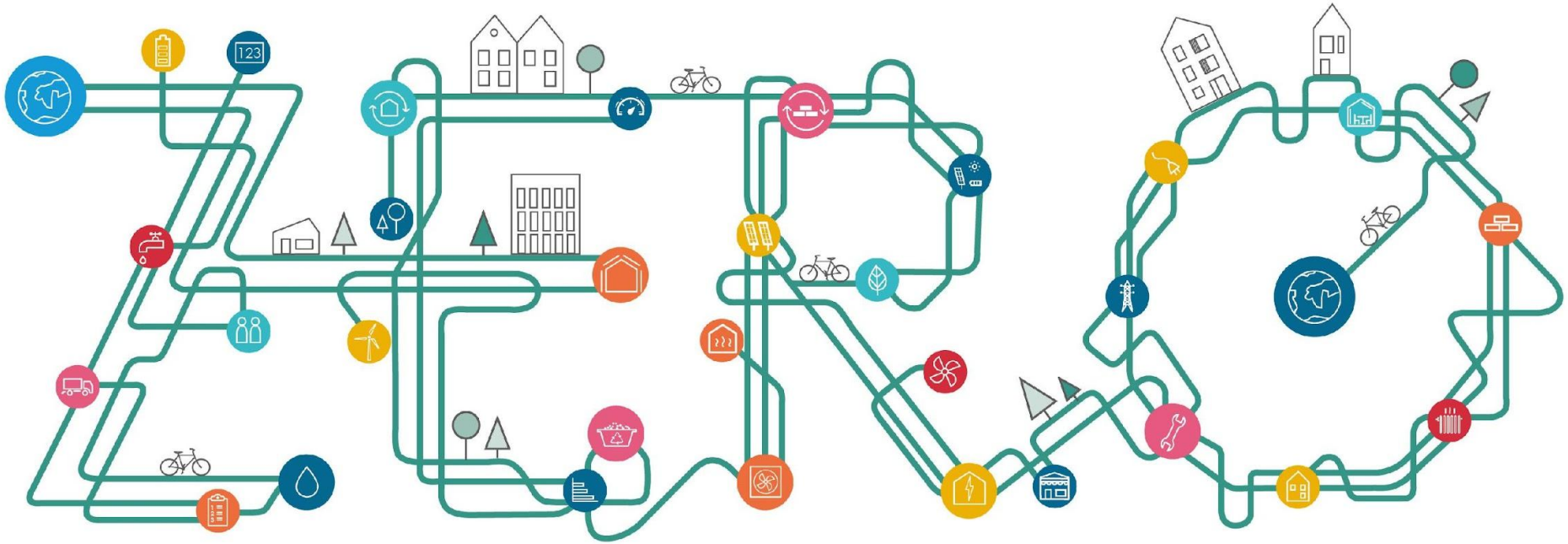
Net Zero FAQs

What does Net Zero mean?



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Introduction and purpose of these FAQs

The built environment in the UK and around the world is increasingly committed to achieve Net Zero buildings. To deliver real progress we need to agree on what this means, in practice and in the detail.

As a step towards this, and building on the work by the UKGBC, in summer 2021 Whole Life Carbon Network (WLCN) and LETI, supported by the RIBA, produced a set of carbon definitions.

From Autumn 2021- Spring 2022 CIBSE and LETI have worked together to produce this set of frequently asked questions (FAQs) on the WLCN-LETI carbon definitions to try to make sure that the definitions are applied consistently and robustly in as many real-life situations are possible.

First we asked what industry wanted clarity on, (informing what questions the FAQs should answer) and then we sought to drive consensus on these issues by carrying out a consultation with LETI and CIBSE members and the wider industry.

These FAQs do not provide a definitive answer to what Net Zero means, for all building types, but it is a step on the road and point towards a direction of approach.

Further work is needed and being planned in collaboration with other industry bodies to develop further clarity and consensus on Net Zero.

Industry support for the carbon definitions and the FAQs

There are huge benefits in the whole sector having a common set of definitions, so all disciplines, clients, investors, occupants are clear on what is being achieved.

These CIBSE-LETI FAQs are supported by:

Industry consultation Nov-Dec 2021

Thanks to the following organisations that promoted the consultation on the FAQs including ACAN, AD Ireland, AECB, Architects Declare, BBP, BRE, Carbon Trust, CIBSE EPG, Contractors Declare, Engineering Council, Good Homes Alliance, IGBC, IStructE, RIAS, RIBA, RICS, Passivhaus Trust, UKGBC and Whole Life Carbon Network.

We received 198 responses

For a summary of the consultation and responses **click here**

List of key FAQs in this document

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List of detailed FAQs in this document

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FAQ20 Once the electricity grid becomes zero carbon, in the UK and many countries, this will rely on nuclear energy: this would not meet the definition's requirement for « all energy to be from renewable sources ». Does it mean a building would still need to generate a portion of its energy use from renewable?

FAQ21 What are upstream emissions? How to calculate them?

FAQ22 How does the definition apply if a building is supplied by 'green gas' produced on site e.g. from anaerobic digestion?

FAQ23 How do the definitions work for buildings served by hydrogen?

Detailed FAQs – Embodied carbon

FAQ24 How to account for carbon sequestered in timber, wood fibre insulation and other plant-based materials?

FAQ25 Why are building-mounted PV panels excluded from the LETI embodied carbon targets?

FAQ26 Why is the embodied carbon of energy infrastructure not included in the Net Zero embodied definitions?

Detailed FAQs – Operational carbon – water use

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CIBSE LETI

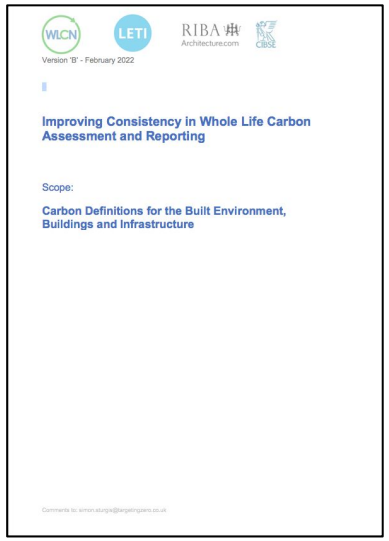
1 The definitions

WLCN-LETI Net Zero definitions

This FAQ document and the survey are focused on the Net Zero definitions showed on the right hand side. These definitions apply to new build, retrofit and infrastructure.

To view the full set, see the WLCN-LETI document here: www.leti.london/carbonalignment. This includes definitions on background terms, such as those used around life cycle assessment.

These carbon definitions are work in progress, and a final version will be included in the RICS Professional Statement update. At that point, the FAQs will be reviewed and updated if needed, although at this stage it is not anticipated that substantial changes in the guidance would be required.


Version 'B' - February 2022

Improving Consistency in Whole Life Carbon Assessment and Reporting

Scope:

Carbon Definitions for the Built Environment, Buildings and Infrastructure

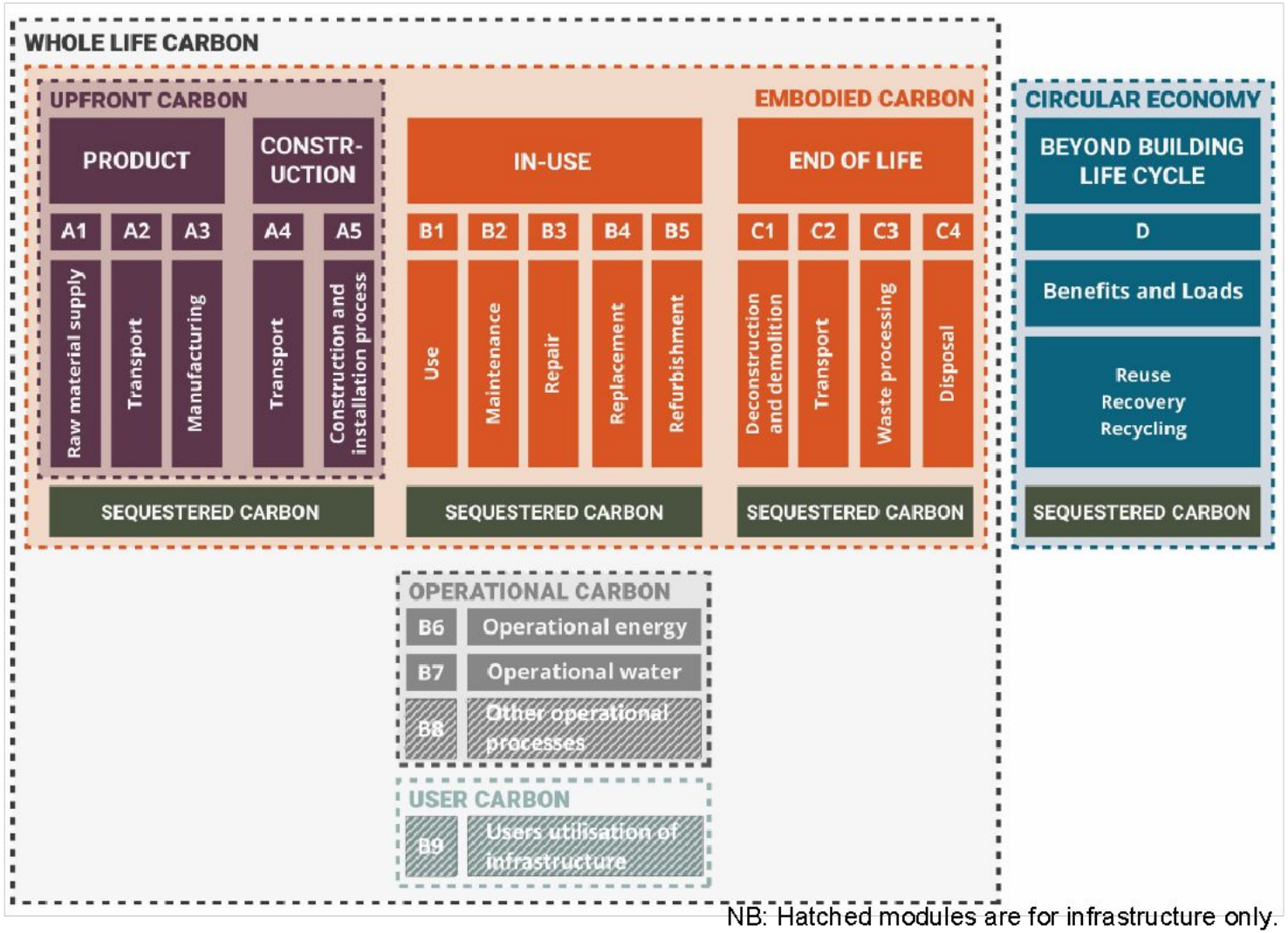
Net Zero Definitions

Net Zero (Whole Life) **Carbon**	**A 'Net Zero** (Whole Life) **Carbon' Asset is one where the sum total of all asset related GHG emissions, both operational and embodied, over an asset's life cycle (Modules A1-A5, B1-B7 (plus B8 and B9 for Infrastructure only), C1-C4) are minimized, meet local carbon, energy and water targets, and with residual 'offsets', equals zero.**
Net Zero Embodied Carbon	A 'Net Zero Embodied Carbon' asset is one where the sum total of GHG emissions and removals over an asset's life cycle (Modules A1-A5, B1-B5 and C1-C4) are minimized, meets local carbon targets (e.g. $kgCO_2e/m^2$), and with additional 'offsets', equals zero.
Net Zero Upfront Carbon	A 'Net Zero Upfront Carbon' asset is one where the sum total of GHG emissions, excluding 'carbon sequestration', from Modules A1-A5 is minimized, meets local carbon targets (e.g. $kgCO_2e/m^2$), and with additional 'offsets', equals zero.
Net Zero Carbon - Operational Energy	A 'Net Zero Carbon – Operational Energy' asset is one where no fossil fuels are used, all energy use (Module B6) has been minimized, meets the local energy use target (e.g. $kWh/m^2/a$) and all energy use is generated on- or off- site using renewables that demonstrate additionality. Direct emissions from renewables and any upstream emissions are 'offset'.
Net Zero Carbon - Operational Water	A 'Net Zero Carbon - Operational Water' asset is one where water use (Module B7) is minimized, meets local water targets (e.g. litres/person/year) and where those GHG emissions arising from water supply and wastewater treatment are 'offset'.

