Major Contractors Group
NFB
National Federation of Builders

National Federation of Builders

Transforming Construction

Delivering a Low Carbon Future

A Handbook for Main Contractors

December 2020

OPEN >

The National Federation of Builders (NFB) is the leading trade association in England and Wales representing real construction and building contractors. The NFB boasts over 600 members representing 1300 construction companies with a combined annual turnover of £6.6bn and 21,000 employees.

The NFB provides expert advice, training, representation and business services for members so that they can comply with industry standards, excel in delivery, and grow successful businesses. Members must observe the NFB's Code of Conduct which commits them to business integrity, good practice and high standards of service.

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Usage: In the spirit of decarbonisation, this report is designed to be accessed digitally.

Contents

Ministerial Foreword

Covid-19 has not changed the need for industry and Government to act on climate change. As the Prime Minister outlined, whilst the world continues to deal with Covid-19, we must look ahead to how we will rebuild - and how we can seize the opportunity to build back better and greener. That is why our commitment to reducing climate change is shared across Government. Earlier this month, the Prime Minister set out his ambitious Ten Point Plan for a green industrial revolution which will create and support up to 250,000 British jobs. It will mobilise £12 billion of government investment to create and support good quality green jobs in the UK, and spur over three times as much private sector investment by 2030.

This plan is the cornerstone of our ambition to build back greener by making the UK the world leader in clean energy, ensuring our public buildings are energy efficient and that we protect and restore our natural environment.

That will require everyone to get take responsibility - and the construction industry has never been one to shirk from its responsibility.

When I first became aware of the Major Contractors Group, I was struck by the frank conversations that were taking place about how the industry and Government can work together to reduce emissions. This is going to be vital if we are to be the first generation to tackle climate change and reach our net zero target.

This report is a welcome step in the right direction, acting as a handbook for main contractors on how to decarbonise their businesses and their supply chains. As we look ahead to the UK co-hosting the Climate Ambition Summit for world leaders at COP26 next year, I encourage everyone to engage with this report as they travel on their own decarbonisation journeys.

Gillian Keegan MP

Minister for Apprenticeships and Skills
HM Government

Introduction

Mark Wakeford, Chair of the NFB Major Contractors Group

In 2019 the National Federation of Builders (NFB) Major Contractors Group (MCG) was set up to tackle some of the biggest challenges facing construction. We wanted to come together to work collaboratively to find solutions to some of the biggest issues facing our industry and our country. While the COVID-19 situation undoubtedly presents a significant immediate risk to us all, few would argue about the momentous threat that climate change presents to all our futures.

Now, in this new report, we set about to arm our colleagues across industry with the tools that they need to start or accelerate their decarbonisation journey. There will be many who looked at our first report and wondered where they should begin, and equally, there will be some who had already started their journeys. If we, as an industry group, are serious about our collaborative approach to delivering our country's net zero ambitions, then we must help each other to do so. This handbook for main contractors is designed to do just that.

It presents a range of actions in a staged process that colleagues can adopt and implement in their own businesses. It focuses on steps that we ultimately all need to take, but does so in a way that should allow any business, at whatever stage of their decarbonisation journey, to be able to apply. We have set about including case studies of a range of businesses, to illustrate the measures that others in the industry are taking and to provide an honest and open assessment of how implementing a decarbonisation agenda through business strategy has differed across businesses.

Mark Wakeford

Chair of the NFB Major Contractors Group
December 2020

About the NFB Major Contractors Group

The Major Contractors Group (MCG) is the division of the National Federation of Builders representing main contractors with an annual turnover of £40m and above. Currently, the group has a membership of over 30 main contractors with values ranging between £40m and £500m turnover per year.

The group was established in 2019 and aims to share intelligence, improve governmental understanding of larger construction businesses and find solutions to current barriers to house building and infrastructure. The MCG is a dynamic forum of major contractors across the UK working collectively to challenge many of the sector's misconceptions and to be a focus for best practice and future-proofing the sector.

In addition to decarbonisation, the group's priorities include:

- **Smarter procurement –** tackling the cost of procurement and challenging the focus on cost over quality
- **Fair payment –** working to tackle the problem of late payment and retention for our members
- **Streamlined planning –** aiding effective delivery of projects from concept to breaking ground
- **Subsidised training –** recognising strategic training needs and the need for targeted subsidy
- Stay safe – working with partners and agencies to ensure continuous safety improvements across the sector
- **Skills –** highlighting construction as a career choice, creating career pathways and developing skills to meet the sector's future needs.

Find out more and join the NFB MCG

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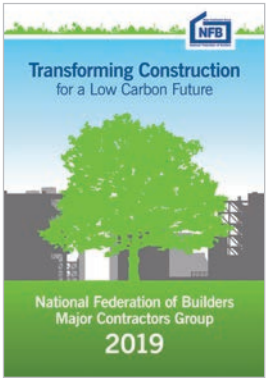
Transforming Construction for a Low Carbon Future (2019)

In 2019 the MCG published its first report, the precursor to this document, entitled *"Transforming Construction for a Low Carbon Future"*. The report acted as a call to arms; highlighting the critical role that construction will play in achieving our net zero ambitions and the unique position of main contractors to influence the supply chain.



The report included insight of 20 key stakeholder organisations, outlining the opportunities for construction, the need for measurement of carbon across the supply chain and other key initiatives that would help the sector to decarbonise. It included recommendations for policy makers, clients, main contractors, the wider supply chain and trade bodies.

The report marked the MCG's entry onto the decarbonisation scene and signalled the group's intent to lead industry to help it meet the country's decarbonisation targets through a business-led approach to innovation and efficiency.

Read the report: Transforming Construction for a Low Carbon Future (2019)

Major Contractors Declare

In August of 2020, the NFB Major Contractors Group became the first trade body representing main contractors to sign up to the #ConstructionDeclares movement. #ConstructionDeclares is a global petition 'uniting all strands of construction and the built environment'. It is both a public declaration of the planet's environmental crises and a commitment to take positive action in response to climate breakdown and biodiversity collapse. This handbook signifies the MCG's intent to deliver on that pledge – by raising awareness, sharing knowledge, engaging supply chains, encouraging collaboration and providing real and tangible steps to progress. This report will help main contractors all over the UK to step up to the plate and deliver the country's Net Zero ambitions.

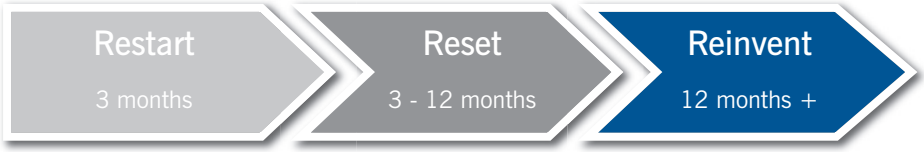
The MCG is encouraging other trade organisations and businesses to take the pledge. Find out more and sign up at: **uk.buildersdeclare.com**

The Contractors Declare Pledges

- Raise awareness of the climate and biodiversity emergencies and the urgent need for mitigation and adaptation action amongst our employees, clients, peers, collaborators and supply chains.
- Advocate for faster change in our industry towards regenerative practices and higher Governmental investment to support a just transition, in line with the UN Sustainable Development Goals.
- Establish climate mitigation and adaptation principles, as well as maximise biodiversity and air quality enhancement. This will be demonstrated through commitments, actions and achievements. Seek for us and our key supply chains to set targets for our own emissions and for the assets we design and build using recognised standards aligned to the 1.5-degree scenario.
- Share knowledge and research on an open source basis, to address the climate and biodiversity emergencies.
- Evaluate all new projects against the aim to contribute positively to mitigating climate and biodiversity breakdown, to adapt to climate change using nature-based solutions and encourage our clients to adopt this approach.
- Support the upgrade of existing assets for extended use as a more carbon efficient alternative to demolition and new build whenever there is a viable choice.
- Support and promote the use of life cycle costing, whole life carbon modelling and post occupancy evaluation/performance measurement. We will do that as part of our standard scope of work to reduce both embodied and operational resource use for the assets we design and build.
- Adopt and support more regenerative principles, with the aim of achieving net zero in line with recognised standards. For buildings this should be in line with the UKGBC's industry created definition of net zero carbon.
- Work together with engineers, designers, clients, collaborators and supply chain to further reduce construction waste and transition to a circular economy.
- Accelerate the shift to low embodied carbon materials in all our work and promote meaningful actions that will lead to reducing embodied carbon by at least 40% by 2030, based on the World Green Building Council call to action.
- Work with clients, designers and supply chains to design out waste in the assets we design and build, and further reduce waste during their construction, operation and deconstruction by transitioning to a circular economy.

