

Delivering Net Zero

An evidence study to support planning policies
which deliver Net Zero Carbon developments

Executive summary

May 2023 | Rev 4

A technical evidence base to inform planning policy development for 18 London boroughs

The Delivering Net Zero report supersedes the Towards Net Zero Carbon report published in 2020 and provides an updated evidence base for the 18 participating boroughs in relation to the delivery of Net Zero carbon development. The key triggers for the update were.

- **The introduction of Part L 2021**

Compliance with Part L 2021 of the building regulations is mandatory for all developments. Part L 2021 is more ambitious than Part L 2013 and is no longer based principally on the carbon metric. Compliance with a primary energy target and (for domestic buildings) a fabric performance target are also required.

Notwithstanding this improvement, it is widely understood that compliance with Building Regulation does not deliver Net Zero Carbon new buildings. There is also a consensus that the performance gap remains a significant issue to address.

- **A very significant shift since 2019**

Beyond the new version of Part L the last few years have seen a significant shift towards Net Zero which has led to a large number of very relevant publications and studies, from the Climate Change Committee (CCC) reports to the RIBA 2030 climate challenge, from the UKGBC framework to the LETI guides and targets, and now the emerging work on the Net Zero Carbon Building Standard.

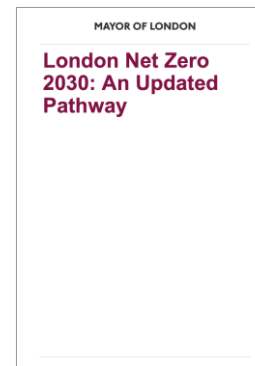
The Mayor of London has also published its updated 2030 pathway in 2022 with important underlying assumptions (e.g. ban on new gas boilers in new developments from 2025) and London boroughs have all developed ambitious Climate Action Plans.

In order to go further and achieve true Net Zero standards in new development, this evidence has considered two policy options.

Policy option 1 continues using the Part L framework as for the last 10-15, whereas Policy option 2 is a new approach based on a suite of energy-based metrics and policies.



The client team comprised the following 18 London boroughs: Barking & Dagenham / Be First, Barnet, Camden, Ealing, Enfield, Greenwich, Hackney, Haringey, Harrow, Havering, Hounslow, Kensington and Chelsea, Merton, Sutton, Tower Hamlets, Waltham Forest, Wandsworth and Westminster.



'A number of very significant documents have been published in the last few years. They form part of the wider evidence base for any new planning policy on the energy and carbon performance of new buildings.'

