Building Decarbonization Public Policy Framework

By Samantha Caputo, Senior Public Policy Associate

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About NEEP

Founded in 1996, NEEP is a non-profit whose goal is to assist the Northeast and Mid-Atlantic region to reduce building sector energy consumption three percent per year and carbon emissions 40 percent by 2030 (relative to 2001). Our mission is to accelerate regional collaboration to promote advanced energy efficiency and related solutions in homes, buildings, industry, and communities. We do this by fostering collaboration and innovation, developing tools, and disseminating knowledge to drive market transformation. We envision the region's homes, buildings, and communities transformed into efficient, affordable, low-carbon, resilient places to live, work, and play. To learn more about NEEP, visit our website at http://www.neep.org.

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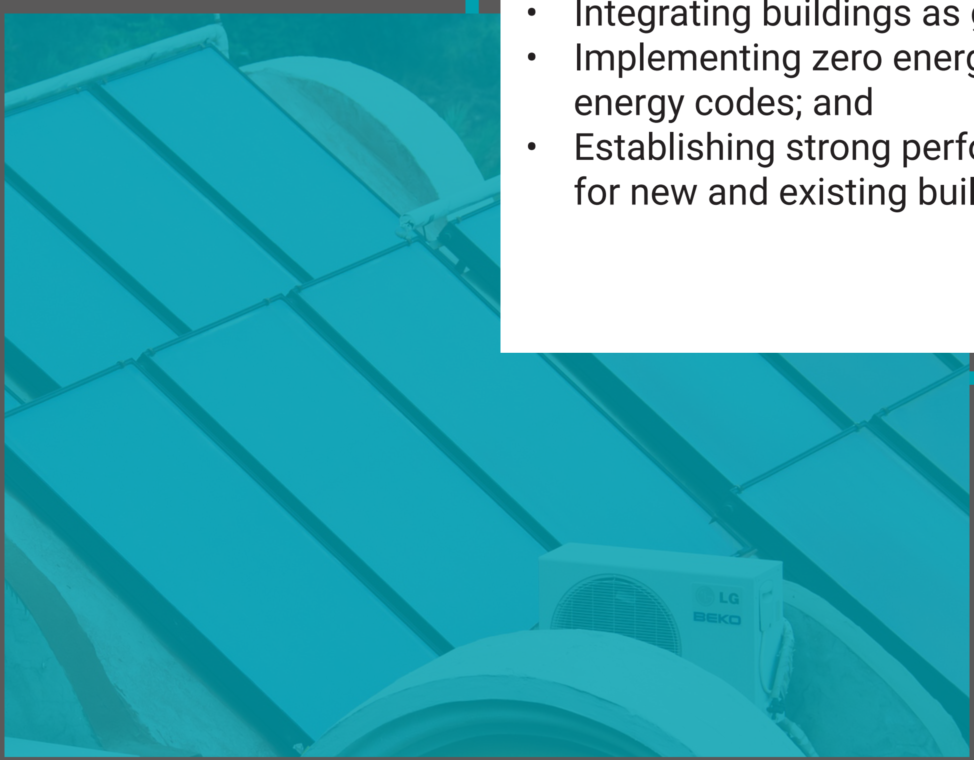
Introduction

In the wake of global climate change, we are faced with the vast challenge of transforming the ways we generate and use energy. To address this challenge, states throughout the Northeast and Mid-Atlantic have adopted goals and are implementing policies and programs to aggressively cut greenhouse gas (GHG) emissions. Most states in the region have adopted the goal of 80 percent GHG reduction by 2050.[1,2] This common policy goal serves as the basis for decarbonization. While the strategies to reach this goal address various sectors, buildings are a critical piece of the solution due to the magnitude of emissions and opportunity for reductions. In addressing building emissions, it is important to consider these strategies:

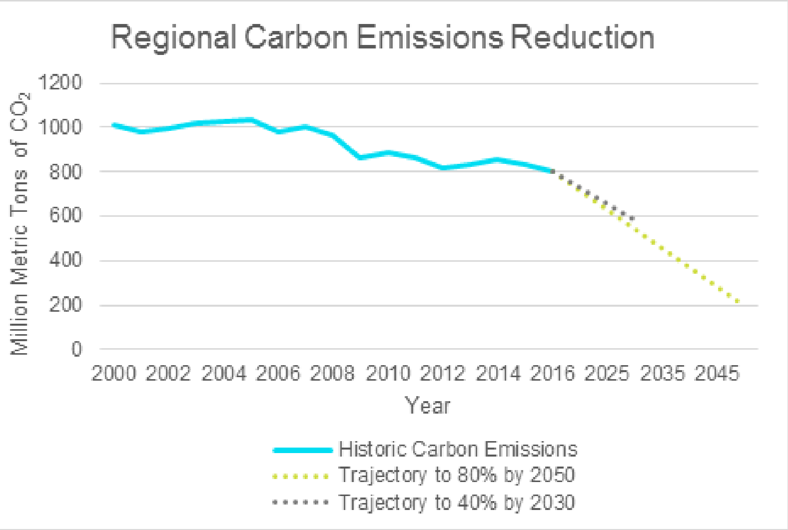
- Enabling grid optimization with building-level zero carbon energy production and developing power systems with zero-carbon energy;
- Deploying widespread energy efficiency measures, especially deep energy retrofits;
- Fuel switching gas and heating oil with renewable fuels, such as renewable electric and thermal technology;
- Integrating buildings as grid assets;
- Implementing zero energy/carbon building energy codes; and
- Establishing strong performance standards for new and existing buildings.



[1] Research reported by the Intergovernmental Panel on Climate Change (IPCC) indicates 80 percent by 2050 is not a sufficient timeline. In order to limit global warming to 1.5C, carbon pollution would have to be cut by 45 percent by 2030 and come down to zero carbon by 2050. Therefore, states should consider amending their timeline towards a more aggressive target aligned with the IPCC special report. Summary for Policymakers available at: https://www.ipcc.ch/site/assets/uploads/2018/10/SR15_SPM_version_stand_alone_LR.pdf

[2] New York Climate Leadership and Community Protection Act of 2019 sets the goal of reducing GHG emissions 85 percent by 2050, and having net zero emissions across all sectors of the economy. Available at: https://assembly.state.ny.us/leg/?default_fld=&leg_video=&bn=A10342&term=2015&Memo=Y&Text=Y

The graph below shows historic carbon emissions relative to achieving GHG reduction goals in 2030 and 2050. The region has already reduced emissions by 17.8 percent relative to 2001. In order to achieve 80 percent by 2050, relative to those same levels, the region needs to reduce emissions an additional 75 percent from 2016 levels. In other words, the region must reduce emissions equivalent to 609 million metric tons of CO_2, comparable to 73 million homes' energy use for a year.[3] With roughly 21 million homes in the Northeast, this is comparable to three years' energy use in the region.[4] Reducing emissions to this tune is a big task. It provides opportunity to think creatively about developing innovative policies and technologies, and shifting individual mindsets and behaviors. This is what must happen to make this vision a reality. States can leverage policies that have already been adopted, build upon them to go even further, and also identify and explore new pathways that haven't yet been implemented.



Of the CO_2 emissions represented in the graph above, buildings account for 31.3 percent in the NEEP region[5] in 2016. Addressing climate change is an economy-wide issue and in order to decarbonize the economy, there must be an aggressive and comprehensive approach towards decarbonizing buildings.

Policies should be designed to drive market transformation in an equitable manner that provides benefits to all populations, particularly within disadvantaged communities. Pursuing decarbonization strategies for all will ensure energy affordability and reliability in an equitable way to account for people's needs. This approach requires addressing comprehensive policies at the state and federal level, building regulation, and evaluation. States and communities have found they benefit from a support network of a broad range of groups and organizations that provide advocacy, technical training, and educational resources to assist in achieving these goals.[6]

Decarbonizing our building stock requires a comprehensive set of actions, occurring in parallel and phased in over time, across different sectors and levels of government. This policy framework lays out the pathway. A successful transition to zero carbon [buildings] will require market transformation with advanced technological solutions, and equitable and fair policy mechanisms. Critical policy areas include comprehensive state and utility policy, building regulation, and federal regulation, as well as alignment with evaluation, measurement, and verification (EM&V).

