exercise.

More detailed responses to questions listed above should be assessed against each of the opportunity areas considered in this report.

7.2. 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 relevant Council departments/teams. Therefore, the Council should consider how it can help facilitate (and initiate) projects, and whether it can source and provide reasonably significant resources for up-front feasibility and project development work.

In gaining support, the Council can utilise the opportunity represented by the increasing interest in climate change and resource management issues, which has generated an increased focus on energy management and carbon dioxide emissions savings. The opportunities regarding installation of community infrastructure (in both new and existing developments) in LBHF may offer significant

reductions in CO_2 emissions and support energy security.

To reinforce the role of the Council, LBHF could consider identifying/creating a central 'Borough Champion' with responsibility for an inter- and cross-borough strategy for decentralised energy delivery. The 'Borough Champion' could be responsible for tasks such as:

- Clearly articulating the contribution decentralised energy generation and heat networks can make to meeting the Borough's CO_2 emissions savings 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 (i.e. to drive behavioural change), information and demonstrations to help build confidence and address organisational barriers; and
- Working with other responsible bodies to ensure the integrated delivery of community infrastructure.

Stakeholder engagement should be one of the key actions to be undertaken by the 'Borough Champion'. This will help gain buy in and bring about behavioural change that will support the deployment of DE networks.

The key stakeholders identified by this Study are presented in *Table 7-1*. The consultation should be designed to assess the potential stakeholders understanding of the benefits provided by the deployment of DE networks. A preliminary questionnaire 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 example, private sector buildings should be encouraged to publish their energy consumption information, e.g. 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.

At later stages of the DE programme, the '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; and
- Committing to changing estate management processes and investment cycles to link in their own property assets as anchor heat load consumers for DE networks. There may also be a need to commit the local authorities own resources.

Table 7-1: List of Potential Stakeholders

Hammersmith Hospital [WCOA]
Charing Cross Hospital [WCOA]
BBC [WCOA]
Imperial College London
Earls Court Exhibition Centre
Imperial Wharf
Broadway Shopping Centre
Empress State Building
Ibis Hotel
W12 Shopping Centre
Olympia Exhibition Centre
Millennium and Copthorne Hotels
The Ark
Wormwood Scrubs Prison [WCOA]
Fulham Broadway Retail Centre
Westfield Group
Westway Sports Centre
Hurlingham Club
Hammersmith and West London College
Wyndham Grand Hotel (Conrad Hotel and leisure centre)

7.3. Strategies and Policies

In order to secure investment, the Council will need to use its planning powers to ensure that consumers connect to heating networks. Developers should be required to incorporate CHP and communal heating on a site specific basis, and ensure that building services are designed to connect to wider networks in the future (future proofing).

Therefore, alignment of planning policy is a key consideration at this stage of the heat mapping process. The *Proposed Submission Core Strategy* states that that energy use in new development should be reduced by appropriate siting, design, landscaping and energy efficiencies within the building. Where buildings are converted or reused,

improvements in energy efficiency should also be implemented. Decentralised energy schemes which produce energy close to where it is used, typically CHP and CCHP, are more efficient than centralised electricity generation where heat and electrical power are wasted in production and transmission, respectively. Where possible, new development should link to existing decentralised energy networks and upgrade/reinforce these networks. New decentralised energy networks should be set up in regeneration areas and other areas where major development is taking place. Energy assessments will be required to demonstrate the carbon dioxide emissions savings achieved by the proposed development. New development also needs to maximise the amount of energy generated from renewable sources in order to meet renewable energy targets for London.

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 networks, 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 and domestic hot water heating systems that are supplied by communal boilers (and CHP plant), with future capped connection provision and safeguarded plant space for heat exchanger plant 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 Area Action Plans and Development Briefs. An example of this approach can be found in Barking & Dagenham, where the Council is seeking to develop a town centre district heating network.

The publication of an energy options map, where specific development sites and the preferred energy strategy options would be identified to inform developers, would also significantly increase the chances of project success by providing the necessary information to help stakeholders identify anchor heat load consumers that allow effective balancing of supply and demand. Specific carbon dioxide emissions savings targets could also be placed within key Council strategies.

As indicated in the Section 6.1, public sector or local authority buildings provide excellent anchor heat load potential. These buildings should be encouraged to connect to planned heating networks at the next available opportunity, i.e. at time of boiler replacement or when energy supply contract comes up for renewal.

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

7.4. Budget Commitment

During this stage, the Council would need to explore available funding streams to help secure a 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.

7.4.1. 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 Services Companies (ESCos). ESCos usually install, finance and manage community energy systems and, therefore, provide an efficient and comparatively lower risk approach to district heating network installation and 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 networks and private wire scheme). Table 7-2 presents a list of ESCos currently operating in London.

Table 7-2: ESCos operating in London

1. Cofely
2. E.ON
3. Dalkia
4. Inexus
5. SSE Utility Solutions

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 Council would need to act as either a partner or a key customer

(by utilising public sector buildings to provide guaranteed custom) for 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/CCHP 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 networks 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 need to be established with EDF[32] such that full electricity back-up is always available. This also ensures that the customer can maintain their right to switch electricity suppliers in line with EU competition regulations. This also motivates ESCos 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 residents/occupants in the correct operation of equipment and appliances.

[32] As owner of the National Grid, EDF would be the utility provider responsible for negotiating a third party connection to a private wire scheme. However, electricity customers are still able to select any electricity supplier as EDF is acting only as the infrastructure provider and not necessarily the electricity supplier.

7.4.2. 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 it 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.

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*[33], procurement routes could include:

- Identification of a private ESCo partner: selection of a specialist CHP provider through a tender process and based on competitive dialogue; and
- Establishment of a 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; and
    - Social enterprise: new enterprise established with local authority support (to provide covenant strength) and board representation.

A report by the London Energy Partnership[34] 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.

[33] TCPA & CHPA, *Community Energy: Urban Planning for a Low Carbon Future*, 2008

[34] London Energy Partnership, *Making ESCOs work – Guidance and advice on setting up and delivering an ESCO,* February 2007

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 anchor heat load consumers for community energy projects.

8. IMPLEMENTATION PLAN

Table 8-1: High Level Implementation Plan

	DE Opportunity	Priority	Notes	Planning Status	Barriers	Next Steps	Key dates	Responsible person
	(Identified by location, name of development, scheme name or other)	(High, Medium or Low based on highest potential for delivery)	(Basis of assessment of delivery potential)	(Planning permission granted, outline application, detailed application, etc.)	(Potential barriers for delivery of opportunity identified)	(Next steps for LA to facilitate delivery of opportunity identified)	(If action is not taken by this date the potential for delivery of the scheme may be reduced)	(Person responsible for taking action)
1	**Hammersmith Town Centre:** offers a very good fit with the DE implementation objectives, particularly when considering the technical parameters							
1a	Charing Cross Hospital	High	The hospital could offer a reliable and constant anchor heat load consumer base. Based on information collected through this Study, the hospital is currently served by central boiler plant and would theoretically be compatible with connection to a district heating network. It could further offer an opportunity for energy centre provision.	Existing building			Key dates are difficult to set at Phase 1 of the heat mapping process as they are usually dependent on the findings of further investigations. The implementation plan for each DE area of opportunity, including notes on key dates for further developments, will be updated as progress is made.	Main contact: Paul Baker, Planning Division T: 020 8753 3431 E: paul.baker@lbhf.gov.uk
1b	Ravenscourt Park Hospital	Medium	Depending on current servicing strategy and asset replacement cycles, and with an estimated heat demand of 15,000MWh/year, the hospital could reliably serve as an anchor heat load consumer and offer an opportunity for energy centre provision.	The hospital is currently not operational, but according to discussions with the Council it is anticipated to re-open in the near future.	No information is available with regards to the timeframe of when the hospital will become functional or its servicing strategy, and whether it is compatible with connection to a DE network.	Contact the relevant NHS Trust for accurate information on the hospital's re-opening timeframes and technical details regarding its servicing strategy.		
1c	Melcombe Primary School	Medium	The school has an internal floor area of approximately 2,500m^2, an estimated heat demand of 700MWh per year and could function as a secondary heat consumer to a potential DE network anchored at the Charing Cross Hospital. Currently, heating is provided by two gas boilers, with a separate boiler for domestic hot water (with storage), demonstrating compatibility with a district heating network. It offers a means of improving the commercial viability of an ESCo operating in the Hammersmith Town Centre area of opportunity.	Existing building	The boiler replacement cycle and whether an opportunity exists to replace these with a district heating connection or future proof for later connection.	Gather information on replacement/maintenance cycle.		
1d	King Street regeneration scheme	High	The scheme proposes the redevelopment of the land adjacent to the existing Hammersmith Town Hall to create a new mixed-use campus of retail and residential accommodation, together with a new Civic Square and associated public realm. A community energy system will be implemented, with a single Energy Centre providing heating and electricity to the whole development, employing a 220kWe gas fired CHP unit.	Currently at the planning application stage	Works are to start on site in 2012. The proposed energy centre could be compatible for connection to a wider community heating system and could ensure that sufficient plant space is safeguarded for possible expansion of the system to serve other nearby heat customers.	Review planning application for information relevant to the compatibility of the scheme with connection to or expansion of a district heating network. Request information of plant space availability.		

