AUTODESK UNIVERSITY

Total Carbon Data Analysis and Insights (AS502555)

Session Description

Buildings and Construction generate nearly 40% of Annual Global CO2 Emissions. Of that 40%, Building Operations account for 28%, while Building Materials and Construction (aka Embodied Carbon Emissions) are responsible for 11%. Achieving Zero Emissions in Operations requires a continued focus on Energy Efficiency, avoid the use of Fossil Fuels and use of Renewable Energy Systems. Unlike Operational Carbon Emissions which occur over the life of a building Embodied Carbon Emissions occur 'up front' and therefore play a bigger role in the Global Carbon Budget in the more immediate future. As such it is more imperative than ever that Architects and other projects stakeholders start to employ Total Carbon Analysis at all stages of every project. In this session you will join Autodesk Product Development and Impact Team members to learn about new Data, Analysis and Insights into Total Carbon to help make effective reductions as part of a more integrated, BIM based design process.

Learning Objectives

1. Understand what Total Carbon is, Why it Matters and How it can be Analyzed as Part of a More Integrated Design Process

2. Use Revit for Establishing a Basis for Total Carbon Analysis (Location, Quantities, Materials, Systems, Operations Data)

3. Get Insights into Embodied, Operational and Total Carbon with Interactive Breakdowns and Tradeoffs

4. View and Modify Data, Analysis and Insights to Meet Different Regional or Project Needs

Safe Harbor Statement

The presentations during this event may contain forward-looking statements about our outlook, future results and related assumptions, total addressable markets, acquisitions, products and product capabilities, and strategies. These statements reflect our best judgment based on currently known factors. Actual events or results could differ materially. Please refer to our SEC filings, including our most recent Form 10-K and Form 10-Q filings available at www.sec.gov, for important risks and other factors that may cause our actual results to differ from those in our forward-looking statements.

The forward-looking statements made in these presentations are being made as of the time and date of their live presentation. If these presentations are reviewed after the time and date of their live presentation, even if subsequently made available by us, on our website or otherwise, these presentations may not contain current or accurate information. We disclaim any obligation to update or revise any forward-looking statements.

Statements regarding planned or future development efforts for our products and services are not intended to be a promise or guarantee of future availability of products, services, or features but merely reflect our current plans and based on factors currently known to us. Purchasing decisions should not be made based upon reliance on these statements.

Who’s Speaking

Ian Molloy
Product Manager,
Insight & MEP

Marta Bouchard
AEC Sustainability Lead

Corina Marinescu
Product Owner,
Insight

AUTODESK UNIVERSITY

Total Carbon

Data, Analysis & Insights

40%

Zero

2°C

40%

One Year of Building Activity

Global GHG emissions attributed to built environment

Embodied Carbon

Extraction
Transportation
Manufacturing

Construction

~12%

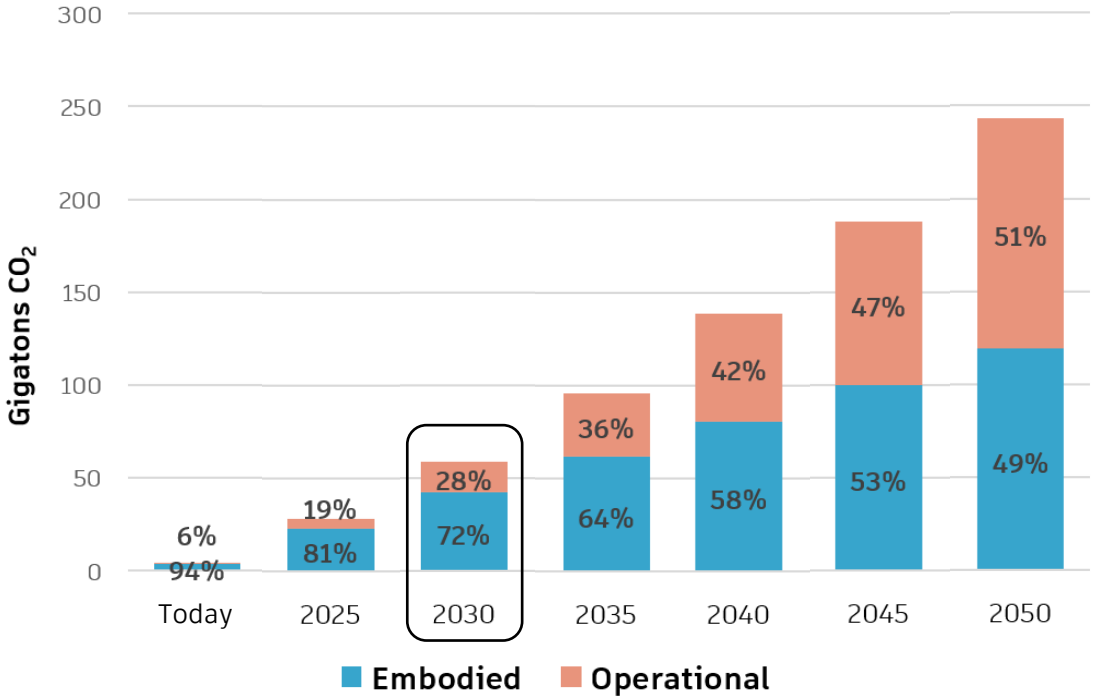
Operational Carbon

Operations

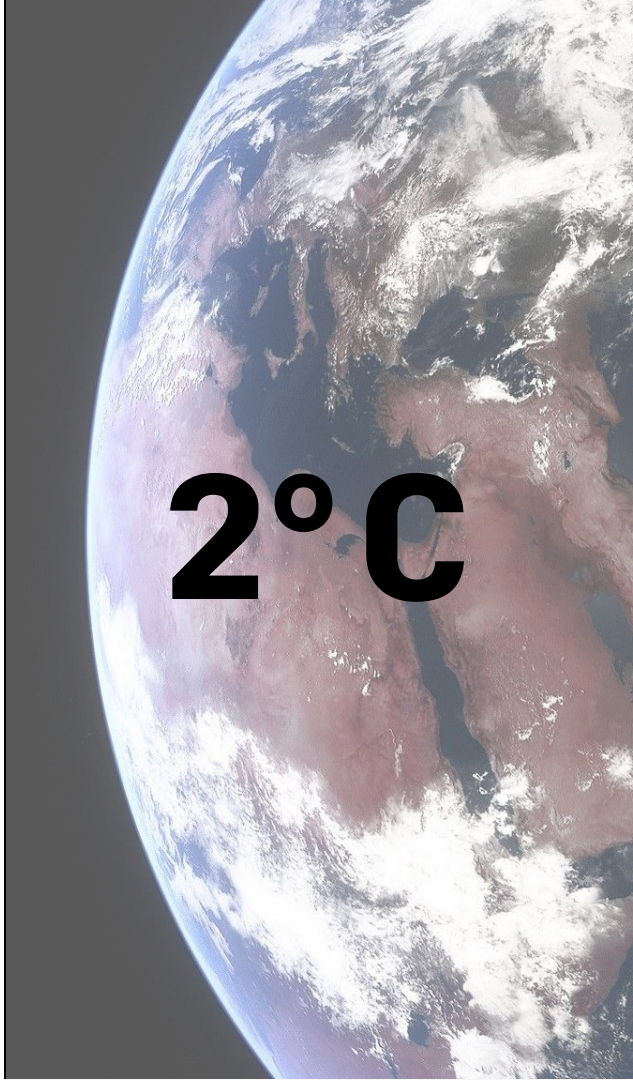
~28%

New Building Activity

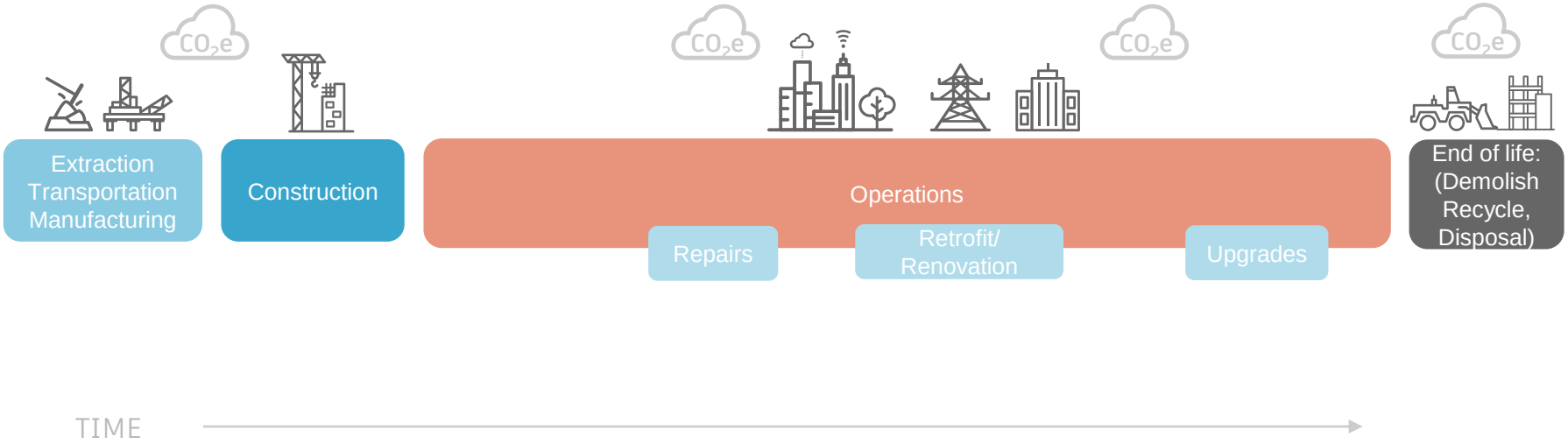
Cumulative Emissions, assuming ‘business as usual’



Adapted from Architecture 2030,
Total Carbon Emissions of Global New Construction



Total Carbon for One Building



Commitment to “Zero” is High

2030
BY THE
NUMBERS

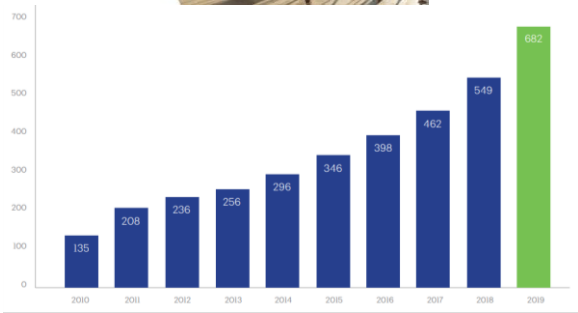
The 2020 summary of the AIA 2030 Commitment

