MA Leading by Example Council Meeting

July 14, 2020

Location: Everywhere

State Government Progress – as of July 2020

Greenhouse Gas (GHG) Emissions	**Energy Use Intensity per Square Foot**	**Electricity via Renewable & Onsite Generation**	**Heating Oil Consumption at State Facilities**
CHP			
↓ 26%	**↓ 13%**	**19%**	**↓ 85%**
2004 -2018	2004-2018	In 2018	2006-2019
28.6 MW Installed Solar PV	**90 LEED Certified State Buildings**	**210 EV Charging Stations at State Sites**	**Leading by Example Grants Awarded**
20.5 MW	**53**	**159**	**$12.6 M**
Since 2015	Since 2015	Since 2015	Since 2015

Webinars and Learning Sessions of Interest

Signup for email alerts for these and other webinars through the EPA State Energy & Environment Program.

EPA Clean-Up Information	Toxics remediation, best practices for site redevelopment. *Upcoming session: July 15, 1pm* - *Power and Pollinators: Pollinator-Friendly Landscapes for Solar Facilities and Beyond*
Northeast Energy Efficiency Partnership	Smart energy buildings, strategic energy management, decarbonization leadership, energy efficiency best practices *Upcoming session: July 16, 11am* - *Decarbonization Policy Framework: Evaluation, Management, and Verification*
PowerOptions	Solar financing and incentive programs. *Upcoming session: July 30, 1pm* - *Get SMART with Solar: New Opportunities with Expanded Solar and Storage Incentives*
Northeast Recycling Council	Solid waste diversion best practices and resources, including topics on anaerobic digestion, recycling, compost, and food waste reduction
DOE Better Buildings	Building efficiency, integrating renewables, financial and technical resources, and case studies
Energy Star	Water management, innovative technology, ask the expert sessions
Clean Energy States Alliance	Programs and policies at partner states driving adoption of clean energy

Eversource Ground Source Heat Pump Pilots

- Eversource is looking to pilot utility ground source heat pump installations
- Three sectors
  - Multi-family dwelling
  - Mixed-use/commercial
  - Low-density residential
- Preference for oil or propane users
- Issues with balancing load within different use types

Decarbonization Resources

LBE developing resources to support efforts on transitioning away from onsite use of fossil fuels for heating and cooling

1. Spreadsheet of ~30 sites across the country that have installed electrified or alternative fuel systems
   - Summary for each project of new systems and their impact
   - Campuses and buildings
   - Includes GSHP (District and not), WSHP, Biomass plants
2. Slide deck of exemplary sites
   - More detailed information for 6-8 sites
   - Scale, cost, timeline, and benefits of projects
   - Lessons learned

Spreadsheet available now; slide deck available in August

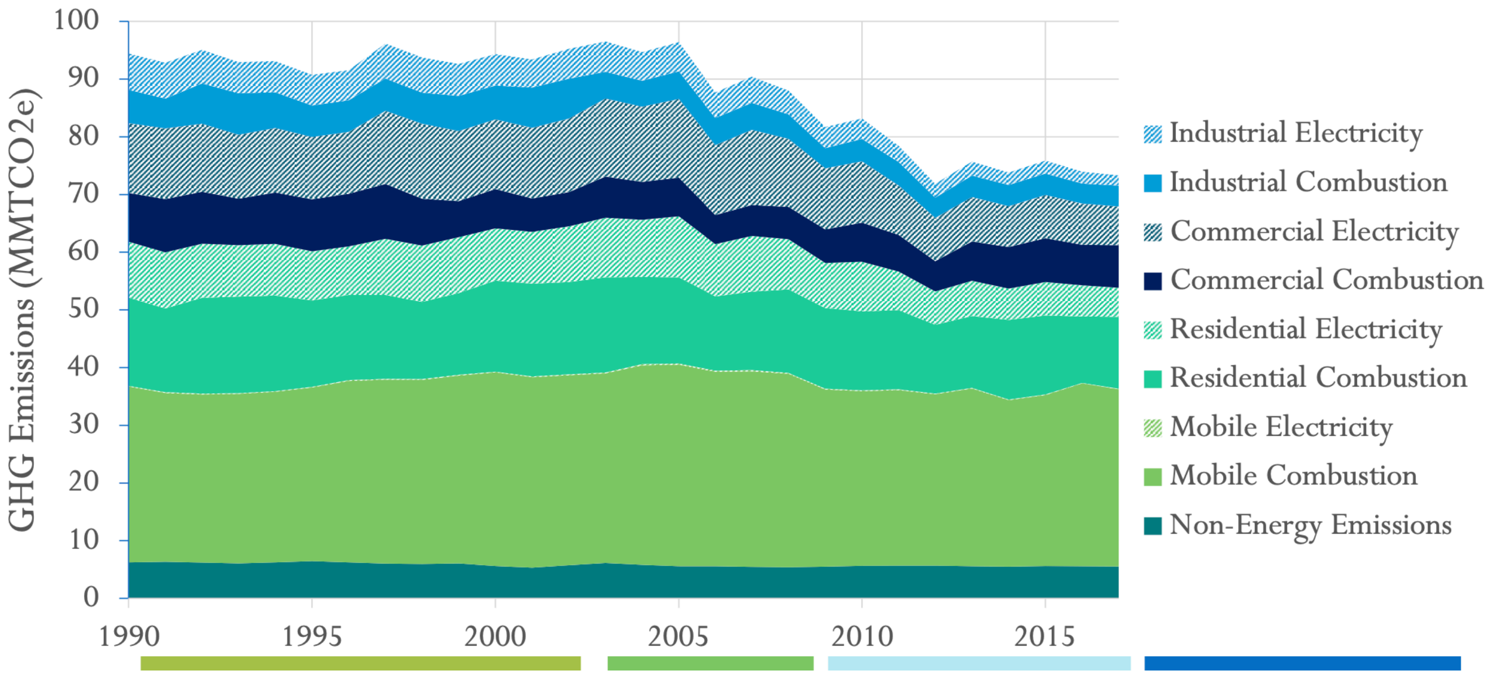
Resources on Electric Vehicles

1. Database of currently available and upcoming BEV and PHEV models
   - Ranges from sedans to medium-duty trucks
   - Includes available specification details
2. Slide deck summarizing overall EV outlook and takeaways from model database
   - Trends for leading companies, vehicle types, market drivers
   - Advancements in technology and policy
   - Use-case comparisons between EV models and ICE counterparts

Both resources to be available in August

Rethinking LBE Emissions Reporting:

Supporting the Commonwealth Decarbonization Roadmap

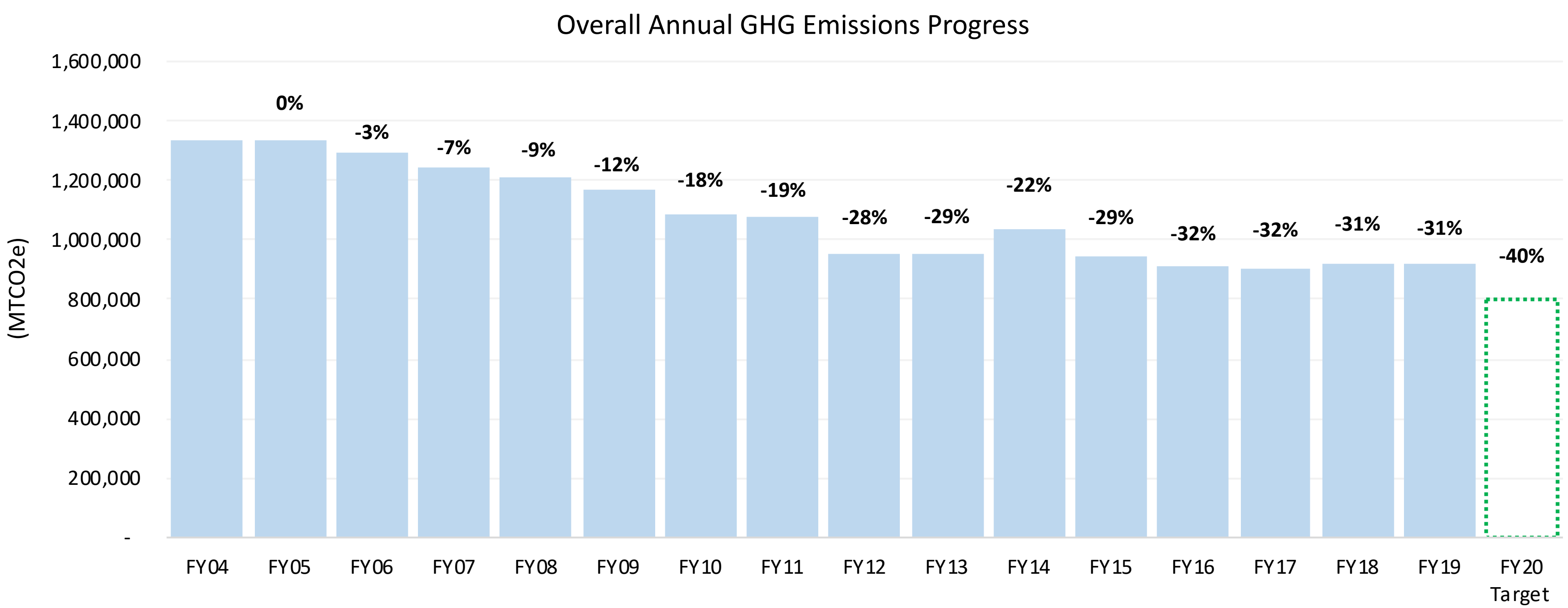


Creating a Clean, Affordable and Resilient Energy Future for the Commonwealth

DOER
Massachusetts Department of Energy Resources

LBE Emissions Reporting: Current Approach

What's included?	What's worked?	What hasn't?
• **Scope 1:** direct emissions including on-site fossil fuel combustion & fleet fuel consumption • **Scope 2**: indirect emissions from the generation of electricity	• Holistic accounting • Consistent with broader policy approaches • Representing impacts from all efforts (EE, fuel switching, electrification, etc.)	• REC/AEC quantification, transparency & double counting complexities • Distinguishing between emissions reductions from agency action vs. greening of the grid



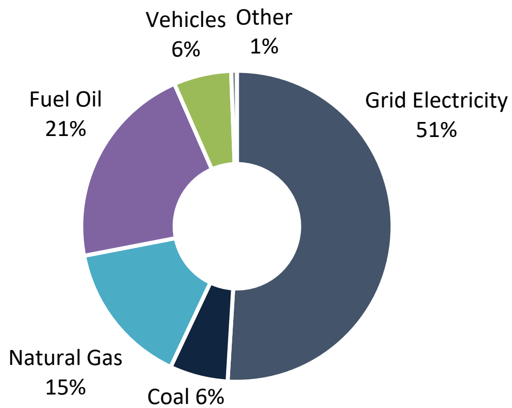
LBE Emissions Reporting: Shifting the Focus

Share of emissions from grid electricity has declined ~12% and will continue to do so with existing & new statewide policies

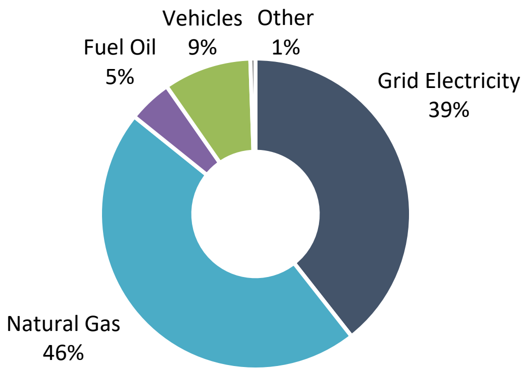
61% of current portfolio emissions come from onsite fossil fuels; this share will continue to increase as grid gets cleaner

To support statewide emissions goals as grid decarbonizes, portfolio efforts should focus on dramatically reducing onsite fossil fuel consumption in state buildings & fleet vehicles

