MAYOR OF LONDON

Energy Monitoring Report

Monitoring the implementation of London Plan energy policies in 2018

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1. Executive summary

The Mayor of London has declared a climate emergency and, as part of this commitment to tackling climate change, he has set a target for London to be net zero-carbon by 2050. This is in line with the highest ambition of the Paris Agreement and the 2018 UN Intergovernmental Panel on Climate Change[1] (IPCC) report, which has reiterated the urgency of responding to the challenges posed by climate change by taking measures to minimise its extent and its impact.

London continues to address these challenges by pushing ahead with targets and policies that contribute to the Mayor's ambition for London to be a zero-carbon city by 2050. Through policies in the new draft London Plan[2], all new buildings will need to be designed, built and operated so they are zero-carbon.

The London Plan contains a range of targets and policies that new major developments are required to comply with, including those covering carbon emissions and energy consumption. When the next version of the London Plan is adopted in 2020 the zero-carbon[3] target that has applied to new major residential developments since October 2016 will be extended to all new major non-residential developments, and carbon reductions through energy efficiency measures will be intensified even further for both residential and non-residential developments.

This report

This report presents the outcomes secured in 2018 from implementing the current London Plan energy policies for new development, covering the 130 strategic planning applications approved by the Mayor in that year. It focuses on the expected carbon emissions reductions[4] and low carbon energy infrastructure commitments secured from developers in order to comply with London Plan policy. It also provides details of how developers intend to achieve those carbon savings, including through energy efficiency measures, installation of heat network infrastructure and renewable energy sources such as solar photovoltaic (PV) panels and heat pumps. It is primarily aimed at developers and their consultants, planning case officers, and local planning authorities.

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[1] https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments/

[2] This document reports progress against the energy policies in the current London Plan and not the new draft London Plan which has not yet been adopted.

[3] Not all applications with residential elements that were approved in 2018 were required to meet the zero-carbon homes target, as this target only applies to those applications submitted on or after 1 October 2016.

[4] Carbon dioxide (CO_2) is by far the most common greenhouse gas (GHG) emitted in London, both in terms of quantity released and total impact on global warming. As such carbon and CO_2 have become the common shorthand terms used when accounting for harmful greenhouse gases.

A summary of the outcomes secured in 2018 is shown in Box 1.

Box 1 – key outcomes secured in 2018 across applications approved by the Mayor from implementation of London Plan energy policies

- A carbon reduction[5] of 36.9 per cent more than required by the 2013 Building Regulations, comfortably surpassing the London Plan target of a 35 per cent reduction.
- A total carbon emissions reduction of just over 39,000 tonnes per annum was secured, an increase of more than 5 per cent compared with the previous year. This is broadly equivalent to the savings achieved from retrofitting loft insulation in more than 63,000 existing houses.
- In the residential sector a 38.9 per cent carbon reduction was secured, and for non-residential developments a 35.2 per cent carbon reduction was secured.
- Significant investment at each stage of the energy hierarchy including:
    - Be Lean - investment in energy efficiency resulted in a 13.5 per cent reduction in CO_2 emissions compared with Building Regulations, a reduction from the 2017 figure (15.8 per cent), but still far exceeding the 2016 figure of 7.4 per cent.
    - Be Clean – substantial increases for 2018 saw more than £94 million (compared with £55 million in 2017) invested in heat network infrastructure and £13.1 million invested in CHP, corresponding to approximately 18.8 MWe CHP capacity (up respectively from 2017 figures of £6.7 million and 9.6 MWe). In line with the latest Energy Assessment Guidance and new London Plan policy it is expected that gas-engine CHP will play a less prominent role in future due to the increasing evidence of adverse air quality impacts and decarbonisation of the grid. A decline in the use of CHP at smaller scale sites is evident in the 2018 results.
    - Be Green – nearly £7 million invested in solar PV panels enabling approximately 5.5 MW of new electricity capacity (compared with £4 million in 2017, enabling 3.5 MW of new electrical capacity), and additional investment in other renewable energy technologies, most notably heat pumps (57 installations compared with 41 in 2017).

[5] This is regulated emissions, i.e. the CO_2 emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation. Unregulated emissions are those not covered by Building Regulations, e.g. those relating to electrical appliances.

Overview of findings

The Mayor is consulted on planning applications of potential strategic importance.[6] In 2018, 130 strategic planning applications were granted provisional permission by the local planning authority and were subsequently considered by the Mayor and approved.

The total reduction in CO_2 emissions for 2018 developments referred to the Mayor is estimated to be just over 39,000 tonnes, accruing to an estimated 36.9 per cent more than required by Building Regulations, and comfortably exceeding the Mayor's target of a 35 per cent carbon reduction against Building Regulations.

Of the 130 applications approved by the Mayor in 2018, 104 (80 per cent) reached the 35 per cent target. In the 26 applications (20 per cent) that did not meet the London Plan target there has been a notable absence of low carbon heat supply through the Be Clean stage of the energy hierarchy. This is mostly down to the CHP not being a suitable technology for the development, as a result of its scale or anticipated heat loads. Additionally, 78 applications with a residential element were required to meet the zero-carbon homes target[7] by achieving at least a 35 per cent reduction in carbon emissions on-site, and to make a carbon offset payment for the residual emissions to zero. The residential elements of these developments achieved an overall saving of 39.4 per cent in carbon emissions. This compares favourably with the equivalent figure (35.6 per cent saving) for the 13 applications that were not required to meet the zero-carbon homes target as they were submitted before the requirement took effect on 1 October 2016.

Developers are required to follow the Mayor's energy hierarchy, set out in the London Plan, to meet the carbon reduction target. By following the hierarchy, applications submitted in 2018 have continued to demonstrate a range of energy solutions based on combinations of energy efficiency, heat networks and low and zero-carbon technologies. The case studies in Appendix 2 demonstrate some of these different approaches, including connection to existing local heat networks; installation of large heat pumps integrated with site-wide heat networks; and enhanced levels of energy efficiency.

The cumulative regulated CO_2 emissions reduction from each stage of the energy hierarchy for all 2018 strategic applications is shown by development type in Figure 1.

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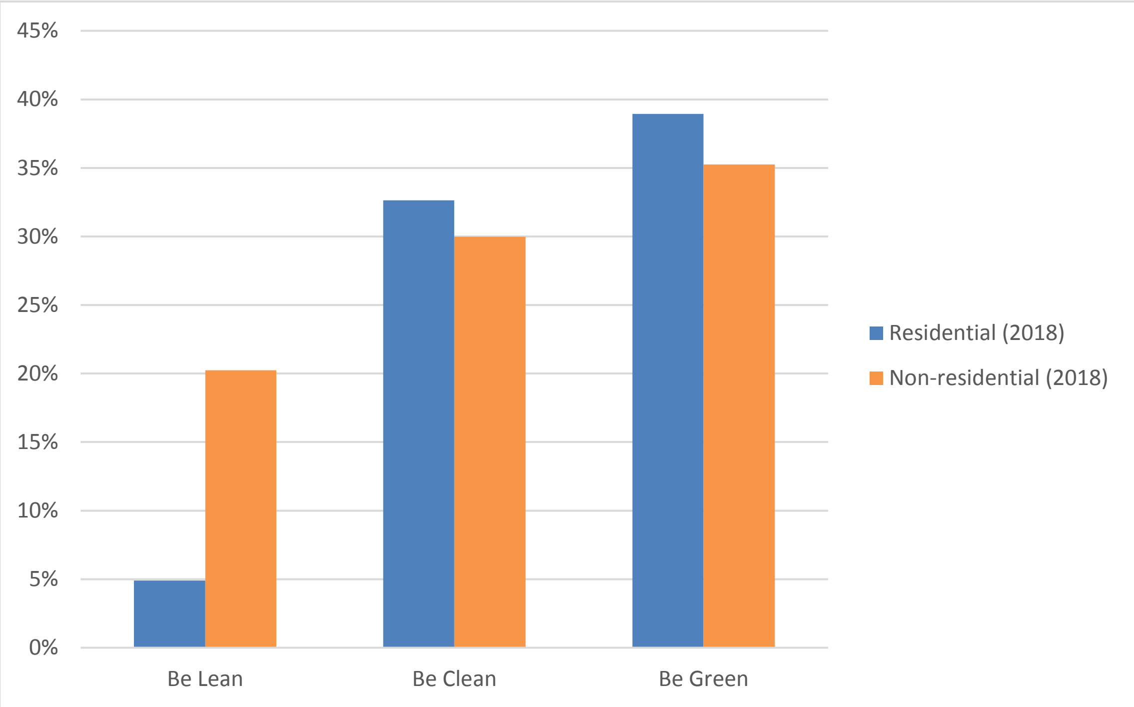
6 An application is referable to the Mayor if it meets the criteria set out in the Mayor of London Order (2008). The criteria include: development of 150 residential units or more, development over 30 metres in height (outside the City of London), development on Green Belt or Metropolitan Open Land. Please see the order for the full criteria.

[7] These applications were submitted on or after 1 October 2016 and were therefore required to meet the zero-carbon homes policy. Any applications with residential elements submitted before this date were not subject to the zero-carbon homes policy and instead were required to meet the previous target of a 35 per cent carbon reduction beyond Building Regulations.

Figure 1: Cumulative CO_2 emission reductions secured by development type at each stage of the energy hierarchy in 2018



The savings arising from Be Lean (energy efficiency), the first stage of the hierarchy, was 13.5 per cent, comprising 4.9 per cent for residential and 20.2 per cent for non-residential developments. Developers will be expected to further strengthen their focus on energy efficiency measures in response to new targets set to emerge when the next version of the London Plan is adopted. Thirteen per cent of residential development and 47 per cent of non-residential development have already met these targets in 2018.

Be Clean (supply energy efficiently), the second stage of the hierarchy, contributed the largest proportion of overall savings, at 17.6 per cent. This is less than in earlier years which is largely due to CHP not being a suitable technology for the non-residential building typologies submitted in 2018 (e.g. commercial premises such as offices, retail etc.). Consideration of alternatives to gas-engine CHP is also a factor, such as heat pumps, due to grid decarbonisation.

A positive finding from the 2018 results is that there was a drop in the proportion of developments featuring small CHP installations below 100 kWe (51 per cent compared with 59 per cent in 2017). This trend was most pronounced for very small (30kWe or below) CHP, with the number falling by more than half. As the carbon emissions from grid electricity generation decrease, the savings achieved by gas-engine CHP are expected to decrease. Consequently, it will become progressively more important for developers to consider other forms of heat generation which are lower carbon and will not worsen air quality, such as heat pumps. The impact of grid decarbonisation is not currently reflected in national Building Regulations but the GLA has been encouraging the use of updated carbon emission factors since January 2019. An indicative analysis of the impact this is expected to have on the energy strategies proposed by planning applicants is provided at the end of Chapter 3.

Nearly 88 per cent of applications included renewable energy, with the overall contribution from this third stage of the hierarchy (Be Green) increasing by more than 20 per cent (from 4.7 per cent in 2017 to 5.8 per cent in 2018). The most popular renewable energy technologies (solar PV and heat pumps) both increased their share compared to previous years. Using renewable energy technologies enabled 32 developments to extend their overall savings sufficiently to reach or exceed the carbon reduction target.

For any development referable to the Mayor that does not reach the applicable carbon reduction target, the developer is required to make up for the shortfall in emissions, either through a cash-in-lieu contribution to a borough's carbon offset fund or by funding an off-site measure in agreement with the relevant borough. These funds are ring-fenced for carbon saving projects elsewhere in the borough.

The aggregate carbon emissions shortfall for referable developments to which the zero-carbon homes standard applied was 23,517 tonnes, leading to a contribution to offset funds and investment in off-site measures of approximately £41 million. The zero-carbon offset figure in 2017 was £8.7 million as only a small number of developments were subject to the zero-carbon policy. This assumes an indicative CO_2 price of £60 per tonne[8] except where boroughs set their own figure (in which case the borough's own figure was applied), and a 30-year lifetime. Of the 78 developments to which the zero-carbon target applied, there were 13 that did not reach the minimum on-site 35 per cent reduction.

For the 52 other developments where the zero-carbon target did not apply (i.e. those with a residential component but which were submitted before the zero-carbon target took effect, and developments that were wholly non-residential) there were twelve that did not meet the 35 per cent carbon reduction target[9]. The aggregate carbon shortfall for these developments amounted to 2,046 tonnes of regulated CO_2 emissions per annum. This shortfall equated in 2018 to approximately a £4.66 million contribution to offset funds. This amounts to a total of £45.71 million investment attributed to the carbon offset funds.

[8] £60 per tonne of CO_2 is the GLA's current recommended carbon offset price. The new draft London Plan includes a new recommended carbon offset price of £95 per tonne of CO_2. Alternatively, boroughs can set their own local carbon offset price.
[9] Some boroughs collect offset payments when this target is missed.

Offsetting is a last resort that is only utilised when on-site savings have been maximised. However, until approaches and technologies improve to allow further on-site reductions, carbon offset funds represent an important flexibility option for developers and provide a valuable stream of funding to support other carbon saving initiatives in the relevant borough. The results of the latest carbon offsetting survey will be published separately and will report on the current value of carbon offset funds and how they are being collected and spent across London.

Conclusions

This report finds that London Plan energy policies in 2018 continued to accelerate the contribution that new build plays towards the decarbonisation of London. It finds that:

- **The London Plan continues to drive greater carbon reductions than required by national policy.** Overall, developers committed to an overall carbon emissions reduction of 36.9 per cent beyond Building Regulations, leading to a total reduction of just over 39,000 tonnes, which would not have been achieved without the London Plan carbon reduction targets. This is an increase of 5.4 per cent compared with the previous year and was mainly due to an increase in the number of dwellings and therefore the size of development being assessed.
- **The zero-carbon standard is driving greater on-site carbon reductions in the residential sector.** Residential developments where the zero-carbon target applied achieved a greater carbon reduction than those where it did not apply. This follows a similar observation in 2017, when the first zero-carbon home assessments were made, suggesting that developers are able to and have responded positively, seeking further emissions reductions on-site because of the new target.
- **New energy efficiency targets being introduced are expected to drive an even greater focus on improving building fabric.** Savings achieved at the first stage of the energy hierarchy demonstrate that developers are making effective choices to reduce energy demand first, before considering low carbon or renewable technologies. Developers are expected to further strengthen their focus on energy efficiency measures to respond to the new London Plan energy efficiency targets when the next version is adopted later in 2020. Commitments made by developers at the first stage of the hierarchy are driving investment in energy efficiency, estimated to result in residential energy cost savings of approximately £470,000 per annum which would otherwise be paid by residents.[10]
- **Investment in CHP increased.** It is estimated that London Plan energy policies resulted in £94 million[11] investment in heat network infrastructure for the dwellings connecting to site-wide heat networks and £13.1 million[12] in CHP capacity in 2018. However, with the decarbonisation of the electricity grid it is anticipated that gas-

[10] Full analysis on the calculation methodology relating to the energy cost savings can be found under footnote 39.
[11] Assumes a heat distribution cost of £2,500 per flat for district heating, taken from Table 51 of Code for Sustainable Homes: A cost review (CLG March 2010). Non-residential buildings will require additional investment.
[12] Assuming an installed capital cost of £700 per kilowatt of electrical capacity for the 18.8MW of CHP electrical capacity committed to in 2018, i.e. 700 x 18.776 x 1000 = £13,143,200.

engine CHP will not be such a prominent solution to meeting carbon reduction targets.