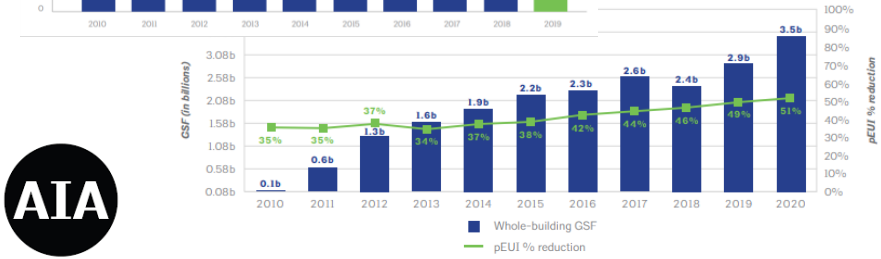
Download the 2020 Report

2020 By the Numbers >

Previous reports

2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 | 2011 | 2010





AIA

Adoption of Design Analysis Tools Remains Low

Complex and Multifaceted Challenges Abound

Business Costs & Risks

- Outside Normal Scope & Fee Structure
- Time/Cost Adopting and Using New Tools
- Increased Risk due to Incorrect Use

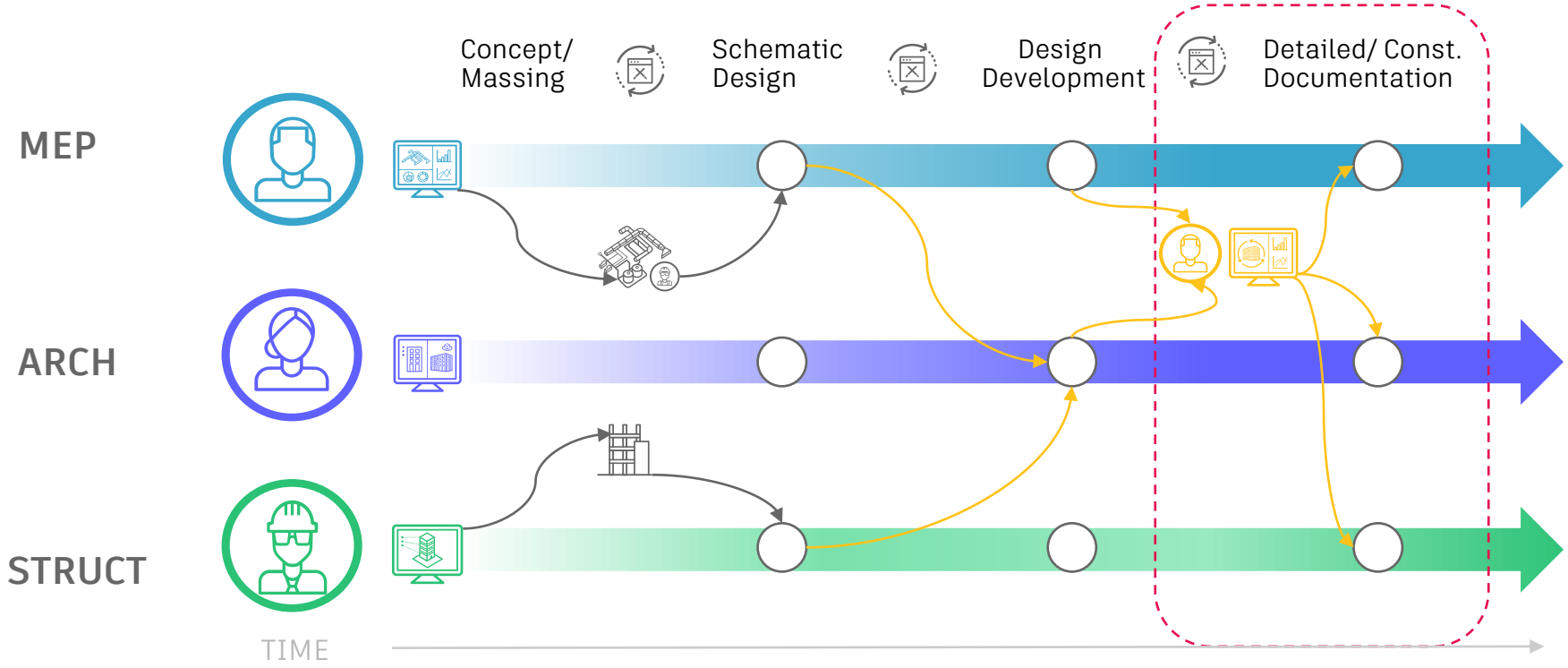
Design Process

- Continuity Across Stages and Levels of Detail
- Meeting Different Stakeholder Needs
- Integrated / Cross Discipline Impacts

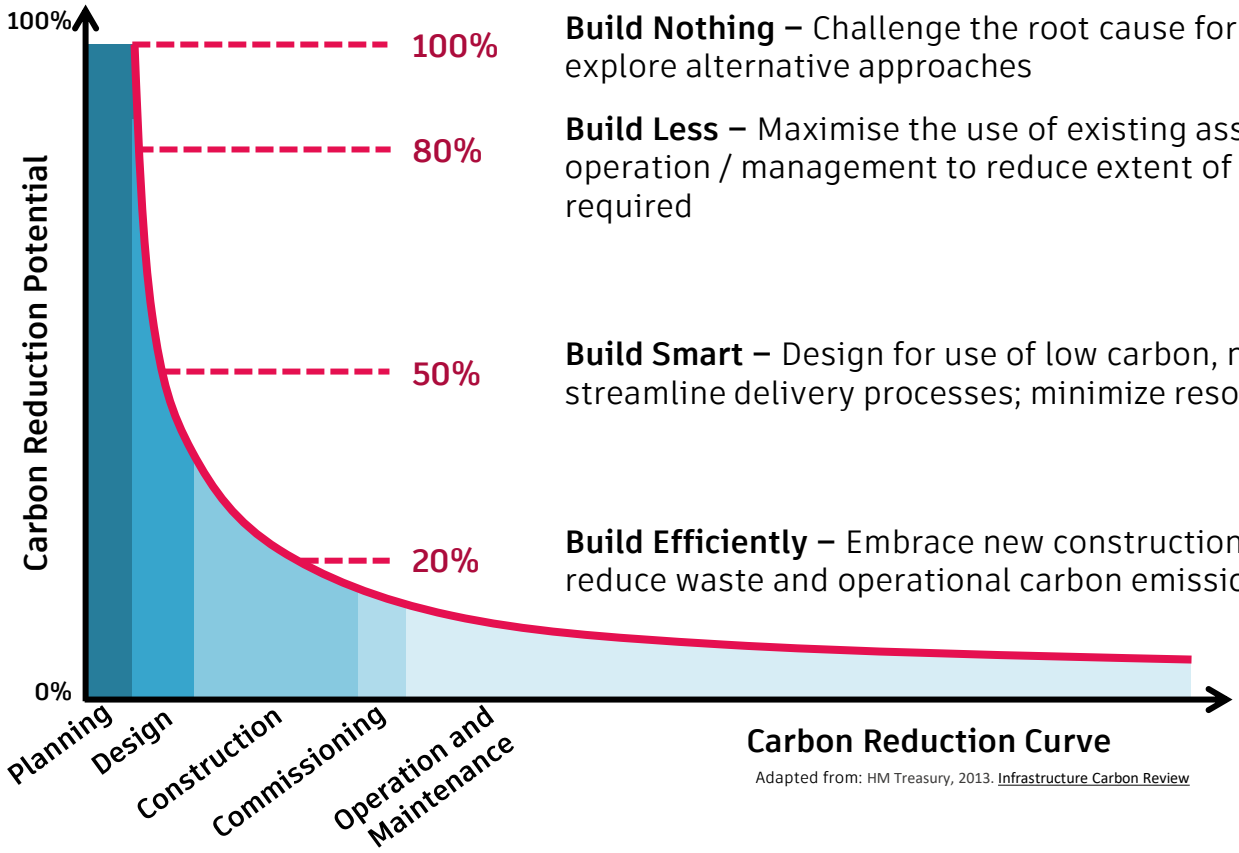
Tools & Data

- Difficulty with Use e.g.: Interop w/ BIM
- Control Over Inputs, Algorithms & Outputs
- Capturing & Re-Use of Best Practices

Conventional Process



Greatest Impact is Reducing Carbon Early



Adapted from: HM Treasury, 2013. Infrastructure Carbon Review

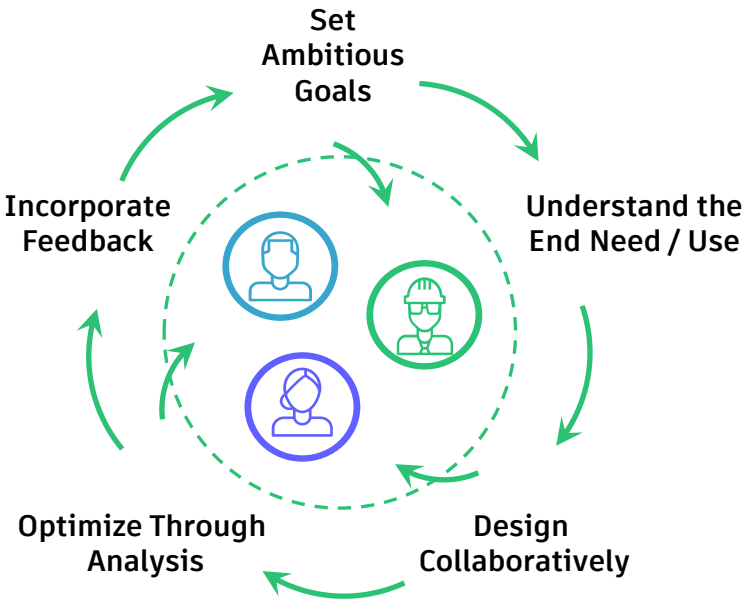
Build Nothing – Challenge the root cause for the need and explore alternative approaches

Build Less – Maximise the use of existing assets; optimize asset operation / management to reduce extent of new construction required

