Photo credit: PRP

Towards a net zero carbon London: Energy Monitoring Report 2021

DECEMBER 2022

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 2021, against the London Plan energy policies.

In 2021, a total of 138 referable planning applications[2] 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 including the number of dwellings and non-residential floor area. Floor areas are not collected for residential developments, so an assumption of **70 m² per dwelling** is used to provide the total values in the table.

Developments approved by the Mayor in 2021

Type	Number	Dwellings	Non-residential floor area (thousand m²)	Estimated residential floor area (thousand m²)
Mixed-use	89	35,393	550	2,479*
Residential	10	2,870	N/A	201*
Non-residential	39	N/A	1,250	N/A
Total	**138**	**38,263**	**1,800**	**2,680***

*assuming 70 m² per dwelling

Table 1: Total number and type of referable developments approved by the Mayor in 2021

[1] 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.

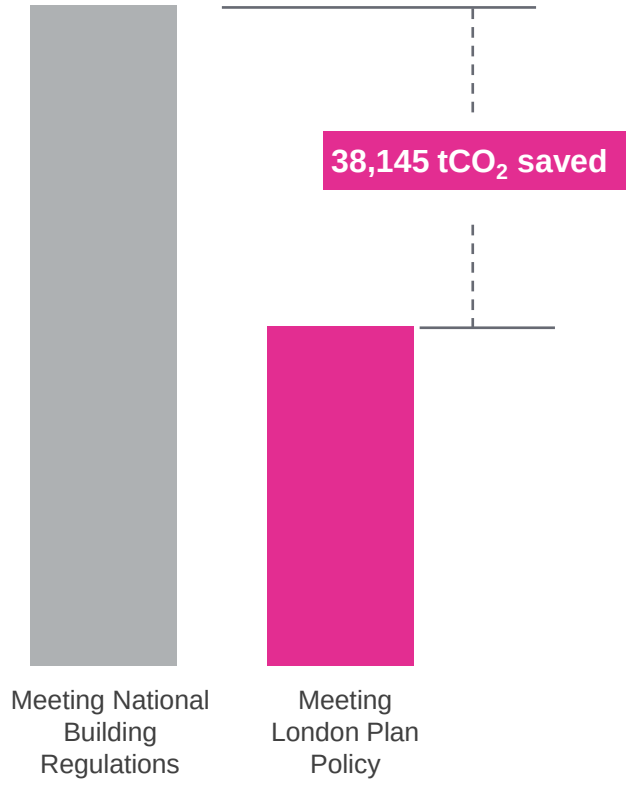
[2] 138 is the total number of planning applications that were referred to the GLA and gained planning approval and had an element of the proposal that could be assessed against London Plan Policy SI 2.

Key findings

London leads the way

London is committed to achieving net zero carbon emissions by 2030. Through the London Plan, the Mayor is ensuring that new buildings are playing their part in reaching this target, exceeding national buildings standards and showing what can be achieved, in partnership with the development sector, by setting higher levels of ambition.

- In 2021, London Plan policy **almost halved the amount of emissions from developments when compared to levels** required to meet **national Building Regulations**
- **38,145 tCO_2 saved in total,** equivalent to **32,000 return flights from London to New York**[3]
- **Energy efficiency measures alone saved 13,540 tCO_2,** equivalent to adding **loft insulation to over 20,000 homes**[4]
- **13** Wembley **football pitches of solar PV** proposed
- **31 developments** reported **Whole Life-Cycle Carbon emissions**



The London Plan is playing its part in achieving net zero carbon by 2030

[3]TravelNav.com
[4]Energy Saving Trust

2021 key findings

London continues to exceed national standards

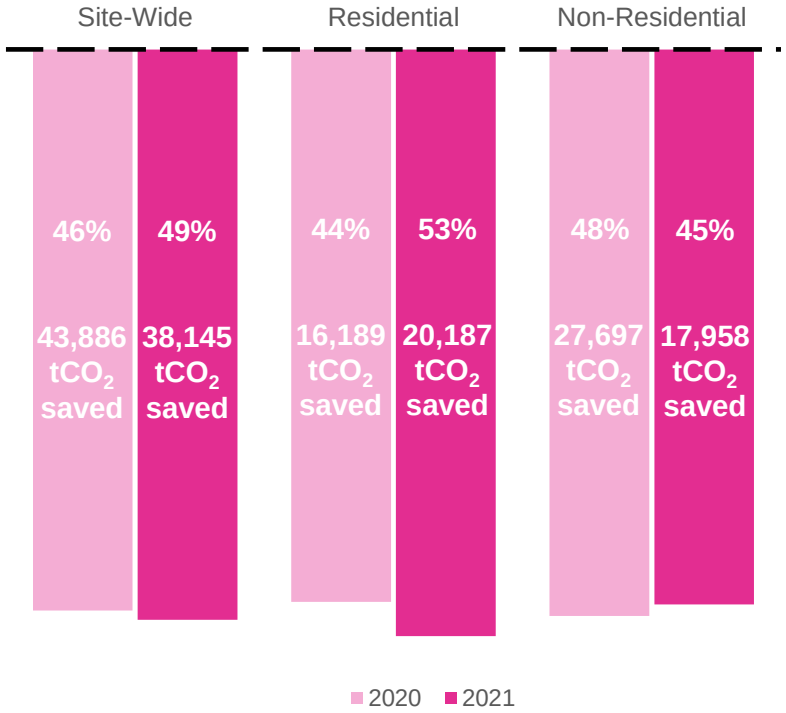
The 138 developments approved in 2021 achieved **an overall on-site carbon reduction of over 48 per cent** beyond 2013 Building Regulations, up from 46 per cent in 2020. This shows London continues to exceed its own 35 per cent improvement target and is far above national standards.

Residential: Almost all developments were subject to the net zero carbon homes target. They achieved an average of **53 per cent CO_2 reduction on Building Regulations**, up from **44 per cent** in 2020, driven mostly by an increase in 'be green' savings (see page 32).

Non-residential: Developments reached an average carbon saving of 44 per cent, down from 47 per cent in 2020. This was due to a combination of one specific, large development performing poorly, and a greater number of developments using the SAP 10 methodology. The **net zero carbon target was extended to non-residential developments** in March 2021 which should result in an increased level of savings next year.

Energy efficiency measures resulted in a **17.3 per cent carbon saving**. This is down from 20 per cent last year but exceeds all other reporting years. Residential developments achieved an average per development saving of **11.4 per cent** and non-residential developments achieved an average of **17.1 per cent**, exceeding their London Plan targets of 10 and 15 per cent respectively.

CO_2 reduction over Part L 2013 baseline



These energy efficiency savings help keep London's homes warmer in winter and residents' bills cheaper. It reflects the importance of local authorities retaining their powers to set standards higher than national regulations. Without these powers London would have achieved far lower savings and Londoners would have higher energy bills.

2021 key findings (1)

London at the forefront of low carbon heat and renewables

Supporting heat networks and reducing gas-based heating solutions: **Over 36,000 dwellings (96 per cent of all new dwellings) are expected to connect to a communal heat network or area-wide district heat network (DHN)**. This includes over 11,000 expected to connect to an existing DHN, compared to around 8,000 in 2020, in line with the estimated potential for heat networks to supply an additional 380,000 connections by 2030. **Only 9 developments proposed gas-engine Combined Heat and Power (CHP)** units in 2021, a big drop from 29 in 2020. London Plan policy prioritises DHN connections for their fuel flexibility and the important role they can play in decarbonising London's buildings.

Driving more heat pump installations: **London's introduction of the SAP 10.0 emission factors led 100 developments to include heat pumps in 2021, compared with 57 in 2020.** This included heat pumps being installed in new low carbon communal heat networks of which 68 per cent served residential or mixed-use developments compared with 51 per cent (29 developments) in 2020. In total, **over 23,000 dwellings were proposing to install heat pumps**, compared to over 10,000 in 2020. Over 1,390,000 m² of non-domestic floor area was proposed to be served by heat pumps, compared to over 770,000 m² in 2020.

New solar PV capacity: **Installation of 10.3 MWp,** down from 14.7 MWp in 2020, from an area of around **59,000 m² of solar PV** (equivalent 2020 figure was around 87,000 m²) leading to approximately **£16 million in new investment**. Although installations were generally smaller than in 2020 (15.5 m² PV/1000 m² floor area in 2021 vs 24.7 m² PV/1000 m² in 2020), a total of **87 per cent of developments have included solar PV,** up from 83 per cent in 2020.

Over 11,000 dwellings to connect to DHNs

£104m investment in new heat network infrastructure

100 developments with heat pumps (57 in 2020)

10.3 MWp of solar PV proposed

2021 key findings (2)

Managing London's heat risk and cooling demand

Overheating: **91 out of 138 developments submitted a dynamic overheating assessment,** up from 72 out of 140 in 2020 representing a 26.4 per cent increase**.**

Cooling: **88 developments proposed active cooling, an increase compared to 75 in 2020.** The **total cooling consumption (15.8 GWh/yr) also increased by 70 per cent compared with 2020.** This increase was largely due to a single data centre development with an exceptionally high cooling load, representing 9.9 of the 15.8 GWh/yr total cooling consumption. In general, following the Mayor's cooling hierarchy ensures cooling demand is kept to a minimum. Active cooling is only proposed when it is deemed necessary and where site constraints prevent passive measures.

