SUPPLY CHAIN SUSTAINABILITY SCHOOL

Designing for Carbon Reduction

James Cadman,
Action Sustainability

House Rules

Be present! Cameras on please. Mics on when you want to talk. Name yourself

Get involved in our poll questions

‘Raise your hand’ or use the chatbox for questions

Please participate in our small group discussions and activities

Share your feedback at the end

Slides will be shared

Tech Support

Real-time polls and audience Q&A

1. Go to www.menti.com in a new browser or tab on your phone or computer.
2. Enter the menti code when you see it on the slide or hear the trainer read it out.
3. Don't disconnect from the webinar, you will still need to hear the trainer.

Workshop Overview

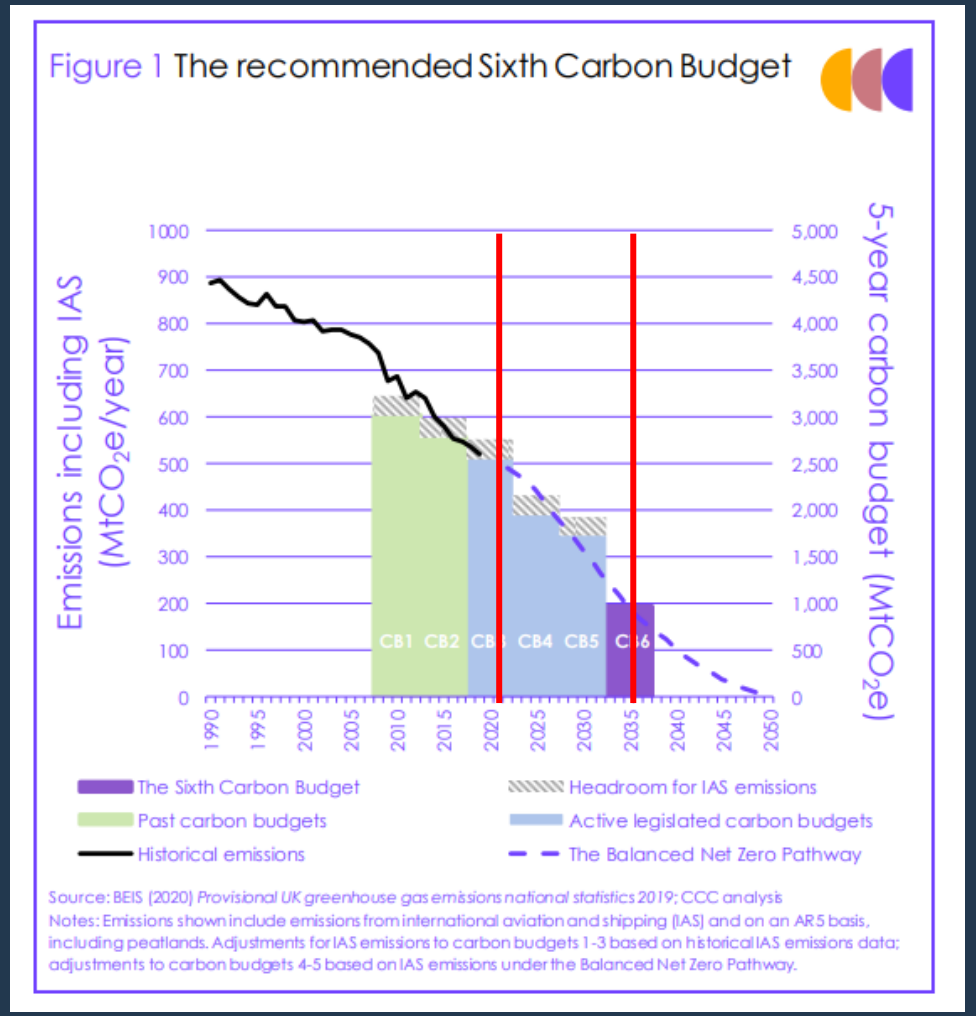
- Why should we design for Carbon reduction?
- How do we go about it?
- Relevant Standards and Tools
- Measuring and optioneering
- Other co-benefits

How much do you know about carbon?

Why should we design for carbon reduction?

The Law!

- UK Climate Change Act target of 100% reduction by 2050 – 'net zero'
- Scotland has legislated to hit net-zero by 2045
- Wales' target to reduce by 95% by 2050 but aiming for net zero
- Ireland has legislated to hit net-zero by 2050
- New intermediate target for UK of 78% by 2035 vs 1990 baseline



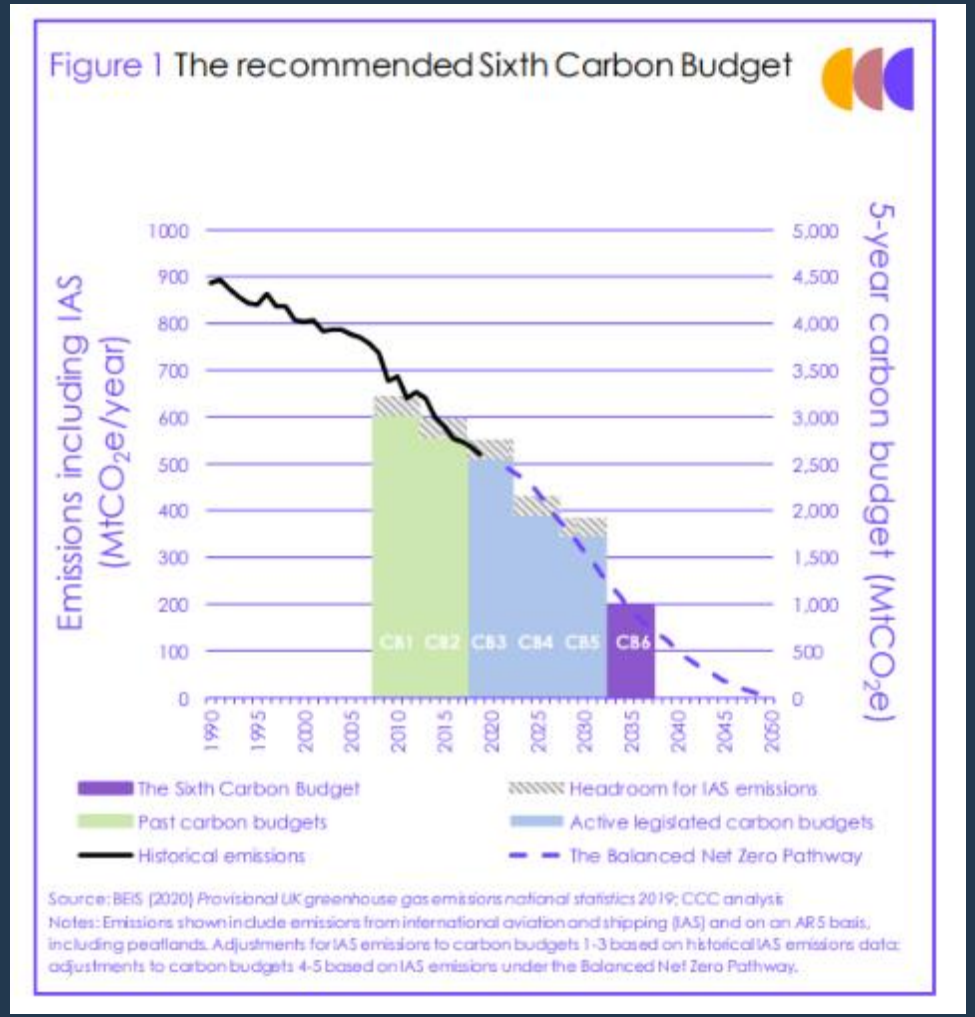
SUPPLY CHAIN SUSTAINABILITY SCHOOL

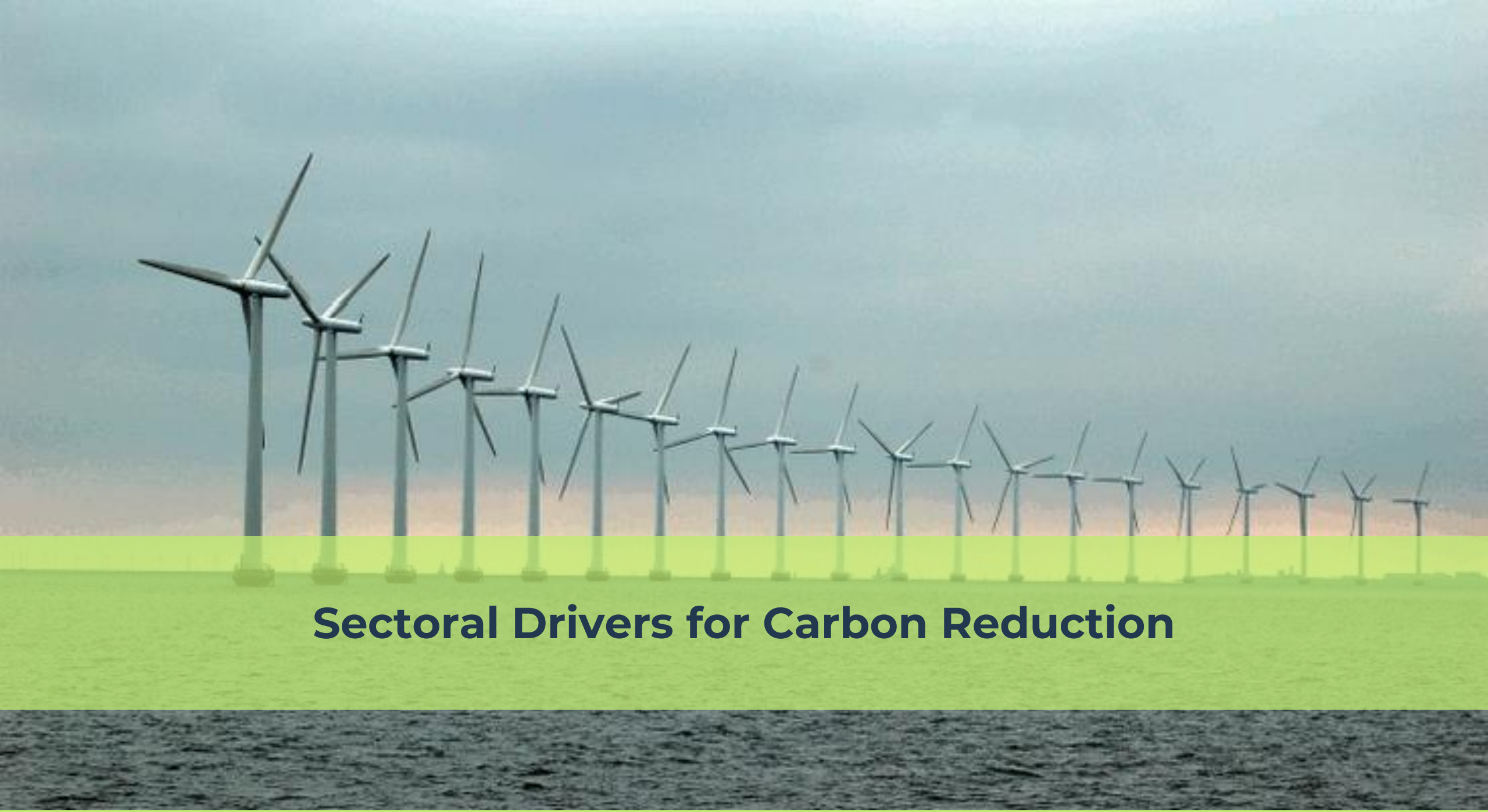
Drivers and Benefits

And the Built Environment's contribution to the total...?

40%

10% from construction;
30% from operation





Sectoral Drivers for Carbon Reduction

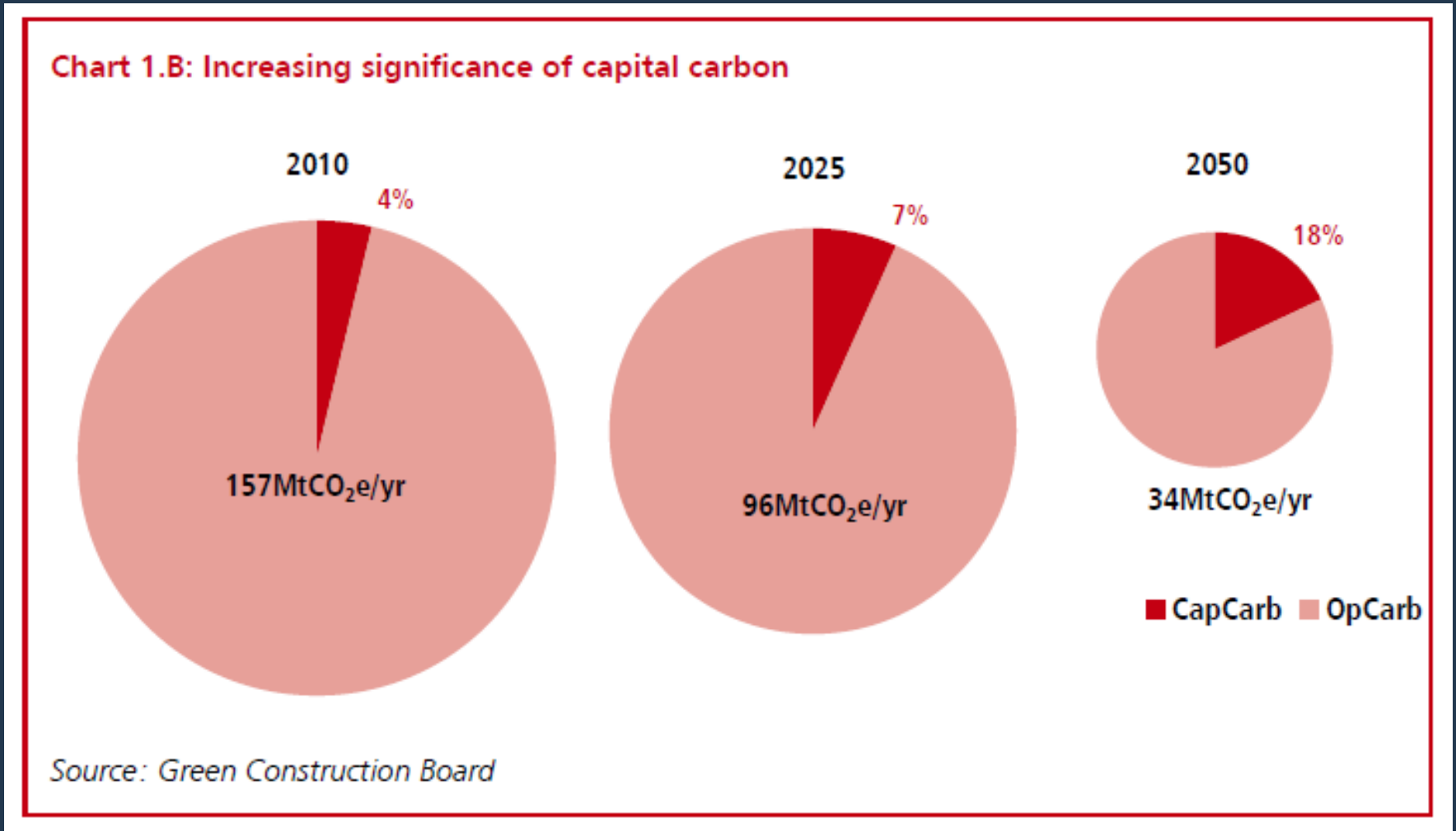
Carbon Infrastructure Review

"..... the UK is driving forward the delivery of new strategic infrastructure alongside the maintenance, modernisation and renewal of existing assets.. **We must achieve this while contributing to national reductions in carbon emissions**

The Government has no doubt that **cutting carbon is fundamentally important to long term global economic, social and environmental sustainability**.

This report makes clear **that reducing carbon reduces costs**. It is part and parcel of saving materials, reducing energy demand and delivering operational efficiencies."

Carbon Infrastructure Review



Construction Leadership Council – 9th March 2021

Transport

1. Zero emission vehicles and onsite plant
2. Modern methods of construction, improved logistics, reducing waste and transport
3. Connection with low carbon transport

Buildings

4. Retrofitting to improve energy efficiency of the existing housing stock
5. Low carbon heat solutions in buildings
6. Enhance the energy performance of new and existing buildings with monitoring

Construction activity

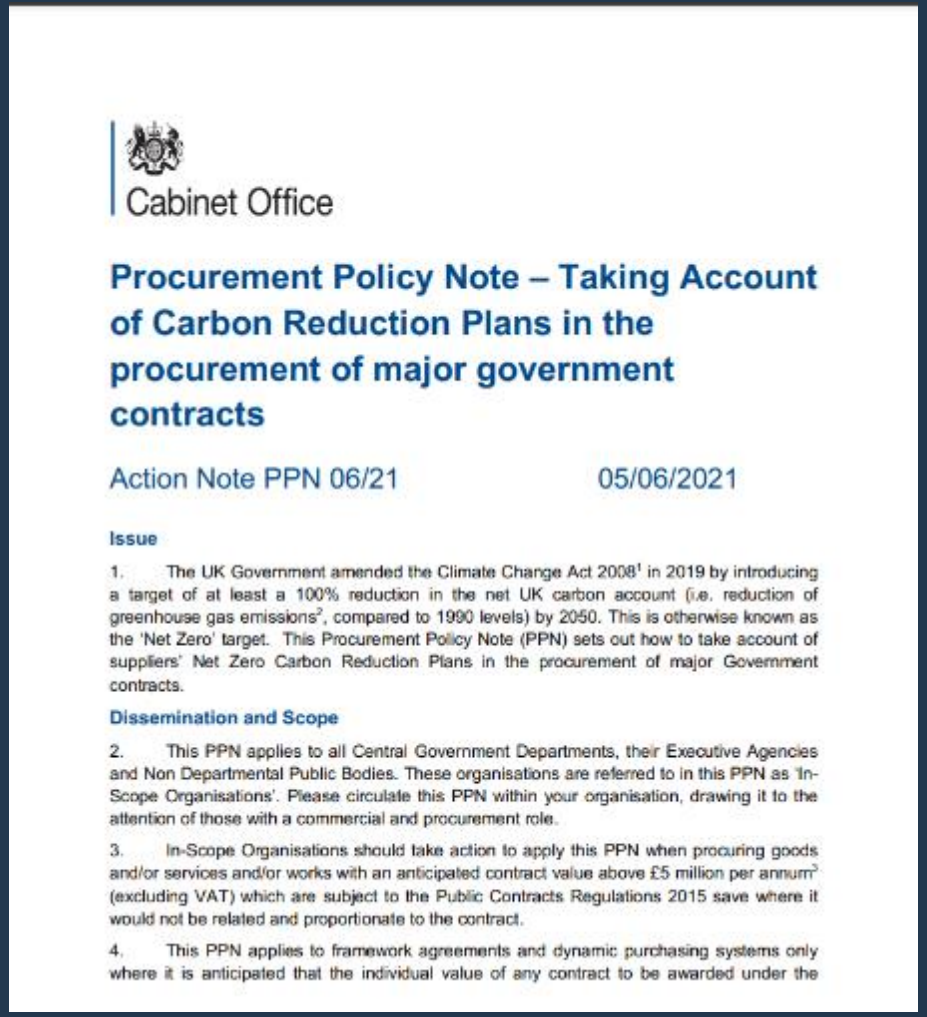
7. Carbon measurement to support quantifiable decisions to remove carbon

8. **Become world leaders in designing out carbon**, developing capability of designers and construction professionals to develop designs in line with circular economy – reducing embedded and operational carbon, shifting commercial models to incentivise and reward measurable carbon reductions.

9. Develop innovative low carbon materials (prioritising concrete and steel), as well as advancing low carbon solutions for manufacturing production processes and distribution.

UK Gov't PPN06/21: 5th June 2021 *Carbon Reduction Plans*

- Bidders for any contract over £5m ex VAT per year from Central Government, their Executive Agencies and NDPBs
- Contractors will have to provide a carbon reduction strategy confirming their commitment to achieving Net Zero by 2050 in the UK
- Covers Scope 1, 2 and certain Scope 3 (Upstream transportation & distribution, Waste generated in operations, Business travel, Employee commuting, Downstream transportation & distribution)
- From 30th September 2021
- Plans for an 'embodied carbon law': The Carbon Emissions (Buildings) Bill, and Part Z of Building Regulations



Cabinet Office

Procurement Policy Note – Taking Account of Carbon Reduction Plans in the procurement of major government contracts

Action Note PPN 06/21 05/06/2021

Issue

1. The UK Government amended the Climate Change Act 2008[1] in 2019 by introducing a target of at least a 100% reduction in the net UK carbon account (i.e. reduction of greenhouse gas emissions[2], compared to 1990 levels) by 2050. This is otherwise known as the 'Net Zero' target. This Procurement Policy Note (PPN) sets out how to take account of suppliers' Net Zero Carbon Reduction Plans in the procurement of major Government contracts.

Dissemination and Scope

2. This PPN applies to all Central Government Departments, their Executive Agencies and Non Departmental Public Bodies. These organisations are referred to in this PPN as 'In-Scope Organisations'. Please circulate this PPN within your organisation, drawing it to the attention of those with a commercial and procurement role.

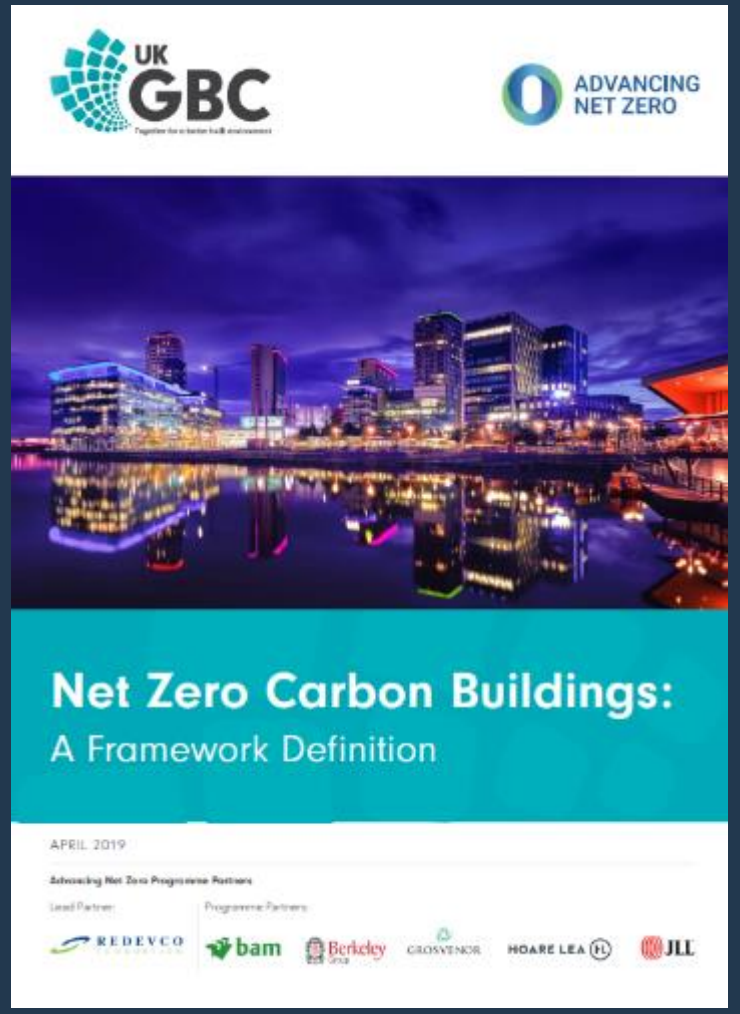
3. In-Scope Organisations should take action to apply this PPN when procuring goods and/or services and/or works with an anticipated contract value above £5 million per annum[3] (excluding VAT) which are subject to the Public Contracts Regulations 2015 save where it would not be related and proportionate to the contract.

