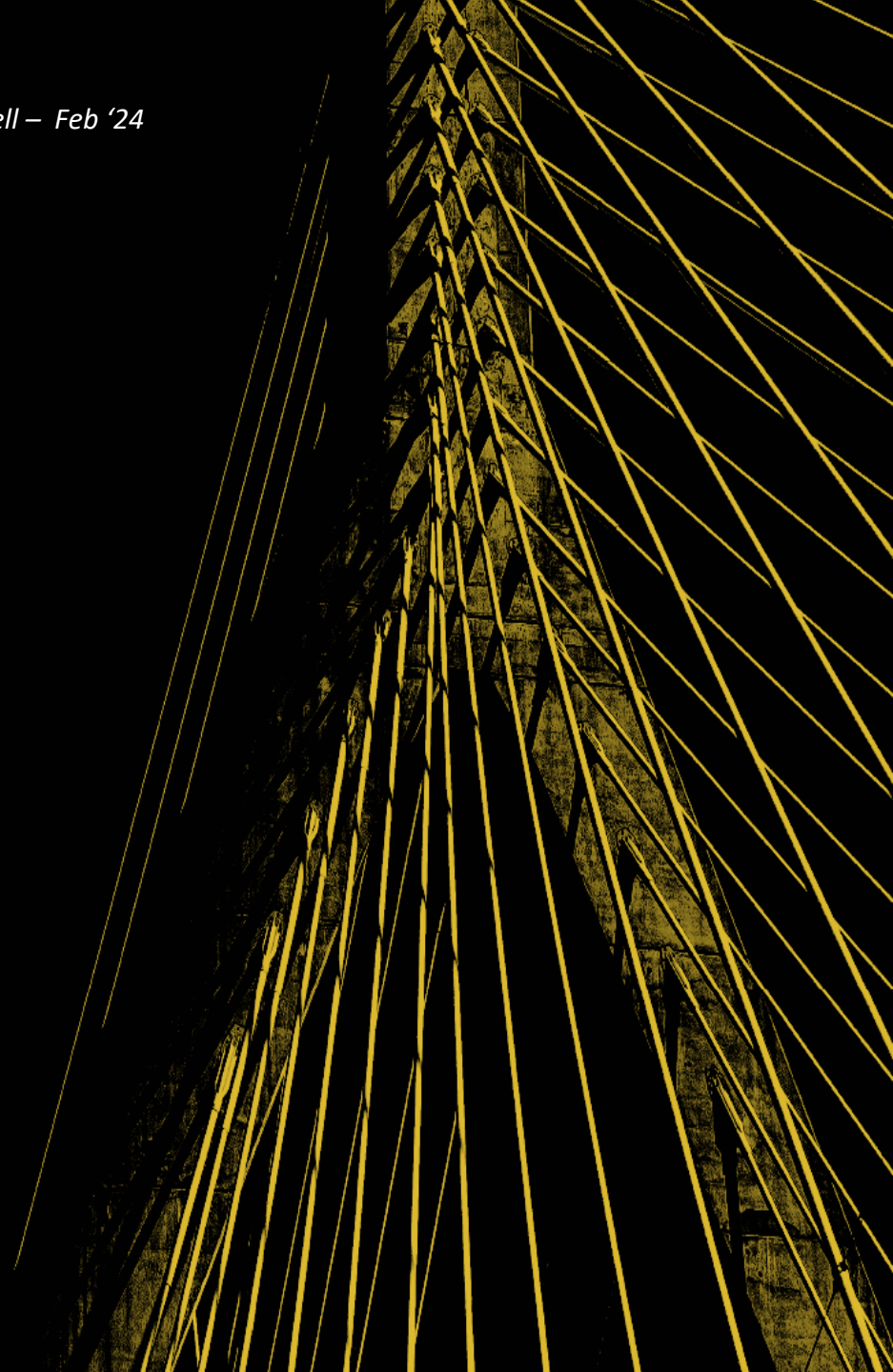
Archie O'Donnell – Feb '24

The Carbon QS

Digitising Sustainability
Monitising Carbon



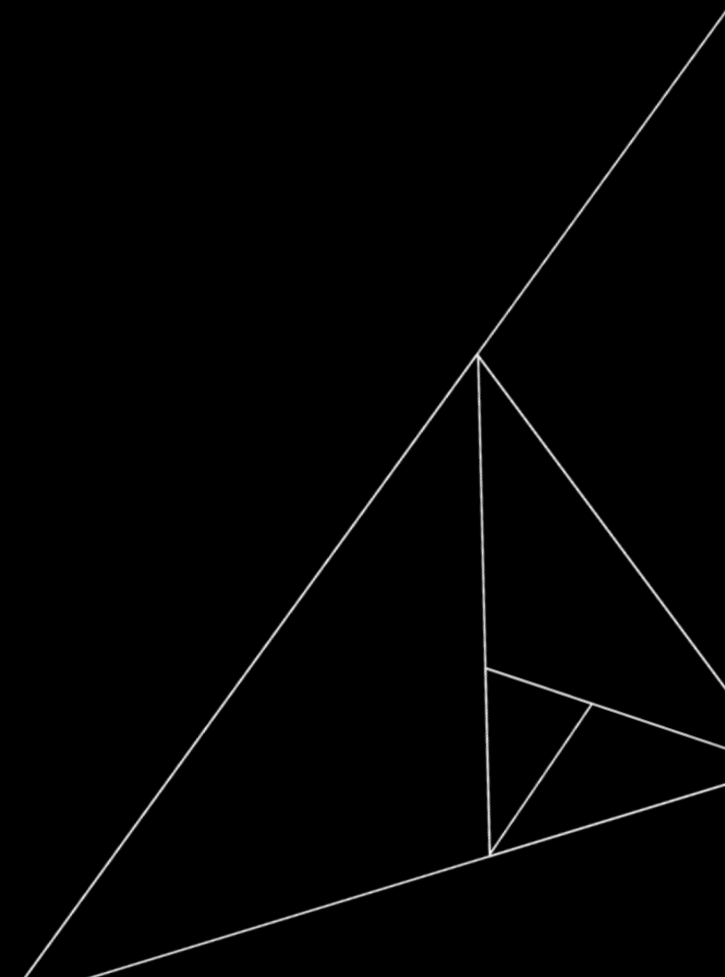
KOSMOS optimal SUSTAINABILITY ADVISORS

Sustainability Workshop

Part 1

Archie, Simon Roger

- The Sustainability Team
- **What is driving Sustainability**
- **The Starting Line**
- **Carbon Literacy**
- **Counting Carbon**
- **Creating Value from Climate Risk**



KOSMOS

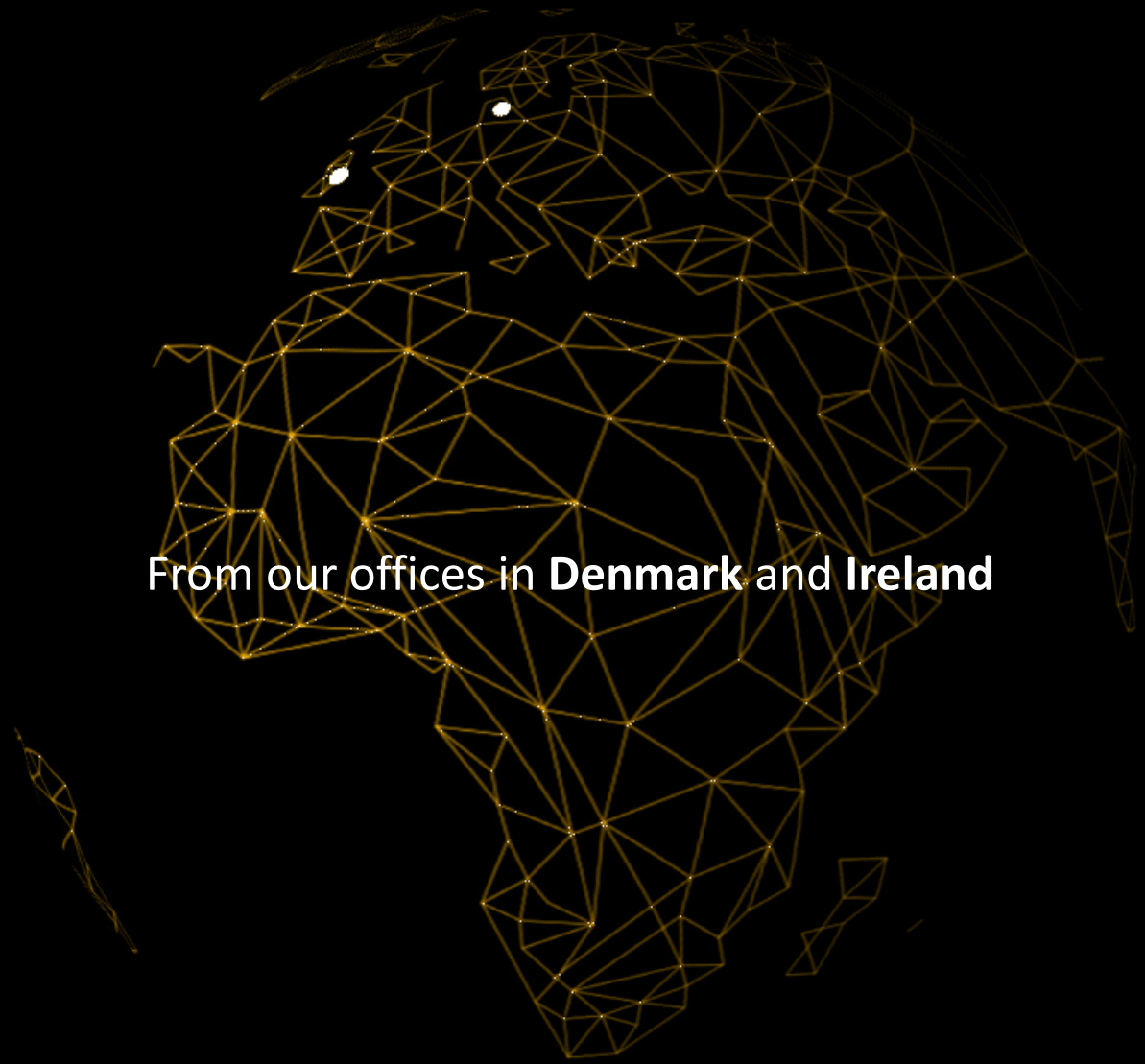
We are **KOSMOS**

This is digital and carbon quantity surveying on a global level

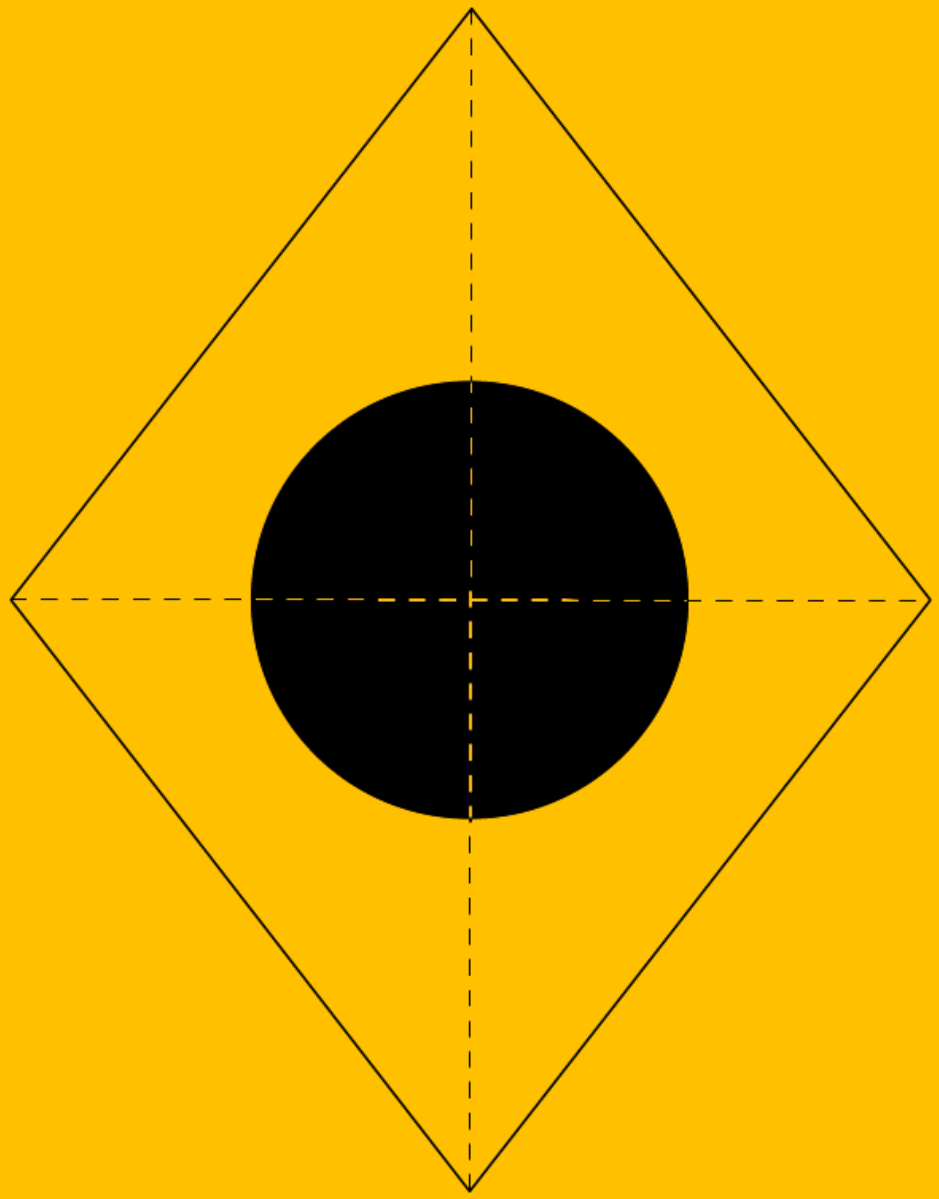
KOSMOS


Greenland
Denmark
Poland
Ireland
Czech Republic
Hungary
USA
China
Vietnam
Mexico
With Global clients
Singapore
Australia

KOSMOS



From our offices in **Denmark** and **Ireland**



KOSMOS are changing how the construction industry is measured, analysed and managed

1,452,197 m2 and counting

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Value Driven Sustainability Management:

“Integrated collaborative approach to designing to carbon budgets, with continuous follow up & cost control.”

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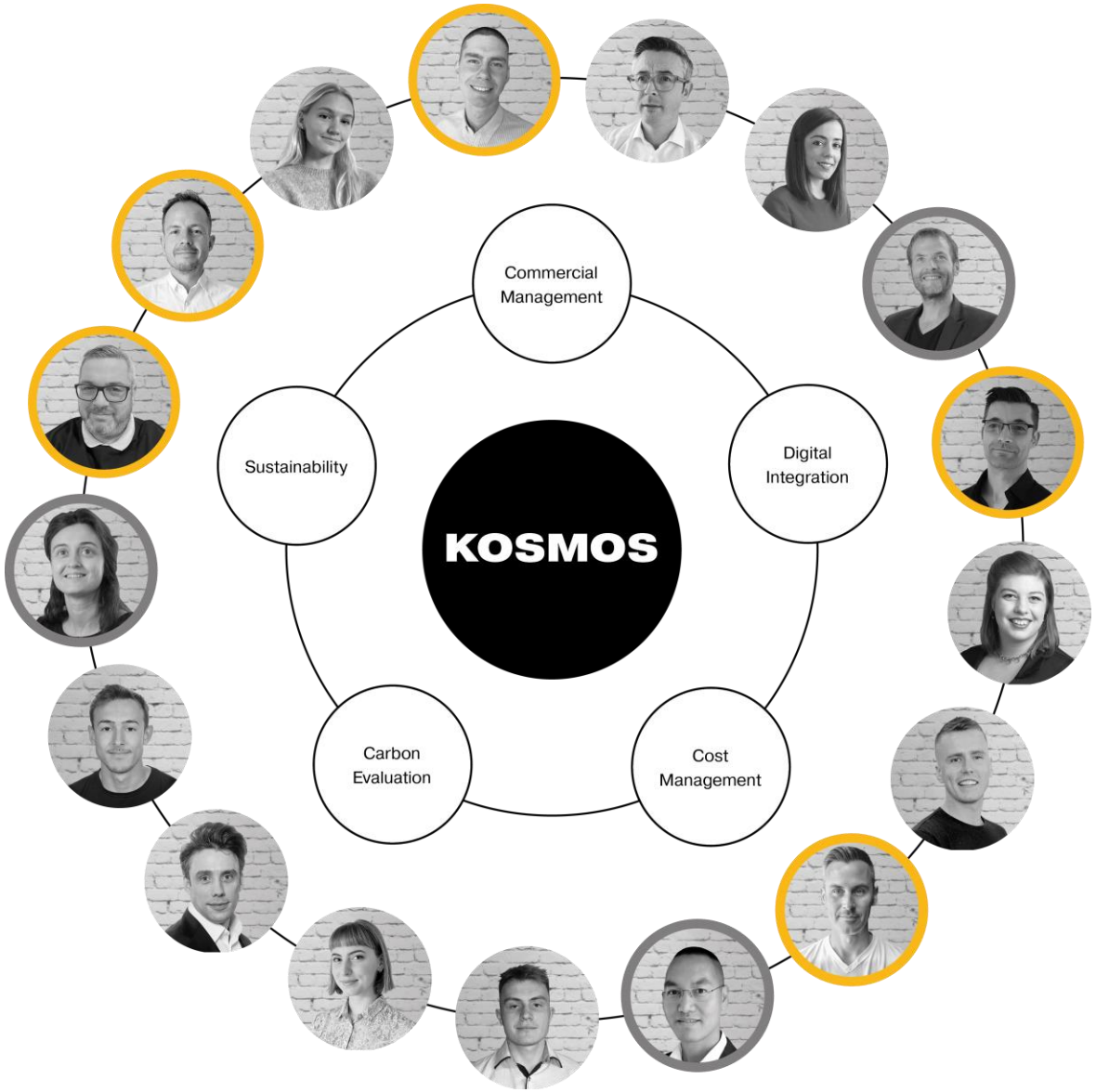
Meet the team



Meet the team

Phil Lucas
Senior MEP Building Services Specialist

Craig Cooper
Sustainability QS, BREEAM AP

Simon top Laustsen
Sustainability Engineer
DNGB

Archie O'Donnell
Senior Sustainability Specialist
LEED/BREEAM/HPI

Roger Barclay
Commercial Manager
Whole Life Carbon QS

What we do

- **Cost**
- **Commercial**
- **Carbon**
- **Digital**

Value add

Integrated Collaboration

Cost Control + Carbon Budgeting = Value Driven Sustainability

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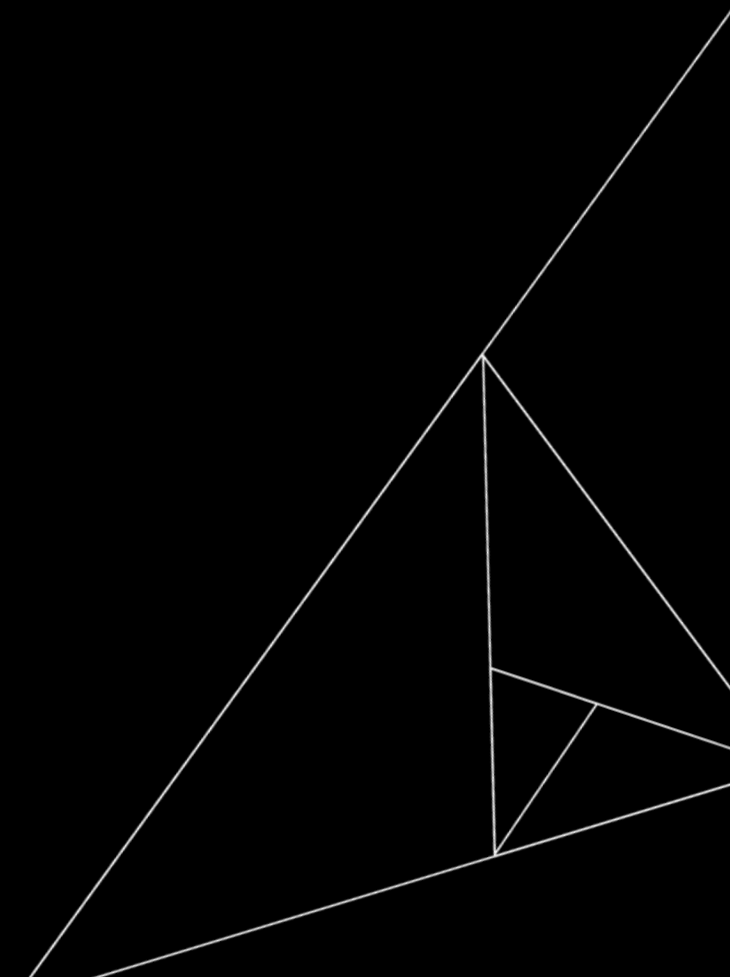
Agenda

1. Understanding Carbon in Buildings

2. Challenges in Counting Carbon

3. Standardisation and Data

4. Learning from International Practice



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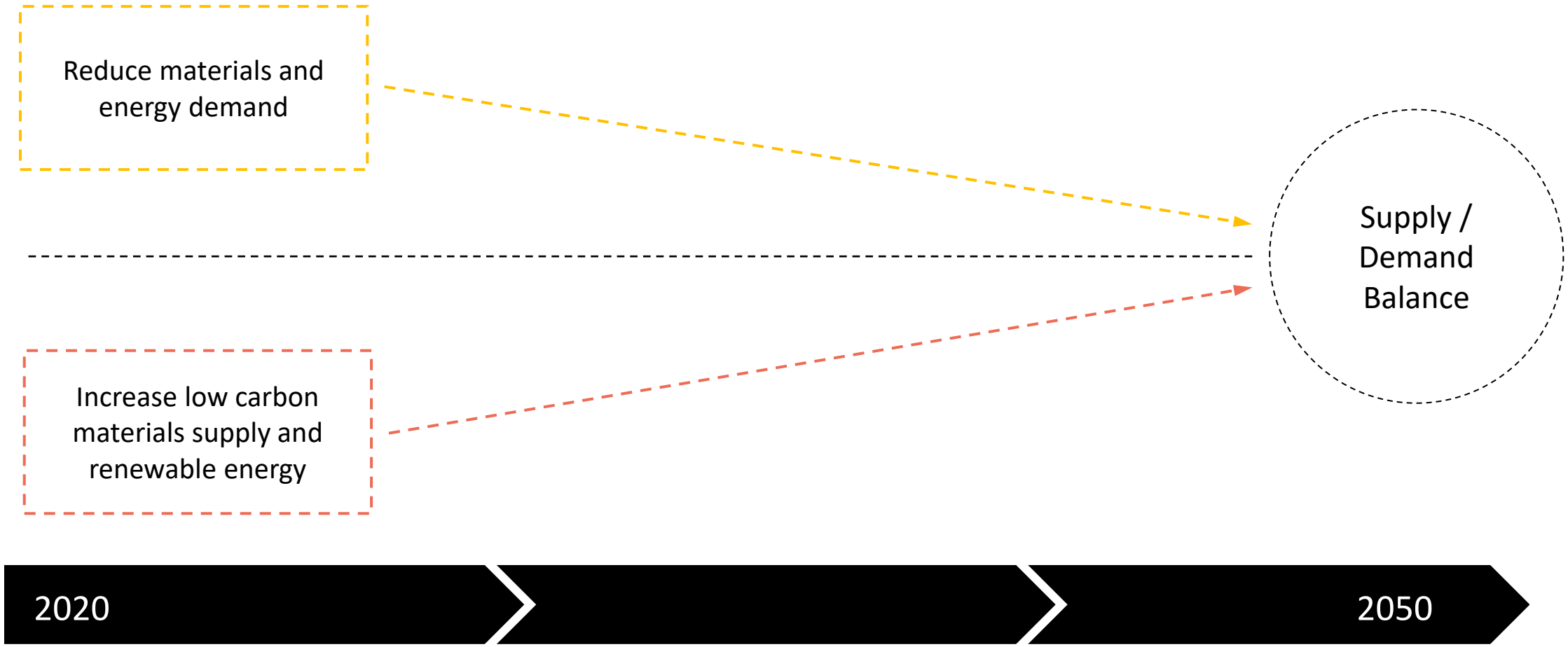
Drivers of Decarbonisation



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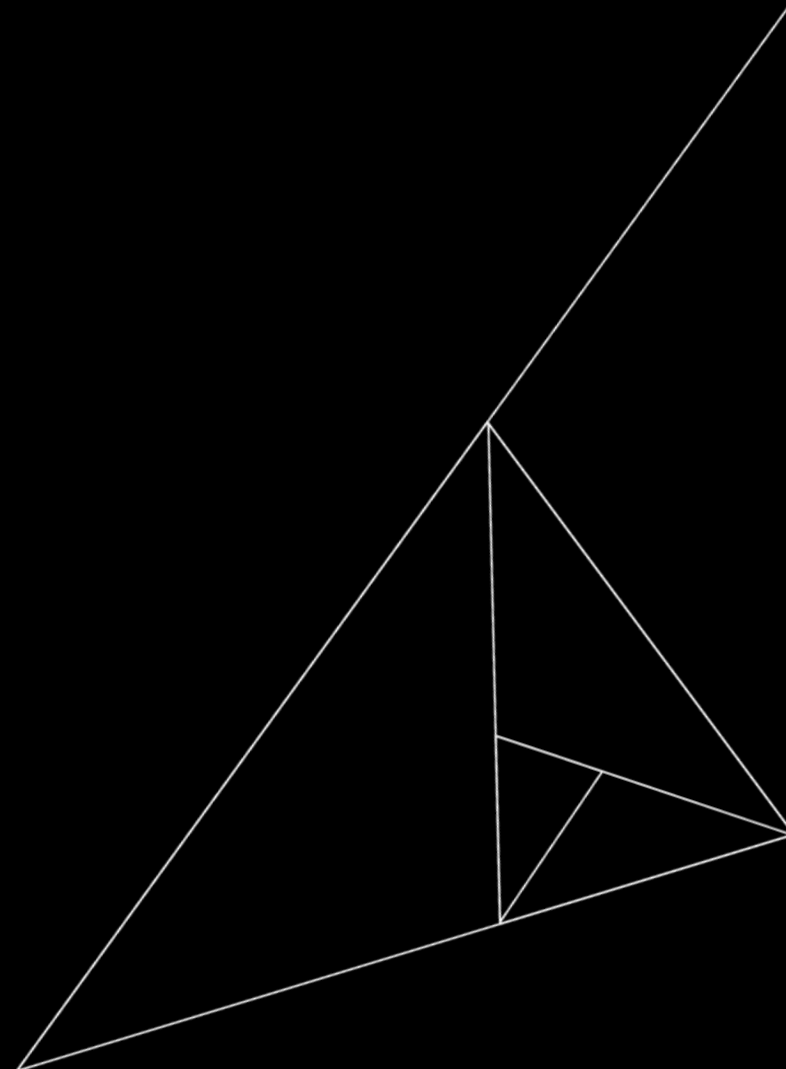
CHAPTER 01

Understanding Carbon in Buildings

CHAPTER 01

Understanding Carbon in Buildings



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What is Whole Building LCA? (wb-LCA)

Whole building life-cycle assessment

- An assessment targeted at understanding the life-cycle environmental impacts of materials used in constructing a building.
- An Assessment that examining the environmental impacts that stem from the life cycle of a product, process, or service.
- Providing climate impact information for decision-making related to the design, construction, operation, maintenance, and eventual demolition or reuse of a building.

