



# H.I.L.D.I.N.G

**Forward Thinking Designers, just like you.**







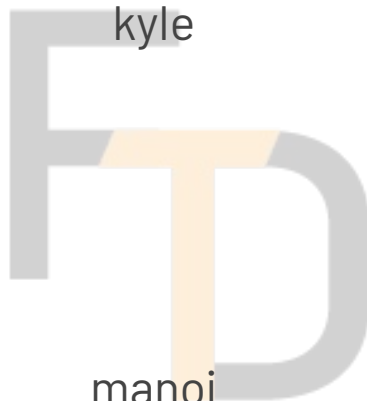
jeb



kyle



derek



teddy

manoj

elana







# Equity + Economic Mobility

## KEY SUB SYSTEM

- Relationship between different economic classes
- Police treatment
- Movements, actions and protests
- Available systems to move through economic classes
- Racial relationships [Racial attitudes?]
- PHA residents and Sharswood residents relationships
  - "- 1964: Race riot on Columbia Ave establishes the end of the specific Jazz scene of North Philly, along with desegregation laws allowing jazz musicians to play all around the city
- 1965: NAACP begins picketing Girard College with visits from nat'l civil rights leaders such as MLK:""for this wall of this school is symbolic of a tragic evil in our nation, it is symbolic of a cancer in the body politic, which must be removed..."

- authorities periodically broke up the pickets: Bernyce Mills -DeVaughn remembers her 14yo sister, Debbie, being attacked by German Shepherds which wouldn't let go of her, and then the police charging her with disturbing the peace and existing arrest
- Cecil B. Moore (president of NAACP) accredited for protecting protesters
- 1967: Sharswood Blumberg Towers built, becoming one of the most notorious housing projects in Philadelphia
- 1968: First 4 black students selected to enter Girard College
- Loss of Middle Class Housing in Sharswood



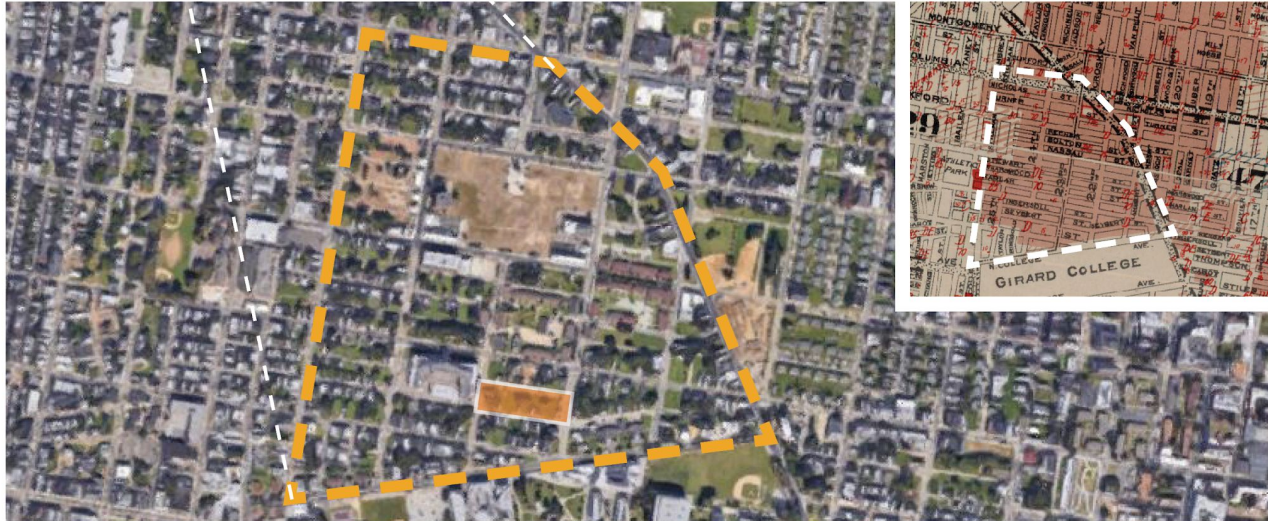
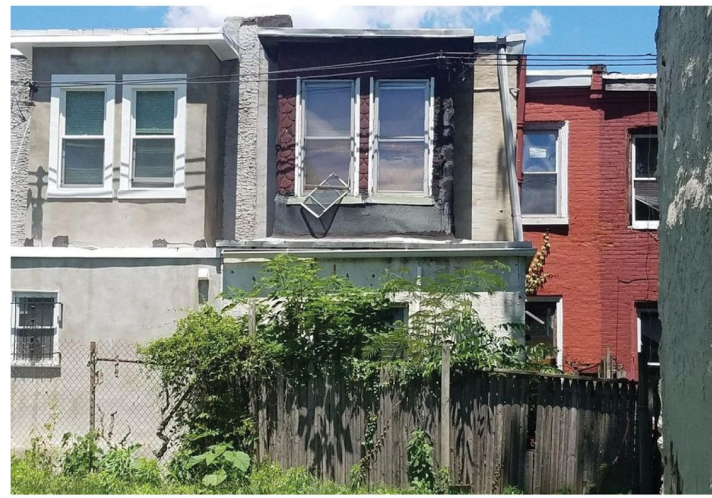
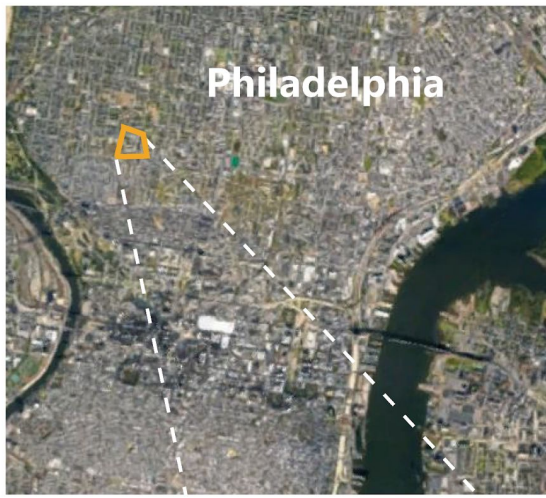
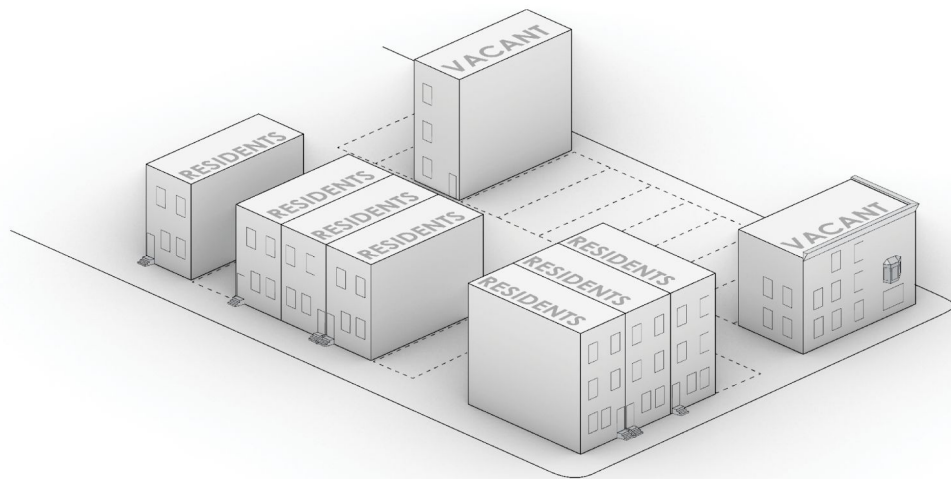


Fig. 2 - 2018 Google Maps outlining site in Sharswood

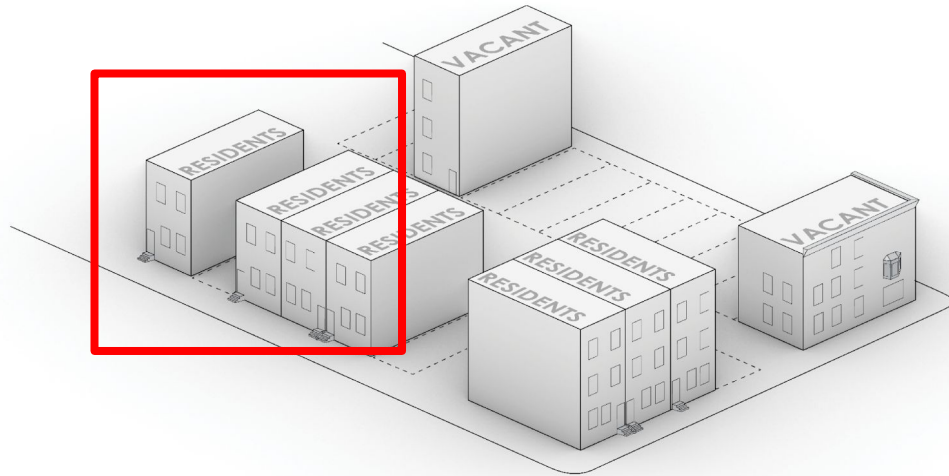
Fig. 3 - 1934 Redlining Map



# Site conditions

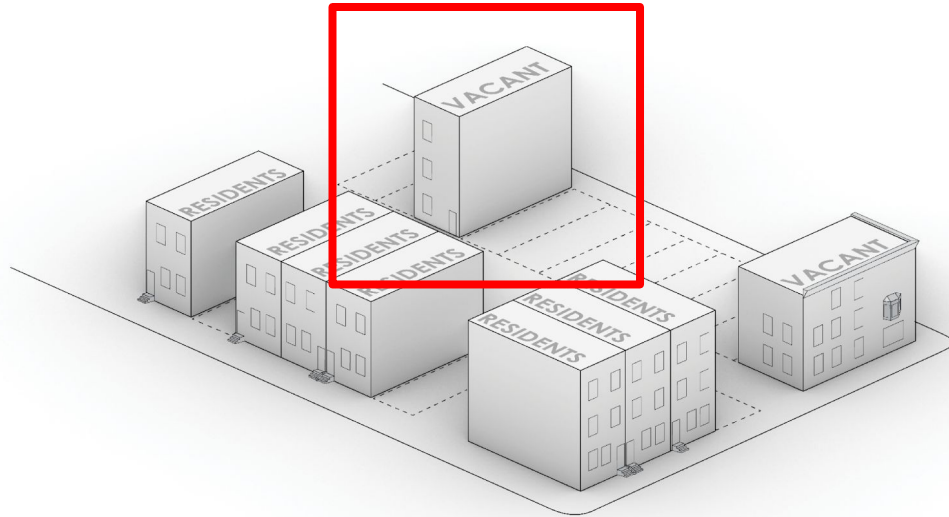


# "Missing Teeth"

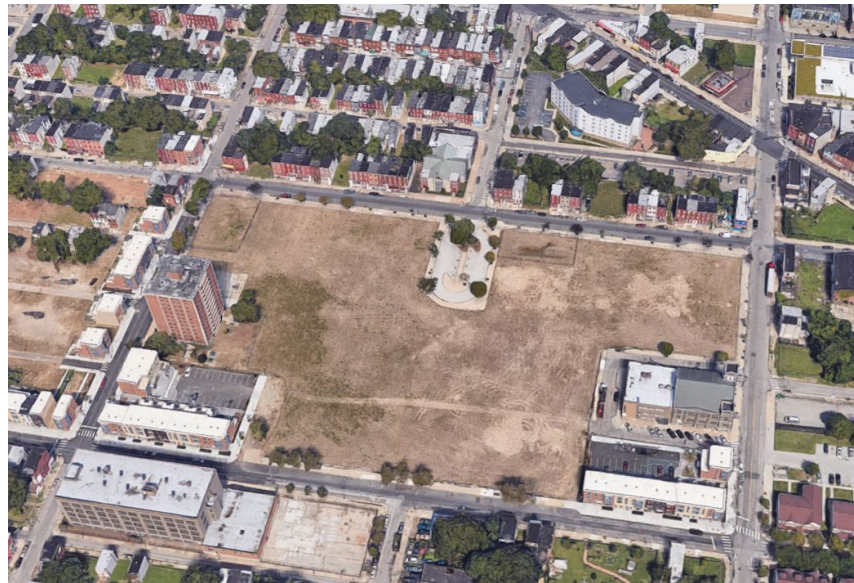
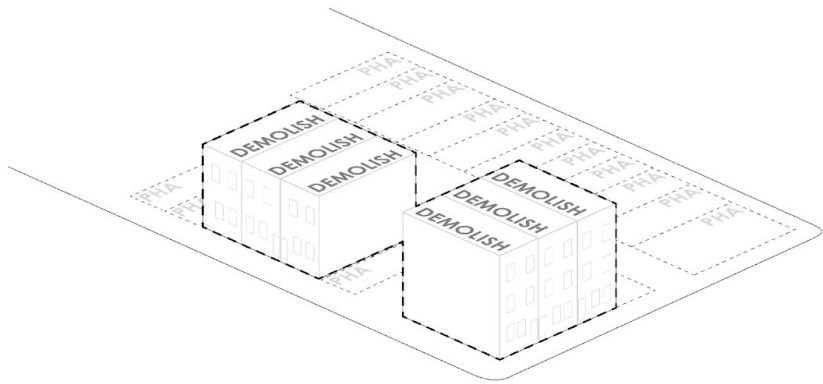




# "Baby Tooth"

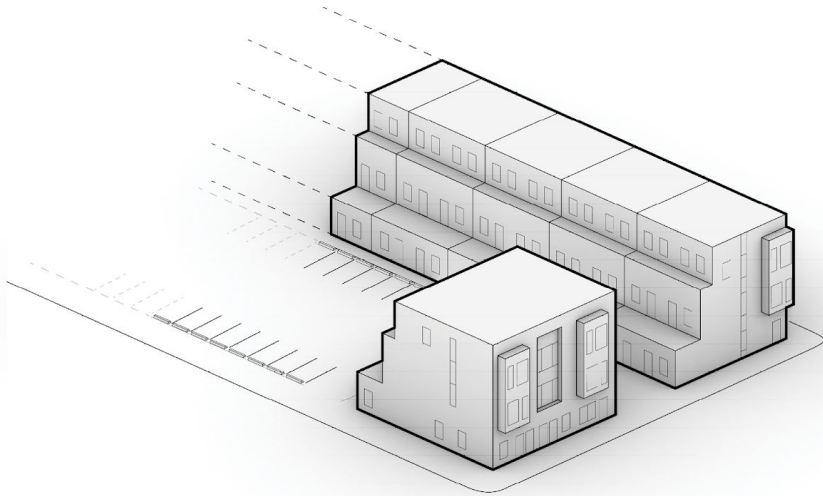


# Housing Authority Clear-Cutting





# PHA Multifamily





What if **energy is the missing link** to making housing affordable?



ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

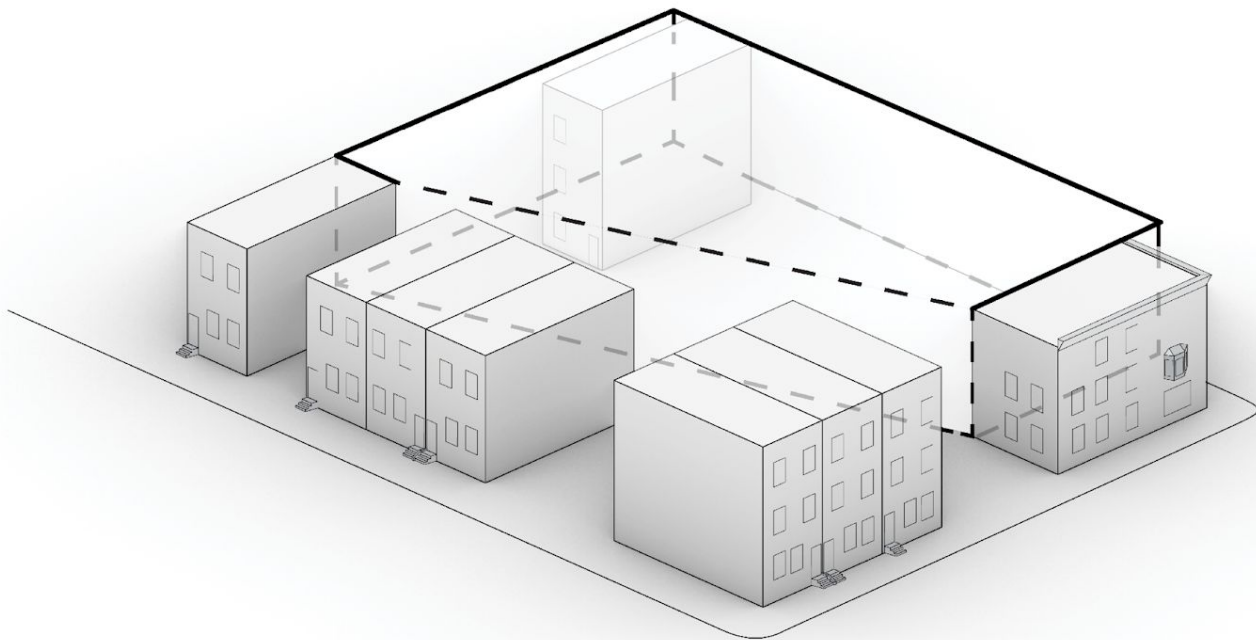
ARCHITECTURE

OPERATIONS

MARKET

COMFORT

INNOVATION



ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

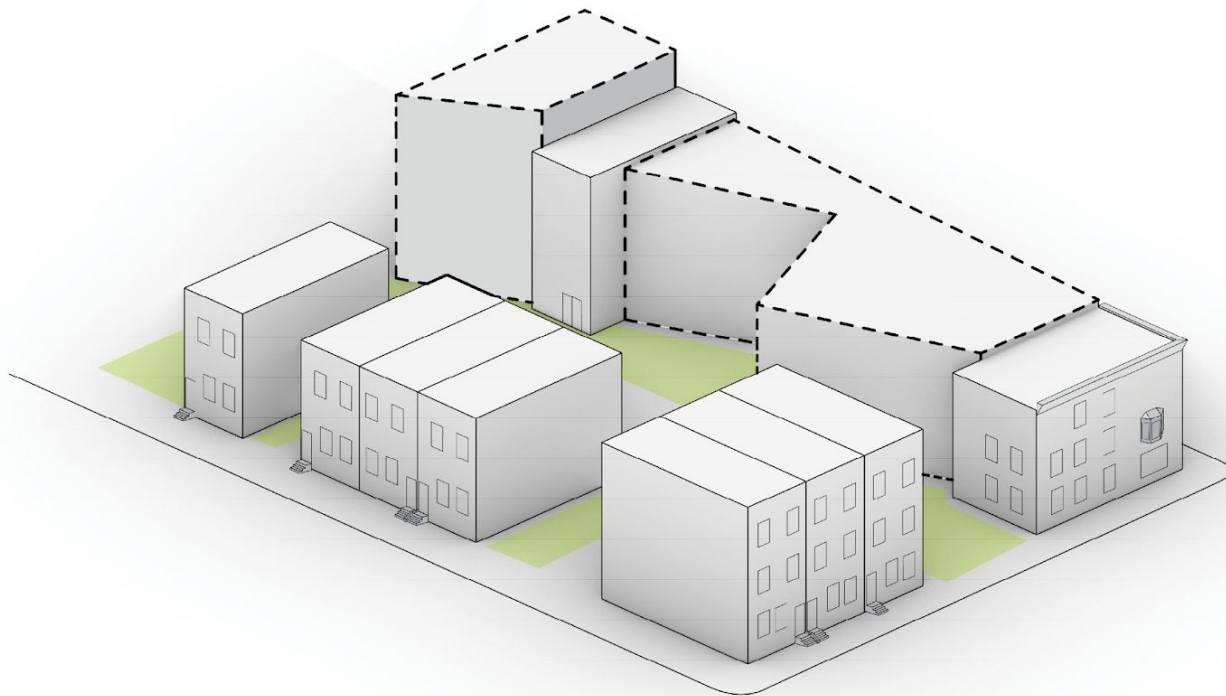
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RESILIENCE

