In Association with

&

Low Carbon, Renewable Energy and Heat Mapping Study

May 2010

Prepared for

London Borough of Redbridge

Revision Schedule

Low Carbon, Renewable Energy and Heat Mapping Study
May 2010

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Table of Contents

Executive Summary

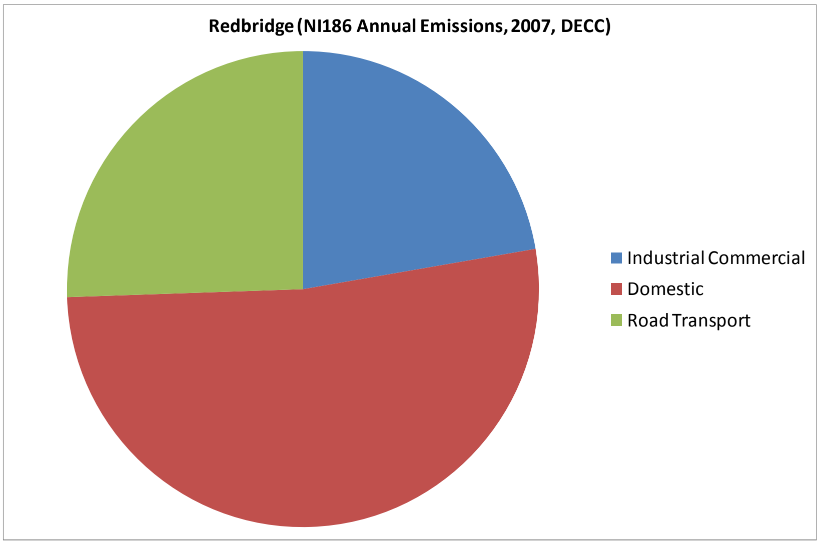
Purpose of the Study

Scott Wilson, in conjunction with its project partners Thameswey Energy and Cyril Sweett, has been commissioned by the London Borough of Redbridge in conjunction with the London Development Agency (LDA) to carry out a Low Carbon, Renewable Energy and Heat Mapping Study for Redbridge.

The study provides an evidence-base for the London Borough of Redbridge's (LBR) future energy policy, and looks at the technological and financial potential for different types of low carbon, decentralised and renewable energy technologies across the Borough, giving consideration to existing opportunities and constraints. The Heat Mapping Study, carried out in conjunction with the LDA, will form part of an evidence base for policies on decentralised energy in Redbridge and identify potential opportunities for decentralised energy networks in Redbridge.

The Borough's Carbon Emissions

An energy demand assessment was carried out as part of this study to assess carbon emissions arising from current and anticipated developments in Redbridge. This information was used to feed into the overall study, particularly the Heat Mapping section. The carbon footprint for Redbridge was found to be 1,033,000 tonnes CO_2 per year[1] (0.24% of UK total). The chart below illustrates that the majority of the Borough's emissions arise from the domestic sector, reflecting the mix of building stock. As explained further throughout this report, even with reduced emissions from new building stock there is a key role to play in reducing emissions from existing housing stock. For Redbridge, even by 2050, it is highly likely that existing dwelling will make up more than two thirds of the housing stock, with many of these existing dwelling being energy inefficient.

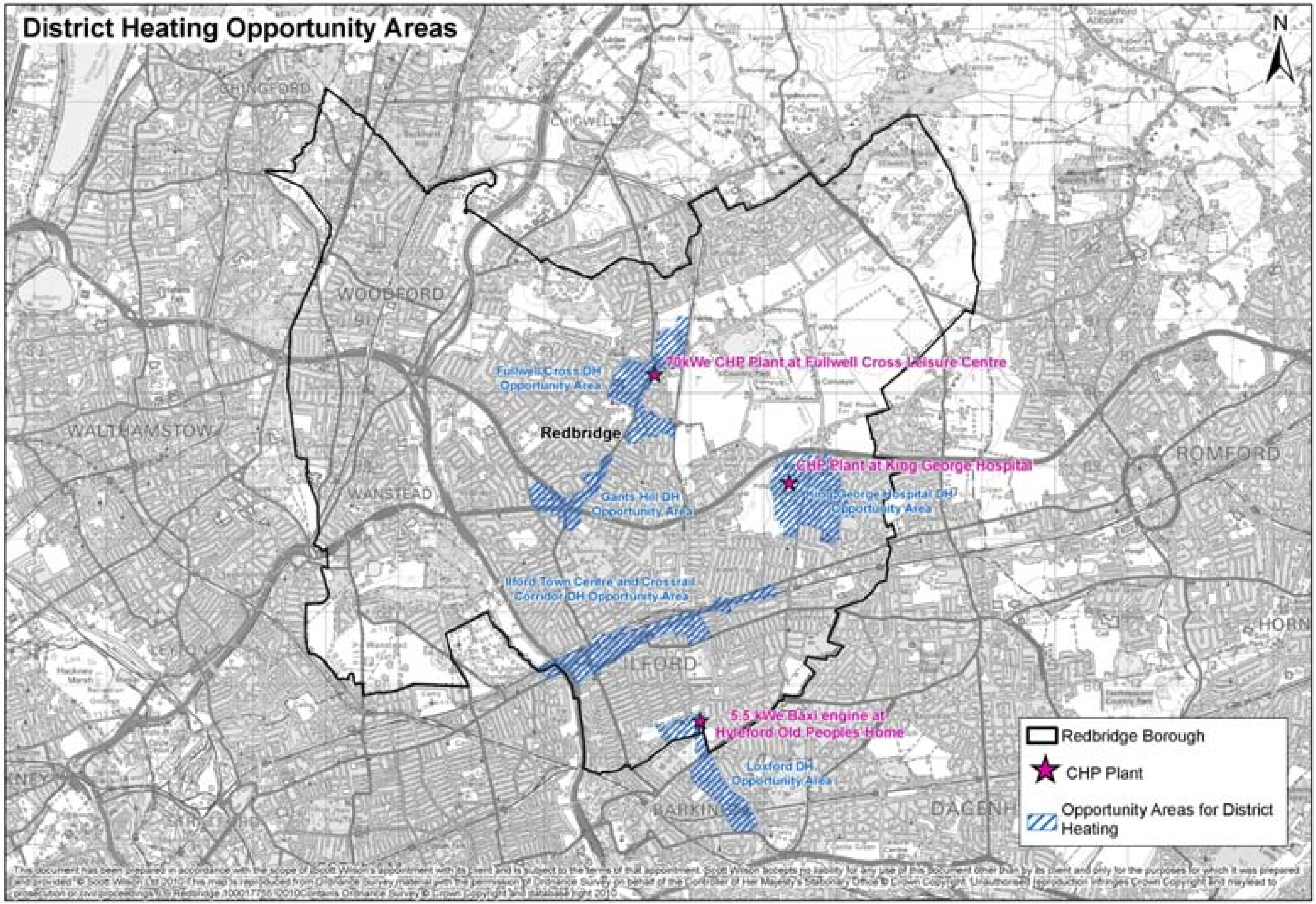


[1] Data from Department of Energy and Climate Change (2007 data)

Heat Mapping Study

The Heat Mapping Study involved working with the Council and other stakeholders to identify buildings with a high heat demand, which included housing estates, leisure centres, schools and hospitals. Identified buildings were both Council owned and privately owned, and included existing buildings and proposed new buildings. A range of stakeholders within the Borough were subsequently contacted to collate actual energy consumption and heat demand data. Data for private and public buildings were mapped using GIS by the LDA, in order to identify potential heat network 'clusters' within Redbridge which could form part of an existing or future decentralised energy network.

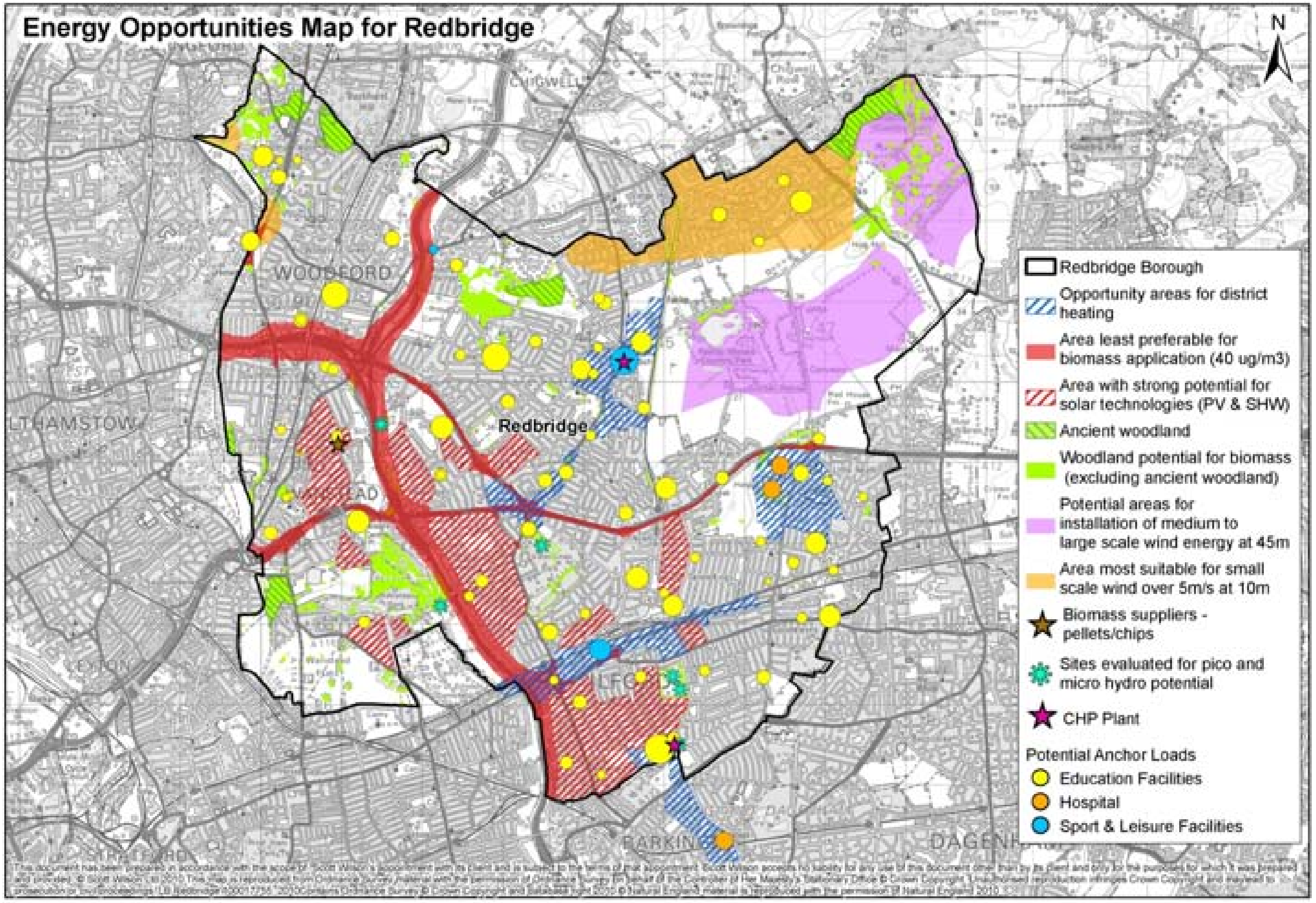
Five 'cluster' sites - Ilford Town Centre and the Crossrail Corridor, Gants Hill, Loxford School area, King George Hospital Site and Fullwell Cross - were identified as potential cluster sites for the deployment of a heat network. These clusters were put into an implementation plan (see Section 4.5) of prioritised decentralised energy opportunities for Redbridge. The potential cluster sites have been illustrated in the figure below:


District Heating Opportunity Areas
N
CHINGFORD
WOODFORD
WALTHAMSTOW
WANSTEAD
Redbridge
ROMFORD
ILFORD
BARKING
DAGENH
HORN
Fullwell Cross DH Opportunity Area
70kWe CHP Plant at Fullwell Cross Leisure Centre
Gants Hill DH Opportunity Area
CHP Plant at King George Hospital
King George Hospital DH Opportunity Area
Ilford Town Centre and Crossrail Corridor DH Opportunity Area
5.5 kWe Baxi engine at Hyleford Old Peoples Home
Loxford DH Opportunity Area
Redbridge Borough
CHP Plant
Opportunity Areas for District Heating

The heat mapping section of this study will feed into the London Heat Map, as part of the LDA's Decentralised Energy Master Planning (DEMaP) programme.

Low Carbon and Renewable Energy Constraints and Opportunities Analysis

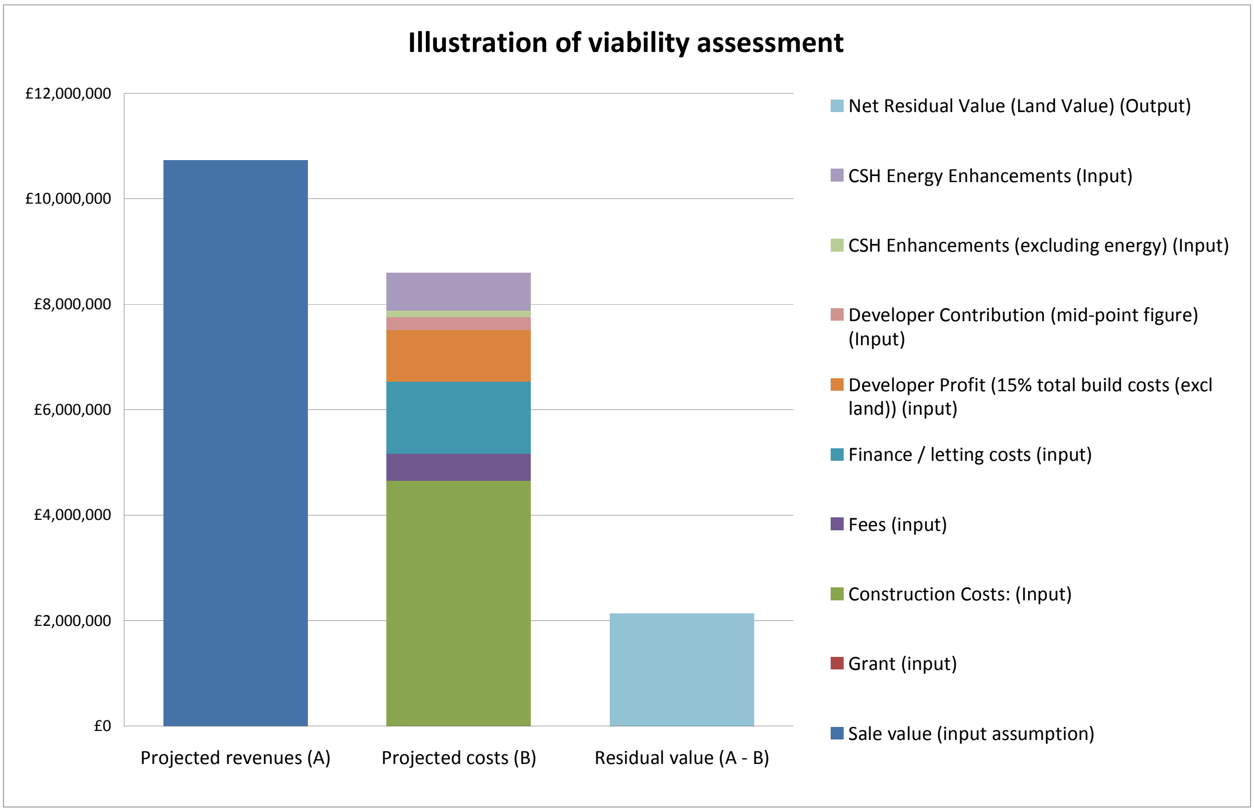
An assessment of the opportunities and constraints associated with renewable energy resource potential within Redbridge was carried out, in accordance with the Department of Energy and Climate Change (DECC) methodology. An Energy Opportunities Map was developed summarising the potential for low carbon and renewable energy within Redbridge (see below),



Energy opportunities map for Redbridge

GSHP are potentially suitable for all new developments, however their viability needs to be addressed on a site by site basis (Please refer to Section 5.11.3 for further details), and therefore have not been included in the figure above on the basis that their applicability extends across the borough.

Based on the baseline emissions calculations carried out as part of the study (see section 3), the proposed development areas identified in Redbridge's Local Development Framework and the emerging Crossrail Corridor Area Action Plan, and the heat demand data obtained as part of the heat mapping study; Ilford Town Centre, Gants Hill and the Crossrail Corridor were identified as strategic sites , and the technical viability of different combinations of renewable energy technologies for these sites has been discussed. Based on the technologies identified as suitable for each site, a land-value based viability test on the basis of market sales values was carried out. The various parameters considered in the land value (which is the residual value once all assumed costs have been derived from the total projected revenue) viability assessment study are illustrated in the figure below. In order for the land value to be positive it must exceed the existing use value (EUV).



It should be noted that the above is only an illustration and although cost inputs are specific to LBR the residual vale or land value is generic and not specific to a site within LBR although the cost is in the order of cost expected for LBR.

A selection of development sizes (5 dwellings, 50 dwellings and 100 dwellings) was analysed and policy options proposed, following which an appraisal of the implications of imposing increasingly higher levels of the Code for Sustainable Homes on new development was carried out.

Key Findings of the Study:

- Through an analysis of domestic and commercial emissions projections, carried out as part of the Heat Mapping Study, it is evident that new build policy has only a limited level of impact on overall building stock emissions. Policy should therefore focus on existing buildings: guidance for Redbridge residents on incorporating energy efficiency and renewable energy technologies within existing homes has been provided in Appendix A.
- As part of the Heat Mapping Study, five 'cluster' sites were identified providing the best potential for the deployment of a heat network. These sites were put into a high level implementation plan (see 4.5) of prioritised decentralised energy opportunities for Redbridge. Existing development with the potential to act as anchor loads due to their high heat demand (over 200MW) were identified in terms of their juxtaposition to proposed development within the Borough. Workshops were held with key stakeholders in the Borough to ascertain local knowledge and provide the most viable sites with a synergy between existing development and new development. The five sites as outlined further in Section 4 are:
    - Fullwell Cross
    - King George Hospital
    - Ilford Town Centre (Total heat demand of 36,175MWh/year) & Crossrail Corridor (Total heat demand of 18,720MWh/year)
    - Gants Hill (Total heat demand of 4,473 MWh/year)
    - Loxford School Area
- Although energy data was sought from a number of Council and privately owned properties, limited actual data for the Heat Mapping exercise was available for privately owned buildings. This is important in terms of lessons learnt. Personally approaching stakeholders instead of requesting information via telephone, email and post would likely produce better results.
- Constraints and opportunities for renewable and decentralised energy resource potential within Redbridge have been mapped as illustrated previously, based on the methodology outlined in the latest PPS1 Supplement – Planning for a Low Carbon Future in a Changing Climate, which refers to DECC guidelines, titled *Renewable and Low Carbon Energy Capacity Methodology*[2].
- A Borough wide renewable energy appraisal to analyse the suitability of different renewable energy technologies for different areas of the Borough has been carried out. In addition, site specific analysis for low carbon and renewable technology feasibility has been provided for Gants Hill, Ilford Town Centre and the Crossrail Corridor. Overall, the three Strategic Sites are highly conducive to district heating solutions due to their high densities.

[2] DECC. Renewable and Low-carbon Energy Capacity Methodology: Methodology for the English Regions. January 2010

Nevertheless, microgeneration can greatly contribute to overall targets, especially during the earlier phases of development.

- In terms of development viability, for all areas of the Borough investigated, development delivers Land Values in a range that suggests viability. In particular the higher market sales values of Wanstead and East Redbridge suggest that these areas could generate the assumed level of developer profit and also high residual value. Of the three strategic sites investigated (Ilford Town Centre, Gants Hill and the Crossrail Corridor), the Crossrail Corridor shows the lowest level of value. In this area, the results show that even the delivery of Code Level 6 for five dwellings in line with the current Government timetable is not viable (e.g. delivers a negative land value) for urban infill development.
- Guidance for developers on the Code for Sustainable Homes has been provided in Appendix H to highlight the achievability of credits for Code Levels 3, 4, 5 and 6.

It should be noted that the residual values identified in the viability modelling have not been compared against the EUV and the development viability analysis has been developed to identify positive and negative trends and thus inform policy development. More detailed site specific viability analysis will be required at the time of application to support site specific verification.

1 Introduction

1.1 Background

Scott Wilson, in conjunction with its project partners Thameswey Energy and Cyril Sweett, has been commissioned by the London Borough of Redbridge (LBR) in conjunction with the London Development Agency (LDA) to carry out a Low Carbon, Renewable Energy and Heat Mapping Study for Redbridge.

The provision of decentralised, renewable or low carbon energy generation will be central to sustainable economic growth and development in Redbridge. It is vital that such development be coordinated through the spatial planning system incorporating technical input from the renewable energy and low carbon sectors. The Climate Change Supplement to Planning Policy Statement 1 (PPS1) is a key driver for this study, along with the need to address ambitious regional targets set out in the London Plan that are both deliverable and viable in accordance with the Council's wider objectives, such as affordable housing.

This Study provides an evidence-base for the LBR's future energy policy through an assessment of the technological and financial potential for different types of low carbon, decentralised and renewable energy technologies throughout the Borough, given existing opportunities and constraints. The Heat Mapping exercise undertaken as part of this Study identified areas of high heat demand in the Borough for possible decentralised energy networks.

An appraisal of the financial implications of imposing increasingly higher levels of the Code for Sustainable Homes for Redbridge and for specific strategic sites, and policy implications are also presented as part of this Study..

1.1.1 Key objectives of the study

The key objectives of the study are:

- To provide a Policy context to the study and review all relevant published documents and studies (Chapter 2).
- To provide a baseline assessment of carbon emissions arising from current and anticipated developments in Redbridge (Chapter 3), which will feed into the Heat Mapping Study.
- Undertake a Heat Mapping Study to identify areas in the Borough of high heat demand. As part of the Heat Mapping Study, collect energy data from key buildings in the borough, both Council owned and privately owned buildings. (Chapter 4).
- To develop a high level implementation plan highlighting key opportunities for decentralised energy within Redbridge (Chapter 4) as a key outcome of the Heat Mapping Study.
- To carry out a Borough-wide and site-specific renewable energy appraisal that will establish the technologies' suitability across the Borough (Chapter 5), and their potential contribution towards renewable energy and CO_2 reduction targets. This was completed in accordance with the methodology outlined in the latest PPS1 Supplement – Planning for a Low Carbon Future in a Changing Climate, which refers to DECC guidelines, titled *Renewable and Low Carbon Energy Capacity Methodology*.

- To assess the viability of renewable energy technologies across strategic sites - Ilford Town Centre, Gants Hill and the Crossrail Corridor (Chapter 6) - based on the renewable energy technologies identified above. The identification of decentralised energy for strategic sites within Redbridge will also feed into the Heat Mapping Study.
- To assess the financial implications of the Council requiring increasingly higher levels of the Code for Sustainable Homes within the Local Development Framework (Chapter 7).
- To discuss future policy options for Redbridge (Chapter 8) and to provide suggestions for energy efficiency measures and renewable energy technologies for existing housing stock in Redbridge, including guidance notes for Redbridge residents (Appendix A);

These deliverables will provide the evidence base for progressing opportunities for decentralised energy; support the LBR's emerging policies for adoption into the Local Development Framework and help the LBR with planning application negotiations. Furthermore, this data will also be used in preparing Redbridge-specific guidance for residents to install renewable energy technologies.

1.1.2 Key drivers for the study

The LBR is required to respond to policies and regulations regarding energy use and carbon dioxide emissions including:

- PPS1 Supplement on Climate Change, PPS 22 on Renewable Energy and the Climate Change Act, 2008
- The European Union target for 20% of energy to be provided from renewable energy resources by 2020.[3];
- The UK-wide target of an 80% reduction in Carbon Dioxide (CO_2) emissions by 2050 based on 1990 levels[4];
- The national Building Regulations for all new homes and non-domestic buildings to be zero carbon by 2016 and 2019 respectively[5];
- National Indicators 185 (CO2 reduction from Local Authority operations); 186 (Per capita reduction in Co2 emissions in the Local Authority area); 187 (Tackling fuel poverty); and188 (Planning to adapt to climate change).[6];
- Achieving deliverable national and regional targets for renewable energy and greenhouse gas emissions;
- Reducing the Borough's energy consumption through existing stock;
- Responding to Climate Change as set out throughout the LBR's Core Strategy and the aspiration to achieve carbon-free development as set out in the Redbridge Local

[3] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.
[4] Climate Change Act 2008
[5] Building a Greener Future: Policy Statement (2007)
[6] The New Performance Framework for Local Authorities and Local Authority Partnerships: Single Set of National Indicators, October 2007

Development Framework Borough Wide Primary Policies Development Plan Document (May 2008)[7]; and

- Local Strategic Partnership Objectives.

Furthermore, the current Redbridge Local Development Framework refers to the London Plan policy 4A.7 on renewable energy, which requires that new developments achieve a reduction in CO_2 emissions of 20% from onsite renewable energy generation.

Further policy context is discussed in Chapter 2 of this report.

1.1.3 Methodology and Structure of the Report

The structure of the report and the methodology followed is briefly described below:

Chapter 1 provides an overview of Redbridge Borough and the objectives and drivers of the Study. LBR publications and relevant studies were reviewed in addition to meetings with the Council, in order to describe the character of the Borough, housing figures and future projections, environmental constraints, and areas of historic interest within Redbridge;

Chapter 2 describes international, European, national, regional and local policy relevant to this Study, and provides the context in which the Study is to be carried out;

Chapter 3 presents an evaluation of the baseline Borough energy demand compared to national indicators discussed in Chapter 2 and provides future emissions projections in order to determine the carbon footprint of the Borough. DECC Data and National Indicators were used for relevant calculations, and the results obtained from this Chapter form the basis for calculating the heat demand within the Borough as part of the Heat Mapping Study. The viability of implementing policy to go beyond national standards for the Code for Sustainable Homes is also discussed in this Chapter, based on calculated emissions savings from proposed development. Guidance for Redbridge residents to improve energy efficiency and incorporate renewable energy within existing homes is provided in Appendix A;

Chapter 4 includes a data collection exercise including stakeholder consultation to obtain actual data to input into the London Heat Map developed by the LDA. This involved identifying major energy suppliers and consumers in the Borough. Actual energy demand data for over 80 Council owned properties and over 40 privately owned properties was sought. Information obtained in Chapters 2, 3 and 4 forms the basis of an implementation plan designed to facilitate the incorporation of decentralised energy within Redbridge;

Chapter 5 reviews the constraints and opportunities for low carbon and renewable energy in Redbridge Borough, based on the results obtained in Chapters 1, 3 and 4. The methodology is based on the DECC guidelines, titled *Renewable and Low Carbon Energy Capacity Methodology*. An Energy Opportunity Map for the Borough is provided, highlighting renewable energy/decentralised energy technologies suitable to various areas within the Borough;

Chapter 6 evaluates the policy options specific to the Redbridge context based on Chapters 1 and 5 and considers their application within the Borough, with specific focus on the strategic sites

[7] London Borough of Redbridge. Local Development Framework, Borough Wide Primary Policies, Development Plan Document. May 2008

identified for this study (Ilford Town Centre, Gants Hill and the Crossrail Corridor). For each of the Strategic Sites we have used information provided from LBR regarding the number of dwellings and floorspace of non-domestic buildings and their phasing over the plan period. Using industry benchmark and government figures for the energy requirements for space and water heating and regulated and unregulated electricity use, we have calculated the overall carbon dioxide emissions and, hence, the baseline from which any improvement/emissions reduction is calculated.

Based on the results obtained in Chapter 5, recommendations for renewable energy technologies appropriate to each strategic site are provided. The identification of decentralised energy for strategic sites within Redbridge also feeds into the Heat Mapping Study;

Chapter 7 reviews development viability of the strategic sites for meeting specific levels of the Code for Sustainable Homes;

Chapter 8 evaluates policy options to determine policy orientation;

Chapter 9 provides conclusions and presents the main findings of this study and provides policy recommendations, including an outline of implications for the Council and its strategic partners.

1.2 Overview of Redbridge Borough

London Borough of Redbridge, located in North-East London, contains one Metropolitan centre: Ilford; four District centres: Gants Hill, Wanstead, South Woodford and Barkingside; and a number of Local centres and key retail parades. These have been illustrated in the figure below:

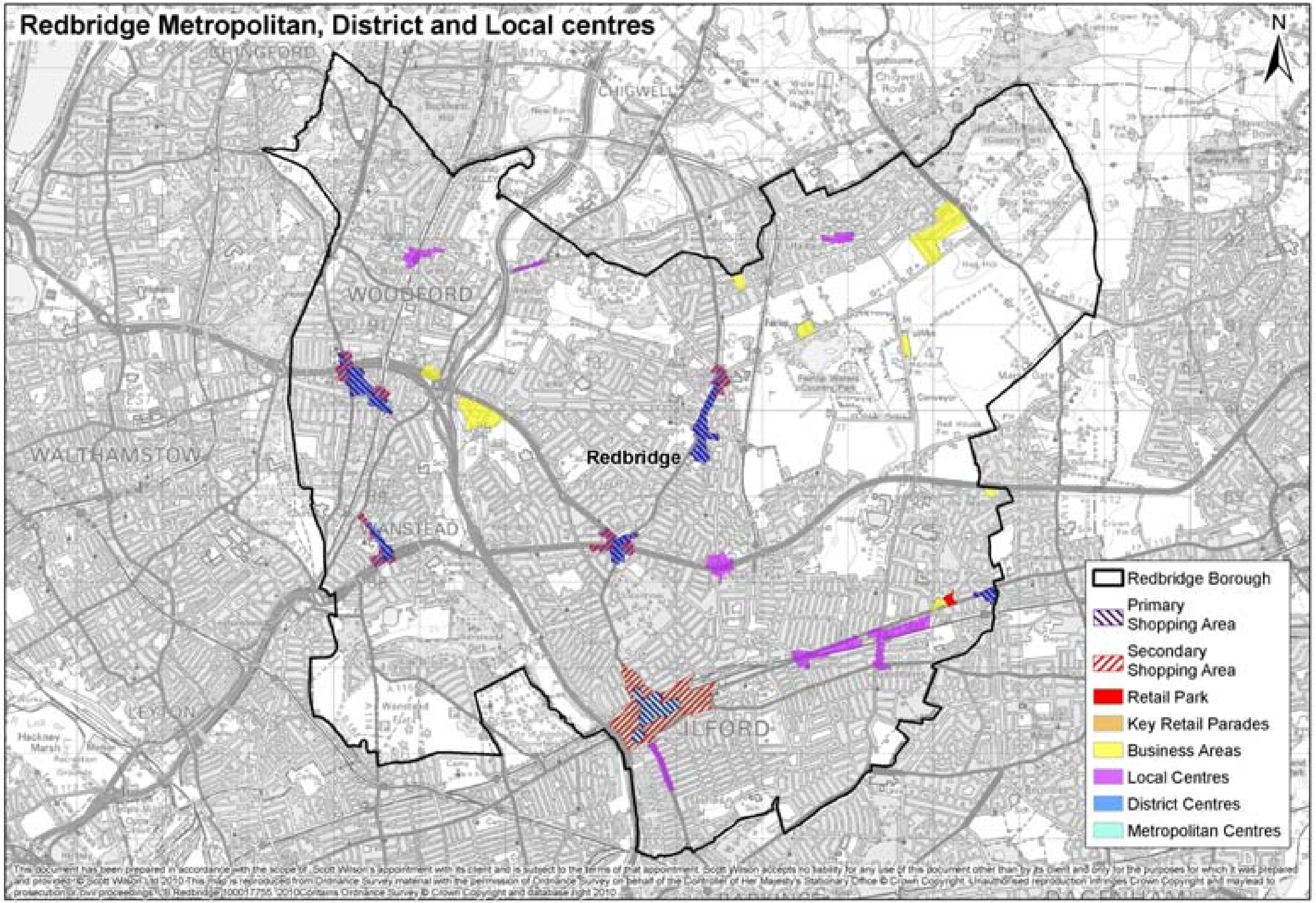


Figure 1-1: Redbridge Metropolitan, District, and Local centres

The Borough is predominantly residential with only two Strategic Employment Locations in Hainault Business Park (Hainault, East Redbridge) and Southend Road Business Area (Woodford Green, West Redbridge)[8] and a number of light industrial areas, generally within close proximity to residential areas.

According to Strategic Policy 1 and Strategic Policy 7 within the Redbridge Core Strategy, new development will be focused on the hierarchy of town centres as follows:

Town Centre	Type of growth	New development to include
Metropolitan Centre of Ilford	Primary area of growth	Housing, retail, office and other commercial, cultural, health, leisure and community facilities 35-50% of new housing to be within Ilford Metropolitan Centre
District Centres of Barkingside, Gants Hill, Wanstead and South Woodford	Some new development will be permitted	Housing, retail, office and other commercial, cultural, health, leisure and community facilities. 15-25% of new housing to be within the District and Local Centres.
Local Centres of Woodford Broadway/ Snakes Lane, Woodford Bridge, Manford Way, Seven Kings, Goodmayes, Ilford Lane and Newbury Park	Local level	Retailing, community facilities and social meeting places. 15-25% of new housing to be within the District and Local Centres and a further 25-35% will be distributed throughout the rest of the borough.

Table 1-1: Hierarchy of Town Centres within Redbridge

The proposed Crossrail network will have four stops within Redbridge Borough; Ilford, Seven Kings, Goodmayes and Chadwell Heath. A Crossrail Corridor Area Action Plan is underway, which identifies a potential capacity along the corridor of 2,000 new homes accompanied by a mixture of commercial, leisure and educational facilities.

1.3 Physical Context

Redbridge Borough covers over 5,600 hectares. Approximately one-third of the Borough lies within greenbelt land and there are 16 conservation areas. In total there are 485 hectares of forest and 243 hectares of green space and parks.

The latest mid year estimates (2008) indicate there are approximately 264,000 residents in Redbridge. Socio-economically, Redbridge's community is diverse with a mixture of affluent areas and pockets of social deprivation.

In the Government's Indices of Deprivation, Redbridge ranks as the 163rd most deprived Local Authority area in the country out of 354 Authorities[9]

The total existing housing stock comprises 98,431 homes[10]. A breakdown of the housing is provided in the table below, indicating that approximately 90% of homes are privately owned, compared to approximately 76% homes in London which are privately owned or rented[11]:

[8] LBR LDF Core Strategy, Development Plan Document, March 2008
[9] LBR Local Implementation Plan 2005/06-2010/11

Housing in Redbridge	Numbers
Council Owned Homes	4,695
Housing Association Homes	5,471
Other Publicly Owned	123
Private Sector	88,142
Total	**98,431**

Table 1-2: Housing ownership in Redbridge

Social housing in Redbridge accounts for around 10% of the total housing stock, compared to 24% for London. As the Council can exercise more control over emissions standards from social housing, the potential for carbon reduction increases with an increase in the percentage of social housing stock. The figure below illustrates the density of the Council-owned housing stock, with dots in blue highlighting postcodes with tenure numbers over 71 dwellings.

[10] LBR Affordable Housing Strategy 2008-2011
[11] Tenure by Region, 2007, http://england.shelter.org.uk/__data/assets/pdf_file/0005/166532/Factsheet_Housing_tenure.pdf

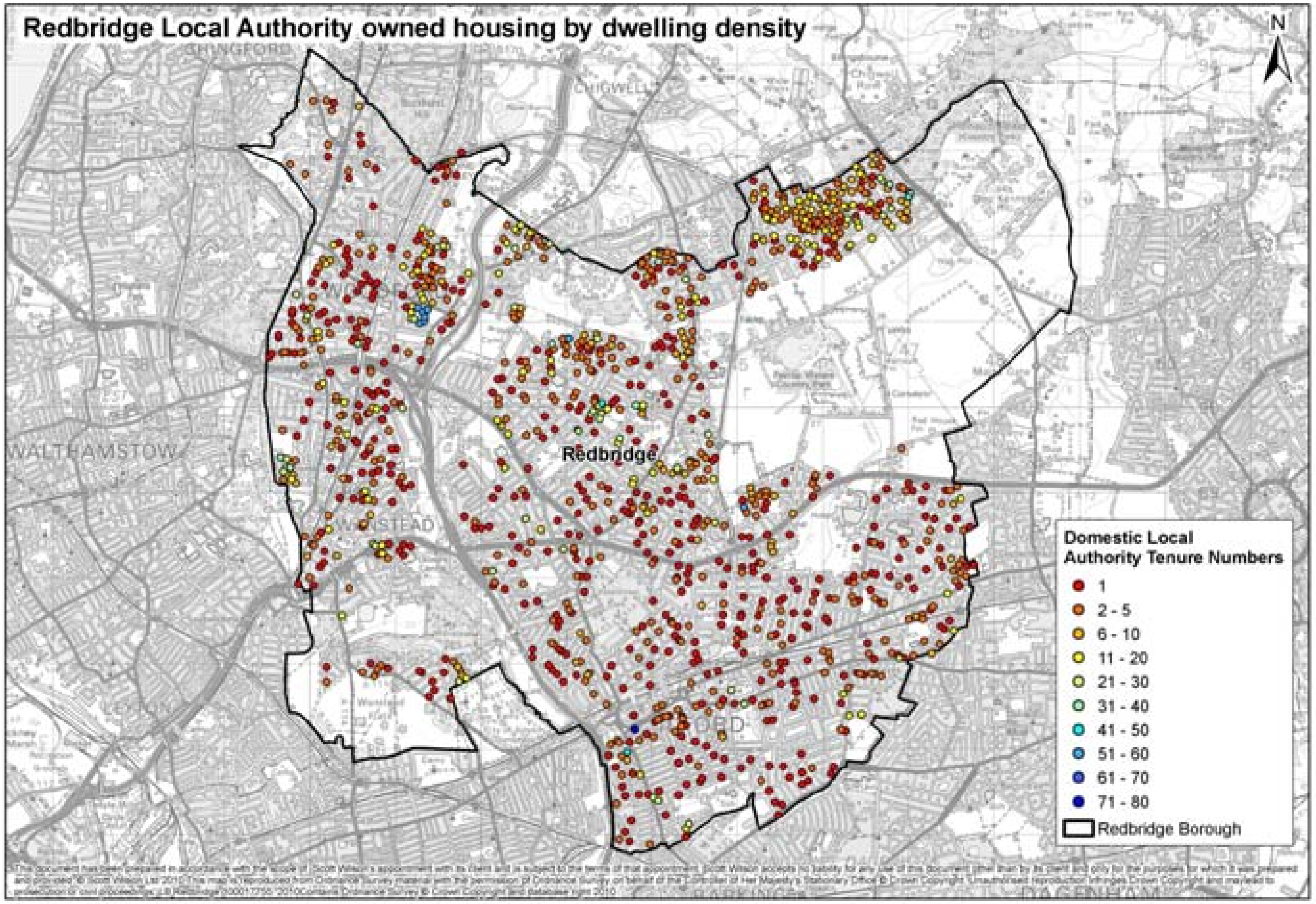


Figure 1-2: Redbridge Local Authority owned housing by dwelling density (excluding HA owned properties)

The London Plan sets out the housing provision targets for all London Boroughs[12]. The current target for Redbridge is to supply a minimum of 9,050 new homes between 2007/08 and 2016/17 (which equates to some 905 new homes per annum).

The figure below provides the distribution of potential housing sites in Redbridge.

[12] The London Plan, Consolidated with Alterations since 2004, Table 3A.1. February 2008

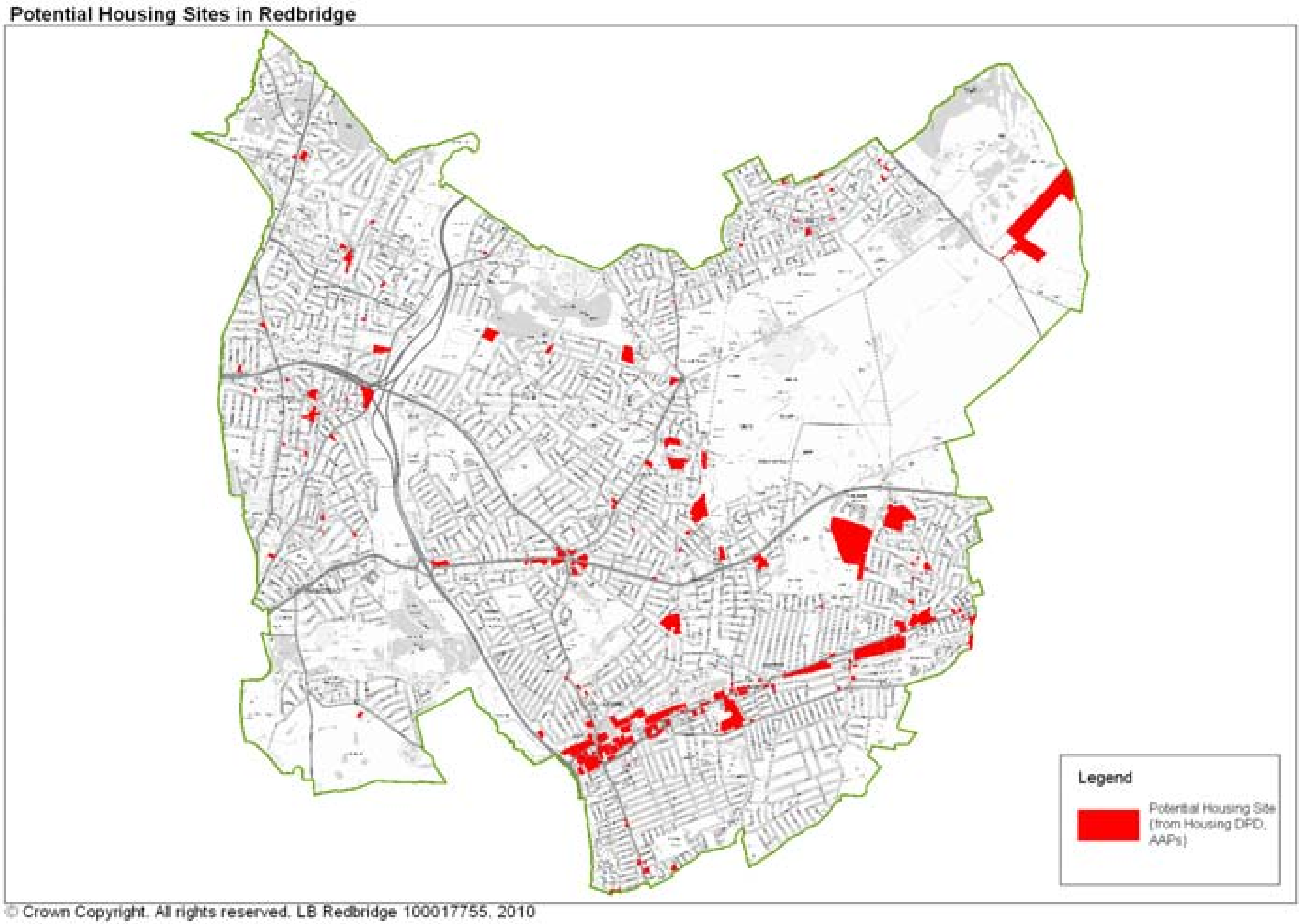


Figure 1-3: Potential Housing Sites in Redbridge[13]

[13] Provided by the LBR, July 2010

In terms of non-housing growth, quantified growth in the Core Strategy is outlined to be 23,000m^2 of new high street and retail floor area in Ilford Town Centre. While other types of residential (e.g. hotels, residential institutions) and non-residential development (e.g. retail, office, industry) can and will occur, these are not quantified within the Core Strategy. However, the LBR have provided the relevant figures for the purpose of this study.

Redbridge, as with other London Boroughs, is being driven to address its current status and its potential to deliver sustainable development. In addition to policy outlined below, the State of the Environment Report (Environment Agency, 2007) and Reducing the South East's Ecological Footprint and Carbon Emissions (SEERA, August 2008) both refer to the need to significantly reduce carbon emissions. However, the extent to which carbon emissions reduction can be carried out through low carbon and renewable energy technologies depends largely on the environmental constraints to technology based on the physical characteristics of Redbridge Borough, including specific constraints such as land designations and flood risk, as outlined in the following sections.

The physical constraints identified in this section will form the basis for an opportunities/constraints analysis for renewable energy technologies identified in accordance with the DECC methodology in Section 5. The constraints analysis under the DECC methodology comprises a study of the physical environmental constraints, where the physical barriers to deployment are explored such as areas where renewables schemes cannot practically be built – e.g. large scale wind turbines on roads and rivers; and the planning and regulatory constraints, where a set of constraints relevant to each renewable technology are explored that reflects the current planning and regulatory framework, such as excluding from the assessment areas and resources which cannot be developed due to e.g. health & safety, air/water quality, environmental protection.

1.3.1 Environment

Although in a predominantly dense part of Greater London, Redbridge contains significant natural or semi-natural areas including woodland, comprising 3.7% by area of Redbridge; scrub, covering 1.4%; wetlands covering around 1.6%; grassland covering 25% and arable land covering 4.6%[14].

There are two Sites of Special Scientific Interest (SSSI) in Redbridge – Hainault Forest and Epping Forest. Epping Forest is also a Special Area of Conservation (SAC) – a protected site designated under the EC Habitats Directive. Redbridge also has 35 Sites of Importance for Nature Conservation (SINCs) (which is made up of 5 sites of Metropolitan Importance, 10 Borough Grade 1 sites, 10 Borough Grade 2 sites and 10 sites of Local Importance). This information is illustrated in the figure below.

[14] LBR Nature Conservation SPD, June 2006

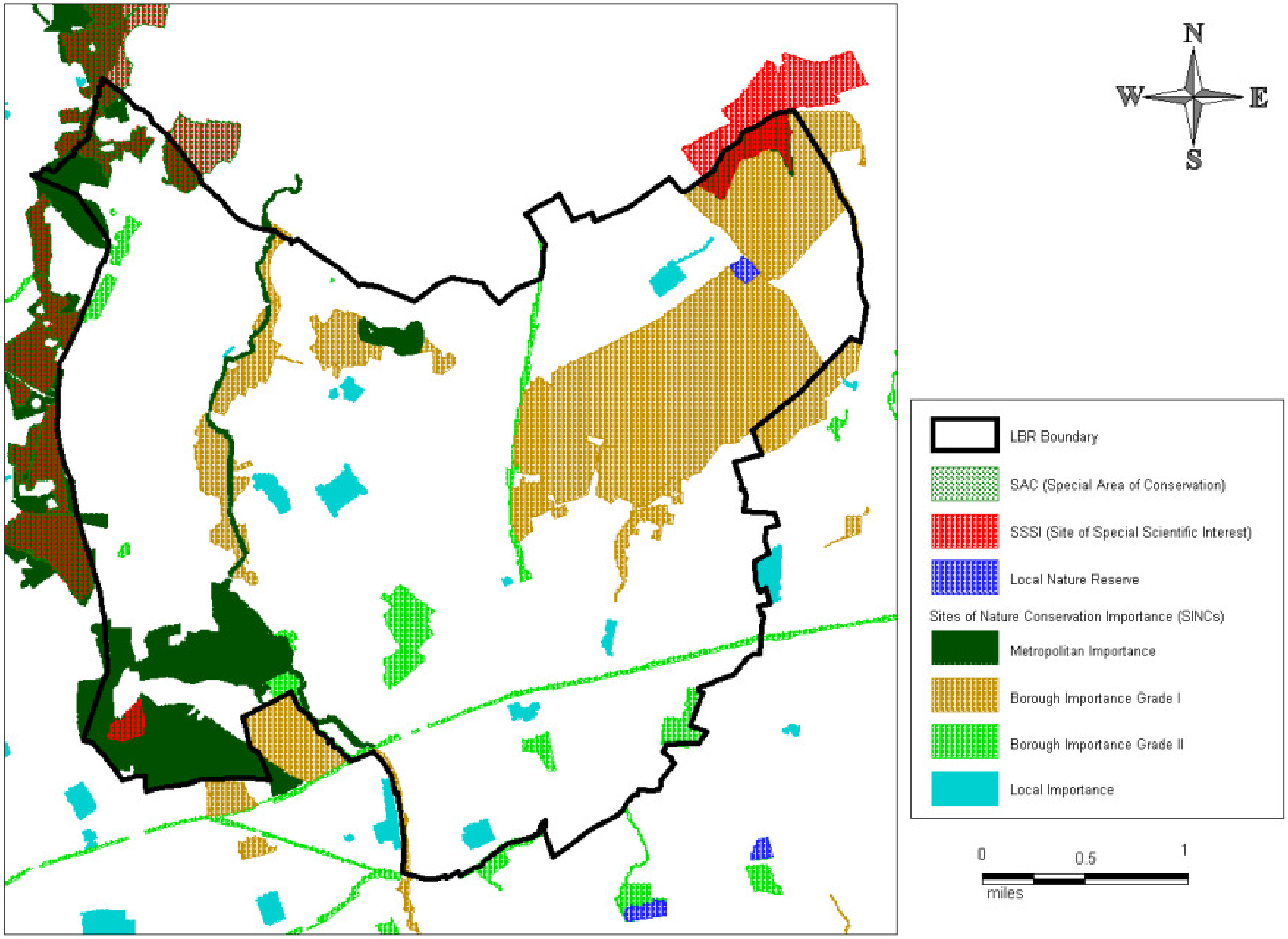


Figure 1-4: Environmental constraints within Redbridge

The main watercourses identified within the London Borough of Redbridge are the river Ching, Ashton Brook, Cran Brook, Loxford Water, Wells Brook and the River Roding. Due to the highly urbanised nature of this part of the catchment, the Loxford Water and Cran Brook are largely culverted and effectively part of the surface water sewer network. Redbridge has some land within flood zones 2 and 3, predominantly around the river Roding, which extends the length of the borough, and also around Loxford Water. Further details can be found in the Strategic Flood Risk Assessment commissioned by the LBR[15]. The figure below illustrates the flood risk sites in the Borough.

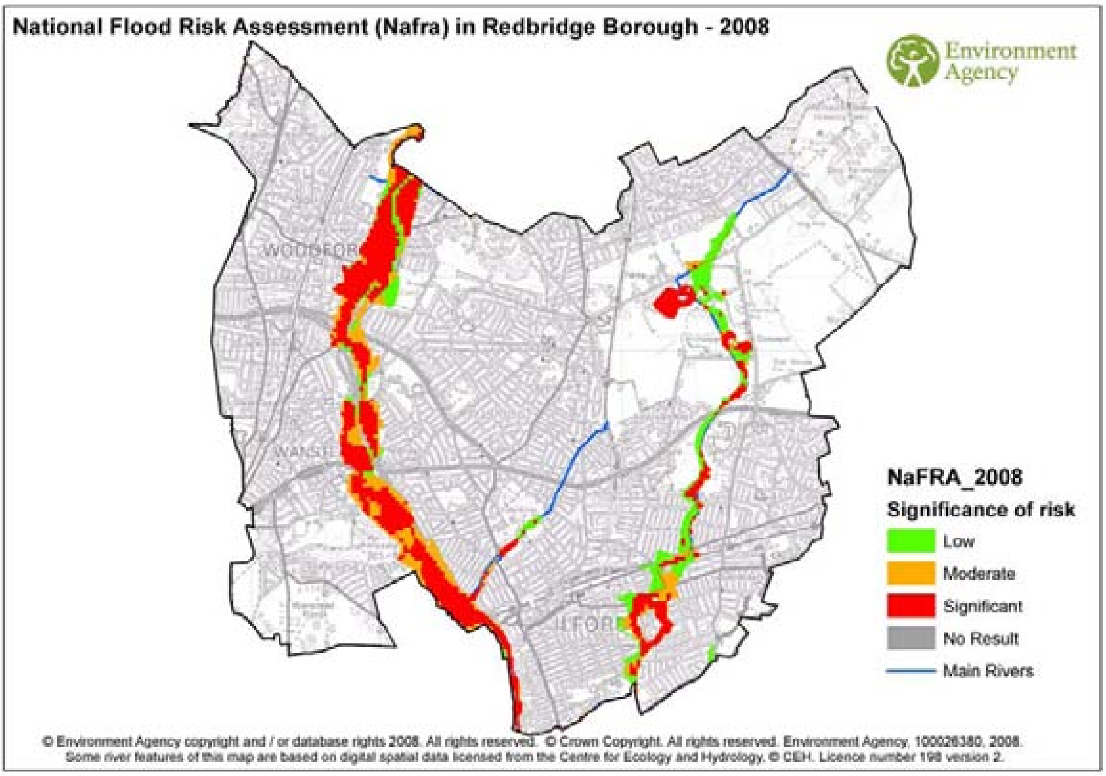


Figure 1-5: Redbridge Flood Risk Assessment map[16]

1.3.2 Historic Environment

There are 129 entries for Listed Buildings in Redbridge, representing nearly 200 listed buildings, which have been highlighted in the figures below. These heritage areas have been identified due to the potential restrictions on the application of technologies such as micro wind, PV's and Solar Hot Water; Ground sourced heating might be explored on properties with larger gardens. New multi-storey buildings in heritage areas are also likely to be restricted.

Figure 1-6 shows the registered heritage areas and Figure 1-7 shows listed buildings in the Redbridge area.

[15] http://www.redbridge.gov.uk/cms/planning_land_and_buildings/planning_policy__regeneration/strategic_flood_risk.aspx
[16] www.redbridge.gov.uk

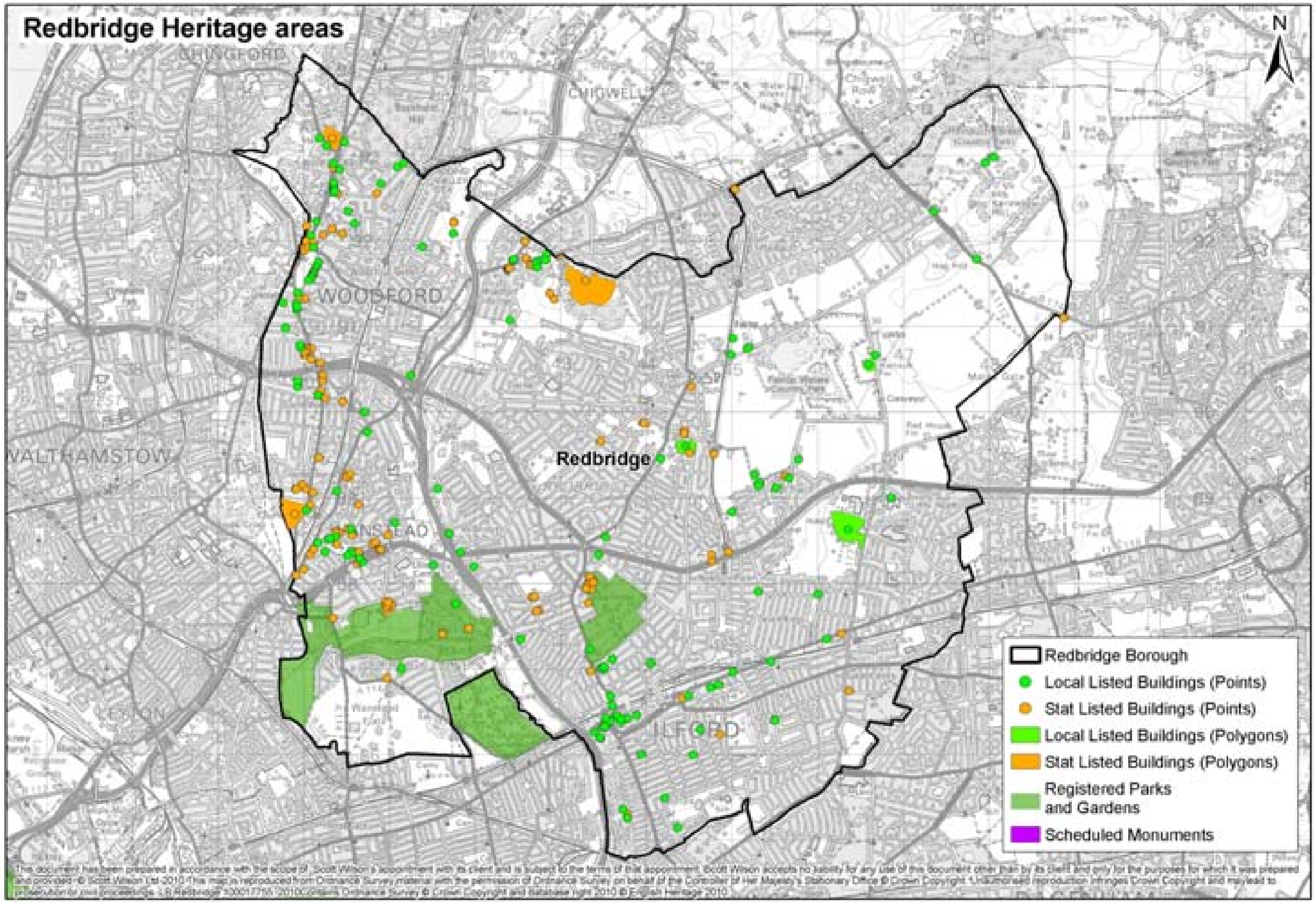


Figure 1-6: Redbridge Heritage areas and listed buildings[17]

[17] Data provided by Redbridge Council GIS department,, April 2010

2 Policy Context

2.1 International & European Policy

The following is a review of national, regional and local policies most relevant to this study.

2.1.1 Kyoto Protocol Agreement[18]

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialised countries and the European Community for reducing greenhouse gas (GHG) emissions. These amount to an average of five per cent against 1990 levels over the five-year period 2008-2012.

The Kyoto Agreement is currently being updated using the 'Bali Roadmap'. Following the Copenhagen summit in December 2009, no agreement was reached in terms of committing the UK to further carbon reductions, technology development and investment. Therefore, UK planning policy currently reflects ambitious internal targets that the Government has set (See Section 2.2 on National Policy).

2.1.2 EU Energy Performance of Buildings Directive (EPBD)[19]

The principal objective of the Energy Performance of Buildings Directive (EPBD) is to promote the improvement of the energy performance of buildings within the EU through cost-effective measures. Key requirements include:

- A calculation methodology, which must be implemented to ascertain the energy performance of buildings, taking account of all factors that influence energy use;
- Minimum energy performance standards to be set for buildings; and
- An energy performance certificate (EPC) to be produced for new buildings (refer to 2.1.4 below).

2.1.3 Renewable Energy (RE) Directive[20]

The RE Directive sets out how the EU will increase the use of renewable energy sources in order to meet the overall target of **20% renewables by 2020**. Under this Directive, the UK will be required to ensure that at least 15% of its final energy consumption comes from renewables by 2020. The Directive sets the UK's interim targets at 4% for 2011/2012, 5.4% for 2013/2014, 7.5% for 2015/2016 and 10.2% for 2017/2018. According to the National Audit Office (NAO), the latest available data from 2008 reveals that only 5.5 percent of power was produced by green technology and just 2.3 percent of all its energy was generated from renewables[21].

[18] http://unfccc.int/resource/docs/convkp/kpeng.pdf
[19] http://ec.europa.eu/energy
[20] http://www.r-e-a.net/document-library/thirdparty/rea-and-fqd-documents/REDDoc_090605_Directive_200928EC_OJ.pdf
[21] National Audit Office (NAO), Government funding for developing renewable energy technologies, June 2010

2.1.4 Energy Performance Certificates[22]

The Energy Performance Certificate (EPC) is a measure introduced across Europe to reflect legislation under the EU Performance of Buildings Directive (EPBD) which aims to reduce buildings' carbon emissions. An Energy Performance Certificate is required for all homes whenever built, rented or sold. The certificate records how energy efficient a property is as a building and provides ratings on a scale of A-G, with 'A' being the most energy efficient and 'G' being the least.

2.2 National Policy

The following sets out the overarching policies of the UK Government.

2.2.1 Securing the Future[23]

Securing the Future is the UK's Sustainable Development Strategy (March 2005) which sets out the principles for sustainable development with a focus on environmental limits. Four priority areas were identified; consumption and production, climate change, natural resource protection and sustainable communities.

2.2.2 UK Strategy for Sustainable Construction[24]

In June 2008, the Government released a Strategy for Sustainable Construction. The Strategy, developed in collaboration with the Strategic Forum for Construction, is aimed at "*providing clarity around the existing policy framework and signalling the future direction of Government policy*".

The Strategy for Sustainable Construction is a joint industry and Government initiative intended to promote leadership and behavioural change. The final Strategy was released on 11th June 2008.

2.2.3 Planning Policy Statement 1: Delivering Sustainable Development[25]

PPS1 sets out the Government's overarching planning policies on the delivery of sustainable development through the planning system. It includes the key principle that local planning authorities should ensure that development plans promote the development of renewable energy resources. It also sets out that development plan policies should seek to promote and encourage, rather than restrict, the use of renewable resources, and that local authorities should promote small scale renewable and low carbon energy schemes in developments.

2.2.4 Planning Policy Statement: Planning and Climate Change Supplement to PPS1[26]

In December 2007, the Government published Planning Policy Statement – Planning and Climate Change, a supplement to PPS1. This document gives an indication of the issues to be

[22] http://epc.direct.gov.uk/index.html
[23] http://www.defra.gov.uk/sustainable/government/publications/uk-strategy/
[24] http://www.bis.gov.uk/sustainableconstructionwww.berr.gov.uk
[25] http://www.communities.gov.uk/publications/planningandbuilding/planningpolicystatement1
[26] Communities and Local Government (2007*) Planning Policy Statement: Planning and Climate Change* [online] available at: http://www.communities.gov.uk/documents/planningandbuilding/pdf/ppsclimatechange.pdf

taken into account in attempting to achieve sustainable development as a contribution to addressing climate change.

Key planning objectives include:

- Enabling new development, securing the highest viable standards of resource and energy efficiency and reduction in carbon emissions;
- Delivering patterns of urban growth that secure sustainable transport movements;
- Securing new development resilient to the effects of climate change; and
- Sustaining biodiversity.

PPS1 supplement on Planning and Climate Change requires Local Authorities to mitigate and adapt to climate change through appropriate location and patterns of development. It states that spatial strategies should abide by the principle that *"new development should be planned to make good use of opportunities for decentralised and renewable or low carbon energy"*. The Supplement, therefore, strengthens the requirement for planners to acknowledge a national need for renewable and low carbon technologies. Planning Authorities should provide a framework that promotes and encourages renewable and low-carbon energy and supporting infrastructure and develop positive policies towards that end.

The Supplement sets out several other measures intended to increase uptake of renewable energy in new development including to: promote consistency with PPS22; encourage the identification of suitable areas for renewables and supporting infrastructure; provide a proportion of energy supply for new development from decentralised and renewable or low-carbon energy sources. Further measures are set out through Local Development Orders (LDOs) including: selecting land for development; local requirements for energy supply to new developments; sustainable design of buildings; and impact of proposed development on renewable energy supplies.

Web-based Practice Guidance[27] has been developed to assist with the implementation of the PPS on Climate Change and to secure good practice. It draws upon the principles in PPS 22: Renewable Energy.

2.2.5 Planning Policy Statement: Planning for a Low Carbon Future in a Changing Climate Supplement to PPS1 (Consultation)

In March 2010 the Government published for consultation Planning Policy Statement: Planning for a Low Carbon Future in a Changing Climate. This consultation document brings together and will replace the 2007 Planning and Climate Change supplement to PPS1 with the 2004 PPS22 on Renewable Energy into a new draft PPS on Planning for a Low Carbon Future in a Changing Climate. It is proposed that this document will become a consolidated supplement to PPS1. This will support and provide an overarching framework for PPS25 on Development and Flood Risk and emerging planning policies on green infrastructure.

27
http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/ppsclimatechange/practiceguidance/

2.2.6 Planning Policy Statement 22: Renewable Energy[28]

PPS 22 on Renewable Energy sets out UK National Policy on renewable energy. It includes a requirement for local authorities to allocate specific sites for renewable energy and to encourage developers to provide on-site renewable energy generation as appropriate.

It requires Local Planning Authorities and developers to consider opportunities for the incorporation of renewable energy into all new developments. Accordingly, Local Authorities should encourage renewable energy schemes through their inclusion in Local Development Documents.

2.2.7 Planning Policy Statement 3: Housing[29]

PPS3 comments on sustainable housing and affordable housing and states that "*Local Planning Authorities should encourage applicants to bring forward sustainable and environmentally friendly new housing developments, including affordable housing developments, and in doing so should reflect the approach set out in the forthcoming PPS on climate change, including the Code for Sustainable Homes*".

2.2.8 Climate Change Act[30]

The Climate Change Act 2008 sets targets for green house gas emission reductions through action in the UK and abroad of at least 80% over 1992 levels by 2050, and reductions in CO_2 emissions of at least 26% by 2020 against a 1990 baseline. As part of the package of measures to achieve this, Government has set a target to generate 20% of the UK's energy demand from renewable sources by 2020.

The Climate Change Act, passed in November 2008, and PPS 22 set out the Government's policies and targets on carbon emissions and renewable energy. These are primarily to:

- Reduce UK greenhouse gas emissions to 12.5% below 1990 levels by 2008-2012;
- Reduce UK CO_2 emissions to 26% below 1990 levels by 2020, with a long term target of 80% below 1990 levels by 2050;
- Meet 10% of UK electricity demand from renewable energy by 2010 and 20% by 2020;
- Have at least 10 GW (gigawatts) of combined heat and power (CHP) capacity in the UK by 2010; and
- Comply with the system of binding five year "carbon budgets", with requirements set out for the Government to report every 5 years on their progress against these and on other climate change impacts and policies.

The April 2009 Budget included a proposal to amend the Climate Change Act to include an interim target for the period covering 2018 – 2022 and increase the 26% reduction in CO_2 emissions to 34%.

[28] ODPM (2004) *Planning Policy Statement 22: Renewable Energy* [online] available at: http://www.communities.gov.uk/publications/planningandbuilding/pps22
[29] http://www.communities.gov.uk/publications/planningandbuilding/pps3housing
[30] The Climate Change Act 2008 is available at: http://www.defra.gov.uk/environment/climatechange/uk/legislation/

2.2.9 UK Renewable Energy Strategy[31]

Published in July 2009, the UK Renewable Energy Strategy aims to tackle Climate Change by reducing carbon dioxide emissions and setting guidelines and targets to increase the renewable energy supply in the UK. It sets out the path for the UK to meet its legally-binding EU target to ensure 15% of its energy comes from renewable sources by 2020; this is almost a seven-fold increase in the share of renewables in scarcely more than a decade.

2.2.10 Planning & Energy White Papers[32]

The UK Fuel Poverty Strategy (2001) set out how the Government proposes to ensure affordable warmth for all households. The subsequent Energy White Paper: Our Energy Future – Creating a Low Carbon Economy (2003) includes the key energy policy goal to *"ensure that every home is adequately and affordably heated"* and the aim *"in England, within reason, for no household to be in fuel poverty by 2016"*. The revised 2007 Energy White Paper includes a strategy to accelerate the deployment of low carbon technologies.

The 2009 Energy White Paper: *The UK Low Carbon Transition Plan* sets out a twelve-year plan for the UK to reduce CO_2 emissions by 18% on 2008 levels.

2.2.11 UK Building Regulations[33]

The 2006 amendments to Part L of the Building Regulations aim to reduce CO_2 emissions from buildings. Key additional requirements of Part L are as follows:

- New buildings must produce 20-28% less CO_2 than a 2002 Building Regulations compliant building;
- All new buildings must be designed to meet the design CO_2 emission target using the Simplified Buildings Energy Model (SBEM) or other approved software;
- Systems should be provided with appropriate controls to enable the achievement of reasonable standards of energy efficiency in use;
- In buildings with floor areas greater than 1,000m^2, automatic meter reading and data collection facilities should be included; and
- An Energy Performance Certificate (EPC) must be provided for buildings over 1,000m^2.
- Consequential improvements apply where the floor area is over 1000 m2 and there is increase in capacity of a fixed building service, or a new extension. The principal works (to new or extended parts) must comply with guidance, and consequential improvements (to the rest of the building) must bring the thermal properties up to stated values, and then upgrade services over 15 years old, install metering and low-zero carbon within stated economic limits and a cap of 10% of principal works cost. Please refer to Section 8 for further details.

[31] http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/res/res.aspx
[32] http://www.communities.gov.uk/publications/planningandbuilding/planningsustainablefuture
[33] www.communities.gov.uk

2.2.12 Code for Sustainable Homes

The Code for Sustainable Homes (CSH) was introduced in April 2007 as a voluntary measure to provide a comprehensive assessment of the sustainability of a new home and replaces the EcoHomes methodology. The Code Level is awarded on the basis of achieving a minimum overall score and a set of mandatory minimum standards for the categories of waste, materials, surface water run-off, energy and potable water consumption.

Ratings under the Code are attributed to each dwelling type within a development and specific mandatory energy targets are set for each level of the Code as outlined in Table 2-1 below.

CSH Level and Star rating	Energy Requirements (Improvement over TER)	Overall Performance Improvement over Baseline
Level 1 (*)	10%	36%
Level 2(**)	18%	48%
Level 3 (***)	25%	57%
Level 4 (****)	44%	68%
Level 5 (*****)	100%	84%
Level 6 (******)	Zero Carbon	90%

Table 2-1: CSH Level and Performance Improvement

The targets above are based on improvements to Part L of the Building Regulations. Currently Level 6 of the Code (zero carbon) is obtained through offsetting all of the CO_2 from both Part L regulated energy uses and non-regulated energy sources such as household appliances and cooking (not assessed under Part L). Unregulated energy use accounts for approximately 30-40% of a household's energy consumption and will require a reduction on the Target Emission Rate (TER) of approximately 150% to attain Code 6. See Figure 2-1 which illustrates regulated and unregulated emissions.

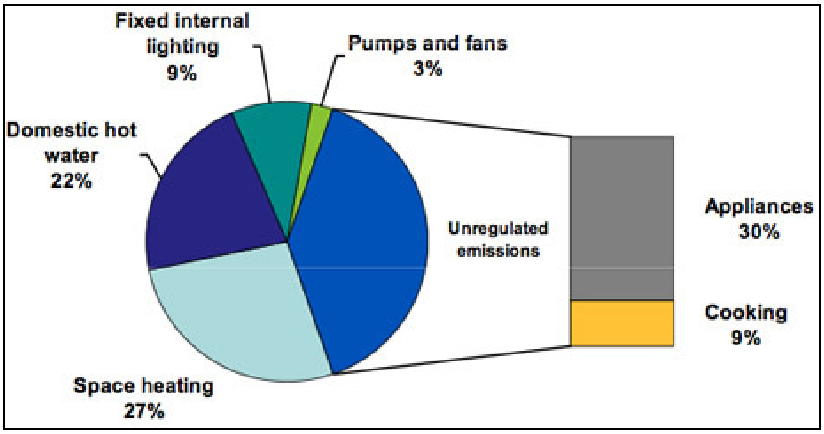


Figure 2-1: Regulated and unregulated emissions as defined by Part L

'Zero carbon' homes as defined by the Code are required to have a maximum heat loss parameter (HLP) from the building fabric of $0.8Wm^2K$. Additionally, low and zero carbon energy generation are required to be either located on the development site or be physically connected to a dwelling via private wire or a District Heat (DH) network. The Code is currently undergoing consultation, which is likely to replace the HLP measure with an energy demand measure in kWh/m^2. Furthermore, Building Regulations will be requiring higher energy efficiency levels as part of the Roadmap to zero carbon homes. There is still ambiguity over the definition of zero carbon and how this is defined by part L of the Building Regulations, however the consultation paper released by the Department of Communities and Local Government[34] sets out the following:

1. A minimum standard of energy efficiency will be required.
2. A minimum carbon reduction should be achieved through a combination of energy efficiency, onsite low and zero carbon (LZC) technologies, and directly connected heat. This is referred to as achieving carbon compliance.
3. Any remaining emissions should be dealt with using allowable solutions, including offsite renewable energy.

2.2.13 BREEAM

BREEAM (Building Research Establishment Environmental Assessment Method) is a tool used to review of the sustainability performance of non-domestic buildings. Depending on the type of building and the use of the building, it can be assessed under various BREEAM methodologies. For each issue, there are a number of credits available. Where the building attains or exceeds various benchmarks of performance, an appropriate number of credits is awarded. The weightings obtained for each credit are applied to the individual issue categories to provide an overall BREEAM Assessment score.

Depending on the number of credits attained in the various issue categories, the results are translated into a corresponding overall single score which gives consideration to the environmental weightings. This single score translates into the BREEAM rating, in accordance with the thresholds illustrated in **Table 2-2**.

BREEAM Industrial Rating	Percentage Score
Pass	**>30%**
Good	**>45%**
Very Good	**>55%**
Excellent	**>70%**
Outstanding	**>85%**

Table 2-2: BREEAM score and associated rating

[34] http://www.communities.gov.uk/publications/planningandbuilding/futureofcodeconsultation

2.2.14 Future Energy Targets – Non-Domestic

Subsequent policy and standards have also been set in order to create a step change to zero carbon for non-domestic buildings. The UK Sustainable Construction Strategy sets out and anticipates the following step change to zero carbon with new schools, public sector buildings and other non-domestic buildings to be zero carbon from 2016, 2018 and 2019 respectively. See Table 2-3 below:

	Anticipated Carbon Reduction Targets												
Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Dwellings Schools Public buildings Non-residential buildings	Part L 2006	25% improvement over Part L 2006			44% improvement over Part L 2006			Zero Carbon					
Equivalent CSH Rating		Level 3			Level 4						Level 6		

Table 2-3: Anticipated Carbon Reduction Targets all Building Types

2.2.15 Climate Change Levy[35]

Renewables are exempt from the CCL, which is designed to encourage the business and public sectors to improve energy efficiency and reduce emissions of greenhouse gases through a price based signal on energy usage.