Emissions by Fuel: FY04

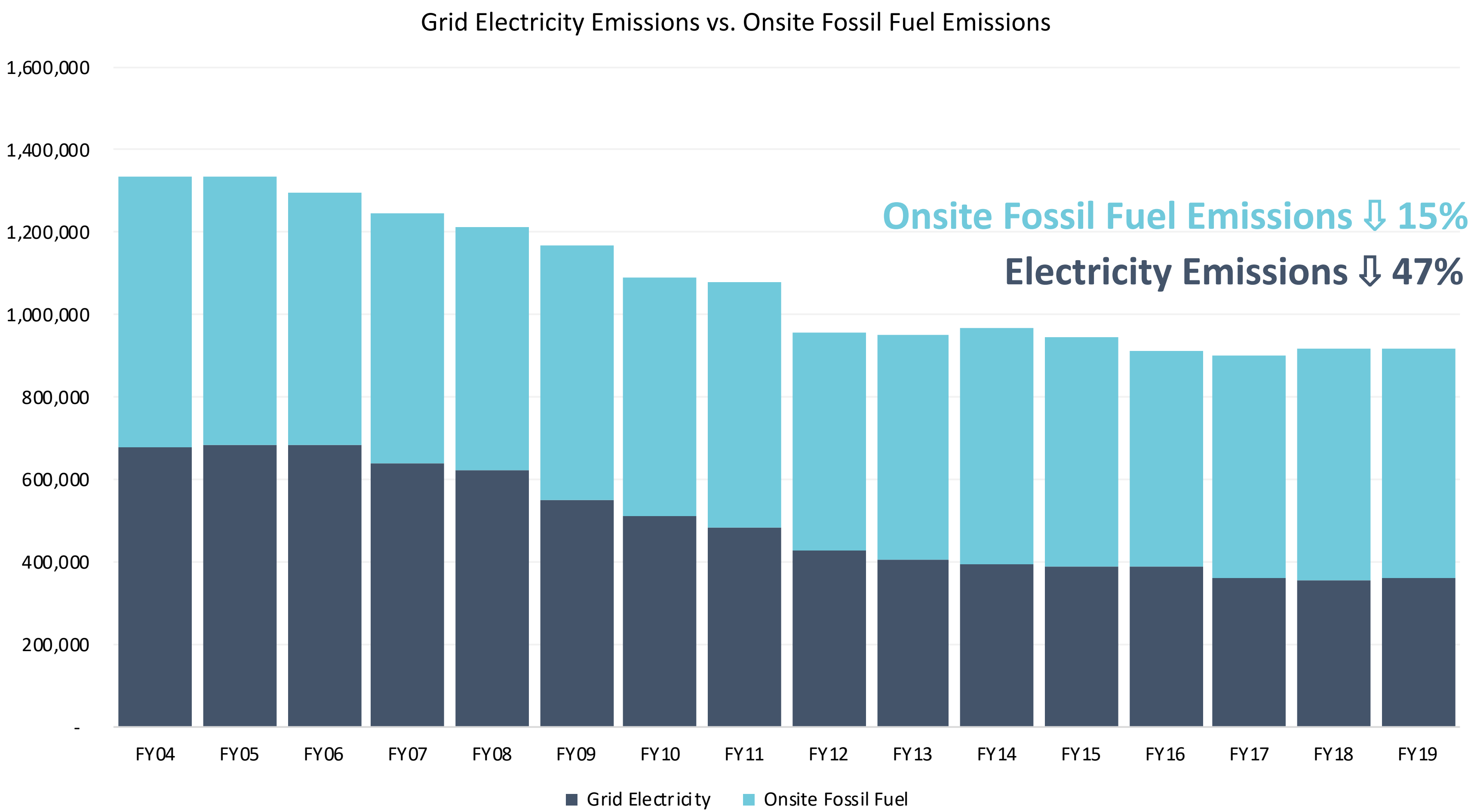


Emissions by Fuel: FY19

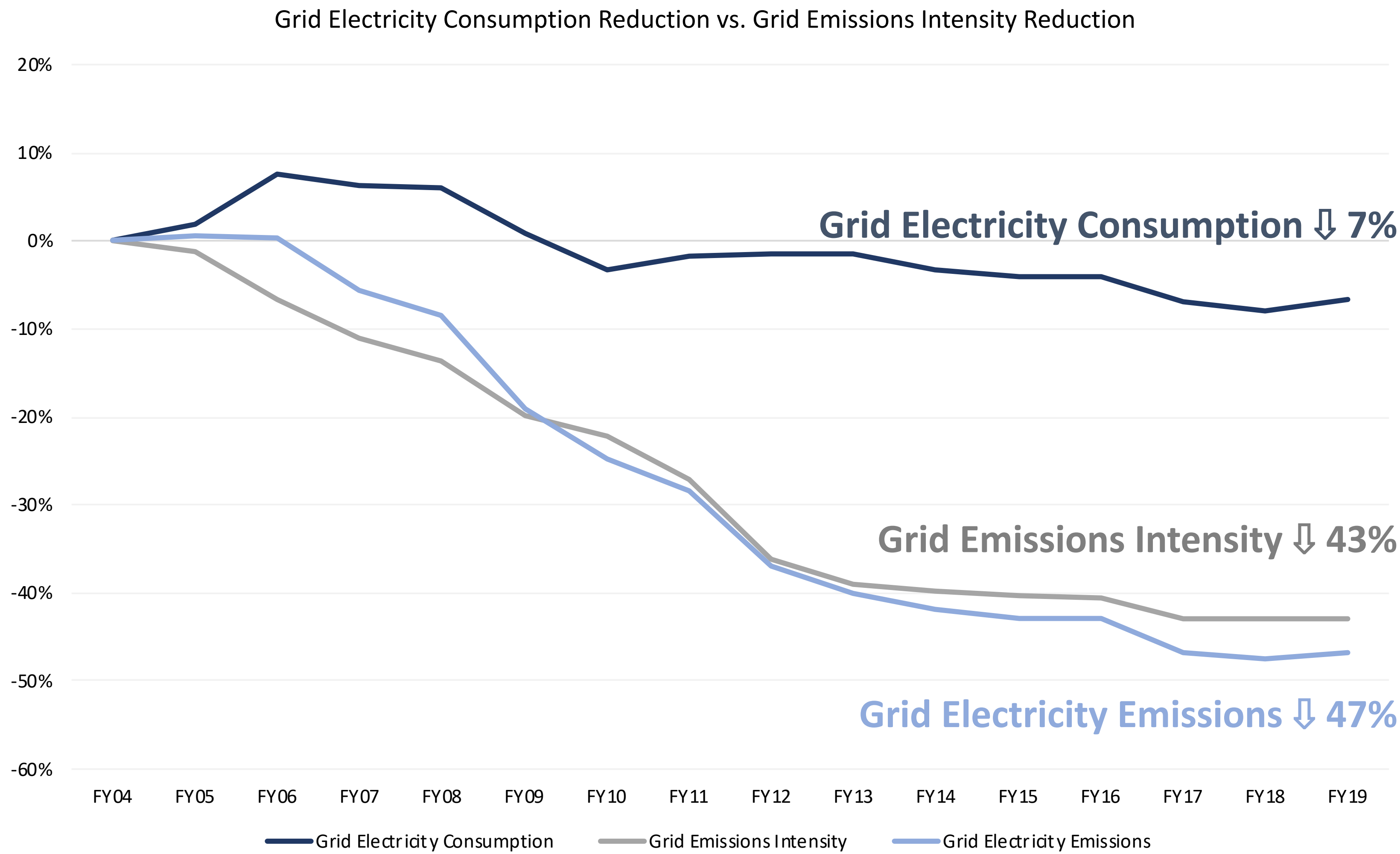


Overall Emissions Progress: All About That Scope

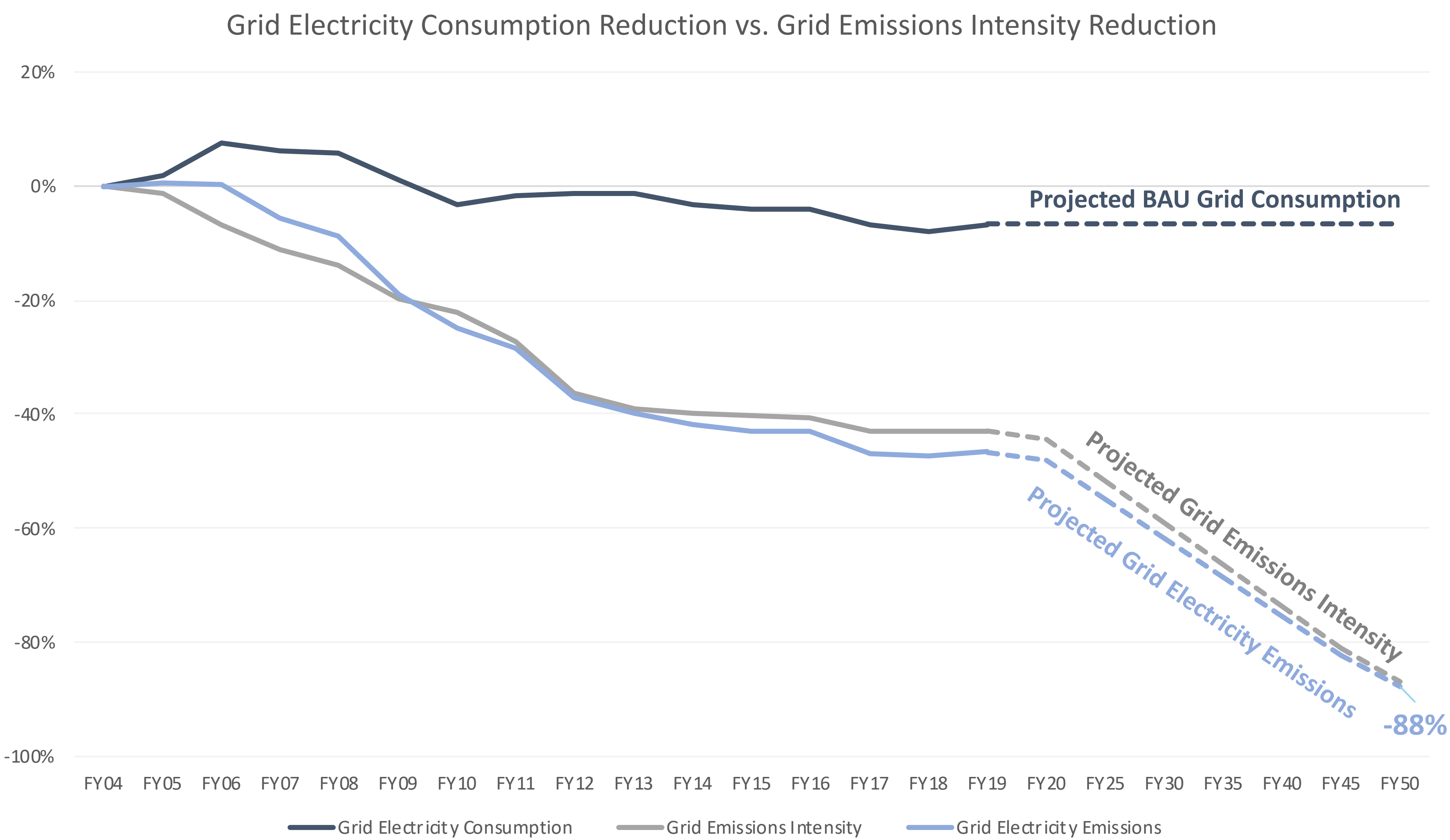
Of the 31% overall emissions reduction since 2004,
grid electricity accounts for 24% while **fossil fuel emissions account for 7%**



Impact of Greening the Grid



Impact of Greening the Grid: Forecasting to 2050



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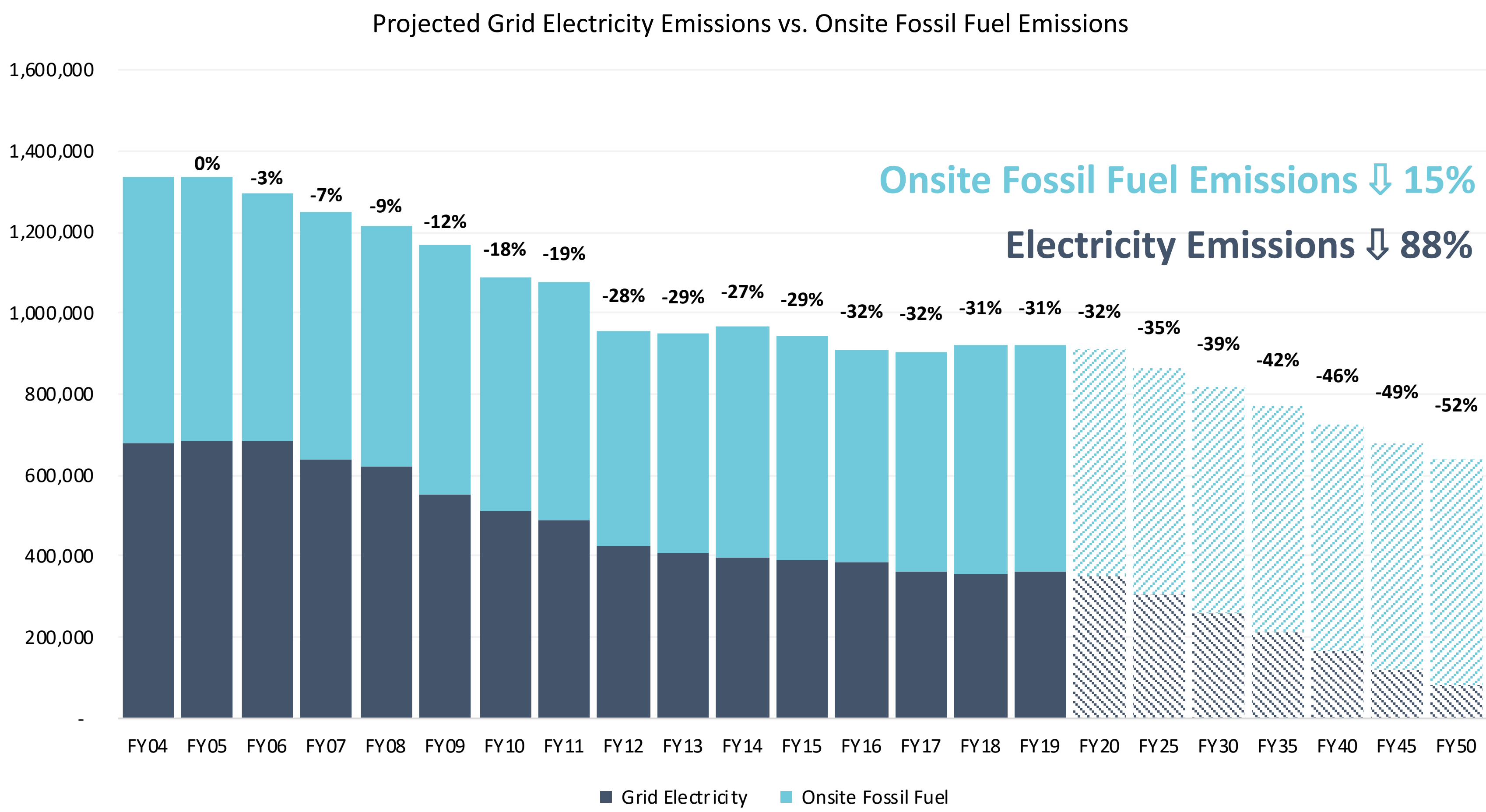
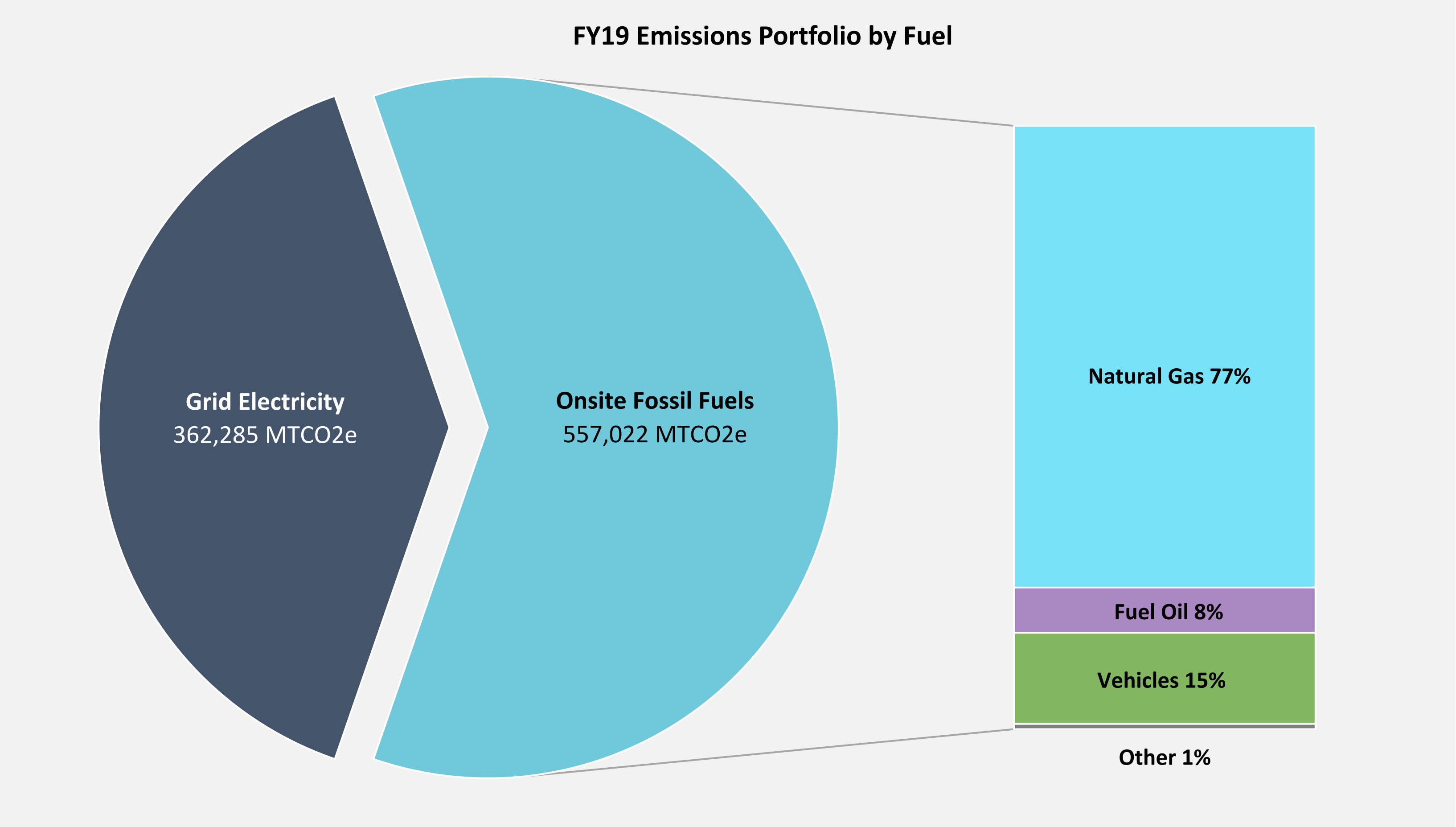
Overall Emissions Progress: Forecasting to 2050