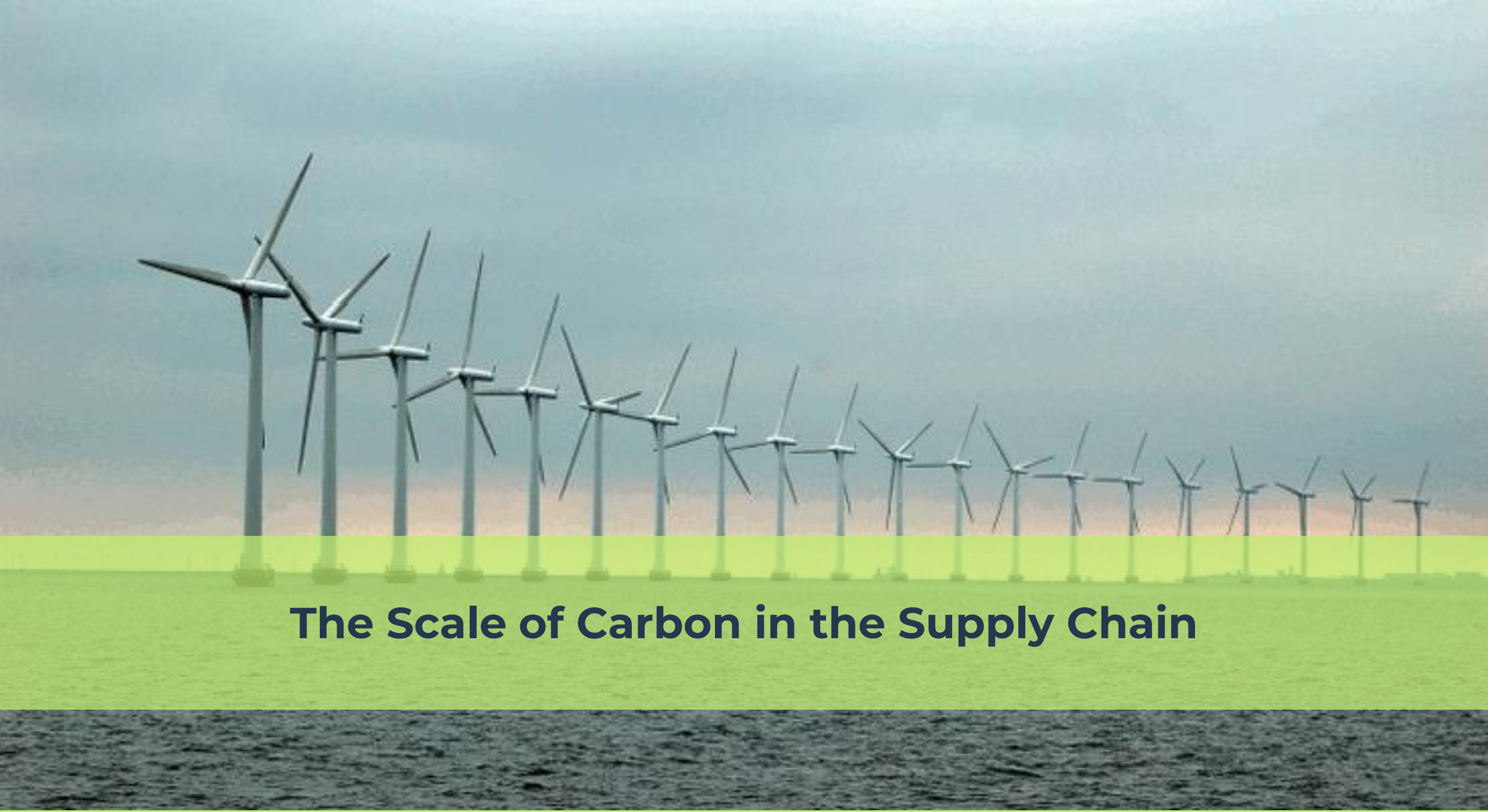
4. This PPN applies to framework agreements and dynamic purchasing systems only where it is anticipated that the individual value of any contract to be awarded under the

UKGBC Framework Definition of a Net Zero Carbon Building

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

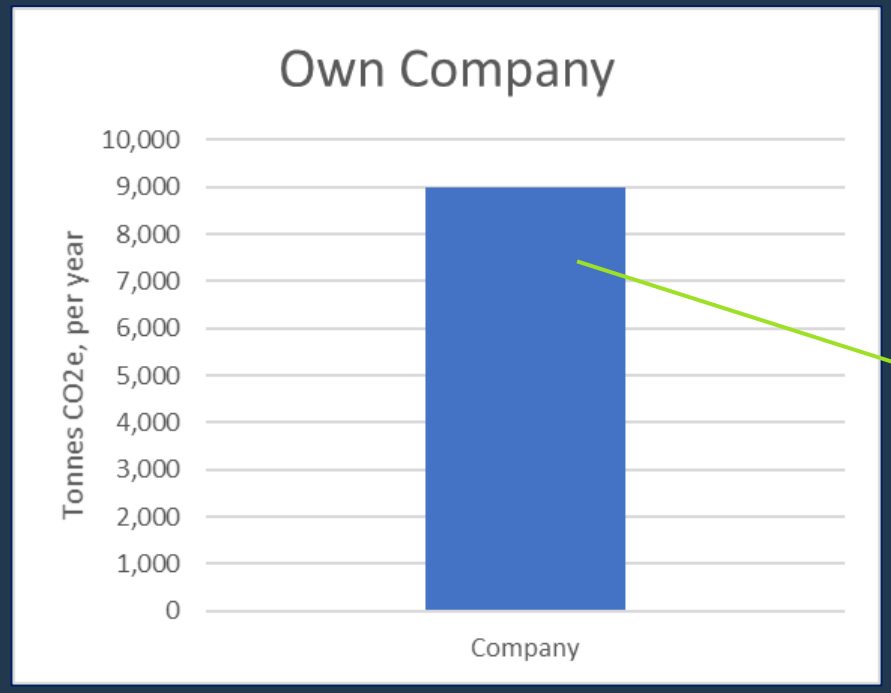
Net zero carbon – operational energy: *"When the amount of carbon emissions associated with the building's operational energy on an annual basis is zero or negative. A net zero carbon building is highly energy efficient and powered from on-site and/or off-site renewable energy sources, with any remaining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

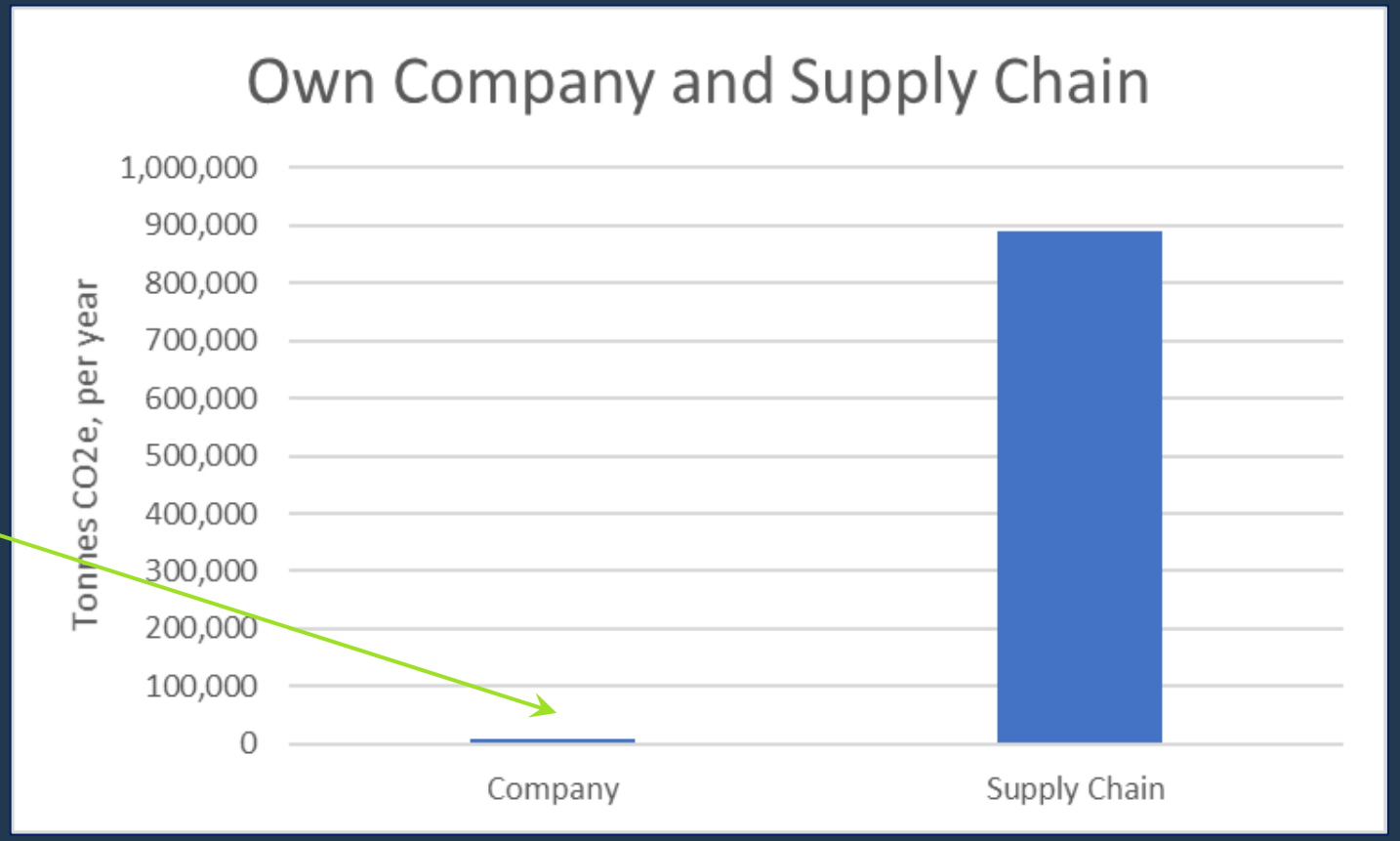




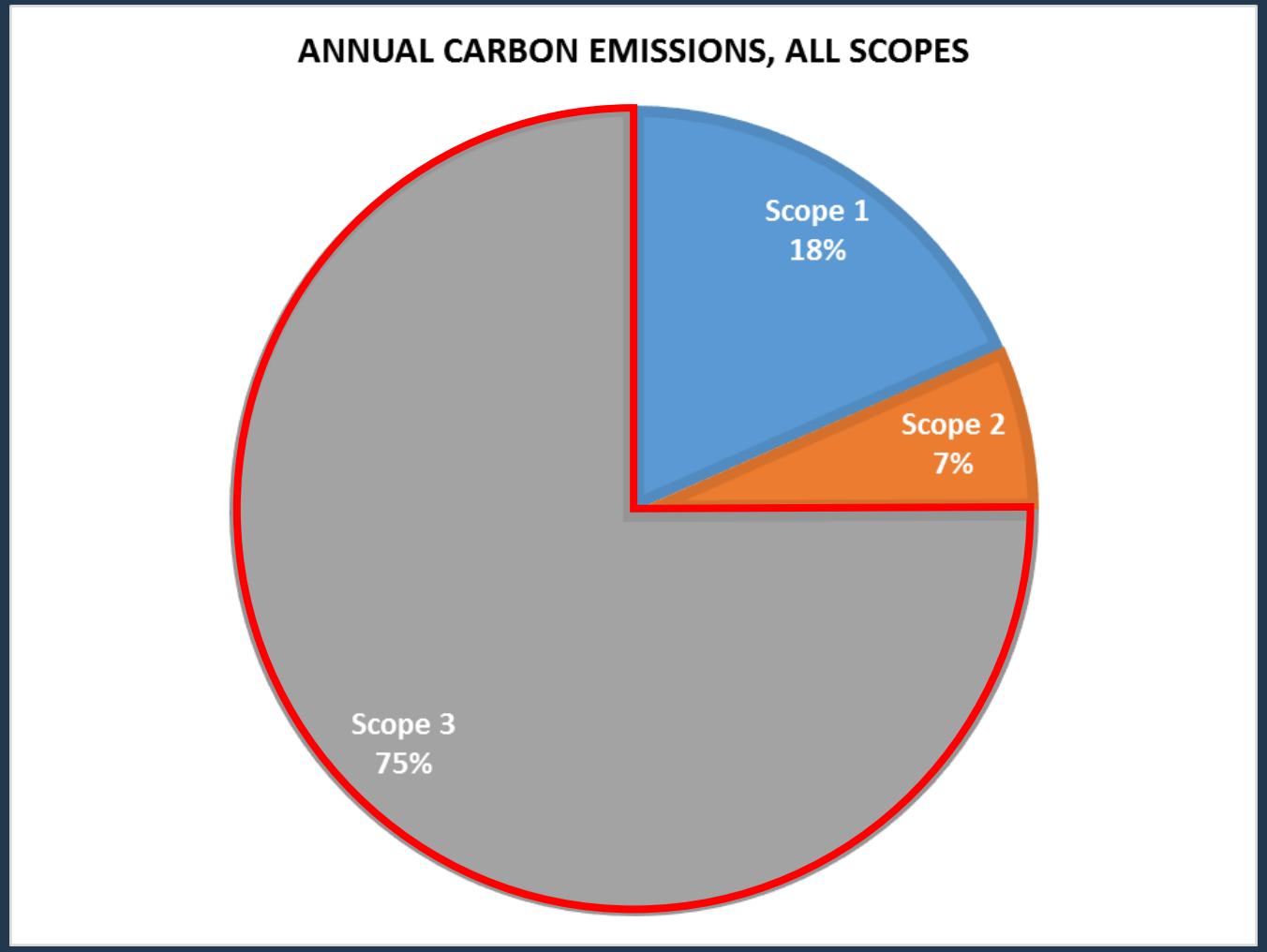
The Scale of Carbon in the Supply Chain

Example of Scale: a Tier 1 Contractor

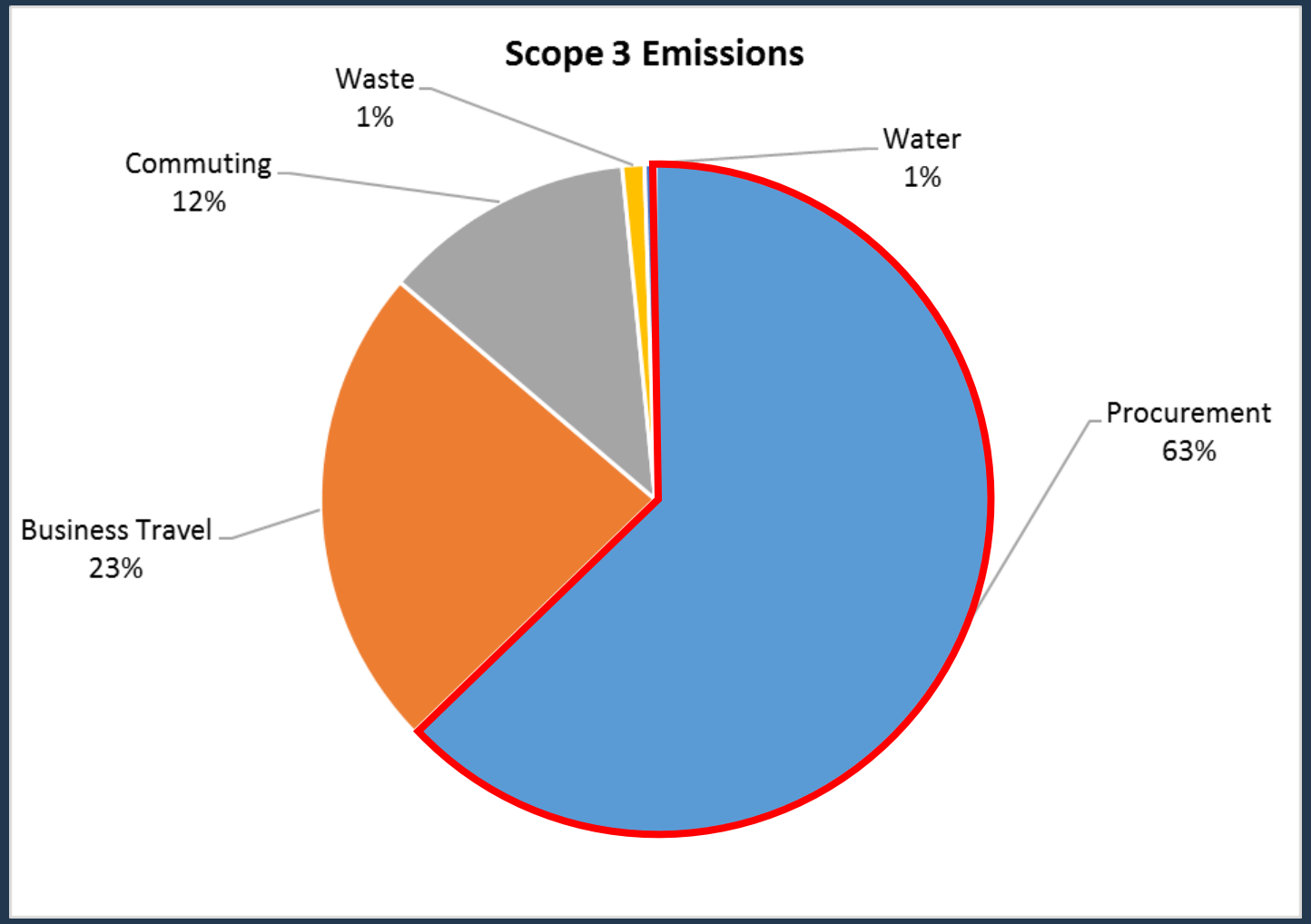




Example of the Scale of the Supply Chain for Carbon: Estates Organisation



Scope 3 Carbon: Supply Chain & Procurement



Where does Carbon come from?

Sources of Carbon Emissions from your Organisation

Your Suppliers

- *Materials, goods and services,*
- *Capital goods,*
- *Delivery*
- *Utilities: electricity, waste and water*
- *Business travel*

"Embodied" Carbon
"Capital" Carbon - CapCarb

Your Business

- *Fuel and energy in company facilities*
- *Vehicles and plant.*
- *Chemical / biological processes, and*
- *Fugitive emissions*

"Operational" Carbon - OpCarb

Your Client

- *In-use emissions from running the building / asset;*
- *End-of-life treatment*
- *Downstream distribution*

"End User" Carbon UseCarb

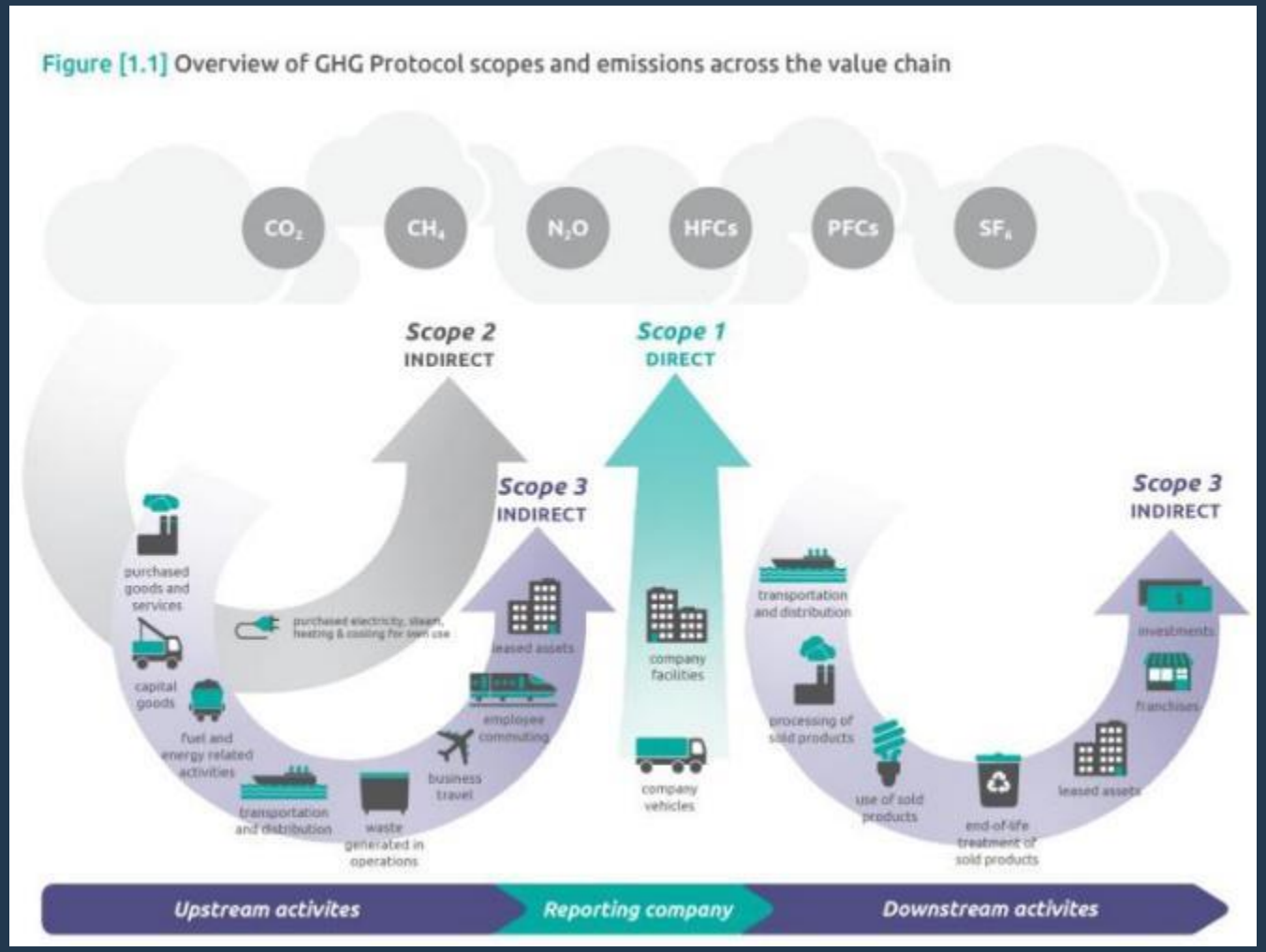
"Upstream Scopes 2 & 3 (Indirect)

Company's Scope 1 (Direct)

Downstream Scope 3 (Indirect)