2.2.16 Carbon Reduction Commitment Energy Efficiency Scheme (CRC)[36]

The CRC Energy Efficiency Scheme, aimed at reducing carbon emissions from large organisations, requires commercial and public sector organisations consuming at least 6,000MWh of electricity on all half-hourly (HH) electricity meters to participate in mandatory emissions trading. Registration for the cap-and-trade scheme began in April 2010, and the first capped phase will begin in January 2013.

2.3 Regional Policy

2.3.1 The London Plan[37]

This Low Carbon, Renewable Energy and Heat Mapping Study responds to the London Plan, which is the Mayor of London's spatial development strategy for London. The London Plan climate change policies as set out in chapter 4A collectively require developments to make the fullest contribution to tackling climate change by minimising carbon dioxide emissions, adopting sustainable design and construction measures, prioritising decentralised energy supply, and incorporating renewable energy technologies with a target of 20% carbon reductions from on-site renewable energy. The policies set out ways in which developers must address mitigation of and

[35] http://www.cclevy.com/
[36] http://www.environment-agency.gov.uk/business/topics/pollution/98263.aspx
[37] http://www.london.gov.uk/thelondonplan/thelondonplan.jsp

adaptation to the effects of climate change. Policies 4A.2 to 4A.8 of the London Plan focus on how to mitigate climate change and the carbon dioxide reduction targets that are necessary across London to achieve this.

2.4 Local Policy

A number of key policy documents within the Local Development Framework have been adopted, including the Core Strategy (March 2008), Borough Wide Primary Policies (May 2008), Development Sites with Housing Capacity (May 2008), Development Opportunity Sites (May 2008), Ilford Town Centre Area Action Plan (May 2008) and the most recent Gants Hill District Centre Area Action Plan (May 2009).

Redbridge Borough does not have its own policy on renewable energy, but relies instead on London Plan Policy 4A.7 Renewable Energy. This states that all new development should seek to achieve a minimum of 20% on-site renewable energy generation.

2.4.1 The Local Development Framework

The Local Development Framework (LDF) comprises a series of Development Plan Documents (DPDs) which contain the policies, and Supplementary Planning Documents (SPDs) which enlarge on, or explain how the policies will be applied.

2.4.2 London Borough of Redbridge Core Strategy and Development Plan Documents[38]

Redbridge has a sound Core Strategy in place that addresses climate change/adaptation at a strategic level, as well as five other sound DPDs that respond to climate change/adaptation at a local level.

Strategic Policy 1 Overall Growth states that the Metropolitan Centre (Ilford) will be the primary area for growth, followed by some growth in the District Centres, with little change expected to occur in the Local Centres.

Strategic Policy 7 Housing, supported by the Borough wide Policy H1 Housing Provision aims to distribute new housing as follows:

- Ilford Town Centre: 35%-50%
- District and Local Centres: 15-25%
- Rest of the Borough: 25-35%

The Borough aims for 90% of new housing to be on previously developed land.

Strategic Policy 2 Green Environment sets out the various types of land which need to be protected, including Green Belt and Metropolitan Open Land, Sites of Special Scientific Interest and a range of sites of acknowledged nature conservation value. It also provides protection for the borough's waterways and floodplain, for natural habitat and trees.

[38] http://www.redbridge.gov.uk/cms/planning_land_and_buildings/planning_policy__regeneration/idoc.ashx

Strategic Policy 3 Built Environment states the Council's determination that all new development should be well designed and gives special attention to development in Conservation Areas, and of listed buildings. It also calls for minimisation of energy use and greenhouse gas production and for water conservation measures.

The Ilford Town Centre Area Action Plan (AAP) and the Gants Hill District Centre AAP provide a detailed expression of the Core Strategy in the context of these two town centres, and have been discussed in further detail in Chapter 6.

2.4.3 Sustainable Design and Construction Supplementary Planning Guidance[39]

The Sustainable Design and Construction Supplementary Planning Guidance (SPG) (May 2005) has been developed to promote sustainable practices in design and construction and is aimed at developers and refers to the design and construction of new developments of all sizes. LBR is aiming to update this guidance in 2010.

2.4.4 Sustainable Design and Construction Checklist[40]

The Council requires all proposals to be designed in accordance with the principles of sustainable development. The Sustainable Design and Construction (SDC) Checklist, based on the Code for Sustainable Homes (CSH), is required to inform a Sustainability Statement that must form part of the Design and Access Statement required for all planning applications involving new dwellings.

2.4.5 Redbridge Environmental Action Plan 2007-2017[41]

The Redbridge Environmental Action Plan (REAct), adopted in July 2008, identifies climate change adaptation as a key issue, and broadly identifies the potential impacts of climate change. REAct brings together all the existing plans and strategies dealing with different environmental matters.

2.4.6 Local Area Agreement[42]

The Local Area Agreement (LAA) is a commitment by the Council and other service providers to support the delivery of the borough's Sustainable Community Strategy, which has an overarching priority of addressing climate change.

Redbridge has signed the Nottingham Declaration on Climate Change. This commits the Council to delivering the UK Climate Change Programme at the local level. The Council will regularly negotiate CO_2 reduction targets with central Government as part of the Local Area Agreement process for relevant National Indicators (NI 185).

[39] http://www.redbridge.gov.uk/cms/planning_land_and_buildings/planning/sustainable_planning/the_councils_sustainability.aspx
[40] Sustainable Design and Construction, Planning Application Checklist, April 2008
http://www.redbridge.gov.uk/cms/planning_land_and_buildings/planning/sustainable_planning/idoc.ashx?docid=3705f33b-8b58-42ee-92f6-93af2b107e1c&version=-1
[41] ttp://www.redbridge.gov.uk/cms/the_environment/what_we_are_doing_in_redbridge/our_environmental_action_plan.aspx
[42] http://cms.redbridge.gov.uk/environment__planning/planning_and_regeneration/regeneration_in_redbridge/local_area_agreement.aspx

The Council has taken part in the Local Authority Carbon Management Programme, in association with the Carbon Trust. This has identified a baseline of carbon emissions from Council activity of 30,000 tonnes in 2005. This detailed investigation will be used as the Redbridge baseline emission data when setting and reporting against CO_2 targets.

2.5 UKCIP09 Projections

2.5.1 Introduction

The UK Climate Projection[43] (UKCIP09) provides projections of climate change for the UK, giving greater spatial and temporal detail than previously released UK climate scenarios. The work of the UK Climate Projections programme gives perspective to the targets and aims of the carbon reduction measures that Redbridge is adopting.

The UKCIP does not attempt to predict the degree to which economic and social change will affect emissions levels, but rather takes as its starting point three different emissions scenarios (A1FI or 'high', A1B or 'medium' and B1 or 'low'), and then calculates the probability of different climate scenarios resulting from these emissions level changes. The levels of annual global emissions adopted under different scenarios are illustrated in Figure 2-2below.

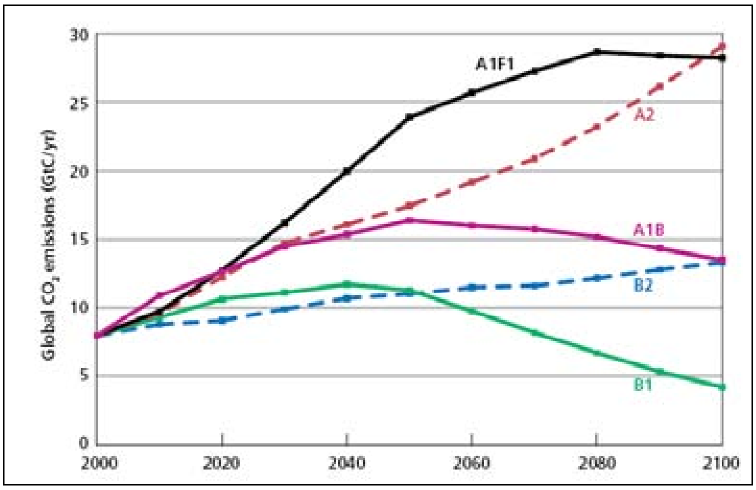


Figure 2-2: Global annual CO2 emissions under the three IPCC scenarios in UKCP09[44]

NB: The dotted lines in Figure 2-2 show UKCIP02 scenarios.

The figure below[45] illustrates projections in global temperature from 21 global models (mean series shown in black dots) under the A1B ('medium') emissions scenario.

[43] UK Climate Impacts Programme, DEFRA, DECC, DOE, The Scottish Government, the Welsh Assembly Government, the Met Office Hadley Centre, July 2009.
[44] www.ukcip.org.uk
[45] Ibid, page 29

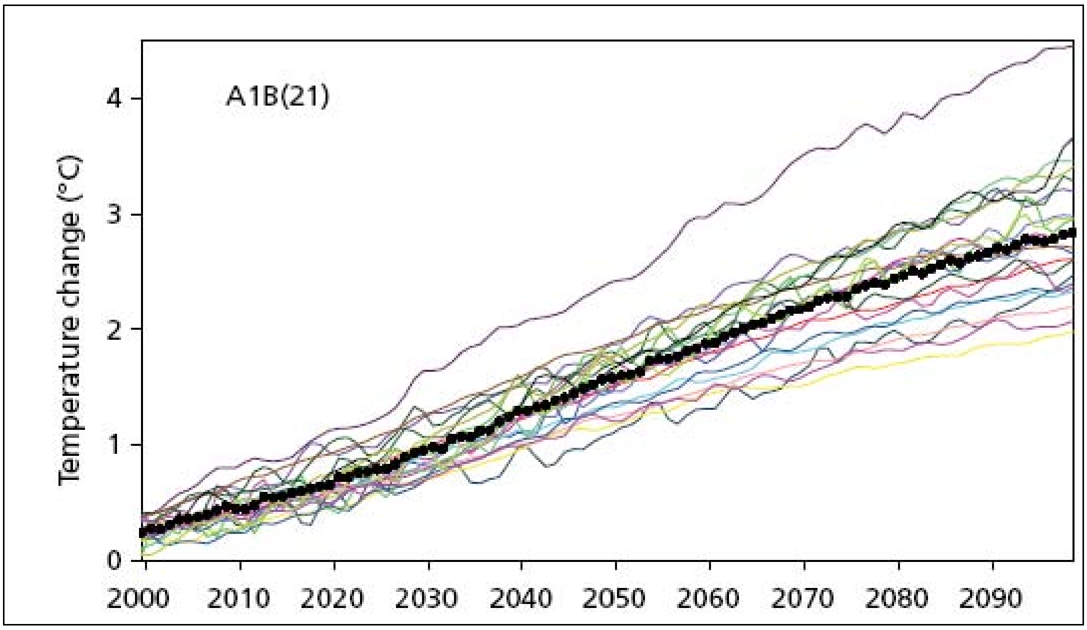


Figure 2-3: Temperature changes under A1B emissions

Whilst global weather changes are critical to the sustainability of human existence, local climate changes also bring home the relevance of intervention at a local level.

For London, under a medium emissions scenario, the following statements are made by UKCP09[46] for 2080:

- Under medium emissions, the central estimate of increase in winter mean temperature is 3ºC; it is very unlikely to be less than 1.6ºC and is very unlikely to be more than 4.7ºC. A wider range of uncertainty is from 1.4ºC to 5.7ºC.
- Under medium emissions, the central estimate of increase in summer mean temperature is 3.9ºC; it is very unlikely to be less than 2ºC and is very unlikely to be more than 6.4ºC. A wider range of uncertainty is from 1.4ºC to 8.1ºC.
- Under medium emissions, the central estimate of change in winter mean precipitation is 19% (increase); it is very unlikely to be less than 3% and is very unlikely to be more than 44%. A wider range of uncertainty is from 3% to 58%.
- Under medium emissions, the central estimate of change in summer mean precipitation is -23% (decrease); it is very unlikely to be less than -48% and is very unlikely to be more than 7%. A wider range of uncertainty is from -56% to 13%.

2.6 Relevant Studies

2.6.1 North East London Biomass Supply Chain Study

The North East London Biomass Study establishes potential demand for and supply of biomass fuel in the London Boroughs of Barking & Dagenham, Havering and Redbridge. The study

[46] http://ukcp09.defra.gov.uk/content/view/38/6/, accessed 02 November 2009

highlights that a 20% offset from renewable energies becomes increasingly challenging for residential developments in blocks with more than 25 dwellings. This is due to the decrease of roof area per dwelling available for photovoltaic (PV) panels.

The Study shows that the combined existing, planned and proposed capacity for Biomass in North East London is 5.2 MW (thermal), excluding a large 8.8MW waste treatment project using waste wood. The Study highlights that if wood products are diverted from recycling to wood fuel production this could have a detrimental impact upon the councils' ability to meet their recycling targets, which could potentially act as a deterrent to using wood products as a fuel.

In terms of Air Quality Management Areas, the Mayor's draft states that small biomass installations must be considered inappropriate for AQMAs unless it can be demonstrated that they will not cause any reduction in air quality.

In terms of wood pellet supply for use within North East London, the study includes capacity from wood pellets transported from as far as Canada. This has been justified by the finding that a significant carbon saving was found despite large distances of transportation, compared to fossil fuel alternatives (the overall carbon content of wood fuel imported from Canada was found to be half that of natural gas).

3 Heat Mapping Study: Redbridge Energy Demand and Future Emissions Projections

3.1 Introduction

This chapter forms the evidence base for the Heat Mapping Study which has been described in further detail in chapter 4. The aims of the energy demand assessment and carbon mapping undertaken on behalf of the LBR were twofold: first, to quantify the level of emissions currently generated by the building stock in the Borough; and, second, to identify those areas with the highest density of carbon emissions. The high density emissions areas represent locations where greatest impact on the overall carbon footprint could be made through suitable policy intervention, and provide an indication of the areas with a high heat demand within Redbridge.

3.2 Methodology and Data Sources

Several sources of data have been explored and adapted in compiling the base data to create a carbon snapshot of Redbridge. Avenues explored included:

- Census 2001 data
- Valuation Office Agency data
- National Statistics Office data
- National Grid
- LBR supplied data
- BRE published data
- DECC published data
- Correspondence with stakeholders

A number of previous statistical studies have addressed the issues of fuel use at a Borough level, and high quality data (e.g. that has achieved the status of National Statistics) is available.

The figures corresponding to the National Indicator 186 methodology have been selected for this study in order to ensure compatibility between this document and the Council's internal monitoring and reporting methodology.

3.3 Redbridge Borough Carbon Footprint

The domestic sector has the highest carbon emissions in Redbridge, accounting for 52% of the total[47]. Domestic gas use is the highest contributor. The industrial and commercial sector and the transport sector have carbon emissions accounting for 23% and 24% respectively[47]. The carbon

[47] Redbridge Borough: Environmental Summary, London State of the Environment report, Environment Agency, 15th February 2010

emissions associated with Redbridge account for 2.3% of total London emissions in 2005, which ranks 25th out of 32 London boroughs.

DECC has published data for Redbridge in the following form, based on 2007 data, as shown in Table 3-1:

Tonnes CO_2 p. a. in thousands	Industrial Commercial Agriculture	Domestic	Road Transport
Redbridge (NI186, 2007)	230	539	264

Table 3-1: Redbridge Carbon Emissions Derived from DECC Data

The results highlighted above summarise the Borough-wide carbon emissions. A pie chart of emissions by sector for the Borough is shown below, illustrating the contribution of the built-environment to the wider basket of carbon emissions.

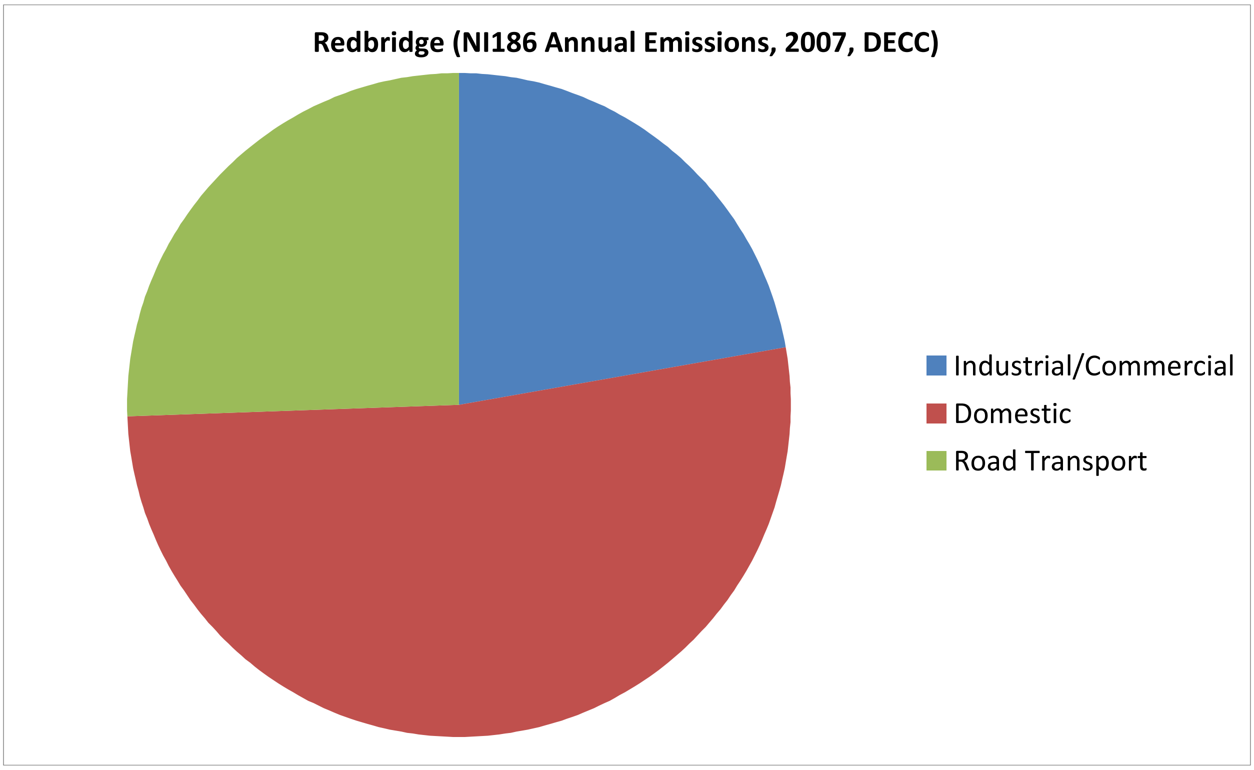


Figure 3-1: Carbon Emissions by Sector in Redbridge

This chart illustrates that the majority of the Borough's emissions arise from the domestic sector, reflecting the mix of building stock.

The overall carbon footprint for Redbridge is illustrated in the table below:

NI186 DECC 2007 figures	Total NI186 Carbon Footprint thousands of tonnes carbon dioxide per annum (% of UK total)
Redbridge	1,033 (0.24%)
UK Total	432,727(100%)

Table 3-2: Redbridge Overall Emissions Footprint

In the national context, the figures for electricity consumption on a per dwelling basis (kWh per customer) can be seen to be fairly low for domestic properties, and low in terms of industrial / commercial consumption levels, as displayed on the following[48] maps. This can be attributed to the fact that London is a high density area, with a large number of customers in a very small area, as compared to the rest of the UK (e.g. rural areas).

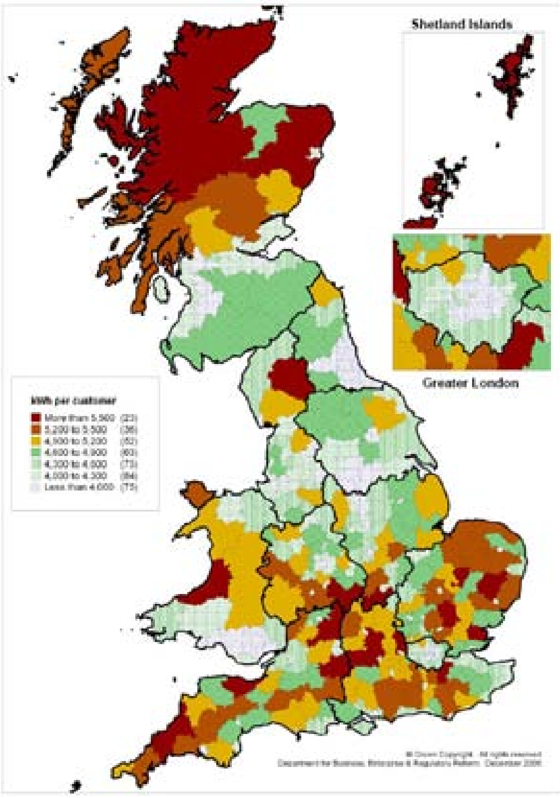


Figure 3-2: Average Domestic Electric Consumption per Meter Point in 2007 (kWh)

[48] DECC, Maps showing domestic, industrial and commercial electricity consumption at local authority level, Publication URN 09D/535,

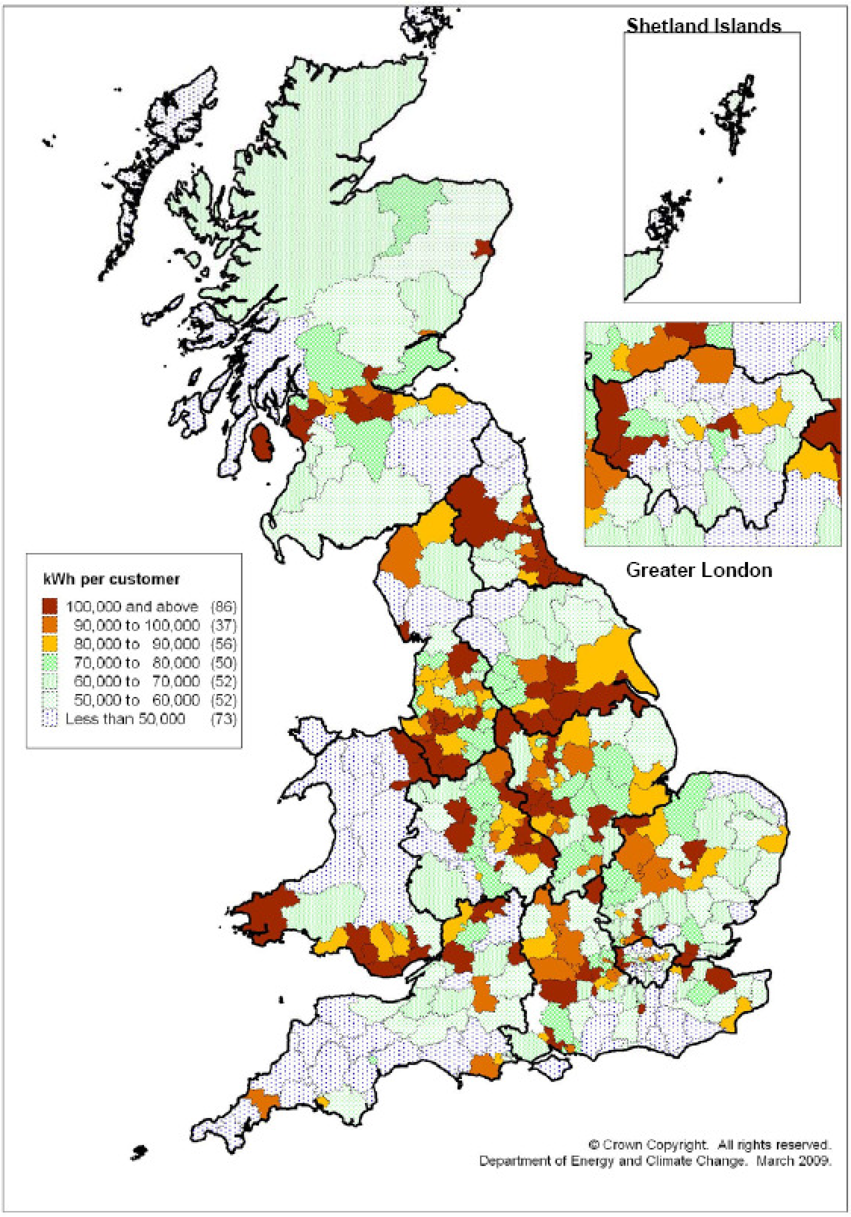


Figure 3-3: Average Industrial / Commercial Electricity Consumption per Meter Point in 2007 (kWh)

On a regional basis, the following figures illustrate the NI186 (DECC 2007) figures for per capita emissions in all London Boroughs.

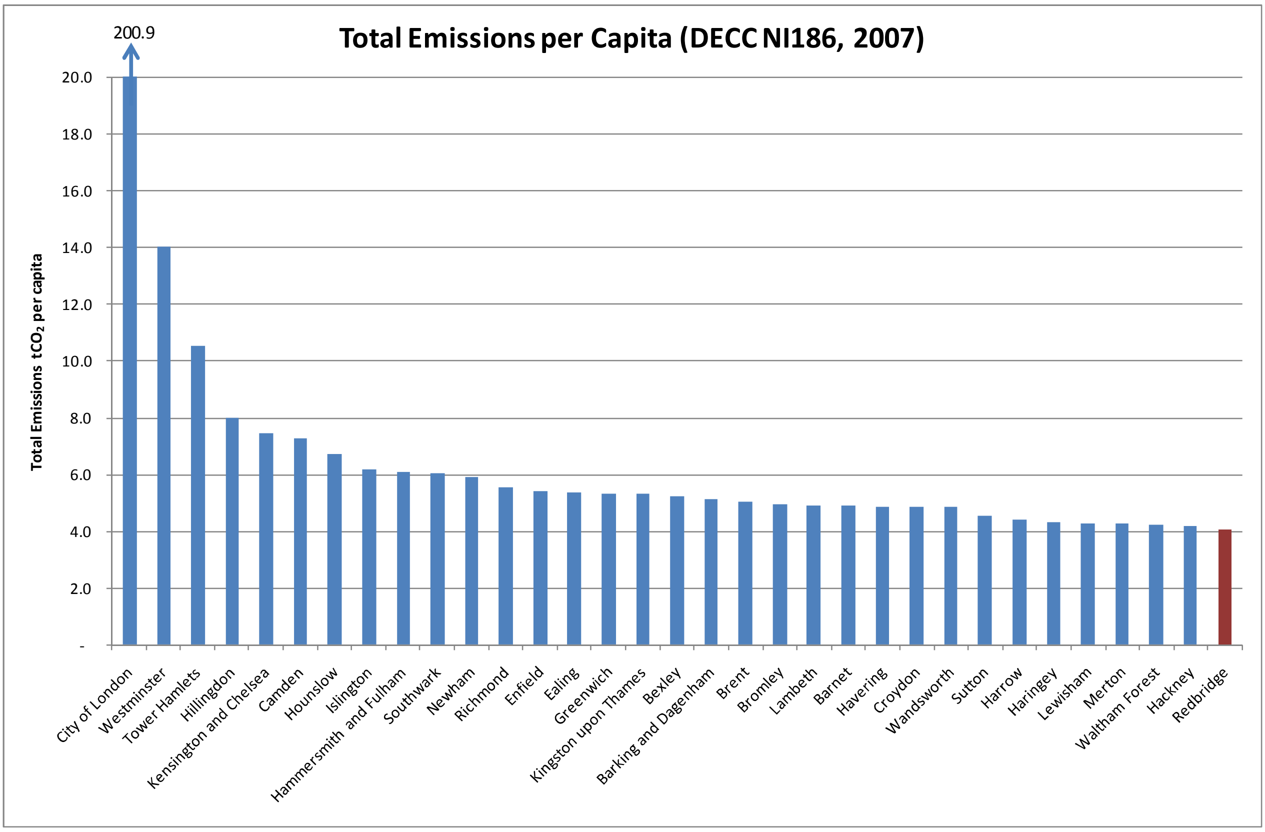


Figure 3-4: London Boroughs Total Emissions Per Capita (DECC, NI186, 2007)

This graph illustrates that Redbridge has the lowest level of per capita emissions of all the London Boroughs. When compared with the graph below, the reason for this can be derived:

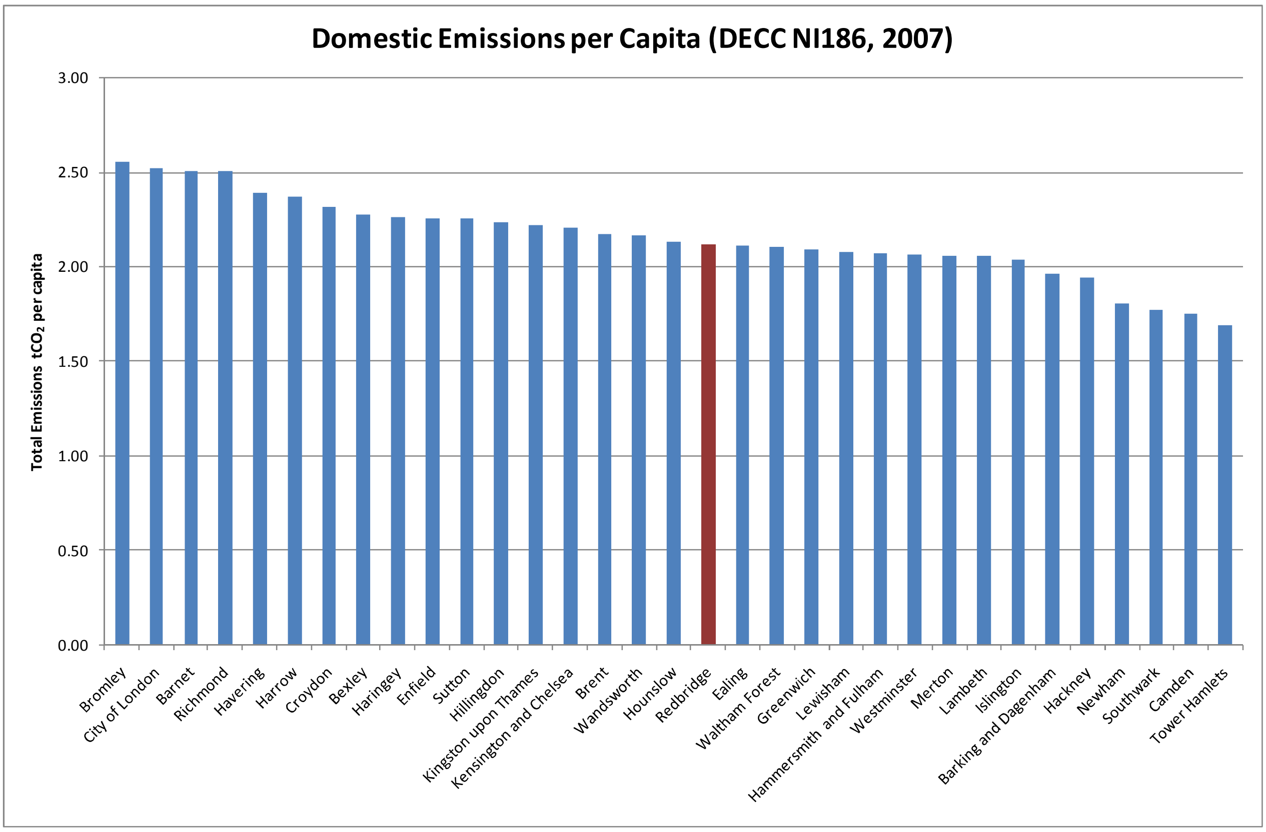


Figure 3-5: Per Capital Domestic Emissions (NI186, DECC, 2007)

Domestic emissions in Redbridge are shown to be mid-range amongst the London Boroughs, and hence it can be deduced that the low level of overall total per capita emissions is a result of low levels of industrial, commercial and agricultural emissions on a per capita basis within the Borough.

3.4 Local Emissions Distribution

Using 2001 Census data, a map of the distribution of emissions within the Borough can be extrapolated from the fossil fuel demand density map for heating and electricity in Redbridge (transport excluded). This is displayed below:

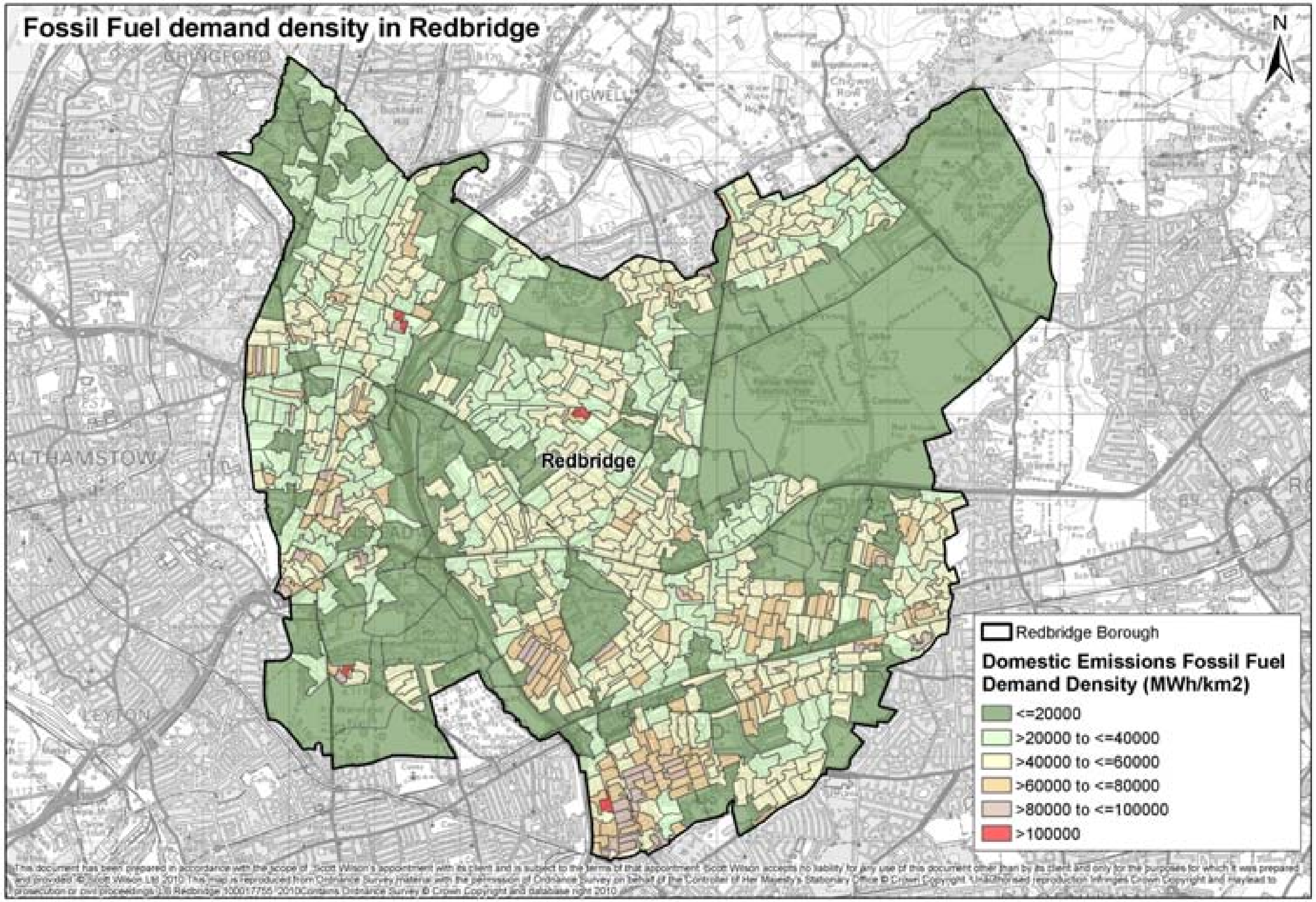


Figure 3-6: Fossil Fuel demand density in Redbridge

Since the figure above is based on Census data (and takes into account growth since 2001 and latest ONS data), which illustrates domestic density rather than individual buildings with heat demands of over 200MW (which is the basis for selection of buildings in the heat mapping study in Chapter 4), a direct correlation cannot be made between the figure above and areas of high heat demand identified in Chapter 4. Although in general the figure above suggests low fossil fuel demand, DH cluster areas can still be identified within a census output area as DH opportunities relate to individual buildings with heat demands of over 200MW. This explains the anomaly between the fossil fuel demand density areas in Redbridge and the areas identified as opportunity areas of district heating in Chapter 4.

Valuation Office Agency (VOA) data has not been used in this study due to legal issues. Commercial development has therefore been extracted from the available DECC data source.

3.5 Emissions Projections

This study has analysed carbon emissions projection modelling for the period until the end of 2017. Using DECC energy consumption information as the starting point for analysis, the level of impact on the different policy options for energy is investigated. It must be noted that in contrast to NI186 emissions figures (which adopt different year on year emissions factors that reflect historic generation fuel mix), the analysis contained within this section adopts Part L2A (2006) emissions factors, and hence the base figures for emissions differ somewhat from the NI186 figures shown above.

3.5.1 Domestic Emissions Scenarios

We have modelled three policy scenarios, equivalent to minimum Government Standards (Option 1 – 2010 Building Regulations), an accelerated timetable of imposition of Government standards (Option 2), and a third option which is more ambitious in its aspirations, imposing zero carbon standards even earlier than under Policy Option 2. The three scenarios are represented by the following timetables of Code for Sustainable Homes Levels:

CFSH Levels	2010/2011	2011/2012	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017
Option 1	3	3	3	4	4	4	6
Option 2	4	4	4	5	5	6	6
Aspirational standards	4	5	5	6	6	6	6

Figure 3-7: Modelled CSH scenarios

3.5.2 Housing Projections

Drawing on information provided by the Council (See Appendix B.2), Scott Wilson has compiled the following projections of housing numbers for the plan period. This summary has been used to assess the impact of the policy options outlined above.

The basis for the projection of housing expansion has been provided by the Council and can be summarised as follows:

Redbridge Borough	2010-2013	2014-2016	2017-2019	2019+
Numbers of net new residential properties	3384	3520	1593	765

Table 3-3: Number of new dwellings projected by period based on the Council's most recent housing trajectory (2009 Annual Monitoring Report), adopted AAP's and the emerging Crossrail Corridor AAP,

A residual floor space of $72m^2$ per dwelling has been assumed based on information provided by the Council.

3.5.3 Domestic Emissions Projections

Given the policy scenarios and housing build projections outlined above, the following domestic emissions scenarios have been modeled.

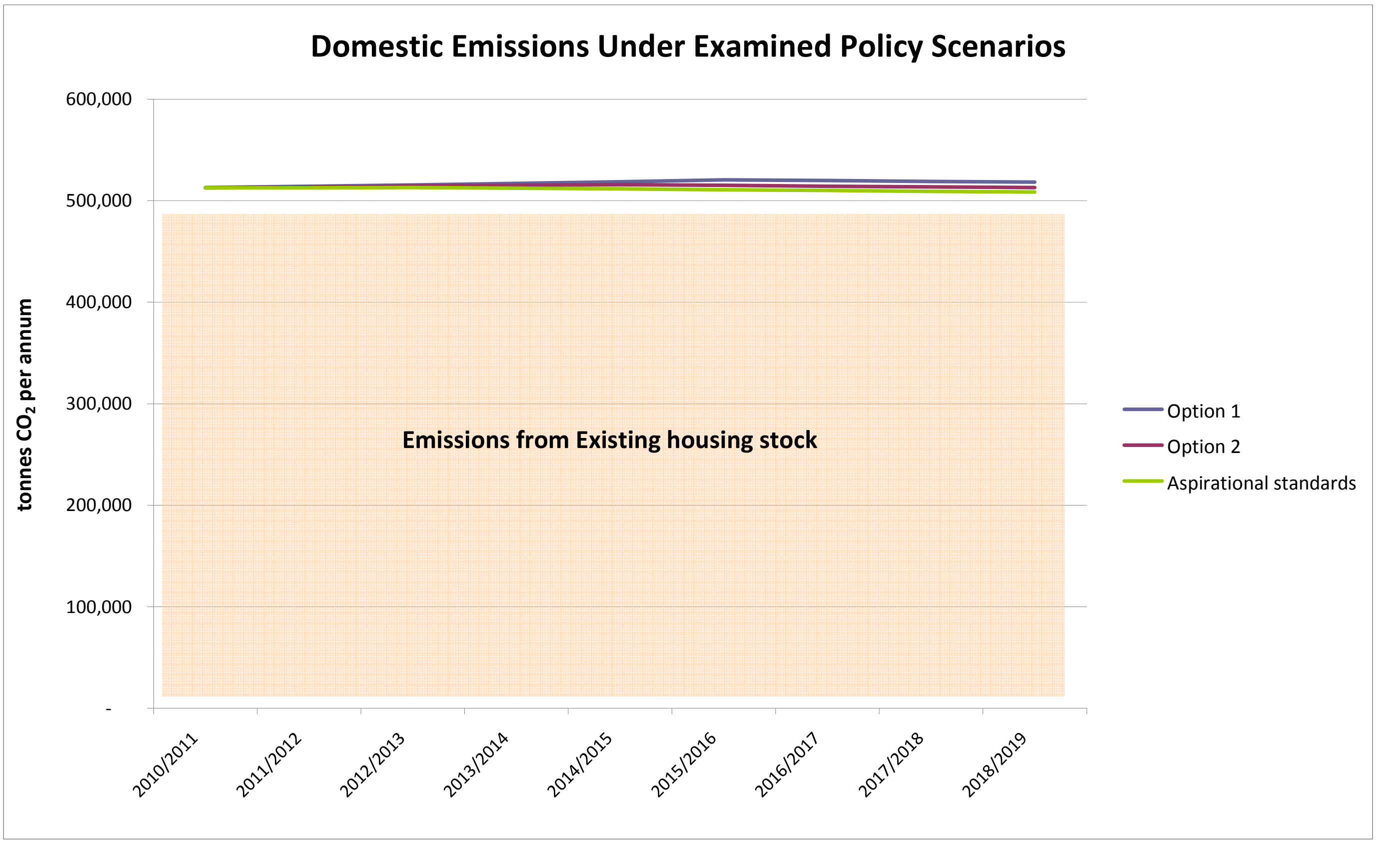


Figure 3-8: Domestic emissions projections under examined policy scenarios

This graph is a key finding of this study. It illustrates the degree to which the acceleration of the imposition of standards will impact overall sector carbon emissions. The area on the graph below 500,000 tonnes CO_2 per annum represents the potential for reduction in emissions from existing domestic buildings. The graph illustrates that any additional policy intervention (bringing forward planned legislation by 2 or 3 years) makes little difference in overall carbon emissions, compared to the potential for reduction in emissions from improvements in the existing stock. This is largely due to the fact that existing housing stock in Redbridge consists of around 99,000 homes, while domestic new build will range from around 800 new homes per year to around 1200 new homes per year between 2010 and 2019. Therefore the potential for carbon reduction through improvements in Building Regulations for new build is restricted in Redbridge. For example, total carbon emissions from existing and new buildings in 2010/2011 (using Option 1) is 513,026 tonnes CO2 per year. Accelerating the introduction of Code Level 4 from 2013/2014 to 2010/2011 enables us to implement improvements in the 846 new homes planned in 2010/2011, which brings carbon emissions for 2010/2011 down to 512,475 tonnes per year, a reduction of 0.12%. Certain assumptions have been made for reduction in emissions from existing homes, i.e. marginal improved energy efficiency over the planning period. These measures, coupled with the aspirational standards are evident in the dip in emissions around 2016.

It must be noted that these modelling results represent a scenario where all new homes projected to be built are subject to the emissions requirements of the policy scenarios, rather than introducing a policy size threshold level above which more challenging environmental targets would be implemented,[49] or distinguishing between the strategic sites and non-strategic site new-build elements.

3.5.4 Commercial/ Industrial New Build Rates

Three policy scenarios were modelled for the non-domestic sector as for the domestic sector, equivalent to minimum Government Standards (Option 1- 2010 Building Regulations), an accelerated timetable of imposition of Government standards (Option 2), and a third option which is more ambitious in its aspirations, imposing zero carbon standards even earlier than under Policy Option 2. The three scenarios are represented by the following timetable:

	% reduction in emissions from 2006 Part L scenario	2010/ 2011	2011/ 2012	2012/ 2013	2013/ 2014	2014/ 2015	2015/ 2016	2016/ 2017	2017/ 2018	2018/ 2019	2019/ 2020
Option 1	regulated energy	25%	25%	25%	44%	44%	44%	100%	100%	100%	100%
	non-regulated energy	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Option 2	regulated energy	44%	44%	44%	100%	100%	100%	100%	100%	100%	100%
	non-regulated energy	0%	0%	0%	0%	0%	0%	100%	100%	100%	100%

49 A minimum number of 10 dwellings often constitutes a large development to which renewable energy policy targets apply.

Aspirational standards	regulated energy	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	non-regulated energy	0%	0%	0%	100%	100%	100%	100%	100%	100%	100%

Figure 3-9: Non-domestic emissions reductions by policy options

The projections for Commercial / Industrial uses have been provided by the LBR Council. The Council has provided floor area figures for each period of anticipated development (e.g. 2014 – 2016) matching anticipated Building Regulation revisions.

Figures in Table 3-4 have been assumed for future non-domestic uses (Use Classes Order types B1, B2, B8) and retail (A1, A2, A3, A4 and A5).

Redbridge Borough	2010-2013	2014-2016	2017-2019	2019+
m^2 of net new non-domestic properties	50,640	73,060	53,145	13,000

Table 3-4: Non-domestic floor area projections based on the phasings outlined in the adopted AAP's and the emerging Crossrail Corridor AAP

The baseline energy consumption figures for the existing non-domestic building sector have been derived from the Commercial and Industrial from DECC statistics[50].

[50] Publication URN 10D/487A, DECC.

3.5.5 Non-domestic Emissions Projections

Given the policy scenarios and non-domestic build projections outlined above, the following emissions projections have been developed:

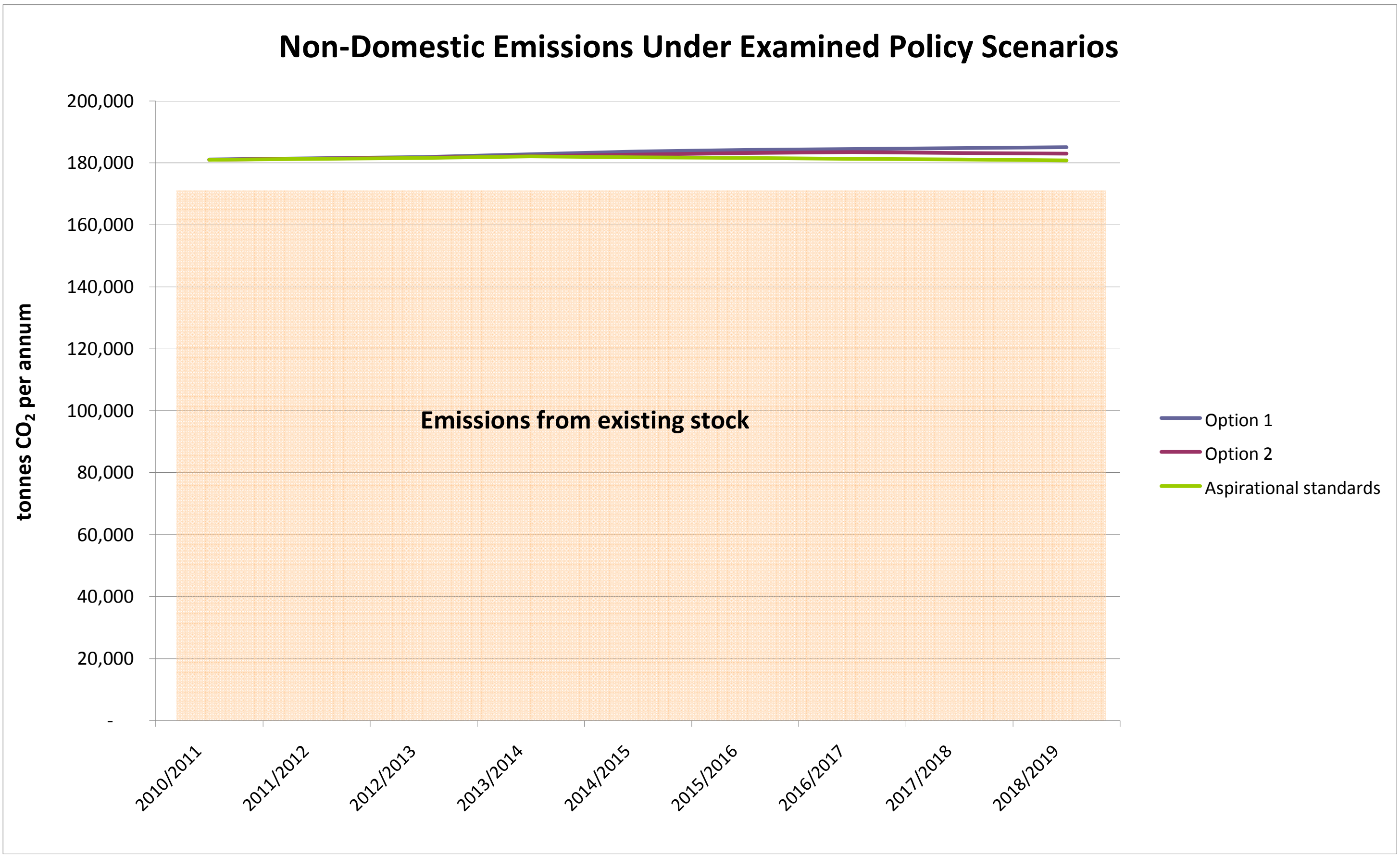


Figure 3-10: Commercial emissions projections under varying policy scenarios[51]

The figure above illustrates the degree to which the acceleration of the imposition of standards will impact overall sector carbon emissions. In terms of overall carbon emissions from the Commercial sector, the difference between the three options is not significant. The area on the graph below 180,000 tonnes CO_2 per annum represents the potential for reduction in emissions from existing commercial buildings.

[51] Please note that these emissions have been calculated from energy consumption projections and emissions factors. The emissions factors that have been adopted in calculation are those from the Building Regulation Approved Document Part L2A (2006). These figures differ from those used in the NI186 methodology, which reflect the actual recorded national generation mix. Projection of the generation mix into the future is beyond the scope of this report and hence fixed figures have been adopted.

3.6 Policy Orientation

The figures above for domestic and commercial emissions projections illustrate clearly that there is only a limited level of impact on overall building stock emissions that new-build policy can make. If the overall goal of Redbridge's policy framework is to reduce carbon emissions, then this analysis strongly points towards the need for policy measures that target the emissions of existing buildings as well as new construction. **Appendix A** provides guidance to Redbridge residents on behavioural changes to reduce domestic energy consumption and measures to improve energy efficiency in existing housing.

4 Heat Mapping Study: Input into London Heat Map and Decentralised Energy Implementation

Following the baseline energy demand assessment, input was provided into the London Heat Map, prepared by the London Development Agency (LDA), with the objective of identifying opportunity areas in Redbridge for district heat networks. Energy data from key buildings was collected and fed into a detailed mapping exercise to map areas in the borough of high heat demand.

The London Heat Map provides a web-based GIS resource containing high level data on decentralised energy across London. The London Heat Map is part of the Decentralised Energy Master Planning (DEMaP) programme, developed by the LDA to meet the Mayor's target of 25% of London's energy supply from decentralised energy by 2020.

Within Redbridge Borough, the heat mapping exercise was carried out in four stages:

- Data collection of actual heat demand for buildings (including energy load mapping, which has been presented in Chapter 3) to identify areas of highest heat demand as well as the locations of any existing combined heat and power plants or decentralised energy networks. A number of stakeholders were contacted, both Council and private landlords, to gather data;
- Completion of LDA spreadsheet in order to obtain GIS outputs;
- Workshop to review opportunities for district heating based on existing and proposed development;
- Identification of 'clusters' of buildings which may have the best potential for future DE networks or connections to existing networks.
- Completion of a high level implementation plan to prioritise DE opportunities for Redbridge.

4.1 Data Collection

The first phase of the data gathering involved identification of the priority buildings within the Borough and presentation of these on a GIS map, alongside new developments identified within Redbridge's Local Development Framework. .

The data collection process is illustrated in the flow diagram in Appendix D.2

In order to establish the energy demand from priority buildings, LBR and the LDA requested actual rather than benchmark data be used, where available, to complete the Heat Mapping spreadsheet (Template provided in Appendix D.4), which was forwarded to the LDA for further evaluation through GIS.

The London Heat Map was evaluated to identify high heat demand providers (areas in dark red in the figure below). Around fifty buildings were selected and the establishments are presented below, with an index of the buildings (including addresses) provided in Appendix D.1.

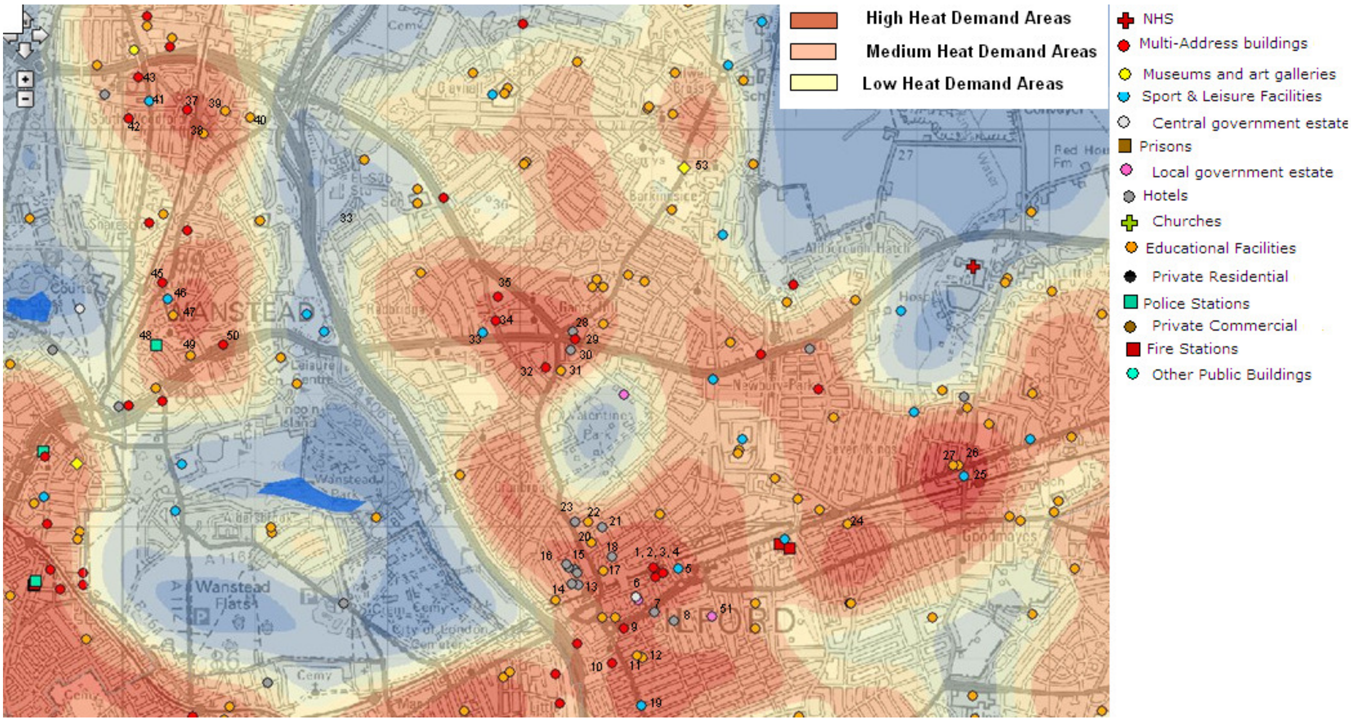


Figure 4-1: London Heat Map showing areas of high heat demand within Redbridge

Potential heat customers in Redbridge that were investigated included properties with a fossil-fuel consumption above 200 MWh p.a, which excludes the vast proportion of small retail units with low district heating connection potential, but includes the majority of significant heat users and large multi-occupancy residential blocks. It is the density of heat demand in a particular area that is the key indicator for district heating viability (setting aside transaction and contractual issues). A combination of premises which came into this threshold and properties selected from the Heat Map illustrated in Figure 4-1 was evaluated in terms of its potential contribution to the growth of a wider heat network.

The information gathering exercise for private buildings involved identifying names and contact numbers for over 40 stakeholders by establishing preliminary contact via telephone to identify a suitable individual to address queries to and obtaining email addresses of relevant individuals. Postal addresses were also confirmed at this stage and relevant individuals were sent a letter requesting information to be provided to Scott Wilson and the Council for the heat mapping study. The responses to the initial telephone conversation were fairly positive with over 60% of the people contacted willing to provide input to the Study. Telephone contact was mainly established with proprietors of hotels, managers of schools (where LBR did not have data), and managers of leisure centres. The Council provided assistance in identifying management agencies for certain multi-residential buildings, and these were contacted in the second phase of phone calls.

The letter sent to each identified establishment provided a written description of the aims and justification for the data request. A spreadsheet to be filled in and returned was provided with the letter. Stakeholders were given the option of either filling in the spreadsheet or providing Scott Wilson with their annual energy bills to simplify the process and facilitate the extraction of relevant information.

Following the letter, a second round of phone calls was conducted, the results of which were poor. Only two stakeholders responded positively, agreeing to provide information on energy bills. Contact could either not be established with the remaining respondents due to a number of reasons including closure of schools for Easter vacation, or a number of respondents avoiding phone calls despite repeated attempts to contact them. For multi-residential buildings, although contact was established with a few managers, they could not provide details on energy consumption due to individualised billing systems.

Energy demand data for over 80 Council owned properties and over 40 privately owned properties was sought. Those establishments which responded fairly positively in the first round of calls, or with whom telephone contact could not be established, were selected for a site visit, carried out by the LBR Council. Approaching premises and personally requesting information was considered to be more likely to be successful, although details on energy consumption were not obtained despite the visits.

A summary of the stakeholder responses has been provided in Appendix D.3.

Limited actual data was available, other than Council data, which we consider important in terms of lessons learnt for future exercises. It is understood that other boroughs participating in the DEMaP process have experienced similar difficulties with regard to private data collection.

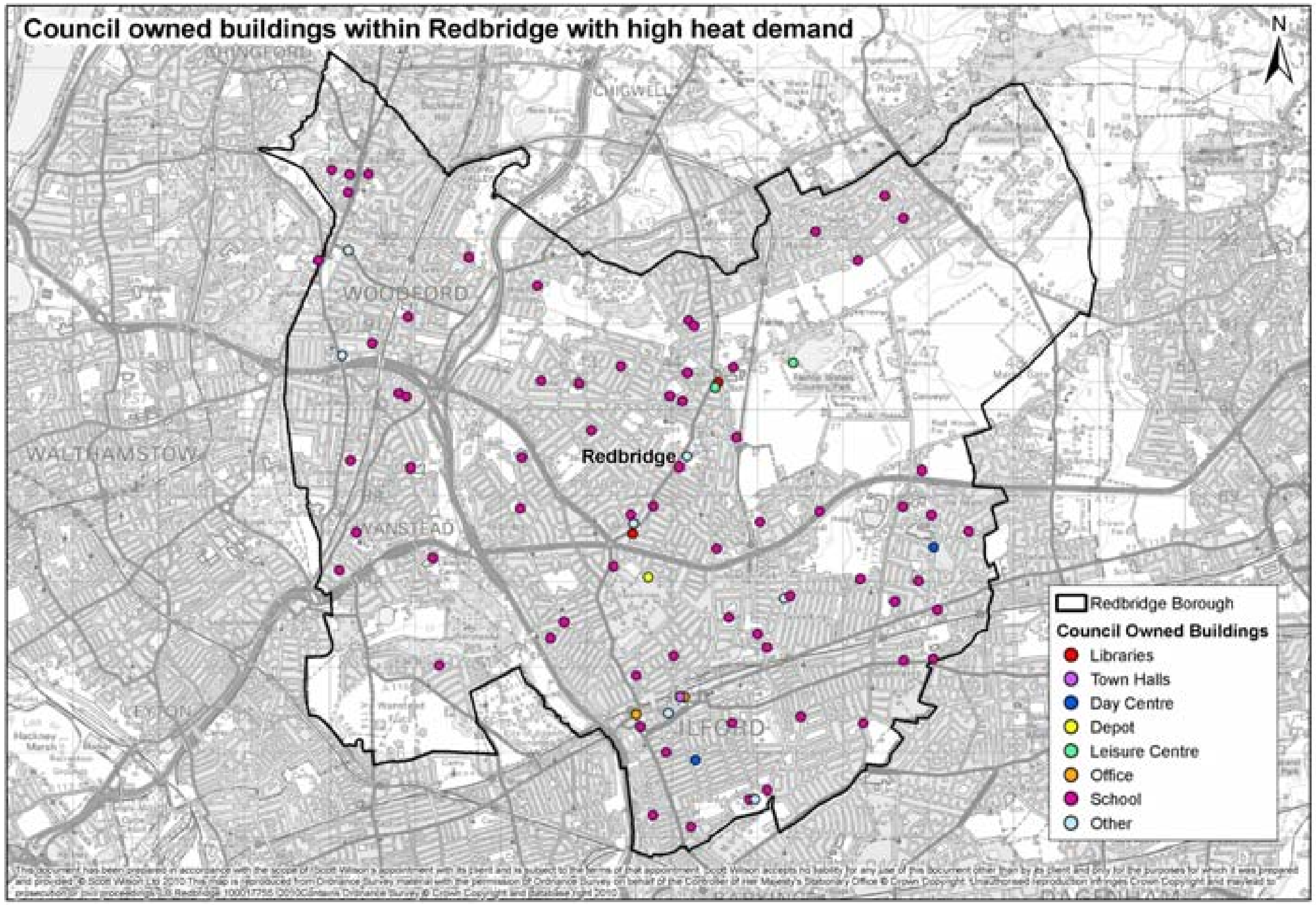


Figure 4-2: Council owned buildings within Redbridge with high heat demand

Successful energy data gathering was carried out on over 80 Council owned properties including schools, leisure centres, office buildings, youth centres and the Town Hall, which have been highlighted in the figure above.

Please refer to Appendix C for a list of the Council owned properties illustrated in these figures including heat demands and contact details for the properties.

The figure below illustrates both the private buildings and the Council owned properties selected for the heat mapping study. Details including addresses and estimated and actual heat demand for the buildings are provided in Appendix C, D. 1 and D.3.

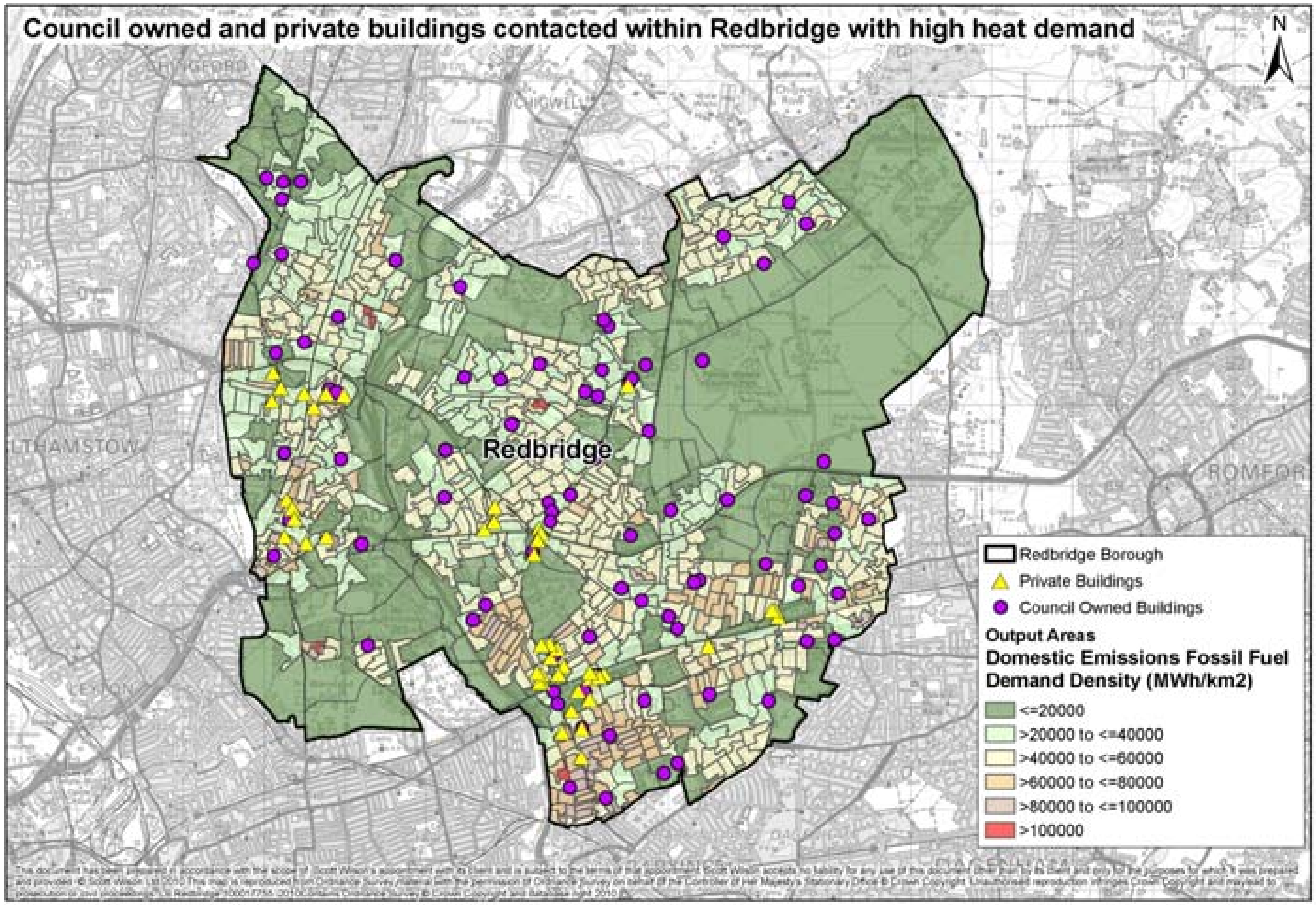


Figure 4-3: Council owned and private buildings contacted within Redbridge with high heat demand

4.2 Completion of LDA Spreadsheet in order to obtain GIS outputs

In order to complete the LDA data spreadsheet as accurately as possible, data obtained from the stakeholder consultation for the private buildings was entered into the spreadsheet. Buildings were viewed on Streetview to ascertain actual size of the property and narrow down the selection process for obtaining actual data, thus excluding those buildings too small to have a significant heat demand. Floor areas for private buildings were obtained via GIS and post code data.

Actual energy information for Council owned properties (over 80 properties were identified) with heat demands of over 200MWh was collated and their OS grid points referenced. Refer to results in Appendix C where heat demands from Council buildings have been summarised in the London Heat mapping template (provided in Appendix D.4).

Both sets of data for private and public buildings were mapped using GIS by the LDA, in order to identify potential heat network 'clusters' (as derived from Figures 4.5 and 4.5, giving preference to both existing and proposed developments with a high heat demand) within a practicable range of the buildings in question. Thresholds for facilitating this evaluation was mapped by the Scott Wilson GIS Team in order to identify relationships between existing developments with a demand over 200MWh illustrated in Figure 4-4 and proposed developments with high heat demand as illustrated in Figure 4-5.

Figures 4.4 & 4.5, illustrate existing buildings with a suitable heat demand and proposed buildings with a high heat demand (over 200MWh). These sites were derived from the heat demand analysis as summarised in Appendix C & D. The GIS images were presented at the heat demand workshops (as outlined in Section 4.3) with LBR and the LDA in attendance, and used to discuss potential relationships with proposed development. The objective was to identify key areas where heat demand was at its highest but was in closest proximity to newly proposed development where surplus heat could be used by customers. Figure 4.5 identifies key anchor loads such as hospitals, schools and leisure centres as these proposed developments provide the greatest opportunity for an energy profile, suitable for decentralised energy such as Combined Heat and Power. Cluster areas were then identified in conjunction with the LDA and LBR as illustrated in Figure 4.6. Clusters have been sized according to 100, 500 and 1000MWh clusters

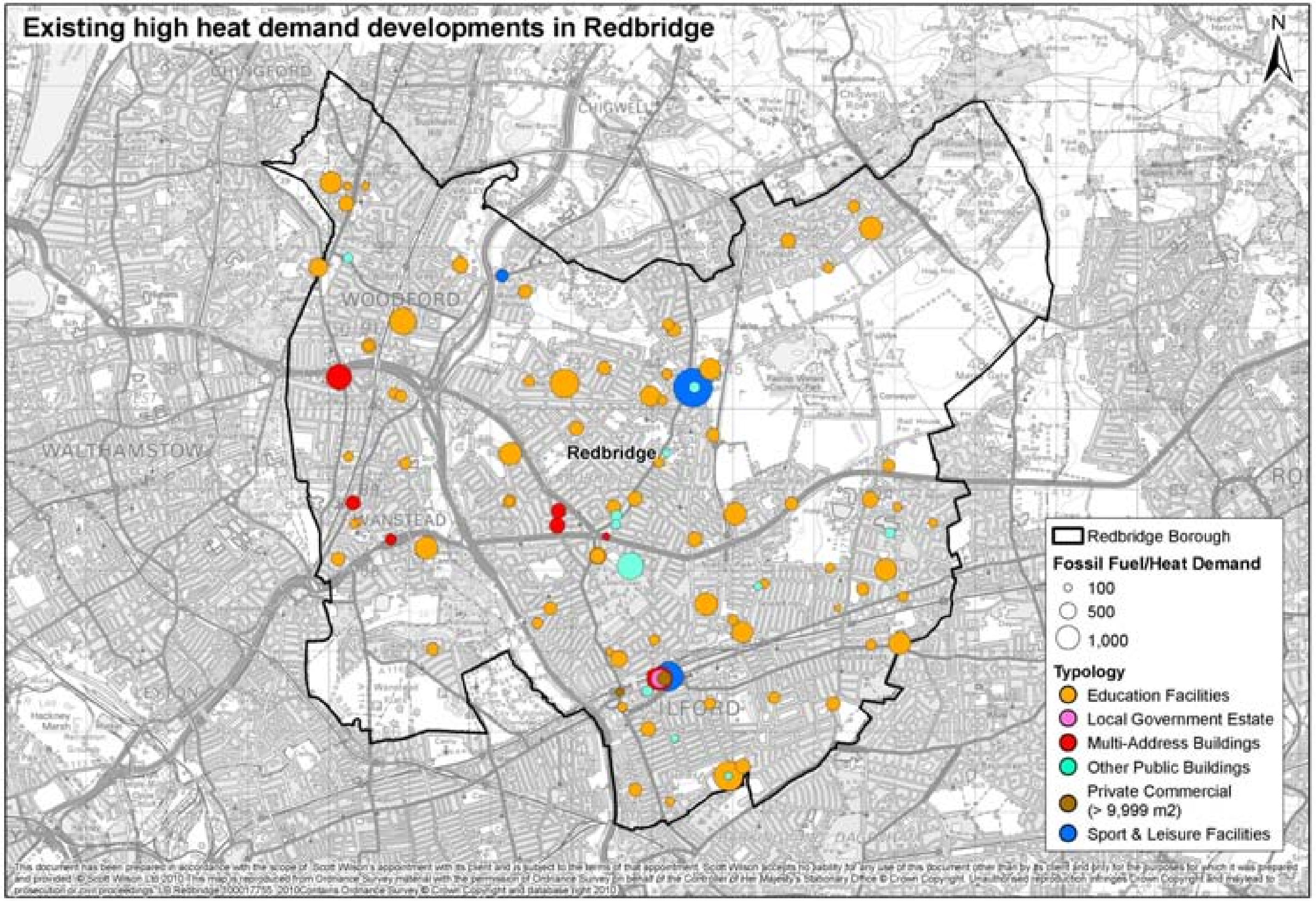


Figure 4-4: Existing Buildings within Redbridge with High Heat Demand

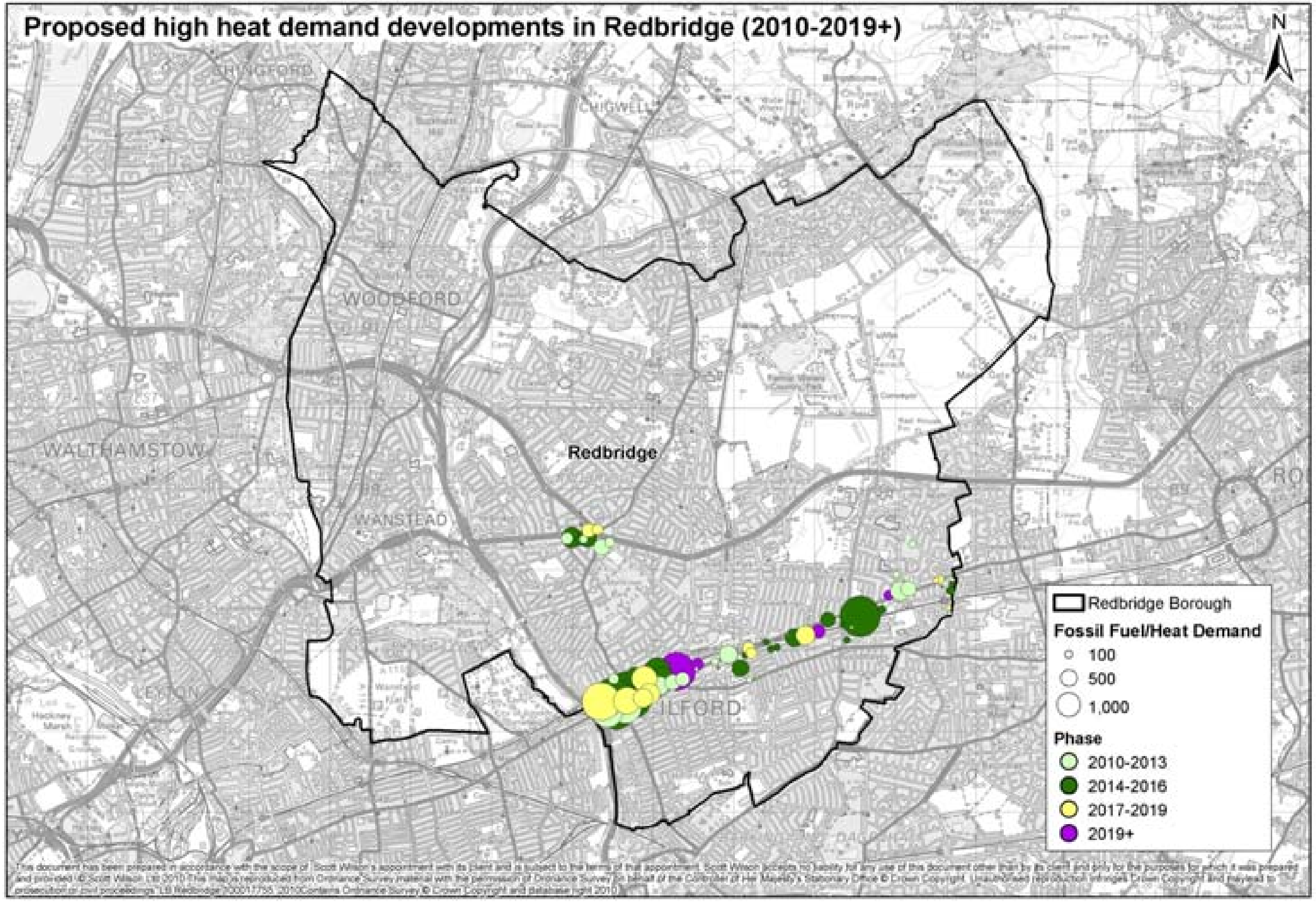


Figure 4-5: Proposed Buildings within Redbridge with High Heat Demand

4.3 Workshop to review opportunities for district heating based on existing and proposed development

In order to objectively determine the most suitable location for the deployment of a heat network or number of heat networks in the London Borough of Redbridge the study team held two workshops to confirm potential locations which could potentially be further evaluated through future phases of the DEMaP programme.

