Towards a net zero carbon London: Energy Monitoring Report 2022

NOVEMBER 2023

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 2022**, against the London Plan energy policies.

In 2022, a total of 142 referable planning applications were granted provisional approval by their local planning authority and were subsequently approved by the Mayor. Of these applications, **134 had an energy element** to the proposal that could be assessed against London Plan Policy SI 2.

Table 1 presents the type and quantity 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 area of **70 m² per dwelling** is assumed to provide the estimated values in the table for scale and comparison.

Developments approved by the Mayor in 2022

Type	Number	Dwellings	Non-residential floor area (thousand m^2)	Estimated residential floor area (thousand m^2)
Mixed-use	76	44,996	1,313	3,150*
Residential	12	2,866	N/A	201*
Non-residential	46	N/A	1,101	N/A
Total[2]	**134**	**47,862**	**2,414**	**3,350***

*assuming 70 m^2 per dwelling

Table 1: Total number and type of referable developments approved by the Mayor in 2022

[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: Residential development of 150 units or more; Non-residential development of more than 100,000 m^2 (in the City of London), more than 20,000 m^2 (in Central London excluding City of London), more than 15,000 m^2 (outside Central London); any development over 30 metres in height (outside the City of London) or on Green Belt or on Metropolitan Open Land. See the Order for the full criteria.

[2] In 2022, the total floor area for referable development increased for both non-residential (1,800 thousand m^2 in 2021) and residential (2,680 thousand m^2 in 2021).

Key findings

2022 key findings

London continues to exceed national standards

The 134 developments, with energy strategies, approved in 2022 achieved **an overall on-site carbon reduction of over 53 per cent** beyond 2013 Building Regulations, up from 48 per cent in 2021. This shows London's construction sector continues to innovate and exceed the Mayor's 35 per cent improvement target, delivering carbon savings far above national standards.

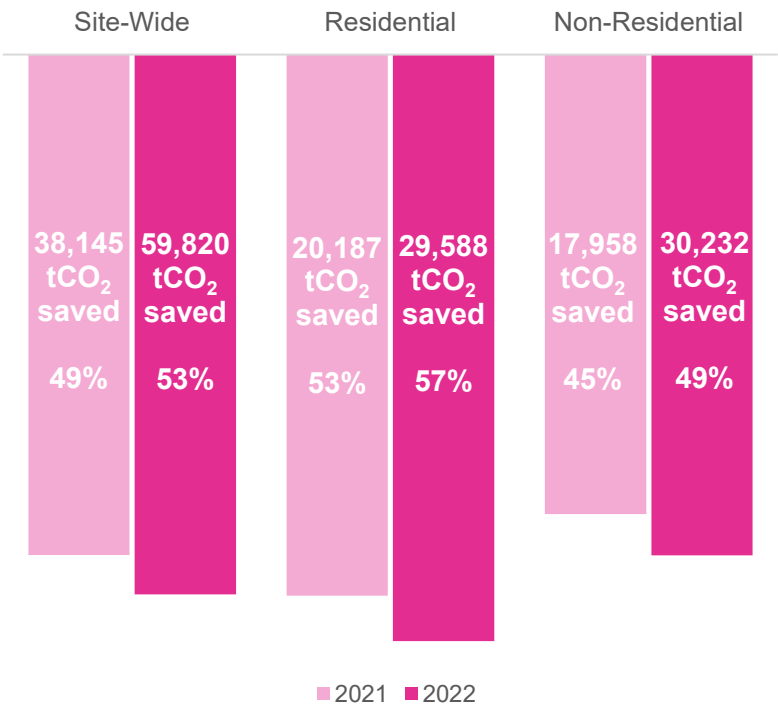
Residential: Developments achieved an average of **57 per cent CO_2 reduction on Building Regulations**, up from **53 per cent** in 2021, driven mostly by an increase in 'be green' savings (see page 32).

Non-residential: Developments reached an **average carbon saving of 49 per cent**, up from 44 per cent in 2021.

On-site net zero carbon: **Eight developments achieved net zero carbon through on-site measures alone** (in 2021 all applications required offsetting to meet net zero carbon). The majority were non-residential only that maximised renewable energy or connected to a DHN.

Energy efficiency measures resulted in a **17.7 per cent carbon saving**. This is up from 17.3 per cent last year. **Residential developments** achieved an average per development saving of **13.3 per cent** and **non-residential developments** achieved an average of **17.3 per cent**, exceeding their London Plan targets of 10 and 15 per cent respectively.

CO_2 reduction over Part L 2013 baseline



Energy efficiency measures help keep London's homes warmer in winter and residents' bills cheaper. This is why local authorities must retain powers to set standards above national regulations. Without these powers London would have achieved far lower carbon savings and Londoners would have higher energy bills.

London still leading the way

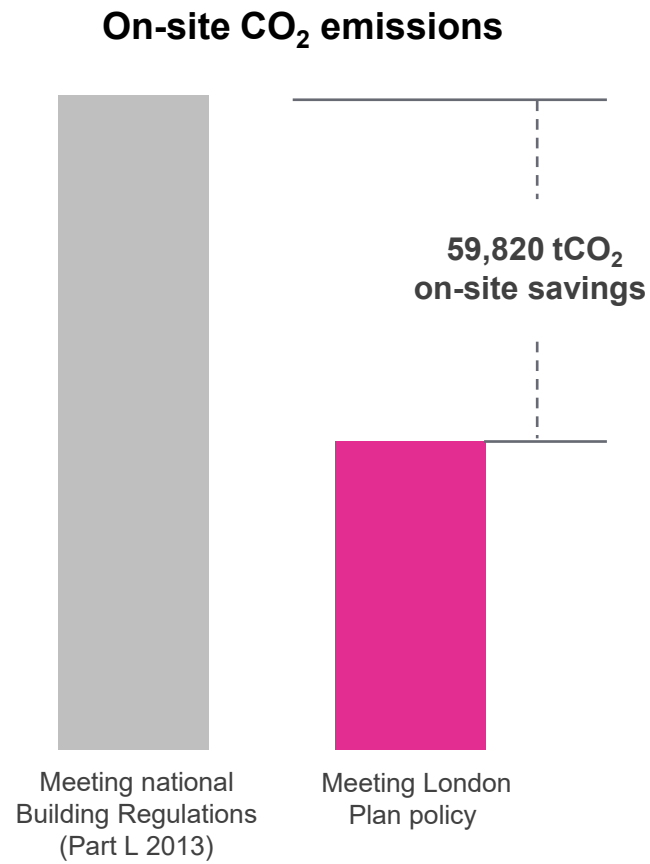
London is committed to achieving net zero carbon emissions by 2030. Through the London Plan, the Mayor is ensuring that new buildings are playing their part in reaching this target, exceeding national buildings standards and showing what can be achieved in a sector through higher levels of ambition and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

In 2022, London Plan policy **more than halved the emissions of developments compared to** if they had just met **national Building Regulations (Part L 2013)**

59,820 total tCO_2 saved, equivalent to **50,000 return flights from London to New York***

Energy efficiency measures saved 19,998 tCO_2, equivalent to adding **loft insulation to over 32,000 homes****

Solar PV proposed could cover **25 Wembley football pitches**



London Plan policy is pushing London forward in pursuit of its net zero carbon 2030 target

*TravelNav.com
**Energy Saving Trust

2022 key findings (2)

London at the forefront of low carbon heat and renewables

Supporting heat networks and reducing gas-based heating solutions: Over 46,000 dwellings (96 per cent of all new dwellings) are expected to connect to either communal heat networks or area-wide district heat networks (DHN). This includes over 8,500 expected to connect to existing DHNs, and over 80% of remaining developments to connect to communal networks, future-proofed for connection to local DHNs once available. This supports London's progress towards the estimated 460,000 new heat network connections needed for the Mayor's 'Accelerated Green' Pathway to net zero by 2030. London Plan policy prioritises DHNs connection to promote an affordable, flexible low carbon energy system that's needed to reach net zero.

Driving more heat pump installations: London's introduction of using SAP 10.0 emission factors led to 118 developments including heat pumps in 2022, compared to 100 in 2021. This included **103 of 118 installations proposed being large centralised heat pumps** supplying communal and site-wide heat networks. In total, **over 31,000 dwellings were proposing to connect to a heat pump-led heating system**, compared to over 23,000 in 2021. Over 3,690,000 m² of the non-domestic floor area was proposed to be served by a heat pump-led heating system, compared to over 1,390,000 m² in 2021.

New solar PV capacity: Installation of 20.2 MWp, up from 10.3 MWp in 2021, from an area of around **116,000 m² of solar PV** (equivalent 2021 figure was around 59,000 m²) leading to approximately **£30 million in new investment**. The average installation size grew compared to 2021 (20.7 m² PV/1000 m² floor area in 2022 vs 15.5 m² PV/1000 m² in 2021), a total of **96 per cent of developments have included solar PV,** up from 87 per cent in 2021.