26% increase in dynamic overheating assessments secured

Offsetting and Whole Life-Cycle Carbon

Carbon offset payments: An estimated **£44.4 million potentially available for collection by boroughs**. For details of the sums being collected and how they are being spent please see the Mayor's Annual Carbon Offset Funds Report.

Whole Life-Cycle Carbon (WLC): **London is the first city in the UK to require WLC assessments** for all building development types and **31 applications were required to report WLC emissions.** In general, **these developments were able to improve their performance beyond the WLC benchmarks**, but the aspirational benchmarks were more challenging to meet.

£44.4 million from carbon offsetting

31 developments required to report WLC emissions

Photo credit PRP

Overview

The role of the planning system in the climate emergency

Pathways to Net Zero Carbon by 2030

The Mayor of London has declared a climate emergency and is aiming for London to be net zero carbon by 2030.

To support this ambition, London has adopted an **Accelerated Green** pathway, balancing **urgency, ambition, social justice and deliverability**. This will require **co-ordinated action** from the Mayor, LPAs, communities, businesses, financiers and the public sector.

There are **many benefits in achieving net zero**, including supporting tens of thousands of **jobs**; minimising global temperature rise and resulting climate impacts; improving health through **better air quality** and more active lifestyles; **reducing inequalities** and improving quality of life for all.

Planning and Net Zero Carbon

The **planning system plays an important role** in our response to the climate and ecological emergencies by reducing carbon emissions, **integrating adaptation measures** and resilience to the impacts of climate change; **improving air quality** and ensuring all new developments aspire to the **highest sustainability standards**. If we don't do this now, then we are only adding to the number of buildings that will need to be retrofitted and at a greater cost and disruption.

The London Plan's net zero carbon target applies to **all major planning applications** and year on year is incentivising on-site carbon reductions **far beyond national building regulations.** This progress is reported on an annual basis through our publicy available energy monitoring reports.

The London Plan is key in ensuring new developments play their part in responding to the climate emergency by minimising carbon emissions, ensuring resilience to the impacts of climate change and reaching net zero by 2030

Meeting the net zero carbon target

The London Plan requires all major developments* to achieve net zero carbon. There is a ***minimum*** **requirement for a 35 per cent on-site carbon improvement** on national Building Regulations.

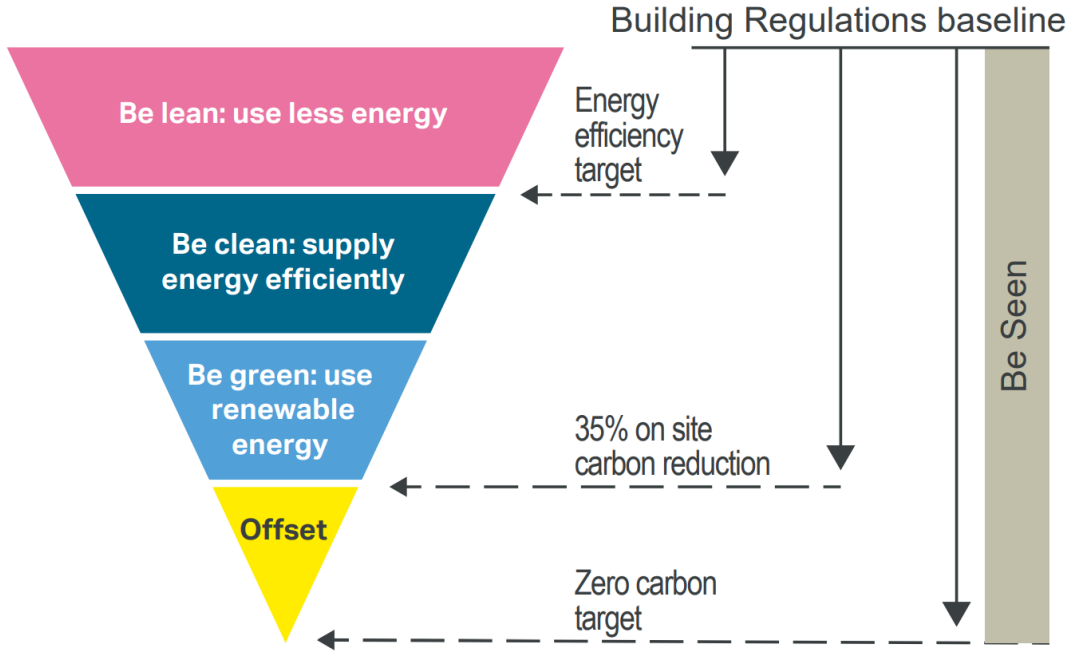
Beyond this, and once on-site carbon reductions have been maximised, the shortfall to zero carbon is offset by making a cash-in-lieu contribution into the relevant Local Planning Authorities (LPA) carbon offset fund.

To meet the target, planning applicants are expected to follow the energy hierarchy:

- **'Be Lean'** – use less energy
- **'Be Clean'** – supply energy efficiently and cleanly
- **'Be Green'** – maximise renewable energy
- **'Be Seen'** – monitor, verify and report energy performance

Planning applicants are expected to maximise savings on-site before paying to offset their residual carbon emissions

The Energy Hierarchy



*those with 10 or more units and those with >1,000 m^2 of floorspace, not just those referred to the Mayor

London’s approach to carbon emission factors

Since January 2019**, the Mayor has encouraged applicants submitting referable planning applications to use the SAP 10.0** carbon emission factors. This more accurately reflects the decarbonisation of the electricity grid, **which encourages** electrically-based low carbon heating, such as **heat pumps**, instead of gas-based solutions, such as gas boilers and gas-engine CHP.

Referable developments with potential to connect to a **DHN may continue to use SAP 2012 emission factors**, provided the heat network operator submits an acceptable decarbonisation strategy to the Mayor. **This supports London Plan policy** to encourage the **expansion and decarbonisation of heat networks** - see the 2020 Energy Assessment Guidance for further information - as they have an important part to play in our future low carbon, flexible energy system.

With the adoption of Part L 2021 (and SAP 10.2) coming into effect on 15th June 2022, this approach will no longer be required for planning applications subject to the new building regulations.

What does this mean for the developments approved in 2021?

111 of the 138 developments approved in 2021 **used the SAP 10.0** carbon emission factors. This process promotes a clear trend towards low carbon solutions such as heat pumps, instead of gas-based systems, enabling generally higher energy efficiency savings and higher on-site carbon savings overall.

The remaining **27 developments were either submitted before** this approach took effect or were **connecting to an existing heat network which has a decarbonisation strategy** and were therefore approved using the SAP 2012 emission factors.

Figure 1: Proportion of applicants using SAP 10 vs SAP 2012

Whole life-cycle carbon emissions reporting

For the **first time, this report includes the whole life-cycle carbon (WLC) emissions reported by referable developments in London** in response to the new WLC policy. Prior to this, only the operational emissions have been reported.

A WLC approach takes account of a development's total carbon impact i.e. its **embodied carbon emissions** as well as its operational emissions. **London is the first city in the UK to require WLC assessments from all new building developments**.

