Sustainable Development -

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School of Architecture, Construction and Environment

Sustainable Development

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Table of Contents -

Title Page 1

Table of Contents 2

Introduction 3

Critical Review of Frameworks 4

Rationale for a Net Zero Regulation 5

Proposed Approved Document – Part-Net 6

Approved Document 7

Implementation Challenges 13

Discussion & New Angle / Conclusion 14

Appendix 16

References 18

Introduction.

Global scale construction is responsible for almost 40% of worldwide carbon emissions, driven by operational energy use and embodied carbon in materials (UKGBC, 2021). Climate change has placed the construction industry at the centre of sustainability agendas, as demonstrated by the UK's Net Zero goal by 2050. Whilst UK Building Regulations address health, safety and performance, they neglect main issues with Net Zero agendas. While Part Net Zero focuses on operational efficiency, it excludes embodied carbon, renewable integration and whole-life performance statistics.

In Wales, the Wellbeing of Future Generations Act 2015 is a legislative foundation for sustainable development, requiring public bodies to address improvements in environmental, social and economic wellbeing in construction (Welsh Government 2025). Through embedding these into UK building regulations it would contribute largely to Wales's sustainability agenda and net zero goals.

While frameworks such as BREEAM, Passivhaus, LEED and the RICS Whole Life Carbon Assessment give methodologies for assessing sustainability (RICS 2017), they remain fragmented and not fully applied. This can lead to challenges for performance, procurement and communication.

This paper proposes a new building regulation to address the need for an Approved Document for Net Zero Carbon, setting out a minimum performance standard and compliance pathway for operational and embodied carbon. Establishing statutory thresholds would prioritise sustainable construction methods contributing to market certainty; assisting designers, contractors and QS teams to deliver Net Zero, sustainable buildings.

Critical Review of Frameworks.

Over the past two decades, the industry has undergone an increase in sustainability assessment frameworks aimed at lowering the environmental impact of buildings. Whilst these have ensured recognition of the challenges, there are limitations as they are voluntary, offering guidance rather than statutory obligations, with no real effect on contractors. Being points based means none fully align with the UK Building Regulations concerned with achieving Net Zero (UK-Net-Zero-Strategy, 2021).

BREEAM continues to be the most recognised certification in the UK as it looks into components such as energy, water, transport and materials (BREEAM, 2022). However its non-statutory nature has been criticised for not allowing proper carbon reduction (Wheeler & Rosan, 2021). Buildings are able to achieve an EXCELLENT rating without fully demonstrating Net Zero alignment, creating opportunities for greenwashing (United Nations, 2025).

LEED uses international recognition and supports integrated design. As it relies on US-based ASHRAE standards, its application in the UK is limited.

Passivhaus is not a regulation but a level of building that can be achieved , ensuring strict operational energy limits such as the 15kWh/m2/year heating need (Passivhaus Trust, 2020). Passivhaus buildings reliably match design predictions which helps close the UK performance gap.

LETI's Climate Emergency Design Guide (2020) provides benchmarks for operational and embodied carbon, including less than 35 kWh/m2/year targets. As a voluntary initiative LETI has no enforceability. In Wales, projects such as the Vale of Glamorgan's net-zero schools programme show LETI influencing design decisions.

The RICS WLCA (2017) is the most robust method for quantifying embodied and whole-life carbon, and its alignment with lifecycle costing provides value for QS practice. Its limitation is no mandatory carbon limits. Welsh guidance such as Woodknowledge Wales shows how RICS WLCA is applied to compare timber, steel and masonry (Woodknowledge,2025).The AECB standard changes Passivhaus principles to become applicable in UK context, offering less than 40 kWh/m2/year targets and guidance on materials and embodied carbon. Similar to LETI, it is voluntary with no repercussions. Summarising , Passivhaus and AECB give strong operational performance, while RICS WLCA and LETI show embodied carbon methodologies. BREEAM, LEED and WELL help sustainability considerations but risk

weakening carbon focus through points-based structures. All these are voluntary, but reinforce the need for a single unified framework within the UK.

