Zero Net Carbon Building Zoning

Virtual Public Meeting #2

Presentation

Zoom Chat Notes have added at the end

boston planning & development agency

October 20, 2021

Zoom Meeting Guidance

It’s great to see you! Participant video can be on during the meeting.

To avoid background noise mics will be muted.

Please **Use the Chat** feature for questions and comments during the presentation and Q&A segment. We will respond to Chat postings as best and we can.

The BPDA will record this meeting.

The recording and presentation with the Q&A / Chat comments will be posted on BPDA’s Zero Net Carbon Building Zoning webpage.

COVID-19 Resources

Stay up-to-date with COVID-19 related announcements, City of Boston reopening plans, and resources for you and your community at:

boston.gov/coronavirus

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AGENDA

1. Welcome and Introductions
2. Carbon Free Boston, Climate Action Plan 2019 Update & Building Emissions Reduction & Disclosure Ordinance
3. Article 37 and ZNC Update Recommendations
   - Framework - John Dalzell
   - Low Carbon Buildings - Colin Schless, Thornton Tomasetti, Jacob Knowles, BR+A
   - On-site Renewable Energy - Debra Perry, CADMUS
   - Renewable Energy Procurement - Vince Martinez, Architecture 2030
   - Embodied Carbon - Michelle Lambert, Carbon Leadership Forum / Lambert Sustainability
4. Next Steps
5. Q & A and Comments - *Zoom Chat Notes have been added at the end.*

Climate Action and Building Emissions Reduction and Disclosure Ordinance (BERDO 2.0)

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Boston’s climate is changing. Global climate change is causing sea level rise, extreme heat and stormwater flooding. Communities of color and other socially vulnerable populations are disproportionately impacted.

We have reduced our emissions by 1/5 since 2005, but our emissions are not decreasing fast enough.

We need to accelerate carbon reductions by pursuing:

1. Efficiency
2. Electrification
3. Clean energy
4. Social equity

CITY OF BOSTON

CLIMATE ACTION PLAN

2019 UPDATE

MAYOR MARTIN J. WALSH

October 2019

1 CONSTRUCT NEW MUNICIPAL BUILDINGS TO A ZERO NET CARBON STANDARD

2 ADOPT A ZERO NET CARBON STANDARD FOR CITY-FUNDED AFFORDABLE HOUSING IN BOSTON

3 STRENGTHEN GREEN BUILDING ZONING REQUIREMENTS TO A ZERO NET CARBON STANDARD

4 INVEST IN ENERGY EFFICIENCY AND RENEWABLE ENERGY GENERATION IN MUNICIPAL BUILDINGS

5 DEVELOP A CARBON EMISSIONS PERFORMANCE STANDARD TO DECARBONIZE EXISTING LARGE BUILDINGS

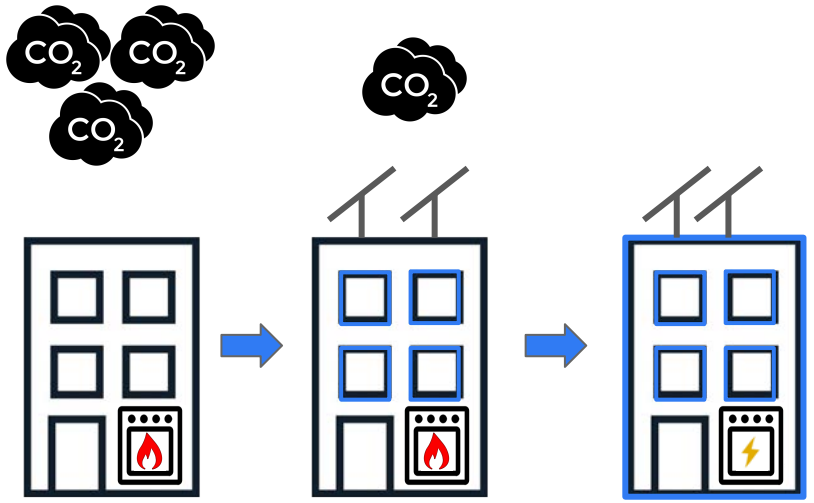
6 EXPAND WORKFORCE DEVELOPMENT PROGRAMS FOR BUILDING DECARBONIZATION

7 ADVOCATE FOR STATE BUILDING POLICIES THAT ALIGN WITH CARBON NEUTRALITY BY 2050

WHAT IS A BUILDING PERFORMANCE STANDARD?

A building performance standard sets carbon targets for existing large buildings that decrease over time.

4% of buildings account for 60% of building sector emissions.



BERDO - EMISSIONS STANDARDS

- Developed through the technical analysis process
- Aligned with citywide goals
- Buildings with multiple use-types can adopt a blended target

Building use	Emissions standard ($kgCO_2e/SF/yr.$)					
	2025-2029	2030-2034	2035-2039	2040-2044	2045-2049	2050-
Assembly	7.8	4.6	3.3	2.1	1.1	0
College/ University	10.2	5.3	3.8	2.5	1.2	0
Education	3.9	2.4	1.8	1.2	0.6	0
Food Sales & Service	17.4	10.9	8.0	5.4	2.7	0
Healthcare	15.4	10.0	7.4	4.9	2.4	0
Lodging	5.8	3.7	2.7	1.8	0.9	0
Manufacturing/ Industrial	23.9	15.3	10.9	6.7	3.2	0
Multifamily housing	4.1	2.4	1.8	1.1	0.6	0
Office	5.3	3.2	2.4	1.6	0.8	0
Retail	7.1	3.4	2.4	1.5	0.7	0
Services	7.5	4.5	3.3	2.2	1.1	0
Storage	5.4	2.8	1.8	1.0	0.4	0
Technology/Science	19.2	11.1	7.8	5.1	2.5	0

Developed by Synapse Energy Economics for the City of Boston.

BERDO 2.0 Key Features

Covered buildings: 20,000+ square feet or 15+ units

Compliance Measures:

- Retrofit for efficiency
- Fuel switch
- Install or purchase renewable electricity
- Make an alternative compliance payment

MORE INFO AT

boston.gov/berdo

Establishes:

- Equitable Emissions Investment Fund
- Review Board

Article 37 / ZNC Update Recommendations

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City of Boston Environment

ZNC and Article 37 Updates

- Establish a ZNC Building Emissions Performance Standard for New Construction
- Lower Applicability Threshold to > 20k SF
- Increase Minimum LEED Outcome
- Align with BERDO Standards & Reporting
- Update Review Process

ZNC Policy Framework

Prioritized Practices:

1. **Low Carbon Building**
   Establish Building Emission Targets
1. **On-site Renewable Energy**
   Set Minimum Generation Standards
1. **Renewable Energy Procurement**
   Determine Acceptable Options

Plus

1. **Embodied Carbon**
   Identify Actions & Introduce Practice Standards

E+ (energy positive) Highland St — Studio G Architects

ZNC Buildings

Landmark Center

Modeled performance:
630,000 sf

- EUI = 101 kBtu/sf/yr
- CEI = 7.0 kg CO2e/sf/yr
- Solar PV 45 kWh
- 100% Renewable Energy Purcure

CO2e Emissions (tons/yr)

Building	3,868.
On-site RE	156. (less)
RE Procure	3,712. (less)
Zero Net	0.

Net Zero Office / Life Science Building
Hybrid Electric Design

- 93% Reduction in Fossil Fuels
- 53% Energy Savings

LEED Gold / 60 Points

ZNC Buildings

BU Center for Computing & Data Sciences

Modeled performance:
316,000 sf

- EUI = 39 kBtu/sf/yr
- CEI = 2.9 kg CO2e/sf/yr
- Solar PV 964 kWh (campus)
- 100% Renewable Energy Purchase

CO2e Emissions (tons/yr)

Building	1,090.
On-site RE	278. (less)
RE Procure	812. (less)
Zero Net	0.

ZNC Buildings (ready - Low Carbon & Installed PV)

Bunker Hill Housing Building F

Modeled performance:
271,844 sf

- EUI 19.1 kBtu/sf/yr
- CEI 1.48 kg CO2e/sf/yr
- Solar PV 81.9 kW

CO2e Emissions (tons/yr)

Building	445.
On-site RE	36. (less)
RE Procure	409. (less)
Zero Net	0.

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LOW CARBON BUILDINGS
TAG Recommendations

boston planning & development agency

Thornton Tomasetti

BRA

Recommended Pathway

Low Carbon Emitting Building - Percentile Emission Targets

Projects must meet a 40% carbon emissions reduction target compared to ASHRAE 90.1-2013 baseline* for all buildings typologies.

Except:

1. Licensed healthcare facilities that are not medical office buildings, which should meet a 30% carbon emissions reduction target.
2. Residential buildings that do NOT trigger stretch code AND the total area of any non-residential program is less than 40,000 GSF and does not exceed 50% of total GSF - these building must meet a HERS score 38 or lower.
3. Buildings committed to achieving Passive House certification via PHIUS+ or PHI.

Note: Calculations should be performed using 2035 Grid Electricity carbon emission factors.

*Project teams may opt to use the Massachusetts stretch code baseline (ASHRAE Standard 90.1-2013 with MA amendments, including additional efficiency packages).

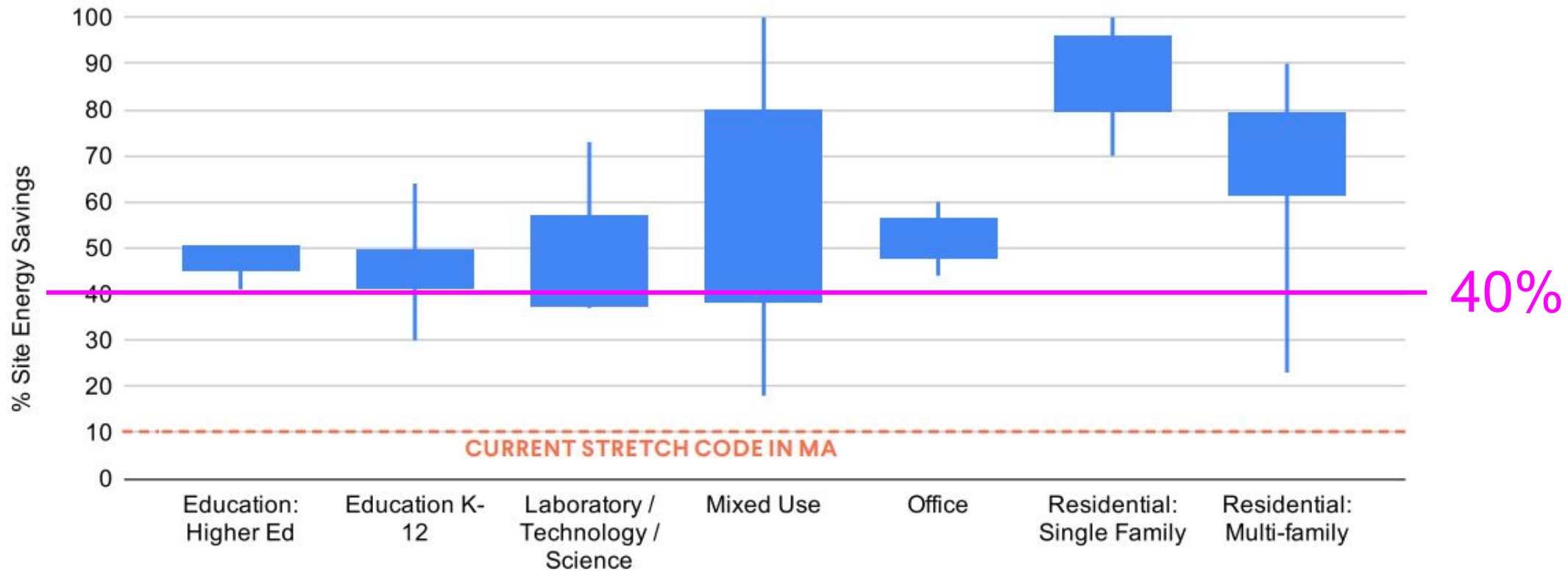
Low Carbon Building TAG

Benefiting from the contributions leading experts and professionals!

Members

- Abe Menzin, Samuels
- Adam Jennings, AHA Consulting Engineers
- Amy Barad, Massachusetts Clean Energy Center
- Andrea Love, Payette
- Andrew Hall, John Moriarty and Associates
- Anwen Robinson, Boston Development Group
- Blake Jackson, Stantec
- Brad Mahoney, MP Boston. /. Millennium Partners
- Chris Gray, PhD. PE, RENU Communities
- Christopher Schaffner, The Green Engineer, Inc.
- Claire McKenna, Rocky Mountain Institute
- Dan Bailey, Takeda Pharmaceuticals
- Darren Port, NEEP
- Gilbert Delgado, FAIA, Northeastern University
- Jacob Higginbottom, EYP
- Jeffrey Rios, AKF Group
- Joelle Jahn, WSP USA
- Julie Janiski, Buro Happold
- Julie Klump, Preservation of Affordable Housing
- Kate Bubriski, Arrowstreet
- Katie Raymond, Epsilon Associates
- Kendra Halliwell, ICON Architecture
- Kristen Fritsch, Elkus Manfredi Architects
- Lauren Baumann, New Ecology, Inc.
- Matthew Fickett, SGA
- Michelle Apigian, ICON Architecture
- Norm Lamonde, Turner Construction Company
- Rebecca Hatchadorian, Arup
- Samira Ahmadi, enviENERGY Studio LLC
- Shirine Boulos Anderson, Ellenzweig Associates Inc.
- Travis Anderson, Placetailor Inc
- Winston Vaughan, Health Care Without Harm
- Yve Torrie, A Better City

Percent Carbon Reduction



Source: Built Environment Plus - Massachusetts is Ready for Net Zero 2021 report

Recommended Pathway

Low Carbon Emitting Building - Carbon Emission Intensity (CEI) Targets

The following building typologies must aim to meet CEI targets below:

Building Typology	CEI Targets [kg CO2e/sf] Recommended	All electric site EUI [kBtu/sf-yr] (for reference only)
Office	1.6	30
College / University Office	1.6	30
K-12 School	1.3	25
Hotel	1.9	35
Residence Hall	1.6	30
Low Density Multifamily	1.1	20
High Density Multifamily	1.6	30
Dry Lab	4.3	80
Wet Lab	6.4	120
Hospital	7.4	139

- Targets are calculated using predicted 2035 carbon emission factors for electricity of 52 kg/MMBtu and current carbon emission factors as published by BERDO.
- Projects that are composed of more than one listed building typology should use a target based on area weighted average.
- Projects with unique conditions (e.g. schedules, loads, etc.) meeting the 40% carbon emissions reduction but not meeting the CEI target should have an opportunity to make a case for an adjusted value.

