

THE SOLAR DECATHLON DESIGN CHALLENGE 2023

THE GROWING HAVEN

A MIXED USE MULTI-FAMILY BUILDING



INTRODUCTION

ARCHITECTURE

MARKET ANALYSIS

PASSIVE + ACTIVE STRATEGIES

ENERGY SIMULATION RESULTS

ENVIRONMENTAL IMPACT

TEAM

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MARKET ANALYSIS

PASSIVE + ACTIVE
STRATEGIES

ENERGY SIMULATION

ENVIRONMENTAL
IMPACT

STUDENTS



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Matteo Calafiura-Soleri



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Nhat Nguyen



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Willa Vigneault



Lydia Davidson

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Marina Beke



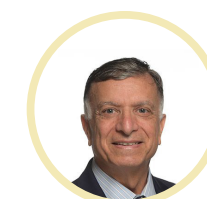
Niharika Hanglem



Mohammad Heidarnejad



Ray Lemming



Jamshid Mohammadi



Laurence Rohter



Deborah Steimel-Clair



Brent Stephens



Thomas Zakrzewski

INDUSTRY PARTNERS



ELEVATE ENERGY
Smarter energy use for all

Cushing Terrell



Sunshine
Gospel Ministries



Larson & Darby Group
Architecture Engineering Interiors



BAUMANN
CONSULTING

db|HMS

HKS

CZDS

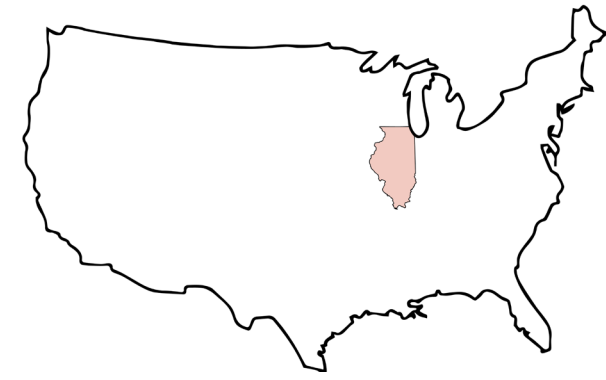
CCE | Callan
CONSULTING ENGINEERS



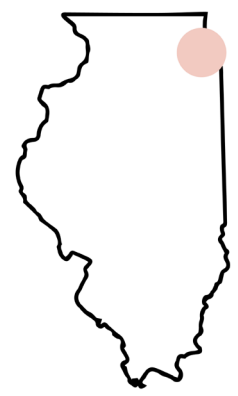
CIVIC PROJECTS
ARCHITECTURE

WOODLAWN - CHICAGO, IL

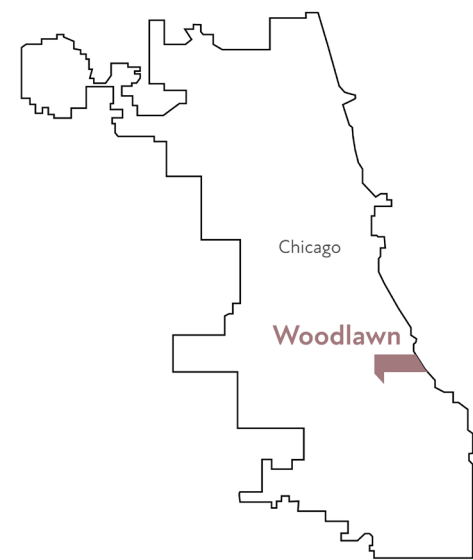
INTRODUCTION



UNITED STATES



ILLINOIS



CHICAGO



ARCHITECTURE

MARKET ANALYSIS

PASSIVE + ACTIVE STRATEGIES

ENERGY SIMULATION

ENVIRONMENTAL IMPACT

COMMUNITY PARTNERS

INTRODUCTION

Over the past 40 years,
Woodlawn's population
has declined

67% ↓

This led to an increase
in vacant lots by

20% ↑

only
30%
of Woodlawn families
own their own home.

<https://www.cmap.illinois.gov/documents/10180/126764/Woodlawn.pdf>

COMMUNITY PARTNER



HOUSING EQUITY INITIATIVE



REVITALIZATION



OWNERSHIP



RETENTION

DESIGN GOALS

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GROW ENGAGEMENT



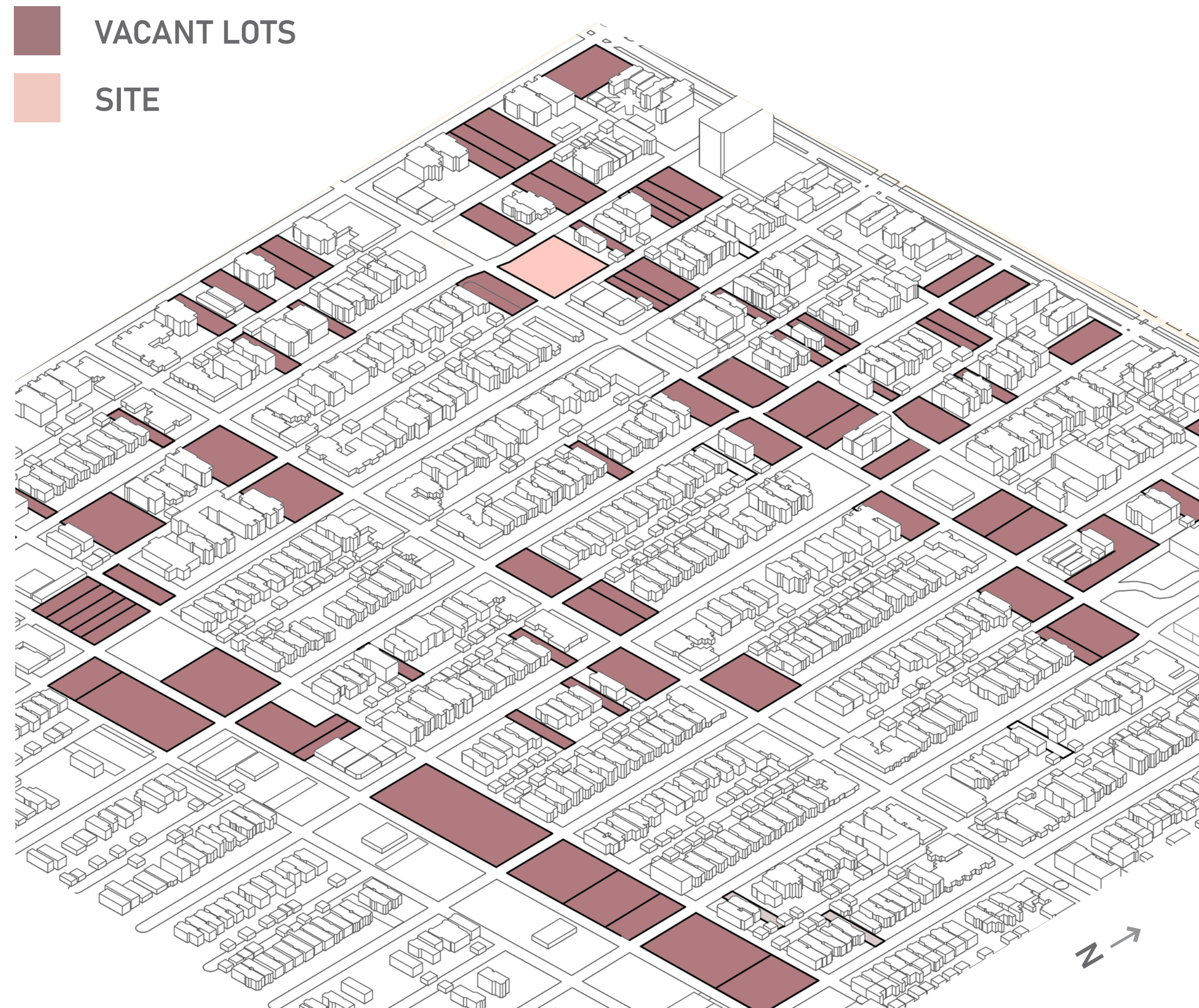
GROW ENERGY



GROW EQUITY

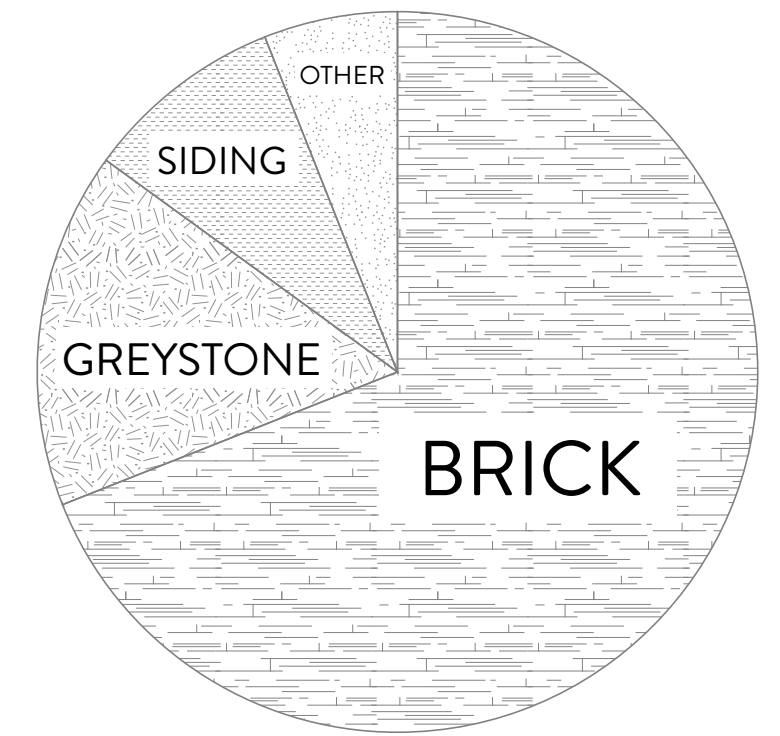
FABRIC OF THE NEIGHBORHOOD

INTRODUCTION



What is a home in Woodlawn?

- Brick and stone are the most common materials.
- The style of a typical home is a Chicago 3-flat (three and a half stories tall)
- Stone details
- Protruding bay windows
- Flat roofs



