

FIRST LEGO LEAGUE KICKOFF PRESENTATION

Stephen R. Lee | AIA, LEED AP

Professor & Head

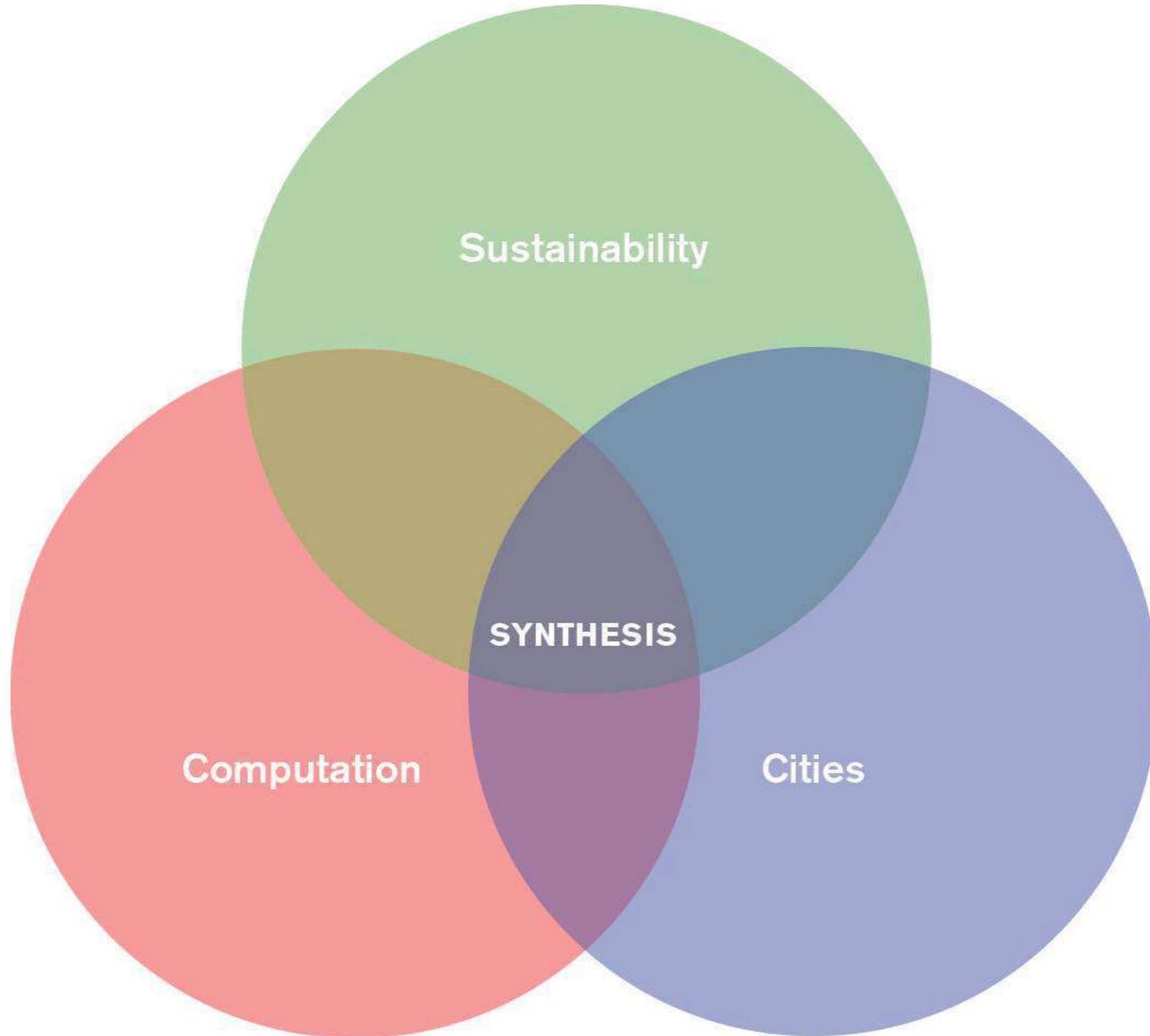
Carnegie Mellon University

School of Architecture

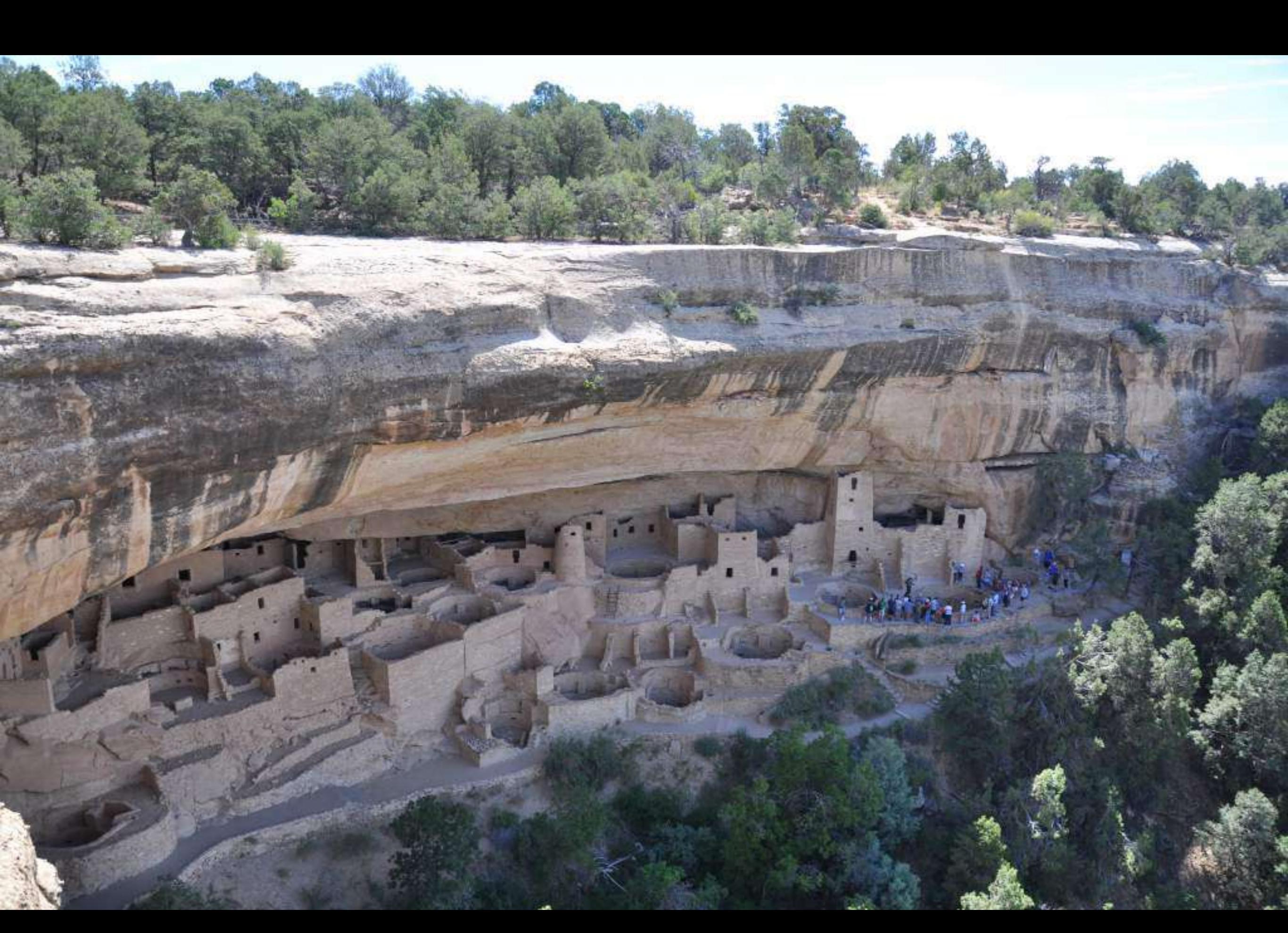
Design Intelligence Scenarios: 2025

- The global population will soar to 8.35 billion people, the majority of whom will live in **cities**
- Standard operating procedure will be based **sustainability sciences**
- Construction sites will be dominated by **construction robotics**
- The **Internet of Things (IoT)** will become (is) ubiquitous & will drive change in buildings

Integrating Three Themes



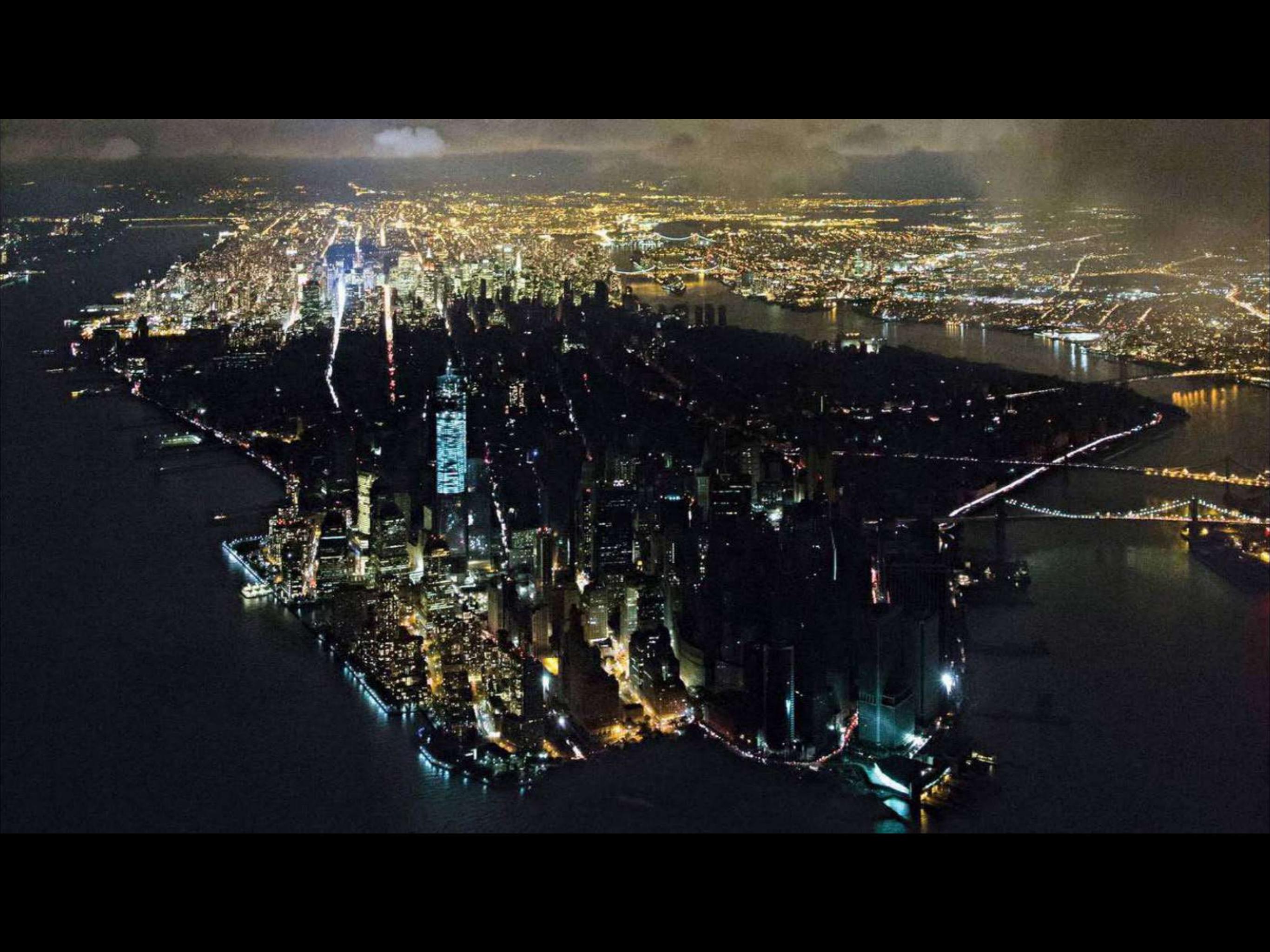
In Teaching, Practice & Research,
the SoA Integrates Around Three Themes to
Synthesize Creative Solutions for the Built Environment





