LOW CARBON LIVING CRC

A Planning Guide for Building Sector SMEs

Preparing your Business for the Zero-Carbon Circular Economy

Acknowledgements

Authors
Barbara Bok (1) and Peter Graham (2)

Title
Preparing your Business for the Zero-Carbon Economy: A Planning Guide for Building Sector SMEs

Date
June 2019

The project benefited greatly from the support and guidance of an expert steering committee. Sincere thanks go to members of the steering committee: Bronwyn Pollock (3), Dr. Tracey Benson (3), Ken Morrison (4), Philip Alviano (5)

The project's partners include the University of NSW and the Infrastructure Sustainability Council of Australia and their support was instrumental in the success of the project.

The authors would also like to specially thank the following contributors for their inputs and reviews of draft versions of the guide: Palaneeswaran Ekambaram (1), Vanessa Morris (3), Erica Kenna (3), Suzanne Lavender (3), Owen Pitman (3), Amy Davidson (3), Suzanne Toumbourou (4), Sandra Qian (6)

ISBN: 978-0-9923879-0-7

LOW CARBON LIVING CRC

Cover photo:
The Commons,
Brunswick,
Melbourne

(1) Centre for Urban Transitions, Swinburne University of Technology

(2) Department of Architecture, Faculty of Art, Design and Architecture (MADA), Monash University

(3) Department of the Environment and Energy

(4) Australian Sustainable Built Environment Council

(5) Master Builders Association

(6) Green Building Council of Australia

Contents

Glossary

Circular Economy
An economy where societal production and consumption maximises natural material and energy flows limited to a level that nature can tolerate and that fits in with ecosystem cycles. Practically it is done through cyclical materials flows emphasising reuse, remanufacturing, refurbishment, repair, upgrade; energy cascading; and using energy derived from renewable sources; all throughout value chains and cradle-to-cradle life cycles.

Ecosystems
A community of living organisms and the nonliving elements in their environments, all interacting as systems forming complex dynamic networks.

Ecological footprint
A measure of the impact of a person, event or community on the environment. It measures human demand on nature, expressed as the quantity of nature required to support human activity. It is often expressed as the number of 'earths' it would take to support everyone if everyone consumed natural resources at the rate of the one being measured.

Industry 4.0 technologies
Also referred to as the fourth industrial revolution. Industry 4.0 technologies includes technologies such as the internet-of-things, big data, artificial intelligence, smart sensors, advanced digitalisation capabilities, autonomous robots, cloud computing, additive manufacturing, cyber security, augmented reality and new generation processes and materials.

Value chain
Rather than only identifying the actors involved in providing the building as a product as such, a value chain takes an end-use perspective. A value chain identifies the wider range of actors involved in providing the many different forms of value delivered by buildings.

Zero-carbon
Zero-carbon is understood as meaning 'net' zero-carbon emissions or even reducing carbon emissions: carbon emissions produced are equal or greater than carbon emissions sequestered.

Zero-carbon economy
A zero-carbon economy produces little or no GHG emissions (specifically refers to carbon dioxide) into Earth's biosphere. A circular economy is proposed by many as an essential element of a zero-carbon economy.

Table 1 Different scopes of GHG emissions

Defining emissions as direct or indirect
Direct GHG emissions: Emissions from sources owned or controlled by the business.
Indirect GHG emissions: Emissions that are a consequence of the activities of the business, but that come from sources owned or controlled by other entities
Defining emissions as scope 1, 2 or 3
Scope 1: All direct emissions
Scope 2: The indirect emissions from using bought electricity, heat or steam
Scope 3: Other indirect emissions, e.g., from using materials or products sold by the business, transport-related activities of vehicles not owned or controlled by the business, electricity-related activities not covered in Scope 2, outsourced activities, etc.

Source: Adapted from Greenhouse Gas Protocol

Table 2 Abbreviations

Abbreviation	Meaning
BIM	Building Information Modelling
EPD	Environmental Product Declaration
GHG	Greenhouse gas
LCA	Life Cycle Analysis
WGBC	World Green Building Council

Transition to a Zero-Carbon Economy

It is clear humans are influencing the climate system and substantial and sustained reductions in GHG emissions and other adaptations are needed to limit the possibility of severe and lasting impacts of climate change risks. The response to the challenge globally is a rebuilding of economies according to the frameworks, rules and behaviour of a zero-carbon economy. A zero-carbon economy redefines industry profit patterns and how business success can be achieved. Industries are now undergoing deep and significant adjustments.

A circular economy is proposed by many as essential move to achieving a zero-carbon economy. In a zero-carbon economy there is value in keeping resources 'in the loop' and maintaining their value (i.e., recirculating, reusing, repairing or remanufacturing resources); this value is not available in a linear once-through economy (Figure 1). Yet, the global economy is only 9% circular and the trend is negative (The Circularity Gap Report 2019).

The aim is for drastic reductions in greenhouse gas (GHG) emissions from direct and indirect business activities. A major share of those carbon emissions reductions will need to come from the building sector and the built environment by 2050 if Australia is to achieve its commitments to global agreements on Climate Change and the U.N. Sustainable Development Goals (SDGs, also known as Agenda 2030).

Globally the transition to a zero-carbon circular economy is accelerating as the next wave of development. Many governments are endorsing the shift and have started setting in place measures and policy packages (e.g., in Australia the National Energy Productivity Plan and funding opportunities under the Climate Solutions Fund) that give clear signals and guidance to economic actors and members of society aiming to speed up the transition. The European Commission (EC), Japan, China and individual European countries, to name just a few, have taken steps that go well beyond setting targets for waste reduction. For example, the EC has completed an ambitious action plan of 54 actions that amends legislation, pools work from different policy areas and

Figure 1 A schematic of a circular economy. Sources: WBCSD & BCG, 2017, The New Big Circle: Achieving Growth and Business Model Innovation through Circular Economy Implementation, World Business Council for Sustainable Development and The Boston Consulting Group.

Documented barriers and opportunities	
Barriers	**Opportunities**
Bottlenecks and fragmentation	New businesses
Lack of collaboration, weak partnerships	New jobs
Lack of leadership and communication	New products
Lack of knowledge and trust	New supply networks
Lack of incentives	New solutions & methods
Technological risk	New customer segments
Lack of policy	New competitive advantage
Financial risk	New power relations
First mover risk	New partnerships
Tender process	New economies of scale
Disregard for whole life costs	New skills
Benefits	
Improves design and production processes	Uses less energy over the whole supply chain
Keeps landscapes green	Contributes to resource efficiency
Increases equity and health	Creates resilient and flexible structures
Safeguards water resources	Minimises waste, maximises reuse
Promotes health and well-being	Enables people to connect

Table 3 Examples of barriers, opportunities and benefits. Sources: Compiled from various sources

drive comprehensive action towards a circular economy. China had endorsed the idea of a circular economy already in the 2006. Whilst initially they focused on reducing pollution, improving resource efficiency and taking an industrial ecology view, since 2017 they have introduced policies to also address product redesign and the sharing economy. On the one hand, the repercussions of such legislative changes were felt in Australia when China banned the importation of foreign waste from 2018.

Further, growing numbers of cities around the world are fast tracking city-wide circular strategies adopting novel approaches that support ecosystems of change and creating ambitious visions and strategies to become minimal or zero-waste cities. Standards organisations are assisting businesses by developing standards frameworks for implementing circular economy principles in organizations. On the other hand, the changes bring opportunities to be more creative problem solvers, designers, producers and builders (Table 1). SME's that take steps now to adjust for the inevitable changes in legislation, internationally and in Australia, will be able to thrive in the emerging zero-carbon economy.

How to use this guide

The guide is a planning resource for small to medium-sized companies involved in the buildings sector value chain. This includes building materials suppliers, trades and contractors; transport companies and architects, engineers and other design firms. The guide is intended for building sector industry practitioners and other end-users of building sector products and services, such as planners, sustainability managers and policy makers in small to medium sized enterprises and local government authorities in, primarily in Australia. Throughout the guide are examples of case studies for ideas about business best practice and experience and links to more information.

The objective of the guide is to help you prepare a plan for reducing carbon emissions from the *business' activities*. Business activities are broadly speaking, any activity that is directly and indirectly producing carbon emissions (**Table 1**). You determine what activities need to be included in the plan. Chapters three to five in this guide describe strategies that matter most for achieving zero-carbon emissions. These chapters describe strategies respective to three perspectives:

- value chain relations
- different sides to the organisation
- types of choices to make

These perspectives are particularly significant to help you prepare the business for working according to the new patterns of doing business in a zero-carbon economy. There are many perspectives from which to present strategies and many strategies could be presented—not all are presented in this guide.

The strategies presented in this guide empower your business to follow principles of circularity that also contribute to mitigating carbon emissions. They are within your power to do something about although what can be done differs from business to business.

Appendix A of this guide lays out the three-step process that guides the planner through the planning process.

For many strategies there are common sets of tools and methods for realising the strategies. **Appendix B** presents technical tools, methods and techniques useful for different strategies. At the start of the appendix is a table that relates the tools to the strategies.

SECTION

01

Zero-Carbon Strategies by Value Chain Relations

When considering the actions a business can take to reduce climate impact, more scalable opportunities can be identified by shifting the focus from the individual business or building to the business relationships.

This chapter gives an overview of zero-carbon circular strategies according to a value chain relational perspective. There are a range of well-documented actions that businesses can take to reduce the carbon footprint of operations within offices or work-sites.

However, the significance of the climate impact and cost-benefit of actions such as using energy efficient appliances, recycling, minimising paper use or car-pooling are relative to the size of individual businesses. More scalable opportunities exist when the focus is shifted from the business or the building, to the business relationships within a values chain (to take a value chain perspective). A value chain perspective identifies not only the business relations needed to produce the building as a product. Rather; it identifies the wide range of actors involved in providing the many different forms of value delivered by buildings (e.g., by exploring the functions of a building). Collective action in a value chain can create economies of scale for procuring low-carbon technologies or provide opportunities for innovation in products or services that reduce the climate impact of the entire value chain, and increase the cost-benefits for all.

Viewing the complexity of the construction and building sector as a value chain has three advantages. The first advantage is to see how the complex interactions of stakeholders—in spite of their order in the supply chain—are important in producing value at each phase of the building project. The conventional view of the value chain is a linear series of relationships between sector actors separated, isolated and ordered by functional specialisations (**Figure 2**). However, this oversimplifies the reality of business relationships formed to derive value from buildings. Rather than linear and stepwise patterns of influence and flows, influence can be in multiple directions and affect actors and outcomes at all stages. For example, the direction of pre-construction influences in a relation is often reversed in post-construction. Or, the contract legal framework affects all supply stages whatever their order in the supply chain, including being important in relationships between stakeholders as well as in each intervention process. In contrast to the conventional view of the construction sector, a value chain perspective identifies all the actors interacting to provide value at a particular phase of the construction process (**Figure 3**).

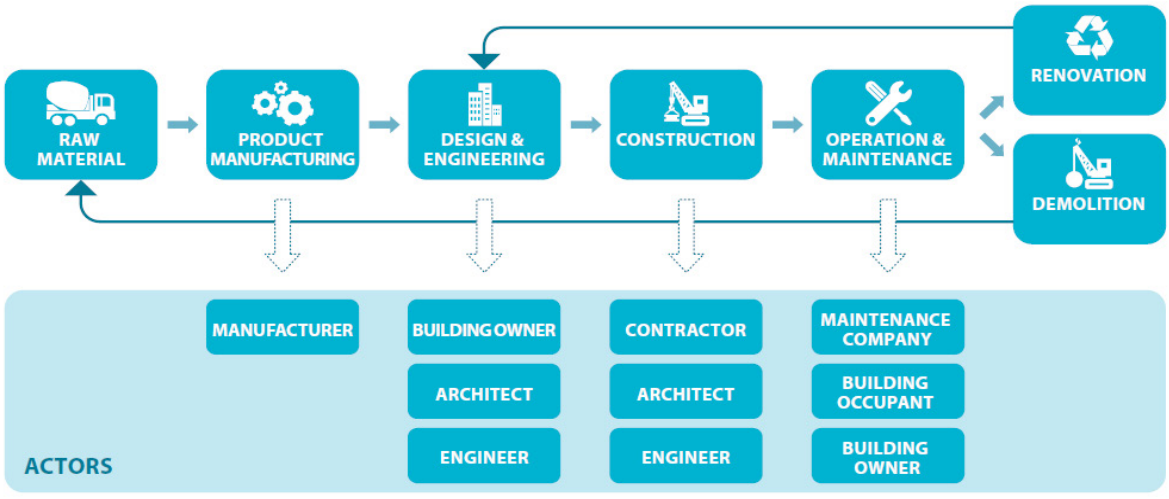


Figure 2 A conventional supply-chain view of construction and building sector relationships. Source: Groote, MD & Lefever, M 2016, *Driving Transformational Change in the Construction Value Chain: Reaching the Untapped Potential*, Buildings Performance Institute Europe.

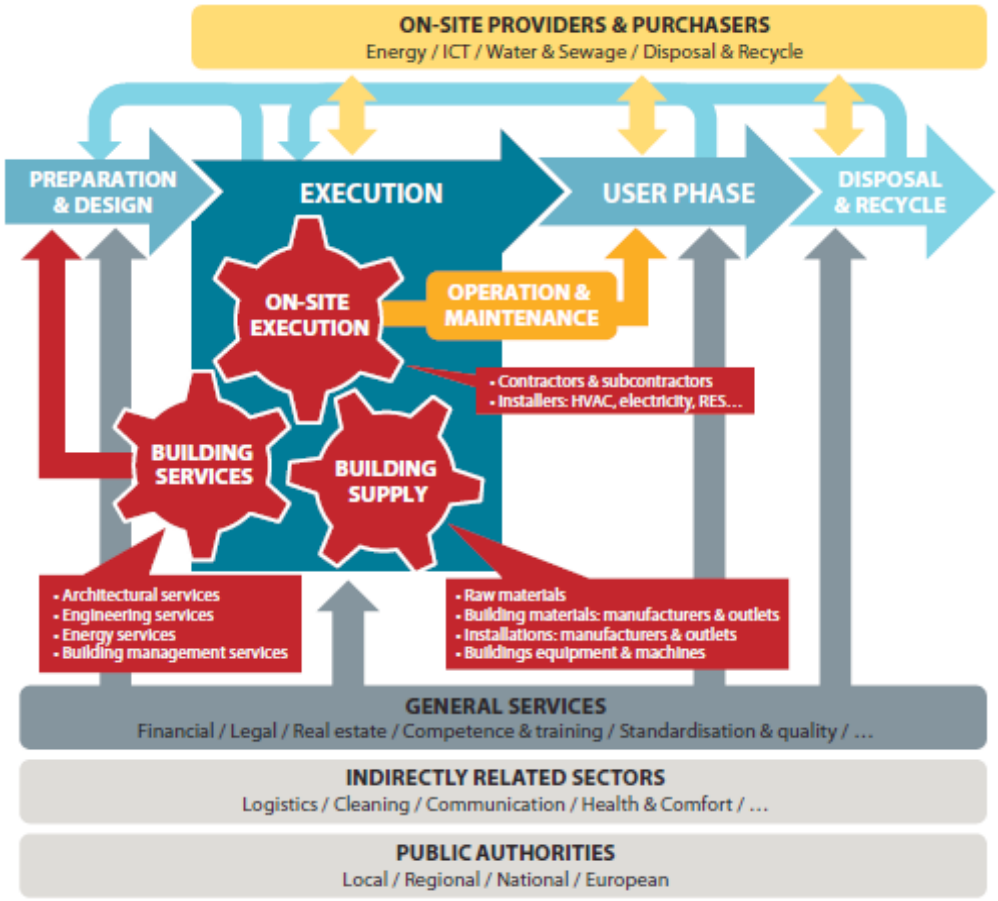


Figure 3 A value chain view of construction and building sector relationships. Source: Groote, MD & Lefever, M 2016, *Driving Transformational Change in the Construction Value Chain: Reaching the Untapped Potential*, Buildings Performance Institute Europe.