Construction Leadership Council Industry Recovery Plan: Roadmap to Recovery

In response to the COVID-19 crisis, the Construction Leadership Council (CLC) called a taskforce of industry bodies and representatives to aid Government and the sector in navigating the construction industry through the crisis period. As the country emerged from the first wave and began to adapt to the new ways of working, the CLC put together an industry recovery plan. The plan, which has Ministerial blessing, set out a three phased approached at recovery and recommitted the industry to the net zero agenda.



The three phases of the Industry Recovery Plan.

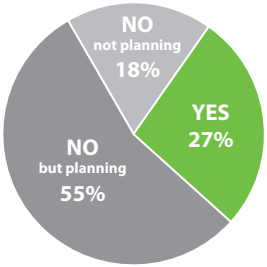
Specifically, the plan commits both industry and Government to improving design, product selection, manufacturing and construction processes to deliver built assets that achieve a 50% reduction in greenhouse gases as part of the pathway towards net zero.

Industry Recovery Plan, Reinvent Stage		
Chapter	**Transformation**	**Value**
Intention	Sustain economic growth through adoption of digital and manufacturing technologies to consistently deliver low carbon, sustainable and better quality outputs and outcomes	Adopting procurement models and approaches across the industry and clients to deliver better value and whole life performance
Action	Embed net zero carbon 2030-2050 targets in planned new infrastructure and housing developments, and in the maintenance and improvement of built assets and homes, develop and utilise digital design, cost and carbon tools to deliver this	Adopt procurement and delivery models focused on whole life performance of buildings and infrastructure, and ensuring these are efficient, safe, sustainable and can be adapted and improved. Improving the energy and heat performance of buildings is critical to responding to climate change and delivering a net zero carbon and climate change resilient economy by 2050.

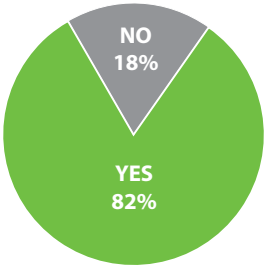
State of the Trade: Main Contractor Decarbonisation Survey

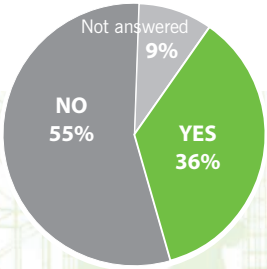
The National Federation of Builders undertook a survey of main contractors in August 2020 to access the progress that main contractors are making in embracing the decarbonisation agenda. The questions were based on recommendations made in the MCG's first Low Carbon report, to monitor the progress made.

Has your business produced a strategy that relates to how you will decarbonise your business?



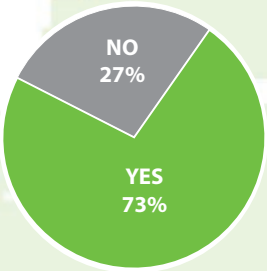
Has your business proactively identified the market opportunities where your skills and resources can make a commercial contribution in respect of decarbonisation?



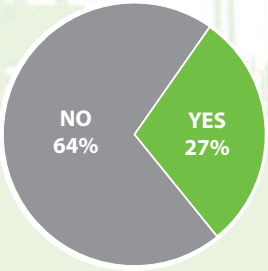


Has your business upskilled your employees (through training) in order to give them the tools to contribute to reducing carbon?

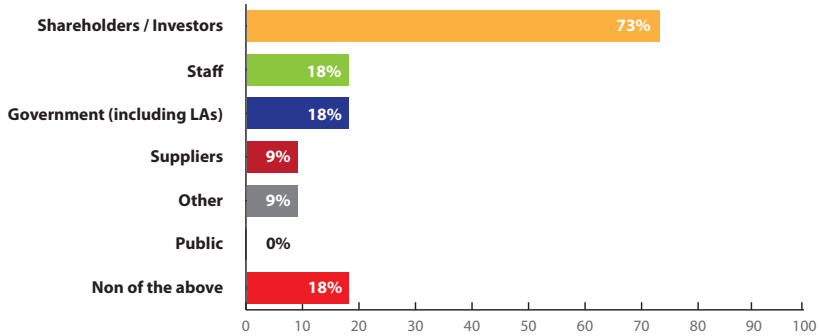
Does your business regularly research new products, partnerships and collaborations to tackle the challenge of decarbonisation?



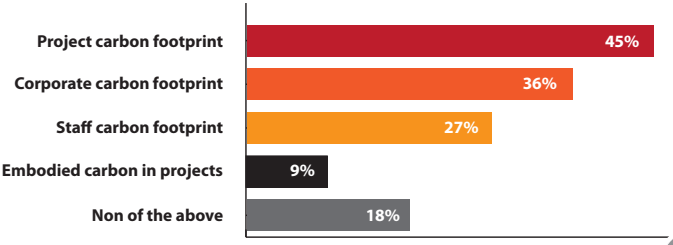
Have you published your corporate focus on decarbonisation (including activities and/or efforts) in your marketing and/or recruitment materials?

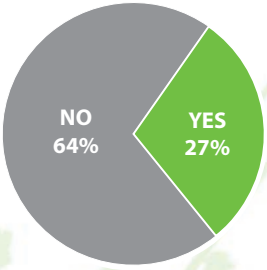


Has your business experienced pressure to decarbonise from the following stakeholders?



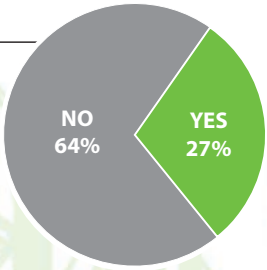
Does your business currently measure carbon in any of the following ways?



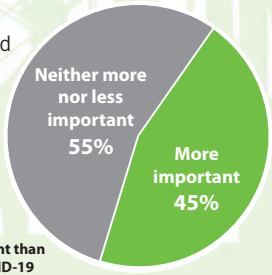


If you do measure carbon footprint, have you used it to provide a benchmark from which to reduce both your footprint and your costs?

Do you currently use a common standard to measure and record embedded carbon and a recognised methodology to measure in-use carbon within your buildings?



Has COVID-19 changed your view on the importance of achieving a Low Carbon future?



Less important than before COVID-19
0%

Chapter 1

Carbon Leadership: Developing Teams to Lead Change

Introduction

Any major business transformation programme must begin with a leader and the will and energy to change. Carbon reduction is no different.

Main contractors who want their businesses to prepare for the new future will need the leadership and the teams to deliver it.

Decarbonisation Accountability Checklist

- Appoint a carbon-change maker at Senior Management Team or Board level to drive the agenda
- Set a carbon reduction ambition or goal
- Develop a carbon-leadership team, consider a cross-section of employees and departments
- Develop a company-wide Carbon-Reduction Strategy with measurable targets and KPIs
- Establish achievable benchmarks in the early years of implementation
- Ensure recognition when key milestones hit
- Incorporate training into the relevant levels (strategic, management, project management)
- Consider appointing external consultants to manage transformation or planning processes.

Setting the carbon reduction goal, useful links

- UN Sustainable Development Goals
- World Green Building Council Embodied Carbon Call to Action
- RIBA Sustainable Outcomes Guide

Management systems

Implementing management systems that assign responsibility and ensure a thorough process in environmental sustainability management are an easy way to begin change within the organisation. While some systems implementation are often required for procurement purposes, if they are truly embraced and adhered to, they can prove transformational. One such example is the ISO 14001 family of standards.