Carbon Emissions Factors

- Consistent Emission Factors should be used for BERDO and ZNC Zoning
- 2035 Grid Electricity emission factors should be used to more accurately represent the average mid-point lifespan of MEP system equipment

BERDO Aligned Carbon Emissions Factor

Fuel type	Emission factor (kg CO_2e/MMBtu)
Natural Gas	53.11
Fuel Oil (No. 1)	73.50
Fuel Oil (No. 2)	74.21
Fuel Oil (No. 4)	75.29
Diesel Oil	74.21
District Steam	66.40
District Hot Water	66.40
Electric Driven Chiller	52.70
Absorption Chiller using Natural Gas	73.89
Engine-Driven Chiller Natural Gas	49.31

Notes:

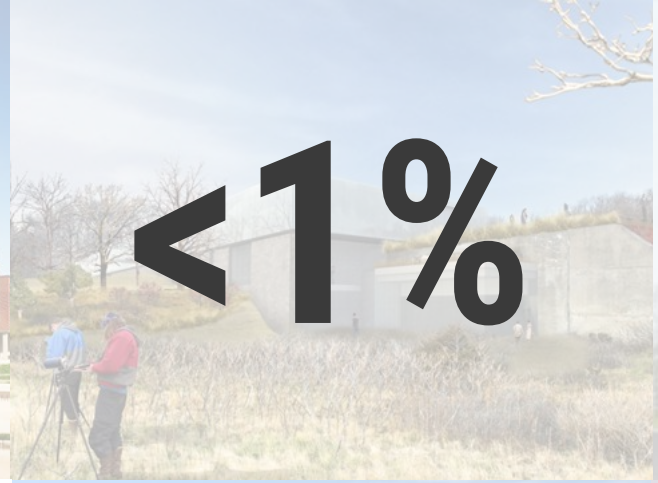
1. For service in Boston, DOER has recently calculated the District Steam Emission Factor to be 87.54 kg CO2e/MMBtu
2. For Grid Electricity, the 2035 Emission Factor is 52 kg CO2e/MMBtu

NET ZERO BUILDINGS

CONSTRUCTION COST PREMIUM

<1%


<1%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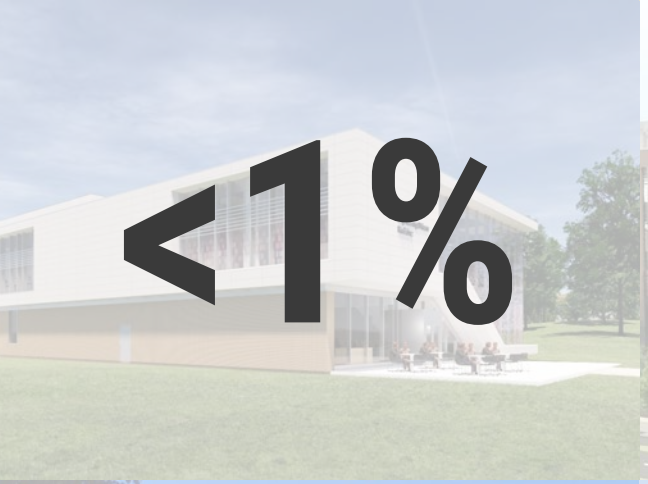
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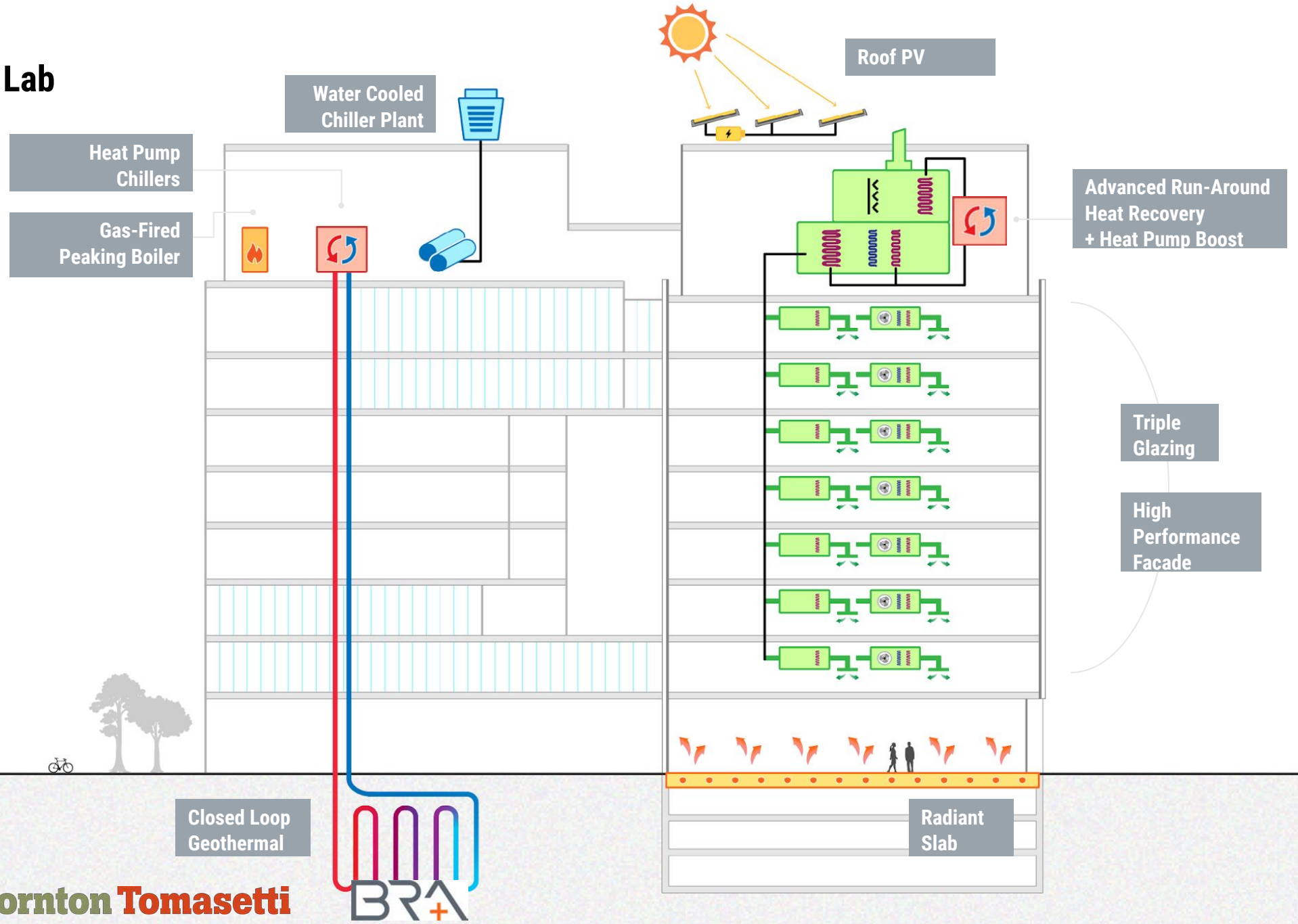
LARGE COLD-CLIMATE C&S LAB, CAMBRIDGE

Confidential Core-Shell Lab

Cambridge, MA



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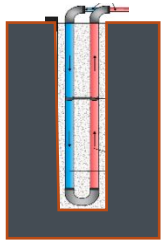
ELECTRIFICATION OPTIONS

1

GROUND-SOURCE

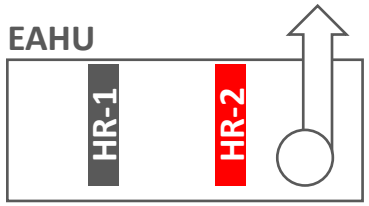


2

AIR-SOURCE

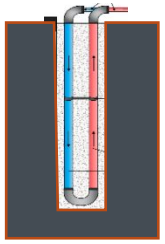
3

EXHAUST-SOURCE



4

AIR-SOURCE GROUND-SOURCE HYBRID



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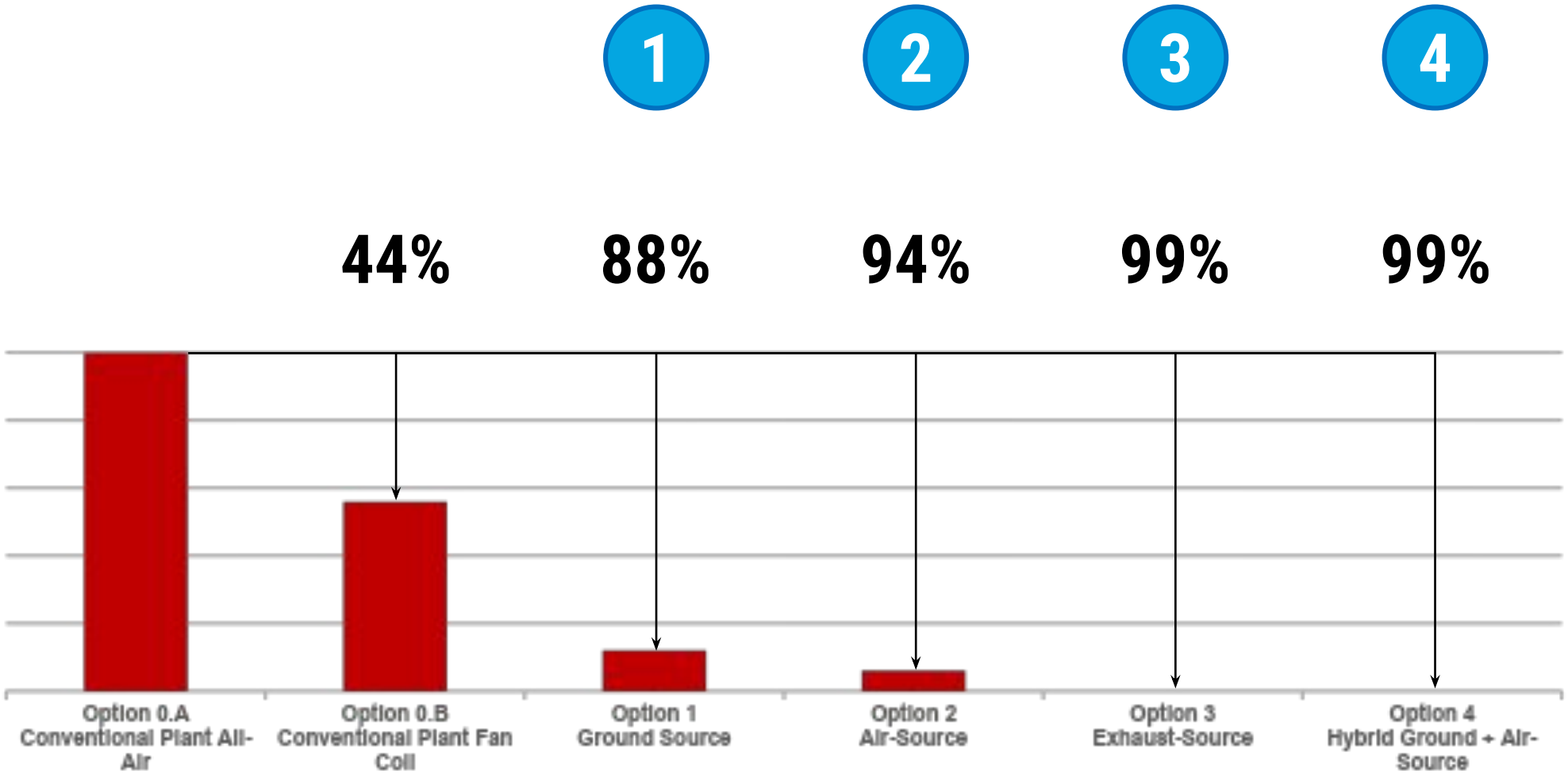
FOSSIL FUEL



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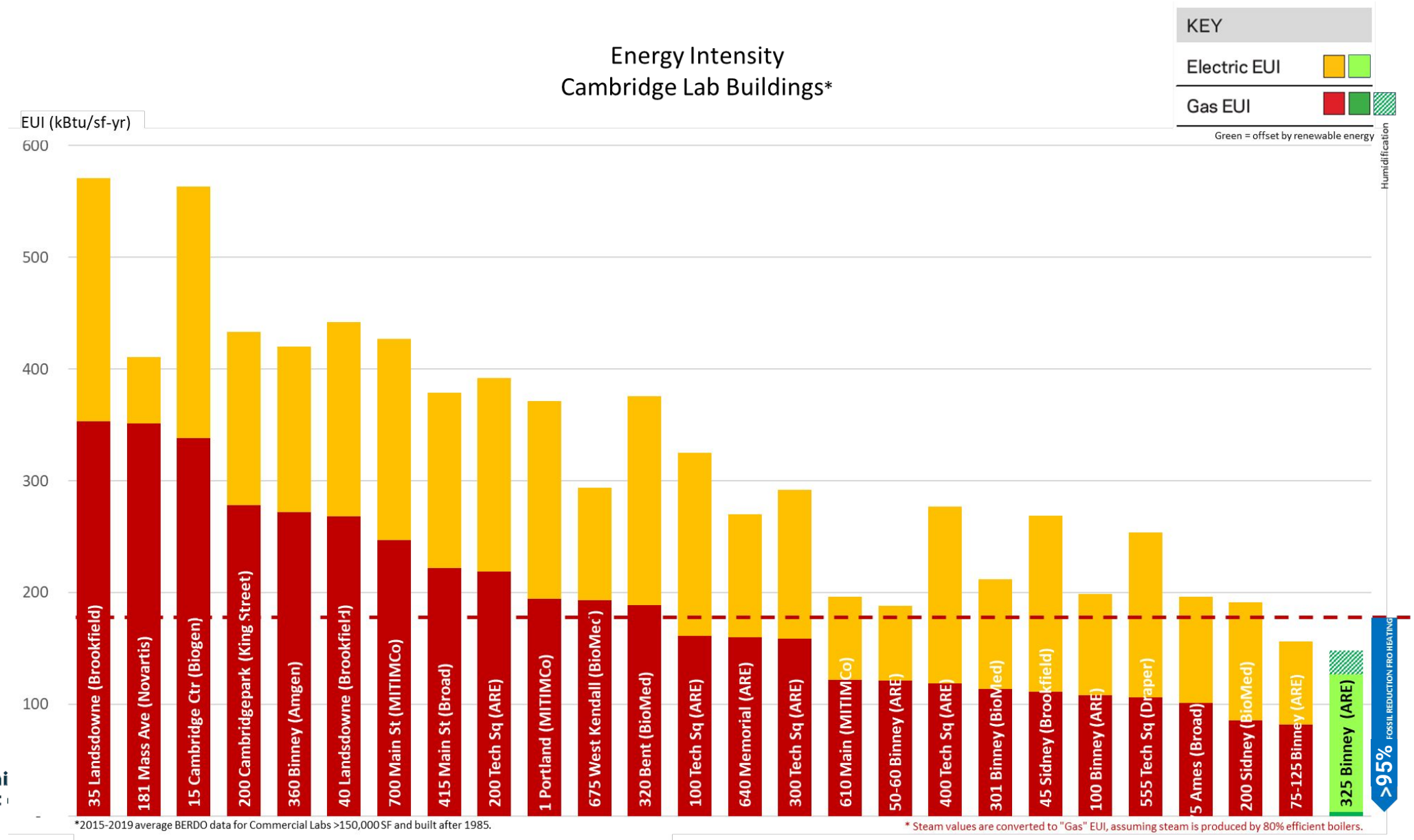
ULTRA-LOW FOSSIL FUEL



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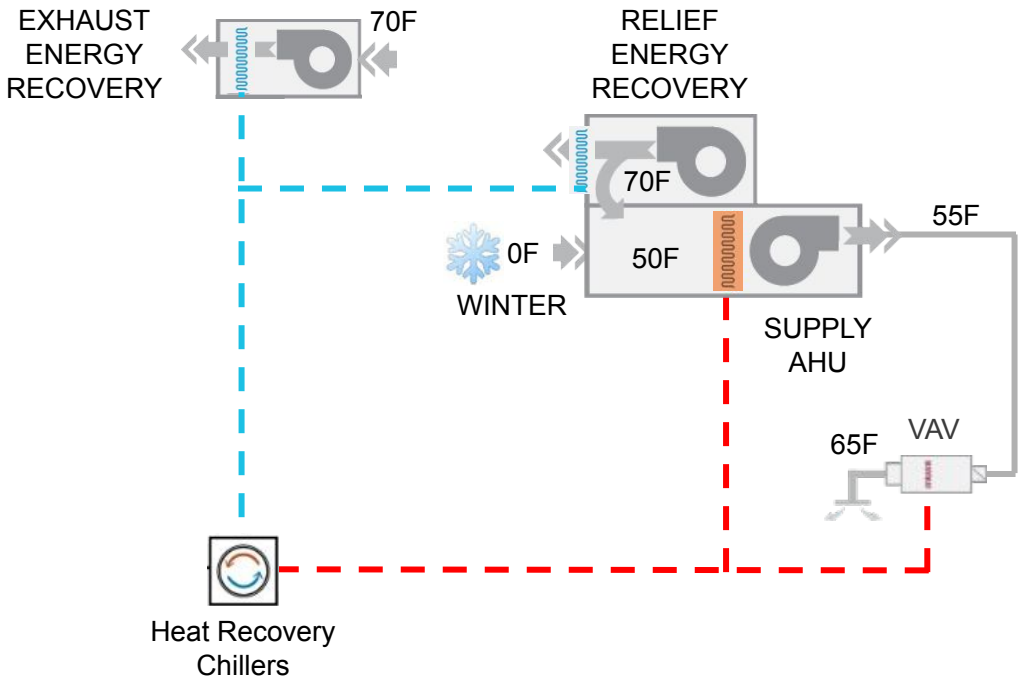
development

LARGE COLD-CLIMATE HOSPITAL
MASS GENERAL, BOSTON

APPROACHING FOSSIL FUEL FREE!



