Belmont High School

energy summit

October 4th, 2018


BELMONT HIGH SCHOOL
PERKINS+WILL

Schedule

Schematic Design – Complete Summer 2018

Belmont's Vote of Approval – November 6, 2018

Construction Start – Spring 2019

Phase 1 Complete for HS (9-12) – Summer 2021

Phase 2 Complete for MS (7-8) – Summer 2023

In-Posse

Zero Net Energy (ZNE) Buildings

Buildings with greatly reduced annual energy needs due to efficient design and operations in which the balance of energy needs are supplied from renewable energy sources.

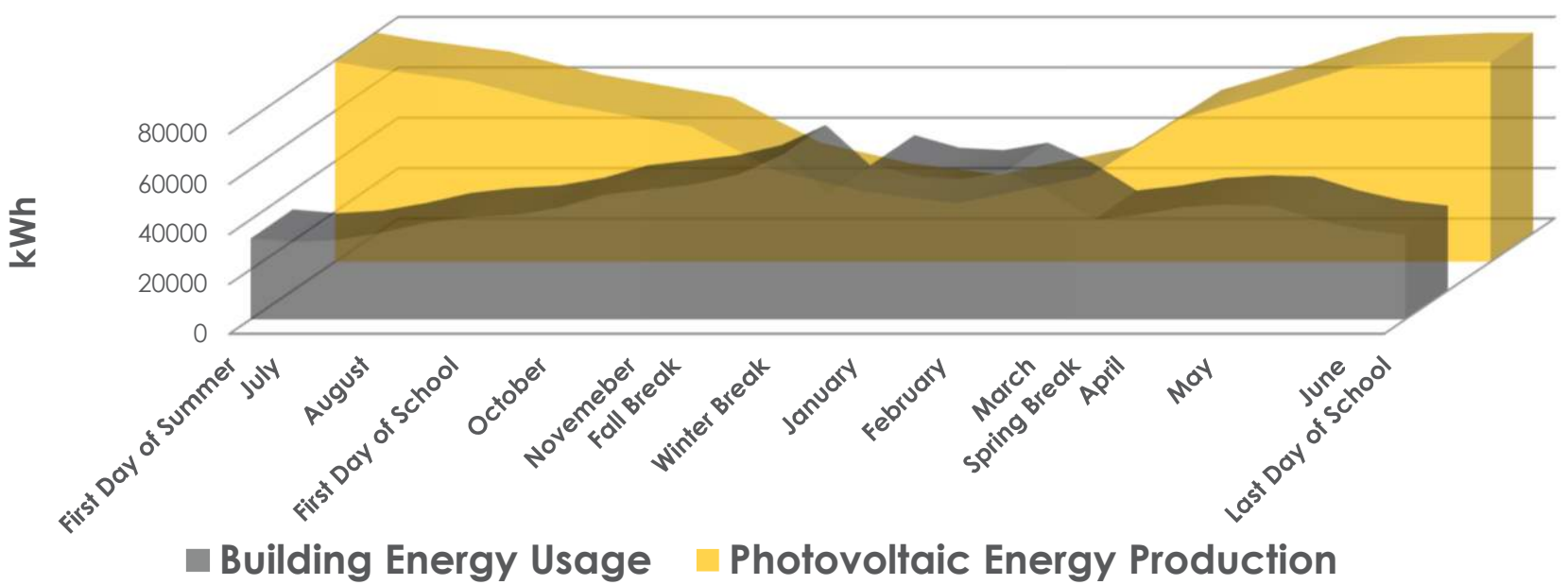
What Makes ZNE Different?

Is *Measured & Absolute* not *Predicted or Theoretical*

Is not "*Business as Usual*"

Is not achieved just with *Design, m*ust include *Occupants* and *Operations*

Energy Used vs. Energy Harvested



Early Adopters

Environmental Groups

Schools & Universities

Government Agencies





NBI - 2018 Getting to Zero Status Update

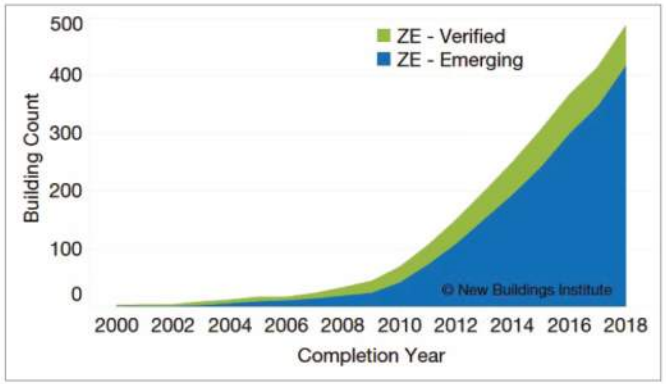
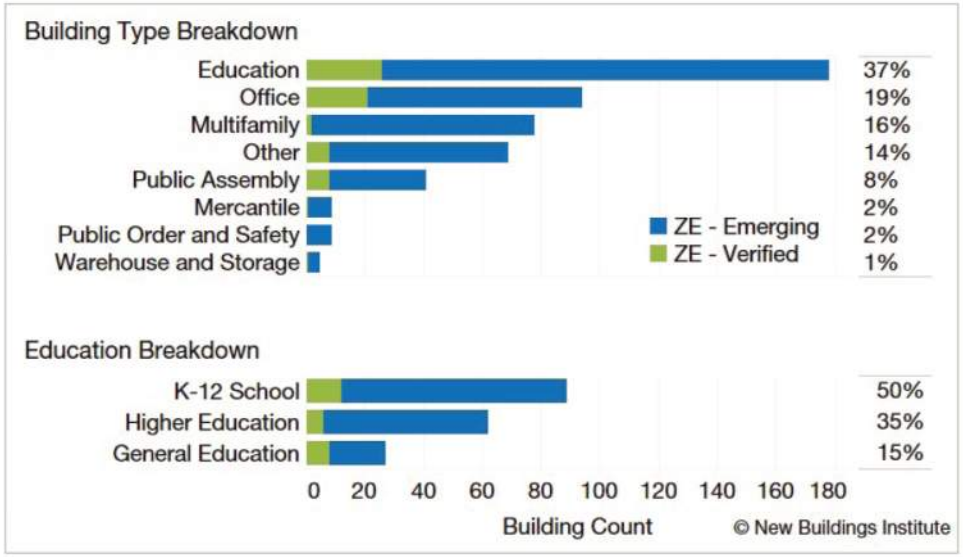


Fig 1. The Buildings List includes nearly 500 projects and is on a steep curve upward, having increased over 700% since 2012.

67 Verified and 415 Emerging ZNE Buildings as of 2018



ILFI Zero Energy Certification

- Zero Net Energy on an annual basis
- Must be supplied by on-site renewable energy
- No combustion allowed

Defining Zero Net Energy

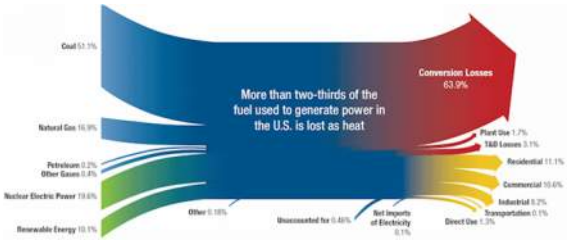
How is energy use accounted for?

How is renewable energy generated?

