AUTODESK UNIVERSITY

Moving Toward the Future of Design with Generative Design in Revit

Lilli Smith with Special Guests

Sr. Product Manager | @LilliMSmith



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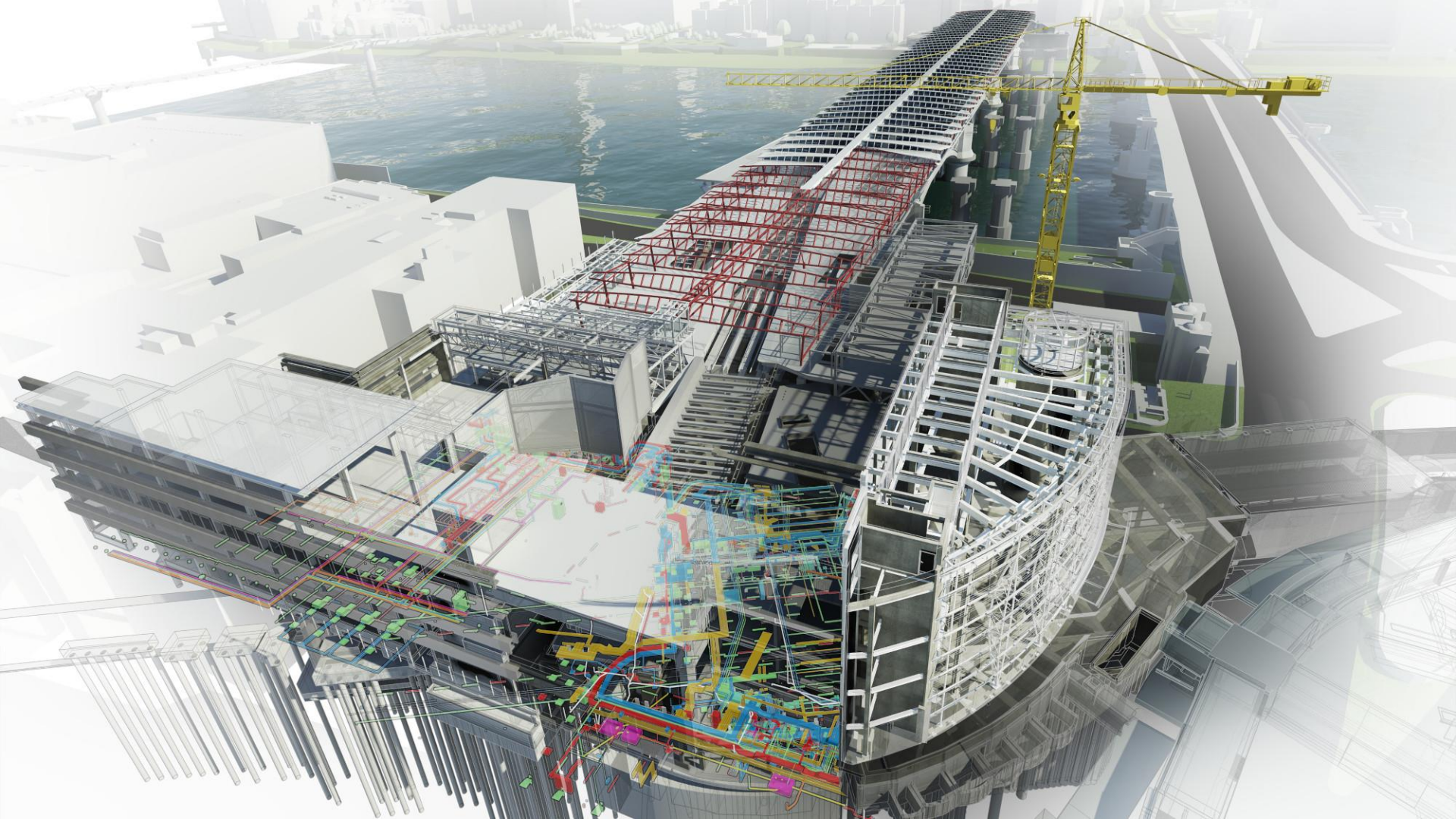

ALJAZEERA
AUGUST 9, 2021
UN CLIMATE REPORT
‘Code red for humanity’

THE FUTURE IS A DESIGN CHALLENGE

Solving tomorrow's challenges with automation and generative design

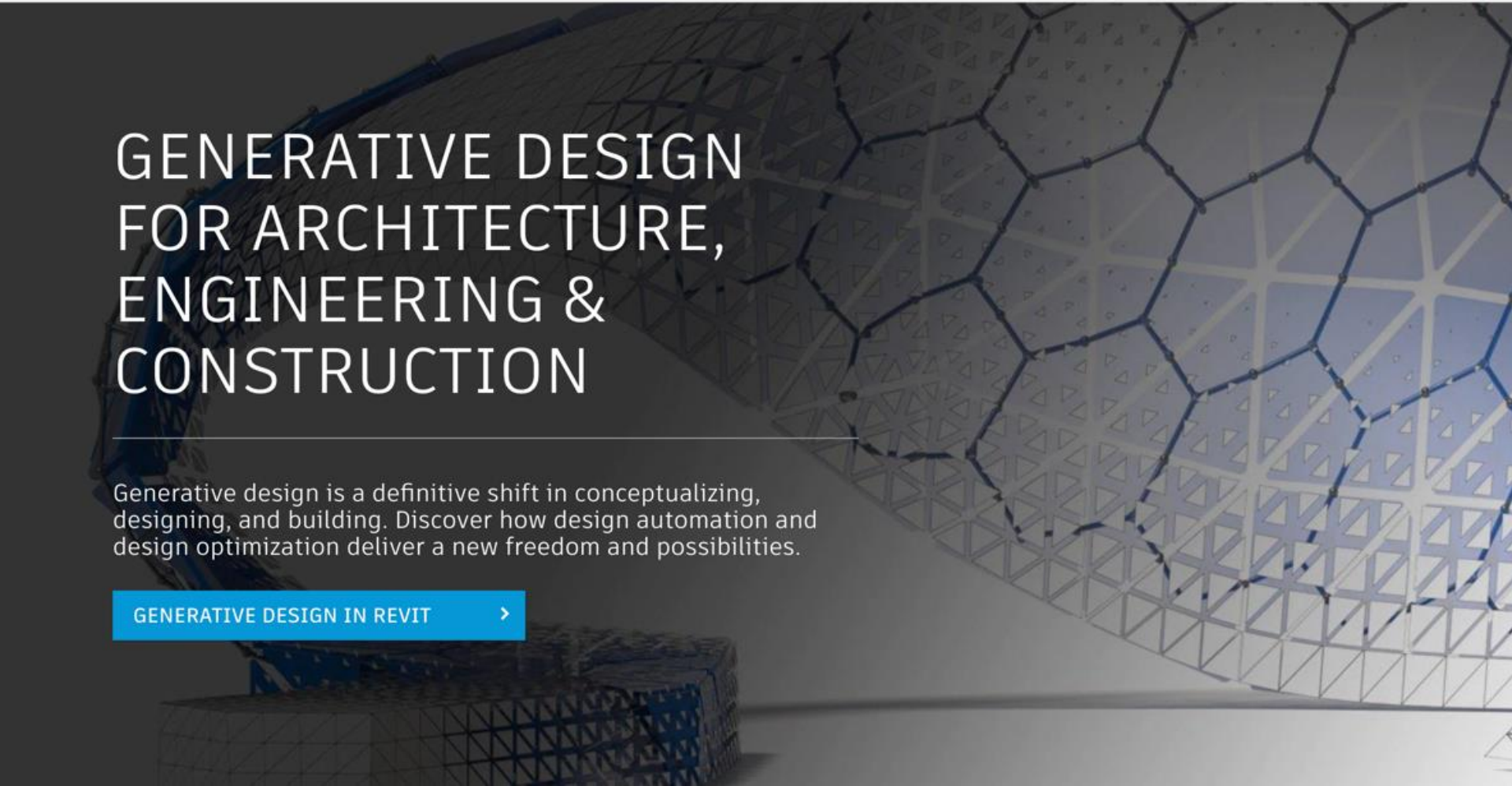



BEDROOM
12.4 mp/14.45m
parchet+zugraveli
HALL
1.9 mp/5.6m
parchet+zugraveli
LIVING ROOM + DINING
39.5 mp/59.58m
parchet+zugraveli
KITCHEN
8.9 mp/12.5m
gresie + faianta
HALL
2.6 mp
parchet
zugraveli
STAIR WELL
16.7 mp
GR SANIT.
2.4 mp/6.6m
gresie + faianta
BATH ROOM
5.8 mp/10.1m
gresie + faianta
KITCHEN
9.5 mp/12.3m
gresie + faianta
+15.10
+11.70
+8.30





