Towards a net zero carbon London: Energy Monitoring Report 2020

SEPTEMBER 2021

Contents

This report

This report summarises the expected energy performance of all referable developments[1] that gained planning approval from the Mayor in the calendar year 2020, against the London Plan climate mitigation policies.

In 2020, a total of 140 referable planning applications were granted provisional approval by their local planning authority and were subsequently approved by the Mayor.

Table 1 presents the type of developments which gained approval.

Developments approved by the Mayor			
Type of development	**Number of developments**	**Number of dwellings**	**Non-residential floor area (million m^2)**
Mixed-use	80	34,839	0.72
Residential	10	2,314	N/A
Non-residential	50	N/A	1.00
Total	**140**	**37,153**	**1.72**

Table 1: Total number and type of referable developments approved by the Mayor in 2020

[1] Referable developments: A planning 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.

Key findings

2020 key findings

- **Total carbon savings:** **An overall on-site carbon reduction of 46.2 per cent** more than required by the 2013 Building Regulations secured for the 140 developments approved in 2020 (the London Plan asks for at least 35 per cent on-site savings). This is a total carbon saving of 43,886 tonnes and is a significant leap in savings from 2019 (40.6 per cent carbon reduction amounting to 33,425 tonnes of carbon saved), reflecting the importance of local authorities retaining their powers to set standards higher than national building regulations. Without these powers London would have achieved far lower carbon reductions.

- **Zero carbon target:** **The Mayor's net zero carbon homes standard is driving greater on-site carbon reductions in the residential sector.** Almost all the residential developments in 2020 were subject to the net zero carbon homes target. They achieved a **44.0 per cent** carbon reduction against Building Regulations**,** exceeding the **40.1 per cent** achieved in 2019 by residential developments to which the net zero carbon target applied.

- **Carbon offsetting:** An estimated **£38.8 million potentially available for collection by boroughs**. This is an approximate figure. For details of the sums being collected and how they are being spent please see the Mayor's annual Carbon Offset Funds Report.

- **Energy efficiency savings:** Savings from energy efficiency measures resulted in a **19.8 per cent** reduction in carbon emissions; this is an increase on the 2019 figure of 16.7 per cent which was itself the highest reduction since reporting began in 2011. For residential developments, the average saving was **10.4 per cent**, already reaching the new London Plan target of 10 per cent. Non-residential developments achieved an average saving of **14.7 per cent**, almost reaching the new target of 15 per cent.

- **District heating networks (DHNs) and Combined Heat and Power (CHP):** **London's approach to emission factors is driving the shift away from site-wide gas-based heating solutions**. The number of CHP units declined by 21 per cent compared to 2019. A total of 8,771 dwellings in 8 developments are expected to connect to an existing DHN, an increase compared to 2019 (6,571 dwellings). This is estimated to lead to circa £88 million investment in new heat network infrastructure.

2020 key findings

- **Solar PV: 2020 saw a huge increase in new solar PV capacity to 14.7MWp (**from 6.7MWp in 2019), more than doubling the investment to nearly £17 million (£7.7m in 2019). Although this is partly due to the greater number of developments, the increase to 24.7m²PV/1000m² floor area (from 15.7m²PV/1000m² in 2019) is impressive.

- **Heat pumps: The introduction of the SAP 10.0 emission factors is driving more heat pump installations** including centralised installations serving new communal heat networks; more are now being supplied by heat pumps than by CHP. Just over 10,000 residential units are expected to be served by heat pumps, which is a huge increase compared to the 2,200 units in 2019, and 77 per cent of non-residential floorspace is expected to be served by heat pumps (over 770,000m² compared with 186,000m² in 2019).

- **Overheating: 72 developments submitted a dynamic overheating assessment report demonstrating how the design proposals will mitigate overheating risk.** All schemes are expected to provide early integration of passive design measures (such as optimised orientation and massing) which offer the greatest benefit without significant design additions and consider incorporation of passive external shading.

- **Cooling proposals: 75 developments proposed active cooling. At 9.28 GWh per annum, the total cooling consumption reported for 2020 is a pro rata increase of 56 per cent compared with 2019.** There may be multiple reasons for this including the typologies of referable applications and the locations of proposed developments resulting in acoustic and air quality constraints which can increase cooling demands. However, active cooling in residential developments is generally discouraged. By following the Mayor's cooling hierarchy, the cooling demand should be kept to a minimum.

Photo credit PRP Architects LLP

Overview

The role of the planning system in the climate emergency

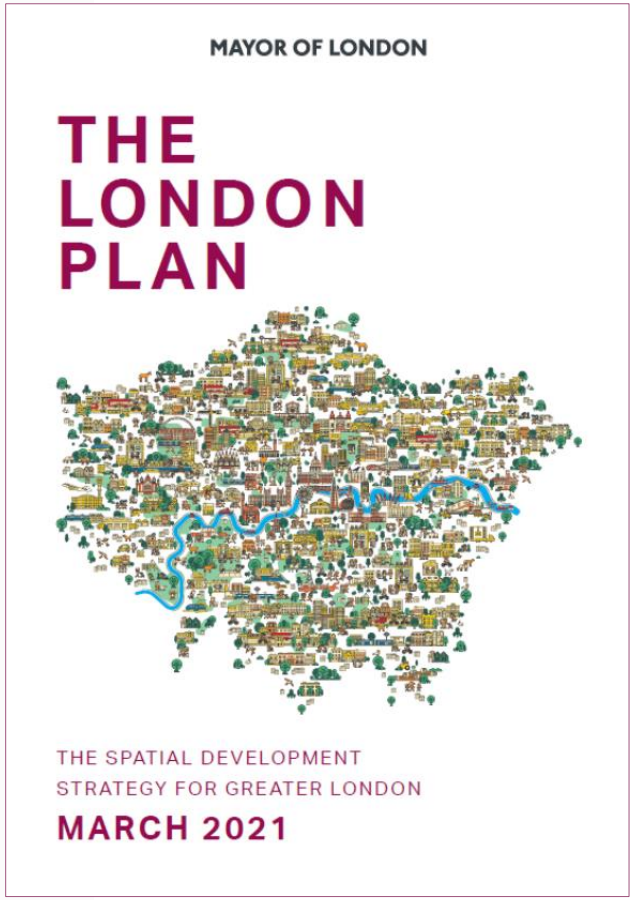
The Mayor of London has declared a climate emergency and has stated his ambition for London to be net zero carbon city by 2030.

His 1.5°C Climate Action Plan looks at the different scenarios available for London to reach net zero carbon. It is compatible with the highest ambition of the Paris Agreement to limit the global average temperature rise to 1.5ºC above pre-industrial levels. The scenarios in the 1.5°C plan are currently being revised as part of our regular assessment process and, when published in Autumn 2021, will align with the Mayor's new target for London to reach net zero by 2030.

The planning system has an important role to play in our response to the climate emergency and improving air quality by ensuring that all new development is net zero carbon. If we don't do this, then we are only adding to the number of buildings that will need to be retrofitted later on at greater cost and disruption.

The new London Plan, which was published in March 2021, has extended the net zero carbon target that has been in place for major residential developments since 2016 to include all major non-residential developments. It also includes a higher carbon offset price to incentivise higher on-site carbon reductions.

The Plan also strengthens the approach to air quality by limiting the use of gas-engine CHP and promoting the use of lower carbon solutions such as heat pumps and secondary heat sources.



Energy hierarchy

The London Plan requires all major developments to achieve a minimum of a 35 per cent on-site carbon improvement on national Building Regulations, using a Part L 2013 baseline and the appropriate carbon emission factors (see overleaf for details on London's approach to carbon emission factors). Major developments are required to go further and meet the Mayor's net zero carbon target; this has applied to residential developments since 2016 and has been extended to non-domestic developments from March 2021.

To achieve these targets, planning applicants are expected to follow the energy hierarchy:

- **'be lean'** use less energy
- **'be clean'** supply energy efficiently
- **'be green'** use renewable energy

Figure 1 presents the latest energy hierarchy and the associated targets in line with the London Plan, which introduces new energy efficiency targets and the 'be seen' energy monitoring requirement.