	DE Opportunity	Priority	Notes	Planning Status	Barriers	Next Steps	Key dates	Responsible person
			It offers wider economic impacts as it allows for infrastructure investment. Delivery and management risks are minimal as this scheme offers commercial viability and reduced financial risks for prospective ESCos.					
1e	Stamford Court Estate (127 units; due for boiler replacement 2013-14) Park Court Estate (63 units) Kings Court Estate (128 units) Flora Gardens Estate (197 units)	Low	These estates offer delivery opportunities whilst mitigating delivery risks, as the associated heat demand and level of density significantly improves the commercial viability of an ESCo.	Existing housing estates	Confirmation of ownership; current servicing strategy.	Resolve ownership issue. For those housing estates identified as Council owned (Flora Gardens Estate), gather and review information on servicing strategy, plant replacement cycle, and plant space availability for energy centre provision.		
1f	Godolphin and Latymer School	Low	The school is located to the north of the Town Centre area and has an estimated gas consumption of approximately 1,100MWh. It would lend itself to connection to DE system.	Existing school	Distance of the school from larger heat consumers that may act as anchor heat load consumers/energy centre locations.	Gather and review information on servicing strategy and plant replacement cycle. Investigate potential for connection to a future district heating network.		
1g	Novotel Hotel, Broadway Shopping Centre, Kings Mall and Metro Building	Low	These private commercial buildings could act as heat consumers and provide the diversity of loads necessary to balance the demand profile and increase the feasibility of a DE network.	Existing private buildings	Stakeholder buy in, perceived financial risks, and compatibility with of servicing strategy for connection to a district heating network.	Engage with the relevant building owners to gauge interest in a potential district heating connection. Assess the technical ramifications to do so.		
2	**Wider White City Area:** offers a very good fit with the DE implementation objectives, particularly when considering the delivery and management parameters							
2a	White City Estate	High	The White City Estate encompasses 35 blocks with approximately 2,000 units.	The *Proposed Submission Core Strategy* identifies the potential for estate regeneration in the future; however, this has not been studied in detail. In the event that estate redevelopment is undertaken, including the community uses, there might be a possibility for some land to be used to house an energy centre.	Existing servicing strategy	Monitor the progress of the regeneration plans; investigate opportunities for energy centre provision within the scheme.	Key dates are difficult to set at Phase 1 of the heat mapping process as they are usually dependent on the findings of further investigations. The implementation plan for each DE area of opportunity, including notes on key dates for further developments, will be updated as progress is made.	Main contact: Paul Baker, Planning Division T: 020 8753 3431 E: paul.baker@lbhf.gov.uk
2b	BBC Media Village	High	The BBC Media Village is served by an energy centre. The site was identified as a potential part of a wider DE network since at the time of plant refurbishment it could potentially be connected into a district heating network.	The site is expected to remain in its current form for the long term with no current plans for plant replacement or refurbishment.		Approach through the stakeholder consultation process to gauge interest in potential to connect to a district heating network.		
2c	BBC Television Centre Complex	Low	The majority of the existing complex is serviced from a central energy centre.	Over the coming years the facilities will either be consolidated into the BBC Media Village or moved off site (primarily to the new site in Salford). This move was originally scheduled for 2012, but the BBC now believes that it may be 2015 before the move is complete.	There are currently no known plans for the site after the BBC leave; however, it seems likely that the site will be developed within the timeframe of the WCOA.	Given its location between two significant regeneration areas, any planned distributed energy systems in these areas should take account of the fact that an additional large heat load may arise at some point after 2015. Approach the BBC through a stakeholder consultation		

	DE Opportunity	Priority	Notes	Planning Status	Barriers	Next Steps	Key dates	Responsible person
						process.		
2d	BBC White City building	Medium	The BBC White City building sits directly next to the Media Village. All heat to the building is supplied via central plant.	Condensing gas boilers are due to be installed within the next year. During the replacement of boilers the building could be future proofed for connection to a potential district heating network in the future.		Engage with the BBC to ensure future proofing measures are integrated into the servicing strategy.		
2e	Hammersmith Hospital	Low	Currently in the process of upgrading its heat generation and distribution systems across the site. It is anticipated that once upgraded, around 60-70% of the demand of the site will be provided by a low temperature hot water system with the remainder of the system still under review.	Two 1MWe gas fired CHP engines will soon be operational at the hospital.	The proposed CHP plants have been sized with capacity to meet all expected loads in the medium term development plan and no spare capacity is expected on site. In the summer there may be some potential for exporting heat to a district heating network to enable an increase in CHP load factor but it is recognised that the cost of pipework infrastructure would have to be justified by the sale of relatively small amounts of heat in the summer. This is therefore unlikely to be viable. The opportunity to house additional CHP plant at the hospital was discussed but this was not found to be possible.	Engage Hammersmith Hospital in the stakeholder consultation process.		
2f	Phoenix High School	Medium	The Phoenix High School is located to the west of White City Estate. Given the significant heating demand potential and the existing centralised heating plant, the school may be considered as a potential heat customer.	The school is due to be redeveloped (6th form block addition) between 2012 and 2014.	Plant replacement cycle is unknown.	Monitor the redevelopment plans for the school and gather information relevant to the servicing strategy.		
2g	Wormwood Scrubs Prison	Medium	The Wormwood Scrubs prison is located to the north of the WCOA area.	The current system was installed in around 1985 and is likely to be replaced in the next two years.	There is a need for high levels of resiliency to maintain security integrity. This means there is a need to maintain the current modular system of individual boilers within each building/wing, in parallel with connection to a district heating network. This would significantly impact on the commercial viability. The distance of the prison from the core WCOA regeneration areas is a factor in determining the economic benefit and would have to be considered in more detail.	It is recommended that the role of the prison is further explored as and when more detailed proposals for DE schemes within the OA are developed.		
2h	Westfield Shopping	Medium	Heating to the existing Westfield	The energy centre plant was	Plant replacement cycle is	The potential should be		