Whole life carbon terminology

Reference Diagram from the WLCN-LETI Definitions document, showing the Life Cycle Modules adapted from BS EN 15978 and PAS2080 (for Infrastructure).

It shows the modules used in assessing all carbon emissions over an asset's entire lifecycle and the various terms that are used.



2 Key FAQs

Key FAQs

Net Zero Carbon - operational energy

WLCN – LETI definition

A '**Net Zero Carbon – Operational Energy**' asset is one where **no fossil fuels** are used, all energy use (Module B6) has been minimized, meets the local **energy use target** (e.g. kWh/m^2/yr) and **all energy use is generated on- or off- site using renewables** that demonstrate additionality. Direct emissions from renewables and any upstream emissions are 'offset'.

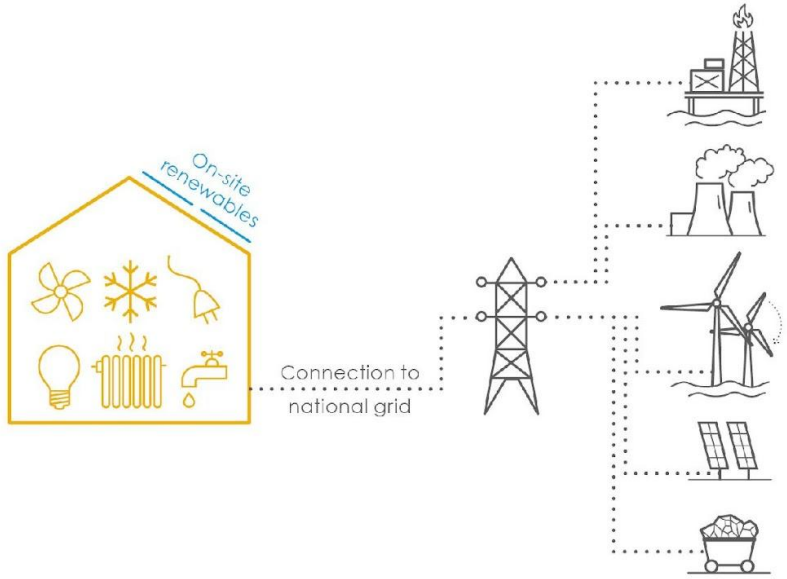
Direct emissions could include CH_4 and N_2O emissions from the combustion of biomass and biodiesel fuels. Upstream emission include: direct and indirect emissions from energy generation and distribution, WTT emissions for energy consumed in the building and from energy generation and distribution.

*see FAQ 21 for details on upstream emissions.

FAQ 1 - Why does a building need to meet energy targets?

To be Net Zero Carbon – Operational Energy, a building needs to meet energy targets because buildings cannot be considered in isolation, achieving Net Zero needs the whole system: in order to contribute to a NZ energy system, buildings need to have low energy use, otherwise a zero carbon grid will not happen, or later and/or at much higher cost (financial and embodied carbon and other resources).

Even a building that is completely off grid, whose whole energy needs are met by on-site renewable energy supplies and storage (e.g. thermal store, batteries), should also be subject to energy targets, because resource efficiency still matters for Net Zero: the building will use embodied carbon resources for its on-site energy supplies; meeting energy targets would help limit the embodied carbon of its on-site supply systems, or generate surplus energy which could be used elsewhere.



Building connected to a grid

Building not connected to a grid

FAQ 2 - What are “local energy targets”?

The definition refers to “local targets” in order to be relevant for various countries. In the UK, the main sources of “local energy use targets” currently are the LETI one-pager* which aligns with the RIBA 2030 Challenge (2030 target). The LETI energy targets for new buildings* aim to ensure that, by 2050, UK building energy use would not exceed available renewable energy.

In offices and some non-domestic buildings, energy ratings can also be used (DEC B(40), Uk NABERS 6*).

* www.leti.london/one-pager, developed in collaboration with UK-GBC and the BBP, with the support of the Good Homes Alliance, RIBA and CIBSE

FAQ 3 - What if there are no “local energy targets” for my building type?

CIBSE, LETI, RIBA and other industry bodies are working together and it is expected that in the future, consensus will grow on energy targets.

Some sectors are developing their own targets e.g. the Department for Education School Output Specification, Annex 2H Energy, the upcoming NHS Net Zero standard and upcoming Scottish Futures Trust Net Zero Public Sector Building Standard. CIBSE and LETI will engage with these bodies on their targets to understand their compatibility with a Net Zero UK, seek alignment, and incorporate them in this guidance in the future, if at all possible.

In the interim, for target setting in building types where no target is yet available, a similar approach to other sectors can be taken e.g. energy use equivalent to achieving Passivhaus with a heat pump. Alternatively, a target of DEC B(40) could be used however, how demanding it is will vary in different sectors, and in some cases it may not be ambitious enough.

Contact CIBSE or LETI if you are interested to create energy use targets for other sectors, or if you would like sources of targets to be added here.

FAQ 4 - What type of energy targets should a building meet?

A building should meet an energy use target, for example EUI or an energy rating. In addition, it is strongly recommended that a space heating and/or space cooling demand target be set, particularly for the design stage, to maximise efforts where design teams have a lot of influence and to increase the likelihood of the overall energy target being met.

Contact CIBSE or LETI if you are interested to create energy use targets for other sectors, or if you would like sources of targets to be added here.

Space heating demand (kWh/m^2.yr): the active heat input required to heat a building. It is influenced by factors such as passive design, fabric performance, internal gains, and heat recovery on the ventilation system. It is independent of the heating system type and efficiency (e.g. boiler, heat pump) which meets that demand.

*Energy use for heating = Space heating demand * Heating system efficiency*

Space cooling demand (kWh/m^2.yr): the active cooling input required to cool a building. It is influenced by factors such as passive design, fabric performance, and internal gains. It is independent of the cooling system type and efficiency (e.g. chiller) which meets that demand.

*Energy use for cooling = Space cooling demand * Cooling system efficiency*

Energy Use Intensity (EUI, kWh/m^2.yr): the energy use per m^2 that is required by a building over a year, included regulated (i.e. domestic hot water, space heating and cooling, lighting, and ventilation) and unregulated loads (e.g. lifts, IT). It is a measure of the building's performance and therefore includes all energy supplied to the building, whether from the grid or on-site systems.

Energy ratings: examples include Display Energy Certificates (DEC) and NABERS ratings. They can vary with factors such as occupancy density and weather, and provide a scale rather than a single target. NABERS allow landlord and tenanted areas to be rated separately.

FAQ 5 - How is an EUI calculated in buildings with an on-site renewable system?

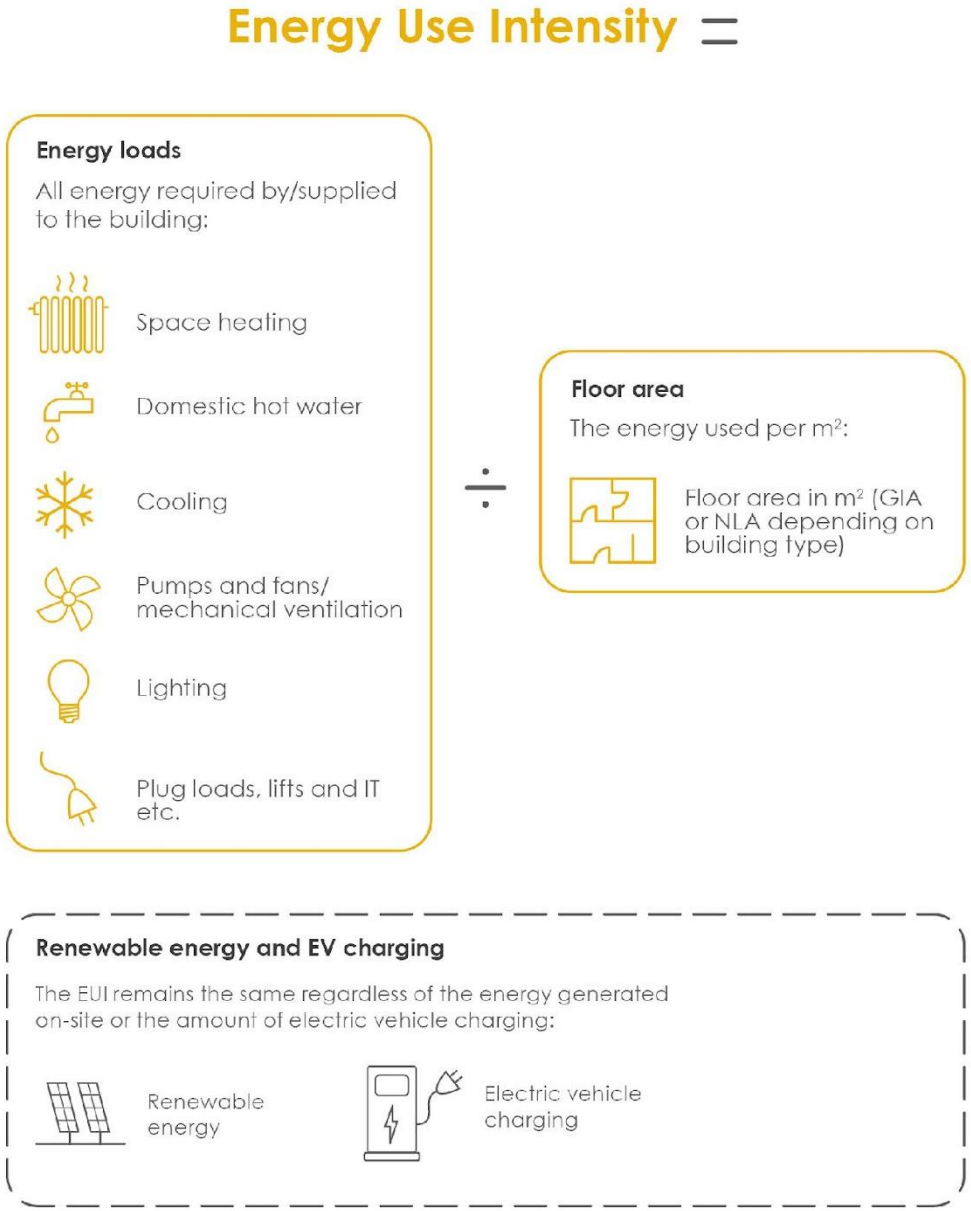
Energy Use Intensity (EUI, kWh/m^2.yr): the energy use per m^2 that is required by a building over a year, including regulated (i.e. domestic hot water, space heating and cooling, lighting, and ventilation) and unregulated loads (e.g. plug loads, lifts, IT). It is a measure of the building's performance and therefore includes all energy supplied to the building, whether from the grid or on-site systems.

An EUI includes all energy used, from all sources. For stand-alone buildings, an EUI is the sum of energy supplies to the building (including supplies from off and on-site systems). EUI does not include EV charging, as long as this is sub-metered.

Energy generated by on-site renewables is **not** deducted: for example, the EUI of a building will be the same whether the building has on-site PVs or not. This is important in order to drive building performance i.e. demand reduction and energy efficiency; in turn, this resource efficiency supports decarbonisation of the building and wider energy system, and it reduces the embodied carbon of the on- and off-site infrastructure required to meet energy needs.

On-site generation is also of course important and it is encouraged before offsite renewable energy procurement, even if it doesn't contribute to the energy targets. Measures to encourage this may be introduced in the future as part of the evolution of the definitions and associated guidance.

The EUI relates to floor area. The floor area definition used in the EUI targets will depend on the building type (e.g. GIA, NLA etc).



FAQ 6 - My building is connected to a community/district energy scheme which uses fossil fuels. Can it be considered NZ Carbon - Operational Energy?

No. The Net Zero Carbon – Operational Energy requires that the building should not rely on the burning of fossil fuels. In the situation where a building is served by a district network using fossil fuels, the building does rely on fossil fuels, and the network may not decarbonise for a very long time.