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[3] Calculated using EPA greenhouse gas equivalencies calculator, available at: https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator
[4] This is based on U.S census data. The U.S. Census does not include Maryland, Delaware, West Virginia, or District of Columbia as a part of the Northeast region. More available here: https://censusreporter.org/profiles/02000US1-northeast-region/
[5] The NEEP region includes: Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia
[6] ACEEE, the 2018 State Energy Efficiency Scorecard, October 2018. Available at: https://aceee.org/research-report/u1808

Goal Setting

At various times over the past decade, states across the region have recognized the seriousness of global climate change and have responded by establishing targets to significantly reduce greenhouse gas (GHG) emissions in the future. Nearly all Northeast states have committed to 80 percent or more carbon emissions reduction by 2050. To ensure states uphold these targets, they should be established through legislative mandate. Table 1 shows the carbon reduction goals for each state in the region and whether it is a target or mandate. In order to achieve these long-term carbon reduction goals, short- and interim- targets must be incorporated to keep states on track. Furthermore, specific and actionable goals that include energy efficiency, electrification technologies, and low emissions energy can help states achieve a higher level carbon reduction target.

Table 1 Greenhouse Gas Reduction Goals

State	Baseline Year	Near-term Goal	Interim Goal	Long-term Goal	Source of Goal
Connecticut	2001	10% by 2020	45% by 2030	80% by 2050	Public Act 18-82
Delaware	2008	30% by 2030			Climate Framework for Delaware
Maine	1990	10% by 2020	45% by 2030	80% by 2050	LD1679
Maryland	2006	25% by 2020	40% by 2030		Greenhouse Gas Reductions Act- Reauthorization
Massachusetts	1990	25% by 2020		80% by 2050	Global Warming Solutions Act
New Hampshire	1990	10% by 2020	20% by 2035	80% by 2050	New Hampshire Climate Action Plan
New Jersey	2006	equal 1990 by 2020		80% by 2050	Global Warming Response Act
New York	1990	40% by 2030		85% by 2050	Climate Leadership and Community Protection Act
Pennsylvania	2005	26% by 2025		80% by 2050	Executive Order 2019-01
Rhode Island	1990	10% by 2020	45% by 2035	80% by 2050	§ 42-6.2-2
Vermont	1990	50% by 2028		75% by 2050	10. V.S.A. §578
Washington D.C.	2006	50% by 2032		100% by 2050	Clean Energy DC plan
West Virginia	N/A				

When mandating carbon reduction targets, states should base the target on the most current scientific consensus and allow for the targets to become more stringent or to expedite the timeline down the line. The mandate should have a baseline year, and there should be a baseline assessment of economy-wide emissions for that year, which will be used to track progress toward meeting the emissions reduction target. The state should also develop a projection of meeting short- and long-term goals under business as usual, moderately aggressive, and aggressive action. This will help states understand necessary strategies to achieve targets established in the mandate. To uphold states to their commitment, an advisory committee may be established to make recommendations for achieving targets based on innovative and aggressive climate policies. The advisory committee can also oversee reporting processes.

State and Utility Regulation

Since buildings interact with the electric grid, decarbonizing buildings requires coordinated regulatory efforts at the utility and state level.[7] Regulatory policy is critical today, as end-uses are increasingly electrified and buildings become increasingly interactive with the grid, regulatory policy will need to evolve to better address the needs of customers and a modernized energy system. Decarbonization of buildings requires a major shift in approach around the role and scope of measures financed in whole or in part with public or utility dollars. There are innovative program approaches and new utility business models that can be part of the solution. In some cases, solutions at the community level will be more cost-effective and go beyond the typical customer towards utility-scale solutions. We are already seeing this transition happen in pieces, such as incentives for heat pumps and heat pump water heaters offered with other energy efficiency measures, but we need to ramp up efforts to unlock the untapped and available savings and non-energy benefits. This transition needs to happen for electric and gas utilities. While this framework focuses on the electric utility transition, solutions for the gas utility should also be developed. The energy system is transitioning at a rapid rate, providing more access to distributed energy resources (DERs) at a time when customers are demanding more consumer choice. In addition, there is increased consumer pressure for resiliency and sustainability in the grid and buildings.[8] These changes are pushing state policy and utility regulation towards incorporating decarbonization as an explicit policy objective.

[7]The primary focus of this framework is state and community level policies. Federal level policies are addressed separately towards the end of the paper, but NEEP recognizes that decarbonizing buildings also requires a coordinated effort at the federal level with building energy codes and appliance eff
[8]RMI, Reimagining the Utility, 2018, Available at: https://rmi.org/insight/reimagining-the-utility/

Evolving Utility Business Models

Some utility business models in vertically-integrated states are based on capitalizing large assets to accommodate supply and demand, which does not work for encouraging behind-the-meter assets that help manage evolving grid needs. In deregulated and decoupled states, the incentives and disincentives are structured very differently. While most states in the NEEP region are deregulated and decoupled, they need to develop strategies in both aspects of industry structuring. In order to help this transition, there needs to be a holistic approach towards reforming utility business models to incorporate these changes.

Long-standing responsibilities of utilities include energy reliability and affordability, as well as safety. Traditional energy efficiency savings are achieved through revenue decoupling and Energy Efficiency Resource Standards (EERS), which set savings targets for electric and gas utilities. Through EERS and performance-based incentives, utilities have viewed energy efficiency as a least cost resource providing cost-effective measures to customers. The electric power industry needs a new business model with an EERS that requires energy savings and considers other state policy goals, such as emissions reduction and equity. This type of model will have a mission and economic framework that encourages utilities to develop and pilot more innovative programs to meet energy efficiency, economic, and carbon goals. This new model should include new innovative program designs, consider environmental impact, building- and utility- scale resiliency, and expanded customer choice. Utilities should also consider how they can strategically intervene in energy efficiency markets to create lasting change in market behavior by removing identified customer barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice. State utility regulation can encourage policies that reflect this.

Role for State Regulation

New utility business models should be developed in each state because there is not one model that will work across the board. State regulation can influence utility business model reform through several avenues. The first is through legislation, such as creating or shifting obligations and incentives for utilities and their customers. Currently, many states' obligation in cost-effectiveness is to achieve maximum benefits to the utility and participant. This is an example where a shift is needed to also incorporate societal costs and benefits aligned with relevant public policy goals. Aligning cost-effectiveness with state policy goals can help create new incentives and program design. A legislature may enable the inclusion of strategic electrification programs and programs that result in customers switching to zero carbon energy sources or other clean energy technologies in existing energy efficiency programs, while broadening cost-effectiveness to capture energy savings and other benefits. A legislature can also add energy savings from all fuels and active demand management, including storage, to the planning process for energy efficiency plans.[9] This type of action aligns regulatory policy with related state public policy goals.

The second method is by directing the regulatory authority, such as a public utility commission (PUC), to open a new proceeding or conduct a study.[10] Publically funded studies provide value in sharing information and leveraging the results for policy and program design. For instance, a study could identify barriers to electrification in transportation and heating sectors and recommend opportunities for electrification through energy efficiency programs. In many instances, legislation is necessary to provide regulators with the authority and guidance to incorporate recommendations from a study to provide a clear path forward. It may also be appropriate to require a pilot program to test results of a study. Legislation can also set energy-related targets above historic savings targets to motivate utility action.

Regulatory proceedings are another option for influencing utility business reform where rulemakings, rate cases, and utility planning take place. A public utility commission can convene an investigation into emerging issue areas (such as electrification, resiliency, cost-effectiveness, etc.) which may present an opportunity for convening workshops to evaluate the best path forward in addressing emerging trends in a particular area. Commissions also oversee planning processes, which identify system needs and potential solutions. This is where PUCs can be proactive (launching new proceedings based on system needs) or reactive (initiating proceedings in response to legislation or utility proposals).[11] Utilities can also self-propose changes ahead of a PUC order or legislation. The table below provides examples of utility reform for particular aspects of the current business model that can impact resource and grid planning.

