Energy vs. Carbon: Jurisdictions and Utilities Align Metrics

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ABSTRACT

Fifty utilities have set goals for net-zero carbon emissions by 2050. But few of these are maximizing the impact of their program efforts in energy-efficiency, let alone addressing carbon emissions. How do we shift a building sector with decades of regulation from utility incentive programs focused on kilowatt hours (kWh) and therm savings to metrics centered on climate action goals of cutting carbon and other greenhouse gas (GHG) emissions? Eight building strategies can support this transition for better programs, including energy-efficiency, on-site renewables, off-site renewables, managing for net-zero operations, eliminating fossil fuel use, building-grid integration, low-global-warming-potential refrigerants, and low-embodied-carbon materials. While the first four strategies commonly relate to zero energy buildings, codes, policies, and programs, we must include the last four for a carbon-neutral future that addresses the whole lifecycle of the built environment. Climate goals give utilities an opportunity to implement these strategies.

This paper presents examples by looking at Massachusetts' comprehensive climate change legislation and the regulation's impact on Eversource, the local investor-owned utility. Similarly, we explore Austin's Climate Equity Plan for net-zero emissions and how the municipal electric provider, Austin Energy, is helping to meet these targets. With both utilities, reducing emissions provides an opportunity to apply new carbon-neutral strategies in programs. Building on the insights from the net-zero working group American Council for an Energy-Efficiency Economy (ACEEE) and New Buildings Institute (NBI) launched in 2020 for utilities and program administrators interested in creating and expanding offerings, this paper presents approaches for future utility program development and collaboration.

Introduction

Aligning state and jurisdiction climate goals for reducing GHG emissions or for carbon neutrality with utility energy efficiency goals can ensure deeper savings and faster decarbonization of the building sector. The building sector is starting to shift from decades of focus on energy efficiency measured in kWh and therms saved to jurisdictional plans centered on carbon and GHG emissions reductions. For example, Eugene, Oregon, has set governmental action centered on carbon and GHG emissions reductions by including an emissions target in its climate action plan. Another groundbreaking example is Ithaca, New York, which has established a plan to decarbonize and electrify buildings in the city by the end of the decade (Shivaram 2021). Jurisdictional action is essential for climate-resilient progress. Jurisdictional carbon goals have encouraged more energy-efficient buildings and shifted toward accounting for carbon emission reductions from building design and operations, more than market actions would have on its own.

While energy and carbon metrics are related, they are not the same. For example, 100 kWh of electricity from a coal-powered power plant provides high-carbon energy, 100 kWh of renewable energy is low- to no-carbon energy. Employing a set of building strategies that support this transition, while focusing on the efforts to decarbonize buildings and reduce GHG emissions, can help align the market on how to design, construct, and operate net-zero buildings. These strategies, which range from net-zero building operations to whole-life embodied carbon neutrality, can help market leaders advance high-performance buildings. The components presented below can support policymakers, program designers, and building design teams in better understanding net-zero buildings and help align policies, programs, and projects.

Though more than 50 U.S. utilities have set goals for net-zero or carbon-free emissions by 2050, very few are on the path to maximizing the impact of their program efforts in energy efficiency to address carbon reduction goals (Specian and Gold 2021). Aligning the jurisdiction's climate goals with the utility's energy efficiency targets can provide utilities the opportunity to implement building strategies to achieve net-zero goals and speed up the efforts to decarbonize buildings. In this paper, we highlight case studies of Eversource and Austin Energy programs. Both utilities have set goals to reduce emissions, with Austin Energy planning for net-zero emissions by 2040. These goals have given both utilities the opportunity to apply new carbon-neutral strategies in their programs.

Eight Building Components for Utility Programs

The core components of a carbon neutral building are similar to the core components of a zero energy (ZE) building. A scan of 15 carbon-neutral programs and definitions around the world, such as the Living Building Challenge, LEED Zero Carbon, and American Institute of Architect's (AIA) 2030 Commitment, found certain commonalities as well as several minor variations (Bowles and Hobart 2021). As seen in figure 1, there may be common threads, but lack of awareness of the distinct characteristics leads to confusion in the market.

