

London Borough of Waltham Forest

**Climate Change Policy Viability
Assessment**

Final Report

4-05

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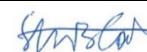
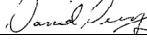
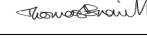
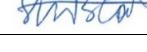
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Executive Summary

Arup was commissioned by the London Borough of Waltham Forest to carry out an assessment of the Council's proposed and potential climate change-related planning policies. This study provides evidence and recommendations for the Council on future policy with particular reference to performance standards, financial contribution levels (Carbon Fund and Community Infrastructure Levy) and guidance on the potential for low carbon technology, whilst taking into consideration the opportunities, barriers and constraints on local renewable energy generation and building retrofit.

Methodology

The steps taken to evaluate policy viability are listed below:

Quantitative analysis

- An estimate of future net additional emissions in Waltham Forest over the life of the Local Development Framework.
- Identify the cost impact of achieving lower carbon emissions through onsite and off-site measures, both energy efficiency and low and zero carbon energy generation
- A comparison of a range of options for combining on- and off-site measures to deliver net zero carbon emissions
- An estimate of the balance of on-site and off-site targets, and the finance required to meet them.

Policy and procedural analysis

- A review of local policy, national and regional planning and statutory framework
- An examination of the implications of government targets on development costs and carbon abatement.
- Identify mechanisms for securing financial contributions from new development to support off-site investment in carbon reduction measures
- Convert conclusions of on- and off-site targets into practical policy targets and mechanisms.

Findings

Arup has reviewed the marginal additional development costs associated with meeting higher levels of the Code for Sustainable Homes (CSH), and compared these costs with the average value of different property types in Waltham Forest. The calculations indicate a sharp upward trend in costs over the Building Regulations 2010 baseline for the higher levels of the CSH. The cost impact for developers as a percentage of the current average sale in Waltham Forest is a modest 1-2% for CSH Level 4. This does rise to a range of 9-15% for CSH Level 6.

In terms of absolute costs, to achieve CSH Level 4 the total uplift in cost required is calculated to be approximately £35/m² for a flat, with over 90% of the costs required to meet the energy target. Our study is focussed on the energy element of the code, which ranges between 70% and nearly 100% of the cost impact of the

higher Code levels. Additional costs associated with the water elements of the CSH were identified; it is recommended that Waltham Forest include a policy in the DM DPD, requiring developments to meet the Draft London Plan requirement and EIP recommendation, equating to 105 litres or less per person per day. In terms of unit cost, the calculations we have produced indicate that marginal additional energy costs range from approximately £25 to £370/m² for Code 4 to Code 6 respectively, subject to dwelling type.

The cost assessments reported are based on national cost estimates. Arup undertook a separate exercise to identify the practical implications of delivering carbon emissions reductions using a sample of development sites representing the type and quantum in Waltham Forest. For the sites considered in the analysis, the combination of building energy efficiency measures and on-site renewables was found to deliver a total maximum onsite percentage reduction in emissions of between 87% and 104% (from a Part L 2006 baseline), but at a very high cost premium.

The cost of maximising carbon reduction on site through energy efficiency and renewable energy generation would be very substantial, with the cost of carbon abatement for all sample development options above £4,000 per tonne. For the smallest development sites (which it should be noted are still large enough to attract a CIL payment obligation), the cost of achieving the maximum required reduction in CO₂ is more than £10,000/tCO₂ per dwelling over 30 years.

Arup has also assessed the potential for low carbon infrastructure, such as district heating and offsite large scale renewable energy generation. Other off-site measures, such as retrofitting for increased energy efficiency were also examined to enable the achievement of net zero emissions from new development. The results indicate that good potential exists to offset carbon emissions from new development through investment in large scale low carbon infrastructure and large-scale retrofit programmes, at a much lower cost premium. It also shows the importance of district heating schemes to delivering CO₂ reductions in the borough.

Finally, the analysis put the on-site and off-site approaches together to explore a number of options to deliver net zero carbon emissions associated with new development, i.e. the equivalent in energy terms of CSH Level 6. Drawing upon the analysis of the on-site costs of achieving different CSH levels and the ranked list of options for off-site reductions, we have generated a locally-relevant estimate of the total additional cost of achieving net zero carbon emissions. Overall, the results show a clear progression of higher net costs as the on-site element of the zero carbon target becomes more demanding.

Summary

In summary, the technical analysis has shown that the delivery of net zero carbon emissions in the borough is likely to be feasible but that very high on-site performance targets may not be feasible or viable. It is considered that an on-site target of 70% reduction on Part L 2006 currently seems to be the practical upper limit which could be viable for developers to meet through on-site measures. However, it should be noted that as building design and renewable technology becomes less costly and more efficient at generating low carbon electricity, the higher target may become more viable in the future.

It should be noted that each development site will have a unique set of circumstances and opportunities which will affect the developer's ability to meet such a target. Indeed, it can be expected that many development sites will not be able to comply in full with the target, particularly at the smaller end of the development scale, conversely it might be viable for larger developments to comply fully with the target. However, on the basis that the 70% target is shown in the analysis to be feasible through on-site measures it is only possible with an estimated 5% uplift in the sale price. This is considered to be an appropriate upper end target for development control.

Key recommendations

If the recommended approach of a combination of off-site and on-site carbon reduction targets is adopted, a Community Infrastructure Levy (CIL) will need to be implemented. A CIL charging schedule will need to be adopted to capture developer contributions for off site low carbon infrastructure. A tariff level for the low-carbon infrastructure identified in this study is recommended at £32.55/m² (including a 5% management fee). It should be noted that this is just for the energy element of CIL and may be difficult to accommodate once all elements of the CIL have been calculated. However, a viability assessment of CIL cannot be undertaken for the energy element alone and therefore no viability-adjusted figure can be proposed as part of this study.

A potential policy tension in relation to the viability of development is perhaps that between affordable housing and carbon performance. Both policy objectives currently set very ambitious standards, and each on their own are recognised to push the limits of development viability. In that context, there exists a potential zero sum game for the local planning authority in determining planning applications. That is, if one accepts that there is a fixed development value for the site, each pound spent on improving the carbon performance of a development site should be matched by a pound less spent in delivering affordable housing.

Development costs are of course driven by many factors, and if the local authority is determined to deliver high levels of affordable housing and achieve high carbon performance standards, it may look to relax other standards, such as the quality of materials and finishes, requirements for green roofs, provision of open space or financial contributions to off-site infrastructure. Should the Council adopt a CIL charging schedule, it will partially lose this option, since the CIL payment is mandatory and in most circumstances not subject to variation or discounts. The Council would therefore need to consider at that stage the three-way balance between its infrastructure plan, its affordable housing trajectory and its ambitions for carbon reduction.

As stated previously the long term policy target recommended is a 70% reduction against Part L 2006 baseline. Statements on the national plan for achieving zero carbon and the London plan both set out a series of rising policy targets to reach the final target. Table 1 below shows Arup's recommended on-site carbon policy targets, which rely upon the CIL recommendations set out above are expressed. The targets are set out in terms of a reduction compared to Part L 2010, providing consistency with the targets outlined in the London Plan 2011. The table illustrates how added carbon reduction contribution of CIL-funded measures could potentially result in an overall acceleration toward net zero carbon.

Table 1. Arup recommendations for on-site policy carbon target

Year	Reduction compared to Part L 2010 Target Emission Rate	
	Residential development (on-site target)	Non-residential development (on-site target)
from date of adoption to end 2012	25%	25%
2013-2015	40%	40%
2016-2018	60%	40%
2019 onwards	60%	60%

Where development is unable to meet the on-site targets set out above, it is recommended that developments are required to make a contribution to a carbon fund to enable residual carbon emissions to be offset elsewhere in the Borough. The recommended carbon fund payment amount is £1,800/tonne (i.e. £60/tonne over 30 years). The fund would need to be setup so it doesn't breach emerging CIL regulations, i.e. the collected monies can't be spent on infrastructure. It is therefore likely that the majority of money will be predominantly invested in building retrofit.

District heating has been identified as one of the key opportunities to reduce carbon emissions within the borough. In addition to a CIL charging schedule for off-site carbon reduction measures, which could be used towards part-financing future district heating systems, it is therefore also recommended that Waltham Forest retain the policy in the Preferred Options DM DPD which requires new development to connect to an existing or planned heat network unless it would not be feasible or viable to do so. The supporting text should make a reference to "planned" meaning having a firm plan to deliver a network within the next three years. Similarly a distance of 1,000m is considered an appropriate reference point to mention in supporting text, but the policy should not be overly precise on the definition of "vicinity" since some schemes further away may be suitable for future connection.

Where an Area Action Plan (AAP) includes proposals for a district heating network, the AAP document should identify the network route and the energy centre location on a plan. Development sites which are in proximity to the route should have a presumption that they will connect.

Abbreviations

AAP	Area Action Plan
BREEAM	Building Research Establishment Environmental Assessment Model
CSH (or Code)	Code for Sustainable Homes
CHP	Combined Heat and Power
CIL	Community Infrastructure Levy
CO ₂	Carbon Dioxide
DCLG	Department for Communities and Local Government
DE	Decentralised Energy
DECC	Department of Energy and Climate Change
DEMaP	Decentralised Energy Masterplanning
DER	Dwelling Emissions Rate
DH	District Heating
DPD	Development Plan Document
EIP	Examination in Public
EU	European Union
FiT	Feed-in Tariff
GLA	Greater London Authority
HLP	Heat Loss Parameter, expressed in W/m ² K (U-value)
kWh	kilowatt-hour (a unit of energy)
kWp	kilowatt Peak (a unit of power output)
kt	kilotonne

LBWF	London Borough of Waltham Forest
LDF	Local Development Framework
MWh	megawatt-hour (a unit of energy), which equals 1,000kWh
PPS1	Planning Policy Statement 1: Delivering Sustainable Development
PPS22	Planning Policy Statement 22: Renewable Energy
PV	Photovoltaic
RHI	Renewable Heat Incentive
SAP	Standard Assessment Procedure
SHLAA	Strategic Housing Land Availability Assessment
SPD	Supplementary Planning Document
TER	Target Emissions Rate
£/tCO ₂	Cost of carbon abatement, expressed as the cost (£) per tonne of CO ₂ saved.

1 Introduction

Arup was commissioned by the London Borough of Waltham Forest (the Council) to carry out an assessment of the council's proposed and other potential climate change-related planning policies. This study provides evidence and recommendations for the Council on future policy with particular reference to performance standards and financial contribution levels, and guidance on the potential for low carbon technology, whilst taking into consideration the opportunities, barriers and constraints on local renewable energy generation and building retrofit.

1.1 Objectives

The key objectives of this study were as follows:

- To provide an estimate of the increase in emissions from future development in the borough, and how these can be reduced or offset.
- To assess the financial impact on developers of meeting higher energy and environmental standards.
- To provide an assessment of the viability of delivering renewable energy in the borough, and to estimate future carbon emissions from future developments.
- To identify a process for enabling the connection of developments to future district heating networks.
- Summarise criteria for assessing the feasibility of connection to future DH networks.
- Assess the cost of retrofitting social housing developments with low carbon technology.
- Provide guidance on the potential for pooling developer contributions to create a "carbon fund" which would support offsite carbon emissions reduction measures.
- Develop a "decision tree" to help planning officers understand the technology choices for reducing CO₂ within the borough.
- To discuss future policy options and how these could ensure delivery of new low carbon technology.

1.2 Key Drivers for the Study

The provision of renewable and decentralised energy generation will be central to the Borough's sustainable future, which includes ambitious targets to reduce carbon: 18% by 2015; and 80% by 2050. Through the local development framework, future developments will be required to meet increasingly stringent energy performance and other sustainable development targets.

The drivers for the Council's targets and for the nature of how those targets will be met, include:

- A 20% EU target of renewable energy generation by 2020. The UK-wide target is an 80% reduction in CO₂ from a 2005 base by 2050.

- PPS1 Supplement on Climate Change, PPS 22 on renewable energy and the Climate Change Act 2008;
- The Planning Act 2008 and the CIL Regulations 2010; and
- The Building Regulations, which are currently expected to increase building performance standards to enable all new domestic and non-domestic buildings to achieve zero carbon by 2016 and 2019 respectively.

1.3 Limitations and assumptions

This report provides a high level analysis of viability implications for climate change policy in Waltham Forest. It builds upon the assessments carried out for the Council's Climate Change Evidence Base report. Although borough-level and site-based analysis have been carried out, this has been a strictly desktop study which has, inevitably, relied upon published benchmarks and Arup's own judgement and experience of similar development and localities. Many variables will affect the actual outcomes of development over the next fifteen years, and all the recommendations need to be understood in this context.

Key assumptions are identified as appropriate throughout the report, with particular attention drawn to the methodology set out in Section 3.

2 Background and literature review

2.1 Current boroughwide emissions

According to the most recent data available from DECC (2010), carbon dioxide (CO_2) emissions within the borough in 2008 are estimated to be 977kt per annum. Figure 1 below shows the breakdown of emissions in the three main sectors of industry/commercial, domestic and transport. This illustrates the large proportion of the borough's emissions (50%) coming from the domestic sector. Building-associated emissions make up a significant portion of that amount, highlighting the importance both of addressing emissions from existing buildings but also of ensuring that new development should be designed and built to avoid as far as possible additional emissions.

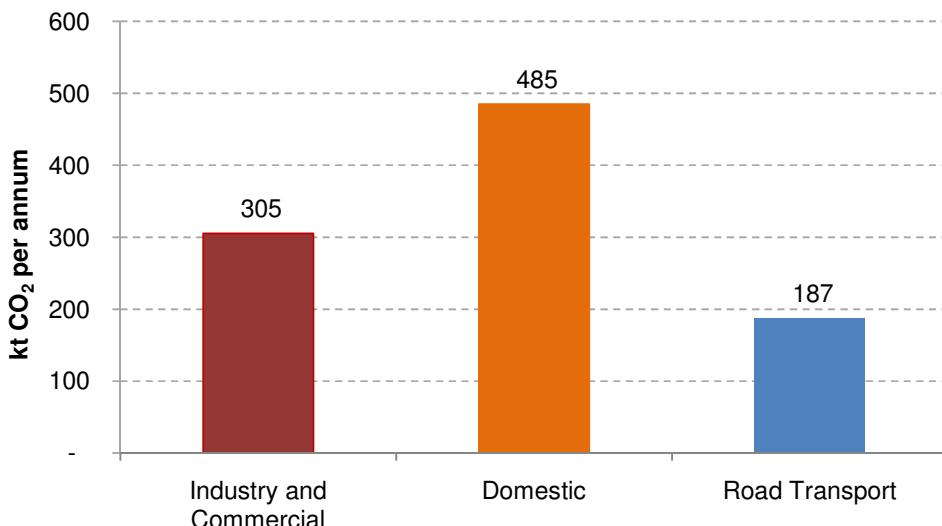


Figure 1. Waltham Forest boroughwide CO_2 emissions (kt/yr)

Source: DECC (2010) NI 186 Emissions

2.2 Regional Planning Policy

2.2.1 London Plan (consolidated with alterations since 2004)

The London Plan is the current strategic spatial planning document for London. This Plan is in the process of being replaced by the Replacement London Plan, more details about which can be found below.

Tackling climate change is a key theme throughout the document and the Plan contains several policies aimed at achieving Objective 6: to make London an exemplary world city in mitigating and adapting to climate change.

The document includes Policy 4A.1 Tackling climate change which states that boroughs should require developments to make the fullest contribution to the mitigation of and adaptation to climate change and to minimise emissions of carbon dioxide. The policy sets out the following hierarchy which should be used in assessing applications:

- using less energy, in particular by adopting sustainable design and construction measures
- supplying energy efficiently, in particular by prioritising decentralised energy generation, and
- using renewable energy.

Policy 4A.2 Mitigating climate change sets out the Mayors target to reduce carbon dioxide emissions by 60 per cent by 2050. The policy requires boroughs to seek to achieve the following minimum reduction targets for London against a 1990 base; these will be monitored and kept under review:

- 15% by 2010
- 20% by 2015
- 25% by 2020
- 30% by 2025.

The Plan also includes Policy 4A.5 relating to the provision of heating and cooling networks. The policy requires boroughs to ensure that all DPDs identify and safeguard existing heating and cooling networks and maximise the opportunities for providing new networks that are supplied by decentralised energy.

In respect of renewable energy, Policy 4A.7 states that boroughs should adopt a presumption that developments will achieve a reduction in carbon dioxide emissions of 20% from on site renewable energy generation (which can include sources of decentralised renewable energy) unless it can be demonstrated that such provision is not feasible.

Policy 4A.16 Water supplies and resource suggests that boroughs should have proper regard to the impact of proposals on water demand and existing capacity. Additionally the policy requires boroughs to apply a maximum water use target of 105 litres per person per day for residential development.

2.2.2 Draft Replacement London Plan

The London Plan is due to be replaced by the Replacement London Plan, the Examination in Public (EIP) for which was held in the Summer 2010. The GLA have since considered the Inspector's recommendations and submitted a final version of the plan to the Secretary of State for Ministerial approval. It is anticipated that the document will be formally adopted in Summer 2011.

As with the current London Plan, mitigating for and adapting to climate change is a key theme in the document.

Policy 5.1 Climate change mitigation accelerates the Mayor's previous target for reduction in London's carbon dioxide emissions and sets the target at a reduction of 60 per cent (below 1990 levels) by 2025. The policy requires boroughs to develop detailed policies and proposals that are consistent with the achievement of this target.

Policy 5.2 Minimising carbon dioxide emissions repeats the energy hierarchy in the current Plan by requiring development proposals to make the fullest

contribution to minimising carbon dioxide emissions in accordance with the following energy hierarchy:

- 1 Be lean: use less energy
- 2 Be clean: supply energy efficiently
- 3 Be green: use renewable energy

The document also introduces targets for carbon dioxide emissions reduction in major developments, expressed as minimum improvements over the Target Emission Rate (TER) outlined in the Building Regulations Part L 2006 leading to zero carbon residential buildings from 2016 and zero carbon non-domestic buildings from 2019. From 2013 to 2016 the Plan proposes a 55 per cent reduction in carbon dioxide emissions over the TER for residential buildings.

The Panel Report from the EIP suggests that this policy should apply to developments of strategic scale as opposed to major development and that Boroughs should also strive to achieve the steeper trajectories than the targets represent.

Policy 5.5 Decentralised energy networks states that within LDFs boroughs should develop policies and proposals to identify and establish decentralised energy network opportunities.

In respect of renewable energy Policy 5.7 suggests that boroughs should develop more detailed policies and proposals to support the development of renewable energy in London.

Finally, Policy 5.15 Water use and supplies states that development should minimise the use of treated water by incorporating water saving measures and equipment and meeting water consumption targets of 105 litres per person per day in residential development.

2.3 Waltham Forest planning policy

2.3.1 Council overall carbon emissions targets

The LBWF Climate Change Strategy (2008) sets out a vision for how the borough will achieve its overall target of an 80% reduction in carbon emissions by 2050. Scenario modelling undertaken for the strategy identifies a trajectory and sector breakdown which is reproduced in Figure 2 below.