A comparative summary of these frameworks is shown in Figure.

Rationale for a Net Zero Regulation.

The UK Building Regulations address energy efficiency mainly through Approved Document Part L (Conservation of Fuel and Power. Although Part L can establish a minimum standard for fabric efficiency and carbon emissions from operational energy, it has several limitations.

It measures performance based on design stage modelling. The design phase does not account for variations such as human error eg. leaving windows open. Whereas using SMART home technology it can detect these losses in real time and alert the home occupier. This can add to the performance gap in UK buildings(UKGBC, 2021). Additionally, it focuses on operational energy while overlooking embodied carbon in materials, construction processes and disposal.

One of the criticisms of the current regulatory framework is the absence of embodied-carbon limits. Whilst Part L prevents operational energy use, it shows no strategy for controlling the carbon intensity of materials. Relying on voluntary assessments like the RICS WLCA creates inconsistency across the industry. By incorporating embodied carbon into statutory regulation this would close the gap by making sure regulation is met regardless of clients ambition. Beyond technical gaps, the fragmented landscape of voluntary frameworks such as BREEAM, Passivhaus, AECB and LETI have created levels of inconsistency over the construction industry. Whilst these frameworks show important benchmarks to achieve , they are voluntary and rely on the clients idea on sustainability. This can lead to uneven application, contractual ambiguity and difficulties for professionals such as Quantity Surveyors in deciding costs or verifying compliance. The industry has called for a clear,

statutory benchmark to provide consistency, promote sustainability and reduce disputes (RICS, 2017; UKGBC, 2021).

The arguments for a Net Zero regulation is also in line with policy imperatives. The UK has a legally binding target in order to achieve Net Zero by 2050, supported by interim carbon budgets under the Climate Change Act (2008). In Wales, this regulatory ambition is reinforced by the Well-being of Future Generations (Wales) Act 2015, which legally requires public bodies to act sustainably.

Including Net Zero directly into Building Regulation would not only provide legal clarity but also send a strong message, aligning with the UK Government's Future Homes and Building Standard (2023). Integrating Net-Zero into regulation also promotes the social and economic pillars of sustainable development by lowering fuel poverty, creating skilled employment in low-carbon construction, and improving occupant wellbeing (United Nations, 2015).

Proposed Approved Document – Part-Net.

In order to address this gap , this paper looks at proposing the creation of Approved Document Part Net-Zero Carbon. Based on other existing approved documents , Part-Net would clearly establish statutory requirements for operation and embodied carbon whilst ensuring clear compliance pathways derived from existing best-practice frameworks such as Passivhaus, AECB and the RICS WLCA. The following section sets out the proposed structure , requirements and guidance for demonstrating compliance.

Approved Document Part-Net.

To accompany the Building (Net Zero Carbon Requirements) (Wales) Regulations [2025].

Welsh Government – Building Regulations Wales.

Contents:

1. Introduction
2. Application of the Requirements
3. Core Requirements
4. Compliance Guidance
5. Example Compliance Pathways
6. Implementation Notes
7. Critical Reflection
8. Appendices

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1. Introduction.

1.1 Scope.

This Approved Document provides guidance for compliance with Part-Net of Schedule 1 – Net Zero Carbon. It sets out design, construction and verification measures necessary to achieve statutory Net Zero performance in new and existing buildings.

1.2 Purpose.

The aim of this guidance is to:

- reduce operational energy demand;
- minimise whole-life embodied carbon;
- integrate low-carbon materials and renewable systems;
- introduce mandatory performance verification;
- ensure consistency with Net Zero 2050 trajectories.

1.3 Relationship with Other Approved Documents.

This document must be read with:

- Approved Document L – Conservation of Fuel and Power.
- Approved Document F – Ventilation.
- Approved Document O – Overheating.

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2. Application of the Requirements.

