



# Developing a carbon offset fund for Lewisham

A report for the London Borough of Lewisham by AECOM

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## 1 Executive Summary

Lewisham Council commissioned AECOM to assess the likely costs of offsetting carbon emissions for a range of policy scenarios and for a range of potential offsetting measures. This was to inform the development of a carbon offset strategy that provides practical alternatives to delivering onsite carbon reduction in line with policies set out in the Lewisham Core Strategy (2011). This mirrors the emerging national approach to delivering zero carbon homes which is expected to be promoted in future amendments to Building Regulations. Recognising that it can be difficult to meet carbon reduction targets cost effectively onsite, the proposals allow for a payment to be made into a fund dedicated to achieving proportional carbon savings elsewhere.

The aim of the offset strategy is to help provide a flexible framework for developers to comply with national, London and local carbon reduction requirements whilst maintaining development viability.

Both the London Plan (2011) and the adopted Lewisham Core Strategy (2011) set out carbon reduction targets beyond those required through the current requirements of Part L of the Building Regulations.

The London Plan policy 5.2 requires:

- 2013-2016 - A 40% reduction on 2010 Building Regulations target emission rate (for both domestic and non-domestic)
- 2016 onwards – as per Building Regulations (zero carbon for domestic. As highlighted below zero carbon has yet to be fully defined in policy)

The London Plan also makes provision for the use of an offset fund, which can be used to offset the remaining emission reductions where developers can demonstrate that they cannot achieve the full carbon reduction targets through onsite measures alone<sup>1</sup>.

Lewisham's Core Strategy policy requires compliance with the London Plan targets set out above, as well as standards in relation to the Code for Sustainable Homes and BREEAM:

- To April 1 2016 – all new homes to meet Code for Sustainable Homes Level 4, which requires an onsite carbon compliance of 25% reduction in regulated emissions.
- From April 1 2016 - all new homes to meet Code for Sustainable Homes Level 6, which requires 'net zero carbon'. All new non-domestic buildings to meet BREEAM Excellent which requires onsite carbon compliance of 25% as part of a number of performance requirements

Based on previous Government announcements it is expected that a national zero carbon policy will be introduced for new housing in 2016 and new non-domestic buildings in 2019. Developers will be required to reduce regulated emissions to zero. As part of this change, buildings will need to meet minimum fabric efficiency standards and a minimum level of carbon savings on site known as "Carbon Compliance" with remaining "residual emissions" offset through allowable solutions or further savings on site beyond the minimum carbon compliance levels. Government has yet to publish its definition of zero

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<sup>1</sup> GLA proposed to develop guidance relating to the use of offset arrangements to meet the 40% reduction target. This, however, was not available at the time of writing this report.

carbon but recommendations have been made by Zero Carbon Hub on some parts of the definition. It should be noted therefore that this report has been based on reasonable assumptions based on these recommendations

Section 2 of this report sets out the key considerations in developing an offset fund, providing an analysis of:

- The residual carbon emissions requiring offset
- The importance of the offset Ratio
- Additionality
- The different ways an offset fund could deliver carbon saving projects
- Measurement and verification of carbon savings
- Carbon accounting
- The scale of uptake required and fund management costs
- Viability

Section 2 also sets out the methodology used within the study. This was based on an understanding of projected growth in the borough and the impact of building performance standards to identify the scale of carbon emissions that might be relevant to a local offset fund.

Section 3 examines the current and future policy environment as summarised in table 1 below to establish three potential future policy scenarios:

- Scenario 1 – Proposed Building Regulations only.
- Scenario 2 – London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter.
- Scenario 3 - Lewisham Planning Policy.

	<b>Domestic</b>		<b>Non Domestic</b>
<b>Proposed Building Regulations (2013)</b> <b>Based on CLG, 2012 consultation on changes to the Building Regulations in England (preferred options)</b>	Aggregate 8% reduction over 2010	<b>Proposed Building Regulations (2013)</b> <b>Based on CLG, 2012 consultation on changes to the Building Regulations in England (preferred options)</b>	Aggregate 20% reduction over 2010 <sup>[1]</sup>
<b>Code for Sustainable Homes level 4 (Current Lewisham Planning Policy)</b>	25% reduction in regulated emissions onsite over 2010 Building Regulations (no offset allow)		
<b>London Plan Policy from 2013</b>	40% reduction in regulated emissions onsite over 2010 Building Regulations (offset allowed)	<b>London Plan Policy from 2013</b>	40% reduction in regulated emissions onsite over 2010 Building Regulation (offset allowed)
<b>Proposed Building Regulations (2016)</b> <b>Based on Zero Carbon Hub recommendations which have not yet been adopted in policy by Government.</b>	On site carbon compliance set at 25% / 41% / 47% reduction on 2010 Building Regulations for flats / semis and terraces / detached on site  Plus 100% reduction in regulated emissions overall through offsets.	<b>Proposed Building Regulations (2016)</b> <b>CLG, Zero carbon non-domestic buildings Phase 3 final report, July 2011 - high scenario<sup>[2]</sup></b>	Aggregate 25% reduction in regulated emissions over 2010
		<b>BREEAM Excellent (Lewisham Planning Policy)</b>	25% reduction in regulated emissions (no Allowable Solutions)

<sup>[1]</sup> Other options are proposed, ranging between 8% - 20% aggregate reductions for non-domestic buildings. The 20% scenario has been taken as the preferred option. Disaggregated targets have been applied to different building types where these are given in the consultation stage impact assessment. Aggregate targets are proposed in recognition of the fact that it is harder to make carbon reductions within certain building types compared to others.

<sup>[2]</sup> The high scenarios have been chosen for non-domestic buildings in 2016 and 2019 as they align best with the preferred option in the 2012 Building Regulations consultation; however these may not reflect government preferences, which have not yet been stated. Although both are proposed to be aggregate targets, i.e. varied across different building types, they have been presented at a fixed level for all building types due to the uncertainty around the disaggregated levels for different building types at this stage.

<b>Code for Sustainable Homes level 5</b>	100% reduction in regulated emissions onsite (no offset allowed)	<b>Building Regulations (2019)</b>	Onsite carbon compliance of 32% reduction on 2010 Building Regulations <sup>2</sup> . Plus 100% reduction in regulated emissions overall through offsets.
<b>Code for Sustainable Homes level 6 (Lewisham Planning Policy from 2016)</b>	100% reduction in regulated AND 100% reduction in unregulated emissions (equivalent to 150-190% reduction in regulated emissions) onsite (no offset allowed)	<b>BREEAM Outstanding</b>	40% reduction in regulated emissions <sup>3</sup> (no offset allowed) 2011 Energy target in BREEAM

Table 1: Summary of current and future carbon reduction targets

The policy scenarios are coupled with the future development proposals for the Borough to predict the likely residual emissions for the Borough, based on the likely performance of different building types.

Table 2 and figure 1 below set out the cumulative residual emissions that must be offset for each of the three policy scenarios described above<sup>4</sup>.

Scenario	Total residual emissions by 2016 (tCO <sub>2</sub> )	Total residual emissions 2016 to 2019 (tCO <sub>2</sub> )	Total residual emissions 2019 to 2026 (tCO <sub>2</sub> )	Total Carbon Emissions to offset (tCO <sub>2</sub> )
1. Proposed Building Regulations only	0	4,563	7282	11,846
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	1,133	4,837	7282	13,252
3. Lewisham Planning Policy	1,133	7,242	11,778	21,154

<sup>2</sup> Med Scenario taken from 'Zero Carbon Non-Domestic Buildings Phase 3 Report' (CLG 2011)

<sup>3</sup> BREEAM New Construction Non-Domestic Buildings Technical Manual (Bre 2011)

<sup>4</sup> Note that these represent the maximum residual emissions requiring offset. If better performance is achieved onsite then this figure will be reduced. In turn this will reduce potential revenue for offset.



Table 2: Predicted residual carbon

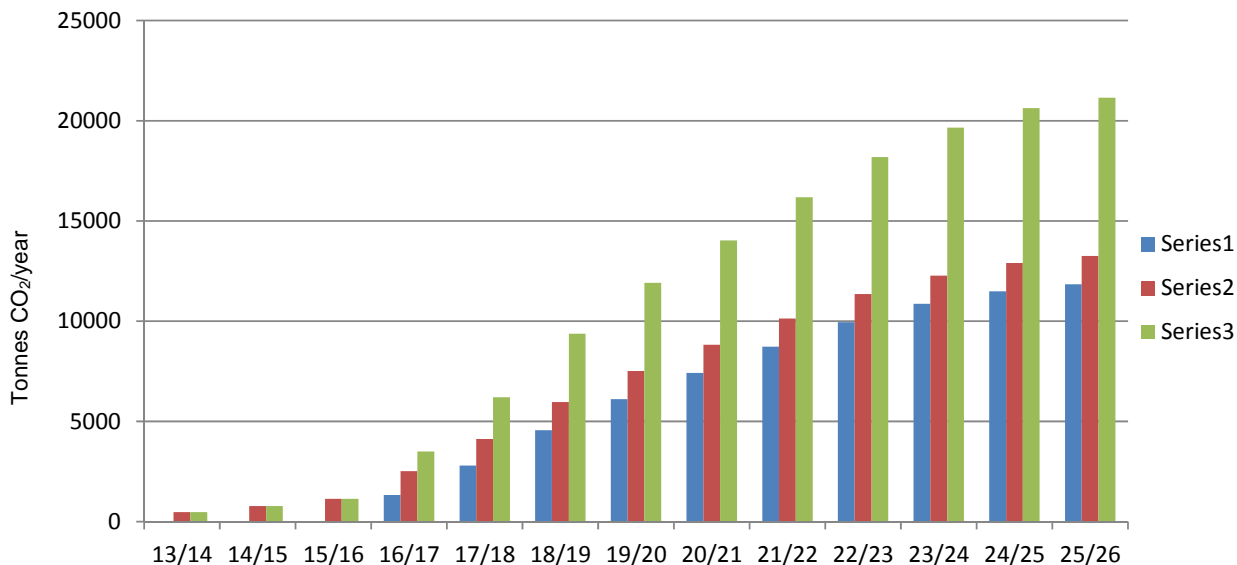


Figure 1 Cumulative annual residual carbon

Section 4 identifies a number of ‘baskets of measures’ each of which is a different way of generating offset fund projects and priorities, these baskets demonstrate a range of energy efficiency measures which could be delivered using money raised through the offset fund route whilst maximising carbon savings and funding which can be leveraged from elsewhere:

- Basket 1: All measures, all sectors – with the widest possible range of carbon saving measures available this scenario will deliver the lowest capital cost per tonne of carbon. However, the scale of measures requiring delivery is likely to increase management costs and therefore the overall cost per tonne. Similarly, overcoming issues with State Aid on private properties can restrict uptake of measures and increase costs. This scenario focuses on the easy to target measures many of which could be funded through other mechanisms and restricts opportunities to target hard to reach measures.
- Basket 2: Lewisham Homes only – confining the basket to measures available within Lewisham’s own housing stock. This option reduces issues relating to State Aid funding and will provide wider social benefits by helping to bring the housing standards up. Management costs are also reduced because it can link in with existing programmes and, as a corollary, access issues and costs will be reduced. However, it contains a number of measures that are likely to be delivered by existing and planned initiatives such as ECO or the Green Deal. It would therefore be difficult to demonstrate that the funding secured through the offset policy was delivering CO<sub>2</sub> savings that would not otherwise have been realised.

- Basket 3: ECO top up, all sectors – Lewisham Council are looking to apply for ECO funding. This basket of measures therefore excludes measures that might be targeted under the ECO funded scheme to offer genuine additionality.
- Basket 4: ECO top up, Lewisham Homes only – As with basket 3, this option excludes measures that might be delivered through ECO but focuses on complementary measures delivered on Lewisham Homes properties.
- Basket 5: Schools – This basket focuses on improving the efficiency of schools. This option would reduce competition risk and provide wider social benefits whilst reducing the running cost of council assets. This option also simplifies the fund management requirements as it focuses on fewer individual projects.

The availability of different measures within each basket determines the overall cost. The baskets assume that as the most cost effective measures available are exhausted, more expensive measures are then utilised. The availability of measures and their associated capital costs have been supplied by Lewisham Council. Assumptions on the costs of managing and delivering the different baskets have been based on previous experience in Lewisham of delivering carbon saving schemes (low) and from the Green Deal Impact Assessment (high).