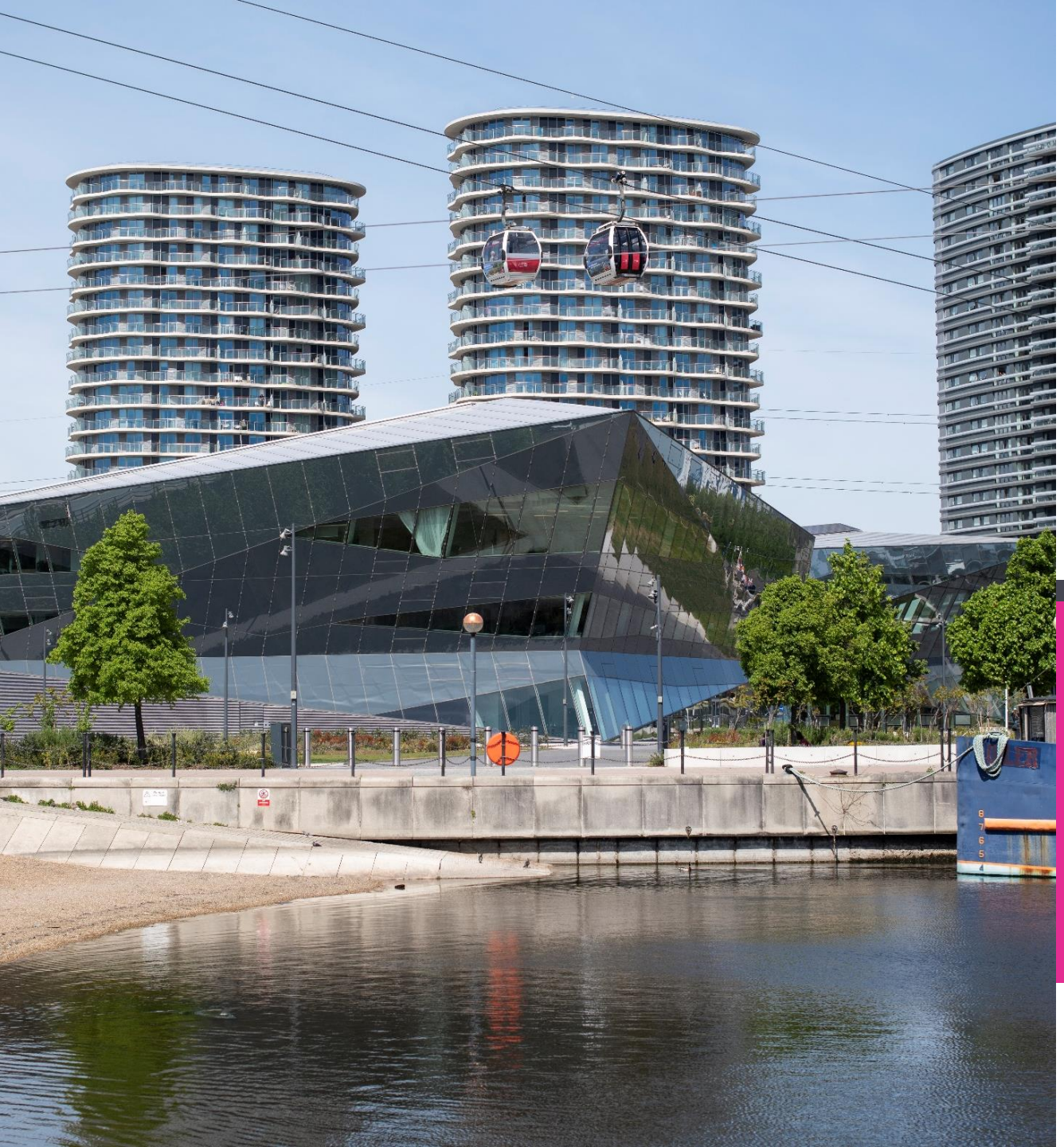
Since September 2020, the Mayor has encouraged applicants submitting referable planning applications to calculate and then work to reduce the WLC emissions of their proposals. This requirement was **formally brought into effect in March 2021** through Policy SI 2 when London Plan 2021 was published.

In 2021, **31 developments which were required to report WLC emissions were approved by the Mayor**. The majority of these developments are mixed-use residential-led schemes.

As the first UK city to require WLC assessments for all new developments, London is again leading the way in tackling the climate emergency

WLC assessments calculate and reduce emissions across a development's life-time using the following life-cycle modules:

- Module A (Product sourcing and construction stage)
  - Including materials extraction and transportation
- Module B (Use stage)
  - Including maintenance/repair and replacement, and in-use energy usage
- Module C (End of life stage)
  - Including demolition and disposal
- Module D (Benefits and loads beyond the system boundary)
  - Including reuse and recycling potential



Overall results

Total on-site carbon savings

An overall carbon reduction of **48.6 per cent** (up from 46.2 per cent in 2020) more than required by the 2013 Building Regulations was secured for the 138 developments approved in 2021.

- **38,145 tonnes CO_2** saved in total
- **20,187 tonnes CO_2 from residential developments** (52.9 per cent savings, up from 44 per cent in 2020)
- **17,958 tonnes CO_2 from non-residential developments** (equating to 44.6 per cent, down from 48 per cent in 2020)

The increase in savings is due to a rise in 'be green' savings. **London's pioneering use of SAP 10.0 emission factors** as the basis for energy assessments is **generating the higher carbon savings** from this part of the energy hierarchy and is fostering a faster transition from fossil-based technologies to lower carbon technologies.

The Mayor's policies demonstrate the potential for raising building regulation standards in response to the climate emergency

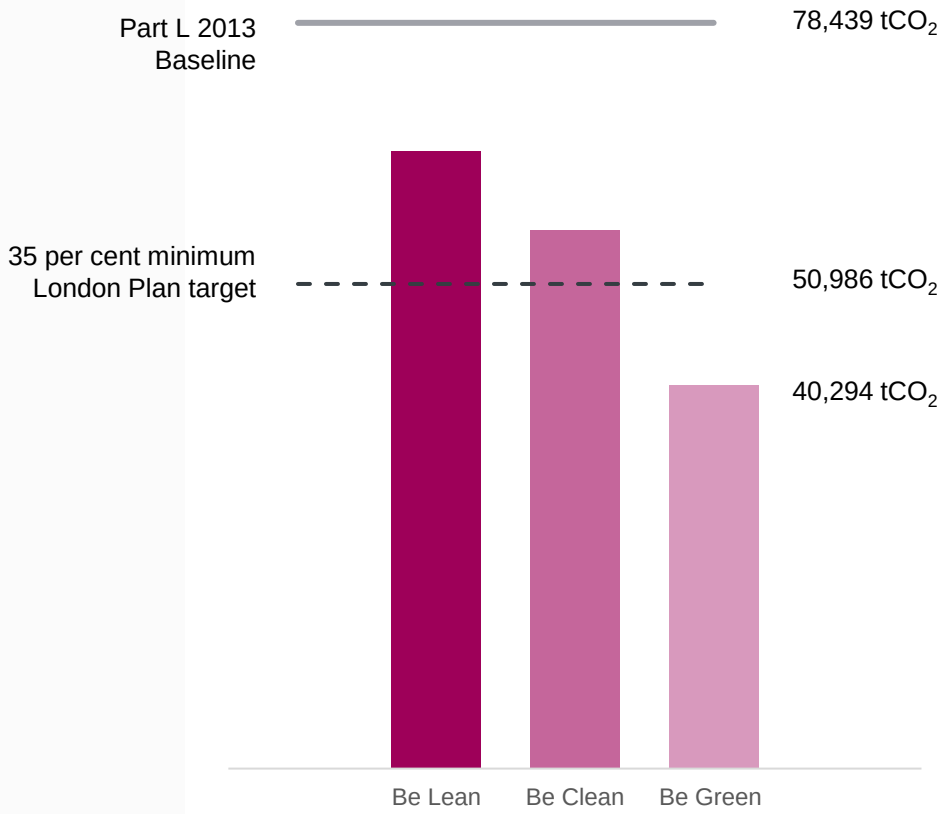


Figure 2: Site-wide carbon emissions after each stage of the energy hierarchy

Carbon savings breakdown

Be Lean

17.3 per cent CO_2 reduction (19.8 per cent in 2020). This is a decrease from last year but the ‘be lean’ stage remains a major proportion of savings. This is in line with London Plan policy to reduce energy demand and prioritise efficiency. See the ‘be lean’ section for further analysis.

Be Clean

10.5 per cent CO_2 reduction (11.5 per cent in 2020) resulting from an estimated £104.5m investment in heat network infrastructure and £5.1m for approximately 7.4 MWe CHP capacity (down from 8.2 MWe in 2020). For the last five years this hierarchy stage has shrunk significantly, largely due to gas-engine CHP being discouraged except where it can stimulate area wide DHNs.** See the ‘be clean’ section for further analysis.

Be Green

20.8 per cent CO_2 reduction (14.9 per cent in 2020), largely from 100 developments with heat pumps, a big increase on previous years (57 in 2020). ‘Be green’ now makes up the largest proportion of CO_2 savings. There are also 120 developments installing 10.3 MWp of solar PV (down from 14.7 MWp in 2020) with an estimated area of 84,400 m^2 and new investment of around £16m. See the ‘be green’ section for further analysis.

*Appendix 1 sets out the total carbon emissions and savings achieved against each stage of the energy hierarchy
**See Case Studies 3 (1-8 Capitol Way) and 4 (Geoffrey Close Estate).