	DE Opportunity	Priority	Notes	Planning Status	Barriers	Next Steps	Key dates	Responsible person
	Centre		Shopping Centre is provided via a centralised boiler system. This would in theory be compatible with a connection to a district heating network. Westfield Shopping Centre is open to the principle of purchasing heat from a DHN and is doing so for their Stratford City development. Westfield have also submitted a pre-application outlining the possible provision of 60,000m2 of retail and 2,500 residential units immediately to the north east of the Westfield site.	installed in 2008 and is therefore not expected to need replacing until around 2028.	unknown.	explored again when the services are replaced. Another alternative is to assess the opportunity for plant retrofit to accommodate a district heating connection (integration of capped connections within the primary heating circuit). If the Westfield extension proposals are implemented, this proposal would support DE provision for both sites through an energy centre that could also connect and supply heat and power to the existing Westfield Shopping Centre. The Council should seek to achieve this through the planning application process.		
2i	Shepherds Bush Market and the Wood Lane Estate public development area	High	The Public Development area, including the Shepherds Bush market and the Wood Lane Estate, is under the ownership of LBHF. As such it represents a major opportunity for catalysing the development of a DE scheme within the area.	Development area		Monitor development proposals and site allocation to ensure compatibility with connection to and development of DE.		
2j	Canberra Primary School and Pope John School	Medium	Located in close proximity to the east and south of White City Estate, respectively. Although smaller in terms of floor area than the Phoenix High School, with an approximate area of 2,800m^2 and 1,800m^2, these schools would also offer an opportunity for connection to a district heating network that may emerge from the regeneration opportunities in the White City Estate.	Existing buildings	Unknown servicing strategy and plant replacement cycles. DE opportunity only feasible through connection to a future district heating network linked to neighboring anchor heat load consumers.	Gather information on existing servicing strategy and plant replacement cycles.		
3	**North Fulham**: offers a very good fit with the DE implementation objectives, particularly when considering the technical, and delivery and management parameters							
3a	Earls Court Exhibition Complex	High	There are 9.5ha of land in this area of opportunity, owned by Transport for London and Capital & Counties (owners of Earls Court & Olympia), which is likely to become available for development from 2012 with the expected closure of the Earls Court Exhibition Complex, together with the Earls Court car park in Seagrave Road (2.5ha). Information in the *Proposed Submission Core Strategy* suggests that the scheme would be a residential led mixed use scheme and, therefore, this area has the potential to accommodate a district heating network.	This area will become available for development from 2012.		Monitor development proposals and site allocation to ensure compatibility with connection to and development of DE.	Key dates are difficult to set at Phase 1 of the heat mapping process as they are usually dependent on the findings of further investigations. The implementation plan for each DE area of opportunity, including notes on key dates for further developments, will be updated as progress is made.	Main contact: Paul Baker, Planning Division T: 020 8753 3431 E: paul.baker@lbhf.gov.uk
3b	Walham Green Court Estate	Medium	151 units served by an existing community heating system/network. The Walham Green Court central	Existing housing estate The Council will continue to formulate policy to encourage	Ownership, current servicing and plant replacement strategy.	Resolve ownership issue. For those housing estates identified as Council owned,		

	DE Opportunity	Priority	Notes	Planning Status	Barriers	Next Steps	Key dates	Responsible person
			boiler (1.63MW) is scheduled for replacement in 2012-2013.	any new networks to link up the Borough's existing district heating networks.				
3c	Star Road Estate	Medium	209 units served by an existing community heating system/network. There are two boiler rooms at the Star Road Estate, housing boilers of a total capacity of 2.61MW. One of the boilers is scheduled for replacement in 2013-14.	Existing housing estate The Council will continue to formulate policy to encourage any new networks to link up the borough's existing district heating networks.	Ownership, current servicing and plant replacement strategy	gather and review information on servicing strategy, plant replacement cycle, and plant space availability for energy centre provision.		
3d	Seagrave Estate	Low	121 units The estate is served by a central boiler (1.06MW) due for replacement between 2012 and 2014.	Existing housing estate	Ownership, current servicing and plant replacement strategy.			
3e	Michael Stewart House Estate	Low	104 units and houses a central boiler of 0.7MW capacity.	Existing housing estate	Ownership, current servicing and plant replacement strategy.			
3f	London Oratory School	Low	Has an internal floor area of 16,000m^2 and an estimated gas consumption of 5,000MWh/year, providing a steady heat load opportunity.	Existing building	Current servicing and plant replacement strategy.	The school's existing heating infrastructure and compatibility for connection to a district heating network would need to be investigated further.		

APPENDIX A – DATA COLLECTION QUESTIONNAIRE

London Borough of Hammersmith and Fulham Heat Mapping Study

1. Heat Mapping Study

Hammersmith and Fulham Council Heat Map Project

Data Collection Questionnaire – District Heating Networks (DHN) in H&F

On behalf of Hammersmith and Fulham Council and the London Development Agency, URS are carrying out a heat mapping study. As part of the study, we need to collate energy consumption data for high energy users across the borough to establish the locations of any clusters of high energy consumption which may be suitable for a district heating network. Your building has been identified as a potential high energy user and one which could benefit in the future from a local network.

Community or district heating is the most common form of decentralised energy supply. 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.

We would like to request data on your building's energy consumption to help create a detailed heat map for the borough. We would therefore greatly appreciate your time in completing the following questionnaire as precisely as possible. However should you not have the exact information we would be grateful if you could provide an estimate.

The information provided in this survey will be used for the purpose of the study only. Organisations will not be identified with specific responses in the heat mapping study.

If you would like to contact the Council to discuss this project, please contact:Paul Baker, Senior Environment Policy & Projects Officer: paul.baker@lbhf.gov.uk / 020 8753 3431.

For further information on heat mapping please see: londonheatmap.org

2.

* 1. What is your Company/Organisation name?

* 2. What is your address?

Number/Street

Postcode

* 3. Information

Your name

Your position

E-mail address

Telephone number

Core nature of business

3.

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London Borough of Hammersmith and Fulham Heat Mapping Study

* 4. Please indicate facility ownership. Choose appropriate option:

- ◯ Public
- ◯ Private
- ◯ Other

Other (please specify)

* 5. Please indicate the type of facility

- ◯ Offices
- ◯ Commercial
- ◯ Sport and Leisure
- ◯ Hotel
- ◯ Educational
- ◯ Hospital
- ◯ Residential
- ◯ Other

Other (please specify)

4.

* 6. What is the building's internal floor area in square metres? (If exact area is not known an estimate can be entered)

* 7. What is the number of dwellings in the building? (If not applicable enter N/A)

5.

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London Borough of Hammersmith and Fulham Heat Mapping Study

8. Which of the following is the heating/hot water supplied by?

- ☐ Individual Boilers
- ☐ Electric Heating
- ☐ Central Gas Boiler
- ☐ CHP (Combined Heat and Power)
- ☐ District Heating
- ☐ Other

Other (please explain)

6.

9. If there are any communal boilers or combined heat and power (CHP) plants serving your building, please respond to the following questions.

If not, please proceed to question 10.

If exact figures are not know estimates can be entered.

a. What is the fuel source (for example, natural gas, renewable energy sources, etc)	
b. What is the installed capacity (e.g. size of boilers in kW/MW)	
c. What is the fuel consumption (MWh/year)	
d. What is the heat generation (MWh/year)	
IN CASE OF A CHP PLANT: a. What is the installed thermal capacity (MWth)?	
b.What is the installed power (MWe)?	

7.

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London Borough of Hammersmith and Fulham Heat Mapping Study

10. Choose the appropriate fuel source for your heating/hot water:

- ☐ Natural gas
- ☐ Electricity
- ☐ Oil
- ☐ Biofuel
- ☐ LPG
- ☐ Other

Other (please explain)

11. What was the total fuel consumption for heating/hot water for the previous year (MWh/year) (e.g. gas bill)?

12. What was the total fuel consumption for electricity for the previous year (MWh/year) (e.g. electricity bill)?

8.

13. What was the annual carbon footprint last year of the building (tonnes CO2/year)?

Thank you very much for your time.