- **The London Plan is driving heat network development, essential for decarbonisation.** 37,555 dwellings have committed to a heat network connection in 2018. This includes developments with a site-wide heat network only, and those committed to connecting to an existing area-wide district heating network (DHN). At 96 per cent of the total dwellings receiving approval, this is a substantial increase on the 2017 figures (18,575 dwellings, 78 per cent of the total).
- **The London Plan is starting to drive the heat pump market in London.** There has been a substantial rise in the number of developments (57) deploying heat pump technologies in 2018 compared with 2017 (41 developments). This trend is expected to accelerate since it will become progressively more important for developers to consider alternatives to gas-engine CHP as the electricity grid decarbonises.
- **The London Plan is also leading to more solar PV installations.** The number of developers proposing to include renewable energy has increased, with an estimated 5.5MW of new electrical capacity from solar PV (an investment of almost £7m), as well as the 57 developments including a heat pump. This is up from 3.5MW solar provision the previous year. There are also two proposals of residential developments using a large heat pump via a heat network.
- **Carbon offsets are necessary to give developers the flexibility to meet the London Plan targets.** They will continue to play a role in future planning applications[13]. We estimate that the referable planning applications approved in 2018 could realise up to £45m of offset funding which could be an important resource for carbon-saving initiatives elsewhere in the relevant borough as part of its pathway for delivering zero-carbon.

Overall, in 2018 we have seen a commitment to a greater proportion of renewable energy, a larger number of heat networks, and a higher total carbon emissions reduction than in the previous year. The zero-carbon target applied in 2018 to the majority of developments that included a residential element and has led to increased carbon savings in those developments. The London Plan will continue to drive developers to devise integrated solutions that contribute to the Mayor's aim for London to be zero-carbon by 2050.

[13] The GLA has published a Carbon Offset Funds guidance document for boroughs which is available on the GLA's website. https://www.london.gov.uk/sites/default/files/carbon_offsett_funds_guidance_2018.pdf

2. Introduction

The London Plan

The London Plan is the Mayor's Spatial Development Strategy. It considers how the Mayor's various relevant strategies, such as those dealing with housing, transport, economic development and the environment can be coordinated to complement one another through new development. It also provides London's planning authorities with an overarching framework for their local plans. It ensures, for example, that boroughs identify enough land to meet local as well as strategic housing needs and provides guidance on issues such as tackling climate change and improving air quality. Legally, all local plans must be in 'general conformity' with the London Plan.

New developments across London range from plans for individual buildings to those involving thousands of new homes and mixed-use developments that will be delivered over several years and through a series of phases. Developers have continued to respond to the ambitious targets set by London Plan energy policies, which substantially exceed those required by national Building Regulations. Planning applications are referred to the Mayor if they meet the criteria set out in the Mayor of London Order (2008)[14] e.g. developments of 150 residential units or more.

The flexibility built into the London Plan means developers can pursue a variety of approaches, ensuring that the technologies chosen are the most appropriate to each development. The common theme is for high standards of energy efficiency together with, heat networks and the integration of low carbon and renewable energy technologies.

These approaches also require local capacity building both for the construction of new buildings and homes, and to deliver energy efficiency measures, new infrastructure and low and zero-carbon technologies, leading to a consequent positive effect on employment and a range of new job opportunities.

The contribution of new-build developments to CO_2 emissions reductions is relatively modest compared to the existing building stock since we expect around 80 per cent of London's current buildings to still be in use by 2050. However, new development has an important role to play in demonstrating best practice in building design, ensuring we don't lock in high carbon emissions through inefficient buildings. It also helps to increase resilience to future climate and energy supply changes, build supply chains for energy efficiency and low carbon technologies and catalyse new, area-wide district heat networks.

[14] https://www.london.gov.uk/what-we-do/planning/planning-applications-and-decisions/what-powers-does-mayor-have-planning

The Mayor has a duty to keep the London Plan under review so that it addresses changing trends and issues, for example around population increase. The next version of the London Plan is expected to be adopted in 2020.

Energy and carbon policies in the London Plan

Carbon targets

Policy 5.2 of the London Plan sets CO_2 emission reduction targets for new buildings. The targets support the development of energy efficient new buildings and investment in infrastructure to supply energy efficiently. These policies also enable additional benefits for building occupants through provision of affordable energy and increased security of energy supply, while also minimising the impact of new development on the energy network.

The London Plan carbon reduction targets are minimum improvements over the carbon targets[15] set for buildings in the 2010 National Building Regulations, which serves as a baseline. When revised Building Regulations came into effect on 6 April 2014, the London Plan target was recalibrated to take account of changes to the baseline. A target of 35 per cent beyond the new national standards across both residential and non-residential buildings was then applied by the Mayor. Subsequently, the target for new major residential developments[16] was raised to zero-carbon from 1 October 2016. The target for zero-carbon is set to be applied to new major non-residential developments once the next version of the London Plan is adopted.

If developments have proven that they are unable to reach the carbon reduction target on-site due to site-specific constraints, the London Plan requires the developer to make a cash-in-lieu contribution to the borough's carbon offset fund or install carbon saving measures off-site in agreement with the local borough to account for the shortfall in CO_2 emission reductions (as in London Plan Policy 5.2E). This contribution is ring-fenced by the borough to secure the delivery of carbon dioxide savings elsewhere.

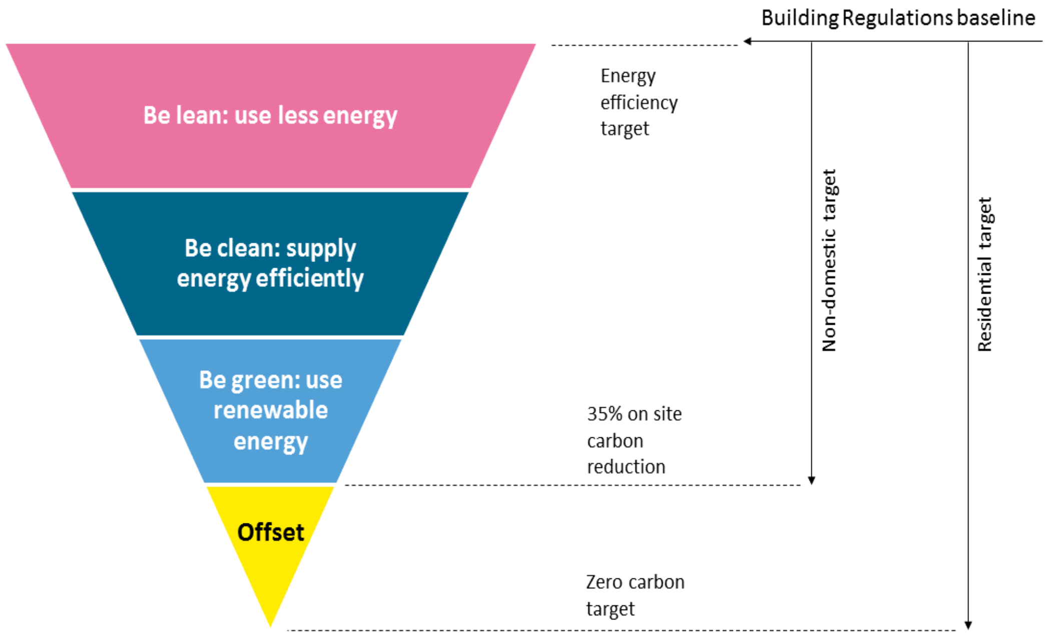
Energy policies

Policy 5.2D of the London Plan requires every planning application referable to the Mayor to be accompanied by an energy assessment, setting out how the development will comply with London Plan energy policies.

Applicants are required to set out how they have applied the Energy Hierarchy (Figure 2).

[15] Target Emission Rates outlined in Part L of Building Regulations.
[16] Developments comprising ≥10 units.

Figure 2: The Energy Hierarchy



In preparing energy statements, applicants are required to follow the Greater London Authority (GLA) Energy Assessment Guidance.[17] Each energy assessment is evaluated by a dedicated GLA energy planning team to ensure compliance with London Plan policies while recognising the circumstances relating to individual developments and the opportunities and constraints that apply in each case.

The case studies in Appendix 2 demonstrate how the energy hierarchy can be applied to developments of very different types and sizes of developments, to meet the carbon reduction targets. All four case studies made savings beyond Part L of the Building Regulations from energy efficiency measures alone, achieving this for both residential and non-residential elements.

[17] https://www.london.gov.uk/sites/default/files/energy_assessment_guidance_2018_-_update.pdf

Be Lean: use less energy

The most effective initial approach to reducing energy consumption is to ensure that energy demand is minimised through high quality building fabric and installing effective energy efficiency measures.

New developments are required to incorporate passive energy efficiency measures, such as optimising orientation and site layout, natural ventilation and thermal mass, to minimise the demand for energy for heating and cooling. In addition, to enhance the design of the building, developments are required to include active measures such as energy efficient lighting, heat recovery systems and advanced controls. They should also include measures to avoid internal overheating and contributing to the urban heat island effect, in line with Policy 5.3C which sets out a range of sustainable design principles.

As energy efficiency is the first element of the energy hierarchy, developers are required to commit to improving energy efficiency before deciding on the most appropriate low or zero-carbon energy supply system. This approach is reinforced by requiring developments to reduce regulated CO_2 emissions[18] below those of a Building Regulations compliant development through energy efficiency alone. The new draft version of the London Plan will drive further improvements by expecting residential developments to achieve a 10 per cent reduction and non-residential developments to achieve a 15 per cent reduction in regulated emissions over Building Regulations through energy efficiency measures alone. Once these new targets are officially adopted developers will be required to place even more emphasis on measures to reduce energy demand which will in turn reduce carbon and keep energy bills lower.

Energy efficiency measures often focus on reducing heating demand, but energy consumption to meet cooling demands should also be minimised. Energy consumption due to cooling demand is growing rapidly globally, in temperate as well as hot climates. Consequently Policy 5.9 sets out a cooling hierarchy for major development proposals to reduce potential overheating and reliance on air conditioning.

Developers are required to undertake dynamic overheating modelling against extreme weather scenarios and report how identified risks can be mitigated in line with existing CIBSE guidance, notably TM59[19], TM52[20] and TM49[21]. In addition to this, residential aspects of developments are also required to provide the GLA's overheating checklist alongside their planning applications at early design stages. These requirements ensure

[18] Regulated emissions include those associated with the energy consumed in the operation of the space heating/cooling and hot-water systems, ventilation and internal lighting.

[19] Technical Memorandum 59: Design methodology for the assessment of overheating risk in homes, Publication Date: May 2017, ISBN:9781912034185

[20] Technical Memorandum 52: The Limits of Thermal Comfort: Avoiding Overheating in European Buildings, Publication Date: Oct 2013

[21] Technical Memorandum 49: Design Summer Years for London, Publication Date: May 2014, ISBN:9781906846275

the risk of overheating is considered early at the detailed design and is mitigated against appropriately.

Measures to reduce overheating include the use of low temperature light-emitting diode (LED) lighting and optimisation of the solar transmittance of glass, together with passive features including balconies and windows set back in recesses for shading, and architectural design to promote natural cross and stack ventilation.

Be Clean: supply energy efficiently

Policy 5.5 of the London Plan requires developers to prioritise connection to existing or planned heat networks where feasible. The new draft London Plan continues to prioritise this.

Where a development comprises multiple buildings, a site-wide heat network allows the buildings within the development to be connected to and supplied from low carbon heating plant, while minimising the plant capacity required to meet the development’s peak demand. This plant may be housed within the development’s own central energy centre, alternatively, if the development is close enough it may be possible to connect to an existing heat network. Such established heat networks that are not confined to a single site or development are known as District Heating Networks (DHNs) which comprise similar infrastructure but at a larger scale. Heat networks at this scale already exist in parts of London, and there are plans being developed for more. In both cases the site’s own site-wide heat network provides the necessary pipe infrastructure to distribute the heat to all the buildings in that development.

For larger developments, the site-wide heat network may itself become the basis for a large area-wide DHN to which other developments in the vicinity may also be able to connect. This growth in the network extends efficiencies and economies of scale. For example, the more connections there are, the more the heat demand is diversified, leading to a smoother aggregate demand, and one which has a proportionately lower peak demand. This is accentuated if the increasing number of connections includes a corresponding growth in building types and complementary demand profiles.

Be Green: use renewable energy

Policy 5.7 of the London Plan requires that, after considering the first two elements of the energy hierarchy, major development proposals should provide further CO_2 emissions reductions by means of on-site renewable energy generation. This is regardless of whether the on-site carbon target has been met. The need to maximise opportunities for renewable energy on-site is continued in the new draft London Plan. For example, boroughs should ensure that all developments maximise opportunities for on-site electricity and heat production from solar technologies (photovoltaic and thermal).

Offsetting any shortfall in carbon emissions

On-site carbon reductions are expected to be maximised before an offset arrangement is considered, with all developments expected to achieve at least a 35 per cent reduction in carbon emissions on-site above Building Regulations. Once the GLA is satisfied that this has been done and there is a carbon shortfall, developers can either make a cash-in-lieu contribution to the borough’s carbon offset fund or install carbon saving measures off-site in agreement with the borough.

While most boroughs use the nationally recognised carbon offset price of £60/tonne, boroughs can also undertake their own studies to determine the cost of offsetting locally and set their own prices. The next version of the London Plan will introduce a new carbon offset price of £95/tonne.

3. Implementation

Targets

Table 1 sets out the London Plan carbon reduction targets that applied to the applications approved in 2018.