New buildings and Net Zero | Two policy options for London boroughs

There are four key differences between Policy options 1 and 2

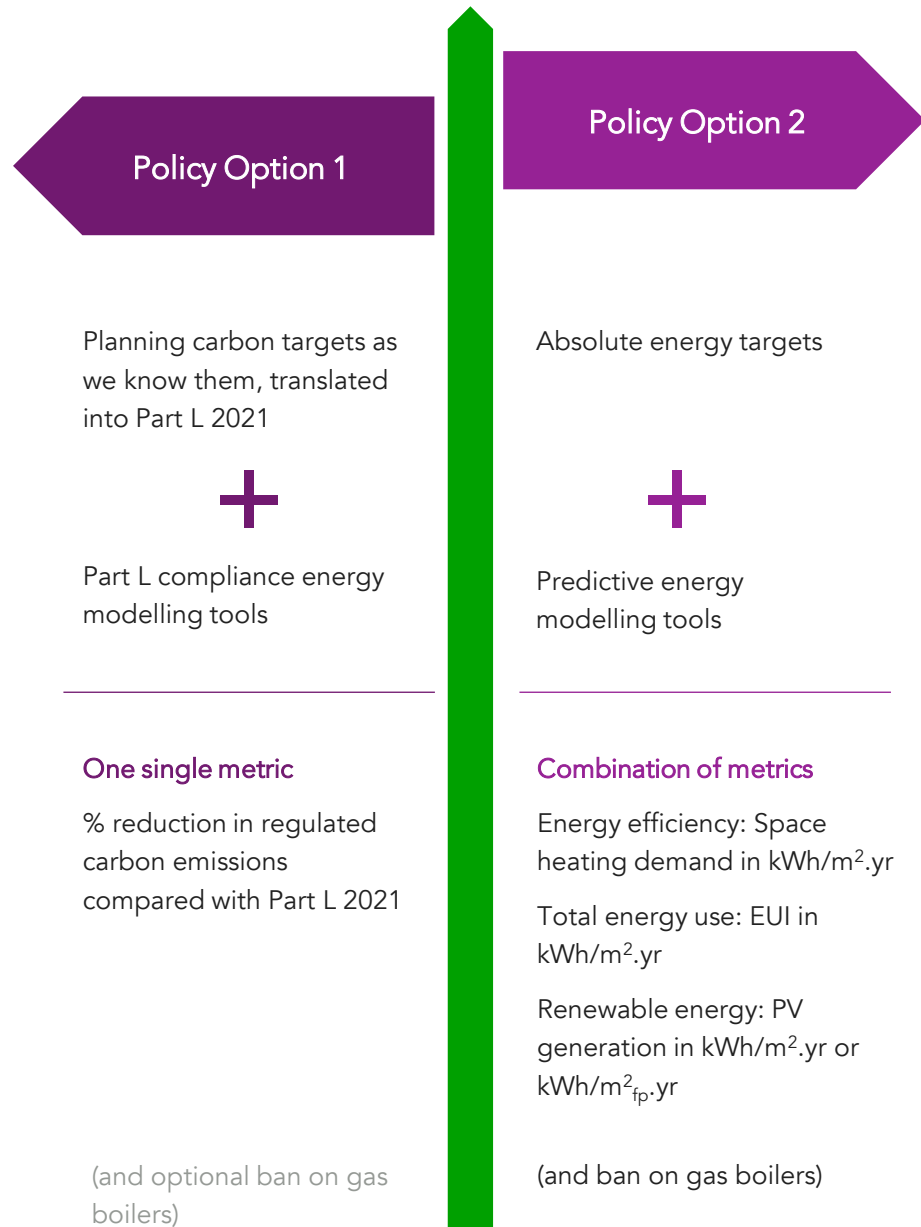
- 1. Definition of 'Net Zero Carbon' new buildings.** Option 1 only considers 'regulated' carbon emissions (e.g. it does not include equipment and appliances). It also allows carbon offsetting to play a significant role. Option 2 considers all energy uses in the building and seeks to achieve a balance between energy use and on-site renewable energy generation, only allowing offsetting to address a potential imbalance.
- 2. Relative or absolute targets.** Option 1 is based on a reduction in regulated carbon emissions over the Part L 2021 target, an intangible requirement that cannot be measured. Option 2 is based on absolute energy use and can be checked against metered energy in the occupied building after completion.
- 3. One or several metrics.** Option 1 uses a single performance metric (reduction in regulated carbon emissions). Instead, Option 2 uses a suite of metrics to separately measure each of the key attributes needed to achieve Net Zero: space heating demand for energy efficiency, total energy use and renewable energy generation. Option 2 also bans the use of gas boilers for new buildings.
- 4. Type of energy modelling.** Option 1 is based on Part L energy modelling, which is not meant to predict energy use. Option 2 is based on predictive energy modelling.

Our recommendation

This study recommends that London boroughs wishing to translate their climate ambitions into requirements for new buildings adopt Policy Option 2.

For boroughs wishing to continue using the Part L framework, Policy Option 1 is recommended.

The consultant team would recommend Policy option 2 over option 1 as it is a more transparent, effective and measurable way to drive the design and construction of better buildings towards Net Zero Carbon.



Two types of approach are possible to go beyond the requirements of Part L 2021

Energy and cost modelling | Analysis and conclusions

The study investigates how different building archetypes would perform against the metrics in Part L 2021, in Policy option 1 and in Policy option 2, testing across a variety of building types, heating systems and specifications.

These results demonstrate technical feasibility and provide a robust evidence base to inform decision-making for boroughs setting new planning policy targets within their emerging Local Plans and supplementary guidance in relation to energy use and carbon emission reduction for new buildings. Cost modelling undertaken for the same archetypes and scenarios can be used to identify the additional cost of these policies above minimum building regulations compliance (Part L 2021).

8 archetypes and 24 different and specific scenarios for each

We selected a specific set of building fabric, ventilation, heating and renewable energy specifications tailored to each archetype that would represent this spread of performance and be practical to build. The performance of these scenarios ranged from 'business as usual' approaches to more ambitious 'exemplary' levels.