Scenario	Average cost per tonne of CO <sub>2</sub> saved including management costs									
	Basket 1: All measures, all sectors		Basket 2: Lewisham Homes only		Basket 3: ECO 'top up' all sectors		Basket 4: : ECO 'top up' in Lewisham Homes only		Basket 5: Schools	
	Low	High	Low	High	Low	High	Low	High	Low	High
1. Proposed Building Regulations only	£10	£15	£45	£68	£90	£136	£91	£138	£60	£91
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£10	£15	£52	£78	£91	£137	£91	£138	£60	£91
3. Lewisham Planning Policy	£10	£16	£69	£104	£92	£139	£136	£206	£60	£91

Table 3: Average cost per tonne of CO<sub>2</sub> saved including management costs

The table below converts the average cost per tonne of carbon into a cost that the developer will be expected to pay to offset annual residual emissions over the assumed 30 year period. This has been done by dividing the estimated average annual cost per tonne of carbon to be offset), by the residual carbon per m<sup>2</sup> requiring offset for each development type (for residential properties this has also been illustrated per unit at 67m<sup>2</sup>). This has then been multiplied by 30 years to establish the total cost of

offsetting the total lifetime residual emissions. It has been assumed the higher management costs are included.

It should also be noted that the cost per tonne of carbon is calculated based on the total cost of measures to offset all the residual emissions over the plan period. However, the residual emissions requiring offsetting change in line with the policy (in 2016 and 2019), as such, the cost to the developer changes at each of these points.

The cost of carbon generated for each basket was also compared with delivering an equivalent saving from installation of Photovoltaics (PV) and with £46 per tonne of carbon which has been used as an illustrative figure within work undertaken by the Zero Carbon Hub in looking at the costs of meeting zero carbon policy. The tables below also summarise these different costs.

Table 4: Indicative cost of carbon: Residential – 2013-2016

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£0.99	£5.24	£9.20	£9.28	£6.09	£8.40	£3.09
3. Lewisham Planning Policy	£1.05	£6.97	£9.32	£13.81	£6.09	£8.40	£3.09

Table 5: Indicative cost of carbon: Residential – 2016 onwards

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	£6.10	£28.59	£57.30	£57.83	£38.08	£52.50	19.32
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£6.22	£32.78	£57.54	£58.01	£38.08	£52.50	19.32
3. Lewisham Planning Policy	£11.51	£76.09	£101.75	£150.81	£66.49	£52.50	33.74

Table 6: Indicative cost of carbon: Non-domestic – 2013-2019

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£1.10	£5.80	£10.19	£10.27	£6.74	£20.86	£7.68
3. Lewisham Planning Policy	£1.17	£7.71	£10.31	£15.29	£6.74	£20.86	£7.68

Table 7: Indicative cost of carbon: Non-domestic – 2019 onwards

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	£7.55	£35.36	£70.88	£71.53	£47.10	£81.70	£30.08
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£7.69	£40.55	£71.17	£71.75	£47.10	£81.70	£30.08
3. Lewisham Planning Policy	£8.15	£53.90	£72.07	£106.83	£47.10	£81.70	£30.08

In conclusion the study finds that as different funding priorities restrict the suite of measures available within different baskets, the cost associated with each basket changes. The options appraisal highlights there are opportunities and issues with each of the different baskets of measures, but that an offset ratio of one can be delivered. Taking a flexible approach to combining baskets therefore offers the best chance to maximise external funding, offer additionality and address priorities on an ongoing basis. This will enable the rate to remain constant which offers developers certainty around the cost whilst maintaining flexibility about the most appropriate delivery mechanisms. Similarly, as the amount of residual carbon increases, as in policy scenarios 2 and 3, the lower cost measures become exhausted quicker and more expensive measures are needed to achieve the desired savings. This is particularly evident post 2016 where in scenario 2 proposed Building Regulations become more stringent and in scenario 3 where Lewisham's Core Strategy requires the equivalent of Code for Sustainable Homes Level 6.

Retaining development viability is also critical. Payment into an offset fund should not stifle the deliverability of development. As such, the potential to charge developers is restricted. To 2016, Baskets 1, 2 and 3 appear to be reasonable based on using PV as a proxy for alternative onsite delivery and in relation to previous CIL sensitivity testing. Post 2016 the cost of available offset measures in all baskets other than basket 1 cost more than using PV. However, it should be noted that it becomes less appropriate to use PV as a proxy for comparison beyond 2016 as it is unlikely that there would be sufficient space available to install the sufficient of PV cells to meet the higher reduction targets on site.

The overall management and delivery of an offset fund will also affect the cost and the ability of the fund to achieve the required carbon savings. There are likely to be restrictions on providing public funding within the private sector. This is generally overcome by calling for applications for funding. However the evidence suggests that this has a tendency to increase fund management and marketing costs. Using the baskets of measures to take a flexible approach to balancing risks and opportunities will ensure delivery costs can be minimised and carbon reductions maximised.

It is for these reasons that a cost per residual tonne of carbon of £104 should be used. This would equate to a cost of £6.97 per m<sup>2</sup> for residential properties and £7.71 per m<sup>2</sup> for non-domestic properties. This figure balances maintaining a flexible approach for developers as to how they choose to meet the carbon reduction targets with a cost that can deliver carbon reduction projects within Lewisham. Post 2016 offset charges will need to be reviewed in light of development viability to maintain the balance going forward.

## 2 Background

### 2.1 What is a carbon offset fund?

Lewisham Council commissioned AECOM to assess the likely costs of offsetting carbon emissions for a range of policy scenarios and for a range of potential offsetting measures. This was to inform the development of a carbon offset strategy that provides practical alternatives to delivering onsite carbon reduction in line with policies set out in the Lewisham Core Strategy (2011). This mirrors the emerging national approach to delivering zero carbon homes which is expected to be promoted in future amendments to Building Regulations. Recognising that it can be difficult to meet carbon reduction targets cost effectively onsite, the proposals allow for a payment to be made into a fund dedicated to achieving proportional carbon savings elsewhere.

### 2.2 Key principles for consideration

There are a number of factors that will influence the price of carbon. This section provides an overview of the key principles that need to be considered when establishing an offset fund. It has, in part, been informed by the limited number of similar 'offset' schemes in more advanced stages of development, including in Milton Keynes, Islington, Croydon and the use of the GLA's RE:NEW / RE:FIT schemes for offsetting Olympic Games emissions, as well as national carbon reduction programmes such as the Carbon Emissions Reduction Target (CERT) and the Green Deal.

#### *Residual carbon requiring offset*

The first question that needs to be addressed is how much carbon needs to be offset from future development in Lewisham? This is influenced by the type, scale and energy performance of future growth. As explained in more detail in section 3 below, assumptions as to the type and scale of growth have been derived from growth projections provided by Lewisham Council. They are based on existing permissions and predicted growth scenarios developed as part of Lewisham's Core Strategy and the ongoing review of development through the Lewisham Planning Service Annual Monitoring Report.

The energy performance of different building types is regulated by Part L of Building Regulations. As highlighted above; the Government has proposed that future amendments to Building Regulations will require higher levels of carbon reduction to eventually achieve 'zero carbon'. Further performance targets are set out in planning policy, through Lewisham's Core Strategy and the London Plan. Each of these targets proposes incremental increases in the levels of carbon reduction or 'carbon compliance' to be achieved onsite over time. The policies also make provision for any remaining 'residual emissions' that have not been reduced onsite to be mitigated through offsetting arrangements. The level of residual emissions requiring mitigation varies, however, across the different performance targets. Section 3 then provides more detail on the required performance targets and how these are likely to change with future proposals in order to make assumptions as to future policy scenarios. Applying these scenarios to the type and scale of future development will provide an indication of the maximum residual emissions requiring offsetting.

### *Offset Ratio*

The price per tonne of carbon that requires offsetting is a factor of the total carbon saving potential of offset measures available and the cost of those measures. The principle of an offset fund is to provide a more cost effective and flexible way of reducing residual emissions than would be possible onsite. Ideally, therefore, any offset fund should achieve at least as much carbon saving as was required onsite: thus giving an offset ratio of one. However, as it becomes more difficult over time to fund lower cost offset measures, more expensive measures will be required to achieve the required residual offset emissions raising the cost per residual tonne of carbon to maintain an offset ratio of one. Alternatively, less carbon can be offset for the same price therefore achieving an offset ratio lower than one. Although maintaining an offset ratio of one has been used in this study as the starting point for determining a price of carbon, there are a number reasons that might restrict the offset measures available (see additionality, uptake required, sector and fund management below) and therefore a viable cost of carbon.

### *Additionality*

It is likely that some carbon reduction measures would occur without offset funding; either due to replacement (i.e. boiler upgrade) or through other available funding designed for carbon reduction such as the Green Deal or ECO. As such, some measures, particularly the most cost effective, are likely to be undertaken anyway. It may therefore be considered more worthwhile for the offset fund to deliver truly additional carbon savings.

Satisfying principles of additionality will however mean fewer cost efficient projects are available, increasing the difficulty of delivering an offset ratio of one. However, as existing programmes are only likely to cover the cost of the cheapest measures, this offset fund could be used to deliver harder to reach savings or more strategic priorities. For example, there is a risk that if a property only has basic efficiency measures installed through existing funding mechanisms such as the Green Deal, it will be harder to regain access to these properties to do additional harder to reach options. This represents a lost opportunity cost. More expensive measures still represent significant carbon reduction opportunities and there may be opportunities to work with existing mechanisms to deliver whole house retrofit<sup>5</sup>. The London Borough of Lewisham is seeking to leverage additional funding, claiming the carbon for any additionality that this might bring. As such, the Council recognises that in some instances they need to take a flexible approach to achieving an offset ratio of one where there are wider benefits.

### *Sector*

Targeting different sectors will influence the way in which the offset fund is organised and performs:

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<sup>5</sup> There are accounting issues that affect working with other funding mechanisms. Each funding mechanism has different rules relating to leveraged funds and who can 'claim' the carbon saving within reporting. The only way to ensure that all carbon savings could be attributed to Lewisham is if an offset fund pays for 100% of the carbon reduction measures. This, therefore, limits the range of projects available and potentially the offset cost/ratio.



- Private sector housing – the scale of carbon saving potential, particularly low cost measures, is greatest within private housing. However, rules on the spending of public money in a way that directly benefits the private sector are likely to restrict the way in which funds are structured. It is important for public allocation of money to demonstrate impartiality. One method of achieving this, that has been used in similar schemes, is to require third party applications for funding that can then be assessed against award criteria. This, however, increases the management costs associated with targeting private housing. Furthermore, the need to undertake marketing to attract applications can exacerbate these additional costs. One way of reducing these costs is to use a third party agent to manage the recruitment of private homes to retrofit. This is similar to the approach used in the GLA’s RE:NEW programme to offset emissions associated with the Olympic Games. In this instance third party agents were responsible for marketing carbon reduction opportunities to a minimum number of households. The average cost for offsetting a tonne of annual residual CO<sub>2</sub> emissions over a period of 30 years was £1187 or £39.5 per annum. One of the main concerns with this approach is the risk that not enough homes would respond to marketing by the third party agent and take up measures. As such, consideration is being given to requiring third party agents to achieve a minimum carbon saving, transferring the risk of not attracting enough homes to the third party agent. It should also be recognised that there are several other national incentives targeted at private households.
- Public sector housing – the scale of potential carbon saving within public sector housing is still significant and some the problems around funding the private sector identified above, are likely to be reduced if local authority owned properties are specifically targeted. By the nature of the properties being targeted, targeting public sector housing is also likely to support those most at need.
- Larger public sector assets (schools, libraries, leisure centres etc) – Although targeting a smaller basket of potential carbon reduction measures, targeting public sector assets will help reduce the overall running costs which can be used to improve service performance. Furthermore, working with a smaller number of projects can help reduce management costs. For example, the measures installed through the GLA Olympic RE:FIT scheme, which focused on school retrofit, cost £785 per tonne over 30 years or £26.6 per annum. As such RE:FIT was more cost effective than RE:NEW.
- Commercial properties / SMEs – The commercial sector, and in particular SMEs, are often underrepresented within carbon reduction programmes. Although private sector funding restrictions are likely to have a similar impact as with residential properties, Islington are considering targeting some measures within this sector.
- Infrastructure – Again, if commercial partners are involved they may face private sector funding restrictions, however funding infrastructure, such as district heating network extensions can provide significant carbon savings. As such, Islington, for example, are looking at opportunities to use offset funds to extend their district heating network. The capital costs of such interventions are, however, likely to be significant and as such it is unlikely that the offset fund would generate sufficient funds to deliver many projects. It is more likely, therefore, that district heating would be delivered through planning applications.

### *Verification*

The ability to verify the level of carbon saving from specific measures differs. The most straight forward measures have been modelled and there are standard benchmarks that can be assumed, however other measures that might be desirable, such as behavioural change initiatives, are likely to be less easy to define – particularly for limited project management costs. The London Borough of Islington recognises, for instance, that behavioural change is important in reducing carbon emissions. As such, they are proposing to fund some behavioural change projects, but only where they complement installed carbon reduction measures. As Lewisham are looking to have a pragmatic approach to management and verification, this might limit projects to those that have more established and understood carbon reduction factors. This pragmatic approach is designed to keep management costs down which allows more funding to be spent on carbon reduction measures, providing more scope for an offset ratio of one to be met whilst protecting developer viability.