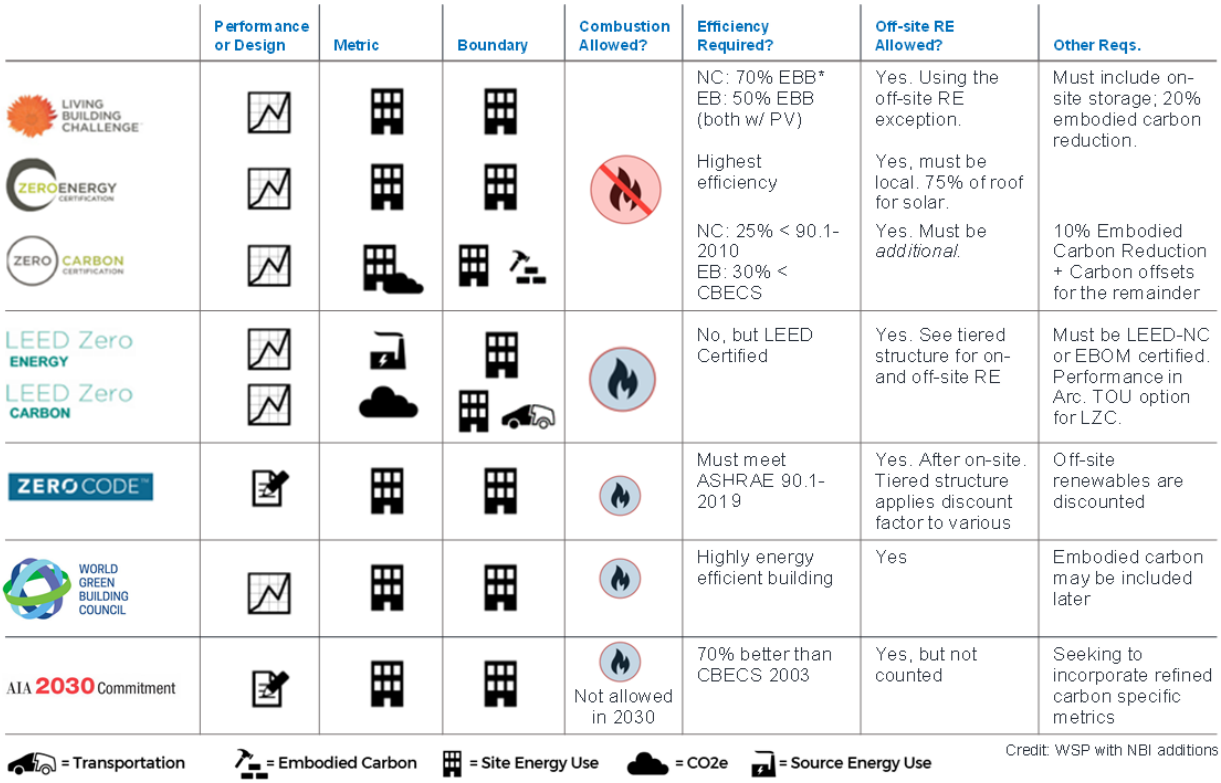

Figure 1. Many third-party rating systems include carbon-related metrics (*Source:* Bowles and Hobart 2021)

Recognizing the shifting landscape of definitions, we present eight building strategies. Energy efficiency remains an essential consideration, prior to the use of renewables, net-zero operations, and building-grid integration. The first four core strategies are to:

1. Maximize energy efficiency
2. Prioritize on-site renewables
3. Utilize off-site renewables
4. Measure and manage for net-zero operations

To reduce GHG emissions effectively and advance efforts to decarbonize, buildings must incorporate four additional components:

5. Eliminate on-site natural gas and other fossil fuel-based appliances (although some use of decarbonized fuels may remain[1])
6. Optimize building-grid integration and on-site energy storage
7. Specify low-global-warming-potential refrigerants in all appliances
8. Select low-embodied-carbon materials

Maximizing energy efficiency is one of the most important aspects of building decarbonization because energy efficiency minimizes grid impacts, regardless of time or source-

[1] Decarbonized fuels can include biogas and hydrogen produced using carbon-free electricity.

energy. Reducing energy demand limits the amount of on- and off-site renewables needed to offset consumption, reducing upfront costs.

Incorporating on-site renewables will produce emission-free energy, offsetting operational emissions. Some projects may need to balance the optimal cost effectiveness between energy efficiency and on-site renewable capacity. Since on-site renewables may not be possible on every project due to site constraints, in such a scenario off-site renewables offer needed flexibility for low-carbon energy sources. Off-site renewables are best when contractual agreements are in place for 15 or more years. Renewable agreements may include direct ownership of off-site systems, power purchase agreements (PPA), community solar, or utility-delivered renewables.

To understand and maintain a building's carbon emissions, ongoing monitoring and tracking of energy consumption and renewable production are essential. Utility bills or a building energy management system can support the review of building system emissions. An easy way to assess performance is by comparing predicted energy and carbon performance against actual consumption and emissions to determine whether systems are operating as designed. Another approach that can support net-zero operations is the implementation of refrigerant-management plans to minimize refrigerant leakage from heat pumps, fire suppression, and other systems.

All-electric buildings eliminate gas and other combustion-based emissions. These buildings support a clean energy future as operational GHG emissions will be eliminated when the grid supplies 100% renewables. However, some buildings will have a slower transition to all-electric and may include gas equipment as an emergency backup or plan to replace gas equipment when equivalent electric versions are available. As a result, electric-ready is an important strategy to plan for future electric conversions and incorporate high-capacity electrical panels, electrical chases, and conduit runs, and locate electrical outlets near gas equipment to support penetration of electric vehicles, heat pumps, and solar.

Building-grid integration is an emerging strategy that allows buildings and the electrical grid to coordinate energy supply and demand to optimize energy consumption, reduce peak demand, offer more clean energy, and provide a reliable electricity supply. Smart design, distributed energy resources, and demand response allow grid operators to adjust building heating, cooling, and lighting, with permission, to reduce power consumption and minimize community-wide service impacts. To avoid peak energy rates, building operators can adjust when they use grid energy by shifting peak loads, using energy storage, and employing other strategies.