Table 1: London Plan carbon reduction targets[22]	
Non-residential	
Dates	Target
1st October 2013 – 5th July 2014	40 per cent beyond Part L 2010
6th April 2014 – adoption of current version of London Plan	35 per cent beyond Part L 2013
Following adoption of next version of London Plan in 2020	Zero-carbon
Residential	
Dates	Target
1st October 2013 – 5th July 2014	40 per cent beyond Part L 2010
6th April 2014 – 30th September 2016	35 per cent beyond Part L 2013
1st October 2016 onwards	Zero-carbon

Overall 2018 results

A total of 155 applications were considered by the Mayor in 2018 and were approved. Of these, 25 applications were either not determined in 2018 or did not contain an energy assessment due to their proposed nature (e.g. non-regulated uses[23]). One of these was a

[23] Energy assessments should only cover those buildings (or parts thereof) which are not exempt from the energy efficiency requirements of building regulations. For the purposes of the energy assessment, process loads are classified as unregulated energy uses.

major refurbishment for which an energy assessment was submitted. These were all excluded from this analysis leaving a total of 130 applications (Table 2).

Of the 130 referable applications approved in 2018, 129 have been assessed against the Part L 2013 baseline, with one assessed against the Part L 2010 baseline, having been granted planning permission as part of a wider development phase several years ago when an earlier target was still in place. For 78 of these applications with a residential element, the zero-carbon homes target applied as they were submitted on or after 1 October 2016.

Table 2: Total number of developments (including dwellings and floor area) approved by the Mayor in 2018

Type of development	Number of developments	Number of dwellings	Non-residential floor area (million m^2)
Mixed-use[24]	73	34,920	0.73
Residential	18	4,314	N/A
Non-residential	39	N/A	0.99
Total	**130**	**39,234**	**1.72**

Overall regulated CO_2 reductions

During 2018, the compliance of new development with London Plan energy policies resulted in a cumulative regulated CO_2 emissions reduction of 39,361 tonnes per annum. This is broadly equivalent to the savings achieved from retrofitting loft insulation in approximately 63,000 existing houses.[25] The saving is approximately 5.4 per cent higher than in 2017, despite an almost identical number of applications (130 compared to 129 in 2017). The increase in savings derives mainly from a substantial increase in the number of dwellings in 2018, and from an increase in savings from renewable energy technologies, the third stage of the energy hierarchy.

Table 3 shows the emissions after each stage of the energy hierarchy for new developments that were referred to the GLA and obtained planning approval in 2018.

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[24] All these developments have a residential and commercial component. The zero-carbon target applies only to the residential element of these developments for applications submitted on or after 1 October 2016.
[25] Assumes average saving per dwelling of 0.6 tonnes of CO_2 per annum for virgin loft insulation, based on Energy Savings Trust calculations.

Table 3: On-site CO_2 emission reductions from applications approved in 2018 and assessed against the target of a 35% improvement on Part L of 2013 Building Regulations[26]			
Stages of the Energy Hierarchy	Regulated CO_2 emissions	Cumulative regulated CO_2 emissions reductions relative to Part L 2013 Building Regulations	
	(tCO_2/year)	(tCO_2/year)	(per cent)
Baseline	106,800	-	-
After energy efficiency	92,343	14,458	13.5
After energy efficiency & heat networks	73,519	33,281	31.2
After energy efficiency, heat networks & renewables	67,439	39,361	36.9

The average percentage savings achieved across all developments in 2018 (36.9 per cent) was less than for 2017 (40.5 per cent). However, the percentage savings have still exceeded the target of reduction of more than 35 per cent beyond Part L 2013, and they are consistent with the average savings over the last five years. Total savings for 2018 have increased by more than 2,000 tonnes of CO_2 compared with 2017, albeit, mostly due to the increased number of dwellings present. Of the 130 applications, 104 (80 per cent) met the 35 per cent carbon emission reduction target beyond Part L (2013) of the Building Regulations.

The savings in the residential sector were maintained, achieving a very slight increase from 38.7 per cent in 2017 to 38.9 per cent in 2018. There were 91 developments that included residential elements, 71 (78 per cent) of these residential elements met the 35 per cent target.

The savings in the non-residential sectors fell from 41.6 per cent in 2017 to 35.2 per cent, but this still meets the target. Of the 112 non-residential elements that featured in the 130 applications, 77 (69 per cent) met the 35 per cent target.

[26] This also includes the savings from one development that was assessed against Part L 2010

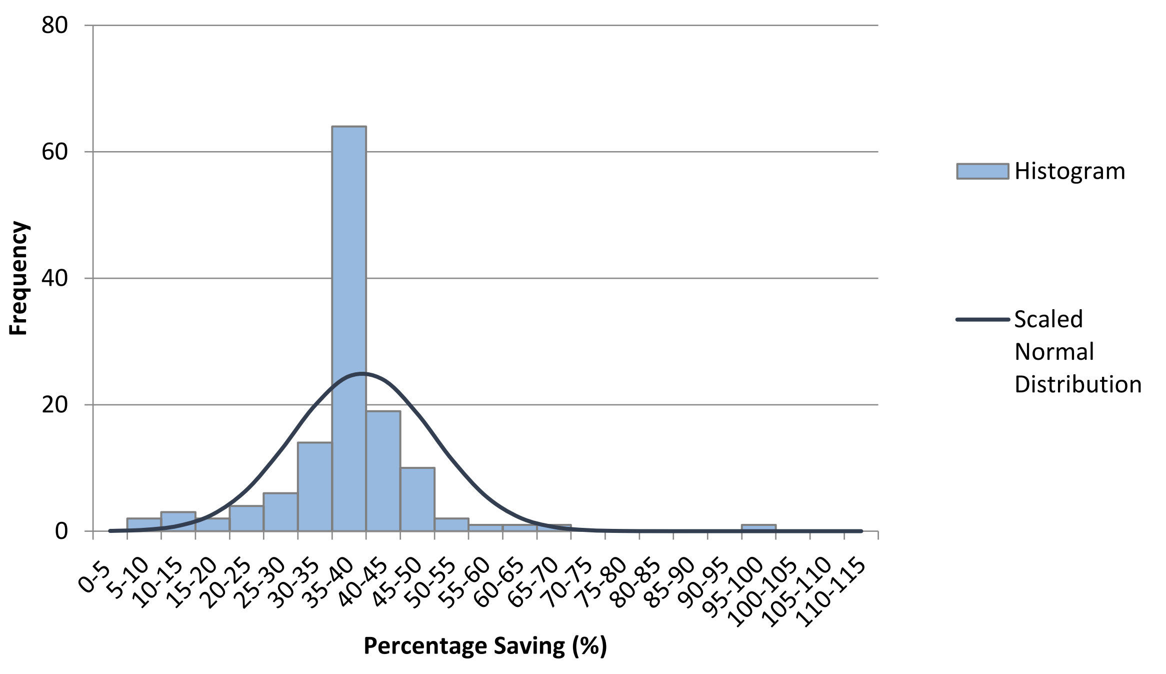
Unlike residential developments, the non-residential category includes a diverse range of building sectors. It is noticeable that during 2018 there was an increase, compared with 2017, in office buildings and a decrease in hotels and leisure buildings, which have energy consumption profiles more conducive to CHP. Consequently, in the non-residential sectors, there were less carbon savings available from CHP, which accounts for the 2018 non-residential savings being lower than in 2017.

Except for two applications, developers have been able to meet the Part L 2013 target with energy efficiency only. The two applications that did not reach this level struggled because one needed to conserve heritage elements, and one was partly a refurbishment, making improvements far more technically challenging and expensive. However, both developments reached the overall 35 per cent target. Further to this, 13 per cent of developments with residential elements managed to reach the proposed new draft London Plan energy efficiency target of a 10 per cent reduction beyond Part L, and 47 per cent of developments with non-residential elements achieved the proposed new target of a 15 per cent reduction beyond Part L for those non-residential elements. Developers are clearly moving in the right direction in light of the forthcoming introduction of these new targets.

In 2018 there were 78 applications that were required to achieve the zero-carbon homes target. On average the residential elements within these applications achieved a 39.4 per cent reduction which is slightly higher than the figure for 2017, the first year such developments were assessed. This indicates that developers have been able to devise energy strategies that reach beyond the minimum 35 per cent target to deliver higher carbon savings and reduce the need for offsetting. The savings for developments where the zero-carbon target did not apply, because the associated planning applications were submitted before the target took effect, were 35.6 per cent. The zero-carbon target will be extended to non-residential development when the new version of the London Plan is adopted, meaning that developers will be expected to adapt to approaches that achieve higher carbon savings on-site before resorting to offsetting.

Figure 3 shows the range and distribution of the carbon savings for 2018. The data here is presented as savings achieved by individual developments (as opposed to the overall carbon reduction figure). As with 2017, most developments achieved savings in the range of 35 - 40 per cent.

Figure 3: Total carbon savings for developments approved in 2018 (bars represent the number of cases within each percentage saving group)



There was one outlier, achieving 100 per cent reduction in carbon emissions beyond Building Regulations. This was a residential development that is committed to connecting to SELCHP, the local waste-to-energy plant[27].

Of the two groups of developments furthest from the mean, the first is a high performing group (at 50 - 70 per cent saving) comprising four mixed-use developments and one very large non-residential development. The most notable characteristic of these developments is the prominence of all stages of the hierarchy. For three developments the largest contribution is from Be Clean, while Be Lean and Be Green are each dominant for one development.

In the second group there were eleven cases (five non-residential, six mixed-use) committing to achieve only 5 - 25 per cent. Here, there was a notable absence of any contribution from Be Clean mainly due to no nearby planned or existing district heating networks being available to connect to, with all developments except one reporting zero for this stage. By contrast, several of these developments perform well with Be Lean, even reaching the forthcoming new London Plan energy efficiency target.

[27] Only the heat generated from the waste-to-energy plant should be considered zero-carbon.

Figure 4 illustrates the percentage savings by development type at each step of the hierarchy for applications approved during 2018, while Figure 5 shows the relative contribution from each stage in the hierarchy.

Figure 4: Reductions secured in CO_2 emissions at each stage of the London Plan hierarchy assessed against Part L

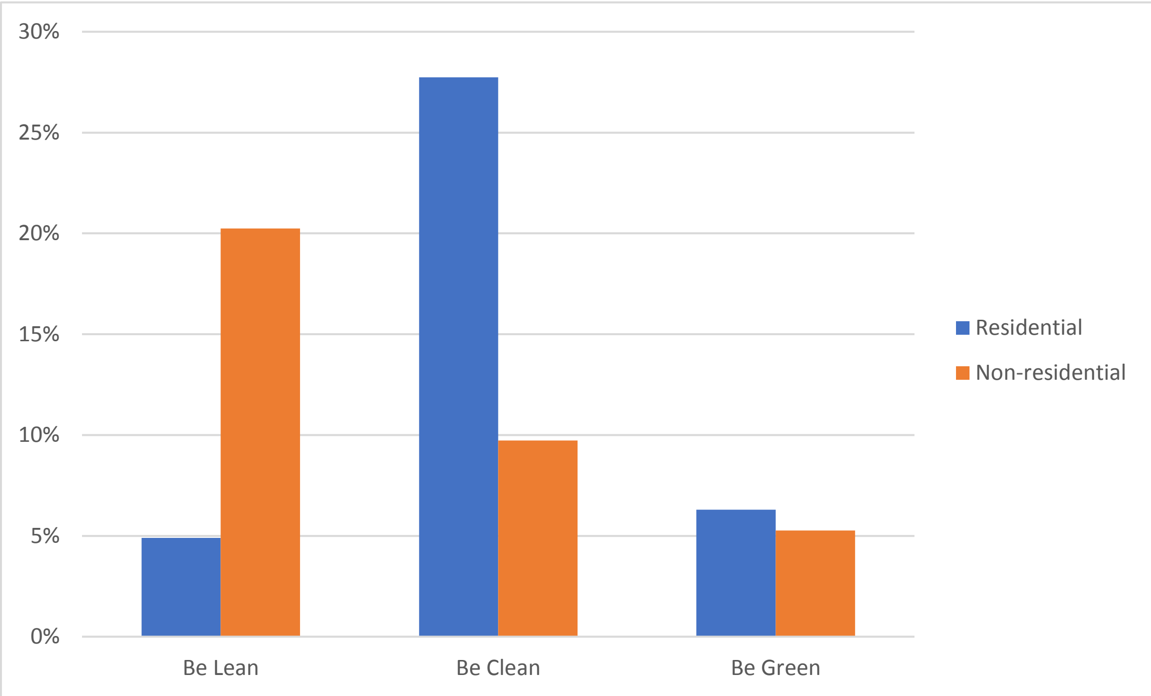
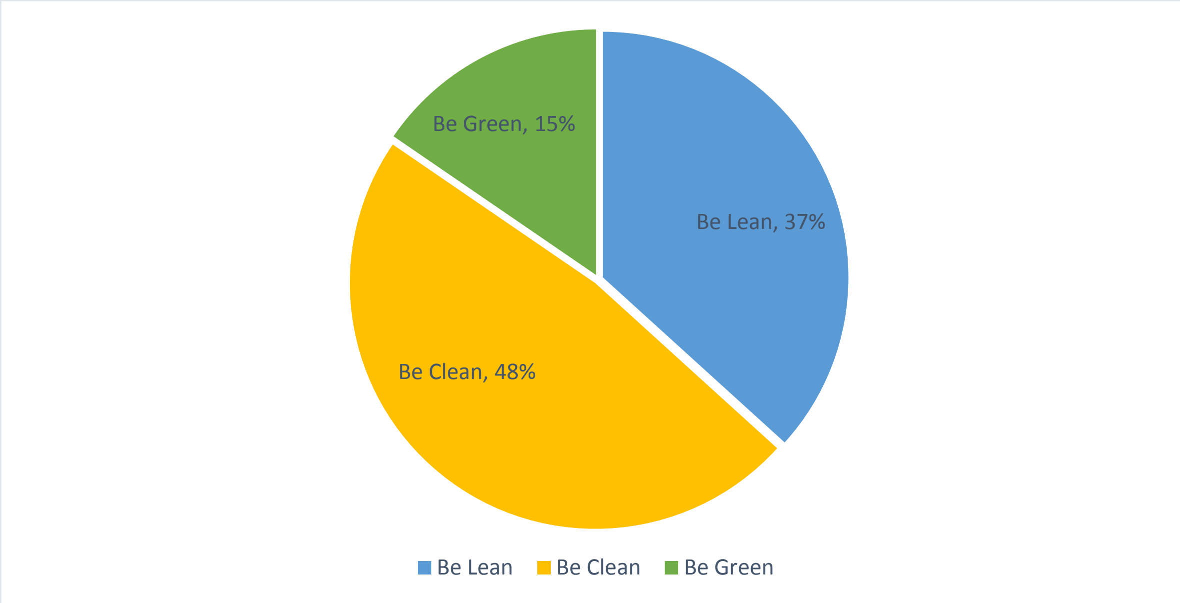


Figure 5: Reductions secured in CO_2 emissions at each stage of the London Plan hierarchy assessed against Part L