If we assume that consumption remains the same,
of the **52% projected overall emissions reduction** in 2050,
grid electricity accounts for 45% while **fossil fuel emissions account for 7%**



Rethinking LBE Emissions Reporting

Shifting focus to report onsite fossil fuels & associated emissions



***Reducing electricity consumption still key to reducing costs & demand on grid**

Update on Energy Master Plans around the Commonwealth

Presented to LBE
July 14, 2020

UMass Dartmouth-Jamie Jacquart

Engineer: Ramboll Corporation

Start Date: July 1, 2020

Expected Report Date: December 1, 2020

% Complete: 45%

Key Findings so far: Likely to switch from high pressure steam to low-temperature hot water. Limited technology options from 26 to 5 to explore more in depth

UMass Dartmouth Lessons Learned

1. Data collection before, during and after is REALLY important
2. The replacement and refurbishment of building stock is a key component of the overall plan
3. Understanding current equipment and infrastructure is necessary to anticipate future expansion (can our internal electrical system handle a double or tripling of capacity as we electrify HVAC systems?)
4. Engineers sometimes skip over insulation of existing envelopes as it’s not sexy
5. Energy technologies are evolving quickly. Something that was experimental 5 years ago is being implemented at scale today.

UMass Lowell-Daniel Abrahamson

Engineer: To Be Determined

Start Date: Anticipated September 2020

Expected Report Date: March 2021

Percent Complete: 0%

Key Findings so far: RFP out for bid 6/22/20 with an anticipated award in August 2020. Focus of study is Alternative Energy Masterplan for UML with consideration for projected energy use, sustainability regulations, financial impacts, infrastructure hurdles, and student engagement opportunities.

UMass Lowell Lessons (to be) Learned

Critical to incorporate all stakeholder needs into study:

Operations, Capital Planning, Sustainability, Administration, and Faculty/Students

Six goals to measure study success:

1. Evaluate existing energy management practices
2. Forecast demands 2020-2050
3. Identify opportunities for resiliency, cost effectiveness, and sustainability
4. Prioritize energy source projects to meet carbon neutrality goals
5. Identify infrastructure/operating constraints
6. Propose mechanisms for community engagement in future planning

Salem State-Tara Gallagher

Engineer: TBD; RFP is currently on COMMBUYS

Start Date: Proposals due Aug. 14th; start in September

Expected Report Date: March 2021

Percent Complete: 0%

Key Findings so far: Budgeting constraints forced focus on solutions, eliminating engagement process and minimizing electrical infrastructure size forecasting. Faculty contract problems have prevented Sustainability Task Force meetings creating engagement difficulties.

Salem State Lessons Learned/Project Focus

Project Focus

- Develop a roadmap for transitioning North Campus away from fossil fuels
- Assess clean fuels, technologies and strategies
- Determine whether to retain the central system serving eight buildings or to transition to a building-specific system
- Provide additional details for near-term projects at Horace Mann and the Meier Hall lab addition

Lessons to be Learned: Anticipate relevance to other state agencies with central gas-fired steam power plant and outdated building infrastructure

UMass Amherst-Ezra Small

Engineer: MEP Associates, Braylsford & Dunlavey, Competitive Energy Services, and GreenerU

Start Date: February 20, 2020

Expected Report Date: January, 2021

Percent Complete: 30% billed

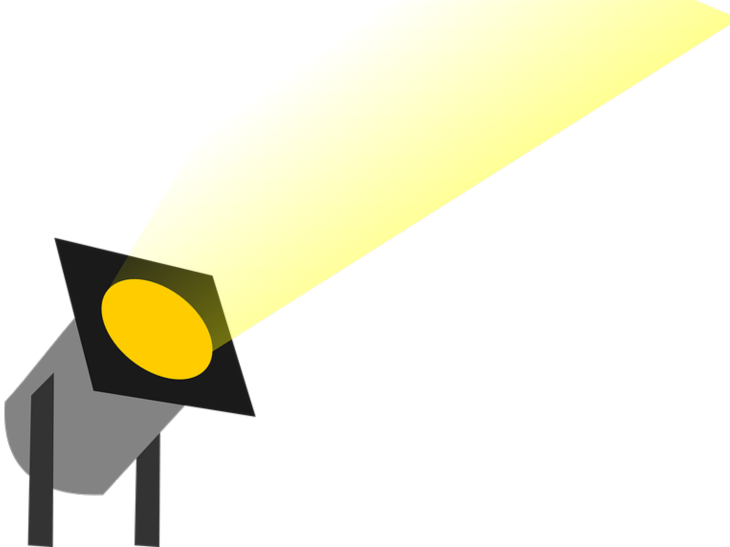
Key Findings so far: GHG BAU Model built on utility data and capital plan assumptions. Solutions are being developed and GHG impact factored into model. Solutions will entail steam to hot water, geo-exchange, REC procurement, etc. We are looking at innovative strategies such as sewage heat recovery.

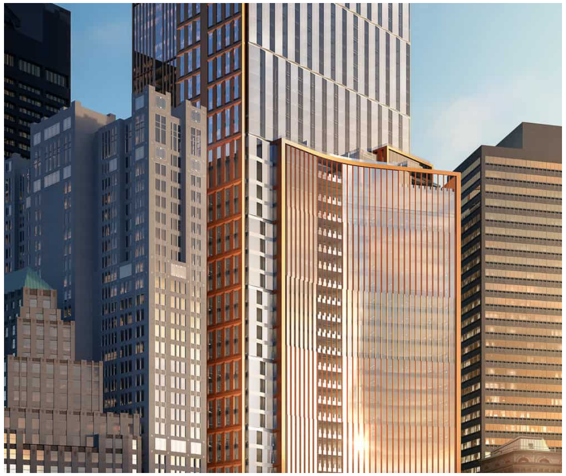
UMass Amherst Lessons Learned

- Working with campus Task Force is a challenge but really important
- Doing almost entire plan remotely during COVID is weird
- Lack of understanding of REC's is a challenge but it was expected
- Task Force wants more energy efficiency solutions (deep energy retrofits)
- Policy conversation is very difficult - realism gets in the way of creativity
- Having a facilitator/project note-taker (GreenerU) is so helpful to stay on task
- Meeting with Capital Planning group ealy on is crucial
- Meeting with Finance Group is crucial
- Roadshow Plan for vetting plan and aspects of plan is really important

Massachusetts Department of Energy Resources

Meeting Spotlight: Passive House as a Decarbonization Strategy



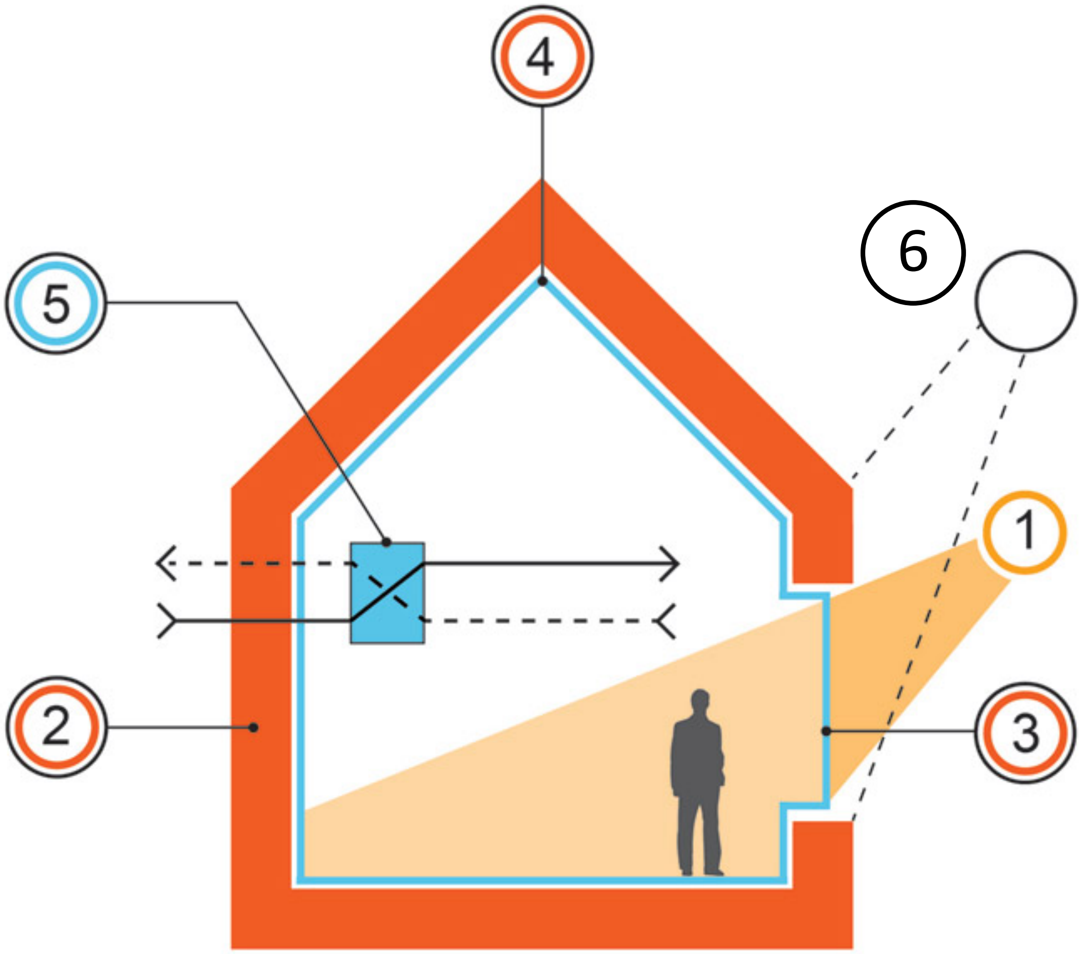


Passivehouse
efficiency, resilience, demand response

Paul Ormond
Department of Energy Resources

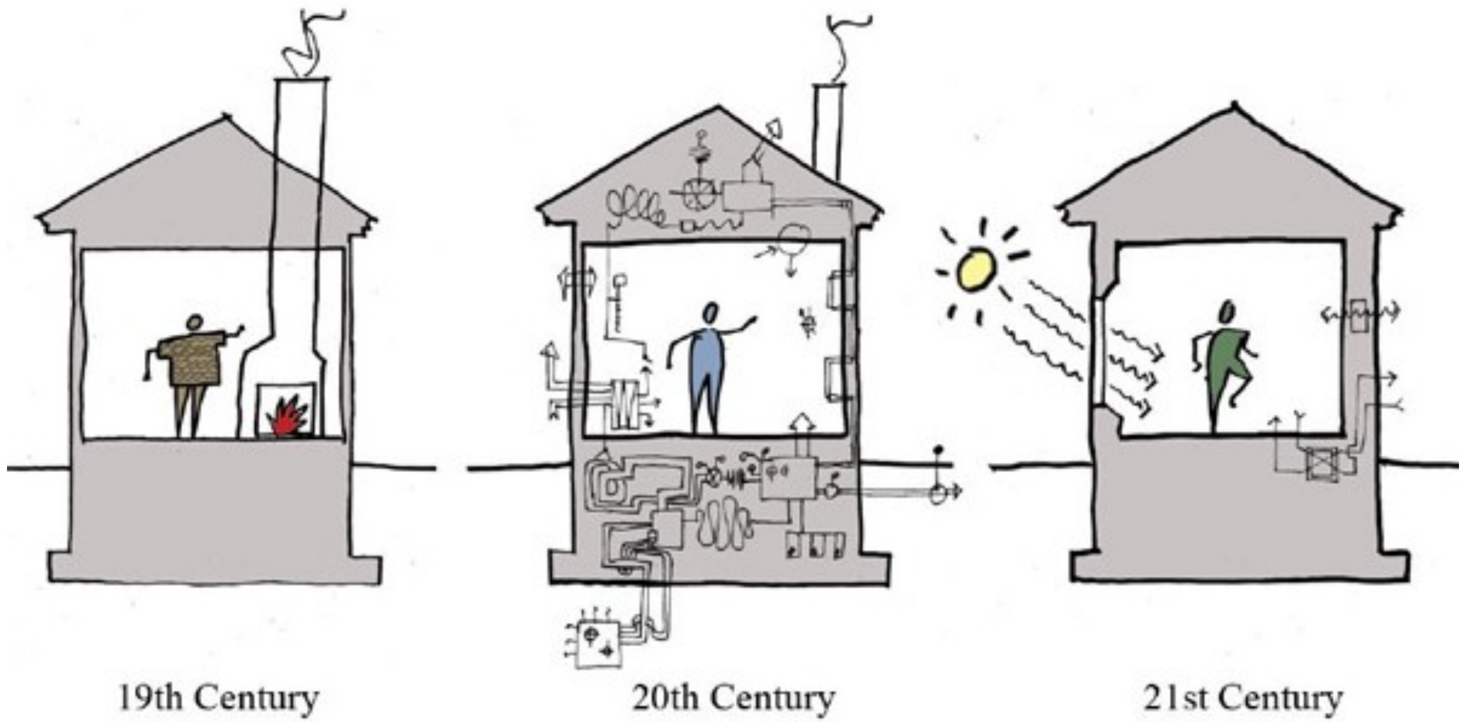
Can You Find the Passive House?