Henry Boot Construction (NFB Member)

Henry Boot Construction is currently in the process of finalising its next five year sustainable business plan, due to be implemented in 2021.The company aims to start with science-based targets, focusing on what the planet needs rather than legislative minimums. The new plan will see a major drive to focus on data, recognising the need to collect and monitor key metrics in order to improve outcomes. To do this, the company is developing a new bespoke model for management accounting of progress against carbon and environmental targets, ensuring monthly management reports, two monthly board reporting and publishing in Annual Reports. The company intends that it will become an important feature of both individual and company performance management.

Tony Shaw, Construction Director, who leads the agenda both for Henry Boot Construction and for the wider Henry Boot Group said: *"It's a big investment and a big step but it reflects the gravity of what we intend to do. We're doing this because reducing our environmental impact and committing ourselves to decarbonisation will become an integral part of Henry Boot Construction's DNA. We aren't looking for knee-jerk or public relations focused activities, this is about long term behaviour change and business transformation."*

Henry Boot Construction set up a carbon reduction task force and took the step of asking for a diverse spread of employees. The call for volunteers saw an oversubscribed appeal, indicating the high level of engagement employees already have for decarbonisation. The Taskforce was encouraged to think outside the box and to look at changing and improving the business, from quick wins to longer term business transformation.

The Taskforce's work has already secured a switch to EV company cars, a new active transport strategy, investment in the company's green transport infrastructure and an improved and enhanced bike to work scheme with incentives that enabled longer journeys on high performing equipment. As part of the launch of the new sustainable business plan, the company intends to roll out a new training programme on environmental sustainability for all employees in 2021, undertaking a 'roadshow' of the company, presenting and visiting all departments, projects and teams.

Henry Boot doesn't just see the need for change internally, it is also committing to taking clients and suppliers along with it, for example developing teams to assist repeat customers with their own decarbonisation journey as well as investing in a new 'Responsible Business Manager' to manage the environmental and social relationship between the board, subsidiaries and stakeholders.

Henry Boot CONSTRUCTION

Woodhead Group (NFB Member)

The Woodhead Group started its decarbonisation commitment with an ambition in the company's business plan to become a 'climate positive contractor' and a commitment to zero single-use plastic on any site by 2030. The Group says it is in the process of developing targets under the 'climate positive contractor' ambition and that these will be measurable, based on industry standards and aligned to the UN Sustainable Development Goals or similar. It aims to work towards Net Zero and become environmentally positive – meaning that the company's projects and activities will result in net environmental gain.

Woodhead's ambition originated from a people-led approach in the business's annual strategic planning workshop, a broad cross-section of the company's employees from board level to junior staff were consulted – setting the tone of widespread employee engagement from the start and signalling an intention to include decarbonisation within the business strategy, rather than additional or separate to it. The Group's leadership on high level decarbonisation and climate action goals comes from Chief Visionary Officer, Glenn Slater, but the ultimate accountability for ensuring its implementation sits with the Managing Director, Teresa Westwood, recognising the importance of the issue. The company considered appointing a specific sustainability lead but reasoned that if it is to be successful, it needs to ensure the agenda does not become a silo issue. Seeing the investment in decarbonisation as critical to ensuring the long-term future of the business, Glenn Slater stated: *"it isn't so much about can we afford to make this investment, as it is can we afford not to?"*.

"If we are serious about doing this, it has to become fundamental to who we are as a company and a core part of our culture and values, for us that meant not appointing a specific person or department but incorporating it into our core business. That's not to say we won't give employees throughout the business ownership of their own green initiatives, just that it has to become a core part of what we all do".

The Group is currently in the process of developing a Climate Action Plan Framework, which will take a themed approach to sustainable business practices, product delivery, corporate responsibility and individual employee responsibility. The plan will cover premises and site operations, product innovation, early awareness with staff and a transition to an education and training programme, for employees, supply chain, customers and other partners.

WOODHEAD GROUP

Useful tools and resources

- Carbon literacy e-learning resource (GOV.UK)
- Science Based Targets Initiative
- Carbon Trust, Streamlined Energy and Carbon Reporting Briefing
- The British Psychological Society. Going Green: The Psychology of Sustainability in the Workplace [PDF]
- CIOB Carbon Action 2050 Toolkit
- National Federation of Builders green training
- ISO 14001 family of management standards

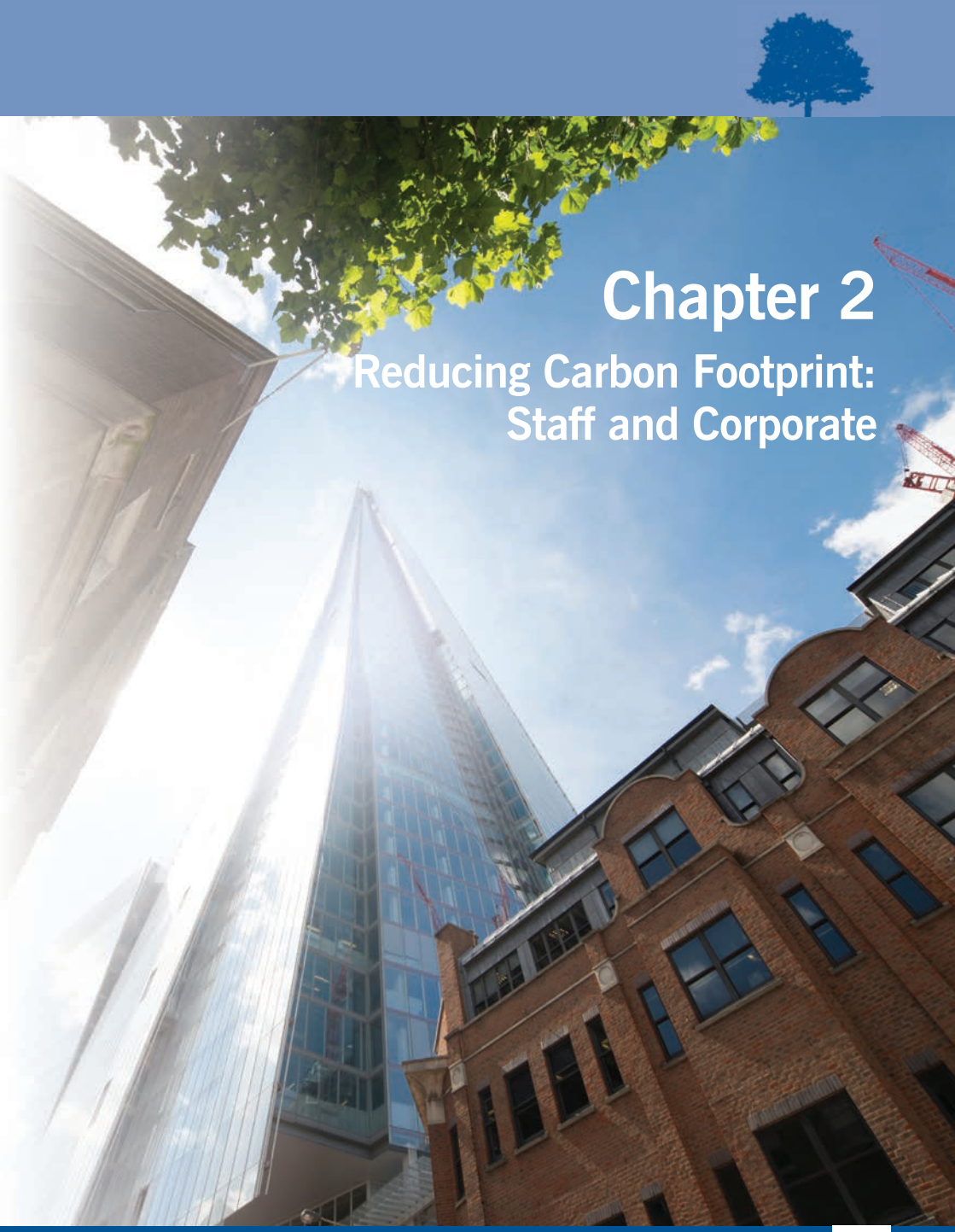
Introductory training options on zero carbon – Supply Chain Sustainability School (SCSS)

The SCSS, which is part funded by CITB, provides a range of free training in topics including energy and carbon, environmental management, sustainable procurement and waste and resource efficiency. Once signed up for the school, employees can complete a short sustainability assessment which will check existing knowledge and produce a personalised action plan of learning. Once completed, reassessment allows a new training plan at the next level.