The study team held an initial workshop with the Council and the LDA on the 27th April, 2010 to discuss potential synergies including consideration of building type, proximity to each other, tenure (public or private), suitable distance and thus identify borough specific locations for the deployment of a heat network. This workshop enabled the study team to determine a shortlist of five locations within the Borough which would be evaluated in further detail in conjunction with local stakeholders.

4.4 Identification of 'clusters' within Redbridge

As a result of the workshops, five cluster sites were identified to be the most suitable for a district heat network in Redbridge as outlined in Figure 4-6 below include:

- Fullwell Cross
- King George Hospital
- Ilford Town Centre & Crossrail Corridor
- Gants Hill
- Loxford School area

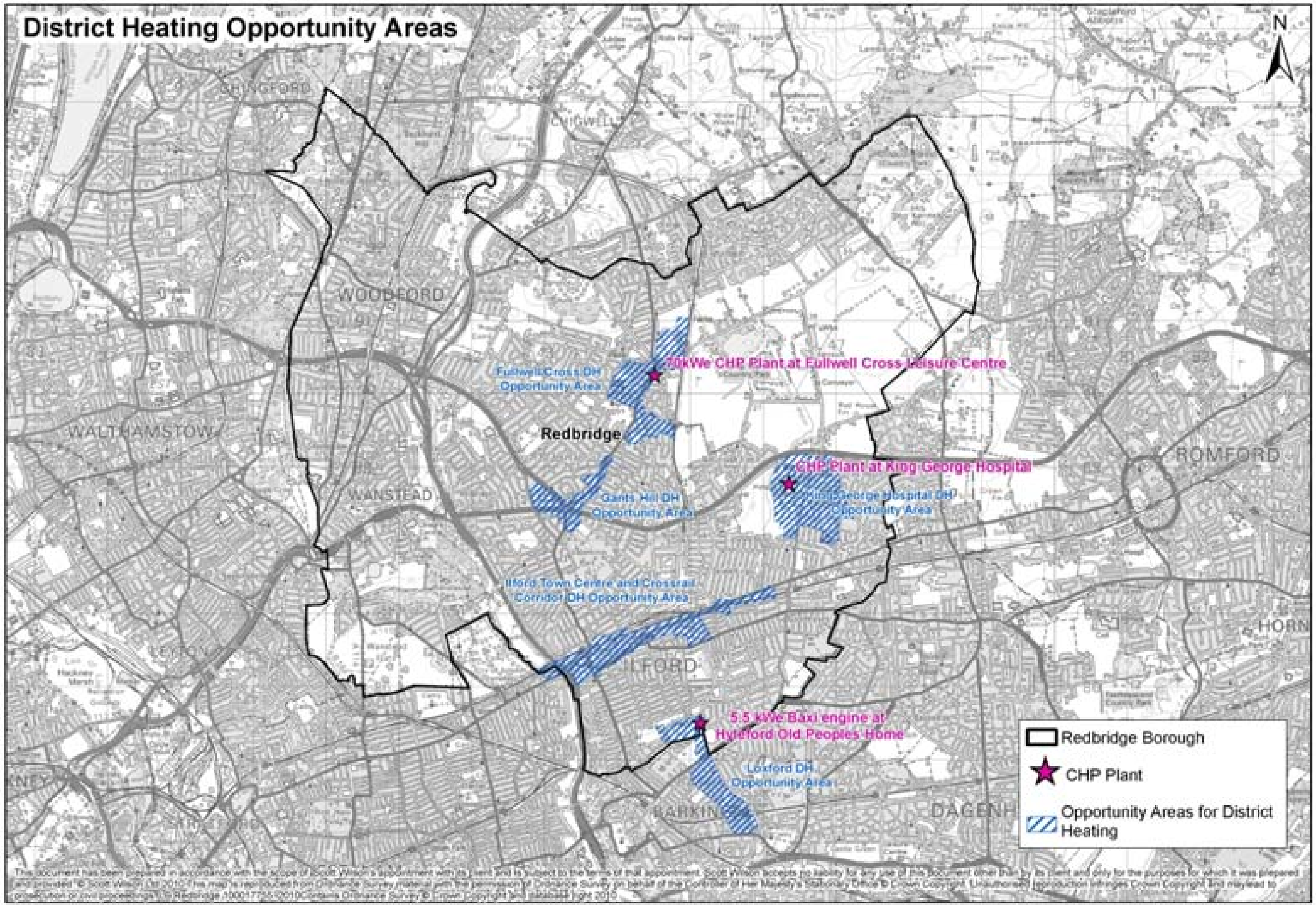


Figure 4-6: District Heating Opportunities in Redbridge

Existing CHP plants in Redbridge have been highlighted in the figure above. These potential sites are evaluated in further detail in the implementation plan table. The table highlights their level of priority, key barriers, next steps, key dates and individuals responsible for championing the liaison required to develop these opportunity areas at the Feasibility Stage. A list of sites is also provided in the implementation plan table below.

It is also noted that the proponents of the Five Oaks Lane development in the north-east of the borough are also considering a site wide heating network.

4.5 Stakeholder Workshop – Implementation Plan

Once the five cluster areas had been identified the study team held a stakeholder workshop on 25th May, 2010. The objective was to present the findings of the study, review each of the five cluster areas identified above and determine suitable synergies from existing buildings to proposed development in each location. A range of stakeholders were invited. Please refer to Appendix D.5 for the list of stakeholders.

Stakeholders were asked to provide local knowledge and input to existing and proposed development within the cluster areas identified having been presented the findings of the study. As a result of this feedback the study team have developed the following implementation plan to facilitate the development of further feasibility of these locations in phase 2 of the LDA's DEMaP programme.

Site One – Fullwell Cross

PRIORITY	DH Opportunity Site (Identified by location, name of opportunity area)	Priority & Basis of Site Selection (Basis of assessment of delivery potential - High Medium or Low priority)	Potential Anchor Nodes & Individual Responsibility (Key Opportunity Buildings & Individual contacts within the Council responsible for liaison)	Key Barriers (Potential barriers for delivery of opportunity identified)	Opportunities & Next Steps (Next steps for LA to facilitate delivery of opportunity identified)
	Fullwell Cross	**Medium Priority** Potential for expansion of existing CHP serving Fullwell Leisure and library plus major development proposed for school (relocation of Ilford Jewish Primary School) and housing south of Fullwell Cross – establishment of a new (larger) primary school at Ilford Jewish Primary School site if relocation successful.	Fullwell Cross Leisure (Kevin O'Brien, LBR) Fullwell Library (Kevin O'Brien, LBR) Tesco, Barkingside (Brian Hoy, LBR) Thomswood Medical Centre (Sean O'Sullivan, PCT) Craven Bank Gardens (Bob Watling, RH) Bernardos – (John Pearce, LBR) Redbridge Sports Centre (Kevin O'Brien, LBR) Fairlop Clinic (Sean O'Sullivan, PCT) Barkingside School (John O'Keefe, LBR) Ilford Jewish Primary School (John O'Keefe, LBR) King Solomon High School (John O'Keefe, LBR)	▪ Good mix of existing and proposed development although distances likely to be problematic for DH pipe work, particularly superstore and housing south of Fullwell Cross ▪ Neighboring school (which may be a suitable anchor load) to Fullwell Leisure is in green built land and so many not be able to be expanded due to local contention ▪ Underfloor heating in library not working efficiently and asbestos in floor which would complicate retrofit and subsequent use of heat within these buildings. ▪ Old landfill site below golf course unlikely to provide methane to feed into DH network as covered for 30 years plus.	**Opportunities** ▪ Existing 70 kWe CHP exists in the sports centre which provides heat to adjacent Fullwell library. ▪ Potential space in the basement of the leisure centre for extending existing CHP ▪ Good mix and scale of both existing and proposed development suitable for further evaluating synergies for DH networks. **Next Steps** ▪ Evaluate status of each building node including status of building services. ▪ Liaise with developers to discuss potential for site to connect to district heating scheme.

*High (Green), Medium (Amber) or Low (Red) based on potential for delivery

Site Two – King George Hospital

PRIORITY	DH Opportunity Site	Priority & Basis of Site Selection	Building Potential Anchor Nodes & Individual Responsibility	Key Barriers	Opportunities & Next Steps
	(Identified by location, name of opportunity area)	(Basis of assessment of delivery potential - High Medium or Low priority)	(Key Opportunity Buildings & Individual contacts within the Council responsible for liaison)	(Potential barriers for delivery of opportunity identified)	(Next steps for LA to facilitate delivery of opportunity identified)
	King George Hospital Site	**High Priority** Publicly owned hospital as anchor load, private development planned adjacent to the hospital on existing mental health hospital site and college. The hospital gas consumption is 35,000MWh and the total annual utility costs are approximately £2million	King George Hospital (Jandi Pearman, BHR) Goodmayes Mental Health Hospital (Sean O'Sullivan, PCT) Redbridge College (David Hughes, LBR) North East London Foundation Trust (Sean O'Sullivan, PCT)	▪ Existing CHP at King George is currently not working effectively. Study being undertaken to determine why and potential future opportunities. ▪ Potential local competition for heat if the proposed refurbishment works are currently being run off Ground Source Heat Pumps as is thought to be the case.	**Opportunities** ▪ Existing CHP in King George Hospital may be in need of refurbishment and upgrade. Study to determine what needs to be done currently being undertaken. ▪ Surplus heat is now available as the laundry is now cleaned off site ▪ Goodmayes Hospital – understood to be already considering Ground Source Heating ▪ Goodmayes Hospital to be relocated to Chapter House and then potential refurbishment into residential. ▪ Redbridge College also proposed for redevelopment (either on current site with an element of relocation or potential relocations to the Crossrail Corridor). ▪ Less stakeholders minimising complexity of negotiations. ▪ Considerable heat loads in the order of 200MW within close proximity to developments which will require additional heat **Next Steps** ▪ Obtain information regarding the existing CHP currently under evaluation ▪ Evaluate status of each building node including status of building services ▪ Applications for development adjacent to King George's hospital to be determined in terms of programme. ▪ Further information to be ascertained on refurbishments of Goodmayes Hospital and Redbridge College ▪ Liaise with PCT to discuss potential for hospital to be developed as an anchor load for the development of district heating scheme ▪ Other stakeholders to be engaged including Mental Health Trust, Hospital Trust and NHS Poly Clinic

*High (Green), Medium (Amber) or Low (Red) based on potential for delivery

Site Three- Ilford Town Centre and Crossrail Corridor

PRIORITY	DH Opportunity Site	Priority & Basis of Site Selection	Potential Anchor Nodes & Individual Responsibility	Key Barriers	Opportunities & Next Steps
	(Identified by location, name of opportunity area)	(Basis of assessment of delivery potential - High Medium or Low priority)	(Key Opportunity Buildings & Individual contacts within the Council responsible for liaison)	(Potential barriers for delivery of opportunity identified)	(Next steps for LA to facilitate delivery of opportunity identified)
	Ilford Town Centre & Crossrail Corridor	**High Priority** Private development and public development planned for completion in coming years and within planned period which may be suitable as anchor loads	Crossrail Tunneling Academy (Mike De Silva, Crossrail)* British Telecom Office Building (Judith Carlson, LBR) Crossrail Station & mixed use (Mike De Silva, Crossrail)* Post Office (Judith Carlson, LBR) Town Hall (David Hughes, LBR) Esporta (Kevin O'Brien, LBR) Lynton House (Brian Hoy, LBR) Police Station (Judith Carlson, LBR) Cricklefields Academy (John O'Keefe, LBR) PCT Polyclinic (Sean O'Sullivan, LBR PCT) Harrison Gibsons (David Hughes, LBR)	▪ Majority of developments which would provide key anchor loads (high heat demand) are proposed post 2013 ▪ Station services and infrastructure may prevent installation of DH network potentially making it cost prohibitive. ▪ Cost of supplying heat may be prohibitive due to complexity of infrastructure provision ▪ Location of energy centre and CHP engines to be determined – town centre location is potentially constrained for space	**Opportunities** ▪ Staged implementation of development with suitable mix and scale of developments may be suitable to match CHP profiles ▪ CHP is already identified in the Ilford AAP and so will be strongly encouraged throughout development of Ilford Town Centre. ▪ AAP could limit the use of other heat producing technologies such as GSHP which could compete with heat required to make community heating viable. ▪ Suitable locations could be identified for energy centers along side rail corridor which would be less visually intrusive and objectionable. **Next Steps** ▪ Ensure other heat producing technologies are limited in local AAP ▪ Phasing and timing of relevant local development to be determined. ▪ Definition over the phasing of development and linkage with existing developments throughout the Corridor to be identified both spatially and in terms of development programme to ascertain potential phasing and suitable locations for energy centers

* Sustainability Manager Crossrail – key contact and involvement to be confirmed

*High (Green), Medium (Amber) or Low (Red) based on potential for delivery

Site Four- Gants Hill

PRIORITY	DH Opportunity Site	Priority & Basis of Site Selection	Potential Anchor Nodes & Individual Responsibility	Key Barriers	Opportunities & Next Steps
	(Identified by location, name of opportunity area)	(Basis of assessment of delivery potential - High Medium or Low priority)	(Key Opportunity Buildings & Individual contacts responsible for liaison)	(Potential barriers for delivery of opportunity identified)	(Next steps for LA to facilitate delivery of opportunity identified)
	Gants Hill	**Low Priority** Publically owned community and education facilities as anchor loads	Redbridge Institute of Adult Education (John O'Keefe, LBR) Beehive Lane Residential (Bob Watling, RH) Cranbrook Road Residential (Bob Watling, RH) Gearies Junior School (John O'Keefe, LBR) Wentworth House (Bob Watling, RH) Kenwood Gardens (Brian Hoy, LBR) AAP opportunity sites (Eastern Avenue) (David Hughes. LBR)	▪ Gants Hill station was used as a munitions factory during the Second World War and its structure was re-inforced. It may therefore be prohibitive and costly to include DH infrastructure such as pipe work under the ground ▪ Ground conditions already identified to be an issue for TFL on the roundabout ▪ Distance between key nodes such as community facilities and Redbridge Institute of Adult Education likely too great to ensure viability of DH infrastructure	**Opportunities** ▪ Redbridge owned properties may facilitate the negotiations of DH potential subject to its viability. ▪ 400 homes currently have obtained consent with further 400 in the process – significant heat load for potential for deployment of heat network **Next Steps** ▪ Identify status of existing building services and ascertain if refurbishment is likely. ▪ Date of community facilities applications to be determined.

*High (Green), Medium (Amber) or Low (Red) based on potential for delivery

Site Five- Loxford School area

PRIORITY	DH Opportunity Site	Priority & Basis of Site Selection	Potential Anchor Nodes & Individual Responsibility	Key Barriers	Opportunities & Next Steps
	(Identified by location, name of opportunity area)	(Basis of assessment of delivery potential - High Medium or Low priority)	(Key Opportunity Buildings & Individual contacts responsible for liaison)	(Potential barriers for delivery of opportunity identified)	(Next steps for LA to facilitate delivery of opportunity identified)
	Loxford School area	**Low Priority** Publically owned schools or hospital as potential anchor loads	Loxford School (John O'Keefe, LBR) Care Village PCT (Brian Hoy, LBR) South Park Clinic (Kevin O'Brien, LBR) Upney Hospital (Barking & Dagenham) Lower Barking Abbey School (Barking & Dagenham)	▪ Cross boarder initiative required ▪ Existing buildings only – currently limited proposals for new development ▪ Distance of hospital from schools for installation is likely to be too great for installation of heat mains (up to 2.5 miles)	**Opportunities** ▪ Loxford School currently has an existing energy centre which may provide initial anchor load and infrastructure for deployment of heat network **Next Steps** ▪ Evaluate status of each building node including status of services, including size type and space availability of energy centre at Loxford School ▪ Liaise with schools and Barking & Dagenham PCT to discuss potential for Upney Hospital to link into the development of district heating scheme, subject to viability

*High (Green), Medium (Amber) or Low (Red) based on potential for delivery

4.5.1 Summary of Preferential Sites

From the tables presented above it is evident that some sites are more preferable to the deployment of a district heat network and therefore warrant further evaluation at the Phase 2 Feasibility Stage of the DEMaP programme.

Of highest priority are the King George Hospital and the Ilford Town Centre & Crossrail Corridor sites.

King George Hospital Site

King George Hospital currently holds the greatest potential for the deployment of a district heat network as an existing CHP boiler generates steam for the hospital, located in the centre of the site in the Steam Boiler House. It incorporates a waste heat steam boiler utilising the high grade energy from the CHP exhaust gases. Where additional demand is required 2 steam boilers take the additional load.

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The total full load rating of the electrical generator plant is 1,070kW and the total electrical energy output of the CHP system – 1,806,564KWh. Electricity generated is 11,000MWh, heat generated is 35,000MWh and the total cost of the system annually is approximately £2M[52]

The Steam Boilers and CHP waste heat boiler have been designed to meet the loads of the on site laundry and Sterile Services (or Decontamination Units). However, the laundry has now been shut down at the hospital. And this is now contracted off site leaving surplus heat to be used elsewhere. This highlights potentially the greatest synergy for further evaluation at the feasibility stage as there are sites in close proximity which could potentially utilise this surplus heat. The implementation plan table identifies Goodmayes Mental Health Hospital and the Redbridge College which have been highlighted for likely relocation and redevelopment in the near future. All of these sites are in close proximity to King George Hospital.

Ilford Town Centre & Crossrail Corridor

With the regeneration of Crossrail Corridor and Ilford Town Centre in its early stages this cluster area is of high importance for further evaluation for the potential for a heat network. Numerous public buildings and private buildings, both existing and proposed, as outlined in the implementation tables above will need to be investigated to ascertain within this site where there is potential synergies in terms of energy load profiles and also to ascertain suitable locations for an energy centre or number of energy centres.

To support its deployment CHP is already identified in the AAP and so will be strongly encouraged throughout development of Ilford Town Centre. The AAP could limit the use of other heat producing technologies such as GSHP which could compete for heat required to make community heating viable thus ensuring the greatest potential for CHP and a community heating network. Suitable locations would need to be identified for energy centres, potentially along side the rail corridor which would be less visually intrusive.

It should be noted that some fairly significant barriers exist which would need to be overcome. As stated in the table above this includes existing services and infrastructure which may prevent the installation of a district heat network, potentially making it cost prohibitive.

[52] Source of information: Jandi Pearman, BHR Hospitals, Outcome of Workshop organised by SW and LBR, May 2010

Fullwell Cross

The Fullwell Cross cluster has fairly good potential for warranting further evaluation for district heating. The site has an existing 70 kWe CHP which exists in the sports centre and provides heat to adjacent Fullwell library. Additionally there is potential space in the basement of the leisure centre for extending the existing CHP. However, the neighbouring area is green belt and so development which could utilise surplus heat and warrant the refurbishment of the CHP is currently uncertain. Other suitable anchor loads and potential users of heat are considered to be too greater distance away, for example the Sainsbury's superstore (of which no immediate refurbishment is expected or confirmed at present) is approximately 2.5 miles away and thus it is likely to be cost prohibitive to run the heat network infrastructure to the south of the site, even when suitable heat users or producers have been identified.

Gants Hill & Loxford School Area

Both Gants Hill and Loxford School area have been considered low priority sites as the barriers for the deployment of district heating is currently considered too great. Gants Hill has limited opportunities in terms of anchor loads in close proximity and the Gants Hill underground station was used as a munitions factory during the Second World War, during which time the roof was reinforced against aerial bombing. Therefore it is likely to be prohibitive and costly to include infrastructure such as pipe work under the ground. Ground conditions have already been identified to be an issue by Transport for London during the recent enhancement works at Gants Hill.

Loxford School area was originally identified as it presented perhaps the greatest opportunity for a cross boarder initiative with London Borough of Barking and Dagenham. However, although Loxford School currently has an existing energy centre which could have provided the initial anchor load and infrastructure for the deployment of heat network, there is insufficient new development in close proximity to warrant further evaluation at this stage.

4.5.2 Data Collection, Lessons Learnt & Scope

We would suggest that future data collection for the initial collation of heat demand (in order to feed into the LDA spreadsheet) prioritises site visits and personal contact instead of communication via email, phone and post. Despite repeated attempts to obtain details on annual energy and heat demand from owners of private buildings in Redbridge, responses were limited. Without any direct incentive (although each potential heat customer was advised of the potential future benefits) to provide information for the Study, stakeholders contacted were not willing to participate in the Study. Obtaining data for multi residential buildings, which were identified as high heat demand properties, was complicated by individualised billing for flats. Contact with energy companies in the Borough to obtain data could be explored in the future, as a more efficient alternative to direct stakeholder contact.

It should be noted that the total heat demand has not been identified for the five sites as only the three strategic sites of Ilford Town Centre, Crossrail Corridor and Gants Hill have been evaluated in depth. It is expected that the heat demands and energy profile analysis for the specific buildings identified would be evaluated further in the Stage 2 Feasibility Study.

5 Renewable Energy Constraints and Opportunities Analysis

5.1 Introduction

This section reviews the linkages for renewables and decentralised energy potential, feeding into the Heat Mapping Study, and provides an analysis of low carbon and renewable technologies within Redbridge Borough. The Study reviews existing energy studies relevant to Redbridge where available and assesses the renewable energy potential across Redbridge with respect to:

- Wind
- Biomass, including Energy from Waste (incineration only)
- Solar
- Hydropower
- Heat pumps

This section also investigates specific opportunities for implementing renewable energy within the Strategic Sites (Gants Hill, Ilford Town Centre and the Crossrail Corridor) agreed upon with LBR Council, commenting on the implications of different levels of carbon reduction and Code Levels.

Redbridge has a carbon footprint of 1,033 kilo tonnes CO_2 per annum. 50% of this comes from the domestic market, with the Industrial and Commercial sector and road transport each contributing to around 25% of the total emissions.

This Chapter explores the low and zero carbon energy potential in Redbridge, broken down into the different technologies. We have followed the methodology outlined in the latest PPS1 Supplement – Planning for a Low Carbon Future in a Changing Climate, which refers to DECC guidelines, titled *Renewable and Low Carbon Energy Capacity Methodology*. For each technology, there are three sections:

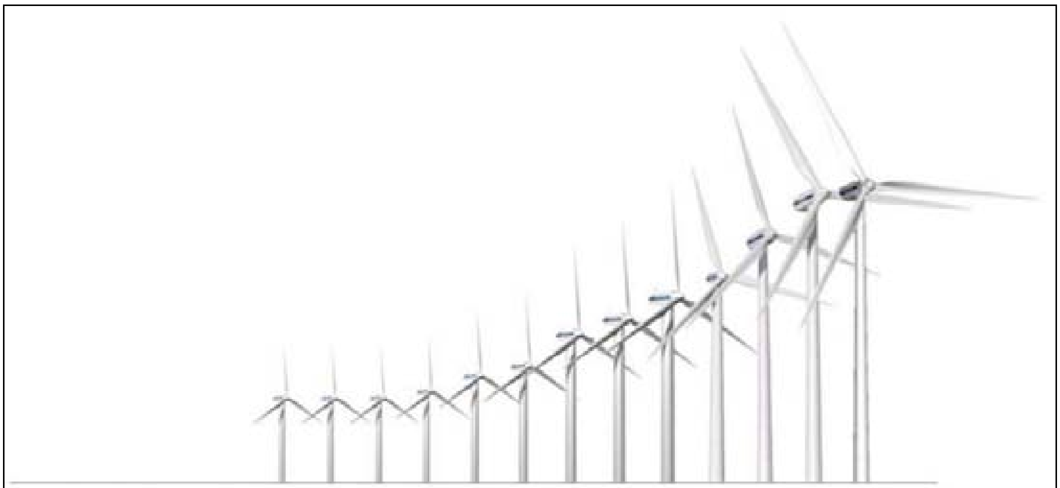
- An introduction, describing the technology;
- A Borough-wide opportunity analysis that includes Stage 1 – Naturally Available Resource and Stage 2 – Technically accessible resource of the Renewable and Low Carbon Energy Capacity Methodology; and
- A Borough-wide constraints analysis that includes Stage 3 – Physical Environment Constraints and Stage 4 – Planning and Regulatory Constraints of the Renewable and Low Carbon Energy Capacity Methodology.
- All conversion rates, yield and other parameters used in this section are based on the DECC methodology unless otherwise stated.

5.2 Wind Energy Potential

5.2.1 On-shore (commercial scale)

There is a wide variety of wind turbines with different power capacities. Commercial scale wind refers to on-shore wind farm developments for commercial energy generation and supply. Most such developments are connected to the grid, however, private-wire schemes are also an option and some already exist. Configurations of groups of wind turbines or individual turbines are used.

Assessing the resource potential and the deployment opportunities relates primarily to the wind speeds available within the region and the ability of current technology to harness this resource in terms of turbine design (size, efficiency) and installation requirements. Figure 5-1 below shows the size and power of a range of Vestas wind turbines[53]. The largest turbine, the V90, is able to generate up to 9,152 MWh/year, which is enough to supply the electrical demand for approximately 2,000 homes.



Product/Rotor diameter (m)	V15	V17	V19	V20	V25	V27	V39	V44	V47	V52	V66	V80	V90
Year of installation	1981	1984	1986	1987	1988	1989	1991	1995	1997	2000	1999	2000	2002
Capacity (kW)	55	75	90	100	200	225	500	600	660	850	1750	2000	3000
MWh/year	217	265	301	346	481	647	1304	1581	1947	2530	4705	6768	9152

Figure 5-1: Turbine Capacity and Output

The following GIS representation (Figure 5-2) provides a summary of wind speeds in Redbridge at 45m above ground level.

53 http://www.vestas.com/

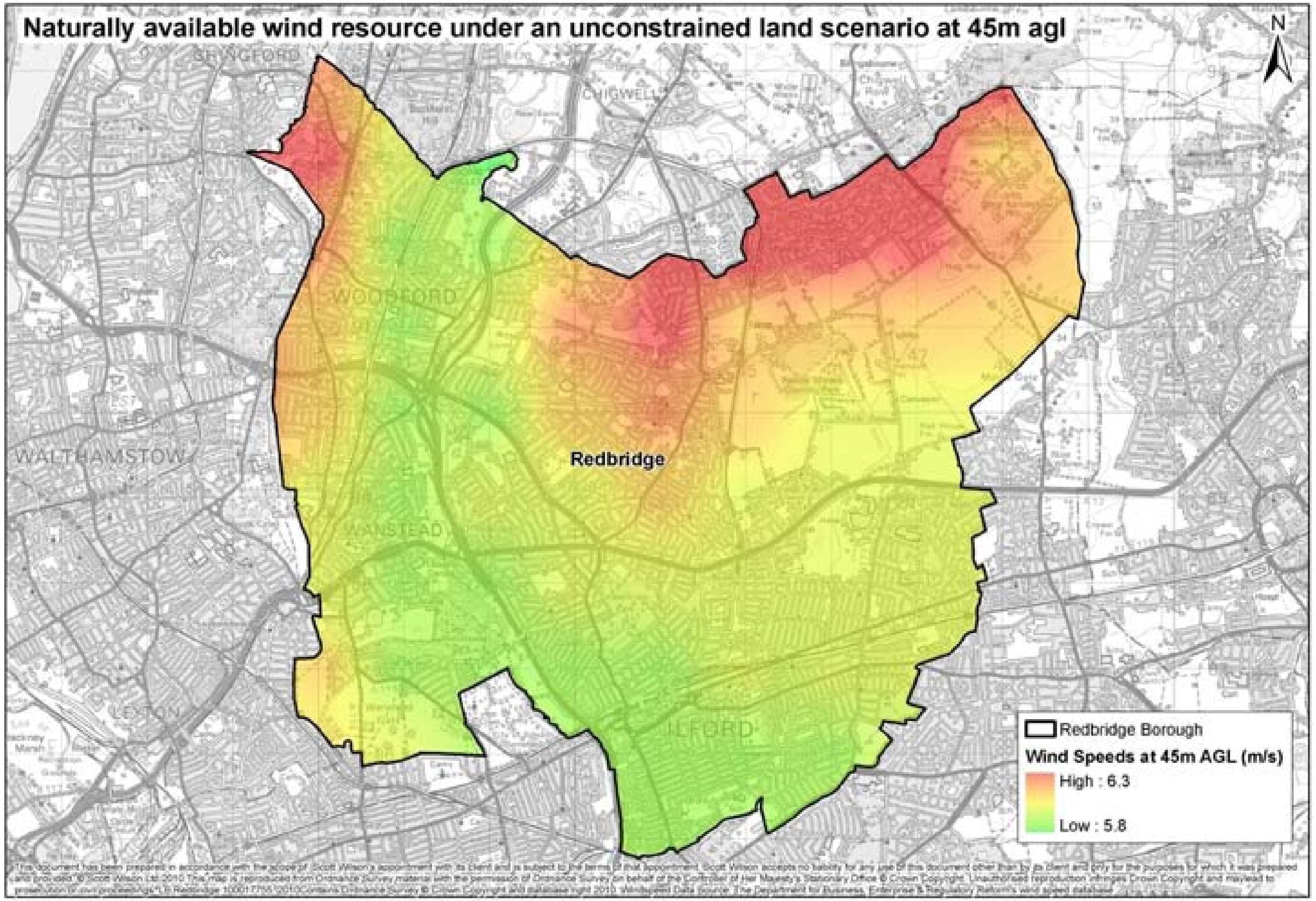


Figure 5-2: Naturally available wind resource[54] under an unconstrained land scenario at 45m agl.

[54] http://www.bwea.com/index.html

Opportunity analysis

The assumptions for calculating the naturally available wind resource have been summarised below based on the following analysis of environmental constraints and land designations.

Parameter description	Data
Total area in Redbridge with wind speeds **above 5 m/s** at 45 m above ground level	56.4 km^2
Wind turbine density (as per DECC methodology)	9 MW/km^2

Given the assumptions above, the theoretical potential installed capacity in Redbridge from large-scale wind is 508 MW (56.4Km2 x 9MW/Km2). Theoretically, this is sufficient to power around 200 2.5MW wind turbines.

Constraints analysis

The theoretical value derived from the opportunity analysis above is reduced following a constraints analysis that includes the following:

- Non-accessible areas, such as roads, railways, inland waters, built-up areas, airports and MOD training sites (not present within Redbridge);
- Exclusion areas, such as ancient semi-natural woodland, sites of historic interest, buffers around roads and rail lines, buffers around build-up areas, buffers around airports and airfields, Civil Air Traffic Control constraints, MOD training areas and explosive safeguard areas;
- Designated landscape and nature conservation areas; and
- MOD constraints, such as MOD sites, air defense and air traffic control radar, other safeguarded areas, danger areas and MOD byelaws.

See GIS figures for constraints and opportunities evaluation below (figures 5-3 and 5-4).

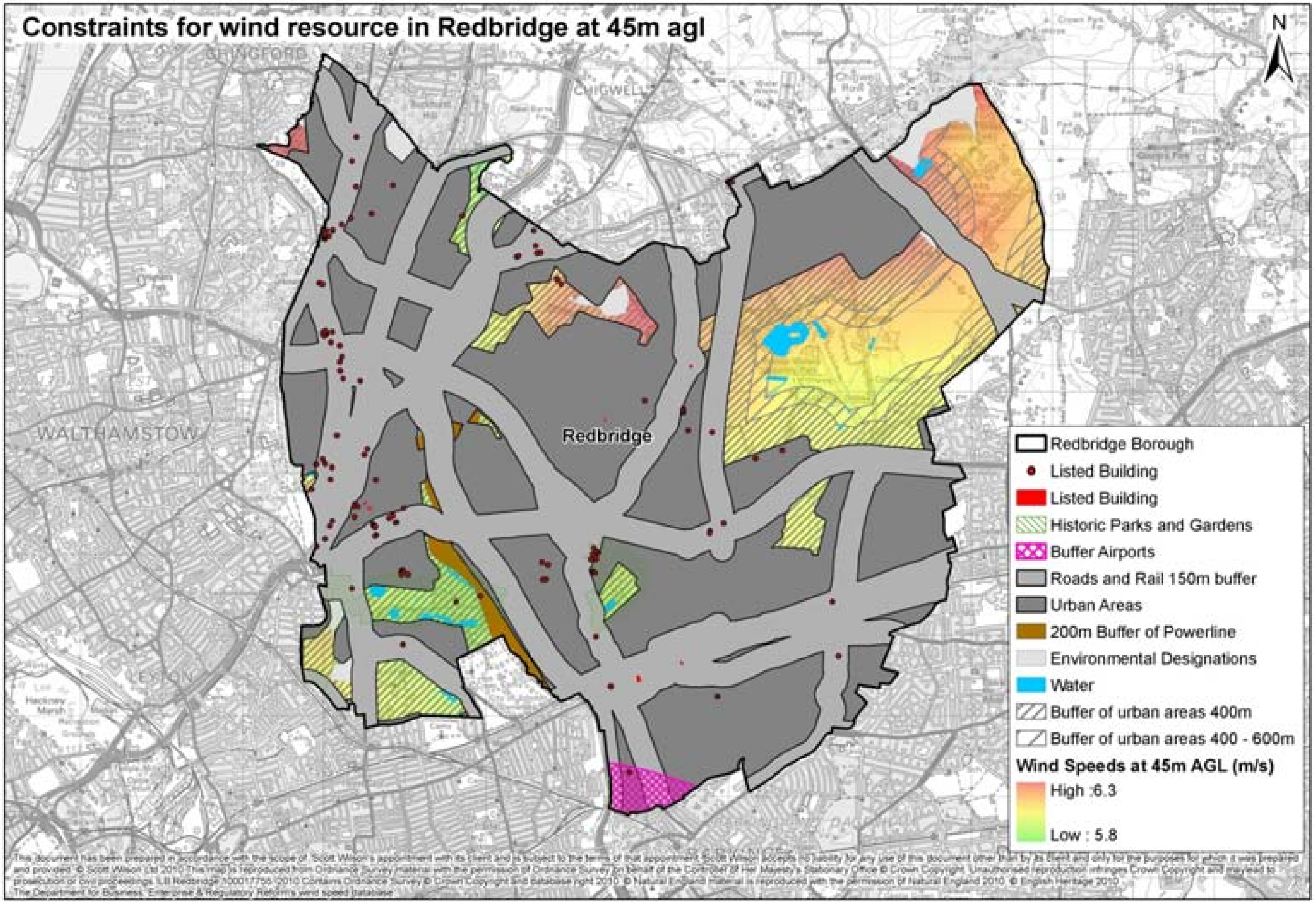


Figure 5-3: Constraints for wind resource in Redbridge at 45m agl

The GIS map below shows the constrained scenario for large-scale wind:

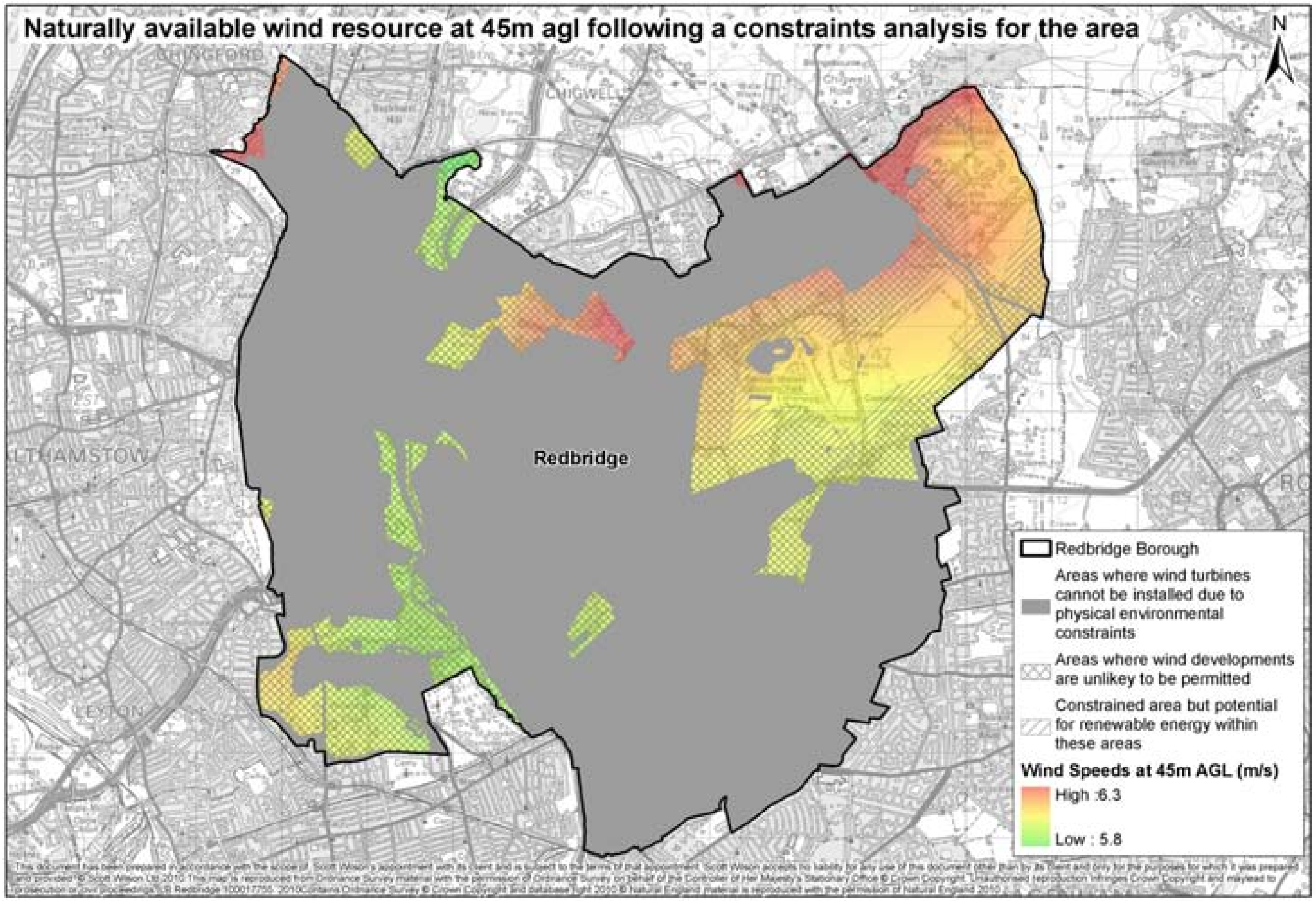


Figure 5-4: Naturally available wind resource at 45m agl following a constraints analysis for the area.

Parameter description	Data
Total unconstrained area in Redbridge with wind speeds above 5 m/s at 45 m above ground	3.45 km^2
Wind turbine density	9 MW/km^2

Following an assessment of all constraints, the actual potential for wind capacity in Redbridge is 32 MW (3.45KM2 x 9MW/Km2). Theoretically, this is sufficient to power 12 wind turbines of 2.5MW each. However, keeping in mind wind speed scaling factors and the urban nature of Redbridge, large scale wind is not considered to be suitable for Redbridge based on existing technology.

Particular consideration will need to be given to the following on a site-by-site basis before commercial wind can be deployed:

- Land ownership
- Noise
- Telecommunications and existing distribution networks
- Visual impact
- Distance from development
- Electrical connection

5.2.2 On-shore (small scale)

A sub-category of on-shore wind is the small scale installation, which can be defined as having capacity of less than 100 kW and typically comprise single turbines. Small scale wind schemes have different characteristics to large scale developments, which is reflected in the assessment parameters and the values applied.

The majority of small scale wind installations are ground-based developments with only a few that are building integrated (roof top). They are typically installed to supply the on-site demand first, before exporting to the grid. This means that they need to be located suitably. The potential number of small wind installations is in practice, therefore, a function of the number of buildings or sites rather than the land area available.

The following GIS representation provides a summary of wind speeds in Redbridge at 10m above ground level.

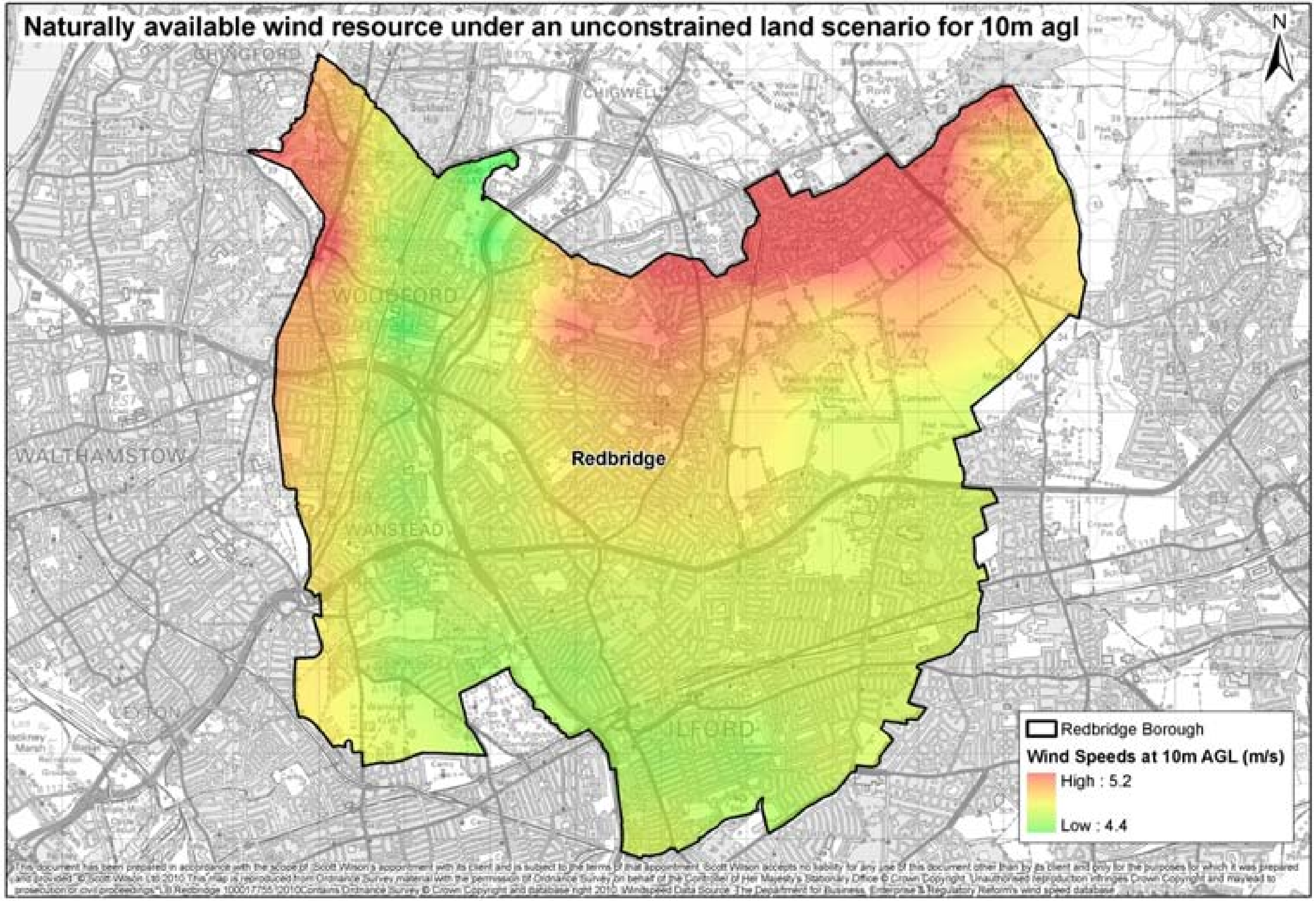


Figure 5-5: Naturally available wind resource under an unconstrained land scenario for 10m agl

Assuming areas with wind speeds greater than 5.0 m/s are suitable for small wind, a typical density of 20 dwellings per hectare (dph) (taking into account a mix of spaces, including non-residential floorspace) and a turbine rated output of 2 kW, the following results have been obtained:

Parameter description	Data
Total area with wind speeds greater than 5.0 m/s at 10 m above ground	3.56 km^2
Total number of dwellings in urban areas with average wind speeds above 5.0 m/s at 10 m above ground	7,120
Wind turbine size (installed capacity per turbine)	2 kW

Based on the assumptions above the theoretical potential installed capacity from small scale wind in Redbridge is 14 MW, which is sufficient to power around 28,000 homes assuming an average annual electricity consumption of 4301KWh per household for Greater London[55]. Wind speed scaling factors have not been taken into account at this stage, as these will be applied on a site by site basis on more accurate and site-specific wind speed data.

Particular consideration will need to be given to the following on a site-by-site basis before commercial wind can be deployed:

- Land ownership
- Noise
- Telecommunications and existing distribution networks
- Visual impact
- Distance from development
- Electrical connection

The DECC methodology assumes that wind speeds above 4.5 m/s are sufficient for small scale wind. However, keeping in mind the highly urban nature of Redbridge, and Scott Wilson's practical experience with deploying small scale wind turbines, a minimum threshold of 5m/s is considered more suitable. Although the DECC methodology assumes 6kW as suitable for small scale wind, this is considered to be unrealistic for Redbridge with high density housing and not much external space for the deployment of 6kW turbines, therefore 2kW turbines have been selected as suitable for Redbridge based on ease of structural integration.

[55] http://www.dti.gov.uk/files/file20328.pdf

5.3 Biomass Resource Potential

5.3.1 Overview

Biomass is biological material derived from living, or recently living organisms. Biomass is a diverse category with regard to the type of available fuels, fuel conversion technology and type of energy output.

Raw materials that can be used to produce biomass fuels are widely available across the UK and come from a large number of different sources and in a wide variety of forms. All of these forms can be used for fuel production purposes; however, not all energy conversion technologies are suitable for all forms of biomass

- **Virgin wood** - Wood can be derived from conventional forestry practice, such as thinning and trimming, as part of sustainable management of woodland. It can also be derived from tree surgery operations and the management of parks, gardens and transport corridors. The wood can come in a range of physical forms such as bark, logs, sawdust, wood chips or wood pellets.

- **Energy crops** - Energy crops are grown specifically for use as fuel and offer high output per hectare with low inputs. The main type of energy crop is short rotation coppice such as willow, or forestry species such as eucalyptus or poplar. Poplar and willow are the most popular crops with an achievable yield of around 8 tonnes per annum.

- **Agricultural residues** - Agricultural residues are of a wide variety of types, and the most appropriate energy conversion technologies and handling protocols vary from type to type. Sources can include arable crop residues such as straw or husks, animal slurries or organic material from excess production or insufficient market, such as grass silage.

- **Industrial waste and co-products** - Many industrial processes and manufacturing operations produce residues, waste or co-products that can potentially be used or converted to biomass fuel. Wood waste can be utilised by a range of thermal conversion technologies such as boilers for the generation of heat for space heating or process heat, or used for electricity generation in a dedicated system or a combined heat and power (CHP) co-generation system.

Conversion Technology

There are three main processes currently available and used:

- Direct combustion of solid biomass;
- Pyrolysis (thermal gasification in the absence of oxygen) of solid biomass; and
- Anaerobic digestion of solid or liquid biomass.

Energy Output

Biomass can be in the form of electricity or heat, depending on the conversion technology. Both options are explored in this section and for fuels that can viably be converted to either output, both options are provided.

This section reviews information publicly available to determine the opportunities and constraints for biomass deployment in Redbridge for the following biomass types:

- Managed woodland
- Energy crops
- Waste wood
- Agricultural arisings (straw)
- Animal biomass – wet organic waste and poultry litter (not applicable to Redbridge due to its highly urban character)
- Municipal Solid Waste

200ha of the 5644 ha of Redbridge comprises woodland cover[56]. The woodland area in Redbridge accounts for less than 2.5% of the total London woodland cover (approximately 7300ha)[57].

5.3.2 Key Constraints to Biomass use within Redbridge

Air Quality Management Area (AQMA)

Redbridge Borough was declared an Air Quality Management Area (AQMA) on 31 December 2003, and this is illustrated in the figure below:

[56] Redbridge Biodiversity Strategy, 29th April 2005
[57] http://www.bexley.gov.uk/index.aspx?articleid=6063

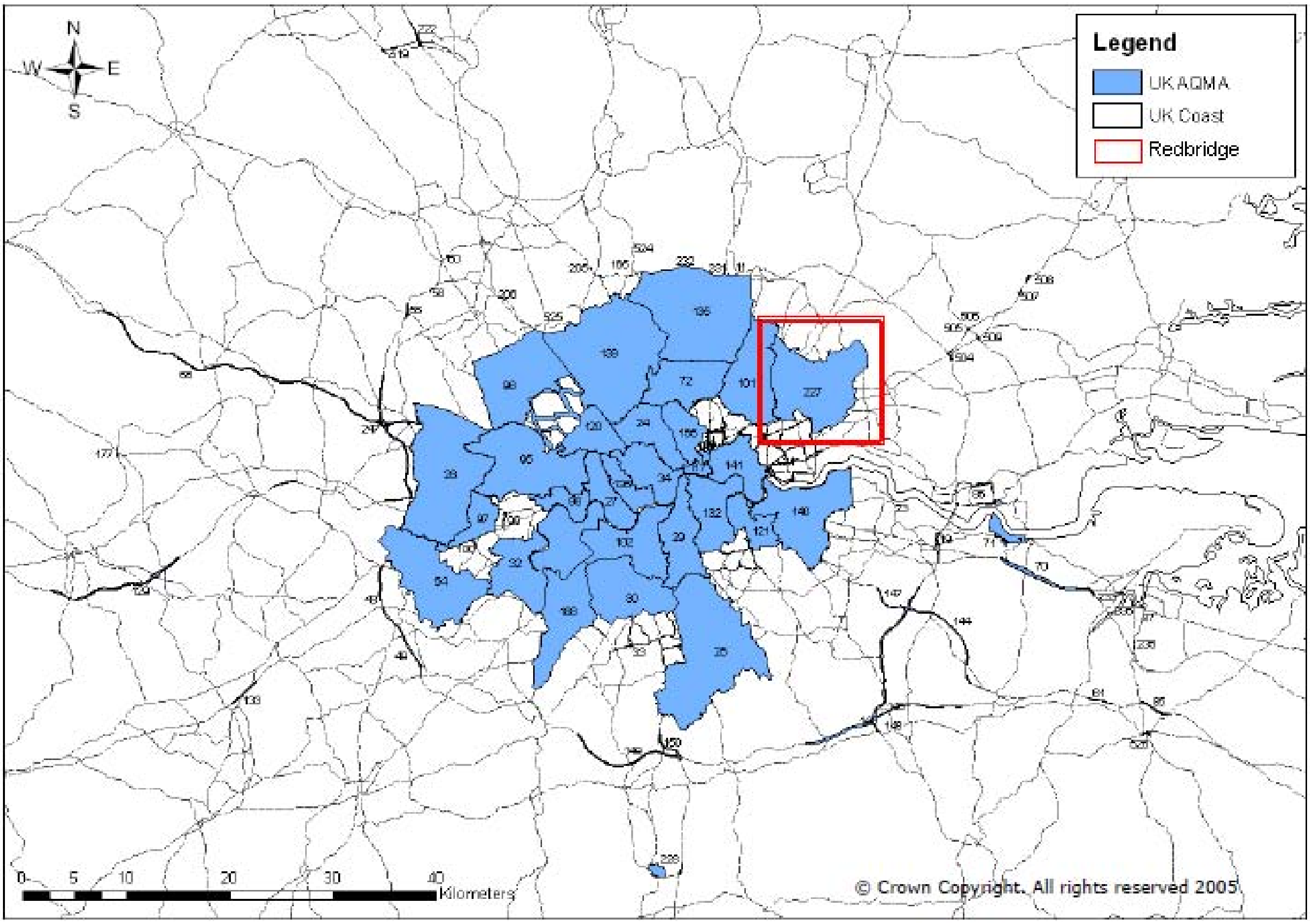


Figure 5-6: AQMAs of London and surrounding areas[58]

The figure below illustrates the predicted annual mean NO_2 results for Redbridge[59]. The areas in yellow and red on the figure below indicate areas within Redbridge with NOx emissions greater than 40 micrograms per m^3.

[58] Sturman J, King K, *GIS Dataset of AQMA's in UK*, March 2005, netcen
[59] Redbridge Air Quality Action Plan 2007

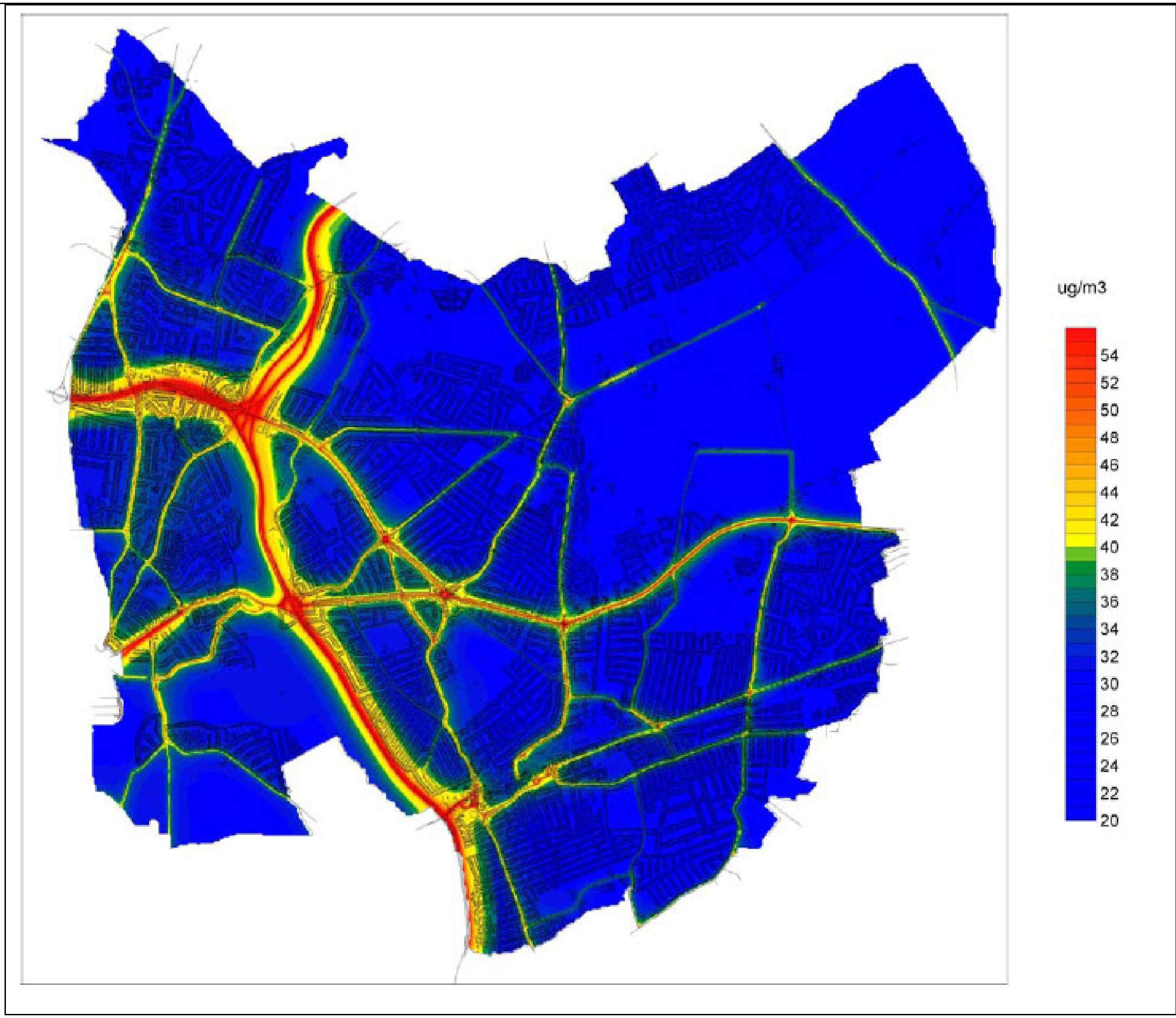


Figure 5-7: Predicted annual mean NO_2 results for Redbridge

The Mayor's draft Air Quality Strategy indicates that small biomass boilers (below 500kWth) in Air Quality Management Areas are considered unsuitable unless they can demonstrate that they have no adverse effects on local air quality when compared with conventional gas fired boilers[60].

Where the use of biomass is proposed, the biomass boiler must be certified as an exempt appliance in accordance with the Clear Air Act 1993. A list of exempt appliances can be found at: http://www.uksmokecontrolareas.co.uk/appliances.php. On the small to medium scale, there is a selection of wood chip and pellet boilers which have been classified as exempt appliances and are therefore able to be installed and operated in smoke control areas as they comply with the Mayor's standards. Air quality objectives included in the Air Quality Regulations (2002)[61] for the purpose of Local Air Quality Management in the UK stipulate that an annual mean of 40 micrograms per m3 of nitrogen dioxide and PM_{10}'s must not be exceeded. Therefore the use of biomass as a resource would be severely constrained in areas with NOx emissions greater than 40 micrograms per m3 as illustrated in Figure 5-7.

Planning Policy: Conflict with recycling targets

The use of waste wood or green waste may conflict with recycling targets set by the Borough. Waste can be recycled, sent to land fill, or diverted (from land fill, for example, biomass processes where used as a fuel). Since green waste makes a significant contribution to these targets, there is an incentive to recycle the waste rather than incinerate it in order to meet stringent recycling targets.

Fuel Supply and demand

The following figure illustrates a review of biomass wood fuel suppliers with head offices in closest proximity to Redbridge, indicating that the Renewable Fuel Company (within Redbridge), Land Energy Limited, Hertswood fuel Ltd., and Writtle Park Tree Services Ltd are preferred suppliers as they are within 35km of Redbridge:

[60] GLA Energy Team Guidance on Planning Energy Assessments, October 2009
[61] http://www.airquality.co.uk/reports/cat18/0806261519_methods.pdf

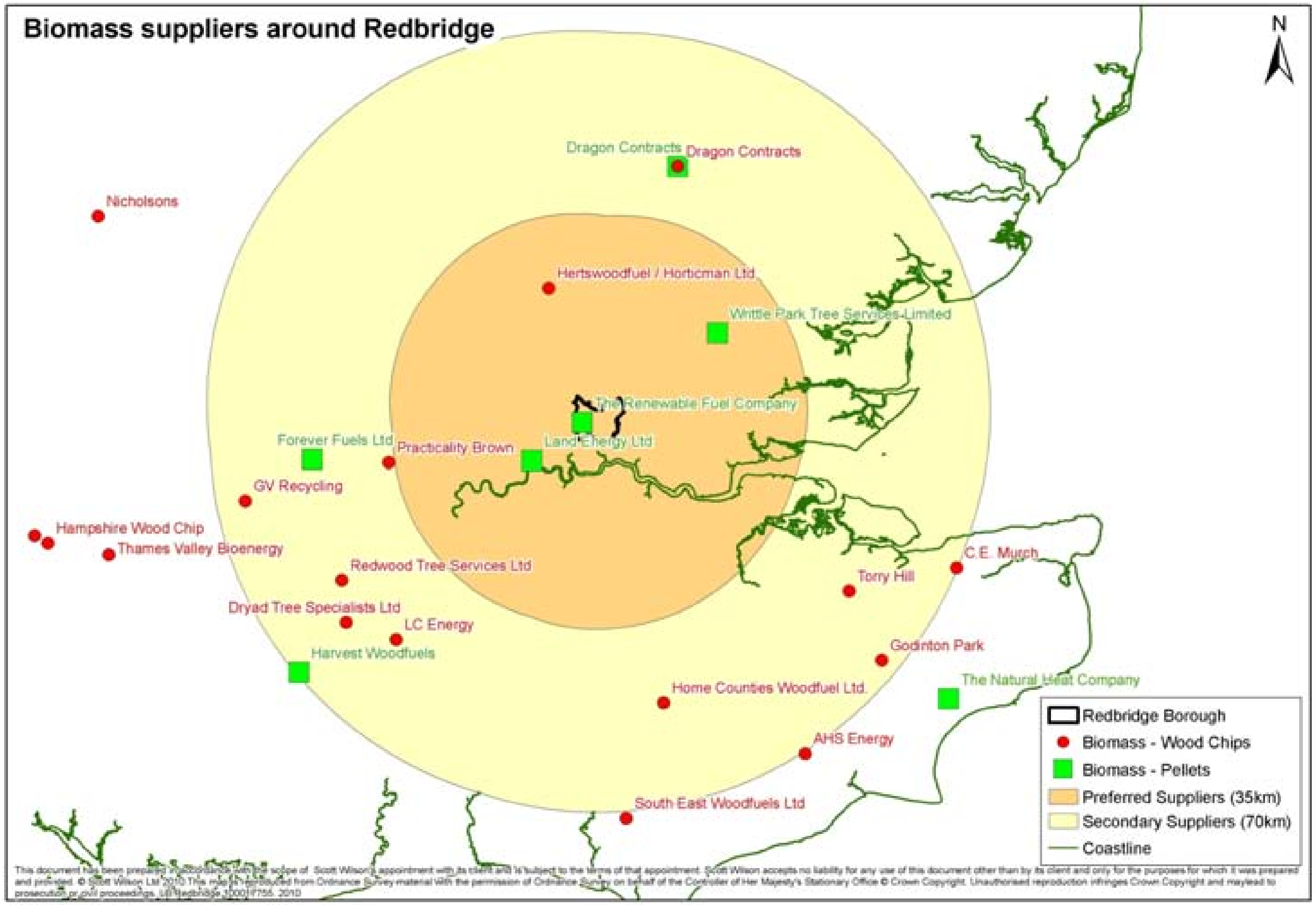


Figure 5-8: Biomass suppliers around Redbridge[62]

62 http://www.biomassenergycentre.org.uk/portal/page?_pageid=77,225275&_dad=portal&_schema=PORTAL

The North East London Biomass study[63] estimates that arboricultural arisings from tree surgeons and woodland are estimated to yield around 1.01 MW capacity annually in North East London for Havering, Barking & Dagenham and Redbridge, which is higher than the estimated capacity from the South East Region pro-rata methodology (0.08MW electricity and 0.12MW heat)[64]. This may be attributed to the fact that the North East London Biomass study takes into account the possibility of international biomass supply including supply from Canada, based on the rationale that transport emissions related to international supply of biomass would be lower than using natural gas as a fuel. Therefore, taking into account international supply attributes a higher figure for energy generation potential than has been calculated within the South East Study.

The table below provides a summary of all planning proposals in Redbridge incorporating biomass and the capacity, fuel type, fuel quantity, and the status of the data provided.

	Place	Capacity (kW)	Fuel	Mass (t/yr)	Postcode	Note
Redbridge	Mansion House	117	Pellet	50*	IG1 1TJ	Existing
	Ray Park visitor centre	36	Pellet	15*	IG9 6ES	Existing
	Grove Farm	330*	Pellet*	140*	RM6 4AQ	Planned
	246-250, High Road,	300*	Pellet*	127*	IG10 1RB	Existing
	Britannia Music Site	100	Pellet	42*	IG1 2PX	Proposed
	Total	883		374		

Table 5-1: Wood fuel demand from planning applications 2005-present[63]

The existing, planned and proposed biomass installations listed in Table 5-1 are shown in the figure below. Biomass installations using pellets as a fuel clearly represent the bulk of installations taking place at the moment largely due to ease of storage of pellets.

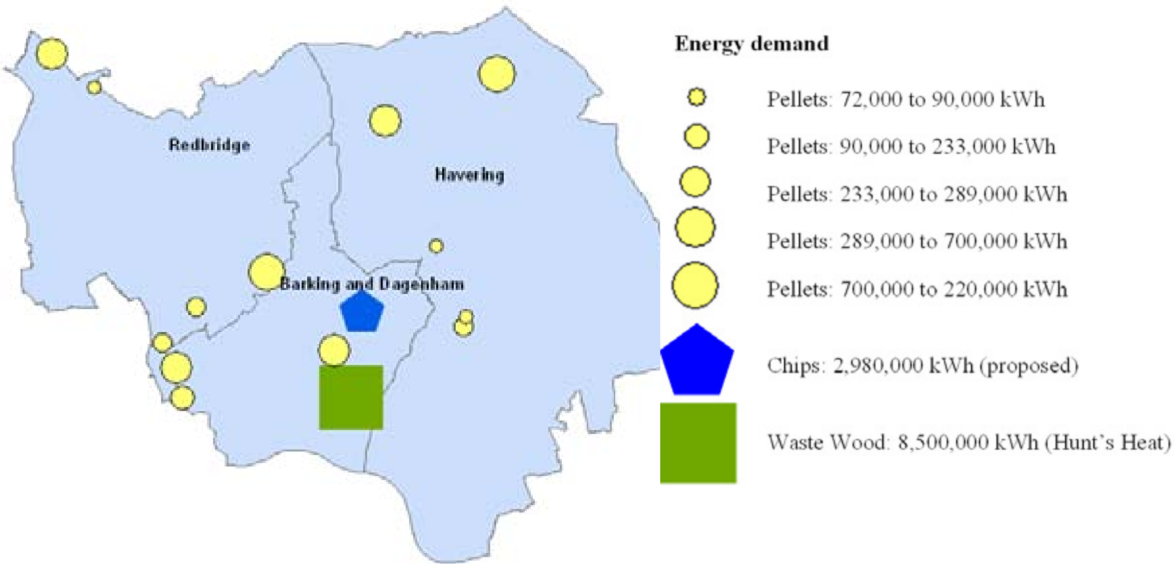


Figure 5-9: Visual representation of biomass demand (kWh)[63]

[63] Biomass supply chains in North East London, CEN Services Ltd, March 2010
[64] http://www.forestry.gov.uk/

5.4 Managed Woodland

5.4.1 Opportunity analysis

The Forestry Commission provides statistical data on the woodfuel resource available in the UK, broken down into regions. Data estimates for the felling and thinning of biomass products in the South East has been extrapolated and presented below. It includes biomass from pines, spruces, conifers and broadleaves and shows a trend of increasing harvest of biomass products to the year 2021. It is forecast that in the year 2021, there will be an annual production of around a million tonnes of biomass potentially available as woodfuel in the South East as illustrated in Figure 5-10 below. It is worth noting that the South East of England has by far the highest percentage of woodland cover in the country at 14.1%, or 270,000 hectares (out of a total land area of 1,909,600 hectares).

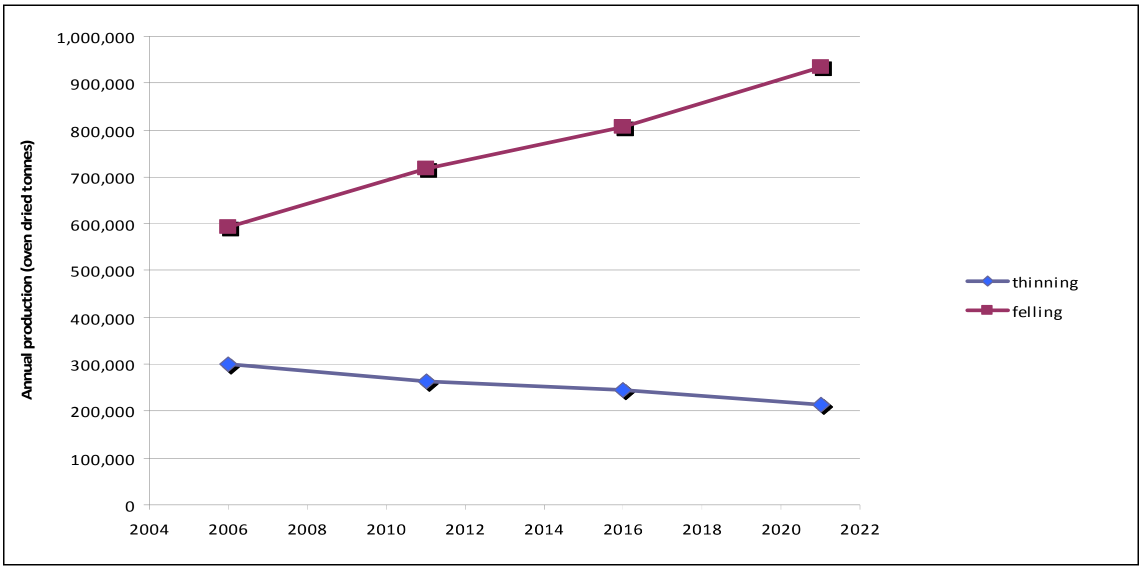


Figure 5-10: Graph showing forecast of woodfuel production in South East[65]

Available data for evaluating biomass has been limited to South East regional data derived from the Forestry Commission Statistics Unit. Data specific to Redbridge and other areas is currently not available.

Forest Research, who is the research arm of the Forestry Commission, has estimated the amount of Forest and Woodland tonnage in the South East region to be 446,396 ODT (oven dried tones). Forest and Woodland tonnage in East of England amounts to 272,810 ODT/year [66] Redbridge woodland area amounts to about 0.07% (200ha) of the total South East woodland area.

[65] www.forestresearch.gov.uk
[66] http://www.eforestry.gov.uk/woodfuel/FR.do#

Electricity: Based on the South East Region estimations, 6,000 ODT per year correspond to 1 MW capacity, therefore total capacity in the South East is 74.4 MW per year. This gives an estimated figure of **0.055 MW** capacity in Redbridge.

Heat: There is inadequate detail to accurately assess the potential heat output in Redbridge specifically. A worst case scenario, which assumes a calorific value of 12.5 GJ/ODT, 80% plant conversion efficiency and 80% plant availability gives 99.1 MW capacity in the South East, which translates to **0.07 MW** in Redbridge.

5.4.2 Constraints Analysis

Woodfuel that is uneconomic to harvest and woodfuel that could go to alternative markets, such as construction, paper, etc. should be excluded from the calculation of total capacity in the South East and Redbridge. Unfortunately, no information on these quantities was available on forestry.gov.uk, therefore SW have made an assumption of 30% being unsuitable for biomass, leaving the South East with a capacity of 52.1 MW of electricity and 69.4 MW heat. Redbridge would have a generation capacity of just over **0.04 MW** electric or **0.05 MW** heat.

5.5 Energy Crops

There is no information available in the public domain specific to energy crop generation within Redbridge. The information within this section has largely been derived from pro rata information for the South East region.