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APPENDIX B – SUMMARY OF QUESTIONNAIRE RESPONSES

London Borough of Hammersmith and Fulham Heat Mapping Study

1. What is your Company/Organisation name?

	Response Count
	35
answered question	35
skipped question	0

2. What is your address?

	Response Percent	Response Count
Number/Street	100.0%	35
Postcode	100.0%	35
answered question		35
skipped question		0

3. Information

	Response Percent	Response Count
Your name	100.0%	35
Your position	100.0%	35
E-mail address	100.0%	35
Telephone number	100.0%	35
Core nature of business	100.0%	35
answered question		35
skipped question		0

4. Please indicate facility ownership. Choose appropriate option:

	Response Percent	Response Count
Public	40.0%	14
Private	42.9%	15
Other	17.1%	6
Other (please specify)		6
answered question		35
skipped question		0

5. Please indicate the type of facility

	Response Percent	Response Count
Offices	11.4%	4
Commercial	5.7%	2
Sport and Leisure	8.6%	3
Hotel	5.7%	2
Educational	37.1%	13
Hospital	2.9%	1
Residential	8.6%	3
Other	20.0%	7
Other (please specify)		7
answered question		35
skipped question		0

6. What is the building's internal floor area in square metres? (If exact area is not known an estimate can be entered)

	Response Count
	27
answered question	27
skipped question	8

7. What is the number of dwellings in the building? (If not applicable enter N/A)

	Response Count
	27
answered question	27
skipped question	8

8. Which of the following is the heating/hot water supplied by?

	Response Percent	Response Count
Individual Boilers	48.0%	12
Electric Heating	4.0%	1
Central Gas Boiler	40.0%	10
CHP (Combined Heat and Power)	8.0%	2
District Heating	8.0%	2
Other	16.0%	4
Other (please explain)		4
answered question		25
skipped question		10

9. If there are any communal boilers or combined heat and power (CHP) plants serving your building, please respond to the following questions. If not, please proceed to question 10. If exact figures are not know estimates can be entered.

	Response Percent	Response Count
a. What is the fuel source (for example, natural gas, renewable energy sources, etc)	100.0%	11
b. What is the installed capacity (e.g. size of boilers in kW/MW)	81.8%	9
c. What is the fuel consumption (MWh/year)	81.8%	9
d. What is the heat generation (MWh/year)	81.8%	9
IN CASE OF A CHP PLANT: a. What is the installed thermal capacity (MWth)?	27.3%	3
b.What is the installed power (MWe)?	27.3%	3
answered question		11
skipped question		24

10. Choose the appropriate fuel source for your heating/hot water:

	Response Percent	Response Count
Natural gas	77.3%	17
Electricity	18.2%	4
Oil	9.1%	2
Biofuel	4.5%	1
LPG	0.0%	0
Other	4.5%	1
Other (please explain)		2
answered question		22
skipped question		13

11. What was the total fuel consumption for heating/hot water for the previous year (MWh/year) (e.g. gas bill)?

	Response Count
	19
answered question	19
skipped question	16

12. What was the total fuel consumption for electricity for the previous year (MWh/year) (e.g. electricity bill)?

	Response Count
	18
answered question	18
skipped question	17

13. What was the annual carbon footprint last year of the building (tonnes CO2/year)?	
	Response Count
	15
answered question	15
skipped question	20

APPENDIX C – PRIORITY BUILDINGS DATA FOR THE SHORTLISTED DE AREAS OF OPPORTUNITY

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
CHARING CROSS HOSPITAL	FULHAM PALACE ROAD, LONDON	W6 8RF	Other public	No	NHS	Central Boilers	Natural gas	44,000	0
The Broadway Shopping Centre – Office (including Coca-Cola)	The Broadway Shopping Centre, Hammersmith, London	W6 9YE	Private	No	Private commercial (> 9,999m^2)			10,418	0
Novotel (Accor UK)	1 Shortlands, London	W6 8DR	Private	No	Hotels (> 99 bedrooms or 4,999m^2)	Individual boilers	Natural gas	9,172	630
The Ark	201 Talgarth Road	W6 8BJ	Private	No	Private commercial (> 9,999m^2)			5,162	0
LATYMER COURT	HAMMERSMITH ROAD, LONDON	W6 7JB	Other	No	Multi-address buildings			4,682	385
Visit Britain (UK) Ltd	Thames Tower, Blacks Road, London	W6 9EL	Private	No	Private commercial (> 9,999m^2)			3,844	0
Bechtel Ltd	245 Hammersmith Road, London	W6 8PW	Private	No	Private commercial (> 9,999m^2)			3,659	0
Walt Disney and Co. Ltd	3 Queen Caroline Street, London	W6 9PE	Private	No	Private commercial (> 9,999m^2)			3,596	0
Broadway Shopping Centre – Retail (Ground floor)	The Broadway Shopping Centre, Hammersmith, London	W6 9YE	Private	No	Private commercial (> 9,999m^2)			2,903	0
L'Oreal (UK) Ltd (includes Accor UK Business & Leisure Hotels Ltd)	255 Hammersmith Road, London	W6 8PL	Private	No	Private commercial (> 9,999m^2)			2,869	0
The Sporting Exchange Ltd	Waterfront Hammersmith Embankment, Chancellors Road, London	W6 9RU	Private	No	Private commercial (> 9,999m^2)			2,732	0

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
ASHCROFT SQUARE	KING STREET, LONDON	W6 0JU	Other	No	Multi-address buildings			2,712	223
Express Holiday Inn	124 King Street	W6 0QU	Private	No	Hotels (> 99 bedrooms or 4,999m^2)			2,506	135
Harper Collins	Elsinore House, 77 Fulham Palace Road, London	W6 8JA	Private	No	Private commercial (> 9,999m^2)			2,477	0
Metro Building	1 Butterwick, Hammersmith	W6 8DL	Private	No	Private commercial (> 9,999m^2)			2,458	0
Flora Gardens	100 FLORA GARDENS, LONDON	W6 0HR	Other	No	Multi-address buildings			2,396	197
Riverside	Manbre Road	W6 9WA	Private	No	Private commercial (> 9,999m^2)			2,334	0
Actix Ltd (includes Sony Ericsson Ltd, Sony Ericsson House	200 Hammersmith Road, London	W6 7DJ	Private	No	Private commercial (> 9,999m^2)			2,230	0
West London Courthouse	181 Talgarth Road	W6 8DN	Local Government	No	Other public buildings			2,066	0
MWB Hammersmith Grove (including George House)	26/28 Hammersmith Grove	W6 7AW	Private	No	Private commercial (> 9,999m^2)			2,027	0
Carling Apollo	45 Queen Caroline Street	W6 9QH	Other	No	Other public buildings			1,850	0
PROPOSED – King Street GIA Residential (27,870m^2)	King Street	W6 9JU	Local Government	Yes	Local government estate			1,679	0

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
HAMMERSMITH POLICE STATION, METROPOLITAN POLICE	SHEPHERDS BUSH ROAD, LONDON	W6 7NX	Other public	No	Police stations			1,415	0
United International Pictures	U I P House, 45 Beadon Road, London	W6 0EG	Private	No	Private commercial (> 9,999m^2)			1,414	0
ST. PAULS GIRLS SCHOOL	Brook Green, London	W6 7BS	Other	No	Education facilities			1,227	0
GODOLPHIN & LATYMER SCHOOL	Iffley Road, London	W6 0PG	Other	No	Education facilities			1,141	0
SACRED HEART HIGH SCHOOL	212 Hammersmith Road, London	W6 7DG	Other public	No	Education facilities		Natural gas	1,111	0
FISH4 Trading Ltd	3rd Floor Broadway Chambers, 14-26 Hammersmith Broadway	W6 7AF	Private	No	Private commercial (> 9,999m^2)			947	0
Kings Mall (including Lyric Theatre)	King Street	W6 9HW	Private	No	Private commercial (> 9,999m^2)			860	0
Jobcentre Plus	22 Glenthorne Road	W6 0NG	Private	No	Private commercial (> 9,999m^2)			825	0
HAMMERSMITH POLICE STATION, BRITISH TRANSPORT POLICE	FULHAM PALACE ROAD, LONDON	W6 8AU	Other public	No	Police stations			739	0
MELCOMBE PRIMARY SCHOOL	Fulham Palace Road, London	W6 9ER	Other public	No	Education facilities		Natural gas	707	0
Hammersmith & Fulham London Borough Council Town Hall	King Street, London	W6 9JU	Local Government	No	Local government estate		Natural gas	615	0