EXISTING SITE

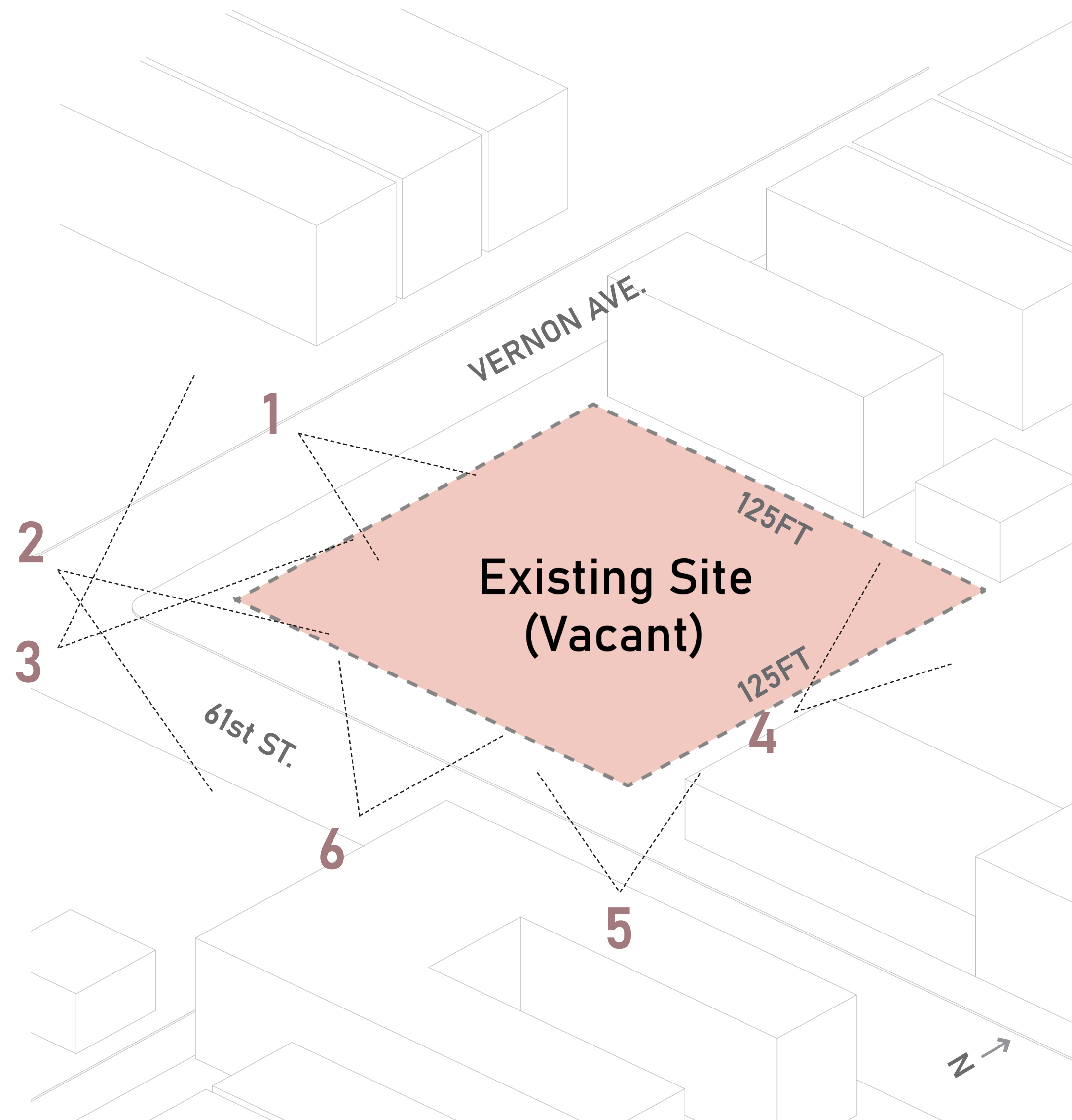
ARCHITECTURE

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FORM CREATION

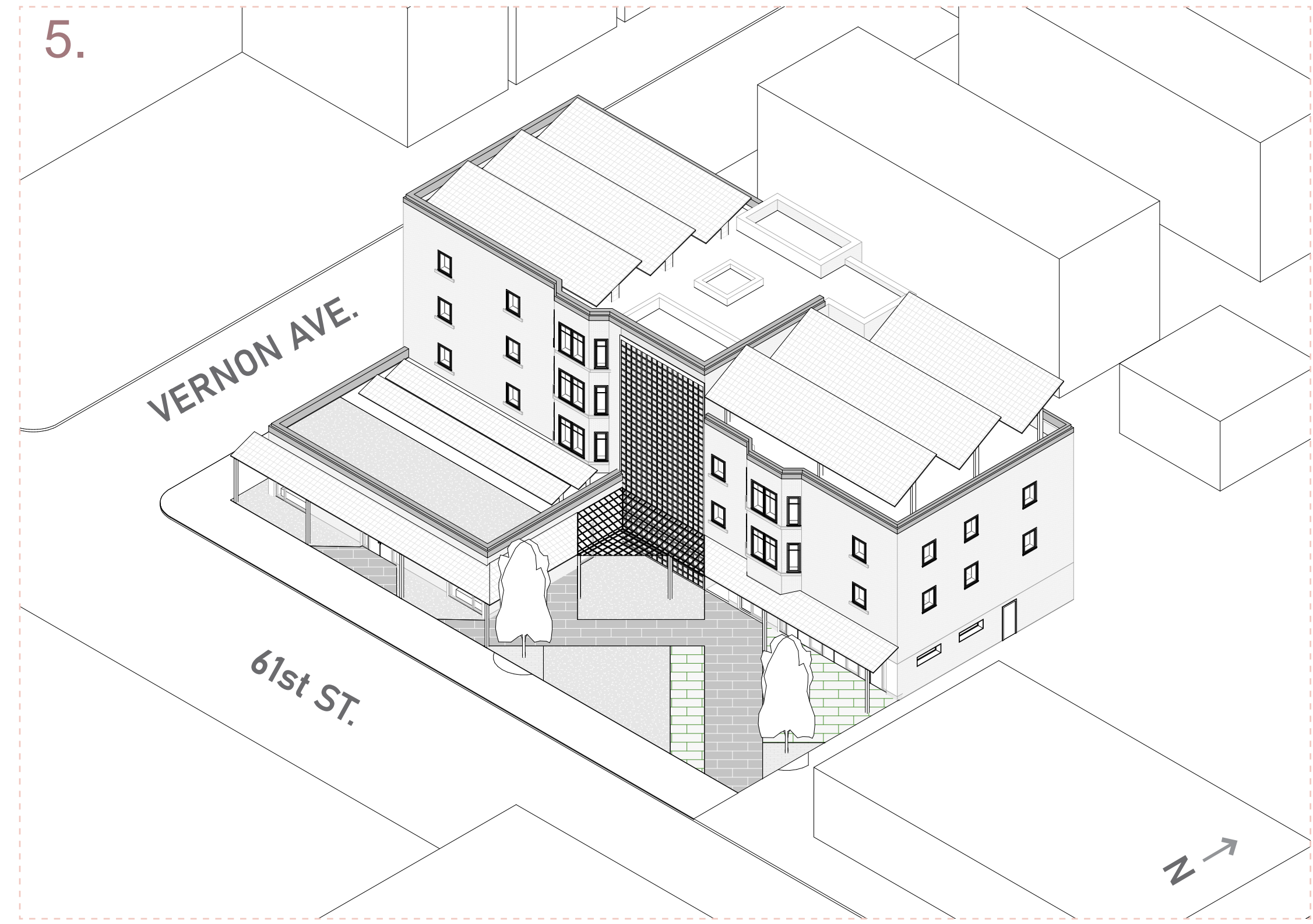
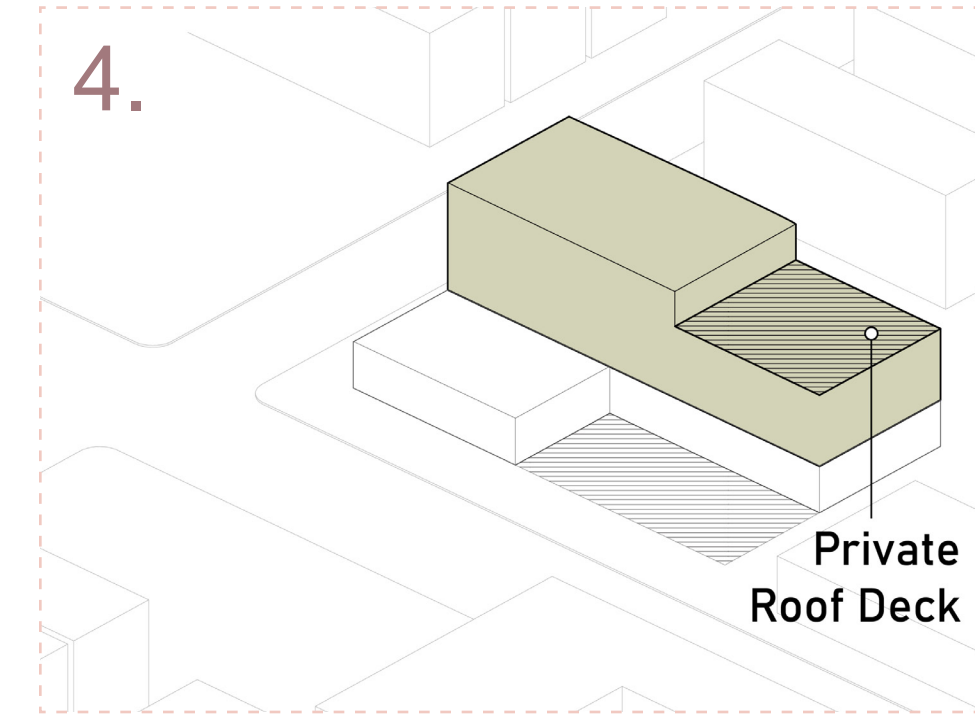
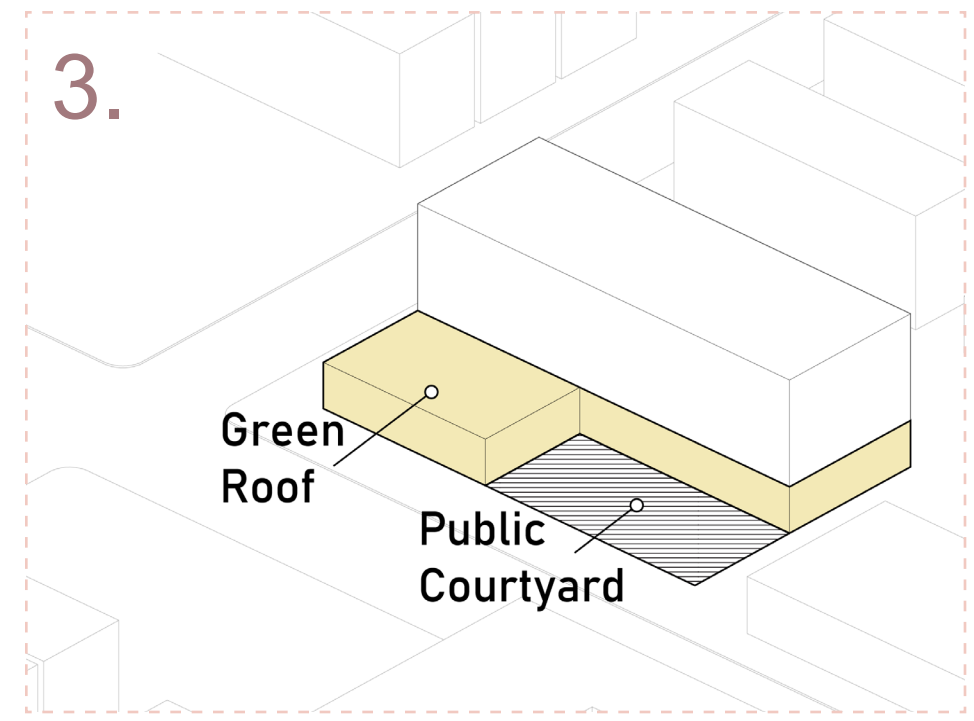
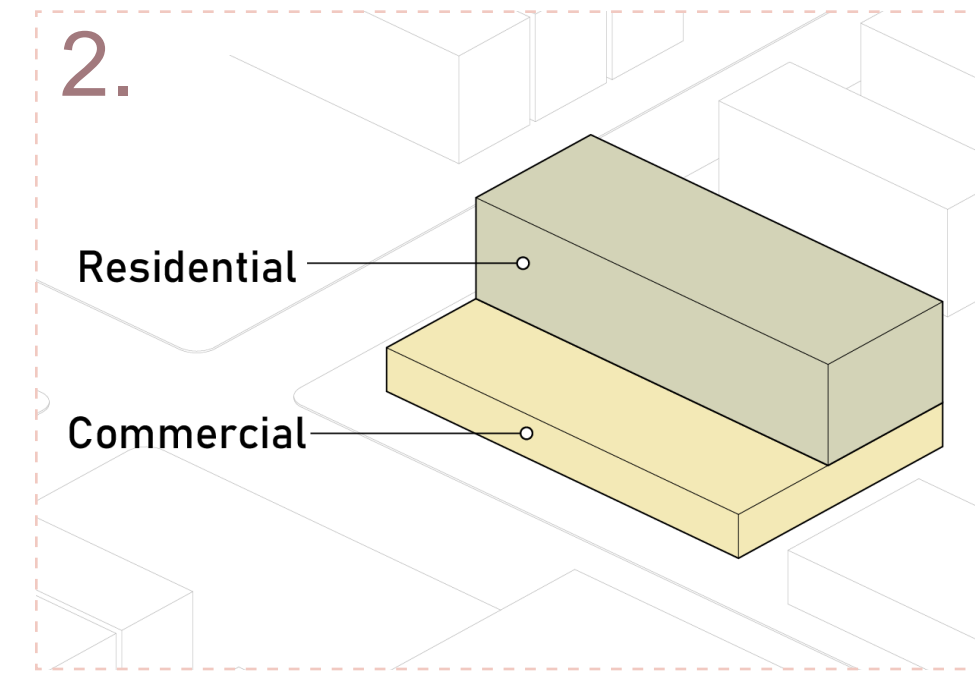
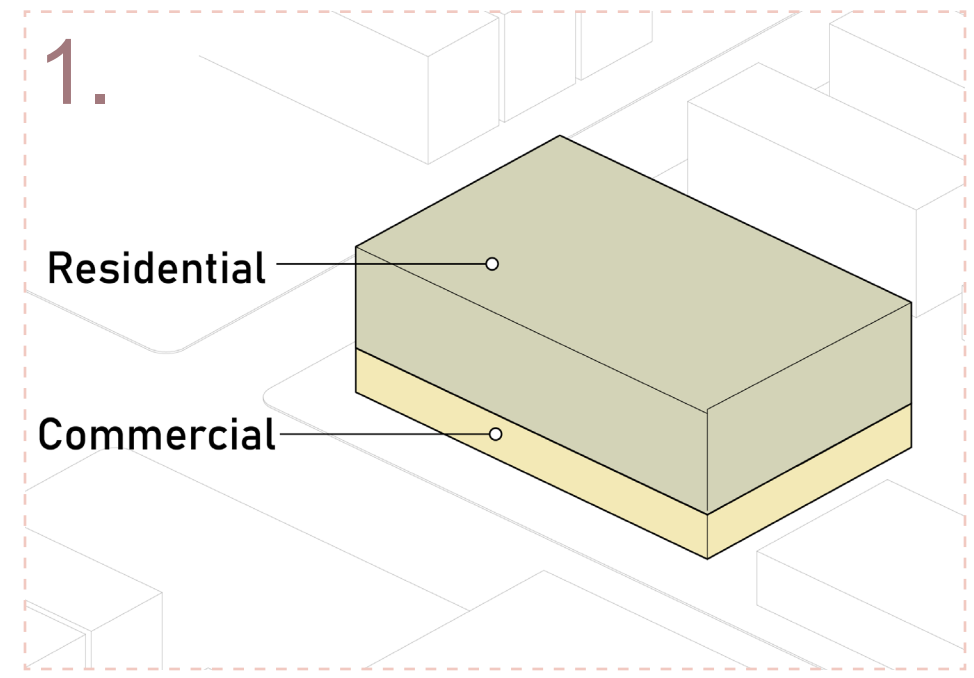
ARCHITECTURE

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PASSIVE + ACTIVE
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ENERGY SIMULATION

ENVIRONMENTAL
IMPACT



61ST STREET ENTRANCE

ARCHITECTURE

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ENVIRONMENTAL
IMPACT

PV ON ROOF DECK

LIVING WALL

BAY WINDOW

GREEN ROOF

PV CANOPY

ACTIVATED ALLEY

MIXTURE OF LANDSCAPE:
PRAIRIE GRASSES
PERMEABLE PAVERS
PAVERS



COMMERCIAL FLOOR

ARCHITECTURE

MARKET ANALYSIS

PASSIVE + ACTIVE STRATEGIES

ENERGY SIMULATION

ENVIRONMENTAL IMPACT

RESIDENTIAL PARKING

TRASH

RESIDENTIAL LOBBY

CAFE

DIVVY BIKE STATION

PERMEABLE PAVERS

BOUTIQUE

STONE PAVERS

NATIVE PRAIRIE GRASSES



BOUTIQUE

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LED LIGHTING

RECLAIMED BRICK

LOCAL BUSINESS

LOCALLY SOURCED WOOD



CAFE

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ENVIRONMENTAL
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LED LIGHTING

RECLAIMED BRICK

STACKED PLUMBING WALL

WINTER VESTIBULE

ENERGY STAR APPLIANCES

DOORS OPEN FOR
OVER FLOW SEATING

LOCAL BUSINESS

LOCALLY SOURCED WOOD



RESIDENTIAL FLOORS 2+3

ARCHITECTURE

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ENVIRONMENTAL
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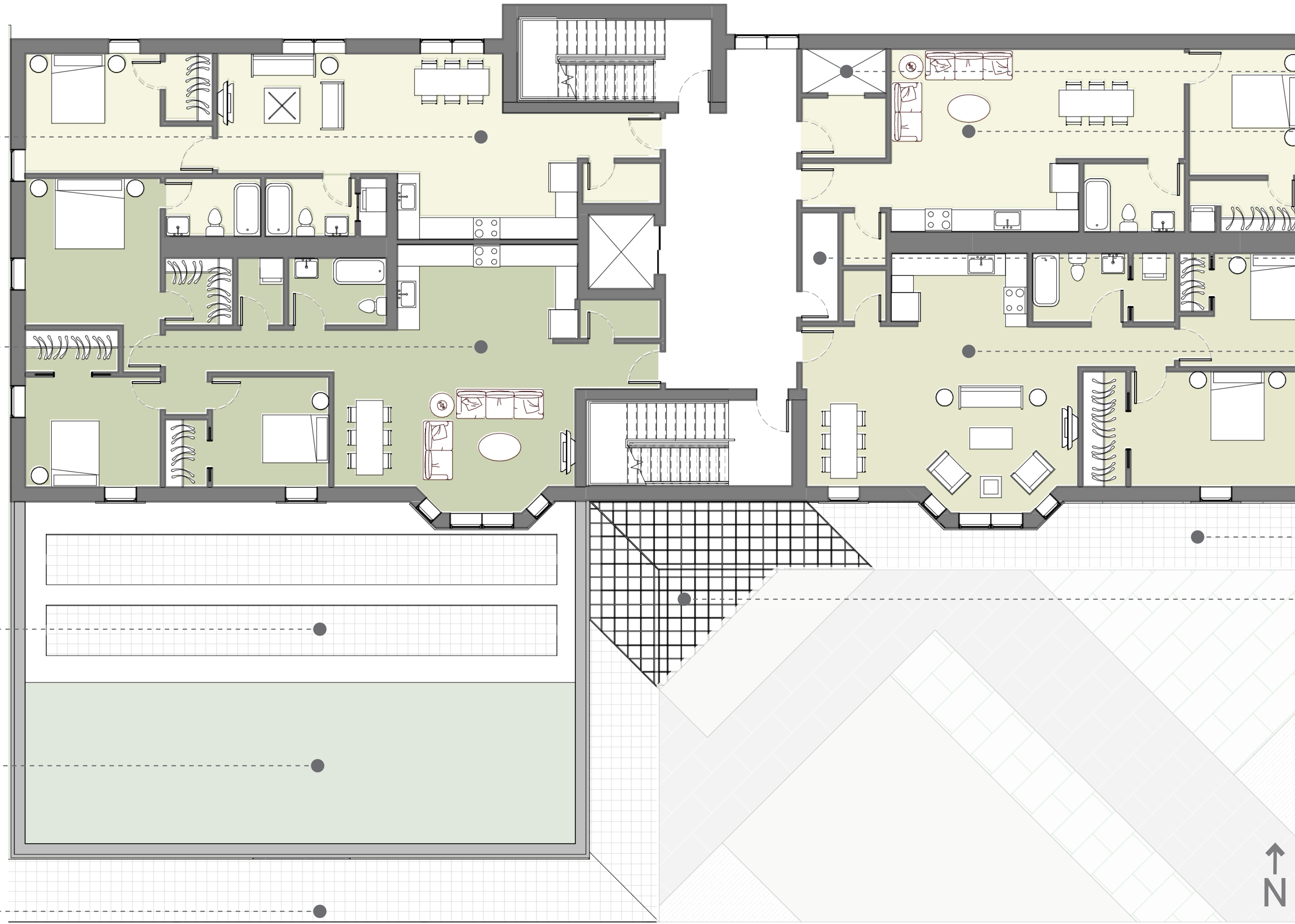
UNIT C: 840 sqft
RENTED
1 BED 1 BATH