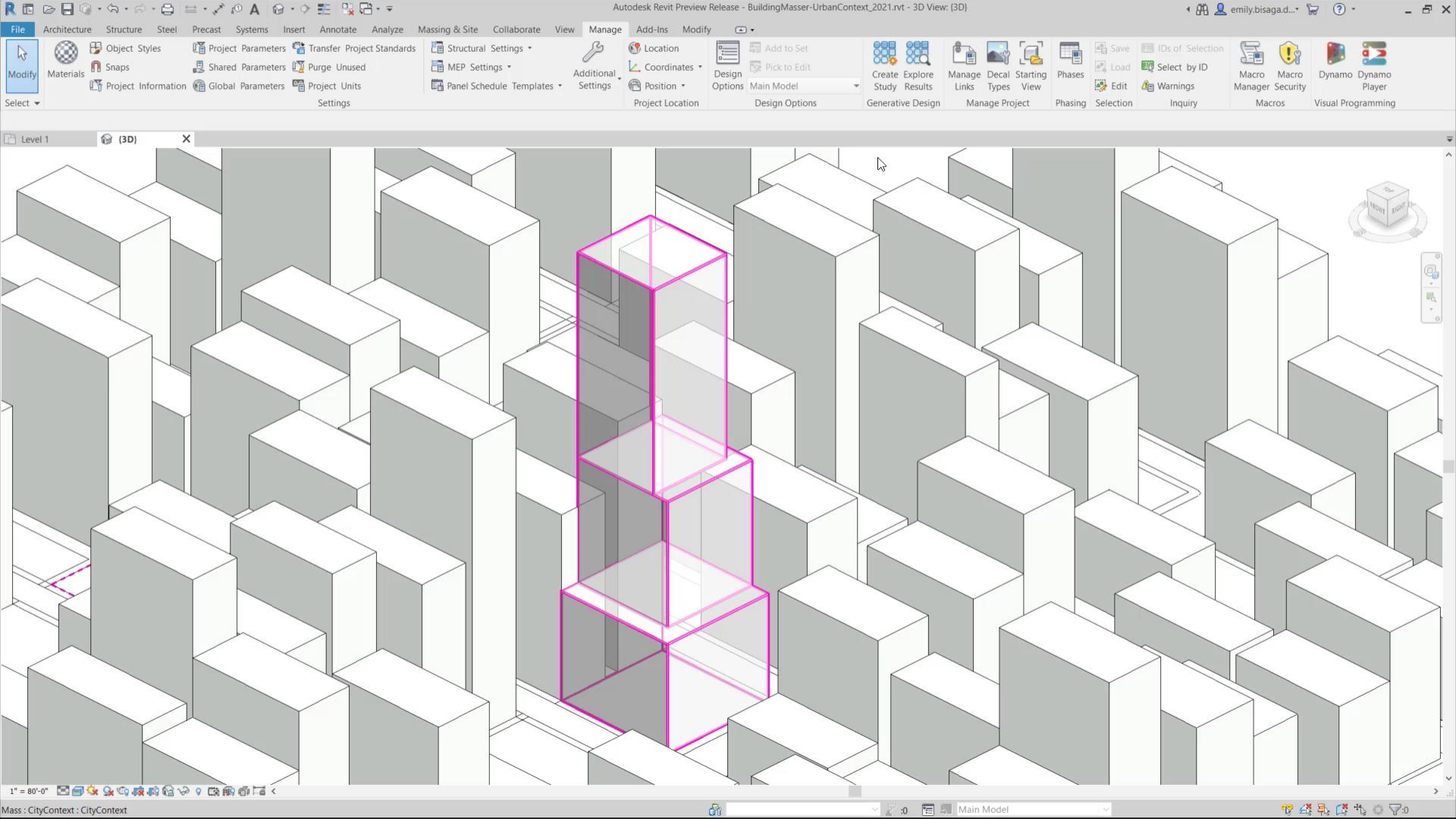

HANSENYUNCKEN
HANSENYUNCKEN



GENERATIVE DESIGN FOR ARCHITECTURE, ENGINEERING & CONSTRUCTION

Generative design is a definitive shift in conceptualizing, designing, and building. Discover how design automation and design optimization deliver a new freedom and possibilities.

GENERATIVE DESIGN IN REVIT ›


Autodesk Revit Preview Release - BuildingMasser-UrbanContext_2021.rvt - 3D View: {3D}
File
Architecture
Structure
Steel
Precast
Systems
Insert
Annotate
Analyze
Massing & Site
Collaborate
View
Manage
Add-Ins
Modify
Modify
Select
Materials
Object Styles
Snaps
Project Information
Project Parameters
Shared Parameters
Global Parameters
Transfer Project Standards
Purge Unused
Project Units
Settings
Structural Settings
MEP Settings
Panel Schedule Templates
Additional Settings
Location
Coordinates
Position
Project Location
Design Options
Add to Set
Pick to Edit
Main Model
Design Options
Create Study
Explore Results
Generative Design
Manage Links
Decal Types
Starting View
Manage Project
Phases
Phasing
Save
Load
Edit
Selection
IDs of Selection
Select by ID
Warnings
Inquiry
Macro Manager
Macro Security
Macros
Dynamo
Dynamo Player
Visual Programming
Level 1
{3D}
1" = 80'-0"
Mass : CityContext : CityContext
Main Model

Agenda

Moving Toward the Future of Design with Generative Design in Revit



What’s new?



How are people using Generative Design in Revit?



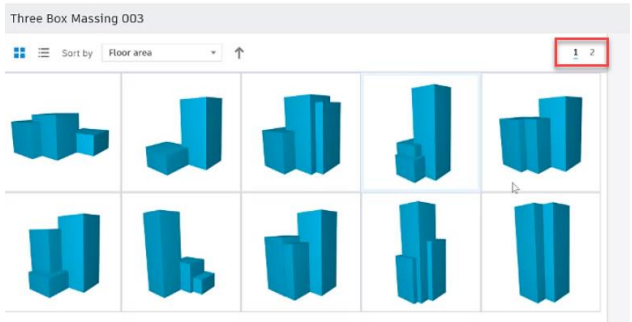
What’s next?

What’s New?