SUPPLY CHAIN SUSTAINABILITY SCHOOL

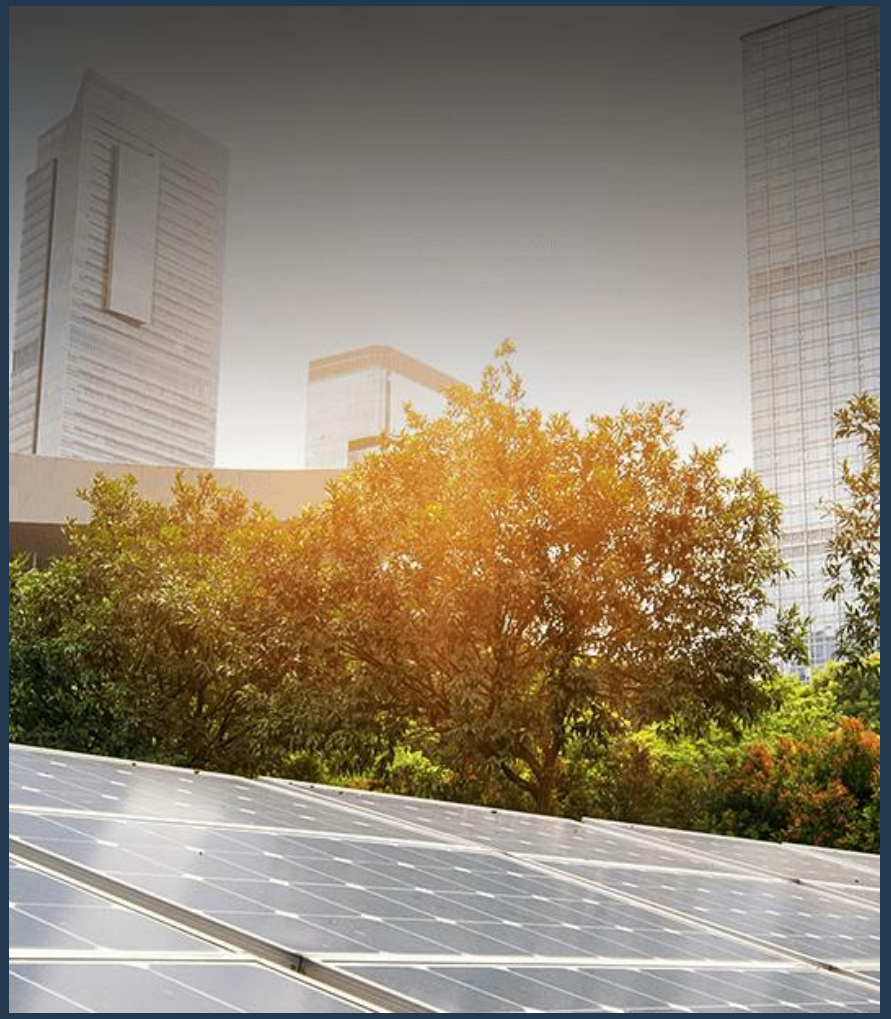
Operational Boundaries – Scopes



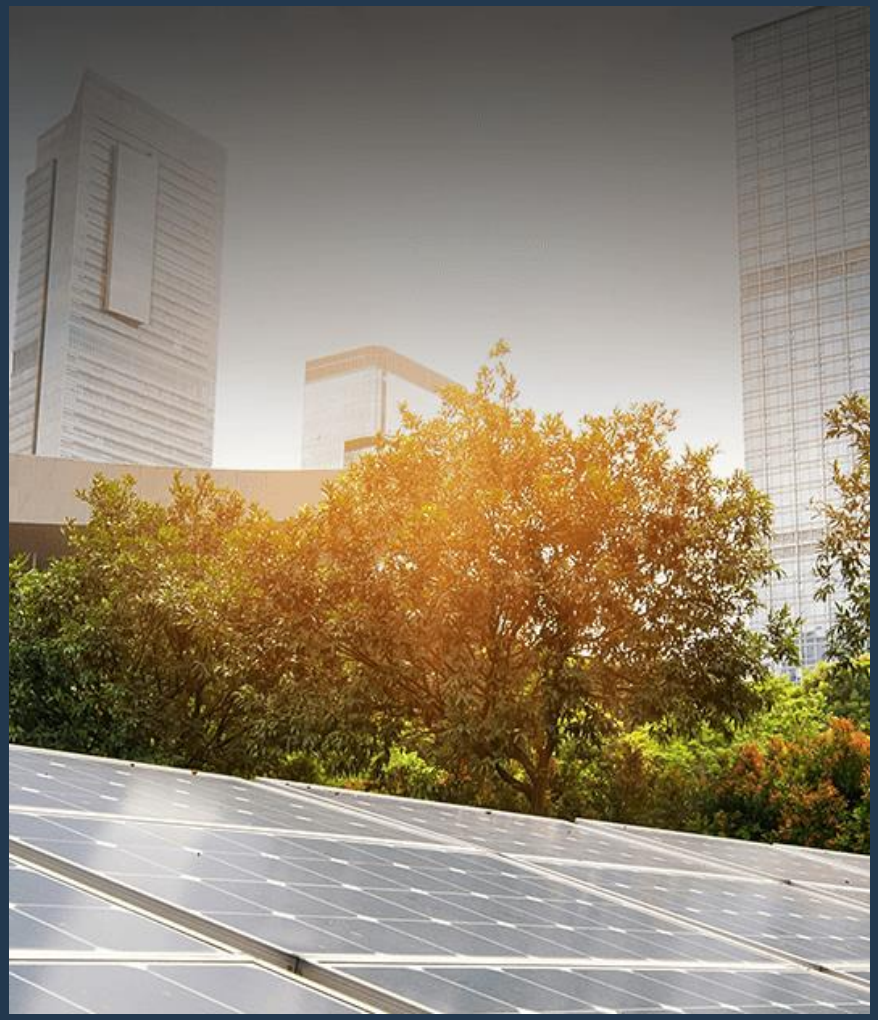
- **Direct emissions** are emissions from sources that are owned or controlled by the reporting company
- **Indirect emissions** are emissions that are a consequence of the activities of the company but occur at sources owned or controlled by another company

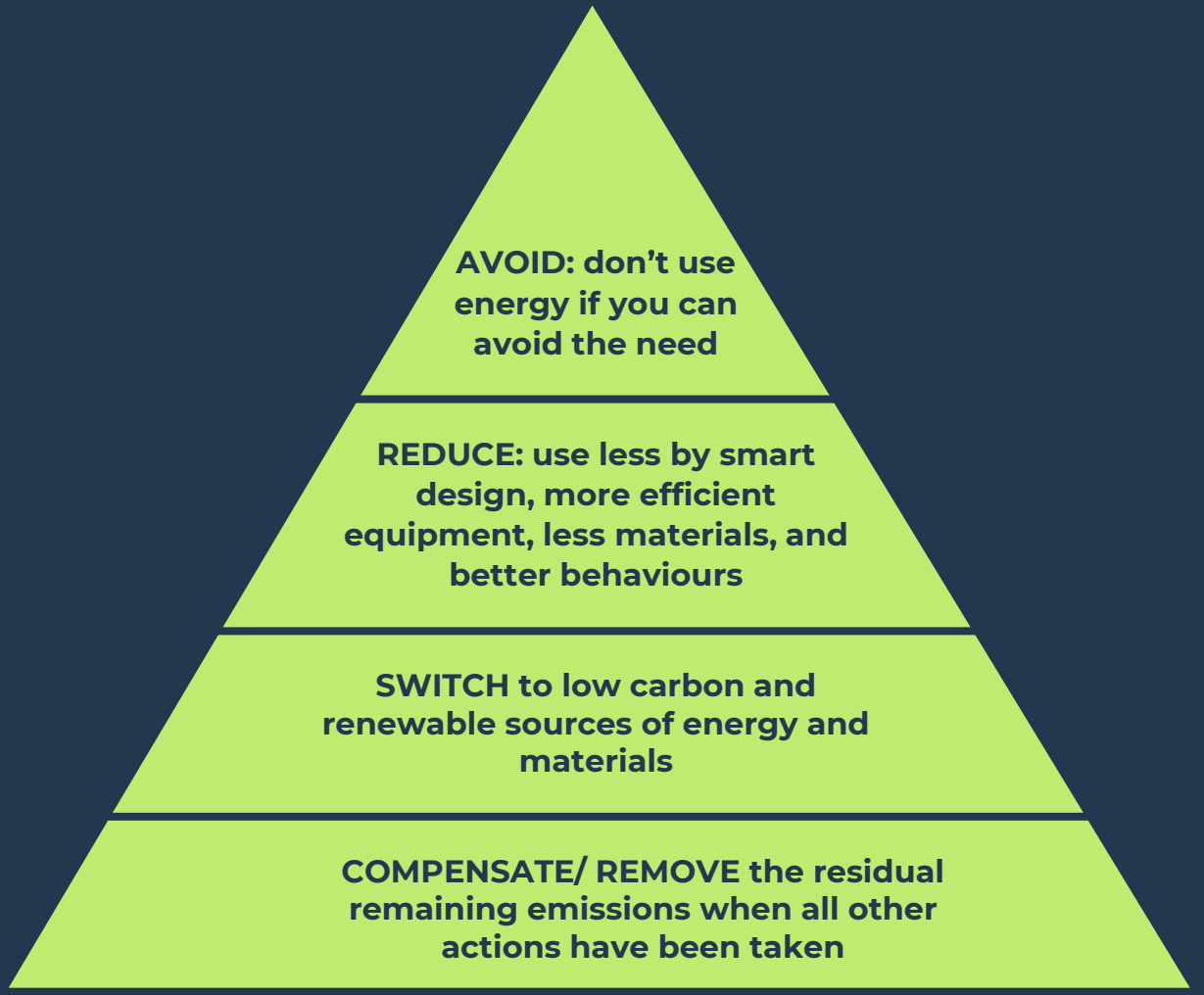
How do we go about it?

- **Carbon hierarchy**
- **Whole-life approach**
- **Options and actions**
- **Stakeholder engagement**
- **Skills and competences**
- **Measuring and optioneering**

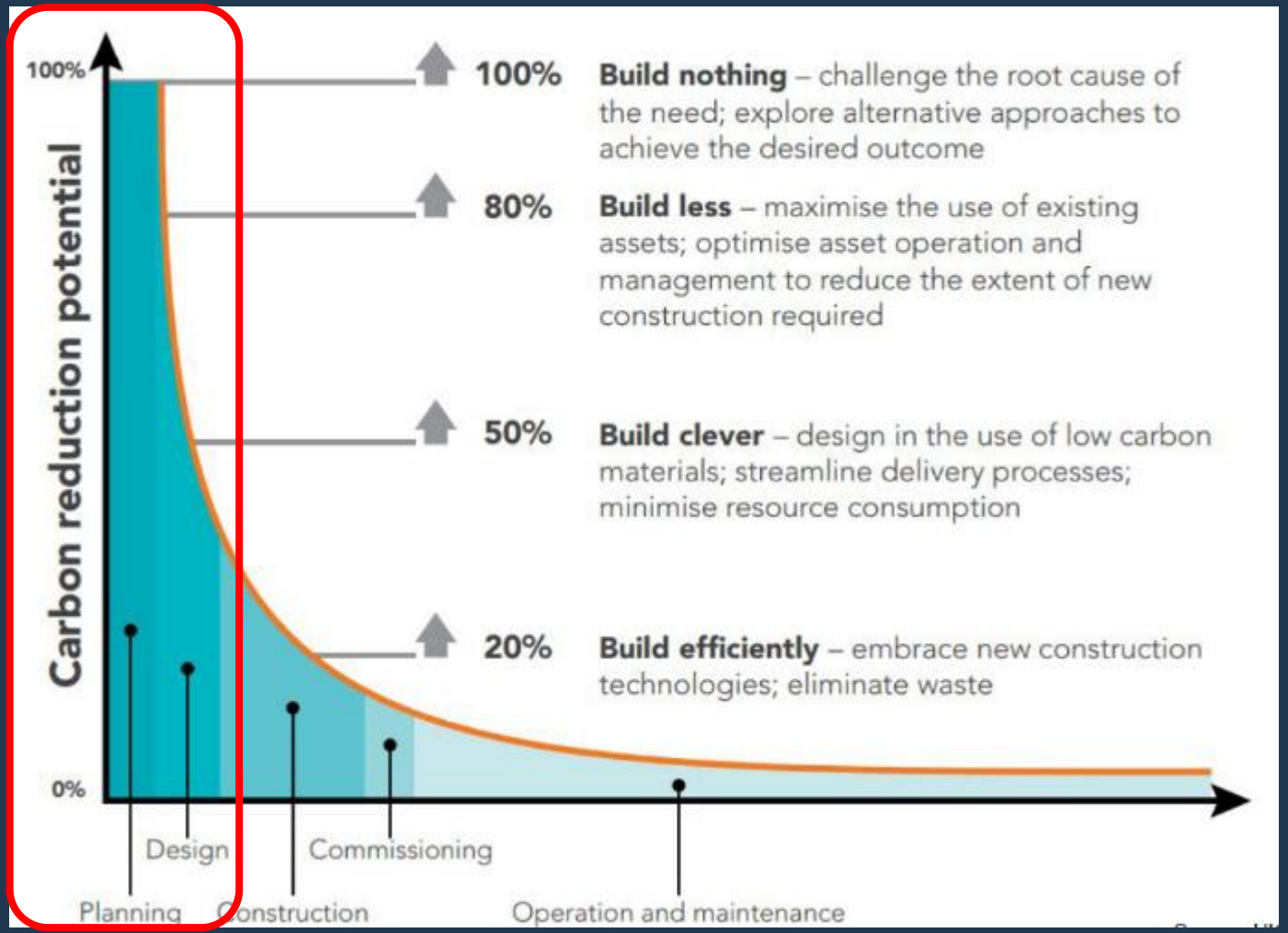


Hierarchy




AVOID: don't use energy if you can avoid the need
REDUCE: use less by smart design, more efficient equipment, less materials, and better behaviours
SWITCH to low carbon and renewable sources of energy and materials
COMPENSATE/ REMOVE the residual remaining emissions when all other actions have been taken

UKGBC


100%
Carbon reduction potential
0%
100%
Build nothing – challenge the root cause of the need; explore alternative approaches to achieve the desired outcome
80%
Build less – maximise the use of existing assets; optimise asset operation and management to reduce the extent of new construction required
50%
Build clever – design in the use of low carbon materials; streamline delivery processes; minimise resource consumption
20%
Build efficiently – embrace new construction technologies; eliminate waste
Planning
Design
Construction
Commissioning
Operation and maintenance

Holistic life cycle approach

Design → Materials and Construction → In Use → Maintenance & Refurb → Circular Economy

Consider both **mitigation** and **adaptation** in your design, development and delivery

Case Study – Retrofitting: the Art of the Possible

1950's Semi-D Residential House, Retrofit. **A range of energy and water-efficient approaches**, materials and equipment installed:

- **Insulation**: walls, floors, roofs, loft, exterior walls cavities filled, high performance double-glazed windows
- **Underfloor space heating** & hot water: woodburner with back boiler, solar thermal panels, condensing boiler with weather compensating controls and thermal store
- **Energy**: Solar PV generated 3,100kWh in 1st year
- **Ventilation**: mechanical ventilation heat recovery recovers 90% of heat
- **Natural light**: sunpipes in toilet, landing, dining areas
- **Energy-efficient appliances**: LEDs, passive infra-red motion detectors
- **Water-efficient appliances**: dual low flush toilets, rainwater harvesting for toilets, clothes, gardening
- Energy use before: 133 kWh/m^2.yr electricity + gas
- Energy use after: 37 kWh / m^2.yr electricity = 72% reduction

Carbon Design Options

Design, energy sources, equipment and transport

- **Passive approach** to minimise operational energy use: orientation, natural and demand-responsive systems for heating, cooling, ventilation and lighting; thermal mass for temperature regulation; green roofs
- **Energy- and water-efficient equipment**, e.g., HVAC, IT, LED, sanitaryware – spec to the right level needed
- **Renewable energy sources**: land / space for heat pumps, solar panels, CHP, etc
- **Low carbon in the build phase**: welfare cabins, plant & equipment

Carbon Design Options

Design, energy sources, equipment and transport

- **Consider infrastructure**: provision of charging points for EV, access to public transport, suitable spaces for cyclists...
- **Allow for future needs** including ease of maintenance access, as well as change of purpose
- **Servitisation** – consider if a service model is appropriate
- **Design for Adaptation to a changing climate**: SUDS, Green roofs and walls, greywater and rainwater harvesting capability

Carbon Design Options

Products, materials, maintenance and upgrade

- **Use less material in absolute terms** – work with design and procurement teams
- Switch to **materials with lower carbon impacts**, either the same material or a different material – encourage innovation
- **Increase reuse and the recycled content** of materials – engage suppliers
- **Eco-design** to enable easier maintenance, repair and upgrade later in the asset's lifetime – DfMA for 'future proofing'

Carbon Design Options

Products, materials, maintenance and upgrade

- **Reduce waste and promote circular economy** – leaner processes
- **Training** on efficient ordering, storage and use of materials
- **Pursue offsite production** where possible: lower environmental impacts as well as output efficiency, reduced safety risks
- **Lean standardisation thinking**: modularise as far as possible

Carbon Design Options

Behaviours and ease of use

- **Building (Energy) Management Systems** – ease of control and adjustment to set at right levels
- **Switches & sensors** – to automate as far as possible and avoid undesired and unintended behaviours and machine idling
- **Training** on how to use equipment efficiently
- **Metering** – half-hourly submeters to identify peak / hotspot loads to enable optimisation and reporting

Its not just about reducing emissions

Mitigation

- Sustainable transportation
- Energy conservation
- Thermal mass / sinks for temperature regulation
- Insulation and heat recovery systems
- Renewable energy
- Energy & carbon efficient materials and products
- Improve vehicle fuel efficiency
- Capture and use landfill & digester gas

- Geothermal
- Green roofs
- Solar thermal
- District heating
- Building design for natural light & ventilation
- Tree planting & care
- Water harvesting & conservation
- Local food production

Adaptation

- Infrastructure upgrades: SUDS, sewers & culverts
- Residential programs: sewer backflow & downspout disconnection
- Health programs and help for vulnerable people
- Emergency & business continuity planning
- Coastal and river bank protection and flood plain maintenance

Mitigation: the globally responsible thing to do

Actions that reduce the emissions that contribute to climate change.

Adaptation: the locally responsible thing to do

Actions that minimize or prevent the negative impacts of climate change.

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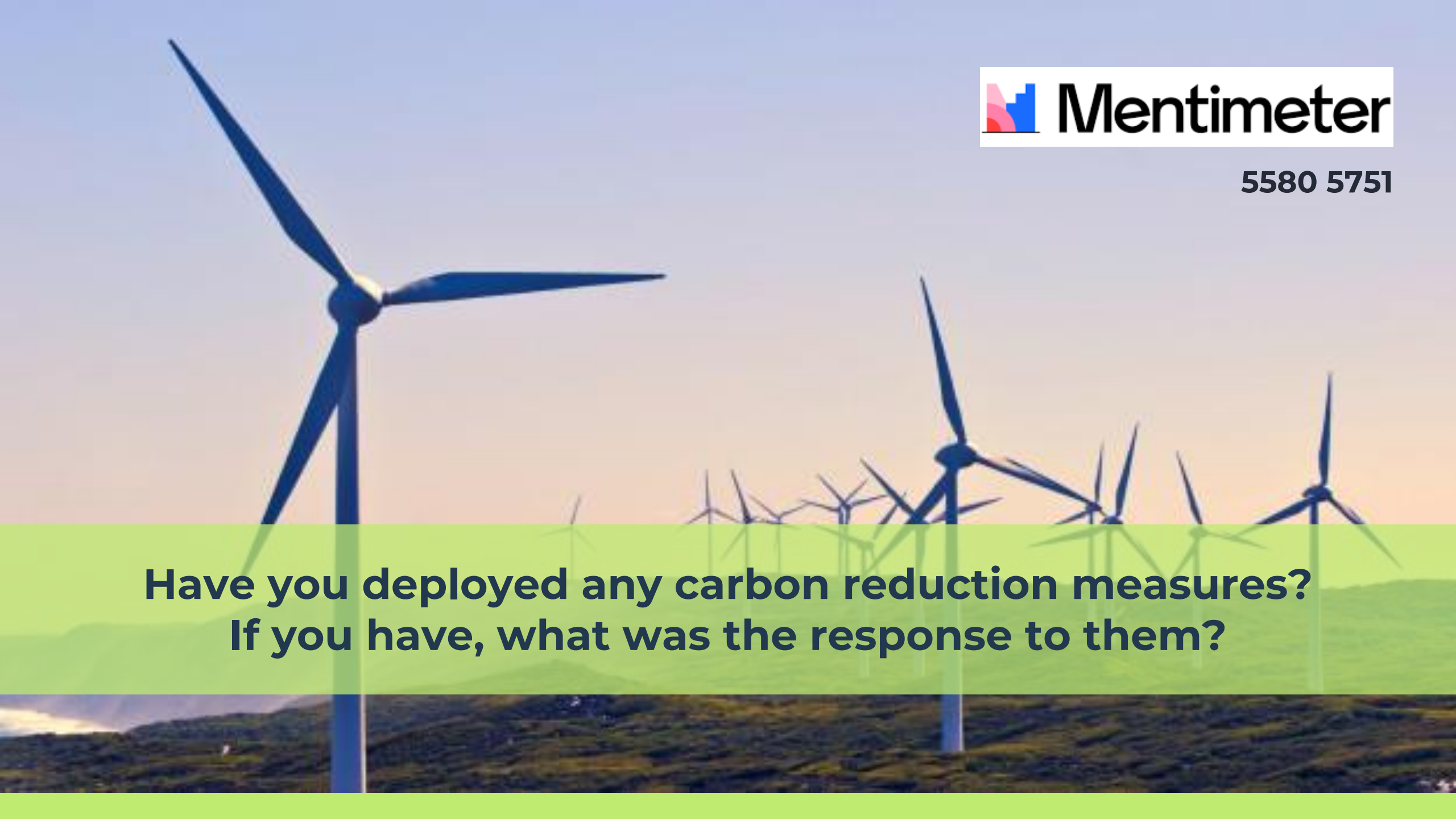
Break for Tea – back in 5 mins


Mentimeter
5580 5751
Have you deployed any carbon reduction measures?
If you have, what was the response to them?

Case Studies

- Coop Bank
- The Forge

Case Study – Cooperative Bank

- The design allows for **natural heating, cooling and lighting**:
  - Fully-glazed **double skin façade** curves around the whole building and **full-height atrium** in its middle
  - **Louvres** at the top of the façade: open in summer to allow warm air trapped between its inner and outer skins to rise up and out of the building; close in winter so the facade can insulate the building
- **Efficient and renewable use of energy and water**
  - **CHP** plant powered by renewable fuel (rapeseed oil) grown on the Co-operative's own farm land
  - **Heat recovery** from IT systems used to heat the building
  - **Energy-efficient LED lighting, IT equipment and lifts**
  - **Greywater and rainwater recycling** for toilet flushing and irrigation
- Predicted 80% less carbon and 50% less energy use than the old head office. Awarded BREEAM "Outstanding" rating.

Case Study – The Forge (105 Sumner St): Landsec

- 139,000 sq ft office development in Southwark
  - Aims to be first commercial building constructed and operated in line with UKGBC's net zero carbon buildings framework
  - Work on both supply chain scope 3 emissions, and operational use
  - Using a platform-led approach to design & construction: P-DfMA, consists of a set of components that can be combined to produce highly customised structures

- The trial had positive results compared to a traditional construction site and techniques:
  - Construction productivity improved by 55%; Installation time 30% less; the final build achieved 33% cost savings
  - Final structure uses less material and less waste, and has an almost 20% reduction in embodied carbon
  - Further savings made in specifications, including high levels of recycled content and cement replacement in the main building materials.
  - Passive design techniques to reduce the energy demand, air source heat pumps for heating and cooling, and solar PV for electricity. Once in operation, these will be run on a 100% renewable electricity tariff.

https://www.futureoflondon.org.uk/2020/11/23/achieving-net-zero-case-study-zero-carbon-commercial-development/

Stakeholders for Carbon Reduction

Mentimeter

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Who needs to be involved in reducing carbon?

Stakeholders


data

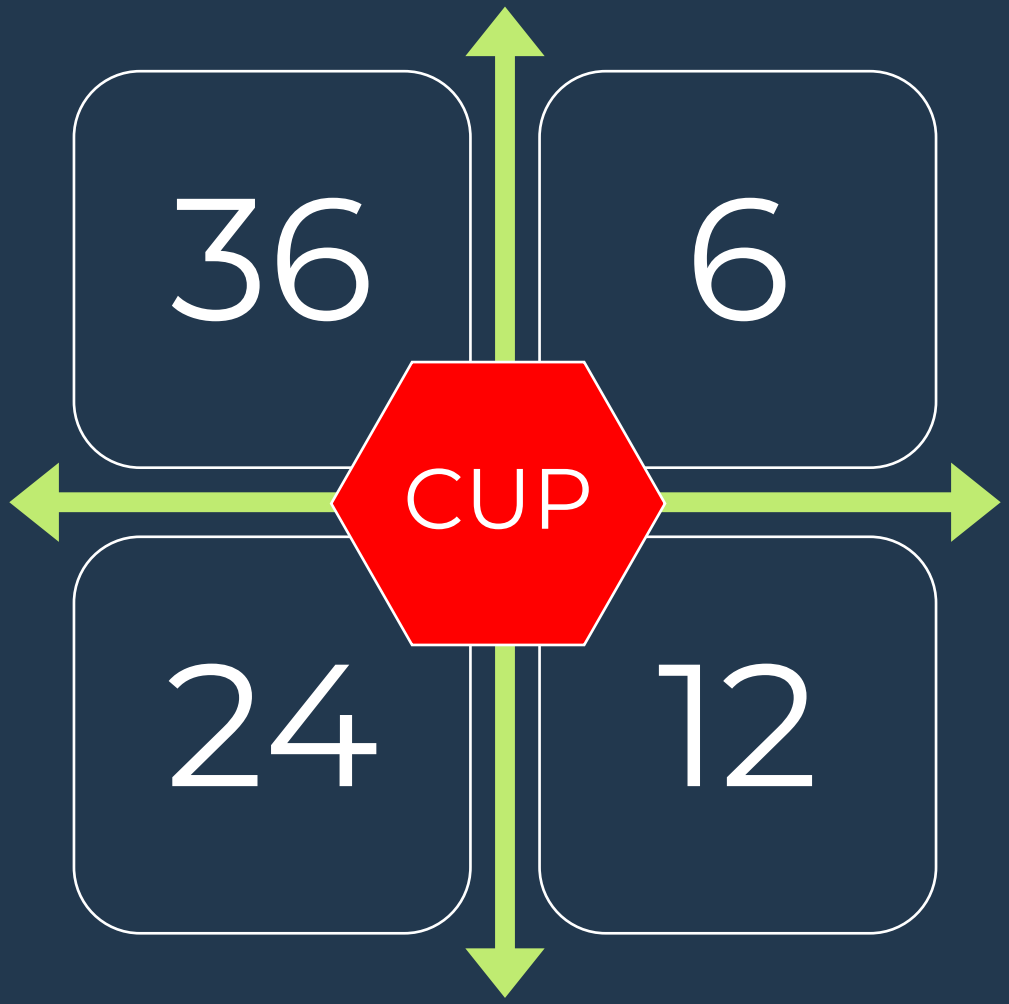
How do you compare?...