Can You Find the Passive House?



1. Solar gain
2. Envelope
3. Windows
4. Infiltration
5. Energy recovery
6. External Shading

Passivehouse simplifies



All Buildings can be Passivehouse

Montessori School
Hollis, NH

Stone Fruit Farm
Westport, MA

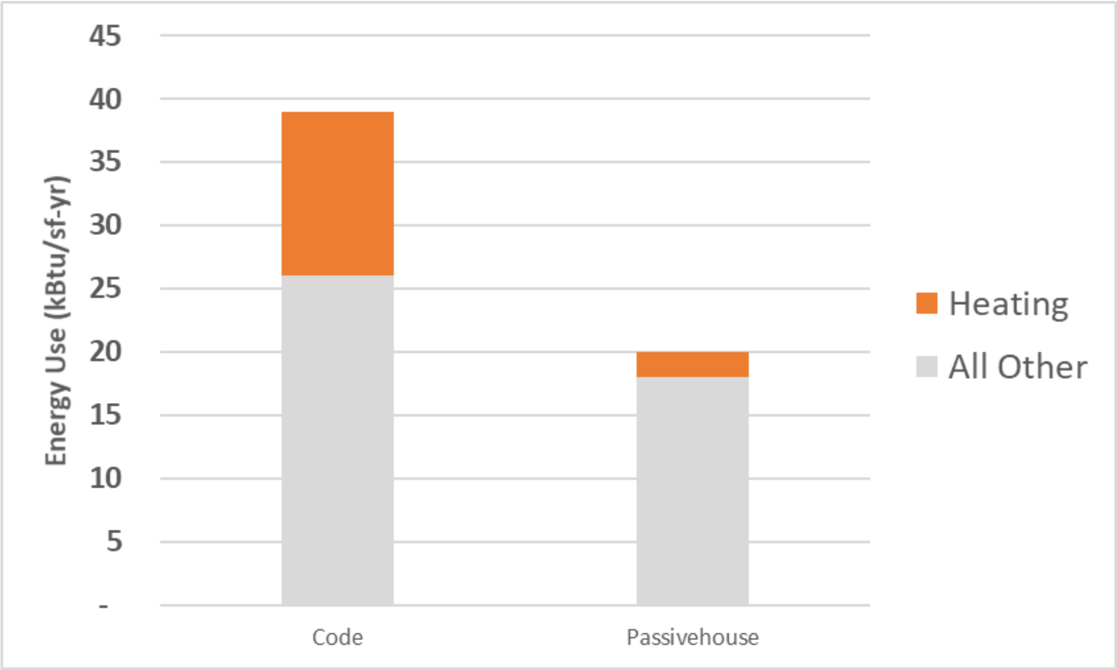
170-Bed Dormitory
Wheaton College

Carnegie Library
Pittsburgh, PA

268,000-sf Office Building
Chicago, IL

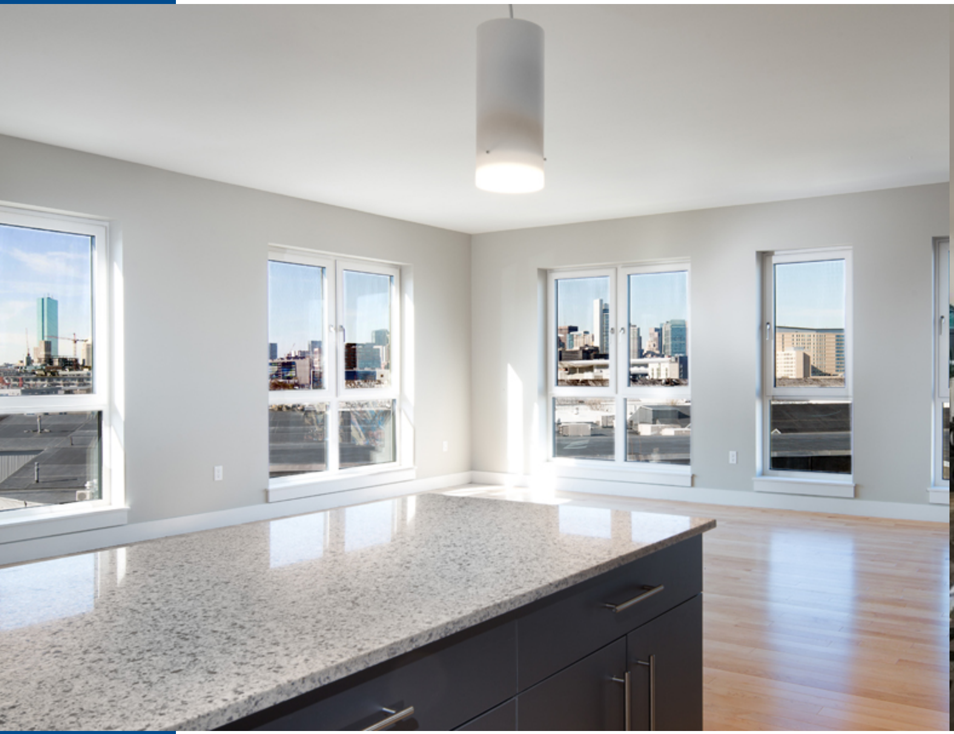
Lake Star Manufacturing Center
Colombo, Sri Lanka

Superior Performance



50% less energy

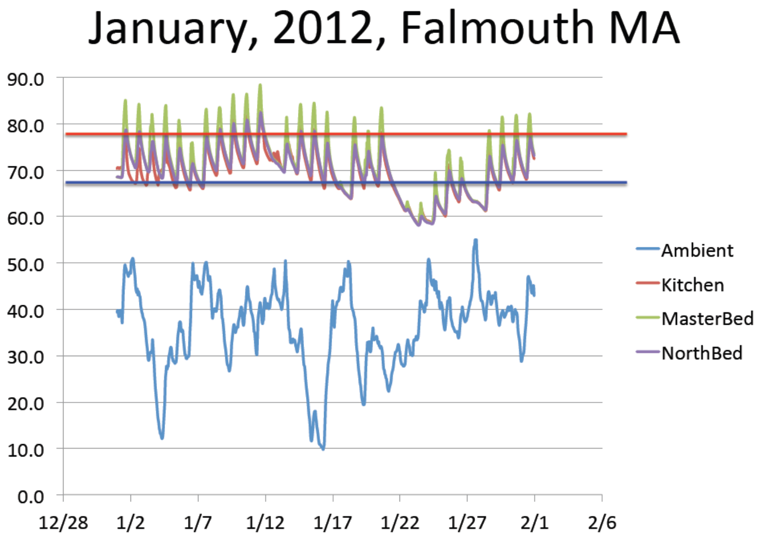
85% less heating



These 2000+ sf units:

- **Small heat pump**
- **No perimeter heating**
- **Simple distribution**

Falmouth Passive House



Passivehouse buildings will maintain internal temperature without mechanical space conditioning for long periods. The implication is that passivehosue can also be a demand side management strategy.

Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

Massachusetts Department of Energy Resources

Historic Retrofits – Insulate from inside

Does code allow it? Experimental?

Passive House Institute

PHIUS
Passive House Institute US

There are over 60,000 passivehouse buildings built world-wide. Passivehouse has been recognized in Massachusetts building code for over 8 years.

Getting results:

Newton Northland,
Newton, MA

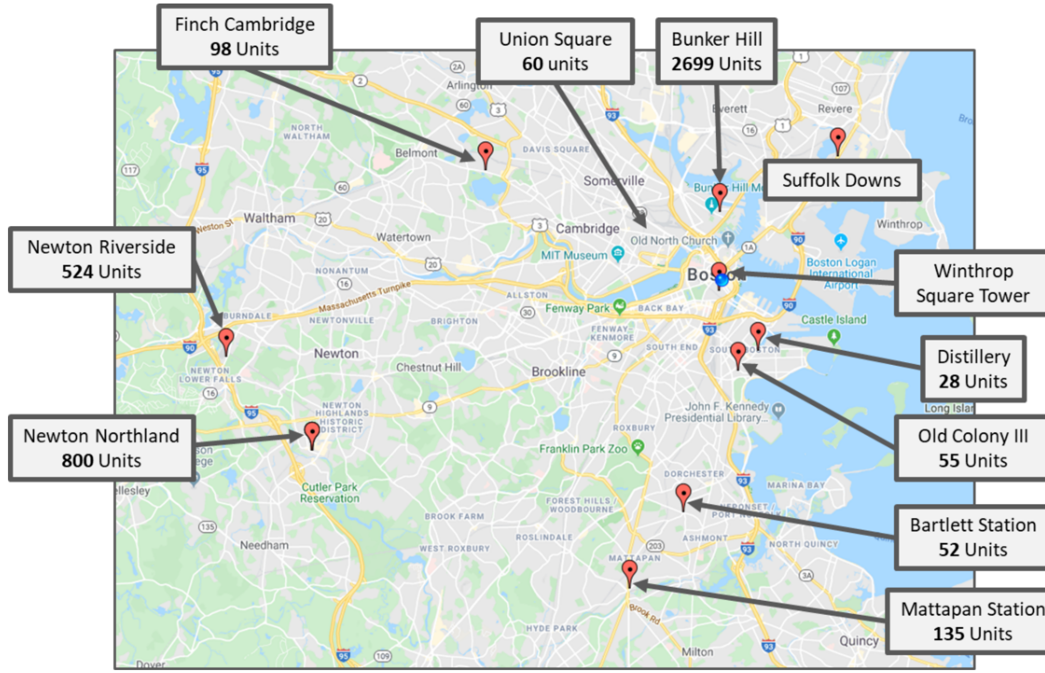
The Distillery
Boston, MA

Bunker Hill
Boston, MA

Winthrop Center
Boston, MA

Finch Cambridge
Cambridge, MA

Mattapan Station
Boston, MA



Creating A Clean, Affordable and Resilient Energy Future For the Commonwealth

Massachusetts Department of Energy Resources

Massachusetts Building Code

- Now in concurrency period
- Required 1 Jan 2021
- Many new/changed Mass amendments
  - EV ready wiring
  - Envelope
  - Solar readiness
  - Interior and exterior lighting
  - More additional efficiency measures (heat pumps, timber, many others)

Massachusetts Department of Energy Resources

Passive House in Action

Passive House Retrofits: 4 Unique Case Studies

By: Lois B. Arena, PE

Since 1972, Steven Winter Associates, Inc. has been providing research, consulting, and advisory services to improve the built environment for private and public sector clients.

Our services include:

- Energy Conservation and Management
- Sustainability Consulting
- Green Building Certification
- Accessibility Consulting

We have over 125 staff across three office locations:
New York, NY | Washington, DC | Norwalk, CT

For more information, visit
www.swinter.com

Pirelli Building, New Haven, CT

- Owner/developer: Becker + Becker
- Hotel Operator: Chesapeake Hospitality
- Architect: Becker + Becker
- MEP: LN Consulting
- Energy modeling: Second Law
- PH, LEED v4, & Enclosures: SWA

1970-1988

Armstrong
Rubber

Offices

Development
labs

1988-2003

Pirelli (tire company) bought and sold building

Vacant →

Vacant →

2003 – 2019

IKEA
owned

Vacant →

Vacant →

Pirelli Building Retrofit (New Haven, CT)

- Owner / Architect – Becker & Becker
- Re-developing to be all electric, net zero hotel and conference space
- Registered as a historic building
- Pursuing:
  - Net Zero
  - LEED Platinum
  - EnerPHit
  - Energy Star
  - UI Incentives
- **Main Driver: Owner wants to do it!**
- Just finished Design Development

Net Zero – Energy Production

- Total annual production ≈ 510,000 kWh/yr
  - ~130 kW on roof (30%)
  - ~290 kW on carport canopies (70%)

Net Zero – Energy Consumption

- Goal < 510,000 kWh/yr
  - **Equates to a site EUI < 18.0 kBtu/sf.yr**
- Currently evaluating how we get there…

KEY CONSIDERATIONS

- Limiting commercial kitchen energy use
- Limiting common area lighting energy
- Predicting annual average occupancy rates
- Ventilation controls
- High efficiency heat recovery on ventilation
- Electrification of domestic hot water (in addition to space heating)
- Passive House level enclosure

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Limiting Commercial Kitchen Energy Use

- **Coordinate** the following **assumptions** with kitchen designer
  - All electric possible?
  - Can we get away with only Type II hoods?
  - Heat recovery limitations on ventilation air
  - List of proposed equipment and electrical power draw
  - How long will each piece of equipment run for?

Limiting Commercial Kitchen Energy Use

- **Coordinate** the following **assumptions** with kitchen designer
  - All electric possible? **Yes**
  - Can we get away with only Type II hoods? **No, need Type I hoods**
  - Heat recovery limitations on ventilation air **Glycol loop (max SRE ≈ 30%)**
  - List of proposed equipment and electrical power draw
  - How long will each piece of equipment run for?

  Initial Pirelli estimates

  Proposed scenario = 301,000 kWh/yr (site EUI - 9.9 kBtu/sf.yr) !!