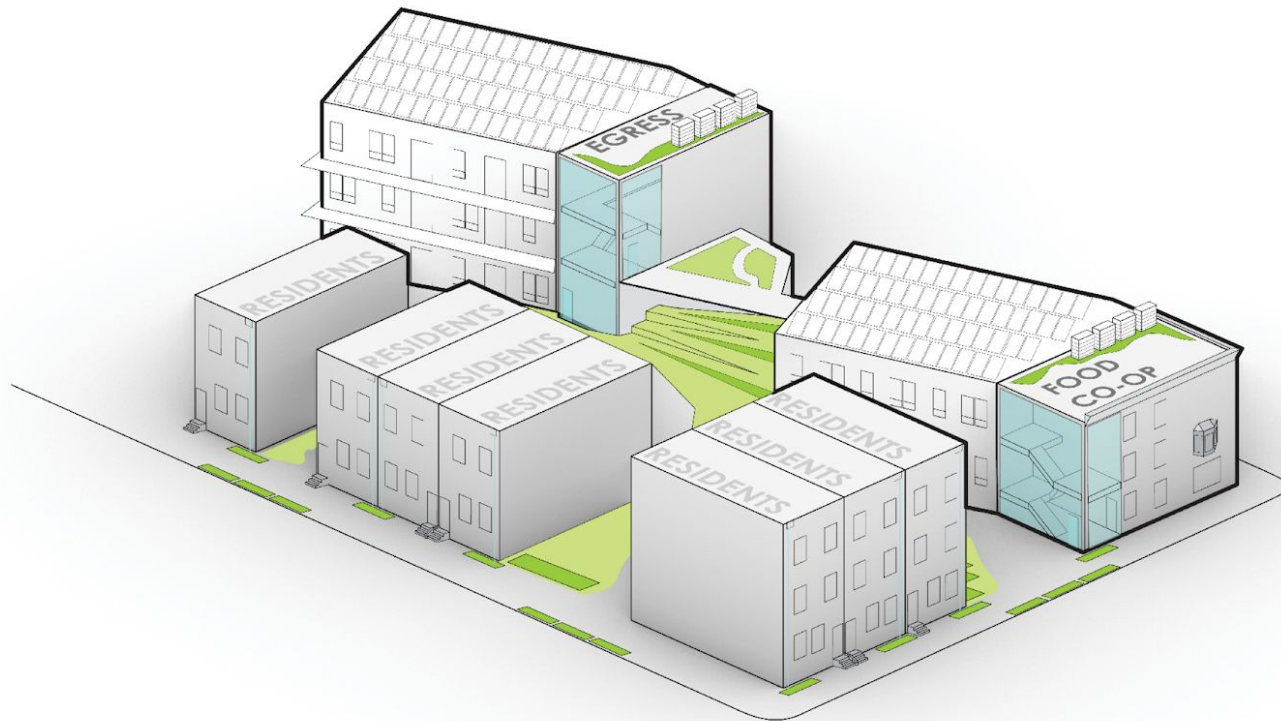
ARCHITECTURE

OPERATIONS

MARKET

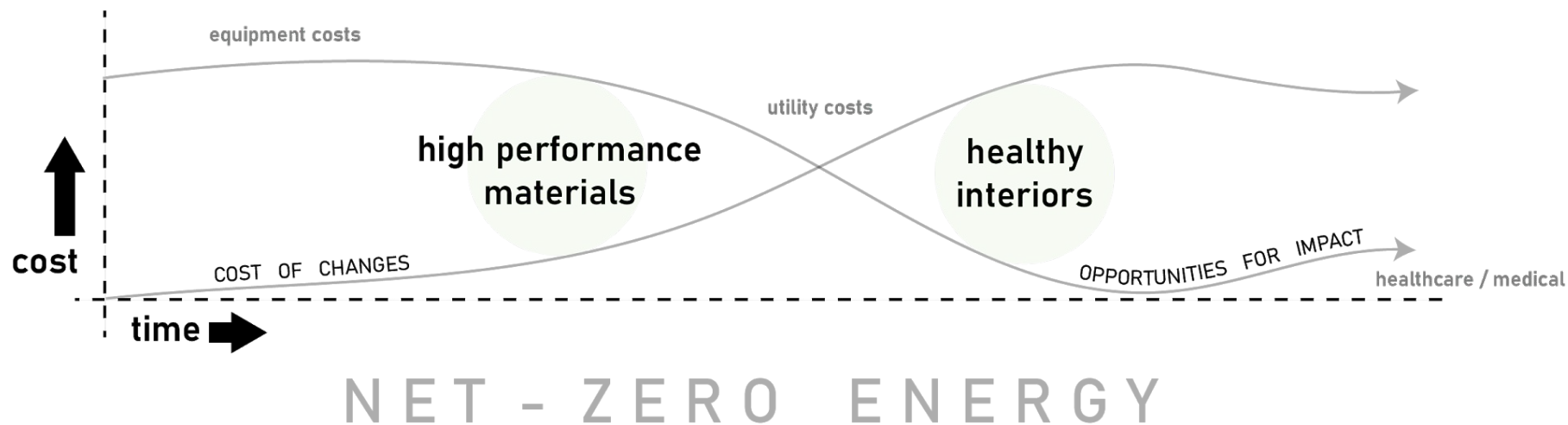
COMFORT

INNOVATION

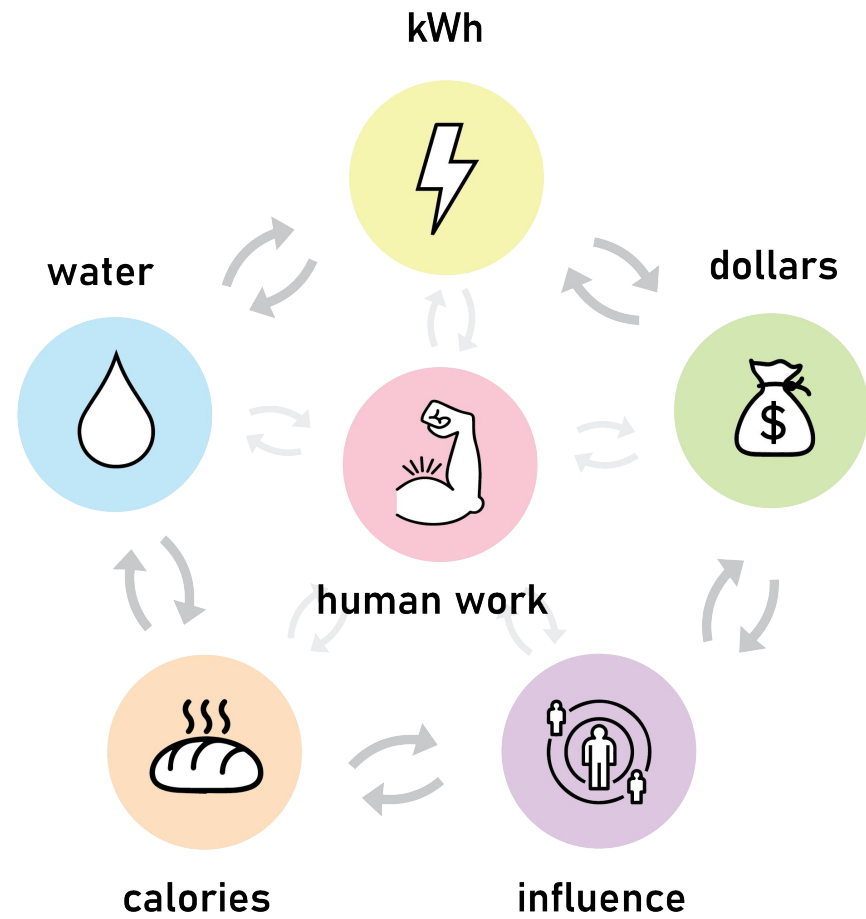




ENERGY	ENGINEERING	AFFORDABLE	RESILIENCE	ARCHITECTURE	OPERATIONS	MARKET	COMFORT	INNOVATION
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ENERGY	ENGINEERING	AFFORDABLE	RESILIENCE	ARCHITECTURE	OPERATIONS	MARKET	COMFORT	INNOVATION
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How can building affordable housing  
**nourish, educate, and empower** both  
stakeholders and stockholders?

