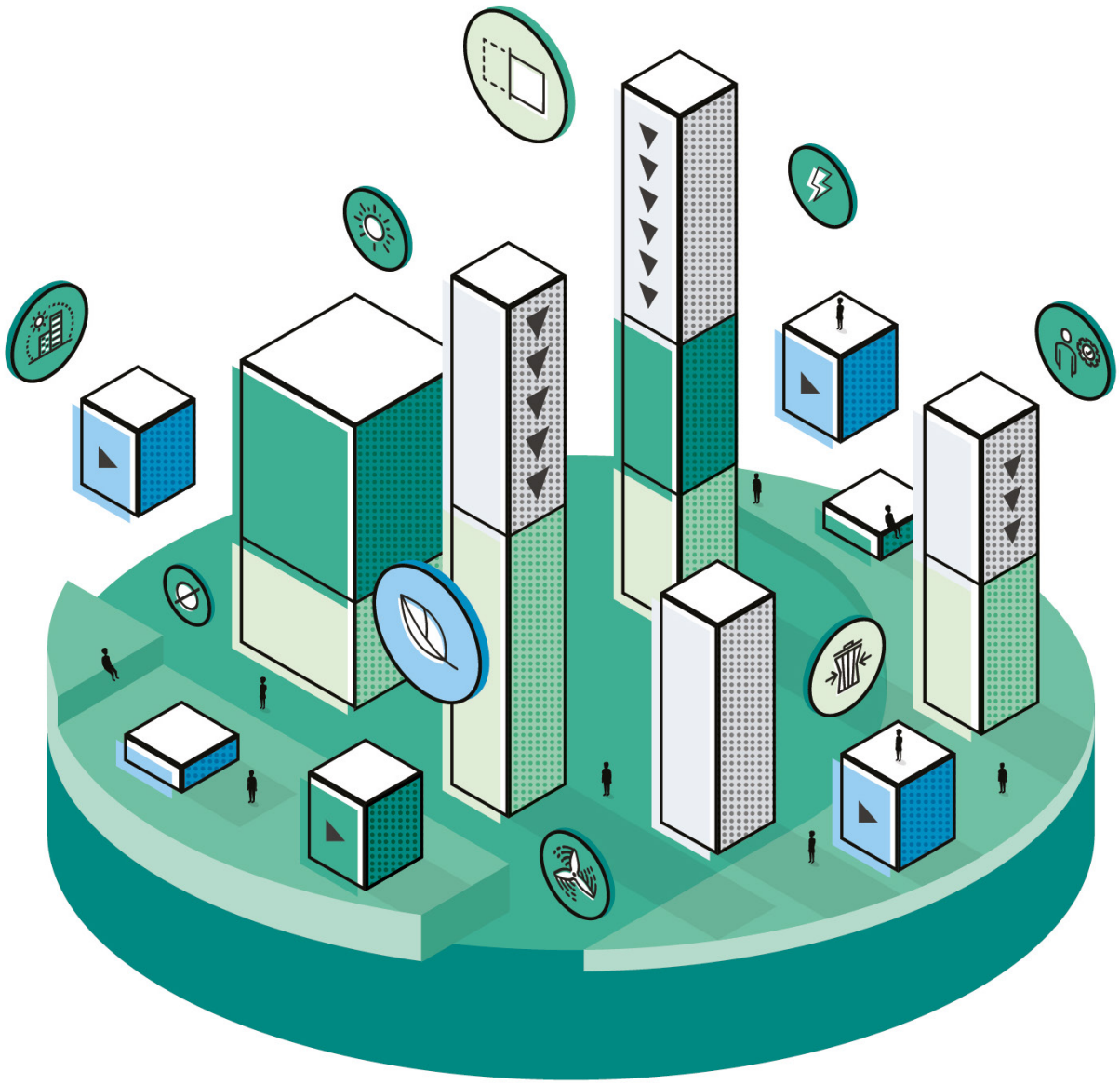
ARUP

THE ROAD TO ZERO

Net Zero Carbon Buildings: Three Steps to Take Now



Contents

“The built environment contributes nearly 40% of the UK’s greenhouse gas emissions. That means achieving net zero will require the biggest transformation our industry has faced yet. A fundamental shift in the planning, delivery and operation of buildings as well as the infrastructure and systems that support them is essential. We have to deliver buildings that are better for people and the planet.”

NIGEL TONKS
Sustainable Development Director
Arup UK, India, Middle East & Africa

A new asset class: net zero property

The scale of the net zero carbon property challenge is starting to be understood. Commitments to decarbonise are coming thick and fast.

Recognition that to avoid the worst impacts of climate change we need to limit global temperature rise to 1.5°C, and the scale of the challenge that implies, has finally prompted the collective penny to drop. We’ve seen the global Climate Strike movement and Extinction Rebellion in the UK. In 2019, the UK Government signed a legally binding target to achieve net zero carbon emissions by 2050.

Since then, the concept of net zero carbon has caught on astonishingly quickly within the UK property sector. Twenty-three leading property organisations — members of the Better Buildings Partnership — signed a climate change commitment, agreeing to set a pathway to net zero carbon for their organisations, something that would have been unthinkable until very recently.

Across the construction sector, thousands of organisations, including architects, engineers, contractors and others have signed one of the “Construction Declares” commitments: https://constructiondeclares.com.

This document summarises key issues that need to be addressed now to ensure the property sector can deliver buildings that contribute to a zero carbon economy.

1.5°C
To avoid the worst impacts of climate change we need to limit global temperature rise to 1.5°C.

2050
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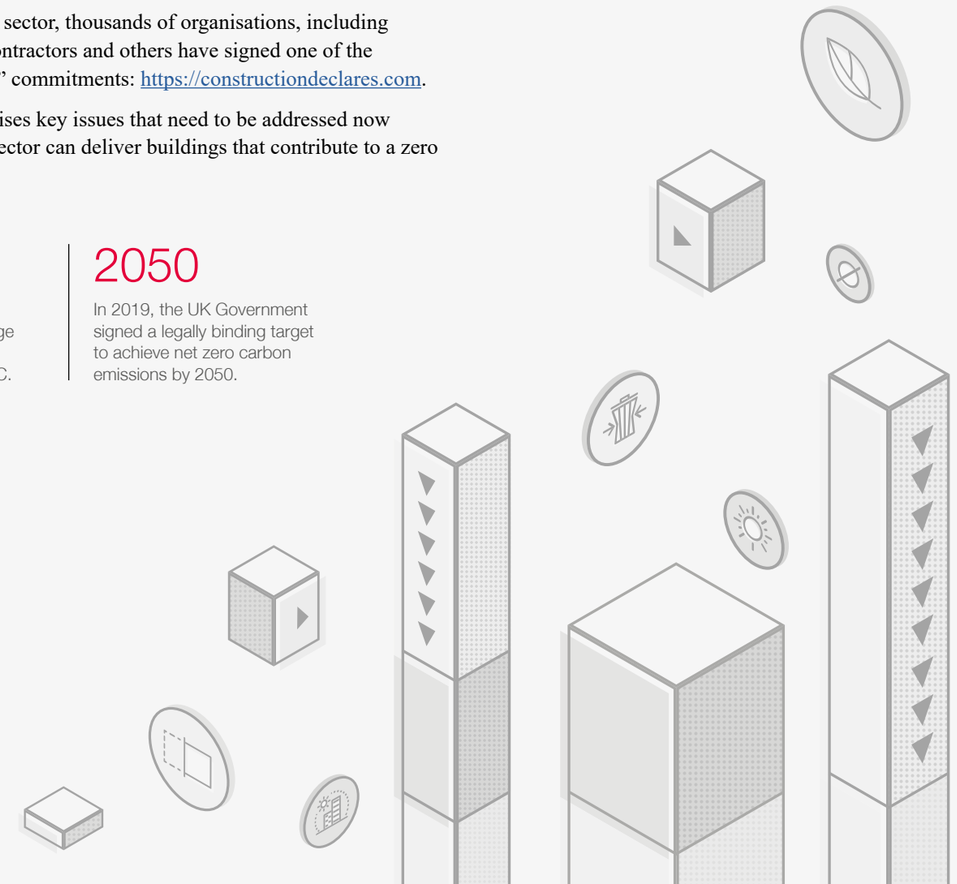