  Improved scenario = 150,000 kWh/yr (site EUI – 4.9 kBtu/sf.yr)

    - *Eliminating the one electric fryer*
    - *Cutting electric kettles (qty. 2) time of use from 12 to 2 hrs/day.*

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Electrification of DHW

- **Load reduction measures**
  - Low flow fixtures
  - Efficient recirculation pipe layout
  - Drain water heat recovery on shower drains
- **Efficient heating strategy**
  - 4 air-sourced heat pump water heaters (located indoors)
  - 700 gallons of DHW storage
- Initial energy estimate = 48,000 kWh/yr (site EUI – 1.6 kBtu/sf.yr)

Net Zero – Energy Consumption

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Passive House Level Enclosure

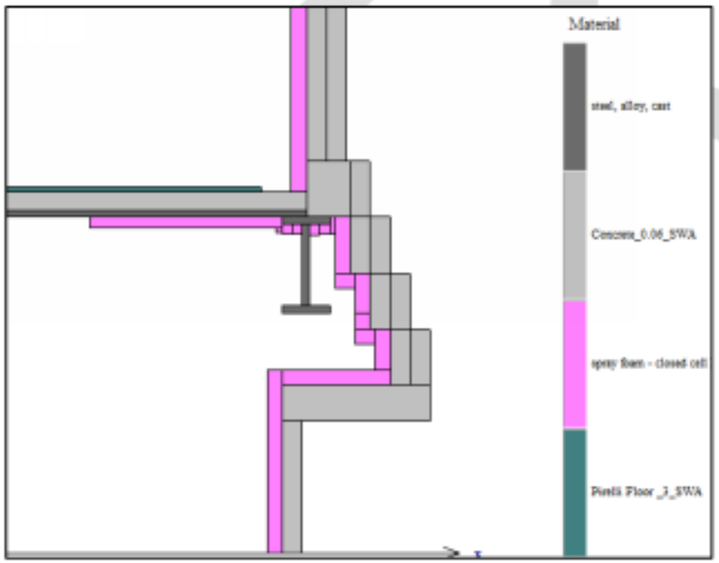
Exploratory site visit

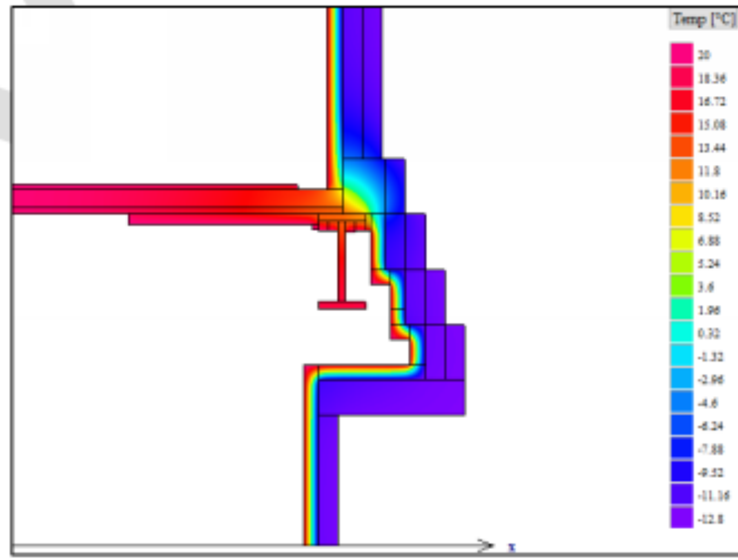
Passive House Level Enclosure

- **Can only insulate on interior. What is right amount of R-value?**
- R-21 to comply w/ EnerPHit
- Ongoing WUFI modeling to ensure no long-term issues
- Proposing a low GWP blowing agent closed cell spray foam (R-6.3 /in)

Passive House Level Enclosure

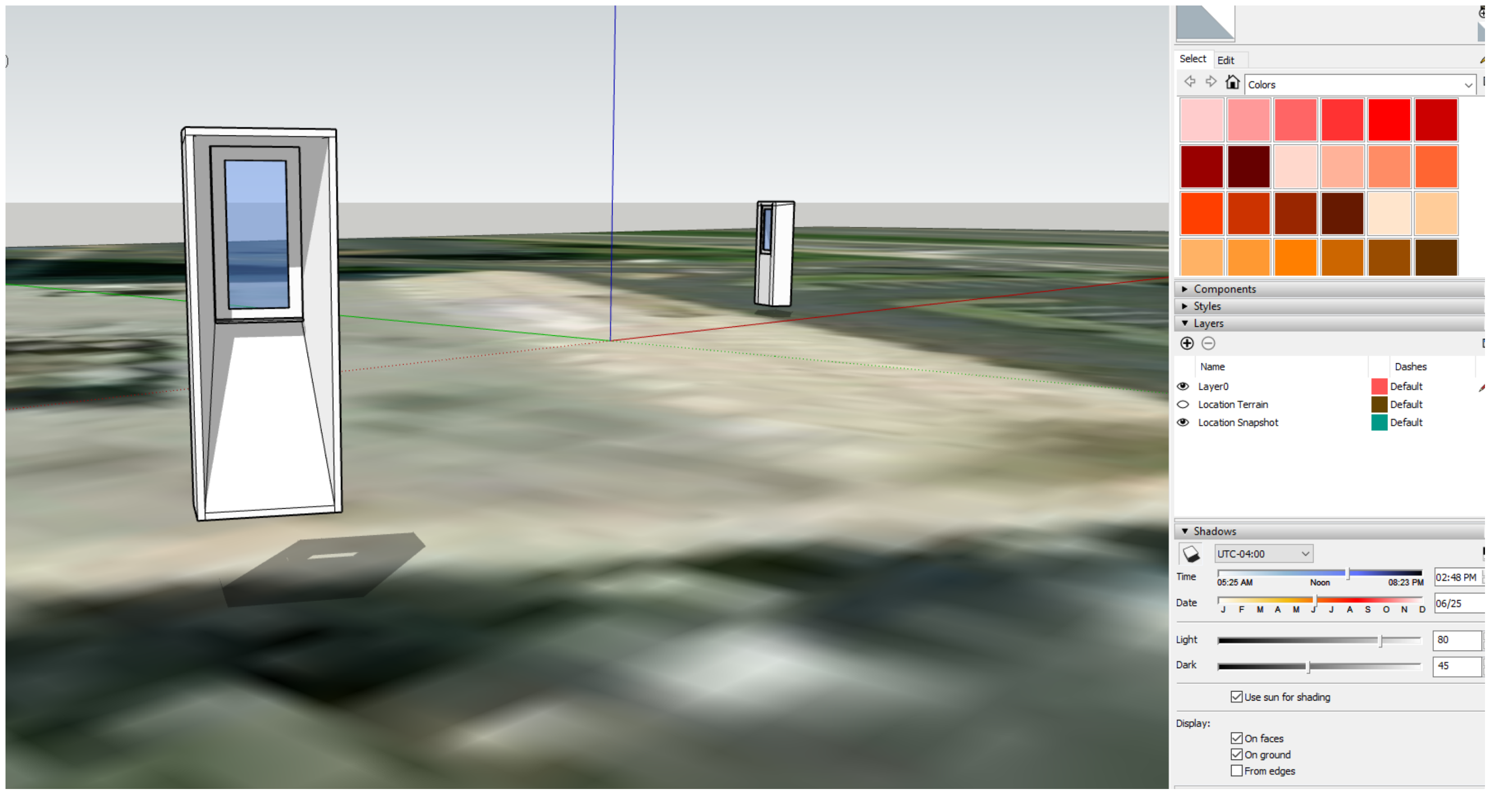
- **Typical slab edge thermal bridge**
- Condition modeled in 3D thermal modeling software





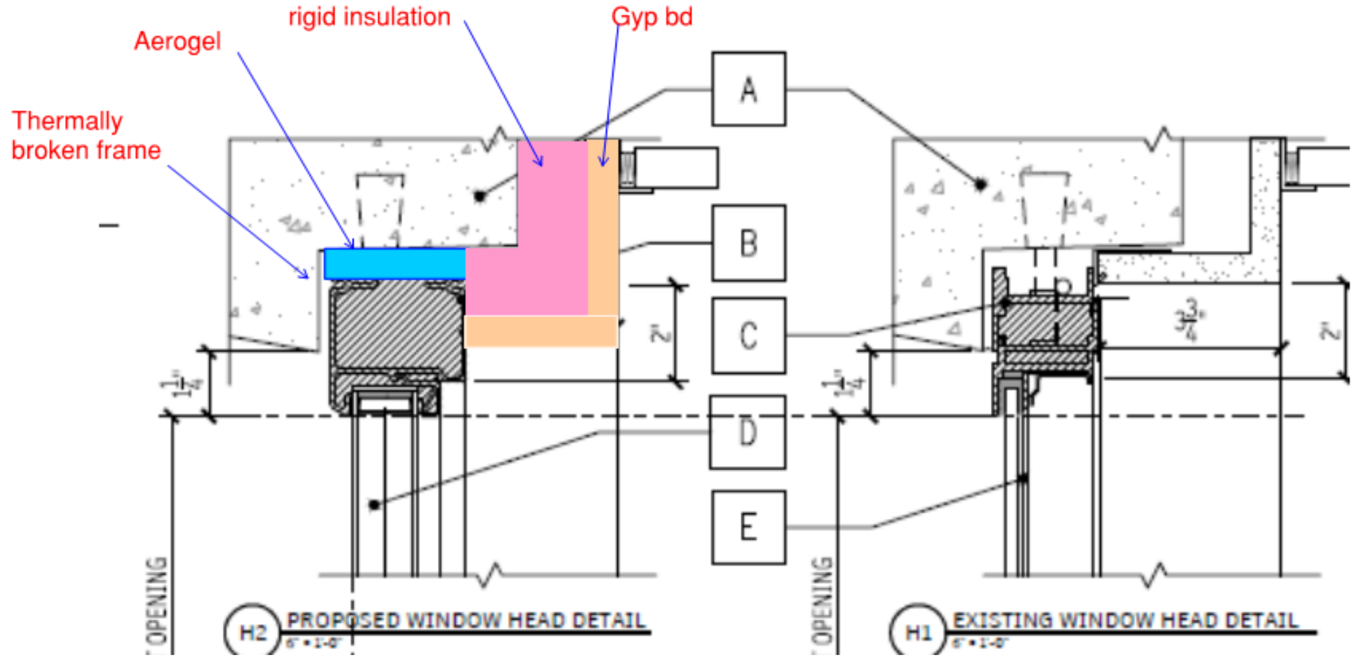
Passive House Level Enclosure

- **Windows**
- Shading Analysis in Sketchup / DesignPH



Passive House Level Enclosure

- **Windows**
- Triple pane
- Metal / uPVC / fiberglass (TBD)



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NND – PH Feasibility Summary

The Northland Newton Development

- Owner / developer – Northland Investment Corp. (note – Nothland is intending on owning these properties into the long-term future, not just a market rate flip)
- CM – Cranshaw
- Architect(s) – Cube3 for about half of the buildings, Stantec for the other half.
- MEP – AHA Engineers
- SWA is doing PH, LEED v4 for homes, and enclosures (and possibly embodied carbon)

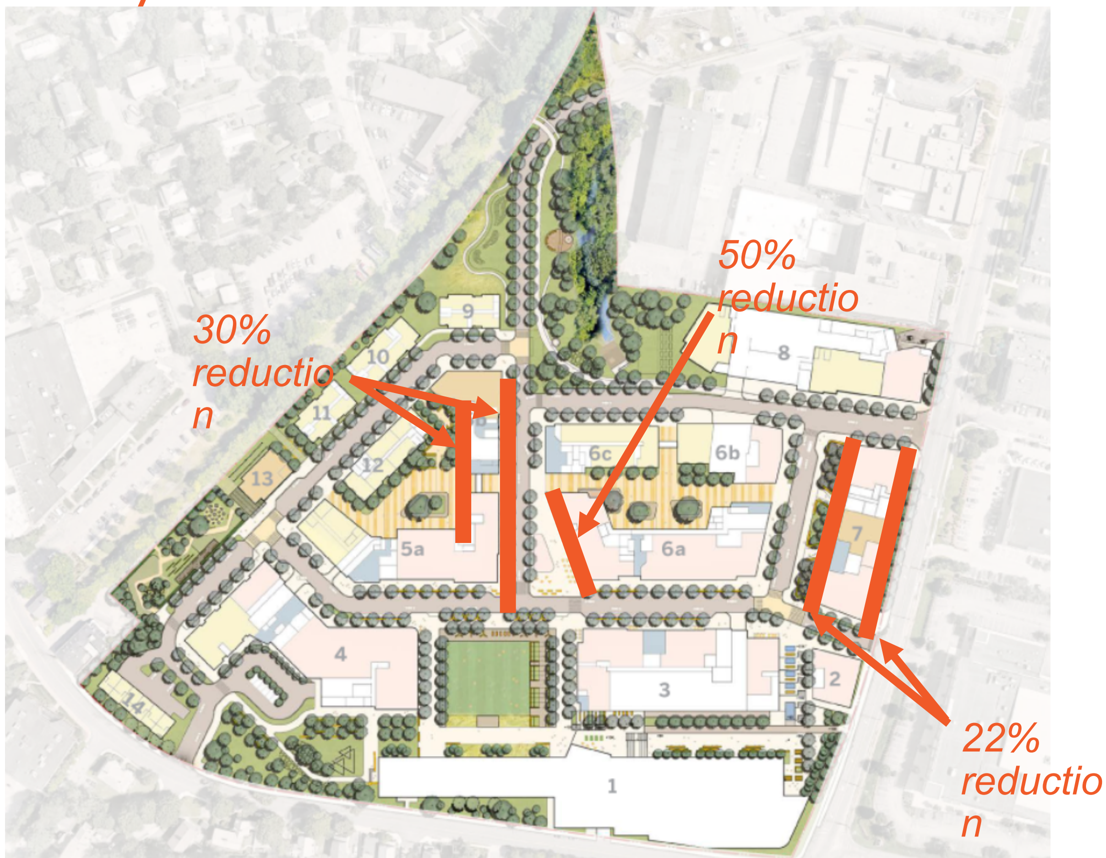
PH Feasibility Summary – **Design Matrix**

Steven Winter Associates, Inc. **NND Passive House Design Matrix**
April 16, 2020