Be Lean: use less energy

Be Lean reductions

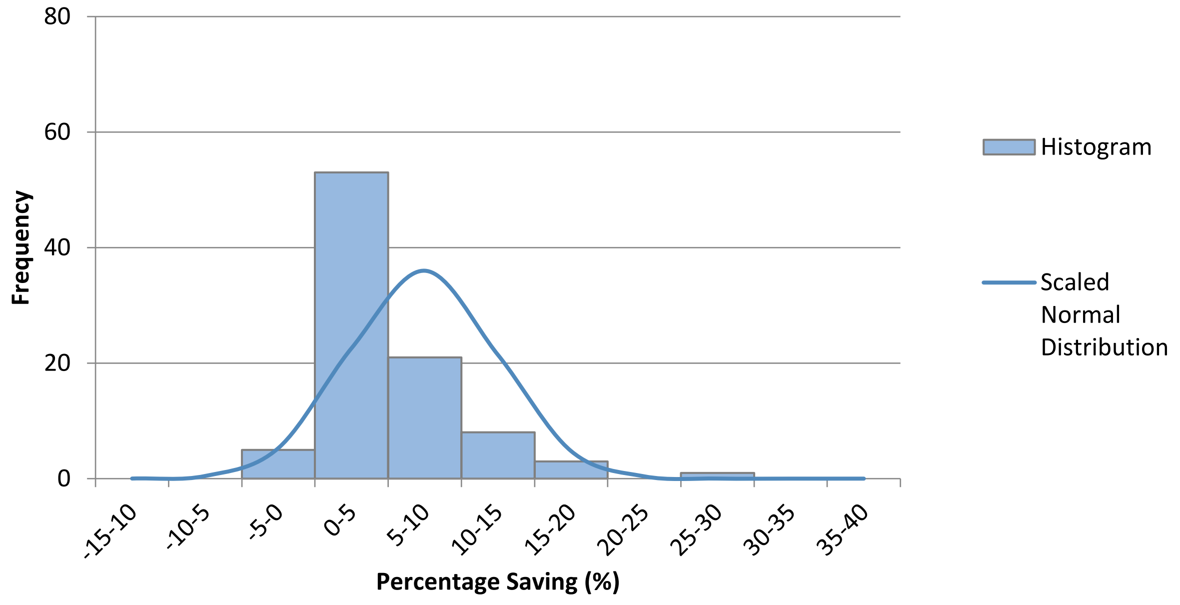
On average, a 13.5 per cent reduction in regulated CO_2 emissions was achieved against Part L 2013 from the first step of the energy hierarchy. This is lower than the 2017 figure (15.8 per cent) but still well above the figure for 2016 (7.4 per cent), hence still indicating that developers are focusing on the requirement to reduce energy demand first before considering low carbon or renewable technologies to achieve carbon savings.

Measures being used by developers include enhanced insulation and air tightness to reduce heating demand, mechanical ventilation with heat recovery (MVHR), low energy LED lights, and design features that minimise associated cooling demand.

Residential elements within developments achieved an average of a 4.9 per cent reduction from energy efficiency alone. This is less than the figure for 2017 (7.1 per cent). Although this still demonstrates developers are achieving levels of energy efficiency beyond Part L, the new version of the London Plan (once adopted) will push for further improvements by requiring residential developments to achieve at least a ten per cent reduction. Of the developments with a residential element 13 per cent were already able to reach this target. The Eastfields Estate in Mitcham (Appendix 2, Case study 4) is one such example of a development already exceeding the new ten per cent target for residential elements.

The range and distribution of the energy efficiency savings for all residential developments in 2018 is shown in Figure 6.

Figure 6: Carbon savings achieved from energy efficiency measures for residential developments (bars represent the number of cases within each percentage saving group)



In general, developments whose residential elements succeeded in reaching or surpassing ten per cent carbon savings for 'Be Lean' applied at least the following energy efficiency measures:

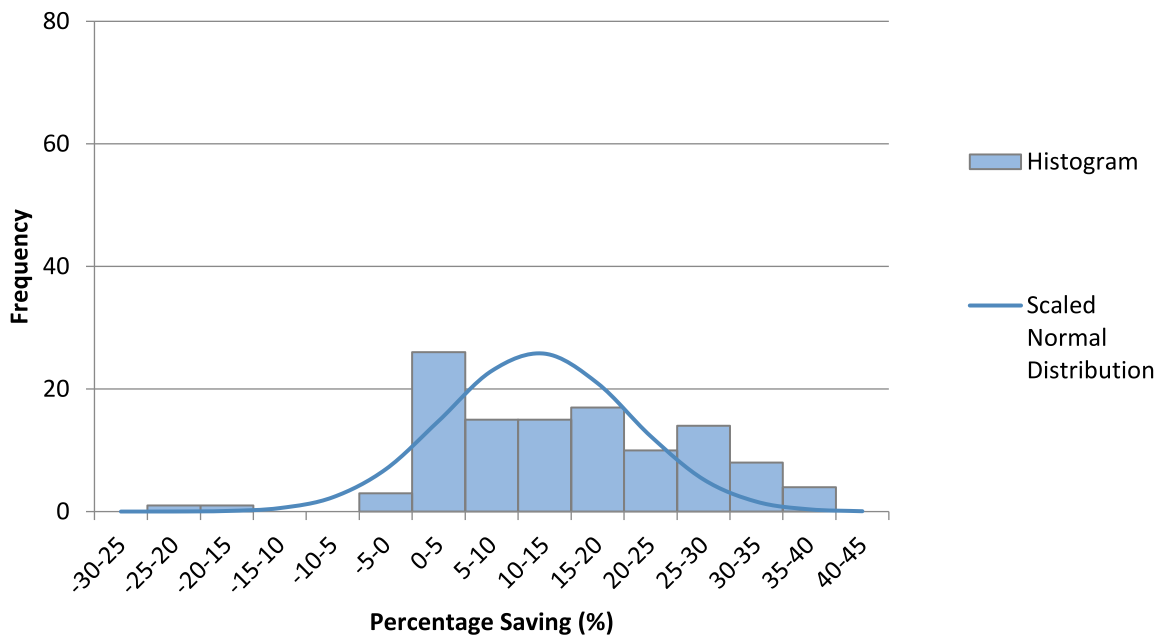
- Air tightness of 3 $m^3/h/m^2$ at 50Pa
- Mechanical ventilation with heat recovery
- External Wall U-values of 0.15 $W/m^2.K$
- Floor U-values 0.10 $W/ m^2.K$

The corresponding figure for non-residential elements in 2018 was 20.2 per cent, a further increase from the 2017 figure (19.2 per cent), already well above the new figure of 15 per cent reduction better than Building Regulations being set by the new version of the London Plan, once it is adopted. Indeed 47 per cent of developments with a non-residential element were able to reach or surpass this target.

The redevelopment of the former Co-op site at East Ham (Appendix 2, case study 3) provides one example of this, achieving a 30.5 per cent reduction for its non-residential elements.

Figure 7 shows the range and distribution of the energy efficiency savings for all non-residential development in 2018. This figure provides an overview of how current development is faring against the new targets, and how much remains to be achieved once these are adopted.

Figure 7: Carbon savings achieved from energy efficiency measures for non-residential developments (bars represent the number of cases within each percentage saving group)



Developments whose non-residential elements succeeded in reaching or surpassing 15 per cent carbon savings for 'Be Lean' applied at least the following energy efficiency measures:

- Efficient (low specific fan power) fans for ventilation
- High efficacy lm/W lighting and improved controls
- External Wall U-values of 0.15 W/ m^2K
- Floor U-values 0.10-0.08 W/ m^2K

All but two of the 130 applications achieved the carbon reductions required by Building Regulations alone through this first step of the energy hierarchy. Both the developments which failed included heritage considerations, with one failing only marginally and still reaching the overall 35 per cent target, while the other failed significantly but also failed to reach 35 per cent savings overall, albeit narrowly.

Overheating and cooling demand

As per the cooling hierarchy, active cooling is discouraged, and it sits in the lowest tier of the hierarchy. Typically, residential developments are expected to mitigate any overheating risk through the incorporation of passive measures first, as outlined in their overheating assessments submitted as part of the application.

A total of 14.9 GWh per annum of cooling demand is expected from the 74 developments which provided data in 2018, more than doubling overall cooling demand compared with 2017. Of this, 97 per cent is attributed to non-residential buildings. A substantial increase in building typologies prone to high cooling requirement (such as offices and retail uses) was identified in 2018.

A total of 72 of the 112 developments with non-residential floor area are proposing to install active cooling.

A total of six of the 91 developments with a residential element are proposing active cooling within some or all the dwellings, a smaller proportion than in 2017.

Of the 91 developments proposing a residential element 51 submitted a TM59 dynamic overheating assessment report demonstrating how the design proposals are to mitigate overheating risk. Of these, 50 demonstrated compliance with the TM49 weather files. More rigorous analysis under the 2020 weather files has been introduced in the Energy Assessment Guidance update (October 2018) and is expected to be reflected in the 2019 monitoring report.

Be Clean: supply energy efficiently

Be Clean reductions

Applications submitted during 2018 achieved, through the Be Clean part of the energy hierarchy, a 17.6 per cent reduction in regulated CO_2 emissions against the relevant Part L baseline. This is lower than the equivalent figure for 2017 which was in turn lower than that of the year before. However, it still forms the highest contribution to overall savings, and the relative contribution from Be Clean declined only marginally (from 49 per cent in 2017 to 48 per cent in 2018).

The savings derived from the installation of new CHP capacity amount to 16,200 tonnes of CO_2 per annum, with a further 2,624 tonnes of CO_2 per annum arising from connection to a local heat network amounting to an overall total of 18,824 tonnes of CO_2 per annum for the second stage of the energy hierarchy.

Heat networks

To aggregate the heat demands at a site, a pipe infrastructure can be installed connecting each of these to a central heat source known as an energy centre. This infrastructure is known as a site-wide heat network. The energy centre may be located within the development itself, enabling a site-wide heat network, or there may be a connection to an area-wide DHN, if close enough. If the development is large enough, it may itself become the basis for an area-wide DHN, to which other developments in the vicinity may be able to connect.

Although energy centres serving heat networks have most commonly housed CHP, heat networks are fuel-flexible, so examples of other energy technologies, such as heat pumps utilising waste heat sources (e.g. Islington council's project at the Bunhill heat network to capture waste heat from London Underground tunnels[28]), are also emerging.

Site-wide heat networks

A total of 37,555 dwellings anticipate connection to a site-wide heat network and/or a DHN. This is nearly 96 per cent of all dwellings receiving approval. Most of these dwellings will be supplied by CHP, either on-site or via the energy centre of an area-wide heat network. Many of London's existing heat networks have grown around CHP systems. However, the carbon savings from gas engine CHP are now declining, as a result of national grid electricity decarbonising, and there is also increasing evidence of adverse air quality impacts. There still remains a strategic case for low-emission CHP systems to support area-wide heat networks, as a means to facilitate a network and allow the transition to a zero-carbon heat source in the future through a single point of supply. However, appropriate mitigation measures should be applied to limit any adverse effect on local air quality.

There are, however, some developments where dwellings are supplied by a heat pump via a site-wide heat network, highlighting the fuel flexibility of heat networks. The redevelopment of the former Co-op in East Ham provides an example of this, and is one of the case studies in Appendix 2. In future years the number of heat networks supplied by heat pumps is likely to grow, due to the decarbonisation of the electricity grid and the air quality impact associated with CHP solutions. This heat network option creates opportunities to utilise secondary heat sources which would otherwise be wasted and is being actively encouraged in the new draft London Plan.

A total of 31,232 dwellings (80 per cent of the total dwellings receiving approval) are expected to connect to site-wide heat networks and be future-proofed to allow connection to an area-wide DHN when this becomes possible.

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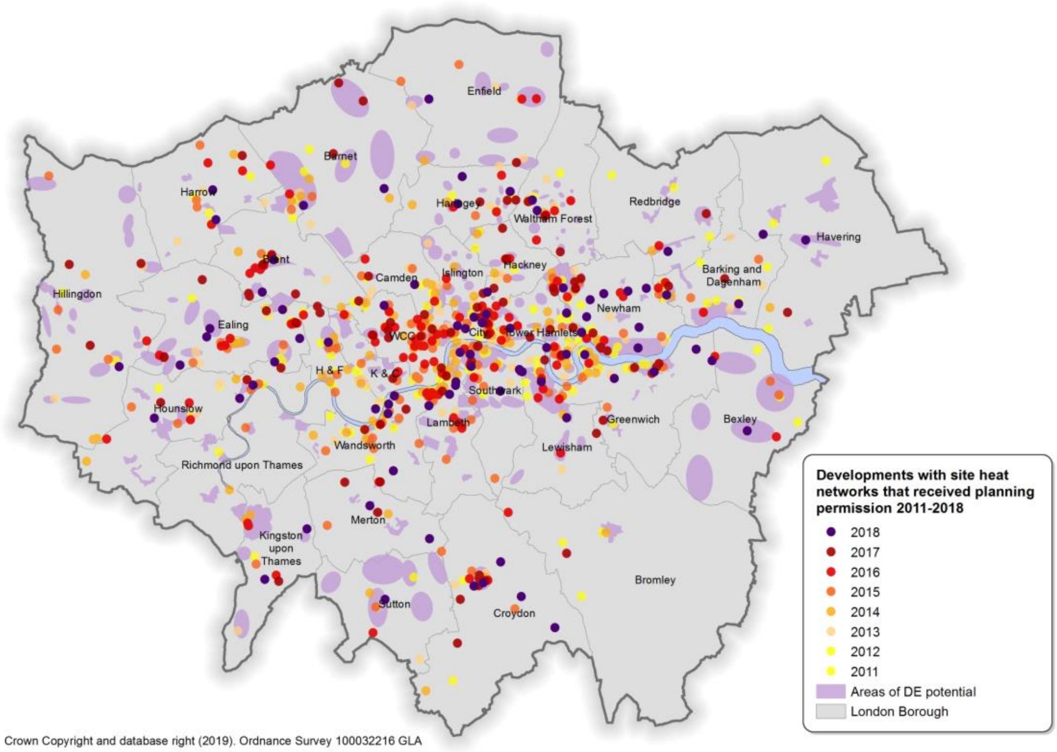
[28] https://www.islington.gov.uk/energy-and-pollution/energy/bunhill-heat-network

Approximately one-quarter (25) of the 104 developments that reached the on-site reduction target, achieved their target without a site-wide heat network. All of these cases were solely non-residential or had a small residential element, achieving their reductions through substantial contributions from the first and third stages of the energy hierarchy.