ENERGY

ENGINEERING

AFFORDABLE

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ARCHITECTURE

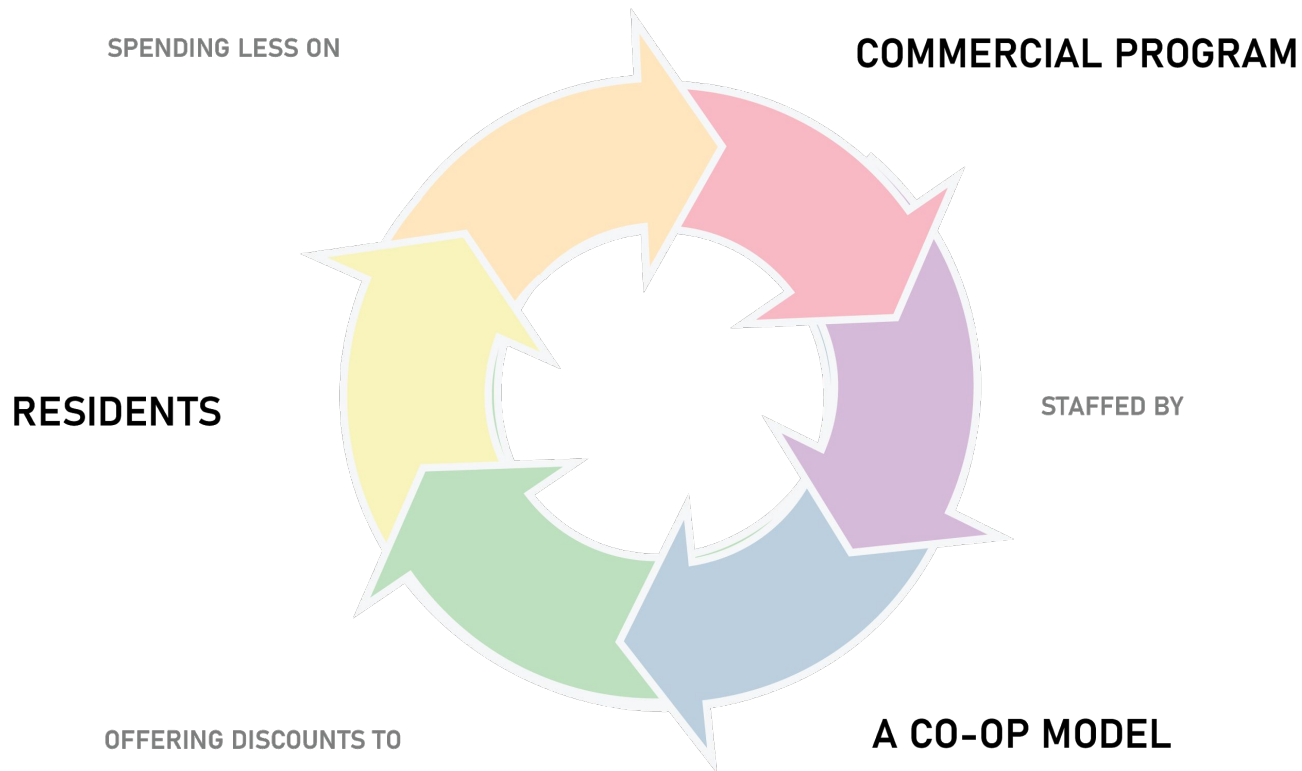
OPERATIONS

MARKET

COMFORT

INNOVATION

# Opportunities for Impact



ENERGY

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ARCHITECTURE

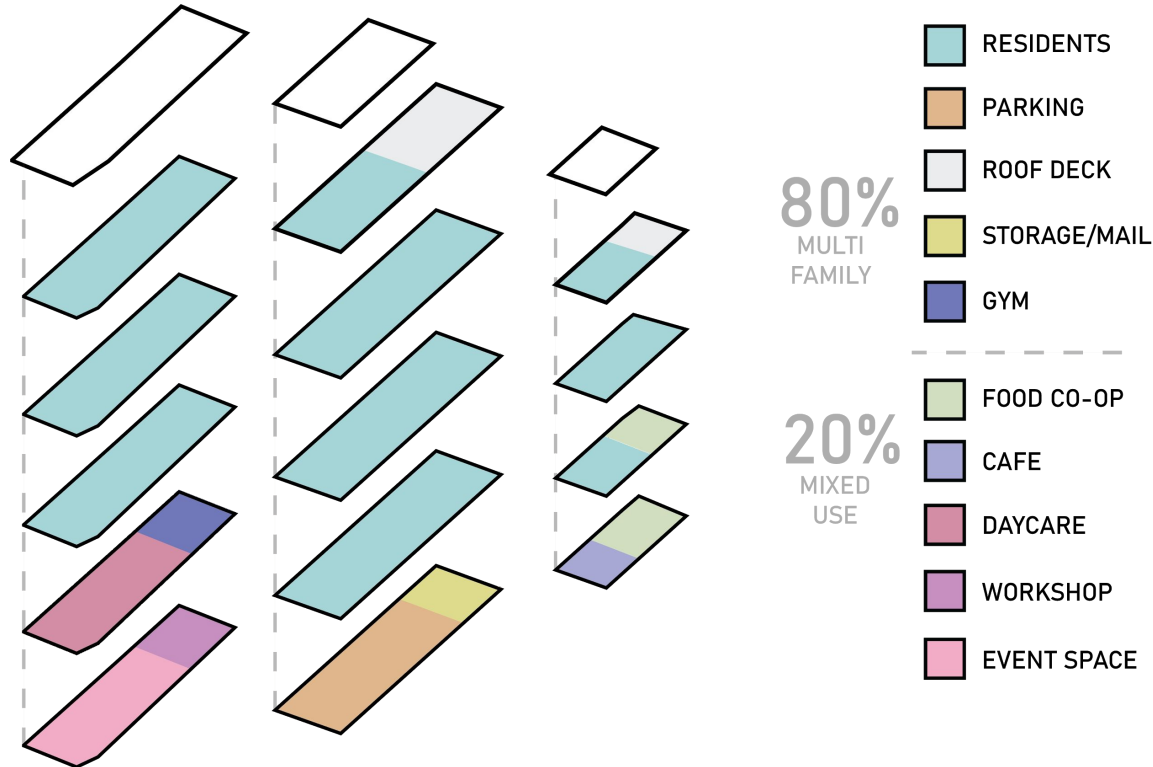
OPERATIONS

MARKET

COMFORT

INNOVATION

# Mixed Use Breakdown





ENERGY

ENGINEERING

AFFORDABLE

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ARCHITECTURE

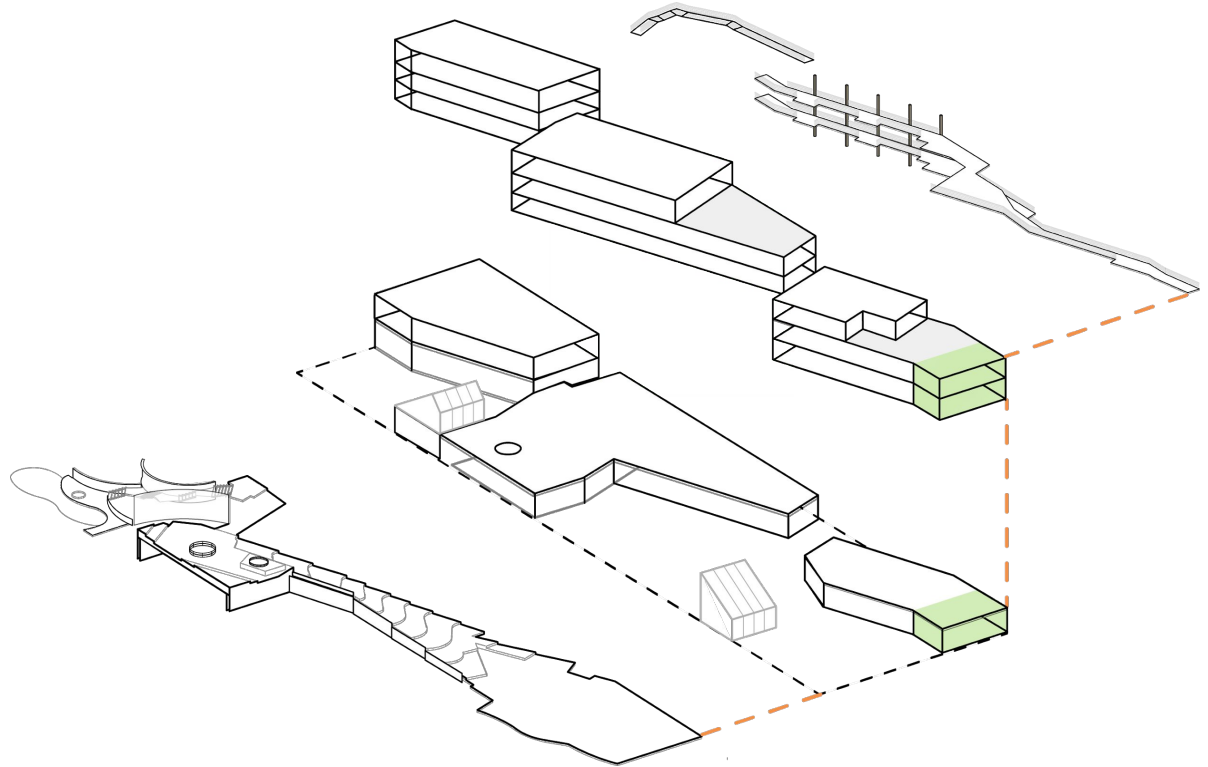
OPERATIONS

MARKET

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# Food Co-op and Cafe





ENERGY

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ARCHITECTURE

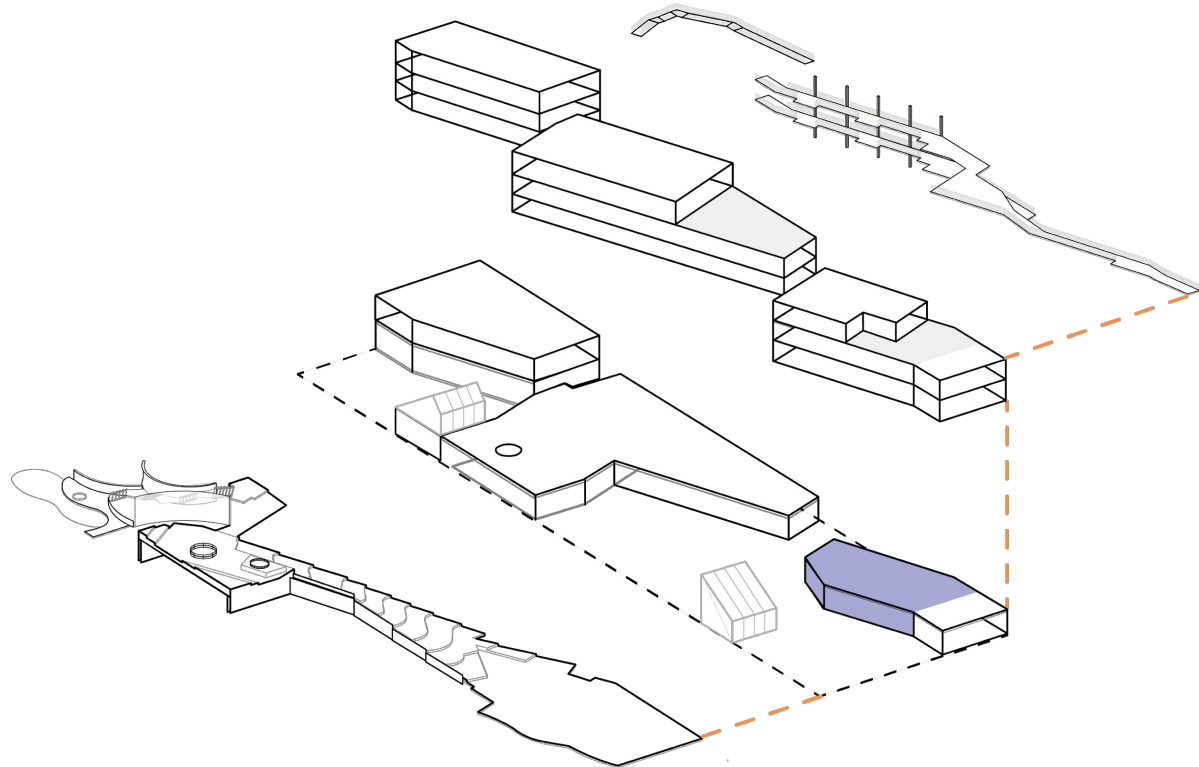
OPERATIONS

MARKET

COMFORT

INNOVATION

# Community Room with Commercial Kitchen







ENERGY

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ARCHITECTURE

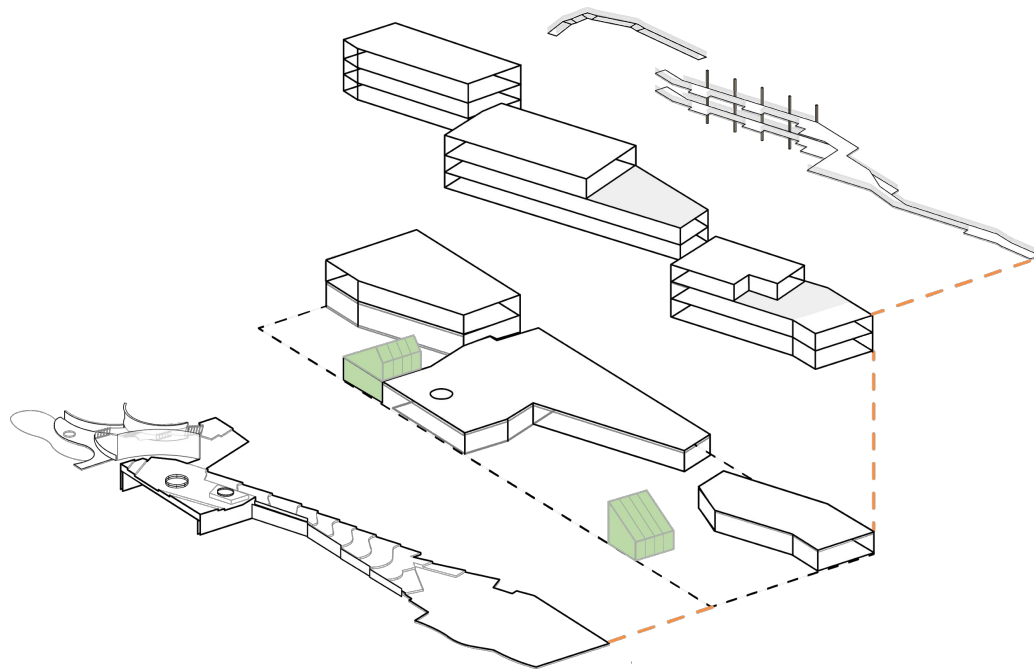
OPERATIONS

MARKET

COMFORT

INNOVATION

# Greenhouse







ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

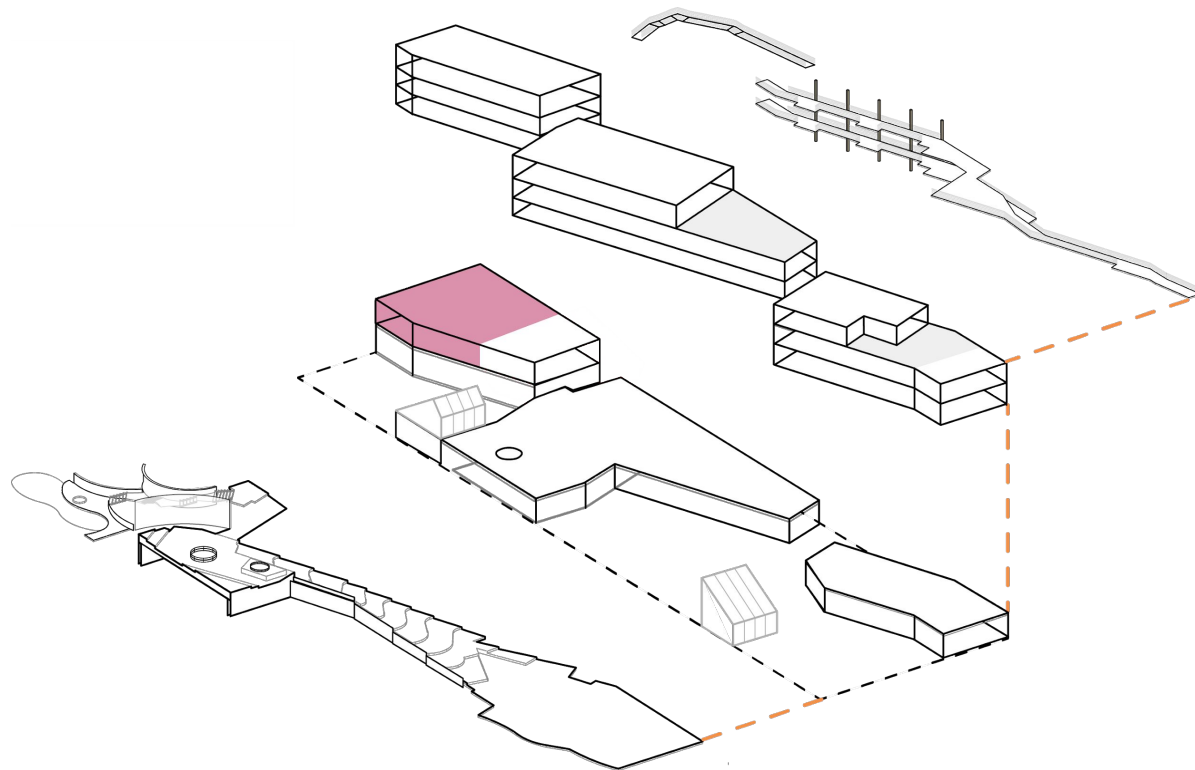
OPERATIONS

MARKET

COMFORT

INNOVATION

# Child Care Center





ENERGY

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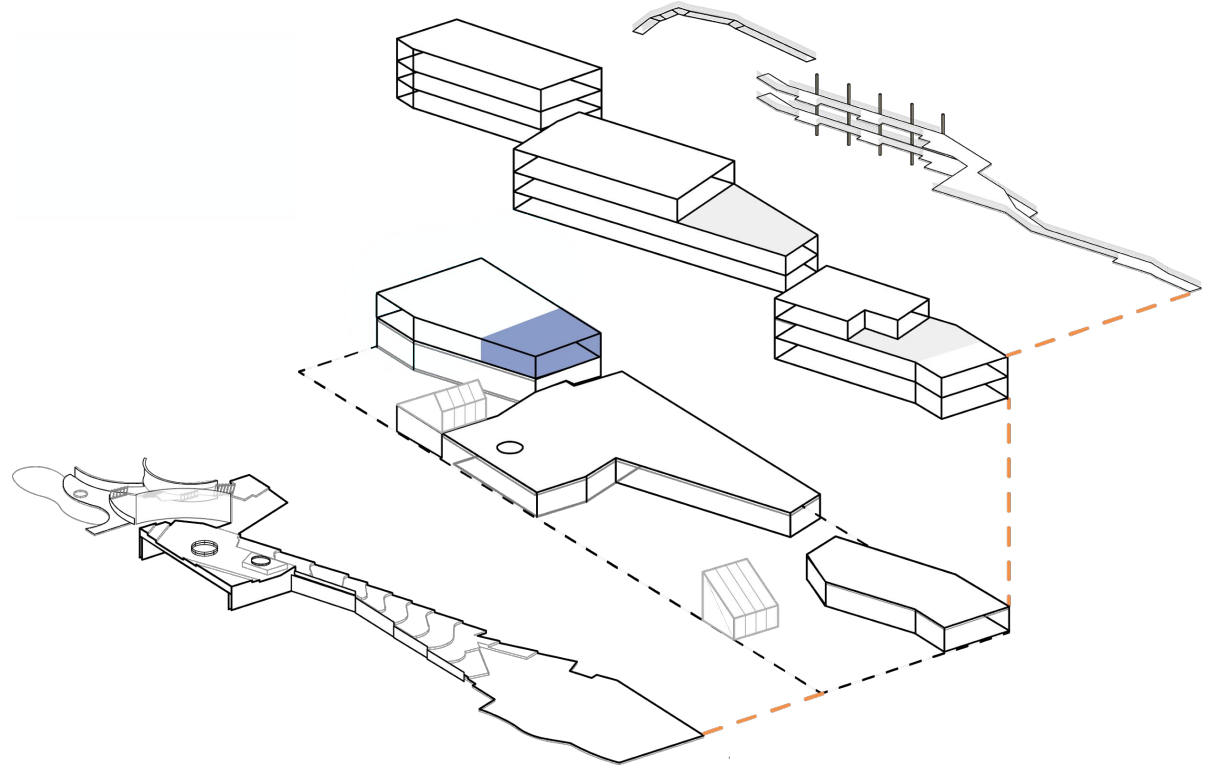
OPERATIONS

MARKET

COMFORT

INNOVATION

# Fitness Center



ENERGY

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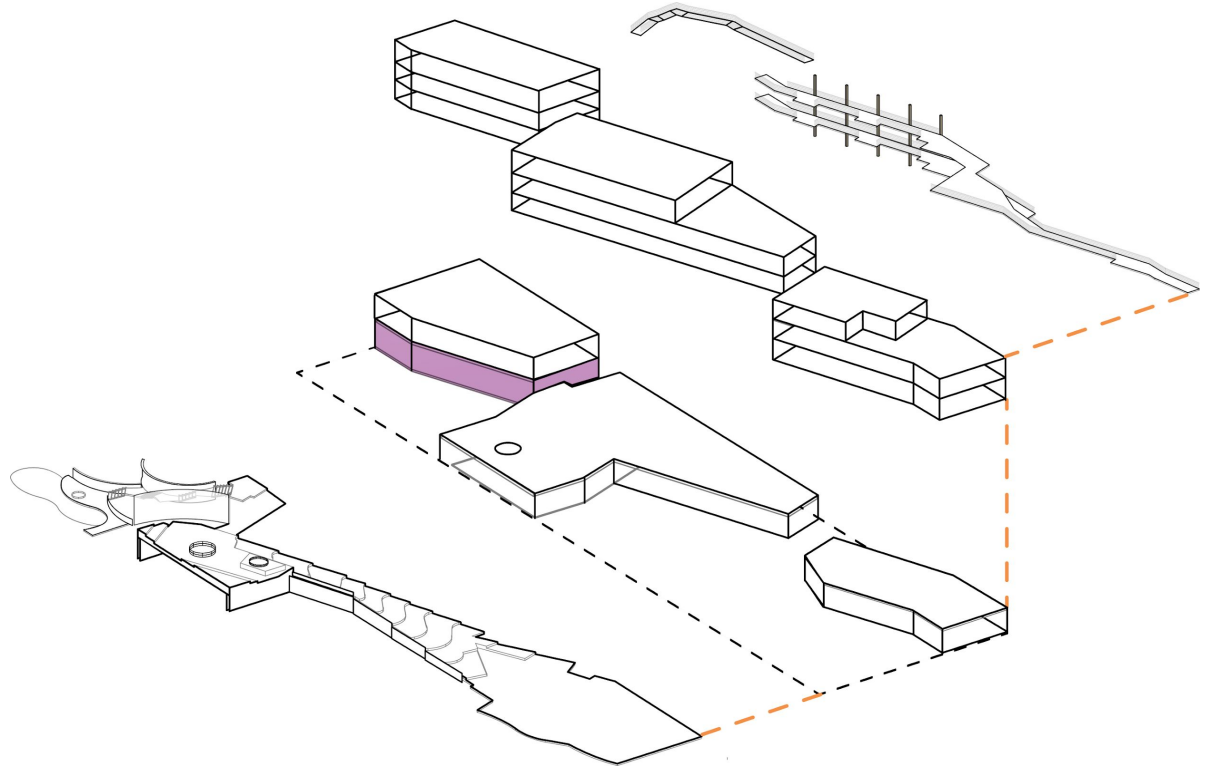
OPERATIONS

MARKET

COMFORT

INNOVATION

# Event Space and Vocational Workshop



ENERGY

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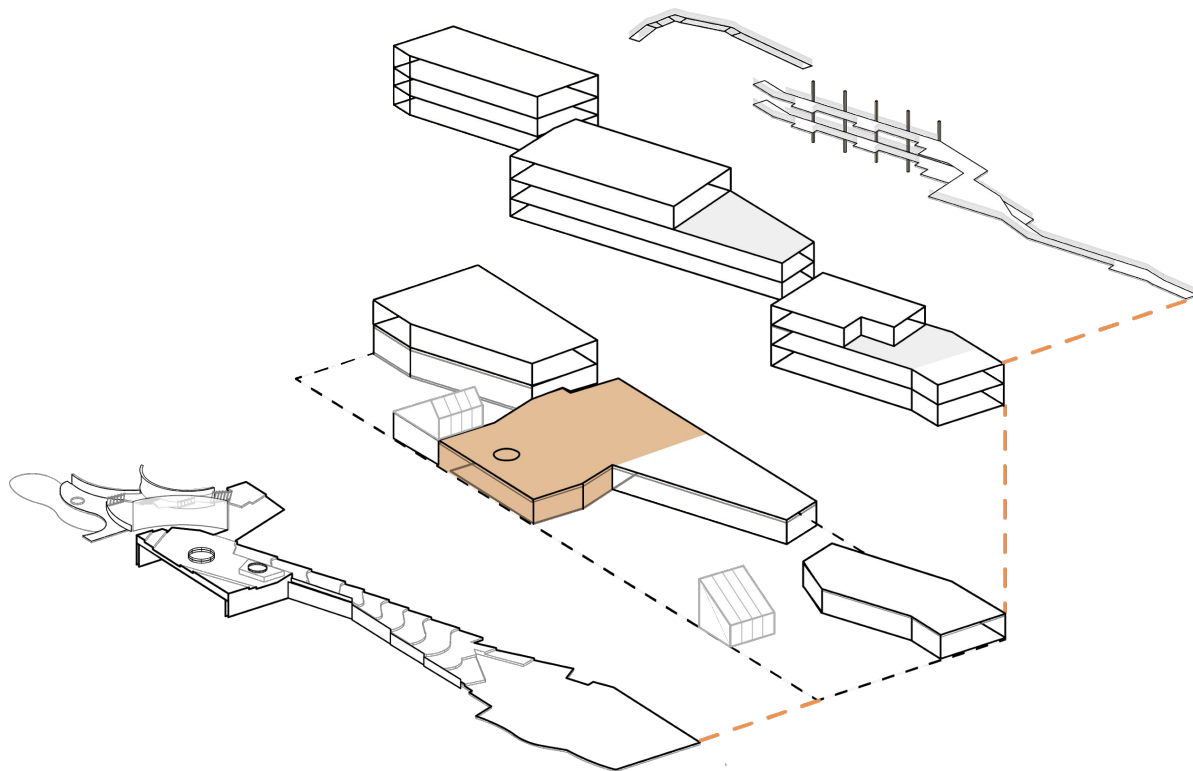
OPERATIONS

MARKET

COMFORT

INNOVATION

# Parking



ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

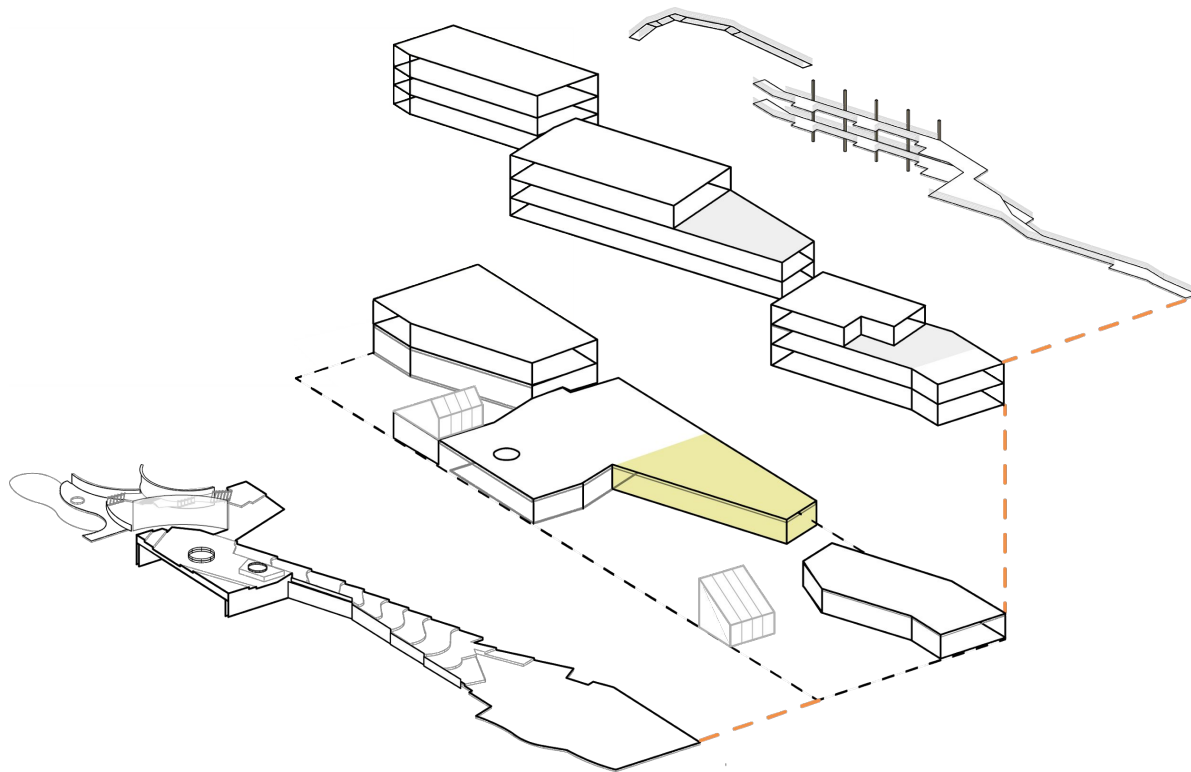
OPERATIONS

MARKET

COMFORT

INNOVATION

# Mail/Storage





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ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