### *Carbon accounting*

One of the major unresolved issues facing emerging Allowable Solutions policy is the proportion of project carbon savings that would be attributed to offset or Allowable Solutions when there are multiple sources of project funding such as CERT, ECO, Green Deal, Feed in Tariff or Renewable Heat Incentive. The funding criteria of each of these sources of funding could potentially restrict complementary additional carbon reduction measures that are likely to be more expensive. However, the additional funding provided by the offset fund might be required to leverage additional funding. As such, there are three emerging approaches to carbon accounting:

- Funder takes all – Where additional funding has been leveraged to allow a project to go ahead, then that funding mechanism is attributed with total carbon saving. This approach is taken by Milton Keynes, who see any supplementary contribution from their offset fund to pay for carbon reduction measures as instrumental to the project taking place; as such they claim all the carbon savings.
- Total proportional – The collective carbon emissions saving is attributed proportionally relative to the total level of funding.
- Measure dependent – Funders are attributed carbon savings relative to the measures they paid for. This method is most likely to impact on the offset ratio as the other funding mechanisms are set up to cover the cost of cheaper initiatives and as such the offset fund is likely to be a top up fund. However, it should be noted there might be lost opportunity costs in not supplying additional funding, such as in total house retrofit i.e. if a household has Green Deal funding to fund the most cost effective carbon saving measures there may be a benefit in offering additional funding for harder to reach carbon saving measures as it may be difficult to get access to the property at a future date.

### *Scale of uptake required and fund management costs*

The types of projects that are suitable to be funded through an offset fund will dictate the management structure. For example, there may be benefits to aligning with existing and established funding structures, or to take everything in house. It will also be sensible to establish an appropriate level of fund

management costs. One of the factors influencing the fund's complexity and administrative costs is the types of projects targeted for funding. If a fund targets the private sector, issues around State Aid, such as ensuring projects are selected through a fair open competition process, may arise. For example the recent round of London RE:NEW funding which looked to fund efficiency improvement measures in private housing spent an average of £97 on 'operations and management' for every £61 spent on the energy efficiency measures<sup>6</sup>. On the other hand, the ODA RE:FIT programme funding school retrofit spent less than 10% on fund management.

Allied to the above, it is important to consider the scale of uptake of different measures. Logistically, delivering high volumes of low cost but low impact measures might have the lowest capital expenditure, but require significant resources to deliver making the total costs prohibitive. Conversely, management of a single larger project may mean capital costs are higher but with lower overall management costs.

### *Viability*

The National Planning Policy Framework (NPPF) states that "development identified in the plan should not be subject to such a scale of obligations and policy burdens that their ability to be developed viably is threatened." This means that the costs of any policy requirements likely to be applied to development, when taken alongside other development costs, should in general be at a level that enables development to still be deliverable.

The requirements for development to meet carbon reduction standards are detailed in the local development plan. Lewisham Core Strategy Policy 8 sets out the needs of both residential and non-residential development in meeting the Code for Sustainable Homes (CfSH) and BREEAM standards respectively, over the plan period until 2026. The Core Strategy requires Code level 4 to be met up until 1<sup>st</sup> April 2016, which requires a 25% reduction in CO<sub>2</sub> emissions against 2010 Building Regulations. Carbon reduction standards are set out in the London Plan and are followed in the Lewisham Core Strategy. As of October 2013 the London Plan moves from requiring a 25% to 40% reduction in CO<sub>2</sub> emissions against 2010 Building Regulations. This creates a difference between the two policies and therefore the Code level, which has been assessed within the CIL viability calculations, will be used as the minimum level of CO<sub>2</sub> emissions for the purposes of testing costs per tonne of carbon.

In general, overall development viability will influence the potential scale of offset revenue and, therefore, the range of measures that can be funded and the offset ratio achievable. The inclusion of allowable solutions offsite (at a rate that does not exceed the cost of onsite delivery) would provide development with an additional option for delivering cost effective carbon dioxide emission reductions. This would increase the likelihood of applicants being able to meet policy without affecting viability and hence encourage development to come forward.

The London Borough of Lewisham employed Lambert Smith Hampton to test the viability of development in relation to bringing forward a Community Infrastructure Levy (CIL), due to be adopted in April 2014. The Lewisham CIL Economic Viability Study found that on the most part, new development in the borough could afford to pay a CIL of between £70 and £100 per square metre. However, the original

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<sup>6</sup> Project Summary Report, RE:NEW Demonstration Phase Study (Mayor of London, LDA, London Councils)  
<http://www.london.gov.uk/sites/default/files/archives/RENEW-Demonstration-project-summary-report-Mar2011.pdf>

study did not include the increased requirements of the London Plan as described above for residential development. As a result the model has required further testing against the added burden of meeting the increased requirements alongside the development of allowable solutions (see section 4).

It is of note that the increased requirements of the London Plan do not make a difference to the positive effect that including allowable solutions (at a rate that does not exceed the cost of onsite delivery) will have on viability. Ultimately, the focus of the offset fund is to provide a more cost effective way of reducing carbon emissions that does not restrict development at all policy levels.

### **2.3 Developing a locally appropriate solution**

The proposed national Allowable Solutions framework, London Plan and Lewisham Core Strategy offset arrangements should reflect local opportunities, barriers and priorities. As such, the cost should reflect an assessment of the available carbon reduction measures within the borough. Each of these measures can be delivered at a cost per tonne of carbon saved. These measures have been derived from studies supplied by Lewisham Council including data developed by Parity using an adjusted RdSAP methodology; Lewisham Renewables Evidence Base Study (2009) and Lewisham Town Centre AAP - Low Carbon and Decentralised Energy Strategy Recommendations (2010).

As part of this study a workshop was held with officers from Lewisham Council and partners. This workshop highlighted that the primary function of an offset fund should be to drive carbon reduction on site without hampering development – in effect mirroring the national priorities and supporting a flexible approach to reducing carbon. In this regard, the fund should be used to reduce overall carbon savings but seek to deliver wider social benefits where possible, such as targeting those most at risk of fuel poverty or reducing the running cost of public assets. It was acknowledged there might be difficulties in co-ordinating/leveraging additional funding. Furthermore if the Lewisham Offset fund was required to pay for harder to treat measures it would impact on the offset ratio that could be achieved. The effort put into accounting for this carbon should be proportional to the total investment against the carbon saved. However it was recognised that not all funding arrangements allow this kind of carbon accounting. It was agreed that as long as reporting the carbon was for separate purposes, this would not matter and Lewisham would continue to report based on the proportion of total investment.

### **2.4 Method statement and limitations**

The starting point for establishing a cost of carbon in Lewisham is based on an understanding of how much it would cost to deliver the measures needed to offset the residual emissions resulting from predicted growth in the borough. It should be noted that it has not been within the scope of this study to generate primary data. As such, assumptions used within the study are dependent on the availability of suitable information. Although every effort has been made to ensure that reliable, established and endorsed sources have been used, the nature of this emerging area of interest means that there are inevitably limits. In these instances assumptions have been developed from case study examples, professional experience and agreed by Lewisham Council.

*Task 1: Predicting residual emissions in Lewisham (see Section 3)*

This task aims to establish an understanding of the type and scale of growth in Lewisham, coupled with an understanding of overall carbon reduction targets and onsite performance requirements:

- Stage A: Predict future growth – Time based growth projections have been provided by Lewisham Council. They are based on existing permissions and predicted growth scenarios developed as part of Lewisham’s Core Strategy and the ongoing review of development through the Lewisham Planning Service Annual Monitoring Report.
- Stage B: Set building performance standards – Part L of the Building Regulations 2010 sets the current minimum building performance standards. Current planning policy in the adopted London Plan and Lewisham Core Strategy includes incremental carbon saving targets against the 2010 Building Regulations baseline over time. Similarly proposed changes to future iterations of Building Regulations will require an uplift in building performance over time. As the level of onsite carbon compliance and the proportion that can be offset changes over time in addition to the uncertainties over the implementation of future targets, this study has developed three potential policy scenarios:
  - Scenario 1 – Proposed Building Regulations only
  - Scenario 2 – London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter
  - Scenario 3 - Lewisham Planning Policy
- Stage C: Model carbon emissions over time – With an understanding of the type and scale of development over time, and assumptions as to the carbon targets and onsite compliance at different points in time, it has been possible to model the residual carbon emissions arising over time for the three scenarios described above.

*Task 2: A measures based approach for calculating cost of carbon (see Section 4)*

This study has taken a measures based approach to establishing a cost per tonne of carbon. As such, the price per tonne of carbon is generated based on the capital and installation costs of implementing the lowest cost carbon saving measures. As opportunities from the lowest cost measures available are exhausted, the next lowest cost measure is used until an offset ratio of one is achieved<sup>7</sup>. In this way, a basket of different measures will be used to achieve the carbon savings.

- Stage D: Identify measures and carbon saving potential - For the purposes of this study, the range of potential offset measures has focussed on retrofit energy efficiency measures as well as a range of low and zero carbon (LZC) technologies. A complete list of potential offset measures assessed is set out in appendix 1.

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<sup>7</sup> This study has assumed an uptake rate of 100%. Although in reality this is unlikely to be achievable, particularly for small scale measures requiring numerous installations. However as the variance in the level of uptake is difficult to predict, an assumption of 100% uptake has been used as a baseline. Not achieving 100% uptake will effectively increase the cost per tonne of carbon as other, more expensive, measure would need to be utilised to offset the residual emissions. The basket approach allows a degree of sensitivity checking in relation to the application of different measures on the cost of carbon.

- Domestic - Evidence for the type, scale and cost of potential measures available within residential properties in the Borough has been supplied by Lewisham Council, drawn from data developed by Parity using an adjusted RdSAP methodology. This study has not independently appraised these assumptions. Data has, however, been adapted to add in the lifetime of measures – assumed to be 30 years for fabric measures and 15 years for services measures - in order to ascertain lifetime carbon savings. Similarly measures involving removal/replacement of Secondary Heating systems have been removed from datasets as replacement would not guarantee carbon savings.
- Non-domestic assumptions – Measures have, where possible, been compiled through benchmarking and case study examples. However, due the variance in building types and occupier behaviour, it is very difficult to get an accurate picture of the impact of energy performance improvement measures within non-domestic buildings. As such, for the purposes of this study it has been agreed to focus on opportunities to retrofit schools, as these could have the potential to deliver significant carbon savings across a smaller range of projects and deliver additional community benefits. Furthermore, information on school performance and carbon saving potential can be extrapolated from a previous desktop study undertaken for Lewisham Council in relation to REFIT opportunities in the Borough<sup>8</sup>.
- LZC opportunities have been derived from Lewisham Renewables Evidence Base Study (2009) and Lewisham Town Centre AAP - Low Carbon and Decentralised Energy Strategy Recommendations (2010) and AECOM experience. These are indicative only.
- Stage E: Testing different basket options – As described above, there are a number of factors, such as additionality and sector that could provide additional social benefits, be more straight forward to manage or target harder to reach measures that restrict the measures available and therefore impact on the overall capital cost of reaching an offset ratio of one. As such, this study has compared the capital expenditure implications of five baskets of measures:
  - Basket 1: All measures, all sectors – with the widest possible range of carbon saving measures available this scenario will deliver the lowest capital cost per tonne of carbon. However, the scale of measures requiring delivery is likely to increase management costs and therefore the overall cost per tonne. Similarly, overcoming issues with State Aid on private properties can restrict uptake of measures and increase costs. This scenario focuses on the easy to target measures many of which could be funded through other mechanisms and restricts opportunities to target hard to reach measures.
  - Basket 2: Lewisham Homes only – confining the basket to measures available within Lewisham’s own housing stock. This option reduces issues relating to State Aid funding and will provide wider social benefits by helping to bring the housing standards up. Management costs are also reduced because it can link in with existing programmes

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<sup>8</sup> Agreed at meeting with London Borough of Lewisham on 16th April 2013

and, as a corollary, access issues and costs will be reduced. However, it contains a number of measures that are likely to be delivered by existing and planned initiatives such as ECO or the Green Deal. It would therefore be difficult to demonstrate that the funding secured through the offset policy was delivering CO2 savings that would not otherwise have been realised.