NREL Definitions: Accounting for Energy

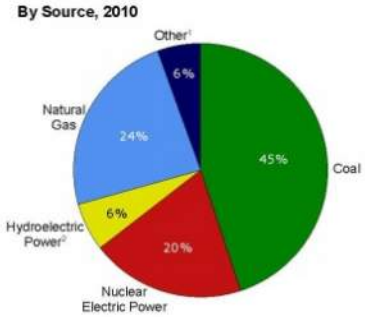
Energy at the Site:

Energy at the Source:



Energy by Cost:

Energy Emissions:



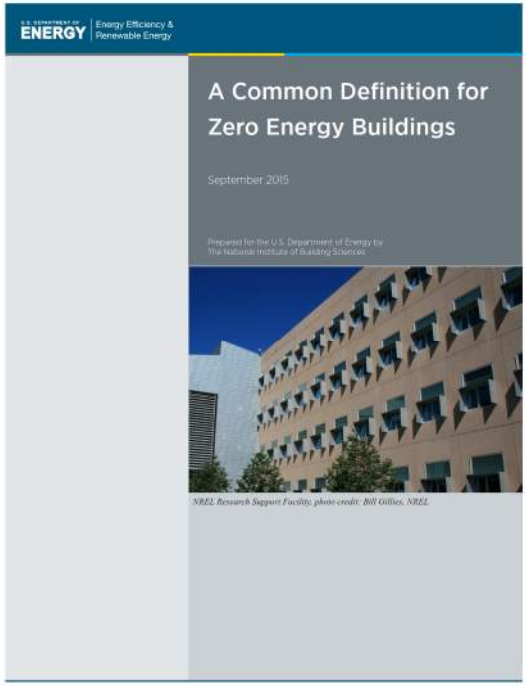
NREL Definitions: Renewable Energy

NZEB:A	**Renewable energy harvested within the building footprint**
NZEB:B	Renewable energy harvested within the building footprint and on the site
NZEB:C	Renewable energy harvested within the building footprint, on site or by renewable sources imported to the site
NZEB:D	Renewable energy harvested within building footprint and/or on site and supplemented by purchased renewable energy certificates

Net-Zero Energy Buildings: A Classification System Based on Renewable Energy Supply Options, NREL, June 2010

Department of Energy Definition

*"An energy efficient building where, on a **source energy basis**, the actual annual delivered energy is less than or equal to the **on-site** renewable exported energy"*



Perkins & Will

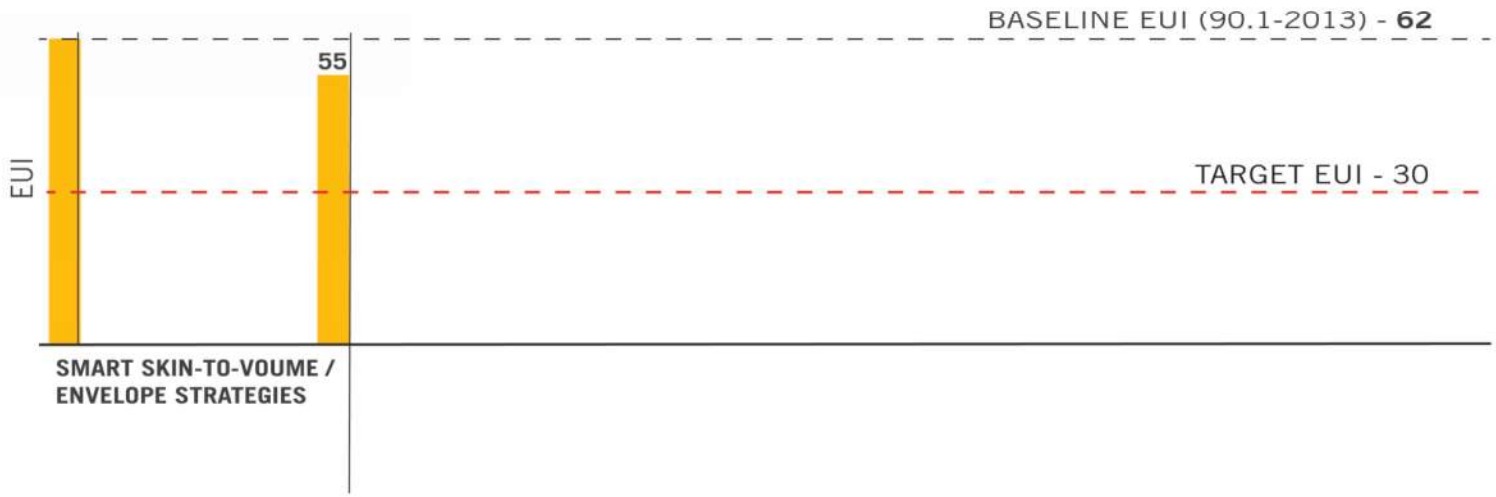
BELMONT ENERGY REDUCTION STRATEGIES

Getting to Net Zero through the right confection of ideas

BELMONT ENERGY REDUCTION STRATEGIES

Getting to Net Zero through the right confection of ideas

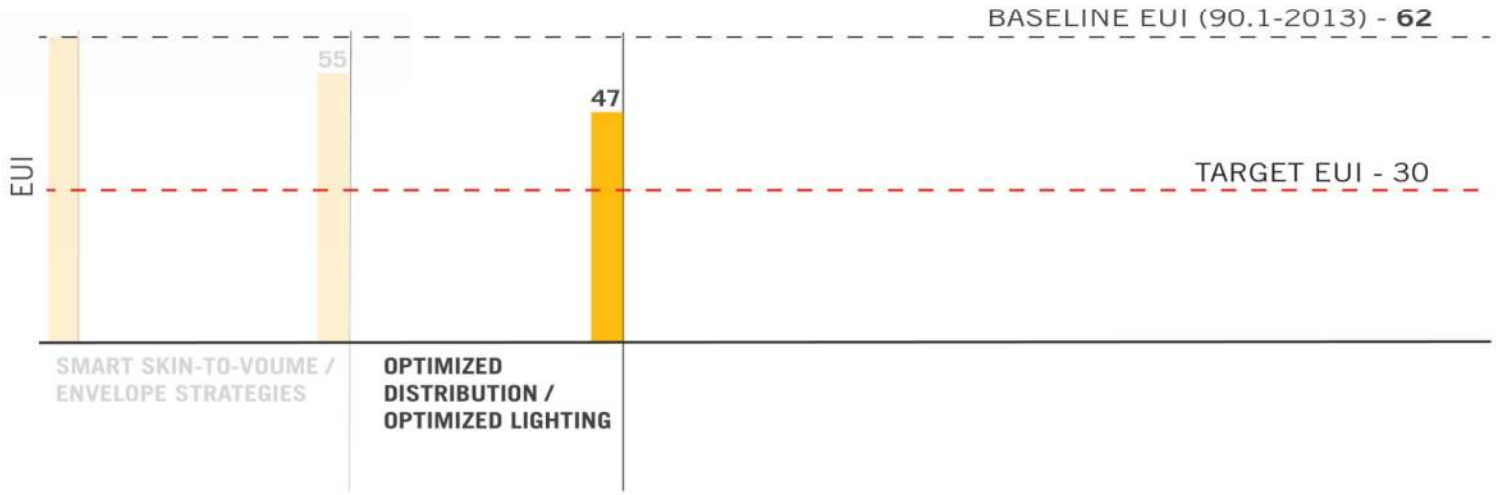
- Minimizing the skin area per square foot of program space
er adjacency
- Set and maintain a window to wall area percentage
- Plan and budget for the design of efficient building skin systems
- Optimize orientation for daylighting quality and efficient control



