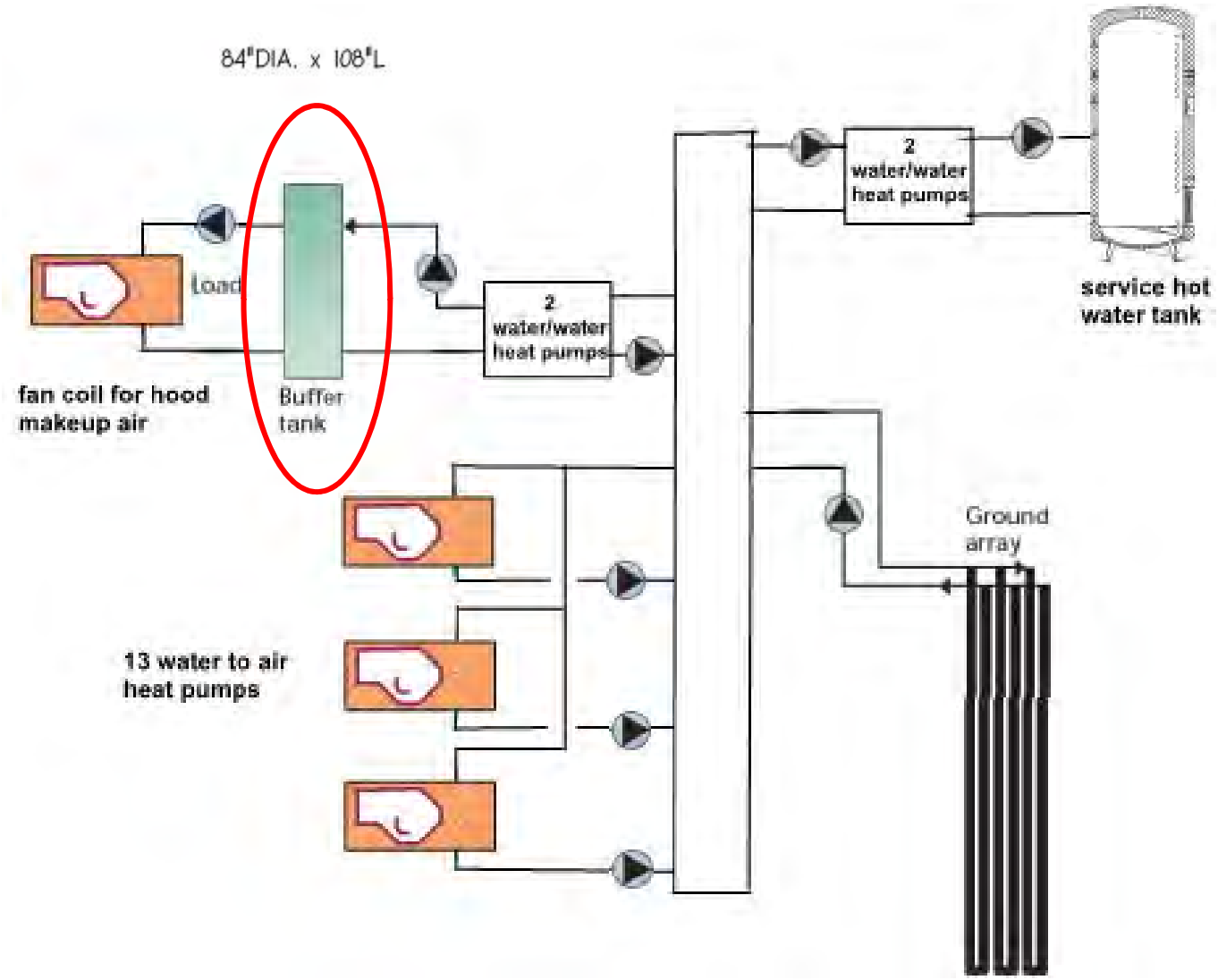
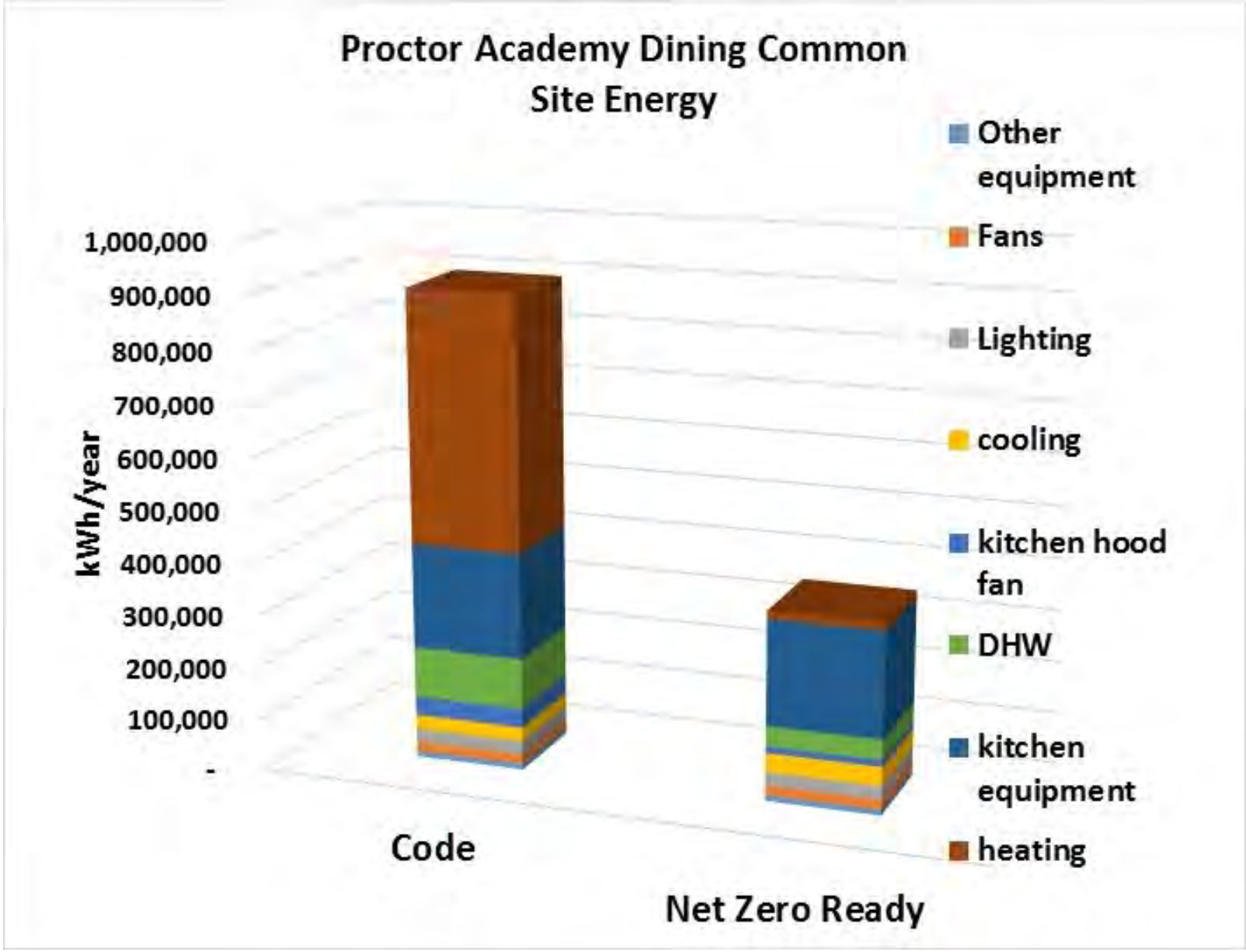
Ground Source Heat Pump System

