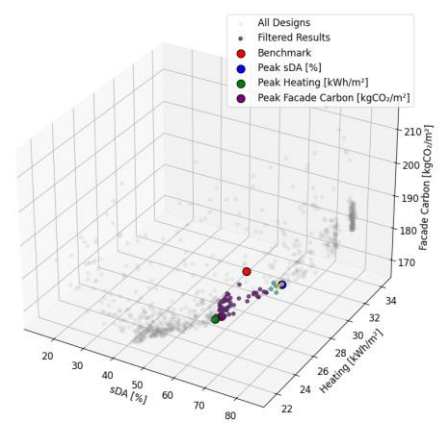
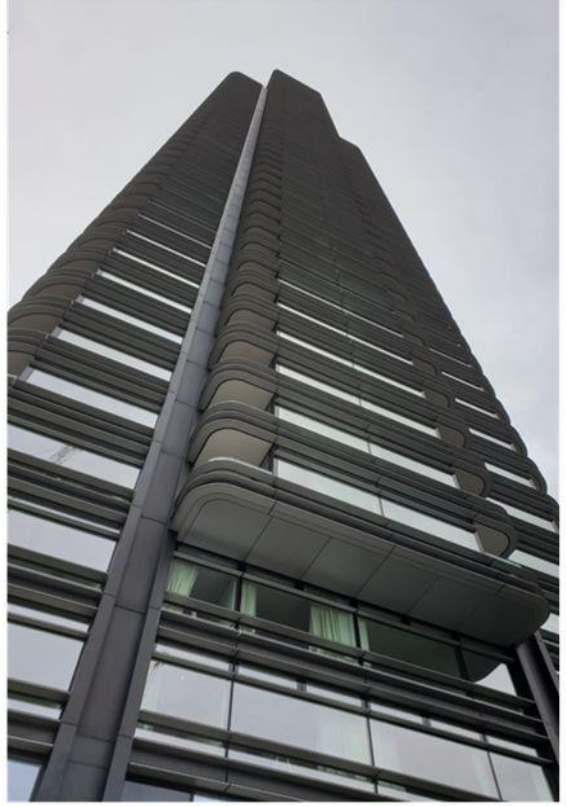
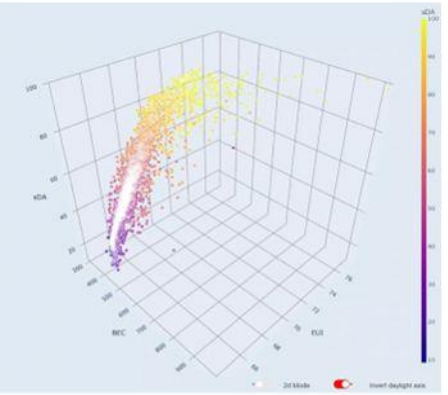
HUMAN-CENTRED
EVIDENCE-BASED

AUGMENTED
INTELLIGENCE

Diego Padilla-Philipps
Director, WSP

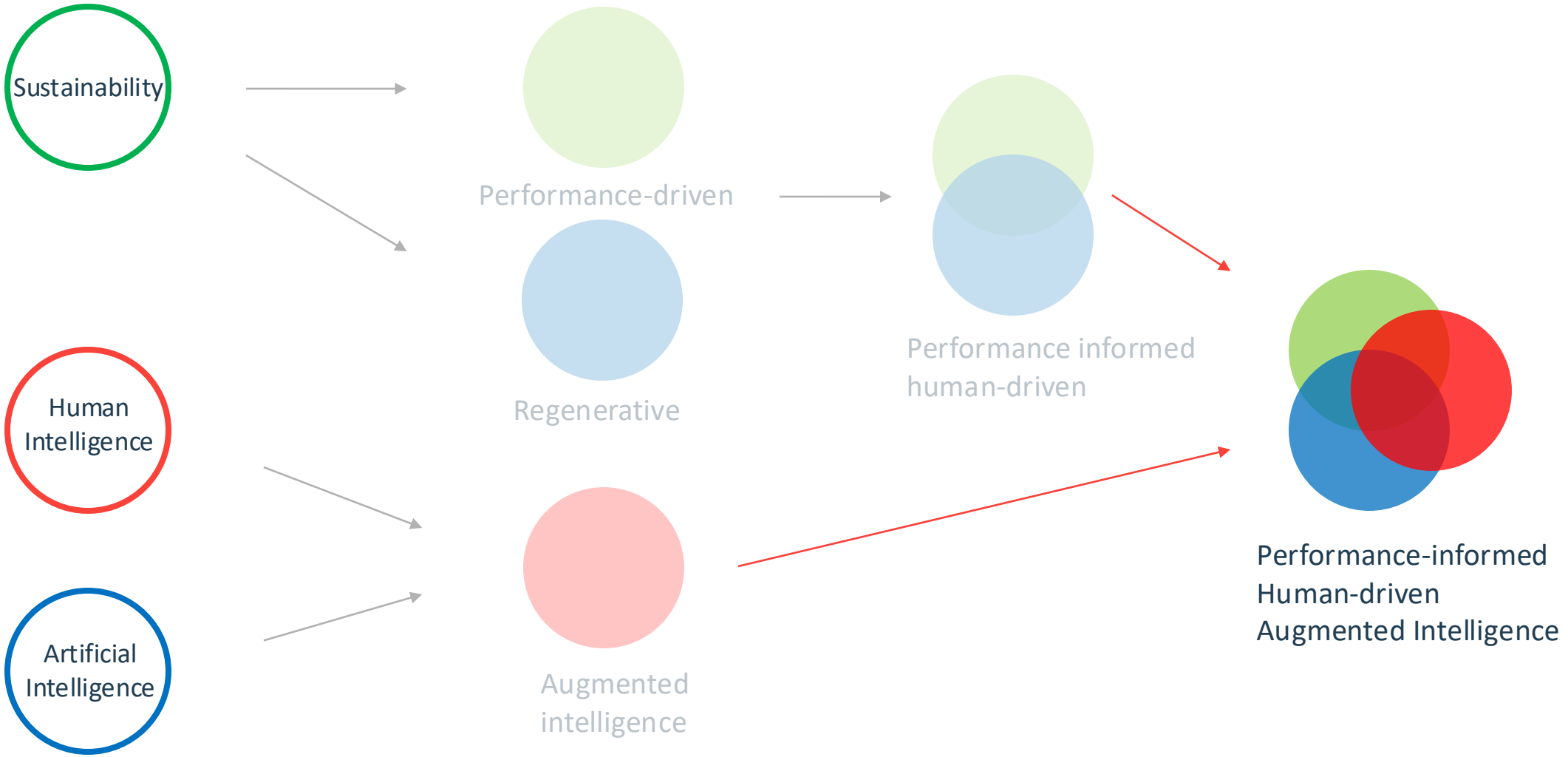

All Designs
Filtered Results
Benchmark
Peak sDA [%]
Peak Heating [kWh/m²]
Peak Facade Carbon [kgCO₂/m²]
sDA [%]
Heating [kWh/m²]
Facade Carbon [kgCO₂/m²]



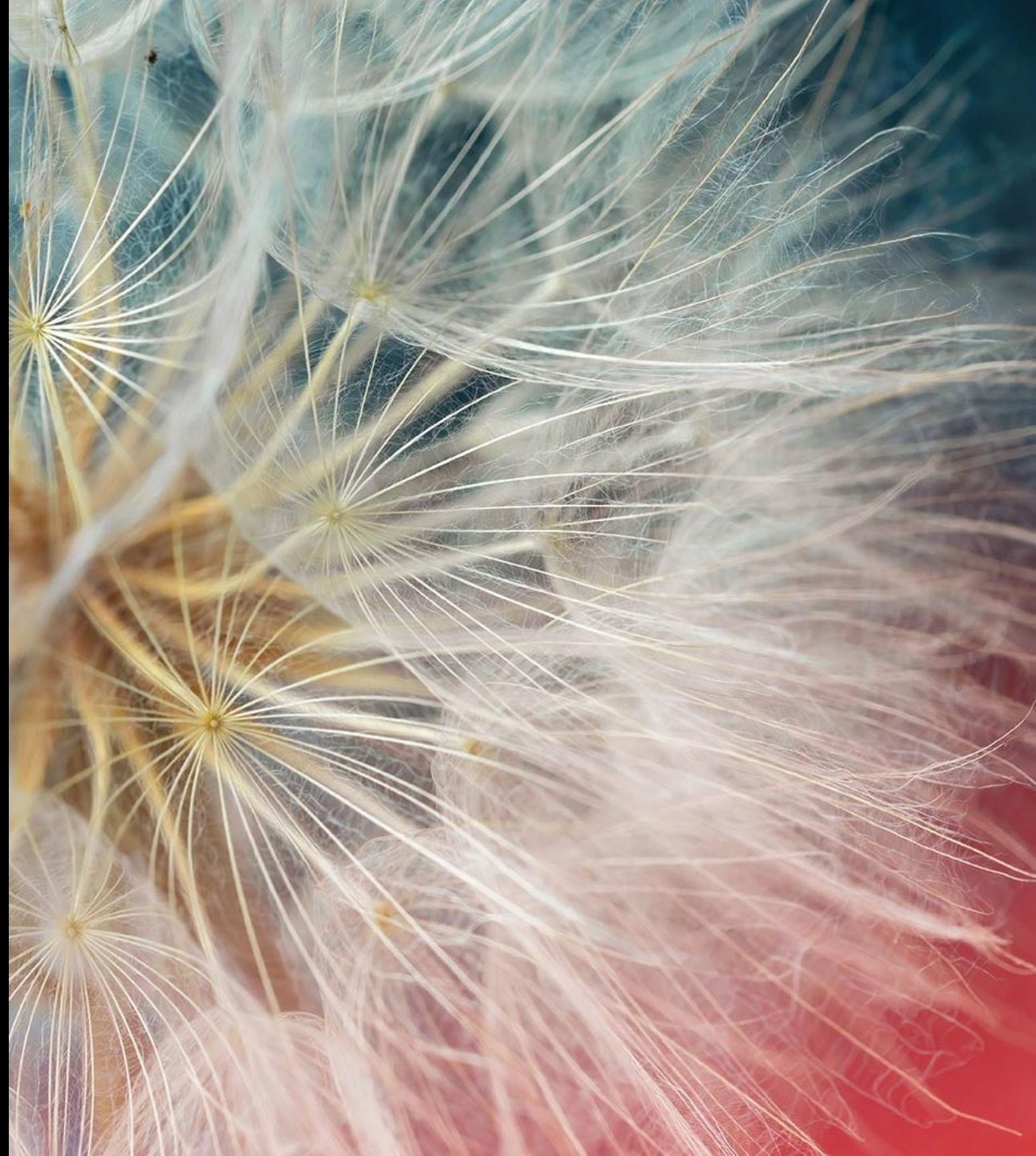


HUMAN-CENTRED
EVIDENCE-BASED

AUGMENTED
INTELLIGENCE

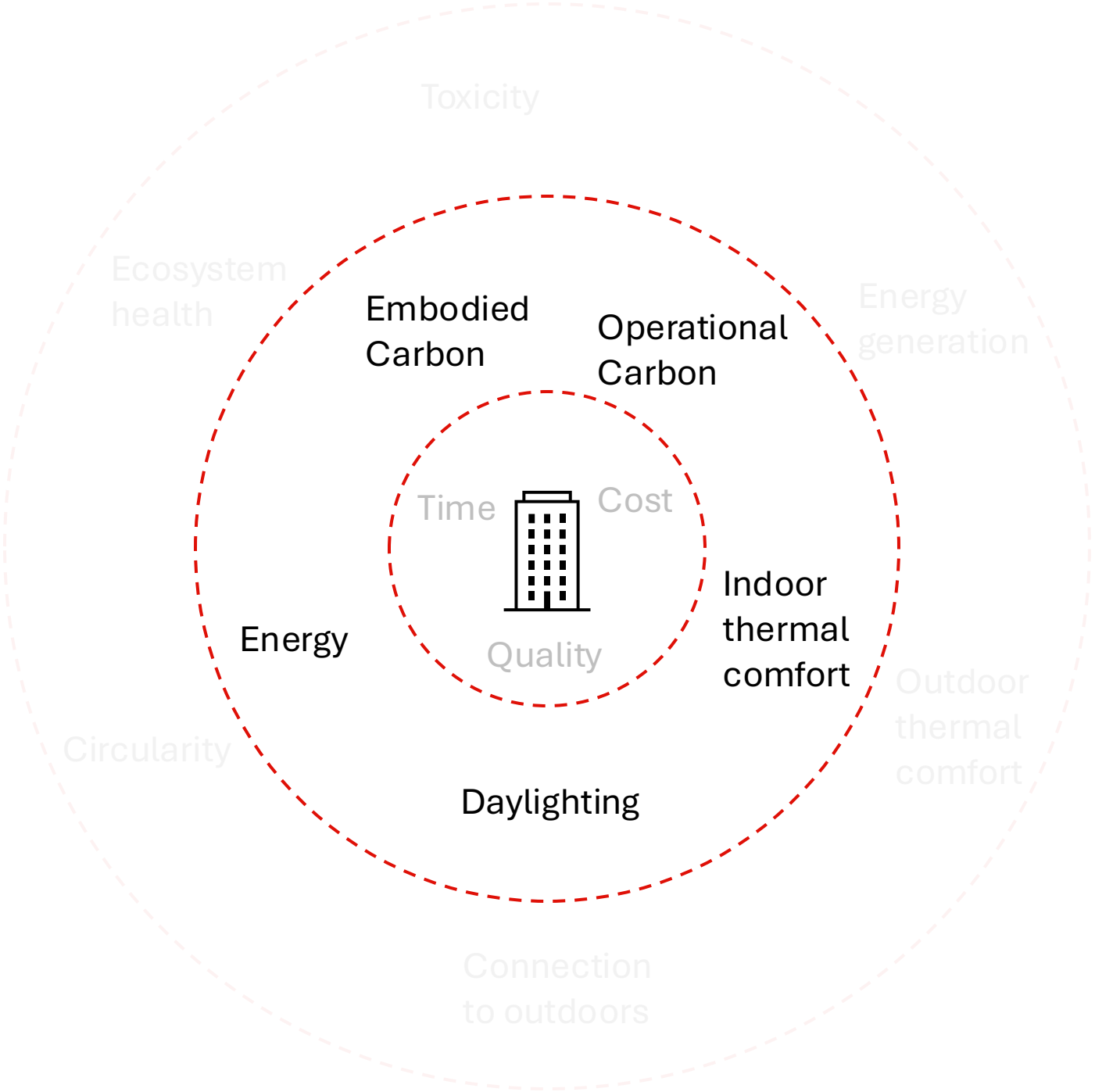

Sustainability
Human Intelligence
Artificial Intelligence
Performance-driven
Regenerative
Augmented intelligence
Performance informed human-driven
Performance-informed Human-driven Augmented Intelligence