BELMONT ENERGY REDUCTION STRATEGIES

Getting to Net Zero through the right confection of ideas

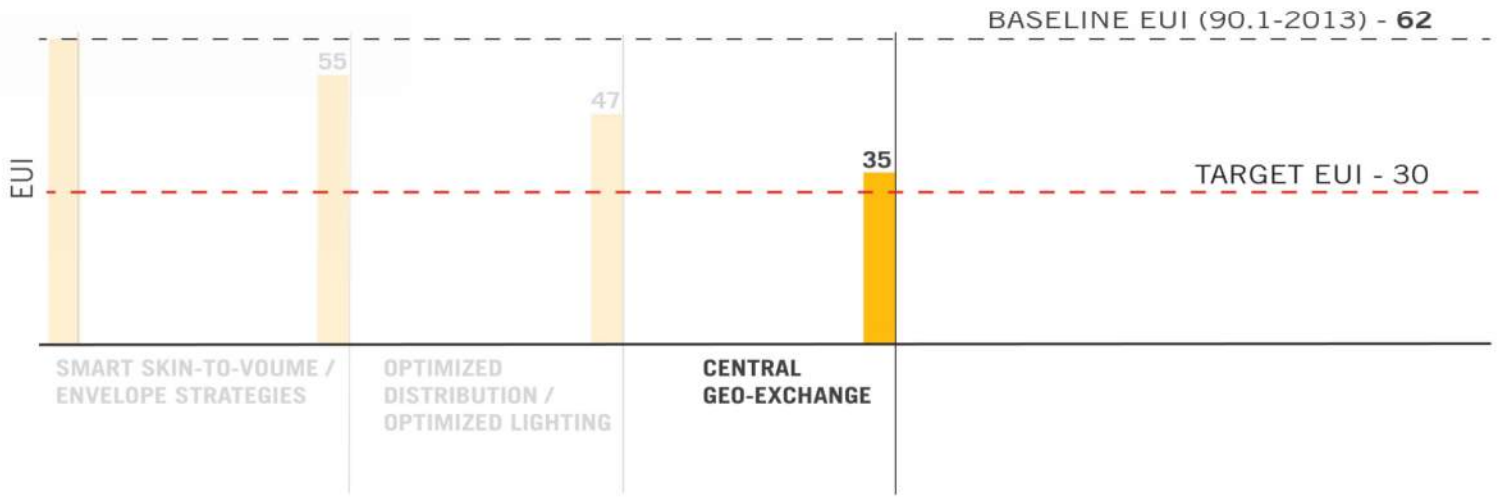
- 100% LED lighting
- Decouple ventilation air from heating and cooling system in classrooms
- Regulate loads through occupancy sensors and daylight monitoring
- Condition multistory spaces with radiant floor systems
- High efficiency delivery systems for high occupancy/low use spaces



BELMONT ENERGY REDUCTION STRATEGIES

Getting to Net Zero through the right confection of ideas

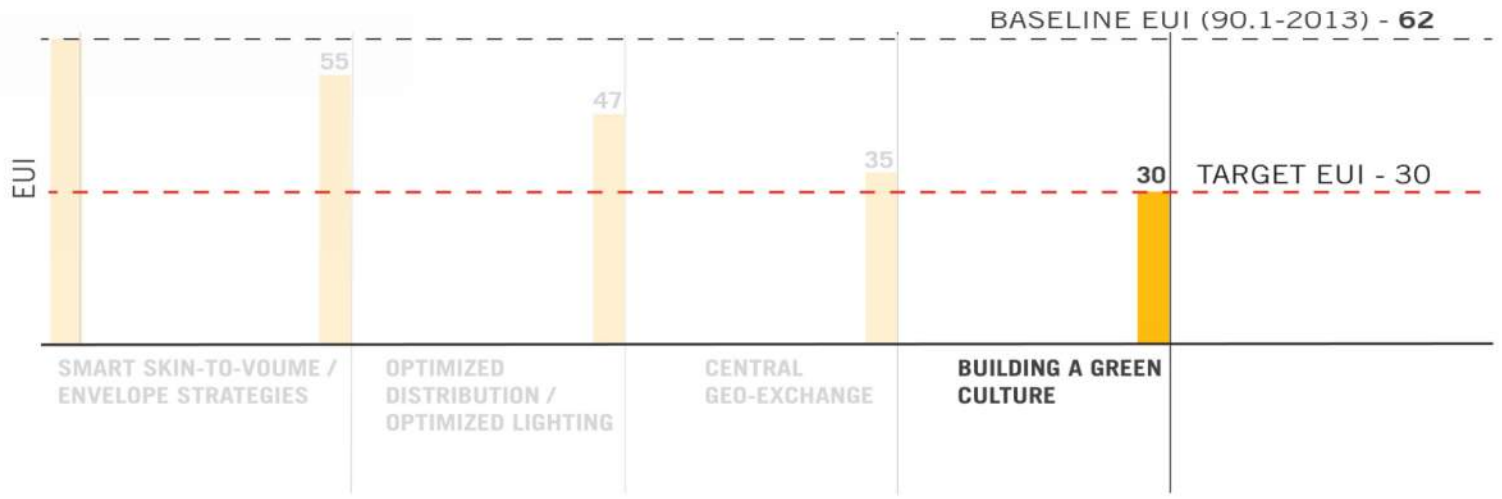
- Create a geo-exchange loop to maximize central plant efficiency
- Allow for the tie-in of future waste heat from a potential adjacent ice rink expansion



BELMONT ENERGY REDUCTION STRATEGIES

Getting to Net Zero through the right confection of ideas

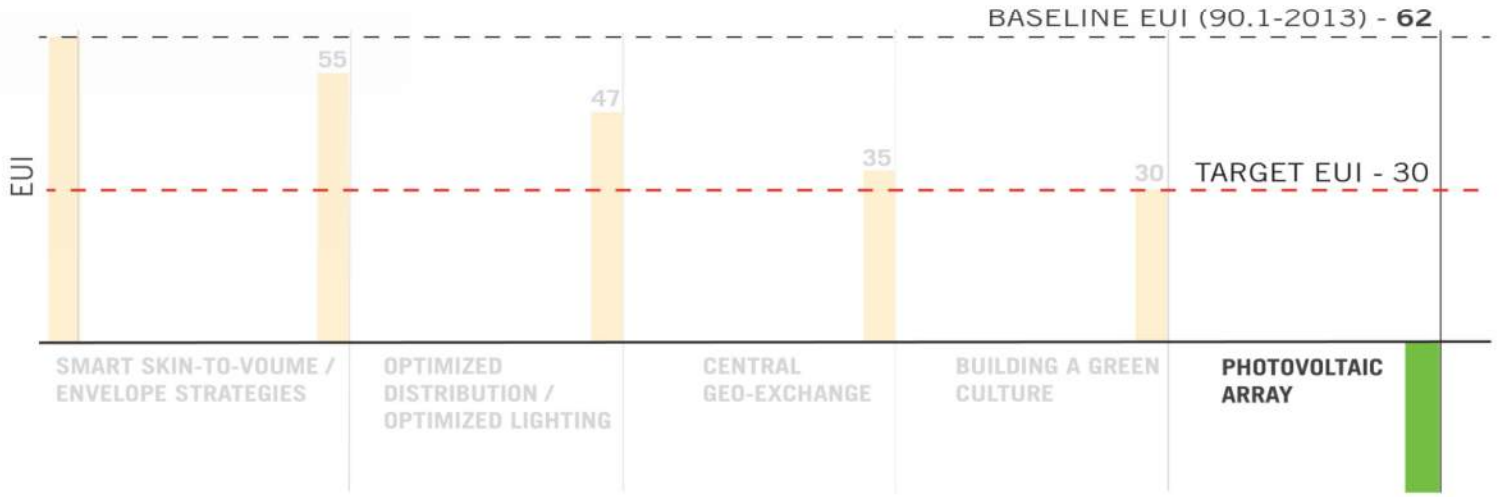
- Build a culture of awareness around energy use decisions and plug-load drivers
- Build a dialog about food service and its effect on the building's energy profile
- Build a dialog with facilities staff aobut best practices for system efficiency



