

RACE TO ZERO MIAMI OH

A PRESENTATION ON SMALL MULTIFAMILY NET ZERO HOUSING

LO ENERGY HI PERFORMANCE



M

LOVE

&

HONOR



MiamiOH.edu

01

DESIGN INTENT

- Off-campus residential community
- Fills a void in housing options for the Graduate and Non-Traditional Student
- Design of not only a home, but destination
- A Living, Learning, Sustainable Laboratory

DESIGN INTENT

TEAM + PARTNERS

PROCESS

CONSTRAINTS

PERSONAS

GOALS

ARCHITECTURAL DESIGN

INTERIOR DESIGN

CONSTRUCTABILITY

ENERGY PRODUCTION

ENERGY ANALYSIS

SPACE CONDITIONING

INDOOR AIR QUALITY

APPLIANCES

FINANCES

INNOVATION

02



- DESIGN INTENT
- TEAM + PARTNERS
- CONSTRAINTS
- PERSONAS
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- ENERGY PRODUCTION
- ENERGY ANALYSIS
- SPACE CONDITIONING
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- APPLIANCES
- FINANCES
- INNOVATION

LYNN BELHUMUER

Team Leader - Architecture

LYKA WILLIAMS

Documentation - Architecture

DIANA SUAREZ

Cost + Finances - Architecture

EMILY ONESCHUCK

Mechanical Systems - Engineering





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TIMELINE TOTALS 10 WEEKS

CONCEPT

- Our Journey Began in November...
- Project Intro
- Team formation
- Application Deadline

DESIGNING

- ...LoHi was conceived in January...
- Site & zoning analysis
- Massing process analysis
- Energy analysis + failures
- Final design executed

DELIVERING

- ...And ends in April
- DOE Finalists
- Campus Gallery Exhibit
- Journey to Colorado

Property Area
48947 SF

30

15

30

15

04

CONSTRAINTS

- Total Lot Area: 39,840 sq. ft.
- Buildable Area: 25,637 sq. ft.
- Max. Occupants: 88 persons
- Zoning Setbacks: 30 ft. Curb
15 ft. Rear/Side
- Height Restriction 35 ft.

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THE INTENDED OCCUPANTS

05



Katie Smith
"The Bachelorette"
 23 years
 single person

Neel Patel
"The Bachelor"
 25 years
 single international person

Remington Edwards
"The Couple"
 38 years
 married with partner

Emily Jones
"The Family"
 33 years
 married with small child

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SUSTAINABLE COMMUNITY &
UNIVERSAL ACCESSABILITY



ENERGY EFFICIENT LIVING
LEARNING LABORATORY



QUALITY INTERIOR
DAYLIGHTING & THERMAL
COMFORT

06

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ARCHITECTURAL DESIGN

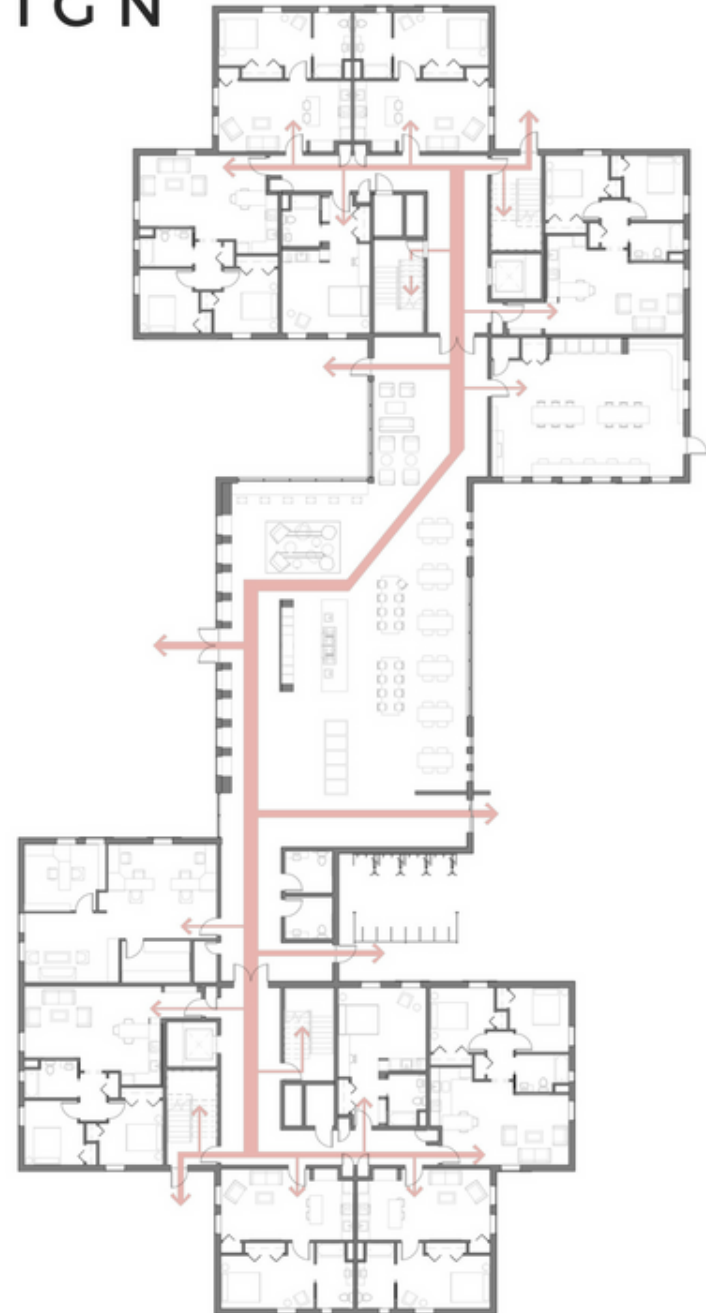
LoHi offers residents the opportunity to live sustainably in an energy efficient apartment style home, while being constantly and integrally exposed to all of the working systems of the building.

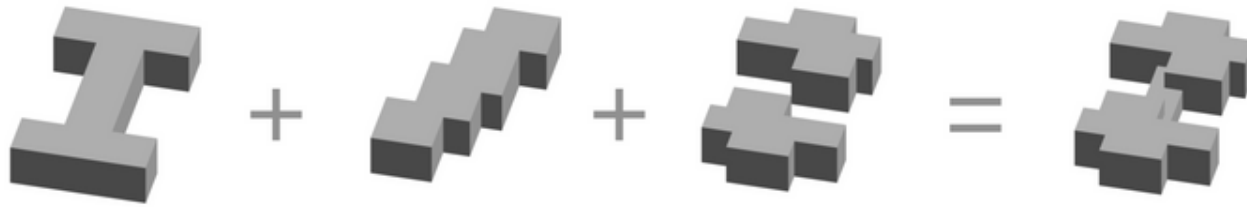
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ARCHITECTURAL DESIGN

CIRCULATION

- DUMBBELL DESIGN CRATED A PRONOUNCED SOCIAL & CLIMATIC ENTRY POINT
- CENTER IS COMMUNITY GATHERING AND LEISURE
- NORTH AND SOUTH TOWERS RESIDENTIAL UNITS
- ACTS AS A NOISE BUFFER
- PROGRAMMATIC ZONING OF INTERIOR SPACES





1. maple wood flooring
2. flax upholstery
3. black paint
4. concrete floor tile
5. red paint
6. peach paint
7. wood surface
8. seating upholstery



OUR MISSION

- MATERIAL SELECTIONS
COMPLIMENTS THE COLOR
SCHEME PRESENT
THROUGHOUT LOHI
-
- PLAYS OFF OF THE SIGNATURE
RED KNOWN OF MIAMI
UNIVERSITY



INTERIOR DESIGN

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According to Vitruvius, the architect should strive to fulfill each of these three attributes as well as possible. Leon Battista Alberti, who elaborates on the ideas of Vitruvius in his treatise, saw beauty primarily as a matter of proportion, although ornament also played a part.



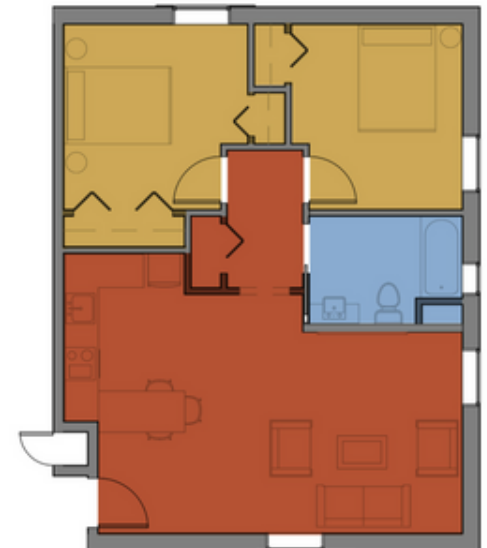
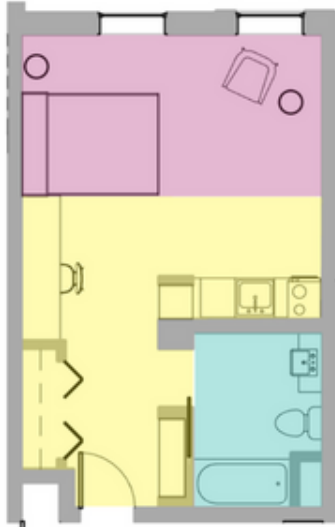
STUDIO



1-BEDROOM



2-BEDROOM



THE CRASH LOAD LAUNDRY CAFE



THE LIVING LAB SEQUENCED PATHWAY



ENERGY EFFICIENT



THE INSPIRATION

PASSIVE HOUSE



Passive House Institute US

- Adaptation of **PHIUS+ 2015 Standards**
- Used **5 Envelope Design Principles**
 - Compact building shape
 - Continuous insulation
 - Energy Gain Windows
 - Continuous Ventilation
 - Building Air Tightness & Climate appropriate vapor Profile
 - Ease of Constructibility

