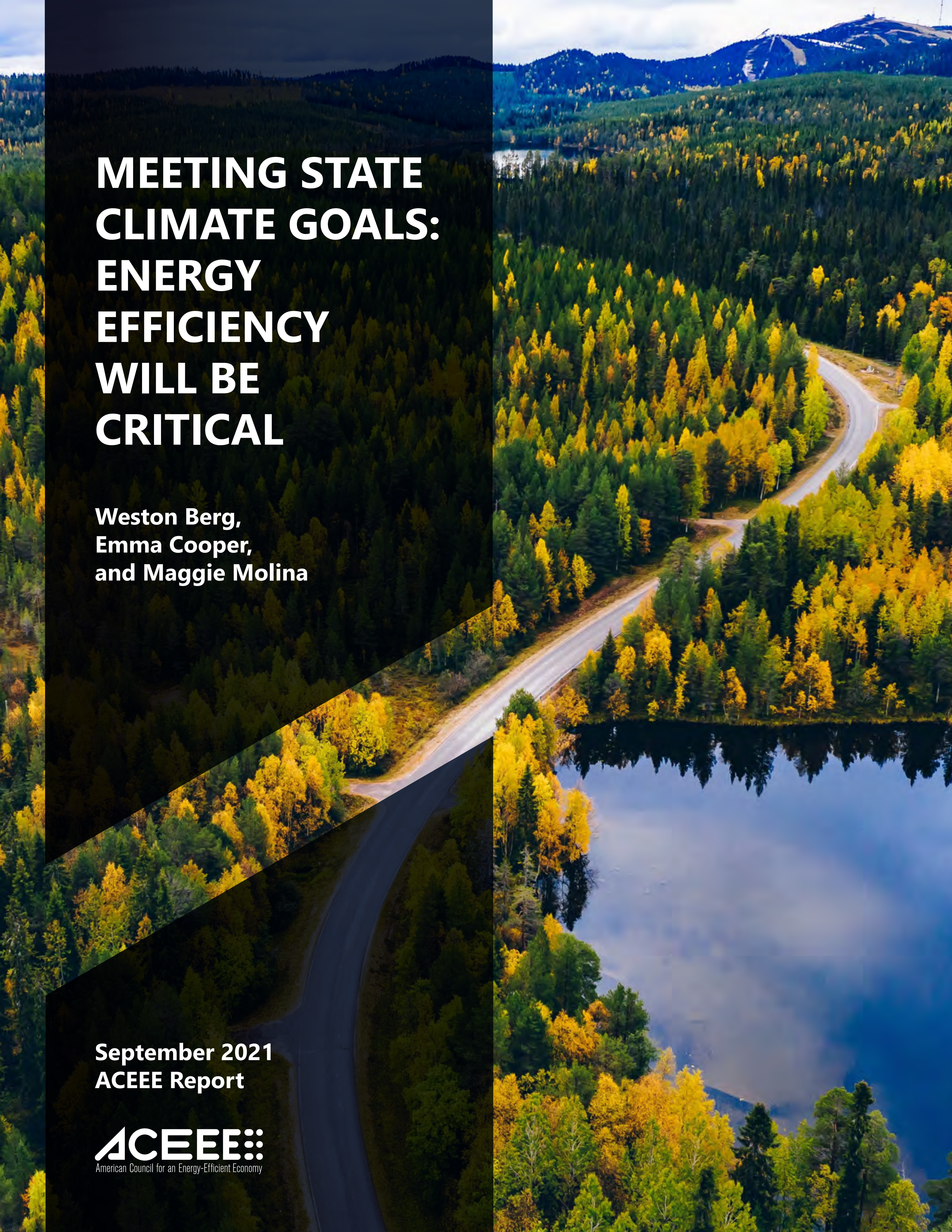

MEETING STATE CLIMATE GOALS: ENERGY EFFICIENCY WILL BE CRITICAL

**Weston Berg,
Emma Cooper,
and Maggie Molina**

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Contents

About ACEEE

The **American Council for an Energy-Efficient Economy** (ACEEE), a nonprofit research organization, develops policies to reduce energy waste and combat climate change. Its independent analysis advances investments, programs, and behaviors that use energy more effectively and help build an equitable clean energy future.

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Executive Summary

KEY FINDINGS

- While a growing list of states have adopted ambitious goals to decarbonize their electric power sectors and reduce economy-wide emissions, in most states current efforts are far short of the trajectory needed to meet those climate commitments.
- In particular, we find that most states adopting a clean electricity standard (CES) or emissions reduction goal are not clearly defining the essential role that energy efficiency must play in order to achieve those ambitious climate goals. Energy efficiency offers states a vast menu of strategies to support their climate goals while reducing costs and delivering a diverse array of other system, health, and equity benefits.
- In our review of the 17 states and territories with a 100% CES, only Virginia and Washington State have incorporated specific efficiency targets within their CES legislation. Of the 24 states and the District of Columbia with emissions reduction goals in place, 8 make no mention of energy efficiency at all, and 15 mention it in an undefined way. Only New York's and the District of Columbia's emissions targets encompass specific energy consumption reduction goals. However, most states reviewed do maintain a separate utility efficiency goal.
- Without clear inclusion of energy efficiency, progress toward meeting climate and clean energy goals will be more difficult. States should consider energy efficiency's potential to (1) reduce the costs of meeting clean electricity standards by managing demand on the grid, (2) aid electrification efforts to support emissions reduction goals, and (3) strengthen and advance equitable decarbonization strategies to ensure that all customers are able to participate in and benefit from the clean energy transition.
- Policymakers can strengthen efficiency's support of clean electricity standards and emissions reduction goals by designing efficiency policies that optimize grid integration of variable renewable resources. This can be accomplished through policies that fully value the time and locational value of efficiency and integrate it into utility resource and distribution system plans.
- State policies can also better leverage energy efficiency in support of emissions reduction goals by accelerating adoption and availability of electric vehicles (EVs) and EV charging infrastructure while phasing out reliance on internal combustion vehicles, and by updating buildings sector efficiency policies to encourage multi-fuel savings from beneficial fuel-switching measures.

Recent years have seen a surge in states adopting increasingly ambitious clean electricity standards (CES) and/or greenhouse gas (GHG) emissions reduction goals (ERG), driven by science showing that global emissions must be drastically reduced in the next decade and beyond to avert catastrophic impacts of climate change. A CES represents a commitment to 100% clean electricity generation by a target year and, relative to the renewable portfolio standards (RPS) of the past, sets a more aggressive goal that measures success on the basis of progress toward a carbon-free power sector.[1] Emissions reduction goals differ from a CES by going beyond the electric power sector to require GHG reductions in additional sectors, such as buildings and transportation, or economy-wide.

Energy efficiency strategies have an important role to play in meeting these goals (Larson et al. 2020; Williams et al. 2021; IEA 2021; NASEM 2021). In fact, ambitious energy efficiency policies can get us about halfway to achieving national GHG goals by 2050 (Nadel and Ungar 2019). However, there is limited research regarding the extent to which states are incorporating energy efficiency into their clean energy standards and climate goals. This paper addresses this gap through a review of the current landscape of state CES and emissions reduction goals and the role that efficiency serves in each state. We characterize opportunities available to state policymakers to leverage energy savings to better support a clean power sector, electrify fossil fuel–dependent end uses, reduce economy-wide emissions, and ensure that the transition to a zero-carbon future is equitable and serves the needs of all customers.

OPPORTUNITIES FOR ENERGY EFFICIENCY TO SUPPORT CLIMATE POLICIES

Although there are promising standards in place, states are a long way from meeting targets for clean energy and emissions reductions. Energy efficiency can play a central role in advancing these efforts in several ways (EDF 2020; Williams et al. 2021). First, in the near term, since fossil fuels currently account for around 60% of power-sector generation, far greater expansion of energy efficiency efforts is needed to provide immediate reductions in emissions, especially where the grid is least decarbonized (EIA 2021d). For example, the International Energy Agency's global road map to reach net zero emissions by 2050 calls for efficiency improvements averaging 4% per year through 2030, about three times the average over the last two decades (IEA 2021).

[1] States vary in their statutory definition of "clean" electricity, but generally this refers to electricity generated from energy sources that do not result in an increase in GHG emissions. This includes renewable energy and may also include nuclear power, fossil fuel generation paired with carbon capture and storage (CCS), or other emerging technologies such as green hydrogen–fired turbines.

Second, as renewable generation increases, energy efficiency can help reduce costs associated with integrating these resources by lowering overall electricity consumption; it can also optimize system value by enabling load flexibility and load shaping to mitigate winter and summer peak demand.

Last, as the carbon intensity of the grid continues to improve, thereby elevating the value of electrification as a climate strategy, energy efficiency will be critical to help manage costs by reducing anticipated new electric loads and the need for new energy infrastructure.

CURRENT STATUS OF ENERGY EFFICIENCY INCLUSION WITHIN CLIMATE GOALS

Our review of state climate policies, including binding and nonbinding legislation and executive orders, finds that as of August 2021, 15 states plus the District of Columbia and Puerto Rico have established a 100% CES, and 24 states and the District of Columbia have emissions reduction goals in place, including 8 with goals to reduce emissions by 100%.[2]

Within these policies, we find that the role of energy efficiency or the degree to which it is expected to contribute to climate goals is rarely defined. Exceptions include Washington State, which specifies that utilities must file four-year plans to pursue “all cost-effective, reliable, and feasible efficiency” in pursuit of its CES under SB 5116.[3] Eleven states with a CES, with the addition of Washington, DC and Puerto Rico, do not directly include efficiency as a means to achieve the clean electricity target but do have a separate efficiency goal, typically in the form of an energy efficiency resource standard (EERS).

Among the 24 states and Washington, DC with an economy-wide emissions reduction goal, 8 have policies that do not stipulate efficiency as a means to meet targets, while 15 recognize its value but do not include a specific savings target or are unclear regarding how efficiency should be deployed. Exceptions include New York—which established a 185 trillion Btu savings goal by 2025 as part of the Climate Leadership and Community Protection Act—

[2] These are Washington, DC, Hawaii, Massachusetts, Nevada, New York, California, Louisiana, and Michigan.

[3] A clean electricity standard approved by the Arizona Corporation Commission in May 2021 includes an annual MWh savings target of 1.3% (averaged over each three-year planning period) and a capacity-based standard requiring savings equal to a 35% reduction in 2020 peak demand by 2030. However, as of July 2021 a formal rulemaking for the CES was still ongoing.

and the District of Columbia, whose Sustainable DC 2.0 lays out a plan to increase energy efficiency by cutting per capita energy use 50% by 2032.

These findings indicate that there are ample opportunities for states to better articulate the role that energy efficiency can serve in meeting their climate goals and to maximize the emissions reductions, cost savings, and other benefits that efficiency offers. Policymakers have multiple options for how to structure energy efficiency requirements in relation to and in support of these climate goals: by designing separate but complementary energy savings and clean supply requirements, by combining targets into a single standard, or by maintaining a single policy with separate sub-targets for efficiency and clean electricity. While all offer viable pathways to achieve state climate goals, each comes with its own unique advantages. Having a separate EERS and CES, for example, maximizes policy flexibility to apply targets to different utilities across different time horizons using different criteria and metrics. On the other hand, a unified standard can allow utilities the freedom to determine the optimal combination of efficiency measures and clean energy options that might work best for them and their customers. Regardless of what framework states choose, it is important they avail themselves of the broad menu of energy efficiency policies that can complement and support these clean energy and climate goals.

