CIBSE
Energy Performance Group

Young Energy Performance Group

Our mission

The group provides:

- Regular news through Twitter and email updates.
- An ***'Ask the expert***' Q&A forum on LinkedIn.
- ***Carbon Bites*** - short leaflets giving a rapid overview of key topics.
- ***Power Hours*** - Industry events to discuss the topic of the moment.
- ***Responses*** to government consultations and legislation.

As a leading source of guidance and standards for building services, CIBSE has prime responsibility for meeting the sustainability challenge head-on. The job of the Energy Performance Group is to ensure that we do it effectively.

Power Hours

CIBSE Energy Performance

Energy Performance Group
About
Committee Members
Carbon Bites
Power Hours

In these fast-paced talks, from our 'Power Hour' events, we have a panel of speakers each with 8 minutes to present followed by a moderated panel discussion.We have a timer counting down from 1 hour and everything needs to be finished in that time!

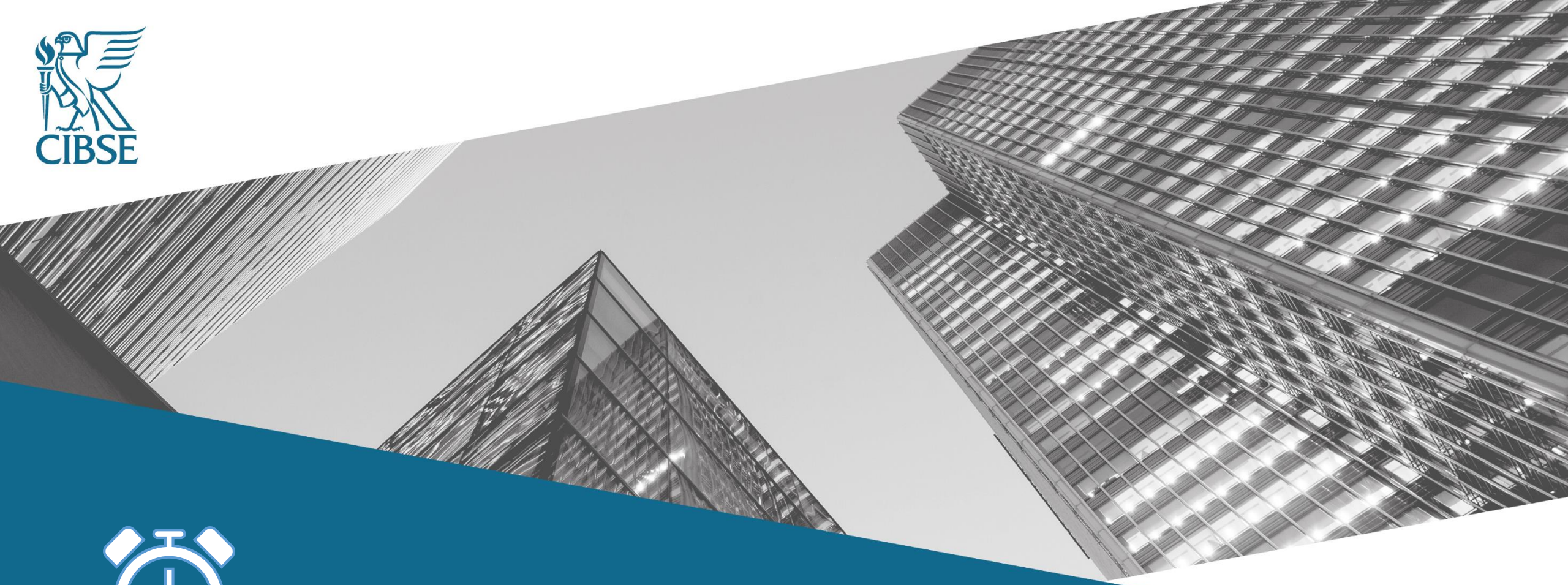
Past Presentations

Our speakers – One year of Part L 2021

1. **Richard Tibenham – IES Consultancy** I What these changes mean for designers?
2. **Samantha Carlsson** – **Derwent London** I Impact on Developers' and Planning Applications
3. **Nektarios Gkanis** – **The Carbon Trust** I Looking forward the new UK Net Zero Buildings Standard

Panel moderator, Gavin Lane , CIBSE YEPG Chair

Event format…



Quiz Time

Lucy Pemble – Carbon Trust and EPG Secretary

Building Regulation in England - Part L Quiz

When did the latest edition of ‘Conservation of fuel and power: Approved Document L’ 2021 come into force?

A. June 2021
B. June 2022
C. June 2023

What is the maximum flow temperature for heating systems under the latest edition of Part L?

A. 60 degrees
B. 55 degrees
C. 80 degrees

Fossil fuel heating is still permitted to be installed under Part L

A. True
B. False

…START THE CLOCK!!!

Part L 2021 (Vol 2)

What these changes mean for designers

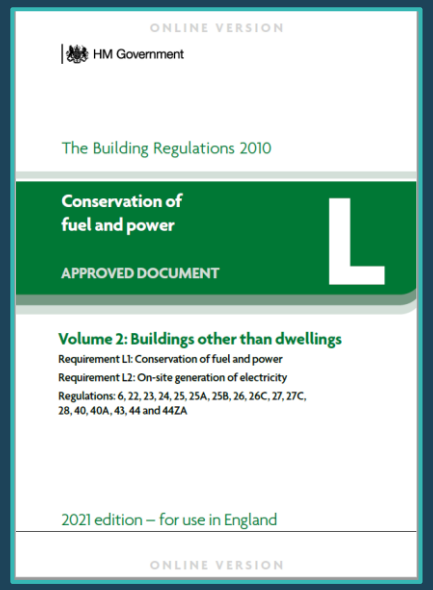
Recording

Richard Tibenham – IES Consultancy
Business Development Manager

www.iesve.com

Introduction

- Effective from 15 June **2022** for new BC applications.
- Effective from 15 June **2023** for existing BC applications.
- For use in England.
- Part L 2013 projects = Part L 2013 EPC.
- Part L 2021 projects = Part L 2021 EPC.



Part L / NCM Modelling Guide Key Changes

1. New primary energy target introduced.
2. New Notional Building specifications target a 27% reduction in CO_2 emissions as compared to ADL2A 2013.
3. 'Where a building is erected, it must be a 'nearly zero-energy building'.
4. New classifications for high & low hot water demand for certain activity types (e.g. sports centre changing facilities).
5. Notional building now includes solar PV.
6. Notional building now includes DHW secondary circulation & storage under certain scenarios.
7. New set of fuel carbon factors introduced, including variable monthly factors grid electricity and export.
8. Revised approach for determining lighting illuminance in the notional building.
9. Revised approach for accounting for primary energy, accounting for onsite energy generation.
10. Upgrade to TRY2016 weather data sets.
11. Updated HVAC options in the actual building.
12. Revised approach for calculating fan energy in demand-controlled systems.

Other Notable Changes

1. A new primary energy target has been introduced (BPER < TPER)

Target CO_2 emission rate (TER), $kgCO_2/m^2$.annum	6.66	
Building CO_2 emission rate (BER), $kgCO_2/m^2$.annum	8.86	
Target primary energy rate (TPER), kWh/m^2.annum	70.36	
Building primary energy rate (BPER), kWh/m^2.annum	94.61	
Do the building's emission and primary energy rates exceed the targets?	BER > TER	BPER > TPER

2. Solar PV is now applied to notional building based on an algorithm accounting for foundation area, conditioned area, number of floors, and HVAC system type.

3. The notional building now accounts for a secondary circulation loop and hot water storage under certain scenarios. Loop length and storage capacity are based on floor area. Heat losses of 8W/m are accounted for.