- Basket 3: ECO top up, all sectors – Lewisham Council are looking to apply for ECO funding. This basket of measures therefore excludes measures that might be targeted under the ECO funded scheme to offer genuine additionality.
  - Basket 4: ECO top up, Lewisham Homes only – As with basket 3, this option excludes measures that might be delivered through ECO but focuses on complementary measures delivered on Lewisham Homes properties.
  - Basket 5: Schools – This basket focuses on improving the efficiency of schools. This option would reduce competition risk and provide wider social benefits whilst reducing the running cost of council assets. This option also simplifies the fund management requirements as it focuses on fewer individual projects.
- Stage F: Establish type, number and cost of measures required to achieve offset ratio of 1 – For each of the measures in each of the baskets described above, the total lifetime carbon saving was derived from information supplied by Lewisham Council based on research undertaken by Parity. This is based on the total number of measures available multiplied by the lifetime carbon saving of that measure. Multiplying this by the capital expenditure for each measure gives a total capex per lifetime carbon saving that could be used to rank each measure. The suite of measures required to deliver an offset ratio of one in the most cost efficient way for each of the policy scenarios described above could then be identified, and the average cost per tonne derived.
  - Stage G: Review fund management costs– In addition to the capital and installation costs, there will be costs associated with managing the scheme including developing offset projects and verification of carbon savings. As highlighted above, predicting the costs associated with delivering carbon saving measures is complicated and depends on the number of measures delivered, the way the fund is structured and local socio-economic factors. Consequently, both a low and high estimate of management costs have been applied to the installed capital cost per tonne of carbon. The low estimate equates to a management cost of 12.5% and is comparable to an earlier carbon reduction scheme run within the Borough. The high estimate of 70% of capital costs has been derived from table 2 in the ‘Final Stage Impact Assessment for the Green Deal and Energy Company Obligation’ (2012).

*Task 3: Benchmarking and testing viability (see section 5)*

- Stage H: Comparison with the cost of using PV as a proxy for development viability to 2016 – This stage compares the cost of meeting carbon reduction targets through offset measures with an equivalent saving delivered through PV for the initial period to 2016 - which would



require an additional 15% reduction in emissions<sup>9</sup>. Although dependent on the availability of space onsite, PV would be the most logical approach to achieving these additional carbon savings if paying into an offset fund was not an option, and therefore represents a sensible proxy for testing viability. Over a longer timeframe with more stringent carbon reduction targets, this proxy becomes less relevant as the type, scale and mix of technologies required to deliver a 100% reduction in regulated emissions (proposed 2016 Building Regulations) or c170% reduction in regulated emissions (equivalent to meeting Code level 6 but offsite) will be more strategic in nature and more complicated to cost.

- Stage I: Comparison with a national benchmark of £46 per tonne – The Zero Carbon Homes Impact Assessment (DCLG, 2011) ‘adopts the average discounted abatement cost of non-traded carbon which is £46 based on current figures from the Department of Energy and Climate Change. This upfront cost incurred is the cumulative value of the carbon emitted from a house in present value terms over 30 years’. This is an illustrative value that is not related to a measures based approach. The Impact Assessment highlights that ‘the Growth Review stated that the onsite requirement [carbon reduction measures] ...will be complemented by cost-effective options for off-site carbon reductions, relative to the Government’s pricing of carbon.’ Thus, ‘the cost incurred by developers should not exceed the average cost of alternative abatement measures in the UK’. At the time of the Impact Assessment ‘the average discounted abatement cost of carbon figure for the period of the policy following HM Treasury Green Book guidance [was] £46 per tonne’ in present value terms. Using this figure, it is possible to compare the offset ratio achievable for each of the policy scenarios and baskets of measures.

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<sup>9</sup> Between 2013 and 2016 the Lewisham Core Strategy requires homes to meet Code for Sustainable Homes level 4, which includes as a mandatory credit a 25% reduction in carbon emission from Building Regulations 2010 to be achieved onsite. For this same period the London Plan requires a 40% reduction in carbon emission from Building Regulations 2010 to be achieved either onsite or offsite. This study takes the Lewisham policy for Code level 4 as the baseline. As such, a further 15% reduction would be required to meet the London Plan policy.



### 3 Predicting residual emissions in Lewisham

#### 3.1 Introduction

As highlighted in section 2.2, the cost of carbon is related to the type, scale and carbon saving potential of offset measures available. It is important to first predict how much residual carbon requires offsetting. This is based on the scale and type of future development expected, and the likely energy performance of that development. This section therefore examines the proposed growth in Lewisham to establish the maximum likely residual carbon emissions that growth will generate based on current and proposed performance targets. Given there are a range of policy options and proposed changes to Building Regulations to consider, three policy scenarios have been tested.

#### 3.2 Developing growth projects

The first stage in predicting the likely residual emissions to be offset requires an understanding of the likely growth across the Borough. Growth projections have been provided by Lewisham Council. They are based on existing permissions and predicted growth scenarios developed as part of Lewisham’s Core Strategy and the ongoing review of development through the Lewisham Planning Service Annual Monitoring Report. Table 9 below summarises the projected growth.

Building Type		2010-2013	2013-2016	2016-2019	2019-2026	Total
C3 (units Flats @67m2))	Residential	1364	3953	11782		17099
A1 (m2)	Retail	8216	21457	13077	6682	49432
A2 (m2)	Retail	1248	3035	3090	2037	9410
A3 (m2)	Restaurant	364	2251	2041	4340	8996
A4 (m2)	Bar	286	944	858	0	2088
A5 (m2)	Takeaway	143	501	501	0	1145
B1 (m2)	Office	4759	47390	7848	8216	68213
B2 (m2)	Industrial	0	-2345	5818	20363	23836
B8 (m2)	Warehouse	16147	4462	0	0	20609
C1 Hotel (m2)	Hotel	408	3498	3498	8162	15566

C2 (m2)	Residential Care	0	2050	0	0	2050
D1 (m2)	Public	14588	12397	5297	667	32949
D2 (m2)	Cultural	714	13412	5359	7169	26654
SG (m2)	Other	0	335	0	0	335

Table 9: Development projections

Note that for the purposes of this study and in line with viability modelling undertaken for Lewisham Council (LSH, 2012) residential properties have been assumed to be flats with an average area of 67m<sup>2</sup>. Hotels are taken as 35m<sup>2</sup> per room equivalent.

### 3.3 Building performance requirements

Part L of the Building Regulations (2010) sets out the minimum performance requirements for different buildings, representing the baseline standard from which building performance has been assessed. The Building Regulations focus on ‘regulated’ emissions; the emissions generated from the energy used ‘as-built performance’ of the building, including heating/cooling, fixed lighting and hot water. It does not cover ‘unregulated’ emissions associated with energy consumed by occupant’s use of appliances such as computers and televisions. As unregulated emissions are heavily influenced by consumer choice and behaviour they are difficult to predict in practice and an assumed amount will be used based upon the Code for Sustainable Homes Technical Appendix 2009<sup>10</sup> calculation for Level 6 which is 70% of regulated emissions.

#### *London Plan and Lewisham planning policy*

Both the London Plan (2011) and the adopted Lewisham Core Strategy (2011) set out carbon reduction targets beyond those required through the current requirements of Part L of the Building Regulations.

The London Plan policy 5.2 requires:

- 2013-2016 - A 40% reduction on 2010 Building Regulations target emission rate (for both domestic and non-domestic)
- 2016 onwards – as per Building Regulations (zero carbon for domestic. As highlighted below zero carbon has yet to be fully defined in policy)

The London Plan also makes provision for the use of an offset fund, which can be used to offset the remaining emission reductions where developers can demonstrate that they cannot achieve the full carbon reduction targets through onsite measures alone. Paragraph 5.23 of the London Plan highlights that ‘Further guidance on the criteria for off-site provision, the types of acceptable projects and

<sup>10</sup> Note later versions do not include the calculation as the definition of the mandatory ENE 1 credit for Code Level 6 is not specifically defined in light of uncertainty as to future Building Regulations.

programmes and a London wide funding scheme will be set out for boroughs. This guidance is however not yet available.

Lewisham's Core Strategy policy requires compliance with the London Plan targets set out above, as well as standards in relation to the Code for Sustainable Homes and BREEAM:

- To April 1 2016 – all new homes to meet Code for Sustainable Homes Level 4, which requires an onsite carbon compliance of 25% reduction in regulated emissions.
- From April 1 2016 - all new homes to meet Code for Sustainable Homes Level 6, which requires 'net zero carbon'. However, it should be noted that the 2010 Code for Sustainable Homes Technical Guide states that 'a definition of a zero carbon home is omitted from this document as it will be defined by future legislation. The requirements of this issue will be updated to align with this legislation once it is set'. As this legislation is yet to be put in place, this study has used the definition of 'net zero carbon' set out in Version 2 of the 2009 Code for Sustainable Homes Technical Guide. This requires an onsite carbon compliance of 100% reduction in both regulated and unregulated emissions which approximately equates to around 170% reduction in regulated emissions on site. It is recognised that achieving this level of carbon reduction onsite is very challenging and would not be technically achievable for all developments. As such, this study has tested delivering an equivalent saving offsite rather than requiring all emissions to be mitigated onsite.
- All new non-domestic buildings to meet BREEAM Excellent which requires onsite carbon compliance of 25% as part of a number of performance requirements

#### *Building regulations and the route to Zero Carbon*

Following consultation, in July 2007 the Government's Building a Greener Future: Policy Statement<sup>11</sup> announced that all new homes should be zero carbon from 2016 with non-residential buildings following from 2019. The expectation is that this policy will be implemented through changes to Building Regulations.

As of March 2011, the Government defined zero carbon to include the 'as-built performance' of the building, including carbon emissions from heating, fixed lighting and hot water (regulated emissions)<sup>12</sup> Unregulated emissions from cooking and 'plug-in' appliances are no longer covered by the policy.

Prior to the introduction of the zero carbon requirements, the following intermediary step changes were proposed to the requirements of Part L of the Building Regulations for dwellings:

- 2013: 25% reduction in regulated emissions (relative to 2010 levels), corresponding to the carbon reduction requirements of Level 4 of the Code for Sustainable Homes.
- 2016: 'Zero carbon'; note however that unlike the 2009 version of Level 6 of the Code for Sustainable homes, this does will not include unregulated emissions<sup>13</sup> (see below).

<sup>11</sup> *Building a Greener Future: policy statement*, Communities and Local Government Publications. Department for Communities and Local Government (DCLG) (2007a)

<sup>12</sup> 'The Plan for Growth'. HM Treasury. March 2011. ISBN 978-1-84532-842-9

Following further consultation on proposals for Part L 2013, which closed in March 2012, the overall carbon reduction targets were proposed to be 8% rather than 25% lower relative to the 2010 levels. Further information regarding the expected route to achieving these savings was proposed in the consultation documents including;

- Fabric Energy Efficiency Standards (FEES) of 39 - 43 kWh/m<sup>2</sup>/yr for apartments and mid-terrace, 46 – 52 kWh/m<sup>2</sup>/yr for end-terrace, semi-detached and attached properties.
- There is more emphasis on limiting the heat gains in summer including the need to insulate circulation pipes for domestic hot water to prevent overheating.
- Regulatory energy demand targets for heating and cooling.

Government has yet to confirm the findings from the consultation or to publish the proposed improvements for 2013 Building Regulations which were originally expected to come into force in October 2013.

Despite the expected downgrading of the interim 2013 target, the Government has previously confirmed its commitment to implementing ‘zero carbon’ policy in 2016 for domestic properties and 2019 for non-domestic properties. However, the way in which ‘zero carbon’ is to be met has yet to be defined. The Zero Carbon Hub, an independent body advising the Government on the development of zero carbon policy highlights that the planned revisions to the Building Regulations Part L and move towards ‘zero carbon policy’ are aimed at providing meaningful steps to significant reductions in carbon emissions, whilst minimising the cost impact on developers. This recognises there are diminishing returns from attempting to mitigate for a building’s carbon emissions on site, and represents a shift away from previous planning based approaches to carbon reduction, such as the Merton Rule that requires minimum onsite renewables. These policies were seen to be negatively impacting upon development viability for limited improvements in carbon reduction performance. The current proposals for ‘zero carbon policy’ include three steps to try and address issues in previous methodologies. Figure 2 summarises the Government’s hierarchy for achieving ‘zero carbon’.

- Step 1 - requires a minimum energy efficiency standard such as the proposed FEES to be achieved through material selection, construction methods, and building layout. This is likely to account for approximately 20-25% reduction in carbon emissions.
- Step 2 – a minimum level of onsite ‘carbon compliance’ to be reached through a range of measures including additional energy efficiency and low carbon energy supply. Carbon compliance levels are yet to be fully defined. The Zero Carbon Hub have recommended to Government that targets are based on as built performance and have suggested targets

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<sup>13</sup> It is a common misconception that all aspects of Code levels will be required under the government proposals, but in fact it is just the CO<sub>2</sub> targets of the Code that will be applied and are mandatory through Building Regulations (the energy category is one of nine different categories in the Code).

which equate approximately to 25% / 41% / 47% reduction in regulated emissions compared to 2010 for flats / semis and terraces / detached homes respectively<sup>14</sup>.

- Step 3 – once carbon compliance has been achieved onsite, further CO<sub>2</sub> reduction can be made either on-site, or by paying a contribution towards approved offsite carbon reduction measures known as ‘Allowable Solutions’. The Government’s framework for Allowable Solutions is still being developed, however one option considered by Zero Carbon Hub is that local planning authorities are required to identify a pipeline of approved Allowable Solutions. This study will help to identify these measures.