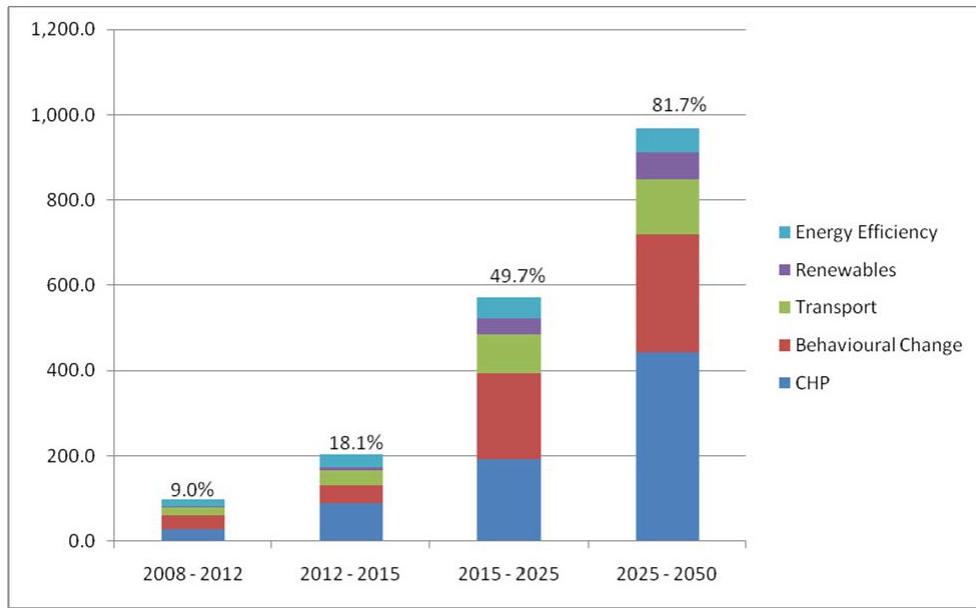


Figure 2. LBWF Climate Change Strategy CO₂ reduction scenario

Source: Figure 3 from LBWF Climate Change Strategy

The strategy relies upon a mix of contributions to deliver the overall target, but with the built environment – building energy efficiency, renewables and CHP systems – delivering the majority of the carbon savings over time.

The key feature of this strategy is that it seeks steady rates of emissions reduction from 2008, even as the amount of development in the borough increases.

2.3.2 Core Strategy (Submission Version)

Consultation on the final version of the Core Strategy closed in February 2011 and the document will now be submitted to the Planning Inspectorate. Once adopted the Strategy will provide a strategic vision, objectives and policies for the Borough up to 2026. As such it is the appropriate document for the Council to set out its overall objectives in terms of carbon reduction and its support for developing decentralised heat and power networks and innovative energy technologies within the Borough.

The Submission version of the document includes Policy CS5 – Minimising and Adapting to Climate Change. The policy recognises the borough climate change strategy and London Plan carbon reduction targets, and sets out the Council's intention to apply the energy hierarchy:

- Using less energy by maximizing energy efficiency;
- Supplying energy efficiently using low carbon heating and cooling systems; and
- Using on-site renewable energy generation.

As well as setting out an overarching commitment to developing decentralised energy networks, the Core Strategy gives direction on the areas with greatest potential for DE, where more stringent requirements should be set. The key

growth areas of Blackhorse Lane, Northern Olympic Fringe, Walthamstow Town Central and Wood Street are highlighted as having potential to support the creation of a viable DE networks. The findings of the heat mapping assessment recently undertaken have confirmed the potential for delivering DE to a number of strategic sites within Waltham Forest.

2.3.3 Development Management DPD

Consultation on the Preferred Options Development Management DPD has recently finished. Once adopted, the DPD will ‘translate the strategic policies in the Core Strategy into more detail to be used in assessing planning applications.’

The latest draft contains three key policies relating to carbon reduction and resource conservation:

- Policy DM11 Resource Efficiency and High Environmental Standards
- Policy DM12 Decentralised and Renewable Energy
- Policy DM35 Water

The Council’s preferred option is to require new developments to achieve or exceed published government targets to achieve zero carbon by 2016 for residential developments and by 2019 for non-residential developments. The preferred policy also requires applications to be submitted with an Energy Assessment. Major development must also achieve at least Code for Sustainable Homes Level 4 and BREEAM ‘excellent’ or equivalent ratings.

Decentralised energy also plays a large part of the Council’s climate change policy. The Council will seek to reduce carbon emissions thorough the development and use of decentralised energy systems and renewable technologies.

The preferred policy also introduces the intention to seek contributions where development cannot reduce energy demand in line with government and regional targets from on-site renewable technology.

Policy DM12 requires major developments to demonstrate how they reduce carbon emissions through the use of decentralised energy systems and renewable energy in line with the energy hierarchy and London Plan targets. The policy requires developments to connect to decentralised energy networks where feasible, and where this is not possible be connection ready for future networks. The policy also seeks a financial contribution where a development has reduced its energy demand as low as practical and feasible and cannot reduce its carbon emissions in line with government and regional targets from on-site renewable technology.

2.3.4 Planning Obligations SPD

The Planning Obligations SPD was adopted in November 2008 and currently provides guidance on the negotiation of planning contributions for developers, applicants and landowners. The document states that in some cases contributions will be required to mitigate the negative impact of development on the Borough’s carbon footprint and its wider sustainability concerns. It is intended that these monies will be used to implement the Climate Change Strategy and other climate change projects.

We understand that Section 106 contributions in respect of climate change and sustainability are rarely sought, and as such the Council does not currently collect any monies that are specifically committed to deliver solutions to tackle the impact of climate change on a boroughwide basis.

2.3.5 Area Action Plans

The Council is currently preparing Area Action Plans (AAPs) for the Northern Olympic Fringe, Blackhorse Lane, Walthamstow Town Centre, and Wood Street.

The Northern Olympic Fringe Area Action Plan is currently at Preferred Options Stage. It is recognised that minimising climate change and its environmental impacts is a particular challenge in the light of the anticipated growth in the Northern Olympic Fringe. The AAP as drafted includes Policy NOF 11 Reduction of Carbon Emission through Energy Efficiency, which seeks to require development to incorporate the three aspects of the energy hierarchy in the London Plan; firstly reduce demand for energy; secondly supply energy in the most efficient way and thirdly use renewable energy sources.

The Blackhorse Lane, Walthamstow Town Centre, and Wood Street Area Action Plan Preferred Options Report are currently under development with consultation scheduled for summer/autumn 2011.

2.4 Community Infrastructure Levy

The Community Infrastructure Levy (CIL) is a new government initiative to aid infrastructure investment in England and Wales. CIL is intended to provide the mechanism through which contributions can be collected from all developments in a simple, fair and transparent manner.

The enabling legislation for CIL in England and Wales was achieved through Part 11 of the Planning Act 2008. Whilst the Act provides the broad framework for CIL, implementation details are contained within the CIL Regulations 2010.

2.4.1 Charging Schedule

Should the Council choose to implement CIL it will need to set its own ‘charging schedule’, which is to be evidence-based, appropriate to the area, consulted on, and scrutinised and approved through independent examination, which effectively gives the charging schedule a status equivalent to Development Plan Documents. In London, the Mayor is identified as an appropriate body to approve borough charging schedules (Regulation 11).

The charging schedule will set out the rates in which CIL is to be priced within the Borough, based on pounds per square metre of net additional floor space (Regulation 40).

2.4.2 Fund Management Structure

The Council would become the ‘charging authority’ and must apply CIL to fund infrastructure that supports the development of its area. CIL will be chargeable to most types of developments; however Part 6 of the CIL Regulations sets out a number of exemptions, including:

- New development with a gross internal area of less than 100 square metres. However, such development that comprises more than one dwelling is liable for CIL (Regulation 42);
- Development by charities for charitable purposes (Regulation 43); and
- Chargeable development that comprises social housing (other floorspace in the same development would attract the levy), (Regulation 49).

Charging authorities are required to monitor receipts and expenditure on CIL for each financial year of collection.

The CIL Regulations and supporting guidance provide limited information on future CIL fund management structures. Current practice with existing tariff-based charging schemes (such as that in place within the London Thames Gateway Development Corporation area) indicate that the charging authority will have considerable flexibility on the location and nature of the works which will be supported. Unlike explicit contributions identified in s.106 agreements there is at present no specific obligation upon charging authorities to spend the money providing infrastructure which directly benefits the developments which make the contributions. In addition, there will not be a right of repayment to the developer if the money is not spent in full.

2.4.3 Low Carbon Infrastructure

The Planning Act is clear that CIL may only be spent on infrastructure.

Although energy infrastructure is not included in the definition of infrastructure in the Act, DCLG has made it clear that the definition is intended to be inclusive and that decentralised energy systems are able to be funded by CIL receipts. This is set out in the CIL companion document which accompanied the Regulations and which was revised and reissued in November 2010.

The limit on what can be constituted infrastructure for the purposes of the Act is a matter which has not yet been tested, given that the first local authorities are only now beginning to consult on proposed CIL charging schedules. This is a question of particular importance for energy and carbon, given that carbon emissions reductions can be delivered through a range of measures but potentially only some of those measures could be funded by CIL receipts.

2.4.4 CIL and Section 106 Regimes

The CIL Regulations provide a reform to the current system of planning obligations to enable both Section 106 contributions and the new CIL to operate effectively alongside each other. The amendments to the use of Section 106 contributions prevent Waltham Forest from pooling contributions to fund energy infrastructure in the future.

As of 6th April 2014, regardless of whether a charging schedule is adopted, authorities will not be able to pool contributions for infrastructure through s106 agreements that can be funded by CIL. The use of pooled contributions will be restricted to up to five planning obligations (Regulation 123 (3b)), beyond which the local authority is expected to implement such an arrangement through CIL.

Furthermore, the appropriate usage of planning obligations when granting planning permissions will be restricted to obligations that are:

- necessary to make the development acceptable in planning terms;
- directly related to the development; and
- fairly and reasonably related in scale and kind to the development (Regulation 122).

Anecdotal evidence from a number of recent appeal cases suggests that the Planning Inspectorate, on behalf of the Secretary of State, is taking a very strict line in interpreting the new regulations. This will mean that any s.106 based approach for pooling financial contributions will need to be very well-defined and evidenced in terms of the application of the funds and the quantification of the mitigation of the defined impact (e.g. tonnes CO₂ saved through a defined package of offsite measures).

It is understood that the Council currently does not collect monies through Section 106 contributions or any other mechanism to fund low carbon initiatives.

2.5 Government incentives and regulation

Changes to Building Regulations now require new developments to meet increasingly stringent energy and emission targets. To support the delivery of on-site renewable energy generation technology, Feed-in Tariffs (FITs) have been introduced to support small-scale renewable generation from <1.5kW to 5MW. Their purpose is to guarantee a price for a period of generation, currently set at 20 years from introduction of the tariff. Renewable Obligations are continuing to be the main support mechanism for schemes with capacities greater than 5MW in scale. In March 2011 the Secretary of State announced a review of FIT which includes a fast-track review of large scale solar PV and farm AD installations. The fast track review proposed reductions in the tariffs for larger PV and AD scheme and is expected to take effect in August 2011. The results of the comprehensive review will not take effect before April 2012.

A second incentive is the Renewable Heat Incentive (RHI), which when implemented will provide a tariff to produce heat from technologies, including: air and ground source heat pumps; solar thermal; biomass fuelled CHP and boilers. However, it should be noted that the LBWF is an Air Quality Management Zone, therefore Biomass is unlikely to be suitable in the borough.

In the UK heat generated from renewable sources accounts for only 1% of total heat demand – which will need to rise to 12% to hit the UK's binding EU target. DECC is currently aiming to deliver new RHI guidelines by Summer 2011.

2.6 Building Regulations

In the UK emissions emitted by buildings account for approximately 45% of the nation's CO₂ emissions. Within Waltham Forest residential and commercial building stock accounts for 50% and 31% respectively. To pursue a policy of carbon reduction, a phased approach to Building Regulations has been implemented to ensure all new domestic buildings are built to zero carbon by 2016, with commercial buildings following three years later. The first of three changes came into effect during October 2010. This change to Part L regulation

requires all new dwellings to emit 25% less CO₂ emissions when compared with 2006 standards. This standard matches the CO₂ element of Code Level 3.

It is anticipated that a reduction in the Target Emissions Rate (TER) will require a 25% reduction in conventional regulated energy use, be that through energy efficiency measures or the adoption of low carbon generation technologies as a direct replacement for conventional carbon-based fuels.

The domestic building analysis assumes that mains gas is the “cleanest” fuel (with an emissions factor of 198g CO₂ per kWh), whilst grid-supplied electricity is the “dirtiest” (at 529g CO₂ per kWh¹).

Table 2. Building Regulations trajectory for CO₂ reductions

Year	Equivalent CSH Level (energy only)	Reduction Compared to Part L 2006 Target Emissions Rate (TER)*
2010 (domestic & non-domestic)	Level 3	25% (regulated energy)
2013 (domestic & non-domestic)	Level 4	44% (regulated energy)
2016 (non-domestic)	Level 5	100% (regulated energy)
2016 (domestic)	Level 6	140% (Zero Carbon) (regulated and unregulated energy) ²
2018 (public non-domestic)	Level 6	Zero Carbon (regulated and unregulated energy)
2019 (all non-domestic)	Level 6	Zero Carbon (regulated and unregulated energy)

*Notes to table: Regulated energy is energy covered by the Building Regulations and related generally to energy loads which are fixed parts of the building (e.g. heating, ventilation and lighting). Unregulated energy is outside the Building Regulations and covers all other energy use, such as appliances plugged into the wall or industrial processes. The above trajectory does not take account of the March 2011 Budget announcements, which indicated that changes will be made to the trajectory.

In December 2008 DCLG launched a consultation document entitled definition of zero carbon homes and non-domestic buildings. It proposed an approach to zero carbon homes that will:

- Achieve large reductions in carbon from all new homes compared to current Building Regulations; and

¹ SAP (2009) – BRE and DECC

² Both Level 5 and 6 can be defined as ‘zero carbon’. Code 5 equates to a 100% reduction in regulated energy use. Code 6 equates to a 140% improvement over Part L 2006 building regulations, and is calculated as a 100% reduction in regulated energy use plus 40% from renewable electrical generation technology (such as PV), to offset unregulated energy use from household appliances.

- Allows a range of solutions for dealing with remaining emissions that will be workable for the full range of housing developments needed to meet our housing targets.

The definition proposed at that time defines zero carbon homes as those built to take account of:

- emissions from space heating, ventilation, hot water and fixed lighting;
- energy use from appliances;
- export and imports of energy from the development (directly connected energy installations)

The buildings will need to be zero carbon across the entire year. The zero carbon energy hierarchy is outlined in Figure 3 below. The target outlines in the CSH indicates that with Code Level 4 compliance requires a reduction of 44%.

Since the consultation document was issued, no formal definition has been announced. The discussion below on zero carbon is therefore based largely on the consultation document, but it is noted that this definition is subject to change in the future as the Government produces its final guidance on zero carbon.

2.7 The Code for Sustainable Homes and the Zero Carbon Definition

The Code for Sustainable Homes (CSH) was introduced in April 2007 as a voluntary measure to assess the sustainability of new homes. A Code Level is attributed through achieving a minimum overall score and a set of mandatory standards for the categories of waste, materials, surface water run-off, energy and potable water consumption, to achieve different levels of the CSH.

Increasing the mandatory energy element of the Code Levels is based on improvements to Part L of UK Building Regulations planned between now and 2016. Level Six can be achieved by offsetting all CO₂ produced by new buildings through regulated and non-regulated energy use. Unregulated energy use accounts for approximately 30% to 40% of a household's energy consumption, which is comprised of energy used in appliances and any loads plugged into a dwelling. A reduction of 140% is therefore needed to attain Zero Carbon.

'Zero carbon' homes as defined by the Code are expected to be required to have a maximum heat loss parameter (HLP) of 0.73W/m²K. The HLP is a combined measure of air tightness and thermal efficiency of the building. Furthermore, building regulations currently require higher energy consumption efficiency levels as part of the progress towards a zero carbon standard.

As Building Regulations progressively introduce tougher energy and emission targets for new buildings, additional development costs are expected to rise. It is important to understand the relationship between the Code for Sustainable Homes, energy requirements at different Code levels and proposed changes to Building Regulations. This allows the marginal costs of implementing each of the various Code levels to be assessed.

The recent Government announcement in the 2011 Budget stated that unregulated energy would not be part of the zero carbon definition for all homes. However, this does not preclude a local authority from requiring it in their planning policy.

Furthermore, the Council's long term target (in common with all UK government bodies) is for a reduction in Boroughwide emissions over the longer term. We have therefore maintained our study basis that zero carbon means carbon emissions associated with both regulated and unregulated energy.

Figure 3 below is reproduced from the Government's consultation on zero carbon. The zero carbon hierarchy is made up of three levels, with energy efficiency first, carbon compliance second – made up of on-site renewables and connections to low carbon energy – and the balance of emissions offset through a basket of allowable solution. These three levels are described in more detail below.

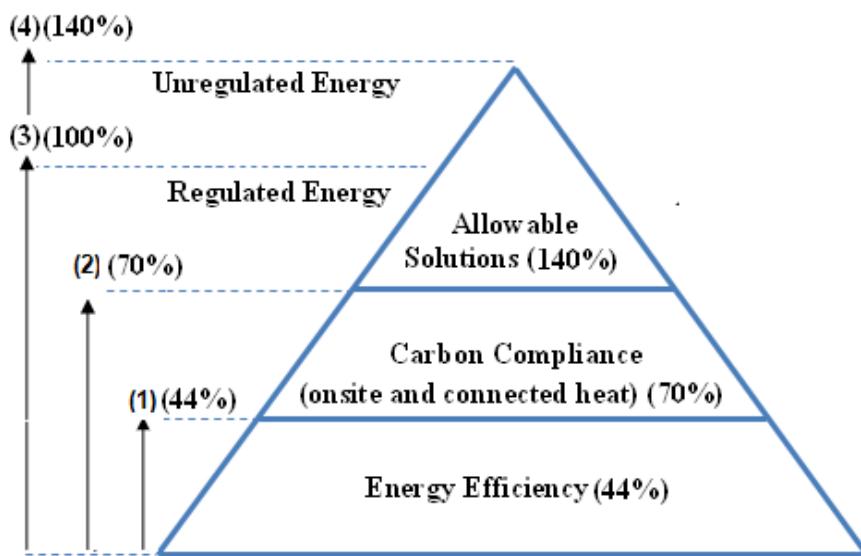


Figure 3. Zero carbon hierarchy (homes)

Source: CLG Definition of Zero Carbon Consultation (2008)

Note: All percentages are based on cumulative emissions reduction as compared with a Part L 2006 Target Energy Requirement (TER) baseline.

2.7.1 Zero Carbon level 1: Energy Efficiency

All new homes will have to be built to very high standards of energy efficiency because these measures are likely to be the most cost effective means of delivering benefits over the lifetime of the home. This is achieved through the good building form, good fabric, air tightness and installing efficient heating, lighting and ventilation. Typically energy efficiency measures alone will enable new homes to meet up to Code Level 4, which represents a 44% reduction in CO₂ emissions relative to the 2006 edition of Part L.

2.7.2 Zero Carbon level 2: Carbon Compliance

This is the minimum level of carbon reduction required to be achieved on-site and/or through direct connection to a distributed energy system which produces little or no carbon. On-site technologies include micro generation (solar heating, solar electric, wind, etc) and the capacity to install these will depend on the site

size and the type of development. Connection to a district heating system can make a useful contribution to minimising carbon emissions, for example through a Combined Heat and Power (CHP) unit or Energy Centre. Current proposals allow for this to be located on-site or off-site.

Building Regulations Part L has changed to require a reduction in emissions of 25% in 2010 and 44% in 2013, work to achieve this is currently underway. The Zero Carbon Consultation proposes that for 2016 and beyond, energy efficiency and compliance measures should be combined to achieve a total of 70% carbon dioxide reductions.

