Survey of U.S. State and Local Building Decarbonization Policies and Programs

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ABSTRACT

Building decarbonization has been a growing focus for climate initiatives among local and state governments in the United States over the past several years. Such initiatives are often focused on building end-use electrification. They include (a) electrification codes for various building types and end-uses in new buildings, (b) building performance standards for existing, large commercial buildings, (c) new funding mechanisms to encourage fuel switching from fossil fuel-based heating to electric heat pumps, (d) modifications to energy efficiency program cost-effectiveness screening to encourage electrification, and (e) heating oil taxes to fund heat pump installations. We reviewed 15 state and local jurisdictions for these policies and programs across the United States representing a range of different approaches. In this paper, we summarize key findings from this survey. We highlight the range of policy and program options that have been implemented, adopted, or are under development and the regulatory and policy mechanisms utilized. We also provide relevant context such as local policy, political culture, building energy use, and utility providers. In addition, our paper summarizes, where relevant, the opinions of various stakeholders expressed during the development of the local and state policies. Finally, based on these assessments, we identify barriers to and success factors for adoption of effective building decarbonization policies. This research offers a variety of cutting-edge policy and program options for state and local governments to consider adopting. The research can also help policymakers, advocates, and other stakeholders assess current and future progress toward building decarbonization policy and program development and implementation.

Introduction

A growing number of local and state governments in the United States have recently started to explore or enact various building decarbonization policies with a focus on electrification, taking advantage of the fact that electrification can reduce emissions now and will do so even more in the future as electric supply becomes cleaner. Leading states on energy efficiency and climate change policies, such as California and the New England states of Massachusetts and Vermont, have made strides on developing building decarbonization policies over the past few years. Such policies include new statewide building codes, new or enhanced incentive programs to encourage fuel switching to heat pumps, and modifications to energy efficiency program cost-effectiveness screening.

Many local governments have also adopted new regulations and programs to meet their long-term greenhouse gas (GHG) emissions reduction targets, especially to reduce emissions from buildings. Such new regulations and programs include all-electric building codes, bans on gas connections or appliances in new buildings, energy or emission performance standards for existing buildings, and new funding mechanisms to encourage fuel switching to heat pumps.

To understand the landscape of the emerging policies and draw thematic findings for future work, we reviewed actions by 15 state and local jurisdictions on their building decarbonization policies across the United States. States reviewed include California, Massachusetts, Vermont, and Maine. Local government policies include actions in New York City (NYC); Washington D.C.; Seattle, Washington; Boulder, Colorado; and seven cities and towns from California. This paper provides a short summary of these case studies, and summarizes a variety of cutting-edge policy and program options for state and local governments to consider adopting and implementing. We hope this research can help policymakers, advocates, and other stakeholders assess current and future progress toward building decarbonization policy and program development and implementation.

Research Methodology

Many of the initiatives surveyed for this research have been adopted or implemented since 2017. In a significant number of cases (many of which come from California local governments), state and local entities started policy consideration in 2019 and began adoption in 2020. A summary map of the 15 cases is presented in Figure 1 below.

While building electrification initiatives are still limited in the country, they are diverse. We selected 15 leading cases with a range of unique approaches in terms of the types of policies and programs (including applicable sector and end-uses), the types of entities (e.g., local governments, municipal utilities, energy efficiency program administrators, state agencies) and climate. Climate is an important factor for building electrification because the performance of heat pumps is significantly affected by temperature.

Geographically, our cases are focused in California and the northeastern states. These are areas with a history of policies and action on shaping how energy is used. For example, Massachusetts, California, and Vermont are the top three ranked states in the 2019 American Council for an Energy-Efficient Economy (ACEEE) state ranking (Berg et al., 2019). While Maine was ranked 15th in the 2019 survey, we included this case because the state is located in a cold climate region and has recently implemented an ambitious heat pump implementation target. Similarly, ACEEE's local government ranking in 2019 includes many of the cases we selected among top local governments: San Francisco (#2), Seattle (#3), Washington D.C. (#5), New York (#6), San Jose (#11), and Sacramento (#20) (Riberio et al., 2019).