Activity: Better or Worse Bingo!

SUPPLY CHAIN SUSTAINABILITY SCHOOL

Which is better for carbon: reusable or disposable cups?

How many times do you need to use a reusable cup before the carbon us less than a disposable cup?



SUPPLY CHAIN SUSTAINABILITY SCHOOL

Mentimeter

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How many times do you need to use a reusable cup before carbon use is less than a disposable cup?

24 times. Easy!

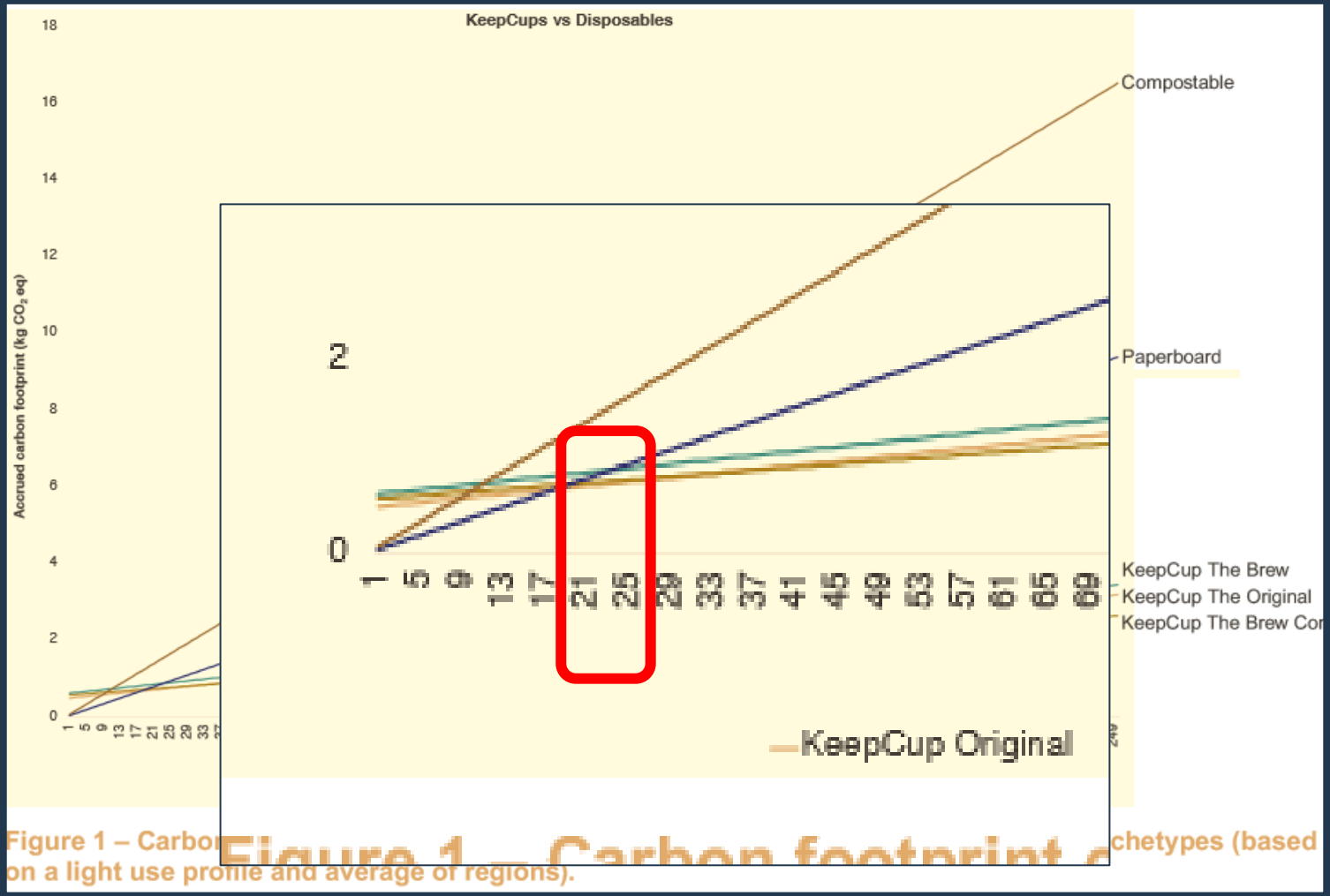


Figure 1 – Carbon footprint archetypes (based on a light use profile and average of regions).

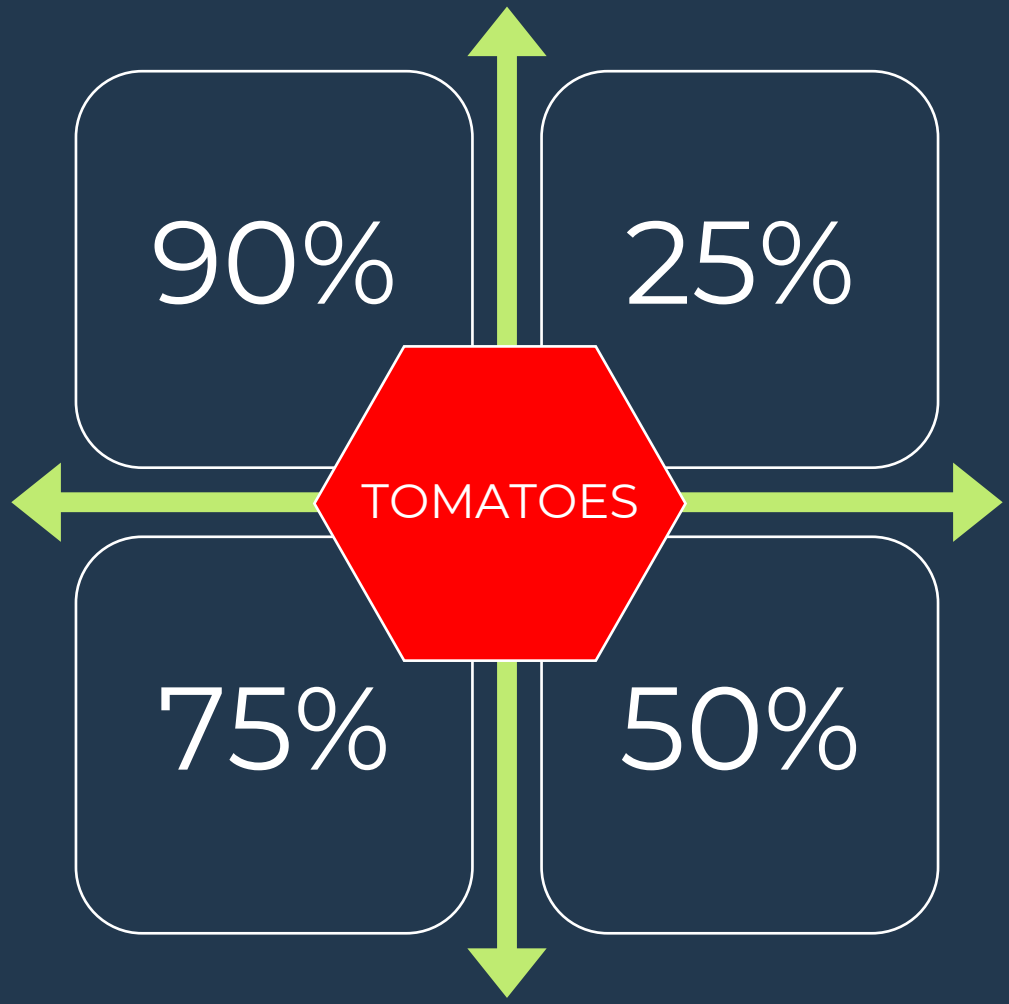
Figure 1 – Carbon footprint archetypes (based on a light use profile and average of regions).

SUPPLY CHAIN SUSTAINABILITY SCHOOL

Which is better for carbon: heated tunnel or non-heated tunnel?

Vs.

How much less carbon is emitted when tomatoes are grown without heating than with (for lifecycle)?



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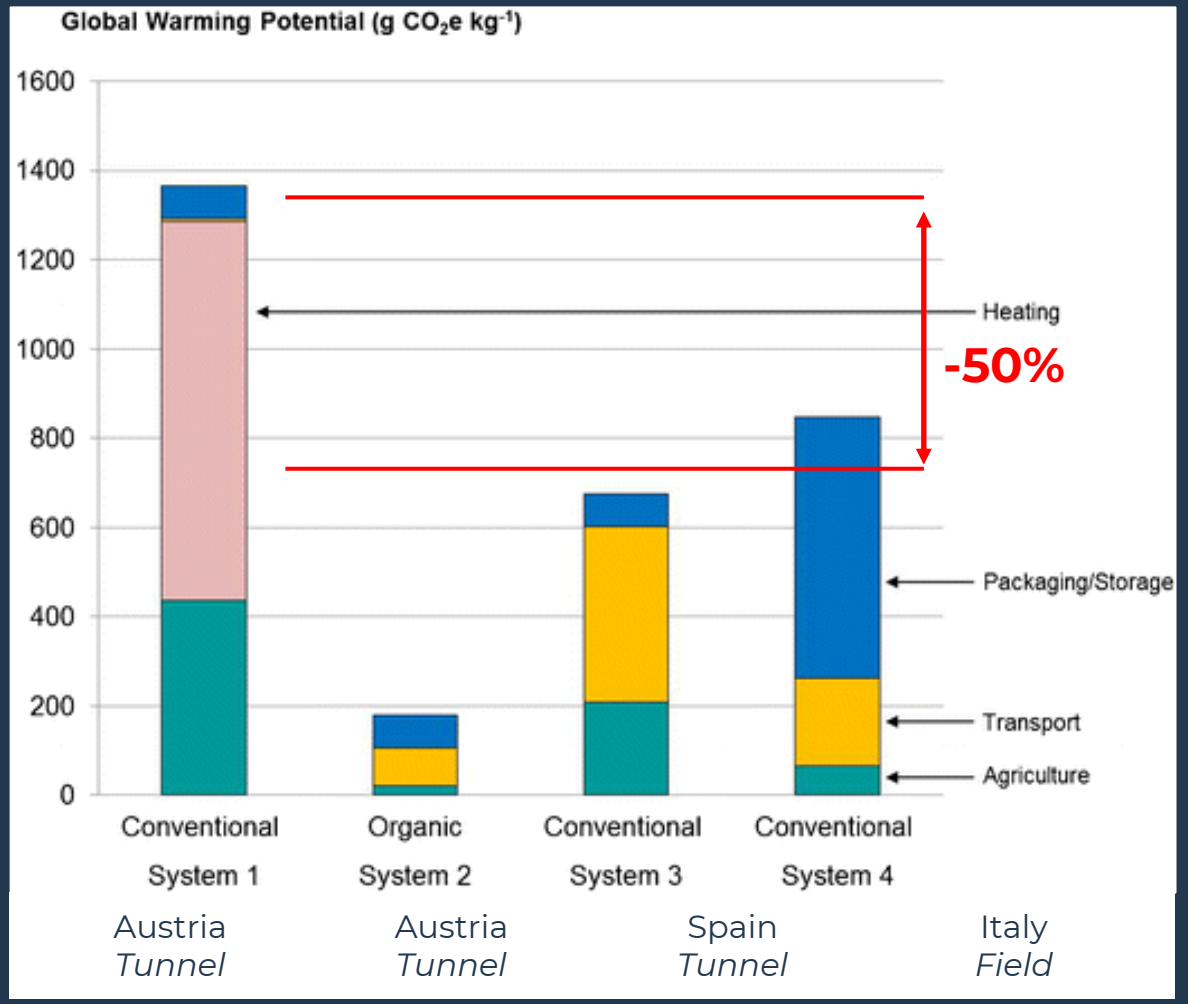
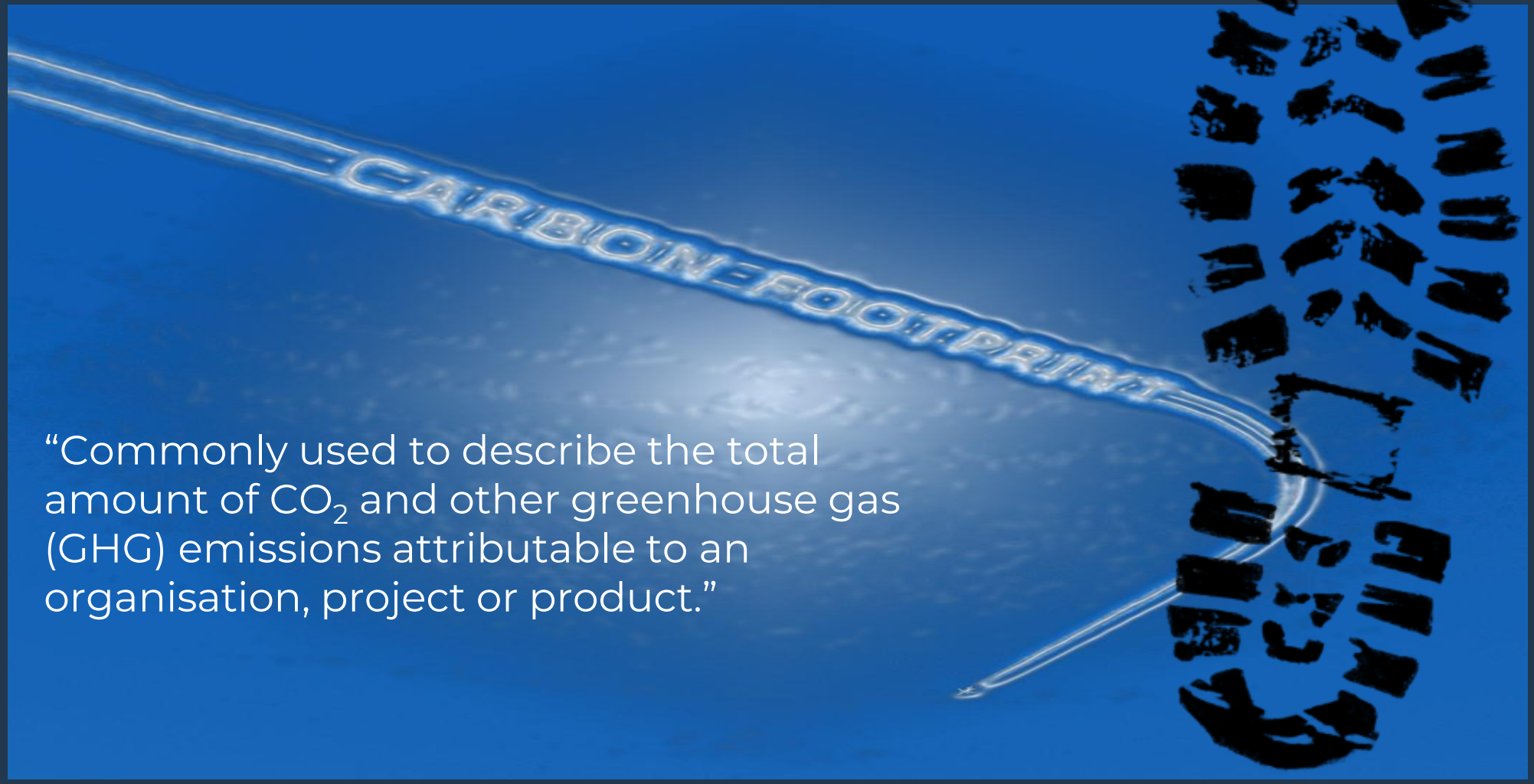


Process for Designing for Carbon Reduction

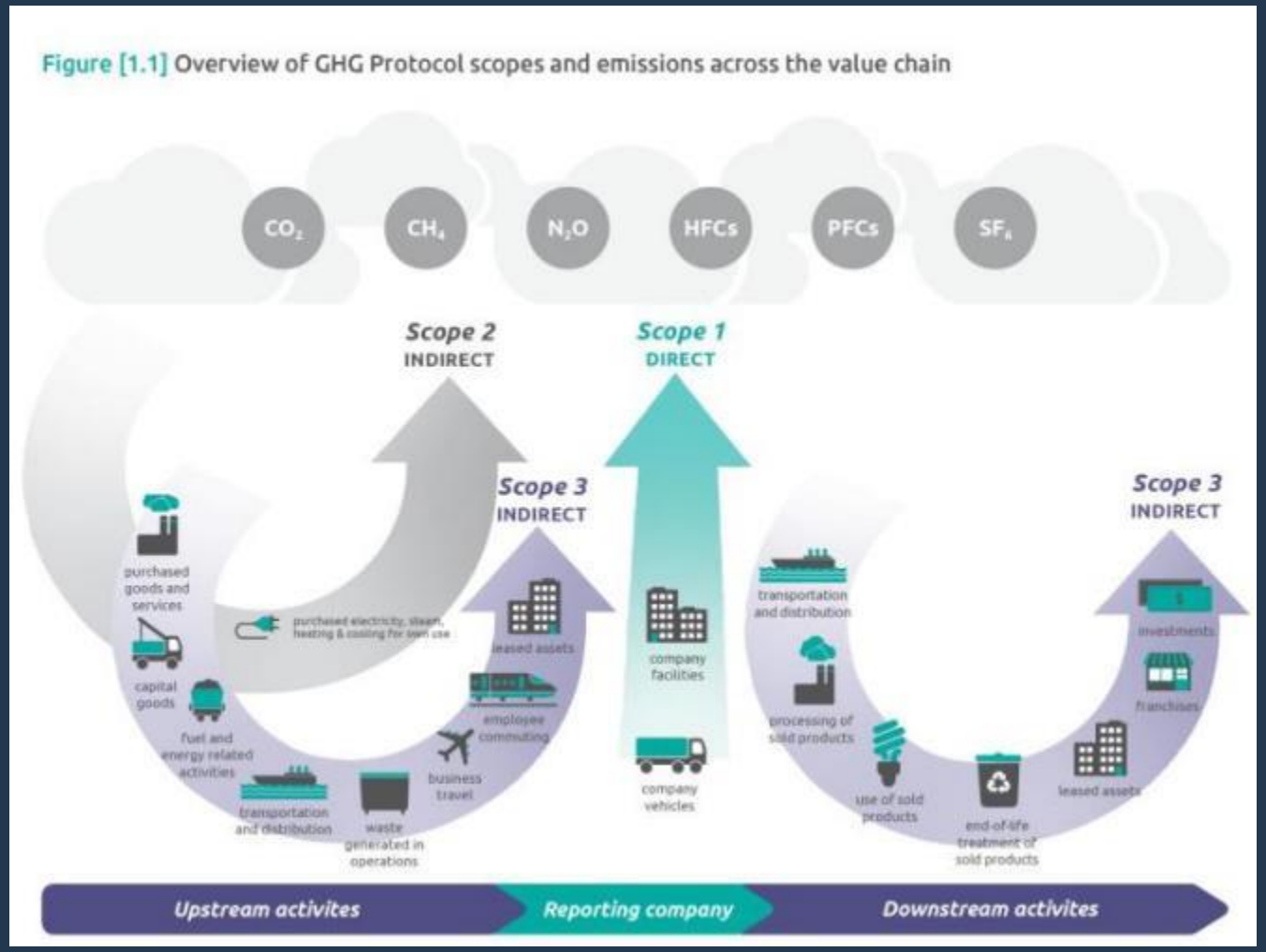
Process for designing for carbon reduction

What is Carbon Footprinting?



"Commonly used to describe the total amount of CO_2 and other greenhouse gas (GHG) emissions attributable to an organisation, project or product."

Operational Boundaries – Scopes



- **Direct emissions** are emissions from sources that are owned or controlled by the reporting company
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Boundaries for your Organisation and sources of carbon

Your Suppliers

- *Materials, goods and services,*
- *Capital goods,*
- *Delivery*
- *Utilities: electricity, waste and water*
- *Business travel*

Your Business

- *Fuel and energy in company facilities*
- *Vehicles and plant.*
- *Chemical / biological processes, and*
- *Fugitive emissions*

Your Client

- *In-use emissions from running the building / asset;*
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- *Downstream distribution*

"Embodied" Carbon
"Capital" Carbon - CapCarb

"Operational" Carbon - OpCarb

"End User" Carbon UseCarb

"Upstream Scopes 2 & 3 (Indirect)

Company's Scope 1 (Direct)

Downstream Scope 3 (Indirect)

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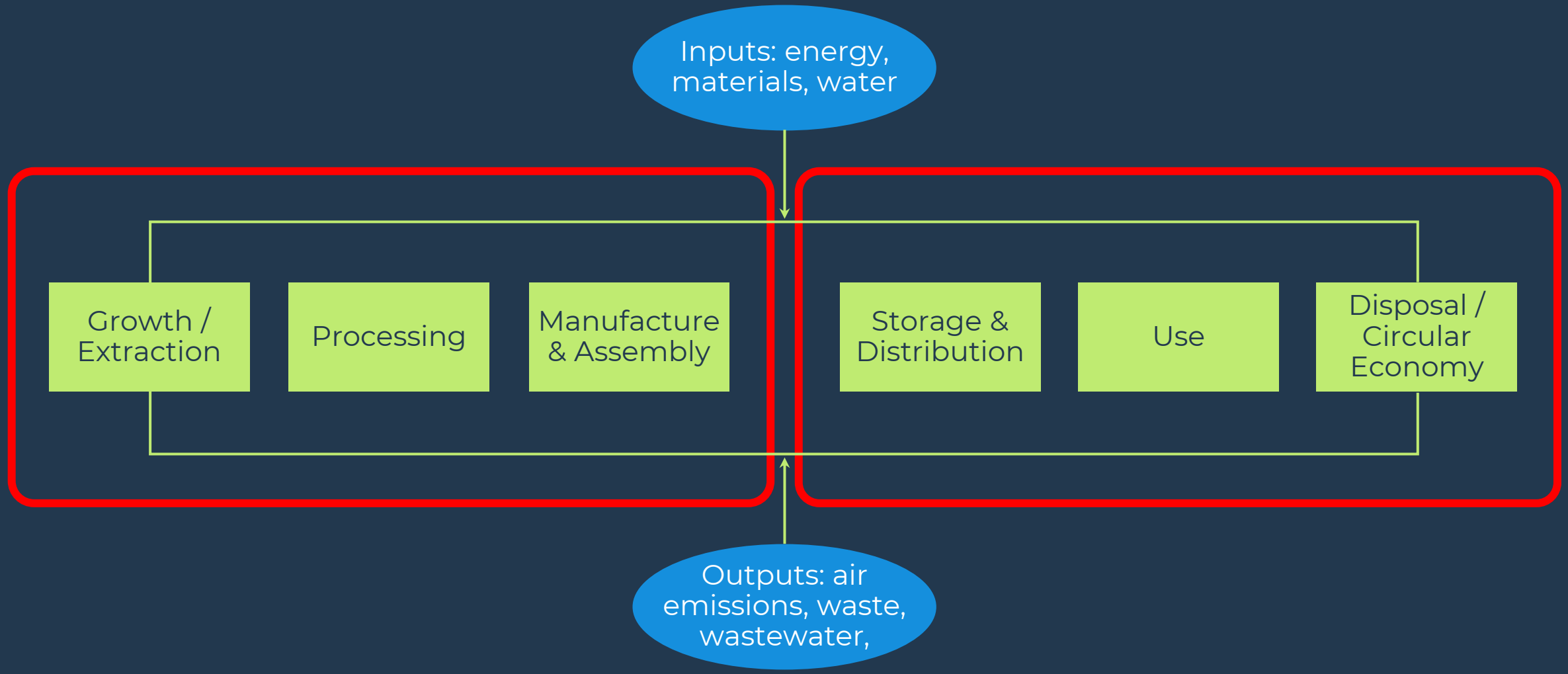
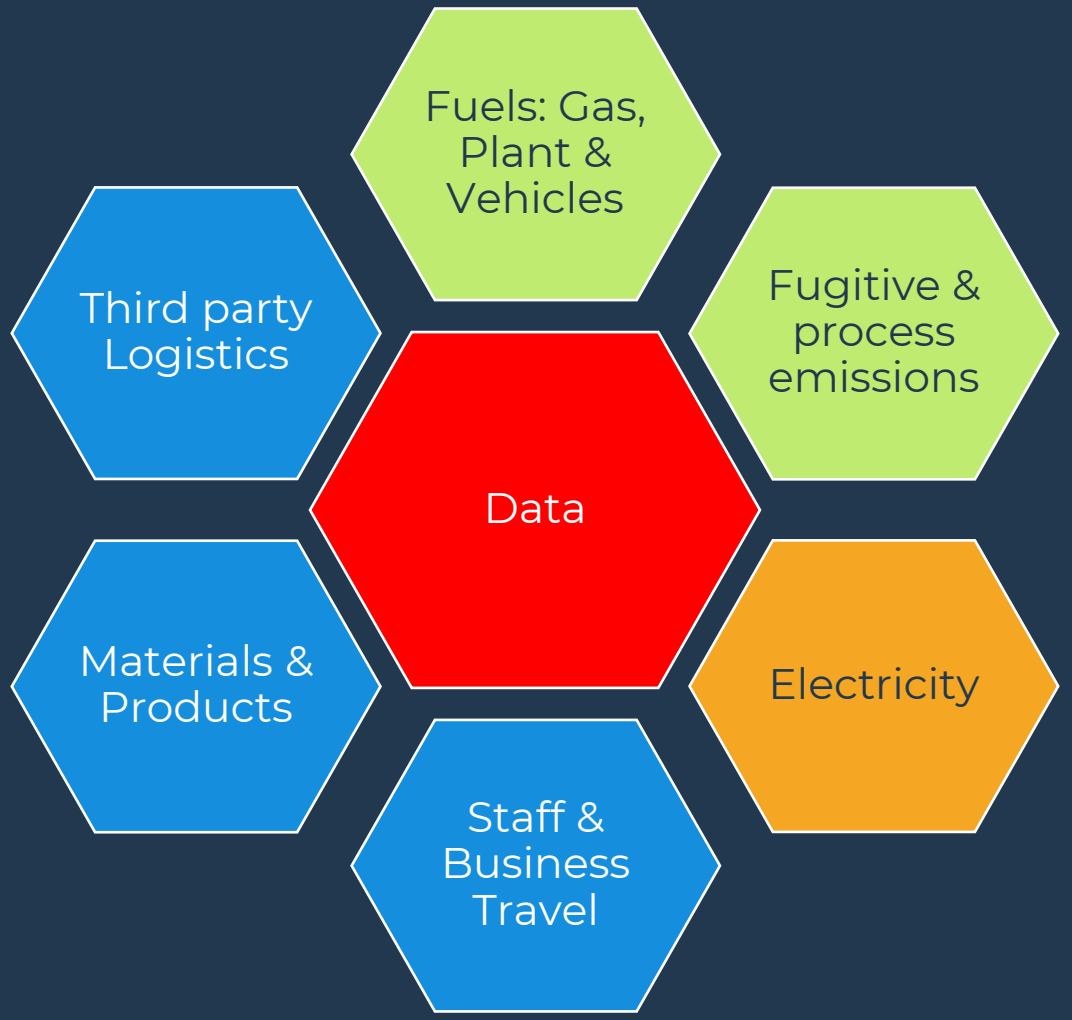
Product Boundaries