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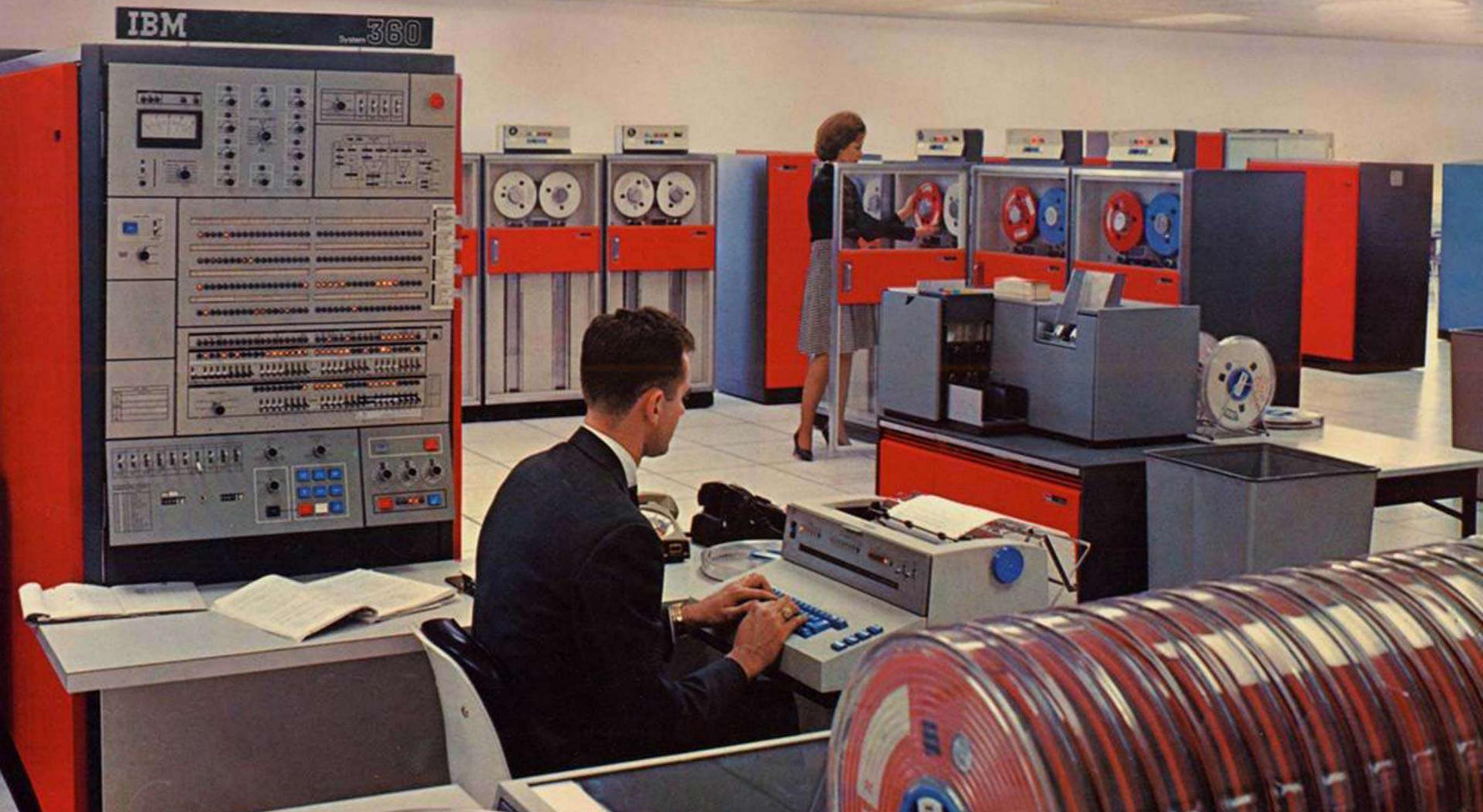






IBM

360







"Did management say you could go off the grid?"



ECO-DISTRICTS

Urban design goals typically include the creation of diverse, mixed use, walkable communities, the identification of economic drivers, and improved connectivity.

Ecodistrict planning quantifies system performance, assigns value to ecological processes and promotes social equity in scalar economies.