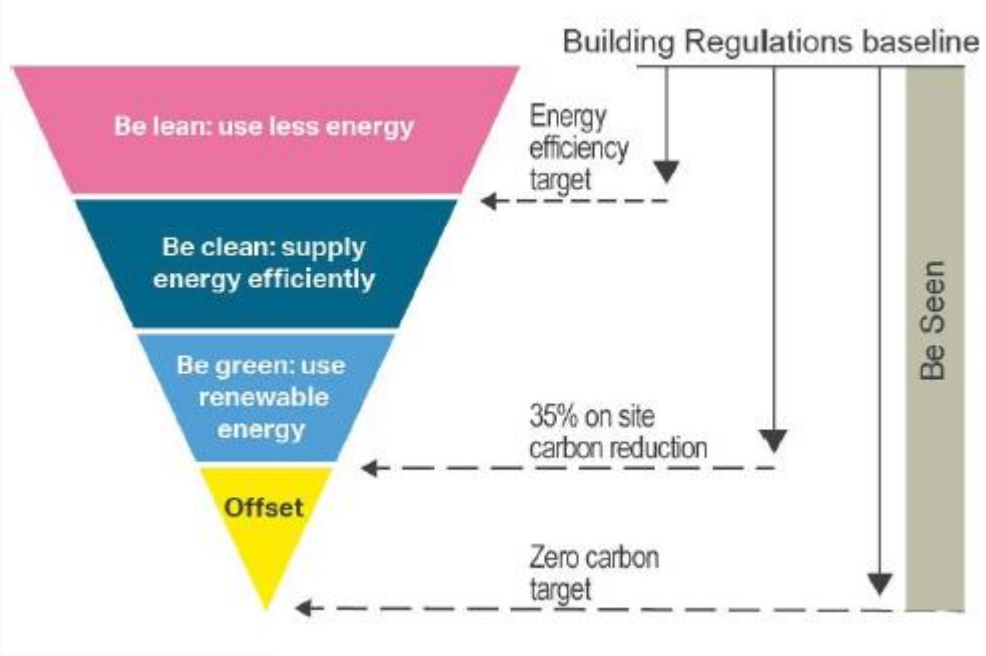


Figure 1: GLA's energy hierarchy and associated targets

London’s approach to carbon emission factors

Using updated carbon emission factors

National Building Regulations use SAP 2012 carbon emission factors which are increasingly out of date and are encouraging the installation of high-carbon systems in new developments. To address this the Mayor has, since January 2019, encouraged applicants submitting referable planning applications to use the updated SAP 10.0 carbon emission factors in areas where there are no opportunities to connect to district heating networks.

Using the updated carbon emission factors better reflects the decarbonisation of the electricity grid and therefore encourages the installation of electrically-based low carbon heating solutions, such as heat pumps, instead of gas-based solutions, such as gas-engine CHP, to meet the carbon targets. It also supports the transition to the new London Plan climate mitigation policies.

Referable developments with potential to connect to a heat network may continue to use the SAP 2012 carbon emission factors, provided that the heat network operator has submitted an acceptable decarbonisation strategy to the Mayor. This exception is in place to support the Mayor’s London Plan policy to encourage the expansion of heat networks.

See the latest Energy Assessment Guidance for further information.

What does this mean for the developments approved in 2020?

The results presented in this report incorporate all 140 developments that were approved in 2020, taking into account the different carbon emission factors used for different applications.

76 of these developments used the SAP 10.0 carbon emission factors and these exhibit a clear trend towards low carbon solutions such as heat pumps, instead of gas-based systems, with generally higher energy efficiency savings and higher on-site carbon savings overall. The remaining 64 developments were submitted before this approach took effect and were approved using the SAP 2012 emission factors.

Updated Building Regulations

The ability of local authorities to set energy efficiency standards higher than national standards has enabled London to achieve much greater carbon savings than would otherwise have been achieved. The Mayor has been clear that these powers must be retained as government introduces new Building Regulations in 2022 and when the Future Homes Standard is adopted. When the Building Regulations are updated with more accurate carbon emission factors, we will review our approach to emission factors and confirm our stance in the Energy Assessment Guidance.

Overall results

Total on-site carbon savings

An overall carbon reduction of **46.2 per cent** more than required by the 2013 Building Regulations was secured for the 140 developments approved in 2020. This amounts to a total carbon saving of 43,886 tonnes. The carbon savings from purely residential proposals amounted to 16,189 tonnes (44.0 per cent savings) and non-residential developments achieved carbon savings of 27,697 tonnes (equating to 47.6 per cent). See Figure 2.

The overall percentage carbon reduction achieved greatly exceeds the Mayor's minimum 35 per cent on-site target and is a big step forward from the 2019 result of a 40.6 per cent carbon reduction, which was itself an improvement on the previous year. **Year on year the Mayor's policies are driving carbon reductions far beyond national standards; this is important progress which demonstrates how far national standards could be raised in response to the climate emergency.**

The increase in savings is mostly attributed to a big increase in 'be green' savings as well as a high 'be lean' savings contribution. London's pioneering use of SAP 10.0 as a basis for energy assessments and an ongoing emphasis on higher levels of energy efficiency is generating carbon higher savings from these parts of the energy hierarchy.

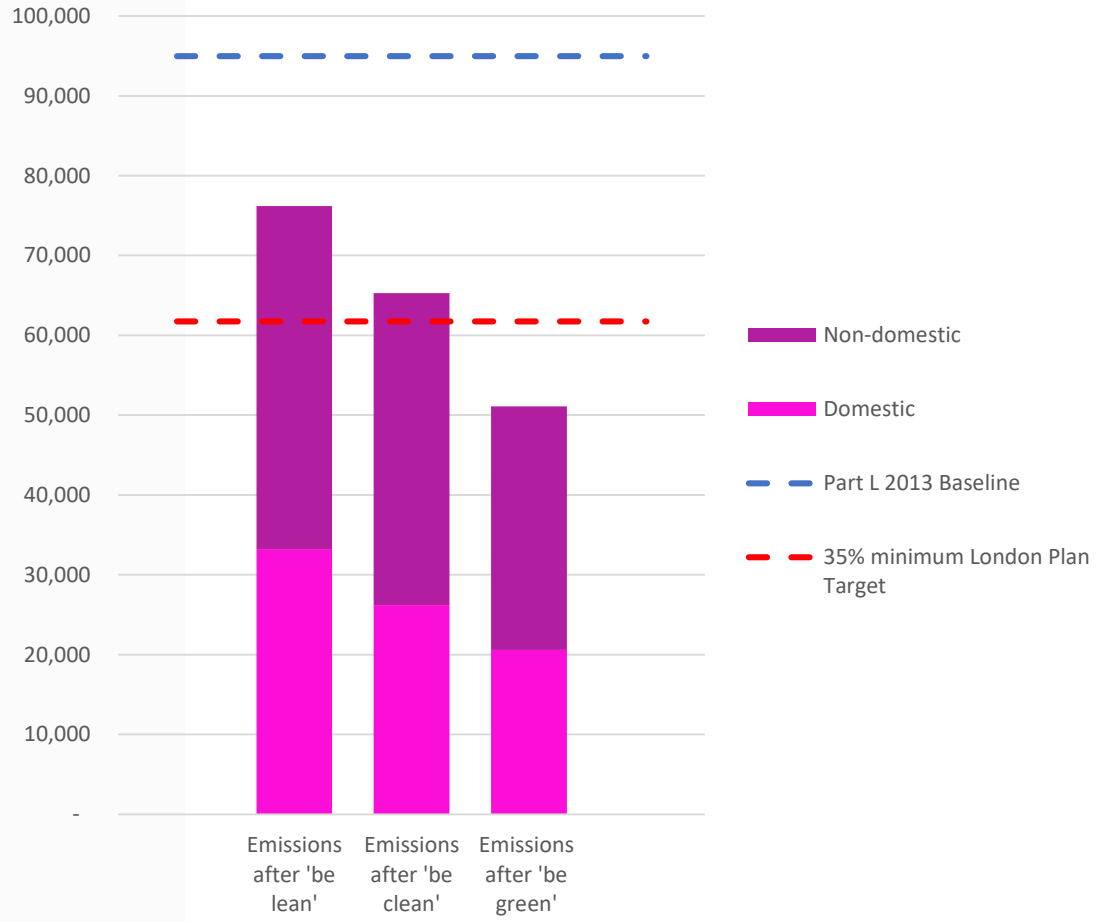


Figure 2: Total carbon emissions (tonnes/CO_2) after each stage of the energy hierarchy