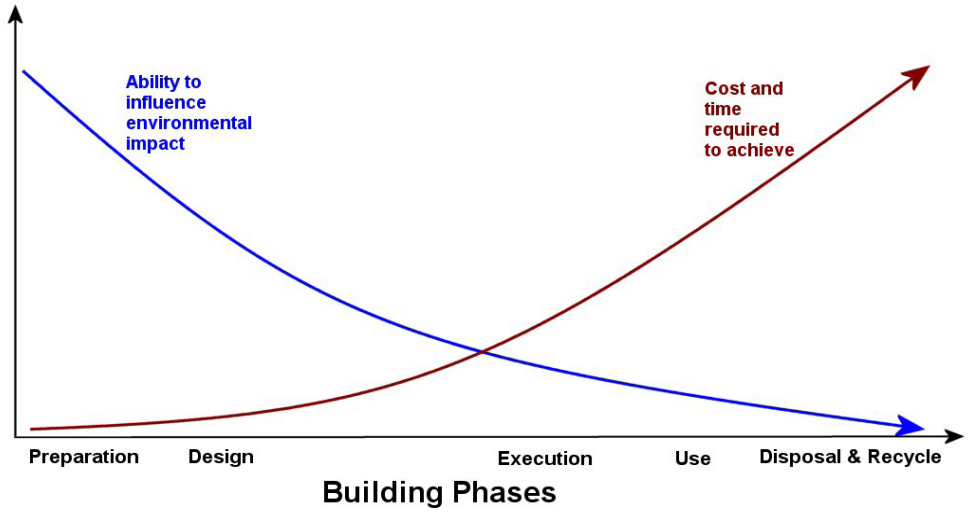


Figure 4 The cost of and potential to influence sustainability over different project phases. Source: Adapted from Lewis H., Gertsakis, J. et al. (2001). Design+Environment: a global guide to designing greener goods. Greenleaf, London; Adapted from ACIF & APCC (2010). A guide to project initiation: For project sponsors, clients & owners. Australian Construction Industry Forum Limited and Australasian Procurement & Construction Council Inc.

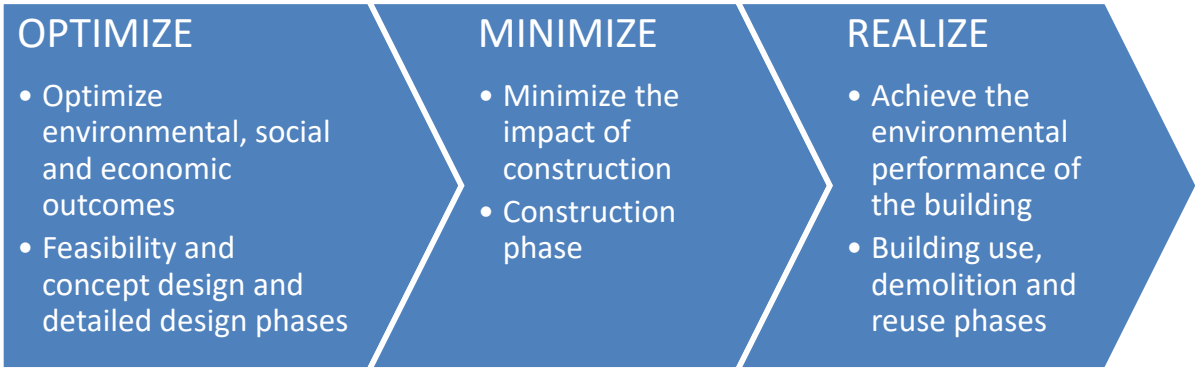


Figure 5 Major process phases for achieving a zero-carbon circular supply chain.

The second advantage of a value chain perspective is to see that early project stages represent the greatest opportunity to reduce carbon emissions by integrating a circular economy approach. A linear supply chain view of the building sector places less importance on the final user of the building and so underestimates the value of zero-carbon and circular solutions to later building phases. However, the execution, operations and maintenance, use and recycle phases all depend on the decisions taken during the early preparation and design phases.

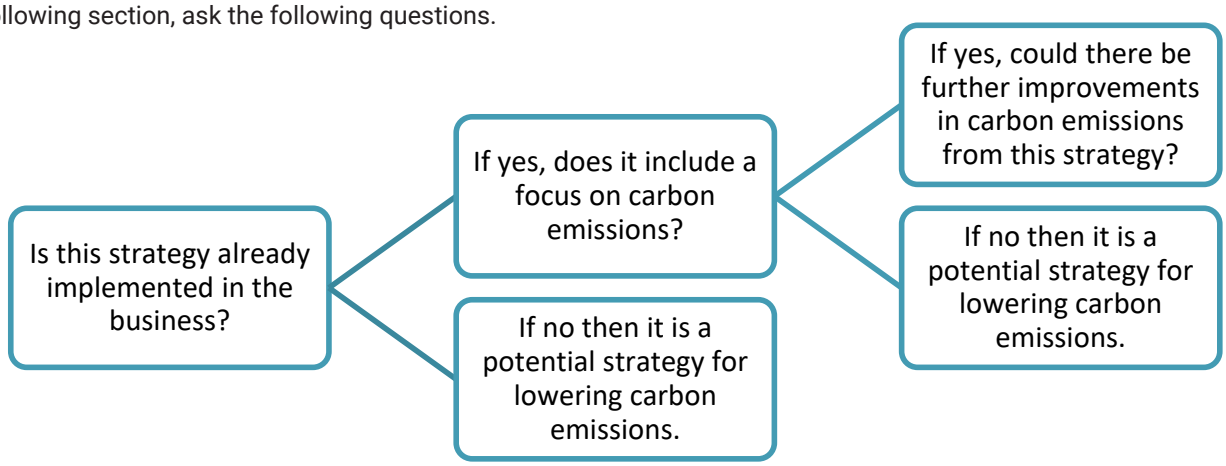
According to circular thinking, the preparation and design stages are the phases with the greatest potential to influence sustainability, circularity and carbon emissions. It is the early phases that set the conditions for the rest of the project. Many zero-carbon circular solutions that eventually turn out to be wrong for later stages of a building project can be avoided if the issues were considered earlier. **Figure 4** shows how important it is to consider sustainability from the earliest in a project to address the project's environmental impact. Zero-carbon circular solutions developed during the design phase will determine most of the eventual environmental impact and will produce more successful results for both the environment and the project budget.

The third advantage of a value chain perspective is to describe the supply chain in new and useful ways. By setting the supply chain goals to achieve a zero-carbon circular supply chain, then, broadly speaking, major phases of the building life cycle are as presented in **Figure 5**.

Optimization is achieved by (the goal of optimisation is to) reducing overall carbon emissions by extending the lifetimes of existing products and buildings, reusing and sharing products so less new product is demanded, increase the feedback rate and improve the use of waste materials across the value chain, designing products or buildings to use less material yet achieve the same outcomes, and choose low carbon materials, including bio-based alternatives, instead of carbon-intensive materials.

Identify potential zero-carbon solutions that increase or shift emissions to other parts of the system
A value chain approach enables businesses to identify the potential zero-carbon solutions that will increase or shift emissions to other parts of the system. Evidence of displacement, shifting, rebound effect and other unintended consequences show conclusively that, unless taken care of, some 'green' solutions or 'green' efficiency introduced in one place can create difficult problems elsewhere or increase the demand for energy service. For instance, low carbon technologies can influence consumer preferences and demand that increase—not decrease, as expected—the demand for energy service. A value chain approach means identifying the design improvements made or strategies implemented at early phases that potentially can lead to greater emissions at later building phases or create harmful problems for someone else. For example, when reducing the number of light fittings to the shell of the building to get a higher green energy star rating also identifies that the gains may be undermined by inefficient energy use by building occupants and hence calls for a solution that does not lead to this unintended negative consequence.

As you read the strategies covered in each of the following section, ask the following questions.



Strategies for optimization during preparation phases

The aim of using the strategies during the building preparation phase is to optimise the economic, social and environmental outcomes of the building project as a whole to have a positive effect on reducing carbon emissions. Typical stakeholders involved at the preparation phases, and who might well follow these strategies, are financial lenders and investors, real estate and valuation surveyors, land-owners, tenants, owners and owner-occupiers, developers and builders and public authorities.

Use permit and incentive schemes to encourage early optimisation behaviour

Two common issues with policies and support are when the specific needs and abilities in the sector are not targeted and when opportunities for innovation at early phases are missed. Permits allow the use or development of something on the understanding that certain conditions will be met and the plans will be followed. Incentive schemes are used to motivate, promote or encourage targeted actions or behaviour.

Business practices may require performance measurement against recognised best practice. The inclusion of performance conditions and an element of motivation of both types of schemes make them important strategies to stimulate action of environmental or sustainability activity at an early stage. They are put in place before the activities begin. When designed well, they can be effective in many types of relationships. For example, both schemes can be used by employers to target zero-carbon economy innovations by suppliers and workers, by contractors to target the abilities of sub-contractors to work together

to create value common to the supply chain, by lenders to attract zero-carbon economy investors by offering incentives for switching and by public authorities to target the use of zero-carbon and circular design methods at early stages.

These strategies can have more indirect benefits. For example, specifically targeted innovative behaviour of suppliers and workers can help reduce risk of new methods, provide justifications for new technologies, and support the gathering of information and collaborative approaches. Or the contractors' collective work could lead to the recovery and use of a waste stream that previously went to landfill.

Zero-carbon circular policies

Prepare new or update existing policies to include a focus on zero-carbon and circular approaches. Policies operate in many contexts, from government authority policies that apply to developers to business policies that apply to procurement from suppliers and workers. Without in-house policies a business has to rely on external requirements like permits, codes, standards, regulatory policies, land-use planning and other external mandates to achieve zero-carbon and circular adaptions—things that are not under the business' control. The fact is also that external environmental policies are often designed to regulate minimum required performance rather than circular/ zero emissions performance or they are too risky to introduce, or, where policies exists, are often not always enforced. So, the business will have limited success in achieving environmental targets and processes by external mandates only. Zero-carbon circular policies need support from senior management to demonstrate commitment to such processes and encourage greater acceptance of zero-carbon and circular requirements and uptake of incentives and supports.

Benchmarking, performance management and voluntary reporting

Monitoring and reporting of environmental performance is an important element of the implementation of zero-carbon circular initiatives (whether for buildings, the business or the supply chain). Reporting of environmental performance is necessary to determine if planned emissions savings have been achieved, but also to share sustainability information to encourage collaboration.

The purpose of benchmarking is to make comparisons to stimulate idea generation for improving processes, developing new approaches or technologies, improve efficiencies or improve relations with stakeholders. Benchmarking can be understood in two ways. First is to give an indicating of what is possible when in a specific area there is a lack of knowledge. The second way is when benchmarking is discussed in relation to building performance benchmarking about the performance that has been achieved. The latter implies making comparison of the actual performance achieved with for instance, the building's expected performance, the building before renovation or another building.

However, it is not only buildings that can be benchmarked but also business operations. In this case the business processes are compared with other business processes in the same sector or more generally. Benchmarking can be done for products, processes, functions or approaches. In terms of zero-carbon economy principles, the focal points of benchmarking could include product and material recycling or reuse processes, zero-carbon and circular design practices, waste recovery, and more.

Use environmental certification (green building rating tools) and adopt voluntary green building standards

Building codes and standards (legal requirements) do not necessarily include environmental performance requirements or guidelines for designing buildings. The gap can be filled by using environmental certification and adopting voluntary environmental standards such as green building rating schemes. By choosing to be aligned with green building rating tools the business can implement environmental targets or standards beyond legal requirements. Benefits to the business of constructing, operating or owning a green building can be both financial and reputational. Furthermore,

alignment with a standard can also act as an incentive to change suppliers' and contractors' behaviours. To avoid missed opportunities at the early stages for achieving environmental targets, ensure there is consistency between in-house policies, schemes and certificates and standards and ensure consistency in how they are applied throughout the building processes.

Alternative procurement models

The conventional model of building construction, the design-bid-build model, tends to eliminate opportunities for alternative and potentially less carbon intensive circular approaches. A lack of stakeholder collaboration to determine greater environmental performance is a key missed opportunity. Two other models that are increasingly used are the design-build and design-build-operate models. Yet, other models are also being used. Examples are collaborative contracting where stakeholders work together in an open and non-adversarial way to deliver optimal outcomes for all; alliance contracting where all parties work as an integrated, collaborative team on all project delivery matters and aim for what is best for the project.

Strategies for optimization during design phases

The aim of using the strategies at the building design phases is to optimize the economic, social and environmental outcomes of the building as a whole to have a positive effect on reducing carbon emissions. They are tools and techniques for the detailed design and specifications stages. Typical stakeholders involved at the design phases, and who might well follow these strategies, are owner-occupiers, the design team (designers, engineers or builder consultants), facility management and public authorities.

Design for circularity (e.g., reuse)

In terms of using materials efficiently, in a zero-carbon economy a focus on design for end-of-life issues of buildings and building products is paramount. The aim of circularity is to keep the value of materials and products at a high level wherever possible. This can be done, for example, by designing for reuse, deconstruction, take-back, or achieving the same levels of performance with less material input. Buildings are often reused many times yet they are often not designed for this. Circular procurement is an important means for providing incentives for enabling design for circularity. Adaptability and flexibility are important aspects of reuse so that over their lifespan a building or product can be modified or refurbished to extend its useful life, resulting in increased utilisation and les resource usage to achieve that. Adaptability and flexibility can be achieved with modularisation and simplification of designs.

Translate environmental requirements into environmental specifications

Environmental certificate schemes and standards rating schemes come into their own in the design phase by providing technical targets and criteria for optimising the building's environmental performance. The design stage need to translate the conceptual design's zero-carbon and circular requirements into environmental specifications and the schemes provide the means for doing so. In so doing, the specifications are supplied early in the design.

Use supply chain audits and environmental criteria specifications for prequalification and selection of main contractors, subcontractors and suppliers

Require that suppliers and contractors have environmental systems in place to improve their environmental performance and to ensure that their products and materials meet environmental performance standards. Many standards are available to choose from, for example on implementing energy management systems, such as ISO 50001 for managing and reducing energy use and costs. Criteria can also be specified by requiring a certain level of green certification according to a green building rating tool or a certain energy performance. Contracts can also include incentives and criteria for low carbon improvements.

Use zero-carbon circular building selection criteria specifications for materials and products use

Use zero-carbon circular specifications to guide the environmental choices of the materials and products. Environmental criteria can specify whether the materials and products are to conserve natural resources and preserve biodiversity or consider the impact of the materials and their derivatives on building occupants. These specifications will be used to enable zero-carbon circular procurement during the next building phases. Suppliers can respond to such selection by obtaining certification of the environmental claims of their products through environmental certificates, 'green credentials' or 'eco labels'. Integrated design practices need to ensure that zero-carbon and circular procurement specifications do not compromise overall sustainability objectives.

