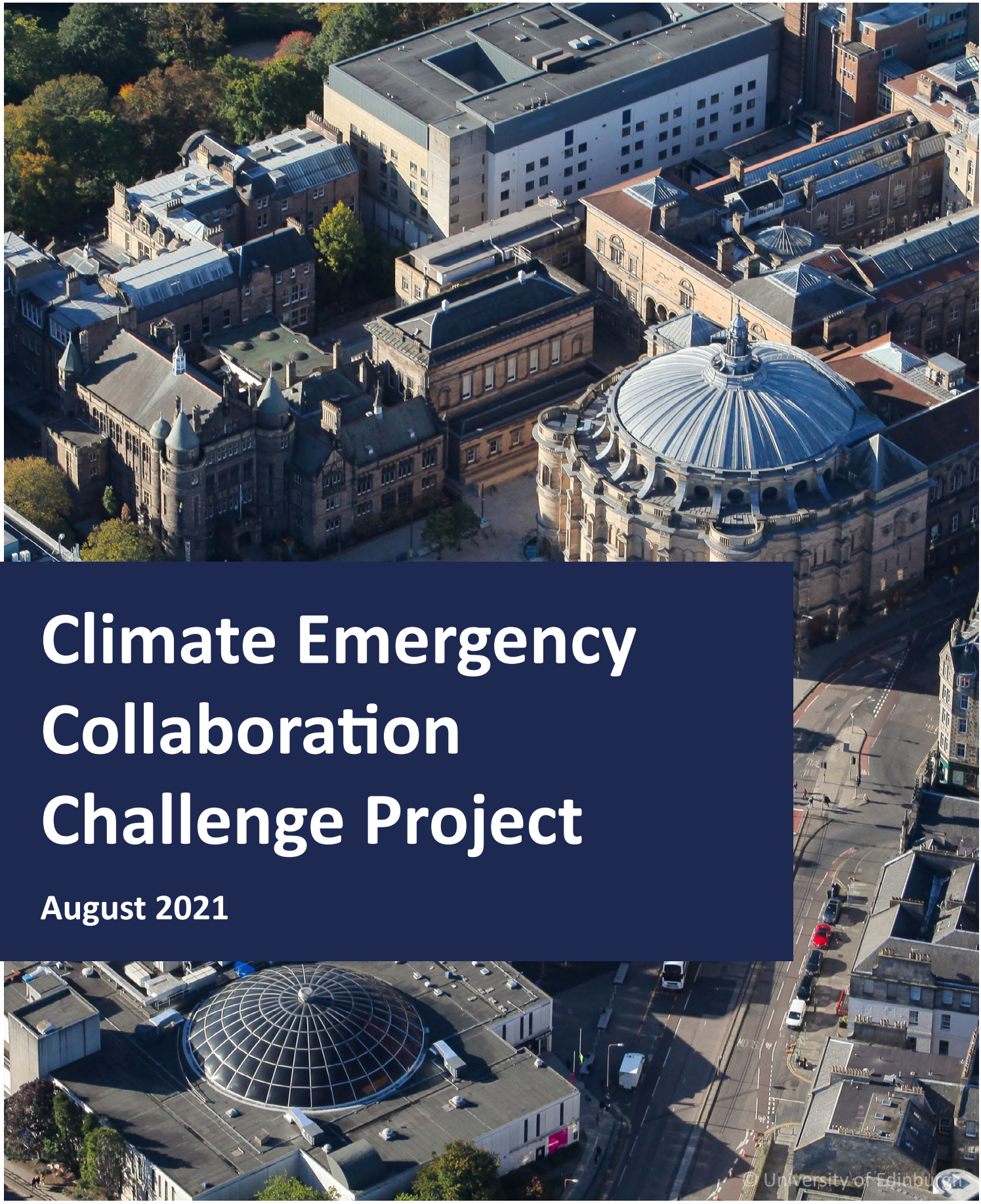


Climate Emergency Collaboration Challenge Project

August 2021

ecci EDINBURGH CLIMATE CHANGE INSTITUTE

THE UNIVERSITY of EDINBURGH

Scottish Funding Council
Promoting further and higher education

Contents

Executive Summary

This report is part of a larger Scottish Funding Council (SFC) project, under their Climate Emergency Collaboration Challenge. The project specifically explored how the University of Edinburgh as a client can work more collaboratively with our construction partners to deliver a zero-carbon built environment. It leveraged campus investments and relationships with Tier 1 Contractors to understand how client and contractor can work together more effectively to achieve better climate building performance outcomes.

A major aim of the project was to look for lessons which can be more widely shared across UK university estates, the public sector, and the construction sector as a whole.

Our engagement with the construction sector shows clients and contractors have, between them, the ambition, intent and capability to deliver better building performance and to reduce the climate impact of construction projects. However, we also found that optimal building performance is rarely delivered, and that current priorities in decision-making can often inhibit sustainability outcomes. Many reports, task forces and committees have come to similar conclusions. The challenges we still see in delivery show the complexity of the challenge needs actions to enable a new approach.

Findings and Recommendations

We present a series of findings from stakeholder workshops and one-to-one interviews as a set of recommendations for action. They emphasise the fact – now widely acknowledged – that the University's zero carbon ambition can only be delivered through earlier engagement and closer collaboration with its commercial partners.

Recommendations are presented under four main themes:

- leadership, governance and finance;
- design and construct process;
- delivery competencies and skills; and
- forecasting and feedback.

Delivering zero carbon starts with senior management so the incentives of decision-makers need to be aligned with emission targets, as is already best practice in the corporate sector. Finance is critical to success, and our findings show the need for visibility of the true cost of carbon over project lifetimes and to build this into the whole decision-making process. Contractors routinely do this for other customers, and conditionality of funding presents the opportunity to drive adoption of the same approach.

Intended outcomes need to be clearly articulated, starting with a concise 'one-page' brief. The client must clearly articulate from the outset, and throughout the process, their desired and priority outcomes for the project. Priorities and how best to achieve them must be shaped by early collaboration and engagement with construction partners, and managed with relevant client knowledge from the start. A programme approach must be taken, to plan for the long term and realise opportunities from connecting projects and scaling investments across the estate and with other city partners.

There will need to be a presumption in favour of refurbishment, rather than new build. Sustainability and zero carbon must be locked in from the start and gateway processes must ensure they are retained throughout the entire design, construct, operate process and at the end-of-life phase. Circular business models will be part of zero carbon delivery, through the choice of materials, addressing both operational and embodied carbon. Competencies and skills need to be built collaboratively, with the application of digital technology and carbon accounting being two main strands. Feedback mechanisms will play a vital role in delivering effective solutions and in supporting the communication process, since a sound evidence base for future decision-making is vital both to meet 2030 targets and to keep on track to 2040.

Our project has also highlighted where progress is being made and can be built on; for example the conditionality of public funding on climate impact, revisions to the University of Edinburgh's business case, and the recent publication of net zero building standards for the public sector.

Delivering Better Outcomes: Key Findings

Our project has highlighted key areas where more effective collaboration between the University and its construction partners is needed to consistently deliver net zero outcomes:

Leadership, Governance and Finance

- The client's net zero outcomes must be clearly articulated into the projects and programmes from the outset, and project governance must ensure these outcomes are ***maintained throughout delivery.***
- ***Whole life costing should be used,*** to make visible the true costs of operational and embodied carbon and allow better informed decisions about both capital and operational expenditure.
- ***Net zero outcomes will be compromised if the costs and risks are always placed with the client.*** A collaborative approach can deliver better outcomes and long-term commercial benefit.
- Project incentives need to ***prioritise net zero outcomes*** for construction quality equally alongside time and budget.

Design and Construct Process

- Sustainability expertise must be introduced early enough to ***influence programme design and outcomes.*** The procurement process should facilitate early collaboration and engagement with construction partners to determine the best way to deliver outcomes.
- ***Collaboration during the capital planning process*** is needed for input at programme level, and to ensure innovative projects are costed and brought forward to the estates programme.
- Contractor must support the client to embed net zero outcomes into the process, and ***be prepared to agree, acknowledge and share risks.***
- Client and contractor must ***adopt and share key sustainability principles,*** including a presumption of refurbishment over new build, and the use of circular design and materials throughout.

Delivery Competencies and Skills

- The partnership of client and contractor must ensure the ***right knowledge and skills are present at all stages of the project,*** and across all stakeholders, to ensure net zero outcomes are designed in from the start, and ***remain embedded*** in the project throughout.
- Sustainability skills must be embedded to ***ensure outcomes are not compromised during project management and delivery.*** This must be supported by the development of knowledge and skills across all project stakeholders.

Forecasting and Feedback

- To ensure performance outcomes are met, ***building performance monitoring into the occupancy phase must be built into delivery contracts*** from the outset.
- There is a recognised need for clearer standards on a building's environmental performance. With no mandatory framework, ***an appropriate standard must be adopted*** by the partnership.
- Data and knowledge from performance monitoring must be collated and harnessed to ***influence future design.***

Priorities for Change

Our engagement across the component parts of the sector – bringing together clients and contractors alongside policy, advisory and leadership bodies – has confirmed that the delivery of better building performance outcomes is no longer truly a technical challenge. The technologies to design, deliver and manage better building performance exist, and are improving all the time.

The challenge now is to shift decision-making priorities and ways of working so that zero carbon outcomes are prioritised, and the skills, knowledge and technologies that exist in the sector are fully harnessed and more widely shared to build capacity and capability across clients and contractors in the sector.

Our recommendations for action focus on supporting that capacity building journey by improving processes to facilitate collaboration and knowledge sharing, and most importantly by changing the priorities for decision making and embedding them throughout development and delivery of the estates programme. Embedding zero carbon outcomes and knowledge as early as possible has emerged as the clear priority, and our recommendations highlight those areas for immediate action we believe most effectively support this.

Recommendations for Action

A more collaborative approach must be client-led, building a foundation to use the expertise of contractors to deliver better outcomes. Our engagement suggests the need for capability, capacity and culture improvements to drive better design and delivery. To embed these into process and practice, we recommend a number of key actions for universities and public sector organisations to show climate leadership:

Leadership, Governance and Finance

Clients and contractors must embed zero carbon outcomes across all stages of programme governance:

- ***Adopt net zero carbon targets ahead of buildings standards and establish internal governance mechanisms using emissions*** as a steering mechanism.
- The ***incentives of decision-makers should be aligned with emission targets***, with delivery against zero carbon targets reflected in staff incentives and rewards.
- ***Appoint zero carbon champions*** throughout the organisational structure.

Design and Construct Process

Processes must change to ensure an embedded focus on climate outcomes throughout projects, in particular business case priorities and processes for procurement and contract management:

- ***Develop business case processes to reflect total emissions costs*** including operational carbon, applying whole life costing, and using internal carbon pricing mechanisms to prioritise projects.
- ***Collaboration must begin early enough to inform the capital planning process*** and shape the development of an integrated and connected estates decarbonisation programme.
- ***Establish processes to support early engagement*** to bring delivery expertise and experience into projects at an earlier stage, supporting design input and enabling transferability of project assets.
- ***Prioritise climate outcomes clearly in a concise one page brief*** *for* new projects.
- ***Enhance zero carbon baselining processes*** in collaboration with contractors, to establish carbon baselines, track progress of projects and set higher standards in future projects.

- ***Embed emissions targets in procurement strategy*** of each built environment project, incentivising contractors and supply chain using smart performance indicators.
- ***Enhance contract management,*** feedback and review processes to ***ensure zero carbon outcomes are locked in,*** in particular to gateway and business case reviews.
- ***Integrate sustainability into Value Engineering process during construction***, assessing carbon and circularity alongside cost, to ensure contractors maintain zero carbon outcomes in the final product.
- Act ahead of legislation and ***establish a mechanism to engage early with innovation,*** stimulating circular business models through choice of materials for refurbishment and new build projects.

Delivery Competencies and Skills

Programmes must be developed to build skills and competency throughout the project lifecycle:

- Roll out ***capability building packages to everyone involved in estates decision-making, and train those using and maintaining buildings*** to operate in line with zero carbon targets.
- Draw on ***academic expertise*** to develop capabilities of staff and contractors.
- ***Share lessons learned on zero carbon built environment*** internally and externally, supporting the sector and Scotland to meet zero carbon targets.

Forecasting and Feedback

We must make better use of modelling and monitoring to improve performance outcomes:

- Use ***modelling techniques to provide accurate estimates of energy*** use and other outcomes, and make gathering data part of ***active building management to test against digital models.***
- Undertake ***Post Occupancy Evaluation for all projects*** to test actual performance against designed outcomes and targets, and ensure results inform decision-making.
- Shared knowledge of ***previous experience from all stakeholders must inform*** development of new briefs.
- Reporting to funding bodies should ***routinely include progress and impact against net zero targets***.
- Disseminate local, regionally, nationally and internationally to advance good practice and knowledge of construction and operation.

University of Edinburgh: Leading the Collaboration Journey

Our report uses 2030 Scenarios to show how the journey to better building performance enabled by closer collaboration with our construction partners can be delivered, if we start now.

Collaboration on Climate Outcomes: Early Changes

The University has already committed to this journey, and is instigating changes in how it designs and delivers projects to facilitate better collaboration and deliver better outcomes. These aim to ensure that marketplace design, contractor competencies, and emerging 'real time' experience and technology influence design decisions early in the process. In particular:

- As a client, the University of Edinburgh **accepts the implications and significance of setting reduced life cycle costs and carbon reduction as key priorities over capital outlay.**
- Our **current delivery processes, procedures and procurement routes are changing** to reflect the context of emerging skills, knowledge, technologies and innovation.
- We are **updating our business case process to prioritise building performance outcomes** and climate.
- We are **changing our procurement process to facilitate earlier engagement** of partner expertise earlier into a collaborative design process.
- We will **incorporate performance modelling into future projects t**o help us better understand and overcome any performance gaps.
- A **'sign off' point must be incorporated in the design process to mitigate late change,** driven by emerging sustainable design advancements.

Collaboration Challenges

We also recognise that adoption of these changes brings challenges to work through collaboratively with both colleagues and construction partners. The most immediate we anticipate are:

- A mind-set shift has to happen in setting key project parameters, from a position of starting by setting capital outlay to the reduction of lifecycle costs and carbon emissions.
- The fundamental cost assumptions for early-stage budgeting and costing, based on building type and size, are no longer fit for purpose.
- This will mean more uncertainty around budget and pricing, a need to share risks and for governance and decision making throughout the project lifecycle to retain climate outcomes as a priority.
- Early estimates and budget advice will have little or no precedent, particularly for bespoke construction projects such as research laboratories and testing facilities. Despite these uncertainties, early estimates are essential to bring projects forward into the capital planning process and to shape an innovative and effective estate decarbonisation programme.
- Commissioning design input separately means there is no guarantee of supplier continuity from design into delivery.

The University is committed to collaborating with suppliers on overcoming these challenges.

Collaborating for Success

Collaboration is vital. The lessons learned from the project emphasise the need for a mature strategic dialogue between leading clients and major contractors, to be led by the public sector in Scotland. The construction industry has consistently signalled its willingness to engage in delivering low carbon solutions. It is now up to leading clients to seize the opportunity to benefit from the innovative solutions such collaboration offers.

While our project suggests the University must take the lead in creating a collaborative environment, giving contractors confidence in client commitment to sustainable outcomes and enabling them to draw fully on the expertise of the sector, it has also shown that contractors must respond in kind. The client should be confident that contractors are eager and willing to participate in that process, and that certain aspects will become more contractor-led as projects progress to construction. This means sharing knowledge, risks and benefits in an enabling approach which will support long term sustainability and business outcomes, balanced against short term costs and returns, particularly when enabling and costing innovation.

By collaborating effectively, the opportunity for universities and contractors is to lead the construction sector in demonstrating how sharing of skills and knowledge can deliver net zero outcomes, and to show how the sector can both lead and benefit from the transition to a zero carbon economy.

This project was led by Jamie Brogan, Climate Partnerships Lead, Edinburgh Climate Change Institute, with expert support provided by Barbara Morton (Sustainable Procurement Ltd), Ranald Boydell (Country Architecture) and Karen Ridgewell (Architecture and Design Scotland).

1. Introduction

1.1 Project Background

This project is part of the Scottish Funding Council's (SFC) Climate Emergency Collaboration Challenge, which was established to fund new business and academic partnerships to tackle climate change and assist Scotland's transition to a net-zero emissions economy. The low carbon built environment strand is one part of that larger project and involves academics from the University of Edinburgh (UoE), specialists in the field of architecture and design, major construction and infrastructure contractors. The project was led by Edinburgh Climate Change Institute (ECCI) and had specialist support from Architecture & Design Scotland.

The project builds on earlier work on low carbon solutions in the construction sector, with the UoE as the main client. In 2018 the UoE launched a Low Carbon Construction Pathfinder project in collaboration with EIT Climate-KIC and co-led by ECCI. The aim of the project was to support innovation and decarbonisation in the construction supply chains of the University, by working with five of the University's major suppliers, who are also among the largest construction companies in Scotland and the UK.

'We will if you will'.

The supply chain element of that project ended with a workshop that summarised the state of play in terms of collaboration in low carbon procurement as: 'We will if you will'. In other words, contractors were signalling their willingness to engage and their ability to deliver innovative, low carbon solutions. There was an appetite for earlier engagement in the design and construct process, not just on University estates projects but much more widely, throughout the public sector. Tier 1 contractors were keen to bring forward the innovative solutions available now - or in the development pipeline - to address the climate emergency.

Building on the outputs of that project as well as the relationships developed during the course of that work, the current project involves representatives from those same contractors being invited to take these outputs to the 'next stage' by helping the University turn joint commitments into practical action.

1.2 Project Methodology

This component of the wider SFC Climate Emergency Collaboration Challenge project was about building capacity for better building performance in the context of a climate emergency, and to develop a more collaborative approach between client (UoE) and contractors that delivers better outcomes.

We have used the term "contractor" as shorthand for all stakeholders on the supply side of the process i.e. the contractors and sub-contractors; the architects, engineers and other design professionals; and the manufacturers and broader construction industry supply chain. Whilst formal engagement during this project was primarily with Tier 1 Contractors, we did seek input in different ways from across the whole sector.

A series of workshops was delivered, aimed at engaging with stakeholders, testing assumptions, developing understanding and proposing solutions.

At the start of these workshops, a number of assumptions were articulated, as follows:

- **Building efficiency** (new and existing) can and should be better optimised in the context of a climate emergency.
- The **building performance** we experience at the end of a project often does not match our original ambition or intent.
- That **performance gap** does not arise because the building technologies and materials to deliver better performance with less climate impact do not exist.
- It arises because of things that happen (or don't happen) at various stages during the project lifecycle … designs, decisions, budgets, and having the right partnerships, skills and knowledge at the right time to support them.

Building on the results of the earlier ECCI Pathfinder Project on Procurement and Supply Chains, workshops were devised as follows:

- **Workshop 1:** Testing
- **Workshop 2:** Validation
- **Workshop 3:** From Shared Commitment to Embedded Action

Workshop 1 was aimed mainly at the University as a client, while Workshop 2 was designed around the contractor, with the intention of supporting a more focussed and open discussion. Workshop 3 brought client and contractor together, to focus on actions.