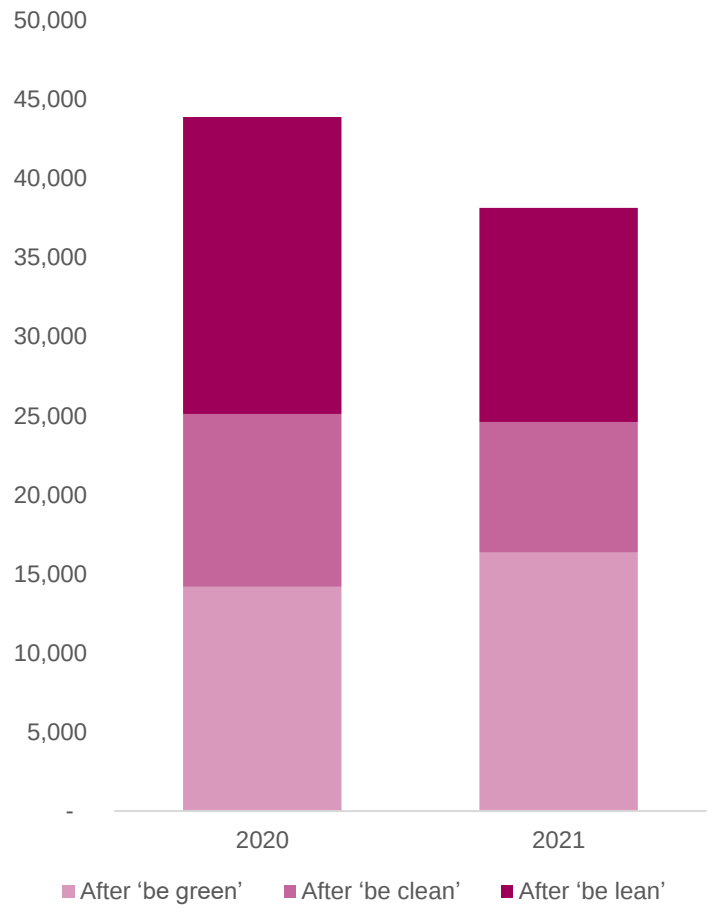


Figure 3: Breakdown of total tCO_2 savings by each stage of the energy hierarchy for all referable developments

Distribution of carbon savings

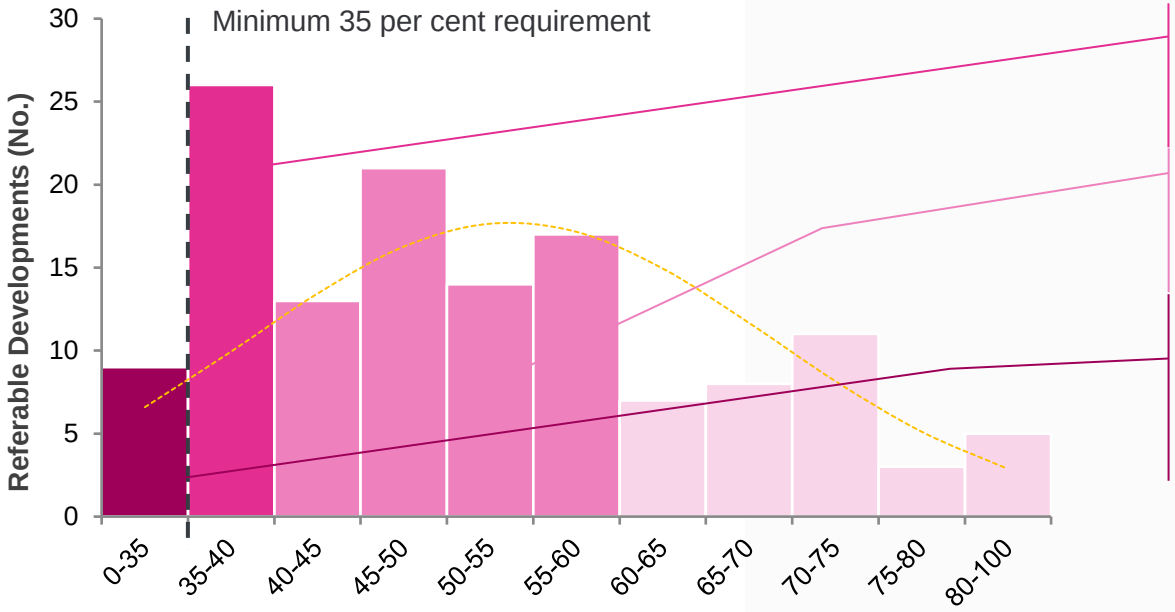


Figure 4: Range, frequency and distribution of CO_2 savings (per cent) achieved in 2021

Most developments achieved a 35-40 per cent improvement beyond Building Regulations, which was also the case in 2020.

47 per cent of developments **achieved 40-60 per cent, vs 34 per cent in 2020** maintaining an increasing trend of securing far greater savings than the minimum target.

9 developments missed the 35 per cent target, fewer than half of those in 2020, with many of them missing by less than one per cent. The others were either not suitable for heat pumps or DHN connection.

93 per cent of developments met or exceeded the minimum 35 per cent on-site target, a 7 per cent improvement on 2020

The highest saving achieved was 97 per cent, an infill development with significant roof space available for solar PV

Developments that significantly exceeded the target were largely able to through a combination of 'be green' and 'be lean' savings (Case Studies 1, 2, and 4).

London's early adoption of SAP 10 emission factors to promote low carbon heat technologies like heat **pumps has facilitated a considerable increase in 'be green' savings** (see page 12).

Several developments also achieved high savings from 'be clean' through connection to low carbon DHNs (Case Study 3).

Appendix 1 sets out the total carbon emissions and savings achieved against each stage of the energy hierarchy

Carbon offsetting

Carbon offsetting is a last resort measure in meeting the London Plan's net zero target, but it does provide flexibility where further on-site savings cannot be affordably achieved. Carbon **offset funds are funding carbon reduction projects across London in support of London's net zero carbon target.** Examples include retrofit and renewable energy projects.

The Mayor's **recommended carbon offset price is £95/tonne**. Alternatively, boroughs can apply their own locally-set price.

It is estimated that up to £44.4 million could ultimately be collected by boroughs from referable developments that have gone through planning between January and December 2021.

The figures above and in the chart 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 that is only utilised when on-site carbon savings have been maximised

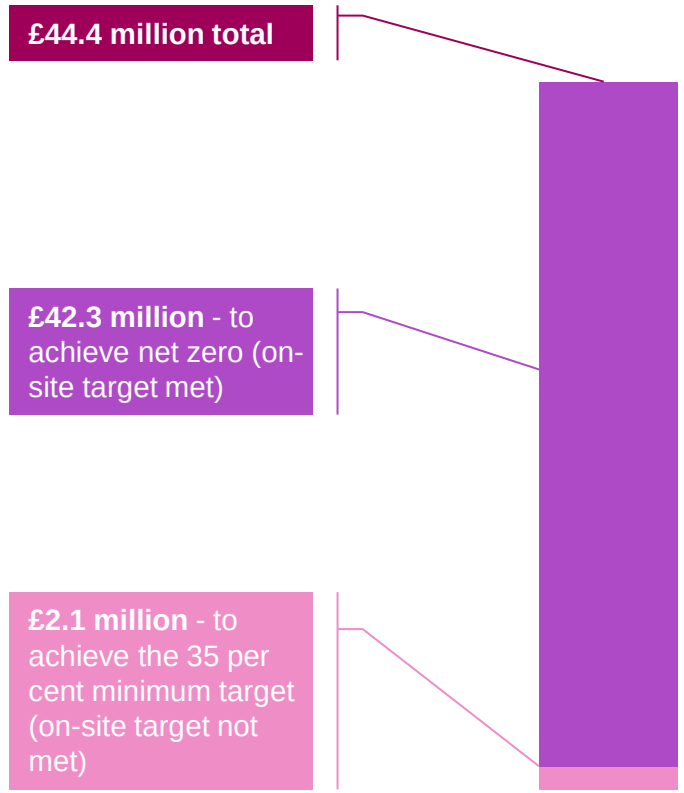


Figure 5: Estimated carbon offset amounts for 2021

Whole life-cycle carbon emissions

On average, **the developments which reported WLC emissions were able to improve performance beyond the WLC benchmarks**, but the aspirational benchmarks were more challenging to meet. A **key proposal** for reducing emissions from almost all applications was the use of **recycled content in concrete and rebar**.

However, as this is the first time WLC reporting has been required at this stage of a building's design it may be that there is only limited information available for some building element categories, meaning these emissions could not be accounted for. **Applicants are expected to report as detailed information as possible** and use estimates or default values when information is limited.

Next year we expect a more comprehensive dataset to be available, in response to market demand, as **more applicants will be subject to the WLC policy** and will have more experience of reporting WLC emissions at this stage of building design. This **will enable us to start identifying trends** and approaches and highlight common and best practice solutions for reducing a development's WLC emissions.

A: Product sourcing and construction stage B: Use stage C: End of life stage	**Module A (kg CO_2e/m^2 GIA)**	**Module B1-B5 and C (kg CO_2e/m^2 GIA)**	**Total (kg CO_2e/ m^2 GIA)**
Reported CO_2 emissions	691	330	**1,021**
WLC residential benchmarks	<850	<350	**<1,200**
Aspirational WLC residential benchmarks	<500	<300	**<800**

Table 2: WLC emissions reported against benchmarks

NB: the figures above do not include the impact of grid decarbonisation. Also, while most applications were mixed-use schemes, applicants are required to report performance against the benchmarks for the dominant use which is why the table above shows comparison against the residential benchmarks only. Actual comparison may therefore be slightly different in practice.

Progress against the WLC benchmarks has been positive, but better datasets and alternative materials along with improved reporting in the future will allow us to identify opportunity for improvement along with trends and best practice solutions

Borough highlights

Opportunities for carbon savings vary between 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.