Preventing stranded assets: the link between carbon performance and value

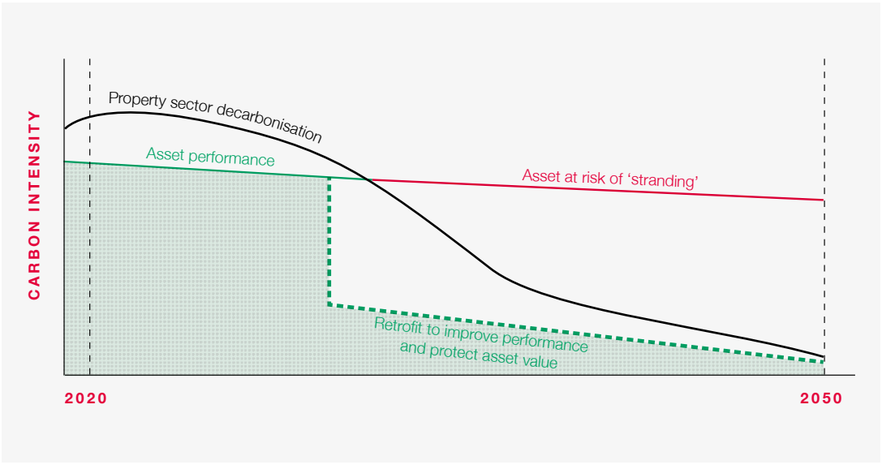
The market has begun to price in operational carbon performance. But embodied carbon is still largely ignored by regulators and the market.

Market expectations of the carbon performance of property assets is changing rapidly. This increases the risk that carbon intensive assets may become "stranded" if action is not taken to decarbonise them. Whilst the market is not yet consistently accounting for carbon intensity in property valuation, asset owners need to be aware of this risk. This has been explored in the EU-funded CRREM (Carbon Risk Real Estate Monitor) research. CRREM provides a free online tool that allows property owners to assess stranding risk for individual assets (www.crrem.eu).

GRESB (Global Real Estate Sustainability Benchmark) was an active partner in the CRREM research, and is in the process of integrating stranding risk assessment within the GRESB Real Estate reporting process. It seems likely that this will encourage the market to make a connection between carbon performance and asset value, something that has been largely absent from the UK property market to date.

For evidence of the link between operational energy/carbon performance and value, we can look to the Australian market. Since its launch in 1998, the NABERS energy rating scheme is credited with halving the average energy intensity of commercial property and reducing the gap between the carbon emission profile of a building at design stage and its actual carbon emissions during performance. Most commercial properties that have a high NABERS rating in Australia benefit from a value premium of approximately 20%. The Better Buildings Partnership has recently launched a NABERS style rating scheme for the UK market, called Design for Performance.

It's important to recognise that all the above is focused on operational carbon. There is no effective link as yet between embodied carbon and asset value. If we are to empower the market to move toward true net zero, we need a robust framework to evaluate and report whole life, not just operational, carbon.



An illustration from the CRREM EU-funded research project (www.crrem.eu) on the risk of 'stranding' for assets or portfolios that fail to keep pace with property sector decarbonisation.[1]

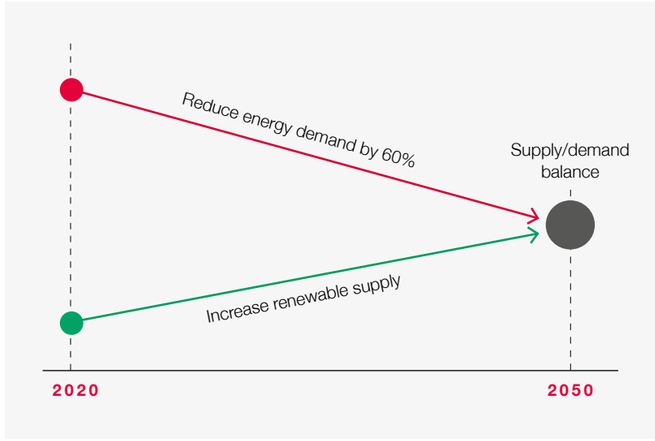
Step 1: Defining net zero

Net zero carbon is defined as a reduction in the demand for energy and materials to a level that can be met solely by sources that do not emit greenhouse gases.

The UK Green Building Council (UKGBC) has led the way in the UK property sector in defining what we mean by net zero carbon. Its document "Net Zero Carbon Buildings: A Framework Definition" was published in 2019. This defines the principle that achieving net zero is about reducing demand (both for energy and materials), with offsetting the last resort for residual emissions.

The UKGBC defined a target trajectory for operational energy efficiency for commercial offices, which can be applied across the property sector: that to be net zero carbon by 2050, we need to reduce our buildings' operational energy use intensity by more than 60%. Whilst the details of the calculation may change over time, the scale of the challenge is clear.

But this is only part of the story. There is as yet no clear understanding as to the level of reduction in embodied emissions that will be required to achieve net zero. A clear view of the extent of embodied carbon reduction that is necessary will be critical to complete the picture and allow us to take a comprehensive approach to decarbonisation.



Research by the UKGBC estimates that a reduction in buildings' energy demand of 60% will be necessary by 2050 for demand to be matched by available renewable supply[2].

60%

To be net zero carbon by 2050 we need to reduce the energy use intensity of our buildings by more than 60%.

Step 2: Incentivising net zero

Buildings that demonstrate the potential to achieve net zero when combined with sufficiently low occupant energy demand should be accredited as ‘net zero enabled’.

Net zero has become common parlance within the UK property sector seemingly in the blink of an eye. We need to recognise that achieving net zero in practice will take time, and that real transformations in how we design, build and use our properties needs to begin immediately but cannot be fully achieved overnight.

In the property market, transformation is driven by incentives and history has shown that rapid transformation is possible if clear incentives are in place. It is essential that we have a clear and rigorous framework in place for assessing net zero across the whole life cycle. The level of interest in the market suggests that with such a framework we should quickly start to see buildings’ net zero credentials have an impact on asset value. There are already signs this is happening, but without a rigorous definition we risk sliding into “zero-wash”.

It is important that we define clear markers for speculative buildings on a net zero trajectory, so that developers and portfolio owners have something to aim for in the short term.
We need to define the concept of ‘net zero enabled’ – buildings that demonstrate the potential to achieve net zero when combined with occupants who maintain sufficiently low energy demand. ‘Net zero enabled’ accreditation will allow us to properly recognise buildings that are capable of achieving net zero once occupant energy demand reduces to an appropriate level.

At the same time we need to be careful. ‘Net zero enabled’ needs to be defined as a temporary staging post, not an end in itself. Any new accreditations need to encourage organisations to continue on the journey to achieving net zero in operation.

Step 3: Taking a whole carbon lifecycle approach

Embodied carbon emissions arising from new-build construction or refurbishment can represent a significant proportion of a building’s whole life carbon impact. Our goal has to be to reduce all carbon emissions to net zero.

Until recently, little attention has been paid to the carbon impacts of constructing and refurbishing buildings. Yet our buildings are constructed using materials, components, and products. All of this material has to be extracted from the ground or (in the case of timber) grown, transported to a facility to be processed, transported again (perhaps numerous times) to be fabricated into a product, transported to site, and craned into place. All of these processes result in the emission of greenhouse gases – fuel for deliveries, and to heat, shape and treat, as well as releases from manufacturing processes.

This impact is repeated on a smaller scale all the way through the life of a building, during its repair, maintenance and any refurbishment programmes. At end of life, we expend energy, and therefore emit carbon, once again in the demolition and disposal of assets.

It is becoming clear that embodied carbon makes a significant contribution – between 30% and 70% of a typical building’s total lifecycle emissions. Our goal has to be for the whole lifecycle emissions of our buildings to be net zero, not just operational emissions. In pursuing this we need to view key decisions through the lens of whole life carbon impact. This approach will ensure that the trade-offs between embodied and operational carbon that are inherent in many of our key decisions become explicit within the decision-making process.

