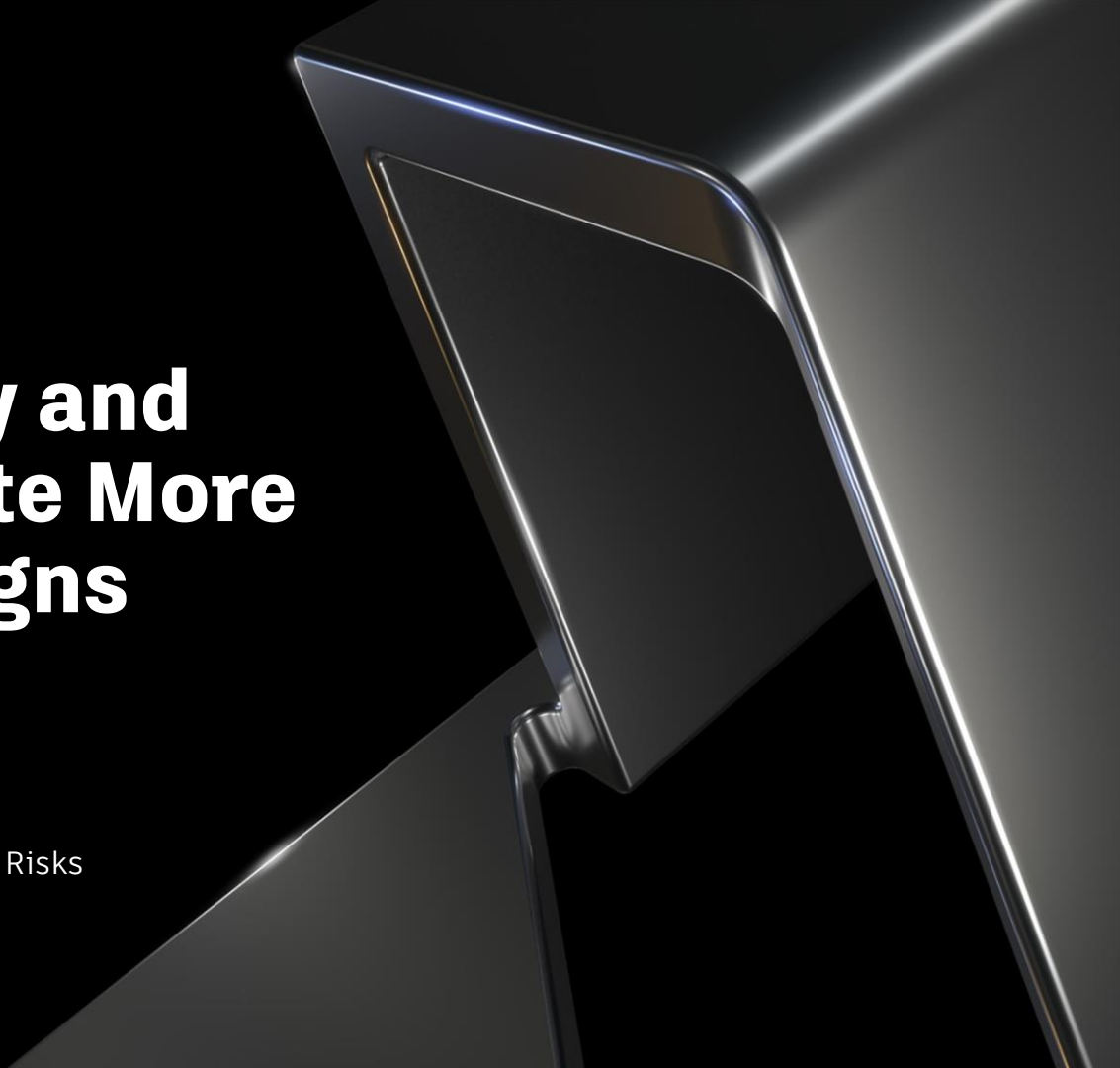


# Using Technology and Software to Create More Sustainable Designs

**May Winfield**

Global Director of Commercial, Legal and Digital Risks  
Buro Happold | @Buildlaw\_Arttea



# Speaker: May Winfield

Global Director of Commercial, Legal and Digital Risks, Buro Happold

- Senior construction lawyer of over 17 years' experience
- Speaks at events worldwide and author of multiple articles on construction technology
- Led drafting of legal guidance on the international standards, ISO 19650, and an ISO19650-compliant Information Protocol document
- Core Team Member of both 4D Construction Group and ZERO Group (created to progress sustainability)
- Working Group member of the CDBB Digital Twin Roadmap and Digital Twin Toolkit
- Co-founder and chair of BIM4Legal
- UK BIM Alliance Ambassador



# BuroHappold – Technology and Sustainability

Taking it seriously



## Expo 2020

Sustainability Pavilion promoted sustainable tech and design



## Tencent Dachan Bay

Computational optimization of wind and solar and integration of sustainable design