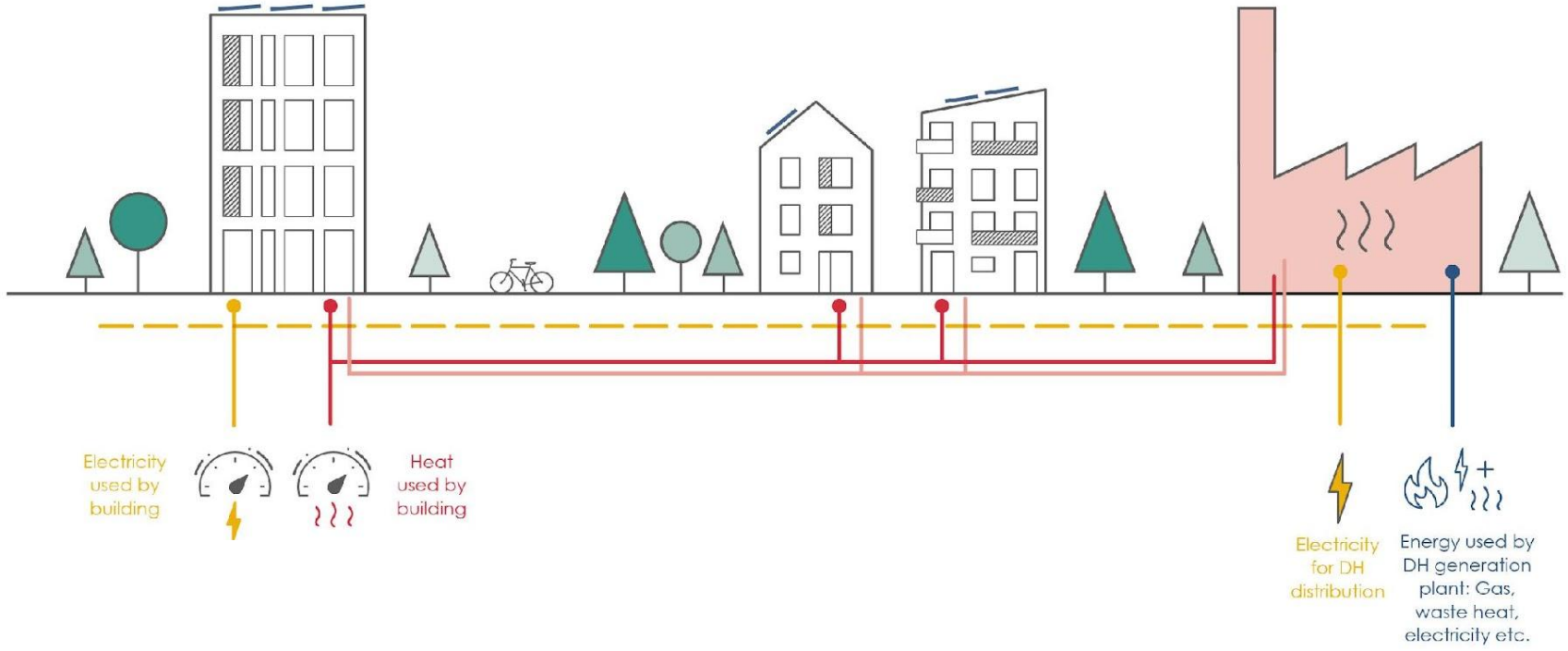
However, it is possible that the building could claim to be "Net Zero In Progress", subject to the network having a Decarbonisation Plan and the building meeting all other requirements – see FAQ17 for details.

FAQ 7 - How are EUIs and associated targets calculated in buildings served by communal or district energy schemes?

There are several considerations in calculating an EUI for a building connected to a district or communal scheme, compared to calculating it for a building with stand-alone supplies:

- How to account for energy used by the system (generation, distribution and storage): counting only heat "at the meter" into a building's EUI would not be comparable with EUIs for stand-alone buildings, which do include systems.
- A district energy scheme may use a variety of energy sources, such as electricity, gas, or waste heat, and it may generate electricity as well as heat (if it has CHP). As a result, how to account for the scheme into the EUI, a simple building measure, is not straightforward.

There is currently no established method to calculate this, and the associated energy targets. Several options are available, described in Appendix. Teams are encouraged to explore these options, but those that do account for the energy scheme are encouraged (Options 2 and 3). It is expected that an industry method will be developed in the future, and associated energy targets. Please contact CIBSE and LETI if you would like to contribute to the work on defining an approach for this.



FAQ 8 - What are acceptable forms of renewable energy procurement?

On-site generation is recommended, as this is likely to maximise benefits for building users, and will contribute to the decarbonisation of the energy system. Where due to site constraints 100% of the energy use cannot be generated on-site, renewable energy should be procured.

If meeting all energy used by onsite renewables is not feasible then renewable energy must be procured.

The forms of renewables procurement listed below are acceptable to meet Net Zero Carbon – Operational energy:

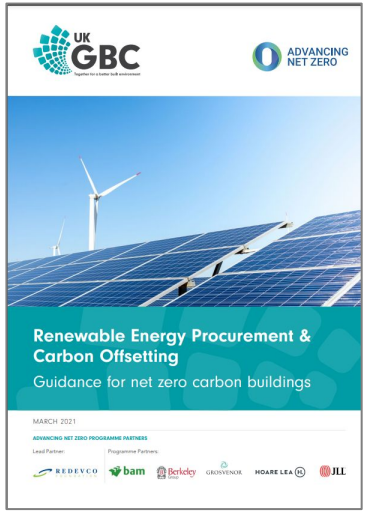
- An investment into additional renewable energy capacity off-site
- A renewable energy power purchase agreement (PPA), for a minimum period e.g. 15 years.
- A green tariff that meets the guidance set out in the UKGBC Renewable Energy Procurement and Carbon Offsetting Guidance for Net Zero Carbon Buildings other green tariffs are not acceptable.

Note: At the time of the initial publication of the LETI One-Pager, no green tariff was considered robust enough to guarantee additional renewable energy capacity, and therefore only Power Purchase Agreements (PPAs) were considered acceptable. However, over the last 3 years, the sector has evolved and further guidance on renewable energy procurement has been developed. As a result, it is considered that in addition to PPAs, some green tariffs are acceptable.

Summary of the UKGBC renewable energy procurement guidance

The quality of electricity procurement is determined by whether the following three principles determining the quality of renewable energy procurement are met:

- **Energy attribute** – there must be ownership and claim of the energy attribute of the renewable electricity generated, either by self-consumption of on-site renewable generation or via REGOs.
- **Renewable sourced** – electricity must be generated from renewable sources.
- **Additionality** – procurement must result in demonstrable additionality.



For more information:
https://www.ukgbc.org/ukgbc-work/renewable-energy-procurement-carbon-offsetting-guidance-for-net-zero-carbon-buildings/

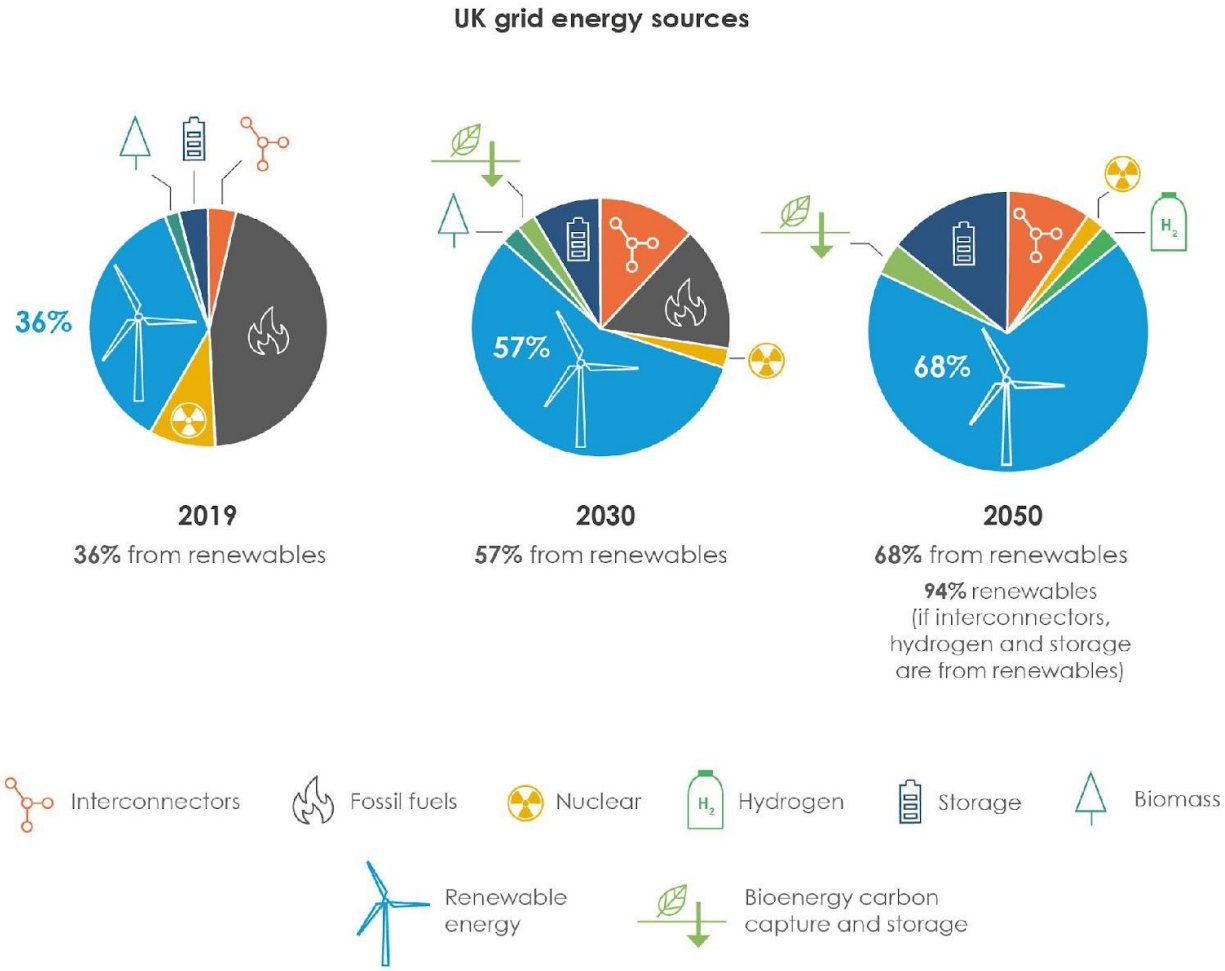
CIBSE LETI

FAQ 9 - The electricity grid is decarbonising, is there a point where renewable energy procurement will no longer be required?

The definition requires ALL energy use to be met by on- or off-site renewable energy sources (e.g. if a building uses 10,000 kWh of grid electricity per year, this all needs to be covered by on-site generation, PPAs or green tariffs, even if a portion of grid electricity is produced by renewables).

The UK grid is continuing to decarbonise, with various scenarios to achieve net zero (or near) well before 2050.

The current thinking is that regardless of the proportion of UK grid electricity which is generated from renewables, buildings must meet their needs either through on-site renewable energy generation or by procuring 100% of their energy from renewables.

