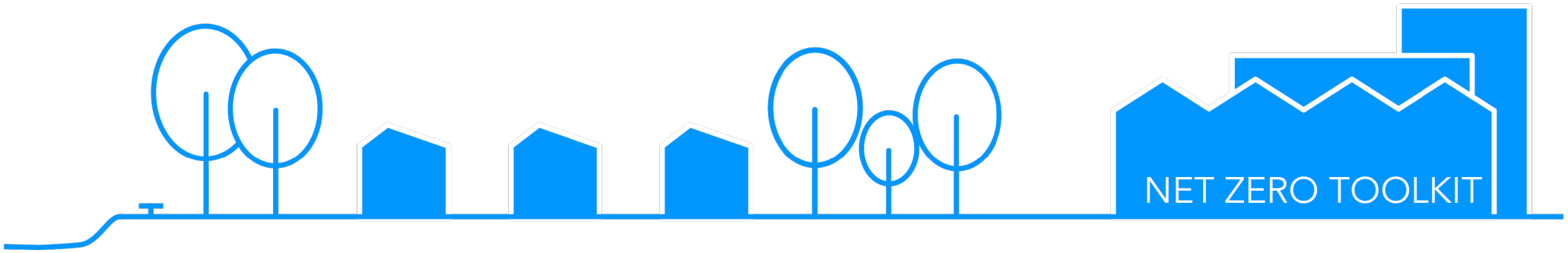
Folkestone & Hythe District Council

Homes England



DECARBONISING BUILDINGS: STRATEGIC OBJECTIVES

September 2023 | Rev F

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Introba

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Foreword and Acknowledgments

Foreword from F&HDC to be added

The Folkestone & Hythe District Council Net Zero Toolkit for New Buildings has been developed in close collaboration with the District Council, Otterpool Park LLP, Homes England and Kent County Council.

We are very grateful to the following individuals for their time, leadership, contributions and comments.

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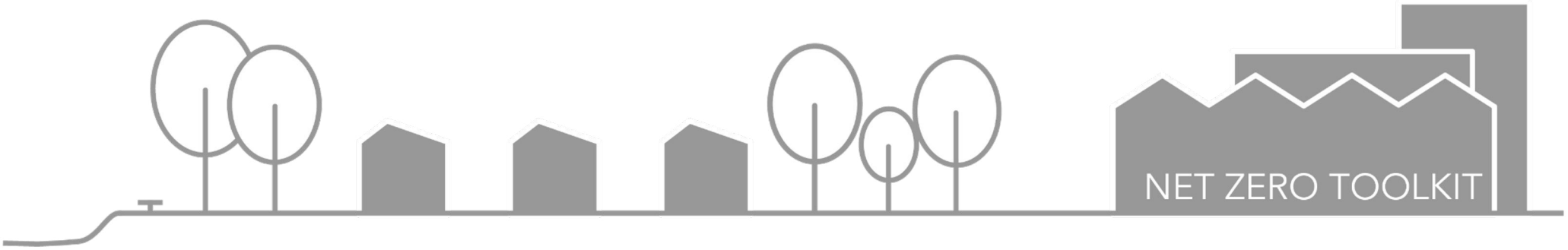
The Folkestone & Hythe District Council Net Zero Toolkit

The Folkestone & Hythe District Council Net Zero Toolkit comprises of four parts, each consisting of a separate document.



This document

Part 1

Decarbonising buildings – Strategic objectives

This part is 6 pages long and aimed at Councillors, officers and other key stakeholders involved in the formation and adoption of the Net Zero Toolkit.

It lays the foundations for the Toolkit documents by explaining legal climate change requirements and policy context. It also explain the "whys" for being ambitious with Net Zero Carbon new buildings.

Part 2

New buildings

This part is 60 pages long and aimed at developers (small and large), architects, consultants, planning officers.

Its main aim is to communicate how new developments that are consistent with climate change objectives can be designed and constructed. It covers both domestic and non-domestic developments and includes useful 'one pagers'.