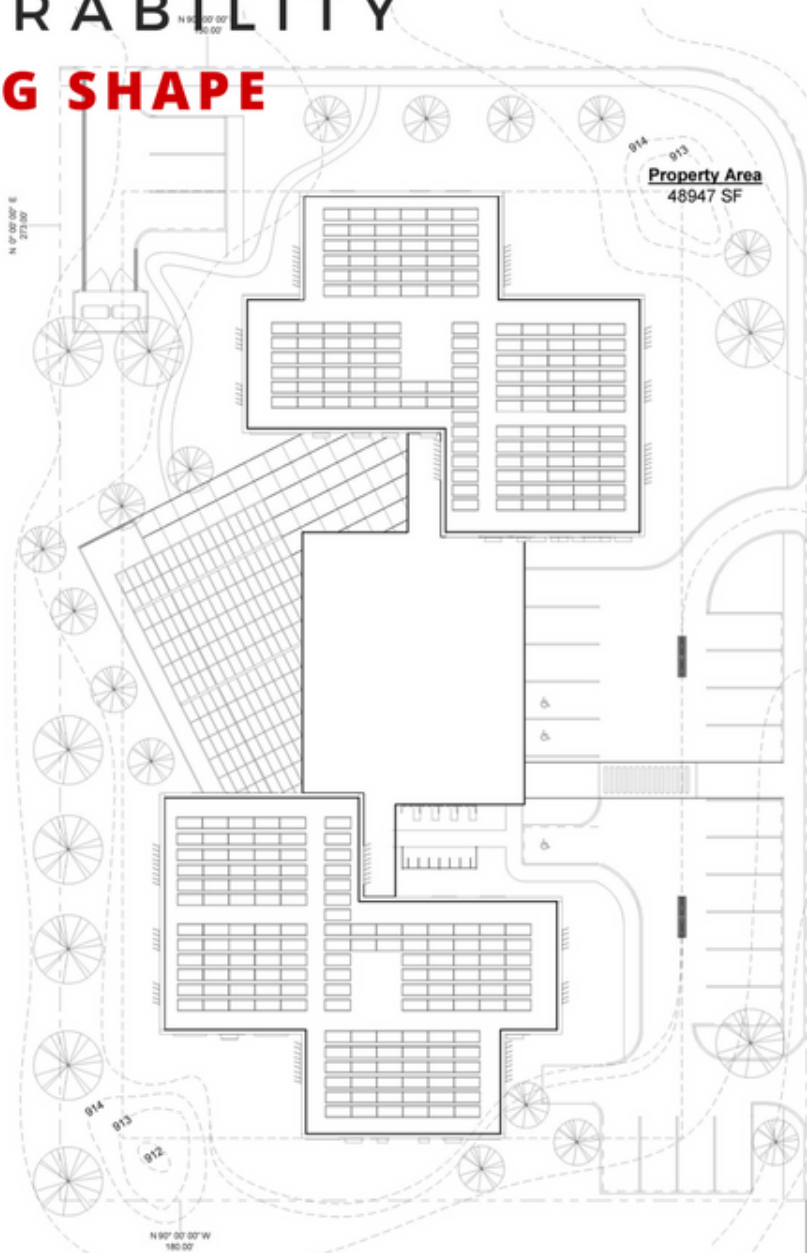
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CONSTRUCTABILITY +

RACE TO ZERO MIAMI OH

ENVELOPE DURABILITY

COMPACT BUILDING SHAPE



Property Area
48947 SF

MCGUFFEY AVE



March Shadow at 4pm



June Shadow at 4pm



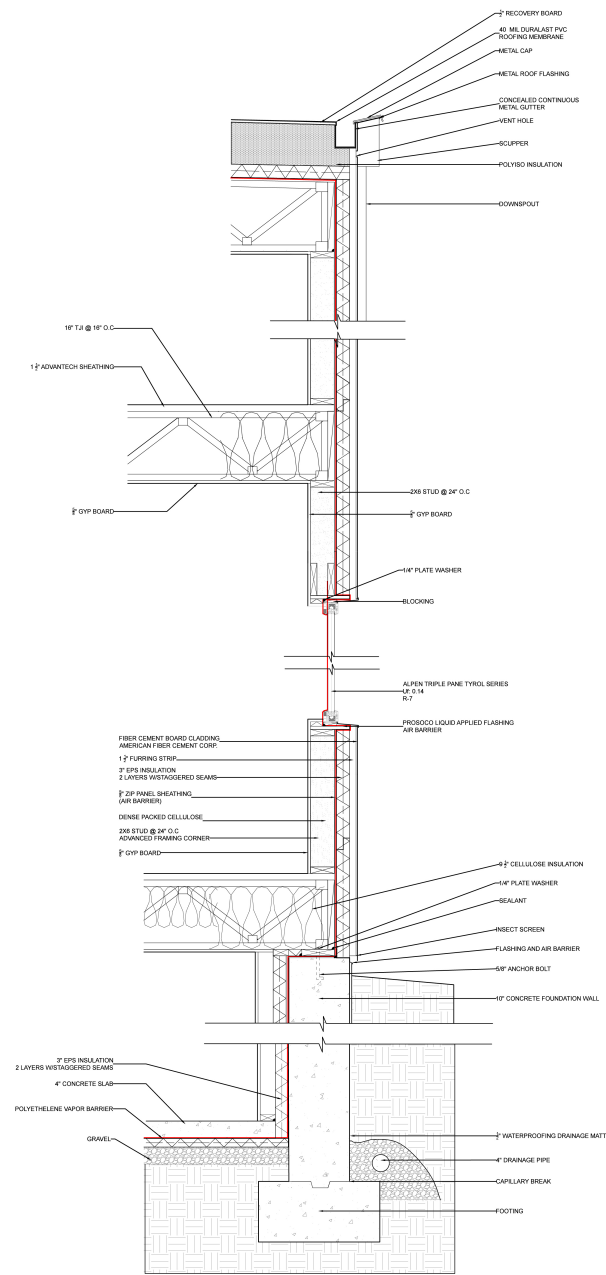
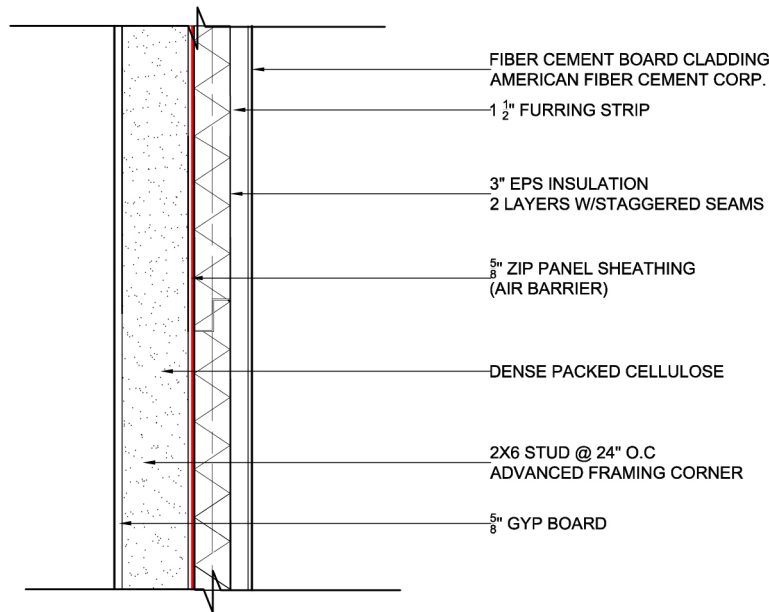
September Shadow at 4pm



December Shadow at 4pm

CONSTRUCTABILITY + ENVELOPE DURABILITY CONTINUOUS INSULATION

RACE TO ZERO MIAMI OH

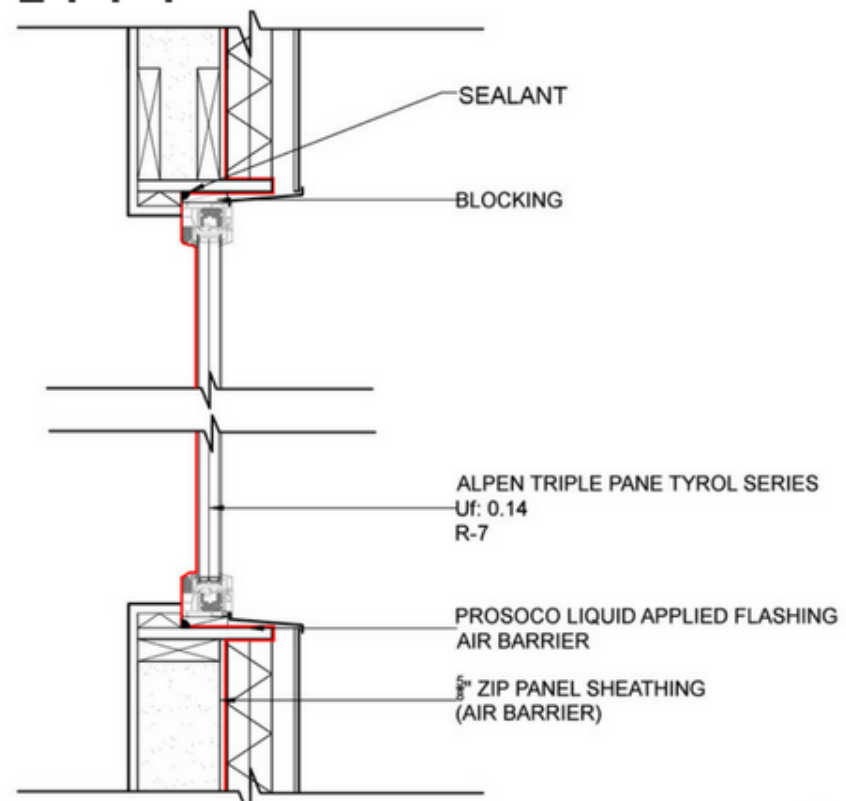


CONSTRUCTABILITY + ENVELOPE DURABILITY

RACE TO ZERO MIAMI OH

ENERGY GAIN WINDOWS

Alpen Window



- Passive House Institute Certified Component
- $U_f = 0.77 \text{ W/m}^2\cdot\text{K}$ ($0.136 \text{ BTU/hr}\cdot^\circ\text{F}\cdot\text{ft}^2$)
- Meets stringent Passive House requirements for air infiltration resistance
- Fiberglass-reinforced profile allows for larger sizes without steel reinforcement