The following free online training is available from the SCSS:

- Introduction to Climate Change and Carbon
- Introduction to Environmental Management
- Introduction to Sustainable Construction
- Introduction to Sustainable Homes
- Introduction to Waste
- Introduction to Water
- Introduction to Economy and Community
- Sustainability on site
- Sustainability and Groundworks
- Sourcing Sustainable Plant For Your Construction Projects
- Sustainable use & management of plastics
- Introduction to Sustainable Construction in Wales

Further support can be provided by NFB Membership Services or your local CITB advisor.



Chapter 2

Reducing Carbon Footprint: Staff and Corporate

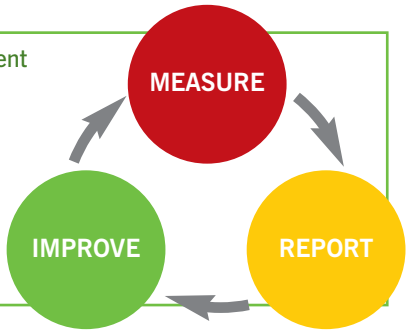
Introduction

The start of any carbon-reduction process that a company embarks on might most easily begin with reducing staff's carbon footprint. It is a straightforward process, requires little upfront investment and has the added benefit of helping to communicate to staff the impact that they personally make in respect of carbon emissions. It also empowers employees by showing the impact that they have in helping both the business and the environment in the small but significant actions that they can take. It creates an automatic buy-in for employees who may otherwise be sceptical or feel excluded from the process and it allows performance management on both a macro and micro level, achieving not only improved outcomes but a cultural shift in favour of measurement, reporting and improvement.

Staff carbon footprint often includes: home energy usage, travel, transport and product and service usage.

Basic Principles Of Carbon Footprint Measurement

1. Develop and agree measurement metrics
2. Collect data over a 12 month period
3. Use the collected data as a benchmark
4. Set a target that sees an achievable reduction on previous year
5. Implement a plan to reach the target, and incentivise to achieve a stretch goal.



Moving to measure corporate footprint

Once a company has started to measure staff footprint, the seeds have been sown for the next and most natural progression – measuring the company's corporate footprint. Much like staff footprint, the principles of 'measure, account, reduce' apply but the number of metrics widen to include the performance of the whole company. Many contractors who are already covered by the Streamlined Energy and Carbon Reporting (SECR) will be familiar with corporate footprint but generally, corporate footprint includes fuel combustion, company vehicles, process emissions, fugitive (unintended) emissions and purchased energy. These standards are set in the Greenhouse Gas (GHG) Protocol, the world's go-to authority on emissions measurement.

Contractors who are advanced in their corporate footprint reporting may also include the following, known as 'scope 3' carbon emissions in the GHG protocol:

- Purchased goods and services
- Capital goods
- Fuel- and energy-related activities
- Upstream transportation and distribution
- Waste generated in operations
- Business travel
- Employee commuting
- Upstream leased assets
- Downstream transportation and distribution
- Processing of sold products
- Use of sold products
- End-of-life treatment of sold products
- Downstream Leased Assets
- Franchises
- Investments

Contractors whose organisations are already Net Zero may wish to certify to PAS 2060, the recognised standard for Net Zero corporate footprint.

How does it benefit the business?

Employee Benefits	Business Benefits
• Greater awareness of personal contribution to carbon emissions and heighten environmental awareness • Shared ownership of business' performance (energy and cost) • Personal ownership and empowerment over carbon reduction • Self-learning and self-measurement	• Low Cost implementation • Highly likely to result in business savings through productivity and efficient use of business resources if measurements are used to benchmark best practice • Provides measurable evidence for business case for decarbonisation adoption more widely • Additional CSR opportunities to use a competitive advantage or as compliance or in procurement • Improves management systems by nature of activities required

Ideas for employee and business footprint transformation

- Investment in greener, cleaner company vehicles
- Employee incentives to use public transport or car-pooling
- Employee incentives for a 'switch off' scheme, encouraging powering down of equipment

- Consider use of BIM and other technological innovations to reduce 'in-person' attendance
- Shift of office-based employees to frequent working from home or flexible working practices
- Company-wide competitions to encourage employee-led innovations in personal footprint reduction.

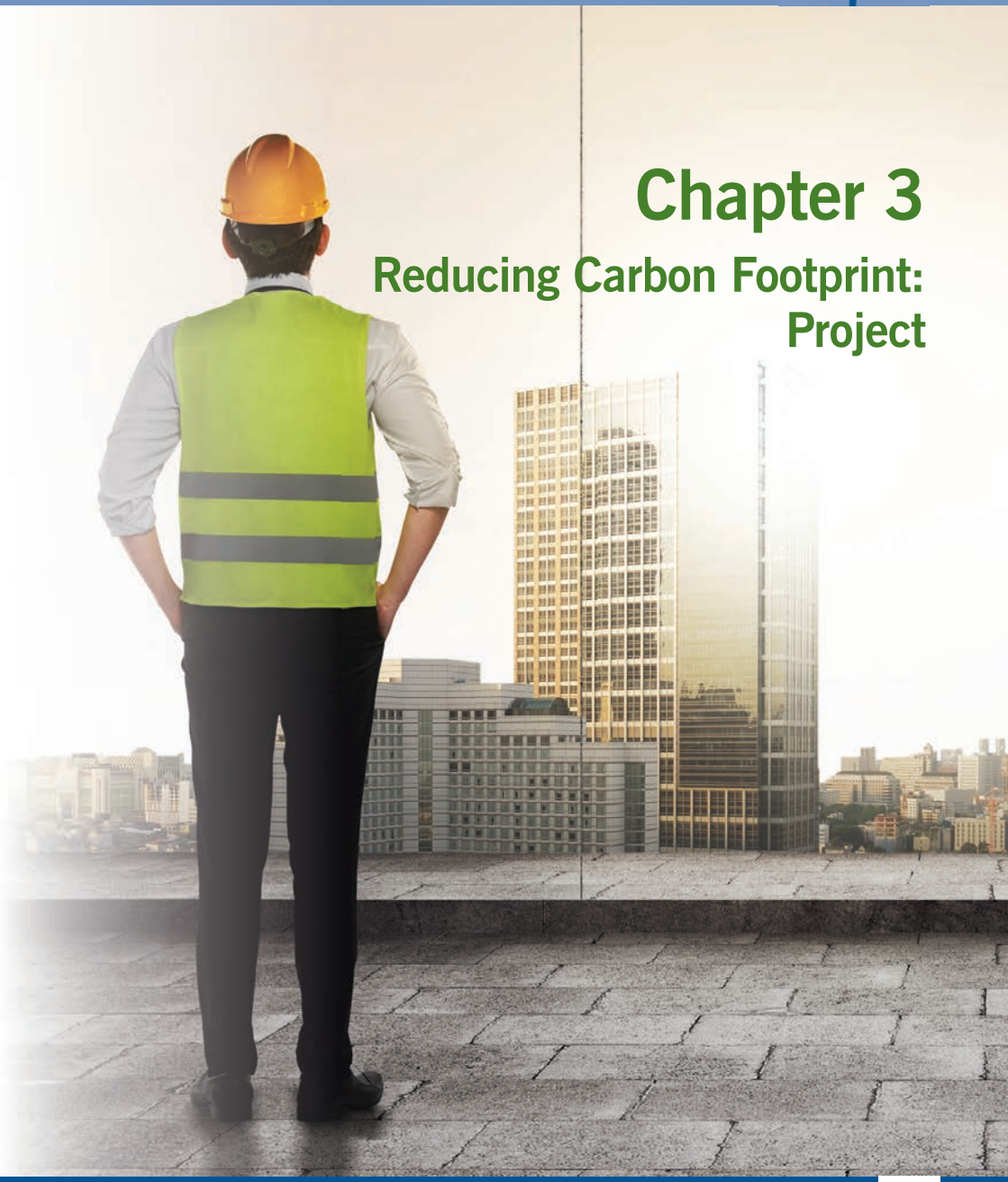
Reducing staff carbon footprint in practice – EvoEnergy

