UK Net Zero Carbon Buildings Standard

The Analysis of Industry Data That Fed into the UKNZCBS Pilot Version Development

May 2025

Introduction

In September 2024, the Pilot Version of the Standard was launched, enabling the UK built environment to start using the Standard on real-world projects. In 2025, we will be Pilot Testing the Standard, along with completing outstanding aspects (e.g., verification, delineation, equivalence) ahead of the launch of Version 1 at the end of the year.

This document has been prepared to outline how the Upfront Carbon (UC) and Operational Energy (OE) Limits were derived. We committed to anonymising all individual data points submitted to the Standard's call for evidence, and so are not sharing individual datasets within this document, but we hope that what is shared will help users of the Standard to understand the rationale behind the Limits that are currently given in Annex A.

Document Overview

Section 1 of this report explains what data and modelling was received and used in order to derive the 'Performance Levels' for the project - the levels of performance currently achievable on projects.

Nearly 500 UK-based new-build projects were analysed to determine embodied carbon levels. For operational energy, the analysis included datasets and individual projects submitted to the NZBCS (66 projects with in-use energy performance data, and 6 large datasets representing over 570 assets), as well as a large number of industry references including benchmarks for the existing stock, and targets from industry or other sources (e.g. public sector targets).

This section also includes a description of how existing building and retrofit performance levels were determined, following on from the new-build performance levels.

Section 1.b focusses on the ways in which team behind the Standard arrived at today's performance levels.

Section 1.c then goes on to explain our expectations for future performance of buildings.

Together, the numbers derived from 1.b and 1.c give the final Performance Levels set out in 1.d.

These Performance Levels were then used to derive upfront carbon and operational energy limits for buildings commencing on site between 2025 and 2050. The limits were derived by combining performance levels with the top-down carbon budget data through a 'Balancing' process as described in Section 2. These figures were then reviewed following the methods described in Section 3 'Cross-Sectoral Review'; this ultimately led to the final limits as published in the Standard and described in Section 4 'Final Limits'.

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01 Performance Levels

UK Net Zero Carbon Buildings Standard

01.1 General Principles

UK Net Zero Carbon Buildings Standard

What the Performance Levels Represent

The first step in developing the NZCBS limits was to develop Performance Levels, which would then inform where to set the limits.

Operational Energy

The operational energy performance levels result from the assessment of what can be achieved at the asset level in individual sectors and sub-sectors, based on benchmarking of the existing stock, metered data from case studies, and energy performance modelling, as well as other industry schemes where available.

Two types of performance levels were developed:

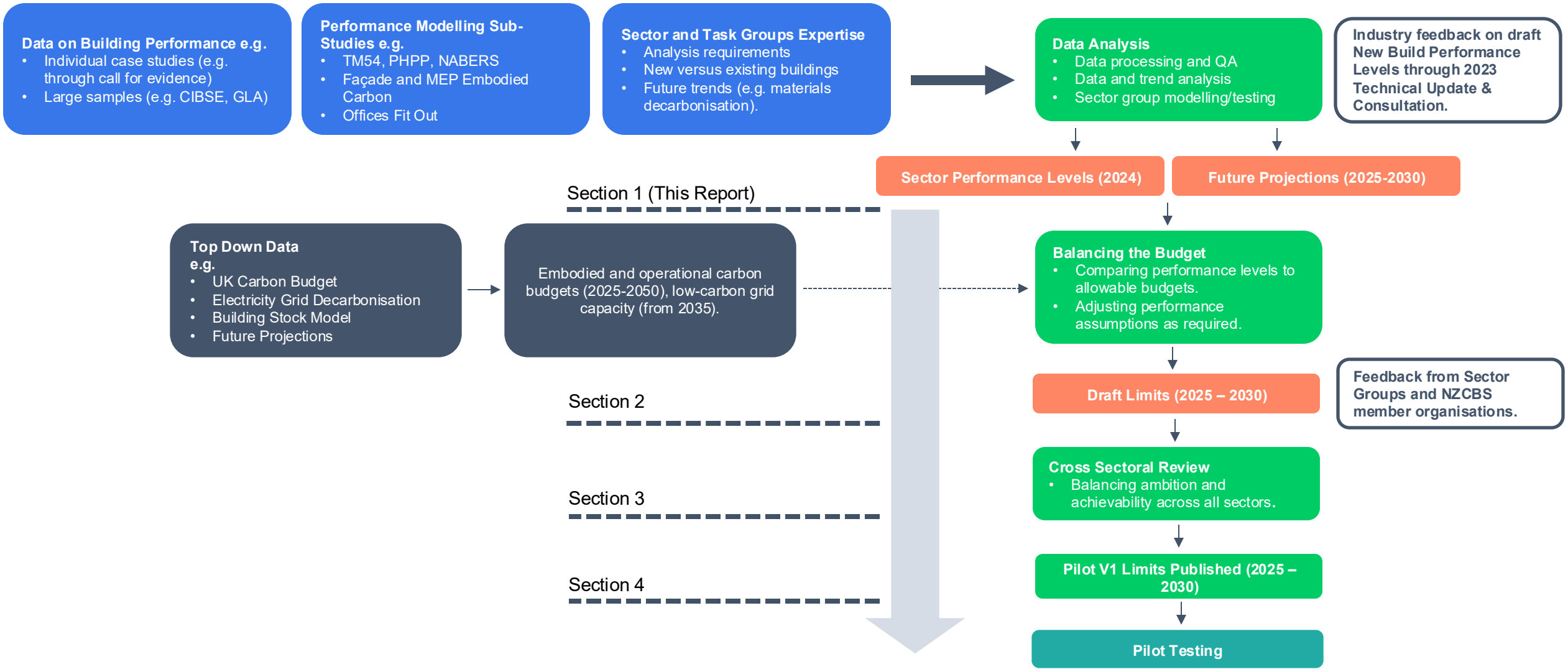
- Best Practice Today
- Future Exemplar

Embodied Carbon

For the embodied carbon performance levels, we are assuming that the data submitted lies somewhere between mean performance and current best practice, as embodied carbon calculations have historically only been undertaken on projects with strong sustainability agendas. We have also not yet differentiated between best practice and future exemplars, the latter of which is based largely on material decarbonisation and can only be driven a little by today's design decisions.

For that reason, embodied carbon performance levels are articulated solely in terms of the range of data received today - percentiles and median/mean values.

Performance Level and Limit Setting Process



01.2 Today’s Performance Levels

UK Net Zero Carbon Buildings Standard

01.2 (i) Today’s Performance Levels

Embodied Carbon

UK Net Zero Carbon Buildings Standard

New Build Embodied Carbon Data Collection

Data Format

Embodied carbon data was collected from several sources, including the beta version of the Built Environment Carbon Database (BECD). Project data was also submitted using the LETI proforma, and OneClick downloads.

Multi-project datasets were submitted by the Greater London Authority, Future Homes Hub, and both Price & Myers and Smith & Wallwork shared their in-house structural embodied carbon datasets.

Scope (Modules)

All building lifecycle modules could be submitted, across modules A-C and D. Sequestered biogenic carbon could be reported, but was to be reported separately to the fossil emissions modules.

Scope (Elements)

Using the element categories provided by the RICS Professional Statement on WLCA in the Built Environment, most submissions concentrated on elements 1 through 5, meaning that facilitating works and external works were omitted from submission.

This means that the Standard team focussed on the analysis of the data submitted for:

- Substructure (1)
- Superstructure (2.1-2.4)
- Facade (2.5-2.6)
- Cat A fitout (2.7-3)
- FF&E (4)
- Building services/MEP (5)

Very few datasets included all six elements shown on this page; many were structure-only (1-2.4).

Sector Specific Differences (EC)

Whilst most sectors follow the process laid out in p.8, with evidence based on modelling and industry-provided data and case studies, a small number of sectors followed a variation on this, to ensure best alignment with other industry initiatives.

Data Centres

Insufficient data was received from the industry for this sector to be able to follow the process.

For embodied carbon, performance levels were based on the Storage & Distribution sector, but with appropriate uplifts for MEP and Facades elements.

Hotels

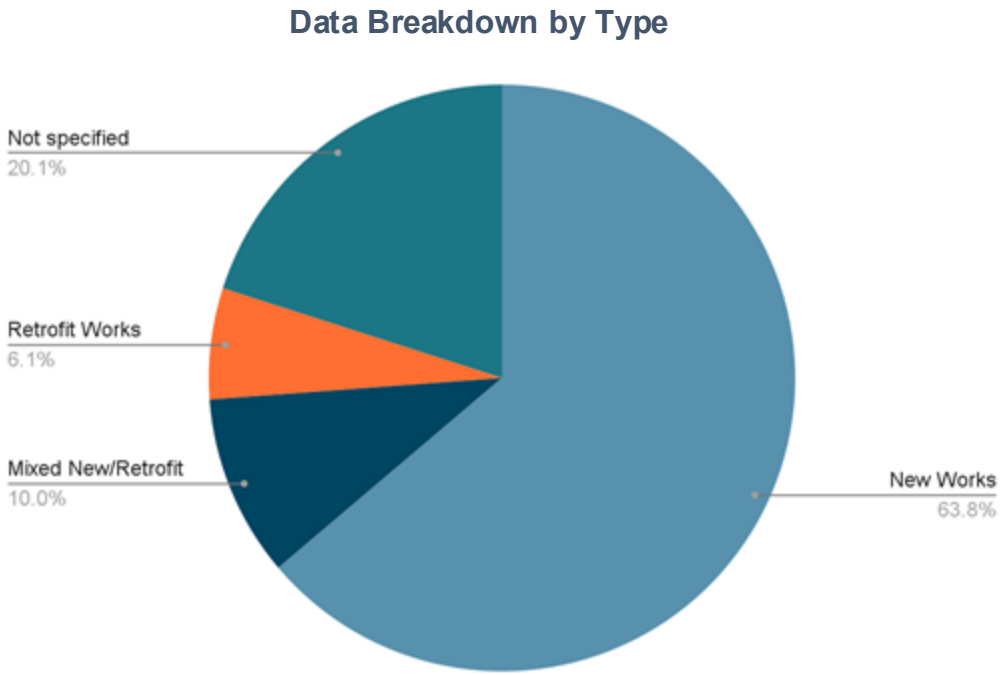
For embodied carbon in Hotel buildings, insufficient data was received from the industry to be able to follow the process, and so performance levels were based on Flats subsector for structural elements, and the Offices sector for all other elements.

Data Breakdown Across All Projects

In total, more than 750 projects were submitted to the call for evidence for the standard.

Of these, around 500 were New Works projects. The process describing how these were then analysed to arrive at performance levels is shown across the following pages.

Only 6% of projects were Retrofit Works schemes, and a further 10% included a mix of new floor area and retrofit. Because this dataset was much smaller, it was not used directly to set performance levels for retrofit projects. Instead, retrofit limits were set following a process shown on p.17. Limits were compared with the retrofit data that was submitted, but this was of limited value due to the size of the data set.



New Build Embodied Carbon Data Analysis

The primary role of the embodied carbon Task Group was to consolidate the various data sources, and ensure that they were comparable in scope to one another.

Validation

We removed data that was largely incomplete or appeared to be too high or low, and imported the remainder into PowerBI to allow the various sources of data to be compared alongside each other.

Backfilling

As most data submitted was only for some elements (e.g. structural-only, with no data for facades, MEP etc.), we backfilled the gaps using average values from where elements did have data submitted.

Elemental Increases

Across all sectors, additional upfront carbon was also added from modelling and substudies where data shown were unrealistically low for select elements. For example, the embodied carbon Task Group estimated typical figures for facades based on CWCT guidance, and MEP systems using TM65, and ensured that each sector surpassed these minimum amounts for each element. The Offices Sector Group similarly provided data for Cat B to ensure that sufficient allowance was made for this element.

Construction emissions allowances from RICS PS V2 were added, as all data was assumed to only follow V1. However no allowances were added for the PS's uncertainty factors, as the Standard is based on measured data after PC, when the uncertainty factor is already very low.

These 'notionally complete' datasets were then used to create embodied carbon histograms for different sectors, and derive percentiles.

This process is shown overleaf.

New Works EC Data Flowchart

BECD
LETI
Price & Myers
Smith & Wallwork
Future Homes Hubs
Other

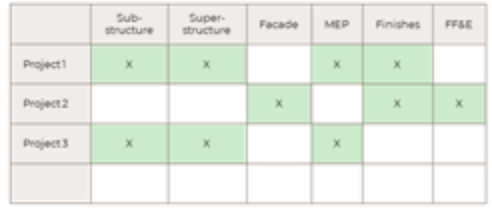
Initial alignment of raw data into common format using PowerBI.

Raw dataset (as received).

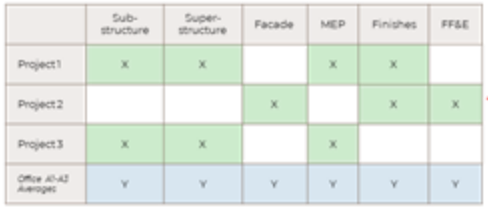
TG1b QA process to remove incomplete/unreliable projects.

TG1b QA process to remove incomplete/unreliable projects.

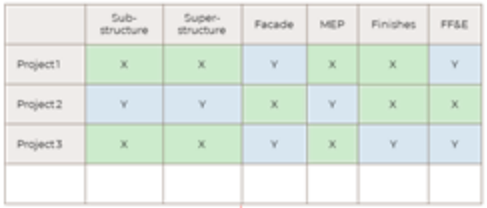
Each project contained only selected elements



Averages calculated for each element, for each sector, for each lifecycle stage



Averages used to backfill projects to obtain full project data



Completed embodied Carbon Dataset.

Histograms created for each sector, for each lifecycle stage

Review of 25th/50th/75th percentiles, averages, medians, etc.

TG1b agrees bottom-up Embodied Carbon Benchmarks.

New Works EC Data Quality

The table to the right shows the number of valid data points within each sector.

For both Data Centres and Hotels sectors, insufficient data received was deemed to be valid, and so performance levels were built up using the average figures from different element types of other sectors. These are outlined on p.12, under 'Sector-Specific Differences'.

The Retail and Sports and Leisure sectors each had fewer than 10 valid data points, and the Healthcare, Higher Education, and Science and Technology sectors each had fewer than 20 valid data points. The performance levels generated in these sectors were treated with more caution.

Many sectors only submitted enough data to understand the performance levels of the sub- and superstructure for that sector.

Other elements were backfilled, following the process on the previous page. Where projects had no data shared for non-structural elements, the A1-A5 average figures from other sectors were backfilled into the gap, using the *Office* sector figures for the Facade elements, and *Commercial Residential* for all other elements.

Most sectors also only submitted sufficient data for upfront embodied carbon (modules A1-A5), meaning that the life cycle embodied carbon performance levels are not understood. It is for this reason that the Pilot version of the Standard does not have life cycle embodied carbon limits at this stage. The intention is to introduce such limits in the future, once sufficient data has been lodged via the Standard.

Sector	Number of Valid Data Points
Commercial Residential	92
Culture and Entertainment	26
Data Centres	-
Healthcare	10
Higher Education	15
Homes (single family homes)	105
Homes (flats)	111
Hotels	-
Offices	72
Retail	7
Schools	87
Science and Technology	17
Sport and Leisure	5
Storage and Distribution	29

Retrofit Works EC Performance Levels

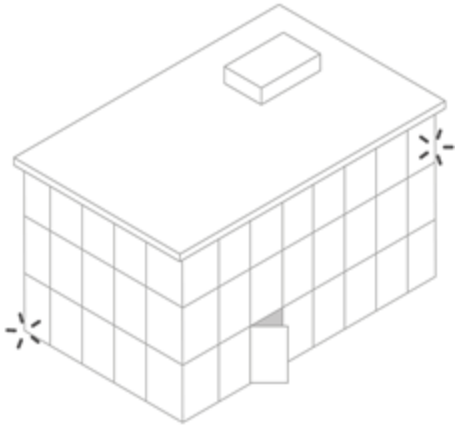
Applying the Limit Setting Approach

These figures demonstrate how the approach outlined on the previous page will be applied, once new-build limits have been set for each sector.

For each element (substructure, facade, etc) within each sector, a Retrofit Factor (RF) will be determined for that element, based on the typical replacement scenarios during Retrofit Works. The RF represents expected upper-bound emissions during retrofit, as a proportion of original emissions for an equivalent new-build.

For example, the RF for facades in the Office sector is set as 1.2 (to represent complete replacement, plus extra to deal with constraints around working to existing floorplates) but for Single-Family Homes was set at 0.8 (to represent the addition of insulation and replacement of the doors and windows).

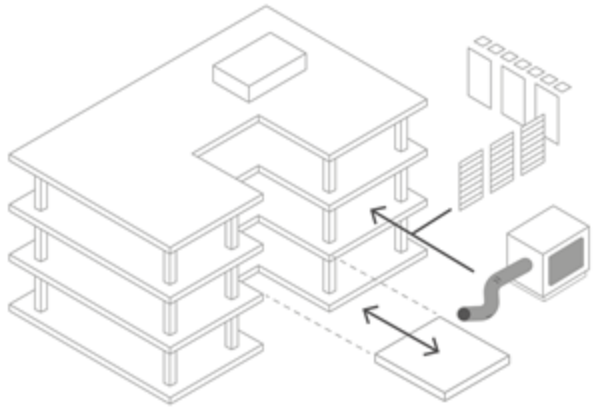
New-build limits are prorated and subdivided to give elemental limits based on typical % split between elements. RFs are applied to these, before summing the factored elemental limits, to give a total Retrofit Works limit for each sector.



New Build Sector X

$$\text{Limit}_{EC} = \sum_{\text{Total}} \left[\text{Limit}_{structure} \; \text{Limit}_{MEP} \; \text{Limit}_{etc...} \right]$$

Individual limits based on element performance levels and sector embodied carbon budget



Retrofit Sector X

$$\text{Limit}_{EC} = \sum_{\text{Total}} \left[\text{RF x Limit}_{structure} \; \text{RF x Limit}_{MEP} \; \text{RF x Limit}_{etc...} \right]$$

Retrofit factors based on expected upper-bound emissions during retrofit, as a proportion of original emissions for an equivalent new-build

Retrofit Factors

		Commercial Residential	Culture, Worship & Entertainment (typical spaces)	Data Centres	Healthcare	Higher Education	Single family homes	Purpose built flats	Hotels	Offices [Whole Building]	Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
Substructure	1.0 Substructure	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
Superstructure	2.1 Frame	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2
	2.2 Upper floors incl balconies														
	2.3 Roof														
	2.4 Stairs and Ramps														
Facade	2.5 External walls	1.2	1.2	1.2	1.2	1.2	0.8	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0.5
	2.6 Windows and external doors														
Finishes	2.7 Internal walls and partitions	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2.8 internal doors														
	3.0 finishes														
FFE	4.0 FF&E	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Services	5.0 MEP	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Construction		0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Demolition		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.2
Weighted Average Overall Factor for Sector:		**79%**	**78%**	**70%**	**78%**	**74%**	**63%**	**75%**	**77%**	**81%**	**69%**	**71%**	**80%**	**79%**	**48%**

01.2 (i) Today’s Performance Levels

Operational Energy

UK Net Zero Carbon Buildings Standard

New Buildings OE Data Collection

Approach to Data Collection

The starting point on operational energy data was very different from that on embodied carbon: data is more readily available, and has been for a number of years, on the energy performance of buildings. On the other hand, a lot of data is simply about ”average” buildings (as opposed to embodied carbon, where data is less available and tends to be biased towards more ambitious projects). The emphasis on operational energy was therefore more on identifying best practice data, rather than collecting as much data as possible.

Data Format

Operational energy data was collected from several sources, including industry benchmarks (e.g. CIBSE, the Building Energy Efficiency Survey) and individual project data submitted through the call for evidence or available through other sources (e.g. through Sector Group members, through CIBSE Building Performance Awards).

In the call for evidence, two data collection forms were made available for people to submit data to the NZCBS:

- One for individual projects, intended to provide information on *best practice* projects.
- One for larger datasets, intended to provide information on *average performance of the existing stock*, for sectors where this information was not available or not considered sufficient from existing industry benchmarks e.g. retail, hotels.

The data collected was for actual metered energy use.

Scope

Where data was collected from large datasets, limited information was usually available on its scope, but likely represented metered data covering all energy uses.

Where data was collected from individual projects, the data collection form requested, where available, information on energy uses included or not. It requested all building-related energy uses to be included, and only other uses such as EV charging to be excluded.

Data submitted to the NZCBS

In total, 66 projects with in-use energy performance data were submitted to the NZCBS in response to the call for evidence on *Best Practice New Buildings* projects.

In addition, 6 large datasets across 5 sectors, representing over 570 assets, were submitted were submitted to the NZCBS in response to the call for evidence on the *existing stock*.