Part 3

Retrofit

This part is 40 pages long and aimed at F&H District Council as it focuses mainly on the Council's own stock.

It seeks to communicate the importance of retrofit, explain which key improvements need to be made in a simple way

It also signposts useful guidance on retrofit.

Part 4

Planning policy recommendations

This part is 20 pages long and aimed at F&H District Council's Planning department.

It provides clear policy recommendations for the Council to consider for the next Local Plan update.

Summary of key principles and KPIs underpinning the Toolkits

The Toolkits for Folkestone & Hythe have been compiled with the following key principles underpinning them.

Operational energy

- To meet necessary carbon reductions, new buildings should go far beyond current existing standards and should aim to be net zero carbon now.
- Targets for buildings should be measured in energy consumption, not carbon emissions.
- Buildings should meet the energy performance Key Performance Indicators (KPIs) set out in the table on the right.
- Predicted energy consumption should be estimated through the Passivhaus Planning Package (PHPP) tool for all buildings, with additional dynamic thermal modelling for non-residential buildings.

Low carbon heat – There should be **no fossil fuel combustion** or connection to the gas network.

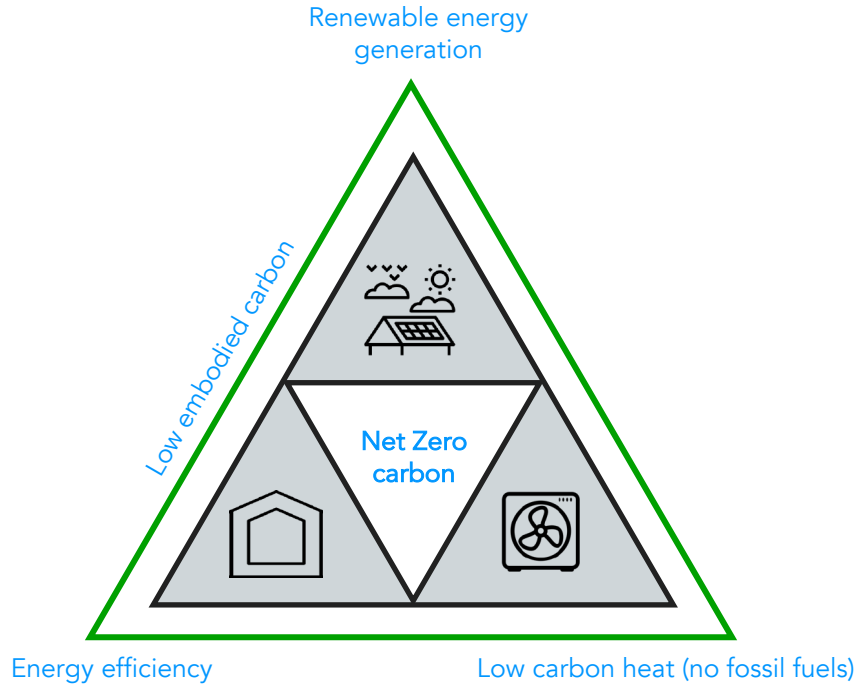
Renewable energy – sufficient renewable energy should be provided on-site so that annual renewable energy generation is equal to annual energy consumption. Where this cannot be provided on-site an appropriate means of off-site provision must be sought.

Carbon offsetting - should not be allowed as a mechanism for achieving compliance for new buildings.

Embodied carbon - all new buildings should be built in line with low embodied carbon targets outlined by LETI in the table on the right.

Broader sustainability objectives – the design of buildings and their surroundings should benefit the wider environment in terms of ecology and biodiversity, water, flood risk, transport and waste.

The rationale for these principles is outlined on the following pages.



Key components of a zero carbon building: energy efficiency, low carbon heat, renewable energy and low embodied carbon.