[9] This type of effort was seen in Massachusetts in 2018 with An Act to Advance Clean Energy, Available at: https://malegislature.gov/Laws/SessionLaws/Acts/2018/Chapter227

[10] RMI, Navigating Utility Business Model Reform, 2018, Available at: https://rmi.org/insight/navigating-utility-business-model-reform/

[11] Id.

Table 2 Examples of Utility Reform

Utility Reform	Examples
Ratepayer Funded Programs	• Include all fuel services in EE programs (fuel-neutrality) • Incorporate new metrics to measure success of programs, such as emissions efficiency by incorporating a GHG metric.[12] This can be used to incentivize deeper carbon savings per project • Provide opportunities for new pilots and innovative program design to incorporate electrification and DERs. • Ensure programs serve low-income households **at least as much** as other households, if not more. Improve existing low-income targeted efficiency efforts for more comprehensive consumer and grid benefits through thoughtful planning. • Align utility financial incentives with environmental, climate, and other relevant public policy goals. Electric utility incentives should allow for fuel-switching within existing energy efficiency programs • Expand geo-targeting based programs
Performance-based Rate Design	• Use time-of-use pricing to fairly compensate energy resources for the value they deliver, fairly allocate costs, and accelerate energy transition to local distributed energy resources • Consider revenue decoupling, multiyear rate plans, performance incentive mechanisms, and shared savings mechanisms to drive higher savings levels.
Improved Asset Utilization	• Establish screening criteria for non-wires solutions and non-pipeline solutions in place of capital investments in traditional transmission and distribution systems to drive more deployment of these alternatives • Procure alternative resources with increased targeted incentives, such as energy efficiency, demand response, and behind-the meter battery storage, instead of pursuing traditional infrastructure upgrades to meet system needs.
Grid Modernization	• Invest in modernization of the distribution network to enable two-way communication and two-way flows of energy. • Deploy advanced metering infrastructure • Develop location-based value models that can be used to target and/or compensate customers that adopt needed technology in particular areas. This can be used to direct efficiency efforts to those who might normally be left out, or at times, harmed by them through impacts on housing costs. Locational-based value models can be used to ensure equitable access to energy efficiency.
Benefit-Cost Analysis	• Incorporate an enhanced and corrected cost benefit analysis approach using the National Standard Practice Manual that provides a consistent framework for cost-effectiveness Examples of key points include balanced benefits and costs; appropriate equipment investment lifetimes; non-energy benefits, and other key inputs into current planning and analysis. • Bring cost-effectiveness testing to the sector level instead of measure level so less cost-effective measures are bundled with more cost-effective measures. This will incentivize savings beyond low-hanging fruit • Include relevant non-energy impacts to public policy goals (e.g. GHG emissions, health, water, etc.) • Adjust energy efficiency savings baseline assumptions to avoid penalizing retrofit programs that offer incentives for accelerated replacement or fossil fuel displacement • Modernize methods for calculating savings from efficiency investments, expanding the support for innovative technologies within utility incentive programs

[12]Emissions efficiency looks at the GHG reductions associated with a measure instead of tradition energy savings. This incorporates the fuels used to power the end-use. For example, the emissions efficiency of an electric vehicle will continue to improve as the grid is powered with renewable resources. Whereas as the energy efficiency of the vehicle will remain the same.

Strategic Electrification of Buildings

While electrification is integrated in other aspects of this framework, policies directly geared toward strategic electrification of transportation and building space and water are important to call out as a specific section.[13] Electrification in the building sector emphasizes displacement and/or replacement of fossil fuel equipment used for space heating and cooling, and domestic hot water heat pump technologies. *Strategic* electrification enables electric loads to shift at various times of the day, which could help meet the growing need for flexible resources to better manage the grid and integrate renewable energy. Policies based on electrification of heating and cooling in buildings should be adopted to advance building decarbonization.[14] Such policies can require the inclusion of air, ground, and water source heat pumps and other electricity-based thermal technologies in energy efficiency plans. This is based on the premise that our electric grid will move to 100 percent zero carbon energy over a modest time frame (20-30 years). Setting targets for statewide increases in the use of renewable thermal technologies can be helpful.

Electrification policies can also focus on workforce development, offering training programs to expand market space for these electrified end-uses. They should similarly include the transportation sector to expand electric vehicle (EV) charging infrastructure, as well as incentives and direct rebates for buying or leasing an EV. Furthermore, integration of battery and thermal storage into deep efficiency and electrification strategies improves performance by reducing the need to use fossil fuels.[15] This also enables more flexibility with the electric grid and shaving peak demand by using stored energy during peak periods. Therefore, it is critical to establish programs and incentives that encourage adoption of these technologies by consumers. One method for doing this is establishing a state-level alternative portfolio standard (APS).[16] Similar to an RPS, an APS can provide consumer incentives for installing alternative energy systems, such as renewable thermal and electric systems, that increase efficiency and reduce the need for fossil fuels. An APS can require a certain percentage of the electric load to be met with eligible technologies.

Zero Carbon Energy Mandates

Scaling to a zero carbon energy economy involves electrifying additional sectors including heating and cooling, transportation, and industrial processes. Setting ambitious energy targets to have 100 percent zero carbon electricity and energy across all sectors is a critical state policy necessary to decarbonize buildings. Reaching these targets can be done by accelerating Renewable Portfolio Standards (RPS) to achieve targets by a certain year. Supply side renewable energy and onsite renewable energy production can be used to meet this target. Due to the intermittency of some zero carbon energy resources (e.g. solar), it is also critical to consider energy storage. Energy storage allows greater grid flexibility, and ensures reliability by helping to meet electricity demands during peak periods.

As states and communities set ambitious GHG reduction targets, plans that reflect these targets and have a pathway to achieve them need to be established to transition the economy away from fossil fuels. This is a component to the economy-wide framework: energy efficiency + zero carbon energy + strategic electrification = decarbonization. In the Northeast, another way to think about this is energy independence because states are largely dependent on importing fossil fuels. Therefore, achieving energy independence will come from procuring local renewable resources. States should consider what level of energy storage procurement would help meet grid needs with increased renewable resources supplying the grid.

Powering the grid with zero carbon energy is critical because the GHG benefits from electrification are highly dependent on the carbon intensity of the grid.[17] As end-uses are electrified and the grid is powered with more carbon-free energy, it becomes cleaner. As such, the GHG benefits of electrification grow because, as the grid is powered with clean energy, emissions reduce over time. Therefore, statewide policies requiring increased zero carbon energy will improve emissions efficiency. Requiring 100 percent zero carbon energy across all sectors pushes states to electrify transportation as well as heating and cooling systems in buildings.

[13] This public policy framework focuses on building sector electrification. There is also significant opportunity for electrification of transportation. For more information on transportation electrification, see RAP's report: Beneficial Electrification or Transportation, January 2019, Available at: https://www.raponline.org/knowledge-center/beneficial-electrification-of-transportation/

[14] For more details on actions for strategic electrification, see NEEP's Action Plan to Accelerate Strategic Electrification in the Northeast, 2018, Available at: https://neep.org/reports/strategic-electrification-action-plan

[15] Id.

[16] An example of this is the Massachusetts APS, Available at: https://www.mass.gov/service-details/program-summaries

[17] Carbon Free Boston, Summary Report 2019, Available at: https://www.greenribboncommission.org/wp-content/uploads/2019/01/Carbon-Free-Boston-Report-web.pdf

Appliance Efficiency Standards

Appliance standards are an opportunity to drive towards carbon reduction goals. In reaction to federal deprioritization of appliance and equipment efficient standards, states should prioritize enacting and promulgating new state-level appliance standards. There are many opportunities that states and utilities have to impact efficiency standards. One is the use of energy efficiency programs which serve to prime the market prior to enactment of standards. Through work with the ENERGY STAR program and more targeted support of specific products with large standards savings opportunities,[18] program administrators can have even greater impact. Utilities could also claim more energy savings attributable to the adoption and implementation of a standard if they are part of the process to realize those savings. As more states adopt appliance standards, there will be greater market benefits and this can help drive renewed prioritization at the federal level.