Fluorinated gas (F-gas) refrigerants are responsible for 2% of total global GHG emissions. Choosing low-global-warming-potential (GWP) refrigerants, maintaining refrigerant-using systems, testing for leaks, and ensuring that refrigerants are collected during maintenance and when equipment is retired can all reduce emissions from these potent liquids and gases.

Embodied carbon refers to the total impact of all human-induced GHG emitted, from material extraction through the end of its useful life. Construction products alone are responsible for about 11% of all global carbon emissions. Embodied carbon from building products is becoming a significant building-related emission as buildings' operational energy efficiency improves and more buildings eliminate the use of fossil fuels. Thoughtful product selection can easily change a building's embodied carbon and reduce global climate emissions.

These strategies, when included in utility incentive programs, can support low-carbon, high-performance building design and practices and help jurisdictions meet their GHG emission targets. Program administrators and implementers can adjust the eight strategies to fit their

unique programs. For example, a program may offer an additional incentive for electrification, demand-response, or encourage the use of local low-embodied-carbon materials.

These elements require us to think past the property line. For example, building electrification continues to get more attention and will continue to rise in prominence as cities pass all-electric building requirements, like Berkeley, California, did in 2019. Electrification and electrification readiness prepare the built environment for a carbon-neutral future because as the grid uses closer to 100% renewable energy, building emissions will be reduced. Many existing buildings are not yet ready to go all-electric, so electric-ready and decarbonization plans can be important in their transition journey.

The first four components are more commonly understood, as there are numerous examples of zero energy buildings, codes, policies, and programs. For example, 95% of zero energy projects in NBI's Getting to Zero Database are all-electric (NBI 2022). Additionally, project teams are starting to incorporate other components, such as building-grid integration measures, use of low-GWP refrigerants, and low-embodied-carbon concrete. As more highly efficient, cost effective, all-electric technologies, processes, and standards emerge, these additional components will become more common.

While these eight essential elements of carbon-neutral buildings are simple in text, the detailed definitions can be complex. Simply identifying the site boundary, energy consumption time of use, quality of carbon offsets, building lifecycle scope, and so on can be complicated. The Austin Energy Green Building Commercial program promotes participation in building-grid integration strategies such as demand-response programs that reduce peak demand on the electric grid. The program requires reductions of at least 10%of the estimated peak electricity demand or 20 kW, whichever is greater. The details behind the requirements ensure that the measure increases system reliability, makes generation and distribution systems more efficient, and reduces environmental impacts and GHG emissions (Austin Energy 2016).

Policy and Program Alignment

ACEEE and NBI have continued to examine the relationship among zero energy projects, policies, and programs to understand how best to scale ZE buildings. NBI tracks ZE commercial projects across the U.S. and Canada and to date has 746 buildings in its public database. Overlaying the distribution of ZE projects across the U.S. and Canada with a representative sample of ZE policies (excluding high-performance building policies or stretch codes, like building performance standards), we see an emerging relationship between the jurisdictions and states with policies and the number of ZE buildings, as seen in figure 2.

California has been the national leader in the number of ZE buildings due to state and local policy. California adopted ambitious environmental and energy policy goals, including AB32, Global Warming Solutions Act in 2006, which set goals of reducing statewide GHG emissions to 1990 levels by 2020 and to 20% of 1990 levels by 2050, and providing 33% of the electricity demand in 2020 from renewable resources. In 2009, AB758, Energy Efficiency Program for Existing Buildings, proposed program strategies including energy assessments, building benchmarking, building energy-use ratings and labels, cost effective energy efficiency improvements, public- and private-sector energy efficiency financing, public outreach and education, and green workforce training. The state has since moved to focus on decarbonization and preparing for a 100% renewable energy grid, but this hasn't stopped the growth of ZE projects in the state.

In 2008, the California Public Utilities Commission (CPUC) adopted the state's first Long-Term Energy Efficiency Strategic Plan, presenting a single roadmap to achieve maximum energy savings across all major sectors in California. The comprehensive Plan for 2009–2020 is the state's first integrated framework of goals and strategies for saving energy, covering government, utility, and private-sector actions. It holds energy efficiency to its role as the highest-priority resource in meeting California's energy needs. Executive Order B-18-12 requires all government projects to be ZE, further leading by example and providing guidance on what's possible.

Jurisdictions within California adopted reach codes, more-stringent energy codes, to meet their own climate action goals. Codes include requirements for on-site renewable energy and restrictions on use of natural gas in new construction. For example, Santa Monica requires multifamily projects with four or more stories to include two watts of renewable energy per square foot, and mixed-fuel projects have more-stringent efficiency requirements.