## Santa Monica City Hall

Meets the Living Building Challenge, most stringent green building rating system



## Driving Net Zero

Developed targets, gathering data and inform policy to achieve net zero carbon



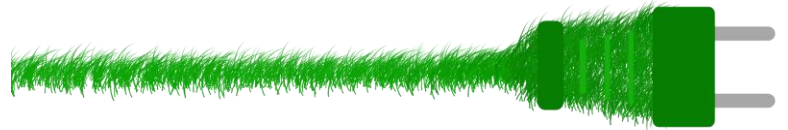
**Why It Matters**

***New building construction “is responsible  
for more than 2.5 gigatons of CO<sub>2</sub>e globally”***

McKinsey, July 14 2021

# The Climate Emergency – Construction's Contribution

- Buildings and construction account for 40% of energy-related CO<sub>2</sub> emissions
- Cement accounts for 8% of global emissions
- Construction industry accounts for 11% of all greenhouse gases globally



***“When we asked 100 senior construction executives what trends they expected to accelerate due to the COVID-19 crisis, 53 percent cited sustainability”***

McKinsey, July 14 2021



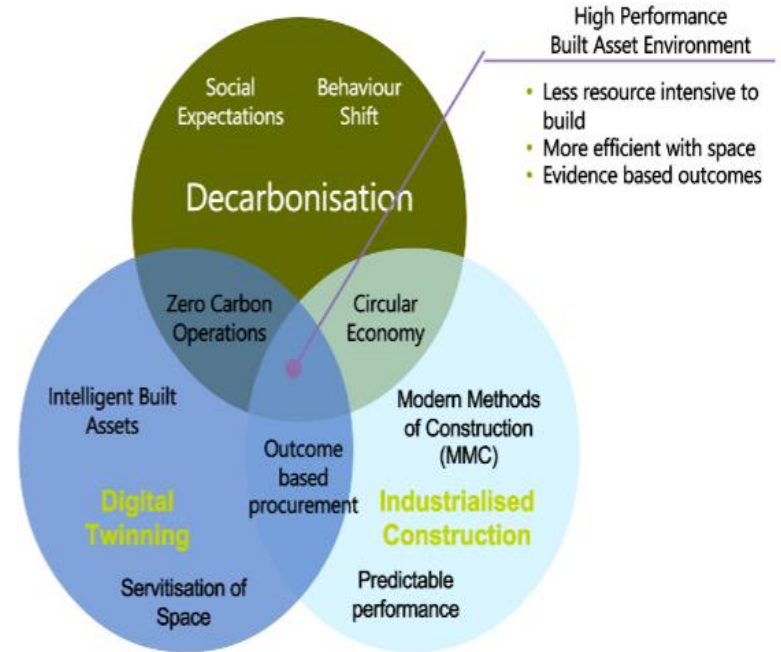
# **Technology and Processes**

**(some examples)**



# Some key technologies

- BIM and Information Management
- DfMA
- Smart Buildings
- Digital Twins
- AI/Machine Learning
- Automation
- Toolkits and Dashboards
- Alternatives to traditional concrete



# Digital Twins Toolkits

Use of generative design and game engine technologies as pathways to net-zero communities

- Smart energy digital twins toolkit
- Streamed to two access platforms for secure, confidential multi-user access
- Incorporates real-world data to support:
  - Intelligent selection and validation of domestic heat network solutions
  - Understand choices and tracking technologies to get to net zero carbon
- Analysis of vast quantities of data points
- Full detail at:  
<https://www.cdbb.cam.ac.uk/news/dt-toolkit-making-business-case-dt>