TOWARD AN OPTIMIZED FRAMEWORK FOR ENERGY EFFICIENCY IN SUPPORT OF STATE CLIMATE POLICIES

Energy efficiency's benefits are diverse and dynamic, accruing to both utilities and customers, and include avoided emissions, reduced system costs, customer bill savings, and environmental, health, and safety impacts. As the grid modernizes and decarbonizes at varying rates across the U.S. in the coming decades, policymakers should refine and update policies in ways that successfully respond to these changing conditions, which include not only shifts toward a carbon-free grid but also evolving economics for electrification, demand flexibility, and storage technologies.

In supporting the transition to a clean energy grid, energy efficiency offers a range of attributes that policymakers can harness to better facilitate integration of renewables and manage associated costs. These include efficiency's potential to pair with electrification measures to minimize added loads and reduce the need for additional capacity investment, especially in winter months, which can improve the affordability of electrification measures. Harnessing efficiency's time and locational attributes can also enable improved planning and resource investment to avoid some expensive transmission and distribution (T&D) upgrades. Energy efficiency can also help manage peak electricity demand that is currently generally met with the most expensive—and often higher-emission—generating units. Energy efficiency, demand response, and demand flexibility should be deployed as part of a suite of strategies states can use to manage the variability of renewables, by both decreasing load during times of grid stress and alternately shifting load to times of over-generation to avoid curtailment of renewables (i.e., deliberately reducing output due to excess generation).

These grid management services complement a range of other important contributions that energy efficiency can make to the electrification of fossil fuel end uses. These include transportation, currently the largest source of GHG emissions in the U.S., and buildings, in which residential and commercial space and water heating alone accounts for 10% of total emissions (EPA 2021). Achieving zero-carbon goals will require fully electrifying most end uses (Larson et al. 2020). In the transportation sector, this means adopting policies to ramp up electric vehicle (EV) sales and expanding EV charging infrastructure in concert with transportation system efficiency measures. In the buildings sector, this generally means promoting measures to replace fossil fuel heating equipment with high-efficiency electric heat pumps and realigning utility policies to encourage the full range of customer cost savings and health benefits these measures provide. Bundling these measures with energy efficiency investments like home weatherization services is essential for reducing costs for both the customer and the utility by right-sizing equipment and reducing new load added to the grid. Large-scale electrification is anticipated to increase electricity consumption as much as 50–67% by 2050 (and potentially more in economy-wide deep decarbonization scenarios), and energy efficiency can help temper the need for new generation, transmission, and distribution assets (T. Mai et al. 2018; EPRI 2018; Williams et al. 2021).

However, electrification is expected to progress gradually. With even the most ambitious state CES policies targeting 100% clean electricity by 2040 at the earliest, states will need to continue to invest in a wide array of efficiency policies that slash fossil fuel consumption in building space-and-water heating and in internal combustion engines, which continue to dominate the transportation sector.[4] These policies include high-efficiency codes like zero-energy or zero-energy-ready standards and building energy performance standards (BEPS), as well as policies that reduce personal vehicles and vehicle-miles traveled via smart growth planning and the expansion of multimodal public transportation.

Looking toward the more distant future, as fossil fuel generation is phased out and low-cost renewable energy occupies a larger portion of the grid, the avoided carbon benefits of

[4] A few cities have set more aggressive targets. For example, Washington, DC has set a 100% renewable portfolio standard by 2032. Also Washington State's SB 5116 (2019), which set a goal of 100% clean electricity by 2045, also set a nearer term 100% carbon-neutral goal for 2030.

energy efficiency may decline. But efficiency will continue to provide other important value streams for utilities and customers that must not be neglected. These benefits, including improved grid stability and reliability, customer bill savings, greater safety and comfort, reductions in non-GHG air pollution, and job creation, must continue to be counted and pursued as part of state energy and climate plans. Given that some customers are not served by efficiency programs due to high upfront costs and other barriers, policies must also incorporate equitable practices to ensure that the benefits of meeting climate goals extend to all customers and do not result in shifting costs or pollution from persisting fossil fuel units to marginalized communities.

RECOMMENDATIONS AND CONCLUSIONS

States, utilities, and regulators should review existing policies and assess the degree to which efficiency has been integrated and incentivized as a core strategy and least-cost resource within the power sector to reduce long-range supply investment costs. By *energy efficiency*, we adhere to ACEEE's definition of the term, referring specifically to policies enabling the use of less energy to provide the same or better products, services, or amenities.[5] Pairing efficiency with renewables, storage, demand response, and other flexible grid resources will provide additional opportunities to improve cost effectiveness by reducing measure costs and optimizing grid value during periods of peak demand. Doing so is essential to help mitigate costs and challenges that could otherwise result from increases in grid demand due to strategic electrification of the building and transportation sectors.

To maximize the potential for energy efficiency to support decarbonization efforts within an optimized framework, we offer the following recommendations for state action:

Energy efficiency policies supporting a CES

- Define and stipulate the priority role of energy efficiency within CES and emissions reduction standards. Consider requirements to support CES and emissions reduction goals with all cost-effective energy efficiency.
- Consider options to harmonize and coordinate efficiency goals with those described in the CES. The majority of states reviewed have established a stand-alone EERS

[5] Examples include appliance standards, home weatherization programs, building energy codes, incentives for electric vehicle adoption, and incentives for building electrification—such as fuel switching to electric heat pumps, hot water heaters, and induction cooktops—when doing so saves energy (in total Btus), saves money, and reduces emissions.

distinct from their CES. This approach allows accounting simplicity and the flexibility to separately adjust savings targets, criteria, and metrics as conditions change. States can also combine efficiency and clean energy requirements into a unified GHG or clean energy standard or encompass them within a single policy by establishing resource-specific sub-targets.

- Set complementary policies to advance energy efficiency in state policy and support other strategic state priorities such as reducing seasonal peak demand, lowering costs, improving grid flexibility and reliability, reducing carbon and other air pollutant emissions, and strengthening market penetration of beneficial technologies like energy-efficient heat pumps.
- Strengthen and standardize progress reporting practices to ensure they are transparent, publicly accessible, and aligned with state renewable energy and GHG reduction goals.
- Establish and adequately fund an energy efficiency resource standard setting multiyear utility savings targets. Incorporating a multiple-goal framework within an EERS can enable policymakers to target and track progress toward additional state priorities.
- Recognize that most utilities have a very different inherent interest regarding electrification versus customer energy efficiency, and ensure that electricity savings goals and business model reforms are in place to adequately incentivize utilities to pursue ambitious customer energy efficiency.
- Ensure that utilities fully identify and value energy efficiency as a grid resource in potential studies and integrated resource planning processes in order to accurately quantify achievable savings and peak demand reductions. Pair with updates to cost-effectiveness screening practices that align with the *National Standard Practice Manual* (*NSPM*), and create clear price signals for consumers through time-varying rates or compensation mechanisms. Studies should consider time and locational impacts and high-electrification scenarios to maximize avoided cost of system-wide and local generation, transmission, and distribution. Consider opportunities for pairing efficiency with demand response, storage, and renewables to improve cost-effectiveness.

Energy Efficiency Policies to Support Emissions Reduction Goals

- Support strong EERS policies to promote immediate and cost-effective emissions reductions in the buildings sector.

- Strengthen transportation electrification planning and investment with binding statewide targets and consumer incentives for EV adoption. Support EV charging infrastructure buildout by establishing policy directions to encourage utility and third-party investment.
- Set targets to reduce vehicle miles traveled (VMT) through policies like smart growth principles and transportation emissions goals.
- Define energy efficiency with an expanded scope that encompasses all savings achieved, including those resulting in net GHG reductions from efficient fuel-switching measures like electrification. Support fuel-neutral goals with guidance clarifying acceptable conditions under which funds can be used toward fuel switching.
- Prioritize policies and programs that reduce natural gas consumption, including beneficial electrification, appliance standards, utility program investment, and refining cost-effectiveness tests to accurately value the present and future benefits of reducing natural gas use.
- Adopt advanced energy efficiency codes and standards to accelerate high-efficiency construction like net zero and zero-energy-ready buildings. Ensure that programs to install heat pumps in existing buildings include efforts to ascertain that the buildings are energy efficient.
- For programs and other efforts to weatherize homes and buildings, integrate efforts to install heat pumps in existing buildings where appropriate (e.g., when existing cooling and heating equipment needs replacement).
- Support efforts to strengthen industrial sector efficiency by fostering collaborative opportunities between large customers and utilities and by connecting industrial facilities to technical assistance. Expand programs focused on industrial efficiency savings to include broader decarbonization opportunities such as use of heat pumps and other electrification technologies; renewable energy; green hydrogen; and carbon capture, utilization, and storage.

Energy efficiency policies to support equitable decarbonization

- To bring about a clean energy transition that meets 100% goals, make sure that participation and resulting benefits extend to all customers, including historically underserved and marginalized communities.
- Adopt policies that reduce transportation burdens among low-income and disadvantaged households by expanding and improving access to clean

transportation. These include rebates, goals, and funding streams to make EVs and public transit more accessible for these communities.

- Adopt policies that reduce household energy burdens. Extending program benefits to historically marginalized households can be achieved through spending and savings carve-outs within EERS goals and by offering enhanced incentives for low-income customers.
- To ensure that programs are responsive to community needs, adopt utility planning processes that integrate stakeholder engagement and analysis in a way that prioritizes marginalized customers, and establish equity-related metrics and reporting frameworks to ensure accountability.
- Prioritize opportunities to leverage efficiency programs to remedy health inequities by valuing avoided health costs in program screening, building health–energy partnerships, and expanding services to reduce deferral rates.

Introduction

Recent years have seen a surge in states adopting increasingly ambitious clean electricity standards (CES) and/or greenhouse gas (GHG) emissions reduction goals, driven by science showing that global emissions must be drastically reduced in the next decade and beyond in order to avert catastrophic impacts of climate change (IPCC 2021). Both types of target are examples of state policy mechanisms to help the U.S. achieve necessary emissions reductions. Energy efficiency can get us about halfway to reaching national GHG goals by 2050, making it a critical part of any state's climate action plan (Nadel and Ungar 2019).

While many have compiled information on this emerging wave of state climate and clean energy goals, there is limited research on whether and to what extent states are incorporating energy efficiency into these state climate and clean energy policies or indirectly pursuing efficiency through other policy strategies to support these goals. This paper bridges this research gap by reviewing the landscape of state CES and emissions reduction goals, examining how efficiency is integrated, and exploring a few state-specific examples. By *energy efficiency*, we adhere to ACEEE's definition of the term, referring specifically to policies enabling the use of less energy to provide the same or better products, services, or amenities. This can also include electrification when it saves energy (in total Btus), saves money, and reduces emissions (Gold, Gilleo, and Berg 2019).[6]

WHAT DEFINES A CLEAN ELECTRICITY STANDARD?

We use the phrase "state climate goals" in this paper to refer collectively to the adoption of a clean electricity standard and/or emissions target. Both are important policies that work together to achieve deep decarbonization goals.