Why is it Important?

Buildings are responsible for approximately 40% of global greenhouse gas emissions.

By understanding the carbon impact of buildings, we can identify areas where we can reduce emissions and make buildings more sustainable.

Whole building life cycle assessment (wbLCA) is one method that can help us understand the environmental impacts of buildings and identify areas where we can improve their sustainability.

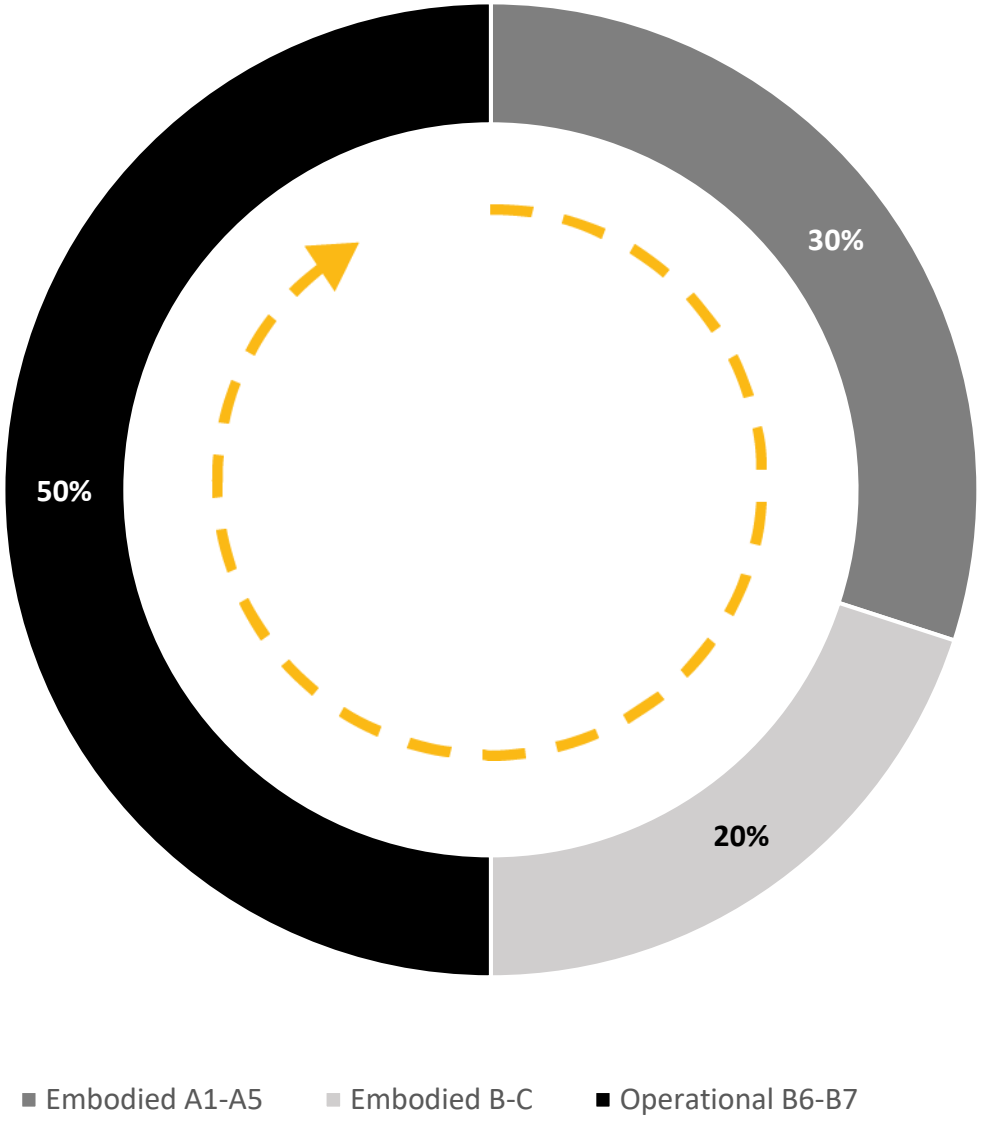
Defining Carbon

Whole Life Carbon

Up Stream Embodied Carbon

Down Stream Carbon
Maintenance and Replacement

In Use
Operational Carbon



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Lifecycle Carbon Timeline

Whole Life Carbon

Up Stream
Embodied Clean

In Use
Operational Carbon

Downstream Carbon
Maintenance and Replacement

Extract | Transport to Factory | Manufacture | Transport to site | Construct | Use and maintain | Demolish | Haul | Landfill or Recycle

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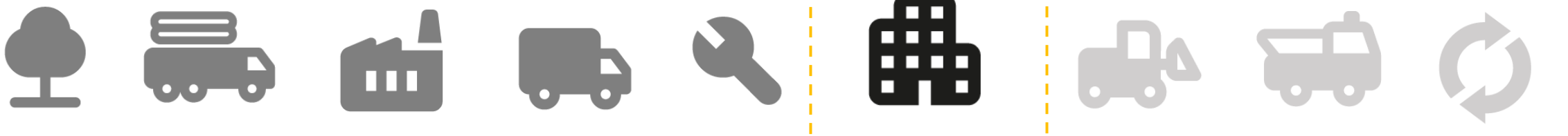
Lifecycle Carbon Timeline

Whole Life Carbon

Up Stream
Embodied Clean

In Use
Operational Carbon

Downstream Carbon
Maintenance and Replacement



Extract | Transport to Factory | Manufacture | Transport to site | Construct | Use and maintain | Demolish | Haul | Landfill or Recycle

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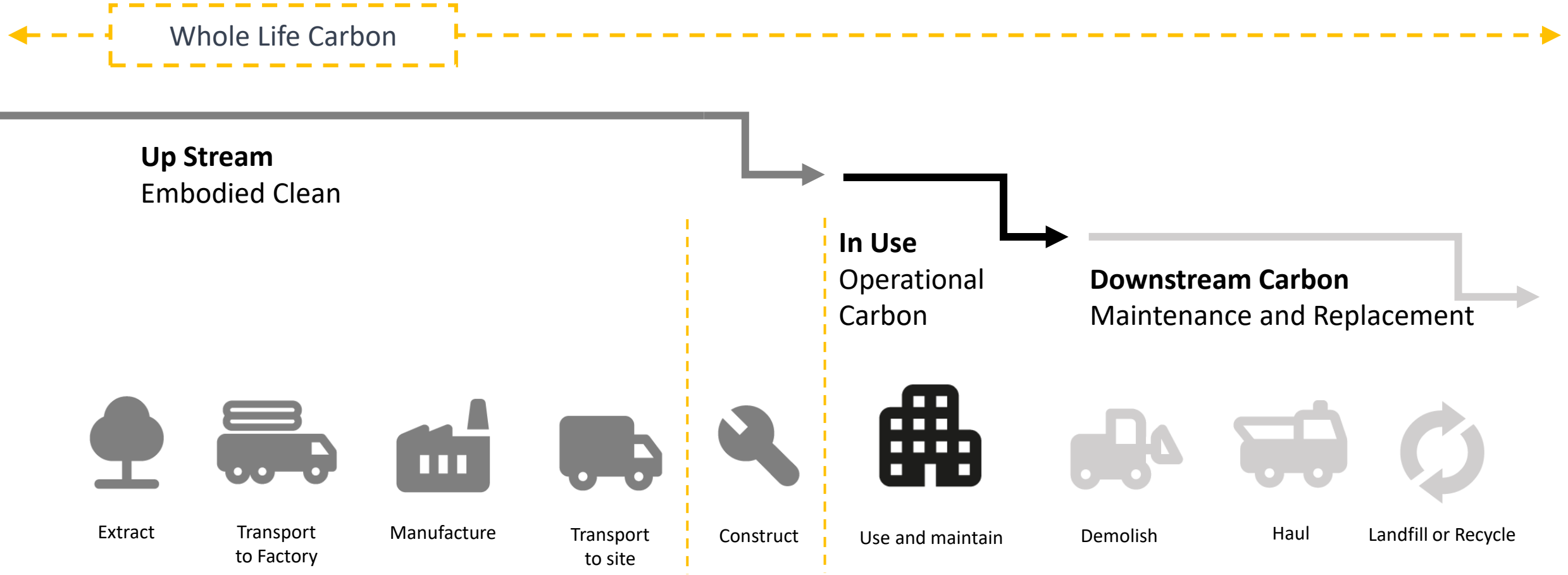
Lifecycle Carbon Timeline



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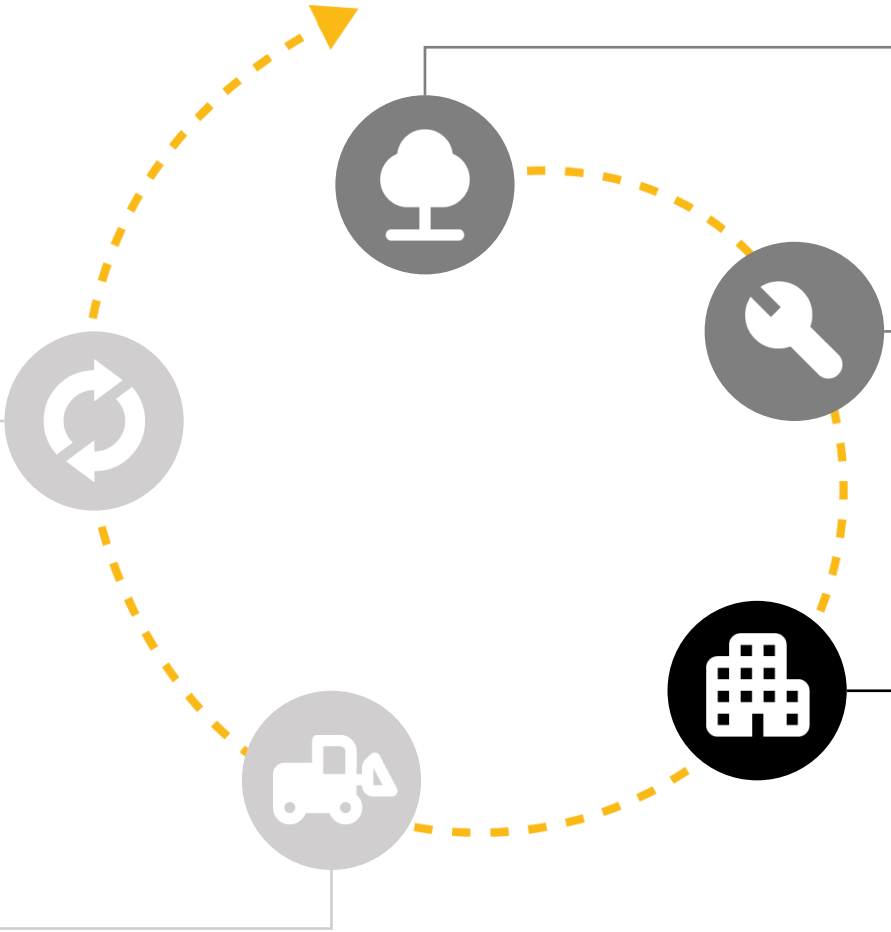
Lifecycle Assessment

Beyond End of Life: Potential for reuse, recycling, energy recovery

End of Life: Deconstruction, waste processing, disposal, transportation



Production: Raw material supply, manufacturing, transportation

Construction: Construction, installation process, transportation

Operation: Maintenance, repair, replacement, refurbishment

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Whole Life Carbon

Upfront Carbon → Embodied Carbon

Product

A1	Raw material supply
A2	Transport
A3	Manufacturing

Construction

A4	Transport
A5	Construction/Install

In Use

B1	Use
B2	Maintenance
B3	Repair
B4	Replacement
B5	Refurbishment

Operational Carbon

B6	Operational Energy
B7	Operational Water

End of Life

C1	Deconstruction
C2	Transport
C3	Waste processing
C4	Disposal

Beyond Lifecycle

D1	Benefits and Loads
D2	Reuse, Recovery, Recycling

Up Stream Carbon | Use/ Use Stage | Beyond the Boundary

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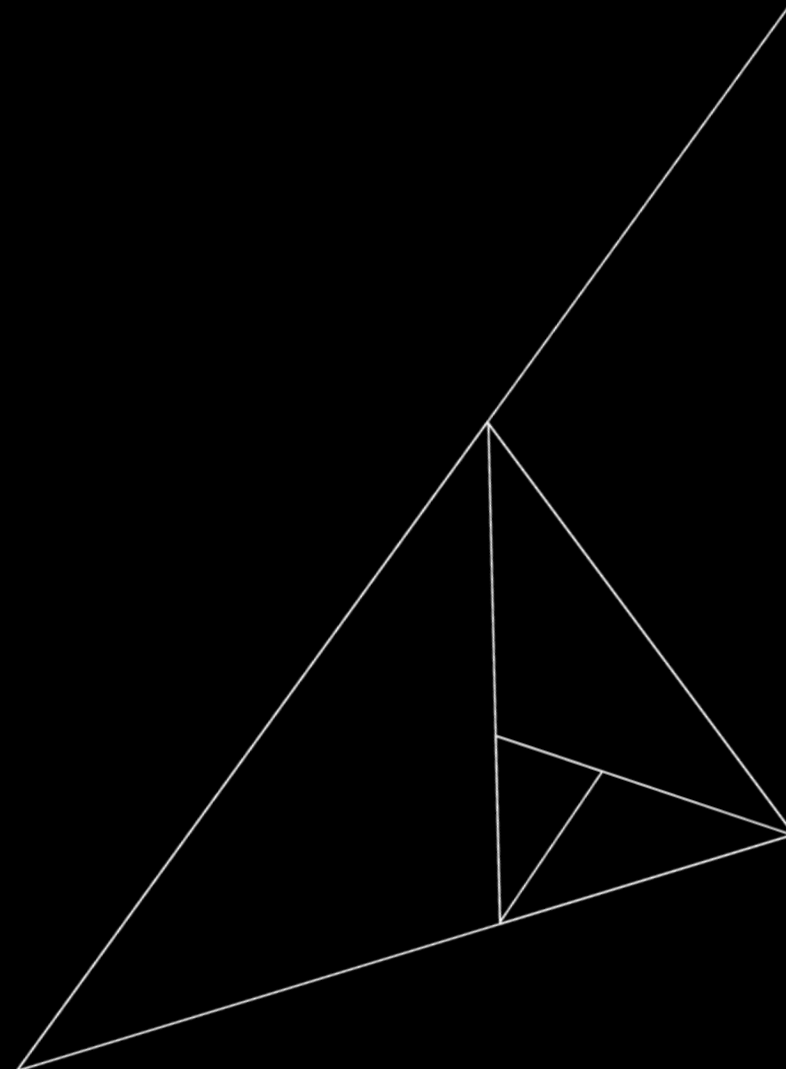
CHAPTER 02

Challenges in Counting Carbon

CHAPTER 02

Challenges in Counting Carbon



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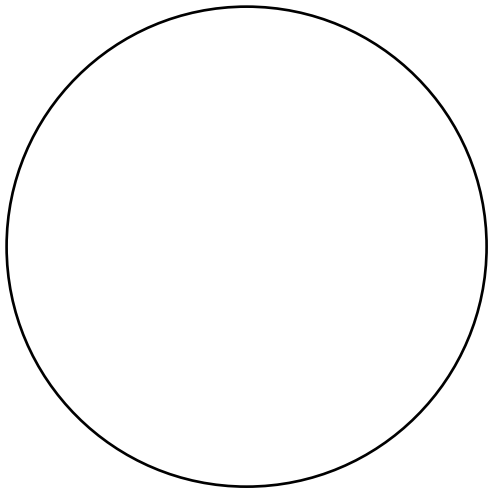
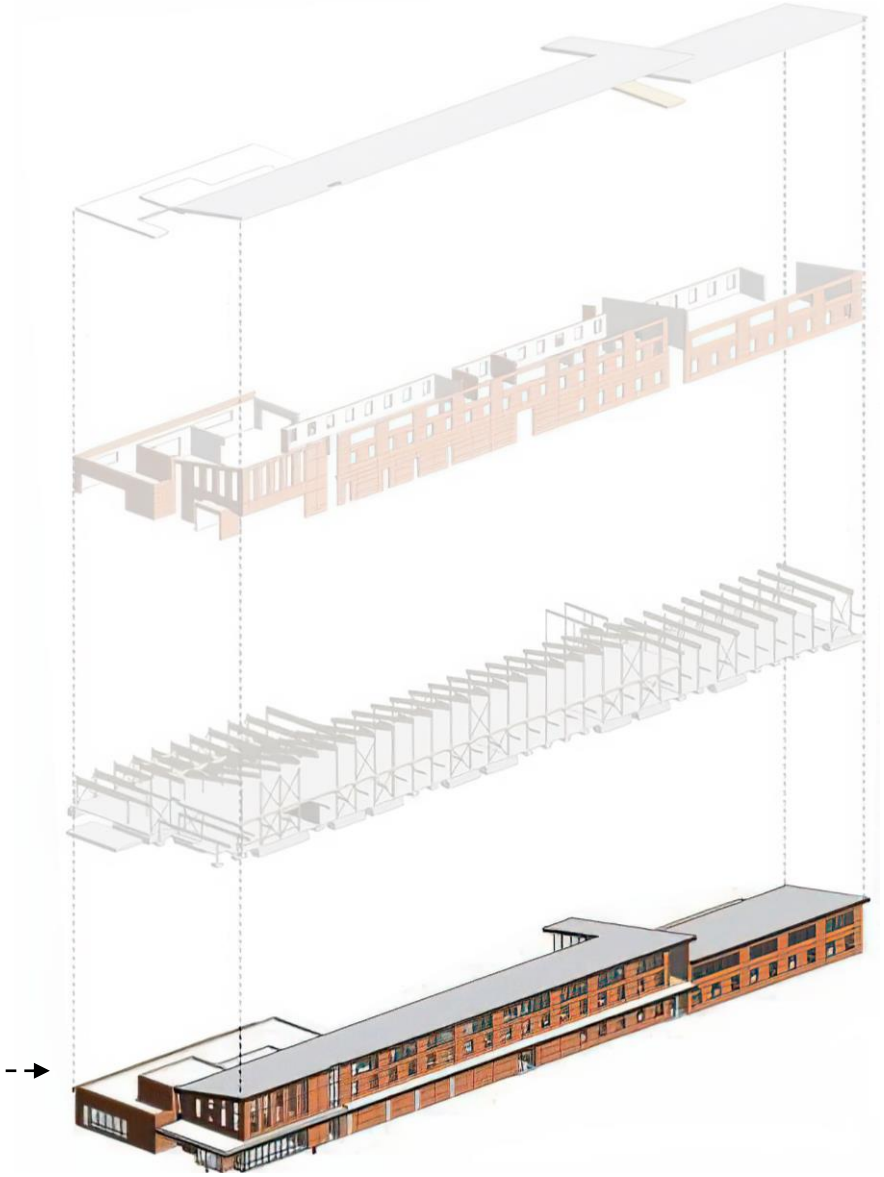
Whole Life Carbon