Zero-carbon circular procurement criteria that will encourage the development of a circular supply chain include:

- set specific resource efficiency levels on a whole lifecycle basis (e.g., limits on the use of water)
- set expected levels of included recycled content (e.g., as a percentage)
- set levels on products' repair-ability, recycle-ability or ability to be dismantled after use
- put a limit on, or better eliminate, the use of harmful chemicals and make sure components are not toxic
- require that products' lifetimes can be extendable through being able to be shared or sold after use, options for repair or refurbishment, be dismantled and renewed or materials extracted and recycled into the manufacture of other products.

Conduct integrated design & BIM

Integrated design involves multidisciplinary collaboration between stakeholders from all stages of the building value chain. The process addresses environmental requirements together with other requirements (e.g., building functionality) by establishing environmental design principles, incentives and benefits from the outset. This avoids having to change the design later for environmental requirements. Doing the integration from the start avoids interference between the different sets of requirements. Develop the initial design concept for the potential of new zero-carbon circular technologies becoming available during the construction phases. The ability to adapt the design introduces flexibility in materials and product choices during contracting.

Strategies for minimization during execution phases

The aim of using the strategies at the building execution phases is to minimise the impact of building and construction activity. All actions taken at the execution phase depend on the decisions made at earlier phases. During the construction phase the contractor constructs to the environmental design and quality management criteria and processes received from the designer, selects suppliers based on criteria that include resource efficiency, apply zero-carbon and circular procurement policy and ensure waste minimisation. Other impacts on resource efficiency come from the ways materials and products production and delivery are handled, the efficiency of the building processes and the selection of energy sources. Typical stakeholders involved at the preparation phases, and who might well follow these strategies, are public authorities, developers and contractors, subcontractors and material and product suppliers.

Integrate environmental management into construction planning

Current approaches typically separate environmental practices from construction planning which means the production and environmental aspects of construction are separately planned. The solution is to simultaneously deal with the production and environmental issues of construction. For example, integrating site water pollution practices (an environmental as well as a social and economic concern) with construction planning (the scheduling, method and layout) is a practical method for reducing site induced water pollution. Digital technologies and building information systems that integrate environmental and construction information will be very helpful (e.g., Green Building information Modelling (BIM)).

Establish a common environmental management system for contractors and subcontractors

An Environment Management System is a tool for managing the impacts of a business's activities on the environment by providing a structured approach to planning and implementing environmental measures. It helps businesses to regularly evaluate their environmental performance and improvement and the implementation of an EMS can be the ideal means and opportunity to implement improvements suitable for a zero-carbon economy. However, EMSs are typically set up within a business resulting in differences between the standards, policies, measures, practices of different businesses.

An EMS that works across the many different business interests, professions, trades and other stakeholders on a building project is difficult to achieve unless the contractor can build a team with environmental credentials based on common environmental policies and standards. Some standards organisations produce guides on integrating management systems standards, for example the guidance at https://www.iso.org/news/ref2347.html. Benefits for carbon emissions improvements lie in strengthening the connections between supply chain actors, enabling peer-to-peer sharing of sustainability learning and knowledge and enabling the ability to team up with others to create shared value.

A common EMS can be achieved in three ways.

1. Agreeing to common management and control frameworks (e.g., ISO14000 (environmental management) and ISO14040 (Life-cycle Assessment) standards) and project wide platforms that establish common definitions and performance goals (such as green building rating tools).
2. Use tender conditions and procurement policies can specify that potential sub-contractors or supplies have a track-record using environmental performance requirements on zero-carbon projects.
3. Contract clauses and sub-contract agreements can specify compliance with the requirements of the lead contractor where contractors or suppliers do not have their own environmental management policies or procedures. Do not rely on simply referring to product standards or zero-carbon and circular specifications in tender or contract documents. Rather, include environmental performance clauses, and other measures such as environmental KPIs and reporting requirement, in tender and contract documents.

Apply zero-carbon circular procurement and specification standards

Zero-carbon circular procurement requires a high level of collaboration on environmental issues between all stakeholders in the value chain. During the execution phase zero-carbon circular design criteria are used for procurement. It is important during the tendering and bidding for contracts that there are incentives for contractors, subcontractors and suppliers who adopt zero-carbon and circular measures and approaches—one incentive is to require that bids are ranked based on demonstration of environmental track record as well as price.

Two complementary approaches will help include circularity principles in procurement. First, focus on procuring more of the products, materials and services that have been certified as zero-carbon or are meeting circular specifications. This can be done by setting zero-carbon and circular criteria in procurement tenders' specifications and requiring that products' lifetimes can be extended after use. Second, promote new procurement models based on collaboration and resource-efficiency rather than the traditional model of transfer of ownership. Other new procurement models include providing a mix of product and services, supplier take-back or supplier-resale agreements involving a third party, and using digital technologies to increase the use rate of underused products through shared use. Consider also the following aspects for strengthen zero-carbon circular procurement: tools that provide information about product lifecycles and lifespans (e.g., how they can be repaired), methods for calculating lifecycle costs and total cost of ownership, product sharing systems, systems for sharing sustainability

information, collaboration across the supply chain on sustainability, legal and policy instruments that cover product and building lifecycle issues and incentives to encourage and reward innovations for reusing products.

Find out more…

The UNEP 2012 guidelines on sustainable public procurement provide guidance for sustainable procurement by national governments, but they can also be used by businesses in the early stages of adoption. The website also contains other topics on the environment. https://www.unenvironment.org/

An integrated Supplier Self-Assessment Questionnaire is a useful tool for businesses wanting to bolster their supply chain sustainability arrangements. Though it was designed for the industrial products sector, it is a 'conversation starter' for those in the building sector who have just started to consider sustainable supply chains. One such self-assessment questionnaire is available at https://www.ceres.org/resources/tools/supplier-self-assessment-questionnaire-saq-building-foundation-sustainable-supply.

Develop zero-carbon circular supply chain systems

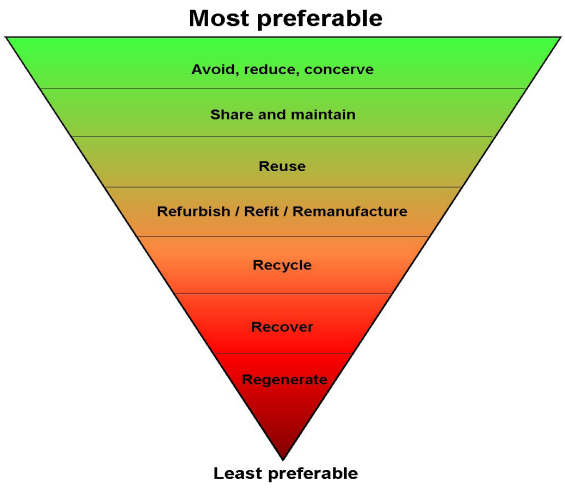
Zero-carbon circular supply chain systems cover more than the transport and handling of the building value chain's produced materials and products. It includes tracking, coordinating and managing the processes between material and product production and the actual utilisation of it at the building construction site. Digital real-time technologies and online platforms can be very helpful in this regard. Handling goods correctly, from the transportation to site to the eventual distribution on site, can reduce transport emissions. Processes that reduce excessive production and procurement can reduce surplus production, transport emissions and unused product. Such systems will also help in keeping track of what is available in the supply chain to most efficiently help maintain, repair or upgrade resource in use to extend their value. Such systems could also enable developing sharing platforms to give products a second life.

Minimise waste as well as use waste as a resource

Waste minimisation requires action on-site to minimise building and demolition waste. Many waste minimisation actions are enabled through good site management. Clean and safe working conditions, the space available for salvaging materials, the availability of recycling bins, up-to-date plans and specifications for workers and appropriate materials storage and handling. Action includes inducting workers on how to ensure healthy work environments, minimise waste and achieve environmental goals and giving them appropriate training. Many actions can be taken at all phases in the building process to eliminate waste: zero-carbon circular procurement, zero-waste policies, designs and design specifications that influence materials requirements, innovative suppliers and commitments of stakeholders to green building principles and practices.

A focus on circular economic principles also directs attention to another way to improve carbon emissions through realising the positive value of waste. Carbon emissions are reduced when waste is recovered for reuse and recycling—rather than procuring them from primary sources—and waste streams are fed back into the supply system as a secondary resource.

Figure 6 The waste hierarchy.
Sources: Compiled from various sources



The Burbank zero-waste home, Victoria

The Burbank zero-waste home introduced waste reduction into an existing residential project. Supported by Sustainability Victoria, and partnering with RMIT University and the Housing Industry Association, they set themselves a challenging target to build a 'zero-waste home' that would not only benefit their processes but the industry as a whole. One of their project objectives was to assess their processes in relation to best practice. During the first stage of the project they visited the site where homes were being built to understand the sort of waste being produced, the volumes of waste and where on site the waste occurred. From the data collected, they found waste was mainly due to over-delivery, over-supply and offcuts. Adopting the 'Waste Management Hierarchy' model of controlling waste, the design team avoided waste by examining many different solutions for redesigning the house using different materials. They achieved a new baseline house, staying with the same house and keeping with simple bricks and mortar solutions. In the second stage they built a house using the new design this time looking for opportunities to reduce waste from their construction practices, for example when something still goes wrong with ordering. Avoiding waste included having metal roof pre-cut off site, working with suppliers to deliver exactly number of pods for the slab that was required, and using square set plater finish that eliminated plasterboard cornice. The focus on collaboration between the design team, the construction team, the business, advisers and suppliers was an important aspect of the project. With the new design and practices, they built the 'zero-waste house', achieving a 72% reduction in waste and a 99% reduction in waste to landfill.

Source: https://www.sustainability.vic.gov.au/About-Us/Case-studies/Building-and-construction

SECTION

02

Zero-Carbon Strategies for Different Stakeholders' Viewpoints

When considering the actions a business can take to reduce climate impact, no single overarching viewpoint is possible. Rather, accounting for four major stakeholder viewpoints provides a more comprehensive framework.

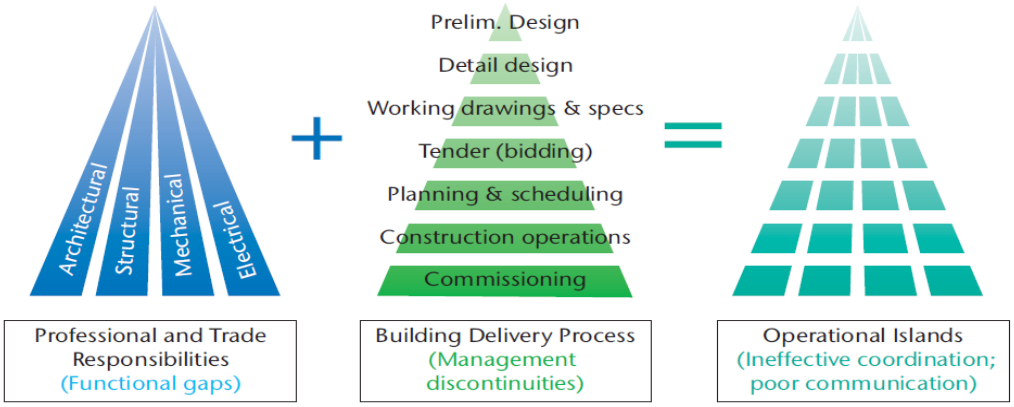


Figure 7 The fragmented nature of the construction and building sector. Source: WBCSD 2007, Energy Efficiency in Buildings: Business realities and opportunities, World Business Council for Sustainable Development

This chapter gives an overview of zero-carbon circular strategies from four major stakeholders' views on the organisation. No single overarching measure for evaluating the environmental or zero-carbon performance of an SME can capture the many stakeholders' viewpoints on the business' sustainability or their many goals and interests for the business.

Rather, there are four major stakeholders' viewpoints of the business that provide a comprehensive overall framework from which to evaluate a business' environmental performance and for which to select strategies: 'Management', 'Workforce', 'Supply Chain' and 'Surrounding Community'. The advantage is that, taken together, the four stakeholders' viewpoints on the business can be used as a monitoring and reporting index of its environmental performance and progress towards achieving the planned transition targets. Furthermore, it can be used as an aid in decision making.

Combining the four major stakeholders' viewpoints on the business with the building sector value chain (Chapter 4), helps to overcome the fragmented view of the sector as displayed by **Figure 7**. Figure 7 shows how an 'island' effect (the third triangle) is created by viewing the building sector as consisting of technical disciplines (the first triangle) and a building construction process (the second triangle). Gaps are created that produce inefficiencies, disconnections and overall lack of unity. A zero-carbon circular approach requires zero-carbon circular strategies to bridge the gaps and go across the whole supply chain. Seen from the four viewpoints on the business, each gap (including the supply chain as a whole) represents a potential point for improvement action that attempts to take into consideration the building project life cycle and the flows of materials (including waste streams), energy, decision making, information, relationships, transparency, competencies, behaviours, and much more as appropriate. A view of the points for zero-carbon circular improvement actions are presented in **Figure 8**.

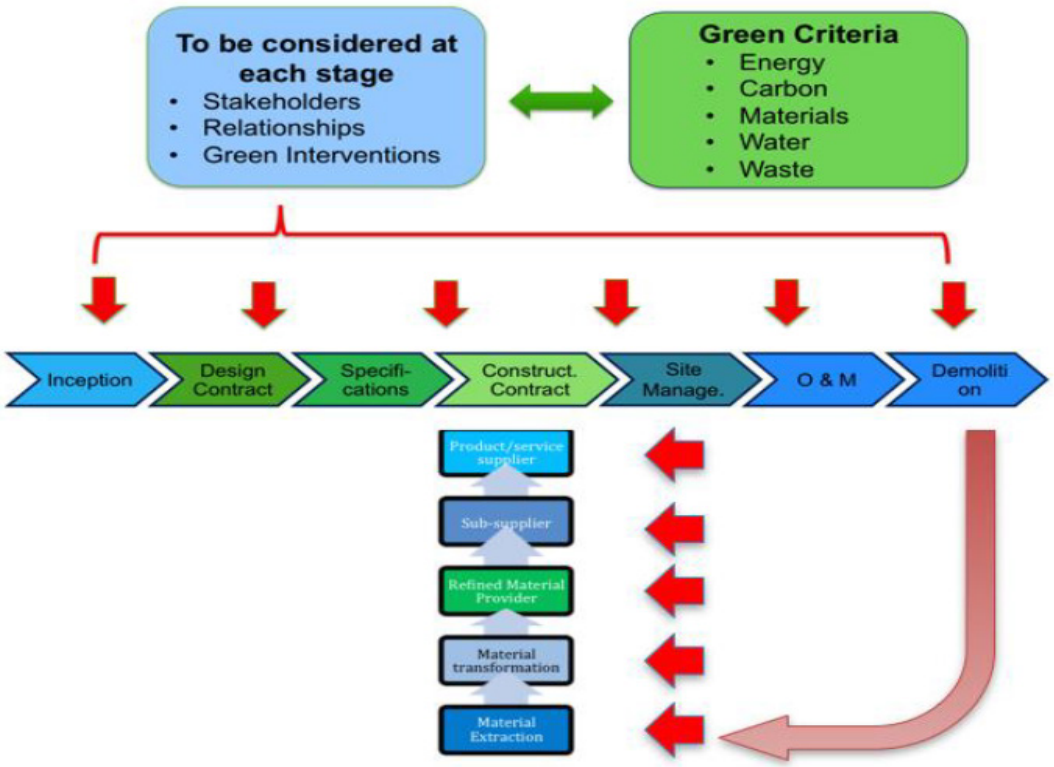
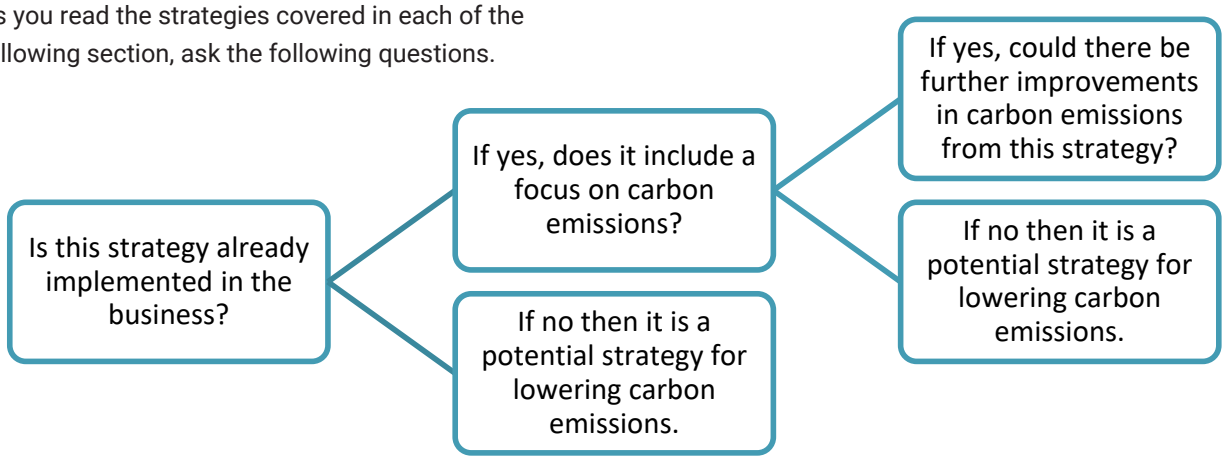


Figure 8 Potential points in the building sector value chain for zero-carbon circular improvement actions.
Source: UNEP-SBCI 2013, UNEP-SBCI Task Force on Greening the Building Supply Chain: Summary Report, Sustainable Buildings and Climate Initiative

As you read the strategies covered in each of the following section, ask the following questions.