UNIT A: 1450 sqft
OWNED
3 BED 2 BATH

PV PANELS

INTENSIVE GREEN ROOF

PV CANOPY



TRASH CHUTE

UNIT D: 835 sqft
RENTED
1 BED 1 BATH

FLOOR MECHANICAL ROOM

UNIT B: 1100 sqft
OWNED
2 BED 1 BATH

PV CANOPY

WOODEN TRELLIS

RESIDENTIAL FLOOR 4

ARCHITECTURE

MARKET ANALYSIS

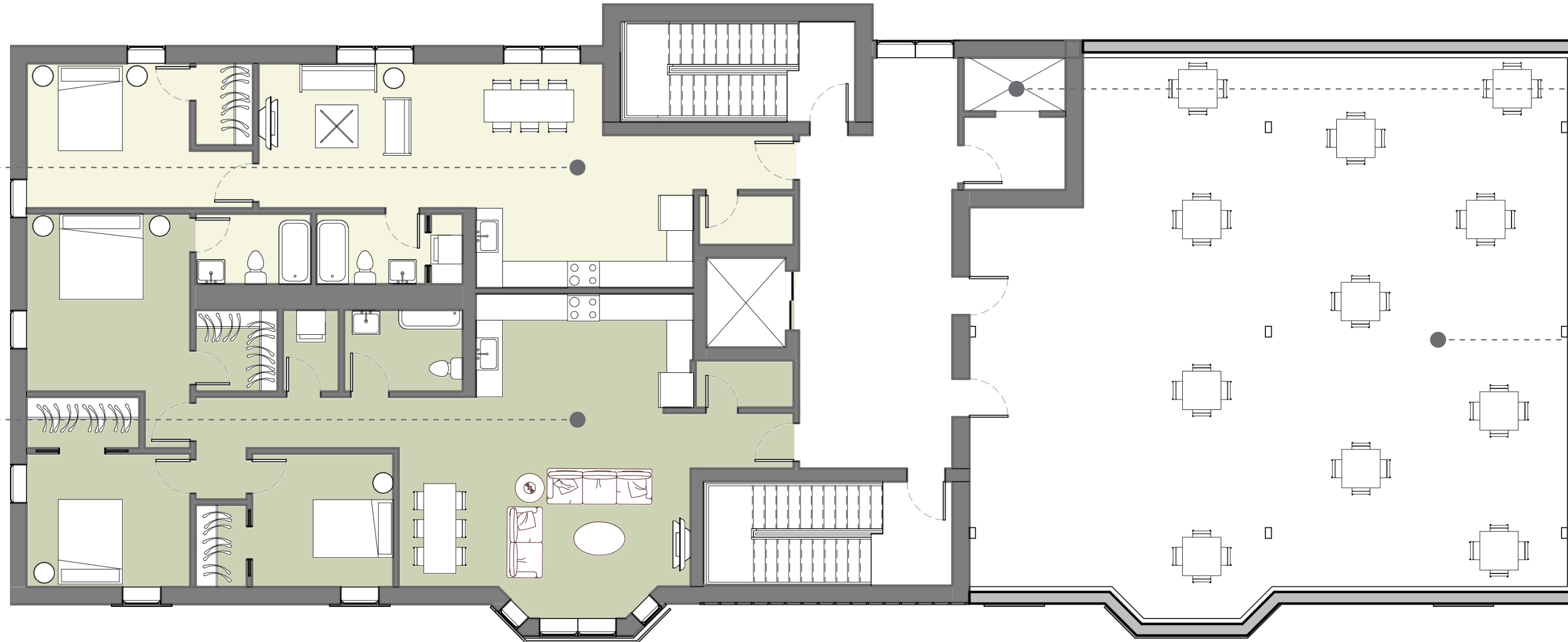
PASSIVE + ACTIVE
STRATEGIES

ENERGY SIMULATION

ENVIRONMENTAL
IMPACT

UNIT C: 840 sqft
RENTED
1 BED 1 BATH

UNIT A: 1450 sqft
OWNED
3 BED 2 BATH



TRASH CHUTE

RESIDENTIAL ROOF DECK



RESIDENTIAL LIVING SPACE

ARCHITECTURE

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ENERGY SIMULATION

ENVIRONMENTAL
IMPACT

UNIT C EXAMPLE LAYOUT

LED LIGHTING

LIGHT SHELF

OPERABLE WINDOW

STACKED PLUMBING WALL

ENERGY STAR APPLIANCE

LOCALLY SOURCED WOOD



RESIDENTIAL BEDROOM

ARCHITECTURE

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STRATEGIES

ENERGY SIMULATION

ENVIRONMENTAL
IMPACT

UNIT C EXAMPLE LAYOUT

LED LIGHTING

OPERABLE WINDOW

AIR TIGHT ENVELOPE

VIEW OF GREEN OUT WINDOW

LOCALLY SOURCED WOOD



CORNER OF VERNON & 61ST

ARCHITECTURE

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ENERGY SIMULATION

ENVIRONMENTAL
IMPACT

PV ON ROOF

WASHINGTON PARK

COMMUNITY MURAL

CORNER-ACTIVATED STORE FRONT

RESIDENTIAL STREET

COMMERCIAL STREET



COMMUNITY ENGAGEMENT

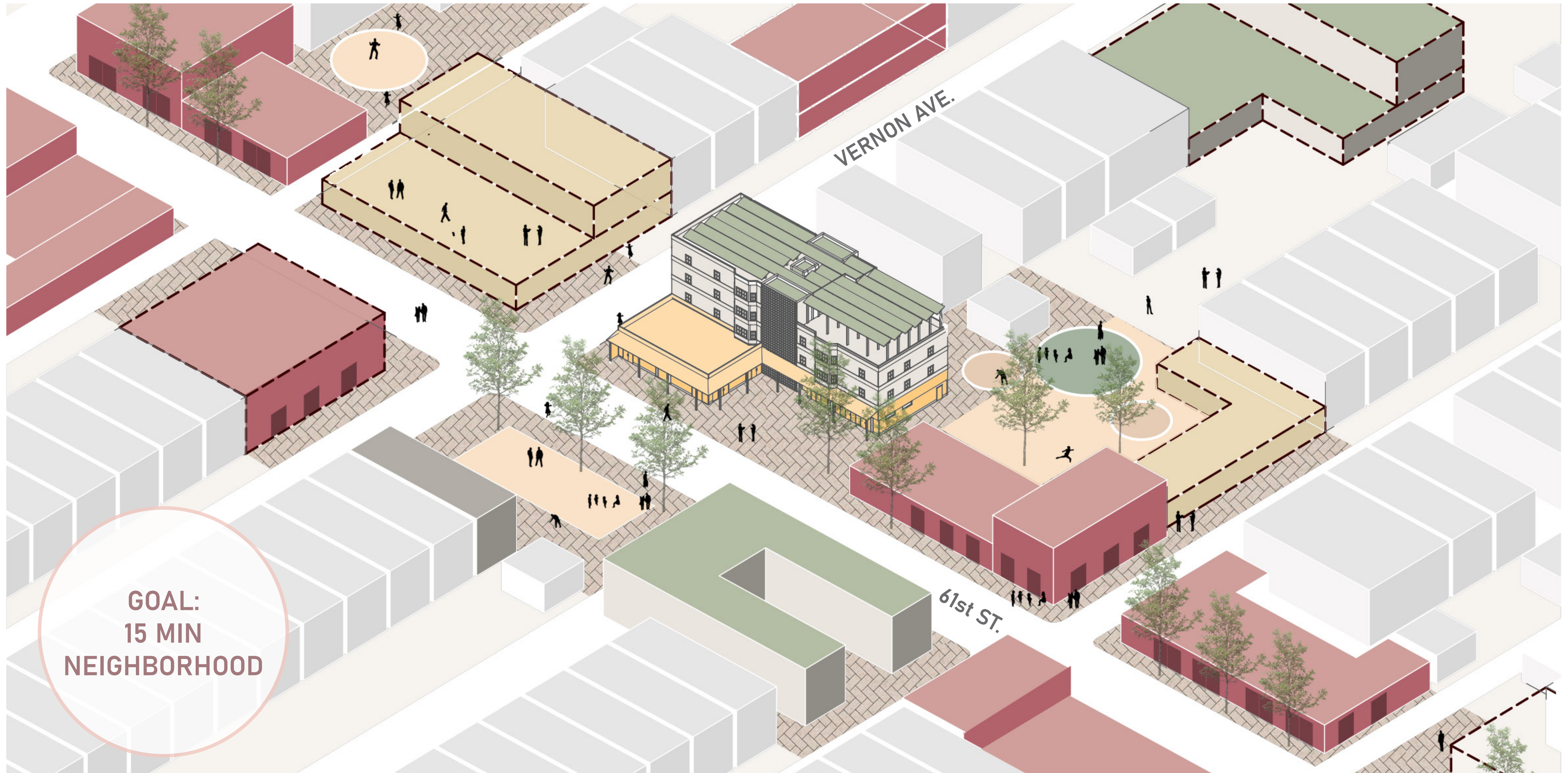
ARCHITECTURE

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ENVIRONMENTAL
IMPACT



GOAL:
15 MIN
NEIGHBORHOOD

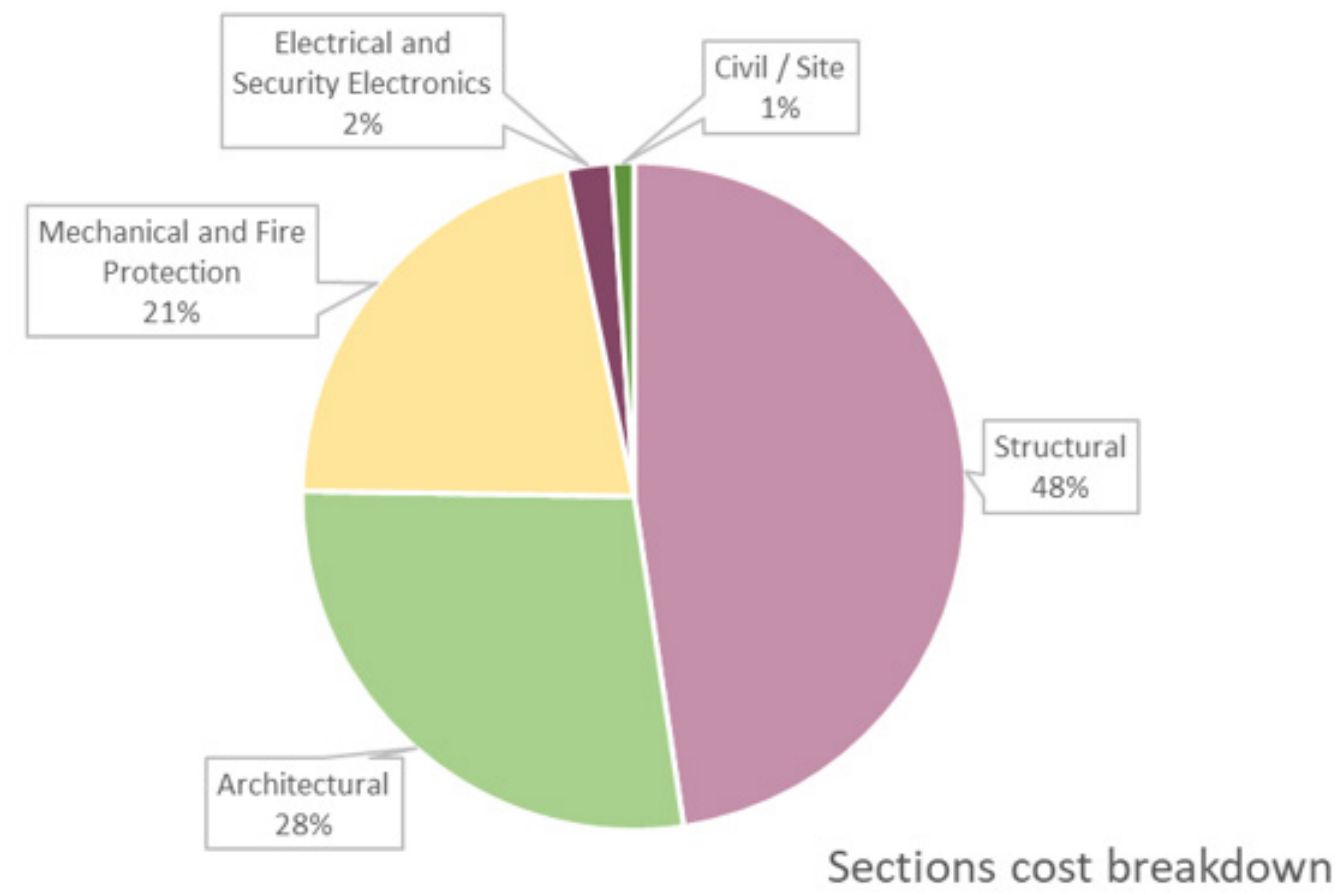
COST OF CONSTRUCTION

MARKET ANALYSIS

PASSIVE + ACTIVE
STRATEGIES

ENERGY SIMULATION

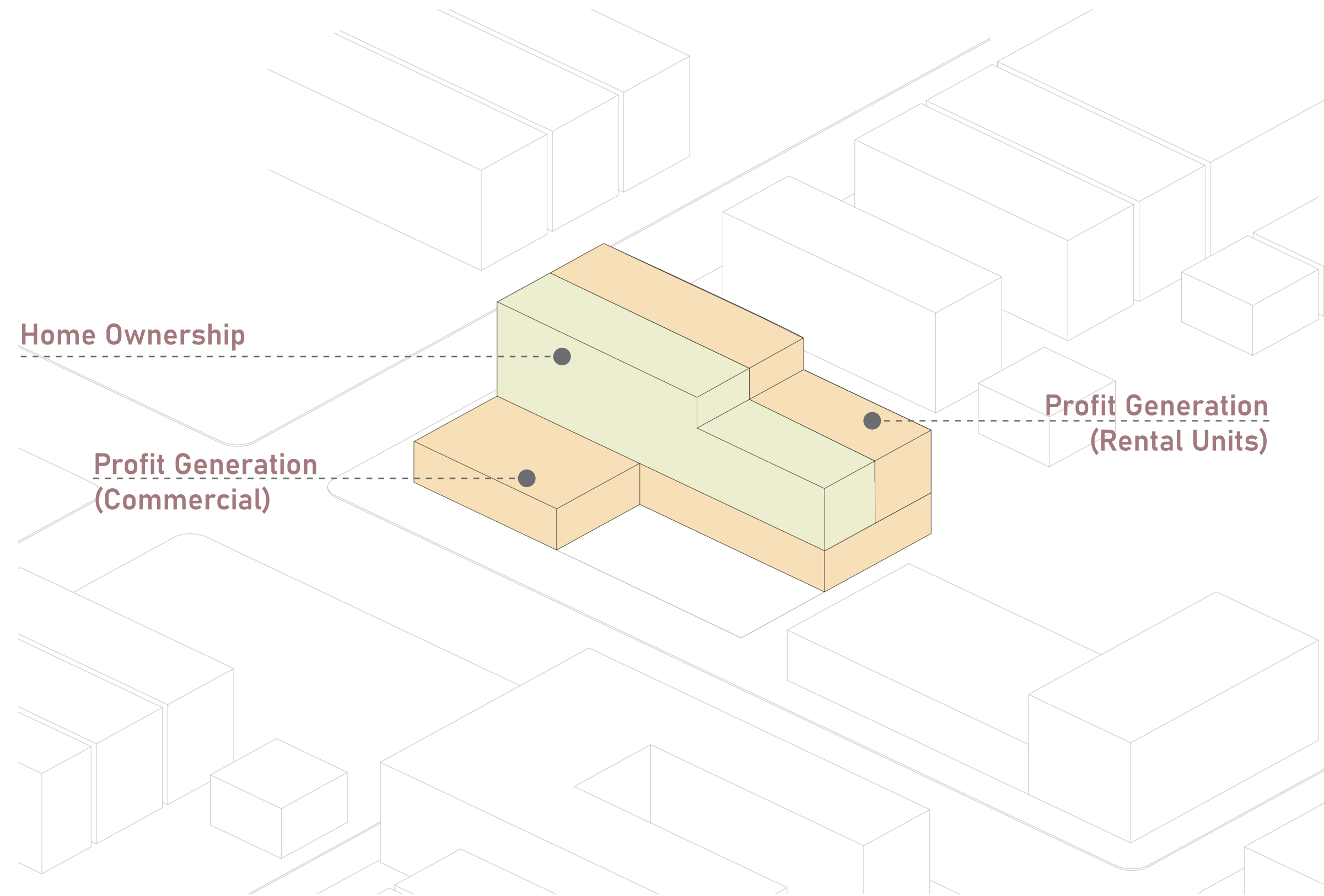
ENVIRONMENTAL
IMPACT



	Cost
Structural	\$2,455,842.00
Architectural	\$1,425,169.00
Mechanical and Fire Protection	\$1,106,697.00
Electrical and Security Electronics	\$114,276.00
Civil / Site	\$55,854.00

CSI Divisions	Cost
Division 1: General Requirements	\$4,595.00
Division 3: Concrete	\$2,217,568.00
Division 4: Masonry	\$224,160.00
Division 5: Metals	\$14,114.00
Division 6: Wood, Plastics, and Composites	\$571,520.00
Division 7: Thermal and Moisture Protection	\$252,566.00
Division 8: Openings	\$140,292.00
Division 9: Finishes	\$643,339.00
Division 11: Equipment	\$53,348.00
Division 12: Furnishings	\$65,423.00
Division 14: Conveying Equipment	\$188,215.00
Division 21: Fire Protection	\$14,040.00
Division 22: Plumbing	\$196,629.00
Division 23: Heating, Ventilating, and Air Conditioning	\$654,365.00
Division 26: Electrical	\$114,276.00
Division 28: Electronic Safety	\$215.00
Division 32: Exterior Improvements	\$55,854.00
Division 33: Utilities	\$100.00
Total	\$5,410.619.00

HOMEOWNERSHIP VS RENTAL SPACES



GRANT RESEARCH

- Justice 40 Initiative
- The Inflation Reduction Act (IRA)
- Greenhouse Gas Reduction Fund
- Chicago Department of Housing (DOH) Woodlawn Housing Prevention Initiative
- Affordable Housing Opportunity Fund
- ComEd Financial Assistance
- IRA Tax Credits
- IDHA Mortgage Plan
- ILHAF Illinois Homeowner Assistance Funds
- U.S, Dept. of Health and Human Services, Community Services Block Grant (CSBG)