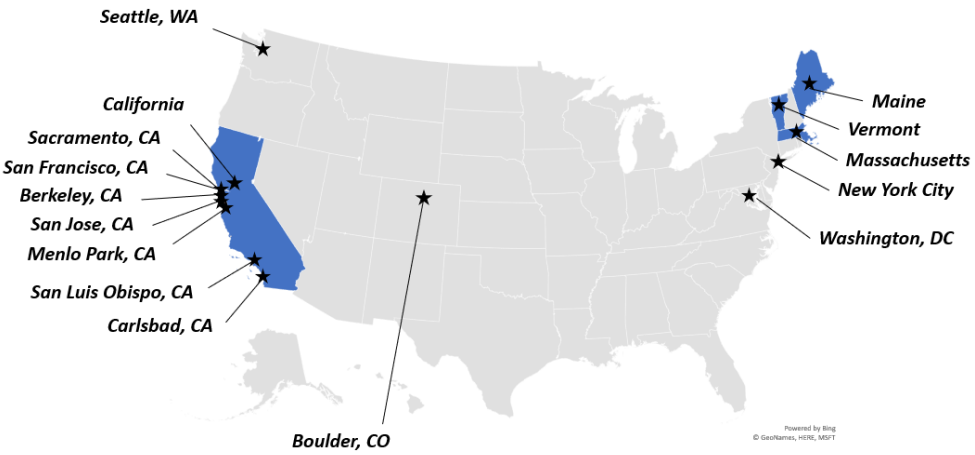

Figure 1. A map of U.S. building decarbonization policy cases.

Our main approach for this study is a literature review, along with limited stakeholder interviews. As part of the literature review, we reviewed proposed and adopted policies (e.g., state legislation, state regulations, and local ordinances), supporting documents for the regulations, and public comments. We conducted interviews with local stakeholders in each area to seek additional information about the policies and gauge stakeholder positions regarding those policies. We investigated the policy context/background (e.g., key related policies, building energy use, utility providers), policy and program contents, and stakeholder reactions. We also observed challenges, success factors, and prospects in adopting and implementing different policies.

Building decarbonization policy and program summary

An Overview of the 15 Cases

The following table provides an overview of the 15 jurisdictions we investigated, including the location name, type of jurisdiction, and the type of policy or program. In the following sections, we summarize these cases by the type of initiatives reviewed and analyze each of the policy and program approaches, incorporating information from these specific jurisdictions. We then discuss any key considerations that are applicable across different jurisdictions or different approaches.

Table 1. Overview of U.S. building decarbonization policy/program case studies

Case	Policy/Program Type	Policy/Program Name/Summary
California	Statewide building decarbonization initiative	Heat pump water heaters and solar PV in statewide building code
	Energy efficiency program framework reform	Reform to the fuel substitution test to support cost-effective electrification
Sacramento, CA	Enhanced rebates	Enhanced rebates for heat pumps
San Francisco, CA	Building electrification code	All Electric code for municipal buildings and Electric Preferred code for other buildings
	Clean energy purchase requirement	Clean energy purchase requirement for large buildings
Berkeley, CA	Building electrification code	All Electric code for low-rise residential buildings
San Jose, CA	Building electrification code	All Electric and Electric Preferred codes for all buildings
Menlo Park, CA	Building electrification code	All Electric code for all buildings
San Louis Obispo, CA	Building electrification code	Electric Preferred code for all buildings
Carlsbad, CA	Building electrification code	All Electric code for residential water heating
New York, NY	Building performance standard	Building emission performance standard

Washington D.C.	Building performance standard	Building energy performance standard
Vermont	Alternative portfolio standard	Energy transformation projects in the Renewable Energy Standard
Massachusetts	Alternative portfolio standard	Heat pump projects in the Alternative Portfolio Standard
	Energy efficiency program framework reform	Strategic electrification in energy efficiency programs
	Enhanced rebates	Multiple state incentive programs to support heat pumps
Maine	Target and enhanced rebates	Statewide heat pump target with enhanced incentives
Boulder, CO	Enhanced rebate and education program	Heat pump rebate and education program
Seattle, WA	Oil tax	Heating oil tax to promote heat pump conversions

Building Electrification Codes

Building energy codes are adopted at the state level in most states. This generally inhibits the majority of local governments from adopting their own codes, with the exception of some large cities that have their own building codes (e.g., New York, Seattle, Boston) and several states that allow local governments to adopt their own codes (e.g., Arizona, California, Kansas, Mississippi, New Hampshire, Texas) (Building Codes Assistance Project 2020). Among the states allowing for local codes, California has a unique approach called the Reach Code. The Reach Code approach was developed specifically to specifically allow cities and towns to develop and adopt their own codes that are more stringent than the statewide minimum building energy code, as long as they prove new codes are cost-effective (CEC 2019). Under this approach, local governments can develop stronger energy codes that promote electrification.