2.1 Scope of Application.

The requirements apply to:

- all new domestic and non-domestic buildings in England and Wales;
- refurbishments or extensions under 1000 m² GIA or <25% additional floor area;
- changes of use involving new building fabric or structural systems.

2.2 Transitional Provisions.

Projects approved prior to commencement may follow earlier regulations but should adopt Part-Net principles where practicable.

- **Z1 – Operational Energy (In-Use Energy).**
- Target Energy Use Intensity (EUI):
  - Residential: <35 kWh/m²/year
  - Non-residential: <55 kWh/m²/year

  (Aligned with LETI 2020 benchmarks.)
- Long-term trajectory: 12–15 kWh/m²/year by 2050.

  Non-compliance may result in post-occupancy penalties.
- Figure 1 – EUI Reduction Pathway (LETI 2020–2050

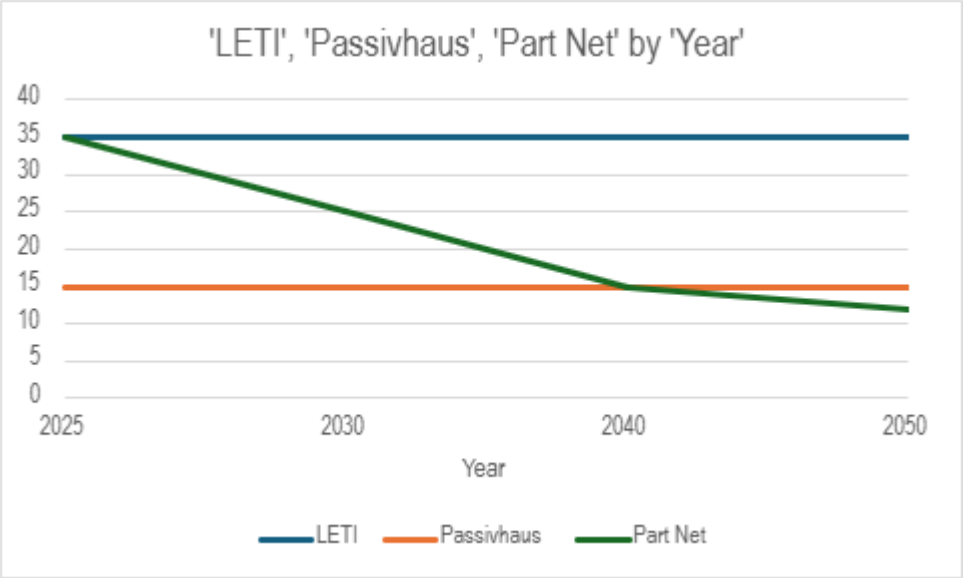

Figure 2 - Sustainable development graph.xlsx

The graph compares LETI and Passivhaus benchmarks with the proposed Part-Net pathway for future Net Zero regulation from 2025 to 2050. LETI and Passivhaus stay constant across the timeline because they represent fixed performance targets rather than year-by-year trajectories. The Part-Net values are estimated projections created for this assignment, showing how a future regulation could be tightened by combining Passivhaus-level standards with smart-home technology to mitigate human error and support consistent energy performance improvements over time.

Z2 – Embodied Carbon (Whole-Life Limits).

Whole-life embodied carbon must not exceed:

- **500 kgCO2e/m2** – residential
- **600 kgCO2e/m2** – non-residential

Assessment must follow the RICS Whole Life Carbon Assessment Methodology (2017), reporting modules A1–A5.

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Z3 – Material Selection (Regulatory Guidance).

Design teams must:

- compare steel, timber and hybrid structures at concept stage;
- justify steel using WLCA and recycled content evidence;
- prioritise timber where feasible (subject to fire and procurement standards);
- adopt hybrid systems when WLCA demonstrates reduced carbon;
- produce mitigation plans for any scheme exceeding limits.

Additional requirements:
• TATA Steel Pattern-Book (or equivalent) for systemised steel design.
• QS verification of quantities using systemised outputs.
• Compliance reports must compare two structural options.
• Evidence of local material sourcing is required.

