



Fossil Fuel-Free Construction

Final Presentation

Climate Solutions Living Lab | Spring 2023

Claire Tham, Cynthia Ma, Dane Underwood, Livesey Pack, Marco Fornara



Claire Tham

Master's in Urban
Planning '23

Harvard Graduate
School of Design



Cynthia Ma

Master's in Public
Health '24

Harvard T.H. Chan
School of Public Health



Dane Underwood

Juris Doctor '23
Harvard Law
School



Livesey Pack

Master's in Urban
Planning '23

Harvard Graduate
School of Design



Marco Fornara

Master's in Public
Policy '23

Harvard Kennedy
School

This presentation is student work product completed to fulfill requirements of the Climate Solutions Living Lab, a 12-week course offered at Harvard Law School. This presentation was researched and written under tight time constraints to answer specific questions posed to the students in their course assignment. Any opinions expressed in the report are those of the students and not of Harvard University or Harvard Law School. If you would like to learn more about the Climate Solutions Living Lab, please contact Aladdine Joroff at aladdine@gmail.com.

Overview

01 Context

02 Scope & Reach

03 Equity & Environmental Justice (EJ) Communities

04 Implementation

05 Enabling Environment

Overview

01 Context

02 Scope & Reach

03 Equity & EJ Communities

04 Implementation

05 Enabling Environment

What is Fossil Fuel-Free Construction?

“As defined by a city or town to include, but not be limited to, an entire building or entire condominium unit that does not, in support of its operation after construction, utilize coal, oil, natural gas, other fuel hydrocarbons, including synthetic equivalents, or other fossil fuels.” Draft 225 CMR 24.02.

Legislative History

Massachusetts Clean Energy and Climate Plan for 2050

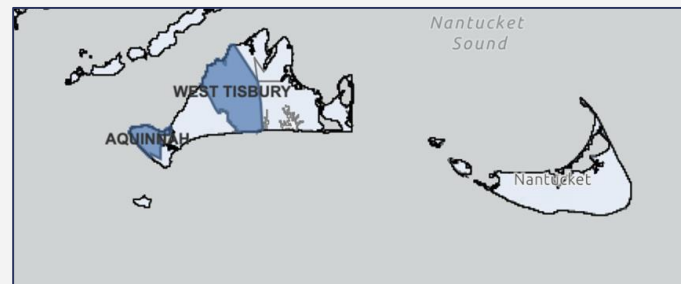
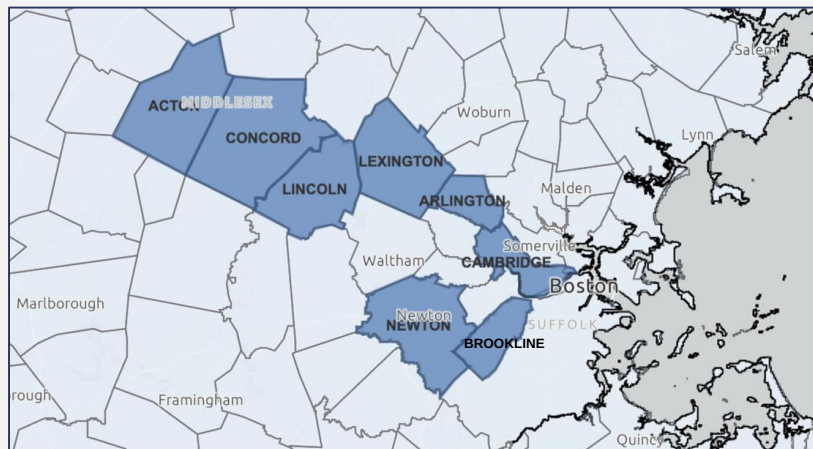
- Net-zero emissions by 2050, including at least an 85% direct reduction in GHG emissions as compared to 1990 levels

Municipal Fossil Fuel Free Building Demonstration Project

- Department of Energy Resources (DOER) pilot initiative
- Enables cities and towns to adopt and amend general or zoning ordinances or by-laws to require new building construction or major renovation projects to be fossil fuel-free

The Demonstration Project

- **10 Prioritized Communities**
 - Home Rule petition filed by August 11, 2022
 - Must meet other DOER eligibility requirements
- **Substitute Communities**
 - Eligible to enter project if a Priority Community withdraws



Setting the stage...