BIG buffer tank for Makeup Air

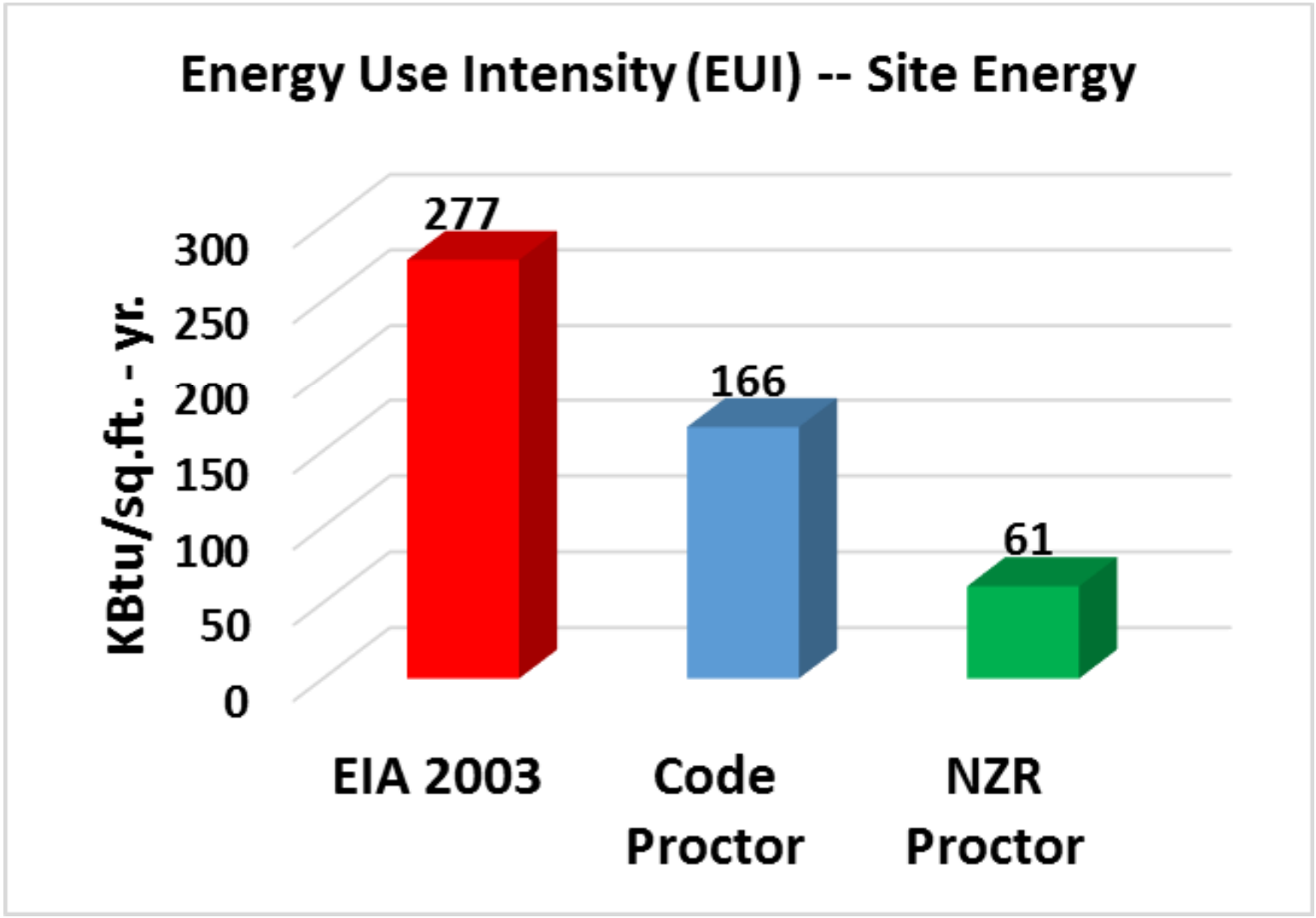
- 3,000 gallons
- Allows "dumb" heat pumps to meet varying loads
- Reduces peak load on heat pumps
- Reduces peak load on borehole field



DD Energy Modeling and Optimizing Systems



DD Energy Modeling and Optimizing Systems



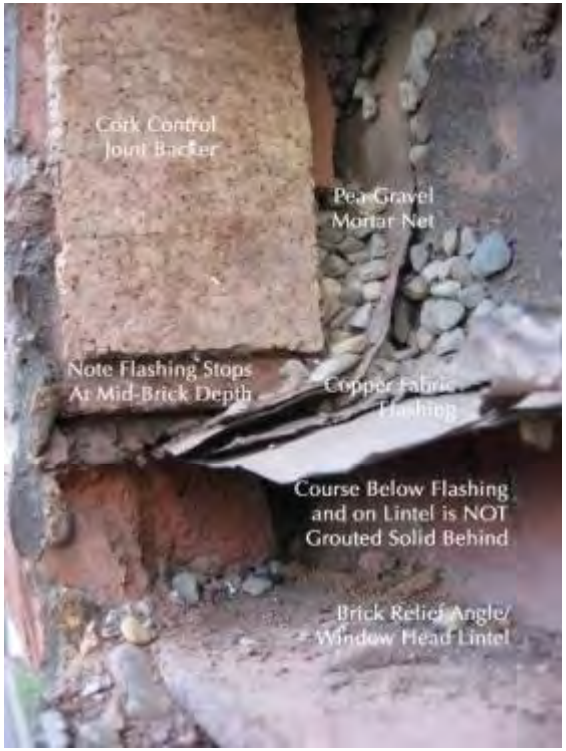
The George D. Aiken Center at the University of Vermont

- Near Net Zero since 2012
- Renovation
- Biophilia

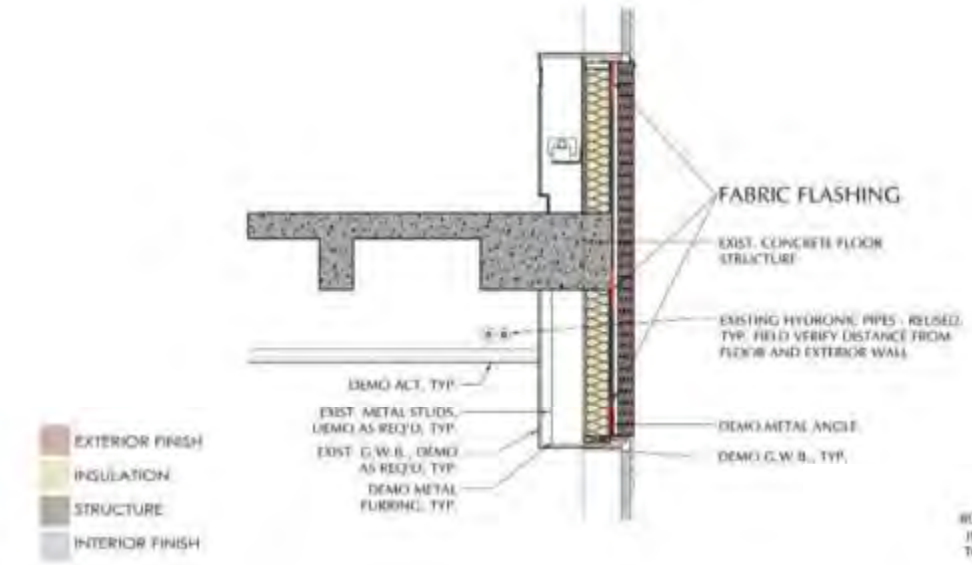
- SF: 40,000 sf
- Existing Building EUI: 89 kBtu/sf/yr (actual)
- EUI: 31 kBtu/sf/yr (modeled)
- EUI with Renewables: 25 kBtu/sf-yr
- LEED Cert: Platinum