Achieving 44% represents a challenge; going beyond this represents a major challenge for many developments because meeting this target will be reliant upon incorporating low carbon renewable technologies.

2.7.3 **Zero Carbon level 3: Allowable Solutions**

It is unlikely that a combination of energy efficiency and carbon compliance will by themselves be sufficient to achieve zero carbon. A range of other allowable solutions are currently being worked up by central government and are intended to be published shortly. The Zero Carbon Consultation indicated that these could include:

- A Section 106 contribution to retrofit and energy efficiency education programs;
- A contribution towards new local energy infrastructure via the Community Infrastructure Levy. This could include low and zero carbon infrastructure sited away from the development (for example large scale wind); and
- Export of low carbon/renewable heat to other sites near to the development.

2.8 **Code for Sustainable Homes water target**

The CSH also contains mandatory requirements for reducing water consumption in new build housing. To attain Code Levels 3 and 4 (less than or equal to 105 litres/person/day), water savings will need to be achieved through a combination of effective internal and external potable water usage. This will involve the installation of efficient: taps; toilets; baths; rain water collectors; irrigation and water butts.

London's consumption of water already outstrips available supplies in dry years and ensuring a sustainable and secure water supply should be a priority for Boroughs. To remain sustainable, London needs to reduce the level of water consumption per person.

2.9 **BREEAM targets**

The BRE Environment Assessment Method (BREEAM) is a voluntary measurement rating for green buildings that was established in the UK by the Building Research Establishment. It is a tool designed to measure sustainability of new non-domestic buildings. It is updated regularly with the latest UK building regulations and is the leading UK indicator for the non-domestic sector.

BREEAM assesses buildings within ten categories with mandatory performance standards which are assessed on a percentage scoring basis. Where a building attains or exceeds various benchmarks of performance, an appropriate number of credits will be awarded. Depending on the total number of credits achieved, the results give an overall score which is translated into an overall BREEAM rating. The relationship between the rating and the percentage score is as follows:

- Good: above 45%
- Very Good: above 55%
- Excellent: above 70%

3 Methodology

3.1 Introduction

The brief for this study involved a number of discrete elements of analysis, albeit with the primary focus being on the impact of higher standards of carbon emissions performance associated with new development. This section presents the approach to this core area of study and then identifies other analysis and review undertaken to meet the remaining elements of the brief.

The steps taken to undertake the policy viability assessment are listed below:

Quantitative analysis

- Estimate net additional emissions associated with new development over the plan period
- Identify the cost impact and practicability of achieving lower carbon emissions through on-site measures
- Identify the cost impact and practicability of achieving carbon emissions reductions through off-site measures
- Compare a range of options for combining on- and off-site measures to deliver net zero carbon emissions
- Draw conclusions on appropriate balance of on-site and off-site targets, and estimate financial requirement to meet them.

Policy and procedural analysis

- Review emerging local policy and national and regional planning and statutory framework
- Identify mechanisms for securing financial contributions from new development to support off-site investment in carbon reduction measures
- Convert conclusions of on- and off-site targets into practical policy targets and mechanisms.

Our overall approach was to carry out an assessment of the cost impact on new development in the borough being required to meet higher carbon performance targets through the adoption of on-site low carbon technologies and connection to decentralised energy networks. We then considered the appropriate contribution levels and policy measures to enable the delivery of a portion of the carbon emissions target through off-site measures. Further details of the method are set out below.

3.2 Quantitative analysis

3.2.1 Net additional emissions from new development

The starting point for the study was to estimate a baseline of additional carbon emissions associated with the expected new development in the borough over the next fifteen years. This estimate was based on a number of factors:

- A target of approximately 10,000 new homes, assumed to be built at an even rate of 667 per annum;
- An assumed mix of dwelling types (flats, terraced, semi-detached and detached) based on recent completions in the borough and the preferred dwelling mix set out in the LBWF Housing Strategy;
- An assumed floorspace and Target Emissions Rate (TER) per square metre for each dwelling type, based upon the Standard Assessment Procedure (SAP) calculations required to assess compliance with Building Regulations;
- a starting point assumption that all new homes would be built to comply with Building Regulations Part L 2010. The current regulations provide an energy performance standard which is equivalent to the energy component of the Code for Sustainable Homes (CSH) Level 3, which as explained in Section 2 above can also be expressed as achieving a 25% reduction in carbon emissions relative to Part L 2006.

From these data an estimate of the total net carbon emissions from new development was generated. Achieving the most economically efficient means of reducing this figure to zero became the overall objective of the study.

As a general preliminary comment, the study was asked to consider the potential for technological improvements to reduce the cost of compliance. As a rule of thumb, long-run technological productivity has improved by 1% on average per annum, but this figure is considered too unreliable in the short term to be applied. The effects of technological development are difficult to quantify and by their nature unpredictable and therefore our current work does not take into account future improvements in technology and market conditions.

3.2.2 Cost impact of on-site measures

The next step was to identify the cost associated with the delivery of greater reductions in carbon emissions and other environmental performance improvements through on-site measures. This combined local property value information with national estimates of the marginal additional costs of construction associated with homes being built under different levels of the CSH. A similar review of national data for non-domestic buildings was undertaken in relation to different levels of BREEAM. It should be noted that we have only considered the implications of ratings ‘very good’ and ‘excellent’.

3.2.3 Feasibility of on-site measures

A separate analysis was then carried out to assess the realistic potential of achieving greater carbon emissions reductions in new development through on-site measures, based on the local context in Waltham Forest. This analysis drew upon a list of ten development sites identified by the Council which reflected the range of development sizes and types expected to be seen in the borough. The development sites ranged from a few residential units up to a 75-unit development. Larger development sites were not considered as no very large development sites were identified in the borough.

A high-level assessment of the maximum forecast potential for installation of on-site renewable energy devices within each development site. The assessment considered the following renewable technologies:

- Micro-wind, also referred to as building-mounted wind;
- Solar PV; and
- Ground source heat pumps (GSHPs).

To achieve the requirements of the CSH we have taken into account the following technologies:

- Micro-wind – due to the relatively urban nature of the borough, we have assumed that three different types of turbine can be delivered: 2.5kW; 6kW; and 15kW. In all three cases very conservative conversion rates have been applied, which reflects the limited available usable wind resource Arup's experience has found in urban and suburban locations typical of Waltham Forest. It should be noted that the main constraint on micro-wind deployment is the availability of roof space and adequate wind speed.
- PV installation is based on an assumption of 8m² per kW of installed (or peak) capacity and annual electricity generation is equal to 650kWh per kilowatt of peak capacity (kWp). Electricity generation from PV is constrained by the annual hours of solar irradiation and the amount of available and suitable roof space (i.e. free from overshadowing and at appropriate angles / direction); and.
- Ground Source Heat Pumps – the contribution of these technologies is limited by the availability of ground space and overall building heat demand. Typically up to 10% of emissions reduction can be met through this technology. This is dependent on the coefficient of performance, which has been assumed to be 3.5³;

Air source heat pumps (ASHPs) were not considered, largely because they typically offer lower average annual coefficients of power (COP) – and hence lower carbon emissions reductions – compared with ground source heat pumps. ASHPs are more distinctly advantageous than GSHPs for retrofit installations but are less so in the new-build context being considered here. Arup's experience is also that ASHP performance varies widely from site to site, reducing the confidence which could be put into any assumed carbon savings from them.

It should be noted that the site assessments are only indicative in nature and do not reflect detailed issues such as roof angle/orientation, actual available wind resource at each site or the risk of nuisance impacts such as noise and vibration from wind turbines.

CHP and district heating systems were not considered at this stage. Arup's experience is that CHP at the scale of the development sites considered for this assessment is likely to be neither viable nor to result in significant carbon emissions reductions, particularly in a context of expected reduction in the carbon intensity of the national electricity grid.

In Arup's experience a minimum density and scale of development is required to make DE economically and financially viable. Before CHP is installed an assessment of how a heat demand is most efficiently served should be carried out.

³ The efficiency of a GSHP is measured by a coefficient of performance, which represents the amount of heat they produce compared to the amount of electricity required to run them.

According to DECC a typical CoP is around 3.2.

http://www.decc.gov.uk/en/content/cms/meeting_energy/microgen/gshps/gshps.aspx

As a rule of thumb, CHP will become increasingly viable when the size of a development passes 500 dwellings or where the development comprises a mix of uses to achieve a more constant heat load with a higher base load and less extreme peaks. Smaller scale and single use developments are more often best served using boilers. Therefore, to avoid problems associated with stranded assets and underutilisation, it is necessary to time the delivery of generation assets to meet future heat demand.

District heating systems were considered as part of the potential off-site measures, as set out in Section 3.2.4 below.

The potential carbon savings from the renewables was coupled with a factor for “best practice” energy efficiency measures likely to be available to developments of the size being assessed. The best practice measures include in particular enhanced building envelope (walls, roof, windows, doors) thermal performance and the application of mechanical ventilation with heat recovery (MVHR).

Together these measures provided an indication of the practical limit of carbon emissions reductions through on-site measures.

3.2.4 Identifying potential off-site measures

Previous studies for the Council have provided an evidence base which provides an indication of the major opportunities for large-scale low carbon infrastructure. Arup collated the findings from these studies and from Arup’s own experience of options typically available to local authorities to assemble a list of potential off-site carbon reduction measures.

These studies provided an indication of the potential for:

- a large-scale stand-alone wind turbine;
- a number of district heating schemes connected to CHP plant. Assumptions on the size and location of the schemes were drawn from the Council’s evidence base documents;
- retrofit solar PV panels and ground source heat pumps on council offices and large school buildings; and
- energy conservation retrofit measures applied to council-owned and registered social landlord-owned housing. Detailed information on the number and condition of social housing units in the borough was not available within the constraints of this study. Therefore a conservative assumption was made based on treating 20% of the number of social rented homes identified in the Core Strategy, resulting in a figure of approximately 4,200 social rented homes to be treated. Based on a rolling programme of retrofitting of these homes over the plan period (15 years), this would equate to treating 250-300 homes per year.

The district heating schemes were taken from previous evidence base studies carried out for LBWF (the Heat Mapping Study and Climate Change Evidence Base). The available data on the schemes were also used in Arup’s decentralised energy pre-feasibility tool with the objective being in particular to consider the potential range of funding gaps associated with each scheme. However, due to the limitations on data availability to support the use of the tool, and also to ensure that LBWF has an evidence base which is consistent between the different studies

it has commissioned, the figures used in the analysis of this study have been taken directly from those published in the various reports

All these options were quantified in terms of cost and tonnes CO₂ saved, based on published benchmark data, high level development project modelling and Arup's experience from actual development projects. The options were then ranked according to their associated cost of carbon abatement (expressed as £/tCO₂).

3.2.5 Assessing options for on- and off-site measures

The preceded steps together provided locally relevant estimates of the practical feasibility and cost of delivering carbon emissions reductions associated with new development through a combination of on- and off-site measures. The data were then combined to identify, based upon the conditions in Waltham Forest, firstly the practical limit to reducing carbon emissions from new development and secondly the expected most cost-effective combination of on- and off-site measures.

The target level of carbon emissions was taken for this assessment to be net zero, based on regulated and unregulated emissions.

The options for on-site reductions reflected the energy performance standards and marginal additional construction costs associated with Levels 3 through 6 of the CSH along with an additional intermediate level between Levels 4 and 5. The off-site measures reflected the amount of off-site capital expenditure required to deliver the net zero carbon emissions, with the measures selected in order of their cost-effectiveness (£/tCO₂).

3.2.6 Recommend balance of on-site and off-site targets

The technical analysis concluded with a recommendation of the appropriate target for on-site reduction of carbon emissions, based on the results of the analysis along with consideration of the practical implications of different target options.

Based on achieving the recommended on-site target, the amount of investment required to deliver the balance of net carbon emissions savings through off-site measures was calculated.

3.3 Policy and procedural analysis

The technical assessment concluded with a recommendation on the appropriate balance of on- and off-site delivery of carbon emissions reductions to achieve net zero emissions associated with new development in the borough. The policy and procedural analysis applied this recommendation to develop an appropriate local policy framework to ensure delivery of the target. The framework contains two main elements, the first being a set of formal policy recommendations for each relevant document within the Council's LDF, and the second being the mechanisms for securing and then disbursing financial contributions from new development to fund delivery of low carbon infrastructure and other off-site carbon reduction, or off-setting, measures.

3.3.1 Policy recommendations

The policy recommendations were based on a critical review of the Council's emerging LDF and of relevant current and emerging statute, policy and guidance at the national and regional levels.

Account was taken of the stage of progress of each LDF document prior to making recommendations. For instance, where a document was at an advanced stage (such as the Core Strategy, which has reached submission stage), the recommendations were necessarily more limited.

The draft LDF documents considered relevant to this study are listed below, with the status given as at the time the policy review was undertaken:

- Core strategy – submission draft;
- Development Management DPD – preferred options draft;
- Area Action Plans – stage depends on AAP.
- Planning Obligations SPD – adopted.

In addition, as noted above, the London Plan EIP Panel report was published prior to the completion of the final draft of this report but after the main analysis was undertaken and conclusions reached on policy. For that reason the implications of this document have not been fully considered, but reference to the report has been made where possible.

3.3.2 Mechanisms for securing financial contributions

Arup's analysis on the potential for financial contributions to fund off-site carbon reduction measures began from an understanding that a local planning authority could in principle choose one or both of two approaches to secure contributions for off-site carbon reductions. The first of these is an infrastructure tariff approach and the other a carbon offset approach.

While these two approaches remain available the analysis highlighted that the flexibility of planning authorities to choose among these approaches has been greatly constrained by the Community Infrastructure Levy (CIL) Regulations 2010. The approach to the analysis therefore was adjusted to consider separately those offsite measures which would be classed as "infrastructure" from those which were not. The former would then be calculated against the requirements of the CIL Regulations in anticipation of the borough adopting a charging schedule, while the latter would be covered under a carbon fund approach. This has somewhat complicated the analysis and recommendations.

The national regulatory and guidance framework for low carbon development is in a dynamic state. Our analysis and recommendations are based on an assumption (informed by recent statements) that the Government's current intention is to enable and empower local authorities to secure zero carbon development rather than to mandate it at a national level.

3.4 Other assessment tasks

3.4.1 District heating connections

The study considered the question of when and how developments should connect to district heating systems. The technical analysis drew upon Arup's design experience on major DH networks and using a CHP and DH pre-feasibility tool developed recently by Arup.

3.4.2 Decision tree

Arup developed a decision tree to support planning officers and applicants to identify the sequence of assessment steps which should be carried out to determine the appropriate low carbon solution for the site and to identify whether any financial contributions are required to be paid.

3.4.3 Water conservation measures

The study also briefly considered the impact of higher water standards on development. The study assessed the cost impact of higher water standards under the Code for Sustainable Homes and BREEAM, and considered the regional policy context to inform recommendations on water conservation policy.

4 Baseline development and carbon emissions projections

4.1 Introduction

This section summarises the Council's projections for development growth over the next fifteen years, and converts that target to a baseline estimate of carbon emissions associated with new development.

4.2 Residential development

The Council's Housing Strategy identifies a target of 10,000 new homes over the next fifteen years. The emerging LDF identifies four main regeneration areas (each covered by an Area Action Plan) where the majority of new development will take place. Other potential housing development sites are identified in the Council's strategic housing land availability assessment (SHLAA).

The Council's 2009/10 Annual Monitoring Report provides data on housing completions in recent years, which shows that the majority of new homes have been at the smaller end of the scale. The housing data in the AMR are broken down by number of bedrooms per unit, as shown in Table 3 below. For the purposes of the carbon assessment, the figures have to be converted to dwelling type. The assumed correlation between unit size and dwelling type are indicated in the table.

Table 3. Housing completions in LBWF, 2004/05 to 2009-10

Year	Total units	1-bed	2-bed	3-bed	4-bed
2004/05	623	289	285	45	4
2005/06	651	340	266	41	4
2006/07	987	407	487	67	26
2007/08	995	414	499	67	15
2008/09	874	408	324	117	25
2009/10	498	267	169	33	29
TOTAL	4,628	2,125	2,030	370	103
<i>Equivalent dwelling type</i>		<i>Flat</i>	<i>Flat</i>	<i>Flat / terraced</i>	<i>Semi-detached / detached</i>

Using the average size for each type of unit provided in SAP 2005, the above historic figures provide a proportional breakdown of units to indicate an average new development dwelling size in Waltham Forest over the next fifteen years of approximately 62m². However, the Council's Housing Strategy seeks to deliver a greater number of larger units than the historic results show have been completed, with a particular emphasis on larger affordable housing units. Assuming the Housing Strategy unit mix is achieved, and assuming the 50% affordable housing policy is also achieved, the average new development dwelling size would be close to 68m². Both of these calculations are shown in Table 4 below.

Table 4. Calculation of average floorspace per new dwelling

Unit type	Typical m ²	Projection based on mix of actual completions		Projection based on policy target for mix of unit sizes		
		% of new units	Weighted m ²	% of new market housing	% of new social housing	Weighted m ²
Flats	61	94%	57.20	70%	65%	41.18
Terraced	73	4%	2.92	20%	25%	16.43
Semi-detached	88	1%	0.98	5%	5%	4.40
Detached	118	1%	1.31	5%	5%	5.90
Weight average floorspace		62.41				67.90

These figures can be compared for reference to the national average dwelling size of 85m², as provided in SAP. A reasonable but conservative approach to the estimate of future carbon emissions would suggest selecting an average unit size at the upper end of the likely range. We have therefore selected the figure of 68m² as an appropriate average unit size in the borough, resulting in an approximate total quantum of residential development of 700,730m².

The same unit type weightings were applied to the estimated emissions rate associated with new housing, resulting in an average annual Target Emissions Rate (based on SAP 2009) of 26.93kg CO₂/m² and a total emissions estimate including both regulated and unregulated energy rising to approximately 18,900 tonnes CO₂ per annum at the end of the plan period (assuming delivery of the full trajectory of new homes built in compliance with Building Regulation 2010 standards).

4.3 Non-residential development

The Council's 2009/10 Annual Monitoring Report provides data on completions of employment and other non-residential development in recent years. This shows an average of 8,700m² per annum of new development, but an average *net reduction* of 7,800m² when losses of development floorspace are taken into account. The year by year results show considerable variation but in no year between 2004/05 and 2009/10 was there a net gain of non-residential floorspace. Furthermore, the AMR confirms that all new development took place on previously developed land, which suggests that in most cases the new development replaced at least some amount of existing floorspace. Other losses are likely to be reflected as conversions to residential.

From a carbon emissions point of view, this loss of floorspace makes a positive contribution by reducing emissions. Furthermore, the replacement of older stock with new stock will generally have lower emissions, further improving the picture for the borough's overall emissions rate.

Although these recent trends may not continue, no reliable information was available for this study on an alternative development trajectory for net new non-residential development. For the purposes of setting an overall emissions estimate for the borough from new development, the effect of non-residential development

will be treated as net zero, resulting in a total emissions baseline from new development being estimated at 18,900 tonnes CO₂.

The effect of new non-residential development in relation to the potential collection of financial contribution is considered later in this report.

4.4 Conclusion

As stated above, the underlying premise of this study has been that, given that the Council's objective over the next 40 years is to reduce borough-wide carbon emissions, new development should result in no net additional carbon emissions, including energy used by occupants of the new buildings (e.g. for electrical equipment, task lighting, and process plant / machinery). This means, therefore, that a the target for the study is to show whether, and if so how, a reduction of 18,900 tonnes CO₂ per annum can be achieved.