ENERGY

DIST. GENERATION &
ENERGY COOPS
economic driver



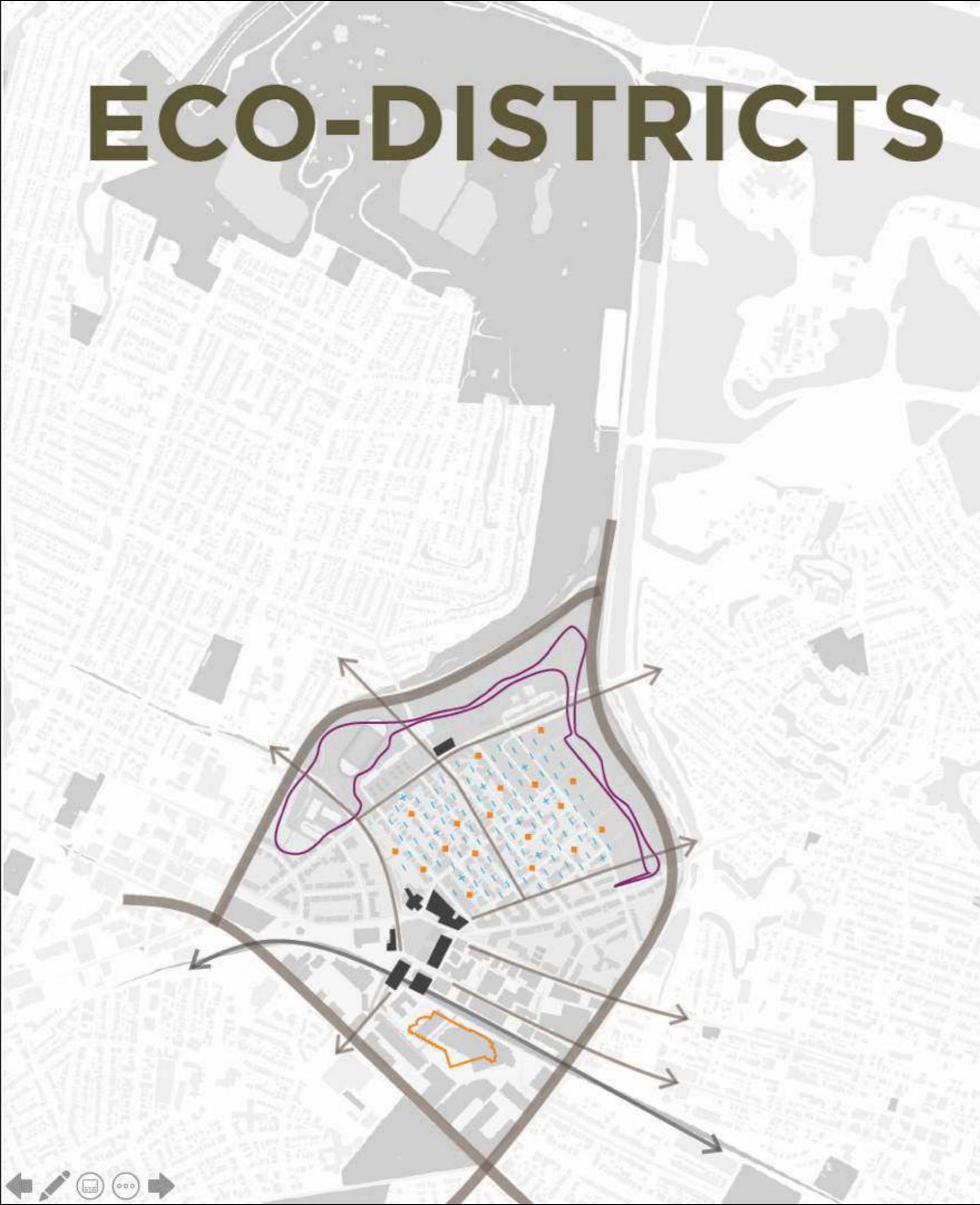
WATER

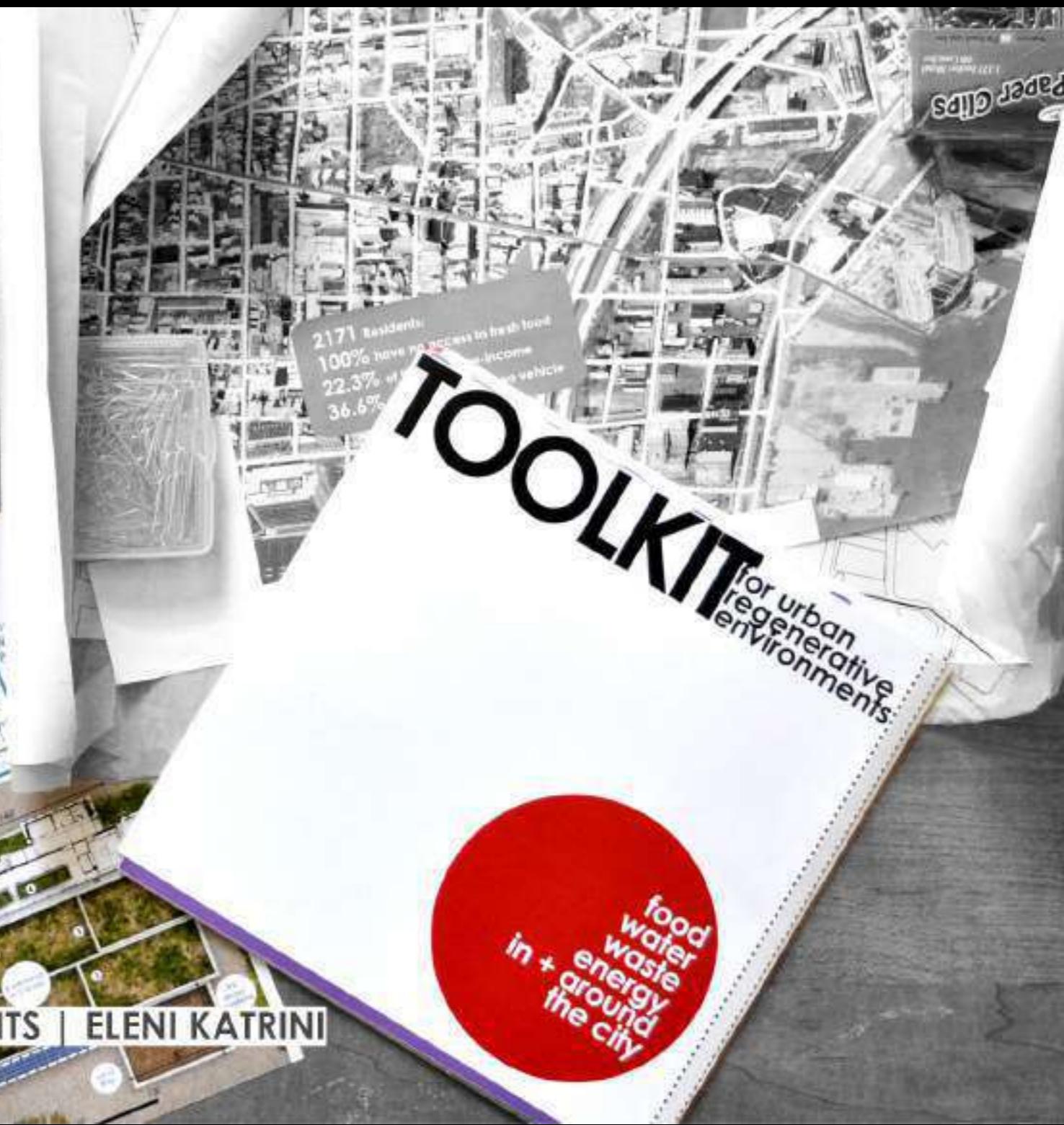
WATER & SEWER
DISTRICTS
economic driver



FOOD

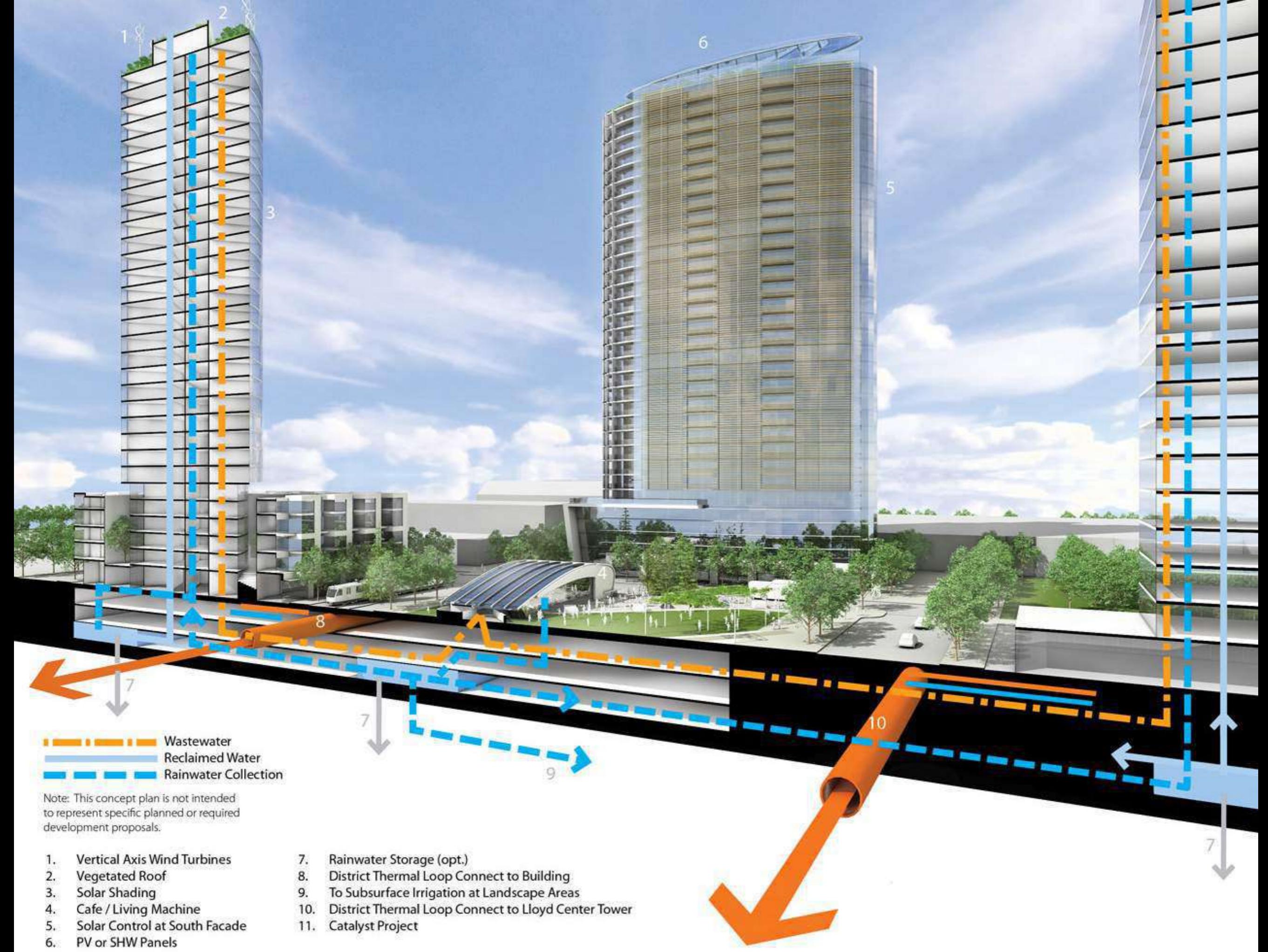
URBAN AGRICULTURE
economic driver





CASE STUDY MATRIX

	FOOD PRODUCTION	STORMWATER MANAGEMENT	WASTEWATER TREATMENT	ENERGY from WASTE
0 - 5 acres	 FOOD PRODUCTION 0.003 acres 320 plants	 STORMWATER MANAGEMENT 0.005 acres 4 in/h	 WASTEWATER TREATMENT 0.020 acres 2,000 gpd	 ENERGY from WASTE
0-0.005 acres	 0.140 acres 1.12 tons	 0.036 acres 1680 plants	 0.060 acres 100,000 gpd	
0.02 - 0.1 acres	 0.850 acres 40 tons	 1.000 acres 3 tons	 0.105 acres 30,000 gpd	 0.310 acres annual waste treatment: 5,000 tons annual biogas: 5,860 mmBtu
0.1- 1.0 acres	 0.850 acres 7 tons	 0.308 acres 7 in/h	 0.140 acres 52,000 gpd	
1.0-10.0 acres	 4.000 acres 12 tons			 7.900 acres 550,000 tons
				 3.000 acres annual treatment: 600,000 tons biogas/yr: 235,438 mmBtu



COMMERZBANK HQ

TALLEST TOWER IN EUROPE
AT 53 STORENS!

GREEN AGENDA...

4 STOREN
GARDENS

VIEWS THRU'
BUILDING

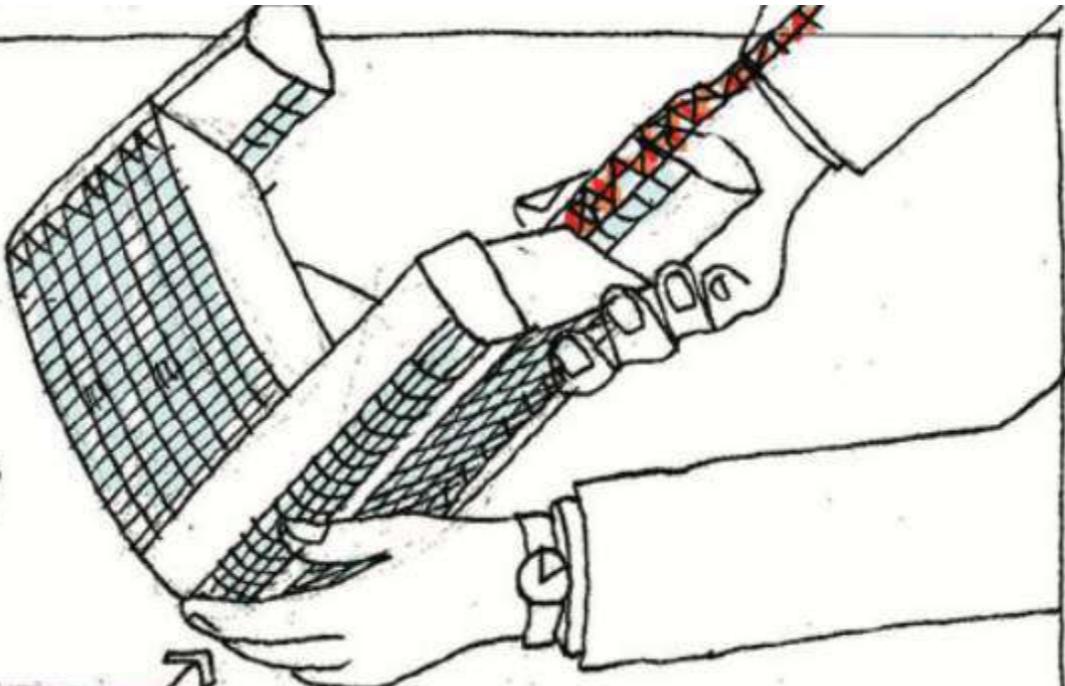
PUBLIC
SPACE
BASE

HIGH SPEED
LIFTS

VIEWS OUT
OF BUILDING,
OVER FRANKFURT

VIEWS FROM, TO AND
THROUGH THE
BUILDING

SOCIAL SPACE
SERVES BANK & COMMUNITY



Eco-District Concept – Millvale



URBAN - FORM

Understanding the Urban Fabric is crucial to analyze any urban environment. The physical relationship between the built up spaces and the open spaces, the connection of the buildings to the street are some to name a few. This would help reinforce the sense of the built environment.