The outcome of discussions held during these workshops and in individual interviews with project participants are summarised in the **Findings section.**

The project then used 2030 scenarios from the perspective of the client and the contractor as a way of 'back-casting' to generate potential solutions and recommendations for action.

The back-casting format was adopted as a means to best reflect the variety of practices amongst organisations represented in the project.

- It focuses on actions needed to meet shared objectives, rather than pointing responsibility at individuals.
- It focuses on those actions most likely to deliver improvement.
- It enables a broad and diverse range of issues to be covered.
- It ensures the report will not be immediately out of date, given the current pace of change amongst many different stakeholders.
- It is designed to encourage action, both individual and collaborative.

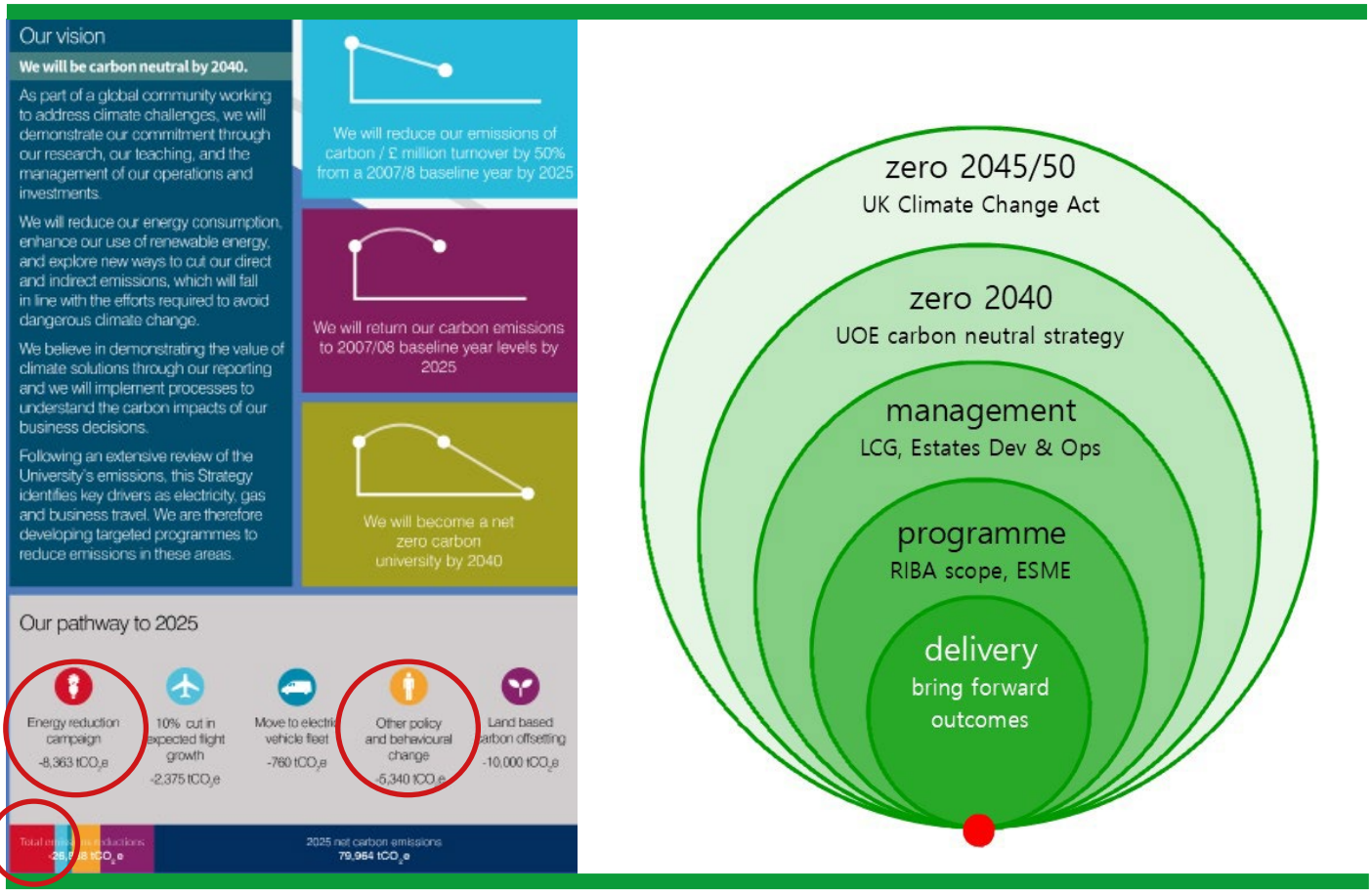
Workshops were held virtually using MS Teams during the period July – November 2020. Each of the workshops were facilitated by Jamie Brogan, Climate Partnership Lead, ECCI, and supported by Procurement Specialist, Barbara Morton, Sustainable Procurement Ltd and Architect Ranald Boydell, Country Architecture.

Expert input to the project was provided by Karen Ridgewell, Principal Design Officer, Architecture & Design Scotland.

2. Context

2.1 The University of Edinburgh Climate Committment

In 2016 the UoE launched their ambitious Climate Change Strategy under the headline “Zero by 2040”. It was a forward looking document, positioning the University at the frontline of action on climate change in the context of the UK Climate Change Act of 2008 and the Paris Climate Agreement of 2015, setting ambitious targets for their estate and management. The ambition of the University’s target extends far beyond their operational estate, with the target of net zero including Scope 3 emissions across all of the international operations.



© University of Edinburgh (left) Country Architecture (right)

Between then and late 2020/early 2021 when this report was being prepared much has changed in terms of government, corporate and community attitudes to Climate Change. The issues surrounding the net-zero target sets the context for this report.

2008	Nov	26	UK Climate Change Act 80% carbon reduction by 2050
2009	Jun	24	Climate Change (Scotland) Act
2015	Dec	12	Paris Agreemnet onm Climate Change adopted by UK
2016			University of Edinburgh Climate Change Strategy
2019	Mar	13	New homes will no longer be heater by gas by 2025
2019	Apr	2	National Grid says it can go 100% renewables by 2025
2019	Apr	23	Extinction Rebellion: climate protesters march on Parliament
2019	Apr	24	School Strike: Greta Thunberg full speech to UK Parliament
2019	Apr	29	Welsh Government declares Climate Emergency
2019	Apr	29	Scottish Government declares Climate Emergency
2019	Apr	30	UKGBC sets out the definition of net zero carbon buildings
2019	May	1	UK Parliament declares Climate Emergency
2019	May	2	UK Committee on Climate Change issues 'Net Zero' report
2019	May	6	UN issues IPBES report on Biodiversity Decline
2019	May	22	UK Clean Growth Mission: halve new building energy by 2030
2019	May	30	Architects Declare launched
2019	June	12	UK Climate Change Act amendment: 100% by 2050
2019	Oct	31	Climate Change (Scotland) Act amendment: 100% by 2045

2.2 Carbon Budgets

The Climate Change Act of 2008 also established the UK Climate Change Committee (UKCCC), its purpose being to: "advise the UK and devolved governments on emissions targets and to report to Parliament on progress made in reducing greenhouse gas emissions and preparing for and adapting to the impacts of climate change". This role includes setting the "Carbon Budgets" as defined by the Act.

Carbon Budgets are based on the fact that in order to meet the Paris target the amount of CO_2 in the atmosphere in total, not just annual emissions, must be limited. Each budget covers a 5 year period and places a restriction on the total amount of greenhouse gases the UK can emit during that period, with the note that:

> **"Under a system of carbon budgets, every tonne of greenhouse gases emitted between now and 2050 will count. Where emissions rise in one sector, the UK will have to achieve corresponding falls in another".**

The CCC has recently reported that:

> **"the first (2008-2012) and second (2013-2017) carbon budgets were met and the UK is on track to meet the third (2018–22), but is not on track to meet the fourth (2023–27) or fifth (2028–32) budgets."**

The sixth Carbon Budget (2033–37) was released on 9 December 2020 and, crucially, was the first to be set since the target was increased to 100% reduction i.e. net zero.

©Climate Change Committee (2020)

The predicted shortfall on the Carbon Budgets for 2023-2032 emphasises the need for actions to be ramped up this decade. This challenge has been taken up by different sectors in different ways, including the construction industry and built environment.

2.3 The Built Environment

Buildings are responsible for about 40% of global carbon emissions. In 2019, at the same time that the Climate Change Act was amended to net zero, the UK Green Building Council (UKGBC) launched their Net Zero Carbon Buildings report[1] which established a framework for measuring and reporting on both operation and embodied carbon emissions, and targets 2030 as the date by which all new buildings should be net zero carbon. It references the Royal Institution of Chartered Surveyors (RICS)[2] professional guidelines for embodied carbon which had been issued in 2017. In 2019 the Royal Institute of British Architects (RIBA) issued their Climate Challenge[3] which sets specific targets for carbon and other issues by 2030.

2019 also saw the launch of Architects Declare, now part of the broader Construction Declares movement which has over 6,000 signatories across all built environment disciplines in 27 countries. The declaration recognises the climate and biodiversity emergencies, the significant role buildings play in that, and how the construction professions have a responsibility to act.

2.4 Scottish Government

The Scottish Government has taken a very proactive stance on a broad range of climate change issues. These include, but are not limited to:

- Energy Efficiency Scotland programme (EES), comprising various initiatives across a range of sectors;
- Net Zero Carbon Public Sector Buildings Standard (NZCPSBS);
- Climate Change Mandatory Reporting Duties, including the November 2020 amendment;
- Learning Estate Improvement Programme, with an ambitious target of 67kWh/m² for energy use.

Government bodies such as the Scottish Futures Trust (SFT) and the SFC have been instrumental in this process.

2.5 Broader Operational Context

The University as a "client" in the construction process operates in the context of UK and international industry protocols as well as specific Scottish legislation, regulation and policy. Likewise, its Tier 1 contractors operate under both UK and Scottish regulations, on procurement for example, and most of them will have active construction projects across all the UK nations.

This project involved representatives from organisations such as the Association of University Director of Estates (AUDE) with a UK-wide remit as well as funding bodies and others, with a remit covering Scotland.

One of the areas where there is a distinct difference relates to the assessment of social value, including the environmental dimension of community benefits. The consequences of different operating regimes is highlighted in this report.

RIBA 2030 Climate Challenge target metrics for non-domestic (new build offices)

RIBA Sustainable Outcome Metrics	Business as usual (new build, compliance approach)	2025 Targets	2030 Targets	Notes
Operational Energy kWh/m²/y	130 kWh/m²/y DEC D (90)	< 75 kWh/m²/y DEC B (50) and/or NABERS Base build 5	< 55 kWh/m²/y DEC B (40) and/or NABERS Base build 6	Targets based on GIA. Figures include regulated & unregulated energy consumption irrespective of source (grid/ renewables). 1. Use a 'Fabric First' approach 2. Minimise energy demand. Use efficient services and low carbon heat 3. Maximise onsite renewables
Embodied Carbon kgCO₂e/m²	1400 kgCO₂e/m²	< 970 kgCO₂e/m²	< 750 kgCO₂e/m²	Use RICS Whole Life Carbon (modules A1-A5, B1-B5, C1-C4 incl sequestration). Analysis should include minimum of 95% of cost, include substructure, superstructure, finishes, fixed FF&E, building services and associated refrigerant leakage. 1. Whole Life Carbon Analysis 2. Use circular economy strategies 3. Minimise offsetting & use as last resort. Use accredited, verifiable schemes (see checklist). BAU aligned with LETI band E; 2025 target aligned with LETI band C and 2030 target aligned with LETI band B.
Potable Water Use Litres/person/day	16 l/p/day (CIRA W11 benchmark)	< 13 l/p/day	< 10 l/p/day	CIBSE Guide G.

2030 Climate Challenge target metrics for non-domestic buildings, ©Royal Institute of British Architects, republished with permission from RIBA

2.6 Common Drivers

This review of the context highlights the common drivers that support the University's Zero 2040 Strategy, demonstrating that it is broadly consistent with:

- Paris Climate Agreement to limit temperature increase to no more than 1.5/2.0°C;
- Scottish and UK Climate Change Acts for net zero carbon by 2045/2050;
- UKCCC Carbon Budgets;
- Various Scottish Government policies, including the EES programme and NZCPSB standard;
- Various initiatives by built environment organisations, including the UKGBC, RIBA and RICS.

This clearly validates the University's own commitment and the duty of the public sector to lead the way towards a net zero built environment.

2.7 Recent Examples

The ability to deliver on these objectives is already well proven, especially in the tertiary education sector. The UoE has many good examples, some of which are covered by the Case Studies which accompany this report.

Following are two examples from other campuses, one for a new-build and another for a refurbishment, which demonstrate that the highest levels of sustainability are possible to achieve within existing procurements and construction frameworks.

New-Build | GSK Carbon Neutral Laboratory, University of Nottingham

This laboratory building for Sustainable Chemistry opened in February 2017, was designed to offset the carbon emissions from construction within the next 25 years, and to utilise water reduction and heat-capturing technologies to deliver an array of additional environmental benefits. The building was awarded the BREEAM Outstanding and LEED Platinum certifications – the highest levels of green building certifications.

The building is estimated to deliver power savings of more than 60% and will use just 15% of the heat needed for a more traditional building design. The annual power consumption of the building is expected to reach 572MWh, which is 37% of the consumption benchmark for a chemistry laboratory. The PV array will deliver approximately 201MWh of solar generation annually and the biofuel CHP will generate 410MWh of power and 503MWh of heat annually. Excess energy created by the building will provide enough carbon credits over 25 years to offset the construction phase, and is being used to heat the nearby office development on campus.

Further details are provided in a case study by the UKGBC.

Project name	GlaxoSmithKline Centre for Sustainable Chemistry
Location	Nottingham
Project Partners	AECOM, Morgan Sindall, Gleeds, Fairhursts Design Group, Northcroft, WSP Safety, Bestfootforward
Building Type	Laboratory
Size	4500 sq. m
Project Status	Completed 2017
Work Area	Advancing net zero

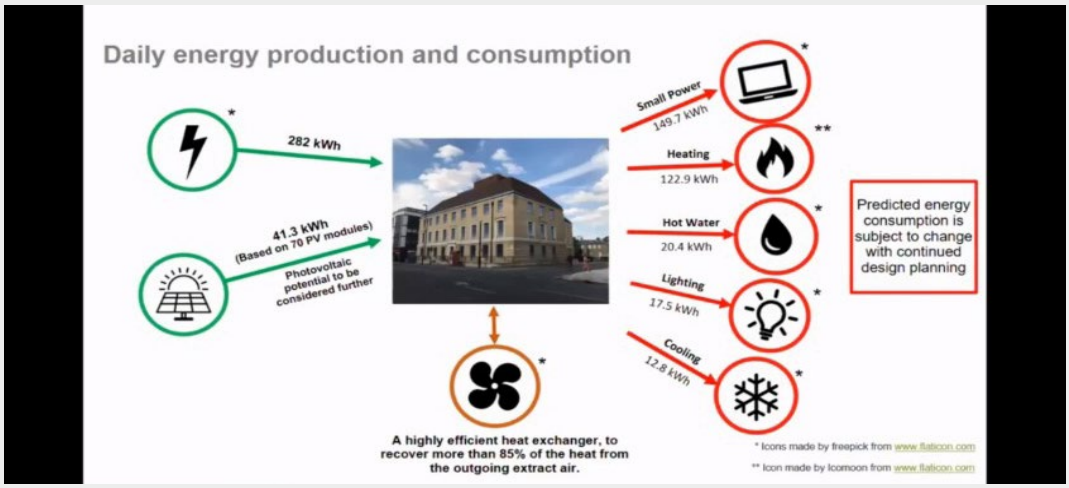
Refurbishment | Entopia Building, University of Cambridge

Located on Regent Street in central Cambridge, this historic building has been refurbished to meet the EnerPHit criteria, the Passivhaus standard for retrofits.

As described by the project engineer, Phil Armitage of Max Fordham at a recent FOOTPRINT webinar:

"the Entopia building exemplifies the process of extending the life and enhancing the value of an ordinary office building through a refurbishment promoting ambitious - and measured - energy, carbon and wellbeing outcomes."

The following slide was taken from a presentation at the EAUC webinar on Embodied Carbon in HE and FE Construction and Procurement (24 February 2021) by Professor John French of the Cambridge Institute for Sustainability Institute, which is based in the Entopia building. Professor French described how the final sticking point for the project was the initial refusal of Cambridge City Council to grant heritage approval to replace the historic multi-paned windows, highlighting how the retrofit process can be compromised by non-construction issues.



2.8 Contractors' commitments to the net zero agenda

Contractors' commitments to the net zero carbon agenda:

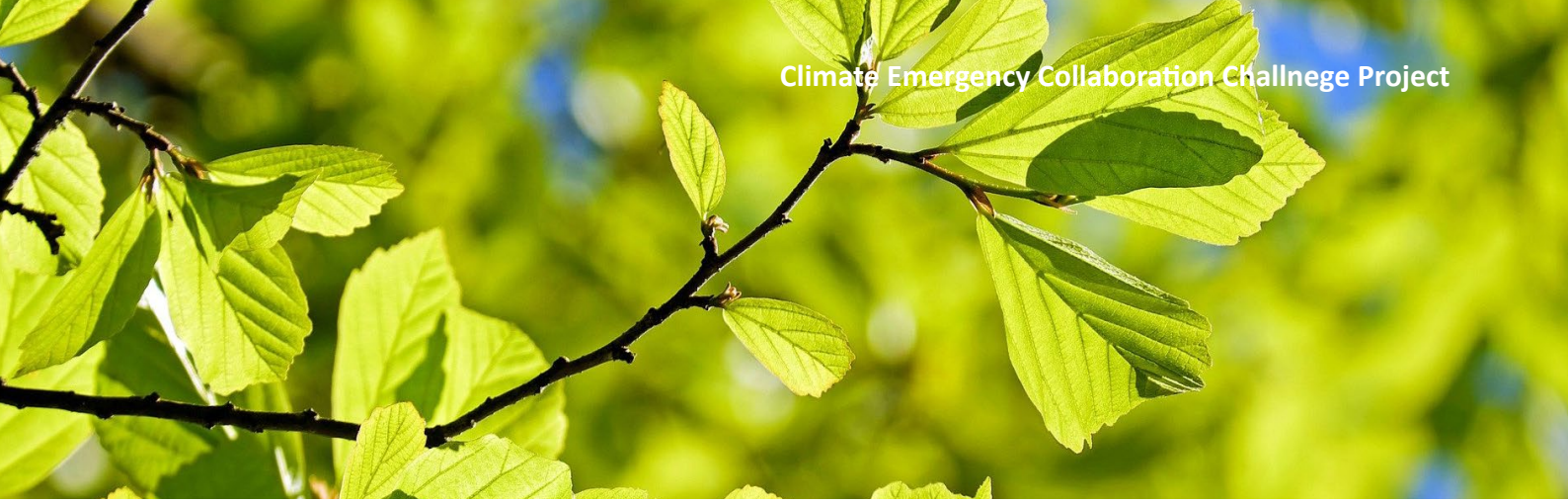
All of the Tier 1 contractors involved in the project have made their own corporate commitments and have set targets on carbon reduction and the wider sustainability agenda. As a project partner, Robertson has outlined its commitment to decarbonisation:

"In terms of climate action, we have committed to ensuring that by 2030 we move beyond being a carbon neutral business to become 'climate positive', generating zero emissions from our offices, commercial fleet and construction sites within our operational control. We will create a biodiversity net gain on our projects and become carbon positive without increasing our offsetting.