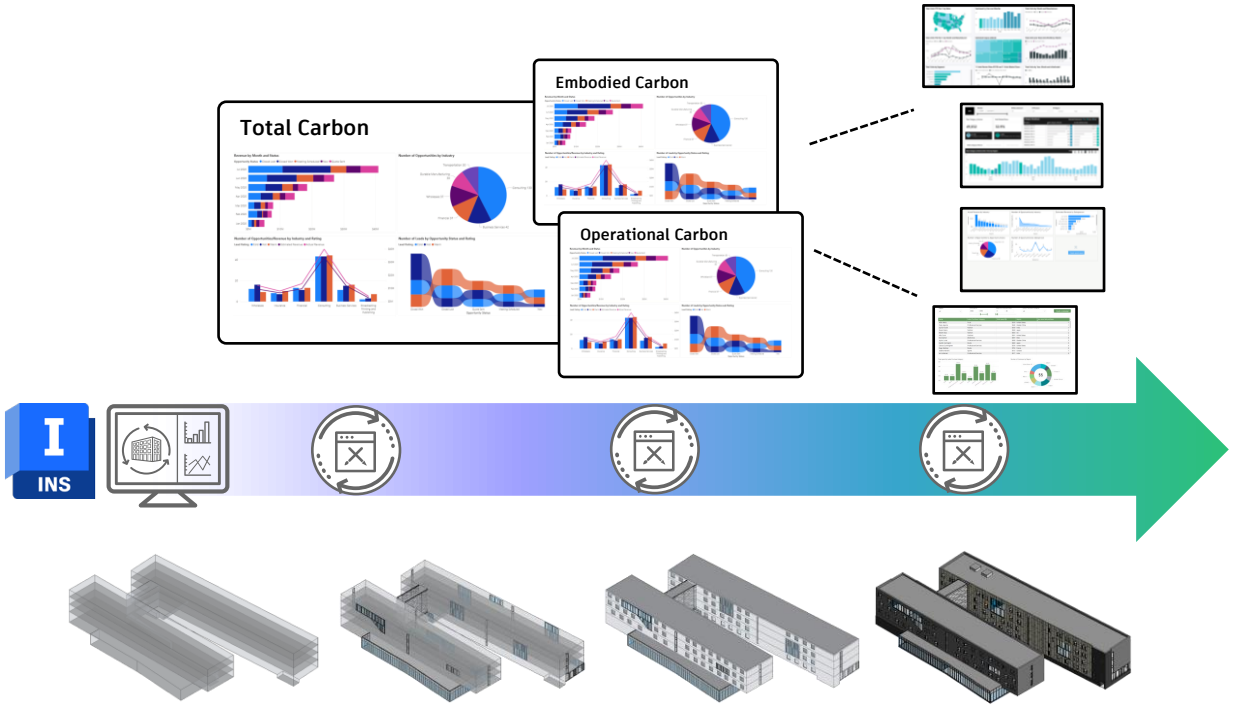
Build Smart – Design for use of low carbon, natural materials; streamline delivery processes; minimize resource consumption

Build Efficiently – Embrace new construction technologies to reduce waste and operational carbon emissions

Integrate Stakeholders

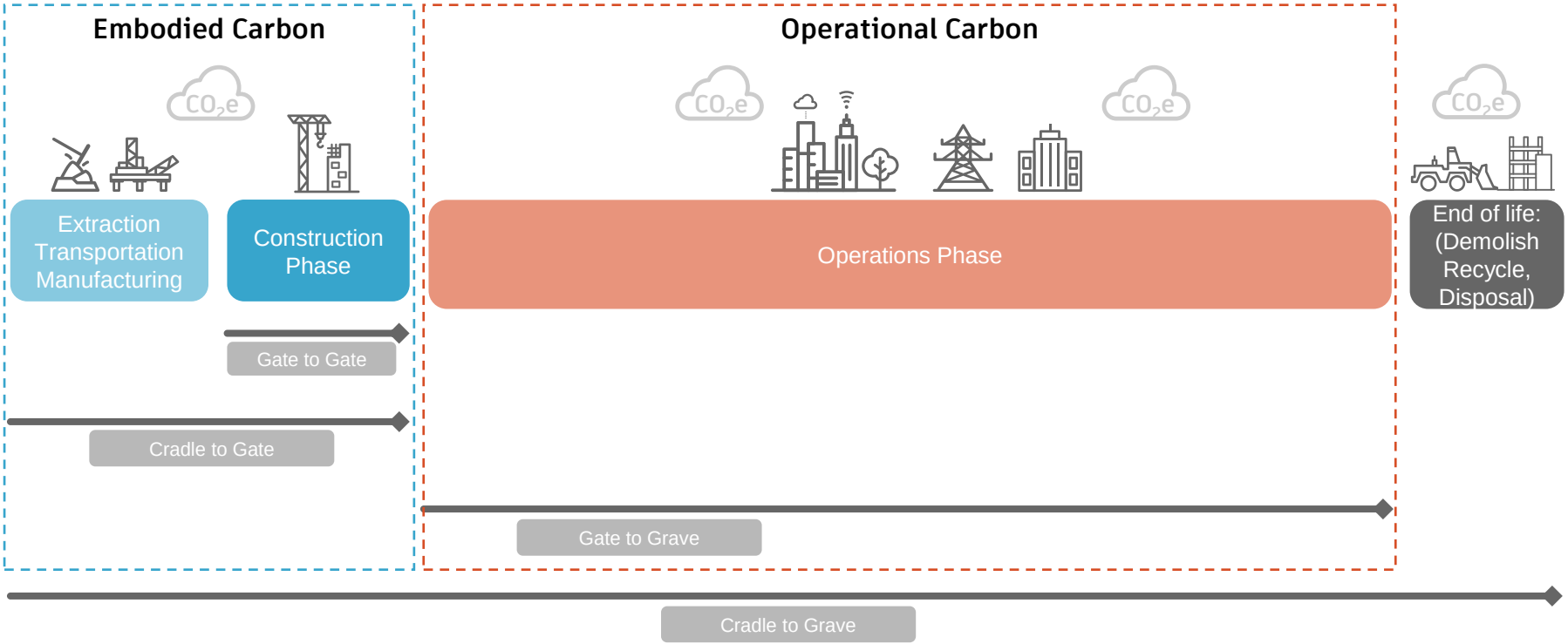


Integrate Data, Analysis & Insights



Quantify Carbon Across the Building Lifecycle

Predicting total carbon starts early in the design process



Landscape of Tools

From manual calculations to customized solutions

Embodied Carbon

References & Proxies

Databases

Spread sheets

BIM Schedules (BOM)