5 The cost of emissions reductions in new development

5.1 Cost impact of the Code for Sustainable Homes

The delivery of progressively more stringent carbon and other environmental performance standards in new buildings while maintaining building size and comfort levels will almost inevitably add to the cost of construction. Higher performance building fabric materials, higher cost lighting units, tighter construction methods and low carbon and renewable energy apparatus all contribute to the net cost impact. In relation to residential property, research carried out for DCLG (Sweet, 2005 and DCLG, 2008) provides a robust national estimate of the marginal onsite cost impact associated with the compliance with each level of the Code for Sustainable Homes⁴.

These national estimates on marginal cost impact have been applied to the local (Waltham Forest) context. Construction costs for different types of dwelling were not available for this study and therefore the recent average purchase price in the borough has been used to quantify the impact of achieving higher standards for new housing.

Table 5 below provides detail of the average house price for each of the four sub-areas within Waltham Forest, which have been used to inform the assessment of cost impact of each CSH level.

Table 5. Average dwelling prices in Waltham Forest (2010)

Dwelling type	Average price
Detached	£428,750
Semi-Detached	£329,542
Terrace	£261,293
Flat	£176,909
Average	£240,244

Source: Land Registry and BBC

The results are shown in Figure 4 below. The chart presents the results of the cost analysis in two ways:

- the marginal increase in development costs above the cost of compliance with Building Regulations 2010, expressed as a proportion of the average sale price in the borough for each dwelling type. This is shown by the columns and the scale on the left hand side of the chart; and
- the marginal increase in development costs above the cost of compliance with Building Regulations 2010, expressed in absolute (£) terms, for each dwelling type. This is shown by the three lines and the scale on the right hand side of the chart.

⁴ This includes the installation of onsite low carbon generation technology and connection to DH.

In both cases the results are broken down into energy, water and other costs. For reference, the CSH levels are:

- Code Level 4;
- Code Level 4+. This is not a defined Code level, but has been used as an additional reference point for the analysis which aligns with the suggested level for Allowable Solutions to be applied (should this idea be put into effect). The analysis applies an Other costs at the midpoint between Levels 4 and 5, a Water cost equal to Level 5 and an Energy cost based on a 70% reduction in carbon emissions from a Part L 2006 baseline;
- Code Level 5; and
- Code Level 6.

5.1.1 Results

The calculations Arup has prepared indicate the sharp upward trend in costs over the Building Regulations 2010 baseline. The cost impact as a percentage of the average sale price in Waltham Forest is indicated as a modest 1-2% for Level 4, but rises to a range of 9-15% for Level 6.

In terms of absolute costs, to achieve Code Level 4 the total uplift in cost required is calculated to be approximately £52/m² for a flat, with over 90% of the costs being to meet the relevant energy target. Our study is focussed on the energy element of the code, which ranges between 70 and nearly 100% of the cost impact of the higher Code levels. In terms of unit cost, the calculations we have produced indicate that marginal additional energy costs range from approximately £25 to £330/m² for Code 4 to Code 6 respectively, subject to dwelling type.

5.2 Costs of BREEAM Targets

The cost of delivering BREEAM targets is based on research carried out by BRE in conjunction with Cyril Sweet and based on BREEAM Policy CS10. Figure 5 overleaf identifies the base build cost to deliver Very Good and Excellent ratings under BREEAM commercial. The BRE report suggests an uplift ranging from 1.5% to 9% to deliver Excellent, demonstrating the challenge of building-based solutions to achieve extreme performance standards.

5.3 Local potential for on-site carbon reduction

The CSH and BREEAM cost assessments reported above are based on national cost estimates. Arup undertook a separate exercise to identify the practical implications of delivering carbon emissions reductions using real examples of development sites in Waltham Forest. The Council provided Arup with a list of ten housing sites along with an indication of the number and type of homes to be delivered. As explained in Section 3 above, each site's feasible potential for "best practice" energy efficiency measures and on-site renewable energy apparatus was assessed, and the resulting carbon savings and costs collated to generate a profile of the feasible potential of delivering carbon savings through on-site measures.

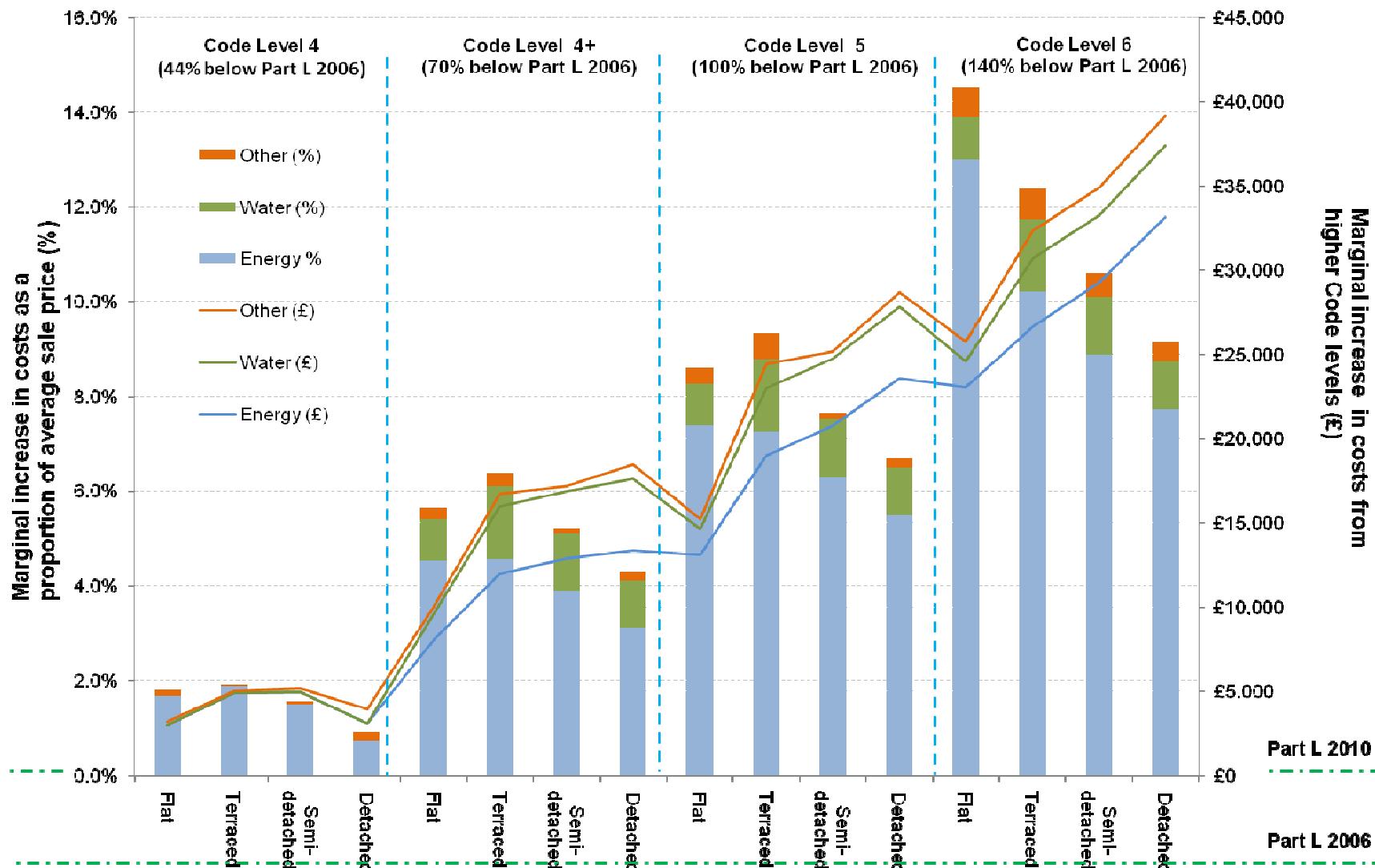


Figure 4. Marginal cost impact in Waltham Forest of the Code for Sustainable Homes, by Code level and by building type

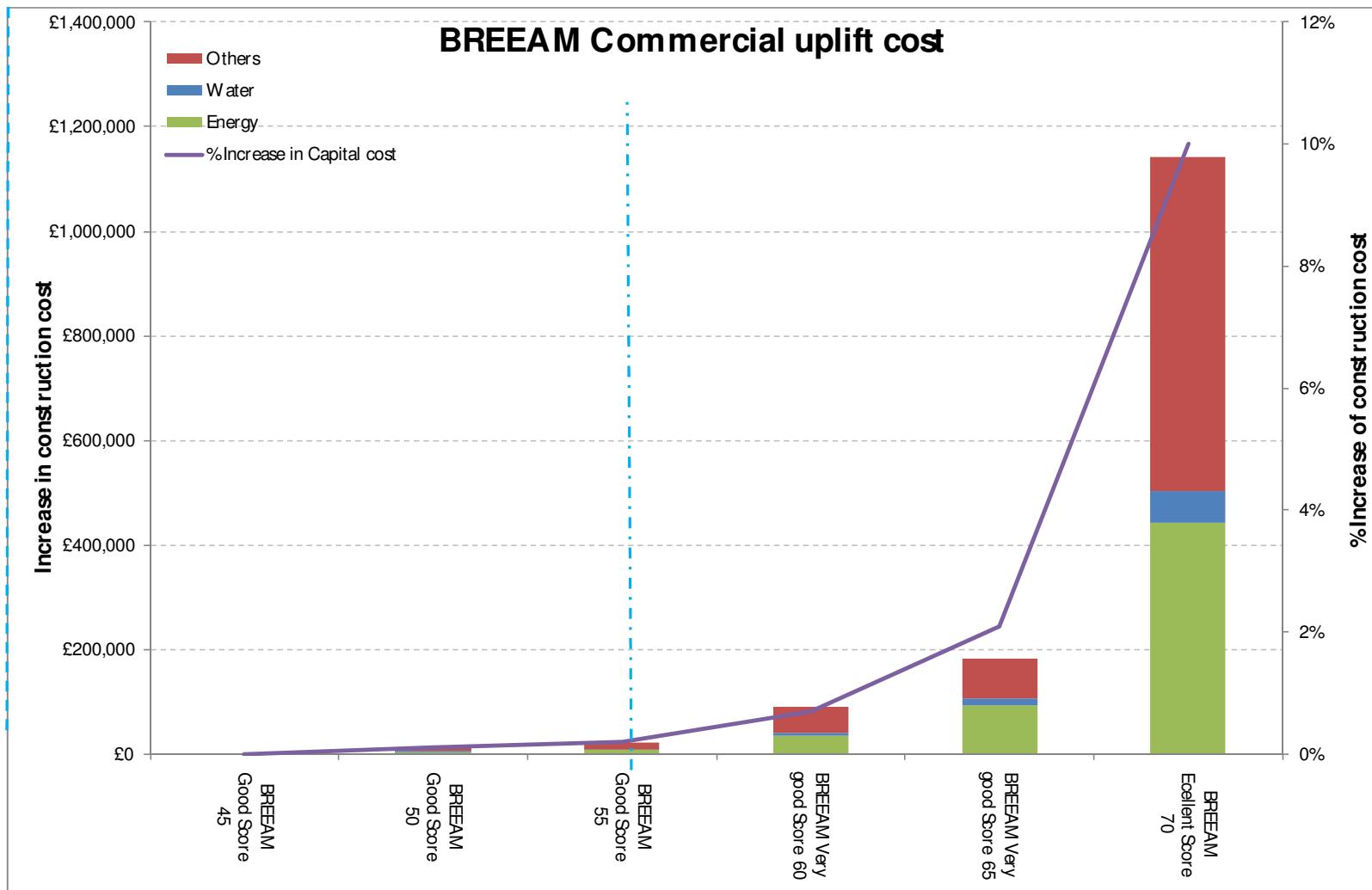


Figure 5. BREEAM Commercial Cost Uplift

A detailed assessment of the range of energy efficiency measures for each development was not possible. Instead, based on Arup's experience of building design, and given the typical size and use of the developments considered, the effect of energy efficiency improvements was set at a 15% reduction in carbon emissions.

A summary of the analysis results is provided in Table 6 below. The table can be understood in terms of three groups of columns, covering:

- summary information on the type and scale of each development;
- specification of the carbon reduction measures;
- summary of the results, in terms of percent reduction of carbon emission and the cost of doing so.

The percentage reductions are expressed in terms of the Part L 2006 baseline, which allows a direct comparison with the percent reduction targets associated with the different CSH Levels (see Table 2 for reference).

The high-level nature of the assessment means that the results need to be treated with some caution. Nevertheless, they provide an important indicator about the practical potential for delivery of carbon reductions through on-site measures within the borough.

For the sites considered in the analysis, the combination of building energy efficiency measures and maximising the use of on-site renewables was found to deliver total percentage reductions between 87% and 104% (from a Part L 2006 baseline). This indicates that compliance with CSH Level 5 will only rarely be achievable through on-site measures. The 70% target reflected in the "Level 4+" shown in Figure 4 above does, on the other hand, appear feasible. The analysis outlined on Table 6 demonstrates how onsite carbon abatement can be maximised through the installation of renewable generation technology: Micro-wind; Solar PV; and Ground Source Heat Pumps. The generation of heat and electricity is however constrained by the availability of ground and roof space, and development heating demand. The potential to apply each of these low and zero carbon technologies are limited by the constraints identified in the methodology (Section 3)

However, the cost of maximising carbon reduction on site would be very substantial, with the cost of carbon abatement for all options above £4,000 per tonne. For the smallest development sites (which it should be noted are still large enough to attract a CIL payment obligation), the cost of achieving the maximum abatement potential is more than £17,000/tCO₂, with unit costs ranging between £80/m² and £290/m². Although the effect of the Feed-in Tariff and Renewable Heat Incentive may reduce the cost impact for a developer, these abatement costs are considered to offer poor value for money, particular when compared with typical abatement costs for building retrofit or district heating schemes, which are typically less than half this figure (these and other alternative options are considered in Section 6).

Table 6. Waltham Forest sample project low carbon feasibility assessment results

Project	No. of dwellings	Floor space (m ²)	Baseline emissions (tonnes CO ₂ /yr) *	CO ₂ reduction through the following measures (tonnes CO ₂ /yr):					CO ₂ reduction on Part L 2006 baseline (%)**)	Total additional cost (£/m ²)	Cost per tonne (£/t CO ₂)	Cost per dwelling (£/Unit)
				“Best practice” energy efficiency	PV	GSHP	Micro-wind	Total reduction				
Project 1 - 3 low density units	3	204	5.48	0.82	1.97	2.76	0.23	5.78	104%	£291	£11,806	£19,790
Project 2 - 3 medium density units	3	204	5.48	0.82	1.31	2.76	0.23	5.13	95%	£211	£10,132	£14,922
Project 3 - 3 high density units	3	204	5.48	0.82	0.98	2.76	0.23	4.80	90%	£128	£7,172	£13,299
Project 4 - 9 low density units	9	611	16.45	2.47	5.91	8.28	0.23	16.89	102%	£194	£7,970	£17,550
Project 5 - 9 medium density units	9	611	16.45	2.47	3.94	8.28	0.23	14.92	93%	£134	£6,402	£12,276

Project	No. of dwellings	Floor space (m ²)	Baseline emissions (tonnes CO ₂ /yr) *	CO ₂ reduction through the following measures (tonnes CO ₂ /yr):					CO ₂ reduction on Part L 2006 baseline (%)**)	Total additional cost (£/m ²)	Cost per tonne (£/t CO ₂)	Cost per dwelling (£/Unit)
				“Best practice” energy efficiency	PV	GSHP	Micro-wind	Total reduction				
Project 6 - 9 high density units	9	611	16.45	2.47	2.95	8.28	0.23	13.94	88%	£103	£5,549	£9,910
Project 7 - 20 medium density units	20	1,358	36.56	5.48	8.76	18.40	0.23	32.87	92%	£120	£5,716	£10,896
Project 8 - 20 high density units	20	1,358	36.56	5.48	6.57	18.40	0.23	30.68	87%	£91	£4,787	£8,458
Project 9 - 75 medium density units	75	5,093	137.12	20.57	2.83	69.01	0.23	122.64	92%	£105	£5,008	£9,513
Project 10 - 75 high density units	75	5,093	137.12	20.57	24.62	69.01	3.48	117.68	89%	£80	£4,100	£7,199

*Based on compliance with Building Regulations Part L 2010. **Compare with a CSH Level 6 target of 140% below Part L 2006.

6 Local off-site carbon reductions

This section reports on the assessment of potential measures to achieve additional carbon reduction through the development of low carbon infrastructure and investment in retrofit programmes to offset the net additional carbon emissions associated with new development. The possible low carbon investments are considered in turn.

6.1 Wind Turbine

The Waltham Forest climate change evidence base study confirmed that wind speeds within the north and east of the borough are well suited to wind energy generation but it concluded that due to a range of environmental constraints (particularly visual and noise), the only identified practical potential for a medium to large scale wind turbine within the borough is the site identified at the time around the Olympic Park.

Notwithstanding the low possibility in the present planning context of a wind turbine proposal being successfully delivered, this assessment included the potential for a single 2.5MW turbine located in the north east of the borough where the best wind resource exists. Such a turbine might have a hub height in the range of 100-120m (a higher turbine will achieve greater energy generation) and an estimated annual output of 4,400MWh.

6.2 District heating schemes with CHP

Five locations have been identified within the Waltham Forest evidence base as having good potential for a district heating network connected to a CHP plant. Each of these schemes were analysed using Arup's decentralised energy pre-feasibility tool. The objective of this exercise has been to understand the energy, carbon and financial performance of each potential DE scheme. Table 7 below provides a summary description of each scheme, provided in the recently completed Heat Mapping Study and Climate Change Evidence Base.

Table 7. Summary of potential borough district heating / CHP schemes (as identified in the LBWF Heat Mapping Study, 2011)

	Scheme	Description
1	Blackhorse Lane South and Blackhorse Lane North	This scheme proposes the installation of a new CHP in the Blackhorse regeneration area. It is an important area for regeneration with potential for up to 2,000 new homes and employment. The potential heat load is estimated to be 11GWh per year.
2	North Olympic Fringe	Regeneration of this area could provide up to 2,500 new homes and provide the basis for a new DH network. There are potential linkages with the Olympic Park CCHP network.
3	Town Hall	This scheme will see the installation of a CHP at the Town Hall. A DH network will be installed and connect to the nearby buildings, including: YMCA; Waltham Forest College; Holy Family College; and St Mary's Junior School

Scheme	Description
4 Walthamstow Town Centre	Regeneration of the Town Centre will provide the opportunity to build 2,000 new homes. This will provide the opportunity to install a new CHP and develop a local DH network.
5 Wood Street South and Wood Street North	Up to 1,000 new homes are anticipated built in this area. The estimated heat load for the area is 15GWh. Each scheme is considered separately in the analysis.

6.3 Renewable energy on existing building stock

There are good opportunities to retrofit solar PV panels and ground source heat pumps into existing public sector buildings in the borough. Although particular sites have not been identified, two types of installation have been modelled based on applying these two technologies to a council office and to a large school building (such as a secondary school). It has been assumed that 5% of the gross floor area is available for ground source heat pumps. It has been assumed that 5% of roof space will be available.

Based on the above assumptions and the typical floorspace for such building types, the modelled plant was:

- 23kW Ground Source Heat Pump (council building);
- 60kW Ground Source Heat Pump (school building);
- 76kW Photovoltaic array (council building); and
- 204kW Photovoltaic array (school building).