Strategies for the Management view on the business

The 'Management' view of the business refers to an SME's environmental performance as assessed through:

- The business' mission and values (or key selling points)
- The sustainability values and attitudes of managers, leaders and administrators
- The sustainability practices and behaviours fostered in the business' activities and spheres

Demonstrate strong sustainability leadership and management that recognise zero-carbon and circularity as key elements

The building sector is a main producer of waste and thus carbon emissions and strong leadership is required to bring about sector change. Environmental requirements or guidance from agencies external to a business will have limited success in helping the business achieve the transition to a zero-carbon economy or improve their environmental performance. That means establishing a governance structure for the environment in the business on which to build sustainability. The significance of a good governance structure should not be underestimated. Transparency about how decisions are made is important.

Commitment to sustainability with zero-carbon and circularity as key elements can be demonstrated through a sustainability policy, statement, charter or code of conduct which outlines the values, ethical business practices, other policies (e.g., planning, procurement and environmental management). It includes a statement that describes the business' commitments to reduce negative environmental, social and economic impacts and increase opportunities for net-positive impacts throughout the value chain, for society and the environment. Ideally the sustainability statements link global environmental trends with national carbon emissions and circularity priorities and pathways (but are not limited to those since they may be few in number) through to the business' sectorial and practical contexts. Those commitments are also reflected in the business mission, values, plans, projects, designs, contracts and other business activities. These are to be made publicly available and shared with others in the supply chain.

In a zero-carbon circular business, decision indexes and measurement systems are important, if not vital. This allows for setting goals and targets, evaluation of progress against those, comparing performance against national and global goals and against best practice targets. A sustainability information system is also a practical tool in helping to foster a sharing attitude, building cooperative networks with suppliers, contractors and in use in tasks such design, procurement, material specifications and more.

The success of environmental efforts depends on everyone's involvement, but it is important that senior members of staff are accountable for recognising, reviewing, managing, implementing sustainability related performance and opportunities and meeting targets. This accountability could be announced at a public event to demonstrate the priority being given to sustainability. Consider further to establish organisational structures, roles and responsibilities for the environment in the business structure. Success also depends on the training that employees receive in understanding and applying sustainability policies and procedures. Other practices needed are environmental risk assessment (including estimation of risk levels and implementing risk controls), inspection and auditing, reporting and review, independent monitoring and decision making.

Obtain environmental certificates and adopt voluntary standards

Obtaining environmental credentials and complying voluntarily with environmental standards communicates leadership and commitment to stakeholders (within and external to the business). Direct benefits are a strengthening of reputation and brand recognition. Indirect benefits include strengthening of employee environmental engagement, building environmental management and innovation capacity and improving worker recruitment and retention.

Establish systems for sharing sustainability information

Establishing systems for sharing sustainability information is important for a number of reasons particular to a zero-carbon economy. First, to design low carbon products and with extended lifetimes or to design such buildings requires having information about the carbon footprints and other measurements and information of those products so that the best choices can be made at different phases of the building project. The same applies for when products and buildings need repair work, upgrades or maintenance. Second, it helps in working collaboratively with suppliers or other stakeholders to create common value and to grow alliances and coalitions of action bringing diverse sets of actors together. Third, it contributes to sustainability and emissions benchmarks, helps with peer review and learning, and establishing best practice; all in all, growing the national and global zero-carbon economy. The first step is to establish systems for capturing and sharing project the sustainability knowledge and information from projects within the business and then with outside stakeholders. Green BIM tools could be a consideration, but many solutions are possible.

Report on the business' sustainability performance

Sustainability reporting is a way to help improve business processes. Sustainability is reported throughout the year to senior management and annually to the public. Desirable elements of sustainability reporting include: sustainability objectives, targets or indicators and identification of areas for improvement. For a zero-carbon economy this includes reporting on carbon emissions produced by the business' activities. Benchmarking is enabled with reporting in that comparisons can be made with other businesses. The purpose of benchmarking is to stimulate idea generation for improving sustainability performance or for making it known what performance is possible when little is known.

Find out more…

The Global Reporting Initiative (GRI) framework is an example of a global system for reporting of business sustainability and emissions.

The National Carbon Offset Standard is an example of an Australian voluntary standard to manage GHG emissions and to achieve carbon neutrality through offsets. It provides best-practice guidance on how to measure, reduce, offset, report and audit emissions for organisations, products and services, events, precincts and buildings.

Introduce climate change adaptation assessments

Future climate change is a long-term consequence of GHG emissions, including carbon dioxide. One element in reducing carbon emissions is designing buildings and building products with extended use in mind. This requires using the right materials for such extended lifetimes. However, with extended useful lifetimes comes a need to consider the conditions under which those buildings and products need to work. This is where climate change comes in as a factor. For each asset (e.g., building), establish processes to identify and adopt suitable climate change projections over the useful and extended (design) life of the asset. Identify climate change risks and assess them for the asset over the extended useful life of the asset. The processes involve affected external stakeholders. Using the climate change projections, establish processes to identify and implement climate change adaptation measures as a design and practical issue for that asset.

Build collaboration and engagement between business and community stakeholders

For successful operation of zero-carbon circular processes that stretch across the construction projects' supply chain, there needs to be collaboration and engagement. This ensures there is information sharing that is timely and accurate.

Actively support sustainable cooperation

When building collaboration, also allow the time to make it a success. Making decisions about limited shared environmental resources require cooperative decision making which takes more time. Under time pressures it is more likely that shared resources are used unsustainably and are depleted. In a zero-carbon economy the focus

is on building the shared value of resources, rethinking business models, working together and reducing material use and enhancing recycling. Compared to the conventional linear throughput thinking economy in use today, all those activities are unfamiliar, and few solutions can be picked off the shelf. This will add to the extra time needed to make collaborative decisions.

Establish zero-carbon circular procurement and supply chain systems

Zero-carbon circular supply chains and procurement systems cover more than the delivery and handling of the supply chain's produced materials and products as it is delivered. It includes processes for co-ordination and management of the process between material and product production and actual utilisation of this for the building construction. Correct handling of goods, from the managed transport to site to the eventual distribution on-site, can reduce transport emissions and unnecessary production.

Zero-carbon circular procurement includes criteria for the prequalification and selection of contractors and contractual incentives and criteria for zero-carbon circular improvements. Such criteria and incentives address energy, water, materials and carbon emissions.

Find out more…

ISO 20400 is the International Standard for Sustainable Procurement.

SDG 12 is about sustainable consumption and production. The aim is to promote resource and energy efficiency, the provision of sustainable infrastructure, and people having access to basic services, green and decent jobs and for everyone to experience a better quality of life. The One Planet Network is a platform that forms a hub for bringing together a global community to make SDG 12 happen. One of the programs on this hub is Sustainable Public Procurement. Whilst the focus is on public procurement, much of the information is useful for SMEs too.

Set up an environmental management system (EMS)

An environmental management system helps management to be aware of how the business activities affect the environment. Reducing the business impact on the environment not only is good for the environment, but also helps business efficiency by using less resources, building a positive image for the business and improves safety through using less harmful chemicals and dealing with waste.

The environmental management system provides a structured approach to planning and managing water, energy and materials. It can help the business cover the minimization of materials, sustainable transport and distribution and waste minimization at supplier's premises and on the construction site. It needs to also help the business to focus on extending product and building lifetimes and see that waste is not only something to be minimised but a valuable resource in a circular economy. It helps businesses to regularly evaluate their environmental performance and improvement and setting up an EMS provides an ideal opportunity to also implement improvements for a zero-carbon economy.

Find out more…

A guide from the Department of the Environment's Profiting from Environmental Improvement in Business provides information suitable for SMEs starting out on eco-efficiency and an EMS. The guide is available at http://www.environment.gov.au/archive/settlements/industry/corporate/eecp/publications/profiting.html

Advice on energy efficiency assessment and management https://www.energy.gov.au/about-business and https://www.energy.gov.au/business/small-medium-businesses/conduct-energy-efficiency-assessment

Find out what grants and assistance are available at https://www.business.gov.au/assistance/search and https://www.business.gov.au/risk-management/environmental-impact/environmental-management/environmental-grants-and-awards-for-business.

Adopt green rating tools and green standards

Various rating tools and standards are used to assess the sustainability performance of buildings. They deliver benefits when used to certify buildings, but they can also be used within the business in other ways. For instance, the levels of a rating tool can be used as a benchmark level for business achievement goals during different building phases. For example, the business could aim to produce building designs, buildings or building-related products or services that achieve above a benchmark level of a specified rating tool. Another example would be to use the rating tool criteria as stand-in standards within the business, without obtaining certification, against which the performance of the business during different building phases are set. Various rating tools and standards are also used to certify the business itself. See also **Appendix B**.

Find out more…

The World Green Building Council challenges businesses to follow five steps to commit to the zero-carbon buildings challenge at https://www.worldgbc.org/thecommitment.

The ISO standards (e.g., ISO 14001 Environmental Management) is another avenue for sustainability certification for the business: https://www.sustainablecertification.com.au/index.php/iso-14001-environmental-management/

Establish a system for keeping track of a mix of tools, methods and systems

There is no single tool or method that can address all the questions and manage or optimise the many aspects of a business' GHG emissions to achieve zero-carbon emissions. Furthermore, every tool has its own strengths and weaknesses for its purposes and often the implementation of the tool (e.g., as a software application) various depending on the developer of the tool introducing yet another list of strengths and weaknesses. As the business grows and develops, so it will also change its requirements for sustainability and environmental information and doing analysis. The aim is to rather to manage these tools and systems so that there is consistency between their zero-carbon circular specifications and across their zero-carbon circular frameworks, ability to integrate sustainability information from different systems and efficiency (they work well) and effectiveness in their use (they work well for their purpose of use).

Case Study: The Barangaroo Project

The Barangaroo Project illustrates how taking leadership and green procurement is implemented through developing policies, setting goals and making that part of the contractual arrangements. The NSW Government established sustainability goals for the Barangaroo project at the start of the project. In 2009, before the start of the Barangaroo precinct construction, the NSW Government committed the precinct to the Climate Positive Development Program, now part of C40 Cities. The aim is that Barangaroo is sustainable for today and for future generations.

The Barangaroo Delivery Authority, on behalf of the NSW Government, included sustainability contractual arrangements in all Development Agreements so that the key requirements of the climate positive program are achieved. The climate positive program had four key requirements: to be carbon neutral (by reducing and then offsetting all the energy used), to be water positive (Recycling and exporting more water than the imported drinking water), to create zero-waste emissions (Responsible waste management, diversion from landfill and zero-waste emissions) and contribute to community well-being.

The Barangaroo Delivery Authority, on behalf of the NSW Government, facilitated these outcomes. To achieve the outcomes, they incorporated robust contractual instruments in all Project Development Agreements and worked collaboratively with developers so that sustainability targets would be implemented and achieved. Collaboration continued throughout construction and operations phases and will continue over all 99-year building leases. Other agreements to ensure the commitment are met include an estate levy in every lease and arrangements that cascade obligations from the NSW Government through to partners, owners and tenants.

In turn, the developer carried out extensive collaboration and stakeholder engagement. They worked closely with internal teams, suppliers, users and investors to ensure the high targets were understood and committed to by all involved. Sustainability commitments were written into commercial leases, supplier agreements and subcontracts. The developer conducted full LCA on the top 20 materials commonly used in construction. They allowed for a minimum 20 per cent reduction in embodied carbon emissions for every building. Because of rainwater tanks, recycling and reusing of water, Barangaroo South is capable of being water positive.

All tender submissions had to show how they would reduce carbon intensity in their products, improve recyclability of products and increase recycled content in their products. All major tenders also had to provide information on the social diversity in their own businesses and how they as a business were committed to the sustainability outcomes at Barangaroo.

The Climate Positive Waste Principles was adopted for the site. Some of the results achieved include:

- 97% diversion of construction waste from landfill
- 80% diversion of waste in the first two years of operations
- All take-away packaging is made from compostable materials and processed with food waste and turned into fertiliser and green energy

Barangaroo targeted carbon neutrality. This required that every aspect of the project needed to reduce carbon emissions and limit energy consumption. Their energy efficiency results include:

- 75% reduction in carbon emissions from building operations, compared to business as usual.
- Passive design features used: building orientation, fin shading system, automatic shading blinds, chilled beam technology that are highly energy efficient and reduce dependence on artificial lighting.
- Provided education and engagement support for all users to ensure energy efficient use of the space.
- In construction they used electric cranes, bio-diesel generators and battery driven tugs instead of standard equipment, solar powered site sheds and a concrete batch plant installed on site reduced 60,000 truck movements a year.

Source: Barangaroo Sustainability in Practice, 2017

Strategies for the Workforce view on the business

Workers have the last word on the implementation of any proposed initiative. Workers include all workers, managers, office staff, contractors, builders, trades people or suppliers. The 'Workforce' viewpoint of the business refers to an SME's environmental performance as assessed through:

- Employee's attitudes and behaviours that demonstrate the business' zero-carbon and circular economy approach
- The tools, equipment and practices that employees use to achieve required zero-carbon economy performance
- The capacities and capabilities employees possess to use the tools, equipment and practices
- The training and continuing professional development workers receive to support them in meeting and achieving sustainable practices
- The job descriptions and performance measurement systems that describe and reward workers' sustainable practices

Training and information systems that support workers to voluntarily put sustainability into practice

Workers demonstrate consciousness of sustainability in the way they interact with stakeholders to motivate the achievement of building with higher than green building benchmark settings from the earliest phases of projects. This requires sustainability training and information systems to support decision making. Training sessions can be supplemented with environmental information in various media, for example newsletters and intranet websites.

