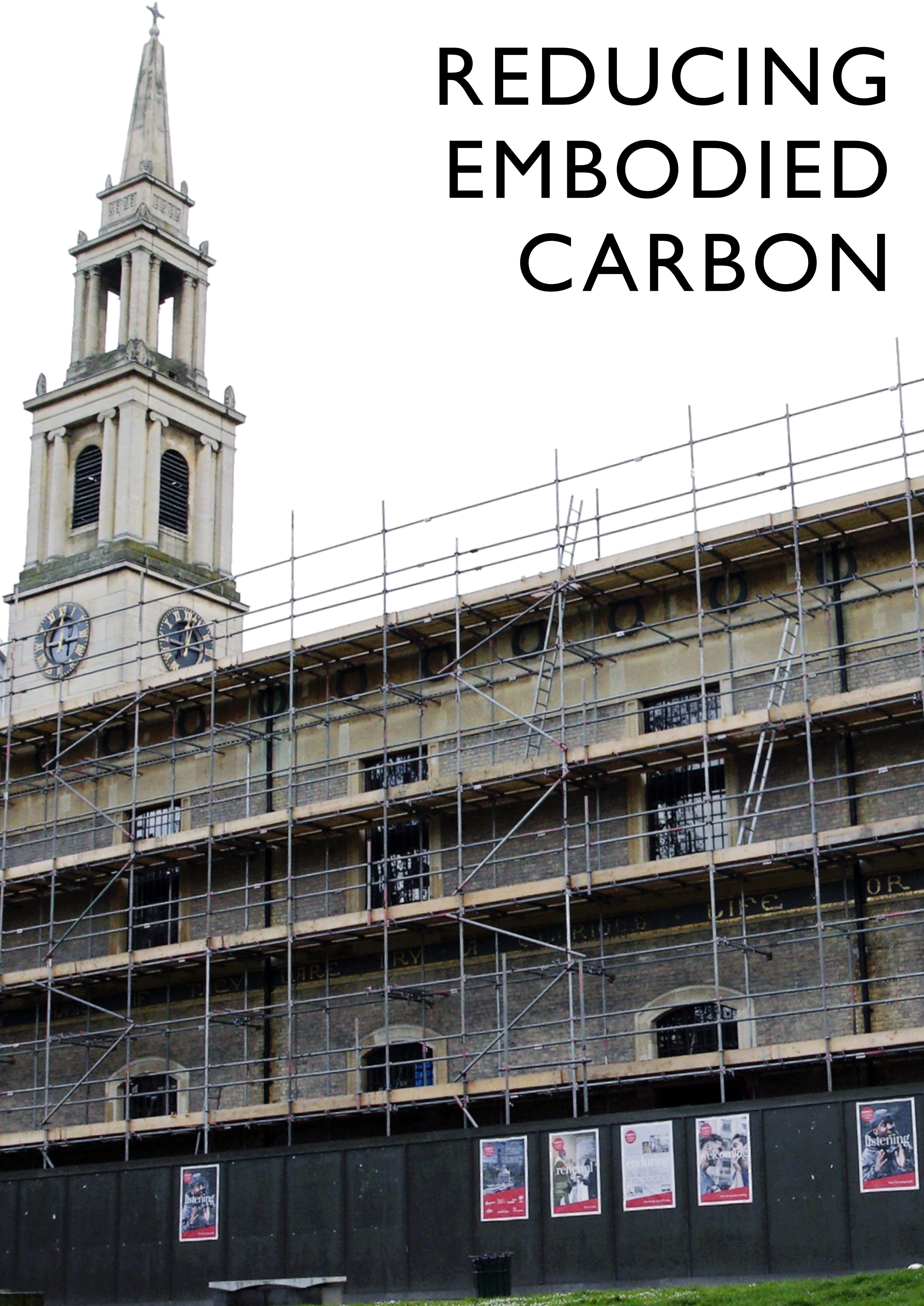
REDUCING EMBODIED CARBON




Our Father
Amen
Amen

REDUCING EMBODIED CARBON

A GUIDE TO REDUCING THE EMBODIED CARBON OF CHURCH BUILDING PROJECTS

CHURCH BUILDINGS COUNCIL
2023

Cover: **Waterloo, St John the Evangelist (Diocese of Southwark)**
Opposite: **St Andrew-by-the-Wardrobe (Diocese of London)**

Imprint

Corrections or queries should be brought to the attention of the Church Buildings Council's secretariat

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INTRODUCTION

This guide introduces the topic of embodied carbon, and recommends good practice for lowering embodied carbon for projects in church buildings. The aim is to help PCCs to learn about embodied carbon, be able to think through ways to reduce embodied carbon, and be equipped to ask architects and professionals to help reduce embodied carbon in projects. This contributes to reducing the environmental impacts of the Church of England's buildings.

The guidance is divided into three main sections:

- Introduction to embodied carbon, and key principles for its reduction
- Useful rules of thumb for reducing embodied carbon
- Further guidance for large scale projects

1a What kind of project is this guidance applicable to?

There are some projects with minimal material changes. The embodied carbon impact of these will be small, and may not need major consideration, but the rules of thumb might be helpful for thinking about environmentally friendly sourcing of products and waste disposal.

The earlier sections of the guidance are relevant to small scale projects where it is not typically feasible to commission a specialist to assess the carbon impact. Example projects are: a major kitchen renovation, introducing toilet facilities, reordering part of the church, or a replacement lighting scheme. The guidance aims to help PCCs think through embodied carbon reduction.

This latter part of the guidance is relevant to larger scale projects, such as a major reordering, an extension, or full building renovation, where professionals are involved. This guidance can be shown to an architect or the design team to help consider embodied carbon reduction throughout the project.