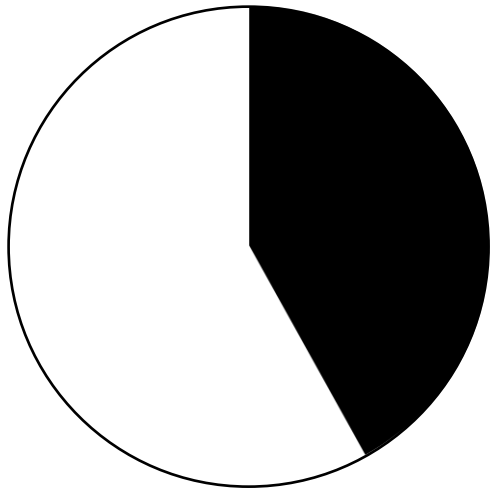
Whole Life Carbon

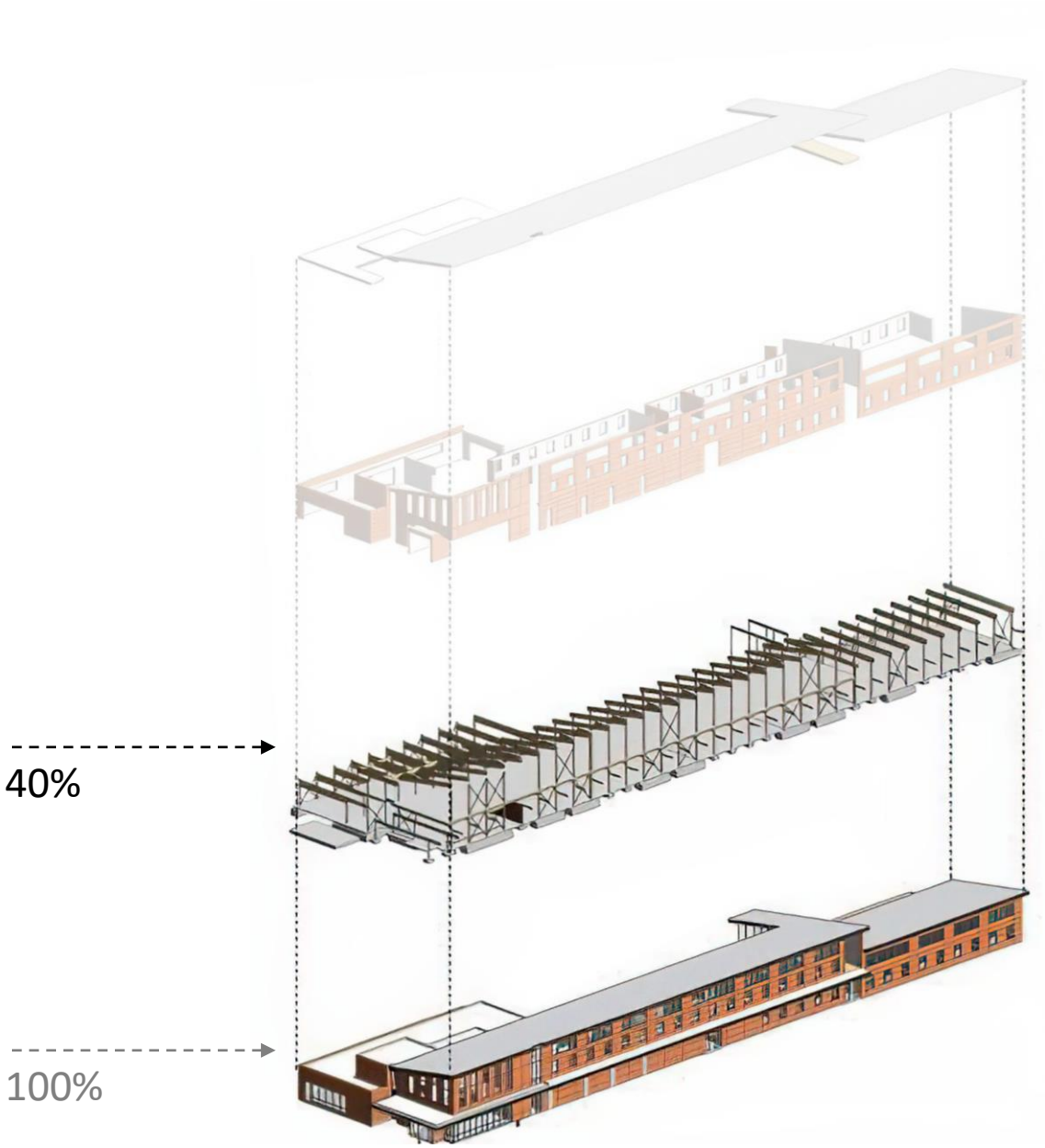




100%

Whole Life Carbon





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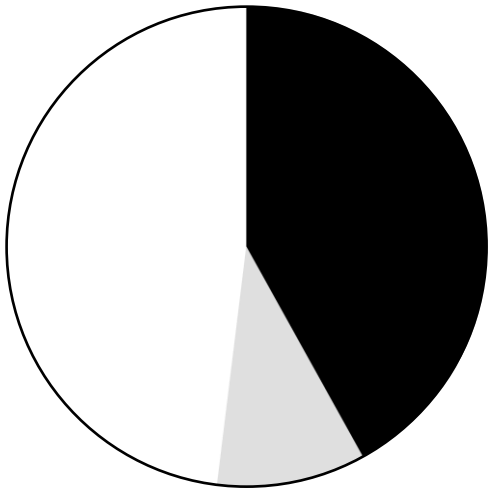
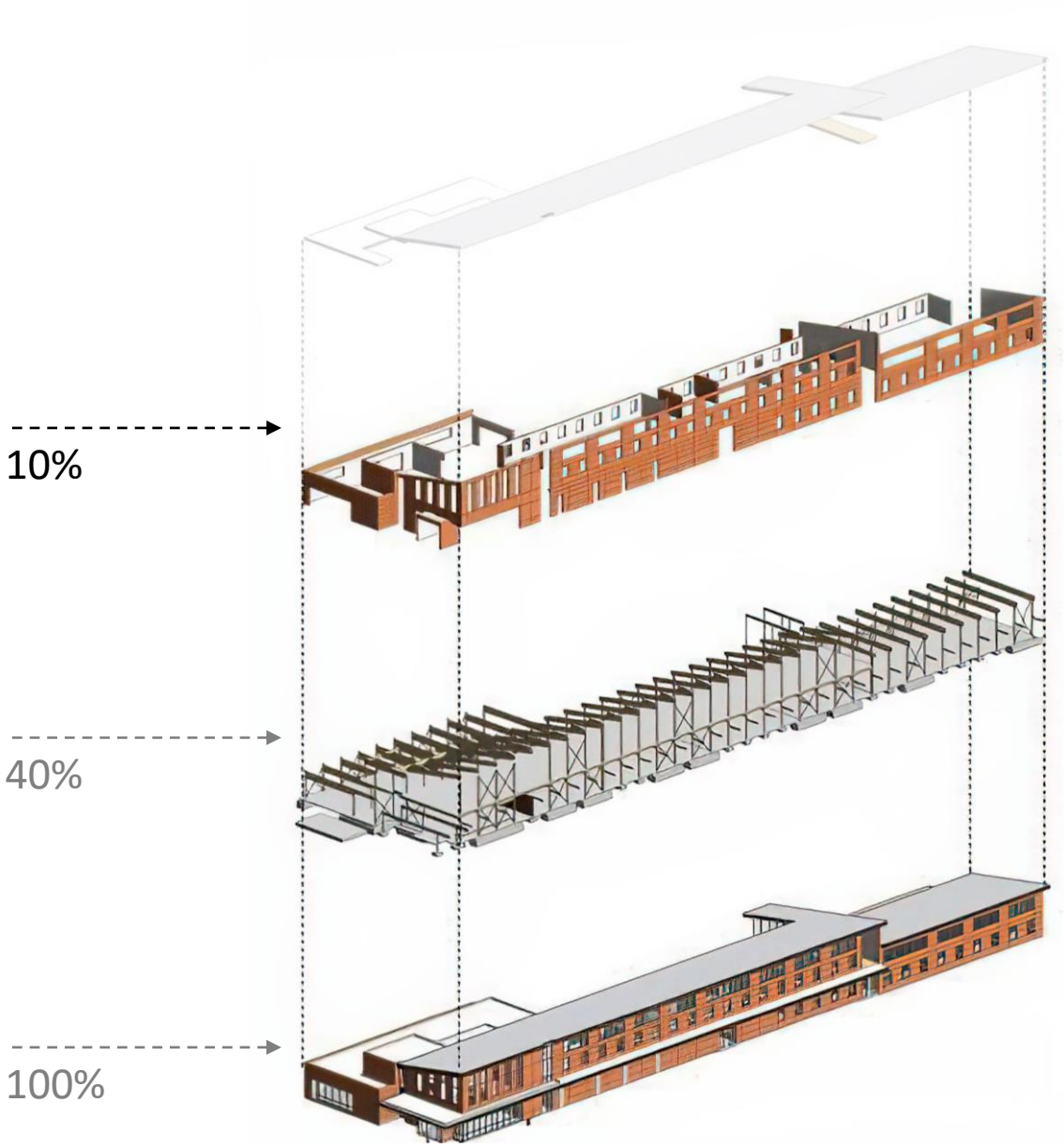
Whole Life Carbon





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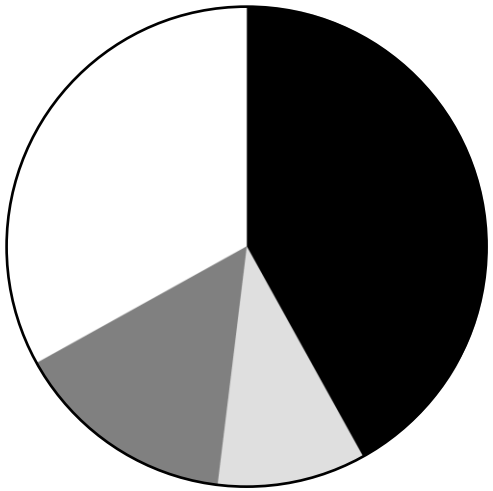
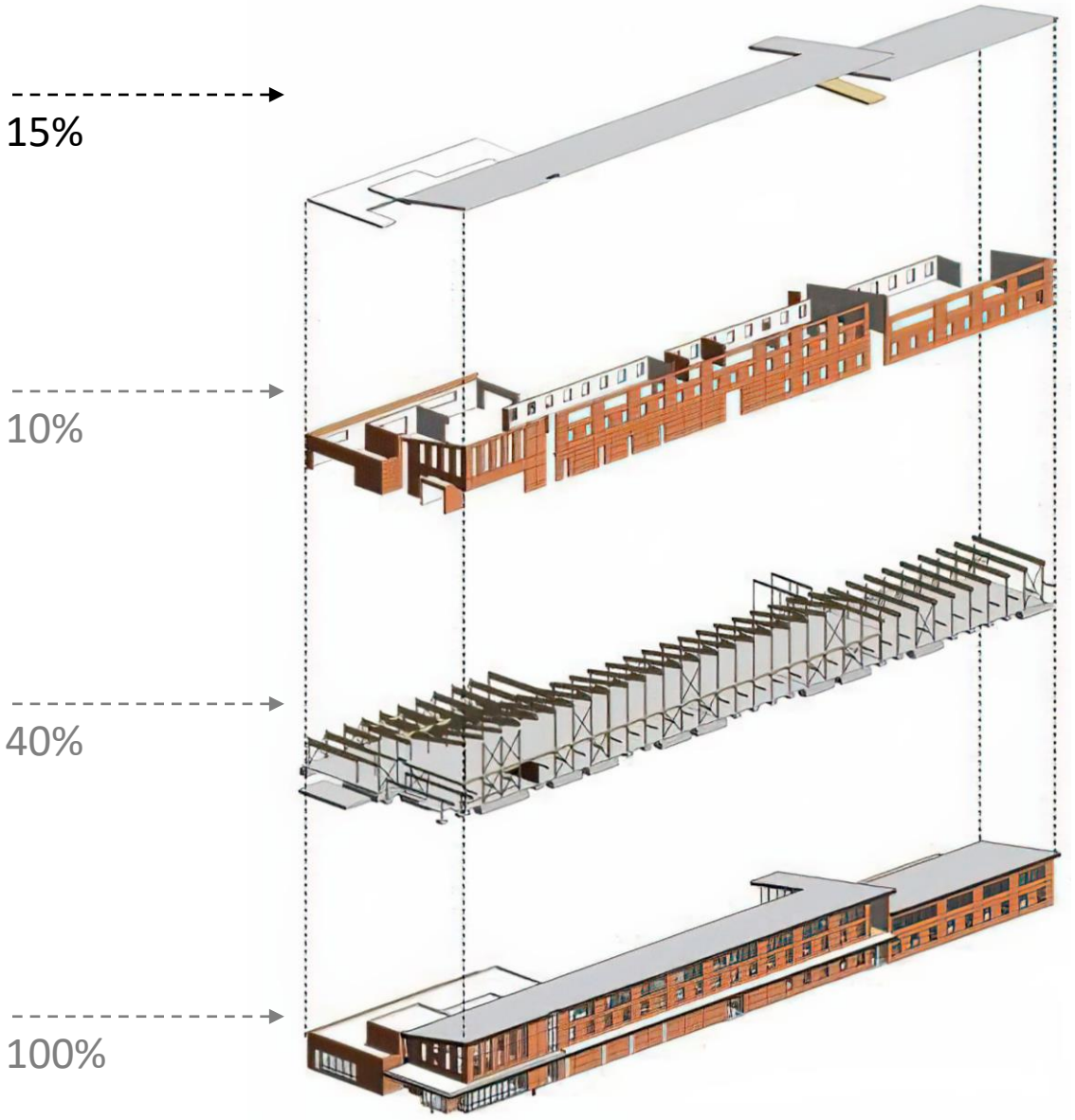
Whole Life Carbon





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The Need for Accurate Measurement

Trust and reliability through accuracy and consistency of LCA

- Data quality
  Define owner and levels of detail.
- Data availability
  Some detail not available at this stage.
- System boundaries
  Consistency in define what is included and excluded from the study.
- Goalsetting
  Function of the Carbon Calculation may not have been clearly defined.

Accuracy and Consistency

Time Cost of detailed analysis.

Data collection, escalating level of detail with project progress

inputs - raw materials, products energy. Carbon coefficients

outputs – reporting for different use cases – LEED, ESG, etc

Accuracy and Consistency

Assumptions

Use of ‘product specific data’ vs National Average data?

National database of materials being built by IGBC

Shortage of Environmental Product Declarations (EPD)

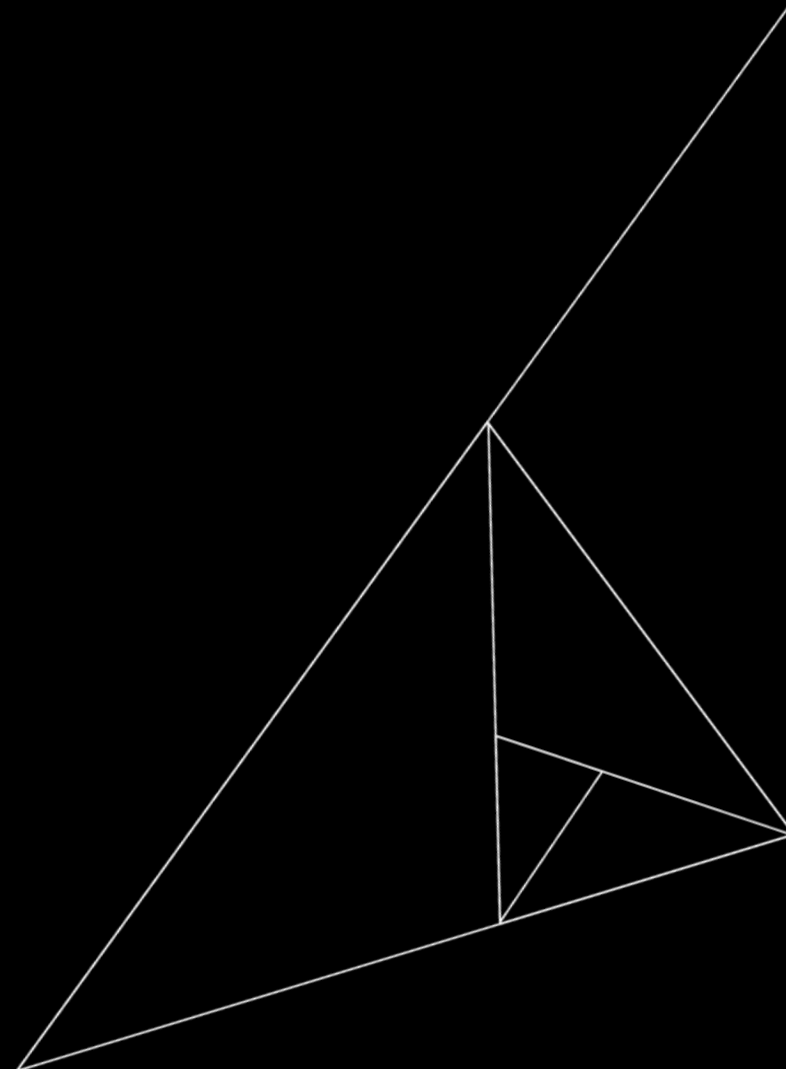
Suppliers using one EPD for multiple products

CHAPTER 03

Standardisation and Data

CHAPTER 03

Standardisation and Data



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Where BIM Comes in Handy!

Information structures to streamline assessment process

- Measure once - BIM can automate quantification and build a material inventory.
- Digitalise - Using digital design tools -BIM, to automate the identification of Carbon hotspots.
- Future BIM - LCA development will focus on highlighting data gaps & lack of quality in models and procedural errors.

STANDARDISATION

The Rules

Does this look familiar?

EN 15978:2011
Sustainability of construction works. Assessment of environmental performance of buildings. Calculation method

ISO 14040:2006 Environmental management
Life cycle assessment
Principles and framework

ISO 14064-1:2018
Greenhouse gases — guidance at the organization level for quantification and reporting of greenhouse gas emissions

ISO 14025:2006
Environmental labels and declarations
Type III environmental declarations
Principles and procedures

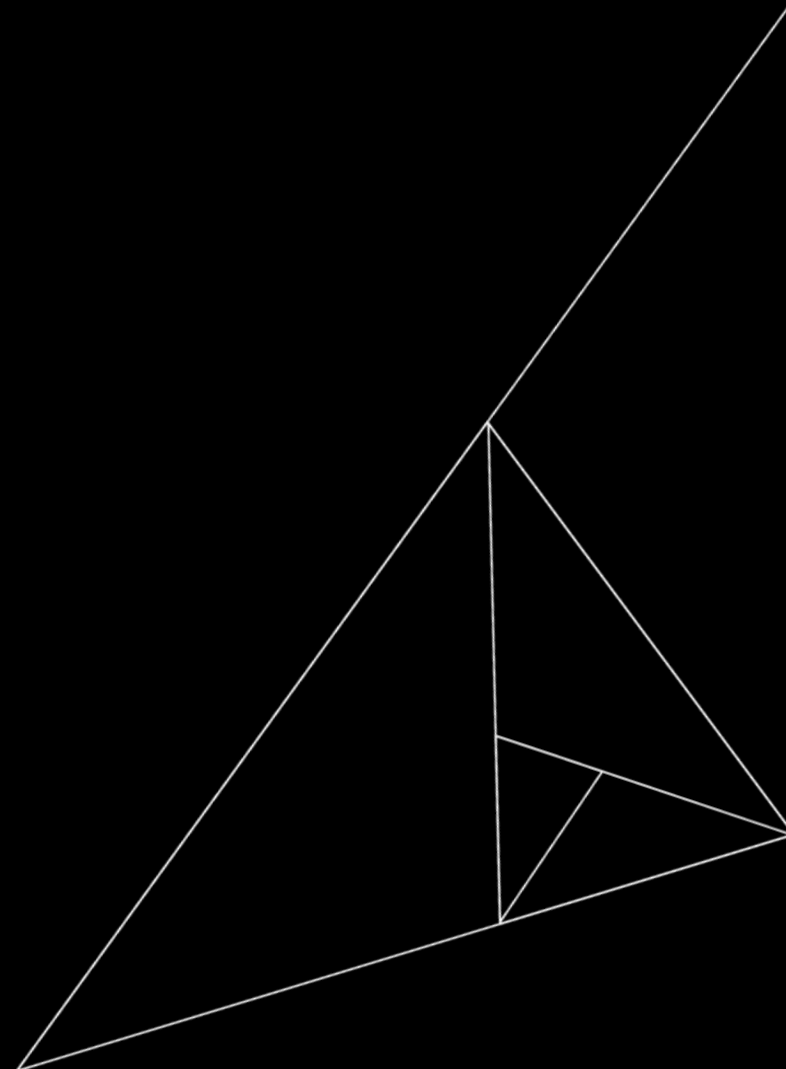
ISO 15686-5:2017
Buildings and constructed assets
Service life planning

CHAPTER 04

Learning from International Practice

CHAPTER 04

Learning from International Practice



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Simplification

Input

Goal

Scope

Inventory

Impacts

The Building

Construction

Use / Operation

Deconstruction

Output

Results

Interpretation

Options

Metrics

Environmental Impacts

Cost Impacts

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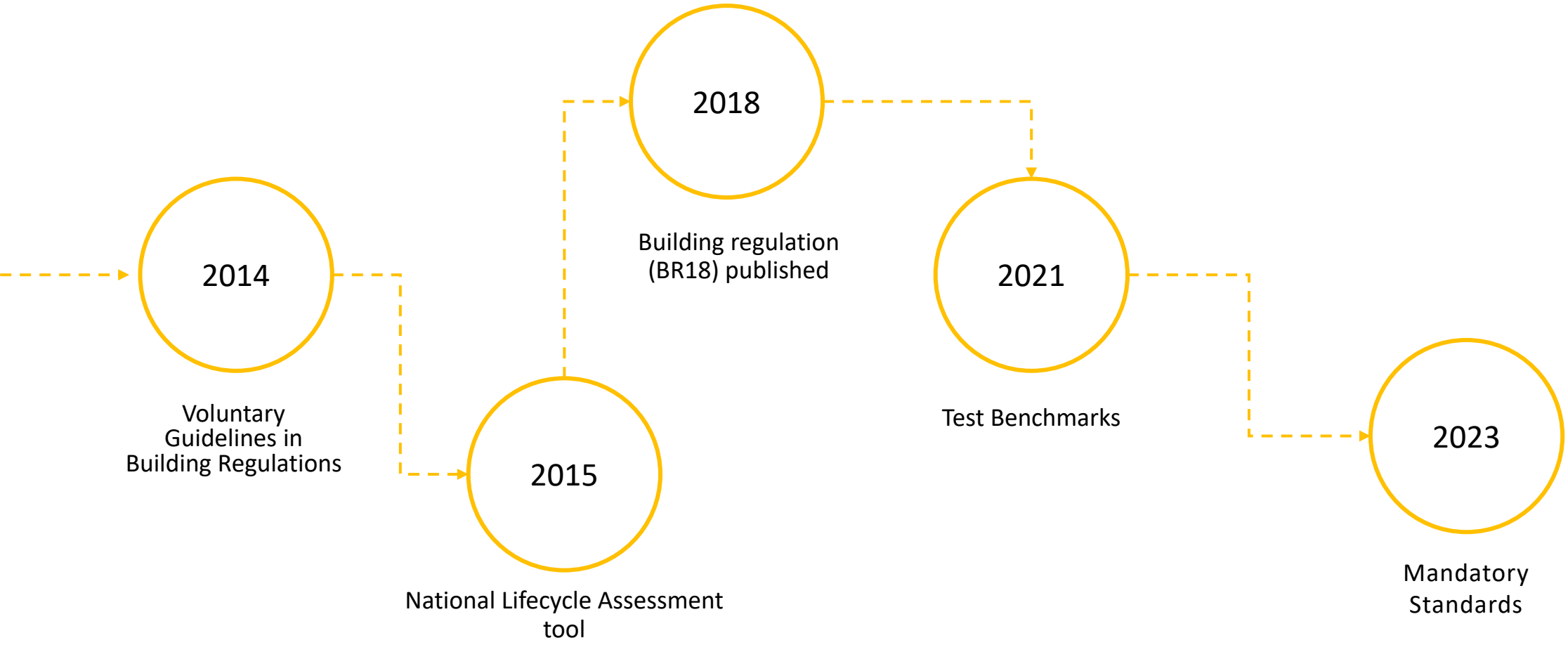
Learning from Denmark
Timeline



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Stage 2B – Detailed Design

Data Quality	Building Elements					
	Structure	**Facade**	**Interior**	**MEP**	**Stuff**	**Site**
Products A1-A3	391	59	51	120	0	
Construction A4-A5	11	1	2	1	0	30
In Use B1-A5	0	59	53	240	0	
In Use Energy B6-B7				620		
End of Life C	50	6	5	13	8	
Emissions	408	120	107	981	8	1,647 $kgC0^2e/m^2$

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Stage 4– Construction

5 High Quality data retrospectivity

2 Lower Quality data representivity

Data Quality	Building Elements					
	Structure	**Facade**	**Interior**	**MEP**	**Stuff**	**Site**
Products A1-A3	5	3	2	2	2	4
Construction A4-A5	4	4	2	2	2	3
In Use B1-A5	4	3	2	2	3	3
In Use Energy B6-B7				N?A		
End of Life C	4	2	2	2	2	2
Emissions	623	44	352	620	8	1,647

Score

66%

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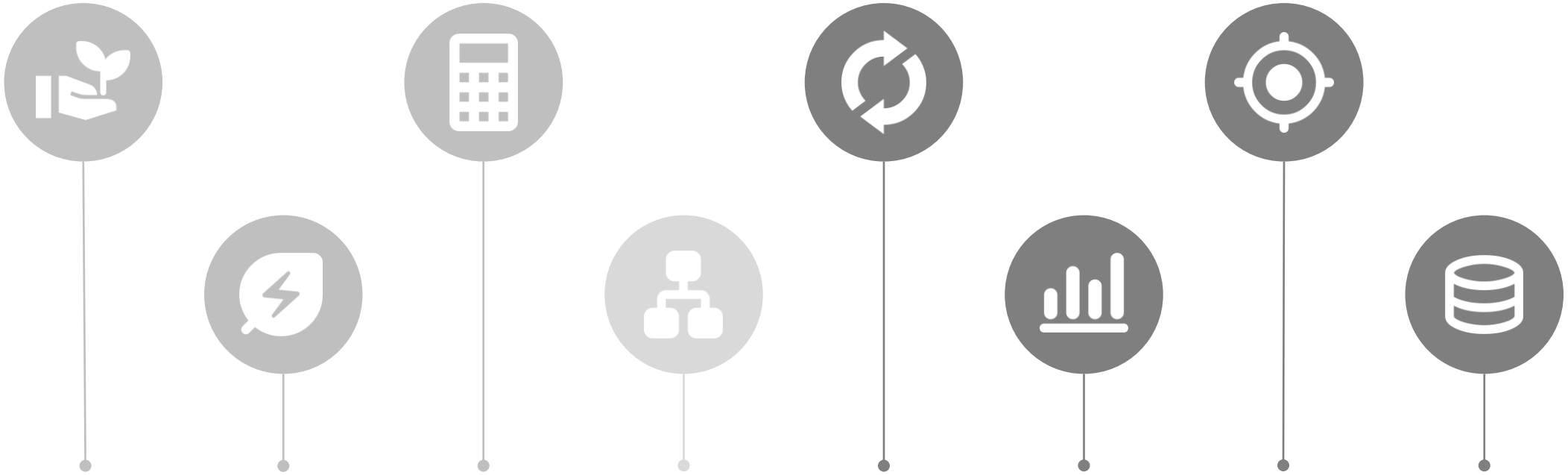
Strategy → Delivery → Zero Carbon Buildings