In turn, we've made a range of commitments that we will deliver by 2030, including:

- **Implementing 100% renewable electrical energy tariffs for all our offices, factories and sites, offering those same green energy tariffs to our customers and our supply chain.**
- **Utilising alternative, sustainable fuels and technologies for our sites and plant.**
- **Transitioning to an all-electric commercial vehicle fleet.**
- **And decarbonising our customers and our supply chain."**

www.robertson.co.uk/decarbonisation



3. Findings

3.1 Introduction

- The project findings presented here emerged from the client and contractor workshops held during 2020.
- They echo many of the conclusions of recent task forces and committees set the task of determining how best to deliver zero carbon solutions in buildings and infrastructure projects.
- The findings reinforce the call to action across the client and contractor communities.
- Findings need to be seen in the context of Scotland's Place Standard, updates to the National Planning Framework (NPF 4), Net Zero Carbon Public Sector Buildings Standard, the Climate Change Reporting Duties 2020 and recent Procurement Policy Notes from Scottish Government, amongst many others.
- Recommendations on commitments to action required are presented later in the report.

The findings are presented under four main themes:

1 Leadership, governance and finance

2 Design and construct process

3 Delivery competencies and skills

4 Forecasting and feedback

1 Leadership, governance and finance

This includes issues such as the need for strategic leadership on the part of the client; the need for clear articulation of intended outcomes from a project; governance arrangements to support the delivery of zero carbon outcomes, including the estates finance process.

The design and construct process includes the role of standards; the application and limitations of techniques such as value engineering.

Competencies and skills touches on those existing – within the University for example - and those required, from the point of view of both the client and the contractor.

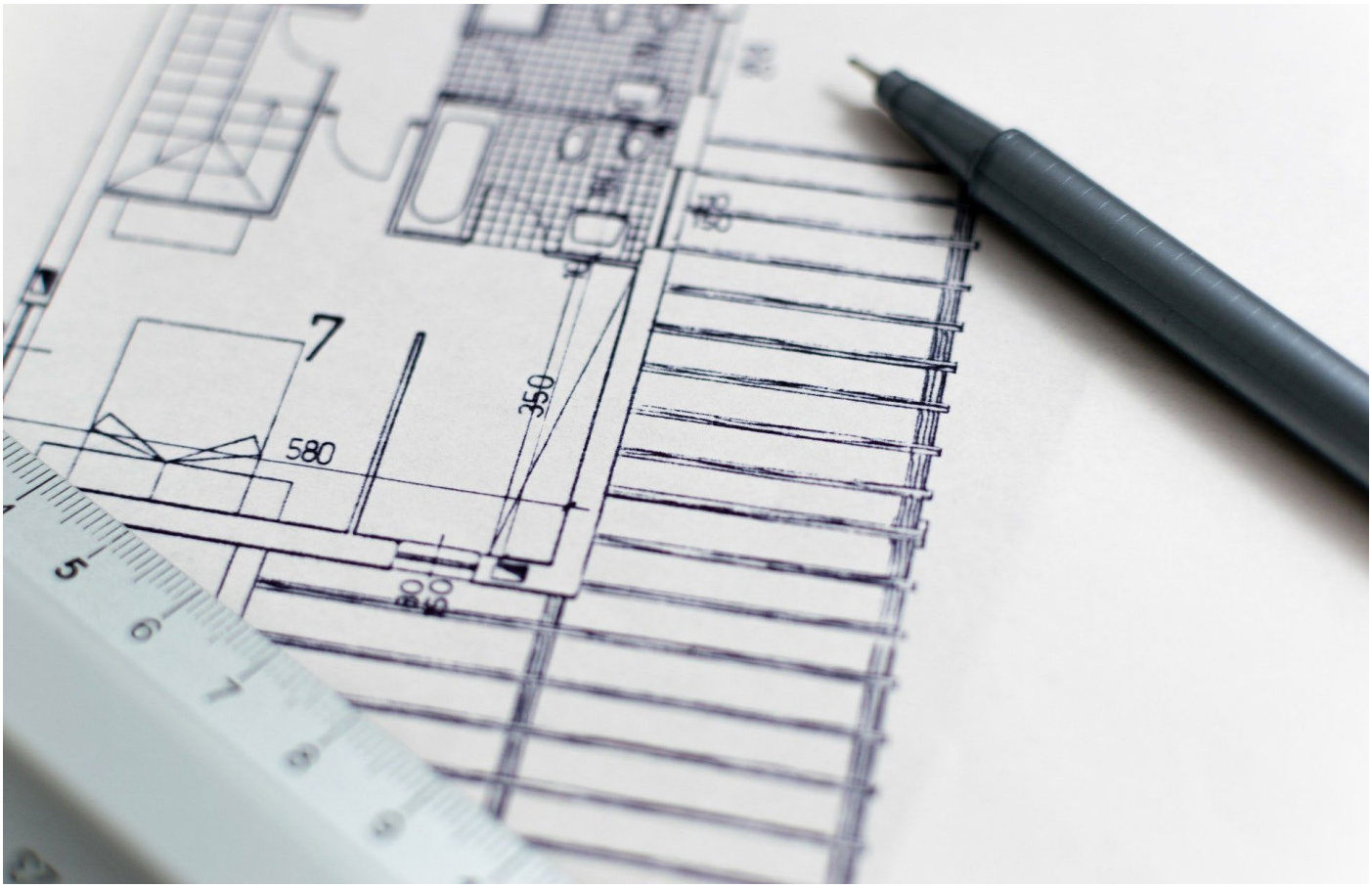
Forecasting and feedback includes the use of modelling in relation to zero carbon targets; establishment of baselines; need for post-occupancy review; data and management information used in monitoring and reporting.

Strategic Leadership

At the UoE, strategic leadership is evident in the Principal's focus on the UN Sustainable Development Goals and in the strategies and policies reflecting that commitment.

The UoE has responded to these challenges by setting ambitious goals including the Zero Carbon by 2040 strategy and by addressing its investment decision-making processes.

The University's position as a leading institution on the global stage alongside concern for its international reputation are factors in the process of establishing these ambitious goals. As an institution it has its foundations in a country that has set itself world leading targets. Since it operates internationally the University is also in a position to demonstrate leadership on the world stage.



Objectives and Outcomes:

- **EARLY INVOLVEMENT.** Contractors report that they are not involved in earliest stages of design. They would like to be, of course – and would be if they were invited in. There is appetite amongst some of them at least to do this collaboratively – and only then to compete – based on a better-informed specification / tender. The UoE may be able to learn from examples of collaborative working from other sectors – schools, commercial clients, etc.
- **CLARITY OF INTENDED OUTCOME.** Contractors interviewed during the course of the project expressed a pressing need for clarity of intended outcomes from the client. This clarity of intended outcome was reported to be lacking in many instances.

  During the workshops a comment by one of the contractors summarised the position relating to clarity of intended sustainability outcomes. Delivering projects at least cost is what contractors are good at. They are not (generally) sustainability consultants. So it follows that the client has to be clear about the sustainability outcomes required – and stick to them throughout the project's development and delivery.
- **GOLDEN THREAD.** There needs to be follow-through on this commitment too. Commitment to delivery throughout the process was reported as being key by contractors.

  Contractors are keen for the client to articulate the importance of any intended outcome and stick to it throughout the process. This has a skills dimension too.

  There needs to be a 'golden thread' throughout the entire process.
- **NATURE-BASED SOLUTIONS IN DECISION MAKING.** Another contractor pointed out the increasing importance of biodiversity - in the context of achieving net zero - and the need for decision-making to take account of a wider set of 'intended outcomes'. This reflects an increasing focus on nature-based solutions amongst leading organisations.
- **CIRCULAR SOLUTIONS.** Participants discussed the role of the circular solutions in delivering against net zero targets, including use of timber, the development of material exchanges – to maximise the re-use of materials on construction projects and minimise waste to landfill. Choice of low carbon materials is recognised to be linked to the role of regulations and standards.
- **SPECIFIC BUILDING DESIGN STANDARDS.** Commitment to specific building design standards provide the focus contractors appreciate. Examples were provided from the schools sector in Scotland.

The role of standards:

- Clarity of intended outcomes will be affected by the development and introduction of new standards. Project participants acknowledged the likely impact of the Net Zero Carbon Public Sector Buildings Standard. It was noted that this is currently voluntary. Project workshops provided an opportunity for this and other standards to be discussed. Opinion varied as to whether there is a need for such standards to be made mandatory.
- Some evidence from previous work in the built environment field (Prof Sean Smith, UoE) pointed to a need for regulation to provide a level playing field and to drive improvement.
- Others provided a word of caution around pushing for mandatory requirements.
- The need for targets and measures was emphasised by some participants. Others argued for a focus on methods.
- NOTE: UoE is considering the adoption of PassivHaus standard.
- PAS 2050 is a publicly available specification (PAS) providing a method for assessing the life cycle greenhouse gas (GHG) emissions of goods and services (jointly referred to as "products"). There is evidence from this project of companies / organisations developing their own.

Governance and Finance:

- The need for strategic leadership has been seen to be influenced by the trend towards conditionality of funding in the higher and further education sector in Scotland and the UK. The SFC and UK Research and Innovation are amongst the bodies now making environmental performance, including response to the climate emergency, part of their funding conditions.
- Having set itself the challenge of Zero Carbon by 2040, the University has also begun to amend its business case process. Training for staff is being rolled out but new ways of working have not yet been cascaded throughout the organisation.
- But the project found that key investment decisions are still being made on the basis of limited information on operational / energy costs / whole life costs.
- The often-quoted Capex/Opex (Capital expenditure / Operational Expenditure) split continues in University processes, in spite of those with responsibilities for each 'being part of the same team'.
- It was reported that value engineering is still used to strip out costs. Value management is not applied to deliver whole life value.
- One contractor emphasised the benefits of whole life carbon assessment - if this is carried through to the investment decision-making process.

As highlighted in the January 2021 World Economic Forum report on Net Zero Carbon: The Supply Chain Opportunity[4], organisations should '..develop internal governance mechanisms that introduce emissions as a steering mechanism and align the incentives of decision-makers with emission targets'.

Good corporate governance increasingly reflects the net zero carbon agenda as illustrated by the March 2021 launch of McLaughlin & Harvey's Net Zero by 2030 Strategy:

> **"Delivery of our Net Zero commitment is a business wide responsibility, from the Board of Directors through our pre-construction and project delivery teams and our supply chain. Strategic actions and requirements will be a key consideration in our decision making, procurement and training processes."**

See: Commiting to Net Zero by 2030

2 Design and construct process

- It was noted that RIBA Stage 0 requires the production of a Sustainability Strategy – that may never be mentioned again.
- Incentives and rewards don't drive actions towards net zero. For example, it was reported that the University's Estates Committee asks for reports on projects in terms of them being delivered on time and on budget but not about 'sustainability'.
- Contractors report that project risk is not apportioned to where it is best managed.
- The issue of carbon - both operational and embodied - were discussed at some length during the course of the project. Contractors all reported having tools & methodologies – either existing or in development to measure and monitor both.
- One of the major issues for contractors is that the cost of operational carbon is not routinely factored into the decision-making process. This means that the true whole life cost of projects is not visible or taken into account appropriately. Contractors are willing and able to cost operational carbon. They are anticipating a greater focus/ emphasis/ importance on embodied carbon in future – and are gearing themselves up for this.

Note: every contractor has developed or is developing their own approach / methodology for embodied carbon, it appears.

Procurement Process

- While the project did not explore alternative procurement models in detail, it is worth noting that at least one contractor pointed out that the SCAPE framework allows early engagement on design. The need for earlier engagement - designer/contractor/sub-contractor is reported by some as being preferable before and certainly no later than RIBA Stage 2 (RIBA Plan of Work 2020). It could involve a 'competitive dialogue style' process and SCAPE allows for this. It was suggested by others that this model could be extended by the University, as a demonstration of leadership. Others pointed out that the current SCAPE framework has less focus on sustainability than previous iterations. The move away from the PFI model has led to more transactional procurement processes. At least one contractor believes that the next iteration of SCAPE framework has potential to address this. Since a review was underway, feedback would reflect the need for sustainability to be addressed to a greater extent in future.
- Contractors supported moves towards greater visibility of the University's (and other) procurement pipelines. This is brought about at least in part by the Procurement Reform (Scotland) Act 2014 and the increasing focus on monitoring and reporting of sustainable outcomes. These outcomes already include delivery against the Scottish Government's 2045 net zero commitment. The built environment will be under increasing attention as a result of the latest Climate Change Reporting Duties which came into force during the course of this project and will take effect for public bodies in 2022.

The view amongst some of the procurement community was that, for smaller institutions in the higher and further education sector in Scotland, legislation would be necessary to deliver the required changes through procurement.

This is supported by an earlier study which concluded that..

> **'without legislation to guide practices and the procurement of projects, change will persist at a slow rate, perpetuated by corporate and individual level cognitive dissonance'.**

Ridgewell, Karen (2018) M.Sc. dissertation "What does Sustainability mean to Construction Professionals in 2018? Are they equipped for the Transformation required to operate within a low Carbon Society?"

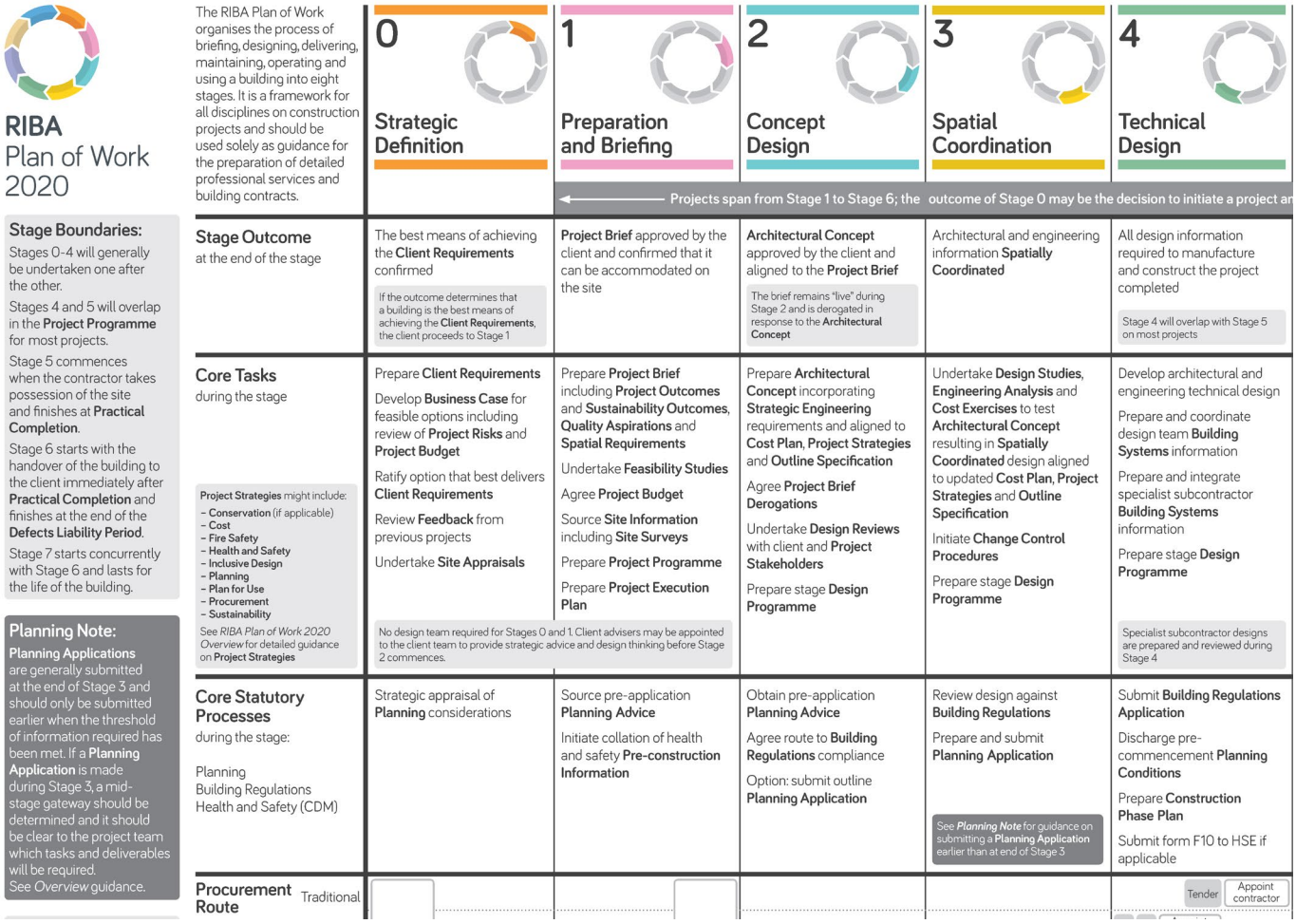
The University is already strengthening demand for low carbon goods, services and works through involvement with APUC, the EAUC and through the Scottish Government's Procurement and Climate Forum all of which are building momentum in relevant markets.

The World Economic Forum report of January 2021 on Net Zero Challenge: The Supply Chain opportunity concludes that:

"*Finally, companies need to align internal targets, funding allocations and incentives to their decarbonization targets. They should embed emission targets into their purchasing strategy and ensure overall reduction targets are adequately cascaded across units in the organization. Where emission reduction may result in higher spending, they need to develop mechanisms for releasing funds – for example, through internal carbon pricing mechanisms. They should align internal incentives to decarbonization targets; for example, by making them a factor in variable compensation. The Carbon Disclosure Project (CDP) found that around half of Europe's largest firms already link their executive pay to climate change. Similarly, companies can link their procurement key performance indicators (KPIs) and team compensation to supply-chain decarbonization initiatives.*"

This applies equally to a higher education institution and has implications for estates, procurement and institutional governance more widely. The same report goes on to say that:

"Companies aiming to decarbonize their supply chains need to change the way they operate. They require more comprehensive data exchange with suppliers and need to set up an organization capable of engaging them on their carbon emissions, as well as integrating emissions into procurement standards and decisions – and aligning targets and incentives in their organization to emission reduction targets. All of this requires governance."



RIBA Plan of Work 2020 Template, © Royal Institute of British Architects, republished with permission from the RIBA

3 Delivery competencies and skills

The project identified a number of potential gaps in skills, competencies and knowledge amongst a range of stakeholders.

As has been pointed out in 'governance', the University has amended its business case process and has begun to roll out training to relevant staff. In spite of this, decisions are being made on the basis of limited information on operational or embodied carbon.