	Glass U-factor (U_g)		Glass SHGC
	($\text{W/m}^2\cdot\text{K}$)	($\text{BTU/hr}\cdot^\circ\text{F}\cdot\text{ft}^2$)	
Balanced-Triple Pane 6	0.64	0.112	0.56
HighGain-6 PH+*	0.65	0.115	0.52
Balanced-6 PH+*	0.55	0.097	0.37
HighGain-9*	0.49	0.087	0.45
Balanced-9*	0.44	0.077	0.33

*Center of glass performance calculated according to EN673. This chart provides representative glazing options. Please contact an Alpen HPP for additional options. * Utilizes suspended coated film technology.*

CONTINUOUS VENTILATION

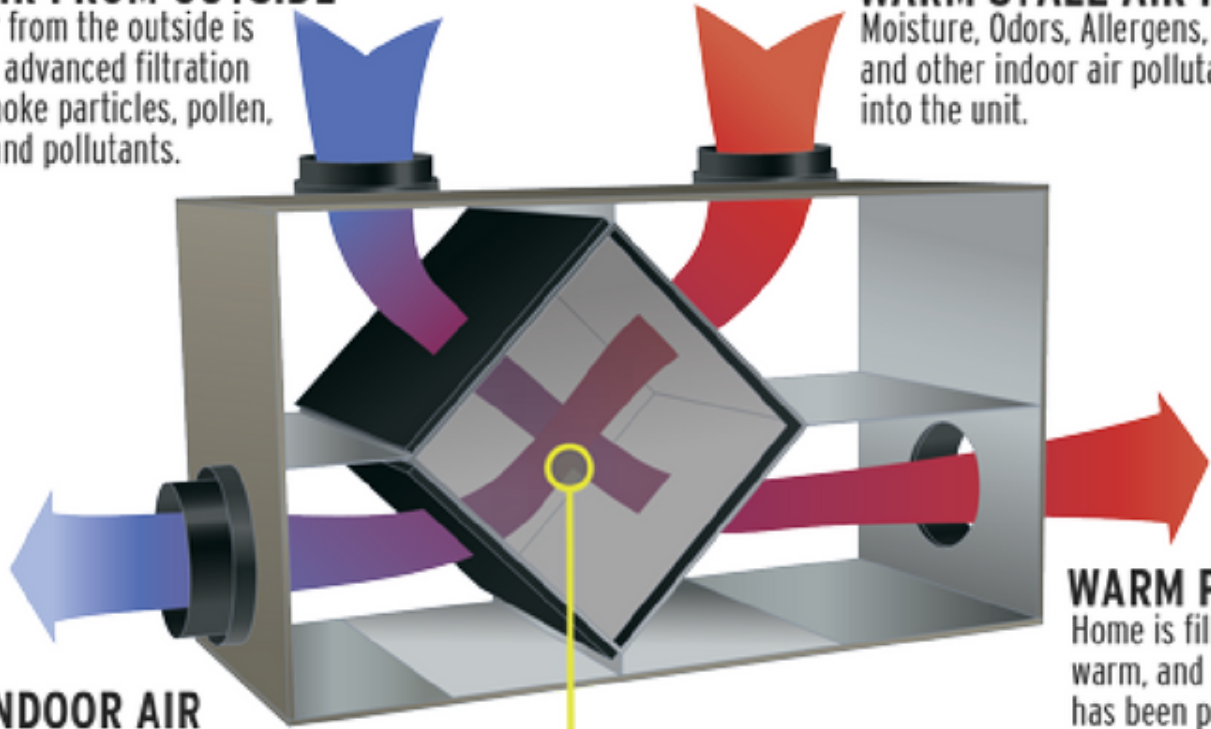
Greenheck ERVe-35

COLD FRESH AIR FROM OUTSIDE

Fresh oxygen rich air from the outside is pulled into the unit's advanced filtration system to remove smoke particles, pollen, and other allergens and pollutants.

WARM STALE AIR FROM INSIDE

Moisture, Odors, Allergens, VOCs, CO and CO₂ and other indoor air pollutants are pulled into the unit.



COOL STALE INDOOR AIR

After the heat is removed from the stale indoor air this air becomes cool and is exhausted outside.

ENERGY RECOVERY CORE

Heat from the stale indoor air is transferred through the unit's core to warm the cold fresh air before it enters the home.

WARM PURIFIED AIR

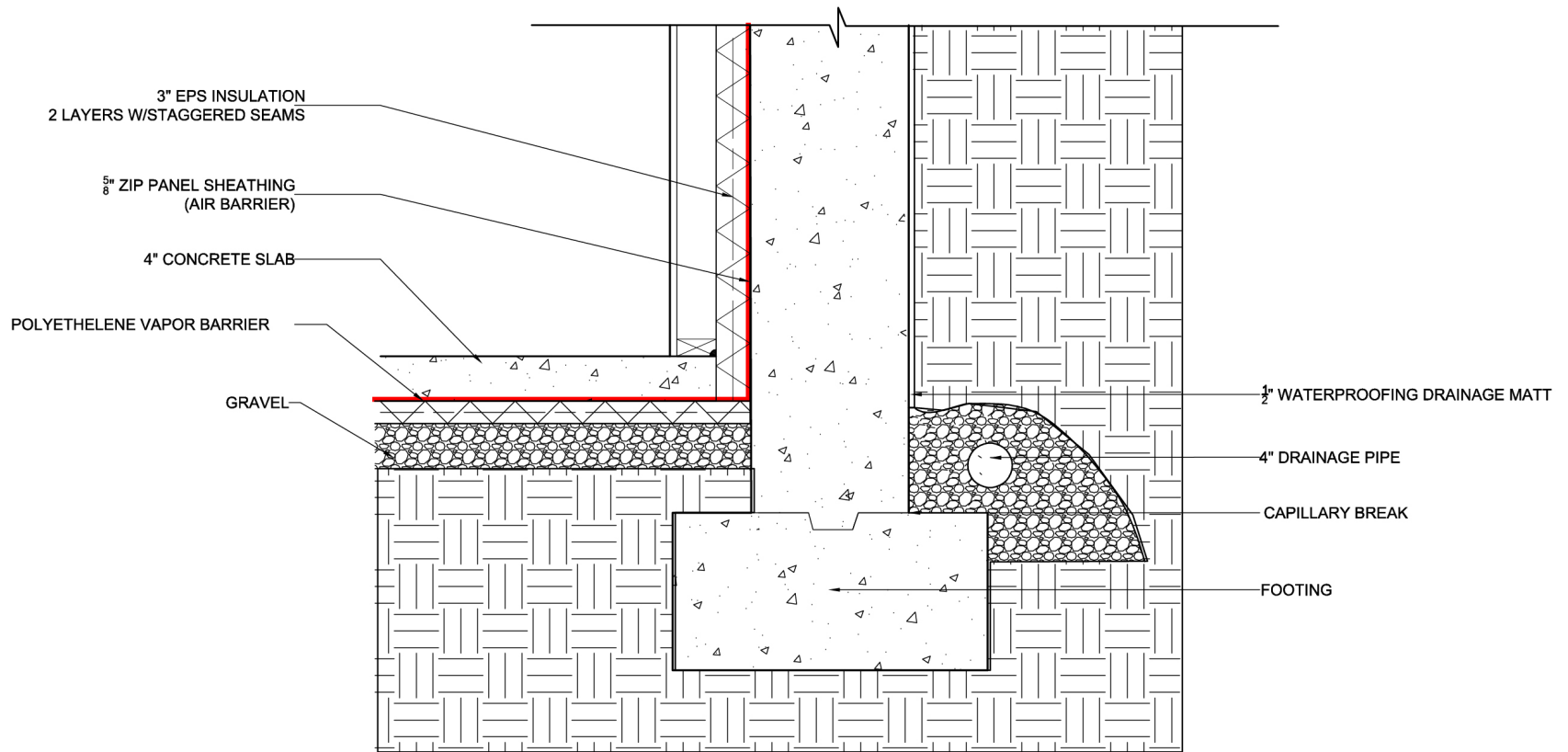
Home is filled with fresh, warm, and oxygenated air that has been purified and tempered by the unit, creating a healthy, efficient, and odor free indoor environment.