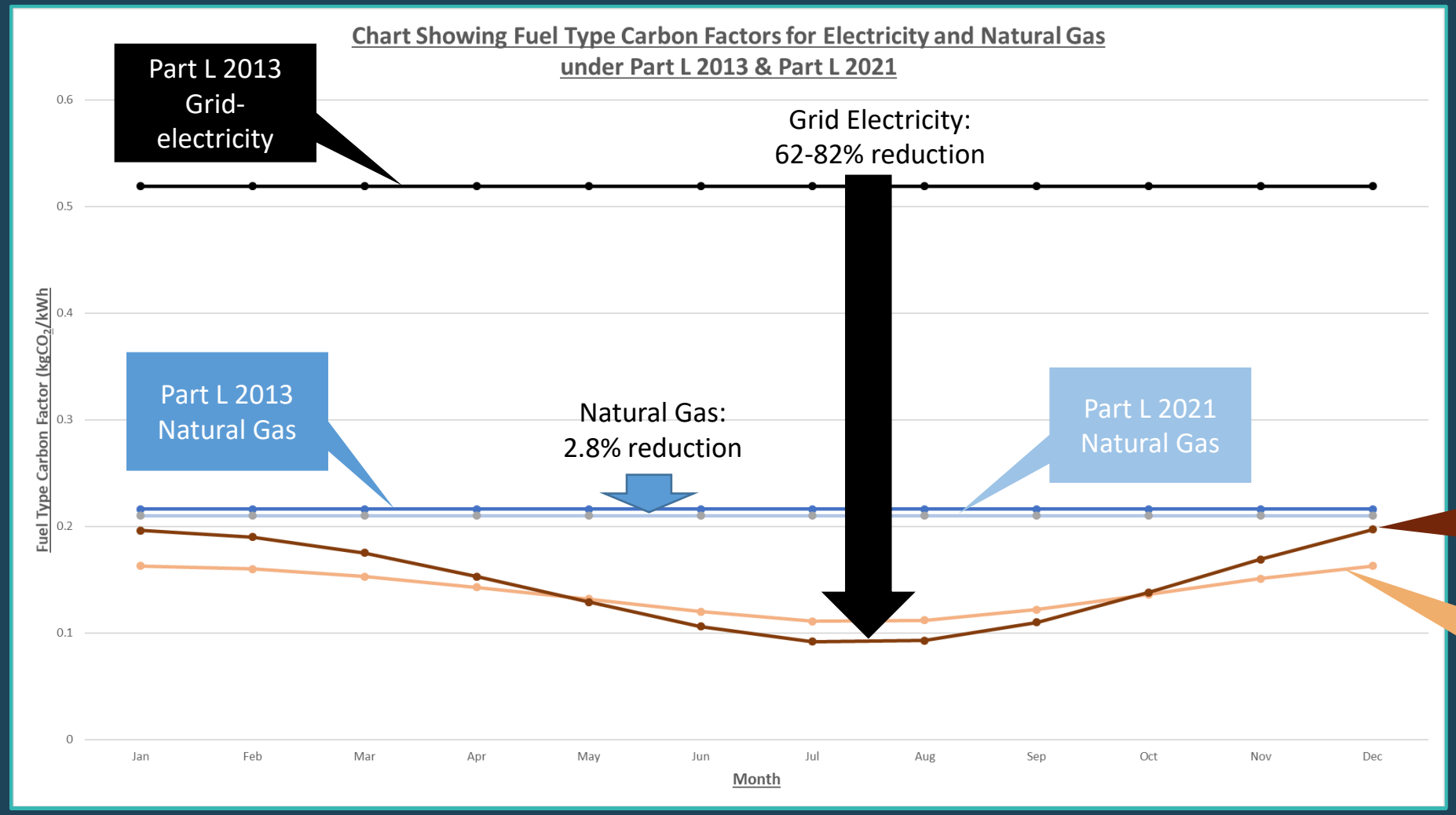
4. The general lighting in the notional building is based on lighting with an efficacy of 95 luminaire lumens per circuit-watt, and the resulting power density (W/m^2) will vary as a function of the geometry of each zone modelled.

5. Any demand control of ventilation will now also affect the auxiliary energy. Where there is demand control of ventilation, the auxiliary energy calculation will use a pro-rated value for the maximum fresh air rate.

6. Default non-repeating thermal bridging in the actual building is increased from 10% to 25% of rated element U-value.

7. For temporary buildings, the age of units will influence the TPER (relaxation of standards for old units).

Part L NCM Carbon Factors



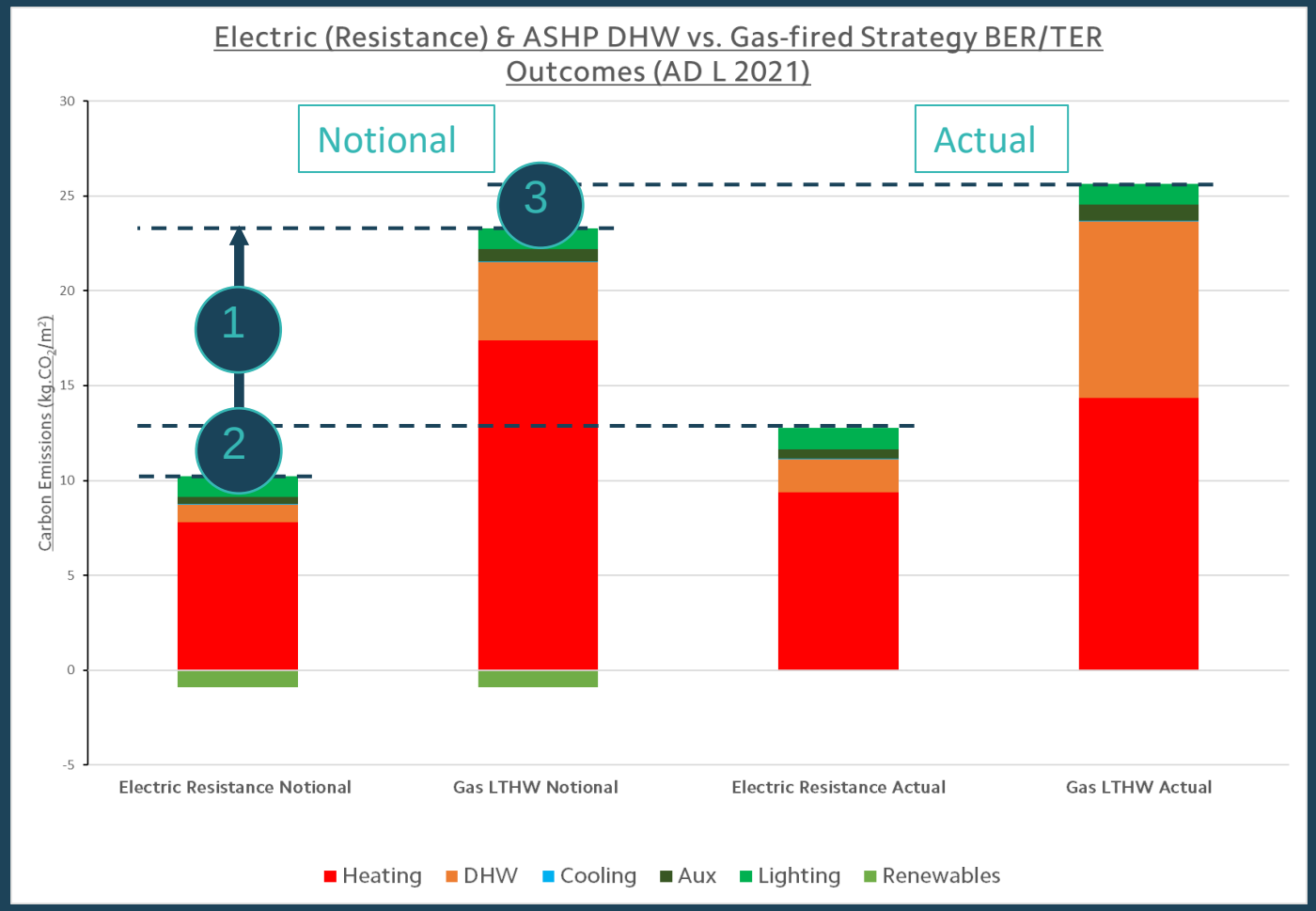
Part L NCM Carbon Factors: General Consequences

- Grid-electricity carbon factor under ADL2 2021 are far lower than ADL2 2013.
- Systems using electricity as a fuel source incur far lower CO_2 emissions.
- Energy generation systems which generate electricity (e.g. solar-PV & CHP) also achieve far lower CO_2 displacement.
- The electricity carbon factor is higher during the winter and lower during the summer, promoting winter time efficiency.
- PV generation is incentivised during the winter.