There is also an opportunity to explore appliance grid optimal standards with appliances that can respond to grid communication around time of use. This will help address load shaping, which will be required with the anticipated high percentage of zero carbon energy in the system. Another important role regarding state appliance standards is database management for new standards. Passing a new standard through legislation or regulation is only half the battle; the other half comes in making sure the standard is implemented and can be enforced. Stakeholders can work to line up databases for compliant products and even enforce spot-checking the standard. This is useful because savings are only achieved when the standard is successfully implemented and enforced. States that are interested in adopting state standards can use the resources established by the Appliance Standards Awareness Project (ASAP)[19], which provides information to assist state energy offices, legislators, and policy advocates.

Carbon Pricing

There are mechanisms that can internalize the cost of carbon, such as cap and trade (establishes a fixed volume and lets the market set the price) and carbon tax (establishes a fixed price). Cap and trade or carbon tax mechanisms provide a market signal giving building owners greater incentive to reduce their energy use. Carbon pricing and cap and trade can be revenue neutral or revenue positive. In order to drive the market towards solutions that reduce carbon emissions, the revenue from a carbon tax or cap and trade program should be put in a fund that supports GHG reduction policies and programs. The impact of spending revenue on GHG programs should be greater than the increased price of energy. In addition, this type of market mechanism needs to be implemented in an equitable way that does not disproportionately impact disadvantaged communities.

Revenue Positive

- Tax monies used to create a government fund where revenue is used for policies and programs aimed at reducing carbon emissions, working towards state policy goals.
- Under this pathway, policymakers should provide guidelines for how funding is used, including provisions preventing the diversion of funds.

[18] such as those identified in a 2016 ASAP Report: https://appliance-standards.org/document/report-overview-next-generation-standards
[19] State Standards, Appliance Standards Awareness Project, Available at: https://appliance-standards.org/states

Building Energy and Information Regulation

Buildings consume about two-thirds of the United States' power supply and produce about 40 percent of carbon emissions nationwide. Existing buildings and buildings being constructed now will have a considerable impact on our region's energy use 50 to 100 years from now. Therefore, the built environment, including residential, commercial, and public structures, presents an opportunity to drastically reduce carbon emissions.

Major building infrastructure projects for existing and new construction can be influenced by planning requirements, legislation, and building codes and standards. It is critical that policy and program goals, and new program approaches, are designed to accelerate change in time to meet this rapid transition towards meeting our carbon reduction goals. Supporting policy and program for new construction and retrofits will help create more effective, widespread efforts.

Building Energy Codes

Building energy codes – as well as code implementation and compliance-related training and support – are critical tools to achieve carbon and energy reductions as they drive higher performance building practices throughout the construction industry. A wide variety of strategies can be used to better position states in utilizing buildings codes to achieve building decarbonization goals.[20] In order to ensure states are adopting the most recent national model codes (IECC and ASHRAE), some states have promulgated rules that require the state to update the code within one year of the national model code and standard publication. This practice ensures states do not fall behind. It's also vital that states do not amend the code with weakening provisions that could reduce the efficiency of the code. To chart a course towards decarbonized buildings, it is time to look beyond current model codes towards zero energy or zero carbon codes for new construction and major renovations for existing buildings. Building codes directly impact all new construction and major retrofits of existing buildings, therefore building codes need to catch up with the realities of GHG emissions and the embodied GHG of buildings. This entails building design that first reduces carbon-based energy consumption through building envelope strategies and efficiency measures and then adds on-site renewable energy generation and/or the procurement of locally-produced off-site renewable energy.[21]

It is critical to have a timeline to achieve a pathway to zero energy/carbon [by 2030-2040]. On par with achieving carbon reduction goals, states could require all new building construction (residential and commercial) be zero carbon/energy by 2030 and all existing buildings decarbonized by 2050. A zero energy code would require enough clean energy generation on site to cover energy use, whereas zero carbon code indicates that no fossil fuel is burned on site. Zero carbon eliminates building-level combustion and switches from energy cost/use metrics to GHG emissions metrics. There are opportunities for both, and states need to determine which pathway best aligns with their policy goals. It is also important to understand whether building to these standards can be done affordably. The cost increase to build to a zero energy or zero energy ready home is much less than consumers, builders, and policymakers realize,[22] and updating state energy codes does not contribute to any slowdowns in construction activity. Instead, building to these standards provides opportunities for great cost, energy, and greenhouse gas emissions savings.[23]

Since the IECC may not get to zero energy by 2030, states can mandate the implementation of stretch codes with provisions to strengthen the base code by 10 to15 percent, and then stretch codes beyond the increase in base code efficiency. This is possible when there are rules that require states to update the base code when an update becomes available. Each aspect builds upon another. While this is a very aggressive set of goals, the key is to start the effort in a more aggressive way and then continually review and update or revise over time as lessons are learned.

Furthermore, adopting stretch codes removes barriers for cities and communities and enables them to act on their climate and resiliency goals. In many states, communities cannot go beyond the state building energy code unless there is a provision for stretch codes and alternative pathways through zoning regulation. Including stretch codes enables communities to take action on their own prerogative. Utility program administrators can also benefit from promoting stretch codes because there is an opportunity for greater energy savings when utility incentives and rebates are used to build or retrofit to a stretch code.

Building energy codes can also help in the transition to electrified end uses and distributed generation by including "ready" code requirements for air source heat pumps (ASHPs), solar photovoltaic (PV), electric vehicle (EV) charging, battery storage, and other existing or emerging technologies in the base code. Ready codes are an effective strategy for states and local government to encourage consumers to invest in one or more of these technologies by making sure the infrastructure needed to support them is already in place. This includes the electrical capacity and pre-wiring to make future installation possible.[24] These would be considered strengthening amendments that go beyond current base code. To move towards zero energy, it is also important that weakening amendments are not included in any code adoption.

[20] Building Energy Codes for a Carbon Constrained Era- A Toolkit of Strategies and Examples, NEEP, December 2017, Available at: https://neep.org/building-energy-codes-carbon-constrained-era-toolkit-strategies-and-examples

[21] https://architecture2030.org/zero-net-carbon-a-new-definition/

[22] RMI, The Economics of Zero-Energy Homes, 2019, Available at: https://rmi.org/insight/economics-of-zero-energy-homes/

[23] NEEP, Construction Codes Myths and Realities, 2018 Update, available at: https://neep.org/construction-codes-northeast-myths-and-realities-energy-code-adoption-and-economic-effects-2018

[24] SWEEP, Cracking the Code on EV-Ready Building Codes, 2018, Available at: http://www.swenergy.org/cracking-the-code-on-ev-ready-building-codes

Table 3 Considerations for Building Energy Code Advancement

Building Energy Codes	Examples
Zero Energy/Carbon Code	• Establish a timeline to achieve zero energy/carbon codes [by 2030-2040] • Adopt a stretch code that is constantly 10-15 percent more efficient than the base code as the base code advances to zero energy/carbon • Require the state to update the base code when an update is available, and update the stretch code at the same time • Do not include weakening amendments in any code updates • Include "ready" code requirements for air source heat pumps (ASHPs), solar photovoltaic (PV), electric vehicle (EV) charging, battery storage, and other existing or emerging technologies • Submit cost-effective code change proposals both on the state and national levels in conjunction with state code adoption or national code development that increase efficiency. • Encourage all state and municipal officials eligible to participate in code development hearings to register as a member of the International Code Council (ICC) and vote during designated voting periods.
Code Compliance	• Conduct code compliance field studies for residential, commercial, and multifamily buildings • Utilize alternative compliance pathways to the energy code that advance energy efficiency. Examples: certification and rating programs such as ENERGY STAR Homes, Passive House, U.S. DOE Zero Energy Ready Homes, Living Building Challenge, Living Future Institute Zero certification, PEARL Certification, and RESNET HERS
Workforce Development	• Provide continuing education/training to code officials, inspectors, and design professionals • Transition code offices to electronic permitting, electronic plan review, and electronic inspection request, in order to streamline the process.
Green Zoning	• Allow local municipalities to adopt energy or green building provisions through zoning or ordinances that go beyond state base codes. Green zoning can be used to address a wide range of planning considerations – such as housing, transportation, natural resource protection, and community energy concerns.