New Buildings OE Analysis

Operational energy performance levels for **new buildings** were developed by the Sector Groups using guidelines developed by Task Group 1a; draft levels were then reviewed by the TSG, to ensure consistency in approach. The process was:

1. Understanding the Sector

- **Determining which sub-sectors should have dedicated performance levels.** Sub-sectors are associated with genuinely different functions, not different servicing strategies (e.g. whether a building is air conditioned or not does not define a different sub-sector, as this would not necessarily encourage the best performance and design strategies).
- **Determining the core end uses** expected to be present in all buildings in that sub-sector, **and additional "special" energy uses*** e.g. in a hotel; bedrooms and general reception, circulation and back-of-house areas are core uses; but a restaurant or swimming pool are special end uses as they represent an additional function which may or may not be present in buildings in that sector. The special end uses, if present in a building, lead to an additional energy allowance in the NZCBS.

2. Defining Performance Metrics for Each Sector and Sub-sector

All sectors include a metric for annual energy use. If the metric proposed is not Energy Use Intensity (EUI, in kWh/m^{2}GIA/yr) then an equivalent EUI is provided to allow comparison and balancing between sectors.

3. Analysis of Energy Performance:

- Reviewing industry benchmarks for the existing stock and additional data available
- Identification of individual best practice projects with metered energy use, to refine the understanding of best practice energy use in the existing stock. This relied on the projects submitted through the Call for Evidence, and others identified separately.
- Reviewing industry schemes and initiatives which already set recommendations or aspirations in terms of energy performance in their sector e.g. NABERS, Passivhaus, LETI, RIBA, UKGBC etc
- Reviewing trends which could lead to changes in energy performance in the future e.g. technological developments.

5. **Energy Performance Modelling** (NOT compliance modelling) e.g. using CIBSE TM54, PHPP or Design for Performance. Where possible, modelling was done under a range of scenarios e.g. occupancy patterns, climate, geographical locations, to provide a level of confidence in the performance levels. Available modelling e.g. from LETI or Design for Performance, could be used instead of or to complement the work.
6. **Combining all the Work into Performance Levels, Taking Account of the Performance Gap**. Two levels were created: **Best practice today, and Future exemplar,** for projects really stretching performance both in terms of the project's ambition and through possible advancements in technology and practice. These 2 levels intended to provide a range to assist the development of NZC limits, now and in the future, by balancing these with the top-down carbon budgets when available.

** Electric Vehicle charging is excluded in all.*

New Buildings OE Analysis Process

1 – Preparation

- Produce list of sub-sectors
- Produce list of “core” and “special” end uses

2 – Develop Sector Specific Performance Metrics

3 – Determine the Sector Profile of the Existing Stock

- Use Call for Evidence data, Sector Group expertise & additional resources
- Define the sector median & best practice zone

4 – Analyse Projects from the Call for Evidence

- Integrate with sector profile, refine best practice
- Review and confirm metrics and special end uses
- Identify useful performance characteristics from these projects, if relevant

5 – Prepare the modelling

- Use Task Group 1A (Operational Energy) guidelines
- Identify resources
- Identify key assumptions
- Identify key performance inputs
- Liaise with other Sector Groups where relevant

6 – Determine the Current Best Practice and Future Exemplar New Buildings Performance Levels

- Determine current best practice and future exemplar modelling inputs
- Carry out modelling, including scenario testing
- Check consistency across the whole sector and whole building
- Carry out Quality Assurance at all steps
- Report the outcomes

Sector Specific Differences (OE)

While most sectors follow the process laid out on p.21 and 22, with evidence based on modelling and industry-provided data and case studies, a small number of sectors followed a variation on this, to ensure best alignment with other industry initiatives.

Data Centres

Insufficient data was received from the industry for this sector to be able to follow the same process as the other groups. For operational energy, performance levels were based on the sector group's analysis of industry trends and standards.

Healthcare

The performance levels follow the NHS Net Zero standard, which was released shortly before the NZCBS work on performance levels analysis started. This was based on advice from the Sector Group, and the desire to align with existing schemes if possible. No further analysis was therefore carried out. The difference is that the NZCBS performance levels (and, in turn, the limits) cover energy uses which are optional in the NHS standard (e.g. Domestic Hot Water).

Commercial Residential, Culture & Entertainment, Hotels, Sports & Leisure

These are sectors where limited data on energy performance is available in the public domain. As a result of this and to limited modelling resources, performance levels were not developed by the Sector Groups for the 2023 Technical Update and Consultation. Instead, the levels were created on the basis of average performance of the existing stock in that sector, to which the same reduction (i.e. improvement) was applied as the average improvement across all other sectors, or the other sub-sectors in that sector if available. pp.35-37, which detail the performance levels in each sector , state where such estimates had to be relied upon.

Existing Buildings (inc. Retrofits) OE Performance Levels

In the overall work to develop the NZCBS, three levels were created for each sector, to represent different levels of performance for Existing Buildings (incl. Retrofits), without pre-judging where the NZCBS limits would be: Light, Medium and Deep. These were used in the balancing model, representing different levels of intervention across the stock.

These levels were created taking account of:

- Relative position compared to the existing stock (e.g. applying improvements to the gas and electricity benchmarks from the existing stock) and the New Buildings levels (i.e. a Deep retrofit was set not to be lower than a New Building level)
- Comparison with other schemes which set recommendations or targets
- Individual projects in-use data, where available.

The levels are described in more detail in 'How the UKNZCBS Limits Were Set' – see p. 31 – 33.

From that balancing exercise, and in consultation with the Task Group 1a and Sector Groups, the performance level was set as “medium” retrofit i.e. Equivalent to some fabric improvements and a switch to electric heating, but not as ambitious as today’s best practice retrofits – see 'How the UKNZBCS Limits Were Set' p. 31 – 33.

01.3 Future Performance Expectations

UK Net Zero Carbon Buildings Standard

01.3 (i) Future Performance Expectations

Embodied Carbon

UK Net Zero Carbon Buildings Standard

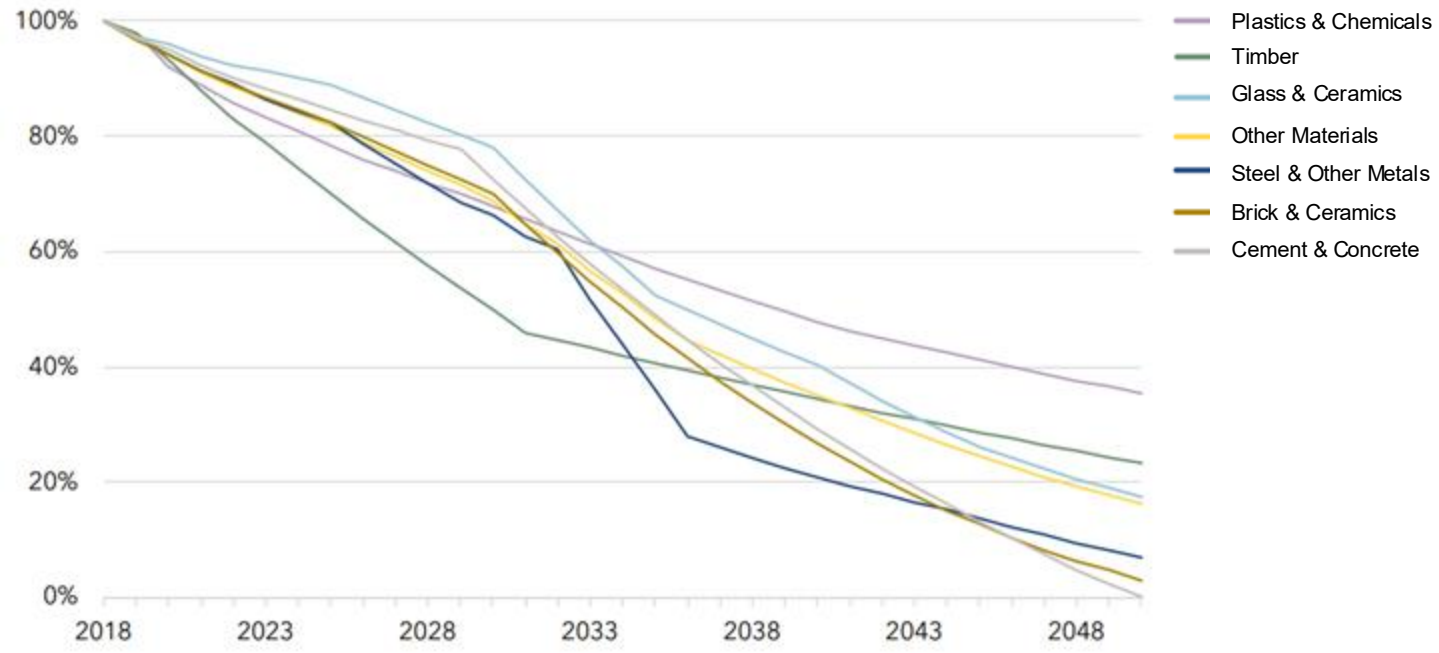
Future Decarbonisation Predictions (1/3)

Future levels of performance were predicted using today's levels as a starting point and then modifying these levels in accordance with project- and industry-level decarbonisation. Three main aspects determined the rate at which decarbonisation was expected to take place: material decarbonisation, material efficiency increases, and material switching opportunities.

Material Decarbonisation

This is the forecast decarbonisation of materials used in the built environment. Figure 14 of the UKGBC "Net Zero Whole Life Carbon Roadmap" (2021) gives trajectories for each material. We researched whether any more recent reports or data would supersede this roadmap, including consulting the roadmap authors, and the only change accounted for is the 2023 Timber Development UK net zero roadmap. These were combined into a weighted average (based on material volumes) as shown later in this section.

(continued overleaf)



From *Net Zero Whole Life Carbon Roadmap (2021), UKGBC*

Future Decarbonisation Predictions (2/3)

Material Efficiency

As part of the industry consultation on our original performance level data, opinions were sought as to how much more efficiently material could be used in comparison with today's typical levels - both for designs today, and a prediction for designs in 2030.

Nearly 200 responses were gathered, and were normally distributed, well-clustered, and free of skew. While the results are opinions and not empirical, the sample size was large enough to draw general tendencies from.

In conclusion, respondents felt that, on average, savings of 30% in upfront carbon were possible today from resource efficiency and on average 40% were possible in 2030. Conservatively, performance levels were therefore reduced by 20% for 2025 levels, ratcheting down to 30% by 2030 and staying at that level beyond.

Material Switching

Finally, the Sector Groups advised on material selection, prioritising the use of the lowest carbon material for each building. Many sectors cited timber as an alternative to steel or concrete for small/medium sized projects including housing, and natural and/or reclaimed materials were highlighted as usable for structure, insulation and finishes. Lower-carbon concrete mixes were commonly seen as an option too.

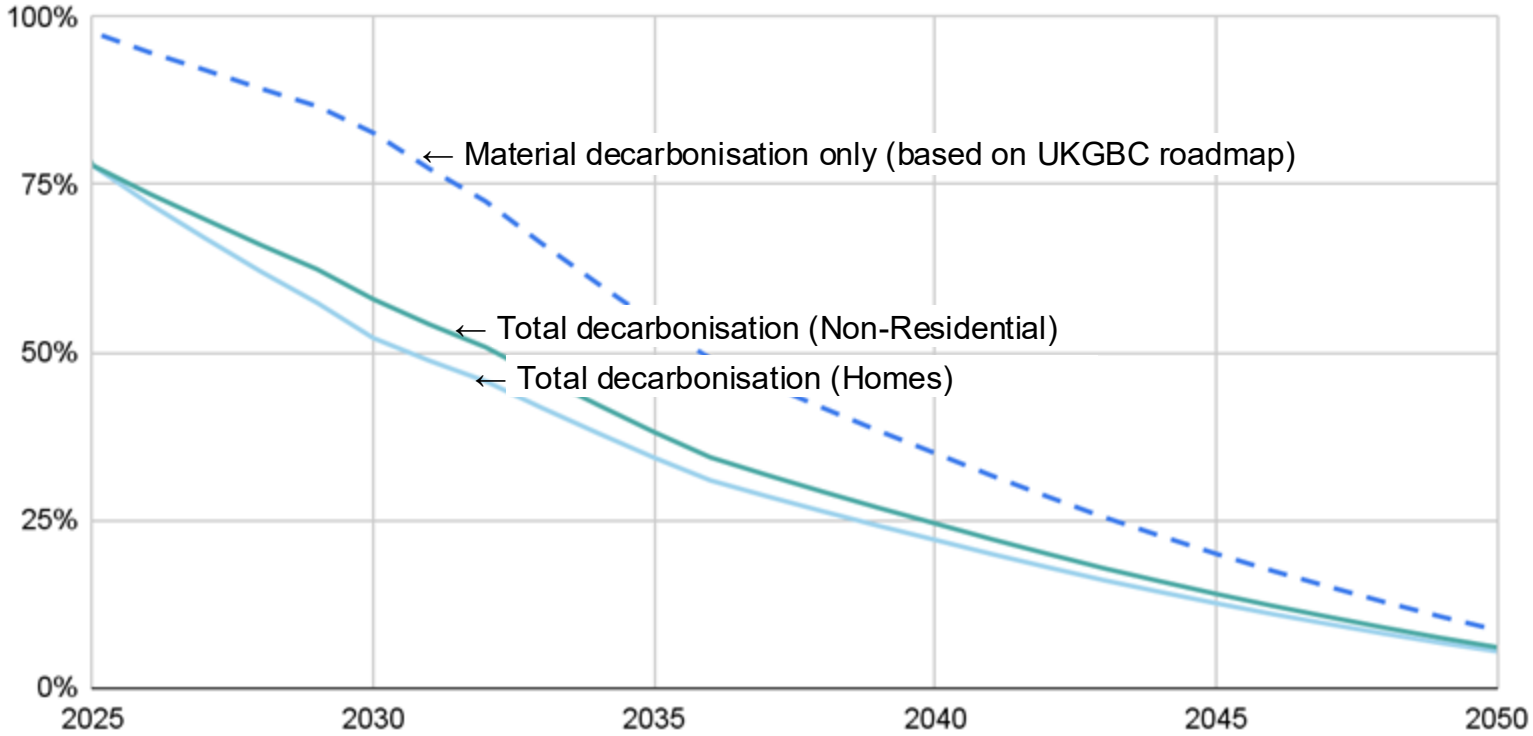
However, it was difficult to find empirical research as to the magnitude of embodied carbon savings presented through such switching of materials in most cases. The Homes sector was the only one where broad studies had been undertaken. For this, figures taken from Wood Knowledge Wales and Nordic Sustainable Construction research indicated that a saving in upfront carbon of more than 10% could be enabled by switching from business as usual construction materials to carbon. Conservatively, a reduction in upfront carbon of 10% was therefore assumed in the Homes sector from 2030 onwards.

Future Decarbonisation Predictions (3/3)

This graph is a visual representation of the three aspects of decarbonisation discussed on the previous page, providing trajectories and performance levels for 2025 - 2050 across all sectors covered by the Standard.

These levels are then shown in absolute terms (i.e. % multiplied by 2024 performance levels) in the tables in section 1.d.i of this report.

Note that these curves do not indicate the final trajectories of the upfront carbon limits, as those were subject to the processes described in Sections 2, 3 and 4 of this report.



01.3 (ii) Future Performance Expectations

Operational Energy

UK Net Zero Carbon Buildings Standard

Future Operational Energy Performance Levels

New Buildings

Future performance levels were derived by the Sector Groups through a combination of:

- In some sectors, in-use data from projects which were considered exemplar and more ambitious than Best Practice today
- Energy performance modelling, either as a variation of the modelling carried out for “Best Practice today” levels with more ambitious inputs, or as dedicated modelling
- In sectors with little data available, improvements (i.e. reductions) applied to the Best Practice Today performance levels, to match average improvements on other sectors.

Existing Buildings (inc. Retrofits)

In each sector, Future performance levels were calculated by applying similar improvements compared to today’s Best Practice, as for the New Buildings levels e.g. in a particular sector, if the Future New Buildings performance levels were 15% better than today’s Best Practice levels, then the Future Existing Buildings (inc. Retrofits) performance levels were calculated as 15% better than today’s Existing Buildings (inc. Retrofits) performance levels.

Overview Across Sectors

The improvements in performance levels over time vary across sectors, depending on the analysis of the Sector Groups. However, compared to the existing stock average (i.e. in % reduction of energy use), there is more variation in today’s Best Practice levels across sectors, than there is in the Future levels i.e. today’s performance levels are more led by the bottom-up analysis of what can be achieved with current practice, which varies a lot across sectors, while the future levels represent more consistent improvements compared to the existing stock.

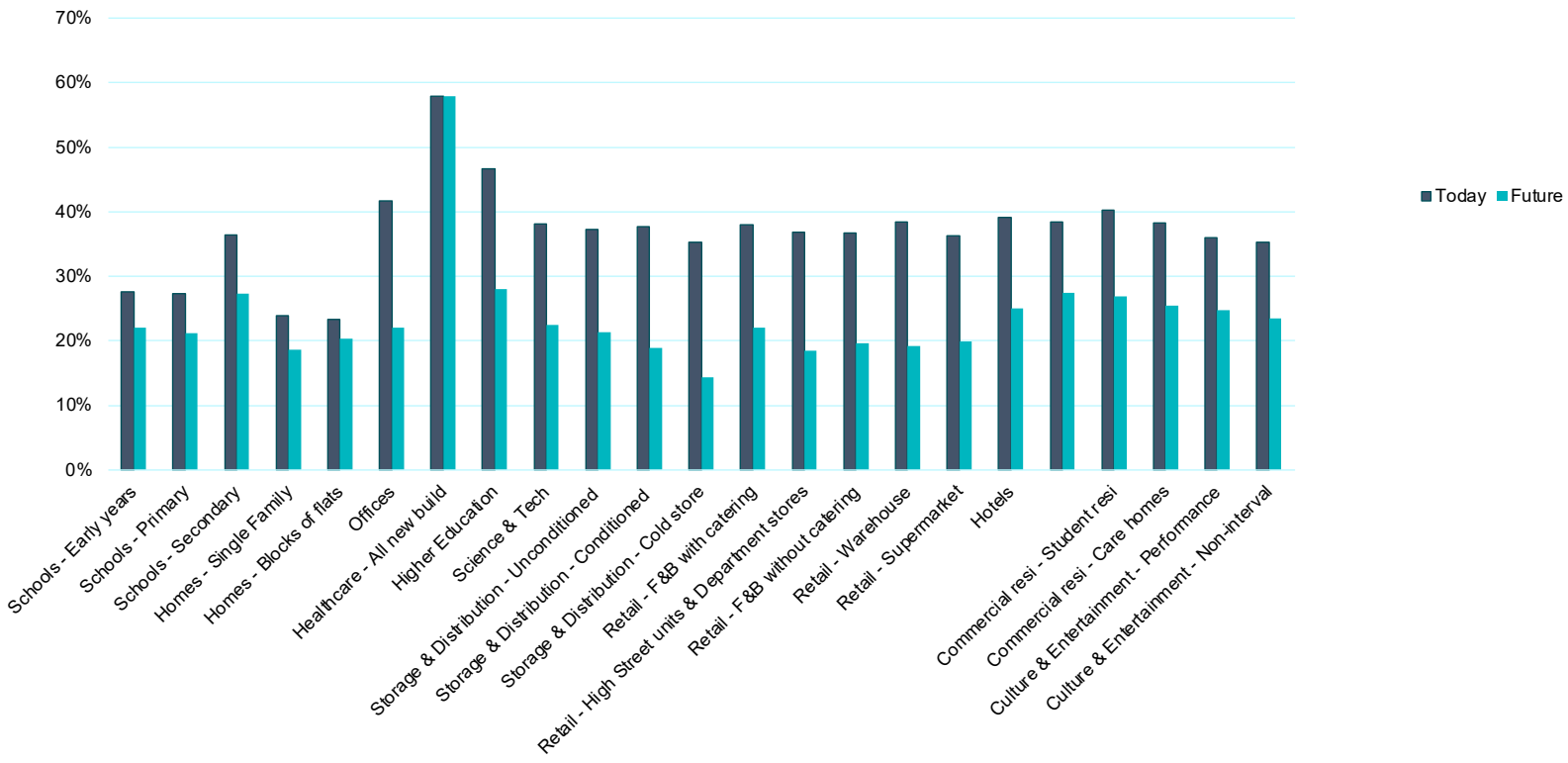
Today’s New Buildings levels represent an average improvement of 66% [53% to 80% across sectors] compared to the average existing stock. Future New Buildings performance levels represent an average improvement of 78% [72% to 86 across sectors].

The improvement over time, from 2025 to 2040 levels, is 34% on average, varying between 13% and 59% across sectors.

Today and Future New Buildings performance levels are represented in the following slides across all sub-sectors, by comparison with the average existing stock energy use in that sub-sector.