So, does this all mean that electricity is favourable over natural gas?

.....not as such. It all depends on the notional model.

Electric (Resistance) Vs. Gas-fired TER/BER Carbon Emissions

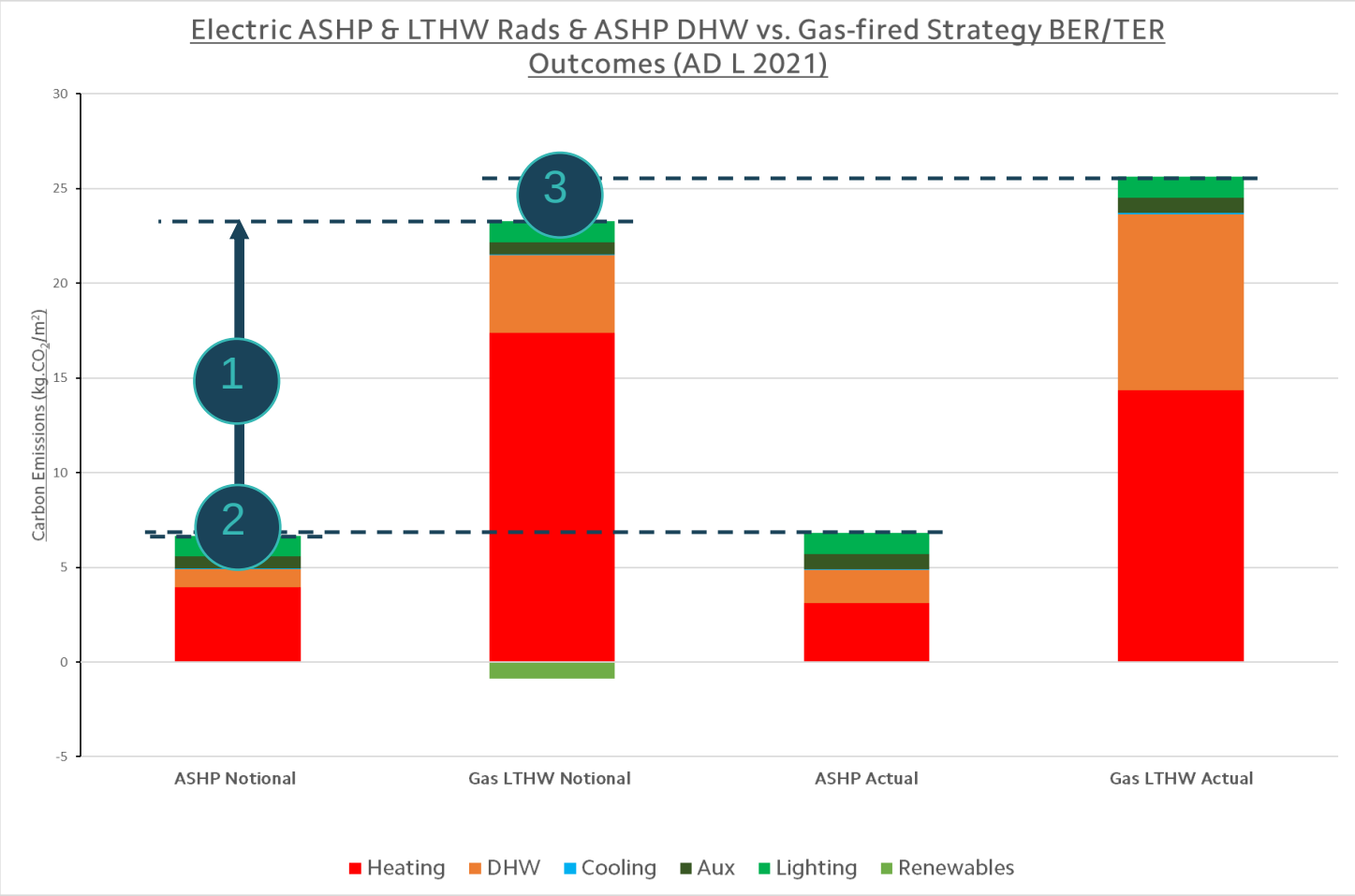


1. Scenario B gas-fired TER is 123% greater than the Electric (Resistance) TER.
2. Scenario A electric (Resistance) BER is 35% greater than the Electric (Resistance) TER. Additional 285m² of additional PV required to secure compliance.
3. Scenario B gas-fired BER is 13% greater than the gas-fired TER. Additional 267m² of additional PV required to secure compliance.

Takeaway:

Electric resistance heating offers a lower absolute CO^2 emission rate as compared to gas, but is less advantageous in satisfying the TER/BER assessment.

Electric ASHP & LTHW Rads Vs. Gas-fired TER/BER Carbon Emissions



1. Scenario B gas-fired TER is 236% greater than the Electric (ASHP) TER.

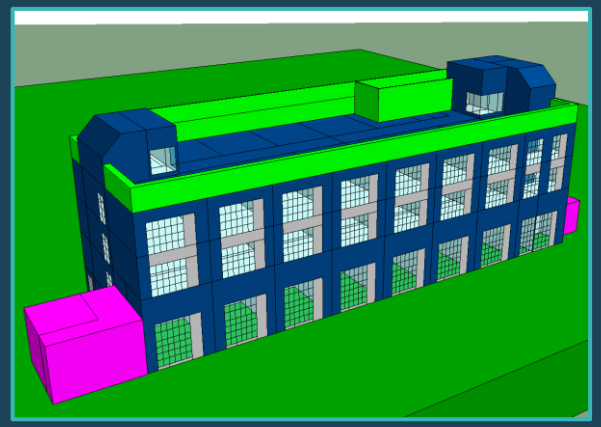
2. Scenarion The Electric (ASHP) BER is 2% greater than the Electric (ASHP) TER. Additional 12m² required to secure compliance.

3. The gas-fired BER is 13% greater than the gas-fired TER. Additional 267m² required to secure compliance.

Takeaway:

Space heating via a heat pump offers a superior TER/BER outcome as compared to a natural gas or electric resistance heating strategy.

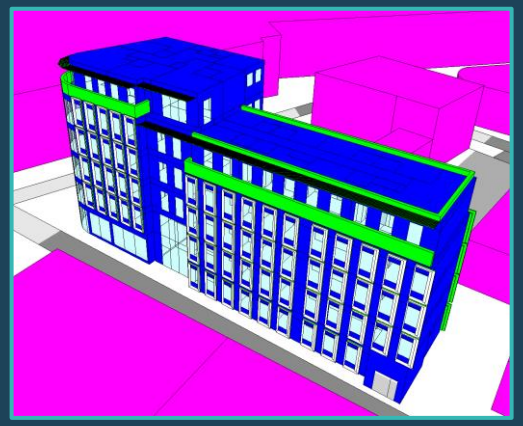
Impact on EPC's



Office building.
ASHP space heating/cooling.
PoU DHW heating.