Early-Stage Carbon Calculations and Benchmarking

Goalsetting and Data Collection Strategy

Life Cycle Assessment (LCA) calculations

LEED / BREEAM Credit Selection or Green Procurement Strategy

Net Zero Carbon Roadmap -1.5□C path

Data Quality evaluation and Reporting

Carbon Reduction and Optimisation

Cost Optimisation

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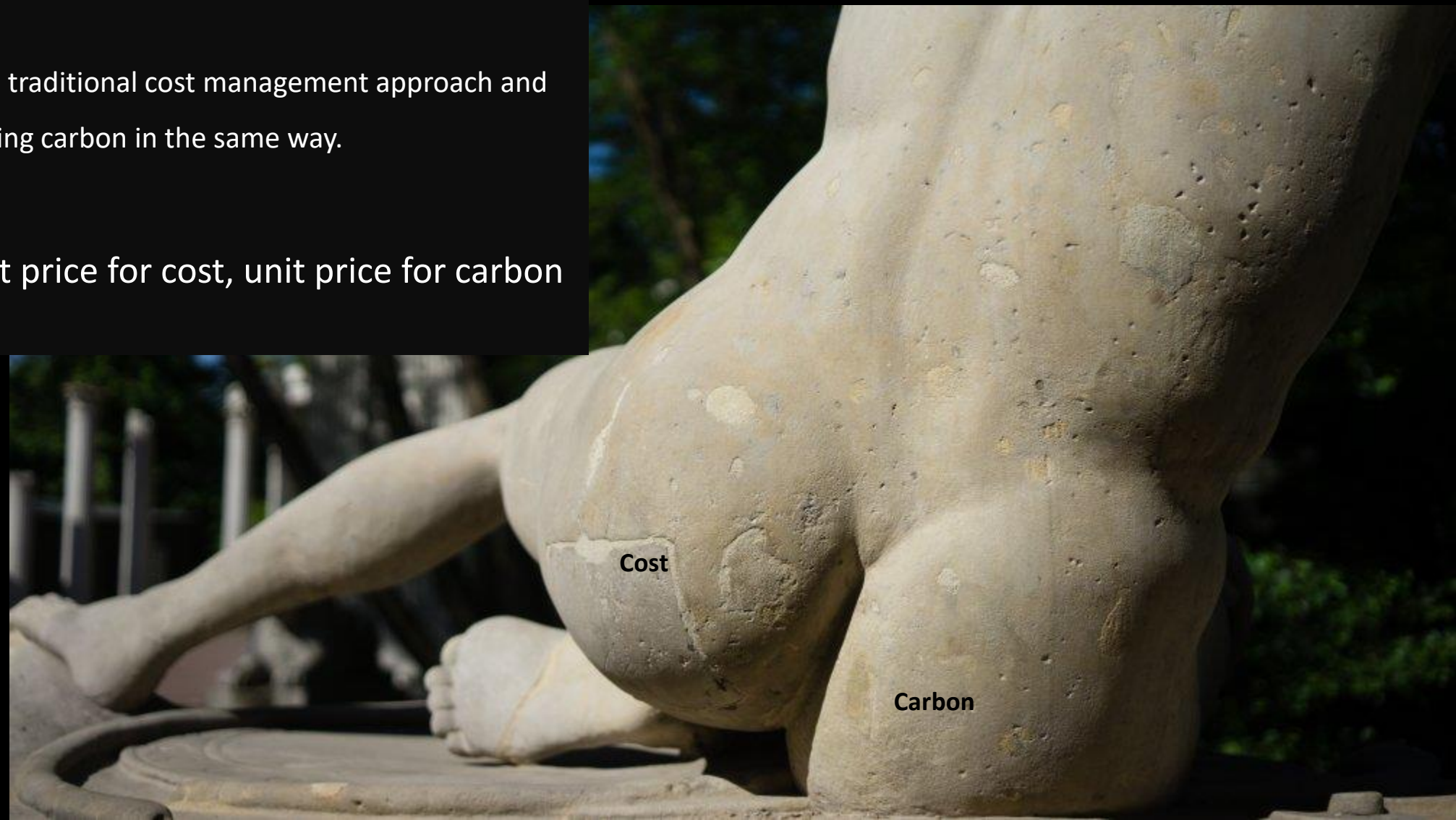
The intrinsic Link between carbon & Cost

Simply Taking our traditional cost management approach and we're just managing carbon in the same way.

Quantum, unit price for cost, unit price for carbon



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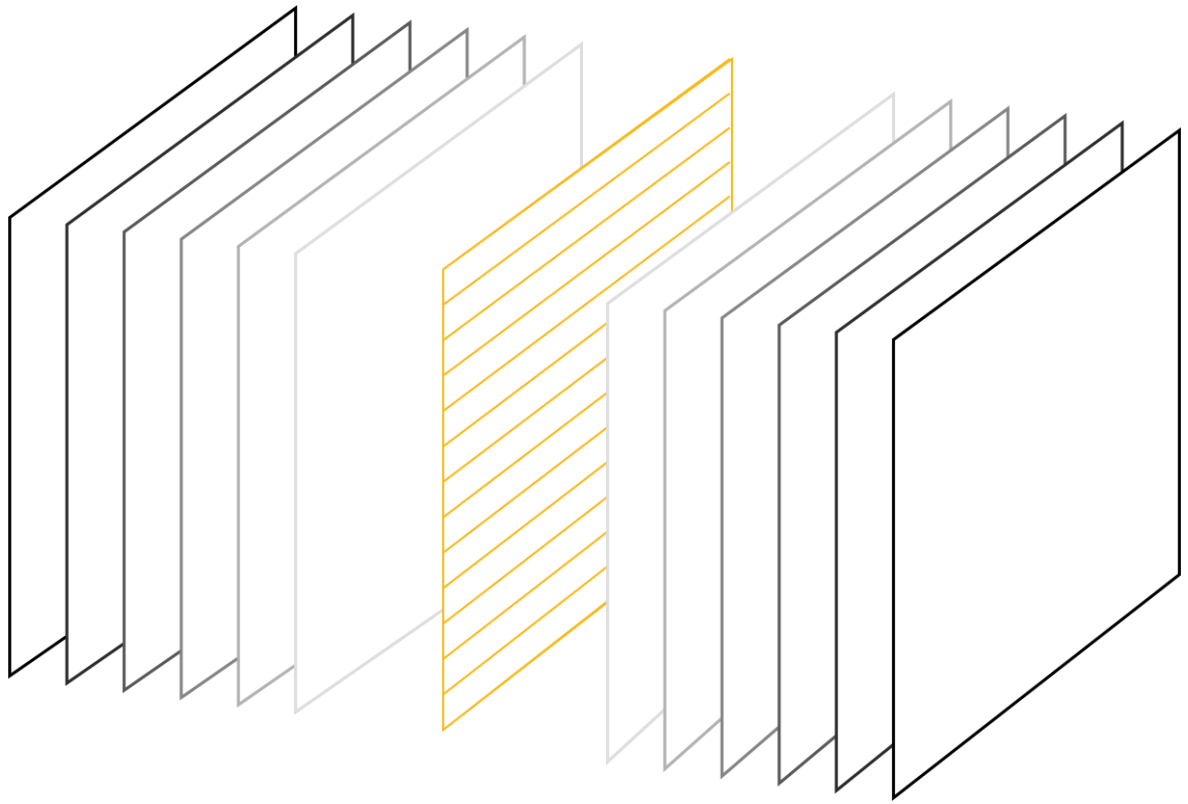
Applying and ESG lens



Investment Risk → Project Delivery → Sustainable Design Solutions

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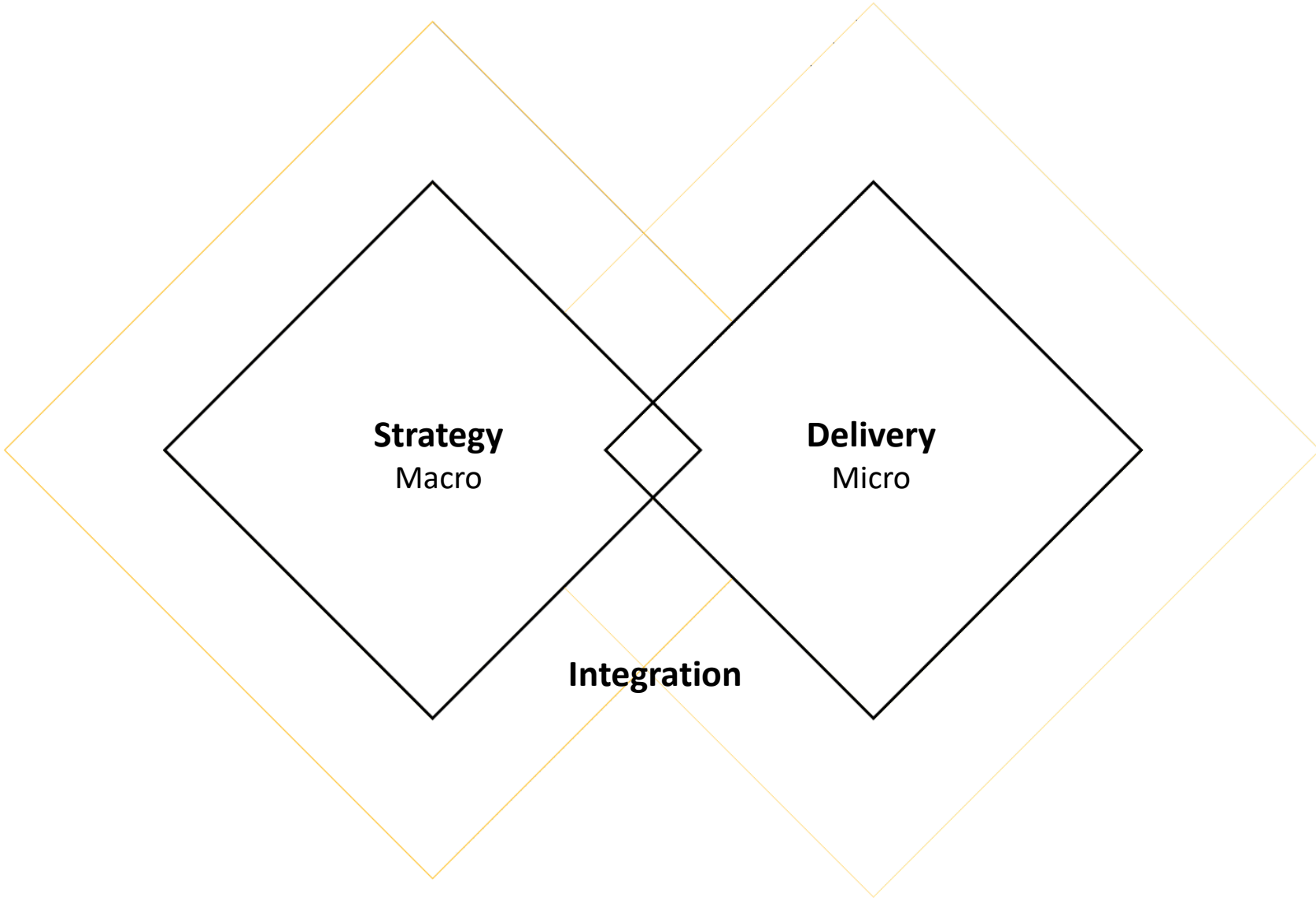
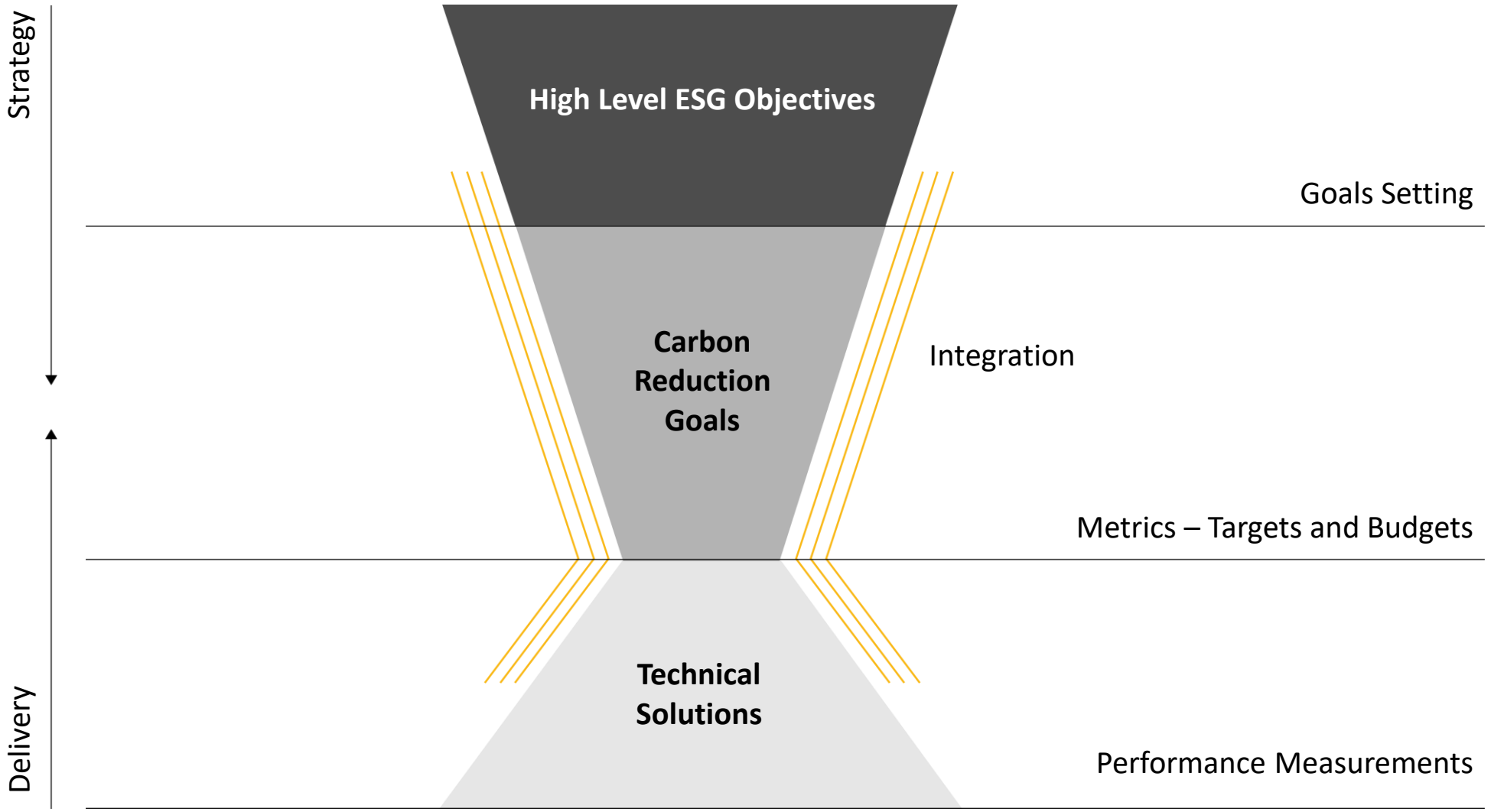
Overview



Overview



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Client journey

Roadmap

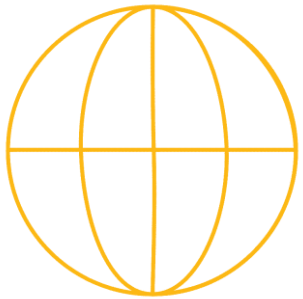
- Carbon risk assessment
- Goalsetting – business case
- Climate neutral Pathway
- Budget – Carbon

Evaluate

- ESG / GRESB, EU taxonomy
- Calculate Value at Risk
- LCA calculation
- evaluate options

Track

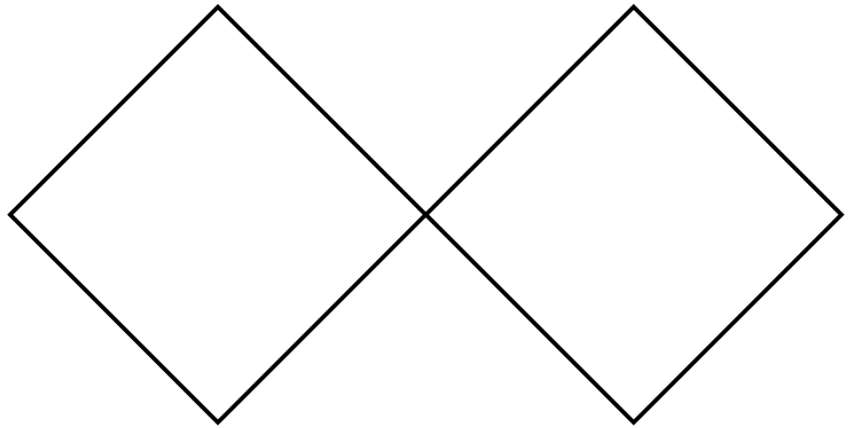
- Cost model
- Carbon budget
- Viability of measures
- Internal Carbon price

Turning high level objectives into real world  actions

International Cost Management Standard
ICMS 3

Benefits of Standardised Reporting on project costs and carbon emissions:

- Transparency through cost data classification
- Consistency in reporting and tracking
- Connected data to merge Carbon & Cost
- Easier comparison between Alternatives
- Better Access to supply chain and digital data libraries



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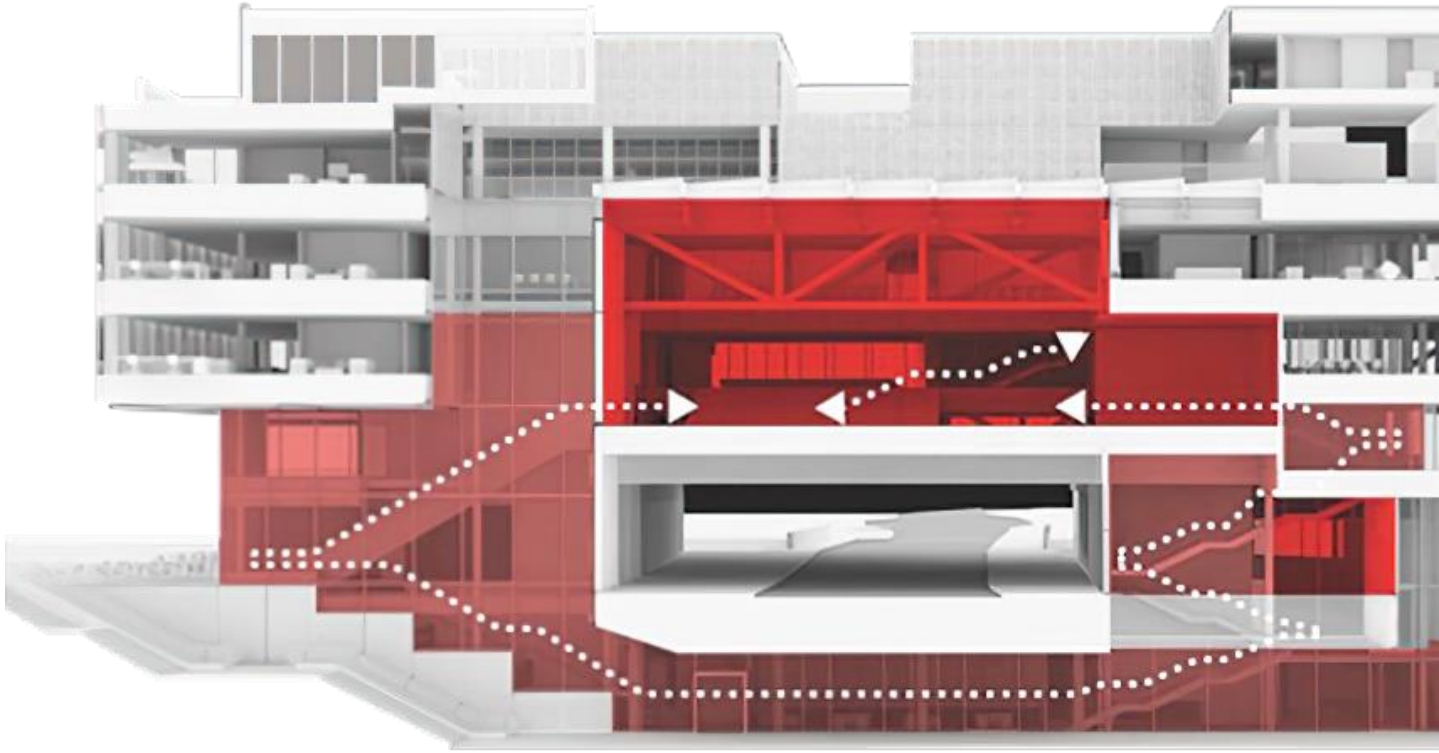
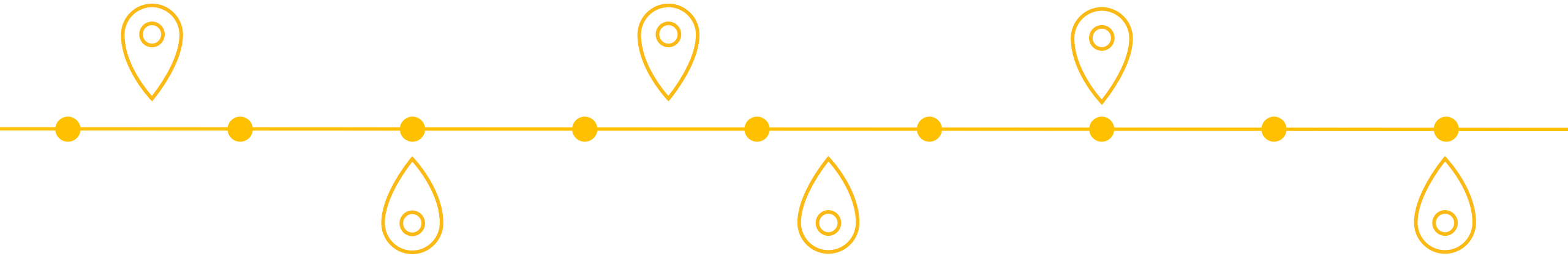
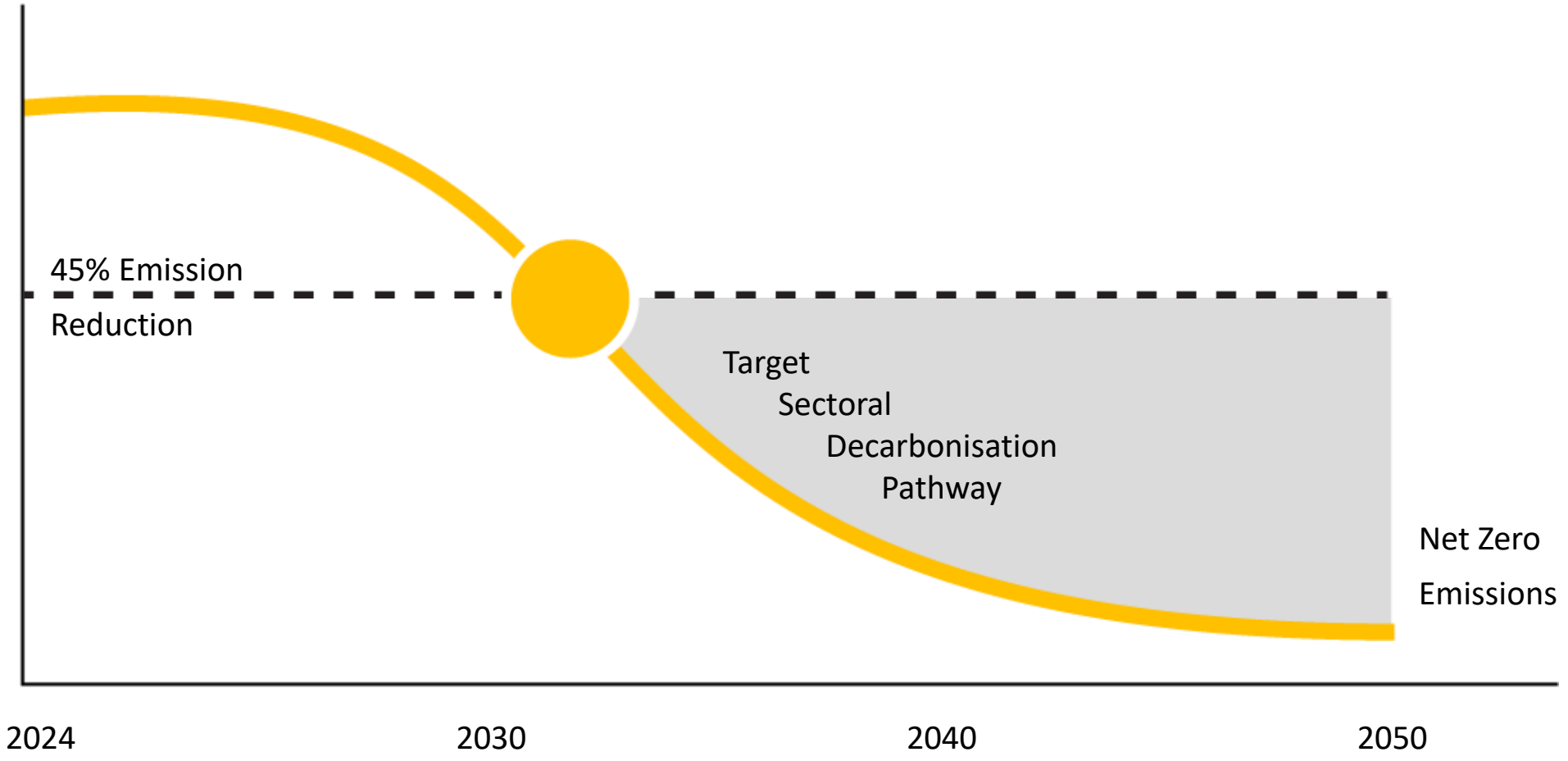
Application to projects