Clean electricity standards represent a commitment to 100% clean electricity generation by a target year, and sometimes they set an interim target as well. A CES is more aggressive than the renewable portfolio standards (RPS) of the past two decades; rather than focusing on incrementally increasing adoption of certain technologies, it measures progress toward a carbon-free power sector. While definitions of clean energy vary, they generally include

[6] Certain forms of electrification may be considered beneficial but do not meet our criteria for energy efficiency due to economics or local grid mixes. However, as conditions change these uses may become energy efficient in the future, for example as the carbon intensity of the local grid diminishes or the price of new technologies changes.

renewable resources like solar, wind, hydro, tidal, and geothermal power and sometimes also include nuclear and carbon capture and sequestration (NRDC 2020).[7]

Emissions reduction goals differ from a CES because they can go beyond the electric power sector (utility generators and independent power producers) to apply to emissions from other sectors (such as buildings or transportation) or to all emissions economy-wide. Nationally, the power sector represents just one-quarter (25%) of emissions, and strategies to achieve deep decarbonization will require reductions from all sectors (see Figure 1). Emissions reduction goals typically describe reductions in GHG emissions by a certain percentage, relative to a baseline year, by a target year.

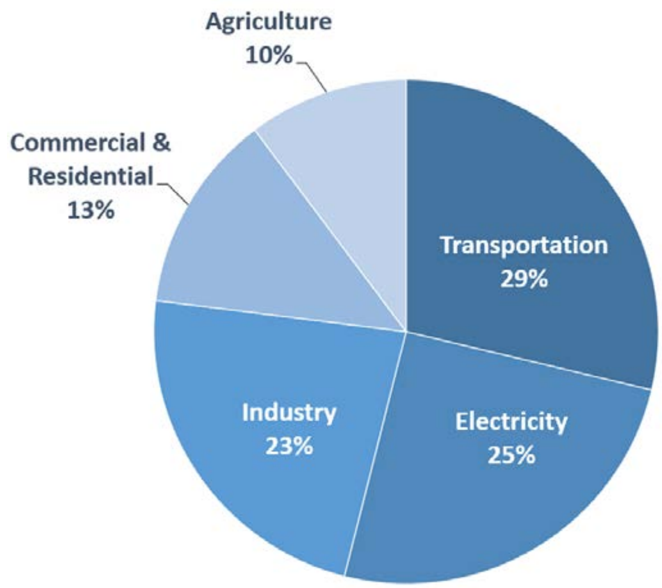

Figure 1. Overview of greenhouse gas emissions in 2019.
Source: EPA 2021.

A CES guides state and utility efforts to decarbonize the power sector, which in turn can make electrification an increasingly effective strategy, driven by complementary policies and

[7] The classification and eligibility of nuclear energy within a CES varies among states. For example, the Virginia Clean Economy Act defines zero-carbon electricity as "electricity generated by any generating unit that does not emit carbon dioxide as a by-product of combusting fuel to generate electricity." As such, both nuclear energy and carbon sequestration technologies are included. Further, while the VCEA's RPS applies to "total electric energy," the act excludes nuclear energy from this total, such that the RPS provisions do not apply to the 30% of statewide electricity supplied by nuclear plants.

market forces. Electrification also supports broader economy-wide emissions reduction goals by transitioning end uses currently relying on fossil fuels, such as home heating and transportation, to electric power. As grid carbon intensity diminishes due to increasing deployment of zero-carbon or renewable sources under a CES, the per unit avoided GHGs from electrifying end uses will continue to grow, strengthening the power sector's effectiveness as a resource for meeting emissions goals. Electrification can also offer a means to deliver energy efficiency, since switching from fossil fuel to electric technologies uses less energy across all systems (Nadel and Perry 2020; Albatayneh et al. 2020). However, policymakers should exercise caution and recognize that some electrification measures may create unintended consequences for equity, affordability, or reliability, absent proactive policies.

Although many municipalities and utilities—and not just states—also have adopted CES and decarbonization goals (NRDC 2021; Benahmed et al. 2020), our focus in this research is on state policy. Therefore, utilities' and municipalities' climate goals fall outside the scope of this paper. And although many examples of these individual voluntary and/or unregulated goals exist within the states we explore, this research is focused on ways states are addressing climate goals and efficiency within a broader statewide policy framework and alongside complementary standards and incentive structures.

We first explore the rationale for using energy efficiency to support clean energy goals and reduce GHG emissions per state climate goals. We then catalog the state-by-state landscape of two distinct policies: CES and emissions reductions goals. In doing so we aim to better understand how states are leveraging efficiency within policies intended to increase deployment of renewable energy across the power sector, as well as to reduce economy-wide emissions. We also explore the extent to which efficiency is embedded in those policies and/or in stand-alone efficiency policies.

In the second part of this report, we examine a selection of energy efficiency policies with the potential to provide the greatest energy and carbon savings. We discuss their roles in supporting the build-out of renewable energy within CES goals and advancing electrification efforts to meet economy-wide emissions reduction goals. We also discuss the additional economic and health benefits of energy efficiency and which policies to prioritize in communities historically burdened by pollution and high energy costs, which will be critical to ensuring an equitable transition to a zero-carbon future that serves the needs of all customers. We conclude with several state profiles to provide examples of how these principles are currently being applied in practice, and how energy efficiency can fill in the gaps.

Rationale for Efficiency in State Climate Policies: Clean Electricity Standards and Emissions Reduction Goals

Despite the clean electricity standards some have in place, states are largely not on track to meet targets for clean energy and emissions reduction. To limit global warming to 1.5°C—which the Intergovernmental Panel on Climate Change (IPCC) says is necessary to mitigate the most severe impacts of climate change—global emissions need to be reduced by about 45% of 2010 levels by 2030 and must reach net zero by 2050 (IPCC 2018). According to a recent report by the Environmental Defense Fund (EDF), the 25 states (plus Puerto Rico) belonging to the U.S. Climate Alliance at the time of the analysis are projected to reduce emissions by just 11% of 2010 levels by 2030, more than 30 percentage points below the recommended level (EDF 2020).[8] Despite the U.S. Climate Alliance pledge to advance the goals of the Paris Agreement, member states are expected to reduce emissions by 18% below 2005 levels by 2025, far short of the 26–28% near-term U.S. commitment under the Agreement.[9] Energy efficiency can play a central role in supporting clean energy and emissions reduction goals and enabling states to get back on track to meet the necessary targets to avert the worst impacts of disruptive climate events.

Energy efficiency should be a foundational strategy to support states' plans to meet their climate policy goals, as multiple long-term deep decarbonization studies have shown (Larson et al. 2020; Williams et al. 2021; IEA 2021; NASEM 2021; Nadel and Ungar 2019). First, in the near term, far greater expansion of energy efficiency efforts is needed to provide immediate reductions in emissions, as fossil fuels accounted for about 60% of utility-scale electricity generation in the U.S. in 2020 (EIA 2021h). These investments can immediately reduce GHG emissions regardless of the carbon intensity—the amount of carbon dioxide (CO_2) per unit of primary energy consumed—of electricity generation, although their impact will be strongest where the grid is least decarbonized. ACEEE has found that energy efficiency has the potential to cut U.S. energy use and GHG emissions in half by 2050 by

[8] As of July 2021, U.S. Climate Alliance members included California, Colorado, Connecticut, Delaware, Hawaii, Illinois, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, Washington, and Wisconsin, as well as Puerto Rico. Montana's governor discontinued the state's membership in the Alliance in July 2021.

[9] In April 2021, the Biden administration announced a new near-term target to achieve a 50–52% reduction in GHG emissions from 2005 levels by 2030, putting the U.S. on a path to achieve net zero emissions by 2050.

significantly ramping up investment in technologies that are either cost effective now or likely to become cost effective (Nadel and Ungar 2019).

Second, as renewable generation increases, energy efficiency can help optimize and reduce costs associated with integration of renewable energy resources onto the grid. It can do this in several ways. Energy efficiency can greatly reduce the amount and cost of renewable energy needed by the electric system by lowering overall electricity consumption. Efficiency can also lower winter and summer peak demand, with some measures offering more peak demand reductions than others (Mims Frick et al. 2019; Specian, Cohn, and York 2021). Combined with demand response (DR) to shift loads from peak to non-peak periods, efficiency can have an even greater impact (Gerke et al. 2020). Further, efficient technologies can enable load flexibility and load shaping by allowing grid operators to control system load and optimize grid performance (York, Relf, and Waters 2019).[10] Combined energy efficiency and demand response strategies are beginning to develop in regions with higher penetration of renewables and storage, but these efforts remain very limited in utility programs and regional markets (York, Relf, and Waters 2019).

Third, energy efficiency can help facilitate electrification. As the grid decarbonizes, electrification of end uses previously served by fossil fuels becomes a critical strategy for meeting decarbonization goals. One of the major concerns with large-scale electrification is that the new electric loads from the transportation, buildings, and industrial sectors could require major build-outs of new generation, transmission, and distribution assets, raising costs and risks for customers, unless such potential growth is reduced by large-scale investments in efficiency and other demand-side solutions. Energy efficiency will be critical to reducing the amount of build-out needed because—quite simply—less energy will be required. Energy efficiency can enable scenarios with high electrification and clean energy generation and storage while reducing overall demand at lower cost than most generation, transmission, and distribution projects, lowering system costs and mitigating ratepayer risks.

[10] Load flexibility, also known as demand flexibility, is the capacity of demand-side loads to change their consumption patterns hourly or on another time scale (Berkeley Lab 2021). Lawrence Berkeley National Laboratory's *California Demand Response Potential Study* introduced a framework for describing four different types of load management: shape, shed, shift, and shimmy, where *shape* describes longer-term load shaping through energy efficiency measures and price signals, *shed* describes load reduction during times of peak demand, *shift* describes moving demand away from peak times, and *shimmy* describes using loads to dynamically adjust demand to alleviate short-run ramp-ups (Alstone et al. 2017).

Curbing growth in energy demand can also mitigate the additional land area that future energy development is expected to require. A 2016 study estimating new land area to be impacted under several Energy Information Administration (EIA) energy production growth scenarios through 2040 projected direct land use impacts of roughly 200,000 km^2. When additional spacing requirements were considered, the study anticipated a total of 800,000 km^2 of total landscape-level impacts, an area larger than Texas.[11] These results highlight the additional potential land conservation benefits inherent to energy efficiency, as well as the potential to minimize land use conflicts that can arise from public opposition to the siting of large-scale industrial energy development (Trainor, McDonald, and Fargione 2016; Gross 2020).

While contributing to cost reductions everywhere, energy efficiency has the potential to provide the most value in utility service territories where carbon intensity remains high, and it will be more important during seasons and hours of the day when high-carbon generation is most likely to run. States should tailor energy efficiency policies to identify these areas of high savings potential and direct investment accordingly.

In addition, research has found that average household spending as a percentage of income on transportation and energy expenses is the highest among low-income customers and environmental justice communities (Drehobl and Ross 2016; Drehobl, Ross, and Ayala 2020; Vaidyanathan, Huether, and Jennings 2021). These individuals also are more likely to live in areas impacted by disproportionate exposure to air pollution and to live in older, less efficient housing. These customers stand to benefit the most from a transition to a clean energy economy; however, they are often excluded due to high upfront costs and other barriers to program participation. States must design policies that are integrated with equity principles to ensure that clean energy investments and opportunities reach these customers. Doing so is important for addressing historical patterns of injustice, current low-income energy burdens, and to avoid leaving these customers behind to shoulder future costs of stranded fossil fuel assets or pollution.