EvoEnergy is an end-to-end renewable energy project service provider that is owned within the Stepnell Group. As a renewable energy company, it has embraced staff footprint measurement (as well as corporate and project) and is now in its third year of data collection and has committed to reducing its own emissions. EvoEnergy's measurement period runs from April – March, and for the year ending March 2020 recorded carbon emissions at 48.63 metric tons of CO^2e (CO^2 equivalent) which is 1.95 metric tons per employee, a drop of 0.02 metric tons per employee.

Using the calculator employees calculated their footprints, including emissions from their house, flights, food consumption, personal goods purchased and miles travelled (including business miles). The results have enabled EvoEnergy to target the activities that are most associated with emissions and have identified that travel to and from the office is an area that can be significantly reduced with greater home-based working. EvoEnergy are estimating that by significantly reducing the frequency of office visits (53% decrease), they can save over 47,000 miles travelled in the next year – saving 9.83 metric tons of CO^2e.

Useful tools and resources

- Greenhouse Gas (GHG) Protocol (includes standards, tools and courses)
- Carbonfootprint.com
- Carbon Disclosure Project – How to disclose as a company
- PAS 2060 Standard on Carbon Neutrality
- Carbon Trust: Standards
- Carbon Trust: Carbon Footprinting Guide
- Carbon Trust: Steps to Energy Saving for SMEs
- The Carbon Reduce Programme (formerly the Certified Emissions Measurement and Reduction Scheme or CEMARS)



Chapter 3

Reducing Carbon Footprint: Project

Introduction

Building buildings is a significant global contributor to carbon emissions, with the industry directly accounting for around 10% of the UK's carbon emissions[1]. While the measuring and reducing the emissions of staff and the corporate footprint are important first steps, and are significantly important in terms of creating the right culture and employee buy-in, if the country is to meet its Net Zero ambitions, the construction industry will have to tackle head-on the emissions associated with actual construction activities.

The next step therefore is to record, account and reduce emissions associated with construction projects. There are many ways to do this, including full carbon intensity measurements such as Skanska UK who report in in tonnes of CO^2 equivalent gases – emitted for each £1 million of Skanska UK's revenue. However, a good place for contractors to start is by measuring the emission producing activities associated with the project, such as:

- Movement of goods, materials, plant and people to and from site
- Movement of goods, materials, plant and people on site
- Use of plant on site
- Energy usage (utilities and fuel consumption of generators etc.)
- Minus credible offsetting schemes

By doing this, contractors can implement carbon reduction schemes to reduce usage either when benchmarked against themselves or an industry average. ConstructCO2 is one tool that offers such services and currently advertises the industry benchmark as 43.51 Kg of CO^2 / £1K project spend.

Useful tools and resources

- Construction CO^2e Management Protocol (ENCORD) [PDF]
- ConstructCO^2
- The Oxford Principles for Net Zero Aligned Carbon Offsetting [PDF]

Chapter references:

1. HM Government, Innovation & Growth Team (2010) Low Carbon Construction. Available online at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/31774/10-1266es-low-carbon-construction-igt-executive-summary.pdf [accessed 19.11.2020]

Baxall Construction (NFB Member)

Baxall Construction has been monitoring and reporting on its carbon usage per project since the beginning of January 2013, utilising the ConstructCO^2 tool.

The company has been measuring visits and the mode of transport to site, by management, operative and visitors, it also records how products and materials arrive on site, by what method and how far they have travelled as well as the fuel burnt on site and utility usage. By doing this, Baxall is able to assess its usage and adjust it, implementing carbon reduction measures such as sustainable transport schemes, improved logistics planning (localisation), reducing waste removal and on-site offsetting. The company now boasts 21% of all journeys to site as low or zero carbon, having identified that 70% of all site footprint emissions were due to travel.

In 2014 the company recorded an average footprint of 32KG CO2 per £1000 project spend. By measuring, reporting and adjusting its operations over successive years, Baxall recorded a footprint of 27KG CO2 per £1000 project spend, the equivalent of 120 tonnes of saved CO2 when compared to 2014 footprint.

Commenting, Baxall Managing Director Malcolm Clarke said: *"The most effective way that we have found to reduce our project footprint is through a systems-based approach. By improving our processes on design, procurement and delivery, we have been able to achieve significant reduction of footprint. We've also spent a lot of time working with the supply chain to educate and include them in this mission. Looking to the future, we are aiming to improve our carbon productivity, ensuring that we get maximum value out of the carbon we do use and the benchmarking, reporting and action planning will be key to achieving that too."*

BAXALL
Buildings built on teamwork

Environmental Training for Site Management

- Site Environmental Awareness Training Scheme (SEATs)
- Site Sustainability Manager (BREEAM)
- Recycling and reuse of material
- Environmental and sustainability issues

These courses may attract CITB short duration grant via the Skills and Training Fund.

Chapter 4
Reducing Embodied Carbon

Introduction

Embodied carbon, unlike the other measures of carbon footprints detailed earlier in this report, takes a much more holistic and 'total' view of the real amount of carbon emissions attributable to the construction of buildings. As opposed to solely the operational emissions associated with the construction project, it considers every element of carbon emissions that have occurred in activity of construction. The ability of the main contractor to directly influence embodied carbon depends upon the type of contract, with much more control over total embodied carbon in a design and build contract.

Defined: Embodied Carbon

The UK Green Building Council defines embodied carbon[1] as:

…the total greenhouse gas (GHG) emissions (often simplified to "carbon") generated to produce a built asset. This includes emissions caused by extraction, manufacture/processing, transportation and assembly of every product and element in an asset. In some cases, (depending on the boundary of an assessment), it may also include the maintenance, replacement, deconstruction, disposal and end-of-life aspects of the materials and systems that make up the asset. It excludes operational emissions of the asset.

Carbon accounting

Physical carbon accounting is a key principle that enables greenhouse gas emissions, associated with an activity, to be measured and accounted for. Full carbon accounting must take into consideration all the aspects associated with the activity which is why considering embodied carbon is such a critical component in understanding the true value of the carbon emissions associated with construction. Only by seeing the full picture can carbon reduction measures really make a significant difference. For example, a main contractor may operate in a highly 'green' manner in respect of the project footprint metrics highlighted in earlier in this report; the building materials used may well have huge amounts of embodied carbon.

Construction CO^2e Measurement Protocol (ENCORD)

The ENCORD (European Network of Construction Companies for Research and Development) protocol is the world's gold standard for measuring carbon (greenhouse gas) emissions in construction. The protocol sets out minimum requirements for measuring and reporting emissions in order to meet best practice but goes beyond to cover all possible aspects of measurement. The guidance has been reviewed by the GHG Protocol and is in

conformance with the GHG Protocol Corporate Accounting and Reporting Standard. Specifically it measures:

1. Fuel (project)
2. Fuel (premises)
3. Process and fugitive
4. Electricity (project)
5. Electricity (premises)
6. Imported heat
7. Vehicle fuel
8. Public transport
9. Subcontractors
10. Waste
11. Materials
12. Product

Tools to Help Account for Embodied Carbon in Materials

There are a number of tools that can help main contractors to assess and record the embodied carbon of materials brought to site, allowing for accurate accounting. The Embodied Carbon in Construction Calculator (EC3) tool is an easy and free to use piece of software developed by over 50 industry partners originating from the Carbon Leadership Forum. It enables easy benchmarking, assessment, and therefore reductions in embodied carbon, focused on the upfront supply chain emissions of construction materials.