ADAPTABLE SPACES

MARKET ANALYSIS

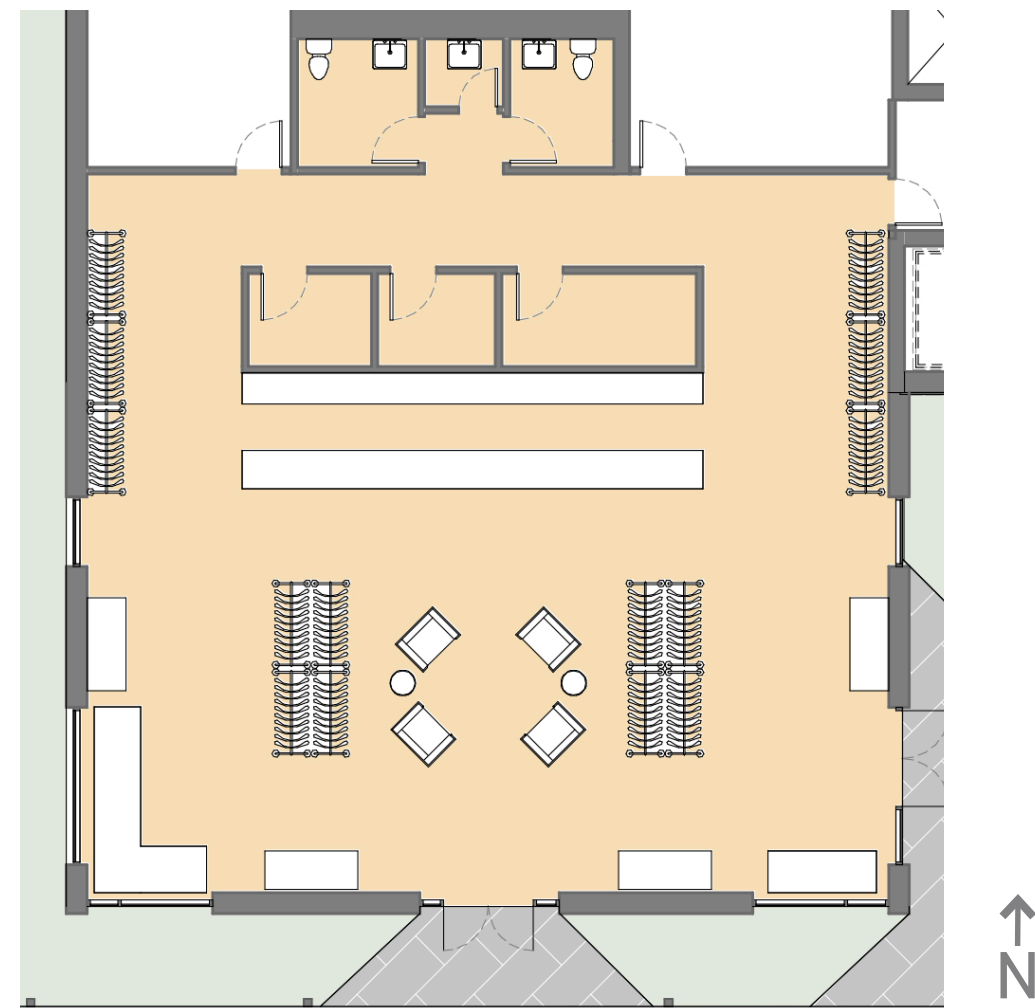
PASSIVE + ACTIVE STRATEGIES

ENERGY SIMULATION

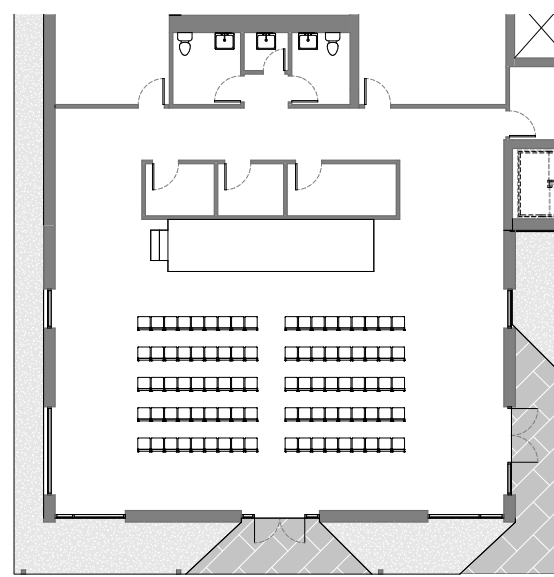
ENVIRONMENTAL IMPACT

COMMERCIAL

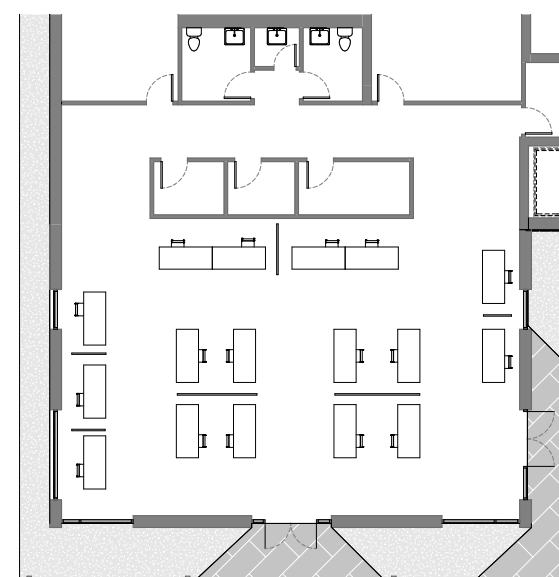
EXISTING BOUTIQUE



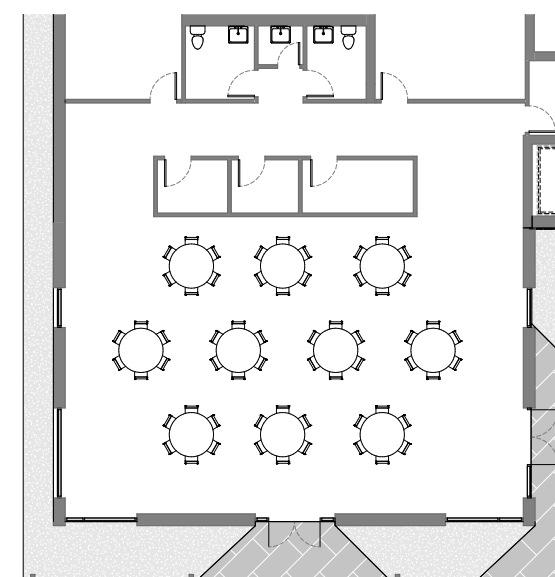
ALTERNATIVE LAYOUTS



PERFORMANCE SPACE



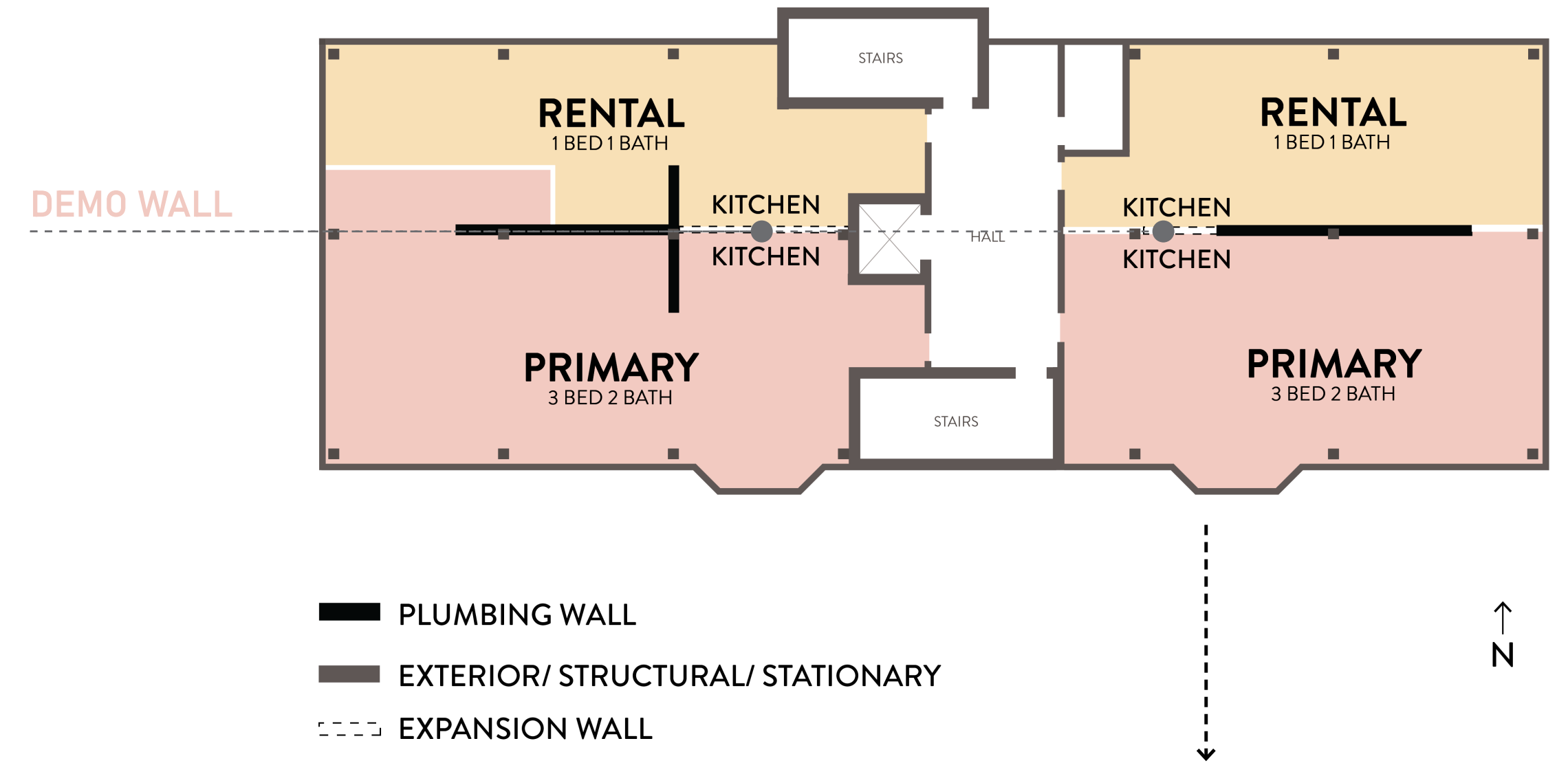
BOOTH BUSINESSES



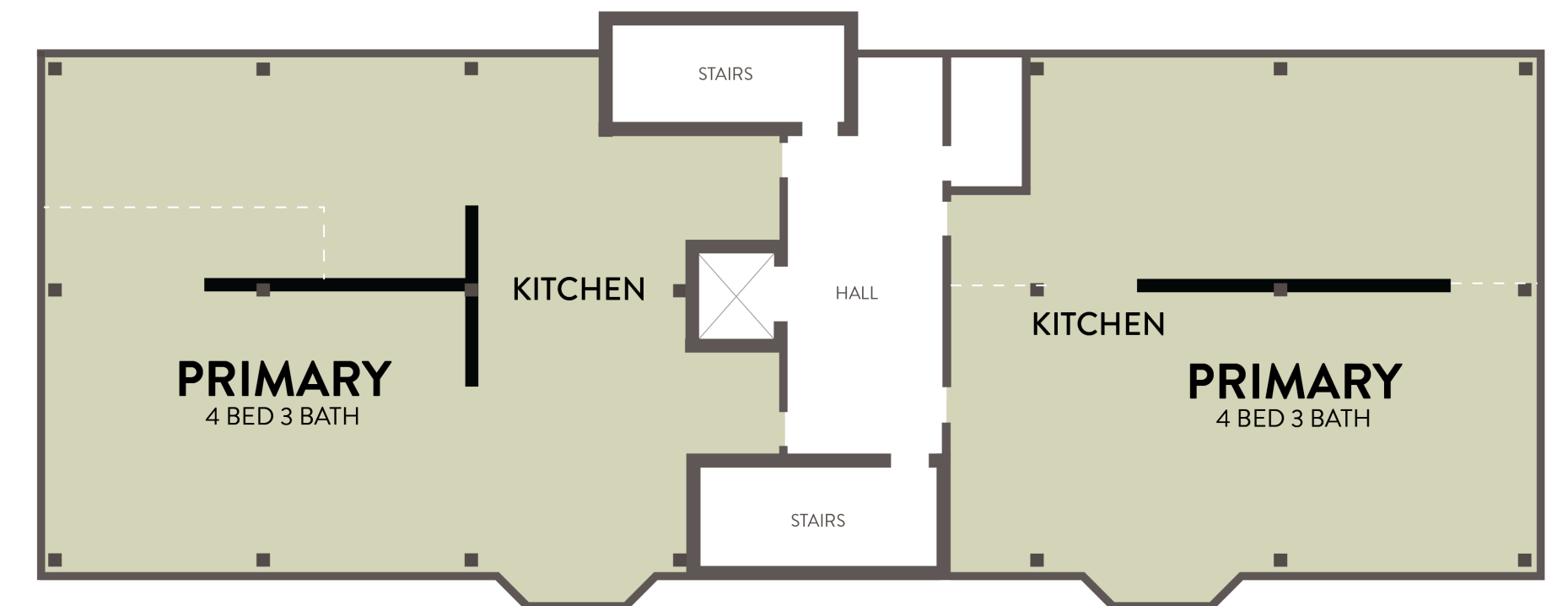
COMMUNITY CENTER

RESIDENTIAL

EXISTING UNITS



EXPANSION UNITS



AFFORDABILITY + PASSIVE STRATEGIES

PASSIVE STRATEGIES

ENERGY SIMULATION

ENVIRONMENTAL IMPACT

HDD65
5814

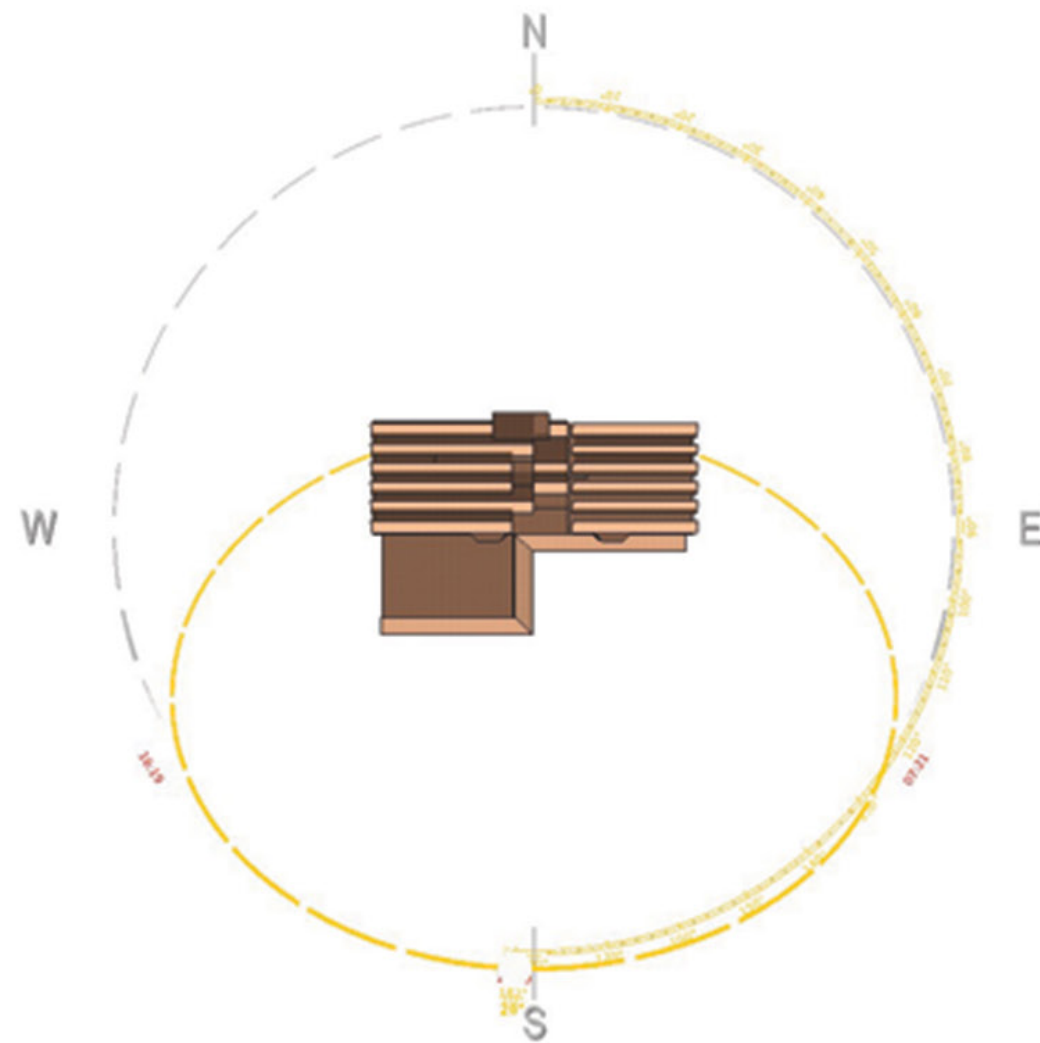
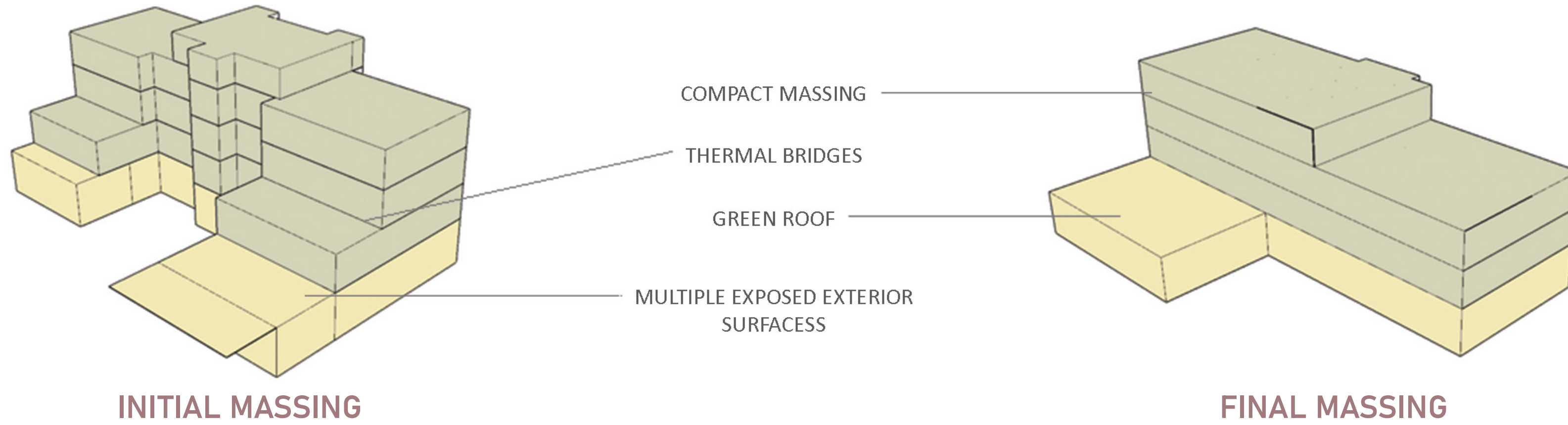
CDD50
3497