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[11] The direct footprint included impacts from activities such as land cleared for dams, well pads, mines, associated roads, pipelines, and wastewater storage. Total area accounts for additional spacing requirements. For example, while wind turbines have a relatively large landscape-level impact (averaging 126.92 km^2/TWhr) due to setback requirements, but only 3% of that land is directly impacted (Trainor, McDonald, and Fargione 2016).

These diverse energy efficiency benefits, including lowered emissions, grid optimization, reduced societal costs of electrification, and advancement of equity goals, are summarized in Table 1.

Table 1. Energy efficiency benefits supporting clean electricity standards and emissions reduction goals

Benefit	Sub-benefits
Lowers emissions regardless of local grid's carbon intensity	Provides direct reductions in use of fossil fuels, such as gasoline for internal combustion vehicles and natural gas or propane for home heating
	Provides indirect reductions in fossil fuel use through lowered electricity demand
	Improves public health by reducing ozone formation and particulate pollution, as well as nitrogen oxides (NOx) and sulfur dioxide (SO_2) emissions from fossil fuel peaker plants
Lowers costs of integrating renewable energy in the power sector by optimizing grid management	Reduces the amount and cost of renewable energy needed by the electric system by lowering overall electricity consumption
	Lowers winter and summer peak demand
	Combines with DR to enable load shaping, reduce peaks, and optimize grid performance
	Can mitigate costs and reliability risks associated with potential oversupply as well as short, steep ramps
Facilitates electrification	Reduces overall demand at lower cost than most generation, transmission, and distribution projects
	Reduces costs of electrification for customers by right-sizing equipment to meet smaller loads
	Reduces land use impacts, and associated costs and conflicts, to accommodate future energy production growth
Advances equitable decarbonization	Can alleviate low-income transportation burdens via targeted investment in public transit, EV infrastructure, and transit-oriented affordable housing directed toward underserved communities
	Alleviates low-income home energy burden through weatherization and enhanced electrification incentives
	Supports state climate goals by extending participation to all populations and geographic areas

Methodology

Our analysis began with a review of available secondary sources to determine which states have adopted clean electricity standards, emissions reduction standards, or both. In particular, we consulted the Natural Resources Defense Council's (NRDC) *Race to 100% Clean* online report, as well as not-for-profit research group Third Way's clean energy dashboard and the NC Clean Energy Technology Center's Database of Incentives for Renewables & Efficiency (DSIRE), to determine each state's CES and emissions targets and the year it plans to meet that target.

Among these states, we also searched relevant climate and clean energy legislation (both binding and nonbinding) and executive orders for more specific information on how the state defines "clean electricity," what counts toward the targets, and how (if at all) it includes energy efficiency. In particular, we researched the extent to which energy efficiency is included as a means to achieve these goals, to what degree, and whether there are separate efficiency targets or policies in place. Given our specific interest in the role of state policy in incorporating efficiency within these standards, we focused on state-developed goals rather than individual utility-declared targets; however, we did examine state goals applying to certain utilities.[12] Though utility and municipal activities were outside the scope of this study, it is important to acknowledge that many utilities and cities have made notable climate commitments where their respective states have not. For example, Duke Energy in North Carolina and Southern Company in Alabama, Georgia, and Mississippi have both set goals for net-zero carbon by 2050, though none of the states in which they operate have established a comparable mandate for electric utilities (St. John 2020).[13]

For the next part of this paper, we sought to address the question of how state policymakers can enable more aggressive energy savings in ways that best promote (1) accelerating build-

[12] For example, state energy efficiency resource standards often apply specifically to large investor-owned utilities and thus may not cover sales from municipal and cooperative utilities.

[13] In 2020 roughly a dozen additional utilities declared 100% carbon-free energy goals, joining a growing list that, as of April 2021, stands at 51 utilities with targets for carbon-free or zero emissions by 2050 (SEPA 2021; ThirdWay 2021). However, several of these companies, such as Alliant Energy, Entergy, Evergy, FirstEnergy, Omaha Public Power District, and Southern, operate in states that have not prioritized climate action or have set only weak renewable energy targets without supportive policy designs to drive ambitious GHG reductions. In the absence of statewide policies, oversight, and technical resources acting in alignment with utilities, achievement of ambitious targets is at a pronounced disadvantage and far less certain (Romankiewicz, Bottorff, Stokes 2021).

out of renewable energy in support of CES goals, (2) scaling electrification in support of state emissions reduction goals, and (3) providing the co-benefits needed to gain wide support for GHG reduction policies while strengthening marginalized communities' participation in and access to programs.

To answer this question, we conducted a review of legislation and key regulatory orders from CES states and those with emissions reduction goals to understand how efficiency is directly or indirectly deployed in support of climate goals and to identify opportunities to strengthen coordination. This included a close review of policy developments in three states in particular: New York, Minnesota, and Virginia. These we selected on the basis of contrasting climates, types of primary home heating, and utility regulatory landscapes, which range from Virginia, now engaged in early-stage efforts to develop efficiency programs to meet the state's first-ever energy efficiency resource standard (EERS), to Minnesota, a Midwest efficiency leader on the cusp of transformational change to enable utility electrification efforts through recent legislative reforms, to New York, where innovative policies are ongoing to expand and align state and utility efficiency programs in pursuit of its ambitious climate goals. By exploring approaches in states in contrasting environments, we sought to highlight how states are tailoring their efficiency and electrification efforts to best meet the needs of the regional grid and their energy customers across sectors.

We also reviewed the current research literature, including recent efficiency potential and impact studies and policy white papers, to gather the latest understanding of policy and technology trends that can best align and prioritize energy savings investment with grid integration of renewables, electrification, and other decarbonization opportunities. This included a review of statewide energy plans, electrification strategies, and efficiency policies supporting underserved customers as gathered through ACEEE's *State Energy Efficiency Scorecard* and *State Transportation Electrification Scorecard*. Building on this analysis, we proposed a suite of best-practice policies constituting an optimized framework for states to consider as they refine energy efficiency's role within their climate plans.

Analysis of Energy Efficiency within State CES and Emissions Reduction Goals

This section summarizes our review of states adopting 100% clean electricity standards and emissions reduction goals, including target year and policy type. We also include a summary of the degree to which these policies have formally integrated energy efficiency measures or strategies to achieve desired results.

COMPILATION OF STATE, TERRITORY, AND DISTRICT CLEAN ELECTRICITY STANDARDS

Table 2 lists the states with clean electricity standards, along with the required percentage of generation that must come from clean energy sources (which may or may not include nuclear, depending on the state), the target year, and whether the standard applies to the power sector statewide. We distinguished between legislative standards and executive orders because executive orders can be more easily reversed with changes in leadership. We also indicated whether the legislation presents a binding or a nonbinding goal.[14]

Table 2. States with clean electricity standards

State	Generation from clean energy sources	Target year	Applies to power sector statewide?	Policy type
Arizona[1]	100%	2070	Yes	Utility rulemaking
California	100%	2045	Yes	Binding legislation
Colorado	100%	2050	Xcel Energy only	Nonbinding legislation
Connecticut	100%	2040	Yes	Executive order
District of Columbia[2]	100%	2032	Yes	Binding legislation
Hawaii	100%	2045	Yes	Binding legislation
Maine[3]	100%	2050	Yes	Nonbinding legislation
Nevada	100%	2050	Yes	Nonbinding legislation
New Jersey	100%	2050	Yes	Executive order
New Mexico	100%	2045	Yes	Binding legislation
New York[4]	100%	2040	Yes	Binding legislation
Oregon	100%	2030	Yes	Binding legislation

[14] We used NRDC's categorization to differentiate between binding and nonbinding legislation. Per NRDC: "Binding legislation refers to laws with explicit targets as passed by a state legislature and signed by the governor. These are binding because they create obligations to achieve the target and penalties for failure to do so. . . . Non-binding goals can be in the form of legislation, executive order, or commitments by utilities or corporations, but only express the intent or the study of achieving specific targets, not requiring them (Ptacek 2020)."

State	Generation from clean energy sources	Target year	Applies to power sector statewide?	Policy type
Puerto Rico	100%	2050	Yes	Binding legislation
Rhode Island	100%	2030	Yes	Executive order
Virginia	100%	2050	Yes	Binding legislation
Washington	100%	2045	Yes	Binding legislation
Wisconsin	100%	2050	Yes	Executive order

[1]Clean electricity standard approved by Arizona Corporation Commission in May 2021; formal rulemaking is ongoing. DC, Maine, and New York all contain interim targets in their legislation. [2]DC has a target for each year. [3]Maine's interim goal target of 80% by 2030 is mandatory but the 100% by 2050 goal is not. [4]New York has a 70% RPS by 2030 goal. The other states do not have interim goals in their legislation. Our CES classification does not include nonbinding nonlegislative clean electricity goals that may be included in state energy plans. For example, North Carolina's Clean Energy Plan includes a goal to "reduce electric power sector greenhouse gas emissions by 70% below 2005 levels by 2030 and attain carbon neutrality by 2050." Source: NRDC 2021. See Appendix A for sources and links to policies.

Table 2 shows that 15 out of 50 states, the District of Columbia, and Puerto Rico have 100% clean electricity standards in place. Nine of those have binding legislation, three have set nonbinding 100% goals through legislation, four have executive orders, and one has an ongoing utility rulemaking. All but one of these standards apply to the statewide power sector, which is what we would expect given the nature of a clean electricity standard. The exception is Colorado, whose standard applies only to Xcel Energy, the only qualifying retail utility as defined in the law. Xcel Energy is Colorado's largest electricity supplier, accounting for about 52% of electricity sales throughout the state in 2018 (EIA 2019).

ROLE OF ENERGY EFFICIENCY IN CES

For this section, we examined how states included efficiency in their CES (if they did) and whether they have separate efficiency targets such as an electric energy efficiency resource standard.[15] We classified states into five categories:

- Yes—the state has a specific efficiency target in its CES that is required to help meet the standard.

[15] ACEEE considers a state to have an EERS if it has a policy in place that 1) sets clear, long-term (3 or more years) targets for utility sector energy savings, 2) makes targets mandatory, and 3) includes sufficient funding for full implementation of programs necessary to meet targets.

- No, but CES legislation includes a separate efficiency goal.
- No, but it has a separate efficiency goal—nothing in the standard mentions efficiency as a means to achieve the CES target, but there is a separate efficiency target or EERS that obligates electric utilities to deliver energy savings.
- Mentioned but undefined—the standard cites the importance of efficiency in achieving goals but does not specify an efficiency target, or the standard language is unclear about how efficiency is included. This category may include some states even if they have a separate efficiency target such as an EERS.
- No—there is no mention of energy efficiency in the standard and no separate efficiency target.

Table 3 shows the results of our analysis.