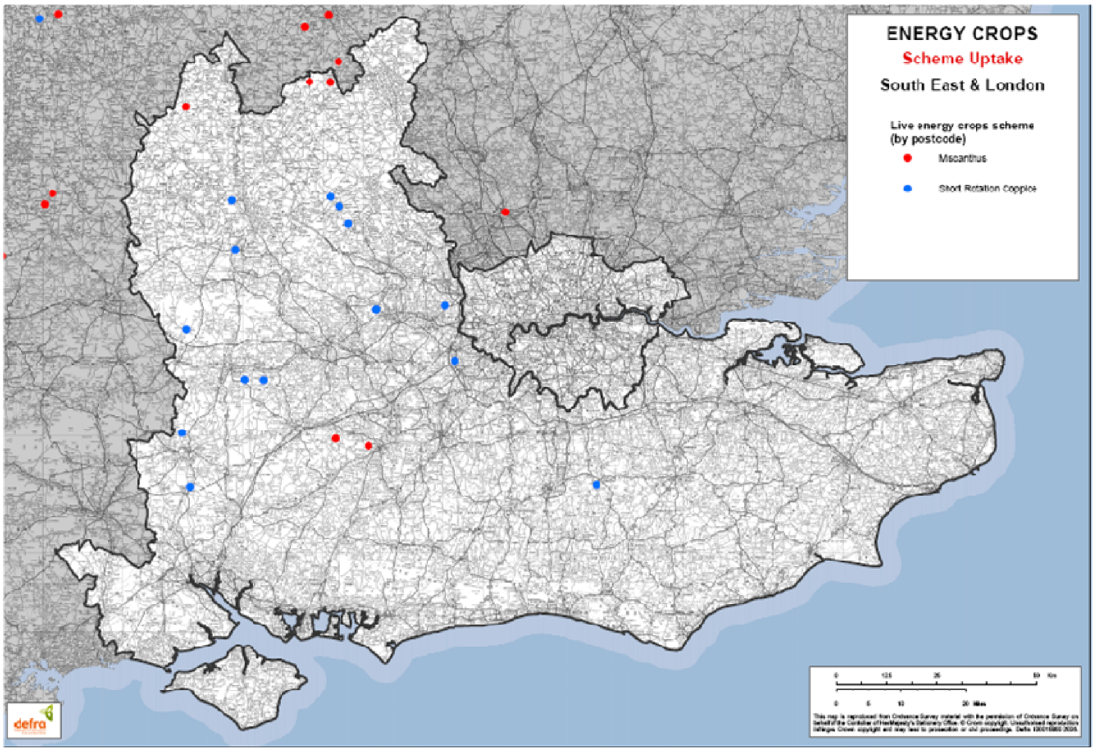


Figure 5-11: Existing Energy Crop Locations in the South East and London

The outputs of the Defra study[67] shown above suggest that there are currently no existing energy crop schemes in Redbridge. There are several limitations to the modeling work carried out by Defra, acknowledged in their study. The model input data includes data on soil types and structure, average rainfall and climatic conditions used to estimate the potential yield of the energy crops. The analysis also used data derived from disaggregation of selected sample studies carried out in the region and therefore locally specific conditions have not been assessed. The following sections will assess the potential for energy crops such as Miscanthus and Short Rotation Coppice within Redbridge.

5.5.1 Miscanthus

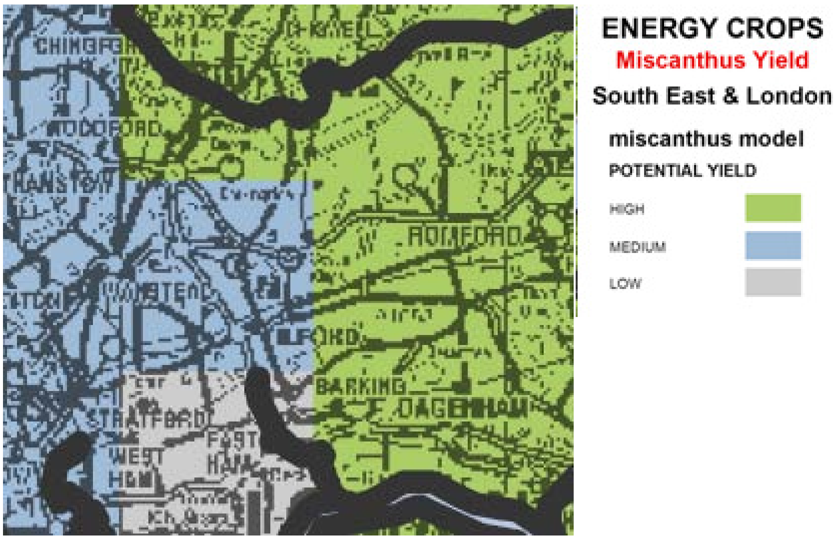


Figure 5-12: Yield Map for Miscanthus in Redbridge

The above figure from Defra[68] identifies areas where high, average and low Miscanthus yields may occur. About 85% of the total area of Redbridge has been identified as having Medium potential for yield of Miscanthus, while East Redbridge has been identified as an area of high potential yield. These figures are inconsistent with the highly urban nature of Redbridge, and have therefore not been used in this Study.

4.6% of Redbridge, equating to 260Ha constitutes arable land[69]. It is assumed that 10% **(**SW estimate based on estimated other uses for arable land) of this will be used for Miscanthus. This translates into a total area of around 26 hectares. At a yield of 15 ODT/ha/year there is a production of 390 $ODT_{miscanthus}$/year.

Electricity: For a standard calorific value of 1MW per 6,000 ODT/year this translates into **0.065 MW** of capacity from Miscanthus generated within Redbridge.

[67] http://www.defra.gov.uk/foodfarm/growing/crops/industrial/energy/index.htm
[68] Maps for Energy Crop potential yields: http://www.defra.gov.uk/foodfarm/growing/crops/industrial/energy/opportunities/se.htm
[69] LBR Nature Conservation SPD, June 2006

Heat: For a worst case scenario for a standard calorific value of 12.5GJ/ODT this translates into a **0.14 MW** capacity of heat from Miscanthus generated within Redbridge.

5.5.2 Short Rotation Coppice (SRC)

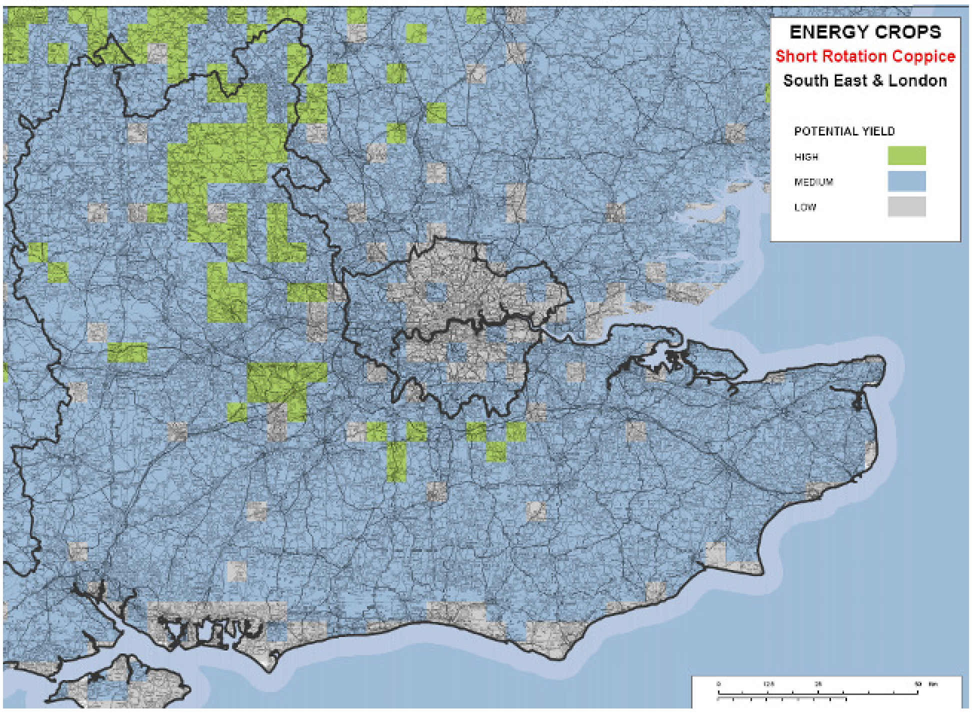


Figure 5-13: Yield Map for Short Rotation Coppice in Redbridge.

The above map from Defra identifies areas where high, average and low SRC yields may occur. The vast majority of Redbridge, about 90% of it, is classified as having medium potential yield. These figures are inconsistent with the highly urban nature of Redbridge, and have therefore not been used directly in this Study, but have been factored down based on aerial maps of the borough.

Assuming most of the land with relatively favourable conditions for Miscanthus is likely to also be used for agriculture, infrastructure and buildings, it is likely that no more than 10% can be used for SRC. Since SRC is less efficient than Miscanthus, it is reasonable to assume that even a smaller proportion of available land will be used for SRC crops, i.e., a percentage of 5%. This translates into a total area 13 hectares. At a yield of 10 ODT/ha/year there is a production of 130 ODT_{SRC}/year.

Electricity: For a standard calorific value of 1MW per 6,000 ODT/year this translates into **0.02 MW** of capacity from SRC generated within Redbridge.

Heat: For a worst case scenario for a standard calorific value of 13GJ/ODT this translates into a **0.05 MW** capacity of heat from SRC generated within Redbridge.

As mentioned in the sections above, the area available for energy crops is severely restricted by the highly urban character of Redbridge. Therefore, although Redbridge is classified as a high/medium potential area for Miscanthus and SRC in the Defra Study, the sections above identify that the actual potential for energy crops is low for Redbridge.

5.6 Waste Wood

5.6.1 Opportunity Analysis

Waste wood in the South East is estimated at 850,000 ODT.[70] This translates into a theoretical capacity of **14.2 MW** of electricity and **12.9 MW** of heat generated from waste wood within the South East. Redbridge woodland area amounts to about 0.07% of the total South East woodland area, amounting to a theoretical capacity of **0.01 MW** of electricity and **0.009 MW** of heat generated from waste wood.

5.6.2 Constraints Analysis

Due to competing uses it has been assumed that only 50% of the total waste wood resource is available for energy. This translates into a capacity of **0.005 MW** of electricity and **0.004 MW** of heat generated from waste wood in the South East.

5.7 Agricultural Arisings

5.7.1 Opportunity Analysis

Forest Research has estimated the amount of agricultural arisings to be 144,645 ODT. This translates into **24.1 MW** potential electrical generation from agricultural arisings within the South East, and approximately **0.01MW** generation for Redbridge.

5.7.2 Constraints Analysis

We assume that 50% of the above resource could be used as feedstock for power generation, bringing the estimated potential for generation to **12.1 MW** for the South East and **0.009MW** for Redbridge.

5.8 Municipal Solid Waste (MSW)

5.8.1 Opportunity Analysis

According to Defra's quarterly MSW statistics report[71] (2008/2009, updated November 2009) there are 116,378 tonnes of MSW generated in Redbridge each year. Based on this figure above and on the assumption that each 10 kilo-tonne of MSW equates to 1 MW power generation capacity, total capacity in Redbridge amounts to **11.6 MW** from Municipal Solid Waste.

[70] http://www.forestry.gov.uk/pdf/eng-see-3-woodfuel-resources.pdf/$FILE/eng-see-3-woodfuel-resources.pdf
[71] http://www.defra.gov.uk/evidence/statistics/environment/wastats/archive/mwb200809a.xls

5.8.2 Constraints Analysis

There are no significant technical constraint parameters identified. However existing contracts for waste disposal (based on trends within London boroughs) and the constraints related to identification of suitable locations for energy from waste plants within the Borough suggest that it is unlikely that energy from waste could be a viable option for Redbridge. Energy recovery is specified as the least favourable option for waste treatment in the ELWA Joint Waste DPD[72]. Theoretically **11.6 MW** of energy could be generated through MSW in Redbridge, however it is likely that cross border initiatives will have to be explored to utilise existing waste treatment facilities.

The following types of biomass have been considered and are presented below along with their availability in Redbridge or the South East region according to bodies such as the Forestry Commissions, National Inventory of Woodlands and Trees, Defra and the Environment Agency. Their potential capacity to generate electricity and/ or heat is further summarised below.

Type of biofuel	Electricity (MW)	Heat (MW)	Reference Area
Managed Woodland	0.04	0.05	Redbridge
Energy Crops – Miscanthus	0.06	0.14	Redbridge
Energy Crops - SRC	0.02	0.05	Redbridge
Waste Wood	0.005	0.004	*(Redbridge)**
Agricultural Arisings (straw)	0.009	Not efficient	*(Redbridge)**
Municipal Solid Waste (MSW)	Not applicable	11.6	Redbridge
TOTAL	0.13	11.84	

**This is an indicative figure, calculated on an area-based scaling factor of 0.0007 (Redbridge as part of the South East).*

Compared with the South East predicted energy capacity of 111 MW by 2010 and 154 MW by 2016, Redbridge in terms of its capacity is estimated to contribute **0.13MW$_e$** and **12MW$_t$.**

5.9 Animal Biomass

Due to its highly urban nature, animal biomass/biogas are not viable resources for energy generation in Redbridge and have therefore not been explored within this study.

[72] Sustainability appraisal of the Joint Waste Development Plan Document, East London Waste Authority, May 2007

5.10 Hydropower

Hydropower involves harnessing the power of flowing or falling water through a turbine in order to produce electricity. The parameters determining the amount of electricity produced include the turbine generating capacity, the turbine discharge flow (the water passing through the turbine at any given time, which will change depending the time of the year) and available head (the vertical distance between the point where the water is at its highest and the turbine).

Hydroelectric schemes are classified into three major categories based on their installed capacities; large hydro; medium hydro; and small hydro schemes. Small hydro schemes are further categorised as mini-, micro- and pico-hydro schemes.

5.10.1 Opportunities within Redbridge

The Environment Agency has identified the potential for hydropower potential within Redbridge which has been illustrated in the figure below:

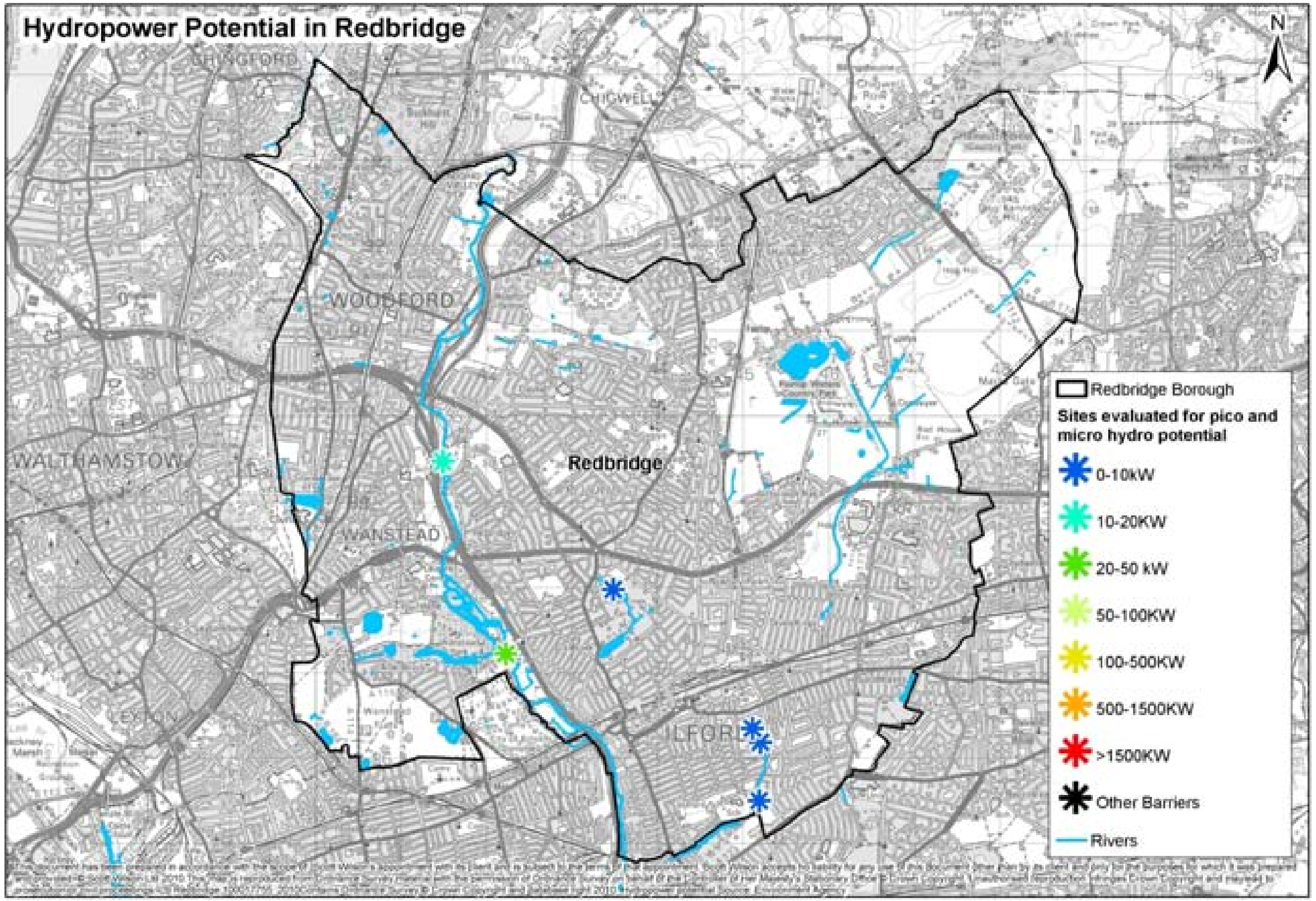


Figure 5-14: Hydropower potential in Redbridge

A detailed analysis of the various factors affecting hydropower potential, including head, and flow data within Redbridge was carried out to ascertain the potential for Hydropower in Redbridge.

An analysis at the highest level demonstrates that Redbridge offers no opportunities for large, medium and small scales of hydro installations due to limited available head and the river flow conditions of the Borough. However, results from a preliminary feasibility review to explore opportunities for Micro- and Pico-scale installations within Redbridge are presented in Appendix E. The results indicate that neither the flow nor the head conditions are appropriate for hydro.

5.11 Microgeneration

Microgeneration typically refers to renewable energy systems that can be integrated into buildings to primarily serve the on-site energy demand. They are applicable to both domestic and non-domestic buildings and can be connected to the grid although this is not required as most of the output is used onsite. Thus Microgeneration systems are typically designed and sized either in relation to the onsite demand or in proportion to the physical constraints onsite, such as available space, whichever is more appropriate.

Microgeneration technologies cover the full range of renewable energy categories: wind, solar, biomass, hydropower and heat pumps. In terms of assessing the regional opportunities and constraints for deployment, some of these categories are already captured previously in this chapter. The full potential of certain technologies such as biomass and hydropower is not directly constrained by the built environment and more specifically by what can be installed onsite as other deployment options are available, such as off-site or large scale capacity deployment. For example, community scale CHP plants utilising biomass in multi-storey buildings may be a more feasible option than individual biomass boilers if a sufficiently high flue height would mitigate potential air quality issues.

Technologies that directly depend on the built environment capacity to take Microgeneration systems are solar (solar water heating and solar photovoltaics) and heat pumps (ground source and air source). The potential for each of these sub-categories is assessed in this section.

5.11.1 Solar Water Heating (SWH)

Solar thermal collects heat from the sun to produce hot water. A typical ($3m^2$ system, based on the DECC methodology) solar collector can generate around $500kWh/m^2/yr$. To put this into context, a typical 72m2 house consumes around 9000kWh/year of energy, comprising of around $3478kWh_e$/year and $5580kWh_t$ /yr. Therefore, using a typical 3m2 panel would generate 1500kWh/yr or 17% of the domestic energy requirement. Solar Water Heating (SWH) depends on three site-specific factors:

- Available roof space to install the system;
- Orientation and exposure of the roof to be able to capture enough solar radiation; and
- Hot water demand onsite (SHW is typically sized to supply 50-60% of the hot water demand, although some systems offer space heating as well).

SHW systems are suitable for most domestic buildings, where the biggest potential exists and for some energy-intensive non-domestic buildings. For the purpose of the study our capacity figures are derived from domestic buildings.

Assumptions

Description	Proportion of appropriate roof space (%)	Total number of buildings	Capacity per building type (kW)	Capacity (MW)
Existing roof space				
Domestic properties	25%	99,928	2	50.0
New development				
Domestic properties	50%	6,996	2	7.0
			Total Capacity (MW)	**57.0**

Following the Government methodology, the total capacity for Solar Hot Water in Redbridge is **57 MW**.

DECC methodology does not indicate any further constraints as these are incorporated into the assumptions above.

5.11.2 Solar Photovoltaics (PV)

Photovoltaic systems produce electricity from sunlight through semiconducting cells utilising the photo-electric effects to generate electrical energy. Photovoltaic panels come in modular panels, which can be fitted to the top of roofs, but other building-integrated panels are also available. A typical PV panel can generate around 100kWe/m^2/yr. To put this into context, a typical 72m2 house consumes around 9000kWh/year of energy, comprising of around 3478kWh$_e$/year and 5580kWh$_t$ /yr. Therefore, using a typical 3m2 panel would generate 300kWh$_e$/yr or 9% of the domestic electrical requirement. Similarly to SHW, solar PV depends on:

- Available roof space to install the system
- Orientation and exposure of the roof to be able to capture enough solar radiation

The figure below provides an indication of the areas with roof orientation and size considered to be suitable for PV's and SHW within Redbridge. It should be noted that the areas specified as suitable for PV's are based on existing buildings, areal maps, GIS maps and images on Google Streetview; areas not specified as suitable for PV's or SHW on the map should not be excluded from consideration as PV's will likely be suitable over majority of Redbridge.

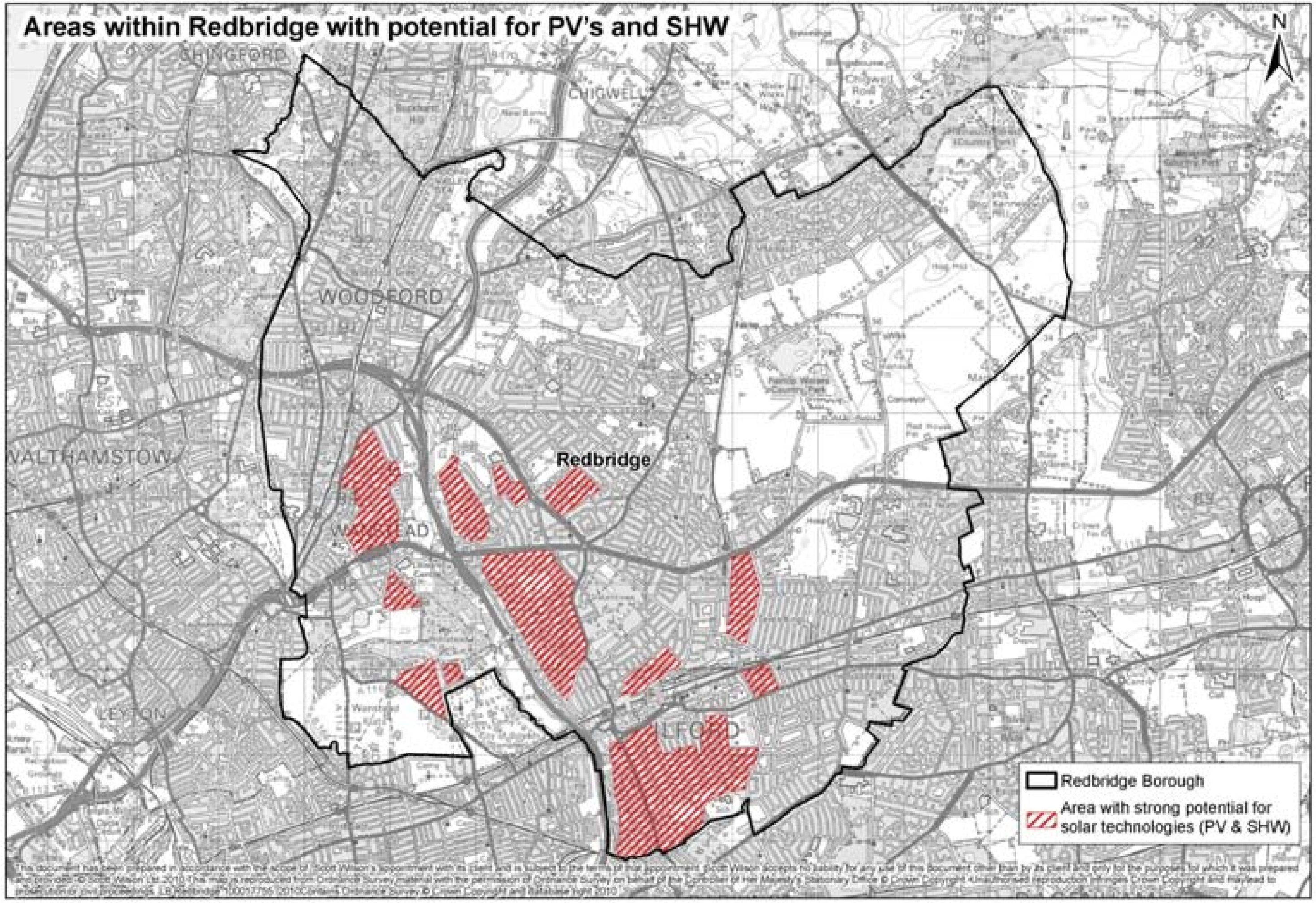


Figure 5-15: Areas within Redbridge with potential for PV's and SHW (indicative only)

Solar PV systems are equally suitable for domestic and non-domestic buildings with greater emphasis on domestic. Domestic buildings tend to have pitched roofs and therefore orientation is a strong factor, unlike commercial and industrial buildings, which often have flat roofs. The capacity assessment explores the entire regional building stock.

Assumptions

Description	Proportion of appropriate roof space (%)[73]	Total number of buildings	Capacity per building type (kW)	Capacity (MW)
Existing roof space				
Domestic properties	25%	99,928	2	50.0
Commercial properties	40%	7,110[74]	5	14.2
Industrial properties	80%	790	10	9.5
New development				
Domestic properties	50%	6,996	2	7.0
			Total Capacity (MW)	**80.7**

Following the DECC methodology the potential capacity in Redbridge from solar Photovoltaics is **81 MW**.

Feasibility of solar technologies is site-specific, depending on the constraints of individual households and buildings such as orientation, roof structures, roof areas, surrounding obstacles as well as individual financial considerations.

5.11.3 Heat Pumps

Ground Source Heat Pumps (GSHP) extract the heat stored in the ground to provide space and water heating. They use electricity in the process. There are two broad sub-categories:

- Open loop systems typically pump warmer water up from an aquifer returning it at a lower temperature; these systems tend to be larger and more suitable for commercial buildings; and

[73] Derived from the DECC methodology
[74] Sub national authority electricity consumption statistics 2008, DECC January 2010, 'assumption that 10% of commercial and industrial buildings are industrial'

- Closed loop systems, where liquid circulates through a closed tube put in the ground, which absorbs the ground heat.

The ground component of closed loop systems can be installed horizontally in trenches or vertically in boreholes and, while the former option requires a considerable amount of land per installation, the latter is relatively compact and can be installed in a small area of land adjacent to the building. Generally GSHP is more suitable for suburban and rural areas where drilling down is more accessible. They are particularly suitable and economically viable in areas with no mains gas supply.

Air Source Heat Pumps (ASHP) extract the ambient heat in the air to provide space and water heating. They use electricity in the process. As the outside air temperature varies considerably during the year, their energy and carbon efficiency varies as well and is overall lower compared with GSHP. Their advantage, however, is their low space requirement and their applicability to most locations, including urban, where they are an alternative to GSHP.

The borough wide assessment of the potential for heat pumps is based on the premise that most buildings (existing stock and new build) are suitable for the deployment of at least one of the heat pump options.

Assumptions

Description	Proportion of appropriate roof space (%)	Total number of buildings	Capacity per building type (kW)	Capacity (MW)
Existing stock[75]				
Domestic: off-grid	100%	70	5	0.35
Domestic: detached and semi-detached	75%	30,426	5	114.1
Domestic: terraced	50%	37,999	5	95.0
Domestic: flats	25%	25,421	5	31.8
Commercial properties	25%	7,110[74]	100	35.6
New development				

[75] www.rightmove.co.uk

Domestic properties	50%	6,996[76]	5	17.5
			Total Capacity (MW)	**294.4**

Although theoretically there appears to be a high potential for energy generation through heat pumps, specific analysis is likely to be far lower due to local constraints such as space and geology. The DECC methodology does not take these constraints into account, and this is considered to be an anomaly in the results.

5.12 Summary of Renewable Energy Capacity in Redbridge

Following the implementation of the Government methodology, we have calculated the following renewable energy capacity in Redbridge:

Technology	Potential Capacity (MW)
Large wind	32
Small wind	14
Biomass – Electric (Waste Wood, energy crops, managed woodland and Agricultural Arisings)	0.134
Biomass – Heat (energy crops, managed woodland and Waste Wood)	0.24
Biomass – Heat (Municipal Solid Waste)	11.6
Hydropower	0
Solar Hot Water	57
Photovoltaics	81

[76] Information provided by the Redbridge Council in the form of a Borough wide phasings table

Heat Pumps	294
TOTAL	490 MW

The above capacities are indicative only and consideration should be given to the principle of additionality; for example, if all available roofspace in domestic buildings is used for Solar Hot Water, then the capacity estimate for Photovoltaics is unrealistic.

It is worth noting that the vast majority of this renewable energy capacity is derived from heat pumps. However, in order to translate this technical potential into actual installations, the inertia for building owners/ occupiers to overcome would significantly limit the realistic authority-wide potential.

Wind energy potential is also considered to be minimal in Redbridge once wind speed scaling factors and the highly urban nature of Redbridge are taken into account.

Barring MSW, biomass resource potential is considered to be negligible within Redbridge, which is consistent with the highly urban nature of the Borough. Although biomass can be imported from abroad to supplement local supply, this is beyond the scope of this study.

Taking into account the above points, we have estimated the total capacity in Redbridge at present to be approximately **138 MW**. This figure is based on the exclusion of heat pumps, wind and MSW from the total contribution. Sufficient information is not available to accurately estimate the contribution from heat pumps, wind energy would need to be considered on a case by case basis, and as energy from waste is not a favoured technology in the area[72,] these technologies have both been excluded at present pending a further detailed viability assessment.

5.12.1 Energy Opportunities Map and Conclusions

Following the above analysis of the potential for low and zero carbon technologies in Redbridge, an Energy Opportunities Map has been developed using GIS, illustrated in the figure below, which identifies areas favourable for specific technologies in Redbridge.

Suitable conditions for medium to large wind exist on the area (over 5m/s), shown below, subject to restrictions from built-up areas, environmental land designations, etc. Small wind is illustrated to be viable on the north of the Borough and in small parts of the north-west.

The Energy Opportunities Map also illustrates district heating opportunity areas and, based on location of potential anchor loads.

Areas suitable for solar technologies are also identified (through a review of GIS aerial maps, and Google Streetview, streets with a south west orientation were identified) where built environment is likely to have a south, south-east or south-west aspect. Finally, areas designated as Air Quality Management Areas, with NOx emissions higher than 40micrograms per m^3, where biomass boilers would be restricted, are identified on the Map.

GSHP are potentially suitable for all new developments, however their viability needs to be addressed on a site by site basis (Please refer to Section 5.11.3 for further details), and therefore have not been included in the figure below on the basis that their applicability extends across the borough.

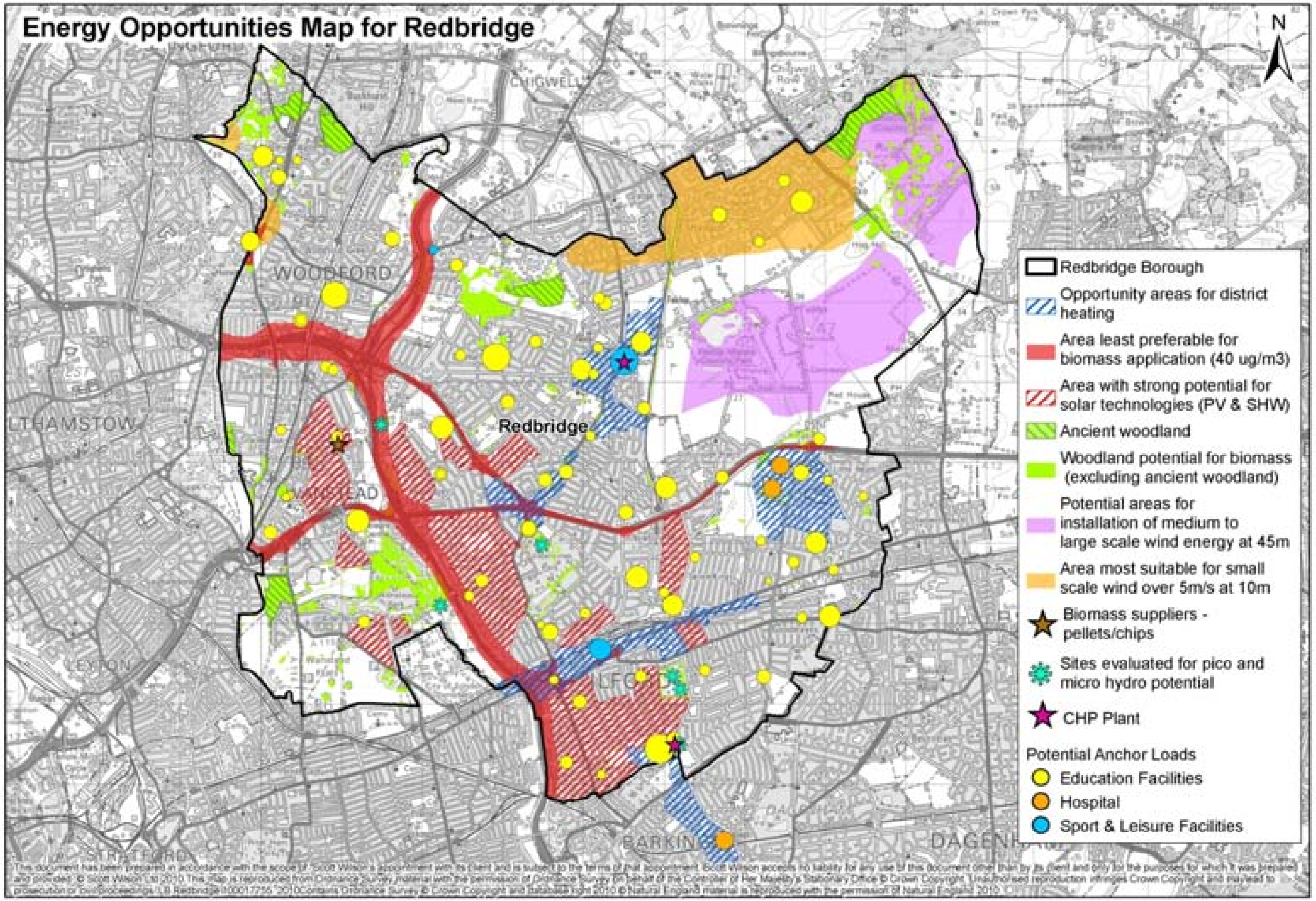


Figure 5-16: Energy Opportunities Map for Redbridge

6 Strategic Development Sites

6.1.1 Introduction

PPS 1 Climate Change Supplement encourages Local Authorities to set higher area or site-wide percentage targets to secure the potential for low or zero carbon energy where there are significant opportunities[77].

Strategic Sites were identified and agreed with the Council to be looked at in more detail regarding low carbon and renewable energy technologies. These reflect an appropriate cross-section of Redbridge in respect to development characteristics, typology and the focus of new development in the Local Development Framework. This chapter focuses on the low and zero carbon energy potential in each of the three Strategic Sites, tying them to different Code for Sustainable Homes (CSH) levels and percentage improvement over Building Regulations 2006 for non-residential buildings. The sites explored in details are: Ilford Town Centre, Gants Hill and the Crossrail Corridor.

Targets in the Code are expressed in terms of the Dwelling Emission Rate over the Target Emission Rate as calculated through the government's Standard Assessment Procedure (SAP). These emission rates take into account both passive measures (orientation, internal heat gains, building fabric performance, etc.) and active measures (low or zero carbon technologies) to reduce carbon dioxide emissions. Expressed in percentage dioxide emissions for the different Code levels; a 25% reduction from 2010 (Level 3), 44% from 2013 (Level 4), and zero carbon from 2016 (150% reduction, including unregulated emissions) (Level 6). This is the Governments current timetable.

In terms of the non-residential development, the percentage improvements over Building Regulations 2006 that are based on Scenario 2 (outlined in chapter 3) – balancing on-site and off-site as presented in the Communities and Local Government consultation document *Zero Carbon for new Non-domestic Buildings* (February 2010). This assumes the following timescale; a 25% improvement from 2010, 44% from 2013, 49% from 2016 and zero carbon by 2019 (54% improvement and the remaining unregulated emissions through allowable solutions). Please note that this is a consultation document and we have selected the option that is generally considered as the most likely case going forward based on Scott Wilson attendance at consultation events. Similarly to domestic buildings, passive and active measures are taken into account when calculating the improved performance and resulting carbon dioxide emissions reductions.

In order to derive our results, we have followed the methodology described below.

6.1.2 Methodology

For each of the Strategic Sites we have used information provided from LB Redbridge regarding the number of dwellings and floorspace of non-domestic buildings and their phasing over the plan period. Using industry benchmark and government figures for their energy requirements for space and water heating and regulated and unregulated electricity use, we have calculated the overall carbon dioxide emissions and, hence, the baseline from which any improvement/ emissions reduction is calculated.

[77] Page 10, Planning Policy Statement: Planning and Climate Change, Supplement to PPS 1, CLG, December 2007

In order to meet the various requirements for domestic and non-domestic development over time (higher Code levels and improved Building Regulations respectively) we have looked at the following technologies and tested the technical viability of different combinations on each of the Strategic Sites. For each of the technologies we have used appropriate criteria to assess their technical viability, as summarised below.

- Small wind – due to the dense development and its urban location, we have assumed that no more than 5-6 small-scale turbines can be installed on each of the Sites based on spatial requirements outlined in the DECC methodology.

- Biomass boilers – while these can greatly contribute towards meeting the lower levels of the Code and Building Regulations up to 2018, they are inappropriate for zero carbon homes and non-residential buildings, unless for individual dwellings, and so have been excluded. Biomass boilers mentioned in the tables below refer to centralised systems, unless stated otherwise.

- Solar Hot Water (SHW) – Based on the DECC assumption that an average individual capacity of 2kW per domestic system should be specified, for Redbridge we have assumed that no more than 4.5 m^2 (i.e. producing 3kW based on the assumptions in the DECC methodology that the peak thermal output of 1m^2 of panel is around 0.7kW) per dwelling or per 70 m^2 of non-residential floorspace is viable. This limit applies to blocks of flats.

- Air and Ground Source Heat Pumps – the contribution of these technologies is limited by the space heating load. Therefore, up to 4% of emissions reductions can be met through Air Source Heat Pumps and up to 14% through Ground Source Heat Pumps (based on calculations carried out by SW). This discrepancy is related to the different Coefficients of Performance that we have assumed for each (3:1 for Ground Source and 2.5:1 for Air Source[78]).

- Biomass Combined Heat and Power (CHP) – the cost of installation would be too high for the lower levels of the Code and early Building Regulations. The efficiency of conversion into electricity has been taken as 25% and into heating as 45%.[79]

- Gas-fired CHP – similar to biomass CHP. The efficiency of conversion into electricity has been taken as 34% and into heating as 39%.[79]

The sizing of these technologies is based on the amount of installed capacity, area or electrical output required to mitigate the required carbon dioxide emissions following the reduction from simple or advanced energy efficiency measures. Following a separate analysis of the domestic and non-domestic elements of development for each of the Strategic Sites, we have recombined the results into a single number for each technology under different scenarios for each of the Sites. These results are presented in the relevant sections below, along with an interpretation of what these overall figures mean on a single-building or community-scale development.

[78] http://www.energysavingtrust.org.uk/Generate-your-own-energy/Ground-source-heat-pumps
[79] Gross calorific value efficiencies: Typical CHP efficiencies from a selection of suppliers data – e.g. EnerG, Congenco, Jenbacher in the size range appropriate for the scale considered in this study

6.2 Ilford Town Centre

6.2.1 Introduction

As the largest town centre in the Borough and one of only 10 Metropolitan Centres in London, Ilford is effectively the "capital" of Redbridge. Ilford Town Centre lies within the North-East London Sub-Region, a priority region in terms of future growth and intensification of development in London. The Council has identified a number of development sites within the Town Centre that it considers have the potential for mixed-use redevelopment within the lifetime of the Local Development Framework (2007 – 2017). These sites, which are in a variety of public/private sector ownership are identified below:

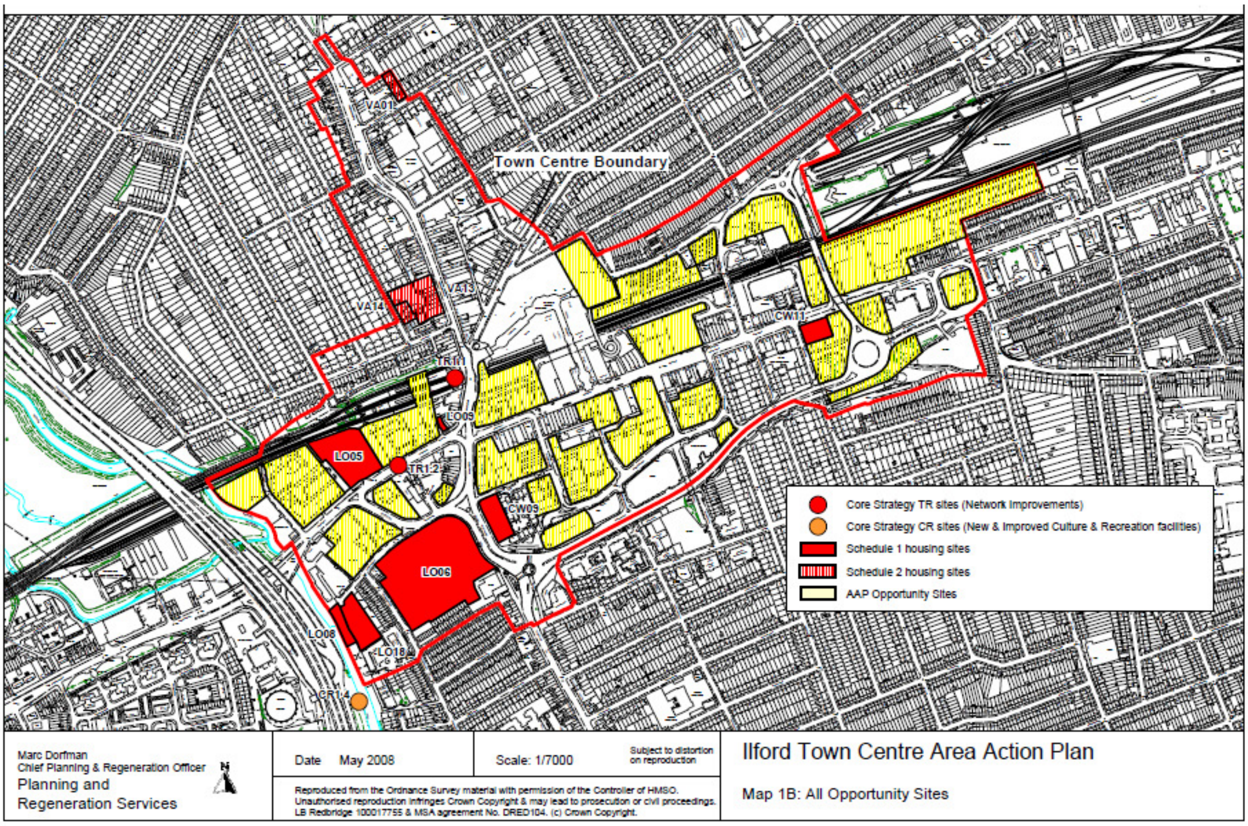


Figure 6-1: Ilford Town Centre opportunity sites

The housing type being delivered in the town centre is mainly one and two bedroom apartments in tall buildings. The town centre has a number of good quality historic buildings such as the Town Hall and two groupings of statutory and locally listed buildings. All the sites within Ilford Town Centre with acknowledged development potential have been listed in Appendix B.1

6.2.2 Site Development Context

Development in Ilford between 2010 – 2019 will result in the creation of 3,882 new dwellings and a total area 88,495 m^2 of non-residential floorspace (as shown in Appendix B.2). Total regulated CO_2 emissions for the site after completion assuming current benchmarks (e.g. Part L 2006

Compliance) amount to 16,740 tCO_2/year and the total energy demand to 70,080 MWh/year. The tables 6.1, 6.2 and 6.3 below summarises the phasing and the implications the Code for Sustainable Homes and improved Building Regulations will have on Ilford Town Centre in terms of emissions reductions.

Number of dwellings	Phasing	Code level (% improvement over BR 2006)	Regulated CO_2 emissions ($kgCO_2$/year)	Emissions to be displaced (kgCO2/year)
1,230	2010/13	3 (25%)	1,576,835	394,209
1,623	2013/16	4 (44%)	2,080,654	915,488
1,029	2016/19	6 (150%)	1,319,157	1,978,736

Table 6-1: Breakdown of domestic development at Ilford Town Centre by phasing, Code levels and regulated CO2 emissions.

Floorspace (m^2)	Phasing	Building Regulations improvement over BR 2006	Regulated CO_2 emissions ($kgCO_2$/year)	Emissions to be displaced (kgCO2/year)
15,863	2010/13	25%	1,784,323	446,081
21,568	2013/16	44%	2,426,061	1,067,467
36,757	2016/19	49%	4,134,643	2,025,975
14,308	2019+	120%	1,609,500	1,931,400

Table 6-2: Breakdown of non-domestic development at Ilford Town Centre by phasing, Building Regulations percentage improvement and regulated CO2 emissions.

To summarise:

Phasing	Emissions to be displaced ($kgCO_2$/year)
2010/13	**840,290**
2013/16	**1,982,955**
2016/19	**4,004,711**
2019+	**1,931,400**

Table 6-3: Summary of Emissions Reductions

6.2.3 Technology Feasibility

The analysis of wind speeds and site constraints indicates that due to the heavily urbanised nature of this site, large scale wind would not be feasible. The potential for **small scale wind** would also be fairly limited due to low wind speeds and high number of potential obstructions.

As discussed in Section 5.3 above, there is some potential for **biomass** although high existing NOx levels may impose restrictions on its deployment.

Finally, **district heating** and biomass-/ gas-fired CHP are comparatively feasible at the high development densities proposed, but viability needs to be tested through detailed feasibility modelling.

6.2.4 Energy Strategies for Different Phases of Development

Based on the available technologies at Ilford Town Centre as presented above, the following tables summarise different scenarios for meeting the residential and non-residential targets over time.

Phase 1: 2010 – 2013

The table below presents options for meeting the CO_2 reduction target required for the 1,230 dwellings under Code level 3 and 15,863 m^2 that require an improvement of 25% of Building Regulations over Building Regulations 2006. The three scenarios look at combining energy efficiency with microgeneration.

2010 – 2013 **Domestic: Code 3 – 25% reduction in regulated CO_2 emissions** **Non-domestic: Building Regulations 2010 – 2013 (25% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions)
	Solar Hot Water	1,200 m^2 (840kW) of SHW panels installed on suitable roofspace, i.e., about 1 m^2 installed on each of the expected new dwellings (or about 2 m^2 on each, if only half the dwellings are suitable). 5% reduction in CO_2 emissions
	Air Source Heat Pumps	A total of just under 265 kW_{th} output capacity to meet just over half the space heating needs of the residential element of the development. 5% reduction in CO_2 emissions

B	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions)
	Photovoltaics	1,590 m^2 (1113kW) of PV panels installed on suitable roofspace, i.e. less than 1.5 m^2 installed on each of the expected new dwellings (or about 2.5 m^2 on each, if only half the dwellings are suitable). 5% reduction in CO_2 emissions
	Ground Source Heat Pumps	A capacity of 526 kW_{th} for the whole development in this phase, equivalent in output to meeting about a third of the space heating requirement of each new dwelling. Assumed to be installed in larger, ground floor dwellings without solar technologies. 5% reduction in CO_2 emissions
C	Energy efficiency	Improved building fabric and optimal orientation. (15% reduction in CO_2 emissions)
	Biomass boiler	A biomass boiler rated at approximately 180 kWth to meet space heating and hot water requirements. This is equivalent to a small commercial or large domestic sized unit. installed on a site wide basis. 10% reduction in CO_2 emissions

The above preliminary calculations show that both Code level 3 and an improvement of 25% over Building Regulations 2006 can be met through energy efficiency and different combinations of microgeneration technologies. Each of the above scenarios reduces carbon dioxide emissions by 25%, i.e. by 394 $tnCO_2$/year. Scenarios A and B are considered to be more suitable in areas with south facing roofs, which Scenario C is considered to be more suitable in areas with NOx emissions less than 40mg/m3, as illustrated on t he energy potential map.

6.2.4.1 Energy Efficiency

Passive design measures are strongly encouraged by Government as a means to reduce emissions.

Preliminary calculations (carried out by SW based on past project experience) show that an energy efficiency of 15% can be achieved in a typical home, including flats and semi-detached homes which are typically seen across Redbridge, with best practice U-values and south-west or south-east orientation. Up to 25% energy efficiency can be achieved, which would meet Code 3 compliance requirements, without the contribution of any LZC technologies; however this may not always be the most cost-effective option for meeting Code 3. It is generally not possible to meet Code levels above level 3 through energy efficiency alone.

Phase 2: 2013 – 2016

The table below presents scenarios for meeting the CO_2 reduction target required for the 1,623 dwellings under **Code level 4** combined with the **44% improvement of the Building Regulations** compared to 2006 levels for the 21,568 m^2 of non-residential floorspace. The three scenarios look at combining energy efficiency with microgeneration and medium/ large scale technologies.

2013 – 2016 **Domestic: Code 4 – 44% reduction in regulated CO_2 emissions** **Non-domestic: Building Regulations 2013 – 2016 (44% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Photovoltaics	3,665 m^2 of PV panels generating around 2,599kW, installed on suitable roofspace, i.e. about 2 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (9% reduction in CO_2 emissions).
	Small wind	12 no. turbines of capacity 6 kW each, amounting to a total of 70 kWe capacity (2% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 1,942 MW_{th} for the whole development, equivalent in output to meeting about a third of the space heating requirement of each new dwelling. Assumed to be installed in larger, ground floor dwellings/non domestic properties without solar technologies (13% reduction in CO_2 emissions).
B	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Biomass boiler	A biomass boiler rated at approximately 691 kW_{th} to meet space heating and hot water requirements. This is equivalent to a large commercial unit. Installed on a centralised basis (29% reduction in CO_2 emissions).

C	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Photovoltaics	1,832 m^2 of PV panels, generating around 1,282kW, installed on suitable roofspaces, i.e., 1 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace. (5% reduction in CO_2 emissions).
	Gas-fired CHP	An output of 504 kW_e (24% reduction in CO_2 emissions).

The above combinations of technologies can reduce carbon dioxide emissions from new development by 44% between 2013 and 2016.

6.4.2.5 Small wind

Under Scenario A, small scale wind could only displace a very small proportion of emissions (up to 2%) due to the urban nature of the development, i.e., about 40 $tnCO_2$/year. Financial and aesthetic factors would need to be considered for areas with adequate wind speeds before installing the turbine(s), in particular in terms of cumulative impacts. A 6kW turbine is approximately 12 m high.

6.4.2.6 Combined Heat and Power (Gas-fired)

In order for Combined Heat and Power (CHP) and district heating to be viable, the density of development will need to be appropriate. It is worth noting, that as the required emissions to be displaced increase, CHP becomes a more cost-effective option compared to microgeneration. Therefore, in order to ensure that the energy requirements can be met in the most cost-effective way during the later phases of development, it is suggested that the CHP unit be oversized for the requirements of the early phases. In order to meet total requirements from 2013 to 2019+, a plant with an output in the order of **1,735 kW_e** would need to be installed.

Phase 3: 2016 – 2019

The table below presents scenarios for meeting **Code Level 6** energy requirements for the 1,029 dwellings expected to be built from 2016 until 2019 and an improvement of **49% over Building Regulations 2006** for the non-residential element of the development. Code 6 includes all regulated energy and occupant electricity, resulting in an overall percentage requirement of 150% improvement over Building Regulations Part L 2006 for domestic regulated energy.

While microgeneration could contribute towards meeting the overall target, most of the reductions will need to be met through efficient, large scale technologies or through the allowable solutions mechanism. The scenarios below assume all emissions are displaced by on-site technologies. As large scale wind has been found unsuitable for the site, examples for gas-fired and biomass CHP are presented below.

2016 – 2019 **Domestic: Code 6 – 150% reduction in regulated CO_2 emissions (includes unregulated emissions)** **Non-domestic: Building Regulations 2016 – 2019 (49% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Gas CHP	An output of 1,063 kW_e. See previous note on sizing the gas-fired CHP between 2013/16 (87% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 1,377 MW_{th} for the whole development, equivalent in output to meeting about a third of the space heating requirement of each new dwelling. Installed in larger, ground floor dwellings without solar technologies (13% reduction in CO_2 emissions).
	Photovoltaics	7,720 m^2 of PV panels, generating around 5400kW, installed on suitable roofspace, i.e., less than 5 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (30% reduction in CO_2 emissions).
B	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Biomass CHP	Biomass CHP to generate 308 kW_e per year (120% reduction in CO_2 emissions).
	Small wind	37No. turbines of capacity 6 kW each, amounting to a total of just over 221 kW of electricity per year (10% reduction in CO_2 emissions).

6.4.2.7 Biomass CHP

Biomass CHP combines the efficiency in fuel conversion of CHP with the low carbon intensity of biomass to enable significant CO_2 savings to be delivered. Similarly to gas-fired CHP, it should be considered at the earliest opportunity whether this technology should be oversized to meet the requirements of several phases. While for the needs of this particular phase a biomass CHP unit of 308 kWe would be adequate, it is recommended that a unit of total output of **328 kW_e** be installed. This would meet the needs in Ilford Town Centre for all development between 2013 and 2019. It would not be possible to meet requirements after 2016 through gas-fired CHP coupled with microgeneration due to requirements for zero carbon, as gas CHP, which is based on fossil fuels, is not considered to be a renewable energy technology.

Phase 4: 2019+

The table below presents options for meeting the **zero carbon** requirements for the remaining non-residential element of the development expected from 2019 and until the end of the plan period. This includes all regulated energy and occupant electricity, resulting in an overall percentage requirement of 120% improvement over Building Regulations Part L 2006.

Similarly to 2016-2019, while microgeneration could contribute towards meeting the overall target, most of the reductions will need to be met through efficient, large scale technologies.

2019+ **Non-domestic: Building Regulations 2019+ (54% reduction in regulated CO_2 emissions plus allowable solutions for zero carbon non-domestic buildings, i.e., 120% reduction)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Gas-fired CHP	An output of 100 kW_e. See note on sizing the gas-fired CHP between 2013/16 (100% reduction in CO_2 emissions).
B	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Biomass CHP	Biomass CHP to generate 20 kW_e per year (100% reduction in CO_2 emissions).

6.2.5 Conclusions for Ilford Town Centre

The analysis suggests that in the earlier phases of scheme development, several options are available for microgeneration combinations. For the later phases of development biomass or gas-fired CHP would enable carbon reduction targets to be met in a cost-effective way due to the high densities of development. A biomass CHP unit of 328 kW_{th} capacity or a gas-fired CHP unit of 1,735 kW_{th} could be installed. In order to maximise technical efficiency it would be recommended that infrastructure compatible with wider site systems, such as DH pipe work and an energy centre, are installed during the early phases.

6.3 Gants Hill

6.3.1 Introduction

Gants Hill is a well-connected district centre and is situated at a busy roundabout junction with the A12 forming a major connection east-west and the A123 and A1400 crossing at this point to provide routes north and south. Valentines Park is also located close to and just south of the district centre. This provides Gants Hill with a major recreational open space and sporting facilities.

There is no industrial property in the vicinity of Gants Hill. The centre does have a number of office buildings dating back to the 1960s which employ 300 to 500 people.

6.3.2 Site Development Context

Development at Gants Hill between 2010 – 2019 will result in the creation of 650 new dwellings and a total area of 5,000 m^2 of non-residential floorspace. Total regulated CO_2 emissions for the new development at completion assuming current benchmarks amount to 835 $tnCO_2$/year and the total energy demand to 7,843 MWh/year. The tables below summarises the phasing and the implications the Code for Sustainable Homes and improved Building Regulations will have on Gants Hill in terms of emissions reductions.

Number of dwellings	Phasing	Code level (% improvement over BR 2006)	Regulated CO_2 emissions ($kgCO_2$/year)	Emissions to be displaced ($kgCO_2$/year)
269	2010/13	3 (25%)	344,853	86,213
189	2013/16	4 (44%)	242,294	106,610
192	2016/19	6 (150%)	246,140	369,210

Table 6-4: Breakdown of domestic development at Gants Hill by phasing, Code levels and regulated CO2 emissions.

Floorspace (m^2)	Phasing	Building Regulations improvement over BR 2006	Regulated CO_2 emissions ($kgCO_2$/year)	Emissions to be displaced ($kgCO_2$/year)
0	2010/13	25%	0	0
3,333	2013/16	44%	428,816	188,679
1,667	2016/19	49%	214,408	105,060

Table 6-5: Breakdown of non-domestic development at Gants Hill by phasing, Building Regulations percentage improvement and regulated CO2 emissions.

To summarise:

Phasing	Emissions to be displaced ($kgCO_2$/year)
2010/13	**86,213**
2013/16	**295,289**
2016/19	**210,120**

Table 6-6: Summary of Emissions Reductions

6.3.3 Technology Feasibility

The analysis of wind speeds and site constraints indicates that due to the heavily urbanised nature of this site, large scale wind would not be feasible. The potential for small scale wind would also be fairly limited due to low wind speeds and high number of potential obstructions.

As discussed in Section 5.3 above, there is some potential for biomass around London, which would need appropriate supply chains to be set up for its full exploitation. The use of biomass could be constrained by the AQMA status of Redbridge, and particularly in Gants Hill where very high traffic volumes are seen.

6.3.4 Energy Strategies for Different Phases of Development

Based on suitable potential technologies at Gants Hill, the following tables summarise different scenarios for meeting the residential and non-residential targets over time.

Phase 1: 2010 – 2013

The table below presents scenarios for meeting the CO_2 reduction target required for the 269 dwellings under **Code Level 3** (no non-residential floorspace is expected between 2010 and 2013). The three scenarios look at combining energy efficiency with microgeneration.

2010 – 2013 **Domestic: Code 3 – 25% reduction in regulated CO_2 emissions** **Non-domestic: Building Regulations 2010 – 2013 (25% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions)

	Solar Hot Water	230 m^2 (161kW) of SHW panels installed on suitable roofspace, i.e. about 1 m^2 installed on each of the expected new dwellings (5% reduction in CO_2 emissions)
	Air Source Heat Pumps	A capacity of 370 kW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (5% reduction in CO_2 emissions)
B	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Photovoltaics	305 m^2 (213kW) of PV panels installed on suitable roofspace, i.e., less than 1.5 m^2 installed on each of the expected new dwellings (or about 2.5m^2 on each, if only half the dwellings are suitable). (5% reduction in CO_2 emissions)
	Ground Source Heat Pumps	A capacity of 230 kW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (5% reduction in CO_2 emissions).
C	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions)
	Biomass boiler	A biomass boiler rated at approximately 60 kW_{th} to meet space heating and hot water requirements. Installed on a centralised basis (10% reduction in CO_2 emissions)

The above preliminary calculations show that both Code level 3 and an improvement of 25% over Building Regulations 2006 can be met through energy efficiency and some different combinations of microgeneration technologies.

Energy Efficiency

Please refer to Section 6.2.4.1 above.

Phase 2: 2013 – 2016

The table below presents scenarios for meeting the CO_2 reduction target required for the 189 dwellings under **Code level 4** combined with the 3,333 m^2 of non-residential floorspace that requires a **44% improvement of the Building Regulations** compared to 2006 levels. The three scenarios look at combining energy efficiency with microgeneration and medium/ large scale technologies.

2013 – 2016 **Domestic: Code 4 – 44% reduction in regulated CO_2 emissions** **Non-domestic: Building Regulations 2013 – 2016 (44% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Photovoltaics	PV panels installed on 1,393 m^2 of roofspace, generating 975kW i.e., under 6 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (9% reduction in CO_2 emissions).
	Small wind	2No. turbines of capacity 6 kW each (2% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 2,603kW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (13% reduction in CO_2 emissions).
B	Energy efficiency	Improved building fabric and optimal orientation. (15% reduction in CO_2 emissions).
	Biomass boiler	Boiler efficiency of 90% to generate 518 kW_{th}. (29% reduction in CO_2 emissions).
C	Energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (15% reduction in CO_2 emissions).

	Photovoltaics	215 m^2 (150kW) of PV panels installed on suitable roofspaces, i.e., 1 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (5% reduction in CO_2 emissions).
	Gas-fired CHP	An output of 439 kW_e (24% reduction in CO_2 emissions).

The above combinations of technologies can reduce carbon dioxide emissions by 44% between 2013 and 2016.

Small wind

Please refer to Section 6.4.2.5 above.

Combined Heat and Power (Gas-fired)

While a gas-fired CHP unit of 439 kWe would meet the requirements for this phase, in order to ensure that the energy requirements can be met in the most cost-effective way during the later phases of development, it is suggested that the CHP unit be oversized for the requirements of the early phases. Therefore, in order to meet total requirements from 2013 to 2019+, it is suggested that plant with an output of **766 kW_e** should be installed.

Phase 3: 2016 – 2019

The table below presents options for meeting **Code Level 6** energy requirements for the 192 dwellings expected to be built from 2016 until the end of the plan period and an improvement of **49% over Building Regulations 2006** for the 1,667 m^2 of non-residential development. Code Level 6 includes all regulated energy and occupant electricity, resulting in an overall percentage requirement of 150% improvement over Building Regulations 2006.

While microgeneration could contribute towards meeting the overall target, most of the reductions will need to be met through efficient, large scale technologies. As large scale wind has been found unsuitable for the site, examples for gas-fired and biomass CHP are presented below.

2016 – 2019 **Domestic: Code 6 – 150% reduction in regulated CO_2 emissions (includes unregulated emissions)** **Non-domestic: Building Regulations 2016 – 2019 (49% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Gas-fired CHP	An output of 327 kW_e. See note on sizing the gas-fired CHP between 2013/19 (97% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 836 MW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (13% reduction in CO_2 emissions).
	Photovoltaics	867 m^2 of PV panels installed on suitable roofspace, i.e., just over 4 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace, generating 607kW (20% reduction in CO_2 emissions).
B	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Biomass CHP	Biomass CHP of 102 kW_{th} (128% reduction in CO_2 emissions).

	Small wind	2No. turbines of capacity 6 kW each, amounting to a total of just over 12 kW of electricity per year (2% reduction in CO_2 emissions).

Biomass CHP

Biomass CHP should be considered at the earliest opportunity whether this technology should be oversized to meet the requirements of several phases. While for the needs of this particular phase a biomass CHP unit of 102 kWe would be adequate, it is recommended that a unit of total output of **241 kW_e** for Gants Hill is considered. This would meet the requirements for all development between 2016 and the end of the plan period.

6.3.5 Conclusions for Gants Hill

Development density at Gants Hill is likely to be reasonably high, increasing the cost-effectiveness for district heating infrastructure. In order to meet carbon reduction targets for the later phases of development, a biomass CHP unit of 241 kW_{th} capacity or a gas-fired CHP unit of 766 kW_{th} could be installed. In order to maximise technical efficiency it would be recommended that infrastructure compatible with wider site systems are installed during the early phases.

6.4 The Crossrail Corridor: Seven Kings and Goodmayes

6.4.1 Introduction

The Crossrail Corridor runs from the eastern edge of Ilford Town Centre to the boundary with the London Borough of Barking and Dagenham in Chadwell Heath along the High road. The High Road contains 6 of the 10 most deprived wards in Redbridge, including the rapidly growing wards of Loxford and Clementswood.

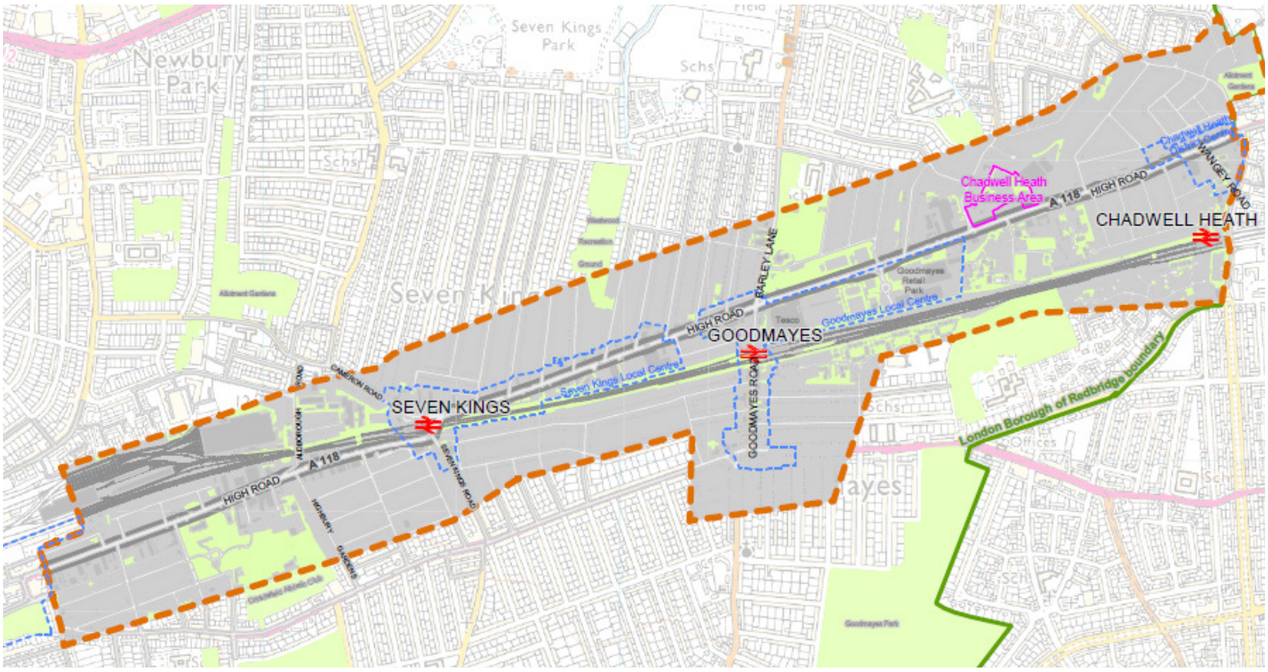


Figure 6-2: Crossrail corridor

6.4.2 Site Development Context

Development at the Crossrail Corridor between 2010 – 2019 will result in the creation of 2,451 new dwellings and a total of 26,020 m^2 of non-residential floorspace. Total regulated CO_2 emissions for the site after completion assuming current benchmarks amount to 3,142 $tnCO_2$/year and the total energy demand to 39,400 MWh/year. The table below summarises the phasing and the implications the Code for Sustainable Homes and improved Building Regulations will have on the Crossrail Corridor in terms of emissions reductions.

Number of dwellings	Phasing	Code level (% improvement over BR 2006)	Regulated CO_2 emissions ($kgCO_2$/year)	Emissions to be displaced ($kgCO_2$/year)
1033	2010/13	3 (25%)	1,324,285	331,071
910	2013/16	4 (44%)	1,166,602	513,305
343	2016/19	6 (150%)	439,719	659,579
165	2019+	6 (150%)	211,527	317,291

Table 6-7: Breakdown of domestic development at the Crossrail Corridor by phasing, Code levels and regulated CO2 emissions.

Floorspace (m^2)	Phasing	Building Regulations improvement over BR 2006	Regulated CO_2 emissions ($kgCO_2$/year)	Emissions to be displaced ($kgCO_2$/year)
6,638	2010/13	25%	548,439	137,110
9,046	2013/16	44%	747,434	328,871
6,697	2016/19	49%	553,328	271,131
3,640	2019+	120%	300,764	360,912

Table 6-8: Breakdown of non-domestic development at the Crossrail Corridor by phasing, Building Regulations percentage improvement and regulated CO2 emissions.

To summarise:

Phasing	Emissions to be displaced ($kgCO_2$/year)
2010/13	**468,181**
2013/16	**842,176**
2016/19	**930,710**
2019+	**678208**

Table 6-9: Summary of Emissions Reductions

6.4.3 Technology Feasibility

Large scale wind is not feasible in this location. The potential for small scale wind would also be fairly limited due to low wind speeds and high number of potential obstructions. Nevertheless, indicative wind speeds are above the threshold commonly used to indicate viability.

As discussed in Section 5.3 above, there is some potential for biomass installation. The use of biomass could be constrained by the **AQMA** status of Redbridge. However, from this perspective the Crossrail Corridor is considered less constrained than the other two strategic sites addressed in this Study (Please refer to Figure 5-7 which illustrates that the majority of the Crossrail Corridor lies in a region with NO_x emissions less than 40 micrograms per m^3.

Finally, **district heating** and biomass / gas-fired CHP are feasible at the development densities proposed, but the railway crossings are likely to increase DH installation costs in this area.

6.4.4 Energy Strategies for Different Phases of Development

Based on the available technologies at the Crossrail Corridor, the following tables summarise different scenarios for meeting the residential and non-residential targets over time.

Phase 1: 2010 – 2013

The table below presents scenarios for meeting the CO_2 reduction target required for the 1,033 dwellings under **Code level 3** and the 6,638 m^2 of non-residential floorspace, which require an improvement of **25% over Building Regulations 2006**. The three scenarios look at combining energy efficiency with microgeneration.

2010 – 2013 **Domestic: Code 3 – 25% reduction in regulated CO_2 emissions** **Non-domestic: Building Regulations 2010 – 2013 (25% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Solar Hot Water	1,605 m^2 (1124kW) of SHW panels installed on suitable roofspace, i.e., about 1.5 m^2 installed on each of the expected new dwellings (or about 3 m^2 on each, if only half the dwellings are suitable) (5% reduction in CO_2 emissions).

	Air Source Heat Pumps	A capacity of 708 kW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (5% reduction in CO_2 emissions).
B	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Photovoltaics	2,131 m^2 (1492kW) of PV panels installed on suitable roofspace, i.e., less than 2 m^2 installed on each of the expected new dwellings (or about 4 m^2 on each, if only half the dwellings are suitable). (5% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 442 kW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (5% reduction in CO_2 emissions) (5% reduction in CO_2 emissions).
C	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Biomass boiler	A biomass boiler rated at approximately 199 kW_{th} to meet space heating and hot water requirements. Installed on a centralised basis. (10% reduction in CO_2 emissions).

The above preliminary calculations show that both Code level 3 and an improvement of 25% over Building Regulations 2006 can be met through energy efficiency and some different combinations of microgeneration technologies.

Energy Efficiency

Please refer to Section 6.2.4.1 above.

Phase 2: 2013 – 2016

The table below presents scenarios for meeting the CO_2 reduction target required for the 910 dwellings under **Code level 4** combined with the 9,046 m^2 of non-residential floorspace that requires a **44% improvement of the Building Regulations compared to 2006 levels**. The three scenarios look at combining energy efficiency with microgeneration and medium/ large scale technologies.

2013 – 2016 **Domestic: Code 4 – 44% reduction in regulated CO_2 emissions** **Non-domestic: Building Regulations 2013 – 2016 (44% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation.
	Photovoltaics	2,131 m^2 (1492kW) of PV panels installed on suitable roofspace, i.e., under 2 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (10% reduction in CO_2 emissions).
	Small wind	7No. turbines of capacity 6 kW each (2% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 1,583 MW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (12% reduction in CO_2 emissions).
B	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).
	Biomass boiler	A biomass boiler rated at approximately 591 kW_{th} to meet space heating and hot water requirements. Installed on a centralised basis (29% reduction in CO_2 emissions).
C	Energy efficiency	Improved building fabric and optimal orientation (15% reduction in CO_2 emissions).

	Photovoltaics	1,027 m^2 (719kW) of PV panels installed on suitable roofspaces, i.e., 1 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (5% reduction in CO_2 emissions).
	Gas-fired CHP	An output of 460 kW_e (24% reduction in CO_2 emissions).

The above combinations of technologies can reduce carbon dioxide emissions by 44% between 2013 and 2016.

Small wind

Please refer to Section 6.4.2.5 above.

Combined Heat and Power (Gas-fired)

While a gas-fired CHP unit of 460 kWe would be adequate to meet the requirements of this phase, in order to ensure that the energy requirements can be met in the most cost-effective way during the later phases of development, it is suggested that the CHP unit be oversized for the requirements of the early phases. In order to meet total requirements from 2013 to 2019+ (i.e. including requirements for Phases 3 and 4), it is suggested that plant with an output of **1,763 kW_e** should be installed.