BELMONT ENERGY REDUCTION STRATEGIES

Getting to Net Zero through the right confection of ideas

- Offset the optimized electric loads



Skanska

Constructing for Net Zero

Belmont MA NZE High School

Beth Heider, CSO Skanska USA 10.04.2018

A part of Skanska's Green Initiative

Early Collaboration is Key

Projects

22

LEED New Construction Projects within 3 Miles of 02478

LEED Projects by Certification

LEED Certified	2 (9.09 %)
LEED Gold	11 (50.00 %)
LEED Silver	7 (31.82 %)
LEED Platinum	2 (9.09 %)

Project Name	zEPI Score	Certification
5 Cowperthwaite Street	77	41 GOLD
32 Quincy St. Expansion and Renovation	68	45 GOLD
Cambridge Public Library	68	35 SILVER
War Memorial Building Renovation	68	35 SILVER
West Cambridge Youth & Community Center	68	35 SILVER
Beech Street Center	68	34 SILVER

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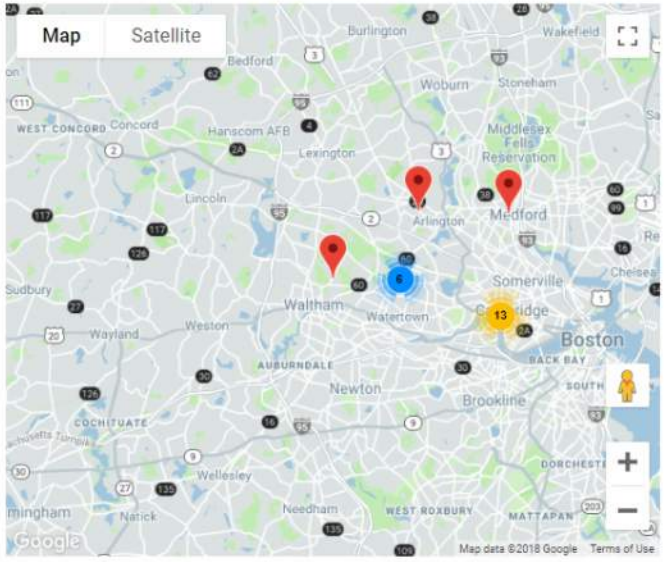
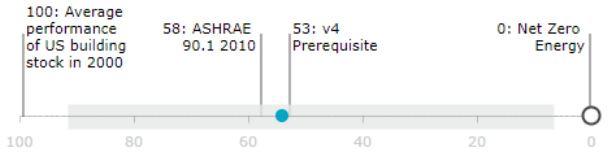
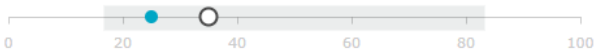
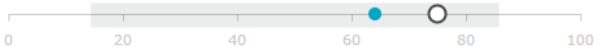


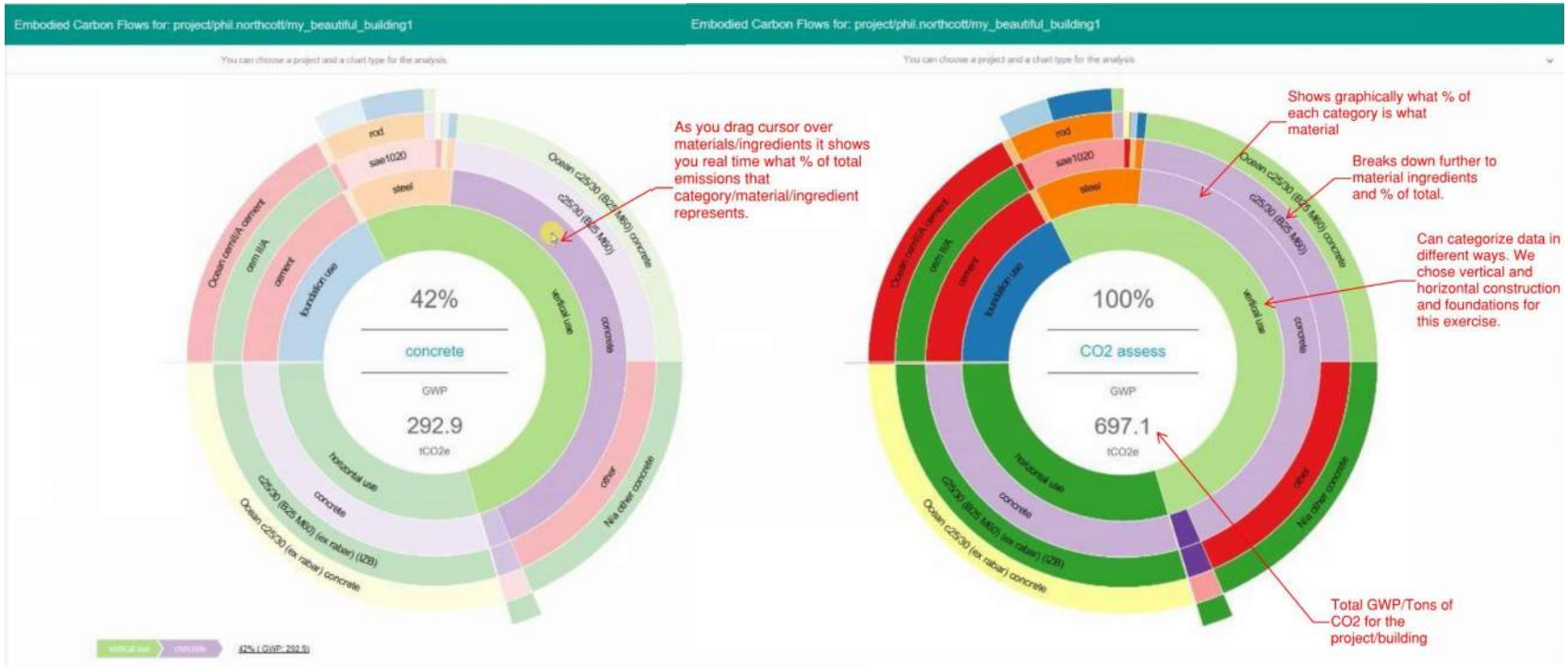
Design Performance

Your **Design Performance** if our recommendations are implemented. Compare this to making no changes which is your **Local Design Performance** for your area.