CONSTRUCTABILITY +

RACE TO ZERO MIAMI OH

ENVELOPE DURABILITY

**BUILDING AIR TIGHTNESS +
CLIMATE APPROPRIATE VAPOR PROFILE +
CONSTRUCTABILITY**

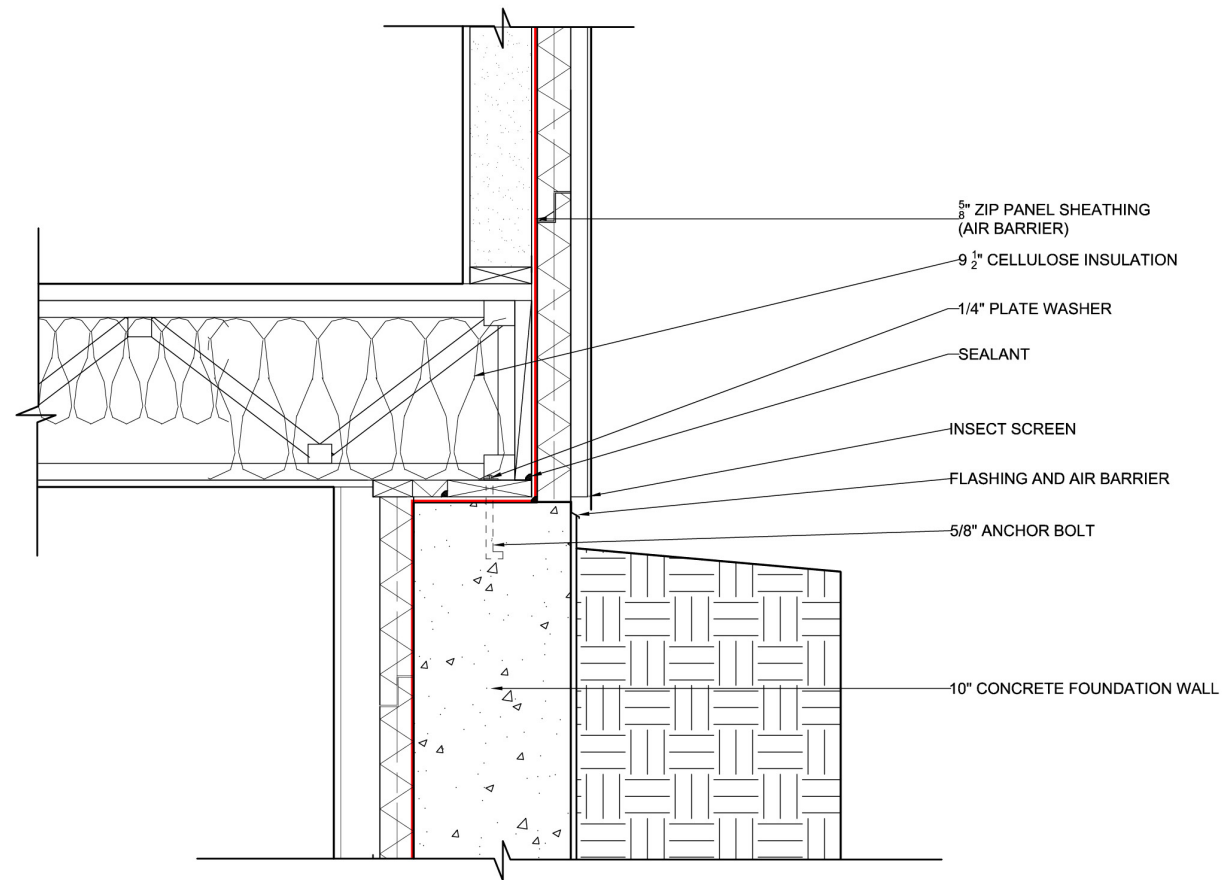


CONSTRUCTABILITY +

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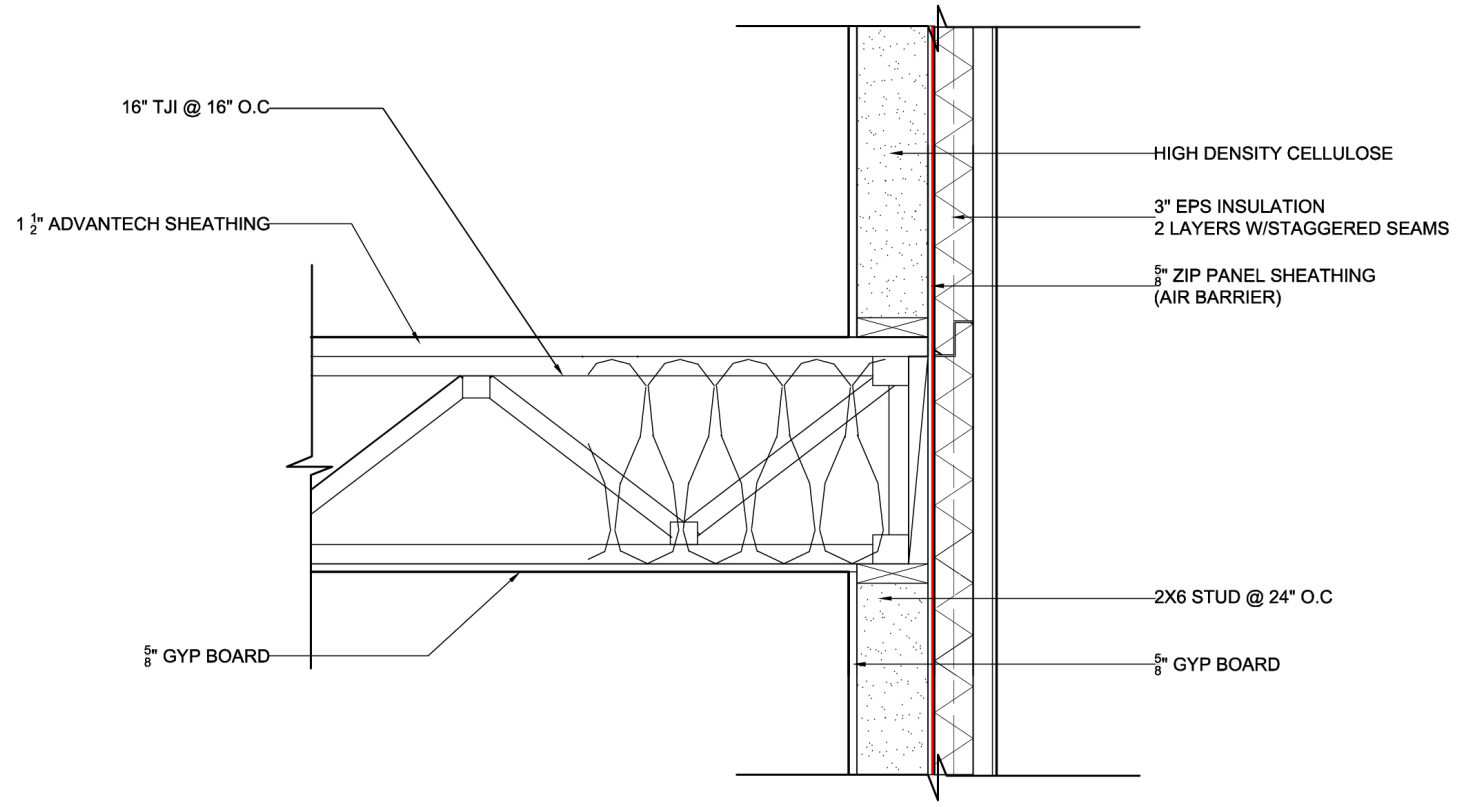


CONSTRUCTABILITY +

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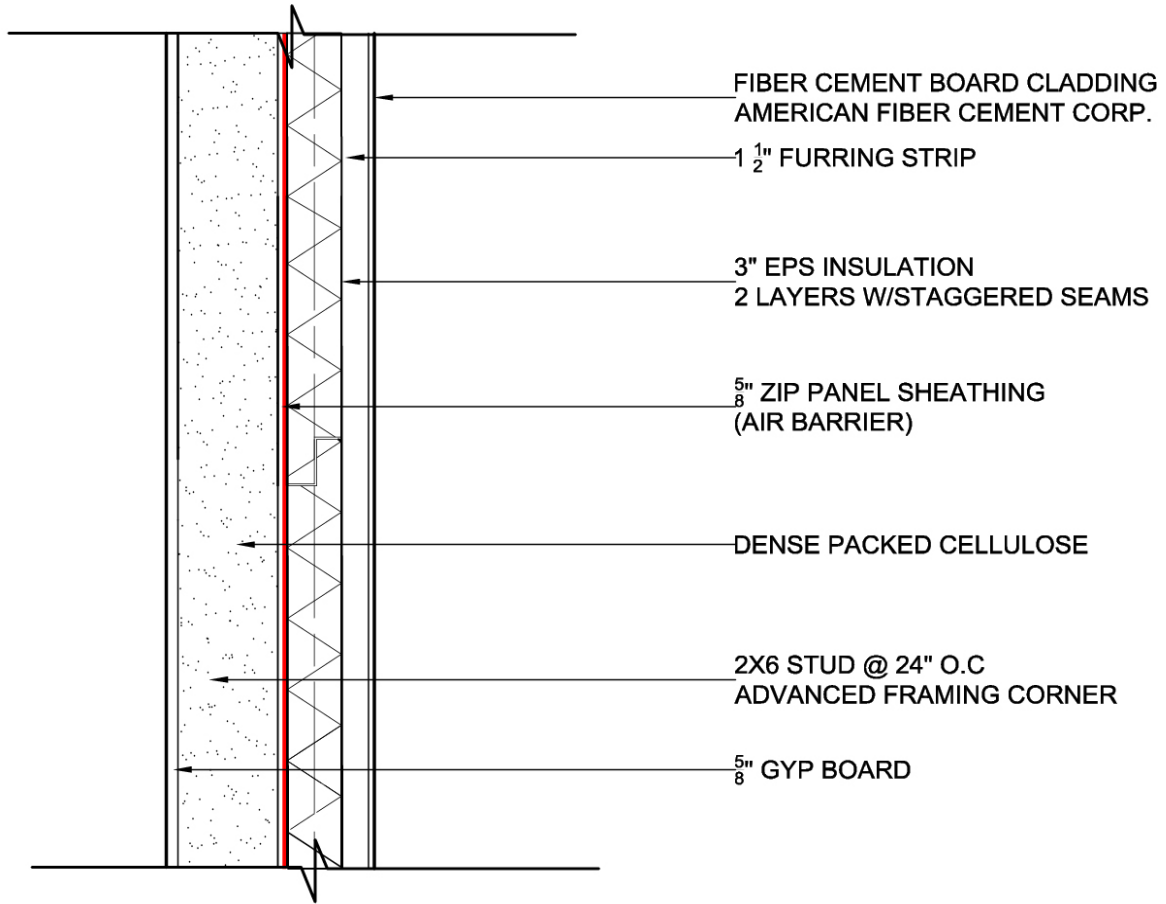