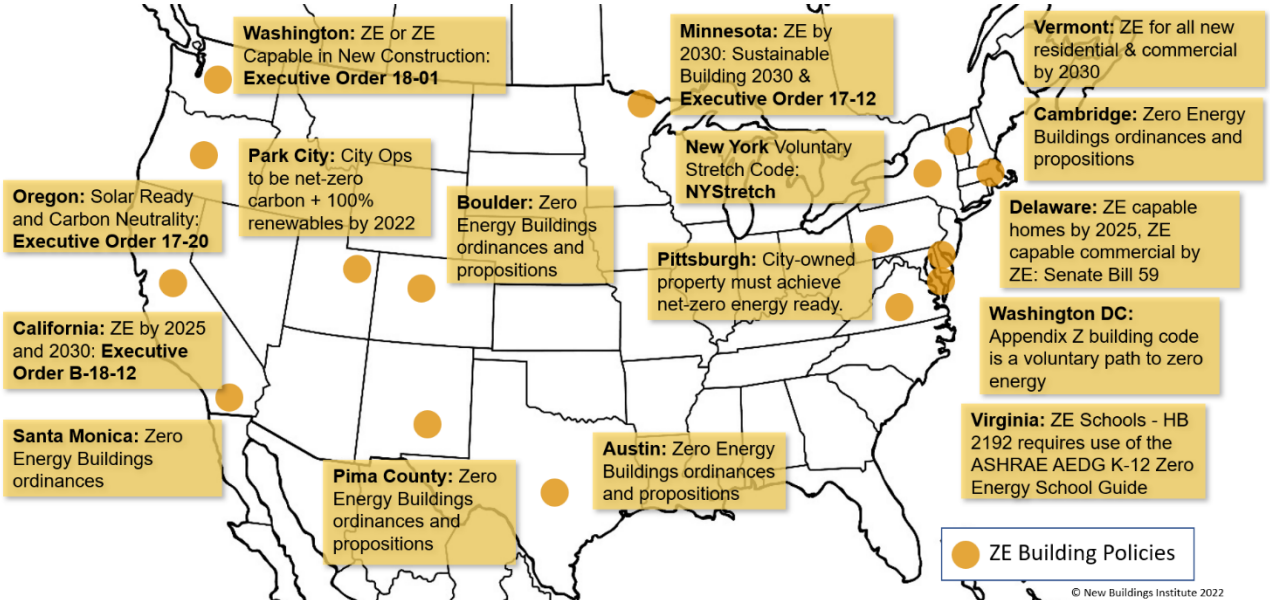

Figure 2. Zero energy policies.

After superimposing the layer of ZE utility programs (indicated in orange dots in figure 2) on the previous map, we see a connection among projects, policies, and programs. ZE utility programs can prepare the market for upcoming code and policy changes, and owners are more likely to participate in programs, knowing they will eventually be required to build to net-zero by code. For example, California has set policy goals to achieve net-zero and the utilities have responded to provide programs to prime the market. To date, California has 290 zero energy emerging and verified projects (NBI 2022).

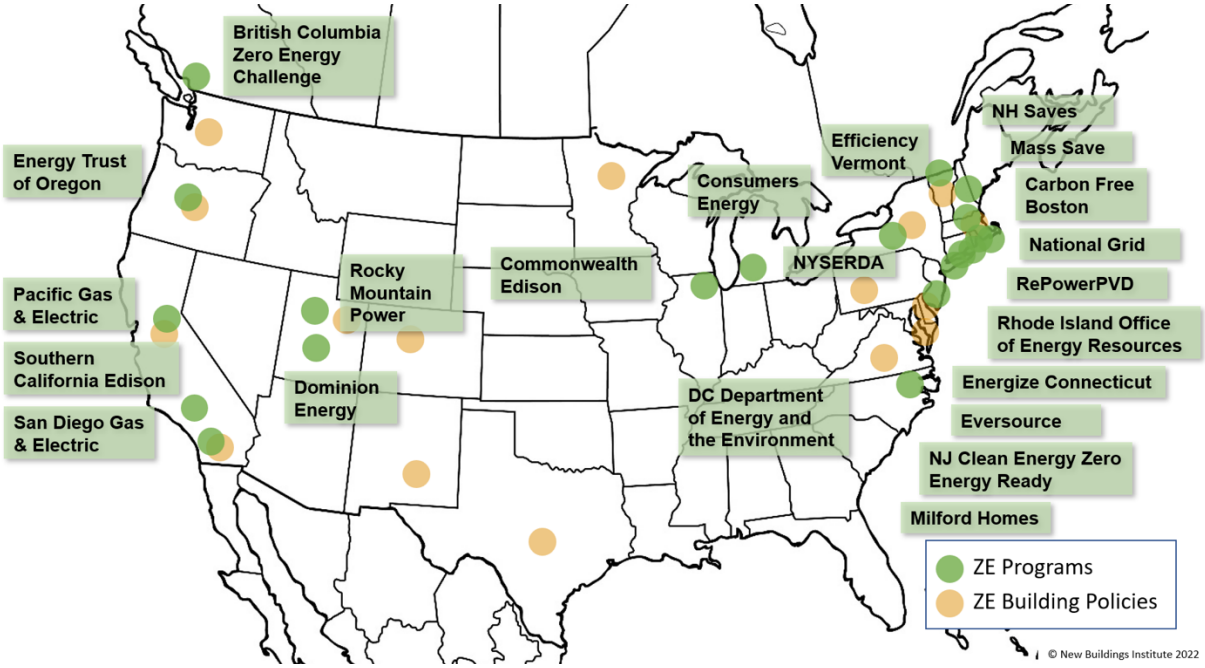

Figure 3. Relationship between zero energy programs and policies.