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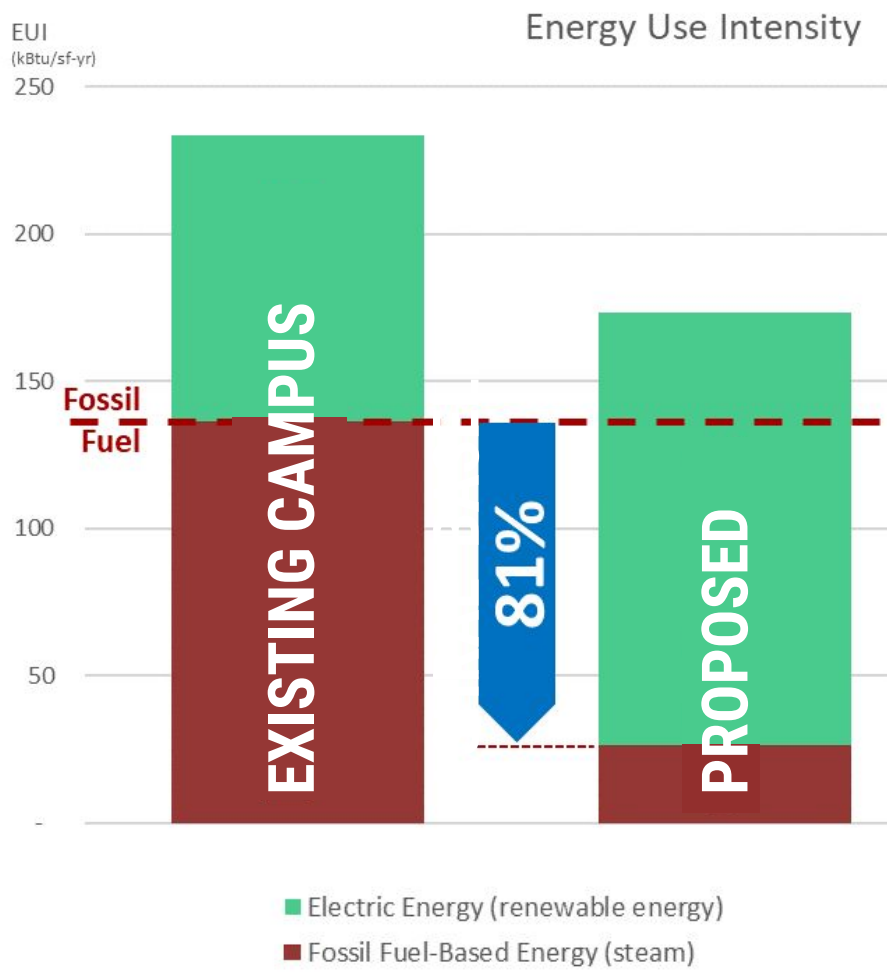

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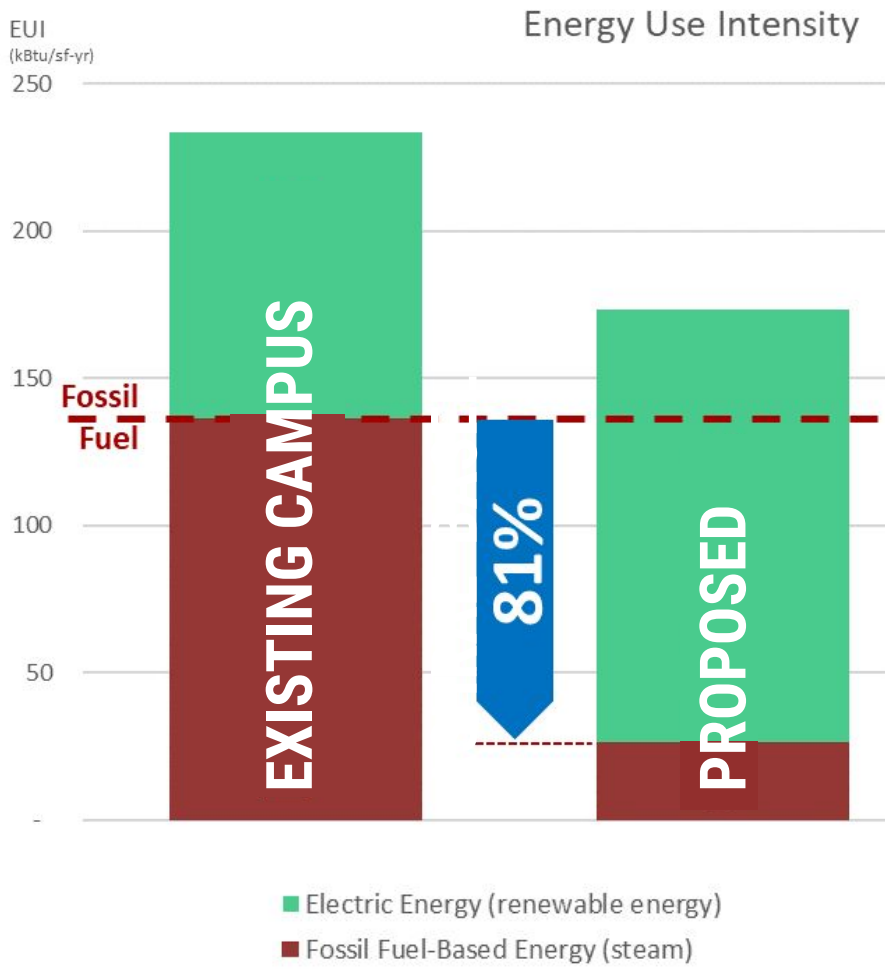
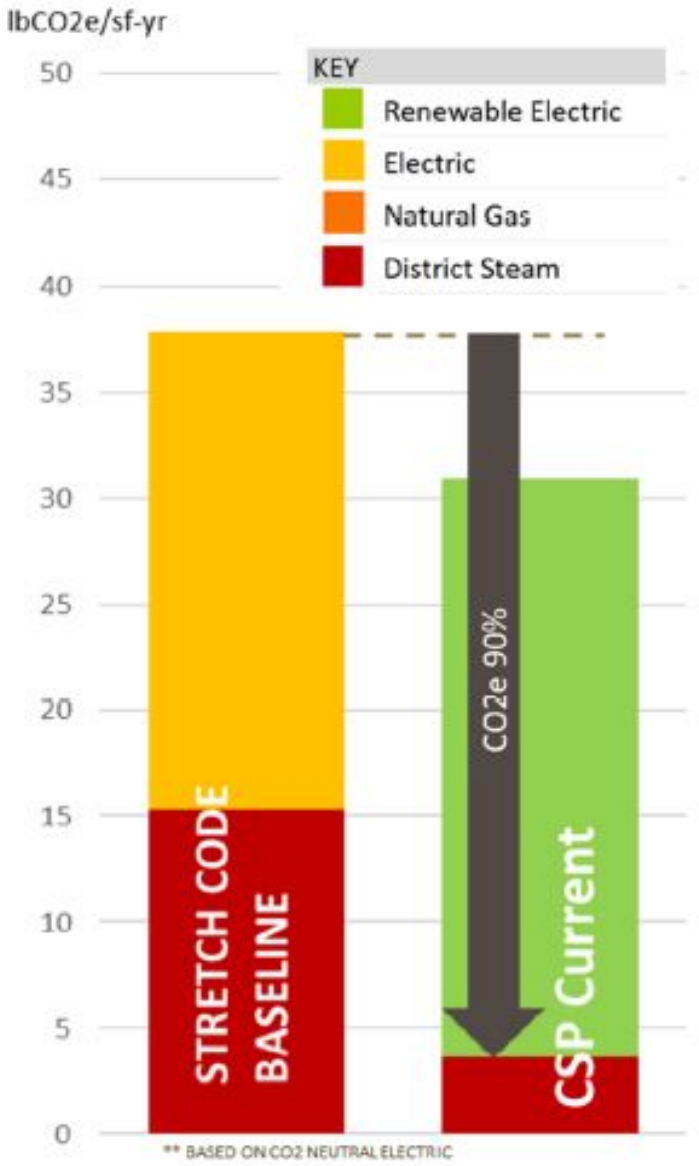
APPROACHING FOSSIL FUEL FREE!





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ON-SITE RENEWABLE ENERGY
TAG Recommendations

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development agency

ZNC Buildings should optimize on-site renewable energy production

Rendering of initial GE Headquarters, Credit: Gensler

On-site Renewable Energy TAG

Recommendations development with the guidance of practice leaders and experts:

Members

- Debra Perry, CADMUS
- Zach Wyman, CADMUS
- Ben Myers, Boston Properties / BXP
- Cammy Peterson, Metropolitan Area Planning Council
- Chris Gray, RENU Communities
- Cynthia Cresswell Cook, Earth Energy LLC
- David Eisenbud, Distributed Solar Development, LLC
- Emily Jones, LISC
- Isaac Baker, Resonant Energy
- James Liebman, HMFH Architects
- James Manzer, ReVision Energy
- Julie Curti Metropolitan Area Planning Council
- Patrick Haswell, Vicinity Energy
- Scott Johnstone, VHB
- Scott McBurney, Vicinity Energy
- Vince Martinez, Architecture 2030

City Staff

- Alison Brizius
- Anna Demina
- Ben Silverman
- Bryan Glascock
- Chris Busch
- David Musselman
- Jeff Hampton
- John Dalzell
- Joseph LaRusso
- Kathleen Pedersen
- Matt Martin
- Manuel Esquivel
- Maura Zlody
- Richard McGuinness

Guiding Principles

The ZNC Building Zoning requirements for On-site Renewable Energy seek to **maximize the benefits of local energy generation,** including:

- Emission Reductions
- Electric Grid Management
- Local Job & Business Creation
- Public Health
- Resilience

while **Recognizing**:

- Physical feasibility: shading, roof uses, setbacks/access
- Regulatory feasibility: utility interconnection, zoning code, building code
- Financial feasibility: costs, incentives, credit, electricity rates and ownership models

And **Driving Innovation**!

Guidance for Building Design

To best realize opportunities for solar, the City will engage project teams at the earliest stages of project planning and require building designs to:

- Maximize south facing solar opportunities on building roofs, facades, and sites
- Layout roof to maximize space free of obstructions
  - Consolidate mechanicals equipment and vents (big and small)
  - Consider complementary uses (solar as shading for roof decks)
  - Avoid roof forms and slopes unsuitable for solar energy systems

Defining Minimum Area for Solar

A ZNC Building shall be planned, designed, engineered, and constructed with an Solar Energy System(s) equal to but not less than:

- 50% of the building roof area(s) that is either flat or oriented between 110 degrees and 270 degrees of true north
- 90% of the parking structure deck(s) uncovered
- 50% of the surface parking area(s)

Solar Zone & Exceptions

Solar Zone(s) - the building and site areas suitable for Solar Energy Systems.

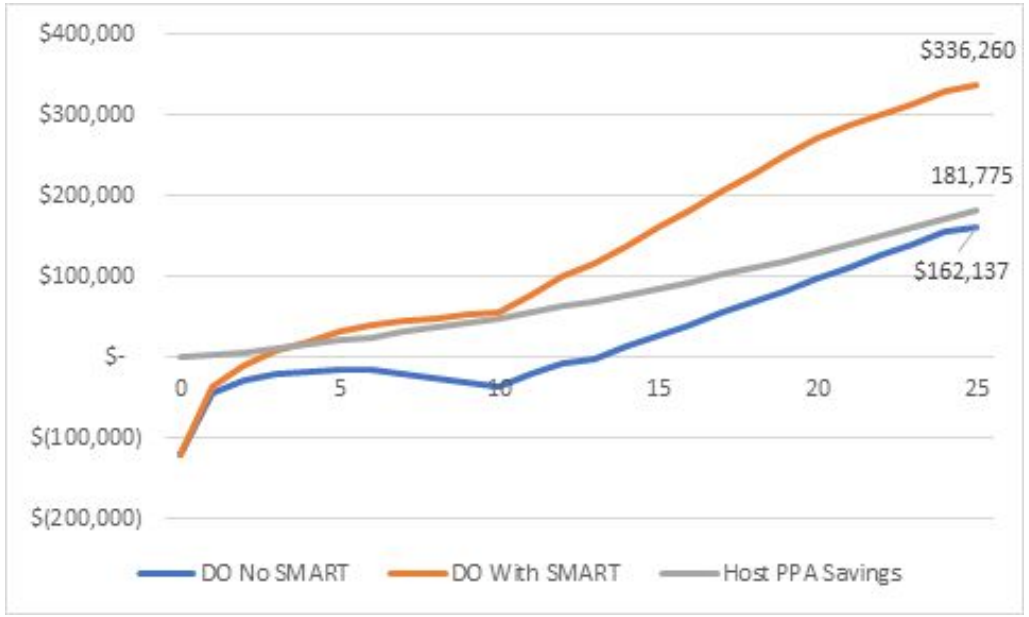
Solar Zone Exceptions & Exclusions - potential partial or full area reductions:

- where building mechanical /structural systems restrict the available Solar Zone(s).
- where the Solar Zone(s) is shaded > 50 percent of daylight hours annually.
- total Solar Energy System(s) output need not exceed 120% of annual energy loads.
- Historic Building Preservation or similar Design Overlay District requirements
- mandatory access and setbacks required by building, and fire codes and regulations.
- electric utility system constraints or output limits.

Solar Energy Systems shall be designed and configured to meet all code requirements and to ensure snow and ice does not shed into unprotected pedestrian travel area(s).