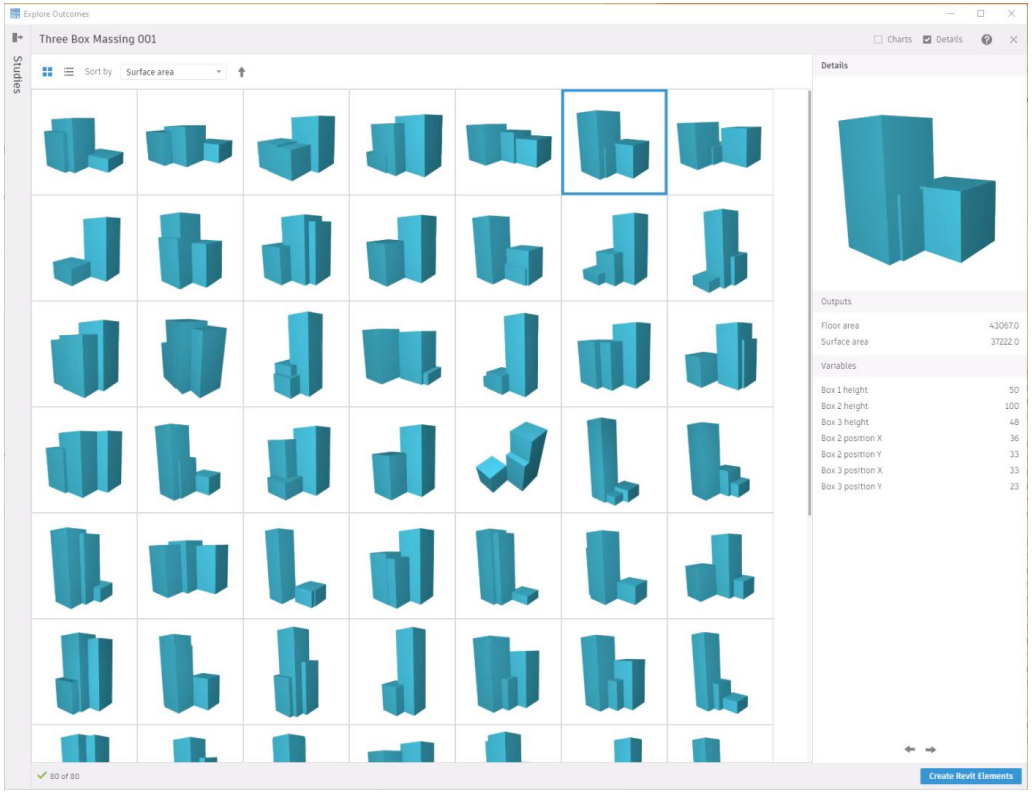
Continuous Scrolling

Generative Design in Revit Outcomes

Old

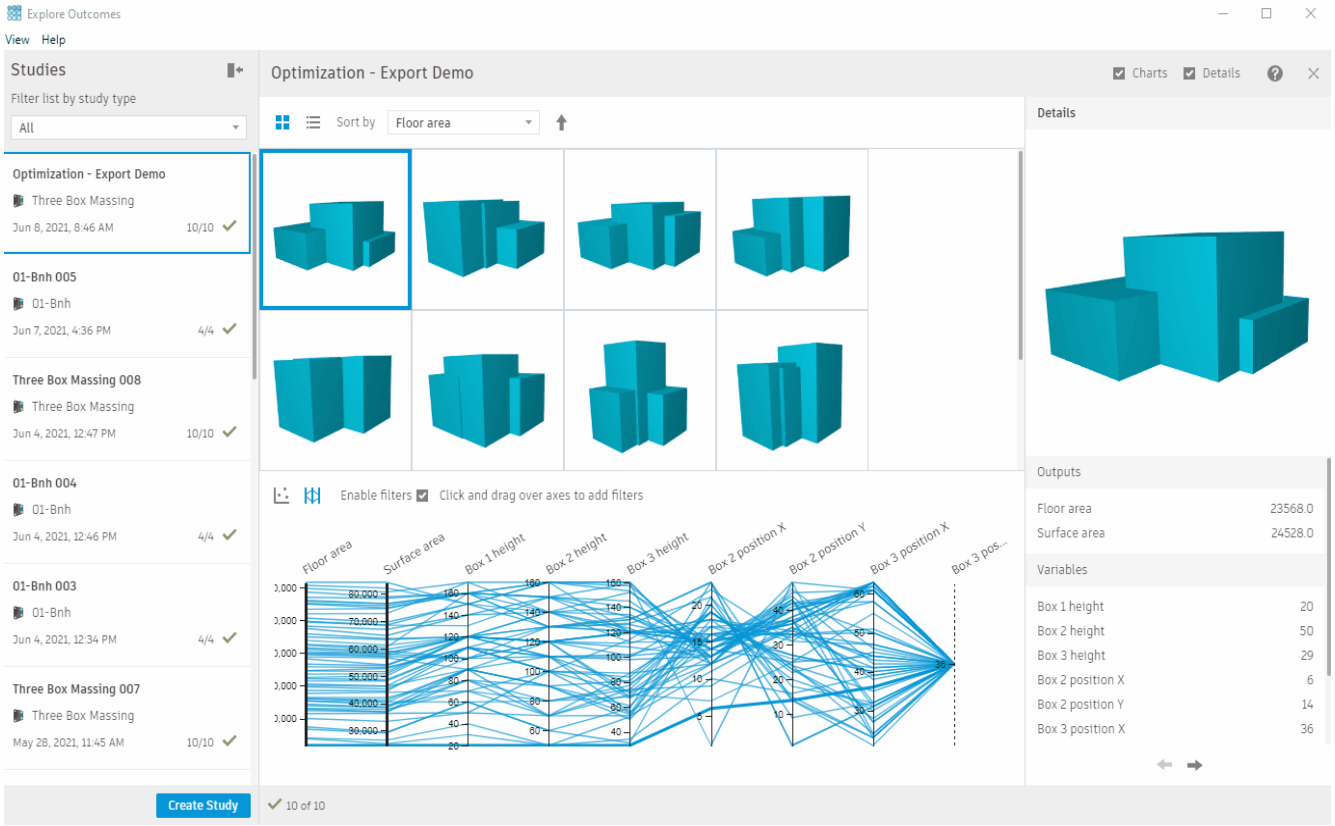


New



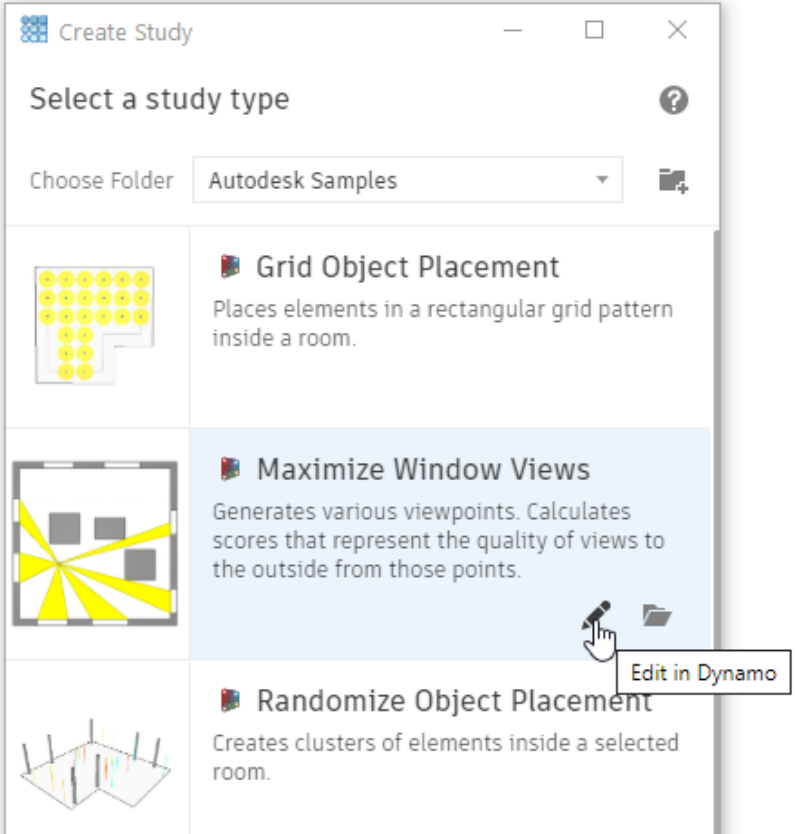
Export Outcomes

Generative Design in Revit Outcomes



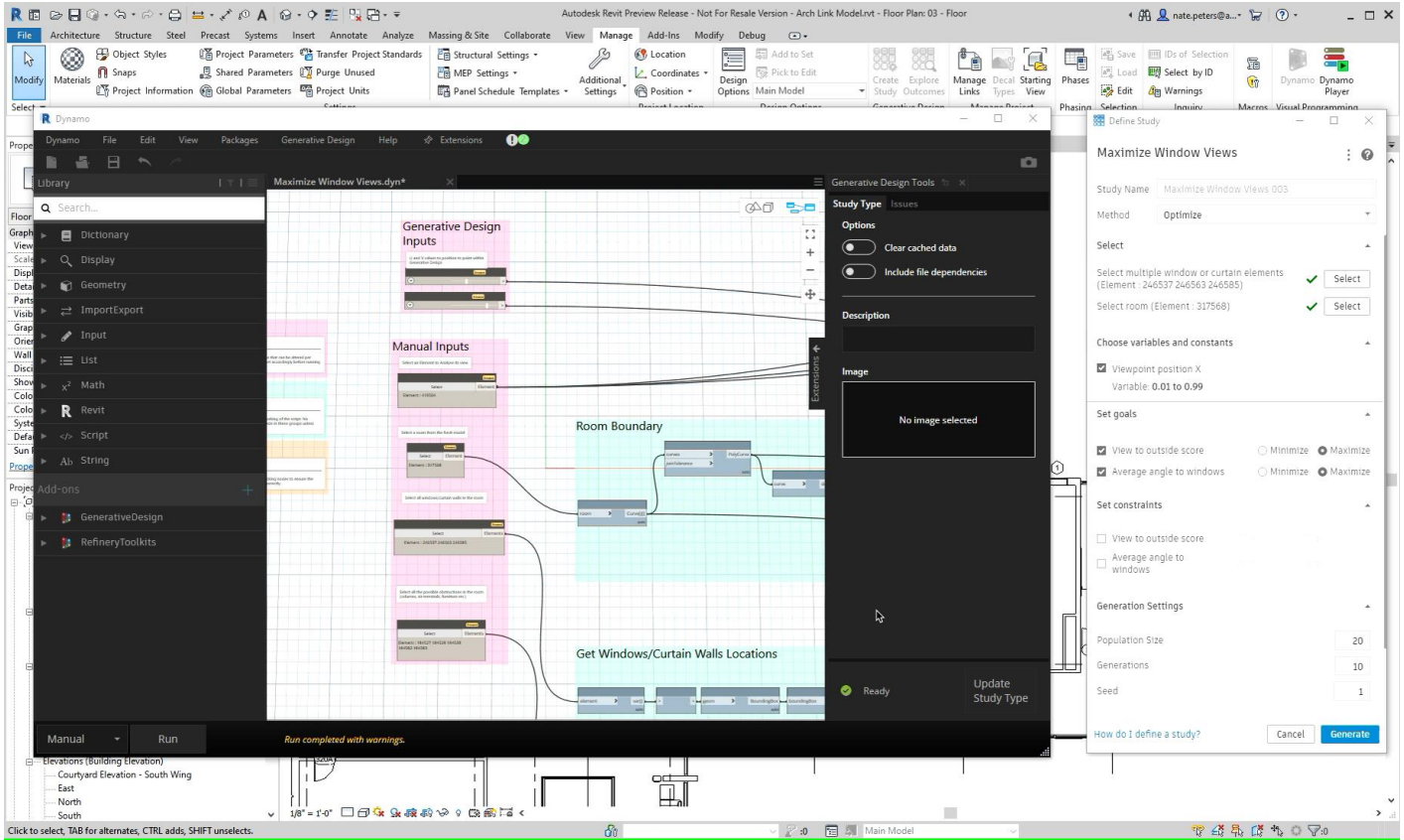
Easily open a study type in Dynamo

Generative Design in Revit Customization



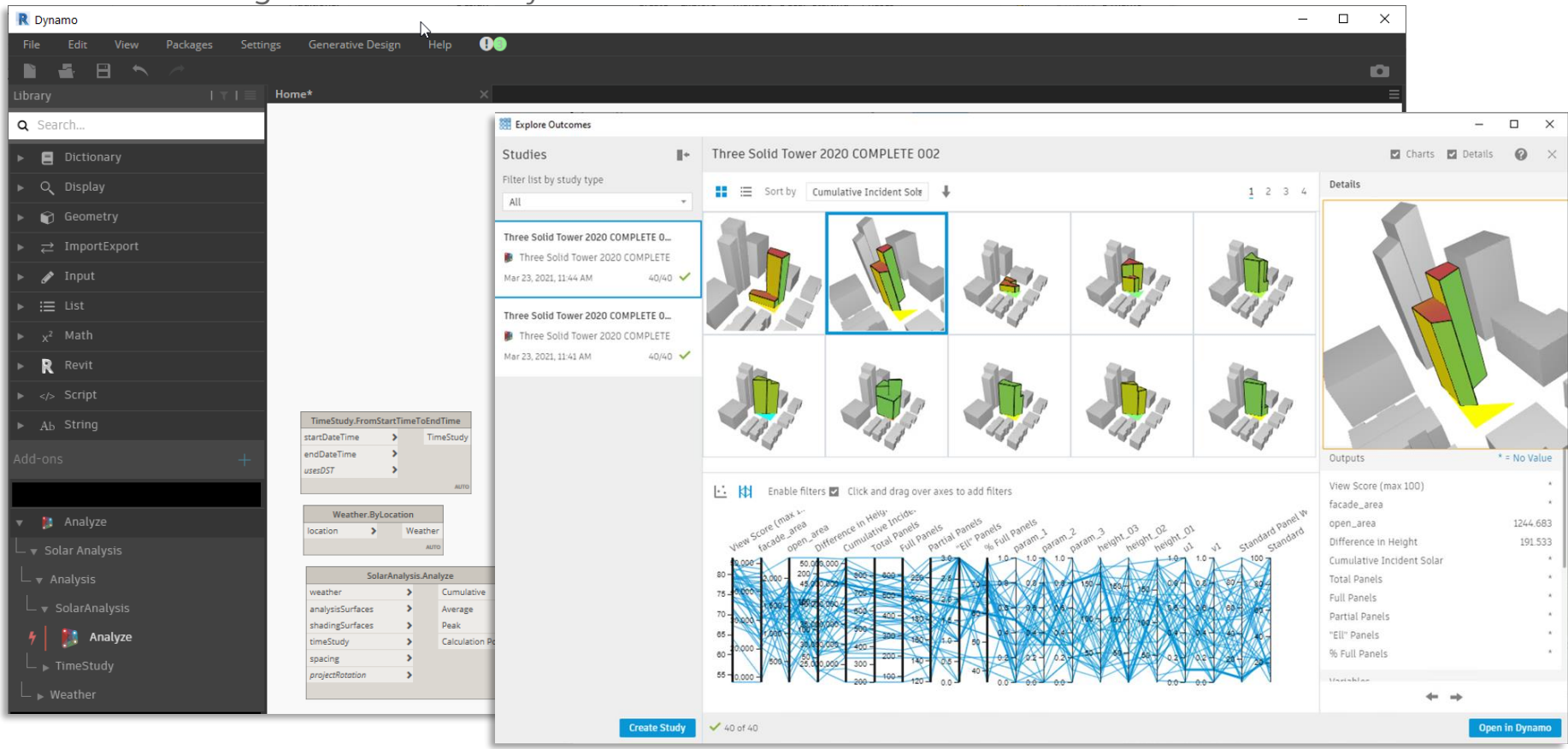
Make updates with Dynamo open

Generative Design in Revit Customization



Solar Analysis for Dynamo

Generative Design in Revit Analysis



Use Cases

Special Guests

Generative Design Practitioners



Esra Abumounshar
Generative Design Lead
at Stantec

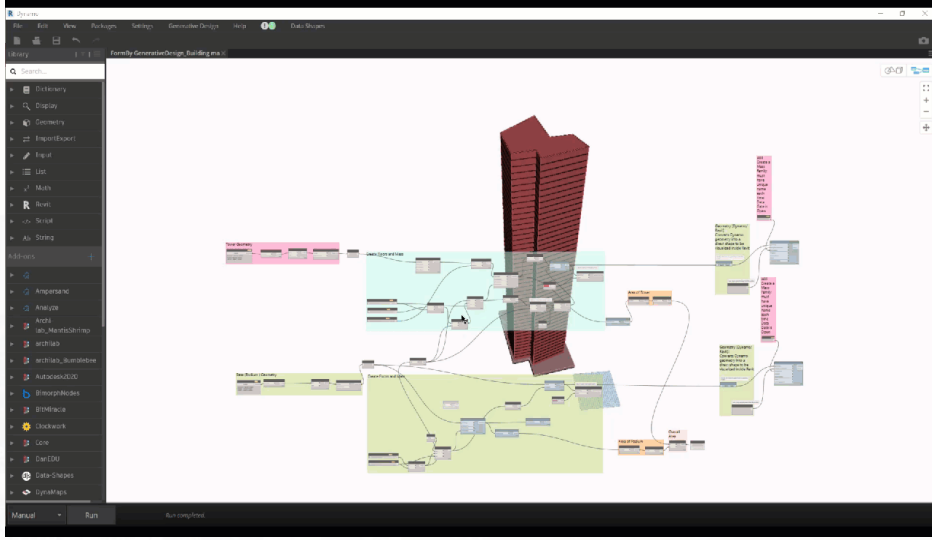
Sean Fruin
Director of Design
Technology at Sigma AEC
Solutions

Elisa Ambrassa
BIM Coordinator at Enel
Green Power Corporation

Building Mass Generator

Stantec

Mass Generator is a Massing Optioneering tool that utilizes Generative Design accessible directly from Revit that helps generate different scenarios for a given building during Programming and SD design phase.