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Z4 – Renewable Energy Integration.

- Minimum 30% of regulated demand must be supplied by on-site or near-site renewables:
  PV, solar thermal, heat pumps, or verified zero-carbon heat networks.

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Z5 – Verification and Data Reporting.

Compliance required at three stages:

Design Stage.

- PHPP or CIBSE TM54.
- WLCA forecast (A1–A5).

Construction Stage.

- airtightness testing.
- thermal imaging.
- EPD checks for high-impact materials.

Post-Occupancy Stage (within 2 years).

- evaluation comparing predicted vs actual.
- energy monitoring and comfort surveys.
- re-testing where required.

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Z6 – Smart Performance & Monitoring Technology.

• Buildings must include real-time monitoring of energy, ventilation and environmental conditions.
• MVHR commissioning and heat-pump optimisation required.
• Smart-meter data interfaces must allow optional reporting to local authorities.
• Systems must support POE and demonstrate narrowing of the performance gap.

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4. Compliance Guidance.

Operational Energy (Z1).

- Passivhaus Classic or Plus = deemed compliant.
- Alternative route: CIBSE TM54 with ≤5% design–actual gap.

Embodied Carbon (Z2).

- WLCA + EPDs required for concrete, steel, timber and façade systems.
- AECB Standard = deemed compliant for residential buildings.

Renewables (Z4).

- Roof-mounted PV meeting ≥30% regulated demand = reasonable provision.
- District/heat-network systems must be verified as zero-carbon.

Verification (Z5).

- POE must include airtightness re-testing, comfort surveys and energy monitoring.
- Failure to submit POE within two years = non-compliance.

4. Example Compliance Pathways.

Requirement	**Method**	**Verified Outcome**
Z1 – Operational Carbon	Passivhaus Classic	15kWh/m2/year heating demand
Z2 – Embodied Carbon	RICS WLCA + EPDs	480 kgCO2e/m2
Z3 – Renewables	50m2 rooftop PV array	32% on-site generation
Z4 – Verification	TM54 POE monitoring	Design–actual gap < 5%

6. Implementation Notes.

Part-Net targets follow the **CCC (2023)** trajectory:

- **2030:** ≤25 kWh/m2/year EUI; ≤400 kgCO2e/m2 embodied
  2040: ≤15 kWh/m2/year EUI; ≤300 kgCO2e/m2 embodied

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7. Critical Reflection.

Part-Net strengthens transparency and clarity but depends on fixing skilled-labour shortages, developer cost resistance and large performance gaps.

Implementation Challenges

Establishing a Net-Zero Building Regulation such as Part Net would show clarity in works, its implementation would face challenges.

The first major challenge is cost implications. High performance standards such as Passivhaus or AECB involve higher upfront costs (Arup, 2020), especially in relation to enhanced fabric performance, airtightness and renewable energy systems. The installation of SMART home technology along with Passivhaus is costly but provides a direct route into achieving Net Zero 2050. However, although lifecycle cost savings are documented, developers often prioritise lower start-up costs. Camden Council's Agar Grove development, the UK's largest Passive House project, reported energy bills 75% lower than traditional homes, allowing the 8% capital uplift to be paid back within 17–20 years (Passivhaus Trust , 2021). For Quantity Surveyors, this presents risks in cost planning, procurement negotiations and whole life value assessments.

The second barrier is the skills deficit within the UK construction industry. Delivering buildings that match the requirements of Net Zero needs advanced knowledge in building physics, airtightness detailing and low carbon material specification. The UK has shortages of architects, contractors and labour that hinder the scalability of Part Net. Countries such as Norway have a labour force trained to complete Passive House projects which have been adopted much more (Della Torre et al., 2020; Passivhaus Trust, 2020). In the UK, upskilling programmes and accreditation frameworks will be essential to supporting compliance. Developer resistance also presents a challenge. Many developers see Net-Zero regulation as a burden that risks reducing profit margins or losing investors.