○ Estimated Value ● Local Average Score ■ Range

Category	Value	Comparisons
Energy	0 ZEPI SCORE	
Water	35 % BELOW EPACT 1992	
Waste	75 % ESTIMATED DIVERSION	

EC3 Tool: Carbon as a Design Tool



Ongoing Collaboration Throughout Construction Phase(s)

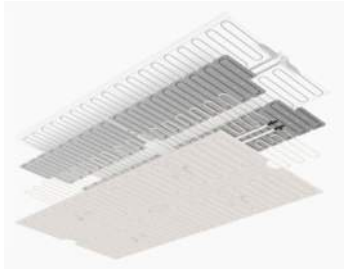
Super-Insulate & Coordinate

DEEPLY INSULATED WALLS & TIGHT CEILING CAVITIES

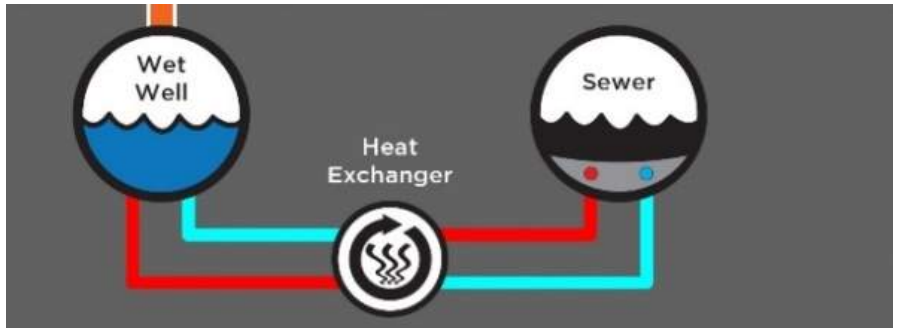
“Geo”thermal + Radiant Cooling

8’ X 8’ – EXISTING SEWER

SORTING OUT THE “WRENCH” IN THE WORKS



RADIANT CEILING COOLING SYSTEM



“WASTE” HEAT TO THERMAL COMFORT

Learning from Leading Technologies

16-PORT DC POWER MODULE

Planning for Success

Commissioning Plan

Renovation + NZE Technologies require adequate float in the schedule

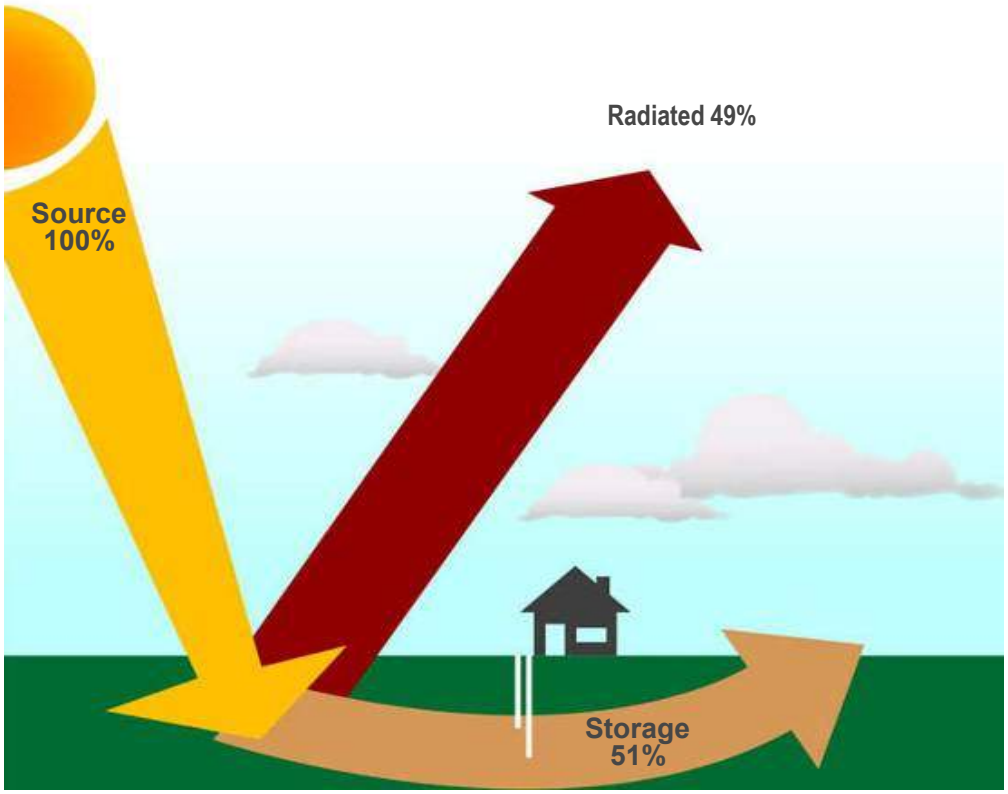
Contingency Planning

Temporary Utilities for Phasing & Start-Up

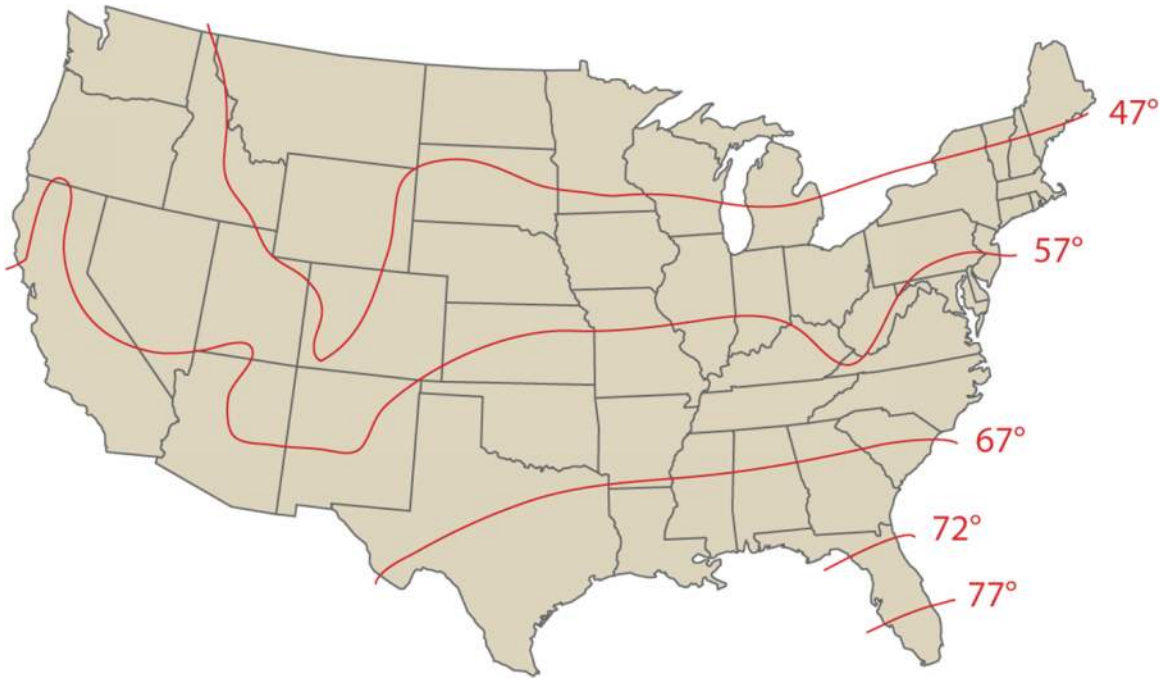
Tweaking throughout Occupancy Year One

Haley & Aldrich

What is Geothermal?