Urban Design/ Build Studio – Puriflume

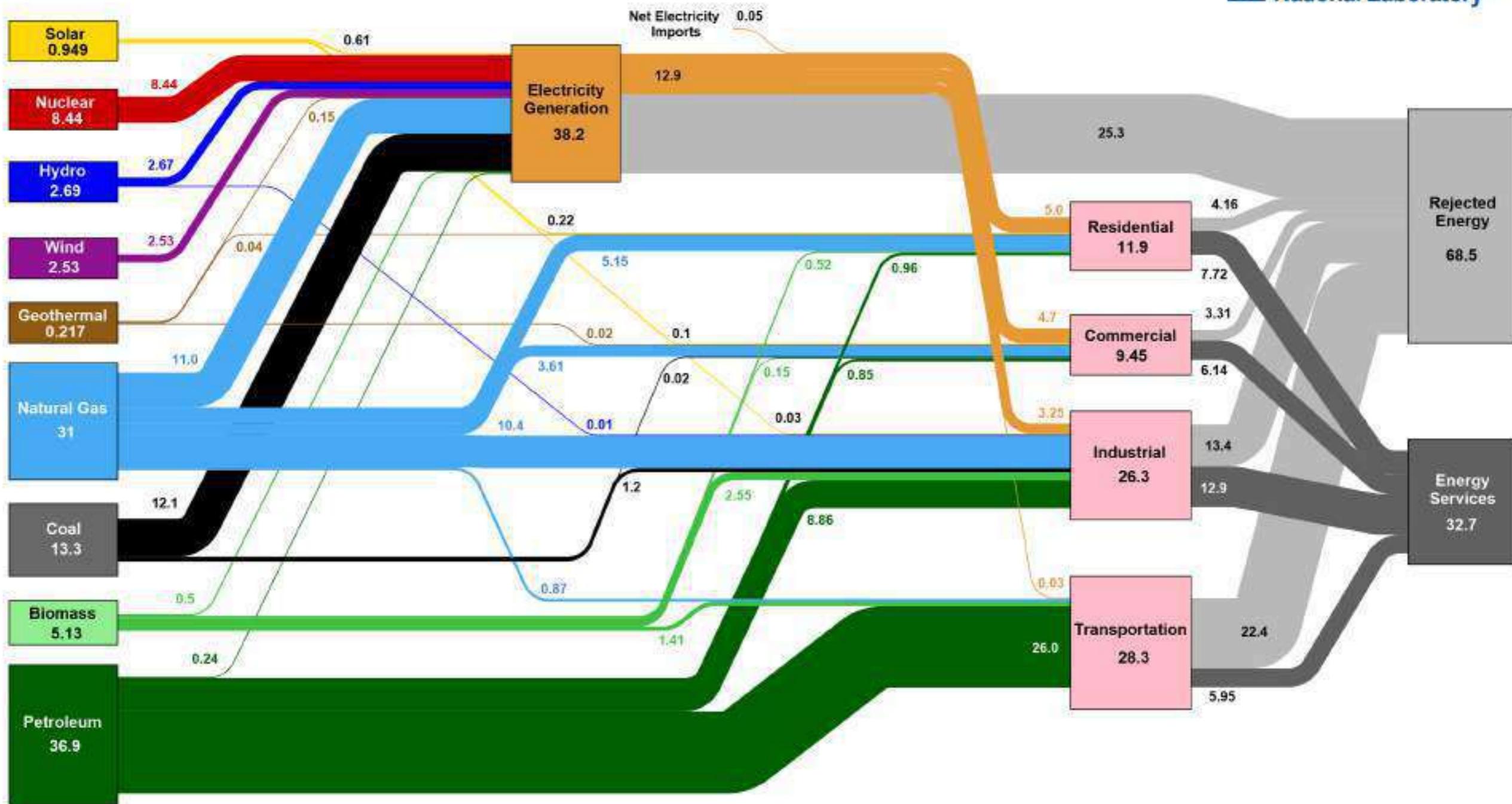




PuriFlume, Urban Design/ Build Studio, Carnegie Mellon SoA, Pittsburgh, PA, USA on Exhibit at the Hong Kong Biennale

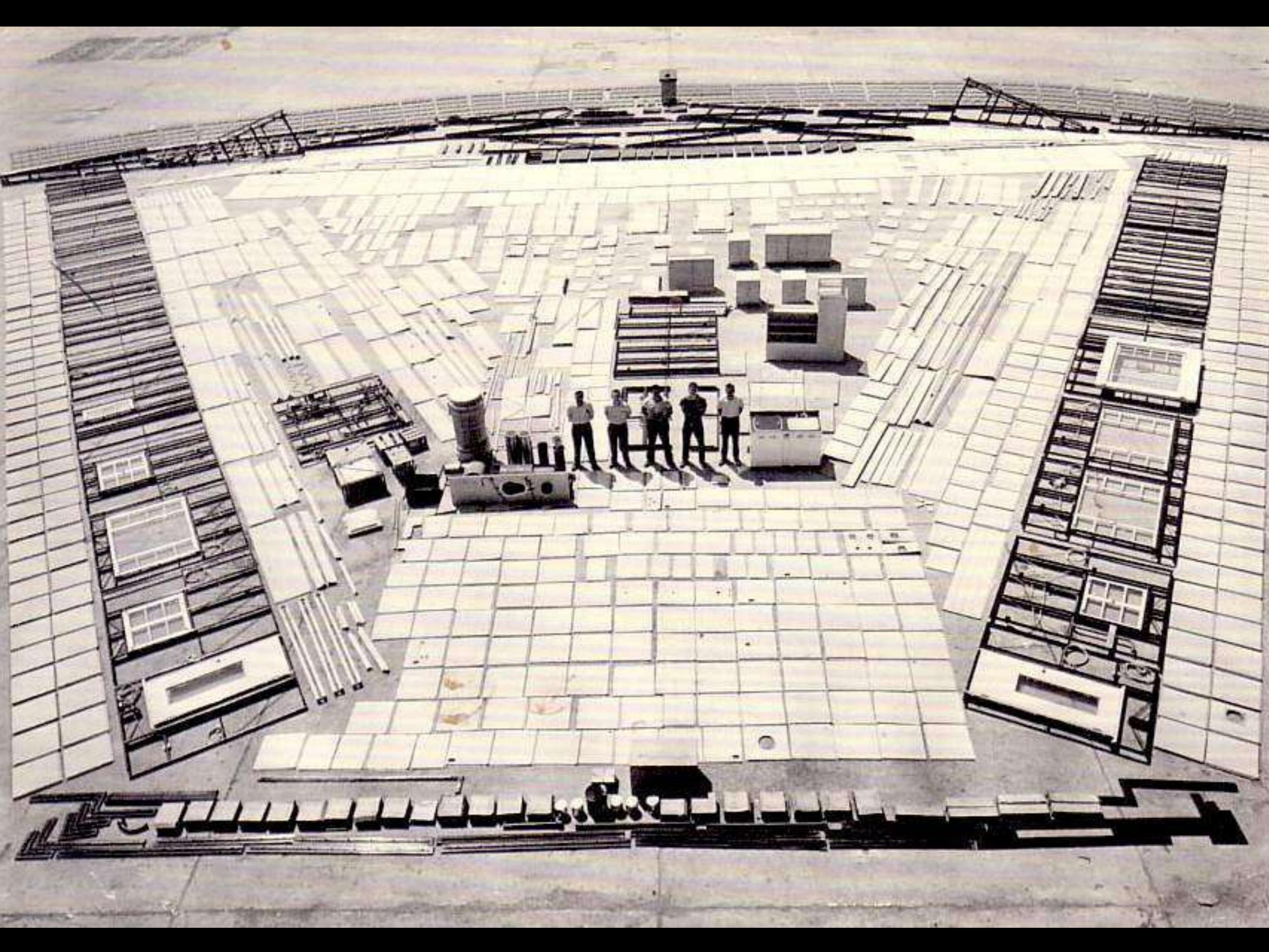
Estimated U.S. Energy Consumption in 2018: 101.2 Quads