Many local governments in California established new Reach Codes to promote electrification by developing new local ordinances in 2019. The type of such electrification code varies across local governments. They are generally grouped into the following three categories depending on whether electrification is mandated or encouraged: Electric Mandatory, Electric Preferred, and Electric Ready. Among these categories, applications also vary based on what type of buildings and end-uses are subject to electrification codes.

- **All Electric codes** prohibit the installation of fossil fuel appliances and equipment for all end-uses or certain end-uses in new buildings and in some cases ban natural gas connections. Carlsbad and San Jose adopted All Electric codes on single-family and low-rise residential buildings, excluding certain end-uses.[1] San Francisco has adopted its All Electric code for all new municipal buildings.
- **Electric Preferred codes** encourage all-electric buildings by mandating additional requirements to new construction buildings that choose to use natural gas or other fossil fuels (e.g., requiring higher efficiency standards beyond the state's minimum building

[1] Low-rise residential buildings are defined in California as residential buildings with three or fewer stories.

codes for new mixed-fuel buildings). Communities that have adopted this approach include San Jose, San Francisco, and San Luis Obispo.[2]

- **Electrification Ready codes** require that new buildings be wired for an eventual switch from gas/propane to electric appliances and/or EV infrastructure.[3] Many communities including Menlo Park, Berkeley, San Francisco, and San Jose have adopted Electrification Ready requirements as part of their main electrification codes.[4]

Communities in California took various approaches, in terms of types of applicable buildings and end-uses, to mandate or encourage electrification suitable for the needs of the communities or accepted by the stakeholders in the communities as follows:

- **San Jose,** the most populous city to implement an electrification code, took a phased approach in which it adopted an All Electric code for single-family and low-rise residential buildings and an Electric Preferred code for high-rise buildings in all sectors. (City of San Jose 2019).
- **Carlsbad**, a community of about 115,000 people located north of San Diego, took an incremental approach where it adopted an All Electric code requirement for water heating only in residential new construction because water heating accounts for the majority of gas use in the community (City of Carlsbad 2019).
- **Menlo Park**, a progressive Silicon Valley town, adopted an All Electric code for all new construction buildings with some exceptions. The code exempts cooking for all residential buildings (except high-rise buildings). It also exempts emergency operations and life science buildings, the latter of which were exempted in response to public comments from life science stakeholders (Menlo Park City Manager's Office 2019).

Further, San Luis Obispo, a community of 50,000 people located between San Francisco and Los Angeles, took a unique Electric Preferred code where new buildings with fossil fuel appliances need to offset emissions expected from the new construction buildings either through undergoing energy retrofit projects in existing buildings or pay an "in-lieu fee" which funds other existing building retrofit projects to counteract the emissions of the new mixed-fuel building. This is an additional requirement on top of higher efficiency standards and electric-ready requirements for such new buildings (Codron 2019).

Successful adoption of these electric building codes is generally attributable to widespread public support and information about cost-effectiveness and benefits of electrification measures. For example, in a number of communities, including Menlo Park, city councils unanimously adopted electrification codes (Paulson, L., 2019). Local electric and gas utilities' support also appears to be a key factor for success. All of the communities that have adopted All Electric codes identified in this paper are served by Pacific Gas & Electric (PG&E), a company which provides both gas and electricity and hence may retain revenue or service

[2] The electric preferred code in San Francisco is applied to residential and commercial buildings.
[3] Buildings need to have the breaker box capacity, wire size, and conduit necessary for high voltage outlets (e.g., 240 Volt) for future electric appliances.
[4] Such codes are applicable to EV infrastructure in San Francisco, and EV infrastructure as well as non-residential mixed fuel and high-rise residential buildings in San Jose.

customers who fuel-switch.[5] PG&E has publicly expressed its support for building electrification (Kenney, R., 2019).