A whole life cycle approach needs to guide our big decisions, and in many cases the biggest of all is whether to demolish or refurbish.

52 LIME STREET, LONDON
Read more: www.arup.com/projects/52-lime-street

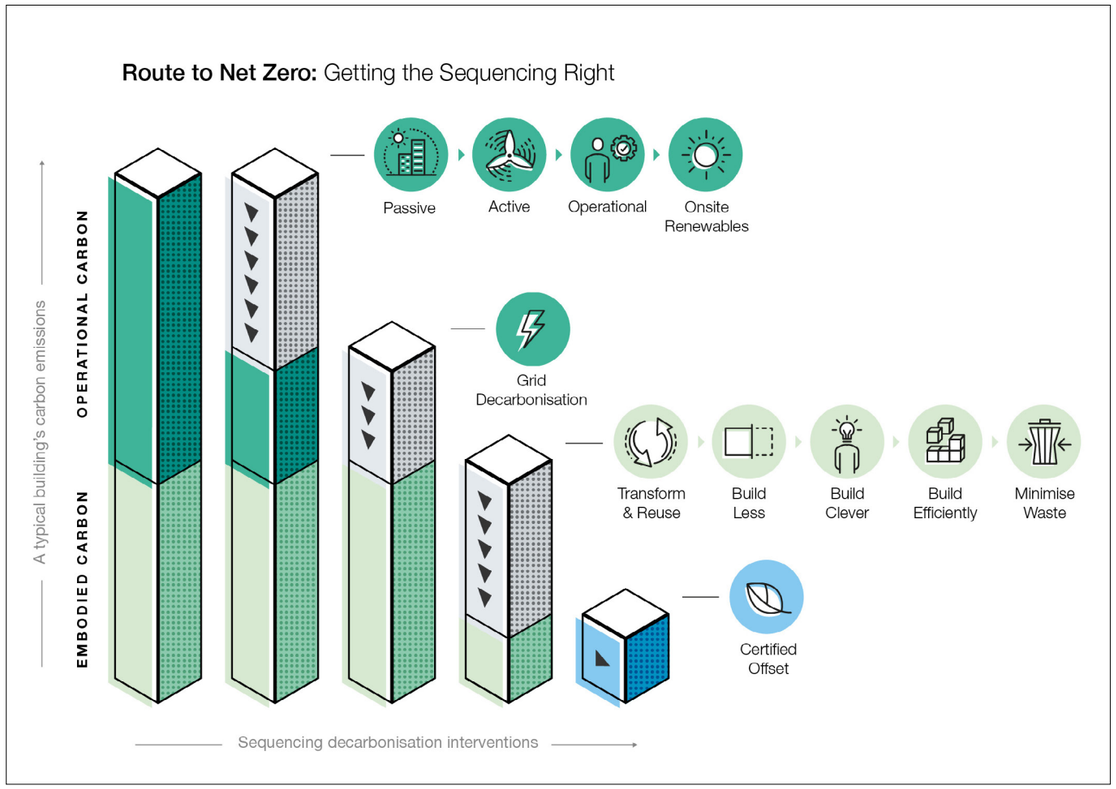
Balancing impacts: Delivering decarbonisation across the lifecycle

A whole lifecycle approach for net zero requires the right design brief, clear thinking about the sequencing of interventions and innovation.

In the diagram below we summarise the sequential approach necessary to arrive at a lasting net zero destination.

Embodied carbon can be minimised by thinking carefully about the spaces that will be needed and prioritising reuse of existing structures, whenever possible. Next, employing lean design principles to minimise the embodied impacts of what must be built.

To address operational carbon emissions, it is essential to begin with strong passive design and to minimise the need for active systems. Efficient systems are combined with operational tools to allow users and operators to choose how they will maintain net zero performance. Add in renewables and grid decarbonisation and we are on a clear course toward net zero.



Every project and site are different. Taking buildings on a journey towards net zero carbon requires a sequential approach to ensure that critical decisions are made at the appropriate point in the design process.

Below are examples of the types of solutions that together may contribute to an effective strategy for a net zero carbon building.

PASSIVE DESIGN

Fundamental decisions made at the earliest stages of the design phase - including massing, floor-to-ceiling heights and facade design - have significant carbon impacts through a building's full lifecycle. Good passive design not only delivers buildings that emit less carbon in operation, they are also often more comfortable and achieve higher levels of occupant satisfaction. Such buildings also tend to be more flexible, so last longer.

Some passive design approaches, such as those involving heavyweight structures, can be naturally high in embodied carbon. Design teams need to consider the embodied-operational balance actively throughout the design process to develop the optimum combination of measures to minimise whole lifecycle carbon.

BUILD CLEVER

Reuse materials. If it's not possible to refurbish an existing building in its entirety, the reuse of materials during the construction of new build developments should be explored. This will reduce embodied carbon and is one way of bringing circular economy principles to life.

MINIMISE WASTE

Offsite prefabrication allows highly efficient processes, including circular economy 'closed loop' approaches, to replace less efficient onsite construction of individual building elements. At the same time, offsite prefabrication often provides workers with safer conditions. If prefabrication is carried out close to a development site further carbon reductions can be achieved thanks to lower transport emissions.

TRANSFORM AND REUSE

In most cases, constructing new buildings generates more carbon emissions than repurposing existing buildings. This is primarily thanks to existing assets 'bringing with them' lower embodied carbon.
The inherent carbon disadvantage of most new property development is a fact that needs to be faced. Any organisation seeking to achieve net zero across its property assets should embed a process that encourages the exploration of refurbishment as a preferred option at the outset of each potential new building development or investment in newly built assets.

EFFICIENT SYSTEMS & SWITCHING TO ELECTRIC

All systems - from heating and air conditioning to lighting - must be designed to be as efficient as possible with good control to maintain effective use. Minimising operational carbon in this way is an important aspect of net zero design.

Typically, supplying buildings with zero carbon energy means switching from an oil or gas supply to an electric system. Depending on building typology, it is likely that either heating or cooling will be the single biggest source of a building's carbon use, and moving it to an electrical source will reduce building emissions as the electricity grid transitions away from fossil fuels and towards renewable and low carbon generation.

DEMAND MANAGEMENT

Reducing operational impacts is not just about how much energy is used overall, but when it's used. Active demand management shifts energy demand away from peak periods when supply emissions are at their highest.It also allows for reduced infrastructure capacity, supporting building operators to make best use of variable renewable generation. Active demand management can simultaneously deliver reduced connection charges. From automatic load shedding and battery technologies in commercial buildings to smart home appliances, there is a range of ways that demand management can be enabled.

ONSITE RENEWABLES

Where practicable, onsite renewable generation, such as solar photovoltaic (PV) panels, should be explored. However, a lifecycle cost and carbon appraisal should be conducted to determine feasibility of any onsite renewable generation. Not all sites or buildings can generate enough renewable energy to make installation worthwhile.

Understanding the whole life carbon building ‘signature’

Working within a whole lifecycle framework allows accurate judgements about how to balance savings in operational and embodied carbon. Without a whole life perspective achieving net zero building isn’t really possible.

The fundamental tools are in place to consistently evaluate whole life carbon, although as we look further into the future uncertainties increase. There is a need to ensure our assumptions about the future are balanced and consistent across the property market.