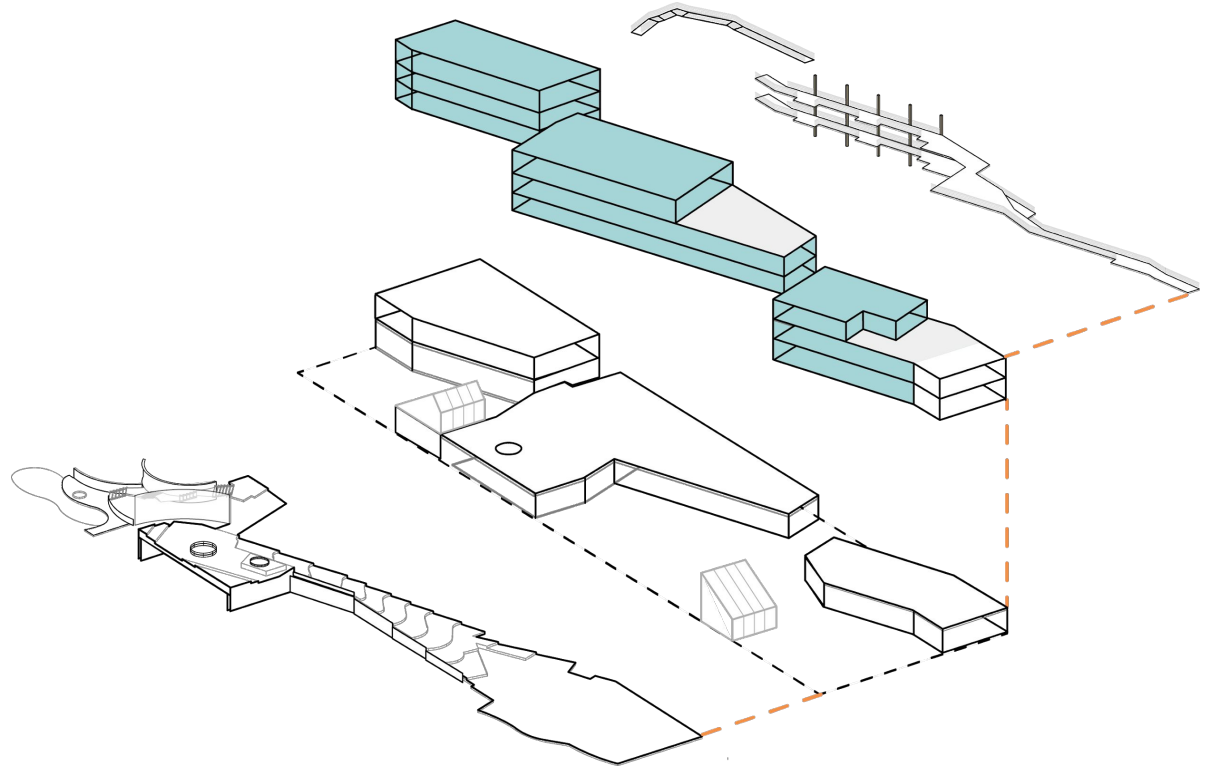
OPERATIONS

MARKET

COMFORT

INNOVATION

# Residential & Laundry



ENERGY

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AFFORDABLE

RESILIENCE

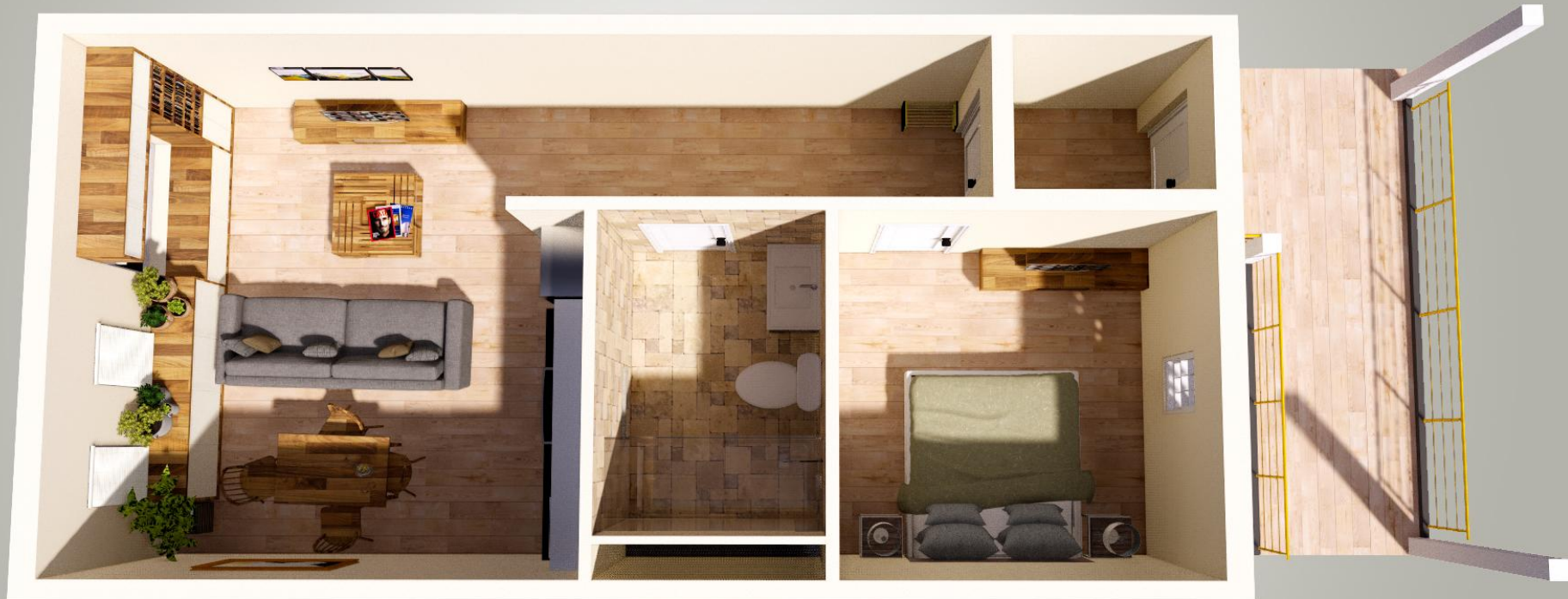
ARCHITECTURE

OPERATIONS

MARKET

COMFORT

INNOVATION







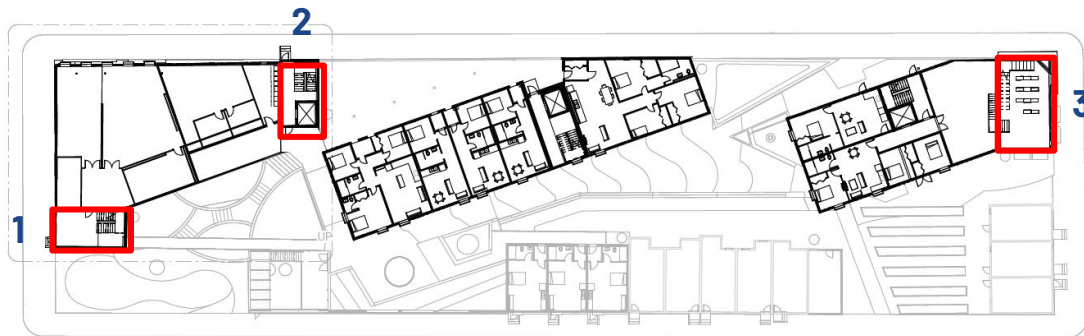






**Should historic building stock be repurposed or demolished?**

1. Year Built: 1920  
Zoning & Building Type: RM-1, Single Family
2. Year Built: 1925  
Zoning & Building Type: RM-1, Single Family
3. Year Built: 1925  
Zoning & Building Type: **CMX-2, Multi-family**



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MARKET

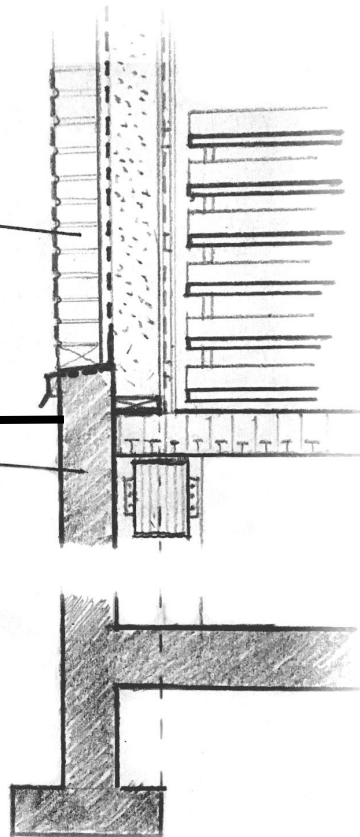
COMFORT

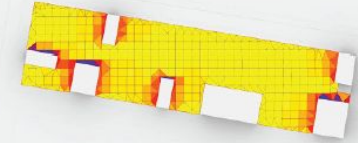
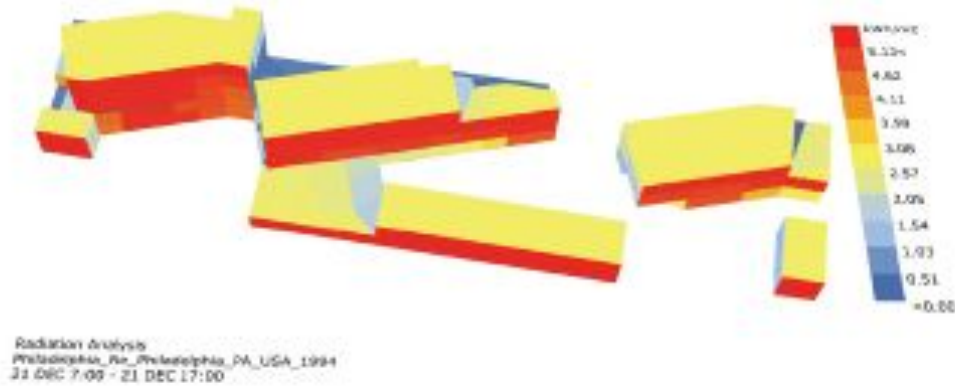
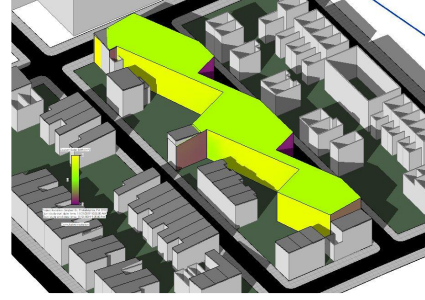
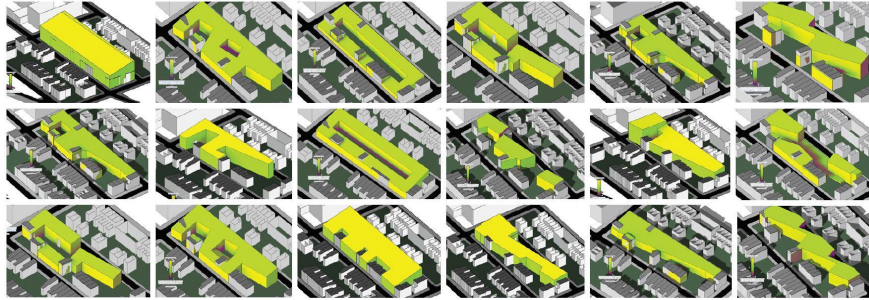
INNOVATION



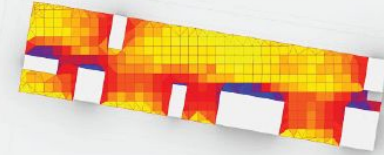
BRICK RAINSCREEN

EXTERIOR FOUNDATION

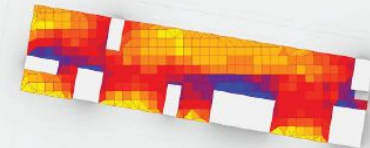




SUNLIGHT HOURS - **THIRD-FIFTH FLOORS** (typical)  
ANALYSIS PERIOD: ONE YEAR



SUNLIGHT HOURS - **SECOND FLOOR** (existing buildings)  
ANALYSIS PERIOD: ONE YEAR



SUNLIGHT HOURS - **GROUND FLOOR** (existing buildings)  
ANALYSIS PERIOD: ONE YEAR

Figure 25 - B - Ladybug Radiation Analysis



ENERGY

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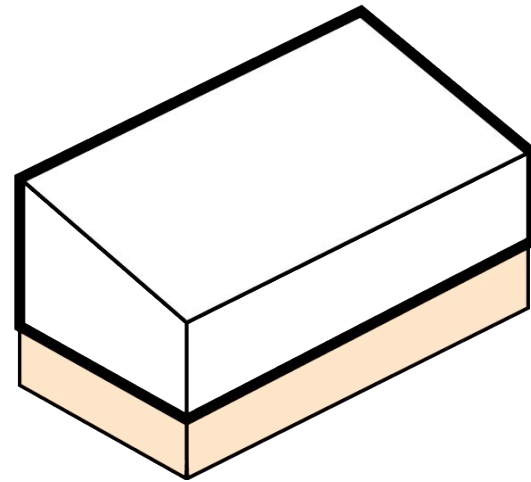
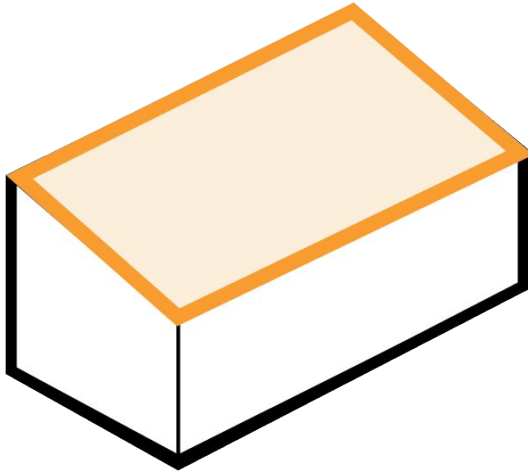
OPERATIONS

MARKET

COMFORT

INNOVATION

# Opportunities & Vulnerabilities



ENERGY

ENGINEERING

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RESILIENCE

ARCHITECTURE

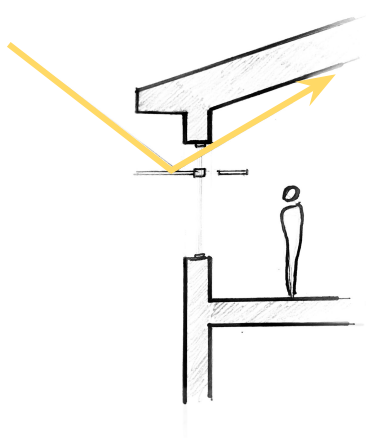
OPERATIONS

MARKET

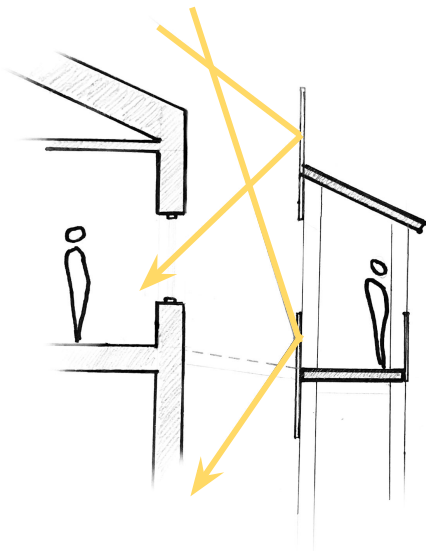
COMFORT

INNOVATION

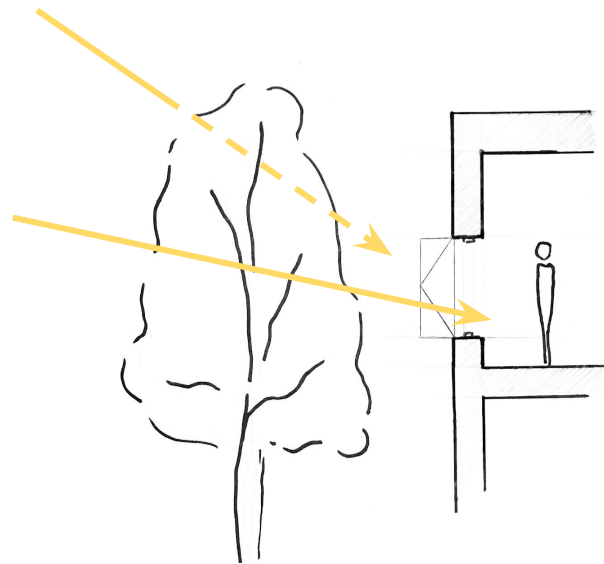
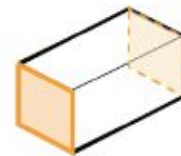
## South Face



## North Face



## East & West Face



ENERGY

COMFORT

INNOVATION

Walls: **R31 - 38**

Floors: **R35 - R86**

Roof: **R50**

Windows: **R7**

Foundations: **R16**



# Energy Modeling

## THERMAL ZONES

### **Mixed-Use:**

Vocational School

Childcare

Food Co-op

### **Residential:**

Residential (North)

Residential (South)

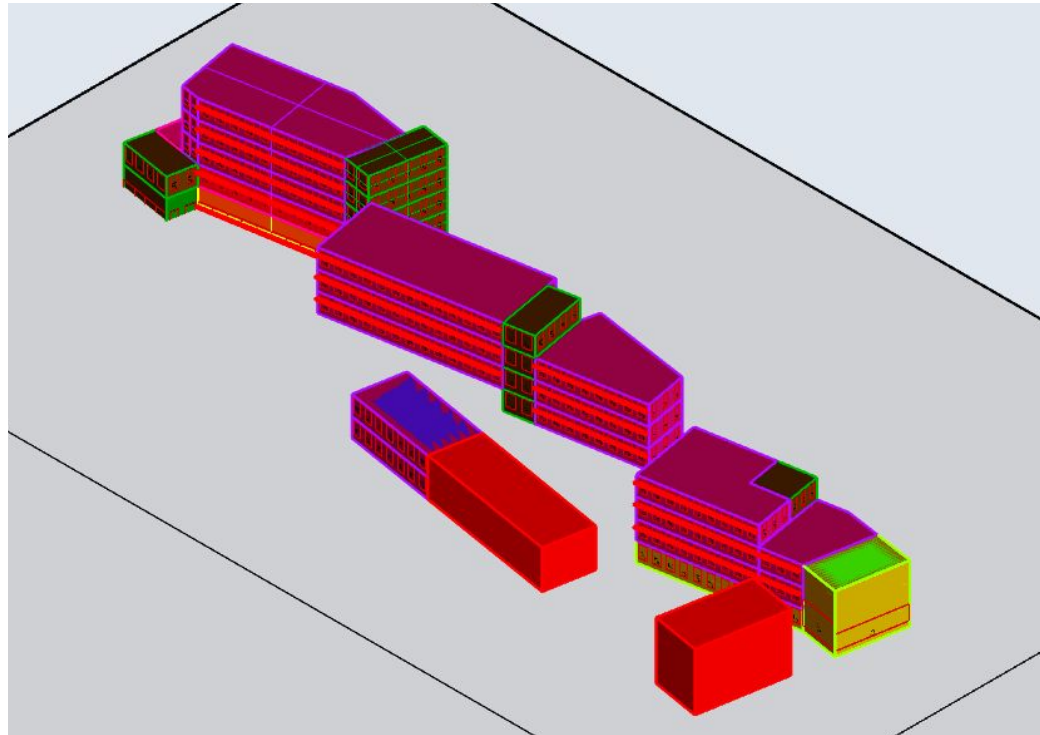
Stair Towers

### **Material Constructions**

ASHRAE 189.1

### **Efficient Active Systems**

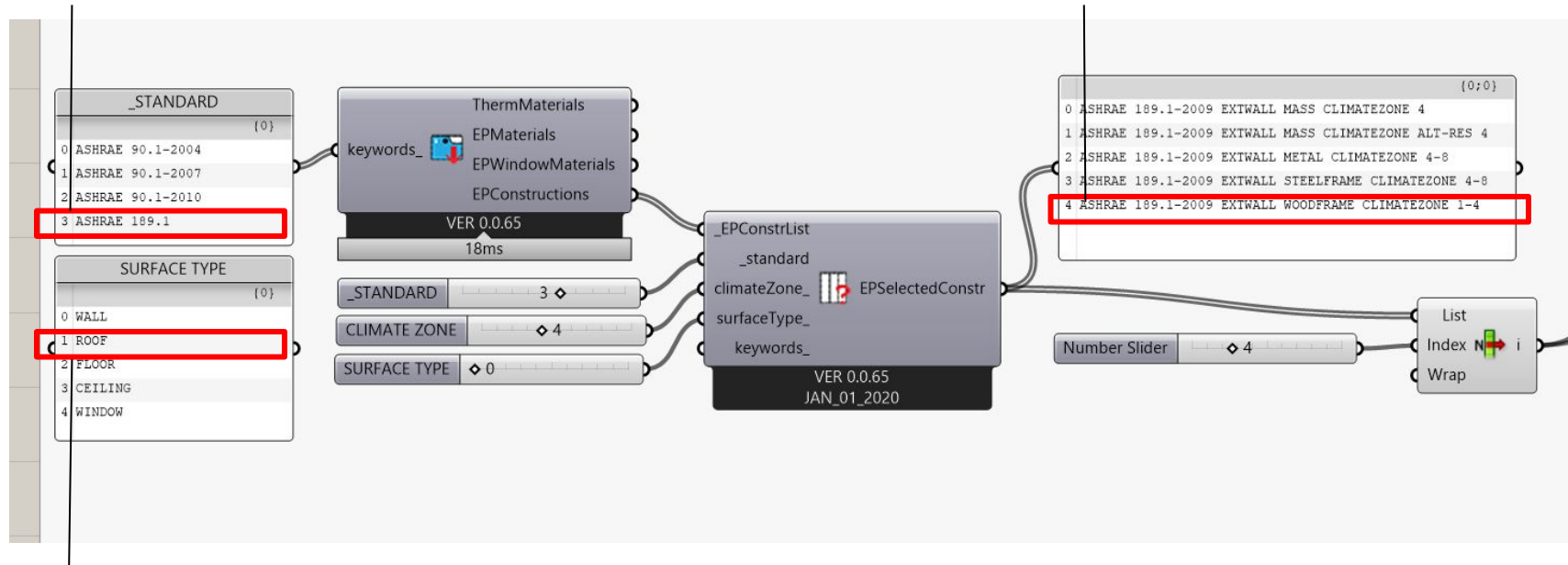
1 unit (kBtu/ft<sup>2</sup>) of energy yields 3.5 heating cooling potential