Carbon savings of 46.2 per cent more than Building Regulations

Carbon savings breakdown

In 2020, applicants achieved the following savings:

- **‘Be lean’** energy efficiency measures resulting in a **19.8 per cent** reduction in carbon emissions. This is a significant increase on the 2019 figure of 16.7 per cent with the ‘be lean’ stage now representing the biggest proportion of savings (Figure 3), in line with London Plan policy to reduce energy demand first. See the ‘be lean’ section for further analysis.

- **‘Be clean’** an **11.5 per cent** carbon emissions reduction resulting from an estimated £88 million investment in heat network infrastructure and £5.7 million for approximately 8.2 MWe of Combined Heat and Power (CHP) capacity (down from 9.3 MWe in 2019). For the fourth consecutive year there is a drop in the contribution of this stage of the hierarchy. This is largely due to CHP being discouraged except where it can stimulate area wide District Heating Networks (DHN). Encouragingly, there is a rise in the number of developments specifying heat pumps for communal networks. See the ‘be clean’ section for further analysis, and Case Study 3 (337-359 Kingsland Road) for an example.

- **‘Be green’** a **14.9 per cent** carbon emissions reduction leading to nearly £17 million invested in an estimated 14.7MWp new solar photovoltaic (PV) capacity, with additional investment in heat pumps through the 57 heat pump applications. This is a significant increase on previous years and is a result of 63 (82 per cent) of the SAP 10.0 developments proposing heat pumps, with associated ‘be green’ carbon savings making up an average of 44 per cent of the total savings, compared to 20 per cent for the SAP 2012 developments. See the ‘be green’ section for further analysis.

Table 2 overleaf sets out the total carbon emissions and savings achieved against each stage of the energy hierarchy.

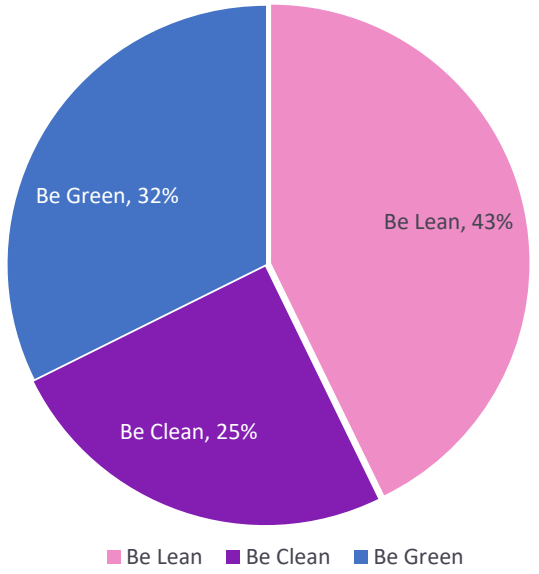


Figure 3: Percentage breakdown (per cent) of total carbon savings by each stage of the energy hierarchy for all referable developments

Carbon savings secured

Cumulative carbon emissions and savings			
Stages of the energy hierarchy	**Regulated emissions**	**Cumulative regulated emissions reductions relative to Part L 2013 Building Regulations**	
	(tCO_2/year)	**(tCO_2/year)**	**(percentage improvement)**
Building Regulations 2013 Baseline	94,975	-	-
After ‘be lean’ (energy efficiency)	76,198	18,778	19.8
After ‘be clean’ (heat network connections)	65,279	29,697	31.3
After ‘be green’ (renewable energy)	51,090	43,886	**46.2**

Table 2: Total cumulative carbon emissions and savings after each stage of the energy hierarchy

Distribution of carbon savings

Most developments achieved carbon savings in the range of 35 – 40 per cent beyond Building Regulations, as shown in Figure 4. This was also the case in 2019. However, **many more developments in 2020 (16.4 per cent) achieved 40 – 45 per cent than in 2019 (7.4 per cent)**, reflecting a general move towards greater savings.

Overall, 86 per cent of developments met or exceeded the minimum 35 per cent on-site target, a 12 per cent improvement from 2019. One outlier achieved a very high saving: this development comprised industrial and storage units with a small heating demand that will be equipped with a large area of PV.

Developments that significantly exceeded the target were largely able to do so through their 'be green' and 'be lean' savings (as in Case Studies 1 and 3). This is a significant change arising from London's early adoption of SAP 10.0 emission factors. Consequently, many more developments are proposing to install heat pumps which results in higher carbon savings compared to gas-based systems using SAP 2012 emission factors. Several developments were able to achieve high savings from 'be clean' through connection to DHNs – see Case Study 2 (Meridian Water Phase 2).

Developments that missed the target (a twelve per cent decrease compared to 2019) mostly did so narrowly, primarily due to being unable to connect to a DHN and being unsuitable for a heat pump installation. In these cases, applicants are required to make an offset payment to the relevant borough.

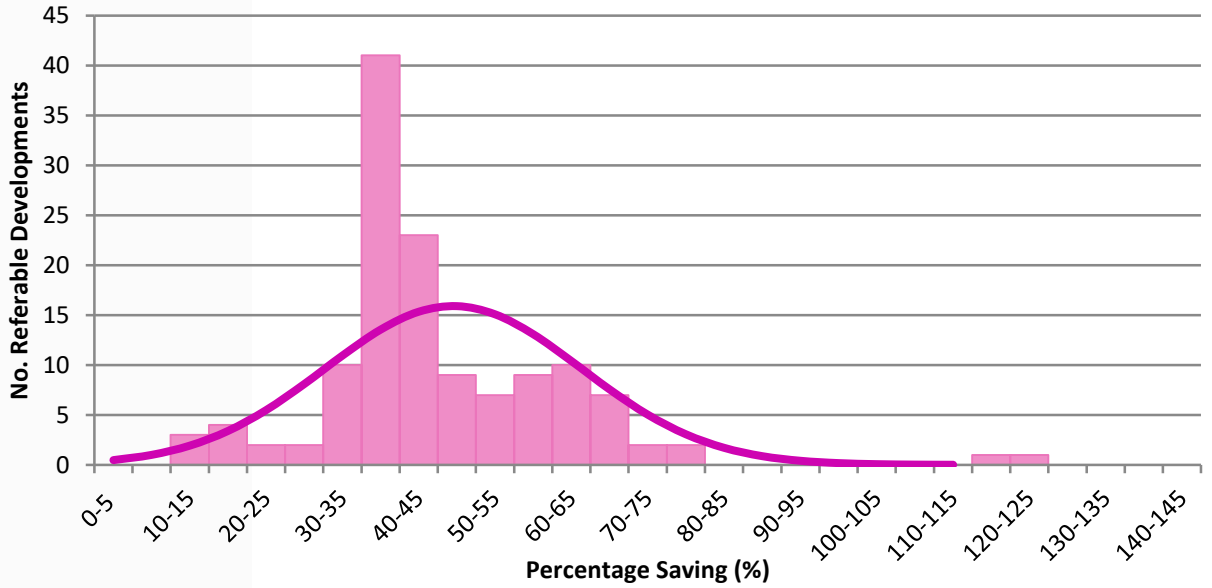


Figure 4: Histogram showing the range, frequency and distribution of the percentage (%) carbon savings achieved in 2020

Carbon offsetting

Carbon offsetting is a last resort measure that is only utilised when on-site carbon savings have been maximised.