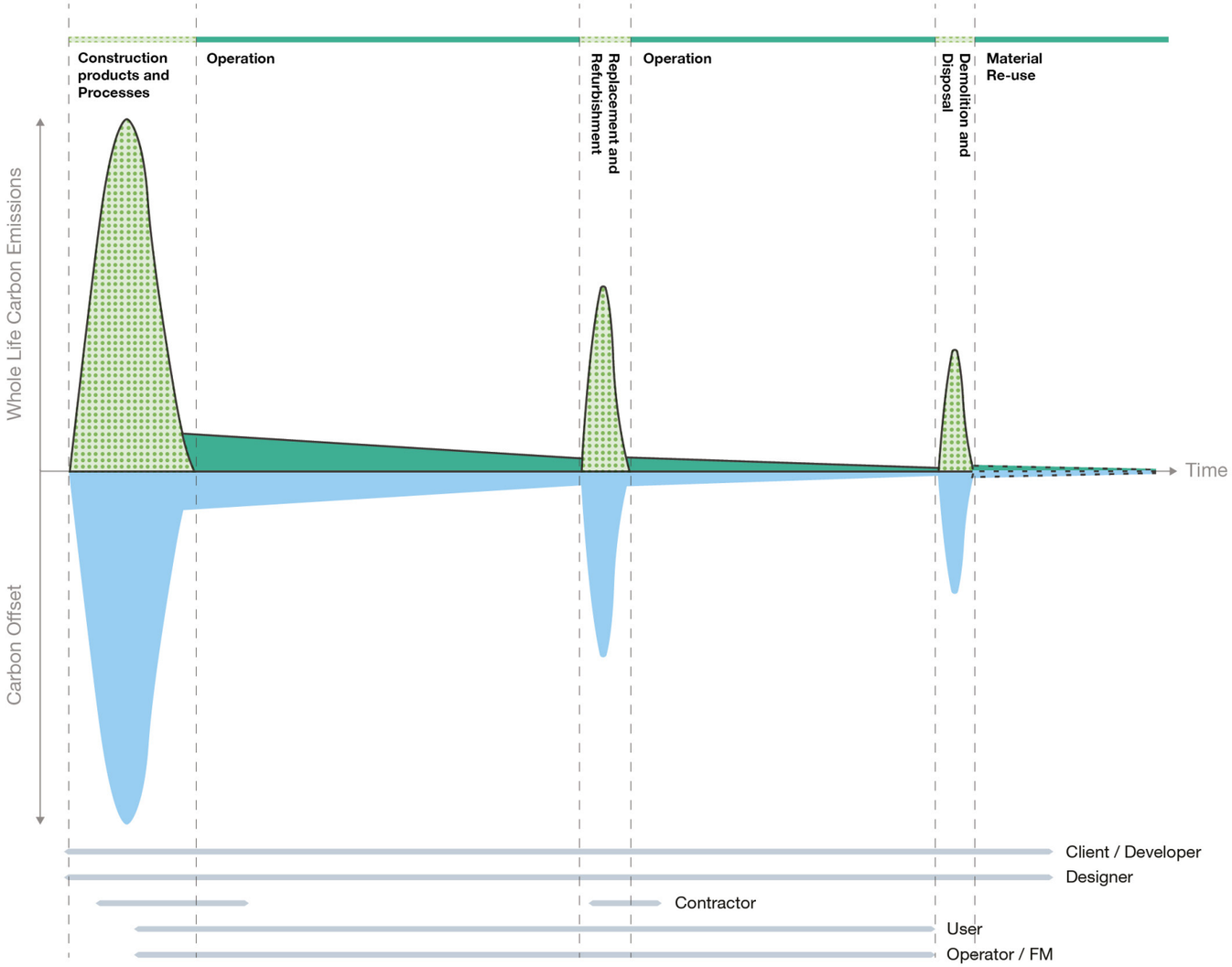
BALANCED DECISION-MAKING

A whole lifecycle approach implies a balancing of short and long term emissions. We need to factor in the decarbonisation of construction activities in future to gain a balanced view. When we do that, an entirely new image emerges of balances and trade-offs between short and long-term impacts. Does triple glazing save enough operational carbon to justify its embodied impact? What’s the carbon payback from the thermal mass associated with a heavyweight structure?

In embracing a whole lifecycle approach, we need to understand that like sands in the desert, the picture is continually changing. As we shift to all-electric operation, our operational emissions are reducing much faster than those associated with manufacture and construction. What made sense yesterday may not make sense tomorrow.

ALLOWING FOR DECARBONISATION

In calculating whole life carbon we need to allow for differing rates of decarbonisation: Decarbonisation of electricity in the UK is predicted to be relatively rapid, reflecting the ongoing addition of renewable capacity to the grid. Decarbonisation of manufacturing and construction is generally assumed to lag behind overall energy-related decarbonisation, which is slower, reflecting the ongoing reliance on natural gas in some sectors of the economy.



BUILD YOUR NET ZERO TEAM

Achieving a positive whole life carbon outcome requires collaboration across a broad range of stakeholders throughout the lifecycle. There is an enormous amount that can be enabled in the design stages of a project – the impact of effective collaboration between developer and designer can be felt right through operation, refurbishment and into end of life and de-construction.

The contractor’s role is critical in converting the designer’s intent into reality. There is an opportunity to transform the contractor’s contribution to achieving net zero through positive incentivisation and involvement in post-completion operational support.

Operational net zero can be enabled through effective design, construction and commissioning, but is only really delivered in operation. As such, the role of both building operator/facility manager and occupant are critical. There has been much written about the operational ‘performance gap’, which refers to the difference between the energy performance and carbon emissions a building was designed and constructed to use and emit and the usually much higher energy demand and emissions of the building when it is in use. This gap can only be closed through close collaboration between designers and operators. Early involvement of operators in the design process is a key factor in a positive outcome.

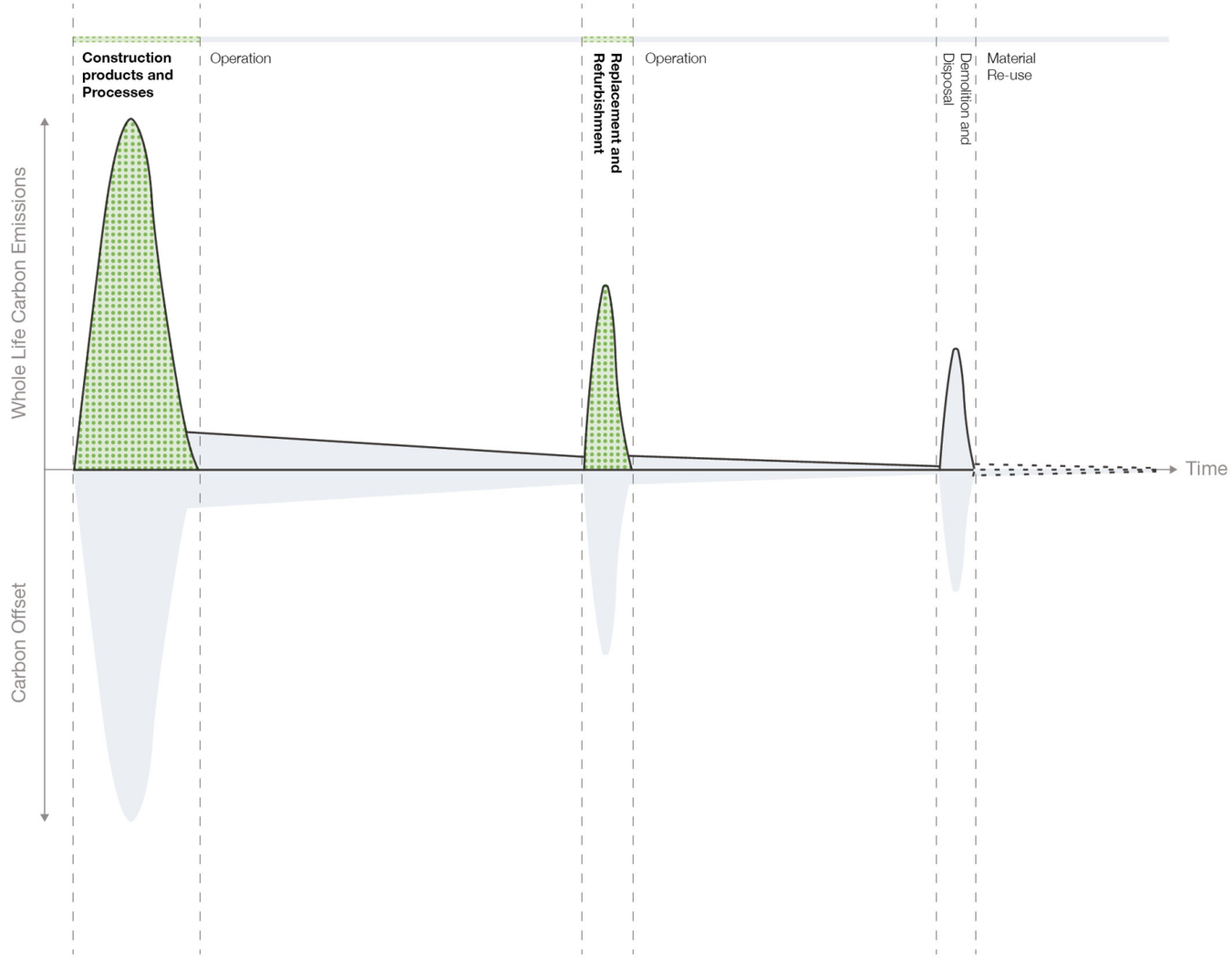
Tackling embodied impacts

If designing for low embodied carbon were easy, everyone would do it. It requires the dynamic integration of site-specific impacts with intelligent use of lifecycle data about material and equipment.