Over 46,000 dwellings to connect to communal heat networks or DHNs

£80m investment in new heat network infrastructure

118 developments with heat pumps (100 in 2021)

20.2 MWp of solar PV proposed

2022 key findings (3)

Managing London's heat risk and cooling demand

Overheating: **101 out of 134 developments submitted a dynamic overheating assessment,** up from 91 out of 138 in 2021 representing a 9.4 per cent increase**.** This assessment is more rigorous than national building regulations requirements and helps in designing better adapted buildings.

9 per cent increase in dynamic overheating assessments secured

Cooling: **101 developments included some element of active cooling, up from 88 in 2021. Total cooling consumption (33.4 GWh/yr) also roughly doubled from 2021.** This was largely due to 6 applications (four data centres and two hospitals) requiring significant cooling totalling 26.8 GWh/yr - around 80 per cent of the total. Active cooling is only proposed when deemed necessary and/or where there are site constraints (eg air quality and noise). **No cooling was proposed in 83 per cent of all residential development,** achieved through the cooling hierarchy which promotes passive measures.

Offsetting and Whole Life-Cycle Carbon

Carbon offset payments: An estimated **£162.2 million potentially available for collection by boroughs,** up from £44.4 million in 2021. Further details on the sums being collected and how they are being spent can be found in the annual Carbon Offset Funds Report.

£162.2 million from carbon offsetting

Whole Life-Cycle Carbon (WLC): **London is the first UK city to require WLC assessments (WLCA)** for all referrable developments. In 2022, **92 applications conducted WLCA** (some were submitted prior to the guidance document being adopted in March 2021)**.** In general, **performance against the benchmarks improved from 2021**; performance against aspirational benchmarks also improved but are still proving more challenging to meet.

92 developments reported WLC emissions

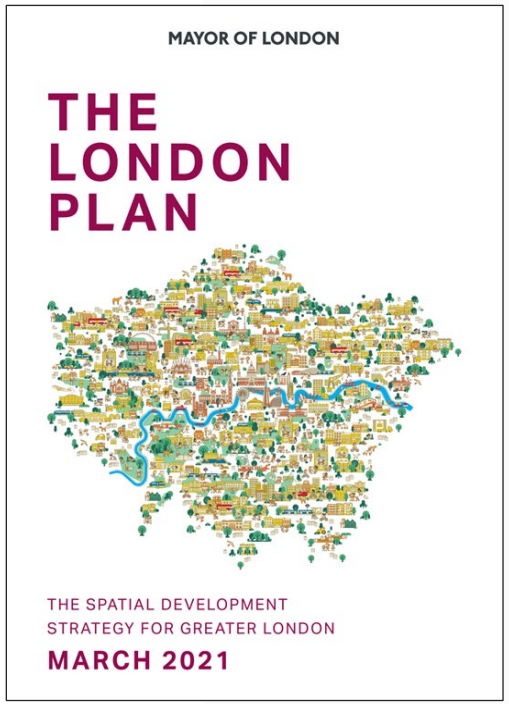
Overview

The role of the planning system in the climate emergency

The London Plan

The **London Plan 2021** is the Spatial Development Strategy for Greater London. It **sets out a framework for how London will develop over the next 20-25 years** and the Mayor's vision for Good Growth.

The Plan is part of the **statutory development plan for London**, meaning that the policies in the Plan should **inform decisions on planning** applications across the capital.



The London Plan is **legally part of each of London's Local Planning Authorities' Development Plans** and must be taken into account when planning decisions are taken in any part of Greater London. **All Development Plan Documents** and Neighbourhood Plans have to be **'in general conformity'** with the London Plan.

Planning and Net Zero Carbon

The Mayor has declared a climate emergency and is aiming for London to be net zero carbon by 2030. 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**. Without this action, we will only add to the number of buildings that 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 ensures new development is responding to the climate emergency by minimising emissions and implementing adaptation measures, ensuring resilience to 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.

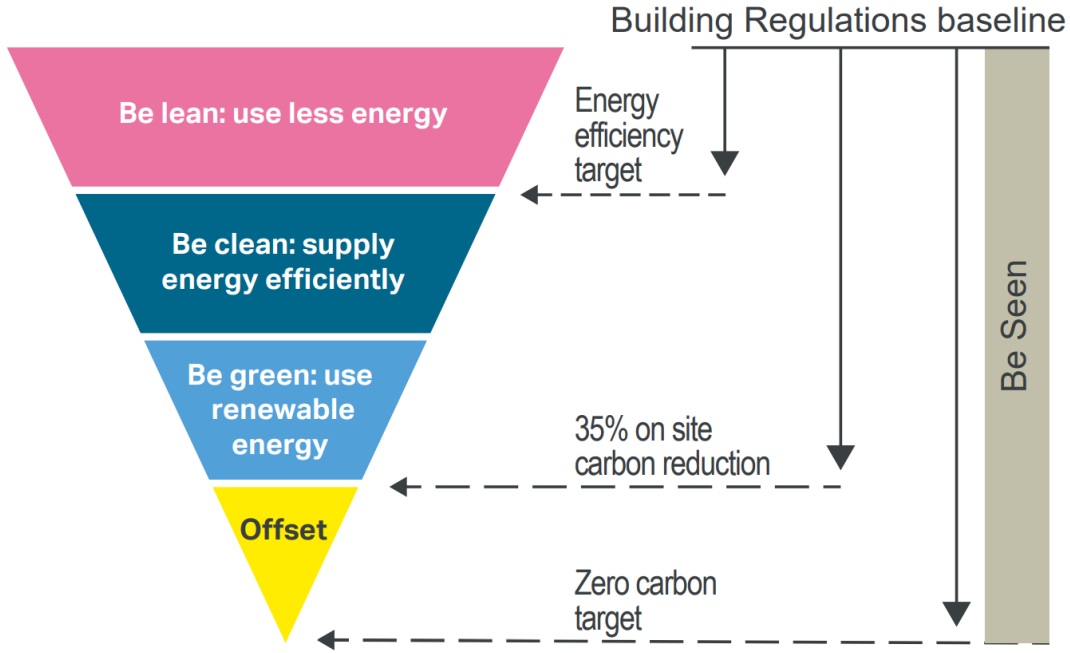
Beyond this, and once on-site carbon reductions have been maximised, the shortfall to zero carbon is offset by making a cash-in-lieu contribution into the relevant Local Planning Authorities (LPA) carbon offset fund.

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

All applications approved in 2022 were under Part L 2013 using the 2020 Energy Assessment Guidance**, which encouraged applicants submitting referable planning applications to use the SAP 10.0** carbon emission factors. This approach more accurately reflected the decarbonisation of the electricity grid under Part L, **which encourages** electrically-based low carbon heating, such as **heat pumps**, instead of gas-based solutions, such as gas boilers and gas-engine CHP.

With the adoption of Part L 2021 (and SAP 10.2) all new planning applications are now required to follow the 2022 guidance; see ‘London’s approach to Part L 2021 section’ for more details.

In 2022, referable developments with potential to connect to a **DHN were able to use SAP 2012 emission factors**, provided the heat network operator submits an acceptable decarbonisation strategy to the Mayor. **This approach enabled London Plan policy** to encourage, where appropriate, the **expansion and decarbonisation of district heat networks** as they have an important part to play in our future low carbon, flexible energy system.

What does this mean for the developments approved in 2022?

126 of the 134 developments approved in 2022 **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 **8 developments** were approved using the SAP 2012 emission factors with the majority of these proposing **connection to an existing heat network which has a decarbonisation strategy**.

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

London’s approach to Part L 2021

On **15 June 2022, national building regulations were updated** to enhance energy performance standards for new buildings through **Part L 2021**. The GLA Energy Assessment Guidance 2022 has subsequently been updated to explain how London Plan policy should be applied now that these updated regulations have taken effect. **Major developments** are now **required** to achieve a **minimum 35 per cent on-site carbon reduction over Part L 2021**.

Government consultations on Part L 2021 reported that the **introduction of the new standard will see improvements on the Part L 2013 standard of 31 per cent and 29 per cent** for **non-residential and residential development** respectively. This brings statutory performance levels closer to London Plan policy, the average performance of approved applications in 2021 was 48.6 per cent improvement over Part L 2013.

Next year's monitoring report for 2023 applications will start to reflect this new standard and will likely **include a mixture of planning applications submitted under Part L 2013 and Part L 2021**, depending on whether applications were submitted before or after the 2022 guidance update. With the introduction of the higher performance standard for Part L 2021, the **percentage improvement over national building regulations may initially be lower** than reported in recent years. However, it is anticipated that the **overall CO_2 emission performance of developments will see further improvement** and the London Plan minimum requirement of a 35 per cent improvement over Part L 2021 will still apply.

