Policy Title:
LP25 - Embodied Carbon

Existing Policies Which adopted Core Strategy or Policies Sites and Places (PSP) policy would eventually be replaced	**N/A - New Policy**
Non-Strategic / Strategic	**Non-Strategic**

Purpose

This policy concerns embodied carbon emissions in new residential and non-residential buildings. Embodied carbon refers to the emissions of carbon dioxide, and other greenhouse gases, produced by the extraction, processing, manufacture and transport of materials used in a building, and emissions from the energy and water used in its production, assembly, construction, and demolition. It also includes any emissions from leakage of the refrigerants used in building services systems, where the refrigerant is a greenhouse gas.

The UK Government has committed to achieving 'net zero' emissions by 2050. This requires a 100% reduction in emissions (from 1990 levels), and any emissions that cannot be eliminated, to be offset by activities that remove an equivalent amount of greenhouse gases from the atmosphere. For buildings 'net zero' includes the emissions from operational energy use (energy used for heating, cooling, lighting, services and appliances), and the embodied carbon emissions. Together, these make up the 'whole life carbon' emissions of a building. As emissions from operational energy use in new buildings reduce, due to higher efficiency standards and renewable heating, embodied carbon emissions make-up a larger proportion of whole life carbon emissions. For this reason, South Gloucestershire Council is introducing polices on operational energy use and emissions, and this policy on embodied carbon emissions.

Embodied carbon emissions will be different for each building and will depend on the embodied carbon of each kilogram of material specified, and the total quantity of that material in the final building. The embodied carbon of a new building can be reduced by selecting materials which have low embodied carbon and by reducing the quantity of materials with high embodied carbon. Where existing buildings are being demolished and replaced, the embodied carbon of the new building will be reduced if materials from the old building can be reclaimed and reused, so this policy is designed to encourage the reuse and recycling of materials, as well as the efficient use of resources. Reducing embodied carbon has also been shown to be mutually compatible with reducing operational energy demand; for example, more energy-efficient buildings will require less extensive heating and cooling systems which are in turn less carbon intensive to produce.

The policy sets targets for embodied carbon in new residential and non-residential buildings. To allow for different sizes of buildings, targets are expressed per square meter of floor area. The need for stronger construction, and therefore higher embodied carbon, in taller buildings is also allowed for in the targets. Developers are required to calculate the embodied carbon emissions of a residential or non-residential building using a nationally recognised assessment methodology. Emissions of greenhouse gases other than carbon dioxide are converted into carbon dioxide equivalent emissions (CO_{2e}) to allow a single target to be set for each development type. In seeking to reduce embodied carbon emissions, developers should ensure that this will not have a detrimental impact on adaptation to changes in the local climate and resilience to overheating over the lifetime of new buildings.

Policy wording

Embodied carbon – general principles

1. **All proposals will be expected to show how development will minimise its embodied carbon.**
2. **In doing so, development should:**
    a. **Prioritise the renovation or retrofit of existing structures, as part of an efficient use of land, subject to technical feasibility, compatibility with the other policies in the local plan, in particular resilience to overheating, and any relevant neighbourhood plans;**
    b. **Minimise the quantity of materials required to meet the building's functional requirements;**
    c. **Select high quality materials and systems which:**
    d. **Have low embodied carbon, and;**
    e. **Minimise the need for replacement over the lifetime of the development, and;**
    f. **Can be reused, recycled and disposed of sustainably at end of life, and**

g. **Ensure that waste reduction is designed-in from project inception to completion, including consideration of the use of standardised components, modular build, and reuse of secondary products and materials;**

h. **Ensure that new buildings are flexible and adaptable to future uses, reducing the need for future redevelopment.**

3. **All proposals should set out how these issues will be addressed in the Energy and Sustainability Statement, with major applications required to provide additional information and calculations as set out below.**

Embodied carbon – major applications

4. **Proposals for major development will be required to include an Embodied Carbon Assessment, submitted as part of the Energy and Sustainability Statement. The assessment should use a nationally recognised embodied carbon assessment methodology, and demonstrate actions taken to reduce whole life-cycle embodied carbon emissions.**