Whole life carbon analysis of all building elements – not just structure, but envelope, services and finishes – is becoming routine on our projects, and this gives us a means to test the balance between construction emissions and the expected life of materials and systems. Investing more embodied carbon day one to secure a longer lifecycle may make sense in some cases, but not in others. Whether it is thanks to regulatory requirements or market forces, the value of achieving low embodied carbon looks set to rise and this will change the balance between cost and environmental impact.

SITE SPECIFICS

Variation in embodied carbon intensity between building types makes setting a target for the embodied component of whole life net zero challenging. High rise towers will always be more carbon intensive than low rises, and use of alternative materials increases risk. Yet high rise buildings can offer significant financial advantages, driving densification of the urban core and unlocking the value of city centre locations. In other locations, factors such as ground conditions or flood risk can impact embodied carbon intensity. We need a framework that recognises site specific challenges, and what is achievable within the context of an individual location.



LIFECYCLE DATA

Lifecycle data for materials and equipment (held in environmental product declarations, or EPDs) is gradually becoming more commonly available. This data is essential if we are to properly analyse and optimise lifecycle carbon. Without it we are reliant on generic lifecycle assumptions and are not realistically able to factor lifecycle differences into material choices.

NET POSITIVE TIMBER

Buildings such as Sky's Believe in Better building demonstrate what's possible with timber. Timber offers the opportunity for net positive buildings, where carbon sequestered in the timber exceeds emissions over a building's lifecycle. But sequestration is dependent on the end-of-life scenario. If timber is disposed of, sequestered emissions are re-released. Alongside the challenges of designing and constructing in timber, which is subject to fire safety regulations and guidance, we need to consider end-of-life scenarios such that timber's carbon sequestration benefits are realised.

SKY BELIEVE IN BETTER BUILDING, LONDON
Sky's Believe in Better building is the tallest commercial timber framed building in the UK.
Read more: www.arup.com/projects/sky-believe-in-better-building

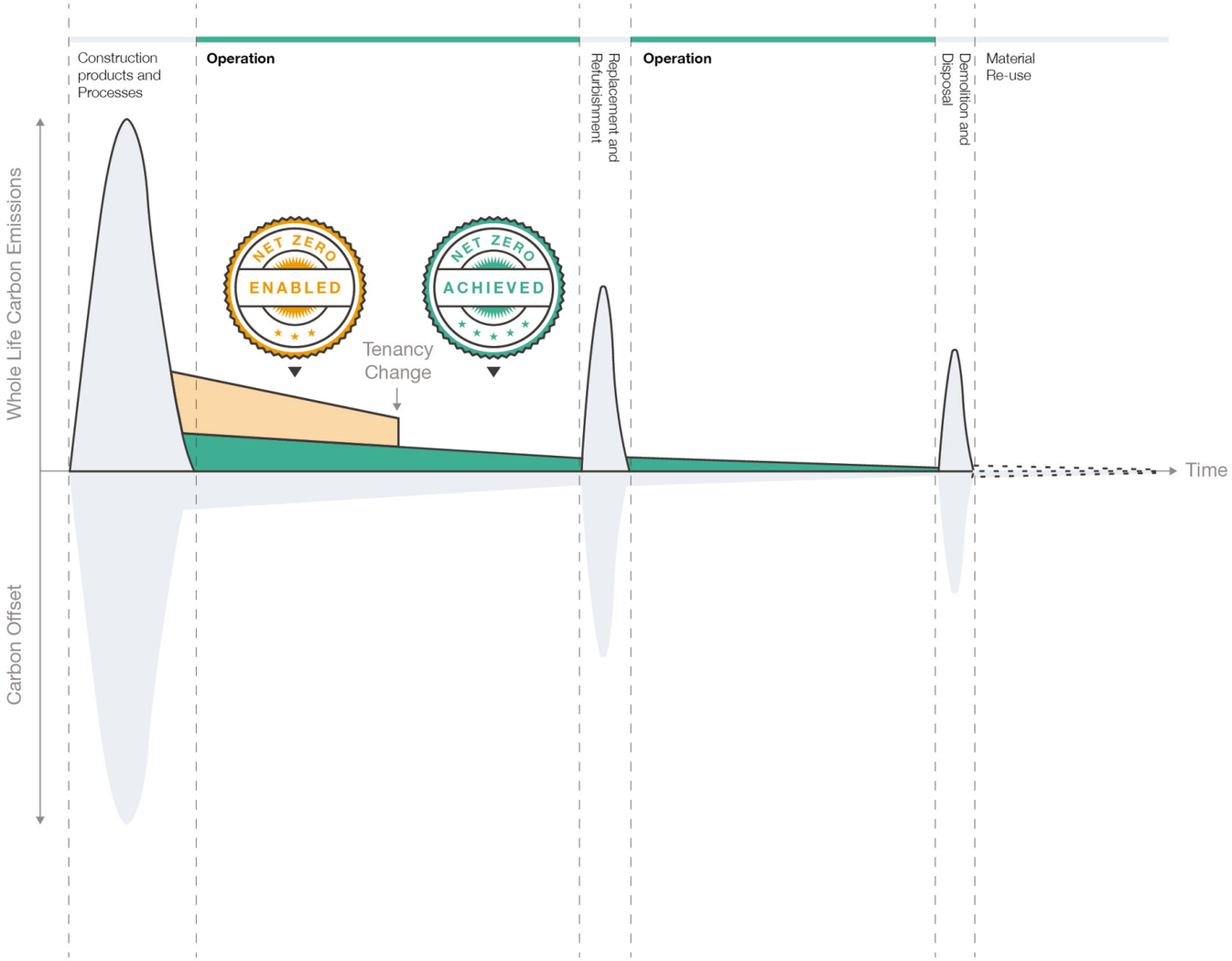
Enabling operational net zero

Operational net zero carbon is not just about design. It requires a combination of the right design, facilities management and occupant behaviour.

Aspirations towards net zero carbon are currently out of step with functional briefs in many cases. Net zero implies an acceptance on the part of occupants of a broader range of comfort conditions and, importantly, tighter control of plug loads. There is a conflict between the environmental aspirations of many building occupants and their operational expectations. This will take time to resolve, and will need to come together with other long-term changes in our use of technology as well as to our attitudes and behaviours, before net zero buildings can become a reality.

Achieving operational net zero requires a partnership between owners, occupants and operators. In the short term, we urgently need to establish a clear industry definition of 'net zero enabled' as a means of recognising the steps developers and owners are taking in this direction. This should encourage more to follow suit and deliver buildings that are capable of achieving net zero in the long term.

Awareness of operational environmental impact is increasing rapidly among some commercial occupants, particularly larger organisations with internal sustainability commitments. Inevitably, it will take time for this awareness to permeate through the market and for awareness to translate into real operational change.
For occupants of a 'net zero enabled' building, their building's accreditation could help reinforce an understanding that the transition from "enabled to achieved" is primarily in their gift and act as an incentive to make the necessary operational and behavioural changes.