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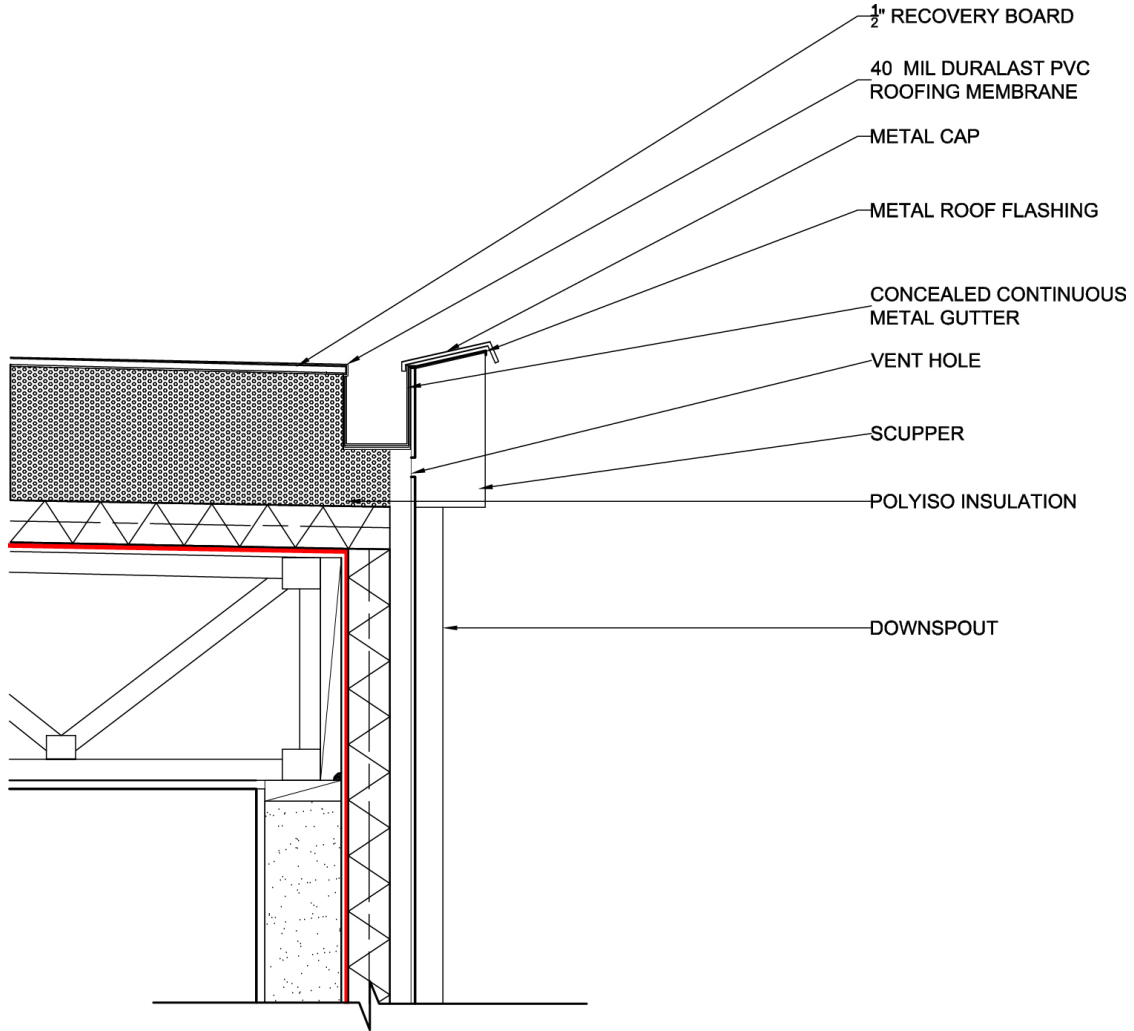


CONSTRUCTABILITY +

RACE TO ZERO MIAMI OH

ENVELOPE DURABILITY

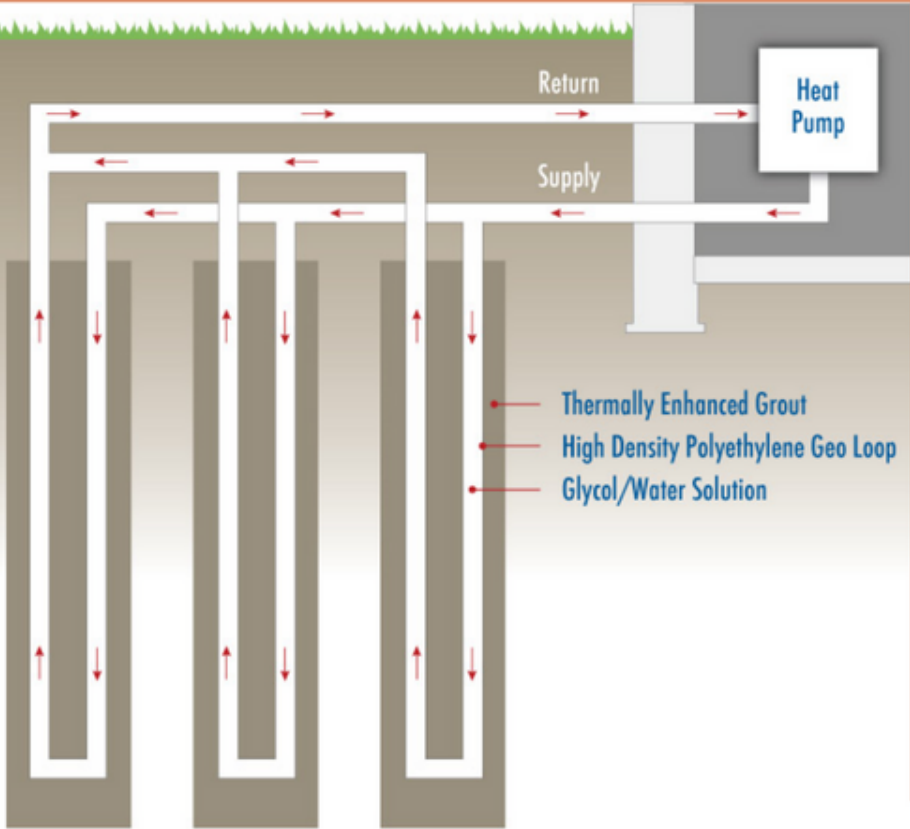
**BUILDING AIR TIGHTNESS +
CLIMATE APPROPRIATE VAPOR PROFILE +
CONSTRUCTABILITY**



HYPER-EFFICIENT PUMP STATION

GEO THERMAL

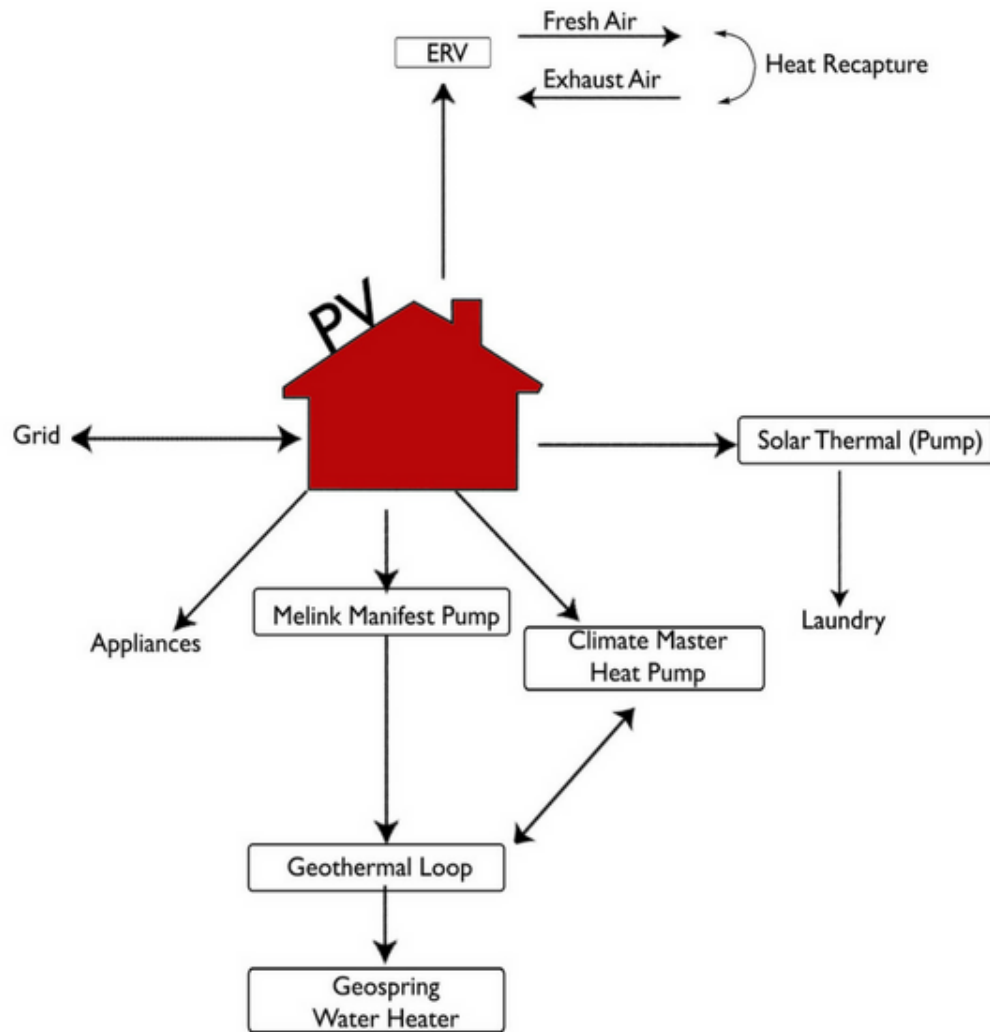
10



- 800 sq. ft. per heating ton → 45 ton heating load
- 500 foot well emits 2.25 tons of heating → 20 wells
- Reverse return layout for optimal efficiency