Phase 3: 2016 – 2019

The table below presents options for meeting **Code level 6** energy requirements for the 343 dwellings expected to be built from 2016 until the end of the plan period and an improvement of **49% over Building Regulations 2006** for the 6,697 m^2 of non-residential development. Code 6 includes all regulated energy and occupant electricity, resulting in an overall percentage requirement of 150% improvement over Building Regulations 2006. While microgeneration could contribute towards meeting the overall target, most of the reductions will need to be met through efficient, large scale technologies. As large scale wind has been found unsuitable for the site, examples for Gas-fired and Biomass CHP are presented below.

2016 – 2019 **Domestic: Code 6 – 150% reduction in regulated CO_2 emissions (includes unregulated emissions)** **Non-domestic: Building Regulations 2016 – 2019 (49% reduction in regulated CO_2 emissions)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Gas CHP	An output of 460 kW_e. See note on sizing the gas-fired CHP between 2013/16 (87% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 1,583 MW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (13% reduction in CO_2 emissions).
	Photovoltaics	4,159 m^2 (2911kW) of PV panels installed on suitable roofspace, i.e., just over 4 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (30% reduction in CO_2 emissions).
B	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Biomass CHP	Biomass CHP to generate 141 kW_e per year (128% reduction in CO_2 emissions).

	Small wind	3No. turbines of capacity 6 kW each, amounting to a total of just over 15 kW of electricity per year (2% reduction in CO_2 emissions).

6.4.4.1 Biomass CHP

Biomass CHP should be considered at the earliest opportunity whether this technology should be oversized to meet the requirements of several phases. While for the needs of this particular phase a biomass CHP unit of 141 kW_e would be adequate, it is recommended that a unit of total output of **358 kW_e** be installed. This would meet the needs of the Crossrail Corridor for all development between 2016 and 2019.

Phase 4: 2019+

The table below presents scenarios for meeting the **zero carbon** requirements for the remaining non-residential element of the development expected from 2019 and until the end of the plan period.

2019+ **Non-domestic: Building Regulations 2019+ (54% reduction in regulated CO_2 emissions plus allowable solutions for zero carbon non-domestic buildings, i.e., 120% reduction)**		
Scenario	**Options**	**Description**
A	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Gas-fired CHP	An output of 867 kW_e (87% reduction in CO_2 emissions).
	Photovoltaics	PV panels installed on 2,322 m^2 (1625kW) of roofspace, i.e., just over 5.5 m^2 installed on each of the expected new dwellings or per 70 m^2 of non-residential floorspace (30% reduction in CO_2 emissions).
	Ground Source Heat Pumps	A capacity of 1,583 MW_{th}, equivalent in output to meeting two thirds of the space heating requirements of the expected development. Installed in larger, ground floor dwellings without solar technologies (13% reduction in CO_2 emissions).
B	Advanced energy efficiency	Advanced Practice U-values, air-tight buildings, high performance mechanical ventilation with heat recovery, optimal orientation (20% reduction in CO_2 emissions).
	Biomass CHP	Biomass CHP to generate 217 kW_e per year (128% reduction in CO_2 emissions).
	Small wind	2No. turbines of capacity 6 kW (2% reduction in CO_2 emissions).

6.4.5 Conclusions for the Crossrail Corridor

Similar to Ilford Town Centre and Gants Hill, development density at the Crossrail Corridor is likely to be high. In order to meet carbon reduction targets for the later phases of development, a biomass CHP unit of 358 kWe capacity or a large gas-fired CHP of 1,763 kW_e capacity could be adopted along side suitable district heating infrastructure.

6.5 Conclusions for the Strategic Sites

Overall, the three Strategic Sites are highly conducive to district heating solutions due to their high densities. Nevertheless, microgeneration can contribute to overall targets, especially during the earlier phases of development. Early oversizing of CHP/ district heating infrastructure would facilitate widespread implementation. In terms of biomass boilers, the Crossrail corridor appears to be least constrained provided road traffic volumes are within acceptable limits for NOx emissions.

7 Economic Analysis – CSH & BREEAM

This chapter presents the viability testing methodology. Three levels of policy viability testing have been carried out, to reflect the potential to accelerate the policy implementation of the Code for Sustainable Homes in advance of Government targets. The viability testing results are presented in the sections following a brief review of Government incentives to encourage decentralised energy.

7.1 Government Incentives

7.1.1 Feed-In Tariffs

Feed-in tariffs (FITs) for small-scale low-carbon electricity generation, up to a maximum limit of 5 megawatts (MW) capacity - 50 kilowatts (KW) in the case of fossil fuelled CHP were introduced in April 2010. FITs guarantee a price for a fixed period for electricity generated using small-scale low carbon technologies, currently estimated to be 38p/kWh, thus encouraging the installation of small scale low carbon technologies. The Renewables Obligation (RO) continues to be the main support mechanism for large scale renewable energy deployment.

7.1.2 Renewable Heat Incentive (RHIs)

In order to meet the 2020 15% renewable energy target as set out by DECC, generating heat from current and new forms of renewable energy will be required. Examples of renewable heat technologies include: air- and ground-source heat pumps, biomass fuelled stoves and boilers, solar thermal water heaters and combined heat and power plants, which use renewable fuels.

Heat generated from renewable sources accounts for only 0.6% of total heat demand – which will need to rise to 12% to hit the UK's binding EU targets. DECC have confirmed that financial assistance will be provided to compensate for cheaper alternatives to heating sources. This financial assistance is expected to expand the market and create economies of scale for renewable heat generation.

Powers in the Energy Act 2008 allow the setting up of a Renewable Heat Incentive (RHI). The Act allows the RHI to provide financial assistance to generators of renewable heat, and producers of renewable biogas and biomethane. Separate tariffs for each type of eligible renewable heat technology or source are proposed, and within each supported technology tariffs will be differentiated based on size of the technology used.

Through a consultation process, DECC propose to develop the RHI which will be set out in regulations to be approved by Parliament and aim to have it in place by April 2011.

7.2 Delivery Partners (ESCos)

The draft Practice Guidance to support PPS1 Supplement emphasises the value of ensuring adequate delivery arrangements are in place to secure new low and zero carbon energy infrastructure. This is of particular importance where decentralised energy equipment requires significant investment that is to be funded entirely or in part through revenue generated by energy sales and/ or there will be a requirement for co-ordinated operation and management arrangements to be put in place. The Practice Guidance recognises the value of third party involvement in the investment in, and operation of, heating and power networks and recommends the use of Energy Services Companies (ESCos) as a partner to delivery.

There is no fixed definition or form for an ESCo. Their primary purpose can include promoting fuel security, combating fuel poverty, promoting energy efficiency and retailing energy to private, public or commercial customers. Similarly there is no single model for the establishment of an ESCo, with a range of different approaches in place including Local Authority-led ESCos (either singularly or via cross-border joint initiatives), joint venture enterprises, public-private partnerships and commercial energy providers. Depending on its business objectives, an ESCo can provide design expertise, investment finance, dedicated operation and management resources and customer services.

The involvement of an ESCo as a delivery partner will often mean a developer is more willing to include decentralised energy networks in a scheme as this can help to reduce the developer's capital expenditure and provides a means of avoiding legacy responsibilities beyond completion of a development.

If a Local Authority elects to take a lead role in the formation of an ESCo this may offer a number of benefits:

- As a dedicated entity with the primary purpose of delivering a Council's climate objectives, an ESCo can operate with a sharper focus and purpose than is available to existing Council services.
- An ESCo can operate as a commercial entity outside a Council's existing services and business structures. This creates a business-orientated environment in which to progress an ESCo's objectives with the consequence that it may be more entrepreneurial in its activities and less directly affected by shorter term Local Authority service objectives.
- The creation of an ESCo provides a means by which a Council can identify and manage its investment risk, maintaining separation between the ESCo and its core services.

The presence of an ESCo within a locality can help to stimulate further development of low carbon energy infrastructure. An initial development with a small distributed energy network operated by an ESCo can provide the catalyst for further expansion and connection to serve later phases of a large scheme, or subsequent developments nearby. This is reflected in paragraph 27 of the Supplement to PPS1 which states that:

> *'Where there are existing decentralised energy supply systems, or firm proposals, planning authorities can expect proposed development to connect to an identified system, or be designed to be able to connect in future.'*

Additionally, the presence of an ESCo will also incentivise the connection of existing buildings to an energy network, by providing enlargement of the ESCo's customer base. This may take the form of physical connection via a heat main to provide district heating to existing buildings; a distributed cooling network to provide air conditioning and cooling; and/ or electricity supply via a private wire network. Alongside the pipe and cable infrastructure, some ESCos also supply local buildings with electricity via the existing local Distribution Network Operator's (DNO) network. These 'virtual' private wire networks have enabled ESCos to supply surplus electricity generated through CHP equipment to customers such as schools and civic buildings within a local community when they are located too far from the CHP to justify the cost of providing a dedicated private wire connection.

7.3 Costs & Delivery Options – Code for Sustainable Homes

House prices in Redbridge are above-average by national standards; at £272,905[80], the average house in the borough is 43.4 % higher than the average in England and Wales[81] as a whole. However, house prices are considerably in comparison to average house price of £408,608 in Greater London (Jan-March 2010 data).

A number of studies into the technologies and projected costs for the delivery of varying levels of the Code for Sustainable Homes have been carried out for the DCLG by Cyril Sweett. Scott Wilson has used the outputs of these studies to inform the viability testing of policy measures considered within this study.

There will be a variety of development styles within Redbridge over the plan period and hence for each of the dwelling types (flats, mid-terrace, semi-detached/ end terrace, detached), the projected uplifts in base build costs are illustrated below82 (see Figure 7-1–Figure 7-4). The key development types are as follows:

- Small development: fewer than 10 units of different housing types, but no flats, representing low density, rural sites, and making up around 15 per cent of new build.
- City infill: flats only, with an average of 18 units, high density city sites, and making up around 3 per cent of new build;
- Market town: an average of 100 units, of 75 per cent houses and 25 per cent flats, making up around 70 per cent of new build. These sites could be part of a larger site, but are treated separately for the purposes of modelling;
- Urban regeneration: large sites of on average 750 units, comprising 90 per cent flats, representing large brownfield, high density, mixed use sites making up around 10 per cent of new build.

Figures 7.1 – 7.4 illustrate the various ways in which specific development types can achieve various levels of the Code for Sustainable Homes, the % uplift in capital cost and the % saving on the target emission rate.

For example, Figure 7.1 illustrates for city infill and urban regeneration that Best Practice Energy efficiency (BPEE) alone can achieve Code Level 3, with a capital cost uplift of approximately 2.5% on 2008 base build costs, achieving a 15% saving on carbon emissions (based on the Target Emission Rate, TER).

80 http://news.bbc.co.uk/1/shared/spl/hi/in_depth/uk_house_prices/html/bc.stm
81 http://www.londoncouncils.gov.uk/London%20Councils/Redbridge.pdf
82 Costs and Benefits of Alternative Definitions of Zero Carbon Homes, DCLG, February 2009,

In contrast to this Ground Source Heating (GSHP) and BPEE would achieve Code level 3 but would incur a 7% increase in capital cost and reduce emissions by 40%.

In terms of Code 6, biomass heating, photovoltaics and BPEE could be achieved with a 16% cost uplift but would achieve 100% saving in emissions from the TER and biomass CHP with photovoltaics and advanced practice energy efficiency (APEE) could be achieved with an 18% cost uplift and between 105-150% saving in emissions from the TER.

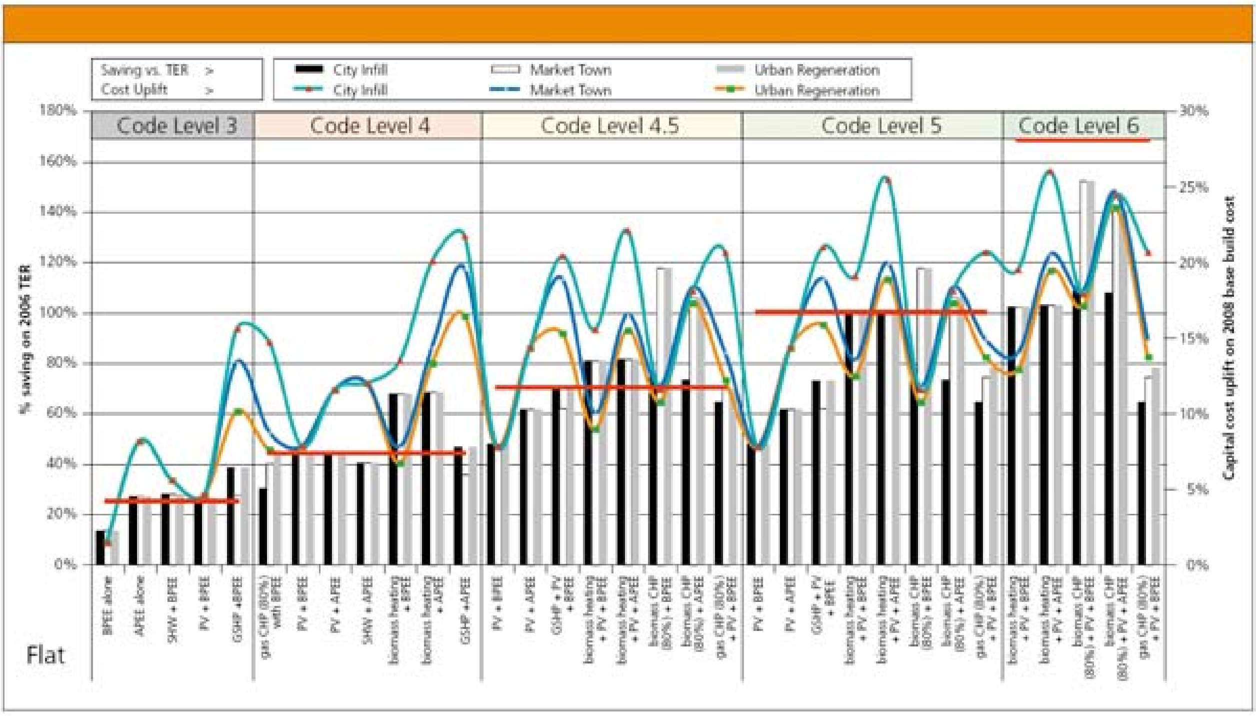


Figure 7-1: DCLG Cost uplift and carbon saving projections (flats)[83]

83 *BPEE- Best Practice Energy Efficiency; APEE- Advanced Practice Energy Efficiency

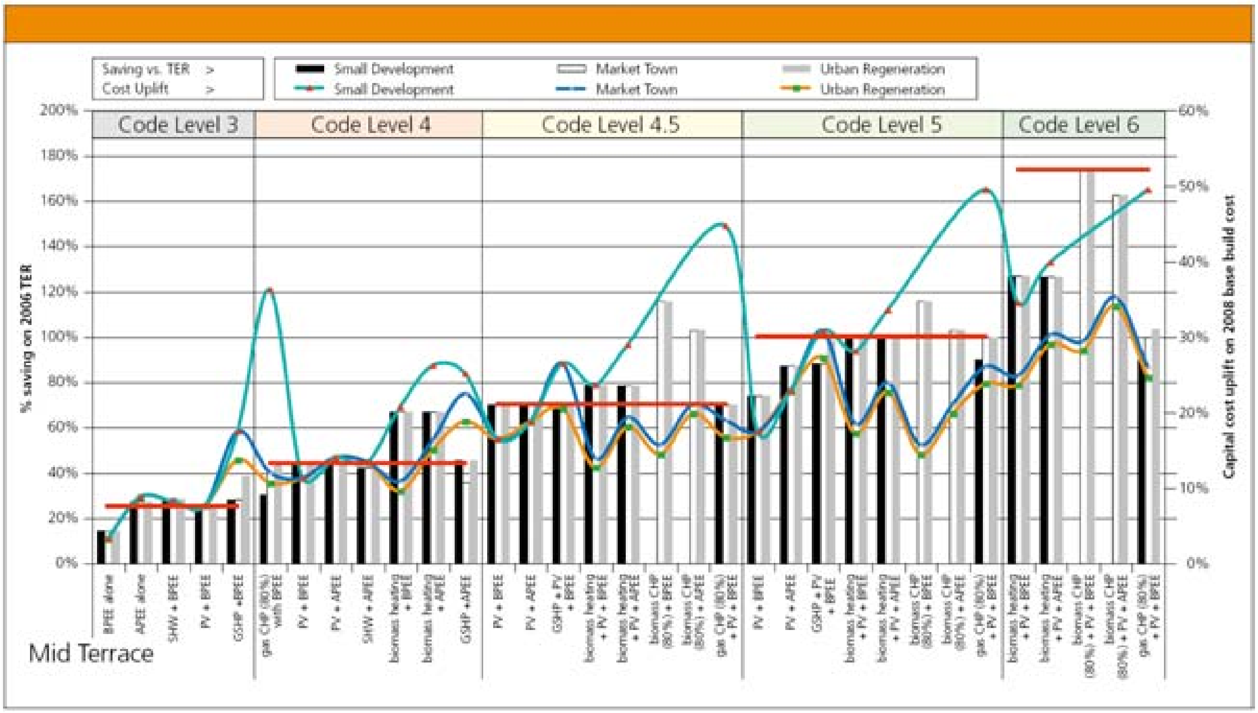


Figure 7-2: DCLG Cost uplift and carbon saving projections (mid-terrace)

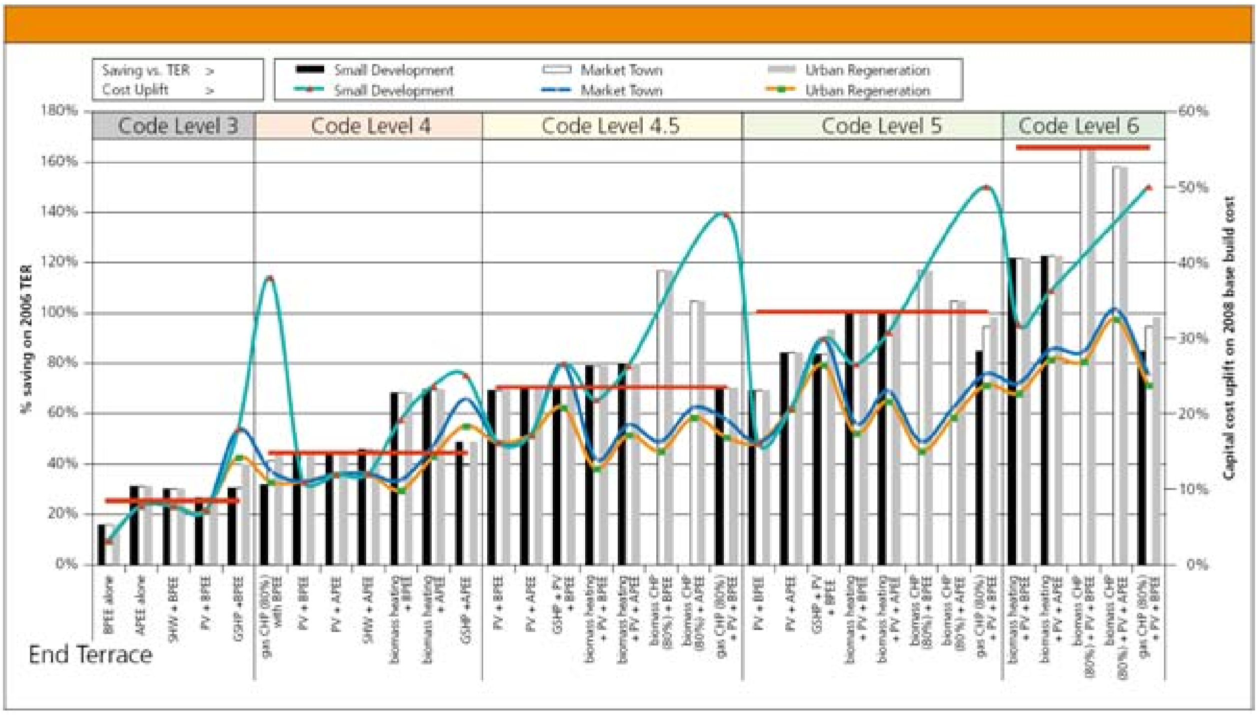


Figure 7-3: DCLG Cost uplift and carbon saving projections (semi-detached/ end-terrace)

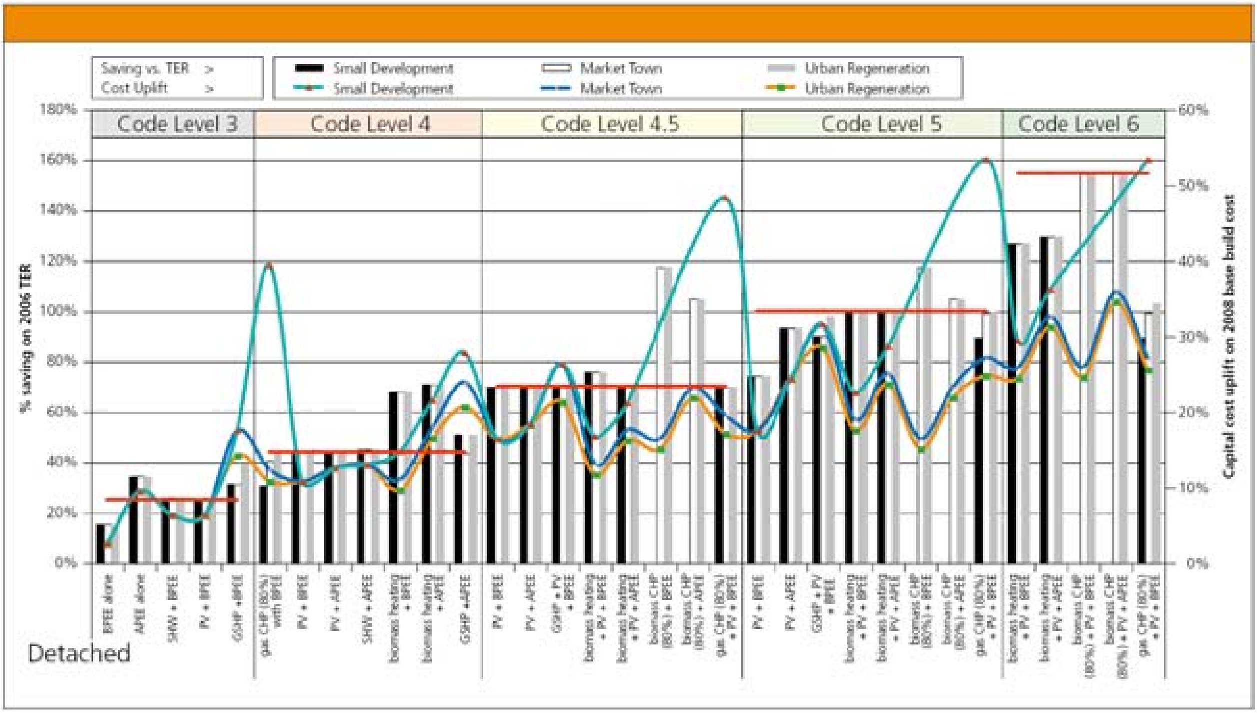


Figure 7-4: DCLG Cost uplift and carbon saving projections (detached)

These graphs provide an indication of the uplift cost for achieving the energy targets for differing Code levels in respect to energy-specific technology which will have wide-ranging implications.

Figure 7-5 summarises the above (indicatively) and provides an indication of the likely build cost (of residential buildings) for achieving both energy and sustainability targets up to Code level 6.

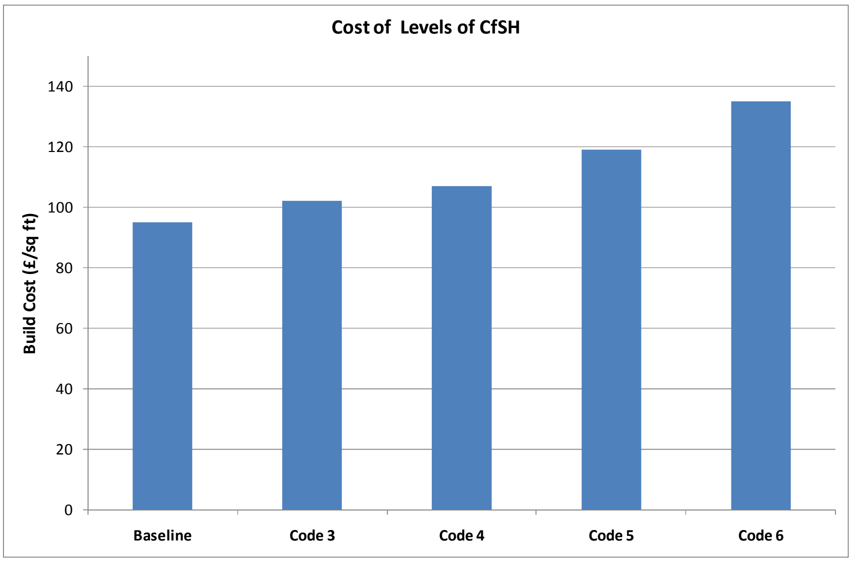


Figure 7-5: Cost Uplift for Code Levels[84]

The above illustrates the general trend for uplift in build costs over the baseline (2006 Building Regulations) associated with the CSH with Code Level 3 at just over £100/sqft rising to over £130/sqft for Code Level 6. The scope of this study relates only to the energy element of the Code, this is illustrated in the figure below via energy extra over costs. The energy extra over costs are measured from a baseline of constructing a 2006 Building Regulation compliant dwelling

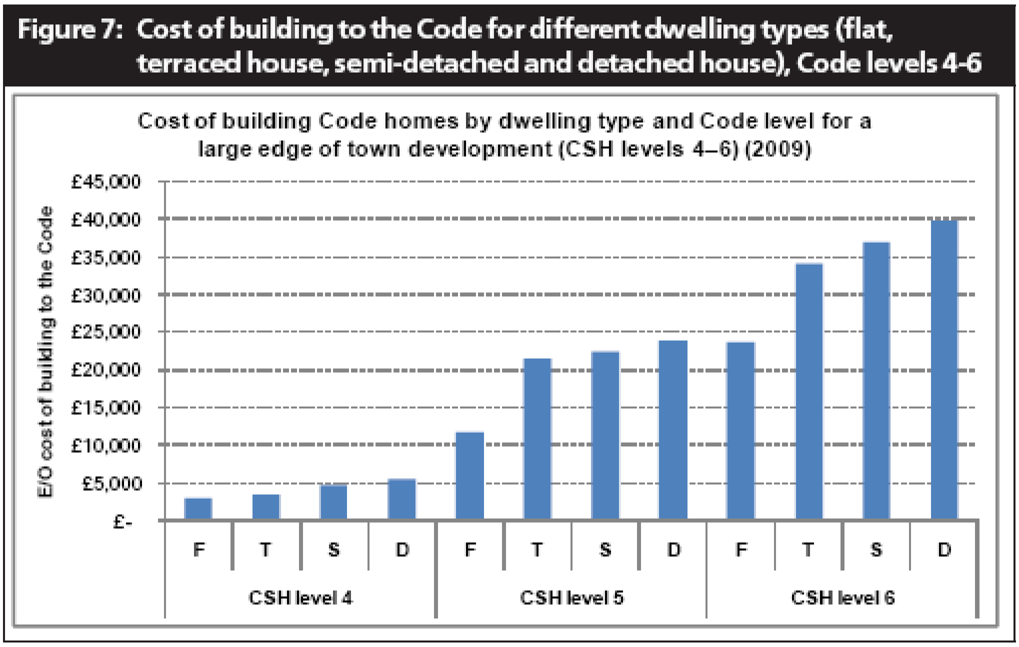


Figure 7-6: Energy over Cost for Different Code Levels[85]

Although the example of a large edge of town development, which has been used as a case study in the DCLG CSH impact assessment study, is not directly relevant to Redbridge, the general trends observed can be extrapolated to Redbridge.

Cost ranges from approximately £2,500 to £40,000 from Code Level 4 to Code Level 6 and differ subject to dwelling type. It should be noted that the steep increase in costs of attaining Code Levels 5 and 6 relative to Code Level 4 is a result of the increasingly stringent CO_2 emission reductions required.

7.4 Costs of Delivering BREEAM Targets

The cost of delivering BREEAM targets is derived from research carried out by the BRE in conjunction with Cyril Sweett and Faithful and Gould for offices[86] and schools[87] respectively.

[84] http://www.communities.gov.uk/documents/planningandbuilding/doc/codecostanalysis.doc
[85] Code for Sustainable Homes Impact Assessment, DCLG, December 2009
[86] *Putting a price on Sustainability – BRE, 2005*

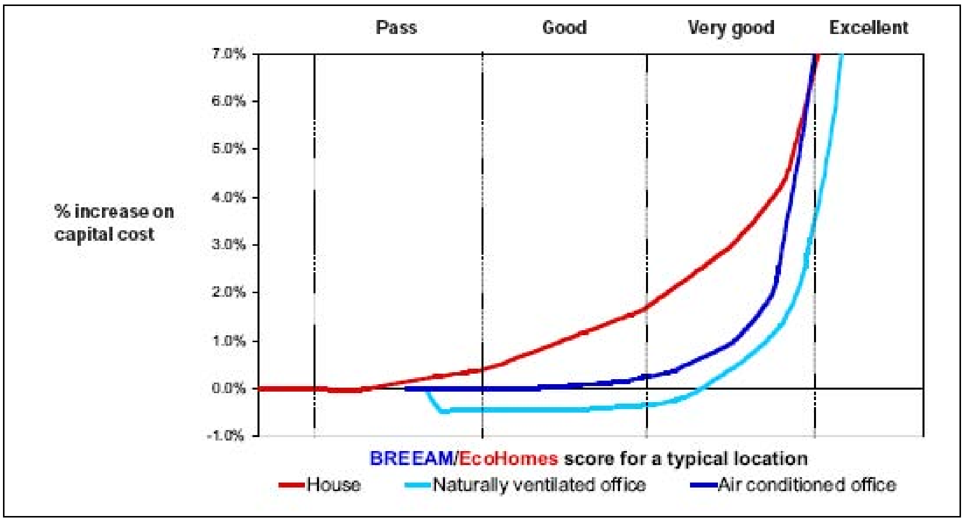


Figure 7-7: Cost for Achieving BREEAM Targets, Offices compared to Housing

In summary, Figure 7-7identifies the base build cost to deliver Good, Very Good and Excellent ratings under BREEAM Offices 2004 and Figure 7-8 identifies the cost to deliver relevant ratings under BREEAM Schools 2006, giving consideration to locational aspects.

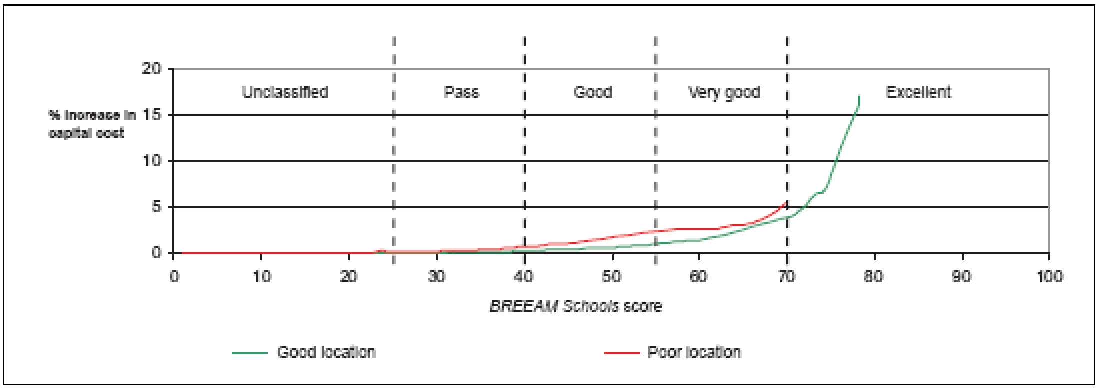


Figure 7-8: Cost for Achieving BRREAM Schools

The BRE report, *Pricing Sustainability in Schools* suggests an uplift of between 3-15% to deliver BREEAM 'Excellent' based on a secondary school block (3,116m2).

There is very limited published information on the costs to deliver energy targets for non-domestic buildings and no published cost data based on meeting BREEAM Offices targets since 2004, therefore cost data is not currently available for the new 2008 BREEAM methodology which has mandatory targets for energy (based on the EPC rating – as discussed in Section 2.1.4).

[87] *Putting a price on sustainable Schools – BRE 2008*

7.5 Development Viability

The general approach adopted for viability testing is illustrated by the flow chart below. In essence this takes the methodology outlined by the document 'Renewable and Low-carbon Energy Capacity Methodology' in order to help identify technologies suitable for each site, and then conducts land-value based viability test on the basis of market sales values.

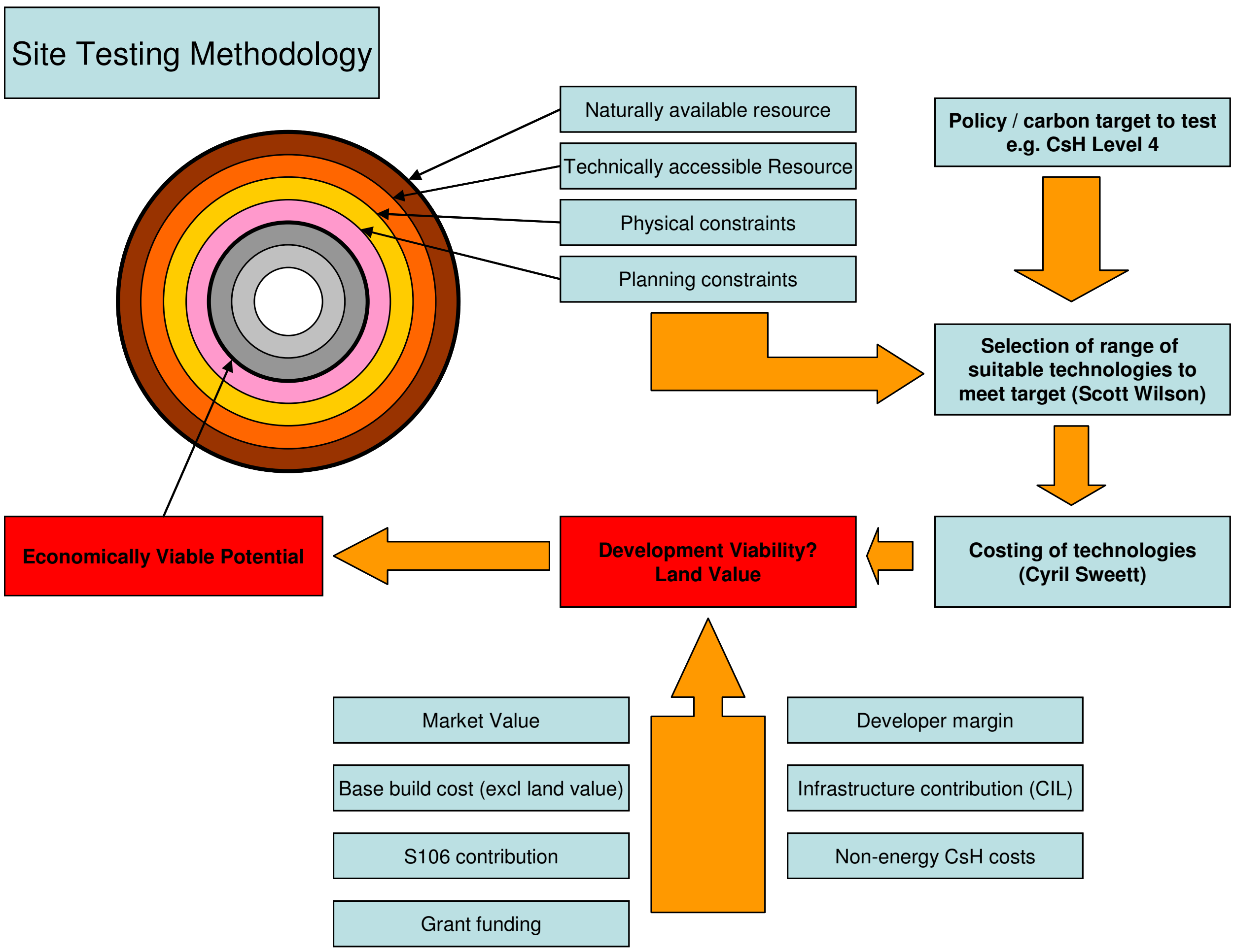


Figure 7-9: Viability testing methodology flow chart

The outputs of this process are further illustrated by the notional graphic below, which highlights relative contributions to costs and revenues of the various elements of the development process.

Figure 7.9 outlines the methodology for evaluating development viability and how it is tested specific to a site. Having evaluated physical and planning constraints, illustrated via the outer concentric rings above, suitable technologies identified are costed. Trends in development viability can then be identified through site specific costs including market value, build costs, S106 costs, CSH costs we can determine the impact on the residual land value as compared to the projected revenue as illustrated in Figure 7.10

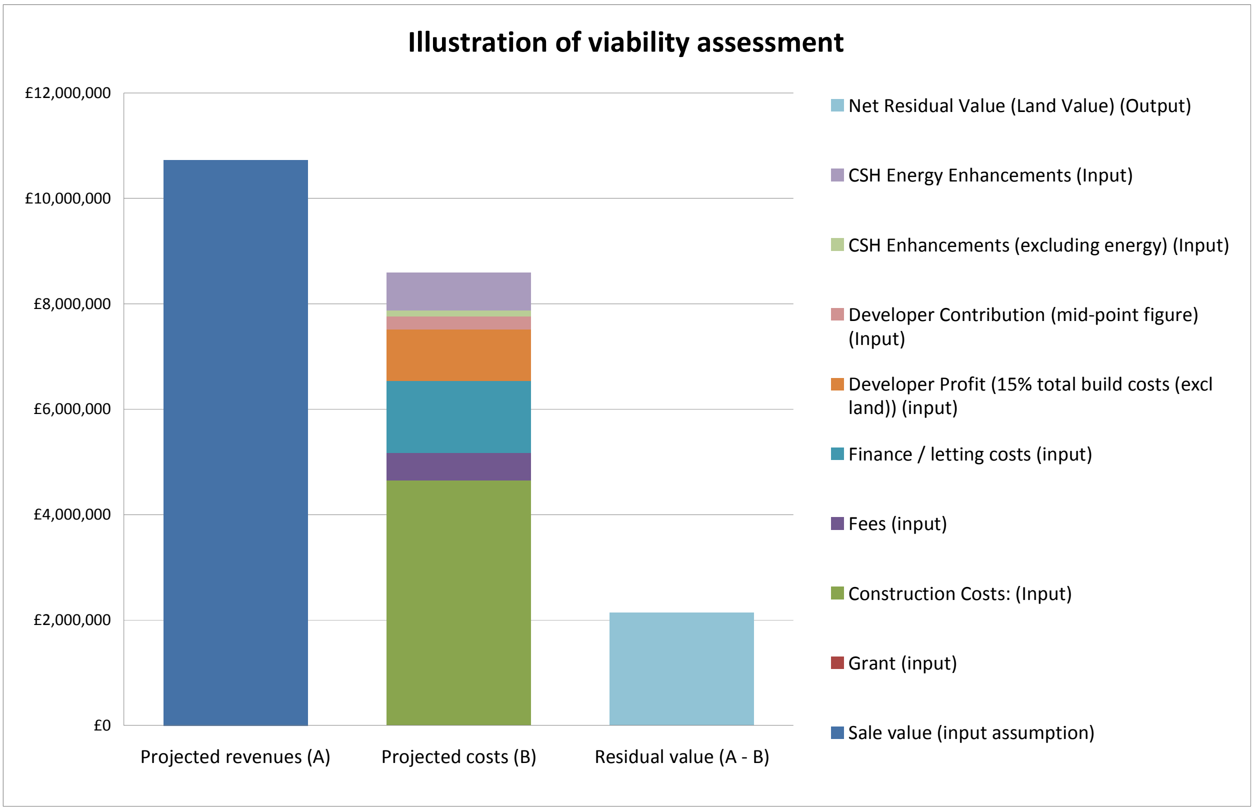


Figure 7-10 : Land value / Residual value illustration

It can be seen from the flow diagram and residual value illustrations above that there are a large number of variables that form part of this model. The inputs used in the site-specific testing are based on Code for Sustainable Homes cost figures generated by Cyril Sweett, information provided by the Council, and other assumed costs agreed amongst the project team. A full list of these assumptions is contained within Appendix F. It should be noted here that these costs assume the installation of on-site technologies to meet the required emissions reductions targets – e.g. the proposed costs of 'allowable solutions' is not modelled here.

As an initial assessment, three levels of policy viability testing have been carried out, to reflect the potential to accelerate the policy implementation of the CSH in advance of Government targets as they currently stand. The geographic zones currently selected for viability testing have been agreed with the Council and include the post code areas IG1 (including Ilford Town Centre), IG2 (including Gants Hill), IG3 (including the Crossrail Corridor), E11 (Wanstead) and RM6 (East Redbridge). The areas selected for viability testing are shown in figure 7-11.

The various parameters considered in the land value (which is the residual value once all assumed costs have been derived from the total projected revenue) viability assessment study are illustrated in the figure below. In order for the land value to be positive it must exceed the existing use value (EUV). Figure 7.10 is only an illustration and although cost inputs are specific to LBR the residual vale or land value is generic and not specific to a site within LBR although the cost 1m+ is in the order of cost expected for LBR.

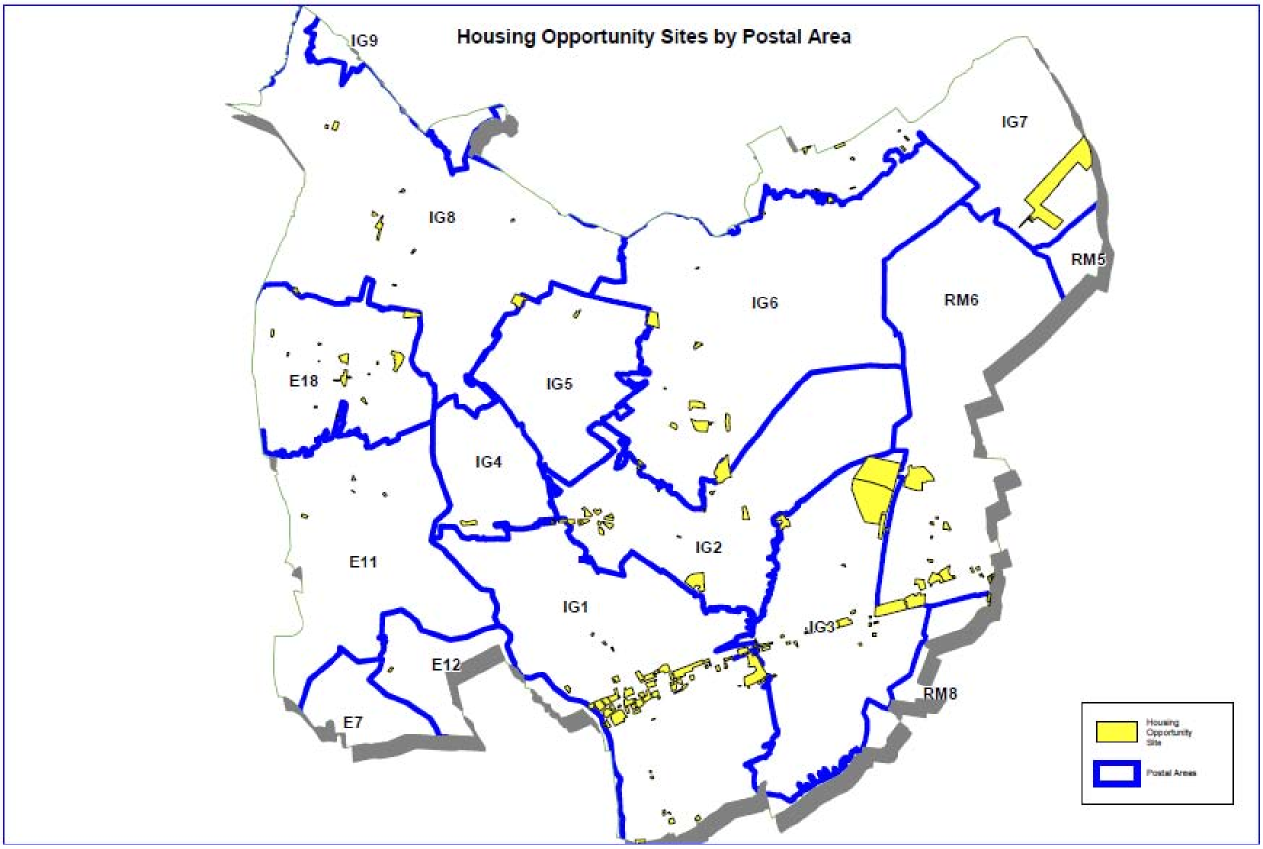


Figure 7-11: Post code areas for development viability testing

Within each of these areas, the following results have been obtained.

7.5.1 Viability Testing Results

A selection of development sizes (5 dwellings, 50 dwellings and 100 dwellings) has been analysed, alongside the policy options as outlined in Section 3.5. Only the 50 dwelling scenario is displayed in this main body of the report, and the remaining figures are included in Appendix G.

How to interpret these results:

It is not necessarily the case that a development will be 'viable' just because the land value is greater than zero. Viability depends upon the proposed scheme's land value being greater than:

a) Retaining the existing use;

b) Alternative uses to which the land might be put;

c) The present value of some future value that might be realised;

d) The regulatory climate and land-owner's views of future prospects for higher sale values.

Whilst the value of non-development uses are not well documented to Scott Wilson's knowledge, it is thought that figures in the low hundreds of thousands of pounds per hectare are more likely than the million of pounds figures that are shown in the results that follow here which is supported by the LBR Community infrastructure Levy Report[88], June 2010

It is also critical to note that there are a number of other site-specific costs that can significantly alter land values that are excluded from the viability model put forward here. A selection of some of these includes:

- Substructure costs
- Below ground and site drainage development costs
- Remediation of site contamination
- Highway works

These additional items are potentially very significant in cost terms when extrapolated to the sizes of developments under consideration here. The highly variable nature of these items has led to the decision not to attempt to cost them on a generalised basis, however, their omission effectively means that a viability threshold should be considered to be at a point above zero land value (as discussed above).

This commentary on land value figures illustrates that they cannot and must not be applied to specific sites and cannot be a substitute for site-specific viability testing. However, it is the aspiration of this modelling to reveal trends across the Borough of Redbridge on a geographic basis and also in terms of the overall comparative impact on viability of various factors.

[88] LBR CIL Report, Prepared by BNP Paribas Real Estate and Christopher Marsh & Co

7.5.2 Policy Option 1 (Government Standards) – 50 Dwellings

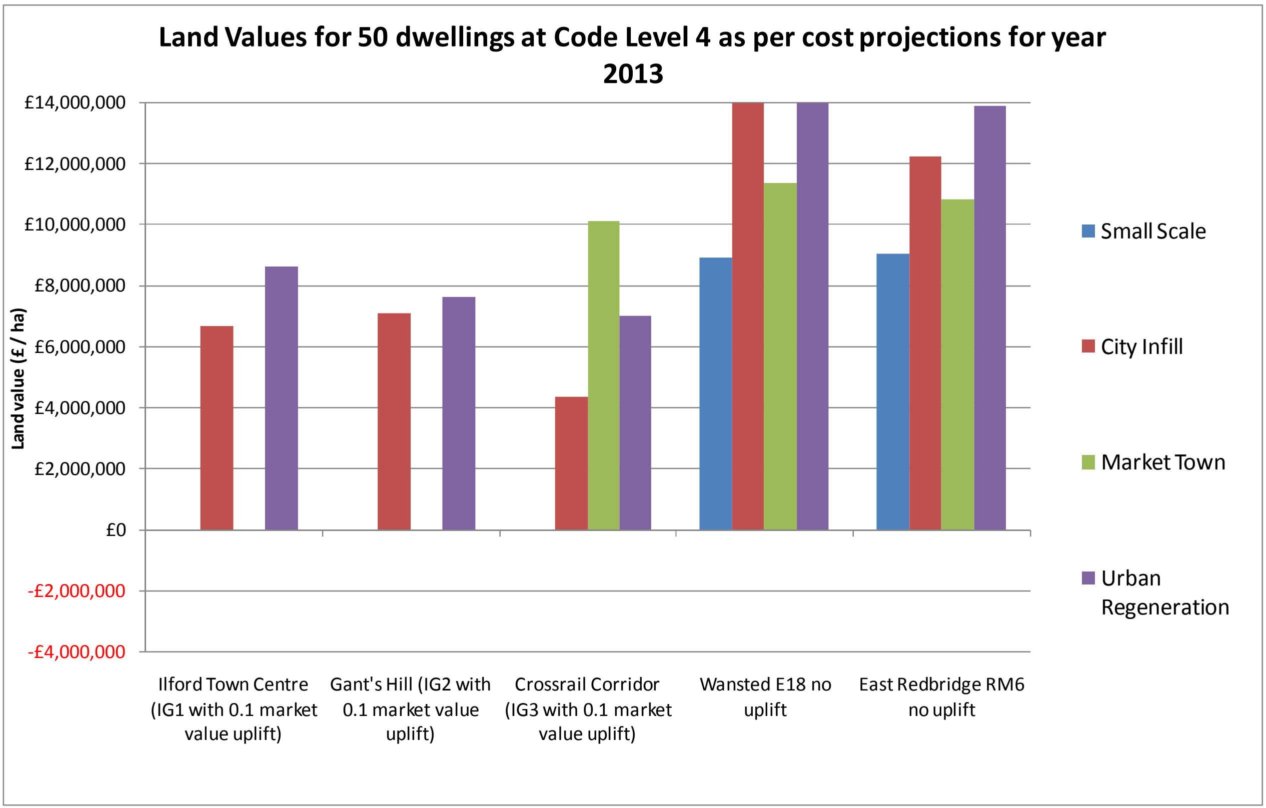


Figure 7-12: Land value as per cost projections for Code Level 4 in 2013 (Policy Option 1)[89]

Although the market town scenario in not directly relevant to Redbridge it has been included to provide a comparison to the other development scenarios in Redbridge.

A constant land value has been assumed over time. Market prediction was not possible within the scope of this study. The only change over time would be in the cost of code compliance, e.g how the market learns to achieve Code 6 at a lower cost.

This chart illustrates that when the CSH is applied (to Code 4 in 2013) as per the current timetable for its introduction, the land values resulting from the analysis methodology outlined above are all positive and considerably higher than zero. Whilst this modelling does not include all costs (as outlined in Section 7.5.1), the level of land values shown suggests that there would be sufficient margin / residual value to allow for an increase in sustainability standards beyond those tested here. Certain typologies are excluded from certain areas; for example small scale development (less than 10 units of different housing types, but no flats) is not included in Ilford and Gants Hill, as City Infill and urban regeneration are considered to constitute majority of the new development. Based on housing projections, the Crossrail Corridor, Wanstead and East Redbridge are expected to have market town type of development (an average of 100 units, of 75 per cent houses and 25 per cent flats, making up around 70 per cent of new build)

[89] **market value uplift – 0.1 is the same as 10%**

Implementation of Code 6 in 2016 (Policy Option 1 – Government Standards) – 50 dwellings.

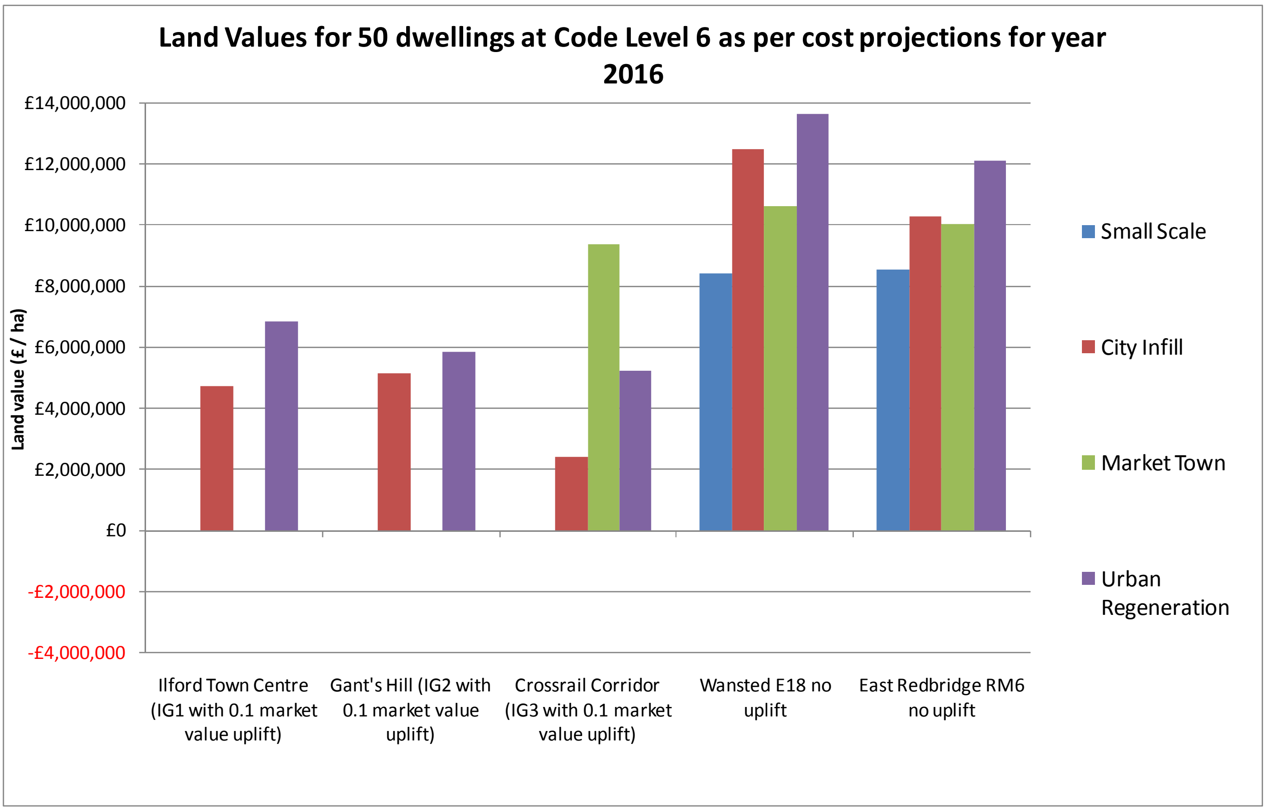


Figure 7-13: Land Values as per Government Standards (Policy Option 1) – Code 6 in 2016 - 50 dwellings

This chart also illustrates that under currently proposed Government standards, when the CSH is applied (to Code 6 in 2016), the resulting land values are all positive. Whilst this modelling does not include all costs (as outlined in Section 7.5.1), the level of land values shown suggests that there would be sufficient margin / residual value to allow the standards to be imposed.

7.5.3 Policy Option 2 (Accelerated Implementation) – 50 Dwellings

Acceleration of Standards to Code 4 in 2010 (Policy Option 2 – Accelerated Implementation) - 50 dwellings.

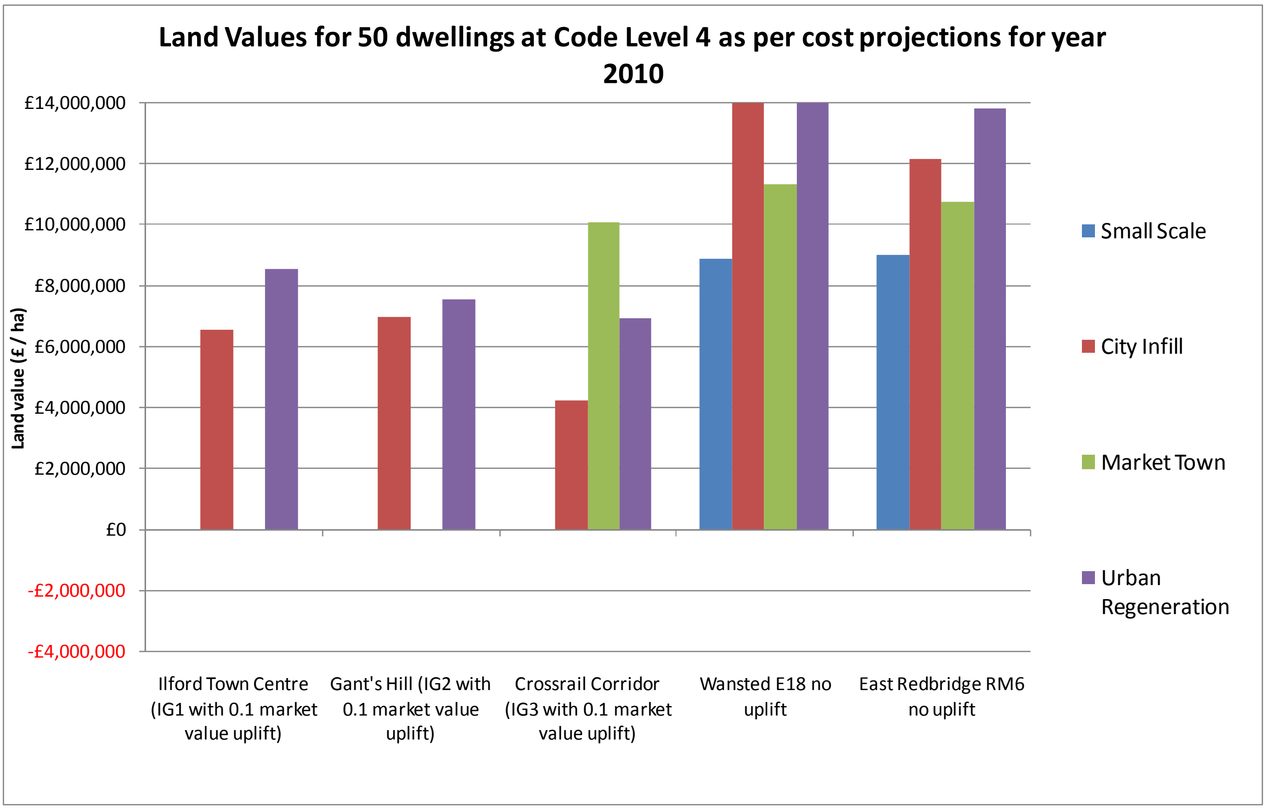


Figure 7-14: Land value as per cost projections for Code Level 4 in 2010 (Option 2) – 50 dwellings

This chart shows a somewhat accelerated timetable of Code standards, and illustrates that in all areas, there would appear to be sufficient margin to allow the sustainability measures to be imposed in this accelerated fashion.

Acceleration of Standards to Cost 6 in 2013 (Policy Option 2)

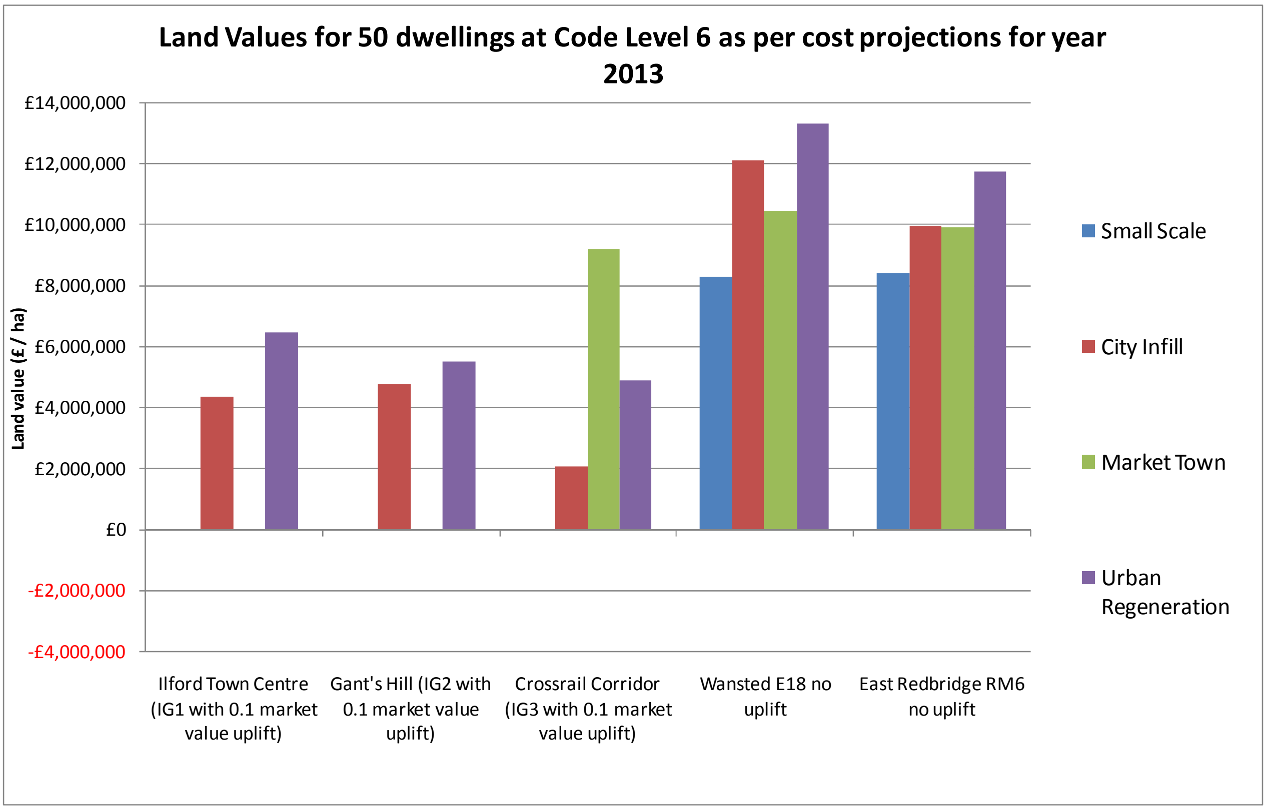


Figure 7-15: Land Values of Accelerated CSH Implementation (Code 6 in 2013) – 50 dwellings

Under the accelerated timetable of Code standards, Code 6 is modelled as being imposed in 2013. Under this timetable, it can be seen that there is a significant reduction in residual values, bringing the Crossrail Corridor area to a level of around half of the value calculated under the 'standard' timetable for CSH standards.

7.5.4 Policy Option 3 (Aspirational Standards) – 50 dwellings

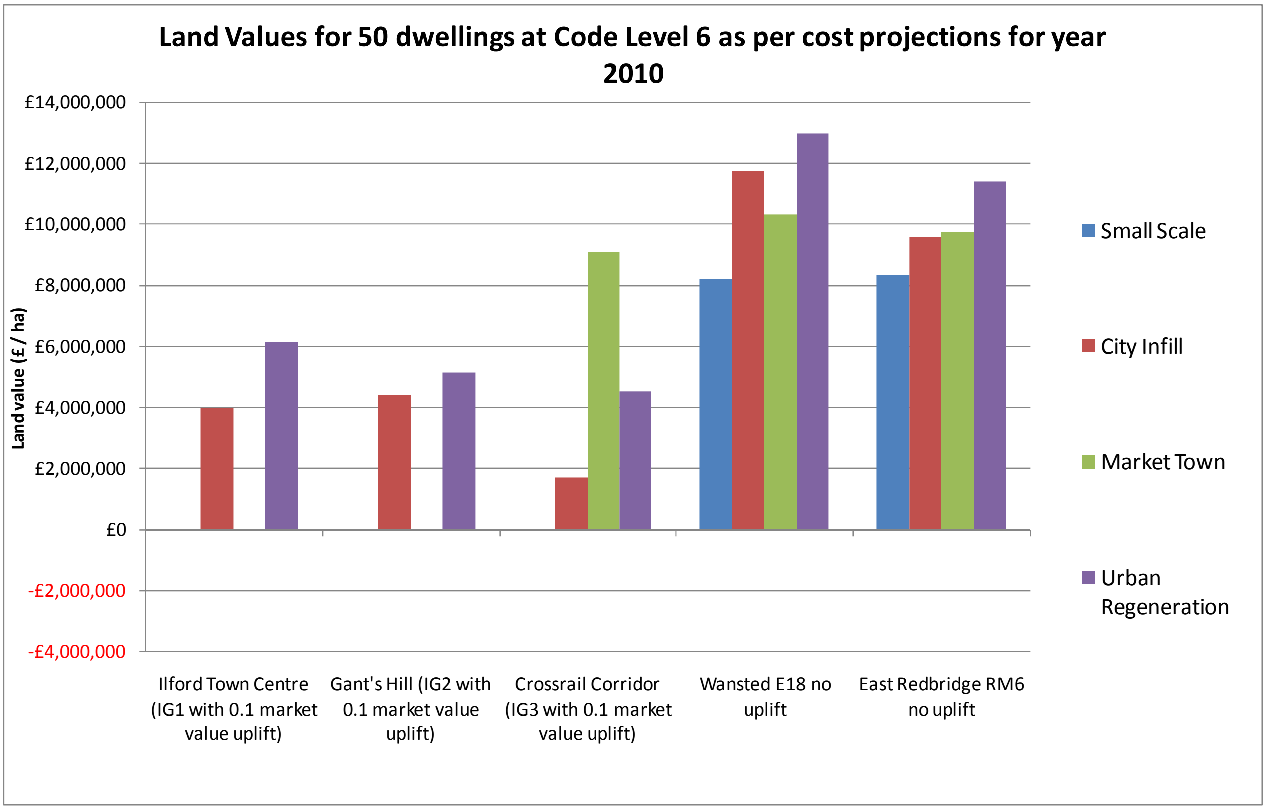


Figure 7-16: Land Values/Residual values of Aspirational CSH Implementation (Code 6 in 2010) - 50 dwellings

When Code 6 is imposed immediately it can be seen that whilst all areas appear to exhibit positive land values, there is a noticeable reduction against the other policy scenarios. Although the graph above indicates that Code Level 6 is achievable right now, it should be noted that this would need to be studied and in further detail through detailed site viability testing.

It should be noted that the residual values identified in the viability modelling have not been compared against the EUV and the development viability analysis has been developed to identify positive and negative trends and thus inform policy development. More detailed site specific viability analysis will be required at the time of application to support site specific verification.

Sensitivity Analysis

The following sensitivity analysis further illustrates that the major components of viability are market value (land value/residual value) and build costs, and that as might be expected under the model outlined above, the energy component only represents a relatively minor element of overall viability.

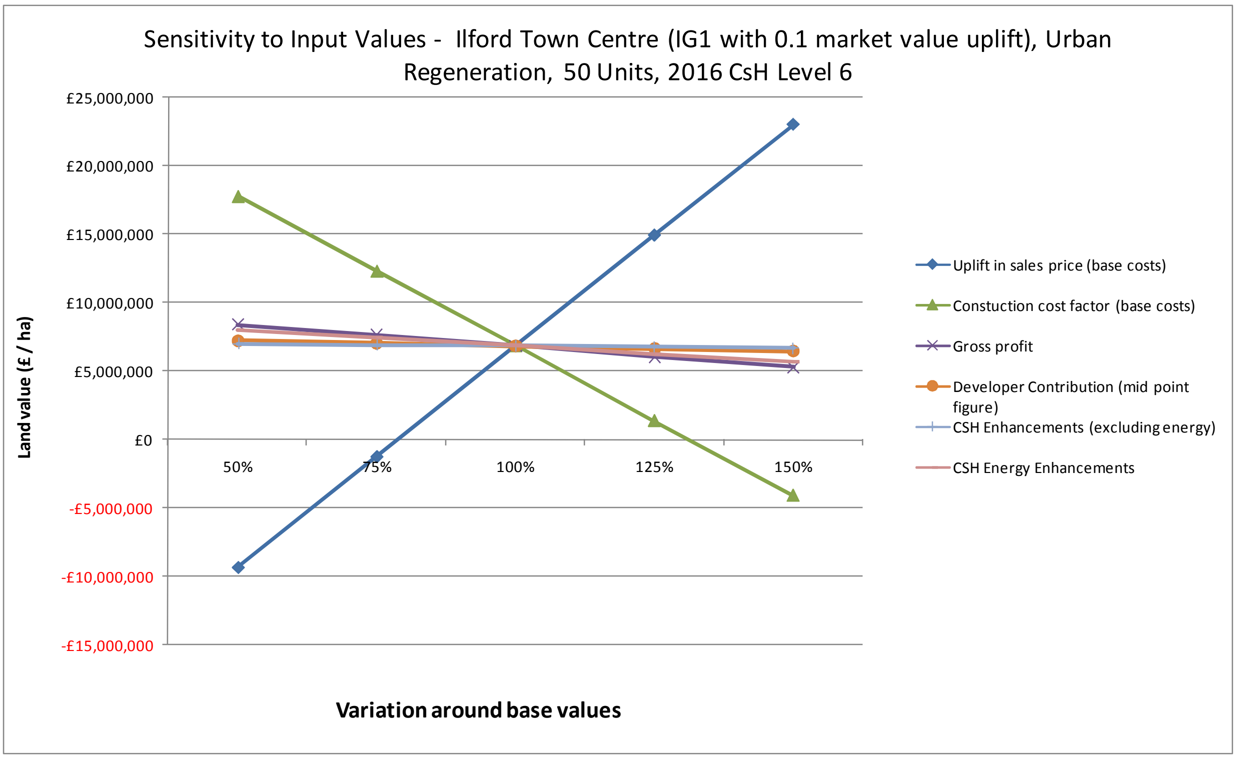


Figure 7-17: Sensitivity chart for viability testing

Figure 7-17 shows that as input values are multiplied by certain percentages (on the x-axis) (e.g. if assumptions made on build costs are multiplied by 110%, then obviously viability decreases and land value decreases). The figure illustrates the comparative impact that various factors have on land value and highlights which are the biggest numbers in the cost build-up.

Figure 7-17 is instructive in clarifying two issues surrounding viability testing. First, that development viability (and hence the viability of increased environmental standards) will much more significantly depend on market conditions rather than variations in the cost of Code enhancements, and second, that the site-specific elements of build-cost make up can also radically outweigh the element of Code enhancements that are under consideration throughout this analysis.

This analysis suggests that from a policy development perspective, it would be appropriate to impose higher standards on development in the knowledge that market conditions and site specific constraints can radically impact viability in directions that policy analysis of this nature cannot predict. The implementation and deliverability of higher levels of energy performance should then be assessed on a site-by-site basis as development comes forward, and the onus of evidence should be placed on the developers to demonstrate viability or non-viability. This must be done in a manner that can be verified by a third party.

7.6 Implication of Feed-in Tariff / Renewable Heat Incentive

There has been considerable discussion regarding the potential of the Feed-in Tariff and Renewable Heat Incentive to impact the viability of development. These discussions have generally focussed around the concept of a sales value premium resulting from the installation of a technology that will benefit from the proposed support mechanisms. E.g. would a prospective purchaser be willing to pay a premium for a given building in the knowledge that the energy systems installed are likely to reduce their running costs substantially for a given period of time?

Unfortunately it is not possible to give a robust, evidence-based answer to this question as this has not yet been tested in the market. The 'conservative' approach adopted here has been to assume that no market premium will be seen, and to conduct a general sensitivity analysis on sales prices.

A further potential mechanism through which the Feed-in Tariff and Renewable Heat Incentive could positively impact viability is through the involvement of a third party. It is anticipated that private companies will propose that they install, own and operate low carbon technology that benefits from the Government policy support mechanisms, and lease the installation back to the building owner. This mechanism would allow the site to meet its carbon emissions reductions commitments without the developer having to bear the capital cost of the low carbon installation. In this instance, however, the building owner / occupier would also not benefit from the reduced running costs that the installation would generate. Given that it is not certain exactly how these leasing schemes will operate nor the degree to which the capital cost of the installation may be supported by the third-party investor, again this potential mechanism has not been directly adopted in viability testing modelling at this stage.

7.7 Implication of ESCos & District Heating

There are also potential viability implications for higher environmental standards surrounding the use of district heating and the involvement of Energy Service Companies (ESCos).

District heating (DH) enables technology thresholds to be crossed and economies of scale to be realised both in plant selection and fuel procurement. This allows high efficiency, low carbon and low cost heat to be provided to a wide customer base given appropriate system design and operation.

The policy demands for low carbon development in constrained sites often leads to a practical requirement for a district heating system. The site development density and heat demand density (as well as other factors) influence the cost-effectiveness of installation on a life-cycle basis, but the following general points can be made for typical sites:

- Viability depends on a large variety of factors some of which are beyond ESCo control and therefore represent a substantial level of risk – e.g. utility price fluctuations and
- Private sector discount factors (linked to risk levels) employed by the ESCos mean that only limited contributions to capital installation costs are generally offered by ESCos. In Scott Wilson's experience these are generally not sufficient to cover the whole of the DH network installation cost and the energy centre plant. Another party, e.g. the developer, therefore has to fund the remainder of the DH installation cost.

The regulatory context in which ESCos are operating is changing with the introduction of the Renewable Heat Incentive, and for renewable fuelled installations this may change the balance of contribution that ESCos are willing to make, but it is considered unlikely that this will substantially alter the overall level of viability of schemes of this nature. It is beyond the scope and resource of this project to identify the impact of the RHI in a DH / ESCo context, and the knock-on effects in terms of costs of more stringent environmental standards. The approach adopted here assumes a standard cost for district heating installations implicit within the higher policy target scenarios, that is then examined in sensitivity analysis.

7.8 Interpretation of Viability Results

The results illustrated here and in the Appendices F and G show that for all areas of the Borough investigated, development delivers Land Values in a range that suggests viability. In particular the higher market sales values of Wanstead and East Redbridge suggest that these areas could generate the assumed level of Developer profit and also high residual value.