Packaged Software Tools

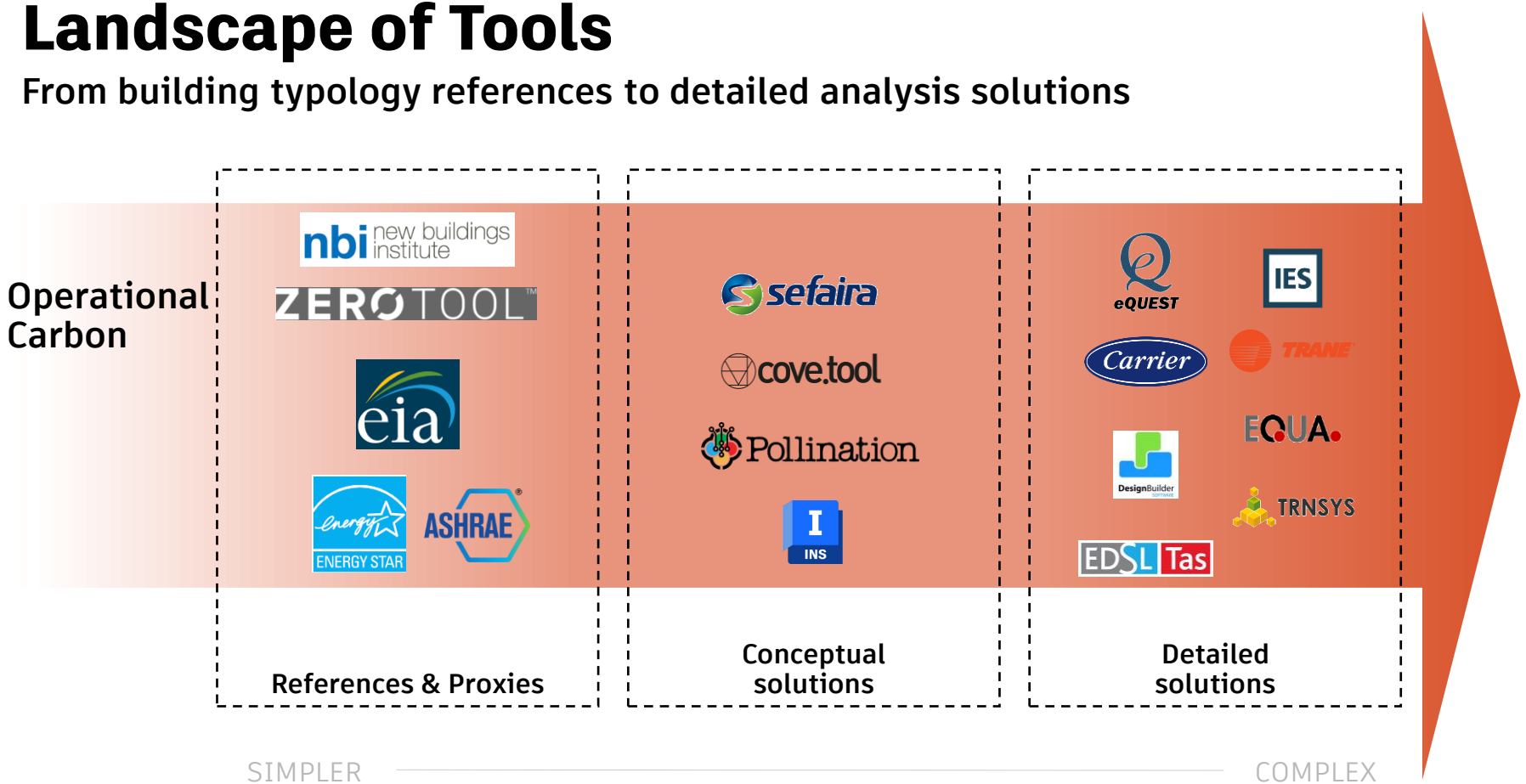
Custom Solutions

LCA Software

SIMPLER — COMPLEX

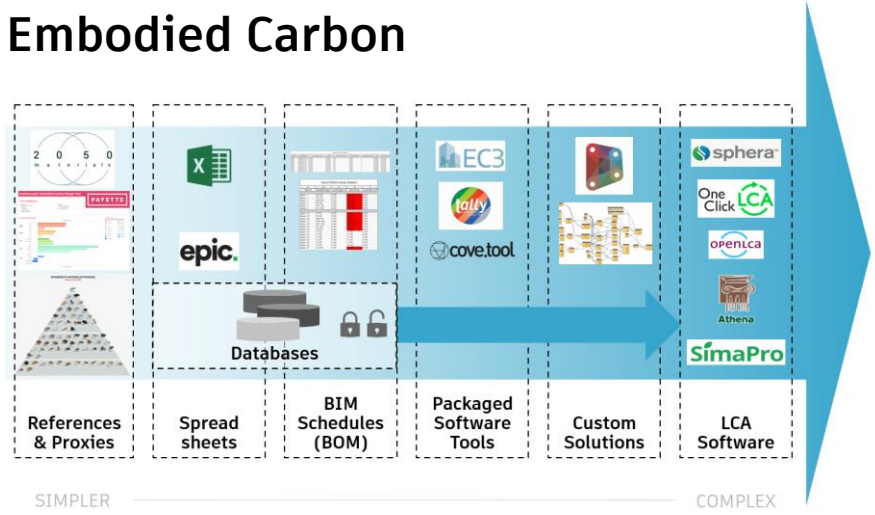
Landscape of Tools

From building typology references to detailed analysis solutions

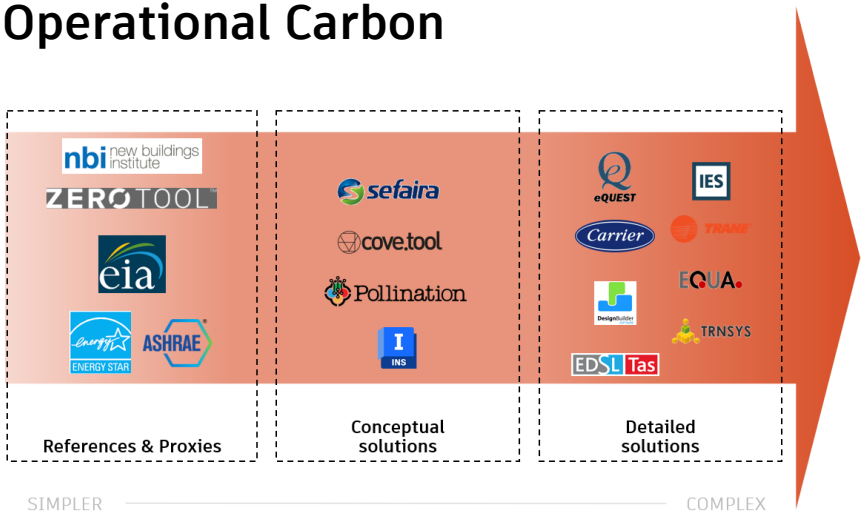


Landscape of Tools

Embodied Carbon

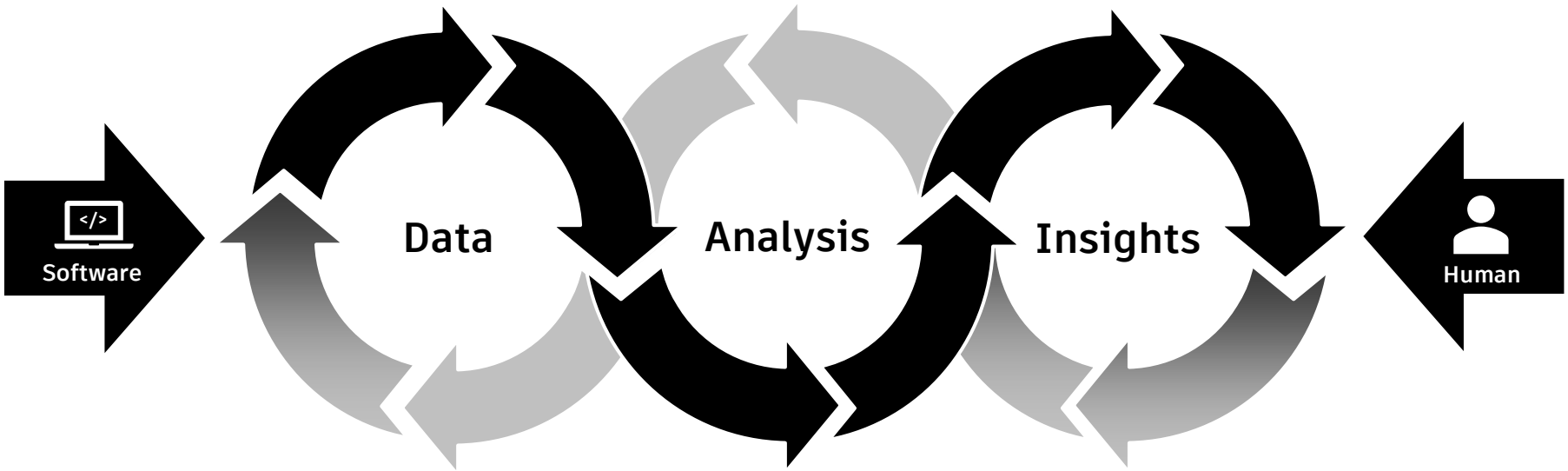


Operational Carbon



AUTODESK UNIVERSITY

Total Carbon
Data, Analysis & Insights


Software
Data
Analysis
Insights
Human

Traditional Toolscape

Specialist

Point Solutions

Closed/Proprietary

Desktop/File Based

Data Analysis Insights

> Open

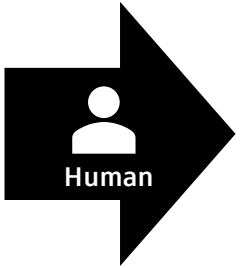
> Transparent

> Collaborative

> Cloud/APIs

> Extensible

‘The New Oil’



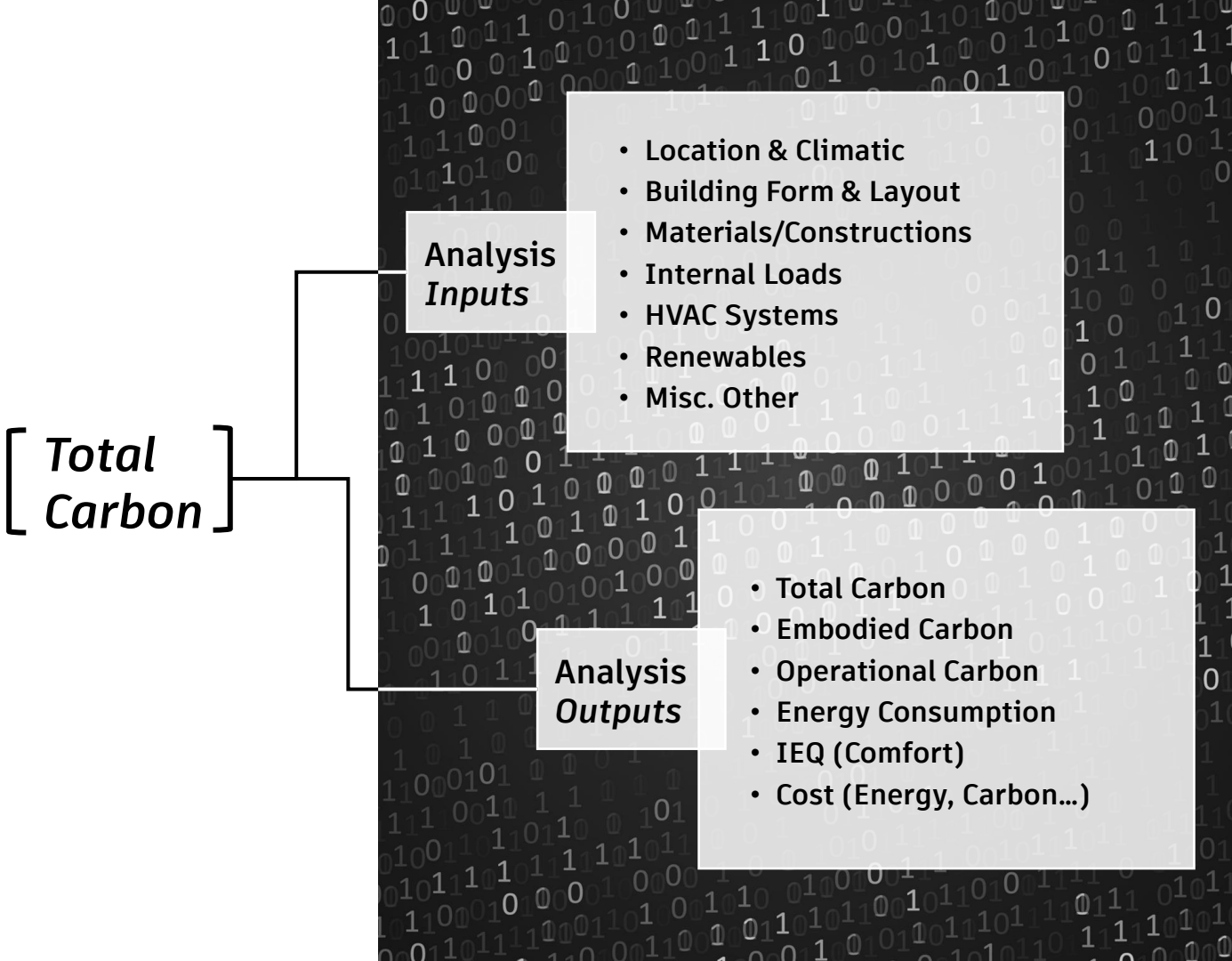
Data
Analysis
Insights

Information w/o Context
e.g. ‘The Answer is 11’