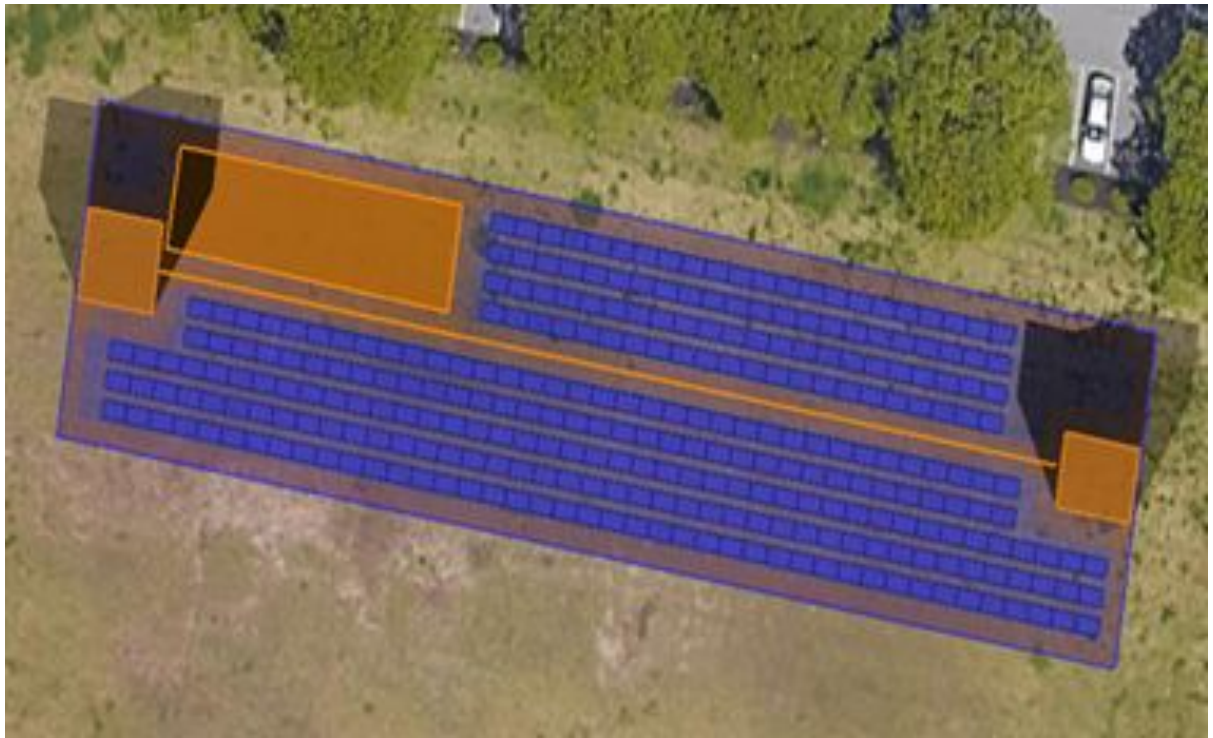
Example Case Study: Multi-Family Residential

25-Year Value to Building Owner



System Specifications

- PV System Area: 8,078 sq. ft. (54% of Roof Area)
- Panels: 284
- PV System Capacity (kW-DC): 105.1kW-DC (82.4kW-AC)
- Annual PV Generation (kWh): 118,000
- Annual Load Offset: 14%
- Installed Cost ($2.50/W):$262,750



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CADMUS

Renewable Energy Procurement TAG Recommendations

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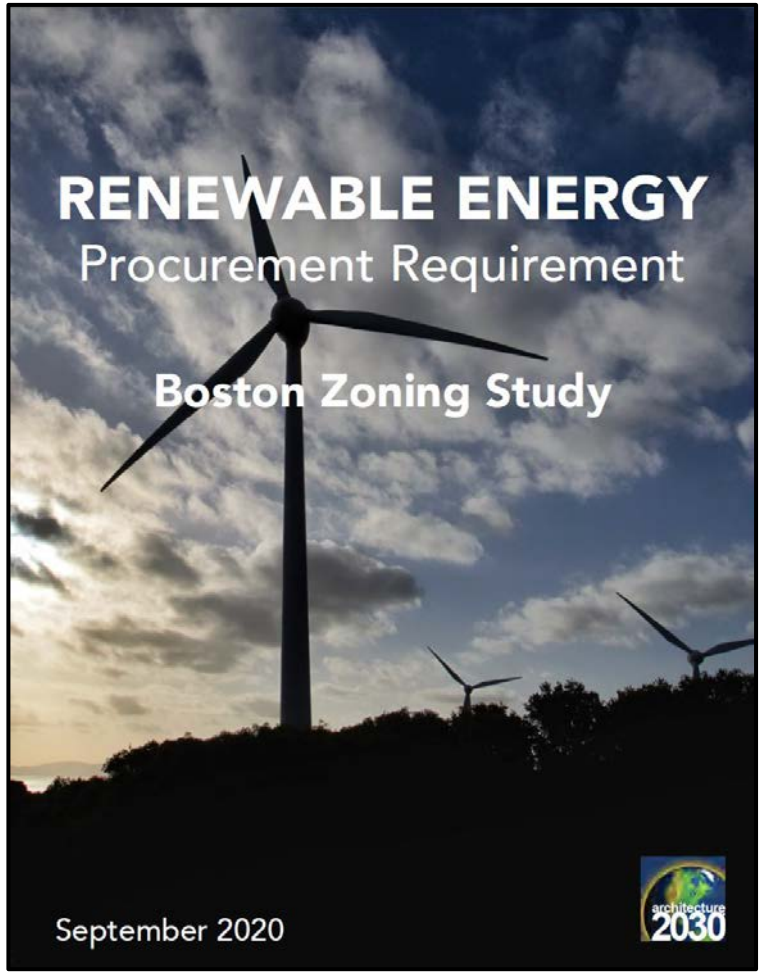
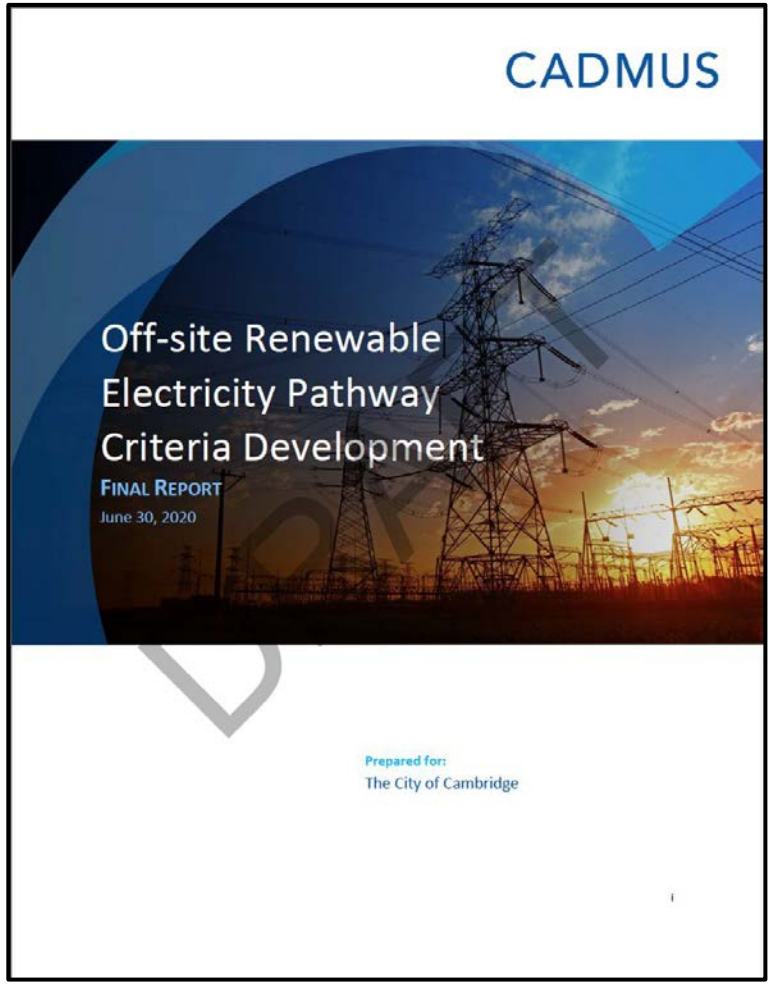
Renewable Energy Procurement

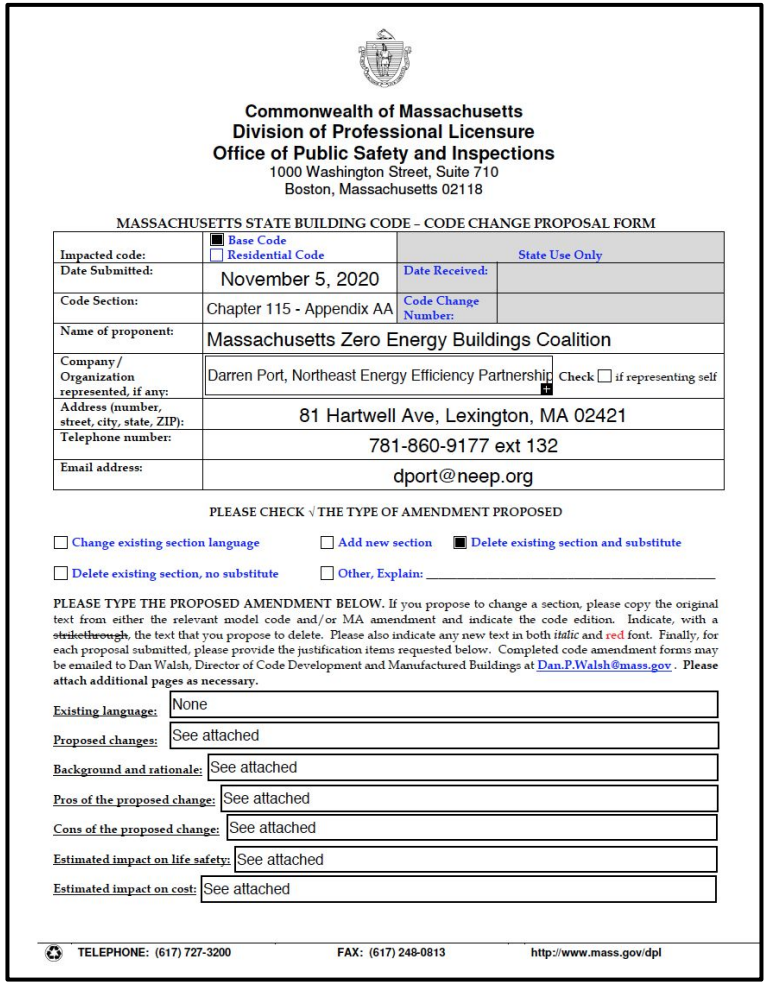
The purchasing of energy and/or its environmental attributes from off-site renewable energy systems.

“Off-site” renewable energy is anything that is not considered “on-site”.

Foundational Documents







Commonwealth of Massachusetts
Division of Professional Licensure
Office of Public Safety and Inspections
1000 Washington Street, Suite 710
Boston, Massachusetts 02118

MASSACHUSETTS STATE BUILDING CODE – CODE CHANGE PROPOSAL FORM

Impacted code:	■ Base Code ☐ Residential Code	State Use Only
Date Submitted:	November 5, 2020	Date Received:
Code Section:	Chapter 115 - Appendix AA	Code Change Number:
Name of proponent:	Massachusetts Zero Energy Buildings Coalition	
Company / Organization represented, if any:	Darren Port, Northeast Energy Efficiency Partnership	Check ☐ if representing self
Address (number, street, city, state, ZIP):	81 Hartwell Ave, Lexington, MA 02421	
Telephone number:	781-860-9177 ext 132	
Email address:	dport@neep.org	

PLEASE CHECK √ THE TYPE OF AMENDMENT PROPOSED

☐ Change existing section language ☐ Add new section ■ Delete existing section and substitute

☐ Delete existing section, no substitute ☐ Other, Explain: _____

PLEASE TYPE THE PROPOSED AMENDMENT BELOW. If you propose to change a section, please copy the original text from either the relevant model code and/or MA amendment and indicate the code edition. Indicate, with a ~~strikethrough~~, the text that you propose to delete. Please also indicate any new text in both *italic* and red font. Finally, for each proposal submitted, please provide the justification items requested below. Completed code amendment forms may be emailed to Dan Walsh, Director of Code Development and Manufactured Buildings at Dan.P.Walsh@mass.gov. **Please attach additional pages as necessary.**

Existing language:	None
Proposed changes:	See attached
Background and rationale:	See attached
Pros of the proposed change:	See attached
Cons of the proposed change:	See attached
Estimated impact on life safety:	See attached
Estimated impact on cost:	See attached

TELEPHONE: (617) 727-3200 FAX: (617) 248-0813 http://www.mass.gov/dpl

Renewable Energy Procurement TAG

Four meetings from January to May 2021

Members

- Vincent Martinez, Architecture 2030, President & COO
- Charles Eley, Architecture 2030, Senior Fellow
- Erin McDade, Architecture 2030, Senior Program Director
- Dennis Carlberg, Boston University
- Scott Johnstone, VHB
- Scott McBurney, Vicinity Energy
- Seth Federspiel, City of Cambridge
- Cammy Peterson, Metropolitan Area Planning Council
- Yve Torrie, A Better City
- Debra Perry, Cadmus
- Joelle Jahn, WSP USA
- Ben Myers, Boston Properties / BXP
- Patrick Haswell, Vicinity Energy
- Angela O'Connor, Vicinity Energy

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- Aidan Smith
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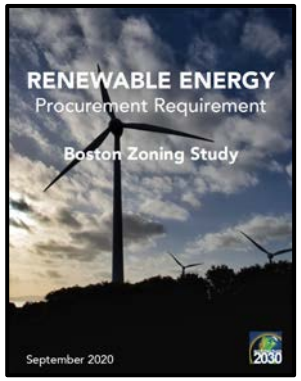
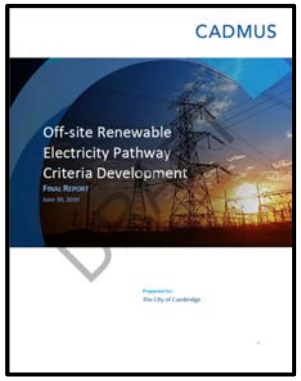
- Anna Demina
- Barry Reeves
- Chris Busch
- Christopher Kramer
- David Musselman
- John Dalzell
- Joseph LaRusso
- Katherine Eshel
- Kathleen Pedersen
- Manuel Esquivel
- Maura Zlody
- Richard McGuinness

Evaluation Criteria / Guiding Principles





- Impact / Additionality
- Durability /Long-Term Commitment
- Locality / Local Impact
- Assignment to Building
- Electricity Credit
- Incremental Acquisition
- Grid Management
- Environmental Impact
- Inspirational/Educational Value
- Permanent Financing
- Renewable Generation Sources
- Equity
- Public Health

BERDO 2.0 Electricity Compliance Mechanisms

a. **Municipal Aggregation**: Buildings may use electricity obtained through the Boston municipal aggregation program, at either the base rate or higher rate, and have the appropriate Emissions Factor applied to such electricity.

b. **Renewable Energy Certificates**: Buildings may mitigate CO2e Emissions from electricity use by purchasing unbundled Renewable Energy Certificates that:
   i. Are generated by non-CO2e emitting renewable sources and meet the RPS Class I eligibility criteria outlined in 225 CMR 14.05, as may be amended from time to time;
   ii. Are tracked by the New England Power Pool Generation Information System;
   iii. Are generated in the compliance period in which they are used; (iv) Are retired within six (6) months after the end of the compliance period in which they are used; and
   iv. Comply with any additional or different requirements set forth in the Regulations, as may be amended from time to time. In the event of a conflict between the requirements for Renewable Energy Credits in this provision and the Regulations, the requirements in the Regulations shall prevail.

c. **Power Purchase Agreements**: Buildings may mitigate CO2e Emissions from electricity use by entering Power Purchase Agreements for Energy generated by renewable non-emitting fuel sources, provided that:
   i. The Energy purchased pursuant to a Power Purchase Agreement is generated during the compliance period for which a Building is mitigating CO2e Emissions;
   ii. The Renewable Energy Credits associated with the Energy purchased under a Power Purchase Agreement are retired by the Building Owner within six (6) months after the end of the compliance period in which used; and
   iii. The Power Purchase Agreement complies with any additional or different requirements set forth in the Regulations, as may be amended from time to time, including but not limited to additionality criteria. In the event of a conflict between the requirements for Power Purchase Agreements in this provision and the Regulations, the requirements in the Regulations shall prevail.