Figure 8 illustrates the distribution of the developments which committed to providing site-wide heat networks between 2010 and 2018, mapped against identified areas of decentralised energy potential.[29] This shows that site-wide heat networks feature in boroughs across London, with greater concentration in the inner London boroughs, where the heat demand density will usually be higher and therefore there are more opportunities for heat networks.

Figure 8: Distribution of developments committed to providing site-wide heat networks



Connection to District Heating Networks

Major new developments that are close to a DHN should prioritise connection to that network. In 2018 there were 23 developments, with 2,900 dwellings, deriving their savings directly from connection to a local DHN that is either already existing or under

[29] Data on areas of decentralised energy potential sourced from the London Heat Map - www.londonheatmap.org.uk/

development, rather than from on-site CHP. One such development, the SW Plot in Hale Village, appears as case study 2 (Appendix 2). For developments where the local DHN is not yet available, a gas-fired boiler serves as an interim solution until the connection materialises.

Table 4 presents the of developments proposing connection to existing or proposed DHNs.

Table 4: DHN connection commitments		
Network name	Existing/proposed	Number of developments connecting
Croydon	Proposed	1
Wembley Masterplan	Proposed	1
Greenwich Peninsula	Existing	1
Church Street	Proposed	1
Olympic Park	Existing	1
Whitechapel	Proposed	1
VNEB	Existing	2
LBBD	Existing	1
Lea Valley	Existing	2
Citigen	Existing	2
Colville Estate	Existing	1
Harrow North	Proposed	1
Hammersmith & Fulham	Proposed	1
City2	Proposed	1
Barkantine	Existing	1
Haringey	Proposed	2
SELCHP	Existing	3
Total number of developments		**23**

There were a further eleven developments not proposing on-site CHP where connection to a nearby planned DHN may be possible in the future, but due to the uncertainty around the timings of a connection the carbon savings are not claimed. All but two of these developments are to be equipped with site-wide heat networks in order to be able to connect at a later time, and the remaining two developments are allowing for connection to their hot water systems.

Major new developments can promote the expansion of existing DHNs and the emergence of new ones. Table 5 shows large new developments with more than 1,000 homes that obtained planning approval in 2018, all of which were mixed-use, and include a total of 12,941 dwellings. The energy infrastructure (e.g. site-wide heat networks) planned for these developments can be a key element in realising area-wide DHNs. Furthermore, the profile of large developments' aggregated demands can act as an 'anchor load' for area-wide DHNs and enhance commercial viability. Due to the scale of these developments they are inevitably multi-phase and often envisaged to take over a decade to complete.

Table 5: New large developments with > 1,000 dwellings obtaining planning permission in 2018

Development Name	Borough	Number of dwellings	Non-residential floor area (m^2)	Total emission reduction (%)[30]
Former Parcel Force Depot, Stephanie Street, West Ham	Newham	4,820	12,004	42%
Northfields Industrial Estate	Brent	2,900	18,100	42%
Acton Gardens	Ealing	1,954	2,950	42%
Haringey Heartlands	Haringey	1,697	23,000	37%
High Path	Merton	1,570	10,000	35%

On-site CHP

A total of 76 developments proposed to meet a proportion of their energy requirements through on-site CHP. Twenty-seven of these are in close proximity to a proposed, rather than an existing, DHN and connection is therefore a longer-term aim.

Table 6 sets out details of this CHP capacity. In 2018 there has been an overall substantial increase in proposed new CHP electrical capacity to 18.8MW, compared with circa 9.6MW

[30] Total carbon emission reductions from the energy hierarchy (be lean, be clean and be green).

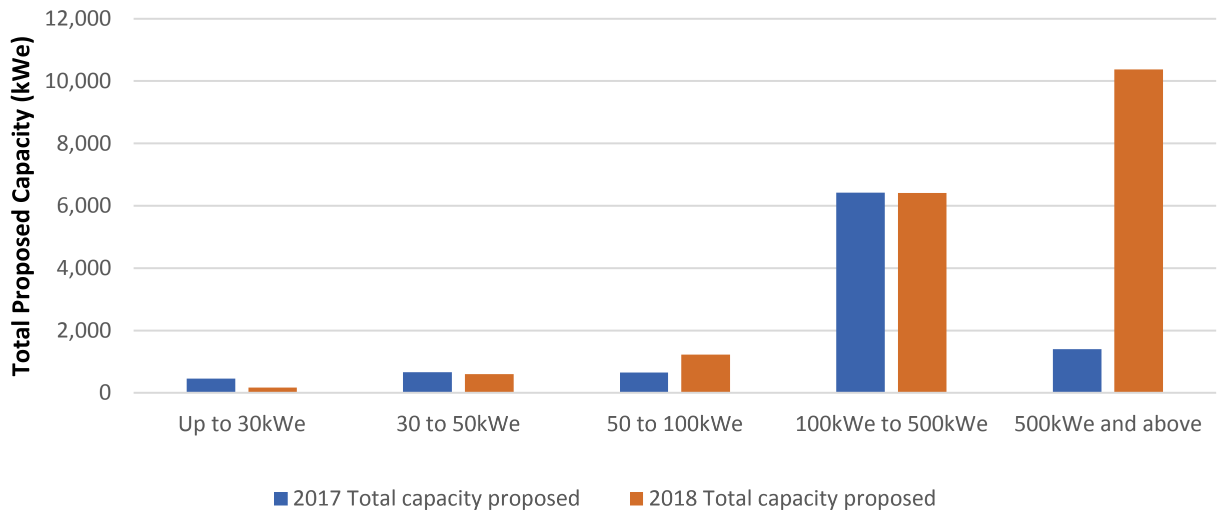
in 2017 (though it is still only half that proposed in 2016). This increase is principally due to the substantial increase in 2018 of the number of dwellings.

Table 6: Proposed CHP sizes in correlation to developments proposals					
CHP engine scale	Number of installations	Total electrical capacity (kW_e)	Average size of installation (kW_e)	Number of dwellings served	Non-residential floor area (m^2)
Up to 30kWe	9	170	19	816	18,489
30kWe to 50kWe	14	599	43	1,777	52,408
50kWe to 100kWe	16	1,224	77	3,513	99,862
100kWe to 499kWe	27	6,407	238	13,719	173,939
500kWe and above	10	10,376	1,038	14,976	431,033
Total	**76**	**18,776**	**247**	**34,801**	**775,731**

A positive finding from the 2018 results (as shown in Figure 9) is that there was a drop in the proportion of developments featuring small CHP installations below 100 kWe (51 per cent compared with 59 per cent in 2017). This trend was most pronounced for very small (30kWe or below) CHP, with the number falling by more than half. This is a positive development because smaller schemes will not typically have the diversity of load required to justify the inclusion of large CHP engines, which have the potential to offer higher electrical efficiencies and therefore more carbon savings. This development is in line with the Energy Assessment Guidance (October 2018) in which CHP is being discouraged at smaller sites due to its air quality adverse impacts and the fact that it is unlikely to be the catalyst for a heat network.

By contrast, there was a much larger proportion of total electrical capacity arising from large CHP (500 kWe and above) with more than 55 per cent of capacity (serving 10 developments) compared with less than 15 per cent (serving two developments) in 2017. All CHP proposals will need to ensure that air quality impacts are mitigated.

Figure 9: Distribution of proposed CHP sizes across developments



Be Green: use renewable energy

Be Green reductions

Through the Be Green part of the energy hierarchy, an average 5.7 per cent reduction in regulated CO_2 emissions against the relevant Part L baseline was secured. This is more than 20 per cent higher than the equivalent figure for 2017 (4.7 per cent).

As the final element of the hierarchy, renewable energy technologies were responsible for nearly 16 per cent of the overall reduction, a significant increase from the previous year (twelve per cent). Despite this being the smallest reduction of the three elements, it is an important and growing element for enabling applicants to reach the target.

The number of developments proposing to meet a proportion of their energy requirements by including renewable energy increased slightly to 114 (87.7 per cent compared to 84 per cent in 2017), and just as in 2017 there were 32 applications that required their renewable energy component to reach the 35 per cent target.

In 2018 the dominant renewable energy technologies remained solar PV and heat pumps. Table 7 shows that the number of developments including PV in 2018 was the same as in 2017, but there has been a significant increase in average system size.

There was also a considerable increase in the number of developments opting for the inclusion of heat pumps; these were primarily for non-residential and mixed-use developments, but there were also two purely residential developments. The number of heat pumps coupled with the utilisation of secondary heat sources is expected to increase, including in residential developments, as the carbon emissions from grid electricity generation decrease. As an example, the case studies presented in Appendix 2 include university buildings supplied by a large ground source heat pump, and a mixed-use development supplied by an air source heat pump.

During 2018 there were no applications featuring solar thermal, indicating that applicants give priority to PV for suitable available roof space. There were no applications involving the use of a biomass boiler either. Use of biomass is discouraged in many parts of London due to the air quality implications.

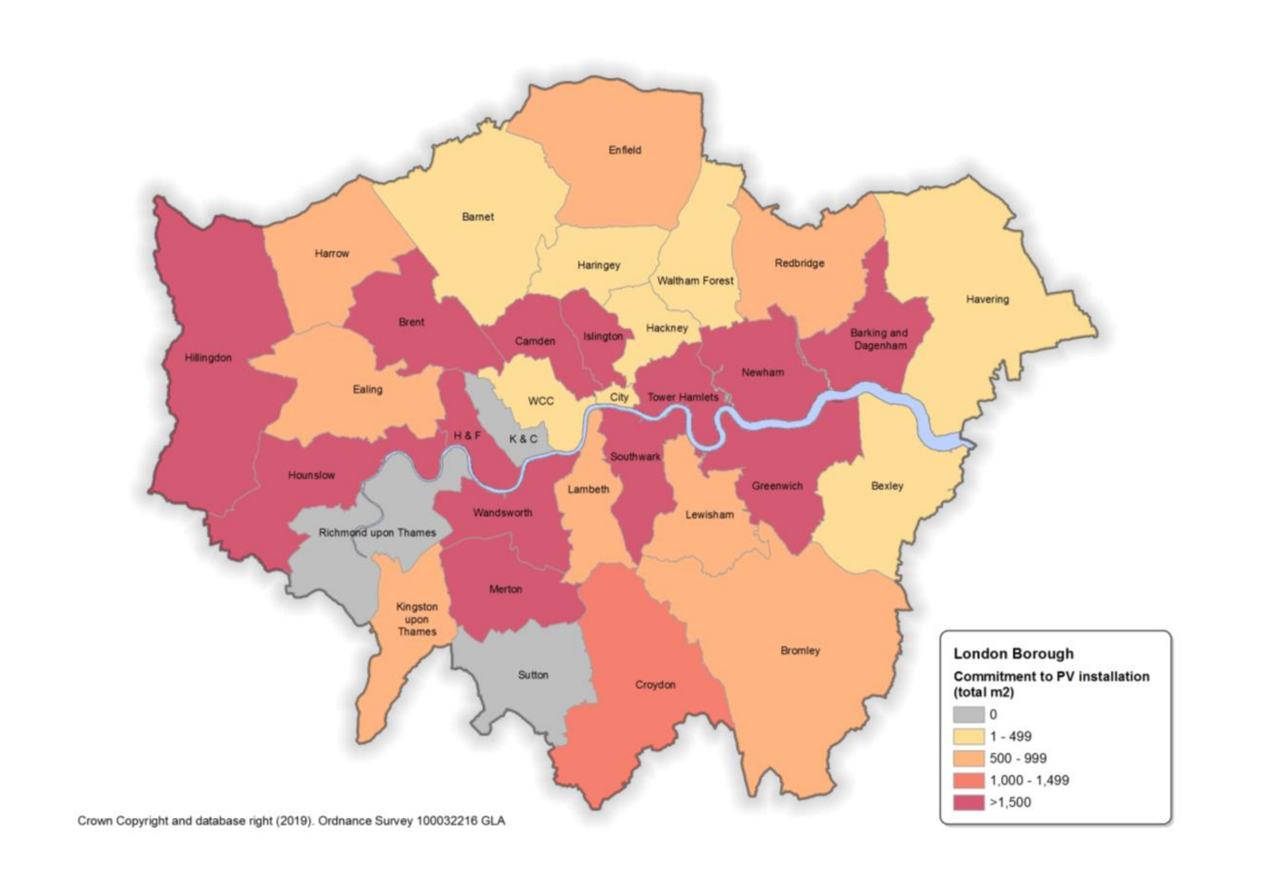
Table 7: Number of applications installing different types of renewable energy systems

	2013	2014	2015	2016	2017	2018
Solar PV	123	98	111	104	100	100
Biomass boilers	8	2	4	1	0	0
Heat pumps	27	43	25	42	41	57
Solar thermal	12	9	4	3	2	0

Solar PV

A total of 100 developments proposed to include PV, accruing to a total installed area of 55,027m^2 and a corresponding total peak output of 5.5 MWe. Figure 10 shows, by borough, the total area of PV commitments in developments approved in 2018. Boroughs that saw substantial increases included Hillingdon and Hounslow, both doubling their uptake of PV in 2018.

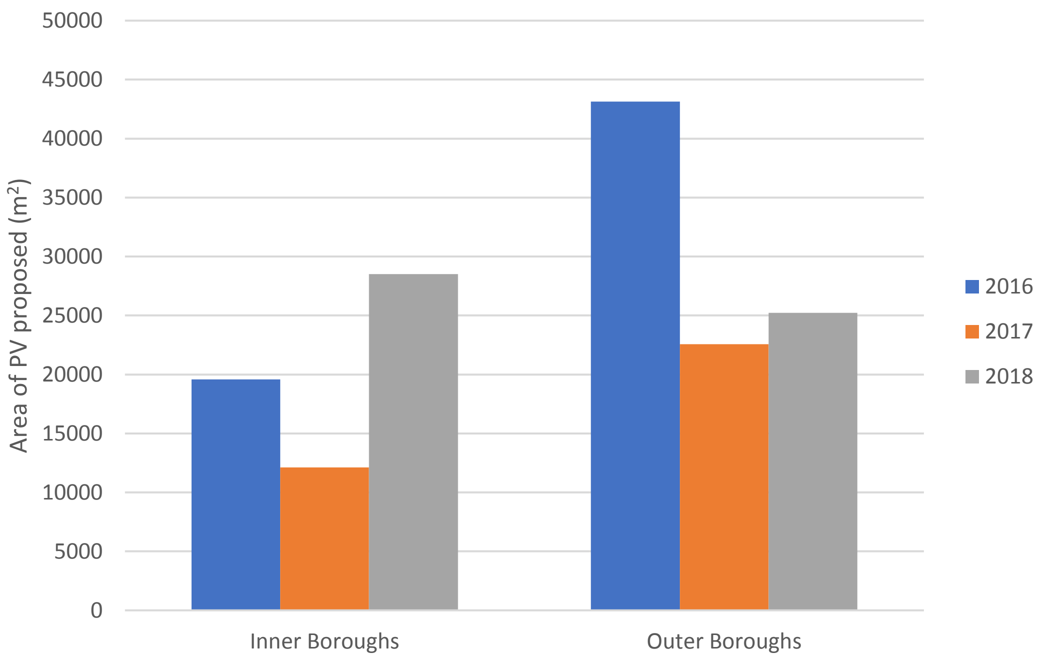
Figure 10: Commitments to PV by borough



The total aggregate PV commitment in 2018 rose dramatically (57 per cent) compared with 2017 despite a similar number of applications. However, the figure for 2017 was low due to a substantial decrease in the average size of PV array being proposed particularly in the inner London boroughs. The figures for 2018 indicate a return to larger installations, notably in the inner London boroughs (approximately 30 per cent higher than in 2017) with figures that are more in line with those of 2016.