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
Marks and Spencer Plc	27-37 King Street, London	W6 9HW	Private	No	Private commercial (> 9,999m^2)			609	0
77-89 Glenthorne Road	77 Glenthorne Road	W6 0LJ	Local Government	No	Local government estate		Natural gas	583	0
Macbeth Centre	Macbeth Street	W6 9JJ	Local Government	No	Local government estate		Natural gas	550	0
Cambridge House	100 Cambridge Grove	W6 0LE	Local Government	No	Local government estate		Natural gas	519	0
Newwave Recruitment Ltd	Brittania House, 11 Glenthorne Road	W6 OLH	Private	No	Private commercial (> 9,999m^2)			476	0
Universal Music (UK) Ltd	1 Sussex Place, London	W6 9EA	Private	No	Private commercial (> 9,999m^2)			430	0
PROPOSED – Kelvin House	63-75 Glenthorne Road	W6 0LJ	Private	Yes	Multi-address buildings			428	67
PROPOSED – King Street GIA Civic Office Space (10,870m^2)	King Street	W6 9JU	Local Government	Yes	Local government estate			412	0
Hammersmith & Fulham Archives and Local History Centre	The Lilla Huset, 191 Talgarth Road	W6 8BJ	Other	No	Museums & Art Galleries			410	0
FLORA GARDENS PRIMARY SCHOOL	Flora Gardens Primary School, Dalling Road, London	W6 0UD	Other public	No	Education facilities		Natural gas	395	0
Boots	43 King Street	W6 9HW	Private	No	Private commercial (> 9,999m^2)			339	0

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
Primark Stores Ltd	Unit 1, Kings Mall, King Street	W6 0PZ	Private	No	Private commercial (> 9,999m^2)			300	0
ST. PAULS PRIMARY SCHOOL	Worlidge Street, London	W6 9BP	Other	No	Education facilities			293	0
Hammersmith Library	Shepherds Bush Road	W6 7AT	Local Government	No	Local government estate		Natural gas	254	0
CAMBRIDGE SCHOOL	Cambridge Grove, London	W6 0LB	Other public	No	Education facilities		Natural gas	248	0
51 Glenthorne Road	51 Glenthorne Road	W6 0LR	Local Government	No	Local government estate			225	0
Diners Club (UK) Ltd	Griffin House, 161 Hammersmith Road, London	W6 8BS	Private	No	Private commercial (> 9,999m^2)			225	0
PROPOSED – King Street GIA Retail Food Store (2,694m^2)	King Street	W6 9JU	Local Government	Yes	Local government estate			207	0
145 King Street	145 King Street	W6 9JT	Local Government	No	Local government estate		Natural gas	202	0
St Paul's, Hammersmith	QUEEN CAROLINE STREET, LONDON	W6 9PJ	Other	No	Churches			180	0
Hammersmith & Fulham Irish Centre	Blacks Road	W6 9DT	Other	No	Museums & Art Galleries			160	0
The Lilla Huset	191 Talgarth Road	W6 8BJ	Local Government	No	Local government estate		Natural gas	149	0
St John the Evangelist	GLENTHORNE ROAD, LONDON	W6 OLS	Other	No	Churches			128	0

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
MACE MONTESSORI SCHOOL	30-40 Dalling Road, London	W6 0JB	Other	No	Education facilities			104	0
PROPOSED – St Paul's Church	QUEEN CAROLINE STREET, LONDON	W6 9PJ	Other	Yes	Churches			99	0
Omni Facilities Management Plc	3 Albion Court, Albion Place	W6 0QT	Private	No	Private commercial (> 9,999m^2)			51	0
Play Facilities: Kidsa and Company Play Group	Distillery Lane	W6 9SA	Local Government	No	Other public buildings		Natural gas	51	0
PROPOSED – King Street Retail (A3) (10,000m^2)	King Street	W6 9JU	Local Government	Yes	Local government estate			44	0
Holy Trinity	41 BROOK GREEN, LONDON	W6 7BL	Other	No	Churches			10	0
Kanoon Towhid Islamic Centre	SOUTHERLAND ROAD, LONDON	W6 0PH	Other	No	Churches			8	0
Broadway Squash & Fitness Centre (Hammersmith Fitness and Squash Centre)	1 Chalkhill Road, London	W6 8DW	Other	No	Sport & Leisure Facilities			0	0
Virgin Active Hammersmith	181 Hammersmith Road	W6 8BT	Private	No	Sport & Leisure Facilities			0	0
PROPOSED – Hammersmith Embankment Phase 3	Chancellors Road	W6 9SF	Private	Yes	Private commercial (> 9,999m^2)			0	0
Kelmscott House Museum (William Morris Society)	26 Upper Mall	W6 9TA	Other	No	Museums & Art Galleries			0	0
Riverside Studios	Crisp Road, London	W6 9RL	Other	No	Museums & Art Galleries			0	0

Name	Address	Postcode	Ownership	New Development	Typology	Heating Supply	Fuel source	Fuel Consumption (MWh/year)	Dwellings/ Bedrooms
Aspen Gardens	32 ASPEN GARDENS, LONDON	W6 9JE	Other	No	Multi-address buildings			0	0
40a Cromwell Avenue	40a Cromwell Avenue	W6 9LA	Local Government	No	Local government estate			0	0

APPENDIX D – CONSULTATION LOG

	Address	Post Code	Data collection – Contact date	Questionnaire Sent?[35]	Questionnaire Completed?
Museums & Art Galleries					
Bharatiya Vidya Bhavan Institute Ltd	4a Castletown Road, London	W14 9HE	21/09/2010	Yes	Yes
Hammersmith & Fulham Irish Centre	Blacks Road	W6 9DT	21/09/2010	Yes	
Kite Studios	2b Bassein Park Road, London	W12 9RY	21/09/2010	Yes	
Fulham Palace	Bishops Avenue	SW6 6EA	21/09/2010	Yes	Yes
Hammersmith & Fulham Archives and Local History Centre	The Lilla Huset, 191 Talgarth Road	W6 8BJ	21/09/2010, 24/09/2010	No	
Pilar Corrias Ltd	37 Ongar Road, London	SW6 1SL	21/09/2010, 24/09/2010	No	
Rebecca Mills Ltd	42 Orbain Road, London	SW6 7JY	21/09/2010, 24/09/2010	No	
Kelmscott House Museum (William Morris Society)	26 Upper Mall	W6 9TA	21/09/2010, 24/09/2010	No	
Westminster Dragoons Museum	87 Fulham High Street, Fulham, London	SW6 3JS	21/09/2010	Yes	
Ayagallery	15 Fulham High Street	SW6 3JH	21/09/2010, 24/09/2010	No	
Bhavan Centre – Institute of Indian Culture	Old Church Buildings, 4a Castletown Road	W14 9HQ	21/09/2010	Yes	

[35] Constraints were identified throughout the study, such as the difficulty in identifying relevant 'energy/facility manager' or other person with access to appropriate data. Additionally, some organisations had no incentive to provide their energy consumption information, especially in cases where such data was considered confidential. Some organisations were not able to respond within the timeframe of the engagement stage and in some cases energy records were collected and managed centrally at the head office for which contact information was not provided within the timeframe of the study.