Scottish Futures Trust (SFT) amongst others pointed out the need for an understanding of the carbon agenda amongst quantity surveyors, for example. Others interviewed extended this point to include architects and designers, accountants and others. This led some participants to suggest that the University might be in a position to develop these skills and disseminate the model to others in the HE/FE sector – and beyond.

It was pointed out that the UoE has experts in the field of carbon accounting for example. These skills are increasingly likely to be part of the required response to the climate emergency.

Note: *Interviews with University staff confirmed that there may be some merit on drawing on academic expertise in carbon accounting for example, as part of the process of developing capability.*

Where post-occupancy review is undertaken, results show a need for greater knowledge on the part of users of the building.

Some doubts were raised about the likelihood of any individual having all of the skills necessary to fulfil the role of Carbon Champion as described in the NZCPSB Standard. It was suggested that the University itself might have a role to play in developing this skill set.

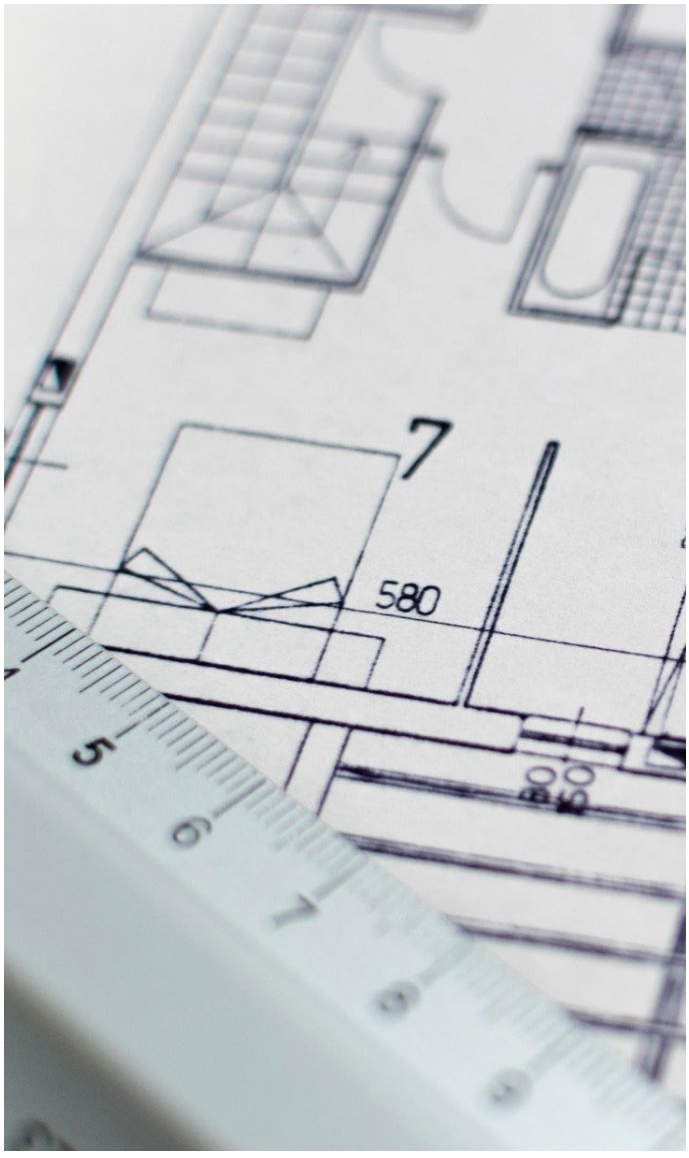
The University's expertise in behavioural change and culture change might also be an asset here, since the culture of any organisation needs to align with its strategic intent. The actions need to deliver on the words.

One contractor raised a point about potential use of technology (and skills too?) to model embodied carbon of existing buildings to help inform future decisions on new build / refurbishment. Tools and skills points also covered:

Contractors' own development of embodied carbon tools to support materials selection, building orientation, etc.

More detail required to inform decisions on sourcing of materials - greater granularity than in ICE carbon database. Note from discussion with specialist: Small manufacturers can't afford to seek the services to create certification etc., especially with a lack of a common labelling system.

During Workshop 3, participants were invited to comment on the need for a Community of Practice and for their views on alternative solutions, such as providing input to existing groups. This will be followed-up in dissemination events.



4 Forecasting and feedback

Contractors felt that target-setting (or identification of sustainability outcomes required) should never be the responsibility of an individual e.g. a project manager alone. Contractors reported that delivery of successful sustainable outcomes is often due to commitment of certain key individuals on a team. [NOTE: We interpret this as something that should be addressed through development of awareness / knowledge / skills / competencies through the team – and therefore throughout the process.]

At the UoE, post-occupancy review is not routinely undertaken, at least from the point of view of carbon and energy costs. This contrasts with the situation reported by the SFT in relation to schools, where a target of 67kWhs per sqm per year) has been set and is routinely monitored. SFT report this as being a major step forward in terms of the climate emergency response and can be traced to Scotland's Learning Estate Strategy 2019 and Learning Estate Investment Programme / Action Plan.

The University does not operate carbon budgeting. Some Universities have started to operate campus-based carbon accounting – see Yale University, for example.

3.2 Key Issues

Findings from this project echo the summary of lessons learned to be found, for example, in 'Scotland's Learning Estate Strategy' 2019:

'Strategic Leadership: ensuring strategic leadership is embedded at the earliest opportunity will shape outcomes and build a consistent approach to realising benefits

Objectives and Outcomes: objectives and outcomes should be agreed early and be achievable. Procedures should be put in place throughout the whole process to ensure they are realised

Governance: strength, accessibility and continuity of governance are key to ensuring outcomes are realised. Governance should be proportionate to project size and consideration should be given to the inclusion of a Senior Champion on large complex projects '.

Each of these lessons and others are addressed in the '2030 Scenarios' that follow.

4. 2030 Scenarios

This section of the report is written from the perspective of two organisations, a client and a contractor, as if they are looking back from 2030. Sometimes referred to as "back-casting" this approach allows a desired future scenario to be established as the basis for explaining how the process needs to unfold to get there.

The format was adopted as a means to best reflect the variety of practices amongst organisations represented in the project.

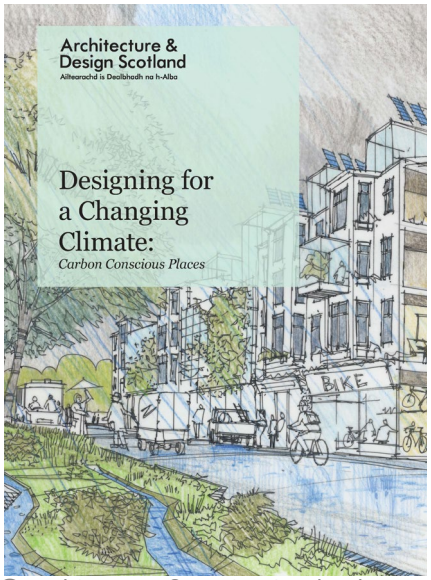
- It focuses on actions needed to meet shared objectives, rather than pointing responsibility at individuals.
- It focuses on those actions most likely to deliver improvement.
- It enables a broad and diverse range of issues to be covered.
- It ensures the report will not be immediately out of date, given the current pace of change amongst many different stakeholders.
- It is designed to encourage action, both individual and collaborative.

Back-casting in the context of Climate Change

Back-casting is now widely used when addressing climate change, where its format lends itself to the long-term forward planning that is required. "The World We Made"[5] is a recent book by Jonathon Porritt, co-founder of Forum for the Future, which provides his take on how society will have changed looking back from 2050.

Back-casting has also been adopted by Architecture and Design Scotland (A&DS) for their report Designing for a Changing Climate - Carbon Conscious Places[6], released in October 2020. The report shares learning from a year-long exploration into climate change adaptation, also using 2050 as the back-casting date. The mandate of A&DS, as a Non-Departmental Public Body, is to champion the Scottish Government's Place Principle and to assist local authorities, communities, and relevant stakeholders to implement Scotland's Climate Change Plan at a local level.

The conclusions from the Pilots action research led to the creation of eight Principles of a Carbon Conscious Place. The Principles in turn have been used to provide a narrative around four 2050 visions for Scotland: City Centres, Urban Neighbourhoods, Towns, and Rural settlements. Each settlement scale demonstrates the theoretical outcomes of the principle's implementation through place planning in the preceding years to reduce, repurpose and absorb carbon and adapt to the impacts of climate change.

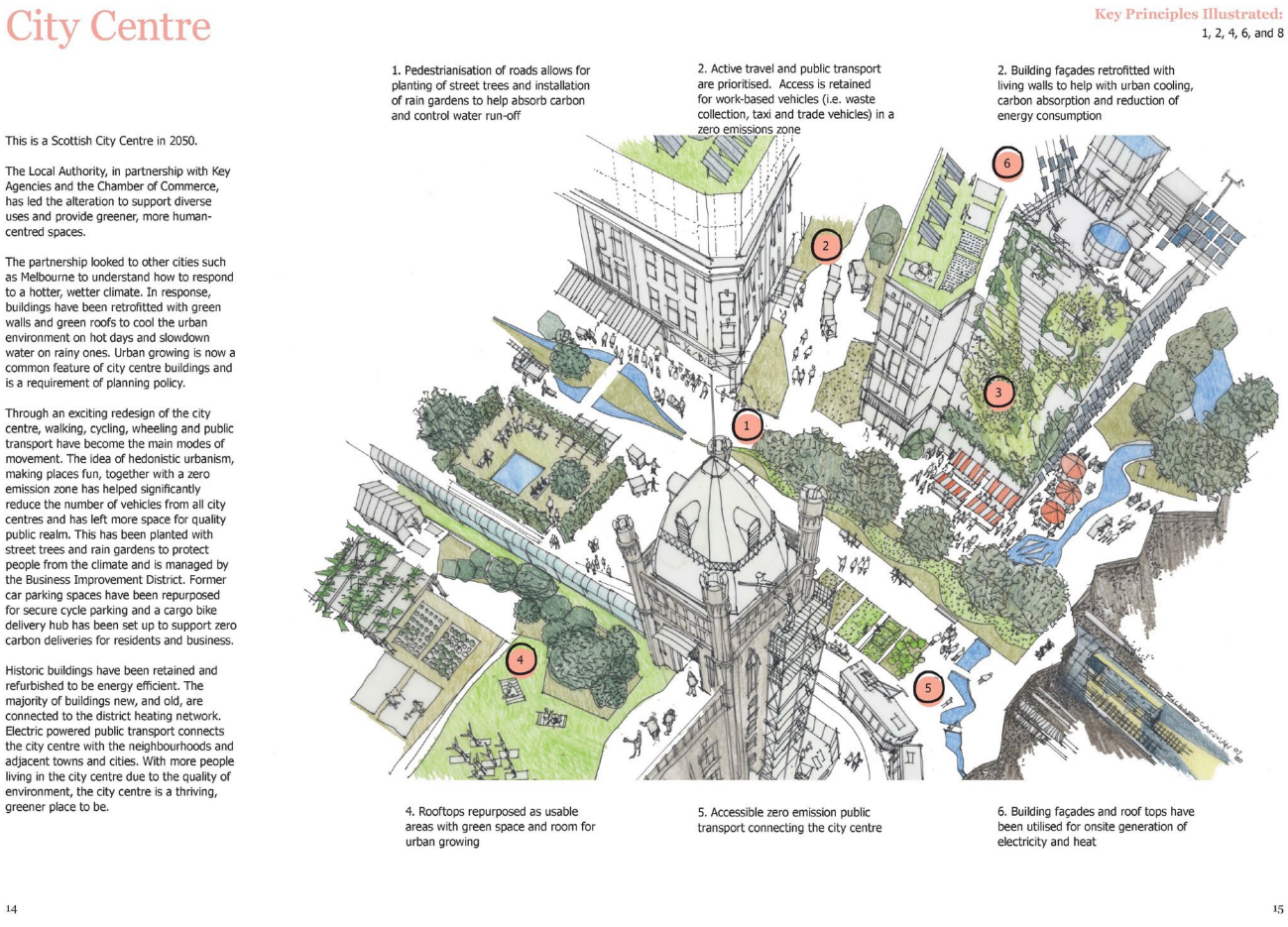


All of these scales are relevant to different parts of the University's assets. For example, the vision for the City Centre includes:

1. Pedestrianisation and soft landscaping of roads
2. Active travel
3. Buildings with living walls
4. Rooftops repurposed as green spaces
5. Zero emission public transport
6. On site renewable energy generation

The report is not designed to be read as a manual. It does not suggest a fixed set of solutions for how to alter places. Instead, it offers examples, principles and illustrations to help guide and inspire people to support a whole place approach to responding to the climate imperative, carbon targets and their place conditions.

This is an example of how A&DS uses back-casting and other tools and techniques, to communicate with a variety of participants, to inspire and facilitate change. The use of visioning exercises aids the exploration of long-term aspirations futures. It stimulates new ideas, challenging complacency, or fixed views, encouraging explorative and systems thinking and highlighting the need to understand the long-term impacts of decisions or inaction. It can be utilised at different stages of a project and is applicable at a variety of scales, from assets to local place and regional planning.



4.1 The Client Perspective

Introduction

This scenario is written from the perspective of the client – in this case the UoE, an institution that has set itself ambitious targets in relation to zero carbon. It has gained a reputation in the field of 'zero carbon built environment' on its estate and in curriculum.

Over the past decade - since 2020 - changes in the legal & regulatory context, including Scotland's National Planning Framework, the Place Standard, Net Zero Carbon Public Sector Buildings Standard, Climate Change Acts and associated reporting duties, have combined to put the University at the centre of zero carbon activity.

In 2030, the University, along with other parts of the economy has prioritised green growth and reimagined its estate and building requirements. The University has capitalised on its own expertise in areas such as carbon accounting and carbon capture and storage, to influence policy-makers, inform new regulations and standards, and to help set Scotland's agenda for 2040 and beyond.

Collaborative contracting models are the norm. New relationships with supply chains reflect mature dialogue started in 2019/2020. Innovation and circularity are routinely delivering steps towards 2040 Zero Carbon. Technology has been deployed relatively rapidly – through shared learning with experienced practitioners on the supply side - meaning that the University now has a good evidence base of zero carbon actions, behaviours and results.

Refurbishment take places by default, new build only by exception.

Carbon pricing and internalising of externalities has revolutionised processes and delivered intended outcomes. The UoE has raised the bar, not just for academic institutions in UK and internationally, but also in terms of public/private collaborative action in the built environment. This is reflected in finances – revenue streams, grants and funding as well as in attraction of staff and students. Delivery modes may have changed, but standards have only increased. Assessments and awards continue to provide the University with the recognition it has earned over the past decade and more.

4.1.2 From strategy to commitment:

◊ Strategic Leadership:

In 2030, the UoE is continuing to demonstrate leadership within the Higher and Further Education sector; within the Edinburgh City Region; within Scotland and internationally.

The strategic leadership that was evident in the Principal's focus on the UN Sustainable Development Goals have resulted in the strategies and policies now embedded in the University's day-to-day operations. Sustainability is part of business as usual for the University.

The University's position as a leading institution on the global stage, alongside concern for its international reputation were factors in the process of establishing ambitious goals from 2015 to 2020. As an institution it has its foundations in a country that had set itself world leading targets and the University has seized the opportunity to adopt a leading position on the world stage through its response to the climate emergency and the challenges of sustainability.

The University set itself ambitious goals, as reflected in its Zero Carbon by 2040 strategy and by addressing its investment decision-making processes in order to position itself at the leading edge of sustainability practice.

In 2030, the University has used its expertise to set new standards and attract new funding in a range of related disciplines from carbon accounting to climate justice. Its expertise is reflected in its operations through the application of world-leading investment and procurement models, for example. The University continues to share its sustainability experience and expertise on the global stage, through its involvement in multi-national climate initiatives. In this respect the University has responded to the challenges outlined in the many reviews and reports delivered by numerous task forces and working groups over preceding years.

The challenges of Covid-19 pandemic served only to hasten many of the changes that have shaped the University's operating model. It accelerated the trend towards remote and blended learning and in so doing, contributed to the reformulation of many of the institution's practices. Lessons learned from this period continue to influence decision-making throughout the University.

The results of this response are reflected in research ratings, the number and calibre of students and staff being attracted to the institution and, critically, in grants and funds that now have climate, carbon and sustainability embedded as core criteria.

As far back as 2020, the University had begun to extend its sustainability expertise, building on its work in the fields of circular economy, carbon accounting, carbon capture and storage and public sector climate change reporting. It was able to capitalise on this expertise to create knowledge hubs to support the green recovery and to build strategic alliances with partners worldwide. The mature dialogue with key supply chain partners has been one of the building blocks of the University's success and enables it to showcase the benefits of low carbon practice in action.

Through its commitment to Zero Carbon by 2040, the University has reflected its role in the wider community – of the city and the region. Its approach has been influenced by studies such as the Net Zero Carbon Roadmap for Edinburgh, published in December 2020.

The University had already set its own target which reflected its activities and the most significant part of its carbon footprint. Its target included Scope 3 emissions from the outset, not least to reflect the international nature of the University's operations.

The institution has been able to support this work through the involvement of academic staff, but crucially it has acted early on emerging findings in its estates infrastructure policy and practices.

◊ Governance:

Findings from this project echo the summary of lessons learned to be found, for example:

At the end of 'Scotland's Learning Estate Strategy' 2019:

'Strategic Leadership: ensuring strategic leadership is embedded at the earliest opportunity will shape outcomes and build a consistent approach to realising benefits;

Objectives and Outcomes: objectives and outcomes should be agreed early and be achievable. Procedures should be put in place throughout the whole process to ensure they are realised;

Governance: strength, accessibility and continuity of governance are key to ensuring outcomes are realised. Governance should be proportionate to project size and consideration should be given to the inclusion of a Senior Champion on large complex projects.

Similarly, The Carbon Infrastructure Transformation Tool project report states that:

"the organisation's leadership must take responsibility for carbon management, ensuring that the organisation's strategy aligns to low carbon targets, and encourages collaboration with other members of the supply chain".

A study by Karen Ridgewell, as part of an MSc thesis[18], published in 2018 concluded that:

Industry is looking to Government and Clients to lead the development of a low carbon construction market. Leadership from outwith the industry is necessary to propel the transformation of its practices, without it, change will persist at a slow rate. In addition, the lack of ownership and accountability for the industry's impact is perpetuating the lack of awareness or urgency for change across the industry.

◊ Conditional Investment:

By 2030, conditionality of funding in the higher and further education sector in Scotland and the UK has reflected the climate emergency and the need for low carbon solutions for many years. It is part of stakeholder expectations, just as it has come to be in the corporate sector, driven by the need for disclosure to extend beyond financial reporting.

The SFC and UK Research and Innovation are amongst the bodies which have made environmental performance, including response to the climate emergency, part of their funding conditions over the past decade. New buildings supported by capital grants from the SFC have been mandated to be net zero over the lifetime of their operations.

Coronavirus (COVID-19): Further and Higher Education sustainability plan.

Having set itself the challenge of Zero Carbon by 2040, the University began to amend its estates finance and business case processes as far back as 2019. Training for staff was rolled out, but it took some time for new ways of working to be cascaded throughout the organisation.