Where does Activity Data come from



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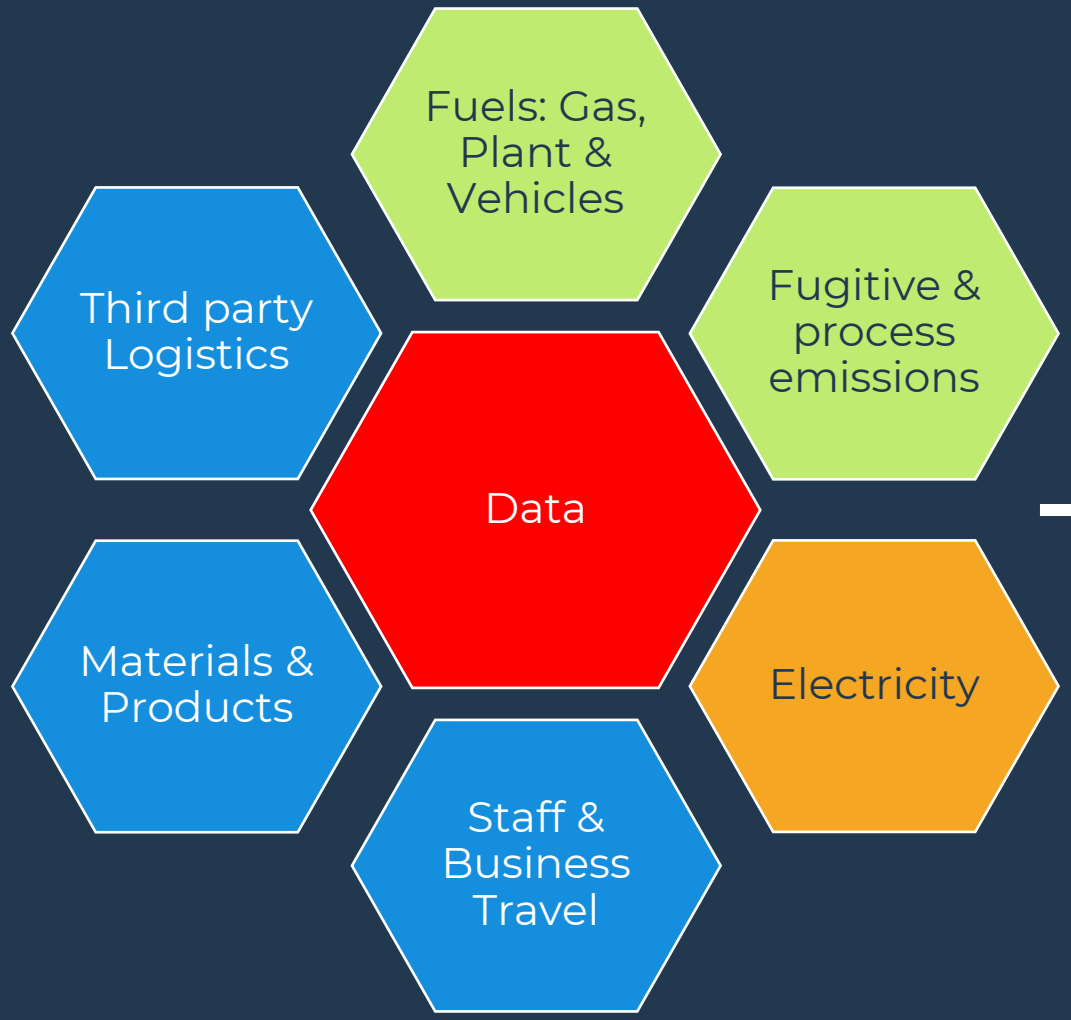


Kinds of Data

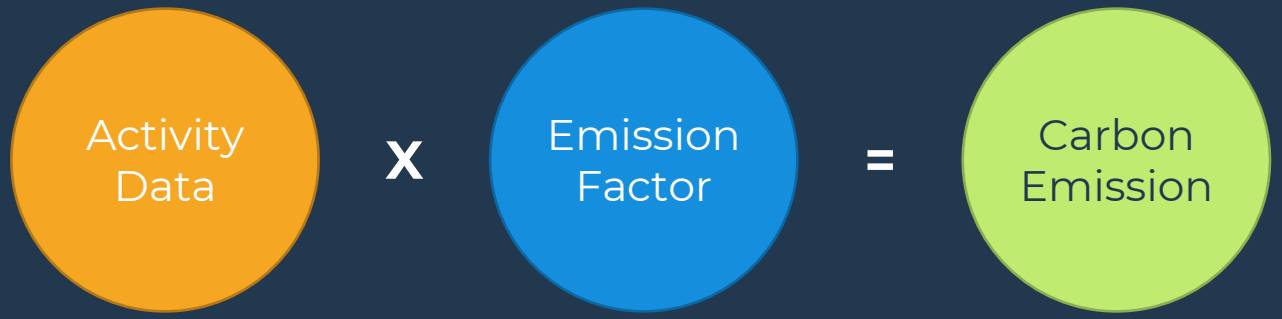
- Litres of fuel (diesel, LPG…)
- Litres of refrigerant
- kWh of electricity
- Mileage travelled
- Tonnes, m^3 of materials

Where the Data is

- Fleet
- Estates
- HR / Travel agent
- Procurement
- Suppliers

How to calculate a carbon footprint

- **A carbon footprint is**



- **For example**

- **$KgCO_2e$ ("equivalent")** takes into account all the main GHGs emitted: CO_2, CH_4 and N_2O, etc.
- Think about **units of measurement** and converting between them: factors of a thousand

Some Fundamentals- Emissions Factors Comparing Power Sources and Modes of Travel

1 kWh grid electricity =

0.291 kg CO_2e

1 kWh red diesel =

0.336 kg CO_2e

500 p.km by train =

18 kg CO_2e

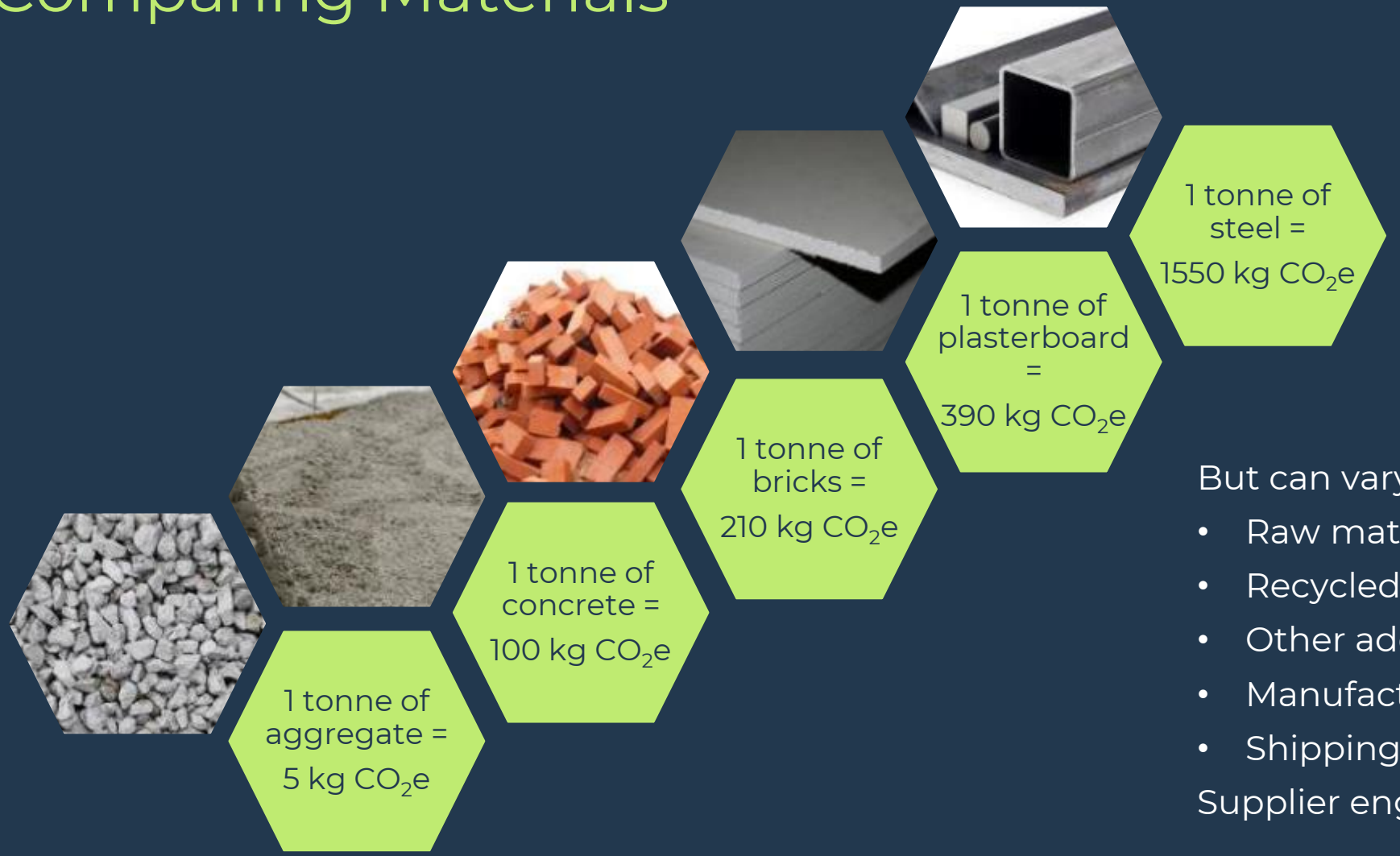
500 km by car =

84 kg CO_2e

500 p.km by airplane =

122 kg CO_2e

Some Fundamentals- Emissions Factors Comparing Materials



But can vary greatly with

- Raw material source
- Recycled content
- Other additives, e.g., PFA, GGBS
- Manufacturing energy source
- Shipping/transport

Supplier engagement and EPDs !

Some fundamentals – Global Warming Potentials: GWP

- It's all relative…
  - CO_2: 1
  - CH_4: 28
  - N_2O: 265
  - SF_6: 23,500
  - HFCs: 4 – 12,400
  - PFCs: 6,630 – 11,100
  - NF_3: 16,100
  - Expressed as "tonnes of CO_2 equivalent"; tCO_2e

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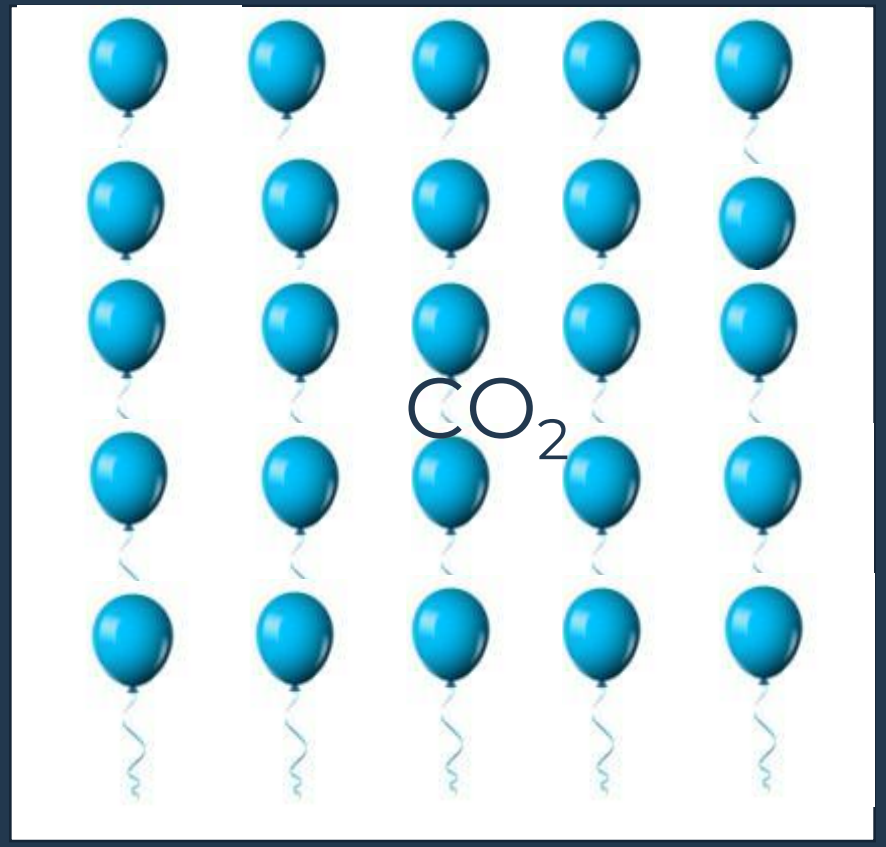
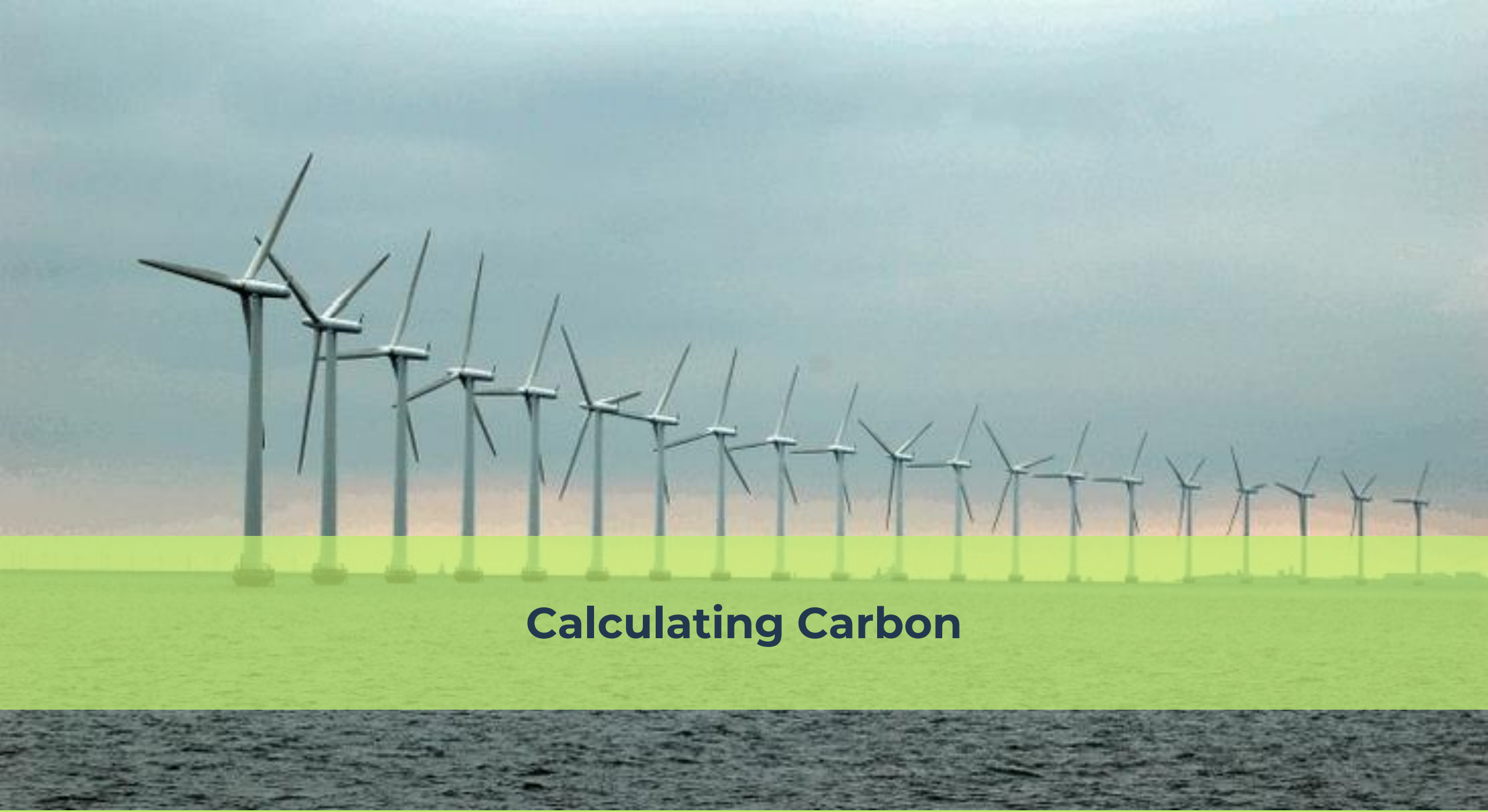




Calculating Carbon

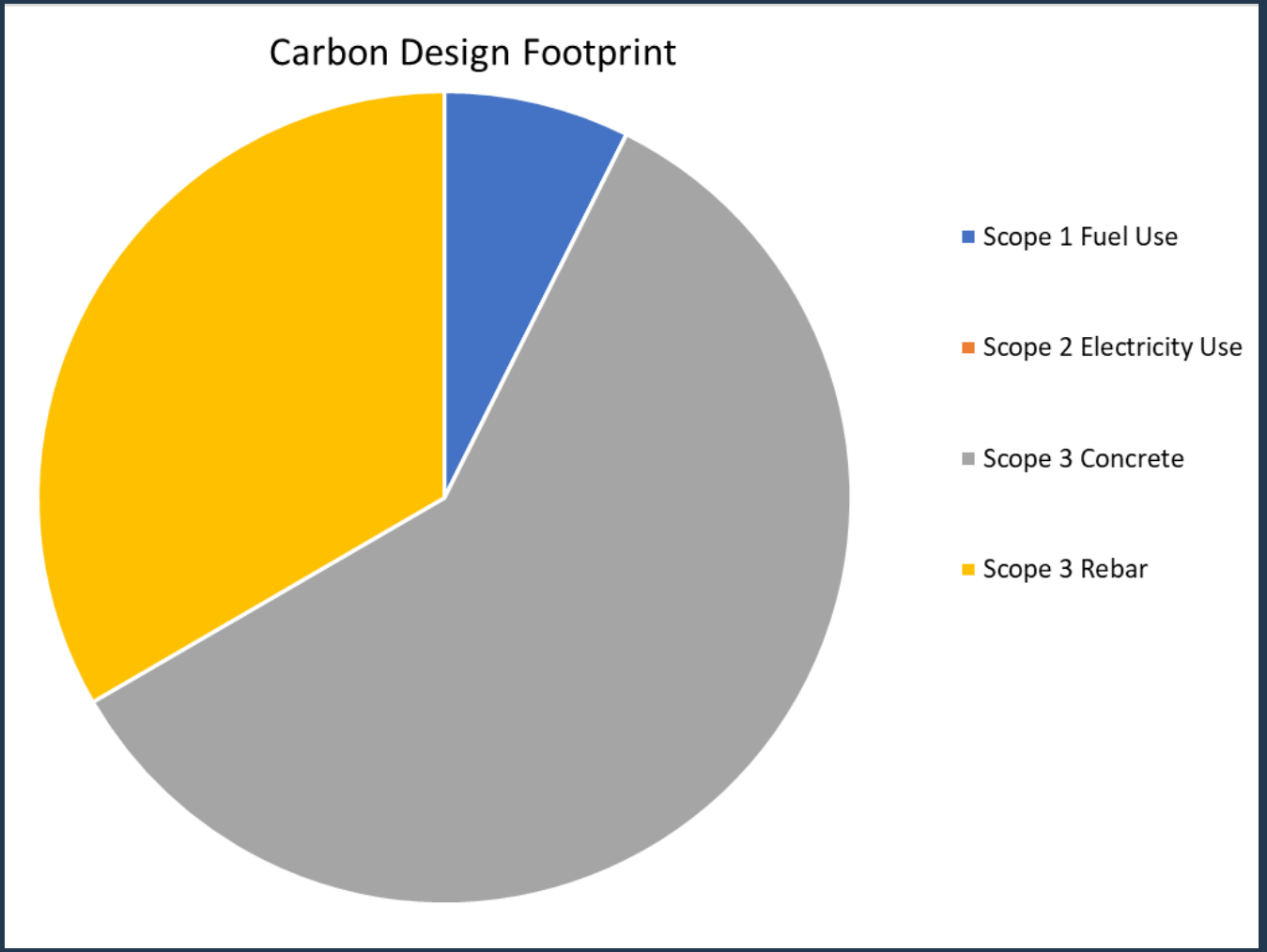
Exercise: Calculate the carbon footprint for design

Calculate the carbon footprint for the design using the data below and emissions factors in the excel sheet and total them under Scopes 1, 2 and 3, as well as the overall total

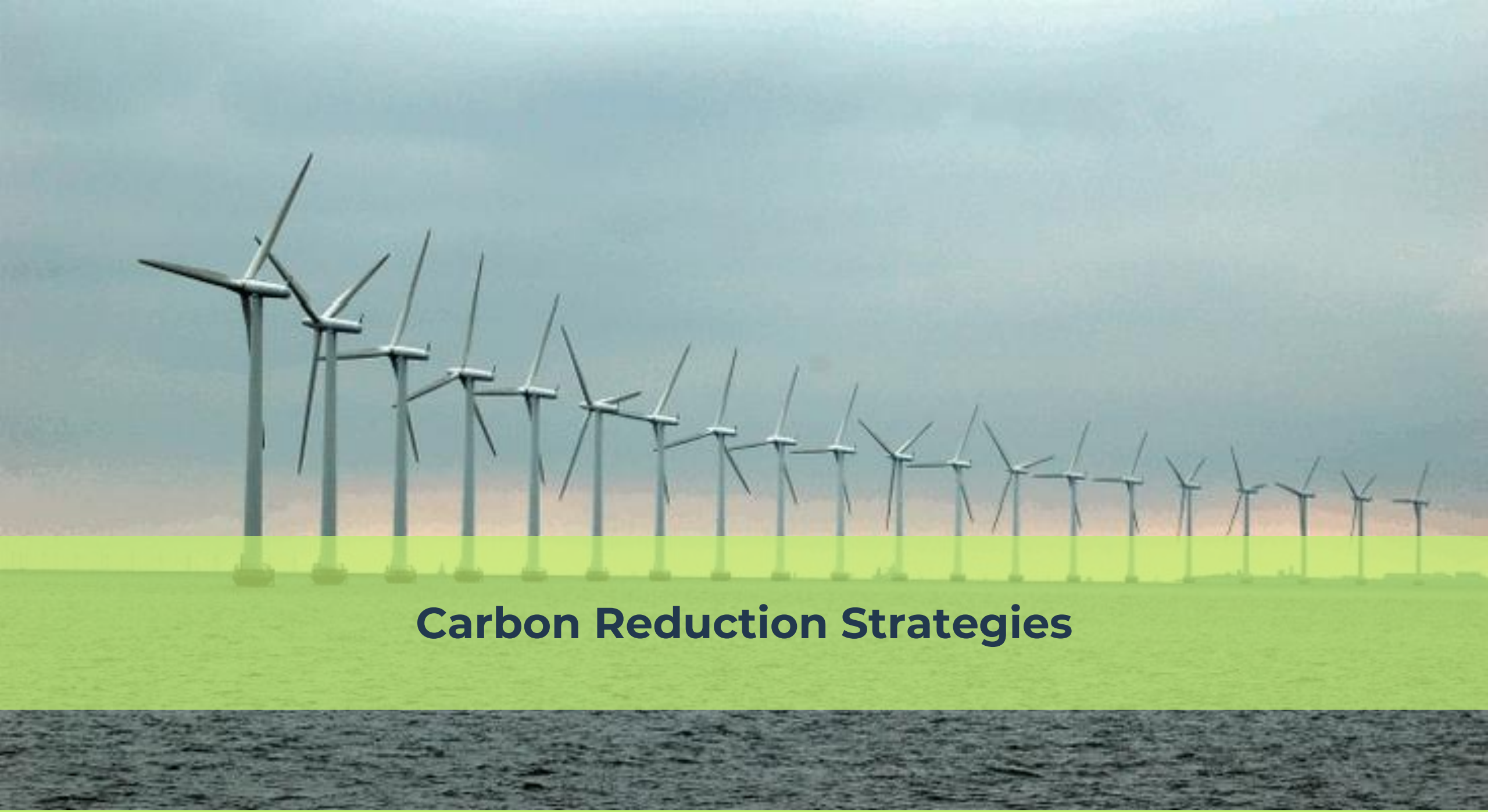
- 950,000 litres of diesel used in your own excavators and dump trucks
- 5.2 MWh grid electricity in welfare accommodation and temporary offices
- 85,000 m^3 'standard' mix concrete
- 5,950 tonnes rebar

And the answers are...