Ground Temperatures



Geothermal Resource Basics

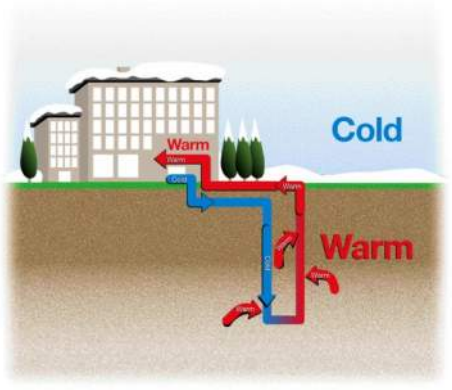
HEATING

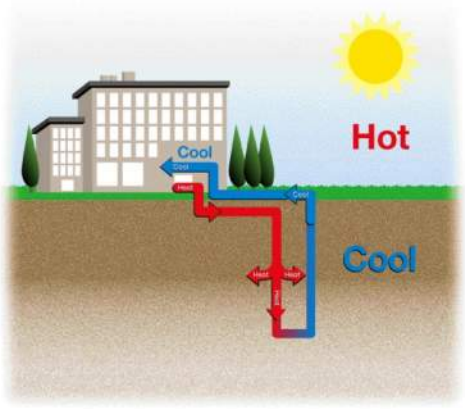
Heat source for ground source heat pumps to extract heat

Higher Coefficients of Performance (COPs)

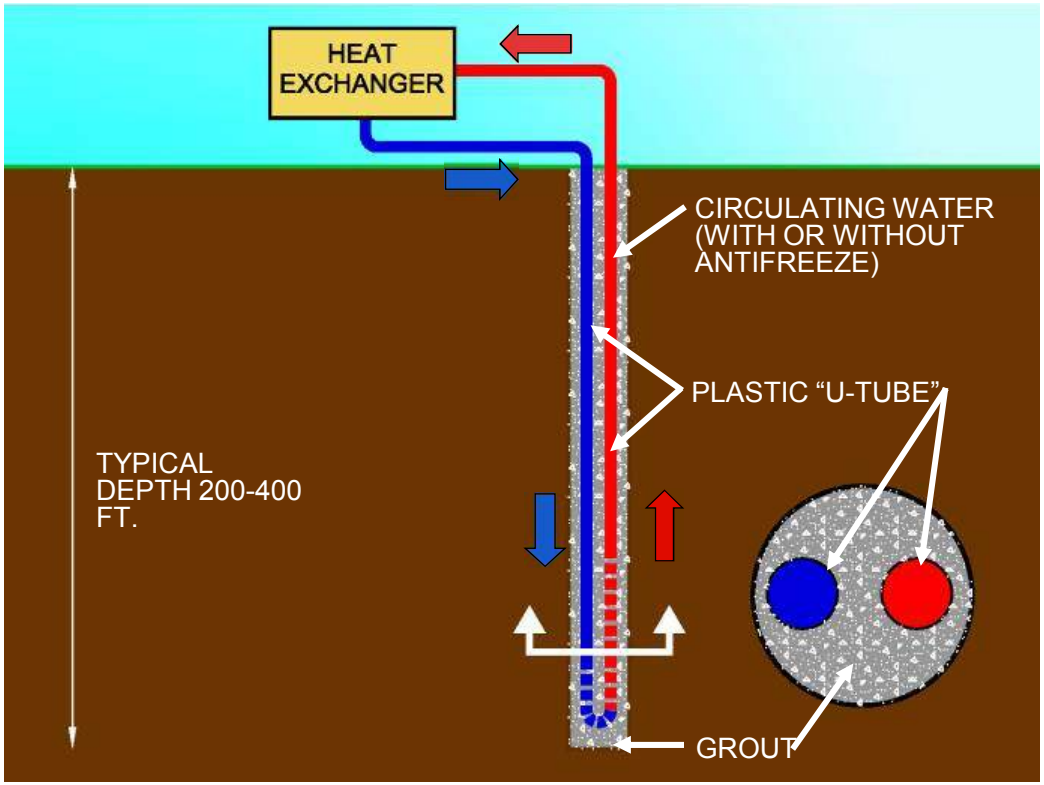
COOLING

- Heat sink for ground source heat pump to inject heat
- Higher Energy Efficiency Ratios (EERs)