This resulted in key investment decisions continuing to be made on the basis of limited information on operational and embodied carbon costs, total energy costs and the real, whole-life costs of projects in general. It took some time for Capex and Opex to be properly integrated.

Part of the solution came in the form of a number of pilot projects that tracked the whole life costs of actual operational costs throughout the project lifetime. By exposing these costs, lessons were learned about the techniques and methodologies that could most usefully be applied to provide visibility of costs through the lifetime of projects. The University benefited from in-house expertise and collaborated with external experts in the field, to develop methods that are now world-leading.

◊ Estates Finance Business Case Process:

All of this had implications for the University's own financial decision-making processes. New business case processes were developed in light of these findings. Decision-makers at all levels of the University, from Estates Committee to individual project managers gained insights into the actual costs of projects over their lifetime. This insight changed attitudes as well as decision-making protocols.

As far back as 2020, the business case process was being amended to add sustainability to the Strategic Need section that detailed the following:

- Sustainability aspect of the Design
- Sustainability aspect of how the building will operate
- What impact/delivery is being made against the UN Sustainable Development Goals

Sustainability & community were added to the Procurement section and a process was introduced that provided for review and assessment of sustainable outcomes for:

- Construction, e.g. materials
- Procurement, e.g. supplier community impact
- Operation, e.g. use of renewable energy, paper use reduction.

Jointly, these initiatives have ensured that the criteria are genuinely embedded and that investment won't be made unless these criteria are met.

The UK Government's publication in December 2020 of The Construction Playbook[7] underscored the importance of early consideration of sustainability.

New Governance governance mechanisms and reporting structures consolidated the University's approach and soon began to provide evidence of successful delivery. These ensured that sustainability outcomes were embedded throughout the project lifecycle and any subsequent decisions on project priorities and deliverables.

The reporting framework allowed senior management, project boards and programme boards to review, scrutinise and approve decisions which have a direct sustainability impact, thus ensuring transparency and alignment to the 2030 Strategy.

Monitoring and reporting increasingly supported decision-making and reflected the need for alignment with Climate Change Reporting Duties, Procurement Annual Reporting as well as reporting to funding bodies. Reporting clearly needs to be consistent and transparent, but the University was well aware that it also had to be proportionate and not too onerous.

◊ Resource Allocation and Budget Setting:

Budgets began to be established on the basis of actual costs – including the cost of carbon. Initially this was confined to operational carbon costs. Feedback from post-occupancy reviews supported this process. This helped to overcome the long-standing issues of short-termism and silo budgeting.

Internal, campus-wide carbon budgets, based on a model originally developed used by Yale University amongst others, allowed the University to experiment with alternative ways of driving low carbon behaviours.

The University experimented with a number of models to incentivise low carbon behaviours. One of these was Yale's Carbon Charge which was originally adopted by Yale University in 2017.

The corporate sector had begun to adopt internal carbon pricing decades before. Carbon Pricing in the Construction Industry Value Chain.

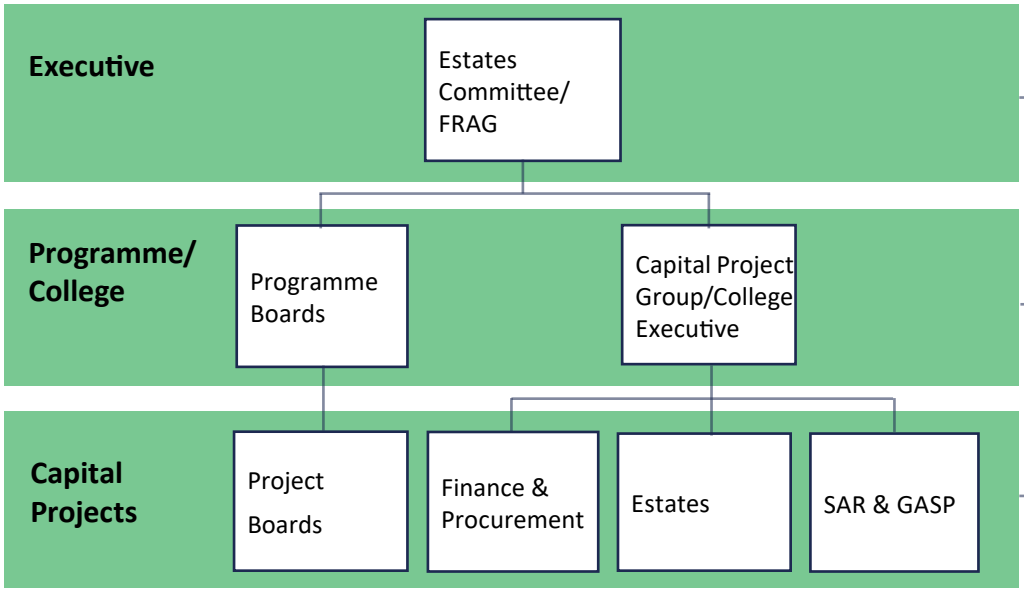
It was soon evident that the University needed to internalise its externalities by adopting carbon pricing and the institution has not looked back since.

The University was amongst the first to recognise what the finance community was waking up to a decade ago, namely: "Construction projects structured to better integrate actors and life-cycle stages for greater accountability, and those whose owners have greater control over priorities through direct financing, are better able to enforce measures that prioritize carbon reduction." International Finance Corporation – Greening Construction: The Role of Carbon Pricing Briefing Note.

The investment decision-making process was supported, of course, by whole life carbon assessment of projects, again drawing on both internal and external expertise. This was in line with the UK Green Building Council's Framework definition of Net Zero Carbon as outlined in 2019.

Sustainability Reporting:

- Purpose of the reporting framework should be to allow senior management, project boards and programme boards to review, scrutinise and approve decisions which have a direct sustainability impact, thus ensuring transparency and alignment to 2030 Strategy.
- Key avenues for sustainability reporting:



- Reporting Framework would need to be consistent and standardised to ensure efficiency and ability to compare results.
- Timeline and frequency of reporting would need to be agreed as not to be onerous.

Net zero carbon – construction (1.1):
"When the amount of carbon emissions associated with a building's product and construction stages up to practical completion is zero or negative, through the use of offsets or the net export of on-site renewable energy."

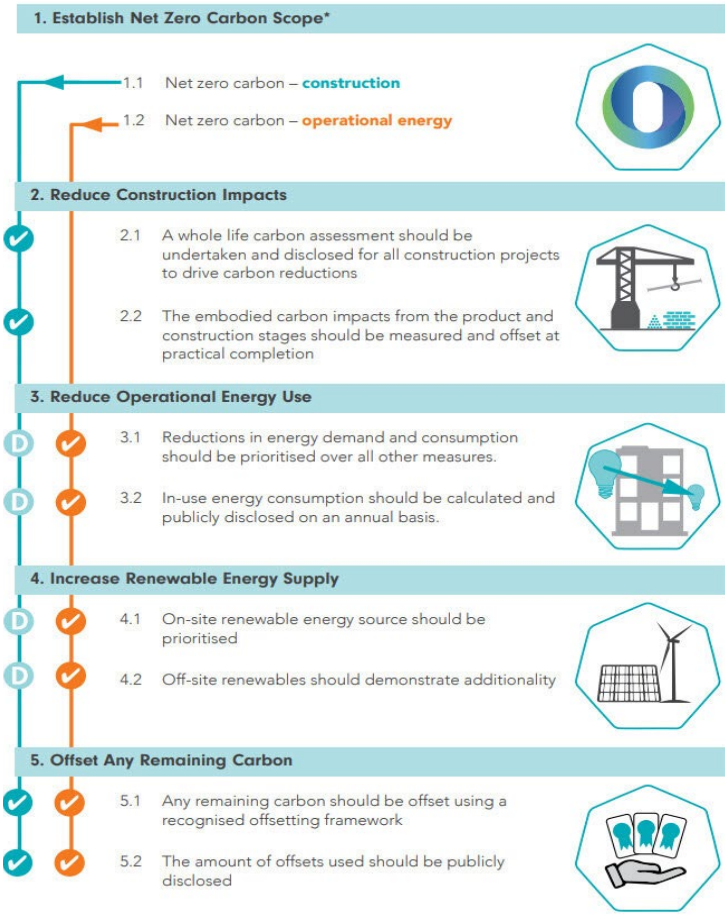
At that time, whole life carbon methodologies were still in their infancy.

"Developers aiming for net zero carbon in construction should design the building to enable net zero carbon for operational energy, and where possible this should be achieved annually in-use.

Net zero carbon – operational energy (1.2): "When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining carbon balance offset."

Net zero carbon for both construction and operational energy represents the greatest level of commitment to the framework.

A third approach for **net zero carbon – whole life (1.3)** is also proposed at a high level, but further work will be needed to define the scope and requirements for this approach."



◊ Objectives and Outcomes:

The University responded ahead of mandatory requirements in delivering low carbon solutions. It did not need the Net Zero Carbon Public Sector Buildings Standard (NZCPSB) to be mandatory, for decisive actions to be taken. The NZCPSB Standard introduced a requirement to account for indirect/ scope 3 emissions in a formal manner. Champions acted as path finders in projects linked to achieving it.

In many ways, the University can be seen to have adopted a similar approach to that used by SFT, SFC and others in the continuing development of the targets within that standard. By learning with and from leading organisations and institutions, the University is able to maintain a position of leadership, through a process of continuous improvement.

By listening to the views of some of external stakeholders, including Tier 1 contractors, the University was able to adopt a leading position and now benefits from doing so. During 2019 and 2020 several projects allowed the University to engage with Tier 1 contractors and to determine actions that would be likely to deliver major progress towards the institution's Zero Carbon by 2040 target. Amongst these was the ECCI Pathfinder project of 2019.

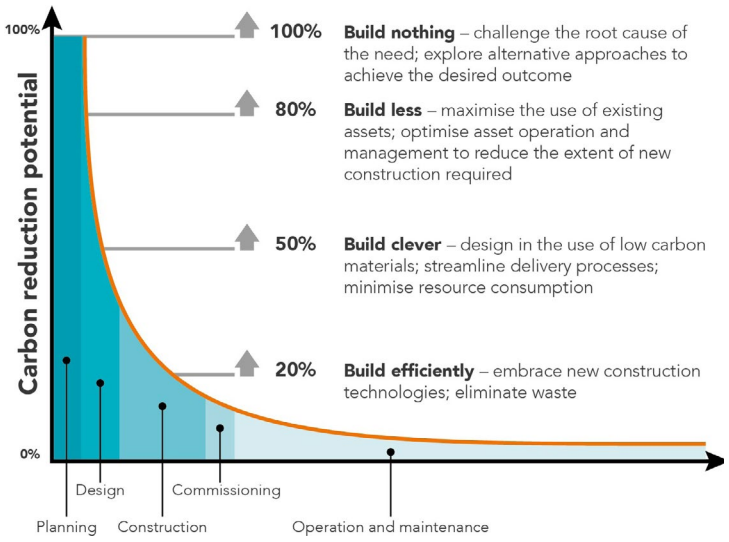
Almost universally, and for a number of years, contractors had expressed a pressing need for clarity of intended outcomes from their clients.

At that time, Scotland's Learning Estate Strategy[8] had recently begun to demonstrate how a mandatory requirement could deliver low carbon outcomes – at first in the schools sector.

Through the work of the SFT and others, the Learning Estate Investment Plan defined an in-use energy target (67kWhs per sqm per year) which affected design strategies. Long term monitoring of energy use and successful achievement of the target affected future funding from SFT and the Scottish Government. The in-use energy target has been seen to deliver real change and began to provide the clarity and certainty contractors needed.

Since then, the University has been identified as amongst the leading clients in Scotland in making a commitment to specific building design standards. In so doing, it has provided the focus contractors appreciate and has allowed them to bring forward innovative solutions to the low carbon challenge. The clarity of intended outcome that was reported to be lacking in many instances has been replaced by a commitment at the start of the process, which is continued throughout. In this respect, it can be argued that the University was simply delivering on the requirements set out in the RIBA Plan of Work – which clearly stated even at that time that sustainability outcomes should be embedded at Stage 0. The University identified this as a challenge and set to work on developing processes that would lock sustainability (and hence innovation) into the process rather than locking it out at an early stage.

Follow-through on commitments made at the start of the process has long been identified as one of the critical factors in meeting Zero Carbon objectives, not least by contractors and their supply chains.



The UoE is now widely acknowledged as having sustainability as a 'golden thread' throughout the entire process.

Institutions in the higher and further education sector and others have followed the embedding of the 'golden thread' in the University's processes and procedures.

4.1.3 How the University of Edinburgh delivered its climate commitment

◊ Procurement and supply chain processes

Supply chain innovators are encouraged to bring forward new solutions now that net zero is universally acknowledged as a shared agenda amongst clients and their supply chains. Incentives and rewards reflect the advantage to both sides of what used to be regarded as largely transactional procurement process.

Contractors are now routinely involved in the earliest stages of design. The University responded to the call to invite contractors in earlier by changing many of its procurement processes to promote earlier dialogue with the market.

Having identified an appetite amongst some contractors at least to work collaboratively – both with the client and across their own sector – the University led the way in establishing new ways of working with its supply chains.

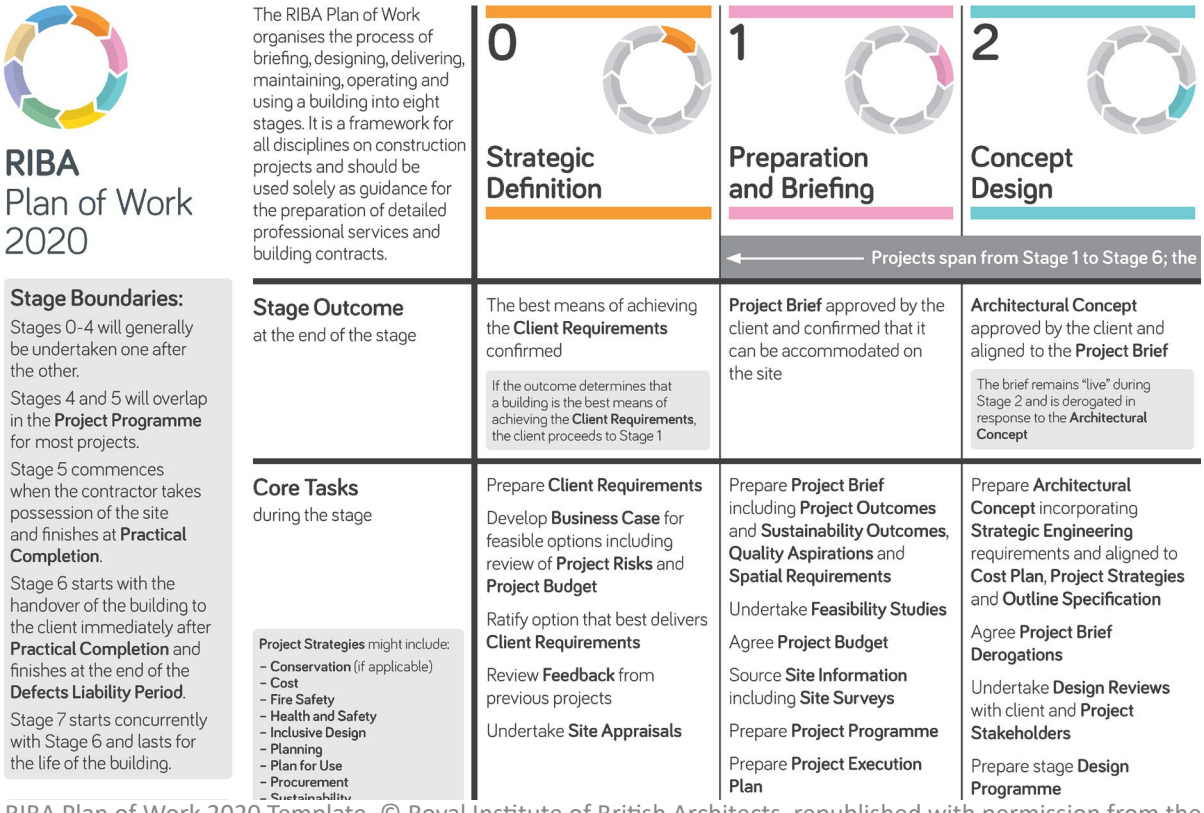
This was part of the response to a call by contractors back in 2019 as part of the ECCI Pathfinder project – and summarised as 'we will if you will'. The procurement approach adopted by the University exploited flexibilities within the then current procurement regulations[9]. Changes in procurement regulations brought about by the UK's exit from the European Union can be seen to have hastened this trend.

UK Government thinking behind these changes was outlined in the Green Paper of December 2020:

"The Government proposes requiring the evaluation of bids to be based on Most Advantageous Tender (MAT) in line with the requirement of the GPA. Adopting MAT (together with accompanying guidance) should provide greater reassurance to contracting authorities that they can take a broader view of what can be included in the evaluation of tenders in assessing value for money including social value as part of the quality assessment. This approach is already provided for in the current regulations under MEAT, so this change would be about reinforcing and adding clarity rather than changing scope."

The new normal for construction and built environment projects involves having contractors respond to outcomes-focused outlines of requirements. These are short documents with sustainable outcomes at their core.

Major contractors frequently collaborate to produce design options, meaning that innovation is encouraged. Only after this initial phase does the 'traditional tender' phase begin. Responses are now based on a better-informed specification and tendering criteria and weightings reflect low carbon, circular and sustainable intended outcomes.