Future Operational Energy Performance Levels

New Build Operational Energy Performance Levels, as % of Existing Stock Sector Average



01.4 Performance Levels

UK Net Zero Carbon Buildings Standard

01.4 (i) Performance Levels

Upfront Carbon

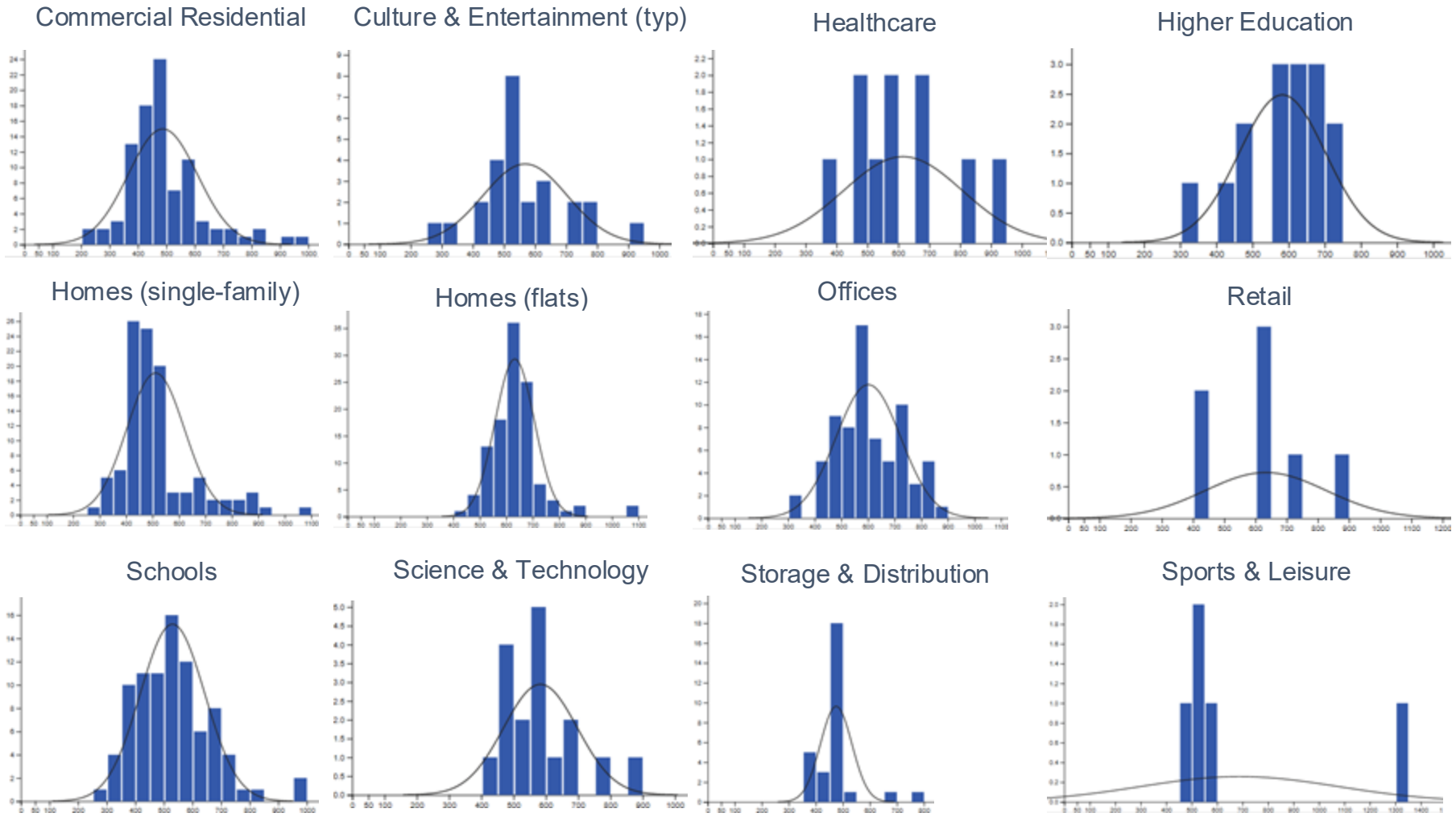
UK Net Zero Carbon Buildings Standard

New Works Upfront Carbon Data Distribution

These histograms demonstrate the range of data submitted for each sector.

The x-axes on these graphs show upfront carbon intensity ($kgCO_2e/m^2$) and are normalised to allow comparison of the distribution of carbon intensity between sectors.

The y-axes give the number of projects in each band, and are different on each graph as the number of projects submitted for each sector varies.



New Works UC Performance Levels

Table shows performance levels in 2024 (mean of received data once adjusted as described in previous pages), along with future predictions for end of each decade, based on material decarbonisation trajectories as outlined on p.27. Note: these are not 'limits', they indicate what is believed to be possible, based on mean data, now and in the future.

	Commercial Residential	Culture & Entertainment (Typical Spaces)	Data Centres*	Healthcare	Higher Education	Homes (Single Family Homes)	Homes (Purpose Built Flats)	Hotels*	Offices (Whole Building)	Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
Mean	618	729	735	776	685	552	689	715	943	763	681	742	701	625
SD	167	182	-	208	139	151	106	-	197	190	171	142	159	112
Min	345	460	-	551	411	301	457	-	640	561	439	606	651	501
Max	1093	1106	-	1069	832	1098	1155	-	1232	1024	1128	1027	1484	920
# of Data Points	92	26	-	10	15	105	111	-	72	7	87	17	5	29

Performance level 2024	618	729	735	776	685	552	689	715	943	763	681	742	701	625
Projected 2025	481	568	572	604	533	430	537	557	734	594	530	578	546	487
Projected 2030	358	422	426	449	397	288	359	414	546	442	394	430	406	362
Projected 2040	151	178	180	190	168	122	152	175	231	187	167	181	171	153
Projected 2050	37	44	44	47	41	30	37	43	57	46	41	44	42	37

**Data Centres and Hotels both based on embodied carbon allowances from other sectors due to a lack of credible data.*
All figures in kgCO_2e/m^2 GIA. 2025-2050 numbers include trajectories based on material efficiency, decarbonisation, and switching described in section 1.3.i of this document.

Retrofit Works UC Performance Levels

Table shows performance levels in 2024 and the future predictions. These are derived from the new-build performance levels from the previous page, multiplied by the retrofit factors shown on p.18. Again, these are not limits but expected performance levels.

	Commercial Residential	Culture & Entertainment (Typical Spaces)	Data Centres*	Healthcare	Higher Education	Homes (Single Family Homes)	Homes (Purpose Built Flats)	Hotels*	Offices (Whole Building)	Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
Performance Level 2024	487	571	516	604	506	346	516	551	455	621	472	530	559	497
Projected 2025	379	445	402	470	394	269	402	429	354	484	368	413	435	387
Projected 2030	282	331	299	350	293	180	269	319	263	360	273	307	324	288
Projected 2040	119	140	126	148	124	76	114	135	111	152	116	130	137	121
Projected 2050	29	34	31	36	30	19	28	33	27	37	28	32	34	30

01.4 (ii) Performance Levels

Operational Energy

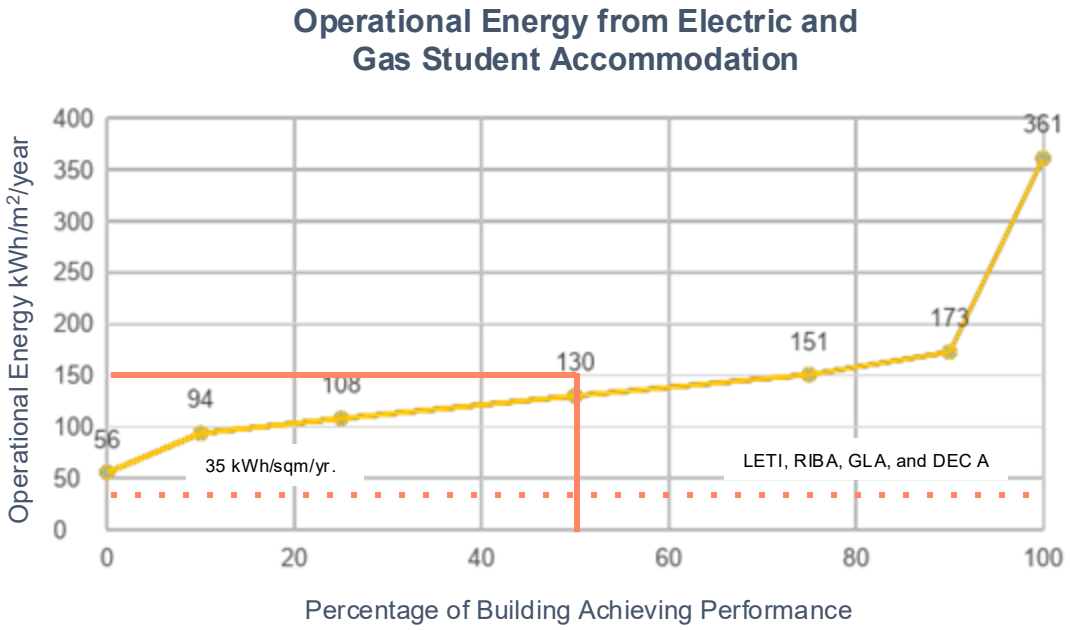
UK Net Zero Carbon Buildings Standard

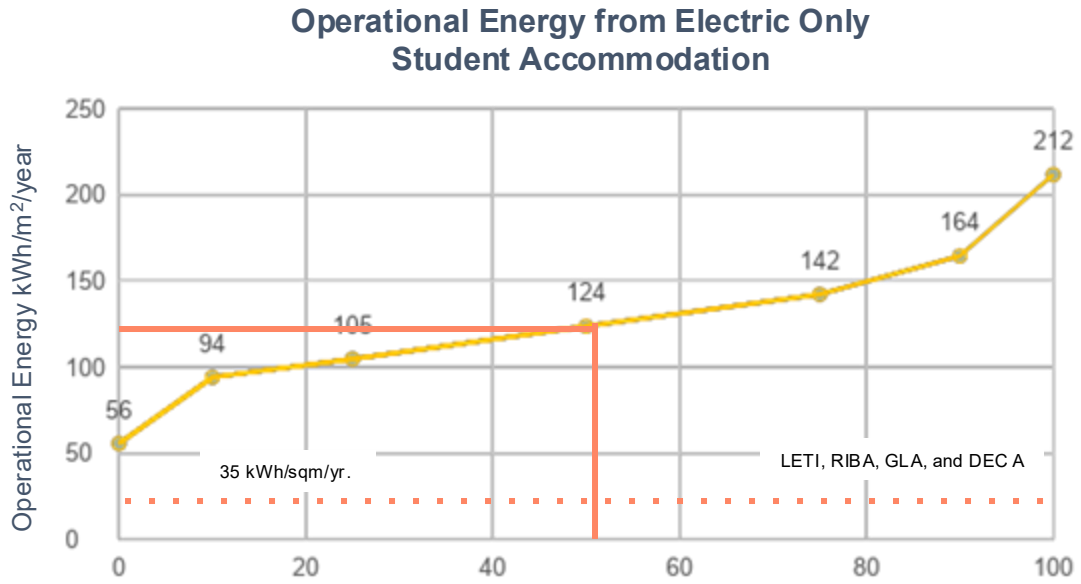
Commercial Residential – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (For Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Student Accommodation	124 (all elec) 130 (gas + elec) (50th)	94 (10th)	71*	35*
Care Homes	Not available. Indicative Range: 130-145 kWh/m²GIA/yr	Not available (see comments on next slide). Indicative Range: 70-90 kWh/m²GIA/yr	151*	74*
Other Schemes	Student Accommodation: The above is based a collection of 80 student accommodation operational energy consumption (2019). Care Homes: No available benchmarks identified. The range above is based on healthcare (as per NHS recommendations to follow LETI offices) and residential (RIBA Challenge), with care homes expected to sit somewhere between the two.		Student Accommodation: • Unite Students Net Zero Target: • Vero Homes Net Zero Inputs • GSA Group • Greater Cambridge, Local Plan First Proposals for consultation, 2021: 35kWh/m²/yr Care Homes: Passivhaus	
Existing Buildings Meeting PL?			Student Accommodation: • Schemes available within large dataset, 5th-10th percentile (see illustration overleaf). • 2 Individual Schemes: Student Residences, Cambridge: 59 kWh/m² GIA/yr (average across 2 buildings, for 59 students); Student Residences, Cambridge: 56 kWh/m² GIA/yr (average across 72 rooms) Care Homes • 1 Passivhaus scheme, 60 beds	
Modelling			N/A	
Performance Gap			N/A	

** Performance Level not developed by the Sector Group, therefore estimated based on the existing stock median, to which was applied the same % improvement, as average across the other Sector Groups (i.e. 62f% for Best Practice, and 81% for Future Exemplar)*

Commercial Residential – Performance Data Review





The dataset represents a collection of 80 student accommodations from the year 2019 operational energy consumption. Graph 1 dataset represents heat from gas boilers, local electric heating, and district heating. Graph 2 dataset is limited to local electric heating and district heating.

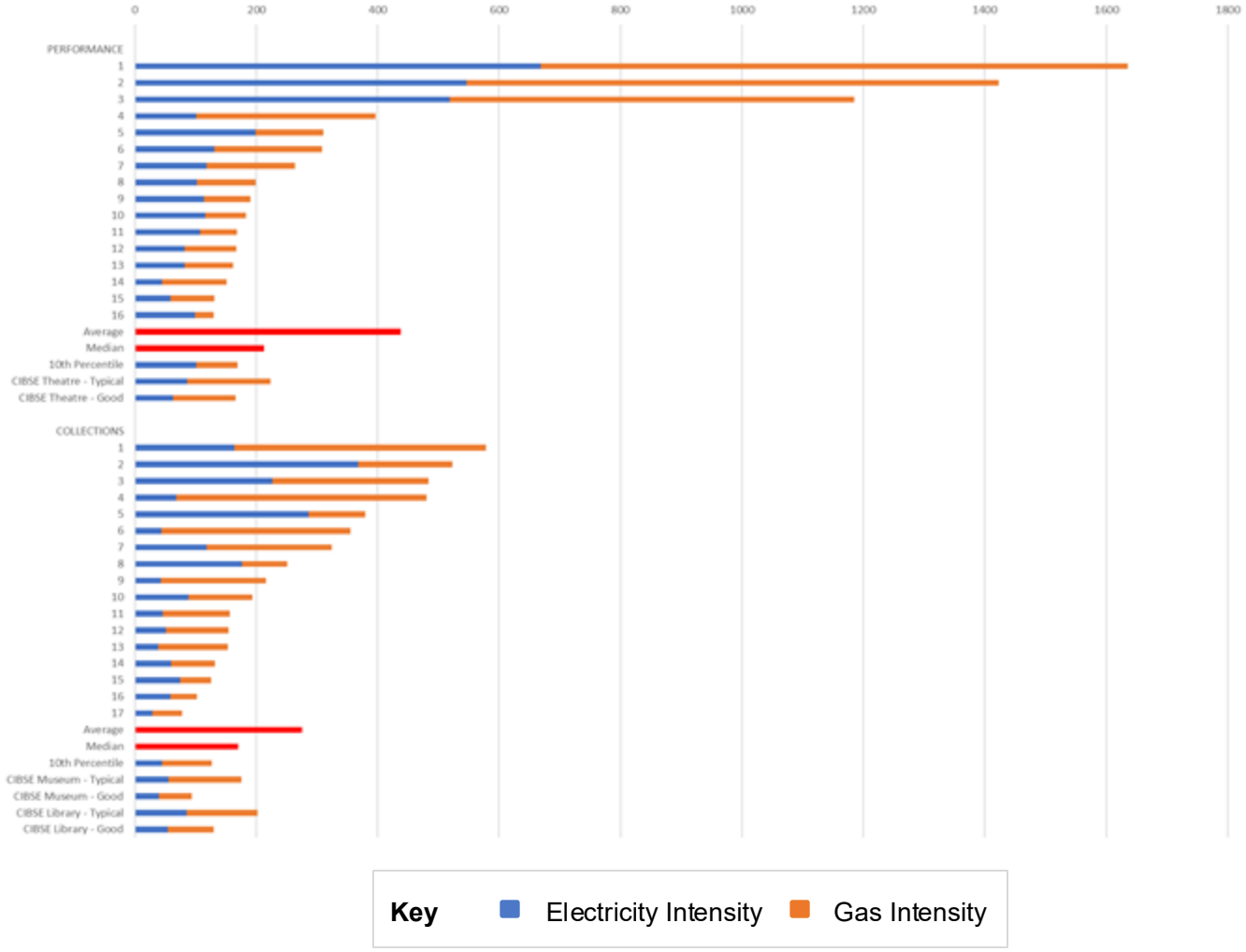
Culture and Entertainment – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (For Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Performance (Interval Based)	Total: 203 (Gas: 102 & Elec: 111)	Total: 134 (Gas: 63 & Elec: 70) (10th Percentile)	85*	42*
Collection Based (Non Interval)	Total: 170 (Gas: 111 & Elec: 59)	Total: 91 (Gas: 50 & Elec: 41) (10th Percentile)	65*	32*
Archive**			5	4
Other Schemes	• Julie's Bicycle: At organisation level • CIBSE: Theatres, Museums and Libraries, based on DECs. They are shown for comparison in the following page. The ones for Cinemas are considered too old. The benchmarks proposed here are derived from a combination of projects from Julie's Bicycle database as well as projects submitted through the call for evidence (see illustration on next page).		No clear recommended targets identified, which are science-based targets.	
Existing Buildings Meeting PL?			None identified, but the buildings in the dataset used gas heating systems; recent projects from Sector Group expected to perform better.	
Modelling			Use of existing PHPP models, complemented by specific modelling: Performance: Modelling carried out, with results significantly better than the current 10th percentile benchmark. Collections Buildings: Modelling carried out on one building. Archive: PHPP modelling from existing projects within the Sector Group.	
Performance Gap			-	

** Performance Level not developed by the Sector Group, therefore estimated based on the existing stock median, to which was applied the same % improvement, as average across the other Sector Groups (i.e. 62% for Best Practice, and 81% for Future Exemplar)*

*** Performance Level identified as needed at the time of the draft limit review, after the 2023 initial development: not included in the original development of Performance Levels, but shown here for completeness.*

Culture and Entertainment – Performance Data Review



Datacentres – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (For Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	PUE*	PUE*	PUE*	PUE*
Low Utilisation **	1.67	TBC	1.4	1.3
High Utilisation **		TBC	1.2	1.1
Other Schemes	Uptime Institute 2020, UK average used above.		NABERS Datacentres (Australia).	
Existing Buildings Meeting PL?			None identified.	
Modelling			Yes – tool developed by one member of the Sector Group, reviewed by other members.	
Performance Gap			Expected to be less significant than in other sectors due to less influence from occupants than in other sectors.	

** Power Usage Effectiveness (PUE), annualised.*
*** Simplified from the 4 utilisation ranges and performance levels originally proposed in the summer 2023 Technical Update and Consultation.*

Healthcare – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (for core end uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Space Types	Space types and limits defined as per NHS standard, each with performance level, with Overall performance level determined by space mix.			
Low Tech Space	75 elec + 194 thermal	94 elec + 152 thermal	Type 1- 30 Type 2- 70	Best Practice today is set to be aligned with NHS Standard performance levels. It is considered ambitious, so no additional level of ambition proposed at this stage.
Medium Tech Space			Type 1- 95 Type 2- 45 Type 3- 40 Type 4- 50	
High Tech Space			Type 1- 165 Type 2- 80	
Ultra High Tech & Specialist Spaces			N/A	
Support Spaces			N/A	
Other Schemes			• NHS Net Zero Standard: The performance levels proposed here are aligned with it. • Scottish Futures Trust: No specific limit, but an indication that it is likely as a whole building limit to be above 100kWh/m²/yr	
Existing Buildings Meeting PL?			No direct comparison with space-type limits, but Passivhaus Foleshill Health Centre: 42kWh/m²GIA/yr	
Modelling			No dedicated modelling for the NZCBS, but modelling was carried out to inform the NHS standard.	
Performance Gap			TBC	

Healthcare

Overview of How UKNZCBS Works with NHS Net Zero Standard, for Operational Energy Performance Levels

See details on right hand side: UKNZCBS only set performance outcomes, not elemental limits.