NET ZERO ENABLED

A 'net zero enabled' building is one demonstrably capable of operating at an energy use intensity (EUI) below the threshold required to achieve net zero carbon. An EUI threshold for commercial office buildings has been proposed by the UK Green Building Council of 70kWhe/ sqmNIA/ annum[3].

'Net zero enabled' may be demonstrated for a building in design through a robust energy modelling approach, such as that advocated by the emerging Design for Performance (UK NABERS) energy rating scheme, led by the Better Building Partnership.

For a building in operation with an EUI above its net zero target, achieving 'net zero enabled' accreditation would be demonstrated through analysis of operational data. This would need to prove that if occupant energy demand reduced to a level compatible with net zero, the overall building EUI would be within the net zero threshold.

NET ZERO ACHIEVED

'Net zero achieved' is demonstrated through analysis of operational energy data, showing that the target EUI has been achieved.

DESIGN for PERFORMANCE

DESIGN FOR PERFORMANCE
'Design for Performance' is an industry-backed project led by the Better Buildings Partnership designed to bring an operational energy rating scheme to the UK commercial property market.
Read more: www.betterbuildingspartnership.co.uk/node/360

Achieving net zero for existing assets

We cannot build our way to net zero. Successful decarbonisation of existing assets will be essential, as will a new net zero-driven approach to managing our buildings.

PATHWAY TO NET ZERO

Transformation of existing assets to net zero requires a plan, and can only be achieved through a partnership between owners and occupants. It will require a change in the way buildings are managed and used, as well as design interventions. For a plan to make commercial sense, interventions need to be woven into the long-term business plan for an asset and aligned with other lifecycle maintenance and refurbishment works. But change is essential if buildings are to remain competitive as market expectations change.

GET THE SEQUENCE RIGHT

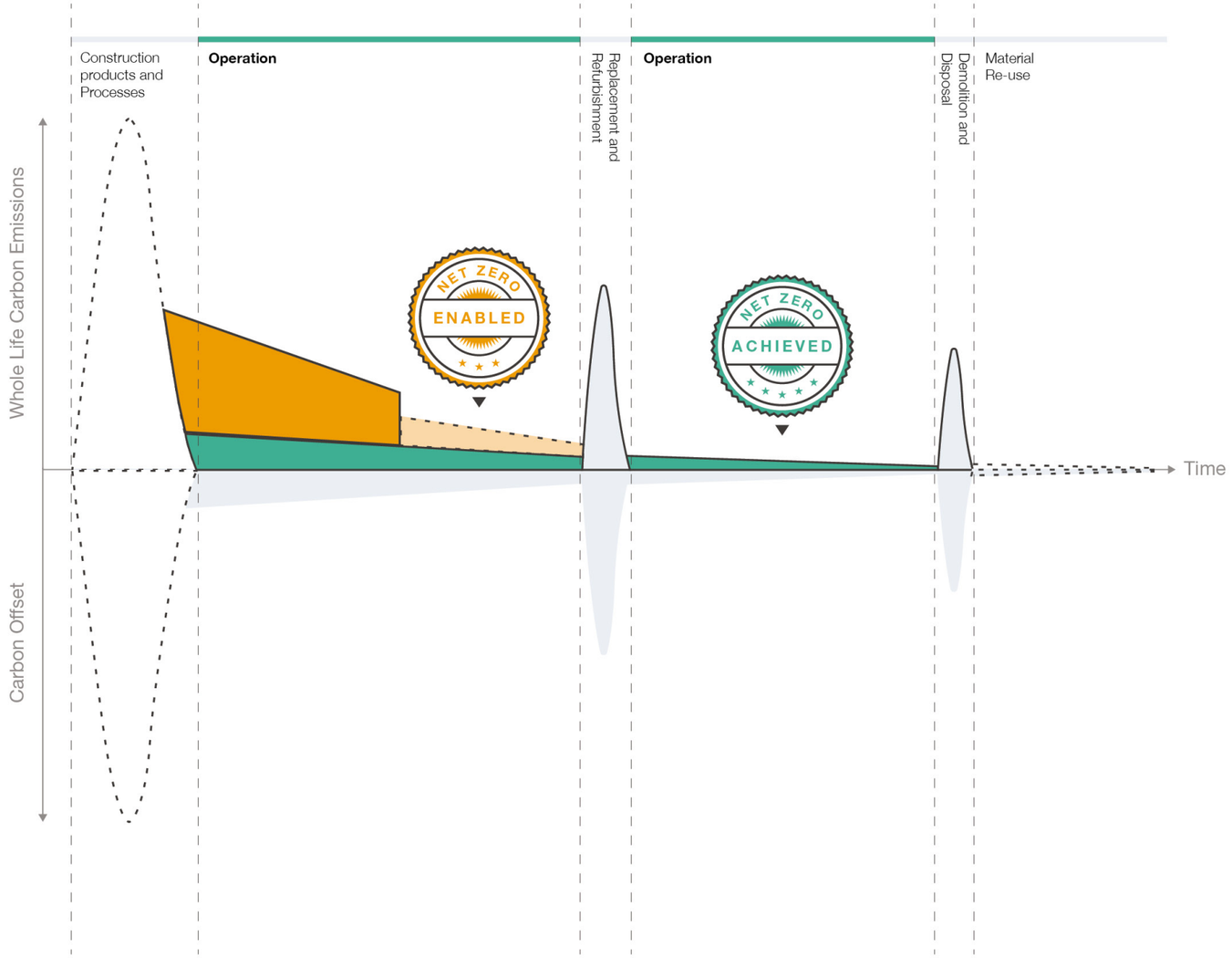
Careful sequencing of the interventions to achieve energy demand reduction is important. Timing of interventions can be planned around factors such as plant replacement, refurbishment, leasing. Or the need to make specific carbon reduction can be the primary driver.

Lifecycle works

Aligning carbon reductions with existing lifecycle replacement strategies allows extra cost associated with carbon reduction to be minimised alongside disruption to operations. This can range from simply moving to best-in-class equipment to full system change, such as a shift from gas-fired boilers to low-carbon heat pumps.

Refurbishment

Planned refurbishments present an opportunity for carbon reduction and savings can be achieved by adapting typical refurbishment design briefs. For example, acceptance of wider comfort conditions might enable a move to more passive cooling or a mixed-mode approach to ventilation, including nature-based options like shading from a ‘green’ building envelope or adjusting windows to cut solar gain and improve air flow.



Carbon reduction projects

Growing urgency associated with net zero carbon may mean that carbon reduction itself becomes the driving force behind capital projects rather than carbon cuts being an add-on to planned lifecycle or refurbishment works.

NET ZERO FM

By putting a value on energy performance, net zero will drive a fundamental shift in the way we operate our buildings. An approach to operation and maintenance driven by data and analytics has been shown to have a substantial impact on performance. But this is far from standard practice in the UK, where many maintenance contracts are based on planned maintenance schedules and reactive calls with no reference to energy performance. A link between performance and value creates an incentive to invest in operation and to create the data-driven approach we know is needed.

FM 2.0 - REIMAGINING FACILITY MANAGEMENT FOR THE DIGITAL AGE

FM 2.0 is our vision for the future of facility management. It applies intelligent automation to take the pressure off people, opening new avenues for creativity in FM and a strong focus on meeting the needs of occupants.
Read more: www.arup.com/perspectives/publications/promotional-materials/section/reimagining-facility-management-for-the-digital-age

Designing for net zero performance

Whether it's a net zero retrofit or the beginning of a new-build project, designing buildings to achieve net zero requires a fundamental change in approach.

For too long, design success has been measured by compliance outcomes, including BREEAM ratings and Part L. Designing for operational performance requires a different approach and a much deeper understanding of how buildings will operate and perform in practice.

MODELLING SUCCESS

Designing for net zero performance makes advanced energy modelling an absolute necessity as well as its seamless integration within the design process. The design develops in response to modelling outcomes.

