Shared Prosperity Fund (SPF) 2022-2025

Net zero construction guide for Good Growth projects

Introduction

Cornwall Council declared a Climate Emergency in 2019 and established the ambitious target of a carbon neutral Cornwall by 2030. We need all of our communities to transition to become net zero without delay, which means reducing net greenhouse gas emissions by at least 100% compared to 1990 levels. In the UK, 49% of annual carbon emissions are attributable to buildings. We must intensify our efforts and eliminate virtually all emissions arising from heating, cooling and energy use in our buildings. It is imperative that the Cornwall and Isles Shared Prosperity Fund programme contributes to decarbonising the built environment through both improving existing buildings and ensuring that new capital works are fit for a net zero future. This can be achieved most efficiently by constructing buildings that conform to net zero standards, but this is not always possible and even making small changes that work towards environmental goals can be of significant value.

Moreover aside from environmental goals, lower carbon buildings are much cheaper to run, thereby occupants are less exposed to energy price changes. They are also dryer, more comfortable and are healthier spaces for occupants. Consequently, regulations will become more stringent over time, early compliance to low or carbon zero standards is the most rational choice in terms of efficiency, longevity, and comfort.

The purpose of this guide is to persuade and inform through outlining all of the key topic areas for sustainable construction and to supply credible information sources. This guide is aimed at Recipients but also at contracted professionals such as architects.

Good Growth Principles

- C1 Reduction in C02 emissions
- C2 Circularity - reduction in use of virgin raw materials. Recycle reuse principles
- G1 Nature recovery

Good Growth Fund recipients with projects involving built structures should embed these principles into the construction or renovation process. Environmental and resource saving enhancements should aim to be above the legal baselines. The following sections outline the topic areas which should be considered to ensure sustainable capital works.

Meeting your Good Growth Contractual Clauses

There are specific clauses that must be met as set out in your contract such as creating a Circular Economy Statement and Carbon Reduction Plan. Full details all clauses and obligations can be found here.

C1 Reduction in C02 emissions

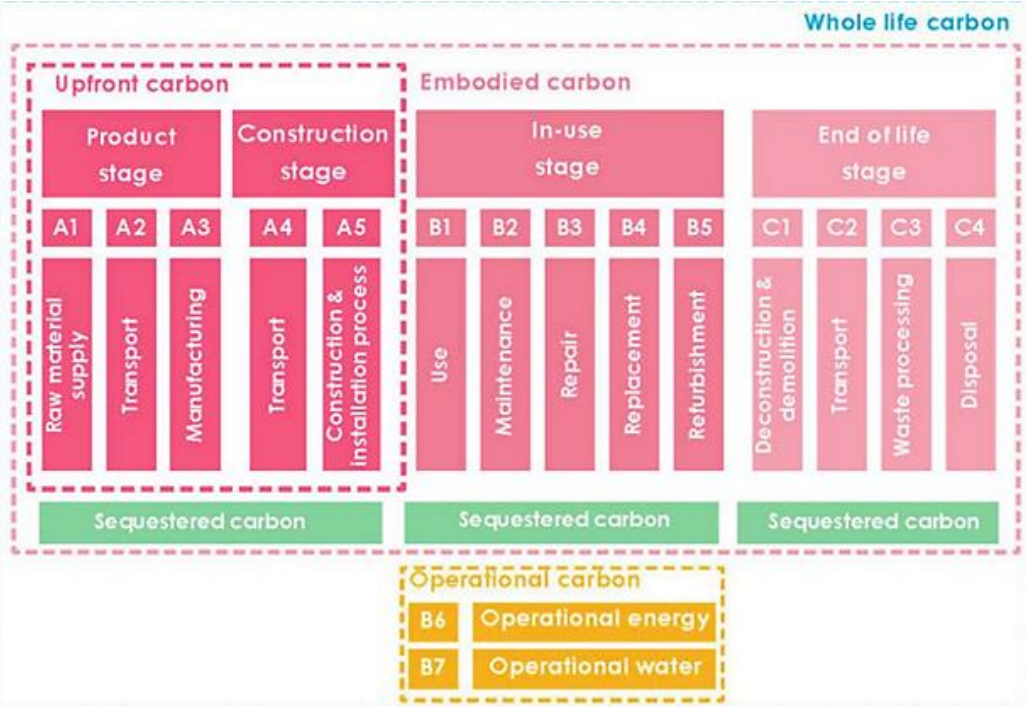
This section will discuss the key steps that can be taken to reduce the whole life greenhouse gas emissions of built structures, both in terms of the initial construction or retrofit as well as the day-to-day operations.