	New housing	New schools	New offices
Space heating demand (kWh/m²/yr)	15*	15*	15*
Energy Use Intensity (EUI) (kWh/m²/yr)	35	55	65
Low carbon heat	No fossil fuel	No fossil fuel	No fossil fuel
Renewable energy (kWh/m²/yr)	Minimum to match EUI	Minimum to match EUI	Minimum to match EUI
Embodied carbon, upfront ($kgCO_2e/m^2$)	<300-500	<600	<600

The KPIs for net zero carbon buildings used throughout the Folkestone & Hythe Net Zero Toolkits. These align with targets set by the London Energy Transformation Initiative (LETI)

**or a heating / cooling load of <10 W/m². .*

The global, local and national context

There is a climate emergency

There is overwhelming scientific consensus that significant climate change is happening. The sixth assessment report from the Intergovernmental Panel on Climate Change (IPCC AR6) released in February 2022, is a "dire warning about the consequences of inaction," said Hoesung Lee, Chair of the IPCC. It concludes that . "Any further delay in concerted global action will miss a brief and rapidly closing window to secure a liveable future."

The Paris Agreement (2015)

The Paris Agreement (2015) is a legally binding international treaty on climate change. 196 countries, including the UK, signed up to the agreement whose goals are to:

i) Limit global warming to 1.5-2 °C

ii) reach global peaking of greenhouse gas emissions as soon as possible and to achieve a climate neutral world by mid-century.

iii) Enhance resilience and adaptation to climate impacts

iv) Align financial flows in the world with these objectives.

The UK's commitment to net zero carbon

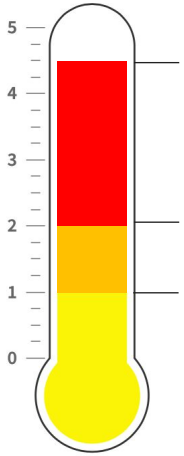
The UK has voluntarily bound its Paris Agreement target of being net zero carbon by 2050 in law through the Climate Change Act 2008 (amended in 2019).

Folkestone & Hythe's commitment to net zero

Folkestone & Hythe declared a Climate Emergency in 2019. The council's Carbon Action Plan states its commitment to reducing its own carbon footprint to net zero by 2030 and has committed to playing a facilitatory role in helping the district's community and businesses achieve the same aim.

The three overarching objectives needed to respond to climate change in Folkestone & Hythe

Reduce carbon emissions to zero + Mitigate against the impacts of climate change + Reduce impact on natural systems and resources



4-5 °C the temperature rise we are likely to see if we continue on a **business as usual** path

1.5-2°C The maximum temperature rise above pre-industrial levels the IPCC recommends.

1°C The temperature rise already created

Reduction in CO_2 emissions the UK government is **legally required** to achieve by 2050 over 1990 levels.

Why action is required now (carbon budgets)

Cumulative carbon is more important than a zero carbon target date

Cumulative carbon in the atmosphere is directly proportional to global temperature rises. Informed by the latest climate science, the IPCC has developed global carbon budgets for limiting global temperature rises to 1.5-2°C.

We will exceed our carbon budget in 4.5 years unless action is taken

Tyndall Carbon Budget Reports derive carbon budgets for each UK local authority from the IPCC's global carbon budget. They are powerful in their simplicity, since they are directly related to actual CO_2 emissions from energy (representing 80% of the UK's greenhouse gas emissions). A local authority can monitor their own local CO_2 emissions from energy (using BEIS datasets) and plan to reduce them in line with the recommended trajectory.

In summary, the report recommends:

- Folkestone & Hythe stays within a maximum cumulative CO_2 emissions budget of 3.1 million tonnes ($MtCO_2$) from 2020.
- If emissions continue at 2017 levels, the entire carbon budget for the area would be used by 2027.
- Emissions cuts must average -13.3% per year to deliver a Paris aligned carbon budget.
- Meeting the budget must not rely on carbon offsets.