Voluntary net-zero programs tell a different story. AIA's 2030 Challenge, its net-zero commitment program, asks architecture firms to make an actionable climate plan using a set of standards and to meet goals for reaching net-zero emissions in the built environment. Architectural firms demonstrate their dedication to reducing energy consumption in buildings and work toward net-zero goals by publicly reporting their progress. In 2020, 378 of the more than 1,000 worldwide firms enrolled in the program reported data on 22,002 projects (AIA 2021). However, only 1% (292) of projects are predicted to be zero energy, and 4% report using renewable energy in projects. Only 15 companies met the 80% predicted energy use intensity (EUI) reduction target for all of their projects. While the program reported 34.6 million metric tons of carbon dioxide equivalent (CO_2e) avoided, it's clear that new construction projects need additional support to get the remaining 363 firms reporting that they achieved the 2030 Challenge to improve performance, let alone the remaining 67,000 U.S. architecture firms who didn't submit any data. Working together with utility programs, the 2030 Challenge has an opportunity to increase participation and improve U.S. building performance. For building owners, the GHG Protocol offers standards, guidance, tools and training to measure and manage emissions on one project or across a full portfolio of buildings and operations (WRI, and WBCSD 2022).

As seen in figures 2 and 3, there are several pathways to support the transition to net-zero, including energy codes; state, city, and county zero energy building ordinances; utility goals to decarbonize; and trade/professional organization commitments. In the next two sections we present two case studies of new construction programs from Eversource in Massachusetts and Austin Energy in Texas that show how policies and utility efficiency programs with many of the eight components we discuss above align to advance zero energy or zero carbon buildings. Both utilities are in jurisdictions that have set strong net-zero-emission targets, and the utilities must adapt their program offerings to meet the goals of building energy efficiency, decarbonization, on- and off-site renewable energy, building-grid integration, and more.

New construction offers an economical way to reach net-zero goals and decarbonize buildings (McKinsey & Company 2021). Utility energy efficiency programs have had a harder time finding energy savings as model building energy codes have become more stringent. As codes improve energy performance, utilities will benefit from net-zero incentive programs to deliver deeper savings and support the greater market's transition to net-zero. Almost all new buildings can pursue a highly efficient design by implementing the eight strategies. Beyond staying ahead of code, the benefits are plentiful: reduce energy use, increase occupant comfort, and reduce customer bill costs. Eversource leverages this opportunity in its commercial and industrial new construction program, which includes several pathways, including a net- zero /EUI pathway that assists with net-zero and zero-energy-ready buildings. Alternatively, Austin Energy uses a holistic approach in its green building rating program to advance energy efficiency, equity, and climate protection objectives.

CASE STUDY I: Massachusetts

In March 2021, Massachusetts Governor Charlie Baker signed into law Chapter 8 of the Acts of 2021, "An Act Creating a Next Generation Roadmap for Massachusetts Climate Policy" (the Climate Act), to reduce GHG emissions, build a greener economy, and prioritize equity and environmental justice. One of the most significant climate policy updates in Massachusetts since the 2008 Global Warming Solutions Act, it instructs the state to achieve net-zero emissions by 2050 with two milestones: by 2030, emissions must be 50% lower than they were in the state in 1990, and by 2040, they must be 75% lower (Berg, Cooper, and DiMascio 2022; Wasser 2021). The Climate Act targets the six highest-emitting sectors: electricity, transportation, commercial and industrial buildings, residential buildings, industrial processes, and natural gas distribution.

The Climate Act updated the priorities for the Department of Public Utilities (DPU), which regulates and oversees the policies associated with one-third of the sectors – the state's electric and natural gas utilities, and required the Executive Office of Environment Affairs (EEA) to establish a GHG emissions goal, expressed in million metric tons of carbon equivalent, for the statewide energy efficiency program (Mass Save®). Setting aggressive goals to cut GHG emissions, starting in 2025, electric utilities operating in the state (National Grid, Eversource, and Unitil) must increase the amount of renewable energy, increase clean energy options, and more (CDP 2021). Electric and gas utilities and other energy service providers operating as sponsors of Mass Save Utilities will need to shift their program offerings to focus not just on energy efficiency, but also decarbonization.

As fortune and good planning would have it, these policies and GHG goals were emerging while the sponsors of Mass Save were developing their three-year energy efficiency program plan. Developed in close coordination with state government partners and an advisory council, the plan includes substantial programming and workforce development support to promote decarbonization and achieve the GHG goals set out by the EEA. The plan, now approved by the DPU, also enables the Mass Save sponsors to claim savings and thereby offer clear incentive support for fuel switching – moving customers off combustion and onto electric solutions – even in situations where fuel switching could result in higher customer utility bills (a major sticking point in the past). This combination of policy drivers and program planning creates a confluence of carrots and sticks for utilities and other energy service providers whereby they are required to meet certain GHG goals, and at the same time they are now free to support fuel switching from gas to electric, and where the sponsors of Mass Save's metrics for success,

now in MMBtus and carbon emissions, align unambiguously with statewide policy for decarbonization.