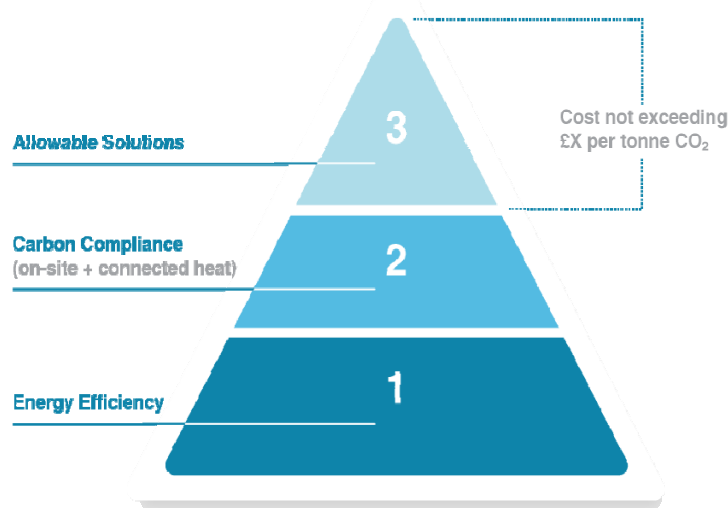


Figure 2: The Government’s hierarchy for achieving ‘zero carbon’ development

Research by the Zero Carbon Hub titled ‘Allowable Solutions for Tomorrow’s Homes’ (July 2011) outlines the latest proposals and recommendations for how Allowable Solutions should be embedded in policy and administered. A key aspect of Allowable Solutions would be for the local planning authority (LPA), such as Lewisham, to collect Allowable Solutions as a financial contribution from developers to mitigate for the residual emissions not reduced onsite. This would provide local councils with the ability to create a policy which could determine how funds can best be used to meet government standards in a way that suits local circumstances. In the absence of local policy, developer contributions would be delivered through a national list of Allowable Solutions projects, the Zero Carbon Hub recommend that LPAs prepare for future Allowable Solutions by developing policies for contribution/collection and identify potential Allowable Solutions projects. By exploring the potential for a local offset fund, this study also helps Lewisham to prepare for the proposed changes to Building Regulations and the introduction of zero carbon policy.

<sup>14</sup> Zero Carbon Hub, Carbon Compliance: Setting an Appropriate Limit for Zero Carbon Homes - Findings and Recommendations, Feb 2011

In lieu of formal guidance from the Government on the details of the proposed changes to Part L of the Building Regulations, zero carbon policy and arrangements for Allowable Solutions, the current recommendations from the Zero Carbon Hub form the basis for predicting residual emission arising.

The table below compares the relative carbon savings for different potential policy positions:

	<b>Domestic</b>		<b>Non Domestic</b>
<b>Proposed Building Regulations (2013)</b> Based on CLG, 2012 consultation on changes to the Building Regulations in England (preferred options)	Aggregate 8% reduction over 2010	<b>Proposed Building Regulations (2013)</b> Based on CLG, 2012 consultation on changes to the Building Regulations in England (preferred options)	Aggregate 20% reduction over 2010 <sup>[1]</sup>
<b>Code for Sustainable Homes level 4</b> <b>(Current Lewisham Planning Policy)</b>	25% reduction in regulated emissions onsite over 2010 Building Regulations (no offset allow)		
<b>London Plan Policy from 2013</b>	40% reduction in regulated emissions onsite over 2010 Building Regulations (offset allowed)	<b>London Plan Policy from 2013</b>	40% reduction in regulated emissions onsite over 2010 Building Regulation (offset allowed)

<sup>[1]</sup> Other options are proposed, ranging between 8% - 20% aggregate reductions for non-domestic buildings. The 20% scenario has been taken as the preferred option. Disaggregated targets have been applied to different building types where these are given in the consultation stage impact assessment. Aggregate targets are proposed in recognition of the fact that it is harder to make carbon reductions within certain building types compared to others.

<p><b>Proposed Building Regulations (2016)</b></p> <p><b>Based on Zero Carbon Hub recommendations which have not yet been adopted in policy by Government.</b></p>	<p>On site carbon compliance set at 25% / 41% / 47% reduction on 2010 Building Regulations for flats / semis and terraces / detached on site</p> <p>Plus 100% reduction in regulated emissions overall through offsets.</p>	<p><b>Proposed Building Regulations (2016)</b></p> <p><b>CLG, Zero carbon non-domestic buildings Phase 3 final report, July 2011 - high scenario<sup>[3]</sup></b></p>	<p>Aggregate 25% reduction in regulated emissions over 2010</p>
		<p><b>BREEAM Excellent (Lewisham Planning Policy)</b></p>	<p>25% reduction in regulated emissions (no Allowable Solutions)</p>
<p><b>Code for Sustainable Homes level 5</b></p>	<p>100% reduction in regulated emissions onsite</p> <p>(no offset allowed)</p>	<p><b>Building Regulations (2019)</b></p>	<p>Onsite carbon compliance of 32% reduction on 2010 Building Regulations<sup>15</sup>.</p> <p>Plus 100% reduction in regulated emissions overall through offsets.</p>
<p><b>Code for Sustainable Homes level 6 (Lewisham Planning Policy from 2016)</b></p>	<p>100% reduction in regulated AND 100% reduction in unregulated emissions (equivalent to 150-190% reduction in regulated emissions) onsite</p> <p>(no offset allowed)</p>	<p><b>BREEAM Outstanding</b></p>	<p>40% reduction in regulated emissions<sup>16</sup></p> <p>(no offset allowed)</p> <p>2011</p> <p>Energy target in BREEAM</p>

Table 10: Summary of current and future carbon reduction targets

<sup>[3]</sup> The high scenarios have been chosen for non-domestic buildings in 2016 and 2019 as they align best with the preferred option in the 2012 Building Regulations consultation; however these do not reflect government preferences, which have not yet been stated. Although both are proposed to be aggregate targets, i.e. varied across different building types, they have been presented at a fixed level for all building types due to the uncertainty around the disaggregated levels for different building types at this stage.

<sup>15</sup> Med Scenario taken from 'Zero Carbon Non-Domestic Buildings Phase 3 Report' (CLG 2011)

<sup>16</sup> BREEAM New Construction Non-Domestic Buildings Technical Manual (Bre 2011)

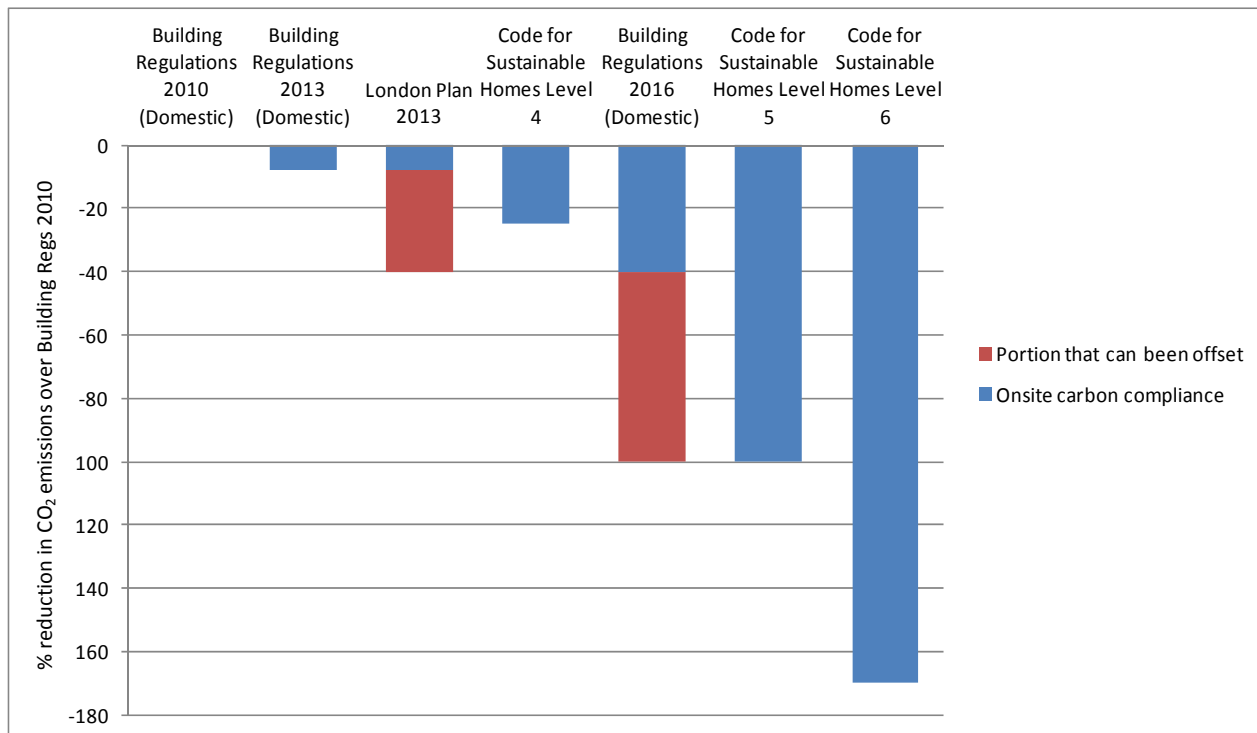


Figure 3: the % reduction in CO<sub>2</sub> emissions over Building Regulations 2010 by different taret

### 3.4 Future Policy scenarios

Presuming the changes to Part L are implemented as recommended by the Zero Carbon Hub, the Building Regulations will set the minimum levels of building performance required. However, up to 2016 the adopted Lewisham Core Strategy and the London Plan require more stringent targets to be met. After this point the London Plan becomes aligned with Building Regulations and Lewisham’s Core Strategy requires further carbon savings from residential properties (Code level 6). This study has modelled three potential policy scenarios:

- Scenario 1 – Proposed Building Regulations only.
  - This scenario represents the likely minimum performance required through proposed changes to Building Regulations. As such it does not permit offset through Allowable Solutions between 2013 and 2016 (residential) and between 2013 and 2019 (non-residential). From 2016 and 2019 respectively this scenario assumes that onsite carbon compliance is met and that the remaining emissions to achieve up to a 100% reduction in regulated emission will be the residual emissions that require offsetting.
- Scenario 2 – London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter.



- This scenario assumes that for the period up to zero carbon policy coming in (2016 residential, 2019 non-residential) Lewisham Core Strategy policies of Code for Sustainable Homes level 4 and BREEAM Excellent are achieved onsite.
- Up to 2016/2019 the London Plan will require additional carbon savings that equal the difference between the Code for Sustainable Homes Level 4 and BREEAM targets (Lewisham Core Strategy) and the London Plan target of a 40% reduction in regulated CO<sub>2</sub> emissions. The scenario assumes these additional savings can be made through offsetting offsite.
- After 2016/2019 the scenario assumes the residual emissions to be offset will be the difference between the minimum onsite carbon compliance level set by Government and the 100% reduction in regulated emissions that is expected to be required by Building Regulations in 2016 /2019.
- Scenario 3 - Lewisham Planning Policy.
  - This scenario assumes that Lewisham Core Strategy policies of Code for Sustainable Homes level 4 and BREEAM are achieved onsite. To 2016/2019 respectively for residential / non-residential development the scenario assumes the additional carbon saving to meet the London Plan 40% reduction target will require offsetting. Beyond 2016 Lewisham Core Strategy requires homes to meet Code for Sustainable Homes Level 6. This is a very challenging target requiring both regulated and unregulated emissions to be reduced to zero onsite. For many schemes this will not be possible and the scenario assumes the residual emissions between Code Level 4 and Code Level 6 can be offset<sup>17</sup>.

### **3.5 Calculating the residual carbon emission required for offsetting**

*Key assumptions in predicting emissions:*

Domestic

- Regulated emissions for a 67sqm flat to CSH4 assumed to be 1 tonne<sup>18</sup>
- 2013-2016: Difference between CSH4 25% and London Plan 40% assumed to be 0.15 tonnes per unit based on predominantly flats<sup>19</sup>.
- Offset requirement post 2016 for Allowable Solutions equal to 0.014 tonnes CO<sub>2</sub> /m<sup>2</sup>/year extrapolated across number of units planned and assuming 67m<sup>2</sup> flats<sup>20</sup>.
- Offset to CSH6 assumed to be an additional 0.7 tonnes per unit (based on Zero Carbon hub data)<sup>21</sup>

<sup>17</sup> This would in effect prevent the development from achieving the official Code rating.