This approach inevitably demands sustained focus on how systems perform when demands are low, an area of building performance that is often neglected in the conventional design process. As an example, it is not uncommon for commercial buildings to operate at 5% of peak load or less for a significant proportion of the year. This means that poor turn-down efficiency can have a crippling effect on performance outcomes.

OPENING THE ENVELOPE

Fully sealed façades with close control air-conditioning are unlikely to be compatible with net zero in the long term. There is a growing realisation that internal comfort conditions will need to relax, but in the context of sealed buildings with little local control this quickly leads to a rise in dissatisfaction amongst occupants and poorer health and wellbeing outcomes.

To achieve net zero, we will need to re-engage with mixed mode and natural ventilation. This will be enabled in part by changes in the external environment – the gradual move to electric vehicles should reduce both noise and improve air quality, putting alternative approaches within reach.

Whilst digital approaches can help optimise mixed ventilation approaches, there remain fundamental challenges to overcome when combined with the commercial reality of large, deep-plan floorplates.

OPERATIONS & CONTROLS

Measuring, verification & commissioning

Occupant energy targeting, green leases

Control and monitoring system installation/upgrade

Explore renewable power purchases

LOCAL SPACES

Low energy occupant, HVAC

Small power load optimisation

Low energy lighting, intelligent controls

Occupant electricity purchasing. Energy targeting green leases

RIGHT-SIZING PLANT

Using advanced energy modelling to inform plant sizing can result in lower peak capacities than more traditional approaches. This can both reduce installation cost and improve efficiency. A combination of reduced peak capacity and differential sizing of main plant can have a particularly transformative effect on performance at low part loads.

DESIGN FOR OPERATION

Design of building systems and interfaces to enable effective operation is essential if net zero targets are to be achieved.

A smart building controls system and accessible, maintainable plant and equipment will allow a facilities management team to minimise the day-to-day energy demands of new buildings. This is critical to maintaining intended performance levels – and therefore carbon impacts – throughout a building's lifecycle.

ENERGY SYSTEMS

A ban on gas-fired heating in new homes is on the horizon in the UK, although exact timing is not yet clear.

High temperature district heating systems are becoming a thing of the past, but there remain opportunities for decarbonisation through district energy infrastructure. Fifth-generation district energy networks employ low temperature "ambient loops" to enable energy sharing between different building use types. In the right circumstances they can effectively exploit variations in daily and seasonal energy demands to minimise plant size and maximise energy efficiency.

CENTRAL PLANT & RENEWABLES

Upgrade plant. Connection to district network if available

Low energy lighting, intelligent controls

All electric building

Renewable generation

BUILDING ENVELOPE

Insulation retrofit (roof, cavity wall)

Local external shading

Natural and/or mixed mode ventilation

Facade replacement for improved u-values and air tightness

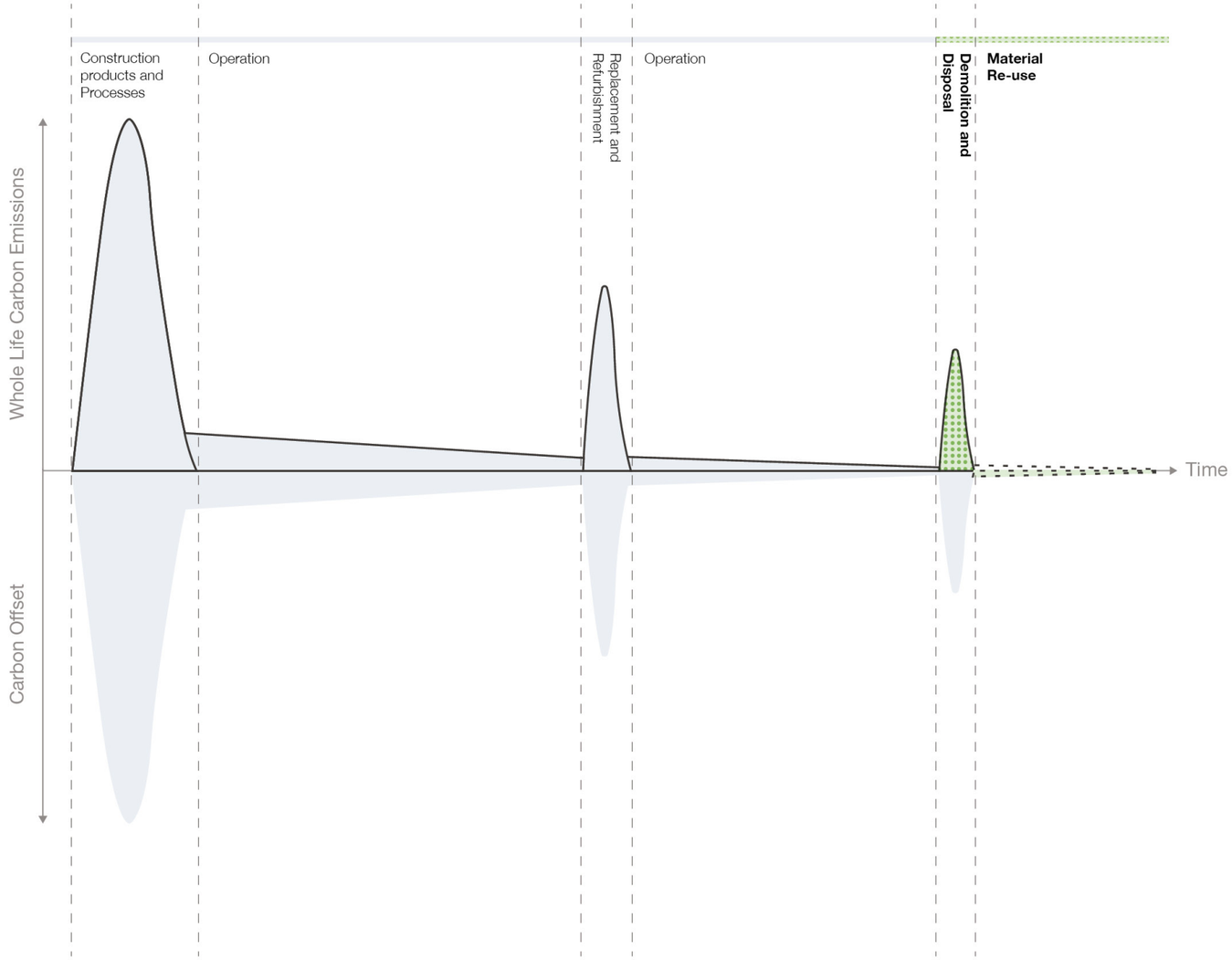
Transformation and reuse: prolonging building life

Our design goal for new buildings needs to be ‘long life, loose fit’. We need to maximise the life of buildings and ensure we get the best return on the embodied carbon we invest in construction.

Many of the buildings demolished recently were built relatively cheaply in the 1960s, with low floor-to-floor heights and little flexibility for change of use. There are other examples of buildings that are more robust, more flexible, and that have stood the test of time.

LONG LIFE, LOOSE FIT

Incorporating the principles of ‘long life loose fit’ into our design of new buildings improves the chances that they will stand the test of time. As well as testing deconstruction scenarios, we need to explore change of use scenarios at design stage. What can we do now to enable a change of use in the future, from commercial to residential for example? There is an inevitable tension to resolve here, between buildings that are more robust and flexible, and lean design that delivers the lowest embodied carbon at completion of construction.



WHITE COLLAR FACTORY, LONDON
The five principles that drove the design concept for White Collar Factory are intended to create a flexible building, fit for the long term: high ceilings, a thermal-mass structure, simple passive façade, flexible floorplates and ‘smart’ servicing.
Read more: www.arup.com/projects/white-collar-factory

DIGITAL MATERIALS DATA

Making information available to future designers via materials passports will be a key enabler of future transformation. Embedding a broad range of data into BIM models, including materials specifications, surveys and loading data, will give future designers the best chance of finding a way to breathe new life into our buildings in the future.

1 TRITON SQUARE, LONDON
The refurbishment of 1 Triton Square demonstrates what’s possible through imaginative reuse, not only reusing and extending the existing structure, but demounting, refurbishing and re-erecting the existing façade.
Read more: www.arup.com/projects/1-triton-square

Intelligent offsetting

After working to minimise a building's whole life carbon emissions, the final step to net zero is to offset what's left.

