GU0

BUILDINGENERGY BOSTON

Resilient Design for Facilities, Communities, and Climate

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Northeast Sustainable Energy Association (NESEA) | March 20, 2024

Presentation Team

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Director of Sustainability

Boston Medical Center: Sustainability Initiatives

#1
in Mass.

Socially responsible hospitals (MA)

#4
in USA

Socially responsible hospitals (USA)

BOSTON GREEN RIBBON COMMISSION

Healthcare Chair: BMC President

$200M
in green bonds

Sustainable Portfolio

GREENOVATE BOSTON

Boston Medical Center: Energy Reductions

2
megawatt

Self-generating heat and power via power plant

$1.5M

Annual energy savings reallocated to patient care

19.4%

2011 to 2021 reduction in energy use

2030

Carbon-neutral goal year

Boston Medical Center: Rooftop Garden

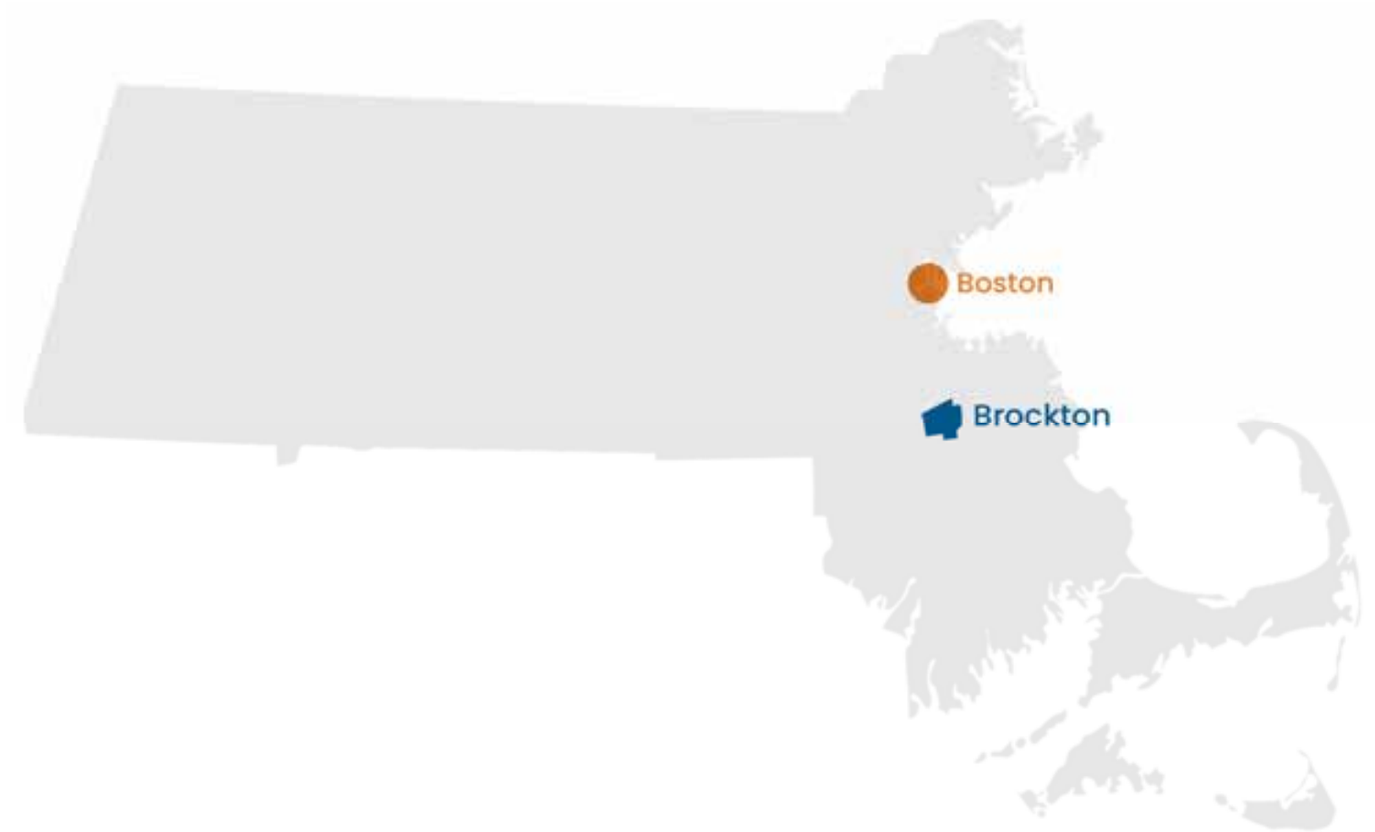
2,700
Square foot roof garden

25
Crop varieties

5K+
Pounds of food harvested annually

15+
Extra years of roof material life

The Case for Brockton



Behavioral Health: The Current Crisis

As of June 2022, **Region 5 (South Shore/Brockton) experienced the third highest peak** in MA of those waiting in ED's for inpatient BH admissions

Brockton Behavioral Health Center (BBHC) will serve to **meet critical member needs** by supplementing existing capacity in the region, and **reduce the overall costs related to unmet BH needs** in MA.

Project Highlights

82 Total Beds
56 Psychiatric Inpatient
26 Clinical Stabilization Services (CSS)

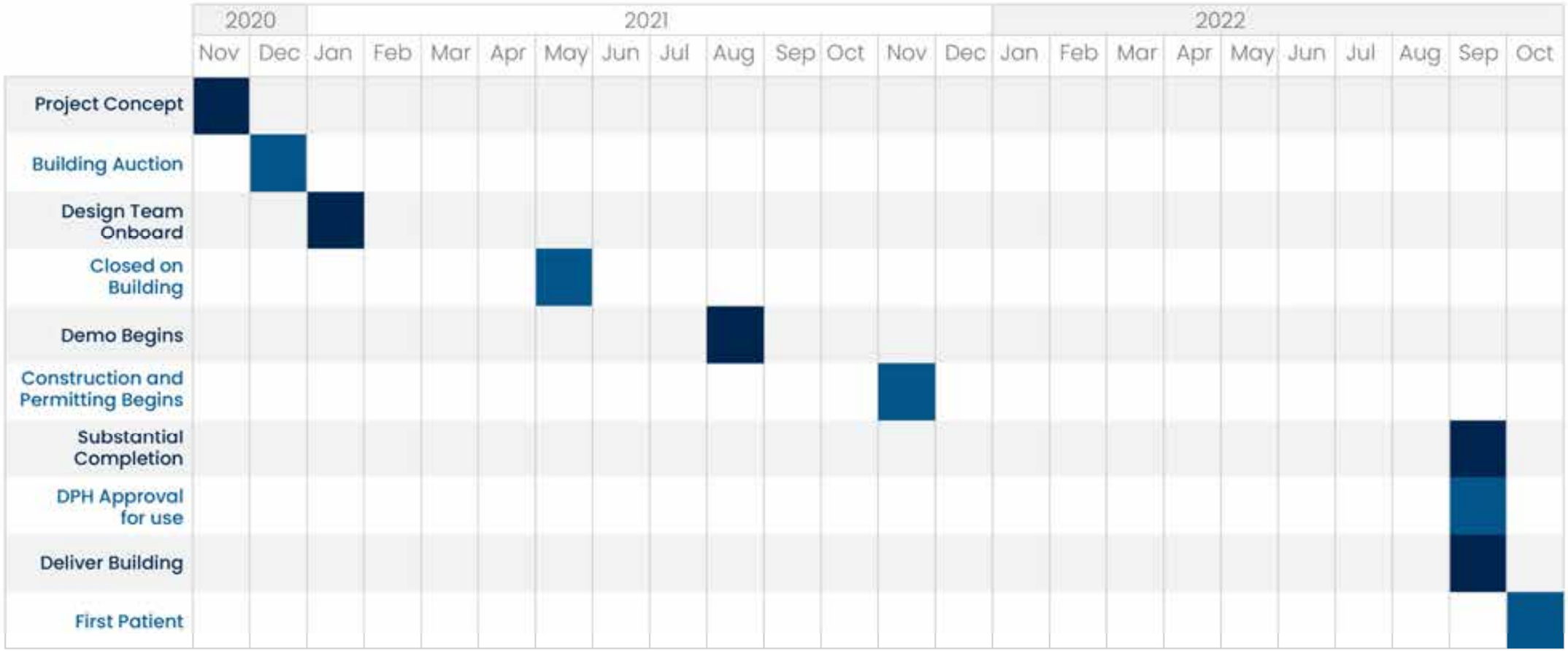
Adaptive Reuse of a derelict Nursing Facility