To be able to hit its climate goals, MA buildings need to decarbonize.

DOER Fossil Fuel-Free (FFF) pilot program is a step in the right direction.

However, more can and should be done to:

- *Expand the scope and reach of the pilot regulation to reduce CO₂*
- *Be more attentive to issues of equality*
- *Ensure that the regulation is implemented well*

Finally, building decarbonization does not happen in a vacuum. It's important to highlight and promote enabling measures for FFF.

Overview

01 Context

02 Scope & Reach

03 Equity & EJ Communities

04 Implementation

05 Enabling Environment

Recommended Criteria for Participating Communities

The number of participating communities should be expanded until the initial demonstration project accounts for a diverse range of communities across the Commonwealth.

Current cohort of Priority Communities are homogenous in terms of:

- *Median household income*
- *Public health profiles*
- *Demographic diversity*

Recommended Criteria for Participating Communities

Current Eligibility Requirements

- Home Rule Petition filed
- Local approval of participation
- Municipality meets one of the following housing criteria:
 - 10% housing affordability threshold per Chapter 40B
 - Safe Harbor Grantee via valid Housing Production Plan
 - ≥1 by-right multi-family residential district

Recommended Eligibility Requirements

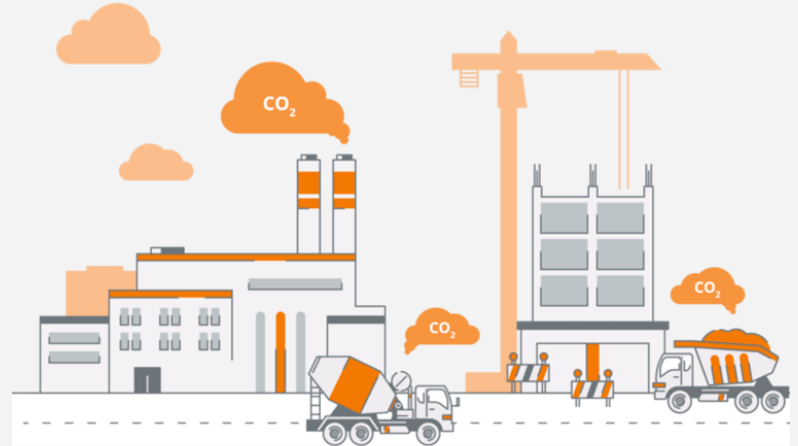
Current requirements AND...

- Contribution to the overall Demonstration Project, including diversity of the following community aspects: demographics; community size; scale of building development; public health profile; and type of housing development
- Ability to meet reporting requirements and effectively monitor and ensure code compliance and implementation
- Localized electric grid investments needed to support the Demonstration Project

Embodied Carbon

Require embodied carbon measurement requirements

- Measurement based on 'whole life-cycle carbon' assessment models and existing reputable calculators
- Sets a standard, educates developers, creates a market for measurement, lowers transaction costs
- Provides the ability to offer option of certifying low-carbon construction and connected incentives



Embodied Carbon

The emissions from manufacturing, transportation, and installation of building materials.

Source: CarbonCure. "What Is Embodied Carbon?" Sep. 22, 2020.
<https://www.carboncure.com/concrete-corner/what-is-embodied-carbon/>.

Exemptions in Draft Regulations

(a) Deviations from the model rule provided by the Department must include exemptions from fossil fuel free requirements for **Research Laboratories for Scientific or Medical Research, or for Hospitals or Medical Offices.**

From DOER draft FFF regulation

1. Economically & Technically Feasible



Source: Nadel, S., and C. Perry. 2020. Electrifying Space Heating in Existing Commercial Buildings: Opportunities and Challenges. Washington, DC: American Council for an Energy-Efficient Economy. [aceee.org/research-report/b2004](https://www.aceee.org/research-report/b2004).