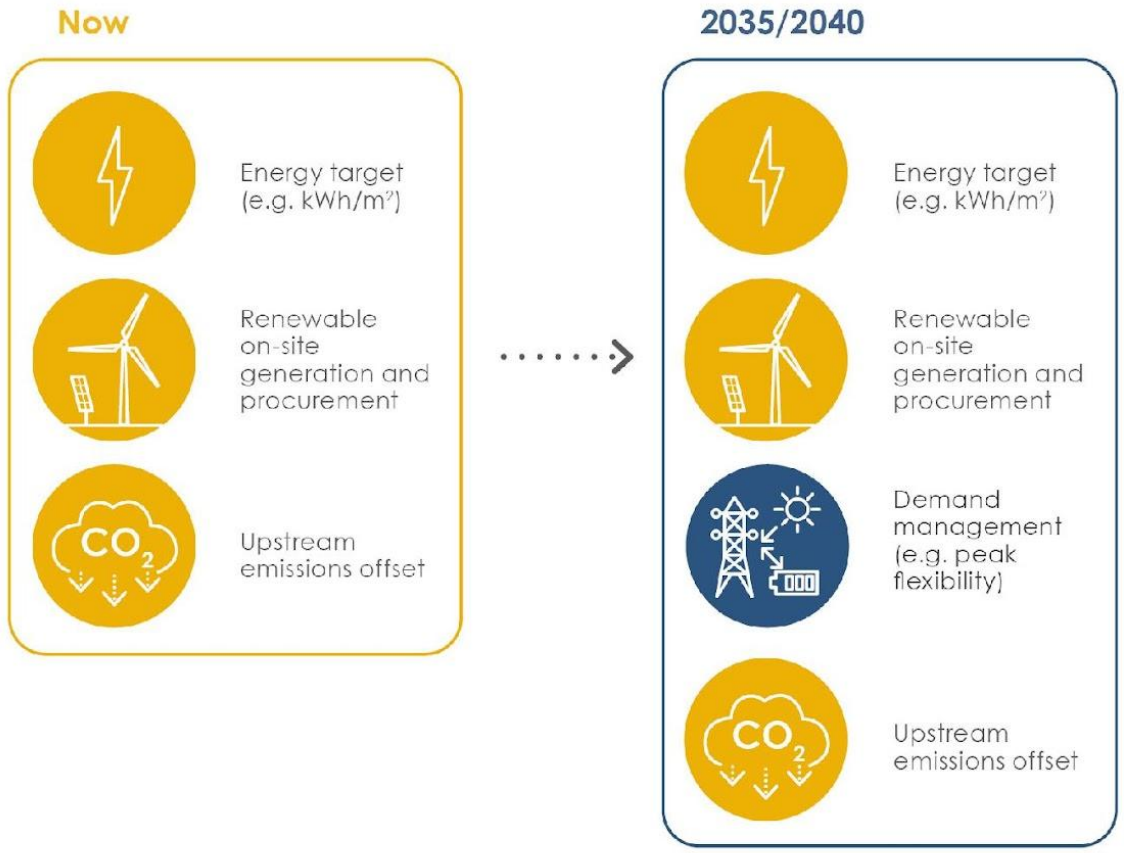


Ref: National Grid Future Energy Scenarios, 2020

FAQ 10 - Will the Net Zero Carbon – Operational Energy definition be valid until 2050, or will it evolve?

As illustrated in FAQ9, the UK electricity grid is rapidly decarbonising. It is expected to become net zero in 2035, under government commitment. Similar evolutions are expected around the world.

The definition is currently based on reducing annual energy use and generating energy from renewable energy sources. However, it may evolve to respond to a changing context, especially to support the UK's electrification and include requirements for demand management (e.g. peak demand, storage provision, other demand management indicator). The focus on annual energy use and renewable energy generation could also potentially evolve.



The diagram above shows the Net Zero Carbon – Operational Energy definition as it is now, and how it could evolve in the future.

Key FAQs

Net Zero embodied carbon

WLCN-LETI definition

Upfront Embodied Carbon
'Upfront Carbon' emissions are the GHG emissions associated with materials and construction processes up to practical completion (Modules A1-A5). Upfront carbon excludes the biogenic carbon sequestered in the installed products at practical completion.

Embodied Carbon (or Life Cycle Embodied Carbon)
The 'Embodied Carbon' emissions of an asset are the total GHG emissions and removals associated with materials and construction processes throughout the life cycle of an asset (Modules A1-A5, B1-B5, C1-C4).

A '**Net Zero Embodied Carbon**' asset is one where the sum total of GHG emissions and removals over an asset's life cycle (Modules A1-A5, B1-B5 and C1-C4) are minimized, meets local carbon targets (e.g. $kgCO_2e/m^2$), and with additional 'offsets', equals zero.

A '**Net Zero Upfront Carbon**' asset is one where the sum total of GHG emissions, excluding 'carbon sequestration', from Modules A1-A5 is minimized, meets local carbon targets (e.g.$kgCO_2e/m^2$), and with additional 'offsets', equals zero.

FAQ 11 - Why does a building need to meet upfront and total embodied carbon targets?

To be Net Zero Embodied Carbon, a building needs to meet embodied carbon targets because buildings cannot be considered in isolation, achieving Net Zero needs consideration of the whole system: in order to contribute to a NZ economy, buildings need to use resources as efficiently as possible.

There are not enough offsets available, at a UK scale and at a global scale, to keep emitting carbon and purchasing offsets without first reducing emissions.

In the UK, the intention of the embodied carbon targets being developed (e.g. by LETI) is to limit the embodied carbon to a value that is achievable in practice and also in line with sectorial carbon budgets. This is likely to include separate targets for upfront embodied carbon, and lifecycle embodied carbon.

As well as meeting the upfront and lifecycle (Stage B and C) embodied carbon targets, the remaining carbon emissions must be offset for the building to qualify as Net Zero Embodied Carbon.

Why the embodied carbon targets are not 0kgCO_2/m^2

With current materials available, unless the building is made of 100% reused or natural materials, and all the energy used in their processing, transportation to site and in site activities is zero carbon, there will be carbon emissions associated with constructing buildings.

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FAQ 12 - What are “local targets” for embodied carbon?

The definition refers to “local targets” in order to be relevant for various countries. In the UK, such targets have not yet been developed as currently there is not enough information available on sectoral UK carbon budgets to understand the embodied carbon budgets available for new and refurbished buildings (“Top Down” approach to targets). The UKGBC’s 2021 Whole Life Carbon Net Zero Roadmap project is expected to generate sectoral carbon budget estimates, which would assist in more detailed building-level target setting, so that embodied carbon targets align to net zero.

For the time being, possible targets can be found in the **LETI “Embodied Carbon Target Alignment”** document, where current **best practice performance** for projects in the design phase is considered to be **a C rating**, while a **B and above is considered a robust stretch target.**

Targets and best practice benchmarks are likely to evolve over time with increased understanding of what is possible and required to achieve.

Through TM65, CIBSE intend to increase knowledge on the embodied carbon impact of building services, and will feed this into industry targets.

We are hoping that in the future, consensus will grow on a single approach to embodied carbon targets.

Key FAQs

Offsets

WLCN- LETI definition

"Carbon offset" means emission reductions or removals achieved by one entity, used to compensate (offset) emissions from another entity.

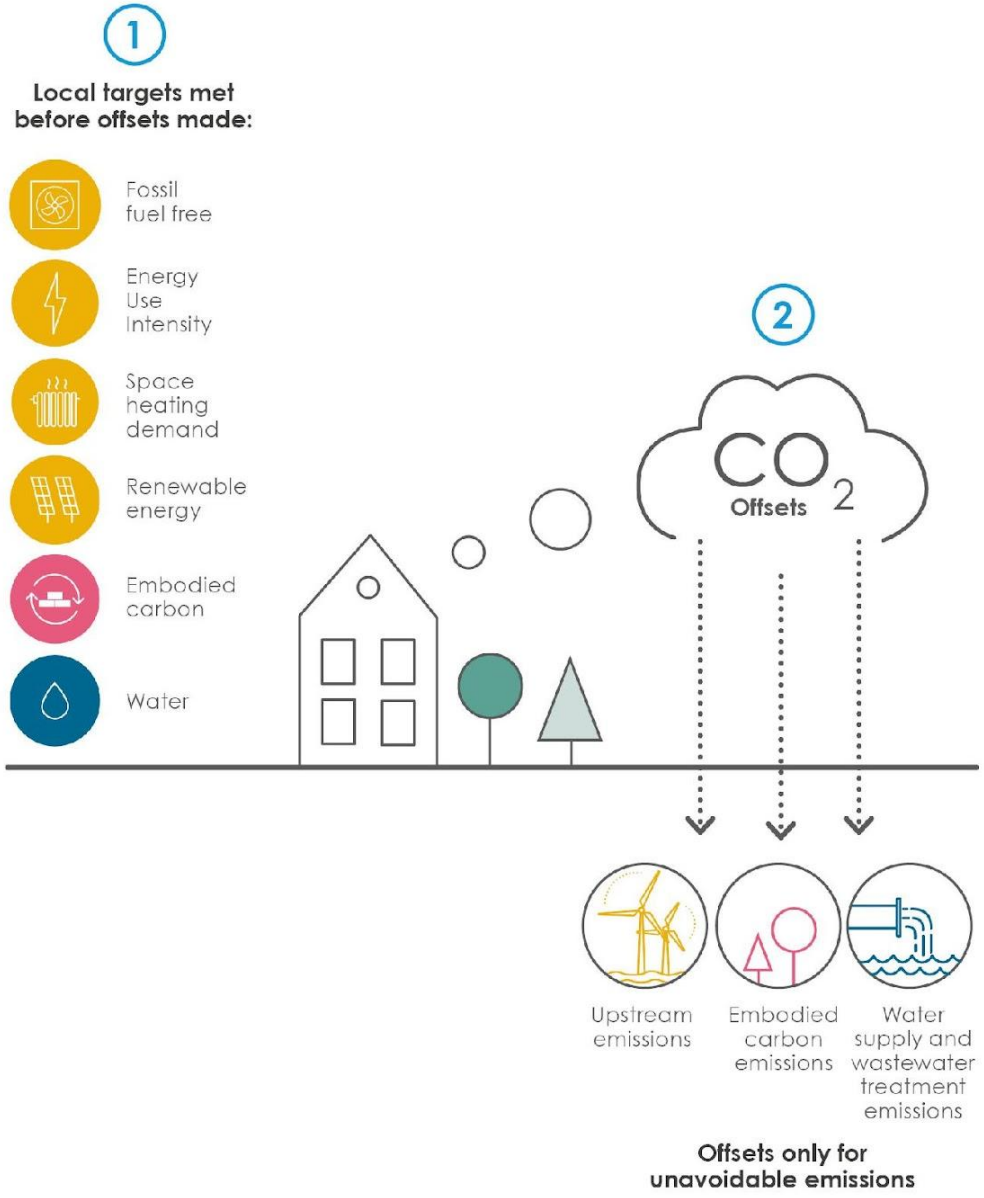
Offsetting Methodology
Modules A1-A5 should be offset post completion based on a verified post practical completion carbon assessment of A1-A5.
Modules B1-B7 (plus B8 and B9 for Infrastructure) should be offset annually, based on verified calculations based on actual activities rather than those predicted at design stage.
Modules C1-C4 are offset post deconstruction and disposal.

FAQ 13 - What role do offsets play?

Offsets are not allowed to cover carbon emissions from energy use: the definition requires energy use to be met from renewable energy sources, as ultimately to become net zero carbon, all buildings will need all energy use to be met by zero carbon sources.

Offsets are only allowed in Net Zero definitions for unavoidable emissions, in a transition period while all parts of the economy decarbonise:

- Embodied carbon emissions, while still meeting local upfront and embodied carbon targets
- Operational carbon – energy use: not allowed, except to cover upstream emissions from energy generation and distribution (see details in FAQ21 on upstream emissions)
- Operational carbon – water use: for those GHG emissions arising from water supply and wastewater treatment, while still meeting local water use targets



FAQ 14 - Is any type of offsets acceptable?

No. Some offset schemes are not a reliable guarantee that carbon savings will be achieved.

The UKGBC - Renewable Energy Procurement and Carbon Offsetting Guidance for Net Zero Carbon Buildings defines 8 quality criteria for offsets (Table 13):

1 – real
2 – avoid leakage
3 – measurable
4 – permanence
5 – additional
6 – independently verified
7 – unique
8 – avoid social and environmental harms.

The UKGBC guidance also sets as minimum requirements that offsets shall be through an approved international or domestic carbon standard, and registration requirements (Table 14*). Approved standards are as listed by ICROA or UK Environmental Reporting Guidelines, and example are provided e.g. Gold Standard, UK Woodland Carbon Code (Figure 7*).

* https://www.ukgbc.org/ukgbc-work/renewable-energy-procurement-carbon-offsetting-guidance-for-net-zero-carbon-buildings/

There are different types of carbon offsets which meet the UKGBC criteria:

- "Compensation": where carbon emission savings are achieved elsewhere: this reduces *emissions*, but doesn't reduce actual atmospheric carbon *levels*.
- "Neutralisation": where carbon is removed from the atmosphere.

Types of Carbon Offsets:

Compensation Emission reduction	**Neutralisation** Carbon removals
Energy efficiency improvements (Retrofit), Carbon capture and storage in industrial processes	**Nature based** solutions, such as reforestation and ecosystem restoration. Other solutions may become available for long-term storage e.g. mineralisation.

Neutralisation offsets are encouraged, and over time they should form the very large majority of offsets as there will be few remaining emissions to reduce e.g. while offsets to retrofit other properties may be acceptable now, in the future those properties will already be retrofitted. In addition, offsets based in the country where the building project is located are encouraged.