Finally, the performance gap across the UK poses a risk for credibility. Even with sufficient design targets, buildings often underperform due to poor workmanship and inadequate commissioning (CIBSE, 2022). For Part-Net to be effective, compulsory post-occupancy evaluation and verification is needed to ensure predicted Net-Zero performance is delivered in real terms.

Discussion & New Angle

A vital problem that is often overlooked in these regulatory debates is whether the 2050 Net Zero target is fully realistic. Recent scientific assessments warn that the first major climate “tipping-point” has already been passed: warm-water coral reefs are undergoing irreversible collapse (Hunt, M. 2025). Looking at it from a quantity surveying perspective, it raises implications of contractual clarity and cost control. If statutory benchmarks are set too high, projects face widespread non-compliance, leading to arguments over liability and final accounts. The lack of standardised carbon benchmarks in contracts leaves space for ambiguity – terms such as ‘’Net Zero Ready’’ or ‘’low carbon’’ can be poorly defined and often worked around. Including transparent, measurable benchmarks such as kWh/m2/year directly into contracts would provide consistency and lower disputes.

Another barrier to achieving effective carbon and quality improvements is competitive pressure within the contractor market. As non-sustainable focused clients prioritise lowest-cost tenders this forces contractors to go for reduced material quality, poor airtightness detailing and value-engineering. To counteract this the new Part Net-Zero needs to create a ‘level playing field’ to remove the incentive of undercutting quality to win work. There are two ways to move forward – mandatory minimum standards, or a quality-weighted procurement model that moves tendering from lowest cost to most sustainable.

Conclusion.

Being responsible for 40% of global emissions, the construction industry stands pivotal. Existing frameworks have furthered sustainability towards Net Zero but remain fragmented, while Part L shows the limits of current legislation does not go far enough towards the UK’s sustainability ambitions.

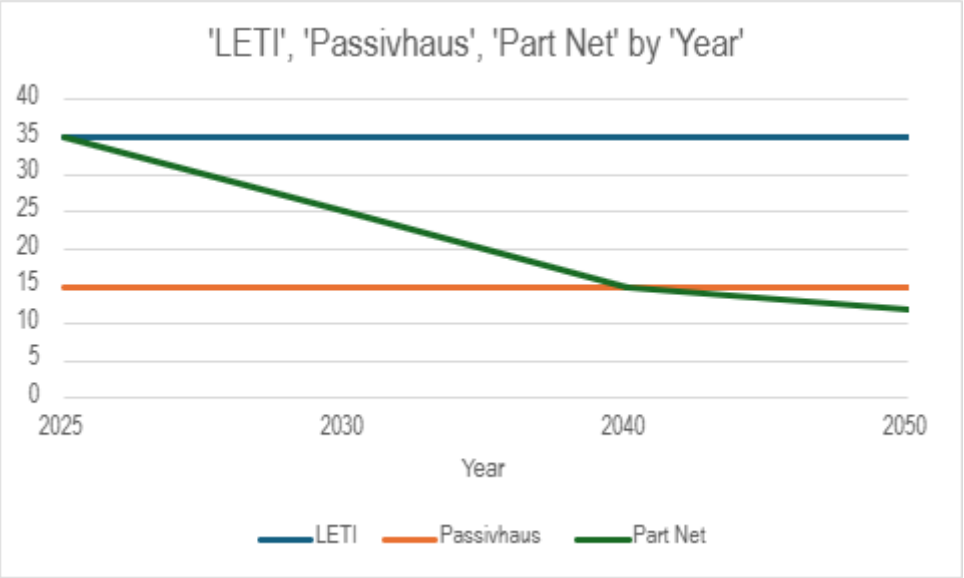
Approved Document Part Net offers a structured strategy, introducing benchmarks for operational and embodied carbon alongside compliance routes and post-occupancy evaluations which has been missing from previous regulations. Whilst there are barriers around cost, skills and industry resistance, regulation gives the clarity, consistency and contractual certainty needed to put changes in motion. For the construction industry, this ensures standardised benchmarks for cost planning, reduces disputes and improves accountability. In the end, whilst there are questions about the achievability of Net Zero 2050, only statutory regulation is able to convert ambition into measurable progress towards a more sustainable future. In Wales, aligning regulation with the Well-being of Future Generations (Wales) Act 2015 would ensure that climate and construction policies work together. Ultimately, statutory reform becomes the mechanism in bridging ambition and delivery, changing voluntary aspiration into enforceable climate action.