TODAY'S *CONTEXT* DEMANDS BUILDING PERFORMANCE PLAY A KEY ROLE

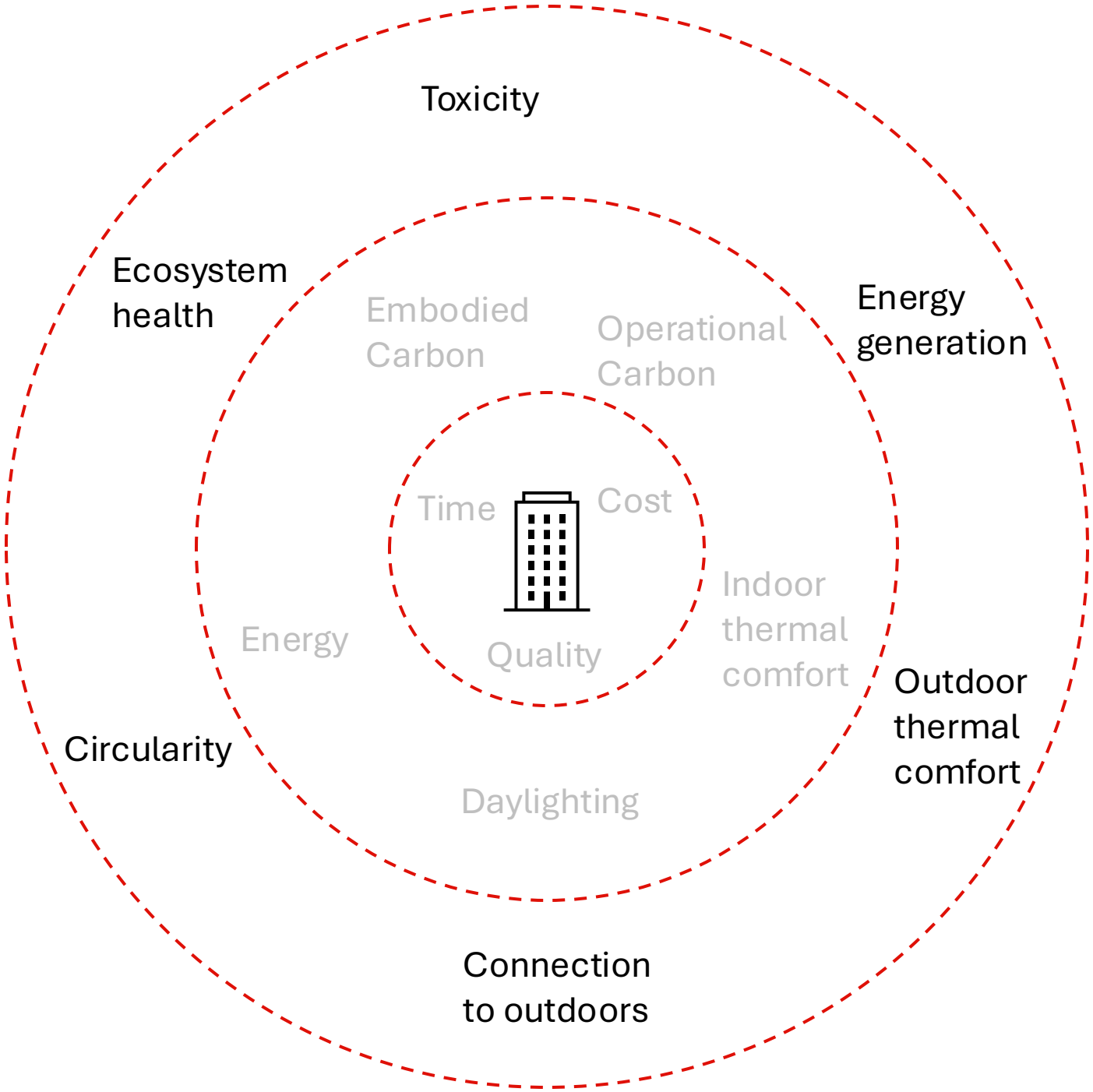


Whole-building performance expands beyond the traditional KPIs...

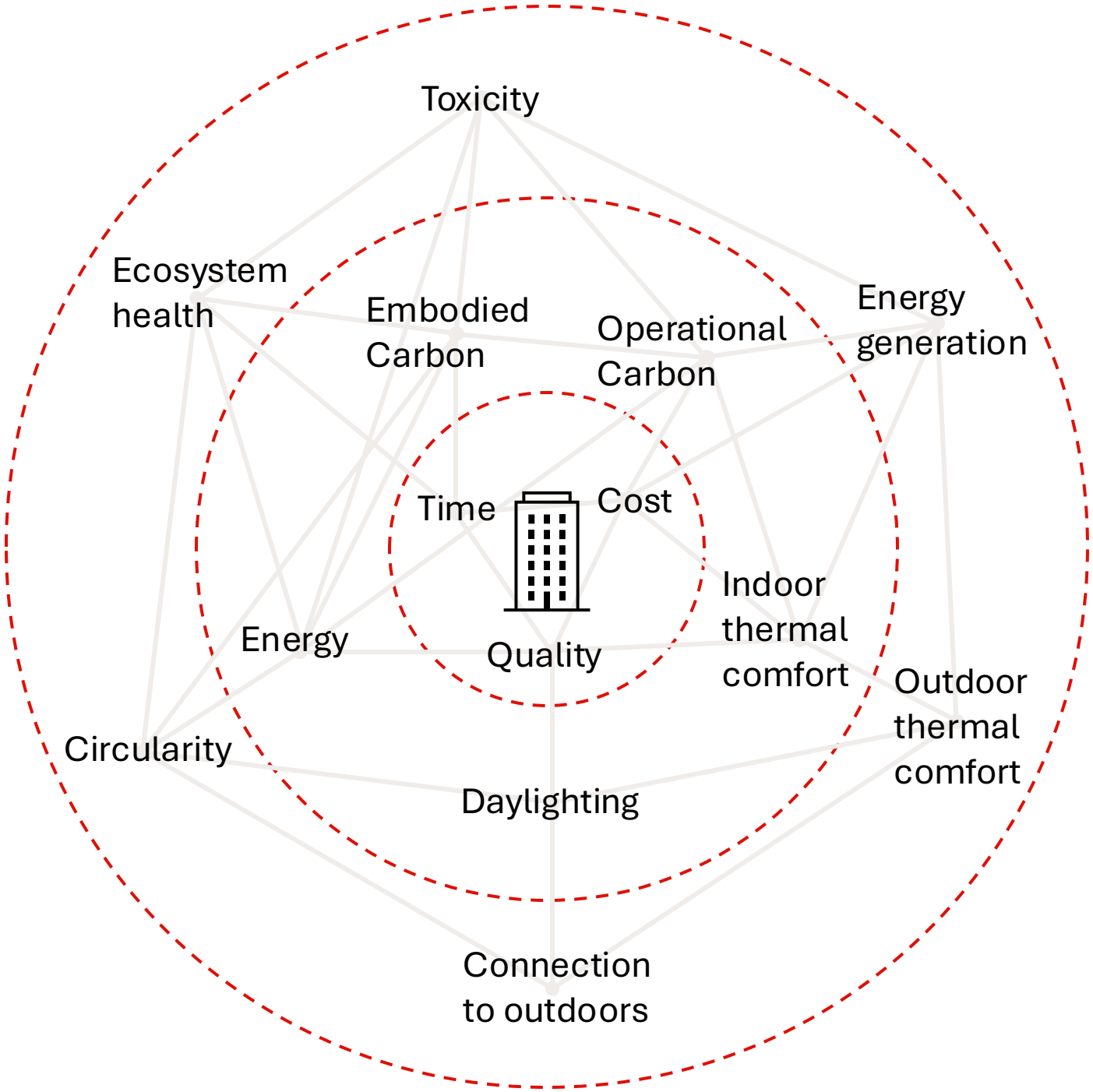
As the list of **performance objectives** continually grows…



And the "**sense of place**" in which a building exists expands...



Including its **interconnectedness** to each performance objective.