Part L (2013)
TER: 33.9
BER: 20.3
EPC: B (28)

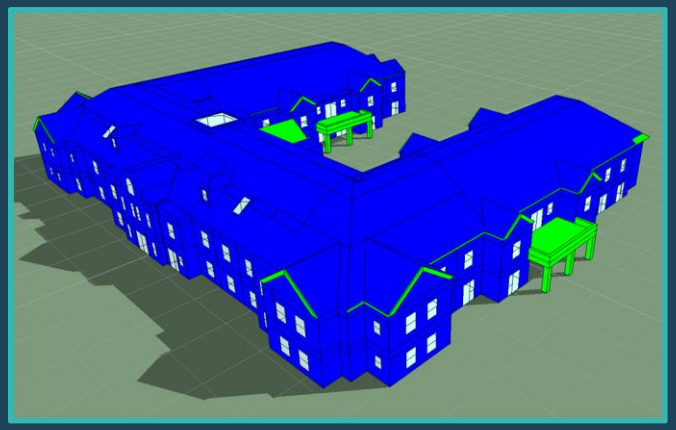
Part L (2021)
TER: 7.8
BER: 6.1
EPC: A (18)



Student accommodation.
Electric (resistance) space heating.
ASHP DHW heating.

Part L (2013)
TER: 54.9
BER: 54.7
EPC: B (42)

Part L (2021)
TER: 9.5
BER: 24.2
EPC: B (26)



Care home.
Natural gas space heating.
Natural gas DHW heating + CHP.

Part L (2013)
TER: 43.4
BER: 31.9
EPC: B (27)

Part L (2021)
TER: 28.6
BER: 31.0
EPC: B (34)

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Tips for achieving compliance

1. ## Review psi-values:
   The standard U-value of fabric elements (inc. windows) is uplifted by a default **25%** in the actual building to account for thermal bridging. This compares to **10%** in the notional building. Calculate psi-values to BS EN ISO 14683 and apply to the model to improve fabric efficiency.

2. ## CHP No Longer Viable:
   Gas-fired CHP now provides only a negligible benefit to the TER/BER assessment due to the changes in the electricity carbon factors. A unit previously offering a 30% reduction in the BER can now expect to offer ~3%.

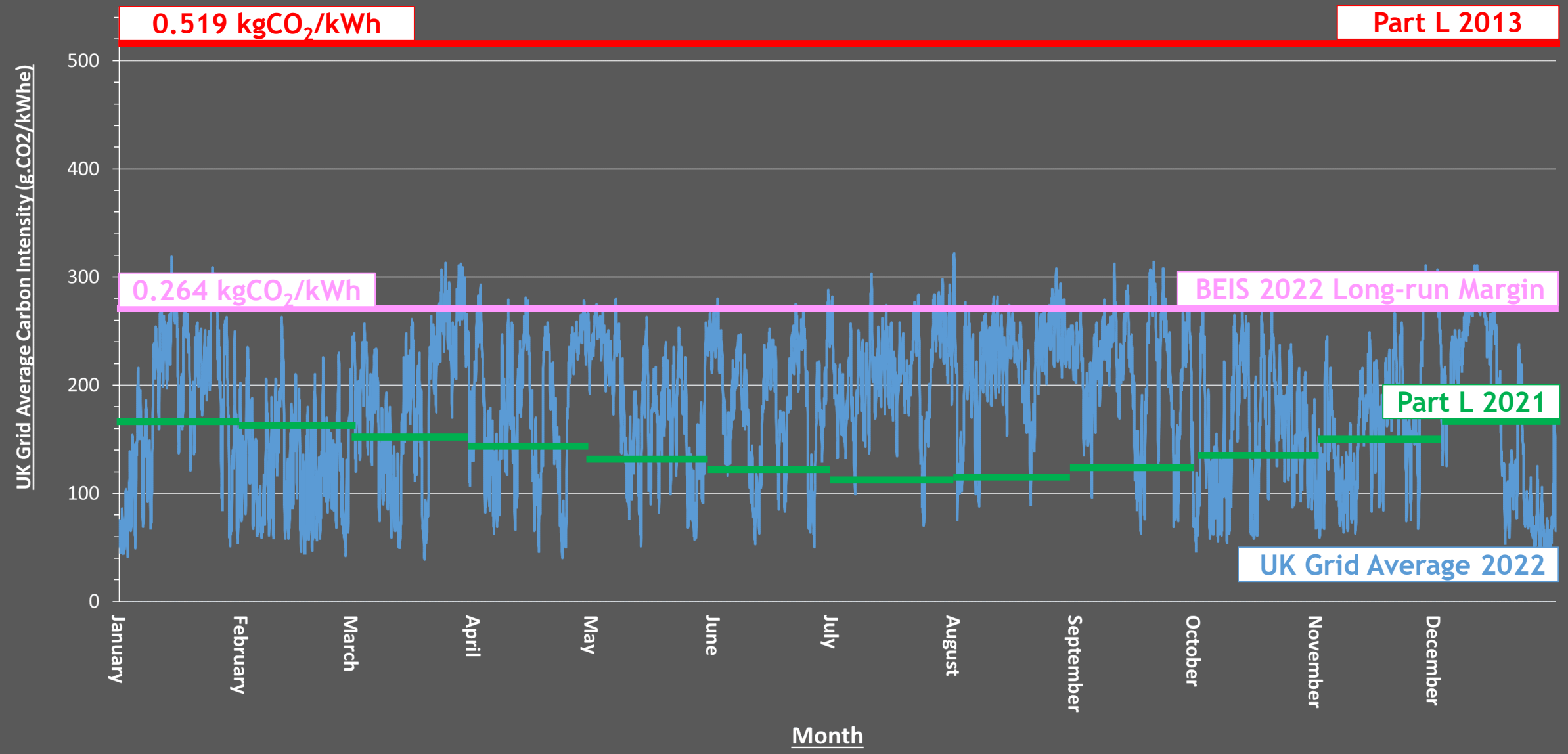
3. ## Consider Solar Thermal:
   Solar thermal now offers approximately twice the carbon savings of solar PV per unit of collector area when offsetting natural gas, again, due to changes in the emissions factors.

4. ## Don't bank on Solar PV:
   Solar PV yields no longer offer a 'get out of jail card' to offset poor air permeability and as-built specification changes.
   Avoid problems via adequate project management and air tightness envelope design & delivery.

5. ## Assess Early:
   Undertake Part L assessments as early as possible to help quantify the compliance risks under the code. Consider architectural design with respect to optimum yields from solar technologies and overheating risks.