6.4 Building retrofit programme

Retrofitting existing, inefficient buildings with a range of energy conservation measures must be a key element of any comprehensive carbon reduction strategy for a local authority. Most buildings standing today will still be here in 2050 and the provision of wall and roof insulation, double glazing and more efficient lighting, ventilation and heating systems can provide a cost-effective route to carbon reduction.

The practical challenge of delivering these improvements across the borough's building stock comes from, amongst other sources, the double complication of existing occupants which would need to be decanted or worked around and multiple landowners which would need to be coordinated on a large scale to achieve material reductions in overall emissions.

We have considered for the purposes of this analysis a balanced programme, which would be to deliver building retrofit measures for the council's stock of social housing. The fact of the council being a single owner with an existing relationship with its tenants makes the delivery of the social housing retrofit programme more likely than a programme which aimed to deliver retrofit within the private owned or rented sectors. The effect of this focus has been to allow the assumed transaction costs of managing and delivering the investment programme

to be reasonably low when compared with the overall total cost⁵. In addition, economies of scale in the purchase of materials and procurement of contractors would also facilitate a lower cost of carbon abatement than would be possible for an individual householder or building manager. However, it should be noted that the technical potential for retrofit would be very similar for many other existing buildings which do not benefit from having a large scale landowner.

As explained in the methodology, a figure of approximately 4,200 social rented homes was used to generate an estimate of the potential carbon savings practically achievable through retrofit of existing stock.

6.5 Results

The results of the analysis are summarised in Table 8, which presents the off-site measures in ranked order of the cost of carbon abatement. The rankings have been calculated using present day capital costs and carbon savings estimates for each technology.

Table 8. Summary of off-site carbon reduction measures

Rank	Project	Capex (£'000s)	Total CO2 savings, per project (tonnes)	Reduction compared to baseline emissions*	Cost of abatement (£/tCO2)
1	2.5MW Wind Turbine	£2,500	2,319	12%	£1,078
2	Wood Street South DH	£2,800	2,100	11%	£1,333
3	Social Housing Retrofit	£7,708	5,372	28%	£1,435
4	Town Hall DH	£2,800	1,712	9%	£1,636
5	Blackhorse Lane DH	£16,014	5,926	31%	£2,702
6	Wood Street North DH	£1,500	523	3%	£2,868
7	Walthamstow Town Centre DH	£1,600	523	3%	£3,059
8	North Olympic Fringe DH	£1,600	436	2%	£3,670
9	Ground Source Heat Pump (Education)	£73	13	0.07%	£5,749
10	Ground Source Heat Pump (Public Building)	£27	5	0.02%	£5,749
11	Photovoltaics (Education)	£612	70	0.37%	£8,725
12	Photovoltaics (Public Building)	£228	26	0.14%	£8,725
	Total	£37,462	19,025	101%	£1,969

⁵ This is an assumption of the study; typical actual transaction costs have not been analysed for this study.

*The baseline emissions estimate is 18,900 tonnes, as explained in Section 4 above.

The results indicate that good potential exists to offset carbon emissions from new development through investment in large scale low carbon infrastructure and large-scale retrofit programmes. It also shows the importance of district heating schemes to delivering carbon emissions reductions in the borough.

It can be further drawn from the results that the opportunities for delivering off-site emissions reductions vary widely in both scale and cost effectiveness. The major infrastructure options of the wind turbine and district heating schemes are all multi-million pound capital schemes but they offer CO₂ savings potential measured in thousands of tonnes per annum, with the resulting carbon abatement cost typically in the range of £1,000-3,000 per tonne. They appear to exhibit considerably greater cost-effectiveness in carbon abatement than the renewable energy measures of ground source heat pump and solar PV, which fall in the range of £5,000-9,000 per tonne.

7 Pairing on-site and off-site carbon reduction measures

The preceding analysis has explored a range of approaches to delivery of carbon emissions reductions associated with new development, with the approaches falling ultimately into either on-site measures or off-site measures.

In this section we have put the two approaches together to explore a number of options to deliver net zero carbon emissions associated with new development, i.e. the equivalent in energy terms of CSH Level 6. Drawing upon the analysis of the on-site costs of achieving different CSH levels and the ranked list of options for off-site reductions, we have generated a locally-relevant estimate of the total additional cost of achieving net zero carbon emissions.

Figure 6 and 7 overleaf shows the results of the analysis, which examined the combination of on- and off-site costs for the following different levels of on-site performance (in achieving net zero carbon). The combinations are labelled on the chart as follows:

- Code Level 4: achieving a 44% improvement on Part L 2006;
- Code Level 4+: achieving a 70% improvement on Part L 2006;
- Code Level 5: achieving a 100% improvement on Part L 2006 ;
- Code Level 6: achieving a 140% improvement on Part L 2006, or net zero carbon.

The costs are expressed as the additional costs beyond those required for compliance with Part L 2010. The costs in Figure 6 are total costs based on the assumed development trajectory of around 10,000 new homes over the next fifteen years. Figure 7 provides the average increase in cost as a percentage of residential sale prices for on and off-site carbon abatement measures for different dwelling types.

At the other end of the scale, there are no additional off-site costs because the net zero carbon target is met by the on-site achievement of Code Level 6. This is acknowledged to be a somewhat false division for Level 6, since as shown in the sample of sites within Waltham Forest, Level 6 can only be achieved through other measures than the on-site measures costed in this analysis. However, the approach is considered appropriate for the purposes of this exercise.

The off-site measures selected for each combination were chosen on the basis of the combination of measures which most closely added up to the balance of emissions to be offset, working down from the most cost-effective to the least cost-effective measure. The one exception to this was that the social housing retrofit programme was not included, due in part to the concerns it would raise in relation to the provable additionality of the carbon savings and also due to the potential limitations on objections to the use of financial contributions from development to fund improvements to Council-owned building stock. A further issue with the retrofit programme relates to the impact of the CIL Regulations; this latter point is dealt with later in this report.

The effect of this selection approach is that the wind turbine is included in each combination but that the majority of the capital funding will go towards one or more district heating schemes dominate the list of off-site measures. For the Code

Level 4 combinations, a small amount of solar PV and ground source heat pump investment was included to meet (but not significantly exceed) the target emissions level.

For comparison Figure 7 illustrates the expected percentage uplift on sales price to achieve the corresponding saving on the 2006 baseline emissions rate for each Code Level.

Overall, the results show a clear progression of higher net costs as the on-site target becomes more demanding.

The immediate conclusion from the evidence of this analysis would appear to be that on-site building performance requirements should not be raised above CSH Level 4, or even beyond the current Building Regulations. However, a number of contextual factors should be recognised which may lead to a different conclusion.

First, it is expected that Building Regulations will be revised in 2013 to require energy performance in domestic buildings equivalent to CSH Level 4. Any policy which sets a lower target would effectively become redundant from 2013.

Similarly, the emerging London Plan sets an accelerated timetable for increasing standards of on-site carbon performance, with an emissions reduction standard from 2013 of 55% below Part L 2006, as compared with the expected Building Regulations standard of a 44% reduction. Whilst the London Plan EIP panel recommended that this higher target relates only to strategic developments (as opposed to major developments), the panel also recommends that boroughs aspire to the higher target.

Finally, higher but achievable standards can be expected to drive innovation among the development industry, while lower standards effectively shift the burden of delivery onto the public sector and increase the likelihood of underperformance against the overall target, i.e. zero carbon.

7.1 Conclusion

The technical analysis has shown that the delivery of net zero carbon emissions in the borough is likely to be feasible but that very high on-site performance targets will not be feasible or viable. It is considered that an on-site target of 70% reduction on Part L 2006 is the practical upper limit which could be viable to meet through on-site measures. As shown in Figure 7, this corresponds to a typical cost uplift of no more than 5-7% of the sale price in the borough for each type of dwelling. Barring significant technological breakthroughs in renewable energy device manufacturing efficiency and/or renewable resource conversion efficiencies, the remaining emissions reductions – i.e. the other 70% – to achieve net zero carbon associated with new development would need to be delivered through off-site measures. As figure 6 shows, the total cost of achieving zero carbon through combined on- and off-site measures using the 70% on-site target will result in an average additional cost of approximately £15,000 per dwelling.

In making this conclusion it is recognised that each development site will have a unique set of circumstances and opportunities which will affect the developer's ability to meet such a target. Indeed, it can be expected that many development sites will not be able to comply in full with the target, particularly at the smaller end of the development scale. There may also be occasional cases where a development can surpass this target, but it is judged that these will be the minority

of cases, especially when the viability of overachievement is considered. On the basis that the 70% target is shown in the analysis to be feasible through on-site measures while staying below a typical marginal cost threshold of 5% of the sale price, it is considered to be an appropriate upper end target.

The timing and policy mechanisms for setting the 70% target are covered in the sections below.

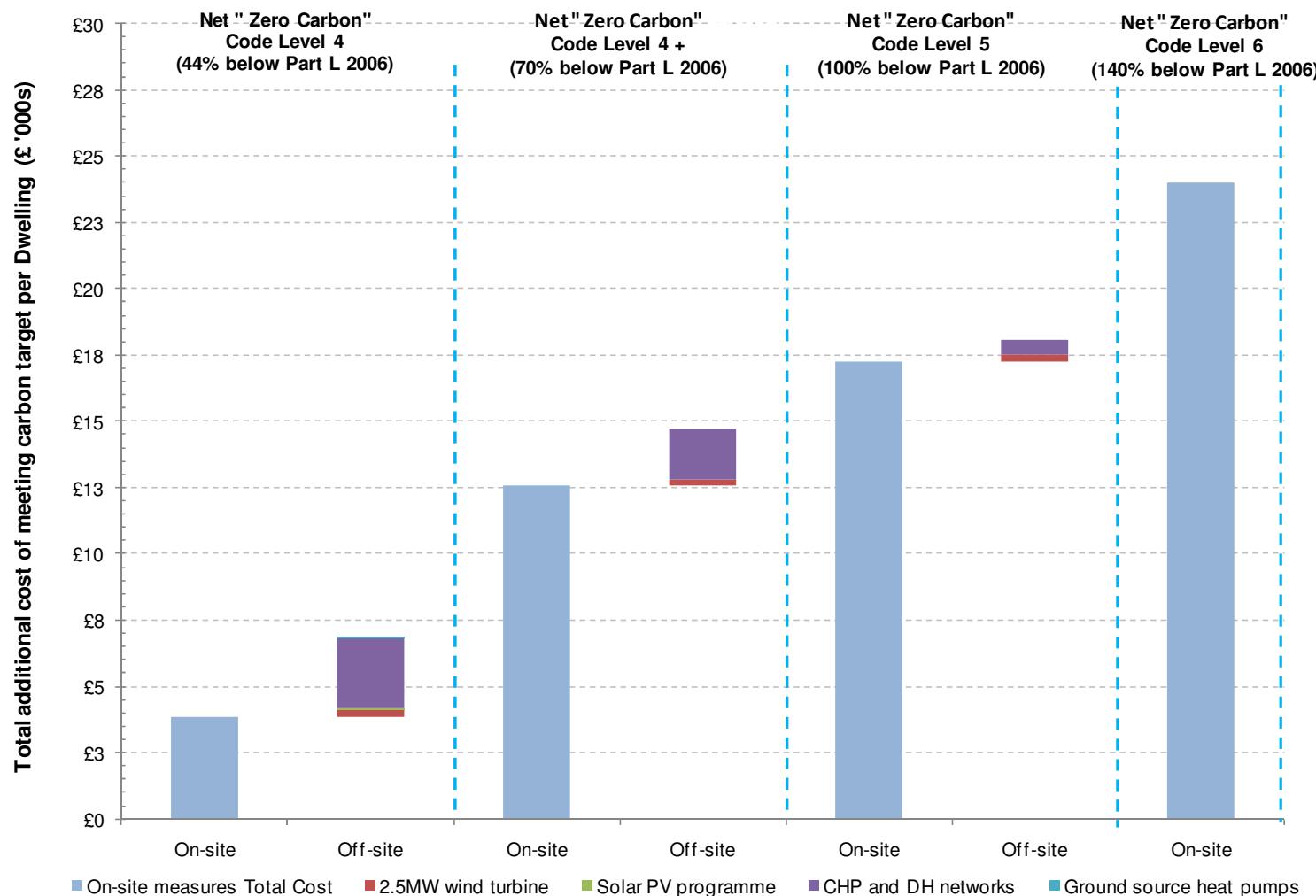
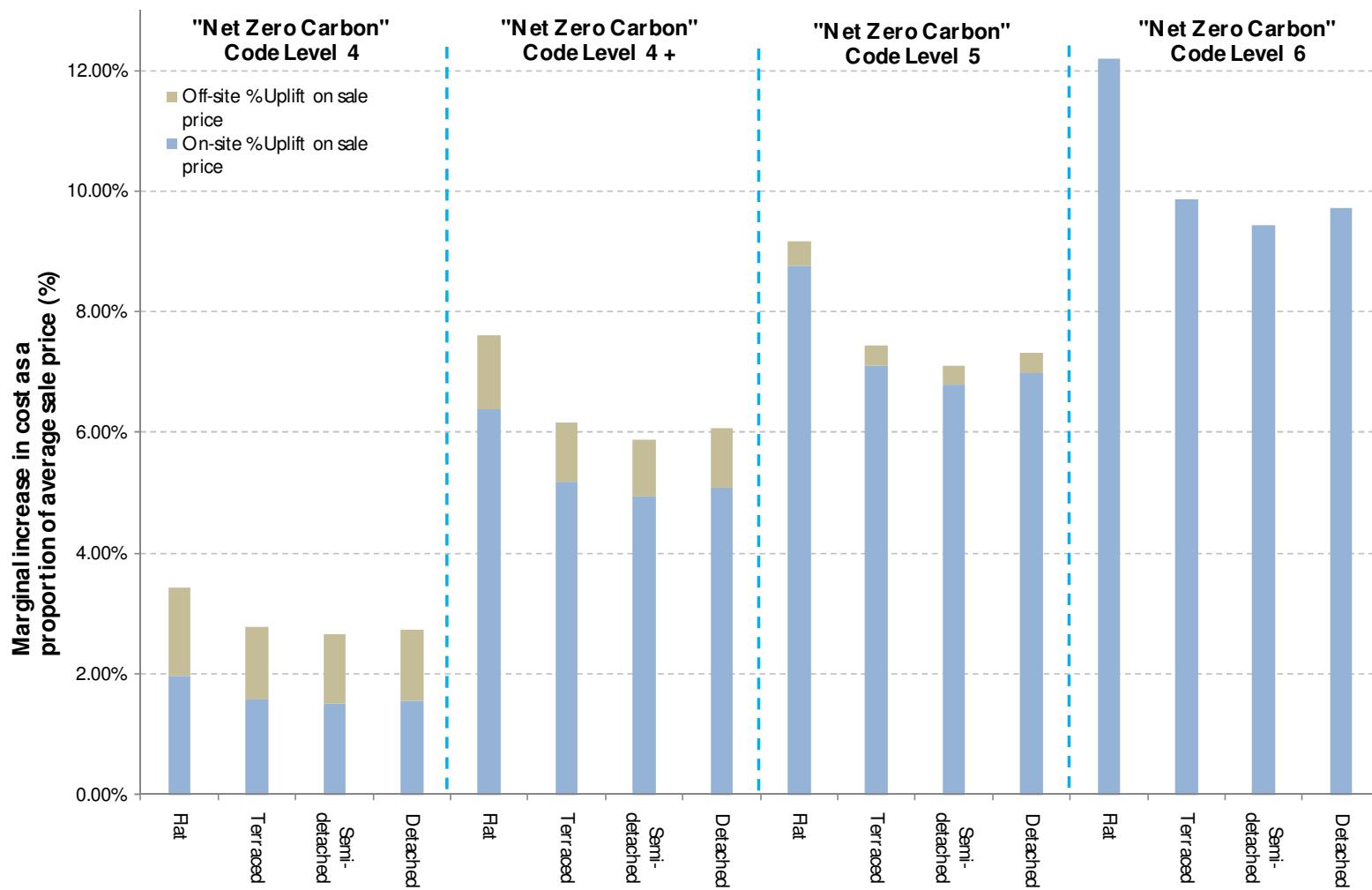


Figure 6, Combined on- and off-site measures to achieve net zero CO₂ emissions from new development within the LDF plan period

Figure 7, Average increase in cost as a percentage increase of dwelling sale price to achieve net zero CO₂

8 Carbon targets and financial contributions

8.1 CIL versus carbon fund

The technical analysis shows that the achievement of carbon emissions reductions beyond a 70% reduction from Part L 2006 would not be viable (or even achievable, in some cases), leaving the remaining 70% of emissions (to achieve net zero carbon) having to be delivered through off-site measures.

Securing developer contributions provides a route to fund off-site measures. The prevailing policy route for this in the recent past has been to use a Section 106 agreement to secure payments from developers in accordance with the carbon emissions which exceed the target. However, as documented in Section 2 above, the introduction of the CIL Regulations 2010 changes the rules over how developer contributions may be collected. Given the inclusion of low carbon infrastructure among the types of project which could be funded by CIL receipts, there are now two routes for securing contributions to fund off-site carbon reduction, being CIL or a carbon offset fund. The features of the two routes are summarised below:

- CIL is collected from all new development on a flat rate per square metre. A single pooled fund is used to pay for all types of infrastructure covered by the council's adopted CIL charging schedule. There are no specific obligations on the council to spend the CIL receipts in accordance with the priorities and proportions set out in the charging schedule. There is no right of refund for developers if the money has not been spent or infrastructure has not been delivered.
- A carbon fund would be a bespoke fund which would collect payments through Section 106 agreements. Developers would be charged on a per tonne CO₂ basis. Each Section 106 agreement would define the purpose of the contribution and would contain mechanisms to enforce the council's covenant to spend the money collected for the defined purpose. The carbon fund could not be spent on infrastructure. Any money not spent by an agreed trigger date could be claimed back by the developer.

8.2 CIL and the definition of infrastructure

The policy and statute review set out in Section 2 above highlights the importance of defining what is included in the definition of infrastructure and what may, or must, be excluded. Given the importance of this question, we have set out in Table 9 below our judgement on which types of carbon reduction measure should fall within the definition of infrastructure and which should not. It is expected that most of these categorisations will be self-evident, but in order to ensure clarity the list has sought to be reasonably exhaustive.

Table 9. Proposed application of the definition of infrastructure to low carbon measures

Measure	Infrastructure?
District heating systems and related energy generation apparatus, including CHP engines	Always infrastructure
Stand-alone medium- to large-scale renewable electricity installation, such as a wind turbine, ground-mounted solar PV array, hydropower plant (including run of river)	Always infrastructure
Low carbon vehicle charging apparatus, including charging points, power cables and related control and customer billing systems and equipment	Always infrastructure
Smart grid apparatus, including smart meters, IT infrastructure and control systems to operate the smart grid.	Normally infrastructure, but smart meters on their own could be excluded.
Building-integrated renewable electricity apparatus, including small- and micro-scale RE installed at ground level within the grounds of a building or campus. The RE generated would be used on site unless supply exceeded demand at the time of its generation.	Normally not infrastructure, but larger schemes could be included if explicitly named in the CIL charging schedule.
Building retrofit measures to improve energy efficiency and/or carbon performance, such as loft and cavity wall insulation, façade treatment for solar gain or shading, mechanical ventilation with heat recovery (MVHR), heat pumps, low energy lighting and energy monitoring devices.	Never infrastructure
Communication and engagement-based measures, including publicity, information and awareness campaigns, bespoke advice and training.	Never infrastructure

The implications of this categorisation can be related back to the ranked list of off-site measures set out in Table 8 above. Some of the measures may be funded by CIL receipts and some may not. For the measures which could be included in a CIL charging schedule, the CIL route would become the only permitted route for using developer contributions to enable those measures to be delivered. The proposed split of infrastructure and non-infrastructure off-site carbon reduction measures is set out in Table 10 below:

Table 10. Application of infrastructure definition to off-site carbon reduction measures

Infrastructure	Not infrastructure
1 2.5MW Wind Turbine	2 Social Housing Retrofit
3 Wood Street South DH	9 Ground Source Heat Pump (Public Building)
4 Town Hall DH	10 Ground Source Heat Pump (Education)
5 Blackhorse Lane DH	11 Photovoltaic (Public Building)
6 Wood Street North DH	12 Photovoltaic (Education)
7 Walthamstow Town Centre DH	
8 North Olympic Fringe DH	

8.3 Setting a CIL level for low carbon infrastructure

Taking the preceding technical and planning analysis together, it is concluded that a CIL charging schedule should be adopted by the borough and that it should contain a schedule of low-carbon infrastructure projects which together deliver off-site carbon reductions amounting to 70% of the expected total emissions associated with new development over the next fifteen years, which equates to approximately 9,400 tonnes CO₂ per annum by the end of the period.