Northland Newton Development Newton, MA								
PH Feasibility Project Code	NORTHNEW01A	NORTHNEW02A	NORTHNEW02B	NORTHNEW03A	NORTHNEW04A	NORTHNEW05A	NORTHNEW06A	NORTHNEW07A
Building	**3**	**4**	**8**	**5a/b**	**6a**	**6b/c**	**7**	**12**
				Design Matrix				
Building	**3**	**4**	**8**	**5a/b**	**6a**	**6b/c**	**7**	**12**
# floors	6	6	6	7	7	7	4	4
Square Footage (TFA)	95,872	111,605	95,615	161,404	115,274	106,369	50,617	25,464
# of apartments	94	106	80	157	126	119	50	23
sf per apartment	1,020	1,053	1,195	1,028	915	894	1,012	1,107
Wall R-value	25	25	23	21	20	21	21	24
Wall construction	2x6 w/ fiberglass batts + 1.5" exterior mineral wool (brick exterior)	2x6 w/ fiberglass batts + 1.5" exterior mineral wool (brick exterior)	2x6 w/ fiberglass batts + 1" exterior mineral wool (brick exterior)	Steel stud backup w/ 4" ccSF + 2.5" exterior mineral wool (brick exterior)	Steel stud backup w/ 4" ccSF + 2.5" exterior mineral wool (brick exterior)	Steel stud backup w/ 4" ccSF + 2.5" exterior mineral wool (brick exterior)	Steel stud backup w/ 4" ccSF + 2.5" exterior mineral wool (brick exterior)	2x4 w/ fiberglass batts + 3.5" XPS (brick exterior)
Window U-value	0.13	0.13	0.14	0.12	0.14	0.12	0.14	0.14
Window-to-wall ratio	42%	42%	33%	34%	53%	39%	57%	20%
WWR reduction required?	No	No	No	Yes	Yes	No	Yes	No
Reduced WWR (if required)	-	-	-	29%	49%	-	47%	-
DHW (central or decentral)	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks	Dectentral in-unit electric tanks
ERV efficiency (%)	84%	84%	84%	83%	84%	83%	84%	84%
ERV fan efficiency (W/CFM)	0.76	0.76	0.76	0.90	0.90	0.90	0.90	0.90
Architect	Stantec	Cube 3	Cube3	Cube3	Stantec	Stantec	Stantec	Cube3

Notes
Building 5a/b *window areas on east and west facades should be decreased by 30% to comply with PH*
Building 6a *window areas on street facing west facade should be decreased by 50% to comply with PH*
Building 7 *window areas on east and west facades should be decreased by 22% to comply with PH*

PH Feasibility – **Window area reductions**



Design Items for Discussion: **Architectural**

- References for PH performance values
  - SWA feasibility report – ***more detailed project specific info***
  - SWA NND design matrix – ***summarized info***
- Exterior wall / façade assumptions
  - Brick exterior façade
- Glazing
  - Window to wall ratios
  - Proportions of curtain wall (stick-built?) vs. punched windows
- Structure of parking garage and ceiling insulation
- Air tightness between residential and commercial spaces
- Apartment compartmentalization
  - See SWA multifamily air sealing guides

Design Items for Discussion: **MEP / HVAC / Appliances**

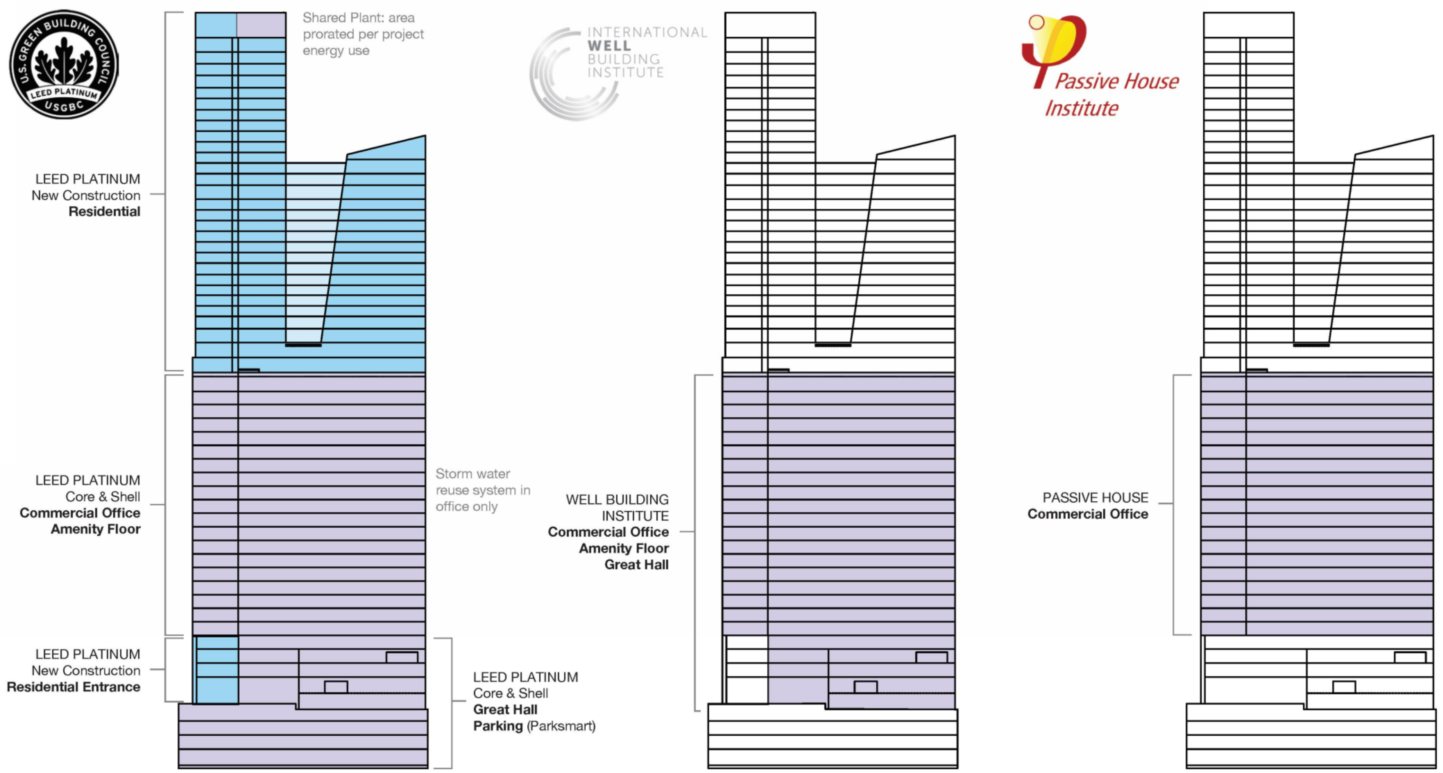
- Heating and cooling
  - Centralized vs. decentralized
  - Implications on LEED testing requirements with ducted systems
- Ventilation
  - Centralized vs. decentralized pros and cons
- Domestic hot water
  - In-unit vs. centralized
  - Electric vs. gas
- Dryers
  - Ventless, heat pump
- Lighting
  - Common area loads

WINTHROP SQAURE

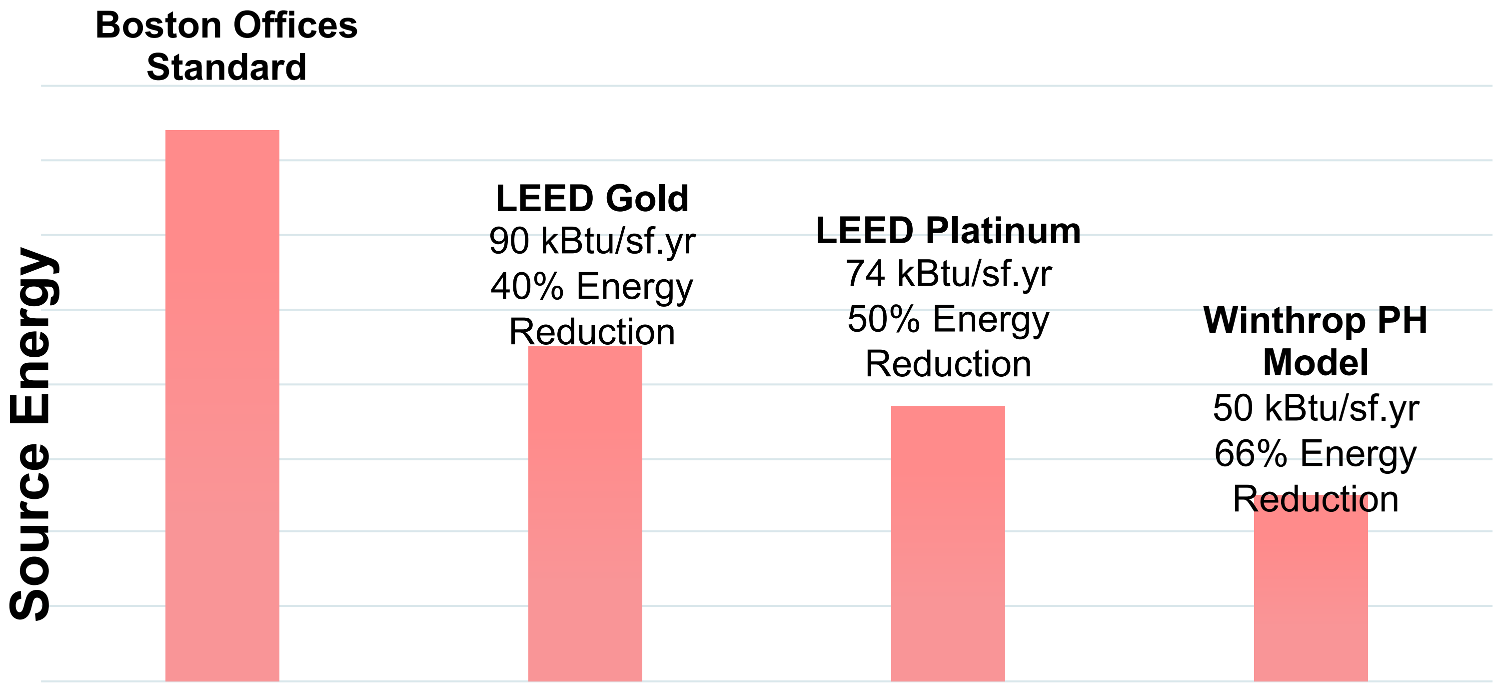
- 55 Story Mixed Use Tower, Boston
- 30 Stories Residential
- 20 Stories Office – 750,000 ft^2
- 5 Stories Retail/Mechanical

- Pursuing LEED Platinum and Passive House for Offices
- LEED Gold for Whole Building

Winthrop Square



EUI Comparison – Winthrop vs. Boston Offices



Curtain Wall Thermal Modeling – R-value Results

OUTPUTS							
	Sum of Heat Flows (W)	U Value (W/m²·K)	U Value (Btu/hr·ft²·F)	R-Value	% Derate on R-value	Psi-value (Btu/hr·ft·F)	Notes
Non TB Case:	26.251	0.137	0.024	41.4	-		No slab edge TB or clip to slab
TB Case:	27.561	0.144	0.025	39.5	4.8%	0.0002	with slab edge and clip
Alt. Case 1:	31.596	0.165	0.029	34.4	16.9%	0.0004	no interior insulation layer
Alt. Case 2:							
Alt. Case 3:							

- Target – R28
- SWA Modeled – R34.4 (22% above minimum threshold)
- Slab Edge Psi-value = 0.0004 Btu/hr.ft.F (0.0007 W/m.K)

PHPP Modeling – Full Occupancy Scenario

	PHI Threshold (kBtu/sf.yr)	Winthrop PHPP Model (kBtu/sf.yr)
Heating Demand	4.75	3.77
Cooling Demand	8.56	6.03
Primary Energy	38.04	73.81

	Assumption / Efficiency	Notes
Window to Wall Ratio	47%	Average across all office facades, % is vision area to total wall area (frames not included)
CW - Opaque Wall R-value	R-18	
CW - Windows	U-installed = 0.239 Btu/hf.ft^2.F SHGC = 0.37	

PHPP Modeling – 25% Occupancy Reduction Scenario

	PHI Threshold (kBtu/sf.yr)	Winthrop PHPP Model (kBtu/sf.yr)
Heating Demand	4.75	4.47
Cooling Demand	8.56	5.36
Primary Energy	38.04	68.13

	Assumption / Efficiency	Notes
Window to Wall Ratio	47%	Average across all office facades, % is vision area to total wall area (frames not included)
CW - Opaque Wall R-value	R-28	
CW - Windows	U-installed = 0.239 Btu/hf.ft^2.F SHGC = 0.37	

Internal Heat Gains

	Heating Season IHGs	Notes
PHI Standard Assumption	1.11 Btu/hr.ft^2 [3.5 W/m^2]	n/a
Winthrop Calculated Full Occupancy Scenario	2.09 Btu/hr.ft^2 [6.6 W/m^2]	Occupancy – 4,312
Winthrop Calculated 25% Reduced Occupancy Scenario	1.72 Btu/hr.ft^2 [5.4 W/m^2]	Occupancy – 3,234

***no** IHG credit additional pump & fan energy power is taken in heating season

2.5 Boundary conditions for the PHPP calculation

When verifying the criteria using the Passive House Planning Package (PHPP), the following boundary conditions must be fulfilled:

- Zoning
  The entire building envelope (e.g. a row of terraced houses, an apartment block or an office building with several thermally connected units) must be taken into account for calculation of the specific values. An overall calculation can be used to provide evidence of this. If all zones have the same set temperature, then a weighted average based on the TFA from individual PHPP calculations of several sub-zones may be used. Combination of thermally separated buildings is not permissible. For the certification of refurbishments or extensions, the area considered must contain at least one external wall, a roof surface and a floor slab or basement ceiling. Single units inside a multi-storey building cannot be certified. Buildings which are adjacent to other buildings (e.g. urban developments) must include at least one exterior wall, a roof area and a floor slab and/or basement ceiling to be eligible for separate certification.

- Internal heat gains
  The PHPP contains standard values for internal heat gains in a range of utilisation types. These are to be used unless PHI has specified other values (e.g. national values). The use of the individually calculated internal heat gains in PHPP is only permitted if it can be shown that actual utilisation will and must differ considerably from the utilisation on which the standard values are based.