Renewable Energy Procurement Recommendations

Options:

- Direct Ownership / Self-owned, off-site project
- Green Municipal Aggregation / Green Retail Tariffs / Green Pricing
- Unbundled Renewable Energy Certificates / Credits (RECs)
- Power Purchase Agreements (PPAs) /
  Virtual Power Purchase Agreements (VPPAs)
- Utility Renewable Energy Contract / Direct Access to the Wholesale Markets
- Renewable Energy Investment Fund

Generation Source Recommendations

The following renewable energy systems are acceptable:

- Solar photovoltaic
- Solar thermal electric
- Wind energy
- Small hydropower
- Marine or hydrokinetic energy
- Geothermal energy (without vapor compression cycle)

Exception: For existing district energy plants that serve thermal energy to multiple buildings, all MA Class I renewable energy sources are acceptable, including: landfill methane, anaerobic digester gas, and eligible biomass fuel.

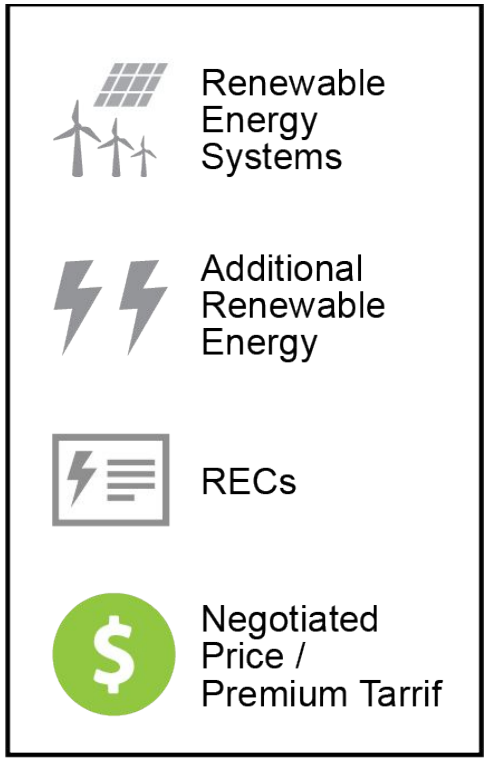
Procurement Recommendations

All off-site renewable energy procurement must satisfy three minimum requirements:

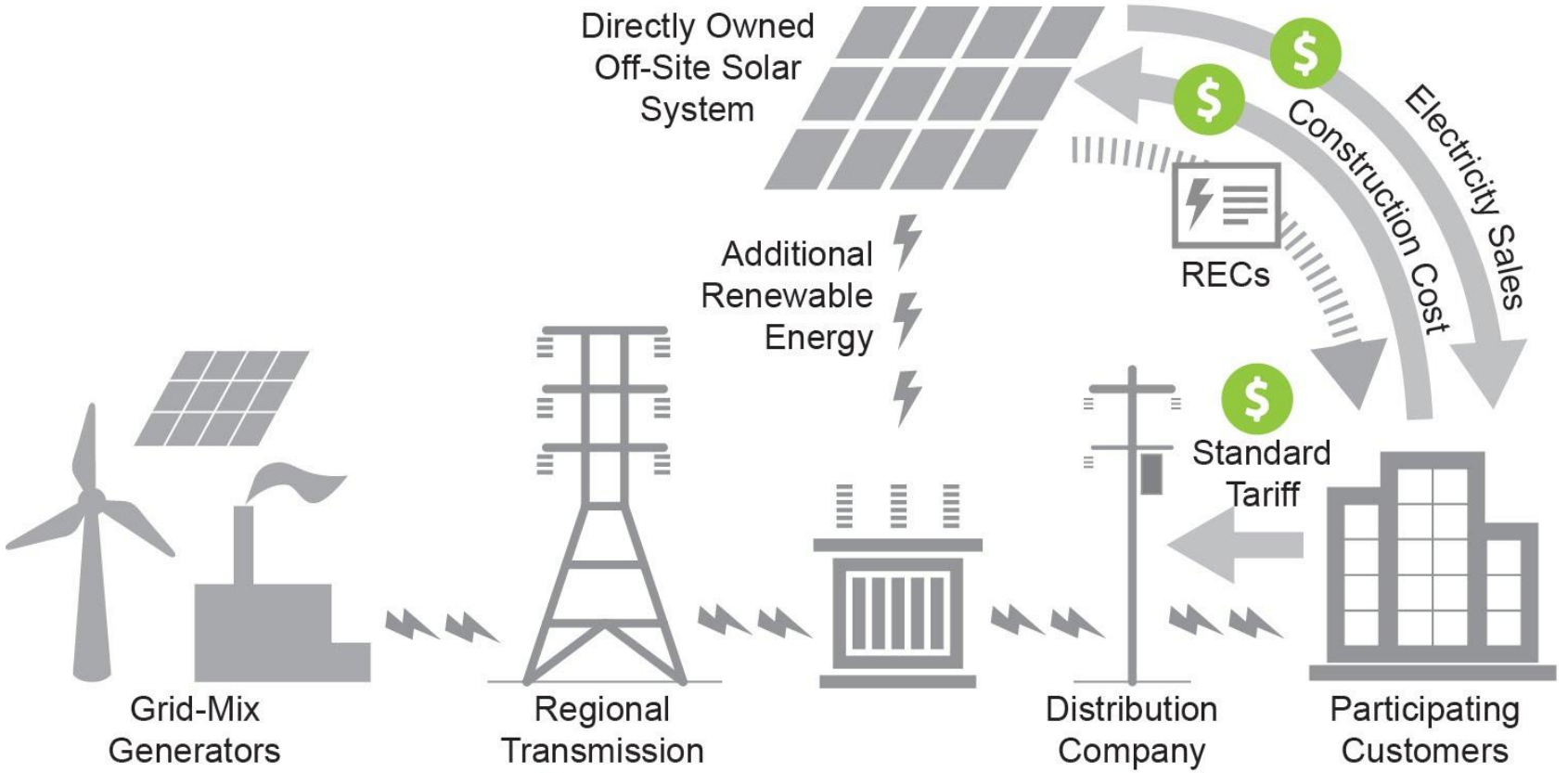
1. The generator must qualify as a Massachusetts Class I generator
2. The purchase commitment must be lasting and verified each year
3. RECs must be retired on behalf of the ZNC building

Exception: Wind or solar generators located outside the ISO New England service territory are allowed for virtual power purchase agreements (vPPAs) when the generators are located in regions where the carbon emissions of the electric grid are higher than those of New England ISO.

Renewable Energy Procurement Options

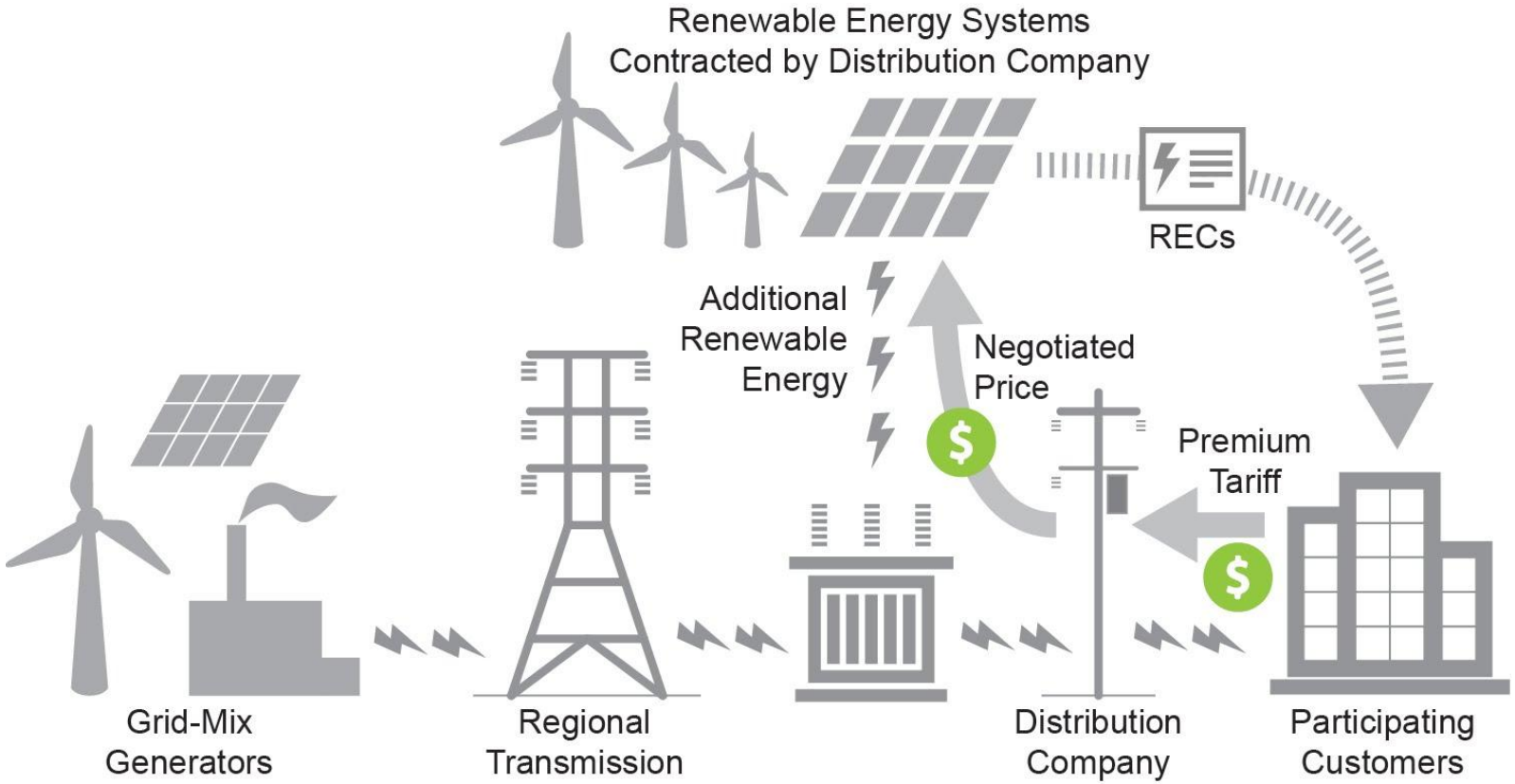


Direct Ownership / Self-owned



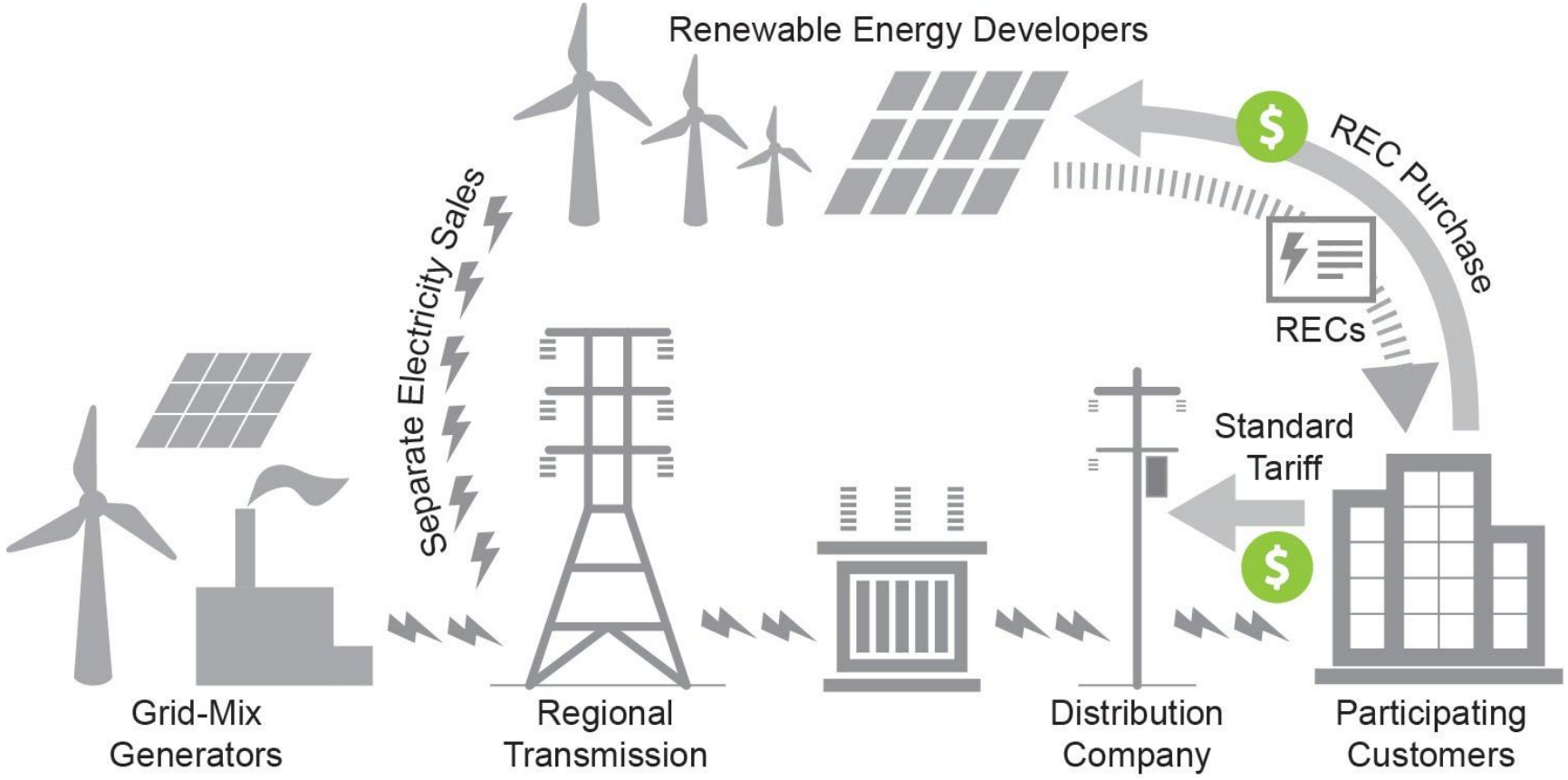
Recommendation is for SMART Program-funded not to qualify under this procurement option as the RECs must go to the local distribution companies (see SMART Program-funded option)