Opposite: **Chedworth, St Andrew (Diocese of Gloucester)**

1b Introduction to embodied carbon

What are carbon emissions?

Greenhouse gas (GHG) emissions generated by human activity, such as the burning of fossil fuels, contribute to climate change. Most of these GHG emissions come from carbon dioxide (CO_2) but there are five other gases that contribute to climate change and each GHG has a different warming effect on the Earth's atmosphere. Each is converted into its equivalent CO_2 warming effect and presented as a total (CO_2e). These primary drivers of climate change need to be reduced in order to avoid the worst impacts.

There are both embodied carbon and operational carbon emissions emitted across the life cycle of a building.

What is embodied carbon and how is it different from operational carbon?

Embodied carbon often gets overlooked, but it is emitted throughout supply chains. For example, when we think of the impact of using a car, we think of the fuel consumed when driving. However, there is an impact associated with the manufacturing of the car itself, such as the energy to make the metals, plastics, rubber tyres, and the many other parts of the vehicle. Fuels are consumed around the world to extract materials from the earth, process them and turn them into products. The resulting emissions contribute to the embodied carbon of these products.

In the construction or modification of buildings, large amounts of materials are used, and the production and disposal of all these materials and products results in the release of carbon emissions. This includes the emissions from extracting raw materials from the earth, processing them into a product, delivering and installing that product on site, maintaining it during its lifespan and sending it for disposal at the end of its life. This is embodied carbon.

It is important to be aware that replacing a product such as carpets, kitchens or windows also contributes to the embodied carbon impact of a building.

There are additional carbon emissions from the use of the building. In the building sector, this includes the carbon emissions to heat a building or power the electricity for lights and sockets. This is the operational carbon of a building.

The General Synod has set a target for the Church of England to be net zero by 2030. This target currently includes only the operational carbon impact of the Church of England's work. Embodied carbon will come into scope after 2030, by which time we expect tools will have been developed to measure it in a practical way. However, churches are still very much encouraged to act now where they can, to reduce the impact of their building projects. While embodied carbon is currently outside of the scope of the Church of England's Net Zero Carbon targets, parishes can still make valuable carbon reductions in the way they implement projects, which supports the 5th mark of mission, to care for creation.

Above: **Embodied carbon and the life cycle of a building. Source: Circular Ecology.**

Why is embodied carbon important?

The UK Green Building Council (UKGBC) estimates that embodied carbon from new construction and refurbishment of buildings makes up approximately 19% of built environment emissions. But as operational carbon emissions for buildings are reduced, embodied carbon will become an increasing proportion of the total. The UKGBC's trajectory results indicate that by 2035, embodied carbon will form over half of all built environment emissions (UKGBC Net Zero Whole Life Carbon Roadmap).

Whilst the embodied carbon of already constructed buildings cannot be reduced, it is possible to reduce the embodied carbon during the inevitable processes of retrofitting, renovating and maintaining them.

Evidence for Heritage Counts shows that we can reduce the carbon emissions of historic buildings by over 60% by 2050 through refurbishment and retrofit (Historic England, Heritage Counts 2019). However, it is also important to consider the carbon impact of these activities alongside the savings they may result in. Planning these projects with carbon in mind can ensure that embodied carbon is reduced wherever feasible and will support the construction industry's aim of lowering their emissions to achieve the UK government's target of net zero emissions by 2050.

When can you reduce embodied carbon?

It is important to understand that the embodied carbon impact cannot be reduced once a project is complete. Once installed, the carbon impact of any materials used has already been emitted and cannot be taken back. Therefore, it is important to consider where embodied carbon savings can be made in the early stages of a project. This will help guide design decisions towards lower carbon options.

An example of an early stage design decision could be what type of flooring to use for a particular space or choosing between two items which have different life spans. The rules of thumb in the following section can help guide these choices.

1c Key principles for reducing embodied carbon

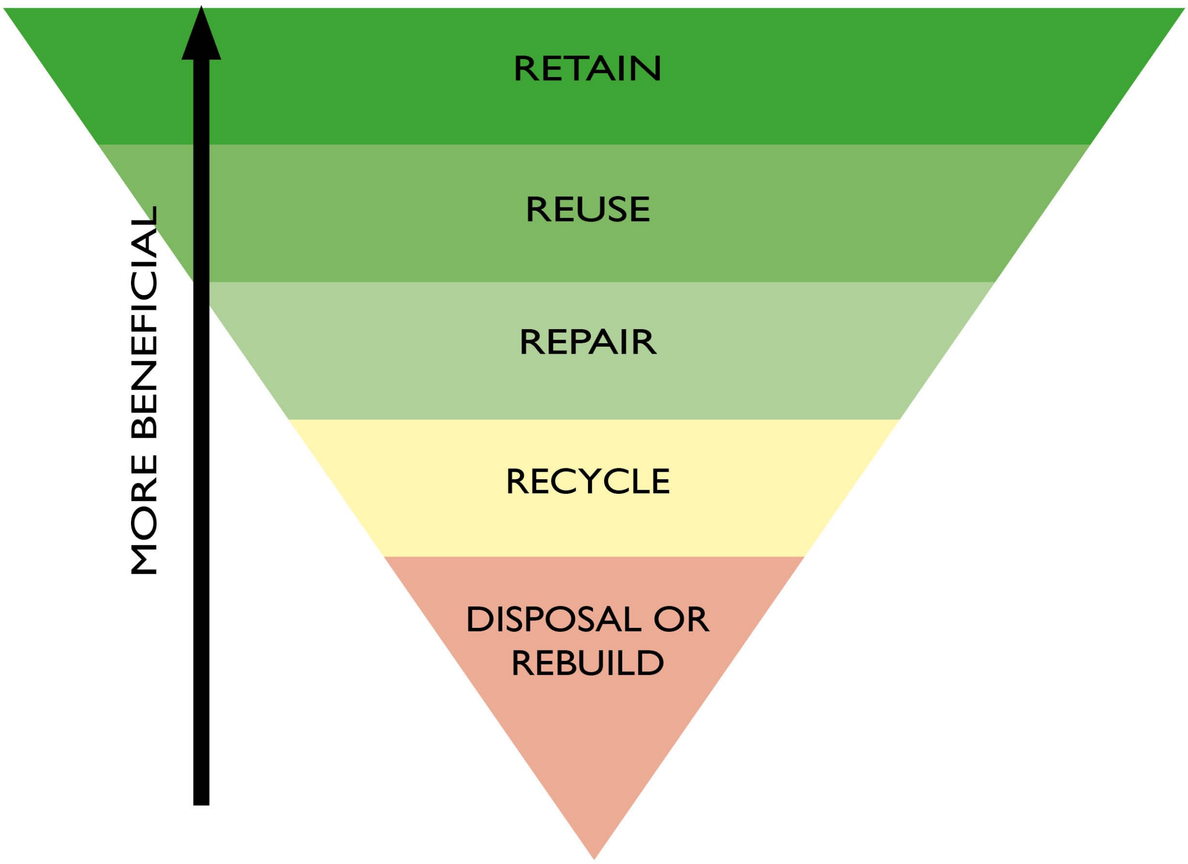
The best way to save embodied carbon is to not build at all, but where building projects are needed to further the mission of your church, the principles guiding the rules of thumb below are: **retain, reuse, repair, recycle. Disposal** and **rebuild** is considered only as the final option.