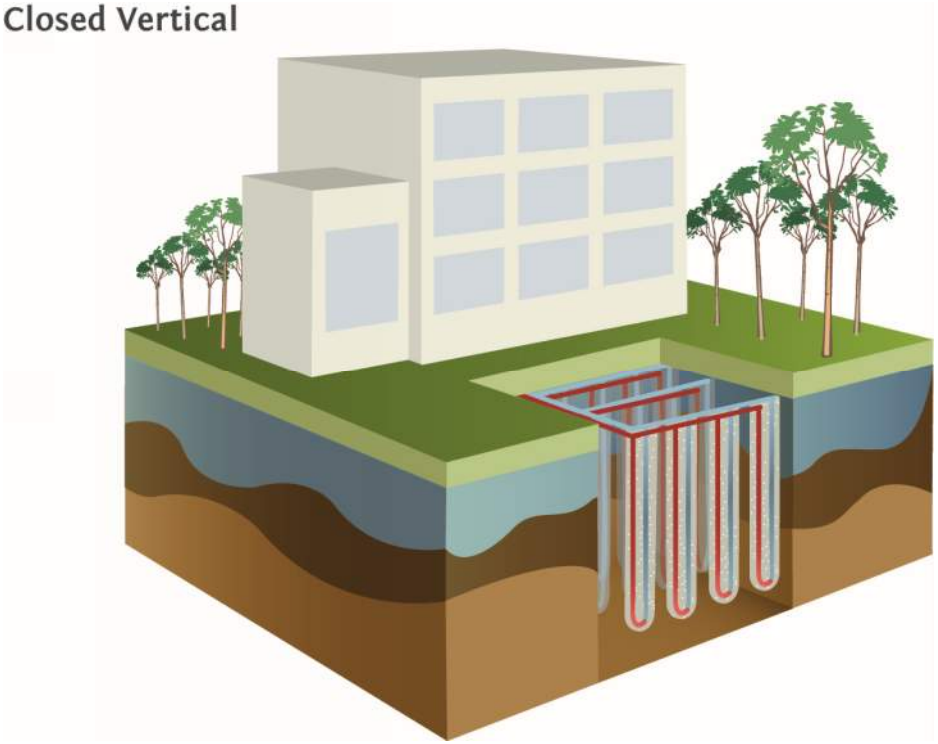




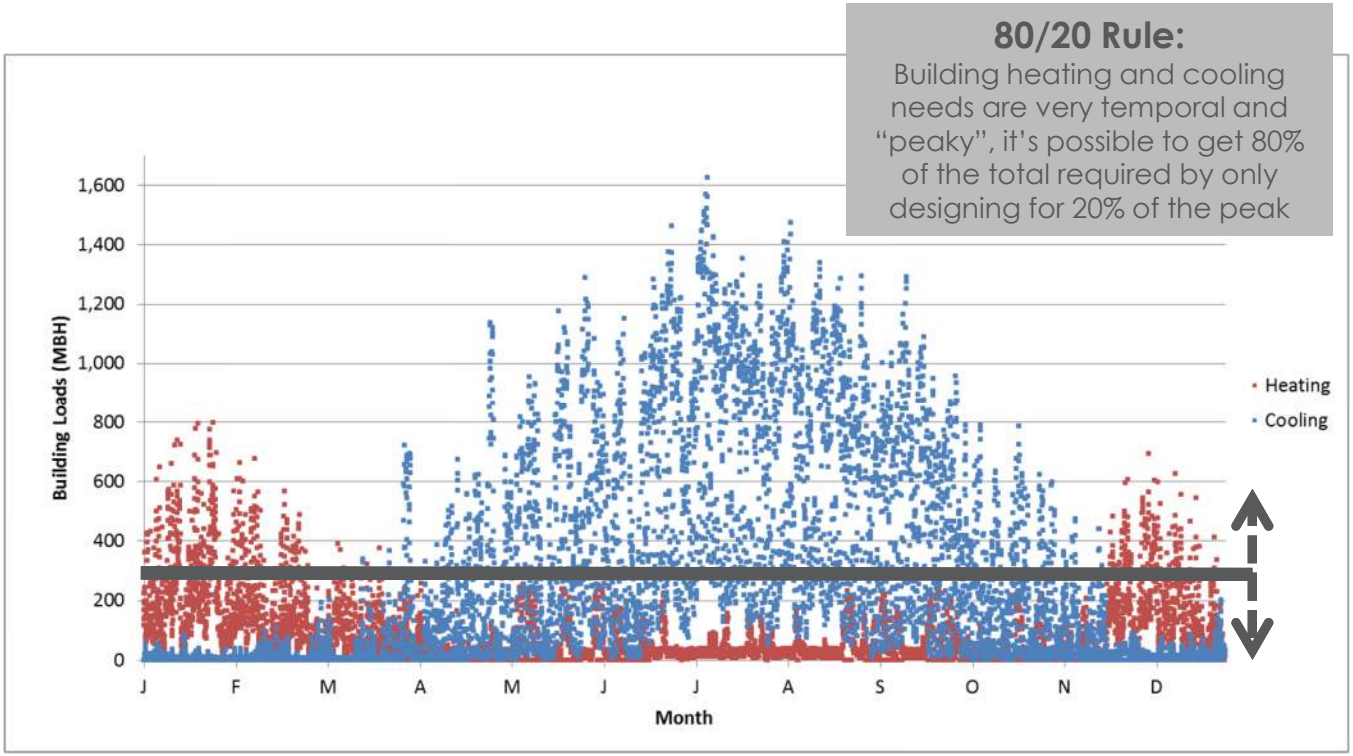
Vertical Closed Loop



Vertical Closed Loop



How can we maximize the system and minimize the cost?



Belmont Light

BELMONT LIGHT
POWERING YOUR COMMUNITY SINCE 1898

- How do we achieve ZNE status?
- Why is ZNE right for us?
- What is Belmont Light's role in achieving ZNE?

Chris Roy, General Manager
croy@belmontlight.com

BELMONT LIGHT
POWERING YOUR COMMUNITY SINCE 1898

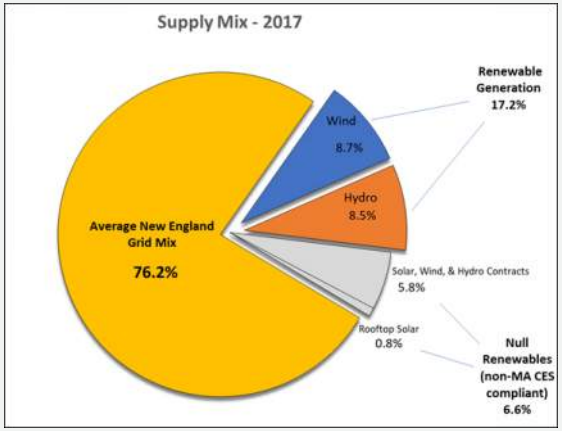
Source: "Achieving Our Climate Action Plan: A Roadmap for Strategic Decarbonization, Members of the Belmont Energy Committee, September 11, 2018 DRAFT

Why ZNE is Right for Belmont

- Strong community interest in sustainability and climate action
- Anticipated TMM activity coincides with BHS timeline
- Multiple cost-effective options make ZNE status attainable

BELMONT LIGHT
POWERING YOUR COMMUNITY SINCE 1898

Why ZNE is Attainable for Belmont



www.BelmontLight.com > Energy Solutions > Portfolio

Public power = community-driven

Belmont Light's strategic priorities:

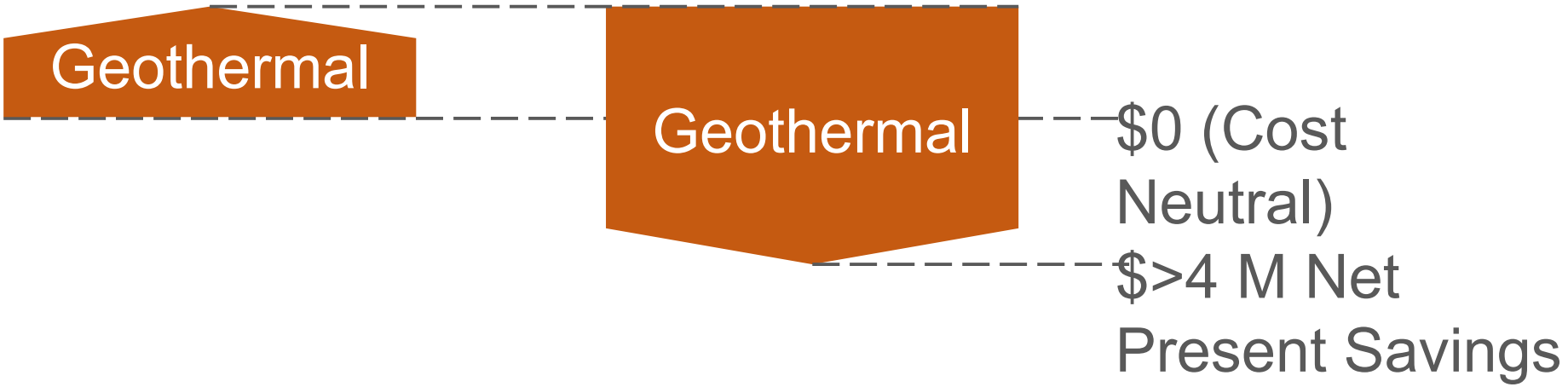
- Decarbonized power supply
- Town-wide electrification