Residential Energy Rating and Labeling

Buying a home is the largest investment most consumers make, but home buyers typically receive little or no information about how much energy they will need to power the homes they see listed for sale (or for rent). This is despite the fact that energy is the highest and one of the most volatile cost of home maintenance. Home energy labels let buyers compare energy efficiency and performance of various homes and raise awareness of energy use and expenses, much like vehicle fuel-economy ratings and EnergyGuide labels for appliances.

Residential energy rating and labeling allows owners and tenants to understand their building's energy use and provide the market with information that can assist in properly valuing building energy efficiency. Disclosing home energy use through ratings and labels can help cities and states reach climate goals by promoting health, safety, comfort, and energy efficiency of a home. There are two ways state and local governments are using labeling schemes: voluntary labeling and mandatory labeling. The Energy Metrics to Promote Residential Energy Scorecards in States (EMPRESS) Guidebook[25] provides a comprehensive framework focused on enhancing large-scale residential home energy labeling. The guidebook provides background information and actionable guidance for jurisdictions thinking about enacting a home energy labeling policy or program.

Voluntary: This structure offers transparency to potential participants in conjunction with energy efficiency programs offered by utility program administrators. This method provides estimated annual energy cost and consumption before and after recommended energy efficiency upgrades to homeowners when completing a home energy audit.

Mandatory: This structure is implemented at the city or state level where the governing jurisdiction requires a home energy label or certification to be completed, often at time of listing, time of sale, time of rental, or when "obtaining a certificate of occupancy". Time of listing is a preferred method for market transformation because the information gleaned from the label can help consumers put home energy choices on a level playing field relative to other home attributes, and helps consumers plan for improvements they many need to make after they are in the home. This allows home buyers to consider home energy information in their decision-making process. Mandatory programs often generate higher market participation compared to voluntary programs. There could also be other effective triggers, such as financial events, property tax assessment, etc.

Mandatory policy schemes have been largely implemented at the city level, but there is opportunity to adopt mandatory policies at the state level, which have primarily focused on voluntary mechanisms. The success of an energy labeling program depends on the uptake, and the most direct way to increase uptake is through regulation. This allows home buyers to include this information in their decision-making process, and helps drive residential energy improvements, which will lower energy bills for homeowners and renters, improve home values, and reduce greenhouse gas emissions.

The design of scorecards can include metrics aligned with climate policy goals to help track progress. For example, if public policy goals include energy efficiency and carbon reduction, scorecards should include energy consumption and CO_2 emissions based on fuel type. For energy affordability, metrics such as energy cost by fuel type, annual generation for on-site units, and current average annual utility retail energy price in dollars, by fuel type, should be included. This should prove the cost-effectiveness of implementing a mandatory program by aligning the costs and benefits of other public policy goals.

[25] EMPRESS: https://empress.naseo.org/Data/Sites/21/media/documents/finalguidebook_draft_version10_clean.pdf

Table 4 Benefits of Home Energy Labeling

Benefits of Home Energy Labeling	
Cost savings	Transparency for homeowners on ways to reduce cost through energy efficient home improvements, as well as information for home buyers about the estimated cost of energy in a home to make better informed decisions.
Market transformation	Reliable and transparent energy information from energy labels may allow real estate markets to better account for the value of energy efficiency in a home. This, in turn, is expected to encourage investments in efficiency improvements and drive long-term market transformation.
Reduced GHG Emissions	Drive demand for energy efficiency and renewable energy projects. This will result in reduced reliance on fossil fuel resources, therefore reducing greenhouse gas emissions, particulate matter emissions, and other air pollutants.
Workforce development	Increased demand for local home energy assessments and local contractors for home energy retrofits

Source: EMPRESS

Building Energy Benchmarking

Benchmarking a building's energy usage carries many benefits. Tracking energy usage is an essential first step towards reducing total energy consumption and associated costs by increasing information transparency. By understanding a building's energy usage, benchmarking provides building owners and managers with the information they need to make informed decisions about building system optimization or efficiency investment. States or cities need to determine the right information to collect to inform the goals of the benchmarking policy. Common metrics in existing policies include energy use intensity (EUI), total energy use, GHG emissions, building characteristics (e.g. sq. footage, building use type), and ENERGY STAR score. Through this data collection process, state and local governments can craft programs, policies, and initiatives that help building owners make investments in their buildings. Benchmarking can be done for public buildings, commercial buildings, and multifamily dwellings. To ensure benchmarking drives actionable measures and market transformation, it is critical that policies and practices are in place to provide quality data and make data access easy for building managers and owners.

Public sector buildings hold unique opportunities to accelerate benchmarking policies. Large public sector building portfolios present tremendous savings opportunities, and in many cases, progress can be driven from the top down through existing administrative structures. Public sector benchmarking policies can be used to demonstrate the value of energy efficiency measures to tax payers and prioritize upgrades when faced with budgetary constraints. Benchmarking public buildings and enacting policies based on performance builds capacity in a jurisdiction's staff for effectively understanding, interpreting, and responding to data. Such policies can also lead markets towards transformation by building capacity in preparation for broader commercial and multifamily building energy benchmarking policies. All cities and states should lead by example by benchmarking their publicly owned/leased buildings.

The majority of states in the Northeast already have policies in place for state buildings, but not all strictly adhere to those policies. States should work with utilities so data is provided to building owners in a format that is readily accessible for the purposes of benchmarking. Furthermore, states should consider adding commercial and multifamily buildings to benchmarking policies. Cities have also been successful in adopting ordinances that require their public buildings to benchmark energy usage, often as the first step of a broader benchmarking and disclosure initiative that phases in commercial and multifamily buildings.

Of public buildings, schools are of particular interest in benchmarking policies. At the state level, programs, policies, and funding availability should be prioritized for the construction and renovation of zero energy/high performance schools. States can require that all new construction or major renovation school projects adhere to a green building criteria such as NE-CHPS. Further, schools can be incentivized to reduce energy usage by linking additional funding opportunities to better performing buildings. A key component of the success of this type of program is ongoing benchmarking of school buildings to ensure they are being operated as they were designed. States should consider an ongoing benchmarking requirement for state funded projects. Rhode Island's School Construction Program, Massachusetts' Green Schools Program, and Maryland's Net Zero Energy School Initiative Grant Program are all exemplary models for how states can help communities achieve healthy, energy efficient schools.

Incorporating commercial and multifamily buildings in benchmarking policies provides cities and states with a comprehensive understanding of its building stock and can be used to inform target-based policies for new buildings. Benchmarking policies can be based on square footage when determining the size of public, commercial, and multifamily buildings that are required to comply. Public buildings at or over 10,000 square feet should lead-by-example, with commercial and multifamily buildings also scaling down to this threshold to capture hard-to-reach small commercial customers. When benchmarking commercial and multifamily buildings, data access is critical. To conduct benchmarking, building owners need access to data, but are often prohibited from accessing energy information for tenant-occupied spaces, where the tenant is the utility customer on record. One way to gain access is to set a data aggregation threshold to simplify the tenant authorization process. Through this pathway, utilities provide building owners with aggregated energy usage information without the need for individual tenant authorization based on the aggregation threshold.[26]

Whole building data aggregation provides a way to benchmark energy data in buildings with multiple tenants, while maintaining customer privacy by aggregating customer data from the meter level to the building level.[27] These thresholds are made more secure by setting a minimum standard, such as four units, and/or a consumption level threshold, such as requiring no single tenant accounting for 50 percent or more of total consumption. Adding the percentage consumption threshold ensures privacy for buildings that have apartments with storefronts on the bottom level.