59,700 SF

Fast Track Design & Construction
Opened October 2022

Net Zero Energy Ready

Timeline


2020
2021
2022
Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct
Project Concept
Building Auction
Design Team Onboard
Closed on Building
Demo Begins
Construction and Permitting Begins
Substantial Completion
DPH Approval for use
Deliver Building
First Patient

Existing Facility

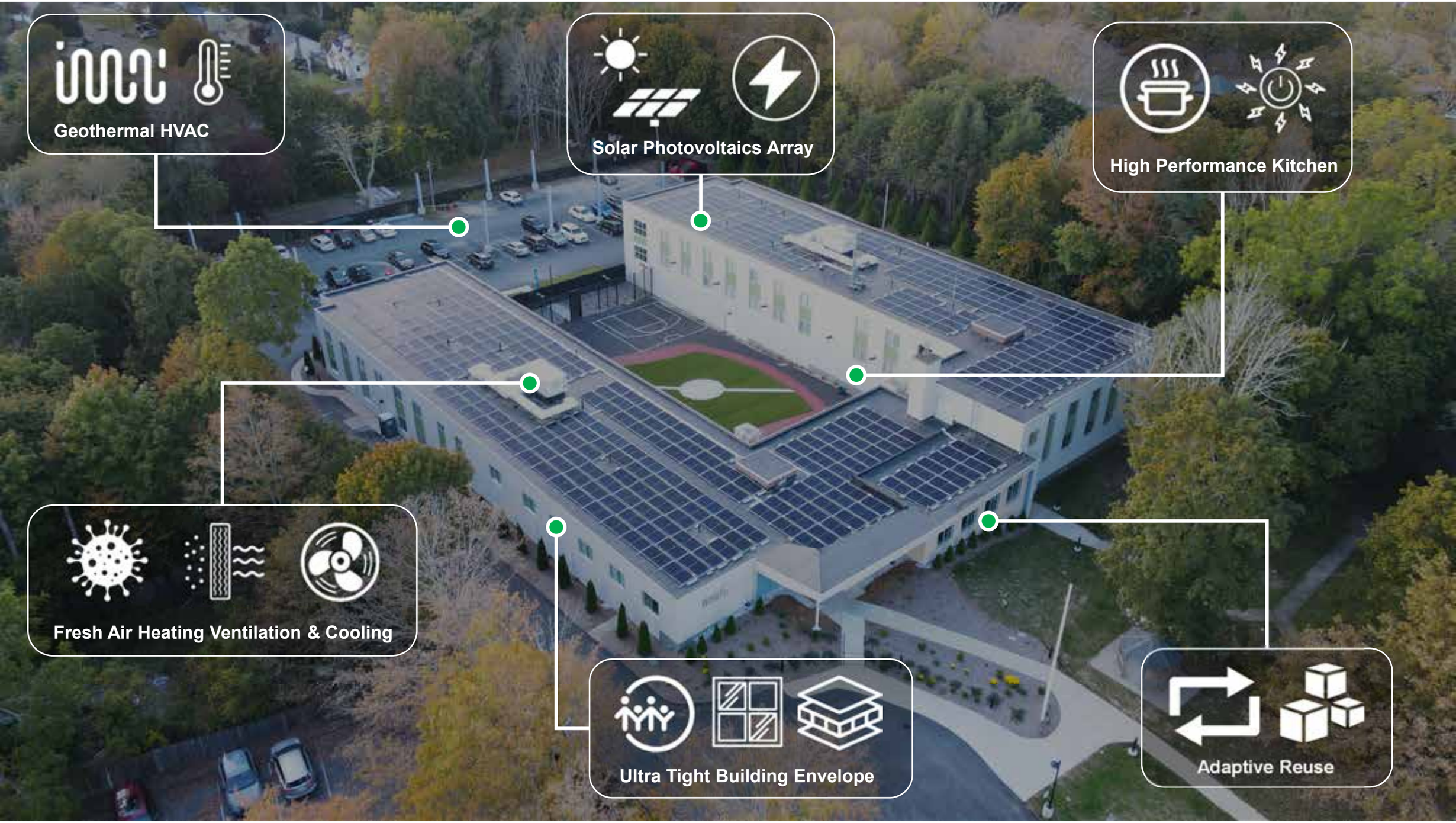
- Redevelopment of an out of service 1960's nursing home
- Relatively low Floor-to-Floor Heights
- Limited amount of existing insulation
- Existing structure was masonry bearing walls with steel joists
- Drab exterior; limited connection with the site

Existing Facility Interiors

Existing Building Systems

- Gas Fired Boilers
- Baseboard Heat in Bedrooms
- No Central Ventilation
- Packaged Rooftop Units for Common Areas
- Domestic Hot Water (DHW) - Fossil Fuel
- Gas Kitchen
- Electric Service Undersized





Geothermal HVAC
Solar Photovoltaics Array
High Performance Kitchen
Fresh Air Heating Ventilation & Cooling
Ultra Tight Building Envelope
Adaptive Reuse