	Address	Post Code	Data collection – Contact date	Questionnaire Sent?[35]	Questionnaire Completed?
Louise T Blouin Institute	3 Olaf Street	W11 4BE	21/09/2010	Yes	
Zest Gallery	Roxby Place	SW6 1RS	21/09/2010	Yes	
Riverside Studios	Crisp Road, London	W6 9RL	21/09/2010	Yes	
Private (Commercial)					
BBC WOODLANDS (MEDIA VILLAGE)	201 Wood Lane	W12 7RJ/7TQ		No	
David Lloyd Leisure Ltd (part of Fulham Broadway Retail Centre)	Unit 24, Fulham Broadway Retail Centre, Fulham Road, London	SW6 1BW	24/09/2010, 30/09/2010 follow up call	Yes	Yes
MWB Hammersmith Grove	26/28 Hammersmith Grove	W6 7BA	28/09/2010, 30/09/2010 follow up call	Yes	
Westfield	Ariel Way	W12 7GF	28/09/2010	No	
Broadway Shopping Centre	Hammersmith, London	W6 9YE	21/09/2010, 30/09/2010 follow up call	Yes	
Hammersmith & Fulham Council	Town Hall, King Street, London	W6 9JU	24/09/2010	Yes	Yes
Metropolitan Police Service (TO BE ROMOVED WITHIN EMPRESS BUILDING)	Empress State Building, Lille Road	SW6 1TR	23/09/2010	No	
Walt Disney and Co. Ltd	3 Queen Caroline Street, London	W6 9PE	20/09/2010, 30/09/2010 follow up call	Yes	
Haymarket Publications	174 Hammersmith Road London	W6 7JP	23/09/2010, 30/09/2010 follow up call	Yes	Yes

	Address	Post Code	Data collection – Contact date	Questionnaire Sent?[35]	Questionnaire Completed?
Car Giant	43-44 Hythe Road, London	NW10 6RJ	20/09/2010, 30/09/2010 follow up call	Yes	
L'Oreal (UK) Ltd	255 Hammersmith Road, London	W6 8PL	23/09/2010	No	
Sainsbury Supermarkets Ltd	51 Townmead Road, London	SW6 2SY	20/09/2010, 30/09/2010 follow up email	Yes	
Tesco Stores Plc	180 Shepherds Bush Road, London	W6 7NL	20/09/2010, 30/09/2010 follow up email	Yes	
Imperial College of Science, Technology & Medicine	Du Cane Road	W12 0NN	24/09/2010	Yes	Yes
EMI Records	E M I House, 43 Brook Green, London	W6 7EF	20/09/2010	No	
Endemol (UK) Plc	Shepherds Building, Charecroft Way, London	W14 0EH	20/09/2010	Yes	
Halcrow Group Ltd	Elms House, 43 Brook Green, London	W6 7EF	24/09/2010	Yes	Yes
Harper Collins	Elsinore House, 77 Fulham Palace Road, London	W6 8JA	24/09/2010	No	
Marks and Spencer Plc	Westfield Ariel Way, London	W12 7GD	21/09/2010, 30/09/2010 follow up email	Yes	
Project Sloane Ltd	The Piper Centre, 50 Carnwath Road	SW6 3JX	20/09/2010	Yes	Yes
AOL (UK) Ltd	80 Hammersmith Road, London	W14 8UD	24/09/2010	No	
CACI Ltd (TO BE REMOVED PART OF KENSINGTON VILLAGE)	CACI House, Avonmore Road, London	W14 8TS	24/09/2010	No	
Omni Facilities Management Plc	3 Albion Court, Albion Place	W6 0QT	20/09/2010	No	

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Barfair Ltd	The School House, 50 Brook Green	W6 7RR	20/09/2010	No	
BMG Music Publishing Ltd	Bedford House, 69-79 Fulham High Street, London	SW6 3JW	21/09/2010, 30/09/2010 follow up email	Yes	
BPP Holdings Plc	Aldine House, 142-144 Uxbridge Road, London	W12 8AA	21/09/2010, 30/09/2010 follow up email	Yes	
Debenhams	Westfield Ariel Way, London	W12 7GF	21/09/2010	No	
Next Retail Ltd	Westfield Ariel Way, London	W12 7GD	21/09/2010	No	
Universal Music (UK) Ltd	1 Sussex Place, London	W6 9EA	20/09/2010	No	
Bechtel Ltd	245 Hammersmith Road, London	W6 8PW	23/09/2010, 29/09/2010 follow up call	Yes	
Cable and Wireless (UK)	Videotron House, 76 Hammersmith Road, London	W14 8UD	23/09/2010	No	
Chelsea Football Club	Fulham Road, London	SW6 1HS	20/09/2010	No	
Hestia Housing & Support	240 Goldhawk Road	W12 9PE	20/09/2010	No	
United International Pictures	U I P House, 45 Beadon Road, London	W6 0EG	20/09/2010	No	
Visit Britain (UK) Ltd	Thames Tower, Blacks Road, London	W6 9EL	23/09/2010	No	
London United Busways Ltd	Wells Road	W12 8DA	24/09/2010	No	
Newwave Recruitment Ltd	Brittania House, 11 Glenthorne Road	W6 OLH	24/09/2010, 30/09/2010 follow up call	Yes	

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RDF Media Ltd (TO BE REMOVED PART OF KENSINGTON VILLAGE)	The Gloucester Building, Avonmore Road	W14 8RF	20/09/2010, 30/09/2010 follow up call	Yes	
Actix Ltd	200 Hammersmith Road, London	W6 7DL	23/09/2010	No	
Boots	43 King Street, London	W6 9HW	23/09/2010, 30/09/2010 follow up call	Yes	
Coca Cola GB	2nd floor, 1 Queen Caroline Street, London	W6 9HQ	20/09/2010	Yes	
Fluid Options (UK) Ltd	194 North End Road	W14 9NX	23/09/2010	No	
Fulham Football Club	Craven Cottage, Stevenage Road, London	SW6 6HH	23/09/2010	Yes	
Jane Shilton Plc	90 Peterborough Road, London	SW6 3HH	20/09/2010	No	
Jobcentre Plus	22 Glenthorne Road	W6 0PP	23/09/2010	Yes	
Laura Ashley	Design Centre, 27 Bagleys Lane, London	SW6 2QA	23/09/2010	No	
Leo Burnett Ltd (TO BE REMOVED PART OF KENSINGTON VILLAGE)	Warwick Building, Avonmore Road, London	W14 8HQ	21/09/2010	Yes	
Novotel (Accor UK)	1 Shortlands, London	W6 8DR	23/09/2010	Yes	Yes
Post Office Ltd	Vencourt Place	W6 9NS	23/09/2010	Yes	
Primark Stores Ltd	Unit 1, Kings Mall, King Street	W6 0QM	23/09/2010	No	
Qantas Airways Ltd	Qantas House, 395-403 King Street, London	W6 9NJ	23/09/2010	No	