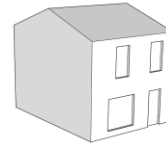
Cost impact: conclusions

For each archetype, a combination of specifications compliant with Part L 2021 has been selected as the 'zero additional cost' baseline and all other options are shown net of this cost.

The report findings confirm that all proposed policy options are viable in terms of build cost. Policy option 1 construction cost uplift ranges from -2% to 1%, while Policy option 2 uplift ranges from 1% to 4%. The level of uplift is considered acceptable and should not prohibit development coming forward.

In general, there are more compliant building specification types for Policy Option 1 than for Policy Option 2, except for the industrial building typology which has more compliant scenarios with Policy Option 2.

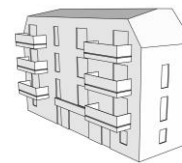
Domestic archetypes selected



Terrace house

95 sqm

This building represents the generic **Terrace house** new build typology

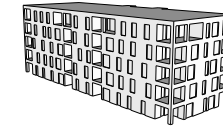


Low-rise

3/4 storeys

641 sqm

This building represents the generic **Low-rise apartment building**-new build typology



Mid-rise

5 storeys

3,200 sqm

This building represents the generic **Mid-rise apartment building** new build typology



High-rise

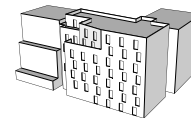
15 storeys

15,500 sqm

This building represents the generic **High-rise apartment building** new build typology

Please note that the findings will be very similar for a high-rise of 40-50 storeys

Non-domestic archetypes selected

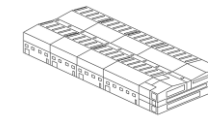


Office

7 storeys

4,000 sqm

This building represents the generic **office building** new build typology

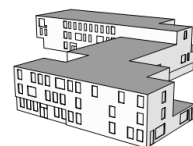


Industrial

2 storeys

9,000 sqm

This building represents the generic **industrial building** new build typology



School

3/4 storeys

6,000 sqm

This building represents the generic **school building** new build typology



Hotel

11 storeys

3,900 sqm

This building represents the generic **hotel building** new build typology

Graphical representation of the 8 buildings chosen as archetypes

Policy option 1 | Analysis and conclusions

Carrying on with the current framework

Some London boroughs may want to carry on using the Part L framework to go beyond the requirements of Part L 2021 and drive the design and construction of better buildings in their boroughs. This system has the advantage of being broadly consistent with the current approach in the GLA energy assessment guidance (2022) but it also has a number of weaknesses evidenced in this report (e.g. the single metric approach does not incentivise energy efficiency or renewable energy generation significantly, Part L energy modelling is not a prediction of energy use, etc.).

Different targets for domestic and non-domestic

Part L 2021 works very differently between domestic and non-domestic buildings, driven mainly by the different Part L energy modelling calculation methodologies: SAP for domestic buildings and NCM/SBEM for non-domestic buildings. Based on this analysis we would recommend requiring different levels of on-site carbon performance for domestic and non-domestic buildings.

Policy targets for non-domestic buildings

National and regional planning policy has previously set one emissions reduction target for all non-domestic buildings, due to a lack of evidence available to justify setting specific targets for different building types. This study sets out detailed evidence for a range of non-domestic buildings and, based on this new evidence, recommends distinct policy targets for each building type thereby maximising potential carbon savings.

Councils may also wish to consider an approach that uses a mid-point percentage uplift for all non-residential typologies

No more 'Be Lean' requirement

The 'Be Lean' requirement was helpful under Part L 2013 but it is now challenging to achieve for non-domestic buildings and, for domestic buildings, has little added value compared with the FEE requirement in Part L 2021.

Indicative policy wording for Policy option 1

Overarching policy

All developments must achieve Net Zero Carbon according to the Building Regulations framework, i.e. a 100% improvement over Part L 2021 and offset their residual emissions.

On-site carbon reduction

All developments must reduce carbon emissions on-site as much as possible. In terms of regulated emissions, the minimum level of on-site performance required is:

- *Domestic buildings: 65% better than Part L 2021*
- *Office buildings: 25% better than Part L 2021*
- *School buildings: 35% better than Part L 2021*
- *Industrial buildings: 45% better than Part L 2021*
- *Hotel: 10% better than Part L 2021*
- *Other non-domestic buildings: 35% better than Part L 2021 (tbc)*

Buildings must also comply with the other requirements of the Building Regulations Part L 2021, e.g. Fabric Energy Efficiency criterion for domestic buildings and Primary Energy criterion for all buildings and demonstrate compliance at planning stage.