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PHOTOVOLTAICS

**2 RESIDENTIAL TOWERS**

5,005 sq. ft. of PV on both roofs combined

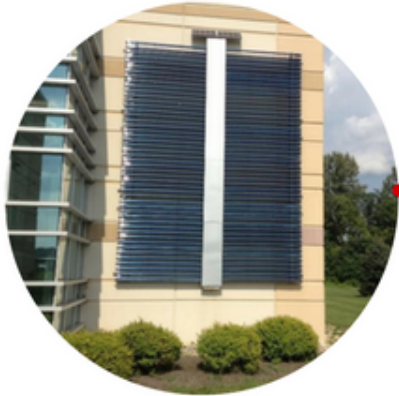
4 EXTERIOR VERTICAL SECTIONS

Mounted on Invisimount rails for maximum stability totalling 960 sq. ft.

4.5 PEAK HOURS

33.5° South angle
 Considerations- Wind, Snow, Efficiency and Sun Exposure

VERTICAL SOLAR THERMAL SYSTEM



1 SYSTEM 960 SQ. FT.

Vertically mounted evacuated tube collectors

82 OCCUPANTS*

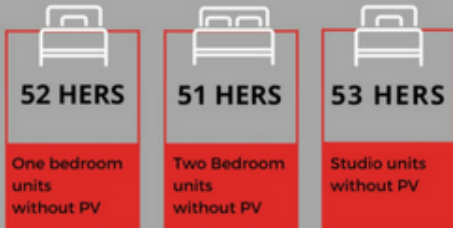
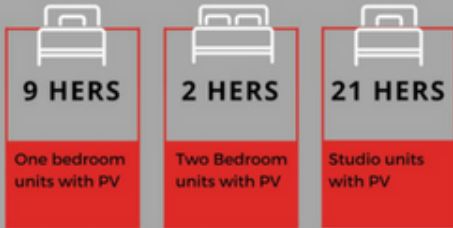
1.5 loads/occupant/week →
548 gallons/ day

1.5 HOT LAUNDRY LOADS

Daily hot water usage based on 1.5 hot laundry loads/occupant/ week

REM RATE

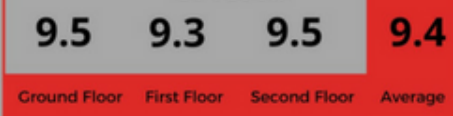
AVERAGE HERS INDEX



286 PANELS

The areas of the roof and wall photovoltaic arrays were apportioned to each unit on a square foot basis.

AVERAGE UNIT HERS INDEX WITH PV BY FLOOR



REM RATE

- Takes the 5 Envelope Design Principles into Account
- Determined performance of each housing unit
- 38 Units rated individually & averaged unit HERS index



STUDIO UNIT
6 AVAILABLE NOW

\$206.00

\$17.17/MONTH

LOHI ANNUAL ENERGY COST (\$/YR)


GRADUATE STUDENT LIVING COMMUNITY
600, MCGUFFEY AVE, OXFORD OH 45056



\$113.80

ONE BEDROOM UNIT
20 AVAILABLE NOW

\$9.50/MONTH



TWO BEDROOM UNIT
12 AVAILABLE NOW

\$72.16

\$6/MONTH

ANALYZING OUR RESULTS

- Units are efficient
-
- Unit positioning served as an asset
-
- Unit size matters
-
- Affordability

SEFAIRA

[Update Analysis](#)

Analysis is out of date. Click Update Analysis to refresh your performance assessment.

Residential in Oxford, OH 45056,...

Properties

Total Floor Area **46,430** sq ft

14 kBTU/ft²/yr

HEATING DOMINATED

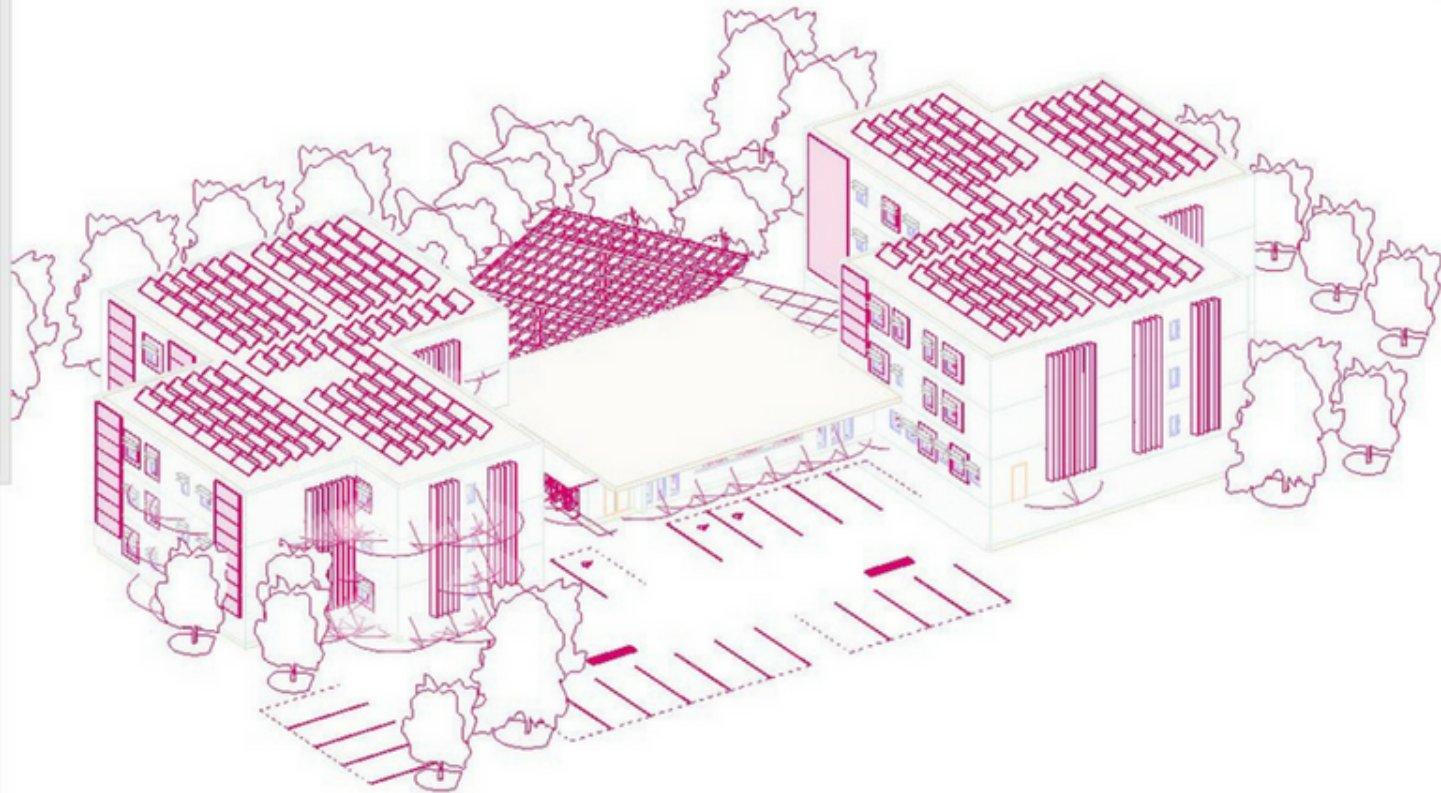
MOSTLY UNDERLIT

Gains & Losses [Guidance](#)

Impact on Heating Impact on Cooling

- Wall Conduction
- Infiltration
- Roof Conduction
- Glazing Conduction
- Equipment and People
- West Solar
- Lighting
- East Solar
- South Solar
- Floor Conduction
- North Solar

Include active gains and losses



WUFI

Scope: **Passive house verification** English/IP/Outer dimensions Assign data Project/Case 1

Project
 Case 1
 Localization/Climate: CINCINNATI MUNICIPAL AP LUNKI OH
 Building
 PH case: Passive house: Residential
 Zone 1: South Tower
 Visualized components
 Component 1: South Tower Slab
 Component 2: South Tower Walls
 Component 3: South Tower Roof
 Component 4: South Tower Windows
 Component 5: South Tower Windows
 Component 6: South Tower Windows
 Component 7: South Tower Windows
 Component 8: South Tower Windows
 Component 9: South Tower Windows
 Component 10: South Tower Windows
 Component 11: South Tower Windows
 Component 12: South Tower Windows
 Component 13: South Tower Windows