All communities in California investigated the cost-effectiveness of their proposed Reach Code per California Energy Commission's regulation as mentioned above. This analysis helped stakeholders and city councilors to support the proposed building codes. A staff member of the City of Carlsbad noted that the City found it helpful to show stakeholders cost-effectiveness results, prepared by a consultant for the City, to assure them that costs would not increase (Grim, M., Senior Program Manager, the City of Carlsbad Environmental Management Department, pers. comm., November 26, 2019).

California local governments and stakeholders also recognized other benefits of electrification, including improved indoor air quality with electric cooking and reduced risks of fires and explosions associated with natural gas infrastructure. These benefits became drivers for the adoption of electrification building codes in some communities (Licardo et al., 2019).

Statewide Building Decarbonization Initiative

In addition to the Reach Code discussed above, California Energy Commission made two major revisions to its statewide building code in 2019: (1) it now requires all new homes to have photovoltaic (PV) solar panels and (2) it modifies building energy efficiency baselines so electric water heaters can compete with gas water heaters on a level playing field (CEC 2019; CEC 2018). These revisions are expected to support more building electrification with lower emission rates and lower electricity costs with solar PV. The underlying impetus of these policy changes is the California Public Utilities Commission's (CPUC) 2008 Energy Efficiency Strategic Plan. This plan has ambitious targets—such as that all new residential construction be zero net-energy (ZNE) with on-site renewable generation by 2020 and all new commercial construction and retrofits will be ZNE by 2030. California state law AB 3232 (2018) requires state agencies to evaluate the feasibility, potential, and the cost-effectiveness of the 40 percent GHG emission reduction from the residential and commercial building stock by January 1, 2030. This analysis will help inform the development of the new code and decarbonization programs in existing buildings toward the 2030 GHG target.

Building Performance Standards

A building performance standard uses regulatory mechanisms to limit and reduce energy or emissions from existing buildings by setting minimum energy or emission limits, typically by building type (e.g., energy or emissions per square foot by building type). In the United States, a few large cities including Washington D.C., NYC, and St. Louis have implemented building performance standards. The City of Boston and other cities are currently examining building performance standards. Performance standards provide the building owners flexibility to determine the most effective and economical way to meet the standard (Institute for Market Transformation. n.d.). As a result, a building performance standard may or may not lead to building electrification. At the initial levels of performance required in each city, extensive electrification is not required or expected. But as the limits become stricter over time, a growing number of building owners and occupants will need to electrify their space and water heating

[5] In other regions, gas and electric services are segmented between different companies, creating winners and losers in an electrification scenario.

end-uses or switch to renewable energy sources (e.g., solar hot water and biomass) to meet the lower limits.

The cities which have adopted building performance standards to date had each previously implemented building disclosure policies to ensure standardized measurement and understand the energy and emissions profiles of existing buildings. This enables local governments to develop appropriate performance standards for the buildings. For example, Washington D.C. and NYC implemented building disclosure policies in 2008 and 2009 respectively (Clean and Affordable Energy Act of 2008; NYC Local Law 84). Cities often first apply both disclosure and performance standard policies to large commercial and multifamily buildings, with other building types and smaller buildings phased in afterward.

Washington D.C. established its Building Energy Performance Standard by law through the Clean Energy DC Omnibus Act of 2018 in order to address the District's GHG emissions in buildings. Building emissions account for 75 percent of the total emissions (DC DOEE 2019). The District's Building Energy Performance Standard will be determined through a rulemaking in 2020 and will have five-year compliance periods, with the first period beginning in 2021 (District of Columbia Code § 8–1772.21). During each compliance period, buildings that are less efficient than the determined efficiency standard will have to either reduce their energy consumption by 20 percent, implement a prescriptive set of cost-effective energy efficiency measures, or follow an alternative compliance pathway established by the District energy agency. If building owners fail to take one of these steps during the five-year compliance period, they will have to pay an alternative compliance penalty. In 2021, buildings larger than 50,000 square feet will be required to meet the standard. Beginning in 2023, buildings between 25,000 and 50,000 square feet will be incorporated into the program, followed by buildings from 10,000 to 25,000 square feet in 2026.