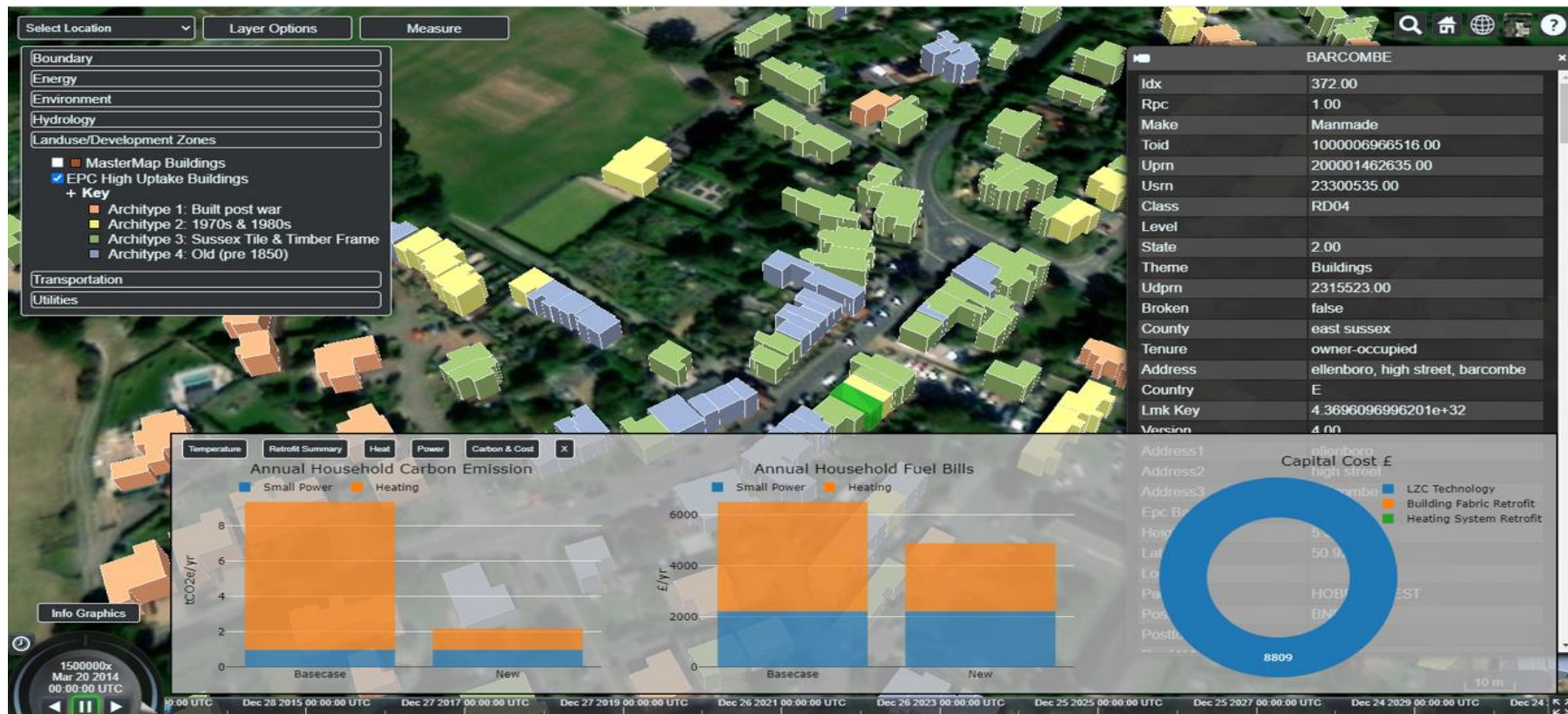


# Example of Smart Energy Digital Twin





# Example of Digital Twin platform with insight infographics



# Building Performance Dashboard

Facilitates achieving overall net zero carbon

- Central reporting on modelled and measured energy data i.e.
  - Energy consumption
  - Operational carbon
  - Embodied carbon
- Collects data centrally for all projects
- Using technology for uniform
  - Data collection
  - Data analysis
  - Communication tool



# Climate Toolkit/Dashboard

Helps design in climate resilient manner

- Shortens time taken to generate a climate or comfort report from 1 day to 10 minutes
- Generation of resources at click of a button
- Tech stack includes database, web app, simulation apps and reporting engine
- Example of use:
  - Upload a weather file
  - Generate some standard summary charts
  - Run full simulations to determine pedestrian thermal conditions under varying strategies
  - Use to assess/mitigate climate challenges



# Example of Climate Dashboard

UTCI configurations already calculated ▼

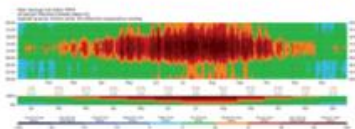
Ground material

Concrete Heavyweight ▼

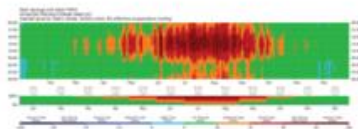
Shade material

Fabric ▼

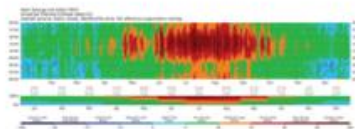
Simulate ground/shade configuration



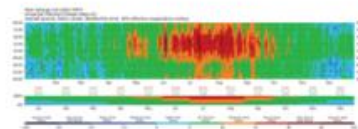
Asphalt ground, 0.0m/s wind, 0% effective evaporative cooling



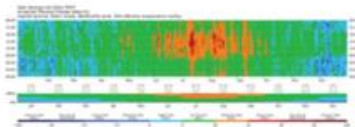
Asphalt ground, Fabric shade, 0.0m/s wind, 0% effective evaporative cooling



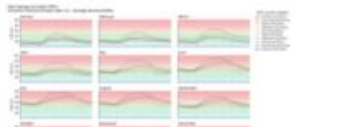
Asphalt ground, Fabric shade, Weatherfile wind, 0% effective evaporative cooling



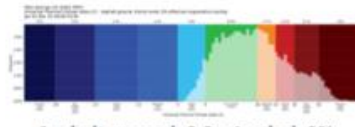
Asphalt ground, Fabric shade, Weatherfile wind, 30% effective evaporative cooling



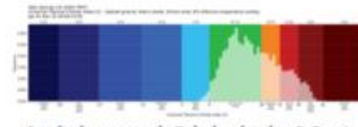
Asphalt ground, Fabric shade, Weatherfile wind, 70% effective evaporative cooling