Table 11 below shows the combination of off-site low carbon infrastructure measures which offer the lowest carbon abatement cost and which approximately equate to the off-site emissions reduction target.

Table 11. Low carbon infrastructure to achieve 70% target

Project	Capex (£ '000s)	Carbon savings (tonnes of CO₂)
1 2.5MW Wind Turbine	£2,500	2,319
4 Town Hall DH	£2,800	1,712
5 Blackhorse Lane DH	£16,014	5,926
TOTAL	£21,314	9,957
<i>Equivalent CIL value*</i>		£30/m ²
<i>Equivalent carbon abatement cost</i>		£2,140/tonne CO ₂

*Based on an assumed total development floorspace of approximately 700,730m².

Arup has undertaken a brief survey of a number of CIL charging schedule consultations. This suggests that CIL levels are settling in the range of £75-£125/m². It is recognised that a rate of £30/m² just for the energy element of CIL is likely to be difficult to accommodate once all elements of the CIL have been calculated. However, a viability assessment of CIL cannot be undertaken for the energy element alone and therefore no viability-adjusted figure can be proposed as part of this study. Furthermore, the process of the CIL viability assessment will enable the council to take account of its overall investment priorities in a resource-constrained context; that is, where choices must be made between fully funding social infrastructure, transport infrastructure, energy infrastructure and affordable housing aspirations, these can only be carried out by the council itself taking account of both political priorities and an understanding of the cost implications of these different infrastructures.

8.4 CIL level sensitivity analysis

Although a formal viability analysis of the base case CIL level has not been undertaken, three alternatives to the base case were considered as part of a sensitivity analysis exercise. The alternatives considered, and the reasons for the alternatives, are:

Option 1: Exclusion of the 2.5MW wind turbine

Although the wind turbine is identified as the most cost-effective carbon abatement infrastructure option, the Council's evidence base highlights the practical risks associated with securing planning permission for a large turbine, given the combination of nearby communities and the protections given to Waltham Forest's open space (green belt and/or metropolitan open land).

Removing the wind turbine would therefore reduce the planning risk associated with the CIL infrastructure schedule but would switch from more cost-effective to less cost-effective abatement measures; and

Option 2: Assuming some external finance for district heating networks

Arup's pre-feasibility modelling of the district heating scheme opportunities in Waltham Forest indicate that although each scheme requires external funding to be viable, the funding gap represents in the order of 50% of the total capital costs. This means that the other 50% of the capital costs might have a sufficient investment value to attract private sector finance. This would effectively halve the capital requirement to be supplied by CIL receipts which would in turn reduce the CIL level required.

Option 3: Both Options 1 and 2 together

In addition, the analysis considers three cross-cutting options which could affect the CIL level:

Option A: Assuming delivery of 50% affordable housing target

The Council has a policy target to deliver 50% of new housing as affordable housing. These units would not be liable to CIL. Therefore the amount of floorspace available to fund CIL could be as little as half the total residential floorspace built.

Option B: Adding future non-residential floorspace

As highlighted in Section 4.4 above, recent trends in non-residential development show a net decrease in development floorspace. The rules of CIL mean that a development which involves redevelopment of existing floorspace would only pay for the net additional floorspace, and hence it may have occurred that much of the new non-residential floorspace would not have been subject to CIL.

An alternative scenario for the future is that the downward trend is reversed and non-residential net floorspace increases, or at least new development occurs separately from the loss of existing floorspace, making that new development floorspace subject to CIL. If the historic trend of 8,700m² per annum of new development floorspace were to continue for the next fifteen years, that would total approximately 130,500m² of new floorspace. We have added half that figure as a working assumption for the purposes of the sensitivity analysis, making a total residential and non-residential floorspace projection under Option A of 766,000m². However, by including the affordable housing impact under Option A, the result is a total floorspace subject to CIL of 350,360m².

• *Option C: Management fee*

We have considered the options of imposing a management fee of 5% on the CIL level. This management fee would apply to the costs of managing the fund and is believed to be compliant with the CIL Regulations. It would not, however, cover the cost of extensive feasibility studies or procurement exercises. The sensitivity analysis considered the impact of the management fee on the Option B CIL levels.

8.4.1 Results

The results of the sensitivity analysis are presented in Table 12.

Table 12. CIL level sensitivity analysis

Option		Projects included	Total abatement (tonnes CO ₂)	Total Capex (£ '000s)	Value of carbon element of CIL (£/m ²)			Option C: Option B CIL plus 5% management fee
					Base case: all residential floorspace	Option A: non-affordable residential floorspace	Option B: non-affordable plus non-residential	
	Base case	Wind Turbine Town Hall DH Blackhorse Lane DH	10,000	£21,300	£30	£61	£51	£53.55
1	Exclusion of the 2.5MW wind turbine	Wood Street South DH Town Hall DH Blackhorse Lane DH	9,700	£21,600	£31	£62	£52	£54.60
2	50% reduction in district heating scheme capital contribution	Wind Turbine Town Hall DH Blackhorse Lane DH	10,000	£11,900	£17	£34	£29	£30.45
3	Options 1 and 2 combined	Wood Street South DH Town Hall DH Blackhorse Lane DH	9,700	£10,800	£15	£31	£26	£27.30

The sensitivity analysis shows first of all the very wide CIL levels which can be generated based on the assumptions used and for this reason the CIL levels will need to be subject to regular reviews to ensure the amounts charged reflect closely the development outcomes and the capital requirements associated with the infrastructure to be delivered.

The analysis shows in particular that the CIL level is highly sensitive to the assumptions regarding affordable housing deployment, and also to the capital requirement assumptions for the district heating scheme opportunities. In this latter regard it is recommended that more extensive pre-feasibility assessments be undertaken for each scheme to establish a more robust estimate of the capital required for each one. Such a study could potentially incorporate a soft market testing exercise to establish the appetite within the ESCO market to take on the opportunities identified and to help test the assumptions about public sector capital requirements.

A further point to consider is that the selected district heating schemes may not prove to be the ones which come forward in the plan period, or they may come forward in a different form; based on experience the greater risk is on the downside, i.e. that CHP schemes will be smaller in scale when delivered than when first modelled. This is likely to erode the carbon abatement cost-effectiveness of the investments, since the schemes included in the CIL estimate were among the top ranked schemes, and other schemes exhibit a higher price per tonne of carbon saved.

Lastly, the actual amount of floorspace projected to be built out will affect the final CIL level. The addition of a conservative estimate of non-residential floorspace made a modest impact on the overall CIL level, but will be seen that a change in the amount of floorspace developed will directly impact the CIL receipts. This effect is likely to be damped however by the corresponding change in projected emissions associated with the rise or fall of projected development. It is noted in this context that the emissions associated with the possible non-residential floorspace have not been estimated, and this figure would imply a need for additional low-carbon infrastructure, which would pull the CIL level (as calculated in Option B) back up towards the level estimated under the “residential only” floorspace calculations.

8.4.2 Recommendations

In the absence of undertaking more detailed pre-feasibility assessments, it is recommended that a CIL level is set on the basis of no wind turbine and a 75% capital requirement for the selected schemes. Similarly, we have taken a mid-range estimate for the amount of affordable housing which will actually be delivered, resulting an assumption of 75% of forecast residential floorspace being subject to CIL. These contingency allowances will absorb the risk of lower viability performance, lower cost-effectiveness of carbon abatement and but will also account for the potential CIL receipt surplus from underperformance against the affordable housing target. The resulting figures are shown in Table 13 below.

Table 13. Final recommended CIL level

Projects included	Total floorspace subject to CIL (m ²)	Total abatement (tonnes CO ₂)	Total Capex (£ '000s)	Value of carbon element of CIL (£/m ²)	CIL plus 5% management fee
Wood Street South DH scheme					
Town Hall DH scheme	526,000	9,700	£16,200	£31	£32.55
Blackhorse Lane DH scheme					

8.5 The carbon target and the carbon fund level

In addition to the funding of off-site low carbon infrastructure through CIL at the borough level, achieving the necessary standards of carbon reduction will require developments to achieve a certain level of energy efficiency and carbon reduction through on-site measures. Where developments do not achieve the carbon emissions targets for the development it is recommended that a charge be made related to the shortfall from that target. This Carbon Fund could therefore be used to ensure all development is effectively achieving zero carbon.

This is in addition to the CIL payment which would be uniform and mandatory irrespective of carbon emissions from the site. Furthermore, the CIL-funded low carbon infrastructure is needed to ensure that overall new development is effectively zero carbon assuming that all development achieves the targets for onsite performance. The CIL-related investments are designed to enable off-site infrastructure to deliver carbon savings equal to half the total emissions from new development, compared to a Part L 2006 baseline. The remainder of the zero carbon target would need to be met by on-site design, or by a combination of on-site design and additional off-measures to be funded by the carbon fund payment. Figure 8 below provides further explanation on the relationship between the on-site targets, CIL and carbon fund.

The figure shows two scenarios for the achievement of net zero carbon. In Scenario A, the development complies with a 70% on-site carbon emissions reduction target and meets this target wholly through site-based measures, such as higher building energy efficiency standards and on-site renewables. Potentially this could include connection to a district heating network (but see section 8.5.1 below).

In Scenario B, the development does not meet the 70% reduction target and is therefore required to enter into a Section 106 agreement to pay a contribution to the carbon fund. The contribution is calculated based on the shortfall of x% below the target of 70% emissions reduction.

Applying the fund should be viewed as a last resort for developers and the Council should aim to capture the remaining predicted carbon emissions from a development only after reasonably practicable options for energy efficiency, efficient supply of energy and on-site renewable energy have been exhausted.

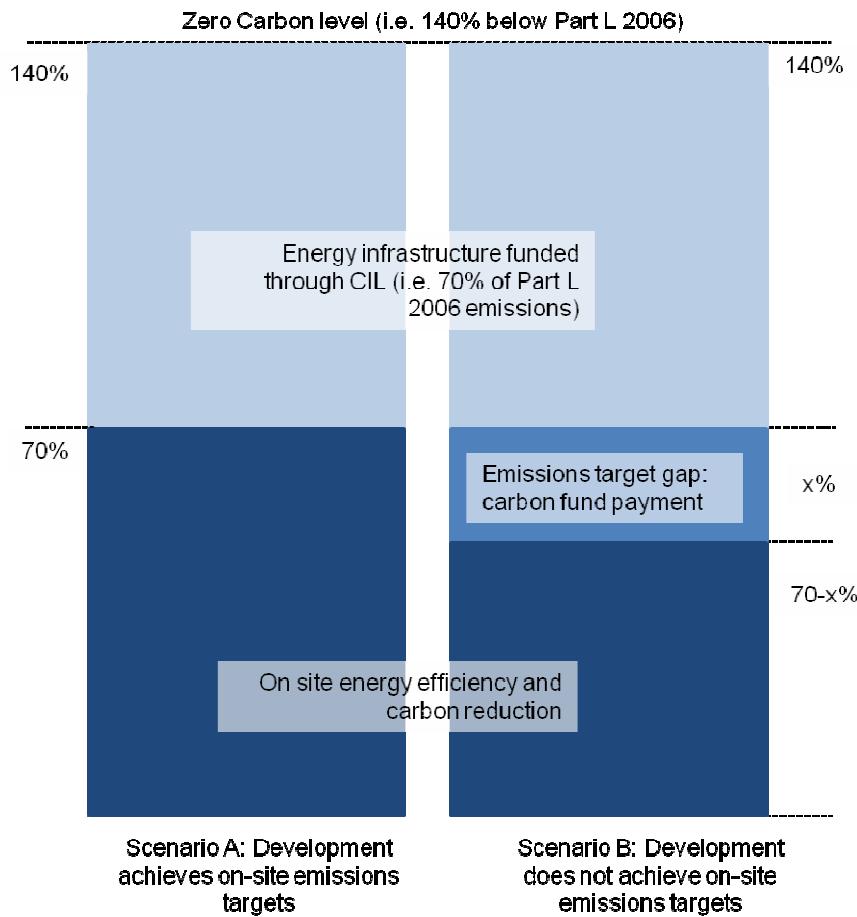


Figure 8. Relationship between on-site targets, CIL and carbon fund

8.5.1 Reconciling the carbon savings from DH network connections

As highlighted previously, this administrative structure has been developed to reconcile the restrictions placed upon the collection and disbursement of financial contributions from developers, i.e. that the CIL money has to go to infrastructure and the carbon fund money has to go to something else. The result of this model is that district heating networks straddle the boundary between the off- and on-site elements of the structure. The result is that where a planning application does commit to a DH network connection, credit would be given towards its on-site carbon emissions reduction target, even as the value of the carbon savings will already have been assumed within the off-site infrastructure to be funded through CIL.

We have considered a number of mechanisms to resolve this potential for overestimating the actual carbon savings, which are briefly reported below:

- The target could be varied between developments which do connect and those which do not. This approach has been adopted by LB Islington, which imposes a 10% higher target (50% vs. 40%) for carbon reduction where a

development connects to a DH network. Setting the higher target needs to take account of the other on-site low and zero carbon heat technologies which would be precluded by a district heating connection, which was considered beyond the level of analytical precision possible within the scope of this study. Furthermore, this approach is considered by Arup to be more practically complicated from a development control perspective and conveys an impression of penalising developments which successfully connect. Should LBWF be successful in securing the creation of a number of heat networks, it is considered that the use of differential targets depending on connection may be appropriate.

- The carbon reduction contribution for the DH connection could be ignored, or heating and hot water could be entirely removed from the carbon calculations. This approach achieves the same effect as setting a higher target (see above) but would create additional work for the applicant and could be seen to lead to the creation of a bespoke method of calculation for LBWF. This option is therefore seen as less attractive than the first option.
- The third option is to retain the same target regardless of whether a DH network connects, which will create an added incentive to developments to connect to networks.

Arup's experience is that the practical challenges, in addition to those directly relating to scheme viability, of DH network development are such that a degree of added incentivisation is appropriate until networks in Waltham Forest are in place and operational. We therefore recommend retaining a single target for all developments, regardless of whether they connect.

8.5.2 Setting the carbon target

This study has, as noted previously, set an overall objective of achieving net zero carbon emissions associated with new development. Part of this will be delivered by off-site low carbon infrastructure, funded by CIL. Because CIL is expressed as a flat rate per square metre, the part of the zero carbon target to be met by CIL cannot be included as a policy target for developers. The long term policy target for new development is therefore recommended, as stated previously, as a 70% reduction against a Part L 2006 baseline.

As explained in Section 2, statements on the national plan for getting to zero carbon and the London Plan both set out a series of steps of rising policy targets to get to the final target. The current London Plan targets and the current understanding of the Building Regulation / Zero Carbon definition targets are reiterated in Table 14 below. These have been expressed terms of both Part L 2006 and Part L 2010.

Table 14. Summary of Government and London Plan CO₂ emissions targets

Year	Reduction compared to Part L 2006		Reduction compared to Part L 2010	
	Building Regs (CSH)*	London Plan	Building Regs (CSH)*	London Plan
2010	25% (Level 3)	44%	0%	25%
2013	44% (Level 4)	55%	25%	40%
2016	100% (Level 5) – homes only	“Zero carbon” – homes only	100% (Level 5) – homes only	“Zero carbon” – homes only
2019	100% (Level 5) – all buildings	“Zero carbon” – all buildings	100% (Level 5) – all buildings	“Zero carbon” – all buildings

*Based on original zero carbon trajectory, informed by March 2011 budget statement.

Table 15 shows Arup’s recommended policy targets for LBWF, which would be applied to all new developments, regardless of size. The targets are based on meeting the emerging London Plan, which sets targets up to 2016 which exceed the Building Regulations trajectory. These targets are considered already stretching for developers; a further acceleration on these levels for Waltham Forest would risk putting the borough at a disadvantage in the short term compared with neighbouring development areas. By bringing in targets at the same time as the rest of London, certain efficiencies of scale and rising competency of construction workers are likely to be realised by developers. In any case, the table shows how the added carbon reduction contribution of the CIL-funded measures could potentially result in an overall acceleration towards net zero carbon compared with the London Plan trajectory.

Table 15. Arup recommendations for policy carbon target for all new development in Waltham Forest WF, based on new Replacement London Plan targets

Year	Reduction compared to Part L 2006		Reduction compared to Part L 2010	
	Site-based policy target	Net reduction, including CIL-funded infrastructure (+ 70%)	Site-based policy target	Net reduction, including CIL-funded infrastructure (+ 60%)
2010	44%	114%	25%	85%
2013	55%	125%	40%	100%
2016	70% (residential)	140% (zero carbon)	60% - homes	120% (zero carbon)
2019	70% (non-residential)	140% (zero carbon)	60% (non-residential)	120% (zero carbon)

8.5.3 Setting the carbon fund price

The appropriate price for contributions to the carbon fund will reflect the cost of delivering carbon emissions off-site without setting the level so low that developers are dissuaded from achieving potentially affordable carbon savings on site. The analysis reported at Table 6 shows that the typical on-site abatement costs range between £4,000 and £9,000/tonne CO₂. Meanwhile, Table 8 shows that the range for off-site low-carbon measures which do not count as infrastructure is as low as £1,100/tonne for the social housing retrofit programme and then rises up to around £6,000/tonne for retrofit installation of renewables such as solar PV and ground source heat pump.

For comparison, a national baseline cost per tonne of carbon has been calculated from an average of the forward £/tonne CO₂ released by DECC (£45/tonne CO₂ per annum) over a 30 year period. This gives a national baseline of £1,350 with which to compare the Council figures we have calculated as part of this study.

A second reference point is the average carbon abatement cost achieved through the off-site low carbon infrastructure measures to be funded by CIL. As shown in Table 11, the overall abatement cost is estimated at £2,140/tonne CO₂.

Setting a carbon fund price at a level to match the national baseline would be a robust approach from a benchmark point of view but would be likely to disincentivise on-site performance due to the likely substantial premium for delivery of carbon reductions through on-site measures. It would also limit the range of measures to which the resulting fund could be applied, since these would be expected to achieve a level of carbon abatement which matched the excess emissions from the developments which made the contributions. A level of £1800/tonne (£60/tonne over 30 years) is recommended as a more balanced figure which is likely to drive on-site performance but which also reflects the average lower abatement costs of off-site non-infrastructure compared with infrastructure measures.