Timeline


Public Spending Code 2019
Green Public Procurement 2019
Digital Mandate 2024 (ICMS-3)
Infrastructure Guidelines 2023
EPBD Energy in Buildings directive
2030 Targets Public Sector Mandate

Tightening targets for carbon and climate performance



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ICMS3

International Cost Management Standard (ICMS)

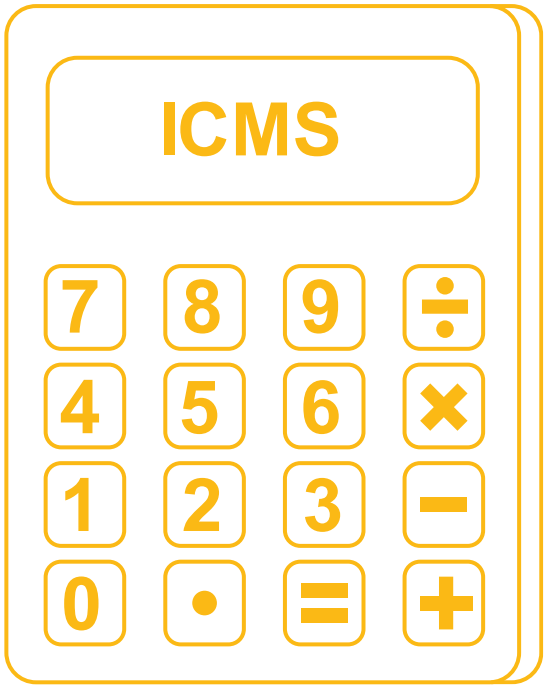
Digital requirements in the Capital Works from January 2024

ICMS 3 creates an intrinsic link between Carbon & Cost

Measures, tracks and reporting on operational and embodied carbon

Enables consistent reporting across the National Development Plan of:

+ Initial Costs + Life cycle costs + Life cycle Carbon



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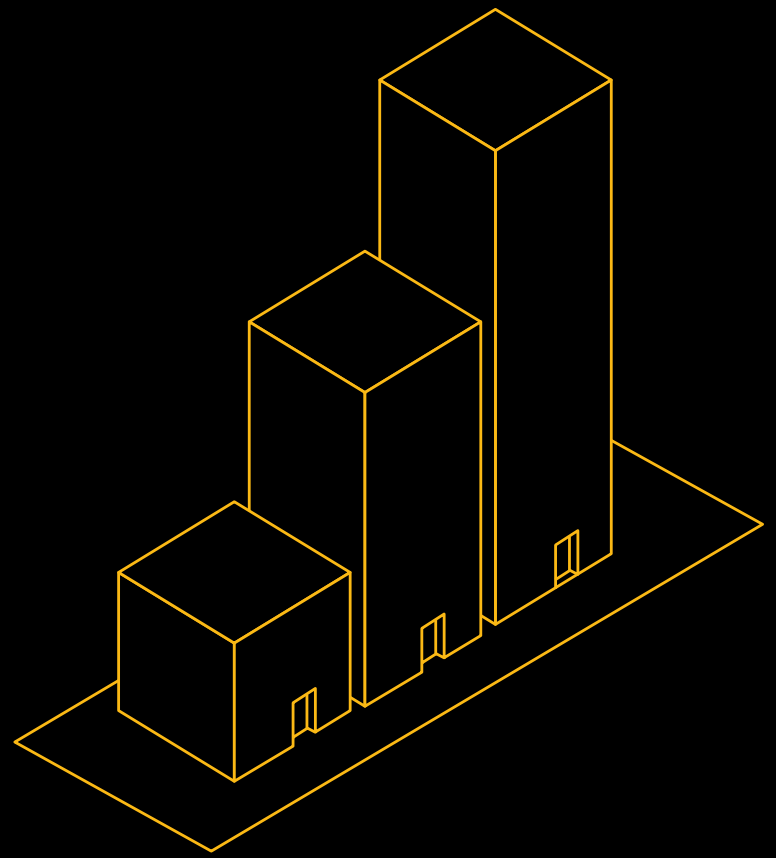
Economic Appraisal
‘Value for Money’

Public Spending Code (PSC updated in 2019)

- Improved Accuracy of cost estimation and forecasting.
- Include Risk identification and risk management

- Requires external evaluation of projects over €20m at six key project lifecycle stages,
- Now includes parameters around lifecycle Carbon



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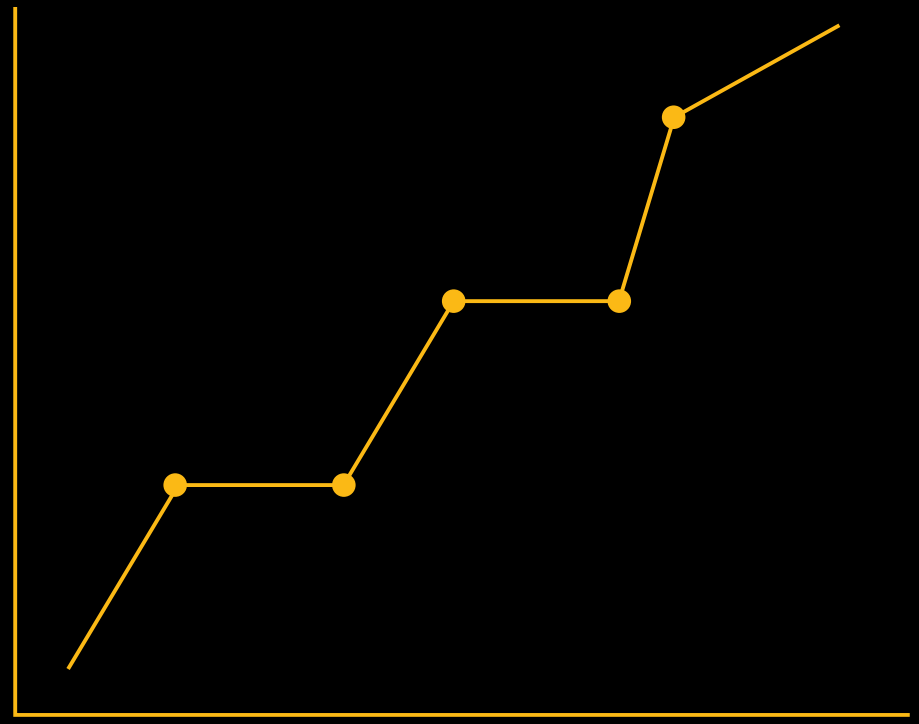
Economic Appraisal
Shadow Price of Carbon

- Used to monetise the value of Carbon Emissions from Greenhouse Gases
- Future projects emissions must be included, and index linked to future hypothetical carbon prices

Link : Section 6 of Central Technical References and Economic Appraisal Parameters.



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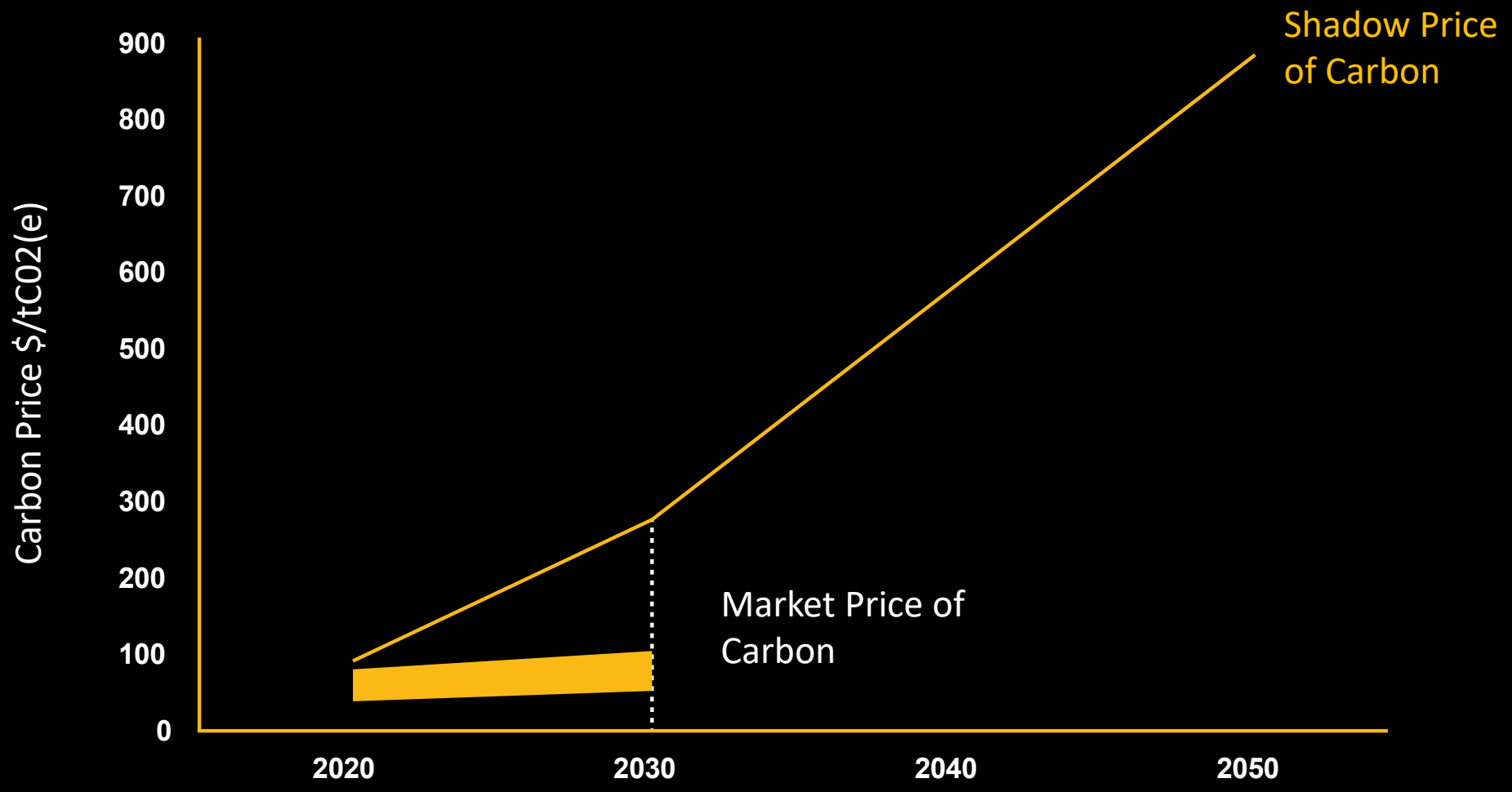
Price of Carbon



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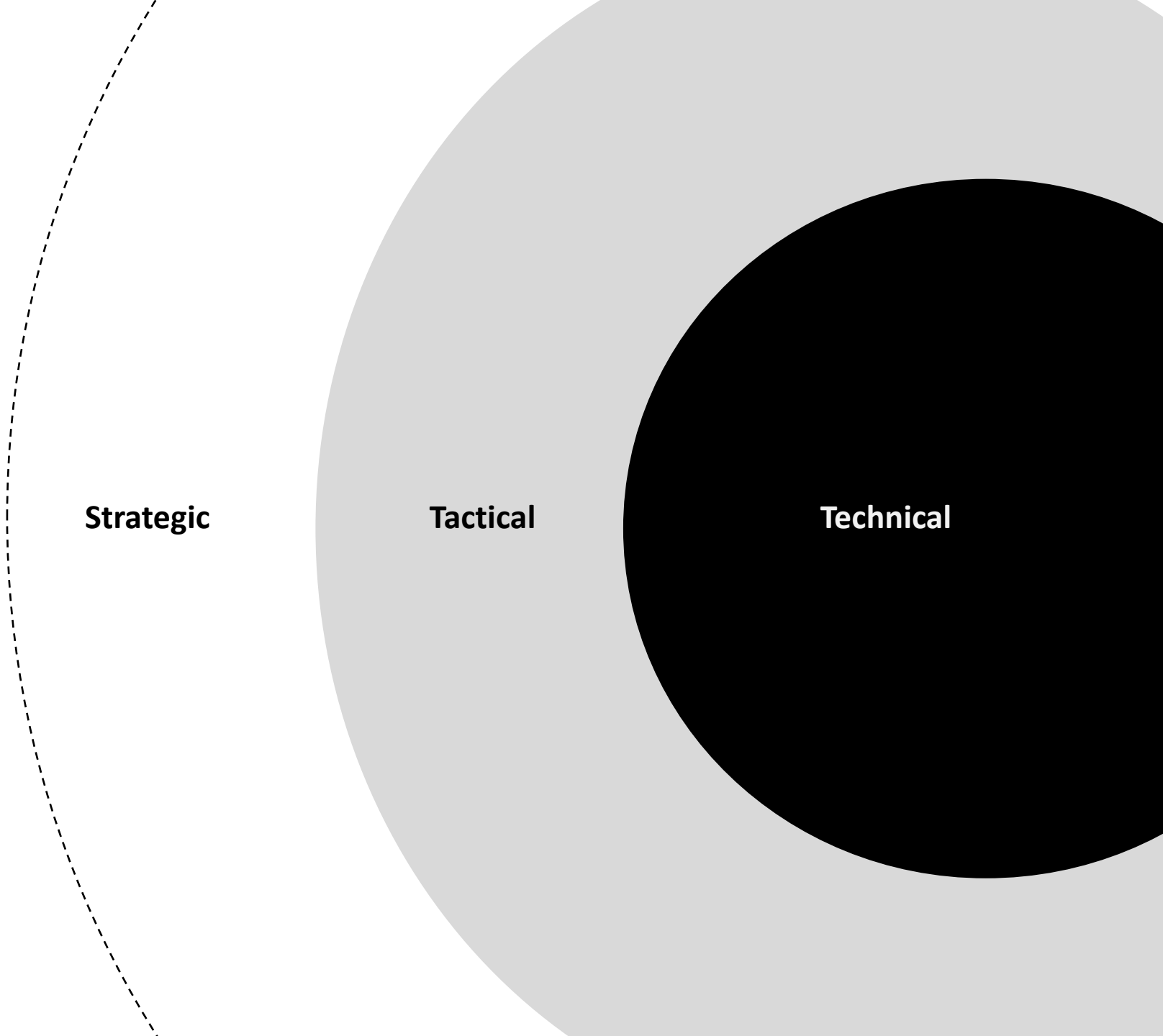
Project Delivery



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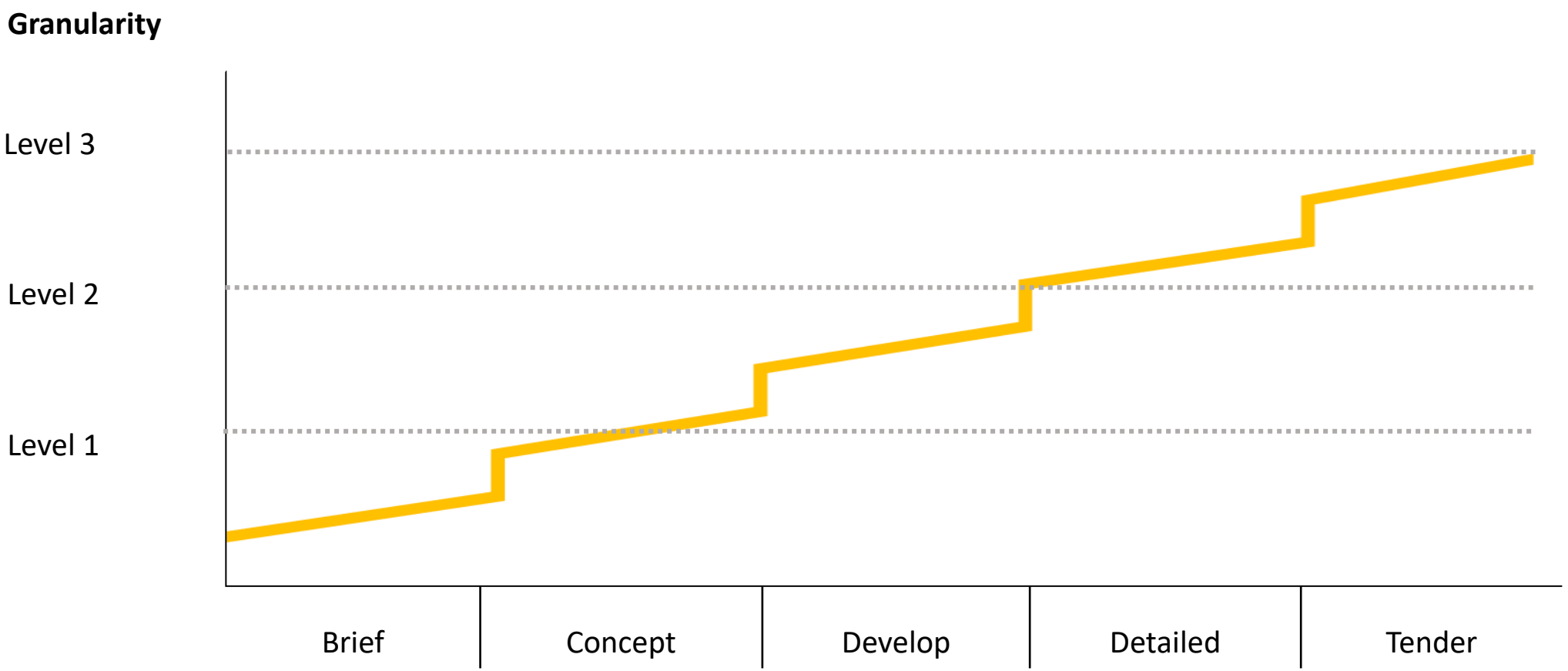
Managing uncertainty and data gaps



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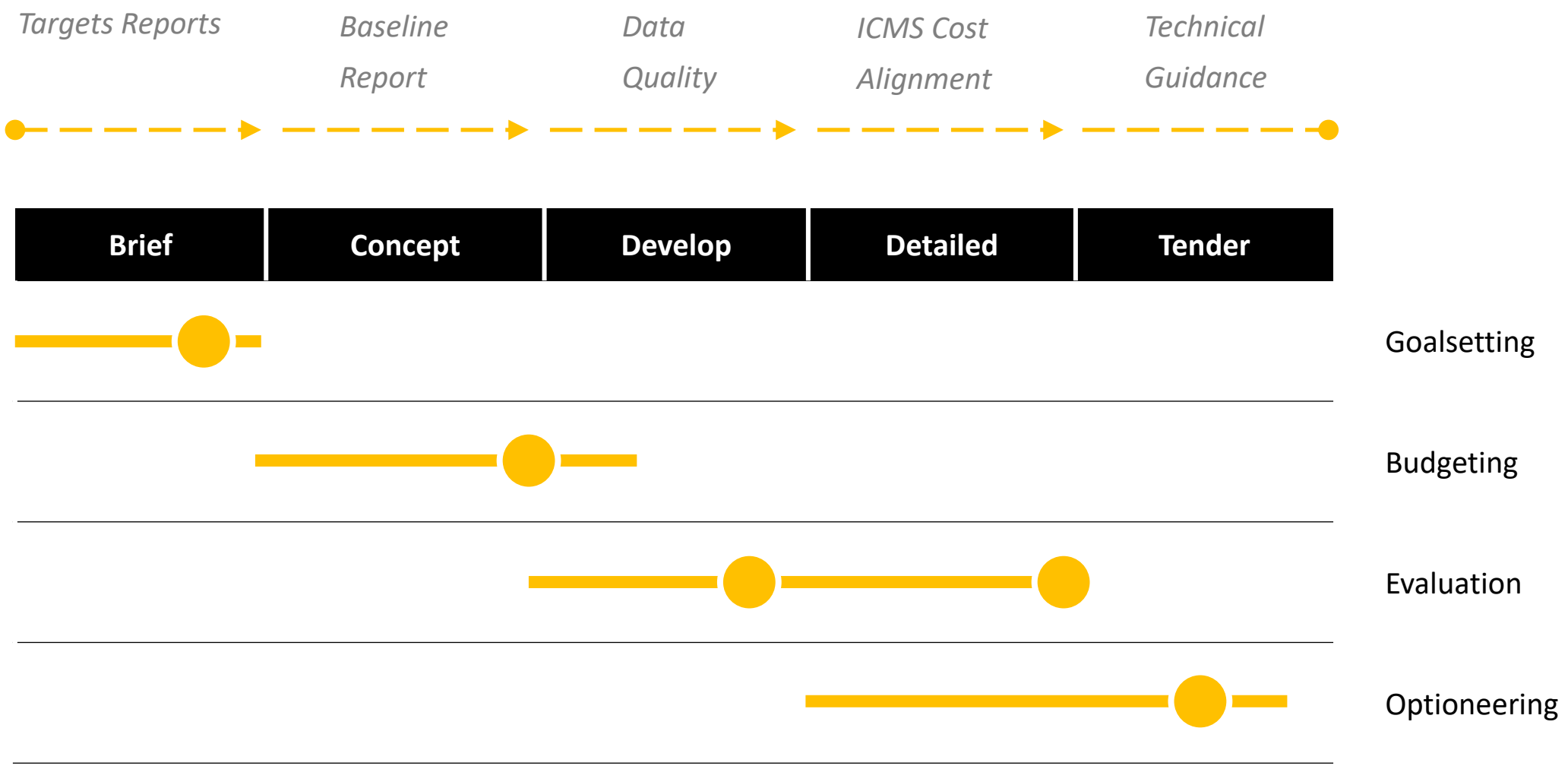
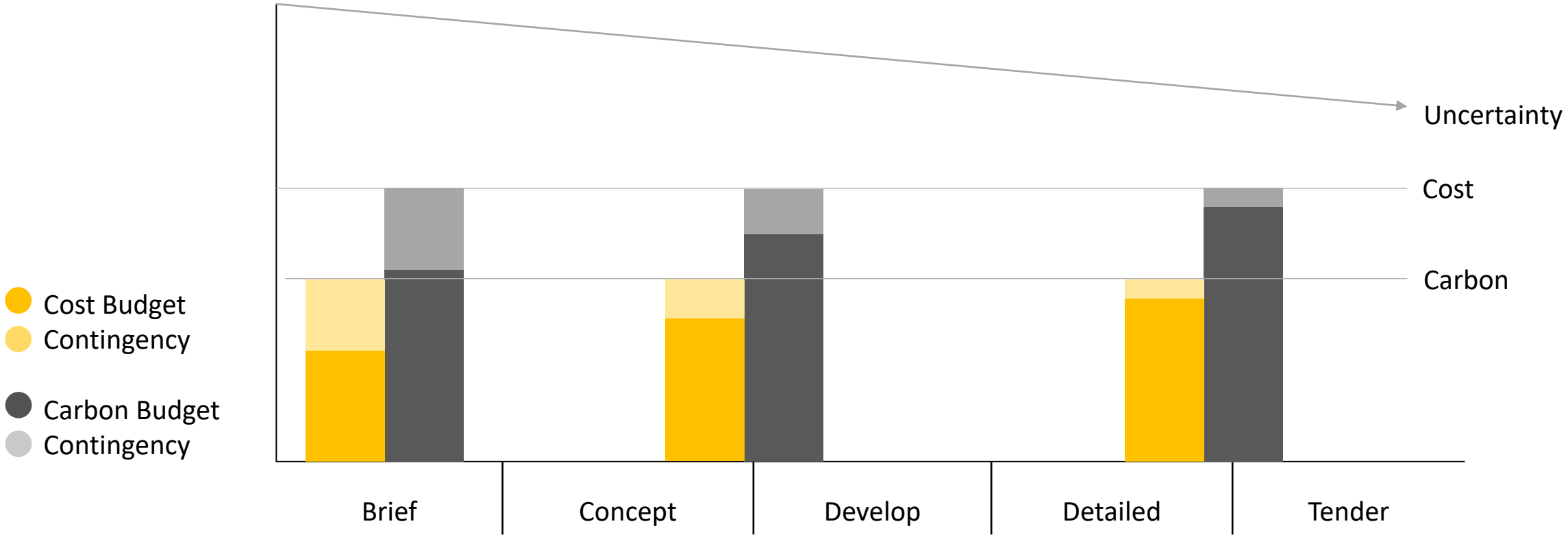
Design Stages