THE INTERWOVEN CHALLENGES

DAYLIGHT FACTOR

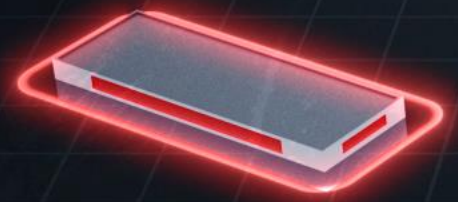
% of Floor Area

OPERATIONAL CARBON

$KgCO_2/m^2$

EMBODIED CARBON

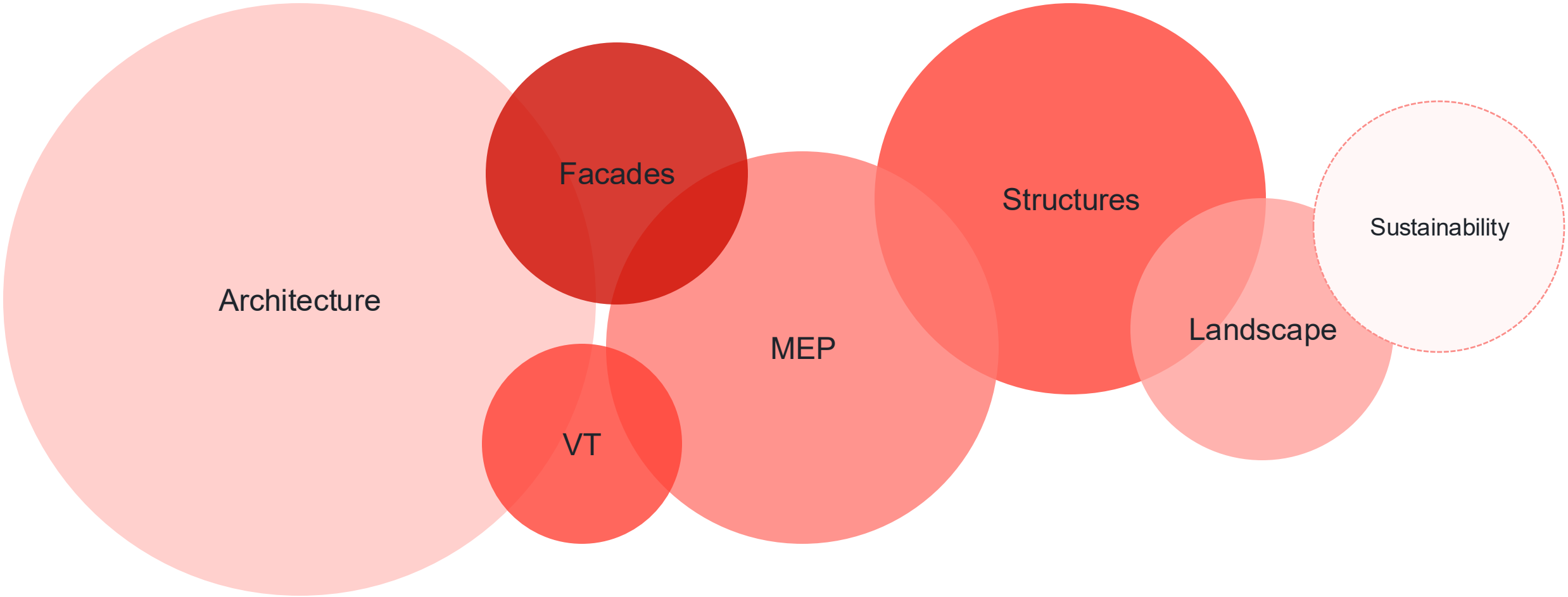
$KgCO_2/m^2$

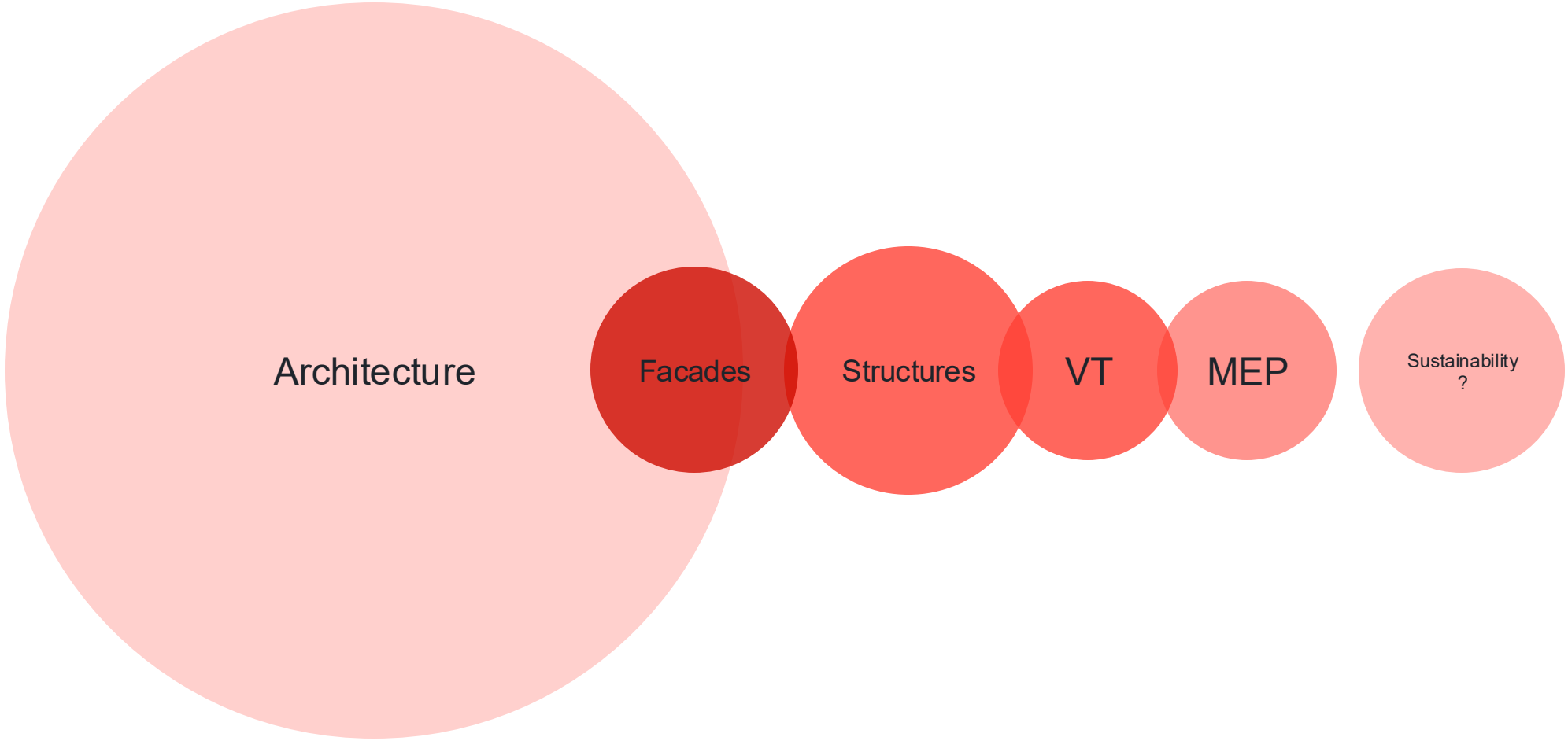


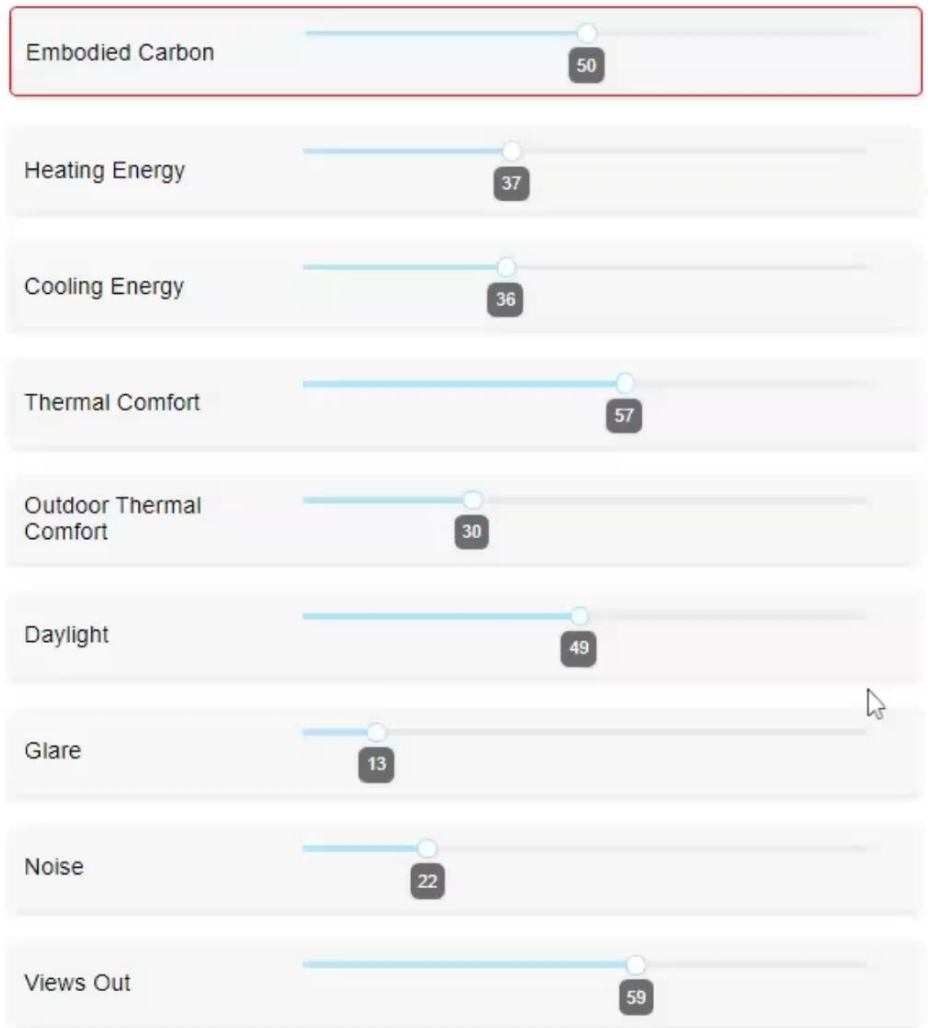
DAYLIGHT FACTOR

OPERATIONAL CARBON

EMBODIED CARBON

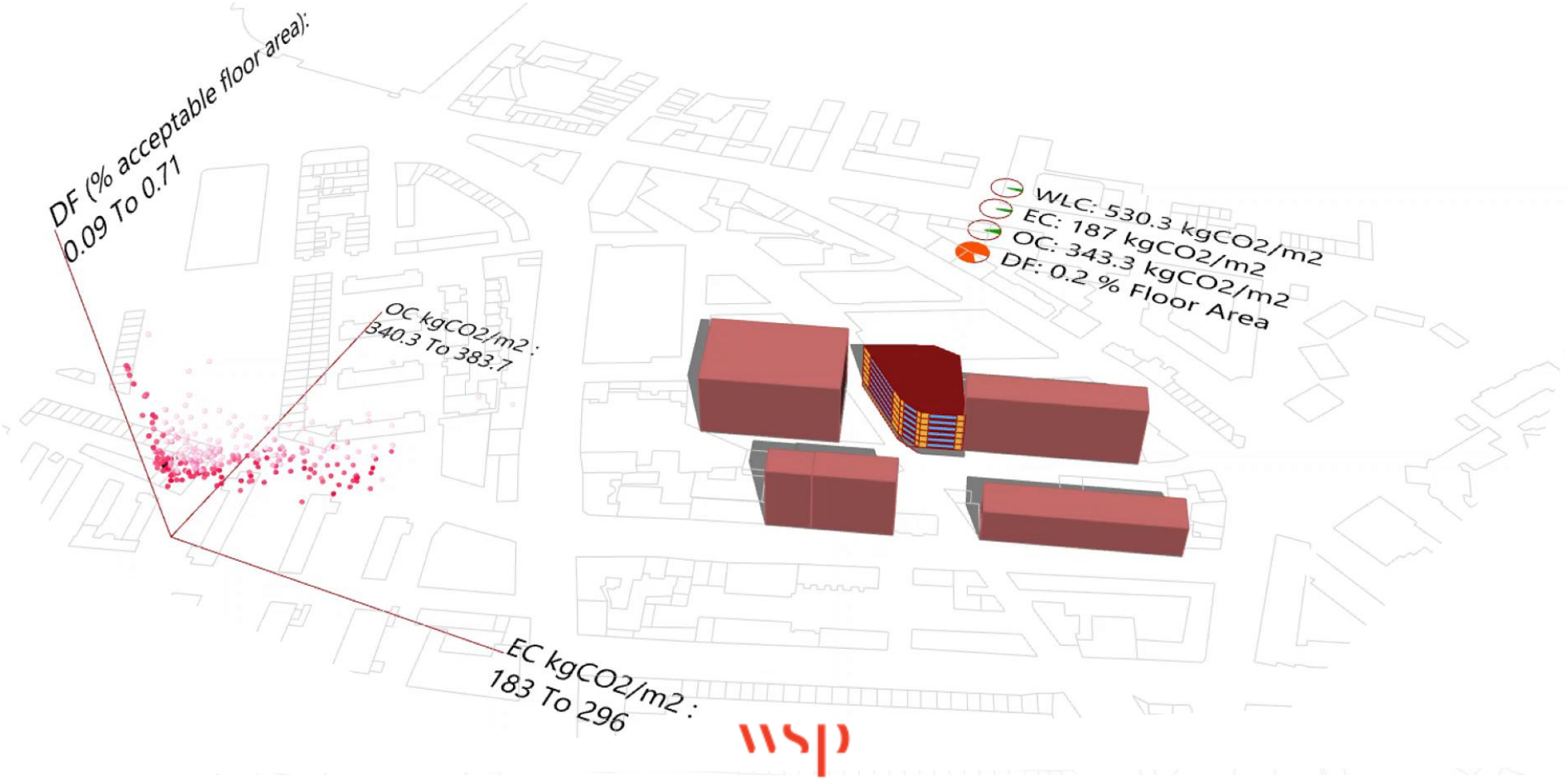

Architecture
Facades
VT
MEP
Structures
Landscape
Sustainability


Architecture
Facades
Structures
VT
MEP
Sustainability
?

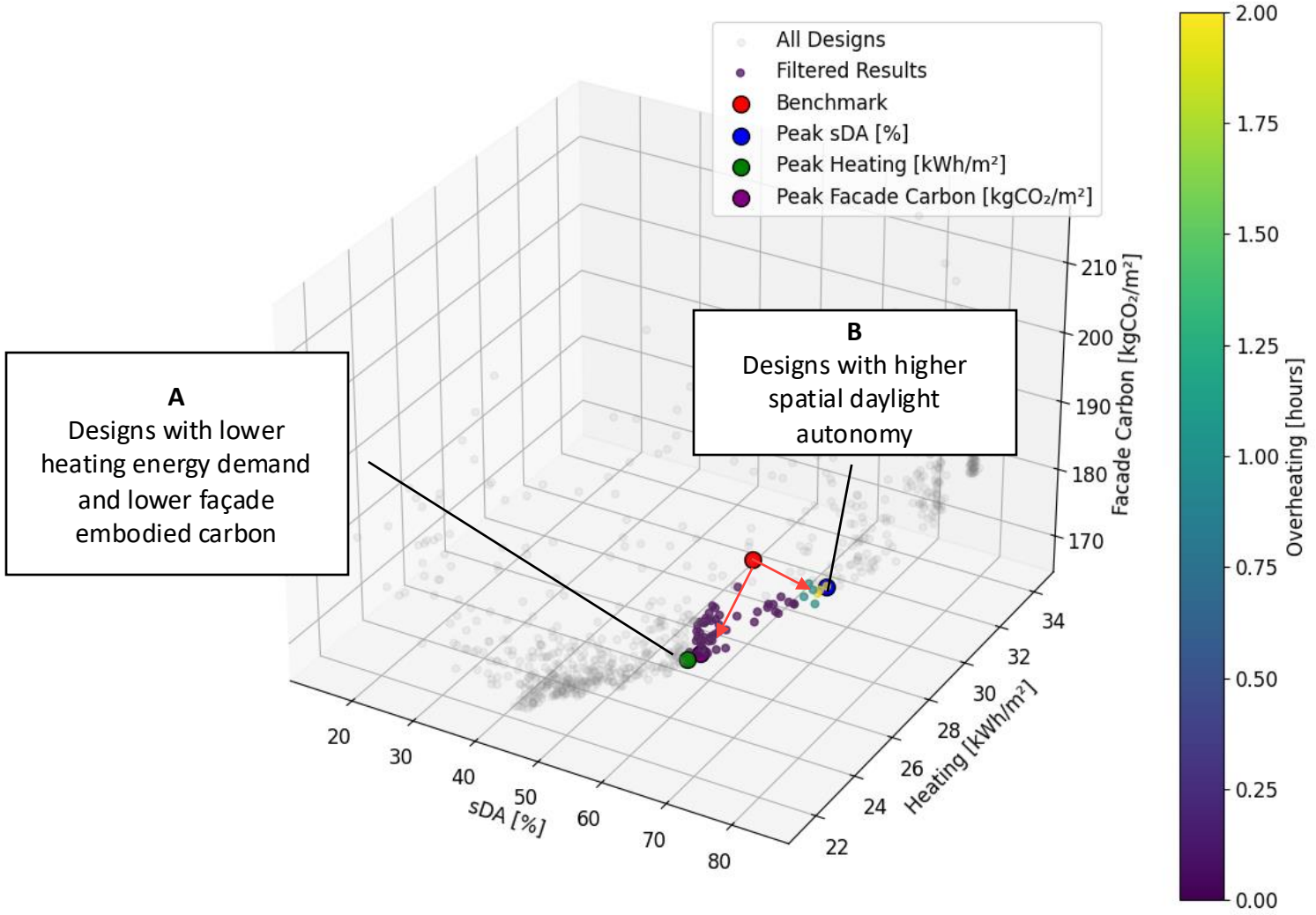

Embodied Carbon
50
Heating Energy
37
Cooling Energy
36
Thermal Comfort
57
Outdoor Thermal Comfort
30
Daylight
49
Glare
13
Noise
22
Views Out
59

The Solution?

Co-Design enables multi-disciplinary optimisation
at the beginning of the project
to identify the solutions that benefit the project holistically.

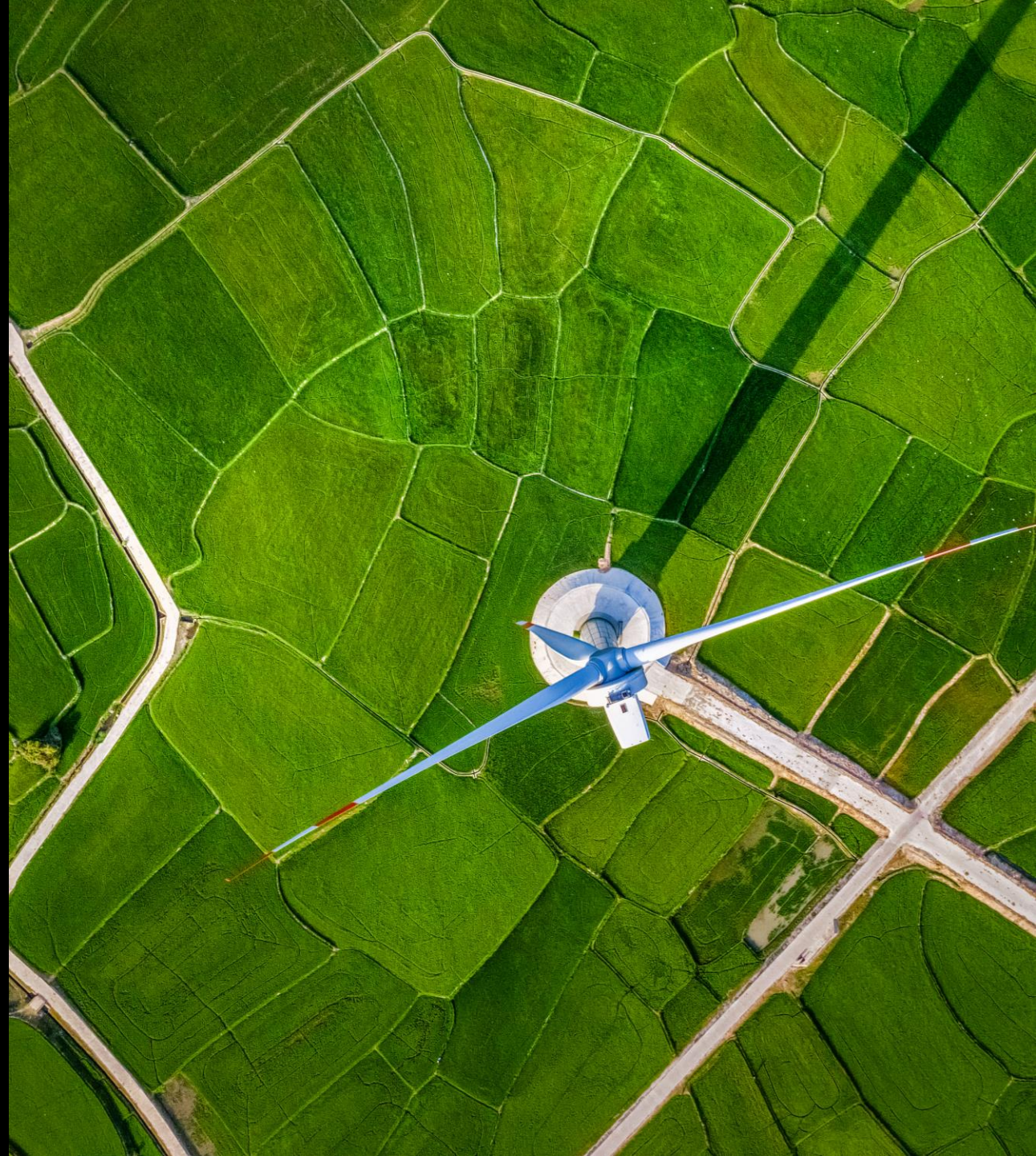


helping us filter and **identify** better designs
Using a powerful computational engine



CO-DESIGN FRAMEWORK:

PERFORMANCE-INFORMED, HUMAN-DRIVEN DESIGN



“**Co-design** is a systems-level, **integrative design approach** that **unites multiple disciplines** to collaboratively address the complexities of **whole-building performance**”