8.6 Implications for affordable housing delivery trajectory

The planning system is designed to mediate between many diverse and sometimes competing objectives. Unlike the Building Regulations, planning decisions are driven by policy, a feature which gives it flexibility but which also means that not all policies can be fully met in every planning decision. Sometimes the policy tension is manifested in the physical constraints of the site, but in other cases the conflict is rooted in the commercial constraints of the development being proposed, i.e. development cannot meet all the policy objectives imposed by the local planning authority and remain viable.

The most stark policy tension in relation to the viability of development is perhaps that between affordable housing and carbon performance. Both policy objectives set very ambitious standards, and each on their own are recognised to push the limits of development viability. In that context, there exists a potential zero sum game for the local planning authority in determining planning applications. That is, if one accepts that there is a fixed development value for the site, each pound spent on improving the carbon performance of a development site must be matched by a pound less spent in delivering affordable housing.

It is beyond the scope of this study to provide a quantified forecast of the impact affordable housing delivery associated with rising standards of development carbon performance, but a number of important qualitative points can be made, which it is hoped will inform the local authority's considerations on how it will decide to balance these two key but potentially competing objectives. For a local authority to escape the constraints of the zero sum game – that is, for it to change the rules – it needs to find a way to enable the total value of the site to be increased, or for other costs to be reduced. This can be achieved in a number of ways, each of which carries other impacts:

Increasing development density

By allowing the development to provide more units on the site (such as by building higher), the total value of the site will increase. If the local authority seeks to maintain the same *percentages* of affordable housing and carbon reductions as for the smaller development, this strategy will be effective only to the extent that more development delivers economies of scale.

The carbon savings potential of increasing density is illustrated in Table 6 above (see Page 32), which shows the desk-based analysis of ten different development sites of varying sizes and development densities. The carbon abatement costs for (low density) Projects 1 and 4, for instance, are nearly twice that for (high density) Projects 3 and 6, which deliver the same number of units but at high density.

Reducing other costs

Development costs are of course driven by many factors, and if the local authority is determined to deliver high levels of affordable housing and achieve high carbon performance standards, it may look to relax other standards, such as the quality of materials and finishes, requirements for green roofs, provision of open space or financial contributions to off-site infrastructure. Should the Council adopt a CIL charging schedule, it will partially lose this option, since the CIL payment is mandatory and in most circumstances not subject to variation or discounts. The Council would therefore need to consider at that stage the three-way balance between its infrastructure plan, its affordable housing trajectory and its ambitions for carbon reduction.

Striking a different balance for different areas

The spatial distribution of existing affordable housing will vary across the borough. Similarly, the scope for achieving higher carbon emissions reductions will depend to an extent on the location of the site, especially in relation to whether a district heating network connection to the site will be viable. Therefore, the AAPs each provide a vehicle for the Council to consider for particular areas what hierarchy is appropriate for competing policy objectives.

9 Implementation of CIL and the carbon fund

9.1 CIL Implementation

The money raised through CIL will be used to fund a wide range of infrastructure that is needed as a result of development. Since CIL receipts are not ring fenced, it will be for Waltham Forest to ensure that a suitable proportion of the money collected is spent on low carbon infrastructure.

It is possible to set differential rates according to the intended land use, which are to be accompanied by a map identifying boundaries and locations of such areas. Additionally Waltham Forest can choose to vary the tariff geographically based on viability. It is recommended that Waltham Forest consider these options when the CIL tariff in respect of all infrastructure has been prepared. However, given that the low-carbon infrastructure will provide carbon savings for the borough as a whole, it is recommended that the CIL element considered in this study be applied across the borough.

In respect of viability testing, it should be stressed that this study has considered only one part of the overall CIL which would be established. Therefore an assessment of viability impact of the CIL level can only be carried out once the full charging schedule has been assembled.

The CIL Regulations and supporting guidance provide limited information on the arrangements for charging authorities to spend the monies collected through CIL, other than a provision entitling charging authorities to use up to 5% of CIL receipts to cover costs incurred in the setting up and administrating the CIL.

It is understood that the council already has in place mechanisms through which Section 106 payments could be collected and distributed, and the CIL fund management structure should therefore be based on existing methods.

9.2 Carbon fund management structure

The Council will need to establish a mechanism through which the carbon fund can be collected and spent. Whilst a Planning Obligations SPD would provide the necessary details for the Carbon Fund, wording within the Development Management DPD will provide information on an overall approach to financial contributions which can be tested through the examination process. This document will also need to contain the policy requiring developers to contribute to the fund where targets are not achieved on site. Further information is provided below.

Existing domestic buildings are the biggest opportunity and biggest challenge for improving the performance of building fabric. A report⁶ recently prepared by Arup for the Carbon Trust found that at present, many of the challenges faced by the building industry are related to the effective application of existing technology rather than the realisation and exploitation of new technologies.

In order to obtain the maximum benefit from the fund, Waltham Forest will need to implement an effective system for collecting and distributing the monies. It is

⁶ Arup on behalf of the Carbon Trust, 2008, LCTPMC Building Fabric Technical Review

anticipated that there will be a significant transaction cost associated with administering the fund and Waltham Forest can choose to reclaim such expenses. The CIL regulations allow up to 5% of CIL receipts to be reclaimed and a similar set up would seem sensible for the carbon fund.

The carbon fund will be created from Section 106 contributions and it is therefore recommended that the Council continue to implement its existing overall mechanisms for collecting, distributing and monitoring Section 106 monies.

As explained in Section 8 above, due to restrictions described above on the use of Section 106 agreements, the Carbon Fund will only be able to be used for non-infrastructure spending. The main opportunities in this category are likely to be:

- building energy efficiency retrofit measures
- building integrated renewable energy installations
- awareness raising or behaviour modification programmes

The Carbon Fund programmes will need to be well defined with a robust estimate of the carbon savings to be achieved, and timescales for delivery. The Section 106 Agreements will need to be precise in how they link the purpose of the payment to the mitigation the money will deliver. Bearing that in mind, it may prove not to be possible to use Section 106 monies to fund awareness and behaviour modifications due to their less measurable outcomes.

Appendix C sets out model clauses suggested for use in securing carbon fund contributions. The wording of the model clauses incorporates a structure for defining the projects which may be supported by the fund, and for the timescales within which the monies must be spent. It should be highlighted that the wording proposed has not been subject to legal advisor scrutiny and therefore it is recommended that the wording is reviewed by the Council's legal advisors before being applied to a particular case.

As part of this study Arup was asked to consider more complex funding structures to support projects, such as making loans to third parties, as a means of extending the reach of limited funds and to capture some of the potential financial benefit from the investments. Arup is not aware of a reason why such structures could not be set up for the financial contributions made by developers. However, the CIL Regulations effectively constrain the complexity of any use of funds, since this would make auditing and monitoring the use of the contributions more difficult. The council would also need carefully to consider credit risk and how it would underwrite the loans or other financial instruments.

On the basis of these practical considerations, it is recommended that the carbon fund is maintained as a more transparent instrument for which the default is that the monies will be spent by the council. Where a third party is to spend the money, it must do so under a contract which clearly defines the outputs to be delivered and the opportunity for claims in the event of non-performance.

Beyond these general comments on fund manager structure, these contractual and legal issues are beyond the scope of this study and it is recommended that specific legal or commercial advice is sought.

10 Other policy recommendations

10.1 CSH and BREEAM standards

This study has focused on energy and carbon in new development. Sustainable development is, of course, about more than these aspects; water consumption, materials use, biodiversity, social and community cohesion and preservation of heritage assets, for instance, are all relevant.

It has been standard practice for many planning authorities to impose a planning condition on new development requiring it to meet a particular standard under BREEAM or, more recently, the Code for Sustainable Homes. CEEQUAL (the Civil Engineering Environmental Quality award) is another standard which is commonly used, albeit most often for major infrastructure projects.

Arup was asked to comment on the application of standards such as BREEAM and the CSH to new development.

The use of such standards can provide a simple means of ensuring a level of environmental quality in new development without having to specify each aspect. This is particularly useful for outline applications, where there is a need to set an appropriate standard but at the same time retain a degree of flexibility for how that standard is met.

On the other hand, there is a risk for the local planning authority that the simplicity and the flexibility of applying a single standard may result in some explicit policies not being complied with. Therefore such a standard should not be applied on its own in a planning permission, but rather it should be accompanied by bespoke conditions which ensure particular issues are addressed or particular policies are complied with. For instance, Arup is aware of particular concerns expressed by the Council in relation to water conservation. Although this issue is covered under BREEAM and CSH, the Council may find that it is more effective to secure more specific and detailed commitments from new development in relation to the particular solutions to reduce water consumption.

In terms of the viability analysis, this study shows that the higher levels of these standards – i.e., BREEAM Excellent and CSH Levels 5 and 6 – will impose significant cost burdens on new development and for many developments will not be viable.

For that reason, and taking account of the preceding points, it is recommended that if the local planning authority is minded to impose a standard such as BREEAM or CSH on new development, it should not normally seek to impose a standard higher than BREEAM Very Good or CSH Level 4. In addition, it is recommended that the local planning authority should use the specific adopted LDF policies relating to different sustainable development aspects as the basis for the standards it requires to be met and the planning conditions it seeks to impose.

Where the Council is directly involved in the funding, procurement or delivery of new development, then it may wish to consider committing to a higher standard.

10.2 Energy Statements

It is recommended that all applications for new development of greater than 100m² should be accompanied by an energy statement demonstrating how the minimum targets for carbon dioxide emissions reduction will be met within the framework of the energy hierarchy.

Energy statements have become a more established feature of planning applications in recent years, and as such it is judged to be reasonable to require one for most developments. It is suggested that Waltham Forest could assist applicants by making available guidance on how to prepare an energy statement. The GLA has prepared some guidance which may be useful; this can be found in Appendix D of the supplementary planning guidance on Sustainable Design and Construction. The 100m² figure matches the threshold for CIL and is likely to capture most development but to exclude most householder developments, where access to technical consultants would be more limited and the burden of evidence to support planning applications would be perceived as unreasonable and onerous.

10.3 Extensions and alterations

Arup has considered the potential to use the planning system to secure improvement to existing buildings. In most cases the scope is limited, but applications for extensions or alterations of existing properties provides one opportunity to consider the original building's energy and carbon performance at the same time as determining the extension proposal. In undertaking this analysis Arup has taken account of a similar policy adopted by Uttlesford District Council in its Energy Efficiency and Renewable Energy SPD (2007).

Seeking significant additional measures to the existing structure as part of an extension must be done with restraint and with due consideration of the overall practicability and impact on viability on the development. With that caveat in mind, it is recommended that the Council includes a policy requiring extensions to take into account the energy efficiency of the existing building being extended or altered. In order for this policy to be found 'effective' and subsequently 'sound' by the Planning Inspectorate, it must be flexible, as well as fair and reasonable.

The requirements placed on developers must be considered in the context of overall viability, and it would therefore be sensible to add wording such as 'where viable / feasible' within the policy. The evidence of potential measures could be achieved by the provision of a Display Energy Certificates (DEC) or Energy Performance Certificate (EPC) where these are available. For smaller properties or householder developments, standard conditions could be applied based on the type of existing building, such as a requirement to install a minimum of 270mm of loft insulation.

It is noted that an energy statement has been recommended for developments of greater than 100m². Where the development is for an extension or alteration comprising more than 100m² of new development, the policy should require the energy statement to document energy performance in relation to the building as a whole.

10.4 Renewable Energy

It is not recommended to set specific targets for the percentage of energy to be generated on-site by renewable energy generation. The overarching energy performance and sustainability standards will ensure that a suitable level of carbon reduction is achieved on-site. The policy is designed to allow developers as much flexibility as possible in achieving the necessary reductions and there is no benefit in setting additional specific requirements.

This approach does not prevent developers installing onsite renewable energy generation where site conditions make them feasible and where they contribute to the highest overall carbon dioxide emissions savings for a development proposal.

10.5 Decision Tree for New Developments

Taking into account the above recommendations, a “decision tree” has been developed to assist planning officers and developers to identify the appropriate sequence in which to consider the range of low carbon renewable heat and electricity technologies available.

The decision tree is attached at Appendix A. The process is structured around the energy hierarchy, with the first steps being around achieving energy efficiency, then considering efficient supply (decentralised energy), then renewable energy and finally payments for off-site measures.

The starting point is to screen the development to determine whether the policies which underpin the decision tree will apply to the development in question.

Following the screening, the early steps – site design and building fabric design – are not set out in detail as they will be the responsibility of the architect and can only be determined on a case by case basis.

The main steps in the decision tree relate to whether the site is suitable for a district heating or CHP solution to provide low carbon heating to the site. This issue is most dependent on site location and development type. Once the CHP and district heating issues have been addressed, developments without potential for DE or CHP will need to consider a range of renewable heat technologies. All developments will then need to consider a range of renewable electricity technologies.

The factors which affect the suitability of particular technologies are highly site dependent and complex. The London Renewables Toolkit provides a good set of flow charts for high level appraisal of each renewable technology, and this document is referenced in the decision tree.

The accompanying tables in the decision tree provide information on the typical carbon abatement cost of each renewable technology, although as stated above these figures are for general guidance only. In accordance with the low carbon resource assessment and the technology preferences expressed by the council, the decision tree and tables exclude geothermal energy, biomass CHP and large scale stand-alone wind turbines from consideration.

The last step in the process is to consider whether the applicant will pay into the Carbon Fund.

It is noted that CIL does not form part of the decision tree as this payment would be independent from any design or technology choices for a development.

10.6 Water policy

It is also recommended that Waltham Forest include a policy intended to reduce the level of water consumption per person. The Consultation Draft Replacement London Plan notes that currently the average Londoner consumes 161 litres/day (l/d), seven per cent above the national average of 150 l/p/d. Projections for population growth in London, as well as predictions of more sporadic and intense rainfall and a higher likelihood of droughts, will mean that new strategic water resources will be required.

The water consumption target set out in Section 12.3.3 is considered to be the most suitable level at which to set the policy as it conforms with Consultation Draft Replacement London Plan Policy 5.15 Water use and supplies, and does not require non cost effective energy efficient measures.

It is not meaningful to set different water consumption targets for non-residential developments, and it is therefore proposed that the usage target only applies to residential development. The rest of the policy should apply to all developments.

11 Considerations for district heating connections

11.1 Estimating the viability of connection

This section provides criteria for connection to a decentralised energy scheme compared to a stand-alone heating solution. For a development there are two distinct alternatives for supplying on-site heat. Both options differ in terms of their running costs and risks, as explained below:

- Connection to a local district heating scheme. Under this option it is assumed that a developer will only pay the local network operator or ESCO for a connection. The process will typically involve a developer calculating and ordering a connection appropriate to the size of development. The key benefit to a developer from connecting to a district heating scheme is the avoidance of cost normally associated with a centralised boiler system. Avoided costs typically include: reduced boiler house space, boilers; pumps; gas supply; operation and maintenance of the internal system. This is the standard approach used for all regulated utility connections such as electricity, water, sewerage and gas supplies.
- Installation of a stand-alone heating system. The second option for a developer is to install a stand-alone system which will supply on-site heat demand, either through in-unit heating equipment or through a communal heating system. Compared with the DH network connection option, the developer will be required to pay all of the relevant costs associated with a heating system. The developer or site owner would pay ongoing costs for fuel delivered to the site.

In summary, there is a trade off between the cost a developer pays for connection to a DH scheme and that paid for purchase and installation of on-site heating plant. Where the connection costs are less than the on-site plant, the connection will normally be considered viable. There are, of course, many other factors which influence the decision to connect to a heating network, including tariff structure, service reliability and risk allocations, but assuming that a developer is minded to connect (or is obliged due to planning policy), then the key test of viability is the connection cost comparison.

The cost of connection is most closely related to the size of the load and the distance from the network to the site. Substituting a standalone system for connection to an energy centre is therefore more beneficial the larger and closer sites are to the DH network.

Figure 9 shows this relationship for a range of residential development scales applicable to the Waltham Forest context. The graph, which is drawn from a CHP and district heating pre-feasibility toolkit developed recently by Arup, shows how heat demand will need to increase for a connection to be more commercially beneficial to a developer. This analysis assumes that the developer would pay for the cost of pipework between the DH network and the development.

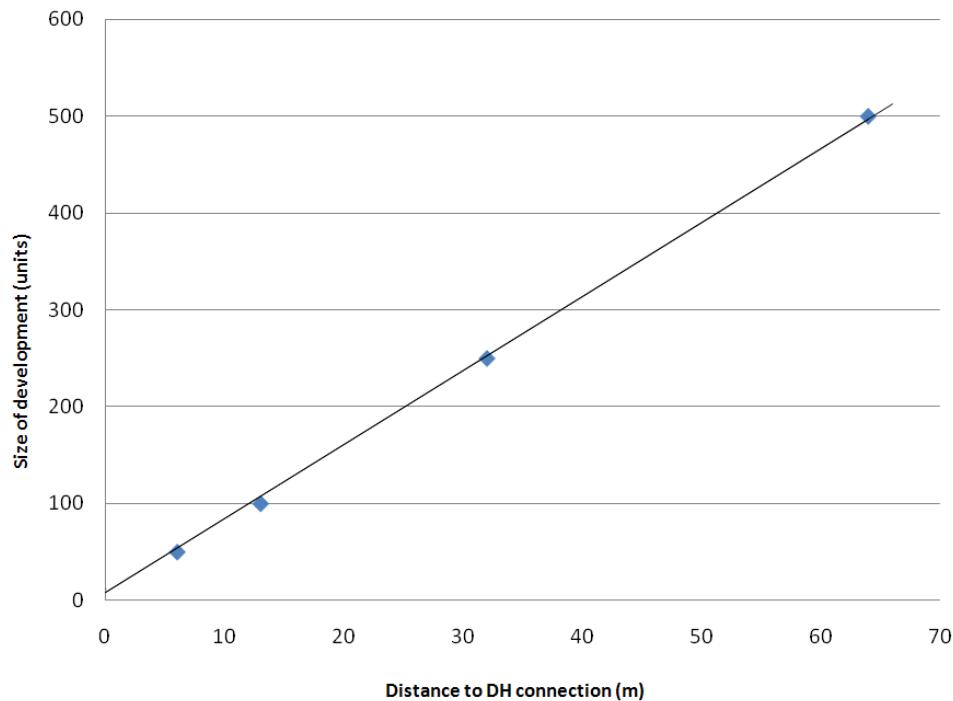


Figure 9. Typical viable distance for district heating connections

However, it should be noted that the cost of pipework varies greatly according to the terrain and type of dig needed (the pipework itself is a relatively small percentage of the total cost). Distribution routes in greenfield open landscape can be up to four times cheaper than pipework laid under roads congested with utilities in an urban environment. These are therefore indicative figures to be used only to establish an expectation of the likely viability of a proposed scheme. The actual viability will need to be modelled in each case and it is recommended that a much greater buffer zone – in the range of 500-1000m from the site boundary – be set where the local planning authority would seek to require a developer to carry out a formal assessment of the potential to connect. Table 16 provides the recommended development control thresholds for developers considering connection to a DH network, providing a guide for a range of cut off points.

Table 16 Distance to DH Connection (m)

Homes	Maximum Length from DH Network
< 50	500m
> 50	500m to 1,000m

11.2 Connecting to heat networks

If a development is in an area where a heat network already exists, the development should be required to connect to that heat network, subject to a test of the viability of connection.

If a development is in a location where a heat network is planned – these areas are identified within the borough's Climate Change Evidence Base report – then the developer should be required to connect to the network when it is installed, subject to an assessment of the viability of connection at the time the network is installed and/or the development is completed.

These two principles are contained within the emerging borough LDF and should be retained and supported by further information on the appropriate safeguarding measures to enable future connection.