Managing Carbon and Cost Budgets
NECX29 Performance Clauses



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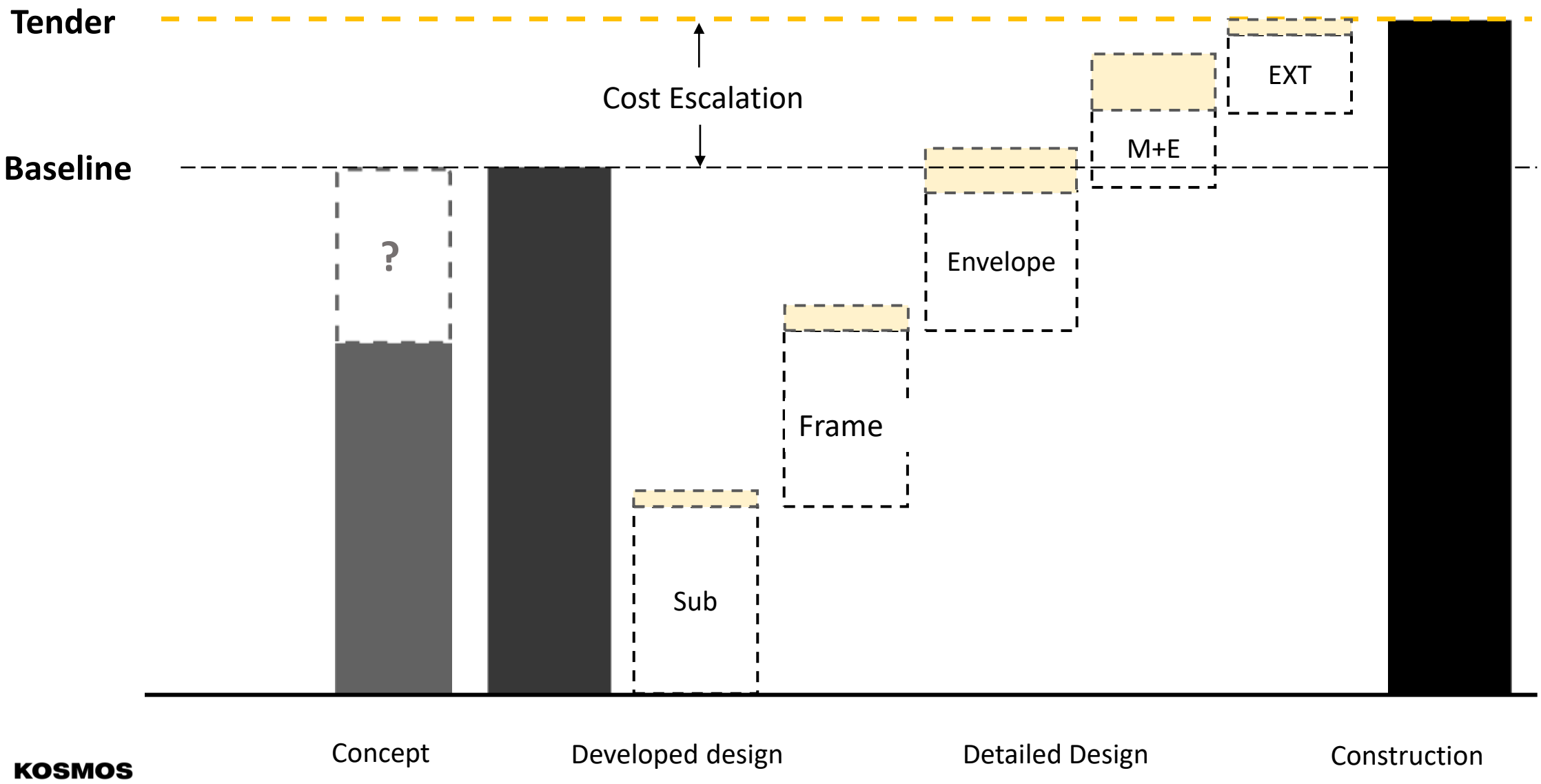
Identifying Carbon Creep



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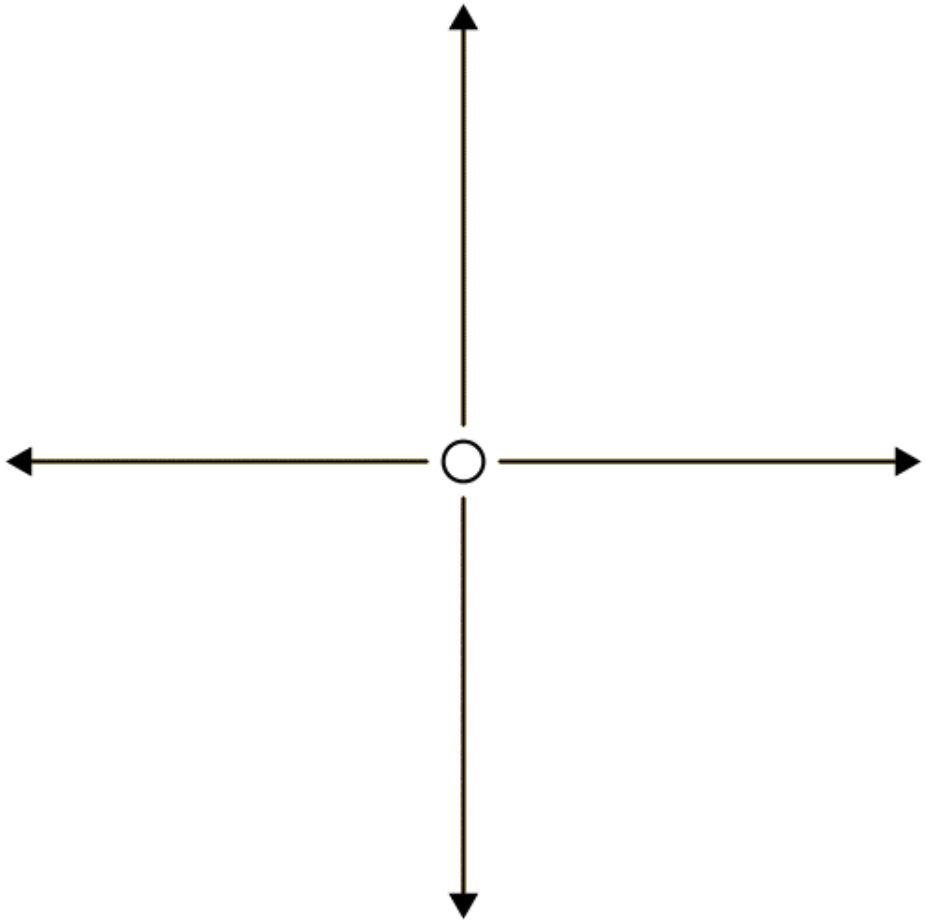
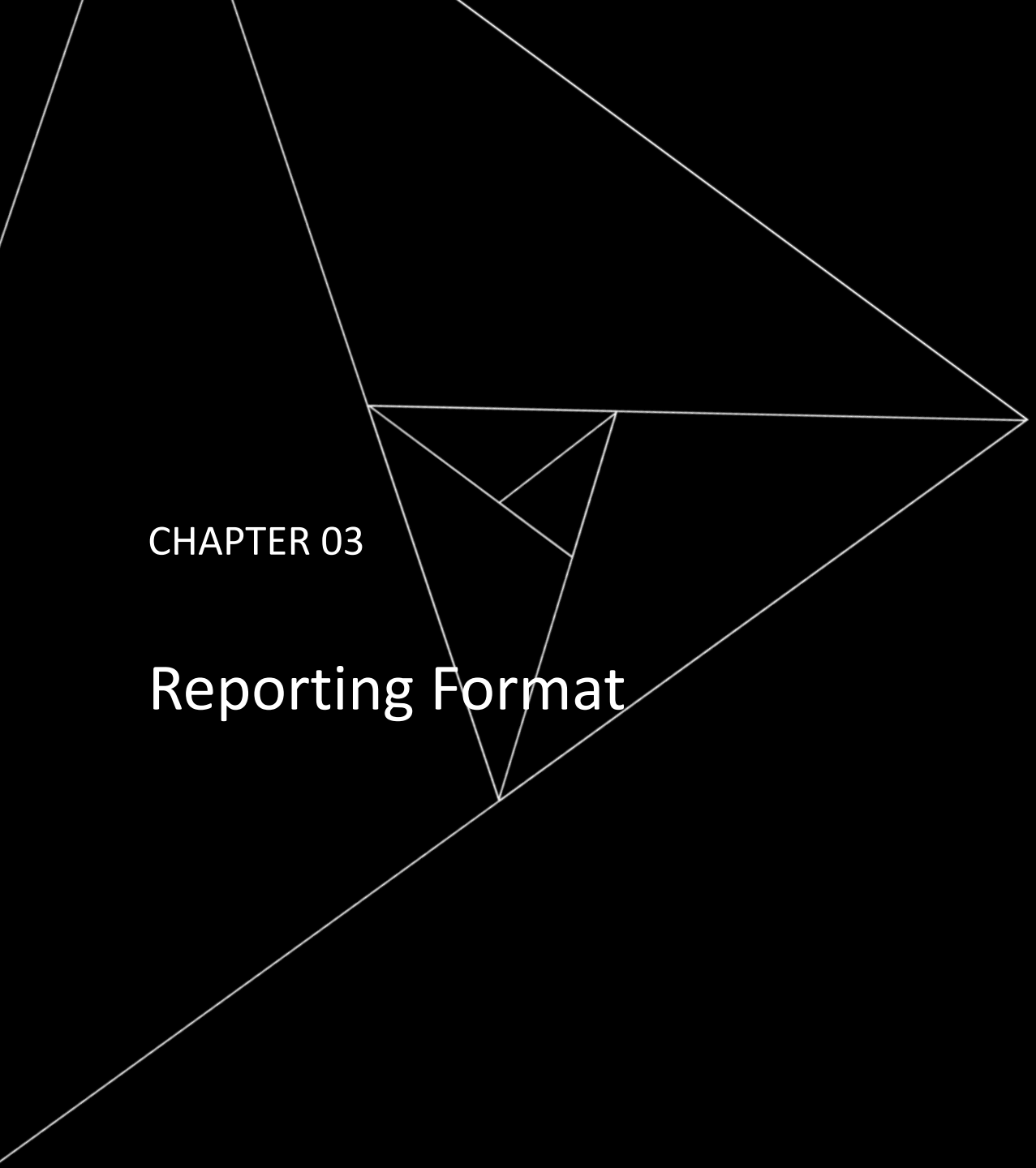
Optioneering

Reconcile cost-benefit trade-offs and Carbon reduction/energy Efficiency savings

- Option A CLT Deck with Screed
- Option B – CLT Deck with P/B soffit
- Option C – Precast with 30% GGBS
- Option D – Base case (Precast)

Cost optimality graph plotting proposed measures to identify the optimal solution





CHAPTER 03

Reporting Format

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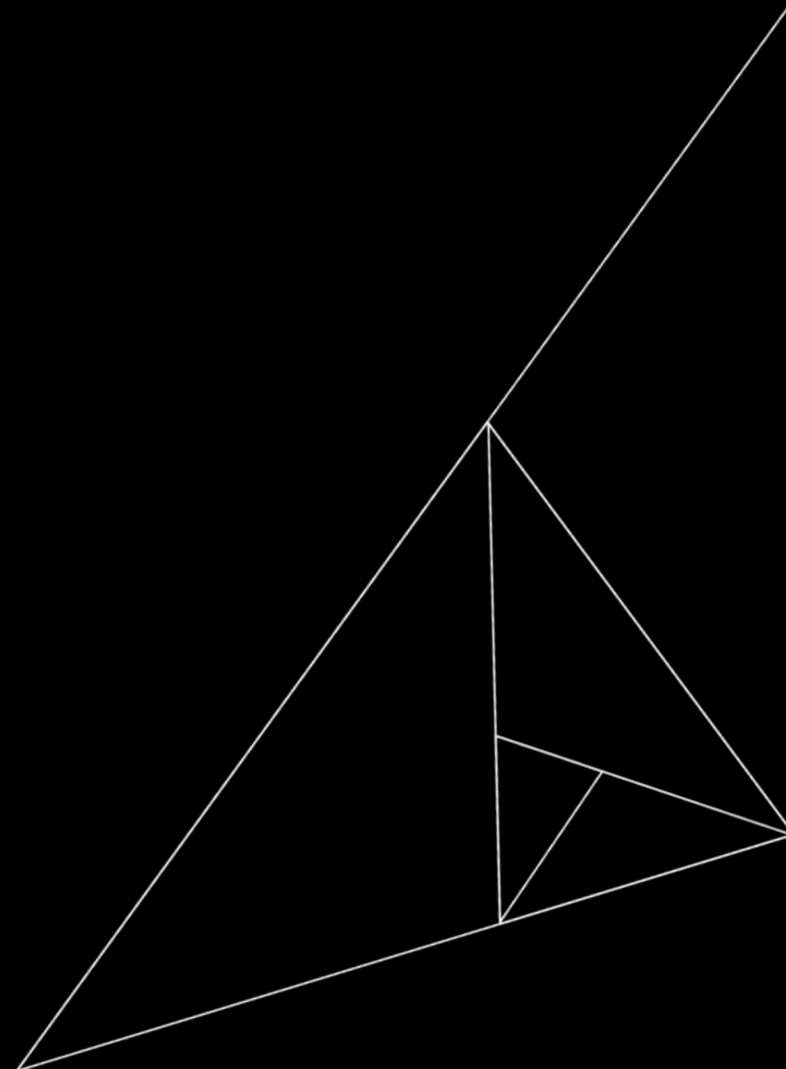
Reporting Format



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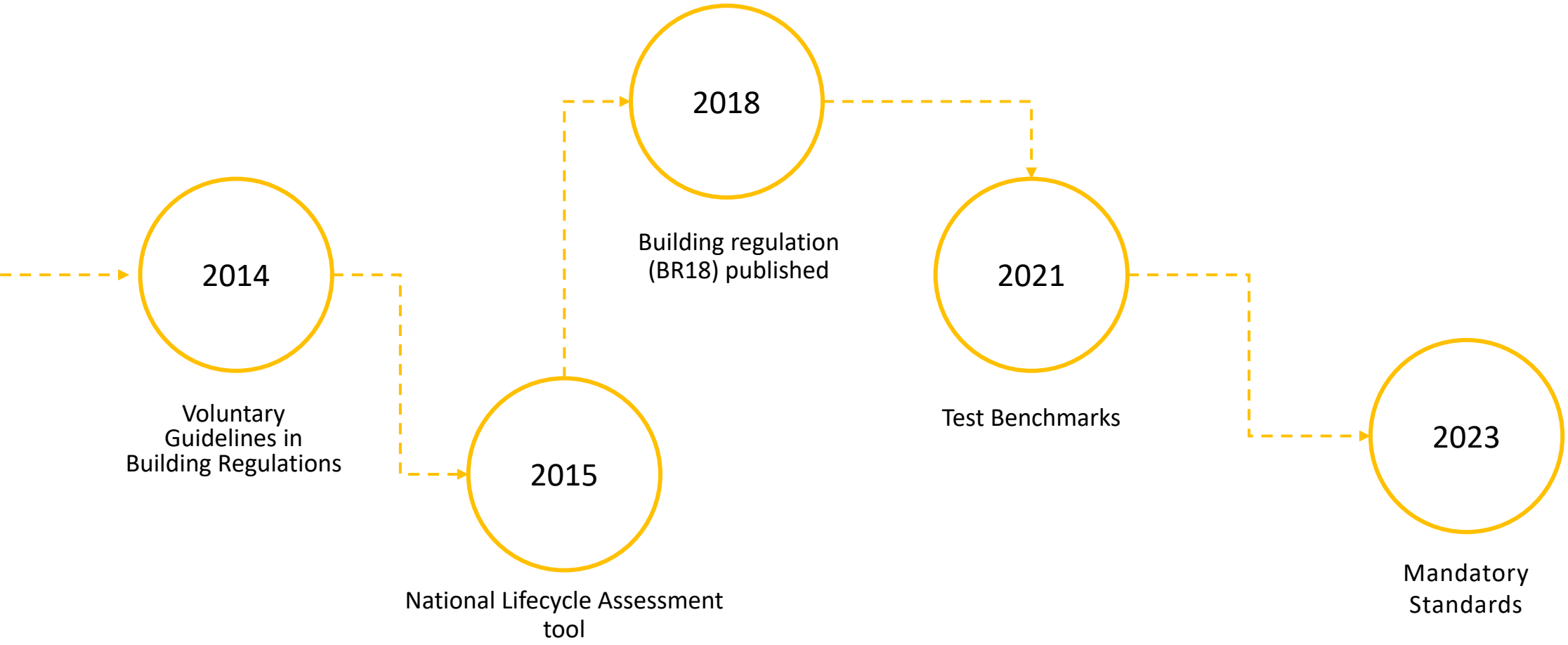
Learning from Denmark
Timeline



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Stage 4 - Construction

5 High Quality data representivity

2 Lower Quality data representivity

Data Quality	Building Elements					
	Structure	**Facade**	**Interior**	**MEP**	**Stuff**	**Site**
Products A1-A3	5	3	2	2	2	4
Construction A4-A5	4	4	2	2	2	3
In Use B1-A5	4	3	2	2	3	3
In Use Energy B6-B7				N?A		
End of Life C	4	2	2	2	2	2
Emissions	623	44	352	620	8	1,647

Score

66%

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Carbon Cost

RIBA Cost Planning Stage	
1	Feasibility
2	Brief
3	Concept
4	Development Design
5	Technical Design
6	Construction
7	Handover
8	Use

Cost plan of works

Cost Planning Tasks
Initial Cost Plan
Establishing budgetary constraints
Preparing initial cost estimates
Preparing detailed cost plan
Schedule of work
Monitor progress against the cost plan
Reconcile final account
Monitoring operational use

Carbon plan of works

WLC Assessment Tasks
Set carbon reduction targets
Identifying carbon reduction opportunities
Assessing the carbon impact of design options
Refining the design to minimize carbons emissions
Specifying low-carbon materials and systems
Monitoring construction activities to minimize carbon emissions
Ensure carbon performance meets expectations
Monitoring performance and identifying opportunities for improvement

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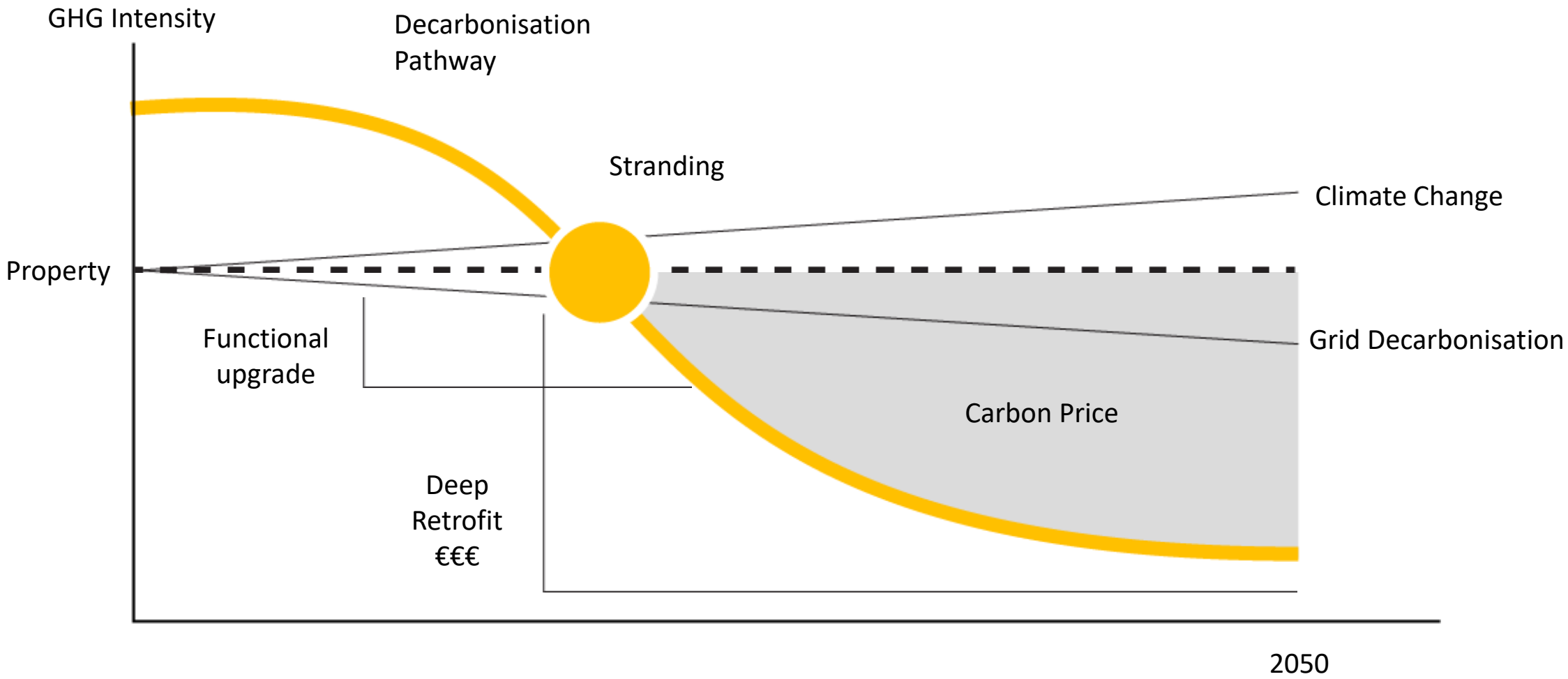
Transition Risk- Asset Stranding



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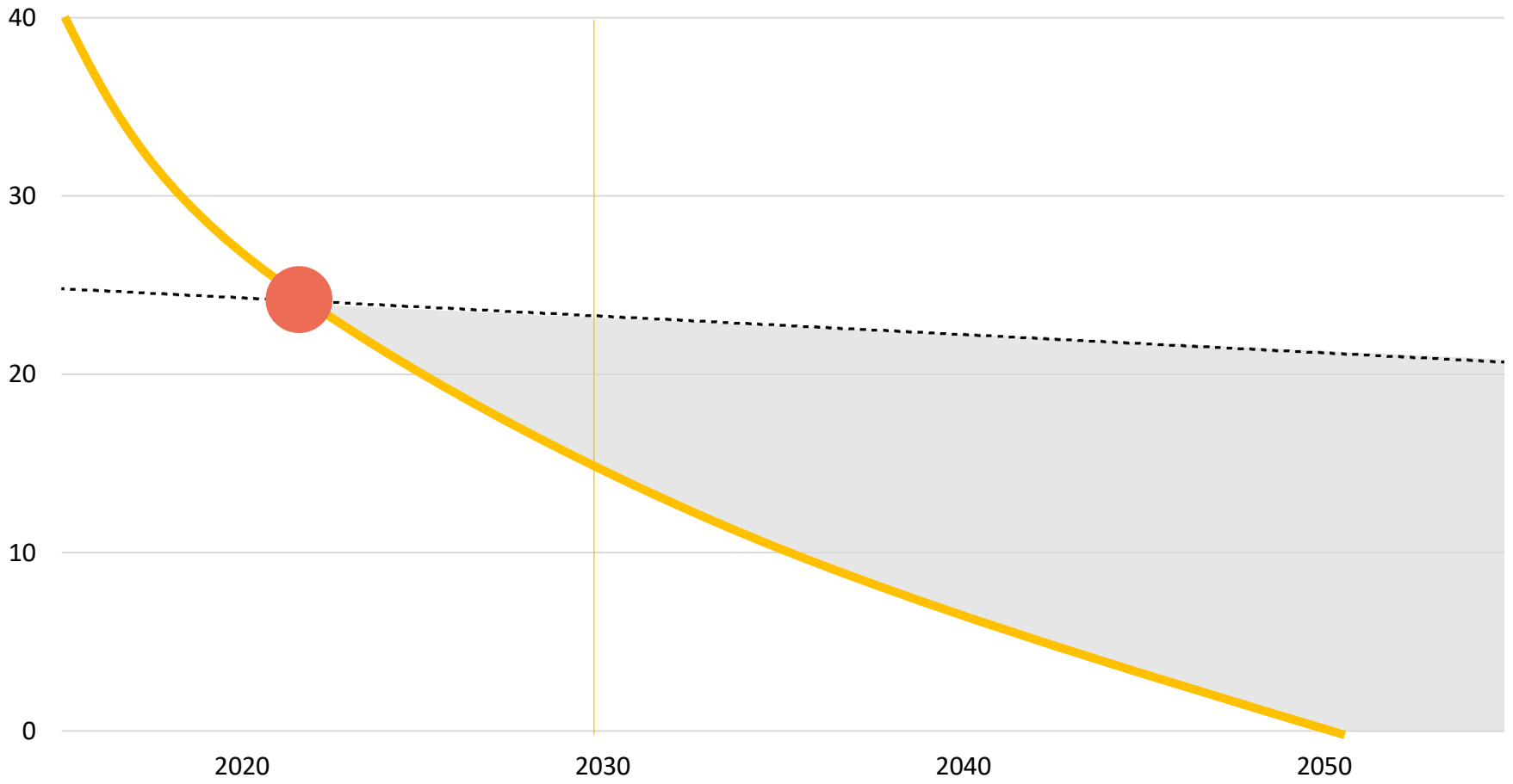
Carbon Intensity