Green Municipal Aggregation / Green Retail Tariffs / Green Pricing



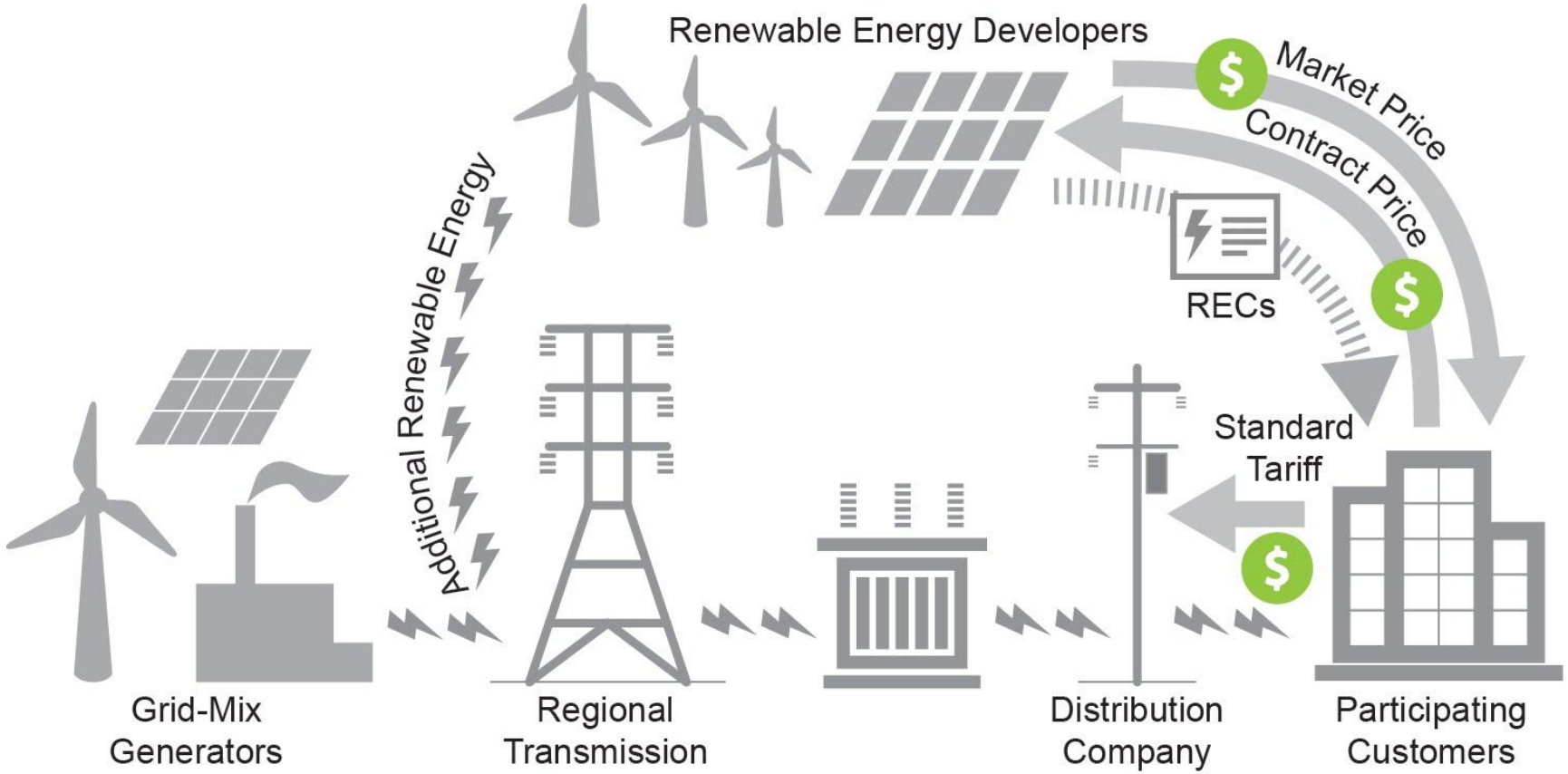
Opt-Up to 100% Renewable Energy Option in the Boston's Community Choice Electricity

Unbundled Renewable Energy Certificates



Class I non-emitting MA RECs

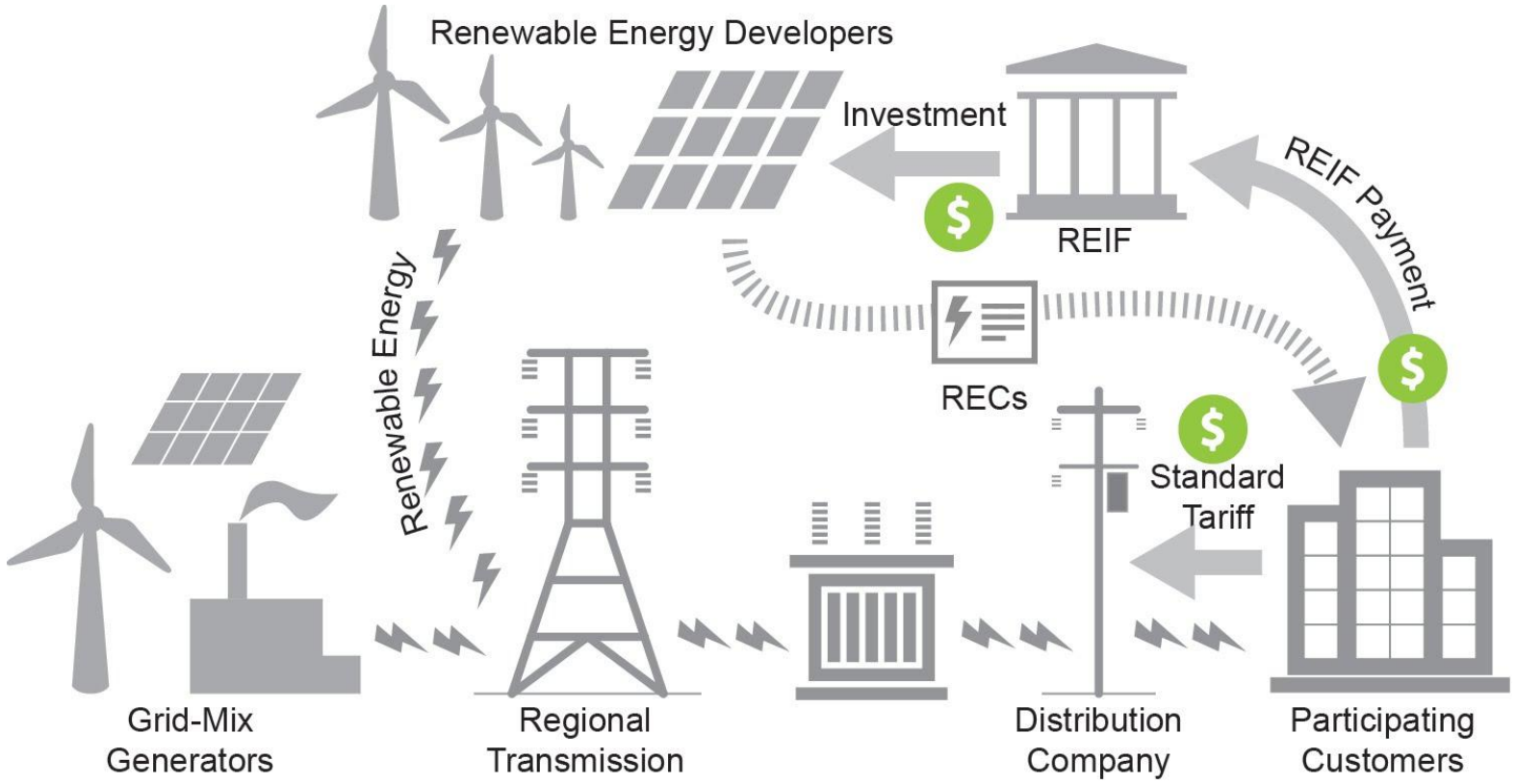
Power Purchase Agreements (PPA / VPPA)



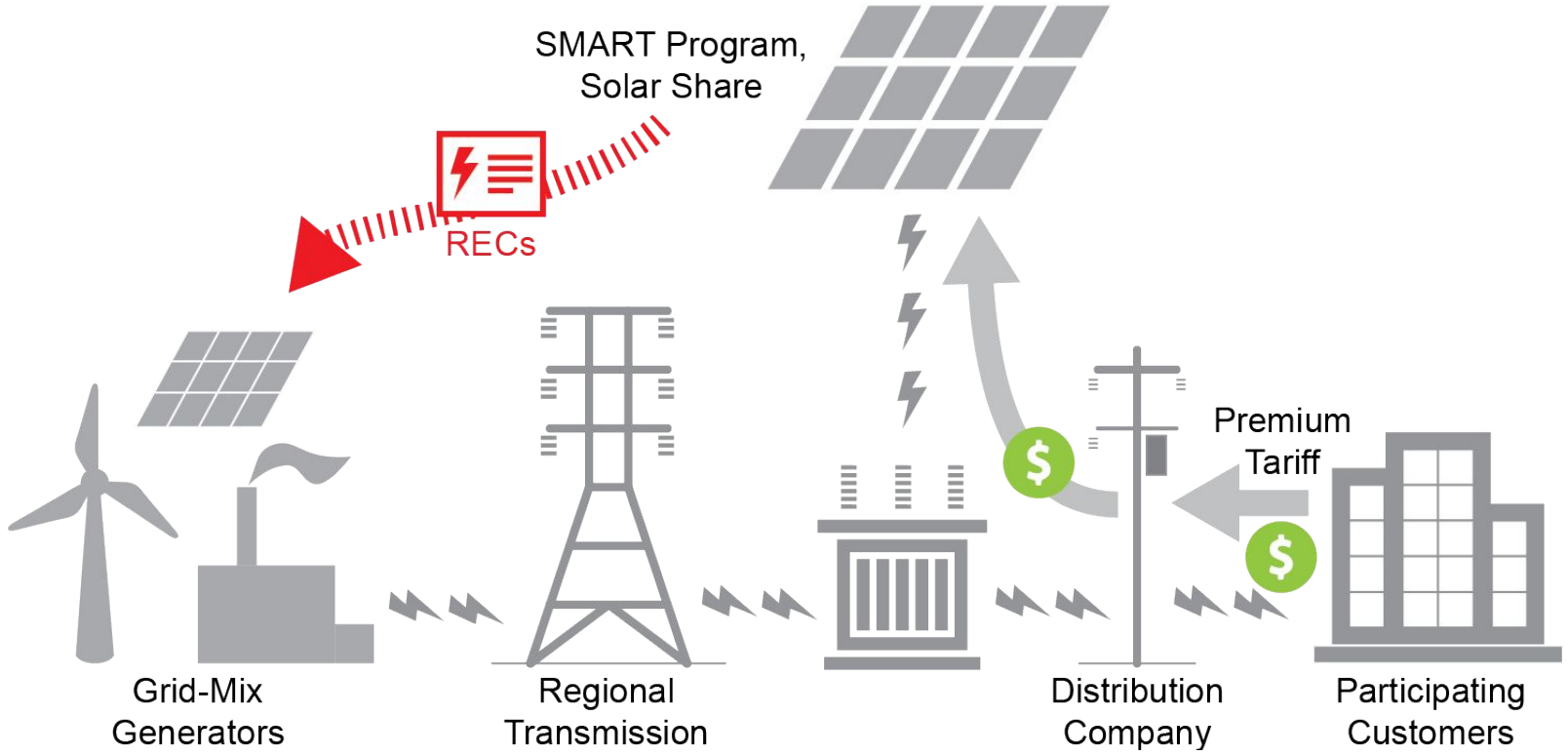
Class I MA RECs or RECs from a grid with higher GHG intensity than ISO NE

Additional procurement options being evaluated ...

Renewable Energy Investment Fund



SMART Program, Solar Share



Recommendation is for this to not qualify for Renewable Energy Procurement because RECs must go to the local distribution companies and are not retired on behalf of the ZNC building

Renewable Energy Procurement Options

- Direct Ownership / Self-owned, off-site project
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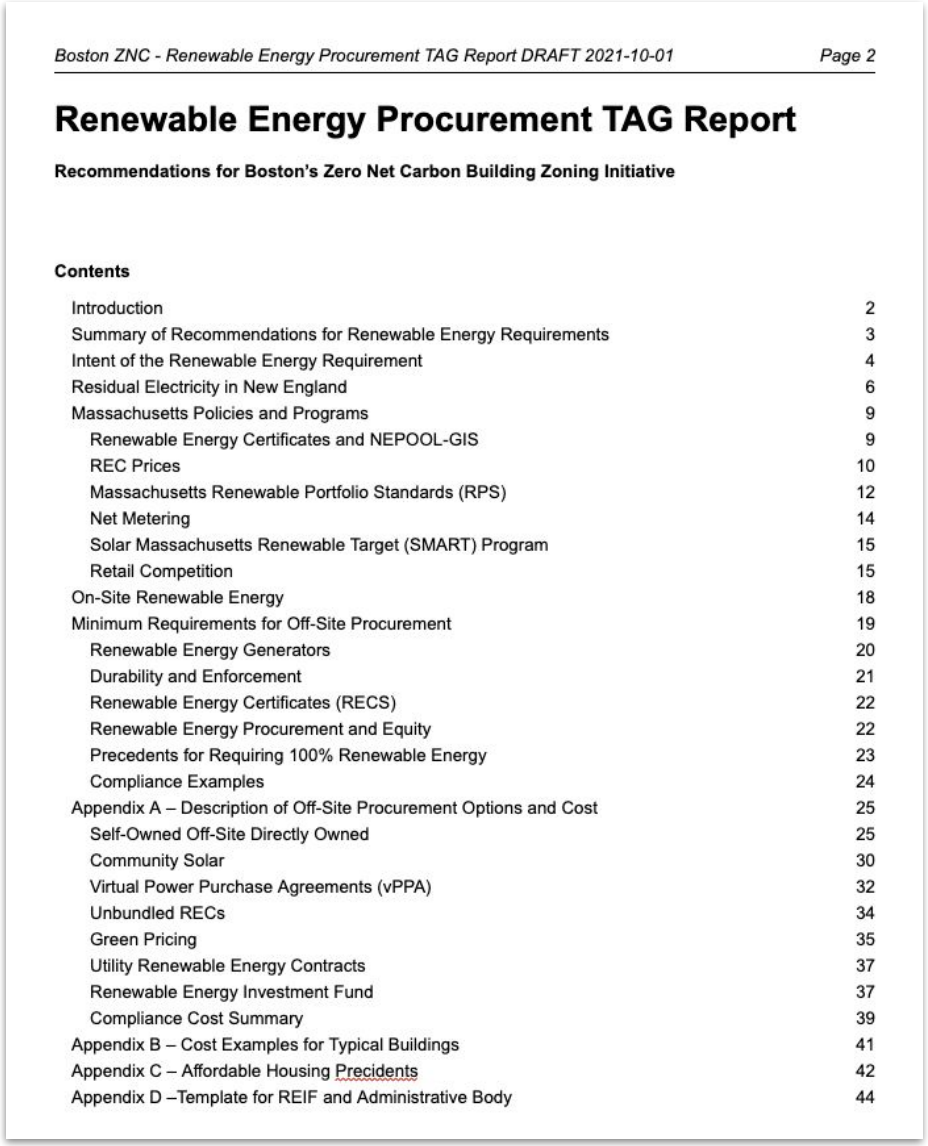

Boston ZNC - Renewable Energy Procurement TAG Report DRAFT 2021-10-01 *Page 2*

Renewable Energy Procurement TAG Report

Recommendations for Boston's Zero Net Carbon Building Zoning Initiative

Contents

boston planning & development agency

EMBODIED CARBON
TAG Recommendations

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development agency

Embodied Carbon Working Group

Members

Michelle Lambert, Lambert Sustainability
Carbon Leadership Forum Boston

Rachelle Ain, Utile Design
Carbon Leadership Forum Boston

Julie Janiski, Buro Happold
Carbon Leadership Forum Boston

Andrea Love, Payette

Lori Ferriss, Goody Clancy

Jennifer Effron, BSA

Meredith Elbaum, Built Environment Plus

Meghan Lewis, Carbon Leadership Forum / University of Washington

Erin McDade, Architecture 2030

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John Dalzell, BPDA

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Chris Busch, BPDA

Kathleen Pedersen, BPDA

Alison Brizius, Commissioner, Environmental Dept.