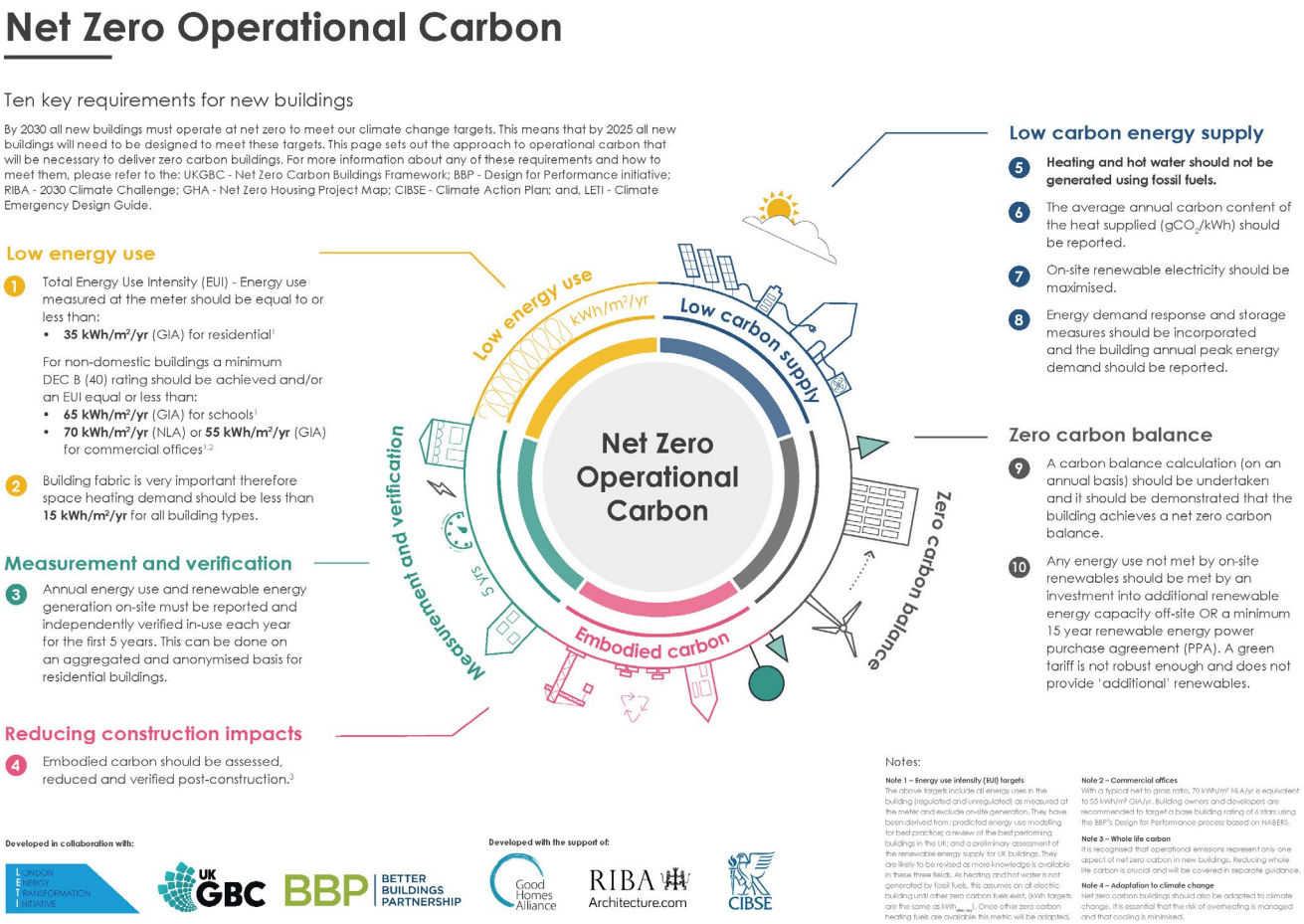
RIBA Plan of Work 2020 Template, © Royal Institute of British Architects, republished with permission from the RIBA

Long-standing pressure to review procurement processes is illustrated in LETI's Embodied Carbon Primer publication[10]:

"LETI urges a review of procurement framework awarding criteria for public buildings and infrastructure. All tender scores must incorporate carbon targets and wider social and economic responsibility in terms of life cycle costs."

Further details are set out in RICS professional statement 'whole life carbon assessment for the built environment' [11] Table 6: Default specifications for main building materials. LETI Embodied Carbon Primer Appendix 12.

Ten key requirements for new buildings – to meet net zero operational carbon targets – were developed collaboratively by LETI, UKGBC, BBP, Good Homes Alliance, RIBA and CIBSE.



Net Zero Operational Carbon, © LETI, republished with permission from LETI

Tenders now routinely reflect circular economy outcomes and the University's concern for 'Horizon net zero'. This has been shown to drive enhanced engineering design solutions. It is consistent with a greener and more resilient supply chain as called for as follows:

> **Short (Achieved by December 2020)**
>
> "Encourage increased use of local, sustainable and recycled materials to minimise embodied carbon including promotion of indigenous supply chain particularly timber and recycled materials and consideration of the potential for specifying minimum content of sustainable natural materials or recycled materials in new public buildings."
>
> **Scottish Construction Leadership Forum (October 2020)**

All of this responds to earlier calls from the Construction Leadership Forum amongst others as part of the recovery from the economic crisis brought on by the Covid-19 pandemic and the need for more resilient supply chains. One of their intended outcomes was to "Encourage increased use of local, sustainable and recycled materials to minimise embodied carbon including promotion of indigenous supply chain particularly timber and recycled materials and consideration of the potential for specifying minimum content of sustainable natural materials or recycled materials in new public buildings." Construction Scotland Leadership Forum.

This was originally one of their immediate targets, intended for delivery by December 2020. As we look back from 2030, it remains valid today. [It should be noted that the University's own academic expertise contributes to this process since the establishment of world class innovation procurement hubs.]

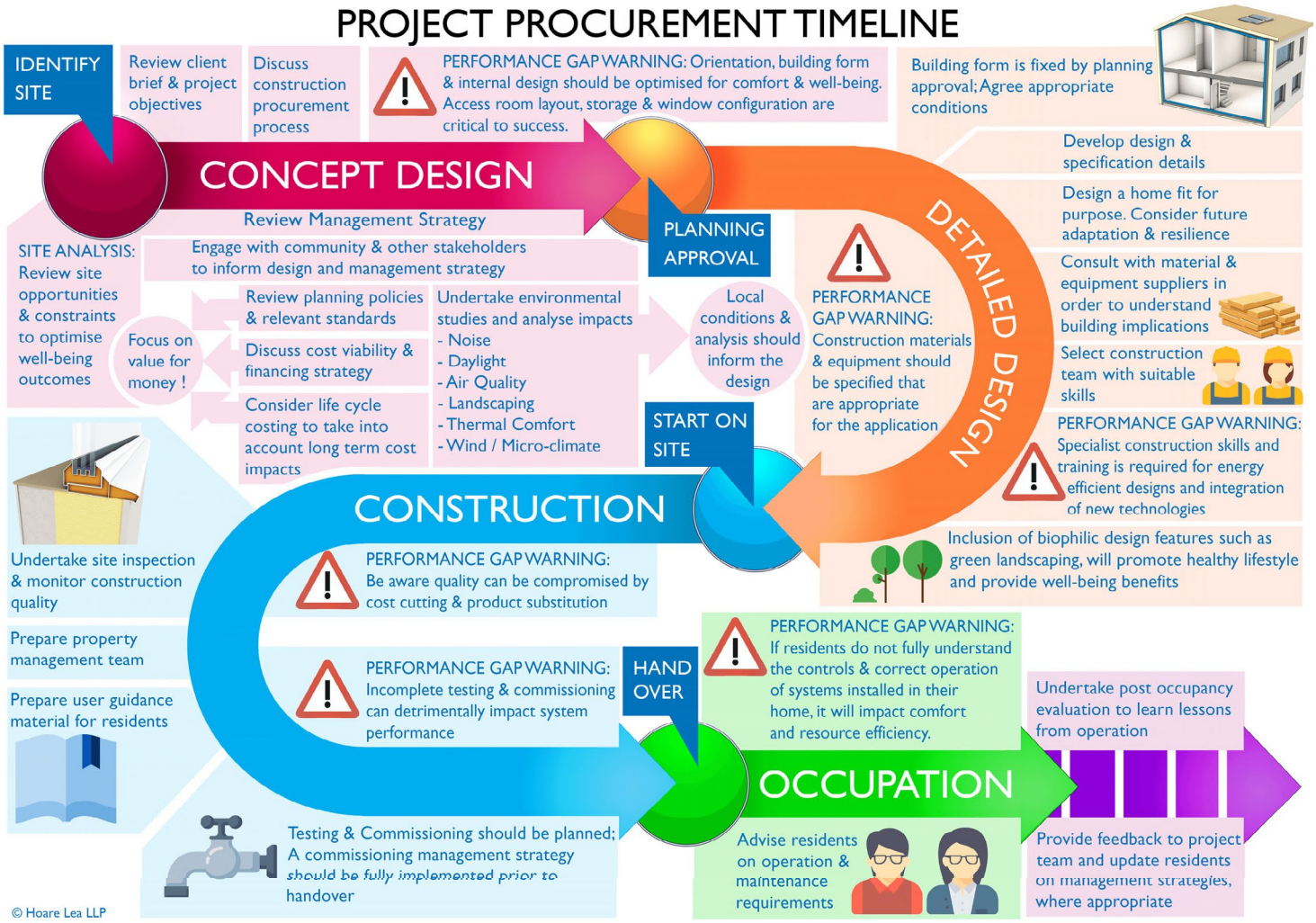
During the process of re-designing its procurement processes, the University was able to learn from examples of collaborative working from other sectors – schools, commercial clients and others. Learning has also been shared with partners in Europe through projects such as the Big Buyers Initiative, which piloted a range of built environment solutions, from zero emissions construction sites in Oslo to the use of circular construction materials in Rotterdam.

This follows analysis undertaken by the University into carbon hotspots associated with procurement, including built environment projects where the carbon intensity of concrete and steel have long been recognised. The adoption of life cycle assessment, environmental product declarations and material passports, combined with a greater appetite for early market engagement have delivered low carbon results. The evidence can be found in reports on Scope 3 emissions – including those associated with bought-in goods and services, where the University has benefited from low carbon innovations offered by its supply chain partners.

Amongst many others, the University and its supply chain partners also benefited from the Scottish Government's investment in a new market support framework for innovation in the early 2020s as part of the Heat in Buildings Strategy. Supply chain development for the Heat in Buildings Strategy was identified as an early priority of the overarching Supply Chain Development Programme.

The focus has been on delivering better outcomes, allowing innovation to play its part at the appropriate stage of the process. Since new procurement approaches were adopted, contractors have been able to bring to bear their skills in innovating for low carbon outcomes – and indeed more sustainable outcomes generally. A broader set of outcomes including biodiversity, equity and climate justice are now all firmly on the radar in terms of delivery.

This does not mean that value for money has been neglected, however. As workshops in 2020 confirmed, delivering projects at least cost is what contractors are good at. The University as the client is now clear about the sustainability outcomes required – as part of value for money - and sticks to these intended throughout the project's development and delivery.



All of these actions have helped to avoid or overcome a number of performance gaps, as illustrated in Transport for London's 'Project Procurement Timeline' for example. This shows 6 stages at which performance gaps could arise. The actions taken by the University and other leading clients – often in collaboration with their contractors – have allowed these pitfalls to be avoided.

◊ Supply chain collaboration

The conclusions of 2019 ECCI Pathfinder project had been summarised as **"we will if you will",** recognising the willingness on the part of major contractors to work collaboratively with their public sector clients.

This echoes the findings of an international study from 2019 which found that:

> "**Collaborative contracting models** are a flexible option to encourage innovation and integrate knowledge of different participants. Many interviewees state the importance of breaking silo-thinking and integrating the supply chain in order to reach greater carbon reductions. Also, long-term alliances allow for continuous learning and more transformational innovation, including incentivising contractors to find ways of fulfilling client goals while building less. However, it should be emphasised that strong client leadership and commitment are essential both to legitimise collaborative contracting models and to achieve more fundamental behavioural change within collaborative projects and alliance schemes."
>
> **Construction Climate Challenge**[13]

Collaboration had been much discussed for many years. Twin drivers in the form of climate emergency declarations and the urgent need for greater supply chain resilience in the wake of Covid-19 pandemic brought real, long-lasting changes in the nature of client-contractor relationships.

In this respect, the University has been responding on its own estate and its relationships locally and regionally, to the challenge laid down by A&DS in 2020:

> "Early and meaningful collaboration is critical in determining the spatial ambitions and priorities and identifying the right developments, in the right place, contributing to decarbonisation and climate adaptation efforts."
>
> **Architecture & Design Scotland; Designing for a Changing Climate**[14]

◊ Whole life costing:

Having adopted various costing models over the past decade, including SFT's Whole Life Appraisal Tool for Construction, the University has benefited from applying its own expertise in low carbon accounting.

The introduction of carbon pricing, combined with new procurement regulations created a regime that provides visibility of total costs throughout the project life cycle. 'Most advantageous tender' replaced 'most economically advantageous tender' as the underpinning criterion for procurement and contract award decisions. The implications are still being felt in 2030 - a wider set of outcomes including low carbon outcomes are now delivered as part of business as usual.

◊ Delivering – and measuring – outcomes:

In 2030, the vexed question of how to measure outcomes, including low carbon and sustainability outcomes continues to exercise academics and practitioners alike. At UK level the emphasis on Themes, Outcomes and Measures arising from the Social Value Act of 2012 resulted in reporting of some environment-related outcomes. In Scotland, the University took account of the outputs of the Scottish Futures Trust's Guidance[12] for Measuring Social Value, April 2020 which was produced in association with the Social Value Portal.

It became clear that the University would need to focus very sharply on zero carbon outcomes – and be able to report them – within the context of its wider sustainability agenda. So, once again, the University led the way in developing tools to highlight the links between 'carbon outcomes' and benefits to society as a whole.

This has become part of the UoE's USP (Unique Selling Point). It has met the unique challenge of becoming one of the world's most sustainable universities while maintaining a historic estate and international operations. It has also led the way as an Edinburgh 'corporate citizen', in using its estate and leading by example to help the city towards its ambitious target of a net zero city by 2030.

The delivery of the wider set of outcomes has allowed the University to demonstrate its contribution to Scotland's National Outcomes and in turn to the UN Sustainable Development Goals.

It was one of the first academic institutions to take the necessary steps to address policy, practice, competencies and reporting mechanisms. Since putting all of these elements in place, the University has been generating the evidence so often lacking amongst organisations on the journey to Zero Carbon. Robust data and management information now provides the sound basis on which the University's planning and investment decisions are made.

◊ Sharing risk

Current contractors appreciate that risk is now apportioned to where it is best managed – this has not always been the case. Their skills support the University's efforts to anticipate future risks and opportunities – horizon scanning is a joint activity since the climate emergency has been appreciated as a shared agenda over the past decade and more. Risk and rewards are discussed and negotiated, but from a much higher base, since data is shared and costs are much more visible to all parties.

As the LETI Embodied Carbon Primer points out:

> **"Risk of future costs arising from carbon embodiment of building maintenance can be avoided by designing low carbon now."**

Contractors are able to deploy technologies including artificial intelligence to better effect. As has been long anticipated, monitoring takes advantage of technology and the data generated supports the University's reporting systems. This all serves to drive enhanced environmental performance. Feedback loops from the post-occupancy review process, which is embedded in finance as well as in estates operations, support reporting too of course.

A significant development over the past decade and more has been the trend towards greater visibility of the University's (and other) procurement pipelines. This emerged originally, at least in part, from the requirements of the Procurement Reform (Scotland) Act 2014 and the increasing focus on monitoring and reporting of sustainable outcomes. As far back as 2019, procurement intended outcomes included delivery against the Scottish Government's 2045 net zero commitment. The built environment then came under increasing attention as a result of revised Climate Change Reporting Duties which came into force in November 2020 and took effect for public bodies in 2022.

As the University was in the vanguard in responding to the climate emergency through procurement and the built environment, it was able to show the way for smaller institutions in the higher and further education sector in Scotland. Subsequent legislation has driven similar changes amongst other public bodies in Scotland.

◊ Competencies and Skills

Over the past decade, the University has continued to build its reputation as a world class institution through the further development of expertise in low carbon and sustainability. Its research base was already well known on the global stage when the Zero by 2040 Climate Strategy was developed. The 'whole institution' approach had already put UoE alongside global leaders in the field such as Harvard, Stanford and University of British Columbia which had met ambitious emissions targets despite growth. Since then, the institution has continued to secure research funding as well as attracting leading academics and students from around the world, as a result, at least in part, of its response to the climate emergency. One of the University's key objectives has been to promote itself as a 'living lab', allowing it to deliver a rich student experience, solving real world problems while improving its own operations.

Professionals across a wide range of disciplines have been able to develop their skills and knowledge in these fields. The fact that the University already had a solid academic base meant that it could share learning within the institution and within the local community. It has continued its long-standing work with the SFC and peers to contribute to climate change policy for the sector and it has long been actively involved in the Environmental Association of Universities and Colleges. On the international stage, links were forged early with the International Sustainable Campus Network amongst others.

The UoE established the world's first MSc in Carbon Finance and has reaped the rewards of a landmark collaboration between schools through the creation of the Carbon Management MSc. The University was able to draw on its own expertise in carbon accounting and management to amend its estates business case process. This followed earlier work to roll out training to relevant staff and has

resulted in decisions are being made with a greater appreciation of total operational and embodied carbon costs.

The work of the Low Carbon Estates Design Group shaped these developments, by transforming how carbon, and sustainability more widely, were addressed in the business case process. Earlier consideration of sustainability provided greater visibility to decision-makers of the value to be gained through low carbon and sustainable choices. Informed decisions could then be made around refurbishment versus new build; the value of investment in low carbon and energy efficient technologies; and material choices including renewable materials.

The business case process continues to include post-occupancy monitoring, but low carbon is now much more explicitly addressed and reported. Future business cases are informed by these results.

The University's specialists in climate literacy and carbon management were soon able to support disciplines such as quantity surveying. This was in part a response to gaps evident in the 2020s and pointed out by SFT amongst others. The University was able to work with its leading contractors to maximise the value of emerging technologies in the built environment.

Since then the University has offered courses to a range of professions from architects and designers to accountants and many others. In this way, the University can be said to have influenced future generations of practitioners. Quantity surveyors and accountants amongst others now benefit from technologies that free them from more routine tasks, allowing them to focus their time and skills on more significant challenges. The built environment will benefit for many years to come – not only within the University context but throughout the public and private sector, nationally and internationally.

In this respect the University has risen to the challenge thrown down by some of Tier 1 contractors in the late 2010's including Balfour Beatty.

In their Innovation 2050 strategy, Balfour Beatty suggested that:

> **"The sector will need a more agile workforce with new skills:**
>
> The sector will need a more dynamic, agile workforce, skilled at challenging conventional solutions. This means that education systems around the world will have to respond to the challenge of teaching students the skills to solve problems that have not occurred or even been imagined."

The same document describes further skills challenges as follows:

> **"Infrastructure owners and designers, regulators and policy makers will need to ensure energy systems are ready for the digital revolution:**
>
> Infrastructure design will need to take account of climate projections and impacts as the number of sensors in the world increases exponentially, putting pressure on energy systems. The use of renewable energy may need to significantly increase and new technologies and ways of storing data will have to be developed.
>
> To play their part in this, regulators and policy makers will themselves need to upskill and ensure that they are providing frameworks which allow industry and digital solutions to flourish, while incentivising the development of new energy solutions and ensuring that resources are not irrevocably depleted."

Balfour Beatty; Innovation 2050 – A digital future for the Infrastructure Industry

The Scottish Government had begun to address these concerns in its 2020 Climate Emergency Skills Action Plan (CESAP), as follows:

> "Potential opportunities for jobs growth and skills implication were identified across five broad areas of economic activity that will make a significant contribution to net zero transition. These areas reflect national priorities and investment within the Scottish Government's Programme for Government to reduce energy demand and greenhouse gas emissions and adapt to climate change."

Construction (including the retrofitting of housing and non-residential properties) was amongst these five priorities. Developing new, quality green jobs was a prime objective of the CESAP, and covered a wide range of opportunities including many relating to the built environment:

"Green jobs can be categorised as:

- new and emerging jobs that relate directly to the transition to net zero e.g. hydrogen cell technicians, carbon monitoring technicians, and urban miners
- jobs affected by the transition to net zero that will need enhanced skills or competencies e.g. architects and environmental consultants
- existing jobs that will be needed in greater numbers as the result of the transition to net zero e.g. insulation installers, energy assessors and designers and multi-skilled on-site operatives."