The average commitment to PV per installation in the outer London boroughs was approximately 60 per cent higher than that of the inner London boroughs, as presented in Figure 11 overleaf. The reasons for this could be related to the design proposals, the availability of roof space or heritage issues which could prevent large amount of PV being installed.

Figure 11: Total area of PV proposed within Inner and Outer London Boroughs between 2016-2018

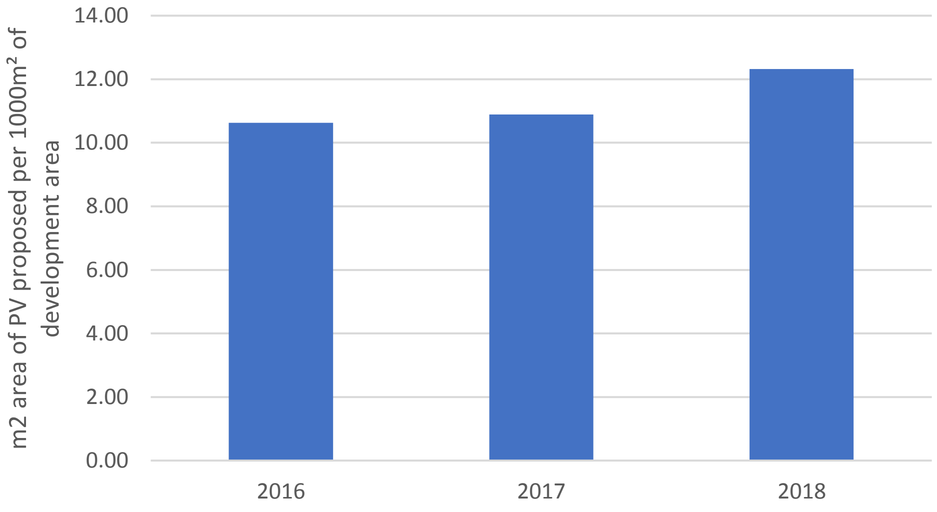


The bigger PV installations were predominantly found on low-rise buildings such as educational campuses. The smallest uptake of PV was found on developments that were relying most on CHP; these included high rise developments where opportunities for solar technologies are more limited.

Two of the case studies (Appendix 2) propose to integrate substantial PV arrays, including a $500m^2$ array at the St George’s Quarter (case study 1) development at South Bank University.

A comparison between 2018 and the past two years shows an increase in the total PV provision per development footprint in 2018. Figure 12 illustrates this rise and confirms that the increase in net PV area in 2018 was not only due to the elevated number of dwellings.

Figure 12: Total area of PV (m^2) proposed per $1000m^2$ of development proposed between 2016-2018



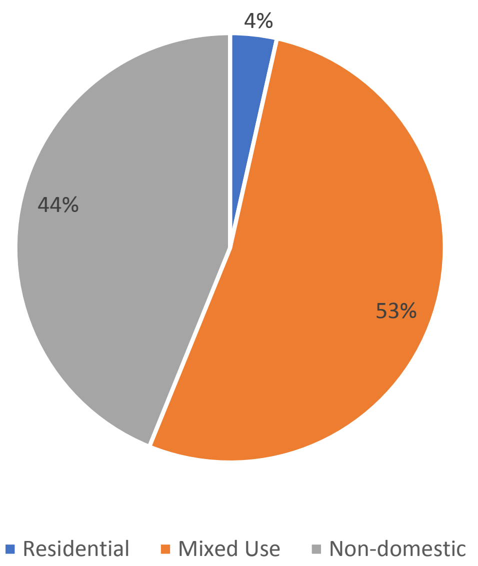
Heat Pumps

A total of 57 applications specified heat pumps, 52 proposed Air Source Heat Pumps (ASHPs), four proposed Ground Source Heat Pumps and one proposed a Water Source Heat Pump. However, the latter are much larger and account for a significantly higher heat output.

Of the developments including air source heat pumps in their specification, 27 have also included CHP. However, in some of these cases the heat pump is for cooling only.

Although previously heat pumps have been almost exclusively serving non-residential developments, there is now evidence that applicants are starting to specify heat pumps serving residential properties and some are also being integrated into heat networks. There were two such developments in 2018, one of which (the former Co-op at East Ham) is highlighted in the Appendix 2 (case study 3).

Figure 13: Percentage split of developments proposing heat pumps to serve all or a proportion of the site heating demands.



There were three cases of ASHPs exceeding 100kW, one of which was serving non-residential buildings only, while the other two served mixed-use developments. Of the mixed-use cases, one was proposing the ASHP to serve residential hot water as well as space heating and cooling, which was to be achieved using an ambient (with approximate flow temperature of 20 degrees Celsius) loop system with two stages of heat pump. The non-residential case has initially been designed to serve the space heating demand only.

Of the five developments with GSHPs or WSHPs, four were large units serving non-residential developments. One example is shown in case study 1, St George's Quarter (Appendix 2) where a university building derives an 18.7 per cent reduction in carbon emissions from renewables including a 400kW GSHP. With the GSHP assumed to operate in heating mode from October to April and cooling mode during the remaining months, it is estimated the GSHP will provide 95 per cent of the space heating demand and 90 per cent of the cooling.

Shortfalls and carbon offsetting

The cumulative shortfall in CO_2 reductions

The aggregate carbon emissions shortfall from zero-carbon home developments was 23,517 tonnes in 2018, leading to a potential contribution to offset funds and investment in off-site measures of approximately £41.05 million from referable developments.

For the 26 developments that did not meet the 35 per cent carbon reduction target[31], there was a further shortfall of 2,045 tonnes of regulated CO_2 emissions per annum, leading to an additional contribution of approximately £4.66 million.

The shortfall figures derive mainly from an indicative CO_2 price of £60 per tonne and a 30-year lifetime used by the GLA. However, there are a few London boroughs using their own carbon prices.

A survey of borough progress with collecting and spending carbon offset funds was undertaken in March 2019 the results of which have been published at the same time with this report.

Results over time

The figures in Table 8 refer to on-site commitments since 2013.

Table 8: Comparison of applications 2013 – 2018 by type and CO_2 emission reductions						
	2013	2014	2015	2016	2017	2018
Number of applications approved	174	142	147	142	129	**130**
Number of dwellings in development	43,178	43,814	52,014	54,199	23,778	**39,243**
Estimated residential floor area[32] (million m^2)	3.0	3.1	3.6	3.8	1.7	**2.7**
Non-residential floor area (million m^2)	2.3	2.0	2.7	2.1	1.5	**1.7**

[31] Some boroughs collect offset payments when this target is missed.

[24] Assumes that the average dwelling receiving planning approval has an internal area of 70m^2

Regulated CO_2 emissions reductions compared to appropriate Part L (2010 or 2013) Building Regulations (percentage)	36%	39%	35%	36%	40%	**37%**
Regulated CO_2 emissions reductions compared to appropriate Part L (2010 or 2013) Building Regulations (tonnes per annum)	49,474	53,423	49,147	48,011	37,053	**39,361**
Regulated CO_2 emissions reductions normalised to Part L 2010 Building Regulations (tonnes per annum)	49,474	53,643	57,305	66,846	50,138	**54,618**

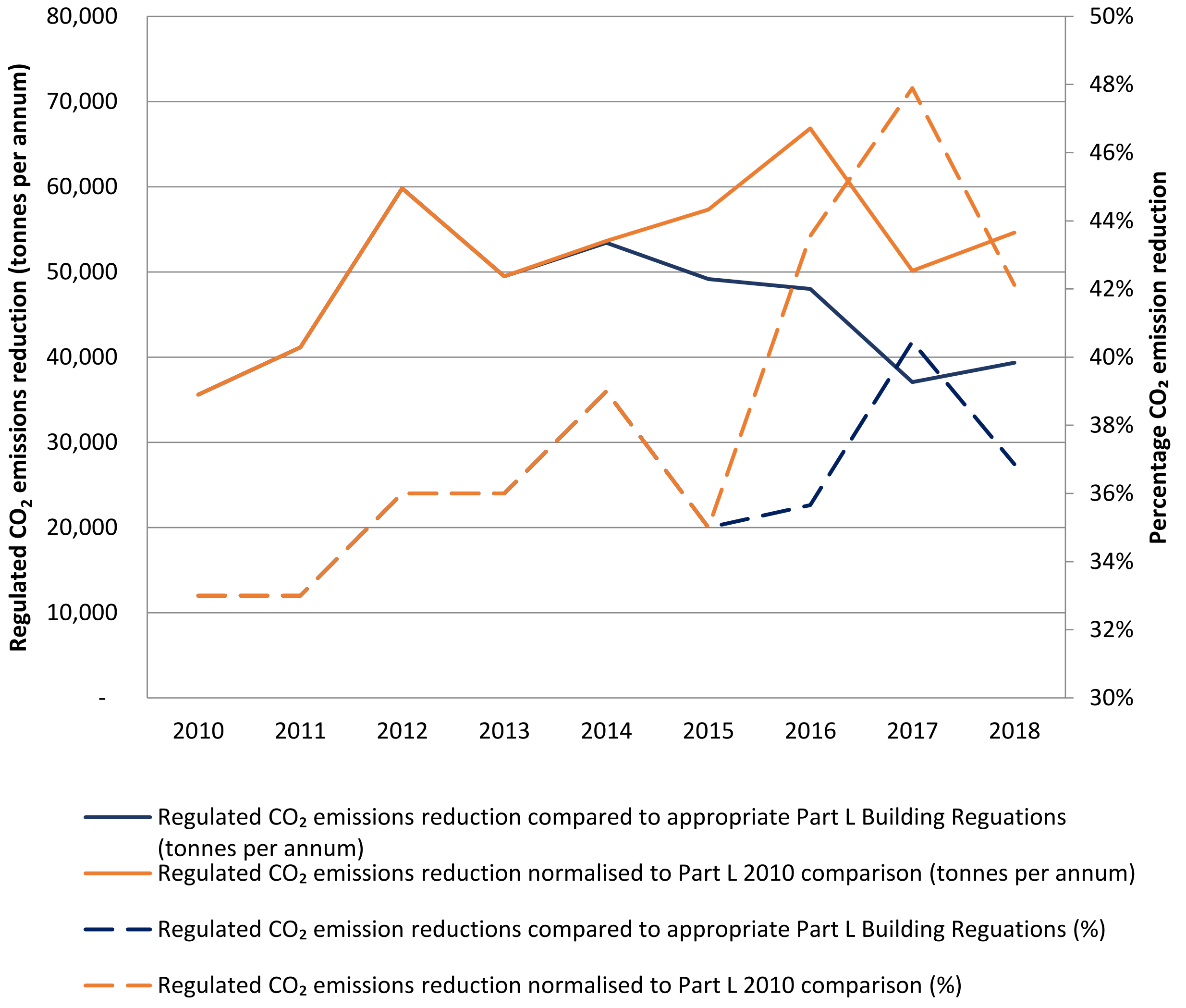
The application of London Plan energy policies to new developments approved in 2018 resulted in cumulative regulated CO_2 emission reductions of **39,361** tonnes per annum, an increase of more than 2,000 tonnes compared with 2017. This amounts to a **36.9 per cent reduction compared with 2013 Building Regulations**. Although this figure is lower than for 2017, it is consistent with the average over the last few years.

National Building regulations were tightened in 2013 so that all new developments had to make greater carbon reductions than under the previous 2010 reductions, moving the baseline against which London Plan policies are assessed. When normalised to the earlier 2010 Part L baseline, which was easier to meet than the 2013, a more realistic comparison year-on-year is made to account for changes to the baseline; the savings in 2018, therefore, rise to **54,618** tonnes per annum, exceeding the figure for 2017 by almost 4,500 tonnes. This amounts to a 47 per cent reduction compared with 2010 Building Regulations.

Although the number of applications was similar there was a substantial increase in the number of dwellings in 2018, reflecting a corresponding increase in the average size of development for residential and, particularly, mixed-use applications. This leads to the baseline carbon emissions figure being 16 per cent higher than that of 2017.

Figure 14 shows the trajectory in carbon emission reductions. The solid blue line indicates carbon emission reductions according to the differing baselines that have been in place over time, i.e. Part L 2010 or 2013. The dotted blue line provides a more realistic picture of how carbon emissions have reduced over time and normalises the data according to a common baseline of Part L 2010. The solid and dotted orange lines show the same information in percentage terms.

Figure 14: Annual reduction in regulated CO_2 emissions referenced to applicable Part L (2010 or 2013) and normalised to Part L 2010



Future results: likely impact of SAP10

It is anticipated that the next iteration of the Building Regulations will reflect grid decarbonisation and therefore impact on the approach developers adopt to achieve carbon reduction targets. The GLA's Energy Assessment Guidance has encouraged the use of the proposed SAP version 10.0 carbon factors for the reporting of carbon emissions for planning applications submitted since January 2019, until the next iteration of the Building Regulations is adopted[33]. To illustrate the impact of this change in approach a sample of

[33] https://www.london.gov.uk/sites/default/files/energy_assessment_guidance_2018_-_update.pdf

development types have been chosen to show the potential variance in carbon savings achieved when assessed by current carbon factors (SAP 2012) and those permitted by the updated guidance (SAP10).

These illustrative developments are not based on any real schemes submitted to the GLA in 2018. The energy strategies assumed have been based on approaches that achieve the 35 per cent savings target on-site for their respective development type. A further residential energy strategy has been based on a residential scheme fed by centralised heat pumps, which is a potential approach anticipated to be proposed by developments reporting the use of SAP10. In total, three illustrative schemes were assessed. All schemes were assumed to meet the new energy efficiency targets for residential and non-residential development that will take effect when the new London Plan is adopted. The schemes selected are:

- a residential scheme employing gas fired CHP and PV;
- a commercial building with variable refrigerant flow (VRF) heat pumps serving the buildings heating and cooling load with PV; and
- a residential scheme using an ASHP-led site-wide heat network with gas-fired boilers acting as a top up and PV.