Sectoral decarbonisation target

Baseline carbon footprint

Stranding without retrofit

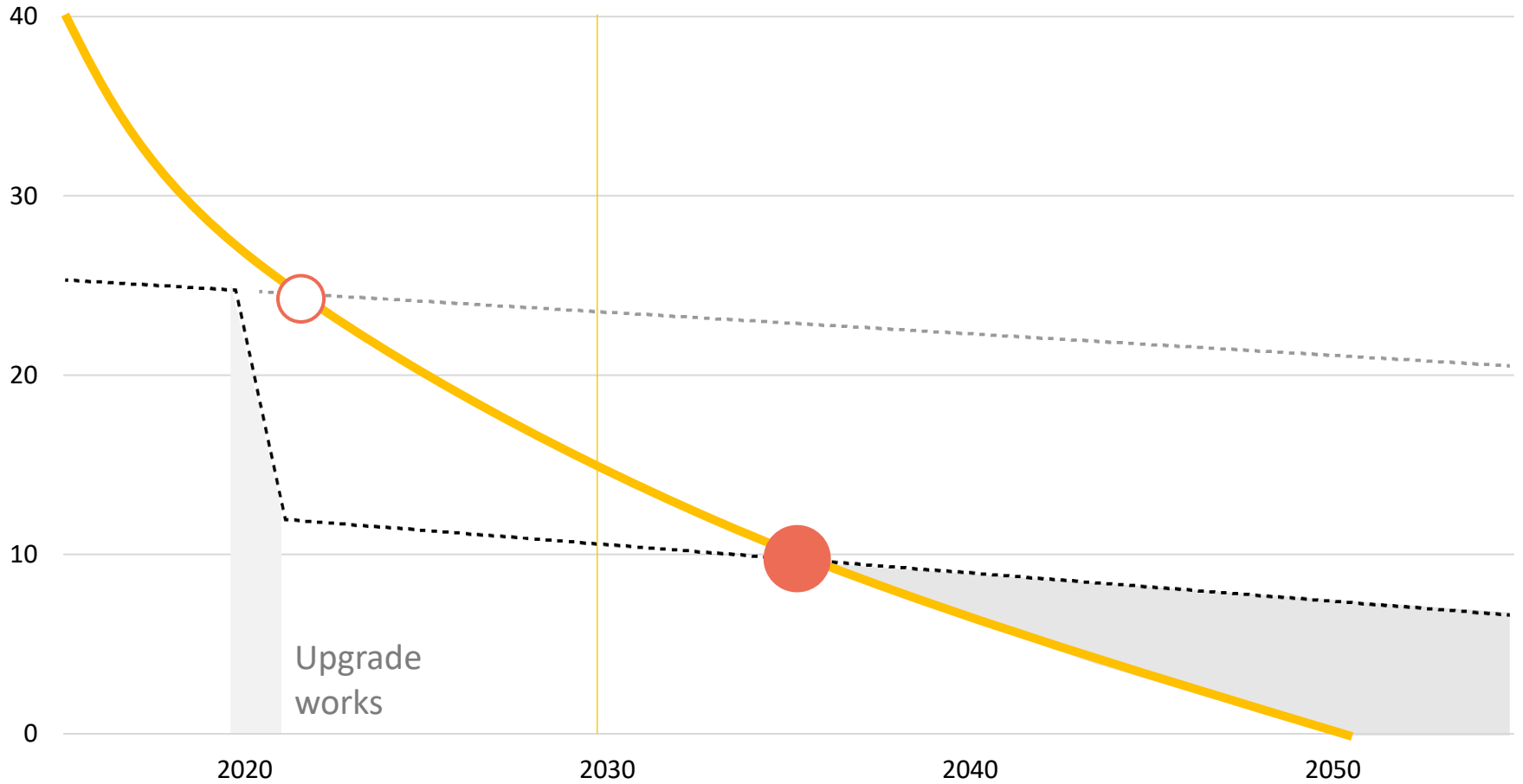


KOSMOS

Sectoral decarbonisation target

Baseline carbon footprint

Stranding with retrofit



KOSMOS

Carbon Intensity

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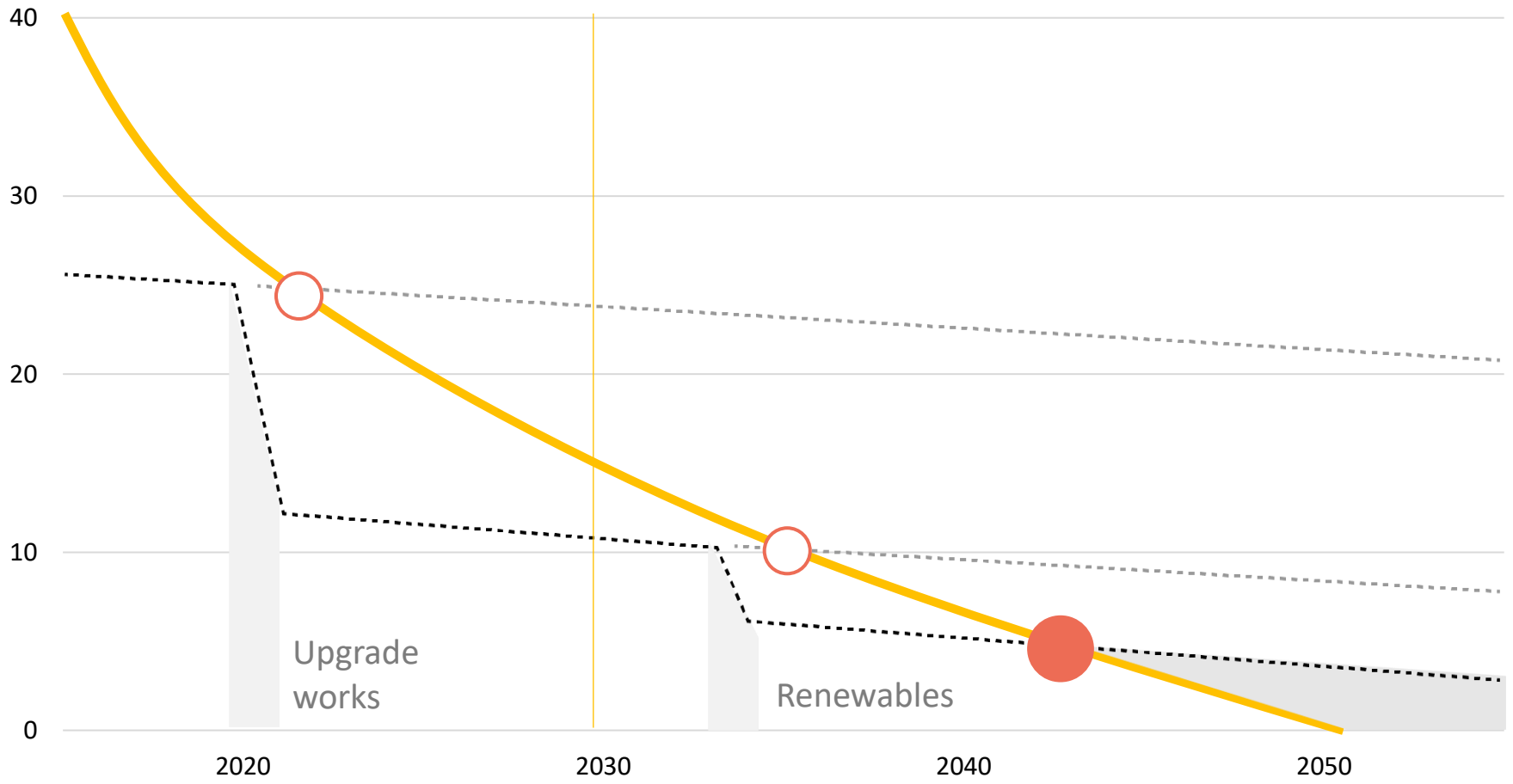


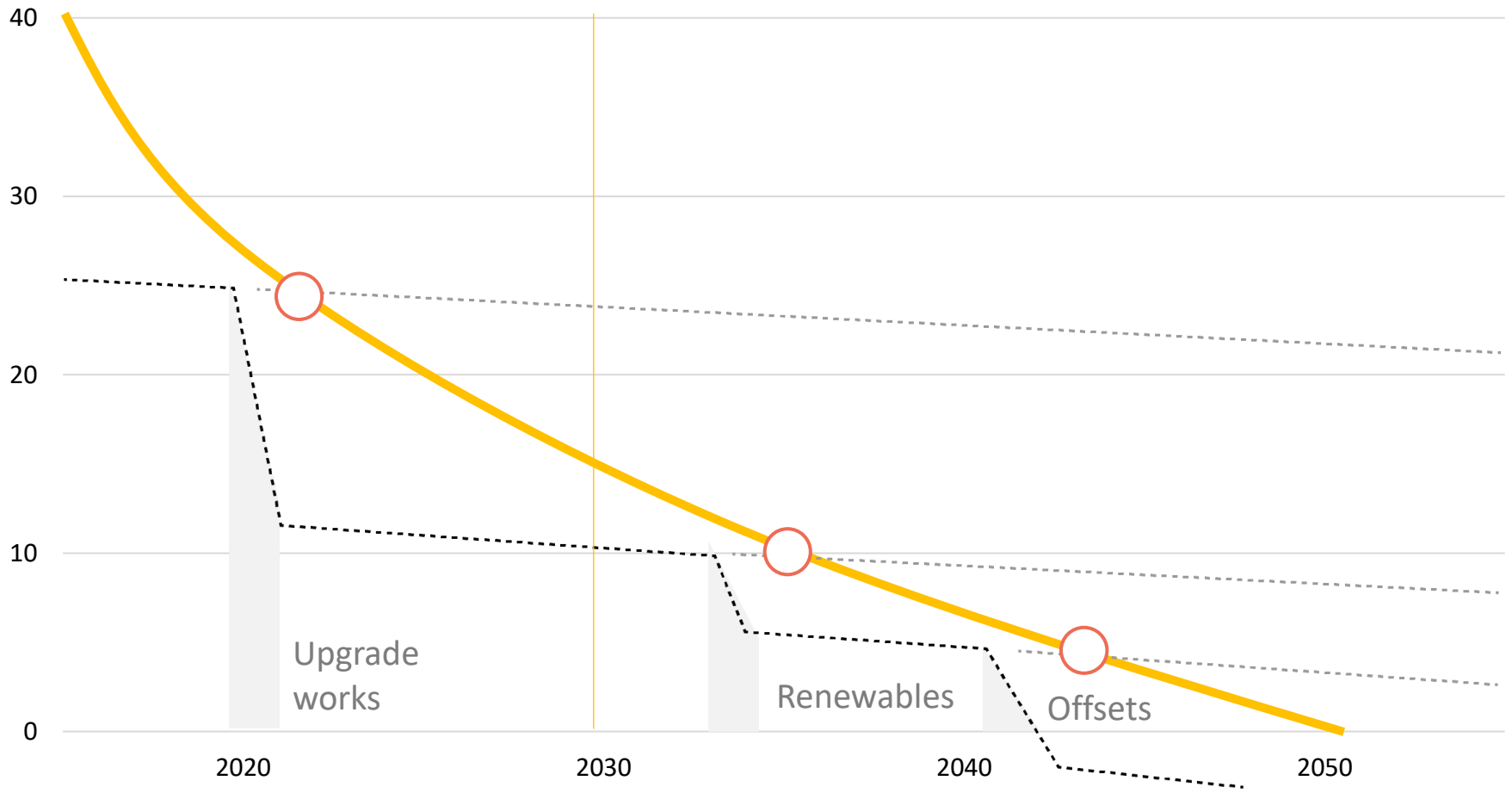
KOSMOS

Carbon Intensity

Sectoral decarbonisation target

Baseline carbon footprint

Stranding with retrofit



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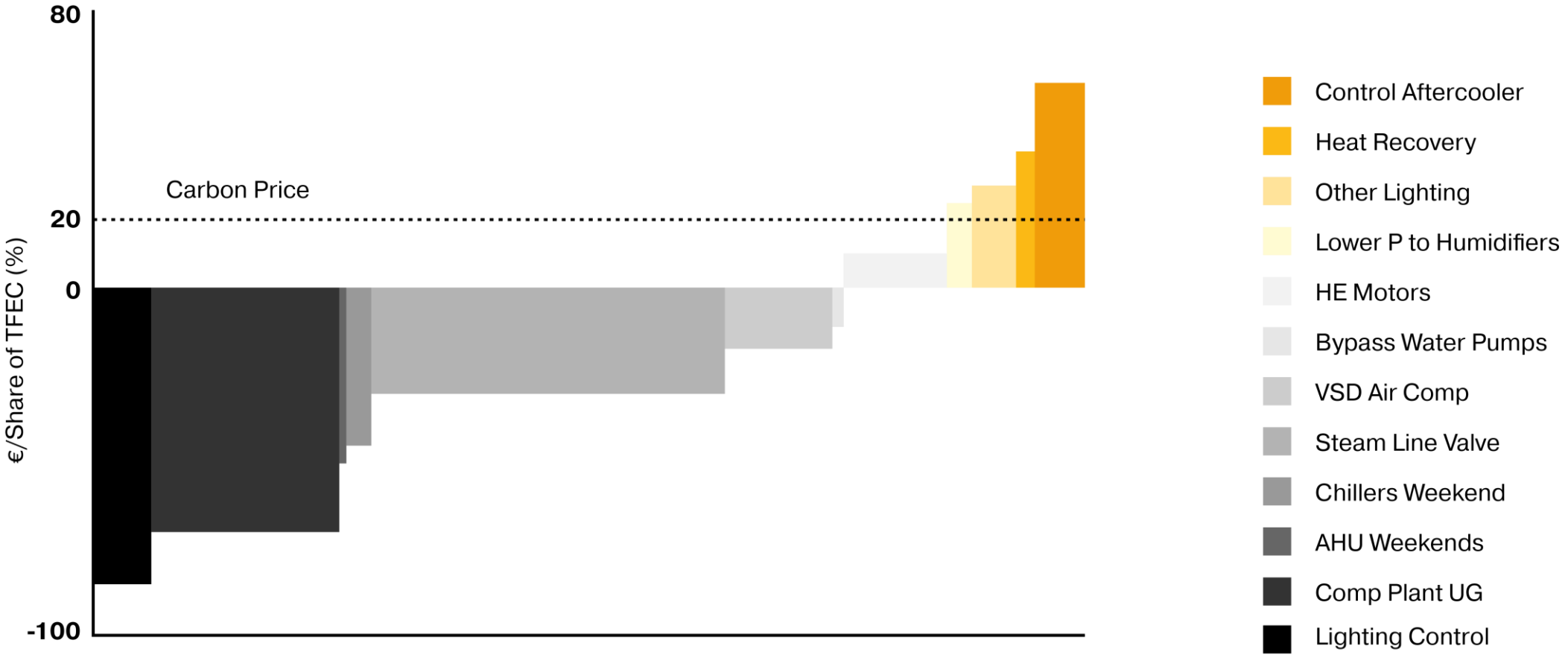
Marginal Abatement Cost Curve



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05 Infrastructure Guidelines

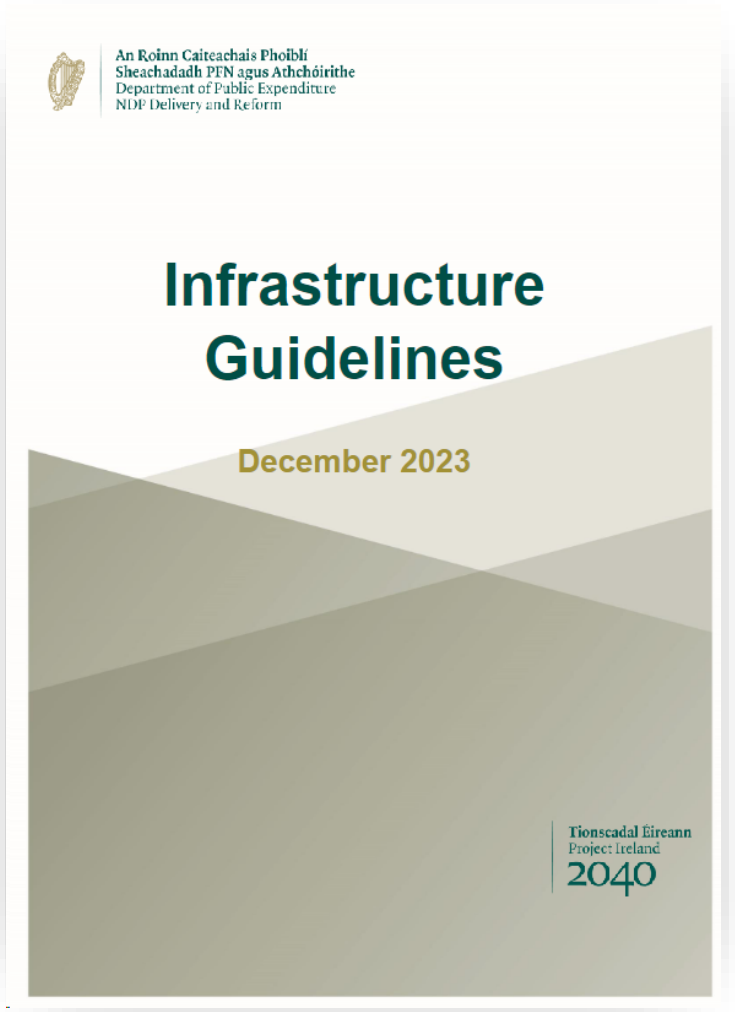
Project Ireland 2040

Replaces the Public Spending Code requirements for capital expenditure

Infrastructure Guidelines set out the value for money calculations

Applies to projects over < € 20m value, With additional requirements for ‘Major Projects’ defined as over >€200m

069538a6-4474-4d5e-8821-43a0852bfd0b.pdf (www.gov.ie)



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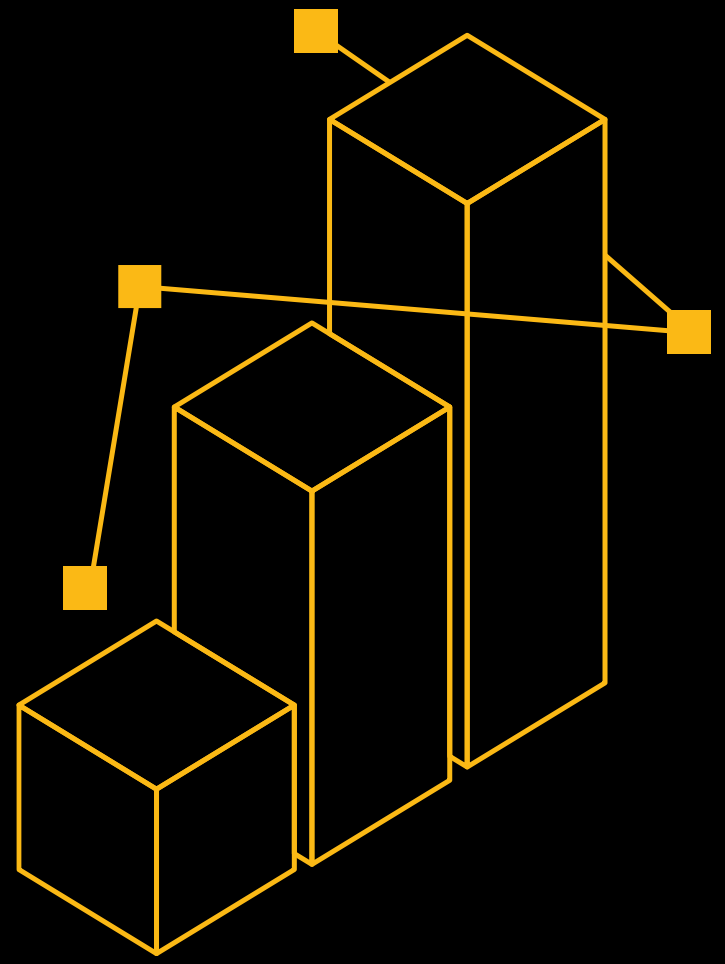
BIM requirements in Capital Works Framework January 2024

International Cost Management Standards (ICMS3).
Cost and carbon reporting templates are mandated for use from the 1st January 2024 in the National Development Plan 2024-2040 (NDP).