Table 3. Energy efficiency inclusion in state clean electricity standards

State	Category	CES policy type	Energy efficiency inclusion or separate efficiency goal
Arizona*	Yes	Utility rulemaking	EERS is included as a specific measure that utilities must use to achieve CES. By 2030 utilities must include a demand-side resource capacity of at least 35% of its 2020 peak demand.
California	No, but separate efficiency goal	Binding legislation	EERS
Colorado	No, but separate efficiency goal	Nonbinding legislation	EERS
Connecticut	No, but separate efficiency goal	Executive order	EERS
District of Columbia	No, but separate efficiency goal	Binding legislation	EERS
Hawaii	No, but separate efficiency goal	Binding legislation	EERS
Maine[1]	No, but separate efficiency goal	Nonbinding legislation	EERS
Nevada	No, but separate efficiency goal	Nonbinding legislation	EERS

State	Category	CES policy type	Energy efficiency inclusion or separate efficiency goal
New Jersey	Mentioned but undefined (also a separate goal)	Executive order	Executive Order No. 28 (2018) directed the creation of a 2019 Energy Master Plan that provides a comprehensive strategy to achieve the standard, including exploring ways to encourage clean, efficient energy alternatives in the transportation sector and the state's ports. EERS
New Mexico	No, but separate efficiency goal	Binding legislation	EERS
New York	No, but separate efficiency goal	Binding legislation	EERS
Oregon	No, but separate efficiency goal	Binding legislation	EERS
Puerto Rico	No, but separate efficiency goal	Binding legislation	SB 1121 calls for meeting a goal to save 30% of electricity use by 2040 as laid out in the Energy Transformation and RELIEF Act, in addition to other efficiency measures such as 100% LED or renewable public lighting by 2030, but not specifically as a method to meet the CES.
Rhode Island	Mentioned but undefined (also a separate goal)	Executive order	No specific plan to include efficiency to meet the standard exists, but it does mention the state's lasting commitment to cost-effective energy efficiency as part of its clean energy future, not relying only on renewable resources. EERS

State	Category	CES policy type	Energy efficiency inclusion or separate efficiency goal
Virginia	No, but CES legislation includes a separate efficiency goal	Binding legislation	EERS
Washington	No, but CES legislation includes a separate efficiency goal (all cost-effective energy efficiency requirement)	Binding legislation	There is no specific target, but legislation does require electric utilities to pursue all cost-effective, reliable, and feasible efficiency resources in pursuit of meeting the standard, as well as to submit four-year implementation plans for the standard that propose specific efficiency targets. EERS
Wisconsin	No, but separate efficiency goal	Executive order	EERS

*** Clean electricity standard approved by Arizona Corporation Commission in May 2021; formal rulemaking is ongoing. [1] Maine's interim goal target of 80% by 2030 is mandatory but the 100% by 2050 goal is not. Note: Our analysis specifically focuses on incorporation of energy efficiency in states that have established a 100% clean electricity standard; therefore, this list is not inclusive of certain states that have established robust renewable portfolio standards of 75% or greater (as have Maine and Vermont) but fall short of a 100% clean electricity goal. See Appendix A for sources and links to policies.**

As shown in Table 4, state clean electricity standards generally do not formally incorporate discrete energy efficiency goals as an eligible resource. The exceptions are Virginia (Virginia Clean Economy Act) and Washington State (Clean Energy Transformation Act), which each include requirements establishing minimum utility savings targets.[16] As of August 2021,

[16] Though not a clean electricity standard, North Carolina's Renewable Energy and Energy Efficiency Portfolio Standard (REPS), passed in 2008, effectively combines standard requirements to increase deployment of renewable energy and energy efficiency. Under the REPS, public electric utilities must obtain renewable energy and energy efficiency savings of 3% of prior-year electricity sales in 2012, increasing incrementally to 12.5% in 2021 and thereafter. For IOUs, energy efficiency is capped at 25% of the 2012–2018 targets and at 40% of the 2021 target. Cooperative and municipal utilities have a lower REPS requirement of 10% savings by 2018, which they may satisfy entirely with energy efficiency, excluding small set-asides for solar and other resources (NC G.S. § 62-133.8).

Arizona's draft clean electricity standard (still pending an ongoing formal rulemaking) specifically requires utilities to meet an electric EERS—with targets such as annual electric savings of 1.3% and a 35% reduction in peak demand by 2030—and includes efficiency as a strategy to achieve the CES. Please note that our analysis considered energy efficiency as "included" within a CES only if the standard specifically incorporates energy savings as an eligible resource toward meeting the state's clean electricity goals.

While directly embedding energy efficiency within a CES offers the freedom to select varying combinations of efficiency and clean electricity resources in diverse ways, it also comes with potential downsides. These include risks to accountability and transparency: Efficiency may be neglected in favor of other options, or there could be potential double counting of efficiency (counting it as an eligible generation resource toward a percentage-of-generation target even as it decreases the statewide generation total used in the calculation). In some cases, integration of energy efficiency goals within a CES could also perpetuate an adversarial dynamic in which efficiency and renewables are seen as being in competition with each other. On the other hand, maintaining a separate EERS or separate efficiency goals offers regulators the flexibility to individually revisit and adjust savings targets, criteria, and metrics depending on changing information or priorities from updated state plans and potential studies. As relatively little time has passed since states began establishing comprehensive climate policies, there is not enough evidence to clearly favor one specific approach over the other. However, regardless of which pathway states pursue, it is critical that policymakers maximize achievable savings and avoided carbon from efficiency.

An EERS in particular provides associated benefits that could help make the transition to clean electricity more cost effective. Of the 17 states and territories with standards, 16 have electric EERSs in place (including Arizona), and Puerto Rico has separate efficiency goals outside of an EERS.

More than half of all EERS states have established goals to fully eliminate GHG emissions from their power sector or have set ambitious renewable standards. The vast majority have also set strong, economy-wide emissions reduction goals. This demonstrates that numerous states have recognized the supporting role an EERS plays by guaranteeing a minimum level of energy savings to complement other statewide GHG and clean energy goals. Illustrating this relationship, Figure 2 shows the 27 states (and DC) that have established a binding EERS, identified with color shadings corresponding to the stringency of their electric savings targets. Lined overlays have been added for eight states (and DC) that have also adopted a binding 100% CES. Dots indicate EERS states with a nonbinding CES (for example, those established by executive orders). The four EERS states (and DC) that have adopted a robust renewable portfolio standard of 75% or higher are marked with a star.

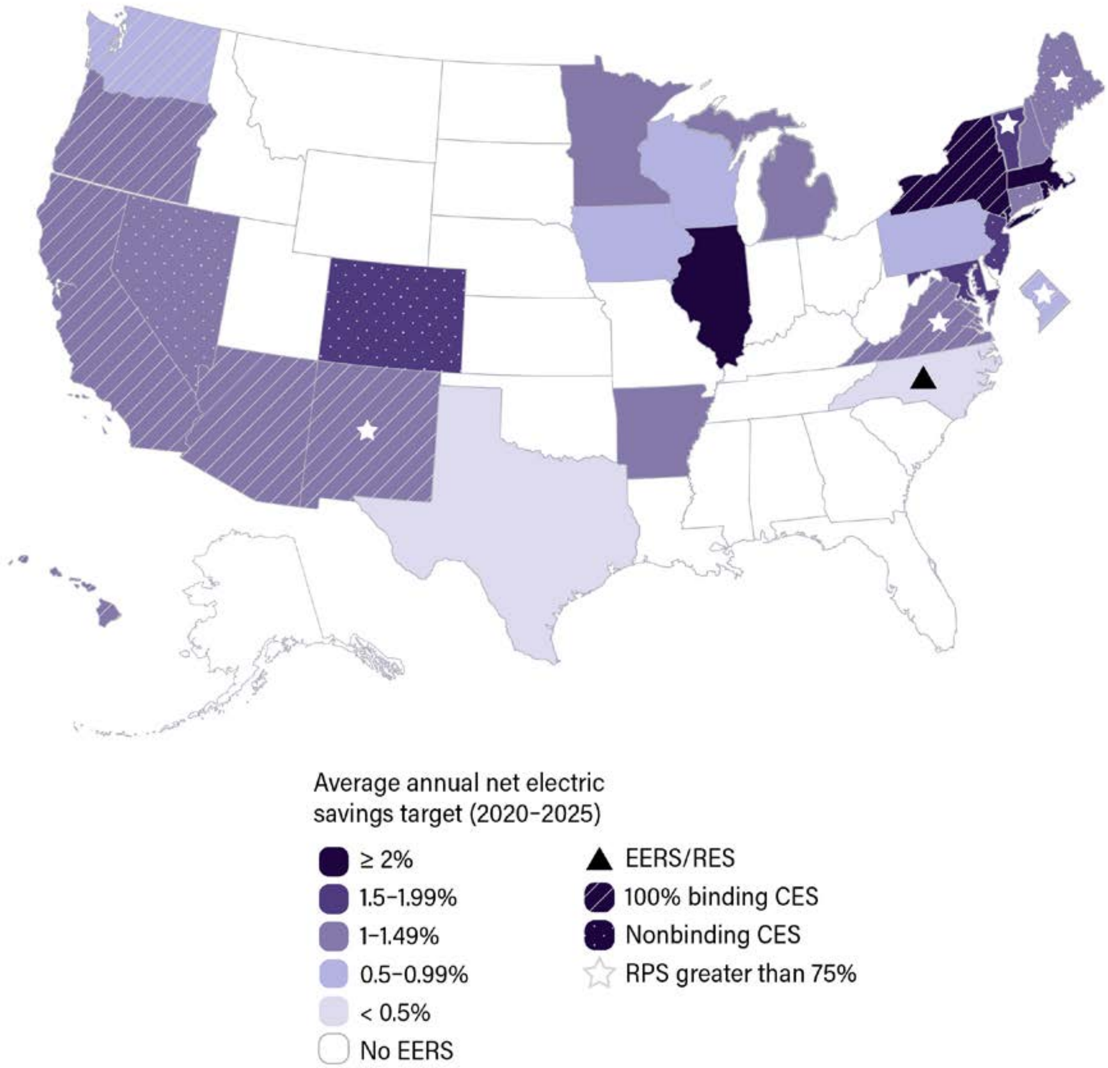

Figure 2. State-level EERS adoptions and clean electricity standards. Source: ACEEE research supplemented with data from NRDC 2021.

COMPILATION OF STATE EMISSIONS REDUCTION GOALS

While clean electricity standards focus on the power sector, emissions reduction goals are applicable economy-wide or focus on sectors beyond just the power sector (such as buildings or transportation). Both are important to accomplishing a state's overarching climate goals and meeting the Paris Agreement.

Table 4 lists the states with emissions reduction goals, along with the specific percentage reduction goal, target year, baseline year, interim targets (if any), and whether the goal is applicable economy-wide. As with the clean electricity standards, it also indicates whether the goals were established by legislation (either binding or nonbinding) or through executive order. Again, for this research, we looked only at state-level data, not municipal governments or utilities, although we are aware that some utilities and local governments have made commitments where the states have not.