[26]DOE Better Buildings, Energy Data Accelerator, Best Practices for Providing Whole-Building Energy Data: A Guide for Utilities, January 2016, Available at: https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/Best%20Practices%20for%20Providing%20Whole-Building%20Energy%20Data%20-%20Guide%20for%20Utilities.pdf
[27]Id.

Building Energy Performance Standards

With benchmarking policies in place, jurisdictions should adopt building energy performance standards, an innovative approach to reducing energy consumption and GHG emissions in the built environment. By adopting a standard with clear compliance pathways, the policy holds building owners and managers accountable for helping achieve climate and carbon reduction goals. This type of standard should acknowledge that buildings have different processes, making it important to consider the building type for compliance levels. For instance, a multifamily building has lower carbon emissions than an office building with a lot of data processing or a cannabis production facility. Colleges and hospitals are examples of multi-building campuses with buildings that are required to run 24 hours a day that may affect compliance with certain standards. In writing this policy, policymakers should consider different compliance for certain types of buildings.

There are different ways to implement this type of policy. A performance target can be triggered when a building undergoes a major renovation, property sale, or lease. Triggers can also be layered where different performance levels trigger different mechanisms. For instance, at time of sale, only buildings with performance worse than a certain level would have to do certain activities. Performance levels could be used to trigger incentive or rebate levels for the buildings where the greatest energy savings can be made. This approach connects emissions reduction with an action that already triggers regulatory review (e.g., permitting).

Performance standards can also be scaled in by building size, having public buildings lead by example. For instance, all privately-owned buildings with at least 50,000 square feet and all publicly-owned buildings with at least 10,000 square feet could be required to comply with the standard first. From there, private buildings of 25,000 square are phased in, and then lastly, buildings of 10,000 square feet will be required to comply.[28] Various compliance pathways can be explored. One option can require a building to demonstrate a percent decrease in normalized site energy use intensity or carbon emissions over a compliance cycle period. A prescriptive pathway for buildings can be used by implementing cost-effective energy efficiency measures with savings comparable to the performance pathway. In this pathway, incentive-based energy efficiency programs have an important supporting role.

District of Columbia enacted the Cleanenergy DC Omnibus Amendment Act Of 2018. The Council established a first-of-its-kind building energy performance standard. Beginning January 1, 2021, all privately-owned buildings of 50,000 square feet and all District-owned buildings with 10,000 square feet will be required to comply with the standard. From there, buildings of 25,000 square in 2023, and by 2026, buildings of 10,000 square will be required to comply.

The intention of this standard is to help the District achieve its short- and long-term climate commitments, including reducing greenhouse gas emissions 50 percent by 2032 and carbon neutrality by 2050.

New York City passed a bill that requires buildings 25,000+ square feet to meet new standards aimed at reducing GHG emissions with the goal of achieving a 40 percent overall reduction of emissions by 2030. The caps set limits for different types of buildings, such as apartment houses or office buildings.

[28]Cleanenergy DC Omnibus Amendment Act Of 2018, Available at: http://lims.dccouncil.us/Download/40667/B22-0904-Enrollment.pdf

Workforce development

Workforce development is a critical component in achieving building decarbonization because having a skilled local workforce can help meet and drive market demand. Scaling up strategic electrification, zero carbon energy, and advanced energy efficiency will require a well-trained workforce. Having a workforce that understands the benefits of advanced energy efficiency technologies, constructing and retrofitting high performance buildings, and how to properly provide these services can help states and communities meet climate goals. Workforce re-development will also be critical as current energy efficiency providers need to understand new technology in the market, and professionals working in the fossil fuel industry will need training opportunities to identify new professional roles in a zero carbon economy.

Building trades professionals produce work that directly contributes to local economies. "A healthy green workforce is a collection of well-sustained local enterprises that generate and satisfy demand for their services within the community."[29] Building energy labeling, benchmarking, and disclosure policies directly support workforce development by increasing the demand for services such as audits and retro-commissioning, energy code compliance, retrofits, and energy efficiency appraisals. There is a wide range of job types that contributes to energy efficiency in the built environment, therefore it is important to target locally-sourced job types in contracting, manufacturing, building design and science, home performance contracting, and more. In developing building energy policies, states and communities should consider offering workforce development programs alongside energy efficiency policies. These could include training opportunities, procurement and contracting for projects within local workforce, and working with school districts to identify opportunities for technical education and alternative pathways from four-year college degree pathways.[30] Deploying deep energy efficiency, investing in local zero carbon energy, and electrifying our end-uses require infrastructure, technology development, and a workforce that is knowledgeable and skillful to execute. The table below from ACEEE's workforce development report[31] summarizes how different stakeholder groups can improve workforce development opportunities.

Table 5 Workforce Development Stakeholders for Local Government

Stakeholder Group	Local Government Opportunities
Utilities	• Promote existing utility-administered energy efficiency training opportunities and incentive programs • Develop training programs as needed
Unions	• Determine which union-led energy efficiency training programs are available • Determine local energy efficiency workforce needs and use findings to inform city strategies
Energy Efficiency Industry-support Organizations	• Coordinate availability of local energy efficiency workforce to support implementation of existing and upcoming policies and programs • Facilitate relationships between state and national trade association chapters and community colleges to coordinate around jobs, skill set gaps within the industry, and industry-led teaching opportunities
State Government	• Promote and coordinate with state-led building energy code compliance trainings, energy efficiency incentives, and workforce development programs
Community Colleges	• Identify skill needs for workers in emerging efficiency initiatives and leverage relevant student expertise to deliver city-led energy efficiency programs • Connect with local workforce investment boards and chambers of commerce to update coursework to reflect local industries' needs
Weatherization Providers	• Publicize weatherization training opportunities through one-stop career centers, with a focus on community-based organizations • Provide pathways for weatherization trained professionals to move into the private sector • Provide a pathway for low-income individuals to energy professional work force by providing support and training during this transition

Source: ACEEE, Through the Local Government Lens: Developing the Energy Efficiency Workforce, 2018

Evaluation, Measurement, and Verification (EM&V)

Building decarbonization to meet aggressive state carbon emission reduction goals and the evolving role of homes and buildings as flexible electric grid resources invites new approaches and information to plan, forecast, and assess the value and impacts of building efficiency integrated with other demand-side solutions. Evaluation, measurement, and verification (EM&V), and reporting of energy and demand savings, costs, avoided emissions, and other impacts of energy efficiency builds transparency and credibility of results necessary to document progress towards goals. The results are inputs to future planning and forecasting, and they help to advance the development of strategies and tools for energy efficiency. EM&V also provides value of evaluation as an activity that can contribute to understanding customers as inputs to planning and design of programs being designed to implement the strategies and policies in this framework. Reporting of results is typically aligned with needs to satisfy regulatory oversight and support policy. The large body of experience with EM&V is with utility energy efficiency programs focused on individual measures. As policy needs evolve for building energy efficiency and decarbonization, EM&V efforts must be ramped up to ensure well-aligned metrics, planning, forecasting, and tracking tools are utilized. EM&V can be used to ensure energy efficiency and distributed energy policies are achieving their forecasted energy and peak demand impacts in order to better plan for future policies and programs. Evaluation of programs incenting and integrating DERS is just emerging and needs to be built out more to support this. This also aids in understanding the magnitude of carbon emissions impacts from energy efficiency and helps governments measure and verify savings to know whether targets are met and benefits are received by customers. There are multiple coordinated strategies and policies in this framework working towards a common goal, therefore it is appropriate to develop metrics that are aligned and supportive across these strategies and to incorporate the metrics into EM&V activities to make sure that programs are managed so they can meet climate goals.