ANNUAL NV
POTENTIAL
8%

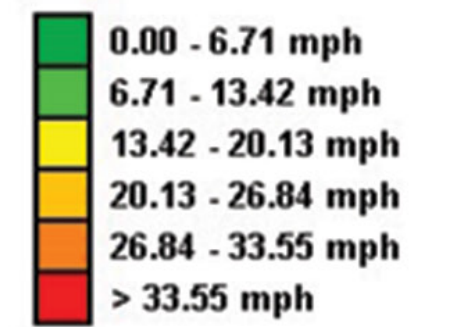
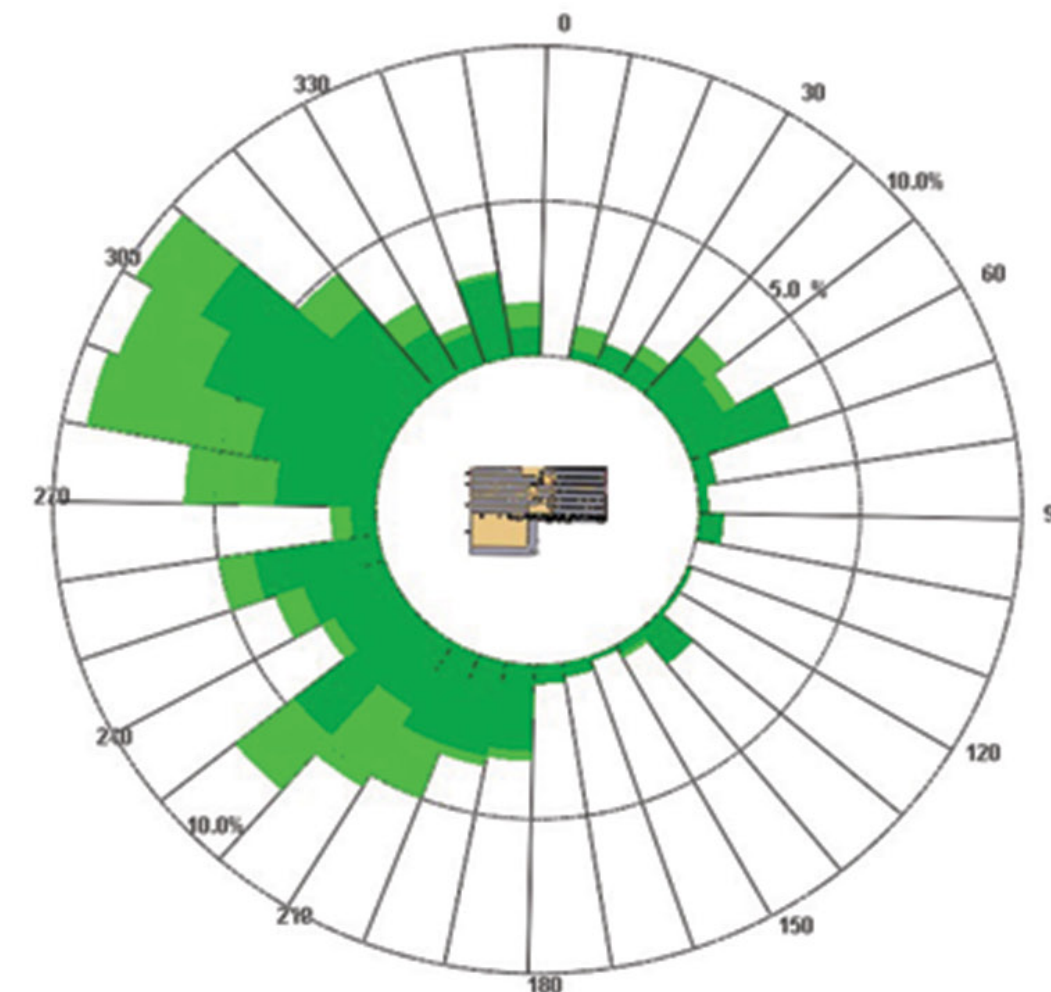


MASSING + ORIENTATION

PASSIVE STRATEGIES



WINTER SOLSTICE SUN PATH



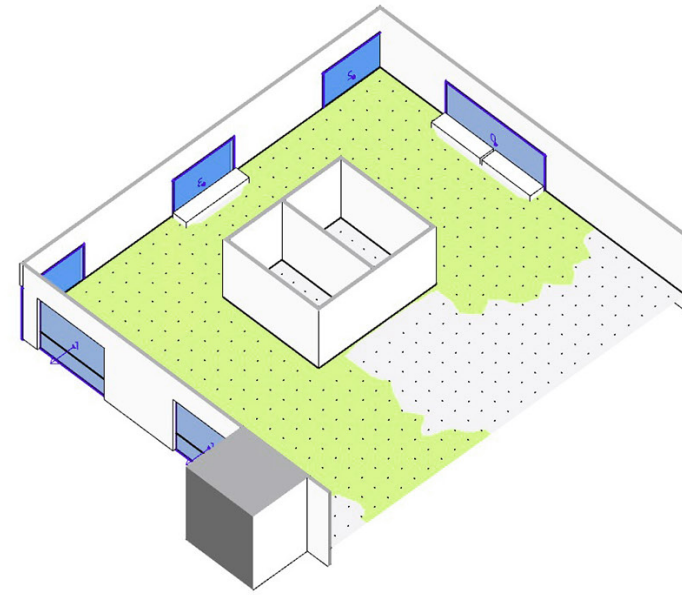
FEBRUARY WIND ROSE

COMMERCIAL DAYLIGHTING

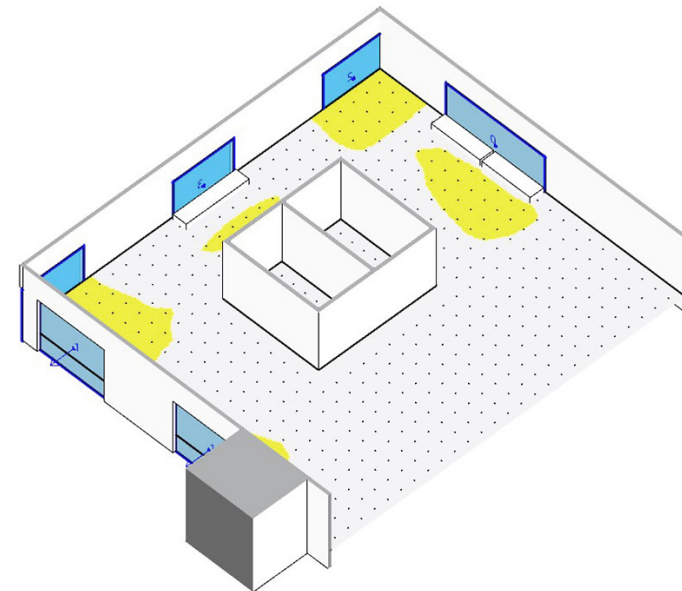
PASSIVE STRATEGIES

ENERGY SIMULATION
ENVIRONMENTAL IMPACT

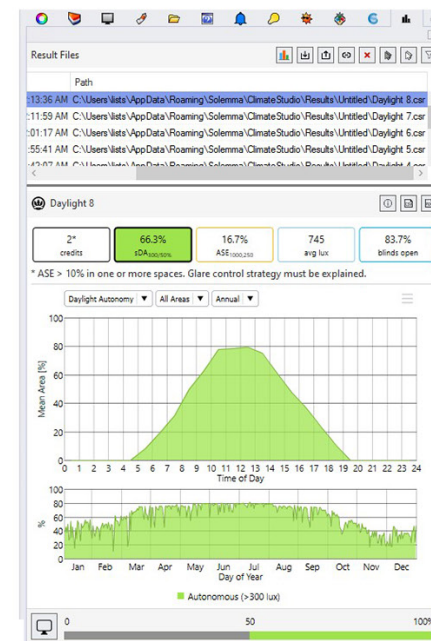
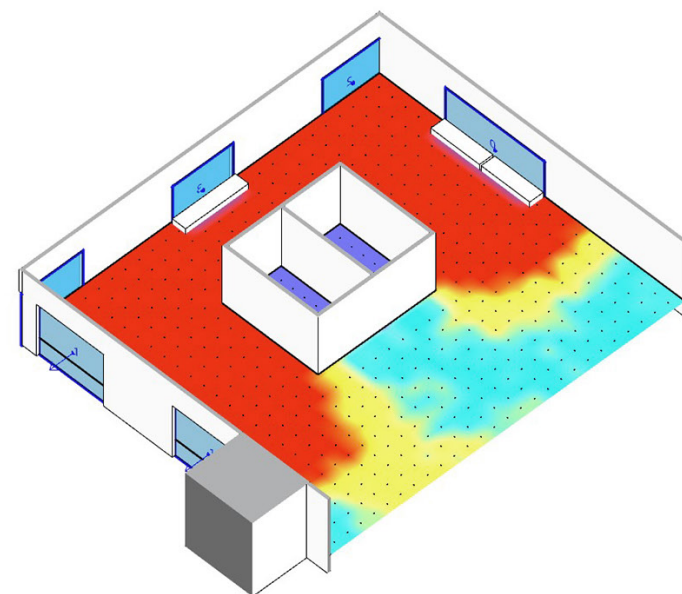
DAYLIGHT AUTONOMY



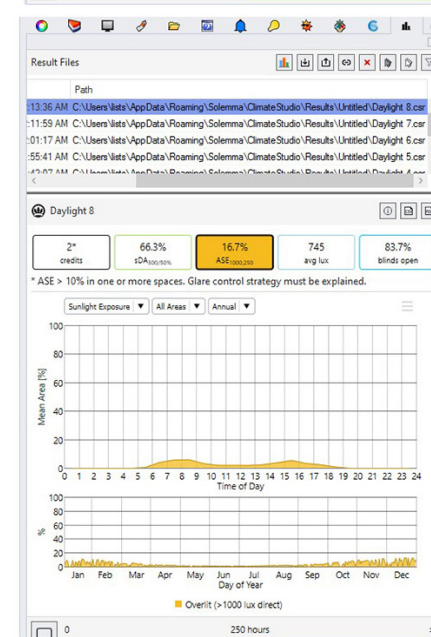
GLARE



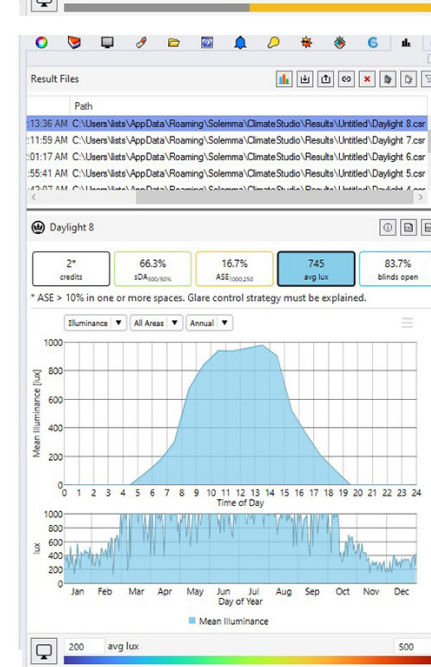
ILLUMINANCE



91.1% ► 66.3%
OF SPACE RECEIVING AT LEAST 300 LUX FOR AT LEAST 50% OF OCCUPIED HOURS



30.7% ► 16.7%
OF SPACE RECEIVING AT LEAST 1000 LUX DIRECT SUN FOR AT LEAST 250 OCCUPIED HOURS



3217 ► 745
LUX IS THE MEAN WORKPLANE ILLUMINANCE DURING OCCUPIED HOURS

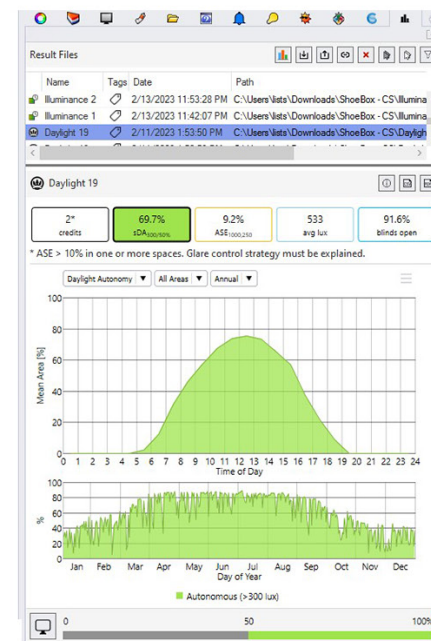
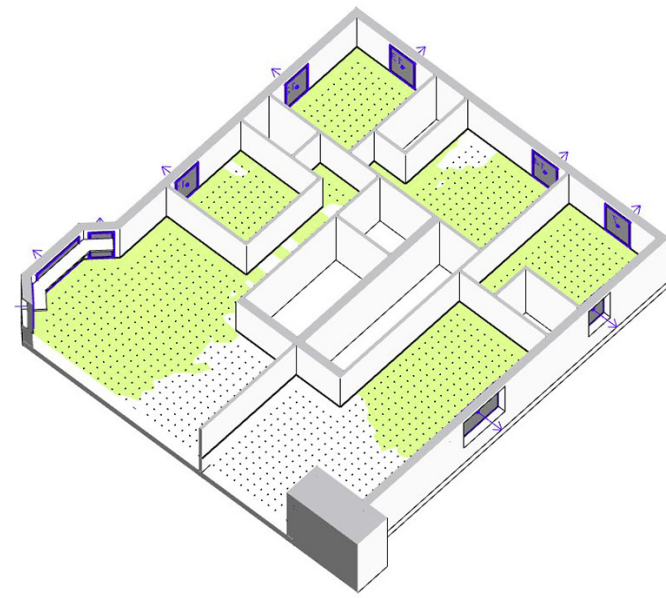


RESIDENTIAL DAYLIGHTING

PASSIVE STRATEGIES

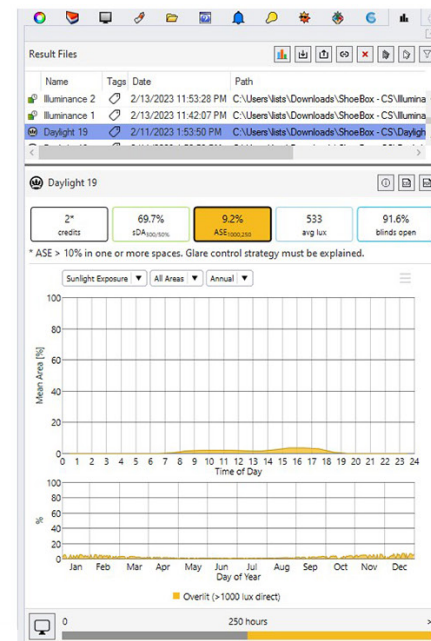
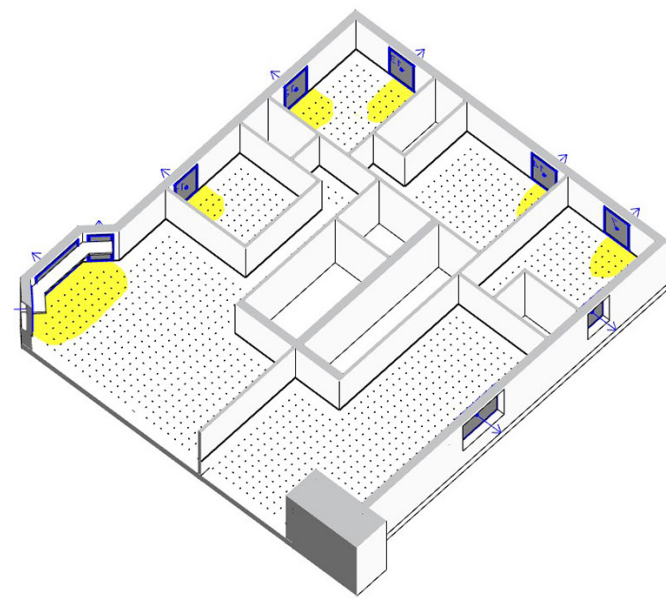
ENERGY SIMULATION
ENVIRONMENTAL IMPACT