However, until approaches and technologies improve to allow further on-site reductions, carbon offset funds provide flexibility to meet the London Plan targets. They provide a source of funding for carbon reduction projects across London and have a role in funding emission reductions from existing buildings where achieving carbon savings can be more challenging compared to new-build. The Mayor has increased the recommended carbon offset price to £95/tonne under the new London Plan. Alternatively, boroughs can apply their own locally-set cost of carbon.

We have estimated that £38.8 million could have been collected by boroughs from referable developments between January to December 2020. This is made up of payments arising from the net zero carbon target for residential developments, along with the payments made by developers to reach the 35 per cent target on non-domestic developments where it was not possible on-site. See Table 3.

These figures are estimates only. Boroughs are responsible for calculating and collecting offset payments. The Mayor undertakes monitoring of the value of carbon offset funds and how they are being spent. These reports are published separately and are available on the GLA website.

Carbon offsetting is a last resort measure but gives flexibility in meeting London Plan targets

Type of offset payment	Estimated total (£ million)
To achieve net zero carbon homes target	£35.1 million
To achieve minimum 35 per cent target (non-domestic development)	£3.7 million
Total	**£38.8 million**

Table 3: Estimated carbon offset contributions to achieve London Plan targets from January to December 2020

Borough highlights

Lambeth, Haringey, Westminster, and Brent have all secured some impressive results in 2020 for specific stages of the energy hierarchy.

Opportunities for carbon savings vary between the boroughs, depending on their density, availability of DHN connections and waste heat sources as well as how the borough is using the planning system to respond to the climate emergency.

- Lambeth achieved significant savings through energy efficiency measures with a 21 per cent carbon reduction across seven referable developments from '**be lean**' alone.
- Haringey has secured DHN connections for two of its three referable developments due to the Upper Lea Valley DHN, achieving 27 per cent savings from '**be clean**'.
- Westminster has 42 per cent savings arising from '**be green**' through solar and heat pump technologies with heat pumps specified for all eight developments.
- Brent is expected to deliver a 46 per cent saving for a total of eleven referable cases, including six large scale heat pumps and connections to two DHNs.

Lambeth

Seven referable developments approved in 2020 which are expected to achieve a:

- **21 per cent** carbon savings from energy efficiency ('be lean')

Haringey

Three referable developments approved in 2020 which are expected to achieve a:

- **27 per cent** carbon savings from DHN connections ('be clean')

Westminster

Eight referable developments approved in 2020 which are expected to achieve a:

- **42 per cent** carbon savings from renewable energy generation ('be green')

Brent

Eleven referable developments approved in 2020 which are expected to achieve a:

- **46 per cent** total carbon reduction

‘Be lean’

‘Be lean’: Residential

Residential developments achieved on average a **10.4 per cent** reduction in carbon emissions from energy efficiency measures alone. **This is a major improvement in performance compared to 2019 when 7.4.per cent was achieved**, which had in turn exceeded the previous year by a similar margin. This is great progress against the new target of a 10 per cent improvement on Building Regulations from energy efficiency, that came into force in March 2021 but has been actively encouraged by the Mayor prior its adoption. Case Study 1 (Land to the Rear of the Tesco Hoover Building) is an example of a residential development that has already been able to reach the new ‘be lean’ target.

The developments which reached the new target used high specification fabric and glazing and paid careful attention to thermal bridging and air tightness (especially at junctions and services penetration), usually with Mechanical Ventilation with Heat Recovery (MVHR). They exhibit a well integrated approach making effective use of passive design opportunities. This demonstrates that the Mayor’s ambitious target has already influenced applicants’ design decisions.

Those developments that were not able to meet the target were often legacy cases or were developments with a high percentage of glazing. Most of these developments were able to meet the overall carbon target through other stages of the energy hierarchy, however.

Now that the target is in place, all developments will be expected to achieve it. For those meeting it already it is vital that proposed measures are properly implemented to ensure these savings are realised in practice.

The London Plan is driving residential ‘be lean’ savings

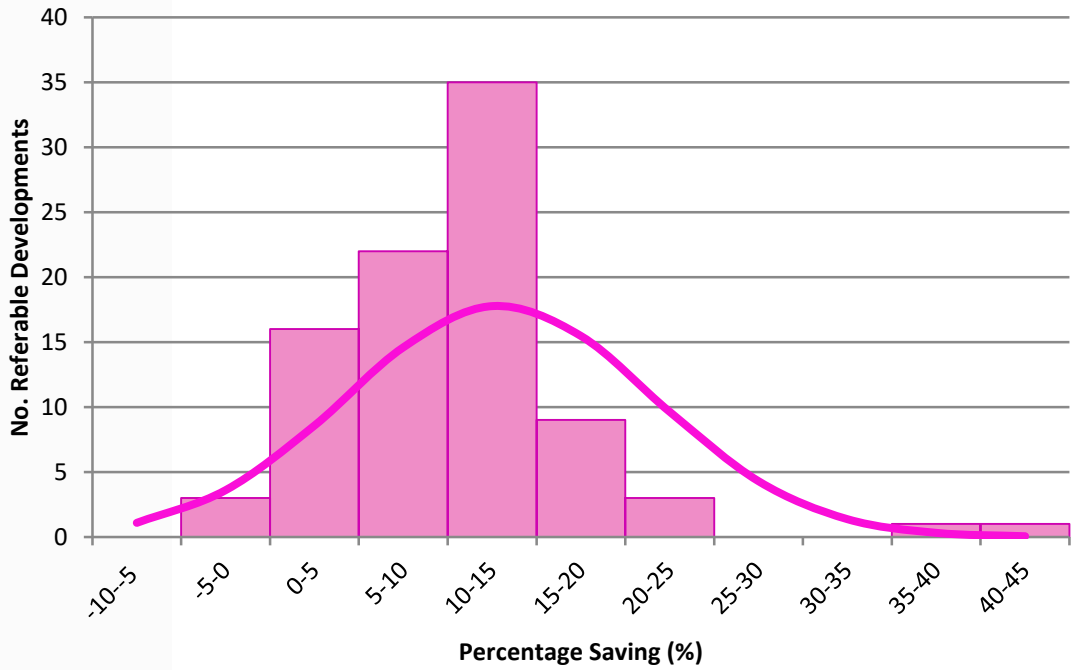


Figure 5: Carbon savings (per cent) achieved from ‘be lean’ measures for residential developments

‘Be lean’: Non-residential

Non-residential developments secured on average a **14.7 per cent** carbon reduction from energy efficiency measures alone. **This is a steady increase from 2019 when the average saving was 13.8 per cent.** Although schemes were not yet required to meet it, this figure is already approaching the Mayor’s new London Plan non-residential energy efficiency target of a 15 per cent improvement on Building Regulations which has now been adopted.

The non-residential category covers a wide range of typologies, each with characteristic energy demands. **51 per cent of non-residential developments were already able to reach or surpass the Mayor’s new target in advance of its adoption.** While many developments have a mix of building typologies, it is noticeable that this group were comprised mainly of offices and retail, which are more readily able to secure higher savings than other typologies.

The remaining developments were often comprised of hotels and student and hostel accommodation. These buildings, which have a high hot water demand, will generally find it more challenging to achieve the target. With a blanket non-domestic target this variation with typology is to be expected. Nevertheless, the hostel development featured in Case Study 3 (337-359 Kingsland Road) achieved 20 per cent of its carbon savings from ‘be lean’.

Although there were a very small number of cases where the non-residential element did not reach the Building Regulations target baseline under the ‘be lean' scenario, most went on to achieve the 35 per cent on-site target once ‘be clean' and ‘be green' measures were included.

The London Plan is driving non-residential ‘be lean’ savings.