Metrics and Goals

Utilities and/or states should critically review current metrics and reporting practices for energy efficiency programs that address decarbonization and buildings-as-grid-asset strategies to ensure alignment of metrics and goals. For strategies that cut across utilities and/or states, it would be appropriate for consistency and transparency to be adopted for metrics, reporting, and analytic approaches. In order to decarbonize buildings, it is imperative to include programs that provide all fuels services to customers. Therefore fuel-neutral (Btu) targets for program performance savings and aligned metrics for tracking progress need to be included in program planning. This enables utilities to claim savings for fossil fuel powered end-uses converted to electric. With this conversion, it is important to offer high performing, energy efficient technology to replace fossil fuel-powered technology.

New metrics for clean energy programs (including energy efficiency, demand management, electrification, energy storage, and zero carbon energy) that include the value of carbon reduction, other environmental benefits, economic impacts, and benefits to the grid should be included in utility program planning processes. For instance, track carbon reduction (not just kW/kWh) as a metric to set the foundation for carbon-based goals and provide the ability to manage what is measured.[32] Combining broader Btu or GHG savings targets with a subset of kWh and therm savings targets can be an effective way to do this to ensure the conversion to electric is done so in the most efficient way possible to continue to effectively using existing grid assets. Calculations for potential savings from energy efficiency programs will also need to be updated and made more flexible in order to account for the grid impacts of efficiency investments driven by DERs and electrification.

Furthermore, metrics and goals for active demand management can contribute to reducing carbon emissions because there is a shift from a duck curve to a more balanced demand curve. Active demand management metrics and targets will reduce summer and winter peaks with system benefits that reduce overall capacity and temporal-energy costs for all customers. Therefore, consider developing goals for demand management that are separate and distinct from goals for traditional energy efficiency. Through updated EM&V practices, the ability to plan, track, and report the capabilities, performance, and costs of active demand management will improve.[33]

The New Frontier

Adopt program metrics and EM&V for demand-side resource programs that reflect total building energy efficiency performance as well as carbon efficiency, such as fuel-neutral targets.

Metrics for peak demand reduction for summer and winter should be considered. It is important to not only meet peak with zero carbon energy, but shave over peak periods.

[32] More details in Looking Towards Future Integration of Energy Efficiency, Clean Energy, and Strategic Electrification, NEEP 2018, available from 2018 ACEEE Summer Study Proceedings, available at: https://aceee.org/files/proceedings/2018/node_modules/pdfjs-dist-viewer-min/build/minified/web/viewer.html?file=../../../../../assets/attachments/0194_0286_000339.pdf#search=%22caputo%22

[33] Massachusetts 2019-2021 EE plan, available at: http://ma-eeac.org/wordpress/wp-content/uploads/Exh.-1-Final-Plan-10-31-18-With-Appendices-no-bulk.pdf

Planning and Forecasting

Planning should be a public process that allows utilities, regulators, and public stakeholders to take an in-depth look at energy demands over an agreed-upon planning horizon, such as 10 to 20 years. Accurate forecasts of demand are crucial to decarbonizing buildings, and building electrification scenarios will need to be included. In addition, integrated planning to envision both the potential for transportation electrification and its effects on the power system should be included as transportation end-uses are electrified. Forecasting resources as the federal (Energy Information Administration) and regional level (regional transmission organizations) are important resources for states to leverage in planning processes.

Cost-effectiveness is a key tool in planning. There is an opportunity to expand on current cost-effectiveness frameworks, including the enablement of assessment of energy efficiency in the context of DER, and to more fully account for the value of energy efficiency, including non-energy impacts. States should consider using the National Standard Practice Manual (NSPM or manual), released in in May, 2017, to evaluate current cost-effectiveness testing.[34] The NSPM provides neutral, objective guidance developed from experience. It addresses the importance of applicable jurisdictional policy goals to provide a clear and transparent framework.

The manual introduces the Resource Value Test (RVT), designed to be flexible with respect to what is included in the test, so that cost-effectiveness can be assessed relative to the scope and evolution of jurisdiction-specific policy goals. It recommends use of the RVT as the primary test, but notes that use of traditional secondary tests may also have value for informing decisions regarding efficiency, such as program design, investment priorities or public discussion of resource acquisition. The manual identifies core principles that are fundamental to sound tests, and offers a multi-step framework to help jurisdictions with the development of its primary test for assessing energy efficiency (and other distributed energy resource) cost-effectiveness. By providing best practices for incorporating non-energy impacts (NEIs) in cost-effectiveness testing, the manual will improve the way utility customer-funded energy efficiency programs are evaluated. The NSPM provides regulatory perspectives and recommends accounting for hard-to-quantify impacts with symmetry across all costs and benefits.[35]

Input assumptions based on program and market intelligence, such as load shapes, are another key component to planning. End-use load profiles are important to better understand the value of energy efficiency, demand response, and other distributed energy resources when energy is actually being used. More granular time and location data to accurately value energy efficiency and carbon impacts can further improve the use of these resources. With interval data, users can access and evaluate load profiles for individual customer records or for any grouping of customers defined by location, business, heating fuel, and other customer variables, which enables better planning.[36] Cloud based simulations can cost effectively provide site- and time-specific load information on efficiency investments. Program or policy strategies that target envelope design load reduction can also reduce the demand impacts of electrification by reducing the size (and therefore the demand impacts) of heating and cooling equipment (heat pumps) used in fossil fuel conversions. Intelligent technology that enables this (such as smart control technologies and advanced metering infrastructure or AMI) can help convey energy consumed in intervals (such as hourly) enable demand response during peak loads on the grid and identify opportunities for fuel-switching and energy saving measures for consumers.

With the growth in deployment of AMI systems, there has been an increasing interest in their safety. Utility companies, energy markets, and regulators are drawn to AMI because the technology facilitates near real-time collection of power flow and usage data. However, AMI systems have yet to establish security measures to handle cyber-attacks beyond fundamental measures commonly employed in general, e.g., network encryption. Cyber-attacks on AMI may involve intelligence gathering, infecting the target AMI systems, exfiltration of data from various attack points of AMI, maintaining control and AMI exploitation; and a targeted attack on AMI could result in shutdown of the power grid, which may disable energy delivery systems. An overall strategy for implementing cyber security in AMI would require several layers of planning – attacker motivation needs to be understood, as well as the potential attack surfaces of AMI systems.[37]

Planning and forecasting also considers available resources as well as those needed to meet projected demand reliably and at least cost. Therefore, it is important to look beyond traditional resources. As utility regulators contemplate major infrastructure investments to keep pace with pockets of growing peak demand throughout the region, less costly non-wires alternatives (NWAs) solutions — based on deployment of distributed energy resources — are becoming more common within transmission and distribution (T&D) system planning processes. Planning and forecasting for EM&V should be integrated with T&D planning to better identify opportunities for NWA.

[34]NSPM, Available at: https://nationalefficiencyscreening.org/national-standard-practice-manual/

[35]NEEP, Non-Energy Impacts Approaches and Values: an Examination of the Northeast, Mid-Atlantic, and Beyond, 2017, Available at: https://neep.org/sites/default/files/resources/NEI%20Final%20Report%20for%20NH%20updated%2010.4.17.pdf

[36]NREL, Available at: https://www.nrel.gov/buildings/end-use-load-profiles.html

[37]Cyber Attack Surface Analysis of Advanced Metering Infrastructure https://www.researchgate.net/publication/305401154_Cyber_Attack_Surface_Analysis_of_Advanced_Metering_Infrastructure

Tracking Progress

One of the pitfalls of current EM&V practice is the time lag between program implementation and evaluation. Utilities and/or states should encourage leveraging relevant data on actual consumption (e.g. AMI) and data from rapid feedback analytical tools (e.g. advanced M&V, smart devices, emerging EE program designs) in the delivery of energy efficiency in order to encourage continuous improvement and as part of a buildings-as-grid-asset strategy or to inform progress toward strategic electrification. Utilities and states should work to minimize barriers associated with the high cost of data acquisition and with making anonymized/consumer-protected data available to inform assessment of progress toward goals. The business of evaluating market transformation can be data-intensive and cost-prohibitive for individual companies or states, and markets typically cross state boundaries, so a regional approach may be a better path forward.