- Embodied Carbon in Construction Calculator (EC3) tool

In addition, the Inventory of Carbon and Energy Database published by environmental consultants Circular Ecology is a free to access database of over 200 materials divided into 30 main material categories that lists the embodied carbon of the materials. Circular Ecology has also provided a tool for working out the embodied carbon contained in concrete mix, called the Concrete Embodied Carbon Calculator.

- Embodied Carbon - The ICE Database (Circular Ecology)
- Concrete Embodied Carbon Calculator (Circular Ecology)

Cradle to Gate Embodied Carbon A1 - A3

Rammed Earth
48kgCO^2e/m^3
Ranges from 40 to 170kgCO^2/m^3

Softwood Timber
110kgCO^2e/m^3
Ranges from 1 to 480kgCO^2/m^3

Rammed Earth
219kgCO^2e/m^3
Ranges from 160 to 320kgCO^2/m^3

Stone Generally
237kgCO^2e/m^3
Ranges from 60 to 2,100kgCO^2/m^3

Clay Brick Wall*
345kgCO^2e/m^3
Ranges from 260 to 1,100kgCO^2/m^3

Reinforced Concrete**
635kgCO^2e/m^3
Ranges from 120 to 1,370kgCO^2/m^3

Glass Generally
3,600kgCO^2e/m^3
Ranges from 2,300 to 5,100kgCO^2/m^3

Steel Section
345kgCO^2e/m^3
Ranges from 7,600 to 28,000kgCO^2/m^3

Aluminium Generally
18,000kgCO^2e/m^3
Ranges from 2,400 to 58,000kgCO^2/m^3

Using database summary values for product stage, does not include construction, use, end of life or benefits stage.
Ranges are presented to show how values can vary, and require interpretation based on source and analysis method.
* Based on values for brick wall, which use 1.500 bricks for 1m^3 mortar.
** Based on C32/40 concrete with 2% reinforcement, maximum based on 4% reinforcement.

The 'True' carbon cost of varying building materials from manufacture to arrival at site. Reproduced under kind permission of Ciaran Malik, original copyright owner (Ciaran Malik ©2020) available at: ciaranmalik.org

Carbon accounting – Skanska UK

Skanska are one of the most forward-thinking and progressive construction companies when it comes to their commitment to decarbonisation. Skanska has implemented what is widely considered as full carbon accounting, adopting the 12 ENCORD Protocol measurement metrics in their reporting.

Of the 12 items identified in the ENCORD Protocol, Skanska routinely report on 11 of the 12 categories at a business level, and the 12th, the 'products' category (which includes post-handover emissions or downstream emissions) on a per asset or customer basis. The company says this is only because at current, there is no established or generally accepted way for construction firms to determine their level of responsibility at a business level. In addition, Skanska are certified to PAS 2080, a standard for whole-life carbon management in infrastructure. By measuring so comprehensively, it is possible to see the significance of materials in construction's carbon footprint. In Skanska's case, materials account for 76% of the overall measured carbon footprint.

By providing such in-depth and comprehensive carbon accounting, Skanska can accurately assess their carbon intensity, the amount in tonnes of CO2 equivalent gases emitted for each £1 million of Skanska UK's revenue. In 2010 the company measured 351 tonnes of CO2e per £1m but by 2018 had reduced that to 215 tonnes of CO2e per £1m. Skanska aim to reduce that further to 130 per £1m by 2030 and 0 by 2045.

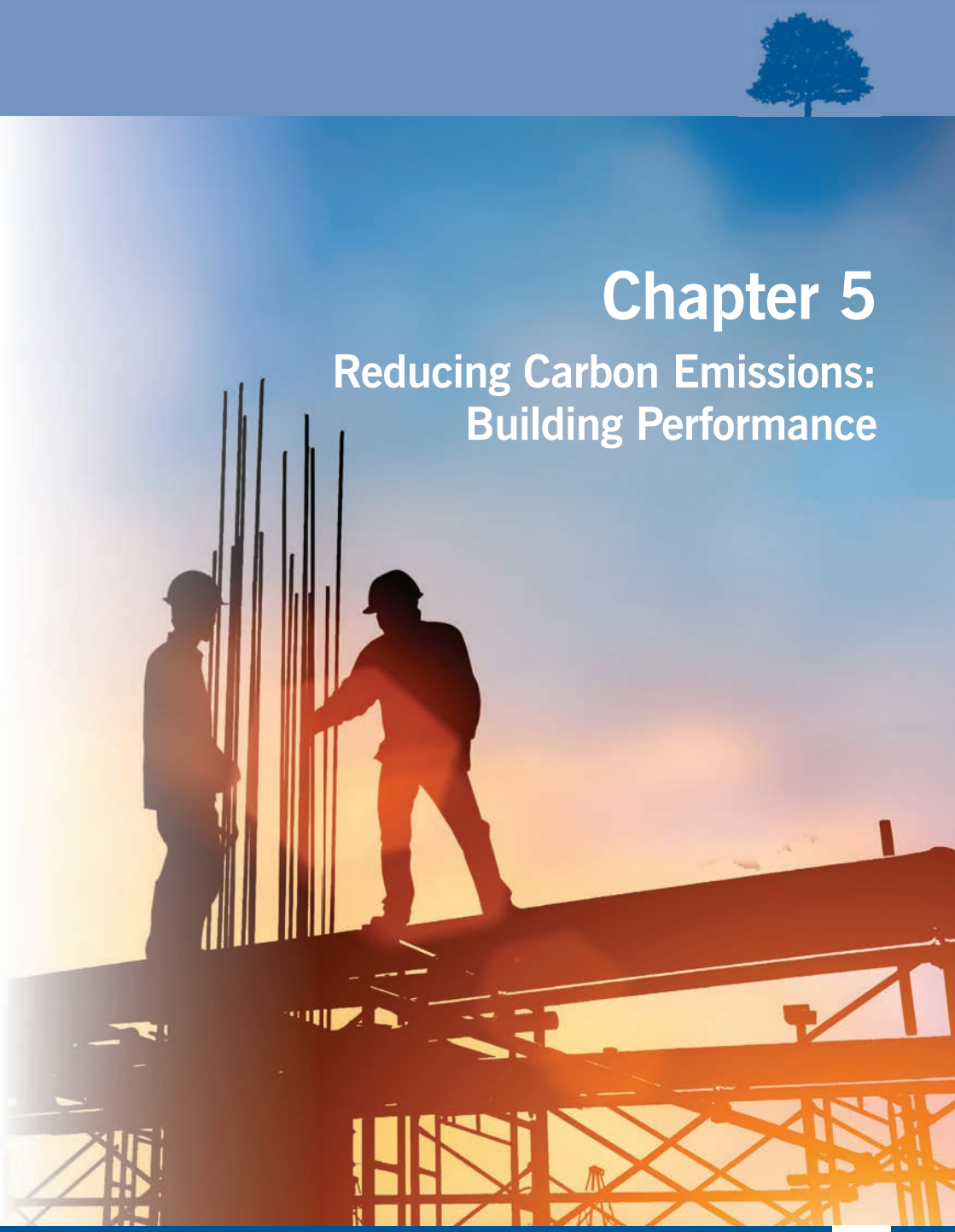
Skanska US has also been involved in the development of a new open-source tool called the Embodied Carbon in Construction Calculator or EC3 tool which allows contractors to accurately estimate embodied carbon.