This is also shown well through the waste hierarchy diagram which can be seen below.

Avoid large changes for small energy savings

Projects should avoid large interventions to make small energy savings. The carbon spent may not be paid back over the product's lifetime.

For example, triple glazed windows provide benefits of thermal comfort and reduced sound, and also reduce operational carbon. But the additional layer of glass over a double glazed window doesn't necessarily payback the carbon over the lifetime of the building. Likewise, moving from single glazing to double glazing should consider how often the building is heated versus unheated. Further information can be found in this Circular Ecology Article.



Above: **Waste hierarchy diagram: retain, reuse, repair, recycle, then dispose or rebuild. Adapted from Circular Ecology.**

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REDUCING EMBODIED CARBON

2a Useful rules of thumb to reduce embodied carbon

If, (after considering retention, reuse, repair and recycling or upgrading), disposal or rebuilding is needed, these rules of thumb can help minimise embodied carbon.

Retain materials and structures

Retaining materials and structures is a great way of saving embodied carbon. Carbon has already been emitted to produce and install these materials and reusing means no new emissions are produced. If there is usable material in an existing building, retain and reuse it where possible. For example, timber from furnishings that are not of significance could be remade into new furniture.

Use less material

When using materials in a construction project it is good practice to use as little as possible. If a component can be redesigned to use less material this will often reduce the embodied carbon. Changing materials is a more complex comparison however reducing material usage is a simple way to reduce environmental impact. This could be something as simple as using less coats of paint or ensuring any tiling layouts make efficient use of the number of tiles required.

Use salvaged materials

If you can't retain materials to reuse on your project, using salvaged products will offer welcome embodied carbon benefits. Salvaged or second-hand items are considered to have very low embodied carbon.

Opposite: **Chedworth, St Andrew (Diocese of Gloucester)**

Use recycled materials

If it is not possible to reuse materials and you need to buy them new, it is good practice to source items made mainly from recycled materials.

When a material is recycled it is processed from its waste form into a new product. This avoids having to go through the process of extracting new raw materials from the earth which results in avoiding emitting the associated emissions. This is especially important with metal and plastic based items. High recycled content in these materials often greatly reduces the embodied carbon impact.

Use natural materials

Natural materials, especially timber-based products, typically have a low carbon impact compared to highly processed alternatives. It is well known that trees take in carbon dioxide throughout their life, this carbon is then stored in the mass of the timber. Therefore, when timber items are used in a construction project, they have already taken in carbon dioxide from the atmosphere and stored it. This typically results in timber items having an extremely low or even negative embodied carbon.

Other natural materials can have a lower impact. Natural materials that can replace highly processed materials are likely a good choice when aiming to reduce embodied carbon. For example, long lifetime timber flooring in place of shorter lifetime carpets. Linoleum or marmoleum, both made from more natural materials, offer an alternative to vinyl flooring which is plastic based. It is worth noting that flooring durability and lifetime are also key factors.

A resource such as The Construction Material Pyramid can be used to estimate and compare the carbon impact of common construction materials without the use of complex software.

When bringing in new materials	When thinking of disposal
Retain/reuse/repair/recycle or upgrade where possible	
Retain materials and structures	Make available for others to repair or reuse
Use less material	Avoid landfill by recycling where possible
Use salvaged materials	
Use recycled materials	
Use natural materials	
Use long-lasting products	
Find products/suppliers with a low carbon footprint through use of clean energy, low carbon supply chains and less transport	

Use long-lasting products

Using long-lasting products ensures they do not need to be replaced again for many years. The lifetime of a product is an important metric when considering embodied carbon impacts. For example, if your kitchen lasts 30 years instead of 15 years, you remove the need for producing a brand-new kitchen. Therefore over 30 years the embodied carbon impact is half that of having a kitchen with a 15-year lifespan, as shown below.