Internal Heat Gains – Full Occupancy Scenario

Under PHI Standard IHG Heating Season Assumption

valk		code/City:	
	US-United States of America	e/Country:	
Interior temperature winter [°F]:	68.0	ummer [°F]:	77.0
Internal heat gains (IHG) heating case [BTU/(hr.ft²)]:	1.11	U/(hr.ft²)]:	2.28
Specific capacity [BTU/F per ft² TFA]:	19.0	al cooling:	x

Utilisation pattern: 20-Office / Admin. building

Values: 2-Standard

Occupancy: 4312 2-User determined

Specific building characteristics with reference to the treated floor area

							Fullfilled?[2]
	Treated floor area	ft²	550181		Criteria		
Space heating	Heating demand	kBTU/(ft²yr)	7.34	≤	4.75	154%	no
	Heating load	BTU/(hr.ft²)	6.55	≤	-	207%	
Space cooling	Cooling & dehum. demand	kBTU/(ft²yr)	6.03	≤	7.92	76%	yes
	Cooling load	BTU/(hr.ft²)	5.03	≤	-	139%	
	Frequency of overheating (> 77 °F)	%	-	≤	-		-
Frequency of excessively high humidity (> 0.012 lb/lb)		%	0.0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/hr	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kBTU/(ft²yr)	75.21	≤	38.04	198%	no
Primary Energy Renewable (PER)	PER demand	kBTU/(ft²yr)	44.19	≤	-	#VALUE!	-
	Generation of renewable energy (in relation to projected building footprint area)	kBTU/(ft²yr)	0.00	≥	-		

[2] Empty field: Data missing; '-': No requirement

Under Calculated IHG Assumption

l 2		Street:	
alk		code/City:	
	US-United States of America	e/Country:	
Interior temperature winter [°F]:	68.0	ummer [°F]:	77.0
Internal heat gains (IHG) heating case [BTU/(hr.ft²)]:	2.09	U/(hr.ft²)]:	2.28
Specific capacity [BTU/F per ft² TFA]:	19.0	al cooling:	x

Internal heat gains

Utilisation pattern: 20-Office / Admin. building

Values: 4-PHPP calculation ('IHG non-res' worksheet)

Occupancy: 4312 2-User determined

Specific building characteristics with reference to the treated floor area

							Fullfilled?[2]
	Treated floor area	ft²	550181		Criteria		
Space heating	Heating demand	kBTU/(ft²yr)	3.76	≤	4.75	79%	yes
	Heating load	BTU/(hr.ft²)	5.57	≤	-	176%	
Space cooling	Cooling & dehum. demand	kBTU/(ft²yr)	6.03	≤	7.92	76%	yes
	Cooling load	BTU/(hr.ft²)	5.03	≤	-	109%	
	Frequency of overheating (> 77 °F)	%	-	≤	-		-
Frequency of excessively high humidity (> 0.012 lb/lb)		%	0.0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/hr	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kBTU/(ft²yr)	72.17	≤	38.04	190%	no
Primary Energy Renewable (PER)	PER demand	kBTU/(ft²yr)	40.00	≤	-	#VALUE!	-
	Generation of renewable energy (in relation to projected building footprint area)	kBTU/(ft²yr)	0.00	≥	-		

[2] Empty field: Data missing; '-': No requirement

IHG – 25% Reduced Occupancy Scenario

Under PHI Standard IHG Assumption

I 2	Street:	Internal heat gains	
alk	tcode/City:	Utilisation pattern:	20-Office / Admin. building
US-United States of America	e/Country:	Values:	2-Standard
Interior temperature winter [°F]:	68.0	mer [°F]:	77.0
Internal heat gains (IHG) heating case [BTU/(hr.ft²)]:	1.11	/(hr.ft²)]:	2.28
Specific capacity [BTU/F per ft² TFA]:	19.0	l cooling:	x
Occupancy	3234	2-User determined	

Specific building characteristics with reference to the treated floor area

	Treated floor area	ft²	550181		Criteria		Fullfilled?[2]
Space heating	Heating demand	kBTU/(ft²yr)	6.79	≤	4.75	143%	no
	Heating load	BTU/(hr.ft²)	6.31	≤	-	199%	
Space cooling	Cooling & dehum. demand	kBTU/(ft²yr)	5.35	≤	6.66	80%	yes
	Cooling load	BTU/(hr.ft²)	4.98	≤	-	138%	
	Frequency of overheating (> 77 °F)	%	-	≤	-		-
Frequency of excessively high humidity (> 0.012 lb/lb)		%	0.0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/hr	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kBTU/(ft²yr)	68.70	≤	38.04	181%	no
Primary Energy Renewable (PER)	PER demand	kBTU/(ft²yr)	39.82	≤	-	#######	-
	Generation of renewable energy (in relation to projected building footprint area)	kBTU/(ft²yr)	0.00	≥	-		

[2] Empty field: Data missing; '-': No requirement

Under Calculated IHG Assumption

I 2	Street:	Internal heat gains	
alk	tcode/City:	Utilisation pattern:	20-Office / Admin. building
US-United States of America	e/Country:	Values:	4-PHPP calculation ('IHG non-res' worksheet)
Interior temperature winter [°F]:	68.0	mer [°F]:	77.0
Internal heat gains (IHG) heating case [BTU/(hr.ft²)]:	1.72	/(hr.ft²)]:	2.28
Specific capacity [BTU/F per ft² TFA]:	19.0	l cooling:	x
Occupancy	3234	2-User determined	

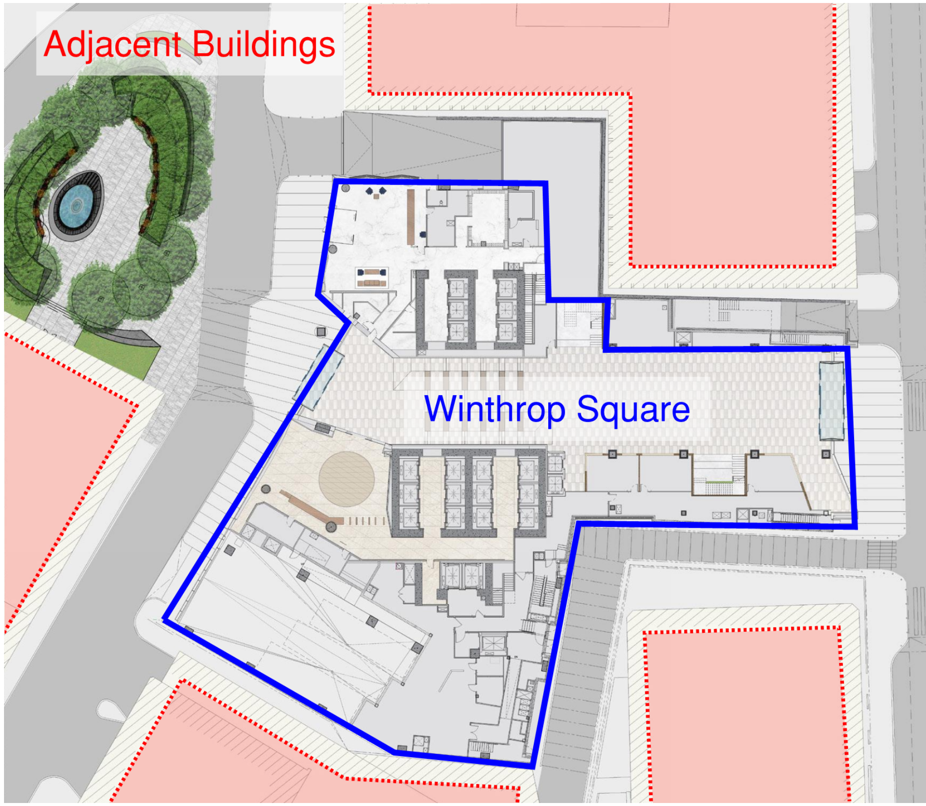
Specific building characteristics with reference to the treated floor area

	Treated floor area	ft²	550181		Criteria		Fullfilled?[2]
Space heating	Heating demand	kBTU/(ft²yr)	4.48	≤	4.75	94%	yes
	Heating load	BTU/(hr.ft²)	5.70	≤	-	180%	
Space cooling	Cooling & dehum. demand	kBTU/(ft²yr)	5.35	≤	6.66	80%	yes
	Cooling load	BTU/(hr.ft²)	4.98	≤	-	118%	
	Frequency of overheating (> 77 °F)	%	-	≤	-		-
Frequency of excessively high humidity (> 0.012 lb/lb)		%	0.0	≤	10		yes
Airtightness	Pressurization test result n_{50}	1/hr	0.6	≤	0.6		yes
Non-renewable Primary Energy (PE)	PE demand	kBTU/(ft²yr)	66.72	≤	38.04	175%	no
Primary Energy Renewable (PER)	PER demand	kBTU/(ft²yr)	37.08	≤	-	#######	-
	Generation of renewable energy (in relation to projected building footprint area)	kBTU/(ft²yr)	0.00	≥	-		

[2] Empty field: Data missing; '-': No requirement

Winthrop Square
Design Requirements

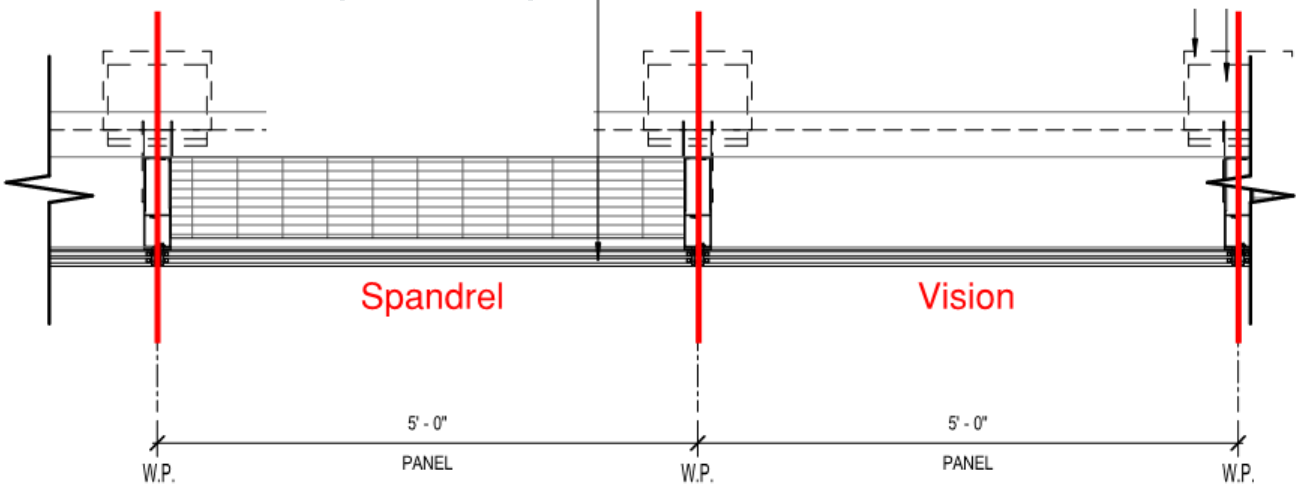
- Completely custom system
- Unitized system in 5 ft modules
- Hung from inside
- High wind loads
- **Stringent thermal requirements for PH** **R-18**
  - Opaque U-value ≤ 0.055 Btu/hr.ft².°F
    (0.312 W/m².K)
  - Vision U-value ≤ 0.220 Btu/hr.ft².°F
    (1.249 W/m².K)



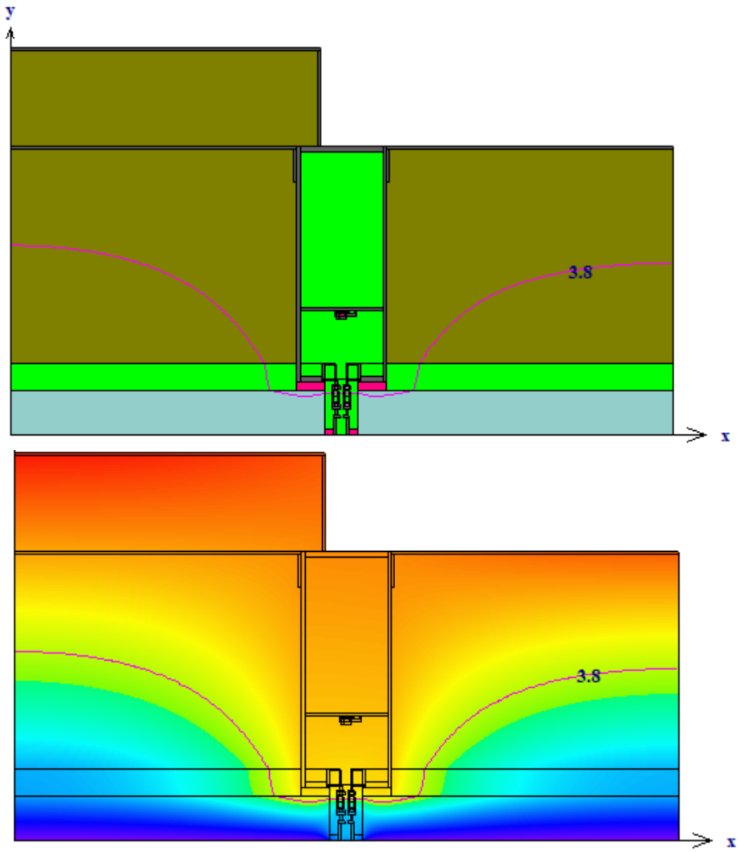
Curtain Wall **Nomenclature Bridge**

Curtain Wall
Nomenclature Bridge

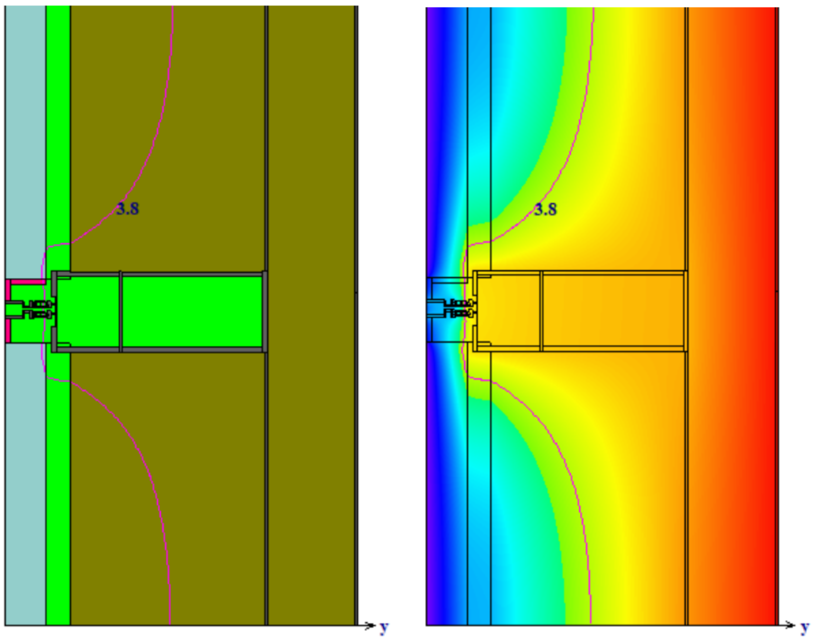
Passive House World	**=**	***Curtain Wall World***
• Window	=	“Vision panel”
• Opaque Wall	=	“Spandrel panel”



Winthrop Square **Condensation Evaluation**



Unique 3D Details (Heat3)



Contact Us

Steven Winter Associates, Inc.