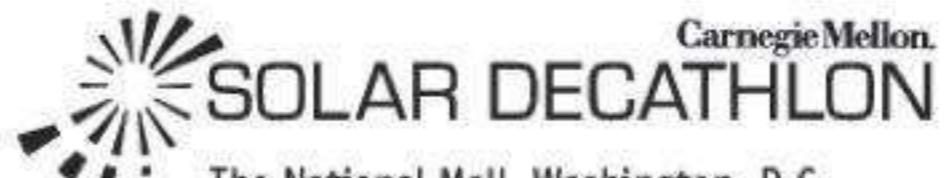
 Lawrence Livermore
National Laboratory



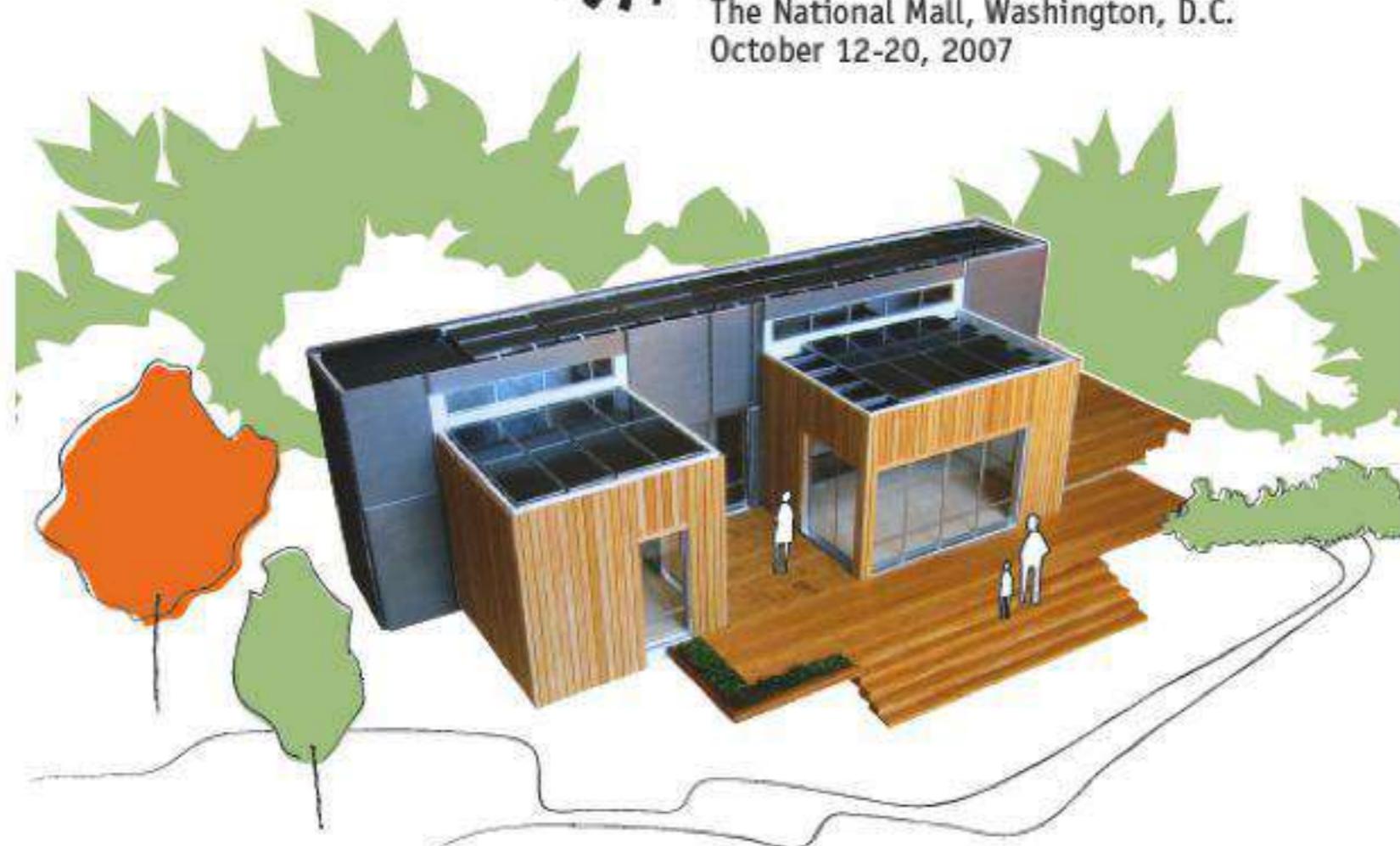
Source: LLNL March, 2019. Data is based on DOE/EIA MER (2018). If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Distributed electricity represents only retail electricity sales and does not include self-generation. EIA reports consumption of renewable resources (i.e., hydro, wind, geothermal and solar) for electricity in BTU-equivalent values by assuming a typical fossil fuel plant heat rate. The efficiency of electricity production is calculated as the total retail electricity delivered divided by the primary energy input into electricity generation. End use efficiency is estimated as 65% for the residential sector, 65% for the commercial sector, 81% for the transportation sector and 49% for the industrial sector, which was updated in 2017 to reflect DOE's analysis of manufacturing. Totals may not equal sum of components due to independent rounding. LLNL-MI-010527.







The National Mall, Washington, D.C.
October 12-20, 2007



triPOD

This year, the team will offer an innovative way of looking at sustainable solar design by creating a "Plug n' Play" housing product that employs modularity on a variety of scales, allowing the user to configure and re-configure their home as personal or family needs dictate. All mechanical systems are contained within a central Core which allows for the addition of living spaces or

"Pods" to be added or exchanged with infinite possibility. A modular in-wall shelving system, combined with standardized wall, ceiling and floor panels allows the inhabitant to customize the interior. For the competition, we have designed TriPOD, an 800 ft² home for two. As the name indicates,

this model has three Pods: Kitchen, Bedroom and Live/Work space. Meanwhile, the Core houses all the home's utilities, including a Bathroom and a laundry closet. Our design also seeks to blend indoor and outdoor spaces, showcasing a Greenscape to the north and a Courtyard to the south.

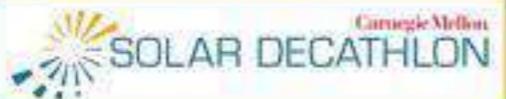
Solar Decathlon is a US Department of Energy sponsored competition that challenges collegiate teams to design and build a solar-powered house. In October of 2007 each of the twenty teams will bring their entry to Washington D.C. where they will compete in a week-long competition. As a third time entrant, we look forward to pushing the envelope even further with this year's "Plug n' Play" modular housing system.