When considering the carbon impact of development, it is important to consider not just the carbon emissions associated with energy use, but to also take a holistic view of the building's entire lifetime carbon footprint, from construction to demolition:

Whole life carbon = Operational carbon + Embodied carbon

Whole life carbon analysis

Whole life carbon assessment (WLC, or Life Cycle Assessment) is the most comprehensive way to assess, measure and ultimately reduce a building's entire lifetime carbon footprint. WLC encompasses operational carbon emissions (day-to-day resource use such as heating, cooking ext.) in addition to the embodied carbon emissions, which result from the materials used and the construction/dismantling process itself. Please see below for a full explanation of operational and embodied carbon.



-Source: Low Energy Transformation Initiative, Whole Life Carbon One-pager

A key strength of using a WLC is that it enables a balance to be struck between the in-use or operational emmissions against the embodied or fabric emmissions. This is important because by prioritising embodied or operational carbon whilst neglecting the other, there may be unintended consequences where for example over-sophisticated systems save less carbon than they embody.

Operational carbon

Operational carbon describes the emissions associated with the operation and maintenance of a built asset including heating, hot water, cooling, ventilation, lighting systems, cooking, equipment, and lifts. A building that meets net zero operational carbon does not burn fossil fuels, is 100% powered by renewable energy, and achieves a very high level of energy performance. To achieve this the development will have maximised fabric performance and energy efficiency, as well as installing renewal heat and/or power technologies. There are also significant cost savings involved in reducing resource use.