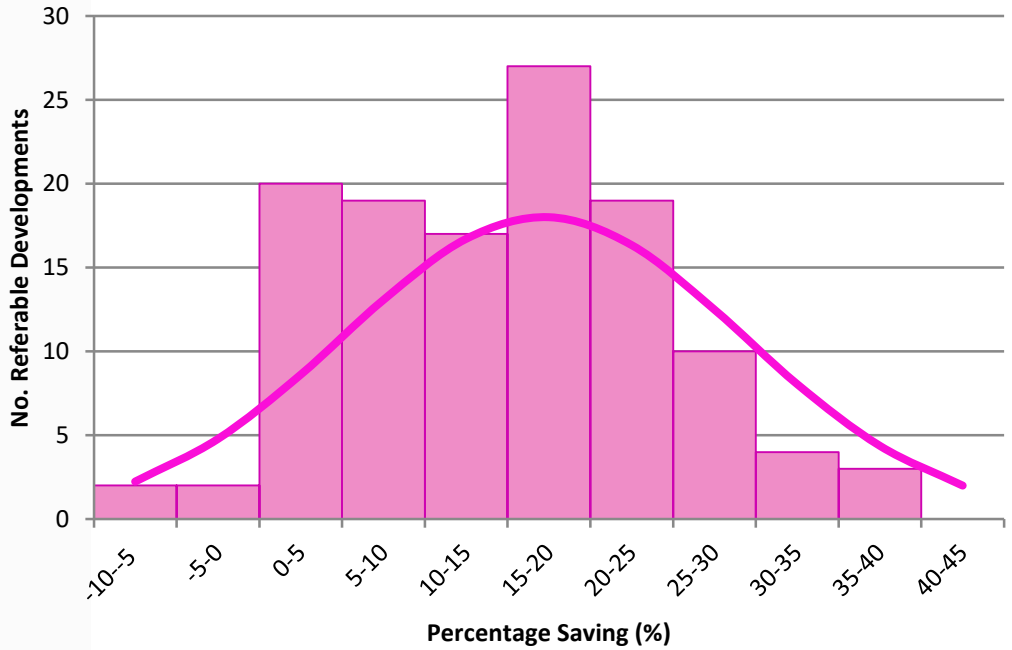


Figure 6: Carbon savings (per cent) achieved from ‘be lean’ measures for non-residential developments

Overheating

The Mayor's cooling hierarchy requires applicants to mitigate potential overheating risks through the use of passive measures. Measures such as external shading are strongly encouraged, particularly in developments with noise or air quality limitations. Other common measures for mitigating overheating risk within a residential development include the use of solar control glazing, which has the ability to reduce solar heat gains while offering high levels of natural light for a comfortable internal environment. Case Study 1 (Land to the Rear of the Tesco Hoover Building) applied an impressive strategy to minimise the risk of overheating.

If an applicant has applied the cooling hierarchy and the risk of overheating still exists, only then should active cooling measures be considered, such as air conditioning. However, active cooling in residential developments is generally discouraged.

For the developments approved in 2020 an average g-value (a measure of how much solar heat is allowed in through a window) of 0.43 was proposed. It is common to see ranges in g-values proposed (in 2019 we saw 0.35 to 0.63) depending on orientation. **To avoid the potential for a major overheating risk, London Plan policy promotes more efficient glazing specifications compared to the default Building Regulations figure of 0.63.**

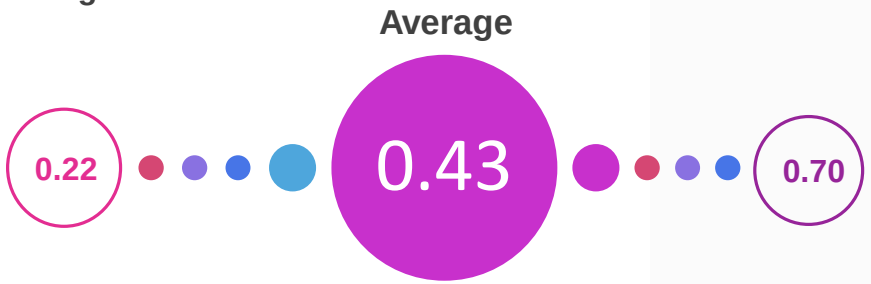


Figure 7: Minimum, average and maximum g-values proposed for residential applications

Tools for assessing overheating risk

To demonstrate that the overheating risk has been mitigated, applicants are required to undertake a CIBSE Technical Memorandum (TM)59 compliant dynamic overheating assessment for residential proposals. Non-residential developments that are proposed to be naturally ventilated are assessed against the TM52 assessment methodology.

Of the 140 developments, 72 (50 residential and 22 non-residential) submitted a TM59 or TM52 dynamic overheating assessment report demonstrating how the design proposals will mitigate overheating risk. For non-domestic development, TM52 is only required where natural ventilation is proposed.

52 developments (72 per cent of all those assessed under TM59 or TM52) demonstrated compliance with the TM49 Design Summer Year (DSY) 1 weather file, which represents summer conditions occurring every other year, through passive measures alone. The remainder were either non-residential developments with active cooling or residential proposals with acoustic and air quality issues that prevented windows from being openable. All schemes are expected to provide early integration of passive design measures (such as optimised orientation and massing) which offer the greatest benefit without significant design additions and consider incorporation of passive external shading.

Preparing for higher temperatures in the future

It is becoming increasingly important for applicants to mitigate the overheating risk as climate change leads to rising temperatures. To respond to this, the latest Energy Assessment Guidance has a mandatory requirement for more rigorous analysis under the future weather files (DSY 2 and DSY 3). This will help applicants to determine and mitigate the risk of overheating during more prolonged warm spells or higher temperature peaks.

Cooling proposals

A total of 75 developments (54 per cent) proposed active cooling (Figure 8). **At 9.28 GWh per annum, the total cooling consumption reported for 2020 is a pro rata increase of 56 per cent compared with 2019.** There may be multiple reasons for this including the typologies of referable applications and the locations of proposed developments resulting in acoustic and air quality constraints which can increase cooling demands. By following our cooling hierarchy, the cooling demand should be kept to a minimum.

Non-residential

The 31 purely non-residential developments (62 per cent of the total number of non-residential developments, up from 57 per cent in 2019) proposing cooling were predominantly comprised of offices and retail units. Those not proposing cooling were typically schools, sports facilities and storage warehouses; however, it was noted that a number of hotels did not specify cooling in 2020.

For non-residential developments proposing active cooling it is expected that the National Calculation Methodology (NCM) calculated cooling demand is lower than the notional estimate. The cooling data provided showed an average cooling demand of approximately 10 kWh/m²/yr (Figure 9), similar to previous years.

Residential

Five mixed-use developments (out of a total of 80) proposed active cooling in the dwellings. This represents 5.6 per cent of residential developments proposing active cooling, a decrease from 7.1 per cent in 2019. **While active cooling is generally discouraged in residential developments, it may be needed where site constraints prevent passive measures** from reducing overheating risk sufficiently.