Skills Development Scotland; Climate emergency Skills Action Plan 2020 - 2025[15]

In this plan, the Scottish Government anticipated that "Demand will likely increase the availability of quality green jobs in sectors including construction, energy, and manufacturing."

Throughout the 2020s, amongst the many activities in which the University has played a leading role with SFC and others, are those resulting from the CESAP of 2020:

> "Evolve the relationships between businesses, universities and colleges to help academic teams form and align to the short, medium and long-term challenges of a just transition.
>
> Support the talent pipeline of future academic and industrial researchers. Explore the role of pooled graduate schools and the demand-led industrial doctorates facilitated by Innovation Centres."

Discussions over the skills and competencies required are still on-going as the world continues to grapple with the climate emergency.

◊ The role of a Champion:

When the Net Zero Carbon Public Sector Buildings Standard was in development in Scotland, much attention was given to the role of a Carbon Champion.

In 2020, the University identified the need for a carbon champion (within their estates department). While this started the process, it soon became clear that no single individual has all of the necessary skills to deliver a low carbon built environment in the University – or anywhere else - and that cross-disciplinary working will always be a critical success factor.

The University's expertise in behavioural change and culture change proved to an asset here, since the culture of any organisation needs to align with its strategic intent. The actions need to deliver on the words – in strategies and policies, for instance.

Capability building was designed and delivered for procurement practitioners, as well as those on whose behalf the procurement was being undertaken – technical specialists, specifiers, budget-holders and end users amongst many others.

Significantly, the University's efforts on low carbon gained traction when contract managers and building managers were given the skills and tools to deliver. Post-occupancy review is now undertaken routinely and the University's investment in technologies including appropriate sub-metering has more than paid for itself. Modelling the embodied carbon of existing buildings helps inform future decisions on refurbishment - or new build as the exception.

◊ Further support for zero carbon and circular solutions:

The University was able to take advantage of its mature relationships with key contractors to apply embodied carbon tools to support decision-making on materials selection, building orientation and many other aspects. See for example: Adopting a Horizon Net-Zero approach. In its quest for Zero Carbon, the University has demonstrated the importance of not losing focus on the wider sustainability agenda including biodiversity and materials security, for instance. Circular construction principles have been widely adopted in University projects, following early examples from across the UK, see: Business in the Community (BITC).

Collaboration with partners across Europe and beyond meant that lessons were learned from then-leading circular construction initiatives such as Kamp-C in Belgium.

This example and others stimulated the University to investigate - and to invest in – alternative procurement models for its built environment projects:

" 't Centrum will be the first 100% circular office building in Flanders. It will be a showcase of circular construction and a demonstration towards (public) clients on how to procure in a circular manner.

The whole procurement is far from traditional as it strives towards a holistic and qualitative procurement, e.g. the price is fixed and will not be a decisive criterion. All the construction partners (architect, engineer, contractor) are present from the start, which has already proven to stimulate creativity whereas "classic" procurement tends to be found restrictive. The partners will design, engineer, build and maintain the building and provide the energy services. They even get the option to develop additional square meters in the building for their own exploitation.

In parallel with its own internal operations, the University has been collaborating over recent years with Architecture & Design Scotland and others in creating further resources to support product choices. Specialists from the University have also contributed their expertise to shape new labelling systems to help level the playing field for smaller suppliers.

The University continues to work with funding bodies and peers, building on earlier work with the Environmental Association for Universities and Colleges (EAUC), to advance sustainability measures and information sharing across the sector and beyond.

Academics and built environment professionals continue to participate in and support relevant communities of practice. Academic and professional networks worldwide continue to benefit from the University's leading practice in the low carbon built environment. By committing itself to acting early on the climate emergency agenda, the University can now reap the rewards in terms of academic reputation, research funding and credibility on the global stage.

4.2 The Contractors Perspective

◊ Introduction

This scenario is written from the perspective of a Tier 1 Contractor. It provides an overview of how the construction industry has met and exceeded its sustainability targets for 2030 as part of a rapid and radical transition to a net zero economy.

◊ Sustainable Value Engineering

In terms of how the construction process is managed, the shift from Value Engineering (VE) to Sustainable Value Engineering (SVE) has perhaps been the most significant.

The outcome of VE was in delivering value for money, and money alone, which had given it a reputation as nothing more than a cost cutting exercise. But with widespread adoption of Capital Value models, such as the Value Toolkit developed by the Construction Innovation Hub, we all now understand that money was not the best measure.

This format of VE was highlighted by Dame Judith Hackitt in her review of building regulations and fire safety[16] following the Grenfell Tower fire in 2018, where she criticised the industry for value engineering, saying it is a phrase she would be "happy to never hear again. It is anything but value, it is cutting costs and quality."

What the SVE process did was to provide a tool by which other values could be assessed and compared as part of a more rounded value engineering process, encompassing:

- carbon engineering
- circular engineering
- co-benefits for social and natural value

It is important to note this was not something radically new at the time, but a bringing together of many different schemes that had been developed in parallel.

◊ Carbon Engineering

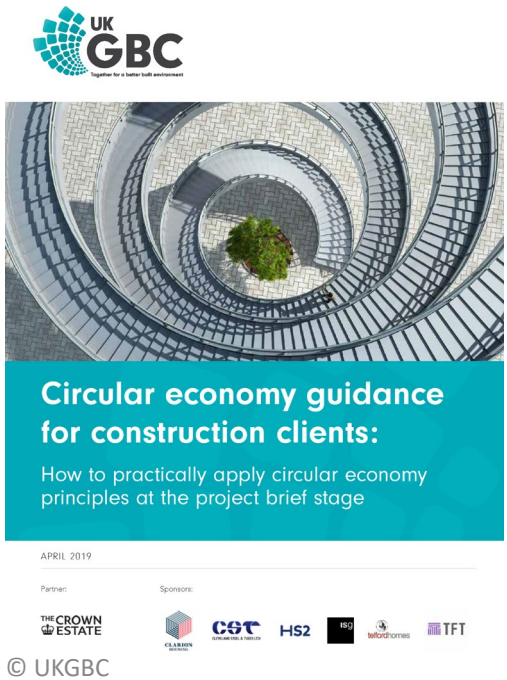
The requirement for some type of formal carbon appraisal and assessment, what is now known as carbon engineering, was spearheaded by documents such as the SFT's Net Zero Public Sector Buildings Standard (NZCPSB) of 2021. Its principles were quickly adopted for most public sector buildings as well as many large private developments.

Carbon Engineering is about the optimisation of carbon outcomes. Its first priority is the minimisation of embodied carbon in the construction process, through the selection of materials used and the way construction is undertaken. It balances this against the operational carbon savings that can be achieved through energy efficiency works, such as increased insulation or on-site renewables. Whilst it took some time for Capex and Opex to be properly integrated from the financial and procurement side, carbon engineering was a key part in supporting the business case for that change.

One area where carbon engineering made a particularly meaningful contribution to the SVE process is that it provided an incentive for product manufacturers to decarbonise their products. Where VE could be characterised as a dumbing-down exercise aimed at finding the minimum viable option, SVE is about optimising outcomes, with a more nuanced and balanced analysis across a range of issues. Hence the Environmental Products Declaration (EPD) for products now invariably reference the manufacturer's specific and accurate carbon intensity figures rather than generic industry benchmarks.

◊ Circular Engineering

The circular economy (CE) is the area where the greatest advancement in construction has occurred over the last decade, transitioning from a fairly



intangible issue, analysed only on a qualitative basis through statements of intent, to something that is quantified and commoditised as part of day-to-day practice.

The groundwork for this was set by two industry guidelines: The UKGBC Circular economy draft guidance for construction clients issued in 2019[17]. The UKGBC guidelines set out the CE criteria in a way that spoke directly to the established work practices of the construction industry, allowing it to be integrated into the tasks of both designers and builders. The GLA guidelines started to show how these issues could be quantified through a methodical process, including calculation of items such as the retention of existing assets, the use of salvaged and recycled materials, and the management of waste, to define the overall "material intensity" of a building.

Three key actions stem from circular engineering which are especially relevant to the construction industry beyond typical circular economy measures:

1. Preserving Future Value: buildings have a very long life cycle, unlike the consumer goods that CE was originally modelled on. Hence the "design-for" strategies of longevity, flexibility, adaptability and deconstruction are especially important, and have made us consider how we futureproof buildings by their design. We are already seeing the outcome of this with the refurbishment of buildings constructed in the early 2020s proving to be much easier, quicker and cheaper than their predecessors.
2. Supply Chain Provenance: all products now come with a "materials passport" which provides comprehensive information about its provenance, performance, installation and maintenance requirements, and decommissioning or recycling criteria. Similar to carbon emissions, this information is typically part of the EPD.
3. Extended Producer Responsibility: key items of building equipment which would formally have been purchased as part of a construction contract are now procured through service or lease agreements. These are negotiated as part of the normal tender process and then contracted direct by the client or their facilities manager.

◊ Co-Benefits for Social and Natural Value

The inclusion of Community Benefits in Scotland can be traced to some pilot projects in 2008, which "sought to secure the delivery of certain 'Community Benefits', namely 'targeted recruitment and training' (TR&T), through the use of public contracts."

For many years these were included in most public tenders but with mixed outcomes, usually as a peripheral issue to the actual construction project. But with the expansion and formalisation of Community Benefits as a range of defined social and natural values they have become much more embedded within the construction process itself.

The way social value is assessed does vary significantly. The Scottish Government has a defined policy to not apply monetary values to social outcomes, as set out in their document Measuring Social Impact in Public Procurement issued in late 2020:

- the Scottish Government does not endorse monetary gauges to measure social impact in procurement as part of the procurement process;
- social impact is not fixed or easily transferable. Impact arises from the interaction between supply and demand, and therefore will be specific to the individual, community, and place. Public bodies must engage with communities who have an interest in the contract to get the best possible outcome;
- care should be taken to ensure that impact measurements do not create a barrier to businesses;
- success in contributing to Scotland's purpose is measured in terms of outcomes. These outcomes align to the National Performance Framework and the UN Sustainable Development Goals; and
- this approach complements procurement principles of relevance and proportionality and Scottish legislation to rule out price only or cost only as the sole award criteria for public contracts

◊ The Role of the Quantity Surveyor

The Quantity Surveyor (QS) has become a much more active and dynamic player in the design and construction process. Their base level input of estimating and managing costs is now largely done through direct digital transfer of design documents with AI and machine learning. This has allowed the QS to focus their professional skills away from data input and towards data analysis, which is a critical part of the SVE process. This type of input from the QS has been crucial at all stages of the project to optimising building performance for carbon and circular engineering metrics.

◊ The Role of the Project Manager

Just as the client needed to adopt the "intelligent client" model, so the Project Manager (PM) needed to become much more informed about the underlying criteria behind design decisions, and about their interconnectedness, rather than focussing only on the logistics of construction on site. Whichever side of the table the PM is sitting on, whether the client's or the contractor's, they are the person tasked with making the final decision on day-to-day issues as a project progresses, often without referral to other stakeholders. The outcome of these cumulative small decisions is crucial to achieving net-zero buildings, and hence it was crucial that PMs had a comprehensive understating of the SVE process.

◊ Digital Technology and Data

The construction industry is notoriously slow to innovate and this was nowhere more obvious than with digital technology. At the start of my career in the 1980's CAD drafting was becoming mainstream practice but right through to the early 2020's it remained essentially a 2D drafting tool – a digital substitute for the drawing board – and did not fulfil its promised potential to automate and coordinate the different aspects of documentation. However with the transition to BIM Level 3 during the mid-2020's, as promoted by the UK Digital Built Britain strategy. This is now standard practice. BIM Level 3 was eventually defined as: "a single, collaborative, online, project model including construction sequencing, cost and lifecycle management information" and it is and it is that collaborative sharing of digital information that has enabled rapid progress across many areas. The Material Passport system would not have been practical without this, it would have been far too data intense to manage as a separate task. It has also enabled things

like the Digital Twin to optimise building performance, and it automatically creates a material reclamation schedule in anticipation of the building's eventual demolition.

◊ Information Sharing & Reporting

The benefits of information sharing were talked about for many years and, whilst the traditional competitive business model hindered this, climate change and sustainable development proved to be an area where all the major industry players were prepared to collaborate and share information on an open basis. In short, the necessity of change became so urgent, but the scale of change so substantial, that it became obvious to everybody it was something we would have to collaborate on.

This point was reinforced by the CEO of the Green Building Council, Cristina Gamboa, in a 2020 interview about their Net Zero Agenda, when she said:

"it's about leapfrogging" - learning from regions or players who have made progress on specific issues and adapting them to areas that were less developed in their net-zero strategy." - see video.

We saw this work at many different levels:

- Cities became some of the leading players, creating global partnerships to hasten progress irrespective of their regional or national context.
- Consortiums of builders, designers, academics and owners working together on prototype schemes with the support of government industrial strategies and innovation bodies.

An area where this had much broader benefits was Post Occupancy Evaluation (POE) which involved sharing information not just between the stakeholders in an individual project, but pooling the outcomes of POEs for many different buildings so that the performance outcomes of one project informed the brief being written for another one. Previously, information about actual building performance was very rarely made available even within an organisation let alone to others, but the increased emphasis on EPCs and the constant drive to eliminate the "performance gap" made greater transparency on this inevitable.

The education sector was an early adopter of POE, where the implications of performance on Indoor Environmental Quality was just as important as energy use. The UoE led the way in adopting post-construction monitoring of building performance to ensure buildings actually performed as specified when in their operational phase of intended use.

This also feeds into the wider issues around transparency and reporting, and the challenges of consistency and methodology that were being experienced in the early 2020s.

◊ Energy Supply and Demand

One of the biggest changes we had to make in energy use was to no longer see supply and demand as separate issues, which historically is how buildings had been serviced. Most buildings now operate as part of a Distributed Energy Resource (DER), where every building is both a user and a supplier. This created significant change in how M&E systems are designed.

All new buildings, without exception, are now built to the highest energy efficiency standards as a matter of course (often referred to as equivalent to Passivhaus standards though not always Passivhaus certified). Organisations such as the UoE were early to pick up on this trend, and whilst it seemed confronting for the first few projects the actions proved to be straightforward: increasing levels of insulation is a simple specification change, and the increased level of airtightness was largely a quality management issue. Hence, space heating demand is now minimal.

But at the same time electrical energy demand has increased significantly because of the transition to heat pumps for space and water heating, the huge expansion of digital equipment which is energy hungry, and the transfer of much transport sector energy with the uptake of electric cars, vans and cycles. All-electric was the phrase used in 2020 and whilst that has turned out not to be totally the case it is close enough.

District Heating (DH) systems have been an integral part of that, and this is another area where the UoE was on the front foot as they were early adopters of a district heating and cooling system (albeit originally fossil fuel). The Heat Networks (Scotland) Bill 2021 turbocharged district heating becoming a mainstream energy source in the UK and provided the basis for the UoE system to connect to other local networks and get paid for energy supplies to non-university properties. The biggest uptake is over the Christmas break when the

demand on campus is minimal but private demand is highest.

◊ Retrofit v New-Build

Retrofits have replaced new builds as the first choice for developments. The architectural icons of the 90s and 00s were tremendously exciting to work on but once embodied carbon targets became embedded in the process justifying the construction of any new building became difficult except on brownfield sites.

Retrofits are undoubtedly a more complicated construction process and require much more active collaboration with all stakeholders, and this is one area where early engagement and different procurement frameworks has been beneficial.

Early Engagement has been helpful in many ways. The Construction Play Book issued by the UK Government in late 2020 included early engagement as one of its key points:

- **Early supply chain involvement** is key to reducing end-to-end programme timescales, identifying opportunity and mitigating risk early and accessing the industry experts' knowledge and experience in all tiers of the supply chain early in the project or programme lifecycle.
- **Early engagement** will help highlight the interdependencies of specialist supply chain members and allow them to be part of developing the solution to the right quality levels and increase safety collaboratively.

From a finance perspective early engagement has not always been straightforward. Some work pro bono is always required, especially within the context of a framework where some level of future contracts is assured. But to make a significant contribution of time and knowledge some level of fee is required whether for contractors or consultants. In many cases this meant bringing costs forward in the expenditure schedule rather than additional costs. Once clients understood the benefit this was accepted, but there is still pushback from some clients about this.

◊ Spatial Demand

When the workshops of the SFC Climate Emergency Collaboration occurred during the COVID-19 lockdown in 2020 we had all been working remotely for a few months already. There was a lot of speculation at the time about whether any of us would return to the office (or the classroom) on a full time basis, and hence whether the demand for additional space would ever bounce back. Organisations questioned their estate requirements and shifted their models for how we used working space to reflect new working models, the result being an overall reduction in spatial demand per person.

A separate driver for that change has been the circular economy design strategies for buildings that are flexible and adaptable. This has made us consider how the spaces we create can be readily adapted to suit changing spatial demands.

◊ Modular Construction

Modular construction is part of what the industry generally refers to as Modern Methods of Construction (MMC), which includes all forms of factory based prefabrication. For some buildings it has been a real boon, with student accommodation being the most obvious example on the university campus. But as so many university buildings are designed to a bespoke brief its benefits are not always obvious. There are also aspects of MMC which do not necessarily support Co-Benefits outcomes.

◊ One Page Brief

During the SFC Collaboration workshops and the previous Pathfinder project one of the key messages the contractors tried to get across was that we needed clear and concise guidance from the client on what they required. As a contractor, our fundamental skill is being presented with a construction objective and being tasked with how to deliver it to give the client the best value for money, and to do that we need the objective clearly stated.

The "one page brief" provides that for all the project objectives, not just sustainability but with operational and management outcomes clearly defined. Targets for energy performance, embodied carbon and circular economy are all part of this. In practice it will often be more than a single page in length, but the theory of providing a simple and concise document, that all stakeholders can agree to at the outset, remains valid. It is normally drafted by the client and then reviewed as an iterative process with the designers and contractors as the project progresses.