Plug n' Play

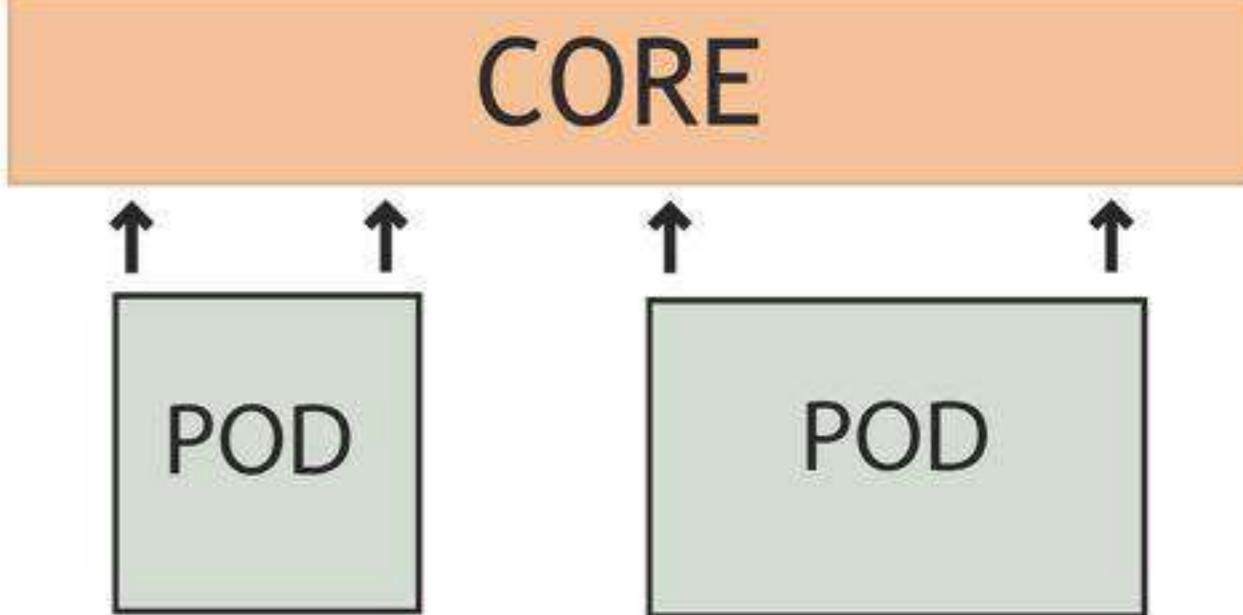
Modularity

Flexibility

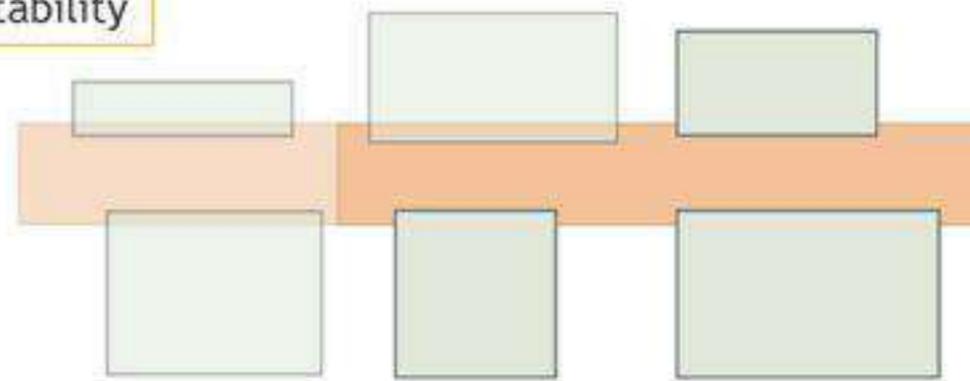
Individual Adaptability



POD



Future Adaptability





Solar Decathlon 2007, SoA, Carnegie Mellon, Pittsburgh, PA, USA

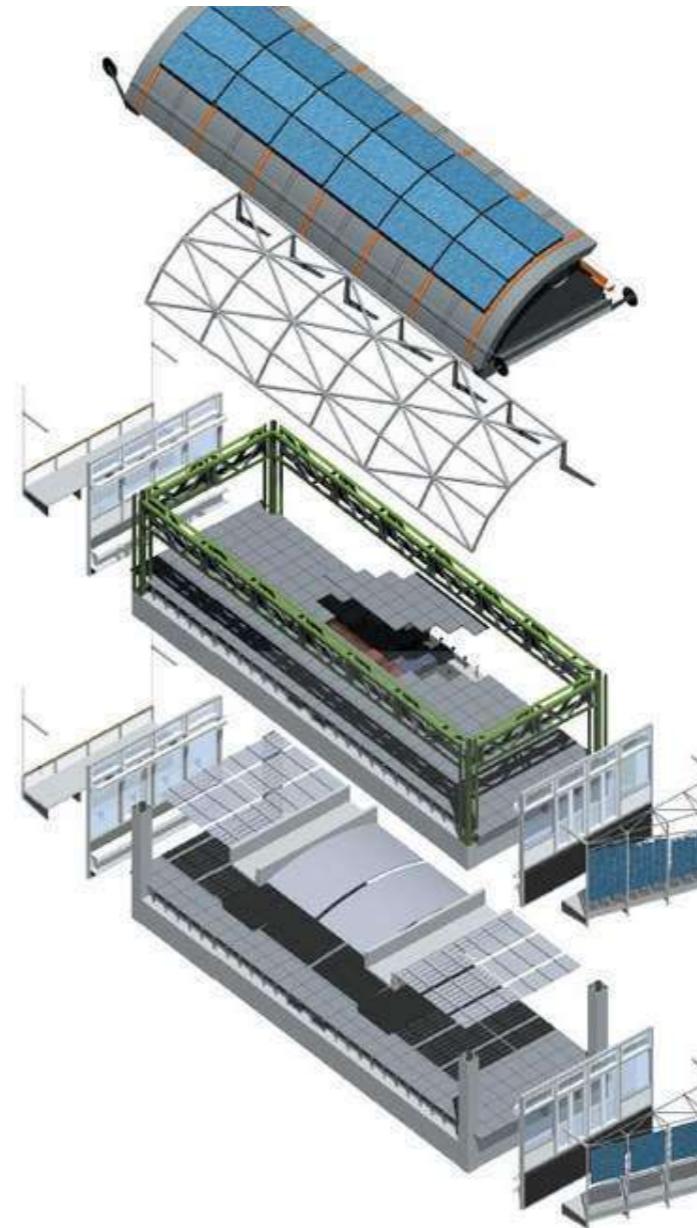
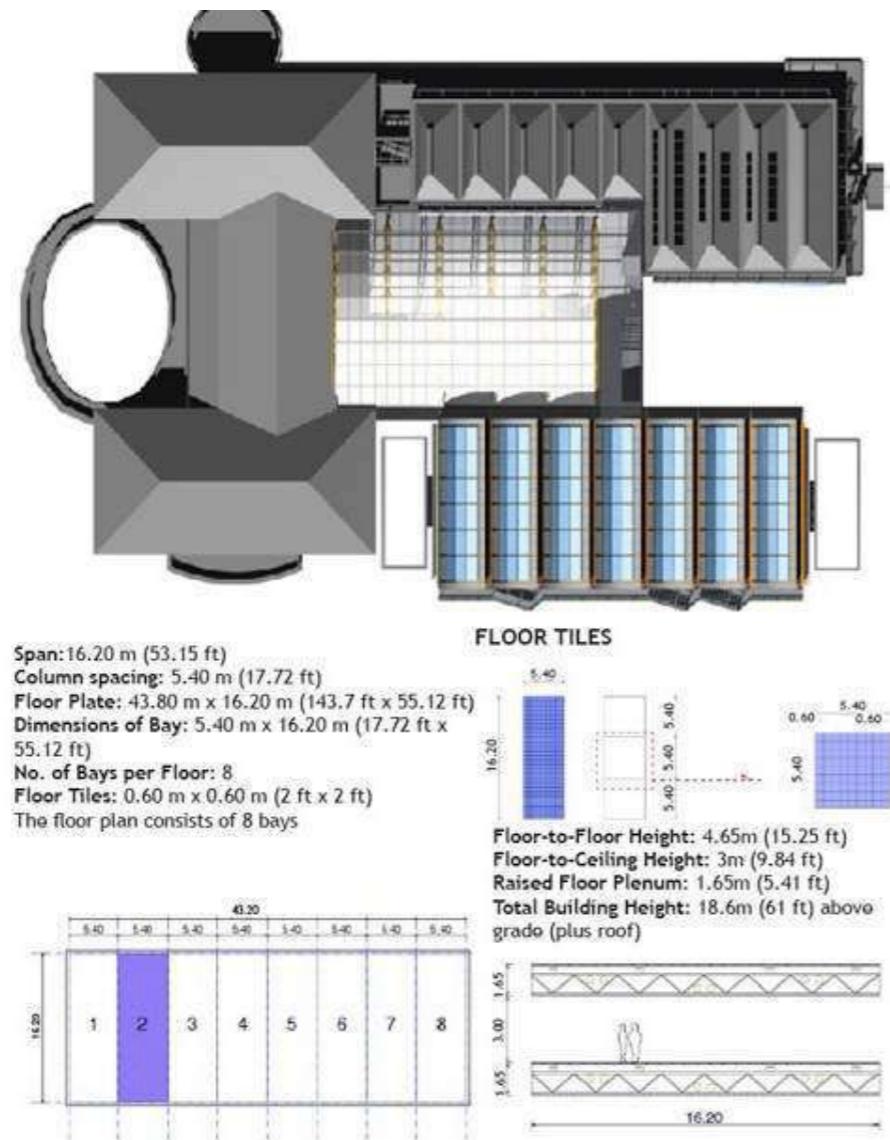




Solar Decathlon 2005, SoA, Carnegie Mellon, Pittsburgh, PA, USA



Systems Integration in the MMX at CMU

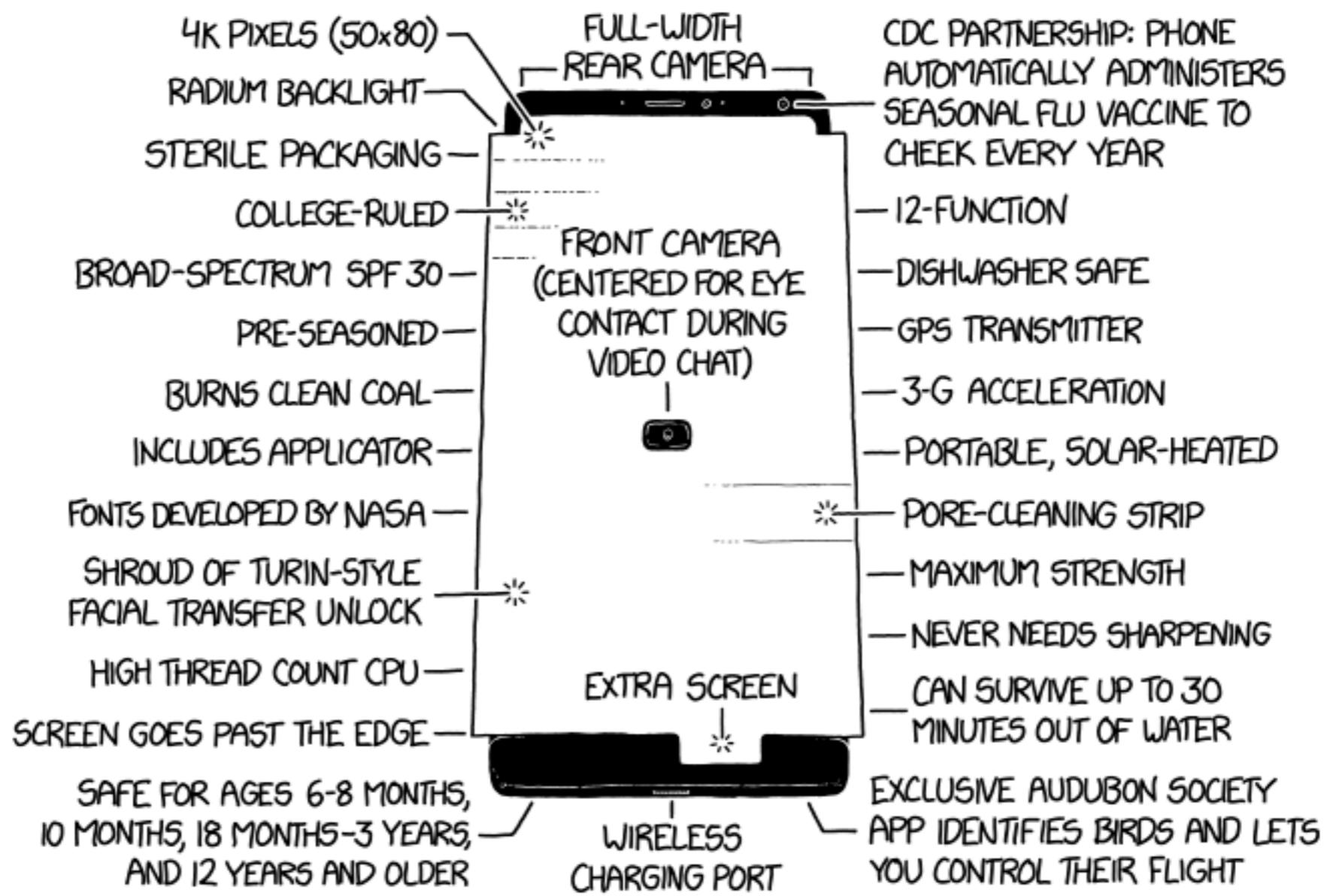




Phipps Center for Sustainable Landscapes, Pittsburgh, PA, USA

Phipps Center for Sustainable Landscapes

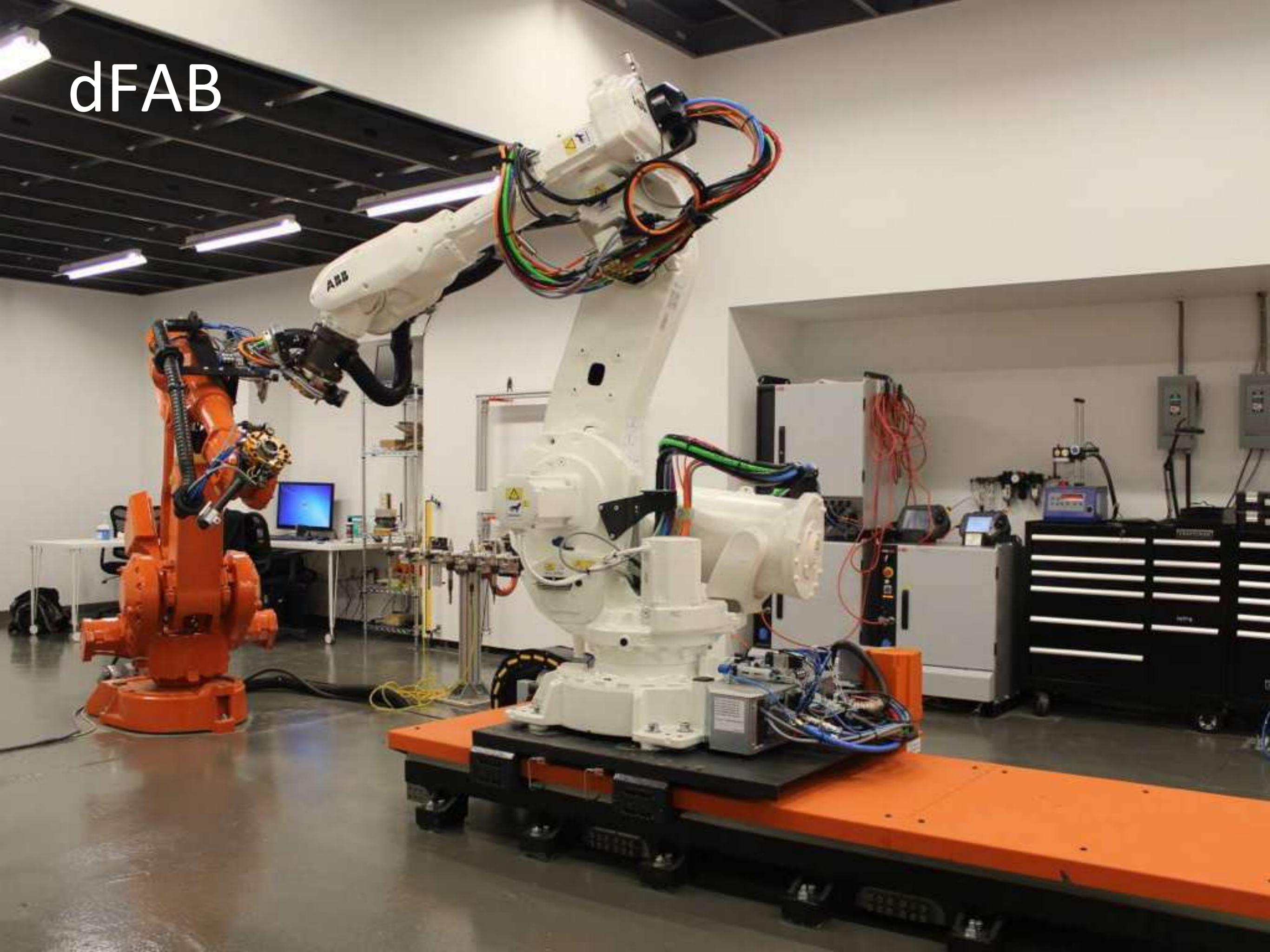
Denmarsh Photography Inc.