Key FAQs

Net Zero claims

Claims for buildings that are not yet operating at Net Zero : Net Zero in Progress (NZiP)

Net Zero Carbon, whether operational or embodied, is only achieved based on actual performance, when requirements have been met and claims can be verified. This is essential to achieve real carbon reduction.

However, it can be useful to recognise **buildings which are on a journey towards Net Zero and cannot yet claim full compliance**, especially if this encourages action towards full Net Zero.

A number of cases are available where "**Net Zero in Progress**" can be claimed, as explained on pages 32-33 and in FAQs 15-18. They do not represent full Net Zero status, but complement the Net Zero definitions by acknowledging important constraints. Refinements and time limits may be put in place in the future to further define when these claims can be made.

Other flexible options may be developed in the future (e.g. for landlord and tenanted areas), but this will require careful examination in order not to allow "greenwash", and only provide flexibility where it is genuinely required and where it will drive improvements towards Net Zero.

"Net Zero in Progress" sub-definitions

In all of these cases, the claim of "Net Zero in Progress" can only be made if:

- The building has done everything in its control at this point in time
- There is a committed plan with a timeframe to meet all requirements.

Time: Where a project is targeting Net Zero and actions relevant to its stage have been undertaken, but the project stage is not yet advanced enough for all requirements to be achievable.

Existing buildings: Where existing buildings do not yet meet Net Zero energy targets, but the building has a Net Zero Retrofit Plan in place to meet the targets. The building must be fossil fuel free.

District energy schemes: Where a building has to (e.g. under planning requirements) be supplied by a non-Net- Zero-compliant energy network (e.g. which uses fossil fuels or is not efficient enough), but the network has a Decarbonisation Plan in place which will allow the building to meet all energy and carbon requirements.

Claims for buildings that are not yet operating at Net Zero : Net Zero in Progress (NZiP)

Net Zero Operational Energy

Building is in use

Energy use meeting the target

+

No fossil fuels

+

Renewable energy and offset of upstream emissions

Net Zero in Progress: options

For buildings in design or built but **not yet operating**

For **existing buildings** where energy use does not meet the energy target, but with a Retrofit Plan in place to meet it.

For buildings which have to connect to non-compliant **energy networks**, where the network has a Decarbonisation Plan in place which will allow the building to meet all NZ requirements

Net Zero Embodied

Building is built

Upfront embodied carbon meeting the target

+

Offset covering upfront embodied emissions

Building is in use

+

Life cycle embodied carbon meeting the target

+

Offset covering Stage B embodied emissions

Net Zero in Progress: options

(For NZ Embodied) For buildings **in design** or built but **not yet operating**

(For NZ Upfront) For buildings **in design**

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Operational Carbon – Net Zero and Net Zero in Progress (NZiP)

At design stage → **Built, not yet operating** → **Operating** → *time*

Net Zero

Net Zero operational carbon

- Metered energy meeting the energy targets
- No fossil fuels
- On- or off-site renewable energy for all energy use
- Offsets for upstream emissions

Net Zero in Progress (NZiP)

At design stage

- Energy performance modelling meeting the energy targets
- Designed not to burn fossil fuels onsite

Built, not yet operating (Enabled)

- As-built energy performance modelling meeting the energy targets
- Built not to burn fossil fuels onsite

Existing buildings in progress towards Net Zero

- *Existing buildings which do not meet the energy target but with a Retrofit Plan to meet it*
- No fossil fuels burnt onsite
- On or off-site renewable energy for all energy use
- Offsets for upstream emissions

Buildings compatible with Net Zero, but connected to non-compliant networks

- *Buildings which have to connect to an energy network which uses fossil fuels and/or is not energy efficient enough to meet Net Zero targets, but which has a Decarbonisation Plan in place to allow the building to meet all Net Zero requirements*
- On or off-site renewable energy for all electricity use
- Offsets for upstream emissions from electricity AND heat/coolth emissions

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Net Zero operational carbon claims

Embodied Carbon – Net Zero and Not Yet Net Zero

Net Zero

Net Zero Upfront carbon

- As-built embodied calculations meeting the upfront targets
- Offset at PC for upfront emissions

Net Zero lifecycle Embodied Carbon

- As-built embodied calculations meeting the upfront targets
- Offset at PC for upfront emissions
- Annual calculations of actual embodied carbon meeting the Stage B embodied targets
- Annual offsets for Stage B embodied emissions

Net Zero in Progress (NZiP)

In design (upfront or lifecycle)

- *(for claims on upfront carbon)* Embodied calculations meeting the upfront targets
- *(AND, for claims on lifecycle carbon)* Embodied calculations meeting the total embodied target

Built, not yet operating (Enabled)

- As-built embodied calculations meeting the upfront targets
- Total embodied calculations meeting the total embodied target

Net Zero embodied carbon claims

FAQ 15 - Can I acknowledge achievements towards Net Zero Carbon - Operational Energy at different project stages ?

Yes. Net Zero Carbon – Operational Energy can only be claimed at the in-use stage, if verified on a annual basis, using measured energy use and a third party verified assessment. However, "Net Zero in Progress" status can be claimed at different project stages, as follows:

- A building that is being designed to meet the energy use targets, with design stage predictive energy modelling calculations meeting the energy use targets.
- A completed building, with as-built predictive energy modelling meeting the energy use targets, but with no energy use data yet. This "enabled" building could be handed over by a project team, for the occupier to follow-on with compliant operation to meet Net Zero.

See also diagrams on previous pages

FAQ 16 - Can I acknowledge progress towards Net Zero?

Yes, for Operational Net Zero – Energy Use, where buildings can claim to be "Net zero in Progress (NZiP)". This applies to **existing buildings** where the following conditions are met:

- No burning of fossil fuels *
- A Net Zero Retrofit Plan in place to meet the energy targets, AND
- On- or off-site renewable energy covers all energy use
- Offsets for upstream emissions.

Currently, progress towards energy targets is not strictly defined. This is likely to evolve in the future, along with requirements for evidence that all opportunities have been implemented.

This does not represent full Net Zero Carbon - Operational Energy status, but aims to recognise constraints on existing buildings, and encourage them to start the journey towards full Net Zero status.

New buildings should already meet energy targets compliant with Net Zero.

To acknowledge constraints related to **energy networks**, see FAQ17.

* The other, very limited exception, is where a building may be reliant on fossil fuel combustion for its special activities (i.e. NOT related to building operations including space heating, hot water and catering), in particular research activities where alternatives to fossil fuels are not available.

Building Net Zero Retrofit Plan

A Net Zero Retrofit Plan for existing buildings should include:

- Key building information, constraints, risks and opportunities
- The key works proposed along with related strategies and details
- Associated energy modelling showing the energy targets will be met
- The sequence of work
- A plan for monitoring and reporting energy use
- Financial and business implications e.g. energy bills for future consumers, how capitals will be made available
- Commitment to implementation
- Timeline for implementation, in steps or as a one-off.

FAQ 17 - Can I acknowledge constraints from energy networks?

Yes, the building can claim to be "Not Yet Net Zero Carbon", if:

- There is evidence it has to connect to a communal or district energy supply network which is not compliant with Net Zero (e.g. by local planning requirements)
- The network has a Decarbonisation Plan allowing the building to meet energy targets, and which does not rely on fossil fuels.
- On- or off-site renewable energy covers electricity use.
- Offsets cover upstream emissions from electricity AND emissions from heat / coolth used by the building.

Requirements are likely to be refined in the future; for example, a time limit may be put in place for the network to decarbonise, and buildings may have to meet energy targets applying to their site boundary, as well as targets relating to the network (see FAQ7).

This does not represent full Net Zero Carbon - Operational Energy status, but aims to recognise achievements by individual parties, and encourage collaboration with other parties towards full Net Zero status.

Network Decarbonisation Plan

A Net Zero Retrofit Plan for networks should include :

- Future plant, distribution efficiencies, operating temperatures, storage plant requirements etc, and associated design implications.
- Resulting carbon content of heat, and calculations showing that the network meets relevant targets and allows buildings to meet their energy targets, if relevant (see FAQ7).
- Commitment by the network or the building to cover renewable energy and offset requirements.
- Implications for tenants / energy consumers.
- Incorporation in the business model (including how capitals will be made available, future revenue streams, and how this will affect energy bills).
- Commitment to implementation.
- Timeline for implementation. This may be in steps, or as a one-off.

FAQ 18 - Can I acknowledge different stages of progress towards Net Zero Embodied Carbon?

Yes. Net Zero Embodied Carbon (upfront or life cycle) can only be claimed once the building is built, as follows:

- NZ **upfront** carbon can only be claimed for a building already built, where the upfront embodied carbon at Practical Completion (PC) meets the target and has been offset.

- **NZ life cycle embodied carbon** can only be claimed for a building already built, where the upfront embodied carbon at Practical Completion meets the upfront target and has been offset, and where, on an annual basis, the in-use (Stage B) embodied carbon is calculated, and offset.

However, "Net Zero in Progress" status can be claimed at different project stages, as follows.

- A building that is being designed to meet the embodied carbon targets. This may apply to Net Zero Upfront, or Net Zero Lifecycle.

- A building already built, where the upfront embodied carbon at Practical Completion meets the target and has been offset. This building has the potential to be net zero lifecycle embodied carbon, if the Stage B targets are met and offset.

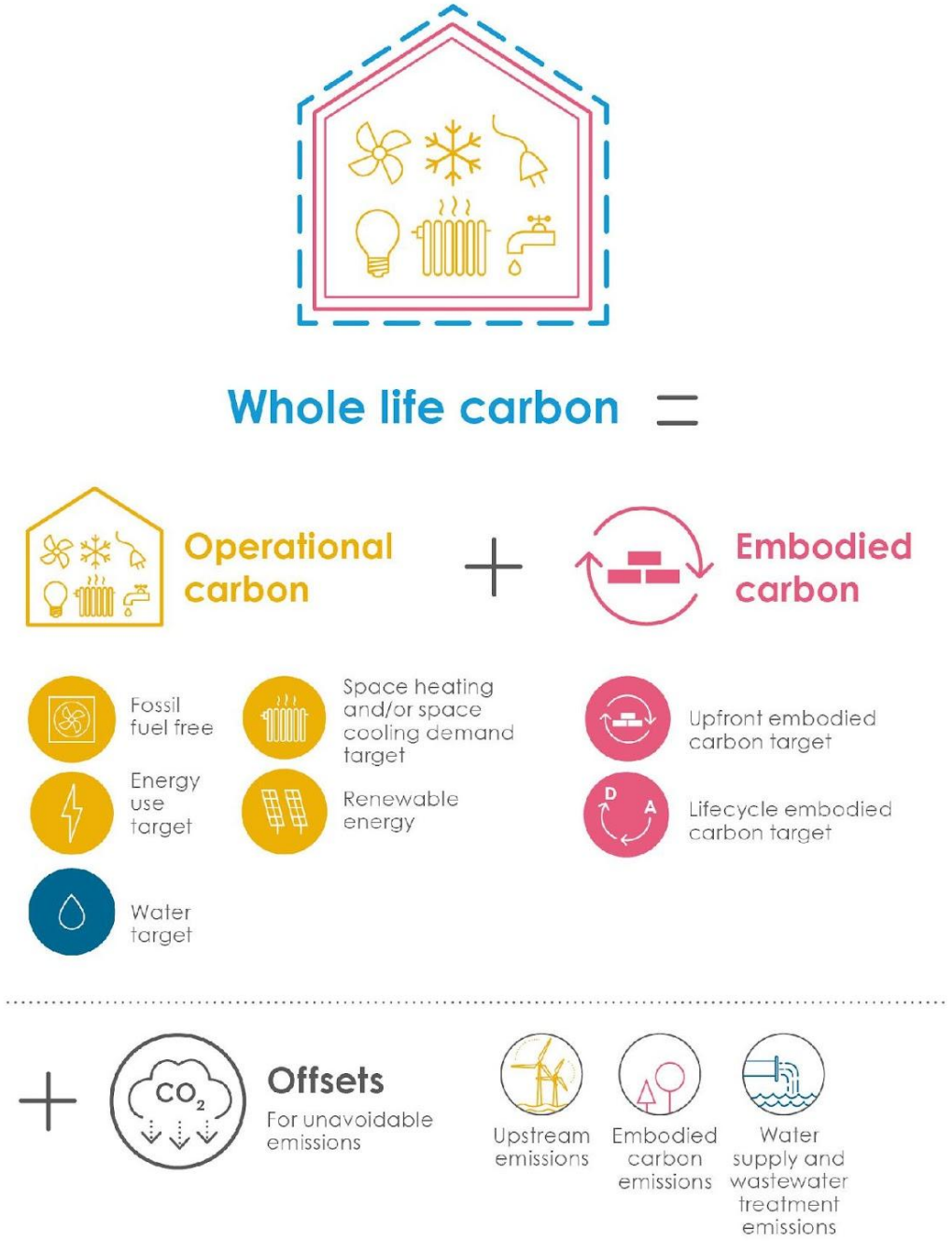
See also diagram on page 34.