Applicants must undertake Part L 2021 modelling to demonstrate compliance. Unregulated emissions must also be reduced as much as possible.

Carbon offsetting

On-site carbon reductions should be maximised as far as possible before any remaining emissions are offset. If the Council is satisfied that the development has maximised on-site reductions but the development is still short of achieving Net Zero Carbon, the developer is expected to make a cash-in-lieu contribution to the Council's carbon offsetting fund at a price of £840/tCO₂ per year over a period of 30 years.

Policy option 2 | Analysis and conclusions

Although policy option 2 introduces multiple requirements and targets to demonstrate compliance with a Net Zero Carbon standard for new buildings, the results will be easier for boroughs to monitor and analyse as they are based on predictive energy modelling (i.e. how the actual building design performs, rather than reductions on a 'notional building'). Therefore they can be directly measured and compared against actual energy use once buildings are in use.

Indicative policy wording for Policy Option 2

Overarching policy

All new buildings should be designed and built to be Net Zero Carbon in operation. They should be ultra-low energy buildings, use low carbon heat, contribute to the generation of renewable energy on-site and be constructed with low levels of embodied carbon.

This is an overarching policy. Compliance with it relies on compliance with the following policies.

- *Space heating demand policy*
- *Low carbon heat policy*
- *Energy Use Intensity (EUI) policy*
- *On-site renewable energy generation policy*
- *Assured energy performance policy*
- *Offsetting (as last resort) policy*
- *Embodied carbon policies (see separate document)*

Buildings must also comply with the other requirements of the Building Regulations Part L 2021, e.g. Fabric Energy Efficiency criterion for domestic buildings and Primary Energy criterion for all buildings and demonstrate compliance at planning stage.

Indicative policy wording for Policy Option 2

Space heating demand policy

- *All dwellings should achieve a space heating demand of less than 15 kWh/m²_{GIA}/yr.*
- *All non-domestic buildings should achieve a space heating demand of less than 15 kWh/m²_{GIA}/yr.*

Energy Use Intensity (EUI) policy

Domestic buildings - *All dwellings should achieve an Energy Use Intensity (EUI) of no more than 35 kWh/m²_{GIA}/yr.*

Non-domestic buildings - *Non-domestic buildings should achieve an Energy Use Intensity (EUI) of no more than the following (where technically feasible) by building type or nearest equivalent:*

- *Student or keyworker accommodation, care homes, extra care homes – 35 kWh/m²_{GIA}/yr*
- *Warehouses and light industrial units – 35 kWh/m²_{GIA}/yr*
- *Schools – 65 kWh/m²_{GIA}/yr*
- *Offices, Retail, HE Teaching facilities, GP surgeries – 70 kWh/m²_{GIA}/yr*
- *Hotels – 160 kWh/m²_{GIA}/yr*

Offsetting (as last resort) policy

Offsetting will only be accepted as a means to achieving planning policy compliance a last resort if the building is compliant with all other Net Zero carbon buildings policies.

In these circumstances, the applicant should establish the shortfall in renewable energy generation to enable the annual renewable energy generation to match the Energy Use Intensity in kWh. The applicant should pay into the Council's offset fund a sum of money equivalent to this shortfall.

Other indicative policies have not been considered in detail in the report, but an example of wording is provided for the low carbon heat, on-site renewable energy generation and assured energy performance policies.

Net Zero Operational Carbon

Ten key requirements for new buildings

By 2030 all new buildings must operate at net zero to meet our climate change targets. This means that by 2025 all new buildings will need to be designed to meet these targets. This page sets out the approach to operational carbon that will be necessary to deliver zero carbon buildings. For more information about any of these requirements and how to meet them, please refer to the: UKBGC - Net Zero Carbon Buildings Framework; BBP - Design for Performance initiative; RIBA - 2030 Climate Challenge; GHA - Net Zero Housing Project Map; CIBSE - Climate Action Plan; and, LETI - Climate Emergency Design Guide.