Photo by: Jim Westphalen

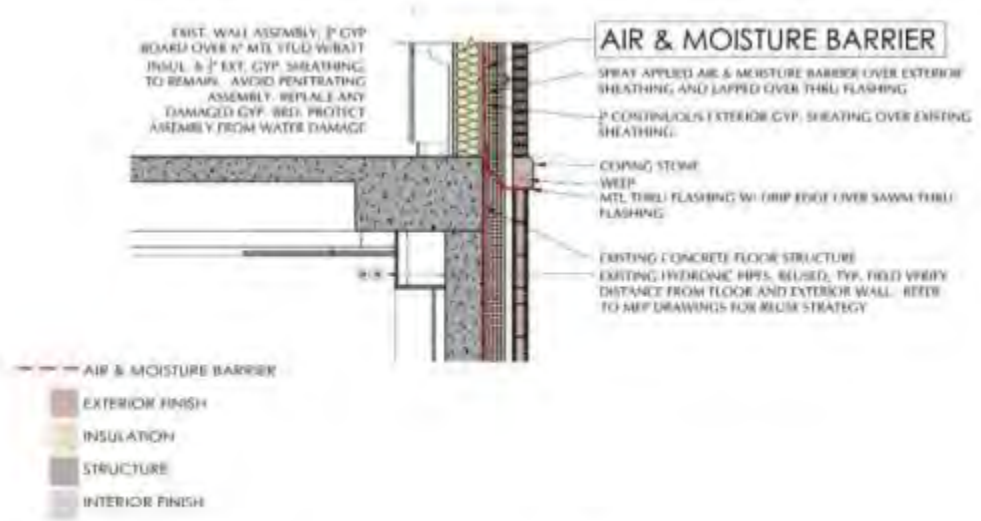
Pre-Renovation Wall Conditions



Detail at floor slab



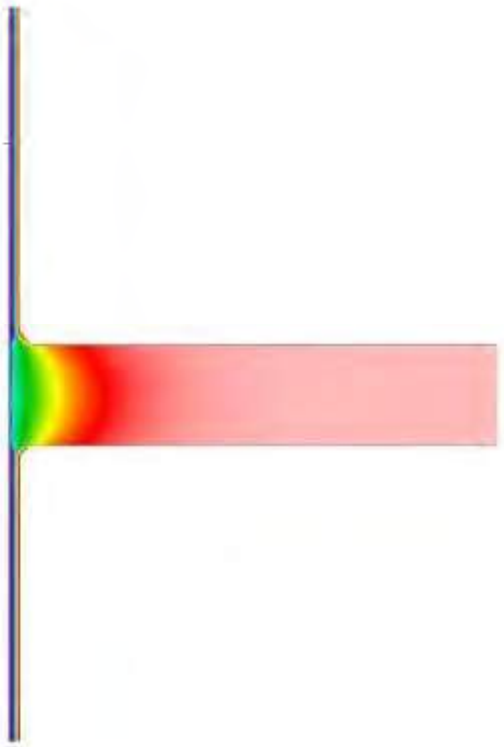
WALL SECTION AT FLOOR SLAB- EXISTING



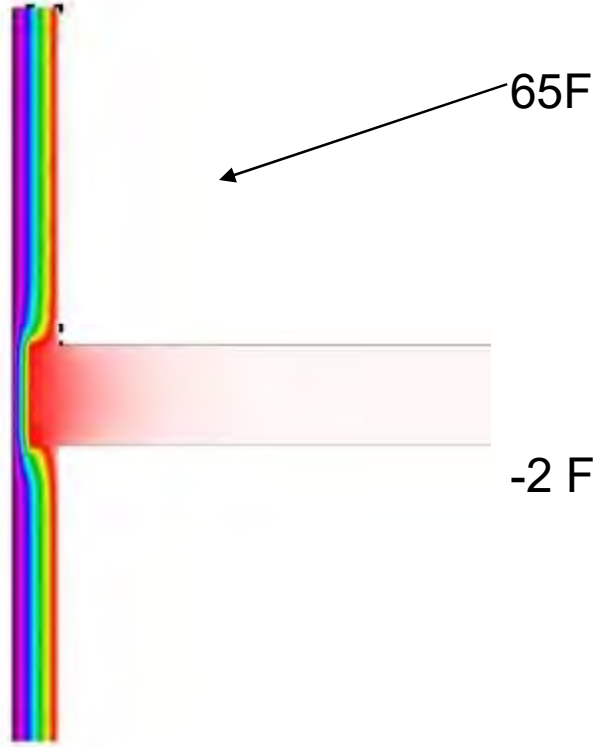
WALL SECTION AT FLOOR SLAB- NEW CONSTRUCTION