Key FAQs

Net Zero whole life carbon

FAQ 19 - To be “net zero whole life carbon”, does the building have to be both NZ operational and NZ embodied carbon?

Yes. To be “NZ whole life carbon”, a building should meet both NZ operational (energy and water) and NZ embodied carbon definitions. There should not be “balancing” of one against the other, because of the need for resource efficiency: both energy and water demand reduction **and** upfront embodied carbon reductions as well as lifecycle cycle embodied carbon reductions apply.



3 Detailed FAQs

Detailed FAQs

Operational carbon - energy

FAQ 20 - Once the electricity grid becomes zero carbon, in the UK and many countries, this will rely on nuclear energy: this would not meet the definition's requirement for « all energy to be from renewable sources ». Does it mean a building would still need to generate a portion of its energy use from renewable?

See FAQ9.

Yes: this is the case regardless of the proportion of renewables and nuclear generation in the grid. Onsite renewables are recommended, especially for new builds, to contribute to the country's total net zero generating capacity.

Note also that in all of the Future Energy Scenarios by the National Grid between now and 2050, nuclear energy represents less than 5% of energy sources contributing to total grid capacity.

FAQ 21 - What are upstream emissions? How to calculate them?

There are several types of emissions associated with energy use. The dominant and most "obvious" ones are those directly associated with energy use e.g.:

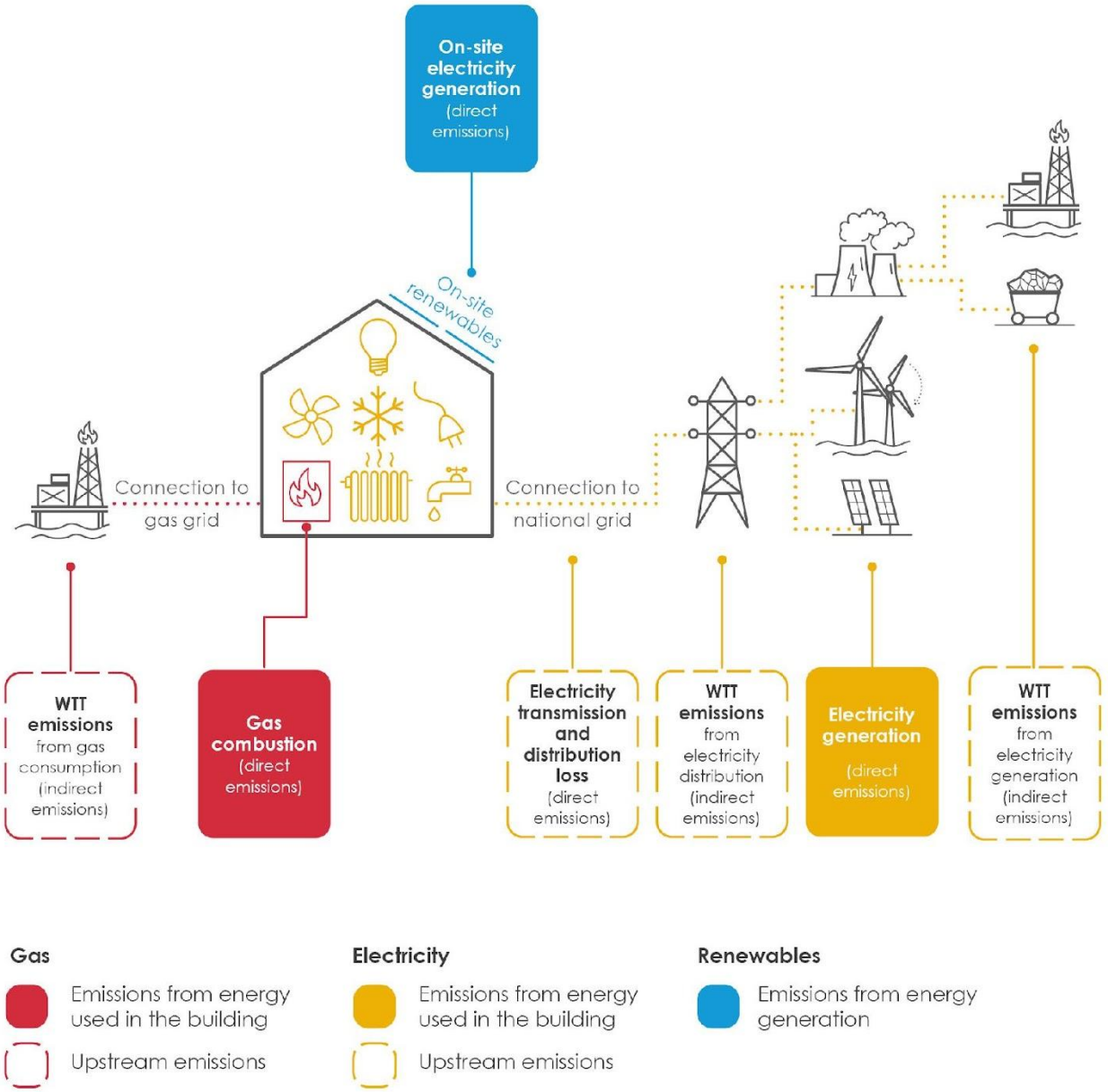
- from the burning of gas
- from the use of electricity which was not generated by net zero carbon sources
- from the burning of biomass: the "net" carbon emissions from combustion are zero as carbon was absorbed during biomass growth, but combustion emits other GHG emissions such as methane and N_2O.

In addition, there are Well-to-Tank emissions (WTT) from the production, processing and delivery of a fuel. This applies to biomass (e.g. processing and transport of pellets), natural gas (e.g. extraction and processing), and electricity (e.g. if it is generated using biomass, oil or gas).

For electricity, the total emissions need to account for that used by the building AND that which is lost in Transmission and Distribution (T&D), and associated WTT emissions.

In the UK, government factors are available for all types of emissions (building and upstream).

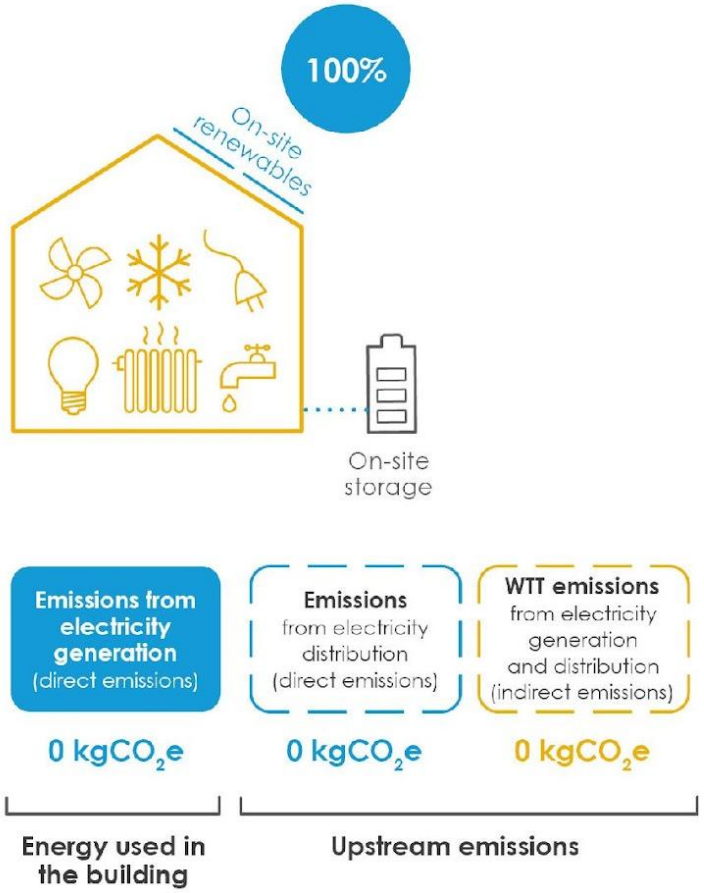
The following pages show examples of the carbon emissions associated with different fuel sources for the energy used in the building and those found upstream.



FAQ 21 - What are upstream emissions? How to calculate them?

Case A: A building that has a large PV array that generates 100% of energy use and a battery and is not connected to the grid; it does not burn gas or any other fossil fuel, nor biomass.

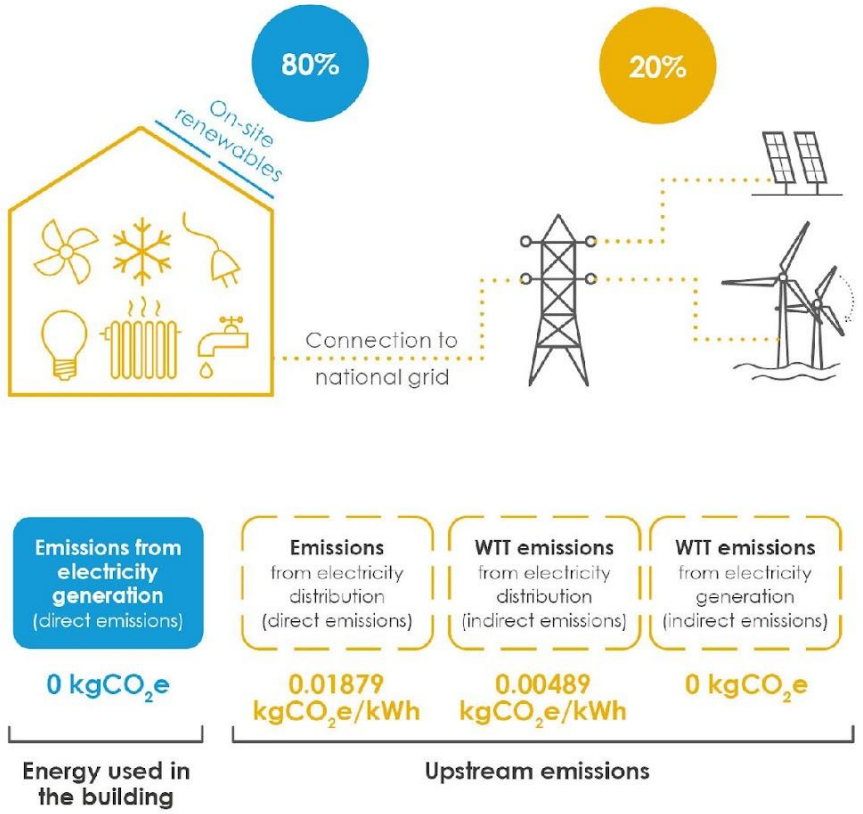
	Emissions $kgCO_2e$
Energy used in the building	
Emissions from **electricity generation** (direct)	0
Upstream emissions	
WTT emissions **electricity generation** (indirect)	0
Emissions from **electricity distribution** (direct)	0
WTT emissions from **electricity distribution** (indirect)	0



FAQ 21 - What are upstream emissions? How to calculate them?

Case B: A building that has a PV array (80% of electricity consumption)- and is connected to the grid - does not burn gas or biomass and procures remaining 20% renewable electricity.