Means of Exchange
b/w Applications

Input to and Output
from Analysis…

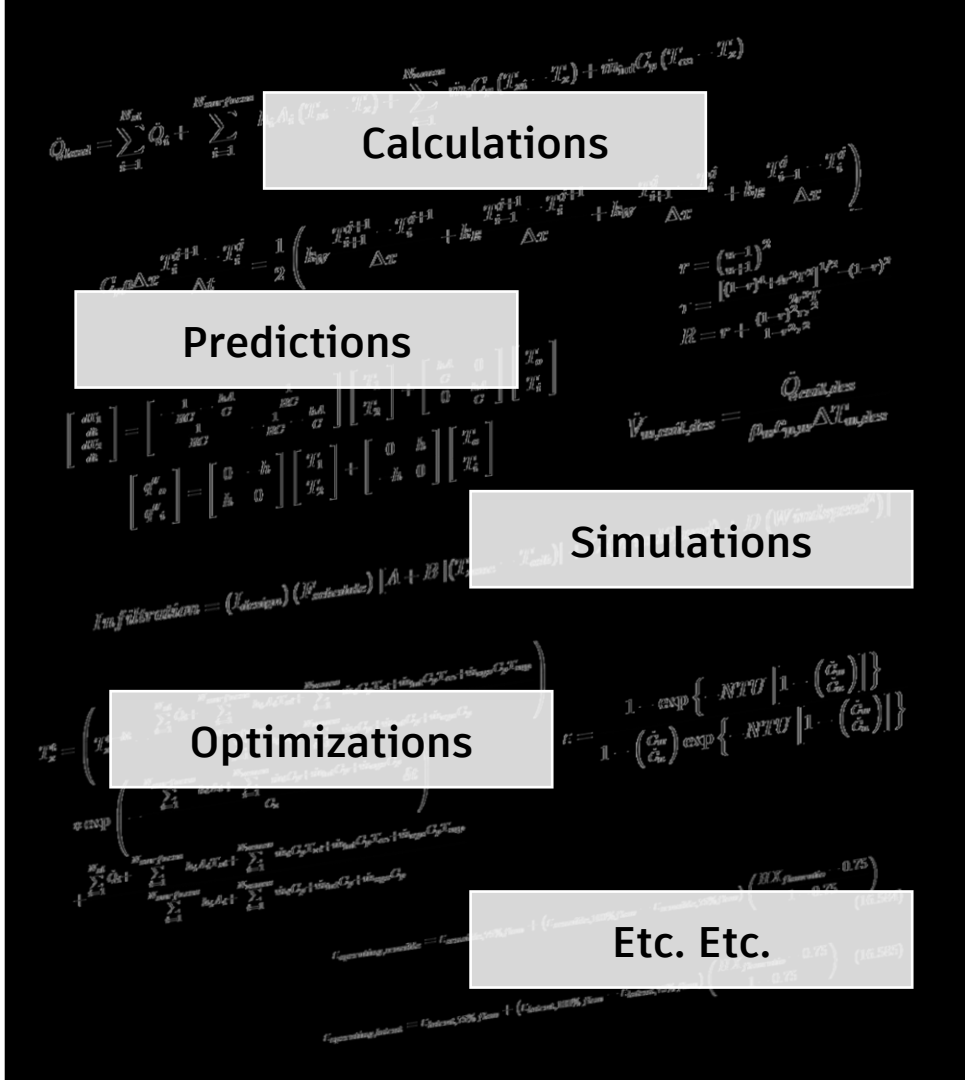
Data
Analysis
Insights



Data

Analysis

Insights



Data
Analysis
Insights

Total Carbon

Embodied Carbon

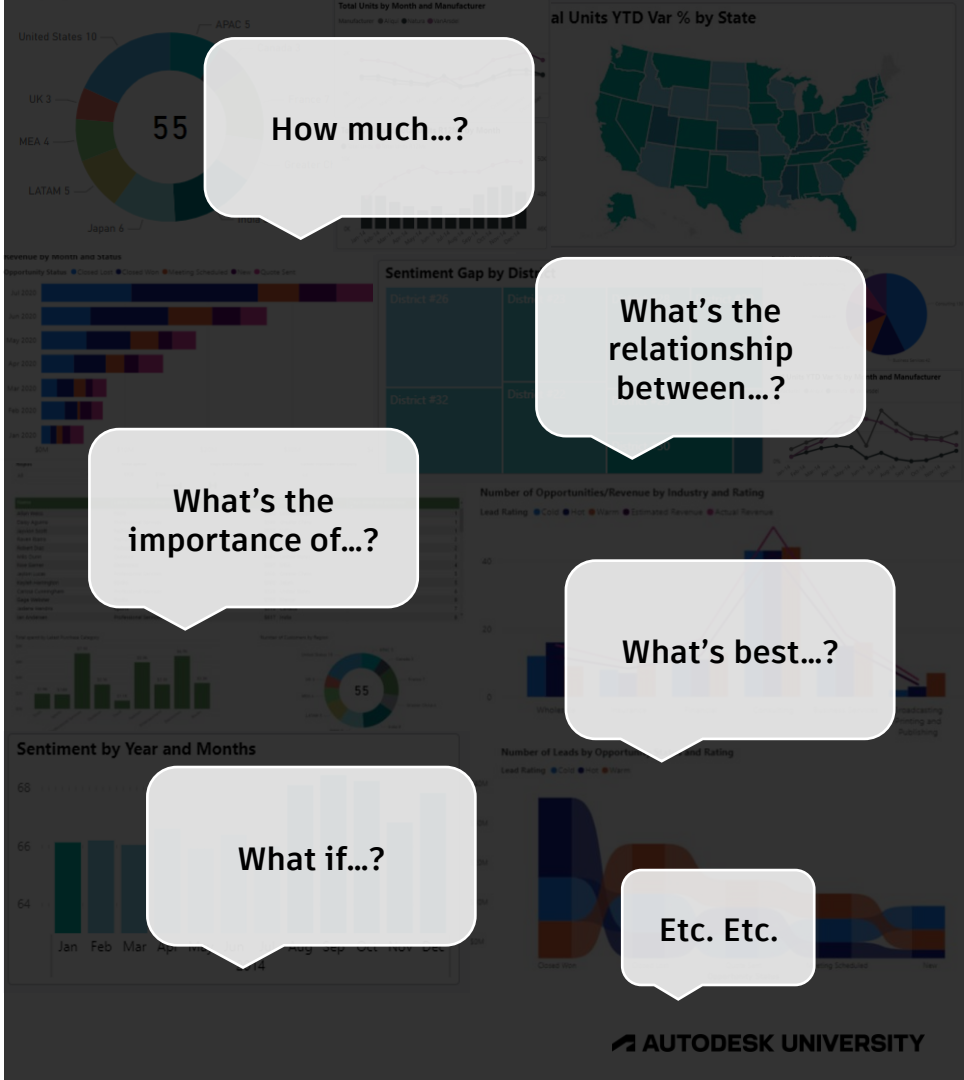
EC3

Operational Carbon

EnergyPlus

OS

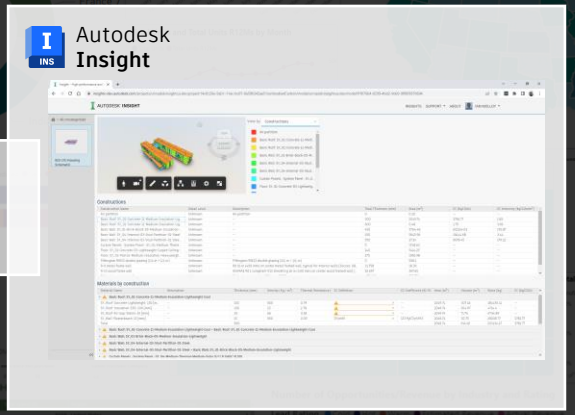
Data
Analysis
Insights



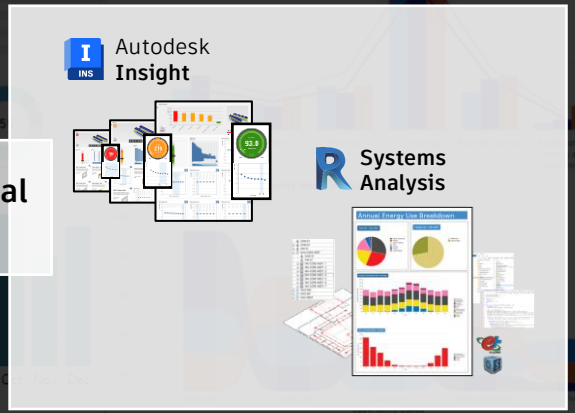
Data Analysis Insights

Total Carbon

Embodied *Carbon*



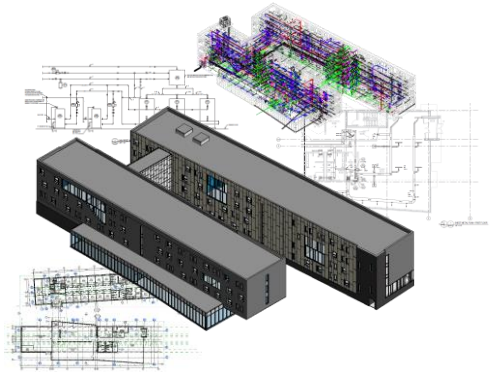
Operational Carbon



Where to Start?

Building Information

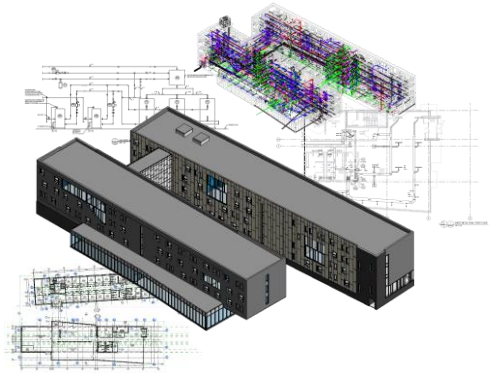
Models



?

Building Information

Models

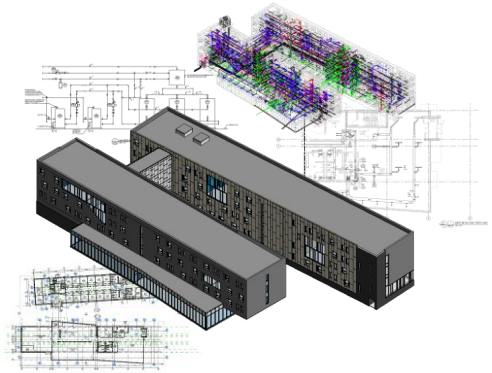


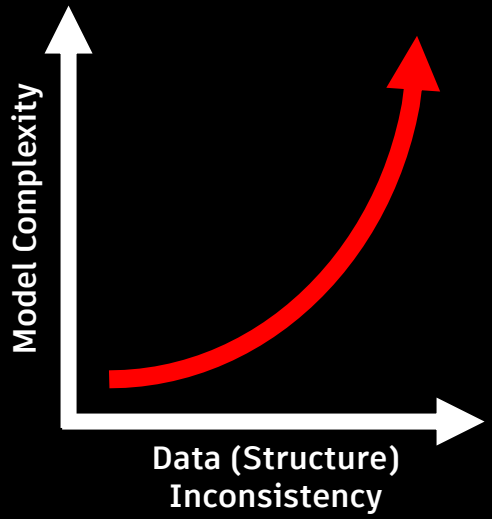
≠

Data
Analysis
Insights

Building Information

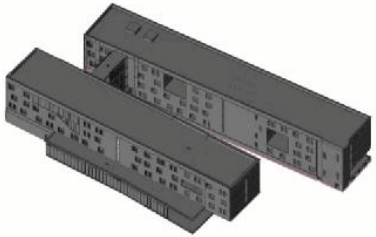
Models



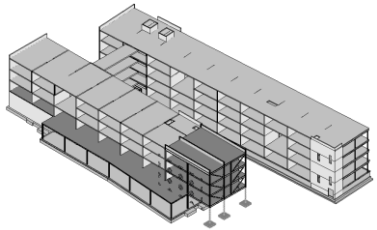


For Example: Typical Revit Architecture Model

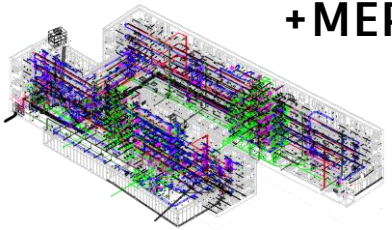
100s/1000s of Individual Parts
Different Modeling Styles,
Levels of Completeness,
& Parameters