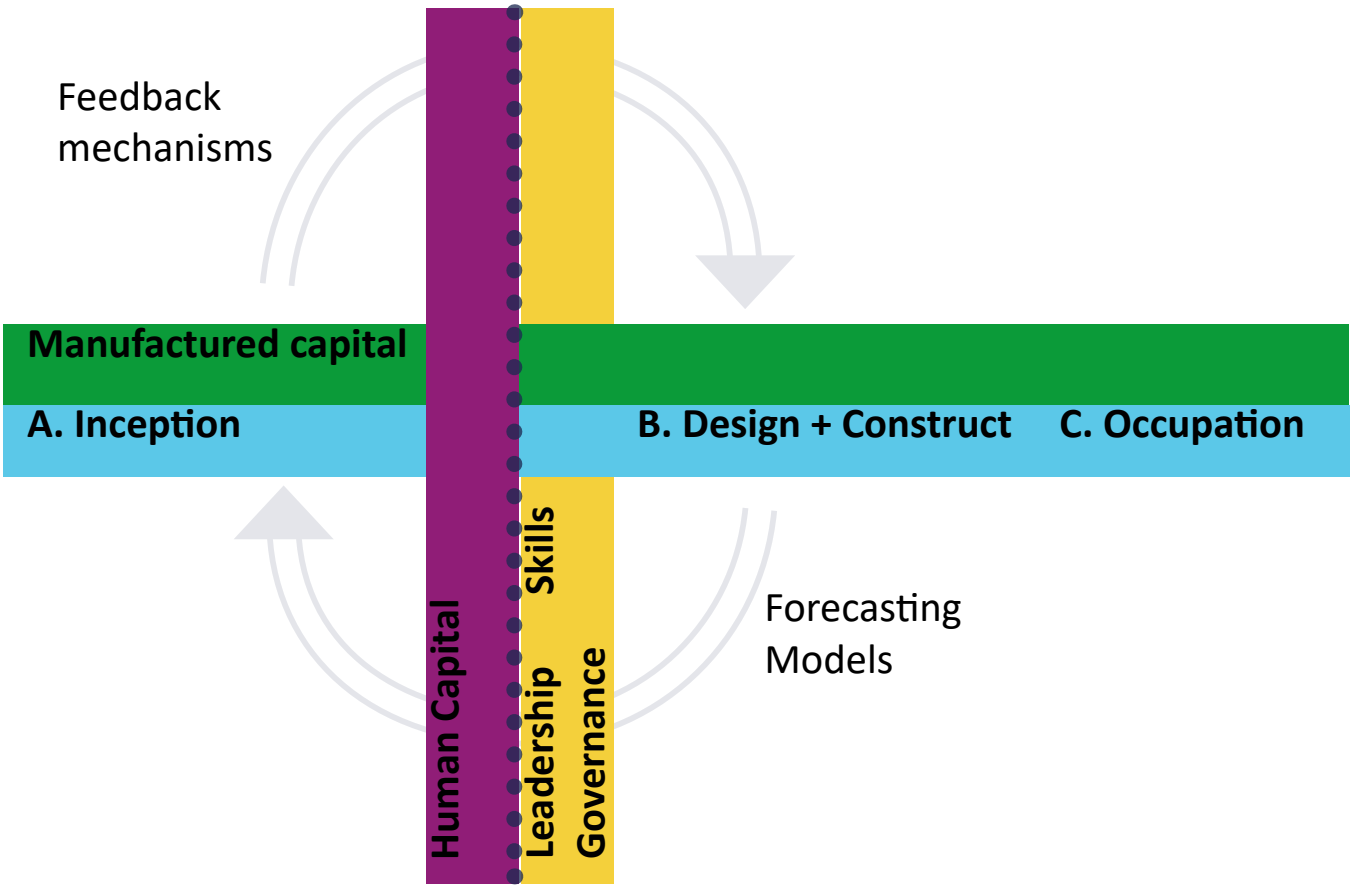
5. Conclusions and Recommendations

5.1 Themes

The findings from workshops and interviews can be summarised under three major themes:

- **People** – covering leadership and governance, competencies and skills.
- **Process** – addressing the construction programme based on the RIBA stages and the associated procurement process.
- **Forecasting & Feedback Mechanisms** – including monitoring and reporting of zero/low carbon outcomes.

Graphically they can be represented as a variation on the 'Celtic Cross' format with a twin spine representing the People themes; Process on the horizontal axis; and Forecasting and Feedback Mechanisms, as follows:



Summary of Conclusions:

- The University has set out bold ambitions in its Zero by 2040 strategy.
- The University has an opportunity to build on its reputation by acting at a local, regional, national and international level in the low carbon built environment.
- Many of the University's key Tier 1 contractors have reiterated a long-held willingness to collaborate in this effort.
- Contractors have innovative solutions to offer but need to be involved much earlier in the process than is currently the case, if the benefits of these solutions are to be realised.
- Delivery against zero/low carbon targets (and sustainability more generally) is increasingly reflected in funding criteria, including those of the SFC.
- The University must express its intended outcomes clearly and consistently at the very start of the process and maintain a focus on these outcomes throughout the entire design and construction process.
- One page brief should be the starting point for zero/low carbon projects.
- Early market involvement should allow for consideration of alternative options.
- Incentives and rewards must reflect the delivery of zero/low carbon outcomes.
- Governance arrangements must support the delivery of zero/low carbon options.
- The estates business case process must make visible to senior decision makers the whole life costs of projects – including both embodied and operational carbon costs.
- The University should maximise the potential offered by circular economy business models and should actively promote their development as part of procurement decision-making.
- Product and material choices for both refurbishment and new build must reflect zero/low carbon targets.
- Operational carbon must be factored into procurement decision-making routinely from now on.
- The University should work with suppliers and contractors to identify and prioritise carbon hotspots in the supply chain.
- Academics and suppliers should be encouraged to bring forward projects with multiple environmental and socio-economic outcomes – such as skills development and job creation aligned with innovative low carbon solutions.
- As the economy emerges from Covid-19, the University should reimagine its estate and maximise the use of technology as part of the green recovery.
- The University should build on its academic excellence and expertise in the fields of carbon accounting and climate solutions by: building capability amongst its own staff, sharing knowledge and learning with its supply chain partners; attracting staff and students to the University.
- Attention should be given to capability building in the areas of building management and maintenance, monitoring and reporting to ensure that zero/low carbon outcomes are successfully delivered and successes are captured and reported.

Recommendations for action

People - Leadership and Governance

- In line with leading corporations, and as recommended recently in a report by the World Economic Forum, the University should develop internal governance mechanisms that introduce emissions as a steering mechanism and align the incentives of decision-makers with emission targets.
- Set zero carbon targets ahead of NZCPS Buildings Standard requirements.
- Appoint zero carbon champions throughout the University structure.
- In line with leading corporate practice, reflect delivery against zero carbon targets in staff incentives and rewards including remuneration.

Process

- Enhance zero carbon baselining processes through engagement / knowledge sharing / collaboration with contractors.
- Establish carbon baseline, track progress of projects and reflect higher standards in future projects.
- Develop business case processes to reflect total costs including operational carbon.
- Embed emissions targets in the procurement strategy of each built environment project.
- Act ahead of legislation to engage early with key markets, identifying ways of delivering against zero carbon targets.
- Establish a mechanism to make early market engagement part of business as usual.
- Make the development of a one page brief the starting point for zero/low carbon projects.
- Enhance gateway reviews to ensure that zero carbon outcomes are locked in throughout the design and construction process.
- Apply whole life costing to the entire process to address any outstanding issues over Capex/Opex split.
- Enhance contract management, feedback and review processes to include zero carbon outcomes. This should include estates business case review processes to address ‘performance gap’ issues.
- Incentivise contractors and supply chain to deliver zero carbon outcomes through the procurement process, using smart key performance indicators.
- Buy into and stimulate the development of circular business models through the choice of materials for refurbishment (and new build) projects.
- Use internal carbon pricing mechanisms to prioritise projects.
- Adopt sustainable value engineering as the norm.

Competencies and Skills

- Roll out capability building packages to everyone involved in estates decision-making processes.
- Train those using and maintaining buildings in how to operate the buildings in line with zero carbon targets.
- Drawing on existing and emerging academic expertise, develop capabilities of University staff and contractors by working collaboratively and sharing knowledge.
- Share lessons learned on zero carbon built environment within the University, the HE/FE sector, nationally and internationally.
- Share knowledge with policy-makers, regulators and others as part of the continuous improvement process, supporting the city, the region and Scotland as a whole to meet zero carbon targets.

Forecasting and Feedback

- Use modelling techniques to provide accurate estimates of energy use and other outcomes.
- Collect and assess data as part of collaborative learning.
- Data gathering and use should be part of active building management, tested against modelling with digital twin.
- Undertake Post Occupancy Evaluation for all projects and ensure that results inform decision-making.
- Share knowledge from all stakeholders of previous experience to inform development of new briefs.
- Reporting to funding bodies, Scottish Government (through Annual Procurement Reports and Climate Change Reporting, etc.) should routinely include results relating to zero/low carbon/sustainability.
- Results of zero/low carbon activity are disseminated local, regionally, nationally & internationally to advance good practice and knowledge.

5.2 Matrix

Leadership and Governance

Theme	Outcome	Lead responsibility
Take responsibility	Zero carbon priority signalled at highest level.	Client
	Clear committments, targets and measures set.	Client
	All levels of management supported to take action and be flexible for issues within their remit.	Client
	Reputation of institution enhanced through exchanges locally, regionally, nationally and internationally.	Client
Governance	Consistent approach to management of climate-related activites throughout the process.	Client (informed by collaboration with contractor)
	Performance and perception gaps are addressed.	Client
	Incentives and rewards reflect priority given to delivery of zero carbon targets.	Client
	Champions embedded throughout the institution ensure zero/low carbon solutions are delivered.	Client
	Business case process, which embeds sustainability, is rolled out to staff at all levels, supporting whole life net zero carbon decision-making.	Client

Design and Construction Processes

Theme	Outcome	Lead responsibility
Business Case Development Proposals	Presumption against new-build/in favour of refurbishment.	Client
Strategic Brief and Project Brief	Clear and consistent outcomes articulated through one page brief.	Client
	Broader range of values / outcomes considered – embodied carbon, circular economy, co-benefits e.g. Horizons	Client
	Zero/low carbon outcomes are embedded in business case process with appropriate metrics.	Client (including learning from contractors' experience)
Finance	Carbon pricing is routinely applied as part of business case process.	Client (informed by collaboration with contractor)

	Capex and Opex effectively integrated through consideration of costs of operational and embodied carbon throughout process.	Client
	Renewables considered as separate investment with ROI.	Client
	Higher targets for energy efficiency adopted immediately. NZCPS Buildings Standard.	Client
	Monitoring of broader sustainability issues to normalise them within construction.	Client (linked to Feedback Mechanism)
	Process of establishing benchmarks begun.	Client (linked to Feedback Mechanism)
Procurement - Early Engagement	Bringing forward engagement of consultants and contractors to inform development of specific aspects of the design.	Client and contractors
Procurement - Tenders	Appropriate weighting applied to sustainability outcomes in tender award criteria / scoring matrix.	Client
	Innovation is incentivised through risks being apportioned to where they are best managed.	Client
	Penalties for non-compliance are set and enforced.	Client
Designers/ consultants	Cross discipline working to integrate sustainable outcomes delivers zero/low carbon design.	Consultants
Contractors/ suppliers	Construction focused on performance outcomes v simple spatial outcomes.	Client (informed by collaboration with contractor)
Construction Sustainable Value Management	Sustainable Value Management principles applied as part of Value Engineering process throughout construction process.	Client

Competencies and Skills

Competencies and Skills	Climate literacy is embedded throughout the organisation and informs senior decision-making.	Client (informed by collaboration with contractor)
	Specific skill sets are developed for emerging best practice especially carbon accounting.	Client (shared with contractor i.e. academic expertise, capability building etc)
	Academic expertise informs and influences estate activities.	Client

Forecasting and Feedback Mechanisms

Theme	Outcome	Lead responsibility
Early Engagement	Bringing forward engagement of consultants and contractors to inform development of specific aspects of the design.	Client & contractor
Testing (forecasting) - Modelling	Modelling techniques are used which give accurate estimates of energy use and other outcomes.	Client
Data	Data collected and assessed as part of collaborative learning.	Client & contractor
	Data gathering and use as part of active building management, tested against modelling with digital twin.	Data gathering and use as part of active building management, tested against modelling with digital twin.
Building Use and Management – Post Occupancy Evaluation	Post Occupancy Evaluation undertaken for all projects and results inform decision-making.	Client & contractor
Learning (information feedback) - Collaborative Learning	Sharing of knowledge from all stakeholders of previous experience to inform development of new briefs.	Client & contractor
Reporting	Reporting to funding bodies, Scottish Government (through Annual Procurement Reports and Climate Change Reporting, etc) routinely includes results relating to zero/low carbon/sustainability.	Client
Dissemination	Results of zero/low carbon activity are disseminated locally, regionally, nationally & internationally to advance good practice and knowledge.	Client. Also client and contractor together when appropriate.

Appendix

Appendix 1 Methodology

This component of the wider SFC Climate Emergency Collaboration Challenge project was about building capacity for better building performance in the context of a climate emergency, and to develop a more collaborative approach between client (UoE) and contractors that delivers better outcomes.

We have used the term "contractor" as shorthand for all stakeholders on the supply side of the process i.e. the contractors and sub-contractors; the architects, engineers and other design professionals; and the manufacturers and broader construction industry supply chain. Whilst formal engagement during this project was primarily with Tier 1 Contractors, we did seek input in different ways from across the whole sector.

A series of workshops were delivered, aimed at engaging with stakeholders, testing assumptions, developing understanding and proposing solutions.

Building on the results of the earlier ECCI Pathfinder Project on Procurement and Supply Chains, workshops were devised as follows:

- Workshop 1 - Testing
- Workshop 2 – Validation
- Workshop 3 – From Shared Commitment to Embedded Action

Workshop 1 was aimed mainly at the University as a client, while Workshop 2 was designed around the contractor, with the intention of supporting a more focussed and open discussion. Workshop 3 brought client and contractor together, to focus on actions.

At the start of these workshops, a number of assumptions was articulated, as follows:

- Building efficiency (new and existing) can and should be better optimised in the context of a climate emergency.
- The building performance we experience at the end of a project often does not match our original ambition or intent.
- That performance gap does not arise because the building technologies and materials to deliver better performance with less climate impact do not exist.
- It arises because of things that happen (or don't happen) at various stages during the project lifecycle … designs, decisions, budgets, and having the right partnerships, skills and knowledge at the right time to support them.

The outcome of discussions held during these workshops and in individual interviews with project participants are summarised in Findings section.

The project then used 2030 scenarios from the perspective of the client and the contractor as a way of 'backcasting' to generate potential solutions and recommendations for action. The backcasting format was adopted as a means to best reflect the variety of practices amongst organisations represented in the project.

- It focuses on actions needed to meet shared objectives, rather than pointing responsibility at individuals.
- It focuses on those actions most likely to deliver improvement.
- It enables a broad and diverse range of issues to be covered.
- It ensures the report will not be immediately out of date, given the current pace of change amongst many different stakeholders.
- It is designed to encourage action, both individual and collaborative.

Workshop 1 - Testing - 29 July 2020

Speakers/Presenters included:

Michelle Brown, Deputy Director of Social Responsibility & Sustainability (SRS), UoE.

Rufus Logan, Assistant Director, Capital and Climate Change, SFC

Dean Drobot, Head of Energy & Utilities, UoE.

(As well as members of the project team Ranald Boydell, Country Architecture + Ecohus Ltd and Barbara Morton, Sustainable Procurement Ltd.)

The purpose of this workshop was:

To validate findings around current approach and process within the UoE and to discuss options to make changes in light of the climate emergency and UoE 2040 target.

Workshop 2 – Validation – 19 August 2020

The purpose of this workshop was:

To validate findings around current approach and process from a contractor's perspective and to discuss how client and contractor can work better together to deliver better sustainability outcomes in light of the climate emergency and the UoE 2040 target.

Speakers included: Paul Dodd, Head of Infrastructure Technology, SFT.

Attendees included: Representatives of Tier 1 Contractors and the supply chain, since this workshop was concerned with understanding more about the contractors' views.

The assumptions made during the opening of Workshop 1 were reiterated at the start of Workshop 2.

The basis of discussion was:

- How can the UoE as a client work better with you as our delivery partners, to deliver better sustainability outcomes? How do we get a shared commitment that enables us to put this into practice?

Three specific questions were asked of attendees:

Q1. What developments have there been in terms of embedding low carbon/sustainability solutions – in the market and in your own organisations – either positive or negative (aside from Covid-19)?

Q2. What more can you do to support clients (the University) to deliver their low carbon / sustainability outcomes?

Q3. How do we work better together to deliver low carbon and sustainability outcomes in the future? (Is it

about the Procurement Process (the sequence of events) or how we measure success?)

Workshop 3: From Shared Commitment to Embedded Action – 04 November 2020

This workshop brought together participants from previous workshops to address jointly a series of questions, emerging from findings to date. The purpose of the workshop was summarised as follows:

- revisit previous commitment "we will if you will"
- now acknowledging "we are all in this together"
- seeking consensus on how to embed actions

The workshop was devised so as to 'look back' to 2020 from the perspective of a time in the future when the University has made significant progress towards its 2040 Zero Carbon target. It was based on a 'Proposition' as follows:

"Consider what a typical construction project will involve when we have reached net-zero, whether that's 2045, or perhaps 2030 which a lot of targets are now being set for.

- Carbon Accounting, Sustainable Value Management, and Whole Life Cycle Assessment will be the norm.
- Clear intended outcomes will be embedded throughout the process from inception, with early engagement & collaboration.
- Operational costs, including energy, will be accounted for throughout – Capex and Opex will be merged.
- Post-Occupancy Evaluation process will support reporting and budgeting."

So the questions addressed at this workshop were:

Q1. How did we embed zero / low carbon outcomes into our processes?

Q2. Who was responsible for ensuring we have the knowledge and skills necessary at the right time to deliver?

Participants discussed these questions and provided feedback, which was captured, written up and disseminated after the event. The workshop closed with a discussion of next steps including: Knowledge exchange; Project report arrangements; Dissemination event and options for a Community of Practice: new or existing.

The outputs from these workshops are addressed in 'Findings' and reflected in '2030 Scenarios'.

Appendix 2 Tier 1 Contractors Commitment

Amongst the other contractors participating in this project, Sir Robert McAlpine has recently reiterated the priority given to its net zero ambitions: “Our sustainability strategy for 2020-2024 is a core driver in realising our ambition to be the Best Place to Work, the Best Builder, and the Best Business.

“It has been designed to deliver year on year improvements and targets in four key categories:

- Net zero carbon emissions
- Resource efficiency
- Ethical procurement
- Social value

See: https://www.srm.com/our-commitments/sustainability/

And/or: https://www.srm.com/news-and-comment/sir-robert-mcalpine-unveils-new-sustainability-strategy/

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Acknowledgements

Thank you to the following people for their participation, insight and contribution to this project and final report:

University of Edinburgh Department colleagues in:

- **Finance**
- **Procurement**
- **Estates**
- **Social Responsibility and Sustainability**
- **University of Edinburgh Business School**
- **Edinburgh Climate Change Institute**

University of Edinburgh's Tier 1 Contractors:

- **Robertson Group**
- **Kier**
- **Balfour Beatty**
- **Sir Robert McAlpine**

Project partners for their support and input:

- **Scottish Futures Trust**
- **Zero Waste Scotland**
- **Environmental Association of Universities and Colleges**
- **Advanced Procurement for Universities and Colleges**
- **Association of University Directors of Estates**
- **Robertson Group**
- **Construction Scotland and Innovation Centre**

With special thanks to:

- **Dr Kate Carter, Edinburgh School of Architecture and Landscape Architecture (ESALA)**
- **Professor Sean Smith, Professor of Future Construction and Director of Centre for Future Infrastructure, University of Edinburgh**
- **Karen Ridgewell, Principal Design Officer, Architecture & Design Scotland**

Thank you to Barbara Morton, Sustainable Procurement Ltd and Ranald Boydell, Country Architecture for their expertise, knowledge and support in the design and delivery of the workshops, liaison with key players and for their contributions to this report.

To the Scottish Funding Council and Scottish Government for funding this Climate Emergency Collaboration Challenge project.