Low energy use

- 1** Total Energy Use Intensity (EUI) - Energy use measured at the meter should be equal to or less than:

 - **35 kWh/m²/yr** (GIA) for residential¹

For non-domestic buildings a minimum DEC B (40) rating should be achieved and/or an EUI equal or less than:

 - **65 kWh/m²/yr** (GIA) for schools¹
 - **70 kWh/m²/yr** (NLA) or **55 kWh/m²/yr** (GIA) for commercial offices^{1,2}

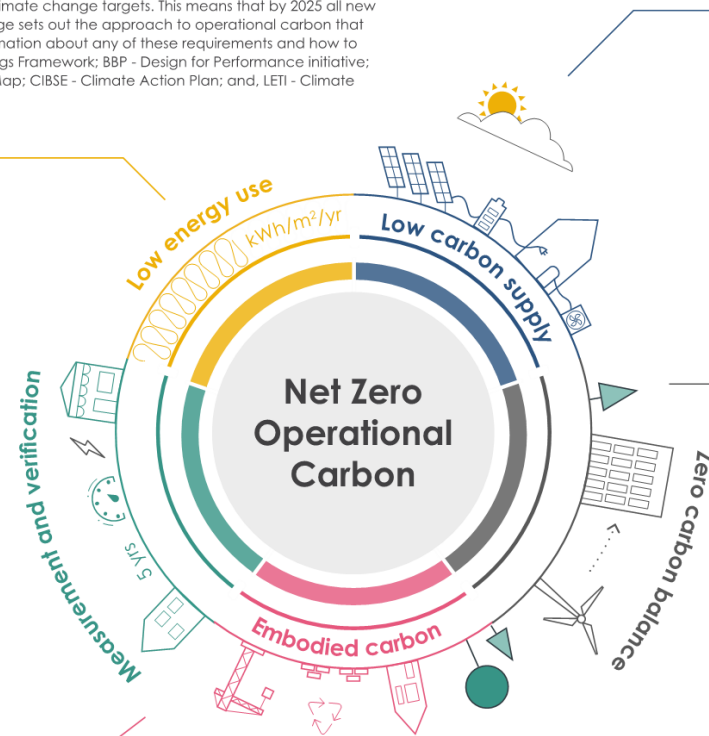
- 2** Building fabric is very important therefore space heating demand should be less than **15 kWh/m²/yr** for all building types.

Measurement and verification

- 3** Annual energy use and renewable energy generation on-site must be reported and independently verified in-use each year for the first 5 years. This can be done on an aggregated and anonymised basis for residential buildings.

Reducing construction impacts

- 4** Embodied carbon should be assessed, reduced and verified post-construction.³



Low carbon energy supply

- 5** Heating and hot water should not be generated using fossil fuels.
- 6** The average annual carbon content of the heat supplied (gCO₂/kWh) should be reported.
- 7** On-site renewable electricity should be maximised.
- 8** Energy demand response and storage measures should be incorporated and the building annual peak energy demand should be reported.

Zero carbon balance

- 9** A carbon balance calculation (on an annual basis) should be undertaken and it should be demonstrated that the building achieves a net zero carbon balance.
- 10** Any energy use not met by on-site renewables should be met by an investment into additional renewable energy capacity off-site OR a minimum 15 year renewable energy power purchase agreement (PPA). A green tariff is not robust enough and does not provide 'additional' renewables.

Notes:

Note 1 - Energy use intensity (EUI) targets
The above targets include all energy uses in the building (regulated and unregulated) as measured at the meter and exclude on-site generation. They have been derived from: predicted energy use modelling for best practice; a review of the best performing buildings in the UK; and a preliminary assessment of the renewable energy supply for UK buildings. They are likely to be revised as more knowledge is available in these three fields. As heating and hot water is not generated by fossil fuels, this assumes an all electric building until other zero carbon fuels exist. kWh targets are the same as kWh_{thermal}. Once other zero carbon heating fuels are available this metric will be adapted.

Note 2 - Commercial offices
With a typical net to gross ratio, 70 kWh/m² NLA/yr is equivalent to 55 kWh/m² GIA/yr. Building owners and developers are recommended to target a base building rating of 4-stars using the BBP's Design for Performance process based on NABERS.

Note 3 - Whole life carbon
It is recognised that operational emissions represent only one aspect of net zero carbon in new buildings. Reducing whole life carbon is crucial and will be covered in separate guidance.

Note 4 - Adaptation to climate change
Net zero carbon buildings should also be adapted to climate change. It is essential that the risk of overheating is managed and that cooling is minimised.

Developed in collaboration with:



Developed with the support of:



Ten key requirements for a Net Zero Operation Carbon

Developed by UKGBC, LETI and BBP, and supported by the Good Homes Alliance, RIBA and CIBSE