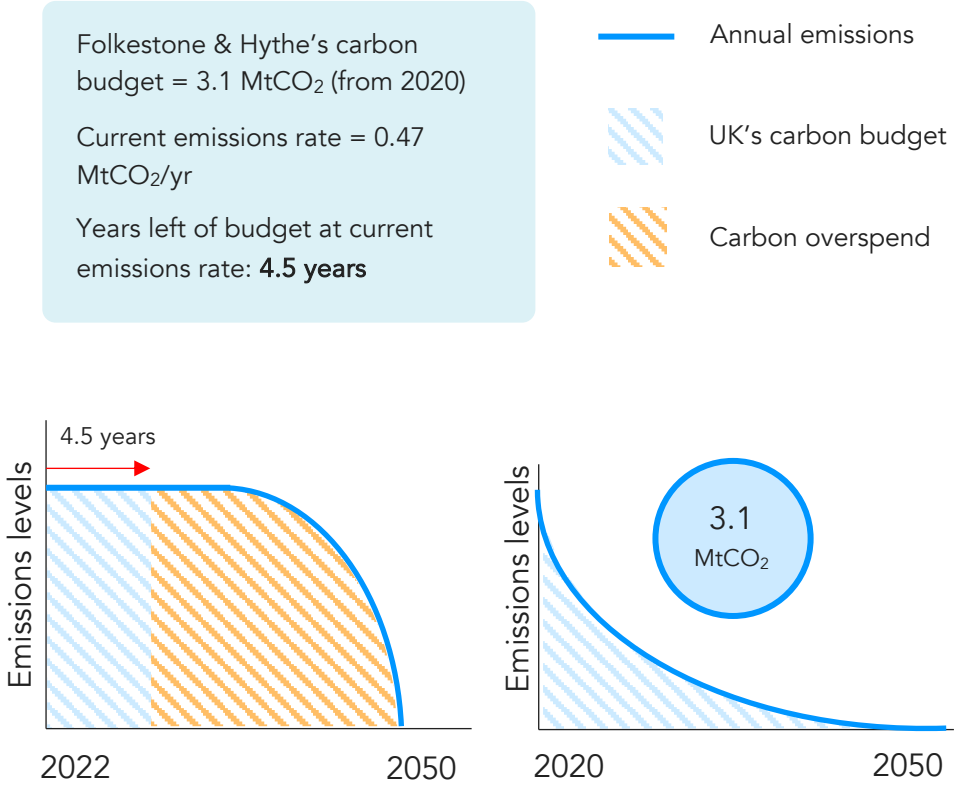
A zero carbon target date is not enough

The UK government's zero carbon by 2050 target is not enough without also taking a science based carbon budgets approach. The graphs on the right illustrate different emissions trajectories for Folkestone & Hythe – both of which get to zero carbon by 2050. However, trajectory A emits three times as much carbon as trajectory B, and would put us on a path to much higher global temperature rises than the target 1.5-2 °C.

Folkestone & Hythe's carbon budget = 3.1 $MtCO_2$ (from 2020)

Current emissions rate = 0.47 $MtCO_2$/yr

Years left of budget at current emissions rate: **4.5 years**



Trajectory type A

This trajectory continues at current emissions rates until the 2030s at which point it drops off steeply.

It is zero carbon by 2050 but the carbon budget is far exceeded.

Trajectory type B

This trajectory sees a 13.3% reduction in emissions year on year. Cumulative emissions stays within the carbon budget.

Other trajectories are possible – but it's imperative that we do not overspend on carbon, otherwise we will not be on a Paris compliant trajectory.

Recommendations of expert bodies

The Climate Change Committee's recommendations

The Climate Change Committee is an independent body appointed to advise the government on how to achieve its climate change target of being net zero carbon by 2050 (legislated by the Climate Change Act). Their 2019 report "Net Zero: The UK's contribution to stopping global warming" provides an in-depth analysis of the actions required across different sectors: buildings; industry; power; transport; aviation & shipping; agriculture & land-use; waste; fluorinated gases and greenhouse gas removals. These are summarised on the right.

Emissions from industry, commerce, freight, air travel and land-use and agriculture emissions are shown to be difficult to abate. This makes it imperative that housing, light transport and waste sectors achieve maximum possible reductions.