Of the three strategic sites investigated (Ilford Town Centre, Gants Hill and the Crossrail Corridor), the Crossrail Corridor shows the lowest level of value. In this area, the results show that for 5 dwellings the delivery of Code Level 6 in line with the current Government timetable is not viable (e.g. delivers a negative land value) for urban infill development (See Appendix G). However, the costs of being 'zero carbon' in this modelling do not take account of 'allowable solutions', which could potentially reduce developer costs and push sites of this nature towards viability.

In essence, viability depends on the land value for the proposed scheme being higher than a) retaining the existing use, b) alternative uses to which the land might be put c) the present value of some future value that might be realised for the land. For development to take place the landowner needs to secure at least as much for the land than they can reasonably expect in the future. If a firm price is paid for the site then this should be sufficient, alternatively if the land value is contingent on other factors (eg sales prices) then the viability will depend on the likely risk of the desired land value not being achieved (and the extent to which this will impact on the developers profit or the land value).

The extent to which it would be better for a landowner to retain existing use or apply for a non residential use will vary with the location and planning context of the site. If LBR were to consider proposing higher performance standards for both residential and non-residential development then it is only a 'non development' use that is unaffected by the policy. It is likely a non development use would realise a higher land value than a development use (even if it were permissible under planning requirements).

When considering bringing forward requirements that will become regulatory in the future then the impact of option c), above, depends on the extent to which the costs of complying with the standard will fall over time (or at least the landowners view on this) and how this relates to the time cost of not selling the site now. Given that the uplift in cost of the land value (approximately £200,000 maximum) and assuming the developer would incur an opportunity cost of at least this much each year they delayed selling the site, it is unlikely that introducing policies in advance of national targets would have a major impact on the likelihood of sites coming to market.

The key question therefore is whether land values can be achieved that are higher than non development uses, these values will vary by location but are typically much lower (in the £100k's not £M's per Ha) depending on the nature of the site. Cyril Sweett have approximated that any land value above, £200K per Ha is likely to be viable on these grounds. It is important to remember that this conclusion does not mean that landowners will be bringing forward sites in the short term because of depressed market conditions. However, it does suggest that the policy in isolation should not be sufficient to make development unviable. The impact of renewable energy / code requirements will not influence the viability of sites unless it a) is has disproportionate costs on one type of development over another, b) pushes land values to a level where the alternative of not developing is more attractive (eg a negative land value).

8 Policy and Implementation Options

8.1 General Core Strategy Policies

8.1.1 Defining Criteria-Based Policies

Planning Policy Statement 22 (Renewable Energy) advises that planning applications for stand-alone renewable energy installations should be assessed against specific criteria that are set out in local development documents. Criteria-based policies should be drafted to reflect local circumstances, focusing on the key criteria that will be used to judge applications, with more detailed issues set out in Supplementary Planning Documents. In areas that are nationally designated, there is a presumption that small-scale developments should be permitted, provided that there is no significant environmental detriment to the area concerned.

The Companion Guide to PPS22 makes it clear that policies should be expressed positively, with the presumption being that stand-alone renewable energy developments will be permitted unless they fail to meet defined criteria. Typically, criteria may include impact on landscape (particularly in designated areas) including visual, cultural and historical character and attributes, as well as a range of other environmental impacts such as noise, dust, odour and traffic generation (see Paragraph 4.11 in the Companion Guide to PPS 22).

PPS1 includes the key principle that local planning authorities should ensure that development plans promote the development of renewable energy resources. It also sets out that development plan policies should seek to promote and encourage, rather than restrict, the use of renewable resources, and that local authorities should promote small scale renewable and low carbon energy schemes in developments. Please refer to Section 2.2.3 for further details

Clearly, the policy criteria by which a proposal is to be assessed must be demonstrably related to the specific circumstances (and in particular environmental sensitivities) that exist within a given area. Visual and landscape character sensitivity will be of concern in certain areas in Redbridge, such as Epping Forest. However, these should not necessarily preclude any opportunities for renewable energy, particularly where resource opportunities (such as wind speed and availability of wood fuel) may favour the location of renewable energy installations, either as stand-alone projects, or where proposed as part of another development proposal.

It is reasonable to assume that as the market for renewable energy grows with the introduction of new financial incentives, such as the proposed Renewable Heat Incentive, further proposals will come forward for renewable energy installations within Redbridge.

8.1.2 Consequential Improvements

In common with many other Local Planning Authorities, the majority of planning applications relate to proposals for small extensions to private dwellings ('Householder Applications'). In 2009, these accounted for around 80% of all applications determined by the Council[90]. Whilst individually they have very limited impact in terms of increased energy demand and carbon emissions, the cumulative impact of these proposals is significant, even compared with many

[90] Redbridge Planning Application Statistics
http://www.redbridge.gov.uk/cms/planning_land_and_buildings/planning/about_us_and_feedback.aspx

major schemes proposing new development. As a result, a number of Councils have considered the introduction of planning policies that seek to address the impact of extensions to existing dwellings. This also provides the opportunity for Planning Authorities to bring about measures that will contribute to National Indicator 186 (per capita reduction in CO_2 emissions).

Uttlesford District Council in Essex has adopted an SPD[91] and uses planning conditions in order to ensure household extensions are carbon neutral through 'consequential improvements' to the property as a whole. Consequential improvement comprises improving the energy efficiency of a building to negate (either in part or entirely) the effect of increased energy use arising from an extension to the building. Uttlesford DC's approach is designed to improve the energy performance of existing residential stock, an area often considered to be outside the remit of the planning process. There is a close relationship between this and Part L (Conservation of Fuel and Power) of the Building Regulations, with a similar requirement for 'consequential works' originally proposed to be implemented through the 2006 revision to Building Regulations. However, this was not included in the adopted version and is not proposed in the amended Regulations to be introduced in 2010.

Uttlesford DC's planning condition '*Improving energy efficiency in an extended dwelling*' states that for any extension or loft or garage conversion granted planning permission after 1st April 2006: *"The Council will require simple, cost effective energy efficiency measures to be carried out on the existing house if possible and practical".* This was originally introduced on the basis of the Supplementary Planning Document on home extensions adopted in November 2005 and has been reinforced through a more recent SPD on energy efficiency and renewable energy. When planning approval is granted for an extension or conversion of a dwelling, the applicant is asked to complete a home energy form. This becomes the basis of a report produced by the Council recommending measures that could be implemented to improve the energy efficiency of the existing building. These are drawn from a menu of eight different measures to improve insulation, the energy efficiency of heating systems or reduce electricity consumption.

Uttlesford Council's Building Control team is responsible for agreeing with the householder which measures are to be implemented to the rest of the building fabric as part of the condition. Householders are asked to implement as many of the eight measures as are practical and cost effective (defined by a payback period of less than 7 years), limited to no more than 10% of the total cost of the extension. In the first two years of implementation of these measures, Uttlesford believes it has achieved a reduction in energy consumption in the District's dwellings of nearly 2,000 MWh, equivalent to over 400 tonnes CO_2 emissions per annum.

The LBR may wish to implement a requirement to ensure its contribution to achieving the targets defined in respect of NI 186 is not undermined by the many small but incremental increases in energy consumption that arise through household extensions. The introduction of measures to secure consequential improvements would provide an effective and measureable strategy to help address this challenge.

91 http://www.uttlesford.gov.uk/documents/website/Climate%20Change/Energy%20Efficiency%20Condition/epbc_uttlesford_spd_cs.pdf

8.2 Defining which elements of building energy use should be included within policy

The term 'regulated' energy relates to all energy consumed within a building for purposes that are included in assessment of compliance with Part L of the Building Regulations. For example, within a house, regulated energy relates only to comfort heating and hot water (including heating system pumps and fans), and fixed lighting (i.e. ceiling and wall-mounted lights). All other energy uses such as cooking and electrical appliances are excluded, and together comprise 'unregulated' energy use. The proportion of total energy demand (i.e. the sum of regulated and unregulated energy) arising through unregulated energy uses can be significant, as shown below.

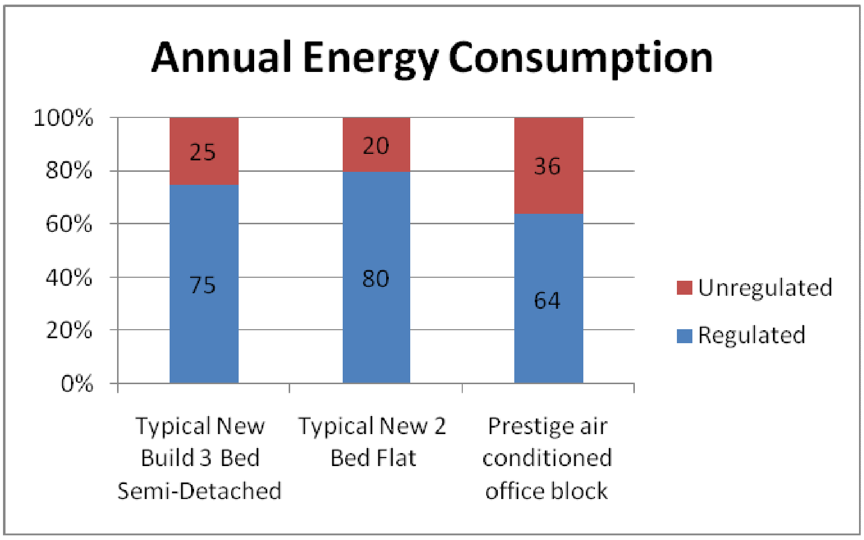


Figure 8-1: Energy Consumption of Dwellings against Offices

Some Local Planning Authorities have set out in their supporting information an expectation that planning applications shall be assessed in terms of their anticipated total energy consumption. This removes a distinction based on regulatory measures that fall outside the planning system and ensures the policy aligns more closely with the planning objective that the whole impacts of a development proposal be considered.

8.2.1 Policy Targets Based on Carbon Emissions

The relative levels of carbon savings arising from a particular LZC energy technology are partly dependent on the 'carbon intensity' of input energy. In wind, solar or hydro energy, the input energy has a carbon intensity of zero. Biomass wood fuel has much lower carbon intensity than natural coal, oil or gas. However, where grid electricity is used as the input energy the carbon intensity is much higher. The relative carbon intensity of a number of fuels (produced by Thameswey) is shown below:

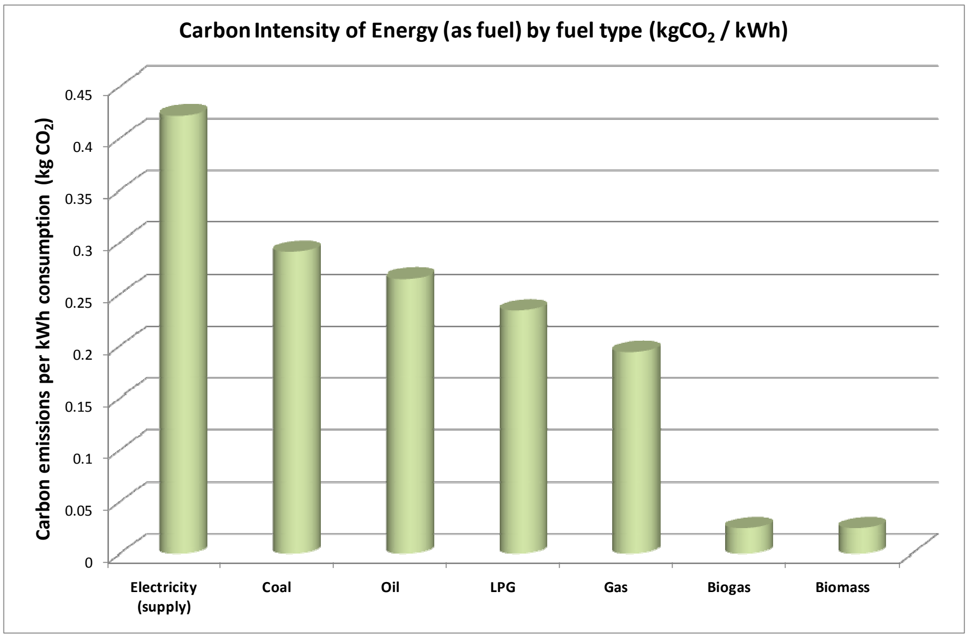


Figure 8-2: Carbon Intensity of Fuel Types

Due to the differing carbon intensity of fuel types, the reduction in carbon emissions arising from different types of LZC technology is dependent on the type of conventional energy that they are replacing. As a general rule, renewable electricity generation (for example from a photovoltaic panel) provides a greater saving in carbon emissions than an equivalent amount of energy generated by a renewable heat source (such as a solar hot water panel). Furthermore, heat-producing LZC technologies that require an input of electricity to operate (such as ground source heat pumps) make the smallest contribution to reducing carbon emissions. As a result, some proposals may meet targets expressed in terms of energy generation on site through LZC means, but achieve a significantly more modest reduction in carbon emissions. The figure below produced by Thameswey illustrates this.

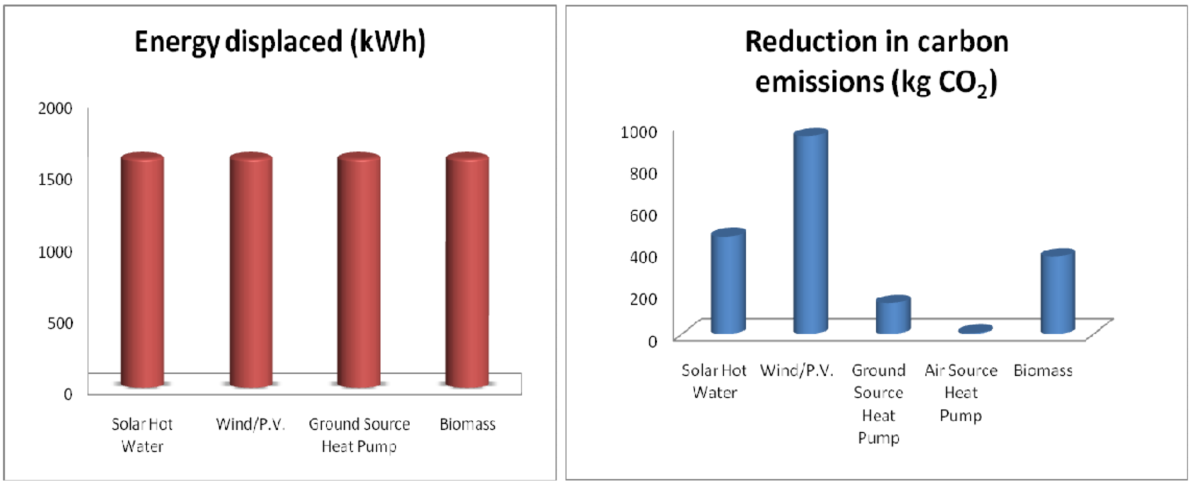


Figure 8-3: Energy Displaced and Reduction in Carbon Emissions

By defining a policy in terms of a target level of reduction in carbon emissions, the Council will be able to ensure it is focusing on the desired outcome of the policy.

8.2.2 Setting a Policy Based on Betterment over the Building Regulations

As described above there are clear linkages between Planning and Building Control. The Council should be clear about how it intends to define the relationship between the two regulatory environments in order to demonstrate it is not duplicating the Building Regulations within its Core Strategy. It should be noted that the Government has announced its proposals to revise the minimum statutory requirements for regulated energy consumption through revised Building Regulations in the latter half of 2010, with further changes proposed in 2013. The 2010 revisions will set a requirement for all residential and non-residential buildings to achieve a 25% improvement in energy efficiency compared with current standards set in 2006.

The Council may wish to consider setting its planning policies against a base defined by the prevailing Building Regulations. This will enable the Council to set targets for new development that require them to demonstrate they will achieve a lower energy demand and/or level of emissions than the 'base case' (i.e. the Building Regulations minimum). This could be achieved by the following individual measures, or a combination of both:

- Assessing development proposals on the basis of predicted total energy consumption (as above) and/or
- Setting a minimum performance improvement over and above the Building Regulations (i.e. developments should secure at least 10% LZC energy production or carbon emissions reduction compared with the minimum standards set out in the current Building Regulations).

8.2.3 Removing the Size Threshold

Policy 4A.7 of the London Plan requires that all development proposals considered by the Mayor should achieve a reduction in carbon dioxide emissions of 20% from onsite renewable energy generation, and seeks to encourage the adoption of the same requirement by London Boroughs when considering development proposals, The London Plan policy does not include minor planning applications for development proposals of 10 houses or less, or less than 1,000 m^2 non-residential floorspace. In Redbridge, 478 minor applications[92] were determined in the year ending 2009. These schemes comprise a significant proportion of all development proposals within the Borough.

Adopting a policy that removes the size threshold currently set within the London Plan would enable the Council to secure significant reductions in energy consumption and carbon emissions in smaller developments.

A further option is to consider applying the targets set out in the London Plan on a phased basis, with an initial requirement for at least 20% of carbon reductions to be on-site generated through renewable technologies, to be replaced through the phased introduction of higher standards over time. This would enable the Council to bring development in line with the Government's planned introduction of milestones towards achievement of zero carbon homes by 2016 (and other

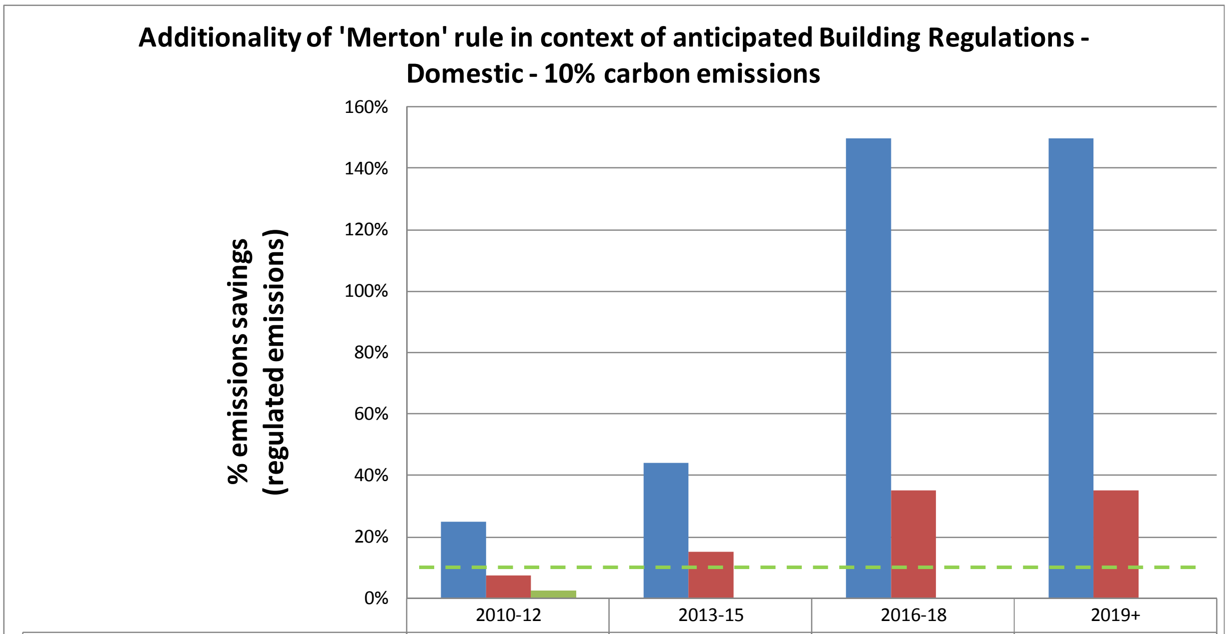
[92] http://www.redbridge.gov.uk/cms/planning_land_and_buildings/planning/about_us_and_feedback.aspx

buildings by 2019) as set out in Chapter 2. However, it would appear that the next revision of the London Plan (currently in draft format) will relax the 20% rule, and hence a policy of this nature imposed through Borough documents could conflict with wider London Plan aspirations. Consultation with the GLA energy team would be required for development of policy of this nature.

8.2.4 Policies Seeking Contributions from Renewable Energy (the 'Merton Rule')

Merton was the first council in the UK to adopt a prescriptive planning policy requiring new commercial buildings to generate at least 10% of their energy needs from on-site renewable technology. It was adopted in 2003 and influential to the point where many other local authorities adopted it, or similar policies. The policy has been challenged, and successfully defended, albeit the national policy backdrop to its introduction has now considerably changed. It is important to note that the 'Merton Rule' was introduced requiring a percentage contribution in *energy* terms, whereas the policy has now been updated to require a percentage contribution to *carbon emissions*. As noted above, the use of carbon emissions targets is considered more appropriate in the wider context of both current legislation and given the use of technologies such as CHP (which increase on-site energy consumption, whilst decreasing overall site emissions).

On this basis, an outline indicative analysis has been taken on the impact of a Merton-style rule (based on carbon emissions) for Redbridge. This is shown graphically below for various policy targets on an illustrative basis:



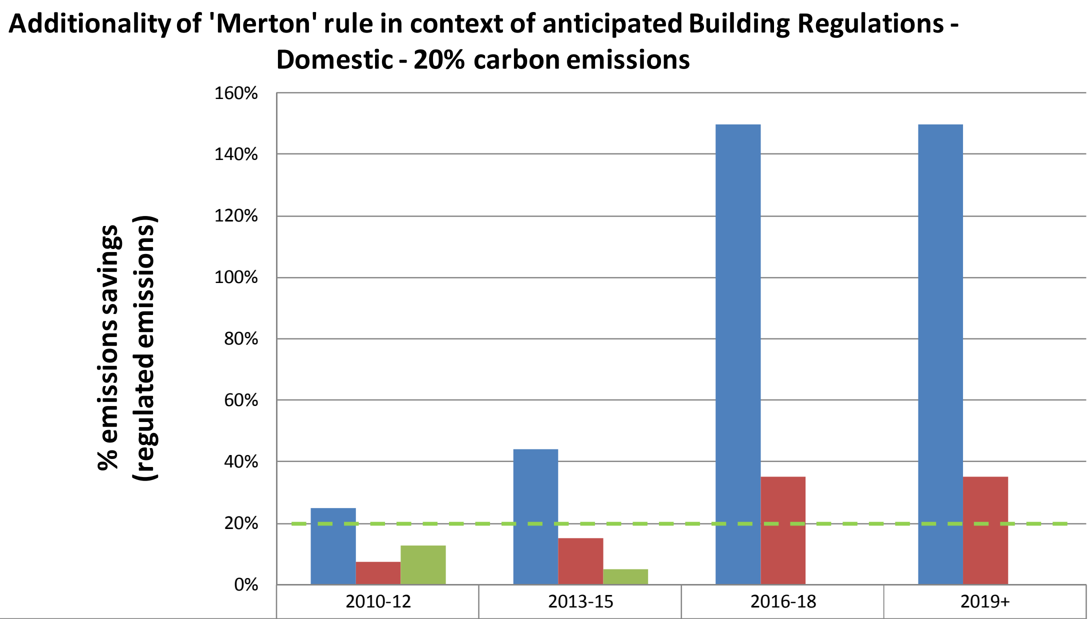
	2010-12	2013-15	2016-18	2019+
Domestic - Overall emissions reduction required (all measures)	25%	44%	150%	150%
Domestic - Renewables anticipated to result from BRs/CSH (without Merton rule)	8%	15%	35%	35%
Additional Domestic Renewable emissions reductions from Merton Rule	3%	0%	0%	0%

Figure 8-4 Additionality of Merton Rule at 10%

This graph shows three coloured bars – the blue columns are the total level of emissions reductions required by Building Regulations or the Code for Sustainable Homes; the red columns represent an estimated level of renewable technology emissions reductions that would be achieved through renewables as an indirect result of BR / CSH (e.g. irrespective of a 'Merton Rule'); the green bar shows the additional contribution to emissions savings that a Merton rule would achieve, in this case assuming the rule were imposed at 10% emissions savings level.

This example shows that it would only be in the period between up to 2013 that any additionality (in terms of carbon savings) would result from a policy of this design.

Further levels of Merton-style rule are shown below:

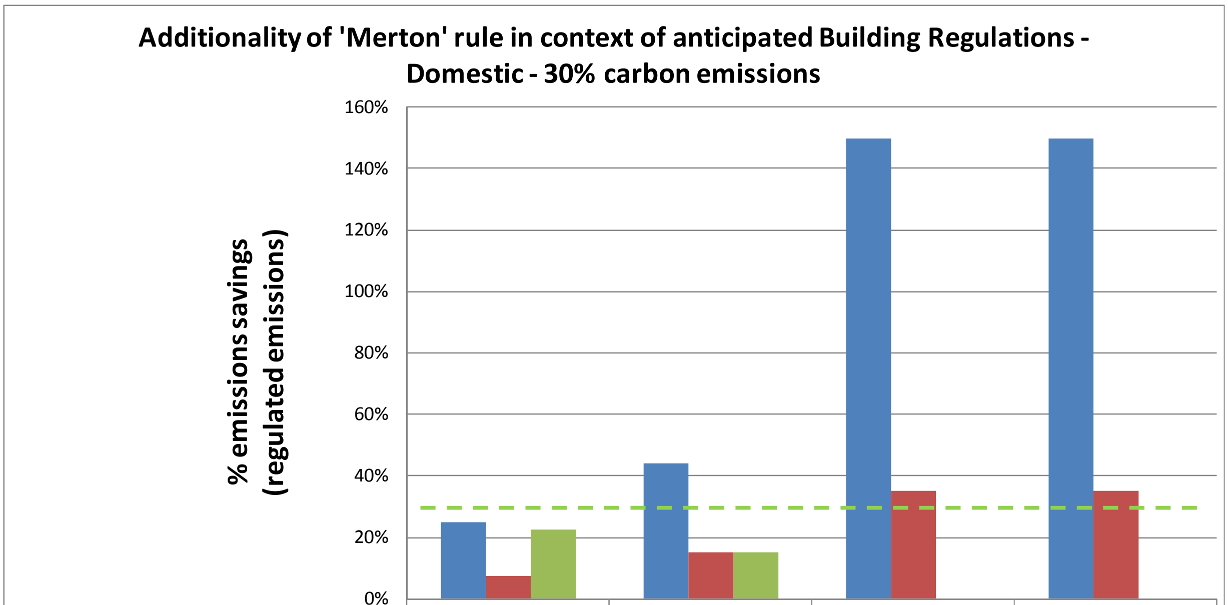


	2010-12	2013-15	2016-18	2019+
Domestic - Overall emissions reduction required (all measures)	25%	44%	150%	150%
Domestic - Renewables anticipated to result from BRs/CSH (without Merton rule)	8%	15%	35%	35%
Additional Domestic Renewable emissions reductions from Merton Rule	13%	5%	0%	0%

Figure 8-5 Additionality of Merton rule at 20%

This case assumes the rule was imposed at 20% emissions savings level.

This example shows that it would only be in the period between up to 2016 that any additionality (in terms of carbon savings) would result from a policy of this design.



	2010-12	2013-15	2016-18	2019+
Domestic - Overall emissions reduction required (all measures)	25%	44%	150%	150%
Domestic - Renewables anticipated to result from BRs/CSH (without Merton rule)	8%	15%	35%	35%
Additional Domestic Renewable emissions reductions from Merton Rule	23%	15%	0%	0%

Figure 8-6 Additionality of 'Merton Rule' at 30%

This figure shows that even when the ambitious target of 30% is imposed, this is only estimated to have any impact on the pre-2016 domestic development.

When this rule is coupled with the volume of domestic development anticipated in the three Redbridge strategic sites evaluated in this report, the following figures are derived:

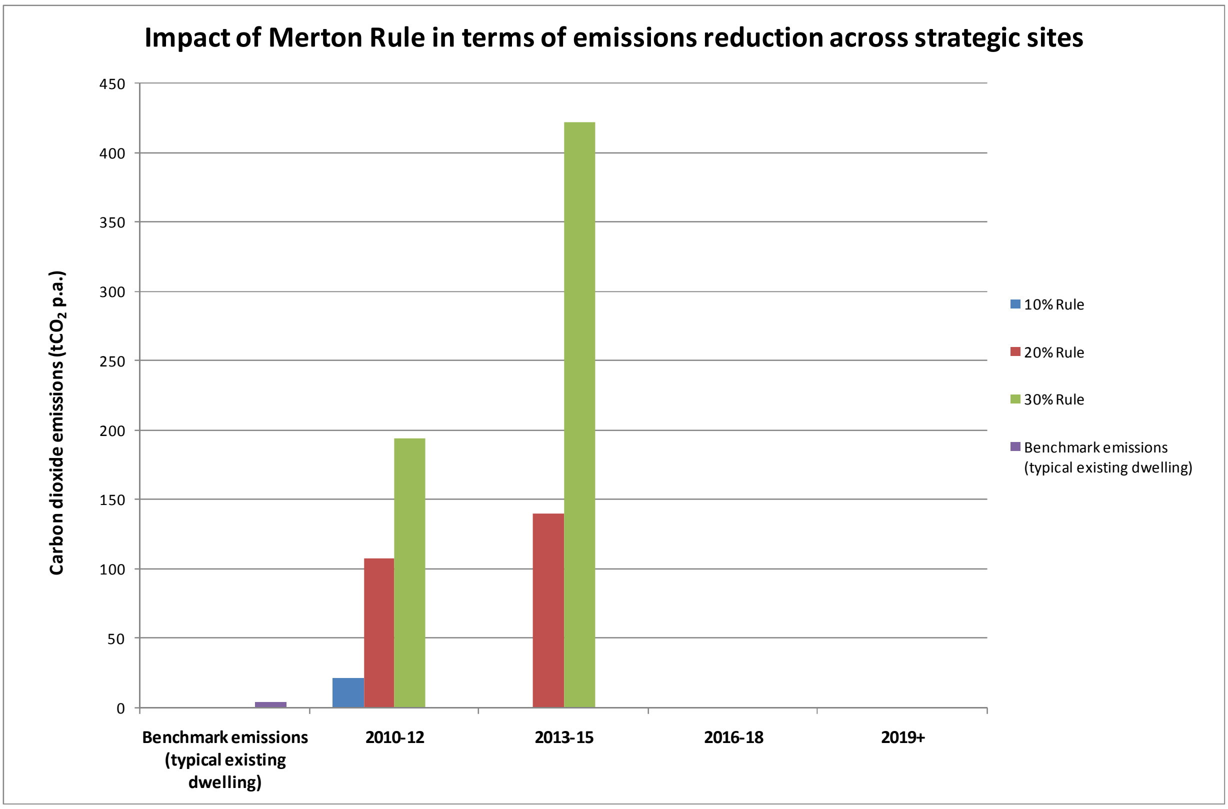


Figure 8-7 Carbon emissions impact of Merton rule at different levels across strategic sites

The vertical axis demonstrates the result of the data that was available on housing developments planned in those different periods (in the strategic sites only), multiplied through with the additional savings that would result from the imposed renewable energy targets.

This graph illustrates that a 10% Merton-style rule (e.g. blue column) would only have an impact equivalent to the emissions of approximately five typical dwellings.

On this basis, it would be suggested that if a Merton-style rule is approved, then the level should be set at 20% or greater in terms of emissions reductions required in order to have any level of significant additionality. However, the time-limited impact of this policy intervention must also be borne in mind – only limited or zero impact would be seen after 2016.

However, by strictly applying % renewable target rules, i.e. where cost effective energy efficient measures are not implemented, developers will be required to install a greater proportion of renewable energy which will incur greater cost to achieve the 20% target. Therefore, targets should specify a level of energy efficiency to be achieved to ensure this as practice as adopted first and foremost. i.e. 5% energy efficiency and 20% renewables = 25% CfSH Level 3.

8.2.5 Carbon Fund - Policies Seeking Aspirational Levels of Carbon Reduction

The draft replacement PPS Planning for a Low Carbon Future in a changing Climate (March 2010) comments that planned revisions to Building Regulations in 2013 and 2016 will be contributing to a shift in the focus of local planning policy and implementation towards community-scale low and zero carbon energy infrastructure. Current proposals for Zero Carbon Homes include a mechanism to secure investment through 'allowable solutions' for local community energy infrastructure and other measures to reduce community carbon emissions through payment into a fund. A number of local authorities have pioneered the establishment of carbon funds as a means of delivering carbon reduction measures in their local communities funded by payments by developers. This has proved in some cases to be an effective means of achieving carbon reductions associated with new developments that are deemed to be 'carbon neutral'.

There are examples of this being set out in the form of a policy requirement for a minimum level of renewable or carbon reduction within a development proposal, plus an aspirational target that seeks to secure further significant carbon reductions through funding and implementation of off-site measures.

This approach offers a number of benefits for Redbridge:

- Developers may pay into a carbon fund where circumstances would prevent high levels of on-site carbon reduction being economically viable, as the charge levied for mitigating carbon emissions through a fund may be significantly less that the costs that would otherwise have to be met by a developer to avoid an equivalent amount of emissions within a development.
- The use of a fund could provide a level of flexibility for the LBR in prioritising the delivery of community carbon reduction measures. For example, it may wish to target insulation within poorer performing stock, thereby also enabling it to deliver its objectives for reducing fuel poverty. Alternatively, the funding may be pooled towards investment in major new energy infrastructure programmes, such as a community heat network.
- The establishment of a local fund can be used to secure additional sources of funding or to focus delivery of carbon reduction measures through existing partnerships and programmes.

The mechanism for contributing to a carbon fund could take a number of forms. For example, Milton Keynes Borough Council in its Local Plan policy D4[93] (adopted 2005), has set a levy based on a single one-off payment set at £200 per tonne of carbon. The levy is calculated on the basis of an aspirational target for all residential developments of more than 5 units (or over 1000m^2 commercial floorspace) should be carbon neutral. This permits new developments to have net emissions as long as they pay into the fund to enable these emissions to be off-set elsewhere within the borough. The payment is based on estimated annual emissions from the new development and recognises the cost-effectiveness of offsetting carbon emissions through low-cost measures to reduce energy use within existing stock. Milton Keynes set the levy on the basis of an offset feasibility study it commissioned in 2004.

[93] http://www.miltonkeynes.gov.uk/planning-policy/documents/Local%5FPlan%5FPart%5F5%2Epdf

Milton Keynes Borough Council uses section 106 agreements to secure financial contributions. The policy has proved to be effective, raising over £800,000 towards a number of measures and initiatives aimed at reducing local carbon emissions.

Ashford Borough Council has adopted a similar policy approach aimed at achieving carbon neutrality. Policy CS10 of its Core Strategy (adopted 2008) states that new development should be carbon neutral "with any shortfall being met by financial contributions to enable residual carbon emissions to be offset elsewhere in the Borough."

Ashford sets out how this policy is to be implemented through an SPD. In common with Milton Keynes, Ashford requires developments to pay a levy based on the predicted emissions arising from energy use in a development over the course of year. A one-off payment is made into the fund, the sum being based on the 'Shadow Price of Carbon', currently set at £27/tCO_2[94] . This has the advantage of using a monetary value that is set by Defra, and avoids detailed justification of the cost per tonne of emissions by the Council. However, the cost of carbon emissions defined within the Shadow Price is considerably lower than the figure set by Milton Keynes and significantly lower than the assumed abatement cost of £95/tCO_2 by the Government under Scenario 2 – Balancing on-site and off-site. Significantly, Ashford states that it will use the sums paid into the carbon fund for reducing energy consumption within existing buildings and tree planting.

Dover District Council's Core Strategy (adopted 2010) includes policy CP9 which sets out the Code for Sustainable Homes and BREEAM levels that it expects new development to achieve. However, there is provision for developers to offset some of the impacts of their proposal through contributions into a fund and where it can be demonstrated that a development is unable to meet these standards, the Council may grant permission if the "applicant makes provision for compensatory energy and water savings elsewhere in the District." Dover's Core Strategy further explains that developments that are unable to meet the standards of Policy CP5 on-site can make commensurate energy and water savings elsewhere in the District by making a financial contribution to the Council to enable it to help fund schemes that would make the savings. The mechanism by which these sums are to be calculated and appropriate schemes are to be identified will be set out in due course by the Council. This approach provides the potential for developers to either take action directly to achieve commensurate levels of energy and water savings elsewhere in the district, or to pay into a fund.

Dover's focus on measures to energy and water measures within the district accords with emerging national policy. The draft replacement PPS proposes that, subject to justification, local planning authorities may set targets for compliance with high levels of the Code for Sustainable Homes, focusing exclusively on the energy and water standards within the Code.

By providing the opportunity to relax the requirement to meet the more demanding standards for water and energy on-site, the policies that have been adopted recognise the high costs that can be encountered in achieving these standards within new developments (especially as these developments are likely to achieve significant improvements in energy and water efficiency over existing stock), and the potential to achieve equivalent levels of energy and water efficiency at a

[94] The Social Cost Of Carbon And The Shadow Price Of Carbon: What They Are, And How To Use Them In Economic Appraisal In The UK, Economics Group, Defra, December 2007.

lower cost through measures to improve the performance of existing stock. Therefore, this can be an effective mechanism for stabilising the growth in emissions through new development where the additional costs of achieving high standards of energy efficiency and/or carbon reduction threaten to exceed the economic viability of a scheme.

However, some local authorities' proposals for seeking carbon fund contributions have not been supported by Inspectors. For example, Reigate and Banstead Borough Council's submission draft Core Strategy (2009) included in its policy CS 10 Sustainable Construction a requirement that development should be 'carbon neutral' through a combination of measures based on accelerated implementation of the Code for Sustainable Homes (or BREEAM 'Excellent'), the use of on-site renewable energy and payment into a 'Carbon Reduction Fund' in respect of residual emissions not mitigated through the other measures. Prior to examination, the inspector expressed some reservations regarding justification for the approach, the basis on which it would be implemented and overall clarity of the proposal. The Council responded by submitting a re-structured policy and further evidence that sought to address the Inspector's comments. However, following further concerns expressed during and following the examination in respect of a number of other substantive issues in the Core Strategy (in addition to the Sustainable Construction policy), the Council withdrew its Core Strategy.

The Inspector subsequently provided an informal advisory letter to Reigate and Banstead in which his concerns were expressed. This re-iterated his concern that there was inadequate justification for requiring compliance with Code standards in advance of national policy. In addition, the Inspector commented that the Core Strategy "did little to provide a framework that promotes and encourages renewable and low energy carbon generation or to facilitate projects to help achieve regional targets". In this regard, the Inspector was clearly not convinced that the Carbon Reduction Fund proposed by the Council would make a significant contribution to generating renewable energy. This reveals a tension between meeting the related but distinct objectives of securing reduced carbon emissions on one hand, whilst also securing increased generation renewable and low carbon generation.

Finally, on the question of economic viability of the proposal to include a carbon fund in the policy, the Inspector commented: "The fact that the policy may be affordable in some circumstances and that the cost of offsetting has a marginal effect on viability is not a justification for introducing the policy. " In other words, the justification for the purpose of the policy must be clearly demonstrated, in addition to demonstrating its economic viability.

If Redbridge concludes that it wishes to establish a carbon fund too, it will need to demonstrate it has a clear programme for implementation of off-site energy measures and an appropriate means of delivering this. In common with other authorities that have adopted policies that permit developments to mitigate a proportion of carbon emissions through off-site measures, Redbridge will need to set out the detail behind this policy in a supplementary document. This should include:

- A sound justification for the policy approach;
- A clear explanation of the circumstances in which a development proposal may mitigate its impact through off-site measures;
- The minimum standards that are to be achieved on-site;

- The funding levels to be applied to calculate the value of contributions to a carbon fund;
- The mechanism to be applied to enable developers to contribute to the fund;
- Whether such measures can be carried out directly by the developer; and
- An indication of the programme of off-site measures that will be targeted for implementation through a carbon fund.

8.3 Measures to Support Implementation of Policies

8.3.1 Pre-application Discussions

Pre-application discussions and encouraging developers to engage with the Council as early as possible will be essential in order for the LBR to respond to the need to apply energy policies and standards.

For strategic sites, such as Ilford Town Centre, where developers will be required to respond to higher standards of sustainable design and construction, Redbridge may be required to take a more flexible approach in order to ensure development proceeds; flexibility may be required in terms of accommodating the increased capital cost imposed by higher standards and policies. On these specific sites, for example, affordable housing contributions may need to be reduced and S106 contributions agreed accordingly.

8.3.2 Skills and Training

In order for the LBR to engage with developers and ensure the successful integration of their policies in development applications, they will require the necessary up-skilling and training on low carbon and renewable technologies, so that appropriate knowledge is available, which can be utilised during the application determination process.

A process for ensuring knowledge transfer and assimilation would be required both internally within the Council, and within the Local Strategic Partnership. This would likely involve a training program for selected planning officers and a simple process to ensure knowledge and skills were not lost if staff moved on. Therefore, it would be essential to ensure more than one officer was adequately trained at any one time, enabling the continual monitoring and measurement of applications, in accordance with energy policy and standards.

Skills and training are important both within the Council and also for owners/occupiers of existing stock. Leaflets providing information and training days run by the Council may be required to further educate and disseminate information within Redbridge. This may best be facilitated via cross-border initiatives, through reliance on the shared resources and knowledge of the Local Strategic Partnership.

8.3.3 Local Development Orders (LDOs)

The Planning and Climate Change Supplement to PPS1 encourages planning authorities to consider using LDOs as a means of helping secure low and zero carbon energy supplies. LDOs could form a suite of tools (including guidance and design codes) that can help stimulate investment in energy infrastructure. For example, by granting additional permitted development rights relating to the installation of community heat plants, some of the cost and uncertainty associated with new low carbon energy infrastructure may be reduced, hence deeming developers less resistant to funding its provision. Other potential applications of an LDO include: broadening the range of 'permitted development rights', in some or all of a Local Authority area, to cover a wider range of householder micro-renewable energy installations; or providing a 'framework permission' for a decentralised energy network to serve a development and/ or existing buildings.

We are not aware of any LDOs having been adopted specifically to facilitate climate change and decentralised energy objectives and indeed their application has thus far been limited. However, an LDO is being piloted by the London Development Agency[95] in respect of the implementation of a cross-boundary approach to the provision of a new district heating network in east London. Elements that may be included in the LDO are, for example: below-ground works, such as trenching and laying of pipes and other apparatus; above-ground apparatus and street furniture; associated small buildings; and building extensions. The LDO will enable staged roll-out of the heat energy network and extensions to the scheme without the need for numerous individual planning applications.

The pilot is still at a relatively early stage with adoption planned for summer 2010. However, if the pilot is successful, the use of LDOs may become more widespread as a means of reducing costs and risk of delays associated with the delivery of community-scale decentralised energy networks.

8.3.4 Planning Performance Agreements (PPAs)

A PPA is a mechanism for dealing with complex development proposals. PPAs bring together a developer, the Local Planning Authority and key stakeholders from an early stage to cooperate throughout all stages of the planning process. They are, essentially, a collaborative project management tool that provides greater certainty and transparency to the assessment of a planning application and decision-making process. PPAs require 'front-loading' of the planning process, ensuring planning applications are of a high standard when they are submitted and, through close collaboration with stakeholders, have addressed many of the key issues prior to submission.

On 1 December 2009, the Government announced the first of six PPAs that are designed to support low carbon and/ or renewable energy developments. The first one refers to an urban extension at Sowerby Gateway in Yorkshire where proposed development comprises over 900 new dwellings to be built by 2026 (of which 40 percent will be affordable). The development will further include offices and commercial space and will use a centralised Combined Heat and Power/district heating scheme and domestic scale solar photovoltaics.

The use of PPAs is becoming more widespread since their introduction in 2008 and a number of Planning Authorities have found them to be a useful mechanism for agreeing with developers on a structured approach to addressing planning issues that may be of a complexity or scale that requires close collaboration with expert advisors, consultees and other stakeholders. The Council may, therefore, wish to consider the use of a PPA in order to secure the provision of low carbon energy infrastructure as part of the development of urban regeneration area such as Ilford Town Centre in particular.

[95] http://www.pas.gov.uk/pas/core/page.do?pageId=194954

8.3.5 Supplementary Planning Documents (SPDs)

Whilst Planning Authorities are expected to set out their requirements relating to decentralised energy supply or the environmental performance of developments in their DPDs, the use of SPDs is an effective mechanism for guiding developers on the more detailed aspects of a proposal, including matters relating to implementation and phasing.

The Council may wish to consider preparing further SPD guidance relating to the delivery or funding of new energy infrastructure in the Borough. For example, Chelmsford Borough Council's Planning Contributions SPD (adopted April 2009)[96] defines a framework for commuted payments to be made in lieu of the provision of infrastructure on-site, and monetary contributions towards Strategic and Off-site Community Infrastructure. These contributions, based on a set of standard charges and/ or formulae, can be pooled to fund provision of large infrastructure. Chelmsford has defined Off-site Community Infrastructure as "*land/ development, works, or facilities necessitated by the combined and cumulative impact of a number of developments where, because of the nature, size and/ or scope of infrastructure, this cannot be provided as part of the development*."

A similar approach could be applied by the LBR to a number of small- or medium-sized developments (for example below 50 house units) where the scale of development is inadequate, or their location inappropriate, for the use of community-scale renewable energy. In such cases small- or medium-sized developments could pool their planning contributions to provide new renewable or low carbon energy infrastructure and hence meet a prescribed proportion of the developments' energy consumption or carbon emissions target.

8.3.6 Monitoring and Review of Policies

The Supplement to PPS1 emphasises the importance of effective monitoring of policies to ensure implementation is line with an Authority's strategy, and this should be incorporated into annual monitoring arrangements.[97] Monitoring should provide key data on outcomes to assess performance against a Council's policy objectives and Regional Spatial Strategy (RSS) targets.

The LBR must ensure it can demonstrate how its objectives and appropriate indicators of outcomes have been adequately identified and that measures have been put in place to adequately monitor their implementation. Targets relating to carbon reductions require consistent and transparent methodologies for assessing proposals, monitoring their implementation and reporting on outcomes. Tools such as the London Renewables Toolkit[98] have established a methodology for expressing the contribution of low and zero carbon decentralised energy towards the energy demand of new developments.

8.3.7 Implementation Plan: Heat Mapping

PPS1 Supplement also requires through Policy LCF 4 that a local planning approach for renewable and low-carbon energy and associated infrastructure is considered:

> *iv. set out how any opportunities for district heating (to supply existing buildings and/or new development) identified through heat mapping will be supported;*

96 http://www.chelmsford.gov.uk/media/pdf/b/t/Planning_Contributions_SPD_-_Final_Adopted_with_Addendum.pdf
97 See Paragraph 34 of the Supplement to PPS1 for details.
98 http://www.lep.org.uk/uploads/renewables_toolkit.pdf

v. set out the decentralised energy opportunities that can supply new development proposed for the area;

Through the heat mapping element of this study, opportunity areas have been identified and how these opportunities relate to new development. Phase 2 of this study will facilitate the development of local policy setting in accordance with the priority areas identified. Area Action Plans and Supplementary Planning Documents can guide applications in the right direction in terms of what is necessary. It is understood the Council has already made progressive steps towards this through the development of Area Action Plans. For example in the Crossrail Corridor, where policy is encouraging decentralised energy in the form of CHP, greater definition will need to be provided by the Council in terms of ensuring other low carbon and renewable technologies do not compete for heat that would otherwise have been used to ensure the viability of a CHP and district heating network. Ilford Town Centre and the Crossrail Corridor provides a good example and SPDs will need to be guided by the outcome of the Phase 2 Feasibility Study.

9 Conclusions and Next Steps

9.1 Conclusions and Recommendations

Global and national policy is undergoing radical transition, as it responds to the scientific certainty of our changing climate and the impact associated with development, which requires a response to mitigate the effects of climate change and global warming through a reduction in building-related carbon emissions.

The study sets out an evidence base which reviews a balance between policy drivers, local constraints and opportunities, including the implications of cost on development viability, with the key aim of developing sustainable communities within Redbridge. These legally binding national policies require Redbridge to take incremental steps to reducing carbon emissions by 80% by 2050 and ensure this be implemented in a way that reflects the local context and physical characteristics of the region.

The carbon footprint of Redbridge is 1,033, 000 tonnes CO2 per year which can be compared to 432,727,000 tonnes CO2 for the UK (Redbridge is 0.24% of the total). Based on an evaluation of this carbon footprint , the figures for domestic and commercial emissions projections identify there is only a limited level of impact on overall building stock emissions that new-build policy can make. If the overall goal of policy design and implementation is to reduce carbon emissions, then this analysis strongly points towards the need for policy measures that target the emissions of existing buildings as well as new construction.

This study involved a heat mapping analysis to identify 'cluster' sites for potential decentralised energy networks. Five 'cluster' sites (Ilford Town Centre and Crossrail Corridor, Gants Hill, Loxford School area, King George Hospital Site and Fullwell Cross) were identified with potential for synergies for the deployment of a heat network. Key barriers, opportunities, next steps and individuals responsible have been identified in order to facilitate Phase 2 of the Heat Mapping Study; a detailed feasibility study of key cluster sites. Two high priority cluster areas and one medium level priority area has been identified in this study.

Site One: Fullwell Cross (Medium Priority)

Site Two: King George Hospital (High Priority)

Site Three: Ilford Town Centre & Crossrail Corridor (High Priority)

Some difficulties were encountered in heat load data collection for private buildings for the Heat Mapping Study. This suggests that an alternative approach to data collection may be required, which could include site visits and contact with energy companies to obtain data directly. From the experience obtained while establishing stakeholder contact, it was felt that a minimum of 1-2 months are required between initial contact with stakeholders and obtaining the final data which would include time for site visits.

A borough wide and site specific renewable energy appraisal was undertaken to evaluate the suitability of low carbon and renewable energy across the borough and for different scales of development. An analysis for Gants Hill, Ilford Town Centre and the Crossrail Corridor was undertaken and revealed that overall the three Strategic Sites are highly conducive to district heating solutions due to their high densities. Nevertheless, microgeneration can also contribute to overall targets, especially during the earlier phases of development, and given their increased viability with feed-in tariffs.

In terms of development viability, for all areas of the Borough investigated, development delivers Land Values in a range that suggests viability. In particular the higher market sales values of Wanstead and East Redbridge suggest that these areas could generate the assumed level of developer profit and also high residual value. Of the three strategic sites investigated (Ilford Town Centre, Gants Hill and the Crossrail Corridor), the Crossrail Corridor shows the lowest level of value.

Addendums to this document provide specific guidance to support the Council's objectives of ensuring both internal staff and developers have a clear understanding of the best strategy for achieving different levels under the Code for Sustainable Homes. **Appendix H** sets out the most cost effective credits which can be achieved by house builders. It also enables LBR planning officers to advise accordingly with respect to planning applications. For example if an application is narrowly missing a specific Code Level the planning officer can respond to the application in question and propose alternative low cost credits, should they have been excluded in the application.

Appendix A provides guidance for residents on applying the energy hierarchy, facilitating the adoption of energy efficiency measures within households, provides information on low carbon and renewable technology and provides an indication of cost savings from the measures proposed. It also provides advice on how residents can access grants and funding and the route they should take in order to access this funding.

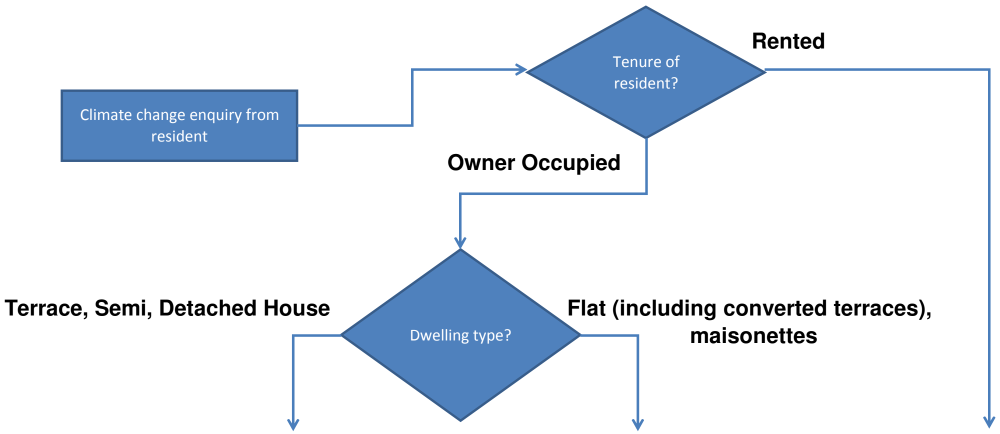
9.2 Next Steps

Recommendations for the Council to follow up on the results of this Study include:

- Incorporation of recommendations made within this Study into LDF Policies;
- Further address emissions from existing housing stock, the need for which is highlighted by the emissions projections study carried out in Section 3;
- Follow up on the next stage of the Heat Mapping Study. For example, a detailed feasibility study of one or more sites should be commissioned.
- Establishing contact with local developers in priority areas to ensure awareness of renewable energy potential and to encourage them to ensure that developments are compatible with district heating; Installation of decentralised energy compatible infrastructure such as plate heat exchange and capped heat pipe connections could be encouraged through the planning framework or Section 106 Agreements
- Consider a program which will enable Council to obtain the necessary skills and training to review applications, enforce policies and engage with developers at a high level in pre application discussions;

APPENDIX A: Energy Efficiency Guidance document for Redbridge Residents

Energy Efficiency and Renewable Energy Decision Flow Diagram



ZERO COST

BEHAVIOURAL CHANGE

Applicable to all tenures and property types

Reducing temperature on thermostat

Showers rather than bath

Laundry drying outside, rather than in dryer

Low temperature laundry setting

Composting organic waste

LOW COST

FITTINGS

Terrace, Detached, Semi	Flat, Maisonette	Rented Living (assumed flat)
Low energy lights	Low energy lights	Low energy lights
Cistern Hippo / reduced flush	Cistern Hippo / reduced flush	Cistern Hippo / reduced flush
Draft proofing	Draft proofing	Draft proofing
Hot water tank installation	Hot water tank installation	
Low flow taps	Low flow taps	

FABRIC

Terrace, Detached, Semi	Flat, Maisonette	Rented Living (assumed flat)
Loft insulation	Loft insulation (top-floor flats)	N/A
Wall insulation	High-specification glazing	
High-specification glazing		

LOW AND ZERO CARBON SUPPLY TECHNOLOGIES

Terrace, Detached, Semi	Flat, Maisonette	Rented Living (assumed flat)
Micro wind-turbines (IG6, IG7, IG8, IG9)	Solar PV (top-floor flats)	N/A
Wood-pellet stoves	ASHP (flats with suitable outside area)	
Solar Hot Water	GSHP (ground-floor with large garden)	
Solar PV	(Solar HW not generally recommended for flats unless demonstrably high hot water consumption)	
GSHP (Detached and semis)		
ASHP (Detached and semis)		

INCREASING COST

Illustration of Potential Value of Energy Efficiency and Behavioural Change

Take a shower instead of a bath
Using a low flow shower can use 1/3rd of the water used during a bath, reducing heating load, saving around 200 kgCO_2 per person per year.

Insulation of water tank
Insulating the hot water tank (75mm) and pipes can save around £50 a year and up to 250kg CO_2.

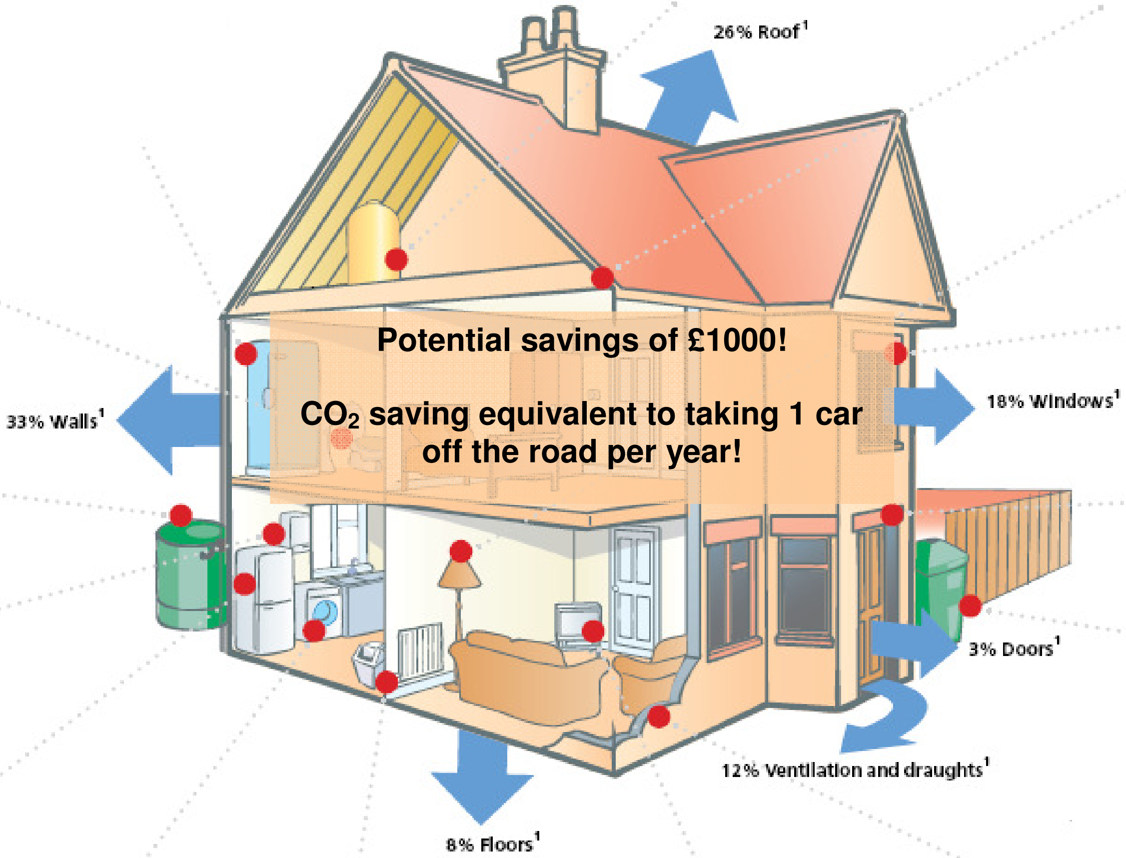
Loft Insulation
Loft insulation (270mm) can save around £190 a year and up to 1039 kg CO_2 per year.

Water displacement device
Treating and distributing water, collecting it as sewage and then treating it before discharging it back into the environment are all processes requiring energy, and therefore result in CO_2. Flushing accounts for at least 31kg CO_2 per year. Installing a simple water displacement device in the toilet cistern reduces water consumption and therefore CO_2 emissions.

Energy saving light bulbs
Replacing inefficient bulbs with energy efficient ones saves around £40 and 135 kg CO_2 per year.

Double glazed windows and doors
Replacing single glazing with C-rated Energy Saving Recommended double glazing saves around £130 and 712 kg CO_2 per year

Installation of a water butt
Rainwater collected can be used for landscaping, cleaning cars, and washing external areas, reducing CO_2 emissions from using potable water



Draught proofing
Saves around £30 and 152 kg CO_2 per year

Use an A-rated boiler
Replacing a G-rated boiler by an A-rated boiler with heating controls can save around £230 and 1,259kg CO_2 per year

Composting and recycling
1200 kg of CO_2 can be saved by recycling half of the waste your household generates per year

Use A-rated appliances
Buying A-rated fridges, freezers, dishwashers and televisions over poorly rated appliances can save around £60 and 210kg CO_2 per year

Drying clothes outdoors
Using a clothes line can save around £30 and 450kg CO_2 when you air dry your clothes for 6 months of the year

Wash laundry at low temperatures
Washing laundry at 30 instead of 60 degrees can save around £10 and 44kg CO_2 per year

Improve occupant control
Install thermostat radiator valves to prevent overheating spaces. Reducing heating by 1° can save £50 and 284kg CO_2 per year

Appliances on stand-by
Shutting appliances off completely rather than leaving on stand-by can save £30 and 126kg CO_2 per year

Wall Insulation
Cavity wall insulation saves around £150 and 799 kg CO_2 per year

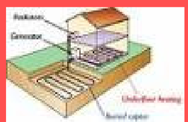
Assumptions:
1. Heat loss based on an uninsulated home
2. Savings based on a period of one year for a 3-bed semi detached gas heated home, gas price of 3.80p/kWh
3. Savings for buying Energy Saving Recommended appliances are based on replacing an old appliance with an A+ or A++ cold appliance or AAA wet appliance
4. Boiler savings assume average levels of insulation when replacing a stock average boiler with efficiency of 72% (gas) or 80% for oil with an Energy Saving Recommended condensing boiler with an efficiency of 90%.260kg
5. These savings provide an estimate only, and generally are based on the averagely insulated home. Actual savings may be higher or lower depending on your original usage of energy and insulation levels.

References

www.energysavingtrust.org.uk , www.lga.gov.uk, www. globalwarming-facts.info, www.terrapass.com, www.epa.gov, Quantifying the energy and carbon effects of water saving (www.energysavingtrust.org.u)

Guidance Information on Zero and Low Carbon Energy Supply Technologies

Technology	Locational Requirements/ Suitability to types of development	Savings	Cost	Further information
 **Solar Hot Water**	**Suitable for detached, semi-detached, terraced houses and some top-floor flats, with south-facing roofs.** • Ensure roof not over-shaded • Is there space for a hot water cylinder (5m^2) • Is current boiler compatible with solar water heating? • Confirm structural roof strength with installer	• Approximately **£50/year** for a 4m^2 panel • **380kg** CO_2 • Financial savings will depend on amount of hot water used, boiler efficiency and the type of fuel used to heat water normally.	**£3,500 - £4,500** for a 4m^2 panel including a new hot water cylinder (150- 200l, however this depends on hot water use). Grant available under the Low Carbon Building Program.	• The system works all year round, though gas boiler is likely to be required during the winter months. • Lower energy bills. A typical house spends 20-25% of their energy bills on heating water • Reduces carbon emissions
 **Wind Turbines (roof mounted)**	**Within Redbridge micro scale wind is likely to be most viable in postcode areas IG6, IG7, IG8 and IG9** • Are there any structural constraints, for example related to vibration? (Please check with installer) • Are there any obstacles to wind nearby (particularly from prevailing wind direction (south west)? • Is average wind speed greater than 4.5m/s?	• A well sited 2.5kW turbine can have a payback of around 9.5 years • **2.6 tonnes CO_2** per year	A 2.5kW roof mounted turbine costs between **£3,000-4,000**	• Lower carbon emissions • Lower electricity bills and support through 'Feed in Tariffs' • Store excess electricity in batteries for calm days, or simply export to grid
 **Photovoltaics**	**Suitable for detached, semi-detached, terraced houses and some top-floor flats, with south-facing roofs.** • Roof or wall that faces within 45 degrees of south with good access to sunlight • Ensure roof not over-shaded • Confirm structural roof strength with installer • About 7.5m^2 of roof space is required for each kWp of a PV system	• **Up to 1 tonne of CO_2** a year • Around **£200 p.a. (not including feed-in-tarrif)**	A 2kWp system costs around **£15,000** and provides 1,700 kWh of electricity per year (half the year's electricity requirement for a 3-bed home)	• Lower carbon emissions • Lower electricity bills • Electricity generated will attract Feed in Tariffs • Batteries can store excess electricity for a cloudy day

Technology	Locational Requirements/ Suitability to types of development	Savings	Cost	Further information
 **Biomass fuelled stoves/boilers**	**Since Redbridge is an AQMA, biomass may not be suitable in all areas unless agreed by the Council. Areas around North Circular road, Chigwell Road, the M11, Eastern Avenue Road, High Road, and Gants Hill are particularly sensitive.** • Fuel storage space • Do you have a route for a suitable flue? Existing chimney can possibly be fitted with a lined flue. • Compliance with Building Regulations / Control • Do you live in a Smoke Control Area? Ensure you select an exempt appliance.	• Up to **9.6 tonnes CO_2** when a wood boiler replaces a solid (coal) fired system. • If replacing electricity, **£170 - £410**	A **15kW** automatically fed boiler costs **~£9,000** including installation and installing a suitable flue. Grant available under the Low Carbon Building Program.	• A low carbon option for providing heat as long as the wood/fuel is sourced locally • Burning wood can be a convenient way of disposing wood that might otherwise be landfilled • Potential support from 2011 via the Renewable Heat Incentive. • A list of pellet and biomass suppliers around Redbridge can be found on websites such as http://www.renewable-energy-directory.co.uk/boiler/london_north.php
 **Ground Sourced Heating (GSH)**	**Particularly suitable for new build detached and semi-detached homes with external land areas of >100m^2 for semi detached and 150m^2 for detached homes for the installation of ground loops. Large garden /external area required for existing homes** • Ground needs to be suitable for digging a trench or a borehole • Is your home well insulated? • What type of heating system is required? Underfloor heating is preferable. Consider installing PVs to power the compressor and pump	The system needs electricity to drive the compressor and pump. Generally GSHP's produce 2.5 to 4 units of heat for every unit of electricity used. The cost of electricity and the amount saved will depend on the fuel replaced. However, average saving is around **£400** (if replacing gas) **to £800** (If replacing electricity). This can also equate to a saving **of 1-2 tonnes of CO_2** per year if replacing gas and **7 tonnes CO_2 per year** if replacing electricity. The savings assume that the GSHP provides up to 50% of domestic hot water as well as 100% of space heating requirements.	A typical **8kWth** system should cost between **£8,000 and £12,000** to install, including the cost of burying the ground loop in your garden (usually sufficient for an average 3-bed home). Cost of heat distribution system – underfloor heating or radiators is not included. Running costs (to produce heating and 50% of domestic hot water) are likely to be around **£540** per year, but will depend on a number of factors - including the size of your home and how well insulated it is. Grant available under the Low Carbon Building Program	• Reduce CO_2 emissions • Reduce fuel bills • Cut down on wasted electricity: heating with a ground source heat pump is much more efficient than using electric radiators.

Technology	Locational Requirements/ Suitability to types of development	Savings	Cost	Further information
 **Air Sourced heat pumps**	**Outside space for the heat pump condenser unit.** • You'll need a place outside your house where a unit can be fitted to a wall or placed on the ground. It will need plenty of space around it to get a good flow of air. • Is your home well insulated? • What type of heating system do you want? Air source heat pumps are much better at powering underfloor heating systems or warm air heating than radiator-based systems	Up **to 5 tonnes** of CO_2 and **£700** per year for a system that replaces an electric heating system.The system does not produce considerable savings when replacing a gas or oil based system.	Costs for installing a typical system suitable for a detached home range from about **£5,000 to £9,000** including installation. Running costs for space heating and hot water for washing are likely to be around £790 per year. Grant available under the Low Carbon Building Program	• Reduce your fuel bills • Cut down on wasted electricity: heating your home with an air source heat pump is much more efficient than using electric radiators

Assumptions:
1. Some of these technologies could require planning permission, for example in listed buildings or in a Conservation Area
2. Savings based on a period of one year for a 3-bed semi-detached home
3. PV savings assume a grant of £2,500 and an annual electricity consumption of 3,300kwh for a typical 3 bed semi-detached home, using a polycrystalline model
4. PVT savings are based on the hot water heating requirements of a 3 bed semi detached home with a 4m2 panel. 2.5p/kWh and 0.19kg CO2/kWh are assumed.

References: www.energysavingtrust.org.uk, www.bwea.com, www.south-facing.co.uk, www.cse.org.uk, www.alternenergy.co.uk, www.inkarenewableenergy.com, DECC Householders project case study on solar thermal hot water, www.stroud.gov.uk, www.downwithco2.co.uk, www.groundtherm.co.uk, http://www.centralheating.co.uk/checklists/buying-a-new-system/renewable-heating/installing-a-heat-pump/how-heat-pumps-work,

Low Cost Technologies
Medium cost Technologies
High Cost Technologies

Grants and Schemes to Promote Energy Efficiency and Carbon Reduction

National Grants

1. *Low Carbon Buildings Programme*

Grants are available for solar thermal hot water, ground source heat pumps, air source heat pumps, wood fuelled heating (biomass); renewable CHP, micro CHP and fuel cells may also qualify for funding once certified installers and products become available. Funding is limited up to a maximum of £2,500 per household depending on technologies involved and to one grant per technology type. The grant runs until June 2010.

2. *Carbon Emissions Reduction Target (CERT)*

The Carbon Emissions Reduction Target (CERT) (2008 – 2011) obligates all domestic energy suppliers with a customer base in excess of 50,000 customers to make savings in the amount of CO_2 emitted by householders. Residents can contact their local utilities provider to avail of grants towards improving energy efficiency.

3. *Landlord's Energy Saving Allowance (LESA)*

LESA is a tax allowance (not a cash payment) that allows landlords to claim up to £1,500 against tax every year. This allowance can be claimed for properties rented out in the UK and abroad. LESA can be claimed for the costs of buying and installing certain energy saving products for properties rented out, but only for what is actually spent. LESA can be claimed for expenses on cavity wall and loft insulation; solid wall insulation; draught proofing and hot water system insulation; floor insulation. LESA can be claimed up to 1 April 2015, when the availability of this allowance will end.

Regional Grants

1. *London Warm Zone Grant*

Free loft and cavity wall insulation is available to those over 70 or on income or disability benefits. Large discounts on insulation are offered to all other homeowners or private tenants and those on certain benefits can also get heating grants. The grant ends 31/3/2011

2. *Home Repair and Improvement Grant*

Help towards installing energy efficiency measures is generally available through local authority grants for home repairs and improvements. Eligibility criteria and details vary among Councils. The scheme ends 31/3/2011

3. *Mayor of London's DIY insulation offer*

Provided by British Gas, the grant offers DIY loft insulation (100mm depth) for £99, with a £50 cash back offer once delivered and payment has been received. The grant is available to London residents only.

Redbridge-specific Local Grants

1. *Redbridge Energy Services*

A dedicated phone line for Redbridge residents to provide free, impartial and independent energy efficiency advice on energy saving measures to reduce residential fuel bills. Ph:02084781318

2. *Repair Grants*

Grants are available for houses which are cold and damp and do not have space heating or insulation, for occupier of 60 years and over or private tenants on income support or equivalent.

3. *New Block Insulation*

Redbridge Homes have secured a £1.575 million grant from the Homes and Communities Agency (HCA) to insulate medium and high-rise blocks for Council tenants

4. *Grants provided by local energy suppliers*

EDF's offer for loft and cavity wall insulation is an example of energy efficiency schemes offered by utility companies in the UK.

- EDF offers loft and cavity wall insulation at £199 per installation.
- Npower offers a similar scheme for £149.
- British Gas offers loft insulation for various-sized home for £198 in partnership with DIY retailer B&Q.

5. *Greener Homes for Redbridge*

The scheme, funded by the HCA, LBR and the NHBC Foundation, is being run by East Thames Group in partnership with Redbridge Council, housing contractor Wates Living Space, BRE and construction consultancy Pellings. The project is addressing water and energy efficiency via 20 street properties in Redbridge, which will act as case studies to showcase a variety of energy and water efficiency and renewable energy technologies

Resident's Step by Step Guide to Implementing Energy Savings Measures

Implementing energy efficiency measures

Step One: Easy wins

Implement the following before deciding on which of the more costly options are suitable:

1. Preferably set thermostat at 21 deg C or lower. Water cylinder thermostat should be set at 60 deg C
2. Close curtains at dusk and draught proof windows and doors
3. Always turn off the lights when you leave the room
4. Don't leave appliances on standby
5. If possible, completely fill up the washing machine, tumble dryer or dishwasher before activating cycle
6. Only boil as much water as you need
7. Fix leaking taps
8. Use energy saving light bulbs
9. If possible, compost organic waste

Step Two: Free advice

For free, independent and local energy saving advice call the Energy Saving Trust on 0800 512 012

Step Three: Energy Audit

Carry out an online energy audit on the Energy Saving Trust Website* which will generate an approximate estimation of your energy use and potential for reduction through various energy efficiency measures. A professional auditor may be employed for more accurate results.

*http://www.energysavingtrust.org.uk/proxy/view/full/165/homeenergycheck

Step Four: Budgeting

Decide on your budget for retrofitting keeping in mind the resulting energy savings and the various grants you may be eligible for

Step Five: Grants

Determine your eligibility for various grants and schemes offered by local authorities and central government through the section above, supplemented by online research.

Check online for latest deals from your energy supplier. Contact your energy supplier and local authority for latest grants available.

Step Six: Obtain a free quote

Obtain a free quote on various energy efficiency measures including glazing, loft and cavity wall insulation and solar energy through websites such as www.quotatis.co.uk, http://www.uk-energy-saving.com/double_glazing.html

Find local insulation installers in your area on the energy saving trust website* and compare quotes for various retrofitting measures

*http://www.energysavingtrust.org.uk/Home-improvements-and-products/Home-insulation-glazing

Step Seven: Higher cost energy efficiency measures

Carry out the following, ranked in order of giving the biggest cuts in household bills and carbon emissions for the lowest cost

1. Replacement of old boiler with A rated boiler with heating controls saves around £230 per year and 1,259kg CO2 per year depending on usage
2. External and cavity wall insulation (33% heat loss takes place through walls based on an uninsulated home; insulation can save around £150 and 799kg CO_2 per year)
3. Loft insulation (270mm) (26% heat loss takes place through walls based on an uninsulated home; insulation can save around £190 and 1039kg CO_2 per year)
4. floor insulation (8% heat loss takes place through walls based on an uninsulated home)
5. Double glazing (replacing all single glazing with C-rated energy saving recommended double glazing; 18% heat loss takes place through windows in an uninsulated home; insulation can save around £130 and 712kg CO_2 per year)
6. Hot water Tank insulation (75mm) can save £50 per year and upto 250kg CO_2
7. Pipe insulation can save around £10 per year

Consideration of Renewable energy technologies following implementation of energy efficiency measures

Step Eight: Check your energy efficiency measures

Ensure energy efficiency has been optimised in your house, before deciding on whether renewable energy technologies are required. The reduction in heating demand from implementing energy efficiency measures will reduce the requirement for renewable energy generation

Step Nine: Gathering information

Talk to appropriate organisations to determine the availability of grants and support schemes for your situation, including schemes such as 'pay as you save' and 'feed in tariffs'. From 1 April householders who install low carbon electricity technology such as PV panels and wind turbines will be paid for the electricity they generate, even if they use it themselves. The level of payment depends on the technology and is linked to inflation.