400 Options

The Graph is able to generate as may as 400 options in less 5 minutes, the Targeted Area is used filter out only the options that meet that criteria.

Inputs/Outputs

- ❑ A Podium
- ❑ A Tower portion
- ❑ Setbacks
- ❑ Minimum/ Max Floor to Floor Height
- ❑ & Number of Floors
- ❑ Targeted Area

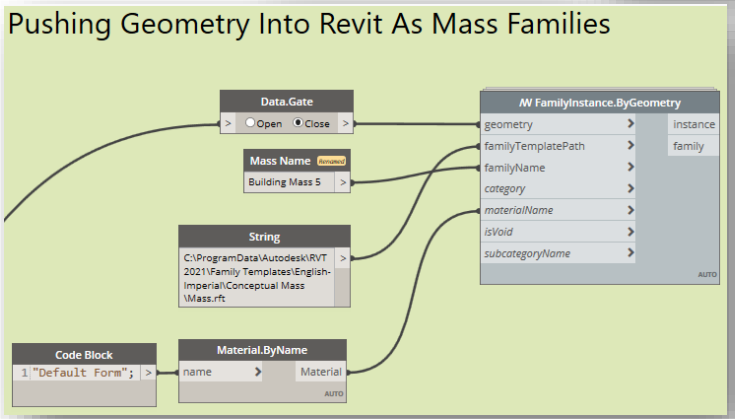
3D Model Automation

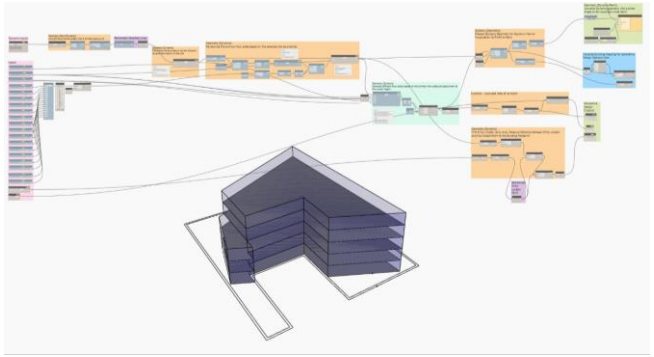
Streamlining 3D modeling in Revit and ability to push geometry directly into Design Options.

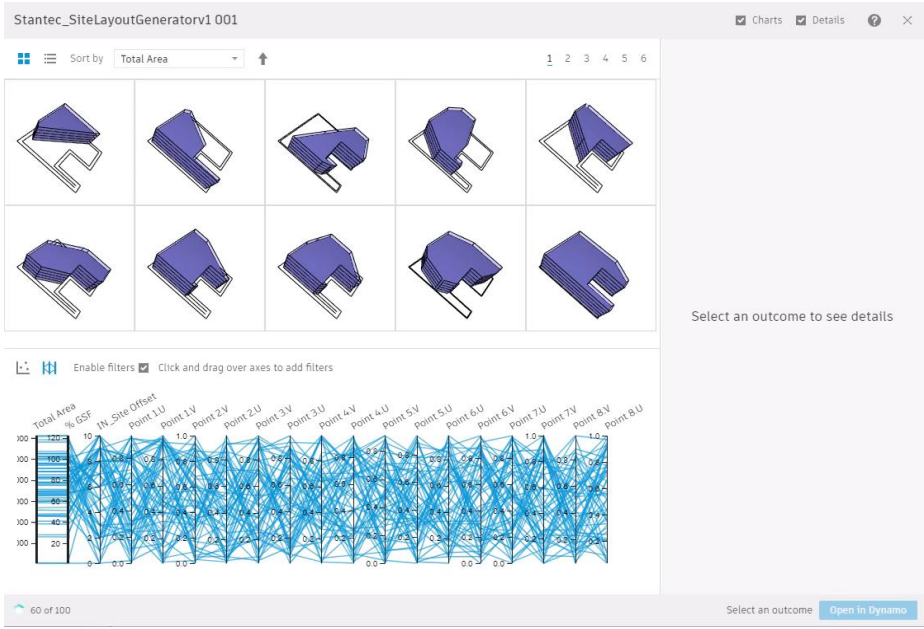
Building Mass Generator

Logic









Special Guests

Generative Design Practitioners

Esra Abumounshar
Generative Design Lead
at Stantec



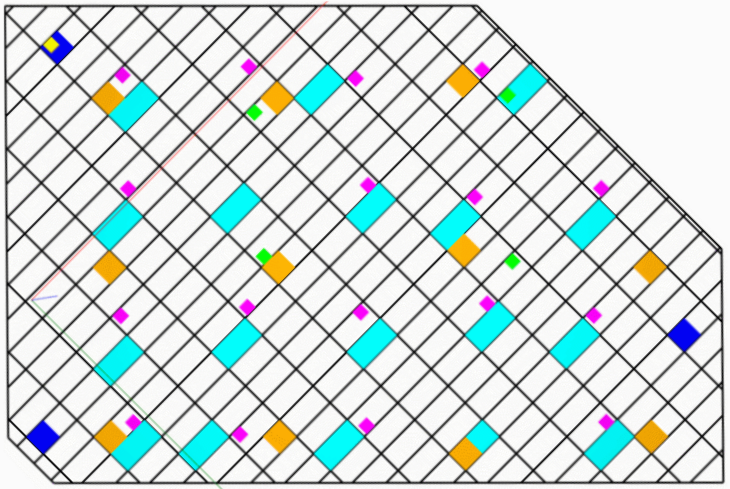
Sean Fruin
Director of Design
Technology at Sigma AEC
Solutions

Elisa Ambrassa
BIM Coordinator at Enel
Green Power Corporation

RCP Coordination

Sigma AEC Solutions

Automated coordination of MEPF fixtures in reflexed ceiling plans.



Inputs

Data - Ceilings
Fixtures

Specified - Priority
Tolerance

Variables - Angle
Distance

Goals

Coordinated

Adhere

Optimized

Value

Collaboration

Flexibility

Speed

Problem

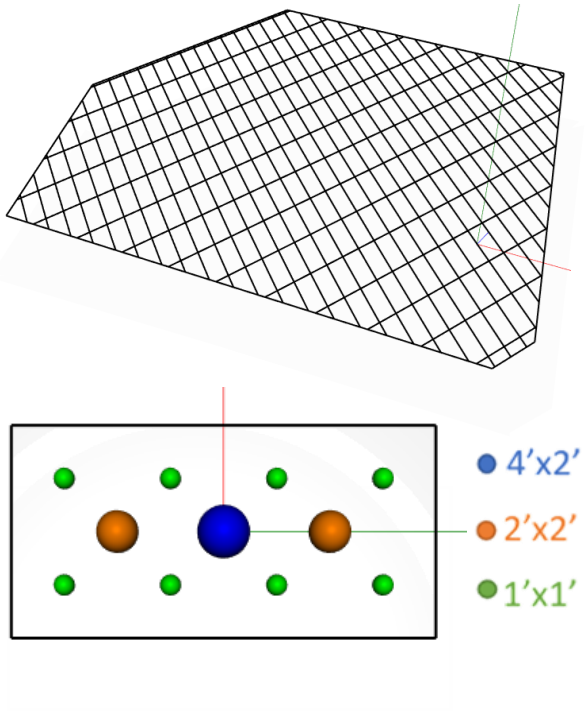
“Coordinating fixtures in a ceiling is a common task and is especially difficult in complex projects where everything is fighting for space.

Teams either hash it out or it's first come first serve due to time constraints.

This leads to solution that works without any investigation into the best options. “

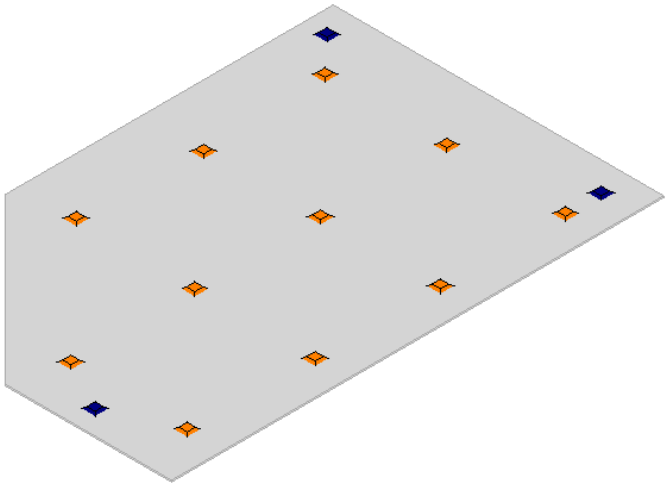
- AEC Sigma Client

Inputs - Ceiling Geometry



grid	The curves that make up the ceiling boundaries and grid lines.
2X4 points	Points on the ceiling grid for 2’ x 4’ fixtures.
2X2 points	Points on the ceiling grid for 2’ x 2’ fixtures.
1X1 points	Points on the ceiling grid for 1’ x 1’ fixtures.

Inputs - Fixtures



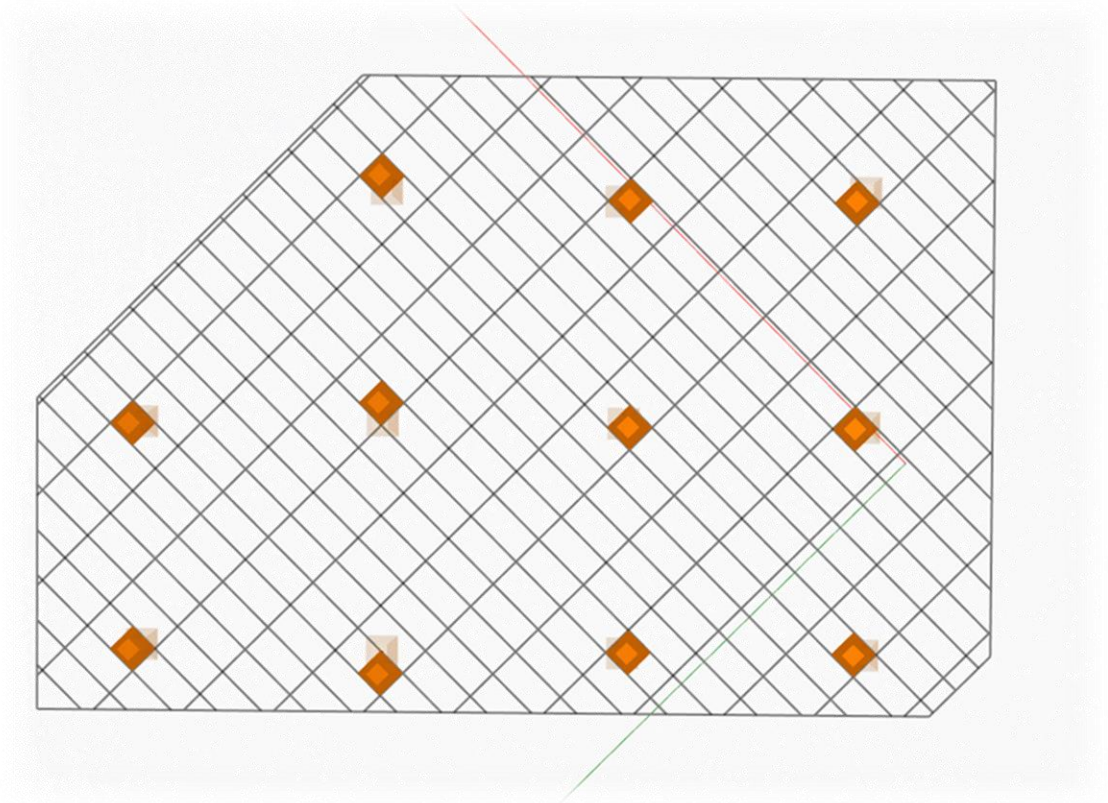
Static

name	Family Type name
length	Family Type length
width	Family Type width
ids	Family Instances Element Ids
origins	Family Instances location points