DAYLIGHT AUTONOMY



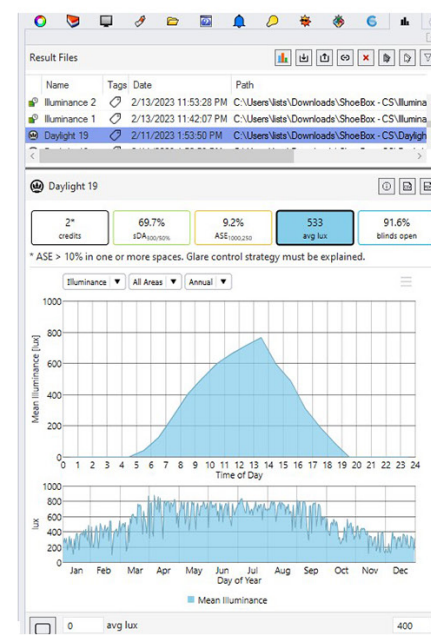
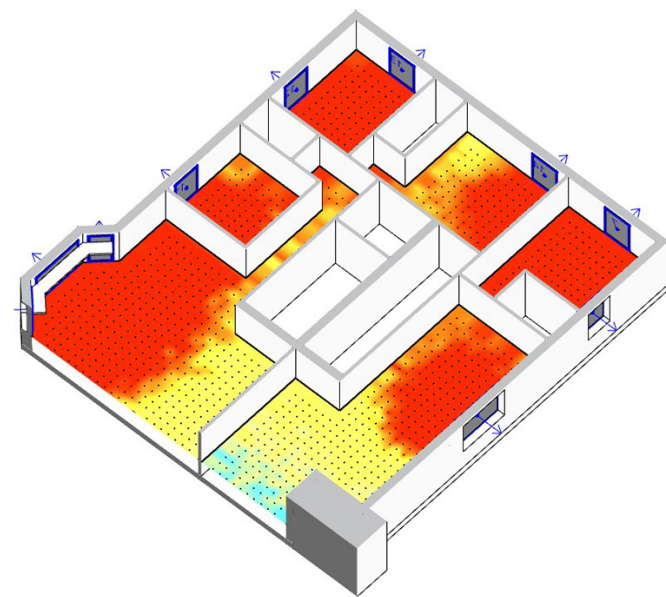
79.8% ► 69.7%
OF SPACE RECEIVING AT LEAST 300 LUX FOR AT LEAST 50% OF OCCUPIED HOURS

GLARE



10.4% ► 9.2%
OF SPACE RECEIVING AT LEAST 1000 LUX DIRECT SUN FOR AT LEAST 250 OCCUPIED HOURS

ILLUMINANCE

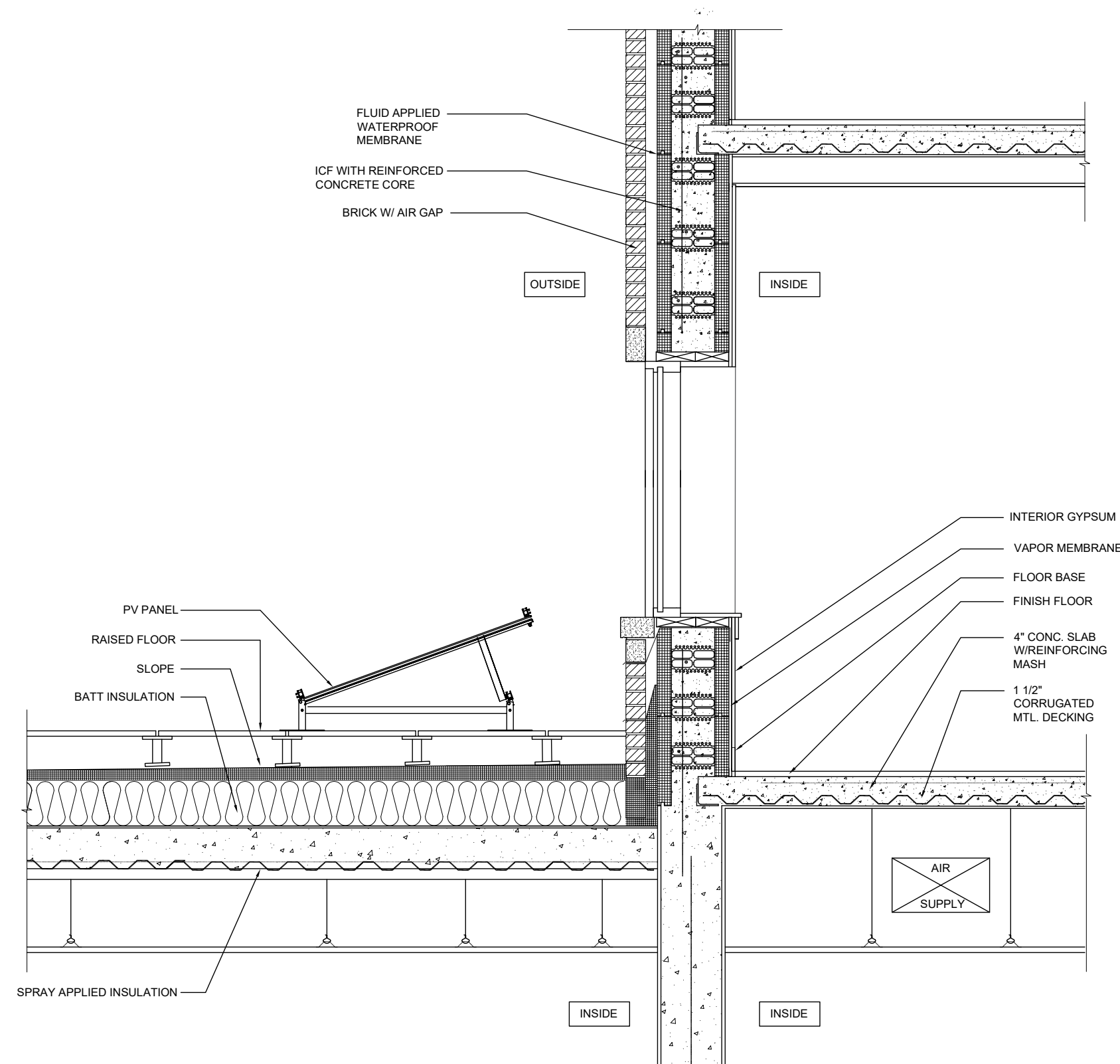


1098 ► 533
LUX IS THE MEAN WORKPLANE ILLUMINANCE DURING OCCUPIED HOURS



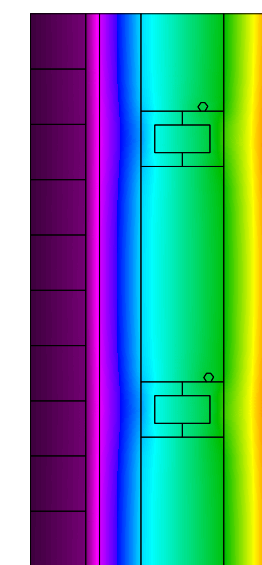
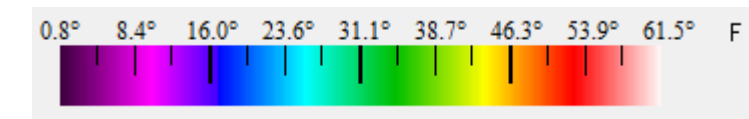
ENVELOPE

PASSIVE STRATEGIES

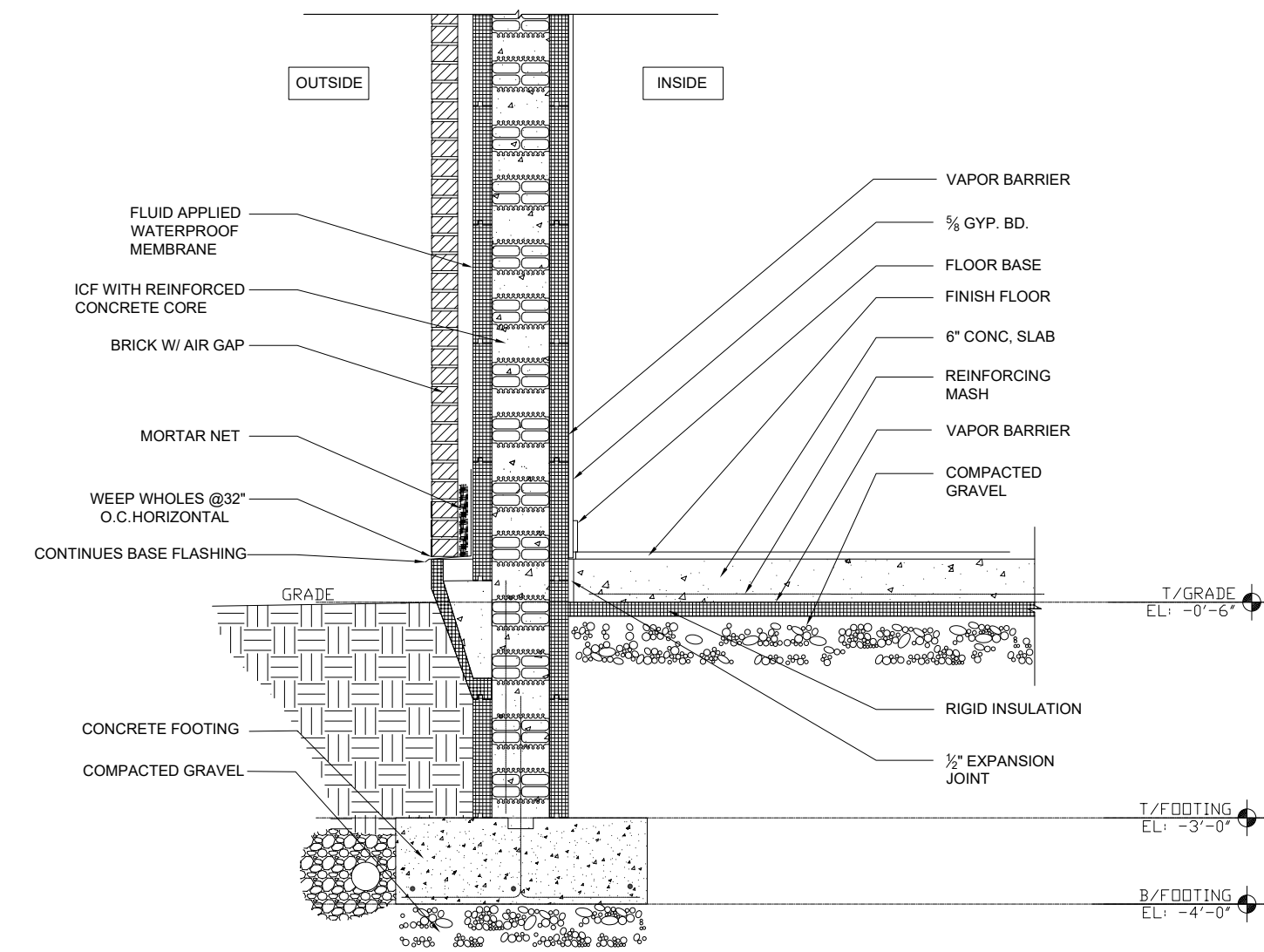


WALL SECTION AT COMMERCIAL ROOF

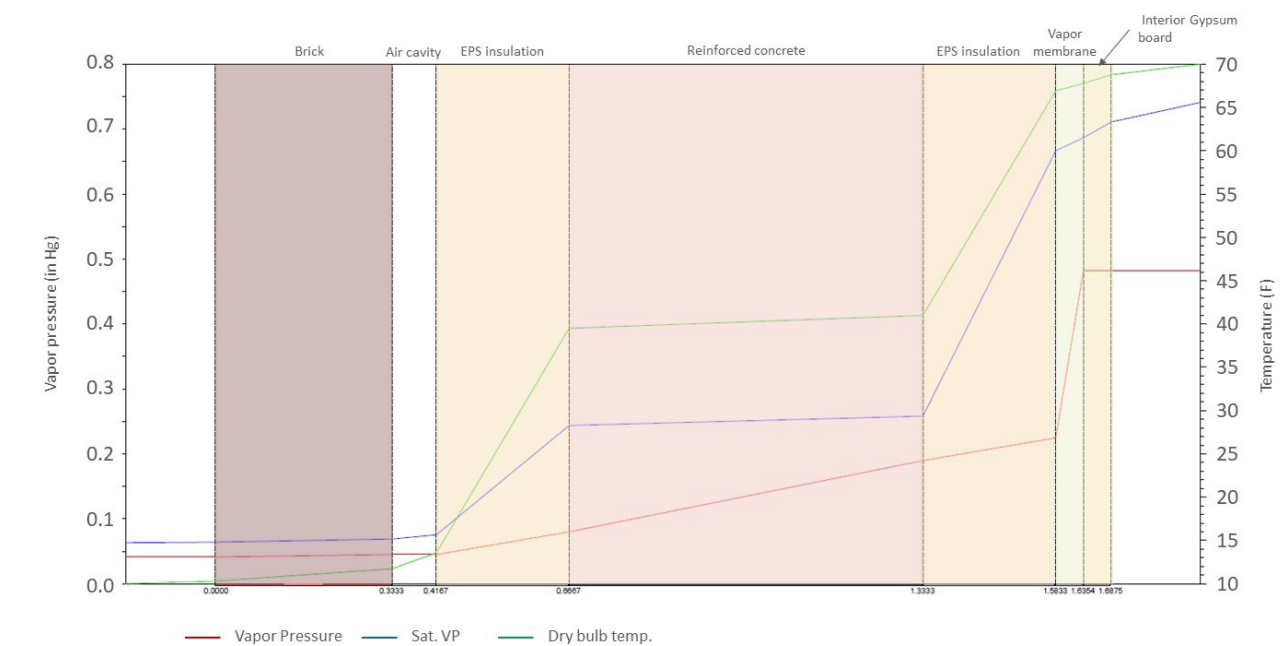
Category	Value
Wall	R-30
Roof	R-40
Floor	R-40
Window - Commercial	U-0.34; SHGC 0.45
Window - Residential	U-0.36 ; SHGC 0.33