Useful tools and resources

- An Introduction to Carbon Accounting, Edinburgh University
- UKGBC Embodied Carbon Practical Guidance
- UKGBC 'Embodied Carbon: Developing a Client Brief' [PDF]
- PAS 2080 – Managing Whole Life Carbon in Infrastructure Delivery CLC Guidance Document [PDF]
- Skanska UK's Carbon Management System, Technical Report [PDF]

Chapter references:

1. UK Green Building Council (2017) Embodied Carbon: Developing a Client Brief. Available online at: https://www.ukgbc.org/sites/default/files/UK-GBC%20EC%20Developing%20Client%20Brief.pdf [Accessed 19.11.2020]



Chapter 5

Reducing Carbon Emissions: Building Performance

Introduction

While the above chapters address the direct carbon emissions of construction companies, their operations and the embodied carbon within buildings, a huge proportion of carbon emissions relate back to the operational energy used over the lifetime of the building, post-completion. The World Green Building Council have stated that emissions relating to building operation account for 28% of all global emissions, compared with the 11% attributable to embodied carbon[1]. Operational energy usage is one of the key metrics in measuring building performance and is frequently referred to in the definition of a sustainable or green building. It is therefore incumbent upon the industry, to build buildings that reduce energy usage attributable to carbon emissions over the duration of their lifespan. To do this, industry will need to build greener and high performance homes and buildings that significantly reduce operational energy use, or derive the energy use from wholly or mainly on-site renewable sources.

World Green Building Council – Definition of a Green Building[2]

"A 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life."

Building Performance Standards

In addition to regulatory minimums, there are various internationally and nationally recognised and well-respected standards that main contractors can achieve in order to showcase the high-performance of their builds, examples include:

- Passivhaus
- BREEAM
- UKGBC Net Zero Buildings 'framework definition' [PDF]
- EnerPHit (Passivhaus retrofit)
- Minergie [PDF]
- LEED
- CEEQUAL

RIBA's Sustainable Outcomes Guide refers to operational energy use and four guiding principles that should be followed in achieving buildings with low operational energy use:

1. **Passive First**
   Use form, fabric and landscape to optimise ambient lighting, heating, cooling and ventilation
2. **Fine-tune, with gentle engineering**
   Use efficient and well-integrated mechanical and electrical systems and user-friendly controls
3. **Incorporate on-site renewables**
   Use low and zero carbon (LZC) technologies to minimise energy purchases and carbon emissions.
4. **Make the building and its systems usable and manageable**
   Avoid designing buildings that prove too complicated to look after, frustrating occupants and wasting energy.

Christow Community Land Trust (CLT) and Pearce Construction (NFB Member)

In 2016, Pearce Construction built 18 certified PassivHaus standard affordable dwellings comprising of two, three, and four bedroom houses and bungalows for Christow CLT in Dartmoor National Park, to accommodate older downsizers and young families. 14 were available to rent as affordable housing and four have been sold on the open market.

Products used in construction included ultra-triple glazed timber entrance doors and triple glazed windows, foam insulation, airtightness tapes and membranes and mechanical ventilation with heat recovery. The timber framed homes also have large window overhangs and solar thermal hot water with annual heating and hot water bills coming in at less than £100 per year with heating predominantly coming from activities in the home. The scheme won the LABC Building Excellence Awards 2017 and Royal Town Planning Institute South West award for Planning Excellence 2017.

Building Regulations vs. PassivHaus Standard

The PassivHaus Trust has undertaken a study of the key differences when building to Building Regulations (minimum) Standard vs PassivHaus Standard:

Cost savings of PassivHaus	Additional costs of PassivHaus
• Up to 90% lower energy use • Excellent air quality • Comfortable temperatures throughout the year • Internal window surface temperature not falling below 17°C on the coldest day of the year • Up to 10% premium compared to traditional build	• Up to 8% extra construction costs • Extra thermal insulation for walls, roof and slab • Triple glazed windows • Ventilation with heat recovery • Boxing to prevent air leakage • Orientation of home • Certification and use of certified PassivHaus consultant

PassivHaus data on a new build:

	Building regulations	Project achievement
Wall	0.3 W/m^{2}k	0.125 W/m^{2}k
Roof	0.15 W/m^{2}k	0.067 W/m^{2}k
Windows	1.6 W/m^{2}k	0.76 W/m^{2}K
Floors	0.25 W/m^{2}k	0.103 W/m^{2}k

Performance of PassivHaus vs Building Regulations taken from a new build project in Camden of a home built on a garage site.

EnerPHit – Dales Contracts Ltd (NFB Member)

It can be complex to achieve the PassivHaus standard for retrofitted projects but a similar standard, EnerPHit can be used and has slightly less stringent standards. Britain does not have many EnerPHit experts but Dales Contracts has been doing this work for more than two decades. For example, in 2011 Dales Contracts undertook an EnerPHit retrofit of a 67m^2, 3 bedroom timber frame, brick-clad end terrace, built in the 1950's as part of a £45,000 refurbishment. The house achieved huge energy savings, as demonstrated in the table below:

Existing	U Value	After refurb	Heat loss reduction	U Value
Ground floor	0.65	Insulation/new flooring	60%	0.26
External walls	1.35	Cavity sealing/insulation/ vapour barrier	87%	0.17
Roof	0.74	Insulation/air tight barrier	90%	0.07
Windows	2.8	Passivframe triple glazed	71%	0.80
External doors	2.8	Passivframe insulated	71%	0.80
Ventilation		MVHR	90%	

Dales Contracts say that the results show what can be achieved with excellent design, high quality workmanship and an attention to detail. While on the surface, it may appear as though the product selection can make a big difference, understanding how to properly install them, what the best practices are and why is also critical to the success of the retrofit.

PassivHaus vs EnerPHit standards:

	PassivHaus	EnerPHit
Specific Heat Demand	≤ 15 kWh/m^2.yr	≤ 25 kWh/m^2.yr
Primary Energy Demand	≤ 120 kWh/m^2.yr	≤ 120 kWh/m^2.yr *
Limiting Value	n50 ≤0.6-1	n50 ≤1.0-1

Useful tools and resources

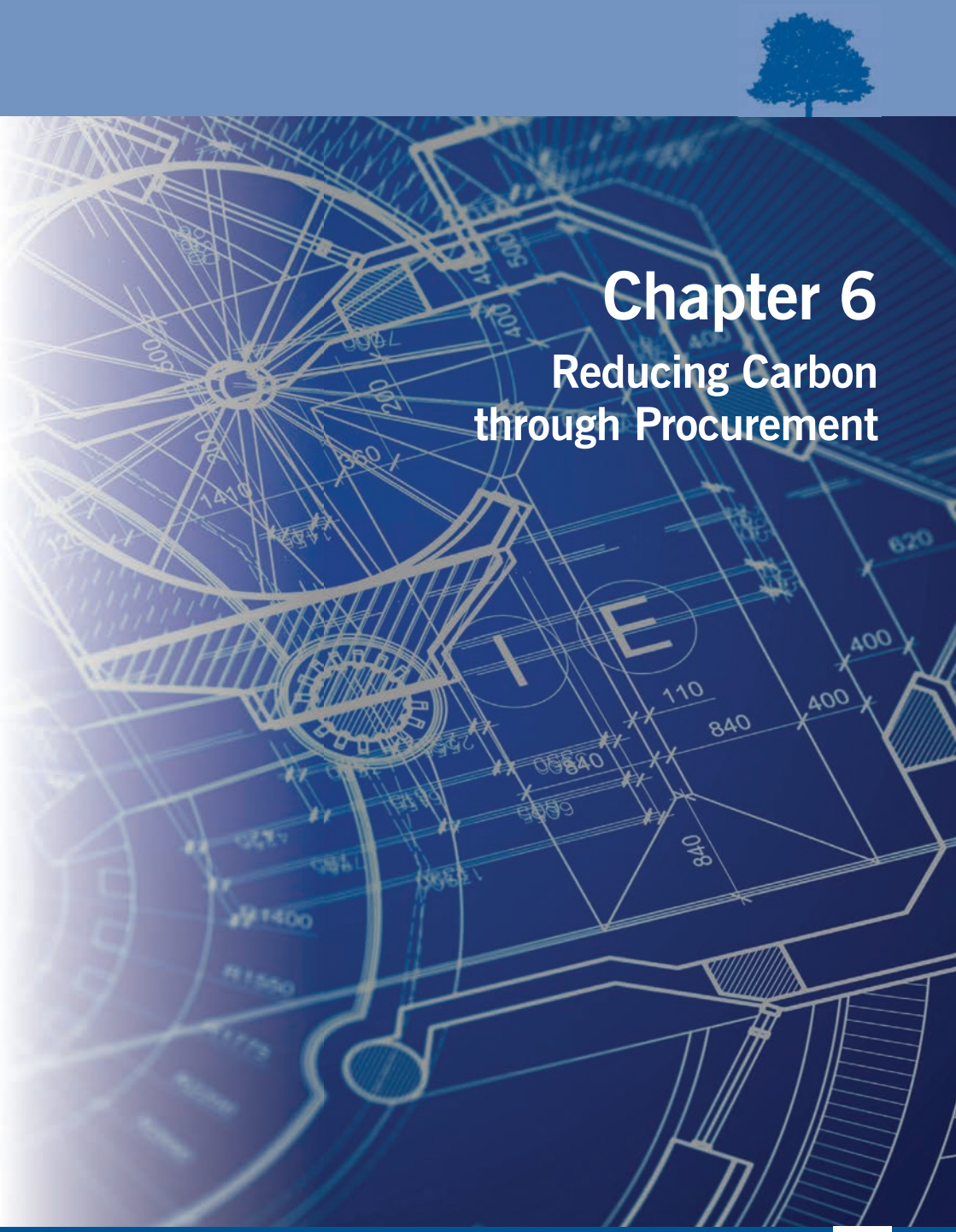
- London Energy Transformation Initiative – The 10 commandments of NeZero Operational Carbon
- BSI guidance on sustainability standards
- Government Soft Landings – ensuring design performance matches in use performance
- Low Carbon Homes Virtual events on retrofit