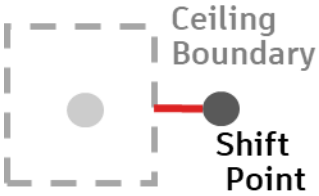
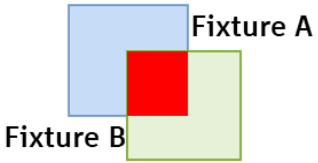
Specified

priority	Rank moving precedence
tolerance	Maximum movable distance

Geometry System

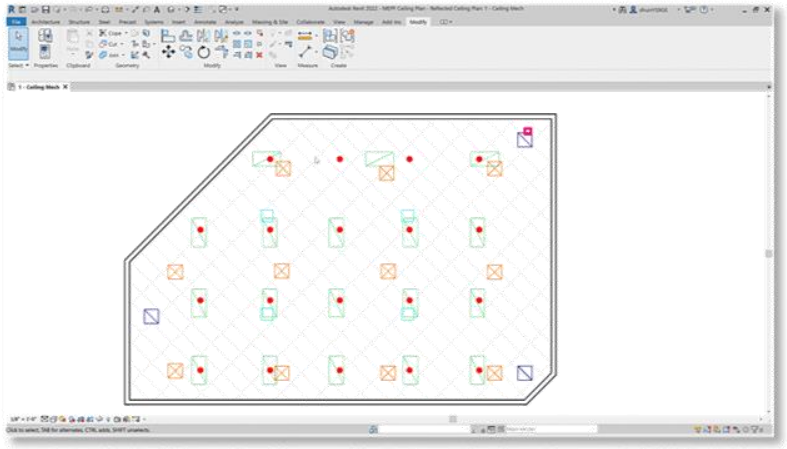


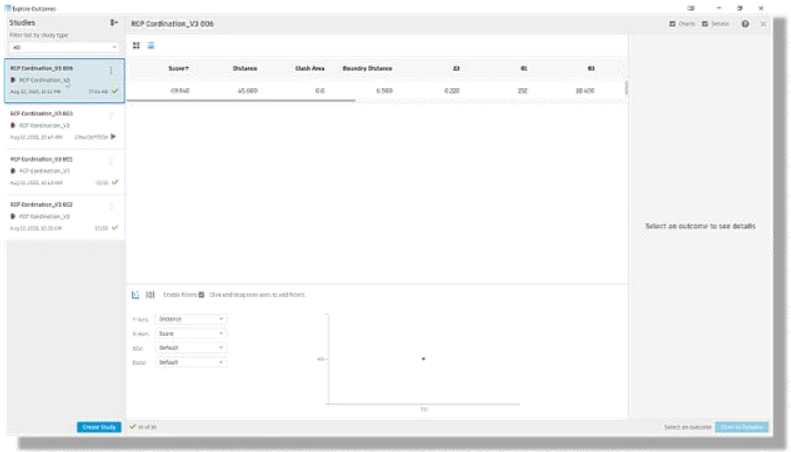
Evaluation Metrics

Total Distance		minimize
Over Distance		minimize
Clash Area		minimize
Fitness Function	$\sum_{Fixture} \text{Fixture Priority} \left(\text{Total Distance} + \text{Over Distance} \right) + \text{Clash Area}^3$	minimize

Generative Design - RCP Coordination

Value Proposition





Special Guests

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at Stantec

Sean Fruin
Director of Design
Technology at Sigma AEC
Solutions



Elisa Ambrassa
BIM Coordinator at Enel
Green Power Corporation

Road Layout

ENEL GROUP

How can we optimize the access roads through a wind farm at the lowest cost and best constructability?



300 Options

From few options in a week with a traditional design, up to 300 in two days with generative design



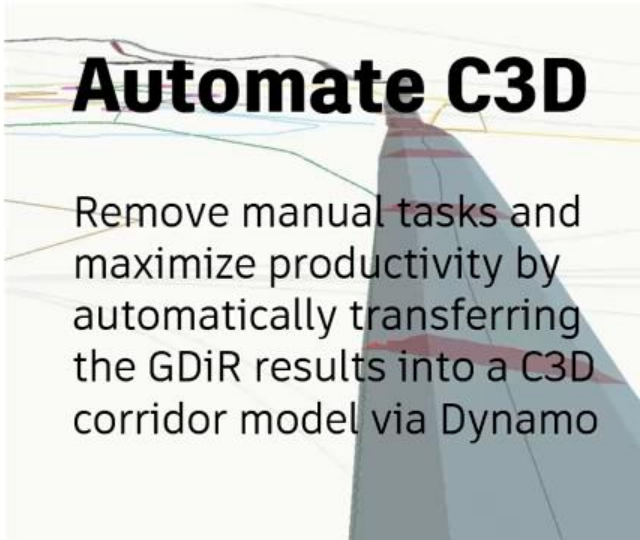
10 Metrics

Data-driven optimization makes it possible to measure design quality, minimizing cut/fill, bridges required and possible slope failures



Automate C3D

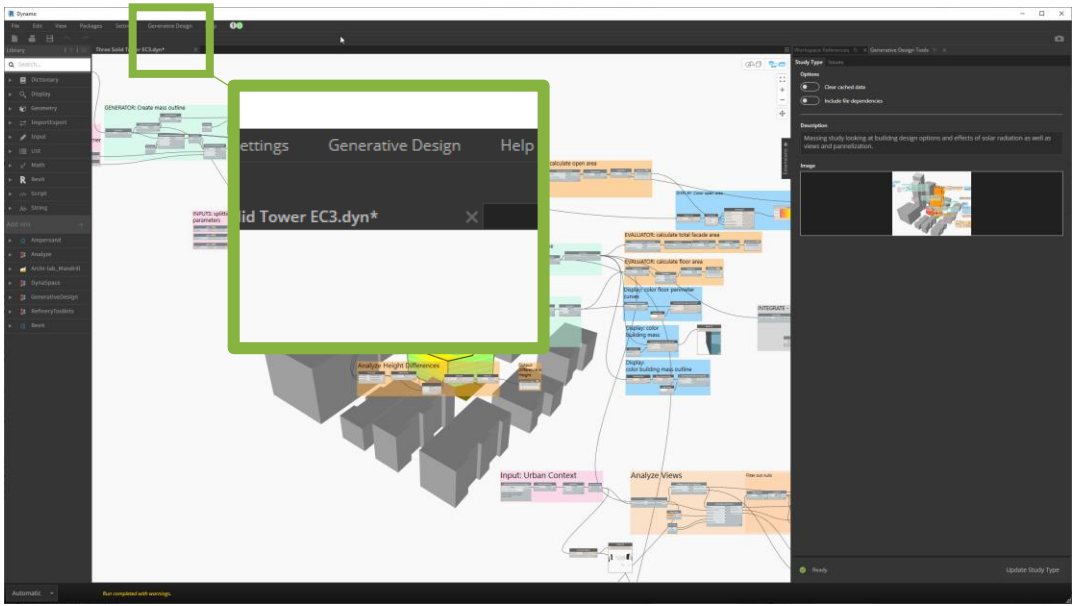
Remove manual tasks and maximize productivity by automatically transferring the GDiR results into a C3D corridor model via Dynamo



What’s Next?