- Scope 1: 2,387 tCO_2e
- Scope 2: 1.2 tCO_2e
- Scope 3: 32,852 tCO_2e
- Total of all Scopes: 35,240 tCO_2e



Break for Tea – back in 5 mins



Carbon Reduction Strategies

Get a Carbon Reduction Strategy

Scope

Agree boundaries, base year and targets

Measure

Measure your footprint, identify hotspots and agree strategy

Reduce

Implement reduction actions, on hotspots first and then other aspects, using carbon hierarchy, and measure the reductions

Remove / Offset

Remove residual GHG emissions, but only after other actions have been taken

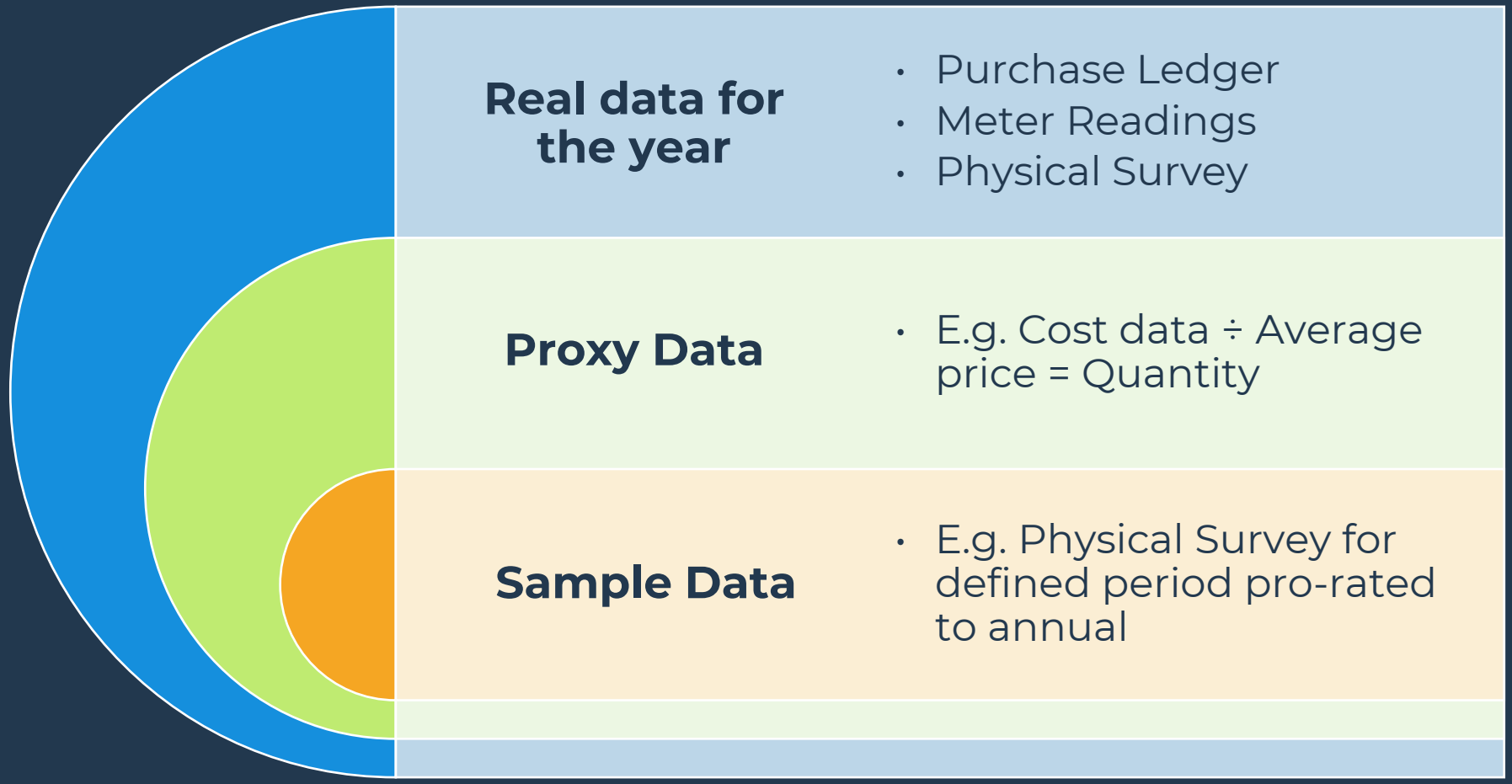
Report

Disclose your emissions and reduction actions. Follow up with revising and continual improvement

SUPPLY CHAIN SUSTAINABILITY SCHOOL

Primary Data: Sources of activity data

Sources of Data – Quantities (tonnes, m^3, etc.)



Primary Data: Reliability

Data

- Relevant data to your situation
- Reliable, unbiased data
- Up-to-date data

Time

- Control and influence
- Time constraints - what do you have time to collect?
- Pareto 80/20

Methods, Standards and Tools for Carbon Reduction

RIBA Plan of Works: 2020

RIBA

The RIBA Plan of Work 2013 organises the process of briefing, designing, constructing, maintaining, operating and using building projects into a number of key stages. The content of stages may vary or overlap to suit specific project requirements. The RIBA Plan of Work 2013 should be used solely as guidance for the preparation of detailed professional services contracts and building contracts.

www.ribaplanofwork.com

RIBA Plan of Work 2013

Tasks / Stages	0 Strategic Definition	1 Preparation and Brief	2 Concept Design	3 Developed Design	4 Technical Design	5 Construction	6 Handover and Close Out	7 In Use
(Net zero) Embodied Energy and CO2 (kWh/m2/yr and kgCO2/m2/yr)	Prioritise total or partial reuse of existing facilities, buildings, components or materials. Consider the scope of new build elements and set ambitious embodied energy targets.	Assess site or existing buildings for reusable parts or components. Define embodied energy and carbon target outcome, including the boundaries of the assessment with regard to net-zero carbon and certification methodologies.	Review the embodied energy and carbon of materials and construction processes in the context of the building's lifespan and operational strategy. Minimise high embodied energy material, prioritise low carbon and recycled materials. Avoid inefficient/ wasteful use of materials. Design out waste where possible.	Use embodied energy and carbon assessment to test relative impacts of design options as part of whole life costs. Prioritise low carbon materials. Create a baseline carbon budget as an outcome target.	Integrate and communicate detailed design strategies to deliver outcomes for embodied energy and carbon. Include materials, construction, manufacturing and supply decisions. Describe the relationship with operational energy and conditioning strategies. Update the carbon budget and included in the specification.	Update embodied energy and carbon assessment. Review impact of the construction process against the carbon budget.	Assess the Sustainability Outcomes for embodied energy and carbon through final assessment of the Asset Information model to compare to initial carbon budget.	Gather Post Occupancy Evaluation data to evaluate, for example, the appropriateness of thermally massive elements.
Other carbon aspects	Operational energy and carbon, being mindful of relationships between embodied and operational, transport and connectivity, as well as whole life £ and carbon costs for design, construction, maintenance and refurb							

SUPPLY CHAIN SUSTAINABILITY SCHOOL

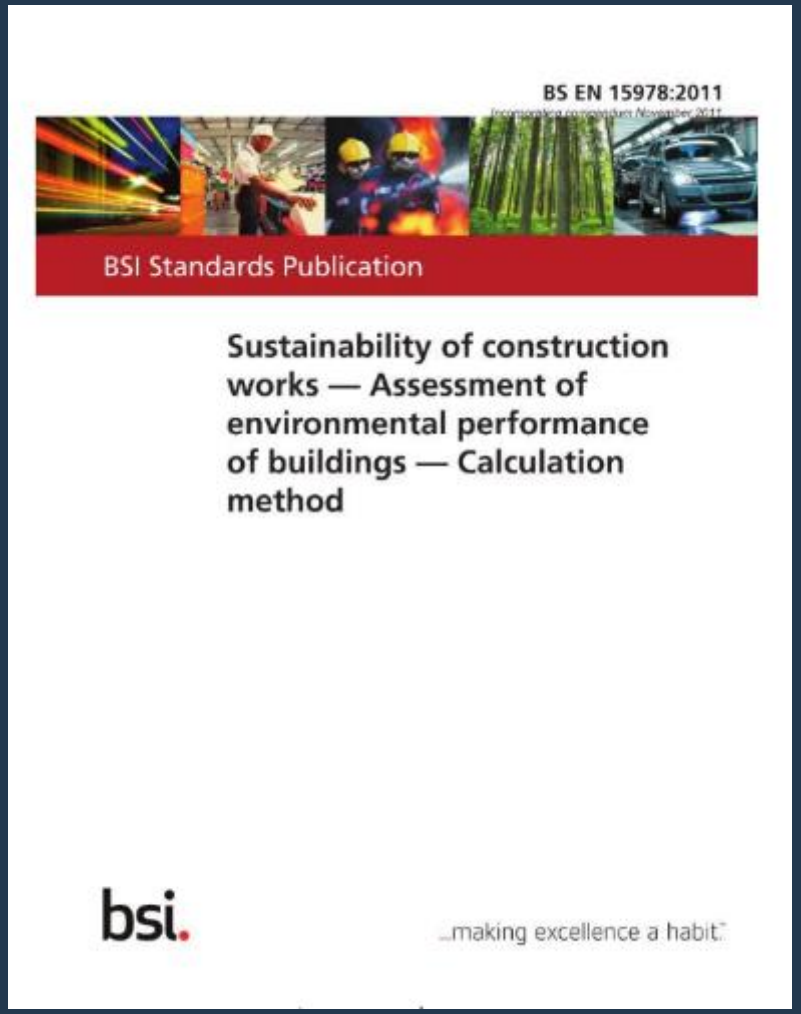
https://www.architecture.com/-/media/GatherContent/Test-resources-page/Additional-Documents/2020RIBAPlanofWorkoverviewpdf.pdf

Introduction to relevant standards

BS EN 15978

BS EN 15978

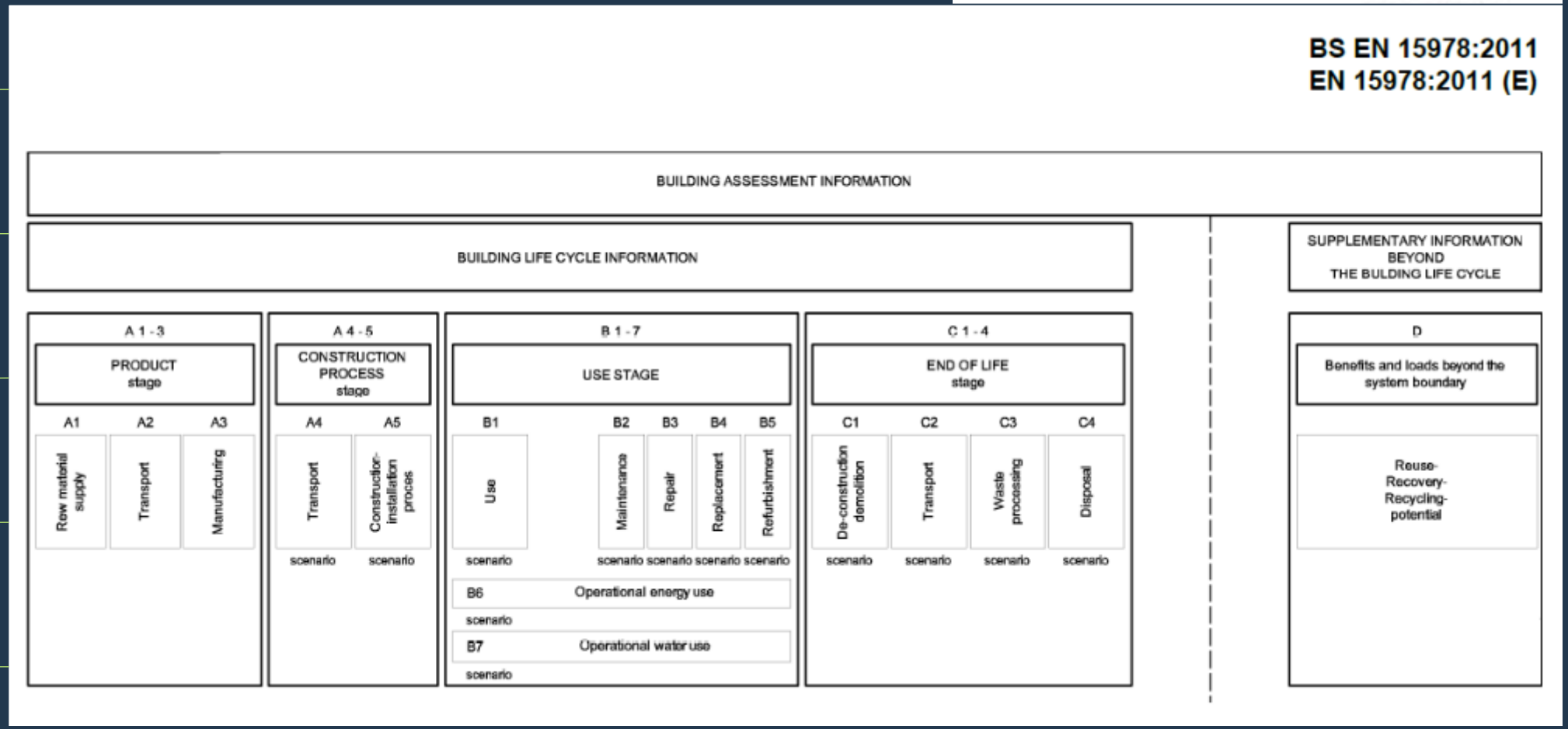
- Applicable to construction projects, services and processes
- Provides a structure to capture all aspects of carbon emissions
- Encompasses life cycle: manufacture, construction, operation, maintenance and demolition
- Allows for fair comparison and a robust route to reducing carbon impacts
- Covers all environmental impacts of a construction project



Introduction to relevant standards

BS EN 15978

BS EN 15978

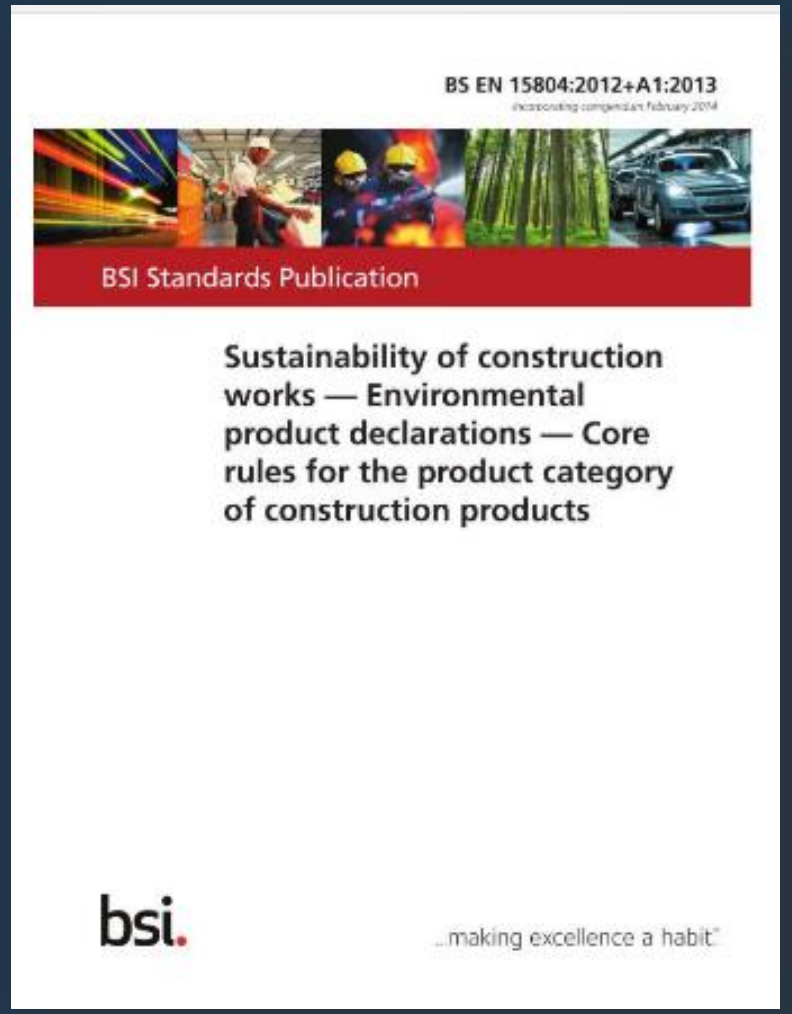


Introduction to relevant standards

BS EN 15804

BS EN 15804

- Applicable to construction products, services and processes
- Provides a structure to ensure that all EPDs are derived, verified and presented in a harmonized way
- EPDs communicate verifiable, accurate, non-misleading environmental information for products
- Allows for fair comparison and a robust route to reducing environmental impacts
- EPDs = Environmental Product Declarations



Environmental Product Declarations: EPDs

A summary of the costs and environmental impacts from the manufacture and expected use of a product

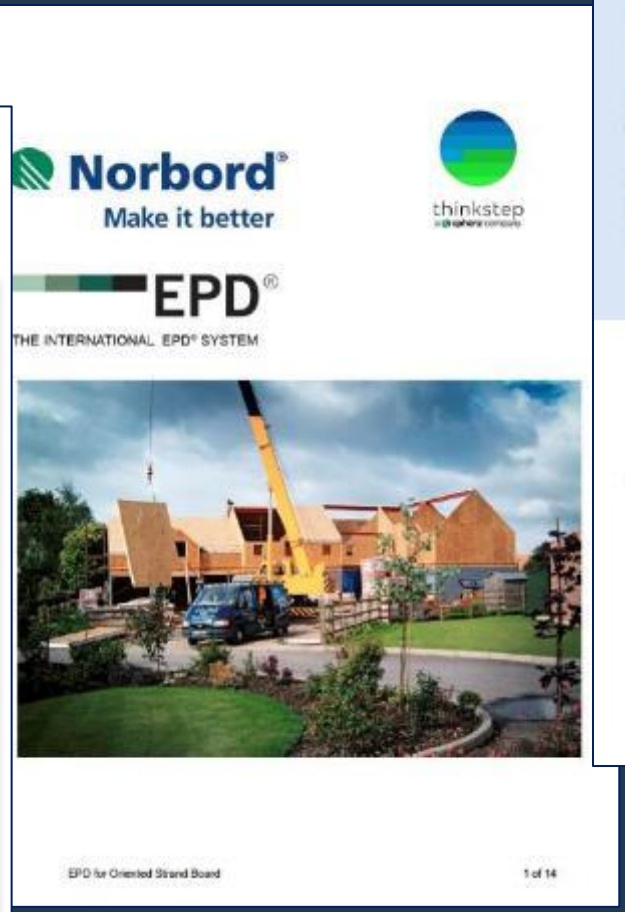

ENVIRONMENTAL PRODUCT DECLARATION

CENTRIFUGAL CHILLERS

MAGNITUDE® MAGNETIC BEARING CHILLER MODELS WMC & WME

DAIKIN

CERTIFIED


Norbord®

Make it better

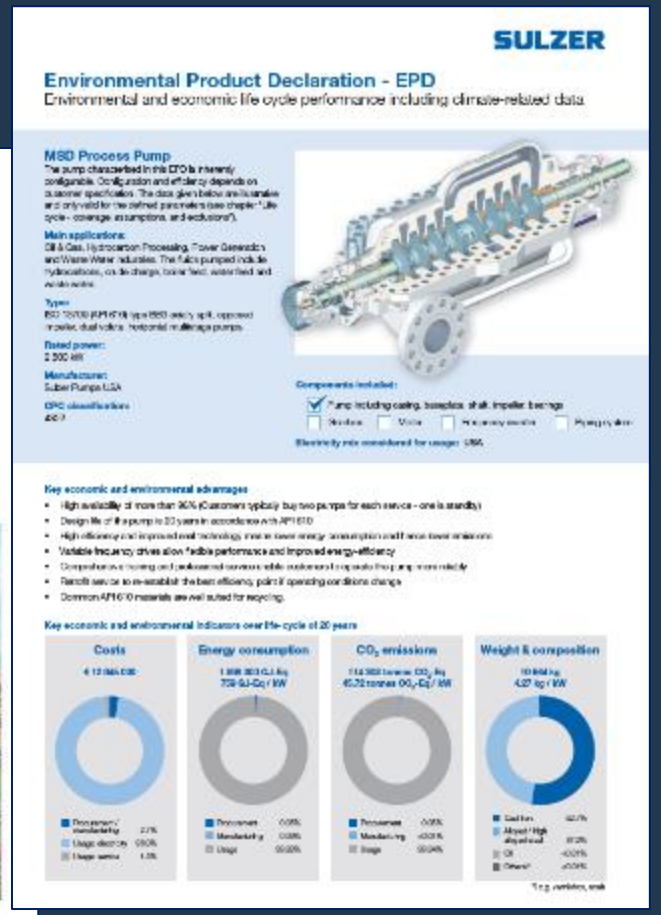
thinkstep

EPD®

THE INTERNATIONAL EPD® SYSTEM

EPD for Oriented Strand Board

1 of 14


SULZER

Environmental Product Declaration - EPD

Environmental and economic life cycle performance including climate-related data

MSD Process Pump

Main applications:

Rated power:

Manufacturer:

Components included:

Key economic and environmental advantages

Key economic and environmental indicators over life cycle of 20 years

Costs

Energy consumption

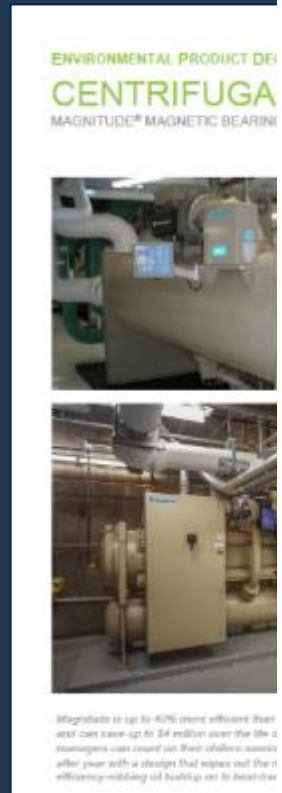
CO_2 emissions

Weight & composition

SUPPLY CHAIN SUSTAINABILITY SCHOOL

Environmental Product Declarations: EPDs

A summary of the costs and environmental impacts from the manufacture and expected use of a product



bre

LCA Results

The results for the declared unit of 1 tonne of BDA average UK brick can be found below. As the average brick is assumed by the BDA to have a mass of 2.13 kg, results can be calculated per average brick by dividing individual values in results tables by a factor of (1000 / 2.13).