The National Grid

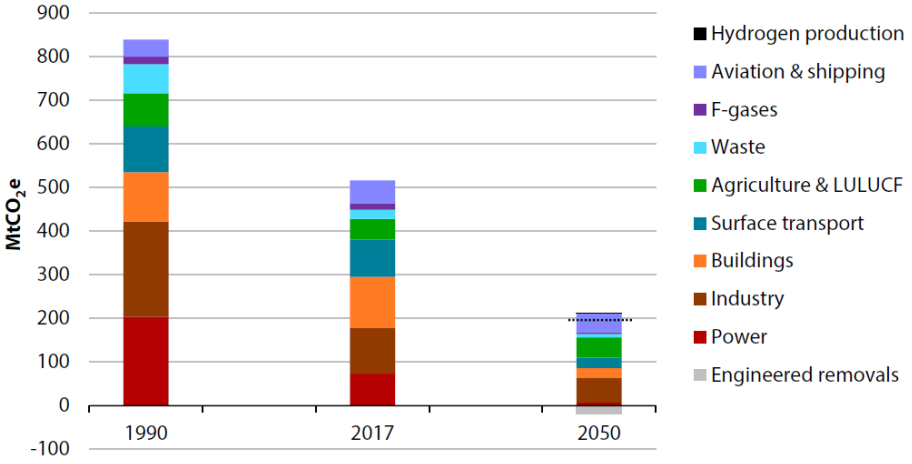
The National Grid in its Future Energy Scenarios 2021, predicts that:

- Electricity generation capacity may need to increase fourfold.
- Solar electricity generation will need to increase by a factor of 6 – rooftop PV could and should be maximised to help achieve this.
- Total energy demand from all homes will need to reduce by 68% from 2020 levels despite increases in the number of homes.

LETI

The London Energy Transformation Initiative (LETI) undertook research culminating in the Climate Emergency Design Guide, which outlines the Key Performance Indicators (KPIs) of new buildings to ensure our emissions reductions targets are met. In summary,

- New homes must be designed to be net zero carbon.
- New homes must be ultra-low energy (extremely energy efficient)
- New homes must be heated by low-carbon heat – e.g. heat pumps. There should be no gas boilers installed in new homes.



Trajectory for emissions in the "Core" scenario by sector, Climate Change Committee. The graph shows that even under this least ambitious scenario emissions from buildings should be minimal.

Key actions required for meeting carbon reduction targets, from the Climate Change Committee

- Fully decarbonise electricity by 2035 while meeting a 50% increase in demand
- All new homes are zero carbon by 2025 at the latest
- Ultra-efficient new homes and non-domestic buildings
- Low carbon heat to all but the most difficult to treat buildings.
- Ambitious programme of retrofit of existing buildings.
- Complete electrification of small vehicles (100% of new sales by 2030).
- Large reduction in waste, zero biodegradable waste to landfill by 2025, zero all waste to landfill by 2040.
- Significant afforestation and restoration of land, including peatland.
- Greenhouse gas removals will likely be required to achieve net zero carbon (but theses are untested and unproven technologies).

Current policy direction is not enough

Current policy direction will not deliver necessary carbon reductions

Building regulations are not delivering the rapid carbon reductions we need to see in buildings. Part L, the aspect of building regulations associated with energy and carbon, was updated in June 2022 but is still not very stretching. The next change will be the proposed Future Homes and Buildings Standard in 2025. The impacts of the proposed changes on energy performance compared to where we need to be are illustrated in the table on the right.

With current policy direction:

- The use of gas boilers will likely be permitted until 2025 – this is too late.
- Both Part L 2021 and the proposed Future Homes and Building Standard do not mandate the levels of energy efficiency that the Committee on Climate Change and LETI recommend, therefore further retrofit will be required in the future.
- The small amount of PV that will be required through building regulations 2021 is a missed opportunity to generate much needed renewable energy and displace gas consumption from power stations.