Appendix -

Figure 1 -

Framework	***Focus***	***Strengths***	***Weaknesses***	***Regulatory Potential***
BREEAM / LEED	Multi-criteria	Broad sustainability scope	Points-Based , risk of greenwashing	Low
Passivhaus	Operational energy	Measured performance	Limited embodied carbon scope	High
RICS WLCA / LETI	Embodied carbon	Robust methodology	Voluntary, non-statutory	Medium
AECB	Practical net-zero housing	Cost-effective, realistic	Voluntary only	High
WELL	Wellbeing	Complements airtight design	Tangential to carbon focus	Low

Figure 2 -



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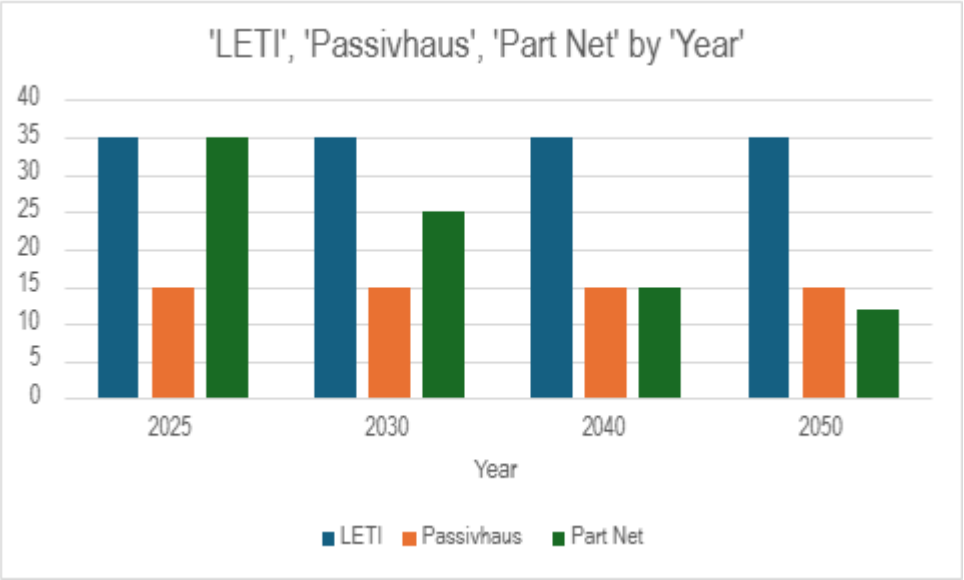

Projected Energy Use Intensity (EUI) trajectory for Part Net (Author's own, based on LETI, 2020 and Passivhaus Trust, 2020). (Sustainable development graph.xlsx)

REFERENCES

Arup, 2020. Net Zero Carbon Buildings: Three Steps to Take Now. [online] Available at: https://www.arup.com/globalassets/downloads/insights/net-zero-carbon-buildings-three-steps-to-take-now.pdf [Accessed 9 November 2025].

BREEAM 2022 Technical Manual. [online] Available at: https://breeam.com/about [Accessed 9 November 2025].

CIBSE, 2022. TM54: Evaluating Operational Energy Use at the Design Stage. [online] Available at: https://www.cibse.org/media/ibelignw/cibse-tm54-2022-julie-godefroy.pdf [Accessed 19 November 2025].