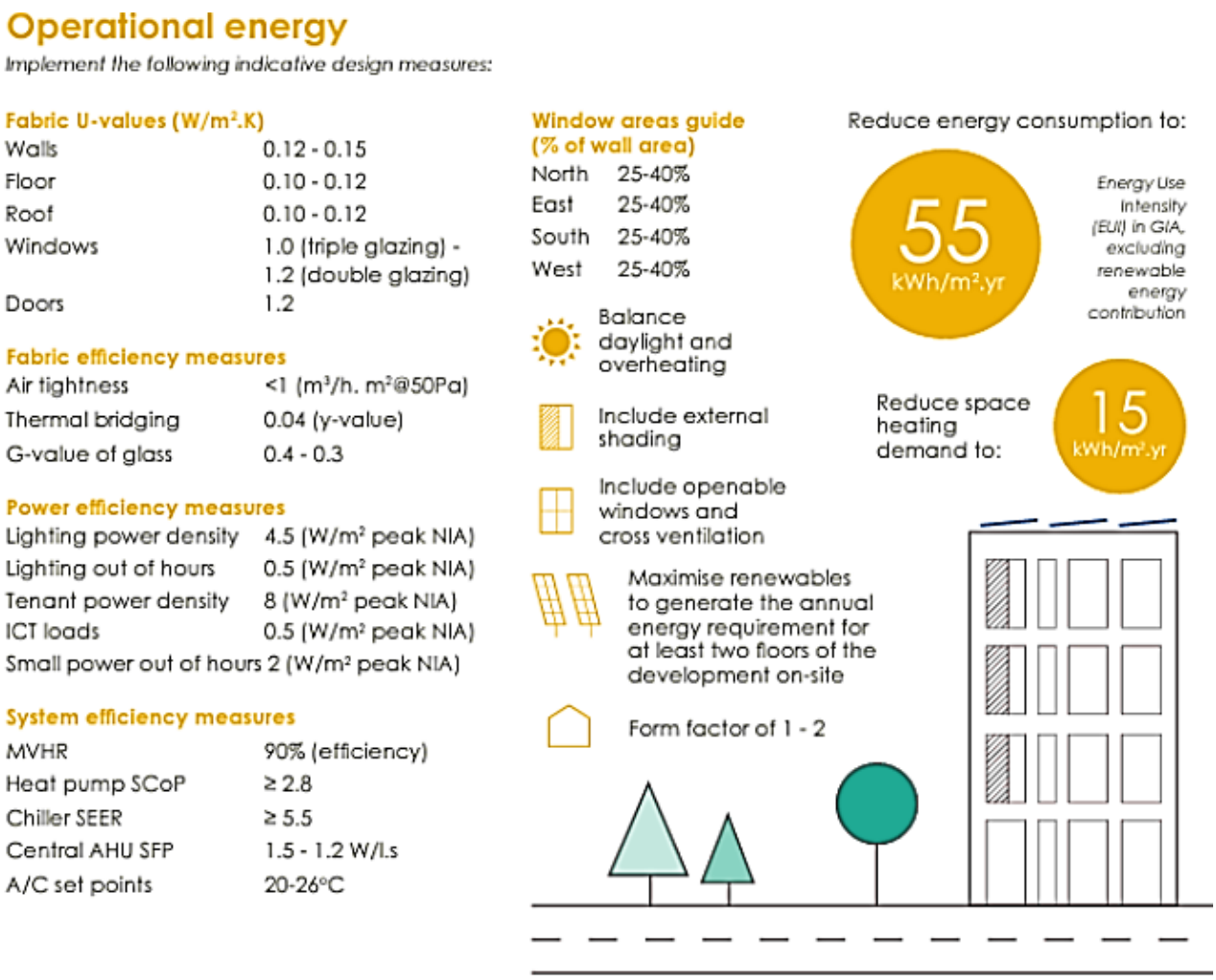
A Fabric First approach

The building 'fabric' is made up of the materials that make up walls, floors, roofs, windows and doors. A 'fabric first' approach to building design involves maximising the performance of the fabric itself, before considering such things as heating, energy or controls. Focusing on the building fabric is more sustainable than relying on energy saving products, or renewable technologies, as designing a building to use as little as possible at the outset is more efficient than retrospectively minimising

resource use. This approach can optimise energy efficiency and reduce carbon emissions, thereby decreasing ongoing operational and maintenance costs.

In order to minimise resource use and greenhouse gas emissions, both operational and embodied carbon emissions must be minimised. The graphics below, reassembled from London Energy Transformation Initiative's Climate Emergency Design Guide, an excellent resource, outlines a detailed picture of the indicative design measures which could be taken to minimise resource use.

This graphic is just to show some of the design considerations your project's architect and construction contractors may explore.



-Source: Graphics reassembled from London Energy Transformation Initiative: Climate Emergency Design Guide;

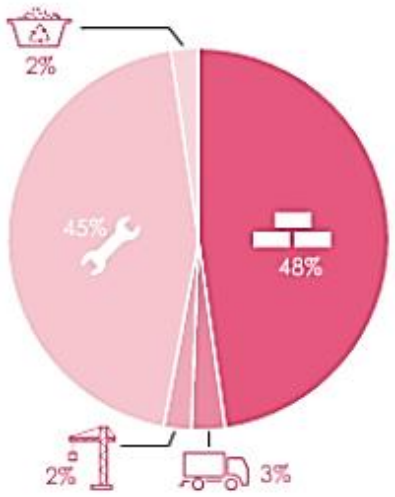
Embodied carbon

Embodied carbon is the total greenhouse gas (GHG) emissions generated to produce a building. This includes emissions caused by material sourcing, fabrication of components, transport, construction, maintenance, repair and replacement, demolition, dismantling and disposal. It is the energy that is embodied in the materials that are used. It excludes operational carbon emmissions.
As initial construction is incredibly resource intensive, the retrofit or reuse of an existing building and thereby getting more use out of an existing structure and materials already on site is typically the lowest carbon option.

Embodied carbon

Focus on reducing embodied carbon for the largest uses:

- Products/materials (A1-A3)
- Transport (A4)
- Construction (A5)
- Maintenance and replacements (B1-B5)
- End of life disposal (C1-C4)



Average split of embodied carbon per building element:

- **48%** - Superstructure
- **17%** - Substructure
- **16%** - Façade
- **15%** - MEP
- **4%** - Internal finishes

Reduce embodied carbon by 40% or to:

<600 $kgCO_2/m^2$

Area in GIA

Heating and hot water

Implement the following measures:

Fuel
Ensure heating and hot water generation is fossil fuel free

Heat
The average carbon content of heat supplied (gCO_2/kWh.yr) should be reported in-use

Heating
Maximum 10 W/m² peak heat loss (including ventilation)

Connect to community wide ambient loop heat-sharing network to allow excess heat from cooling to be made available to other buildings

Hot water
Maximum dead leg of 1 litre for hot water pipework

'Green' Euro Water Label should be used for hot water outlets (e.g.: certified 6 L/min shower head – not using flow restrictors).