5. **Major new development will be expected to achieve the following targets as a minimum:**

   a. **Upfront embodied carbon (construction phase),**

      i. **Residential (4 storeys or fewer) - <400 $kgCO_{2e}/m^2$**

      ii. **Residential (5 storeys or greater) - <500 $kgCO_{2e}/m^2$**

      iii. **Major non-residential schemes - <600 $kgCO_{2e}/m^2$**

   b. **Whole life-cycle embodied carbon:**

      i. **Residential (4 storeys or fewer) - <625 $kgCO_{2e}/m^2$**

      ii. **Residential (5 storeys or greater) - <800 $kgCO_{2e}/m^2$**

      iii. **Major non-residential schemes - <970 $kgCO_{2e}/m^2$**

6. **Where it is not viable to meet these targets for embodied carbon, a full justification will be required as part of the Embodied Carbon Assessment within the Energy and Sustainability Statement.**

7. **Any shortfall against the embodied carbon targets will be offset through a financial contribution towards South Gloucestershire Council's carbon offset fund.**

8. **The value of a tonne of CO_{2e} is tied to the 'high' scenario in the Valuation of Energy Use and Greenhouse Gas supplementary guidance to the Treasury's Green Book (£373 at the time of publication), and will be updated accordingly.**

Refrigerants

9. **In all new development with fixed building services that include a refrigerant, the global warming potential (GWP) of the refrigerants should be minimised, by designing systems to have the lowest possible refrigerant mass/charge and specifying appliances (including heat pumps, VRFs, VRVs and chillers) that use refrigerants with the lowest global warming potential available, and implementing measures to minimise the risk of refrigerant leakage, and to detect refrigerant leakage.**
10. **Refrigerants and their associated impacts should be included and accounted for within the embodied carbon assessment conducted by the developer using an approved methodology as set out in the guidance.**

Materials

11. **The materials used in development should use and manage resources as efficiently as possible. As well as having low embodied carbon within the materials, the wider environmental impacts arising from their sourcing, manufacture, construction, and end of life demolition and disposal must be considered within the Energy and Sustainability Statement.**
12. **Development should avoid the use of tropical hardwoods, unless these are reclaimed, reused or recycled, and if virgin tropical hardwoods are specified, provide full justification showing that there are no feasible alternatives.**

Demolitions, waste and recycling

13. **Development proposals should seek to minimise and design-out construction and end-of-life waste, ensuring that waste reduction is planned in from project inception to completion, including consideration of standardised components, modular build, designing for deconstruction, and reuse of secondary products and materials. Where waste is generated, reuse and recycling should be maximised.**
14. **Where development proposals include demolition, this should aim to maximise the amount of material recovered for reuse and recycling, either on-site or at another site (either directly or via broker). Demolition materials should be recovered at their highest value possible.**
15. **Major proposals should submit a site waste management plan as part of their Energy and Sustainability Statement.**

Supporting text

Embodied Carbon

1. Embodied carbon refers to the emissions of carbon dioxide, and other greenhouse gases, produced by the extraction, processing, manufacture and transport of materials used in a building, and emissions from the energy and water used in its production, assembly, construction, and deconstruction and demolition. It also includes any emissions from leakage of refrigerants in building services systems, where the refrigerant is a greenhouse gas.
2. It is important that measures to reduce embodied carbon emissions are considered and implemented alongside other polices on climate mitigation and adaptation and operational energy. If these policies are not considered together there is a risk that buildings become more vulnerable to overheating (for example through the selection of materials with a lower thermal mass combined with a reduction in air permeability) and that demand for active cooling will increase, which will in-turn lead to higher operational energy demand, energy running costs and lifetime emissions.

Embodied carbon – general principles

3. This policy is intended to reduce the embodied carbon in new buildings and to encourage the reuse and recycling of materials, as well as the efficient use of resources.
4. Emissions are produced at all stages of the development process with the majority of embodied carbon emissions being 'upfront', meaning that they are produced at the beginning of the development cycle. Embodied carbon emissions will be different for each building and will depend on the embodied carbon of each kilogram of material specified, and the total quantity of that material used to construct the building. Embodied carbon can be reduced by selecting materials which have low embodied carbon and by reducing the quantity of materials with high embodied carbon, and by combining these approaches.