Thermal diagram

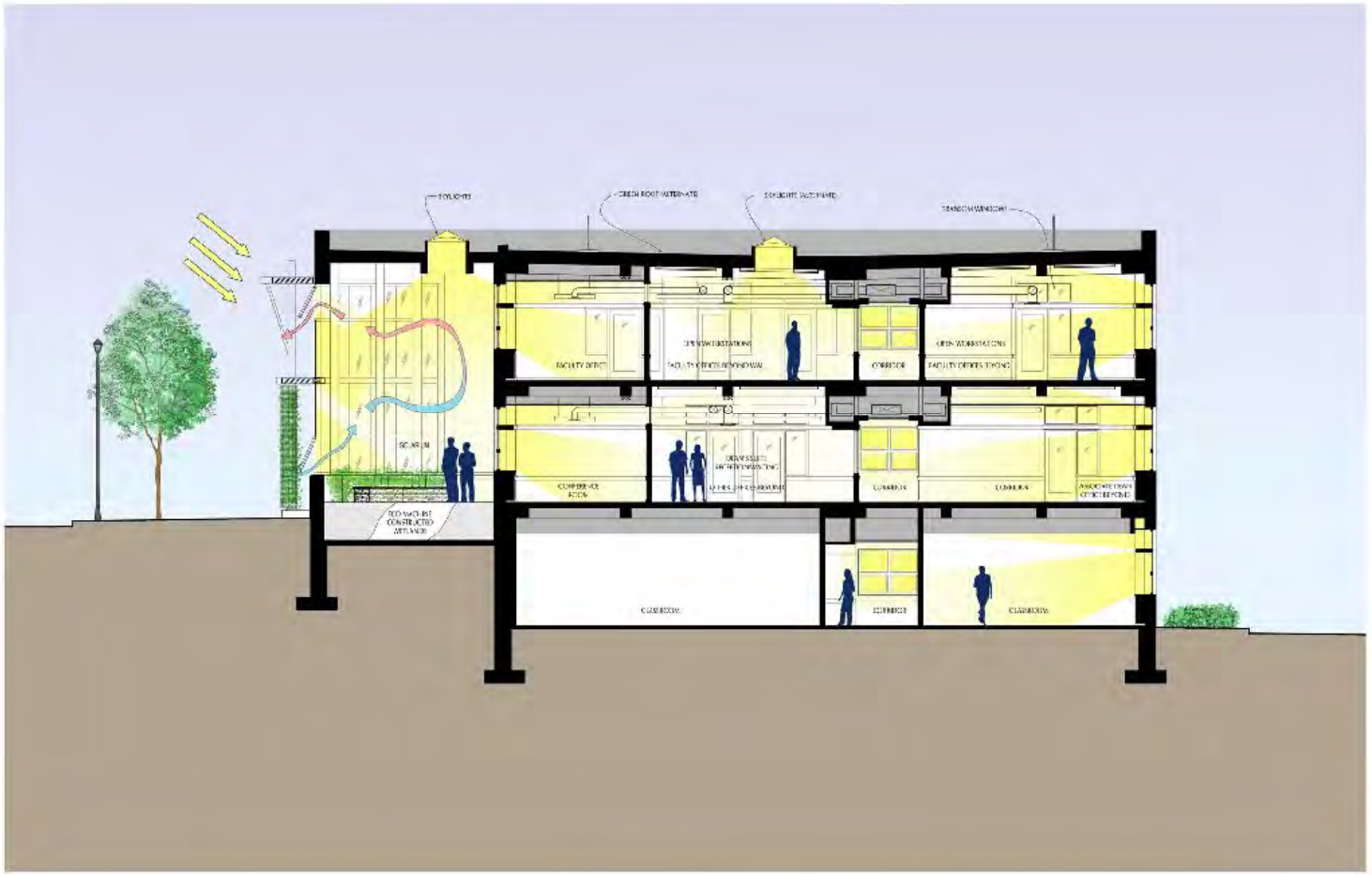
Pre-renovation



Post-renovation



Integrated design



George D. Aiken Center - University of Vermont

Building Section - Solarium

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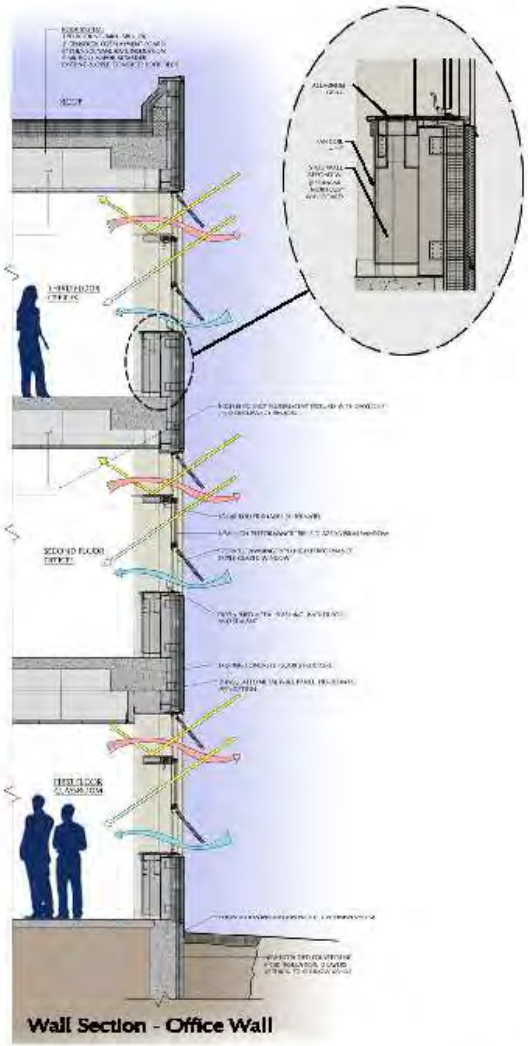
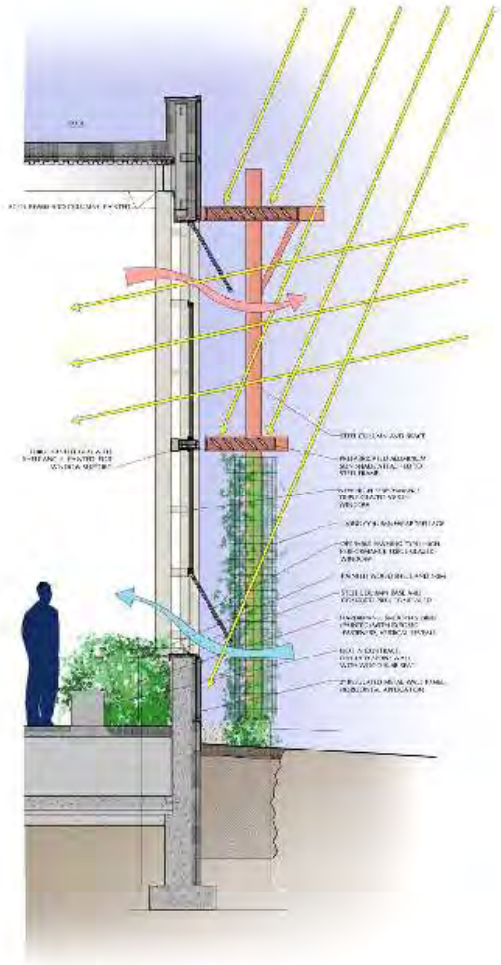
Daylighting strategy



Wall Section - Office Wall



Wall Section - Solarium

South Elevation View

Proposed Elevation

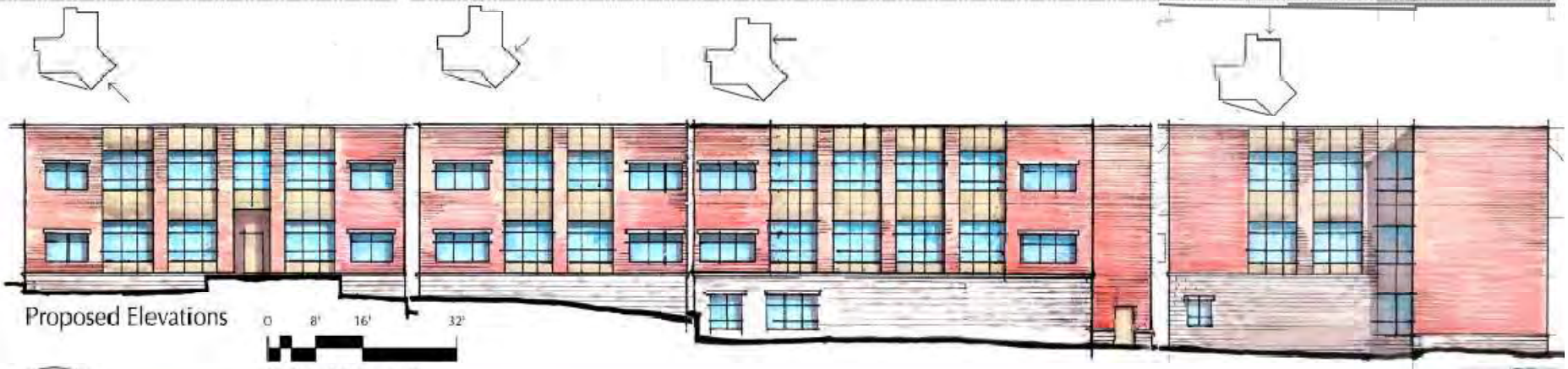
South East elevation view

North East elevation view

East elevation view

North elevation view

Existing Elevations



Proposed Elevations

0 8' 16' 32'

SCALE: 1/16" = 1'-0"