Demand response

Implement the following measures to smooth energy demand and consumption:

Peak reduction
Reduce heating and hot water peak energy demand

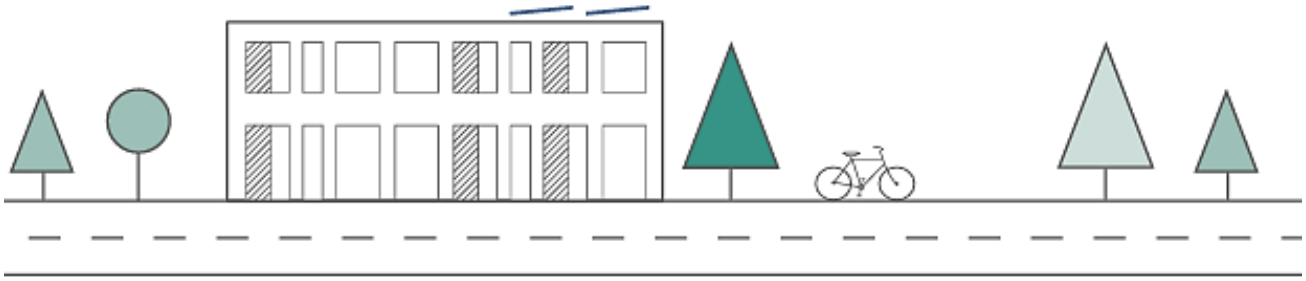
Active demand response measures
Install heating and cooling set point control

Reduce lighting, ventilation and small power energy consumption

Electricity generation and storage
Consider battery storage

Electric vehicle (EV) charging
Electric vehicle turn down
Reverse charging EV technology

Behaviour change
Incentives to reduce power consumption and peak grid constraints
Encourage responsible occupancy.



-Source: Graphics reassembled from London Energy Transformation Initiative: Climate Emergency Design Guide;

This graphic is just to show some of the design considerations your project's architect and construction contractors may explore.

Net zero design principles

In addition to considerations of the above, the Royal Institute of British Architects has recommended the following principles for the design and retrofit of net zero and low carbon buildings Sustainable Outcomes Guide:

1. **Passive First**

Use form, fabric and landscape to optimise ambient lighting, heating, cooling and ventilation

- Location, orientation, massing, protection and shading
- Windows, daylighting, ventilation, solar and acoustic control
- Insulation, airtightness and thermal mass

2. **Fine-tune, with gentle engineering**

Use efficient and well-integrated mechanical and electrical systems and user-friendly controls

- Lighting systems, with effective;
- Ventilation systems, both natural and mechanical
- Heating, cooling heat storage and heat recovery systems
- Responsive system and room controls, with good user interfaces

3. **Incorporate on-site renewables**

Use low and zero carbon technologies to minimise energy purchases and carbon emissions. Consider:

- Building Integrated photovoltaic and solar hot water panels
- Ground, water and air source heat pumps and opportunities for heat recovery
- Heat and electricity storage, to improve load management and demands on mains supplies
- Local opportunities for wind and water power and for community systems

Key information sources

- UK Green Building Council: Resource use and the built environment, including circular economy principles and a wealth of other useful resources.
- RIBA: Sustainable Outcomes Guide
- RICS: Whole life carbon assessment for the built environment
- HM Cabinet Office: The Construction Playbook
- London Energy Transformation Initiative: Climate Emergency Design Guide;
- London Energy Transformation Initiative: Defining and Aligning: Whole Life Carbon & Embodied Carbon

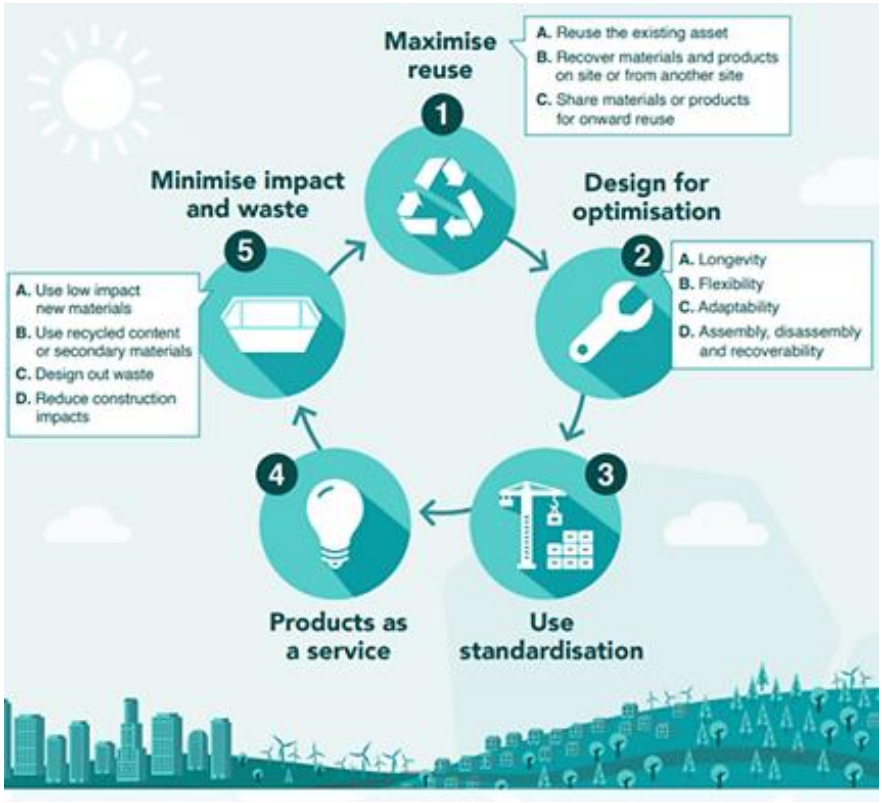
Examples of *certified* approaches to sustainable buildings that Good Growth recipients could consider using:

- Passivhaus standards are a fabric first building standard that exceed current national and local standards, certified by the Passivhaus Trust. Passivhaus adopts a whole-building approach with measured targets, focused on high-quality construction, certified through a quality assurance process. Standards exist for new build (Passivhaus) and retrofit (EnerPHit).

- CarbonLite standards, developed by the AECB are designed to deliver environmentally responsible building practices and the creation of sustainable low energy, low carbon buildings. They work with Passivhaus standards but also cover whole life carbon. CarbonLite have certified standards for New Build and Retrofit.
- BREEAM standards, developed by the BRE Trust offer sustainable building standards for new build and retrofit for many different types of development.

C2 Circularity - reduction in use of virgin raw materials. Recycle reuse principles

'In our current economy, we take materials from the Earth, make products from them, and eventually throw them away as waste – the process is linear. In a circular economy, by contrast, we stop waste being produced in the first place.'



. -Source: UK Green Building Council, Circular Economy Metrics Paper

The circular economy is based on three principles, driven by design:

- Eliminate waste and pollution: Currently, our economy takes raw materials from the Earth, we make products, and eventually we discard them as waste, the end point often being landfills or incinerators. This system cannot work in the long term because our planetary resources are finite. In terms of construction, we need to design how the materials can re-enter the economy at the end of their use
- Circulate products and materials (at their highest value): Building on the above principle, this means designing products so they can be useful at every stage of their life. Thereby products should be kept in use for as long as possible, and then if unavoidable, reused, repaired, remanufactured, and recycled or composted.

- Regenerate nature: By moving to a circular economy, we minimise the amount of land and resources we need and maximise space for nature to thrive.

RIBA's Built for the Environment report shows that 40% of global greenhouse gas emissions are attributable to buildings and construction, consuming about 50% of all raw materials worldwide in the process. In addition, over 50,000 buildings are demolished each year across the UK, many of which could have been repurposed. The circular economy offers ways to reduce these unsustainable figures, seeking to eliminating waste by reusing buildings and their material components wherever possible.

Key information sources

- UK Green Building Council circular economy guidance
- London Assembly: Circular Economy Statement Guidance
- Buildings As Material Banks: Materials Passports
- Architects Climate Action Network: Circular Series
- University of Sheffield: Regenerate - a circular economy engagement tool

G1 Nature recovery

Constructing or renovating a built structure will always have an impact directly or indirectly on the natural environment, but there are ways to enhance the surrounding area and support nature recovery. Many of these measures are easy and low cost but can make a tangible difference:

- Protect and create natural functioning habitats to generate biodiversity gain
- Provide wildlife corridors (green and blue) to allow wildlife movements
- Blurred boundary design to patchwork habitats
- Installing creature features e.g., bird or bat boxes, insect hotels or bee bricks
- Creating wildflower meadows
- Creating a wildlife pond
- Nature-friendly lighting
- Pollinator-friendly mowing regimes
- Appropriate tree planting
- Stopping the use of artificial pesticides and/or wider land-management improvements.

The best way to make a difference for nature locally is to understand what's already in your local environment and what can be done to enhance the local ecosystem. The Cornwall and Isles of Scilly Local Nature Partnership has devised a step by step guide for exactly this purpose.

Key information sources

- Cornwall and Isles of Scilly Local Nature Partnership: Nature recovery toolkit
- Carbon Neutral Cornwall 2030 Hive: Together We Can Toolkit
- UK Green Building Council: Biodiversity net gain factsheets