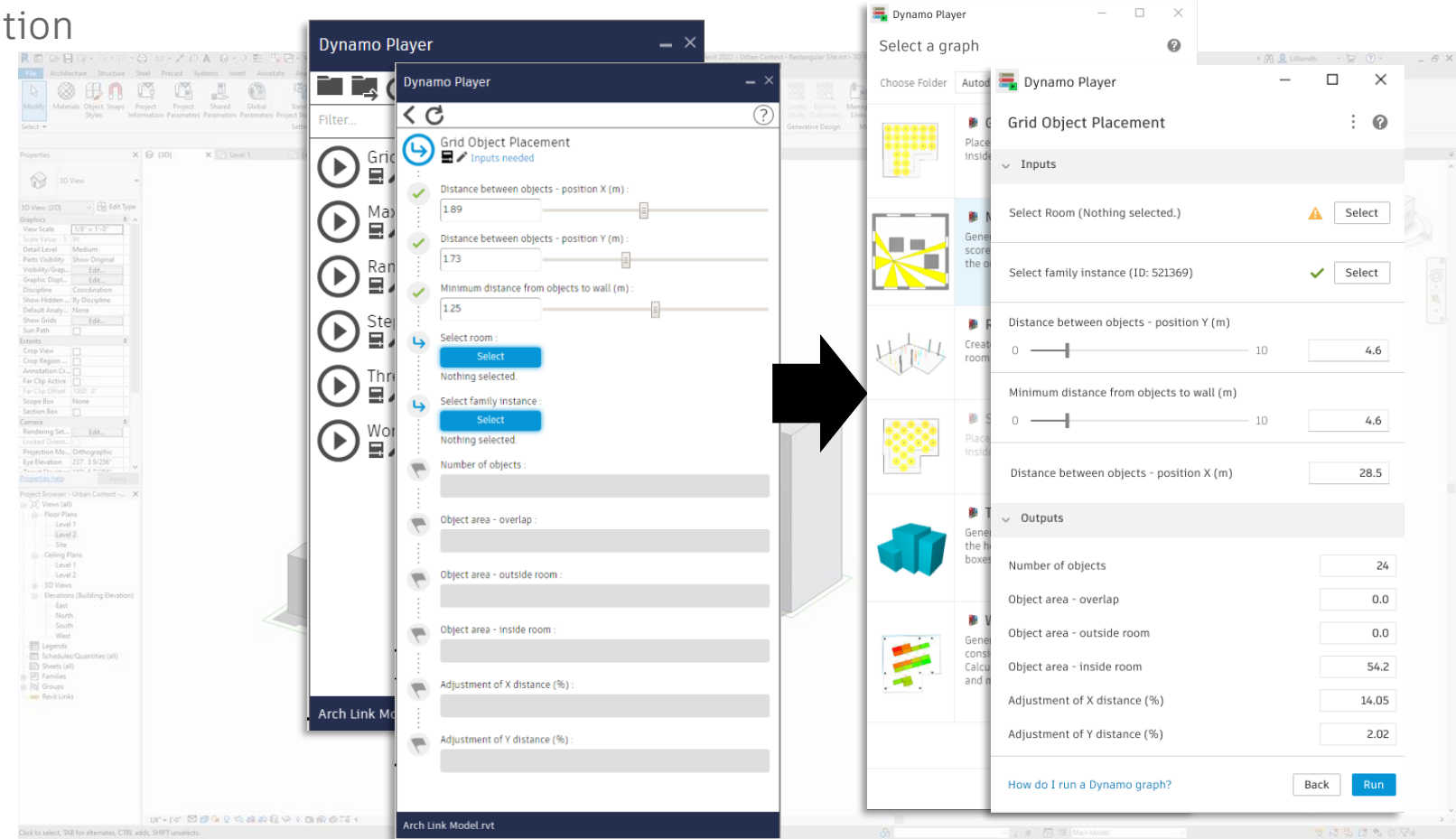
Generative Design to Core Dynamo

For use with all Dynamo Integrations



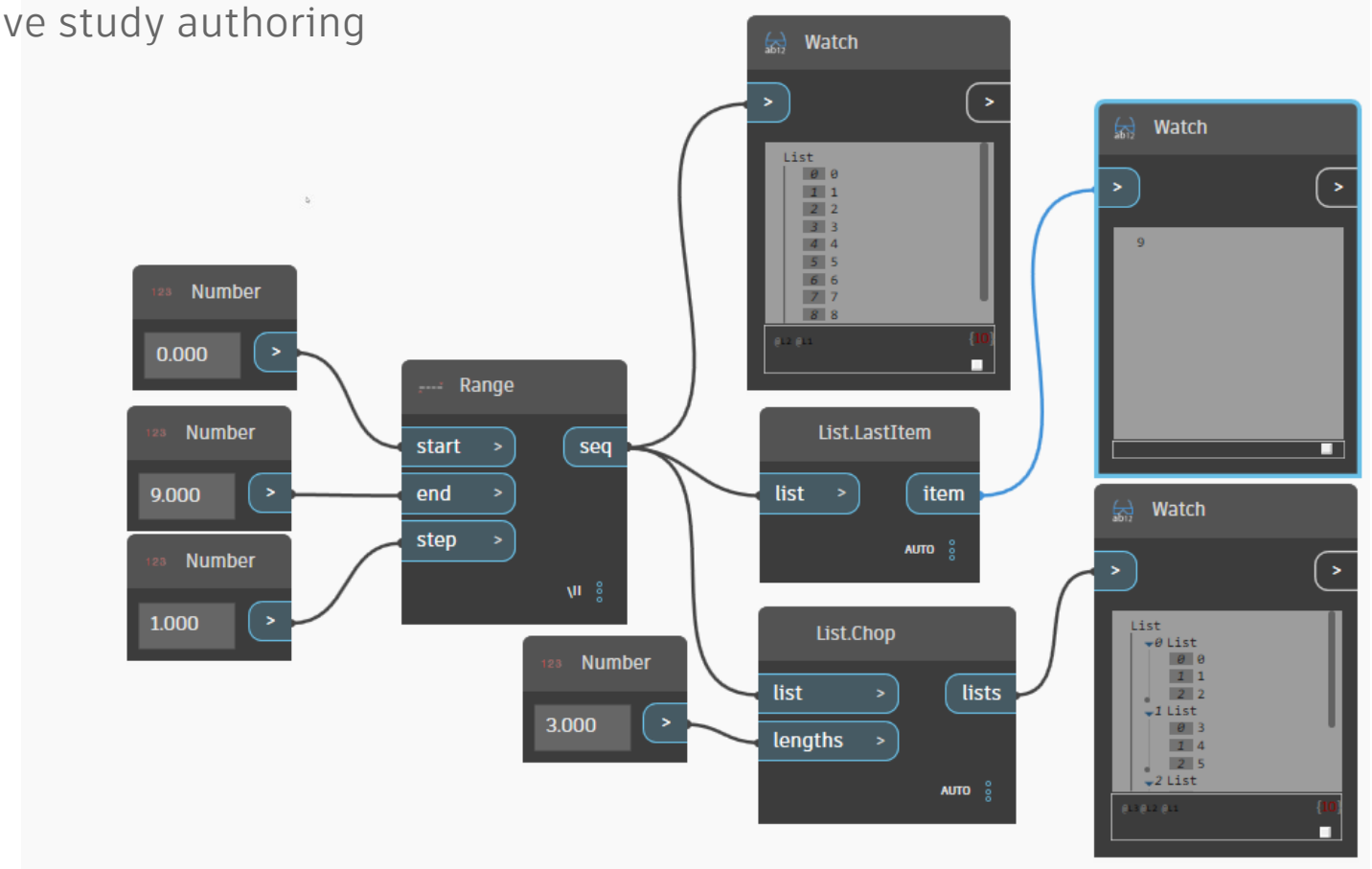
Dynamo Player Updates

BIM automation



Dynamo UI Updates

Easier generative study authoring



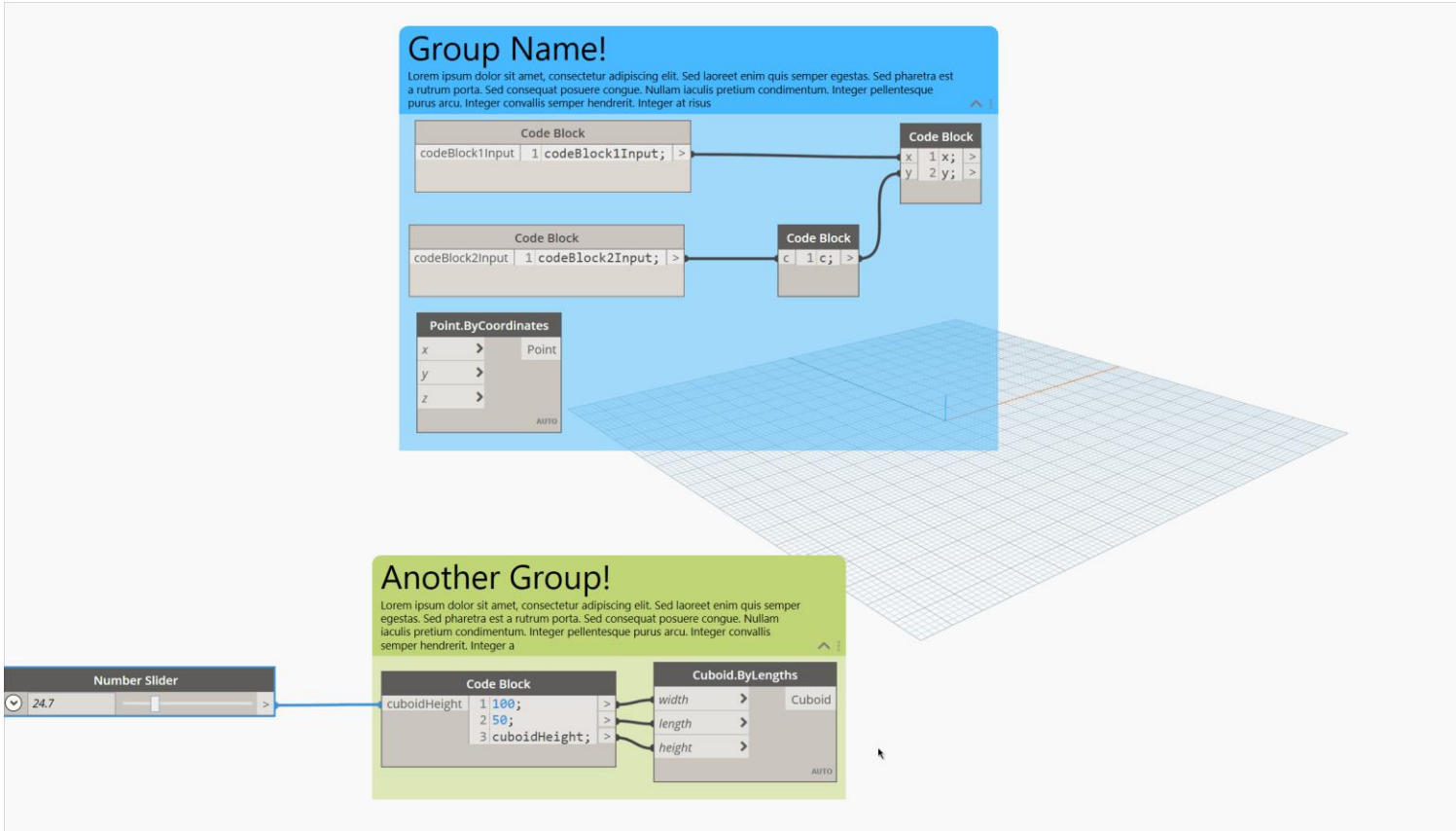
Dynamo UI Updates

Easier authoring



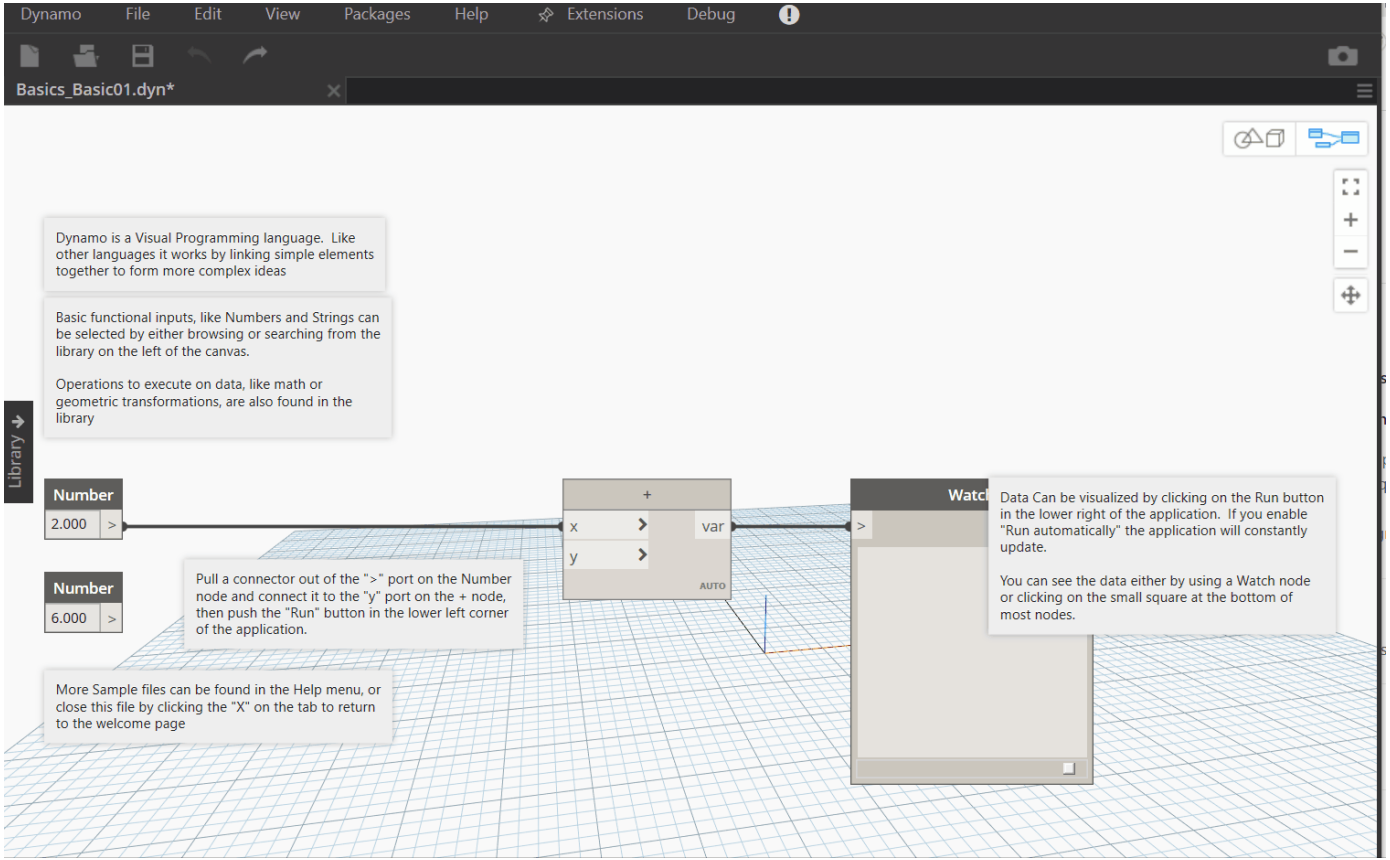
Dynamo UI Updates