	Emissions $kgCO_2e$	GHG conversions 2021	$kgCO_2e/kWh$
Energy used in the building			
Emissions from **electricity generation** (direct)	0		
Upstream emissions			
WTT emissions **electricity generation** (indirect)	0		
Emissions from **electricity distribution** (direct)		Transmission and distribution of electricity (Tab - 'transmission and distribution' in full set advanced- users)	0.01879
WTT emissions from **electricity distribution** (indirect)		WTT- UK electricity (T&D) (Tab - 'WTT- UK and overseas elec' in full set advanced- users)	0.00489

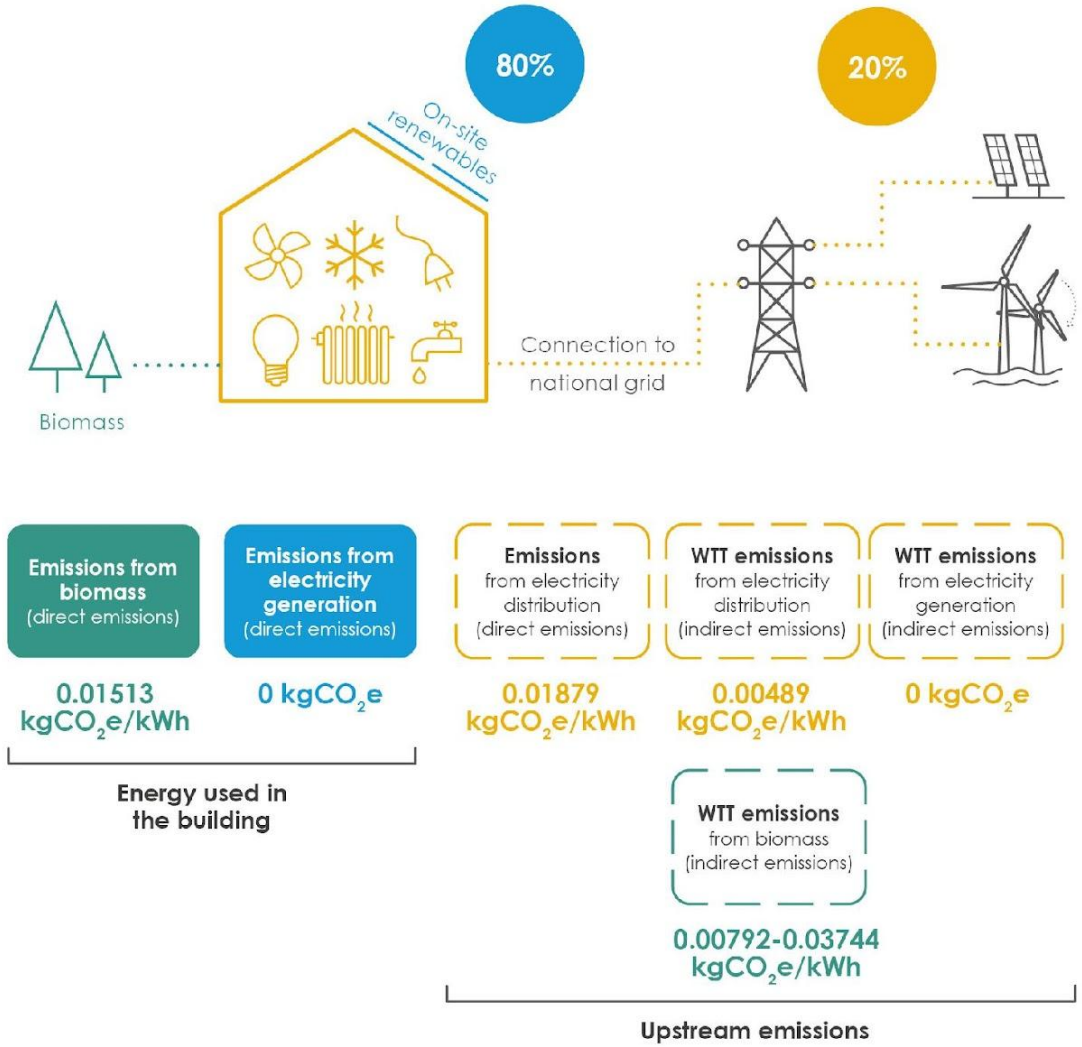


The 2021 factors (revised Jan 2022) are shown as an example. The correct factors for the year that the calculation is being carried out for must be used.

FAQ 21 - What are upstream emissions? How to calculate them?

Case C: A building that has a large PV array (80% of electricity consumption) - and is connected to the grid - does not burn gas but DOES burn biomass and procures remaining 20% renewable electricity.

	Emissions $kgCO_2e$	GHG conversions 2021	$kgCO_2e/kWh$
Energy used in the building			
Emissions from **biomass** (direct)		Biomass (Tab - 'bioenergy' in full set advanced- users)	Wood logs=0.01513 Wood chips=0.01513 Wood pellets=0.01513
Emissions from **electricity generation** (direct)	0		
Upstream emissions			
WTT emissions from **biomass** (indirect)		WTT of the biomass (Tab - 'WTT-fuels' in full set advanced- users)	Wood logs=0.01277 Wood chips=0.00792 Wood pellets=0.03744
WTT emissions **electricity generation** (indirect)	0		
Emissions from **electricity distribution** (direct)		Transmission and distribution of electricity (Tab - 'transmission and distribution' in full set advanced- users)	0.01879
WTT emissions from **electricity distribution** (indirect)		WTT- UK electricity (T&D) (Tab - 'WTT- UK and overseas elec' in full set advanced- users)	0.00489



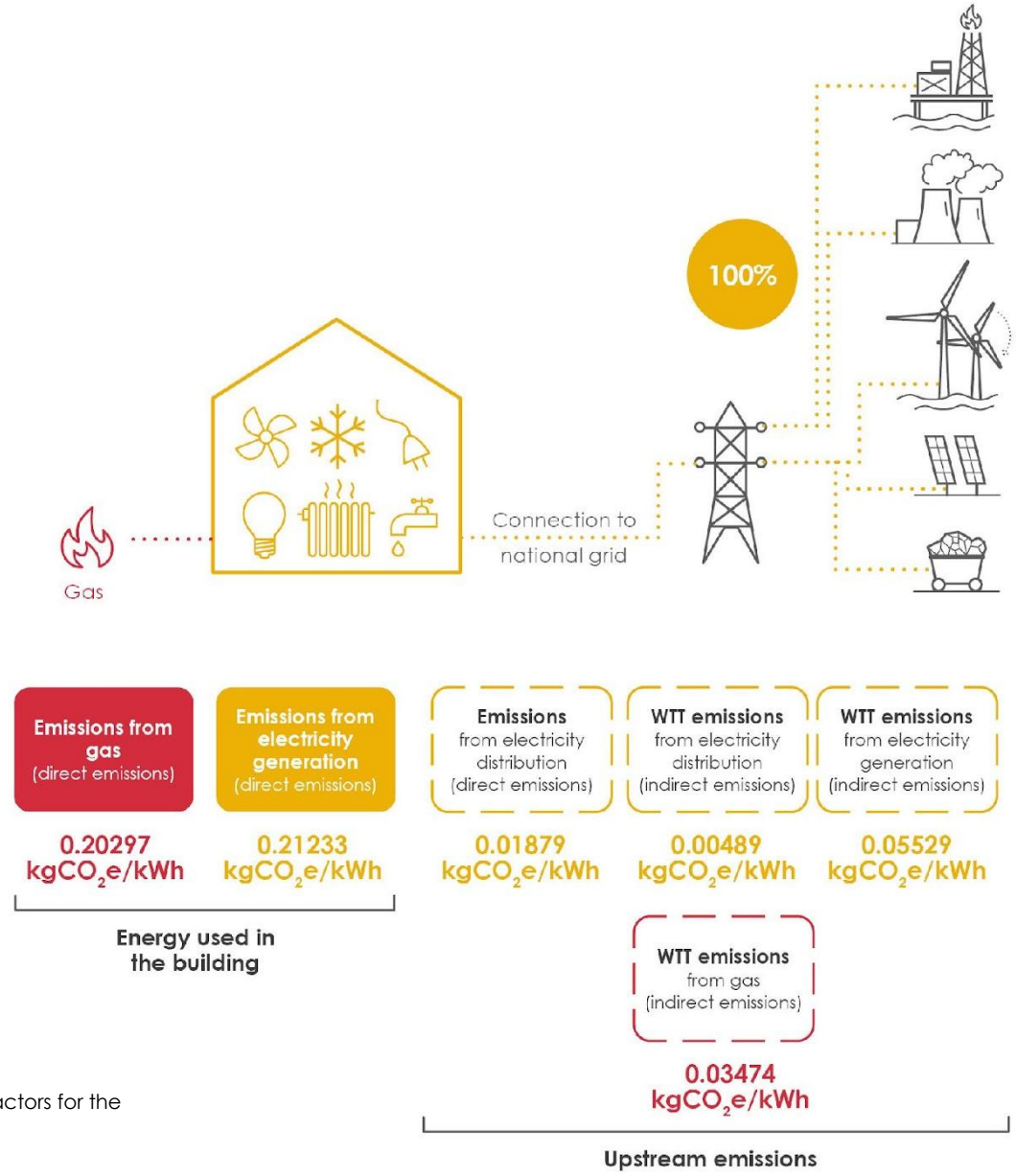
The 2021 factors (revised Jan 2022) are shown as an example. The correct factors for the year that the calculation is being carried out for must be used.

FAQ 21 - What are upstream emissions? How to calculate them?

Case D: A building that has no PV array, is connected to the grid - DOES burn gas and does NOT procure 100% renewable electricity.

	GHG conversions 2021	$kgCO_2e/kWh$
Energy used in the building		
Emissions from **gas** (direct)	Natural gas (Tab - 'Fuels' in full set advanced- users)	0.20297
Emissions from **electricity generation** (direct)	UK Electricity (Tab - 'UK Electricity' in full set advanced- users)	0.21233
Upstream emissions		
WTT emissions from **gas** (indirect)	WTT of the Natural gas (Tab - 'WTT-fuels' in full set advanced- users)	0.03474
WTT emissions **electricity generation** (indirect)	WTT- UK electricity (Tab - 'WTT- UK and overseas elec' in full set advanced- users)	0.05529
Emissions from **electricity distribution** (direct)	Transmission and distribution of electricity (Tab - 'transmission and distribution' in full set advanced- users)	0.01879
WTT emissions from **electricity distribution** (indirect)	WTT- UK electricity (T&D) (Tab - 'WTT- UK and overseas elec' in full set advanced- users)	0.00489

This building **would not be net zero** as gas is burnt onsite and electricity is not procured from renewables, but is shows as it provides a way of calculating the carbon emissions of this building



The 2021 factors (revised Jan 2022) are shown as an example. The correct factors for the year that the calculation is being carried out for must be used.

FAQ 22 - How does the Net Zero Carbon – Operational Energy definition apply if a building is supplied by 'green gas' produced on site e.g. from anaerobic digestion?

If anaerobic digestion happens onsite, the green gas is deemed renewable and the building can qualify as Net Zero (if it meets the other requirements of the definition).

It must be noted that the building must run 100% on green gas, or another renewable, and it must never use a fossil fuel source, in order to qualify as Net Zero (e.g. a "net" balancing of exported green gas and imported natural gas is not acceptable).

While additional guidance may develop, and more certainty on the carbon benefits of green gas tariffs, currently, buildings that burn natural gas, but buy a green gas tariff, do not meet the net zero definition.

If the green gas is made out of forestry-based products, then it is only net zero if the forestry-based products are sustainably certified (i.e. are replaced).

Upstream emissions relating to biogas (sometimes called residual emissions) must be accounted for and offset - see FAQ 21 for details.

Recommendations are provided in the UKGBC Renewable Energy Procurement and Carbon Offsetting Guidance for Net Zero Carbon Buildings* for consumers who do wish to purchase such tariffs to support the growth of the UK green gas market or for ESG purposes.

* https://www.ukgbc.org/ukgbc-work/renewable-energy-procurement-carbon-offsetting-guidance-for-net-zero-carbon-buildings/

	GHG conversions 2021	$kgCO_2e/kg$
Energy used in the building		
Emissions from **green gas** (direct)		0
Upstream emissions		
WTT emissions from **green gas** (indirect)	WTT of the green gas (Tab - 'WTT-biogas' in full set advanced- users)	Biomethane -0.85513

Example carbon offset calculation for Biomethane

The 2021 factors (revised Jan 2022) are shown as an example. The correct factors for the relevant year of energy use must be used.

FAQ 23 - How do the definitions work for buildings supplied by hydrogen?

Hydrogen is not yet available for use in UK buildings. Even if available, buildings are not considered a priority use, compared to other applications which have few other options for decarbonisation .

The government have recently consulted on a low-carbon hydrogen standard. Subject to the outcome of the consultation, hydrogen meeting that standard may be accepted under the Net Zero definitions; this cannot be confirmed at this stage.