Further information can be found on www.decc.gov.uk

Step Ten : Identify An appropriate technology

This may involve talking to suppliers, the local authority, and your own research and knowledge of local conditions to determine the most appropriate energy saving technology for you.

Step Eleven: Check legislative requirements

Determine whether the extent of your planned works require a planning application by contacting the Council's Building Control or Planning Teams. Up-to-date contact details can be found on www.redbridge.gov.uk

Step Twelve: Budgeting

Determine your budget keeping in mind potential payback period for technology and incentives such as 'feed in tariffs'.

Step Thirteen: Obtain quotes and select a supplier for installation

Research local suppliers and installers online and give them a call to obtain quotes. Check that suppliers are certified - either with the Micro generation Certification Scheme (for all UK micro generation products and installers) or the Solar Keymark (Solar thermal products and installers across Europe).

APPENDIX B : Strategic Sites and Phasings

APPENDIX B.1 : Sites with development potential within Ilford Town Centre

Phasing Periods **Period 1: Up to 2010** **Period 2: 2011-2016** **Period 3: 2017+**

Ref.	Name/Address	Area (ha)	Existing Use	Preferred Use	Phasing Period	Development Potential
Sites in Ilford Town Centre allocated by the *Development Sites with Housing Capacity* Development Plan Document						
CW09	Former Pioneer Market.	0.23	Former market site.	Ground and first floor retail/commercial Residential above	1	Up to 264 units
CW11	226-244 High Road.	0.14	Ground floor retail with office above.	Ground floor retail with residential above	1	Up to 38 units
LO05	Peachy House.	0.59	Offices.	Mixed office/residential	1	Up to 223 units
LO06	Sainsbury's.	1.96	Supermarket	Supermarket with residential	1	Up to 180 units
LO08	Victor Wharf.	0.10	Paper Mill	Residential	1	Up to 32 units
LO09	73-77 Ilford Hill.	0.02	Ground floor retail with residential above.	Ground floor retail with residential above	1	Up to 16 units
LO18	Ilford Wharf.	0.25	Industrial buildings	Residential	1	Up to 73 units
VA01	Coventry Road.	0.08	Garages.	Residential	1	Up to 4 units
VA13	51-71 Cranbrook Road	0.35	Ground floor retail with office above.	Ground floor retail with residential above.	1	Up to 45 units
VA14	Mansfield Road.	0.11	Residential.	Residential	1	Up to 6 units
Sites in Ilford Town Centre allocated by this Area Action Plan						
OS01	Land between Mill Road and the Railway Line.	0.30	Car Park.	Residential	1	Up to 90 units
OS02	Mill House.	1.04	BT offices, depot and car parking.	Employment/commercial Ground floor mixed-use Upper floor residential	3	Up to 26,500 m^2 Up to 1,150 m^2 Up to 110 units

Ref.	Name/Address	Area (ha)	Existing Use	Preferred Use	Phasing Period	Development Potential
OS03	51-85 Ilford Hill and 1-27 Cranbrook Road.	0.90	Office buildings, public house and Ilford Station.	Employment/commercial Ground floor mixed-use Upper floor residential New station building and public square	1	Up to 1,000 m² Up to 3,270 m² Up to 370 units
OS04	60-70 Roden Street and land between Chapel Road and Roden Street.	0.70	Britannia Music warehouse/offices/depot.	Employment/commercial Ground floor mixed-use Upper floor residential	1	Up to 4,500 m² Up to 2,500 m² Up to 330 units
OS05	40 Ilford Hill.	0.29	Former police station and car park.	Ground floor mixed-use Upper floor residential	1	Up to 1,500 m² Up to 85 units
OS06	22-32 Chapel Road.	0.06	Public toilets and retail outlets with residential above.	Ground floor mixed-use Upper floor residential	1	Up to 450 m² Up to 20 units
OS07	Land adjacent to Cranbrook Road, High Road and the railway, incorporating Station Road.	0.80	Retail/finance/food outlets with offices on upper floors.	Ground floor retail Upper floor residential	2	Up to 8,150 m² Up to 465 units
OS08	Site bounded by Chapel Road, High Road and Clements Lane.	0.69	Ground floor retail, office above, servicing and car parking.	Ground floor retail Upper floor residential	2	Up to 6,230 m² Up to 270 units
OS09	Land adjacent to Clements Lane and Clements Road.	0.24	Offices with retail at ground floor, car park, hotel.	Ground floor retail Upper floor residential	2	Up to 2,400 m² Up to 95 units
OS10	Britannia car park.	0.20	Multi-storey car park.	Car parking retained/reprovided on site Additional residential	2	Up to 50 units
OS11	Land bounded by Clements Road, Chadwick Road and Postway Mews.	0.77	Royal Mail sorting office, depot, retail outlets and Church.	Ground floor retail Upper floor residential	2	Up to 6,000 m² Up to 175 units
OS12	112-114 High Road.	0.20	Retail outlets with offices above.	Ground floor retail Upper floor residential New town square	1	Up to 1,000 m² Up to 30 units
OS13	Town Hall car park.	0.78	Private car park and small retail units.	Ground floor retail Upper floor residential New civic space (Unity Square) New theatre	1	Up to 2,095 m² Up to 270 units
Ref.	**Name/Address**	**Area (ha)**	**Existing Use**	**Preferred Use**	**Phasing Period**	**Development Potential**
OS14	Library service yard.	0.05	Service yard.	Residential	1	Up to 25 units
OS15	Kenneth More Theatre.	0.78	Theatre, theatre store and warehouses.	Ground floor mixed-use Residential	1	Up to 850 m² Up to 200 units
OS16	187-207 High Road	0.70	Retail units with offices above.	Ground floor retail Residential	2	Up to 5,000 m² Up to 150 units
OS17	Exchange shopping centre car park.	0.50	Multi-storey car park.	New floor of mixed-use	1	5,000 m²
OS18	69-126 Ley Street and Opal Mews.	0.76	Terrace houses, vacant retail units.	Employment/commercial Ground floor mixed-use Residential	2	Up to 4,000 m² Up to 2,000 m² Up to 230 units
OS19	Ley Street car park and bus depot.	0.80	Multi-storey car park and bus depot.	Reprovide car parking Ground floor mixed-use Residential	2	Up to 500 m² Up to 270 units
OS20	Rear of Lynton House.	0.20	Servicing and car parking.	Extension to Council offices	1	8,000 m²
OS21	Former Jumpin Jacks and land to the south.	0.43	Vacant buildings and derelict land.	Ground floor mixed-use Residential	1	Up to 2,000 m² Up to 225 units
OS22	262-268 High Road.	0.13	Public toilets and retail units.	Ground floor mixed-use Residential	3	Up to 800 m² Up to 85 units
OS23	Land to the south of Winston Way roundabout.	0.50	Vacant land/buffer strip.	Ground floor community use Residential above	1	Up to 1,000 m² Up to 50 units
OS24	300-318 High Road	0.27	Restaurant	Ground floor mixed-use Residential	1	Up to 900 m² Up to 65 units
OS25	Redbridge Enterprise and Ilford Retail Park.	3.10	Retail units, employment units and residential.	Reprovide/new employment space Ground floor mixed use Residential	3	Up to 8,000 m² Up to 3,000 m² Up to 600 units

APPENDIX B.2: Redbridge Borough wide phasings

Redbridge Borough	2010-2013	2014-2016	2017-2019	2019+
Numbers of net new Residential properties	3384	3520	1593	765
m2 of net new Residential properties	243648	253440	114696	55080
Numbers of net new Non residential properties				
m2 of net new Non residential properties	50640	73060	53145	13000

(Assumed residential floor space average - 72 sqm per dwelling)[99]

[99] Information provided by Redbridge Council, dated 21st April 2010

Appendix B.3: Indicative Phasing for Strategic Sites in Redbridge

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
2010 - 2013		**Ilford Town Centre (Area Action Plan)**				
	CW09	Former Pioneer Market	Under construction	294 units	4300 sqm retail and 1700 sqm commercial (office or community use)	
	CW11	226-244 High Road	Approval Pending	101 units	400 sqm retail and 1900 sqm commercial (office or hotel)	
	VA13	51-71 Cranbrook Road	Approval granted	45 units		
	OS4	Britannia Music (60-70 Roden Street and land between Chapel Road / Roden Street)	Approval pending	330 units	700 sqm retail and 2500 sqm commercial	
	OS5	40 Ilford Hill	Proposed	85 units	1500 sqm retail / commercial	
	OS6	22-32 Chapel Road	Proposed	20 units	450 sqm retail / commercial	
	OS12	112-114 High Road	Proposed	30 units	1000 sqm retail	
	OS14	Library Service Yard	Proposed	25 units		
	OS16	187-207 High Road	Pre-application	150 units	5000 sqm retail	
	OS22	262-268 High Road	Proposed	85 units	800 sqm mixed use	
	OS24	300-318 High Road	Proposed	65 units	900 sqm mixed use	
		Total		1230 units	21 150 sqm	
		Gants Hill				
	CR03	Bramley Crescent	Under construction	122 units		
	NE11	Odeon Site	Under construction	47 units (balance)		
	Site A	Wentworth House	Proposed	65 units		Existing office building

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
	Site D	Montrose House	Proposed	35 units		Existing office building
		Total		269 units		
		Crossrail Corridor				
	CH01	Chadwell Heath Service Station (1023 High Road, Chadwell Heath)	Approved	8 units		
	CH06	Water Company Site, Gresham Drive, Chadwell Heath	Approved	4 units		
	CH07	Polygram Building, Unit 1 Clyde Works, Grove Road, Chadwell Heath	Proposed	26 units		
	CH10	Car Park junction of Wangey Road / Cedar Gardens, Chadwell Heath	Proposed	10 units		
	CW03	395-405 High Road, Ilford	Proposed	7 units		
	CW07	561A High Road, Ilford	Proposed	18 units		
	CW13	1-3 Pelham Road, Ilford	Approved	4 units		
	CW16	461 High Road, Ilford	Proposed	22 units	250 sqm retail	
	CW20	225-227 Green Lane, Ilford	Proposed	17 units		
	GM01	569 High Road, Seven Kings	Approved	7 units		
	GM07	56-64 Goodmayes Road, Goodmayes	Proposed	12 units	250 sqm retail	
	CCOS17	519 Green Lane, Goodmayes	Proposed	9 units		
	CCOS31	679 High Road, Seven Kings	Proposed		100 sqm library	
	CCOS14	Grove Farm, rear of 951-1009 High Road, Chadwell Heath	Proposed	130 units	1400 sqm + retail, community, business	
	CCOS15	Chadwell Heath (Grove Farm) Retail Park, High Road, Chadwell Heath	Proposed	75 units	500 sqm business	
	CCOS24	Hinds Head PH, 2A Burnside Road and 76-80 Valance Avenue, Chadwell Heath	Proposed	7 units	100 sqm retail	
	CCOS25	75 - 85 Grove Road, Romford, RM6	Proposed	10 units	150 sqm business	

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
	CCOS02	531-549 High Road, Ilford	Pre-application	122 units	1000 sqm retail, community, business, leisure	
		Totals		488 units	3750 sqm	
		Goodmayes (Hospitals / College)				
	CCOS26	Goodmayes Hospital, Barley Lane, Goodmayes	Proposed	120 units	1500 sqm health / education	
	CCOS27	King George Hospital, Barley Lane, Goodmayes	Proposed		3600+ sqm Polyclinic	
		Totals		120 units	5100 sqm	
		Five Oaks Lane				
	HA09	Five Oaks Lane	Approved	425 units		Potential to seek a new planning permission.
		Totals		425 units		

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
2014-2016		**Ilford Town Centre (Area Action Plan)**				
	LO06	Sainsburys	Proposed	180 units	3000 sqm retail (supermarket)	
	LO09	73-77 Ilford Hill	Proposed	18 units	100 sqm retail	
	OS03	51-85 Ilford Hill and 1-27 Cranbrook Road	Proposed	370 units	1000 sqm employment / commercial 3270 sqm retail	
	OS07	Land adjacent to Cranbrook Road, High Road,	Proposed	465 units	8150 sqm ground floor retail	
	OS09	Land adjacent to Clements Lane and Clements Road	Proposed	95 units	2400 sqm ground floor retail	
	OS10	Britannia car park	Proposed	50 units		
	OS11	Land bound by Clements Road, Chadwick Road and Postway Mews	Proposed	175 units	6000 sqm ground floor retail	
	OS17	Exchange Shopping Centre Car Park	Proposed		5000 sqm mixed use (new floor)	
	OS19	Ley Street car park and bus depot	Proposed	270 units	500 sqm ground floor mixed	

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
					use	
	OS20	Rear of Lynton House	Proposed		8000 sqm office (extension to Council offices)	
		Totals		1623 units	37420 sqm	
		Gants Hill				
	Site B	Eastern Avenue Storage Buildings	Proposed	91 units	2500 sqm retail floor space (supermarket) – Site B or Site E	
	Site C	Commercial House	Proposed	37 units		Existing office building
	Site E	Car Showroom	Proposed	61 units	2500 sqm retail floor space (supermarket) – Site B or Site E	
		Totals		189 units	2500 sqm	
		Crossrail Corridor				
	CH08	8a Cedar Park Gardens	Proposed	2 units		
	SK06	Seven Kings Car Park and Lorry Park, High Road, Seven Kings	Proposed	109 units	750 sqm retail / community / business / leisure	
	CCOS03	Ilford Swimming Pool, Cricklefields, 468-488 High Road, Ilford	Proposed	82 units	1000+ sqm community, leisure	
	CCOS04	514-518 High Road, Ilford	Proposed	4 units	150 sqm business / retail	
	CCOS07	The Joker Public House, Cameron Road, Seven Kings	Proposed	8 units	75 sqm business / retail	
	CCOS08	Seven Kings Health Centre	Proposed	13 units	100 sqm community	
	CCOS09	Seven Kings Methodist Church and Hall, Balmoral Gardens, Seven Kings	Proposed	15 units	100 sqm community	
	CCOS16	Car Park and Works, corner of Cedar Park Gardens and Wangey Road, Chadwell Health	Proposed	29 units		
	CCOS19	55-61 Goodmayes Road, Goodmayes	Proposed	13 units	200 sqm retail	
	CCOS20	Telephone Exchange, Corner of Kingswood Road and High Road, Goodmayes	Proposed	14 units	1000 sqm business / health care	
	CCOS21	Corner of Wangey Road and Station	Proposed	8 units	150 sqm retail / community	

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
		Road, Chadwell Heath				
	CCOS29	36-48 Goodmayes Road, Goodmayes	Proposed	10 units	75 sqm retail	
	CCOS11	822 (Tesco) High Road, Goodmayes	Proposed	533 units	3000 sqm retail / healthcare	
	CCOS12	Goodmayes Retail Park, High Road, Goodmayes	Proposed		1000 sqm retail / business / healthcare	
		Totals		840 units	7600 sqm	
		Goodmayes (Hospitals / College)				
	CCOS28	Redbridge College, Little Heath, Goodmayes	Proposed	60 units	2500+ sqm education	
		Totals		60 units	2500 sqm	
		South Woodford				
	RO09	120 Chigwell Road, South Woodford (Charlie Browns Roundabout)	Proposed	106 units	5000 sqm commercial / community use	
	CE08	96 George Lane & 53-55 Marlborough Road, South Woodford	Proposed	41 units		
	CE01	Station Estate, off George Lane, South Woodford	Proposed	76 units	Potential mixed use.	
		Totals		223 units	5000 sqm	

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
2017-2019		**Ilford Town Centre (Area Action Plan)**				
	OS02	Mill House, Ilford Hill (BT Offices)	Proposed	110 units	26500 sqm employment / commercial 1150 sqm ground floor mixed use	
	OS08	Site bounded by Chapel Road, High Road and Clements Lane	Proposed	270 units	6330 sqm retail	
	OS13	Town Hall Car Park	Proposed	175 units	2095 sqm retail	
	OS15	Kenneth More Theatre	Proposed	244 units	850 sqm mixed use	
	OS18	62-126 Ley Street and Opal Mews	Proposed	230 units	4000 sqm employment / commercial 2000 sqm mixed use	
		Totals		1029 units	42925 sqm	
		Gants Hill				
	Site F	Woodford Avenue / Eastern Avenue	Proposed	117 units		

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
		Corner				
	Site G	Woodford Avenue / Cranbrook Road North	Proposed	75 units		
		Totals		192 units		
		Crossrail Corridor				
	GM08	83-85 Highbury Gardens, Goodmayes	Proposed	7 units		
	GM11	Car Park adj. To Chadwell Heath Stn, Chadwell Heath	Proposed	19 units		
	SK02	674-700 High Road, Seven Kings	Proposed	186 units	1000 sqm retail, community, business, healthcare	
	CCOS05	530-562 High Road, Ilford	Proposed	30 units	750 sqm business / healthcare	
	CCOS06	573-603 High Road, Ilford	Proposed	52 units	750 sqm business / healthcare	
	CCOS30	Ilford County Court, High Road, Ilford	Proposed	14 units	1000 sqm community / retail	
	CCOS18	Car Park rear of 39 Goodmayes Road, Goodmayes	Proposed	8 units		
	CCOS22	1145 (Alfa Romeo) High Road, Chadwell Heath	Proposed	15 units	1000 sqm retail / healthcare	
	CCOS23	1171 (Kia) High Road, Chadwell Heath	Proposed	12 units	420 sqm retail	
		Totals		343 units	4920 sqm	

Phase	Site Ref	Opportunity Site	Status	Residential	Other	Notes
2019 +		**Ilford Town Centre (Area Action Plan)**				
	OS25	Redbridge Enterprise and Ilford Retail Park	Proposed	600 units	8000 sqm commercial (re-provision) 3000 sqm mixed-use	
		Totals		600 units	11000 sqm	
		Crossrail Corridor				
	CCOS01	Redbridge Recycling Centre, rear of 407-409 High Road, Ilford	Proposed	28 units	750 sqm business	
	CCOS10	706 - 720 (Homebase) High Road, Seven Kings	Proposed	91 units	500 sqm retail	
	CCOS13	Metropolitan Police, 919 - 925 High Road, Chadwell Heath	Proposed	46 units	750 sqm business / healthcare / primary school	
		Totals				

APPENDIX C: Council owned properties with heat demands and OS data[100]

Postcode	Easting	Northing	ID	Building or site	Energy User	Category (for graphs)	Gross Internal Area (m²)	Energy type	Amount used (kWh)	Number of degree days	CO_2 emission (kg)	CO_2 emission (kg, weather corrected)
#N/A			189	GLASBURY HOUSE	Other	Other operational buildings	1,466	Gas oil	272,395	1,921	68,496	87,787
IG6 2EA	544507	190262	192	FULLWELL CROSS SWIMMING	Leisure Centre (Lrg Pool)	Other operational buildings	3,661	Natural gas	3,045,222	1,921	563,275	721,906
IG1 2UT	544939	185448	193	LOXFORD SCHOOL OF SCIENC	School - Secondary (with pool)	Schools	10,005	Natural gas	2,503,177	1,921	463,013	593,408
IG5 0QW	542915	190310	194	CATERHAM HIGH SCHOOL	School - Secondary (with pool)	Schools	13,659	Natural gas	2,412,681	1,921	446,274	571,955
IG2 6EA	543724	188052	195	LEY STREET DEPOT	Depot	Other operational buildings	13,192	Natural gas	2,135,226	1,921	394,953	506,181
IG8 7DQ	540912	191083	196	WOODBRIDGE HIGH SCHOOL	School - Secondary (no pool)	Schools	13,707	Natural gas	2,068,749	1,921	382,657	490,422
E11 2JZ	541203	188279	197	WANSTEAD HIGH SCHOOL(INC	School - Secondary (no pool)	Schools	14,432	Natural gas	1,567,313	1,921	289,906	371,550
IG6 3TN	546703	192240	198	HAINAULT FOREST HIGH	School - Secondary (no pool)	Schools	10,148	Natural gas	1,561,880	1,921	288,901	370,262
IG4 5LP	542242	189440	199	BEAL HIGH SCHOOL	School - Secondary (no pool)	Schools	11,664	Natural gas	1,535,618	1,921	284,043	364,037
IG2 7BT	544664	187577	200	SEVEN KINGS HIGH	School - Secondary (no pool)	Schools	9,761	Natural gas	1,524,305	1,921	281,951	361,355
IG2 7PQ	545026	188695	201	OAKS PARK HIGH SCHOOL	School - Secondary (no pool)	Schools	11,644	Natural gas	1,464,410	1,921	270,872	347,156
RM6 4RS	546883	188007	202	CHADWELL HEATH FOUNDATIO	School - Secondary (no pool)	Schools	13,552	Natural gas	1,385,378	1,921	256,253	328,421
RM8 1XS	547055	187095	203	MAYFIELD HIGH SCHOOL	School - Secondary (no pool)	Schools	9,562	Natural gas	1,378,092	1,921	254,906	326,693
IG3 8EU	545110	187232	204	CANON PALMER R.C. HIGH	School - Secondary (no pool)	Schools	11,203	Natural gas	1,346,775	1,921	249,113	319,269
IG6 3HA	544719	190495	205	KING SOLOMON HIGH SCHOOL	School - Secondary (no pool)	Schools	12,420	Natural gas	1,311,681	1,921	242,622	310,950
IG8 0TP	540024	192805	206	TRINITY HIGH SCHOOL (UPP	School - Secondary (no pool)	Schools	7,677	Natural gas	1,299,138	1,921	240,302	307,976
IG6 2JB	543973	190161	207	ILFORD COUNTY HIGH SCHOO	School - Secondary (with pool)	Schools	7,787	Natural gas	1,221,337	1,921	225,911	289,533
IG8 9LA	539868	191750	208	WOODFORD COUNTY HIGH SCH	School - Secondary (no pool)	Schools	8,177	Natural gas	1,049,863	1,921	194,193	248,883
IG1 1NH	544095	186655	209	TOWN HALL	Council - Town Halls	Other operational buildings	9,313	Natural gas	897,097	1,921	165,936	212,668
IG2 6HX	543321	188179	210	VALENTINES HIGH SCHOOL	School - Secondary (no pool)	Schools	11,236	Natural gas	891,647	1,921	164,928	211,376
IG3 8XS	546697	188876	211	NEWBRIDGE SCHOOL (BARLEY	School - Secondary (with pool)	Schools	2,552	Natural gas	821,049	1,921	151,869	194,640
IG1 4JU	543583	186898	212	ILFORD URSULINE HIGH SCH	School - Secondary (no pool)	Schools	5,967	Natural gas	785,535	1,921	145,300	186,221
IG1 1NY	544144	186655	213	LYNTON HOUSE	Office - AirCon Standard type3	Other operational buildings	10,146	Natural gas	759,298	1,921	140,447	180,001
#N/A	#N/A	#N/A	214	SOUTH WOODFORD LIBRARY/C	Other	Other operational buildings	1,242	Natural gas	758,953	1,921	140,384	179,919
IG8 0TB	540216	192545	215	TRINITY HIGH SCHOOL (LOW	School - Secondary (no pool)	Schools	5,529	Natural gas	712,862	1,921	131,858	168,993
IG8 7JQ	541627	191783	216	RAY LODGE PRIMARY	School - Primary (no pool)	Schools	5,082	Natural gas	702,827	1,921	130,002	166,614
IG7 4BX	545679	192082	217	MANFORD PRIMARY SCHOOL	School - Primary (no pool)	Schools	3,822	Natural gas	669,732	1,921	123,880	158,768
E18 2RB	540492	190774	218	CHURCHFIELDS JUNIOR & DR	School - Primary (no pool)	Schools	1,083	Natural gas	661,722	1,921	122,399	156,869
IG3 9AR	545116	185566	219	NEWBRIDGE SCHOOL (LOXFO	School - Secondary (with pool)	Schools	2,081	Natural gas	645,602	1,921	119,417	153,048
#N/A	#N/A	#N/A	220	HYLEFORD OLD PEOPLES HOM	Council - Care Homes	Other operational buildings	1,676	Natural gas	626,844	1,921	115,947	148,601
IG2 6RG	543786	188884	221	ST AUGUSTINES R.C. PRIMA	School - Primary (no pool)	Schools	2,505	Natural gas	625,289	1,921	115,660	148,232
IG2 7LB	544526	188383	222	NEWBURY PARK PRIMARY (IN	School - Primary (no pool)	Schools	4,408	Natural gas	618,002	1,921	114,312	146,505
#N/A	#N/A	#N/A	223	CLEVELAND SCHOOL (INF &	School - Primary (no pool)	Schools	4,284	Natural gas	613,412	1,921	113,463	145,417
IG5 0DB	543057	189755	224	PARKHILL SCHOOLS (INF &	School - Primary (no pool)	Schools	3,611	Natural gas	597,769	1,921	110,569	141,708
IG2 6TF	543520	188785	225	GEARIES INFANTS & JUNIOR	School - Primary (no pool)	Schools	2,971	Natural gas	593,523	1,921	109,784	140,702
E11 2TA	540115	188133	226	OUR LADY OF LOURDES R.C.	School - Primary (no pool)	Schools	2,175	Natural gas	572,223	1,921	105,844	135,652
IG6 2LJ	544261	190979	227	NEW RUSH HALL SCHOOL (IN	School - Secondary (no pool)	Schools	1,766	Natural gas	571,571	1,921	105,723	135,498
IG3 9PX	546235	186343	228	MAYESPARK PRIMARY SCHOOL	School - Primary (no pool)	Schools	4,380	Natural gas	570,608	1,921	105,545	135,269
IG8 8NP	542424	191453	229	RODING PRIMARY SCHOOL	School - Primary (no pool)	Schools	3,479	Natural gas	537,331	1,921	99,390	127,381
IG2 7RZ	545723	188822	230	WILLIAM TORBITT INF & JU	School - Primary (no pool)	Schools	4,045	Natural gas	521,155	1,921	96,398	123,546
#N/A	#N/A	#N/A	231	CENTRAL LENDING LIBRARY	Council - Libraries	Other operational buildings	6,318	Natural gas	519,983	1,921	96,181	123,268
IG6 1LZ	544753	189677	232	ILFORD JEWISH PRIMARY SC	School - Primary (no pool)	Schools	3,278	Natural gas	517,668	1,921	95,753	122,719
IG4 5HW	542227	188856	233	REDBRIDGE JUNIOR SCHOOL	School - Primary (no pool)	Schools	2,423	Natural gas	501,776	1,921	92,814	118,952
#N/A	#N/A	#N/A	234	UPHALL PRIMARY (INC THE	School - Primary (no pool)	Schools	4,030	Natural gas	496,459	1,921	91,830	117,692
IG1 3JB	542735	187530	235	CRANBROOK PRIMARY SCHOOL	School - Primary (no pool)	Schools	5,818	Natural gas	489,390	1,921	90,522	116,016
IG5 0TL	543403	190506	236	GILBERT COLVIN PRIMARY S	School - Primary (no pool)	Schools	2,483	Natural gas	486,374	1,921	89,965	115,301
RM6 4RJ	546605	187764	237	BARLEY LANE PRIMARY SCHO	School - Primary (no pool)	Schools	3,204	Natural gas	478,982	1,921	88,597	113,548
E12 5HL	541281	187022	238	ALDERSBROOK PRIMARY SCHO	School - Primary (no pool)	Schools	2,563	Natural gas	461,975	1,921	85,452	109,517
E11 2DB	541077	541077	239	WANSTEAD YOUTH CNTR(NIGH	Other	Other operational buildings	1,459	Natural gas	455,363	1,921	84,228	107,949
IG7 4AL	546489	192502	240	COPPICE PRIMARY SCHOOL	School - Primary (no pool)	Schools	2,970	Natural gas	447,552	1,921	82,784	106,098
RM6 5RX	546921	189297	241	LITTLE HEATH SCHOOL	School - Secondary (no pool)	Schools	2,074	Natural gas	445,409	1,921	82,387	105,590
E18 1JU	540805	190190	242	OAKDALE INFANTS SCHOOL	School - Primary (no pool)	Schools	1,432	Natural gas	418,732	1,921	77,453	99,265
IG3 9HF	545504	186420	243	SOUTH PARK PRIMARY (INF,	School - Primary (no pool)	Schools	3,851	Natural gas	416,064	1,921	76,959	98,633
E18 1PL	540945	189327	244	NIGHTINGALE PRIMARY	School - Primary (no pool)	Schools	3,028	Natural gas	415,951	1,921	76,938	98,606
#N/A	#N/A	#N/A	245	FAIRLOP COUNTRY PARK	Leisure Centre (Dry)	Community Assets	-	Natural gas	395,098	1,921	73,081	93,663
IG6 2LH	544192	191047	246	FAIRLOP PRIMARY SCHOOL	School - Primary (no pool)	Schools	3,604	Natural gas	394,209	1,921	72,917	93,452
IG1 1SP	544706	186346	247	SS PETER & PAULS R.C. PR	School - Primary (no pool)	Schools	2,418	Natural gas	389,431	1,921	72,033	92,319
IG2 6TB	543553	188678	248	REDBRIDGE INSTITUTE OF A	Other	Other operational buildings	3,067	Natural gas	378,780	1,921	70,063	89,794
E18 1JX	540893	190154	249	OAKDALE JUNIOR SCHOOL	School - Primary (no pool)	Schools	2,061	Natural gas	373,253	1,921	69,041	88,484
#N/A	#N/A	#N/A	250	CHADWELL CENTRE	Day Centre	Other operational buildings	1,751	Natural gas	370,149	1,921	68,466	87,748
#N/A	#N/A	#N/A	251	DANE TEACHERS CENTRE	Other	Other operational buildings	2,719	Natural gas	364,447	1,921	67,412	86,397
IG1 3LF	542581	187342	252	HIGHLANDS SCHOOL (INF &	School - Primary (no pool)	Schools	3,639	Natural gas	362,153	1,921	66,987	85,853
IG3 9RW	546708	187076	253	GOODMAYES PRIMARY (INF &	School - Primary (no pool)	Schools	2,873	Natural gas	360,004	1,921	66,590	85,343
IG5 0PF	542473	190341	254	GLADE PRIMARY SCHOOL	School - Primary (no pool)	Schools	2,185	Natural gas	355,411	1,921	65,740	84,254
IG6 3EE	546178	191746	255	JOHN BRAMSTON PRIMARY SC	School - Primary (no pool)	Schools	2,266	Natural gas	353,066	1,921	65,307	83,699
IG1 4LQ	544022	187133	256	CHRISTCHURCH SCHOOL	School - Primary (no pool)	Schools	4,209	Natural gas	350,032	1,921	64,745	82,979
#N/A	#N/A	#N/A	257	KENNETH MORE THEATRE	Other	Other operational buildings	1,880	Natural gas	340,539	1,921	62,989	80,729
#N/A	#N/A	#N/A	258	FULLWELL CROSS LIBRARY	Council - Libraries	Other operational buildings	1,128	Natural gas	338,358	1,921	62,586	80,212
#N/A	#N/A	#N/A	259	BROADWAY CHAMBERS	Office - No AirCon OpenPlan type2	Non operational Assets	1,365	Natural gas	324,589	1,921	60,039	76,948
#N/A	#N/A	#N/A	260	ASHTON PLAYING FIELDS	Leisure Centre (Dry)	Community Assets	1,067	Natural gas	323,135	1,921	59,770	76,603
#N/A	#N/A	#N/A	261	SIR JAMES HAWKEY HALL	Other	Community Assets	965	Natural gas	311,969	1,921	57,705	73,956
#N/A	#N/A	#N/A	262	ELDERBERRIES DAY CENTRE	Day Centre	Other operational buildings	565	Natural gas	311,645	1,921	57,645	73,879
RM6 4EU	547101	187672	263	CHADWELL PRIMARY SCHOOL	School - Primary (no pool)	Schools	2,419	Natural gas	307,637	1,921	56,904	72,929
IG6 1ER	544083	189336	264	FULLWOOD PRIMARY SCHOOL	School - Primary (no pool)	Schools	1,749	Natural gas	297,325	1,921	54,996	70,484
IG6 2JN	544180	190430	265	CLORE TIKVA SCHOOL	School - Primary (no pool)	Schools	1,881	Natural gas	296,088	1,921	54,767	70,191
E18 2RB	540492	190774	266	CHURCHFIELDS INFANTS	School - Primary (no pool)	Schools	1,623	Natural gas	295,242	1,921	54,611	69,991
IG6 2EW	544125	190103	267	MOSSFORD GREEN PRIMARY &	School - Primary (no pool)	Schools	1,827	Natural gas	285,626	1,921	52,832	67,711
IG1 4AS	544998	187388	268	ST AIDANS R.C. PRIMARY	School - Primary (no pool)	Schools	2,455	Natural gas	285,430	1,921	52,796	67,665
E18 2EN	540245	189405	269	SNARESBROOK PRIMARY	School - Primary (no pool)	Schools	2,059	Natural gas	284,272	1,921	52,582	67,390
IG3 8UY	546200	188029	270	FARNHAM GREEN PRIMARY SC	School - Primary (no pool)	Schools	2,386	Natural gas	282,318	1,921	52,220	66,927
#N/A	#N/A	#N/A	271	GANTS HILL LIBRARY	Council - Libraries	Other operational buildings	896	Natural gas	282,111	1,921	52,182	66,878
IG3 8UG	545380	187830	272	DOWNSHALL PRIMARY SCHOOL	School - Primary (no pool)	Schools	2,418	Natural gas	278,971	1,921	51,601	66,133
RM6 4XS	547031	188780	273	GROVE PRIMARY SCHOOL	School - Primary (no pool)	Schools	2,271	Natural gas	273,066	1,921	50,509	64,734
IG1 2RA	543630	186304	274	WINSTON WAY PRIMARY SCHO	School - Primary (no pool)	Schools	3,812	Natural gas	262,471	1,921	48,549	62,222
#N/A	#N/A	#N/A	275	CHILDREN LIVING AWAY FRO	Other	Other operational buildings	1,547	Natural gas	253,925	1,921	46,969	60,196
RM6 5RR	547472	188587	276	ST BEDES R.C. PRIMARY	School - Primary (no pool)	Schools	2,073	Natural gas	246,611	1,921	45,616	58,462
IG1 2PJ	544220	185133	277	WOODLANDS INF/JUN SCHOOL	School - Primary (no pool)	Schools	4,282	Natural gas	244,958	1,921	45,310	58,070
IG6 1JS	544175	189453	278	QUEEN VICTORIA HOUSE	Other	Other operational buildings	917	Natural gas	239,993	1,921	44,392	56,893
IG4 5HW	542227	188856	279	REDBRIDGE INFANTS & NURS	School - Primary (no pool)	Schools	1,652	Natural gas	234,098	1,921	43,301	55,496
IG8 0TX	540233	192756	280	ST ANTHONYS R.C. PRIMARY	School - Primary (no pool)	Schools	1,964	Natural gas	222,758	1,921	41,204	52,807
IG3 8HZ	545309	187803	281	DOWNSHALL CENTRE	Other	Other operational buildings	1,679	Natural gas	222,443	1,921	41,145	52,733
IG1 1HF	544274	185915	282	MILDMAY HOUSE	Day Centre	Other operational buildings	1,220	Natural gas	213,780	1,921	39,543	50,679
#N/A	#N/A	#N/A	283	THACKERAY DRIVE FAMILY C	Other	Other operational buildings	628	Natural gas	209,238	1,921	38,703	49,602
#N/A	#N/A	#N/A	284	WOODBINE CLUB HOUSE	Day Centre	Other operational buildings	408	Natural gas	207,515	1,921	38,384	49,194
E11 2SS	540310	188573	285	WANSTEAD C OF E PRIMARY	School - Primary (no pool)	Schools	1,354	Natural gas	203,292	1,921	37,603	48,193
IG8 0PP	540451	192758	286	WELLS PRIMARY	School - Primary (no pool)	Schools	1,712	Natural gas	194,605	1,921	35,996	46,133
IG1 2UT	544939	185448	287	LOXFORD YOUTH CENTRE	Other	Other operational buildings	598	Natural gas	193,413	1,921	35,776	45,851

[100] LBR NI185 spreadsheet

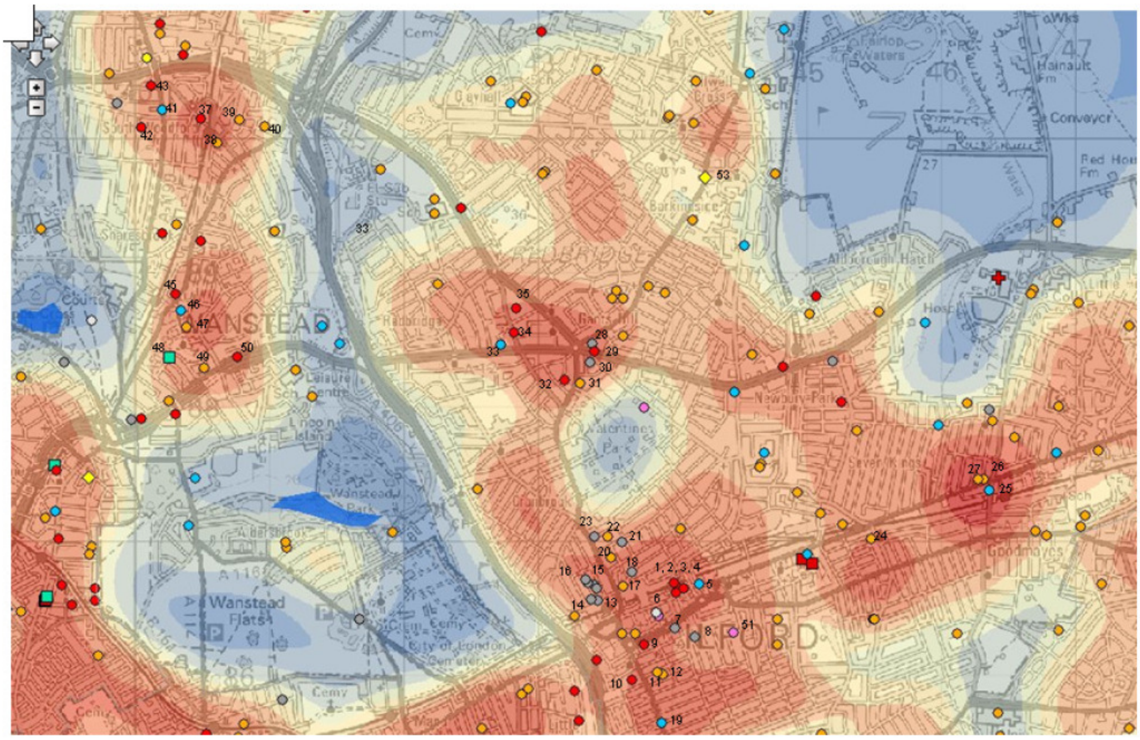
Appendix D: Heat Mapping Study Appendices

Appendix D.1: Index of developments in Redbridge with high heat demand

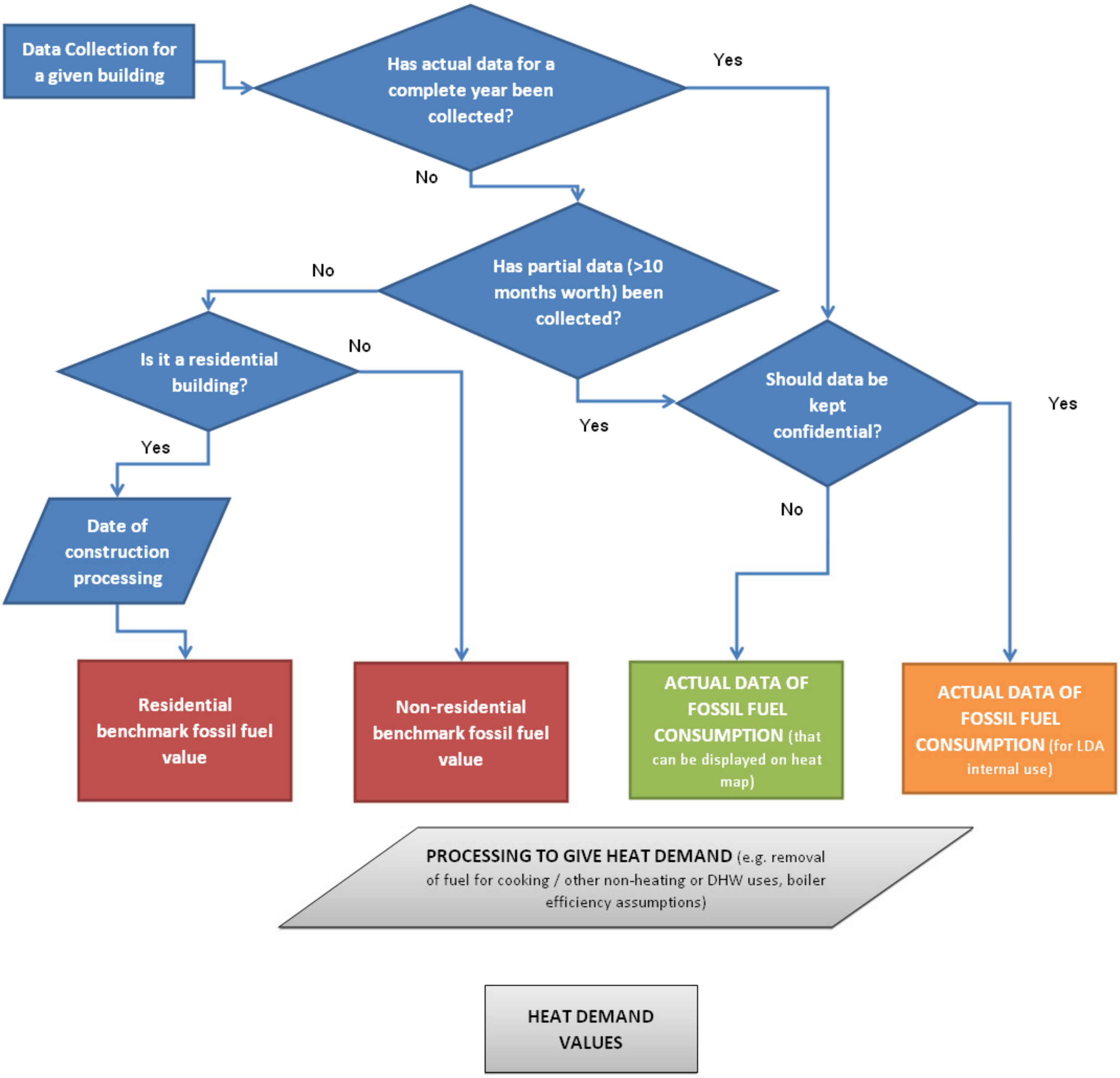
Index of developments with high heat demand

	Ilford Town centre		
1	Thamesview	centreway apartments	Multi residential
2	City view		Multi residential
3	Spectrum tower		Multi residential
4	Redbridge foyer	Flat 1 Sylvan road Ilford	Multi residential
5	Fitness First	261-275 High road Ilford IG11NJ	
6	LBR Town hall	High Road, IG11DD	Council Owned
7	Woodlands hotel	Woodlands road, Ilford IG11JJ	
8	Grosvenor hotel	Grosvenor road, IG11LB	
9	Null	1 Albert road, Oakfield lodge, Ilford IG11HJ	Multi residential
10	Null	1 fern ways, Ilford IG12EL	Multi residential
11	Cleveland junior school	IG11EN	Council Owned
12	Cleveland junior and infant school	IG11EN	
13	York hotel	York road, Ilford IG13AD	
14	Cedars hotel	Argyle road, Ilford IG13BH	
15	Ferndale hotel;	Mansfield road, IGI3BA	
16	Tudor rose hotel	Argyle road, Ilford IG13BQ	
17	Montessori School	IG14HP	
18	Balfour hotel	Balfour road, IG14HP	
19	New Physique fitness centre	233 Ilford lane IG12RZ	
20	Ursuline high school	IG14JU	
21	Cranbrook hotel	Coventry road, IG14QR	
22	Park school for girls	IG14RS	
23	Banks hotel	park avenue, IG14RS	
	Crossrail corridor		
24	Wenn stage school	IG38BY	
25	Goodmans health club	Goodmayes road IG39UN	
26	Maytime Montessori Nursery school	IG38XB	
27	Eastcourt independent school	IG38UW	

	Gants Hill		
28	St Georgio hotel Ltd	Cranbrook road IG26LL	
29	City gate house 399-425	Flat 81, Eastern avenue IG26LQ	Multi residential
30	Valentine Hotel	Perth road IG26BX	
31	Valentines high school	IG26HX	
32	Gabrielle house 332-336	45 Perth road IG26FF	Multi residential
33	Ilford cricket school	Beehive lane, IG45DR	
34	Home heather house	Flat 1, 128 beehive lane, IG45EF	Multi residential
35	Null	1 BEEHIVE lane, Limewood court, IG45EL	Multi residential
	Woodford		
37	Null	113 George lane, London E181AB	Multi residential
38	Victoria house special needs school	E181LW	
39	Oakdale infant school	E181JU	
40	Oakdale junior school	E181JX	
41	Hoypoxi sports and leisure	24 High road London E182QL	
42	Malford Court	Flat 12A The drive London E182HR	Multi residential
43	Regency Court 89-111	Flat 1 , high road, E182JT	Multi residential
	Wanstead		
45	Stavely Court	Flat 1 Herman Hill, E112BD	Multi residential
46	The complete Studio	15 High street, Wanstead, E112AA	
47	Wanstead Church school	E112SS	
48	Wanstead Police Station	Spratt Hall road, E112RQ	
49	Treehouse Nursery school	E112RH	Multi residential
50	Null	1 Gardner Close E112HN	Multi residential
51	Redbridge Town hall	High road, Ilford	Council Owned
	CHP SITES		
53	Fulwell cross swimming pool		



Appendix D.2: Heat Mapping Process Flow Diagram

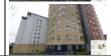
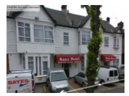
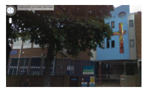


Appendix D.3: List of Stakeholders for Heat Mapping Study

Heat Mapping Study: List of Stakeholders

Contact 1: Phone call on 18/3/10 by PN, email addresses and contact names were obtained
Contact 2: Letters were sent out by post to Stakeholders on 25/3/10
Contact 3: Emails sent out to Stakeholders on 25/3/10
Contact 4: Phone calls on 7/4/10 and 8/4/10 with follow up emails on 8/4/10
Contact 5: Site visit by Adam Hickman on 14/4/10 & 15/4/10 followed by phone calls by PN on 15/4/10

Summary of Actions:

	Name	Address	Type of establishment	Phone	Email	Responses to Phone call on 7/4/10 by Priti Nigam	Responses to Site visits on 14/4/10 and 15/4/10 by Adam Hickman	Responses to follow up phone calls by Priti Nigam on 15/4/10	Number of floors based on Streetview	Pictures
			Ilford							
1	The Manager, Thamesview	Flat 66 Axon place centreway apartments Ilford IG11NB	Multi residential			No telephone number was found therefore telephone contact was not established. Letter has been sent by post to the Manager of the premises. Buildings appears to have 9 stories **ACTION:** Redbridge Council to establish contact locally			9	
2	City view		Multi residential			No telephone number or postal address were found therefore contact was not established. Buildings appears to have 11 stories based on Streetview **ACTION:** Redbridge Council to establish contact locally			11	
3	Spectrum tower		Multi residential			No telephone number or postal address were found therefore contact was not established. Buildings appears to have 11 stories based on Streetview **ACTION:** Redbridge Council to establish contact locally			11	
4	The Manager, Redbridge foyer	Flat 1 Sylvan road Ilford	Multi residential			No telephone number or postal address were found therefore contact was not established. Building appears to have 6 floors based on Streetview **ACTION:** Redbridge Council to establish contact locally	I was not able to speak to anyone who could complete the spreadsheet. It was suggested to speak to George Anastasi (020 8514 1952), however George is not available until tomorrow or Monday.		6	
5	Woodlands hotel	34-36 Woodlands road, Ilford IG11JJ	Hotel	020 8478 5445		The telephone number listed on the website is incorrect therefore contact has only been established through letter sent by post. Streetview illustrates that the hotel has approximately 10-20 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** Redbridge Council to establish contact locally			2	
6	Grosvenor hotel	Grosvenor road, Redbridge IG11LB	Hotel	02089244142		The telephone number listed on the website is incorrect therefore contact has only been established through letter sent by post. No picture was found on Streetview **ACTION:** Redbridge Council to establish contact locally, but this is a low priority building as it is likely the establishment is no longer in existence.				NO picture found
7	Ferndale hotel;	13 Mansfield road, Ilford IGI3BA	Hotel	020 8478 3625		The telephone number listed on the website is incorrect therefore contact has only been established through letter sent by post. Streetview illustrates that the hotel has approximately 10-20 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** Redbridge Council to establish contact locally	No answer when I knocked. The telephone number you have (which you mention is not correct) was the same number above the hotel door.		2	
8	Mr. Deep Banks hotel	7 Park Avenue Ilford, Essex IG1 4RS	Hotel	02085542515	info@bankshotel.com	Contact was not established with Mr Deep despite repeated calls, therefore it is presumed that he is not interested in the study. Contact was established via email and by post but no response was received. Streetview illustrates that the hotel has approximately 10-15 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** Redbridge Council to establish contact locally	Seemed interested and I went back twice but the relevant person to complete the form (the Manager) was unavailable.		2	
9	Ursuline high school	Morland Road Ilford IG1 4JU	Educational	020 8554 1995		No telephone contact was established despite repeated calls as the school appeared to be closed for the Easter break. Building appears to have 2 stories based on Streetview **ACTION:** Redbridge Council to establish contact locally			2	

Heat Mapping Study: List of Stakeholders

Contact 1: Phone call on 18/3/10 by PN, email addresses and contact names were obtained
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Summary of Actions:

	Name	Address	Type of establishment	Phone	Email	Responses to Phone call on 7/4/10 by Priti Nigam	Responses to Site visits on 14/4/10 and 15/4/10 by Adam Hickman	Responses to follow up phone calls by Priti Nigam on 15/4/10	Number of floors based on Streetview	Pictures
10	G Mussenden Park school for girls	20-22 Park Avenue Ilford IG1 4RS	Educational	020 8554 2466	gmussenden@parkschool.org.uk	Ms Mussenden had confirmed on 25/3/10 that she would be happy to help with the study, however she would be unable to provide any information until mid April. Telephone contact could not be established on 7/4/10 despite repeated calls, therefore a message was left on the answering machine. No response was received to the email or letter sent by post. **ACTION:** Redbridge Council to establish contact locally	Not open.		2	NO picture found
11	Fitness First	261-275 High road Ilford IG11NJ	Sports/leisure	020 8514 7666, 01202845000, **01202845920**	nickdent@fitnessfirst.com	Nick Dent at the head office was contacted via telephone and a follow up email was sent on 8/4/10 with details of the heat mapping letter. Nick has confirmed that he will try and send information over to SW by week ending 16/4/10. Nick was contacted again on 14/4/10, but he was not available. A message was left for him on his answering machine.			1-2	
12	LBR Town hall	255 - 259 High Road, Ilford, Essex, IG1 1NN	Council Owned			Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				
13	The Manager	1 Albert road, Oakfield lodge, Ilford IG11HJ	Council owned adult care home	020 8708 9221		Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				
14	The Manager	1 fern ways, Ilford IG12EL	Council owned adult care home	020 8708 9401		Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				
15	Cleveland junior school	IG11EN	Council Owned	020 8478 3601		Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				
16	Cleveland junior and infant school	IG11EN	Council owned			Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				
17	Mr Ikram, Cranbrook hotel	22-24 Coventry Road Ilford, Essex IG1 4QR	Hotel	02085546544	manager@expresslodging.co.uk	Contact was not established with Mr Ikram despite repeated calls, therefore it is presumed that he is not interested in the study. Contact was established via email and by post but no response was received. Streetview illustrates that the hotel has approximately 10-20 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** Redbridge Council to establish contact locally	The Manager does not have time at the moment to be part of the study.		2	
18	The Manager York hotel	8 York road, Ilford IG13AD	Hotel	02085141166	manager@expresslodging.co.uk	Shama at the hotel confirmed that Mr Ikram does not wish to participate in the study, as the hotel is closing down for refurbishment and will only reopen in 2-3 years. Streetview illustrates that the hotel has approximately 10 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** Redbridge Council to establish contact locally, but this is a low priority building as there appear to be approximately 10 rooms.	It seems as though the Manager of this hotel is the same as the Cranbrook Hotel, and therefore insufficient time to participate in the study.		2	
19	Harry Cedars hotel	1 Argyle Road Ilford IG1 3BH	Hotel	020 8478 2046, 02085543481		Contact was not established with Mr Deepu despite repeated calls, therefore it is presumed that he is not interested in the study. Contact was established via email and by post but no response was received. Streetview illustrates that the hotel has approximately 10-20 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** Redbridge Council to establish contact locally			2	

Heat Mapping Study: List of Stakeholders

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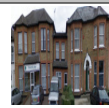
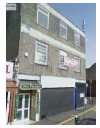
20	Mr Mann Tudor rose hotel	20 Argyle road, Ilford IG13BQ	Hotel	020 8478 7472	oakwoodlodge@btinternet.com	The Manager (Irene Luton) has confirmed that the energy bills are in the possession of the accountant and that these cannot be obtained for the study. Streetview illustrates that the hotel has approximately 10-20 rooms and therefore a higher heat demand than the Council's average 2-3 bed housing stock. **ACTION:** No action as energy bills are not available			2	
21	Balfour hotel	31 Balfour Road Ilford, Essex IG1 4HP	Hotel	02085143238		Telephone conversation with the Proprietor on 7/4/10 confirmed that he does not wish to take part in the study. Streetview illustrates that the hotel has approximately 5-7 rooms and is therefore unlikely to have a significant heat demand **ACTION:** No action			2	
22	Montessori School	7 Balfour Road, Ilford, IG1 4HP	Educational	020 8553 1886	info@balfournursery.com	Telephone conversation with the receptionist confirmed that Hovinder Dhaliwal, who is in change of energy bills and energy management of the premises, is on holiday until 27th April, and no one else is able to help in his absence. **ACTION**: No action as energy bills are not available within the timeframe of the Study				NO picture found
23	Ryan New Physique fitness centre	233 Ilford lane Ilford IG12RZ	Sports/leisure	020 8553 5572	newphysique@btconnect.com	Telephone conversation with the proprietor's son confirmed that the proprietor is ill and will not return within the timeframe of the Study (i.e. he will only be back in May). He confirmed that the annual electricity bill was around £2000 **ACTION:** No action			2	
		Crossrail corridor								
24	Wenn stage school	6-7 Seven Kings Rd Electric Pde, Ilford, IG38BY	Educational	020 8597 6033		No telephone contact was established despite repeated calls as the school appeared to be closed for the Easter break. **ACTION:** Redbridge Council to establish contact locally				Unsure about picture, seems quite big but hard to tell if building is a church or a school
25	Goodmans health club	16 Goodmayes road IG39UN	Sports/leisure	020 8599 8276		No telephone contact was established despite repeated calls, and no picture was found on Streetview **ACTION:** Redbridge Council to establish contact locally				NO picture found
26	Mrs J Mahoney Maytime Montessori Nursery school	2 Eastwood Road, Ilford, IG3 8XB	Educational	020 8599 3744	maytimenursery@yahoo.co.uk	Mrs Mahoney, who is responsible for energy bills, is out of town until 16/4/10 and no one else can provide assistance with the Study. Natasha, who answered the phone, confirmed that she would chase the matter with Mrs Mahoney upon her return. **ACTION:** No action at present			2	
27	Mrs Bishop Eastcourt independent school	1-5 Eastwood Road Ilford, Essex IG3 8UW	Educational	020 8590 5472	admin@eastcourt.org.uk	Jane Forbes has confirmed that she will attempt to provide SW with some information, but in the absence of Mrs Bishop, who will not return until 23/4/10, she cannot promise us energy bills. **ACTION:** No action at present			2	
		Gants Hill								

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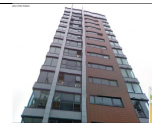
Summary of Actions:

	Name	Address	Type of establishment	Phone	Email	Responses to Phone call on 7/4/10 by Priti Nigam	Responses to Site visits on 14/4/10 and 15/4/10 by Adam Hickman	Responses to follow up phone calls by Priti Nigam on 15/4/10	Number of floors based on Streetview	Pictures
28	The Manager St Georgio hotel Ltd	454 Cranbrook Road Gants Hill, Ilford, Essex IG2 6LL	Hotel		info@stgeorgio.co.uk	A telephone call was received by the Manager at St Georgio hotel confirming that they would provide us with the required information. However, no response has been received and no telephone contact could be established. This is a fairly big hotel as viewed on Streetview. **ACTION:** Redbridge Council to establish contact locally	George, one of the Managers. They seem happy to participate and would like a phone call to run through completing the form over the phone. I did leave a form, but due to timeframes I would follow up with a phone call.	Christina (The Manager) has confirmed that she will send SW the data by 20/4/10	2 plus attic	This is a big hotel as viewed on Streetview. Minimum 127 rooms on street front, attic rooms included
29	Valentines high school	IG26HX	Educational	020 8554 3608		No telephone contact was established despite repeated calls as the school appeared to be closed for the Easter break. **ACTION:** Redbridge Council to establish contact locally			2	
30	Ilford cricket school	Beehive lane, IG45DR	Educational	020 8550 0041		Telephone contact was established after repeated calls, and PN was advised to contact Paul Shukla, the Manager, by email. He was not available for a telephone conversation. Email was sent on 8/4/10. **ACTION:** Redbridge Council to establish contact locally			1	NO picture found
31	The Manager - Peverell Retirement Home heather house	Flat 1, 128 beehive lane, IG45EF	Multi residential	0845 880 5560	homeheatherhouse.10234@peverell.co.uk	Contact was established with the Manager, Angela Smith, who will try and send SW information by Monday ACTION: No action at present			3	
32	The Manager - Peverell Retirement	1 BEEHIVE lane, Limewood court, IG45EL	Multi residential	0845 880 5560		Contact was established with the Manager, Angela Smith, who will try and send SW information by Monday ACTION: No action at present			2	
33	The Manager Gabrielle house 332-336	45 Perth road IG26FF	Multi residential - George Wimpey developers	012 7723 6800		No response	The office was closed, but I did get a phone number - 0845 688 1553. This is a very large development so definitely worth calling.	Two attempts to call George Wimpy Developments were made, relevant person could not be located.	10	
34	The Manager, City gate house 399-425	Fairview New Homes - developers Flat 81, Eastern avenue IG26LQ	Multi residential	020 8366 1271	kirk.achibald@fnhltd.co.uk	Kirk Archibald has confirmed that the building does not have a concierge, and it includes a refurbished block and a new block. Most units have individual boilers, and since units are billed separately, he has suggested we contact energy providers, or contact each occupant individually to obtain energy bills. He will provide us with SAP calculations for the dwellings which will provide an indication of floor areas and number of units. **ACTION:** No action at present			12	
			Woodford							
35	The Manager	113 George lane, London E181AB	Multi residential			No telephone number was found therefore telephone contact was not established. Letter has been sent by post to the Manager of the premises. **ACTION:** Redbridge Council to establish contact locally	No response			No picture found
36	The Manager- Tudorvale Properties Regency Court 89-111	Flat 1 , High road, E182JT	Multi residential	0207 554 4801		No telephone contact was established as number connected to a fax machine. Letters were sent by post. **ACTION:** Redbridge Council to establish contact locally	The person to speak to is John Willis, 07908 709303, who is available to speak tomorrow morning. This is also a very large development and definitely worth following up on	John Willis is unable to assist us with any details as he does not have any knowledge of the property. He has confirmed that all bills are individualised.	5	

Heat Mapping Study: List of Stakeholders

Contact 1: Phone call on 18/3/10 by PN, email addresses and contact names were obtained
Contact 2: Letters were sent out by post to Stakeholders on 25/3/10
Contact 3: Emails sent out to Stakeholders on 25/3/10
Contact 4: Phone calls on 7/4/10 and 8/4/10 with follow up emails on 8/4/10
Contact 5: Site visit by Adam Hickman on 14/4/10 & 15/4/10 followed by phone calls by PN on 15/4/10

Summary of Actions:

	Name	Address	Type of establishment	Phone	Email	Responses to Phone call on 7/4/10 by Priti Nigam	Responses to Site visits on 14/4/10 and 15/4/10 by Adam Hickman	Responses to follow up phone calls by Priti Nigam on 15/4/10	Number of floors based on Streetview	Pictures
37	Victoria house special needs school	62-64 George Lane, South Woodford, London E18 1LW	Educational			No telephone number was found therefore telephone contact was not established. Letter has been sent by post to the Manager of the premises. **ACTION:** Redbridge Council to establish contact locally				NO picture found
38	Oakdale infant school	E181JU	Educational	020 8532 9920						
39	Oakdale junior school	E181JX	Educational	020 8989 7471		No telephone contact was established despite repeated calls as the school appeared to be closed for the Easter break. **ACTION:** Redbridge Council to establish contact locally			2	
40	Sylvia Hypoxi sports and leisure	24 High road London E182QL	Sports/leisure	0208 989 2700	info@hypoxiwls.co.uk	Sylvia has confirmed that she will send us some information by 12/4/10. Sylvia was contacted again on 14/4/10, but she was away. A message was left for her **ACTION:** No action at present			2	
41	The Manager - Strettons Malford Court	Flat 12A London E182HR	Multi residential	0208 509 4423 , **02085094435**		Lenn Church, the Manager for the property has confirmed that the building has 102 units, mainly 1-2 bed, built in 1930's. No significant refurbishment has been carried out, and almost all units are heated by gas boilers, with a few units using electric heating. Since all tenants are billed separately, he could not provide any information on energy bills or on floor areas **ACTION:** No action at present				
			Wanstead							
42	The Manager Staveley Court	Flat 1 Herman Hill, E112BD	Multi residential			No telephone number was found therefore telephone contact was not established. Letter has been sent by post to the Manager of the premises. **ACTION:** Redbridge Council to establish contact locally	I could not speak to anyone but the Managers number is 020 8530 3947. This is a small development, so if there are time pressures I would prioritise others over this one.	No response to phone call.	2	No picture found, building in picture is only 2 storey
43	The Manager	1 Gardner Close E112HN	Multi residential			No telephone number was found therefore telephone contact was not established. Letter has been sent by post to the Manager of the premises. **ACTION:** Redbridge Council to establish contact locally	I spoke to the caretaker, who informed me Redbridge Homes manage this estate (Bukola Williams, 020 8708 7734). This is a large development.	No response to phone call.	5	
44	The complete Studio	15 High street, Wanstead, E112AA	Sports/leisure			No telephone number was found therefore telephone contact was not established. Letter has been sent by post to the Manager of the premises. The establishment could not be located on Streetview **ACTION:** Redbridge Council to establish contact locally	Phone number is 020 8532 2778. This is not a large sports / leisure centre, it is very small (similar size to the shops along the High Street), so if there are time pressures this is probably not a priority.	No response to phone call.	1	NO picture found
45	Wanstead Church school	Church Path London E11 2SS	Educational	020 8989 6001		No telephone contact was established despite repeated calls as the school appeared to be closed for the Easter break. **ACTION:** Redbridge Council to establish contact locally			2	
46	Treehouse Nursery school	35 Woodbine Place London E11 2RH	Educational	020 8532 2535		No telephone contact was established despite repeated calls as the school appeared to be closed for the Easter break. **ACTION:** Redbridge Council to establish contact locally				NO picture found
47	Wanstead Police Station	Spratt Hall road, E112RQ	Council owned			Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				
48	Redbridge Town hall	High road, Ilford	Council Owned			Information for this premises has already been provided to SW by the Council **ACTION**: SW to consolidate data, no action from Redbridge Council				

Appendix D.4: London Heat Map Data Template

Major Heat Loads

OXS	OYS	Object ID	Name	Address	Postcode	Ownership	New Development	Typology	Heating supply	Fuel source	Fuel consumption from all assets excluding CHP (MWh/year)	Fuel consumption from CHP (MWh/year)	Gross internal floor area (m^2)	Number of dwellings	Installed thermal capacity from all assets excluding CHP	CHP Installed power (MWe)	CHP Installed thermal capacity (MWe)	CO2 emissions (tCO2/year)	Year of Construction	Year of data collection	Start date	Completion date	Data Source	Confidentiality of data
514665	159144	1	Example Site	1 A Street, Town	W1T 4BQ	Private	No	commercial (> 9,99	Assets including CHP	Natural gas	2151.013819	0	0	0.00	0.640182684	0.00	0.00	628.466		2009			Example	Yes
					TOTAL						**2,151**	**0**	**0**	**0**	**0.64**	**0.00**	**0.00**	**628**	**-**	**-**	**-**	**-**	**-**	**-**

	Manual input (wording)
(yellow)	Select from drop-down list
(red)	Mandatory input
(green)	Desirable input

Appendix D.5: List of Stakeholders for Heat Mapping Workshop

Name	Organisation	Attended
Karl Walker	Scott Wilson	Yes
James Eland	Scott Wilson	Yes
Sean Rendall	Thameswey	Yes
Thomas Briault	LDA	Yes
John Mitchinson	LBR, Property Services	Yes
Brian Hoy	LBR, Property Services	Yes
Adam Hickman	LBR, P&R	Yes
David Hughes	LBR, P&R	Yes
Sean O'Sullivan (Capital Programme Manager)	Redbridge PCT	Yes
Jandi Pearman	BHR Hospitals	Yes
John O'Keefe	Education	No
John Pearce	LBR, P&R	Yes
Bob Watling	Redbridge Homes	No
Kevin O'Brien	LBR, Culture, Sport & Community Learning	Yes
John Start	LBR, Community Care	No

List of Stakeholders for Heat Mapping Workshop

APPENDIX E: Hydropower potential in Redbridge

Hydroelectric schemes are classified into three major categories based on their installed capacities; large hydro; medium hydro; and small hydro schemes. Small hydro schemes are further categorised as mini-, micro- and pico-hydro schemes.

The figure below illustrates the classification of hydropower schemes widely followed in UK.

Scale Description	Installed Capacity
Large hydro	50 MW and above
Medium hydro	5-50 MW
Small hydro*	Below 5 MW
Mini-hydro	500 kW-5 MW
Micro-hydro	500 kW -10 kW
Pico-hydro	Below 10 kW

**Small hydro further categorised into mini-, micro- and pico-hydro.*

Flow data within Redbridge

The Environment Agency measures the flow rate in most significant rivers and streams in UK, and data from around 1,300 gauging stations can be obtained from 'Centre for Ecology & Hydrology' (CEH) in Wallingford or from CEH's web pages. Redbridge falls under the Environmental Agency Thames region.

Based on the above list, SW has identified a single gauge station within LBR boundaries, that for the river Roding. The identified FDC of the river Roding at Redbridge is illustrated below.

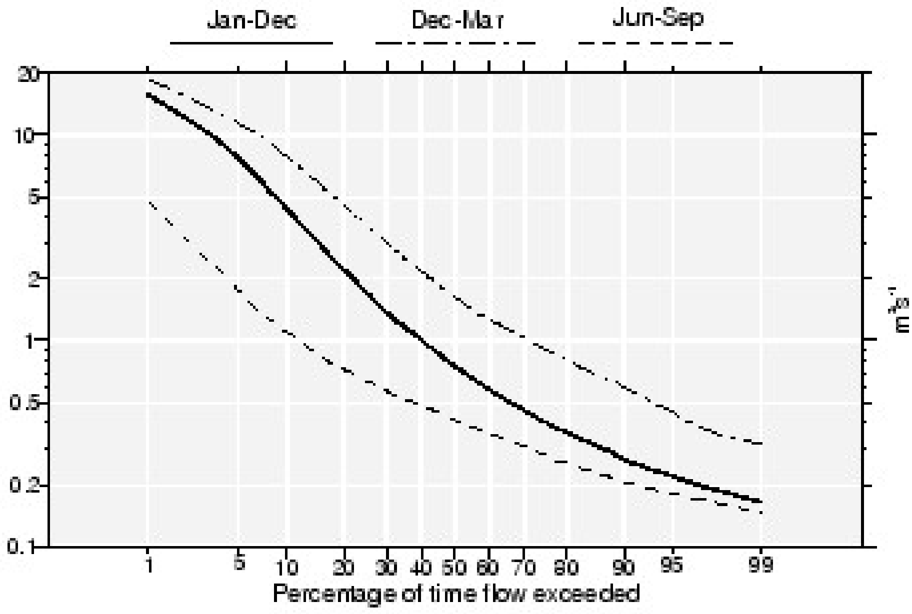


Figure 0-1: Flow Distribution Curve- River Roding at Redbridge (Gauge Station 37001) [101]

Compensation Flow

An uncontrolled abstraction of water from rivers and streams for power generation purposes may lead to sections of the rivers/streams suffering from dry conditions. To avoid such conditions, a percentage of the river flow will need to by-pass the hydropower scheme for environmental reasons. In abstraction schemes, where water is diverted from the main course of the river, this percentage flow is termed as compensation flow. Compensation flow is needed to maintain the ecology and aesthetic appearance of the river/stream in the depleted stretch. Compensation flow is also termed as reserved flow, residual flow or minimum environmental flow, depending on the country and relevant authority. Guide to UK mini hydro developments suggests that the amount of compensation flow will depend on site-specific concerns, but a reasonable first estimate will lie between the Q_{90} and Q_{99} values of river flow. In the above example (Redbridge gauge station), the compensation flow could be circa 0.3 m^3/s (Q_{90} flow from FDC above), however for any hydropower development this should be agreed with the Environmental Agency.

Available flow

British hydro power association's guide to mini hydro installation states that;

It is unlikely that schemes using significantly more than the mean river flow (Q_{mean}) will be either environmentally acceptable or economically attractive. Therefore the turbine design flow for a run-of river scheme (a scheme operating with no appreciable water storage) will not normally be greater than Q_{mean}. The exception would be a scheme specifically designed to capture very high winter flows, which is very rare in mini-hydro applications.

[101] http://www.nwl.ac.uk/ih/nrfa/webdata/037001/g.html

The mean flow at Redbridge is 1.3 m^3/s and the allowed compensation flow has been taken as 0.3 m^3/s (Q_{90} value). Although the example figures above can be used to illustrate the generic level of hydro power potential within LB Redbridge, different project locations will have different flow conditions based on several factors such as evaporation rate, soil conditions, catchment area, upstream water abductions and diversions, etc.

Head

Considering the geography of Redbridge, the maximum feasible head for a site appears to be in the range of 0.5 m. The lower limit of head is often restricted by turbines that are available in the hydropower industry. Until recently it was thought that schemes with less than 3m head were not economically viable and any sites below 3m head were often called 'ultra low head'. However propeller and Kaplan type turbines now offer minimum head only up to 1m.

These results indicate that there neither the flow nor the head conditions are appropriate for hydropower within Redbridge

APPENDIX F: Development Viability Modelling Assumptions

a. Market Values

	Detached	Semi	Terraced	Flats
Ilford Town Centre (IG1 with 10% market value uplift)	£545,943	£416,695	£291,938	£195,384
Gants Hill (IG2 with 10% market value uplift)	£352,000	£356,074	£295,247	£197,915
Crossrail Corridor (IG3 with 10% market value uplift)	£565,522	£456,390	£324,034	£181,823
Wanstead (E11 no uplift)	£576,505	£459,062	£356,130	£241,113
East Redbridge (RM6 no uplift)	£663,713	£390,123	£300,994	£228,281

1. Derived from www.rightmove.co.uk

2. Based on last two years actual sales values, accessed April 2010

3. The market uplift value is based upon an estimate of the additional value that new build properties will attract in comparison with the general market.