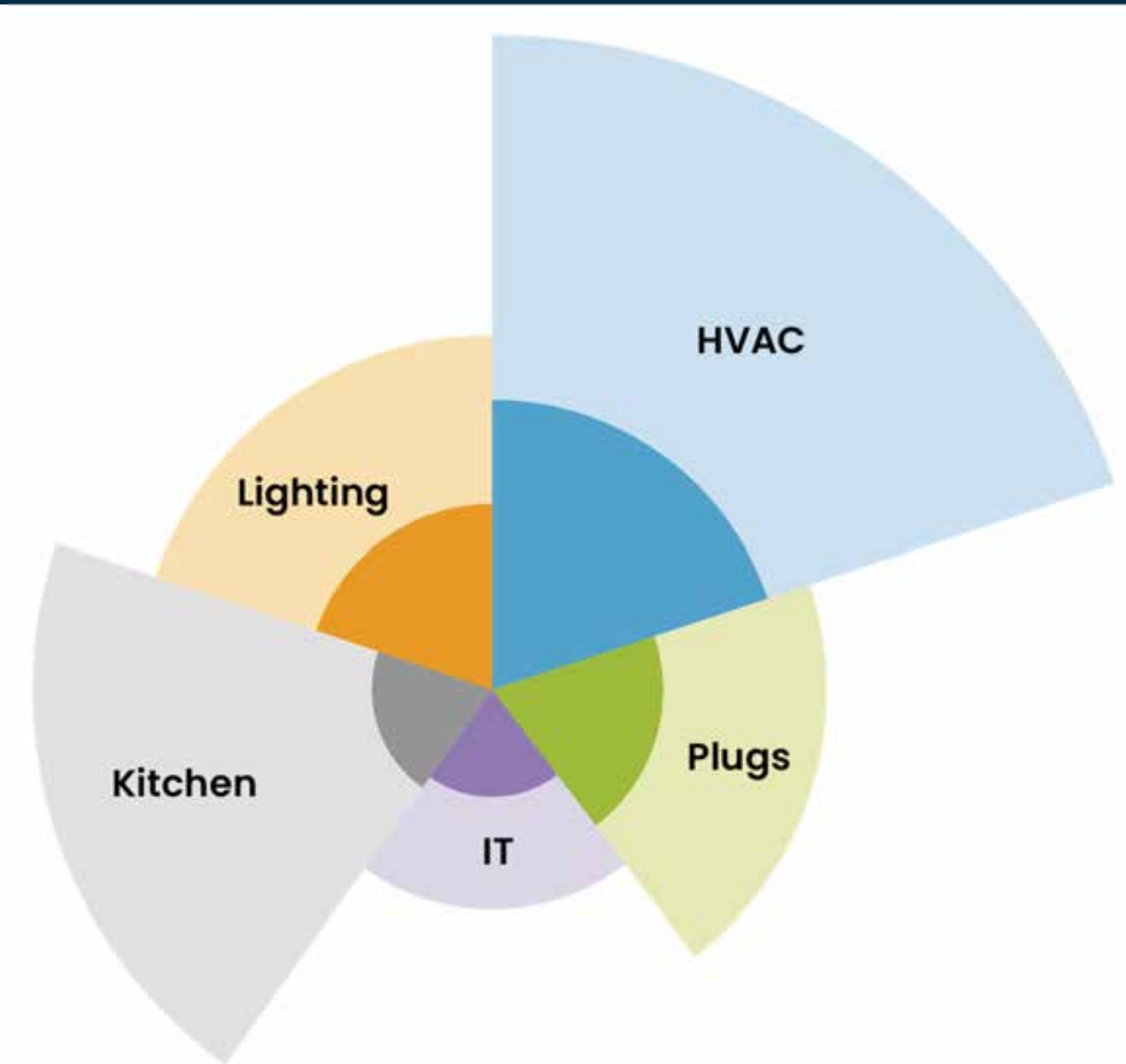
Renovated Entrance

Overall Program

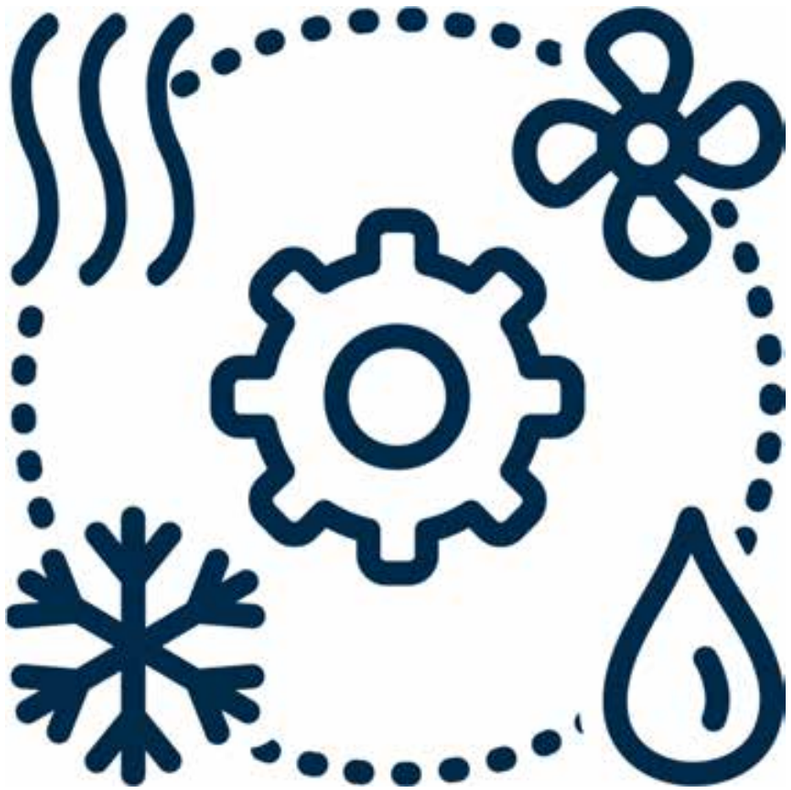
Total 59,700 gsf

Drastic Energy Reduction is the Key

- HVAC ~45%
- Kitchen ~20%
- Lighting ~20%
- Plug Loads ~10%
- Information Technology (IT) ~5%

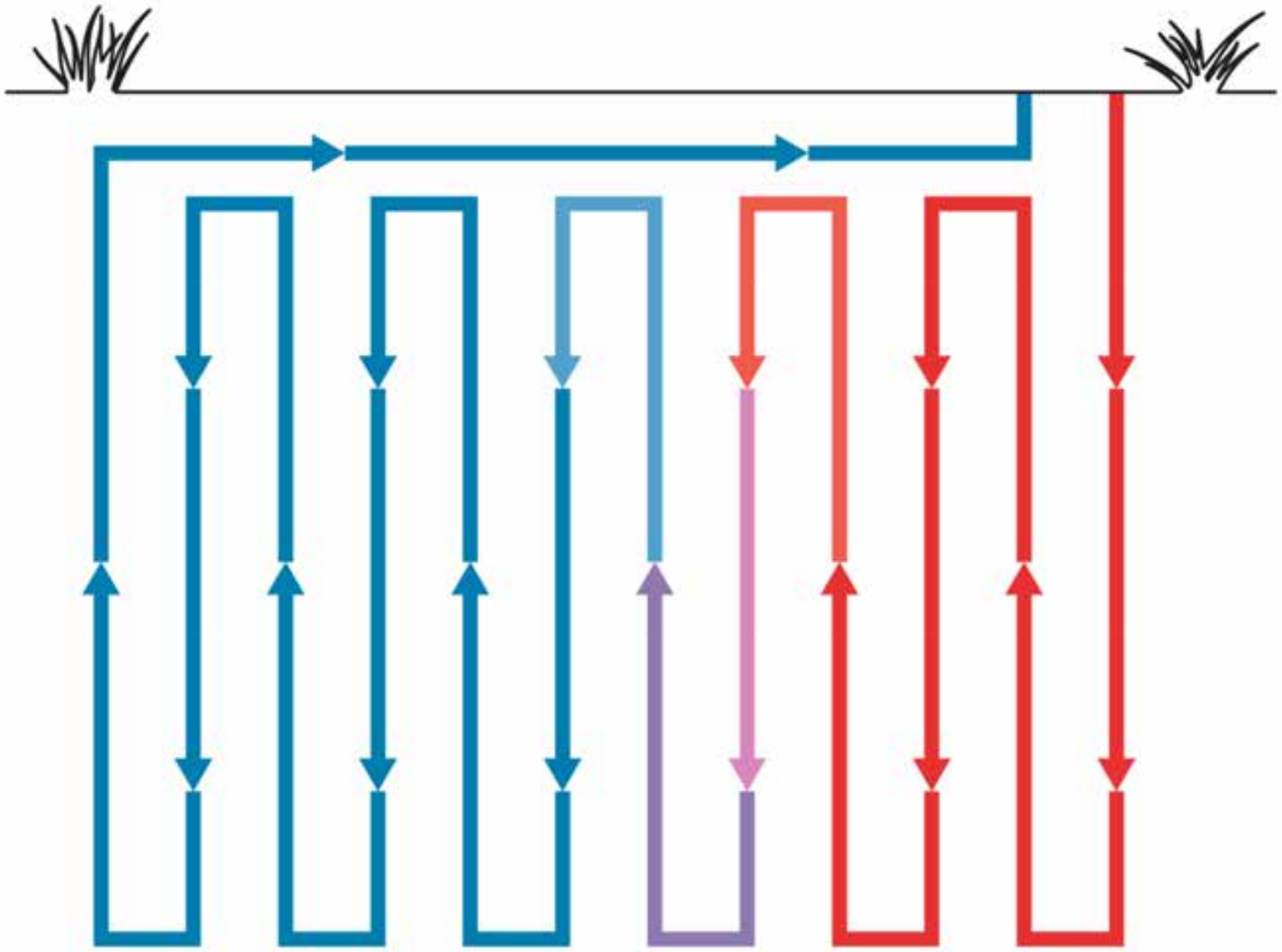


Energy Conservation



- Geothermal Heat Pump HVAC
- Geothermal Domestic Hot Water Heating
- Heat Pump Dedicated Outdoor Air System (DOAS) Units with Heat Recovery
- All Electric Kitchen
- Water Source Kitchen Refrigeration and Ice Makers
- Kitchen Hood Demand Control

How Does a Geothermal System Work?