The Climate Act further encourages utilities interested in more-innovative energy and decarbonization solutions by reducing regulatory burdens and financial risk if they experiment and test clean energy technologies and load flexibility. For example, Eversource is developing a pilot program to install neighborhood ground-source heat pump systems. These systems use pipes dug deep into the earth to exchange heat with the ground to warm buildings in winter and pump heat from buildings into the ground in summer to cool them. The system has the potential to augment or replace fossil fuels for heating and cooling. In addition to the goals for utilities, the legislation calls for development of a new stretch code with net-zero performance standards for jurisdictions to adopt in 2022 (Berg, Cooper, and DiMascio 2022). The draft code can provide opportunities for municipalities to further electrify building end uses and reduce or eliminate reliance on fossil fuels. Additionally, the Climate Act gives more citizens the chance to access clean, renewable energy. Beyond individual solar panels on roof tops, utility customers can participate in community solar projects, accessing a new grant program, or purchase solar from businesses or buildings with excess solar energy.

This new set of policies and GHG goals puts Massachusetts on a path to meet its decarbonization future by encouraging the eight building components. Utilities operating in the state already offer energy efficiency incentive programs and on-site renewable opportunities. The Climate Act expands off-site renewable energy offers and expands buildings' ability to manage and measure net-zero operations. Further, the switch to decarbonizing the building sector and encouraging building-grid integration means that nearly all of the components will be implemented.

Eversource Net Zero Energy/Deep Energy Savings Program

Eversource is a Massachusetts' investor-owned utility (IOU) and one of the Mass Save sponsors alongside other large IOUs and other energy service providers that deliver energy efficiency services to customers across the Commonwealth. Eversource, which also operates in Connecticut and New Hampshire, offers consistent new construction energy efficiency programming across all three states. In 2019, Eversource committed to carbon neutrality by 2030 in its own operations. Eversource's zero energy commercial new construction program, targeting and supporting commercial customers as they work toward zero, is part of its overall carbon-reduction and strategic electrification strategy and is one of the participation pathways available to customers in all three states.

With declining new construction program savings available with each energy code update, Eversource set out to explore Energy Use Intensity (EUI) and net-zero projects as a tool for increasing energy savings, but also as a way to refocus the program on market transformation. These internal programmatic drivers, together with the local policy initiatives and state leadership around carbon neutrality, informed the development of Eversource's Net Zero (NZ)/ Deep Energy Savings program. In 2020, Eversource began offering the program across the tri-state region of New Hampshire, Massachusetts, and Connecticut. The program is for customers who are interested in pursuing a ZE or ZE-ready building while maintaining focus on reducing the EUI of their building. The program initially set out to have customers target a site EUI of 25 or less, but if that was not achievable, projects were asked to target at least 40% savings relative to the building code, assuming a fossil fuel baseline (Nadel 2020). Commercial buildings with 10,000 square feet or more of conditioned space and year-round occupancy can

participate. The hallmark of the program is its focus on post-occupancy performance. Final customer incentives and program savings are tied to the building's operational EUI after a one year post-occupancy period.

In addition to incentives tied to the completion of construction, the program includes early technical assistance and incentives for measurement and verification (M&V) of performance at two, six, and twelve months of building occupancy. Buildings achieving LEED Zero, Living Future, or Passive House Certification may receive a bonus incentive of $3,000 (Mass Save 2020). Significant post-occupancy incentives ensure that project teams remain focused on operational performance, not just designed or predicted performance. Maximum post-occupancy incentives are available to customers only if their project achieves the target EUI in operation.

Since 2020, program administrators have made some program changes that they expect will increase participation, enable greater program influence toward electrification and low EUI, maintain customer focus on post-occupancy performance, and streamline EUI target setting. As owners and design teams are becoming more familiar with EUI target setting, and because zero energy EUI targets can vary across different buildings even within the same sector, the Sponsors of Mass Save expanded the program to include an additional tier of EUI targets for various building types, enabling more program participation. Making the program more of a path to hitting zero encourages more customers to participate in an outcomes-based path where post-occupancy performance is the ultimate goal.

The program initially saw that 25 EUI works extremely well for kindergarten through high school (K-12) schools and some other project types, but other sectors require different targets. To make participation easier, Eversource recently established targets for specific building types that will help draw more projects into the program. Program EUI targets for public safety buildings, K-12 schools, libraries, offices, and hotels are now published. Wherever feasible, the EUI targets align closely with targets published by New Buildings Institute and the City of Boston for its Low Carbon Zoning Ordinance (Carbonnier 2019).

The program now offers incentive adders on a per-cooling-ton basis for using heat pump technology for heating and cooling, including air-source, variable refrigerant flow (VRF), and ground-source heat pump technologies. The highest per-ton incentive is available for ground-source, followed by VRF, and then air-source technologies. These incentives are meant to promote electrification/decarbonization and are combined with the per-square-foot incentives offered for projects designed to achieve the EUI targets.