# Honeybee - Setting Baselines

Set Baseline

Set Type ie: **"WOODFRAME CLIMATEZONE 1-4"**

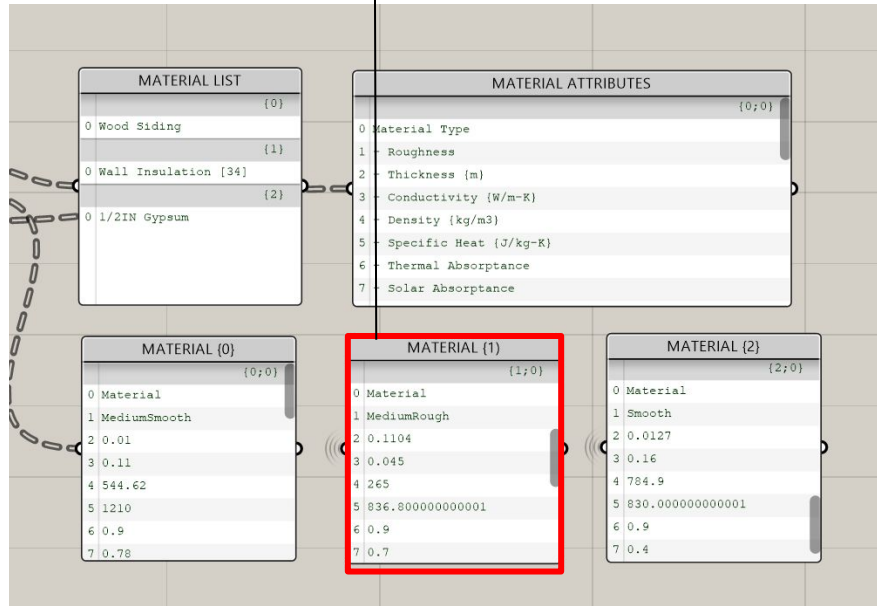


Set Entity

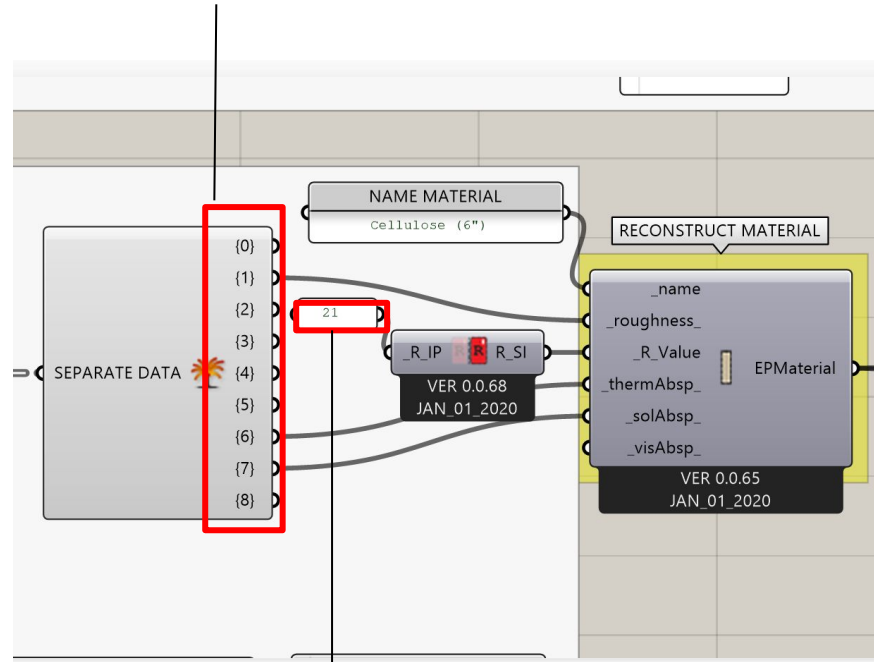


# Honeybee - Fine Tune

Select material to adjust ie: **"Wall Insulation"**



Assume Default Variables



Set new R-Value: **Reconstruct with whole assembly**

ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

OPERATIONS

MARKET

COMFORT

INNOVATION



ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

OPERATIONS

MARKET

COMFORT

INNOVATION





ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

OPERATIONS

MARKET

COMFORT

INNOVATION





ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

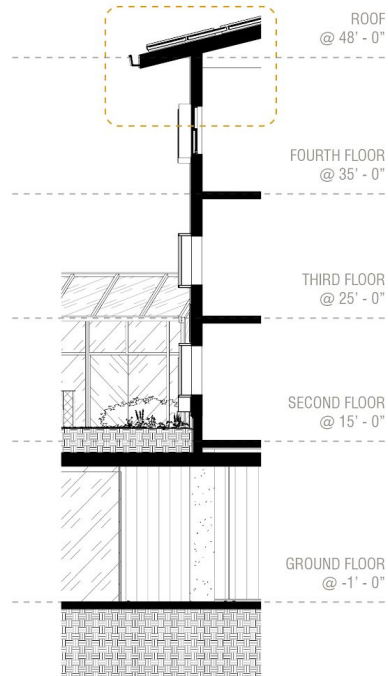
ARCHITECTURE

OPERATIONS

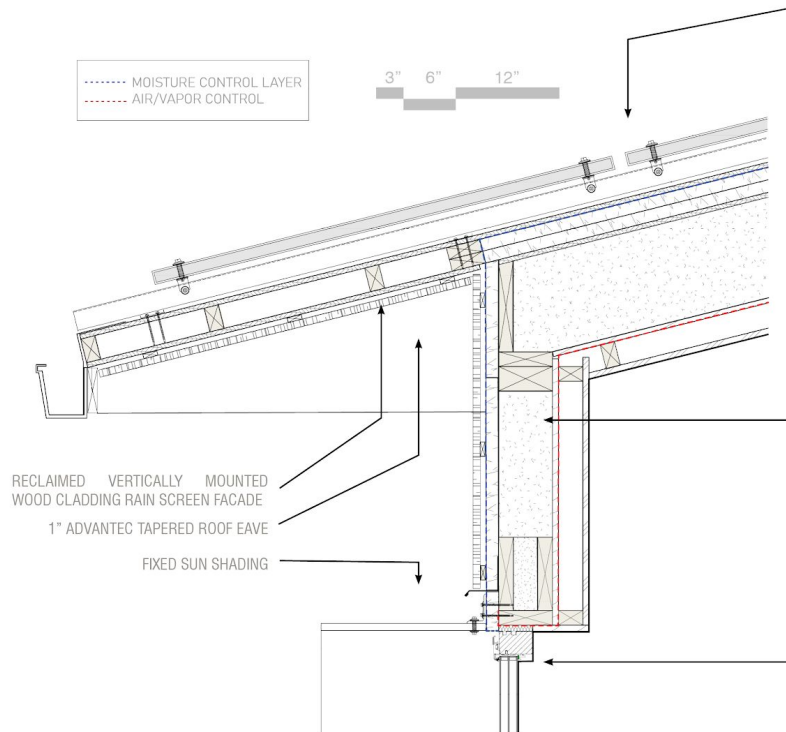
MARKET

COMFORT

INNOVATION



1 DETAIL - ROOF  
1/8" = 1'-0"



#### SOLAR ROOF ASSEMBLY \\ R-50

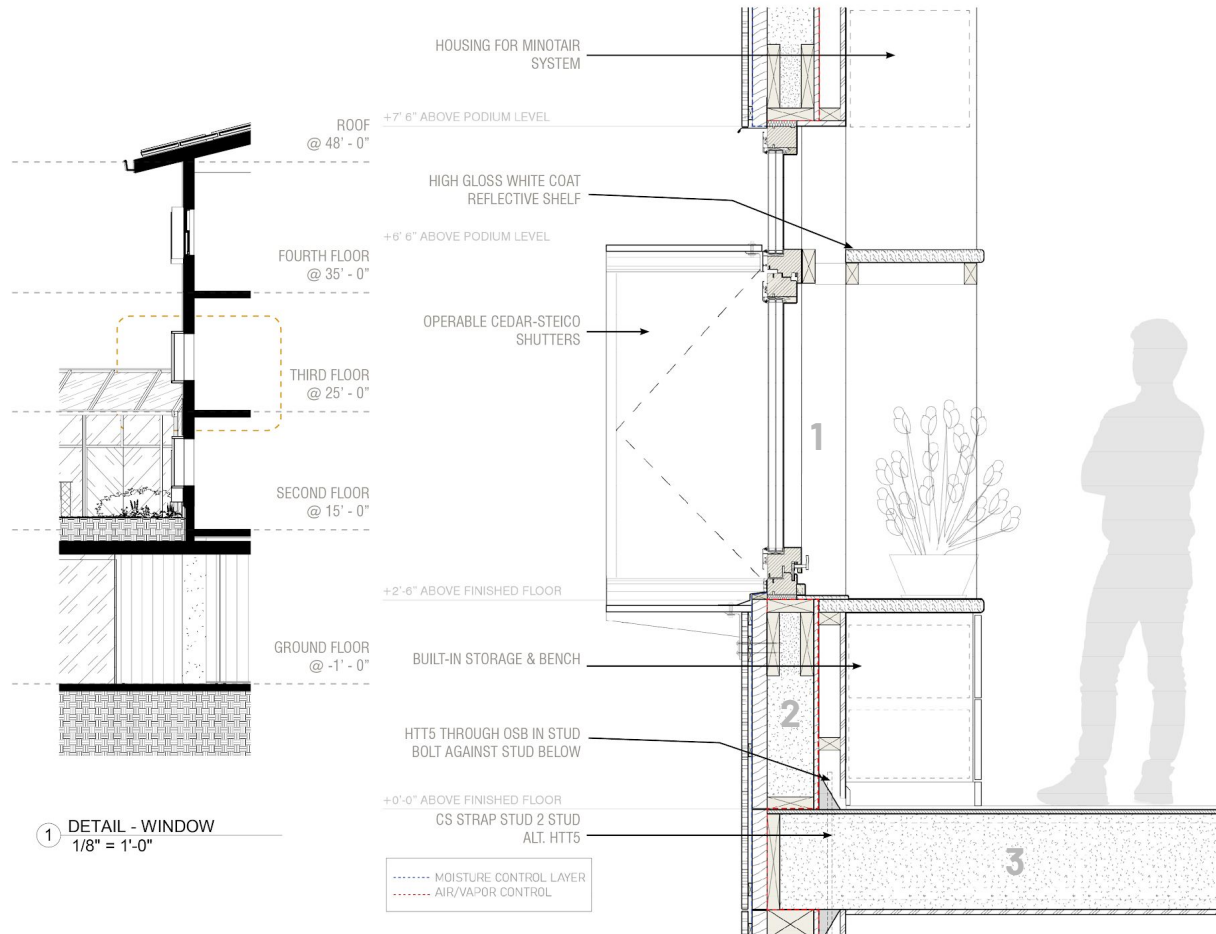
SUNPOWER 327W SOLAR PANELS W/ ACECLAMP® MOUNTING SYSTEM FIXED TO STANDING SEAMS (NO PENETRATION)  
 3" STEICO thermDRY ©  
 [RIGID WOOD FIBER INSUL. (R-15)]  
 10" DENSE PACKED CELLULOSE INSUL. (R-35)  
 10" X 1/2" WOOD I-BEAM RAFTERS @ 24" O.C.  
 5/8" ZIP SHEATHING  
 (COMBINED AIR & VAPOR BARRIER)  
 1/2" (12MM) STRAWTEC PANEL

#### WALL ASSEMBLY \\ R-31

RECLAIMED VERTICALLY MOUNTED WOOD CLADDING  
 RAIN SCREEN FACADE  
 3" STEICO thermDRY ©  
 [RIGID WOOD FIBER INSUL. (R-15)]  
 6" DENSE PACKED CELLULOSE INSULATION (R-21)  
 5/8" ZIP SHEATHING  
 (COMBINED AIR & VAPOR BARRIER)  
 2X3 WOOD FURRING & ACCESS CAVITY  
 1/2" (12MM) STRAWTEC PANEL

#### WINDOW ASSEMBLY \\ R-7

ZOLA THERMO CLAD UPVC™ WINDOW SYSTEM W/ COMBINED FIXED & OPERABLE AWNING TRIPLE GLAZING ND MTL. SILL FLASHING (U-VALUE: .15/ R-7)  
 SPRAY FOAM INSULATION AND AIR-TIGHT TAPING APPLIED @ SILL AND HEAD

**1 WINDOW ASSEMBLY \\ R-7 [HOLZRAUM]**

ZOLA THERMO CLAD UPVC™ WINDOW SYSTEM W/ COMBINED FIXED & OPERABLE AWNING TRIPLE GLAZING  
ND MTL. SILL FLASHING (U-VALUE: .15/ R-7)  
CEDAR SHUTTERS STEICO SANDWICH PREFAB. CON.  
SPRAY FOAM INSULATION AND AIR-TIGHT TAPING  
APPLIED @ SILL AND HEAD

**2 WALL ASSEMBLY \\ R - 31 [HOLZRAUM]**

RECLAIMED VERTICALLY MOUNTED WOOD CLADDING  
RAIN SCREEN FACADE  
3" STEICO thermDRY ©  
[RIGID WOOD FIBER INSUL. (R-15)]  
6" DENSE PACKED CELLULOSE INSULATION (R-21)  
5/8" ZIP SHEATHING  
(COMBINED AIR & VAPOR BARRIER)  
2X3 WOOD FURRING & ACCESS CAVITY  
1/2" (12MM) STRAWTEC PANEL

**3 FLOOR ASSEMBLY \\ R-35 [HOLZRAUM]**

9/16" CALI BAMBOO (3 3/4" WIDTH) FINISHED FLOOR  
3/4" PLYWOOD SHEATHING  
10" DENSE PACKED CELLULOSE INSUL. (R-35)  
[BUILT-IT MEP SPECIFIED TO BLUEPRINT ROBOTICS]  
1/2" STRAWTEC PANEL

ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

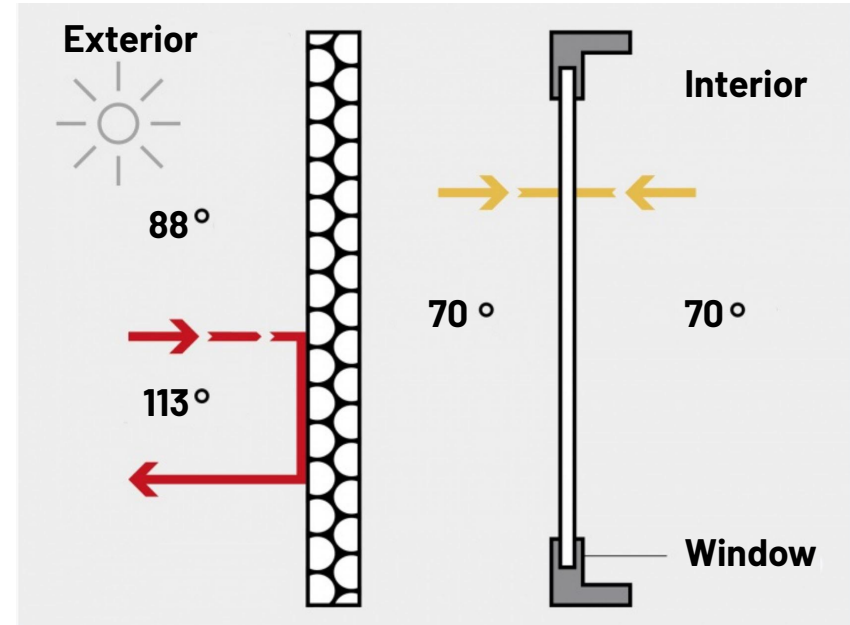
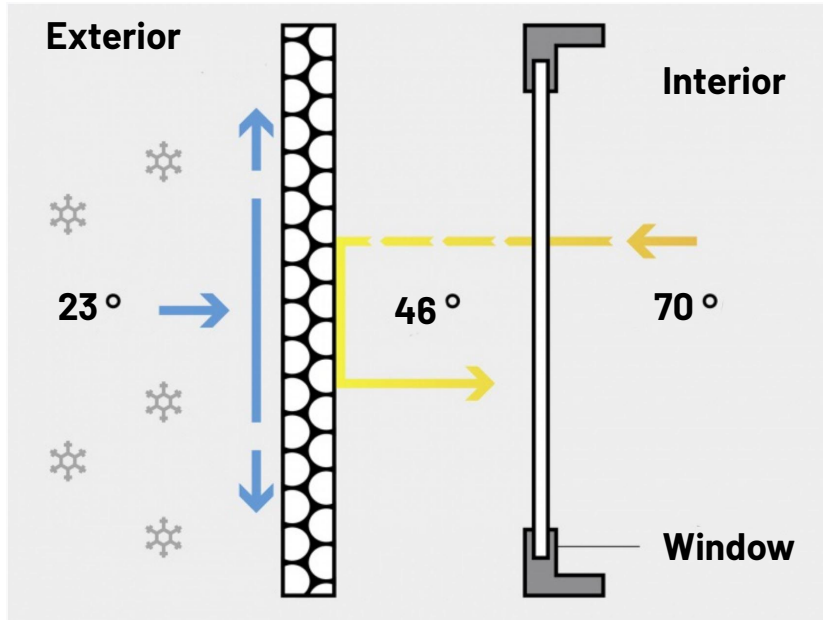
ARCHITECTURE

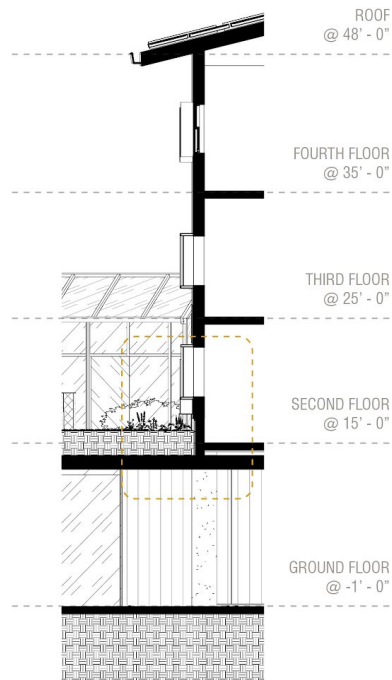
OPERATIONS

MARKET

COMFORT

INNOVATION





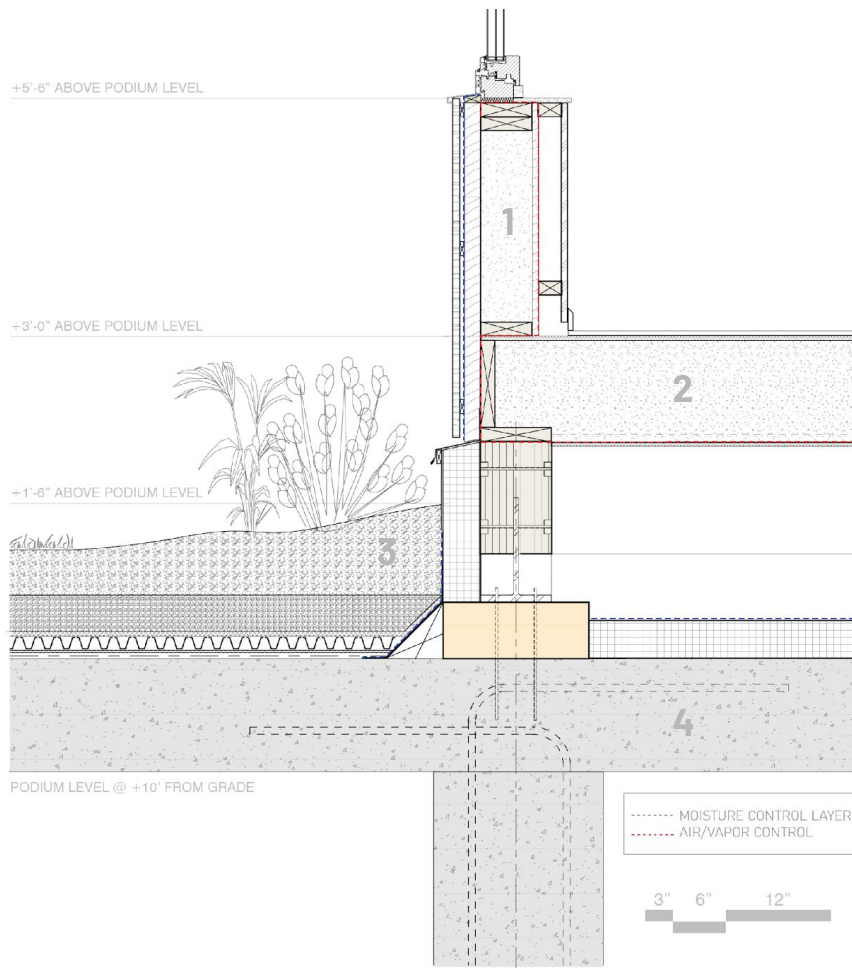
② DETAIL - HOLZRAUM @ PODIUM  
1/8" = 1'-0"

+5'-6" ABOVE PODIUM LEVEL

+3'-0" ABOVE PODIUM LEVEL

+1'-6" ABOVE PODIUM LEVEL

PODIUM LEVEL @ +10' FROM GRADE



- 1 WALL ASSEMBLY \\ R - 31 [HOLZRAUM]**  
 RECLAIMED VERTICALLY MOUNTED WOOD CLADDING  
 RAIN SCREEN FACADE  
 3" STEICO thermDRY ©  
 [RIGID WOOD FIBER INSUL. (R-15)]  
 6" DENSE PACKED CELLULOSE INSULATION (R-21)  
 5/8" ZIP SHEATHING  
 (COMBINED AIR & VAPOR BARRIER)  
 2X3 WOOD FURRING & ACCESS CAVITY  
 1/2" (12MM) STRAWTEC PANEL

- 2 FLOOR ASSEMBLY @ PODIUM \\ R-51 [HOLZRAUM]**  
 9/16" CALI BAMBOO (3 3/4" WIDTH) FINISHED FLOOR  
 3/4" PLYWOOD SHEATHING  
 10" DENSE PACKED CELLULOSE INSUL. (R-35)  
 3/4" PLYWOOD SHEATHING  
 8X12 CLT SPANNING BEAM (16'-10")  
 ARMATHERM™ 500 STRUCTURAL THERMAL BREAK  
 4" EPS INSUL. (R-16)  
 [EPS SITE INSTALLED WITH WATER PROOF BARRIER]

- 3 GREEN ROOF \\ [ZINCO]**  
 SYSTEM SUBSTRATE [VARIES BY SPECIES]  
 DRIPPERLINE 500-L2  
 AQUAFLEECE AF 300  
 FLORADRAIN® FD 40-E\*  
 PROTECTION MAT SSM 45

- 4 PODIUM \\ [ON-SITE]**  
 12" CAST IN PLACE REINFORCED CONCRETE  
 [20% FLY-ASH 50% RECYCLED AGGREGATE]