George D. Aiken Center - University of Vermont

Elevation Concepts Part 1 of 2

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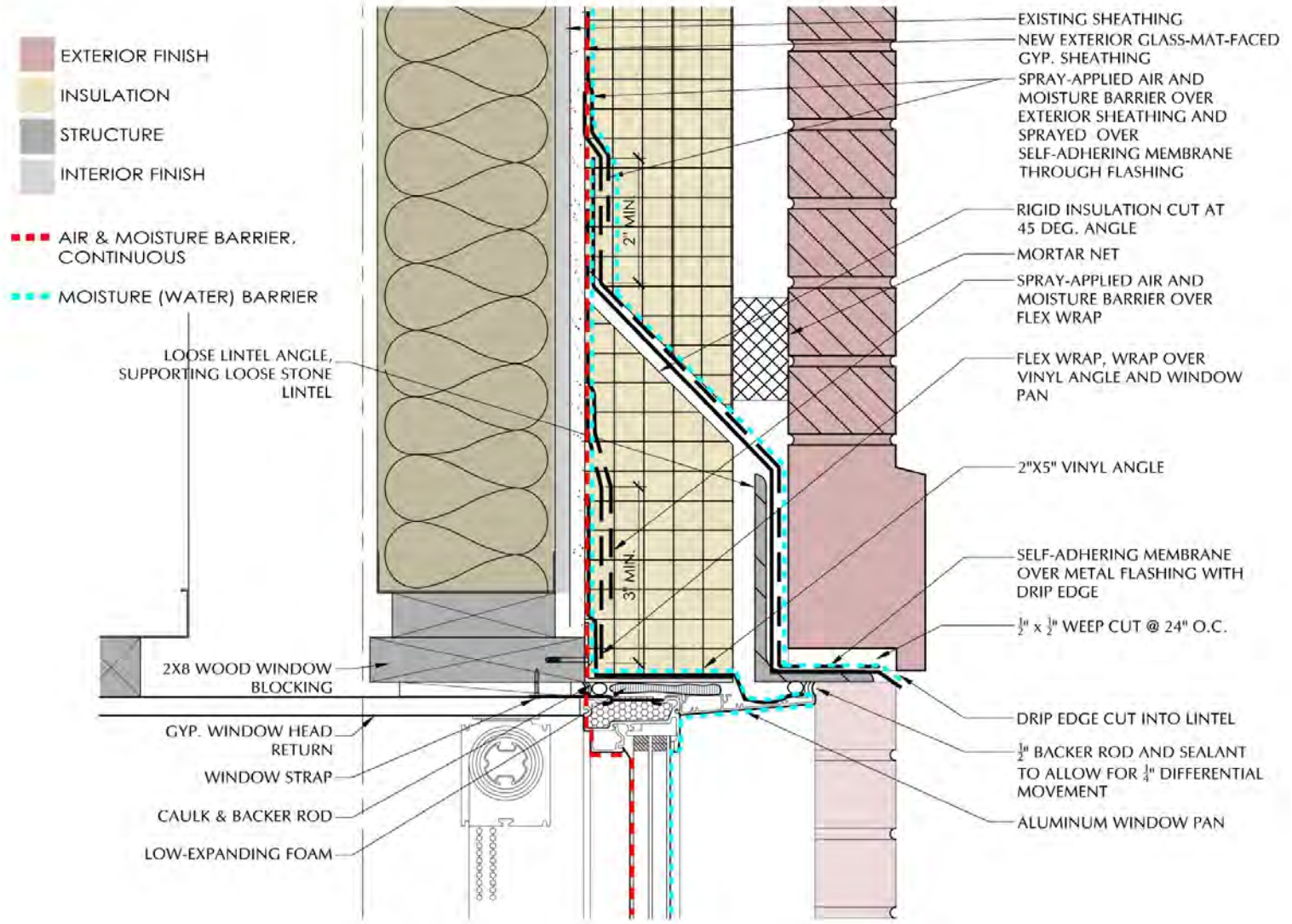
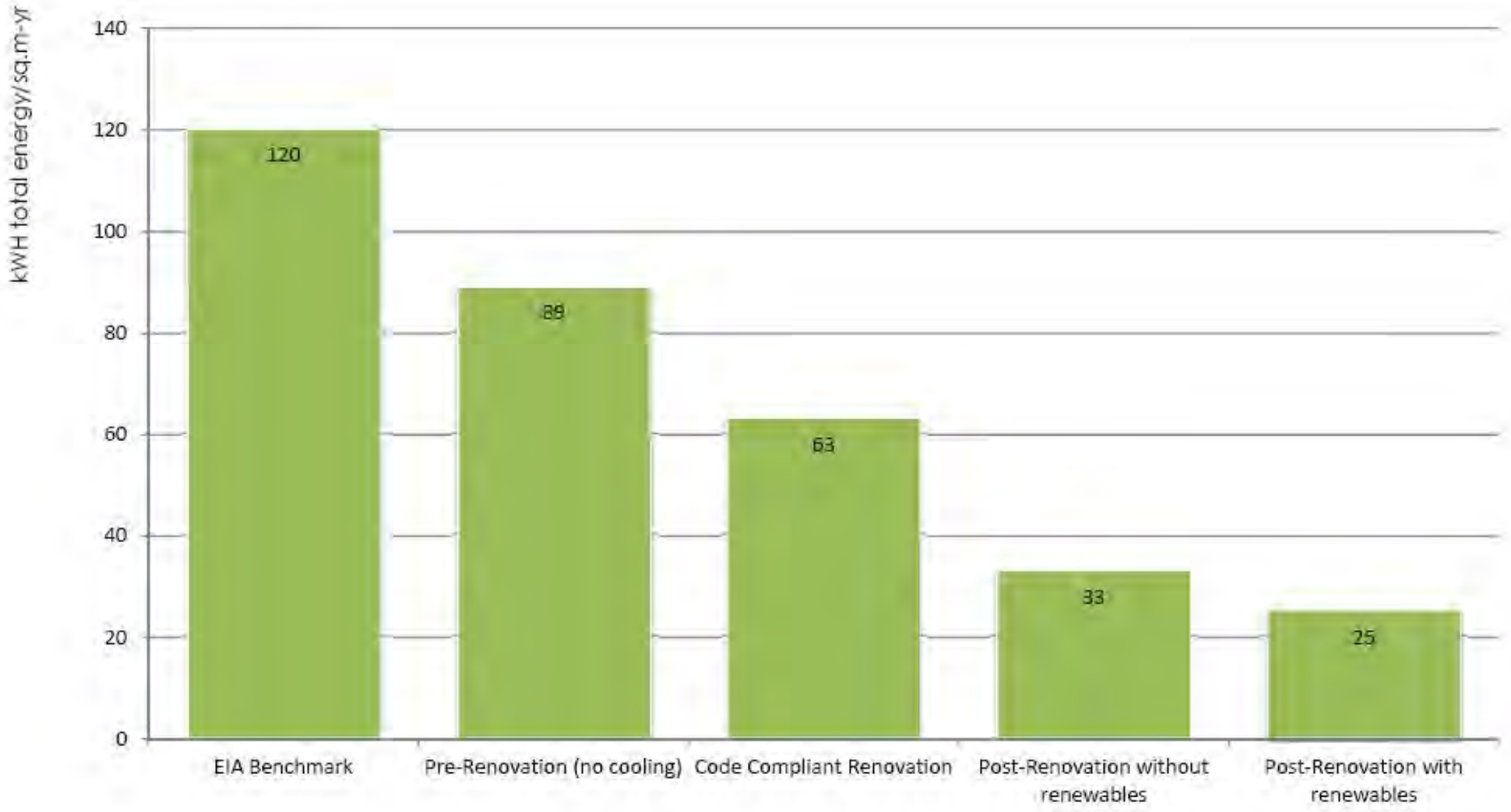
11/18/09