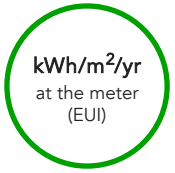
Energy metrics provide targets that are absolute and measurable

Energy metrics provide a straightforward and measurable target for designing buildings, that can be measured in operation in order to assess whether the building is meeting its energy targets, better enabling us to close the performance gap. The current building regulations methodology (SAP and SBEM) has a number of shortcomings: it uses a relative carbon performance approach that cannot be measured in operation; carbon factors go out of date quickly; and the "notional" building approach does not encourage good design through optimized form – something that will be essential to achieving net zero carbon buildings. Using Passivhaus Planning Package (PHPP) or dynamic thermal modelling in accordance with CIBSE's TM54 addresses these issues.

	Part L 2021	Future Homes Standard	Recommended
When	2022	2025	2023
Ban on gas boilers?	No	Yes	Yes
Renewable energy required?	Yes	No	Yes
Space heating demand, kWh/m²/yr	52	45	15-20
Energy Use Intensity, kWh/m²/yr	96	43	35
Net emissions, $kgCO_2/m^2/yr$	18	3	0
Net zero carbon	No	No	Net zero energy

Comparison of Part L 2021, the Future Homes and Buildings Standard and the recommended KPIs for new buildings. Figures for Part L 2021 and FHS are based on modelling carried out in PHPP of a typical semi-detached house.

- ✗ Is not a 'physical' metric
- ✗ Is a concept only experts can understand
- ✗ Cannot be checked during operation
- ✗ Cannot be used to 'close the loop' and improve the system over time
- ✗ Does not reward good architectural design e.g. form



- ✓ Is a 'physical' metric which can be measured
- ✓ Can be understood by all professionals, and most consumers
- ✓ Can be checked against in-use data
- ✓ Can be checked to improve SAP prediction of energy use over time

The relative metric introduced by the Notional Building approach (i.e. % improvement over Part L) has a number of unintended consequences which hinder the continuous improvement of building design, consumer trust and performance outcomes.

New homes need to be ahead of the curve

Buildings should decarbonise more quickly than other sectors

As we have seen, it is imperative to take a carbon budgets approach if we are to meet Paris Agreement targets and limit global warming to 1.5-2°C.

Some sectors have the means to decarbonise sooner (e.g. buildings) and so should arguably have a smaller share of the budget than those sectors which do not yet have all the technological means of decarbonising quickly (e.g. industry and transport).

New homes are easy to make zero carbon

New homes (and some non-residential buildings) are relatively easy to build to zero carbon standards. The technology already exists and the costs are becoming increasingly affordable*.

New buildings should not add to the retrofit burden

The retrofit of existing homes to low carbon heat sources (and the energy efficiency measures that will enable the transition) is a huge challenge.

The vast majority of Folkestone & Hythe's 51,000 existing homes are heated by gas and oil boilers. To meet carbon budgets we estimate that these would need to be replaced by the early 2030s.

There is no logic in contributing to the future retrofit burden of Folkestone & Hythe by continuing to build new homes with gas boilers and mediocre levels of energy efficiency.

Communal heating and heat networks

Communal heating can be a viable low carbon solution in some circumstances. However, heat losses through distribution pipework can reduce overall efficiencies substantially and can lead to unwanted overheating. We therefore recommend distribution networks flow at ambient temperatures and buildings and units have local heat pumps to raise the temperature.

Heat networks similarly suffer large distribution losses. For energy efficient buildings with low heat demands this represents an untenable proportion of heat being wasted. This, together with complexities in operation and large amounts of infrastructure, mean we do not recommend using them for new buildings.

Hydrogen is not likely to play a large role in the heating of homes

The growing consensus is that hydrogen is unlikely to play a significant role in the short to medium term (if at all) for this purpose.

The Climate Change Committee foresees a limited role where 'electrification reaches the limits of feasibility and cost-effectiveness'.

Hydrogen is currently produced via four methods, three of which require a fossil fuel feedstock to create 'blue hydrogen'. With inherently high emissions these methods are subsequently reliant on unproven carbon capture and storage (CCS) technologies. Sustainable 'green hydrogen' is currently not able to be produced in the quantities required.