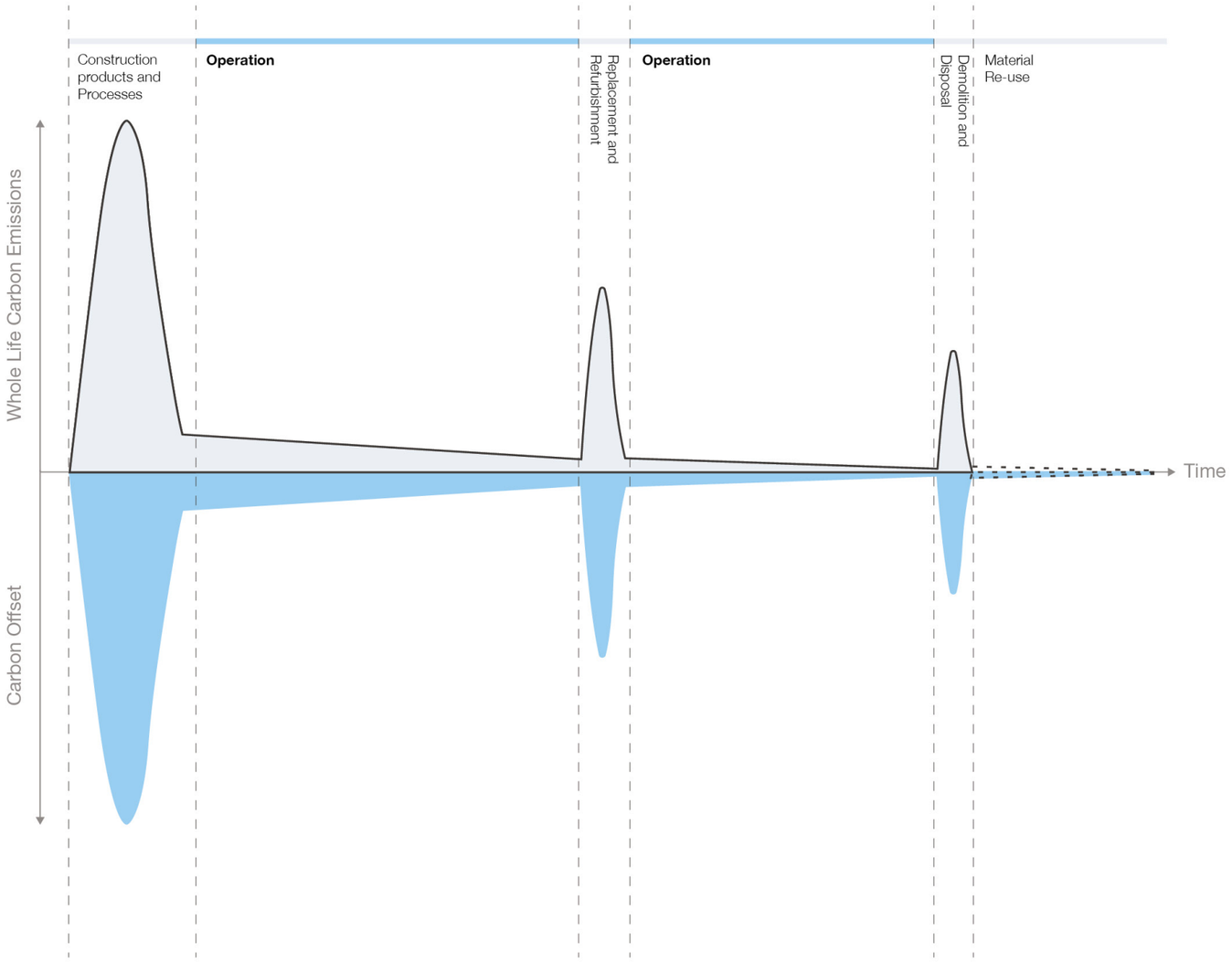
Offsetting a building's carbon impacts without intervening to minimise both embodied and operational carbon may be tempting, but it doesn't offer a lasting solution.

Beyond purchase of green energy, there is little consensus in the market on robust strategies to carbon offsetting, although industry bodies are working to improve available guidance. The key principle is that offsetting carbon must involve permanent additional reduction in emissions or removal of carbon from the atmosphere to be credible. Whether local or global, carbon offsetting has the potential to make a positive difference, funding projects that would otherwise not go ahead. Offsetting can also deliver substantial co-benefits such as reduction in fuel poverty. However, trust in the carbon offset industry is low and offsetting decisions may need to be reviewed regularly, as investing in offsets of questionable value increases reputational risk.

RENEWABLE ENERGY PROCUREMENT

Once onsite decarbonisation opportunities have been exhausted, procuring a 100% renewable energy tariff is the final step towards achieving net zero. There are different ways of procuring renewable energy with varying impacts on price, complexity and additionality. Power purchase agreements (PPAs) can present a good middle ground for offsetters. This provides additionality through the development of new renewable generation without the complexity and capital for an investment in a renewable energy asset.

A diversified approach is recommended, with a PPA to cover base consumption and short term green tariffs to capture peaks and fluctuations in energy consumption.



SUMMER 2020 — £13 per tonne

2035 FORECAST — £43 per tonne

CARBON'S MARKET VALUE

The UK government publishes traded carbon values. In mid-2020, this was a modest £13/tonne, but is forecast to rise to £43/tonne by 2035. The global carbon trading market is valued at over £500M annually.

In London, the Greater London Authority's draft London Plan sets a carbon offset price for referable property developments of £95/tonne, intended to represent the higher cost of offsetting carbon within London and provide an incentive for developments to invest in onsite carbon reduction.

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[2] Net Zero Carbon: Energy Performance Targets for Offices. UKGBC, January 2020 www.ukgbc.org/wp-content/uploads/2020/01/UKGBC-Net-Zero-Carbon-Energy-Performance-Targets-for-Offices.pdf

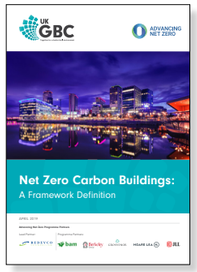
[3] Note this is similar to the target for commercial offices defined in the LETI Climate Emergency Design Guide of 55kWhe/sqm (GIA)/anum

Further reading

FM 2.0

FM 2.0 provides a vision for the digital future of Facility Management and how we can improve the performance of our buildings.

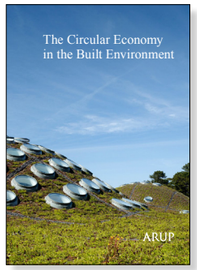
www.arup.com/perspectives/publications/promotional-materials/section/reimagining-facility- management-for-the-digital-age



UKGBC NET ZERO CARBON BUILDINGS: A FRAMEWORK DEFINITION

The UK Green Building Council has developed a framework definition for net zero carbon buildings to provide the industry with clarity on how to achieve net zero carbon in construction and operation.

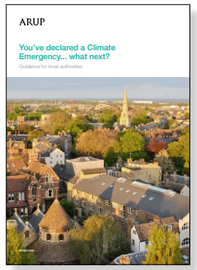
www.ukgbc.org/ukgbc-work/net-zero-carbon-buildings-a-framework-definition



CIRCULAR ECONOMY IN THE BUILT ENVIRONMENT

Our research outlines key principles of the circular economy, using the Ellen MacArthur Foundation's ReSOLVE framework to explore and contextualise practical applications in the built environment.

www.arup.com/perspectives/publications/research/section/circular-economy-in-the-built-environment



YOU'VE DECLARED A CLIMATE EMERGENCY, WHAT NEXT?

Our guidance sets out nine key stages for climate action planning, while emphasising above all that we need to begin now, and act fast, to reach a net zero emissions and climate-safe world.

www.arup.com/perspectives/publications/promotional-materials/section/youve-declared-a-climate-emergency-what-next-guidance-for-local-authorities

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