2. No special prescribed exemptions in other similar regulations (e.g. SF)



Recommended Changes to Exemptions

Treat all new buildings equally and allow exemptions based on a waiver process that assesses substantial physical or technical infeasibility

- Infeasibility can include lack of utility infrastructure, emergency reasons for non electric power, etc.
- If waiver is allowed, non-electric energy is limited, health benefits must be close to equivalent and electric ready features must be included
- Waiver is granted upon the use of best available technology with comparable energy efficiency achieved by the top 10% of the best performing buildings in the same category

Overview

01 Context

02 Scope & Reach

03 Equity & EJ Communities

04 Implementation

05 Enabling Environment

Affordable Housing & EJ Communities

Minimize upfront and operational costs

- Expand availability of affordable housing
 - Housing finance authority, public-private housing partnerships, affordable housing accelerator
- Loosen zoning requirements
- Financial assistance for low-income renters

Recommended Changes to “Major Renovations” Definition

Current definition (based on % surface) is broad and may lead to the unintended consequence of stifling renovations especially in low-income communities

any other general or special law to the contrary, adopt and amend general or zoning ordinances or by-laws that require new building construction or **Major Renovation** projects to be fossil fuel-free, and enforce restrictions and prohibitions on new building construction and **Major Renovation** projects that are not fossil fuel-free, including through the withholding or conditioning of building permits

From DOER draft FFF regulation

Change regulation to reference “major renovation of the building’s energy system” to align economic incentives to ensure cost-effectiveness

Assistance Program

Financial and technical assistance should be provided to minimize challenges that might threaten the viability of affordable housing developments.

- High capital investment might deter affordable housing providers from modifying project scope or major renovation.
- Financial assistance on cost differential* could address the split incentives between private affordable housing providers and renters.
- State governments could provide additional support for EJ communities and communities with a population < 50,000

*DOER should initiate data collection and produce publicly available information on appliance cost, HVAC system replacement cost, and labor cost for traditional building technologies versus FFF upgrades.

Overview

01 Context

02 Scope & Reach

03 Equity & EJ Communities

04 Implementation

05 Enabling Environment

Success Metrics

Studies	Goal	Indicators of Interest
Baseline studies	Determine the appropriate reference for comparison	Direct carbon emissions from building operations; indoor air quality before electrification
Technology evaluations	Independently assess the effectiveness of various fossil fuel-free building technologies	Scope 1 & Scope 2 carbon emissions; total energy consumption; fixed and operational costs
Process evaluations	Assess the effectiveness of program operation	Average permitting time
Impact evaluations	Analyze attributable carbon emission reductions and co-benefits	Reduced greenhouse gas emissions; indoor air quality; energy accessibility and affordability; health equity at the community level
Market characterization	Assess program impact on the greater economy	Green jobs added; additional investment for sustainable grid infrastructure

Enforcement Standards in Draft Regulations

(1) Recommended Process. The Department has published a model rule and other guidance in order to assist Participating Communities in achieving the objectives of the Demonstration Project. The Department recommends that cities or towns seeking to participate in the Demonstration Project:

- (a) Adopt the Specialized Municipal Opt-in Energy Code, as established in 225 CMR 22.00 and 225 CMR 23.00, and
- (b) Adopt through Local Approval the model rule published by the Department.