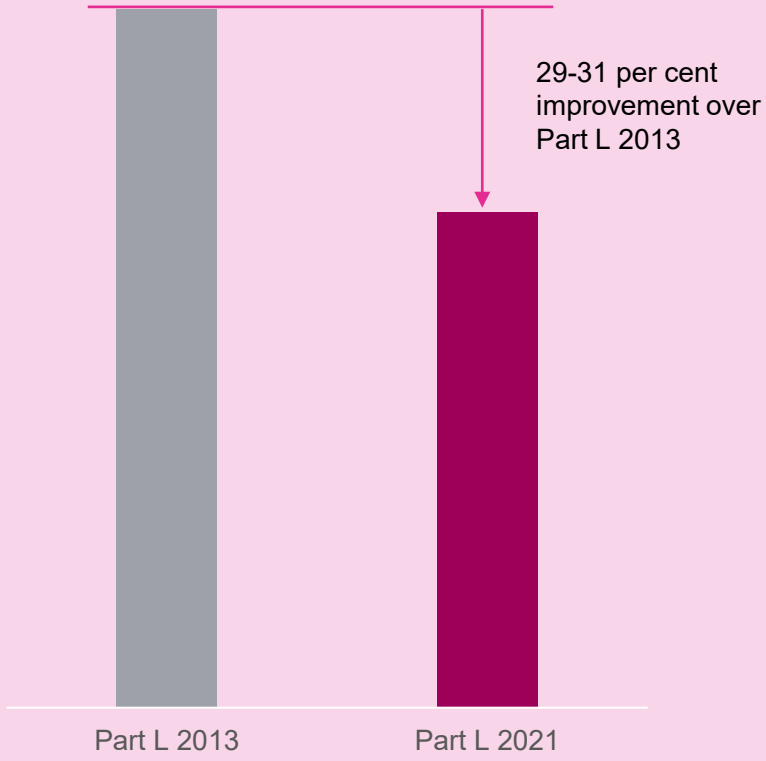


Figure 2: Part L 2013 and Part L 2021 CO_2 emission comparison

Whole life-cycle carbon emissions reporting

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.

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**.

The 2021 Energy Monitoring Report was the first monitoring report to include the whole life-cycle carbon (WLC) emissions reported by referable developments in London. In 2022, **92 developments approved by the Mayor reported WLC emissions**. This is a significant increase on 2021, where 31 developments reported WLC emissions.

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 system boundary)
- Including reuse and recycling potential

Overall results

Total on-site carbon savings

An overall carbon reduction of **52.9 per cent** (up from 48.6 per cent in 2021) more than required by the 2013 Building Regulations was secured for the 134 developments approved in 2022.

- **59,820 tonnes of CO_2 saved in total** (equating to a 52.9 per cent, up from 48.6 per cent in 2021)
- **24,799 tonnes of CO_2 from residential developments** (equating to 57.0 per cent savings, up from 52.9 per cent in 2021)
- **26,070 tonnes of CO_2 from non-residential developments** (equating to 48.9 per cent, up from 44.6 per cent in 2021)

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, fostering a faster transition from fossil-based heating technologies to lower carbon technologies.

The Mayor's policies demonstrate the important role that raising building regulation standards can play in tackling the climate emergency

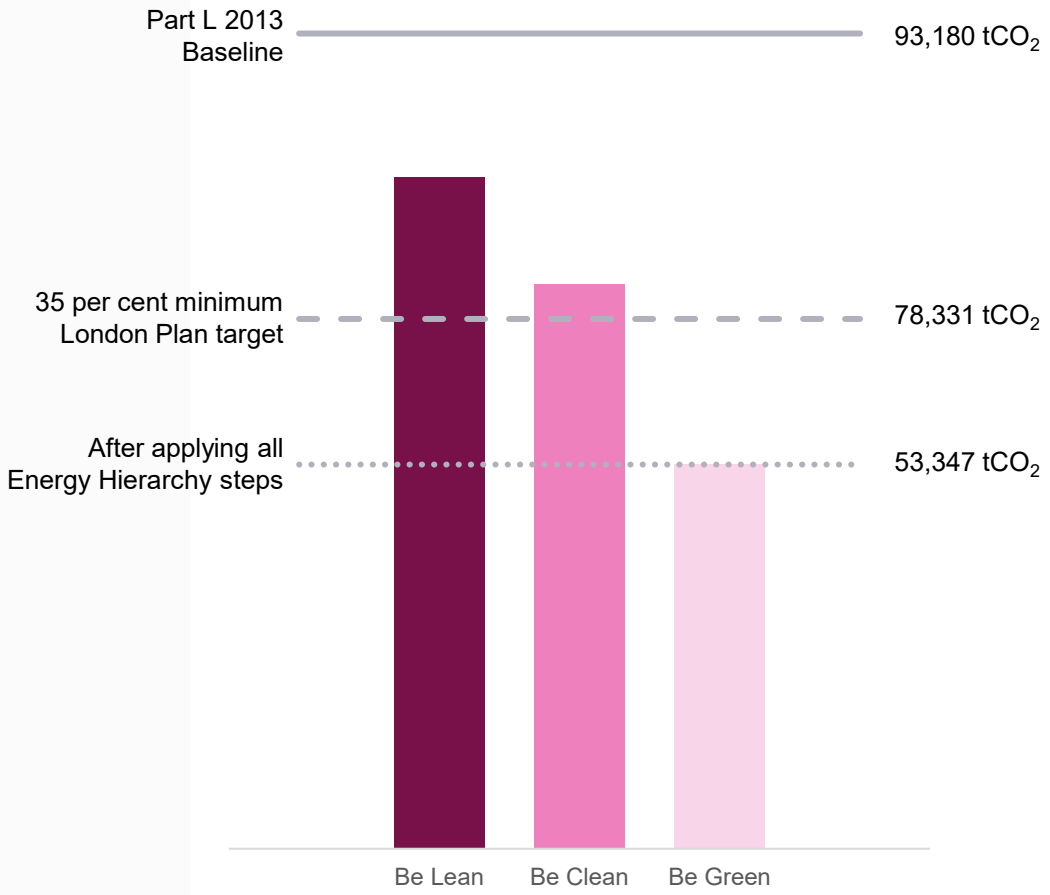


Figure 3: Site-wide carbon emissions after each stage of the energy hierarchy

Carbon savings breakdown

Be Lean

17.7 per cent CO_2 reduction (17.3 per cent in 2021). This is an **increase from last year** with the 'be lean' stage representing a major proportion of savings due to the implementation of specific energy efficiency targets. 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

13.1 per cent CO_2 reduction (10.5 per cent in 2021) resulting from an estimated **£80m investment in heat network infrastructure**. For the past five years this hierarchy stage has shrunk significantly, largely due to gas-engine CHP being discouraged except where it can stimulate area wide DHNs. No new CHP capacity was proposed in 2022 (down from 7.4 MWe in 2021). See the 'be clean' section for further analysis.

Be Green

22.1 per cent CO_2 reduction (20.8 per cent in 2021), largely from 118 developments with heat pumps, continuing to rise compared to previous years (100 in 2021). As in 2021, **'be green' now makes up the largest proportion of CO_2 savings**. There are also 129 developments installing 20.2 MWp of solar PV (up from 10.3 MWp in 2021) with an estimated area of 116,399 m^2 and new investment of around £30m. 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

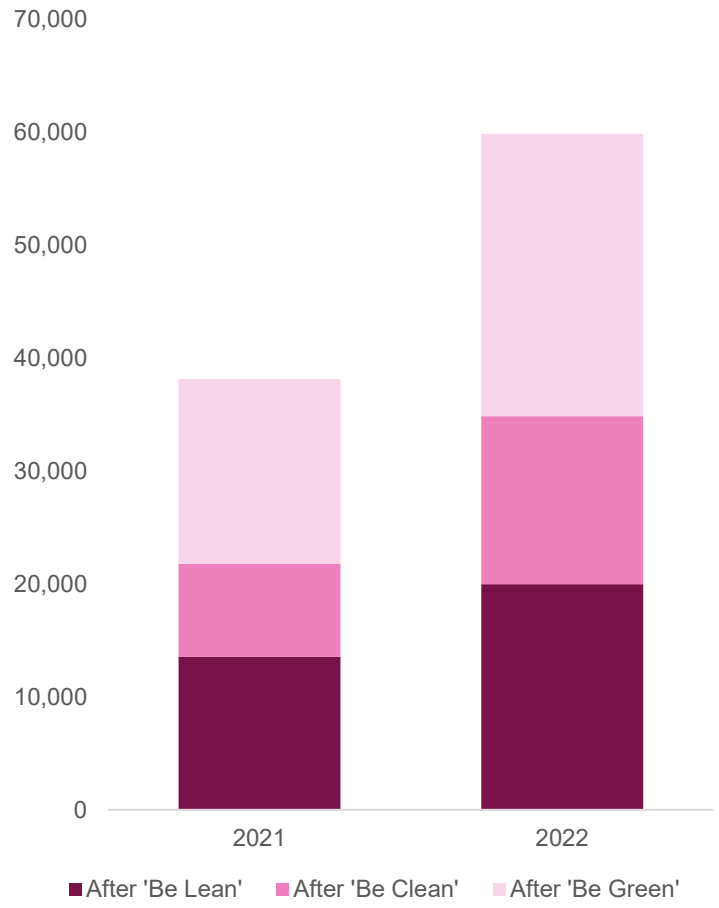


Figure 4: Breakdown of total tCO_2 savings by each stage of the energy hierarchy for all referable developments