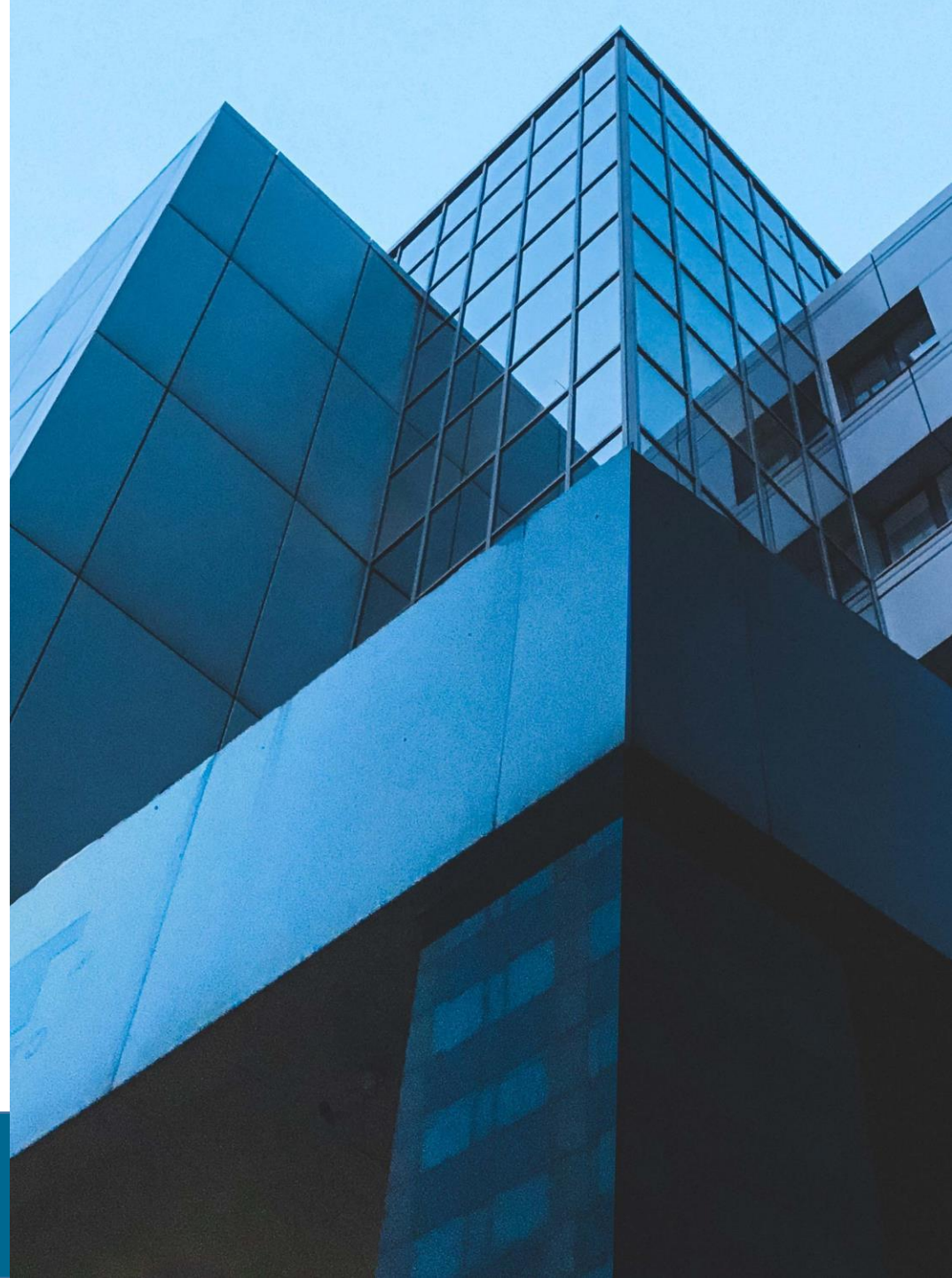
6. ## Consider the Bigger Picture:
   Do consider the bigger picture. Gas-fired systems may perform for Part L compliance, but may not address additional client requirements such as NABERS, GLA London Plan, LETI guidance, BREEAM *etc*.

Chart Showing UK Electricity Grid Carbon Intensity & Various Industry Average Metrics



How Accurate are Operational Carbon Emissions Projections?

Richard Tibenham – IES Consultancy

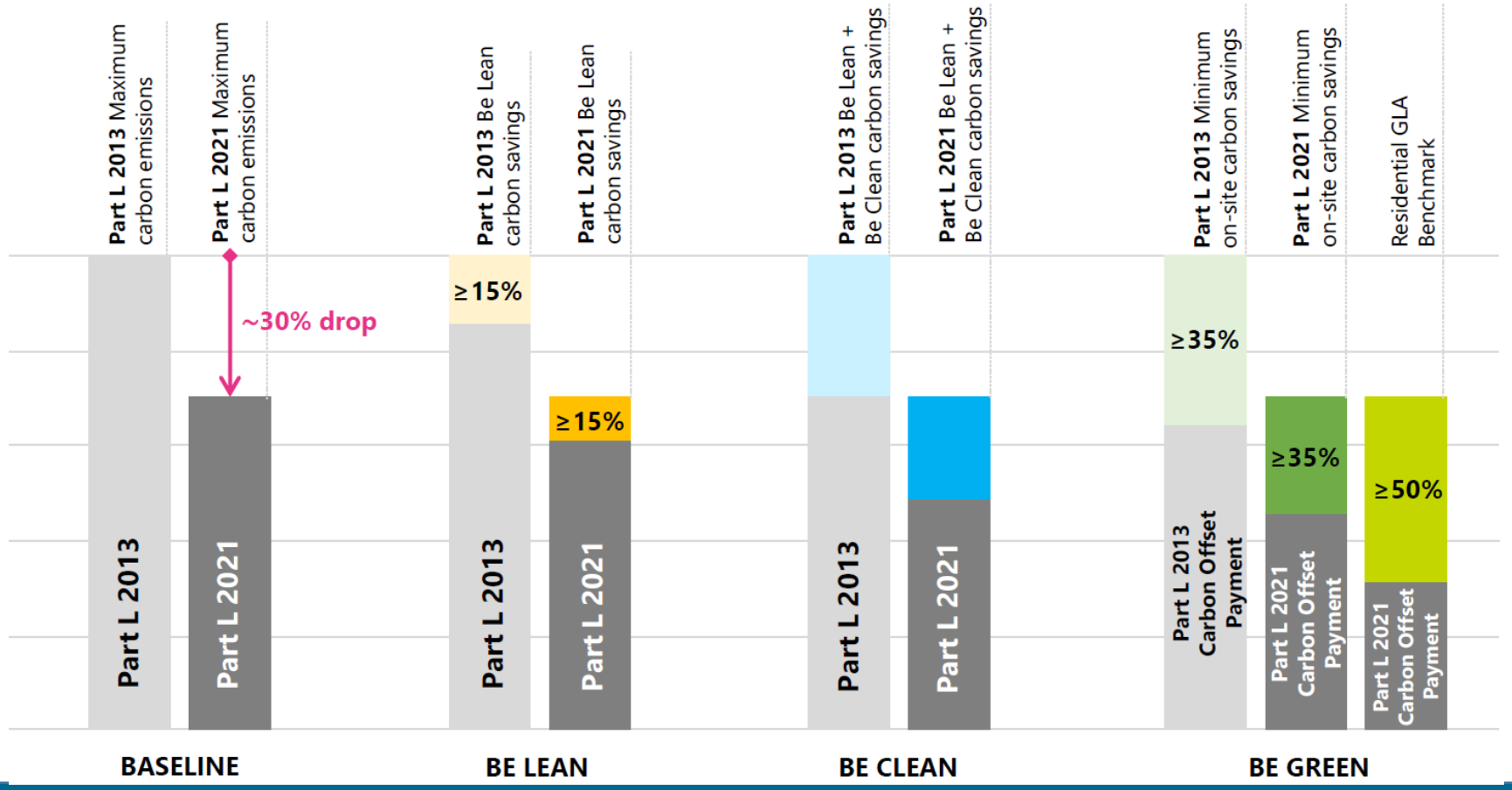


Samantha Carlsson

Senior Sustainability Manager | Derwent London

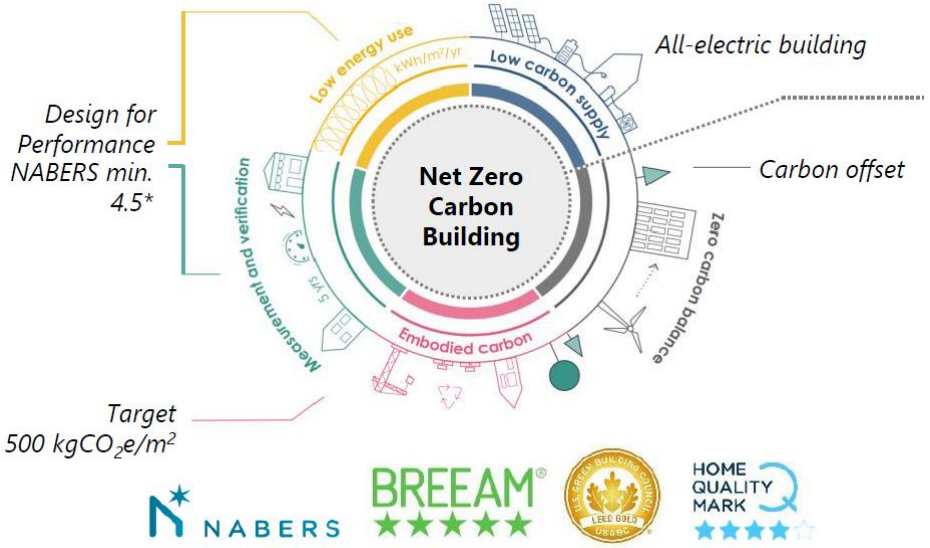
What Part L 2021 Changes Means for London Developers' and New Planning Applications