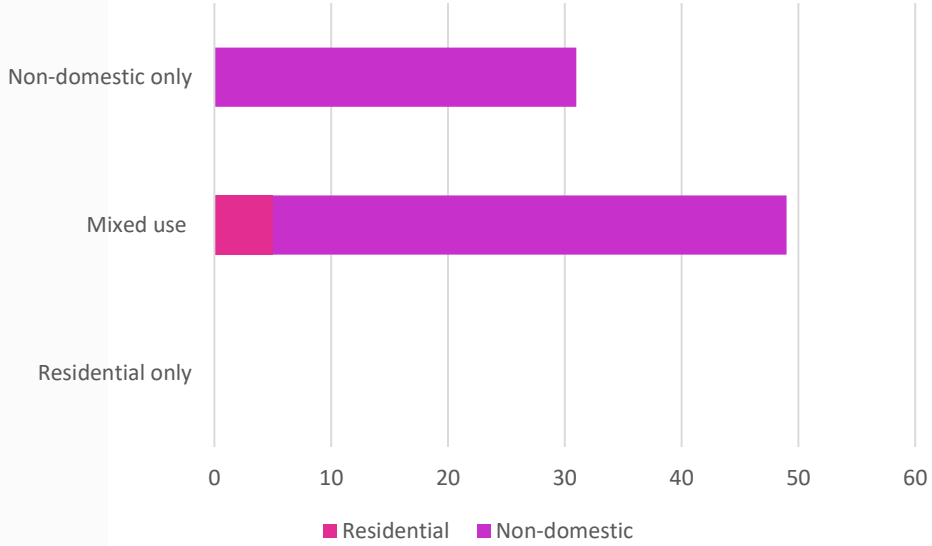


Figure 8: Number of cooling proposals by development type

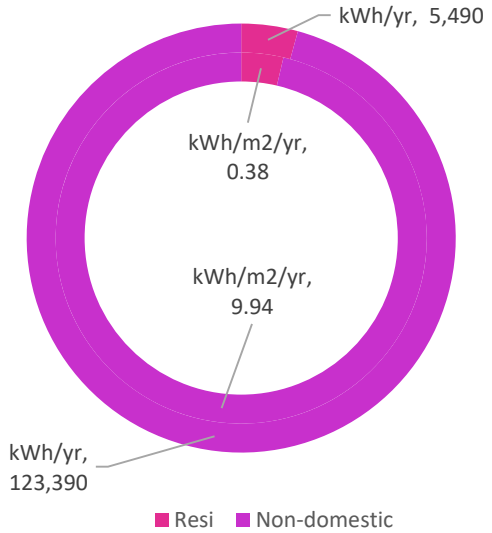


Figure 9: Average annual cooling demand (kWh and kWh/m²) by development type

Case study 1: Land to the rear of the Tesco Hoover building

The Tesco Hoover building in the London Borough of Ealing is an iconic art-deco building from the 1930s. Sited at its rear, and complementing its design, the proposed development is a part 15-storey, part 10-storey residential building for 278 homes. Highlights include:

- **58 per cent total carbon savings** achieved on-site.
- **'Be lean':** high standards of building fabric and air permeability are specified, as well as a clear focus on thermal bridging resulting in 14 per cent carbon savings from energy efficiency. Consequently this development already significantly exceeds the new London Plan residential energy efficiency target of at least 10 per cent beyond Part L requirements.
- **Managing overheating risk:** a combination of natural cross-ventilation, recessed windows and balconies, together with guidance for future residents on installation of blinds and further shading, all contribute to reducing the risk of overheating. Internal heat gains from non-regulated energy use are also minimised by specifying 'A'-rated appliances, efficient LED lighting and well-insulated pipes and hot water tanks.
- **'Be clean':** there is no district heating network in the vicinity. However, future connection to a network is designed in with a safeguarded pipe route to the site boundary.
- **'Be green':** a site-wide heat network will connect all the dwellings, with centralised heat pumps to provide 830kW heating capacity. The development is also set to include 38kWp of high efficiency (21.1 per cent) PV panels, bringing the total carbon savings from renewable energy to 43 per cent.

Photo credits: Mecserve

Photo credit Paul Raftery

‘Be clean’

District heating network (DHN) connections

District heat networks (DHNs) play an important role in London's plans to decarbonise its buildings and become a net zero carbon city. DHNs offer an efficient and competitive solution for heating buildings in urban areas with high heat density and provide the added benefit of enabling the use of secondary energy and waste heat sources.

Across London there are several examples of existing and proposed DHNs. Applicants are required to refer to the London Heat Map and consult with borough energy officers to identify if their site is in the vicinity of such a network. If a network exists then the applicant is expected to prioritise connection, either immediately or when the network expands to the site boundary. If a network is planned and not yet in existence, applicants are expected to design an on-site solution which is future-proofed for connection later on. In this way, heat networks can serve a growing number of buildings with low or zero carbon heat.

In 2020, a total of 8,771 dwellings in 5 developments are expected to connect to an existing DHN (Table 4). This is an increase compared to last year (6,571 dwellings in 2019). **DHN connection opportunities continue to be actively pursued**. In total 16,441 dwellings are expected to connect to DHNs, including those which are future-proofed for connection later on. Case Study 2 (Meridian Water Phase 2) is an example of a development achieving high 'be clean' savings by connecting directly to a DHN.

Connection type	No. of developments	No. of dwellings	Name of DHN
Connecting to an existing DHN	5	8,771	Queen Elizabeth Olympic Park, SELCHP, ExCeL, White City, E.ON Fairview
Connecting to existing DHN in the future	5	4,669	Meridian Water, Barking Town Centre, Old Vinyl Factory, Woodberry Down, South Kilburn
Future connection to proposed DHN	8	2,971	Queen Elizabeth Olympic Park, SELCHP, Elephant Park, Royal Docks, Southall, VNEB

Table 4: Number of developments and dwellings connecting to existing and proposed DHNs

Communal heat networks

Developments in Heat Network Priority Areas (HNPAs) are expected to have a communal heat network to enable connection to a DHN, either now or in the future. A communal heat network connects individual dwellings to a centralised heating system, delivering efficiencies through management of energy demand.

In 2020, a total of 30,943 dwellings are expected to connect to a site-wide communal heat network or an area-wide DHN (83 per cent of all dwellings). This is a slight drop compared to 2019 (87 per cent) which is probably due to the location and typology of applications. However, **we see developments consistently proposing communal networks as a means of future proofing for connection to area wide DHNs**. Figure 10 shows the development of communal heat networks in London over the years.

In 2020 there has been a significant change to the heat supply for these dwellings, with **37 communal heat networks supplied by heat pumps, eclipsing for the first time those supplied by CHP (29).** This is a significant development that highlights the leading role London is playing in adopting up-to-date emission factors to drive the decarbonisation of buildings. See 'be green' for further details about the number of heat pumps proposed. Now that the new London Plan is in place this trend is expected to continue, with low emission CHP limited only to sites that can facilitate the delivery of an area-wide heat network.

The London Plan is driving heat network development

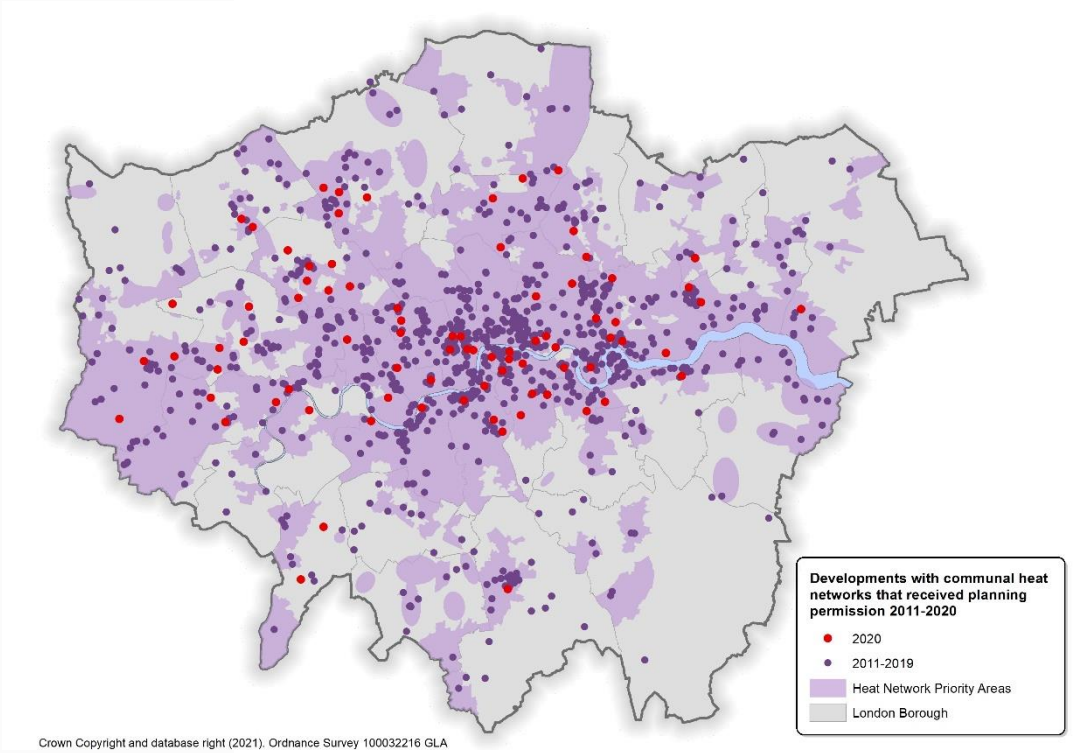


Figure 10: Distribution of developments committed to providing site-wide heat networks

On-site Combined Heat and Power (CHP)

In 2020, 29 developments (21 per cent) proposed to install on-site CHP with a total capacity of approximately 8.2 MW. Compared to 2019 this represents a further 15 per cent decline in the proportion of developments installing this technology, and an accompanying reduction in total electrical CHP capacity and investment. This reduction is due in large part to transitioning to the new London Plan policies. Additionally, the typologies proposed in 2020 were less suitable for on-site CHP and there were fewer large-scale developments which would typically enable the development of an area-wide CHP DHN.