INTRODUCING
THE XKCD PHONE 6, VII, 10, X, 26, AND 1876

WE DIDN'T START THIS NONCONSECUTIVE VERSION NUMBER WAR, BUT WE WILL NOT LOSE IT.™®©°

dFAB



dFAB



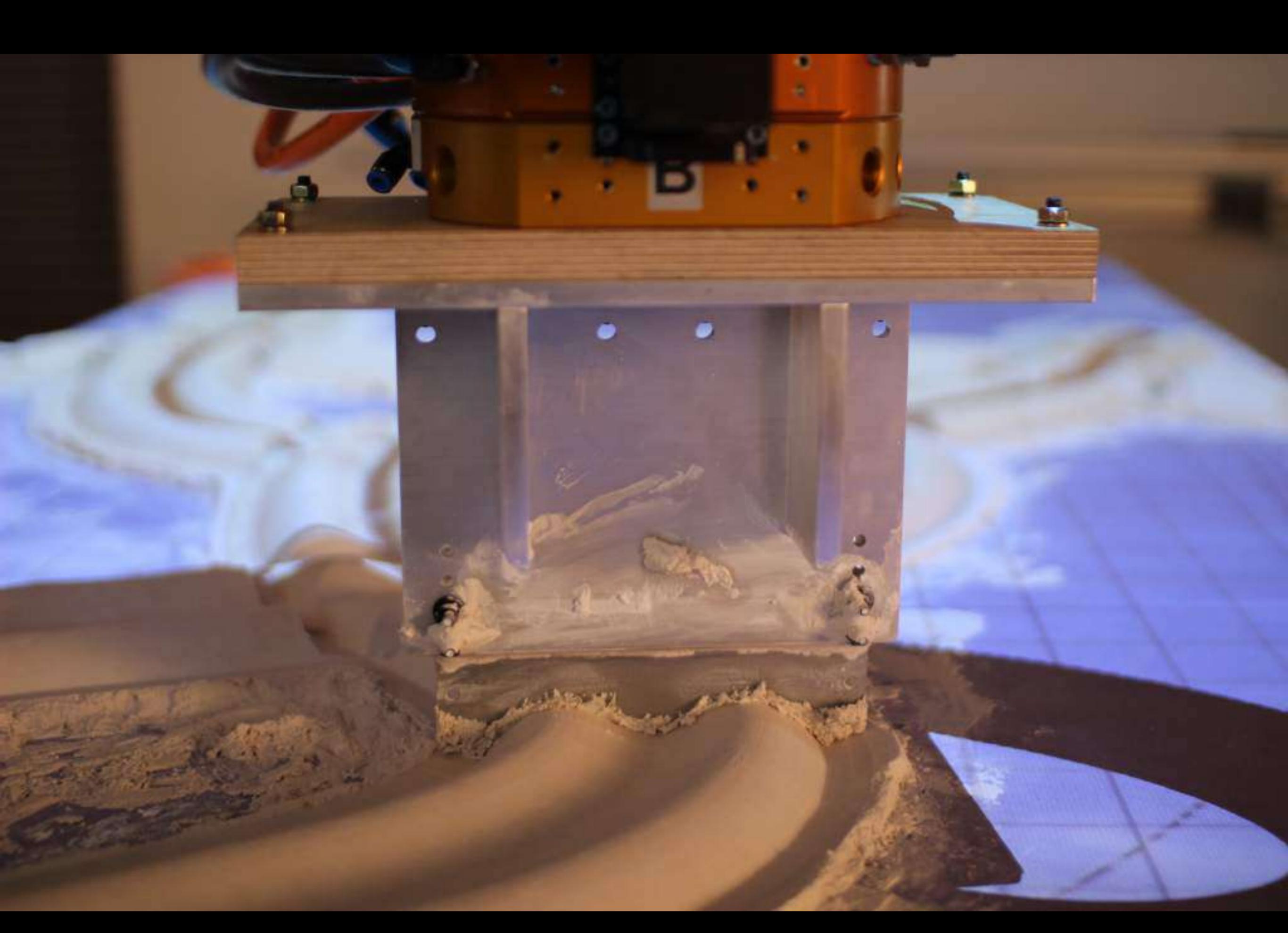
the second in a series called HACLab
that invites you to take part in the
conversation, provide feedback, and
experiment with us as we explore the
significance of the Hall of Architecture
in the 21st century.

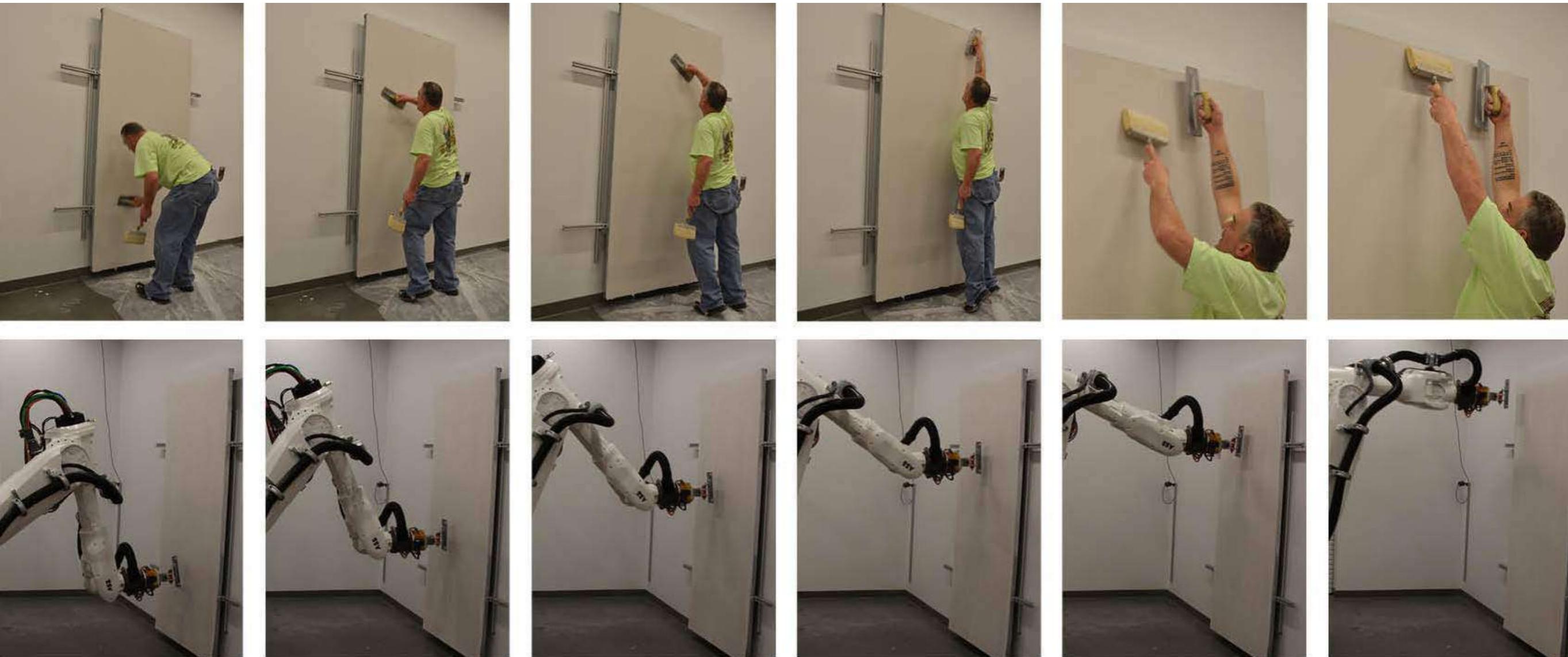
#cmoacopypaste











ROBOTIC PLASTERING

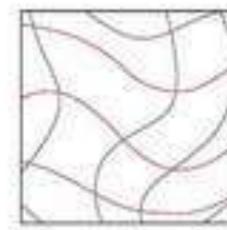
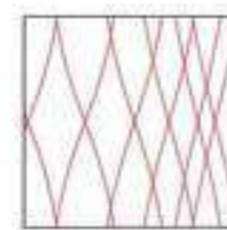
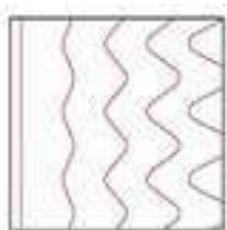
In the face of shrinking labor forces robots will function in on and off-site construction