Asphalt ground, Fabric shade Comparison



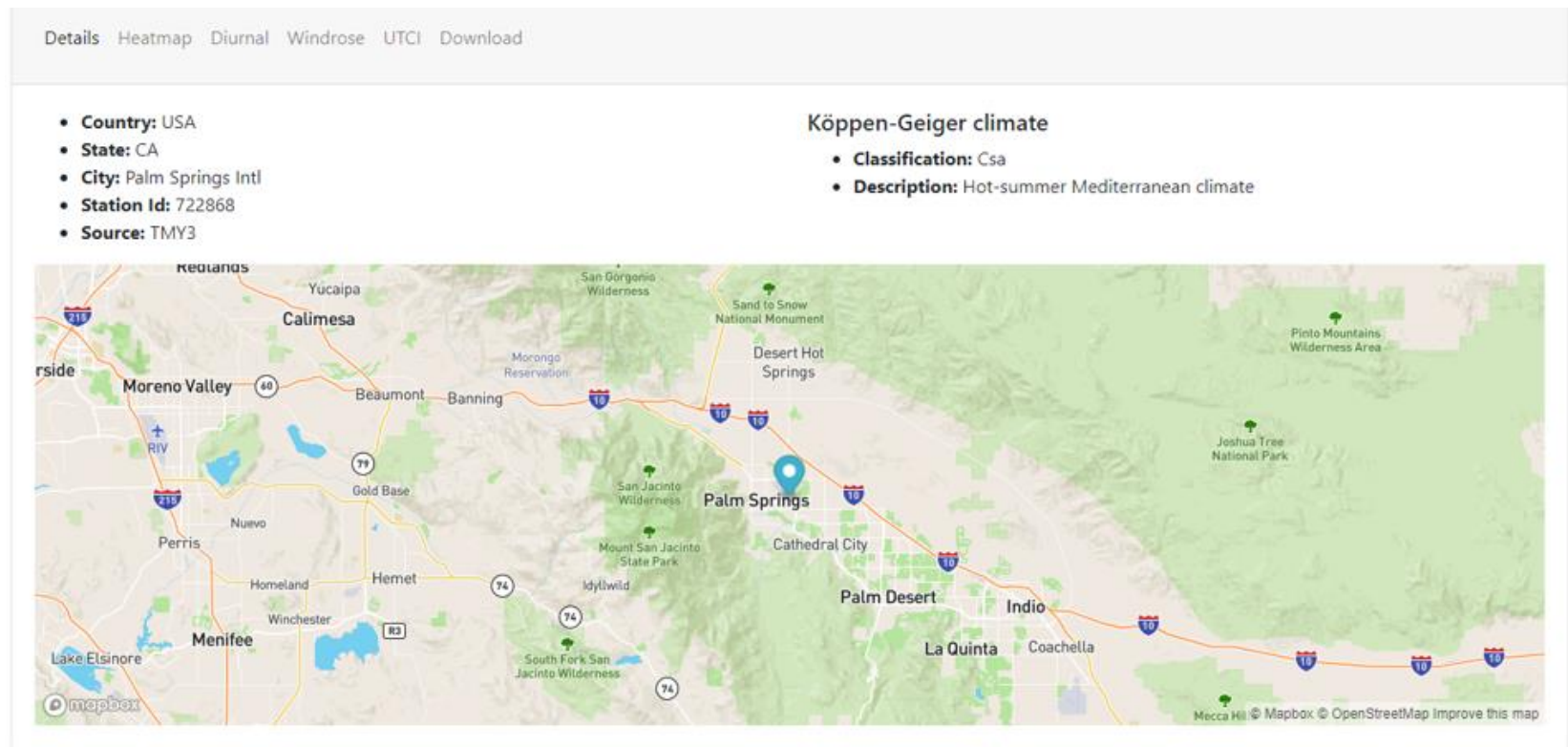
Asphalt ground, 0.0m/s wind, 0% effective evaporative cooling - Jan-Dec Daily



Asphalt ground, Fabric shade, 0.0m/s wind, 0% effective evaporative cooling - Jan-Dec Daily



# Example of Climate Dashboard





# BHoM LCA Toolkit

BHoM = Buildings and Habitats Object Model

LCA = Life Cycle Assessment is comprised of several scope objects, which contain their respective building elements and materials

- Modelling methodology used to quantify carbon emissions and other environmental impacts of a process through life cycle stages
- Allows party to assess carbon on early models
- Informs early design decisions to minimise environmental impact
- Allows an analysis of the elements within an existing structural Revit model
- Find out more at:  
[https://github.com/BHoM/LifeCycleAssessment\\_Toolkit/wiki](https://github.com/BHoM/LifeCycleAssessment_Toolkit/wiki)