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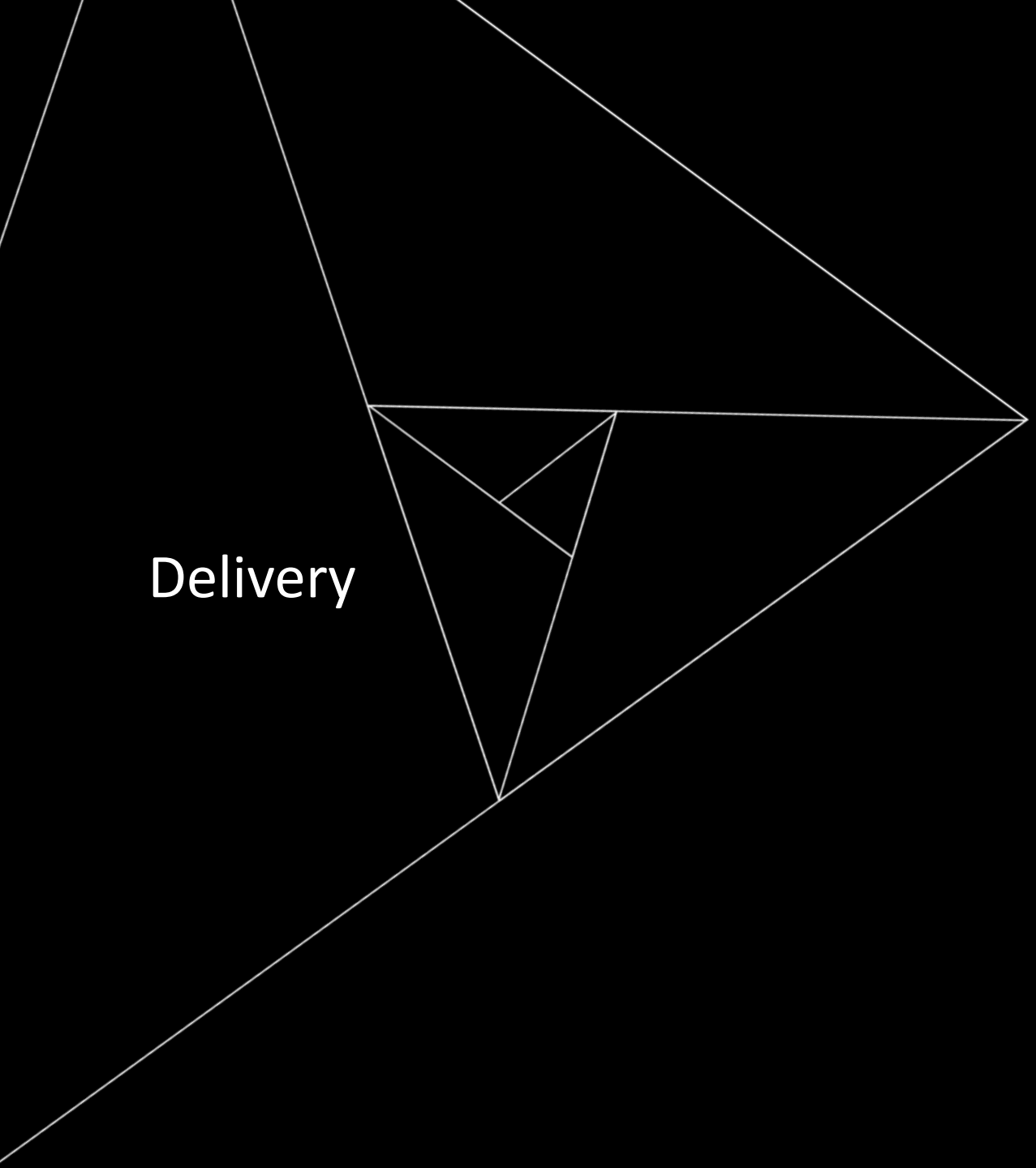
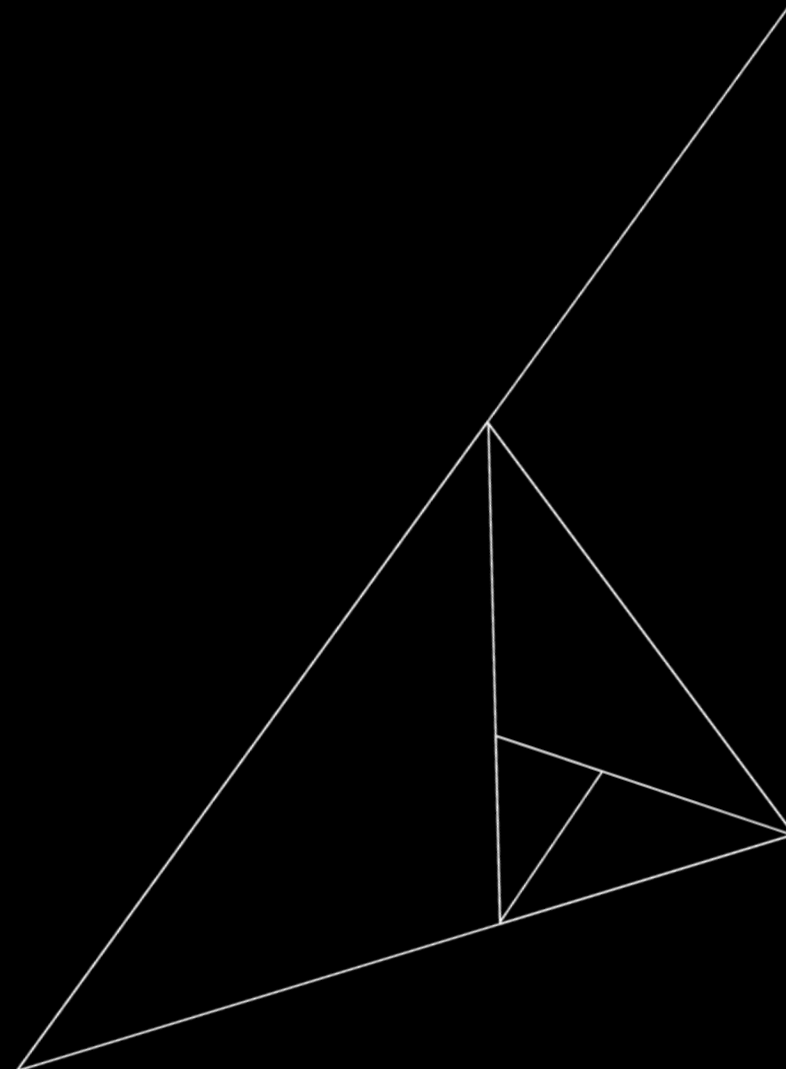
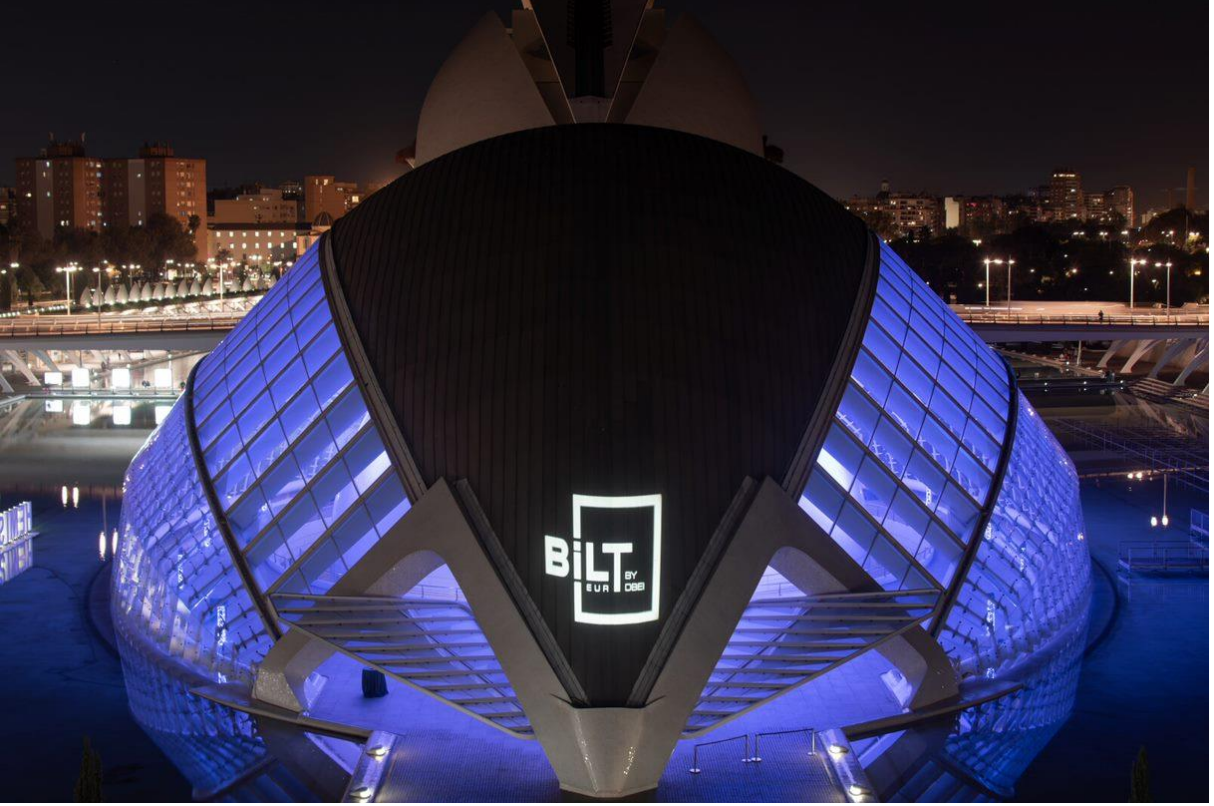


Delivery

Delivery

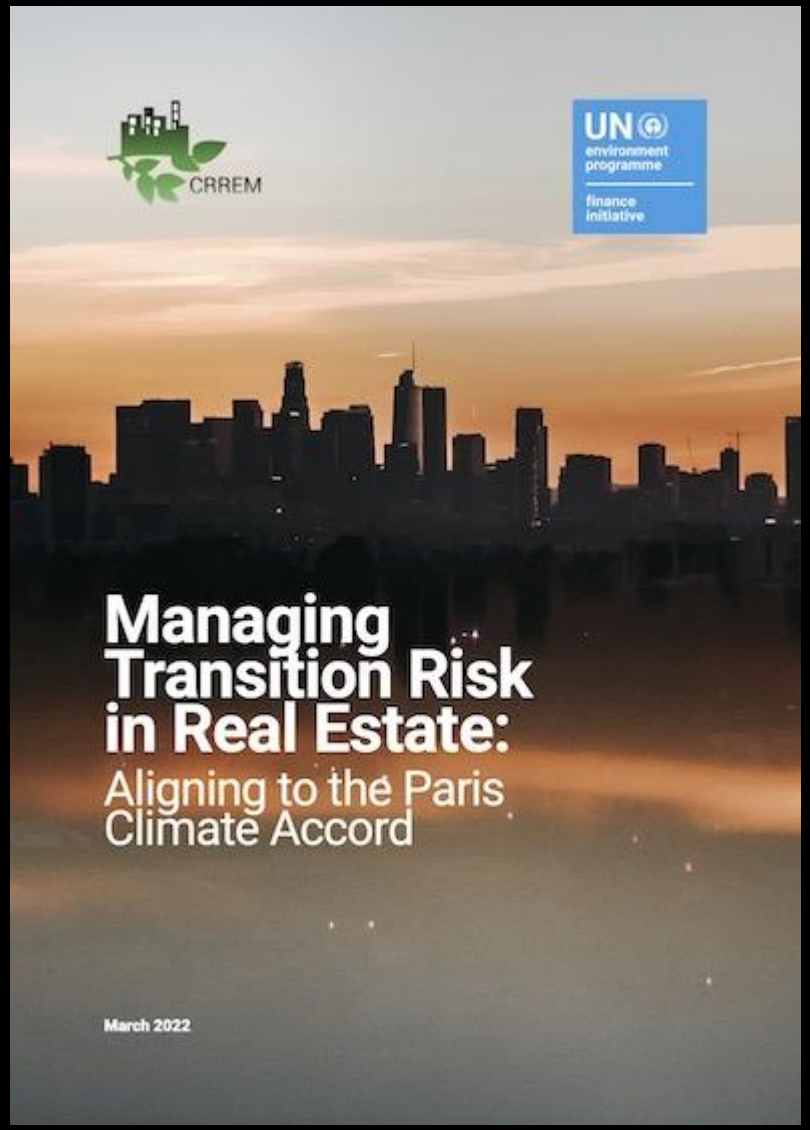




[Event Website]
[Program]
[Past event teaser]

Case Study - Henning Larsen tops Danish sewage works with park

Henning Larsen tops Danish sewage works with park (dezeen.com)


CRREM
UN environment programme
finance initiative
Managing Transition Risk in Real Estate:
Aligning to the Paris Climate Accord
March 2022

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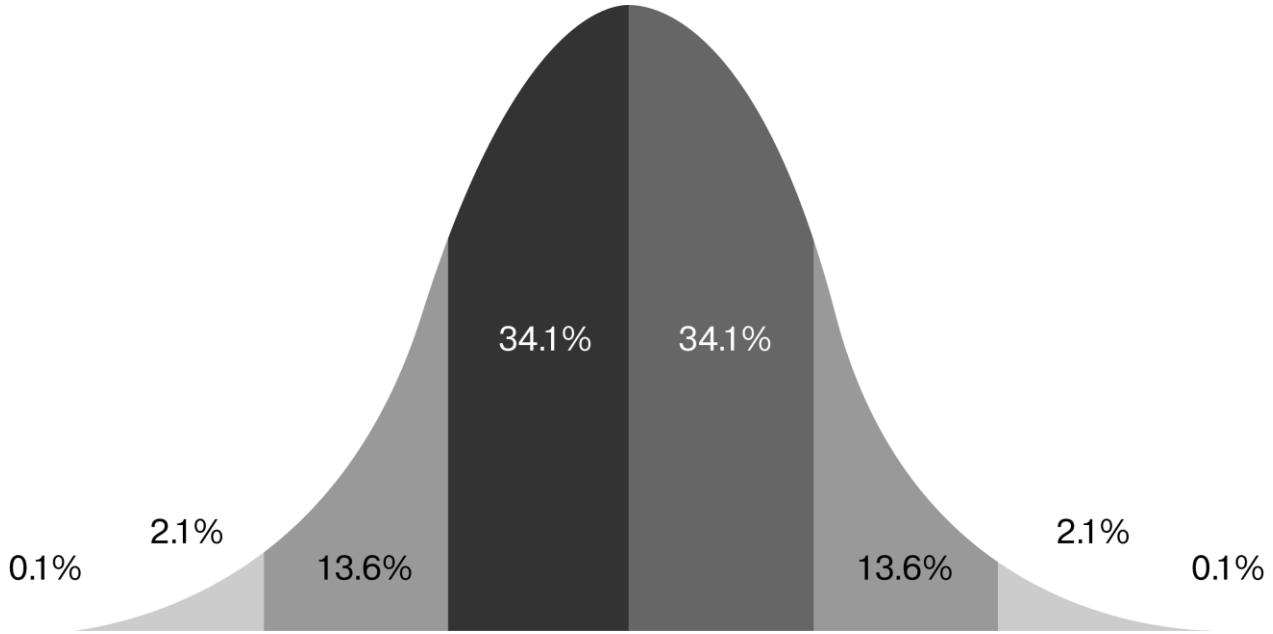
Lessons from Denmark

Risk Modelling

- Use Data to Quantify Carbon Transition Risk.
- Manage uncertainty by allocating contingency to climate related targets
- Generate and update an Opportunity Register
- Adjust contingency budget dynamic risk scoring
- Track risk through project and use opportunities to balance risk.



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Lessons from Denmark

Prioritisation	1. Detailed Climate criteria in Tenders and weighted to reflect urgency
Level playing field	2. Consistency – creating a detailed evaluation system to measure on a like for like basis.
Value for money	3. Value focused approach that can consider cost, practicality and carbon
Targets	4. Metrics based approach to communicate to carbon and climate targets for each project using a national tool (LCCbyk)
Risk	5. Consider a Risk based approach to climate targets

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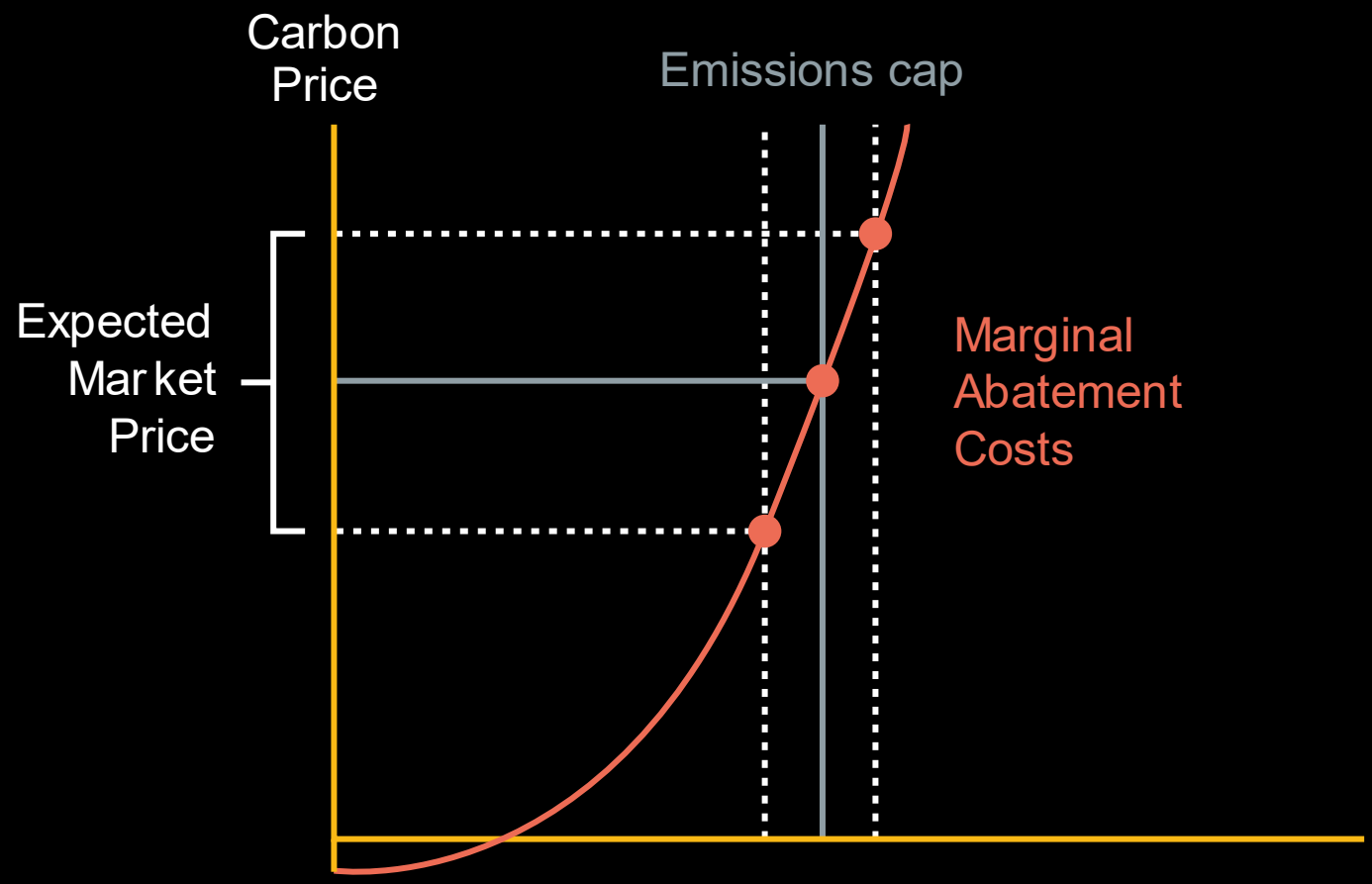
Valuing Carbon in Infrastructure Projects



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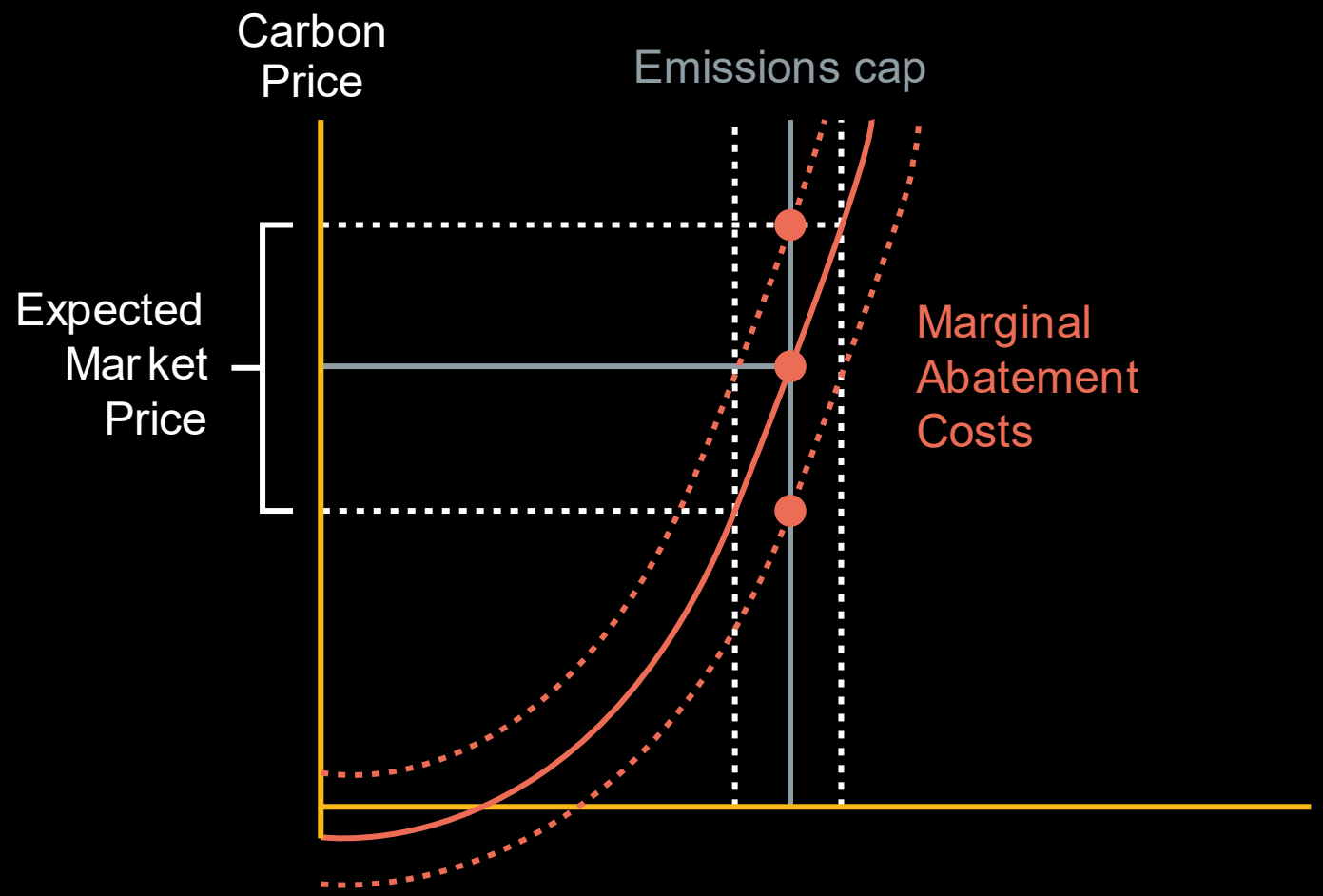
Valuing Carbon in Infrastructure Projects



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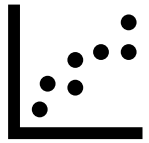
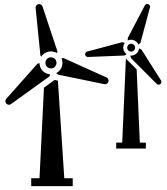
Economic Appraisal – Business case for Carbon emission reduction



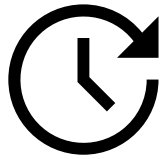
Establish a base case
Do-nothing Scenario

Do minimum Scenario,
current default strategy



Identify Measures that can Reduce Carbon emissions

Explore climate risk hot-spots and opportunities
+ alternative energy technologies,
+ lower embodied carbon materials
+ i.e. GGBS in concrete mix

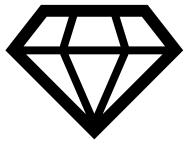


Factor longer-term variables - electricity, carbon and time **escalation costs**.

Include the time cost of finance and discount rate of 4%

Monetise carbon emissions With 10-30 year projections.

2019 projected price of carbon. replaced by 2024 Social Cost of Carbon. €100 per ton €280 per ton



Cost benefit, net value presented in present tense

Full Lifecycle cost of a measured over 30 years including O+M and future hypothetical cost of carbon established

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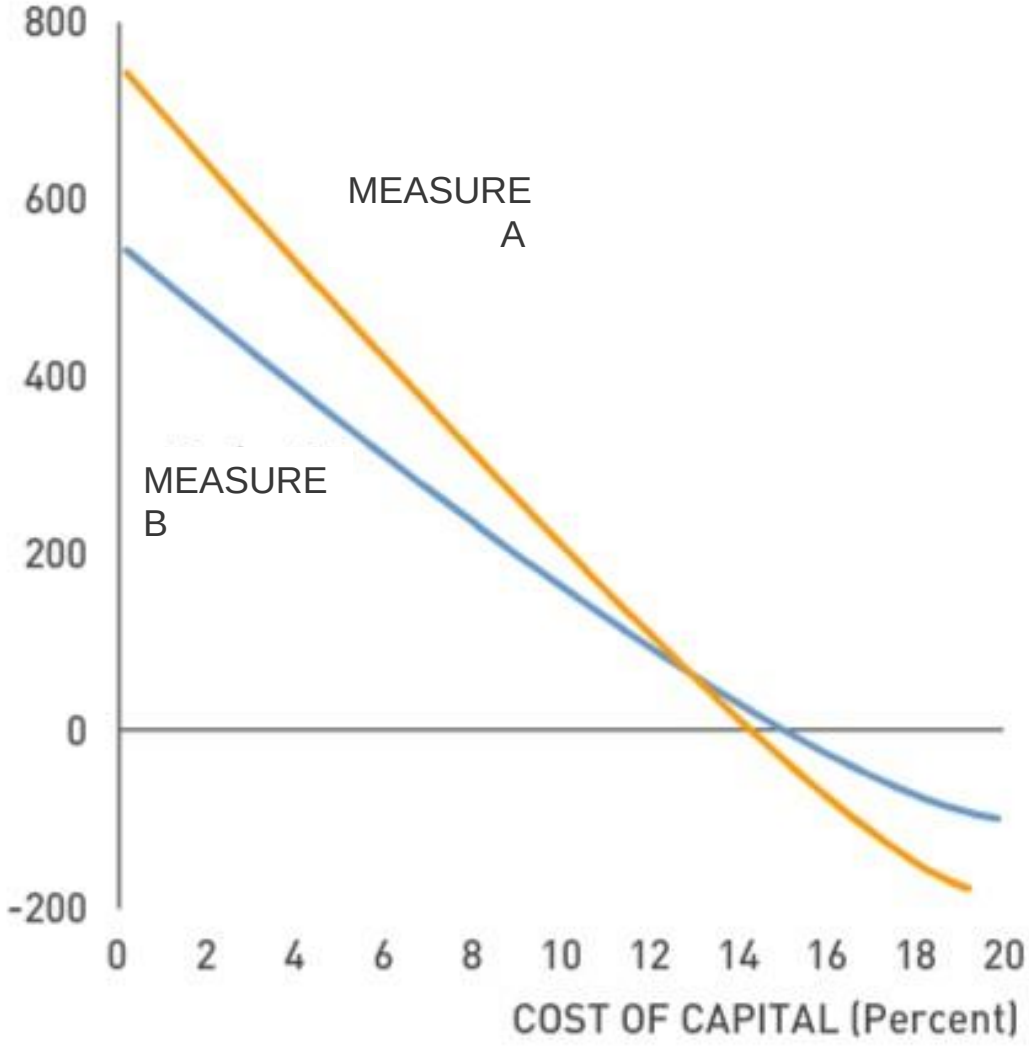
Economic Appraisal

Business case for Carbon emission reduction

Cost benefit, net present value

Net Present Cost and benefit



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Key Takeaways

1. Align ambition & capability
2. Integrate Cost & Carbon budgets
3. Risk Assessment to manage uncertainty
4. Communicate targets to contractors
5. Track with NRM2 & ICMS3

Archie O’Donnell – 07 September 2023

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Archie O’Donnell

Senior Sustainability Specialist

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