Workers demonstrate their commitment to sustainability in their preference for tools, equipment and practices that identify and enable environmental savings. They show their commitment in various ways. They adapt practices to extend the lifespans of products or buildings (e.g., in how they design or select materials). Workers use sustainable technologies and information systems to track and report on sustainability measures on a regular basis so that optimum use of resources can be made. They prepare site-based or project-based environmental management plans for day to day site work and construction that include actions for maintaining, repairing and upgrading equipment and resources so their use can be maximized. In addition to transport and distribution management, workers do more than apply general waste minimization principles to their on-site and office work; they think of waste as a source of resources and look for ways to recover, reuse and recycle. They also show a preference for using low carbon resources rather than carbon intensive materials (i.e., products that do the same with less, bio-based materials and renewable, reusable, non-toxic materials).

Workers engage spontaneously in collaborate efforts with all parties in the value network to ensure sustainability across the whole supply chain is optimised. They work transparently and share sustainability (i.e., carbon and circularity) information. The sustainability information is not only shared with business stakeholders (e.g., a parent company), but beyond the project and business to key stakeholder and the wider sector networks. The shared sustainability knowledge refers to 'good' results and to problematic issues. Workers have the competencies to make the most of the information systems. Workers efficiently handle goods according to sustainability principles, not only when receiving of suppliers' goods but also between production and subsequent use on-site and in the transporting to construction site. Workers use information and their project knowledge to ensure only those goods arriving or being used on-site as required to avoid unused products and materials. Workers' sustainable attitudes help, for example, designers to avoid excessive safety factors or specifications in terms of resources quantities. It also means they handle goods correctly (to minimize mistakes), whether it is the managed transport to site or subsequent distribution on-site.

Workers use waste as a resource and prioritise resources that can be regenerated

Workers actively go beyond waste minimisation on-site. Whilst many waste minimisation actions are enabled by good site management, realising that waste is a resource requires more. With waste minimisation, workers contribute by keeping working conditions safe and clean, making space for materials salvage, using recycling bins, ensuring their plans and specifications are up to date and appropriately storing and handling materials. Being able to take action because waste is a resource requires knowledge of the waste stream materials, information systems to look up unknowns, practices to prevent, reuse the materials or feed it back into the process. This requires induction and training that covers not only their responsibilities for maintaining a healthy working environment, minimising waste and helping to achieve environmental goals, but also the knowledge they need for what they can do with waste and the procedures to make that happen.

Workers have and use environmental information systems to mitigate carbon impacts

Workers use information systems to help reduce the impacts of carbon emissions. Mitigation can focus on minimisation as well on extending the useful lives of product, sharing products, reducing materials used through design, and choosing low carbon products. Carbon emissions can be minimised by addressing the emissions from transport activity and what is represented in excess production. They can do this by improving coordination and management of the processes between material and product production and actual use of the same for the building construction. Minimisation can also come from not requiring the materials inputs into the process by designing for less to achieve the same results. Carbon impacts can be reduced by not requiring new products but rather keeping the value of existing products high and extending their lives through maintenance, repair and the like and by sharing products. To achieve all these activities require that workers have information systems to capture sustainability knowledge from inside and outside the project and can share that within projects and external to projects. Workers also need to be knowledgeable about best practices and models about sustainability used in information systems. BIM is a type of system that is often mentioned for the construction sector.

Workers have and use a toolset of systems, procedures, tools and techniques for circular life cycle management

Workers are competent in the use of life cycle and circular systems thinking tools, whether applied to the business operations, to building projects, buildings or products (e.g., eco-labelling, LCA or green building certification). They draw competently from multiple systems and procedures to manage emissions according to a life cycle and circular approach. Workers are familiar with and competent in using a range of methods, certificates, standards, auditing and reporting systems. They can select the most appropriate method or tool for a specific situation or to achieve a specific outcome.

Strategies for the Supply chain view on the business

The 'Supply chain' viewpoint on the business refers to the supply chain factors (e.g., the physical and production systems) that affect the extent to which the business can change the environmental impact of its operations. These factors derive from the characteristics of the flows of materials and energy through the supply chain's infrastructure, its materials and equipment and its production systems. For example, the production and delivery processes and the types of materials used by a cement supplier is different to that of an electrical services provider and this affects the sustainability improvement approaches available to the business.

Develop different procurement models

The conventional model of procurement/contracting in the building sector, the design-bid-build model, tends to eliminate opportunities for alternative and potentially lower carbon and more circular approaches. Two other models that are increasingly used are the design-build and design-build-operate models. Yet, other models are also available to introduce zero-carbon circularity principles into procurement. Examples are:

- collaborative contracting where stakeholders work together in an open and non-adversarial way to deliver optimal outcomes for all
- alliance contracting where all parties work as an integrated, collaborative team on all project delivery matters and aim for what is best for the project
- supplier take-back or supplier-resale agreements involving a third party.

Encourage zero-carbon circular behaviour across the supply chain

Both sides of the procurement relationship (i.e., contractor and supplier) can takes measures to encourage or improve the uptake of sustainable product, or products that meet eco standards or include circular economy principles. BIM and the One Planet network are two very different approaches that can be used, but the most suitable system will depend on supply chain factors (e.g., the physical and production systems). There are general principles that can help in many situations.

- Use information tools that support improvements to the lifetimes of the products and that provide information relevant to the products' lifespans (e.g., their repair-ability or dismantling and reuse). Public webpages and online knowledge bases like Ecospecifier are tools for making this type of information possible.
- Use tools that take life cycle approaches to calculate all costs of production and consumption, including end-of-life and externalities costs, and the value of the resources. The range of LCA tools is described in **Appendix B**.
- Cooperate with other businesses to set up sharing and reusing systems and create new markets for sustainable products or services through increased purchasing volumes. Some product value chains (e.g., for building tools and equipment) will find this easier to implement than others, but the same principle applies to buildings and in a wider sense to recycling of building materials.
- Install knowledge and information management systems for sharing sustainability information and increasing collaboration. Ecospecifier is an Australian example of a public online system of sustainable products and materials. Other ways of communicating environmental information are through having ecolabels, Environmental Product Declarations (EPDs) and Green BIM tools (see **Appendix B**) and online blogs (see for example https://www.infiniteenergy.com.au/top-10-australian-green-and-sustainable-living-blogs/). In many cases eco-certifiers also provide a searchable database of certified eco-products, for example Ecospecifier and GECA at http://www.geca.eco/product-finder/.
- Develop company policy and legal instruments that not only cover waste management-related issues, but also other aspects of the product's whole lifecycle. Provisions to include should address production and distribution, extraction and sourcing of materials (e.g. by phasing out harmful chemicals) and eco-design.

- Where there are higher upfront costs to developing new sustainable products or improving the sustainability of existing products, providing financial resources and incentives to suppliers as the business' own initiatives in establishing partnerships can be one way to overcome such barriers. Another way is to find grants and financial incentives; links to various environmental government grants is available at: https://www.business.gov.au/risk-management/environmental-impact/environmental-management/environmental-grants-and-awards-for-business.
- Support the development of new ways of delivering value of the supply, and thus the sector, by making recommendations, providing incentives and rewards, encourage long-term relations and long-term service agreements. This has a synergistic effect with the support, development and training of the workforce to make environmental performance part of their jobs through their performance measurement, job descriptions, training and continuing professional development.

Apply circular economy principles to the whole supply chain

The issue of emissions from transport logistics provides an example of how shifting focus can produce different results. Often improvement in logistics to minimise transport emissions by reducing energy use is done at the single business level. However, by shifting the focus on energy efficiency to the whole supply chain, likely very different result for improvement could be found. This is because, for instance, for some products improving energy efficiency is especially needed at the starts and ends of logistics, where deliveries consist of individual orders and each order must be picked up and delivered to different locations. Industry 4.0 technologies are being developed that will make it possible to optimise energy consumption and carbon emissions across a whole supply chain.

The principle of shifting focus is the same for materials (and combined materials and energy) flows. By shifting the focus to the whole supply chain, a range of improvements could be achieved, some of which are listed next. First, achieving the same (or more) outcomes with less material used overall. Second, a bigger picture view helps to see how to eliminate waste (material and carbon emissions) and maintain or increase the environmental or economic value of the materials. Third, seeing the overall flows and how they link with and influence each other and the overall effects of their interactions. Fourth, it improves the ability to set collective goals and measurement frameworks for the whole supply chain, which will help with benchmarking performance and can feed into national and global ambitions. Fifth, seeing the optimal place where the life of a product can be extended, or where it is best to place a product sharing or repairing facility. Fifth, it could make visible where best to strengthen the environmental performance of the value chain with information or alignment of incentives.

Establish zero-carbon circular procurement and supply chain systems

Definitions of zero-carbon circular procurement include the following elements:

- businesses meet their needs for products, services, works and utilities
- the way they meet their needs achieves value for money on a whole life basis
- the value achieved is measured in terms of generating benefits not only to the organisation, but also to society and the economy
- fits in with natural ecosystems and is limited to what nature can tolerate

Every purchase in a procurement process is an opportunity to consider and influence the environmental, social and economic consequences of the value chain. This sorts of things that can be influenced given the supply chain factors (e.g., the physical and production systems) are design; the use of renewable materials or bio-materials; the methods of production; the tracking of, delivery, transport and optimal use of materials and products; the delivery of services; the service-ability (maintenance, repair, take-back or upgrade) of products and their composition so as to extend their lifetimes

and; preferential choosing of renewed, reusable, renewable, recycled, regenerated, non-toxic and shared resources over new resources; end-of-life issues; transparency; and suppliers' capabilities to address these issues and consequences throughout the supply chain. These are all possible benefits that translate into value for the business from implementing zero-carbon circular procurement.

There are several principles for a zero-carbon circular procurement system that in the implementation may be impacted by the different supply chain factors (e.g., the physical and production systems) of different supply infrastructures (**Table 4**). Further, a minimal set of sustainability information is needed for implementation (**Table 5**).

Table 4 List of principles of zero-carbon circular procurement.

- Requiring that environmental issues (including carbon emissions and circularity) are considered, making them public and making them part of the business' environmental goals and targets.
- Engaging with suppliers about the specific factors that affect their sustainability performance and making sustainability part of the selection and evaluation of suppliers.
- Making sustainability part of the tendering and bid process in the requirements specifications and evaluation of bids.
- Making sustainability part of the performance monitoring of suppliers during the contract and to align incentives with environmental performance.
- Working together throughout the supply chain, with teams formed from staff in the business and from suppliers and including the public sector to increase transparency.

Table 5 Sustainability information needed for implementing zero-carbon circular procurement.

A minimal set of sustainability information needed for implementation include:

- Evidence of emissions monitoring over the asset lifecycle.
- Processes for identifying and acting on carbon reduction opportunities
- Measures of the use of renewable energy.
- A track record of zero-carbon circular procurement that include zero-carbon economy principles.
- The use of life cycle technical and management tools for assessing and choosing materials.
- Monitoring and acting on the impacts of materials and energy used.
- The use of auditing processes to verify claims made and performance achieved.
- Evidence of climate change adaptation planning and implementation programs.

Share sustainability knowledge with the supply chain

In a zero-carbon economy targets and goals are agreed at global and national levels that are translated into goals and targets for sectors that apply to businesses. Also, the ability of the business to generally be successful as a zero-carbon circular business will depend on the availability of (good) sustainability information relevant their specific production infrastructure, use of energy and materials and operations. An important component of environmental success is to have systems for sharing sustainability knowledge with the supply chain. That includes capturing and sharing knowledge about sustainability from within the business (e.g., its projects) and from external to the business. Ideally the knowledge includes 'good' results as well as 'mistakes'.

Sustainability knowledge can be shared with workers through a variety of formats, including training sessions, newsletters, bulletin boards, intranet sites and public websites. Sustainability knowledge can be

shared with the supply chain businesses through local business events and business networks. Events are also often organised or publicised by local chambers of commerce, industry associations like ASBEC and WGBC, professional institutes and associations like Australian institute of Architects, Engineers Australia and business networks like C40 Cities.

Strategies for the Surrounding community view on the business

A business is not isolated from the environment in which it operates. It experiences various tensions to adopt zero-carbon and circular practices and in turn increases 'pressures' on others to do the same. The 'Surrounding Community' view on the organisation refers to:

- the SME's roles in many systems in which the business operates (e.g., social, informational, bio-physical, organisational, professional, trade and technological systems)
- in those roles, the relationships it has with the other actors and agents and how those relationships shape the business's practices and values and are in turn shaped by the business' practices and values

To maximize the effects of the zero-carbon circular interventions mentioned in this guide and those implemented by SMEs for decreasing carbon efficiency and using circular economy principles across the entire building sector value chain:

- Communicate clear information, guidance and requirements for zero-carbon circular practices and processes and improve the information available for the whole supply chain
- Monitor, measure, assess and report sustainability performance information periodically
- Support efforts by various stakeholders for sustainability education, capacity building, planning, standards and policies
- Develop and support new business models
- Carry out or support more research in how zero-carbon economy principles can be promoted and implemented

SECTION

03

Zero-Carbon Strategies by Types of Choices Made

When considering the actions a business can take to reduce climate impact, the different ways in which problems are identified and solutions proposed can be changed by emphasising different types of decision making.

This chapter gives an overview of zero-carbon circular strategies according to three types of choices made. Different opportunities and outcomes are realised when individuals and groups involved in decision making give attention to the different types of choices they make.

The significance of the outcomes from decision making processes is relative to the ways problems are responded to, solutions are developed and who influences and controls things. Figure 9 shows that more transformative opportunities exist when the emphasis of decision making is shifted between three ways of responding to issues:

1. Making operational choices: knowing how to do things right and when things are not right reacting by making compliant corrections
2. Making collective choices: coming up with different solutions by rethinking the frameworks that define what is 'right'
3. Making constitutional choices: redefining the problems (and thus the possible solutions) by transforming how situations (contexts) are understood and recognising and developing the assumptions in those contexts that make that understanding 'right'

A benefit of being aware of the different types of choices that can be made is in changing the relationships between the stakeholders to be involved—thus changing the types of choices that can be made—to create opportunities that might otherwise be thought impossible, incorrect or non-compliant. The conventional supply chain view links sector actors in a hierarchical order in a supply chain. This simplification constrains problem identification and potential solutions to a subsection of the whole sector (e.g., only to architects) and to a narrow selection of stakeholders (e.g., only to contractors and subcontractors) leaving the overall supply chain unchanged. Yet, the reality is that the influential actions and choices of individual and groups of stakeholders have been transforming the building and

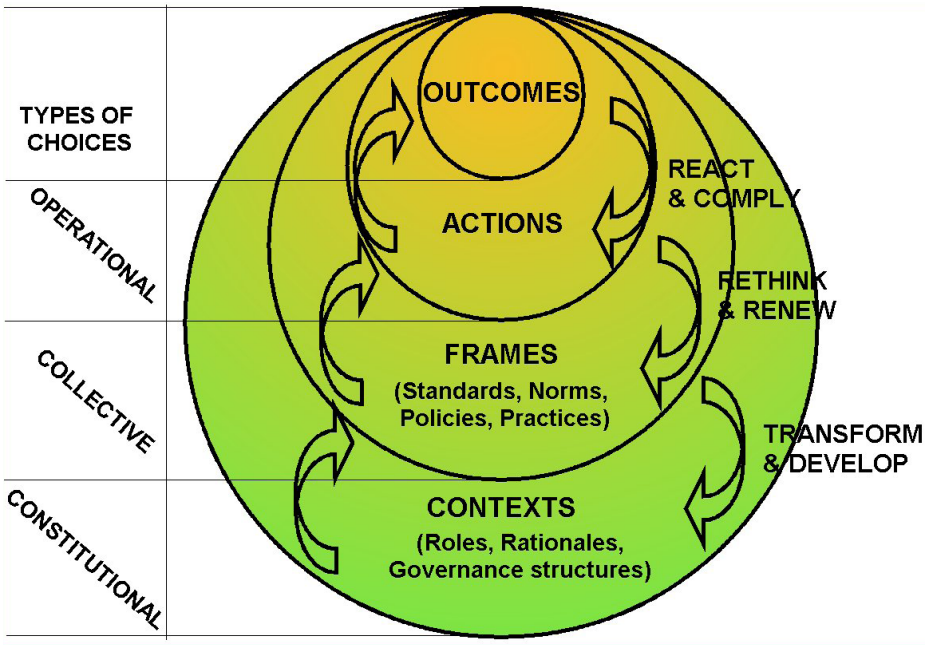


Figure 9 Three types of choices.