Framework pillars

01

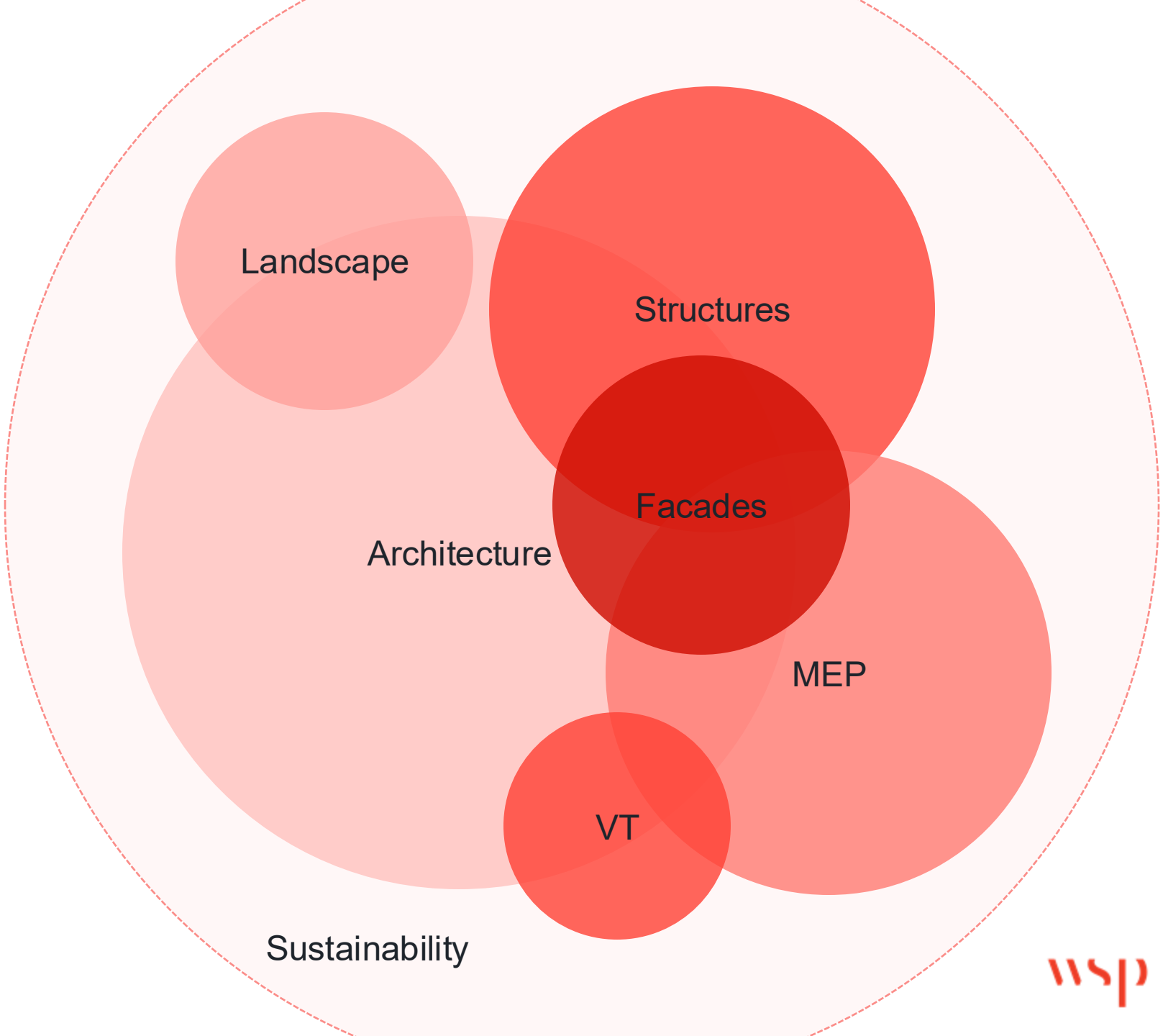
Multi-disciplinary collaboration

02

Early-stage asset simulation

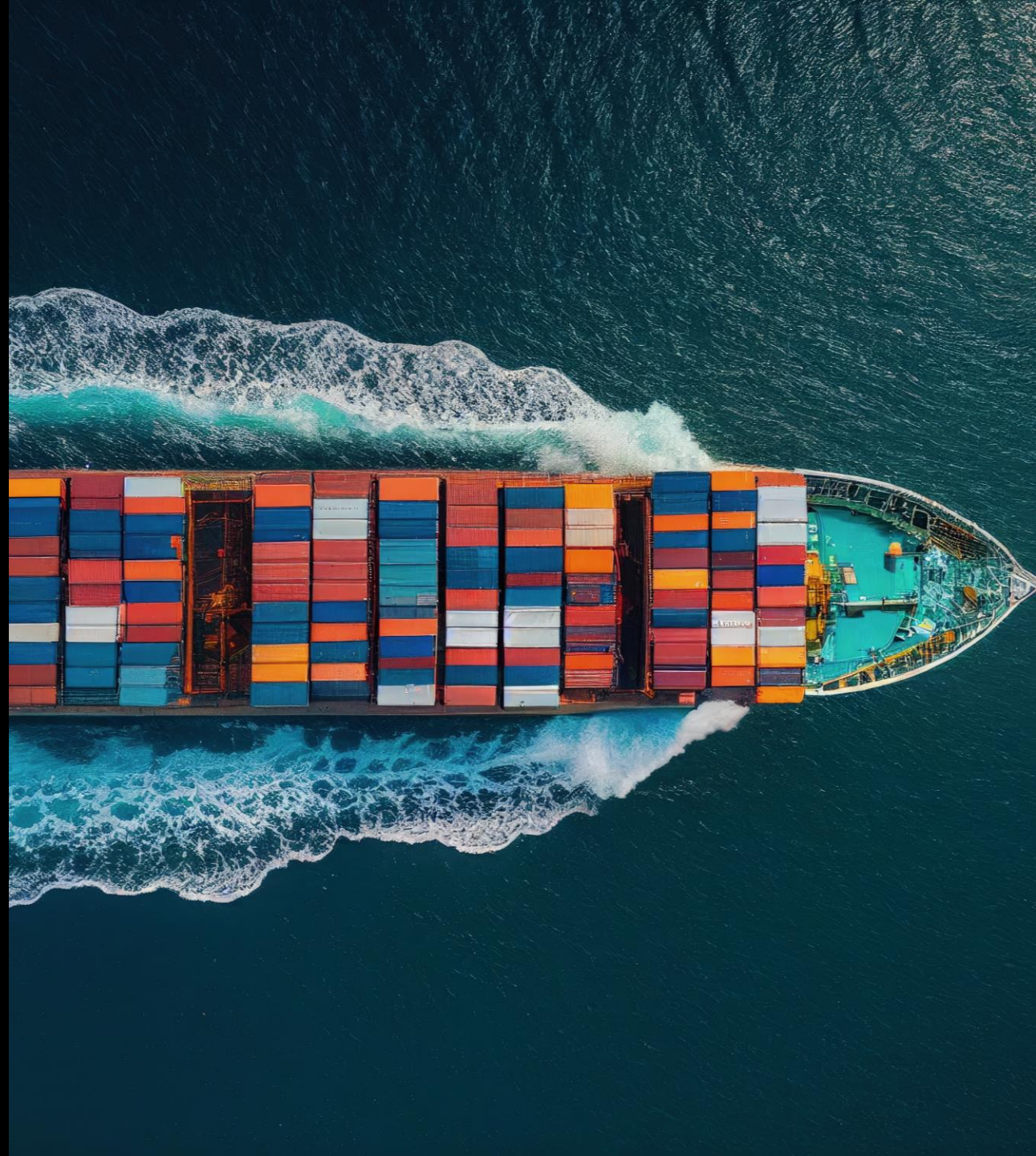
03

Evidence-based decision making


Landscape
Structures
Facades
Architecture
MEP
VT
Sustainability

CO-DESIGN EXAMPLES:

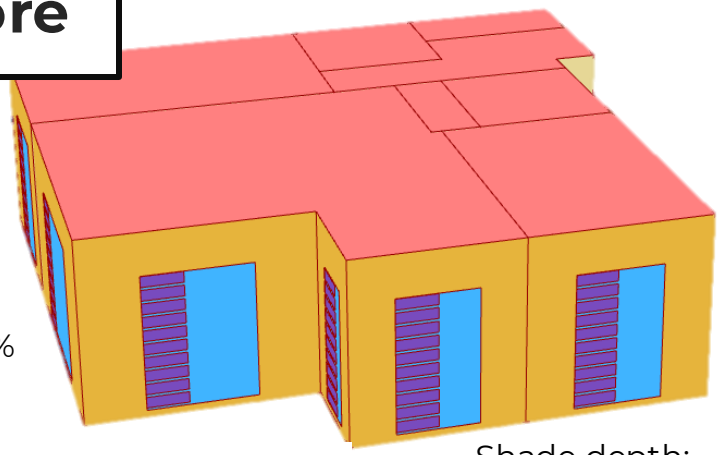
IN PRACTICE



At a single unit level

Small changes led to better performance

Before

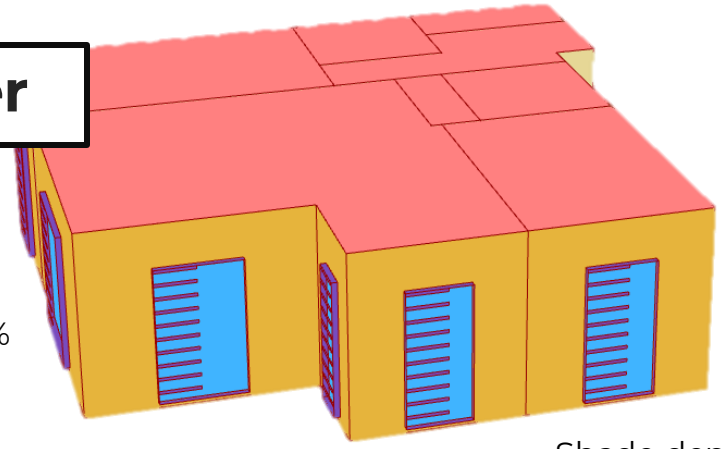


WWR: 0.35 %

Transparency: 0.20 %

Shade depth:
0.0 m

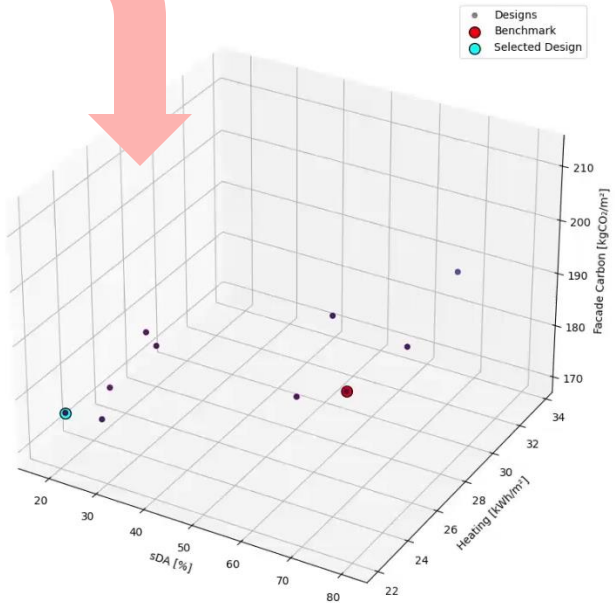
After

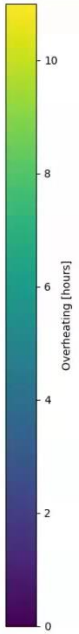


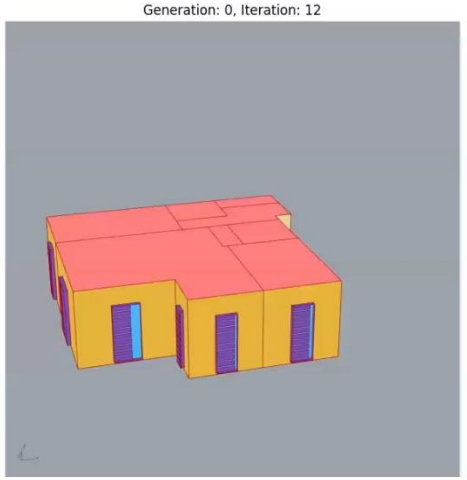
WWR: 0.28 %

Transparency: 0.77 %

Shade depth:
0.09 m

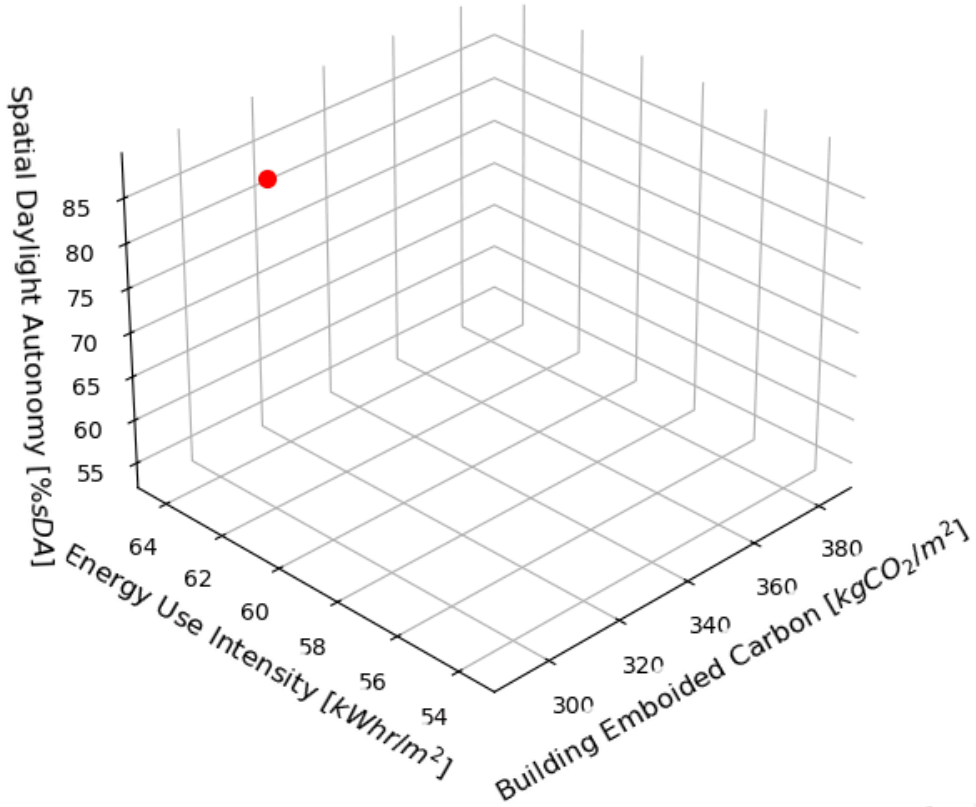


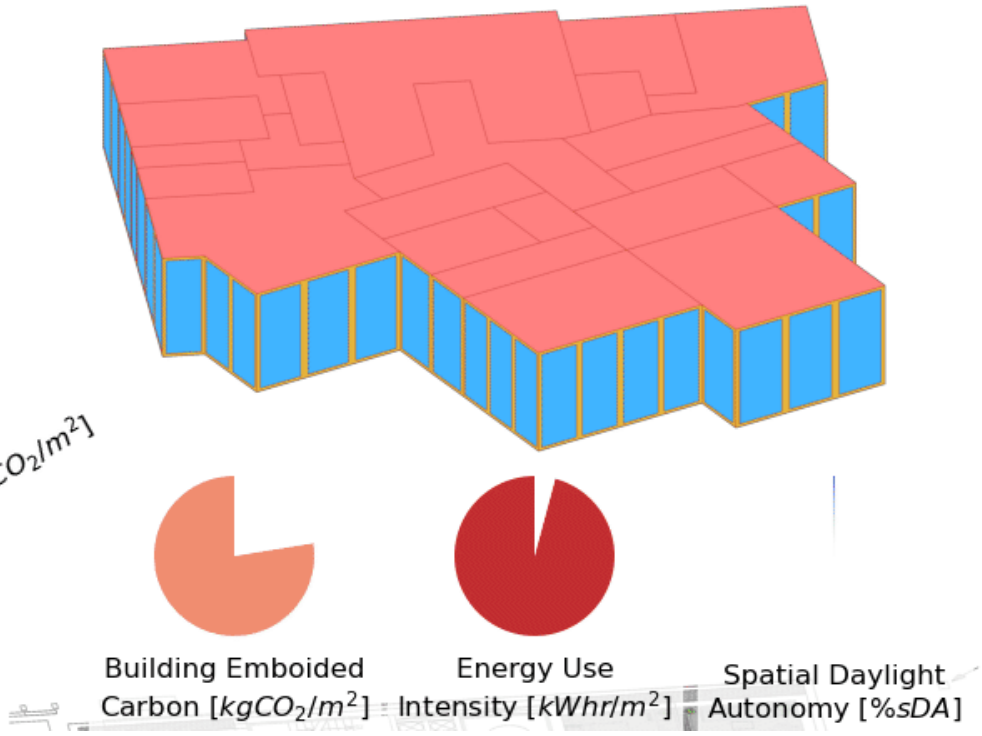




A whole floor

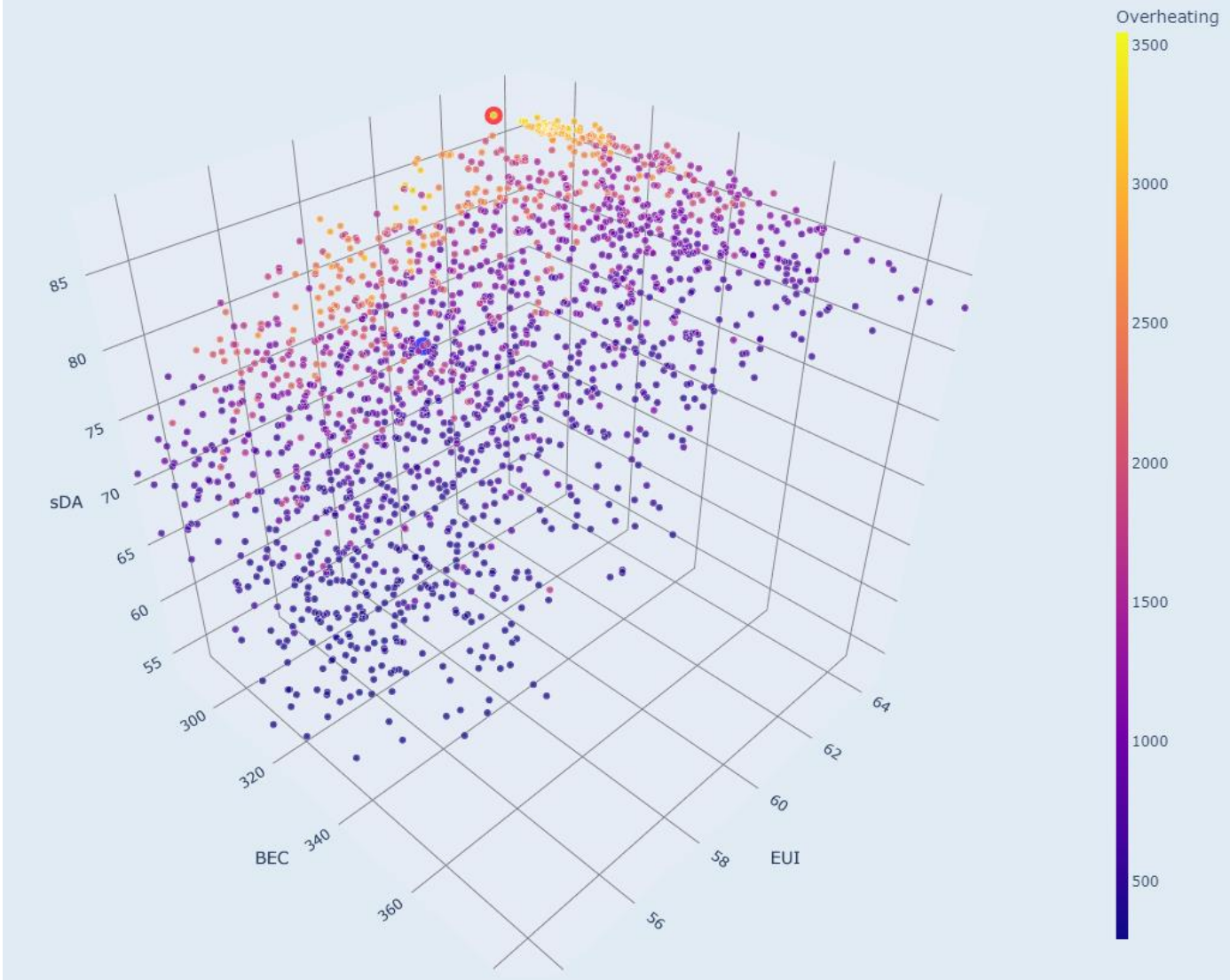
Being able to test thousands of options





Results

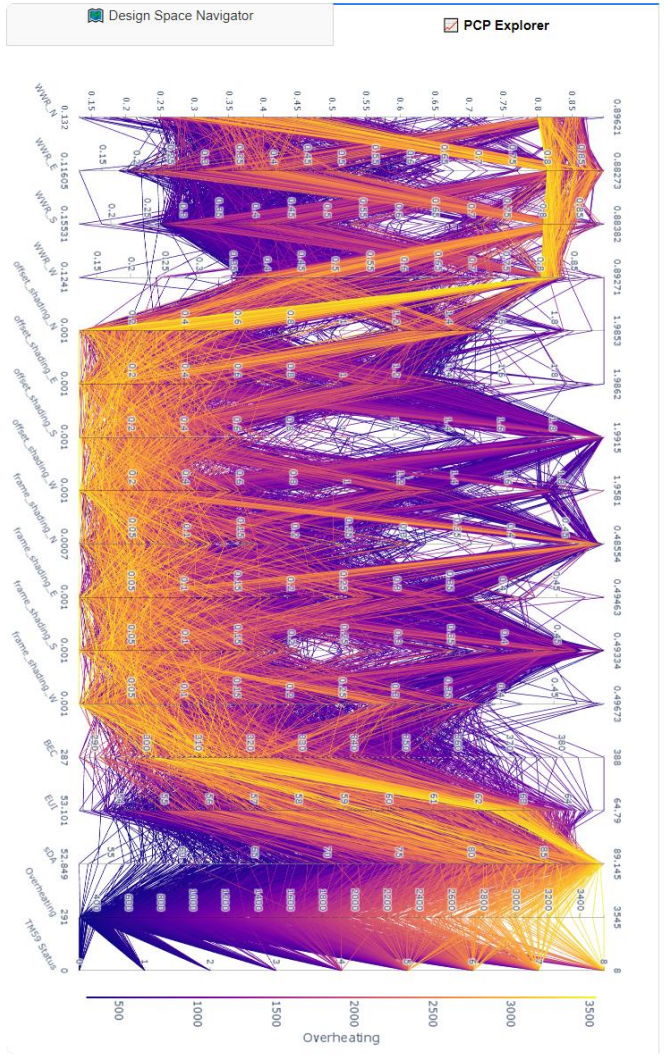
Over 1,750 simulation of embodied carbon, energy use, daylight penetration and overheating ran.

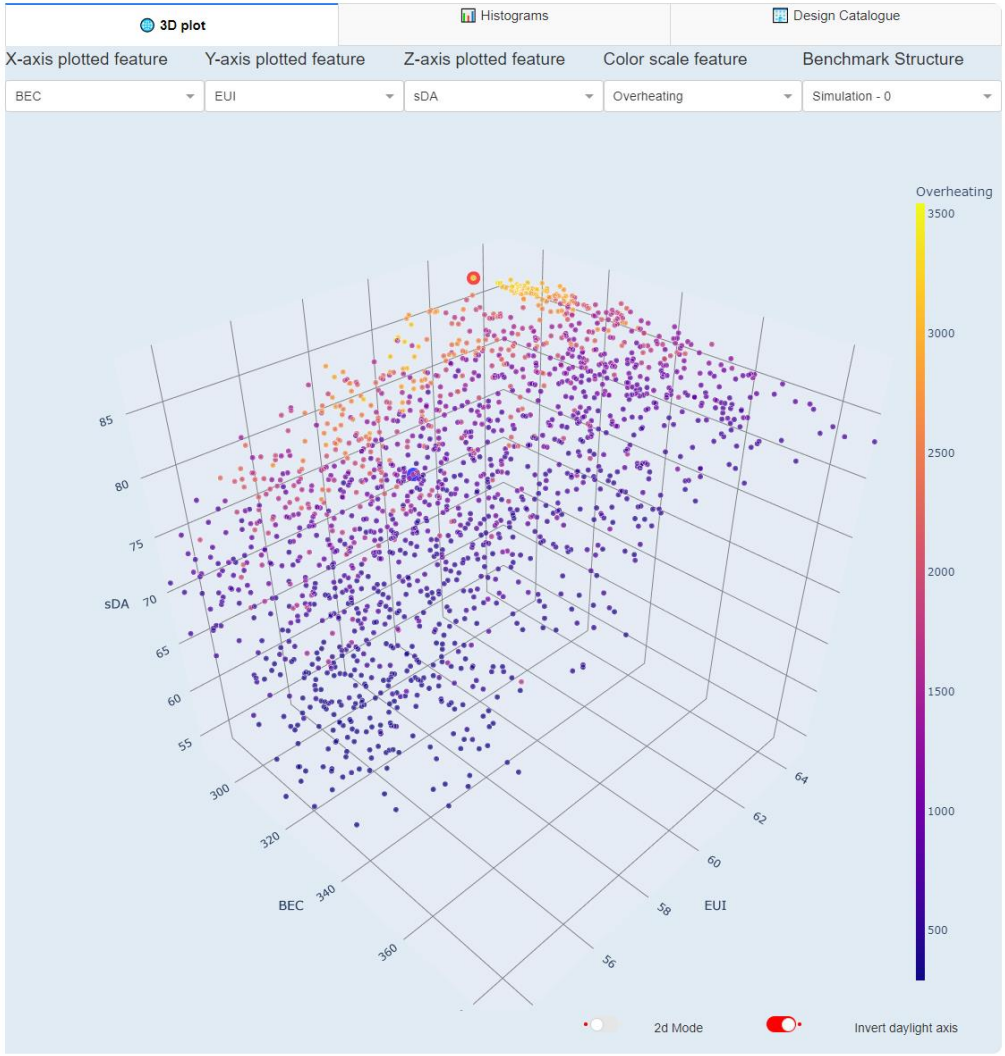


Select BEC performance

Filter to identify designs with:

Embodied Carbon <320kg/CO2/m2





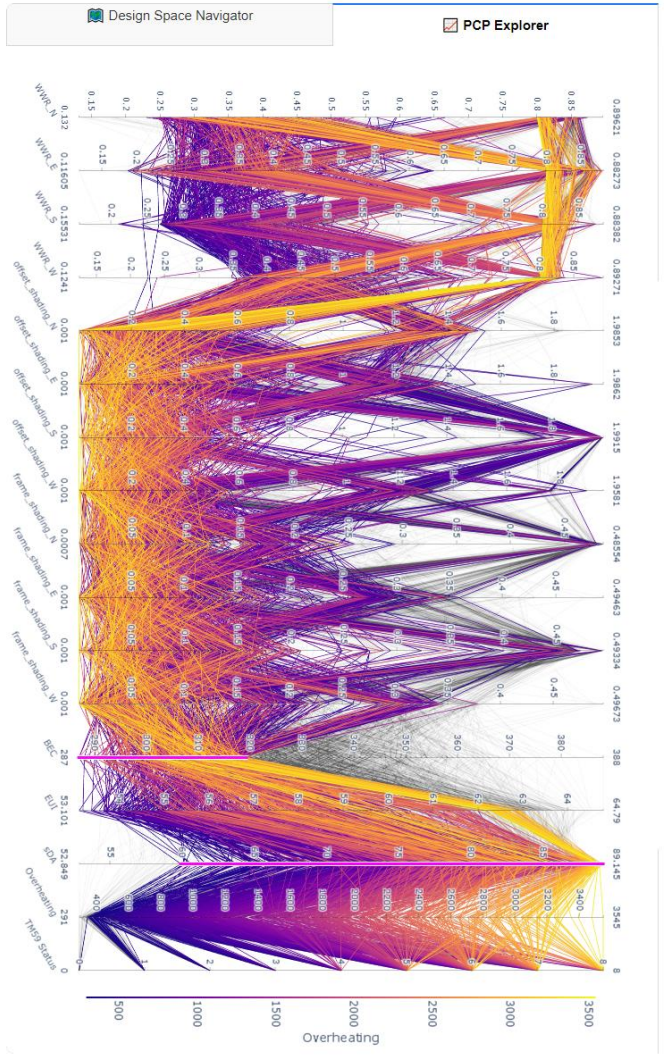
Select sDA performance

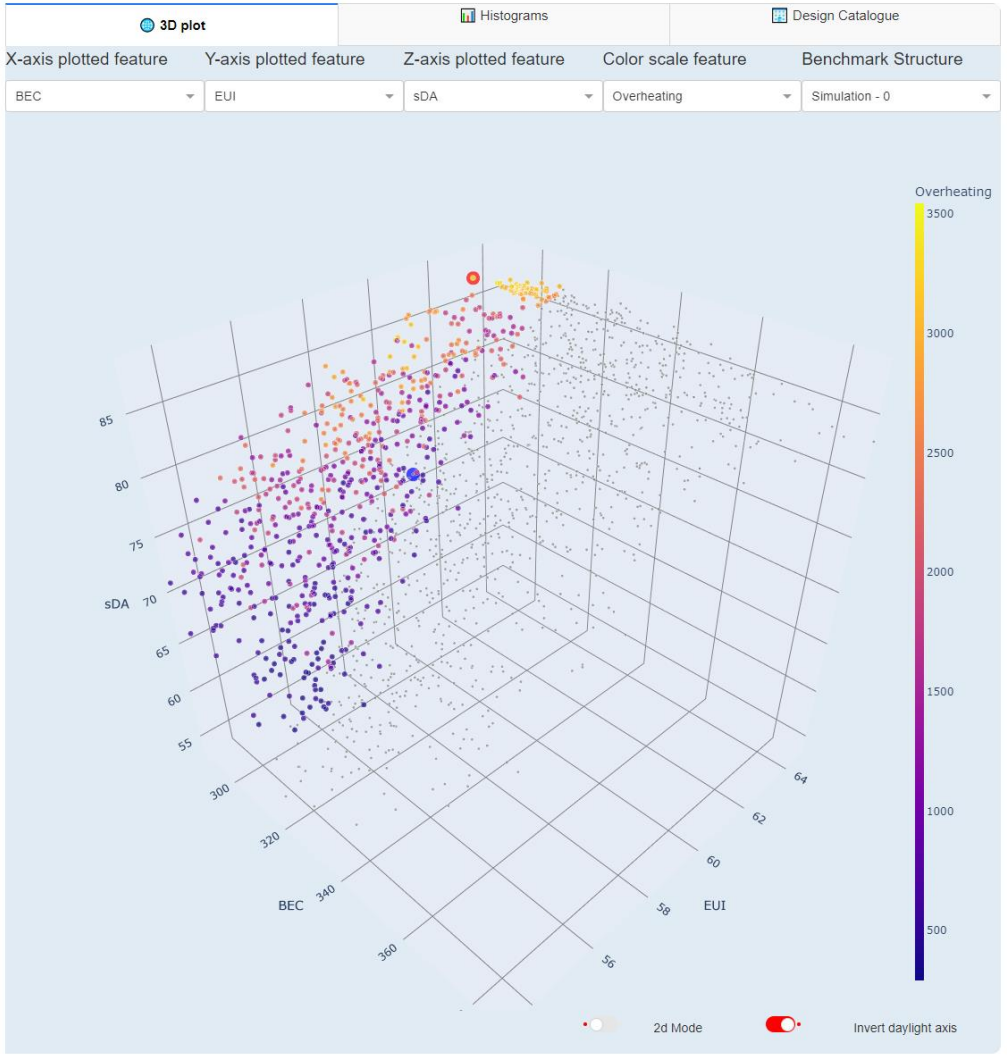
Filter to identify designs with:

Embodied Carbon <320kg/CO2/m2

and

Spatial Daylight >60%





Select EUI performance

Filter to identify designs with:

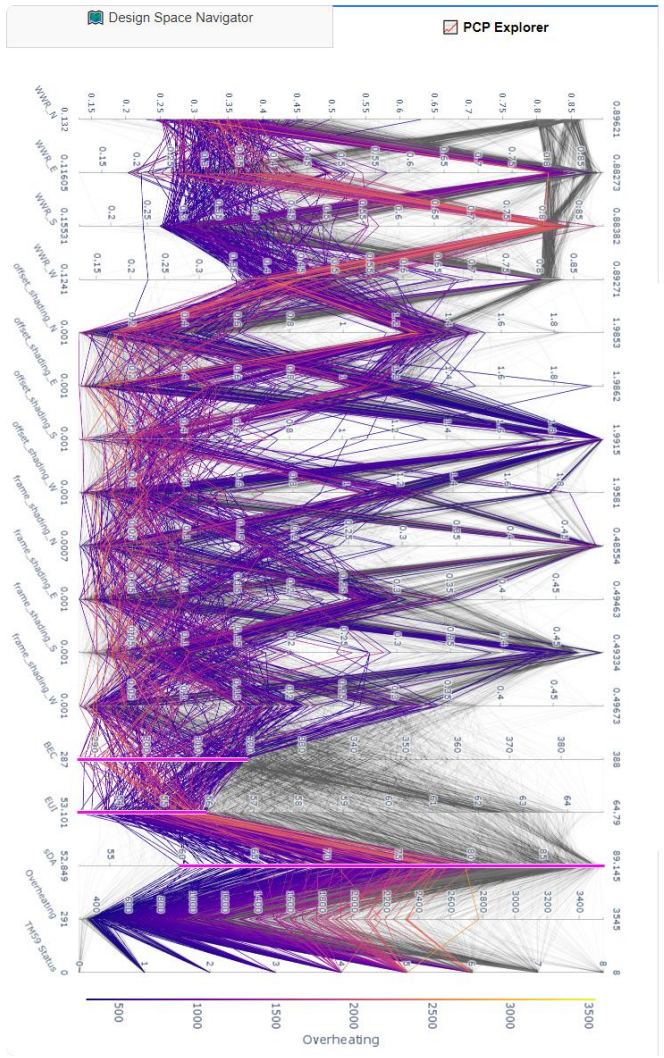
Embodied Carbon <320kg/CO2/m2

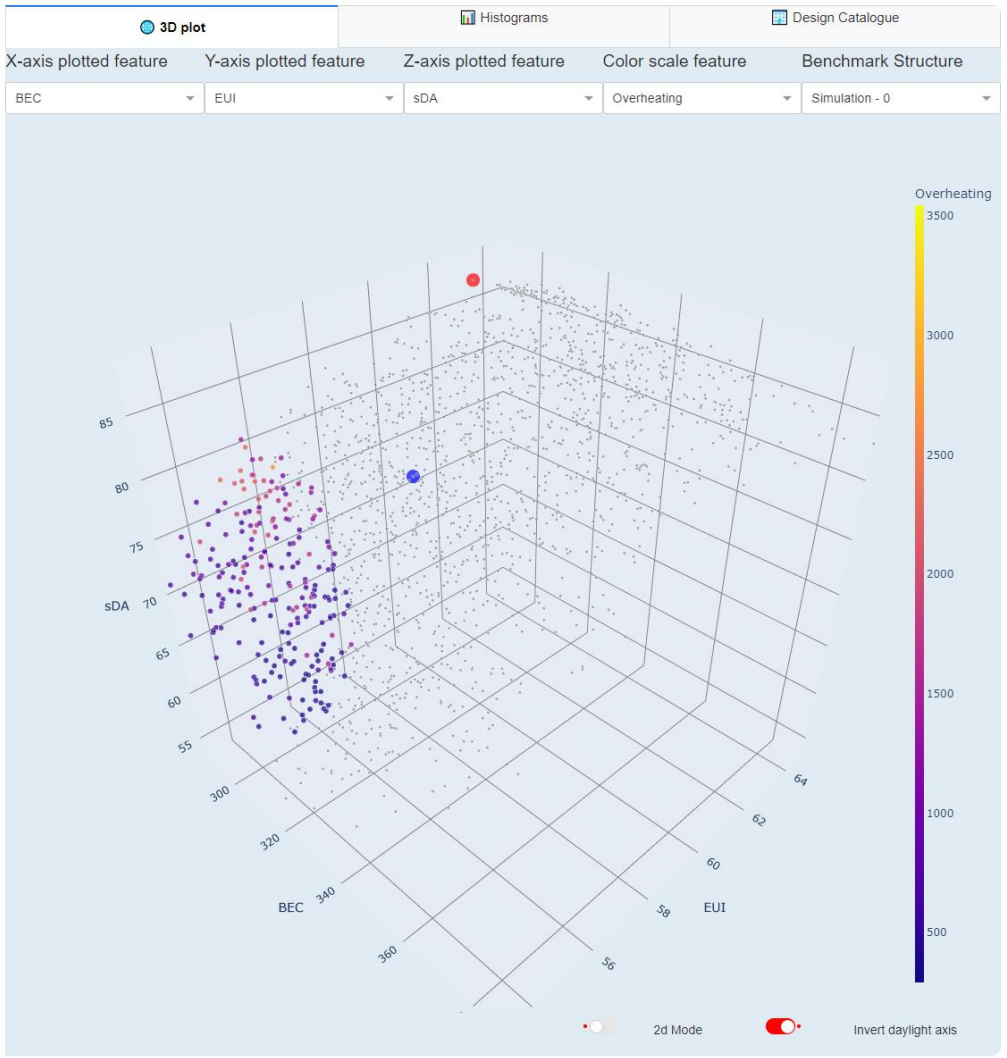
and

Spatial Daylight >60%

and

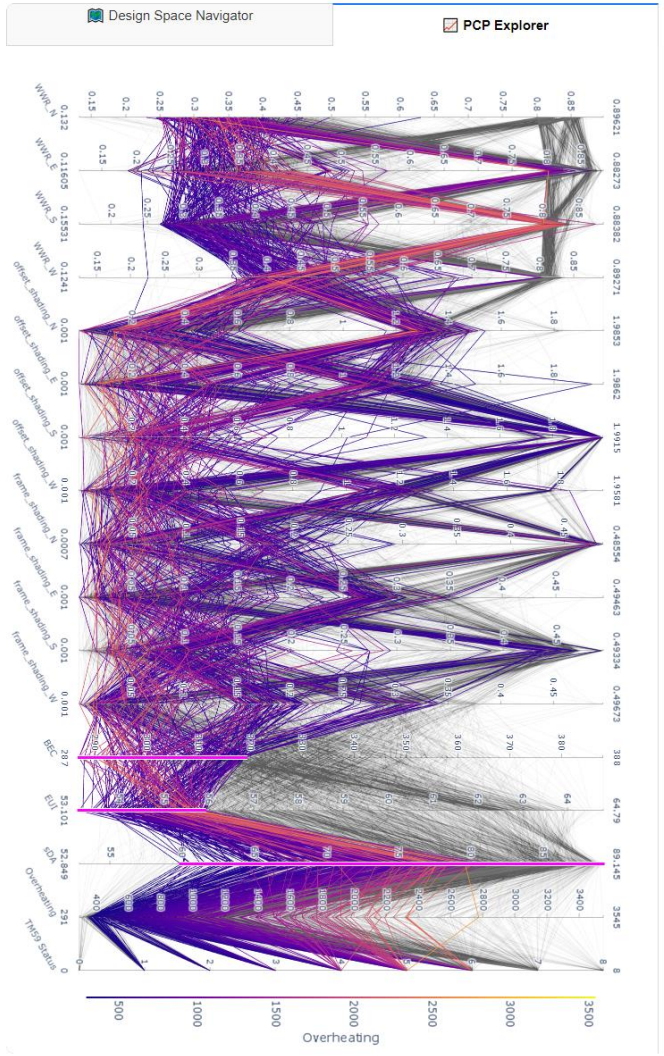
Energy Use Intensity < 56kWhr/m2

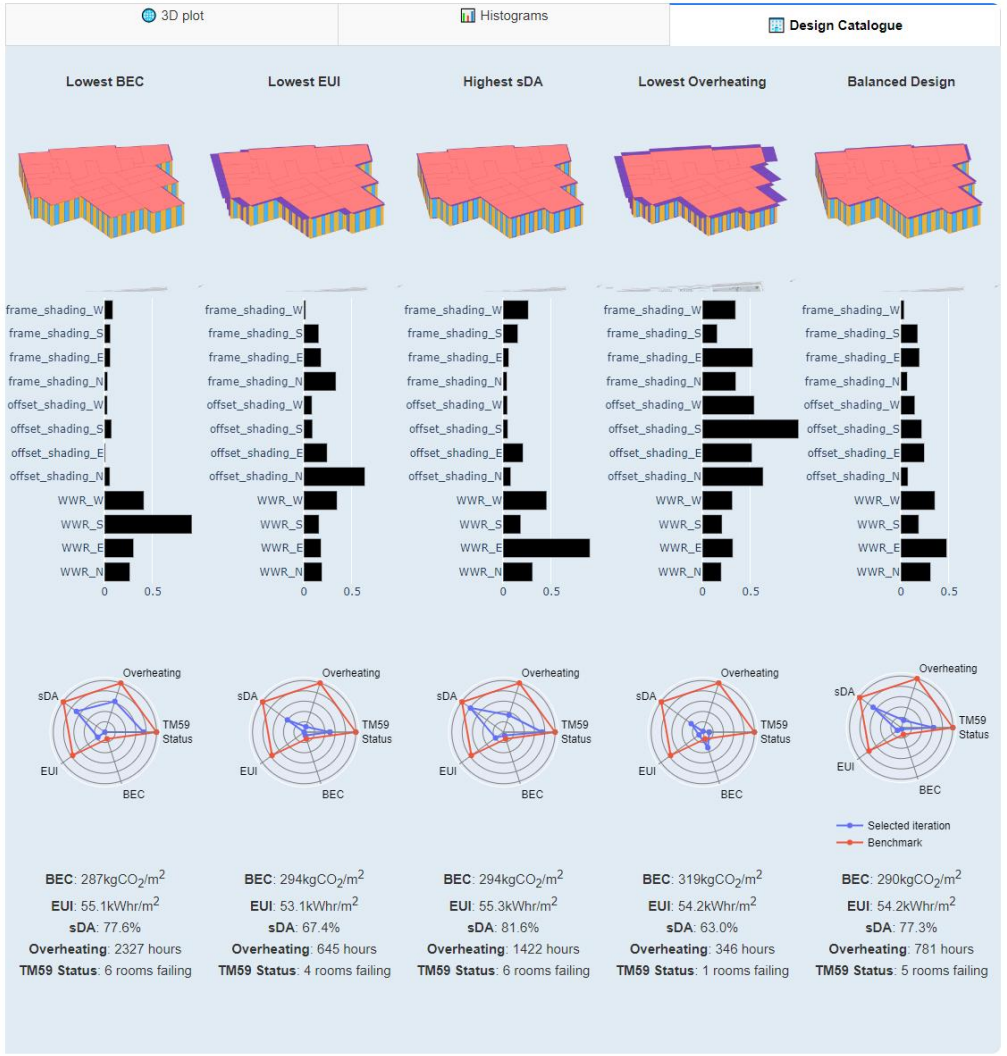




Going deeper – looking at specific designs

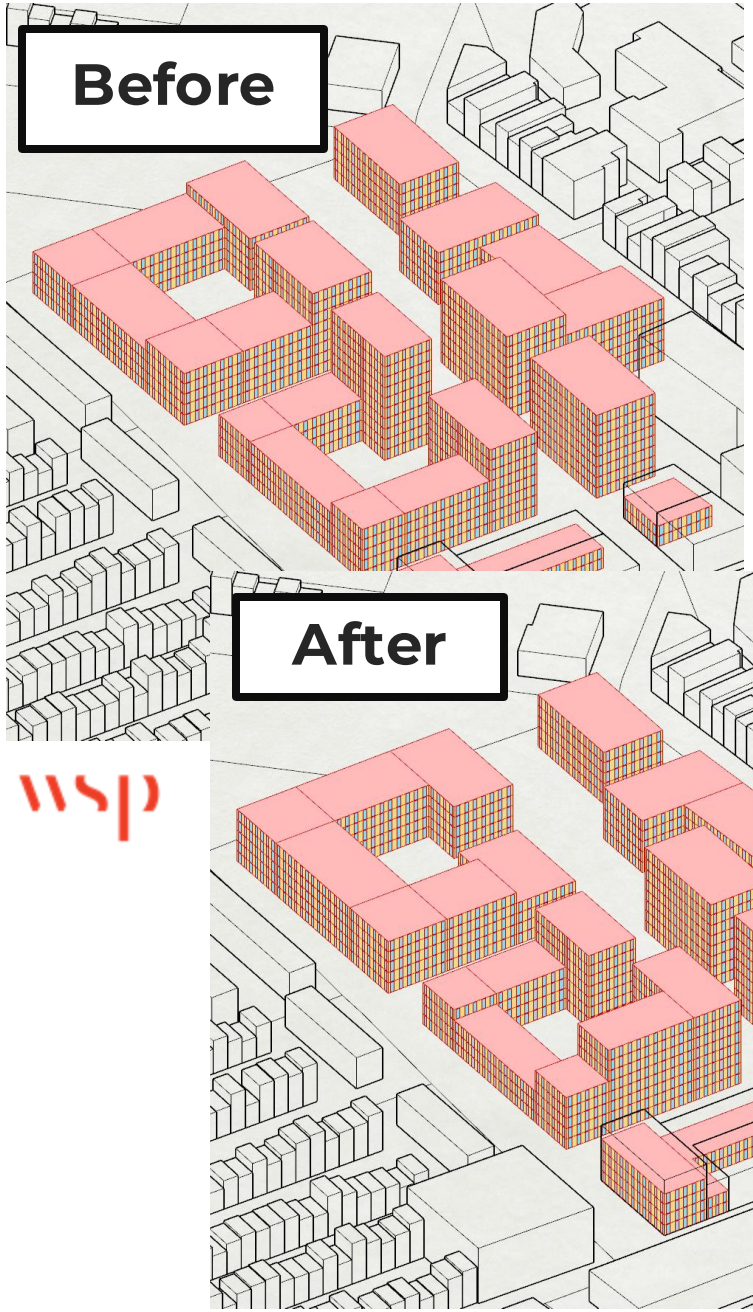
The **design catalogue** allows us to compare the extremities of the design space for the filtered dataset.