Step 1: Building Performance Targets

Whole Building

At whole building level, the performance targets are to be applied to the envelope and other whole building systems

Step 2: Space-type Energy Limit and Performance Targets

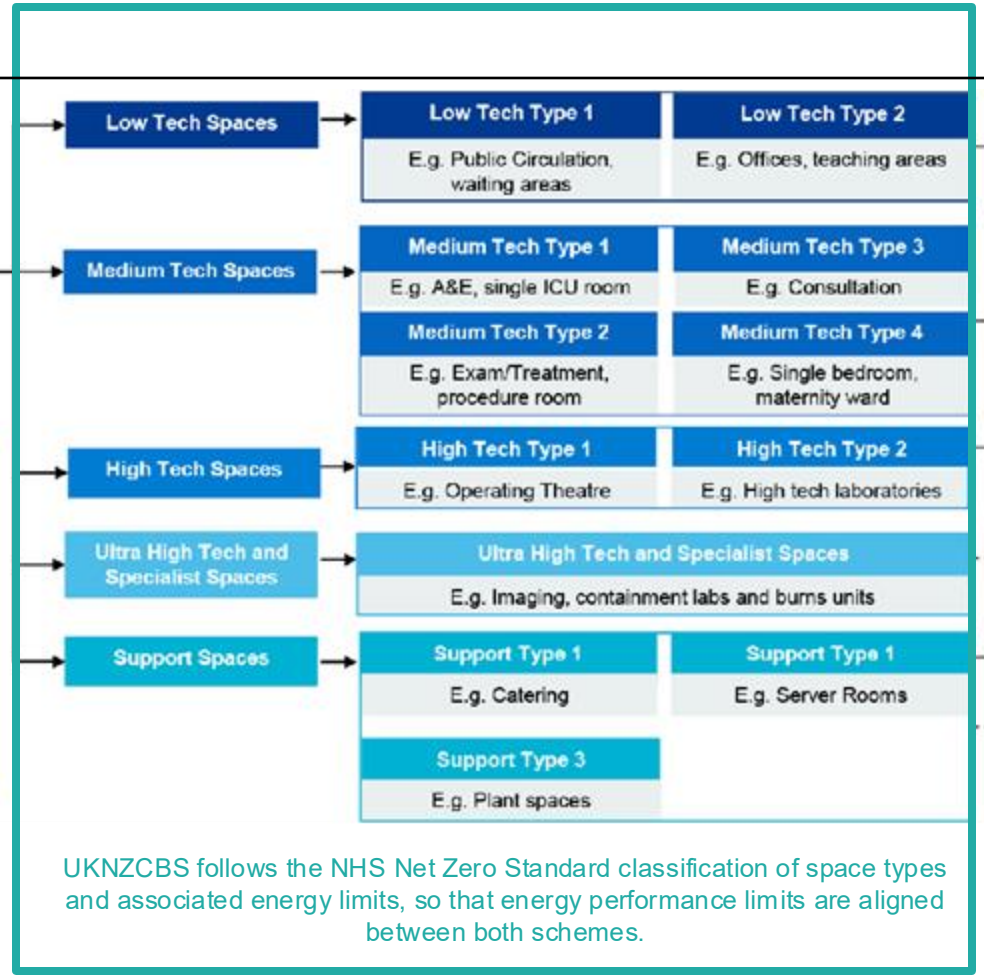
Space-type

Identify the relevant Energy Limit or Building Services Performance Targets in the Standard for all space-types in the design

Measurement and Verification – Section 6

- Engaging Facilities Management through Government Soft Landings and Post Occupancy Evaluation Rigorous enhanced commissioning
- Extensive monitoring, metering and controls of energy usage, including publicly reported and disclosed.
- Data collection to enable the ability to report per patient outcome and treatment in the future to support decarbonising the whole NHS

Required by UKNZCBS: Compliance is only achieved with in-use verification, to the UK NZCBS verification rules.



UKNZCBS follows the NHS Net Zero Standard classification of space types and associated energy limits, so that energy performance limits are aligned between both schemes.

~~Select Building Performance Targets~~

~~Select and specify the performance targets values that are best suited to the building, construction type and location. **Performance targets include:** Envelope - U values, airtightness, glazing parameters. Other - metering and monitoring of energy systems, refrigerant GWP, and domestic hot water (DHW) efficiencies~~

Not required by UKNZCBS: No elemental requirements, only in-use performance outcome requirements.

Energy Limits

Derive Energy Limits based on space-type, location, equipment and domestic hot water demand (DHW) based on provided ranges of values.

Advisory limits for DHW and unregulated loads.

Required by UKNZCBS: DHW and unregulated loads to be included in overall performance limits.

~~Follow Performance Targets~~

~~Follow building services performance parameters for specialist and support spaces including AHU SFPs, SCOPs, SEERs, heat recovery efficiency and lighting loads.~~

Not required by UKNZCBS: No elemental requirements, only in-use performance outcome requirements.

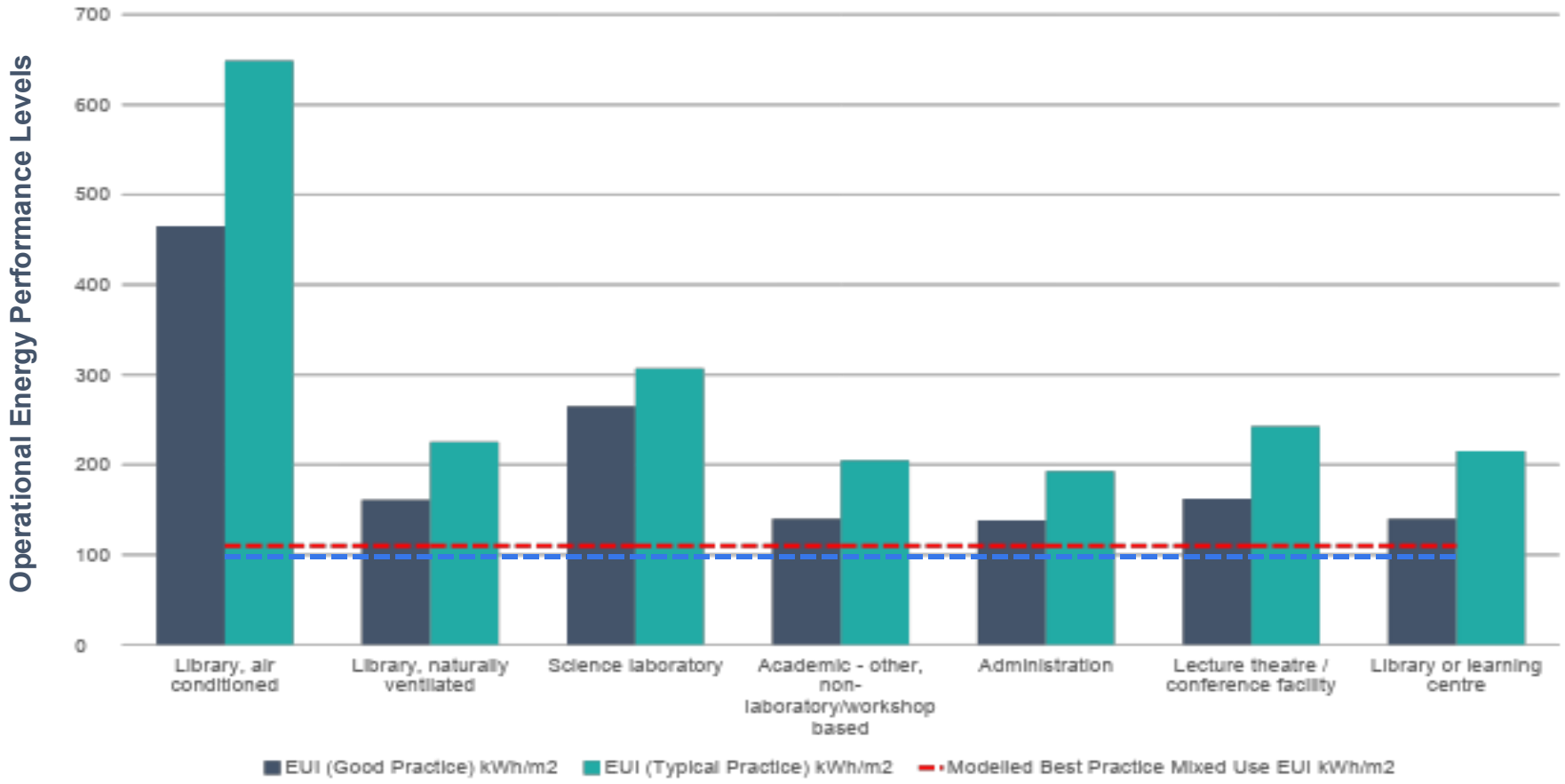
Higher Education – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (For Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Higher Education	216 (gas + elec) 184 (all-elec)	N/A	110*	43**
Seminar/Teaching Spaces *	196 - 261 (gas + elec)	162 - 223 (gas + elec)		
Library/Learning Centre *	215 (gas + elec)	140 (gas + elec)		
Lecture Theatre *	243 (gas + elec)	162 (gas + elec)		
Workshop *	205 (gas + elec)	140 (gas + elec)		
Other Schemes	BEES as overall average used above. CIBSE Typical and Good Practice, used above for space types. For "seminar / teaching spaces", the range represents several CIBSE benchmarks available: Higher Ed - Lecture theatre, Further & Higher Ed – Lecture room – Arts and – Science.		• Scottish Futures Trust Net Zero Public Sector Building Standard: general operational energy limit of 100kWh/m²/yr for mixed-use higher education buildings/campus, possibly higher in some cases (e.g. buildings with labs) or lower in others (e.g. higher education teaching) • Greater Cambridge, Local Plan First Proposals for consultation, 2021: 55kWh/m²/yr (teaching facilities)	
Existing Buildings Meeting PL?			Limited selection of existing building information to provide analysis against differing space types: • One 'mixed use' new build project currently at ~126kWh/m². • Mixed use Passivhaus facility performing at ~97kWh/m².	-
Modelling			TM54 model on one 'mixed use' building to provide indication of performance for a 'general' facility.	N/A
Performance Gap			Integrated within TM54 model, through consideration of operational factors (occupancy, system run hours, small power usage etc.).	

** In the 2023 Technical Update and Consultation, it was originally proposed that limits would be applied by space type rather than whole buildings – as shown here in grey. A "general mix" building was modelled for which these space types would lead to a performance level of 110 kWh/m2GIA/yr. Over subsequent developments, the overall building level was adopted instead, complemented by levels from other sectors (e.g. datacentres, labs etc) if relevant.*

*** Performance Level not developed by the Sector Group, therefore estimated using a similar improvement on the existing stock median, as average across the other sector groups (i.e. 78%).*

Higher Education – Performance Data Review



"Best practice today" performance level: 110 kWh/m²/yr

Scottish Futures Trust limit (broadly, with possible variations): 100 kWh/m²/yr

Note: Typical and Good Practice benchmark EUIs presented here are a simple addition of electricity and gas benchmarks.

Homes – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (for core end uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m2GIA/yr	kWh/m2GIA/yr	EUI, kWh/m2GIA/yr	EUI, kWh/m2GIA/yr
Flats	123 (all-elec) 175 (gas+elec)	85 (all-elec) 120 (gas+elec)	35	35**
Detached	118 (all-elec) 199 (gas+elec)	58 (all-elec) 148 (gas+elec)	40	
Semi Detached and End Terrace	127 -141(all-elec) 196-203 (gas+elec)	79-95 (all-elec) 145-152 (gas+elec)	42*	
Bungalow	158 (all-elec) 225 (gas+elec)	106 (all-elec) 165 (gas+elec)	49*	
Other Schemes	Benchmarks: CIBSE (large database, QAed): Used above GRESB: 120kWh/yr, Europe, residential sector		• LETI: EUI of 35 • RIBA Challenge: As per LETI • Passivhaus: Broadly as per LETI, with a heat pump • Future Homes Hub: Future Homes Standard Contender Specs. The comparison is not exact as some of the FHH figures take account of the benefits of on-site PVs; and they come from SAP, not energy performance modelling. A range is available across Contender Spec 2, 3 and 4, expressed in kWh/m²TFA/yr (not GIA): End Terrace: 50-58. Room-in-Roof Semi-Detached: 47-56. Mid-Terrace: 45-52. Detached: 47. Large Detached: 36-43. Bungalow: 49-58. • Local Authorities e.g. Corwall Council: 40kWh/m²/yr; Basingstoke and Deane, Local Plan update for consultation, 2024: 35kWh/m²/yr; Winchester District Local Plan, December 2024 submission for examination: 35kWh/m²/yr; Greater Cambridge, Local Plan First Proposals for consultation, 2021: 35kWh/m²/yr	
Existing Buildings Meeting PL?			Flats:15 flats across 3 projects in Swansea: Median 57.4kWh/m2/yr (24-98); 3 of them meeting or close to Performance Level Detached Houses: Identified by sector group: 14 houses across 6 projects: Median 69kWh/m2/yr (32-124); 3 of them meeting Performance Level. Small number of other projects identified subsequently. Semi-Detached and End Terrace: 2 houses across 2 projects: 50-80kWh/m2/yr Bungalow: 2 Bungalows across 2 Projects : 25-50kWh/m2/yr	Small number of individual homes meeting, or close to.
Modelling			Energy performance modelling (PHPP) for Detached houses (1 model); flats (2 models), including testing in different climates(London, Swindon, Birmingham and Glasgow). Use of industry performance modelling, through comparison against LETI levels	
Performance Gap			The Performance Levels are not directly the modelling results: they also take account of analysis of in-use projects, which inherently incorporate a performance gap.	

** Performance Level not developed by Sector Group, therefore estimated based on the existing stock median, to which was applied the same % improvement, as average across the Flats and Detached House sub-sectors.*

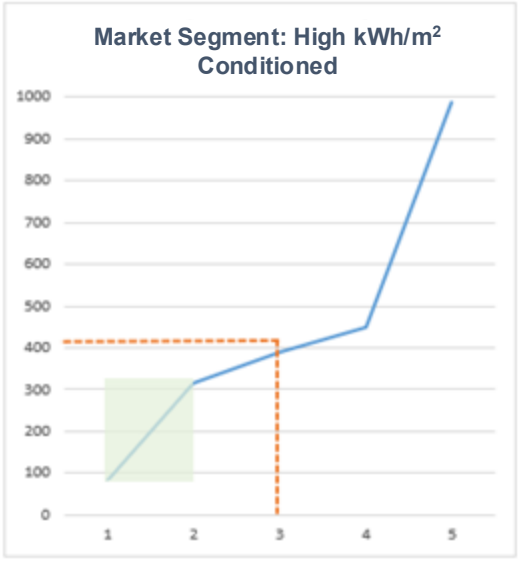
*** Performance Level not developed by Sector Group, therefore proposed as aligned with LETI and RIBA. This represents a similar improvement on the existing stock median, as across the other sector groups (i.e. 81%, vs 78% on average across other sectors).*

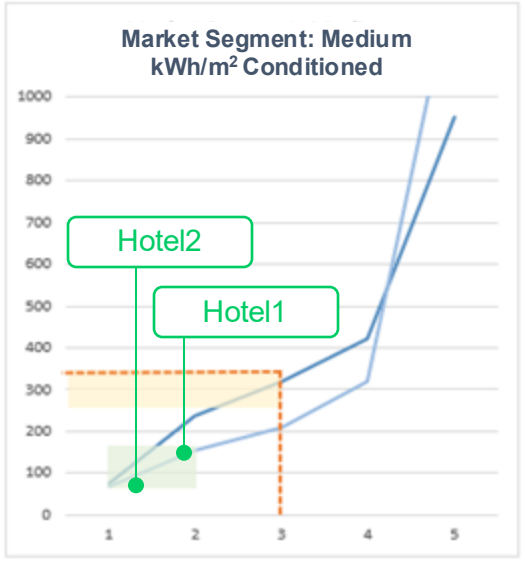
Hotels – Performance Levels

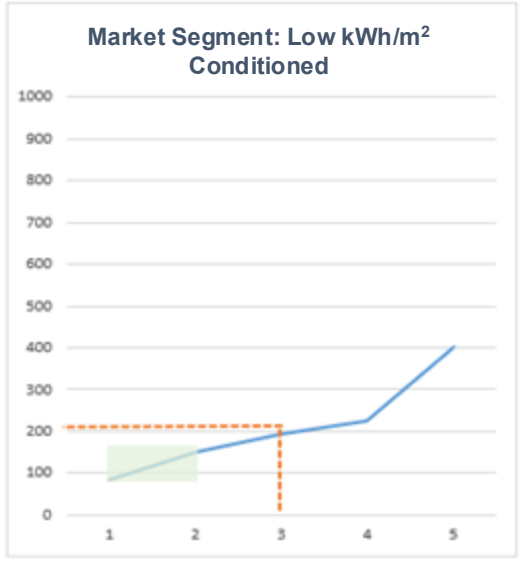
	Existing Stock Benchmarks		New Build Performance Levels (for Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Hotels			123 *	61 *
High (5 Star) **	389 (m²CA) or 311 (m² GIA)	82-314 (m²CA) or 65-251 (m² GIA)	TBC	TBC
Medium (3-4 Star) **	210-320 (m²CA) or 168-256 (m² GIA)	68-153 (m²CA) or 54-123 (m² GIA)	TBC	TBC
Low (2-1 Star) **	195 (m²CA) or 156 (m² GIA)	82-151 (m²CA) or 65-121 (m² GIA)	TBC	TBC \
Other Schemes	CIBSE and BEES datasets are from 2012 and 2014 respectively, and are not considered representative of latest technologies and practices. BEES doesn't provide market segment granularity. The Cornell dataset has been used here as it contains data from 2019 and includes multiple granularity levels.		• Passivhaus Hotels (Europe; 1 in construction in UK) • NABERS Hotels (Australia) • Greater Cambridge, Local Plan First Proposals for consultation, 2021: 55kWh/m²/yr	
Existing Buildings Meeting PL?			Yes, through Cornell dataset and projects submitted to the call for evidence (see illustration on following slide).	
Modelling			N/A	
Performance Gap			-	

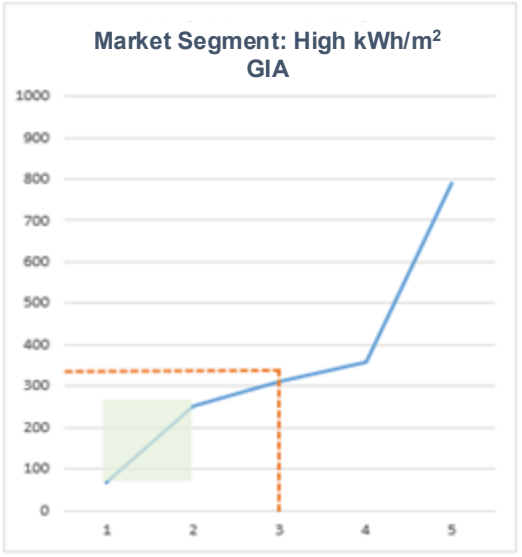
** Performance Level not developed by the Sector Group, therefore estimated using a similar improvement on the existing stock median, as on average across the other sectors.*
*** Performance Levels were originally proposed to be developed which would differ depending on the hotel "star" ratings. This was subsequently changed in the development of the Pilot, due to industry feedback, with a single level across the sector (and only differentiations for functions which may differ e.g. swimming pool). The original benchmarking, per hotel rating, is shown here in grey for reference.*

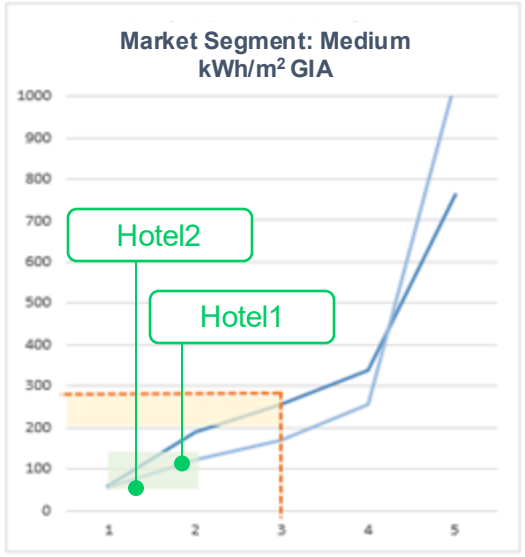
Hotels – Performance Data Review

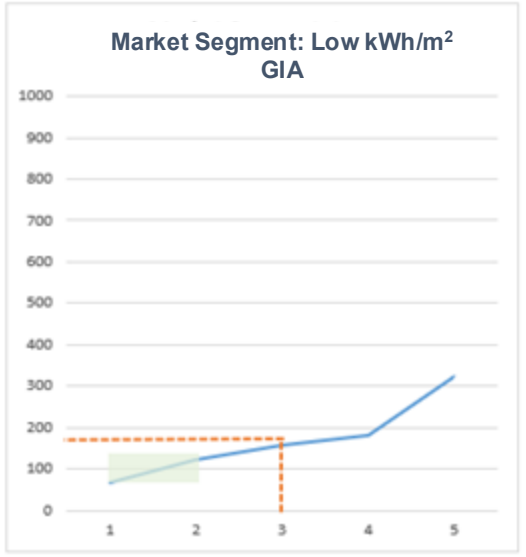












4 Star
3 Star

Note: As noted in the previous slide, CIBSE and BEES benchmarks are not used here due to lower levels of confidence.