Geo-Exchange

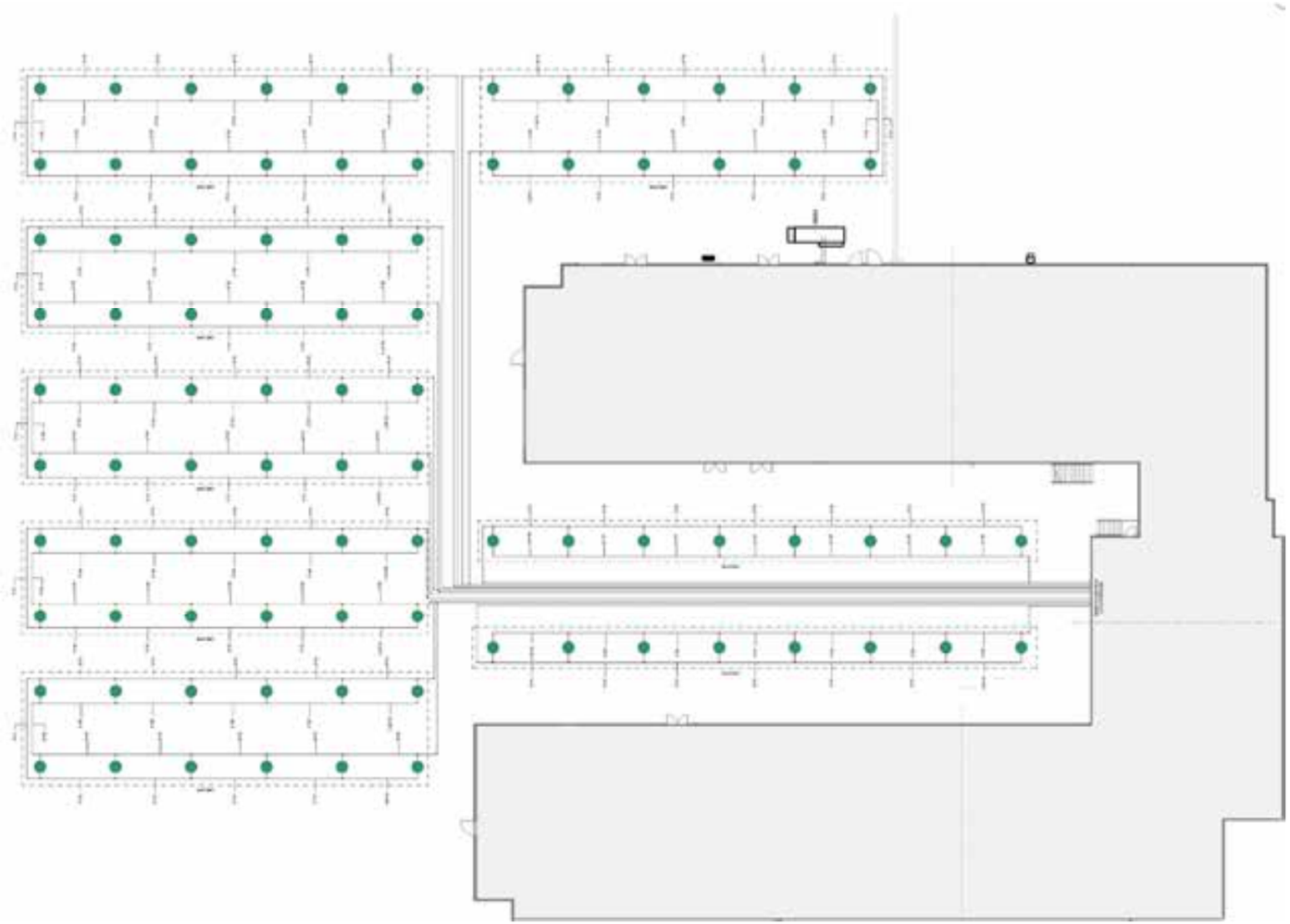
The earth's constant underground temperature is a renewable resource that cools and heats water from the terminal building. In the winter, the water is heated by the earth, then exchanged in the terminal building.

In the summer, the water is cooled by the earth, then exchanged in the terminal building.

Geothermal Benefits

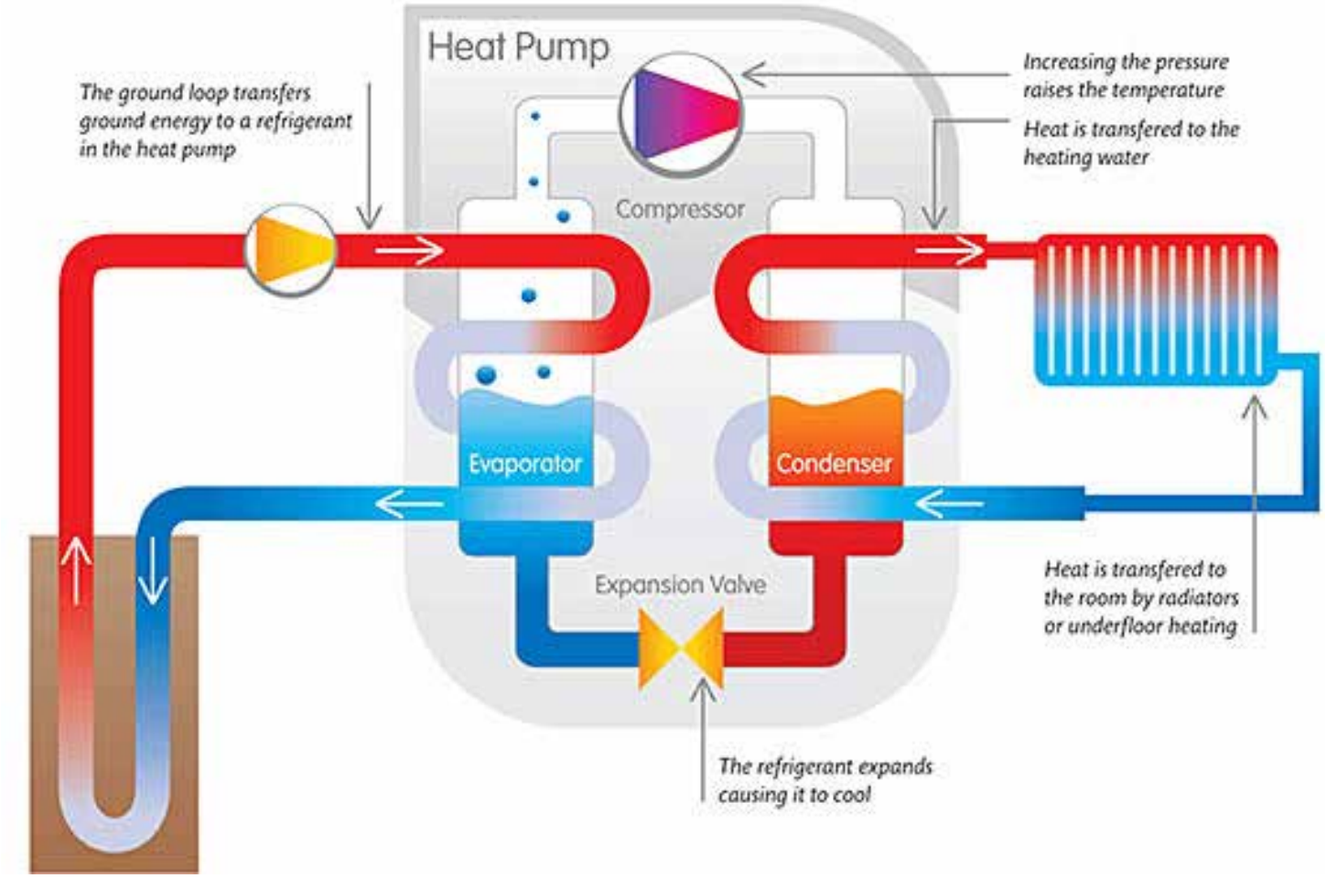
- Less Space Needed for Equipment / Units
- Noise Reduction vs. Other Systems
- Carbon Emissions Eliminated on Site
- Operating Cost Savings
- 40% More Efficient than Traditional System
- 50+ Year Life Expectancy of Wellfield
- No Chemical Treatment
- Water Savings
- Less Maintenance
- Redundancy

Geothermal Well Field



88 wells @ 500 ft. depth

It's a Simple System



Standard Filter Sizes, Drain Pan and Evaporator Coil, Fan/EC Motor, Condenser Coil, Warranty, Trouble Shooting