Distribution of carbon savings

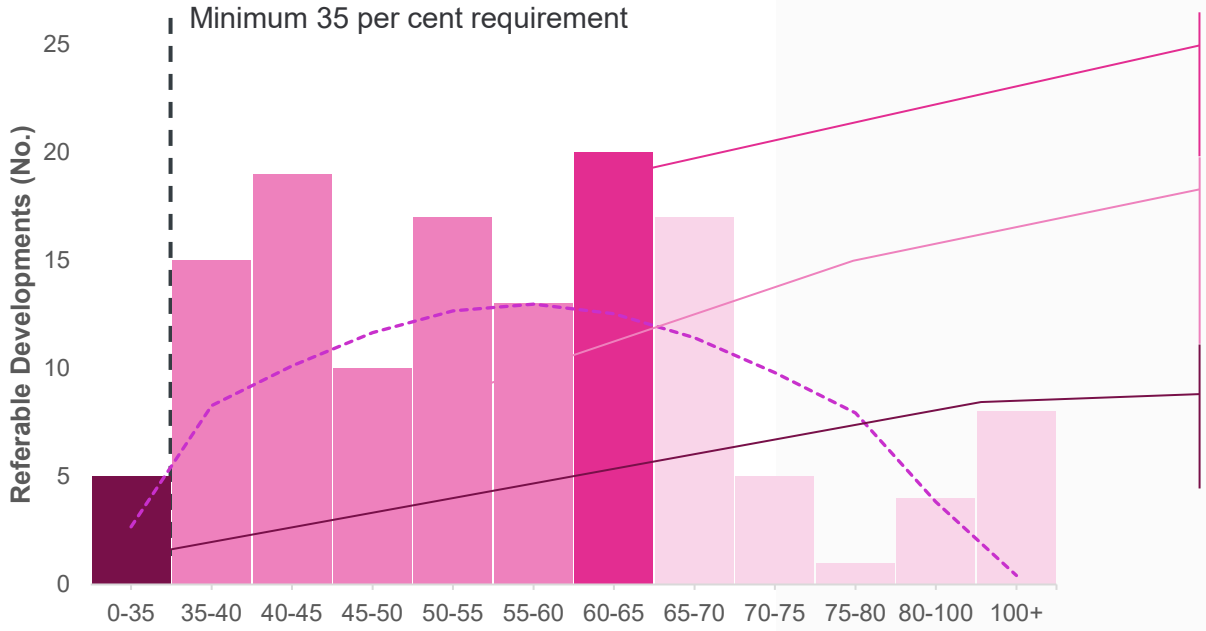


Figure 5: Range, frequency and distribution of CO_2 savings (per cent) achieved in 2022

Most developments achieved a 60-65 per cent improvement beyond Building Regulations (Part L 2013), compared to 35-40 per cent in 2021.

44 per cent of developments **achieved 40-60 per cent, vs 47 per cent in 2021** - a decrease compared to last year due to there being an increase in the overall average emissions in 2022 reduction.

5 developments missed the 35 per cent target, a decrease on those in 2021. These applications were non-typical, for example a temporary football stand.

96 per cent of developments met or exceeded the minimum 35 per cent on-site target, a 3 per cent improvement on 2021

Several developments achieved more than 100% savings - predominantly outer borough development with large PV arrays.

Developments significantly exceeding the target were able to largely through a combination of 'be green' and 'be lean' savings.

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

Several developments also achieved high savings in 'be clean' through connection to low carbon DHNs (Case Study 1 and 2).

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 £162.2 million could ultimately be collected by boroughs from referable developments that have gone through planning between January and December 2022.

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 maximized. **Eight** developments were able to meet the **London Plan net zero target without offsetting**, up from zero in 2021.

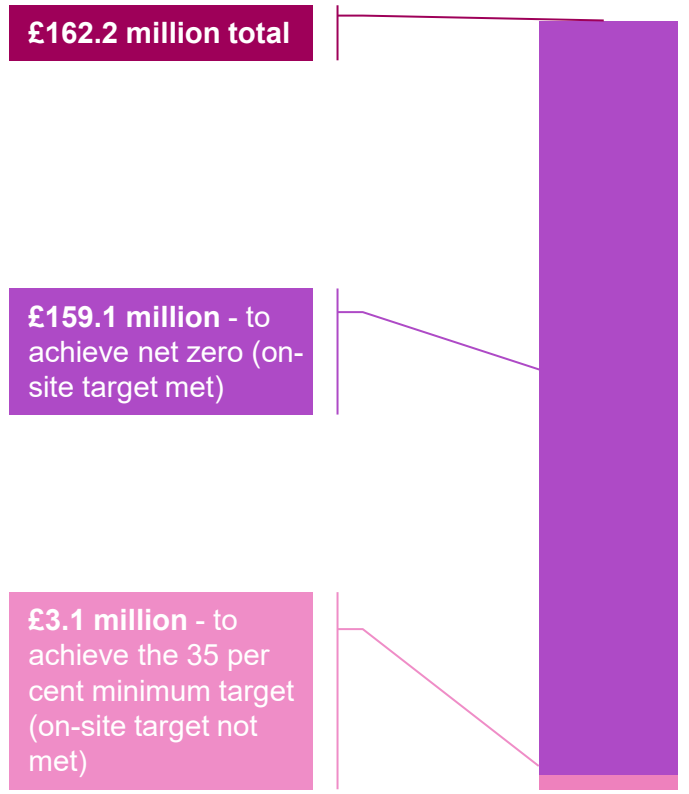


Figure 6: Estimated carbon offset amounts for 2022

Whole life-cycle carbon emissions

The average WLC CO_2 emissions reported per development in 2022 was **908 kg CO_2e/m² GIA** (1,021 kg CO_2e/m² GIA in 2021) **improving performance beyond the WLC benchmarks**. The aspirational benchmarks remain more challenging to meet but the significant improvement in performance has resulted in developments getting closer than in 2021.

Applicants are required to outline the key actions to achieve the WLC emissions reported and estimate the emission reductions expected. **The average reduction in reported CO_2 emissions following the WLC assessment was 112 kg CO_2e/m² GIA.** A **key proposal** for reducing emissions across many applications was the use of **cement replacement in concrete** at higher percentages than the UK typical supply. Applicants also reported **lean design** and **efficiency** as actions.

Applicants must also estimate potential savings from the reuse or recycling of components at the end of a building's useful life. In 2022, applicants on average reported further potential savings of **64 kg CO_2e/m² GIA.** Examples **included further increases of cement replacement**, **structural steel from electric arc furnaces**, and an improved **refrigerant specification.**

A: Product sourcing and construction stage B: Use stage C: End of life stage	Module A (kg CO_2e/m² GIA)	Module B1-B5 & C (kg CO_2e/m² GIA)	Total (kg CO_2e/m² GIA)
Reported CO_2 emissions	**582**	**326**	**908**
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.

The Mayor's industry-leading WLC policy is driving change in the sector. The benchmarks are pushing applicants to make design choices that are much more sustainable across the lifecycle of a building

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.

Hillingdon achieved a **57 per cent CO_2 reduction** across six referable developments from **fabric first measures** through '**be lean**'.

Enfield secured **DHN connections for more than 3,000 homes**. All developments propose to connect to a heat network, with two of these to connect to the Meridian Water Heat Network.

Bexley achieved an **86 per cent 'be green'** CO_2 reduction from air source heat pumps and solar PV from a single development. The 'be green' saving achieved by this development lead to Bexley seeing ~~sees~~ the greatest savings **across the whole energy hierarchy,** with this being **net carbon positive** (Case Study 3).

Hillingdon

Six referable developments expected to achieve a:

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

Enfield

Three referable developments expected to achieve a:

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

Bexley

One referable development expected to achieve a:

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

Net carbon positive development

‘Be lean’

‘Be lean’: Residential

Planning applications for residential developments in 2022:

- achieved on average a **13.3 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 four years**.
- saw a significant reduction in the number of developments missing the energy efficiency target compared to 2021.

91 per cent of residential development was able to meet or exceed the 10 per cent minimum energy efficiency target. Two of the applications achieving more than a 20 per cent energy efficiency saving through PassivHaus levels of building fabric.*

Except for 1 case utilising SAP 2012 factors, all developments missing the ‘be lean’ target exceeded the minimum 35 per cent requirement after applying the rest of the energy hierarchy.