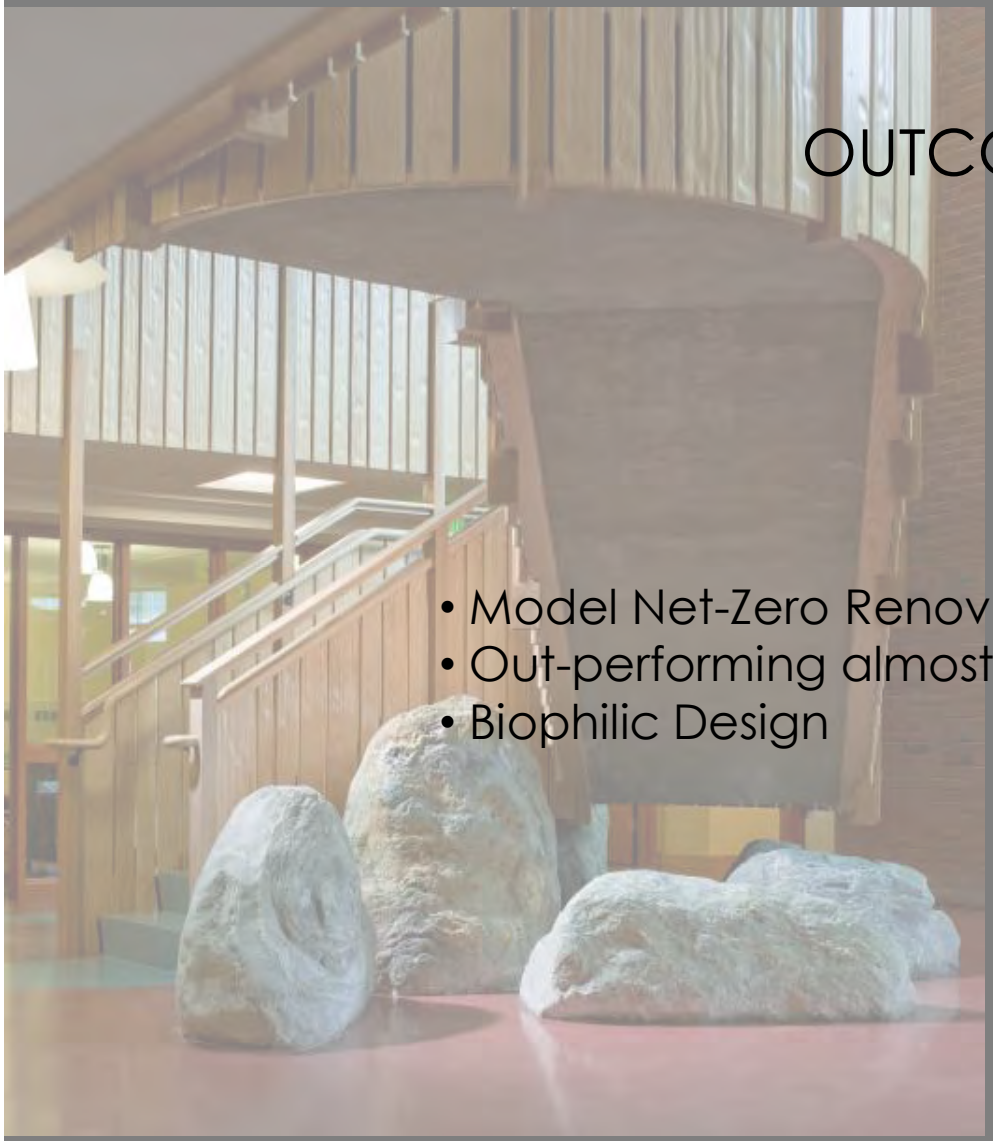
Window head

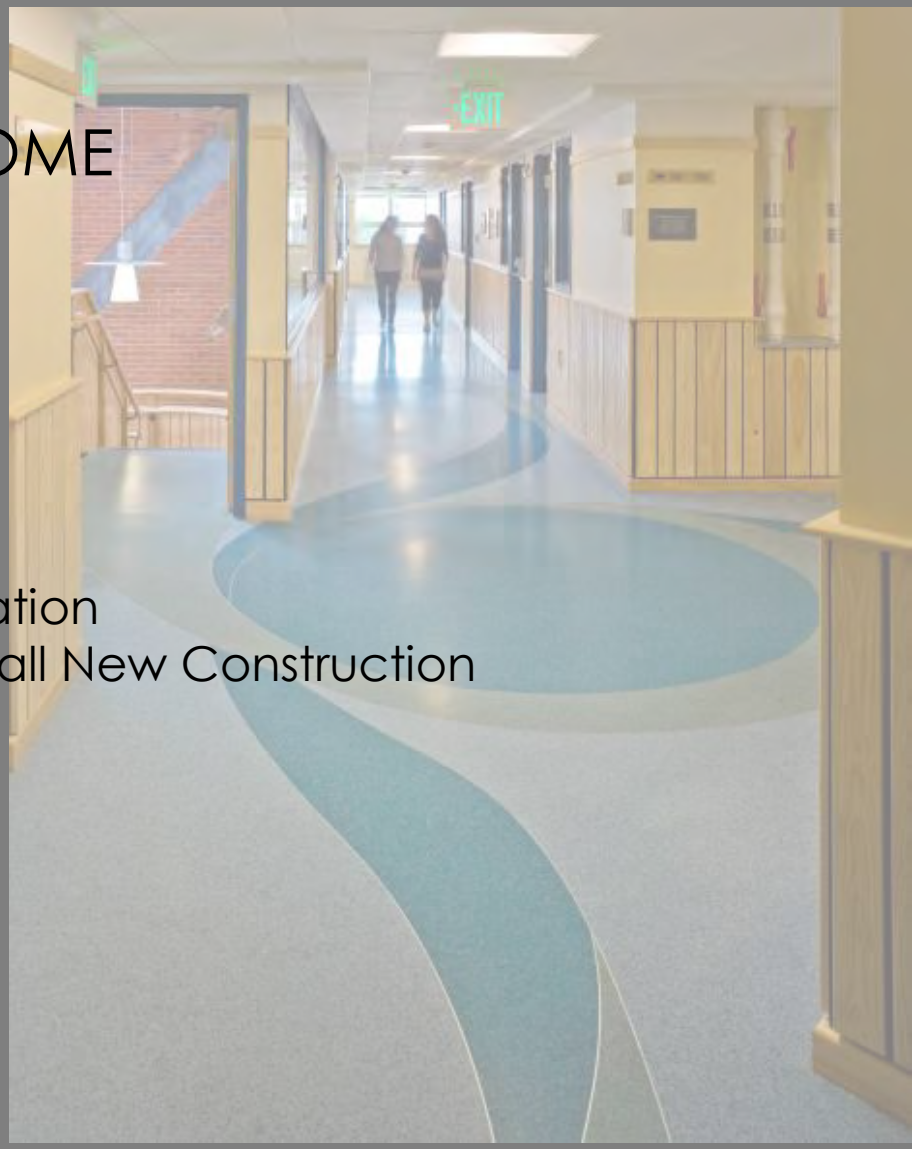

EXTERIOR FINISH
INSULATION
STRUCTURE
INTERIOR FINISH
AIR & MOISTURE BARRIER, CONTINUOUS
MOISTURE (WATER) BARRIER
LOOSE LINTEL ANGLE, SUPPORTING LOOSE STONE LINTEL
2X8 WOOD WINDOW BLOCKING
GYP. WINDOW HEAD RETURN
WINDOW STRAP
CAULK & BACKER ROD
LOW-EXPANDING FOAM
2" MIN.
3" MIN.
EXISTING SHEATHING
NEW EXTERIOR GLASS-MAT-FACED GYP. SHEATHING
SPRAY-APPLIED AIR AND MOISTURE BARRIER OVER EXTERIOR SHEATHING AND SPRAYED OVER SELF-ADHERING MEMBRANE THROUGH FLASHING
RIGID INSULATION CUT AT 45 DEG. ANGLE
MORTAR NET
SPRAY-APPLIED AIR AND MOISTURE BARRIER OVER FLEX WRAP
FLEX WRAP, WRAP OVER VINYL ANGLE AND WINDOW PAN
2"X5" VINYL ANGLE
SELF-ADHERING MEMBRANE OVER METAL FLASHING WITH DRIP EDGE
½" x ½" WEEP CUT @ 24" O.C.
DRIP EDGE CUT INTO LINTEL
½" BACKER ROD AND SEALANT TO ALLOW FOR ¼" DIFFERENTIAL MOVEMENT
ALUMINUM WINDOW PAN

Total building energy intensity



OUTCOME





- Model Net-Zero Renovation
- Out-performing almost all New Construction
- Biophilic Design

NRG Systems

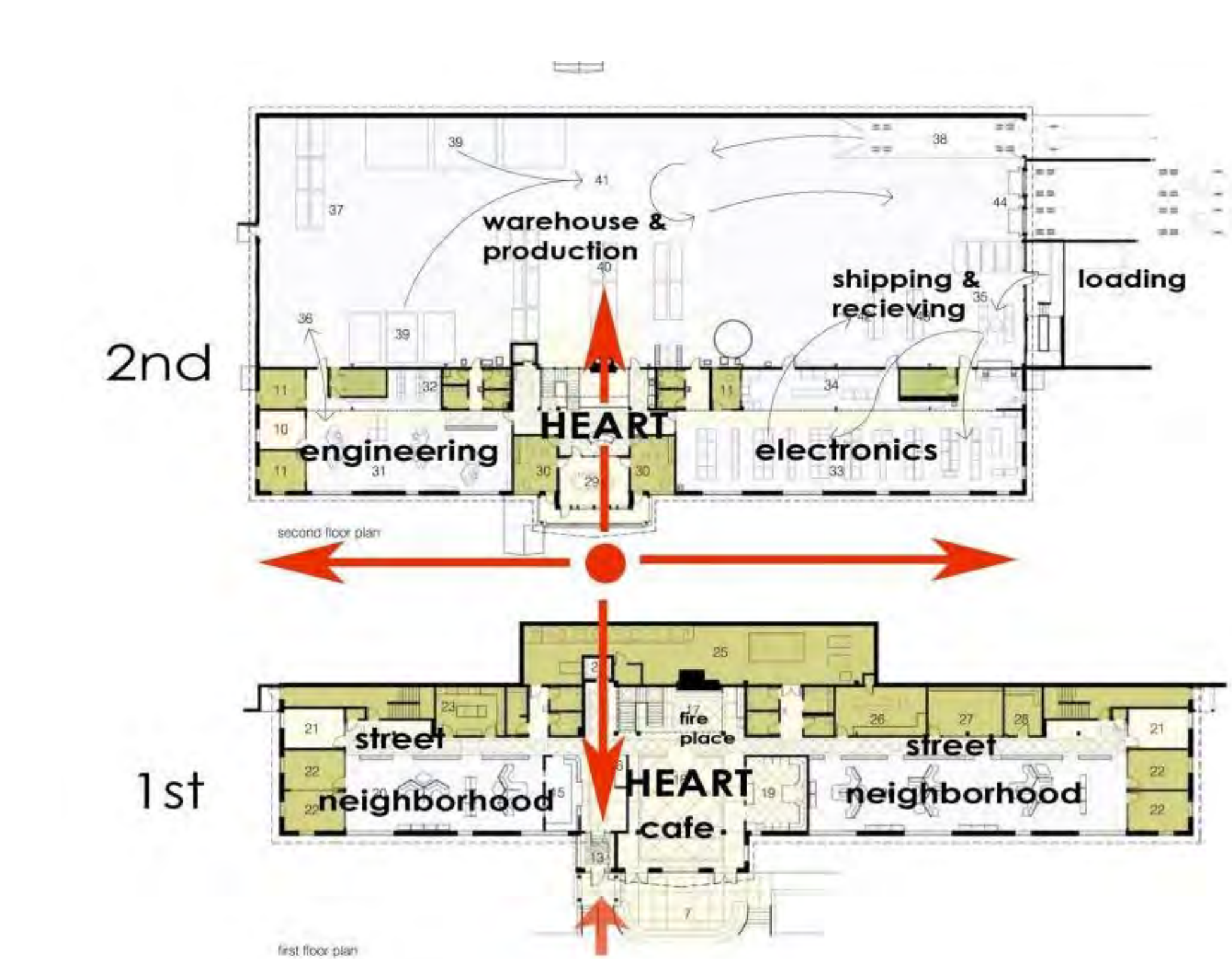
- Near Net Zero since 2004 + 2008
- 75,000 sf Office and Manufacturing
- Thousands of visitors / year