City of London achieved a **23 per cent CO_2 reduction** across six referable developments from **fabric first measures** through '**be lean**'.

Enfield secured **DHN connections for nearly 2,000 homes**. The Meridian Water Heat Network will take very low carbon heat from the new Energy Recovery Facility at Edmonton EcoPark from 2026.

Hounslow achieved a **25 per cent 'be green'** CO_2 reduction from air source heat pumps, hybrid systems, and an ambient loop together with PV.

Lewisham sees significant savings **across the whole energy hierarchy,** with seven developments achieving energy efficiency targets and substantial contributions from heat pumps and PV, as well as **3 connections to the SELCHP District Heating Network**.

City of London

Six referable developments expected to achieve a:

23 per cent reduction from energy efficiency measures ('be lean')

Enfield

Three referable developments expected to achieve a:

63 per cent CO_2 savings from DHN connections ('be clean')

Hounslow

Six referable developments expected to achieve a:

25 per cent CO_2 savings from renewable energy ('be green')

Lewisham

Seven referable developments expected to achieve a:

58 per cent total CO_2 reduction

‘Be lean’

‘Be lean’: Residential

Planning applications for residential developments in 2021:

- achieved on average an **11.4 per cent** reduction in CO_2 emissions from energy efficiency measures alone, exceeding the 10 per cent energy efficiency target.
- Have maintained an **increase in energy efficiency savings over the last three years**.
- Reduction in the number of developments missing the energy efficiency target compared to 2020.

The energy efficiency target only came into place part way through 2021 and there were a minority of legacy cases that were not subject to the 10 per cent minimum reduction target. However, **almost all of these developments met the minimum 35 per cent target** through savings in other stages of the energy hierarchy.

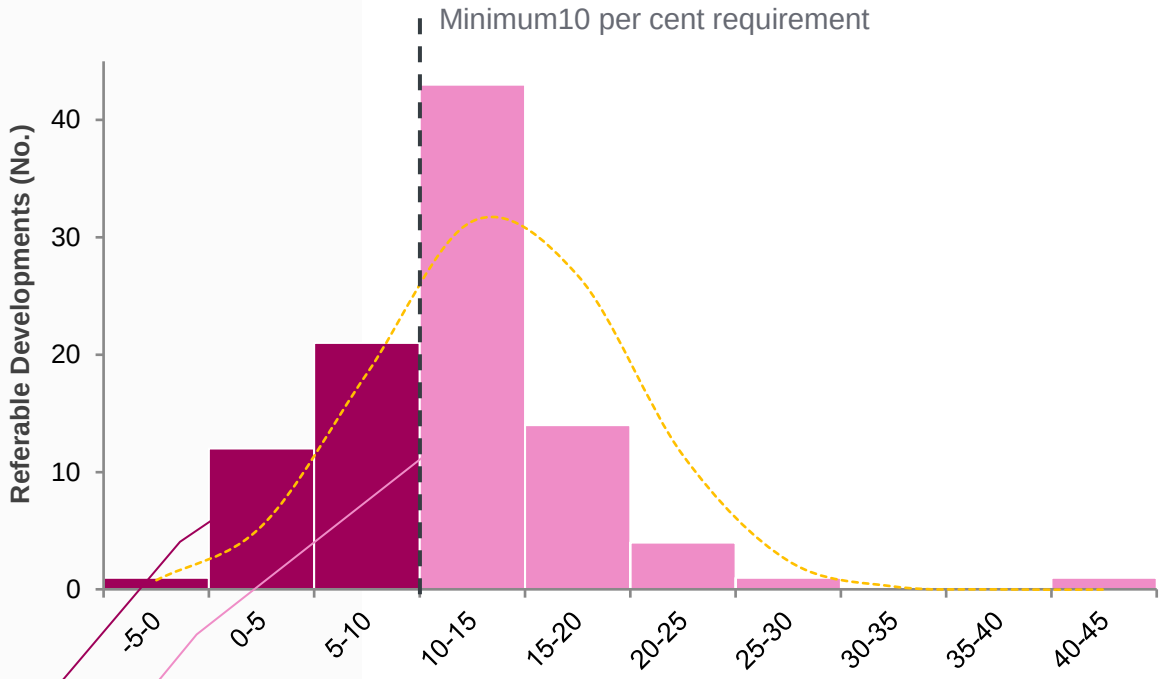


Figure 6: CO_2 savings (per cent) achieved from ‘be lean’ measures for residential developments

The majority of developments that failed to meet the 10 per cent target did so only marginally e.g. less than 2 per cent

Developments meeting the energy efficiency target used high specification fabric and glazing and paid careful attention to thermal bridging and air tightness, usually with Mechanical Ventilation and Heat Recovery. They exhibit a well-integrated approach making effective use of passive design opportunities too.

The Mayor’s ambitious energy efficiency target influences applicants’ design decisions, reducing energy demand, CO_2 emissions and energy bills

‘Be lean’: Non-residential

Planning applications for non-residential developments in 2021:

- secured on average a **17.3 per cent** carbon reduction from energy efficiency measures alone, a big increase from 14.7 per cent in 2020.
- 65 per cent of non-residential developments **exceeded the** non-residential energy efficiency **target** (15 per cent improvement on Building Regulations) adopted in 2021.

This is a major achievement when compared to previous years and demonstrates how the Mayor’s policies continue to drive energy efficiency.* The majority of savings typically arise from lighting and ventilation system efficiencies being significantly better than the notional levels.

Many of the developments which failed to reach the 15 per cent target had a high hot water demand (e.g. hotel and sports facilities) making the target more challenging. While some also had on average a much smaller proportion of non-residential floor space.

There were three cases where the non-residential element did not reach the Building Regulations baseline through ‘be lean’ measures alone. Whereas one performed poorly overall, the other two failed marginally and also had much smaller non-residential elements compared to their residential element. However, both achieved the minimum 35 per cent on-site target after ‘be clean' and ‘be green' measures were accounted for.

*Case Study 2 is a good example of a 30 per cent CO_2 reduction from energy efficiency.

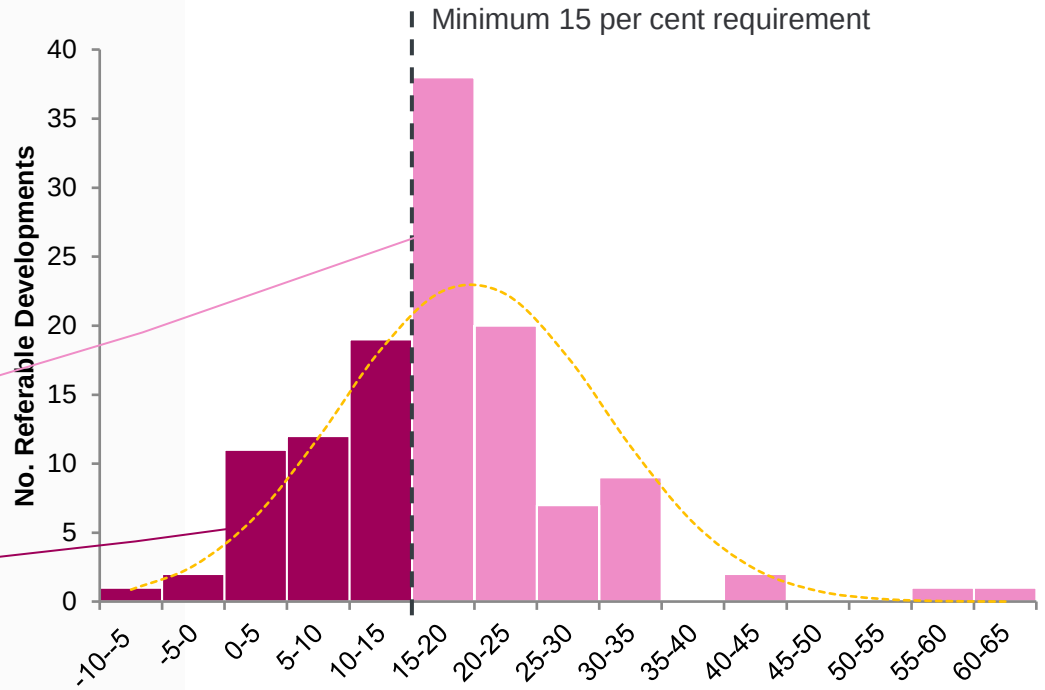


Figure 7: CO_2 savings (per cent) from ‘be lean’ measures for non-residential developments

65 per cent of non-residential developments met or surpassed the new target, up from 51 per cent in 2020

Overheating

The Mayor's cooling hierarchy (London Plan Policy SI 4) requires applicants to mitigate overheating risks using passive measures. **External shading is strongly encouraged,** as is solar control glazing, and these can significantly reduce solar heat gains while maintaining natural light.

Active cooling measures (e.g. air conditioning or air tempering) are discouraged in residential developments. Applicants should follow the cooling hierarchy and prioritise passive design solutions, such as external shading.