<sup>18</sup> AECOM assumption

<sup>19</sup> AECOM assumption

<sup>20</sup> Carbon compliance – what is the appropriate level for 2016’, Zero Carbon Hub, December 2010

<sup>21</sup> Based on calculation from Code For Sustainable Homes Technical Appendix May 2009

*Non-domestic*

- BREEAM Excellent assumes flat 25% reduction relative to Building Regulations 2010<sup>22</sup>
- London Plan policy 2013-2016 assumes 40% flat reduction relative to Building Regulations 2010<sup>23</sup>
- Building Regulations 2013/16/19 reductions based on medium regulated emission reduction requirements scenario<sup>24</sup>
- Benchmark emissions based on AECOM work for Building Regulations 2013
- Savings 2013-2016 based on difference between meeting BREEAM Excellent (25%) and London Plan (40%)
- Savings 2016-2019 based on difference between meeting BREEAM Excellent (25%) and London Plan (i.e. stays at 40%)
- Savings 2019 based on residual CO2 after meeting Building Regulations 2019

The table and figure below sets out the cumulative annual residual emissions requiring offsetting for each of the three policy scenarios described above<sup>25</sup>.

<b>Scenario</b>	<b>Total residual emissions by 2016 (tCO<sub>2</sub>)</b>	<b>Total residual emissions 2016 to 2019 (tCO<sub>2</sub>)</b>	<b>Total residual emissions 2019 to 2026 (tCO<sub>2</sub>)</b>	<b>Total Carbon Emissions to offset (tCO<sub>2</sub>)</b>
1. Proposed Building Regulations only	0	4,563	7282	11,846
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	1,133	4,837	7282	13,252
3. Lewisham Planning Policy	1,133	7,242	11,778	21,154

Table 11: Predicted cumulative annual residual emissions

<sup>22</sup> AECOM assumption

<sup>23</sup> London Plan, GLA, 2011

<sup>24</sup> Zero Carbon for Non-domestic Buildings Phase 3 Final Report', CLG, July 2011

<sup>25</sup> Note that these represent the maximum residual emissions requiring offset. If better performance is achieved onsite then this figure will be reduced. In turn this will reduce potential revenue for offset.

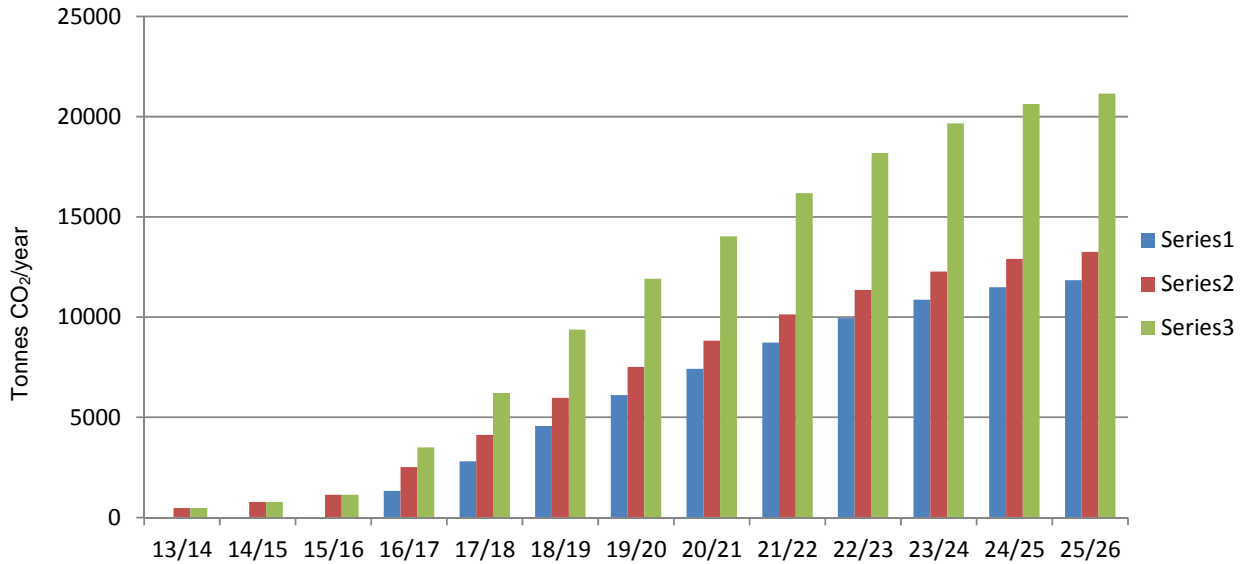


Figure 4: Cumulative annual residual carbon

Although the above graph and table represent the total level of residual carbon emissions that needs offsetting, it is also important to understand the yearly projected residual emissions. The annual residual emission profile will relate to the rate of revenue generated through the offset fund. The graph below highlights the predicted annual residual emissions. It highlights the jump in residual emissions associated with the proposed introduction of zero carbon policy in 2016 for residential buildings and peaking in 2019 reflecting the proposed zero carbon policy for non-domestic buildings. After this point the emissions tail off, reflecting the difficulty in making growth projections so far into the future.

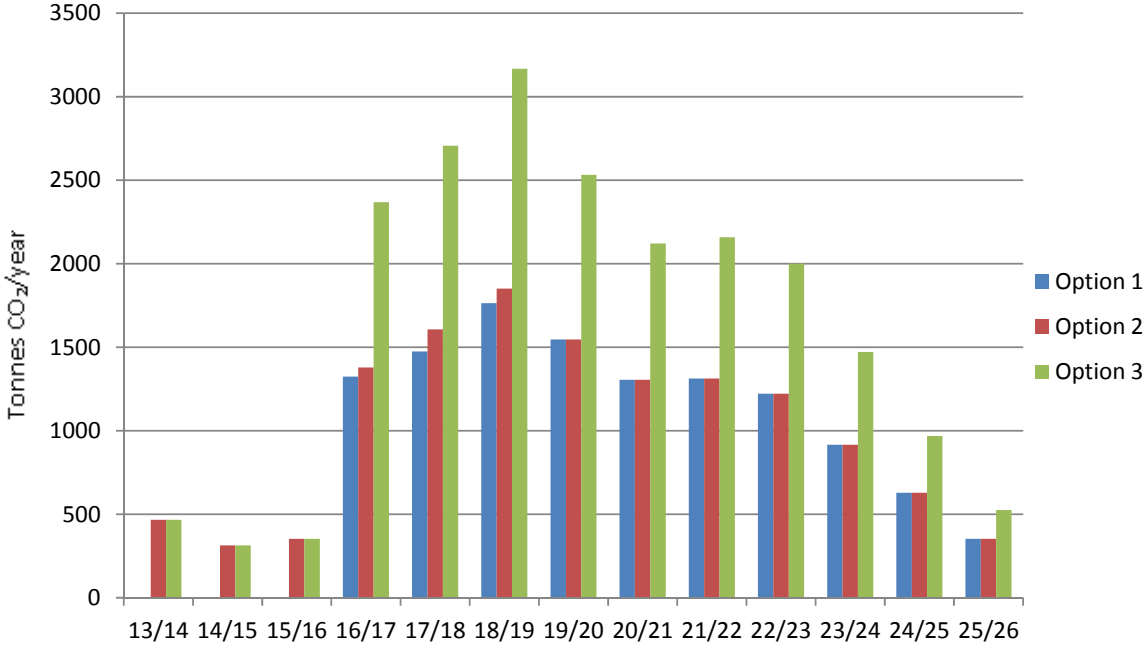


Figure 5: Annual residual carbon

## 4 A measures based approach to calculate the cost of carbon

### 4.1 Introduction

This section explores the costs of maintaining an offset ratio of one using the most cost effective measures (grouped in ‘baskets’ to provide an indicative outline of the types of measures which could be realistically delivered at different price points) to meet the residual emissions targets within the three policy scenarios (set out in section 3.4) and by targeting different sectors (as described in section 2.4):

- Basket 1: All measures, all
- Basket 2: Lewisham Homes only
- Basket 3: ECO top up, all sectors
- Basket 4: ECO top up, Lewisham Homes
- Basket 5: Schools

Section 4.2 sets out the average capital cost (including installation) per tonne of carbon saved for the measures included in each of the baskets.

Section 4.3 adds an assumed uplift in the average capital cost to take account of fund management costs. It sets out low and high scenarios based on historic evidence.

Section 4.4 converts the cost per tonne of carbon into a cost per m<sup>2</sup> based on the residual emissions that require offsetting within each of the scenarios to provide a figure that can be used to estimate the additional cost to developers.

Section 4.5 compares the cost of PV to deliver equivalent savings to 2016 as a proxy for viability.

Section 4.6 compares the cost of delivering the different baskets of measures with a national benchmark of £46 per annual residual tonne of carbon used as an illustrative figure in the Government’s Zero Carbon Homes Impact Assessment of May 2011<sup>26</sup>.

The baskets are a manageable way of showing a range of different ways to generate costs for offsetting carbon within Lewisham which are anchored in the specific opportunities which exist within the borough. In practice of course, opportunities for carbon reduction arise in a more dynamic, less certain way – both in relation to the size and frequency of money which may arise as result of payments into an offset fund, as well as carbon reduction opportunities. The baskets provide confidence that measures can be delivered.

### 4.2 Average capital cost per tonne

The table below sets out the average cost per tonne of carbon saved for the measures assumed for each of the baskets of measures and for each scenario<sup>27</sup>. For a summary of the measures included in each basket see appendix 1. For the purposes of this study it is assumed that annual residual emissions would

<sup>26</sup> Zero Carbon Homes Impact Assessment. Department of Government and Local communities. May 2011

<sup>27</sup> Note that this is expressed in the same units as the illustrative £46/per tonne figure used in Government Zero Carbon policy impact assessment which is carbon saved in present value terms.

have to be offset for a period of 30 years, this is the assumption used in previous policy announcements and assessments by Government and the Zero Carbon Hub in relation to zero carbon policy.

Scenario	Average capital cost per tonne of CO <sub>2</sub> saved				
	Basket 1: All measures, all sectors	Basket 2: Lewisham Homes only	Basket 3: ECO 'top up' all sectors	Basket 4: : ECO 'top up' in Lewisham Homes only	Basket 5: Schools <sup>28</sup>
1. Proposed Building Regulations only	£8.55	£40.04	£80.26	£80.99	£53.33
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£8.71	£45.92	£80.58	£81.24	£53.33
3. Lewisham Planning Policy	£9.23	£61.02	£81.60	£120.96	£53.33

Table 12: Average capital cost per tonne CO<sub>2</sub> saved

### 4.3 Total cost per tonne including management assumptions

A key issue with the costs assumed in all scenarios is that they do not take account of the marketing and management costs associated with delivery of measures. Experience from previous energy efficiency retrofit programmes, in particular those targeted at the private sector is that there are significant promotional costs associated with recruiting projects for measures to be applied to. As described above, estimating the management cost associated with administering the schemes is difficult. For the purposes of this study a range of management cost estimates have been assumed. A low estimate of 12.5% uplift has been based on the management cost associated with previous carbon saving programmes in Lewisham. The high estimate of 70% has been based on the additional cost assumptions developed as part of the Final Stage Impact Assessment for the Green Deal and Energy Company Obligation (2012).

<sup>28</sup> This figure is based on data provided by Lewisham Council based on RE:FIT assessments which assumed an average figure of £1200 for whole school retrofit projects. It also assumes an average measure lifespan of 22.5 years (reflecting 50% of savings from fabric measures with an assumed lifetime of 30 years and 50% from services measures with an assumed lifetime of 15 years. Furthermore it is assumed that all the required CO<sub>2</sub> savings can be achieved from schools.

Scenario	Average cost per tonne of CO <sub>2</sub> saved including management costs									
	Basket 1: All measures, all sectors		Basket 2: Lewisham Homes only		Basket 3: ECO 'top up' all sectors		Basket 4: : ECO 'top up' in Lewisham Homes only		Basket 5: Schools	
	Low	High	Low	High	Low	High	Low	High	Low	High
1. Proposed Building Regulations only	£10	£15	£45	£68	£90	£136	£91	£138	£60	£91
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£10	£15	£52	£78	£91	£137	£91	£138	£60	£91
3. Lewisham Planning Policy	£10	£16	£69	£104	£92	£139	£136	£206	£60	£91

Table 13: Average cost per tonne of CO<sub>2</sub> saved including management costs

#### 4.4 Cost to developers

The table below converts the average cost per tonne of carbon into a cost that the developer will be expected to pay to offset annual residual emissions over the assumed 30 year period.

This has been done by dividing the estimated average annual cost per tonne of carbon to be offset), by the residual carbon per m<sup>2</sup> requiring offset for each development type (for residential properties this has also been illustrated per unit at 67m<sup>2</sup>). This has then been multiplied by 30 years to establish the total cost of offsetting the total lifetime residual emissions – a period of 30 years has been chosen as this is the standard average lifetime assumed for offset measures. It has assumed the higher management costs are included.

It should also be noted that the cost per tonne of carbon is calculated based on the total cost of measures to offset all the residual emissions over the plan period. However, the residual emissions requiring offsetting change in line with the policy (in 2016 and 2019), as such, the cost to the developer changes at each of these points.