Building One - 2004

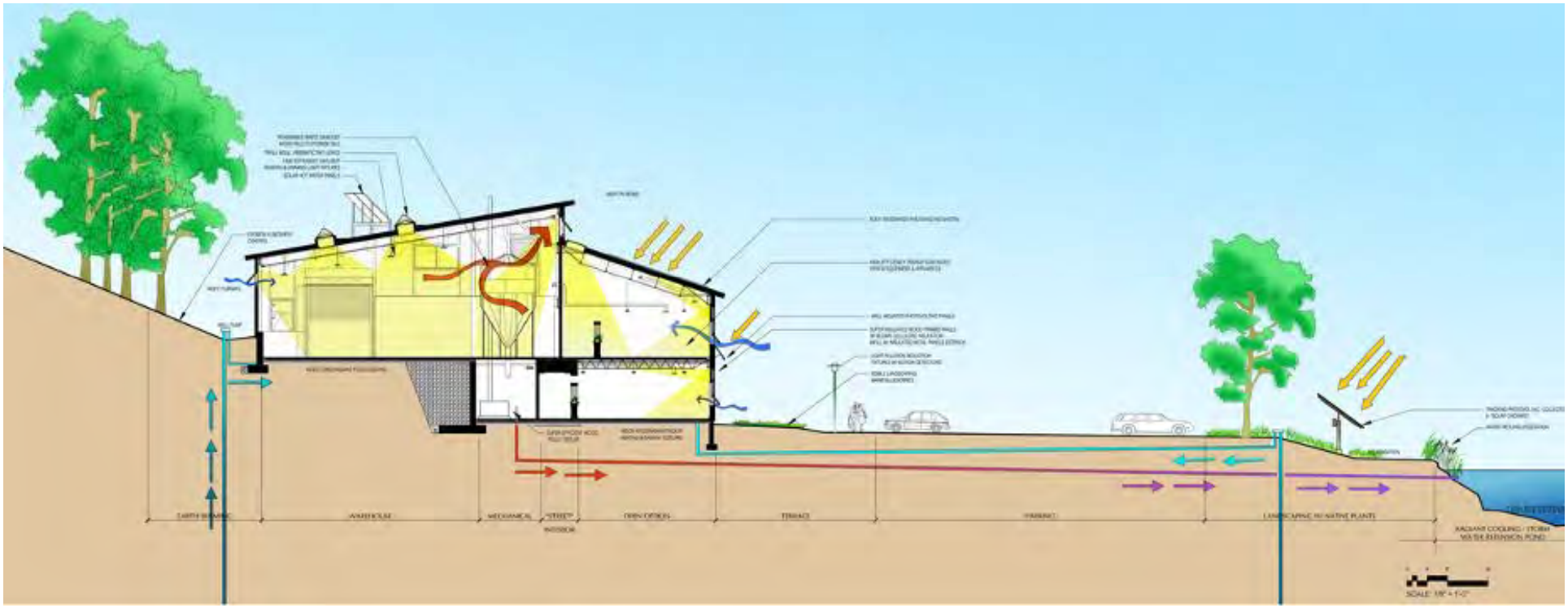
- SF: 46,000 sf
- EUI: 18.2 kBtu/sf/yr (actual)
- EUI w/ Renewables: 12.8 kBtu/sf-yr
- LEED Cert: Gold

Building Two - 2008

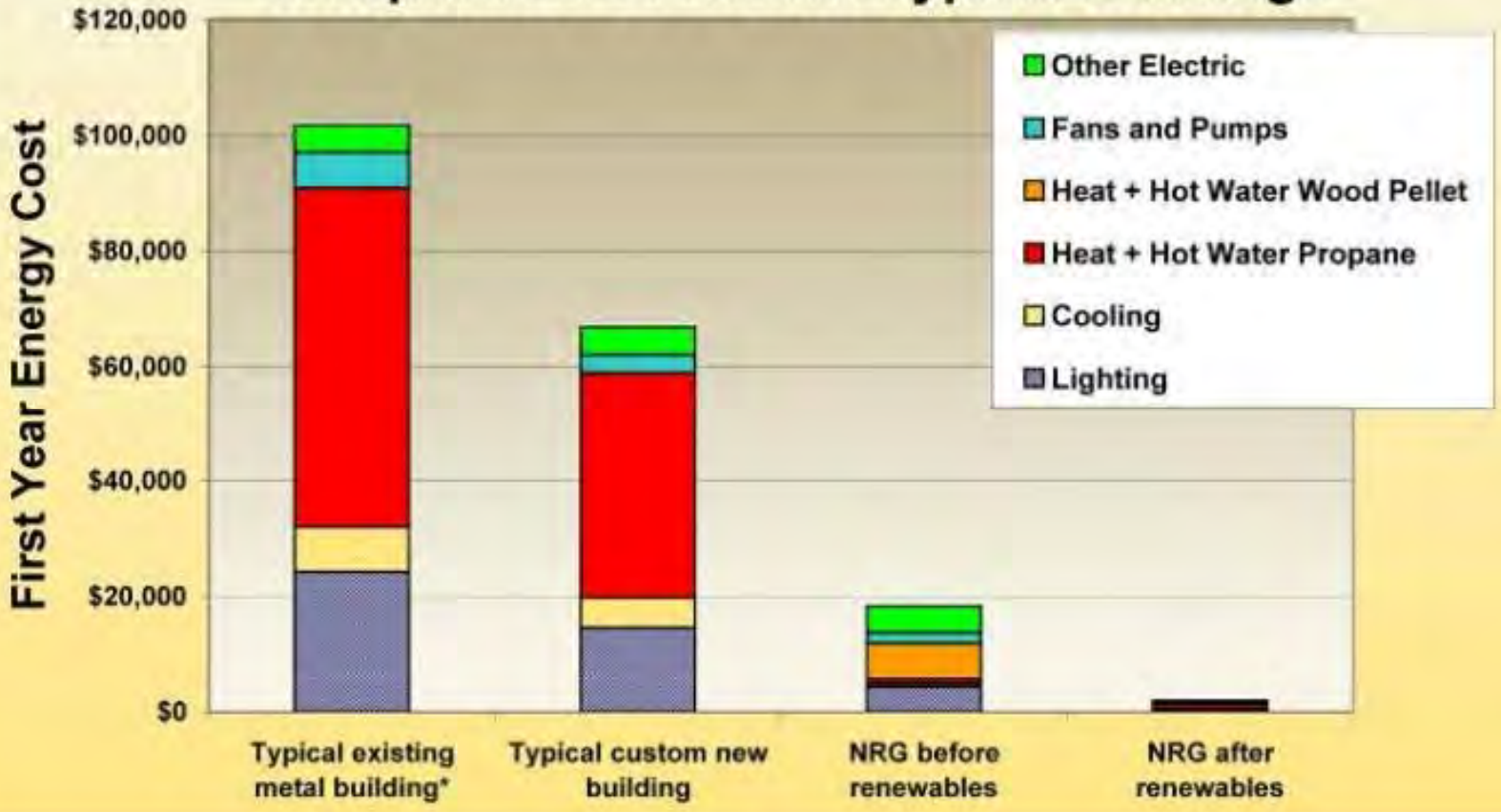
- SF: 31,000 sf
- EUI: 17.7 kBtu/sf/yr (actual)
- EUI w/ Renewables: 9.4 kBtu/sf-yr
- LEED Cert: Gold


2nd
warehouse &
production
shipping &
recieving
loading
HEART
engineering
electronics
second floor plan
1st
street
neighborhood
fire
place
HEART
cafe
street
neighborhood
first floor plan