GLA Energy Targets



The Building

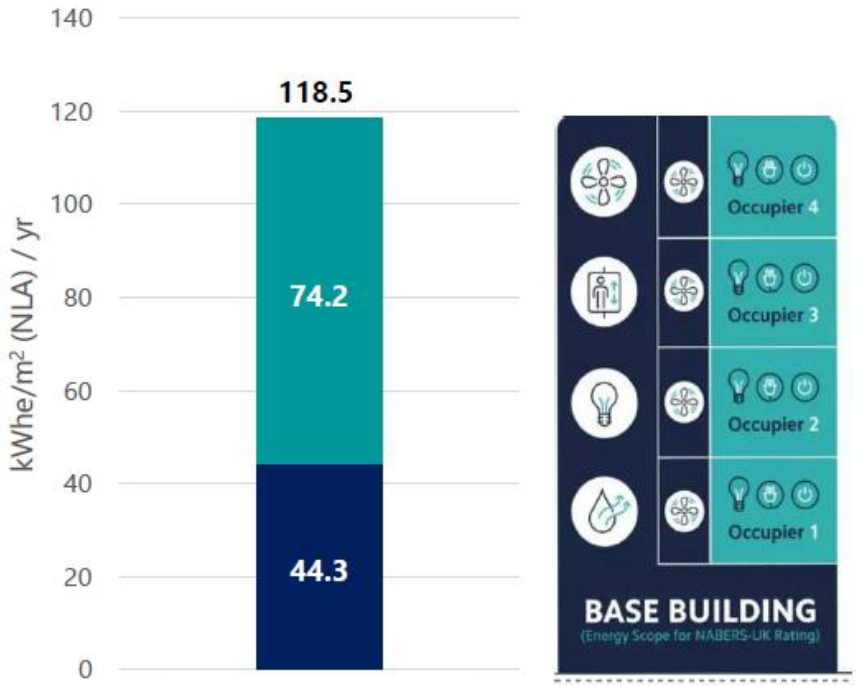
- Office-led scheme
  - Retail on ground floor
  - Residential



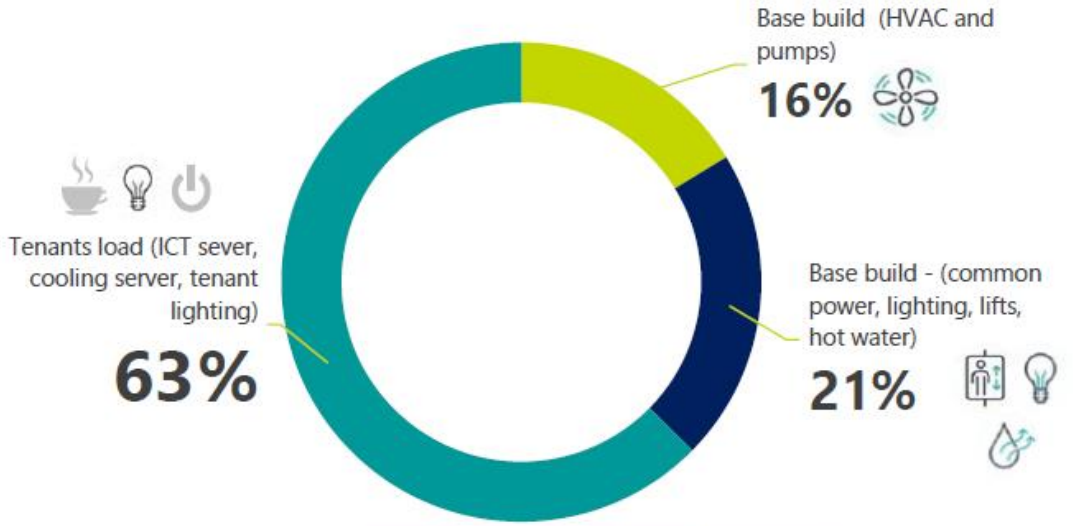
Fabric First

	Part L2 2022	DL Project	Passivhaus
Air permeability	8$m^3/h/m^2$ @ 50pa	**3$m^3/h/m^2$ @ 50pa**	1 $m^3/h/m^2$ @ 50pa
External wall	0.26 W/m^2K	**0.15 W/m^2K**	0.15 W/m^2K
Roof	0.18 W/m^2K	**0.12 W/m^2K**	0.12 W/m^2K
Floor	0.18 W/m^2K	**0.12 W/m^2K**	0.12 W/m^2K
Window	1.60 W/m^2K	**1.40 W/m^2K**	0.85 W/m^2K
Rooflight	2.20 W/m^2K	**Fixed: 1.70 W/m^2K** **Openable: 1.80 W/m^2K**	0.85 W/m^2K
Glazing g-value[2]	Side lit: 0.29 Top lit: 0.40	**0.32**	0.32
Glazing Lighting Transmittance	N/A	**0.65**	0.65

Operational Energy



DL Project



UKGBC 2030-2035 target and
NABERS 5.5 Star rating aspirations

UKGBC Paris Proof and interim energy performance targets

		Interim Targets			Paris Proof Target
Scope	Metric	2020-2025	2025-2030	2030-2035	2035-2050
Whole building energy	kWhe/m2 (NLA) / year	160	115	90	70
	kWhe/m2 (GIA) / year	130	90	70	55
	DEC rating	D90	C65	B50	B40
Base building energy	kWhe/m2 (NLA) / year	90	70	55	35
	kWhe/m2 (GIA) / year	70	55	45	30
	NABERS star rating	4.5	5	5.5	6
Tenant energy	kWhe/m2 (NLA) / year	70	45	35	35

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Results: Part L 2021 only

				Minimum Be Lean GLA Target ≥15% Commercial		Minimum On Site GLA Target ≥35% Commercial
	Option	**Description**	**Be Lean**	**Be Lean Carbon Savings (%)**	**Be Green**	**On-Site Carbon Savings (%)**
Optimised Fabric	**1**	**FCU**	Fabric as designed Parameters as agreed with GLA	**18%** (24.7 kWh/m²)	No PVs	**23%** (23.5 kWh/m²)
					With PVs: 650m², 276 No. cells	**35%** (20 kWh/m²)
	2	**Embedded Coil**	Fabric as designed Parameters as agreed with GLA	**20%** (23.6 kWh/m²)	No PVs	**26%** (22.5 kWh/m²)
					With PVs 350m², 150 No. cells	**28%** (22 kWh/m²)
					With PVs for GLA compliance: 470m², 200 No. cells	**35%** (20 kWh/m²)
Passive House	**1b**	**FCU**	Passivhaus Fabric Parameters as agreed with GLA	**21%** (23.4 kWh/m²)	No PVs	**25%** (22.8 kWh/m²)
					With PVs: 550m², 235 No. cells	**35%** (20 kWh/m²)
	2b	**Embedded Coil**	Passivhaus Fabric Parameters as agreed with GLA	**23%** (23.3 kWh/m²)	No PVs	**29%** (21.7 kWh/m²)
					With PVs: 400m², 170 No. cells	**35%** (20 kWh/m²)