Easier authoring



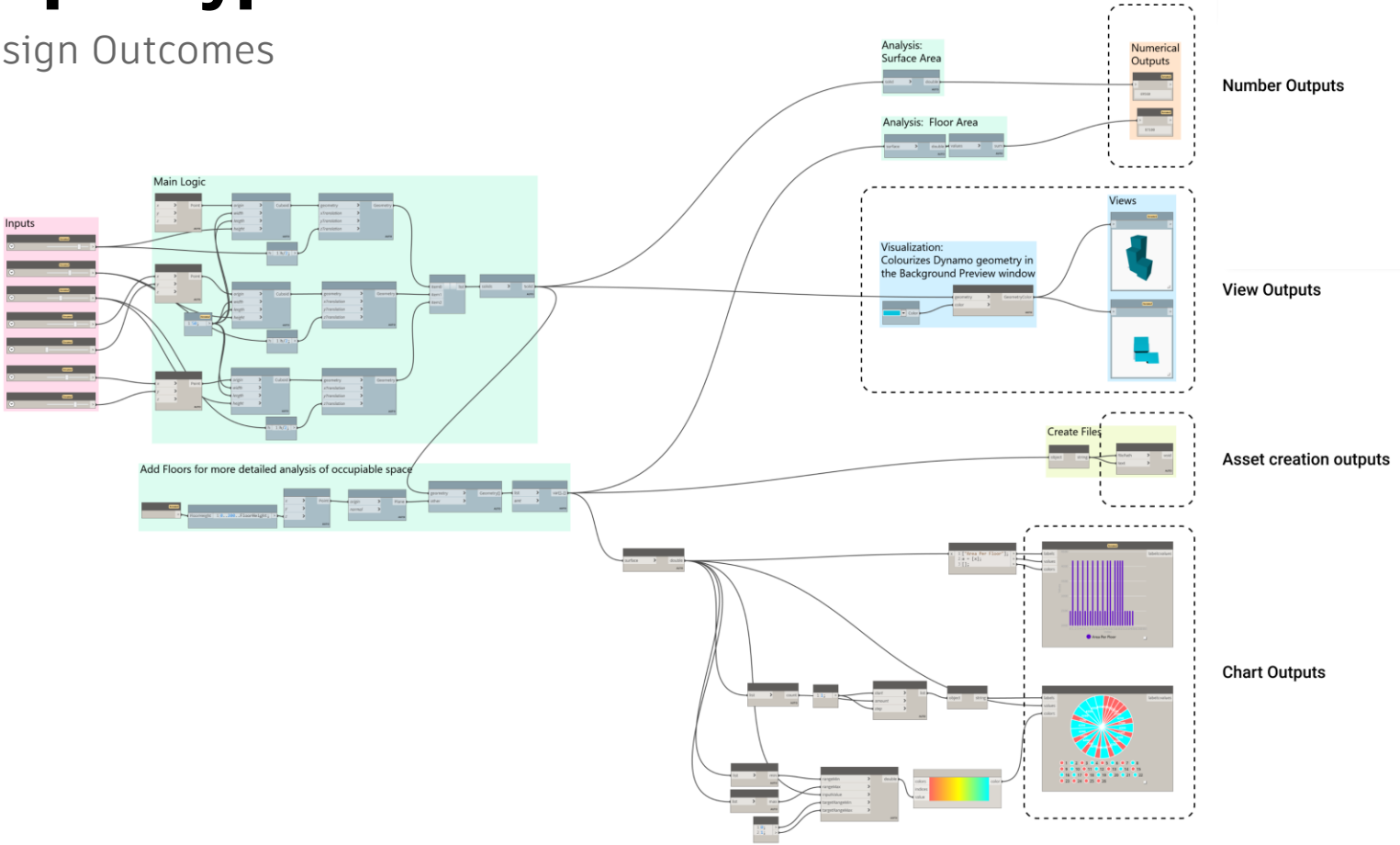
Dynamo Node Auto-complete

Easier authoring



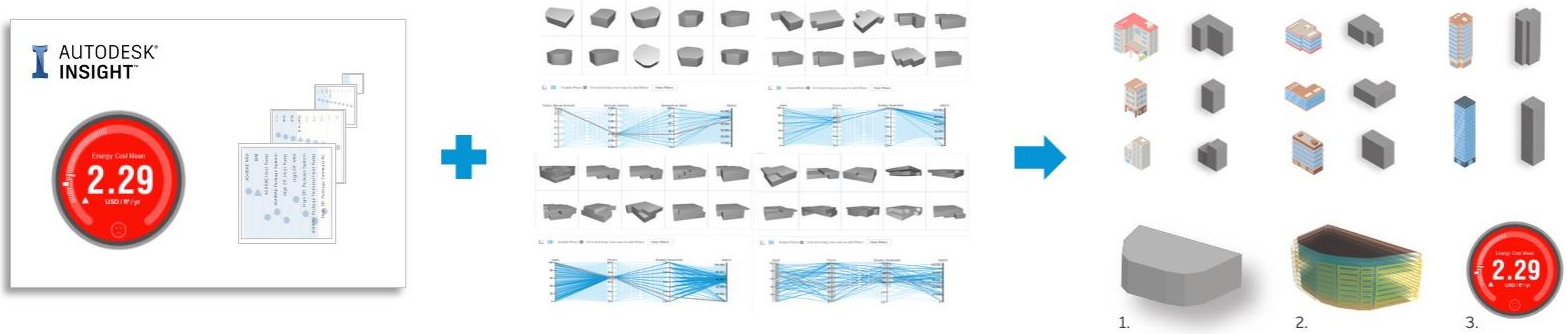
More output types

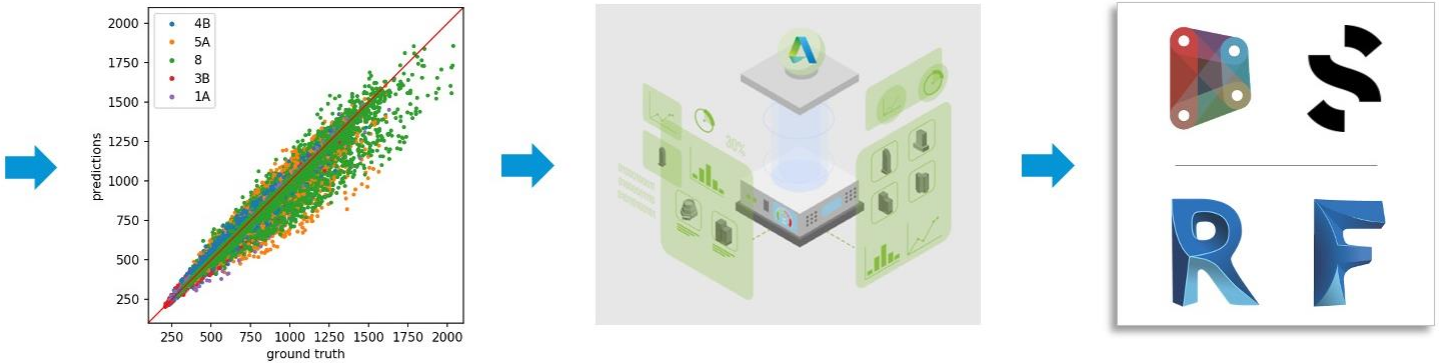
Generative Design Outcomes



Fast Energy Analysis

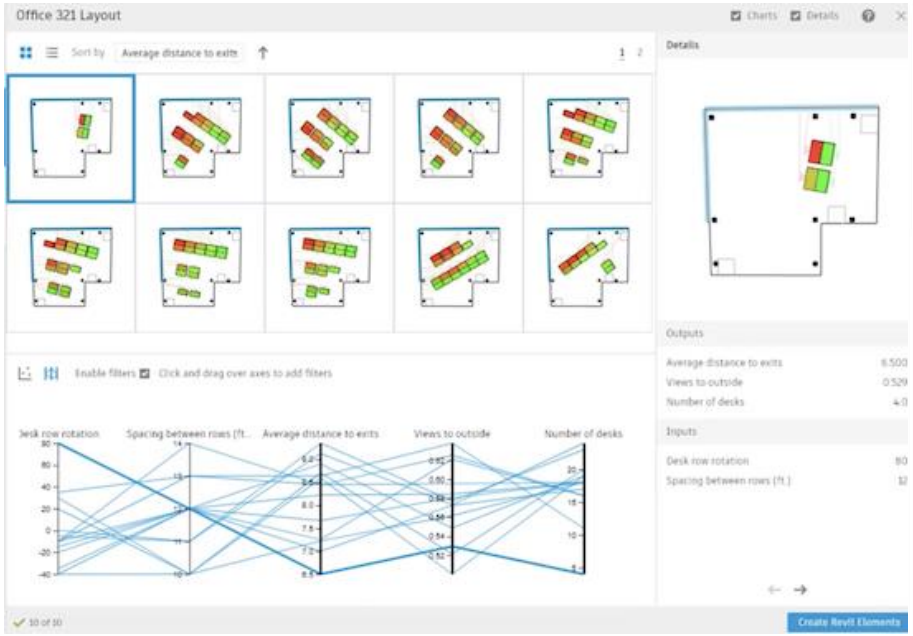
Machine learning enabled energy analysis for use with generative design