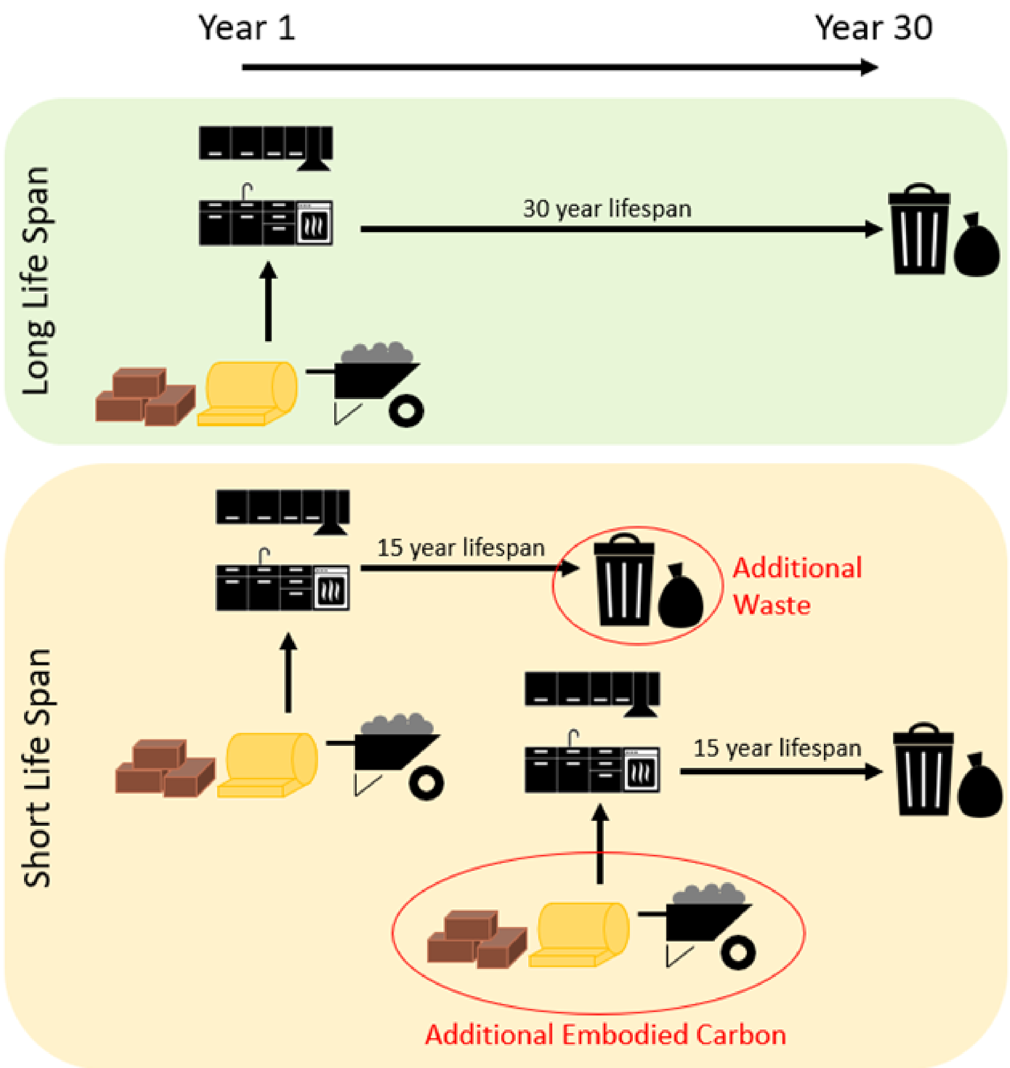
Find manufacturers that use cleaner energy

Some companies source their manufacturing energy from renewable sources such as hydroelectricity, wind energy or solar photovoltaics, thereby lowering the embodied carbon of their products.

Manufacturers may have sustainability information available on their website or they could be contacted to find out if they use cleaner energy.

Role of transport in embodied carbon

There is often confusion about the impact of transport. The carbon emissions of transporting raw materials through the supply chain and the delivery to site is part of an embodied carbon profile. This leads to the misconception that local is always lower carbon than global. Local procurement is a good policy in many aspects, especially in terms of social sustainability, keeping the local industries alive and the local economy thriving. However, for many embodied carbon assessments, with a few exceptions, the carbon emissions from transport are often just a few percent of the total embodied carbon. Most of the embodied carbon is typically released from making and processing materials in factories and refineries. When looking at the embodied carbon impact of new products, consider manufacture as well as local production.



Above: **How lifespan influences embodied carbon. Source: Circular Ecology.**

Waste management

Typically, most of the embodied carbon of a product comes from the production stage. However, as items reach the end of their life it is wise to consider where items are going to end up as this can have impacts for disposal. Firstly, repairing the items is a great approach to extending the lifetime of a product, therefore removing the need for a new one and preventing waste. If this is not feasible, it can be sent for reuse. In addition to salvage yards, there are various online platforms where materials can be sourced, given away or sold. For example, Enviromate, or similar platforms. Reclaiming materials, or even full kitchen fitouts, for other people to reuse can help other people reduce the embodied carbon of their projects.

If materials and products cannot be repaired or reused at the end of their life it is best to send them for recycling. Recycling reduces the need for new materials to be extracted from the earth so properly recycling waste items will reduce a product's carbon impact at the end of its life and can go on to reduce the impact of products made from the recycled waste. The exception here is hazardous waste, which should be disposed of in accordance with UK regulations.

A waste management approach should minimise materials sent to landfill. This involves separating waste into streams based on their material for recycling. Some materials can then be collected by specialist services, and general items can be taken to a local recycling centre. www.envirocraft.co.uk is a useful resource to find local services for specialist collection and recycling. Dealing with waste locally can minimise both the amount of materials going to landfill, and the travel miles involved.

Waste management in construction projects is good practice and widely adopted by contractors. It can be easily expanded to all manner of projects at any scale. Early discussion with the contractors is recommended to develop a waste management approach.