Only the second two heat pump-led schemes would meet the carbon reduction target using the updated carbon factors.

- The residential development with CHP and PV achieved a 35 per cent saving on the current baseline but fell three per cent short of the target, meeting only 32 per cent, when re-calculated using SAP10.
- The commercial premises indicated a marginal improvement when assessed using SAP10 with the savings increasing from a 38 per cent to a 41 per cent improvement on the recalculated SAP10 baseline.
- The residential development, proposing a hybrid gas boiler and heat pumps, achieved a 19 per cent saving when assessed with current carbon factors and a 35 per cent saving when assessed using SAP10.

This demonstrates that the updating of carbon factors, to better reflect actual carbon emissions resulting from new developments, will favour a move to heat pump-led schemes.

4. Investment due to London Plan energy policies

The London Plan energy policies are driving investment in low carbon and renewable energy generation and infrastructure. Substantial overall investment is anticipated as a result of planning commitments in 2018:

- **£94 million to fund heat network infrastructure**

  The site-wide heat network infrastructure for distributing low carbon and renewable heat requires significant investment. It is estimated that an outlay of circa £94 million[34] will be required to fund the heat network infrastructure for the 37,555 dwellings connecting to site-wide heat networks in 2018 applications. This is a substantial increase on 2017 where we estimated £55 million of heat network infrastructure would be required. The non-residential buildings will require additional further investment for the associated heat network infrastructure.

  A workforce will be required to operate and maintain the heat network infrastructure and associated energy generation equipment serving the new developments. It is estimated that the developer commitments obtained in 2018 will result in about 48 permanent jobs[35], the majority being in energy services companies (ESCOs).

- **£13.1 million investment in CHP capacity**

  Assuming an installed capital cost of £700 per kilowatt of electrical capacity, the installation of new CHP electrical capacity (nearly 18.8MWe) committed to in 2018 is estimated to require investment of approximately £13.1 million[36].

- **£6.9 million investment in solar PV**

  Investment in renewable energy systems was also proposed to help achieve the CO_2 reduction commitments. Using an installed capital cost estimate of £1,220[37] per kilowatt, providing more than 5.5MW[38] of PV panel electrical capacity will require an investment of approximately £6.9 million. Further investment will also be required to implement the larger heat pumps, both at individual sites and for heat

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[34] Assumes a heat distribution cost of £2,500 per flat for district heating, taken from Table 51 of Code for Sustainable Homes: A cost review (CLG March 2010).
[35] Assumes 0.5 jobs per mixed-use/residential development for maintaining a site network and 96 networks
[36] i.e. 700 x 18.776 x 1000 = £13,143,200.
[37] Figure calculated based on PV costs sourced from the Microgeneration Certification Scheme - MCS Installation Database and covers schemes installed during 2015/16.
[38] Based on 1 kWp to each 10 m^2.

networks, accruing to approximately £1,200/kW for the heat pump itself and £12,000/kW for boreholes.

- **£470,000 energy savings from investment in residential energy efficiency**

  The estimated energy cost savings came to approximately £470,000 per annum[39] as a result of investment in energy efficiency in 2018, which otherwise would have been paid by residents, with additional energy cost savings for non-residential building occupants. By requiring even higher energy efficiency standards than national building regulations, energy policies in the new London Plan will continue to increase investment in energy efficiency in the future.

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[39] This has been calculated using SAP 2012 modelling and BEIS cost data. A sample of archetypes (small flats, large flats and terrace houses) were modelled using SAP 2012 methodology to determine the annual fuel demands for a number of fabric and ventilation specifications. The results for each archetype's gas and electricity consumptions were plotted dependent on the percentage saving achieved relative to the Part L 2013 notional baseline carbon emissions. The fuel consumptions associated with dwelling emission reduction of 5 per cent (proportional to the 4.9 per cent average achieved by the 2018 residential development proposal) was identified using interpolation.

The 'Valuation of Energy Use and Greenhouse Gas Emission Appraisal' supporting tables 4-5 were used to source the residential electricity and gas prices for 2018. The 2018 average prices were multiplied with the fuel consumption calculated for the 5 per cent reduction architype cases and the equivalent Part L 2013 notional cases. The difference between the 5 per cent reduction case and the notional case was defined as the annual saving for each architype. The three archetypes were assumed to occur equally across the proposed residential development for 2018.

The total number of dwelling proposed have been combined with the average annual saving per dwelling saving of 5 per cent at the 'Be Lean' stage of the energy hierarchy to provide the total annual reduction to residential bills. The figure for a 5 per cent reduction in carbon emissions from energy efficiency measures is estimated to be £470,000 per annum. The same approach was applied to calculate what the potential annual residential bill reduction arising from a 10 per cent reduction on the target baseline, as required by draft London Plan policy. This figure is estimated to be £950,000 per annum for the 2018 residential development proposal.

5. Conclusions

Overall carbon savings from developments submitted in 2018 rose by approximately 6 per cent compared with the previous year. This arose from an almost identical number of submissions, although the baseline was quite different owing to the composition and number of building types. Figure 15 shows the proportion of total savings achieved at each stage of the energy hierarchy for developments that were successful in meeting their on-site target for carbon emission reductions.

While every development has its own individual characteristics and circumstances, there are some general trends that can be observed among different categories of application:

- Non-residential developments and the non-residential elements of mixed-use developments attain high contributions from the Be Lean stage of the energy hierarchy. Although the pattern wavers a little, in general this trend becomes more prevalent for larger developments. New targets that will come into effect when the new draft London Plan is adopted will require developers to increase their focus on Be Lean.
- Residential developments and the residential elements of mixed-use developments display a particularly high contribution from the Be Clean stage of the energy hierarchy and are therefore relying on heat networks, mainly supplied by CHP. This trend is consistent with previous years and indicates the suitability of CHP and heat networks for serving medium and large residential developments, whose heat demand profiles extend throughout the year.
- However, the number of CHP installations proposed in non-residential development fell in 2018 as there were less suitable buildings types (e.g. hotels, hospitals and leisure centres) coming forward.
- The average size of CHP installation in 2018 has increased, and there has been a reduction in the number of small CHPs being proposed, particularly in very small units. This is encouraged as larger CHP installations are more efficient as outlined in the Energy Assessment Guidance and the new draft London Plan policies which does not recommend the use of CHP on small sites.
- As the carbon emissions from grid electricity generation decrease, the savings achieved by gas-engine CHP are expected to decrease. Consequently, it will become progressively more important for developers to consider other forms of heat generation, which are lower carbon and will not worsen air quality, particularly in London’s 187 Air Quality Focus Areas.
- Heat pumps are beginning to be seen in residential as well as commercial and mixed used developments and can provide hot water and space heating, as well as cooling where required. Secondary sources of heat that might be used in conjunction with heat

pumps include the River Thames and its tributaries, sewage, and even the chillers of other buildings, particularly those with a high cooling load, most notably data centres.

- Developers are beginning to make successful use of larger scale heat pumps, and two are integrating them into site-wide heat networks. This indicates that heat pumps can be a viable alternative to CHP both at a building scale and in the context of heat networks.
- Small and medium schemes make the largest percentage use of the Be Green stage of the energy hierarchy (renewable energy), most prominently PV. This is likely to be because there is generally more roof area per footprint area for such schemes. Carbon savings from Be Green is likely to grow in future due to an increased prominence of heat pumps.

Figure 15: Proportion of savings at each stage of the energy hierarchy for successful developments

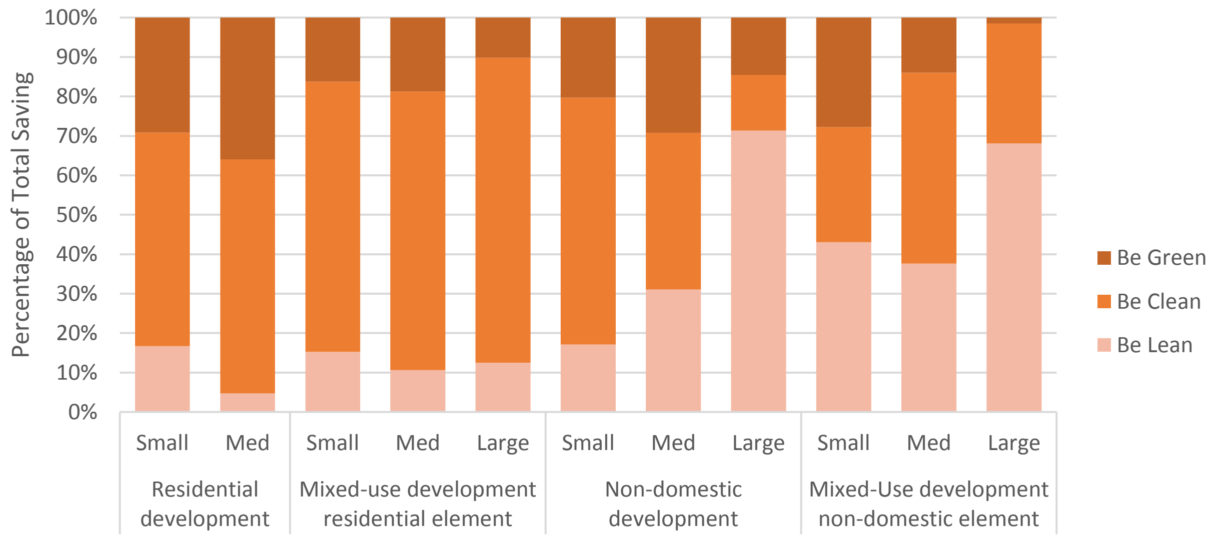


Table 9: Sizing parameters for development categories in Figure 9

Development Size	Development category sizing parameters		
	Residential (No. dwellings)	Non-residential (m^2 total floor area)	Mixed-use (No. dwellings)
Small	<100	<15,000	<100
Medium	≥100	≥15,000	≥100
	<500	<30,000	<500
Large	≥500	≥30,000	≥500

Bibliography

The London Plan, Mayor of London, March 2015

The Draft New London Plan, Mayor of London, July 2018

Carbon Offset Funds, Greater London Authority guidance for London's Local Planning Authorities on establishing carbon offset funds, October 2018

Energy Planning: Greater London Authority guidance on preparing energy assessments, Greater London Authority, March 2016

London Heat Map - www.londonheatmap.org.uk/

Supplementary Planning Guidance (SPG) on Sustainable Design and Construction, Mayor of London, April 2014

District Heating Manual for London, Mayor of London supported by Intelligent Energy Europe, February 2013[40]

London's Zero-Carbon Energy Resource – secondary heat, Mayor of London, July 2013

Homes for London: The London Housing Strategy – Draft for consultation, Mayor of London, November 2013

International Energy Agency District Heating and Cooling programme: www.iea-dhc.org

[40] Available at: www.londonheatmap.org.uk

Appendix 1

Glossary

Building Emissions Rate (BER) or Dwelling Emission Rate (DER) is the actual building/dwelling CO_2 emission rate. In order to comply with Part L of the Building Regulations, the BER/DER must be less than the TER (see below).

Combined Heat and Power (CHP) is defined as the simultaneous generation of heat and power in a single process. The power output is usually electricity but may include mechanical power. Heat outputs include hot water for space heating or residential hot water production.

CHP Electrical Capacity (CHPe) is the maximum power generation capacity of CHP.

DHN – District Heating Network

kilowatt (kW) – One thousand watts. A watt is a measure of power.

LED – Light-emitting Diode

Megawatt (MW) – One million watts. A watt is a measure of power.

Part L of the Building Regulations – Approved documents L1A and L2A of the Building Regulations relate to the conservation of fuel and power in new dwellings and new buildings other than dwellings respectively.

Regulated CO_2 emissions – The CO_2 emissions arising from energy used by fixed building services, as defined in Approved Document Part L of the Building Regulations. These include fixed systems for lighting, heating, hot water, air conditioning and mechanical ventilation.

Site-wide heat network – a set of flow and return pipes circulating hot water to the apartment blocks (and apartments contained therein) and non-residential buildings on a development.

Standard Assessment Procedure (SAP) is a methodology for assessing and comparing the energy and environmental performance of dwellings. Its purpose is to provide accurate and reliable assessments of a dwelling's energy performance that are needed to underpin building regulations and other policy initiatives.

Target CO_2 Emission Rate (TER) is the minimum energy performance requirement for a new dwelling/building. It is expressed in terms of the mass of CO_2 emitted per year per square metre of the total useful floor area of the building (kg/m^2/year).

Appendix 2

The case studies in Appendix 2 demonstrate how the energy hierarchy can be applied to developments of very different types and sizes of developments, to meet the carbon reduction targets. These comprise:

- a university building which will make use of a ground source heat pump using a borehole of depth 107m; it is estimated that the heat pump will supply 400kW cooling or 500 kW heat to the 25,000m^2 building

- a mixed-use development of 279 homes and approximately 1,600m^2 commercial space which will connect to and become an integral part of a local heat network currently supplied by gas-fired CHP and biomass, the latter is being phased out demonstrating how changing priorities can be accommodated by heat network solutions

- a mixed-use development of almost 100 homes, together with retail space and a gym, for which a heat pump feeding a site-wide heat network is proposed; this demonstrates that as circumstances change heat networks can be supplied by technologies other than CHP

- a primarily residential-led development of circa 800 units which forms part of a wider estate renewal programme; the development features CHP alongside PVs and achieves more than 10% savings from energy efficiency measures, the EE target that will come into effect when the new draft London plan is adopted.