THERMAL ANALYSIS OF TYPICAL WALL



TYPICAL WALL SECTION

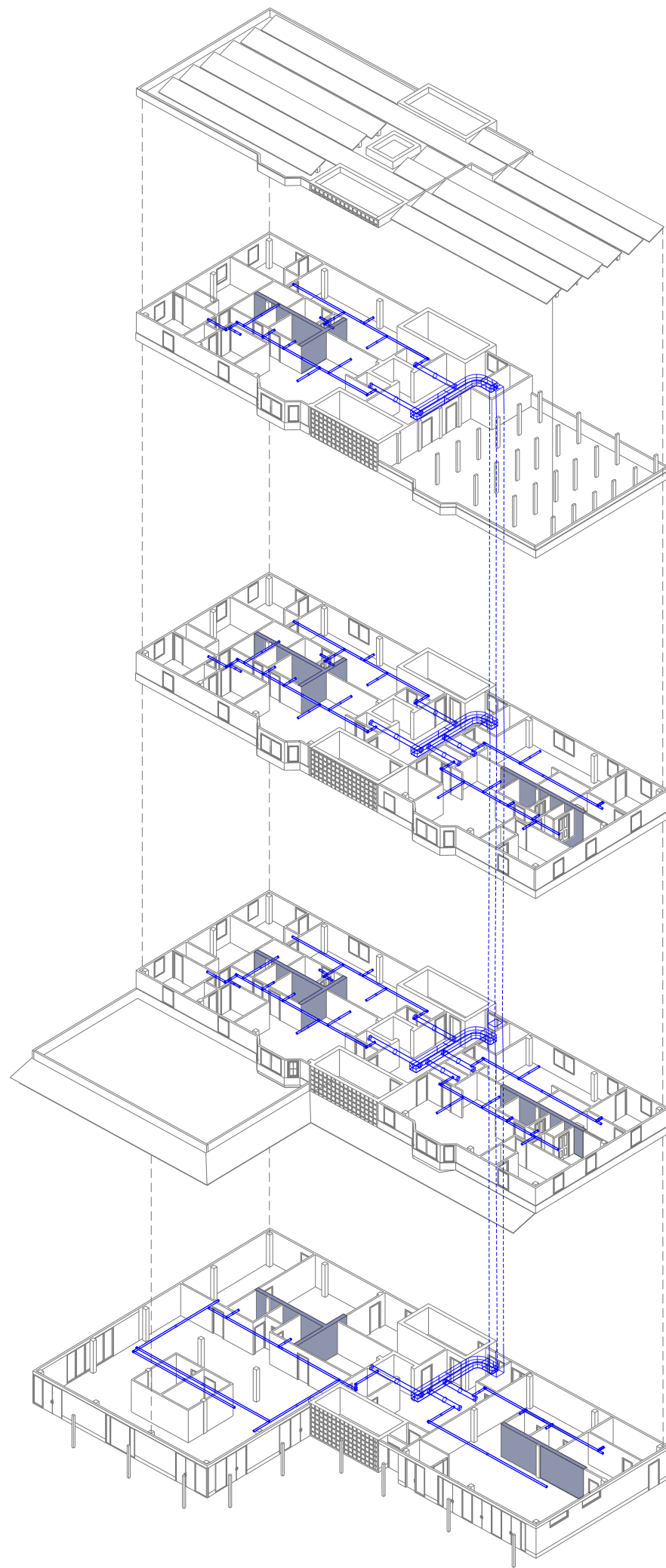


CONDENSATION ANALYSIS OF TYPICAL WALL

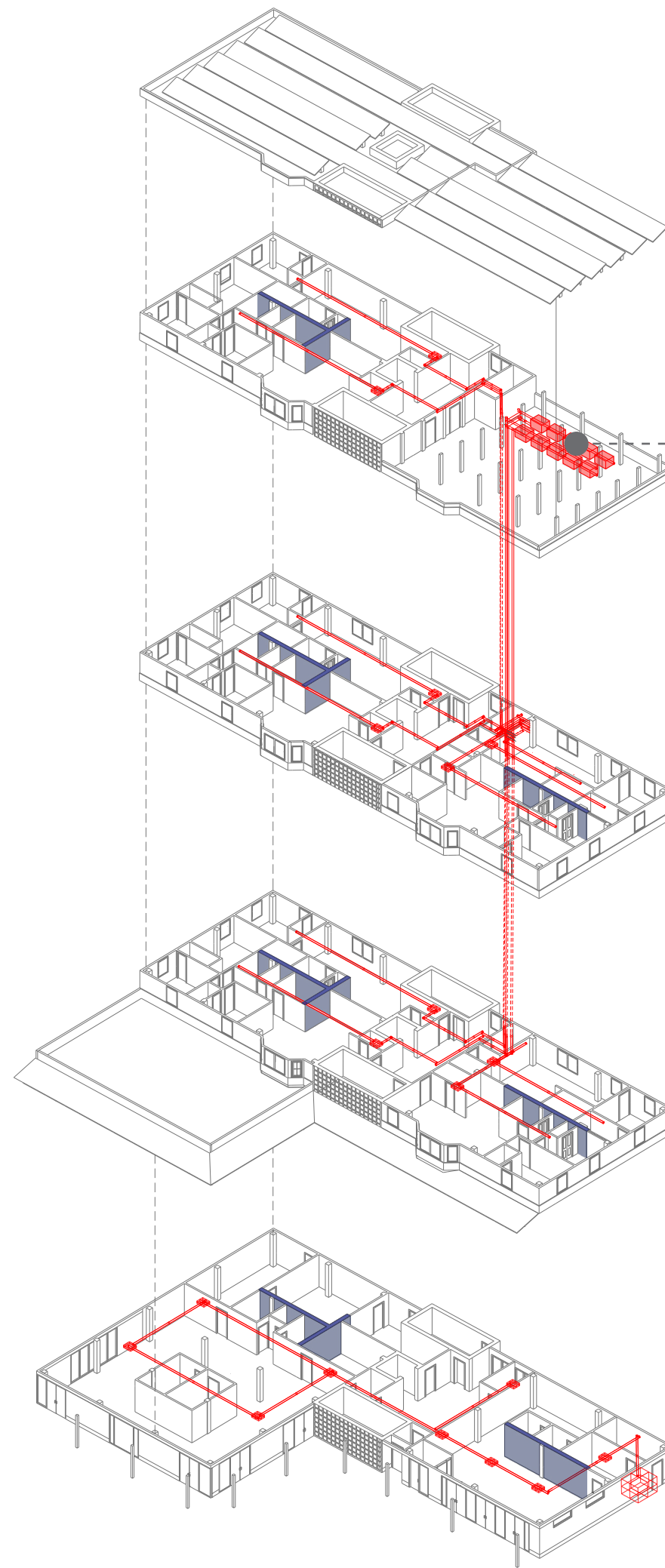
HVAC & PLUMBING

ACTIVE STRATEGIES

ENERGY SIMULATION
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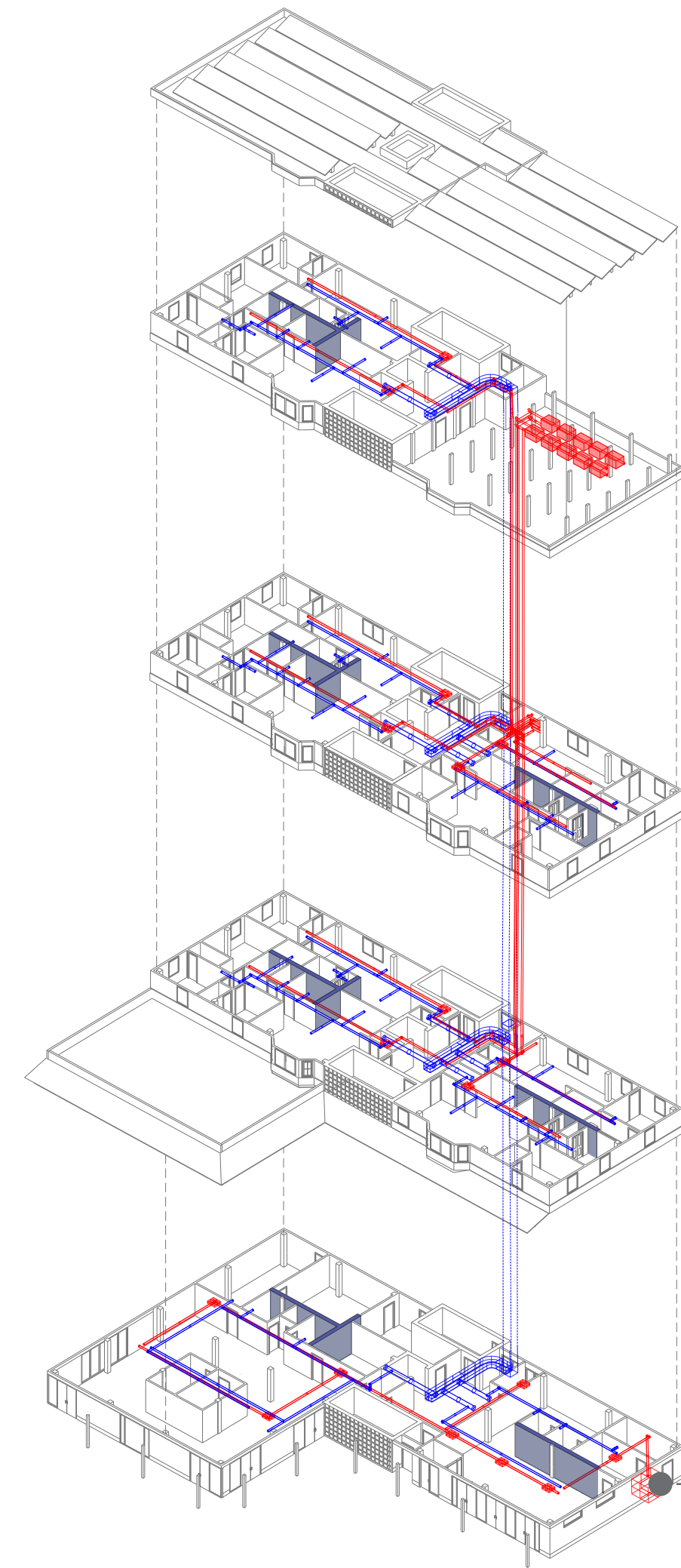


AIR SUPPLY



REFRIGERANT FLOW

VRF ROOF
TOP UNITS

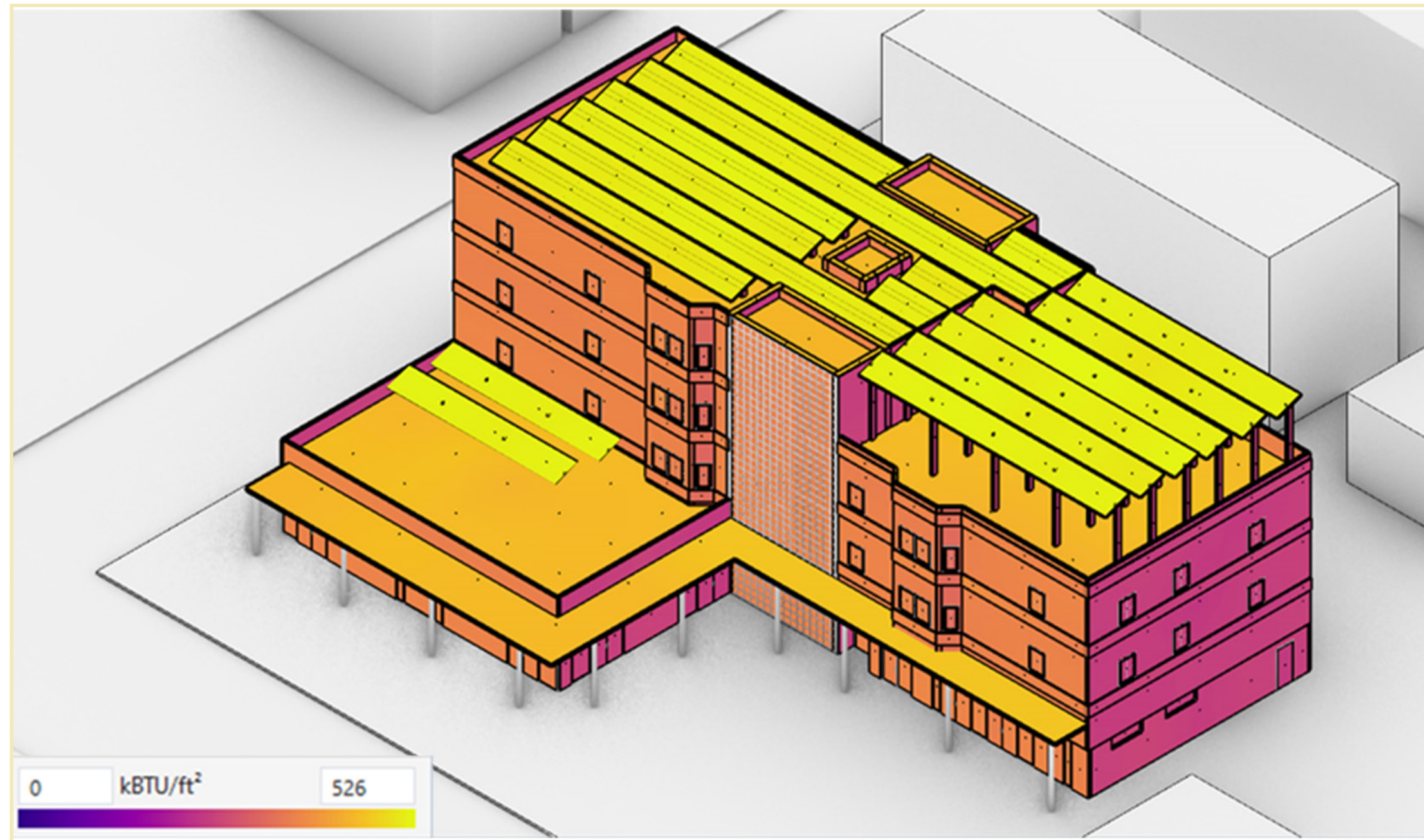


VRF + 100%
OA UNIT

COMBINATION

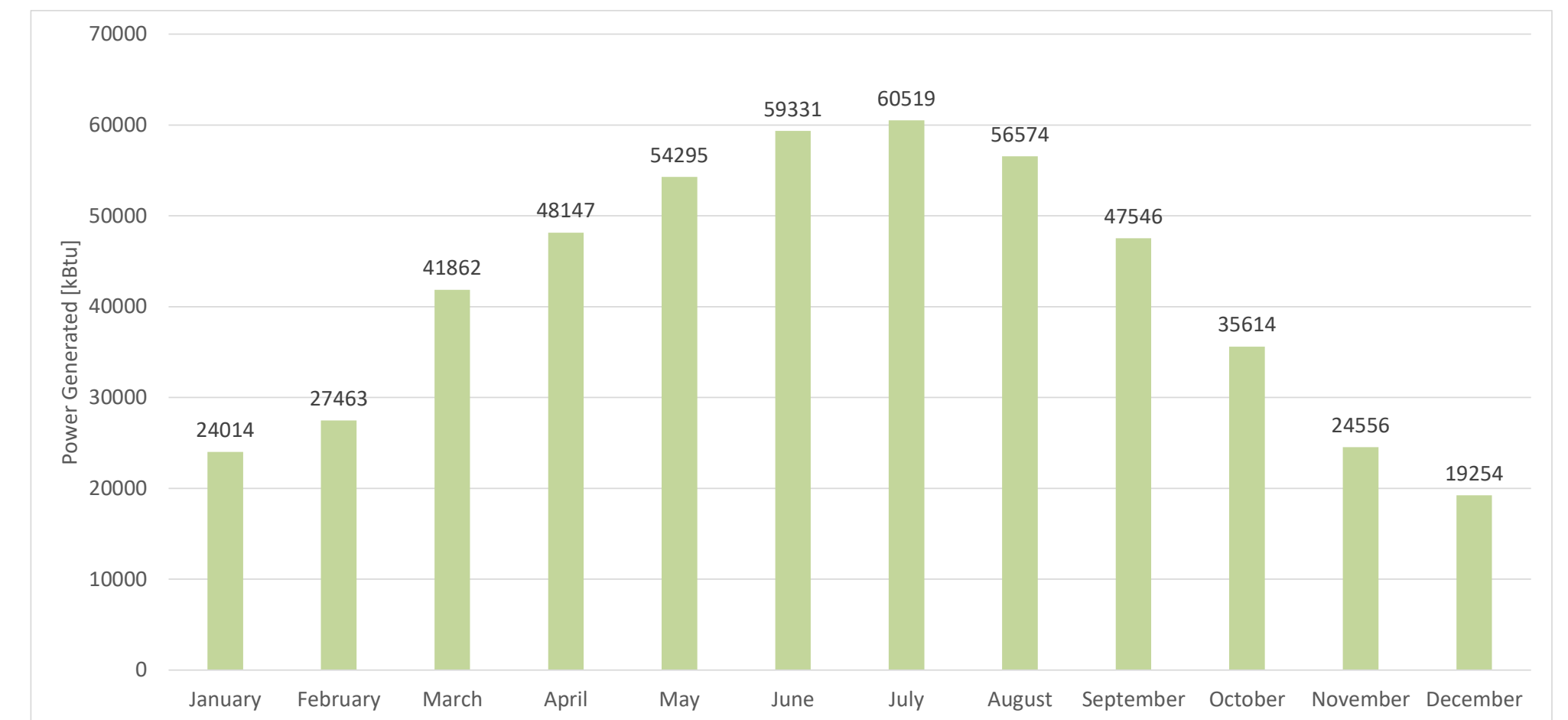
PV

ACTIVE STRATEGIES



ANNUAL RADIANCE MAP

PV System Design		
Module	Canadian Solar HiKu CS3W-440MS	
Nominal Power	440	Watts
Array Size	101	kW AC
Number of Modules	240	Modules
Tilt	30	Degrees (from horizontal)
Orientation	180	Degrees (South)
Total Energy Production	146,300	kWh