Questions to Consider

For your PCC or Building Project Group

→ What can we retain, reuse, repair or recycle rather than buying new?

→ Are we making a large change for a small energy saving? If yes, what should we do instead?

→ Has embodied carbon been considered in our project proposal?

→ Have different options been reviewed, from both a cost perspective and embodied carbon perspective?

→ Are there areas of our project where we can use less new material?

→ Can we reuse items or materials and use them elsewhere in the church, or pass them on to others for reuse?

→ Can we use reclaimed, recycled or natural materials?

→ Suppliers and manufacturers with robust schemes for low carbon impact will often advertise their sustainable approach. Have we looked at websites to find products and materials with low carbon impact?

→ How are we managing waste produced through the project?

→ Have we asked our architect for advice?

3

GUIDANCE FOR LARGE PROJECTS

3a Reducing embodied carbon for large projects

Large projects are considered to be those which have an architect or design team involved to make a substantial change to the building. Examples of projects include: a major reordering, an extension, or a full renovation.

For these projects, it may be possible to engage with the design team on the environmental impact, or if the project is large enough, to have a specialist conduct a whole life embodied carbon assessment. An environmental construction specialist will be able to recommend tried and tested ways to reduce embodied carbon and provide advice throughout the design process. This guidance is designed to be shown to your architect and wider design team to further encourage embodied carbon reduction throughout the project.

3b Whole life carbon assessments

What is a whole life carbon assessment and how can it help you?

A whole life carbon assessment is the combination of embodied and operational carbon emissions over the life cycle of a building. To best reduce your environmental impact, it is important to first know where you should make reductions.

A whole life carbon assessment in the early stages of any retrofit enables the embodied carbon of upgrades to be considered. This allows for lower-carbon choices made during design decisions and will reduce the overall carbon impact of the building over its life cycle.

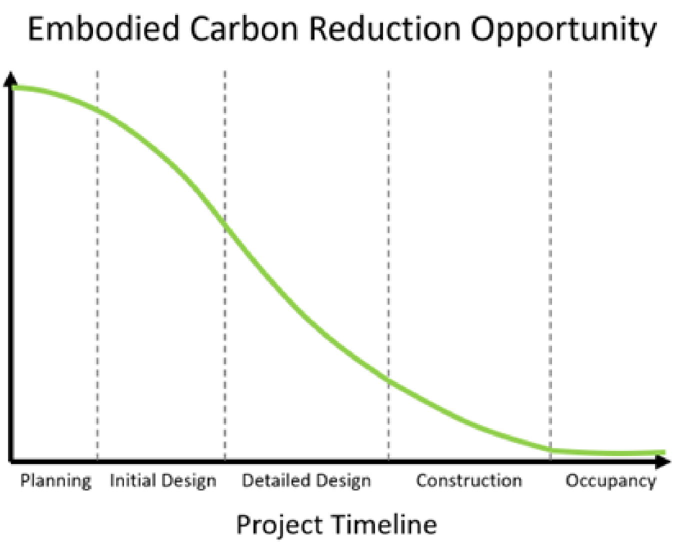
Research from Historic England (Heritage Counts, 2019), and others, highlights the importance of considering a whole life approach and refurbishing with embodied carbon in mind.

Opposite: **Waterloo, St John the Evangelist (Diocese of Southwark)**

When to reduce the embodied carbon of larger projects

A whole life carbon assessment can be conducted at any time during the design or construction process. When conducting an assessment at an early stage, the aim is to guide design decisions towards lower carbon options. The earlier this is carried out, the easier it is to implement the reductions. Assessments undertaken at a later stage are more detailed and provide a more accurate record of embodied carbon. However, trying to find carbon reductions once construction work is underway is more difficult.

Despite an early stage estimate often having the greatest effect on reducing the environmental impact, there are opportunities at various stages of a project, as shown below.



Above: **Embodied carbon reduction opportunity. Source: Circular Ecology.**

3c Additional rules of thumb for reducing the embodied carbon of large projects

Here are some additional rules of thumb that could help to reduce the embodied carbon of large projects. The key principles for achieving maximum whole life embodied carbon reductions should be applied at the conceptual design stage, whether for a retrofit or a new build, to increase the chance of them being adopted. In addition to this document, the London Plan contains a good list of items to consider within the guidance on whole life cycle carbon assessments.

Reuse and retrofit of existing built structures

The best way to reduce embodied carbon is to not build at all or to reduce the amount being built. For this reason, refurbishing existing buildings and structures instead of demolishing and rebuilding could save large amounts of embodied carbon. Even if part of a structure can be retained, such as external brick walls, it could offer a welcome carbon saving.

Designing for durability and flexibility

A building that is adaptable and flexible is one that is likely to be standing for a long time. If the intended use of the space changes in the future, a flexible and adaptable space which can easily be reconfigured for layout and purpose, will avoid the need for more extensive adaptations or new buildings.

Carbon stored in timber

Timber physically stores carbon, where around 50% of the mass of a piece of timber is actually composed of the element Carbon (C). This is because when a tree grows, it absorbs Carbon Dioxide (CO_2) from the air. The tree keeps the Carbon (C) which becomes part of the tree, and it releases the Oxygen (O_2) back to the air, through photosynthesis. When the timber is from a sustainably managed forest, this can be a carbon benefit. Locking up the Carbon through the lifetime of the timber product. Using timber in your design instead of manufactured materials is generally a very low carbon approach.

Waste management

In addition to the guidance for all projects, a waste management plan could be included within contract requirements for larger scale projects. Your architect can write this into a technical specification or scope.

Identify carbon hotspots

The high impact areas of the building vary with building type and construction method. An early-stage assessment will quickly highlight the components of a building that are contributing the most to the embodied carbon. This allows reductions to be focused on areas that will make the biggest reductions.