Embodied carbon assessments

5. Embodied carbon assessments should be undertake using a council approved methodology, which is proven to accurately assess embodied carbon and should demonstrate actions taken to reduce life-cycle carbon emissions.
6. Currently, our preferred methodology is the RICS Professional Statement Whole Life Carbon Assessment for the Built Environment. Any changes to this will be detailed in supporting guidance.
7. The scope should include the substructure, superstructure, finishes, fixed furniture, fixtures and equipment, building services and associated refrigerant leakage.
8. The following life-cycle stages as defined in BS EN 15978 Sustainability of Construction Works should be included within the assessment and reported on separately and in aggregate:
    a. A1-A5
    b. B1-B5

c. C1-C4

9. The upfront embodied carbon targets refer to life-cycle stages A1-A5 and the whole life-cycle embodied carbon target refer to life-cycle stages A1-A5; B1-B5; and C1-C4.
10. The assessments will be expected to address a minimum of 95% of the cost associated with each of the following elements:
    a. Demolition.
    b. Substructure.
    c. Superstructure.
    d. Internal finishes.
    e. Fixed furniture, fixtures and equipment.
    f. Building services.
11. The carbon assessment targets do not include external works outside the building footprint.
12. Where the embodied carbon assessment indicates that it is not feasible to meet the targets in this policy, full justification will be required, and assessments will be evaluated for technical quality and to determine whether appropriate actions have been taken to reduce embodied carbon throughout the project's development. Any change to this will be detailed in guidance issued by the council.

Carbon offset fund

13. For use of the offset mechanism to be permissible, the applicant will be expected to justify and demonstrate to the satisfaction of the planning authority that it is not possible to achieve the embodied carbon targets.
14. The council's carbon offset fund will be spent on built environment carbon reduction projects. Details of the fund and the cost per tonne of carbon, which will be index linked, will be provided on the council's website.

Refrigerants

15. Many refrigerants used in fixed building services like heating and cooling systems are potent greenhouse gases with the potential to make significant contributions to global warming if released to the atmosphere. As appliances using refrigerants such as heat pumps become more common in new and existing buildings it is important to consider the climate impact of the refrigerants they use.
16. For reference, many of the refrigerants commonly used in heat pumps and chillers have a global warming potential (GWP) many times higher than CO_2. For example, R32 has a global warming potential 675 times that of CO_2 and R410A is a greenhouse gas 2,088 times more potent than CO_2. This means that releasing 1kg of R32 into the atmosphere is equivalent to releasing 675kg of CO_2, and releasing a kilogram of R410A is equivalent to releasing over 2 tonnes of CO_2.

17. The global warming impact of refrigerants should be minimised by:
    a. Minimising the mass of refrigerants used in a development by:
        i. Reducing or eliminating the need for heating or cooling systems through energy efficient design.
        ii. Avoiding the use of systems that have high refrigerant charge per kW capacity, such as systems that use refrigerant as the distribution medium to emitters.
    b. Minimising the potential impact of the refrigerant used by selecting equipment that uses refrigerants with the lowest available global warming potential.
    c. Minimising the risk of refrigerant leakage through:
        i. Avoiding the use of systems that use refrigerant as a distribution medium, particularly where refrigerant is distributed to emitters.
        ii. Specifying leak detection and monitoring systems in accordance with industry best practice.
        iii. Regular maintenance.
        iv. Ensuring that installation, maintenance, decommissioning and disposal of all appliances using refrigerants is only ever undertaken by suitably qualified persons.
18. In major developments where heat pumps of any type (including VRF and VRV units) are proposed, the global warming impact from refrigerant leakage should be included within the embodied carbon calculation using an approved methodology (please refer to detailed technical guidance for approved methodologies).
19. Where heat pump systems use refrigerants that have a global warming potential (GWP) of 750 or greater are specified, full justification will be required including numerical whole-life carbon modelling, comparing their use to low global warming potential refrigerants.

Tropical hardwoods

20. Tropical forests have an essential role to play in providing eco-system services, biodiversity and climate change mitigation and adaptation. However, they are vulnerable to deforestation, degradation and the direct impacts of changes in the local, native climate as a consequence of global heating.
21. Research has found that even ‘sustainable harvesting’ of timber can lead to the degradation of forest ecosystems. For these reasons developers should not specify any tropical hardwoods in new development, unless these are shown to be reclaimed, reused or recycled.

Demolitions, waste and recycling

22. Ensuring that materials are reused and recycled whenever possible, and that waste is minimised at all stages of development, including the final end-of-life stage, is an important consideration in reducing the embodied carbon and other environmental impacts of new development.

23. Construction stage waste should be considered as part of the Construction Environmental Management Plan (CEMP) for the site, which should set out how materials can be reused and recycled as much as possible.

24. Though, it is not possible to control how a building will be dismantled, demolished and disposed of until it reaches the end of its life, in specifying and designing new buildings, developers should consider how to minimise the use of materials that cannot be easily reused and recycled, and materials which may toxic and difficult to dispose safely.

Additions	
Key evidence	
Other relevant policies to cross-reference?	