G-values

A g-value is a measure of solar heat gain through a window. For residential developments approved in 2021, **an average g-value of 0.42 was proposed,** a third lower than the Part L notional value of 0.63, demonstrating a good improvement on national regulations when specifically considering overheating risk.

G-values often vary with orientation. For non-domestic developments, cooling demands should be reduced below the figure calculated for the Part L notional building. Where reported, **77 of the 87 applications with a non-domestic element managed to reduce their cooling demand** below that of the notional building.

Tools for assessing overheating risk

To demonstrate the mitigation of overheating risk, **applicants are required to undertake a CIBSE** Technical Memorandum TM59 compliant **dynamic overheating assessment**. Non-residential developments with natural ventilation must use TM52.

91 (69 residential, 22 non-residential) submitted a TM59 or TM52 dynamic **overheating assessment**, up from 72 last year.

66 showed compliance (up from 52 last year) with the TM49 Design Summer Year (DSY) 1 weather file - representing summer conditions occurring every other year.

Preparing for higher temperatures in the future

It is becoming **increasingly important to mitigate overheating risk** as climate change leads to rising temperatures. To respond to this, the **Energy Assessment Guidance requires a more rigorous analysis** under the future weather files (DSY 2 and DSY 3). This helps applicants design developments that are well adapted for more prolonged warm spells and/or higher temperature peaks.

Cooling proposals

Residential – 1 residential only, and 10 mixed-use developments proposed residential active cooling. This represents 11.1 per cent of developments with a residential component, an increase from 5.6 per cent in 2020. **While active cooling is discouraged, it may be needed where site constraints prevent passive measures** from reducing overheating risk sufficiently.

Non-residential – 21 non-domestic only and 66 mixed-use developments proposed active cooling (68 per cent of developments with a non-domestic element, up from 62 per cent in 2020) and were **mostly offices and retail units**. Those not proposing cooling were typically schools, sports facilities, warehouses and some hotels.

The **total proposed cooling** reported was **15.8 GWh/yr - a pro rata increase of 70 per cent from 2020.** Typically, this is related to typology and locations of proposed developments having acoustic and air quality constraints which limit the applicability of passive measures. In 2021, **the proposed cooling increase was driven by a single data centre application with an exceptionally high cooling requirement** of 9.9 GWh/yr.

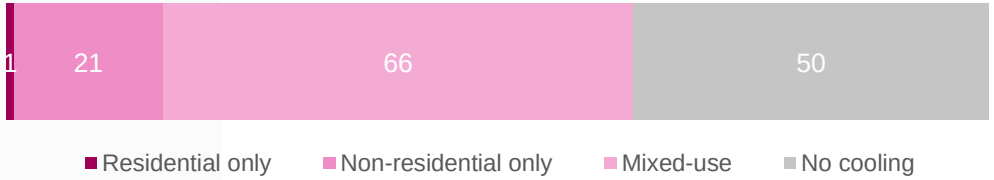


Figure 8: Number of developments proposing cooling by development type

As discussed on page 24, **the cooling hierarchy prioritises passive design measures to minimise any reliance on energy intensive active cooling measures**. As such, the number of overheating assessments undertaken increased in 2021. For developments that do propose active cooling, the demand calculated using the National Calculation Methodology (NCM) should be lower than the notional estimate.

Although the total proposed cooling reported in 2021 increased compared to 2020, in general, following the cooling hierarchy keeps cooling demand to a minimum

Case study 1: 267 Barking Road, East Ham

The disused Hartley Centre in **East Ham** in the London Borough of **Newham** is to be redeveloped into **84 dwellings and 1,646 m^2 of non-domestic floorspace**. The development performed very well in a number of areas:

Overheating: Dwellings will have openable windows, and additional air flow through the MVHR can be provided, bypassing the heat recovery. Free cooling will also be available to non-domestic elements which will have low g-value glazing to limit solar gain while maximising daylighting. Internal gains will be minimised throughout with LED lighting, highly insulated pipework and attention to unregulated energy use.

Energy efficiency: Kitchens will be fitted with A-rated appliances, meters with displays and guidance will be provided to occupants to promote energy efficient behaviours.

56 per cent total carbon savings achieved on-site.

Be Lean

18 per cent reduction in carbon emissions from energy efficiency measures alone

High standards of building fabric and air permeability

Reduction of thermal bridging (including accreditation)

Mechanical Ventilation with Heat Recovery

Be Clean

Designed for future DHN connection should this become available

Be Green

Site-wide heat network with centralised ASHPs of **total capacity 756 kW$_{th}$** to deliver **45 kWp**

Solar PV area of **205 m^2**

Photo credits: MAE

Case study 2: 70 Gracechurch Street

A new development comprising **33 upper storeys** for **offices, retail and hot food takeaway**. Highlights include:

Overheating: A curtain wall will include terracotta spandrels to reduce the glazing to façade ratio and provide shading. An evaporative cooling system will be installed and topped up with rainwater, with cooled water will be stored in the basement. It is expected that this will provide 90-100 per cent of the cooling requirement.

47 per cent total carbon savings achieved on-site.

Be Lean

30 per cent reduction in carbon emissions from energy efficiency measures alone.

Reduction of thermal bridging (including accreditation) plus bespoke elements.

Great care will be taken to **ensure air tightness is achieved**, with specific attention to vulnerable junctions and service openings.

Peaks in heating and cooling loads will be minimised through high levels of thermal mass, with office floors having exposed concrete soffits.

Be Clean

The development lies <1 km from a heat network. **Future DHN connection is secured** with a safeguarded pipe route to the site boundary.

Be Green

Water source heat pump with a cool water storage tank. It will provide both space heating and domestic hot water without additional top-up, and is projected to operate with an exceptionally high efficiency.

Photo credits: KPF

‘Be clean’

District heating network (DHN) connections

DHNs have an important role to play in London's path to net zero. They offer an **efficient and competitive low carbon solution for heating buildings** in high density areas and can make use of secondary energy and waste heat sources. 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 a heat network. If they are, **the applicant is expected to prioritise connection**, and connect either immediately or when the heat network expands to the site boundary.

If a heat network is planned and not yet in existence, **applicants must design an on-site solution which is future-proofed for later connection**. In this way, heat networks can serve a growing number of buildings in an area with low or zero carbon heat.

A total of 11,263 dwellings in 11 developments are expected to connect to an existing DHN. This is a substantial increase compared to last year (8,771 dwellings across 5 developments)

Connection type	Developments	Dwellings	Name of DHN
Existing DHN (immediate connection)	11	11,263	Colindale DHN, Kidbrooke Masterplan Network, Kings Crescent Phases 1 & 2, Grange Farm, Olympic Park, SELCHP.
Existing DHN (later connection)	3	143	Citigen, Royal Docks.
Future connection to proposed DHN	12	4,138	Elephant Park, Barking Town Centre, East London Biogas, Grand Union Masterplan, Kings Cross, Meridian Water Network, Royal Arsenal Riverside, Harrow View East Masterplan, Brentford Masterplan DHN, Kingston DHN, EOHN, Southall, VNEB.

Table 3: Number of developments and dwellings connecting to existing and proposed DHNs

Communal heat networks

A communal heat network connects individual dwellings on a site to a centralised site-wide heating system, which is more efficient for managing heat demand. Developments in Heat Network Priority Areas are expected to have communal networks to enable connection to a DHN in the future.

In 2021, a total of **36,745 dwellings are expected to connect** to a communal heat network or an area-wide DHN (**96 per cent of all dwellings**) – an increase on 83 per cent in 2020. Figure 9 shows the development of communal heat networks in London since 2011.

2021 saw a further shift to a low carbon heat supply for these dwellings, with **31 communal heat networks supplied by heat pumps, now far ahead those supplied by CHP (9).** This is an ongoing development that highlights the leading role London is playing by adopting up-to-date emission factors to drive decarbonisation. See 'be green' for further details about the number of heat pumps proposed.

The 2021 London Plan is expected to continue this trend, with low emission CHP limited to sites that can facilitate area-wide heat networks.