Table 4. States with emissions reduction goals

State	Reduction goal	Target year	Baseline year	Interim target	Applies economy-wide?	Policy type
Legislation						
Colorado	90%	2050	2005	26% by 2025; 50% by 2030	Yes	Binding
Connecticut	80%	2050	2001	10% below 1990 levels by 2020; 45% below 2001 levels by 2030	Yes	Binding
Hawaii	100%	2045	1990	1990 levels by 2020	Yes	Binding
Maine[1]	80%	2050	1990	45% by 2030	Yes	Binding
Maryland	40%	2030	2006	25% by 2020	Yes	Binding
Massachusetts[2]	100%	2050	1990	50% by 2030; 75% by 2040	Yes	Binding
Minnesota	80%	2050	2005	15% by 2015; 30% by 2025	Yes	Nonbinding
Nevada	100%	2050	2005	28% by 2025; 45% by 2030	Yes	Nonbinding
New Jersey	80%	2050	2006	1990 levels by 2020	Yes	Binding
New York	100%	2050	1990	40% by 2030	Yes	Binding
Oregon[3]	75%	2050	1990	10% by 2020	Yes	Nonbinding
Rhode Island	80%	2050	1990	10% by 2020; 45% by 2035	Yes	Binding
Vermont	80%	2050	1990	40% by 2030	Yes	Binding

State	Reduction goal	Target year	Baseline year	Interim target	Applies economy-wide?	Policy type
Washington	95%	2050	1990	45% by 2030, 70% by 2040	Yes	Nonbinding legislation (HB 2311) made binding by SB 5126
Executive orders						
Arizona	50%	2040	2000	2000 levels by 2020	Yes	Executive order
California	Carbon-neutral	2045	1990	1990 levels by 2020; 40% by 2030; 80% by 2050	Yes	Executive order
Delaware	30%	2030	2008	--	Yes	Executive order
District of Columbia	100%	2050	2006	50% by 2032	Yes	Nonbinding mayoral plan
Florida	80%	2050	1990	1990 levels by 2025	Yes	Executive order
Louisiana	100%	2050	2005	26-28% by 2025; 40-50% by 2030	Yes	Executive order
Michigan	100%	2050		28% below 2005 levels by 2025	Yes	Executive directive
New Hampshire	80%	2050	1990	20% by 2025	Yes	Executive order
New Mexico	45%	2030	2005	--	Yes	Executive order
North Carolina[4]	40%	2025	2005	--	Yes	Executive order
Pennsylvania	80%	2050	2005	26% by 2025	Yes	Executive order

Though Virginia has not established specific emissions reduction targets, HB 714/SB 94 (2020) calls for a new state energy plan that will identify actions to achieve a net-zero carbon economy by 2045 for all sectors. [1] Maine also has a more recent executive order that includes a goal of achieving a 100% carbon neutral economy by 2045. [2] Massachusetts legislation also requires five-year emissions reduction goals for each of six sectors: electricity, transportation, commercial and industrial buildings, residential buildings, industrial processes, and natural gas distribution. [3] Oregon has a more recent executive order (EO 20-04) that includes a more ambitious 80% emissions reduction goal by 2050 (also based on 1990 levels) with an interim goal of 45% by 2035. [4] The North Carolina Clean Energy Plan, released in 2019, calls for strengthened goals to reduce electric power sector GHG emissions by 70% below 2005 levels by 2030 and attain carbon neutrality by 2050. Source: NRDC 2021. See Appendix A for sources and links to policies.

Twenty-four states and the District of Columbia have emissions reduction goals in place. As shown in Table 4, these goals often vary significantly with respect to their strength, relative stringency, and level of commitment to achieving them through corresponding adoption of actionable, transparent policies. Eleven of these emissions reduction goals have been adopted through binding legislation, 4 through nonbinding legislation, and 10 via executive orders.

The table also points to a trend of states adopting increasingly strong GHG reduction goals. Since 2017 five states (Colorado, Hawaii, Massachusetts, New York, and Washington) have adopted binding targets to reduce emissions at least 90%, and five states (California, Louisiana, Maine, Michigan, Nevada) have set nonbinding 100% or carbon-neutral goals. Twenty states have emissions reduction goals above 50%. Of the 17 states and territories with clean electricity standards (listed in Table 2), the vast majority (13) also have emissions reduction goals; Virginia, Wisconsin, and Puerto Rico are the only 3 that do not, though in 2020 Virginia passed legislation, SB 94, calling for the next state energy plan to identify strategies to achieve economy-wide net-zero emissions by 2045. The remaining 12 states listed in Table 4 have only emissions reduction goals.[17]

ROLE OF ENERGY EFFICIENCY IN EMISSIONS REDUCTION GOALS

Our analysis of emissions reduction goals uses the three categories below, similar to those used for clean electricity standards:

- Yes—the state has a specific efficiency target that is required to help meet the emissions reduction goal.
- Mentioned but undefined—the goal mentions the importance of efficiency in achieving targets but does not specify an efficiency target, or the goal language is unclear about how efficiency is included.
- No—there is no mention of energy efficiency in the goal.

Additionally, we include for reference whether the state has a separate EERS. However, it should be noted that the energy savings requirement of an EERS works in parallel with a CES and covers only a fraction of the economy-wide emissions reduction goals within each state. We did not find any examples of states with separate, economy-wide efficiency goals that cover all energy usage.

[17] These are Delaware, Florida, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, North Carolina, Oregon, Pennsylvania, and Vermont.

Table 5 shows the results of our analysis.

Table 5. Energy efficiency inclusion in state emissions reduction goals

State	Category	Policy type	Energy efficiency inclusion	EERS?
Arizona	No	Executive order	Not included	Yes
California	No	Executive order	The EO does not specify particular energy efficiency measures. It directs the California Air Resources Board to work with relevant state agencies to develop a framework for implementation and accounting that tracks progress toward the goal.	Yes
Colorado	Mentioned but undefined	Binding legislation	The commission must perform audits on energy-intensive sources of GHGs every five years to make sure they are using the best available emissions control technologies and energy efficiency practices, and must provide incentives to those that do not meet these standards.	Yes
Connecticut	No	Binding legislation	Not included	Yes
Delaware	Mentioned but undefined	Executive order	The EO creates and directs a committee to develop an implementation plan that identifies an emissions reduction goal as well as strategies to achieve said goal; one such recommendation was energy efficiency practices and programs.	No
District of Columbia	Yes	Nonbinding mayoral plan	Sustainable 2.0 plan specifically has a goal to “improve the efficiency of District-wide energy use to reduce overall consumption” by cutting per capita energy use District-wide by 50% by 2032, listing several steps to achieve this goal through efficiency measures.	Yes
Florida	Mentioned but undefined	Executive order	The EO directs development of an “Energy and Climate Change Action Plan” that includes recommendations on policies to enhance energy efficiency.	No
Hawaii	No	Binding legislation	Not included	Yes

State	Category	Policy type	Energy efficiency inclusion	EERS?
Louisiana	No	Executive order	Not included	No
Maine	Mentioned but undefined	Binding legislation	The commission may enter into contracts for energy efficiency capacity resources as long as the contracts are consistent with the emissions reduction goal; the legislation also directs the state's triennial plan to determine how its energy efficiency and weatherization programs affect the state's ability to achieve its emissions reduction goal.	Yes
Maryland	No	Binding legislation	Not included	Yes
Massachusetts	Mentioned but undefined	Binding legislation	In addition to setting the emissions reduction goal, the state's climate law sets new efficiency standards for appliances, creates an opt-in net-zero energy building stretch code, and requires Mass Save to put more emphasis on reducing emissions by pointing customers toward emission-free products such as a ground-source heat pumps.	Yes
Michigan	Mentioned but undefined	Executive order	The previous MI Climate Action Plan, in which a reductions goal was laid out, highlighted the importance of efficiency in achieving the goal; the most recent EO directs the Department of Technology, Management, and Budget to investigate the cost-effectiveness of energy efficiency opportunities in state-owned renovated and new buildings.	Yes
Minnesota	No	Nonbinding legislation	Not included	Yes
Nevada	No	Nonbinding legislation	Not included	Yes
New Hampshire	Mentioned but undefined	Executive order	The EO directs development of a Climate Change Policy task force to create a Climate Action Plan. This plan lists the emissions goal and highlights energy efficiency as the source of the most significant reductions in emissions and cost.	Yes

State	Category	Policy type	Energy efficiency inclusion	EERS?
New Jersey	Mentioned but undefined	Binding legislation	The legislation declares that any emissions trading program established in the state to reduce emissions should provide incentives to reduce emissions at their sources and consumer benefit incentives to reduce the demand for energy, which includes promoting energy efficiency. The legislation also highlights the importance of energy efficiency to the state and its citizens.	Yes
New Mexico	Mentioned but undefined	Executive order	The EO directs the Climate Change Task Force to evaluate policies and regulatory strategies to achieve reductions in GHG pollution, including adoption of low-emission vehicle emissions standards and zero-emission vehicle performance standards as well as adoption of building codes.	Yes
New York	Yes	Binding legislation	The legislation directs the state Climate Action Council to prepare and approve a scoping plan that outlines recommendations to achieve the emissions reduction goal, which must include measures to reduce emissions in the electricity sector and the buildings sector by using renewable energy or various energy efficiency measures; this includes a 185 trillion Btu energy efficiency goal that applies to certain sectors only.	Yes
North Carolina	Mentioned but undefined	Executive order	In achieving the emissions reduction goal, the EO directs the state Department of Environmental Quality (DEQ) to develop a Clean Energy Plan that encourages the use of clean energy resources, including energy efficiency; the order also directs the DEQ to reduce building energy consumption through energy efficiency best practices.	Yes

State	Category	Policy type	Energy efficiency inclusion	EERS?
Oregon	Mentioned but undefined	Nonbinding legislation	Legislation created the Oregon Global Warming Commission to recommend ways to coordinate state and local efforts to reduce GHG emissions consistent with state goals. Among its responsibilities are examination of possible funding mechanisms to obtain low-cost GHG reductions and energy efficiency enhancements, including but not limited to those in the natural gas industry.	Yes
Pennsylvania	Mentioned but undefined	Executive order	The EO creates a GreenGov Council responsible for achieving the emissions reduction goal by encouraging energy efficiency best practices and strategies, among other measures.	Yes
Rhode Island	Mentioned but undefined	Binding legislation	The law calls for a plan that includes strategies, programs, and actions to meet targets for GHG emissions reductions. The plan's requirements include a study of the effectiveness of carbon pricing measures to incentivize institutions and industry to reduce carbon emissions, including the effectiveness of allocating revenues generated to fund enhanced incentives to institutions and industry for targeted efficiency measures.	Yes
Vermont	Mentioned but undefined	Binding legislation	The Vermont Global Warming Solutions Act of 2020 clarifies that it is state policy to "identify and evaluate, on an ongoing basis, resources that will meet Vermont's energy service needs in accordance with the principles of reducing greenhouse gas emissions and least-cost integrated planning; including efficiency, conservation, and load management alternatives; wise use of renewable resources; and environmentally sound energy supply."	Yes

State	Category	Policy type	Energy efficiency inclusion	EERS?
Washington	Mentioned but undefined	Binding legislation	The Climate Commitment Act (SB 5126), signed in 2021, puts a firm and declining limit on climate pollution from the largest emitters in the state in order to meet emissions targets adopted in 2020: 45% below 1990 levels by 2030, 70% by 2040, and 95% by 2050. The legislation requires proceeds from auction revenues collected by natural gas utilities to be returned to customers through a range of actions including energy efficiency and weatherization services. The law also creates a Climate Commitment Account that will fund a range of eligible projects, including those addressing efficiency in the industrial, agricultural, and buildings sectors, as well as market transformation activities and actions to reduce the low-income energy burden.	Yes

See Appendix A for sources and links to policies. Based on our categorization, only the District of Columbia and New York's emissions reduction policies meet the criteria for "Yes"—i.e., they include specific efficiency targets in the service of emissions goals. Fifteen out of 25 emissions reduction policies were categorized as "Mentioned but undefined," while the last eight had no mention of efficiency (the "No" category). Only 3 of the 25 states with emissions reduction goals do not have a separate electric EERS.[18]

Table 6 provides a comparison of states with electric EERSs, clean electricity standards, and/or emissions reduction goals.