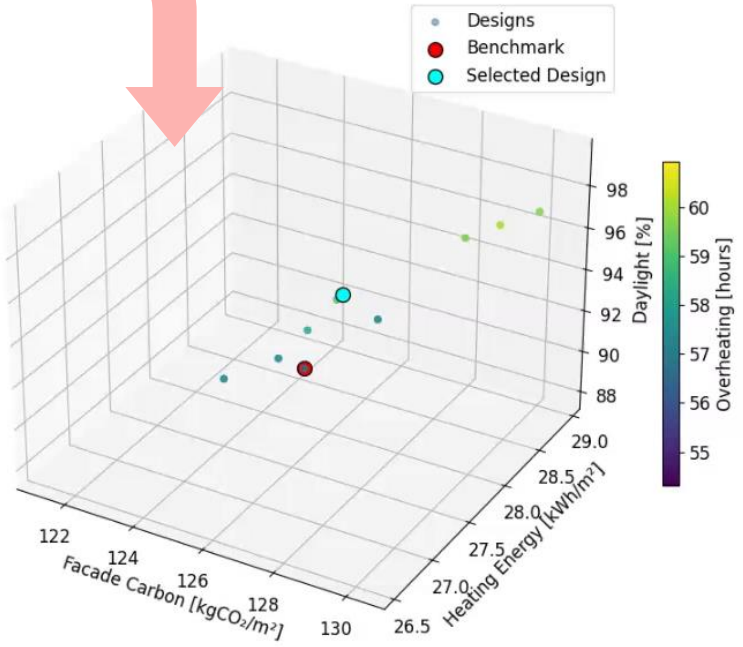


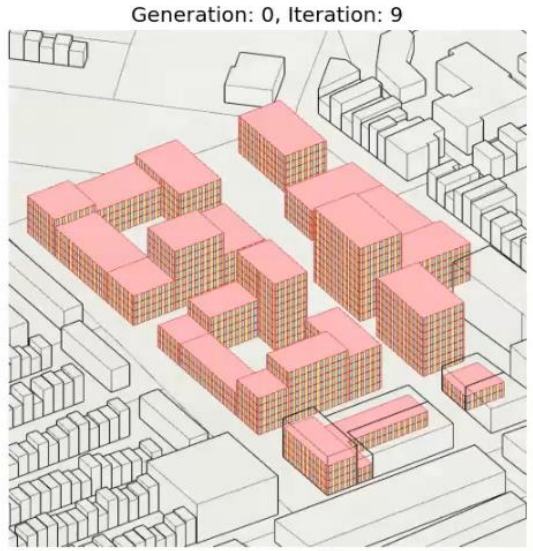


BEC <320kg/CO_2/m^2 & sDA>60% & EUI< 56kWhr/m^2

Full site masterplan







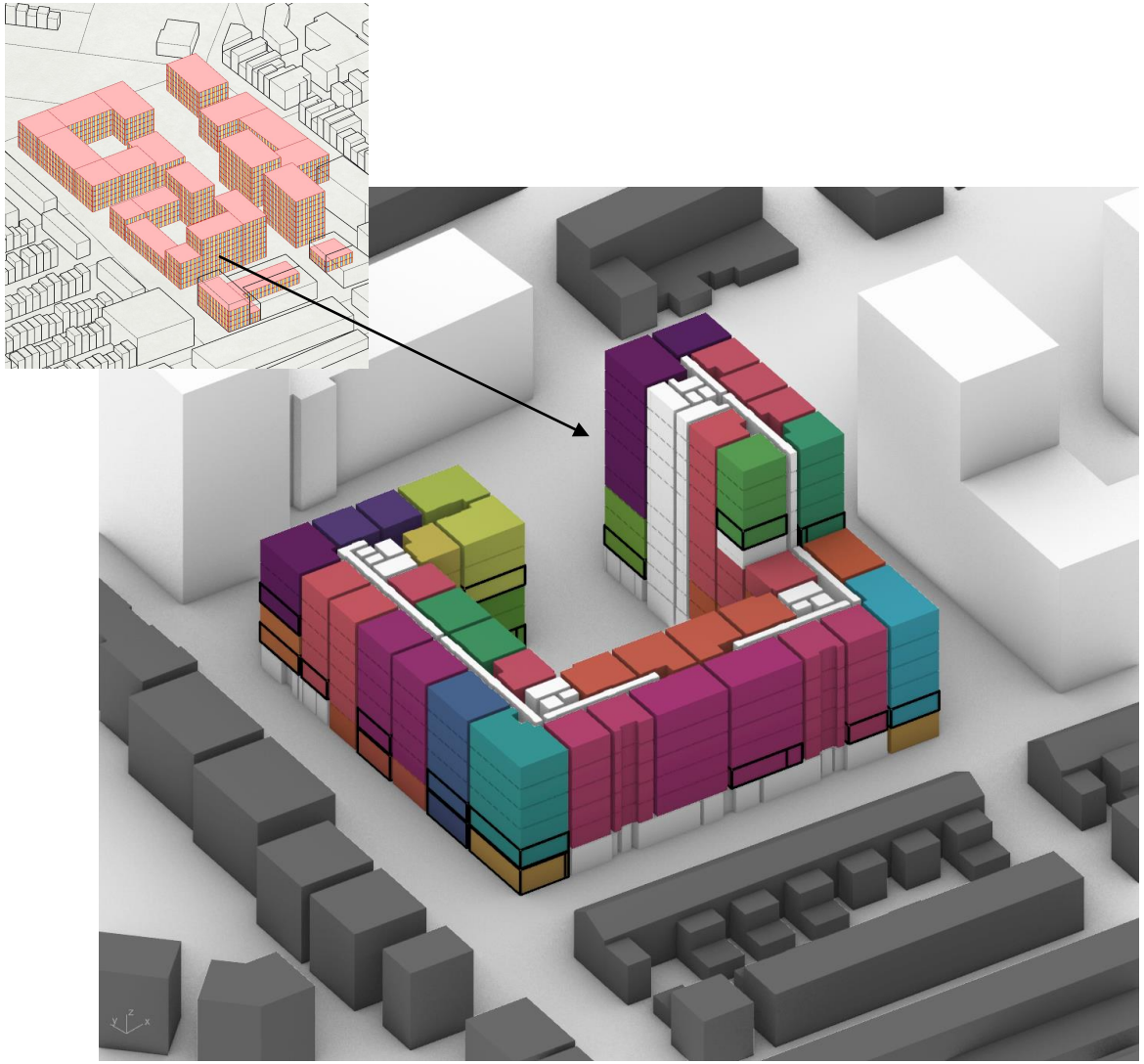
182 tCO_2 Reduction

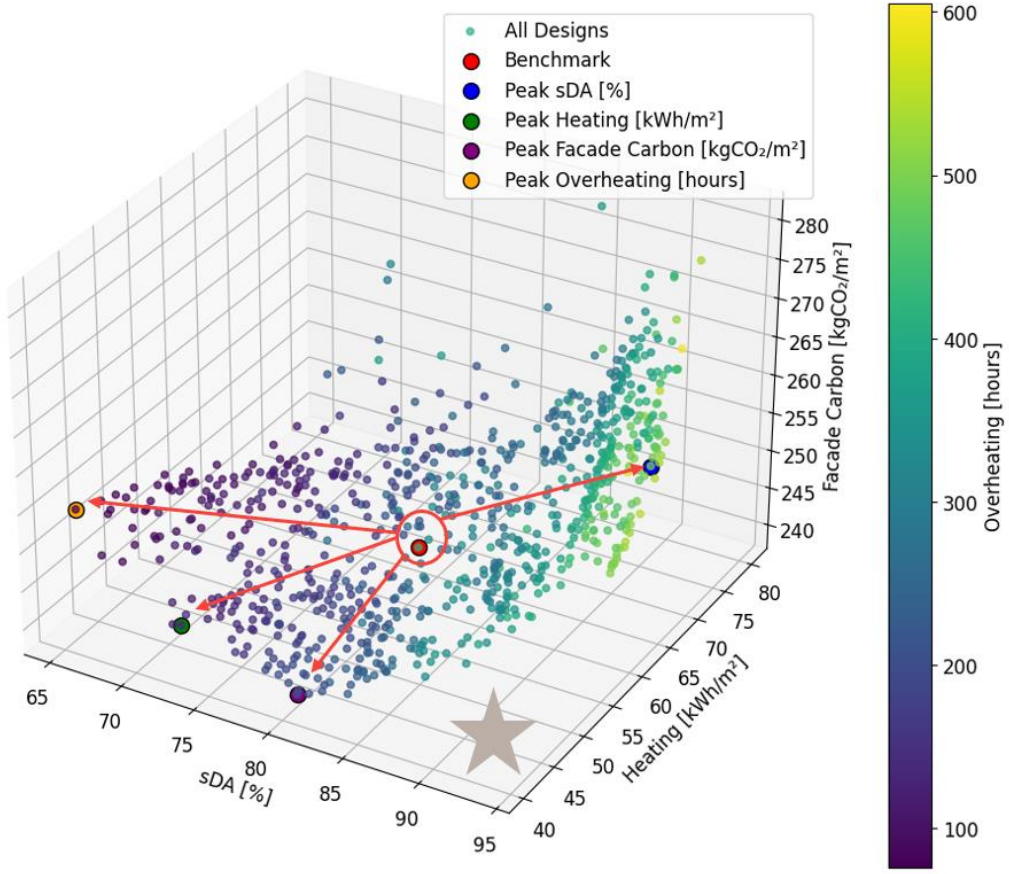
£420,000 savings (less façade area)

Reduce Heating Bills

Reduce Overheating Risk

Maintain Access to daylight




All Designs
Benchmark
Peak sDA [%]
Peak Heating [kWh/m²]
Peak Facade Carbon [kgCO₂/m²]
Peak Overheating [hours]
sDA [%]
Heating [kWh/m²]
Facade Carbon [kgCO₂/m²]
Overheating [hours]

Design Solutions

A3

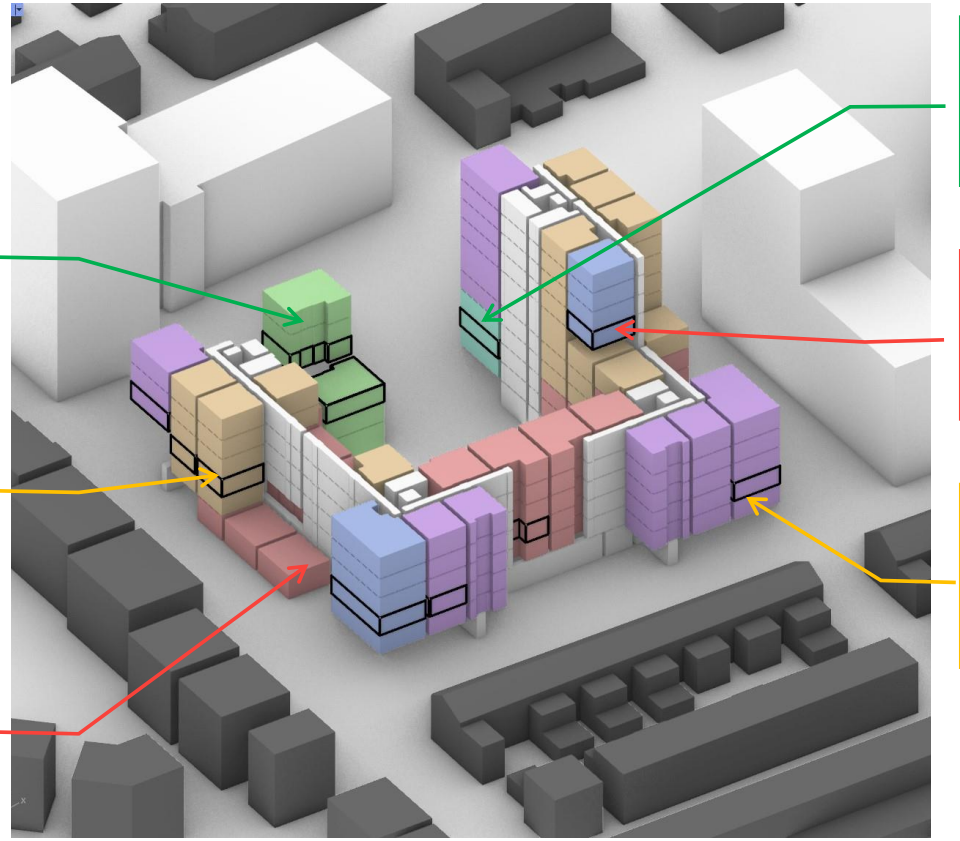
Improve daylight
- Minor increase in glazing ratio
- Addition of some shading
- Evenly spaced windows

A2

Improve daylight
- Minor fabric upgrade (g -value increase)
- Increase glazing ratio
- Restricted to Part-L limits

A1

Improve daylight
- Layout change
- *And/or* glazing ratio increase + fabric upgrade
- Restricted to Part-L limits



B1

Reduce energy
- Minor decrease in glazing ratio
- Evenly spaced windows

C1

Reduce overheating risk
- Reduce glazing ratio or add shading (or both)
- "Design out" cooling

C2

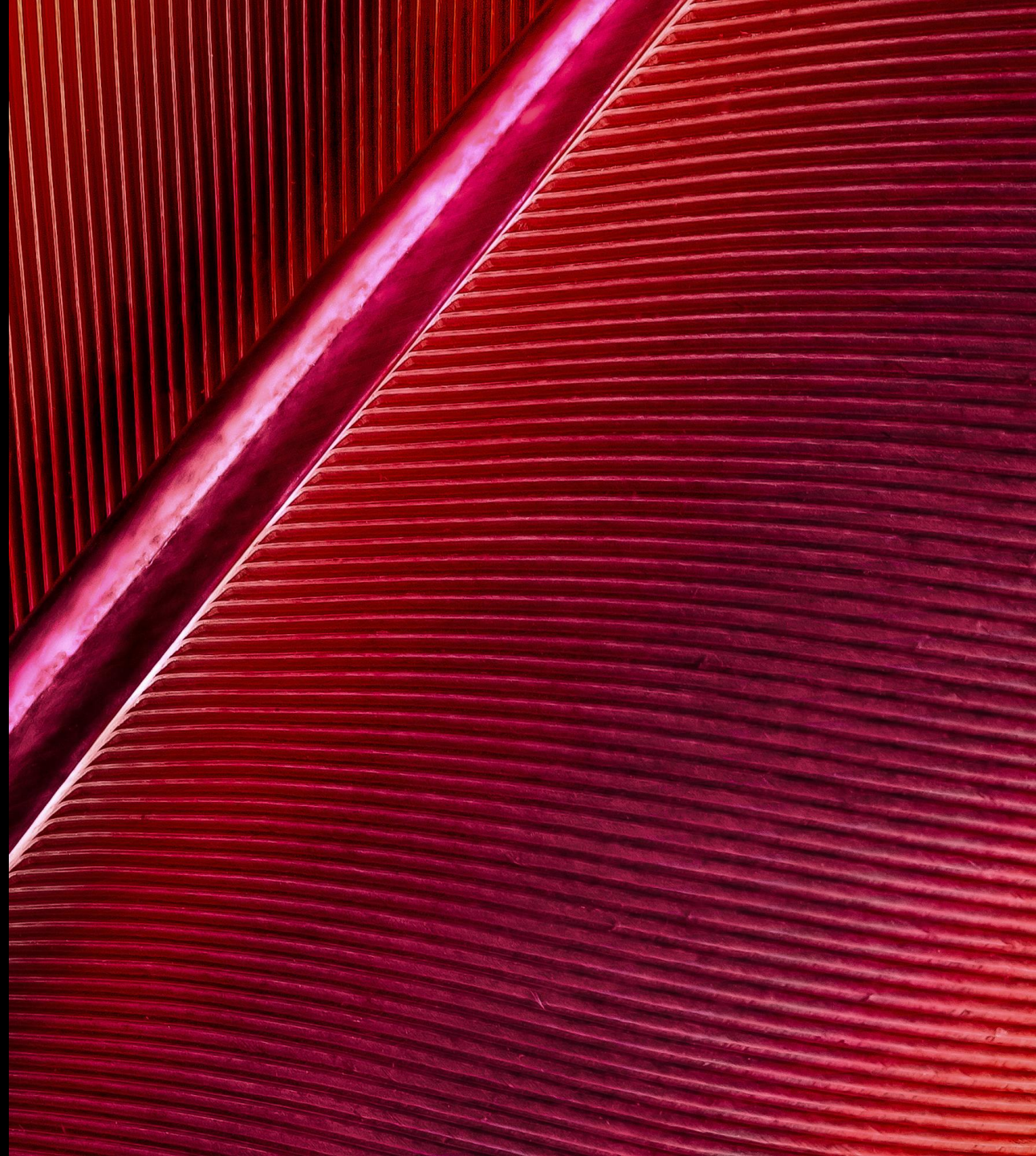
Reduce overheating risk
- Reduce glazing ratio
- *And/or* add shading