NYC's building performance standard targets GHG emission intensity, rather than energy intensity as in Washington D.C. NYC enacted its building performance standard through Local Law 97 as part of the Climate Mobilization Act to help meet the City's target of an 80 percent GHG reduction by 2050. Local Law 97 targets emissions reduction for large buildings in a two-phase strategy. The law set different emission limits per square foot by various building types for 2024 and for 2030 with the 2030 limits substantially more stringent (about half of or less than half of the 2024 limits). The law applies to existing large buildings over 25,000 square feet with some exemptions (e.g., industrial facilities with power or steam generation, a certain type of low-rise multifamily building, municipal buildings).[6] However, municipal buildings have stricter emissions requirements than privately owned buildings (i.e., 40 percent reduction by 2025) (Russo 2019). If building owners do not comply with their building emissions limits, they are subject to fine by a civil court or an administrative tribunal in an amount proportional to their emissions overrun.[7] The law establishes the NYC Office of Building Energy and Emissions Performance (OBEEP) to administer and oversee policy implementation and track emission compliance. Buildings can apply for alternate compliance pathways through OBEEP, which may include GHG offsets, Renewable Energy Certificates (REC), hardship waivers, and case-by-case emissions limit adjustments (NYC Local Law 97).

[6] Industrial facilities for power or steam generation, multifamily buildings with three or fewer stories in which each unit has distinct ownership and heating systems, city buildings, housing developments or buildings on NYC housing authority land, rent regulated accommodations, and public places of worship.

[7] The fine is discretionary based on factors such as the owner's compliance history and efforts they've made to achieve reductions, with the fine capped at $268 per excess ton of CO2 equivalent. See NYC § 28-320.6.

Stakeholder reactions to the proposed regulations in NYC and Washington D.C. were slightly different, while the potential cost of the regulations was a single major issue raised by some stakeholders in both jurisdictions. During the development stage of the regulation, NYC received pushback from a variety of stakeholder groups including landlords, real estate groups, and building owners. They expressed concerns about potential cost and rent increases, difficulty of installing in-unit efficiency measures in tenants' units and inability of controlling tenants' energy use (Chiu 2019; Kace 2019). On the other hand, some stakeholders in Washington D.C. expressed support specifically for Washington D.C.'s proposed building energy performance standard, pointing to the large potential energy and carbon emissions reductions from existing buildings. However, some representatives of building owners raised concerns about the cost of complying with the regulation and a potential real estate disadvantage relative to neighboring municipalities. One building industry group also expressed concerns about the cost of the proposed building energy performance standard, saying that it would increase the cost of developing residential and commercial properties and create economic challenges for affordable housing developments (Council of the District of Columbia Committee on Transportation and the Environment 2018).

Real challenges are still ahead of the two cities since neither has begun to implement the regulations yet. Retrofitting large buildings is a major undertaking and will require NYC and Washington D.C. to execute effective leadership. Another potential issue is a contractor and builder shortage that could be pronounced if many buildings delay renovations until close to the deadline. A failure to implement the new regulations smoothly could result in legal complications, especially for NYC as the city has powerful building owners and tenants and has already received significant pushback from various stakeholders. On the other hand, the impact of these regulations is substantial because they are applied to largest buildings in Washington D.C. and NYC. If successful, they could serve as good examples that other large cities can emulate.

Energy Efficiency Program Framework Reform

The ratepayer-funded energy efficiency programs—operated by electric and gas utilities in most states and by third-party administrators in some states—have traditionally not encouraged fuel switching or electrification measures for a number of reasons, even when such measures are cost-effective or reduce emissions. One of the primary reasons is that the main objective of energy efficiency programs is to offer cost-effective energy efficiency services to consumers and reduce consumption in one fuel type (i.e., electricity or natural gas). Fuel switching to heat pumps would not help meet kWh reduction goals by electric utilities because it would increase their electric load. Another objective of energy efficiency is to reduce system costs. When utilities and regulators use efficiency as a least-cost resource to avoid investments in expensive supply resources, efficiency programs that reduce the consumption of another fuel type do not help reduce system costs and are therefore not encouraged (Hopkins, Takahashi, and Lis, 2018).

To address these barriers and support cost-effective electrification, a few states have been exploring potential reforms to their program frameworks or recently reformed their program framework. For example, Massachusetts updated its Green Communities Act in 2018 with An Act to Advance Clean Energy (AACE) which redefined the role of the program administrators and opened the doors for heating electrification. It does this by including more advanced technologies than standard energy efficiency such as "renewable resources, energy storage,

strategic electrification, and other clean energy technologies" (Besser, 2018). Prior to this reform, most program administrators, which are all gas and electric utilities except one independent administrator, did not include any fuel switching measures from oil or propane. Now, because of the reform to new energy efficiency framework, the program administrators have planned to achieve savings and allocated budgets for heat pump measures that switch fuel from oil or propane as part of the Mass Save efficiency program.