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts

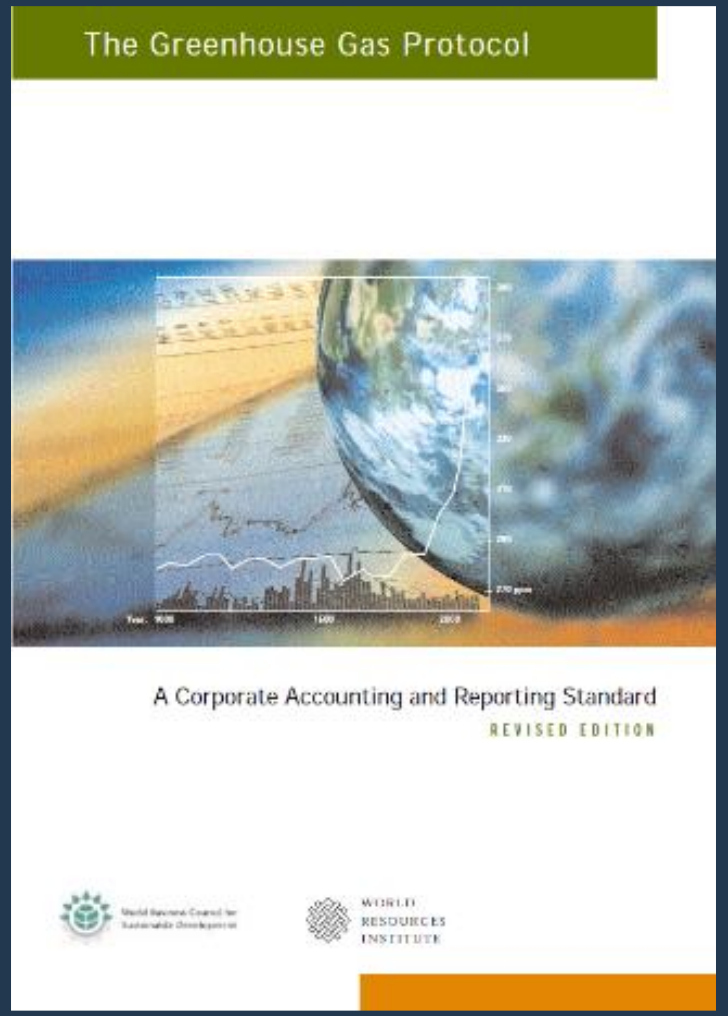
			GWP	ODP	AP	EP	POCP	ADPE	ADPF
			kg CO_2 equiv.	kg CFC 11 equiv.	kg SO_2 equiv.	kg $(PO_4)^{3-}$ equiv.	kg C_2H_4 equiv.	kg Sb equiv.	MJ, net calorific value
Product stage	Raw material supply	A1	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Transport	A2	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Manufacturing	A3	AGG	AGG	AGG	AGG	AGG	AGG	AGG
	Total (of product stage)	A1-3	213	1.85e-5	3.49	0.107	0.177	1.24e-4	2370
Construction process stage	Transport	A4	8.026	1.48E-06	0.027	7.08E-03	4.68E-03	2.11E-05	121.2
	Construction	A5	11.466	1.08E-06	0.177	6.07E-03	9.31E-03	8.41E-06	130.9
	Use	B1	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Maintenance	B2	MNR	MNR	MNR	MNR	MNR	MNR	MNR
	Repair	B3	MNR	MNR	MNR	MNR	MNR	MNR	MNR

SUPPLY CHAIN SUSTAINABILITY SCHOOL

GHG Protocol

GHG Protocol

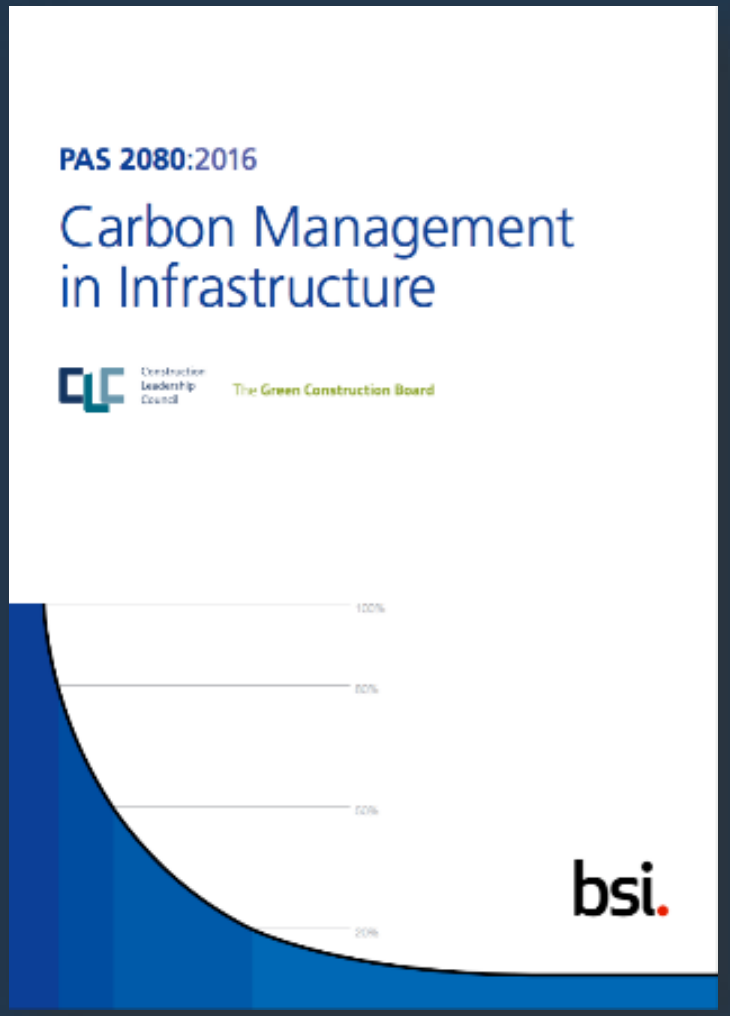
- Accounting and Reporting of 6 greenhouse gases (Kyoto Protocol)
- GHG inventory using standardised approaches and principles
- Develop an effective strategy to manage and reduce GHG emissions
- Consistency and transparency in GHG Accounting and Reporting
- Construction-specific GHG Protocol - Encord



PAS 2080

PAS 2080: 2016

- Management of carbon reduction across infrastructure value chain
- Determining baselines, establishing metrics and setting targets
- Selecting carbon emissions quantification methodologies
- Reporting at appropriate stages & visibility of performance
- Continual improvement of management and performance



PAS 2050

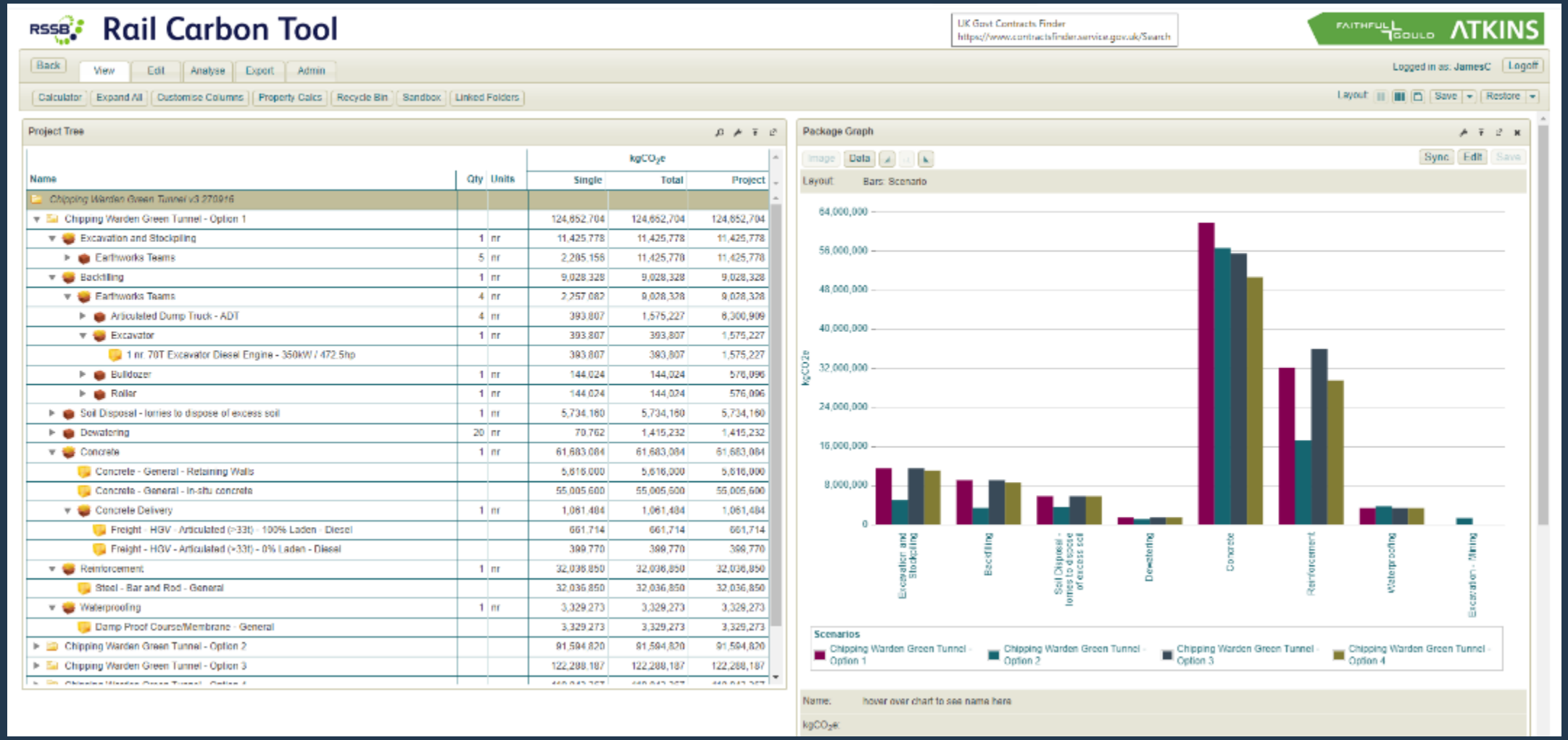
PAS 2050: 2011

- Publicly Available Specification (PAS)
- Standardised approach to product Carbon Footprinting
- Applicable to products life cycle and/ or cradle-to-gate
- Design for all organisation regardless of size and sector
- Additional economic, social and environmental impacts are not assessed

Resources Guidance – Free Carbon Data and Tools

- **Defra/BEIS 2021 Greenhouse gas reporting conversion factors :** the UK Government's database of carbon factors for fuel, energy, transport, and materials, updated annually. https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021
- **Bath Inventory of Carbon and Energy (ICE)** database: a well-established database of embodied carbon factors for a variety of materials, updated periodically. http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html
- **Supply Chain School Carbon Calculator:** a free tool from the School to measure scope 1, 2 and 3 emissions in your supply chain. https://carbon.sustainabilitytool.com/
- **The Embodied Carbon in Construction Calculator (EC3) Tool:** a database of EPDs for construction products https://buildingtransparency.org/ec3
- **Carbon Trust Carbon Calculator** for SMEs: The Carbon Footprint Calculator has been designed to help UK based SMEs measure their corporate emission footprint following GHG Protocol Guidance, including direct emissions from fuel and processes (Scope 1 emissions) and those emissions from purchased electricity (or Scope 2 emissions) for the assets they operate https://www.carbontrust.com/resources/tools/carbon-footprint-calculator
- **Highways England Carbon Tool:** a free-to-download Excel tool to calculate carbon emissions for operational, construction and maintenance activities undertaken on behalf of Highways England that draws on Defra and Bath ICE datasets www.gov.uk/government/publications/carbon-tool
- **The RSSB Rail Carbon Tool** is a web-based tool that allows you to calculate, assess, analyse, report and reduce your rail project carbon footprint by evaluating low-carbon options using verified, centrally-available carbon factor data that draws on Defra and Bath ICE datasets https://www.railindustrycarbon.com/
- **Environment Agency Carbon Calculator:** a free-to-download tool to calculate the carbon impact of different material and transport options in your project www.ice.org.uk/knowledge-and-resources/best-practice/environment-agency-carbon-calculator-tool
- **Hawkins\Brown: Emission Reduction Tool \.** An open source Revit-based tool that enables design teams to quickly analyse and clearly visualise the embodied carbon emissions of different building components and construction material options at any time during the design process. https://www.hawkinsbrown.com/services/hbert