Kat Eshel, Environmental Dept.

Brenda Pike, Environmental Dept.

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Embodied Carbon TAG Members

Members

- Alison Nash, DiMella Shaffer
- Anthony Pak, Priopta
- Brad Mahoney, MP Boston
- Caroline Shannon, Howeler + Yoon Architecture
- Chen Qin, HED (Harley Ellis Devereaux)
- Chris Hardy, Sasaki Associates, Inc.
- Christopher Stanley, Trinity Financial
- Ciarán Smyth, BALA Engineers
- Courtney Koslow, Beacon Communities
- Dan Whittet, AHA Consulting Engineers
- Daniel Bailey, Takeda Pharmaceuticals
- Dennis Carlberg, Boston University
- Gunnar Hubbard, Thornton Tomasetti
- Ivan Lee, Morrison Hershfield
- Jim Newman, Linnean Solutions, LLC
- Kayla Natividad, NSG Pilkington North America
- Kevin Maguire, Oxbow Urban LLC
- Lisa Goodwin Robbins, Kalin Associates
- Michael Gryniuk, LeMessurier
- Michael Orbank, Commodore Builders
- Michelle Apigian, ICON Architecture
- Nicole St. Clair Knobloch, Olifant, LLC
- Olivia Humphrey, Jacobs
- Patrick Kenny, Thornton Tomasetti
- Paul Richardson, Buro Happold
- Peter Sun, BPDA
- Steven Burke, Consigli Construction Company, Inc.
- Tamar Warburg, Sasaki Associates, Inc.
- Tom Chase, New Ecology, Inc.
- Turan Karakus, BR+A Consulting Engineers

Timeline & Topics

April 27, 2021 - Public Event Kickoff

TAG Meeting #1, May 12 – Framework of Practice / Policy / Awareness

- **Embodied Carbon in Design and Construction,** Lindsay Rasmussen, Architecture 2030
- **Low Carbon Structural Options-** Mike Gryniuk, LeMessurier
- **Embodied Carbon Policy Examples-** Meghan Lewis, Carbon Leadership Forum, UW

TAG Meeting #2, June 2 –

- **Deep Dive Into Policy Precedents,** Meghan Lewis, Carbon Leadership Forum, UW
- **Opportunities to Build Awareness,** John Dalzell BPDA

TAG Meeting #3, July 14 -

- **Diversity, Equity, and Inclusion,** Barry Reaves, BPDA Director of Diversity, Equity, and Inclusion
- **Wood / Mass Timber Practices, Benefits and Regional Challenges**, Nicole St. Clair Knobloch, Olifant

TAG Meeting #4, August 4 -

- Review 12 draft recommendations in Policy / Practice / Awareness
- Impact, Ease of implementation, Time frame (immediate, near-term, long-term)

October 7- Draft Report to TAG for comments

EMBODIED CARBON

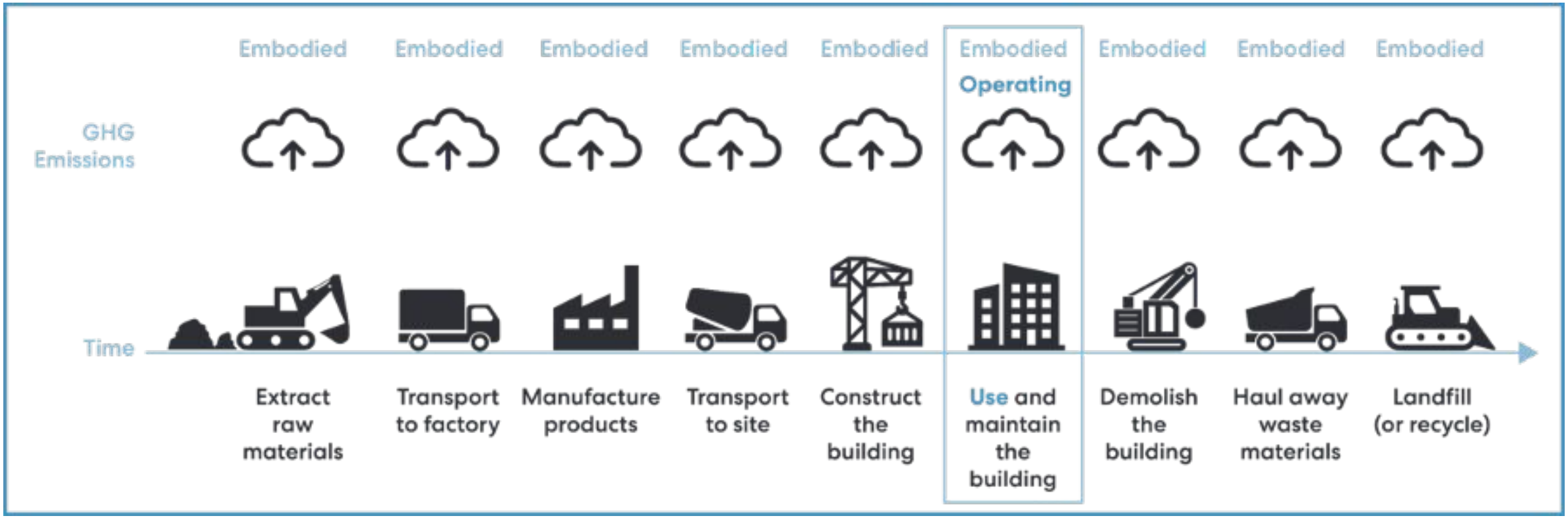

Image credit: Think Wood

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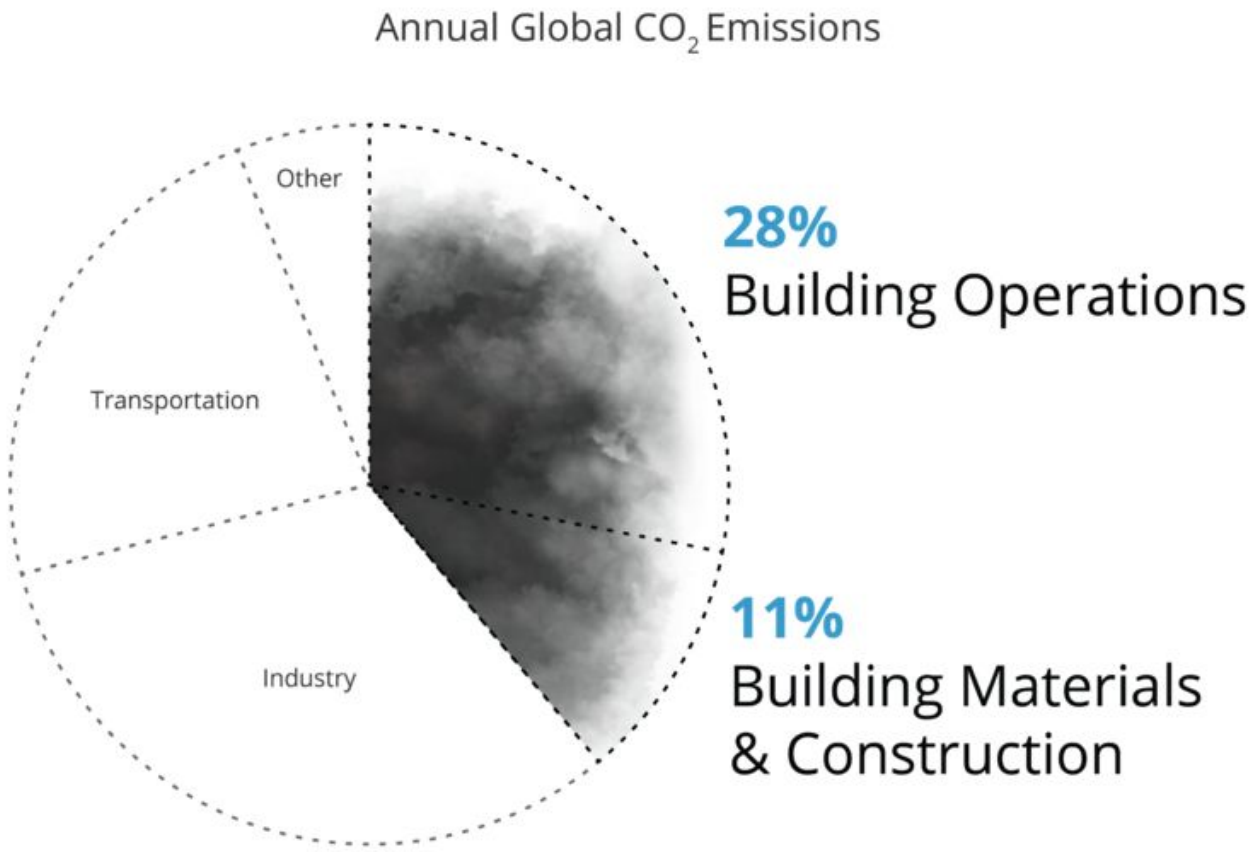
EMBODIED CARBON

THE BUILDING SECTOR



Data Sources: Global ABC Global Status Report 2018, EIA

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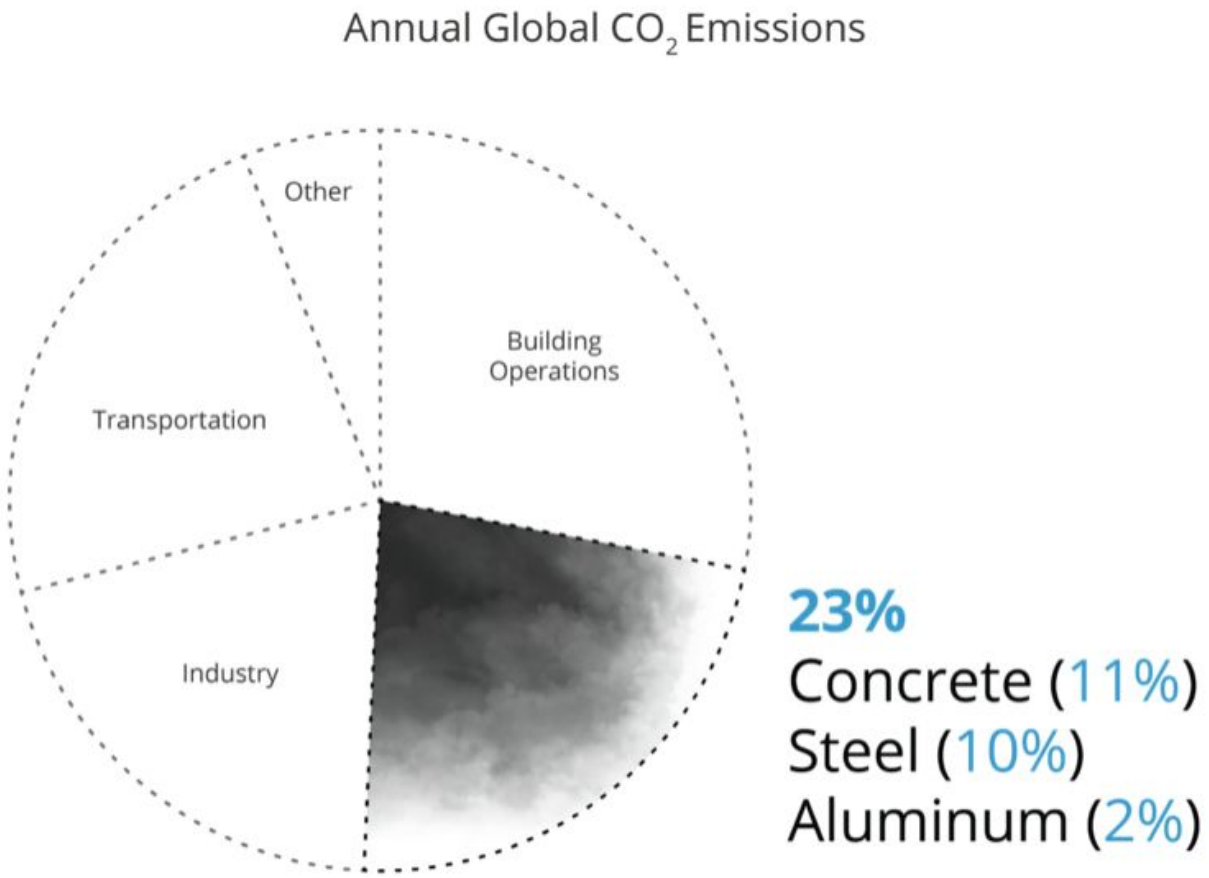
EMBODIED CARBON



Data Sources: Global ABC Global Status Report 2018, EIA

Embodied Carbon TAG Recommendations

POLICY	PRACTICE	AWARENESS
[01] Climate Action Plan: Update with embodied carbon goals and strategies	[06] Pilot Programs / Demonstration Projects	[9] Recognition for Best Practices
[02] Building reuse and deconstruction ordinance(s)	[07] Incentives	[10] City Capacity and Expertise
[03] Require LEED embodied carbon-related/LCA Credits	[08] Professional Advisory Group to the City	[11] Workforce Development
[04] Require whole-building LCA in zoning/permitting process		[12] AEC Industry Resources
[05] Municipal & State collaboration		

Embodied Carbon TAG Recommendations

POLICY
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Embodied Carbon TAG Recommendations

AWARENESS
[9] Recognition for Best Practices
[10] City Capacity and Expertise
[11] Workforce Development
[12] AEC Industry Resources

Embodied Carbon Reductions of Concrete

BU Center for Computing & Data Sciences

- Goal of 10% reduction structural and facade system EC (total)
- Focused on concrete
- High portland cement replacement concrete mixes
- Achieved 13% reduction (no change to facade)

LeMessurier.