61 Washington Street, Norwalk, CT 06854

Lois Arena, Director, Passive House Services

larena@swinter.com

203.857.0200 x 2140

www.swinter.com

COMMITTED TO ENERGY EFFICIENCY *ACROSS NEW ENGLAND*

Brendan Giza-Sisson
Energy Consultant
Eversource

Kimberly Cullinane
Senior Energy Efficiency Consultant
Eversource

Agenda

EVERSOURCE

- What is Mass Save?
- The Big Picture – Emission Reductions
- New Construction/Major Renovation – new/improved pathways

What is Mass Save?

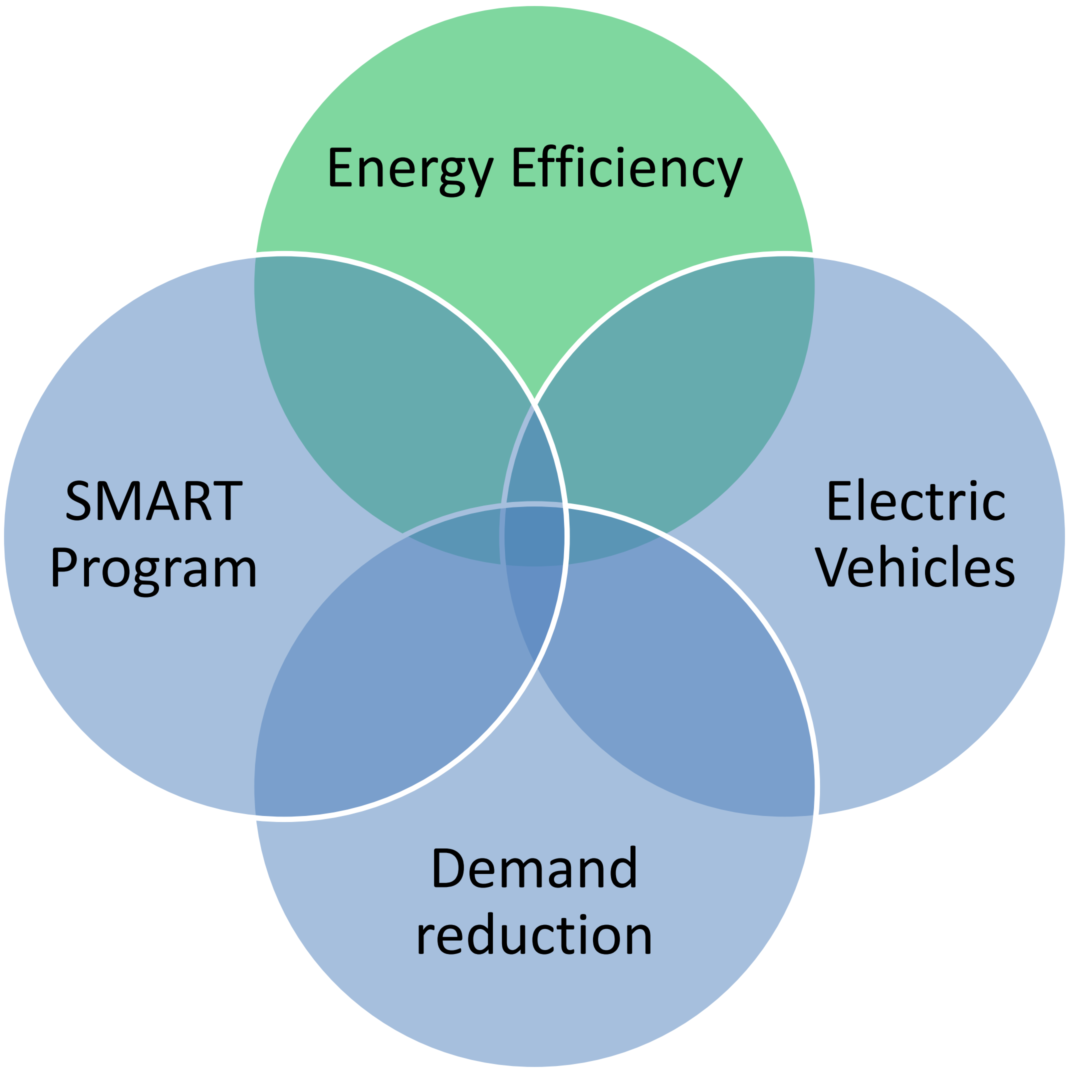
WE ARE MASS SAVE®:

"Helping residents and businesses across Massachusetts save money and energy, leading our state to a clean and energy efficient future"

- Per Green Communities Act – a System Benefit Charge is applied to electric and gas customers based on their usage
- Mass Save Sponsors provide energy efficiency incentives and technical support with these dollars

The Big Picture - Reducing Emissions

EVERSOURCE

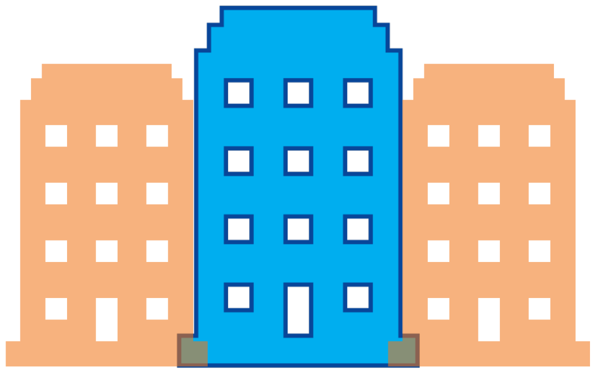


Zero Net Energy Building and Passive House

EVERSOURCE

Zero Energy Building

Heat pumps, LED, improved insulation, and solar to build a path to zero energy. Easier to build in infrastructure for DR and EV.



Passive House

A path to Zero Net Energy that focuses on the envelope, insulation, windows, air tightness and simplified mechanical systems

mass save

Why Zero Net Energy/Passive House and EUI Reduction Focus?

EVERSOURCE

Declining Savings

Code	kWh/ft²	Therm/ft²
IECC 2012	2.21	0.22
IECC 2015 + ISP	1.37	0.11
IECC 2018 + ISP	TBD	TBD

Investigate and Test New Approaches

TYP 2019-2021 says PAs will

- Explore using Energy Use Intensity (EUI) as a tool for driving savings
- Explore basing savings and incentives on actual building performance versus modeled
- Explore program models that focus on zero net energy and Passive House

Zero net new construction is part of locally driven carbon reduction plans

→

Accelerate trends & respond to customer needs

Passive House – Multi-Family New Construction

EVERSOURCE

Offer	Amount	Max. incentive
Feasibility Study	100% of feasibility costs	$5,000
Energy Modeling	75% of energy modeling costs	$20,000
Pre-Certification	$500/unit	N/A

Offer	Amount	Max. incentive
Certification	$2500/unit	N/A
Net Performance Bonus	$0.75/kWh	N/A
	$7.50/therm	N/A

https://www.masssave.com/saving/residential-rebates/passive-house-incentives

mass save

Passive House – Training

- Passive House Training
  - No-cost Lunch & Learns
  - No-cost Hands-On Workshops
  - 50% PHIUS/PHI Professional Accreditation Cost Share

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https://www.masssave.com/en/saving/residential-rebates/passive-house-training

Proposed Program Pathways

EVERSOURCE

PAs must be able to reach all NC customers and building types

	Path 1	Path 2	Path 3	Path 4
New Paths	Zero Net Energy/Deep Energy Savings	Whole Building EUI Reduction	Whole Building Streamlined	Systems
Former Paths	No targeted path – projects supported through Integrated Design	Integrated Design – Large Bldg	Integrated Design – Small Bldg	Systems (same)

Key program changes are in Paths 1 and 2

Zero Net Energy/Deep Energy Savings Path

EVERSOURCE

Requirements

- ZNE, Zero Net Ready or Passive House (as a pathway to zero) intended
- Minimum 20,000 sf of heated and cooled space
- Engage your Mass Save Program Administrator before 50% Schematic Design
- Year round occupancy
- Enhanced commissioning, including envelope
- Customers must be willing to drive toward achieving the EUI target during occupancy (and willing to work with PA through 1 year post occupancy)

Technical Assistance

- ZNE expert provided and supported to help set EUI target and optimize EUI reduction strategies, energy modeling, mid-design feedback

Zero Net Energy/Deep Energy Savings Path

EVERSOURCE

Summary of ZNE/Deep Energy Savings Incentives		
Customer Incentives		
Construction Incentive	Paid if the project design successfully achieves either a 25 EUI or negotiated EUI target	$1.25/sf
Bonus Post Occupancy Incentive	Available 1-year post-occupancy period if customer successfully shows the project achieved the target EUI in practice	$1.00/sf
ZNE or PH Certification Incentive	Paid to customers who officially certify their projects as NZE or PH	$3,000
Design Team Incentives		
Calculated at $0.20/sf and capped at $15,000, but not less than $8,000 per project		

Whole Building EUI Reduction Path

Requirements

- Minimum 50,000 sf of heated and cooled space
- Engage Eversource before 50% Design Development
- Participating projects must aim at meeting at least a 10% EUI reduction from the Mass Save baseline
- Energy-intensive projects less than 50,000 sf in size may also be eligible to participate

Technical Assistance

- EUI target setting, EUI reduction strategy support, energy modeling, mid-design feedback

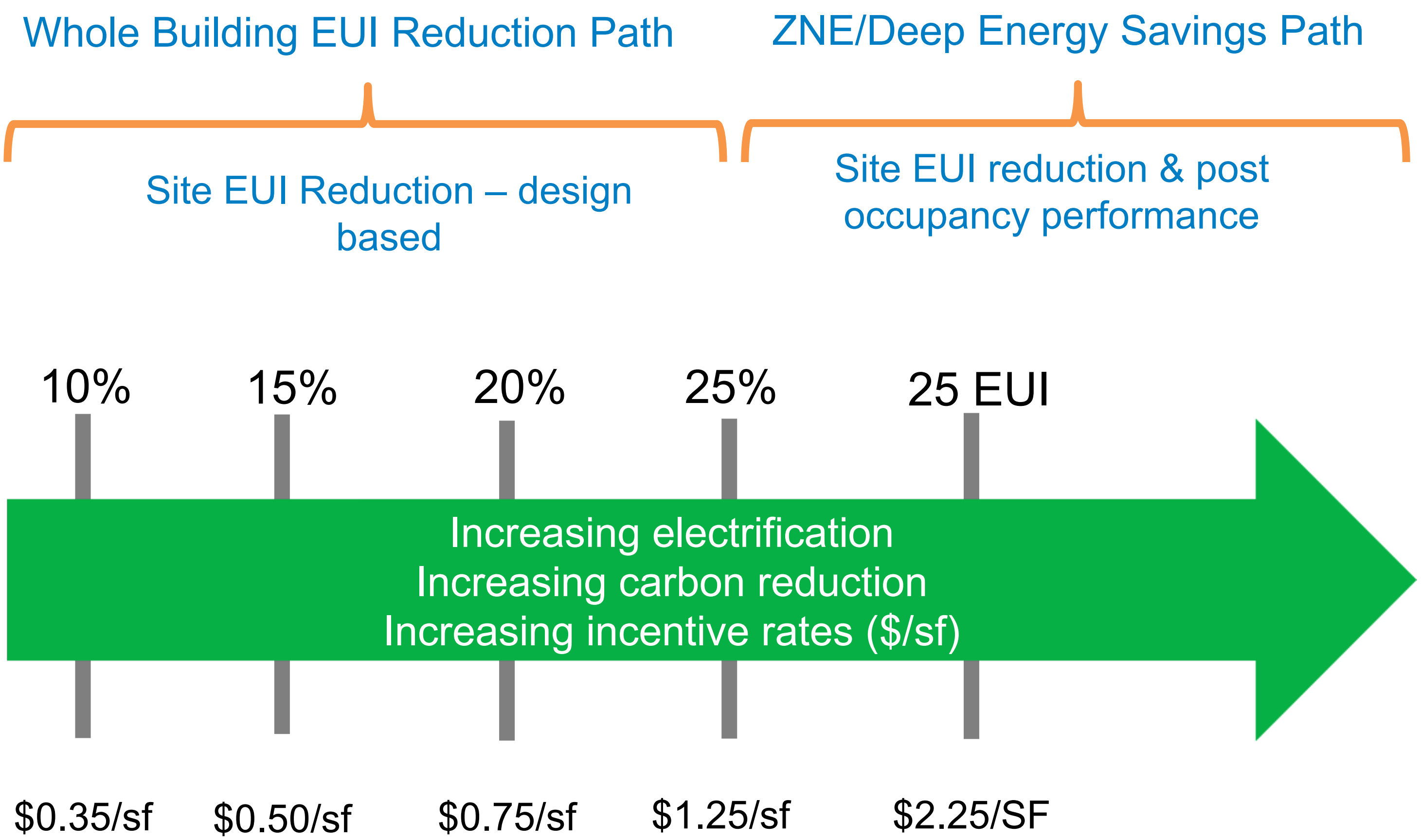
Whole Building EUI Reduction Path

EVERSOURCE

DRAFT Whole Building EUI Reduction Incentives	
Customer Incentives	
Percent EUI Reduction	**Rate**
10.0% - 14.9%	$0.35/sf
15.0% - 19.9%	$0.50/sf
20.0% - 24.9%	$0.75/sf
25.0% and above	$1.25/sf
Design Team Incentives	
Based on Percent EUI Reduction	Rates TBD (capped at $15,000 per project)

Key Program Change – Incentivizing Low Site EUIs

EVERSOURCE



As EUI % reductions increase, so do incentive rates

Proposed Upcoming LBE Council Topics

- Financing and incentives for clean energy and sustainability projects
- Effective sustainability marketing and communications
- Biofuels (bioheat and biodiesel)
- Building electrification through air source heat pumps
- 2050 Decarbonization Roadmap and 2030 Implementation Plan
- Other ideas?

Next LBE Council Meeting

Save the Date!

Tuesday, September 8, 2020

10:00 am–12:30 pm

Upcoming Tentative Meeting Dates:

Nov 10

Jan 12

March 9