Image from: digtheheat.com

Electrical Systems

Normal electrical service size - 2,000A @ 208Y/120V

Emergency power system - 300kW Diesel Generator

Required Life Safety, Critical & Equipment Branches

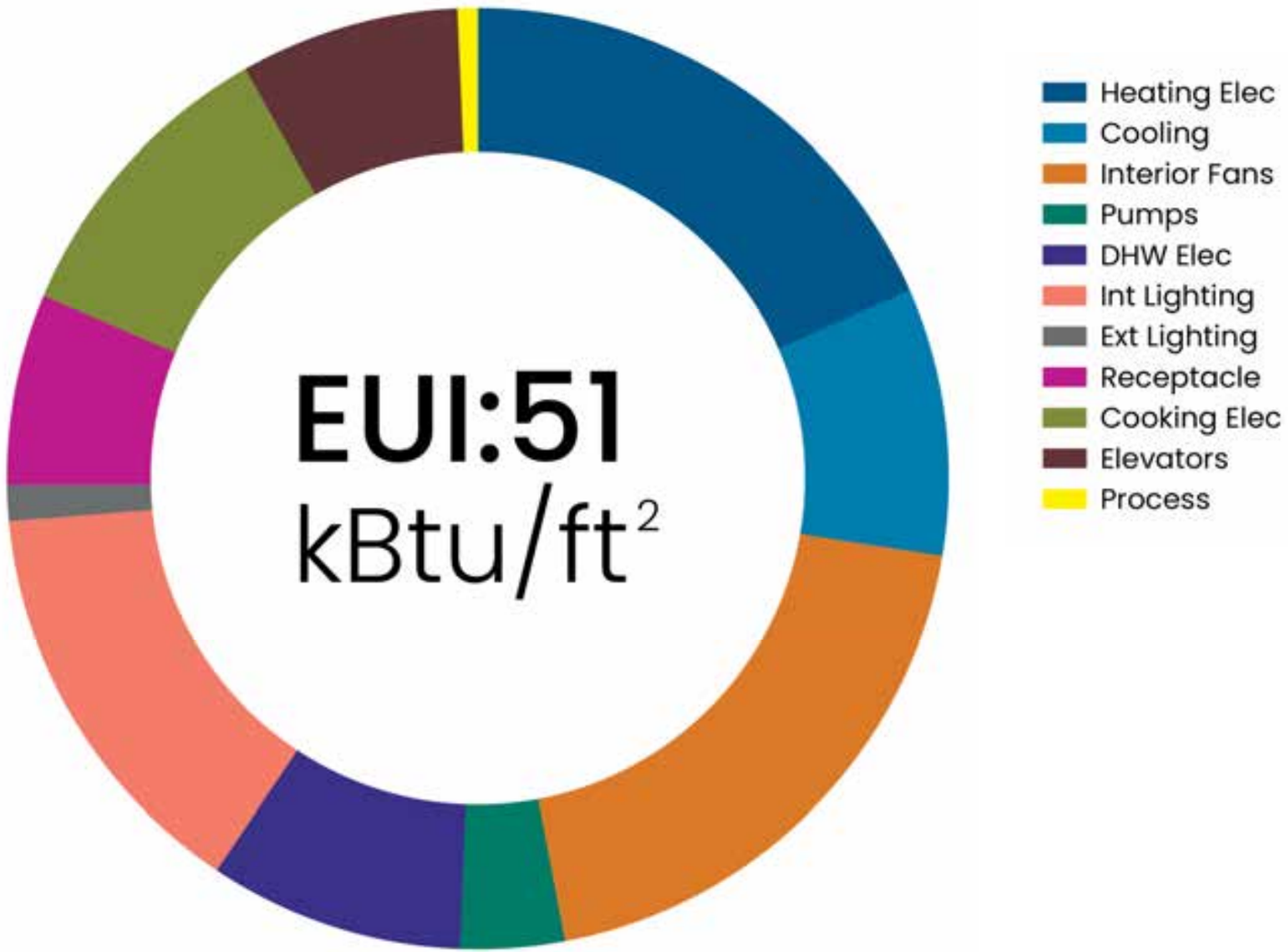
Optional Standby Branch includes all kitchen loads and (3) riser panels that exclusively feed heat pumps

Through Optional Standby Branch the entire facility has back up heating.

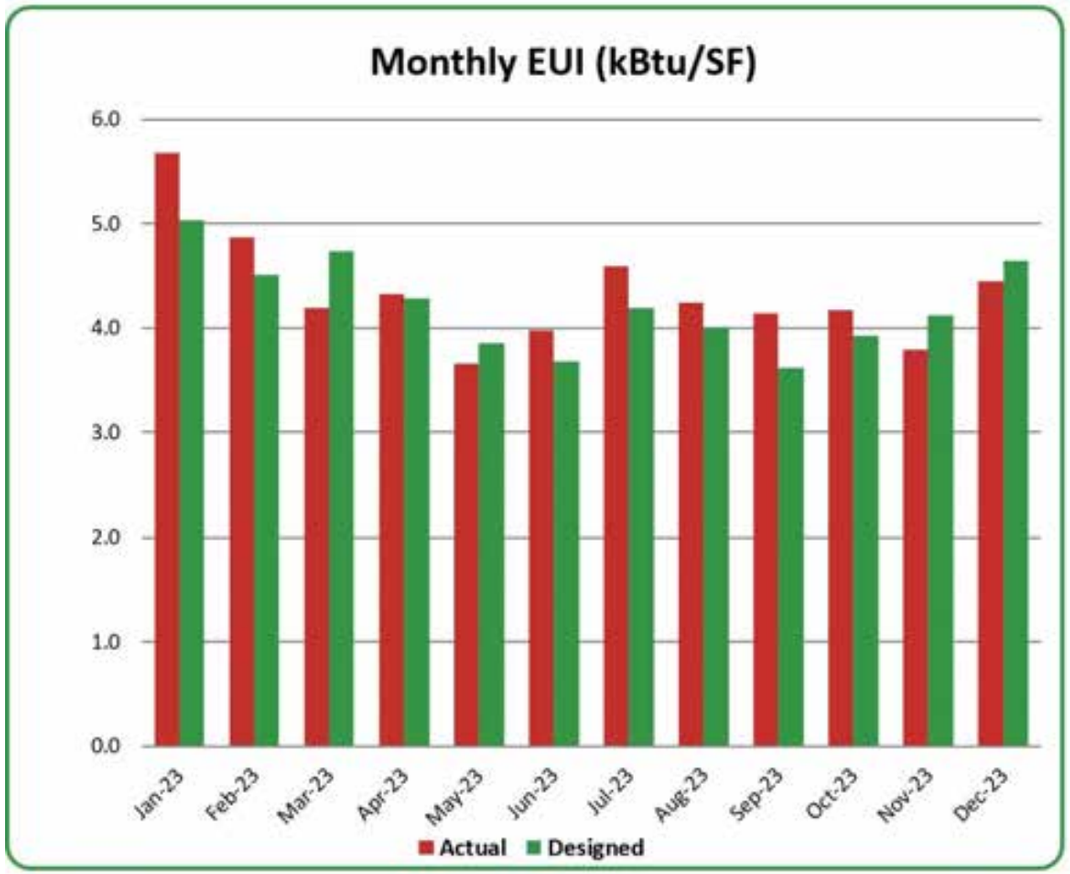
Energy Model is Critical Element

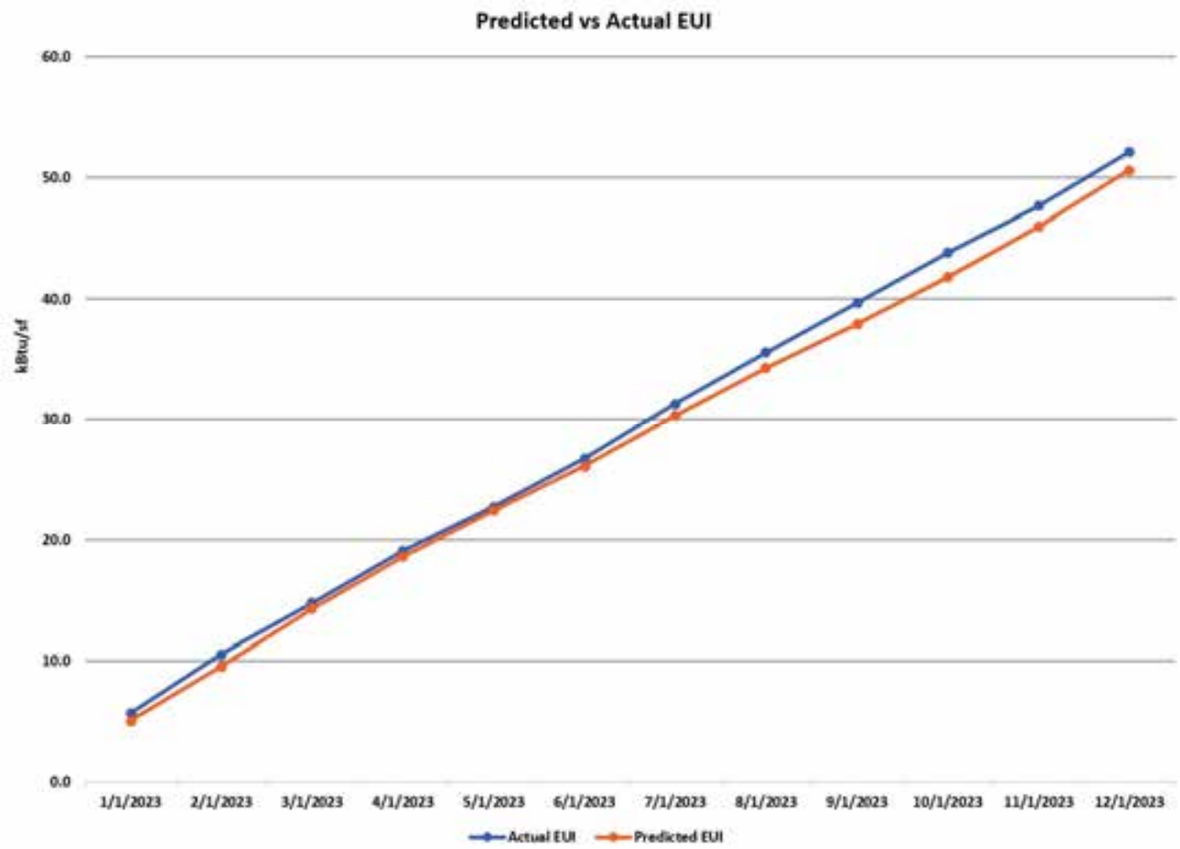
Energy Model Output

- Electricity Cost = $184,800
- Building Annual Electric Consumption = 840,000 kWh
- Published EUI Comparisons:
  - Senior Living = 116
  - Incarceration = 84.2



Results!