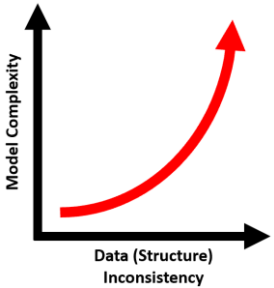


+Structure



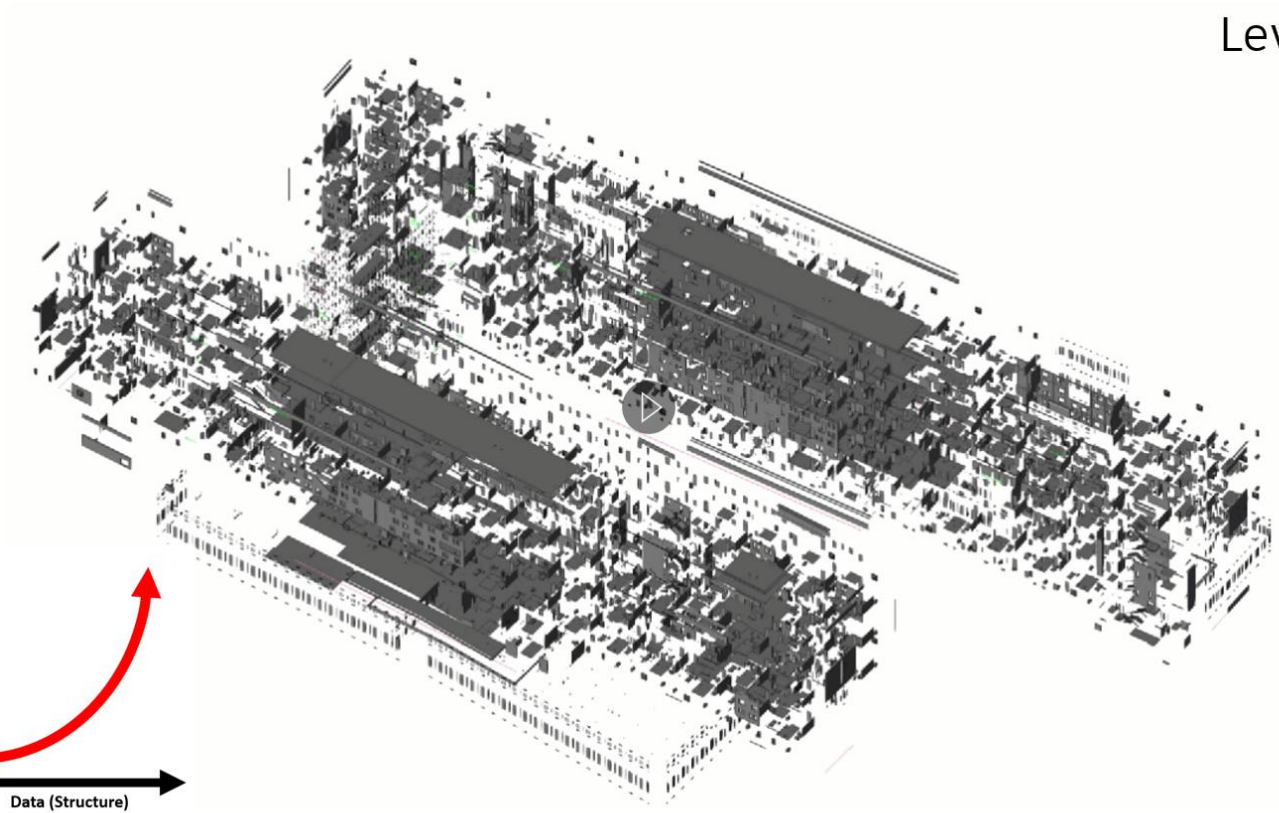
+MEP

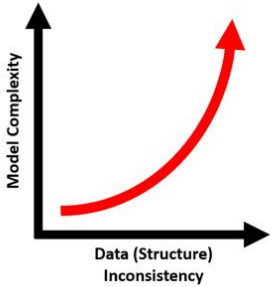




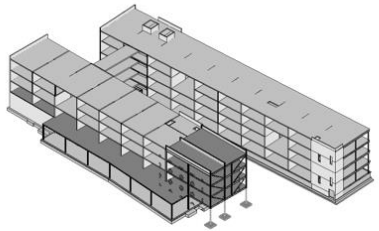
For Example: Typical Revit Architecture Model

100s/1000s of Individual Parts
Different Modeling Styles,
Levels of Completeness,
& Parameters

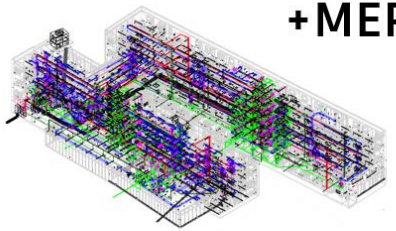




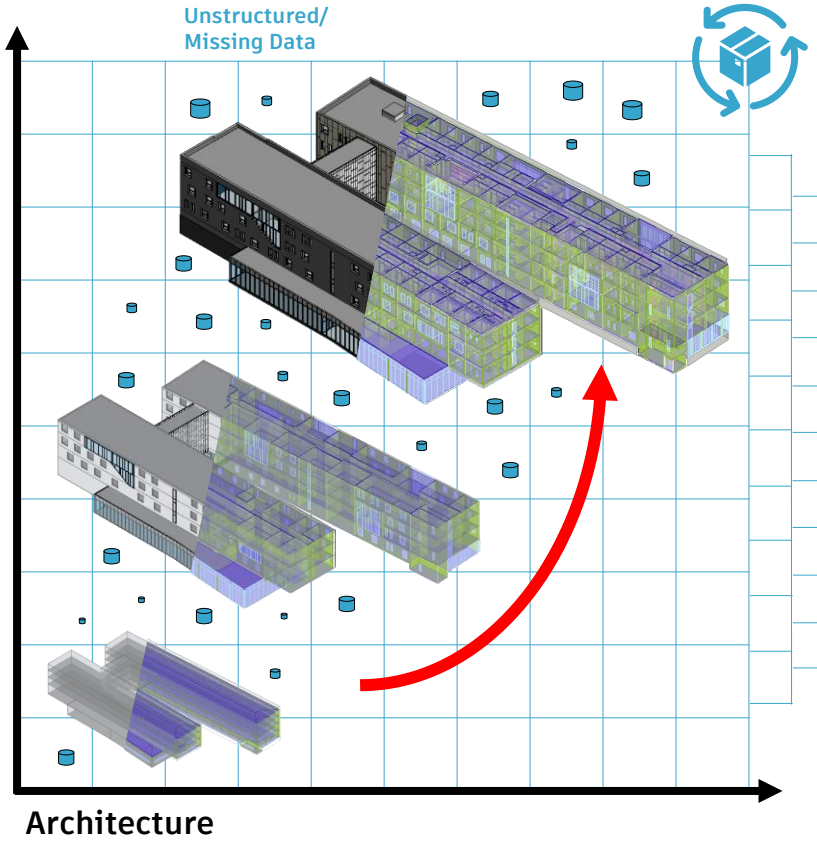
+Structure



+MEP



Energy Analytical Model



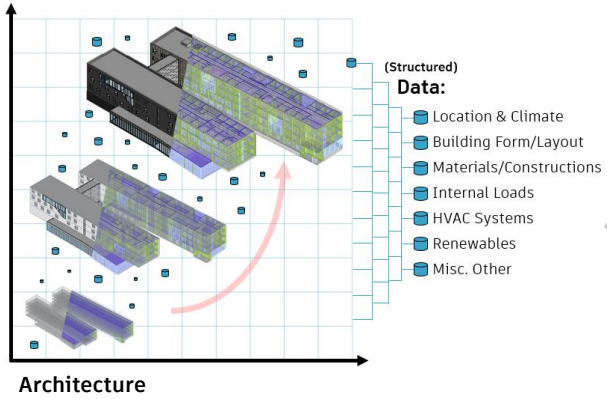
Structured

Data:

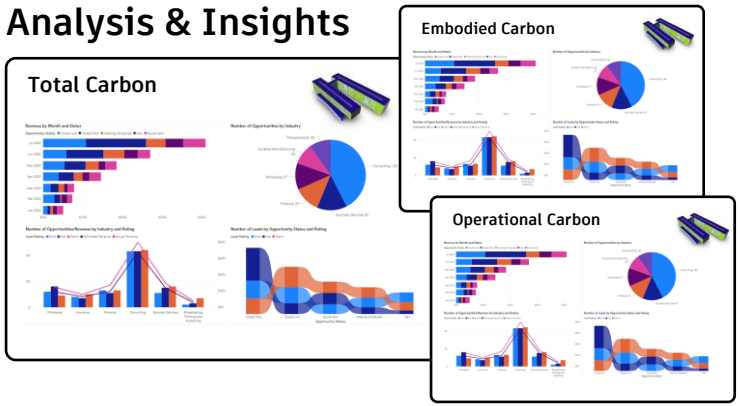
- Location & Climate
- Building Form/Layout
- Materials/Constructions
- Internal Loads
- HVAC Systems
- Renewables
- Misc. Other