Table 14: Indicative cost of carbon: Residential – 2013-2016

	Basket 1: All measures, all sectors		Basket 2: Lewisham Homes only		Basket 3: ECO 'top up' all sectors		Basket 4: ECO 'top up' in Lewisham Homes only		Basket 5: Schools	
Scenario	Cost per m <sup>2</sup>	Cost per Unit <sup>29</sup>	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit
1. Proposed Building Regulations only	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£0.99	£66.65	£5.24	£351.26	£9.20	£616.46	£9.28	£621.49	£6.09	£407.97
3. Lewisham Planning Policy	£1.05	£70.63	£6.97	£466.83	£9.32	£624.28	£13.81	£925.31	£6.09	£407.97

Table 15: Indicative cost of carbon: Residential – 2016 onwards

	Basket 1: All measures, all sectors		Basket 2: Lewisham Homes only		Basket 3: ECO 'top up' all sectors		Basket 4: : ECO 'top up' in Lewisham Homes only		Basket 5: Schools	
Scenario	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit	Cost per m <sup>2</sup>	Cost per Unit
1. Proposed Building Regulations only	£6.10	£408.86	£28.59	£1,915.37	£57.30	£3,839.36	£57.83	£3,874.58	£38.08	£2,551.20
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£6.22	£416.77	£32.78	£2,196.58	£57.54	£3,854.90	£58.01	£3,886.39	£38.08	£2,551.20
3. Lewisham Planning Policy	£11.51	£771.25	£76.09	£5,097.79	£101.75	£6,817.11	£150.81	£10,104.39	£66.49	£4,455.08

Table 16: Indicative cost of carbon: Non-domestic – 2013-2019

<sup>29</sup> Costs per Unit are based on a 67m<sup>2</sup> flat



Scenario	Basket 1: All measures, all sectors (Cost per m <sup>2</sup> )	Basket 2: Lewisham Homes only (Cost per m <sup>2</sup> )	Basket 3: ECO 'top up' all sectors (Cost per m <sup>2</sup> )	Basket 4: : ECO 'top up' in Lewisham Homes only (Cost per m <sup>2</sup> )	Basket 5: Schools (Cost per m <sup>2</sup> )
1. Proposed Building Regulations only	N/A	N/A	N/A	N/A	N/A
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£1.10	£5.80	£10.19	£10.27	£6.74
3. Lewisham Planning Policy	£1.17	£7.71	£10.31	£15.29	£6.74

Table 17: Indicative cost of carbon: Non-domestic – 2019 onwards

Scenario	Basket 1: All measures, all sectors (Cost per m <sup>2</sup> )	Basket 2: Lewisham Homes only (Cost per m <sup>2</sup> )	Basket 3: ECO 'top up' all sectors (Cost per m <sup>2</sup> )	Basket 4: : ECO 'top up' in Lewisham Homes only (Cost per m <sup>2</sup> )	Basket 5: Schools (Cost per m <sup>2</sup> )
1. Proposed Building Regulations only	£7.55	£35.36	£70.88	£71.53	£47.10
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£7.69	£40.55	£71.17	£71.75	£47.10
3. Lewisham Planning Policy	£8.15	£53.90	£72.07	£106.83	£47.10

#### 4.5 Testing viability to 2016 - comparison with the cost of using PV

In the absence of an offset fund, developers would be expected to meet carbon reduction targets on site. For the period from 2013 to 2016 this would equate to an uplift from a 25% reduction in emissions above Building Regulations 2010 (from Lewisham Core Strategy Policy for Code for Sustainable Homes) to a 40% reduction in emissions over Building Regulations 2010 (as required by the London Plan). If the space were available, the most cost effective method of achieving this additional 15% reduction is likely to be through the use of PV. Consequently, the estimated cost of using PV to achieve this saving can be considered a reasonable proxy for the cost of delivering the London Plan policy. As the offset should ideally provide a more cost effective way of reducing carbon than onsite, the cost per tonne of carbon

used within the fund should demonstrate greater carbon savings for an equivalent price than the PV proxy. This approach becomes less robust beyond 2016. This is because as carbon reduction targets ramp up further, the approach to achieving them becomes more complex; most likely requiring strategic infrastructure delivered across several sites.

To estimate the cost of using PV to achieve the additional 15% reduction in carbon, the Standard Assessment Procedure assumed output of 850kWh/kWp has been used along with a 0.8% annual degradation rate and a capital cost of £1,500 per kWp. Based on these assumptions the cost of achieving carbon savings through the use of PV is equivalent to around £3750 per tonne for one year of savings or **£125 per tonne** of lifetime savings assuming a 30 year life.

Tables 18 to 21 in the next section compare the cost per tonne of offsetting the residual emissions for each policy scenario with the cost of delivering the same saving using PV. They show that PV is generally a fairly expensive option that is considerably more costly than basket 1 (all sectors) and higher than both baskets 2 (Lewisham homes) and 5 (schools). However focusing on measure that are not included in the package of measure available under ECO, results in a higher cost than the onsite PV option.

#### **4.6 Testing viability beyond 2016 - comparison with national benchmark of £46 per tonne**

The most recent Government impact assessment for the Zero Carbon Homes policy<sup>30</sup> used £46/tonne of residual carbon emissions as an illustrative figure of the cost that developers would need to pay to offset annual residual emissions. It also assumed that developers would be required to offset the emissions for a thirty year period. This cost was based on the Green Book average carbon abatement cost for the 30 year period from 2017 and was used as an illustrative figure as the aim of the policy is to ensure that the cost incurred by developers making payments for Allowable Solutions should not exceed the average cost of alternative abatement measures in the UK<sup>26</sup>. The actual price cap that would be adopted in policy has yet to be defined by Government. The £46/tonne figure is in present value terms, and assumes, in effect, that this is the cost that the developer would pay upfront on completion of each new dwelling.

The table below compares the notional £46/tonne figure with the cost per tonne of carbon generated using the baskets of measure for different sector and using PV as a proxy. The only basket of measures that falls below this figure is basket 1, which is open to the widest range of offset measures.

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<sup>30</sup> CLG, Zero Carbon Homes, Impact Assessment, May 2011

Table 18: Indicative cost of carbon: Residential – 2013-2016

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£0.99	£5.24	£9.20	£9.28	£6.09	£8.40	£3.09
3. Lewisham Planning Policy	£1.05	£6.97	£9.32	£13.81	£6.09	£8.40	£3.09

Table 19: Indicative cost of carbon: Residential – 2016 onwards

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	£6.10	£28.59	£57.30	£57.83	£38.08	£52.50	19.32
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£6.22	£32.78	£57.54	£58.01	£38.08	£52.50	19.32
3. Lewisham Planning Policy	£11.51	£76.09	£101.75	£150.81	£66.49	£52.50	33.74

Table 20: Indicative cost of carbon: Non-domestic – 2013-2019

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£1.10	£5.80	£10.19	£10.27	£6.74	£20.86	£7.68
3. Lewisham Planning Policy	£1.17	£7.71	£10.31	£15.29	£6.74	£20.86	£7.68

Table 21: Indicative cost of carbon: Non-domestic – 2019 onwards

Scenario	Basket 1: All measures, all sectors Cost per m <sup>2</sup>	Basket 2: Lewisham Homes only Cost per m <sup>2</sup>	Basket 3: ECO 'top up' all sectors Cost per m <sup>2</sup>	Basket 4: ECO 'top up' in Lewisham Homes only Cost per m <sup>2</sup>	Basket 5: Schools Cost per m <sup>2</sup>	PV Proxy Cost per m <sup>2</sup>	National Benchmark of £46 per tonne Cost per m <sup>2</sup>
1. Proposed Building Regulations only	£7.55	£35.36	£70.88	£71.53	£47.10	£81.70	£30.08
2. London Plan / Lewisham Core Strategy to 2016/2019 and proposed Building Regulations thereafter	£7.69	£40.55	£71.17	£71.75	£47.10	£81.70	£30.08
3. Lewisham Planning Policy	£8.15	£53.90	£72.07	£106.83	£47.10	£81.70	£30.08

#### **4.7 Fund structure**

In lieu of any other mechanism that might be brought in as part of zero carbon policy associated with proposed changes to Building Regulations in 2016, the only legal mechanism open to local authorities to charge developers a variable rate is through Section 106 (s106) payments. The Community Infrastructure Levy (CIL), the other mechanism for charging developers, is not appropriate as it applies a fixed tariff that cannot take account of the variable rates of residual carbon emission to be offset. It is expected that s106 funds will be spent within 5 years of payment. Furthermore, after April 2014, s106 funds will no longer be allowed to be pooled. This means each s106 payment for offsetting residual emissions should technically pay for specific offset measures. This is more likely to be demonstrable within a programme of smaller offset measures such as homes retrofit; where a specific number of homes could be attributed to offsetting a particular development's emissions. This becomes less straight forward when using offset funds to pay for a smaller number of large-scale carbon reduction measures such as school retrofits or infrastructure installations.

Generating, appraising and verifying projects are likely to have the most significant impacts on fund management. There are three overarching approaches:

- Open call – Opening to the widest range of opportunities and reducing State Aid restrictions would be an open call for carbon reduction projects. This would however require the development of assessment criteria on which to judge potential projects. For example, applicants could be asked to demonstrate how they would achieve a particular carbon saving for a fixed price or might request funding for particular activities. Table 22 below provides an illustrative assessment proforma and weightings. There is a risk however with this approach in that sufficient or appropriate projects might not come forward and, as such, Lewisham Council will have less control over what is funded.
- Lewisham Defined Projects – Targeting specific interventions has the greatest level of control for Lewisham Council. Rules over public money funding the private sector is likely to restrict working with private entities and there would be a smaller pool of potential projects which, as highlighted above would raise the overall cost per tonne of carbon or, reduce the offset ratio achievable within a viable price.
- Developer defined – Removing the responsibility for project identification, delivery and funding from the Council, developers could be conditioned to identify and deliver offset projects themselves. Again the Council would have less control over the projects coming forward but equally there would be less risk associated with fund management as this is passed on to the developer, although there would need to be some form of verification that developers had delivered the projects required.

Project information required	Weighting	Rationale
<b>Offset scheme project cost-effectiveness (£/tCO<sub>2</sub>) = (A + B) / C</b>	<b>60</b>	Cost per tonne of carbon should be the main factor in any competition of funding. Sub-weights would favour fewer schemes with higher savings and provide a small incentive to keep admin costs low.
A. Offset Solutions allocation towards project technical implementation costs (£)	(35)	
B. Offset Solutions allocation towards project administration overhead (capped at 10%)	(5)	
C. Proportionate share of lifetime carbon savings (tCO <sub>2</sub> )	(20)	
<b>Overall whole life project cost-effectiveness (£year/tCO<sub>2</sub>) = D / E</b>	<b>15</b>	Favours projects with higher overall carbon savings and cost-effectiveness, taking account of bill savings, and other lifetime costs and income.
D. Discounted net costs (£) including admin	(5)	
E. Total lifetime carbon savings (tCO <sub>2</sub> )	(10)	
<b>Additionality</b>	<b>10</b>	Ensures scheme administrators have some information on which to make judgements about relative additionality of projects.
Describe how project increases or brings forward carbon savings compared to a Business As Usual baseline.	(10)	
<b>Added value</b>	<b>15</b>	Provides scope to give preference to projects that provide added value.
Additional community benefits, e.g. job creation, skills development	(10)	
Good practice & sustainability: describe how the project meets applicable good practice and sustainability guidelines and avoids or appropriately manages adverse environmental impacts.	(5)	

Table 22: Example assessment criteria

#### 4.8 Relationship with ECO Funding

For the purposes of this study it was assumed that within baskets 3 and 4 where possible measure could be delivered using ECO funding they were. As such, these measures were excluded from the basket and the cost of carbon was calculated using the remaining measure available. However, it is likely that any proposed application for ECO funding made by Lewisham will result in a shortfall in funding. As such, there is an additional option where this offset fund is used to make up this shortfall. The cost per tonne of carbon therefore becomes a question of carbon accounting. If the carbon savings are attributed proportionally to each funding partner then the cost of carbon is simply related directly to the total cost divided by the total carbon saved. However, this gets more complicated if one or more funding partner (including the beneficiary) claims responsibility for delivering particularly measures, such as the cheapest ones. In this instance the cost of carbon would increase as the range of measure available to fund would be increasingly limited. Furthermore, the auction nature of the ECO brokerage scheme makes it difficult to ascertain real costs as the size of the fund is related to the willingness of the Energy Companies to buy the ‘lots’ of ‘ECO Carbon Saving Obligation’ offered by potential providers. As such creating a dynamic market.