Cornell Data (Blue Lines on Graphs)

kWh/m² Conditioned

Sub Sector	Sub-T	Low	Lower Q	Median	Upper Q	High
High	5 Stars	82	314	389	449	988
Medium	4 Stars	74	237	320	423	953
	3 Stars	68	153	210	320	1298
Low	2 Stars	82	151	195	226	402

kWh/m² GIA

Sub Sector	Sub-T	Low	Lower Q	Median	Upper Q	High
High	5 Stars	65	251	311	360	791
Medium	4 Stars	60	189	256	339	763
	3 Stars	54	123	168	256	1038
Low	2 Stars	65	121	156	181	321

Hotels from Call for Evidence

Hotel 1 (High End)

kWh/yr	712,000		
GIA	4,000	178	kWh/m2 GIA
Conditioned	3,200	223	kWh/m2 Conditioned

Hotel 2 (High End)

kWh/yr	393,207		
GIA	3,200	123	kWh/m2 GIA
Conditioned	2,560	154	kWh/m2 Conditioned

Offices – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (for core end uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWhe/m²NIA (gas @0.4 kWhe)	kWhe/m²NIA (gas @0.4 kWhe)	EUI, kWh/m²GIA/yr unless stated otherwise	EUI, kWh/m2GIA/yr unless stated otherwise
Offices	CIBSE Typical Practice: • 165 Local Government Offices • 174 Central Government Offices REEB Good Practice: 114 GRESB: 154kWh/yr, Europe, office sector		60 (or 75 per m2NIA) NABERS 5 star rating as alternative route	30 (or 40 per m2NIA) NABERS 6 star as alternative route
Other Schemes			• REEB Best Practice: 90 kWhe/m²NIA (gas @0.4 kWhe) • CIBSE Good Practice: 121 Local Government Offices; 126.5 Central Government Offices – all in kWhe/m²NIA (gas @0.4 kWhe) • NABERS: 5 stars: Estimated equivalent to 75-140 kWh/m²NIA/yr; 6 stars: Estimated equivalent to 38-70 kWh/m²NIA/yr • UKGBC Paris-proof trajectory (2020), LETI and RIBA Challenge: 70 kWh/m2NIA/yr or 55 kWh/m²GIA/yr • Greater Cambridge, Local Plan First Proposals for consultation, 2021: 55kWh/m²/yr	
Existing Buildings Meeting PL?			Buildings Energy Mission 2030: 5 buildings, single occupier and relatively small, completed 5-20 years ago, achieving between 70 and 107 kWh/m²GIA/yr (some with gas or district heating). 1 additional Passivhaus project identified, 2024 . One project identified through publication of the Pilot, 2025. Potentially over 20 buildings identified through the DEC database lodged within the last 5 years, but not checked for reliability of data.	
Modelling			No dedicated modelling for UKNZCBS. 2 Passivhaus projects with PHPP modelling expected to meet the level, 2024. As of mid-2023, independently verified Design for Performance modelling for at least 12 buildings targeting NABERS 5 star, and 1 targeting 5.5 stars, typically at the design stage and base build ratings only.	No dedicated modelling for UKNZCBS. Evidence for future achievability of NABERS 6 Stars through performance modelling (Cohen, Desai, Elia and Twinn, BSERT, 2021).
Performance Gap			25% margin on predicted performance is accounted for explicitly within Design for Performance modelling, in addition to mandatory off-axis scenarios to account for potential design failure modes and different intensities of use.	

Retail – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (For Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr unless stated	EUI, kWh/m²GIA/yr unless stated
High Street Retail Units	125	69	70 *	35 **
High Street Retail – Food & Beverage	723	180	215 *	111 **
Retail Centre – Landlord Areas	137	63	23 per m² CPA	12 per m² CPA **
Retail Warehouse	183	84	81	39 **
Supermarket	459	342	192	105 **
Other Schemes	Several benchmarks e.g. REEB, CIBSE; GRESB (160kWh/yr, Europe, retail sector). Those above are based on submitted datasets, converted to approximate all-electric total using a conversion factor from gas to electricity of 0.76.		• Passivhaus Supermarkets (Europe, not UK) • NABERS Shopping Centres (Australia) • Greater Cambridge, Local Plan First Proposals for consultation, 2021: 55kWh/m²/yr	
Existing Buildings Meeting PL?			None identified at this stage.	
Modelling			TM54 dynamic modelling carried out on supermarket and warehouse. Scenario testing: London and Glasgow; 2020 and 2080; normal and extended operating hours. Supermarket: detailed HVAC modelling. Warehouse retail: simple HVAC, considered acceptable given the limited level of complexity in the servicing strategy, the end-uses and the overall operation of a retail warehouse	
Performance Gap			The modelling results included some scenario testing to incorporate an element of performance gap: “typical hours” use as well as extended operational scenarios have been modelled to understand the range of EUI performances between a perfect operation within standard operating hours and a 24-hour operation.	

** Performance Level not developed by the Sector Group, therefore estimated using a similar improvement on the existing stockmedian, as on average across the Retail Warehouse and Supermarket sub-sectors*
*** Performance Level not developed by the Sector Group, therefore estimated using a similar improvement on the existing stockmedian, as on average across the other sectors.*

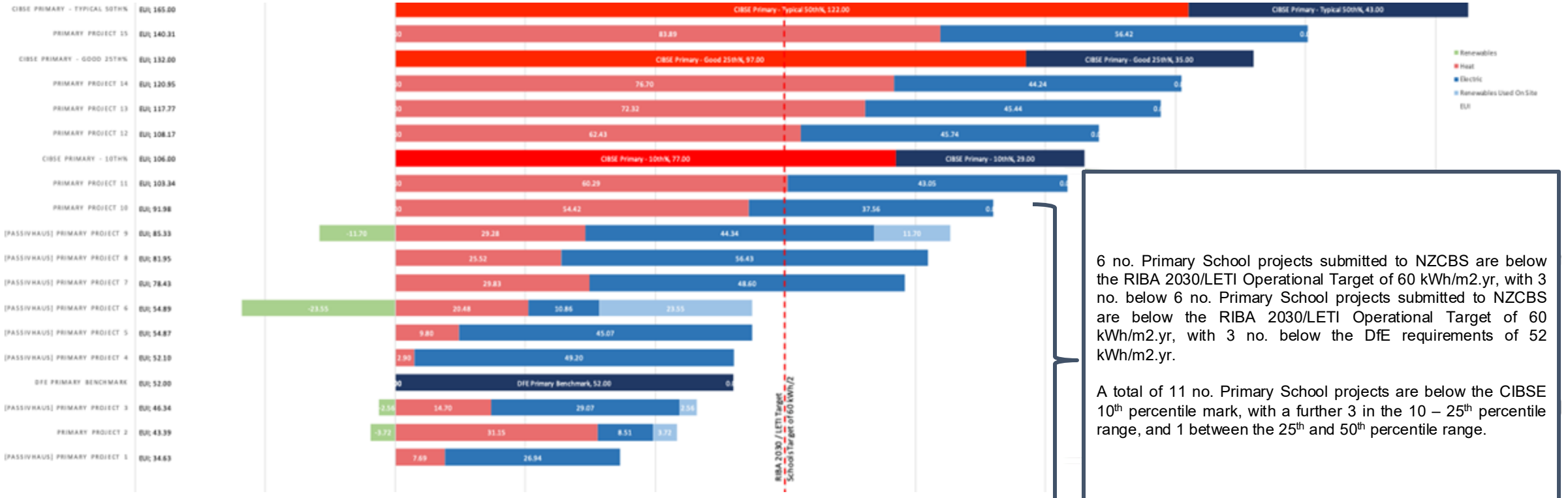
Schools – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (for core end uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Early Years or Pre School	183 (gas + elec) or 152 (all-elec) (BEES)	N/A	53*	40*
Primary (incl. SEN)	122 (CIBSE 50th)	77 (CIBSE 10th)	38	30
Secondary & 6th form (incl. SEN)	113 (CIBSE 50th)	66 (CIBSE 10th)	58	43
Other Schemes	Benchmarks: CIBSE, as used above.		• Primary: DfE (52); LETI (65); RIBA Challenge (60) • Secondary: DfE (67), LETI (65); RIBA Challenge (60) • Primary and secondary: Scottish Futures Trust: expectation to be below 100kWh/m²/yr; sliding scale of funding depending on in-use energy after two years, with full funding if within 67-83 kWh/m²/yr • All: Greater Cambridge, Local Plan First Proposals for consultation, 2021: 65kWh/m²/yr	
Existing Buildings Meeting PL?			Yes: The proposed performance levels are based on the analysis of in-use projects (modified to convert the fossil fuel gas elements into electric ASHP). The Best Practice Today levels are based on the average of the top 5 schools (i.e. approximately half of the data points submitted below the CIBSE 10th Percentile 11no Primary & 9no Secondary) (see graphs overleaf). Potentially 5-10 buildings identified through the DEC database lodged within the last 5 years, but not checked for reliability of data	Yes, but fewer than meeting the Best Practice today. The same process was used as for Best Practice Today, based on in-use operational data of existing buildings, but assuming technological performance would improve over time: • Primary: Performance was clustered closely. The second highest performing school data point was used i.e. 30 kWh/m2.yr. • Secondary: Less data was available, and it was less clustered. The average of the top three performing schools was used. A review was also carried out of the reductions on an elemental breakdown, to ensure the targets improvements seemed reasonable.
Modelling			No Dedicated Modelling: The proposed performance levels are based on the analysis of in-use projects, as described above.	
Performance Gap			The performance levels are based on existing buildings, so inherently incorporate a performance gap (see details above).	The performance levels are based on existing buildings, so inherently incorporate a performance gap, but reduced due to the more onerous levels (see details above).

** Performance Level not developed by the Sector Group, therefore estimated based on the existing stock median, to which was applied the same % improvement, as average across the Primary and Secondary School sub-sectors (i.e. 71% for Best Practice, and 78% for Future Exemplar)*

Primary Schools Performance Data Review

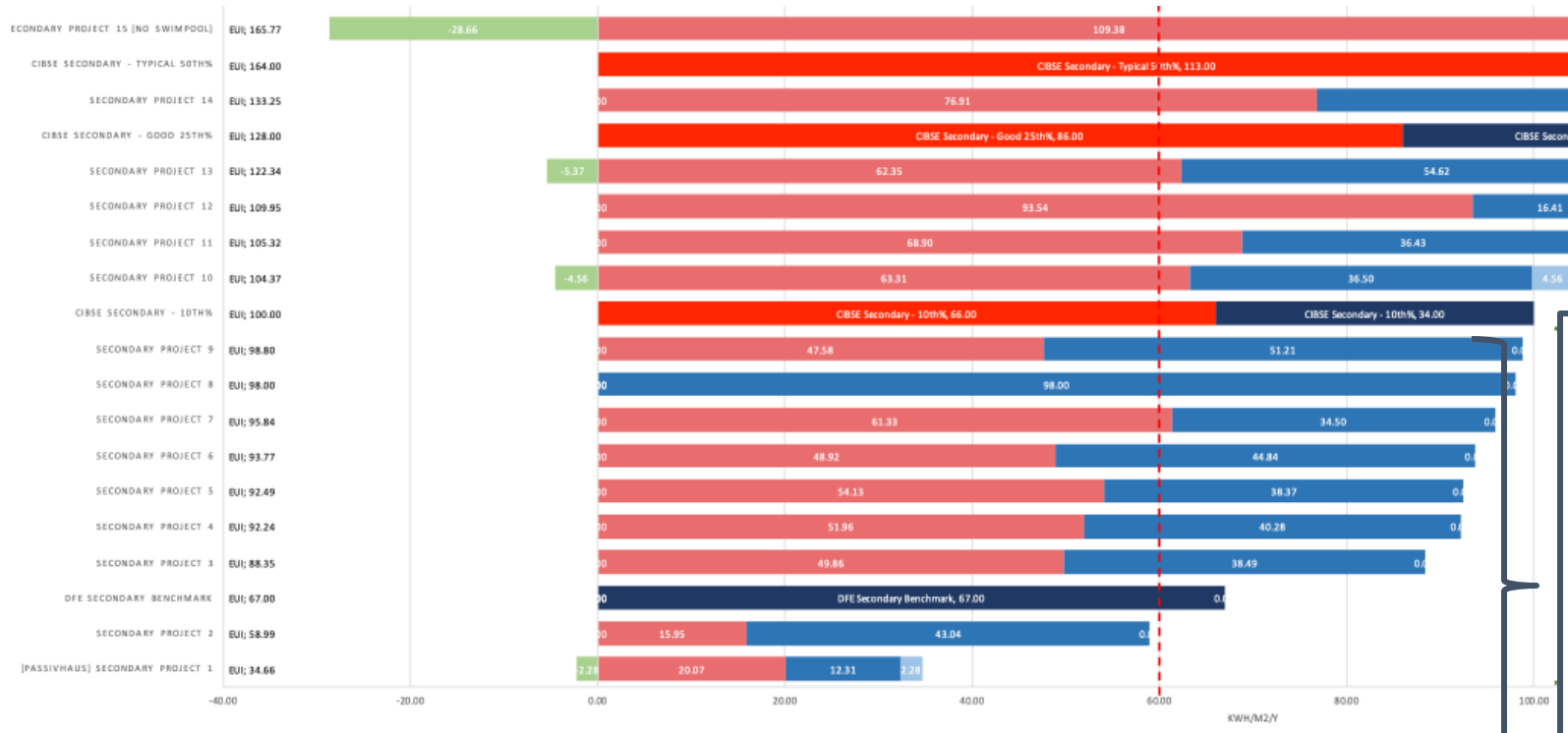
Education Buildings Energy Use Intensity (EUI)



6 no. Primary School projects submitted to NZCBS are below the RIBA 2030/LETI Operational Target of 60 kWh/m2.yr, with 3 no. below 6 no. Primary School projects submitted to NZCBS are below the RIBA 2030/LETI Operational Target of 60 kWh/m2.yr, with 3 no. below the DfE requirements of 52 kWh/m2.yr.

A total of 11 no. Primary School projects are below the CIBSE 10th percentile mark, with a further 3 in the 10 – 25th percentile range, and 1 between the 25th and 50th percentile range.

Secondary Schools Performance Data Review



2 no. Secondary School projects submitted to NZCBS are below the RIBA 2030/LETI Operational Target of 60 kWh/m^2.yr & DfE new requirements of 67 kWh/m^2.yr.

A total of 9 no. Secondary School projects are below the CIBSE 10th Percentile Mark, with a further 4 in the 10 – 25th percentile range, 1 between the 25th and 50th percentile range.

Science and Tech – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (for Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Research Lab – General (< or = CL 2)	860 (median)	400 (10th percentile from i2SL)	305	163*
Other Schemes	Median: BEES: Low confidence Best practice: 306 buildings, taken mainly from i2SL (International Institute for Sustainable Laboratories) benchmarking tool. All are in-use US Lab buildings, screened by matching climate zone as UK) plus 12 labs sourced from the call for evidence, from DEFRA and Astra Zeneca.		• Greater Cambridge, Local Plan First Proposals for consultation, 2021: 150kWh/m²/yr (research facilities)	
Existing Buildings Meeting PL?			As of summer 2023, there were 28 US buildings achieving the performance level, from the available data set.	
Modelling			TM54 modelling, under a range of inputs and profiles to give an indicative level of performance.	
Performance Gap			-	

** Performance Level not developed by the Sector Group, therefore estimated using a similar improvement on the existing stock median, as average across the other sector groups (i.e. 78%)*

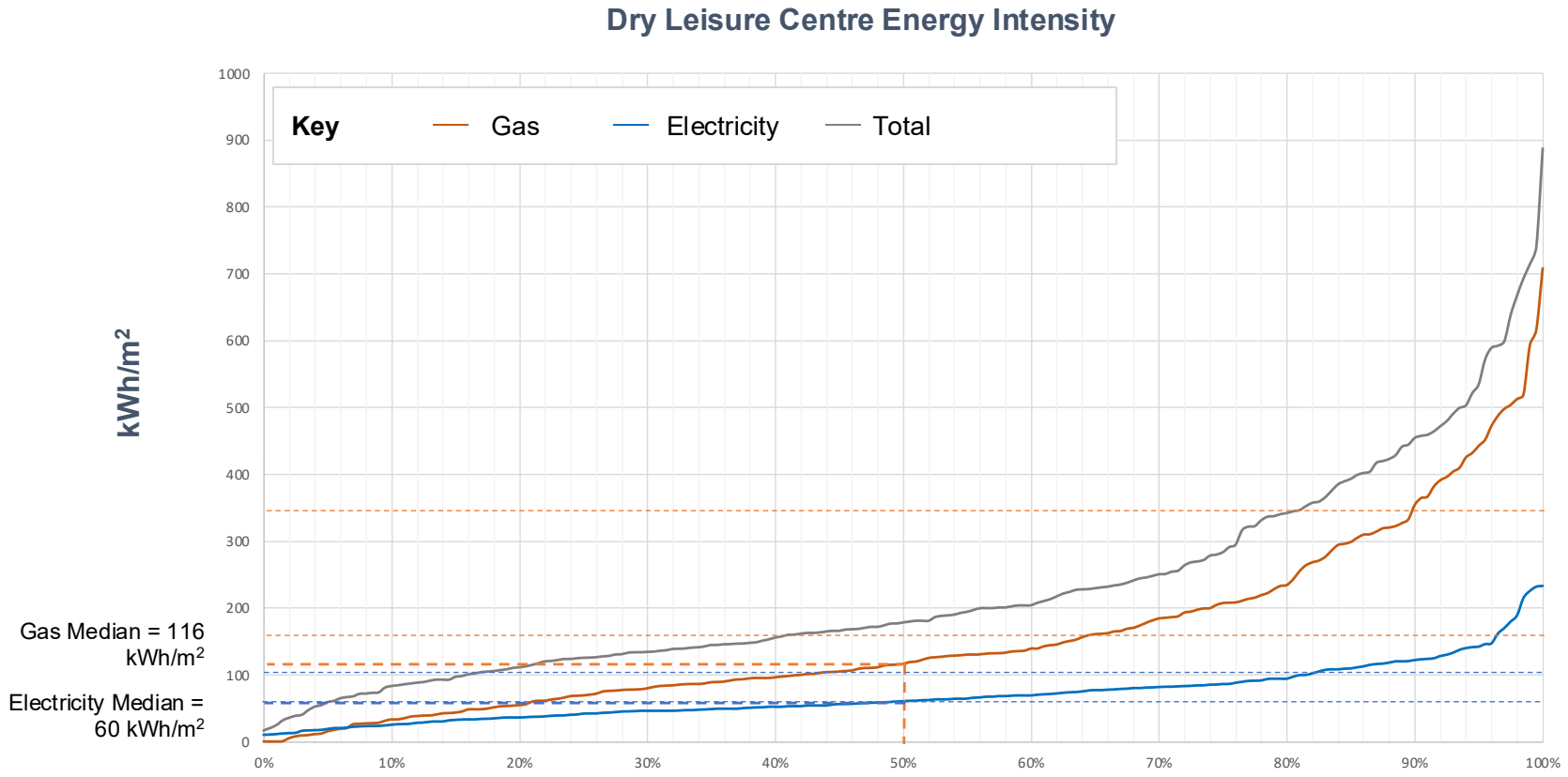
Sports and Leisure – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (For Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Dry Leisure Centre	Electric 60 + Fossil fuel 116 (ref: See below)	Electric/total 90 No fossil fuel	140 (210)	90 (104)*
Wet Leisure Centre	Electric 111 + Fossil fuel 380 (ref: See below)	Electric/total 320 No fossil fuel	350 (210)*	250 (104)*
Other Schemes	Figures above are from DEC + 2 datasets from large sports & leisure operators (GLL and 1 other operator) CIBSE benchmark: Considered too high.		• Sports England reference designs were used for building typologies for modelling; recommendations for "sustainable" design are out of date (10+ years). • Scottish Futures Trust: No set limit, but an indication that the operational energy use limit for dry leisure centres should be below 100kWh/m²/yr, and that for wet leisure centres should be above.	
Existing Buildings Meeting PL?			Yes, as part of large datasets: 25th-30th percentile (see illustrations on following pages). Wet/mixed (completed in last 3-4 years): 2 individual projects within, or very close to, the performance level. Potentially 5-10 buildings identified through the DEC database lodged within the last 5 years, but not checked for reliability of data.	Wet: 5th percentile within dataset (see illustrations on following pages)
Modelling			TM54 modelling carried out based on the Sports England reference building types.	
Performance Gap			Accounted for within the model.	

** Performance Levels were originally not developed by the Sector Group, therefore a first estimate of performance levels was made for the whole sector, using a similar improvement on the existing stock median, as on average across the other sectors. This whole-sector, 1st draft, performance level is shown here in grey text in brackets.*

Sports & Leisure – Dry – Performance Data Review

This combines data from the DEC database, and that from 2 large sports & leisure operators, made available to the UKNZCBS through the call for evidence.