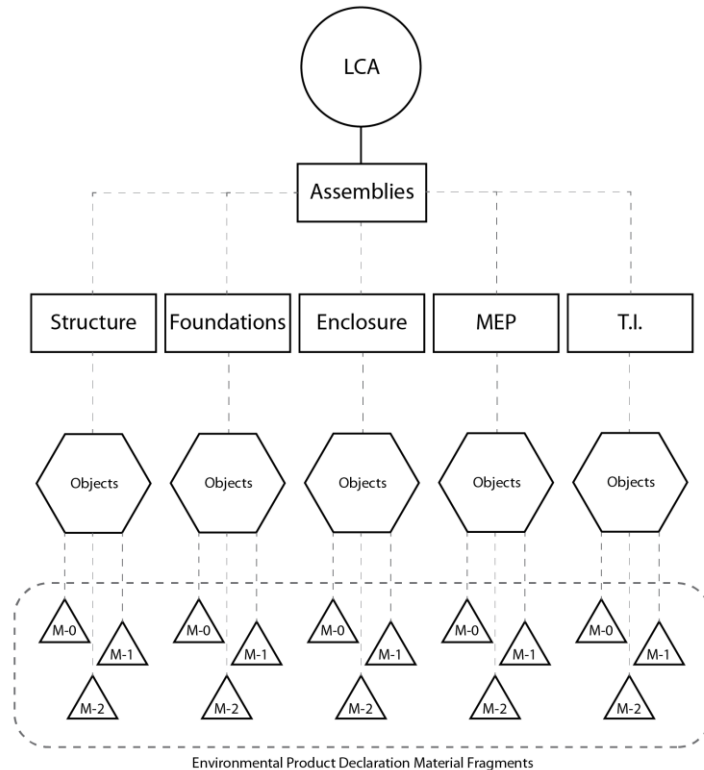


# Toolkit Logic



SUSTAINABLE CODE AT SCALE

**The Buildings and  
Habitats object Model**



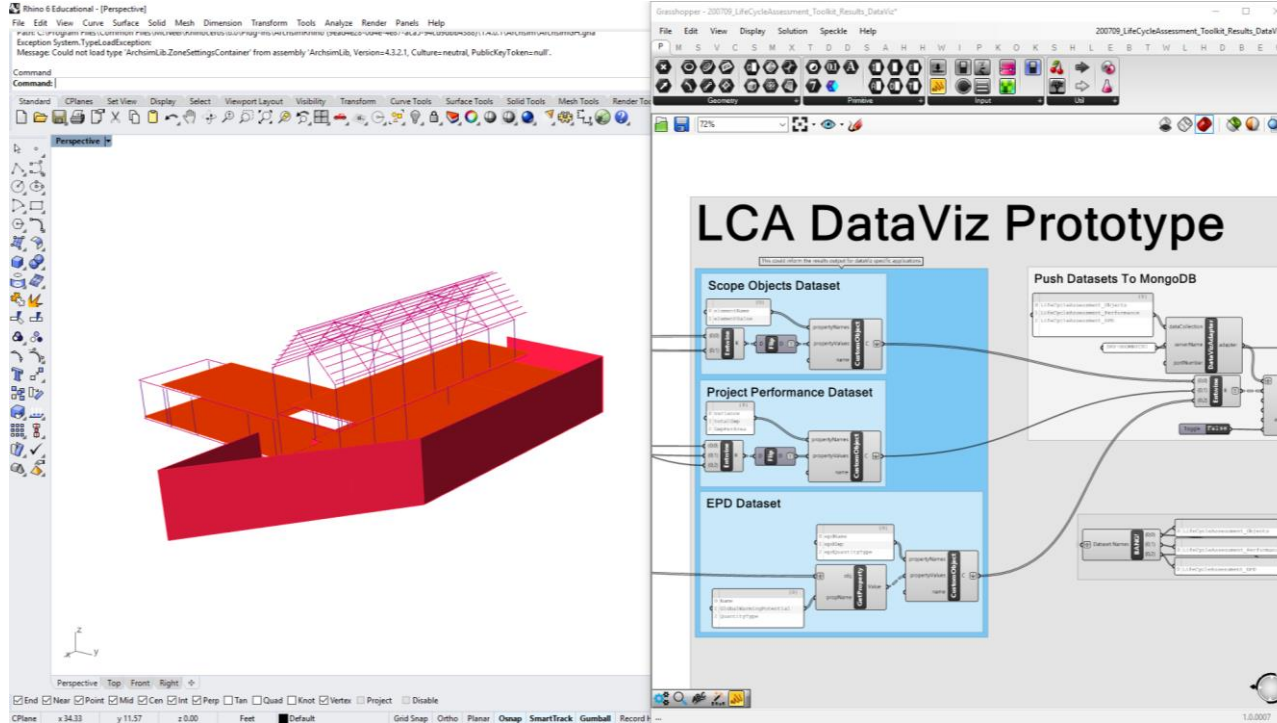
- The LCA Toolkit is built upon the foundational principles provided by the Carbon Leadership Forum Best Practice Guide:  
<http://www.carbonleadershipforum.org/wp-content/uploads/2018/06/CLF-LCA-Practice-Guide-v1.0-2018-06-28.pdf>
- Structured Scope Objects allow for an organised, and systematic approach to compiling an LCA. In contrast, one could easily neglect to assess certain building elements within their LCA.