Since January 2019, the GLA has discouraged gas-engine CHP on small-medium sites due to their adverse air quality impact and because such schemes do not typically have the potential to offer high electrical efficiencies and therefore high carbon savings. **Consequently, there has been a year-on-year decrease in the proportion of developments proposing CHP.** This is further strengthened by the new London Plan heating hierarchy now in place which limits the role of low emission CHP to where it can enable the delivery of an area-wide heat network.

Table 5 sets out the number of CHP installations proposed, their scale and the total electrical capacity. The proportion of smaller scale CHP units up to 100kWe remains high at 55 per cent of all CHP schemes though these are predominantly legacy schemes. In future, this will decline with small CHP units being replaced by lower carbon solutions such as heat pumps utilising low grade waste or environmental heat sources.

Table 5 also shows that there were five larger developments proposing CHP installations >500kWe, making up more than 70 per cent of the total electrical capacity. Larger developments, especially those with a mix of building types with complementary heat demand profiles, can form the nucleus for area-wide DHNs.

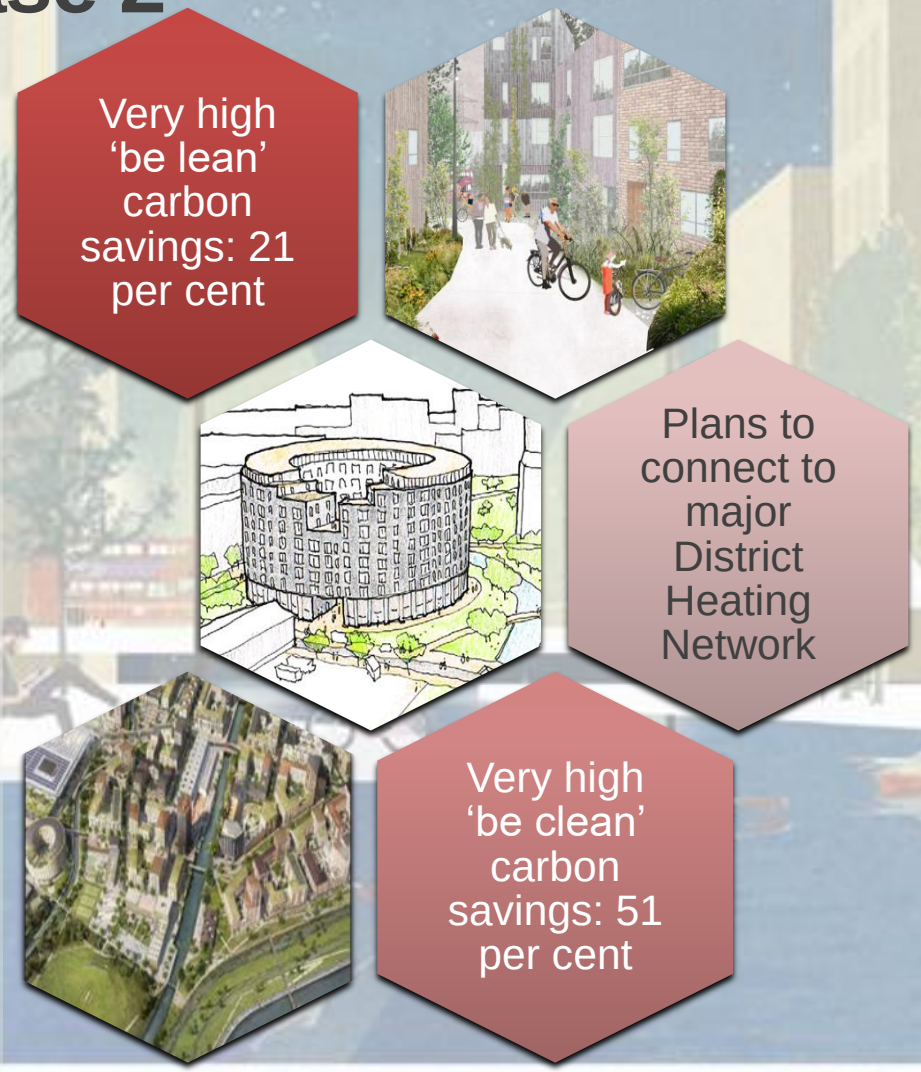
CHP engine (kWe)	Number of installations	Total electrical capacity (kW_e)
Up to 100kWe	16	756
100 – 500kWe	8	1,570
Above 500kWe	5	5,830
Total	**29**	**8,156**

Table 5: Number of CHP installations and total electrical capacity proposed by CHP size

Case study 2: Meridian Water Phase 2

Meridian Water Phase 2 covers approximately 12 hectares of residential-led mixed use redevelopment in the London Borough of Enfield. It is the second phase in the development of Meridian Water, comprising up to 2,030 residential units, a hotel, commercial development; retail, social infrastructure, and a primary school. Highlights include:

- **76 per cent total carbon savings** achieved on site, far beyond the 35 per cent minimum target.
- **'Be lean':** measures to reduce energy demand include enhanced building fabric and air tightness (70 per cent better than Part L limiting values), and high efficiency glazing, achieving 21 per cent carbon savings from energy efficiency. East to west orientations will limit solar gain during the summer, as will shading which will still allow solar gain and daylight throughout winter. As well as limiting internal gains with high efficiency appliances and passive design, the presence of trees, green roofs, high albedo materials, openable windows and ground floor ventilation grates all help to reduce the risk of overheating.
- **'Be clean':** One of the largest proposed heat networks in London, the Lee Valley Heat Network (LVHN), is under development in Enfield. The Meridian Water Heat Network (MWHN) is one of five planned energy centres for the LHVN which is set to supply 10,000 new homes with heat by 2037. The intention is for the network to take very low carbon heat from the new Energy Recovery Facility at Edmonton EcoPark from 2027.
- **'Be green':** 20 per cent of the roof area will benefit from PV panels, contributing a further 4 per cent to overall carbon savings.



Picture credits: Karakusevic Carson architects, Periscope & ARUP

‘Be green’

Solar energy

In 2020, 117 developments proposed to install PV resulting expected new solar PV capacity of 14.7MWp (up from 6.7MWp in 2019). This is an area of 87,099m^2 of PV panels with an average installation area of 744m^2. This is more than double the proposed PV area of 39,599m^2 in 2019, when the average installation area was 364m^2. **Even allowing for the lower (108) number of applications in 2019 this reflects a very encouraging increase in the inclusion of PV by applicants.**

We estimate this equates to an investment of almost £17 million, with almost 84 per cent of applicants proposing solar PV this year (compared with 78 per cent in 2019).