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.

*Case Study 1 includes an example of a development exceeding the ‘be lean’ target

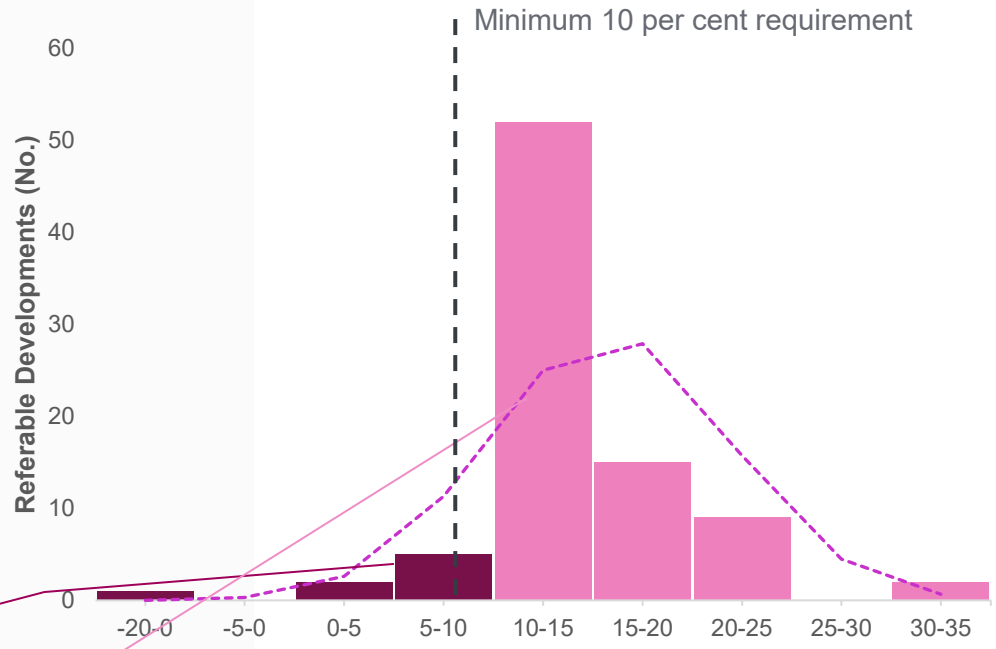


Figure 7: CO_2 savings (per cent) achieved from ‘be lean’ measures for residential developments

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 2022:

- secured on average a **17.3 per cent carbon reduction from energy efficiency measures** alone, the same as in 2021, maintaining the increase from 14.7 per cent in 2020.
- **72.5 per cent** of non-residential developments **met or exceeded the** non-residential 15 per cent **energy efficiency target.**

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.

Most cases missing the 15 per cent target were schemes with schools, hotels, student accommodation and leisure elements with a high hot water demand making the target more challenging. Of these cases, the majority (except for 2 using SAP 2012 factors) met or exceeded the 35 per cent site-wide requirement once the rest of the energy hierarchy stages were applied.

There were 4 cases where the non-residential element did not reach the Building Regulations baseline through ‘be lean’ measures alone. All were able to achieve at least a 50 per cent saving after 'be clean' and 'be green' were accounted for and all were non-residential only developments.

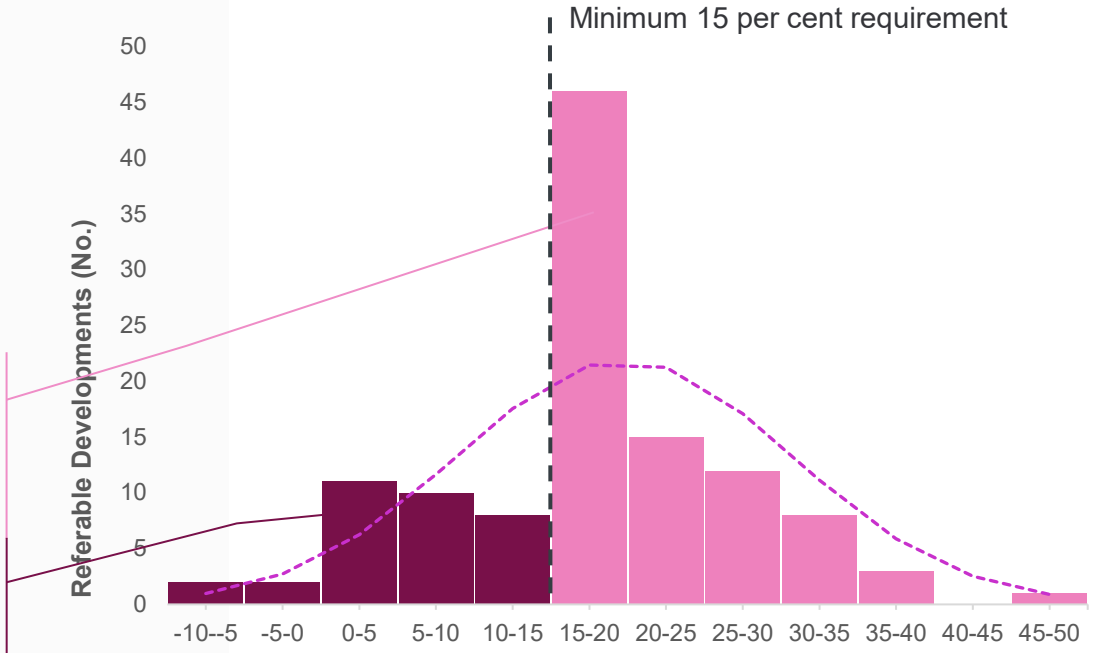


Figure 8: CO_2 savings (per cent) from ‘be lean’ measures for non-residential developments

72.5 per cent of non-residential developments met or surpassed the energy efficiency target, up from 65 per cent in 2021

Overheating

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

Active cooling (e.g. air conditioning or tempering) is discouraged in residential developments. Applicants must follow the cooling hierarchy and prioritise passive design solutions, such as external shading. Nearly 70 per cent of applications propose natural ventilation.

G-values

A g-value is a measure of solar heat gain through a window. For residential developments approved in 2022, **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, **86 of the 99 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.

101 (76 residential, 25 non-residential) submitted a TM59 or TM52 dynamic **overheating assessment**, up from 91 last year.

95 showed compliance (up from 66 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. In response to this, the GLA **Energy Assessment Guidance 2022 requires a more rigorous analysis** under the future weather files (DSY 2 and DSY 3). This helps applicants design developments that are better adapted for more prolonged warm spells and/or higher temperature peaks.

Cooling proposals

Residential – 1 residential only, and 13 mixed-use developments proposed residential active cooling. This represents 17.0 per cent of developments with a residential component, an increase from 11.1 per cent in 2021. **While active cooling is discouraged, it may be needed where site constraints prevent passive measures** from reducing overheating risk sufficiently. This includes where there are air quality, noise and/or security issues that impact the ability to open windows.

Non-residential – 43 non-domestic only and 53 mixed-use developments proposed active cooling (78.7 per cent of developments with a non-domestic element, up from 68.0 per cent in 2021)

The **total proposed cooling** reported was **33.4 GWh/yr - this total consumption has more than doubled since 2021**. The vast majority of the cooling increase can be attributed to 6 applications, each with a cooling demand of more than 1 GWh/year. The 6 applications comprised of 2 hospitals and 4 data centres, **together they account for 26.8 GWh/yr** of the proposed cooling total.

Figure 9: Number of developments proposing cooling by development type

As discussed on page 25, **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 2022. 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 2022 increased compared to 2021, in general, for the majority of developments, following the cooling hierarchy keeps cooling demand to a minimum

Case study 1: Ashley Road Depot

A new development in the London Borough of **Haringey** comprising **272 dwellings** across buildings ranging from 4 to 12 storeys, with **two flexible commercial units** at ground-floor level. Highlights include:

Project Targets: The strategy implements best practice KPIs to assess performance: **15 kWh/m² space heating demand**, **35 kWh/m² total energy** consumed on-site.

Energy efficiency: Site-wide energy use **intensity (EUI) predicted to be 27 kWh/m²/yr** with 15 kWh/m²/yr on-site renewable energy generation. 55 per cent of the development's energy use is expected to be met on-site.

30 per cent carbon savings from energy efficiency: **PHPP modelling undertaken** to assess against the **EUI target demonstrates** that the majority of **buildings could seek PassivHaus certification if desired**.

Be Lean

U-value of **0.13 W/m².K** is proposed to the main external walls, with a targeted air tightness of **0.6 m³/h/m² @ 50Pa,** and **triple glazing proposed.**

MVHR unit with a minimum efficiency of 90 per cent is targeted.

Detailed **interrogation of thermal bridging** undertaken.

Be Clean

Preferred strategy is to connect all uses to the future **Edmonton EfW District Energy Network (DEN)**.

Be Green

Connection to the DEN allows for PV to be maximised compared to the back-up ASHP strategy with rooftop plant. A total **350 kWp** capacity is proposed.