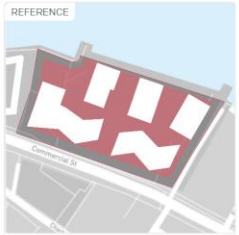




Spacemaker Synergies

Data driven design exploration





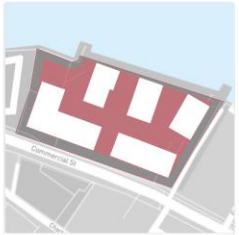
L Family_copy1
Scenario: kronz01
Folder: ---
Last edited: 7 Dec

Geometry	
GFA	635541 ft²
GFA % site area	137.44 %
GIA	571987 ft²
GIA % site area	123.7 %
BC	173515 ft²
BC % site area	37.52 %
Facade area	766819 ft²
Noise	
Outdoor area in red zone	27.7 %
Facade in red zone	14.6 %
View	
View - facade	859 ft
Area: River	35.42 %
Area: Park	19.11 %



Podium and Tower
Scenario: kronz01
Folder: ---
Last edited: 7 Dec

Geometry	
GFA	-58419 ft² (-9.2%)
GFA % site area	-12.63 pp (-9.2%)
GIA	-52577 ft² (-9.2%)
GIA % site area	-11.37 pp (-9.2%)
BC	+14072 ft² (+8.1%)
BC % site area	+3.05 pp (+8.1%)
Facade area	-61960 ft² (-8.1%)
Noise	
Outdoor area in red zone	-2.9 pp (-10.5%)
Facade in red zone	-1.2 pp (-8.2%)
View	
View - facade	+43 ft (+5.0%)
Area: River	-1.21 pp (-3.4%)
Area: Park	-4.9 pp (-25.6%)



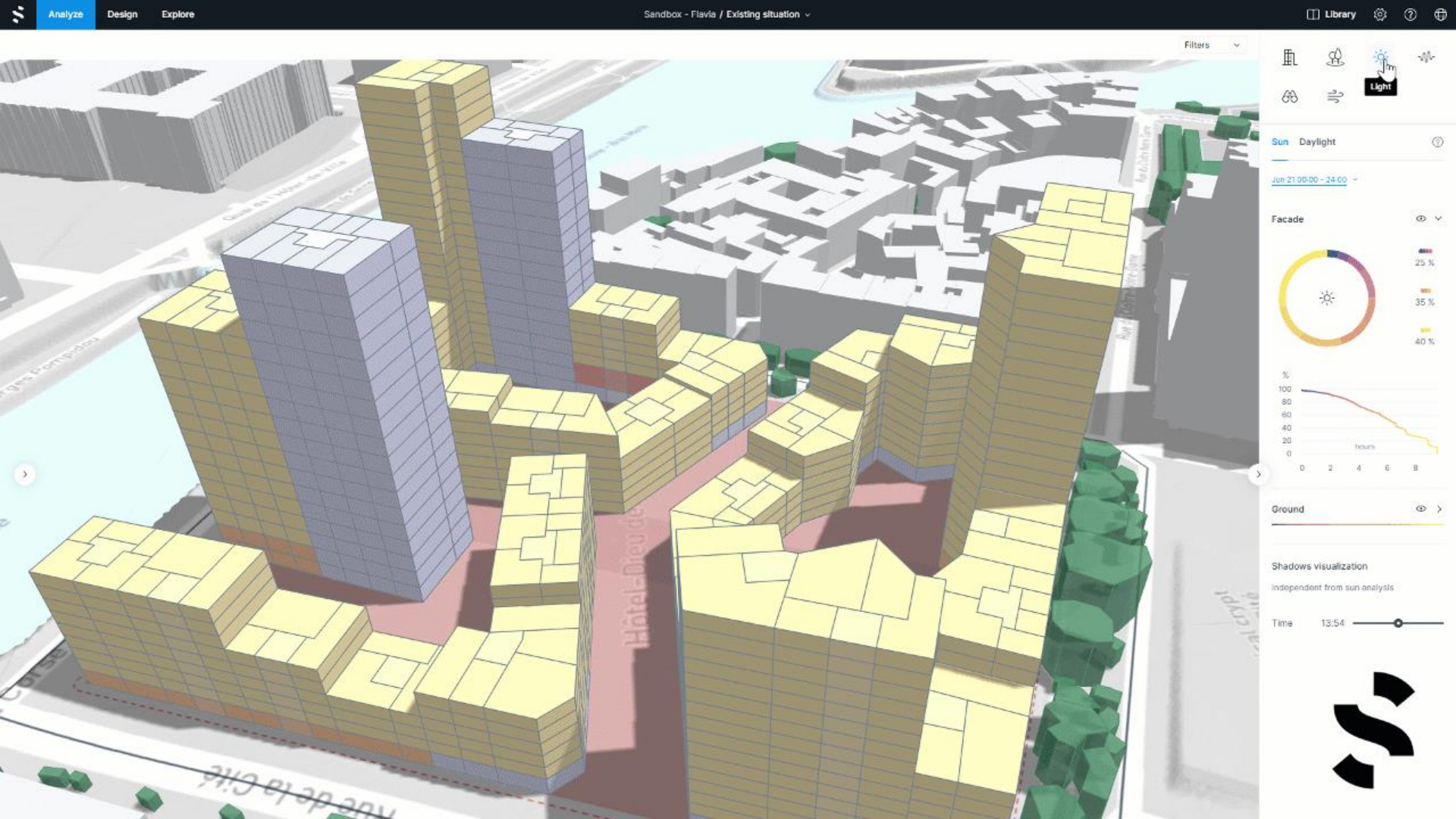
L Family
Scenario: kronz01
Folder: ---
Last edited: 7 Dec

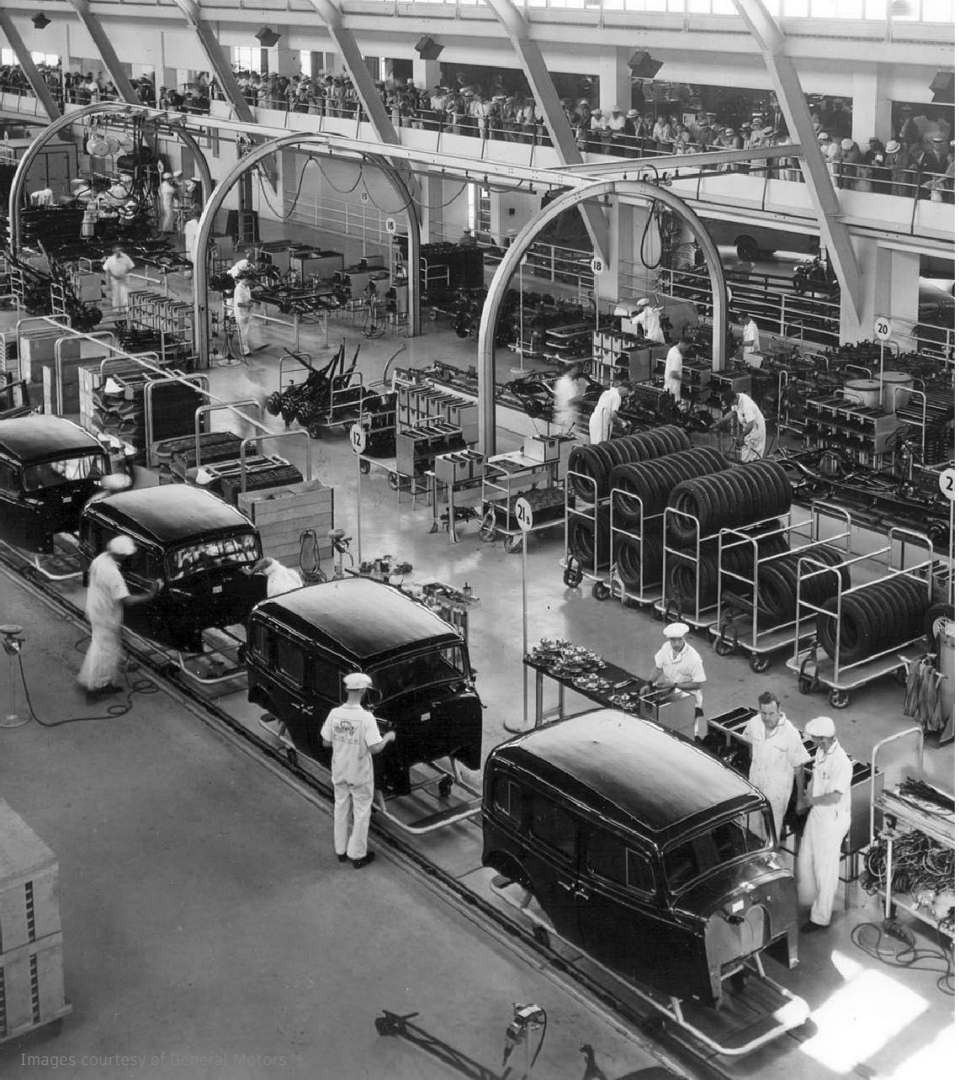
Geometry	
GFA	+19122 ft² (+3.0%)
GFA % site area	+4.14 pp (+3.0%)
GIA	+17210 ft² (+3.0%)
GIA % site area	+3.72 pp (+3.0%)
BC	+2109 ft² (+1.2%)
BC % site area	+0.46 pp (+1.2%)
Facade area	+284 ft² (+0.0%)
Noise	
Outdoor area in red zone	-6.4 pp (-23.1%)
Facade in red zone	+0 pp (+0.0%)
View	
View - facade	-6 ft (-0.7%)
Area: River	-0.01 pp (-0.0%)
Area: Park	-1.62 pp (-8.5%)



LLU Scheme
Scenario: kronz01
Folder: ---
Last edited: 7 Dec

Geometry	
GFA	+24048 ft² (+3.8%)
GFA % site area	+5.21 pp (+3.8%)
GIA	+21643 ft² (+3.8%)
GIA % site area	+4.68 pp (+3.8%)
BC	-2550 ft² (-1.5%)
BC % site area	-0.55 pp (-1.5%)
Facade area	-66030 ft² (-8.6%)
Noise	
Outdoor area in red zone	+3.7 pp (+13.4%)
Facade in red zone	-2.6 pp (-17.8%)
View	
View - facade	+111 ft (+12.9%)
Area: River	+1.47 pp (+4.2%)


Analyze
Design
Explore
Sandbox - Flavia / Existing situation
Library
Filters
Light
Sun
Daylight
Jun 21 00:00 - 24:00
Facade
25 %
35 %
40 %
%
100
80
60
40
20
0
hours
0
2
4
6
8
Ground
Shadows visualization
Independent from sun analysis
Time
13:54



Images courtesy of General Motors




002·B1·L2·T11
73-7 3/8
002·B1·L4·T10
FIRE
FIRE
CINTAS


enel
Green Power

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