Provides a Single Consistent Path to *Start* Total Carbon Analysis & Insights

Energy Analytical Model

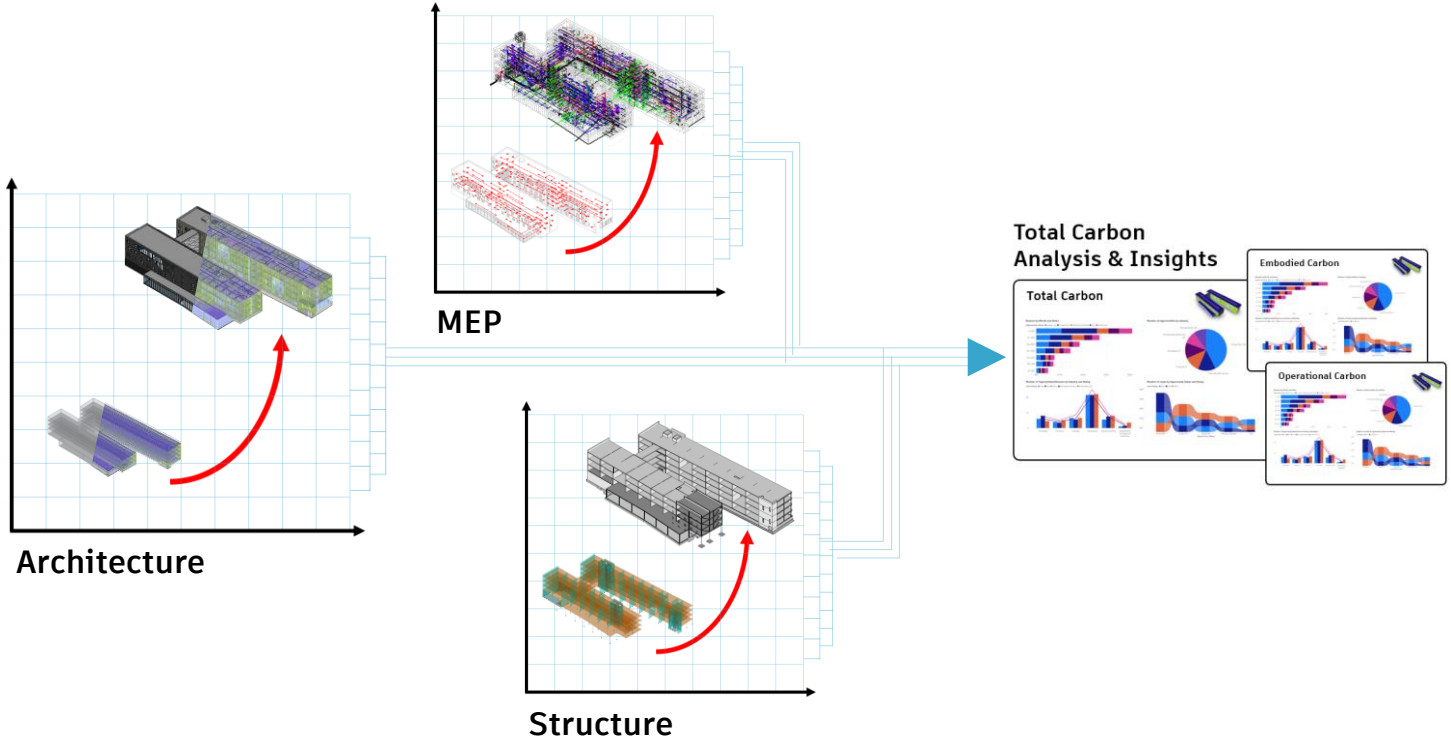


Total Carbon Analysis & Insights



(*Future*) Multi-Discipline Data Aggregation

Energy Analytical Model



Energy Analytical Model

Consider Different Workflow Options…

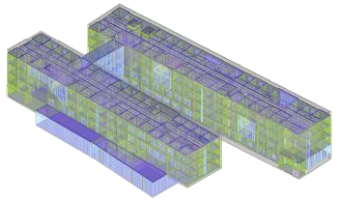
Use Existing Model?
OR
Model from Scratch

Use as a Link?
OR
Use Directly?

Link as NRB?
OR
Link as RB?

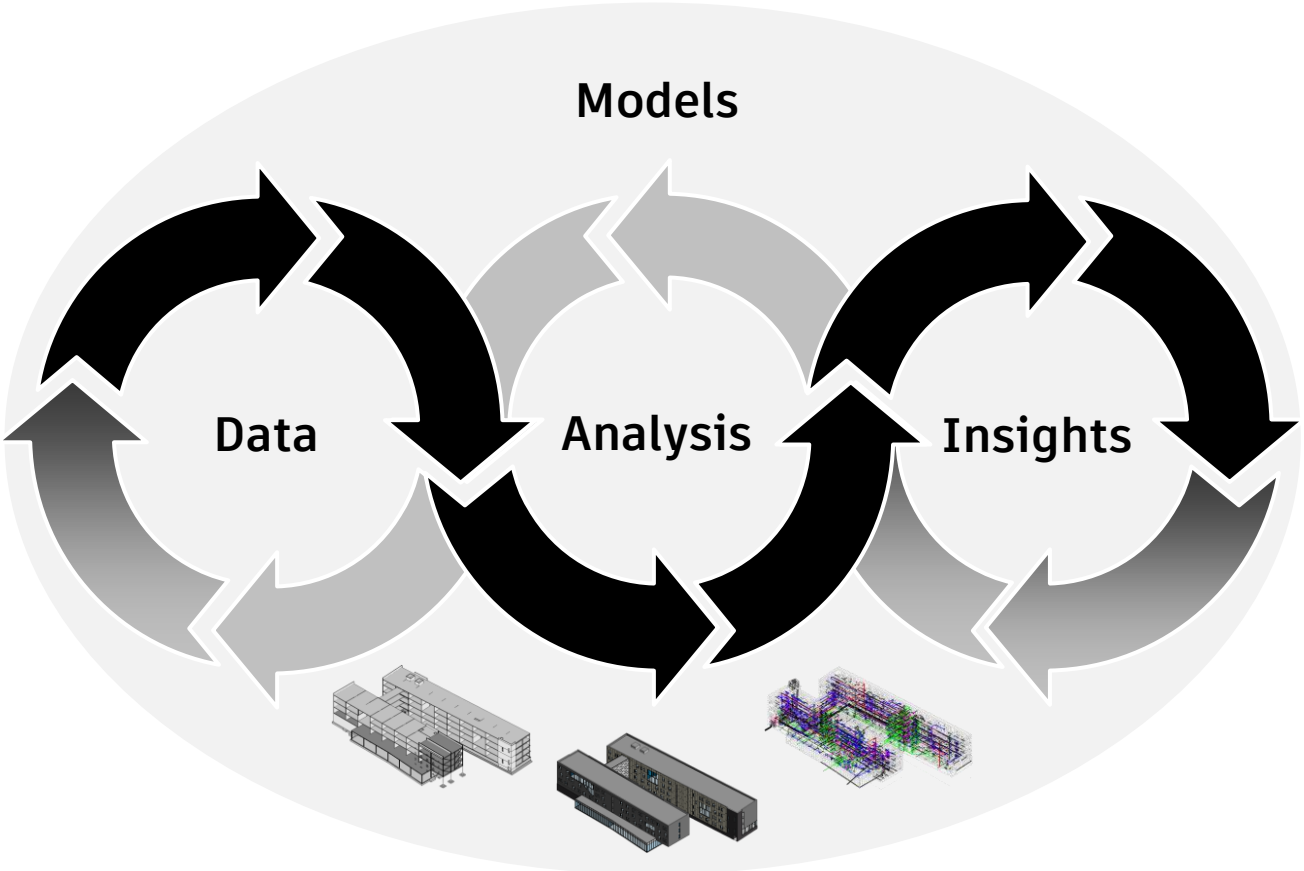
What Elements to Use?

What Energy Settings?



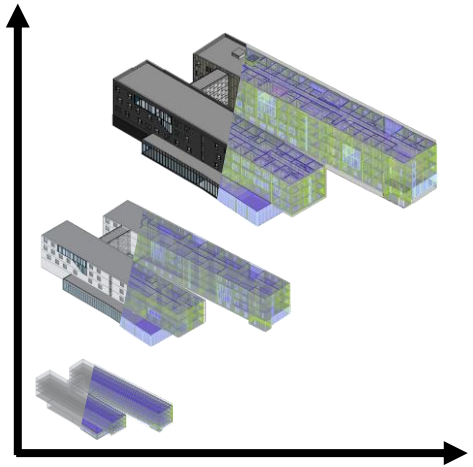
How to Create and Check the EAM?

Etc.


Models
Data
Analysis
Insights

Autodesk Insight

Energy Analytical Model



Autodesk Insight

Incl. w/ Subscription to: AUTODESK REVIT | ARCHITECTURE, ENGINEERING & CONSTRUCTION COLLECTION

Autodesk
Insight

Customer Case Studies

"The ability to quickly gauge the impact of multiple energy-saving options in one step– instead of creating several separate energy analyses–saves the firm time and money, and improves the energy data accuracy"

"Now the teams aren't just running analysis for the sake of it but are actually using it to help make and explain design decisions. Being able to do this directly from Revit is fantastic. So far everyone that has tried it has been very successful."

"It's accurate. We checked it against around ten other whole building energy models we'd done before, and we were amazed…within 5 kBTU/ft²/yr in all cases. That's unbelievable."

https://www.autodesk.com/products/insight/case-studies

Autodesk
Insight

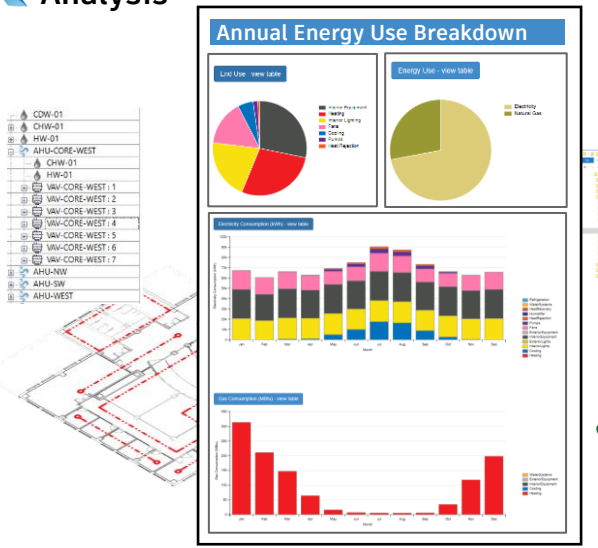
Key Customer Requests

- Energy Use/Cost Intensity (Only) ✓
- No Energy End Use Breakdowns ✓
- Limited HVAC System Definitions ✓
- Fixed Benchmarks & Factors
- Legacy Technology
  - DOE2.2 ✓ [EnergyPlus, OpenStudio]
  - Not Built w/ Forge (Runs on Desktop)