Significant risk

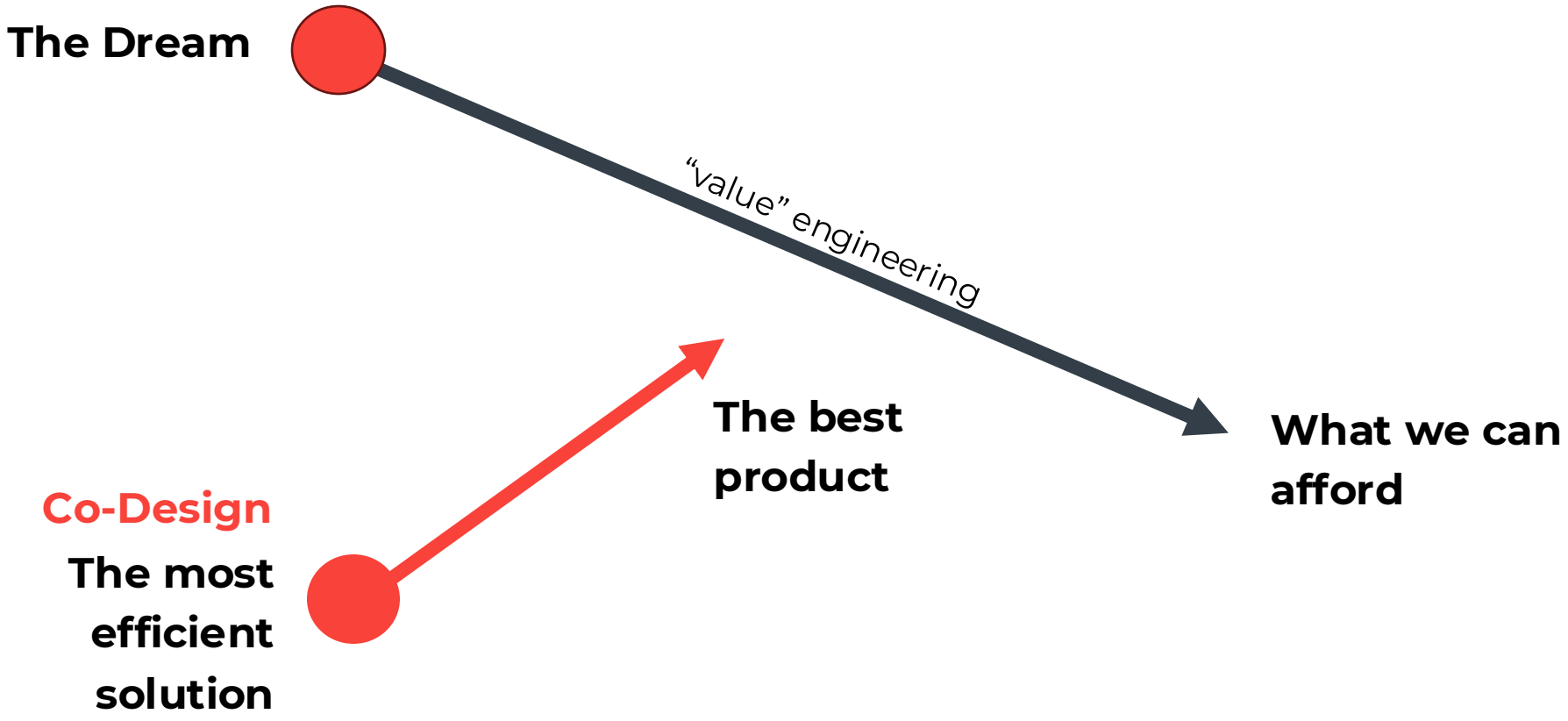
Moderate risk

Low risk

A NEW DESIGN PARADIGM



The traditional workflow

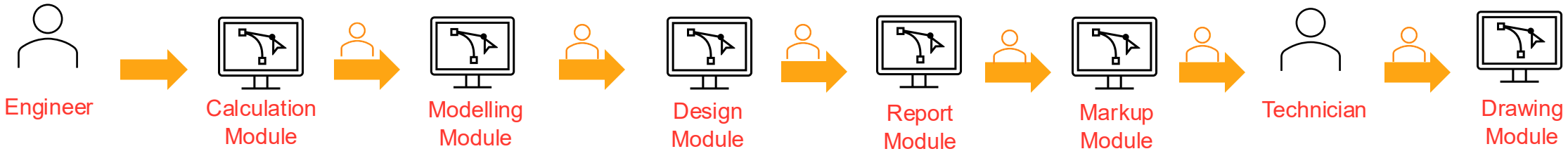


THE AI TRANSFORMATION

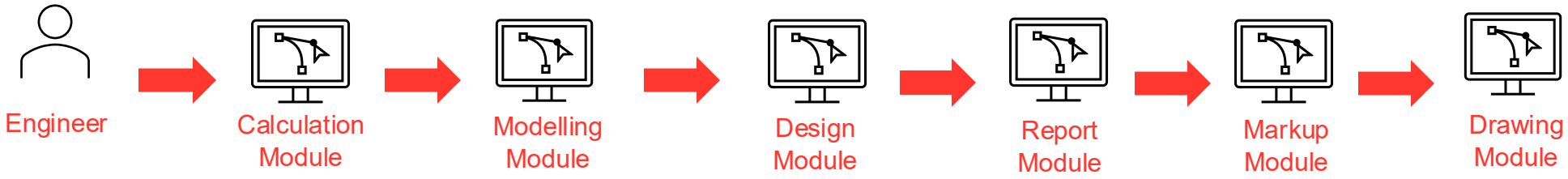

ChatGPT
ChatGPT

Current Design Workflow

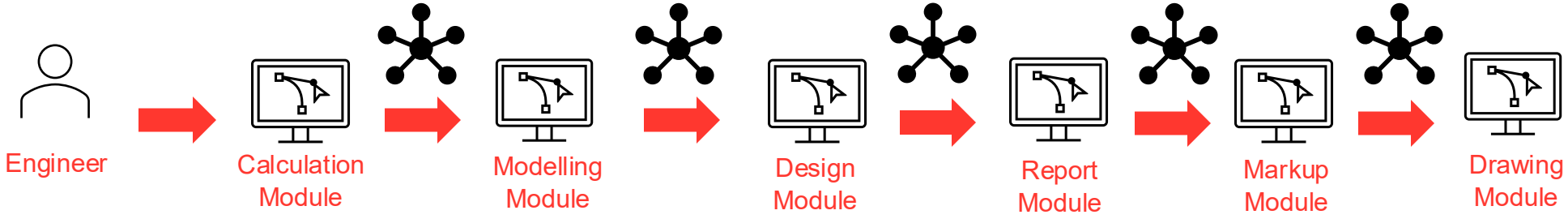
Stage 1: Modular Workflow

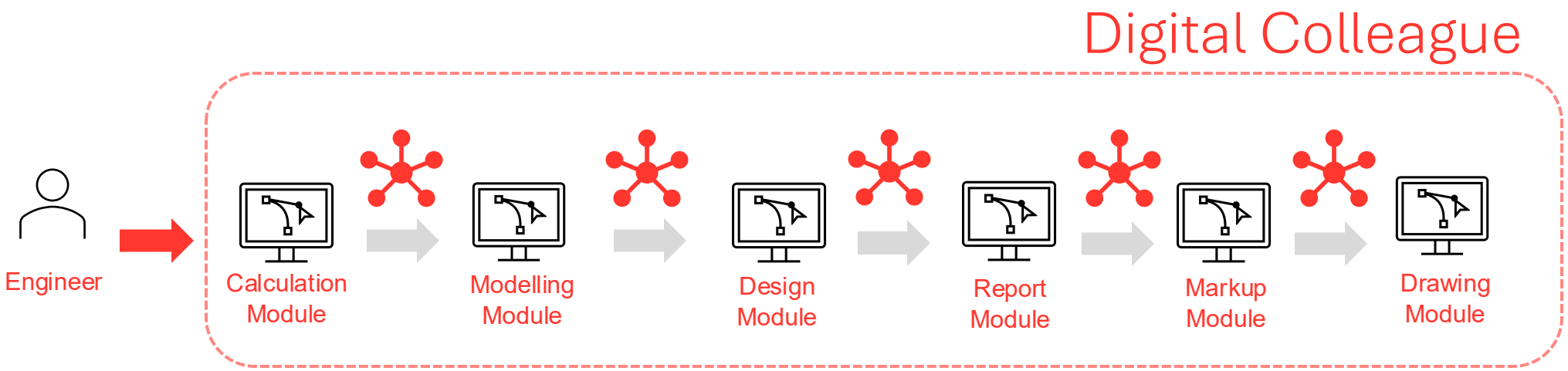


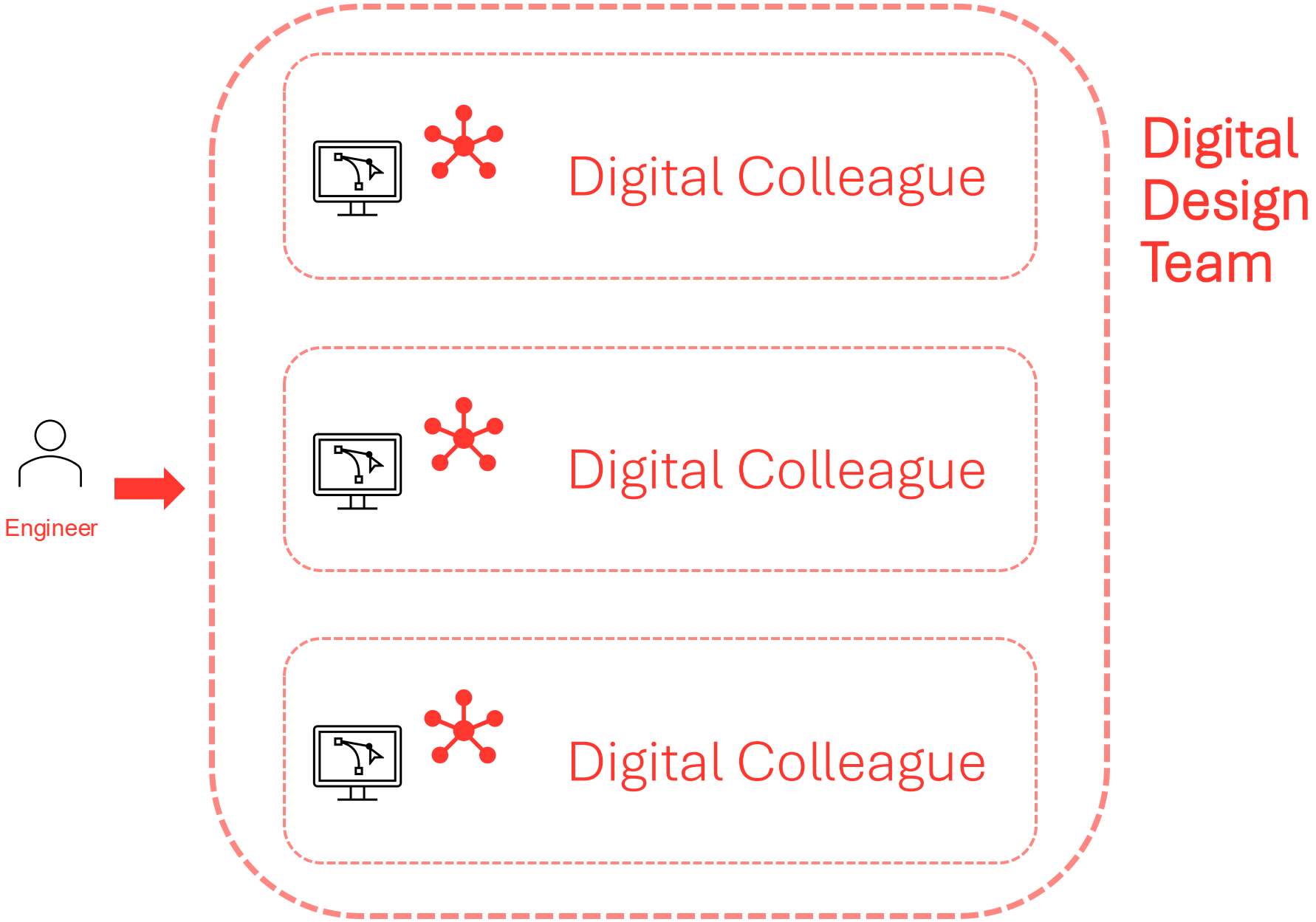
Stage 3: Modular Automation

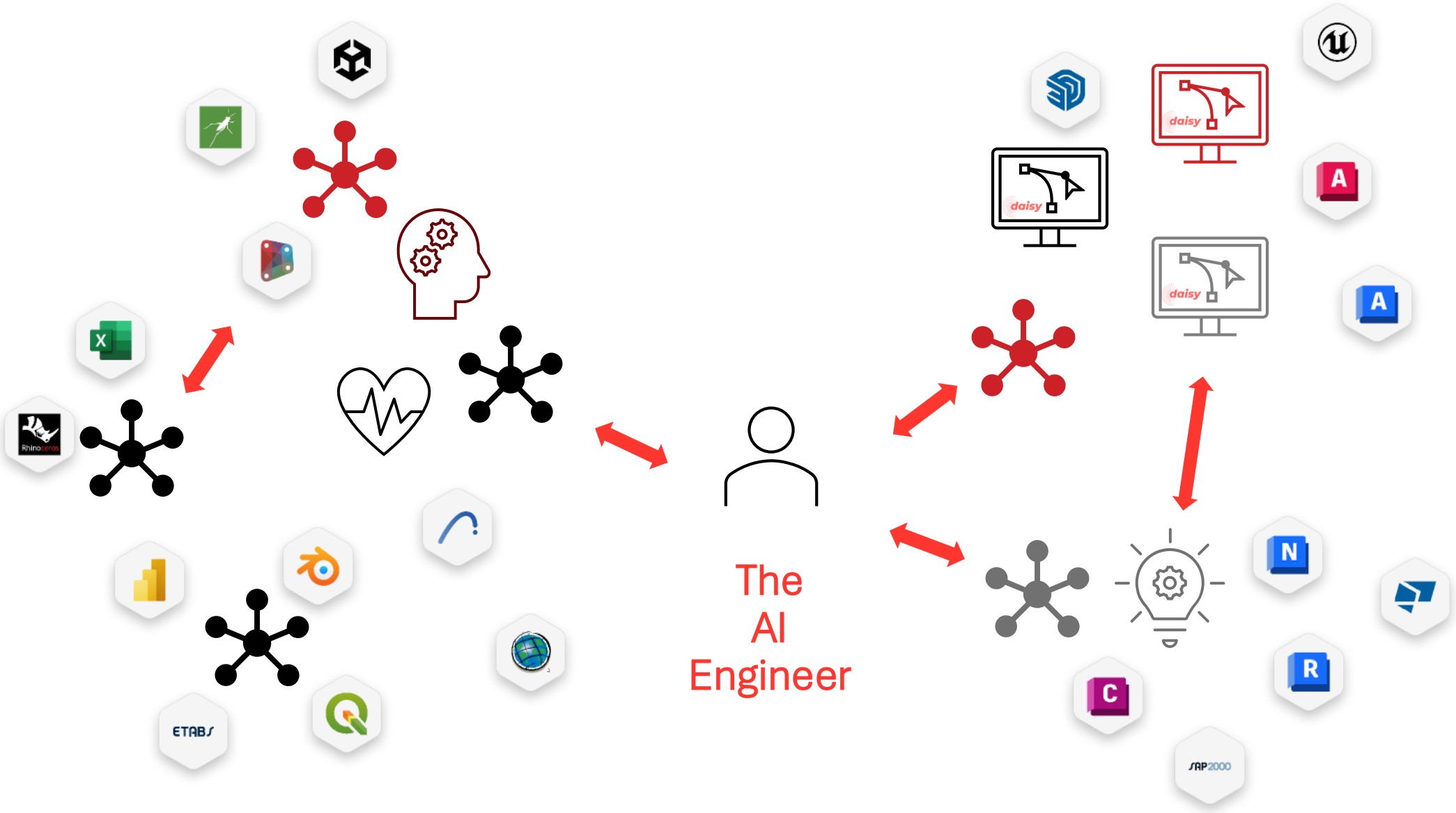


Stage 4: **Agentic** Pipeline




Digital Colleague
Engineer
Calculation Module
Modelling Module
Design Module
Report Module
Markup Module
Drawing Module


Digital Colleague
Digital Colleague
Digital Colleague
Engineer
Digital
Design
Team


daisy
daisy
daisy
Rhinoceros
ETABS
SAP2000
The
AI
Engineer

HUMAN-CENTRED
EVIDENCE-BASED

AUGMENTED
INTELLIGENCE

Diego Padilla-Philipps
Director, WSP