Photo credits: Levitt Bernstein

Hierarchy Stage	Emissions (tCO_2)	Saving (%)
Baseline	326.0	-
'Be Lean'	229.3	29.7
'Be Clean'	113.1	65.3
'Be Green'	51.1	84.3

Case study 2: Legacy Wharf

Legacy Wharf is the second redevelopment phase of a site in the Pudding Mill area of **Newham.** A total of **196 dwellings** will be delivered in a single building ranging from 5 to 9 storeys, with **2,258 m² of flexible commercial space** beneath the podium at ground floor level. Highlights include:

- **36 per cent carbon savings from 'be clean':** SAP 2012 factors were used where the development proposes to **connect to the Olympic Park heat network**, a network with an approved decarbonisation plan in place.
- **PV Maximisation: Through the planning consultation process and discussions with Newham and the GLA**, the total **PV capacity** in the final proposed strategy compared to at the initial engagement stages **increased by a factor of 6**.

Be Lean

A U-value of **0.13 W/m².K** is proposed to the residential external walls, with a combination ACDs and bespoke details, and an MVHR unit with a minimum efficiency of 89 per cent.

Be Clean

The dwellings will connect to the **Olympic Park heat network**, whilst the commercial uses will be served by VRF.

Be Green

At Stage 1, a PV array of **16 kWp** was proposed. Following engagement throughout the planning process, the development now proposes **99 kWp, an increase of more than 6 times,** enabling the development to demonstrate that opportunities for producing, storing and using **renewable energy on-site** have been **maximised**, in line with Policy SI 2 of the London Plan.

Photo credits: Maccreanor Lavington

Hierarchy Stage	Emissions (tCO_2)	Saving (%)
Baseline	256.4	-
'Be Lean'	220.5	14.0
'Be Clean'	129.5	49.5
'Be Green'	85.1	66.8

‘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, environmental and waste heat sources. Applicants must refer to the London Heat Map and consult with heat network operators and/or borough energy officers to identify if their site is in the vicinity of an existing or planned heat network. If they are, **the applicant is expected to prioritise connection**, and connect either immediately or when the heat network ~~expands to~~ arrives at the site boundary.

If a heat network is planned and not yet in existence, **applicants must design a communal 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. The GLA works with network operators to ensure that existing DHNs are developing and implementing decarbonisation strategies.

8,632 dwellings in 11 developments are expected to connect to existing DHNs, down from 2021 (11,263 dwellings in 11 developments). Connection numbers depend on the proximity of development to DHNs. 80 per cent of applications approved in 2022 will be supplied by communal networks, future-proofed for DHN connection once this is available.

Connection type	Developments	Dwellings	Name of DHN
Existing DHN (immediate connection)	11	8,632	SELCHP, ExCel Network, Greenwich Peninsula, Wood Street South, White City Masterplan
Existing DHN (later connection)	7	2,820	Barkantine, Olympic Park, Wembley Park, Embassy Quarter
Future connection to proposed DHN	11	9,056	Energetik/Meridian Water HN, RBKUT DEN, Meridian Water, Upper Lea Valley, Tower Hamlets, Citigen Extension, Love Lane, East London DE Scheme, Barratt London

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 2022, a total of **46,013 dwellings are expected to connect** to a communal heat network or an area-wide DHN (**96 per cent of all dwellings**) – sustained from 96 per cent in 2021. Figure 9 shows the development of communal heat networks in London since 2011.

2022 saw a further shift to a low carbon heat supply for new development across London, with **103 communal and site-wide heat networks supplied by heat pumps**. There were no communal heat networks brought forward in 2022 proposing installation of new on-site CHP capacity. See 'be green' for further details about the number of heat pumps proposed.

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

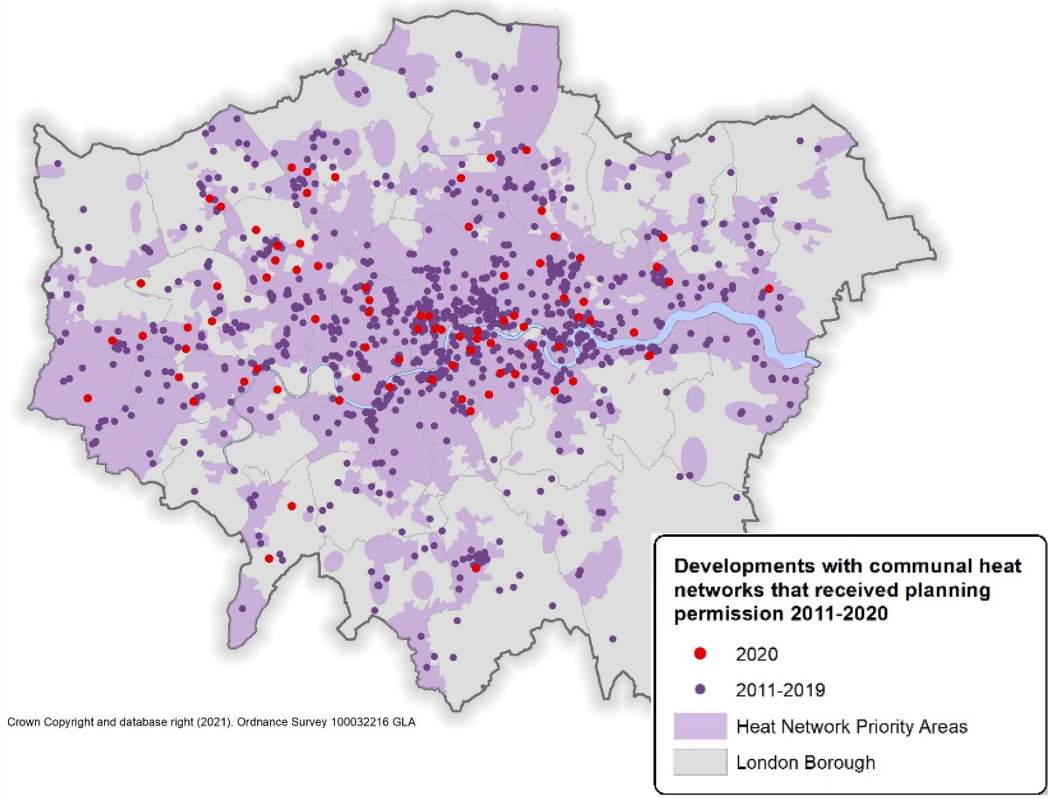


Figure 9: Distribution of developments committed to providing communal heat networks

On-site Combined Heat and Power (CHP)

In 2022, **zero developments proposed to install on-site CHP**. Compared to 2021 this is a significant drop in the number of CHP installations. **This is due to a shift away from development scale 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

Despite the growth in development scale, there is no new CHP capacity proposed in 2022.

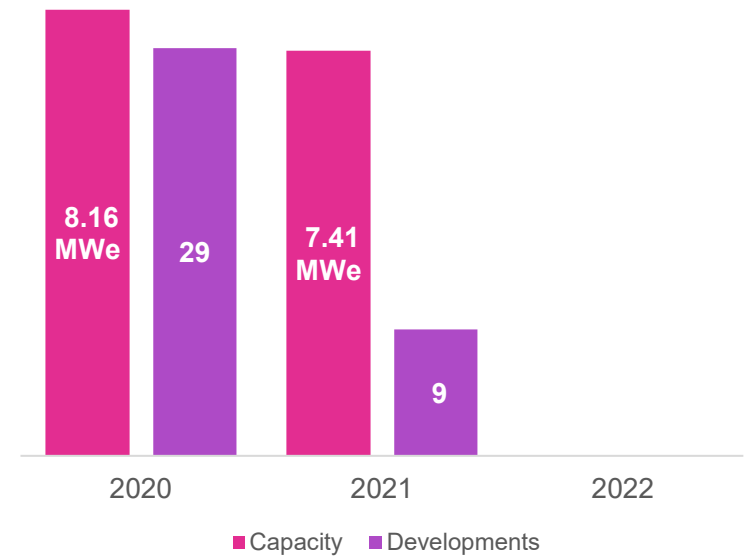


Figure 10: Change in CHP developments from 2020-2022

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

‘Be green’

Solar energy

In 2022, **129 developments proposed new solar PV capacity amounting to 20.2 MWp** (up from 10.3 MWp in 2021) from 96 per cent of developments (up from 87 per cent in 2021). We estimate **this equates to an investment of £30 million.**

This represents an area of **116,399 m²** (up from 59,834 m² in 2021), giving an **average installation area of 902 m²**. This is almost double the 2021 average, driven by a rise in sites with very large PV installations. In 2022 there were 28 developments proposing PV arrays of 1,000 m² or more. The total area of solar PV per 1,000 m² of floor area in 2022 increased from that observed in 2021 (20.7 vs 15.7 m² PV/1,000 m²).