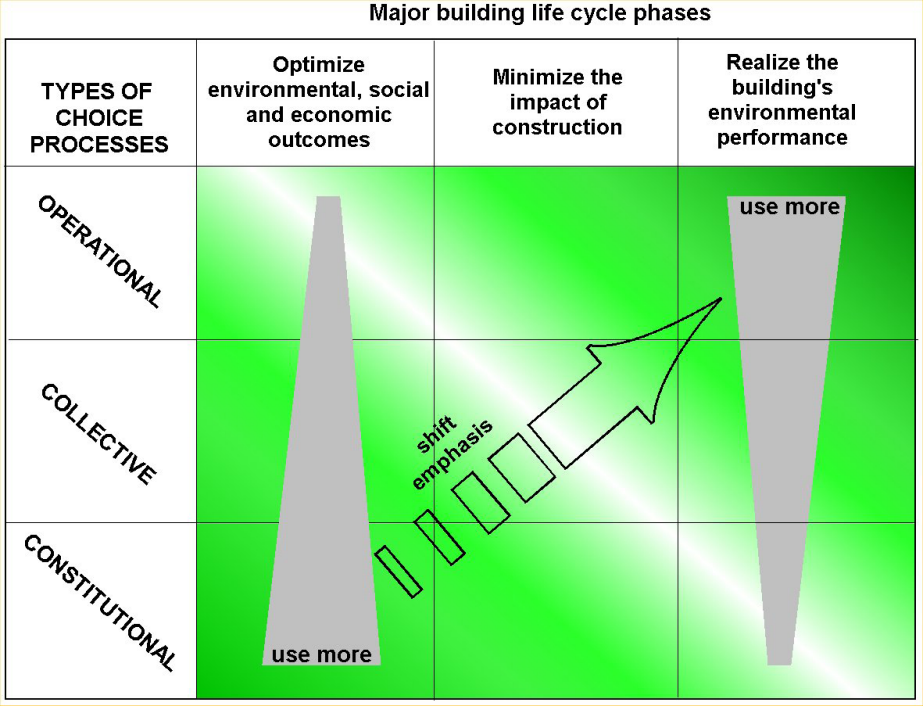
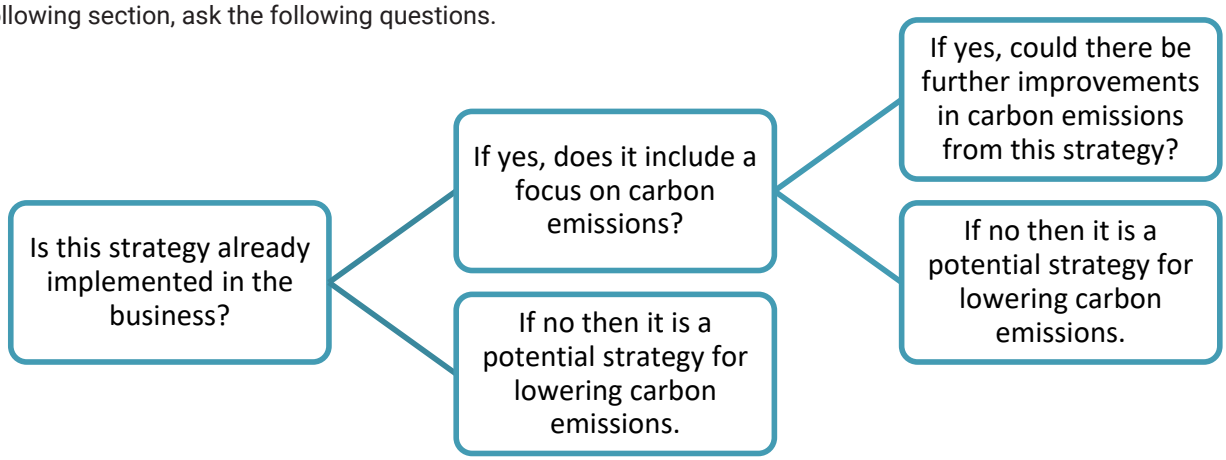


Figure 10 A shift in emphasis on types of choice processes over the phases of a building project.

construction value chain and changing the conditions for everyone as long as humans have needed buildings. It means that making different types of choices can realise opportunities like new business models, new understanding of the role of buildings in economic ecosystems, new products and new services.

However, there is a time and place for every type of choice process. As shown in **Figure 4**, the best opportunity to influence sustainable performance is in the earliest phases of the building project. That is when thinking about problems needs to be at its most creative and the gains in benefits at their highest. At later phases, such as procurement, the emphasis is on achieving targets, demonstrating compliance and working to specifications. **Figure 10** shows how the use of the different types of choice processes should shift over the phases of a project (as shown in **Figure 5**).

As you read the strategies covered in each of the following section, ask the following questions.



Strategies for operational choices

Operational choices are made when practical choices are make between available options. Available options depend on what people already know or assume are the right thing to do—it is those options that comply with existing rules, instructions, beliefs, tacit and explicit knowledge, standards, policies and norms, including the reasons for why these options are the right ones to use, who are allowed to be involved in making the choices and how power to make the choices should be assigned. Practical operational environmental choices involve preventing deviations from current emissions goals, targets and adjusting actions so zero-carbon and circularity outcomes can be achieved more efficiently. The changes brought about by operational choices are incremental in the sense that deviating situations are brought back into conformance with specifications.

Rules constraining operational choices are not the same as constraints imposed by natural systems

Many decision-making situations concern natural systems and many rules are about those natural systems (e.g., rules to protect endangered species). However, the dynamics of actual natural systems are not under the control of any decision makers. In this sense, the dynamics of those actual natural systems are considered external driving forces rather than constraints on operational choices.

In the ideal, the benefit of operational choices is that results are done efficiently and as specified. There is a very wide range of strategies for creating business cultures and relations with that encourage and motivate people to work according to the stated and unstated rules. Examples include selection for people with the required environmental training, induction that include environmental issues, rewards and incentives for achieving environmental outcomes, correctly calibrated tools and equipment to do the environmental aspects of the job and documented environmental policies, accreditations, certifications and procedures.

Specific strategies to consider

- Increase the productivity of materials by providing solution options for doing the same (or more) with less.
- Eliminate waste by providing solution options for feeding materials back as a resource into the supply chain.
- Extend the lifetimes of products (e.g., by specifying longer lasting materials during design) or sustain or increase the value of products (e.g., through product sharing schemes)
- Efficiently prioritise renewable, reusable, regenerative and non-toxic resources.
- Work collaboratively with internal and external stakeholders.
- Establish a framework of key information about zero-carbon and circularity issues that can be efficiently used to guide operational choices, and procedures for measuring performance against that key information

Strategies for collective choices

Collective level choices are made when choices are made about the options available for making operational choices. To establish the options available means establishing the rules and criteria that can (and cannot) be used to make operational choices. Practical collective choices involve evaluating the outcomes of operational choices (e.g., finding out and assessing what happened) and deciding what better solutions and what better goals, objectives, policies, norms, instructions, strategies, norms, frameworks, and rules are needed. The aim is to really understand the issues and to renew and rethink the existing solutions and rules so that things can be done right. Further, collective choices involve deciding which options and rules are, should be, or are not available to those making operational choices, who can make the operational choices, who can be involved in making the choices (and how) and what powers they have.

The benefit of collective choices is that the learning, creativity and critical thinking needed to make these types of choices open up possibilities for new ventures such as new products, new businesses, new environments and new market segments.

Specific strategies to consider.

- Provide the facilities and resources to experiment with new ideas
- Train and educate people to envision and design for zero-carbon and circularity, e.g., to create zero-carbon circular materials (e.g., molecular level re-assembling of plastic), products, business models, business processes (e.g., production and procurement), and supply chains
- Make available funding and build coalitions of cooperative partners within and external to the business

Table 6 Examples of circular business models for the built environment. Source: Adapted from Carra, G & Magdani, N 2017, Circular business models for the built environment, ARUP, BAM & CE100.

Circular supplies
Circular materials
Circular ownership
Circular financing

In working out what is 'right', not all approaches are equal

There are two ideal approaches. Top-down goal setting happens when, for instance, a government sets a mandatory target that defines the 'right' target for the whole supply chain. Bottom-up goal setting happens when, for instance, agreements are negotiated by stakeholders from across the supply chain and set by their commitment based on personal and business values. A top-down approach has at times been associated with slave-labour practices. However, a bottom-up approach is not without its problems, for example, not getting collaboration or being bogged down.

Case Study: Nightingale buildings, Victoria

Nightingale buildings, Victoria are community-led buildings for owner-occupiers. Nightingale buildings are developed according to the principles of the 'Nightingale Model'. One of the principles of the model is affordable housing and the financial model being followed is the German Baugruppen movement. The sustainability measures mandated include:

- are completely fossil fuel free and carbon neutral
- requires a minimum 7.5 star NatHERS energy rating
- rainwater harvesting
- passive ventilation and the use of low embodied energy materials

In addition to the environmental measures, a key element of the model is the social sustainability of the community created. The community includes the owner-occupiers and the local urban community. The aim is to make a positive contribution through quality urban design.

Photo: The first Nightingale building – Nightingale 1 (Source: https://nightingalehousing.org/nightingale-1)

Strategies for constitutional choices

Constitutional level choices are made when choices are made about how the contexts themselves are understood—the contexts are the rules and processes that define, maintain, measure and modify the collective level rules and (political) processes. Constitutional-level choices involve evaluating the outcomes of actions and realising that the way we understand things—the collective frames, rules, frameworks and points of view that guide our problem definitions and solution creation—is limiting in some ways. Making constitutional choices is about understanding how we decide what is right and on what principles we take one thing to be the right problem or solution and not another. Making constitutional choices involve deciding about the qualities to cultivate that will improve the choice processes and the integration and legitimacy of choices and performances, strategies and governance. The constitutional choices involve deciding who must or should be included in collective decision making and the powers they have in making collective level choices.

The greatest benefit of constitutional choices is the possibility of greater inclusivity, fluency in taking different perspectives, managing greater complexity, ability to hold paradoxes rather than making oversimplifications, natural empathy and recognition of differences in relationships.

Specific strategies to consider.

- Understand how problems and solutions—actions and outcomes—are related, even when they do not occur at the same time or in the same place. Develop capabilities to realise how the actions taken create the conditions that bring about current problems—to understand the dynamics of a situation or system. Systems thinking, systems modelling and systems analysis approaches and the use of systems tools to represent the interactions of systems and their parts are ways of implementing these strategies. A highly recommended non-technical book about dynamic systems thinking is: Meadows D and Wright D (2008) *Thinking in Systems – A Primer*. Chelsea Green Publishing, White River Junction, VT, USA. A free pdf version of the book may be available from the Internet.

- Develop capabilities to change the understanding of things, change purposes and deepen insights into the rationales that justify what are done. Capacity for this can be developed through workers who have opportunity to learn, grow and develop. For instance, through training programs, gaining experience in different parts of an organisation, through gaining experience in other businesses or gaining experience of other cultures.

- Develop 'circular governance' capabilities to work with dynamic and fluid situations that cross business or authority boundaries (e.g., ways of communicating that are not divisive or polarising and ways of working out who gains most when it works, who loses most when it does not work and who are responsible).

- Develop capabilities to work with extended futures (e.g., to design for extended product lifetimes or to identify and have the foresight to recognise future consequences). Capacity for futures thinking can be developed through futures training and educational courses.

Case Study: White Gum Valley, Fremantle, Western Australia

White Gum Valley (WGV) located in the City of Fremantle is a residential estate (2.2ha medium density, 80 residential dwellings) that is about more than green, energy efficient buildings. LandCorp, the Western Australia (WA) State Government's land development agency, partnered with the City of Fremantle and community groups to help ensure future WGV residents could, for example, lead healthy and happy lifestyles, conduct fair trade and support the local economy, create a culturally vibrant and sustainable community, protect and manage the habitat ecologically, manage water efficiently and produce sustainable food locally.

In their corporate charter, the development manager LandCorp, required working partnerships are developed with the public and private sector and present industry leadership. Further, they were to facilitate innovation in the building sector. This was implemented through two key methods. First, they proactively supported innovation on the site that gave LandCorp more flexibility in terms of proposing "out of the ordinary" initiatives. WGV is a 'Living Laboratory' project and demonstrates the experimental attitude needed in a zero-carbon economy. The four-year research program focuses on the achievement of low carbon outcomes, their acceptance and uptake and to making those outcomes mainstream. It involves monitoring the performance of the homes located on the estate, including the Gen Y demonstration project. The research findings are then shared with the wider community and building sector.

Second, the application of the One Planet Living Framework as the sustainability 'standard' specified in contracts (in the form of comprehensive guides). This was essential as both a form of buyer education to adopt the initiatives, but also to communicate sustainability initiatives and creating an expectation of a two-way commitment between buyers and LandCorp. LandCorp developed comprehensive guides for residents that sets out the sustainability initiatives that have been implemented on the site and how residents can help achieve the One Planet Principles. The guidelines were stipulated in the contractual condition between the buyer and LandCorp. The guidelines included, for example, guidelines for indoor water efficiency and alternative water sources. Energy efficiency was set well above compliance requirements. Homes were fitted with solar photovoltaics for energy supply and batteries for energy storage. These systems have the potential for peer-to-peer energy sharing. A range of water sensitive measures are also in place. Rainwater is harvested and stormwater is reused in private and public gardens.

References and Further Reading

ACIF & APCC (2010). A guide to project initiation: For project sponsors, clients & owners. Australian Construction Industry Forum Limited and Australasian Procurement & Construction Council Inc.

Adams, KT, Osmani, M, Thorpe, T, Thornback, J, 2017, Circular economy in construction: current awareness, challenges and enablers, Waste and Resource Management, Volume 170 Issue WR1

Architecture 2030 Challenge https://architecture2030.org/2030_challenges/2030-challenge/

Arup, 2016, The Circular Economy in the Built Environment, London.

Carra, G & Magdani, N 2017, *Circular business models for the built environment*, ARUP, BAM & CE100.