The London Plan is driving the development of low carbon heat networks and the decarbonisation of existing networks, including those supplied by heat pumps utilising low carbon heat sources

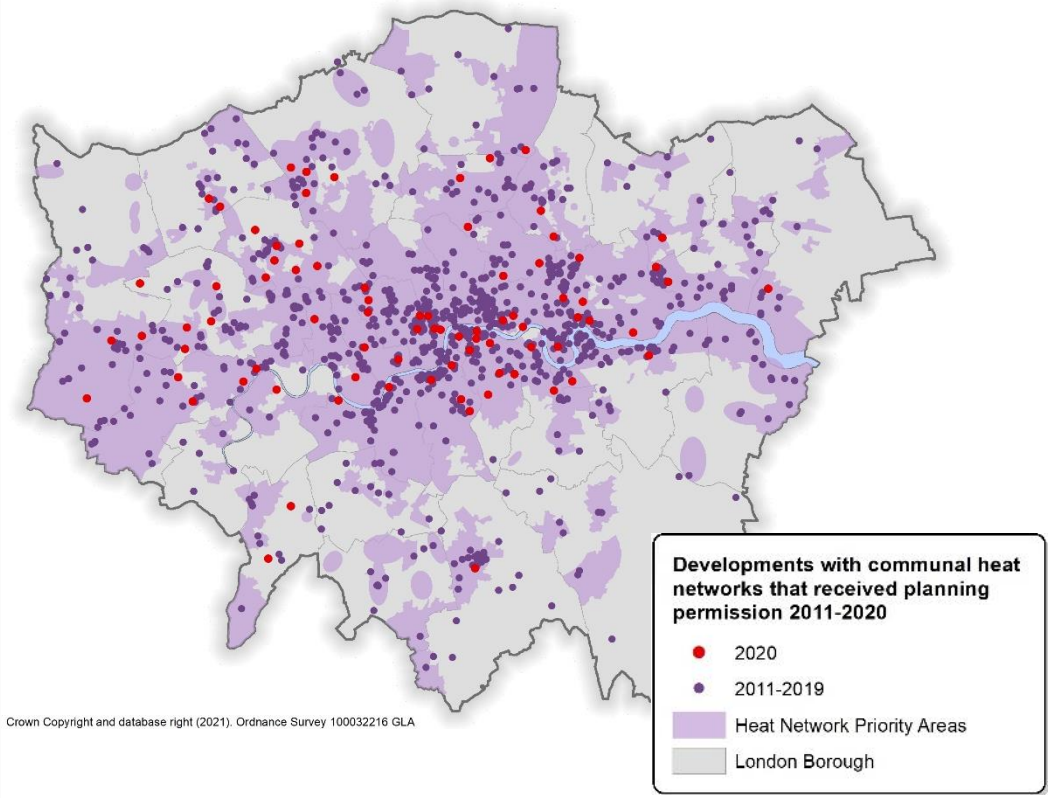


Figure 9: Distribution of developments committed to providing communal heat networks

On-site Combined Heat and Power (CHP)

In 2021, **9 developments (6.5 per cent) proposed to install on-site CHP** with a total electrical **capacity of approximately 7.4 MW**. Compared to 2020 this is a big drop in the number of CHP installations, but only a small drop in the total electrical CHP capacity. **This is due to a shift away from small CHP plant**, driven by new policy, towards lower carbon solutions such as heat pumps that are utilising low-grade waste or environmental heat sources.

Since January 2019, the GLA has discouraged gas-engine CHP on small-medium sites due to their:

- adverse air quality impact
- lack of high electrical efficiencies
- reduced carbon savings

The proportion of smaller scale CHP units up to 100 kW_e has fallen from 16 out of 29 in 2020 to just 2 out of 9 in 2021. **Table 4 shows how larger developments with CHP >500kW_e, make up nearly 88 per cent of the total installed electrical capacity**. Larger developments with a mix of building types, greater electrical demand and complementary heat demand profiles, can form the nucleus for area-wide heat networks.

The latest London Plan has driven a year-on-year decrease in developments proposing CHP. The heating hierarchy limits low emission CHP only to where it enables the delivery of an area-wide heat network

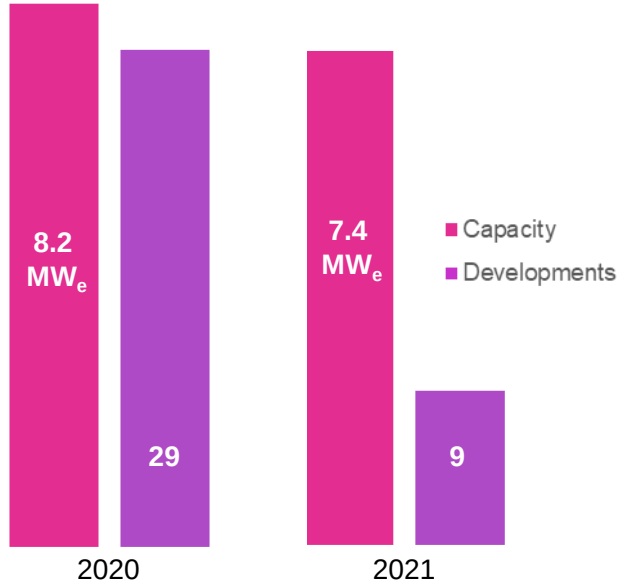


Figure 10: Change in CHP developments from 2020-2021

CHP engine	Number of installations	Total electrical capacity (kW_e)
Up to 100 kW_e	2	85
100-500 kW_e	3	816
Above 500 kW_e	4	6,510

Table 4: Total electrical capacity (kW_e) proposed by year

‘Be green’

Solar energy

In 2021, **120 developments proposed new solar PV capacity amounting to 10.3 MWp** (down from 14.7 MWp in 2020) from 87 per cent of developments (up from 83 per cent in 2020). We estimate **this equates to an investment of almost £16 million.**

This represents an area of **59,834 m²** (down from 87,099 m² in 2020), giving an **average installation area of 476 m²**. This is significantly less than in 2020, when there were several sites with very large PV installations. In addition, in 2021 there were more developments with larger floor areas but smaller roof areas (e.g. denser blocks of flats). The total area of solar PV per 1,000 m² of floor area in 2021 reduced from that observed in 2020 (15.7 vs 24.6 m² PV/1,000 m²).

Despite the **proportion of developments proposing** a solar PV array **increasing**, the **average** array **size reduced.** However, solar PV area is dependent on development type. Typically, higher density developments and those with rooftop amenity provide less solar PV area relative to the development area.

It is noted that **outer London planning authorities** like Brent and Barking & Dagenham **proposed the highest area of solar PV** in 2021, with Greenwich proposing the highest of the inner boroughs.

The area of solar PV panel proposed in 2021 would cover 13 Wembley football pitches

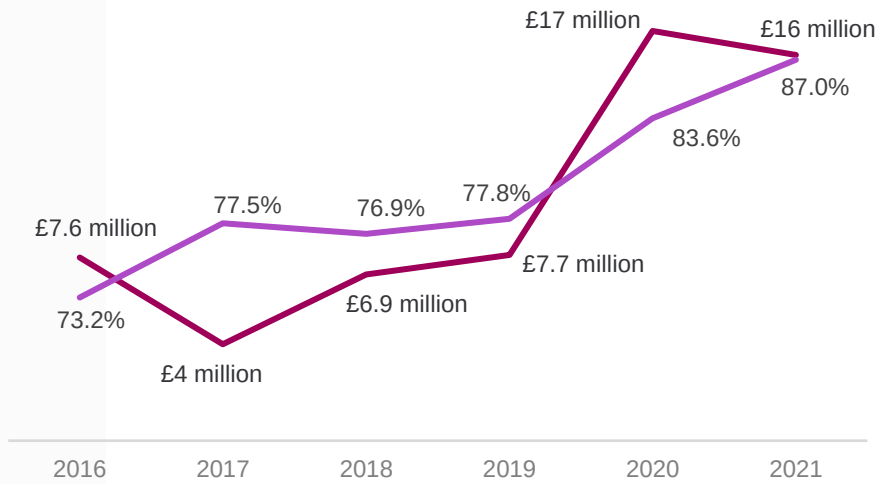


Figure 11: Proposed solar PV by percentage of developments and estimated investment

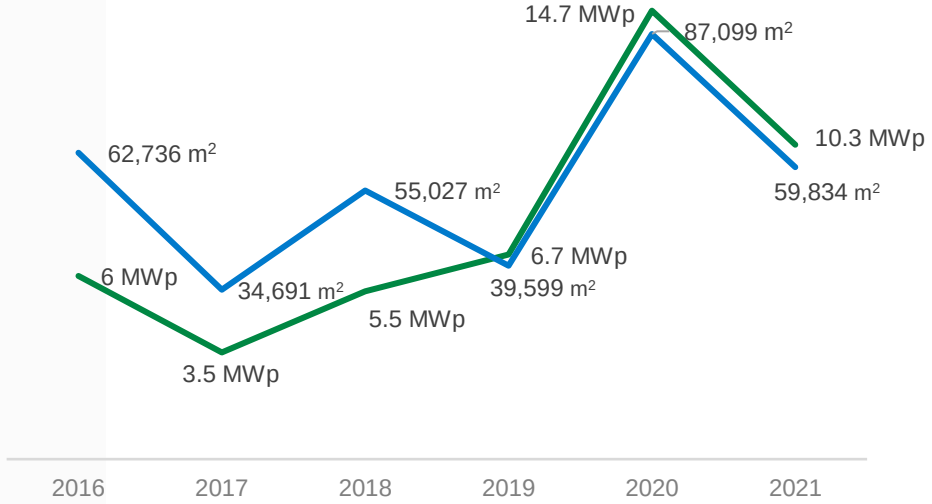
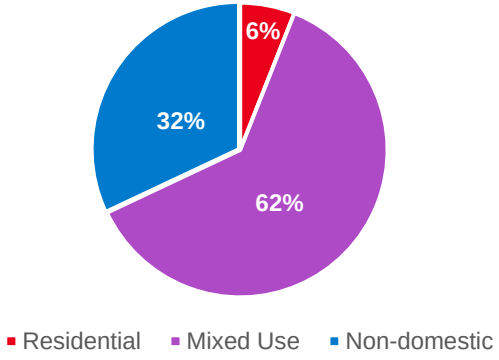


Figure 12: Proposed solar PV proposed by floor area and capacity

Heat pumps

In 2021, 100 developments (72 per cent of all developments) committed to installing a heat pump, compared with 57 (40 per cent) in 2020. The 2021 proposals included 63 developments planning to install only heat pumps or ambient loops, 4 cases proposed a hybrid system using two types of heat pumps: air source (ASHP) with either ground source (GSHP) or water source (WSHP) which were typically configured to share load. The remainder were hybrids with ASHPs and gas boilers.