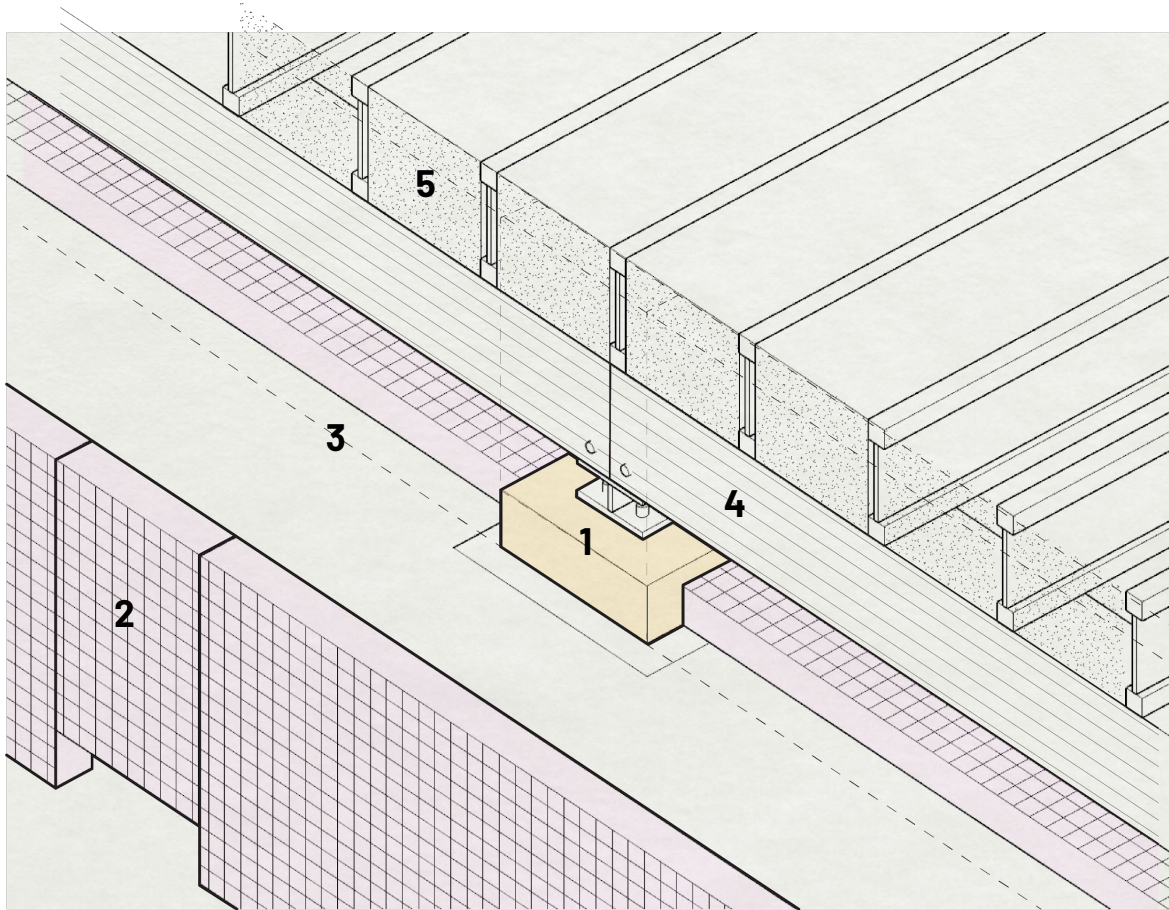
**Step 1:** ARMATHERM™ 500  
STRUCTURAL THERMAL BREAK

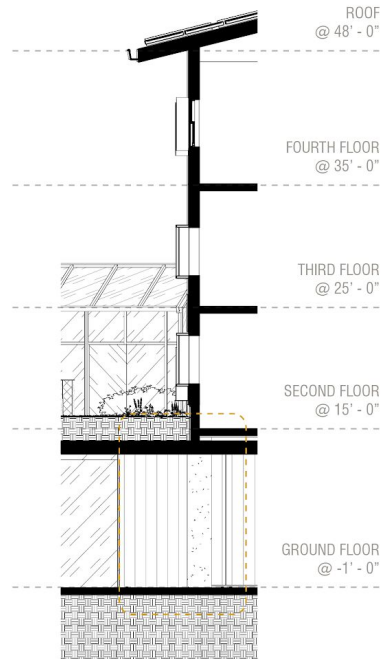
**Step 2:** RIGID STONE WOOL

**Step 3:** MOISTURE BARRIER

**Step 4:** CLT BEAM

**Step 5:** HOLZRAUM FLOOR SYSTEM





② DETAIL - HOLZRAUM @ PODIUM  
1/8" = 1'-0"

..... MOISTURE CONTROL LAYER  
- - - - - AIR/VAPOR CONTROL

3" 6" 12"

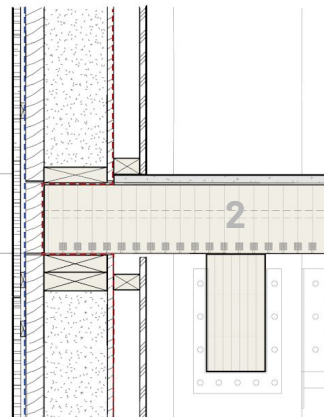
16'-0" ABOVE GRADE

15'-2" ABOVE GRADE

2'-0" ABOVE GRADE

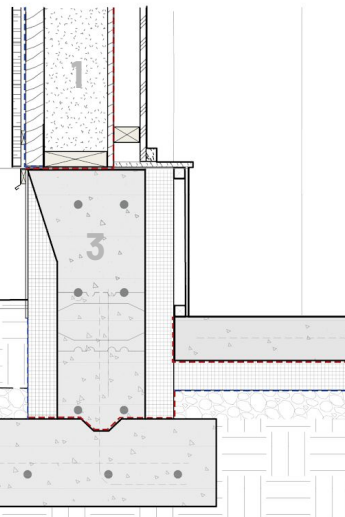
\*Varies according to perimeter condition

0'-0" ABOVE GRADE



- 1 WALL ASSEMBLY \\ R - 39 [HOLZRAUM]**  
RECLAIMED VERTICALLY MOUNTED WOOD CLADDING  
RAIN SCREEN FACADE  
1 1/2" STEICO thermDRY ©  
[RIGID WOOD FIBER INSUL. (R-7)]  
8" DENSE PACKED CELLULOSE INSULATION (R-32)  
5/8" ZIP SHEATHING  
(COMBINED AIR & VAPOR BARRIER)  
2X3 WOOD FURRING & ACCESS CAVITY  
1/2" (12MM) STRAWTEC PANEL

- 2 FLOOR ASSEMBLY @ COMMERCIAL \\ [BLUEPRINT]**  
2" REINF. CONC. TOPPER SLAB  
9.75" DOWEL LAMINATED TIMBER SLAB W/ ACOUSTIC  
FIBERGLASS EMBEDDED PROFILE



- 3 FOUNDATION ASSEMBLY @ COMMERCIAL \\ R-38**  
INSULATED CONC. FOUNDATION  
(4" EPS, 12" REINF. CONC., 4" EPS)  
2X WD. FURRING  
1/2" (12MM) STRAWTEC WALL PANEL

ENERGY

ENGINEERING

AFFORDABLE

RESILIENCE

ARCHITECTURE

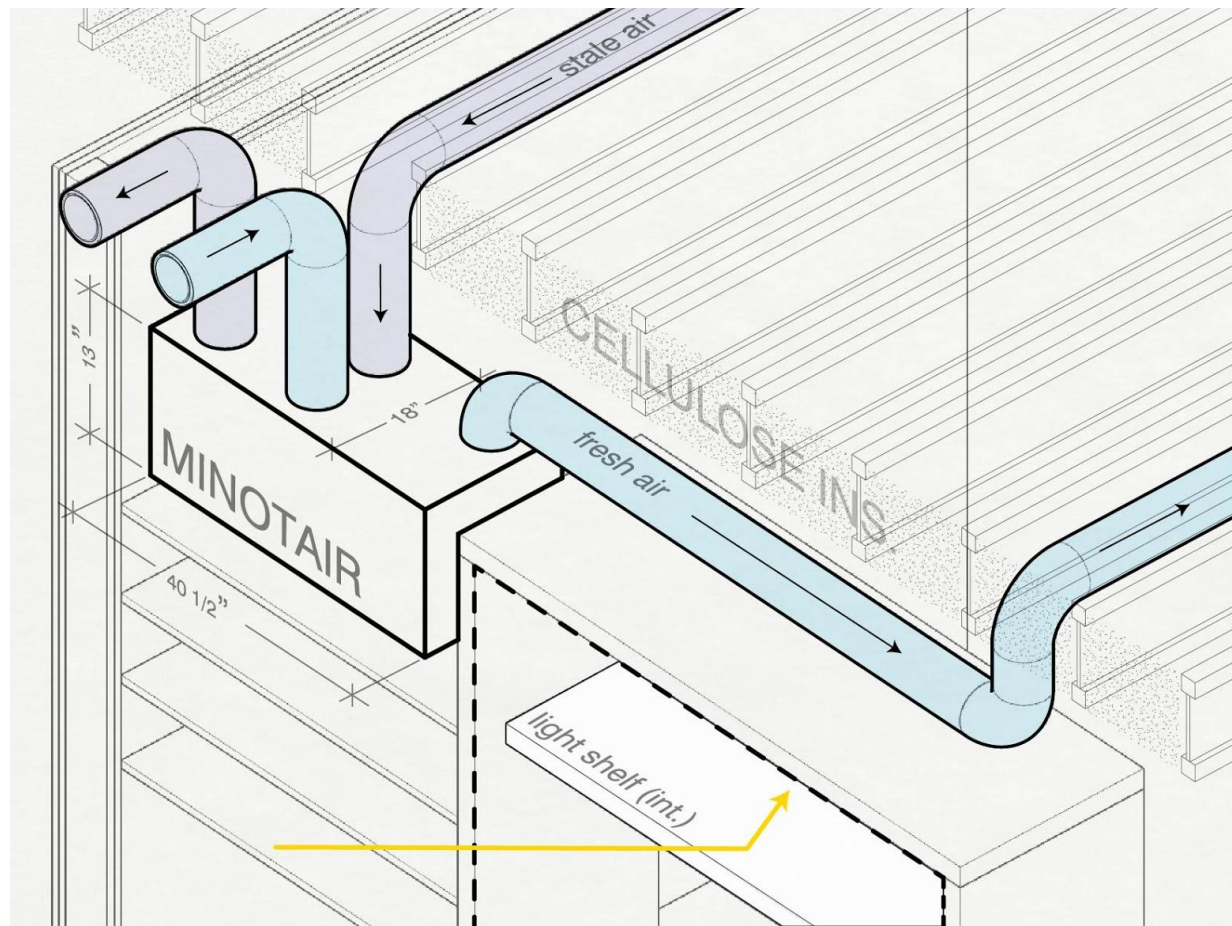
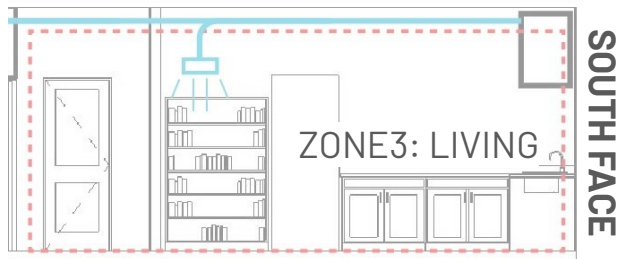
OPERATIONS

MARKET

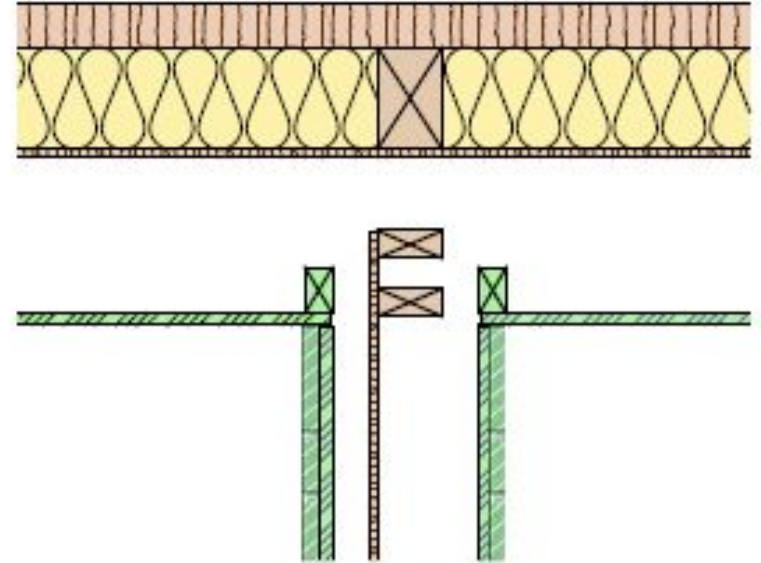
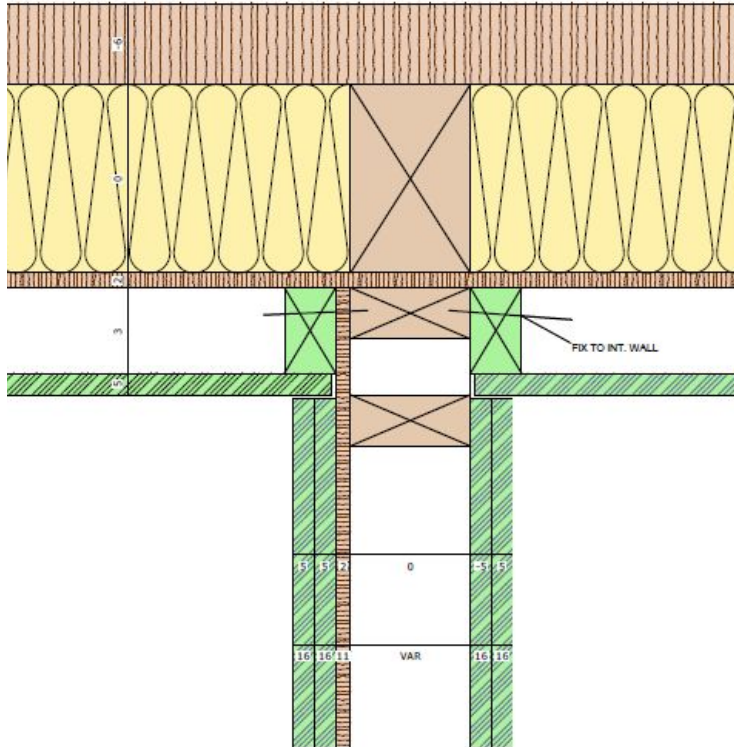
COMFORT

INNOVATION

NORTH FACE



# STC & Fire Rated Assemblies



Instructions for production:

DETAIL DRAWINGS  
180508\_STEICO

EW-IW T-JOINT

blueprint  
robotics

2018-05-16



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AFFORDABLE

RESILIENCE

ARCHITECTURE

OPERATIONS

MARKET

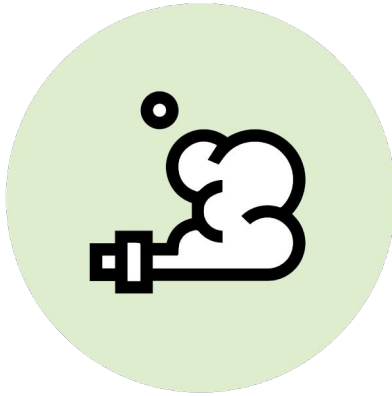
COMFORT

INNOVATION

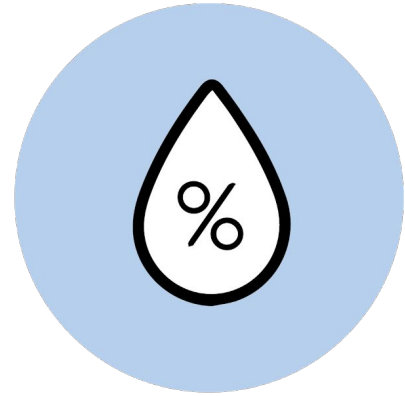
# Intro to HVAC



**FRESH AIR**



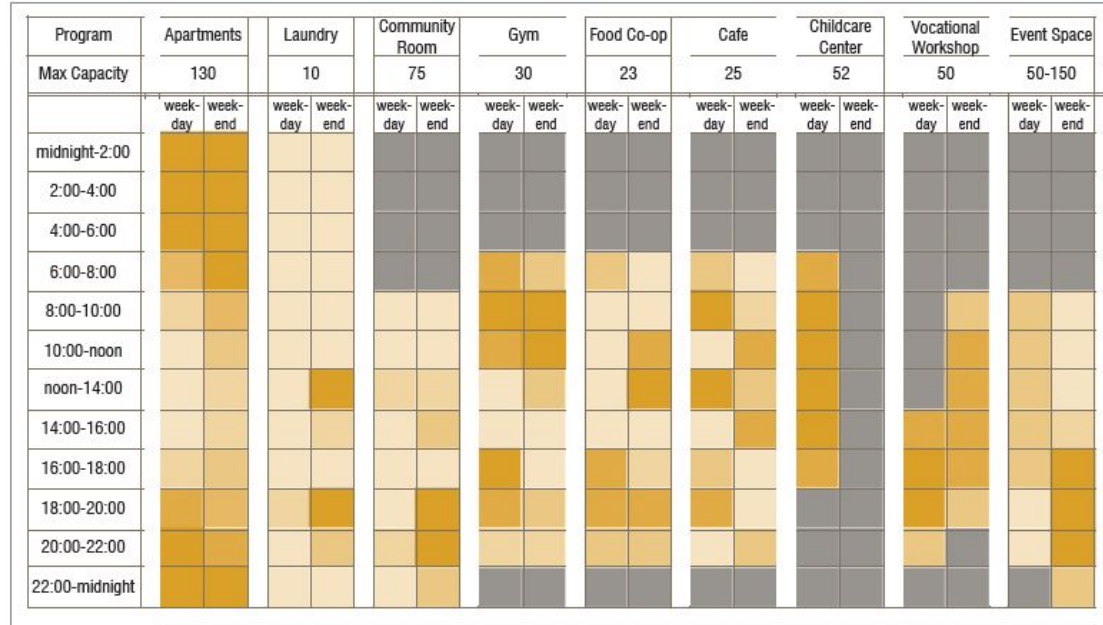
**EVACUATE POLLUTANTS**



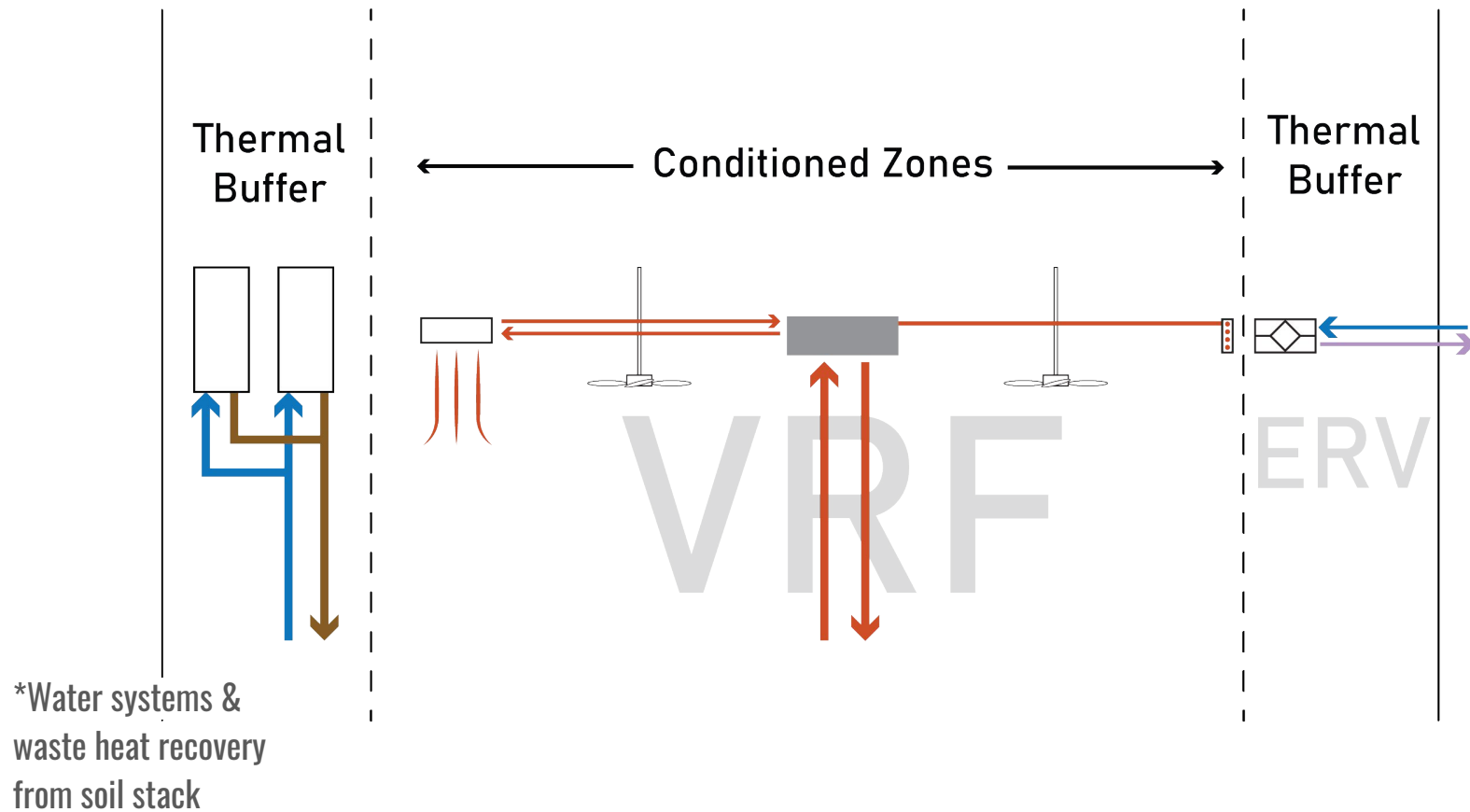
**MANAGE HUMIDITY**

# Occupancy Schedule by Program

Lowest Usage  Peak Usage  Facility Closed 



Weekday and weekend usage data, in two hour increments.