The Circularity Gap Report 2019 https://circulareconomy.europa.eu/platform/en/news-and-events/all-news/2019-circularity-gap-report-reveals-world-only-9-circular-and-trend-negative

Commonwealth of Australia, 2017, The National Carbon Offset Standard for Organisations (Organisation Standard).

Ellen MacArthur Foundation, 2015, Growth within: A circular economy vision for a competitive Europe.

Groote, MD & Lefever, M 2016, *Driving Transformational Change in the Construction Value Chain: Reaching the Untapped Potential,* Buildings Performance Institute Europe.

International Living Future Institute, 2016, Living Building ChallengesSM 3.1, A Visionary Path to a Regenerative Future, Seattle, WA.

Lewis H., Gertsakis, J. et al. (2001). Design+Environment: a global guide to designing greener goods. Greenleaf, London

Meadows D and Wright D (2008) Thinking in Systems – A Primer. Chelsea Green Publishing, White River Junction, VT, USA. A free pdf version of the book may be available from the Internet.

One Planet Living, 2017, One Planet Goals and Guidance for Companies & Organisations

UNEP-SBCI 2013, *UNEP-SBCI Task Force on Greening the Building Supply Chain: Summary Report*, Sustainable Buildings and Climate Initiative.

United Nations Environment Programme (2018), Building circularity into our economies though sustainable procurement.

WBCSD & BCG, 2017, The New Big Circle: Achieving Growth and Business Model Innovation through Circular Economy Implementation, World Business Council for Sustainable Development and The Boston Consulting Group.

WBCSD 2007, *Energy Efficiency in Buildings: Business realities and opportunities*, World Business Council for Sustainable Development

WBCSD, 2017, CEO Guide to the Circular Economy, World Business Council for Sustainable Development.

Appendix A: The Planning Process

Before you begin the planning process

Before starting the planning process, consider the following:

Decide on the purpose for the plan. Will the plan be used within the business or will it be shared with external stakeholders? Is the intent to get initial support from stakeholders or will you hand it to others to complete or implement? Knowing your intended audience and your expectations of their response will help you focus the plan.

Who is the intended audience of the plan?	
What is to be achieved by writing this plan for this audience?	

Gather information and conduct research. Key decisions need to be made before you can complete your plan, such as determining a carbon footprint analysis. You might consider seeking help from an accountant or trusted business adviser.

Are there concerns over keeping this planning project, information or research confidential?	
Who could help you get the information or doing research?	

Decide on the focus area of this plan. Few businesses will achieve a transition to a zero-carbon economy with a single plan in a single implementation step. More likely it is a process that will be repeated multiple times focusing on different areas of the business or giving attention to different aspects of the business over time. Will this plan cover a specific product or project, a range of products or projects, a specific business function or the whole business? In terms of timing, will the plan be for the next new product, project or for a product or project already underway?

What is the focus area of this plan?	

Set up an oversight group of trusted and diverse set of stakeholders. The aim is to reflect on the whole planning and implementation process itself and the result achieved, to take out lessons, look for areas of improvement and measure and monitor, learn from other examples and do experiments with alternatives.

Where do you want the business to be in ten years?	
Are there concerns over confidentiality that needs to be considered?	
Who could you invite to be a member of the oversight group?	

How will the group monitor the plan (action steps)?	
How will the group measure improvement or success?	
Over what period or how often will the group review the plan?	

The planning process to transition a business to the zero-carbon economy is organised around three main phases (Figure 11).

Figure 11 The planning process for preparing a business for the zero-carbon circular economy.

Establish a baseline and set targets

The aim of this planning phase is to establish where the business is starting from and setting the step change targets that will take the business towards being a zero-carbon circular business. It is particularly important to establish a holistic set of baseline indicators to form a point of reference against which to set aspirational transition targets and to measure progress made.

BASELINE INDICATORS = CARBON FOOTPRINT
+ SOCIAL-ECONOMIC INDICATORS
+ BUSINESS VALUES

Carbon footprint

The number of tools and services to determine the business carbon footprint is growing. Here are some examples (in no specific order):

- https://www.environment.gov.au/climate-change/government/carbon-neutral
- http://carbonfootprintservices.com.au/
- https://carbonneutral.com.au/measure-your-carbon-footprint/
- https://noco2.com.au/
- https://www.ecocitizenaustralia.com.au/carbon-footprint-australia/
- https://www.carbonfootprint.com/small_business_calculator.html
- https://nativeenergy.com/small-business-calculator/
- https://ghgprotocol.org/

Social-economic indicators

In a zero-carbon economy the economic objective is to reduce the costs from resources and environmental management controls, laws and taxes, including the risk of a negative public image, whilst increasing innovation opportunities that grow the value of the circulating resources. The social objective of a zero-carbon economy is increased sharing, employment and participative decision making, and more efficient use of resources by a cooperative community. Answer the following questions.

Zero-carbon circular image value. What is the value to the company of having a zero-carbon, circular and responsible image and what is the market potential? What is the value of new investment that has been (or could be) attracted to the business because of the zero-carbon circular image?	$
New jobs and markets. How many new jobs or work processes were created in the business because of new uses of the value in resources? How many new markets have been found for the value in resources?	
Sense of community. On a scale of 0 to 10, where 10 is the greatest cohesion, what is the sense of community, cooperation and participation because of sharing resources?	
Sharing. Of all the products produced by your company, what fraction is shared products (in contrast to products owned and consumed by individuals)?	%

Business values

A business' values express what the business believes are important and right. They guide the daily business activities and determine how business decisions are made. Business activities are the source of carbon emissions and the ways in which business decisions are made shows how 'circular' the business thinking is. Yet, business activities and decision making processes are not independent of the values of suppliers, workers, and the surrounding community. If the business is yet to establish a set of values, the following website could be of help.

- https://www.business.qld.gov.au/starting-business/planning/business-planning/values

Identify and prioritise transition opportunities

The aim of this planning phase is to develop a list of opportunities with strategies for realising them that will take the business towards being a zero-carbon circular business. The opportunities and strategies need to get the business to the planned transition targets set in the previous phase. This phase of the planning can be done by groups working in parallel. The five steps of this phase are:

1. **Decide who should be involved in discovering lower carbon emissions opportunities (the 'Low Carbon Group').** Convene representatives from within the business and across the supply chain as early as possible in the process for the task of discovering and prioritising opportunities for lowering carbon emissions. The importance of wide representation of stakeholders should not be underestimated. The choices of strategies and the types of choices for lowering carbon emissions are dependent on the variety of stakeholders you involve.

   No two businesses have relationships with the same stakeholders or in the same way. Some businesses will have more relationships than others. Some will have more influence in the relationships. It is important to identify the relationships since they will be addressed during the de-risking planning. Business relations can be identified through the business-to-business (or human-to-human) interactions as well as through relations with non-human objects that link businesses together. For example, a piece of equipment means there is a relationship with a supplier and a tax invoice shows there is relationship with a client. See **Table 7** *A worked example of key value chain stakeholders to engage to identify opportunities* for a worked example.

2. **Decide on the information you are likely to need for identifying and prioritising opportunities to lower carbon emissions.** The Low Carbon Group will need information to assist in deciding which opportunities will achieve the planned business transition targets. Decide what information will need to be collected and what it will be used for. It may well change as other stakeholders become involved. See **Table 7** *A worked example of key value chain stakeholders to engage to identify opportunities* for a worked example.

3. **Map the opportunities and their strategies that are likely to achieve the planned business transition targets.** See **Table 8** *A worked example of opportunities with potential to achieve planned business transition targets* for a worked example. Map opportunities for achieving lower carbon emissions according to four business perspectives: 'Management', 'Workforce', 'Supply Chain' and 'Surrounding Community'. Mapping will involve the Low Carbon Group in gathering data, seeking advice and deciding how and to what extent opportunities could achieve lower carbon emissions. It may also highlight the need to invite other supply chain stakeholders to join the group. Understanding the issues that impact carbon emissions will help with identifying what matters most, how much control the groups has over changes, identifying tools and techniques to use and the potential outcomes of the changes.

Table 7 A worked example of key value chain stakeholders to engage to identify opportunities.

Planning focus: The project preparation and design phase			
Breadth of value chain stakeholders to involve: Builders, local trades, demolition contractors			
Potential meeting date: 1 March 2004			
Value chain relationships	**Representative**	**Likely information sources of environmental / carbon performance**	**Use analysis results for**
Client	Luigi Rosselli Architects	client specifications, Passive House rating criteria	passive house design and project design criteria
Façade construction	Callum Coombe	experiments to determine best cooling effects of different recycled materials	façade design
Builder	Jim Miliotis	builders' environmental track record, Green Star & Passive House rating criteria	tender documents, builder selection, contract clauses,
Demolition contractor	not known	embodied energy of different recycled materials	design

Source: Creatively using information from the Beehive case study.

4. **Prioritise the opportunities.** See Table 10 *A worked example of hotspots identified* for a worked example. The Low Carbon Group works with internal and external stakeholders to agree on and quantify the extent to which the opportunities could positively or adversely affect carbon emissions in each area. Use Table 9 *A colour code key to record current hotspot status* as a coding guide to assign a status to each of the cells (boxes) of the completed table. The most promising opportunities to implement are those with the most red and amber cells.

Table 8 A worked example of opportunities with potential to achieve planned business transition targets.

Planning focus: The project preparation and design phase		
Summary of planned business transition targets: Achieve Passive House design, demonstrate increase value of recycled materials, 40% recycled materials, Firmly establish as a green architectural consultancy		
Business Perspective	**Project preparation phase opportunities**	**Project design phase opportunities**
Management	Encourage collaboration, share passive house information to develop a network of architects and builders with access to projects slated for demolition	Find builders with flexibility and adaptability to work with unfamiliar and imperfect objects and non-standard construction. Policy: Adopt Passive house standard
Management	Sharing of passive house information to develop clients appreciative of sustainability principles and willingness to accept repurposed objects rather than new	Experimentation: rapid design techniques to demonstrate alternatives based on availability of re-usable materials
Workforce	Training for project team to experiment with and find uses for recovered materials, Contract incentives to motivate and inspire builder to "change perceptions of beauty and value in materials"	Independent auditing of staffs' design practices for adequacy for reuse design. Communication to raise staff consciousness of healthy work styles.
Workforce	Inspires new clients to healthy living and passive house designs, to educate them for whole lifecycle thinking, to "change perceptions of beauty and value in materials"	Use Life Cycle Analysis tools to calculate embodied energy and materials savings, produce calculations that appeals to the client's rational requirements and also to optimise environmental outcomes
Supply chain	Collaboration and sharing of findings as incentives to get access to and study materials on projects slated for demolition	Collaboration and incentives with craftsmen to conduct the experiments. Builder – clauses in contract
Supply chain	Public demonstration examples to "change perceptions of beauty and value in (re-used and repurposed) materials"	Life cycle analysis tools that can calculate embodied energy savings.
Surrounding Community	An office environment that encourages community and healthy behaviour	Greater attention to design elements that effect healthy work practices
Surrounding Community	Inspire local community by demonstrations of biophilic design and passive house, public event	Exceed expectations of sustainability criteria; communicate results

Source: Creatively using information from the Beehive case study.

Note. In a complex interconnected world, problems cannot be simply and unambiguously described and permanently fixed without also impacting on other areas. This implies there will be a level of uncertainty with describing the opportunities, their strategies and assessing likely impact. Therefore, the less 'hot' opportunities are not necessarily eliminated from consideration. It is possible that in choosing and implementing an opportunity, already 'zero-carbon circular' areas are further improved or adversely impacted by the opportunity.

Table 9 A colour code key to record current hotspot status.

G	Green	Good	Minor obstacles remain that can be resolved with refinement and systematic implementation
Y	Yellow	Issues	Obstacles in a few areas that require substantial attention, the remaining areas good
A	Amber	Problematic	Major obstacles in a few areas and minor obstacles in other areas, overall requires substantial attention
R	Red	Highly problematic	Requires urgent and decisive attention

The example from **Table 8** *A worked example of opportunities with potential to achieve planned business transition targets* with options completed is shown in **Table 10** *A worked example of hotspots identified*.

Table 10 A worked example of hotspots identified.

Planning focus: The project preparation and design phase				
Summary of planned business transition targets: Achieve Passive House design, demonstrate increase value of recycled materials, 40% recycled materials, Firmly establish as a green architectural consultancy				
Business Perspective	**Project preparation phase opportunities**		**Project design phase opportunities**	
Management		Encourage collaboration, share passive house information to develop a network of architects and builders with access to projects slated for demolition		Find builders with flexibility and adaptability to work with unfamiliar and imperfect objects and non-standard construction. Policy: Adopt Passive house standard
Management		Sharing of passive house information to develop clients appreciative of sustainability principles and willingness to accept repurposed objects rather than new		Experimentation: rapid design techniques to demonstrate alternatives based on availability of re-usable materials
Workforce		Training for project team to experiment with and find uses for recovered materials, Contract incentives to motivate and inspire builder to "change perceptions of beauty and value in materials"		Independent auditing of staffs' design practices for adequacy for reuse design. Communication to raise staff consciousness of healthy work styles.
Workforce		Inspires new clients to healthy living and passive house designs, to educate them for whole lifecycle thinking, to "change perceptions of beauty and value in materials"		Use Life Cycle Analysis tools to calculate embodied energy and materials savings, produce calculations that appeals to the client's rational requirements and also to optimise environmental outcomes
Supply chain		Collaboration and sharing of findings as incentives to get access to and study materials on projects slated for demolition		Collaboration and incentives with craftsmen to conduct the experiments. Builder – clauses in contract
Supply chain		Public demonstration examples to "change perceptions of beauty and value in (re-used and repurposed) materials"		Life cycle analysis tools that can calculate embodied energy savings.
Surrounding Community		An office environment that encourages community and healthy behaviour		Greater attention to design elements that effect healthy work practices
Surrounding Community		Inspire local community by demonstrations of biophilic design and passive house, public event		Exceed expectations of sustainability criteria; communicate results

Source: Creatively using information from the Beehive case study.

5. **Quantify the impact of improvement strategies.** Having worked with stakeholders to develop strategies in each individual area, use the expected impacts to quantify overall impact. Keep in mind the systemic effects that improvement in one area can have on others. It is best not to focus on any area as if it is separated from other areas.