✓ **Capabilities Now Provided by Revit Systems Analysis (2020.1+)**

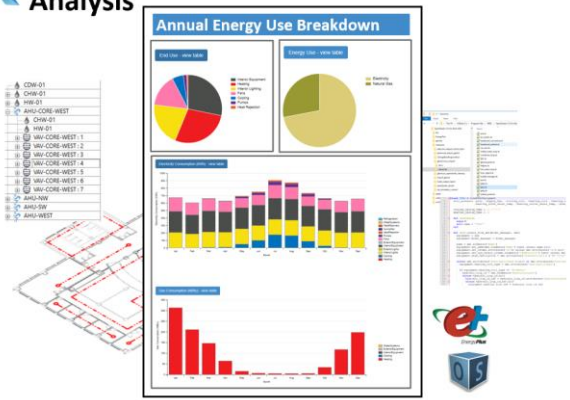
Autodesk
Insight

Systems Analysis



Autodesk Insight

Systems Analysis

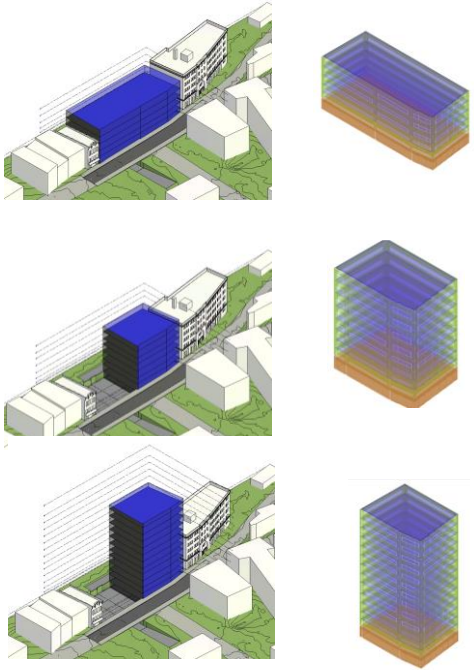


‘Next Gen’ Autodesk Insight

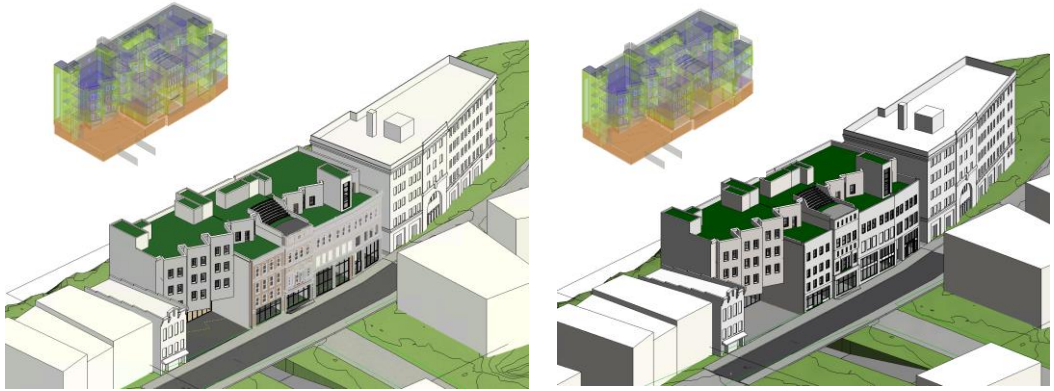
- Total Carbon
  - Operational Energy/Carbon
  - Embodied Carbon
- Open & Extensible Benchmarks, Factors & Ranges (Targeting, Tradeoff, Tracking)
- New Tech Stack (EnergyPlus, OpenStudio, EC3, Built w/ Forge)

Next Gen Insight Embodied Carbon (Beta)

1) **Mass Form Analysis:** Exterior Wall Impacts



2) **Façade Analysis:** New Construction vs Keep Existing Facade



AUTODESK INSIGHT

INSIGHTS SUPPORT ABOUT CORINA MARINESCU

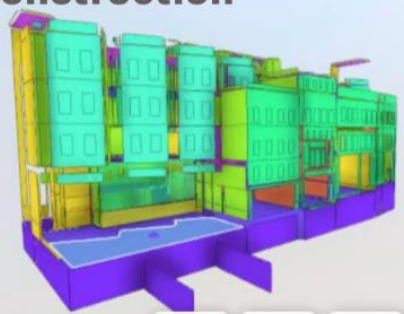
DEMO

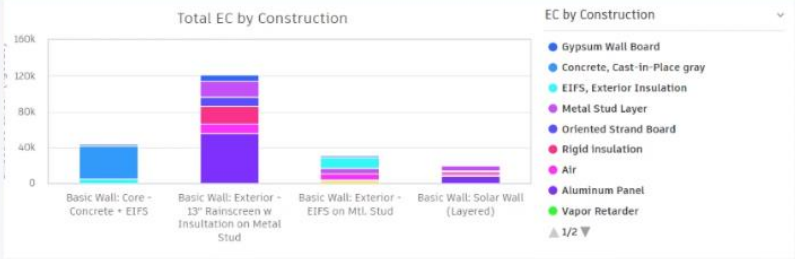
Architecture Model_Build New

Architecture Model_Existing facade

Settings

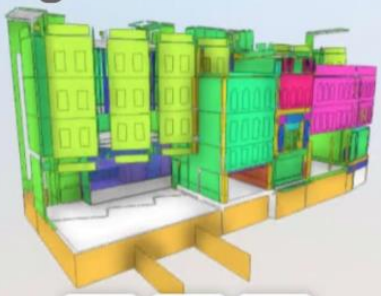
New Construction





	Total Thickness (mm)	Area (m^2)	EC ($kgCO_2e$)	EC Intensity ($kgCO_2e/m^2$)
	254	428.37	43560.14	101.69
	330.2	1598.57	121381.49	75.93
	311.15	519.19	30829.41	59.38
	609.8	233.88	20421.88	87.32
		2780.02	216192.93	

Keep existing facade



-10%

EC Definition	EC Coefficient (A1-A3)	Area(m^2)	Volume(m^3)	Mass(kg)	EC ($kgCO_2e$)

What's Next?

Next Gen
Autodesk
Insight

Technology Preview

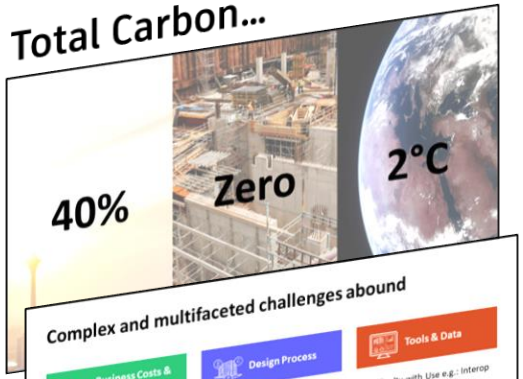
Coming Soon!

How to Get Involved?

- For information on how to get involved and to provide feedback, contact the Insight development team at:

  insight.support@autodesk.com

Total Carbon…



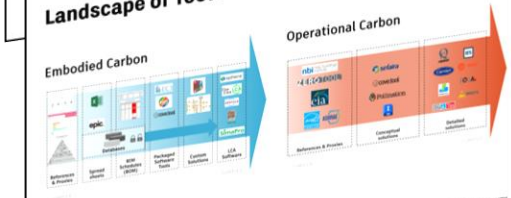
Complex and multifaceted challenges abound

Business Costs & Risks
- Outside Normal Scope & Fee Structure
- Time/Cost Adopting and Using New Tools
- Increased Risk due to Incorrect Use

Design Process
- Continuity Across Stages and Levels of Detail
- Meeting Different Stakeholder Needs
- Integrated / Cross Discipline Impacts

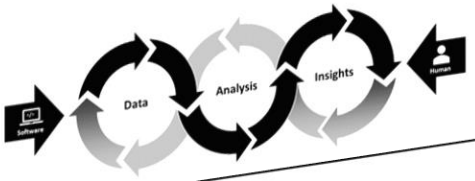
Tools & Data
- Difficulty with Use e.g.: Interop w/ BIM
- Control Over Inputs, Algorithms & Outputs
- Capturing & Re-Use of Best Practices

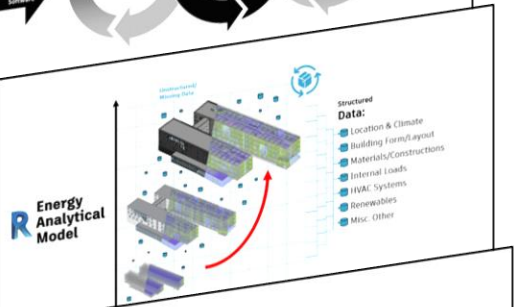
Landscape of Tools

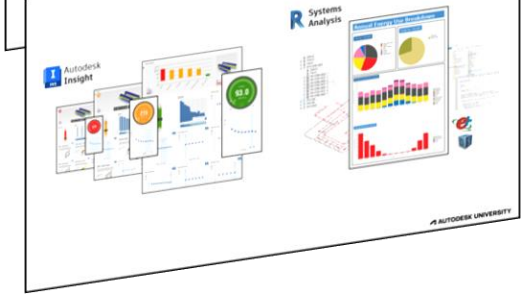


AUTODESK UNIVERSITY

Data, Analysis & Insights…

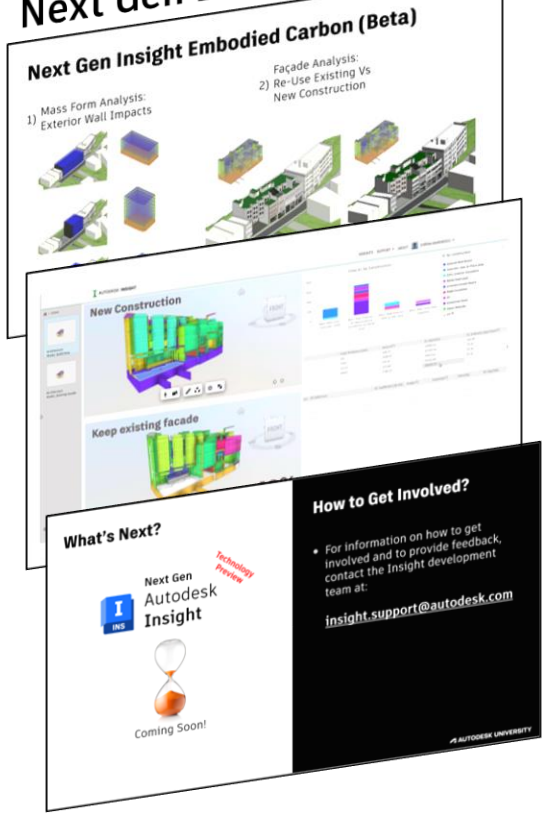






AUTODESK UNIVERSITY

Next Gen Insight Demo



AUTODESK UNIVERSITY