Any hydrogen production will have energy and carbon implications, which would need to be addressed for schemes using hydrogen to claim Net Zero status.

Schemes supplied by hydrogen seeking recognition under the Net Zero definitions should contact CIBSE for discussions on a case by case basis.

"Green" hydrogen, produced by renewables through electrolysis, is currently expected to be the lower carbon option and therefore the one favoured. However, its deployment requires significant additional renewable energy capacity: for the hydrogen produced to be truly low carbon, evidence would be required that additional renewable capacity has been installed to meet the increased electricity demand for the electrolysis process.

"Blue" hydrogen, produced by fossil fuels with carbon capture and storage, may be a transition option but there are concerns that it creates the risk of continued dependency on fossil fuels. For it to be truly low carbon, evidence would be required of low leakage from extraction and throughout the production process, and effective carbon capture in practice.

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Detailed FAQs

Embodied carbon

FAQ 24 - How to account for carbon sequestered in timber, wood fibre insulation and other plant-based materials?

Upfront embodied carbon

The carbon sequestered during the growth of timber and other plant- and bio-based materials (e.g. leather, wool and fungi) is NOT deducted from their upfront embodied carbon during an embodied carbon assessment, because its release or transfer at the building's end of life or at some point in the building's lifecycle must also be considered and the emissions at that point will depend on how these materials are dealt with or disposed of (e.g. they may go to landfill, or be burnt in an energy-from-waste plant or re-used). This aligns with ISO 14067, EN 15804, EN 15978.

Lifecycle embodied carbon

Both the removals (sequestration) and the emissions at end of life of timber and other plant- and bio-based materials (e.g. leather, wool and fungi) ARE accounted for when carrying out whole life cycle embodied carbon assessments (Stage A-C).

FAQ 25 - Why are building-mounted PV panels excluded from the LETI embodied carbon targets?

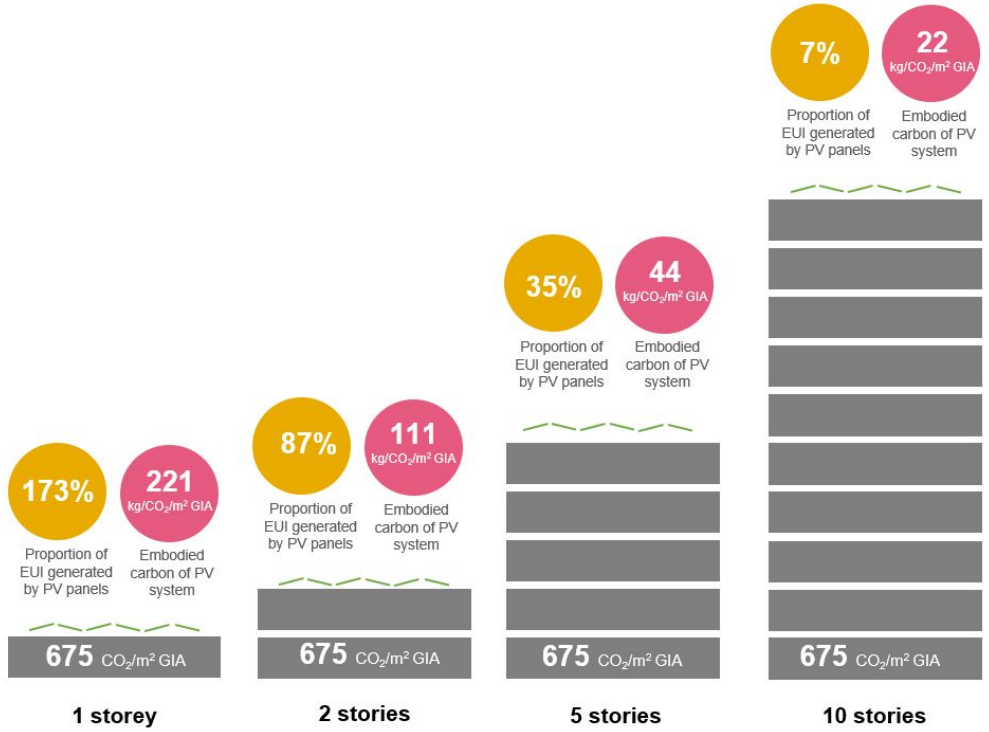
The current LETI embodied carbon targets exclude PV systems. The rationale is that PVs are part of the wider energy system, helping to decarbonise electricity. The embodied carbon of that wider infrastructure is not included in buildings embodied carbon targets, so including PVs would not provide a "fair" comparison and could disincentivise their installation*.

However, arguments for including them are:

- As they are installed within a specific building contract, excluding them potentially means their embodied carbon is not counted anywhere else.
- The boundary is not always clear e.g. when PVs are integrated as a façade element (as these elements ARE included in embodied carbon targets).
- It could incentivise manufacturers to develop products of reduced embodied carbon and increased output.

An alternative could be to include the quantum of PVs that relate to the energy used by the building, but exclude those that over-provide and export to the grid.

* Solar thermal systems are included as these systems only connect to the building, not to a wider network/infrastructure.



Study by Elementa Consulting and Wilmott Dixon on embodied carbon of PV for a school. It shows the relative impact of the embodied carbon in PV systems can be from 22-221 kg CO_2/m^2 compared to the rest of the building – assuming the building meets a LETI embodied carbon rating C, this could add 3-33% of embodied carbon.*
* LETI Embodied Carbon Target alignment, 2021

FAQ 26 - Why is the embodied carbon of energy infrastructure not included in the Net Zero embodied definitions?

The current Net Zero definitions for buildings do not include calculating and offsetting the embodied carbon associated with energy infrastructure required to supply buildings, where these are part of the wider national system; this means for example that items such as power cables, transformers, PV farms, wind turbine, storage (such as hydro or compressed air, or batteries) etc are excluded from the Net Zero definitions for buildings.

Typically these are accounted for in different sectorial budgets (power sector, infrastructure), rather than buildings.

It may be that the embodied carbon of infrastructure will be included in the embodied carbon targets in the future especially if onsite PV is also included, see FAQ 25.

Detailed FAQs

Operational carbon – Water use

FAQ 27 - How are GHG emissions (and offsets) arising from water supply and wastewater treatment calculated?

GHG emissions associated with water supply and wastewater treatment should be calculated using carbon factors supplied by the water company (counting both water supply and treatment); if this is not available, the government GHG conversion factors can be used, for the year that the water is used .

The latest government factors can be found here: https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting .

At the time of publishing these FAQs, the latest issue is the 22nd January 2022 one, and the 2021 factors are shown below:

Water supply: 0.149 kg CO_2e/m^3 of water supplied to the building
Wastewater treatment: 0.272 kg CO_2e/m^3 of waste water that needs to be treated.

4 Appendix

Appendix to FAQ 7 - How are EUIs and associated targets calculated in buildings served by communal or district energy schemes?

There is currently no established method for calculating an EUI for a building connected to a district or communal scheme. Several options are available:

Option 1
The EUI could be calculated based on heat delivered alone, and the targets could be adjusted to only consider thermal demand. The EUI would then be compared with an adjusted target, including thermal demand rather than energy used to meet that demand. This is NOT consistent with the approach for buildings with individual systems, which does consider system efficiency, and it may remove an incentive for energy schemes to decarbonise. *(this is option 1 on the next page)*

Option 2
To consider not only the building but the scheme serving it, one way could be to apply targets for buildings (i.e. an adjusted EUI, as above) and targets for the district energy scheme performance (e.g. carbon content of heat and distribution efficiency).
(this is option 2 on the next page)

Option 3
Alternatively, the building's EUI could take account of the scheme's total energy use for generation, distribution etc, apportioned to energy delivered to individual buildings. This would provide direct comparisons with buildings served by individual systems, against the same energy targets. However, how to account for several energy sources within the EUI needs consideration.
(this is option 3 on the next page)

Teams are encouraged to explore these options, but those that do account for the energy scheme are encouraged (Options 2 and 3). It is expected that an industry method will be developed in the future, and associated energy targets. Please contact CIBSE and LETI if you would like to contribute to the work on defining an approach for this.

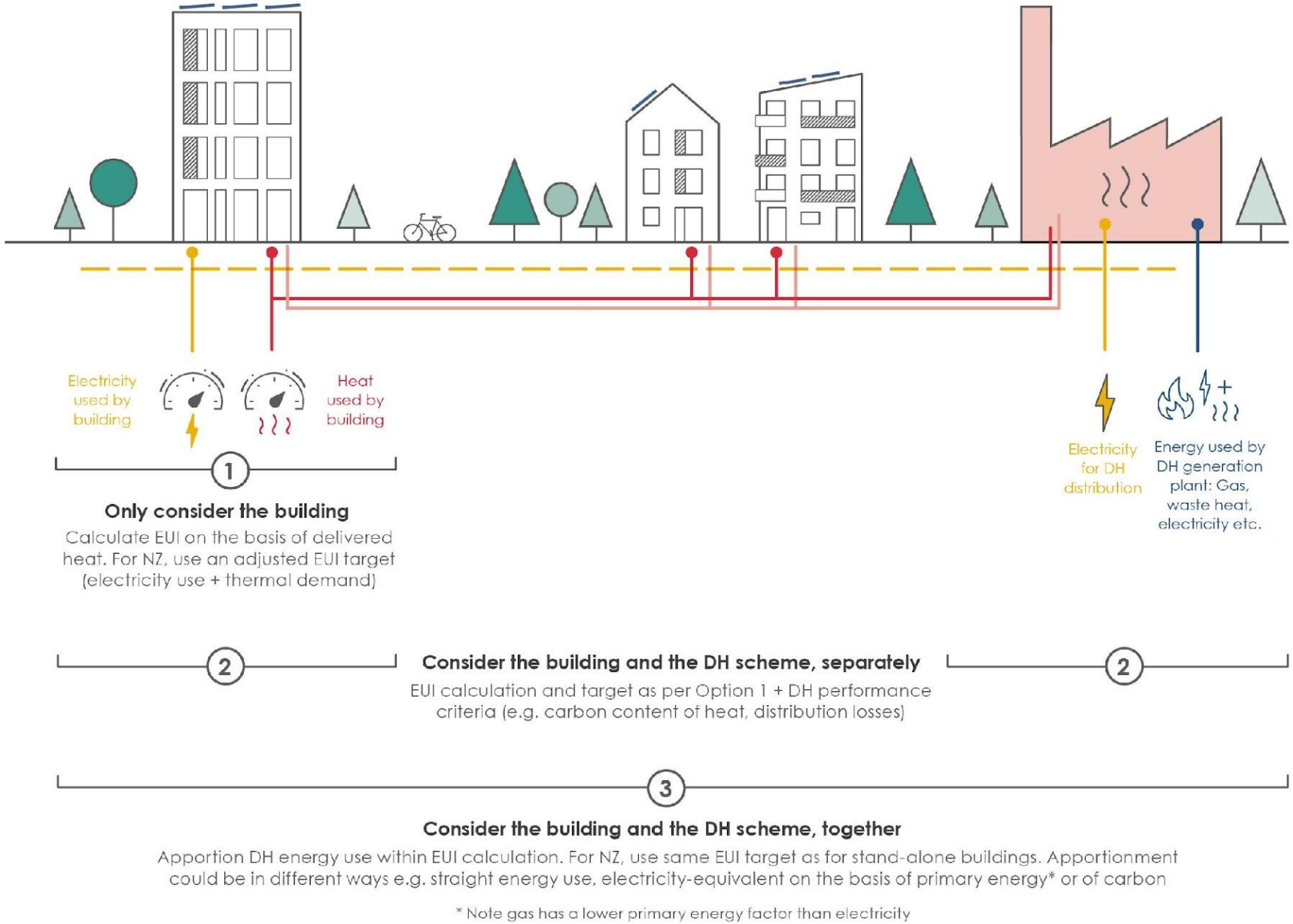
Appendix to FAQ 7 - How are EUIs and associated targets calculated in buildings served by communal or district energy schemes?

This diagram shows the 3 options described on the previous page. The options that do account for the energy scheme are encouraged (i.e. Options 2 and 3).

1. **Option 1** - EUI calculated based on the building only

2. **Option 2** - EUI calculated on the building, and DH scheme considered separately

3. **Option 3** - EUI calculated on the building and DH scheme together



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@CIBSE @LETI_London #WhatIsZero

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