# Sample Results



SUSTAINABLE CODE AT SCALE

**The Buildings and  
Habitats object Model**



# Sample Results



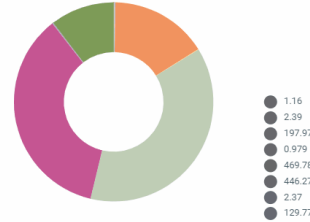
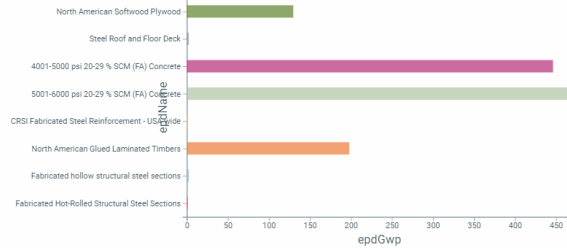
SUSTAINABLE CODE AT SCALE

## The Buildings and Habitats object Model

LifeCycleAssessment\_Test

LifeCycleAssessment\_Test

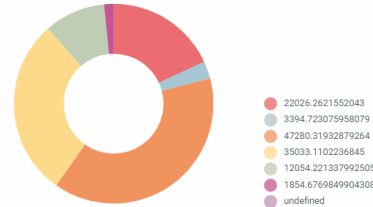
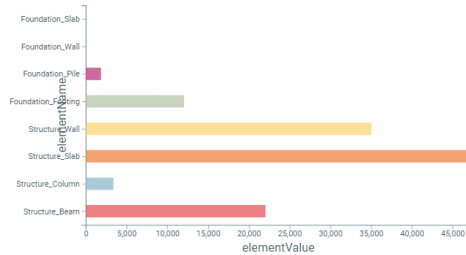
Global Warming Potential per EPD



Project Performance Metrics

Total Global Warming Potential = 121.644k kgCO2  
Total GWP/Area = 277 kgCO2/m2  
Difference vs Benchmark = 28%

Global Warming Potential per Scope Object



Environmental Product Declarations

1. Fabricated Hot-Rolled Structural Steel Sections
2. Fabricated hollow structural steel sections
3. North American Glued Laminated Timbers
4. CRSI Fabricated Steel Reinforcement - USA wide
5. 5001-6000 psi 20-29 % SCM (FA) Concrete
6. 4001-5000 psi 20-29 % SCM (FA) Concrete
7. Steel Roof and Floor Deck
8. North American Softwood Plywood