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FISH4 Trading Ltd.	3rd Floor, Broadway Chambers, 14-26 Hammersmith Broadway	W6 7AF	23/09/2010	No	
Lion Re:Sources UK Ltd	Pembroke Building, Kensington	W14 8DG	21/09/2010	Yes	
Richard Rogers Partnership	Thames Wharf, Rainville Road, London	W6 9HA	23/09/2010	No	
Sothebys Olympia Ltd	Olympia Exhibition Centre, Hammersmith Road, London	W14 8UX	21/09/2010	Yes	
Arc Marketing Ltd (TO BE REMOVED PART OF KENSINGTON VILLAGE)	Warwick Building, Avonmore Road, London	W14 8HQ	21/09/2010	Yes	
Cockpit Hotel (London) Ltd	47 Lillie Road	SW6 1UD	23/09/2010	No	
Diners Club (UK) Ltd	Griffin House, 161 Hammersmith Road, London	W6 8BS	23/09/2010	No	
House of Fraser	Westfield Ariel Way, London	W12 7GD	21/09/2010	No	
Innocent Drinks	3 Goldhawk Estate, Brackenbury Road, London	W6 0BA	23/09/2010	Yes	
Marks and Spencer Plc	27-37 King Street, London	W6 9HW	21/09/2010	Yes	
Queen's Park Rangers Football Club	Loftus Road Stadium, South Africa Road, London	W12 7PA	23/09/2010	Yes	
Rpm London Ltd	The Old Treacle Factory, 24-40 Goodwin Road	W12 9JW	23/09/2010	No	
Sony Ericsson Ltd	Sony Ericsson House, 202 Hammersmith Road, London	W6 7DJ	21/09/2010	No	
Starbucks Coffee (UK) Ltd	11 Heathmans Road, London	SW6 4TJ	23/09/2010	No	

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The Sporting Exchange Ltd	Waterfront Hammersmith Embankment, Chancellors Road, London	W6 9RU	21/09/2010	No	
Transport for London (TO BE REMOVED WITHIN EMPRESS BUILDING)	24th Floor, Empress State Building	SW6 1TR	23/09/2010	No	
Virgin Retail Ltd	50 Brook Green, London	W6 7BJ	23/09/2010	No	
Accor UK Business & Leisure Hotels Ltd	255 Hammersmith Road	W6 8SJ	21/09/2010	No	
Sargent Cancer Care for Children	161 Hammersmith Road	W6 8SG	23/09/2010	No	
Workthing Ltd (TO BE REMOVED PART OF KENSINGTON VILLAGE)	Beaumont House, Avonmore Road, London	W14 8TS	23/09/2010	No	
Hotels					
ST. PETERS HOTEL	GOLDHAWK ROAD, LONDON	W6 0SA	15/09/2010	No	
BROOK HOTEL	STAMFORD BROOK ROAD, LONDON	W6 0XL	15/09/2010	Yes	
SANI HOTEL	UXBRIDGE ROAD, LONDON	W12 9DS	15/09/2010	Yes	
PREMIER WEST HOTEL	GLENTHORNE ROAD, LONDON	W6 0LS	15/09/2010	No	
GRANTLY HOTEL	SHEPHERDS BUSH GREEN, LONDON	W12 8PS	15/09/2010	Yes	
KENSINGTON HOTEL (K WEST HOTEL)	RICHMOND WAY, LONDON	W14 0AX	20/09/2010, 22/09/2010	Yes	Yes
STAR HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7LP	20/09/2010	Yes	

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GOLDEN STRAND HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7LR	20/09/2010	Yes	
DALMACIA HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7LS	20/09/2010	Yes	
REX HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7LU	20/09/2010	No	
PLAZA HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7LU	20/09/2010	No	
BROOK GREEN HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7PB	20/09/2010, 22/09/2010	No	
BATOUM LODGE HOTEL	BATOUM GARDENS, LONDON	W6 7QD	20/09/2010, 22/09/2010	No	
GROVE HOUSE HOTEL	HAMMERSMITH GROVE, LONDON	W6 7HG	22/09/2010	No	
HAMMERSMITH HOTEL	HAMMERSMITH GROVE, LONDON	W6 7HG	20/09/2010	No	
HELLENIC HOTEL	SHEPHERDS BUSH ROAD, LONDON	W6 7LR	20/09/2010	No	
ABBEY HOTEL	WOOD LANE, LONDON	W12 7DP	20/09/2010	Yes	
PAVILION HOTEL	WOOD LANE, LONDON	W12 0HQ	20/09/2010	No	
AVONMORE HOTEL	AVONMORE ROAD, LONDON	W14 8RS	20/09/2010	Yes	
TALGARTH HOTEL	TALGARTH ROAD, LONDON	W14 9DB	20/09/2010, 22/09/2010, 24/09/2010	No	
ACE HOTEL	GUNTERSTONE ROAD, LONDON	W14 9BX	20/09/2010	Yes	

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CHELSEA VILLAGE HOTEL	FULHAM ROAD, LONDON	SW6 1HS	20/09/2010	Yes	
WYNDHAM GRAND HOTEL (Conrad Hotel and Leisure Centre)	CHELSEA HARBOUR, LONDON	SW10 0XG	20/09/2010, 24/09/2010	No	
Churches					
All Saints, Fulham	PRYORS BANK, BISHOPS PARK, LONDON	SW6 3LA	22/09/2010	No	
St Andrew's, Fulham Fields	10 ST ANDREWS ROAD, LONDON	W14 9SX	22/09/2010	No	
St Alban's, Fulham	MARGRAVINE ROAD, LONDON	W6 8HJ	22/09/2010	No	
ChristChurch, Fulham	67 STUDDRIDGE STREET, LONDON	SW6 3TD	22/09/2010	No	
St Dionis, Parsons Green	18 PARSONS GREEN, LONDON	SW6 4UH	22/09/2010	No	
St Ethelreda's & St Clement's	FULHAM PALACE ROAD, LONDON	SW6 6JF	22/09/2010	No	
St John's, Fulham	NORTH END ROAD, LONDON	SW6 1PB	22/09/2010	Yes	
St Mary's, West Kensington	2 EDITH ROAD, LONDON	W14 9BA	23/09/2010	No	
St Matthew's, Fulham	WANDSWORTH BRIDGE ROAD	SW6 2TZ	23/09/2010	No	
St Peter's, Fulham	ST PETER'S TERRACE, LONDON	SW6 7JS	23/09/2010	Yes	
St Paul's, Hammersmith	QUEEN CAROLINE STREET, LONDON	W6 9PJ	23/09/2010	Yes	

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Holy Innocent's, Hammersmith	PADDENSWICK ROAD, LONDON	W6 OUB	23/09/2010	Yes	
St Luke's, Uxbridge	450 UXBIRDGE ROAD	W12 0NS	23/09/2010	Yes	
St Katherine's, Westway	WESTWAY, ACTON	W12 0SD	23/09/2010	No	
St Matthew's, Hammersmith	SINCLAIR ROAD, LONDON	W14	23/09/2010	No	
St Peter's, Hammersmith	BLACK LION LANE, LONDON	W6 9BE	23/09/2010	No	
St Saviour's, Wendell Park	COBBOLD ROAD, LONDON	W12 9LN	23/09/2010	Yes	Yes
St Simon's, Hammersmith	ROCKLEY ROAD, LONDON	W14 0DA	23/09/2010	Yes	Yes
St Steven and St Thomas	1 COVERDALE ROAD, LONDON	W12 8JJ	23/09/2010	No	
St Michael and St George	1 COMMONWEALTH AVENUE, LONDON	W12 7QR	23/09/2010	No	
Holy Trinity, Hammersmith	41 BROOK GREEN, LONDON	W6 7BL	23/09/2010	Yes	
Chinese Church in London, Hammersmith	70 BROOK GREEN, LONDON	W6 7BE	23/09/2010	Yes	
St John the Evangelist, Hammersmith	GLENTHORNE ROAD, LONDON	W6 OLS	23/09/2010	No	
Uxbridge Road Tabernacle	2 BLOEMFONTEIN ROAD, LONDON	W12 7BX	23/09/2010	No	
Fulham Baptist Church	DAWES ROAD, LONDON	SW6 7EG	23/09/2010	No	