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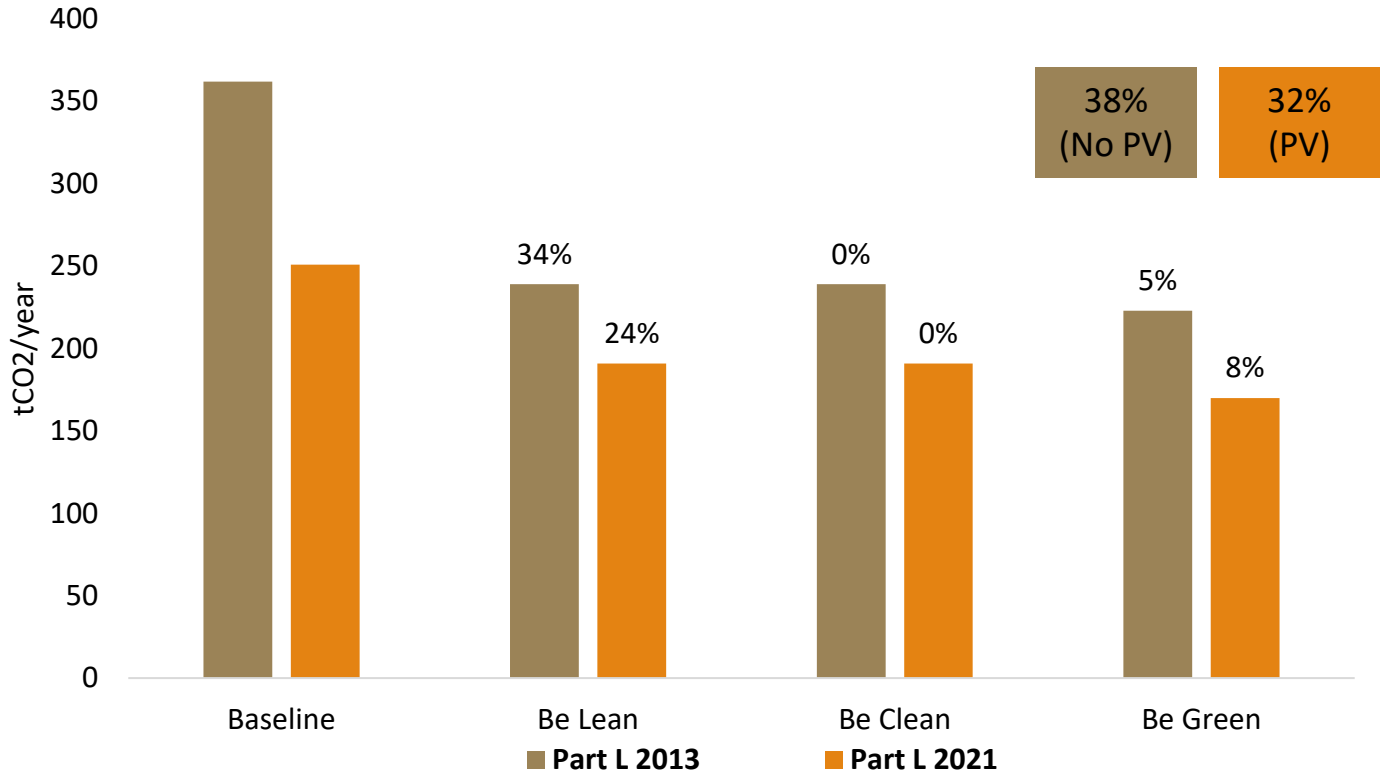
Results: Part L 2013 vs 2021



Discussions with the GLA

- Clearly laid out & detailed roof plan
- Energy in use narrative / NABERS
- Urban Greening factor
- Investigate heat networks

Optimising Roof Space

Plant space
Landlord & Tenant

Tenant Amenity &
urban greening

Renewable
Technology

Nektarios Gkanis

Commercial Real Estate Lead | The Carbon Trust

TSG Member, Chair – Reporting, Disclosure & Verification | UK Net Zero Carbon Buildings Standard

UK Net Zero Carbon Buildings Standard

Background

Net Zero Carbon

Achieving a balance between the greenhouse gases emitted into and removed from the atmosphere. In order to mitigate the worst impacts of climate change on humanity and natural ecosystems, climate science has shown that we need to limit global heating to 1.5°C over pre-industrial levels. In order to stand a reasonable chance of doing so, we need to achieve net zero carbon globally by 2050 and limit cumulative emissions between now and then to within the remaining ‘carbon budget'.

UK Net Zero Carbon Buildings Standard

General application

What will the Standard cover?

- Will set out metrics by which net zero carbon performance is evaluated, and provide performance targets and limits.
- Will be science-based, 1.5ºC-aligned, and aligned with delivering a Net Zero Carbon UK by 2050 and a 78% reduction by 2035 in the UK.
- Will incorporate targets and limits that have been derived from an analysis of the UK's Sixth Carbon Budget and from data gathered across different sectors within the built.

- **Who is it for?**

Developers, contractors, asset owners and managers, occupiers, investors, financiers and funders, consultants, building industry professionals, building managers and product/material manufacturers, suppliers, and distributors.

- **Which construction stages it applies at?**

Design, Practical completion, In-use

UK Net Zero Carbon Buildings Standard

Application of the Standard

Homes	Sport and Leisure	Hotels
Offices	Retail	Commercial Residential
Schools and Further Education	Culture and Entertainment	Logistics / Warehouses
Healthcare	Heritage	Datacentres
	Science and Technology	

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UK Net Zero Carbon Buildings Standard

Principles

Overall Principles

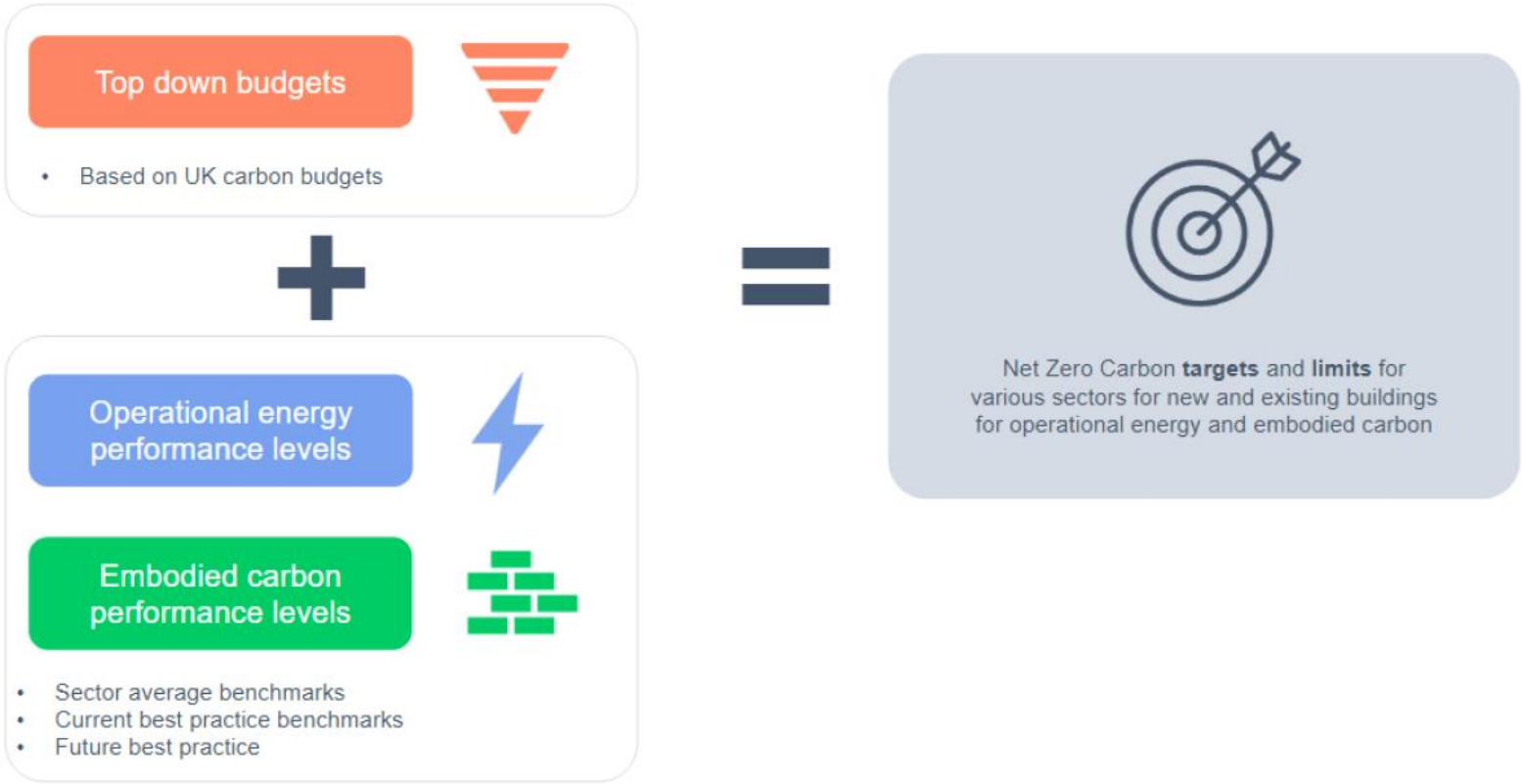
- Providing clear, consistent definitions and trajectories for Net Zero Carbon buildings and the built environment.
- Driving market transformation through industry engagement, uptake and support.
- Ensuring an easily used and understood Standard, with achievable but stretching requirements.
- Aligning asset-level requirements with the system-level changes needed for a Net Zero Carbon UK.