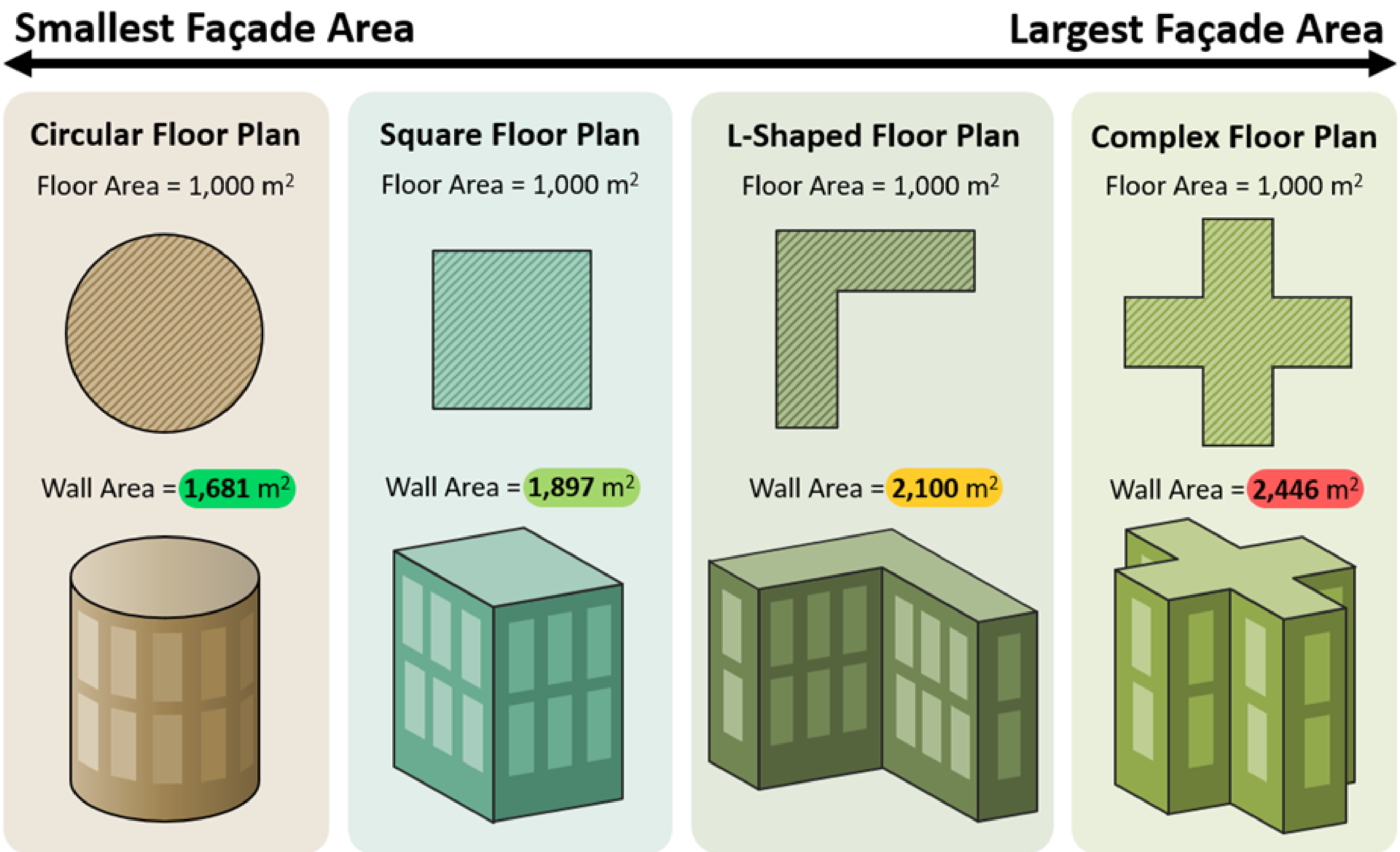
Typically, the materials that contribute the most to the embodied carbon are the ones that have the largest volume. This depends heavily on the construction of a building but often concretes and steels are large contributors to new builds. Some materials and products do have a higher impact than others, however these are often used in lesser quantities. Throughout the design and construction process small assessments can be conducted to find, investigate and quantify lower carbon options.

Building shape and form

The shape of the building affects how much material is required for external walls, floors and roofing, as seen in the diagram below. If there are various layouts being considered to provide the same building floor area, consider which is the most efficient on the quantity of materials needed to build that structure. This is relevant to extensions to church buildings or new hall facilities.

Material selection

Just as with smaller projects, the choice of materials has a big impact on embodied carbon. With larger projects that use more materials, those choices can have greater impact. Generally, natural and minimally processed materials have a lower embodied carbon. To see how big a difference material selection can make, take a look at the comparisons overleaf for different types of concrete and aluminium. You might also consider using a different material altogether.