# **Contracts and Documentation**



I LOVE  
YOU



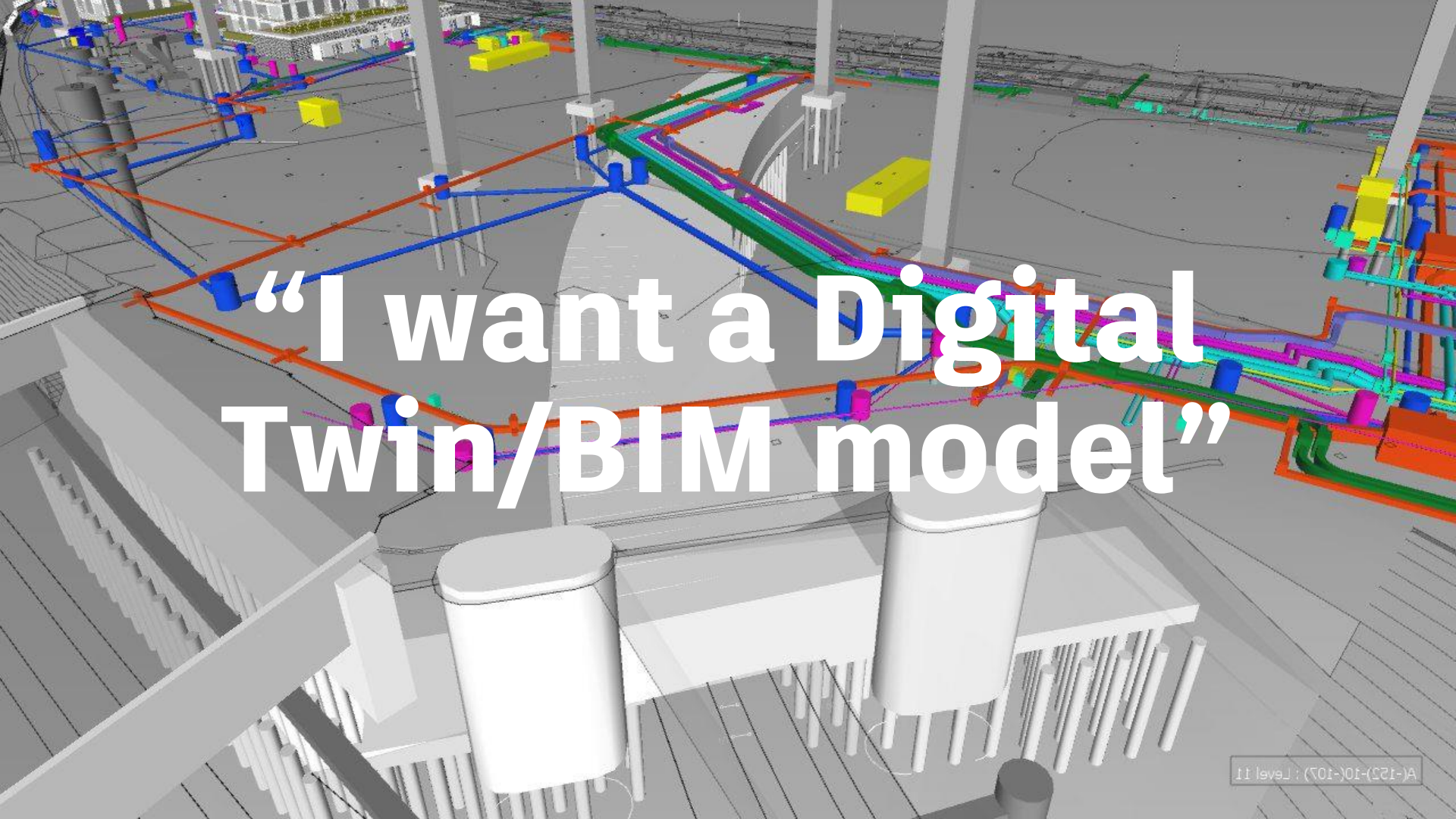


A photograph of a wind farm at sunrise. Several wind turbines are visible, silhouetted against a bright orange and yellow sky. The foreground is a field of tall grass, and a layer of mist or fog hangs over the middle ground. The text "Make it sustainable" is overlaid in white, bold, sans-serif font, with the first part enclosed in quotation marks.

**“Make it sustainable”**



**“Use *that* software”**



**“I want a Digital  
Twin/BIM model”**

**“Achieve these KPIs”**





**“Achieve Net  
Zero Carbon”**



**“Expert/Best in Class”**



Be

smart



**“That’s not my  
responsibility”**



# What Does This Mean In Practice?

The issues and how to deal with them

Clarity of specifications/scope – who does what, when and how?

- Split of responsibilities between project team
- Software specifications (tying in with intentions)
- Reasonable and achievable requirements/scope
- Do some...stuff
- Does the Client know what it wants?

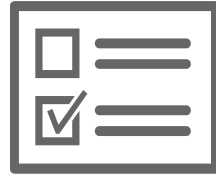
Clarity in (and liability for) the results

- Basis of design/findings and disclaimers
- Strict and uninsured promises
- Unlimited scope and reliance
- Compliance with changing standards and regulations

# Summary of Some Key Risk Management



Exclusions and  
Limitations



Clear Scope and  
Intended Results



No Gaps in  
Responsibilities





# **Internal Processes and Documentation**



**Working Together**

# Organised Systems

A black and white photograph of a library or archive. The image shows rows of bookshelves filled with books and binders. The perspective is from a slightly low angle, looking down the length of the shelves. The lighting is soft, creating a sense of depth. The text 'Organised Systems' is overlaid in large, bold, white letters across the center of the image.

# Creating effective internal systems

what, where and how

Clarity of documentation and processes

- Standard templates, scope and processes
- Understanding of services and processes
- Guidance, checklists and training

Push and Pull

- From senior management
- From those carrying out and developing services
- Organisation published and expressed ethos, plans and actions

# Summary of how to work out what you need

Start with a blank sheet of paper...