CITB courses that attract CITB grant and skills training funding

- BREEAM accredited professional
- PassivHaus tradesperson course

Chapter references:
1. World Green Building Council (2019) New report: the building and construction sector can reach net zero carbon emissions by 2050. Available online at: https://www.worldgbc.org/news-media/WorldGBC-embodied-carbon-report-published#_ftn1 [Accessed 19.11.2020]

2. World Green Building Council (2020) About Green Building. Available online at: https://www.worldgbc.org/what-green-building [Accessed 19.11.2020]



Chapter 6

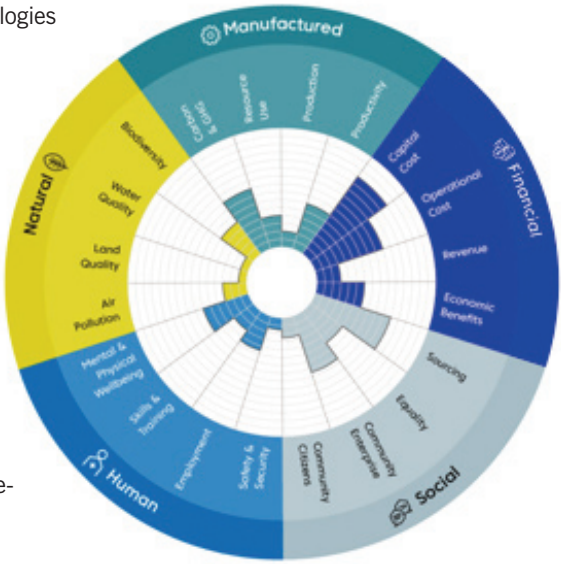
Reducing Carbon through Procurement

Introduction

Main contractors will increasingly find that clients demand, frameworks require and procurement generally is geared more and more towards achieving the country's Net Zero ambitions. Whether it be a market-led desire by forward thinking clients, a greater market consciousness or new regulatory standards, the move towards realising low carbon in procurement is underway and irreversible.

Whole life value

In 2018, the Government and the construction sector agreed and published the 'Construction Sector Deal', an ambitious partnership committing the signatories to transform the sector's productivity through innovative technologies and a more highly skilled workforce. The deal saw the launch of the Transforming Construction Programme to support industry in adopting technologies that will enable infrastructure and buildings to be constructed 50% faster, 33% cheaper and with 50% lower lifetime carbon emissions, which originated in Construction 2025 [PDF]. It also saw the birth of the Construction Innovation Hub who are tasked with delivering a refocus on the considered 'value' of buildings to focus less on the capital cost and more on the whole life value. This year, 2020, the Hub has worked with Government, clients and industry to develop a value toolkit, to support faster, value-based decision-making across the investment lifecycle.



Example value profile, considering whole life value. Credit: Construction Innovation Hub (2020).

National Association of Construction Frameworks (NACF) and Constructing West Midlands (CWM)

The National Association of Construction Frameworks (NACF), which represents the 11 local government-owned construction frameworks in England and Wales (with a throughput of £6.3bn of public sector construction work per year) is currently in the process of collaboratively developing a common, nationally agreed and mandatory KPI for inclusion in regional frameworks to address carbon.

Peter Yates, Vice Chair of the NACF and Regional Framework Director for Constructing West Midlands (CWM) said: *"We recognise the need for a tangible, measurable standard in order to ensure the work that comes through our frameworks helps to deliver the country's low carbon ambitions. We're working collaboratively with contractors and academic leaders at Cambridge University as well as the Green Construction Board to establish a KPI which we hope to roll-out across the frameworks in the near future."*

While a national standard is soon to emerge, many frameworks already include weighted scoring on environmental and decarbonisation activities and commitments made in the tender process are considered binding.

The Constructing West Midlands (CWM) Framework has a proven track record in driving best practice procurement and includes weighted scoring on questions relating to efficiency and environmental performance. Specifically, contractors can improve their scoring by: detailing how they will reduce water usage, embodied water, waste and waste-to-landfill; specifying the use of environmentally friendly materials; implementing sustainable transport plans for labour and material delivery, and reducing greenhouse gas emissions in the construction processes, manufacturing and the delivery of goods, works and services. Contractors will also be awarded more points for future-proofing their work to ensure easier climate change adaptation. The CWM Framework asks contractors to commit to a minimum amount of CO^2 savings per £1m of works contracted through the framework, for which a benchmark target of 25 tonnes has currently been set. Bidders are required to set a value for CO^2 savings and detail how they will achieve and evidence these CO^2 savings.

Useful tools and resources

- The Construction Innovation Hub Value toolkit
- Welsh Government Procurement Advice Note on Decarbonisation [PDF]
- A video introduction to ISO20400 and sustainable procurement (SCSS)

Conclusion

Carbon is the defining issue of our generation. It is the challenge that our industry must rise to if we are to keep our way of life and our social structures intact. Success will mean that we have new priorities that drive different outcomes on our projects. Success will mean that our products may provide similar primary outcomes but with drastically lower energy consumption both in delivery and use. It will also mean many more possibilities to support the circular economy and better end of life options to ensure sustainability for generations to come.

Our customers will need supporting throughout this journey. Main contractors will have to demonstrate the benefits of working in different ways, explain the constraints that low carbon working will impose and support our customers to make the right choices. These changes will not come without risks and the industry, and main contractors in particular, will need to have their wits about them to identify and manage that risk. There will be some tough discussions with clients and their funders to encourage the paradigm shift that our industry must implement, but these will be necessary if we are to play our part in achieving the UK's net-zero goal.

Our industry is gearing up, up-skilling and learning how to make these changes. There are early adopters who are leading the field and who might expect to benefit from early client carbon awareness. It is not too late for those who are yet to start and this guide is intended to support your journey. Success will come from wide collaboration, both within the industry and beyond. Those who commit to reducing carbon within their organisations and their supply chain, as well as supporting their customers to do the same, will reap the benefits. I commend this series of reports by the National Federation of Builders to all within our industry. Time is short, the challenge large, but with informed leadership, enthusiasm and an open mind our industry can deliver on the large carbon reductions that are our responsibility.

Mark Wakeford

Chair of the NFB Major Contractors Group
Joint Managing Director of Stepnell Ltd.

Find out more and join the

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