To maximise the potential for future connections to be feasible and viable, the development must be compatible with district heating; space for installation of decentralised energy infrastructure such as plate heat exchangers and a connection pit with sleeved connections into the building for later installation of pipework.

11.2.1 Future proofing measures

Policy should require a range of enabling or future-proofing measures where there is no district heating network at the time or where such a connection would not be feasible and viable. Examples of future proofing include:

- Requiring the incorporation of communal heating systems instead of in-unit boilers for developments where a future DH network connection would be viable. As a minimum policy should specify 'wet' heating systems and prohibit electrical heating systems;
- Ensuring any system is DE ready – i.e. it could be connected to supply a DE network with minimum retrofit. This would include:
 - safeguarding an identified route within the development site for DE network connection apparatus (pipes, heat exchangers etc) or requiring the installation of pipe connections up to the property boundary; and
 - building-in penetrations through building walls to the energy centre, allowing a pipe to be pushed through the wall without structural alterations;
- For energy-consuming developments, securing on-going obligations through S106 agreements to connect to a future DE network (subject to agreeing reasonable commercial terms); and
- For energy-generating developments, securing a commitment to supply heat to future DE networks.

11.3 On-site CHP versus a future DH connection

For areas where there is a future potential for a district heating network but that network does not have a firm delivery programme, the provision of an on-site CHP system is likely to come up for consideration. CHP systems offer benefits in terms of lower carbon emissions and potentially additional advantages such as avoiding reinforcement of the district power supply, should the existing network be insufficient to supply the new development. Given the policy restrictions on solid fuel energy generation, most CHP systems being considered will be gas-fired.

In spite of the potential advantages of an on-site CHP as a fallback solution if a DH network is not ready, there are a couple of points which the Council should consider:

- Future decarbonisation of the grid. Given that natural gas is not a renewable fuel, the carbon efficiency advantage over grid electricity is likely to diminish and then reverse in the coming years, as the UK's energy mix takes on more large scale renewables and low carbon sources to replace coal-fired and other high carbon power sources.
- Precluding a future DH network connection. The additional investment in the CHP (as opposed to high efficiency boilers and a standard grid connection) represents an amount of investment which might have been used to fund the DH network instead. If the local planning authority accepted a lower carbon emissions performance for a site, but was able to capture a more robust commitment to connect to a future DH network, this might in the long run achieve greater CO₂ reductions than the on-site CHP solution. Put another way, an on-site CHP risks locking in a stand-alone system for longer and thereby inhibiting the potential for a large-scale district heating network.
- Dispersed CHP plants will only grow into a network when it becomes commercially viable to connect. Factors which effect a developments connecting to a DH network include: distance; density; and scale. The further sites are located away from one another, the higher the heat demand will need to be for linking to become commercially attractive. Before a network can grow an analysis of current and forecast demand will need to be carried out, including a forecast of the heating technology most appropriate to serve the development. As a rule of thumb, CHP will become more viable when the size of a development passes 500 dwellings.

These factors do not mean that on-site CHP will never be suitable. Arup recommends, however, that the Council consider these wider issues and the opportunity costs associated with a gas CHP solution for a particular planning application.

12 Specific policy recommendations

12.1 CIL Charging Schedule

If the recommended approach is adopted, a CIL Charging Schedule needs to be adopted. A tariff level for the low-carbon infrastructure identified in this study is recommended at £32.55/m² (including a 5% management fee).

The charging schedule would effectively sit alongside the Borough's planning policies. CIL will replace many types of planning contributions under a Section 106 agreement and as such all references in planning policy to Section 106 contributions will need to be updated.

12.2 Core Strategy

The Core Strategy is at an advanced stage of preparation and the policies as drafted are considered appropriate in relation to the matters considered in this report. The Council should, however, consider whether any of the references to Section 106 agreements need to be amended to take account of a future adoption of a CIL charging schedule.

12.3 Development Management DPD

12.3.1 Policy DM11

Policy DM11 Energy Performance and Sustainability Standards should include the following components:

1. Requiring all applications for new development of greater than 100m² (gross external floorspace), except householder applications, to be submitted with an energy statement demonstrating how the minimum targets for carbon dioxide emissions reduction outlined above are to be met within the framework of the energy hierarchy. The level of detail contained in the Statement should be commensurate with the type and scale of application.
2. Requiring all proposed development of greater than 100m² (gross external floorspace) to meet the following targets for carbon dioxide emissions reduction in buildings. These targets are expressed as minimum improvements over the 2010 Part L Target Emission Rate (TER) outlined in the national Building Regulations.

Table 17 DM DPD carbon emissions levels

Year	Reduction compared to Part L 2010 Target Emission Rate	
	Residential development	Non-residential development
from date of adoption to end 2012	25%	25%
2013-2015	40%	40%
2016-2018	60%	40%
2019 onwards	60%	60%

3. Where development is unable to meet the targets set out above, it is recommended that developments are required to make a contribution to a carbon fund to enable residual carbon emissions to be offset elsewhere in the Borough. The recommended carbon fund payment amount is £1,800/tonne (i.e. £60/tonne over 30 years).

4. In relation to extensions or alterations (such as mezzanine development) where a property is proposed to be extended by more than 100m², the Council will expect cost-effective energy efficiency measures to be carried out on the existing building. This should be detailed in an energy statement. Such a requirement must take into account the overall scheme viability. For smaller extensions and alterations, the policy should encourage consideration of whole building energy and should reserve the ability of the council to require certain basic energy conservation measures to be undertaken as part of the works. Such measures could include loft insulation, draught proofing and replacement of incandescent light bulbs with compact fluorescent bulbs where appropriate.

5. In all cases, the 100m² threshold relates to the amount of new development irrespective of any demolition or other loss of floorspace which forms part of the proposed development.

12.3.2 District heating

It is recommended that Waltham Forest retain the policy in the Preferred Options DM DPD which requires new development to connect to an existing or planned heat network unless it would not be feasible or viable to do so. The supporting text should make a reference to “planned” meaning having a firm plan to deliver a network within the next three years. Similarly a distance of 1,000m is considered an appropriate reference point to mention in supporting text, but the policy should not be overly precise on the definition of “vicinity” since some schemes further away may be suitable for future connection.

It is not advised that LBWF set a size threshold below which developments need not consider connection to a heat network since the viability and practicality of connecting will depend on numerous factors, of which the size of development is only one. Notwithstanding, the policy expectation to connect should be stronger for major applications than minor. Table 16, provides recommended distances for development control when considering connection to a local DH network.

Such a policy should be borough-wide in its application but will have effect in practice only in areas of good DE potential. The potential for connection to DH should be identified through the heat mapping exercise and followed up with a high-level pre-feasibility assessment for strategic development sites. This approach maximises the potential connection to DH by not excluding any developments from the requirement to connect where feasible and viable.

The policy should include a sequence of alternative measures to be considered or mandated where a development does not connect. The alternative measures should include:

- the enabling or future-proofing measures set out in Section 11. These measures could be specified in a Supplementary Planning Document.

- planning obligations should be agreed which retain a right of a future heat network operator to connect to the development (see Appendix C for model clauses).
- Although the potential for on-site CHP should be considered in accordance with the energy hierarchy, consideration should be given on a case by case basis to forego CHP in favour of a more firm commitment to a future district heating connection. This would need to be supported by a full viability assessment of CHP and district heating connections to the development as well as an acceptable level of confidence in the timing of the future district heating network. In any case the right to connect clause should also apply to sites with CHP.

12.3.3 Water conservation policy

Waltham Forest should include a policy in the DM DPD which includes the following provisions:

- For residential development, requiring development to meet the Consultation Draft Replacement London Plan requirement and EIP recommendation to minimise the use of treated water by designing dwellings with the aim that, through the use of water saving measures and equipment, treated water consumption would typically equate to about 105 litres or less per head per day;
- For new development of greater than 100m², requiring development to incorporate water saving measures and equipment;
- A caveat to the policy should be included to avoid where practicable specifying water conservation measures which have a high net operational energy demand, e.g. pumping systems for rainwater harvesting. Where such systems are proposed, the energy impact of their inclusion should be documented in the energy statement.

12.3.4 Relationship to CIL

The draft Development Management DPD includes several references to Section 106 contributions which will need to be reconsidered should the authority pursue CIL.

12.4 Area Action Plans

Where an Area Action Plan (AAP) includes proposals for a district heating network, the AAP document should identify the network route and the energy centre location on a plan. Development sites which are in proximity to the route should have a presumption that they will connect.

It is not recommended that AAPs set different policy targets for particular areas of the Borough in respect of DH connection or carbon emissions. The principles set out in the DM DPD requiring connection to DE are applicable in all parts of the borough and the main driver for connection is the DH potential, as opposed to the geographical boundaries of an AAP.

The Council should consider commissioning specific pre-feasibility studies for each of the DE opportunity areas. It is understood that a pre-feasibility assessment is currently underway for the Upper Lee Valley and the findings of this study should be incorporated into any relevant AAPs. Such a study would provide a robust assessment of the funding requirement and the carbon performance of the scheme and would help to identify suitable locations for the energy centre and network route.

In the absence of such a study, the completed LBWF heat map would guide developers and case officers where more detailed connection feasibility and viability assessments will be required.

Similarly, it is considered inappropriate to set more stretching targets in respect of carbon savings in particular parts of the Borough. The targets set out in the DM DPD recommendations are considered to be at a threshold which is reasonable and achievable for all developments. Setting more challenging targets in AAP areas may discourage development in these parts of the Borough.

12.5 Planning Obligations SPD

Based on the recommended adoption of a CIL Charging Schedule, the adopted Planning Obligations SPD will need to be replaced.

12.6 Sustainable Design and Construction SPD

The detailed list of measures to safeguard the potential for future connection to a district heating network could be contained in a Sustainable Design and Construction SPD, for example setting out the examples of future proofing given in Section 11 above.

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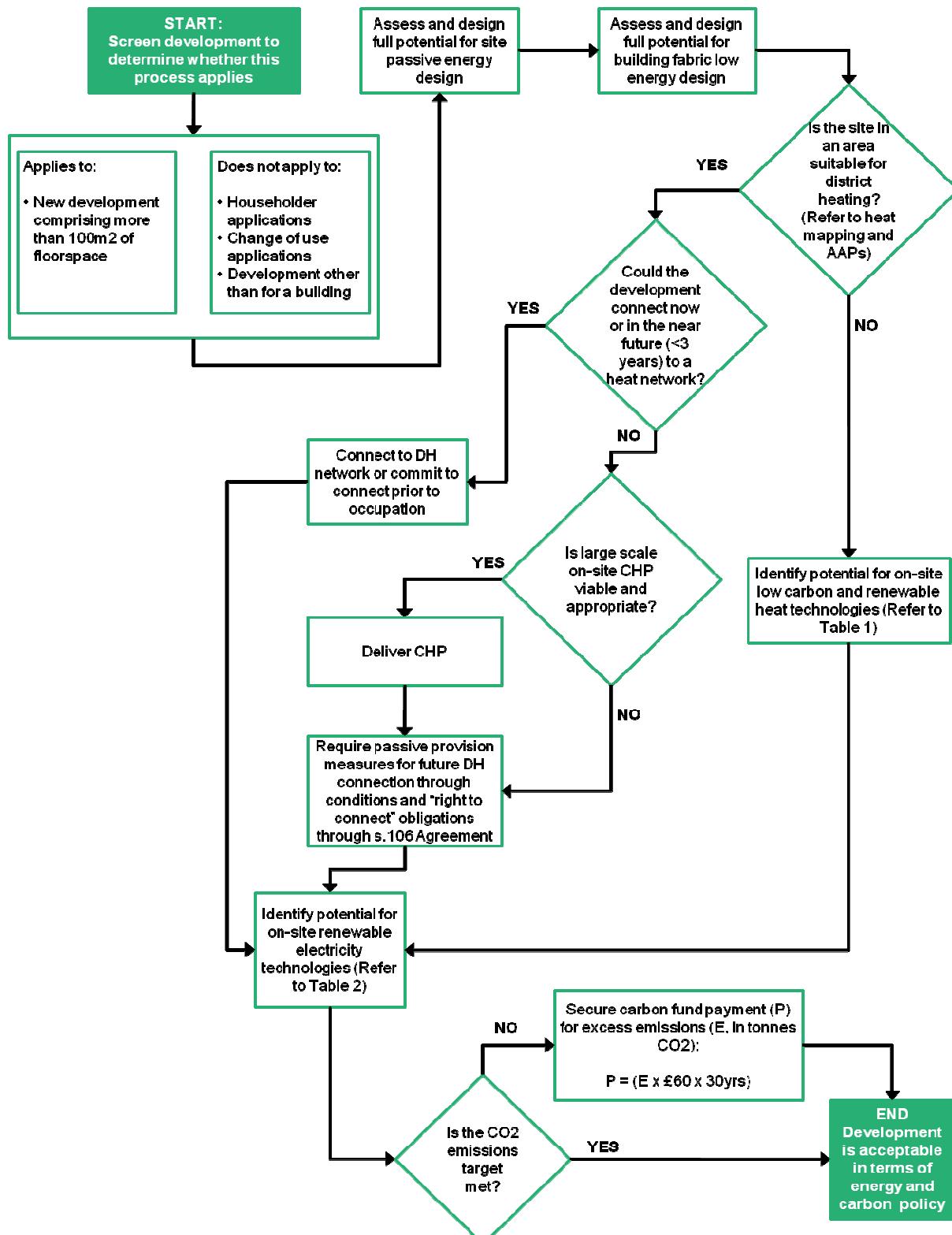
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Appendix A

Decision Tree

***Note on flowchart:**

The boundary between “smaller scale” and “larger scale” developments cannot be drawn sharply, but for guidance larger scale residential developments would be at least 150 units or on a site of at least 0.5 hectares, while larger scale non-residential (or mixed use) developments would be at least 15,000m². However, each case will need to be considered on the basis of the particular nature of the development proposed. It should also be noted that large-scale on-site CHP refers to on-site provision for large scale development.

TABLE 1. Low carbon on-site heat technology matrix for LBWF
 (For further information on selection of technologies for a particular site, please refer to Section 4 of the London Renewables Toolkit*)

	Residential	Non-residential
Smaller scale	<ul style="list-style-type: none"> • Ground source heat pump • Air Source heat pump • Solar thermal 	<ul style="list-style-type: none"> • Ground source heat pump • Air Source heat pump • Solar thermal
Larger scale	<ul style="list-style-type: none"> • Connection to a nearby source of waste heat (retrofit CHP) • On-site gas CHP • Ground source heat pump • Air Source heat pump • Solar thermal 	<ul style="list-style-type: none"> • Connection to a nearby source of waste heat (retrofit CHP) • On-site gas CHP • Ground source heat pump • Air Source heat pump • Solar thermal

TABLE 2. On-site renewable electricity hierarchy matrix for LBWF
 (For further information on selection of technologies for a particular site, please refer to Section 4 of the London Renewables Toolkit*)

	Residential	Non-residential
Smaller scale	<ul style="list-style-type: none"> • Solar PV • Building mounted wind, <5kW 	<ul style="list-style-type: none"> • Solar PV • Building mounted wind, <10kW
Larger scale	<ul style="list-style-type: none"> • Solar PV • Building mounted wind, <10kW 	<ul style="list-style-type: none"> • Solar PV • Building mounted wind, <15kW

*Note to tables:

Weblink for London Renewables Toolkit:

http://legacy.london.gov.uk/mayor/environment/energy/docs/renewables_toolkit.pdf

Appendix B

Model Conditions and Clauses

B1 Model Conditions for Connection

B1.1 Connection of an on-site heat network

No more than [500] units of the development hereby approved shall be occupied until the proposed CHP plant has been installed and commissioned and all units have been connected to the site district heating network. All units completed thereafter shall be connected to the site district heating network prior to occupation.

B1.2 Connection to an off-site heat network

The development hereby approved shall not be occupied until a physical connection to the [name of] District Heating Network has been installed and commissioned, unless otherwise approved in writing by the local planning authority.

B2 Model Clause for Carbon Fund Payment

The following text is suggested as a form of words for a planning obligation for the carbon fund payment. It has not been reviewed by a lawyer; this should be done prior to its use in a Section 106 agreement.

Interpretation

“Carbon Fund Payment” means a sum calculated using the formula:

$$P = (E \times £1800)$$

where:

P is the Carbon Fund Payment; and

E is the Excess Emissions.

“Excess Emissions” means the absolute number of tonnes of CO₂ emitted per annum associated with the Development which are calculated using an agreed methodology to exceed the target CO₂ emissions level.

Owner Covenants

1 The Carbon Fund Payment

1.1 Prior to Commencement of Development, the Owner will pay to the Council the Carbon Fund Payment.

OR

1.1 Prior to the occupation of [for example, the 100th residential unit or 1,000m²], the Owner will pay to the Council the Carbon Fund Payment.

Council Covenants

The Council covenants with the Owner as follows:

1 It will use the Carbon Fund Payment for the purpose of achieving reductions in carbon emissions in the borough equivalent to or greater than the Excess Emissions from the Development.

2 It will use its Reasonable Endeavours to achieve the target carbon emissions reductions.

3 No portion of the Carbon Fund Payment will be used directly or indirectly for the provision of infrastructure which for the avoidance of doubt shall include district heating network apparatus and stand-alone grid-connected renewable energy installations.

4 Within 28 days of receipt of receipt of a reasonable written request from the Owner the Council will provide evidence of compliance or progress towards compliance with the provisions of this Deed.

5 If a surplus of the Carbon Fund Payment remains uncommitted as at [10 years from the date of Commencement of Development] the Council will use reasonable endeavours to return an appropriate and equitable proportion of such surplus to the Owner.

B3 Model Clauses for Right to Connect

The following text is suggested as a form of words for a planning obligation to require a development to connect to a future district heating network. Although it is based on real examples, the form of words set out below has not been reviewed by a lawyer; this should be done prior to its use in a Section 106 agreement.

Interpretation

“Qualifying Heat Network Operator” or “QHNO” means a person currently operating or capable of operating a district heating network with sufficient capacity to serve the Development and the capability to connect to the Development. For the avoidance of doubt, the Council or its nominee may qualify as a QHNO.

“Qualifying Heat Network” or “QHN” means a network currently operated or planned to be operated by a QHNO.

1 Right to Connect Clause

1.1 In the event of a Qualifying Heat Network Operator being identified by the Council, the Council may serve notice upon the Developer to connect the Qualifying Heat Network to the Development to enable the QHN to supply the heating and hot water requirements of the Development.

- 1.2 The right of the QHNO to connect to the Development shall be subject to the following conditions being satisfied:
 - (a) the proposed tariff structures must protect the interests of the Developer and occupiers, in that total costs for delivery of the service shall be no more than would have been the case if the on-site CHP or conventional heating system had been provided. Tariffs include unit consumption charges, standing charges, management fees and plant replacement funds;
 - (b) connection charges to the network are reasonable and economically viable; and
 - (c) a service level agreement can be entered into to protect the interests of the Developer and occupiers by way of a guarantee of system availability.
- 1.3 The right to connect shall also be subject to any regulatory changes governing the communal supply of energy.
- 1.4 The Developer shall use reasonable endeavours to agree the tariffs, charges, service level agreement and all other commercial terms necessary to enable the QHN to connect to and supply heat to the Development.
- 1.5 In the event that the network is available to the development prior to completion of construction, and the Developer connects to the network, the developer will be released from obligations to install stand-alone CHP plant.
- 1.6 In the event that the network is not available to the development prior to completion of construction, the developer will remain obliged to connect to the network at any economically viable opportunity, but it is recognised that this opportunity may not arise until the end of the economic life of the stand-alone CHP plant.