BUILDING INFORMATION

Category: **Residential**
 Status: **In planning**
 Building type: **New construction**
 Year of construction:
 Units: **40**
 Number of occupants: **78.6 (Verification)**

Boundary conditions **Building geometry**

Climate: **CINCINNATI MUNICIPAL AP LUNKI OH**
 Internal heat gains: **0.7 Btu/hr ft²**
 Interior temperature: **68 °F**
 Overheat temperature: **77 °F**

Enclosed volume: **405220.2 ft³**
 Total area envelope: **55807.6 ft²**
 AV ratio: **0.1 1/ft**
 Floor area: **29619.7 ft²**

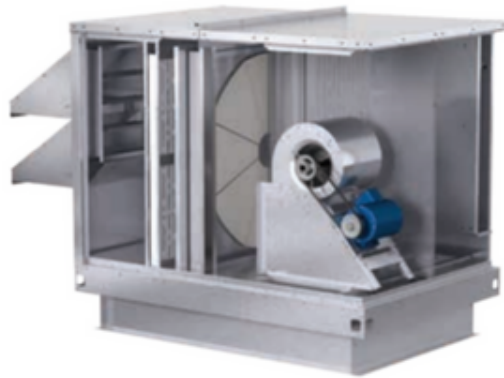
PASSIVEHOUSE REQUIREMENTS

Certificate criteria: **Default Standard**

Data state/results show warnings

Heating demand:	3.56 kBtu/ft ² yr		✓
Cooling demand:	2.31 kBtu/ft ² yr		✓
Heating load:	2.48 Btu/hr ft ²		✓
Cooling load:	1.76 Btu/hr ft ²		✓
Primary energy:	22.69 kBtu/ft ² yr		✓
Site energy:	11.38 kBtu/ft ² yr		✓

VENTILATION SYSTEM



Greenheck
ERVe-35

HEATING & COOLING SYSTEMS



½ Ton
ClimateMaster
Tranquility heat
pump



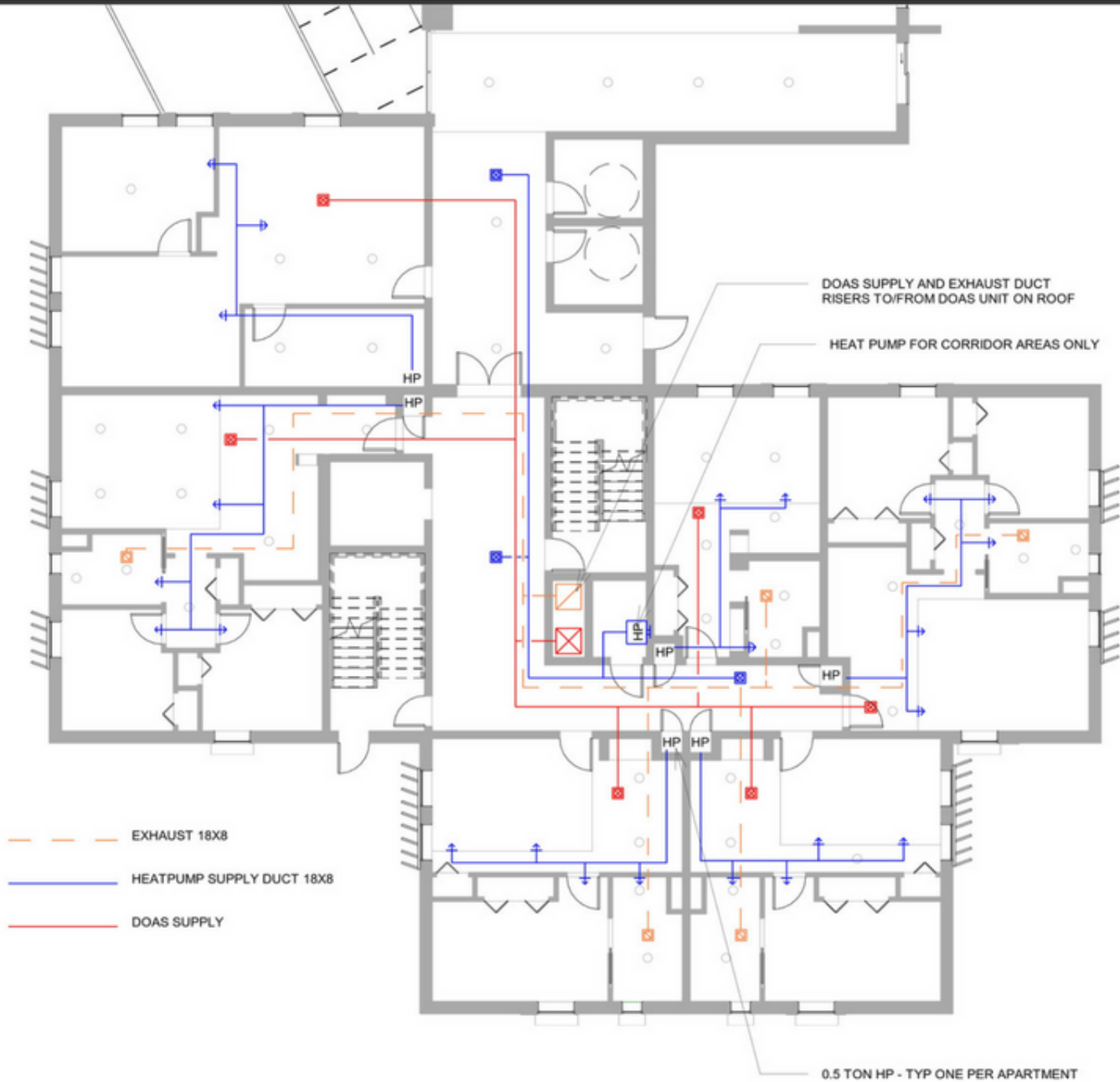
GeoSpring 80
Gal Hybrid Water
heaters

12

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TYPICAL UNIT LAYOUT

RACE TO ZERO MIAMI OH



ENERGY
RECOVERY
VENTILATOR

ERV

13

- Fresh air introduced to units via **centralized roof mounted ERV**

- Increases air circulation & utilizes heat produced from exhaust air

- Increases O₂ levels while **filtering out pollutants**

- **Decreases odors, moisture and CO₂ levels**

- 2250 CFM required per tower to meet Passive House requirement of 0.30 ACH

- Volatile organic compounds minimized by consciously selecting interior finishes

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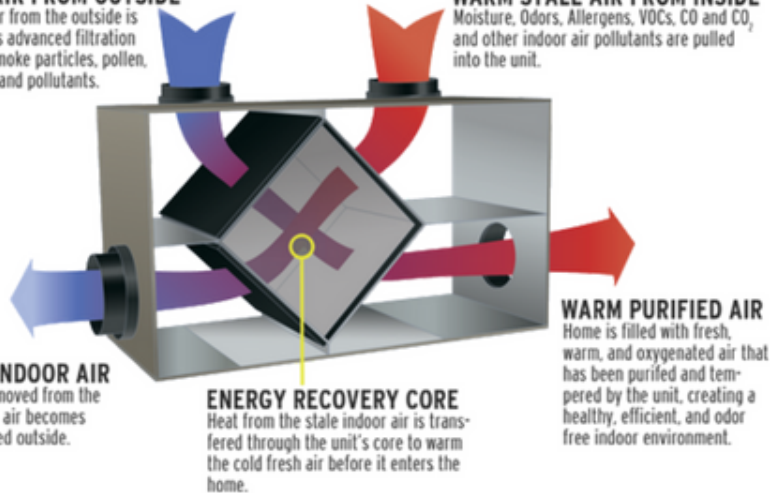
INNOVATION

COLD FRESH AIR FROM OUTSIDE

Fresh oxygen rich air from the outside is pulled into the unit's advanced filtration system to remove smoke particles, pollen, and other allergens and pollutants.

WARM STALE AIR FROM INSIDE

Moisture, Odors, Allergens, VOCs, CO and CO₂, and other indoor air pollutants are pulled into the unit.

**COOL STALE INDOOR AIR**

After the heat is removed from the stale indoor air this air becomes cool and is exhausted outside.