Gas Median = 116 kWh/m²

Electricity Median = 60 kWh/m²

Gas CIBSE Typical (2021) = 343 kWh/m²

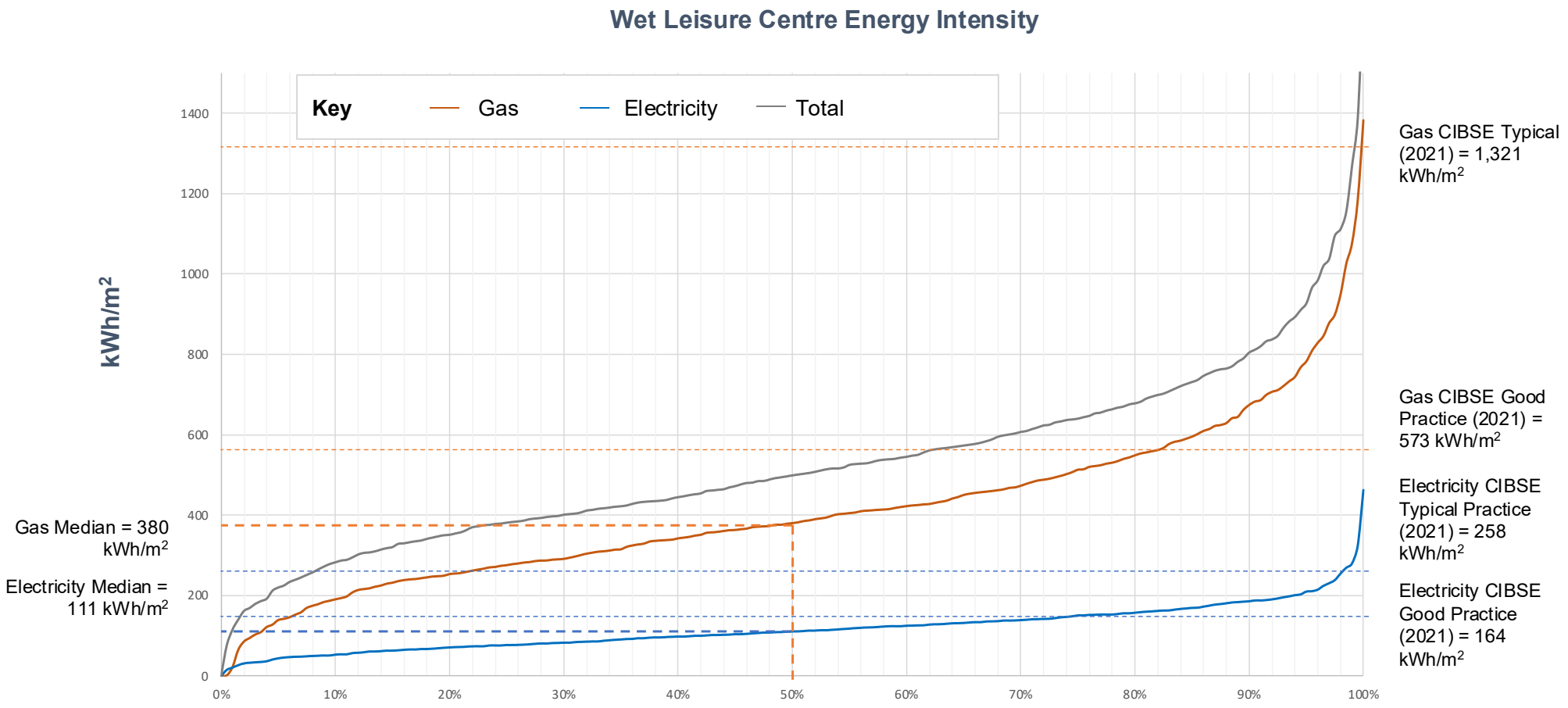
Gas CIBSE Good Practice (2021) = 158 kWh/m²

Electricity CIBSE Typical Practice (2021) = 158 kWh/m²

Electricity CIBSE Good Practice(2021) = 64 kWh/m²

Sports & Leisure – Wet – Performance Data Review

This combines data from the DEC database, and that from 2 large sports & leisure operators, made available to the UKNZCBS through the call for evidence.



Storage & Distribution – Performance Levels

	Existing Stock Benchmarks		New Build Performance Levels (for Core End Uses)	
	Median	**Best Practice**	**Best Practice Today**	**Future Exemplar**
Metrics	kWh/m²GIA/yr	kWh/m²GIA/yr	EUI, kWh/m²GIA/yr	EUI, kWh/m²GIA/yr
Unconditioned Storage	Electric 67 + Fossil fuel 169 (CIBSE Typical Distribution Warehouses)	Electric 53 + Fossil fuel 103 (CIBSE Good – <u>not Best</u> Distribution Warehouses)	34	13
Conditioned Storage **			TBC**	TBC**
Manual Picking*			TBC	TBC
Distribution Sorting – Main Hub *			294 (Draft TBC)	125 (Draft TBC)
Distribution – Final Mile *			TBC	TBC
Automated Picking *			TBC	TBC
Cold Store	454 (gas + elec) 452 (all elec)	N/A	163***	61***
Other Schemes	CIBSE, used above for warehouses; BEES, used above for cold store		None identified (other than CRREM, which is for whole sector trajectories rather than new build – see comparison on p. 82-83).	
Existing Buildings Meeting PL?			In-use projects identified within the sector group and network, which have shown a similar range of improvement (more than 40% improvement), and thus guided the evaluation process.	
Modelling			TM54 modelling: 1 model per sub-sector.	TM54 modelling: 1 model per sub-sector.
Performance Gap			Not accounted for in the modelling.	

** In the 2023 Technical Update and Consultation, additional sub-sectors were proposed. Due to lack of data, these are not available in the Pilot NZCBS but the draft performance levels proposed at the time, are shown here in grey.*

*** Performance Level not developed by the Sector Group, but identified as needed during the draft limit review – see p. 67-69. At that stage, it was therefore set at the same level as Retail Warehouse which is also, approximately, mid-point between the Cold Store and Un-conditioned Storage levels.*

**** Performance Level not developed by the Sector Group, therefore estimated using a similar improvement on the existing stock median, as in the Un-conditioned Storage sub-sector.*

2. Balancing the Budget

Balancing Approach

The 'How the UKNZCBS Limits Were Set' document details how the performance levels were used in the balancing model, representing the whole UK stock. In summary:

For both embodied carbon and operational energy, a proportion of the stock was assumed to perform better than the rest, and this proportion increased over time.

Embodied Carbon

The 2025-2050 performance levels shown in section 01.4.i were input into the tool. To recap, these were based on the 2024 performance levels (derived from submitted data), multiplied by factors to account for material decarbonisation, efficiency, and switching (Homes only).

Operational Energy

The performance levels shown in section 01.4.ii were input into the tool, varying over time from 2025 to 2050.

The balancing exercise then informed what the NZCBS draft limits should be, compared to the performance levels (i.e. more or less ambitious).

3. Cross Sectoral Review

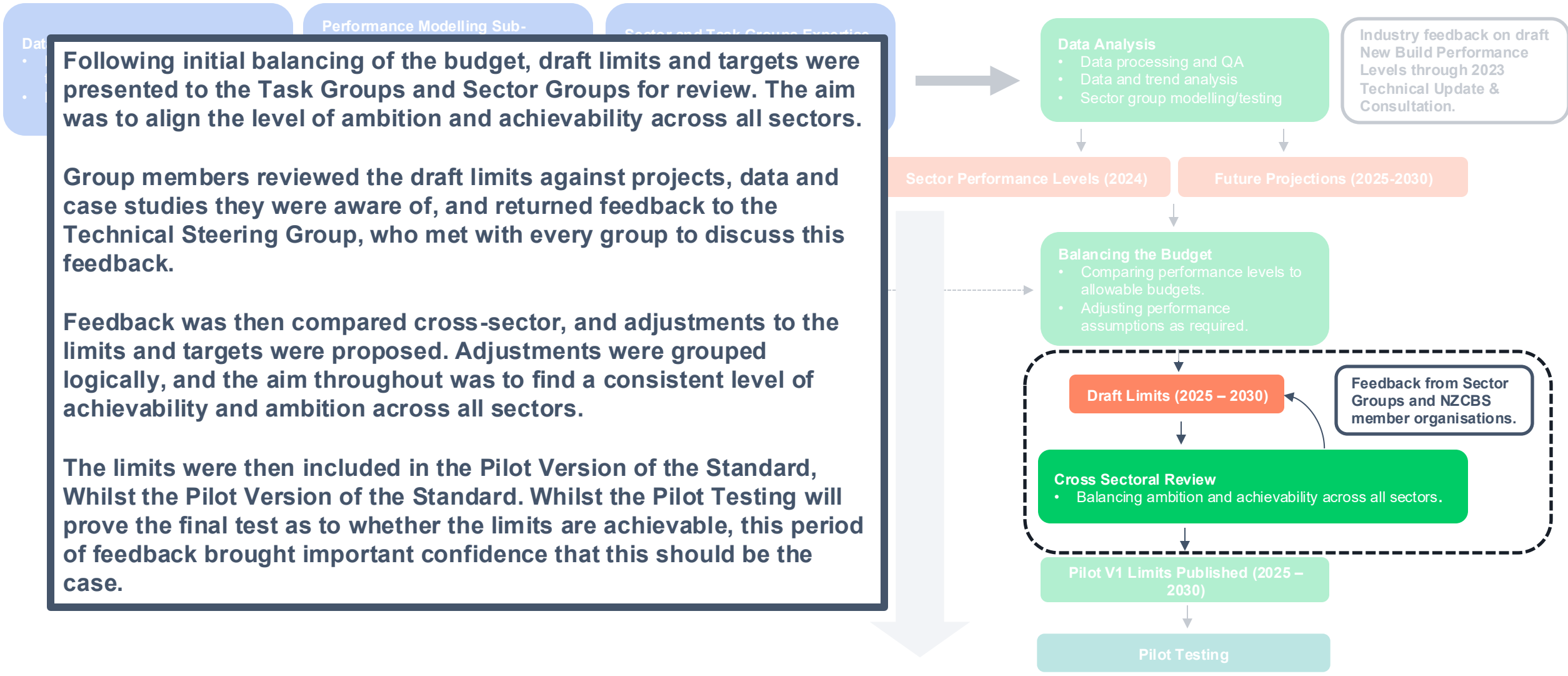
Sector and Task Groups Feedback

Following initial balancing of the budget, draft limits and targets were presented to the Task Groups and Sector Groups for review. The aim was to align the level of ambition and achievability across all sectors.

Group members reviewed the draft limits against projects, data and case studies they were aware of, and returned feedback to the Technical Steering Group, who met with every group to discuss this feedback.

Feedback was then compared cross-sector, and adjustments to the limits and targets were proposed. Adjustments were grouped logically, and the aim throughout was to find a consistent level of achievability and ambition across all sectors.

The limits were then included in the Pilot Version of the Standard, Whilst the Pilot Version of the Standard. Whilst the Pilot Testing will prove the final test as to whether the limits are achievable, this period of feedback brought important confidence that this should be the case.



Upfront Carbon Draft Limits Feedback

Sector	New Works (2025)			Retrofit Works (2025)			Other Key Feedback	Key Changes Made Compared to Draft Limits
	Draft limit	Feedback	Pilot limit	Draft limit	Feedback	Pilot limit		
Commercial Residential	481	Too ambitious	580	379	About right	460	In addition to generally being too hard, note that second staircase rules further increase EC	20%
Culture and Entertainment (Typ)	568	About right	570	445	About right	450	-	No change
Culture and Ent (Theatre Spaces)	568	Far too ambitious	855	445	Too ambitious	605	Sector Group shared extra data to demonstrate requirement for a much higher limit for theatres, as a standalone subsector.	+50% (based on new data)
Data Centres	572	Far too ambitious	745	402	Too ambitious	525	Significant increases required for new build	30%
Healthcare	604	Far too ambitious	790	470	Too ambitious	615	-	30%
Higher Education	533	Too ambitious	640	394	Too easy	475	Retrofitting seems too easy, but acknowledged that data on this is slim	20%
Homes (Single Family Homes)	430	About right	430	207	Too ambitious	270	New Works are similar to Future Homes Hub levels so achievable. But Retrofit factors must be too low.	No change to NW, but retrofit factors increased
Homes (Flats)	537	Slightly too ambitious	565	402	Slightly too ambitious	425	-	5%
Hotels	557	Too ambitious	670	429	About right	520	-	20%
Offices	734	About right	735	598	Too easy	600	Offices Reportable Works (fit-out) seems a little too low (nb. only applied to New Works for now)	No change for Whole Building limit, but 8% moved from Shell and Core limit into Reportable Works, as furtehr allowance for office refits
Offices Reportable Works (i.e fit-out)	241	Too ambitious	260	-	-	-		
Retail	594	Too ambitious	715	412	Too easy	500	Insufficient allowance for fit-out seems to have been made so far	20%
Schools	530	About right	530	379	About right	380	-	No change
Science and Technology	578	Far too ambitious	755	461	About right	605	-	30%
Sport and Leisure	546	Far too ambitious	820	434	Too ambitious	655	Sector Group shared extra data to demonstrate requirement for a much higher limit.	+50% (based on new data)
Storage and Distribution	487	Far too ambitious	635	235	About right	310	-	30%
General	General feedback included the fact that RICS v2 leads to increases in EC figures, MEP & facades need checking (e.g. against TM65), and numbers needed rounding. Note also that the same % changes are made to New Works and Retrofit Works unless noted otherwise, due to the RW limits being a ratio of the NW limits.							

Operational Energy, Draft Limits Vs Performance Levels

For operational energy, the following approach was taken, informed by the balancing exercise:

- **New Build:** Limits set at the performance levels, evolving over time from today's best practice to future.

- **Existing Buildings (incl. Retrofits):** Limits set at "Medium" depth retrofit performance levels, evolving over time from today's best practice to future.

Operational Energy Draft Limits Feedback

This table summarises the feedback received as part of the draft limits review process. Small numerical changes are not listed, only important ones applied for technical or strategic reasons e.g. informed by new evidence available to the Sector Group, since the original development of the performance levels. The table also captures other important developments, beyond the numerical limits themselves e.g. creation of sub-sectors to better acknowledge different functions affecting energy use. The draft limits are available in Annex A for reference.

Sector	Sector Group Feedback on the Draft Limits			Feedback From Others on the Draft Limits e.g. Technical Steering Group Organisations	Key Changes Made Compared to Draft Limits	
	New Buildings	Existing Buildings (Inc. Retrofits)	Sector Wide Feedback		New Buildings	Existing & Retrofits
General	The limits generally seem ambitious, but this is needed for new buildings (with caveats per sector, detailed below).	Support to One Go vs Stepped Retrofit approach. The One Go Retrofit limit should evolve (i.e. become more ambitious for later projects), as for New Build.	All sector groups were asked to confirm the end uses to which limits apply (vs those which are excluded from the limits, or subject to additional allowances). All sector groups were asked to provide additional parameters which should be reported by projects seeking verification, in order to inform the potential future development of the metrics and associated limits e.g. occupancy density, operating hours	-	Across all sectors, small changes were made to some of the limits for rounding purposes.	Across all sectors, modification of the One Go Retrofit limit so the 2025 One Go Retrofit became less ambitious, and evolves over time (i.e. becomes more ambitious for later projects), on a similar trajectory as for New Build and with a similar 2040 end point as through the Stepped Retrofit route. Across all sectors, small changes were made to some of the limits for rounding purposes.
Commercial Residential	**Student Residential**: About right **Care Homes**: Not sure	About right	Consider whether Built To Rent should be within this sector rather than Homes Care Homes: Differentiate care & nursing, vs care homes only.	-	**Student Residential:** 15% decrease for 2025 New Buildings limit, due to new data sources (Passivhaus Trust and CIBSE awards). **Care Homes**: Differentiation of nursing homes not implemented due to lack of data, but to be kept under review No change to categorisation of Build to Rent, but to be kept under review.	-

[Continued]

Sector	Sector Group Feedback on the Draft Limits			Feedback From Others on the Draft Limits e.g. TSG Organisations	Key Changes Made Compared to Draft Limits	
	New Buildings	Existing Buildings (Inc. Retrofits)	Sector Wide Feedback		New Buildings	Existing & Retrofits
Culture, Worship & Entertainment	About right, could possibly be more ambitious	About right, could possibly be more ambitious	A new sub-sector should be created for Archives	-	Creation of Archives as a sub-sector	-
Datacentres	About right	About right	-	Query whether PUE is the right metric to drive energy use reductions	None. PUE retained, as widely used in the sector, and no clear suitable alternative - to be kept under review.	
Healthcare	About right, as aligned with NHS NZ standard. SG has reservations about NHS NZ standard but recommends it.	No draft limits available as none from NHS NZ standard – no consensus steer from SG.	-	Need for limits to Existing Buildings (incl. Retrofit), even if not yet covered by NHS NZ Standard.	No change: Alignment with NHS NZ standard retained - to be kept under review as part of the pilot testing and future developments.	Creation of draft limits based on existing stock benchmarks, applied to sub-sectors, to which improvement are applied. The "existing best practice" levels recommended by the SG in the TUC showed only little improvement against the "existing median", so there is not much evidence that significant improvements could be targeted. Due to this limited analysis, the improvements are at the lower end of improvements achieved across other sectors i.e. 34% for One Go retrofit, and 26% for Stepped retrofit. No improvement is applied from 2025 to 2040 limits, to match the approach taken on new build, and avoid being too optimistic - to be kept under review as part of the pilot testing and future developments .
Higher Education	*No Comments*	*No Comments*	Instead of space-type limits (previously proposed in the performance levels), a whole building limit can be used at this stage, with the use of limits from other sectors where relevant e.g. Science & Tech - to be kept under review as part of the pilot testing and future developments.	-	10% increase to the 2040 limit which, on review across the sectors, appeared too ambitious.	-
Homes	Too hard for "mass scale", may be ok for aspirational .	**Stepped Retrofit 2025:** Too easy. **One Go Retrofit:** About right.	Queries as to why limits should be different across typologies.	Queries as to why limits should be different across typologies **New Build**: About right **Stepped Retrofit 2025:** Too easy	7-15% increase in 2025 limit across most single-family typologies. Change to apply the same limit to all single-family homes.	Approx. 15% decrease (i.e. more ambitious) in Stepped Retrofit 2025 limit.
Hotels	*No Comments*	*No Comments*	-	-	-	-

[Continued]

Sector	Sector Group Feedback on the Draft Limits			Feedback From Others on the Draft Limits e.g. TSG Organisations	Key Changes Made Compared to Draft Limits	
	New Buildings	Existing Buildings (Inc. Retrofits)	Sector Wide Feedback		New Buildings	Existing & Retrofits
Offices	About right – with caveats on intensity of use.	2025 Stepped Retrofit Limit: Too easy 2040 end point: Too hard	Important to create limits delineating between landlords and tenants. Important to acknowledge intensity of use.	EUI limit is too onerous, based on industry feedback on LETI and RIBA targets.	Increase (30%) in limit for general office, to approximate mid-range of NABERS 5 star rating, rather than low end. Additional allowances for high-intensity spaces (i.e. call centres, trading floors). Pilot retains whole building limits, but a working group is tasked with delineation approach.	Reduction (approx. 15%) in 2025 Stepped Retrofit limit. Reduction to 2040 end point (15%), based on review against other industry targets and trajectories, and comparison with improvements applied to other sectors – but with the creation of allowances for high intensity spaces, as per new build.
Retail	About right	**Retail units**: 2025 Stepped Retrofit too easy; end point about right **F&B**: Too hard **Retail Warehouse and Supermarket**: 2025 Stepped Retrofit about right; end point too easy.	Limits should differentiate spaces with and without catering.	Need limits for commercial centres.	Creation of limits with and without catering, using feedback from Sector Group and additional analysis e.g. CIBSE benchmarks, BEES. Treatment of Commercial Centres: Through combination of limits for retail spaces and landlord areas	Small modifications to limits to take account of feedback e.g. supermarket end point limit made more onerous, more similar to new build.
Schools	**Primary:** Too hard **Secondary:** About right	Too hard, especially 2025 Stepped Retrofit entry point	Query whether single limit across sector would be better – no firm proposal for this.	**Primary**: Too hard	Increase (15-20%) for Primary, based on supplementary Sector Group analysis. Small decrease to Early Years limit and small increase to Secondary limit.	Increase (approx. 15%) to 2025 Stepped Retrofit Limits.
Science & Technology	2025 limit about right, but 2040 too hard.	About right	-	-	Increase (10%) to 2040 limit.	-
Sports & Leisure	-	-	Need differentiation between wet / dry / fitness areas, rather than single whole-sector limit.	-	Change to space-based limits (wet / dry / fitness), supported by further analysis by Sector Group since the development of performance levels. Across the whole sector, this resulted in a similar averages.	
Storage & Distribution	About right	About right	-	Need limits for Conditioned Store, in addition to Un-conditioned and Cold store.	Creation of limit for Conditioned Store; no additional analysis was available, so this was based on Retail Warehouse limit.	