As another example, California recently implemented several critical reforms to its fuel substitution test called the "Three-Prong Test" in order to encourage cost-effective electrification measures. As one of the reforms, the CPUC eliminated one of the requirements under this test that the fuel substitution measures had to pass cost-effectiveness testing at the measure level from the perspectives of both the implementing utility (excluding benefits of other fuel savings) and the total resource (including other fuel savings) (CPUC, 2019, page 6). That requirement had created a barrier for measures that would replace gas fuel with electric fuel because they are not cost-effective as electric efficiency measures from the electric utility's perspective (because they increase electric consumption). The test now requires that the overall energy efficiency portfolio must remain cost-effective. In addition, the CPUC's decision changed the name of the test from the Three-Prong Test to the Fuel Substitution test. Further, the PUC revised its methodology to calculate avoided emission rates so that the emission rates from the electricity grid reflect long-term fuel mix changes considered in the state's electric sector planning. This policy change is aimed at appropriately evaluating and quantifying emissions reduction benefits anticipated from heat pumps as the grid emissions are expected to be reduced over time with the increased penetration of clean electricity supply resources.

Enhanced Equipment Rebates

Another key initiative that jurisdictions have employed to decarbonize heating is providing rebates for heat pump conversions from other heating systems. These rebates are being initiated by a variety of entities including state agencies, utilities, third-party energy efficiency administrators, municipal utilities, and local governments. In Massachusetts, as mentioned above, the Mass Save program now offers rebates for residential customers heating with oil, propane, or electric resistance ($1,250 per ton of heating capacity with an additional rebate for an integrated control system) (Mass Save, 2020). In addition, Massachusetts Clean Energy Center (MassCEC), a quasi-state agency, now offers a pilot program that targets a different customer base. This program provides natural gas heating residential customers rebates (between $3,000 to $5,500) to install heat pumps whereby customers size the systems to meet the home's entire heating load (MassCEC, 2020). Recent legislation in Maine sets a target of installing 100,000 new high-performance air source heat pumps by 2025 and has allocated new funds from Efficiency Maine's forward capacity market revenues to meet this goal (Maine L.D. 1766, § 6, 129th Legis, 2019). Efficiency Maine, the statewide energy efficiency administrator, is now offering rebates ranging from $1,000 to $1,500 per system (Efficiency Maine, 2020). In 2018, Sacramento Municipal Utility District (SMUD) began offering large rebates to its customers for replacing natural gas appliances with efficient electric appliances including heat pumps and cooking equipment (Greentech Media 2018). SMUD is offering rebates of $4,000 for customers who upgrade from natural gas furnaces to heat pump HVAC systems (SMUD, 2020), in part due to the increased utility revenue expected from electrifying new end-uses (S. Blunk, Strategic Business Planner, SMUD, pers. comm. January 16, 2020). Boulder, Colorado is offering an array of incentives to residents through a partnership between the city, county, electric utility, and a

heat pump manufacturer. A cold climate mini-split heat pump is eligible for a combined $1,350 in rebates from these organizations, as well as an additional $500 if the heat pump is used to replace natural gas heating equipment. Boulder is pairing its financial incentives with free assistance and customer support for navigating the heating system selection and installation process (EnergySmart, 2018).

To cover higher cost hurdles of switching from other fuels, rebates for heat pump conversions are generally higher than typical HVAC rebates that are intended to encourage incrementally more efficient equipment. Further, some jurisdictions provide additional incentives to ensure that fuel switching occurs (e.g., $500 additional rebate for fuel switching from natural gas) or require heat pump systems to be sized to cover the entire heating load (e.g., MassCEC program). Finally, SMUD considers the benefits of increased revenues due to electrification in setting incentive levels. SMUD has been proactive in promoting electrification in California partly because the entity is not regulated by the state's Public Utilities Commission and thus was not subject to the Three-Prong Test discussed above.

Alternative Energy Portfolio Standard

Currently 29 states and Washington D.C. have renewable energy portfolio standards (RPS) which require electric companies to procure a growing amount of renewable energy from eligible renewable energy projects over time (DSIRE, 2019). Among such states, Massachusetts and Vermont took a novel approach to promote building electrification within their RPS frameworks.