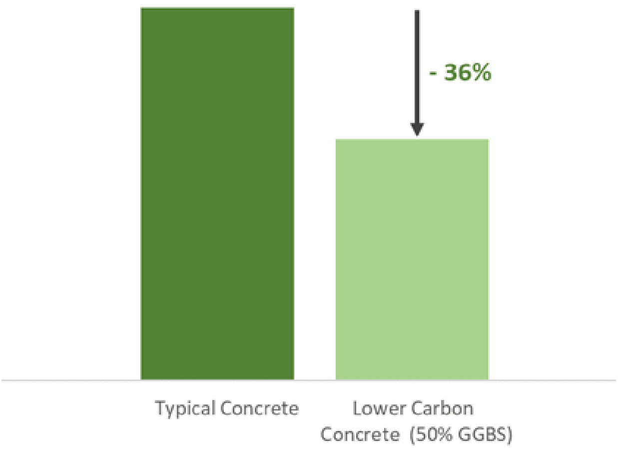


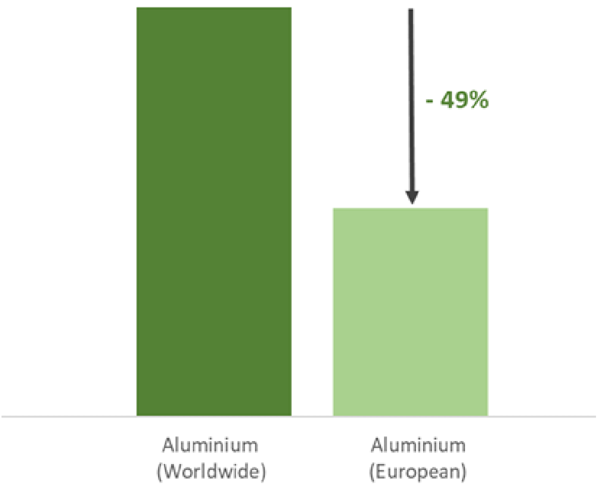
Above: **Building form factor. Source: Circular Ecology.**

3d Reduction examples

Using lower carbon concrete is an area that can help to reduce the embodied carbon of projects. For a typical concrete, cement content provides the largest contribution to the embodied carbon, often responsible for over 80% of the emissions. The remainder comes from the aggregates and other minor ingredients. There are lower carbon binders that can replace part of the cement content, such as GGBS, which is a waste product of steel making. There is usually potential for GGBS to replace 30-50% of the cement in a concrete mixture. An example of the potential carbon saving is shown below.

For another example of an embodied carbon saving, products made in Europe may have a lower embodied carbon. This is quite notable for aluminium, where European made aluminium is often made with a cleaner production process, shown below.





Above: **Embodied carbon reduction potential in concrete (above) and aluminium (below). Source: Circular Ecology.**

3e Completing a detailed embodied carbon assessment

Finding a suitable specialist

There are specialist embodied carbon consultants, which can be found by searching online for 'embodied carbon assessments'. However, embodied carbon assessments are also being completed by an increasing range of professionals, such as some of the more environmentally minded architects and engineers. Ask your project team if they undertake embodied carbon assessments or search online for companies who specialise in this.

Embodied carbon standards

A detailed embodied carbon assessment would typically be compliant with the Royal Institute of Chartered Surveyors (RICS) methodology for reporting whole life carbon. That method provides a more standardised way of undertaking and reporting whole life carbon assessments for buildings. If a building project aspires to be Net Zero Carbon for embodied carbon, for example to the UK Green Building Framework Definition, a detailed embodied carbon assessment in line with the RICS whole life carbon method is required.

Cost of an assessment

The cost of a whole life embodied carbon assessment varies depending on the size and complexity of a building and detail of the assessment. For an early stage, concept design LCA to inform decision making, a professional may be able to undertake carbon reduction option modelling with a few days work. However, that would offer advice on the carbon benefits of potential options rather than a whole building life cycle assessment.

For a detailed RICS method compliant assessment, a specialist would expect to take 5-20 days (or more) to complete the assessment for many building projects, dependent upon the size and complexity of the project. It is therefore not a small piece of work to do a detailed assessment for a whole building. However, an increasing number of construction professionals are taking an interest in embodied carbon and may be able to complete it as part of their project scope.

Alternatives to a detailed assessment

If a project is not able to accommodate the costs of a fully detailed embodied carbon assessment, then targeting embodied carbon optioneering calculations for key parts of the building could also be completed. For example, external walls, floors, or roof options. These are all areas with notable embodied carbon and could be compared on a per unit area (m^2) basis for the key design options. Or alternatively a comparison of the impact of one product against another, to show the difference of material or product selection.

Tools to help measure embodied carbon

There are numerous different tools out there to help calculate the carbon impact of a project. These typically require some knowledge on the construction of a building and a base knowledge of embodied carbon. A review of all the LCA tools available on the market at that time (Spring 2022) to see which worked best for the needs of the Church of England, with listed buildings made of specialist historic materials, found the following were the best.

Detailed tools

These tools allow complex assessments, in line with standards on embodied carbon. If you are commissioning an LCA, we suggest you look for an architect/specialist using one of these two tools (although the consultants may also have their own custom tool). These are paid for tools, best utilised alongside training on the tools:

- OneClick LCA - https://www.oneclicklca.com/
- eTool - https://etoolglobal.com/

Other options

These are low cost or free, but less wide-ranging / powerful as the two above:

- AECB Embodied Carbon Tool - https://aecb.net/aecb-phribbon-embodied-co2/
- IStructE Structural Carbon Tool (core structure only) - https://www.istructe.org/resources/guidance/the-structural-carbon-tool/
- EC3 - https://www.buildingtransparency.org/

There are many other tools in the marketplace, with new tools regularly being released. Construction professionals may already have their own tool of choice.

3f Researching materials: embodied carbon data for materials

There are various resources where embodied carbon data is typically taken. The Inventory of Carbon and Energy (ICE) database is a well-used and free resource to show the embodied carbon of common construction materials. This is a downloadable Excel spreadsheet for materials, but it does not give data for specific products.

For data on specific products, Environmental Product Declarations (EPDs), can be used. EPDs are a voluntary reporting format manufacturers or industries use to report the environmental impact of their products. EPDs are typically made available on manufacturers' websites or are sometimes available on request; however, there are a number of EPD databases that can be searched to find specific data.