De-risk the plan

The aim of this planning phase is to develop ways of overcoming barriers and reducing the risks that will limit the effectiveness of the strategies and prevent the plan implementation from meeting the planned transition targets. Various resources are available to help prepare risk management plans. Here are some examples (in no specific order):

- https://www.smallbusiness.wa.gov.au/business-advice/insurance-and-risk-management/risk-management
- https://www.cpaaustralia.com.au/~/media/corporate/allfiles/document/professional-resources/business/risk-management-guide-for-small-to-medium-businesses.pdf?la=en
- https://www.business.gov.au/risk-management/risk-assessment-and-planning/risk-management-plans
- https://www.business.qld.gov.au/running-business/protecting-business/risk-management/preparing-plan
- https://www.sampletemplates.com/business-templates/business-risk-assessment.html
- http://environment.gov.au/science/supervising-scientist/publications/ssr/environmental-risk-assessment-australian-perspective
- https://www.business.qld.gov.au/running-business/environment/environment-business/risks
- https://www.epa.vic.gov.au/business-and-industry/how-to-manage-your-environmental-impact/environmental-risk-management

Develop the action plan

The action plan is a list of what is to be done, at what time and to implement the plan. Various resources are available to help prepare risk management plans. Here are some examples (in no specific order):

- http://consciousgovernance.com/blog-archives/how-to-create-an-action-plan-that-supports-your-strategy
- https://www.linkedin.com/pulse/20141006212125-128014-5-steps-to-convert-a-strategic-plan-into-action
- https://www.business.vic.gov.au/setting-up-a-business/how-to-start-a-business/write-a-business-plan
- https://www.template.net/business/plan-templates/strategic-action-plan-template/

Photo: Ben Hosking

Case Study: The Beehive, City of Sydney, Surry Hills

The Client Luigi Rosselli

Architect Raffaello Rosselli

Manufacturers Rockcote, Monier, Bisane tiles

The search for waste materials

The project started with the study of material waste streams. The architect's aim was to intentionally add value to recycled materials early on rather than as an add-on later. The architect needed a suitable object to construct a brise-soleil to filter the harsh western sun. Recycled terracotta tiles were chosen as it is easily sourced and without an adequate reuse market (out of manufacture tiles are collected, but newer tiles end in landfill). The majority of the tiles were recovered from a house reroofed in slate; the Marseilles roof tiles would have been taken to the tip. The tiles are also part of an evaporative cooling system and in the interior for a 'pigeon hole' bookshelf as a semi-enclosed partition. The design is based around recycled materials, reuse of buildings and passive building systems.

Other components of the upcycling were:

- repurposed working booths from a previous studio
- an awning constructed from old fence boards
- a window was repurposed from another construction project, where the client decided on a more conventionally shaped window
- a sculpture made from an offcut from the upper-level curved window.

New relations are needed

The architect realised from his experience that architects or builders need to be connected at a local level with projects slated for demolition to stop materials going to landfill. This would also mean that rather than materials

that are recycled, like the tiles, it can be reused. Recycling materials often means materials like tiles are crushed down into aggregate and down cycled into products like road materials. However, recycling is lower on the Waste Management Hierarchy and involves more handling and environmental costs than material reuse can achieve. This project, by reusing tiles, produced near-zero embodied energy through the materials.

Designing through making 1:1 prototypes

Experimentation and design are creative and practical processes; expensive computing and advanced construction methods are not always needed for reusing building materials. The façade design was largely achieved through a unique rapid hand-built prototyping process involving full scale tests. The architect worked closely with the local designer/maker, Callum Coombe.

Builders

Initially the architect got resistance from trades and builders. The builders had trepidations about using old roof tiles rescued from a demolition site. The idea was very different from what they are trained to do. Natural or recycled materials are imperfect and not perfect in alignment, and that is contrary to the builders' efforts to do everything perfectly. Yet, they got used to the idea of working with the tiles and ideas after realising the beauty and value in the unconventional materials.

Public/client relations

The project is the architect's conscious attempt to show clients and the wider public about the reuse of construction waste products and materials and highlighting their intrinsic beauty. It is not only reuse but also attempting to add value to the materials through reuse and repurpose and change the often negative perception of the public of material and product reuse.

Other features of the building

On the upper floor, the studio is lit by daylight 90% of the time. On particularly cloudy days, the suspended lights are powered by solar panels on the roof.

The fire stairs leading to the studio features marble mosaic tiles and is designed to encourage people to walk the short distance rather than take the lift. Enclosed and sealed fire stairs may be fire safe but they force people to opt for the lift and therefore they are a health risk.

Source: https://luigirosselli.com/public-commercial/workspaces/beehive; https://sydneylivingmuseums.com.au/sydneyopen/2018/beehive; https://arcspace.com/feature/the-beehive/; https://www.thefifthestate.com.au/innovation/architecture/roselli-on-sustainable-reuse/

Appendix B: Tools, Techniques and Methods

Table 12 Summary of strategies mentioned in this guide and corresponding tools, techniques and methods presented in this Appendix.

	Building project & building or community level tools			Materials or product level tools	Life cycle level methods and tools				Business level tools			Systems level tools
(section) Strategies	Green rating tools & green standards	Green BIM	The Charrette	EPDs, ecolabels & certificates	LCA	LCSA	LCC	EEIO	Carbon Footprint	Value chain analysis	Non-financial reporting & disclosure	Systems theory & thinking
(3.1) For optimization during preparation phases	✓	✓		✓						✓	✓	
(3.2) For optimization during design phases	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
(3.3) For minimization during execution phases	✓	✓		✓					✓			
(4.1) For the Management view on the business	✓	✓		✓					✓		✓	
(4.2) For the Workforce view on the business	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
(4.3) For the Supply chain view on the business	✓	✓		✓						✓	✓	
(4.4) For the Surrounding community view on the business	✓	✓		✓					✓		✓	
(5.1) For operational choices	✓	✓		✓	✓	✓	✓	✓				
(5.2) For collective choices		✓	✓							✓		
(5.3) For constitutional choices												✓

A variety of tools, techniques and methods are suitable for use during specific or several building phases in a zero-carbon economy.

This chapter lists a selection of the many tools that have been proven to work successfully. Many have been developed by both NGO's and government agencies and are available for free.

Building project & building or community level tools

Green building rating tools and green standards provide independent assessment of the sustainable design or performance of a building. A certification process is undertaken to assess the building or its designs according to the criteria defined by the rating program. The criteria are often specified at different levels of performance and, since they define a specific best practice baseline is at the time, they are updated to newer versions as the baseline increases. For example, as understanding of green building have moved beyond simply energy or water efficiency in operations, rating schemes have started to recognise factors such as indoor environment quality, life-cycles of materials and even further the governance, liveability and prosperity of communities. These tools are used to specify criteria of building performance at early building phases, as a way to prove a buildings' environmental performance to investors and have been successful in raising awareness and stimulating demand for green buildings. Whilst criticisms are directed at rating tools, they can function in complementary ways with other strategies. Rating schemes can be used as stand-in standards in, for example, building procurement.

Find out more...

Green rating tools recognised internationally are: LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method) and Green Star. A list of green rating tools with links is given at https://www.worldgbc.org/rating-tools. An overview of rating tools and standards with descriptions of terms can be found at https://www.wbdg.org/resources/green-building-standards-and-certification-systems. A comparison of green rating tools can be found at https://eprints.qut.edu.au/86649/.

The Green Star voluntary environmental rating system launched by the Green Building Council Australia is well established in Australia: https://new.gbca.org.au/ and provides certification for the design and construction of a building, the operational performance of a building, the interior fitout of a building and a plan for a precinct-scale development.

The Nationwide House Energy Ratings Scheme (NatHERS) (a star rating system) rates the energy efficiency of a home based on its design: http://cynapse.com/. Three rating tools have been accredited for use by the Nationwide House Energy Ratings Scheme (NatHERS): AccuRate, BERS Pro and FirstRate5 http://nathers.gov.au/nathers-accredited-software

The National Australian Built Environment Rating System (NABERS) is a rating tool for existing buildings. It rates various measures of a building, such as its energy efficiency, carbon emissions, water consumption and waste production. These figures are compared to other similar buildings. https://www.nabers.gov.au/

The National Carbon Offset Standard in Australia http://www.environment.gov.au/climate-change/government/carbon-neutral/ncos is a voluntary standard that can be used to get certification of carbon neutrality through reducing and offsetting carbon emissions but also to manage GHG emissions. The standard has been prepared for organisations, products and service, buildings, precincts and events.

The NSW Government's Building Sustainability Index (BASIX) provides an online sustainability assessment tool for certification: https://www.planningportal.nsw.gov.au/planning-tools/basix.

Passive House is a voluntary standard for designing and constructing near-zero energy efficiency in building. The building requires little energy for space heating or cooling. More information can be found at https://passivehouseaustralia.org/. Some building projects have pursued both Passive House and Green Star certification.

The Greenhouse Gas Protocol consists of comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains and provide mitigation actions. Find out more at http://ghgprotocol.org/.

Green Building Information Modelling (Green BIM) is a practical tool (more accurately various tools and technologies) that provides information for life cycle and circular economy decision making and supply chain collaboration across a supply chain and in the execution phase improves construction and procurement processes. There is available a range of BIM software applications, include free open source versions.

BIM provides a digital visualisation of a building with all its physical and functional information so that the same information can be shared with all stakeholders and be updated during the whole building lifecycle. In addition to visualisation, BIM can also allow automatic updating of alterations to building structures and furnishing, trying out different designs that supports optimisation, manages different kinds of data and building lifetime efficiency analysis.

When used during the concept definition phase, it helps stakeholders visualise alternative designs. When used during the design phase, it supports optimisation by providing information about the implications of different design solutions. When used during the executions and construction phase, it supports efficient construction methods by providing information for controlling quality and quantity. Because of the ability to share information, it encourages and facilitates communication between different stakeholders, it improves information transparency and trust, it facilitates zero-carbon circular innovations and holistic solutions, it helps to improve integration of products and reduce errors and risk, and finally it addresses knowledge gaps.

The Charrette is a method for cooperation during design. It involves bringing everyone from the project team together for an intense period of planning and design to achieve a design with sustainability outcomes. By involving the whole project team discussing the future project, the majority of the building design and systems are resolved in an integrated holistic approach. At the end of the process all the participants understand the systems and why they are in place. The focus on collaboration is important for achieving an integrated design concept.

Materials and product level tools

Environmental Product Declarations (EPDs), ecolabels and product certificates

EPDs are prepared under ISO14025 standards and independently verified. They communicate the environmental performance of products (or buildings) as determined by LCA of all its materials at all stages of its production and management processes. Since LCA of a product's environmental performance relies on consistent environmental data, EPDs provide a consistent and objective way to inform buyers and thus to build trust and transparency. The trend is for greater use of EPDs in green building rating tools. The setup of an EPD system can be difficult and expensive.

Find out more…

A guide on EPDs by Department of the Environment and Energy is available at https://www.environment.gov.au/climate-change/government/carbon-neutral/publications/epd-guidance

Ecospecifier (http://www.ecospecifier.com.au/) is a large Australian online knowledge base of sustainable products and materials. They provide

information on life-cycle assessed product based on various green certificate tools and labelling systems (e.g., Green Tag labelling). There are many such directories, usually on a pay-for-service basis.

Global GreenTag's certificate programs score products against six sustainability criteria and twenty life cycle and social criteria. It also has a program for GBCA Green Star points for green design, green procurement, and green facilities management. It is also a BIM-based product rating and certification system.

The Greenhouse Gas Protocol consists of comprehensive global standardized frameworks to measure and manage GHG emissions from product life cycles and provide mitigation actions. Find out more at http://ghgprotocol.org/.

The Good Environmental Choice Australia Ecolabel http://www.geca.eco/.

A list of all ecolabels in Australia: http://www.ecolabelindex.com/ecolabels/?st=country,au

Life cycle level methods and tools

In a zero-carbon economy the aim is to preserve the value of resources. Various impact assessment methods widely used in public and private contexts provide evidence that can help make decisions about value over lifecycles. Their strength is in being able to be applied to problems of very different scales such as a single product, factory or project to nation states or geopolitical areas. One such family of methods is Materials Flow Analysis (an overview is available at https://www.oecd.org/environment/indicators-modelling-outlooks/MFA-Guide.pdf). Specific members of the MFA family are described next. These methods have been implemented into many different software applications.

Life cycle assessment (LCA) is a tool for conducting an inventory of all the inputs and outputs of a product (e.g., a building) system and then used with impact assessment methodologies to understand the effects on the environment and the ecology. LCA provides simple and modular frameworks that enable whole life thinking of products, buildings and service processes. It can be used for self-assessment or third-party assessment. LCA provides consistent definitions and language for doing carbon assessments across different areas and thus can convey clear signals of costs, benefits, impacts, challenges and successes.

Life Cycle Sustainability Assessment (LCSA) is an extension of LCA. It provides a holistic evaluation by integrating assessments for environmental, economic and social impacts.

Life cycle costing (LCC) provide an economic evaluation of the total cost of a product, building or process throughout its life cycle. **Whole life costing (WLC)** takes that a step further to include a broader range of costs such as the likely content of buildings, land purchasing costs and income generated from leases. A weakness of these methods is in using one measurement unit (monetary cost) and devaluing future costs and benefits.

Environmentally Extended Input-Output Analysis (EEIO) can be used to analyse the full supply chain for environmental and economic impacts based on market exchanges.

Find out more…
The UN Environment hosts the Life Cycle Initiative at https://www.unenvironment.org/explore-topics/resource-efficiency/what-we-do/life-cycle-initiative with information on Life Cycle Thinking (LCT), methodologies case studies and free e-learning modules.

Business level tools

Carbon Footprint Analysis is a method for calculating the total GHG emissions attributable to the business operations. An assessor can calculate the business carbon footprint consistent with standards set out by internationally reputable guidelines such as the Greenhouse Gas Protocol, the Global Reporting Initiative, the Carbon Disclosure Project or the National Carbon Offset Standard.

Find out more…
The Greenhouse Gas Protocol consists of comprehensive global standardized frameworks to measure and manage GHG emissions from private and public sector operations, value chains, product life cycles, projects and mitigation actions. Find out more at http://ghgprotocol.org/.

The National Carbon Offset Standard (http://www.environment.gov.au/climate-change/government/carbon-neutral/ncos) is an example of an Australian voluntary standard to manage GHG emissions and to achieve carbon neutrality. It provides best-practice guidance on how to measure, reduce, offset, report and audit emissions for organisations, products and services, events, precincts and buildings.

Value chain analysis or value chain mapping is a range of methods used to examine the main activities of the different actors (businesses as well as other actors) in a supply chain and their influence in the chain, particularly in looking at where the most value is added. It maps all the actors, markets and factors that affect their performance. It can be used to answer many questions about the value chain, for example for identifying collaborative opportunities that can benefit the whole chain.

Non-financial reporting & disclosure tools
Annual reporting of a business' activities can form the basis for transparent and balanced appraisal and communication of the impacts (both positive and negative, both direct and indirect). It communicates how the business is managing environmental risks and opportunities. Such reporting is often done through corporate sustainability or responsibility reports describing the business' economic, environmental, social and governance performance. Most of this type of reporting is voluntary action.

Third party reporting mechanisms are also available, for example the Global Reporting Initiative (GRI). GRI provides sustainability reporting guidelines and a reporting framework. Other frameworks focus on reporting of specific environmental aspects. For example, the CDP (formerly the Carbon Disclosure Project) collects detailed information about large companies' carbon, water and materials use (both from its direct operations (scope 1 and 2) and, in the case of carbon, the indirect (scope 3) GHG emissions).

Find out more…
The Global Reporting Initiative (GRI) framework (https://www.globalreporting.org/Pages/default.aspx) is an example of a global system for reporting of business sustainability and emissions.

Systems level tools

Systems theory and systems thinking. Today many disciplines have a systems theory branch that studies that interrelations and processes of parts of systems and interacting systems. A highly recommended book that introduces system's thinking is Meadows D and Wright D (2008) Thinking in Systems – A Primer. Chelsea Green Publishing, White River Junction, VT, USA. A free pdf version of the book may be available from the Internet.

LOW CARBON LIVING CRC

CRC for Low Carbon Living Ltd
Email: info@lowcarbonlivingcrc.com.au
Telephone: +61 2 9385 5402 Fax: +61 2 9385 5530

This research is funded by the CRC for Low Carbon Living Ltd supported by the Cooperative Research Centres program, an Australian Government initiative.

Australian Government
Department of Industry, Innovation and Science

Business Cooperative Research Centres Programme