[End]

04 Final Limits, Pilot Version

UK Net Zero Carbon Buildings Standard

04.1 Final Comparisons

UK Net Zero Carbon Buildings Standard

04.1 (i) Final Comparisons

Upfront Carbon

UK Net Zero Carbon Buildings Standard

Upfront Carbon Confidence Levels

New Works

Sector	Upfront Carbon Limits, New Works, 2025	Confidence Levels
Commercial Residential	580	High - Large dataset
Culture and Entertainment (Typ)	570	High - Large dataset
Culture and Ent (Theatre Spaces)	855	Low - Small dataset provided by sector group during review of draft limits
Data Centres	745	Low - Small and incomplete dataset
Healthcare	790	High - Large dataset
Higher Education	640	Medium - Dataset smaller than preferred
Homes (Single Family Homes)	430	High - Large dataset
Homes (Flats)	565	High - Large dataset
Hotels	670	Low - Small and incomplete dataset
Offices	735	High - Large dataset
Retail	715	Low - Small and incomplete dataset
Schools	530	High - Large dataset
Science and Technology	755	Medium - Dataset smaller than preferred
Sport and Leisure	820	Low - Small dataset provided by sector group during review of draft limits
Storage and Distribution	635	Low - Small and incomplete dataset

Upfront Carbon, Limits Vs Performance Levels

Sector	Upfront Carbon Limits, New Works, 2025	New Works Performance Levels		Commentary
		Mean	Ideal Lower Bound (mean minus standard deviation)	
Commercial Residential	580	618	451	Between mean and lower-bound
Culture and Entertainment (Typ)	570	729	547	Between mean and lower-bound
Culture and Ent (Theatre Spaces)	855			Additional data from sector group justified increasing limit substantially above mean
Data Centres	745	735	-	1% above mean
Healthcare	790	776	568	2% above mean
Higher Education	640	685	546	Between mean and lower-bound
Homes (Single Family Homes)	430	552	401	Between mean and lower-bound
Homes (Flats)	565	689	583	3% below lower-bound
Hotels	670	715	-	Between mean and expected lower-bound
Offices	735	943	746	1% below lower-bound
Retail	715	763	573	Between mean and lower-bound
Schools	530	681	510	Between mean and lower-bound
Science and Technology	755	742	600	2% above mean
Sport and Leisure	820	701	542	Additional data from sector group justified increasing limit substantially above mean
Storage and Distribution	635	625	513	2% above mean

Upfront Carbon, Heavy Vs Light Buildings

Sector	Upfront Carbon Limits, New Works, 2025
Commercial Residential	580
Culture and Entertainment (Typ)	570
Culture and Ent (Theatre Spaces)	**855**
Data Centres	**745**
Healthcare	**790**
Higher Education	640
Homes (Single Family Homes)	430
Homes (Flats)	565
Hotels	670
Offices	735
Retail	715
Schools	530
Science and Technology	**755**
Sport and Leisure	**820**
Storage and Distribution	635

It is recognised that some sector types are typically ‘heavier’ than others in terms of material usage, due to increased vibration and loading requirements.

These are highlighted here.

Upfront Carbon Vs Other Schemes

Sector	Upfront carbon limits, New Works, 2025	LETI A	LETI C	RIBA 2030 Climate Challenge	GLA Aspirational	GLA Benchmark	Future Homes Hub average	SBTi 2025 Target	OneClickLCA Carbon Heroes Average**	ILFI Zero Carbon Threshold***
Commercial Residential	580	-	-	-	-	-	-	504	-	350
Culture and Entertainment (Typ)	570	-	-	-	-	-	-	504	581	350
Culture and Ent (Theatre Spaces)	855	400*	700*	-	-	-	-	504	-	350
Data Centres	745	-	-	-	-	-	-	504	552	350
Healthcare	790	-	-	-	-	-	-	504	666	350
Higher Education	640	-	-	-	-	-	-	504	736	350
Homes (Single Family Homes)	430	300	500	-	500	850	417	407	-	350
Homes (Flats)	565	300	500	800	500	850	635	407	758	350
Hotels	670	-	-	-	-	-	-	504	538	350
Offices	735	375	600	970	600	950	-	599	799	350
Retail	715	-	-	-	-	-	-	638	693	350
Schools	530	300	500	675	500	750	-	504	726	350
Science and Technology	755	-	-	-	-	-	-	504	-	350
Sport and Leisure	820	-	-	-	-	-	-	504	743	350
Storage and Distribution	635	-	-	-	-	-	-	504	747	350

Note that scope, and RIBA Stage, varies between schemes.

**Theatre LETI numbers taken from Bennetts Associates Net Zero Theatres report and their "Proposed LETI Banding"*

***Data provided directly to NZCBS by OneClickLCA ***Excludes MEP and FF&E*

Upfront Carbon, Retrofit Works

Sector	Upfront Carbon Limits, Retrofit Works, 2025
Commercial Residential	460
Culture and Entertainment (Typ)	450
Culture and Ent (Theatre Spaces)	605
Data Centres	525
Healthcare	615
Higher Education	475
Homes (Single Family Homes)	270
Homes (Flats)	425
Hotels	520
Offices	600
Retail	500
Schools	380
Science and Technology	605
Sport and Leisure	655
Storage and Distribution	310

For most sectors, insufficient data was received to be able to undertake a thorough comparison of performance levels against the retrofit limit.

The only sector with extensive data was the Offices sector. For this, the mean performance level for retrofit works was 391 $kgCO_2e/m^2$ – approximately 35% lower than the Retrofit Works limit shown here.

Fuller review of retrofit limits will occur through Pilot Testing.

04.1 (ii) Final Comparisons

Operational Energy

UK Net Zero Carbon Buildings Standard

Operational Energy Limits: Confidence Levels

There are different levels of confidence in the operational energy limits across the NZCBS sectors.

Sectors with Reasonably High Confidence

This applies to: Homes, Offices, Schools.

Typically, these are sectors where:

- The performance levels, which led to the limits, were informed by modelling, in-use projects, analysis of industry benchmarks, and consideration of the performance gap.
- There are available industry references to compare the limits with.

Sectors With Medium Confidence

This applies to: Datacentres, Healthcare*, Higher Education, Logistics & Warehouses, Retail, Science and Technology.

Typically, these are sectors where:

- The performance levels were based on more limited data from in-use projects, modelling scope and testing (e.g. fewer models, limited scenario testing, no dedicated accounting of the performance gap in the modelling).

AND/OR

- There are few industry references that can be used to compare the limits with.

** In the 2023 Technical Update and Consultation, Healthcare was given a high level of confidence, due to the availability of the NHS Net Zero Standard and the analysis that underpinned it, but subsequent Sector Group feedback to the NZCBS means it is considered to have a "medium" confidence level.*

Sectors With Low Confidence

This applies to: Commercial Residential, Culture & Entertainment, Hotels, Sports & Leisure.

Typically, these are sectors which are less well understood by the wider industry, with limited data in the public domain. As a result, estimates had to be made, as summarised on p.23 sector specific differences and the sector OE pages.

In addition, these are typically sectors with few publicly available, widely used, target-setting or benchmarking schemes, limiting the possibility to develop performance levels and limits by aligning with such schemes.

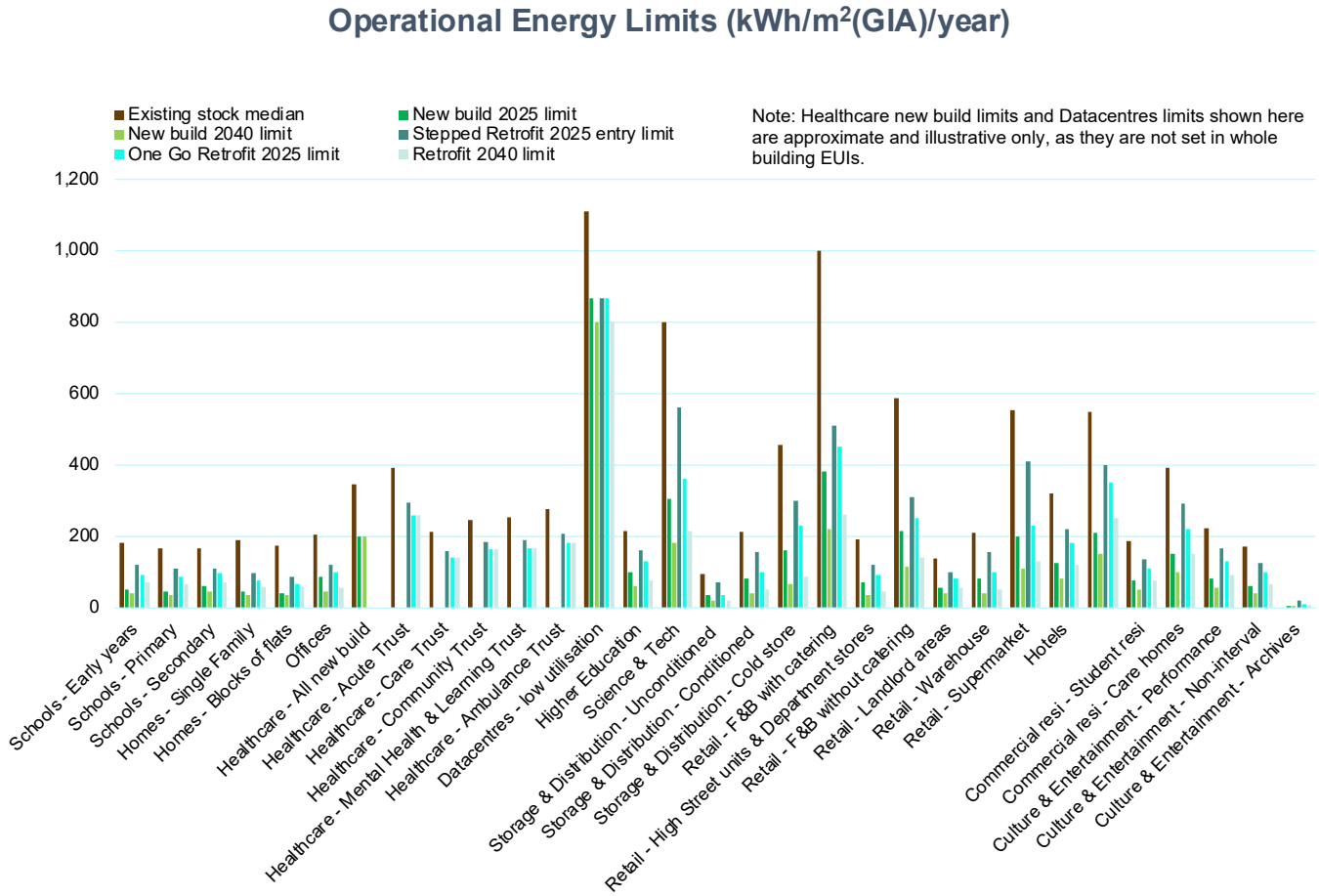
Operational Energy Limits Across Sectors

Simple checks were carried out on the limits across sectors e.g.:

The lowest limits are for Archives (by far), followed by Logistics - Unconditioned storage. Within occupied sectors, the lowest limits are for Homes. Schools, Offices, Conditioned Store and Culture are next and similar, but Offices get additional allowance for high-intensity uses such as trading floors and call centres.
Student Residential and Care Homes are higher than Homes - this is justified by higher density of occupation and special uses (e.g. medical care).

The highest limits are for Data Centres (by far), followed by Retail F&B with catering and Science & Tech. The second highest grouping is Retail F&B without catering, Supermarket, Sports & Leisure, Healthcare.

Energy use improvements through retrofit are typically higher in sectors more dominated by equipment and services (e.g. retail, datacentre), where re-fits and retrofits are expected to allow performance closer to a new build, and lesser where fabric performance and building shape are expected to be more influential and therefore more of a constraint (e.g. homes).



Operational Energy Limits Vs Other Schemes - New Buildings

A detailed review of schemes which could inform the NZCBS New Build operational energy performance levels and limits was carried out when developing the performance levels.

It is detailed for each sector across p. 38 to 60.

Operational Energy Limits Vs Other Schemes - Existing Buildings (inc. Retrofits)

There are fewer target-setting schemes for existing buildings (including retrofits) than for new buildings.

Sector	Sub - Sector	Existing Buildings (inc. Retrofit) Pilot Limits			CRREM v2, 1.5°C Pathway* (Commercial Real Estate)		LETI	Enerphit
		2025 One Go Retrofit	2025 Stepped Retrofit	2040 Stepped Retrofit End Point	2025	End Point		
Commercial Residential	Student Resi.	110	135	75				
	Care homes	220	290	150				
Culture & Entertainment	Performance	130	165	90	177	100 by 2036		
	Collection	100	125	65				
	Archives	10	20	7				
Data Centres	Low Utilisation	1.4 PUE	1.4 PUE	1.3				
	High Utilisation	1.2 PUE	1.2 PUE	1.1				
Healthcare	Acute Trust	258	293	258	258	110 by 2038		
	Care Trust	140	159	140				
	Community Trust	162	185	162				
	Mental Health & Learning Trust	166	189	166				
	Ambulance Trust	182	206	182				
Higher Ed.	-	130	160	75				
Homes	Single Family Homes	75	95	58	119	60 by 2034	Best Practice: 50 + 10 if constrained Exemplar: 40	Depends on UK region and expressed in primary energy, but similar to LETI Exemplar.
	Flats	65	85	57	103	55 by 2034		
Hotels	-	180	220	120	195	95 by 2037		

** The comparison with CRREM cannot be direct, as CRREM provides whole sector decarbonisation pathways: for the sector as a whole is to meet the pathway, parts of it will achieve better performance will others may fall behind.*
*** Enerphit can be applied across a range of sectors, but the ones shown here are those where in practice it has been used inthe UK without the need for sector-specific adaptations.*

Operational Energy Limits Vs Other Schemes - Existing Buildings (inc. Retrofits)

Sector	Sub - Sector	Existing Buildings (inc. Retrofit) Pilot Limits			CRREM v2, 1.5°C Pathway* (Commercial Real Estate)		UKGBC
		2025 One Go Retrofit	2025 Stepped Retrofit	2040 Stepped Retrofit End Point	2025	End Point	
Offices	General	100	120	55	167	85 by 2036	2025-2030: NABERS 5 stars / DEC C65 2030-2035: NABERS 5.5 stars / DEC B50 2035 onwards: NABERS 6 stars / DEC B40
	Call Centres	191	207	127			
	Trading Floors	220	238	147			
Retail	Supermarket	230	410	130	High Street: 204 Shopping Centre: 173	High Street: 110 by 2036 Shopping Centre: 95 by 2036	
	High street retail, dept. store	90	120	45			
	F&B without catering	250	310	140			
	F&B with catering	450	510	260			
	Landlord areas	80	100	55			
	Retail warehouse	100	155	50			
Schools	Early years	90	120	70			
	Primary	85	110	65			
	Secondary incl. SEN	95	110	70			
Science & Tech.	-	360	560	215			
Sports & Leisure	Dry	210	300	150	177	100 by 2036	
	Wet	500	650	350			
	Fitness	280	400	200			
Storage & Distribution	Unconditioned storage	35	70	20	Distribution Warehouse - Cold: 109 Distribution Warehouse – Warm: 48	Distribution Warehouse Cold: 65 by 2035 Distribution Warehouse Warm: 25 by 2036	
	Conditioned storage	100	155	50			
	Cold Stores	230	300	85			

** The comparison with CRREM cannot be direct, as CRREM provides whole sector decarbonisation pathways: for the sector as a whole is to meet the pathway, parts of it will achieve better performance will others may fall behind.*

04.2 Copy of Final Limits from Pilot Version

(for reference only - refer to www.nzcbuildings.co.uk for current limits)

UK Net Zero Carbon Buildings Standard

Copy of Final Limits (for reference)

The following pages contain screenshots of the tables included in Annex A of the Pilot Version Rev 2, included here for ease of reference with the rest of this document.

However, check the latest version of the Standard to view the most up to date upfront carbon and operational energy limits. This can be accessed at www.nzcbuildings.co.uk.

Table EC-1: Upfront carbon limits, New Works

← Date of commencement on site	Commercial Residential	Culture, Worship & Entertainment		Data Centres	Healthcare	Higher Education	Homes		Hotels	Offices		Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
	-	General	Performance Spaces	-	-	-	Single family homes	Flats	-	Whole building	Shell and core limit	-	-	-	-	-
	kgCO$_2$e/m^{2}GIA															
2025	580	570	855	745	790	640	430	565	670	735	475	715	530	755	820	635
2026	550	540	810	705	750	610	400	525	635	700	450	680	505	715	780	605
2027	525	515	770	670	710	575	375	490	605	660	425	645	480	680	740	570
2028	495	485	725	635	670	545	345	450	570	625	400	610	450	640	695	540
2029	465	460	685	600	635	515	320	420	540	590	380	575	425	605	660	510
2030	435	425	640	555	590	480	290	380	500	550	355	535	395	565	610	475
2031	405	400	595	520	550	445	270	355	470	515	330	500	370	525	575	445
2032	380	375	560	490	515	420	255	335	440	480	310	470	350	495	535	415
2033	350	340	510	445	475	385	235	305	400	440	285	430	320	450	490	380
2034	315	310	465	405	430	350	210	280	365	400	255	390	290	410	445	345
2035	285	280	420	365	390	315	190	250	330	360	230	350	260	370	405	315
2036	260	255	380	330	350	285	175	225	300	325	210	320	235	335	365	280
2037	240	235	350	305	325	265	160	210	275	300	190	295	220	310	335	260
2038	220	215	325	280	300	240	150	195	255	280	180	270	200	285	310	240
2039	200	200	295	260	275	225	135	175	235	255	165	250	185	260	285	220
2040	185	180	270	235	250	205	125	160	215	235	150	225	170	240	260	200
2041	165	165	245	215	225	185	110	145	195	210	135	205	155	215	235	185
2042	150	150	220	195	205	165	100	135	175	190	120	185	140	195	210	165
2043	135	135	200	175	185	150	90	120	155	170	110	165	125	175	190	150
2044	120	120	175	155	165	135	80	105	140	150	95	150	110	155	170	130
2045	105	105	155	135	145	115	70	95	125	135	85	130	100	140	150	115
2046	95	90	135	120	125	105	65	80	105	120	75	115	85	120	130	100
2047	80	80	120	105	110	90	55	70	95	100	60	100	75	105	115	90
2048	70	70	100	90	95	75	45	60	80	85	55	85	65	90	95	75
2049	60	55	85	75	80	65	40	50	65	70	45	70	55	75	80	65
2050	45	45	70	60	65	50	30	40	55	60	35	60	45	60	65	50

For details of commencement dates, see section 4.2.6

Table EC-2: Upfront carbon limits, Retrofit works

← Date of commencement on site	Commercial Residential	Culture, Worship & Entertainment		Data Centres	Healthcare	Higher Education	Homes		Hotels	Offices		Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
	-	General	Performance Spaces	-	-	-	Single family homes	Flats	-	Whole building	Shell and core limit	-	-	-	-	-
	kgCO$_2$e/m^{2}GIA															
2025	460	450	605	525	615	475	270	425	520	600	n/a	500	380	605	655	310
2026	435	425	570	495	585	455	255	395	490	575		475	365	575	620	295
2027	415	405	545	475	555	425	235	370	470	540		450	345	545	590	275
2028	390	385	510	450	525	405	220	340	440	510		425	325	515	555	265
2029	370	365	485	425	495	385	205	315	420	485		400	305	485	525	250
2030	345	335	450	390	460	355	185	285	390	450		375	285	455	485	230
2031	320	315	420	370	430	330	170	270	365	420		350	265	420	460	215
2032	300	295	395	345	405	315	160	255	340	395		330	255	395	430	205
2033	280	270	360	315	370	285	150	230	310	360		300	230	360	390	185
2034	250	245	330	285	335	260	135	210	285	330		275	210	330	355	170
2035	225	220	295	260	305	235	120	190	255	295		245	190	300	325	155
2036	205	200	270	235	275	215	110	170	235	265		225	170	270	295	140
2037	190	185	250	215	255	200	105	160	215	245		205	160	250	270	130
2038	175	170	230	200	235	180	95	150	200	230		190	145	230	250	120
2039	160	160	210	185	215	170	85	135	185	210		175	135	210	230	110
2040	150	145	190	165	195	155	80	120	170	195		160	125	195	210	100
2041	130	130	175	155	180	140	70	110	155	175		145	115	175	190	90
2042	120	120	155	140	160	125	65	105	135	155		130	105	160	170	80
2043	110	110	145	125	145	115	60	90	120	140		115	90	140	155	75
2044	95	95	125	110	130	100	55	80	110	125		105	80	125	140	65
2045	85	85	110	95	115	85	45	75	100	110		95	75	115	120	60
2046	75	75	95	85	100	80	45	60	85	100		80	65	100	105	50
2047	65	65	85	75	90	70	35	55	75	85		70	55	85	95	45
2048	60	55	75	65	75	60	30	45	65	70		60	50	75	80	40
2049	50	45	60	55	65	50	30	40	55	60		50	40	60	65	35
2050	40	40	50	45	55	40	20	30	45	50		45	35	50	55	25

Refer www.nzcbuildings.co.uk for latest version of all limits.