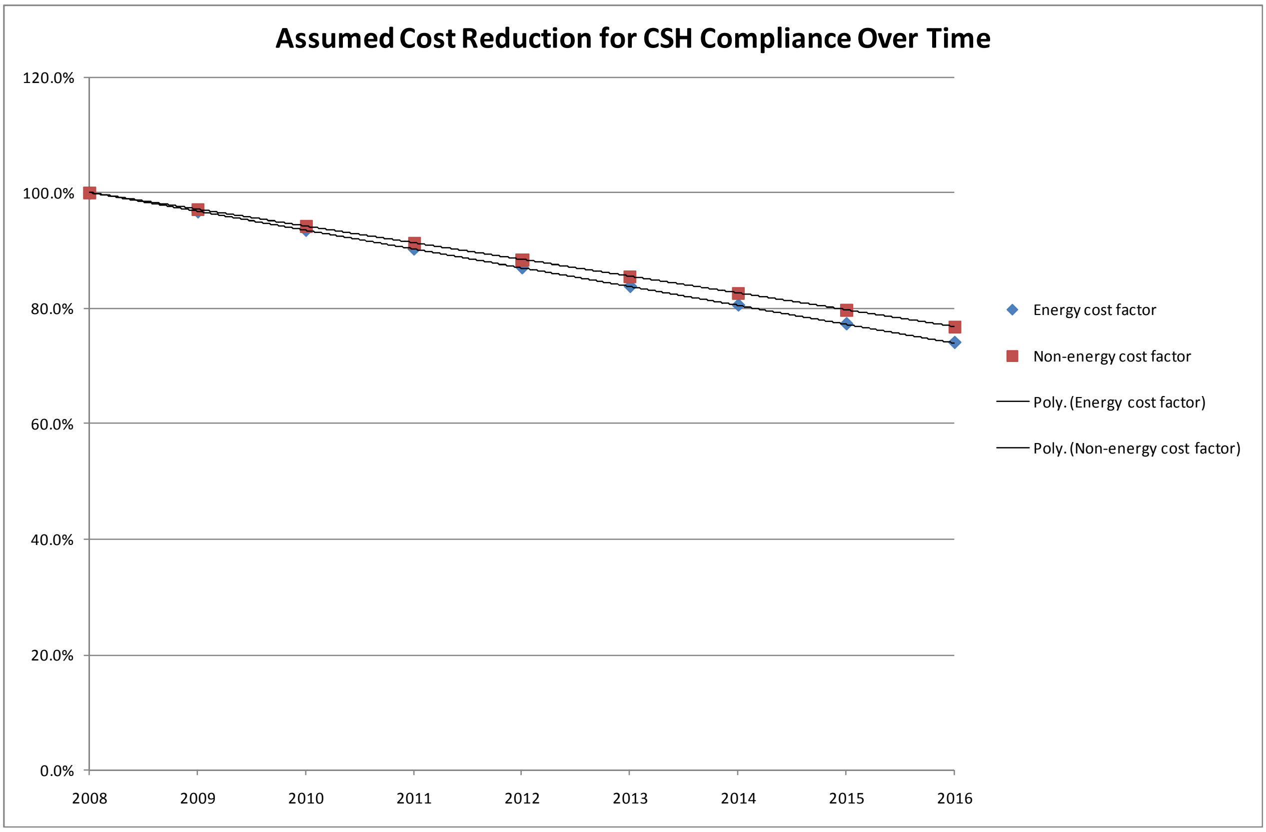
b. Development Mixes / Scenarios*

Development Types		Density (Dwell per ha)	Detached	Terraced	End terrace / Semi	Flat
1	Small Scale	30	45%	33%	22%	0%
2	City Infill	180	0%	0%	0%	100%
3	Market Town	50	25%	27%	21%	27%
4	Urban Regeneration	160	4%	2%	1%	93%

*Derived from Cyril Sweett analysis of the cost of the Code for Sustainable Homes, 2008

c. Code for Sustainable Homes Cost Uplift

Based on medium case in Tables 4.1, 4.2, 4.3 of Cost Analysis of the CSH, 2008, and projections for 2016 costs. The following curve illustrates the anticipated reduction in CSH compliance costs over time:



d. Construction Costs

	Construction cost £ / m^2
Detached	£930
Semi	£1,067
Terraces	£1,067
Flats	£1,334

The cost of flat construction has been assumed to increase when more than 100 units are being constructed due to complications in design. The increased cost is assumed to be £1,545 per m^2.

e. External Works and Services

The following assumptions have been made:

	% of construction cost element	Fixed cost element (£)

External works and services	**9.5%**	**20,000**
Utilities	5.4%	5,000

f. Fees

The following cost assumptions have been adopted for design development fees (e.g. architectural, utilities, mechanical design, electrical design, public health design, fire safety etc.)

Fees – 10% of construction and utilities cost, plus a fixed element of £50,000

g. Finance / Acquisition Costs

Finance costs	10%
Marketing costs	3%
Disposal costs	2%
Contractor's return	6%

These Finance / acquisition cost levels are all expressed as percentages of total construction costs including external works and services and fees.

h. Planning – related / Developer Contribution Costs

	per dwelling basis
Developer Contribution	£4,968
CSH Enhancements (excluding energy, e.g. water, materials, waste etc.)	£341
CSH Energy Enhancements	£2,530

i. Developer Margin

A gross development profit of 15% has been assumed, on the total cost of development including fees, planning costs, finance / acquisition costs and external works and services.

Appendix G: Viability Testing Results for 5 dwelling and 100 dwelling scenarios

1.1 Development Viability – 5 Dwellings

1.1.1 Policy Option 1 (Government Standards) – 5 Dwellings

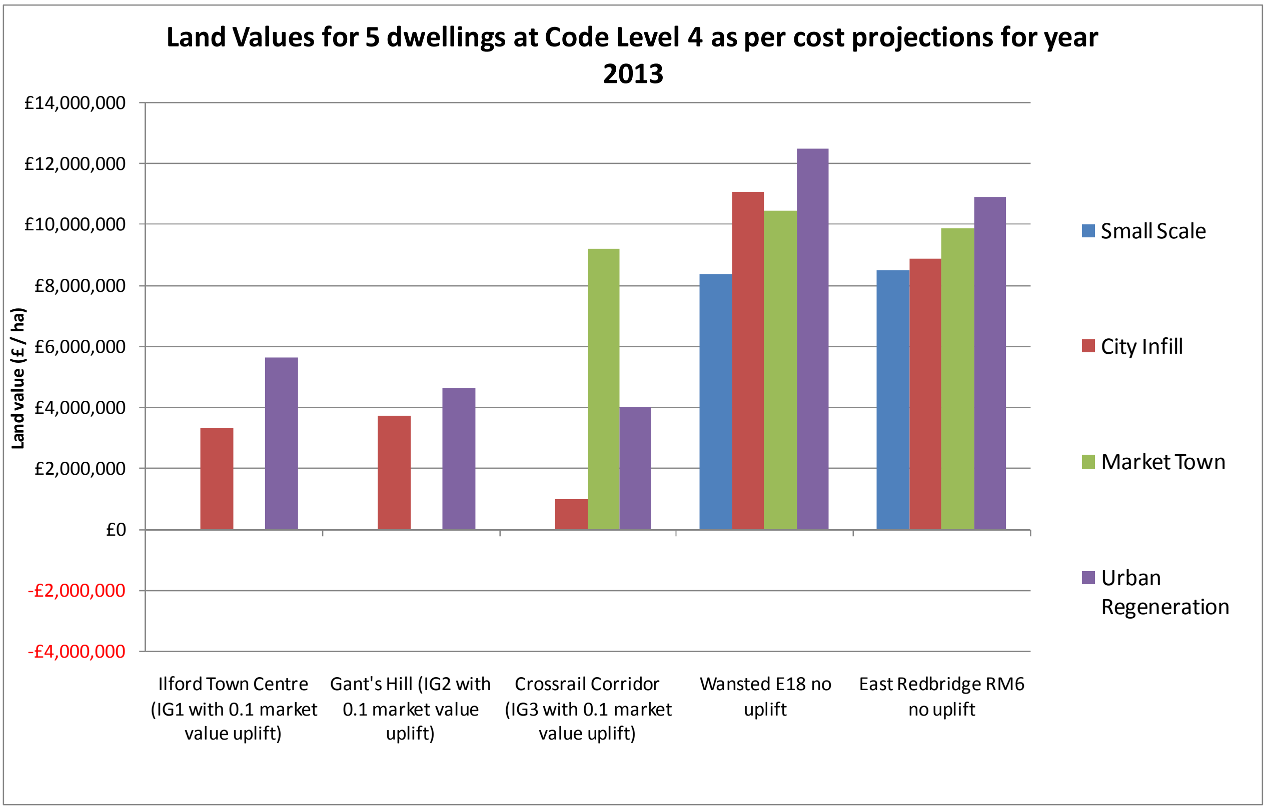


Figure 0-1: Land value as per cost projections for Code Level 4 in 2013 (Policy Option 1)

Implementation of Code 6 in 2016 (Policy Option 1 – Government Standards) – 5 dwellings.

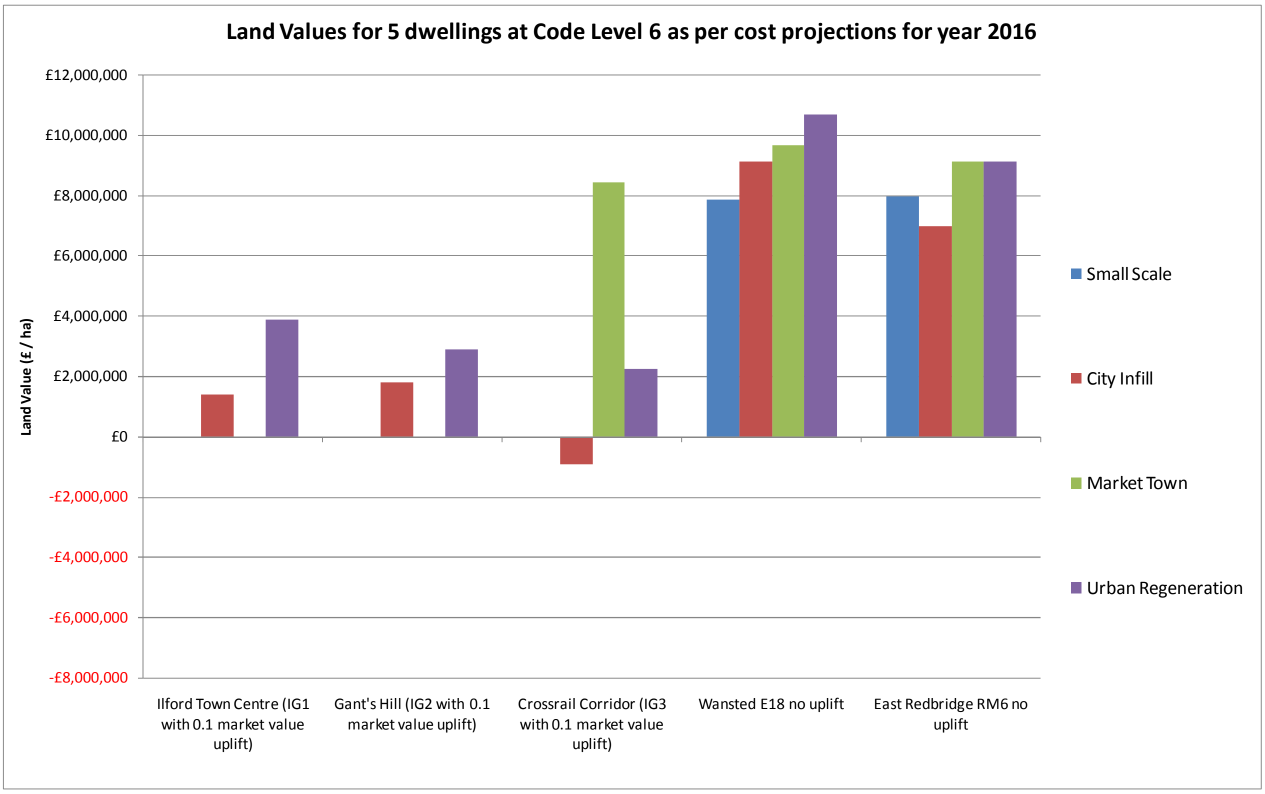


Figure 0-2: Land Values as per Government Standards (Policy Option 1) – Code 6 in 2016 - 5 dwellings

1.1.2 Policy Option 2 (Accelerated Implementation) – 5 Dwellings

Acceleration of Standards to Code 4 in 2010 (Policy Option 2 – Accelerated Implementation) - 5 dwellings.

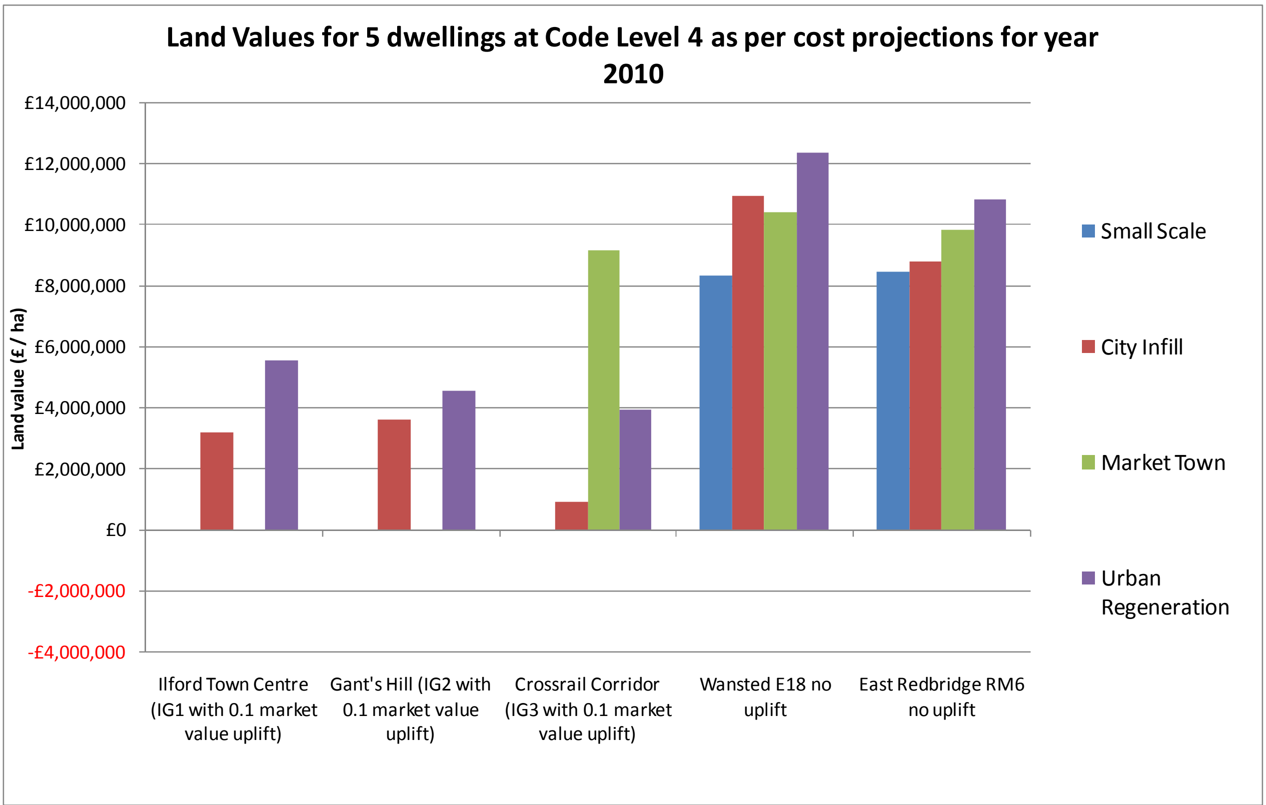


Figure 0-3 Land value as per cost projections for Code Level 4 in 2010 (Option 2) – 5 dwellings

Acceleration of Standards to Cost 6 in 2013 (Policy Option 2)

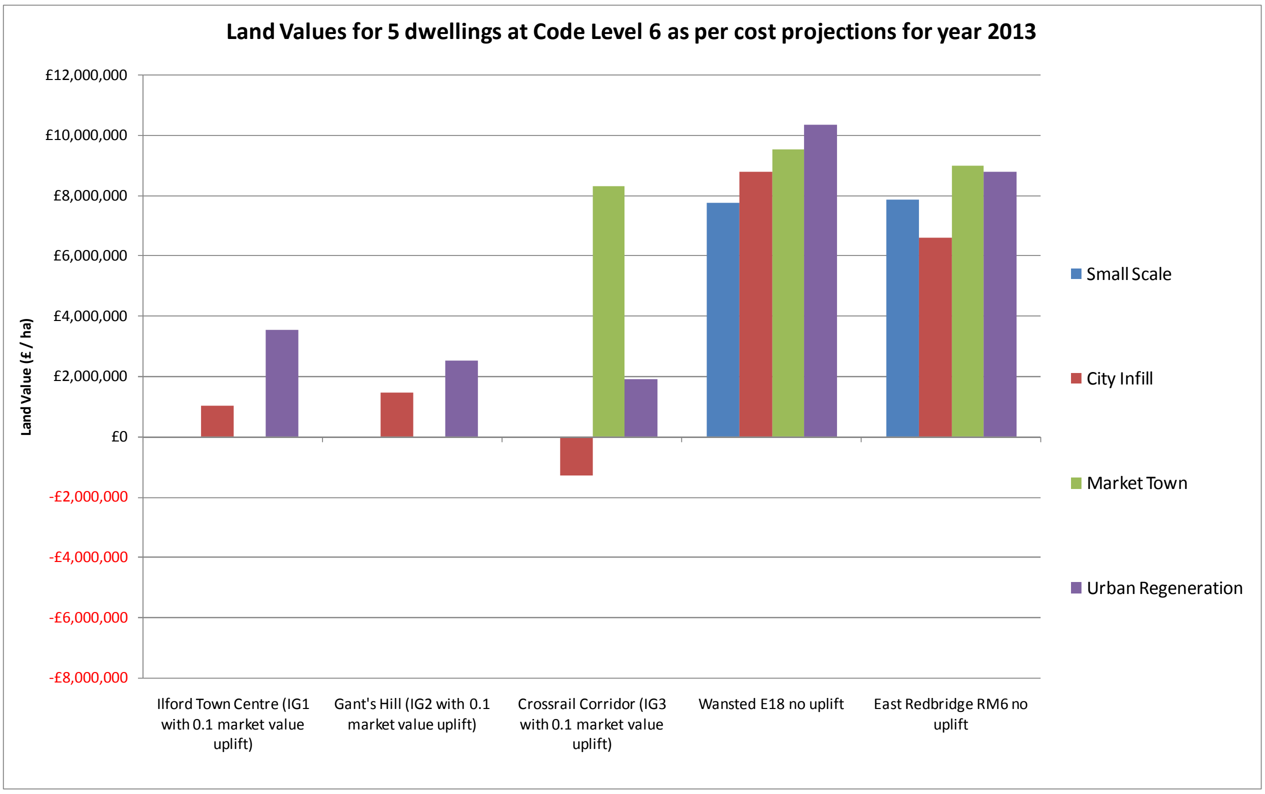


Figure 0-4 Land Values of Accelerated CSH Implementation (Code 6 in 2013) – 5 dwellings

1.1.3 Policy Option 3 (Aspirational Standards) – 5 dwellings

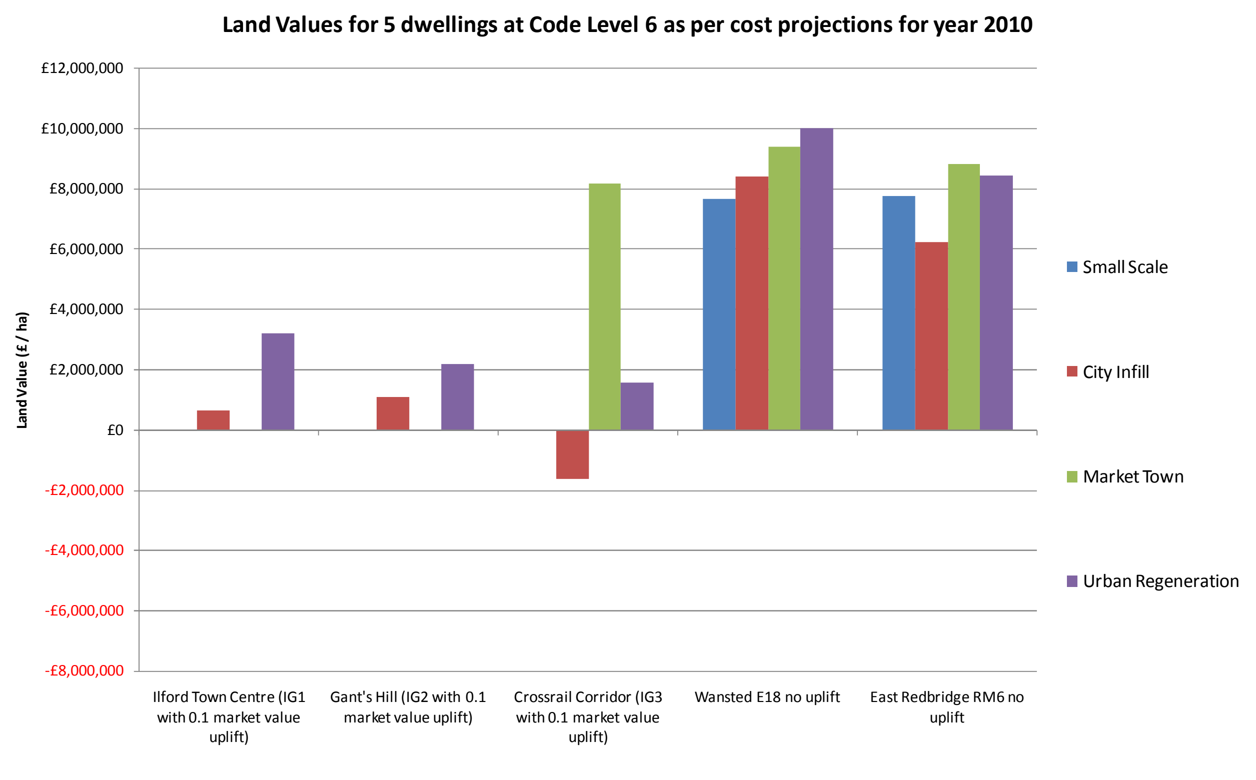


Figure 0-5 Land Values of Aspirational CSH Implementation (Code 6 in 2010) - 5 dwellings

1.2 Development Viability – 100 Dwellings

1.2.1 Policy Option 1 (Government Standards) – 100 Dwellings

Implementation of Code 4 in 2013 (Policy Option 1 – Government Standards) – 100 dwellings

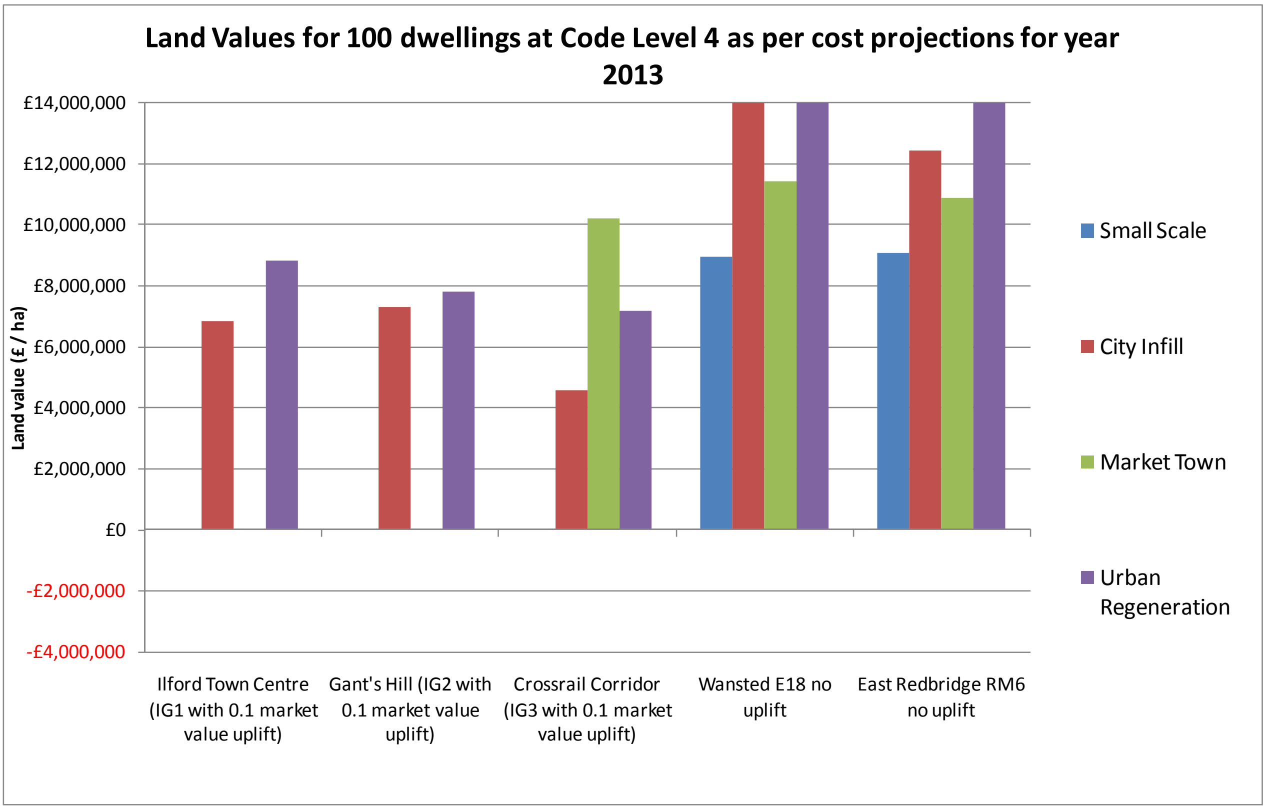


Figure 0-6 Land value as per cost projections for Code Level 4 in 2013 (Policy Option 1) – 100 dwellings

The graph illustrates that only the construction cost for flats increases above 100 units, and only one of the development types is all flats – therefore only this development type is affected.

Implementation of Code 6 in 2016 (Policy Option 1 – Government Standards) – 100 dwellings.

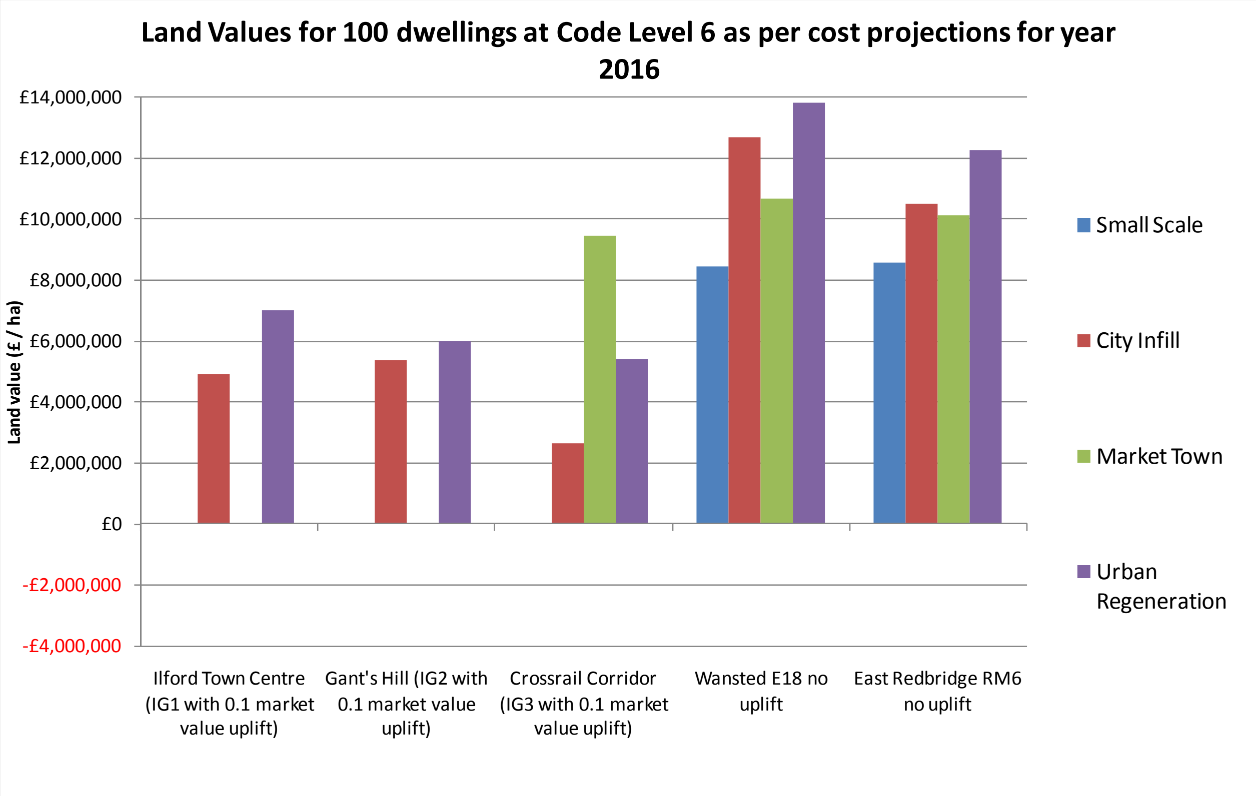


Figure 0-7 Land Values as per Government Standards (Policy Option 1) – Code 6 in 2016 - 100 dwellings

1.2.2 Policy Option 2 (Accelerated Implementation) – 100 Dwellings

Acceleration of Standards to Code 4 in 2010 (Policy Option 2 – Accelerated Implementation) - 100 dwellings.

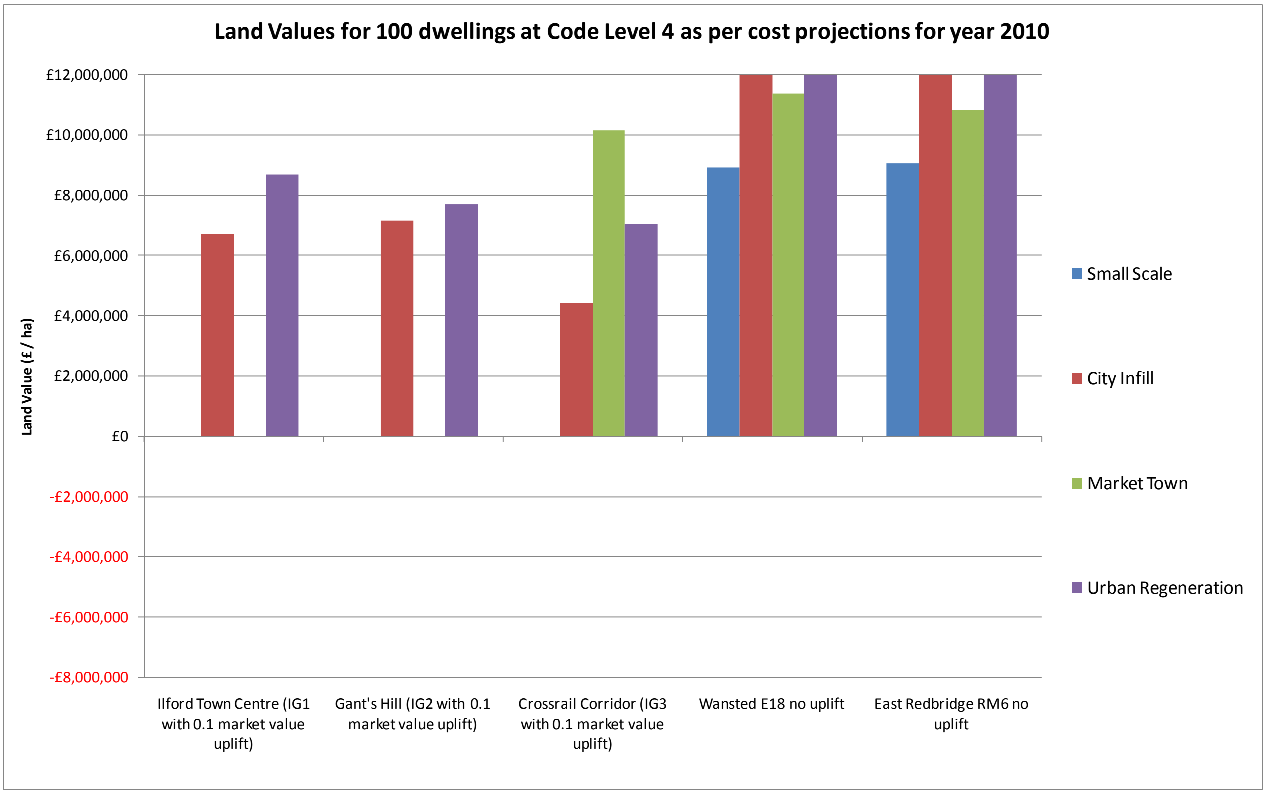


Figure 0-8 Land value as per cost projections for Code Level 4 in 2010 (Option 2) – 100 dwellings

Acceleration of Standards to Cost 6 in 2013 (Policy Option 2)

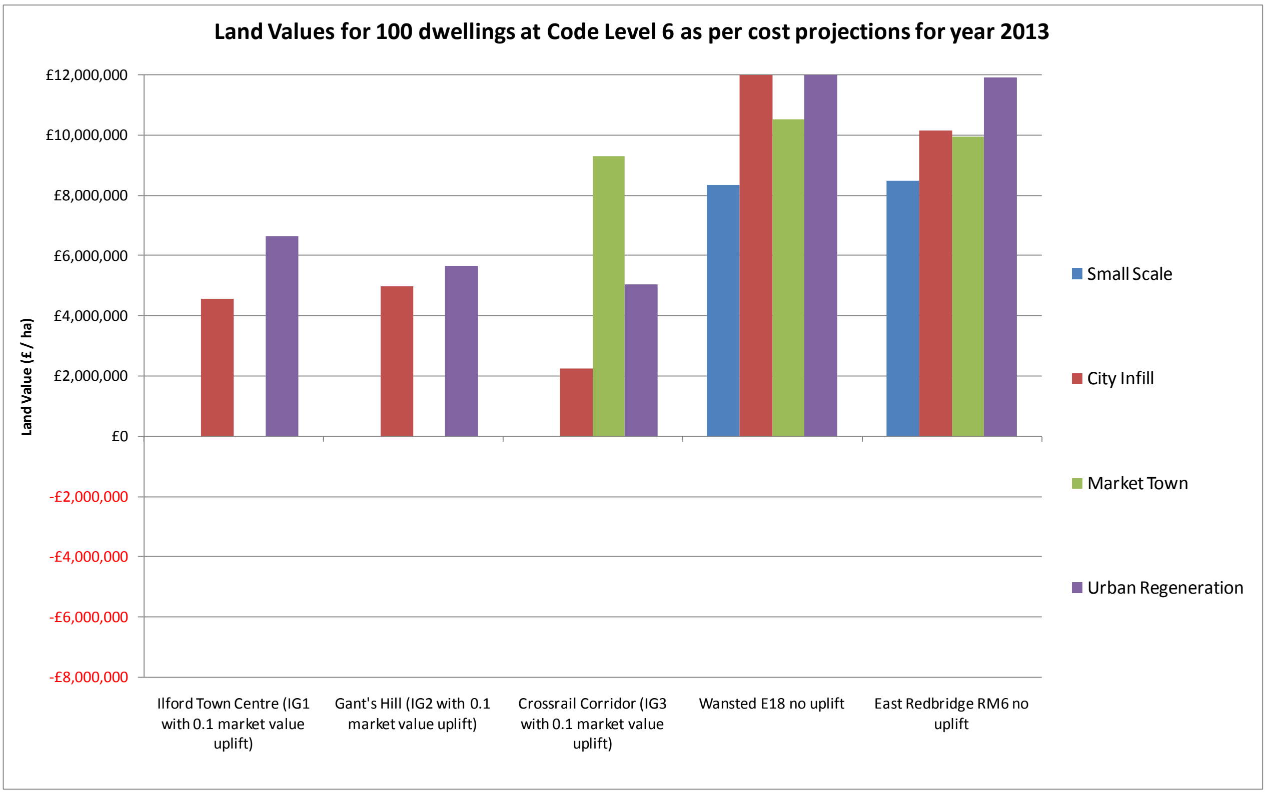


Figure 0-9 Land Values of Accelerated CSH Implementation (Code 6 in 2013) – 100 dwellings

1.2.3 Policy Option 3 (Aspirational Standards) – 100 dwellings

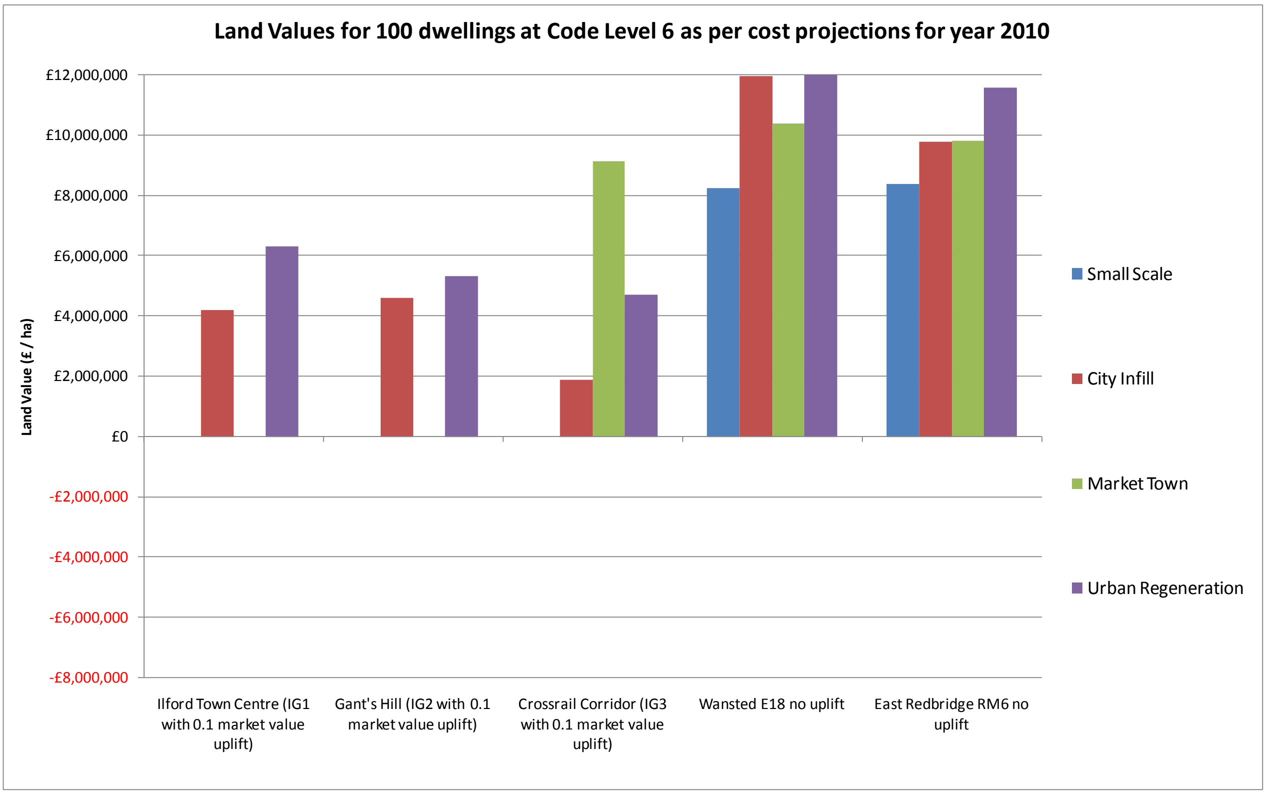


Figure 0-10 Land Values of Aspirational CSH Implementation (Code 6 in 2010) - 100 dwellings

APPENDIX H: Guidance document for Developers on the Code for Sustainable Homes

Code for Sustainable Homes - Design Guide for Developers

Redbridge Borough

Design guide for Developers: Low Cost/Low effort credits for the Code for Sustainable Homes (CSH) Assessment process in Redbridge Borough

Prepared By: Priti Nigam
Approved By: Karl Walker
Date: April 2010

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Fax: 020 7798 5001
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INTRODUCTION

This report classifies the credits obtainable under the Code for Sustainable Homes (CSH) Assessment into low cost/medium cost/higher cost items, assisting developers to prioritise actions while carrying out the CSH Assessment. Guidance is also provided on the credits which are required in order to obtain a Code Level 3, Code Level 4, Level 5 and a Level 6 rating.

The credits specified in this report are achievable at low effort/low cost based on the assumption that provision will be made to include the credit requirements at the design stage. For example, achieving the credit for insulants with a low global warming potential is fairly easy if these insulants are specified at the design stage. Similarly, if sustainable procurement (by ensuring suppliers are ISO14001 certified) is specified at the design stage, a higher number of credits can be achieved. Though the items classified as low cost/medium cost/effort only account for around 50% of the total score, it should be kept in mind that a number of credits have been classified as 'uncertain', because they are site dependent. For example, a number of credits under the Ecology section have been classified as 'uncertain/higher cost' , though some of these credits are not usually high cost items.

CSH provides a credible and transparent label of environmental performance for homes and offers important marketing opportunities for developers since their customers – landlords and occupiers – benefit from reduced running costs, more efficient building services and a healthy and safe place to live. There are also benefits to be gained in public relations from the CSH label, by improving relations with those from neighbouring developments.

The CSH methodology supersedes EcoHomes, and is independent, based on many years of construction and environmental research carried out by the Building Research Establishment (BRE) together with input and experience of the construction and property industries, government and public regulators.

The main aims of this document are to provide developers with an action list for the CSH assessment process and an indication of the level of effort and comparative costs of achieving various credits during the assessment process.

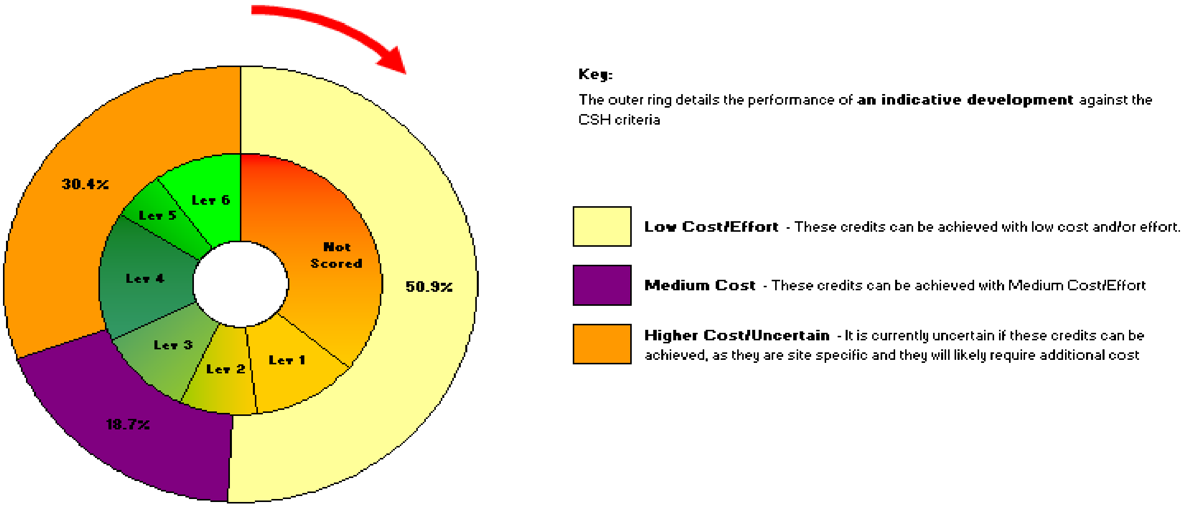
Scott Wilson have devised a simple system to assist design teams in prioritising their decisions in developing the design towards the required CSH rating. Under this system, all credits are classified using a simple A B C system according to the ease with which they could be achieved by the development as follows:

A = Features that could be incorporated in the development with low effort and/or cost;
B = Features that could be incorporated in the development with medium effort and/or cost; and
C = Features that are currently uncertain or could be incorporated in the development at a higher cost.

This indicative assessment is based on the assessors knowledge of the assessment scheme and also prior project experience based on feedback from members of design teams relating to the costs associated with design alterations or submissions of appropriate evidence.

Figure 1 below summarises the current CSH performance for the indicative development:

Figure 1: Indicative Code For Sustainable Homes Score



CODE FOR SUSTAINABLE HOMES ASSESSMENT RESULTS

The following section details the indicative costing of credits based on CSH criteria, with the number of points likely to be achieved in each code range in columns A, B and C.

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Category 1: Energy and Carbon Dioxide Emissions														
Ene 1	Dwelling Emission Rate	Credits are awarded based on the percentage improvement in the Dwelling Emission Rate (DER) over the Target Emission Rate (TER), as defined by 2006 Building Regulations. Credits are awarded as follows: **1 credit**: ≥ 10% improvement **2 credits**: ≥ 14% improvement **3 credits**: ≥ 18% improvement **4 credits**: ≥ 22% improvement **5 credits**: ≥ 25% improvement **6 credits**: ≥ 31% improvement **7 credits**: ≥ 37% improvement **8 credits**: ≥ 44% improvement **9 credits**: ≥ 52% improvement **10 credits**: ≥ 60% improvement **11 credits**: ≥ 69% improvement **12 credits**: ≥ 79% improvement **13 credits**: ≥ 89% improvement **14 credits**: ≥ 100% improvement **15 credits**: 'True Zero Carbon'	15	18.8%	Y	Not Scored	**5**	**4**	**6**	The minimum requirement for Code Level 3 which is mandatory from 2010, is a 25% improvement in DER over TER, which is equivalent to 5 credits.	**5**	**8**	**14**	**15**
Ene 2	Building Fabric	Credits are awarded based on the Heat Loss Parameter as follows: **1 credit**: HLP ≤ 1.3 **2 credits**: HLP ≤ 1.1	2	2.5%	N		**1**	**1**		Specifying building fabric with a heat loss parameter of 1.3 or lower is likely to be a medium cost/higher cost measure.	**1**	**2**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Ene 3	Internal Lighting	Credits are awarded for the provision of fixed dedicated energy efficient internal light fittings as follows: **1 credit**: where ≥ 40% of fixed internal fittings are dedicated and energy efficient **2 credits**: where ≥ 75% of fixed internal fittings are dedicated and energy efficient	2	2.5%	N		**2**			Since non energy efficient light bulbs have been phased out in the UK, achieving these credits should be in line with best practice procedures. However, the requirement to specify lighting at 40 lumens per circuit watt or less must be taken into consideration at the design stage.	**2**	**2**	**2**	**2**
Ene 4	Drying Space	**1 credit** is awarded where space is provided for drying clothes, with posts and footings or fixings capable of holding: 4m+ of drying line for 1–2 bed dwellings; or 6m+ of drying line for 3+ bed dwellings This space (internal or external) should be secure.	1	1.3%	N		**1**			Providing drying space should be a relatively low cost measure as space can also be provided within the bathrooms via foldable lines. However, care must be taken to provide adequate ventilation in line with the CSH requirements.	**1**	**1**	**1**	**1**
Ene 5	Energy Labelled White Goods	**1 credit** is awarded where fridges, freezers and fridge / freezers have an A+ rating under the EU Energy Efficiency Labelling Scheme; **and/or** **1 credit** is awarded where washing machines and dishwashers have an A rating and washer dryers or tumble dryers have a B rating. **OR:** **1 credit** is awarded where no white goods are provided, but information on the EU Energy Efficiency Labelling Scheme of efficient white goods is provided to each dwelling.	2	2.5%	N		**1**	**1**		One credit is classified as low cost for providing information on the EU energy efficiency labelling scheme for efficient while goods to each dwelling.	**2**	**2**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Ene 6	External Lighting	**1 credit** is awarded where all external space lighting, including lighting in common areas, is provided by dedicated energy efficient fittings, taking into account the needs of people who have visual impairments; **and/or** **1 credit** is awarded where all security light fittings are designed for energy efficiency and are adequately controlled such that: - all burglar security lights have a maximum wattage of 150W, movement detecting control devices (PIR) and daylight cut-off sensors; and - all other security lighting has dedicated energy efficient fittings and is fitted with daylight cut-off sensors. NB - If no security lighting is provided, the security lighting credit can be awarded by default provided all the conditions of the first issue covering space lighting have been met. Dual lamp luminaires with both space and security lamps can also be awarded both credits provided they meet the above criteria for energy efficiency.	2	2.5%	N		**2**			Since non energy efficient light bulbs have been phased out in the UK, achieving these credits should be in line with best practice procedures. However, the requirement to specify lighting at 40 lumens per circuit watt or less must be taken into consideration at the design stage.	**2**	**2**	**2**	**2**
Ene 7	Zero or Low Carbon (ZLC) Energy technologies	Credits are awarded where energy is supplied from local renewable or low carbon energy sources funded under the Low Carbon Building Programme (or similar), or is designed and installed in a manner endorsed by a feasibility study prepared by an independent energy specialist. **1 credit** is awarded where there is a 10% reduction in carbon emissions as a result of this method of supply. **2 credits** are awarded where there is a 15% reduction in carbon emissions as a result of this method of supply	2	2.5%	N				**2**	These credits are site dependent	**2**	**2**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Ene 8	Cycle Storage	Credits are awarded where safe, secure, convenient and weatherproof cycle storage is provided, either individually or communally, for the following number of cycles: **1 credit**: 1 cycle for each two studio / 1 bedroom dwellings; 1 cycle for each 2/3 bedroom dwelling; and 2 cycles for each dwelling of 4 bedrooms or above. **2 credits**: 1 cycle for each studio / 1 bedroom dwelling; 2 cycles for each 2/3 bedroom dwelling; and 4 cycles for each dwelling of 4 or more bedrooms.	2	2.5%	N		**1**	**1**		These credits are site dependent	**1**	**1**	**1**	**1**
Ene 9	Home Office	**1 credit** is awarded where sufficient space and services are provided to allow the occupants to set up a home office in a suitable quiet room.	1	1.3%	N		**1**			This credit requires annotated drawings of the units to be provided. Care must be taken to comply with the CSH requirements for numbers of sockets and telephone/internet connection at the design stage.	**1**	**1**	**1**	**1**
Category 2: Water														
Wat 1	Internal Potable Water Use	Credits are awarded as follows, based on the predicted average household water consumption per person per day (calculated by the assessor based on sanitary ware specifications): **1 credit**: ≤ 120 litres/person/day **2 credits**: ≤ 110 litres/person/day **3 credits**: ≤ 105 litres/person/day **4 credits**: ≤ 90 litres/person/day **5 credits**: ≤ 80 litres/person/day	5	7.5%	Y	Not Scored	**1**	**2**	**2**	The mandatory level for this credit must be satisfied depending on the Code Level that is to be achieved. It is anticipated that 1 credit will be relatively low cost.	**3**	**3**	**5**	**5**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Wat 2	External Potable Water Use	**1 credit** is awarded where a correctly specified system to collect rainwater for external/internal irrigation use has been provided to a dwelling with a garden, patio or communal garden space (examples of such systems include rainwater butts and central rainwater collection systems). NB - This credit can be awarded by default where no individual or communal garden spaces are specified or if only balconies are provided.	1	1.5%	N		**1**			A water butt or equivalent can be installed at low cost. However, rigorous storage capacity requirements must be kept in mind at the design stage.	**1**	**1**	**1**	**1**
Category 3: Materials														
Mat 1	Environmental Impact of Materials	It is a **mandatory requirement** that at least three of the key elements listed achieve a Green Guide rating of A+ to D. Credits are awarded based on the *Green Guide 2007* rating of the following building elements: - Roof - External Walls - Internal Walls (including separating walls) - Upper and ground floors (including separating floors) - Windows The number of credits allocated is calculated by the assessor using the *CSH Materials Calculator.*	15	4.5%	Y	N	**3**	**2**	**10**	These credits are easy to achieve if requirements are specified at the design stage. It is anticipated that 3 credits will be achieved at low cost	**3**	**6**	**10**	**13**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Mat 2	Responsible Sourcing of Materials - Basic Building Elements	Credits are awarded where materials used in the following key building elements are responsibly sourced: - Frame - Ground floor - Upper floors (including separating floors) - Roof - External walls - Internal walls (including separating walls) - Foundation / substructure - Staircase The number of credits allocated is calculated by the assessor using the *CSH Materials Calculator.*	6	1.8%	N		**2**	**1**	**3**	These credits are easy to achieve if the requirement to procure materials from suppliers with ISO14001 certificates is specified at the design stage	**2**	**2**	**2**	**5**
Mat 3	Responsible Sourcing of Materials - Finishing Elements	Credits are awarded where materials used in the following finishing elements are responsibly sourced: - Stairs - Windows - External and internal doors - Skirting - Panelling - Furniture - Fascias - Any other significant use The number of credits allocated is calculated by the assessor using the *CSH Materials Calculator.*	3	0.9%	N		**1**	**1**	**1**	These credits are easy to achieve if the requirement to procure materials from suppliers with ISO14001 certificates is specified at the design stage	**0**	**1**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Category 4: Surface Water Runoff														
Sur 1	Reduction of Surface Water Runoff From Site	Credits are awarded where rainwater holding facilities / sustainable drainage systems (SuDS) are used to provide attenuation of water run-off to either natural watercourses or surface water drainage systems, with the following peak time attenuation levels: - 50% in low flood risk areas - 75% in medium flood risk areas - 100% in high flood risk areas **1 credit** is awarded for providing this level of attenuation from hard surfaces, and **1 credit** is awarded for providing this level of attenuation from roofs. NB - It is a **mandatory requirement** that peak run-off rates and annual volumes of run-off post development will be no greater than the previous conditions for the site.	2	1.1%	Y	N	**2**			These credits are mandatory	**2**	**2**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Sur 2	Flood Risk	**2 credits** are awarded where the assessed dwelling is located in an area with low annual probability of flooding. **1 credit** is awarded where the dwelling is located in an area of medium / high annual probability of flooding, where: - the ground level of the dwelling, access routes to the ground level and the site are at least 600mm above the design flood level of the flood zone in which the development is located. NB - A single credit can be awarded where the development has been permitted even though the ground levels of the topography / infrastructure immediately adjacent to the site fall below the 600mm threshold, provided there are no other practical solutions for the site above this level and safe access can still be provided by raising both the access and the lowest occupied rooms to at least 600mm above the notional flood level. A single credit can also be awarded where maintained flood defences are in place, or where non-structural measures are used to control risk to the development (e.g. flood storage potential either within the development or upstream).	2	1.1%	N				**2**	These credits are site dependent	**0**	**0**	**0**	**0**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Category 5: Waste														
Was 1	Household Waste Storage and Recycling Facilities	It is a **mandatory requirement** that the space provided for waste storage is sized to hold the larger of the two of the following: - All external containers provided under the relevant local authority refuse collection / recycling schemes; or - The minimum capacity of waste storage as calculated from *BS 5906* **2 credits** are awarded where there is no external storage for recyclable waste and no Local Authority Collection Scheme, provided three internal storage bins are provided: - with a minimum total capacity of 60 litres; - where no individual bin is smaller than 15 litres; and - located in an adequate internal space. **4 credits** are awarded where either of the following is provided: - three internal storage bins with a minimum total capacity of 30 litres, where no individual bin is smaller than 7 litres; or - a single 30 litre bin linked with a Local Authority service that collects at least 3 types of recyclable material in a single bin. AND either of the following is provided: - adequate external storage space for bins plus a Local Authority scheme that collects at least three types of recyclable waste; - for individual dwellings, adequate external storage space for three external bins with a total capacity of at least 180 litres, where no individual bin is smaller than 40 litres, located within 10m of an external door; or - for blocks of flats, a private recycling scheme to maintain the bins and collect recyclable waste on a regular basis.	4	3.7%	Y	N	**4**			Providing storage space for bins and procuring adequately sized bins is a relatively low cost item	**4**	**4**	**4**	**4**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Was 2	Construction Site Waste Management	For developments costing £200,000 or more, it is a **mandatory requirement** that a *Site Waste Management Plan* is produced and implemented. This will require the monitoring of waste generated on site and the setting of targets to promote resource efficiency in accordance with the relevant guidance. Specific targets are not required. **1 credit** is awarded where the *Site Waste Management Plan* includes procedures and commitments for minimising waste generated on site in accordance with the relevant guidance; and **1 credit**s awarded where the *Site Waste Management Plan* includes procedures and commitments to sort, reuse and recycle construction waste, either on site or through a licensed external contractor.	2	1.8%	Y	N	**1**	**1**		Producing a SWMP is part of best practice procedures. 1 additional credit involving sorting, reuse and recycling construction waste can be achieved at medium cost.	**2**	**2**	**2**	**2**
Was 3	Composting	**1 credit** is awarded where: - individual home composting facilities are provided; - a communal or community composting service is provided (within 50m of the external door), either run by the Local Authority or with a management plan in place; or - a local authority kitchen waste collection scheme is in place. NB - All facilities must be in a dedicated position and accessible to disabled people.	1	0.9%	N		**1**			Provision of composting facilities is a low cost/effort item	**0**	**0**	**1**	**1**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Category 6: Pollution														
Pol 1	Global Warming Potential (GWP) of Insulants	**1 credit** is awarded where all insulating materials in the following building elements have a GWP of less than 5: - Roofs (including loft access); - Walls, internal and external, including lintels and acoustic insulation; - Floors (including ground and upper floors); - Hot water cylinder, pipe insulation and other thermal stores; - Cold water storage tanks where provided; and - External doors	1	0.7%	N		**1**			Insulants specified at the design stage should have a GWP of less than 5. A number of insulants including Kooltherm and Kingspan offer a range of insulants with a low GWP and ozone depletion potential.	**1**	**1**	**1**	**1**
Pol 2	NOx Emissions	Credits are awarded based on the NOx emissions arising from the operation of space heating and hot water systems for each dwelling type. Credits are awarded as follows: **1 credit**: ≤ 100 mg/kWh **2 credits**: ≤ 70 mg/kWh **3 credits**: ≤ 40 mg/kWh	3	2.1%	N				**3**	This credit may be site dependant based on flue height.	**0**	**1**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Category 7: Health and Wellbeing														
Hea 1	Daylighting	**1 credit** is awarded where kitchens achieve a daylight factor of at least 2%; and **1 credit** is awarded where all living rooms, dining rooms and studies (including any room designated as a home office under *ENE 9*) achieve a daylight factor of at least 1.5%; and **1 credit** is awarded where 80% of the working plane in kitchens, living rooms, dining rooms and studies including any room designated as a home office under *ENE 9*) has a view of the sky.	3	3.5%	N				**3**	This credit is site dependant	**0**	**0**	**0**	**1**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Hea 2	Sound Insulation	Credits are awarded where there is a commitment to carry out a programme of pre-completion testing based on the programme of testing described in *Approved Document E* for every group or sub-group of houses or flats, and to achieve the following levels: **1 credit**: airborne sound insulation values at least 3dB higher, and impact sound insulation values at least 3dB lower, than the performance standards set out in *Approved Document E* **3 credits**: airborne sound insulation values at least 5dB higher, and impact sound insulation values at least 5dB lower, than the performance standards set out in *Approved Document E* **4 credits**: airborne sound insulation values at least 8dB higher, and impact sound insulation values at least 8dB lower, than the performance standards set out in *Approved Document E* NB - Alternatively, a commitment can be given to use constructions for all relevant building elements that have been assessed and approved by *Robust Details Limited* and found to achieve the above performance standards. Detached dwellings are awarded 4 credits by default, and attached dwellings where separating walls or floors only occur between non habitable rooms are awarded 3 credits by default.	4	4.7%	N		**2**	**2**		This credit requires a high level of sound proofing and a number of sound tests in addition to those required under Building Regulations. Therefore these credits may be higher cost/medium cost to achieve.	**2**	**2**	**4**	**4**
Hea 3	Private Space	**1 credit** is awarded where outdoor space (private or semi-private) is provided that: - is of a minimum size that allows all occupants to sit outside; - allows easy access by all occupants, including wheelchair users; and - is accessible only to occupants of designated dwellings	1	1.2%	N				**1**	This credit is site dependant	**0**	**1**	**1**	**1**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Hea 4	Lifetime Homes	**4 credits** are awarded where all the principles of Lifetime Homes have been complied with.	4	4.7%	N		**4**			Although the requirements for Lifetime Homes are extensive, they are not high cost items. Certain issues such as adequate space for a wheelchair within rooms and bathrooms may not be complied with in certain homes and the requirements for these credits would have to be incorporated at design stage, failing which these credits would not be achieved.	**4**	**4**	**4**	**4**
Category 8: Management														
Man 1	Home User Guide	**2 credits** are awarded where a stand-alone *Home User Guide* is provided, covering all of the requirements of C*hecklist Man 1 Part 1*, and where the guide is available in alternative accessible formats; or **3 credits** are awarded where the guide also covers information relating to the site and its surroundings, compiled using *Checklist Man 1 Part 2*	3	3.3%	N		**3**			This credit is a low cost item	**3**	**3**	**3**	**3**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Man 2	Considerate Constructors Scheme	**1 credit** is awarded where there is a regular audit under a nationally recognised independent certification scheme such as certification under the *Considerate Constructors Scheme*; or **2 credits** are awarded where the commitment is to go significantly beyond best practice including a regular audit under a nationally recognised independent certification scheme such as the *Considerate constructors Scheme* and to achieve a *CCS* score of above 32, or equivalent.	2	2.2%	N		**1**	**1**		Achieving 1 credit under the CCS is likely to be low cost/low effort. Hoverer achieving a score of 32 or above could involve a small additional cost/effort.	**2**	**2**	**2**	**2**
Man 3	Construction Site Impacts	Credits are awarded where there is a commitment and strategy to operate site management procedures as follows: a. Monitor, report and set targets for CO2 production or energy use arising from site activities; b. Monitor and report CO2 emissions or energy use arising from commercial transport to and from site; c. Monitor, report and set targets for water consumption from site activities; d. Adopt best practice policies in respect of air (dust) pollution arising from site activities; e. Adopt best practice policies in respect of water (ground and surface) pollution occurring on the site; f. 80% of site timber is reclaimed, reused or responsibly sourced **1 credit** is awarded where 2 or more of the above items are covered; or **2 credits** are awarded where 4 or more of the above items are covered.	2	2.2%	N		**2**			Achieving best practice in terms of air (dust) pollution and water pollution is a low cost item. Monitoring water consumption from site activities and using responsible sourced timber could involve an additional effort, but in unlikely to add to costs.	**2**	**2**	**2**	**2**

INDICATIVE ASSESSMENT RESULTS

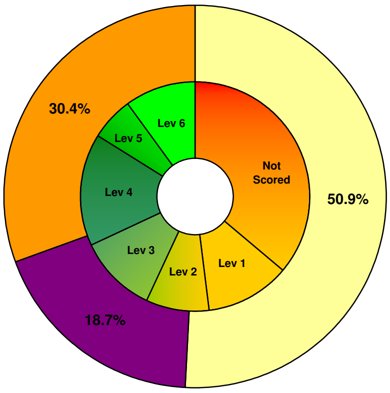
Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Man 4	Security	**2 credits** are awarded where an *Architectural Liaison Officer* or *Crime Prevention Officer* from the local police force is consulted at the design stage, and their recommendations are incorporated into the design of the dwelling.	2	2.2%	N		**2**			This credit is a low cost item, as long as the ALO is consulted at the design stage	**2**	**2**	**2**	**2**
Category 9: Ecology														
Eco 1	Ecological Value of Site	**1 credit** is awarded where the development site is confirmed as land of inherently low ecological value either: - by meeting the criteria for low ecological value as listed in *Checklist Eco 1* ; or - by confirmation from a suitably qualified ecologist. OR - where an independent ecological report of the site states that the construction zone is of low or insignificant ecological value, and any land of ecological value outside the construction zone, but within the development site, will remain undisturbed by the construction works.	1	1.3%	N		**1**			This credit is site dependent, however in line with the Council's aspiration for all development to be on brownfield land, this credit is considered to be achievable	**0**	**1**	**1**	**1**
Eco 2	Ecological Enhancement	**1 credit** is awarded where a suitably qualified ecologist has been appointed to recommend appropriate ecological features that will positively enhance the ecology of the site, and where the developer adopts all key recommendations and at least 30% of additional recommendations.	1	1.3%	N		**1**			This credit is site dependent, however in line with the Council's aspiration for all development to be on brownfield land, this credit is considered to be achievable	**1**	**1**	**1**	**1**

INDICATIVE ASSESSMENT RESULTS

Credit Ref.	Credit Title	Assessment Criteria	Credits Available	% Worth	Mandatory Element?	Mandatory Level Achieved	Low Cost / Effort (A)	Medium Cost (B)	Higher Cost/ Uncertain (C)	Justification	Credits required for Code Level 3	Credits required for Code Level 4	Credits required for Code Level 5	Credits required for Code Level 6
Eco 3	Protection of Ecological Features	**1 credit** is awarded where all existing features of ecological value on the development site potentially effected by the works are maintained and adequately protected during site clearance, preparation and construction works. NB - The credit can be awarded by default where the site has been classified has having low ecological value in accordance with *Eco 1 - Ecological Value of the Site.*	1	1.3%	N		**1**			This credit is site dependent, however in line with the Council's aspiration for all development to be on brownfield land, this credit is considered to be achievable	**1**	**1**	**1**	**1**
Eco 4	Change in Ecological Value of Site	Credits are awarded where the resulting change in ecological value, calculated by the assessor using the *Change in Ecological Value Calculator*, is as follows: **1 credit**: Minor negative change (between -9 and -3) **2 credits**: Neutral (between -3 and +3) **3 credits**: Minor enhancement (between +3 and +9) **4 credits**: Major enhancement (greater than +9)	4	5.3%	N		**1**	**1**	**2**	This credit is site dependent, however in line with the Council's aspiration for all development to be on brownfield land, this credit is considered to be achievable	**0**	**2**	**2**	**2**
Eco 5	Building Footprint	For houses, **1 credit** is awarded where the Net Internal Floor Area: Net Internal Ground Floor Area ratio is greater than 2.5:1. **2 credits** are awarded where the ratio is greater than 3:1. For flats, **1 credit** is awarded where the Net Internal Floor Area: Net Internal Ground Floor Area ratio is greater than 3:1. **2 credits** are awarded where the ratio is greater than 4:1. For a combination of houses and flats, the ratio must be greater than the weighted average of the ratios given above to achieve the credits.	2	2.7%	N				**2**	This credit is site dependent	**0**	**0**	**2**	**2**

Credits in Blue = Mandatory elements for CSH;

Figure : Summary of the CSH performance for an indicative development:



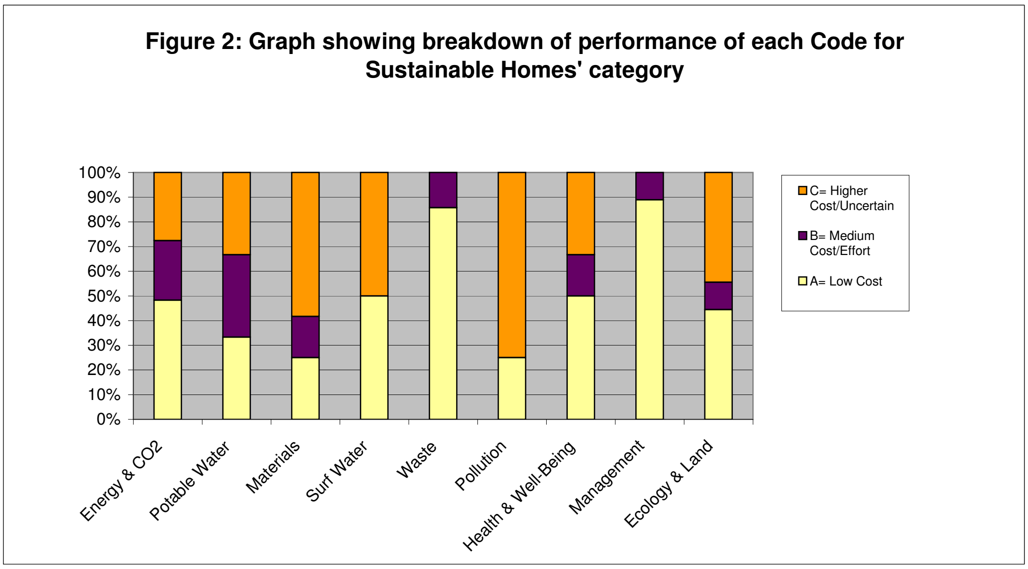
Key:

The outer ring details the performance of **an indicative development** against the CSH criteria

Low Cost/Effort - These credits can be achieved with low cost and/or effort.

Medium Cost - These credits can be achieved with Medium Cost/Effort

Higher Cost/Uncertain - It is currently uncertain if these credits can be achieved, as they are site specific and they will likely require additional cost



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Appendices

Appendix 1: Code for Sustainable Homes Methodology

The Code for Sustainable Homes is an environmental assessment system for new housing in England which:
• Presents a range of environmental standards, which have been researched as being reasonable and achievable
• Assesses the environmental performance using objective criteria and verification methods
• Provides a formal certificate showing performance

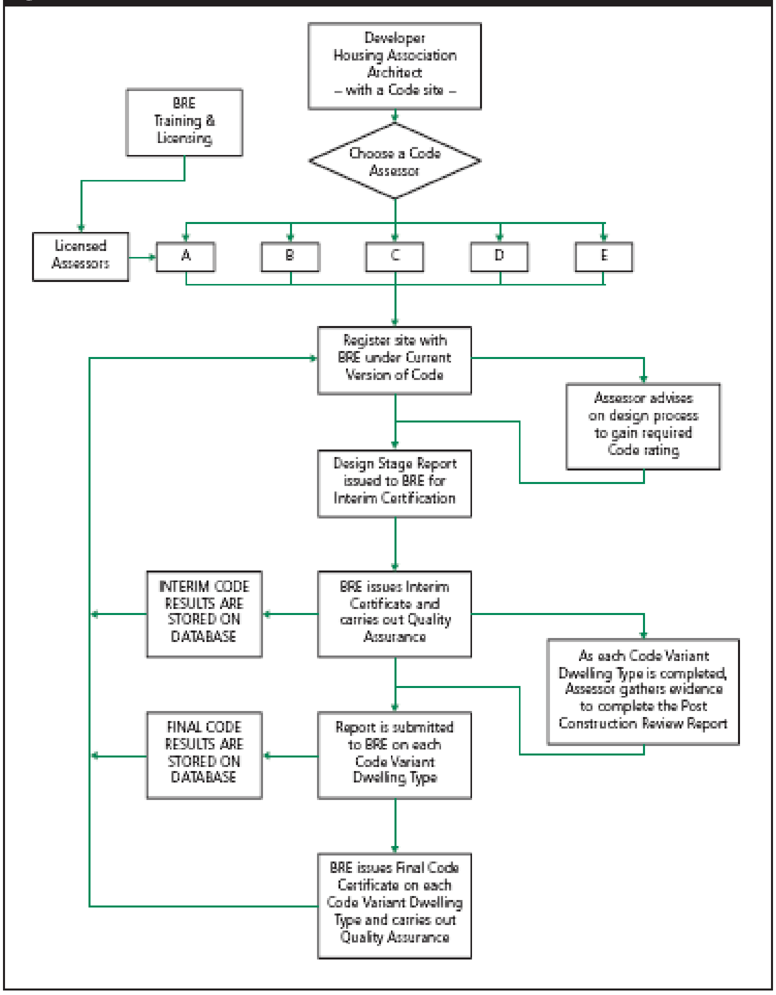
The 'Code for Sustainable Homes: A Step-change in sustainable home building practice' (Department for Communities and Local Government 2006) defined a set of sustainable design principles for new housing covering performance in nine key areas, known as 'Categories' listed below:

• Energy and CO2 Emissions
• Water
• Materials
• Surface Water Run-off
• Waste
• Pollution
• Heath and Wellbeing
• Management
• Ecology

The Assessment system assigns to each Issue a simple number of CREDITS (One, two, three). The Credits allocated for each Issue are then summed to give a total number of credits per Category.

Each category is allocated a total maximum score in terms of Percentage POINTS. The weighting system is designed to reflect the importance of that environmental category in the view of a cross-section of stakeholders, and the methodology for arriving at these weightings. As a result, the value of weightings in different sections is not the same. Assessment of any particular development is carried out against these environmental criteria and credits are awarded, from which Points are calculated.

Figure 1 The Code for Sustainable Homes Assessment Process



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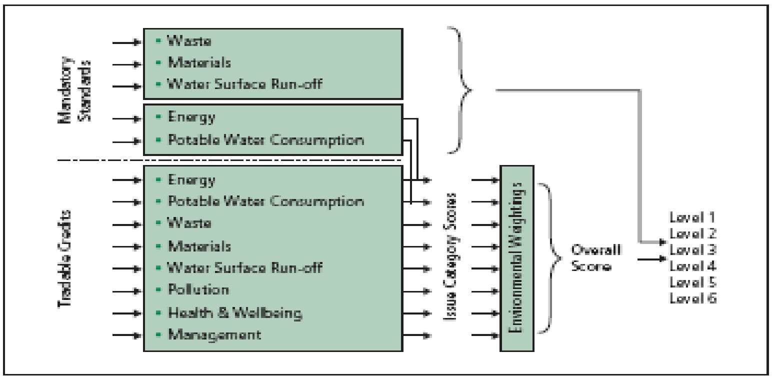

The Code has six levels as follows:

• Code Level 1 - above regulatory standards and a similar standard to BRE's Ecohomes PASS level and the EST's Good Practice Standard for energy efficiency
• Code Level 2 - a similar standard to BRE's EcoHomes GOOD level
• Code Level 3 - a broadly similar standard to BRE's EcoHomes VERY GOOD level and the EST's Best Practice Standard for energy efficiency
• Code Level 4 - Broadly set at current exemplary performance
• Code Level 5 - Based on exemplary performance with high standards of energy and water efficiency
• Code Level 6 - aspirational standard based on zero carbon emissions for the dwelling and high performance across all environmental categories