Case Study 1: St George's Quarter, South Bank, Southwark

New buildings for South Bank University saving 35.9 per cent carbon emissions overall

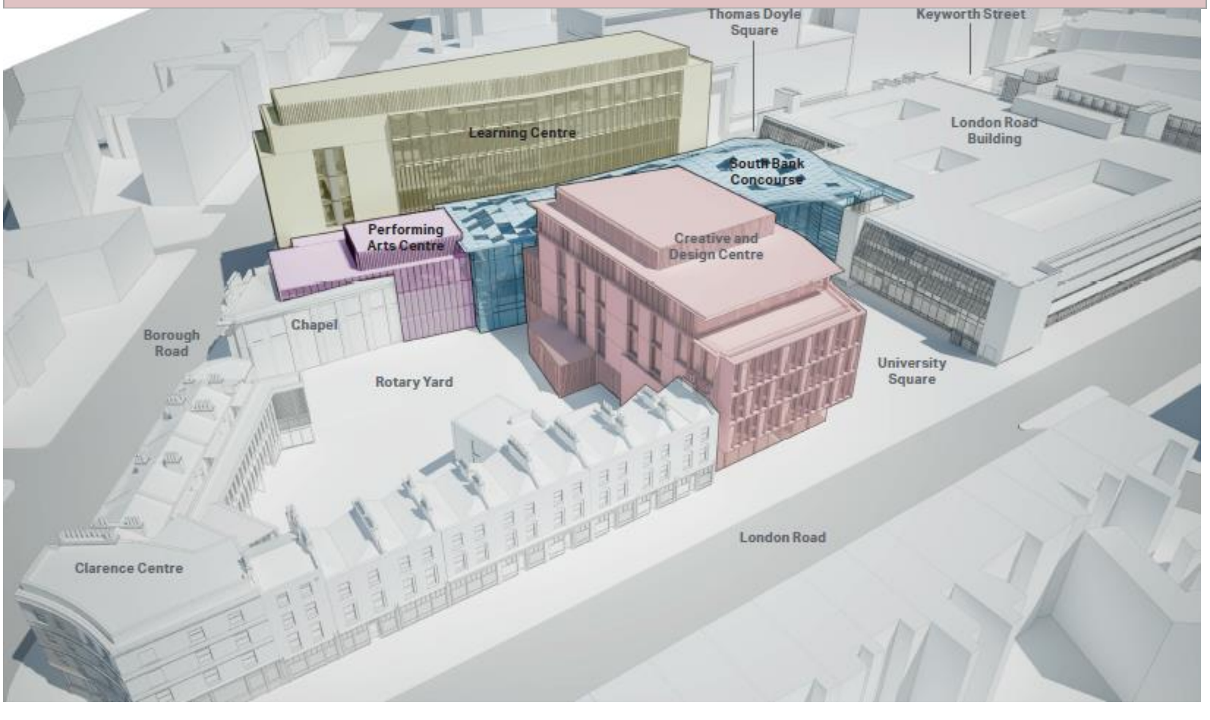
Energy efficiency measures, including a mixed mode system using passive cooling and thermal mass, leads to a 17.2 per cent saving at the first stage of the hierarchy.

Ground source heat pump using an existing borehole, saving 18.7 per cent at the third stage of the hierarchy

This development uses passive design measures to reduce its energy demand and carbon footprint, and a substantially sized ground source heat pump (GSHP) to retrieve and upgrade heat from a borehole, together with integrated controls to optimise performance.

The proposed new St George's Quarter Development at London South Bank University (LSBU) will occupy land between London road and Borough Road, in the north-western corner of LSBU's Southwark Campus. The development will include a new Learning Centre and Performing Arts Centre, the latter to be integrated with an existing chapel (Figure 16). Reductions in emissions for the site have been demonstrated, in accordance with GLA guidance and Southwark's Core Strategy (2011) and Sustainable Design and Construction SPD. The overall regulated emissions improvement targeted by the building exceeds that required by Part L 2013 by 35.9 per cent.

Figure 16: Model of proposed development at St George's Quarter, South Bank



The development optimises envelope performance with U-Values exceeding Part L2A (2013) requirements, robust airtightness measures, and provision to provide summer solar shading.

The London Plan cooling hierarchy has been used to reduce the cooling load and minimise the risk of overheating. Strategies to minimise overheating include shading and overhangs, reducing glazed areas and introducing fritting of rooflight glass. Provision for a green roof area has also been made.

A mixed-mode strategy will reduce the need for mechanical ventilation, with natural ventilation assisted by thermal storage on the ground floor slab in the concourse. Openable windows also help when external noise levels allow, while the inclusion of earth tubes provides the passive tempering of incoming fresh air.

The remaining ventilation requirement will be met by means of high efficiency (70 per cent) heat recovery with variable speed fans and generously sized ductwork. Fan powers will be restricted to 1.6 W/l/s or less, with extract air from toilets, showers and kitchen under demand control via passive infra-red (PIR) sensors. For lecture theatres, variable volume dampers controlled by CO_2 sensors will ensure the minimum air volume is delivered for comfort while optimising energy use.

Daylight penetration has also been optimised to reduce the need for electric lighting, and an ICT specialist was appointed to identify and restrict heat gains from lighting and office equipment.

These ‘Be Lean’ measures achieve a regulated energy carbon reduction of 17.2 per cent, contributing an estimated carbon saving of 73 tCO_2.

A Building Energy Management System (BEMS) that interfaces with other systems including fire and security will optimise the operation of plant and equipment and minimise energy use through smart metering and monitoring of end uses in accordance with BREEAM and CIBSE TM39.

The primary source of heating and cooling will be an open loop ground water heat pump system, making use of an existing 107m deep borehole on site with water temperature typically between 10 – 14°C. This favourable temperature regime will enable the system to provide 400kW cooling or 500kW heating, operating with an estimated Coefficient of Performance (COP) of 4.9.

Additional cooling demands will be met by two chillers located at roof level. This will provide an element of standby capacity and in the event of a major chiller failure under peak conditions the BEMS will be able to ‘load shed’ less critical areas.

Additional demands for heating and hot water will be met by high-efficiency gas boilers. Constant flow low temperature hot water (LTHW) primary pump sets will be sized to match the boilers and two LTHW circuits with high efficiency variable speed pumps will serve all space heating equipment and air handling units (AHUs).

Heating will be delivered through four-pipe perimeter trench heaters. Air is heated by the convector before being discharged into the room via an energy-efficient electronically commutated (EC) fan. The ground floor concourse will be heated via underfloor heating.

With the heat pump operating in heating mode from October to April and cooling mode during the remaining months, it is estimated the heat pump will provide 95 per cent of space heating demand and 90 per cent of the cooling. A 500 m^2 PV array will be installed with its aspect close to south, with a nominal efficiency of 15 per cent.

The combination of renewable energy technologies reduces emissions by 18.7 per cent, over the lean measures applied, providing an estimated carbon saving of 75 tCO_2.

Figure 17: View of University Square and main entrance at the proposed St George's Quarter development, South Bank

Case Study 2: Anthology Hale Works, SW Plot Hale Village, Haringey

Mixed-use development achieving 44 per cent carbon reductions overall

Energy efficient fabric design featuring curtain walls resulting in 10.4 per cent saved at the first stage of the hierarchy

Connecting to an existing district heating network saving 33.5 per cent at the second stage of the hierarchy

The proposed development lies within and is the last remaining development plot of the Hale Village Masterplan, occupying just under one acre next to existing residential and student buildings. It is situated in the Upper Lea Valley Opportunity Area and the Tottenham Housing Zone. It comprises a new eleven to 33 storey mixed-use development of 279 homes together with 1,588m^2 commercial space (Figure 18).

In accordance with both the London Plan and Haringey's Local Plan, the development will be energy efficient. A range of passive design features and demand reduction measures are proposed to reduce the carbon emissions of the proposed development. Both air permeability and heat loss parameters will be improved beyond the minimum backstop values required by building regulations. Enhanced thermal bridging characteristics are also proposed; curtain wall U-value calculations take into account all thermal bridging within the façade and are estimated to be 0.83 – 1.02 W/m^2K.

Low energy lighting and controls will also be used throughout. The demand for cooling will be minimised through Mechanical Ventilation Heat Recovery (MVHR), low g-values and balconies for solar shading.

For the first step of the London Plan energy hierarchy, the development is estimated to achieve a reduction of 45 tonnes per annum (10.4 per cent), going some way towards the new targets for energy efficiency that are set to be implemented when the new version of the London Plan is adopted.

It is estimated that the development will reduce carbon emissions by a further 145 tonnes per annum (33.6 per cent) by connecting to the existing district heating network at Hale Village. This network was established in 2011 as an integral part of the development of the whole site.

The Hale Village network was first conceived based on 50 per cent of the heat supply from biomass, 37 per cent from gas-fired CHP and the remaining 13 per cent from gas-fired boilers. However, the operator Veolia has confirmed a highly significant change in these heat delivery proportions to take place soon.

Specifically, heat delivery is being proposed to change to 10 per cent biomass, 75 per cent gas-fired CHP and 15 per cent gas-fired boilers. This demonstrates the fuel flexibility inherent in heat networks: when circumstances dictate that the heat supply source needs to change, the change that is made at a single energy centre can be conveyed to all connected buildings.

Overall the Hale Village development will, through energy efficiency measures and its connection to an existing heat network, save an estimated 44 per cent in regulated CO_2 emissions compared to a 2013 Building Regulations compliant development.

Figure 18: Proposed new development at Hale Village

Case Study 3: Former Co-op, East Ham

Mixed-use development which reaches carbon target with energy efficiency and renewable technologies only, achieving overall carbon savings of 38.8 per cent

Innovative approach to energy efficiency achieving 22.9 per cent savings at the first stage of the hierarchy

Application of air source heat pump, supplying a heat network, and photovoltaics saving 15.9 per cent at the third stage of the hierarchy

This site in East Ham, in the London Borough of Newham, was for many years a Co-op but has since 1990 been a temporary car park (Figure 19), earmarked for redevelopment. Bearing in mind its town centre location and proximity to a Grade 2 listed pub this development will be sensitively designed with frontages that integrate with its surroundings.

Figure 19: The proposed site at the former Coop in East Ham is currently a temporary car park

Newham’s Core Strategy classifies East Ham as a strategic site for redevelopment to promote an Enhanced Town Centre, and this specifically includes the proposed development site. The London Plan also identifies East Ham as an area in need of regeneration. The proposed development will provide 98 new homes and almost 4000 m^2 of retail and recreational floorspace.

Overall the development reaches an overall estimated saving of 39 per cent equating to 149 tonnes in regulated emissions of CO_2, using energy efficiency techniques and two renewable energy technologies. Both the non-residential and residential parts of the development exceed the current target compared to a 2013 Building Regulations compliant development. However, the residential part is additionally required to meet the zero-carbon target, so the remaining regulated CO_2 emissions will be met through a contribution to the borough’s offset fund.

Figure 20: View showing the proposed design for the former Co-op, East Ham

Savings attributed to energy efficiency amount to 23 per cent with a range of proposed passive design features and demand reduction measures. Both air permeability and heat loss parameters will be improved beyond the minimum backstop values required by building regulations. Other features include low energy lighting, variable speed drives on air handling plant and pumps, heat recovery with mechanical ventilation, and controls set up to dynamically adjust heating, ventilation, and hot water generation.

Low specific fan power will be achieved by means of effective ventilation design, with efficient fan systems and over sizing of the ductwork if required to minimise pressure losses within the ductwork. These measures enable the non-residential part of the development to achieve an estimated reduction of 30.5 per cent over Part L of the Building Regulations through energy efficiency alone, well above the new target that will be implemented when the new version of the London Plan is adopted.

Close attention has been devoted to daylighting with the internal layout of apartments designed to maximise daylight penetration for resident comfort while also reducing electricity consumption. Low energy lighting will be used with controls linked to daylight sensors and movement sensors. Building massing has also been subject to both external and internal daylight and sunlight analysis.

The development will have its own site heat network with centralised plant for both space heating and residential hot water for all the residential properties and the gym. Both space heating and residential hot water will be produced by an ASHP with back up gas boilers. Only the retail spaces will have their own individual localised Variable Refrigerant Flow (VRF) for space heating & cooling, and electric point of use water heaters for their small hot water requirement.

The ASHP will be coupled with the extract air stream to provide a higher air temperature to the condenser fans, enabling a higher COP estimated at 5.41. This is of particular value during the winter months for hot water production.

Additionally, due to the large residential hot water requirement in the gym it is proposed to use waste water heat recovery to extract heat from shower water. This secondary heat will be used to warm the incoming mains water.

The site will have an extensive roof area, on which PV panels with an estimated electricity generation potential of 40,441 kWh/annum will be installed. A reduction in regulated CO_2 emissions of 61 tonnes per annum (16 per cent) will be achieved through the third element of the energy hierarchy.

Case Study 4: Eastfields Estate, Mitcham

Primarily residential development achieving overall carbon savings of 46.2 per cent

Savings for residential elements at the first stage of the hierarchy are 12.9 per cent, exceeding the requirement for energy efficiency that will come into effect when the new draft London plan is adopted

Implementation of CHP at scale and PV lead to this development achieving significant savings at each stage of the energy hierarchy

The comprehensive redevelopment of the Eastfields Estate in Mitcham is part of a wider estate renewal programme which started in 2010. The existing estate was constructed in the 1970s and comprised a mix of houses and three storey blocks of flats. The application proposes the demolition of the 466 existing residential units at Eastfields and the construction of up to 800 new dwellings in buildings ranging from one to nine storeys, comprising a range of apartment blocks and mews houses. There will also be a 275m^2 devoted to commercial floorspace. A distinctive character will be sought with a variety of types, sizes and heights for the new homes which will improve the variety and appearance of the townscape.

A range of passive design features and demand reduction measures are proposed to reduce the carbon emissions of the proposed development. Both air permeability and heat loss parameters will be improved beyond the minimum backstop values required by building regulations with U-values for walls, floor and roof all significantly better than those specified in Part L 2013. Attention is also being paid to minimising heat loss through thermal bridging, attaining a Y-value of 0.04 W/mK.

From the first stage of the energy hierarchy alone, the development is estimated to achieve a reduction of 12.9 per cent in regulated CO_2 emissions compared to a 2013 Building Regulations compliant development and therefore already exceeds the new target of at least 10 per cent beyond Part L 2013, that will be implemented when the new draft London Plan is adopted.

There are no existing or planned district heating networks within the vicinity of the proposed development. Consequently, the development will have a site-wide heat network connecting to all apartments and non-residential buildings from a single energy centre that will house a 512kWe gas-fired CHP unit as the lead heat source for the site-wide heat network. The CHP is sized to provide the residential hot water load, as well as a proportion of the space heating accruing to 60 per cent of the annual heating and hot water demand. A reduction in regulated CO_2 emissions of 24.6 per cent will be achieved through this second part of the energy hierarchy.

The applicant investigated the feasibility of a range of renewable energy technologies and is proposing to install 1,173m^2 of PV panels. A reduction in regulated CO_2 emissions of 8.8 per cent will be achieved through this third element of the energy hierarchy.

An overall on-site reduction of 384 tonnes of CO_2 per year in regulated emissions compared to a 2013 Building Regulations compliant development is expected for the residential buildings, equivalent to a saving of 46.2 per cent. This significantly exceeds the on-site target set within Policy 5.2 of the London Plan. However, the residential buildings are required to meet the zero-carbon target and consequently the remaining regulated CO_2 emissions, equivalent to 427 tonnes of CO_2 per annum, will be met through a contribution to the borough's offset fund.

Figure 21: Plan of the redeveloped Eastfields Estate

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