Since 2020, program incentives have increased dramatically. Previously, the maximum available incentive was $2.25 per square foot. For projects targeting the NZ level EUIs and deploying ground-source heat pumps, the available incentives are now significantly higher and is expected to play a real role in customer decision making. Regulations prohibit Eversource from using rate-payer funds to cover the cost of solar installations. However, support for solar is embedded in the program through the focus on zero energy buildings. The program also coordinates well with other related utility programs for electric vehicle (EV) infrastructure and active demand-response support.

The program incentives help customers offset the cost of designing and implementing many of the core and additional building strategies discussed throughout this paper. Engaging a ZE specialist and customers early in the design process ensures more-efficient designs with low-EUI targets, prioritizes and utilizes renewables, and plans for measuring and managing post-occupancy EUI. Projects must comply with ASHRAE 90.1 – 2016, Energy Standard for

Buildings Except Low-rise Residential Buildings Section 8.4.3 for submetering and data storage to monitor the annual building energy consumption. Measuring energy usage at multiple points of occupancy enables customers to identify issues and carry out corrective action if project performance strays from the final design EUI. The focus on post-occupancy M&V facilitates more accurate zero energy operations and ensures the building will continue to achieve and maintain a low EUI.

Since the program's start in 2020, 19 projects have enrolled and are participating in the program across Eversource territory in all three states, including eleven k-12 schools targeting 25 site EUI or lower, one large office building, three fire stations, two college/university projects, one nonprofit, and one town administrative building. Recently, Eversource has seen increased interest from and expects additional upcoming enrollments with public safety facilities (fire and police) and libraries. Key lessons learned since program inception in August 2020 include the following:

- There is great value in setting an absolute target. Setting an absolute energy use target has been instrumental for all the participants thus far. The 25 EUI is understandable for all decision makers, including non-technical building and school committee members. People rally around that target throughout the design process. They also understand that design changes can affect the project's ability to achieve that EUI outcome, and so proposed design changes are weighed against their impact on predicted EUIs during the value engineering process.
- Focus on outcomes has led to important conversations that would not have taken place before. Historically Eversource's involvement in a project would have focused only on "regulated loads" or loads that the energy code addresses. Now, because the program and final incentives are based on operational outcomes, there's much more to consider. Plug loads, for example, are becoming a much larger percentage of the overall building energy use pie and need to be thoroughly accounted for and considered under the energy reduction strategies to minimize loads.
- The program's emphasis is not just on building design/architecture/engineering, but also on policies related to how buildings will be used and operated. The program emphasizes that the design team can make a building capable of ultra-low EUI and zero-net energy, but the building occupants and the operator play critical roles in achieving success and must be engaged from the start.

In addition to supporting and improving individual projects as described above, the Eversource program ultimately strives to achieve market transformation such that very low EUI buildings are standard practice. Long-term goals include studying post-occupancy performance, comparing to predicted performance, and understanding where the deltas are and whether building designs can be improved, whether model predictability can be improved, and whether construction- and operations-related issues can be uncovered and addressed going forward. The feedback loops that the program generates are intended to reduce overall EUIs over time. Combined with communication and collaboration with other utilities designing net-zero-related programs, Eversource is positioned to usher customers into a carbon-neutral future.

CASE STUDY II: Austin, Texas

Austin's Community Climate Plan was adopted in 2015. It helped set the direction for net-zero emissions in Austin by 2050. In 2021, the plan was revised to lead with equity and was quickly adopted with the overarching plan to achieve net-zero community-wide GHG emissions by 2040. (City of Austin 2021a) The plan sets goals across five focus areas: sustainable buildings, transportation and land use, transportation electrification, food and product consumption, and natural systems.

According to the City of Austin, in the area of sustainable buildings, emissions reductions can be attained by achieving net-zero carbon for all new buildings and reducing emissions by 25% for existing buildings, addressing refrigerants, and managing construction materials more sustainably (City of Austin 2021b). The climate equity plan advocates for reducing the embodied carbon footprint of building materials by 40% and encourages the use of low-carbon materials as an important and accessible strategy. As buildings become more efficient, the carbon embedded in the building materials can make up a larger share of the carbon associated with the lifecycle of the building. Selecting lower-carbon materials is a low- to no-cost carbon-reduction solution. When project materials are evaluated through a lifecycle perspective, they can have a significant positive impact on local product procurement, operation and maintenance costs, and indoor air quality.

Austin Energy, the local municipal utility, developed the Resource Plan that commits the utility to provide affordable, dependable, and safe electricity service to residents and businesses while pursuing Austin's climate-change and sustainability goals, including the Austin Climate Emergency Resolution (City of Austin 2021b). The plan envisions:

- 93% carbon-free generation by 2030 and 100% by 2035.
- 1,200 megawatts (MW) of conservation, including 225 MW of peak demand response capacity.
- 1% of retail sales per year in energy efficiency savings. A target to serve at least 25,000 residential and business customers per year, with at least 25% being limited-income customers.
- 375 MW of local solar, 200 MW of customer-sited solar.
- 40 MW of local thermal storage.
- commitment to equity evaluation of programs.

These six initiatives address the majority of the net-zero building components. The overlap includes energy efficiency, on- and off-site renewable energy, building-grid integration, distributed generation, and decarbonization. Combined with the City of Austin's goals, they address all eight components discussed above.