Carbon offsetting should be reserved for the hardest to treat sectors

Natural, land-based carbon sequestration is limited, and should be reserved for the hardest to treat sectors. Carbon capture and storage is an unproven technology that should not be relied upon to deliver carbon reductions.

Carbon offset funds, where developers pay money into a fund in lieu of meeting carbon reduction targets on-site, should only be used where it is not technically possible to achieve the requisite reductions – typically this will be in high density situations where there is not enough roof space to install sufficient renewable energy technology. Clear rules on how monies are spent should be drawn up. Our recommendation is that these are not used on energy efficiency measures in existing stock (typically difficult to administer, spend and guarantee carbon savings) but for investing in shortfall of renewable energy production elsewhere.

*Net Zero Carbon Toolkit, Cotswold, West Oxfordshire and Forest of Dean District Councils.

Glossary

Air Source Heat Pumps (ASHP) – an electric heating system that gathers ambient heat from surroundings to efficiently heat a dwelling.

Air-tightness – A measure of how much air naturally leaks out of or into a building, through gaps around doors, windows, keyholes etc. Usually measured in $m^3/m^2/hr$ @ 50Pa.

Building fabric – a term used to describe collectively the walls, roof, floor, windows and doors of a building.

Carbon budgets – a term used to state remaining carbon emissions, or share of carbon emissions, that can be emitted before the amount of cumulative emissions exceeds that aligned with a given atmospheric temperature change.

Carbon footprint – the amount of carbon emitted by a person or organisation in a given timeframe.

Carbon offsets – a way of balancing emissions in one area by reducing emissions in another or by sequestration of carbon*.

Climate resilience – enabling a building, dwelling, geographical area or organisation to adapt to the changing climate.

CO_2 – carbon dioxide, a greenhouse gas.

Coefficient of Performance (CoP) - a measure of efficiency usually used when describing heat pumps. The CoP is the amount of useful heat (or coolth) produces from every kilowatt of electricity used. E.g. a heat pump with a CoP of 3 produces 3 kW heat for every 1 kW of electricity it uses.

Communal heating system – a multi dwelling heating system.

Energy efficiency – the relative amount of energy a building or system uses to achieve a certain aim (e.g. maintain a specific internal temperature)

Fabric Efficiency – a measure of how effective a building's fabric is at retaining heat or staying cool.

Greenhouse gas – a gas that retains heat in the atmosphere, e.g. carbon dioxide (CO_2) and methane (CH_4).

ktCO_2 – kiloton of CO_2, a measure of the amount of carbon dioxide emitted or offset.

kWh – kilowatt hour, a measure of the amount of energy used or generated in one hour.

Leaky building – A building with a low level of air-tightness.

Mechanical Ventilation with Heat Recovery (MVHR) – a form of building ventilation that recovers heat from stale air before it is vented outside the building and uses it to warm incoming fresh air.

Net Zero Carbon – where the amount greenhouse gases emitted by an organisation are equivalent to the emissions either: i) sequestered or offset , ii) displaced by production of renewable energy.

Renewable energy – energy from a renewable source e.g. wind or solar.

Space heating demand (SHD) – the amount of heat energy required to heat a space. SHD is a reflection of building fabric efficiency and is usually expressed in $kWh/m^2/yr$.

***Sequestration** – the storing of carbon in land based assets.

Solar photovoltaic (PV) – a form of renewable electricity generation from solar energy well suited to buildings and urban environments. Can be stated in installed capacity (kW), annual generation (kWh/yr) or annual generation per m^2 of building footprint ($kWh/m^2/yr$)

Waste Water Heat Recovery (WWHR) – A proprietary system fitted to the outlets from sinks, showers and baths, which collects heat from the waste water and transfers it to the cold water feeding a hot water store.

Whole House Retrofit – where a building is retrofitted for energy efficiency in an holistic manner, and many different fabric elements and systems are considered at once.