**What**

## **Process/Tasks**

What is actually wanted and what is needed

**Who**

## **Allocating**

What could go wrong and who should bear the roles/liability

**How**

## **Reducing Issues**

What processes, records and skills to clarify and reduce risks

**Risk**

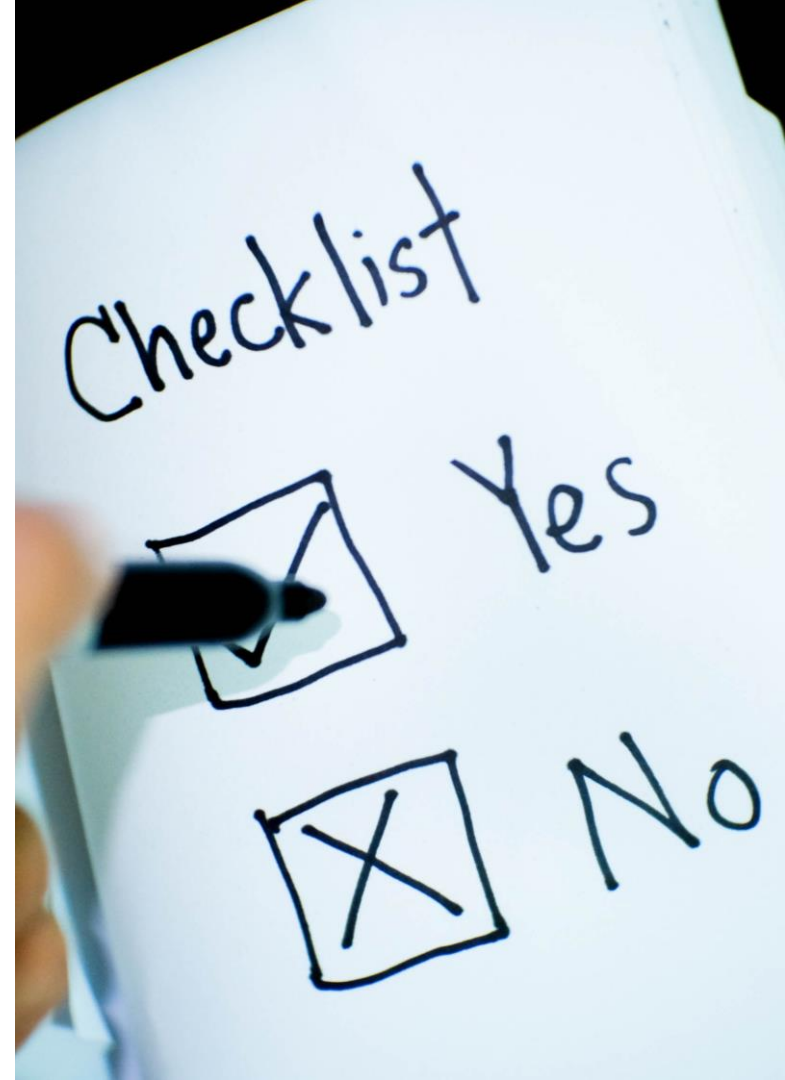
## **Analyzing**

How likely are the risks and are they big or small

# When does this matter?

(Answer = all the time)

- At the outset
- Throughout the project
- Designed with parties and users in mind
- Agile and practical
- Clarity of responsibilities and outcomes



The background is a dark, abstract composition of geometric shapes. A large, dark, rounded rectangle occupies the center. To its left and right are diagonal bands of slightly different shades of dark gray. Thin, bright, glowing lines run diagonally across the image, intersecting the dark shapes. The overall effect is modern and high-tech.

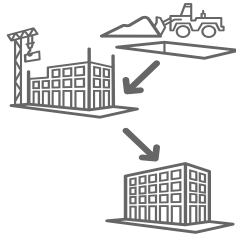
**Ethos**

# Summary of establishing ethos

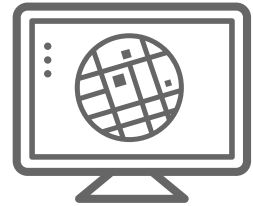
Clarity and buy-in



Vision



Purpose and Targets




Organisation-Wide Steps



# Buro Happold's Published Targets

Change requires real commitment



**Buro Happold announces validation of Science-Based Targets and offset of operational emissions**

News

Reduce our own operational carbon emissions by 21% by 2025 and aim to be net zero carbon from April 2021 by offsetting residual emissions



**Our response to the UK Government's planned 68% reduction in GHG emissions by 2030**

News

Design all new build projects to be net zero carbon in operation by 2030



**Buro Happold joins UK construction's net zero carbon business champions**

News

Reduce embodied carbon intensity of all new buildings, major retrofits and infrastructure projects by 50% by 2030

# Some lessons learnt

(From those who are in the thick of it)

**“It’s not that I’m so smart. It’s just that I stay with problems longer.”**

**Albert Einstein**

- Encouraging/Ensuring adoption
- Technology is an enabler and tool
- Technology is not a panacea
  - Some tasks will still be time consuming
  - Human input is fallible
  - No sole technology/software solution
- Awareness of skillset limitations
- Collaboration is key



# Communication

# Final Summary

- Multi-pronged approach
- Technology and Measuring
- Data and Process
- Mindset and Policy
- And don't forget document clarity...
  - Targets and Aims
  - Responsible for
  - Not responsible for
  - Mind the gaps



***“Demand for sustainable buildings is increasing, doubling every three years”***

Emmanuel De Giacomo  
Autodesk University 2020 Article

The background of the slide features four abstract, dark gray, three-dimensional geometric shapes in the corners. These shapes resemble stylized, faceted crystals or architectural elements, each with sharp edges and reflective surfaces that catch the light, creating bright highlights and deep shadows. They are positioned in the top-left, top-right, bottom-left, and bottom-right corners, framing the central text.

# AUTODESK UNIVERSITY

Autodesk and the Autodesk logo are registered trademarks or trademarks of Autodesk, Inc., and/or its subsidiaries and/or affiliates in the USA and/or other countries. All other brand names, product names, or trademarks belong to their respective holders. Autodesk reserves the right to alter product offerings, specifications and pricing at any time without notice, and is not responsible for typographical or graphical errors that may appear in this document.

© 2021 Autodesk. All rights reserved.