ENERGY

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AFFORDABLE

RESILIENCE

ARCHITECTURE

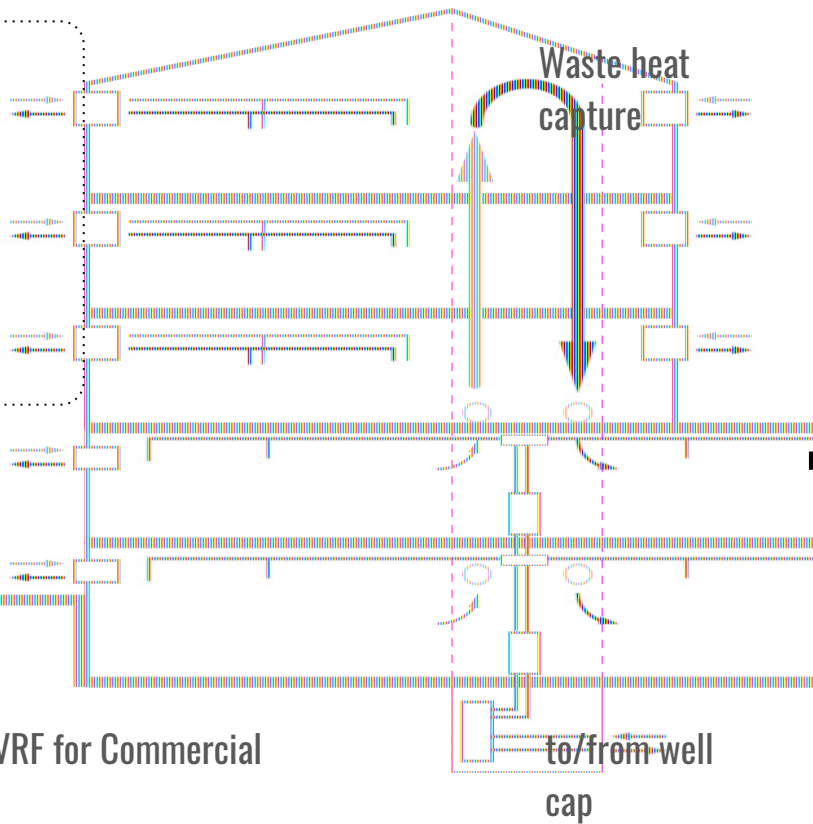
OPERATIONS

MARKET

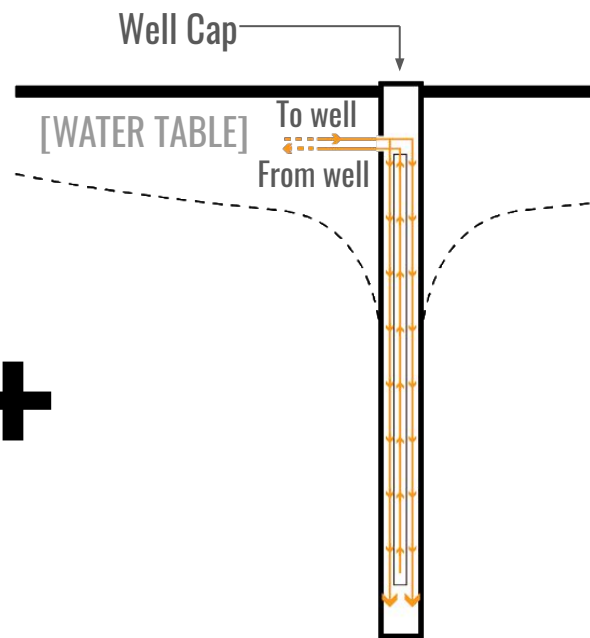
COMFORT

INNOVATION

MINOTAIR



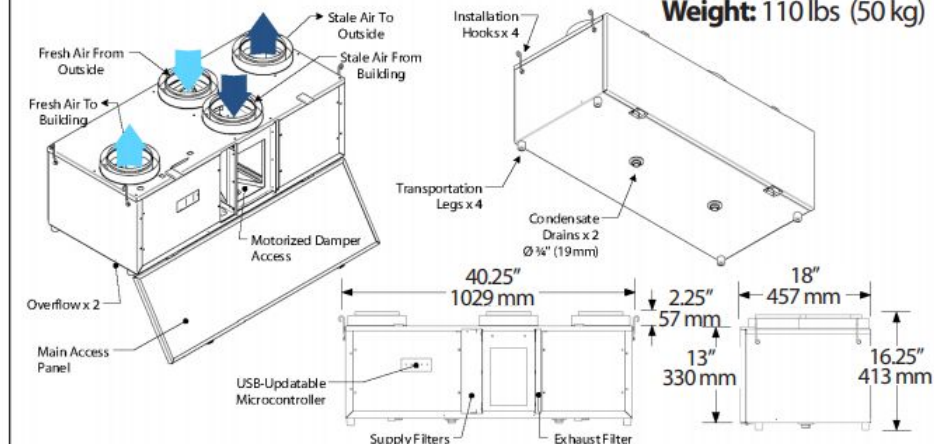
Combined ERV &amp; VRF for Commercial





## DIMENSIONS AND WEIGHT

**Weight: 110 lbs (50 kg)**



## VENTILATION/AIR EXCHANGE MODE: ENERGY PERFORMANCE

CAN/CSA-C439-09 Standard, results tested and verified by Exova and certified by HVI	Sensible Recovery Efficiency (SRE) <i>"When all electricity is deducted"</i>	Adjusted Sensible Recovery Efficiency (ASRE) <i>"Mostly used by PHIUS"</i>	Apparent Sensible Effectiveness (ASE) <i>"A.K.A. the thermal efficiency"</i>
Certified + published online by HVI	YES	YES	No more published
Lab results from Exova Lab	YES	YES	YES

## HEAT RECOVERY PERFORMANCE (fresh air from outside)

°F	°C	CFM	m³/h	%	%	%
32	0	100	170	116	119	178
32	0	248	421	87	94	112
-13	-25	100	170	72	74	98

*CFM = Cubic Feet per Minute    m³/h = Cubic meter per Hour*

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INNOVATION

# PATH TO ZERO

2020 MULTIFAMILY  
BASELINE EUI

122  
kBTU

## PASSIVE STRATEGIES

- LIMIT CIRCULATION SPACE TO EXTERIOR, UNCONDITIONED.
- COMPLETELY AIR SEALED WITH AVOIDED PENETRATIONS
- HIGH EFFICIENCY PREFAB W/ PRECISE TOLERANCE

64  
kBTU

## SUPER TIGHT ENVELOPE

- CONTINUOUS SUPER INSULATED DENSE PACK CELLULOSE

28  
kBTU

## HEATING/COOLING

- MINOTAIR THERMAL VENTILATION

14  
kBTU

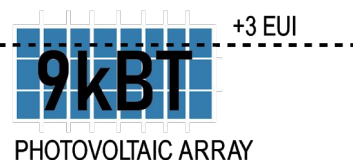
## TENANT & COMMUNITY

- OCCUPANT BEHAVIOR
- PLUG LOADS

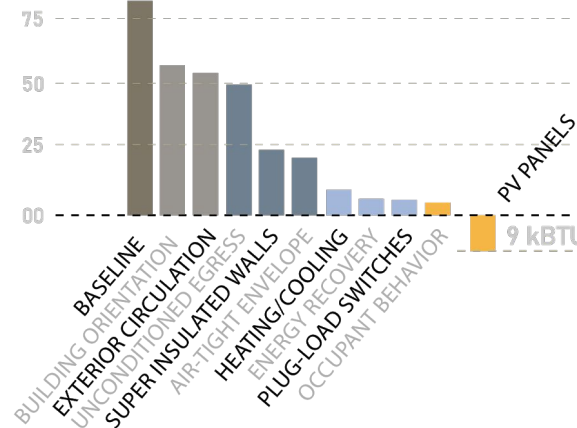
6  
kBTU

EUI OPERATIONS FOR ENERGY PERFORMANCE OVER TIME

+



## HERS RESIDENTIAL ENERGY RATING



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RESILIENCE

ARCHITECTURE

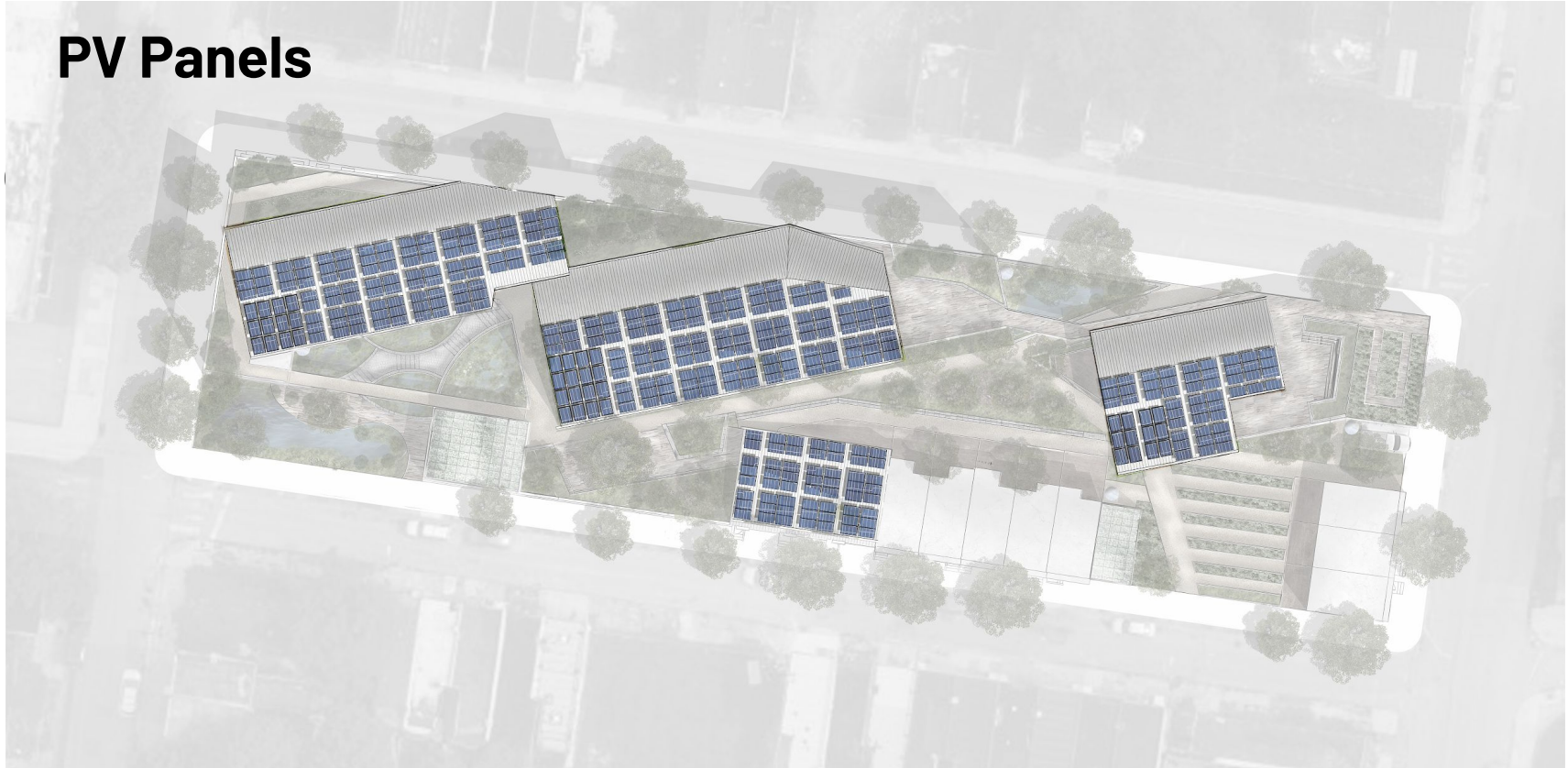
OPERATIONS

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## PV Panels





Is a building actually net-zero  
energy in operation if it is reliant  
on municipal water?

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ENERGY

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ARCHITECTURE

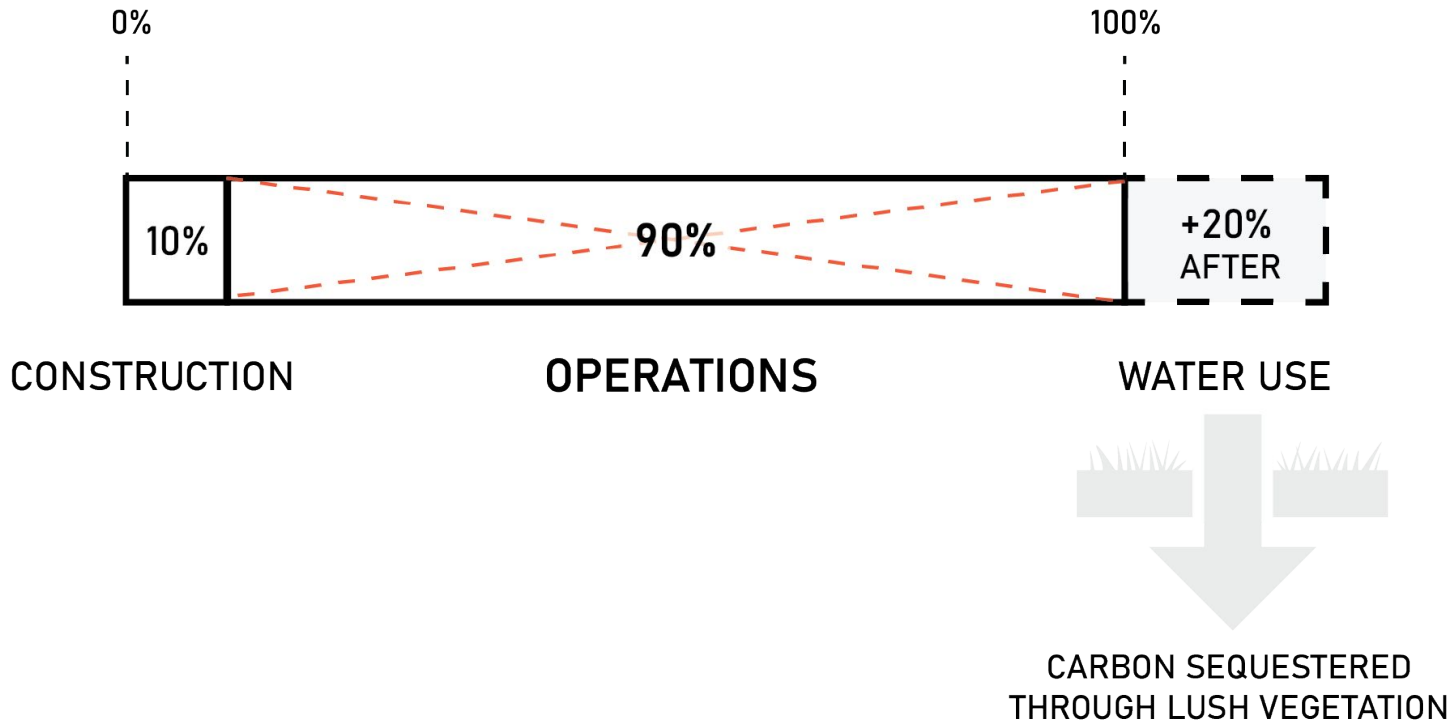
OPERATIONS

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INNOVATION

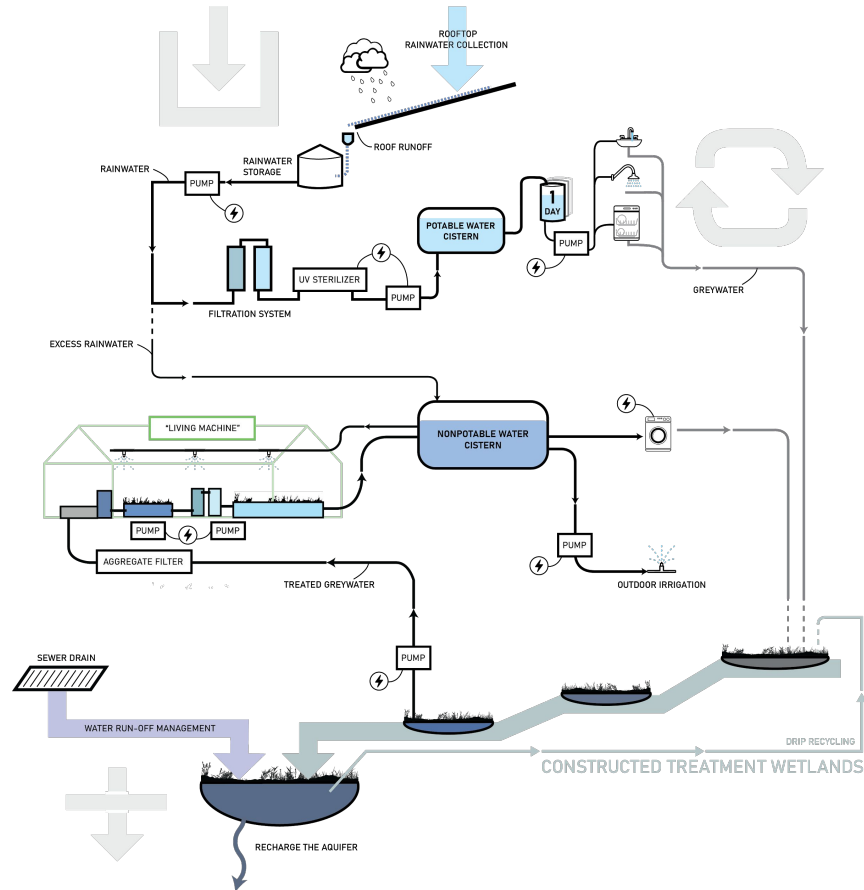
# Carbon



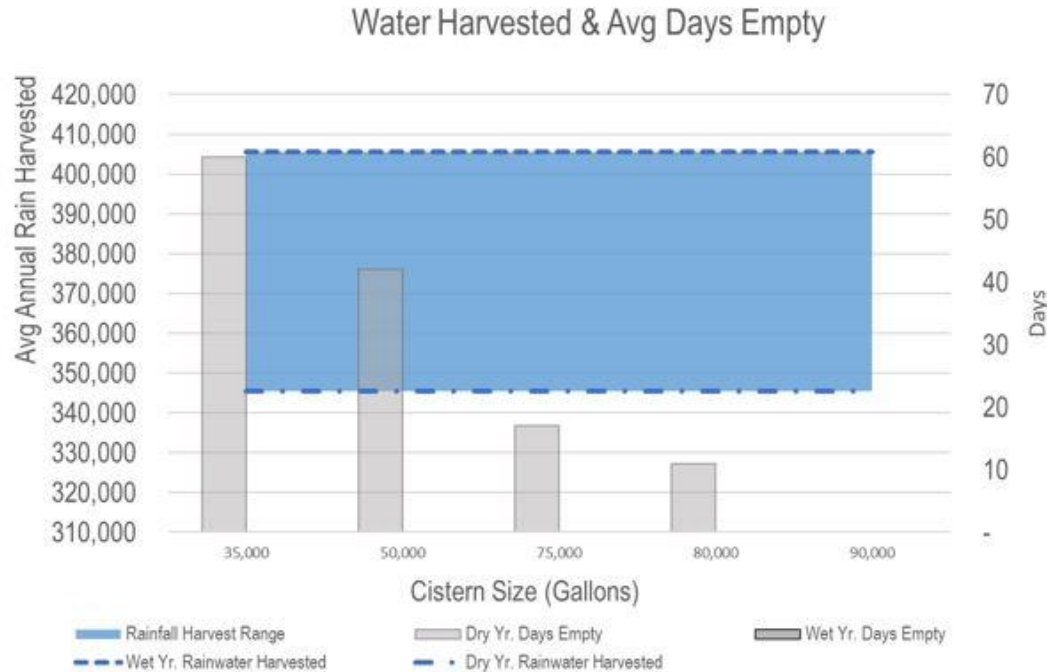
# Water Management

4 stage process:

Collection  
Filtration  
Recirculation  
Irrigation



# Cistern Sizing



# Water Usage & Scheduling



1

dishwasher load  
every 2 days

(3 gal. standard, 0.75 gal. HE)



1.5

showers

(25.8 gal. standard, 21 gal. HE)



5

flushes

(30 gal. standard, 5 gal. HE)



10

faucet uses

(wash hands, brush teeth, etc.)  
(10.7 gal. standard, 8.8 gal. HE)



1

wash

(20 gal. standard, 16 gal. HE)



1

washing machine  
load every 5 days

(8.2 gal. standard, 2.9 gal. HE)



8

glasses of water

(wash hands, brush teeth, etc.)  
(0.5 gallons)

Off-Peak Peak

	Peak Water Use	
	week-day	week-end
midnight-2:00		
2:00-4:00		
4:00-6:00		
6:00-8:00		
8:00-10:00		
10:00-noon		
noon-14:00		
14:00-16:00		
16:00-18:00		
18:00-20:00		
20:00-22:00		
22:00-midnight		

Figure 65 - Water Use Data



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What if your rent was immediately  
reinvested into your community?