Climate Change Committee (2023) 2023 Progress Report to Parliament. Available at: https://www.theccc.org.uk/wp-content/uploads/2023/06/Progress-in-reducing-UK-emissions-2023-Report-to-Parliament-1.pdf (Accessed: 4 December 2025).

Climate Change Committee (2025) CCC Mitigation Monitoring Framework. Available at: https://www.theccc.org.uk/publication/ccc-monitoring-framework/ (Accessed: 4 December 2025).

Della Torre, S., Cattaneo, S., Lenzi, C. & Zanelli, A. (eds.), 2020. Regeneration of the Built Environment from a Circular Economy Perspective. [online] Available at: https://library.oapen.org/viewer/web/viewer.html?file=/bitstream/handle/20.500.12657/23059/1007099.pdf?sequence=1&isAllowed=y [Accessed 14 November 2025].

Department for Levelling Up, Housing and Communities (2023). The Future Homes and Buildings Standard: Consultation Response. https://assets.publishing.service.gov.uk/media/65785c4b254aaa0010050b35/hemfhs-tp-05-fhs-fuel-factors.pdf [online] UK Government. Available at: [Accessed 10 November 2025].

Hunt, M. (2025) 'First climate 'tipping point' has been crossed, finds major report in stark warning ahead of COP30', Global Government Forum, 15 October. Available at: https://www.globalgovernmentforum.com/first-climate-tipping-point-has-been-crossed-finds-major-report-in-stark-warning-ahead-of-cop30 (Accessed: 3 December 2025).

LETI, 2020. Climate Emergency Design Guide. [online] Available at: https://www.leti.uk/_files/ugd/252d09_3b0f2acf2bb24c019f5ed9173fc5d9f4.pdf [Accessed 9 November 2025].

Passivhaus Trust , 2021 - - Agar Grove Phase 1A [online] Passivhaus Trust. Available at https://www.passivhaustrust.org.uk/projects/detail/?cId=100 [Accessed 2 December 2025]

RICS, 2023. Professional Statement: Whole Life Carbon Assessment. [online] Available at: https://www.rics.org/content/dam/ricsglobal/documents/standards/Whole_life_carbon_assessment_PS_Sept23.pdf [Accessed 9 November 2025].

RICS (2017) Whole Life Carbon Assessment: Professional Statement. Available at: https://acrobat.adobe.com/id/urn:aaid:sc:EU:914f8494-ee6d-4dfa-8672-ebbe4180ca51 (Accessed: 10 November 2025).

UKGBC, 2021. Net Zero Whole Life Carbon Roadmap. [online] Available at: https://ukgbc.org/our-work/topics/whole-life-carbon-roadmap/ [Accessed 9 November 2025].

United Kingdom Government , 2021. Net Zero Strategy: Build Back Greener. [online] Available at: https://assets.publishing.service.gov.uk/media/6194dfa4d3bf7f0555071b1b/net-zero-strategy-beis.pdf [Accessed 4 December 2025].

United Nations (2025). *Greenwashing – the deceptive tactics behind environmental claims*. [online] United Nations. Available at: https://www.un.org/en/climatechange/science/climate-issues/greenwashing [Accessed 3 December 2025].

United Nations (2015) *Transforming our world: the 2030 Agenda for Sustainable Development*. New York: United Nations. Available at: https://sdgs.un.org/2030agenda (Accessed: 4 December 2025).

Welsh Government, 2015. *Well-being of Future Generations (Wales) Act 2015*. [online] Available at: https://www.gov.wales/well-being-of-future-generations-wales [Accessed 4 December 2025].

Welsh Government *(2025) Shaping Wales' Future blog. Available at: https://shapingwalesfuture.blog.gov.wales/ (Accessed: 4 December 2025).*

World Commission on Environment and Development (1987) Our Common Future. Oxford: Oxford University Press. Available at: https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf (Accessed: 10 November 2025).

Woodknowledge Wales (2025) What we do. Available at: What we do - Woodknowledge Wales , Accessed - (8 December 2025).