Vermont's renewable energy standard (RES) requires utilities to purchase 75 percent renewable energy by 2032 and has three tiers for different types of clean energy resources. Tier III, termed the Energy Transformation category, requires utilities to support either additional distributed renewable generation (as required by Tier II) or to support energy transformation projects that reduce the fossil fuel consumption, and associated GHG emissions, of utility customers (30 V.S.A. § 8005), such as through rebates. Heat pump installations are among the approved energy transformation projects (Vermont Department of Public Service, 2018).

Massachusetts established the Alternative Energy Portfolio Standard (APS) along with its RPS in 2008. Under the APS, each retail electricity supplier has an obligation to meet a growing amount of energy supply from alternative energy resources including combined heat and power. (DSIRE, 2017). In 2017 the Massachusetts Department of Energy Resources (DOER) proposed an amendment to the APS to include heat pumps in addition to other renewable thermal technologies, fuel cells, and waste-to-energy thermal (Mass.Gov, 2019).

In Massachusetts, the proposed change, at least as it applied to heat pumps, was positively received and public comments generally supported the proposal (S. Meserve, Deputy Director, MA DOER, pers. comm., January 2020). In Vermont, the majority of the stakeholders were supportive of the Tier III program (Vermont General Assembly, 2015). Electric utilities and large industrial ratepayers supported the program because the program could generate additional revenues for the utilities and could result in rate reductions due to increasing electricity sales from heat pumps and electric vehicles. Interestingly some fuel dealers saw an opportunity in this program to achieve emissions reductions by providing biodiesel to displace fossil fuel consumption. They also thought that heat pumps would compete with natural gas and might slow the expansion of the natural gas network, which would help fuel dealer businesses.

Both Vermont and Massachusetts offer multiple incentive programs for electrification from different sources and have faced or are facing challenges in streamlining these programs. In

Vermont, which also offers enhanced heat pump incentives through the statewide efficiency program administrator Efficiency Vermont, the various entities now pool some of their money in a central fund and have worked out a way to share the energy savings credit achieved through this funding (GMP, 2020). In Massachusetts, three separate entities or programs (i.e., the APS, MassCEC, and Mass Save) are offering incentives for heat pumps. This structure is making it difficult for consumers to quickly determine how to receive full incentives, although there appears to be some coordination among the programs.[8]

Fuel Oil Tax to Promote Heat Pump Conversions

The City of Seattle, Washington has a unique policy in its tax on heating fuel oil, imposed for the purpose to advancing decarbonization. The new Seattle law will set a $0.236 per gallon tax on heating oil, effective September 1, 2020. It directs the tax revenue to various programs and financial incentives for heating oil consumers to switch to electric heat pumps. Such programs and incentives include education, outreach, rebates for heat pumps, funding of total heat pump installation costs for low-income households, a $120 annual credit for low-income households with oil heating, and workforce training programs for oil service providers and their employees (City of Seattle, 2019). The largest portion of the revenue will be used to fund conversions from oil heating to heat pumps for low-income households. The intent of the legislation is to accelerate conversions of oil heating to heat pumps by reducing the upfront cost barriers associated with installing heat pumps, as well as by making oil more expensive (Seattle Office of Sustainability and Environment, 2019).

Stakeholder comments to the Seattle City Council were generally supportive (Seattle Channel, 2019). Environmental groups were supportive of the oil tax ordinance, citing the need to reduce fossil fuel consumption. Some individuals noted co-benefits of replacing oil heating such as improving air quality and eliminating the risk of oil leaks and spills. Stakeholders also noted that the ordinance implements the tax in an equitable manner by aiding low-income households with oil heating and by providing job training for oil providers. These aspects of the policy helped generate buy-in from a variety of stakeholders for the policy.

Cross Policy and Program Consideration

Our review of the policies and programs in the 15 jurisdictions identified several key considerations that impact effectiveness across multiple policies and programs.