Table 6. List of states with electric EERS, clean electricity standards, and/or emissions reduction goals

State	EERS	Clean electricity standard	Emissions reduction goal	State	EERS	Clean electricity standard	Emissions reduction goal
Arizona[†]	•	•	•	Minnesota	•		•
Arkansas	•			Nevada	•	•	•
California	•	•	•	New Hampshire	•		•

[18] These are Delaware, Florida, and Louisiana.

State	EERS	Clean electricity standard	Emissions reduction goal	State	EERS	Clean electricity standard	Emissions reduction goal
Colorado	•	•	•	New Jersey	•	•	•
Connecticut	•	•	•	New Mexico	•	•	•
Delaware			•	New York	•	•	•
District of Columbia	•	•	•	North Carolina	•		•
Florida			•	Oregon	•	•	•
Hawaii	•	•	•	Pennsylvania	•		•
Illinois	•			Puerto Rico		•	
Iowa	•			Rhode Island	•	•	•
Louisiana			•	Texas	•		
Maine	•	•	•	Vermont	•		•
Maryland	•		•	Virginia	•	•	
Massachusetts	•		•	Washington	•	•	•
Michigan	•		•	Wisconsin	•	•	

*** Clean electricity standard approved by Arizona Corporation Commission in May 2021; formal rulemaking is ongoing. Source: Berg et al. 2020.**

We find that states have rarely formalized energy efficiency sub-goals within clean electricity standards or emissions reduction goals. It is not critical that states formally articulate savings targets within these state climate polices. However, efficiency should clearly be positioned to serve as a first-in-line resource to avoid the build-out of unnecessary, expensive, and polluting peaking plants—which typically use fossil gas—as well as the consumption of clean energy resources in excess of that required if energy efficiency and DR are prioritized. Policymakers should ensure that states have sufficient direction, funding, and rules to enable utilities to maximize energy efficiency deployment. Establishment of strong multiyear savings goals is one essential policy component, but these can be set separately through other means, ideally through an energy efficiency resource standard, typically put in place through legislation and/or utility regulations.

For example, Washington's CES (SB 5116) calls for plans that include not just renewables but all cost-effective, reliable efficiency, requiring four-year implementation proposals with specific efficiency targets (WA State Legislature 2019). The District of Columbia's Sustainable

2.0 lays out a plan to increase energy efficiency by cutting per capita energy use District-wide by 50% by 2032 (DOEE and DC Office of Planning 2019), and New York's Climate Leadership and Community Protection Act (CLCPA) lists a 185 trillion Btu energy efficiency goal by 2025 as part of its emissions reduction strategy (NYS 2019). In cases where it would be easier for the state to implement an efficiency target separate from its clean energy goals (e.g., in Vermont), an EERS should at the very least be considered.

Creating an Optimized Framework for Energy Efficiency's Role within State Climate Policies: Findings and Policy Trends

Our research shows that the states vary widely in the degree to which they are considering and leveraging energy efficiency in support of goals for clean electricity, renewable energy, and emissions reductions. As noted above, this research included a close review of policies in New York, Minnesota, and Virginia (with noteworthy examples from other states as well), where regulators have taken somewhat different pathways to expanding efficiency in contrasting environments.

We see many opportunities to focus on policies that improve efficiency across multiple sectors and maximize the diverse and dynamic benefits that energy savings deliver. These benefits, which accrue to both utilities and customers, include avoided emissions and cost savings, as well as health and safety impacts, and can be expected to vary among different populations according to time and location, changing conditions of the grid, and socioeconomic factors such as household income, housing age and type, and regional energy prices. With most adopted state climate goals extending out across mid-century time horizons, policymakers will want to refine and update these policies in ways that successfully respond to these changing conditions, including improving the carbon intensity of the grid and advancing capabilities of grid-interactive technology.

In the near term, immediate and consistent investment in energy efficiency is critical as it provides instant GHG savings, regardless of the carbon intensity of fuel consumed. For example, new homes built today can last 50–100 years, and if they are built to inefficient standards, they will lock in patterns of energy waste for decades to come. And although EV registrations grew to 2% of the overall U.S. light vehicle market in 2020, carbon-emitting internal combustion engine (ICE) vehicles, which continue to make up the vast majority of sales, can be expected to remain on the road for a decade or two (IHS Markit 2021).

Electrification of high-emitting uses such as natural gas and oil in home heating and gasoline in ICE vehicles is also a critical decarbonization strategy (Billimoria et al. 2018; EPRI

2015; Mai et al. 2018). For example, according to a 2021 International Energy Agency (IEA) report detailing steps needed to reach global net-zero emissions by 2050, electrification fills a prominent role in achieving the goal, accounting for around 20% of the total emissions reductions needed, alongside an expected doubling of global electricity demand between 2020 and 2050 as fossil fuel end uses are phased out (IEA 2021). ACEEE considers electrification a form of energy efficiency when it saves total primary energy and meets customer savings and emissions reduction criteria (Gold, Gilleo, and Berg 2019). This relationship, between energy-efficient beneficial electrification and broader forms of electrification, is illustrated in Figure 3.

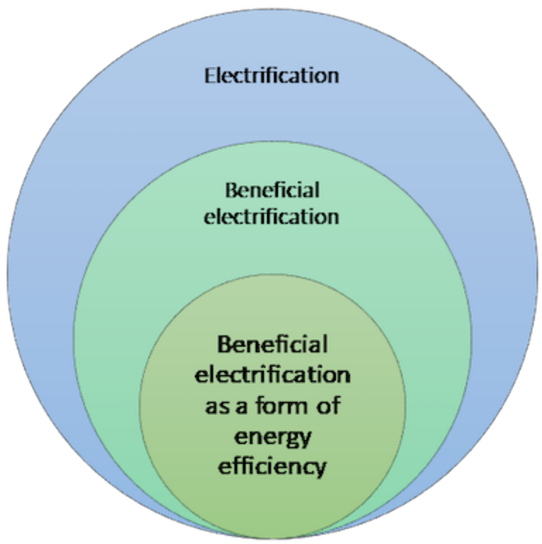

Figure 3. Relationship between energy-efficient beneficial electrification and electrification more broadly.

While the movement to transition to electrified buildings, industry, and transportation certainly plays a central role in decarbonization, this is only part of the story for several important reasons:

- Research by ACEEE and others has consistently found that low-income households and environmental justice communities tend to live in older, less efficient homes, live farther away from public transit, and spend a larger share of their incomes on energy and transportation (Drehobl and Ross 2016; Drehobl, Ross, and Ayala 2020; Ma et al. 2019). These customers are also less likely to be able to afford the costs of equipment (such as energy-efficient heat pumps and heating systems that do not run on fossil fuels). Further, they may lack control over important decisions pertaining to home energy upgrades because they live in multifamily housing or other types of rental property. Energy efficiency investment targeted to these households can help mitigate these inequities and extend clean energy benefits to all customers.

- While many electrification measures deliver energy savings, it is important to carefully consider electric product specifications and load profiles relative to grid peak hours to ascertain that impacts to the grid and to customer bills are beneficial. Pairing these measures with other forms of energy efficiency can help achieve exactly that, minimizing the need for additional capacity investment from added load and ensuring that any additional load is efficient.
- Electrification is only as clean as the grid. It is important to keep this in mind, though the carbon intensity of power generation is projected to decline over time, especially as states and utilities strengthen their clean energy efforts. However, with fossil fuels accounting for about 60% of U.S. utility-scale generation on average in 2020 (and with some states, like Kentucky and West Virginia, above 90%), much time and effort will be required before the grid achieves carbon neutrality (EPA 2021, 2021d, 2021g).[19]
- Even a desirable high-decarbonization scenario, in which all states adopt zero-energy building codes for new construction and phase out sales of fossil fuel–powered vehicles within 10 years, does not address the current inefficient building stock that will remain in place for decades to come.[20] Nor does electrification alone address the millions of internal combustion engine (ICE) vehicles on our roadways that will continue to be driven and passed on in the used vehicle market. These uses must be targeted through efficiency policies that reduce fossil fuel consumption in space and water heating, cut emissions in manufacturing and industry, and decrease vehicle-miles traveled through public transit investment and smart-growth strategies.

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[19] As of 2018, 20 states still relied mostly on natural gas, and 15 states depended mostly on coal (Popovich and Plumer 2020).

[20] The National Renewable Energy Laboratory’s Electrification Futures Study (EFS) explores the potential levels of electrification expansion and impacts to U.S. electricity demand and consumption. The report considers a Reference case and plausible Medium and High scenarios. In the High scenario, 240 million light-duty electric cars and trucks, 7 million medium- and heavy-duty electric trucks, and 80,000 electric transit buses would be on U.S. roads by 2050, up from 560,000 plug-in EVs in 2016. However, these would account for no more than 76% of VMT in 2050, with many ICE vehicles still on the road (Mai et al. 2018).

- Managing peak electricity demand will remain a primary challenge for utilities and grid operators for the foreseeable future and poses particularly strong implications for meeting climate goals. Peak demand is often met by ramping up expensive, polluting sources such as natural gas combustion turbines or oil-burning peaker plants. This means that energy efficiency and DR delivered during these times can provide the highest value for reducing emissions and costs by avoiding the need to build new generation and T&D. Also, while peak demand has typically occurred in the summer for most utilities, trends in electrification of space and water heating and EV adoption are expected to increase the number of utilities experiencing winter peak demand over the next 10–20 years. Demand-side measures that reduce heating load offer the greatest potential for managing these winter peaks (Specian, Cohn, and York 2021).

For all these reasons, energy efficiency has a vital role to play in the transition to a largely electrified economy. It will also be important in a highly renewable future. Paired with flexible load technologies, energy efficiency and DR can help accommodate variable availability of renewable resources, providing rapid load reductions during peak demand as well as shifting load to absorb excess electricity during times of over-generation to avoid curtailment of renewable energy (Hledik et al. 2019).

Although some energy efficiency benefits such as avoided carbon are anticipated to become less compelling as the avoided carbon per kWh saved falls, efficiency still provides benefits that otherwise would be neglected by a narrow focus on renewable energy investment (IEA 2019). These other critical benefits include

- System benefits like improved grid reliability from tailoring grid demand to match variable load, and added dependability from minimizing demand during stress events such as outages due to wildfires or extreme weather (Relf, York, and Kushler 2018)
- Customer benefits, particularly bill savings and reduced costs from right-sizing equipment to meet more efficient loads, as well as improved home safety and comfort
- Societal benefits, such as strengthened local economies through job creation; other societal gains include non-GHG-related environmental and health benefits, such as reductions in air pollutants like fine particulate matter ($PM_{2.5}$), nitrogen oxides (NOx), and sulfur dioxide (SO_2), which harm respiratory and cardiovascular health (Hayes and Kubes 2018)

Given that the value of electricity energy efficiency varies by time and location—and will continue to change as the power grid evolves—it's critical that efficiency policy designs adapt to capture this nuanced value and target investment in a way that maximizes system, customer, and societal benefits. The following sections analyze how specific efficiency policies can do exactly that. First, we examine policies that can support state CES initiatives by strategically reducing grid demand; then we take up policies supporting broader statewide emissions targets through reducing and/or electrifying fossil fuel end uses. Next, we turn to opportunities to ensure the benefits of energy efficiency are inclusive of all customers through policies advancing equitable decarbonization policies that enable energy efficiency to support clean electricity and renewable energy portfolio standards.