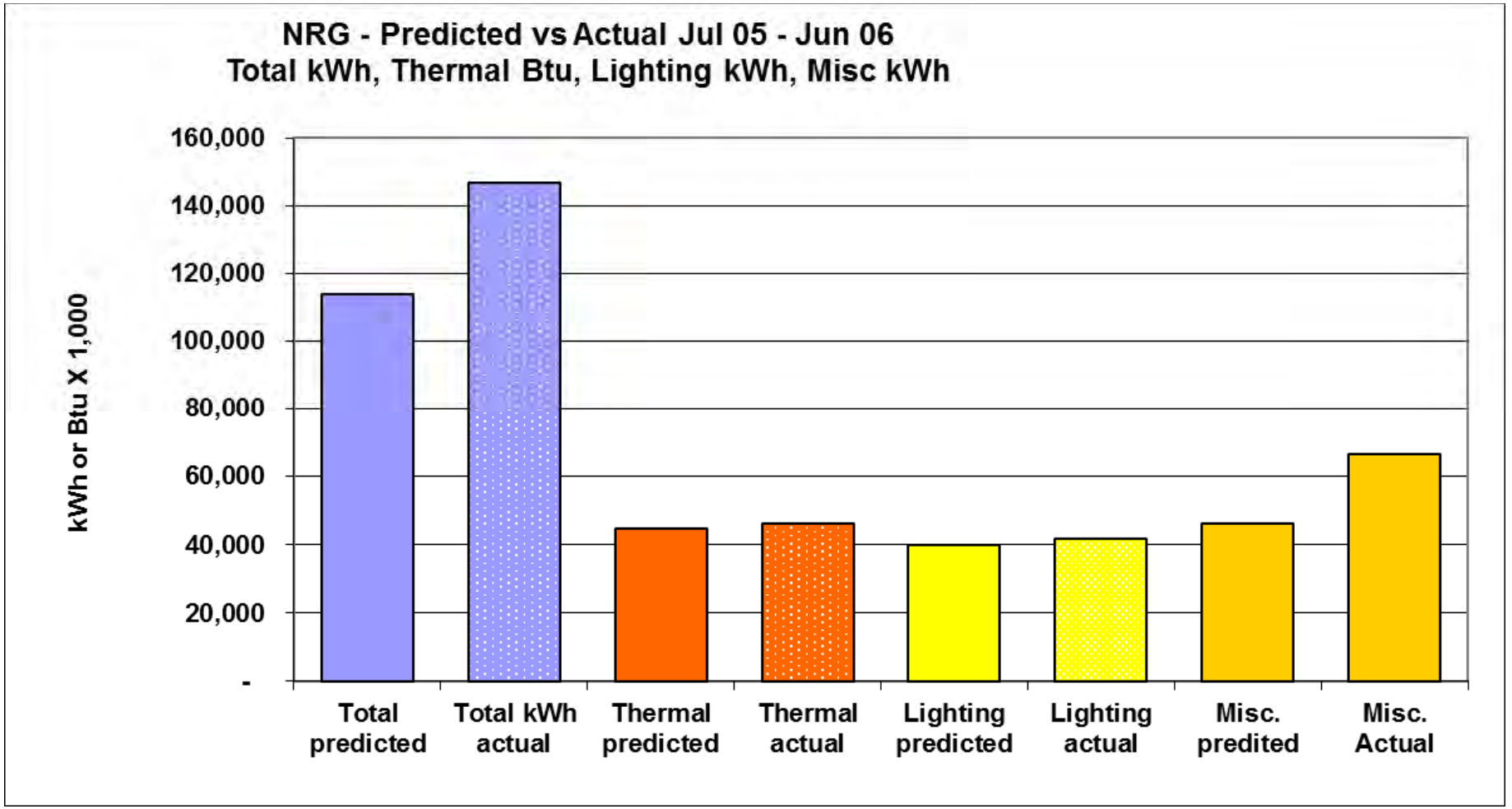
Integrated Environmental Design & Systems

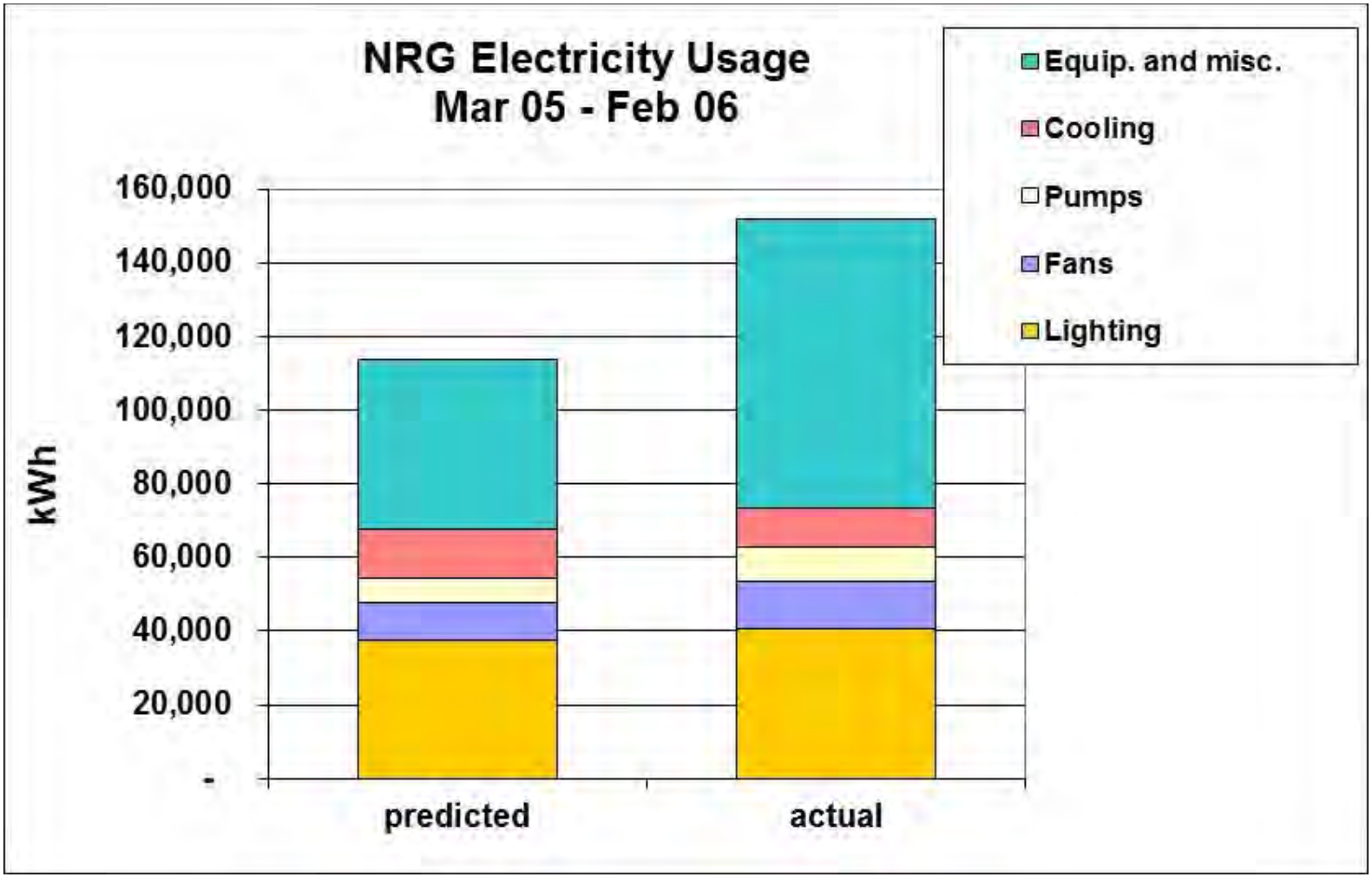


NRG Systems 60 Riggs Rd
Estimated Annual Energy Cost
Compared to Code and Typical Buildings**



* Based on energy usage of similar sized existing facility, rough estimate
** Based on computer modeling of building performance and estimates of renewables contribution
*** Propane at $2.50/gallon, pellets at $250/ton, electricity at Avg $0.14/kWh
**** Purchased non-renewable fuel (propane and grid electricity - PV's estimated to provide 90% of electricity, pellets 95% of thermal)


NRG - Predicted vs Actual Jul 05 - Jun 06
Total kWh, Thermal Btu, Lighting kWh, Misc kWh
kWh or Btu X 1,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
Total predicted
Total kWh actual
Thermal predicted
Thermal actual
Lighting predicted
Lighting actual
Misc. predited
Misc. Actual


NRG Electricity Usage
Mar 05 - Feb 06
kWh
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
-
predicted
actual
Equip. and misc.
Cooling
Pumps
Fans
Lighting

Energy Conservation