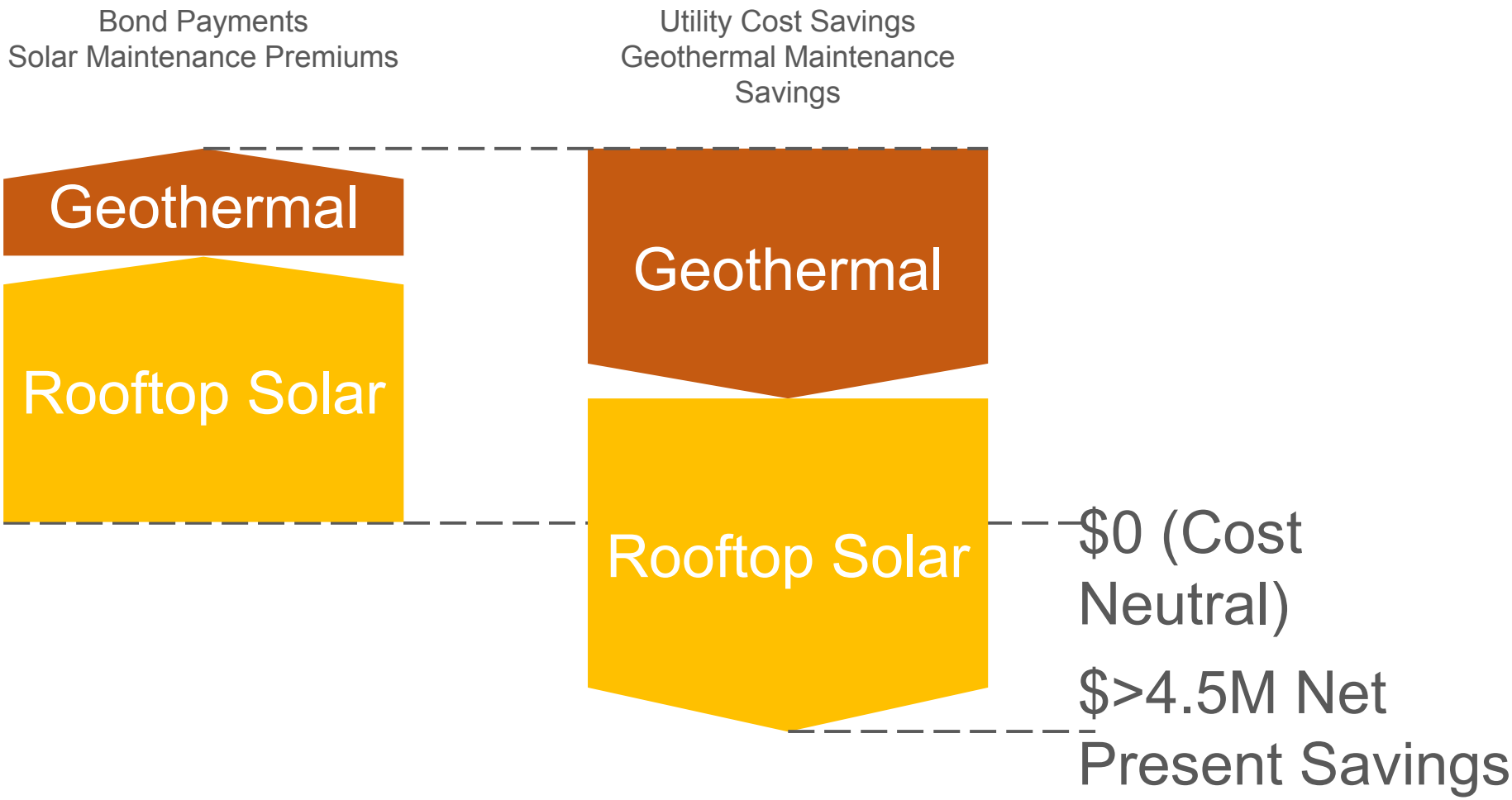
→Pathway to ZNE Class D already incorporated in Belmont Light portfolio

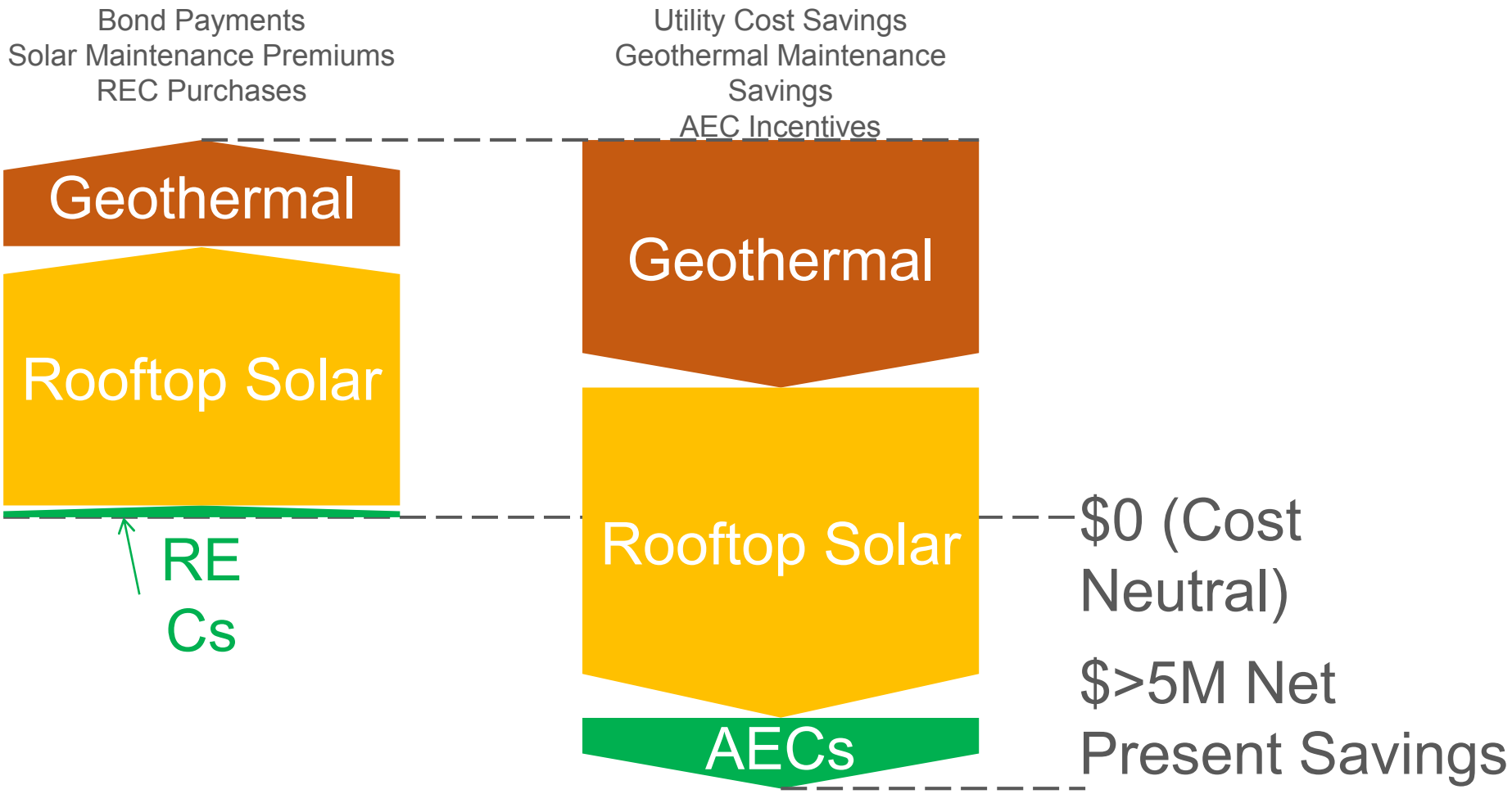
Belmont Energy Committee

Bond Payments

Utility Cost Savings
Geothermal Maintenance
Savings




Bond Payments
Solar Maintenance Premiums
Utility Cost Savings
Geothermal Maintenance Savings
Geothermal
Rooftop Solar
Geothermal
Rooftop Solar
$0 (Cost Neutral)
$>4.5M Net Present Savings


Bond Payments
Solar Maintenance Premiums
REC Purchases
Utility Cost Savings
Geothermal Maintenance Savings
AEC Incentives
Geothermal
Rooftop Solar
RE Cs
Geothermal
Rooftop Solar
AECs
$0 (Cost Neutral)
$>5M Net Present Savings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