Table EC-3: Upfront carbon limits, Reportable works

← Date of commencement on site	Commercial Residential	Culture, Worship & Entertainment	Data Centres	Healthcare	Higher Education	Homes	Hotels	Office	Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
	$kgCO_2e/m^2GIA$												
2025	To be confirmed once sufficient data lodged via the Standard							260	To be confirmed once sufficient data lodged via the Standard				
2026								250					
2027								235					
2028								225					
2029								210					
2030								195					
2031								185					
2032								170					
2033								155					
2034								145					
2035								130					
2036								115					
2037								110					
2038								100					
2039								90					
2040								85					
2041								75					
2042								70					
2043								60					
2044								55					
2045								50					
2046								45					
2047								40					
2048								30					
2049								25					
2050								25					

Table EC-4: Life cycle embodied carbon limits, New Works

	Commercial Residential	Culture, Worship & Entertainment	Data Centres	Healthcare	Higher Education	Homes	Hotels	Office	Retail	School	Science & Technology	Sport & Leisure	Storage & Distribution
2025	To be confirmed once sufficient data lodged via the Standard												
2026													
2027													
2028													
2029													
2030													
2031													
2032													
2033													
2034													
2035													
2036													
2037													
2038													
2039													
2040													
2041													
2042													
2043													
2044													
2045													
2046													
2047													
2048													
2049													
2050													

For details of commencement dates, see section 4.2.6

Refer www.nzcbuildings.co.uk for latest version of all limits.

Table OE-1: Energy use intensity limits, New Building

← Date of commencement on site	Commercial Residential		Culture & Entertainment			Data Centres		Healthcare	Higher Ed.	Homes		Hotels	Offices (either /GIA or /NIA metrics may be used)				Retail						Schools			Science & Tech.	Sport & Leisure			Storage & Distribution		
	Student resi.	Care homes	Perfor-mance	Collec-tion	Archives	Low utilisation	High utilisation	-	-	Single family homes	Flats	-	General		Call Centres		Trading Floors		Supermarket	High street retail, dept. store	F&B without catering[a]	F&B with catering[b]	Landlord areas[c]	Retail warehouse	Early years	Primary	Secondary incl. SEN	-	Dry	Wet	Fitness	Unconditioned storage	Conditioned storage	Cold store
	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	PUE	PUE	As per NHS-NZ Standard	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²CPA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr
2025	75	150	80	60	5	1.4	1.2		100	45	40	125	85	107	127	159	147	184	200	70	215	380	55	80	50	45	60	305	80	350	150	35	80	160
2026	74	147	79	59	5	1.4	1.2		98	45	40	122	83	104	123	154	143	179	194	68	209	370	54	78	50	45	59	297	79	344	148	34	78	154
2027	72	144	77	58	5	1.39	1.19		95	44	40	119	80	100	119	149	138	173	188	66	202	359	53	75	49	44	58	289	78	337	145	33	75	148
2028	70	140	75	56	5	1.38	1.18		92	43	39	116	77	97	115	144	133	167	182	63	195	348	52	72	48	43	57	280	76	330	142	32	72	141
2029	69	137	74	55	5	1.38	1.18		90	43	39	113	75	94	111	139	128	160	176	61	189	338	51	70	48	43	56	272	75	324	140	31	70	135
2030	67	134	72	54	5	1.37	1.17		87	42	39	110	72	90	106	133	123	154	170	59	182	327	50	67	47	42	55	264	74	317	137	30	67	129
2031	65	130	70	52	5	1.36	1.16		84	41	38	107	69	87	102	128	118	148	164	56	175	316	49	64	46	41	54	255	72	310	134	29	64	122
2032	64	127	69	51	5	1.36	1.16		82	41	38	104	67	84	98	123	113	142	158	54	169	306	48	62	46	41	53	247	71	304	132	28	62	116

[a] i.e. only cold/hot drinks or cold food, no on-site kitchen

[b] e.g., restaurant, pub, fast food with on-site food preparation / catering

[c] in this Pilot version, this is only for use in Commercial Centres, to create area-weighted whole building limits, using the landlord areas and retail mix

For details of commencement dates, see section 4.2.6

Refer www.nzcbuildings.co.uk for latest version of all limits.

← Date of commencement on site	Commercial Residential		Culture & Entertainment			Data Centres		Healthcare	Higher Ed.	Homes		Hotels	Offices (either /GIA or /NIA metrics may be used)						Retail						Schools			Science & Tech	Sport & Leisure			Storage & Distribution		
	Student resi.	Care homes	Perfor-mance	-	Archives	Low utilisation	High utilisation		-	Single family homes	Flats	-	General		Call Centres		Trading Floors		Supermarket	High street retail, dept. store	F&B without catering[a]	F&B with catering[b]	Landlord areas[c]	Retail warehouse	Early years	Primary	Secondary incl. SEN	-	Dry	Wet	Fitness	Unconditioned storage	Conditioned storage	Cold store
	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	PUE	PUE		kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}CPA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr
2033	62	124	67	50	5	1.35	1.15	As per NHS-NZ Standard	79	40	38	101	64	80	94	118	109	137	152	52	162	295	47	59	45	40	52	239	70	297	129	27	59	110
2034	60	120	65	48	5	1.34	1.14		76	39	37	98	61	77	90	113	104	130	146	49	155	284	46	56	44	39	51	230	68	290	126	26	56	103
2035	59	117	64	47	5	1.34	1.14		74	39	37	95	59	74	85	107	99	124	140	47	149	274	45	54	44	39	50	222	67	284	124	25	54	97
2036	57	114	62	46	5	1.33	1.13		71	38	37	92	56	70	81	102	94	118	134	45	142	263	44	51	43	38	49	214	66	277	121	24	51	91
2037	55	110	60	44	5	1.32	1.12		68	37	36	89	53	67	77	97	89	112	128	42	135	252	43	48	42	37	48	205	64	270	118	23	48	84
2038	54	107	59	43	5	1.32	1.12		66	37	36	86	51	64	73	92	84	105	122	40	129	242	42	46	42	37	47	197	63	264	116	22	46	78
2039	52	104	57	42	5	1.31	1.11		63	36	36	83	48	60	69	87	79	99	116	38	122	231	41	43	41	36	46	189	62	257	113	21	43	72
2040	50	100	55	40	4	1.3	1.1		60	35	35	80	45	57	64	80	74	93	110	35	115	220	40	40	40	35	45	180	60	250	110	20	40	65
2050	50	100	55	40	4	1.3	1.1		60	35	35	80	45	57	64	80	74	93	110	35	115	220	40	40	40	35	45	180	60	250	110	20	40	65

[a] i.e. only cold/hot drinks or cold food, no on-site kitchen
[b] e.g., restaurant, pub, fast food with on-site food preparation / catering
[c] in this Pilot version, this is only for use in Commercial Centres, to create area-weighted whole building limits, using the landlord areas and retail mix
For details of commencement dates, see section 4.2.6

Refer www.nzcbuildings.co.uk for latest version of all limits.

Table OE-2: Energy use intensity limits, Existing Building with One-Go Retrofit

← Date of commencement on site	Commercial Residential		Culture & Entertainment			Data Centres		Healthcare					Higher Ed.	Homes		Hotels	Offices (either /GIA or /NIA metrics may be used)				Retail						Schools			Science & Tech.	Sport & Leisure			Storage & Distribution		
	Student resi.	Care homes	Performance	Collection	Archives	Low utilisation	High utilisation	Acute Trust	Care Trust	Community Trust	Mental health & Learning Trust	Ambulance Trust	-	Single family homes	Flats		General		Call Centres		Trading Floors		Supermarket	High street retail, Department store	F&B without catering [a]	F&B with catering [b]	Landlord areas [c]	Retail warehouse	Early years	Primary	Secondary incl. SEN	-	Dry	Wet	Fitness	Unconditioned storage	Conditioned storage	Cold store
	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	PUE	PUE	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²CPA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr
2025	110	220	130	100	10	1.4	1.2	258	140	162	166	182	130	75	65	180	100	125	191	239	220	275	230	90	250	450	80	100	90	85	95	360	210	500	280	35	100	230
2026	108	216	128	98	10	1.4	1.2	259	140	163	167	182	127	74	65	176	97	122	187	234	216	270	224	87	243	438	79	97	89	84	94	351	206	490	275	34	97	221
2027	106	211	125	96	10	1.39	1.19	259	140	163	167	182	123	73	64	172	94	118	183	229	211	264	217	84	236	425	77	94	88	83	92	341	202	480	270	33	94	211
2028	103	206	122	93	10	1.38	1.18	259	140	163	167	182	119	72	64	168	91	114	179	224	206	258	210	81	228	412	75	90	86	81	90	331	198	470	264	32	90	201
2029	101	202	120	91	10	1.38	1.18	259	140	163	167	182	116	71	63	164	88	110	174	218	201	252	204	78	221	400	74	87	85	80	89	322	194	460	259	31	87	192
2030	99	197	117	89	9	1.37	1.17	259	140	163	167	182	112	70	63	160	85	107	170	213	196	245	197	75	214	387	72	84	84	79	87	312	190	450	254	30	84	182
2031	96	192	114	86	9	1.36	1.16	259	140	163	167	182	108	69	62	156	82	103	166	208	191	239	190	72	206	374	70	80	82	77	85	302	186	440	248	29	80	172
2032	94	188	112	84	9	1.36	1.16	259	140	163	167	182	105	68	62	152	79	99	162	203	186	233	184	69	199	362	69	77	81	76	84	293	182	430	243	28	77	163

[a] i.e. only cold/hot drinks or cold food, no on-site kitchen

[b] e.g., restaurant, pub, fast food with on-site food preparation / catering

[c] in this Pilot version, this is only for use in Commercial Centres, to create area-weighted whole building limits, using the landlord areas and retail mix

For details of commencement dates, see section 4.2.6

Refer www.nzcbuildings.co.uk for latest version of all limits.

← Date of commencement on site	Commercial Residential		Culture & Entertainment			Data Centres		Healthcare					Higher Ed.	Homes		Hotels	Offices (either /GIA or /NIA metrics may be used)						Retail						Schools			Science & Tech.	Sport & Leisure			Storage & Distribution		
	Student resi.	Care homes	Performance	Collection	Archives	Low utilisation	High utilisation	Acute Trust	Care Trust	Community Trust	Mental health & Learning Trust	Ambulance Trust	-	Single family homes	Flats		General		Call Centres		Trading Floors		Supermarket	High street retail, Department store	F&B without catering [a]	F&B with catering [b]	Landlord areas [c]	Retail warehouse	Early years	Primary	Secondary incl. SEN	-	Dry	Wet	Fitness	Unconditioned storage	Conditioned storage	Cold store
	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	PUE	PUE	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}CPA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr
2033	92	183	109	82	9	1.35	1.15	259	140	163	167	182	101	66	61	148	76	95	157	197	182	228	177	66	192	349	67	74	80	75	82	283	178	420	238	27	74	153
2034	89	178	106	79	9	1.34	1.14	259	140	163	167	182	97	65	61	144	73	92	153	192	177	222	170	63	184	336	65	70	78	73	80	273	174	410	232	26	70	143
2035	87	174	104	77	8	1.34	1.14	259	140	163	167	182	94	64	60	140	70	88	149	187	172	215	164	60	177	324	64	67	77	72	79	264	170	400	227	25	67	134
2036	85	169	101	75	8	1.33	1.13	259	140	163	167	182	90	63	60	136	67	84	145	182	167	209	157	57	170	311	62	64	76	71	77	254	166	390	222	24	64	124
2037	82	164	98	72	8	1.32	1.12	259	140	163	167	182	86	62	59	132	64	80	140	175	162	203	150	54	162	298	60	60	74	69	75	244	162	380	216	23	60	114
2038	80	160	96	70	8	1.32	1.12	259	140	163	167	182	83	61	59	128	61	77	136	170	157	197	144	51	155	286	59	57	73	68	74	235	158	370	211	22	57	105
2039	78	155	93	68	8	1.31	1.11	259	140	163	167	182	79	60	58	124	58	73	132	165	152	190	137	48	148	273	57	54	72	67	72	225	154	360	206	21	54	95
2040	75	150	90	65	7	1.3	1.1	258	140	162	166	182	75	58	57	120	55	69	127	159	147	184	130	45	140	260	55	50	70	65	70	215	150	350	200	20	50	85
2050	75	150	90	65	7	1.3	1.1	258	140	162	166	182	75	58	57	120	55	69	127	159	147	184	130	45	140	260	55	50	70	65	70	215	150	350	200	20	50	85

[a] i.e. only cold/hot drinks or cold food, no on-site kitchen
[b] e.g., restaurant, pub, fast food with on-site food preparation / catering
[c] in this Pilot version, this is only for use in Commercial Centres, to create area-weighted whole building limits, using the landlord areas and retail mix
For details of commencement dates, see section 4.2.6

Refer www.nzcbuildings.co.uk for latest version of all limits.

Table OE-3: Energy use intensity limits, Existing Building with Stepped Retrofit

← Date of commencement on site	Commercial Residential		Culture & Entertainment			Data Centres		Healthcare					Higher Ed.	Homes		Hotels	Offices (either /GIA or /NIA metrics may be used)				Retail						Schools			Science & Tech.	Sport & Leisure			Storage & Distribution		
	Student resi.	Care homes	Performance	Collection	Archives	Low utilisation	High utilisation	Acute Trust	Care Trust	Community Trust	Mental health & Learning Trust	Ambulance Trust	-	Single family homes	Flats		General		Call Centres		Trading Floors		Supermarket	High street retail, dept. store	F&B without catering [a]	F&B with catering [b]	Landlord areas [c]	Retail warehouse	Early years	Primary	Secondary incl. SEN	-	Dry	Wet	Fitness	Unconditioned storage	Conditioned storage	Cold store
	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	PUE	PUE	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²NIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²CPA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr	kWh/m²GIA/yr
2025	135	290	165	125	20	1.4	1.2	293	159	185	189	206	160	95	85	220	120	150	207	259	238	298	410	120	310	510	100	155	120	110	110	560	300	650	400	70	155	300
2026	131	281	160	121	20	1.4	1.2	291	158	184	188	205	155	93	84	214	116	145	202	253	233	292	392	115	299	494	97	148	117	107	108	537	290	630	387	67	148	286
2027	127	272	155	117	19	1.39	1.19	289	157	182	186	204	149	91	82	207	112	140	197	247	227	284	373	110	288	477	94	141	114	104	105	514	280	610	374	64	141	272
2028	123	262	150	113	18	1.38	1.18	287	156	181	185	202	143	88	80	200	107	134	191	239	220	275	354	105	276	460	91	134	110	101	102	491	270	590	360	60	134	257
2029	119	253	145	109	17	1.38	1.18	284	154	179	183	200	138	86	78	194	103	129	186	233	214	268	336	100	265	444	88	127	107	98	100	468	260	570	347	57	127	243
2030	115	244	140	105	16	1.37	1.17	282	153	178	182	199	132	83	76	187	99	124	181	227	208	260	317	95	254	427	85	120	104	95	97	445	250	550	334	54	120	229
2031	111	234	135	101	15	1.36	1.16	280	152	176	180	197	126	81	74	180	94	118	175	219	202	253	298	90	242	410	82	113	100	92	94	422	240	530	320	50	113	214
2032	107	225	130	97	14	1.36	1.16	277	151	175	179	195	121	78	72	174	90	113	170	213	196	245	280	85	231	394	79	106	97	89	92	399	230	510	307	47	106	200

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[b] e.g., restaurant, pub, fast food with on-site food preparation / catering
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For details of commencement dates, see section 4.2.6

Refer www.nzcbuildings.co.uk for latest version of all limits.

← Date of commencement on site	Commercial Residential		Culture & Entertainment			Data Centres		Healthcare					Higher Ed.	Homes		Hotels	Offices (either /GIA or /NIA metrics may be used)						Retail						Schools			Science & Tech.	Sport & Leisure			Storage & Distribution		
	Student resi.	Care homes	Performance	Collection	Archives	Low utilisation	High utilisation	Acute Trust	Care Trust	Community Trust	Mental health & Learning Trust	Ambulance Trust	-	Single family homes	Flats		General		Call Centres		Trading Floors		Supermarket	High street retail, dept. store	F&B without catering [a]	F&B with catering [b]	Landlord areas [c]	Retail warehouse	Early years	Primary	Secondary incl. SEN	-	Dry	Wet	Fitness	Unconditioned storage	Conditioned storage	Cold store
	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	PUE	PUE	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}NIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}CPA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr	kWh/m^{2}GIA/yr
2033	103	216	125	93	14	1.35	1.15	275	149	173	177	194	115	76	71	167	86	108	165	207	190	238	261	80	220	377	76	99	94	86	89	376	220	490	294	44	99	186
2034	99	206	120	89	13	1.34	1.14	273	148	172	176	192	109	73	69	160	81	102	159	199	184	230	242	75	208	360	73	92	90	83	86	353	210	470	280	40	92	171
2035	95	197	115	85	12	1.34	1.14	270	147	170	174	190	104	71	67	154	77	97	154	193	178	223	224	70	197	344	70	85	87	80	84	330	200	450	267	37	85	157
2036	91	188	110	81	11	1.33	1.13	268	146	169	173	189	98	68	65	147	73	92	149	187	172	215	205	65	186	327	67	78	84	77	81	307	190	430	254	34	78	143
2037	87	178	105	77	10	1.32	1.12	266	144	167	171	187	92	66	63	140	68	85	143	179	166	208	186	60	174	310	64	71	80	74	78	284	180	410	240	30	71	128
2038	83	169	100	73	9	1.32	1.12	263	143	166	170	185	87	63	61	134	64	80	138	173	160	200	168	55	163	294	61	64	77	71	76	261	170	390	227	27	64	114
2039	79	160	95	69	8	1.31	1.11	261	142	164	168	184	81	61	59	127	60	75	133	167	154	193	149	50	152	277	58	57	74	68	73	238	160	370	214	24	57	100
2040	75	150	90	65	7	1.3	1.1	258	140	162	166	182	75	58	57	120	55	69	127	159	147	184	130	45	140	260	55	50	70	65	70	215	150	350	200	20	50	85
2050	75	150	90	65	7	1.3	1.1	258	140	162	166	182	75	58	57	120	55	69	127	159	147	184	130	45	140	260	55	50	70	65	70	215	150	350	200	20	50	85

[a] i.e. only cold/hot drinks or cold food, no on-site kitchen
[b] e.g., restaurant, pub, fast food with on-site food preparation / catering
[c] in this Pilot version, this is only for use in Commercial Centres, to create area-weighted whole building limits, using the landlord areas and retail mix
For details of commencement dates, see section 4.2.6

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Annex A

Draft Operational Limits

UK Net Zero Carbon Buildings Standard

Draft OE New Build Limits

Key
Commencement Year : 2025 2040

Homes

Detached	Mid-Terrace	Semi-Detached & End Terrace	Bungalow	Flats	Office	Science & Technology
40 / 35	38 / 35	42 / 35	49 / 35	35 / 35	60 / 30	305 / 163
kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr

Commercial Residential

Student Accommodation	Care Homes	Hotel
71 / 35	151 / 74	123 / 61
kWh/m².yr	kWh/m².yr	kWh/m².yr

Culture and Entertainment

Performance (interval based)	Collection Based (non interval)	Sports & Leisure
85 / 42	65 / 32	210 / 104
kWh/m².yr	kWh/m².yr	kWh/m².yr

Schools

Early Years	Primary	Secondary
53 / 40	38 / 30	58 / 43
kWh/m².yr	kWh/m².yr	kWh/m².yr

Higher Education

110 / 43 kWh/m².yr

Data Centres

Low Utilisation	High Utilisation
1.4 / 1.3	1.2 / 1.1
PUE	PUE

Healthcare

Limits as per NHS Net Zero Standard.

Retail

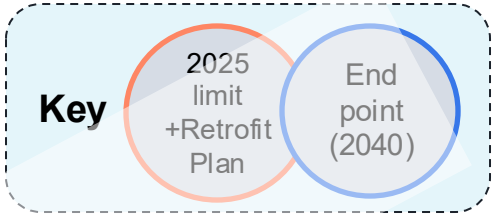
Retail Units	Food and Beverage	Retail Warehouse	Supermarket
70 / 36	215 / 112	81 / 42	192 / 100
kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr

Logistics

Unconditioned Store	Cold tore
34 / 13	163 / 61
kWh/m².yr	kWh/m².yr

Note: All m² is GIA unless marked otherwise.

Draft OE Existing Building/Retrofit Limits



Homes

Detached	Mid-Terrace	Semi-Detached & End Terrace	Bungalow	Flats	Office	Science & Technology
110 / 70	113 / 78	114 / 79	135 / 94	105 / 73	175 / 85	567 / 359
kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m²NIA.yr	kWh/m².yr

Commercial Residential

Student Accommodation	Care Homes	Hotel	Performance (interval based)	Collection Based (non interval)	Sports & Leisure
136 / 87	290 / 184	223 / 142	157 / 100	127 / 81	401 / 254
kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr

Education

Early Years	Primary	Secondary	Higher Education
122 / 77	109 / 69	111 / 70	156 / 115
kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr

Data Centres

Low Utilisation	High Utilisation
1.4 / 1.3	1.2 / 1.1
PUE	PUE

Retail

Retail Units	Food and Beverage	Retail Warehouse	Supermarket
147 / 93	419 / 266	157 / 99	413 / 262
kWh/m².yr	kWh/m².yr	kWh/m².yr	kWh/m².yr

Logistics

Unconditioned Store	Cold Store
64 / 41	364 / 231
kWh/m².yr	kWh/m².yr