51 EUI vs 52.5 EUI – 3%

What did MEP cost?

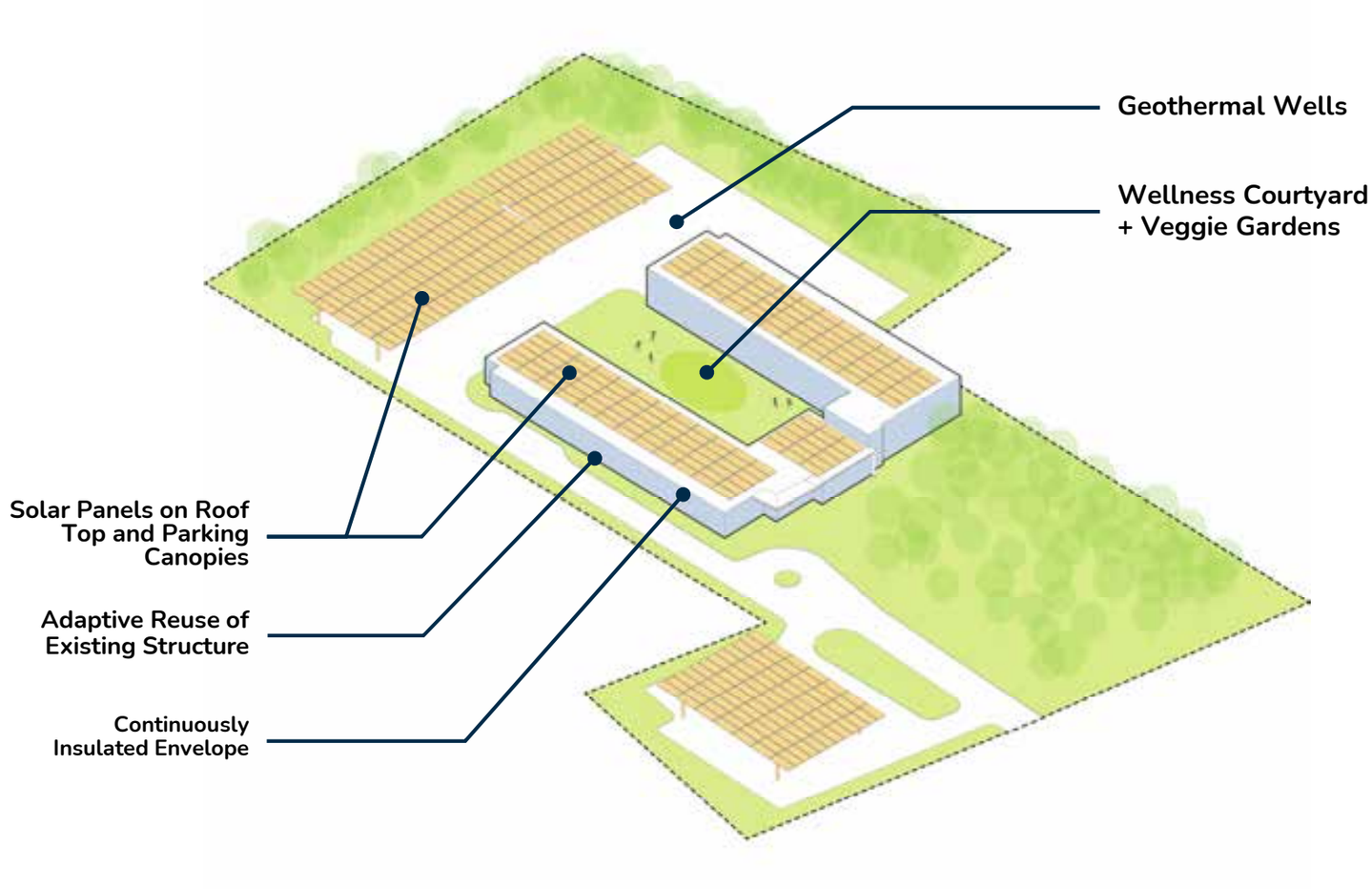
HVAC	$4,500,000	$80/SF
Plumbing	$2,300,000	$41/SF
Electrical	$2,500,000	$45/SF
FP	$265,000	$5/SF
Wellfield	$1,980,000	$35/SF
Total	**$11,545,000**	**$206/SF**

$31,000,000 - $550/SF

Unique Site and Building Features

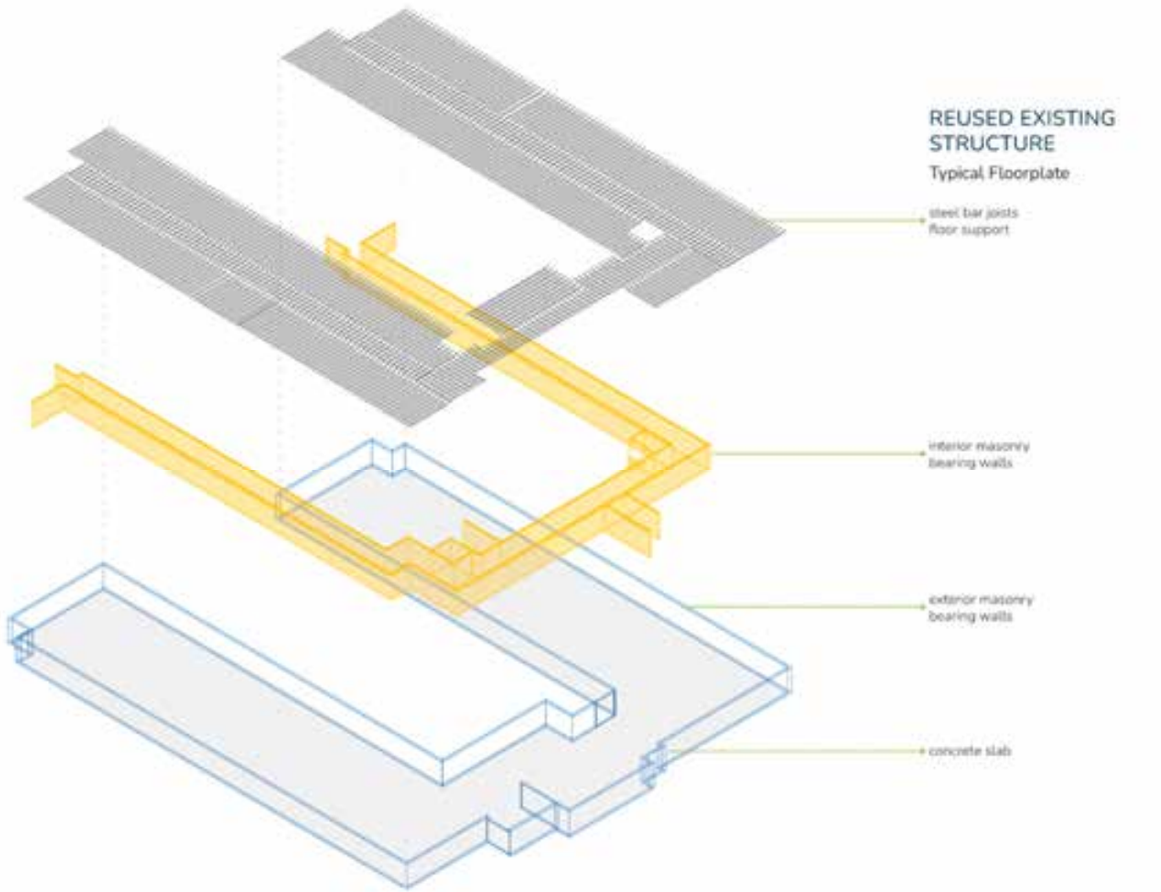
System Features:

- 700 kW system
- Modules = 1,367
- Energy to Grid = 971,148.8 kWh
- Designed for a 500 kWh energy storage system



Adaptive Reuse

Adaptive Reuse of Structure



Structure and Shell Reuse

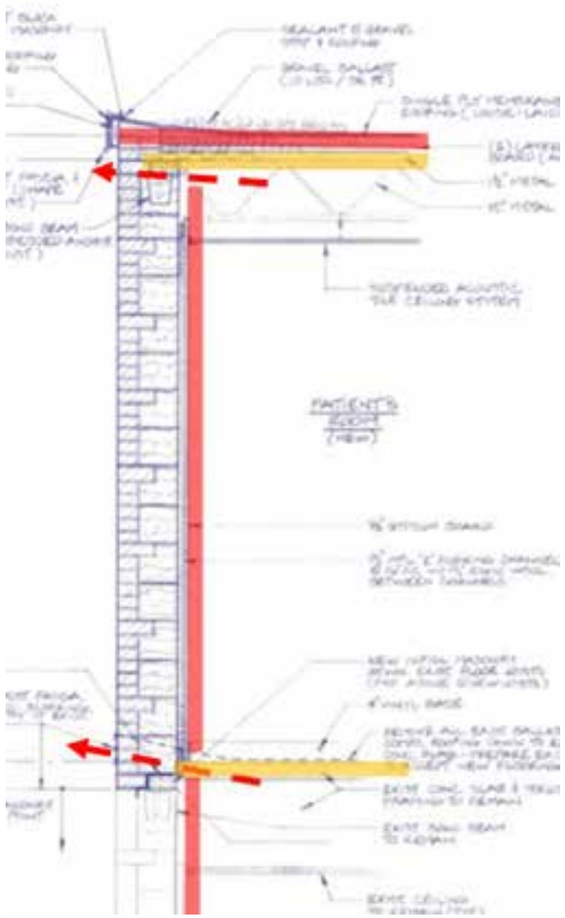
- Fortunately, the building's original program as a nursing home was a relatively straightforward conversion
- Primary structure is composed of masonry bearing walls and steel bar joists
- The steel and masonry structure was almost entirely reused; new openings in interior bearing walls were minimized to avoid schedule and structural impacts

EMBODIED CARBON

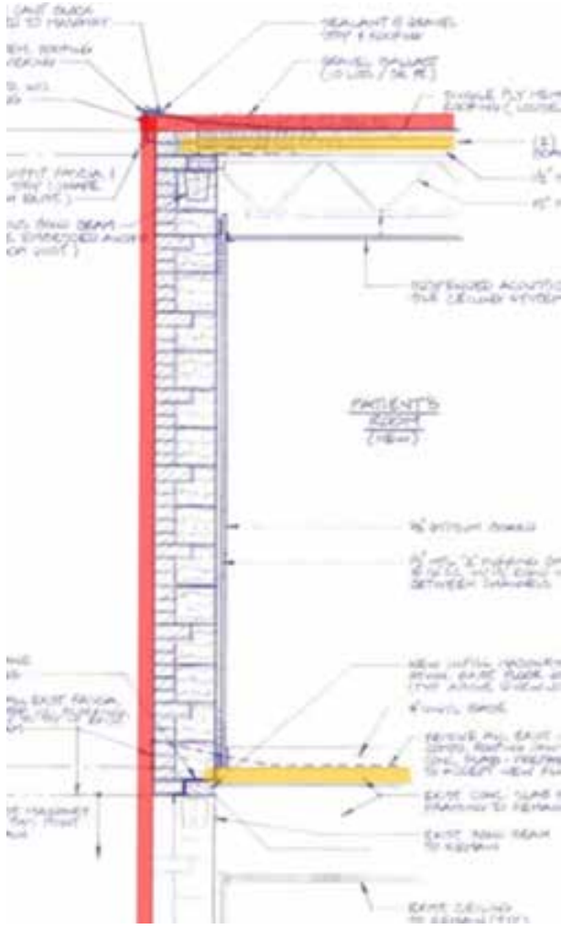
108 $kgCO_2e/m^2$

Envelope Upgrade

Interior Insulation (non-continuous)

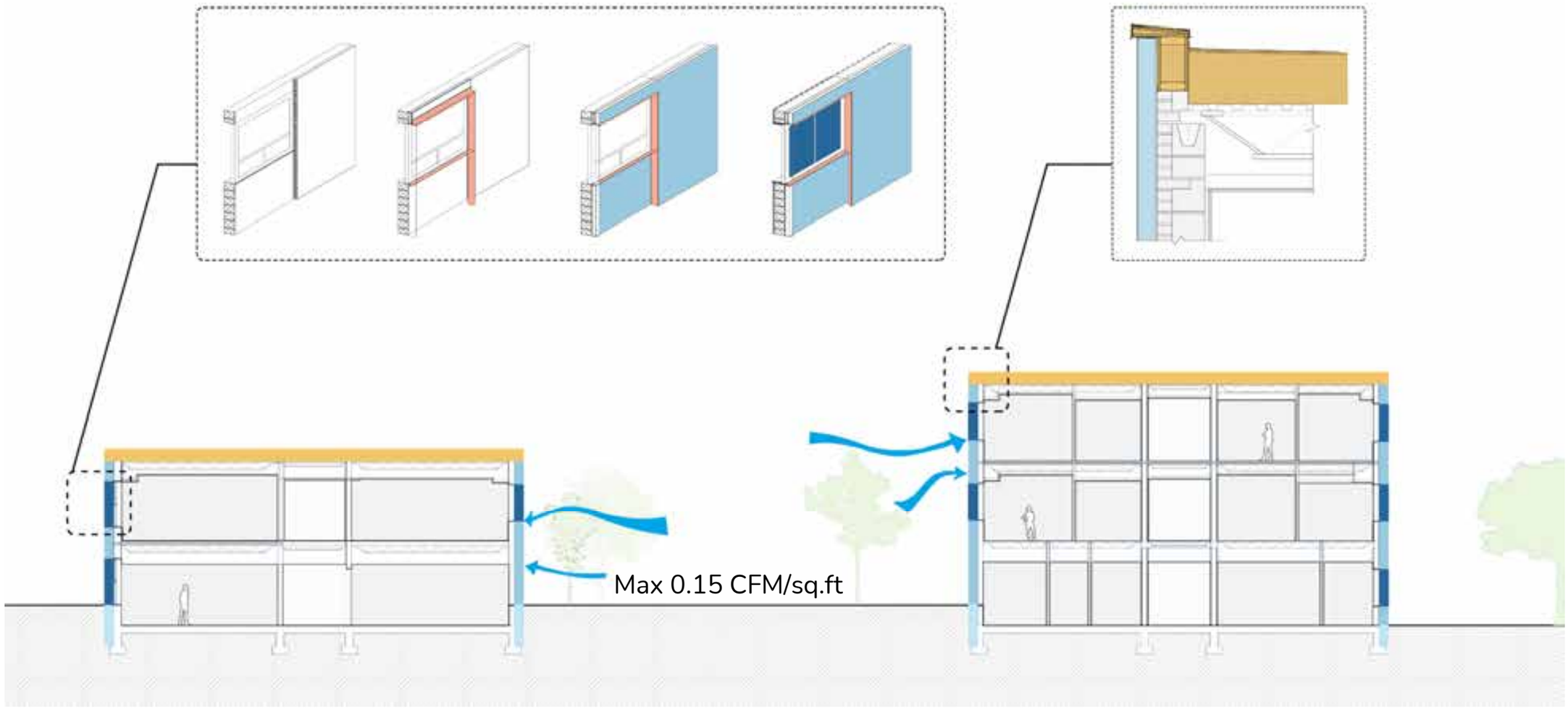


Exterior Insulation (continuous)