List of EPD databases:

- The International EPD System - https://www.environdec.com/home
- Greenbook Live - https://www.greenbooklive.com/
- Eco Platform - https://www.eco-platform.org/eco-portal-access-point-to-digital-product-data.html
- Irish Green Building Council - https://www.igbc.ie/epd-search/
- OKOBAUDAT - https://www.oekobaudat.de/no_cache/en/database/search.html
- IBU - https://ibu-epd.com/en/published-epds/
- ASTM - https://www.astm.org/products-services/certification/environmental-product-declarations/epd-pcr.html

There is also a newer project from various professional membership bodies, called Built Environment Carbon Database (BECD), which aspires to become the central repository of carbon data for products.

It is worth being cautious around drawing comparisons between materials without considering wider topics or consulting a specialist. Comparing steel and aluminium based on their impact per kg is not a suitable comparison. The amount of steel or aluminium used will vary for different applications.

Embodied carbon reduction should also not be done at the expense of a higher operational carbon performance. For example, a thinner insulation product will have a lower embodied carbon but will increase the operational carbon of the building. To compare this fairly, the thickness of insulation options would need to be considered. For example, the thickness of PIR versus the thickness of mineral wool to achieve the same thermal performance of the building.

Embodied carbon of commonly used materials

The table below has a few examples of the embodied carbon of commonly used materials in church projects, presented per kg of material. Be careful not to compare different materials, where per kg isn't a fair comparison. Different materials have different properties and densities, so require different amounts to provide the same function.

Material	Embodied Carbon (kgCO2e/kg)	Source
Aggregate	0.00747	ICE V3
Concrete 32/40 MPa	0.138	ICE V3
Concrete 32/40 MPa (50% GGBS)	0.089	ICE V3
Steel Rebar (Average Recycled)	0.76	BREG EN EPD No: 000125
Steel Sections (UK)	2.45	EPD-TS-2020-003
Glass	1.44	ICE V3
Mortar (1:3 Cement:Sand mix)	0.20	ICE V3
Mortar (1:2:9 Cement:Lime:Sand mix)	0.13	ICE V3
Asphalt (5% Binder)	0.0542	ICE V3
Aluminium (Worldwide Average)	13.1	ICE V3
Aluminium (European Average)	6.67	ICE V3
Mineral Wool Insulation	1.28	ICE V2
Polyurethane Rigid Foam Insulation	4.26	ICE V2
Softwood	0.263	ICE V3 (excluding Biogenic Carbon)
Glulam	0.28	IStructE – Mass Timber Embodied Carbon Factors (excluding Biogenic Carbon)
Cross Laminated Timber	0.29	IStructE – Mass Timber Embodied Carbon Factors (excluding Biogenic Carbon)

Questions to Consider

For Your Architect or Design Team

An increasing number of professionals in the construction sector are becoming aware of the environmental impact of their projects and are looking for ways to improve this.

Questions to ask the design team:

→ Are you measuring embodied carbon?

→ What are you doing to reduce embodied carbon?

→ Are you measuring operational carbon?

→ What are you doing to reduce operational carbon?

→ Are you engaging and collaborating with all the designers and contractors at all stages to reduce the whole life carbon impact of the project?

→ At a high level, where are the largest sources of embodied carbon likely to be in our project, and what feasible options are there to reduce it?

→ What would it cost to complete a whole life carbon assessment on our project?

Questions for contractors:

→ Are you collecting data on your fuel and energy usage for this project?

→ Are you collecting data for the waste produced on site?

→ What are you doing to reduce your energy consumption, transport, and waste?

→ How are you managing the waste produced on site?

Questions around the environmental impact of a project can be built into the procurement process to ensure all parties involved have the same aspirations and expectations for lowering the impact.

It is recommended that you show this guide to your architect/design team to further encourage and advise on embodied carbon reduction.


4

CONCLUSIONS

4a Summary principles

Embodied carbon is the carbon associated with the material extraction, transport, manufacture and installation of a product. Whilst embodied carbon is not in scope of the Church of England's net zero carbon target until after 2030, churches can take action now, and it is important to consider when carrying out maintenance and renovations to further aid emissions reduction.

For small projects, it may not be cost effective to consult with specialists to help reduce embodied carbon. The first sets of rules of thumb outlined in the guidance can be applied to all projects. In summary, consider the principles:

- **Retain/reuse/repair/recycle or upgrade before disposal/rebuild**
- **Avoid large changes for small energy savings**

When new items or rebuilding are required:

- **Retain materials and structures**
- **Use less material**
- **Use salvaged materials**
- **Use recycled materials**
- **Use natural materials**
- **Use long-lasting products**
- **Find products/suppliers with a low carbon footprint through using clean energy, low carbon supply chains and less transport**
- **Consider waste disposal**

The embodied carbon of large projects can be measured and managed, to help reduce carbon emissions. For large projects, it may be possible to engage with the wider design and construction team to collaboratively work to lower the carbon impact. Early-stage assessments can help guide the team to focus on the key impact hotspots where small changes can make a big difference. This guide presents additional rules of thumb that could be applied to large scale projects without the additional resource needed for a detailed assessment.

4b Further information and guidance

- Have a look at the Practical Path to Net Zero for help and ideas on reducing the church's carbon footprint
- Watch the Church of England's webinars on Reaching Carbon Net Zero
- Read the Cathedral and Church Buildings Division's Statement on Sustainability and the Environment
- Read The Home-Grown Homes Guide on Embodied Carbon
- Read ASBP's Introduction to Environmental Product Declarations (EPDs)
- Read WRAP's guide to circular economy
- Show your architect this guide from EASA on Project Sustainability
- Find your local Diocesan Environment Officer
- Learn about the whole life carbon emissions of historic buildings from Historic England's research

Opposite: **Harrogate, St Mark (Diocese of Leeds)**

CHURCHCARE