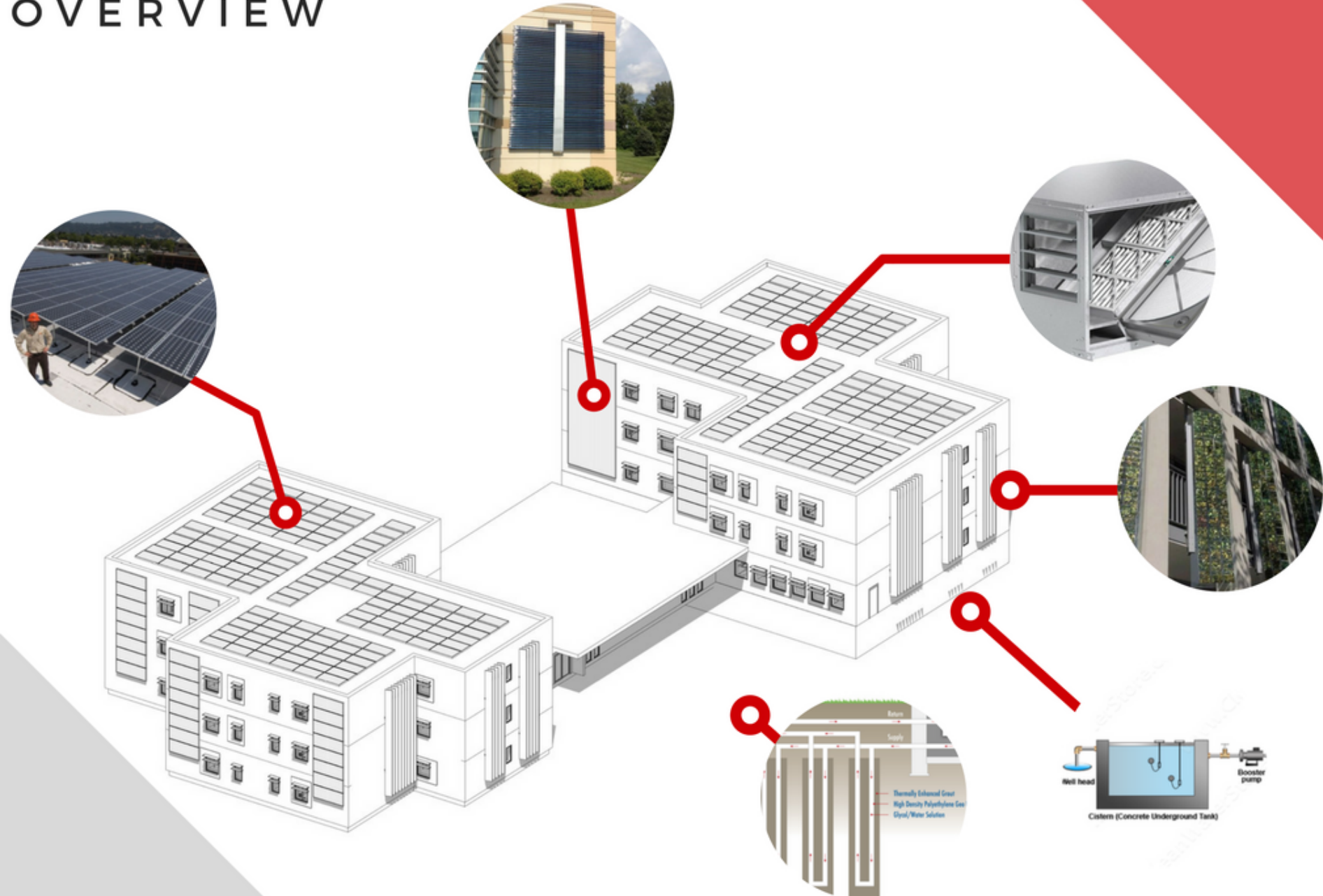
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Heat from the stale indoor air is transferred through the unit's core to warm the cold fresh air before it enters the home.

WARM PURIFIED AIR

Home is filled with fresh, warm, and oxygenated air that has been purified and tempered by the unit, creating a healthy, efficient, and odor free indoor environment.

OVERVIEW





REFRIGERATOR
 KENMORE 69313 19 CU. FT. BOTTOM-FREEZER
 REFRIGERATOR
 (STAINLESS STEEL)



14



DISHWASHER
 BOSCH ASCENTA 46-DECIBEL BUILT-IN
 DISHWASHER
 (STAINLESS STEEL)



RANGE/OVEN
 KENMORE 94173 5.3 CU. FT. ELECTRIC
 FREESTANDING RANGE W/ SELF-CLEAN
 (STAINLESS STEEL)



WASHER & DRYER
 LG WT7500CW MEGA CAPACITY WITH
 TURBOWASH TECHNOLOGY

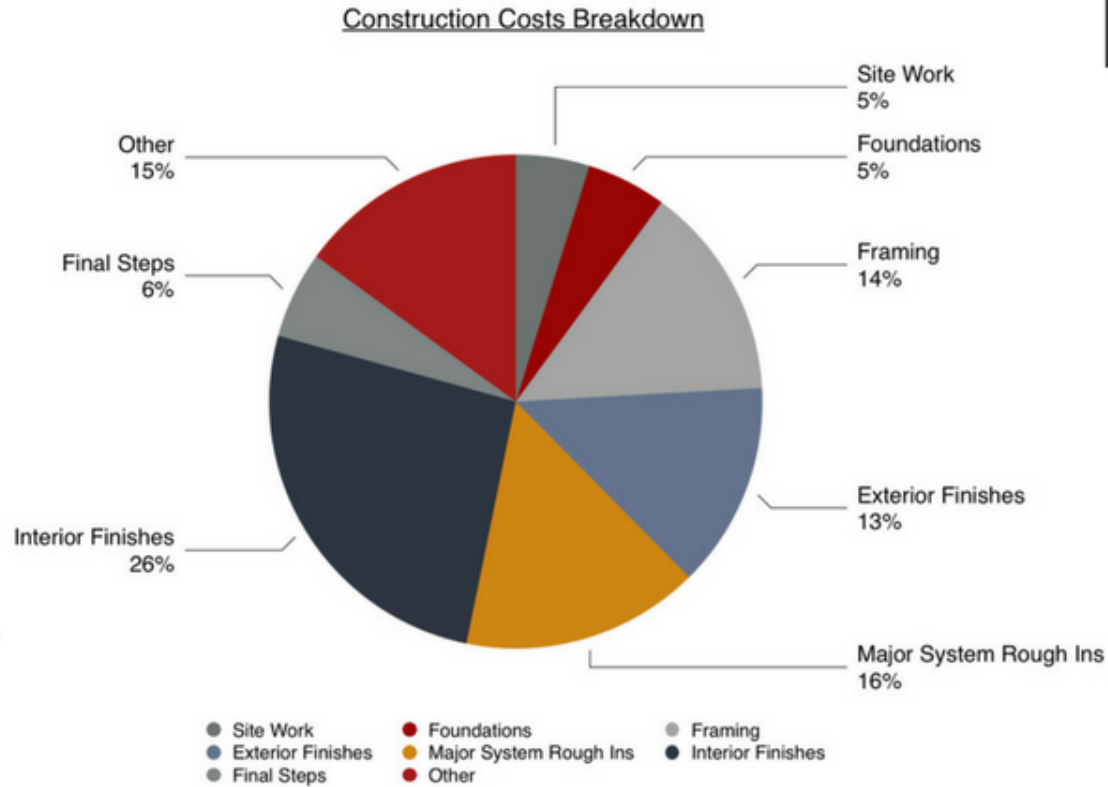
LG DLE7200WE SUPER CAPACITY ELECTRIC
 DRYER WITH SENSOR DRY TECHNOLOGY

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UNIVERSITY OWNED
STUDENT DESIRED

15

In the scenario where Miami University purchases the building as their graduate residence complex, funding would be sourced from bonds financing which has a lower interest rate than a conventional bank.



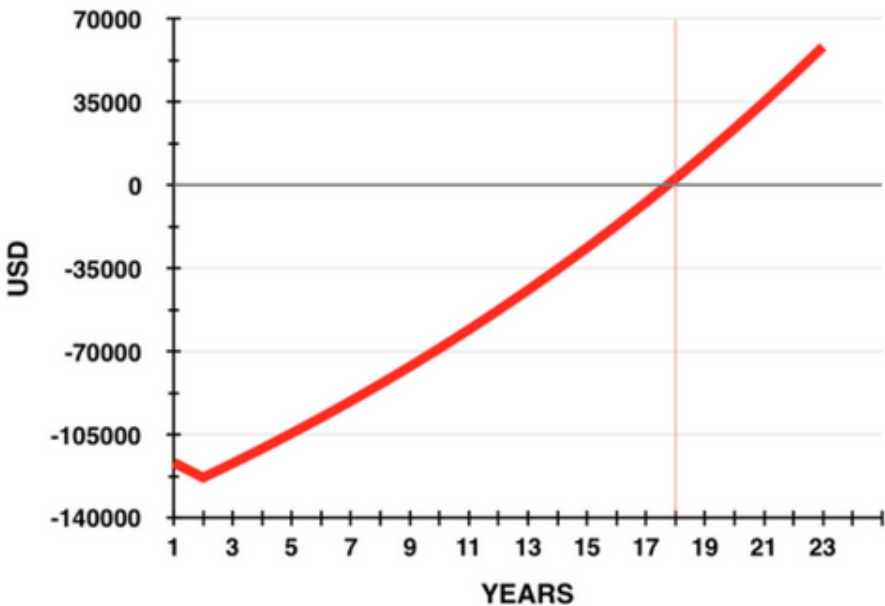
Total: \$4,976,261 + \$822,827 (Development Costs) = \$5,799,088

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2

LONG TERM. CASH FLOW IS ESTIMATED TO SEE A **POSITIVE VALUE AT 18 YEARS.**

CASH FLOW AVAILABLE FOR DISTRIBUTION



THE ASSUMPTIONS

- 3% RENT INC/YEAR
- 2% OP COST INC/YEAR
- 2% RESERVES INC/YEAR
- 5% VACANCY.

A 2-BED UNIT RENTS FOR \$850

A 1-BED UNIT RENTS FOR \$650

A STUDIO UNIT RENTS FOR \$500

3 EACH UNIT IS INDIVIDUALLY METERED
TO INCENTIVIZE SAVINGS.

4 LED LIGHTING FOR
LIGHTING REBATES
VIA THE LOCAL ENERGY
PROVIDER DUKE
ENERGY

5 IRS TAX CREDIT
(PV)
(NATIONAL)

THE STRATEGY

- Builds into Miamis University's market for Sustainability
- Standard presence in Miami's new academic & residential buildings
- Low energy costs leads to long term viability



SMART HOUSE
TECHNOLOGY



CAR SHARING



GREEN ROOF &
RAIN GARDEN



WATER CISTERN



THE GEN2 ELEVATOR



COMMUNITY GREEN
GARDEN

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- INDOOR AIR QUALITY
- APPLIANCES
- FINANCES
- INNOVATION

LOVE, HONOR, LIVE

WELCOME TO LOHII



THANK YOU!