Benchmarking and residential labeling are necessary for tracking progress toward public policy goals. Tracking energy usage is essential in understanding total energy consumption and associated costs. By understanding a building's energy usage, benchmarking provides building owners and managers with the information they need to make informed decisions about building system optimization or efficiency investment. Benchmarking can be done for public buildings, commercial, and multifamily, with residential labeling for homes. In addition, including rescoring (providing an updated score) after energy efficiency retrofits have been completed provides a way to track GHG emission reductions driven by labeling. Through this data collection process, residential labeling and building energy benchmarking provides improved information on the building stock in a jurisdiction. State and local governments can craft programs, policies, and initiatives that help building owners make investments in their buildings.

Federal Regulation

The federal government's authority over areas relating to building decarbonization include: appliance standards and building codes, infrastructure projects including interstate gas pipelines and electric transmission lines, policies regarding federal buildings, and the allocation and spending of federal funds. Federal regulation has direct implications for state policies and programs for building decarbonization. Whether the federal administration is actively or passively engaged in decarbonization policy, there are federal-level considerations to take into account.

Federal regulation should focus on policies that would help wholesale markets drive decarbonization through the Federal Energy Regulatory Commission (FERC) regulation of electric and gas wholesale markets. With authority over electric transmission lines and interstate pipeline projects, federal regulators are creating rules regulating the energy system that are designed for old power models and are a barrier to modernization. The wholesale market is currently defined by supply-side traditional resources. This needs to evolve to define rules around resource generation based on what resources can do and how they can meet consumer needs. A prioritization shift towards demand-side resources can offer opportunities for advanced energy efficiency, reduce costs, and service distributed energy resources. This will enable improved utilization of system asserts and provide opportunities to include strategic electrification in forecasting and planning as an advanced energy solution to meet customer needs.

To dramatically reduce carbon emissions, there must be market incentives aligned with the policies outlined in this framework. Comprehensive climate legislation can also provide a clear path forward for federal policies. In times where the federal administration may not act on such a broad set of legislation, however, there are opportunities for complementary steps to garner bipartisan support. For instance, federal policies geared towards modernizing infrastructure can have an impact on decarbonization and resiliency. Infrastructure programs can include modernizing the grid, improving the resiliency of buildings, and ensuring infrastructure is built to last in the wake of increasing extreme weather events.

With buildings consuming over 40 percent of energy in the United States, decarbonization requires significant policy innovation in both state and federal codes and standards. Building energy consumption is largely geared towards appliances and building-related equipment. Federal standards for building energy codes can drive new construction and retrofits to zero energy buildings. Codes should center on the importance of fuel-switching from fossil fuels to zero carbon energy, and electrification of end-uses. Building codes can maximize energy efficiency by requiring improved building envelopes and requiring high efficiency electric equipment.[38] For appliance standards, the Department of Energy (U.S. DOE) implements minimum efficiency standards for a wide range of appliances and equipment used in residential and commercial buildings. Though states can adopt their own appliance standards during moments when the federal government is not pursuing them, it is important to continue to push for federal standards for consistency across states. These regulations keep inefficient, low-quality products out of the market to ensure minimum energy and water efficiency levels are reached by all products.[39]

Federal agencies are required to meter electricity, gas, and steam in federal buildings with advanced metering. Pursuant to §103 of the EPAct 2005,[40] federal agencies are required to meter electricity used in federal buildings for the purposes of efficient use of energy and reduction in the cost of electricity.[41] This provides an opportunity for federal buildings to lead by example. Federal buildings have the opportunity to set building energy performance standards for all buildings based on benchmarking energy usage.[42] From there, cities and states may adopt building energy performance standards for their public and privately-owned buildings.

There is a lot to consider at the federal level as the policies directly impact states and cities. While this framework only touches on a few policy areas, it is important to be cognizant of what is happening at the federal level and what that means for state and local policy.

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[38]Paddock, L. & McCoy, C., Deep Decarbonization of New Buildings, George Washington University Law, 2018, available at: https://www.law.gwu.edu/sites/g/files/zaxdzs2351/f/downloads/48.10130.pdf
[39]NEEP, Appliance Standards Initiative, Available at: https://neep.org/initiatives/integrated-advanced-efficiency-solutions/appliance-efficiency-standards
[40]Energy Policy Act of 2005, Available at: https://www.ferc.gov/enforcement/enforce-res/EPAct2005.pdf
[41]Supra note 6
[42]The EPAct of 2005 established building performance standards for new buildings to be designed to achieve energy consumption levels that are at least 30 percent below the levels established in the version of the ASHRAE Standard or the International Energy Conservation Code, as appropriate, See pg. 22 of the EPAct (Supra note 8)

Clean Air Act: State Implementation Plans

Under the Clean Air Act, the Environmental Protection Agency (EPA) has the authority to set National Ambient Air Quality Standards (NAAQS) and regulations to protect public health and the environment. States are required to submit a State Implementation Plan (SIP) to attain and maintain NAAQS. According to the Emmett Institute on Climate Change & the Environment, Section 115 of the Clean Air Act[43] titled "International Air Pollution" could be used to address emissions that contribute to air pollution endangering public health or welfare of other countries, if other countries provide the United States with reciprocal protections. Since the Paris Agreement provides the basis for this, Section 115 of the Clean Air Act provides an opportunity for EPA and states to address international air pollution comprehensively through the Clean Air Act's SIP process. This is significant because Section 115 does not limit EPA to regulating a particular source-type or a particular industrial or economic sector, allowing states to identify such sectors in its perspective SIP.[44] This provision could be used to regulate GHG emissions from a particular sector of the economy, or as an economy-wide solution, and would provide for the ability of market mechanisms, such as fees, market permits, and auctions of emissions rights, to be used to meet the GHG regulation.

[43]42 U.S. Code § 7415.International air pollution of the Clean Air Act, available at: https://www.law.cornell.edu/uscode/text/42/7415
[44]More detail on this alternative pathway for regulation of GHG emissions is available here: https://law.ucla.edu/centers/environmental-law/emmett-institute-on-climate-change-and-the-environment/publications/legal-pathways-to-reducing-greenhouse-gas-emissions-under-section-115-of-the-clean-air-act/

Conclusion

While the progress accomplished thus far to reduce carbon emissions throughout the region is laudable, there is much more work to be done. Under the status quo, states will not be able to achieve deep decarbonization of 80 percent or zero carbon by 2050. A more evolved approach is necessary. The need for a more holistic approach presents an opportunity to come up with new, innovative ideas to catalyze states into a zero carbon future. This timeline is tight, but by looking at this as an opportunity, the Northeast and Mid-Atlantic states can lead the way for decarbonization. Decarbonizing our building stock requires a comprehensive set of actions, occurring in parallel and phased in over time, across different sectors and levels of government. The importance of this policy framework is the idea of bringing different sectors of policy together to tackle a very complex issue.

This policy framework highlights innovative and advanced policy mechanisms that can be used to achieve deep decarbonization of the building sector, a critical component to economy-wide decarbonization. This framework will continue to evolve as new solutions make their way into the market. Comprehensive policy can transition the fossil fuel economy into a new, green economy that is environmentally sustainable, economically secure, and socially just. Comprehensive climate policies can provide an economy-wide framework to address the cornerstones of social and climate justice through economic reform. Energy and infrastructure are central pieces, including retrofitting existing buildings and building new buildings for deep energy efficiency, water efficiency, safety, affordability, comfort, and durability, including through electrification. This framework can help guide cities and states through various types of policies that require action for building decarbonization. NEEP hopes this has served as a bit of inspiration to the region's policymakers and stakeholders to move these elements of advanced efficiency forward in states and communities. It will take a collective, sustained effort to achieve the promise of a low-carbon energy system. We encourage leaders across all these areas to make building decarbonization a priority, and to use existing forums and programs to advance solutions and conduct research to fill gaps.