Austin Energy Green Building (AEGB) Program

AEGB was developed in 1991 as the first rating system in the U.S. for evaluating the sustainability of buildings. The rating system is updated regularly to maintain an Austin-specific focus, tailoring it to the Central Texas climate, local materials, and construction techniques. The rating system is required for those seeking Planned Unit Development (PUD) zoning, density bonus programs, Safe, Mixed-Income, Accessible, Reasonably Priced, and Transit-Oriented

(SMART) housing participation, and is an alternate compliance pathway for those pursuing utility incentives.

The program encourages innovative, sustainable building practices to enhance economic and human well-being and create a market for high-performing buildings. AEGB includes proven green building strategies to help advance Austin's environmental initiatives, building on the city's code and local building regulations. Tools and guidelines are provided for rating the sustainability efforts of new and remodeled single-family, multifamily, and commercial projects.

The AEGB program includes many green building components providing up to 100 voluntary measures. Projects that incorporate more voluntary measures can attain a higher AEGB Star Rating, according to the thresholds described in Table 1. The basic requirements and voluntary measures cover seven major aspects – integrated design, site, energy, water, indoor environmental quality, materials and resources, and education and equity.

Table 1. The AEGB commercial rating point thresholds

AEGB Commercial Rating	Star Levels
1 Star	Basic Requirements
2 Stars	35-44 points
3 Stars	45-54 points
4 Stars	55-74 points
5 Stars	75 points or more

Source: Austin Energy

AEGB provides customized consulting services throughout a project's lifecycle to ensure efficient building design and the highest rating possible. After registration of a project, the project team receives assistance in the design phase and in establishing the performance goals, recommendations on materials and systems, ongoing verification during the construction phase, and an evaluation of the project's environmental and community impacts.

Like Eversource's Net Zero program, AEGB encourages customers to engage with the program team early in the design phase and consider the building holistically. This helps with the selection of a design team and setting of performance goals that exceed the efficiency requirements of the current version of the city code. AEGB is also responsible for shepherding the local energy code through the approval process. In September 2021, Austin became the first jurisdiction in the U.S. to adopt the 2021 International Energy Conservation Code (IECC). This ensures that all projects built to code in Austin meet stringent energy requirements, not just the AEGB-rated projects. AEGB projects must also agree to commission systems to ensure performance. As part of the voluntary measures, teams receive one to three points for conducting a whole-building lifecycle assessment and demonstrating overall reduction in lifecycle impacts compared to a reference building.

The AEGB program was developed prior to the recent update to the climate equity plan and will be regularly updated going forward. In 2020 alone, close to 4,221,000 square feet of floor area were certified under the rating system, collectively achieving energy savings of 13,315 MWh and demand savings of 5.74 MW (Austin Energy 2020). The continued program innovation and rating update every three years has allowed the utility to stay ahead of policy requirements and prepare the market for the coming changes, enabling their customers transition into a carbon-neutral future.

Aligning Metrics and Moving Toward Net-Zero Programs

Utility energy efficiency programs for new construction continue to evolve as cities and states focus on issues of environmental protection, equity, and economic development. Aligning state and jurisdiction climate goals for reducing GHG emissions or carbon neutrality with utility energy efficiency goals can ensure deeper savings and decarbonization of the building sector. With climate-action legislation and plans focusing on emissions reduction, utilities can integrate the core and additional carbon-neutral building strategies we discuss in this paper to help cities and states meet their climate commitments. Both Eversource and Austin Energy have set carbon-neutral goals, and the new-construction programs are an integral part of their carbon-reduction plans.

Both Eversource's Net Zero and Austin Energy's AEGB programs highlighted in this paper rely on engaging customers early in the feasibility or schematic phase to help select the design team and assist with setting EUI or building performance targets. The programs offer a suite of services and technical assistance during the design, construction, commissioning, and operations phases to ensure buildings are designed, constructed, and operated to deliver the anticipated savings. The additional support ensures design teams are on track, that owners/developers will receive funding, and that the utilities can expect a minimum level of energy and carbon savings.

Peer-to-peer exchanges are also critical to the design of innovative programs that cut building-related emissions and save energy. For example, Eversource interviewed utility peers who were administering or developing net-zero programs and professionals and organizations working on net-zero building projects. The interviews allowed them to test concepts before developing their net-zero-energy new-construction program. This enabled the utility to work through the complexity of a new approach and obtain buy-in from different stakeholders. Eversource now convenes an annual zero energy conference, Zero Energy Commercial Building Conference, providing the opportunity for net-zero teams to share stories and lessons learned across the tri-state area. Other peer exchange opportunities like utility working groups can provide a safe space for sharing program ideas, opportunities, and challenges.

Although zero energy programs are not near the scale needed to meet emissions-reduction goals in the building sector, the two programs highlighted in this paper show how jurisdictions and utility programs can integrate the eight essential net-zero building strategies needed for a carbon-neutral future: energy efficiency, renewables, management of net-zero operations, all-electric, building-grid integration, low-GWP refrigerants, and low-embodied-carbon materials.

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