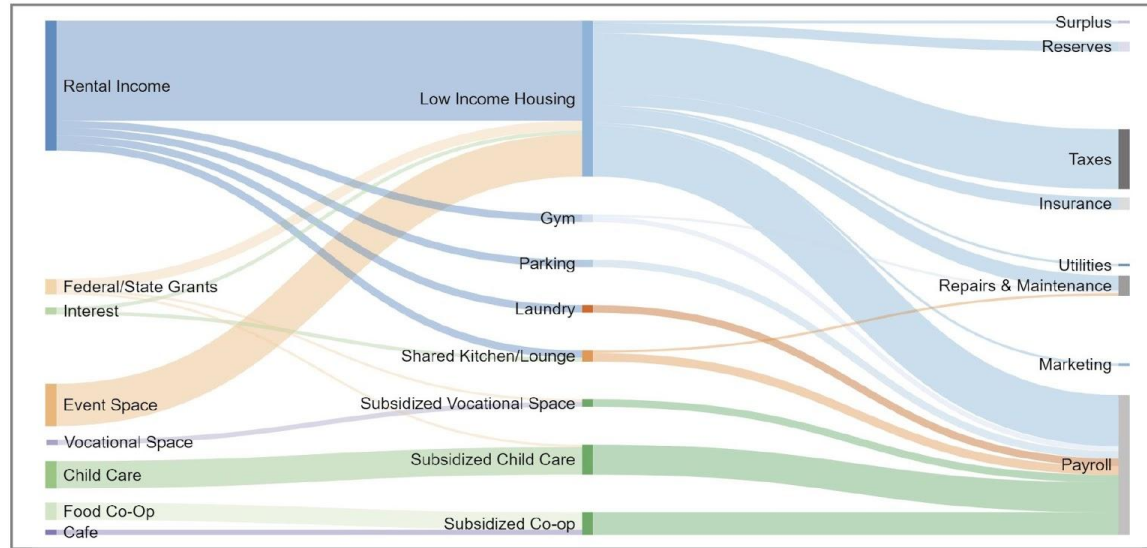
# Affordability: Balancing Energy

## INCOME STREAMS

rental income 52%

interest 3%  
grants 6%

event space 17%  
vocational space 2%  
child care 11%  
food co-op 8%  
cafe 2%



Flow of Capital

## REVENUE DISTRIBUTION

1% surplus  
4% reserves

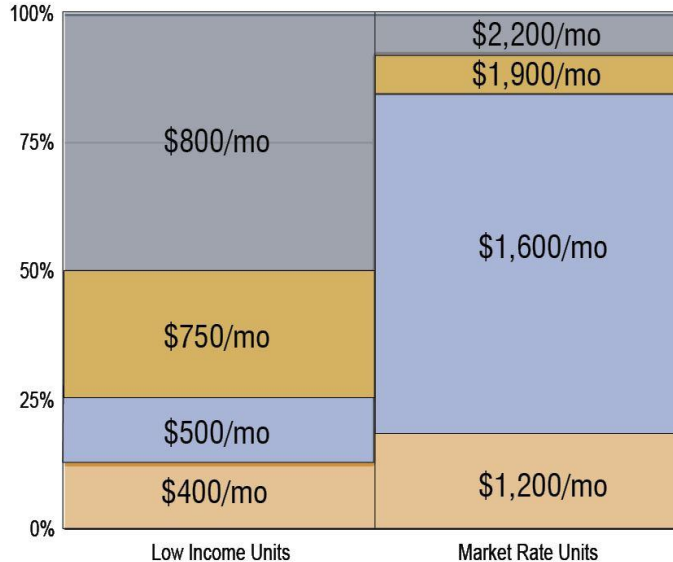
26% taxes  
5% insurance

1% utilities  
9% repairs + maintenance

55% payroll  
1% marketing



# Apartment Unit Distribution and Rents



Yearly Rental Income  
Accounting for an 8%  
vacancy, yearly rental  
income = \$518,880

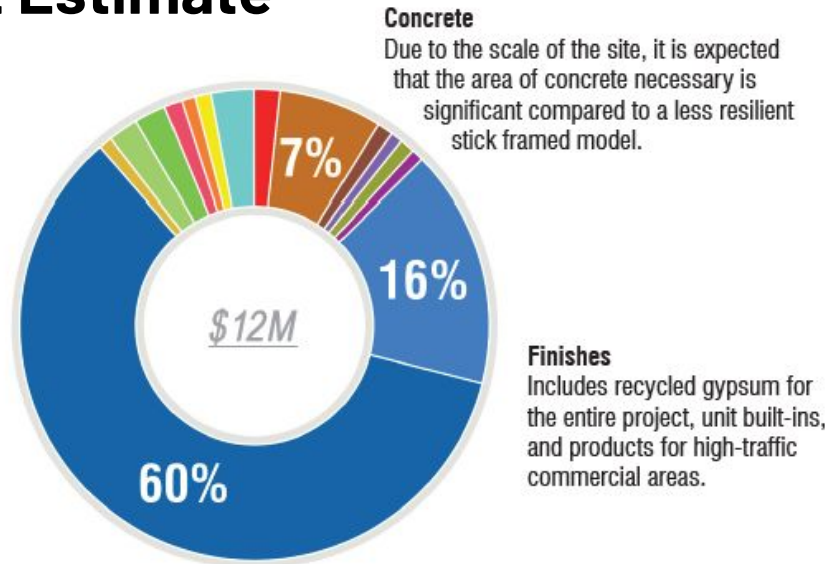
## KEY

- Three Bedroom
- Two Bedroom
- One Bedroom
- Studio

Market Rate and Low-Income Units



# Cost Estimate



Site Work	\$212814	2%
Concrete	\$869910	7%
Masonry	\$132616	1%
Metals	\$98630	1%
Wood	\$126900	1%
Glazing	\$103593	1%
Finishes	\$1980000	16%
HolzRaum	\$7238100	60%
Equipment	\$111950	1%
Furnishing	\$250675	2%
Spl Equipment	\$262480	2%
Conveying	\$150000	1%
Plumbing	\$120000	1%
HVAC	\$134681	1%
Electrical	\$360608	3%
<b>Total Cost</b>	<b>\$12731856</b>	<b>100%</b>

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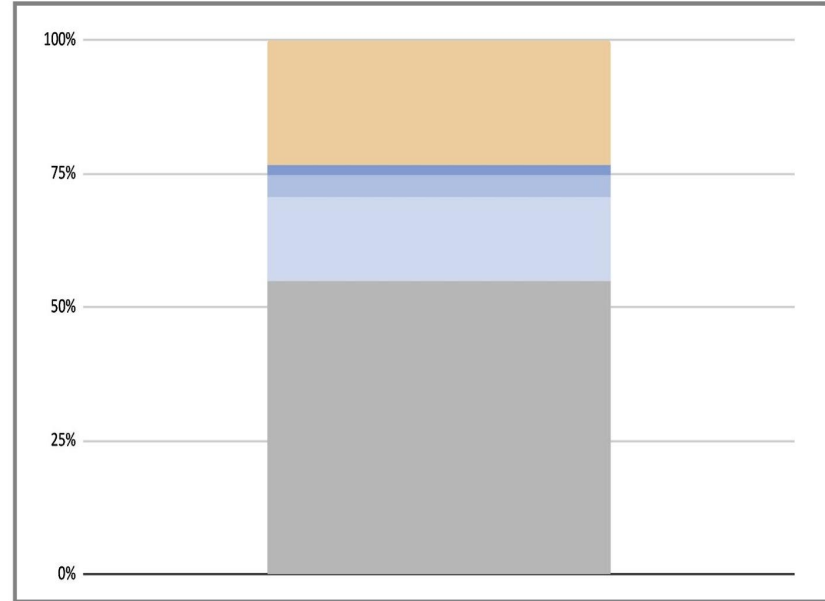
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# Capital Stack

## KEY

- Construction Loan from Local Bank
- State Grants
- Federal Grants
- Grants from Melville Charitable Trust
- Equity from Syndicated Housing Tax Credit



Capital Stack

Assumptions		Debt	
Property Name	Hilling	Loan Amount	\$3,000,000
Number of Units	34	Interest Rate	5.5%
Purchase Price	\$0	Amortization	360 months
Going-in Cap Rate	5.5%	Monthly Payment	\$16,396

[illegible]

Assumptions		Debt	
Property Name	Hilling	Loan Amount	\$3,000,000
Number of Units	34	Interest Rate	5.5%
Purchase Price	\$0	Amortization	360 months
Going-in Cap Rate	5.5%	Monthly Payment	\$16,396

[illegible]



Assumptions		Debt	
Property Name	Hilding	Loan Amount	\$3,000,000
Number of Units	34	Interest Rate	5.5%
Purchase Price	\$0	Amortization	360 months
Going-in Cap Rate	5.5%	Monthly Payment	\$16,396

[illegible]



How can the local housing authority  
and the neighborhood create lasting  
capital together?

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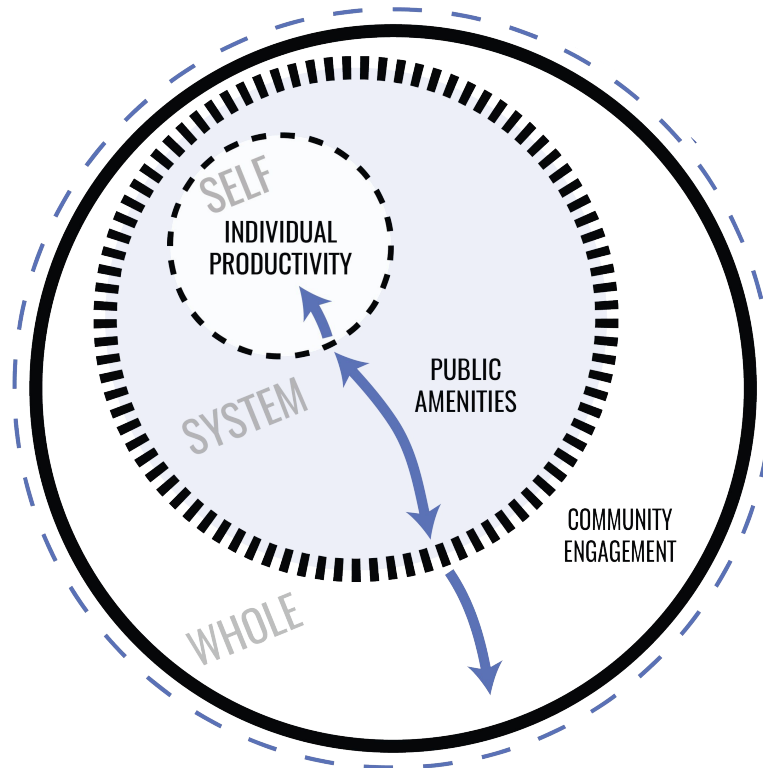
OPERATIONS

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# Creating Ownership



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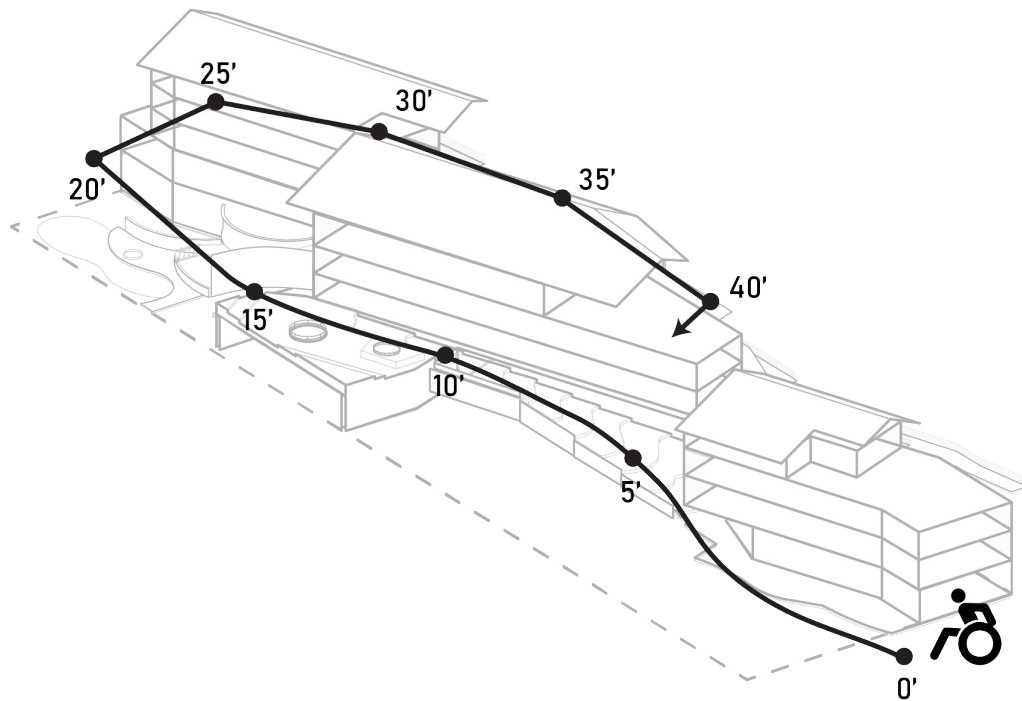
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# Accessibility for All













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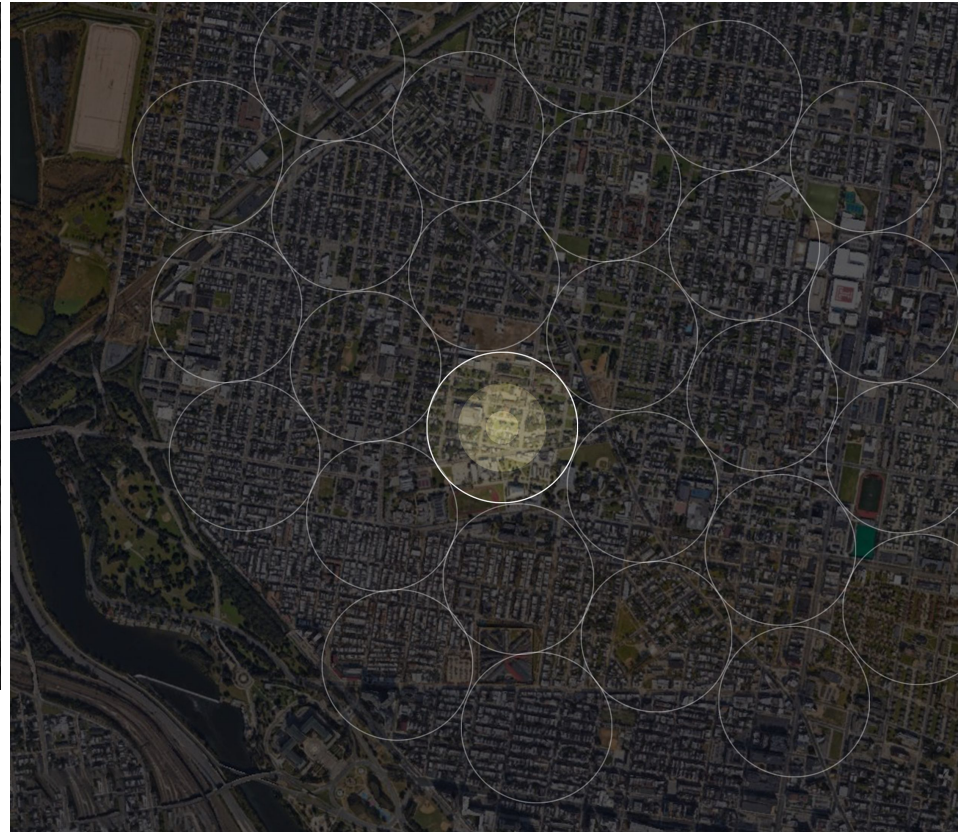
OPERATIONS

MARKET

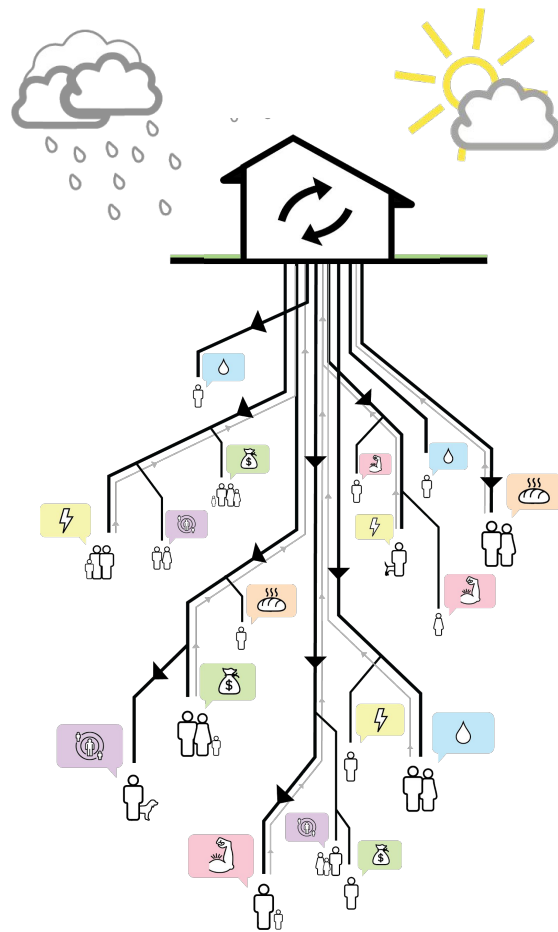
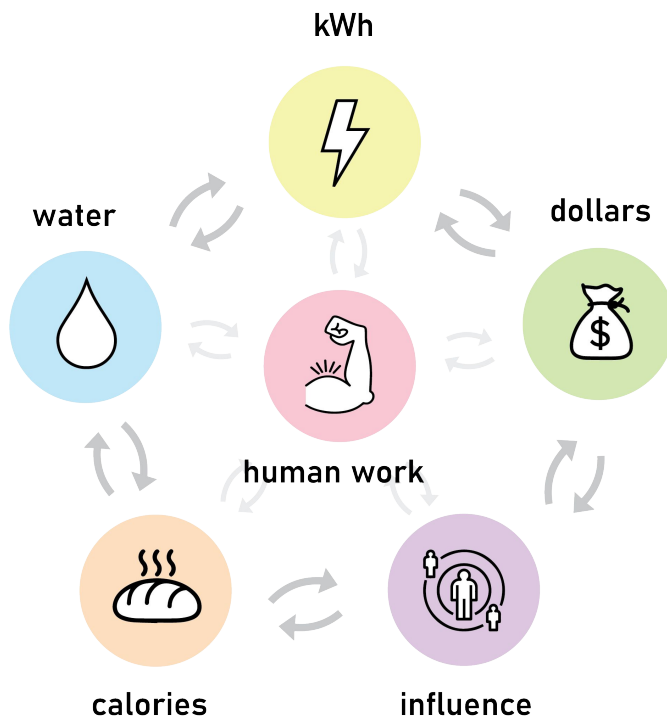
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# Resilience



# Expand the model





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# Thank you