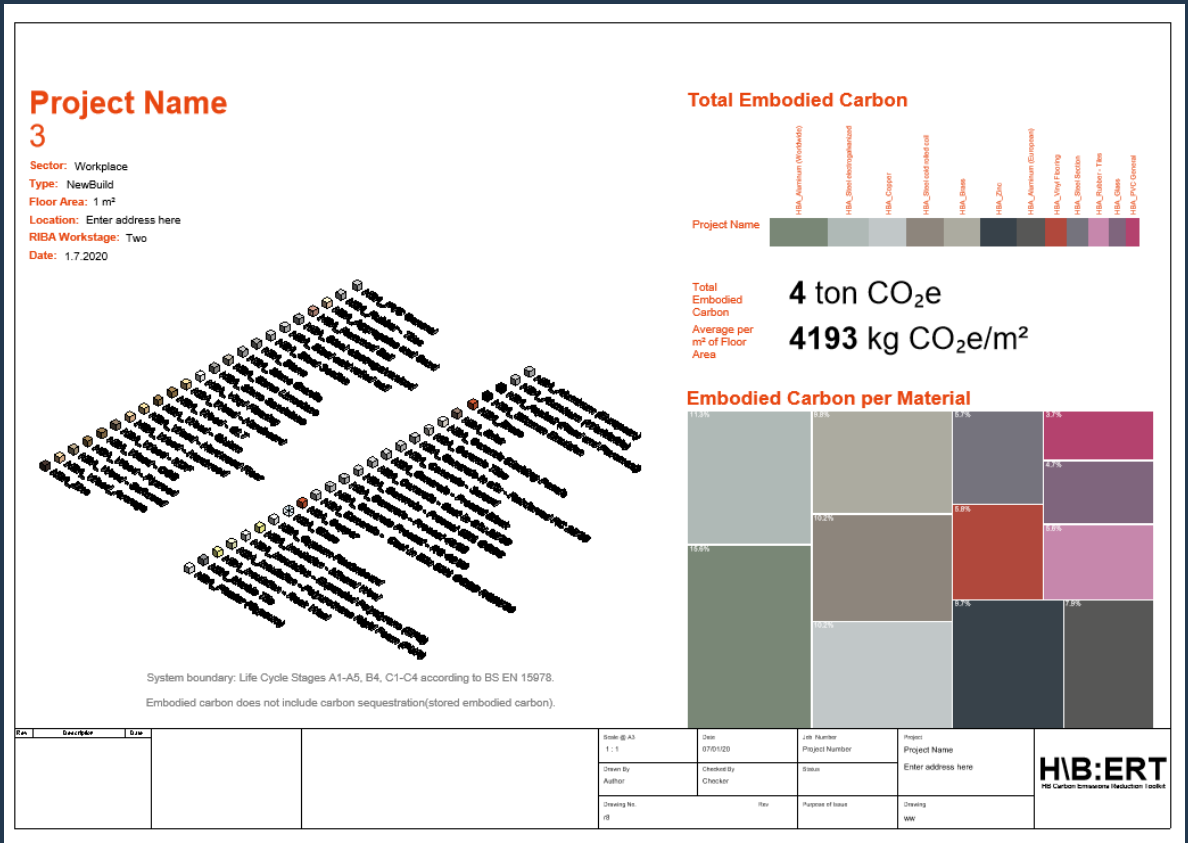
Rail Carbon Tool

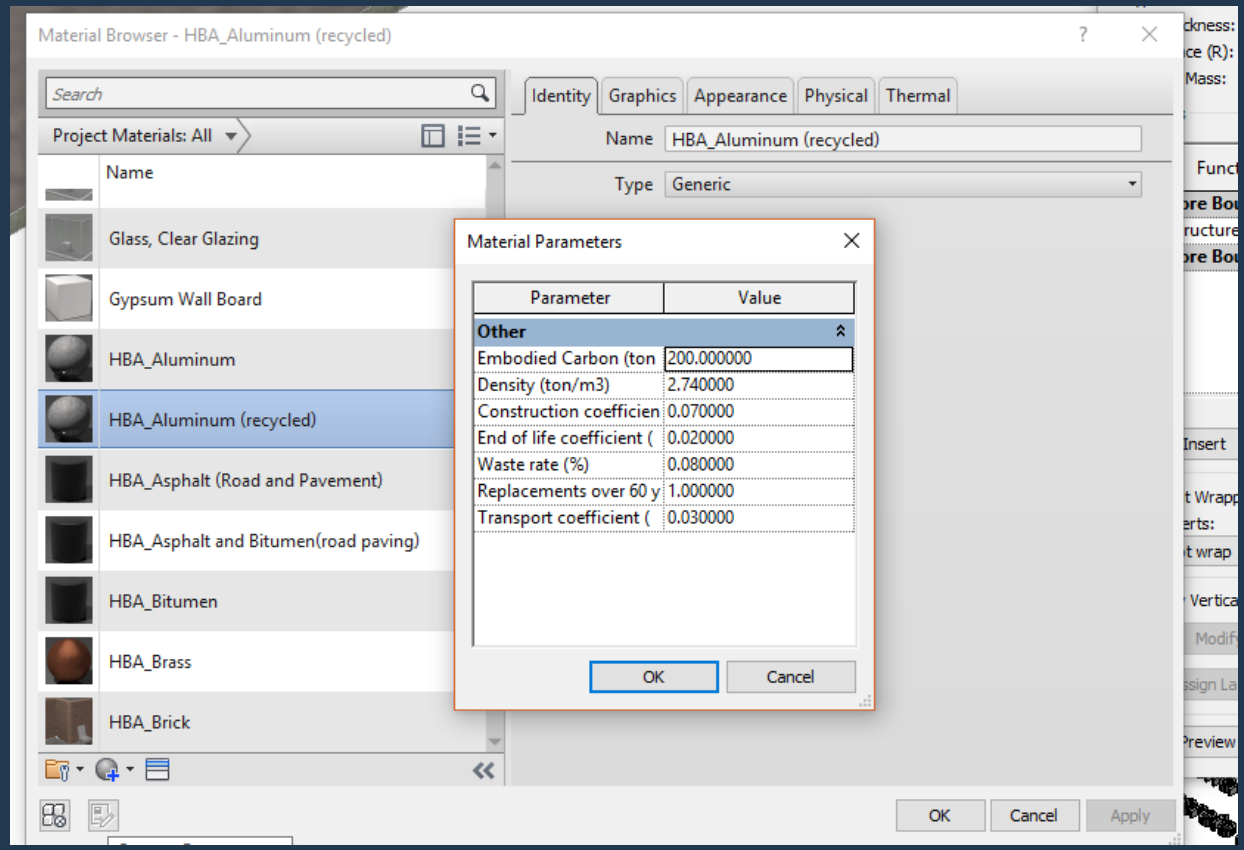


https://www.railindustrycarbon.com/Account/LogOn?ReturnUrl=%2f

SUPPLY CHAIN SUSTAINABILITY SCHOOL

H\B:ERT Carbon Tool

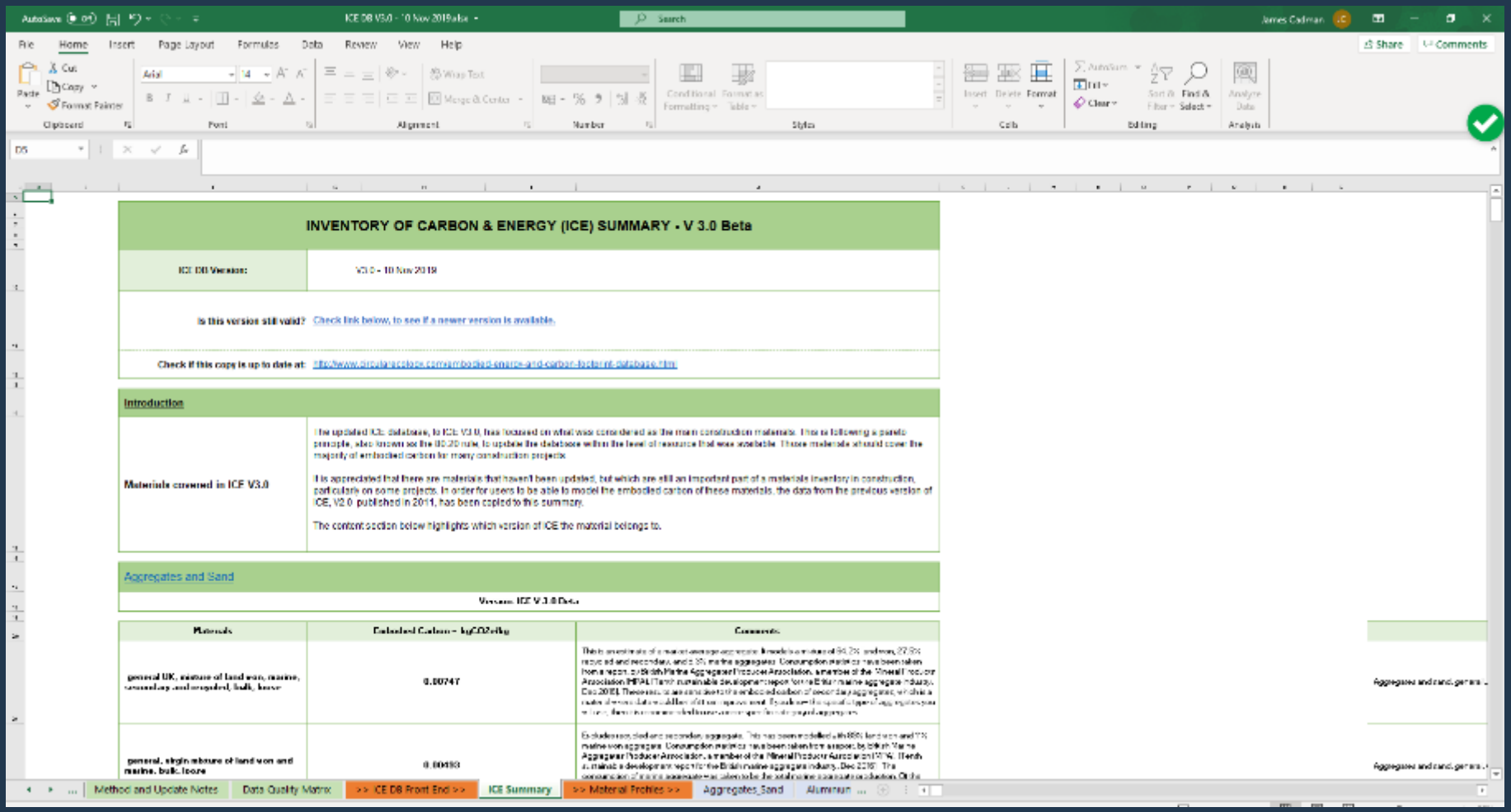




https://www.hawkinsbrown.com/services/hbert

SUPPLY CHAIN SUSTAINABILITY SCHOOL

Bath ICE Database

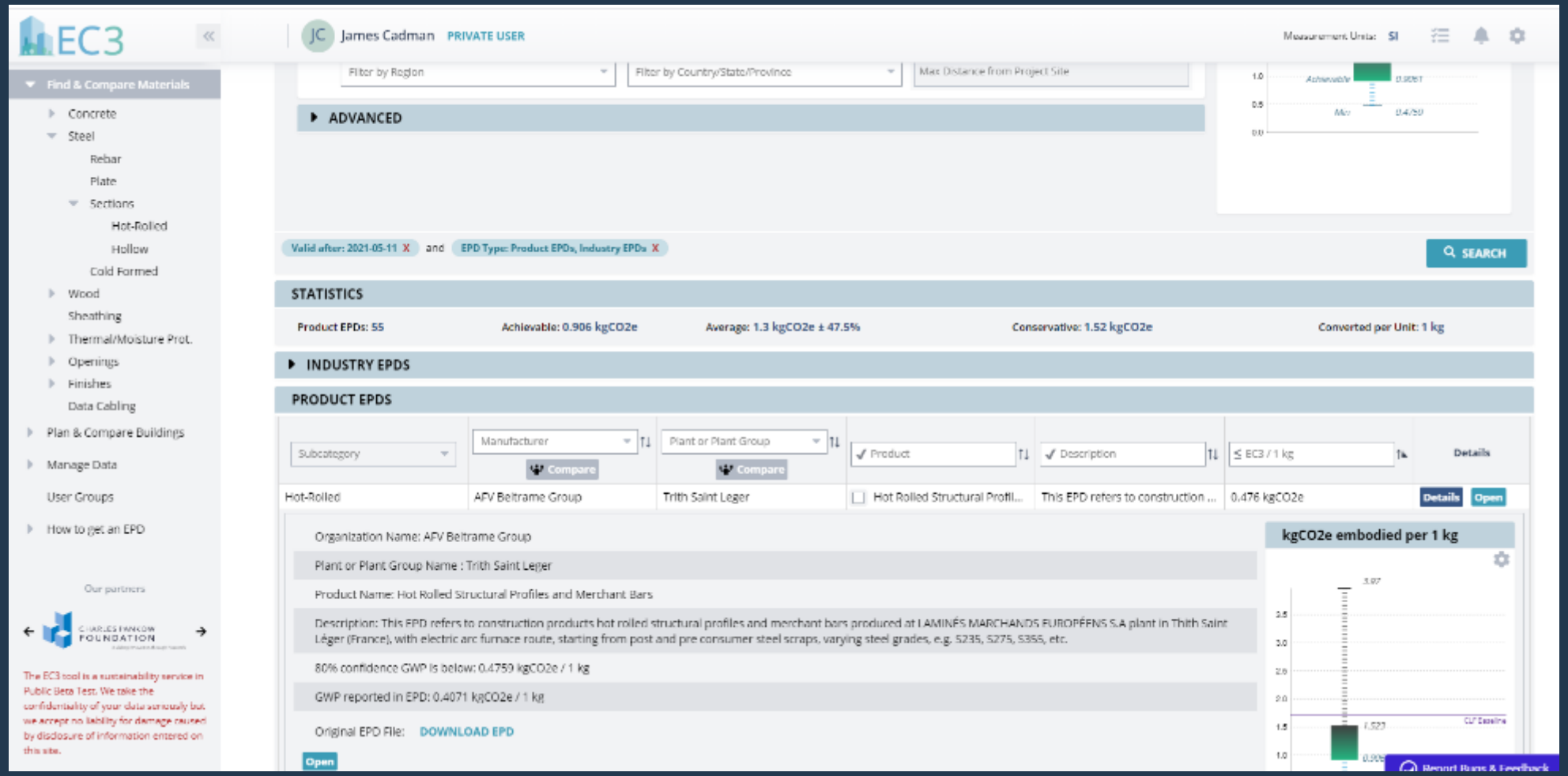


http://www.circularecology.com/embodied-energy-and-carbon-footprint-database.html

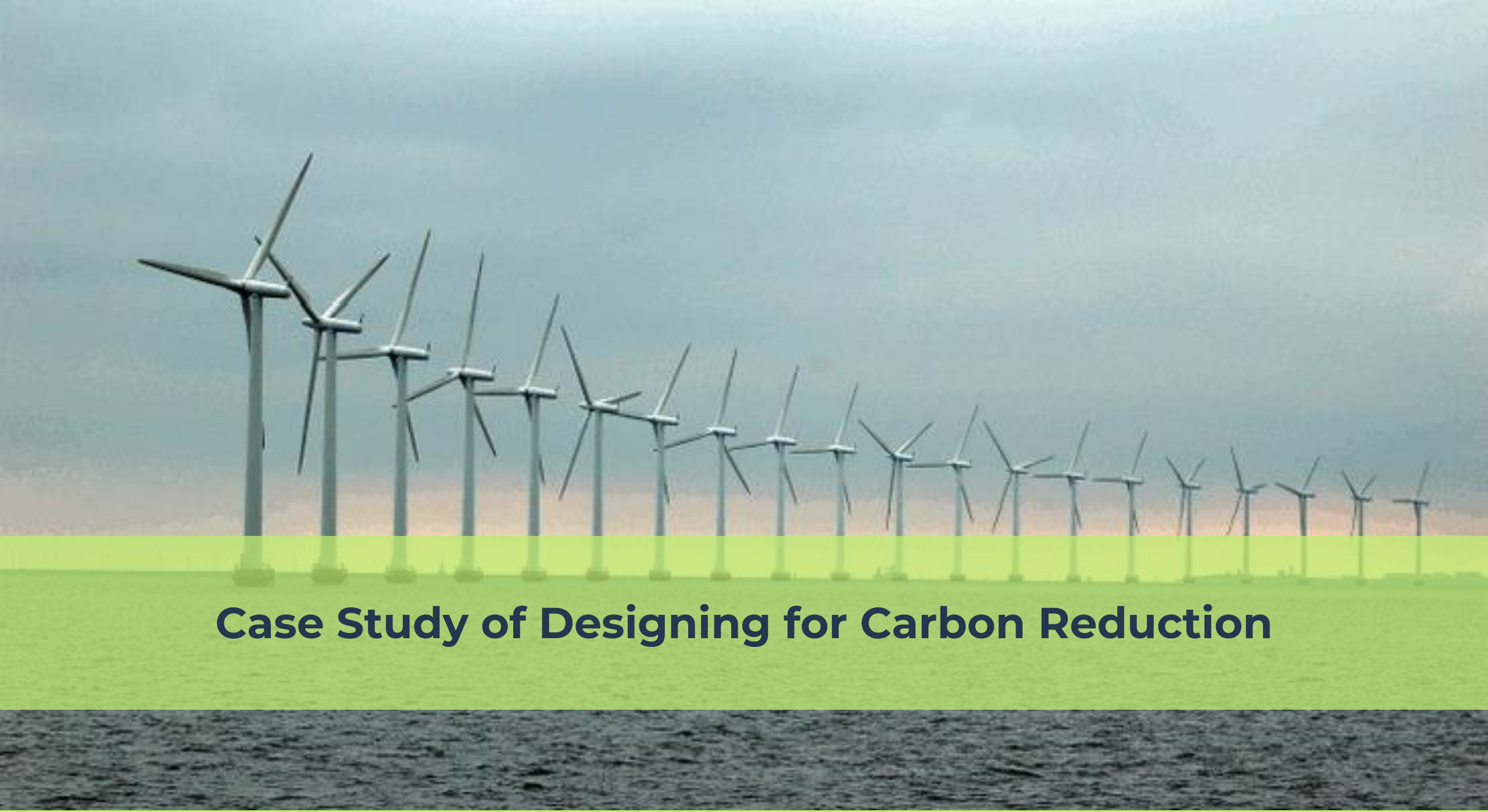
Built Environment Carbon Database (BECD)

- Coming soon! The Built Environment Carbon Database
- A collaboration between several organisations to have ione source of truth
- It is a database of product level LCA information (EPDs)
- It is not a tool or calculating software
- It will combine the WRAP / RICS database, the Bath ICE database and others
- Due to launch October 2022

EC3 Database



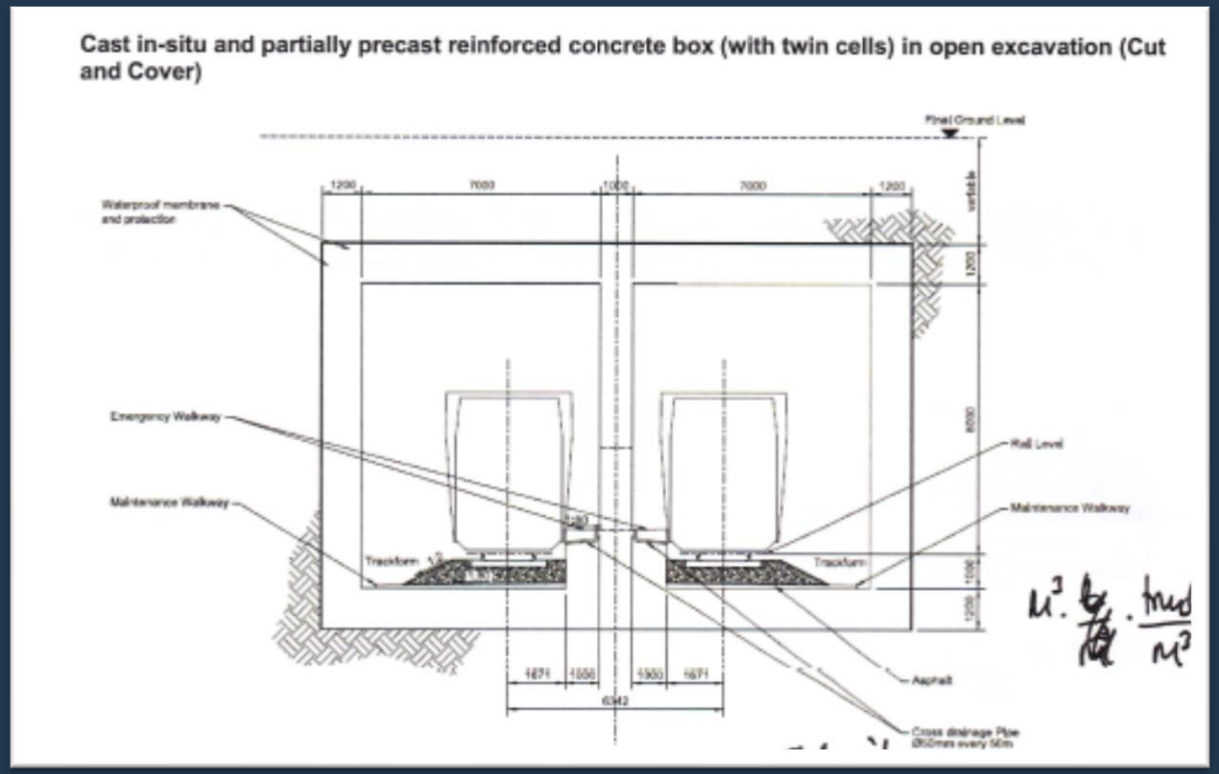
https://buildingtransparency.org/ec3



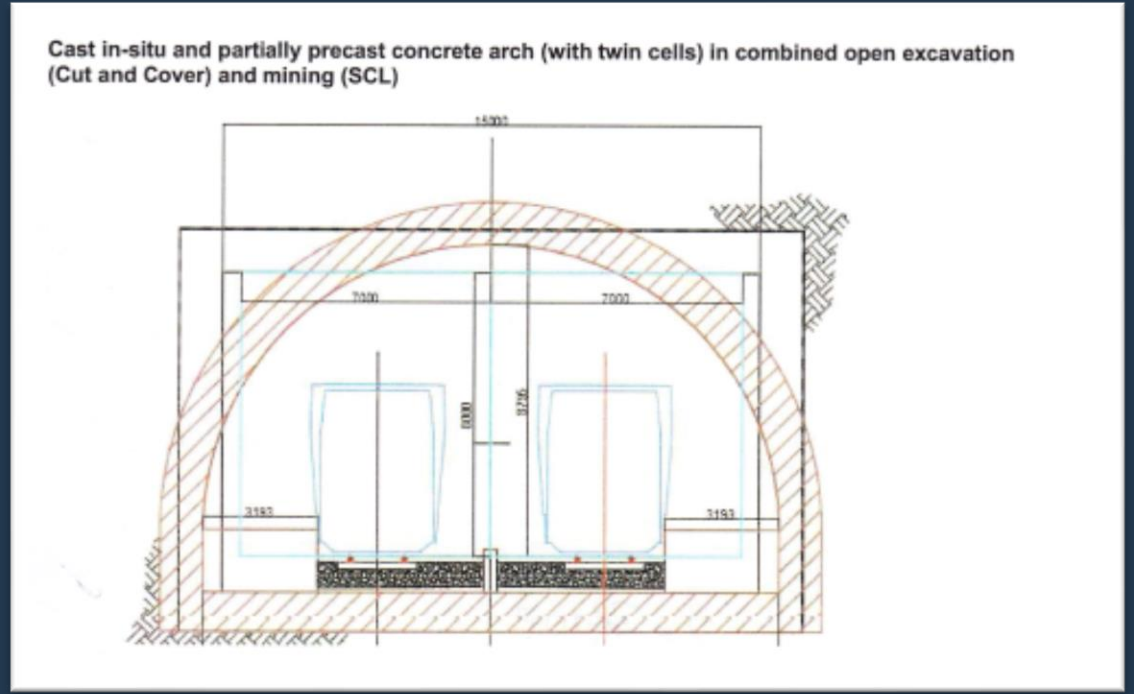
Case Study of Designing for Carbon Reduction

Example: building a train tunnel

Different Engineering Options

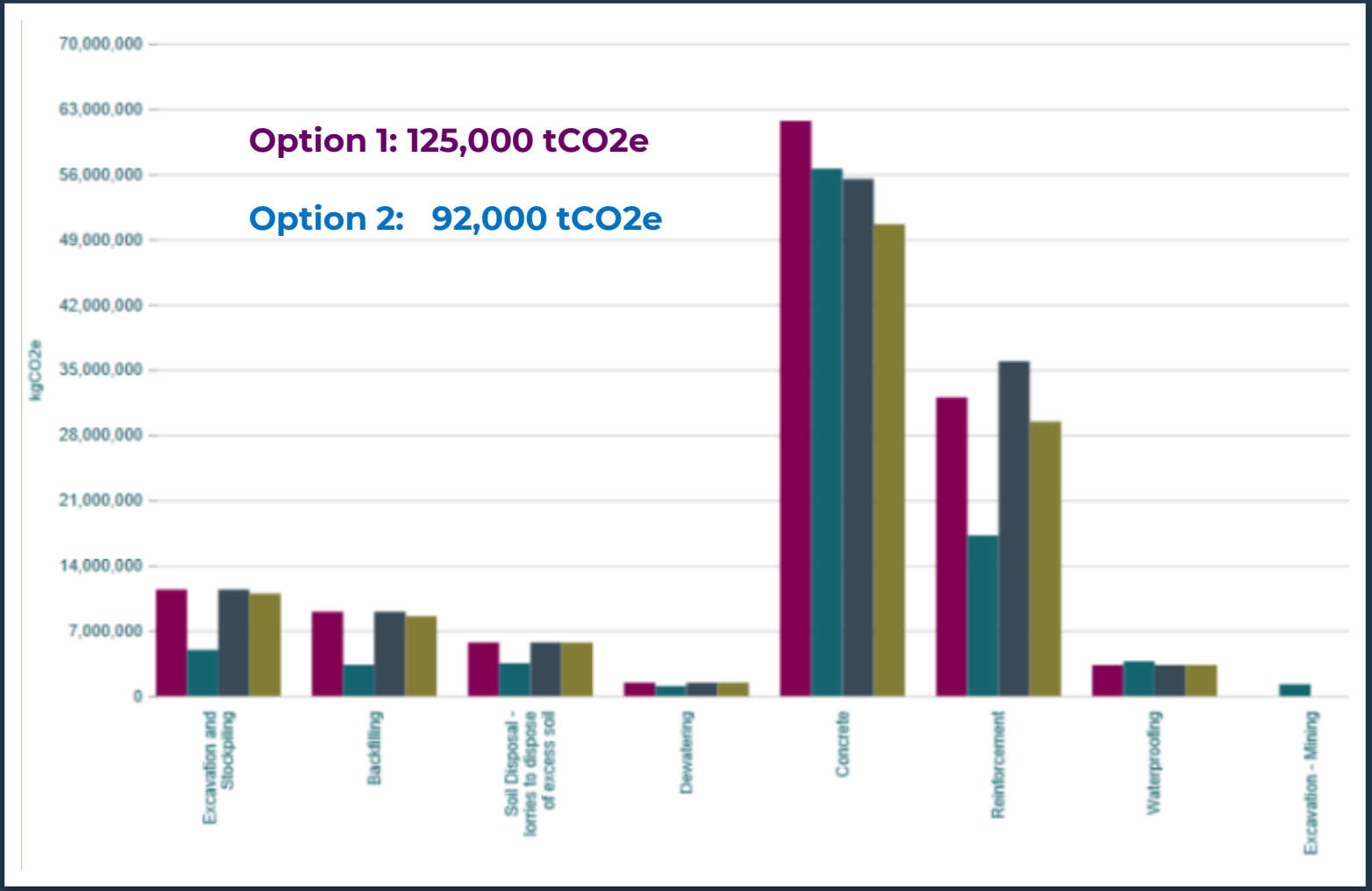


- Variations on
  - Cut & cover and/or mining
  - Concrete and/or steel
  - Boxes and/or arches



SUPPLY CHAIN SUSTAINABILITY SCHOOL

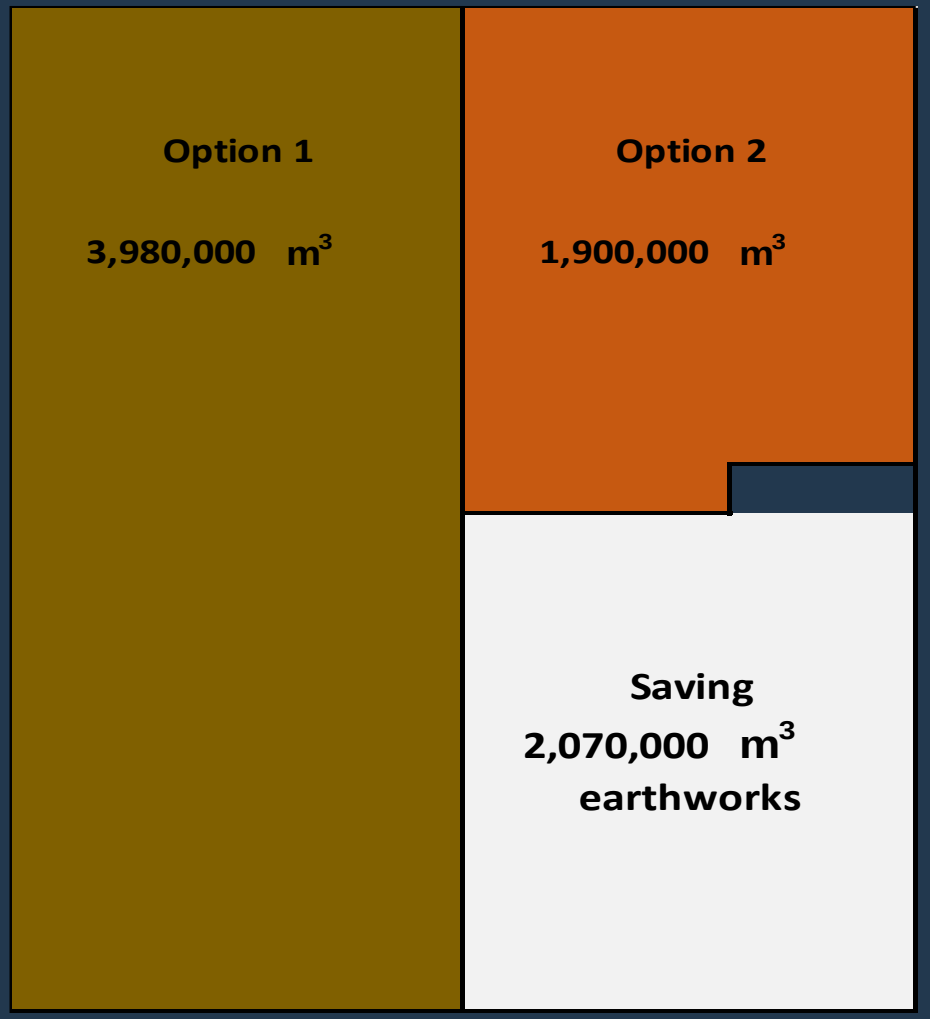
Carbon impacts for the options



1. Excavation
2. Backfilling
3. Soil disposal
4. Dewatering
5. Concrete
6. Reinforcement
7. Waterproofing
8. Mining

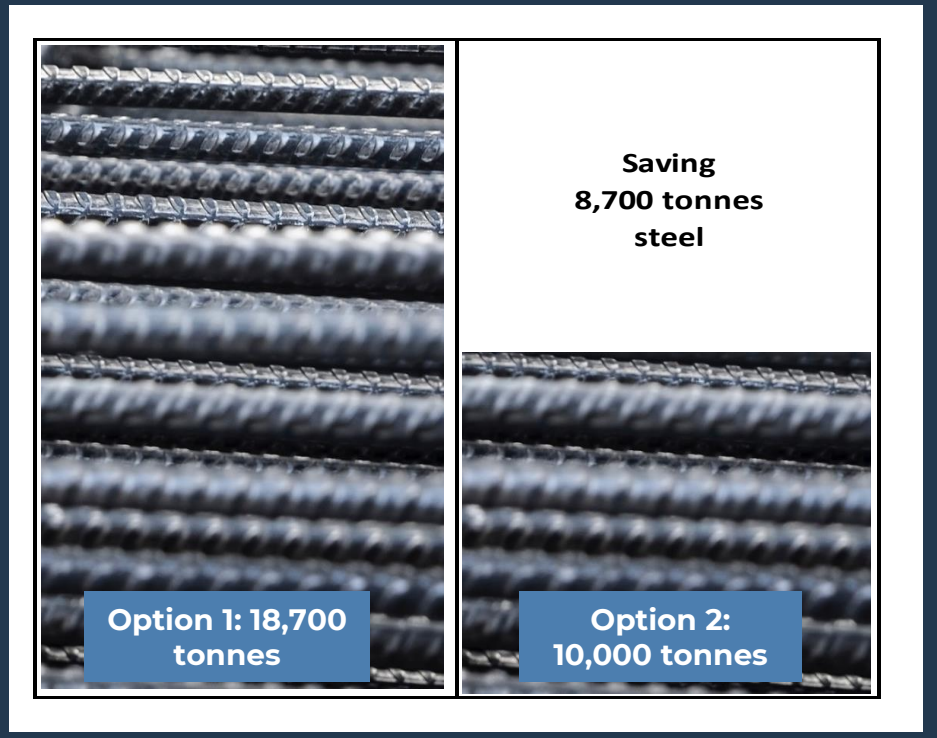
Savings: Option 1 vs Option 2

Carbon and Earthworks savings



SUPPLY CHAIN SUSTAINABILITY SCHOOL

Concrete and steel savings



SUPPLY CHAIN SUSTAINABILITY SCHOOL

Carbon Equivalency

- 33,000 tCO_2e saved is equivalent to avoiding:
  - 1000 HGVs, each driving 24,000 miles; or
  - 40 full A380 flights from LHR to NYC; or
  - Emissions from grid electric and gas used in 10,000 UK homes for a year – roughly equivalent to a town the size of Aberdare, Pontypridd, Winsford, or Beverley

Business Reality

National Grid

“One idea that’s really worked is the start of a 5% carbon weighting on our new construction projects.

We’re saying to our suppliers that if you can design a lower-carbon solution you stand a better chance of winning our business.”

National Grid Example

- New electricity substation at Wimbledon
- Smarter thinking on design and use of materials
- Calculated carbon savings of 20% across the asset's life, equivalent to about 39,000 tCO_2
- Saved £3 million in costs compared with the original design

"By having clear data on carbon emissions, we can use energy and resources more efficiently. We've been able to prove the business case that lower carbon can equal lower cost"

The end of the training... for now...

...but the beginning of your carbon reduction plans!....

Questions, Answers and Feedback

Thank you!

James Cadman

- Lead Consultant at Action Sustainability
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- www.actionsustainability.com
- @Action_Sustain