68 per cent of proposed installations are large centralised heat pumps supplying communal heat networks serving residential or mixed-use developments, up from 42 per cent in 2020. Large scale heat pumps are well suited to serve mixed-use developments through a communal heat network from a centralised energy centre.

It is encouraging to see large-scale centralised heat pumps in these numbers serving residential and commercial units, which in the past would have been served by a CHP-led network.

In total, **23,166 dwellings are proposed** to be served by **heat pumps** (compared to over 10,000 in 2020). **1,392,879 m² of non-domestic floor area** are proposed to be served by heat pumps (compared to over 770,000 m² in 2020).

The London Plan is accelerating the transition from gas to heat pump-led heating solutions

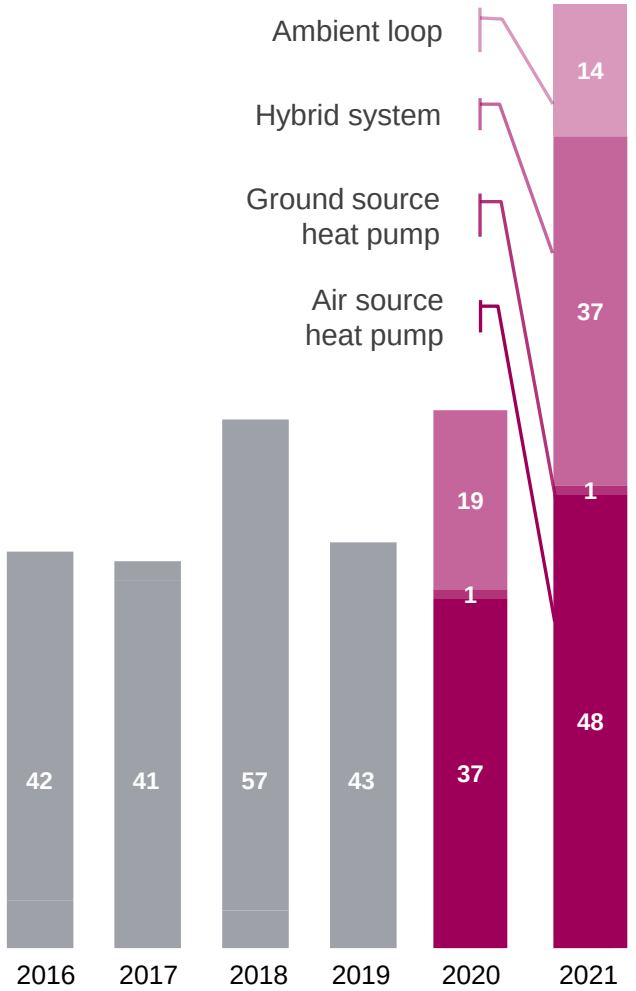


Figure 13: Number of developments proposing heat pumps by type

Case study 3: 1-8 Capitol Way

A vacant warehouse at the edge of an Industrial Park in **Colindale**, London Borough of **Brent**, is set to be redeveloped into **six residential apartment buildings** between **4 and 9 storeys**, **eight** mews **houses** and **4,000 m² commercial floorspace**. Highlights include:

- **56 per cent total carbon savings** achieved on-site, far beyond the on-site 35 per cent target.

Be Lean

12.4 per cent improvement on building regulations for carbon through energy efficiency measures alone

Measures to achieve this include high standards of insulation and air-tightness, optimised glazing size and specification, LED lights, mechanical ventilation with heat recovery, smart meters and controls to monitor and operate plant efficiently.

Be Clean

A site wide heat network will be installed with provision for connection to a DHN should one become available in the vicinity.

Be Green

ASHPs will supply low temperature **space heating** from an energy centre. Local WSHPs will provide additional heating for hot water generation in each flat. Total **heat pump capacity is 2,800 $kW_{th,}$** displacing the original CHP-led energy strategy, in line with the London Plan. Further renewable energy provided from **265 m² of solar PV.**

Photo credits: Dunnett Craven

Case study 4: Geoffrey Close Estate

The Geoffrey Close Estate in the London Borough of **Lambeth** will be redeveloped with **six residential buildings** ranging from **5 to 13 storeys** comprising **441 dwellings**, and a small amount of accompanying non-residential floorspace. Highlights include:

- **37 per cent total carbon savings** achieved on-site, exceeding the on-site 35 per cent target.

Be Lean

14 per cent carbon reduction through energy efficiency measures alone

Savings for the small non-residential floorspace are projected to reach 20 per cent, exceeding the 15 per cent target.

High standards of insulation and air-tightness are proposed, and dwellings will be equipped with MVHR.

Be Clean

A site wide heat network will be installed with provision for later connection to the SELCHP DHN if this becomes viable in future.

Be Green

A hybrid system will be configured with most **heat** supplied **by ASHPs delivering 308 kW_{th}** energy, and a gas boiler back up at peak times. The heating plant will be installed at an energy centre with a thermal store. There will also be a total solar **PV area of 516 m^2**. Collectively, **'be green' carbon savings** are expected to be **23 per cent**.

Photo credits: PRP

Conclusions

2021 Conclusions

New developments in London are continuing to achieve far higher carbon savings than required by national policy. In 2021, developments achieved an overall 48.6 per cent carbon reduction improvement on National Building Regulations (2013).

The Mayor's net zero carbon standard combined with the 35 per cent minimum on-site target is driving greater on-site reductions for homes. A similar trend is expected in the non-residential sector with the net zero target taking effect in 2021.

Carbon offsetting continues to play a role in achieving the London Plan net zero target, with an estimated £44.4 million potentially available for collection in 2021 by boroughs, compared to an estimated £38.8 million available for collection in 2020.

Awareness of the new London Plan energy efficiency targets has already generated CO_2 savings despite only being adopted in March 2021. Building fabric improvements achieved an overall 17.3 per cent reduction in 2021, and the average for both residential and non-residential exceeded their respective targets.

London's pioneering approach to emission factors is driving the necessary shift away from gas-based heating solutions in support of the Mayor's net zero and air quality ambitions. Just 9 developments proposed gas-engine CHPs, compared to 29 in 2020.

The London Plan is driving district heat network development and decarbonisation. Significantly more dwellings are expected to connect to existing networks with decarbonisation plans - 11,263 compared to 8,771 in 2020. Investment in district heat network infrastructure has also increased from £88m in 2020 to £104.5m.

Solar PV continues to be prioritised in London, with capacity in 2021 totalling 10.3 MWp from an area of 59,834 m². Although this is down from 14.7 MWp and 87,099 m² in 2020, 87 per cent of developments included PV, up from 83 per cent in 2020.

London Plan policies are promoting the uptake of both communal and individual heat pumps, decarbonising heat in London's new homes. 100 developments with 23,166 dwellings committed to being served by heat pumps, up from over 10,000 in 2020. 1,392,879 m² of non-domestic floor area propose using heat pumps, up from over 770,000 m² in 2020.

91 developments submitted a TM59 or TM52 dynamic overheating assessment, up from 72 in 2020.

The introduction of WLC reporting means, for the first time, developers reported embodied carbon emissions. 31 developments reported and, on average, were able to improve their performance beyond the WLC benchmarks.

Appendices

Appendix - Carbon savings secured

Cumulative carbon emissions and savings				
Stages of the energy hierarchy	Regulated emissions	Regulated emissions reduction	Cumulative regulated emissions reductions relative to Part L 2013 Building Regulations	
	(tCO_2/year)	(tCO_2/year)	(tCO_2/year)	(percentage improvement)
Building Regulations 2013 Baseline	78,439	-	-	-
After ‘be lean’ (energy efficiency)	64,900	13,539	13,539	17.3
After ‘be clean’ (heat network connections)	56,652	8,248	21,787	27.8
After ‘be green’ (renewable energy)	40,294	16,358	38,145	**48.6**

Table 5: Total cumulative carbon emissions and savings after each stage of the energy hierarchy