In 2022, both the **proportion of developments** proposing a solar PV array and the **average** array **size increased.** However, this is dependent on development type; the **28 developments proposing arrays of over 1,000 m²** represent about two thirds of all development (by floor area) approved in 2022.

Outer London planning authorities continue to lead by total PV area proposed. **Barking & Dagenham** again **proposed the highest area of solar PV** in 2022. **Wandsworth** proposed the second highest area, and the **highest of the inner boroughs**.

The area of solar PV panel proposed in 2022 would cover 25 Wembley football pitches

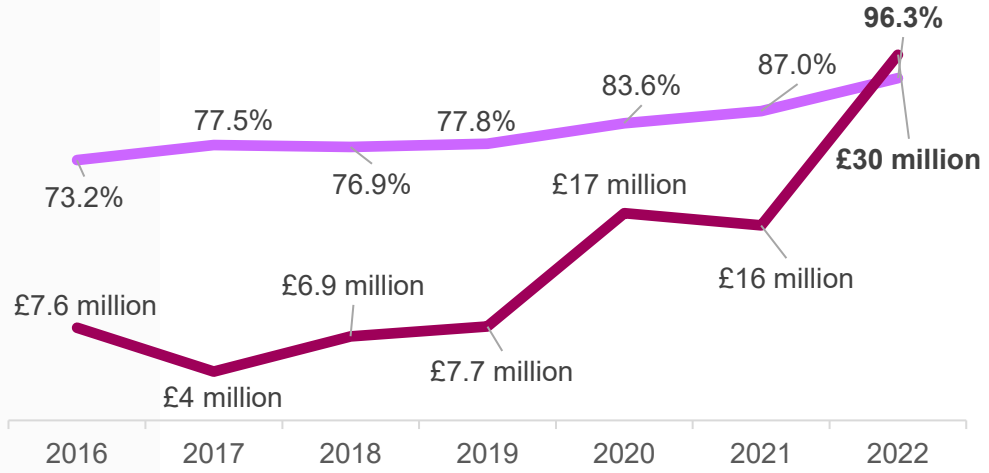


Figure 11: Proposed solar PV by percentage of developments and estimated investment

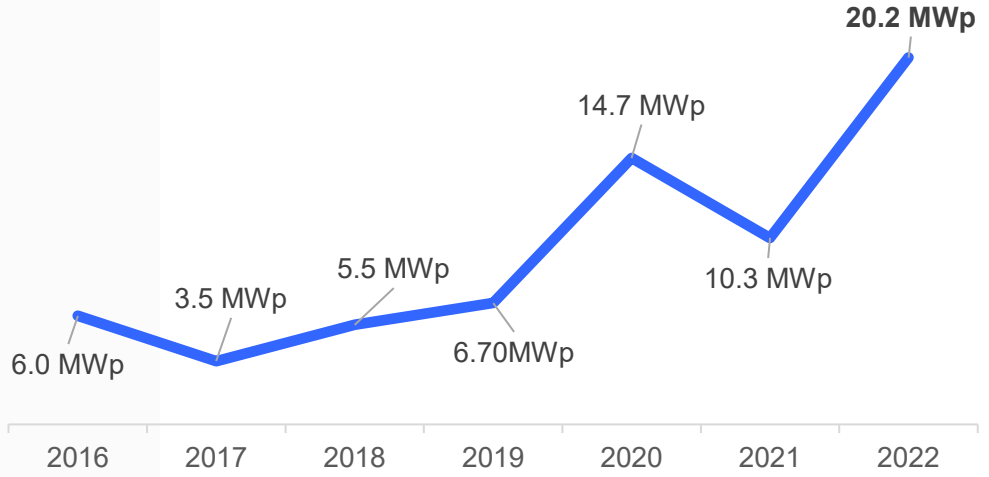
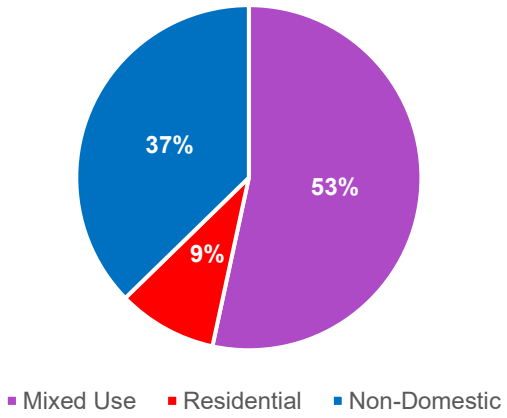


Figure 12: Proposed solar PV proposed by capacity

Heat pumps

In 2022, 118 developments (88 per cent of all developments) committed to installing a heat pump, compared with 100 (72 per cent) in 2021. The 2022 proposals included 98 developments planning to install only heat pumps or ambient loops, of which 3 cases proposed a hybrid air source (ASHP) and ground source (GSHP) arrangement, which were typically configured to share load. The majority of remaining developments propose a hybrid system with ASHPs and gas boilers.



103 of 118 installations proposed are large centralised heat pumps supplying communal and site-wide heat networks. Large scale heat pumps are well suited to serve mixed-use developments through a communal heat network from a centralised energy centre.

The growth in heat pump uptake can in part be attributed to both the elimination of on-site CHP in 2021 and the decrease in the number of developments proposing day one connection to local DHNs.

In total, **31,053 dwellings are proposed** to be served by **heat pumps** (compared to over 23,000 in 2021). **3,691,224 m² of non-domestic floor area** are proposed to be served by heat pumps (compared to over 1,390,000 m² in 2021).

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

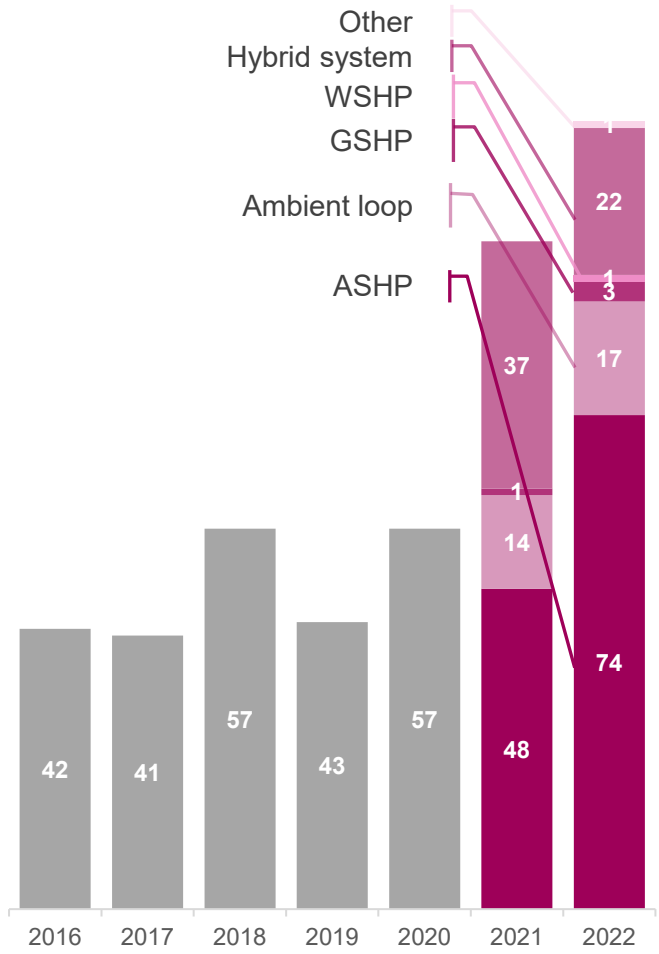


Figure 13: Number of developments proposing heat pumps by type

Case study 3: St Edward's Academy

St. Edward's Academy is a development in the London Borough of **Havering**, proposing a new **Special Education Needs and Disability School** (SEND) in a detached two-storey building of approximately **2,000 m²**. Highlights include:

- **All-electric development:** The development proposes an **all-electric approach** heated and cooled by a Variable Refrigerant Flow (VRF) heat pump system.
- **Incorporating natural ventilation:** A **hybrid ventilation approach** is taken in the key occupied teaching and office spaces.
- **Beyond net-zero carbon regulated emissions:** The development **achieves beyond net zero carbon** using a fossil fuel-free electric-only energy strategy in line with priorities for the decarbonisation of buildings.

Be Lean

A specification is applied which allows for a 'be lean' reduction of 18.8 per cent to be achieved, **exceeding the non-domestic energy efficiency target.**

Be Clean

The Site lies outside of a Heat Network Priority Area or Heat Map Study Area. There are no existing or proposed heat networks or transmission routes within the vicinity.

Be Green

The development uses **VRFs served by split ASHPs to provide heating (and cooling** where required) to the key occupied teaching and office spaces.

The development proposes a **PV array** equal to approximately **20 per cent of the total floor area** to be delivered on the site to maximise savings from renewables.