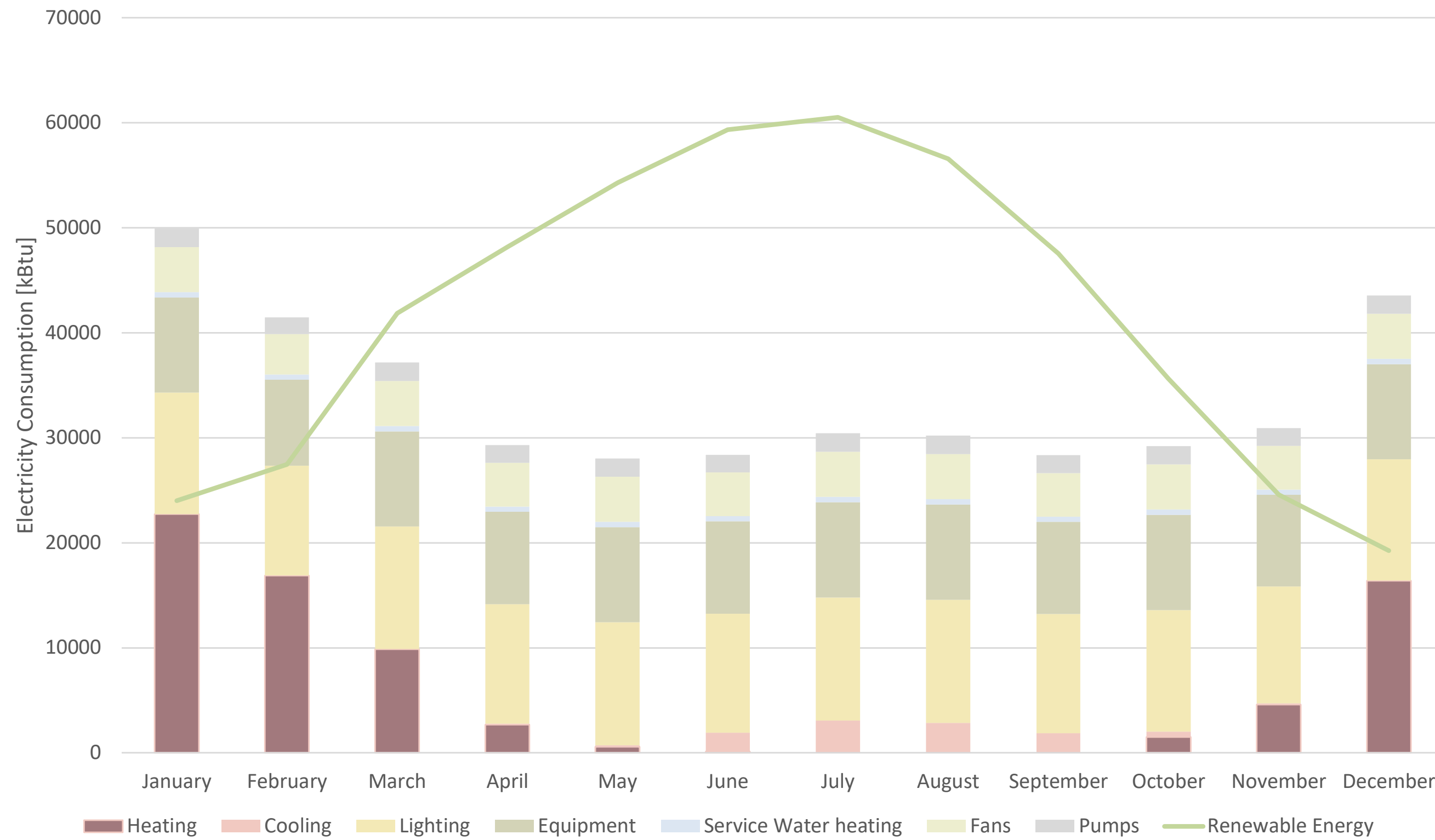


MONTHLY POWER GENERATION

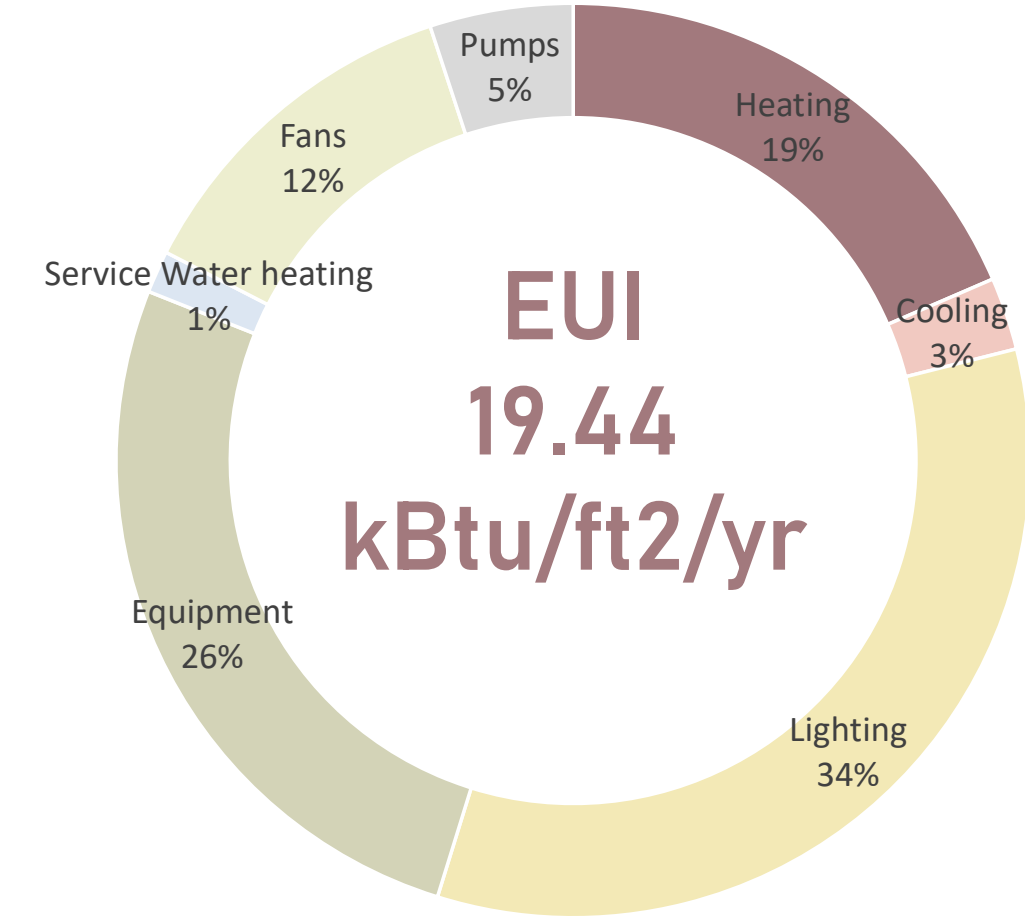
ENERGY SIMULATION RESULTS

ENERGY SIMULATION

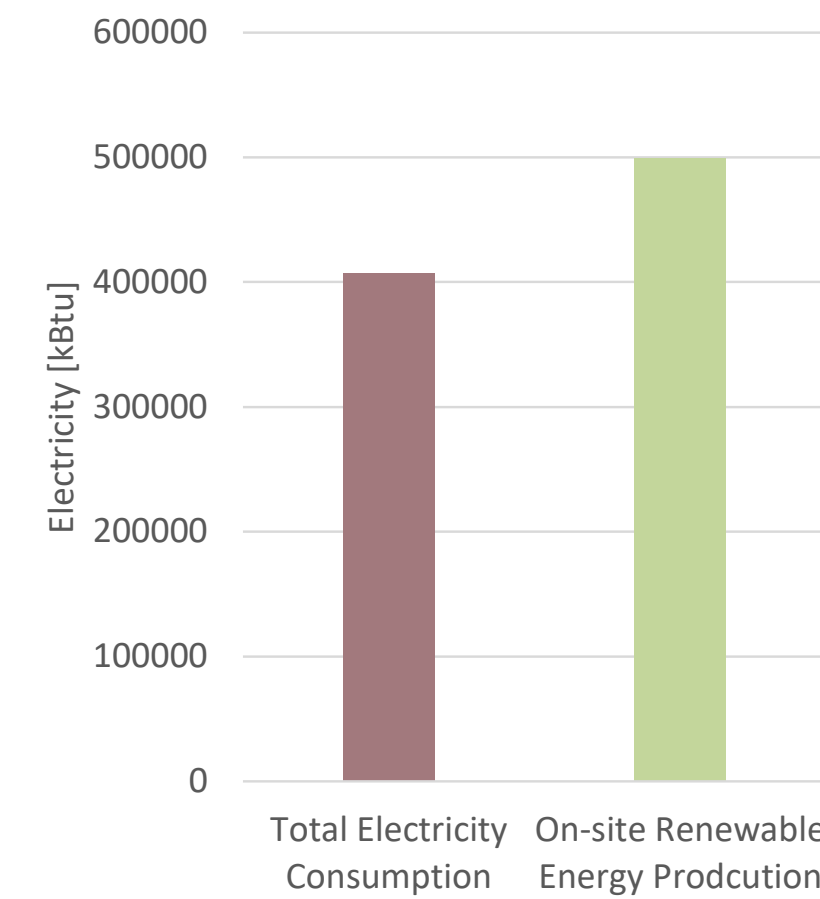
ENVIRONMENTAL IMPACT



MONTHLY ENERGY CONSUMPTION VS GENERATION



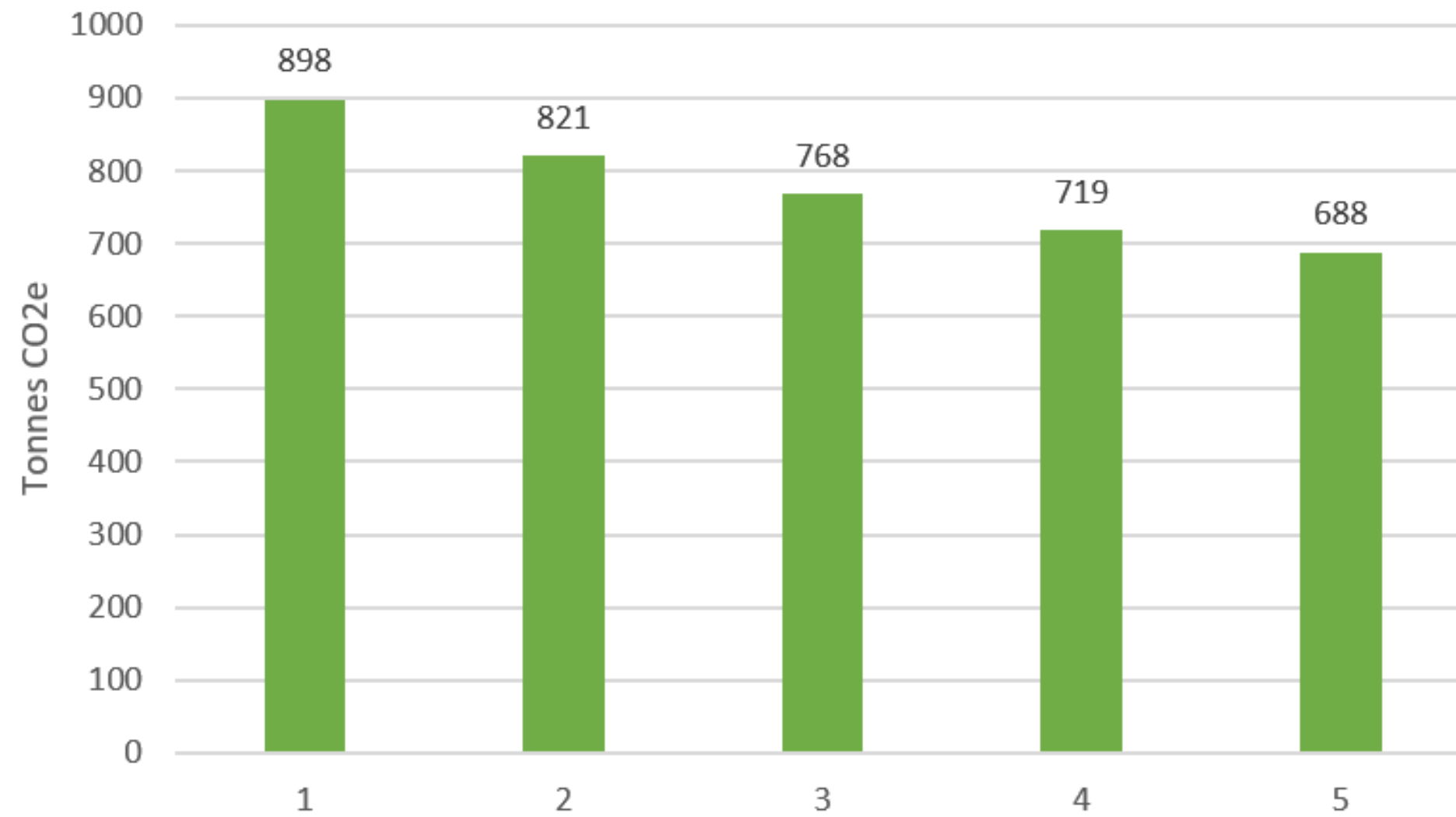
ANNUAL ENERGY END-USE BREAKDOWN



TOTAL ENERGY CONSUMPTION VS GENERATION

EMBODIED CARBON - LCA

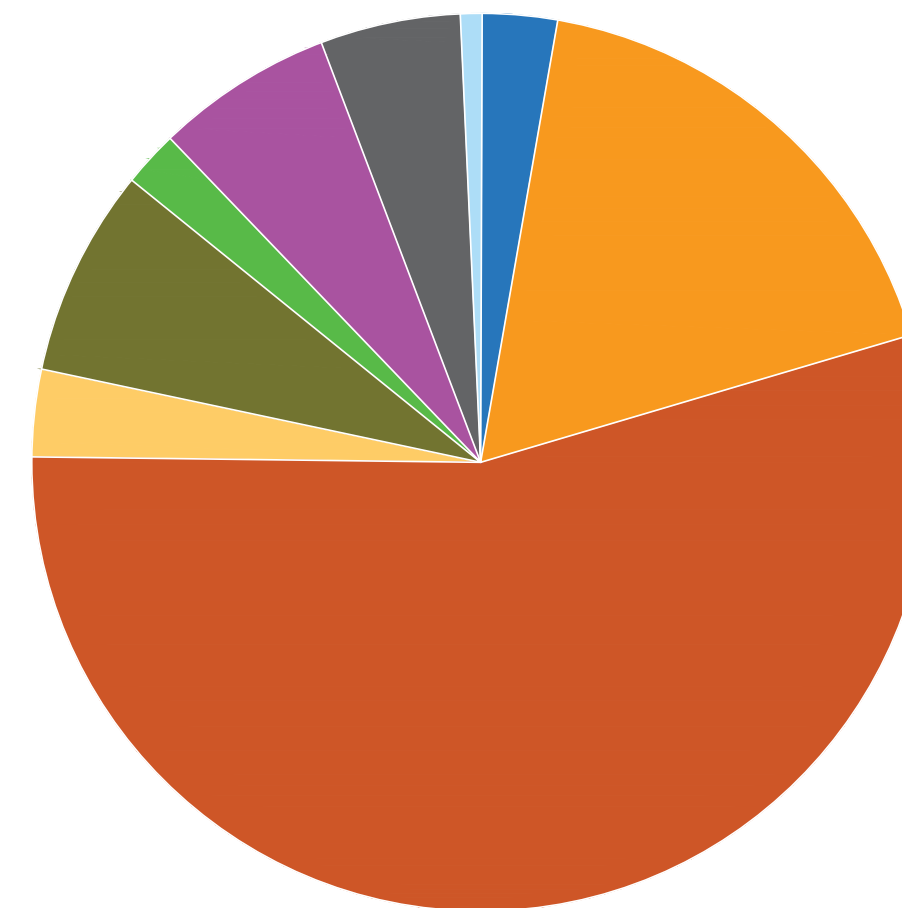
ENVIROMENTAL IMPACT



	Material	CO2 emissions Reductions
2	Rebar (97% Recycled content)	77 Tonnes -8.6%
3	Concrete	53 Tonnes -5.9%
4	Extruded Aluminum	49 Tonnes -5.4%
5	EPS	31 Tonnes -3.7%

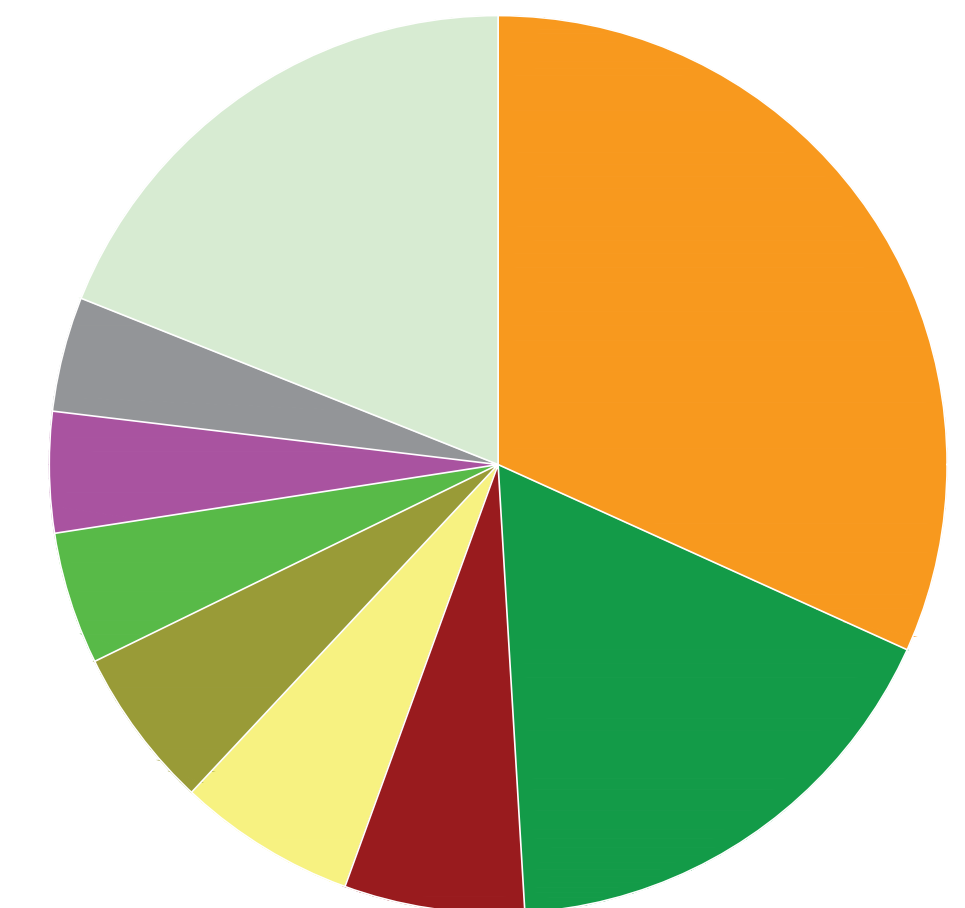
Carbon Dioxide Emissions Reduction Based on Material Selection

- 21-01 10 10. Standard Foundations - 2.7%
- 21-02 10 10. Floor Construction - 17.2%
- 21-02 20 10. Exterior Walls - 55.6%
- 21-02 20 20. Exterior Windows - 3.2%
- 21-02 20 50. Exterior Doors and Grilles - 7.6%
- 21-03 20 10. Suspended Ceiling Construction - 1.9%
- 21-03 20 10. Wall Finishes - 6.3%
- 21-03 20 30. Flooring - 5.1%
- Other classifications - 0.4%



Global Warming kg CO2e: Classifications

- Ready-mix concrete, high strenght - 31.7%
- Ready-mix concrete for external walls and floors - 17.2%
- Paints, coatings and lacquers - 6.6%
- Metal and Industrial doors - 6.4%
- EPS (expanded polystyrene) insulation - 4.7%
- Reinforcement for concrete (rebar) - 4.7%
- Plain wood/timber (softwood and hardwood) - 4.5%
- Aluminium - 4.3%
- Other resource types - 18.8%



Global Warming kg CO2e: Resource Types



THANK YOU