The Importance of Overarching GHG Emission Targets and Building Electrification

One of the common themes across many cases we examined is the recognition of building electrification as a key pathway to meeting overarching GHG emission targets. For example, Vermont first adopted its 2050 goal of 90 percent renewable energy across all sectors in its 2010 Comprehensive Energy Plan, and then developed and adopted Tier III of the Renewable Energy Standard in 2015. As another example, in 2019 the NYC Council passed a set of bundled laws, called the Climate Mobilization Act, to help the City meet its 80 x 50 goal that was established in 2014. Boulder's programs are also focused on meeting climate goals and are

[8] For example, once Mass Save started offering rebates for heat pump conversions from oil and propane in 2019, MassCEC replaced its old program with a new pilot for new and existing homes.

partially funded by the city's Climate Action Plan tax (EnergySmart, 2018). Massachusetts, Maine, and Boulder have all committed to reduce GHG emissions 80 percent by 2050. SMUD is aiming for net zero emissions to serve its customers' electric load by 2040 (SMUD, 2019).

Policies on New vs. Existing Buildings

Our review revealed that there are various policy and program tools to address fossil fuel use and reduce emissions from the building sector. Building codes can take many different forms in mandating or encouraging building electrification in new buildings, and there are many such examples, even within California. On the other hand, a regulatory approach to restrict or reduce emissions from existing buildings through a building performance standard is still limited. We found only three such cases (Washington D.C., NYC, and St. Louis). However, we also learned that a growing number of jurisdictions at both the state and local levels are implementing a variety of programs to incentivize building decarbonization measures in both new and existing buildings. For example, the City of Boulder, SMUD, and the states of Maine and Massachusetts now provide incentives for building electrification measures through utility energy efficiency programs and/or government rebate programs. Further, the City of Seattle established a unique fuel oil tax and is promoting heat pump conversions using the tax proceeds as a funding source.

Synergies between Clean Energy Supply Policies and Building Demand Policies

Some jurisdictions implemented both supply-side and demand-side policies to promote building electrification and decarbonization with the recognition that they need policies in both sides to fully decarbonize the building sector. For example, in 2019 San Francisco adopted an ordinance to require commercial buildings to meet all electricity demand by procuring GHG-free or renewable resources, with the requirement phased in between 2022 and 2030. The city then adopted two new ordinances at the beginning of 2020 to ban natural gas connection from new municipal buildings and to adopt an Electric Preferred code for other buildings. In addition, as discussed above, Vermont and Massachusetts blended supply- and demand-side approaches by incorporating heat pumps and other building electrification measures as eligible measures under special tiers in their clean energy supply portfolio policy frameworks.

Municipal Leadership

Municipal governments also took leadership and mandated stronger building decarbonization regulations on municipal buildings than on private buildings. For example, Local Law 97 recently adopted by the City of New York mandates stricter building emission standards for municipal buildings (i.e., 40 percent reduction by 2025 and 50 percent by 2030) (Russo, 2019). As another example, San Francisco adopted an All Electric code that bans gas connection to all municipal buildings ahead of other building types. A city official stated that this policy would "demonstrate the city's commitment to leading the transition to an all-electric future" (Bay City News, 2019).

Program Coordination

Our survey found that in some places multiple entities are now offering rebates, public outreach, and technical support for promoting heat pump conversions (e.g., the cases for Massachusetts and City of Boulder), but most of them do not appear to be coordinating well with

each other. We expect that as more resources and funding become available to support building electrification across the country, we may see more cases where multiple entities start offering different programs within the same jurisdictions. This situation could create consumer confusion and make it challenging for consumers to easily receive full incentives. On the other hand, program administrators also need to make sure that the combined rebates are not excessive, to avoid excessive free ridership. Thus, it is imperative for multiple entities to coordinate with each other and offer streamlined and integrated program support for building electrification measures.

Equity

The City of Seattle's fuel oil tax directs the largest portion of the tax revenue toward funding heat pump conversions for low-income households. While our survey did not find any other policies that specifically support low-income households, we believe this will become a key consideration in electrification policies and programs. These customers merit particular attention because they are the most at risk of being left behind with fossil fuel heating systems and the legacy cost of fossil fuel infrastructure as other customers electrify.

Conclusion

The building decarbonization and electrification actions presented here together represent a variety of cutting-edge policy and program options for all jurisdictions that are considering acting on their building decarbonization objectives. We have identified the importance of overarching GHG emission targets and building electrification, the role of different policies targeting new vs. existing buildings, important synergies between clean energy supply policies and building demand policies, the role of municipal leadership, the need for program coordination, and the importance of addressing equity issues. We hope these key considerations help policymakers, advocates, and other stakeholders assess current and future progress toward building decarbonization policy and program development and implementation.

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