Photo credits: HLM Architects

Hierarchy Stage	Emissions (tCO_2)	Saving (%)
Baseline	32.0	-
'Be Lean'	26.0	18.8%
'Be Clean'	26.0	0%
'Be Green'	-8.0	125.0%

Case study 4: Former Holloway Prison

The redevelopment of the former Holloway Prison site in the London Borough of **Islington** will provide **985 residential homes** including **60 extra care homes**, a **Women's Centre** and **flexible commercial floorspace**. Highlights include:

All-electric development: The development proposes an **all-electric communal heating system provided by air source heat pumps**. The site has been designed to be **future proofed for a heat network connection** as there are no existing heat networks or transmission routes within the vicinity.

Overheating mitigation strategy: **Early design analysis** and **targeted strategy for noise sensitive areas** was undertaken to refine the development proposals and ensure compliance with CIBSE TM59 assessment.

Be Lean

A specification is applied which allows for a 'be lean' reduction of 10.1 per cent to be achieved for the residential element, **exceeding the energy efficiency target.**

Be Green

The site will used **ASHP compatible with a DHN connection,** and **1,500 m² of PV** will be incorporated with green roof systems.

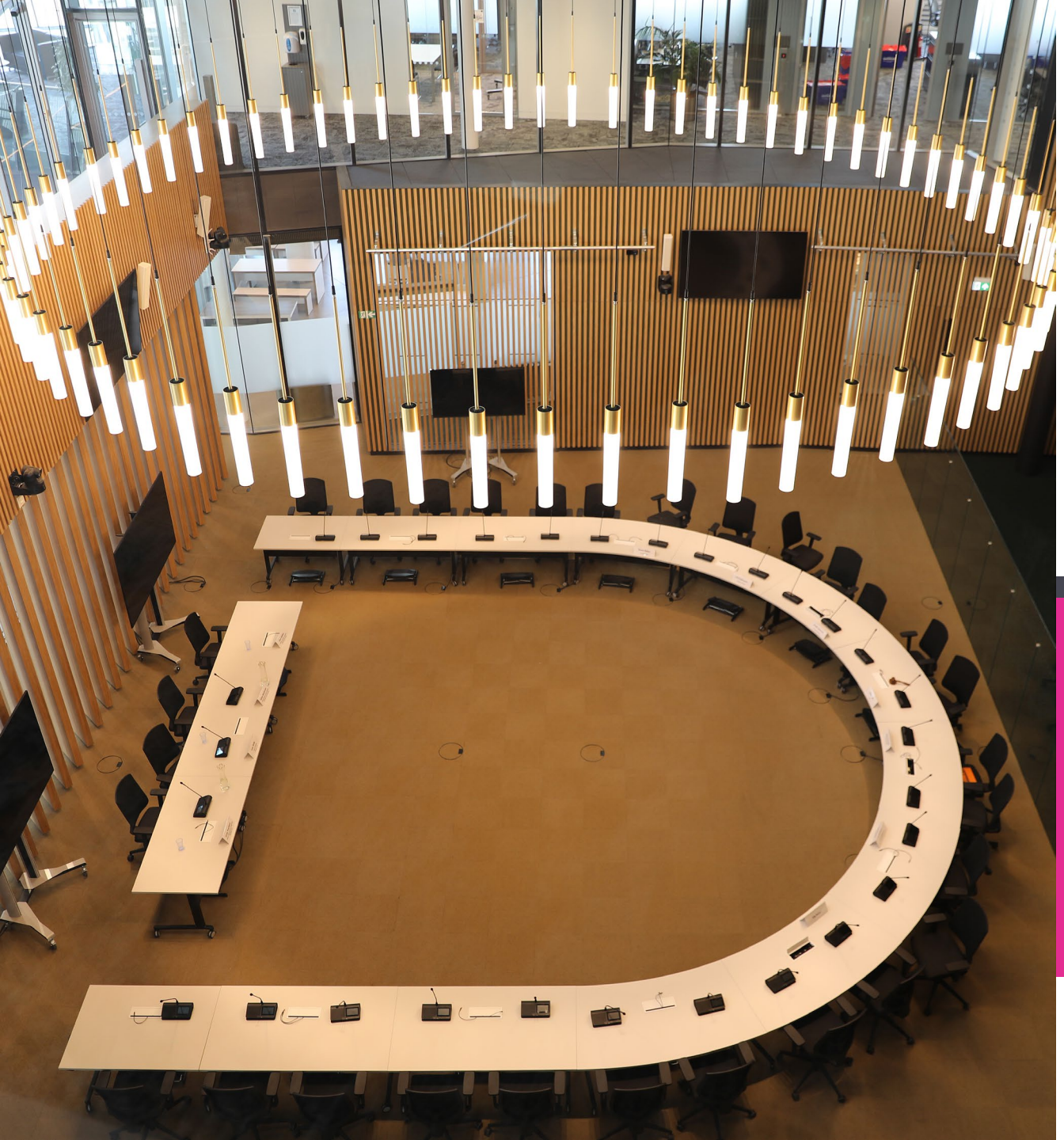
Overheating strategy

The overheating strategy includes:

- **Optimised glazing areas** for daylighting.
- **Louvre panels that will provide ventilation** and minimise solar gain and external noise.
- **Integrated external blinds** and **tempered air through MVHR** is proposed where there are restrictions on louvres due to daylighting requirements.

Photo credits:Allford Hall Monaghan Morris Ltd

Hierarchy Stage	Emissions (tCO_2)	Saving (%)
Baseline	1,159	-
'Be Lean'	1,046	9.7%
'Be Clean'	1,046	9.7%
'Be Green'	555	52.1%



Conclusions

2022 Conclusions

New developments in London are continuing to achieve far higher carbon savings than required by national policy. In 2022, approved developments achieved an overall 52.9 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 with a 60 to 65 per cent reduction achieved by most developments, beyond the minimum required to demonstrate compliance with London Plan Policy SI 2.

Carbon offsetting continues to play a role in achieving the London Plan net zero target, with an estimated £162.2 million potentially available for collection in 2022 by boroughs.

Energy efficiency improvements achieved an overall 17.7 per cent reduction saving 19,998 tCO_2, equivalent to adding loft insulation to over 32,000 homes. The average reduction from both residential and non-residential development exceeded their respective targets by at least 2 per cent.

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 ambition, with no new on-site CHP capacity proposed in 2022.

The London Plan is driving district heat network development and decarbonisation. 8,632 dwellings are expected to connect to existing networks with decarbonisation plans. While initial connection opportunities are lower in 2022, 80 per cent of developments were future-proofed to enable connection to a DHN as they expand.

Solar PV continues to be prioritised in London, with capacity in 2022 totalling 20.2 MWp from 116,399 m^2 - equivalent to over 25 football pitches. This is up from 10.3 MWp and 59,834 m^2 in 2021; 96 per cent of developments proposed PV, up from 87 per cent in 2021.

London Plan policies are promoting the uptake of heat pumps. 118 developments with 31,053 dwellings / 3,691,224 m^2 of non-domestic floor area committed to being served by heat pumps, up from over 23,000 / 1,390,000 m^2 in 2021.

To demonstrate the mitigation of overheating risk, 101 developments submitted a dynamic overheating assessment up from 91 in 2021. The vast majority of developments were able to meet requirements without active cooling.

On average, developments were able to improve their performance beyond the WLC benchmarks. 92 developments reported WLC emissions, showing a significant improvement in performance on the 2021 figures.

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 per year)	**(tCO_2 per year)**	**(tCO_2 per year)**	**(percentage improvement)**
Building Regulations 2013 Baseline	113,167	-	-	-
After 'be lean' (energy efficiency)	93,180	19,988	19,988	17.7%
After 'be clean' (heat network connections)	78,331	14,848	34,836	30.8%
After 'be green' (renewable energy)	53,347	24,984	59,820	**52.9%**

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

Appendix – Results since 2016

Progress in the outcomes from London Plan energy policies since 2016							
Key outcome	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Percentage improvement over Part L 2013	35.7%	40.5%	36.9%	40.6%	46.2%	48.6%	**52.9%**
Savings from energy efficiency measures compared to Part L 2013	7.4%	15.8%	13.5%	16.7%	19.8%	17.3%	**17.7%**
Number of developments proposing heat pumps	42	41	57	43	57	100	**118**
Proportion of developments proposing solar PV	73.2%	77.5%	76.9%	77.8%	83.6%	87.0%	**96.3%**
Estimated investment in solar PV	£7.6 million	£4 million	£6.9 million	£7.7 million	£17 million	£16 million	**£30 million**
Proposed PV capacity	6.0 MWp	3.5 MWp	5.5 MWp	6.7 MWp	14.7 MWp	10.3 MWp	**20.2 MWp**
Proposed PV area	62,736 m²	34,691 m²	55,027 m²	39,599 m²	87,099 m²	59,834 m²	**116,399 m²**

Table 6: Key outcomes from London Plan energy policies since 2016