Technical Principles

- Creating a Standard which is science-based
- Including both operational and embodied carbon
- Prioritising energy efficiency and eliminating the performance gap
- Prioritising the reuse of existing buildings and assets
- Adopting a whole life carbon approach
- Enhancing renewable energy generation
- Ensuring that buildings are responsive to electricity grid

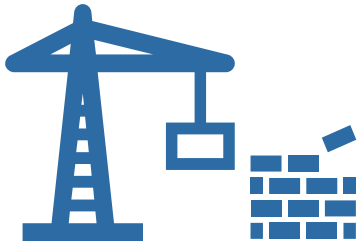
UK Net Zero Carbon Buildings Standard

Developing Net Zero Carbon Limits



UK Net Zero Carbon Buildings Standard

Technical requirements



Embodied Carbon Limits

Operational Energy Limits

Fossil Fuel Free

District Heating & Cooling Networks

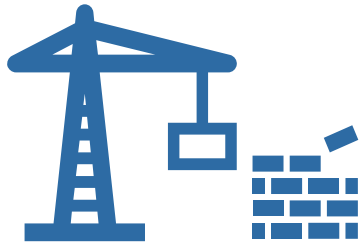
Demand Management Reporting

Onsite Renewables

Refrigerants & Leakage

UK Net Zero Carbon Buildings Standard

Technical requirements



Embodied Carbon Limits

Upfront Embodied Carbon (A1-A5) – Limited

Limits will be set, defining a building's required embodied carbon performance in $kgCO_2e/m^2GIA$

Existing Buildings	Retrofit	New-build	Mixed new/retrofit
1. Above a threshold 2. Office, Retail, Hotels	1. >25% of envelope renovation 2. Significant mechanical	1. New-build 2. Reuse, where >50%of existing slab demolished	<50%of existing slab demolished + building is extended

Lifecycle Embodied Carbon (A1-A5, B1-B5, C1-C4) – Reported

Will be required to be reported, but will not be limited in this version of the Standard. The metric will be $kgCO_2e/m^2GIA$ over the building's Reference Study Period (default being 60 years, in accordance with the RICS Professional Statement).

The limits will be set based on both top-down budgets and bottom-up performance levels, the same approach as operational energy.

The reporting for A1-A5 will require measured, as-built quantities. Product-specific EPDs are to be used where available -where not, the standard will set out the hierarchy of other carbon factor options that can be used instead.

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UK Net Zero Carbon Buildings Standard

Technical requirements

Operational Energy Limits

Operational Energy - Limited

In general, all electrical and thermal energy uses are covered by the Standard, and are limited. However, a small number of exceptions apply:

- **EV charging**
- **Heavy process loads**

  if the carbon emissions from these processes are already managed as part of that industry's carbon emissions and do not come under the 'built environment' heading.

Operational energy limits must be met

New-build	Existing Buildings & Retrofit

Verification of conformity will be on actual outcomes

UK Net Zero Carbon Buildings Standard

Technical requirements

Fossil Fuel Free

District Heating & Cooling Networks

Fossil Fuel Free

Buildings with on-site plant (e.g. heating, cooking, generator) will be required to be **fossil fuel free**, with the exceptions of:

- Energy uses, not covered by the Standard
- Emergency and back-up:
  - Emergency and life safety uses
  - Back-up to essential functions in buildings and sites defined of critical importance (Class IV buildings – BS EN 1998:2004+A1:2013
  - Back-up [power in datacentres

Buildings connected to a **new** district heating or cooling scheme will only be able to certify if the scheme is fossil fuel free.

Buildings connected to an **existing** district heating or cooling scheme using fossil fuels may be able to certify, ***if***:

- The scheme has a decarbonisation plan in place, and
- There is a limit to the contribution from fossil fuels.

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UK Net Zero Carbon Buildings Standard

Technical requirements

Demand Management Reporting

Demand Management – Reporting

No limits or targets will be set with regards to demand management and/or flexibility but they may be proposed in some sectors.

Reporting against a range of metrics will be required, to support the ongoing review and future development of the Standard. As a minimum:

- **Peak Demand**
- **Time of peak**

The embodied carbon of all demand management solutions, including batteries will be counted as part of the overall building's embodied carbon.

UK Net Zero Carbon Buildings Standard

Technical requirements

Onsite Renewables

Onsite Renewables - Target

New buildings should be required to provide on site renewable electricity systems, with targets expressed in kWh/m^2 (all TBC).

1-2-storey industrial	All other buildings	Houses / low-rise
150-200	80-120	

Flexibility would be provided in the following conditions, with evidence:

- Planning or legal constraints
- Impractical to provide generation
- Target not achievable due to practical constraint
- Poor conditions for generation

The embodied carbon of renewable electricity generating systems, will be subject to separate limits than the A1-A5, with the limit expressed in kgCO_2e/kWp.

UK Net Zero Carbon Buildings Standard

Technical requirements

Refrigerants & Leakage

Refrigerants & Leakage – Limited

- Refrigerants will be accounted for within embodied carbon calculations.
- The Standard will place a limit on the Global Warming Potential (GWP) of refrigerants.
- The initial proposal for the GWP limit is based on R32: 675 GWP.
- The Standard will require the GWP of refrigerants to match the most recently published IPCC publications, as per the RICS Professional Statement on Whole Life Carbon Assessment for the Built Environment.
- Refrigerant leak detection must be installed
- Refrigerant leakage must be reoported

Panel Discussion

1. **Richard Tibenham – IES Consultancy** | What these changes mean for designers?
2. **Samantha Carlsson** – **Derwent London** | Impact on Developers' and Planning Applications
3. **Nektarios Gkanis** – **The Carbon Trust** | Looking forward the new UK Net Zero Buildings Standard

Panel moderator, Gavin Lane , CIBSE YEPG Chair

Thank You!

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