## 5 Options Appraisal and conclusions

### 5.1 Options appraisal

The following table provides an overview of the assumed costs, benefits and constraints of each basket of measures in achieving each of the different approaches to developing a cost of carbon:

	Basket 1: All measures, all sectors	Basket 2: Lewisham Homes only	Basket 3: ECO 'top up' all sectors	Basket 4: ECO 'top up' in Lewisham Homes only	Basket 5: Schools
Cost	Lowest average capital costs per residual tonne	Low average capital costs per residual tonne	High average capital costs per residual tonne	Highest average capital costs per residual tonne	Middle average capital costs per residual tonne
PV proxy to 2016	Cheaper than PV	Cheaper than PV	More expensive than PV	More expensive than PV	Cheaper than PV
Fund management issues	Restrictions of funding private sector likely to increase management costs Higher marketing costs to attract schemes Likely to increase fund management costs	Projects within Lewisham's control	Needs coordination alongside ECO funding application	Needs coordination alongside ECO funding application Projects within Lewisham's control	May be issues with pooling s106 funding Projects within Lewisham's control
Delivery issues	Only targets lowest cost measures. Reduces opportunities for whole home retrofit Requires a large number measures to	Only targets the lowest cost measures. Less impact on opportunity for whole home retrofit as part of Council ALMO stock should be accessible in	Support delivery of hard to reach measures Requires a large number measures to be installed	Support delivery of hard to reach measures Requires a large number measures to be installed	Small number of projects within Lewisham's control.

	be installed	the future for future rounds of improvement. Requires a large number measures to be installed			
Additionality	Could be competing with existing carbon reduction schemes	Could be competing with existing carbon reduction schemes	Greater chance of delivering additionality	Greater chance of delivering additionality	Greater chance of delivering additionality
Carbon accounting	No issues	No issues	Delivering alongside of carbon reduction programmes requires agreed carbon accounting	Delivering alongside of carbon reduction programmes requires agreed carbon accounting	No issues
Additional benefits	None	Supports those most at risk	None	Supports those most at risk	Reduces the running cost of public assets

Table 23: Summary of benefits and constraints

**5.2 Testing viability of the increased London Plan requirements**

As described in section 3.3, the London Plan sets the requirement for new residential development to deliver a 40% improvement on 2010 Building Regulations as a minimum improvement over the target emission rates for carbon dioxide emissions reductions from October 2013 to 2016. This is more stringent than the 25% reduction required by the Lewisham Core Strategy that was tested in the Lewisham CIL Economic Viability Study. Therefore in developing a carbon offset fund it became apparent that the increased requirement needed viability testing through the CIL model.

Tables 18 to 21 details the cost of providing the additional 15% carbon saving onsite using PV as a proxy and identifies a resulting cost of £8.40m<sup>2</sup>. This figure has been tested against the assumptions and results of the model used in the Lewisham CIL Economic Viability Study. When CIL is adopted, there will remain a requirement for the current planning obligations system (known as ‘Section 106’) to continue to collect developer contributions for a number of non-infrastructure matters, including some parts of renewable energy



provision. The CIL model includes £14.90 m<sup>2</sup> to account for these residual Section 106 costs. Calculations by the London Borough<sup>31</sup> of Lewisham show that it is expected that only half of this allowed cost will be required in most cases. The remaining half (£7.45m<sup>2</sup>) is available to support the £8.40m<sup>2</sup> required to deliver the 15% increase in the carbon emissions reduction target without affecting the overall economic viability of development.

### **5.3 Conclusion**

The Lewisham Core Strategy makes provision for developments that cannot meet carbon saving targets onsite to pay into an offset fund. This offset fund will, in turn, be used to deliver carbon savings elsewhere in the borough. To achieve carbon savings using offset measures that are equal to the residual emissions onsite, the cost per residual tonne is related to the cost of potential carbon saving measures available. This study has predicted the residual carbon emissions for three potential future policy and regulatory scenarios, before estimating a range of indicative costs per tonne of carbon to offset these residual emissions.

The indicative costs are based on the availability of different baskets of measures to deliver different funding priorities. As the different funding priorities restrict the suite of measures available within different baskets, the cost associated with each basket changes. The options appraisal highlights there are opportunities and issues with each of the different baskets of measures, but that an offset ratio of one can be delivered. Taking a flexible approach to combining baskets therefore offers the best chance to maximise external funding, offer additionality and address priorities on an ongoing basis. This will enable the rate to remain constant which offers developers certainty around the cost whilst maintaining flexibility about the most appropriate delivery mechanisms.

Similarly, as the amount of residual carbon increases, as in policy scenarios 2 and 3, the lower cost measures become exhausted quicker and more expensive measures are needed to achieve the desired savings. This is particularly evident post 2016 where in scenario 2 proposed Building Regulations become more stringent and in scenario 3 where Lewisham's Core Strategy requires the equivalent of Code for Sustainable Homes Level 6.

Retaining development viability is also critical. Payment into an offset fund should not stifle the deliverability of development. As such, the potential to charge developers is restricted. To 2016, Baskets 1, 2 and 3 appear to be reasonable based on using PV as a proxy for alternative onsite delivery and in relation to previous CIL sensitivity testing. Post 2016 the cost of available offset measures in all baskets other than basket 1 cost more than using PV. However, it should be noted that it becomes less appropriate to use PV as a proxy for comparison beyond 2016 as it is unlikely that there would be sufficient space available to install the sufficient of PV cells to meet the higher reduction targets on site.

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<sup>31</sup> Agree with the London Borough of Lewisham at a meeting on 16<sup>th</sup> April 2013.

The overall management and delivery of an offset fund will also affect the cost and the ability of the fund to achieve the required carbon savings. There are likely to be restrictions on providing public funding within the private sector. This is generally overcome by calling for applications for funding. However the evidence suggests that this has a tendency to increase fund management and marketing costs. Using the baskets of measures to take a flexible approach to balancing risks and opportunities will ensure delivery costs can be minimised and carbon reductions maximised.

It is for these reasons that a cost per residual tonne of carbon of £ £104 should be used. This would equate to a cost of £6.97per m<sup>2</sup> for residential properties and £7.71 per m<sup>2</sup> for non-domestic. This figure balances maintaining a flexible approach for developers as to how they choose to meet the carbon reduction targets with a cost that can deliver carbon reduction projects within Lewisham. Post 2016 offset charges will need to be reviewed in light of development viability.

## Appendix

### Basket 1: All measures, All Buildings

Sector		Measure	Number of measures <sup>32</sup>	Total tonnes CO2 saved by measures per annum	Lifetime cost/tonne CO2 <sup>33</sup>
Domestic	Public Other	Add 80mm jacket to uninsulated cylinder	390	296	£2
Domestic	Private	Add 80mm jacket to uninsulated cylinder	1835	1,392	£2
Domestic	Council	Add 80mm jacket to uninsulated cylinder	649	492	£2
Domestic	Public Other	Replace uninsulated cylinder with 80mm foam cylinder	390	325	£10
Domestic	Council	Replace uninsulated cylinder with 80mm foam cylinder	649	541	£10
Domestic	Private	Replace uninsulated cylinder with 80mm foam cylinder	1835	1,530	£10
Domestic	Private	Insulate loft from 0mm to 300mm	11109	12,826	£10
Domestic	Public Other	Insulate loft from 0mm to 300mm	2359	2,723	£10
Domestic	Council	Insulate loft from 0mm to 300mm	1656	1,912	£10

<sup>32</sup> These figures represent the theoretical technical potential for numbers of installations in Lewisham's homes

<sup>33</sup> These costs do not allow for marketing and programme management costs

Basket 2: All measures, Lewisham Homes only

Sector		Measure	Number of measures <sup>34</sup>	Total tonnes CO2 saved by measures per annum	Lifetime cost/tonne CO2 <sup>35</sup>
Domestic	Council	Add 80mm jacket to uninsulated cylinder	649	492	£2
Domestic	Council	Replace uninsulated cylinder with 80mm foam cylinder	649	541	£10
Domestic	Council	Insulate loft from 0mm to 300mm	1656	1,912	£10
Domestic	Council	Block open chimneys	848	177	£12
Domestic	Council	Cavity wall insulation to pre 1975 cavity wall	2530	1,833	£14
Domestic	Council	Insulate loft from 12mm to 300mm	5	4	£15
Domestic	Council	Replace 12mm jacket cylinder with 80mm foam cylinder	542	229	£20
Domestic	Council	Cavity wall insulation to 1976-1982 cavity wall	1400	558	£25
Domestic	Council	Replace 25mm jacket cylinder with 80mm foam cylinder	654	166	£33
Domestic	Council	Insulate loft from 50mm to 300mm	1232	361	£34
Domestic	Council	Add full controls (TRVs, room thermostat) from programmer only	332	188	£41
Domestic	Council	Upgrade to full zone controls (TRVs, room thermostat) from single programmer only	10	11	£45
Domestic	Council	Replace 12mm foam cylinder with 80mm foam cylinder	2193	399	£46
Domestic	Council	Insulate loft from 75mm to 300mm	358	68	£53
Domestic	Council	Upgrade to full controls (TRVs, programmer room thermostat) from none	189	104	£55
Domestic	Council	Replace 38mm jacket cylinder with 80mm foam cylinder	164	25	£55
Domestic	Council	Replace 50mm jacket cylinder with 80mm foam cylinder	153	22	£59
Domestic	Council	Add hot water tank thermostat	5361	898	£60
Domestic	Council	Insulate 1900-1966 stone main walls internally	10	17	£70
Domestic	Council	Insulate loft from 100mm to 300mm	1002	138	£72
Domestic	Council	Insulate pre 1975 system built walls internally	1589	1,704	£78
Domestic	Council	Replace Storage Heaters with A rated combi system, Gas in property	123	353	£81
Domestic	Council	Insulate pre 1975 solid main walls internally	7871	9,009	£83
Domestic	Council	Replace electric heaters with A rated combi system, Gas in property	133	356	£87
Domestic	Council	Single to dual immersion	378	72	£88
Domestic	Council	Fill and add internal insulation to empty pre 1975 cavity walls	2530	2,322	£98

<sup>34</sup> These figures represent the theoretical technical potential for numbers of installations in Lewisham's homes

<sup>35</sup> These costs do not allow for marketing and programme management costs

Basket 3: Limited Measures, All Buildings

Sector		Measure	Number of measures <sup>36</sup>	Total tonnes CO2 saved by measures per annum	Lifetime cost/tonne CO2 <sup>37</sup>
Domestic	Council	Insulate 1900-1966 stone main walls internally	10	17	£70
Domestic	Public Other	Insulate 1900-1966 stone main walls internally	9	15	£70
Domestic	Private	Insulate 1900-1966 stone main walls internally	42	69	£70
Standalone	N/A	Deliver a DHN at New Cross	1	1,500	£71
Domestic	Council	Insulate pre 1975 system built walls internally	1589	1,704	£78
Domestic	Private	Insulate pre 1975 system built walls internally	1102	1,181	£78
Domestic	Public Other	Insulate pre 1975 system built walls internally	234	251	£78
Domestic	Council	Insulate pre 1975 solid main walls internally	7871	9,009	£83
Domestic	Private	Insulate pre 1975 solid main walls internally	42079	48,165	£83

<sup>36</sup> These figures represent the theoretical technical potential for numbers of installations in Lewisham’s homes

<sup>37</sup> These costs do not allow for marketing and programme management costs

Basket 4: Constrained measures, Lewisham Homes only

Sector		Measure	Number of measures <sup>38</sup>	Total tonnes CO2 saved by measures per annum	Lifetime cost/tonne CO2 <sup>39</sup>
Domestic	Council	Insulate 1900-1966 stone main walls internally	10	17	£70
Standalone	N/A	Deliver a DHN at New Cross	1	1,500	£71
Domestic	Council	Insulate pre 1975 system built walls internally	1589	1,704	£78
Domestic	Council	Insulate pre 1975 solid main walls internally	7871	9,009	£83
Domestic	Council	Insulate loft from 150mm to 300mm	859	84	£103
Domestic	Council	Insulate 1900-1966 timber frame main walls internally	56	41	£110
Domestic	Council	Insulate 1900-1966 stone main walls externally	10	17	£114
Domestic	Council	Install 2kWp system	1941	1,745	£237
Domestic	Council	Insulate pre 1975 system built walls externally	1589	1,704	£128
Domestic	Council	Upgrade community heating to Gas CHP, upgrade controls	1359	1,552	£146
Domestic	Council	Fill and add internal insulation to empty 1976-1982 cavity walls	1400	768	£156
Domestic	Council	Externally insulate exposed floor	1058	362	£162
Domestic	Council	Upgrade regular E rated gas boiler to combi	2392	1,968	£194
Domestic	Council	Upgrade regular E rated gas boiler	2392	1,465	£196

<sup>38</sup> These figures represent the theoretical technical potential for numbers of installations in Lewisham's homes

<sup>39</sup> These costs do not allow for marketing and programme management costs

Basket 5: Schools

Sector		Measure	Number of measures <sup>40</sup>	Total tonnes CO2 saved by measures per annum	Lifetime cost/tonne CO2 <sup>41</sup>
Non-Domestic	Council	Whole building retrofit	?	?	£53

<sup>40</sup> These figures represent the theoretical technical potential for numbers of installations in Lewisham’s homes

<sup>41</sup> These costs do not allow for marketing and programme management costs