4x4

19740



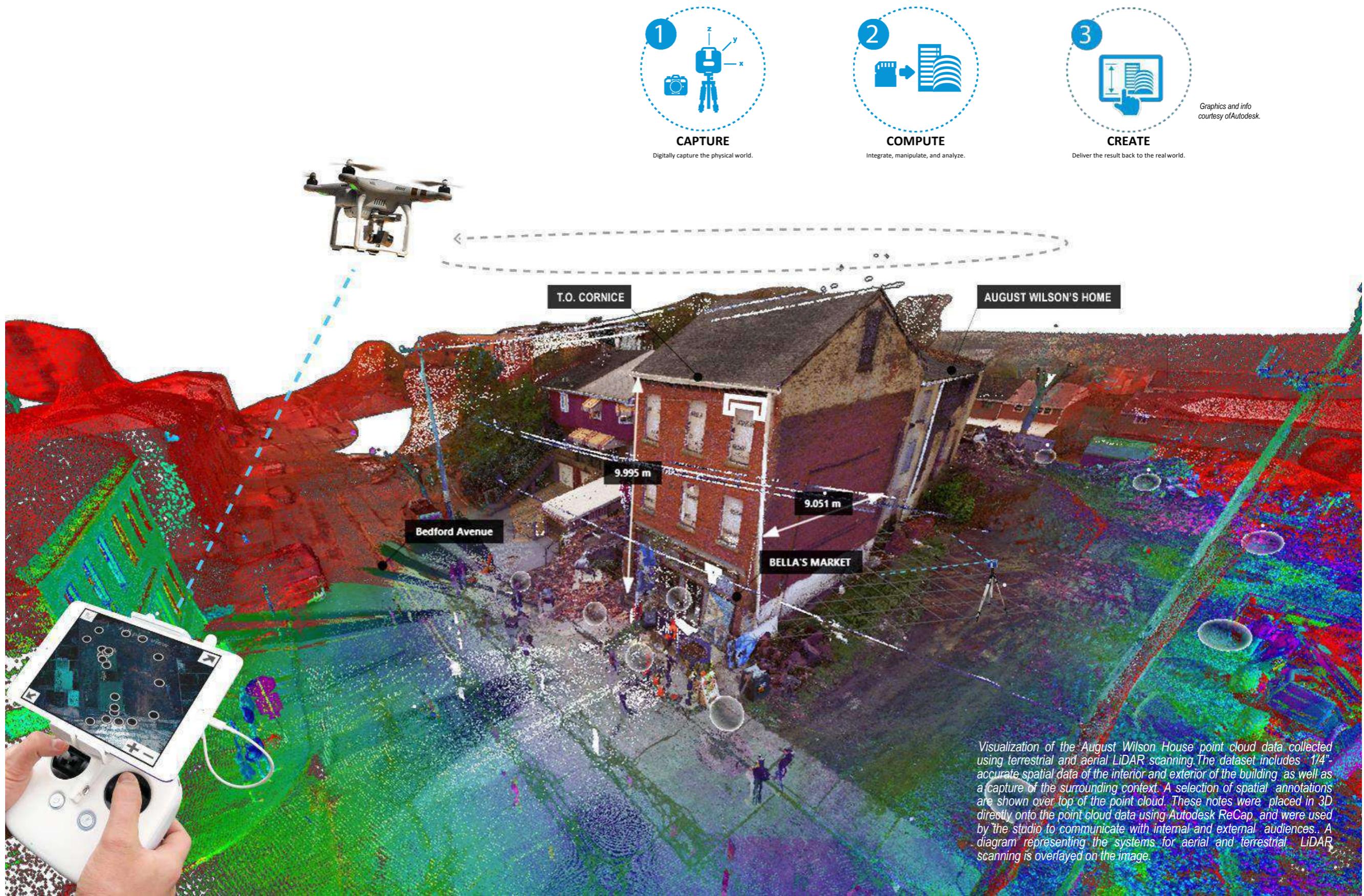




AUGUST WILSON HOUSE
CULTURAL CONSTRUCTION

REALITY COMPUTING

Reality Computing is an emerging field of technology concerned with the **translation of information between physical and digital environments**. Using capture technologies such as **photogrammetry** or **terrestrial/aerial LiDAR** scanning, objects in the physical world can be brought into digital workflows for manipulation/analysis via computational and/or modeling softwares. Experiential technologies including **virtual/augmented reality** and digital fabrication methods such as **3D-printing** and **CNC-milling** can then be used to deliver results back to the physical world. The CULTURAL CONSTRUCTION Studio utilized the August Wilson House as a test-case for developing **innovative applications of Reality Computing technologies for enhancing the efficacy of Historic Preservation**.



Visualization of the August Wilson House point cloud data collected using terrestrial and aerial LiDAR scanning. The dataset includes 1/4-accurate spatial data of the interior and exterior of the building as well as a capture of the surrounding context. A selection of spatial annotations are shown over top of the point cloud. These notes were placed in 3D directly onto the point cloud data using Autodesk ReCap, and were used by the studio to communicate with internal and external audiences. A diagram representing the systems for aerial and terrestrial LiDAR scanning is overlaid on the image.

COMPUTE

Using Photogrammetry and reality computing software

Autodesk ReMake, 3D meshes of existing

artifacts were generated

and analyzed digitally to facilitate reproduction.

Working over top of true orthographic views of the object allowed for precise geometric delineation and eliminated

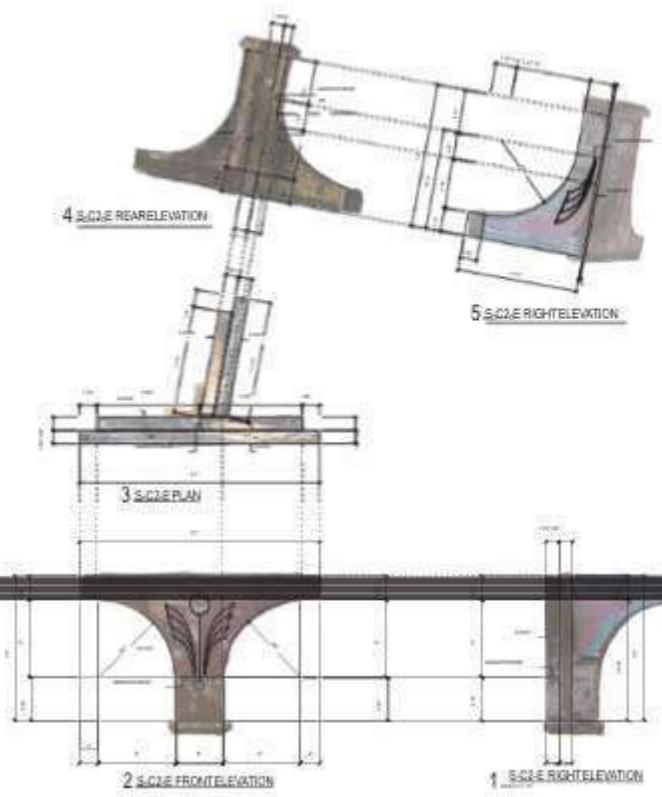
time and labor required to measure and record every facet of the object

via traditional methods.



Front view of colonnette capital 3D-mesh

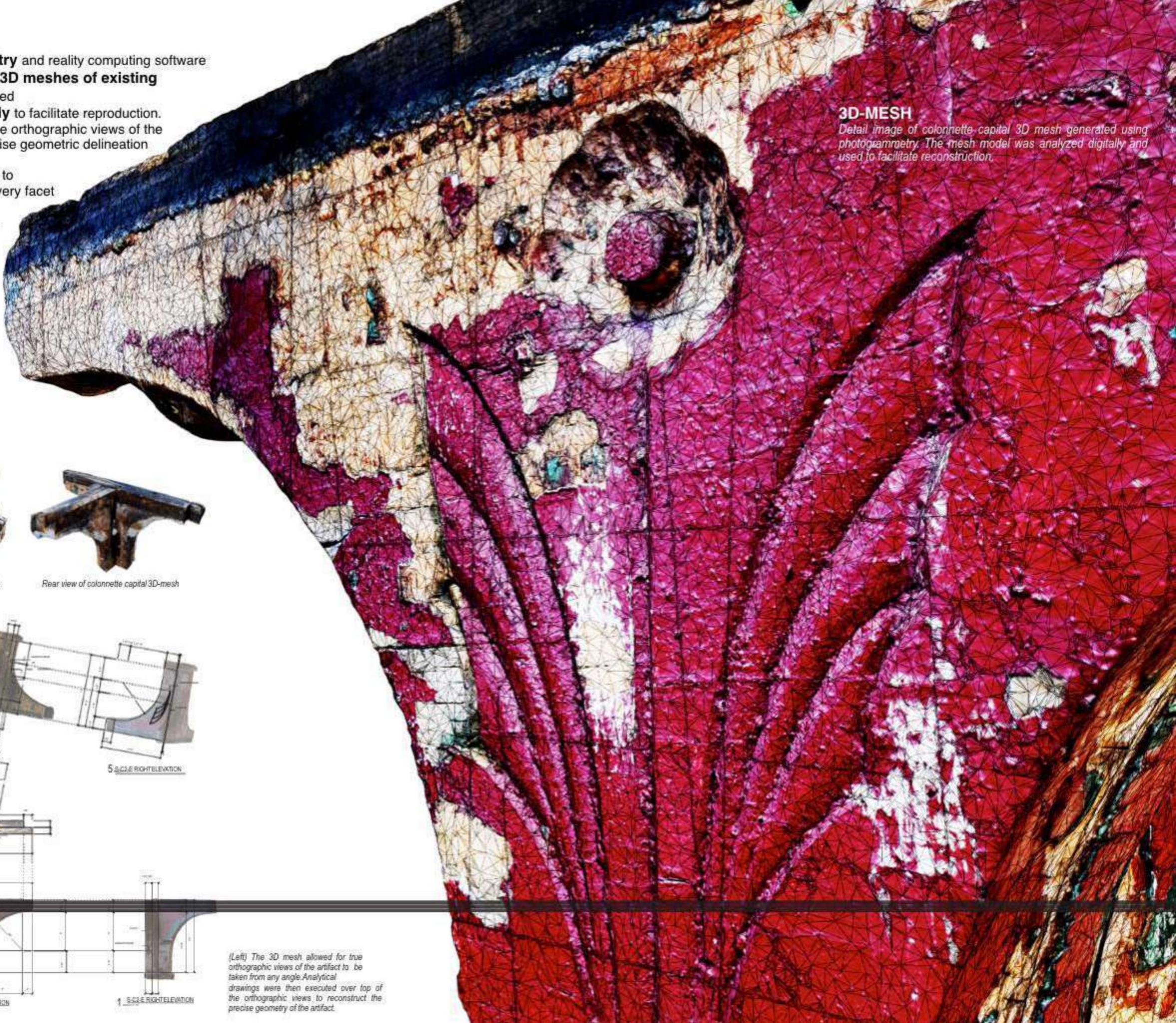
Rear view of colonnette capital 3D-mesh



(Left) The 3D mesh allowed for true orthographic views of the artifact to be taken from any angle. Analytical drawings were then executed over top of the orthographic views to reconstruct the precise geometry of the artifact.

3D-MESH

Detail image of colonnette capital 3D mesh generated using photogrammetry. The mesh model was analyzed digitally and used to facilitate reconstruction.







MODE 3: PRE-FABRICATION

Programs

- Bachelor of Arts in Architecture
- Bachelor of Architecture
- Minors for SoA Students:
 - Architectural Design Fabrication, Architectural History, Architectural Representation & Visualization, Building Science
 - Integrative Design, Arts, and Technology (IDeATe)
- Accelerated Masters Program (AMP)
- Studio-based Masters Programs (3)
 - Advanced Architectural Design, Urban Design, M.Arch (F17)

Programs

- Master of Science Programs (4)
AECM, Building Performance & Diagnostics, Sustainable Design, Computational Design
- PhD Programs (3)
AECM,
Building Performance & Diagnostics,
Computational Design

What traits will help make you be successful??

- From Slee (& Google):

Curiosity,

Emergent leadership,

Ownership &

Humility

Basic skills are assumed, but not “expertise”