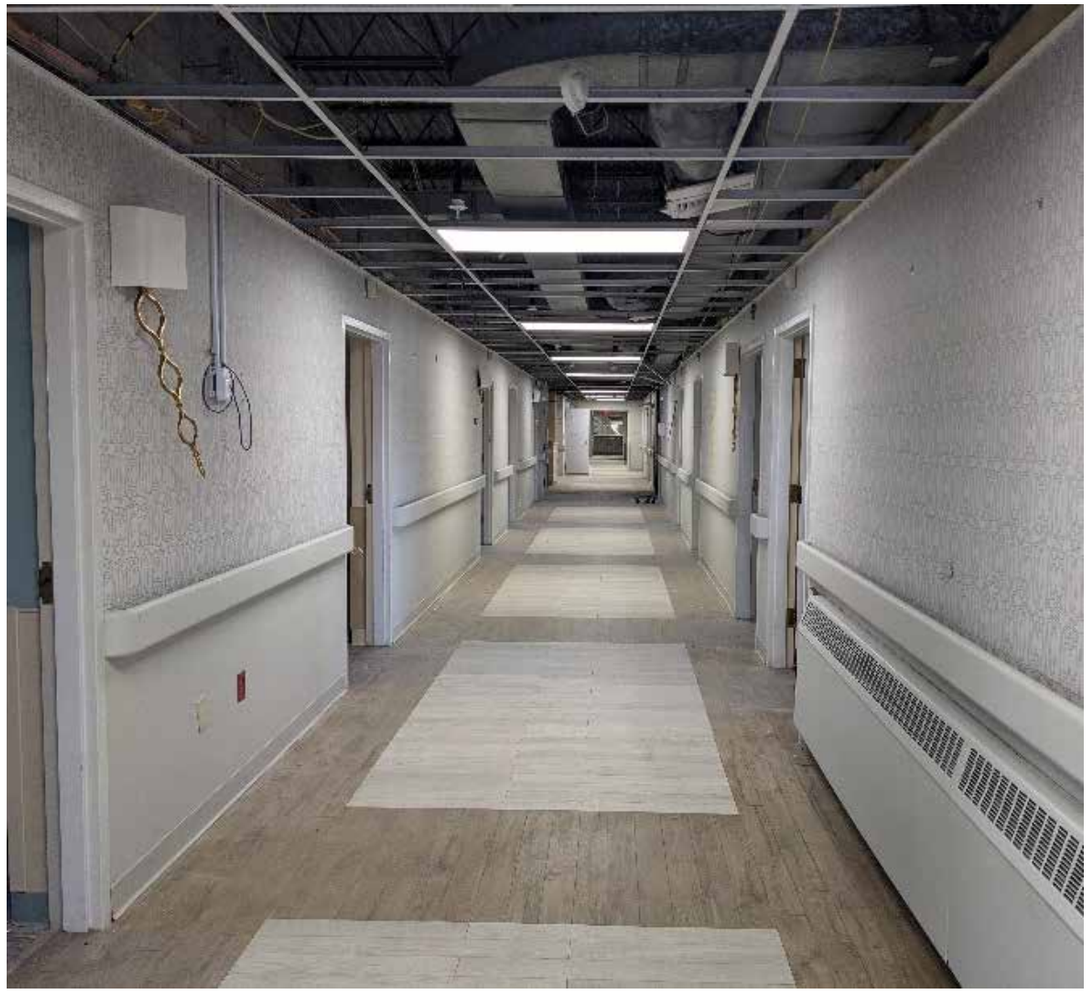
Above grade: 5” EPS continuous exterior insulation added R-19 to the existing mass walls
Below grade: R-15 (down 12”)

Envelope Upgrades



Window Mockup

Before/After



Before/After

Patient-Centered Design

Nature-Based Design

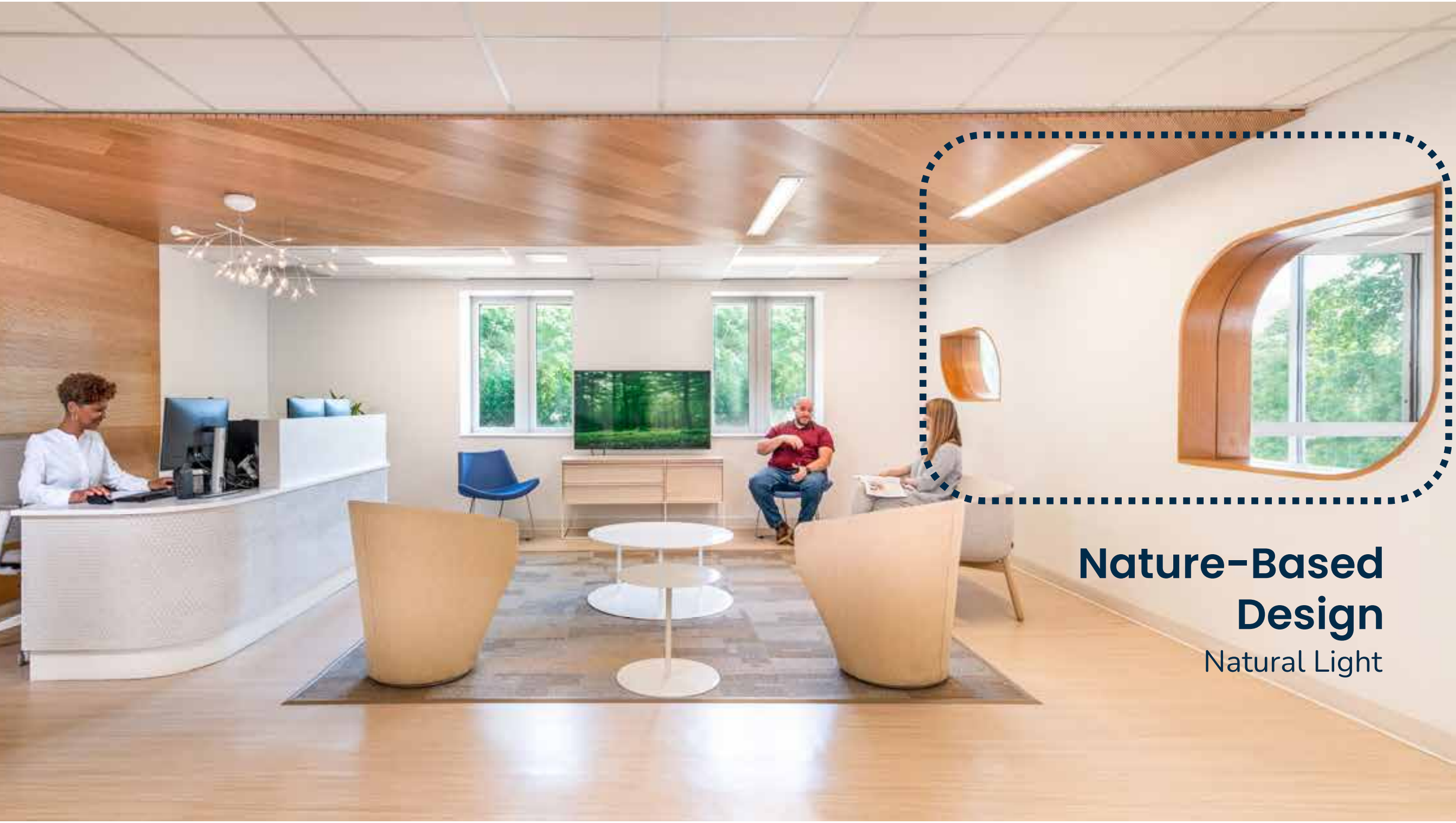
Greenhouses

Nature-Based Design

Greenhouses

Nature-Based Design

Natural Materials



Nature-Based Design

Natural Light

Placemaking

Hospitality-Driven Design

Placemaking

Personal Choice &
Control over
Environment

Color as Wayfinding

Resiliency: We have had to rapidly change our operations to bring additional IP Psych beds online in response to a regional BH emergency

- A **February 7th 10-alarm fire at Signature's Brockton Hospital** resulted in the closure of all inpatient services (including a 22-bed psych unit) and the emergency department at that hospital exacerbating BH access and capacity constraints in the region
- In response to the Signature Brockton fire, we relocated our 26-bed CSS from our Brockton facility to a shuttered 21-bed CSS unit in Brockton's High Point Treatment Center, **to add 24 new IP psych beds** (for a total of 80 IP Psych Beds)
- We anticipate our CSS operating in the High Point space temporarily (initial lease period of 12 months) before **relocating to a permanent** location (to be identified)
- We anticipate this new IP unit to be **a permanent addition** to the region's BH treatment landscape

Access is the true north of our work

80
beds

Net Zero
design

60,000 sf

100%
repurposed

Open
Oct 2022

What Makes a Healthy Building?

References

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