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Our Lady of Perpetual Help	STEPHENDALE ROAD, LONDON	SW6 2PN	23/09/2010	No	
Holy Cross, Parsons Green	22 CORTAYNE ROAD	SW6 3QA	23/09/2010	Yes	
Holy Ghost and St Stephen	44 ASHCHURCH ROAD	W12 9BU	23/09/2010	No	
Our Lady of Fatima	COMMONWEALTH AVENUE, LONDON	W12 7QR	23/09/2010	Yes	Yes
Hammersmith Baptist	DALLING ROAD, LONDON	W6 0EU	23/09/2010	Yes	
St Thomas of Canterbury	60 RYLSTON ROAD, LONDON	SW6 7HW	23/09/2010	Yes	
United Reform Church	FULHAM PALACE ROAD, LONDON	SW6 6PL	23/09/2010	No	
Fulham Broadway Methodist	FULHAM ROAD, LONDON	SW6 1BW	23/09/2010	No	
Kanoon Towhid Islamic Centre	SOUTHERLAND ROAD, LONDON	W6 0PH	23/09/2010	No	
West End Baptist	7 RAVENSCOURT ROAD, LONDON	W6 0UH	23/09/2010	No	
Prisons					
H M PRISON WORMWOOD SCRUBS	DU CANE ROAD	W12 0AE	21/10/2010	Yes	
Schools					
WENDELL PARK PRIMARY SCHOOL		W12 9LB	21/09/2010	Yes	

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OLD OAK PRIMARY SCHOOL	W12 0AS	22/09/2010	Yes	
LATYMER UPPER SCHOOL	W6 9LR	23/09/2010	No	
GODOLPHIN & LATYMER SCHOOL	W6 0PG	24/09/2010	Yes	Yes
VANESSA NURSERY SCHOOL	W12 9JA	25/09/2010	Yes	Yes
BRACKENBURY PRIMARY SCHOOL	W6 0BA	26/09/2010	Yes	Yes
JOHN BETTS PRIMARY SCHOOL	W6 0UA	27/09/2010	Yes	
WORMHOLT PARK PRIMARY SCHOOL	W12 0SR	28/09/2010	Yes	
POPE JOHN SCHOOL	W12 7QR	29/09/2010	Yes	
BURLINGTON DANES SCHOOL	W12 0HR	30/09/2010	Yes	Yes
WOOD LANE HIGH SCHOOL	W12 0TN	01/10/2010	Yes	Yes
BENTWORTH PRIMARY SCHOOL	W12 7AJ	02/10/2010	Yes	
ST. PAULS GIRLS SCHOOL	W6 7BS	03/10/2010	No	
ST. PAULS PRIMARY SCHOOL	W6 9BP	04/10/2010	No	
ST. MARYS PRIMARY SCHOOL	W14 0LT	05/10/2010	Yes	

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LENA GARDENS PRIMARY SCHOOL	W6 7PZ	06/10/2010	No	
SINCLAIR SCHOOL	SW6 6DA	07/10/2010	No	
THE MOAT SCHOOL	SW6 6EG	08/10/2010	Yes	
BAYONNE NURSERY SCHOOL	W6 8PF	09/10/2010	Yes	Yes
ST. AUGUSTINES PRIMARY SCHOOL	W6 8QE	10/10/2010	Yes	
JAMES LEE NURSERY SCHOOL	W14 9BH	11/10/2010	Yes	Yes
L'ECOLE DES PETITS SCHOOL	SW6 2NB	12/10/2010	Yes	Yes
LANGFORD PRIMARY SCHOOL	SW6 2LG	13/10/2010	Yes	Yes
HOLY CROSS SCHOOL	SW6 4BL	14/10/2010	Yes	
FULHAM PRIMARY SCHOOL	SW6 1JU	15/10/2010	Yes	
Randolph Beresford Early Years Centre	W17 7PH	16/10/2010	No	
St John's Walham Green C of E Primary School	SW6 6AS	17/10/2010	No	
St Stephen's C of E Primary School	W12 8LH	18/10/2010	Yes	
JORDANS MONTESSORI SCHOOL	W6 0UB	19/10/2010	Yes	Yes

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MONTESSORI NEIGHBOURHOOD NURSERY SCHOOL		W14 9QE	20/10/2010	Yes	
TWICE TIMES NURSERY SCHOOL		SW6 3AF	21/10/2010	Yes	
ZEBEDEE NURSERY SCHOOL		SW6 4TN	22/10/2010	No	
IVY HOUSE NURSERY SCHOOL & DAY NURSERY		SW6 4XE	23/10/2010	No	
PEQUES ANGLO SPANISH NURSERY SCHOOL		SW6 1PB	24/10/2010	Yes	Yes
Hammersmith and West London College		W14 9BL	25/10/2010	No	
Leisure and Fitness Centres					
Broadway Squash & Fitness Centre (Hammersmith Fitness and Squash Centre) (Also called Lillie Road Fitness Centre, but with different post code)	1, Chalkhill Road, London	W6 8DW	21/09/2010	Yes	
Lillie Road Fitness Centre	Lillie Road, London	SW6 7PD	21/09/2010, 22/09/2010	No	Yes
Cannons Health & Fitness Ltd	Stevenage Road, London	SW6 6PF	21/09/2010	Yes	
Chelsea Club Ltd	Stamford Bridge, Fulham Road, London	SW6 1HS	21/09/2010, 22/09/2010	No	
Virgin Active Fulham (Fulham Pools)	Lillie Road, London	SW6 7ST	20/09/2010	No	

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Phoenix Sports and Fitness Centre and Janet Adegoke Swimming pool	Bloemfontein Road	W12 7DB	20/09/2010	No	
Pilates Room	Unit 9, 75 Filmer Road, London	SW6 7JF		No	
Sands End Sports Hall	Sands End Community Centre, 59-61 Broughton Road, London	SW6 2LE	21/09/2010	Yes	
Harbour Club	Watermeadow Lane	SW6 2RR	21/09/2010, 22/09/2010, 23/09/2010	No	
Thirtysevendegrees Health & Fitness (Olympia)	10 Beaconsfield Terrace Road, London	W14 0PP	21/09/2010	Yes	
Charing Cross Sports Club	Aspenlea Road	W6 8LH	21/09/2010	Yes	
Virgin Active Hammersmith	181 Hammersmith Road	W6 8BT (or W6 8BS)	21/09/2010	No	
Hurlingham Club	Ranelagh Gardens	SW6 3PR	21/09/2010, 22/09/2010	No	
New Grampian Squash Club	1 Shepherds Bush Road	W6 7LN	21/09/2010, 22/09/2010, 23/09/2010	No	
Hartswood Lawn Tennis Club	33 Hartswood Road	W12 9NE	21/09/2010, 22/09/2010, 23/09/2010	No	
The Parsons Green Club	103 Broomhouse Lane	SW6 3DP	21/09/2010, 22/09/2010, 23/09/2010	No	
Fulham Yogashala	The Glasshouse, 11-12 Lettice Street	SW6 4EH	21/09/2010	Yes	Yes
Royal Fitness	23-25 Uxbridge Road	W12 8LH	21/09/2010, 22/09/2010	No	

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Police Stations					
HAMMERSMITH POLICE STATION, METROPOLITAN POLICE	SHEPHERDS BUSH ROAD, LONDON	W6 7NX		Yes	
HAMMERSMITH POLICE STATION, BRITISH TRANSPORT POLICE	FULHAM PALACE ROAD, LONDON	W6 8AU		Yes	
SHEPHERDS BUSH POLICE STATION, METROPOLITAN POLICE	252-258 UXBRIDGE ROAD, LONDON	W12 7JB		Yes	
FULHAM POLICE STATION, METROPOLITAN POLICE	HECKFIELD PLACE, LONDON	SW6 5NL		Yes	
Hospitals					
THE HAMMERSMITH HOSPITALS NHS TRUST	DU CANE ROAD, LONDON	W12 0HS	21/09/2010	Yes	Yes
CHARING CROSS HOSPITAL	FULHAM PALACE ROAD, LONDON	W6 8RF	21/09/2010	Yes	Yes