From DOER draft FFF regulation

- Only focuses on the existing regulations on electrification but does not specify that buildings should remain fossil fuel free during building's lifetime
- Does not specify the enforcement process

Recommended Changes to Enforcement Standards

- Enforcement process incorporated into the building regulations process in collaboration with the Massachusetts Board of Building Regulations and Standards (BBRS)
- Regular Inspections of fossil fuel-free specifications built into regular building inspections during the permitting process for building approvals and during the building maintenance after construction

Overview

01 Context

02 Scope & Reach

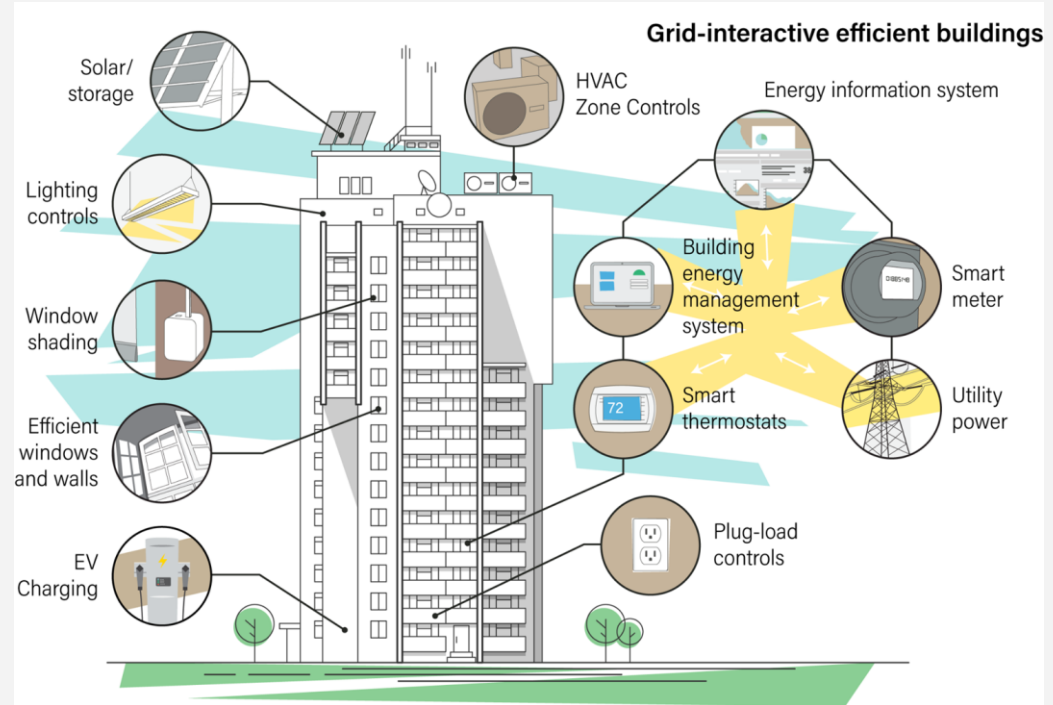
03 Equity & EJ Communities

04 Implementation

05 Enabling Environment

Grid Management: Demand Side

- Electrification of buildings will add peak demand to the grid
- **It is important to incentivize energy efficiency and demand flexibility in FFF buildings**
 - Home Energy Rating System (HERS) score 42 or below
 - Peak demand response systems
 - Tax incentives