NEXT STEPS

Technical Advisory Group Draft Reports & Recommendations will be Posted for Public Comments for 30 Days
Comments are due by November 19, 2021

Tonight's Meeting Materials and Recording will be Posted

Visit "Zero Net Carbon Building Zoning Initiative" webpage:
bostonplans.org/ZNCBuildingZoning

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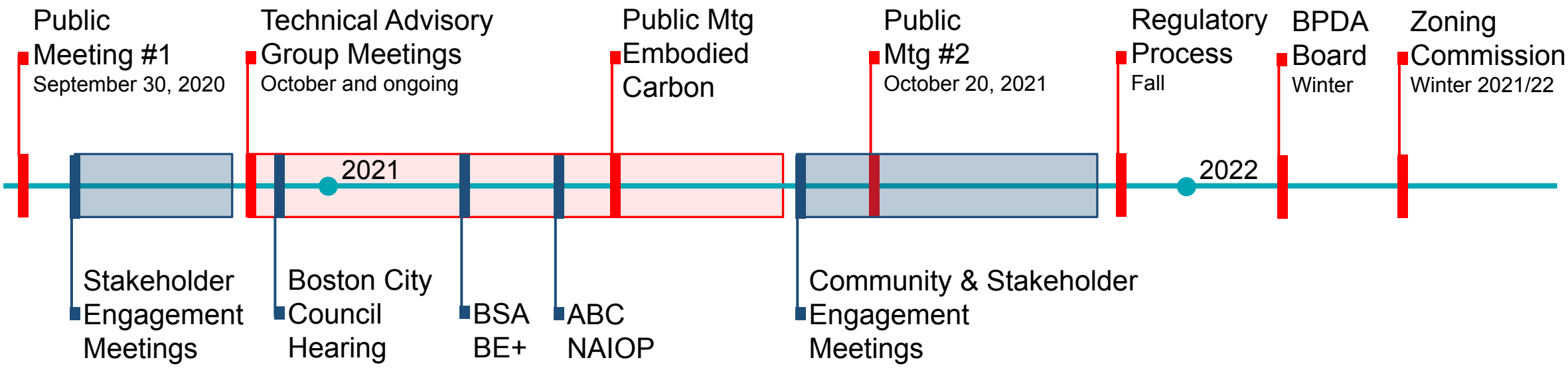
ZNC Building Zoning

PUBLIC PROCESS TIMELINE



- Community & Stakeholder Meetings – *ongoing through December*
- Open House and Office Hours events - *to be scheduled November and ongoing*

ZNC Building Zoning Materials and Contacts

For information, materials, updates and submitting comments, please visit the "Zero Net Carbon Building Zoning Initiative" webpage:
bostonplans.org/ZNCBuildingZoning

- Comments may be submitted directly from project webpage or emailed to John.Dalzell@Boston.gov
- Meeting presentations and recording will be uploaded to the project webpage in the next two days.

Zoom Chat Notes

John Dalzell: Please post any questions or comments in the Chat, we will response as best we can.

Nicole Knobloch: Where does the EEIF funding come from? Sounds great.

Andee Krasner: Will buildings approved this year but opening in the future have to comply with the new NZC zoning code? In other words, will they be grandfathered in?

Teofilo Carbonell: What is the Sponsoring Government Agency for this project?

Julie Janiski: Nicole - EEIF Funding comes from projects choosing those payments for compliance (a form of offset), and potentially other sources in addition

Hannah Payne, Boston Environment Dept.: @Nicole, The Alternative Compliance Payments, which can be paid by buildings at $234/ton to comply with the required emissions standard, will be paid into the Equitable Emissions Investment Fund.

Nicole Knobloch: Thanks, both - that is really interesting and innovative. Like a cap and trade.

Peter Alspach: How does Landmark get to zero when it seems to have some marginal fossil fuel usage remaining?

Robert Tumposky: Unless we know that the renewable energy procurement created new solar or wind development, this process cannot actually create net zero buildings.

Hannah Payne, Boston Environment Dept.: @Andee, zoning only applies to new development projects. However, buildings that have already been approved under zoning that meet the BERDO threshold will have to comply with BERDO once they are in operation.

julie klump: Maybe we should let go of LEED and just focus on energy and carbon?

Anastasia Nicolaou: Are any of the studied net-zero projects in MA over 100,000SF? I missed the slide I apologize

Debra Shepard: What global warming potentials are you using? Many orgs are using 5AR rather than 3AR.

Peter Alspach: Using a single fixed value for district energy systems does not allow utilities to get recognition for improvements and their market differentiation. How is this going to be addressed and aligned with other regulatory requirements, such as cogeneration ISO reporting?

Meredith Elbaum: Yes, there are buildings over 100,000 gsf. Here's the link to the report: https://builtenvironmentplus.org/road-to-net-zero/

Dennis Carlberg: @Anastasia the Center for Computing and Data Sciences at BU is 345,000 square feet. 19 stories.

Meredith Elbaum: The report was done in March 2021. There are many more buildings including large lab buildings like the one John mentioned that have become public since March. We are working on an update.

Zoom Chat Notes - continued

Andee Krasner: MGH is locking in methane based steam and should not be held up as an example

Anastasia Nicolaou: @Dennis - thanks!

Catie Snyder: When talking about the RE purchases to offset emissions for these buildings, are these primarily green e RECs from outside the region?

Peter Alspach: Many of the examples include hybrid heating systems that ultimately rely on fossil fuels. How does one get to zero with this type of approach since off-site renewable electricity purchases do not directly offset that consumption?

Christopher Schaffner: Glad we have advocates saying Boston is not going far enough. Too often we here from folks saying what's currently being done in our best projects actually can't be done.

Dennis Carlberg: @Catie, BU's are Green e certified. Very important

Meredith Elbaum: @Julie Klump. I agree that Energy and Carbon are super important. So is environmental degradation, species loss, human health and well being, potable water and more. That's why I advocate for LEED.

Michele Brooks: Were there any community groups involved in this process, in particular from EJ communities, like the Resident Advisory Committee in BERDO?

Christopher Schaffner: Meredith +1 - LEED is an important part if we care about human health, etc.

Eric Studer: Are systems being developed for dealing with shadows cast from new buildings on existing PV? It seems like this is going to be a serious point of contention down the road.

Peter Alspach: so is the requirement 50% of the resulting solar zone? is the solar area calculated just by panel area or by the total area including rack systems, walkways, etc that are dedicated to the solar equipment?

Dennis Carlberg: How do we balance the need for air source systems and building mounted solar?

julie klump: passive house creates great IAQ and resiliency. Codes protect the environment, species, etc.

Debra Perry: Eric there have been advances in the technology that make shading less of an issue than it once was, but we do think the solar zone should only include areas that are shaded less than 50% of daylight hours annually. Off-site procurement will definitely be an important strategy for projects that are very shaded.

Christopher Schaffner: Passive House is great but it doesn't address things like product transparency, construction waste, water conservation, rainwater management, daylight, embodied carbon, etc.

Zoom Chat Notes - continued

Hank Keating: PH used in conjunction with LEED or Enterprise Green Communities cover all of this.

Christopher Schaffner: Hank+1

Julie Janiski: I would challenge the idea that codes protect species - if that were true we wouldn't have devastating species loss to date

julie klump: PH is better than LEED for water conservation. Boston has strict storm water management codes and has for years. lets just be clear what we get from each program and what they cost. product transparency doesn't contribute to net zero, nor does daylight. For affordable housing PH plus enterprise green communities makes sense.

Hannah Payne, Boston Environment Dept.: Find out more about Boston's CCE program here: https://www.boston.gov/departments/environment/community-choice-electricity

Debra Perry: Peter- The solar zone is essentially the maximum area where we think solar is viable and that area should be considered throughout the design and permitting process. However, the min requirement to install on-site solar is 50% of the total roof area and is flat or south facing.

Christopher Schaffner: Product transparency contributes to reducing carbon. And human health matters too. Not everything can be solved with more insulation and air testing.

Hank Keating: Are we making sure that the utility companies are honoring true net metering ad not claiming they cannot accept more renewables at parity pricing?

Jim Newman: agree with Chris

David Eisenbud: Ideally there could be a credit support function from the REIF to help lower RE rates.

Maynard Clark: Would Low-rise, MEDIUM-rise, and HIGHER-rise buildings (old AND new) present different challenges?

Jim Newman: Yay! Building Re-Use!

Maynard Clark: HOW DURABLE ARE RE-USED BUILDING MATERIALS. WE DO NOT WANT COLLAPSING BUILDINGS !

Maynard Clark: HOW ABOUT BUILDING TALLER BUILDINGS? We cannot expand the city limits outward?

Christopher Schaffner: When do we expect the new regs to be effective? Will there be a period between the adoption date and the date they become effective?

Janice Henderson: Given the complexity - can we extend the public comment period?

Rickie Harvey: What is the next step after comments are submitted?

Zoom Chat Notes - continued

Christopher Schaffner: Net zero is not the same as zero.

Maynard Clark: Is a BUILDING - new or old - that attracts MORE vehicular traffic EVER a 'green building'??? If a recreational or artistic center brings more burning of fossil fuels, how can the City with 'green goals' EVER approve that??

Timothy Lawrence: Would the alternative compliance path be required to offset natural gas use for laboratory use/gas turrets if everything else in the building was electric? Can someone address lab use of gas please?

julie klump: would the city ever consider incentivizing concrete suppliers to lower carbon? there are some infrastructure changes that have to be made

Eric Studer: Is the global warming potential of refrigerant leaks from all of the heat pump systems going to be taken into account?

Debra Shepard: Thank you!

Anastasia Nicolaou: If the City votes to adopt the forthcoming municipal opt in stretch code - would this zoning article change to be updated?

James Cox: Very informative, thank you for having me.

Michelle Lambert: Julie K- most of the low carbon concrete procurement policies that have been passed in the US have been at the state level. There is a concrete sub-group of the Carbon Leadership Forum Boston actively discussing this in MA

julie klump: thanks. I have met with a couple suppliers and know what they think they need to do. It didn't seem like a huge lift, just not a huge demand, yet.

Kristen Simmons: What is being proposed for workforce training to complement this ordinance? The requirements will have broad and deep impact on construction in Boston.

Adam Jennings: Agreeing with Eric, refrigerant leaks are a contributor. That also opens the door to non-hvac uses of GHG/ODP gases for process uses that wouldn’t normally be reported.

Kristen Simmons: What is cost of the ordinance as proposed, including documentation and reporting, taking into account all elements?

julie klump: One suggestion is to show how an affordable housing project would move the zoning process. The permitting and zoning process is already cumbersome, and to satisfy DHCD and DND would have to align or creating needed housing will be harder than it already is.

Julie Janiski: Eric S, Adam J - I'm optimistic the embodied carbon angle will start to include MEP components soon - with refrigerant being a priority. Please join the brand new MEP 2040 Commitment and the MEP community working on this topic! https://carbonleadershipforum.org/mep2040/

Julie Janiski: Adam - Same re process refrigerant - there are companies working on zero carbon plans that include this in their carbon boundary - it's getting exciting!

Zoom Chat Notes - continued

Michelle Lambert: Yes Julie, totally agree! We need the embodied carbon of MEP systems to add to the data

julie klump: new systems coming out that use refrigerant but minimize use within buildings. still heat pump efficiency but converts to water delivery to minimize leaks.

Hannah Payne, Boston Environment Dept.: Here is the technical methods memo that informed the BERDO policy including the Alternative Compliance Payment: https://www.boston.gov/sites/default/files/file/2021/02/Boston_Performance_Standard_Technical_Methods_2021-02-18_20-013_0.pdf

Maynard Clark: Can we (a) MEASURE our progress to NetZero AND (b) measure air quality throughout the city by installing high quality outdoor air quality measurement devices (Perkin-Elmer or others? perhaps in pilot programs that the manufacturers fully fund?) and piping that data real time into decisionmakers' dashboards - perhaps in the BPHC and the environment department and the schools department and the traffic department???

Maynard Clark: … what we deem WORTHY of measurement and why...

Julie Janiski: Combustion-free labs are do-able.

Dennis Carlberg: How will embodied carbon be accounted in concert with operational carbon?

Debra Shepard: Traditional carbon accounting standards also cover refrigerant leaks. EPA has guidance that's relatively easy to follow for building owners or organizations to measure.

Debra Shepard: https://www.epa.gov/sites/default/files/2015-07/documents/fugitiveemissions.pdf

Maynard Clark: Who is actively writing the HISTORY of the Cities', States', and Nations' decarbonization? How are universities AND historians AND archivists contemplating the complex uses of rational capacities to solve these overwhelming global problems so that post-crisis 'historical coverage' will not be superficial and unhelpful???

Vincent Martinez, Architecture 2030 (he/him/his): The new US DOE Initiative for Better Energy, Emissions, and Equity (E3 Initiative) will focus on advancing the research, development, and national deployment of clean heating and cooling systems that include electric heat pumps, advanced water heaters, low-to-no global warming potential refrigerants, smarter HVAC diagnostic tools, and advanced window technologies. https://www.energy.gov/eere/buildings/energy-emissions-and-equity-e3-initiative

Debra Shepard: The modeling can be really tricky - it might have to be run 3 different ways: LEED, MassSave, local zoning...

Peter Alspach: Debra - I might suggest an alternate approach to % area that is being used in Arlington, VA. They have a minimum of X W/SF of roof area. That makes the calculation easier to document than area. I would also suggest a minimum annual solar radiation exposure for a qualified roof area - e.g. lower podium roofs or if surrounded by taller buildings.

Zoom Chat Notes - continued

Charles Eley: The California CPUC has developed a refrigerants calculator based on CARB data. Go to https://willdan.app.box.com/v/2021CPUCAvoidedCosts/folder/136593940728

Kat Eshel, Boston Environment Dpt: The City of Boston is also building out additional green jobs initiatives in partnership with the Office of Workforce Development that John referenced: boston.gov/green-jobs

Tim Frank: have you worked with the building trades on the benefits of using skilled and trained workers to do the work?

Maynard Clark: How are compliance burden COSTS reduced for the long-term good of all concerned? Do we have compliance 'best practices'??

Gwill York: Congratulations on explaining the diminutive cost of this.

Dennis Carlberg: How will embodied carbon be accounted for in concert with operational carbon? How do we align these goals?

Peter Alspach: Given the impact of embodied carbon in the very important near term emissions reductions that we need to do, how will the City accelerate the introduction of embodied carbon limits so there is meaningful impact before 2030?

Maynard Clark: How should owners, residents, and managers of older gas-heated buildings think about the City's greening efforts when we know that ecological harms of natural gas and methane?

Debra Shepard: Great question Dennis! I wonder if we could borrow from the LCA world and define a functional unit for the building (i.e. operational carbon x lifespan). Then the embodied and operational carbon could be combined into a full LCA view.

Ross Cameron: Are there components of the embodied carbon TAG's research that could be used to strengthen the article 85 demolition delay process as it relates to saving / reusing existing buildings? Currently there is no requirement to analyze the embodied carbon in an existing building.

Julie Janiski: +1 Peter re near-term impact

Peter Alspach: I might suggest a start to embodied carbon by requiring the disclosure of materials quantities for building structure with default emissions factors as a starting point for the basics of data collection that can then be a launch point for future regulations. The City of Seattle took this approach with air leakage - first code cycle was test and report with no failure, then from that data came compliance thresholds.

Zoom Chat Notes - continued

Julie Janiski: Peter - thanks! The EC TAG discussed exactly this idea, it's a good one.

Julie Janiski: The Commonwealth issued regulation 310 CMR 7.76 last December that mirrored other states and the Kigali Agreement in terms of HFC Phase outs for chillers. The current language will prohibit R-134a in new chiller installations starting January 1, 2024 (see page 8 of the doc labeled “hfcf-reg”).

https://www.mass.gov/service-details/prohibitions-on-the-use-of-certain-hydrofluorocarbons-310-cmr-776

Peter Alspach: could take a similar approach to refrigerant emissions, too.

Maynard Clark: TUVM

02:12:52 Hannah Payne, Boston Environment Dept.: Maynard, I’m also happy to connect with you to discuss your specific building situation and how it could transition to comply with BERDO

James Cox: Thank you, everyone.....

Rickie Harvey: Agreed! Huge thanks to the TAG teams! You all are amazing.

Amy Longsworth: Great meeting, John and team. Thank you to the TAGs.

Debra Shepard: Amazing work and great discussion all. Thank you!

Dennis Carlberg: Thank you to the City, BPDA, BR+A, TT, Vincent and Charles, Debra, Michelle, and the experts for leading this effort!

Agnes Vorbrodt: Thank you!!

John Dalzell, BPDA: Thank you all for joining us tonight and once again, a big thank you all the TAG Member and Team Leaders who contributed their time and expertise to this efforts! Cheers, John

END

Thank you!