The total area of solar PV per 1,000m^2 of floor area is significantly greater than that of 2019 (24.7m^{2}PV/1000m^2 in 2020 compared to 15.7m^{2}PV/1000m^2). This is due to a higher proportion of developments proposing a solar PV array compared to 2019 and a larger average array size across all developments. Outer London planning authorities like Barking and Dagenham, Harrow and Enfield proposed the highest area of PV in 2020, with Southwark proposing the highest of the inner boroughs.

Case Study 3 (337 – 359 Kingsland Road) includes a total area of 369m^2 of PV panels, with a peak output of 55kWp.

A vast increase in solar PV capacity

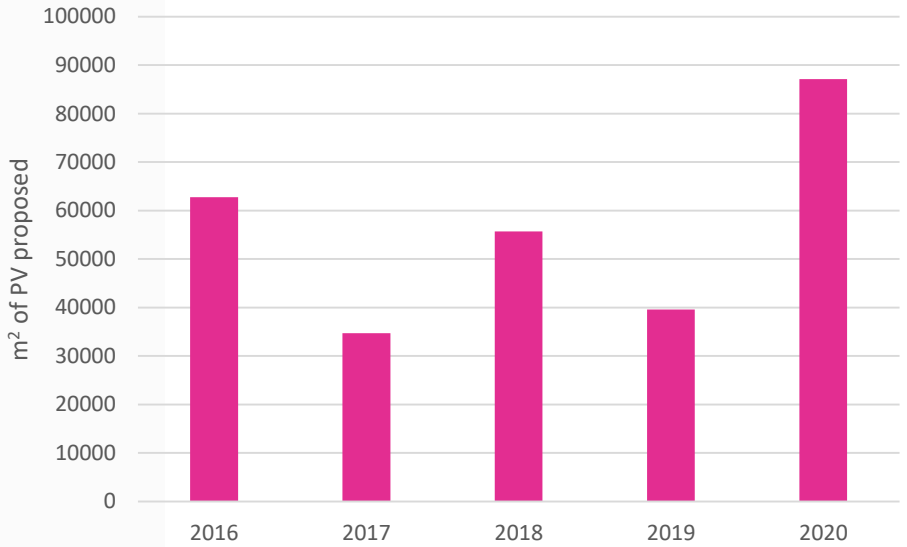


Figure 11: Total PV area (m^2) proposed per annum

Heat pumps

In 2020, 57 developments committed to installing a heat pump, compared with 43 heat pump installations in 2019. The 2020 proposals included 37 developments planning to install Air Source Heat Pumps, one Ground Source Heat Pump, with the remaining 19 developments putting forward hybrid proposals, comprising an ASHP with gas boilers for peak generation. Case Study 3 (337-359 Kingsland Road) is a hybrid proposal which includes a 600kWth ASHP.

Crucial to the migration away from gas, 42 per cent of developments including a heat pump in 2020 served residential or mixed–use developments compared with only 26 per cent in 2019. Even more significantly, a total of 37 from the 57 that were proposed in 2020 were centralised heat pump installations, compared with 14 in 2019. Figure 12 shows the capacity split by typology with mixed-use developments making up over half of heat pump capacity.

Of the 37 centralised installations, 24 will serve residential units, and all 24 were large scale (>25kW) heat pumps. These large scale heat pump installations are well suited to serve mixed-use developments from a centralised energy centre. **It is encouraging to see centralised heat pumps of this scale serving residential units, which in the past would have been served by a CHP-led network.** The remaining 13 centralised installations served non-residential developments.

With the number of applications approved using SAP 10.0 emission factors increasing, we expect to see a continuation in the larger number of heat pump proposals coming forward, particularly with centralised heat pump applications supplying residential or mixed-use schemes.

The London Plan is driving more residential heat pump installations

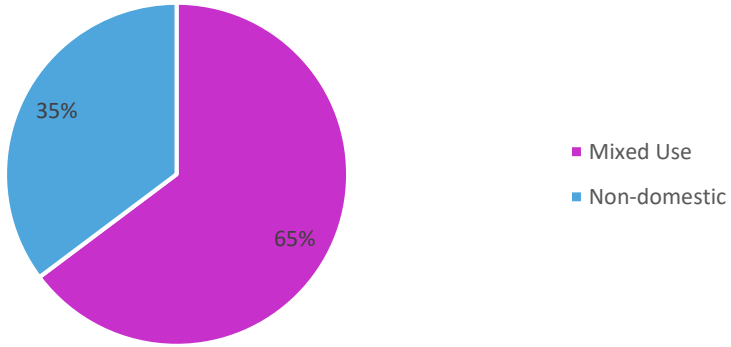


Figure 12: Percentage of centralised heat pump capacity (kW) by development type

Case study 3: 337 - 359 Kingsland Road

The development of a 292-room hostel offering temporary accommodation is proposed for a triangular piece of cleared land at 337-359 Kingsland Road in the London Borough of Hackney. Highlights include:

- **58 per cent total carbon savings** achieved on-site, far beyond the on-site 35 per cent target.
- **'Be lean':** the applicant has been able to achieve very high energy efficiency savings of 20 per cent, having progressively improved specifications as planning has proceeded to exceed the new London Plan energy efficiency target of a 15 per cent carbon improvement beyond Part L.
- **Managing heat risk:** the development will have openable glazing with low g-value windows and external louvres in order to mitigate the risk of overheating.
- **'Be clean':** the lack of a district heating system in the vicinity to connect to means that savings from 'be clean' were not applicable to this single building development.
- '**Be green**': in line with London Plan policy the applicant has altered its original energy strategy by switching from gas-engine CHP to a hybrid system comprising a 600kWth heat pump together with gas boilers to meet peak demand.

Very high 'be lean' carbon savings: 20 per cent

Switched from CHP to heat pump

Very high 'be green' savings: 38 per cent

600kWth ASHP and 369 m^2 PV to be installed

Photo credits: XCO2

Conclusions

Conclusions

- **New developments in London are continuing to achieve far higher carbon savings than required by national policy.** In 2020, developments achieved an overall 46.2 per cent carbon reduction improvement on national Building Regulations, well beyond the London Plan minimum carbon reduction target of a minimum on-site 35 per cent improvement.
- **The Mayor's net zero carbon homes standard is driving greater on-site carbon reductions in the residential sector.** A similar trend is expected in the non-residential sector now that the new London Plan has been adopted with a net zero target for non-residential development.
- **Carbon offsetting continues to play a role in achieving the London Plan net zero carbon target**, with an estimated £38.8 million potentially available for collection by boroughs (compared to an estimated £30.6 million available for collection in 2019).
- **Although not formally adopted until March 2021, the awareness of the new London Plan energy efficiency targets has already led to further carbon savings** through building fabric improvements to reduce energy demand. Developments in 2020 achieved a 19.8 per cent reduction from energy efficiency measures; the highest ever.
- **London's pioneering approach to emission factors is creating the necessary shift away from gas-based heating solutions** in support of the Mayor's zero carbon and air quality ambitions. The number of gas-engine CHP units declined by a further 21 per cent compared to 2019 which itself had seen a similar year-on-year decrease.
- **The London Plan is driving heat network development with a significant increase in the number of dwellings which are expected to connect to existing DHNs** (8,771 compared to 6,571in 2019) **with decarbonisation plans**. Investment in heat network infrastructure has correspondingly increased from £66 million in 2019 to £88 million with the total number of dwellings connecting to a site-wide communal heat network or an area-wide DHN also rising to 30,943 compared to 26,344 in 2019.
- **New solar PV capacity continues to increase with a total PV area of 87,099m^2 proposed**, more than double the area proposed in 2019, and amounting to 14.7kWp of PV new capacity. This represents an investment of nearly £17 million with 83 per cent of applicants proposing solar PV this year.
- **The London Plan is driving the heat pump market in London**, including supplying the heat demand of homes. Of particular note is the number of centralised heat pumps specified, with 24 of these set to provide heat to more than 10,000 homes, compared with 2,200 in 2019.
- **London is leading the way on net zero carbon new build development.** The developments approved using SAP 10.0 emission factors are achieving higher overall carbon savings and higher energy efficiency savings.