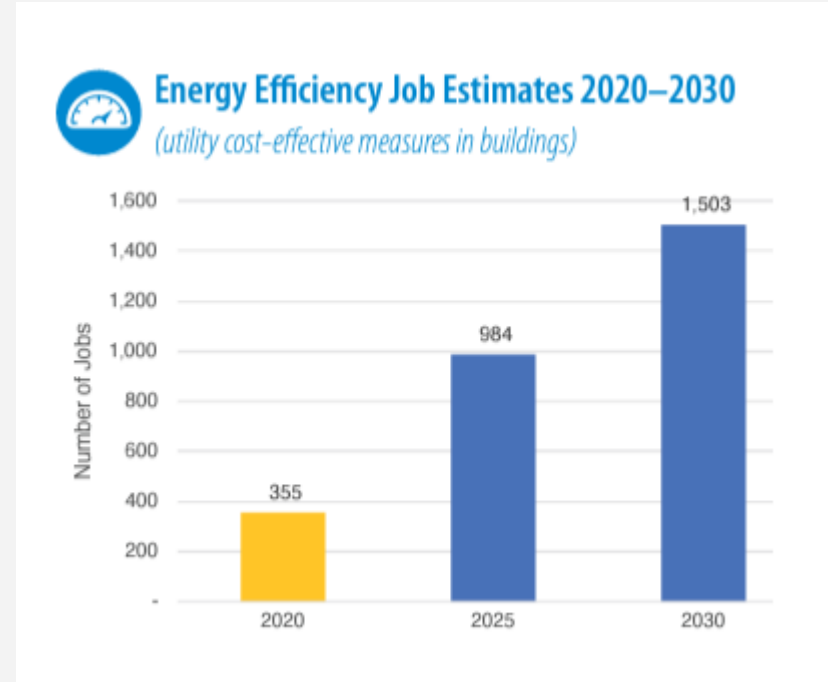
Source: American Council for an Energy-Efficient Economy (ACEEE). Grid-interactive Efficient Buildings Are the Future, and Utilities Can Help Lead the Way. Nov. 20, 2019.

<https://www.aceee.org/blog/2019/11/grid-interactive-efficient-buildings>.

Workforce Development Program

Municipalities should assist in clean energy workforce development and training

- Achieve equity goals including members of disadvantaged communities
- Sources of funds from ARPA, MassCEC, U.S. Department of Treasury and Labor



Source: National Renewable Energy Laboratory

Workforce Development Program

Case Study

New York State Energy Research & Development Authority's (NYSERDA) On the Job Training Program & Pay for Success Clean Energy Training

- **Training** for building and operations staff to properly operate and maintain building systems
- **On-the-job training** for new clean energy staff
- **Internships** for students seeking hands-on experience at a clean energy company
- **Curriculum development** to meet the demands of clean energy employers
- Creation of a **sustainable talent pipeline** that can reduce the costs and risks of hiring new employees
- **Career pathways training** for installing and maintaining high-efficiency HVAC and heat pumps



Fossil Fuel Free Buildings for all



Questions & Discussion

Appendix

Methodology



Methodology

Organization	Contact	Location
Building Decarbonization Coalition	Ted Tiffany	California-based with national focus
San Francisco Dept. of Environment	Barry Hooper Nik Kaestner	San Francisco, CA
City of Boston	Hannah Payne	Boston, MA
Boston Housing Authority	Joel Wool	Boston, MA
Housing Partnership Network	Adam Meier	Boston-based with national focus
Sullivan & Worcester LLP	Ed Woll	New England

Technical Exemption

If technical infeasibility is proved, property owners can appeal for exemptions contingent upon the adoption of the best available technology.

- “Best available technology” identifies the current average level of energy efficiency achieved by the top 10% of the best-performing similar buildings.
- The standard should be reviewed every 8-10 years until no major technological obstacles for FFF upgrades.

Major Renovations

any other general or special law to the contrary, adopt and amend general or zoning ordinances or by-laws that require new building construction or **Major Renovation** projects to be fossil fuel-free, and enforce restrictions and prohibitions on new building construction and **Major Renovation** projects that are not fossil fuel-free, including through the withholding or conditioning of building permits

From DOER draft FFF regulation

“Over 50% of the home is renovated and configured”

-
- Broad definition
 - Could lead to unintended consequences

Major Renovations

Modify current definitions to refer to major renovations to energy systems, as follows:

“A major renovation within a building is defined as a major renovation of a scope 1 fossil fuel-using building system or scope 1 fossil fuel-using component that provide significant opportunities for energy efficiency or reduction in fossil fuel-related energy consumption. This includes, but is not limited to, replacement of the HVAC system, hot water system, or cooking system, or other fossil fuel-using systems or components of the building that have a major impact on fossil fuel usage.”

This definition would be used to assess the proposed renovations of existing buildings. Municipalities would have the flexibility to decide how they interpret the term “major” for each renovation proposal (e.g., by cost, by CO2 emission, or by multiple indicators combined).