While some states are recognizing the central role that efficiency must play within policies and plans in order to cost effectively meet clean electricity goals, other states focus relatively narrowly on renewable generation, thus running the risk of overlooking the ample opportunities for energy efficiency to lower energy demand and the cost of integrating renewable resources into the grid. State clean energy policies must clarify and make explicit the importance of maximizing the multidimensional benefits that efficiency offers.

In the sections that follow, we examine further details regarding each of these recommended policies (Table 7) and consider state examples.

Table 7. Summary of state policies supporting CES goals

Policy areas	Specific policies and sub-policies
Establish an energy efficiency resource standard.	• Establish an energy efficiency resource standard alongside a CES, including an all-cost-effective energy efficiency requirement or ambitious energy savings goals. • Include multiple goals to ensure that the efficiency portfolio meets state clean electricity, emissions, and equity or affordability priorities. • Integrate energy efficiency as a resource within utility integrated resource plans and distribution system planning. • Coordinate resource planning and savings target design with transportation electrification goals.
Fully value energy efficiency as a grid resource.	• Update cost-effectiveness screening practices for energy efficiency and distributed energy resources (DERs) to meet fundamental benefit-cost analysis (BCA) principles in the *National Standard Practice Manual*. • Create clear price signals for customers to encourage overall energy efficiency and influence the timing of

Policy areas	Specific policies and sub-policies
	energy use through time-varying rates or compensation mechanisms. • Update planning processes to fully value and incorporate energy efficiency as a utility system resource, including its reliability benefits.
Address regulatory barriers to integrated demand-side management (DSM).	• Update utility rules and guidance for identifying and valuing benefits of integrated programs. • Reform utility business models to remove barriers to integrated DSM and to align revenues with desired reliability, affordability, and decarbonization outcomes.
Standardize reporting protocols for energy savings.	• Make reporting transparent and publicly accessible. • Coordinate with reporting toward goal tracking for renewable energy and GHG reduction.

Establish an Energy Efficiency Resource Standard Alongside a CES

Among the states reviewed in this study, the driving policy spurring utilities to consistently deliver established levels of annual savings through customer incentive programs has been an energy efficiency resource standard, a policy adopted in 27 states and Washington, DC as of August 2021.

ACEEE research has consistently shown that having an EERS is one of the most effective ways for a state to guarantee long-term energy savings; states that have adopted such a policy on average achieve incremental electricity savings three to four times higher (1.2% versus 0.3%) than the savings in states without an EERS (ACEEE 2019a). According to ACEEE's *2020 State Energy Efficiency Scorecard*, net incremental savings achieved in 2019 from utility programs across the United States totaled 26.9 million MWh, 0.7% of nationwide electric sales. States with an EERS contributed 21.7 million MWh in savings, 80% of the nationwide total. And the benefits of these efficiency programs add up significantly over time, with measures installed in prior years continuing to deliver savings in the future. ACEEE has estimated that total annual savings in 2019, including measures installed that year and in previous years, came to approximately 273 million MWh, equivalent to 7.1% of 2019 electricity consumption, or the average energy use of roughly 25.6 million American homes. This illustrates the powerful potential of these programs to support state clean energy goals by drastically reducing the amount of overall consumption to be addressed through investment in new renewable energy supplies.

There are multiple options for supporting a CES with complimentary energy efficiency savings goals. Almost all states with requirements to increase clean energy supplies and energy efficiency savings keep them as separate CES and EERS targets. This is the simplest approach, and one that maximizes flexibility to set different qualifying criteria and metrics, vary targets for different utilities, establish different mechanisms to maintain compliance, and separately adjust or strengthen savings targets across different time horizons on the basis of new information. For example, New Mexico's EERS under HB 291 (2019) sets near-term goals for the state's three public utilities to achieve savings of 5% of 2020 retail sales by 2025, but also specifically directs the public regulation commission to set additional targets through 2030.

A few states have tried combined savings and supply targets by allowing energy efficiency to count as an eligible measure toward a statewide RPS. These have included North Carolina and Nevada, although the latter has since established a stand-alone EERS for NV Energy, with the state public utilities commission (PUC) setting savings goals as directed by SB 150 (2017). A combined target can give utilities greater flexibility to choose the combination of efficiency measures and clean generation that works best for them and their customers. Another approach is to establish a CES with separate sub-targets for energy efficiency. For example, Arizona's clean energy rules adopted in May 2021 to reach a 100% carbon-free power sector by 2070 include goals for utilities to reduce electric peak demand at least 35% (relative to 2020 peak demand) by 2030.[21]

Policy options to incorporate energy efficiency within clean electricity standards

Our review of state clean electricity standards found few that call for the deployment of energy efficiency in a specific way to complement and support the proliferation of renewable energy resources; instead, efficiency rules are often addressed separately in other stand-alone EERS statutes. However, there are recent exceptions, including Washington State, which in 2019 passed SB 5116 establishing a 2045 target to transition to 100% clean and renewable electricity and calling for a complete phaseout of coal power by 2025 (Washington State Legislature 2019). The legislation also notably prioritizes efficiency, specifying that compliance is predicated on a utility pursuing "all cost-effective, reliable, and feasible conservation and efficiency

[21] As of June 2021, Arizona's clean energy rules and CES had been approved by the Arizona Corporation Commission, but a formal rulemaking process is ongoing and still awaits a final commission vote.

resources, and demand response," in accordance with the state's main efficiency statute.[22] SB 5116 also requires that by 2022, each investor-owned utility develop a four-year clean energy implementation plan for the standards, including specific targets for energy efficiency, DR, and renewable energy. These requirements make clear that clean electricity goals should work in concert with, and not replace, energy efficiency measures, which should be deployed as a first-in-line resource for cost effectively meeting targets.[23]

The stand-alone EERS approach as a complementary policy to a clean electricity standard has the advantage of accounting simplicity, but it also has the disadvantage of considering energy efficiency as a resource outside the context of how carbon-free electricity is directly measured in the CES. While a number of states initially enacted combined EERS/RPS policies, only North Carolina still has such a policy in place. Established in 2008 under SB 3, the policy set a combined efficiency and renewable power target of 12.5% of sales by 2021, with efficiency's contribution to the target capped at 40% of the goal.

To bring energy efficiency more directly into a CES, policymakers must structure a joint target so as to avoid the potential for double counting of savings in a way that might impede progress toward the 100% goal. This could occur for example in a situation in which energy savings count as an eligible measure toward the clean energy percentage goal (numerator) and are also included as a reduction in statewide electric sales (denominator). In such a case, energy efficiency's contribution is overstated, thereby allowing a portion of "dirty generation" to persist along with associated carbon emissions. Several options to address this include

- Expressing targets in MWh rather than as a percentage of sales
- Adding the saved MWhs back into the denominator of total sales against which the standard is measured, producing a policy signal to pursue energy efficiency without decreasing the total investment in carbon-free electricity supply

Looking farther out toward mid-century targets as penetration of carbon-free electricity approaches 100%, policymakers can ramp down the proportion of energy efficiency in the standard over time, such that total annual energy efficiency savings are zero by the compliance

[22] This statute is RCW 19.285.040, originally established under the state's 2006 Energy Independence Act.

[23] Six states besides Washington require all cost-effective efficiency. They are California, Connecticut, Maine, Massachusetts, Rhode Island, and Vermont. Connecticut sets budgets first, then achieves all cost-effective efficiency within that limit, which produces a lower savings target.

year. For example, if energy efficiency portfolios have a weighted average measure life of 11 years, a policy design targeting 2040 could ramp incremental annual energy efficiency to zero by 2029.

It should be noted, however, that even the most ambitious state goals to decarbonize the power sector do not anticipate a 100% carbon-free grid until mid-century. Therefore, energy efficiency that delivers savings when fossil fuel power plants are on the margin will continue to reduce greenhouse gas emissions by avoiding use of these plants that remain in place for the coming decades. Policies should continue to prioritize efficiency investment in a way that immediately maximizes its carbon benefits for the foreseeable future and should not be slowed by policy remedies to address efficiency's future carbon value, which regulators will have ample time to address in the coming decades.

Virginia is the most recent state to adopt an EERS and only the second southeastern state to do so. The Virginia Clean Economy Act (VCEA), passed in 2020, requires Dominion Energy to achieve 5% energy savings and Appalachian Power Company to achieve 2% energy savings by 2025, relative to a 2019 baseline. This is expected to save an estimated seven million metric tons of GHG emissions over four years and continue to reduce emissions as measures continue to save energy. Importantly, the legislation also sets up a process to strengthen the EERS after 2025 and adjust energy efficiency targets every three years. Utilities will have to prove they are reaching those targets before they can build new fossil fuel plants (ACEEE 2020b). However, because the VCEA focuses primarily on decarbonizing the electric sector and has no established statewide or subsector emissions reduction target, opportunities remain for Virginia to align policies with its emissions reduction pledge as a signatory to the U.S. Climate Alliance.

The flexible policy framework provided by an EERS can also accommodate multiple goals beyond simple energy savings, enabling a state to target and track progress toward other energy- and non-energy–related objectives that can work in concert with power sector decarbonization policies. Some states, like Massachusetts, have incorporated season-specific goals to reduce peak demand, prioritizing efficiency measures that can reduce energy use during particular times of the day in the summer and winter, when heating or cooling demand tends to be highest. Target designs that measure lifetime savings or cumulative persisting savings—as found in

Examples of multiple goals within EERS designs

- Electric/natural gas savings
- All fuels MMBtus
- CO_2e reductions
- Fossil fuel reductions
- Summer/winter peak demand savings

Illinois and Hawaii—can also help focus investment on measures providing long-lasting savings, but these may require additional research and data collection to accurately assess persisting impacts.

Importantly, an EERS also offers regulatory certainty, enabling utilities to deliberately incorporate established levels of efficiency into their long-range integrated resource plans (IRPs). This is critical—given that a utility's IRP is the main planning document outlining its load forecasts, typically over a 10- to 20-year period—to direct the mix of potential supply-side and demand-side resources to meet that load in a way that minimizes system costs (Wilson and Biewald 2013).[24] Including a robust consideration of efficiency within the IRP is thus necessary to manage load growth and avoid overinvestment in other generation and T&D assets.

However, beyond simply establishing a minimum floor of required energy savings, states should also spur utilities to further integrate efficiency as a resource. For example, in 2019 the Michigan Public Service Commission (MPSC) launched MI Power Grid, a multiyear stakeholder initiative and proceeding to explore new technologies, pilots, and utility business models that will optimize the transition to a clean energy grid. In August 2020, the MPSC followed up with an order calling for the next iterations of distribution system plans from each of the state's investor-owned utilities (IOUs) to contain a robust consideration of energy efficiency. This includes modeling locational impacts from customer behavior (such as efficiency, adoption of plug-in EVs, storage, distributed solar, and demand response) to evaluate opportunities to avoid expensive T&D upgrades through non-wires alternatives (Michigan PSC 2020b). That same month the MPSC also issued an order forming a collaborative group to review ways to better align distribution planning with the IRP process and include public health and environmental justice considerations in future IRP cases (Michigan PSC 2020a).

Energy efficiency target setting should also be considered relative to trends in transportation electrification, which represents the bulk of electrification potential projected in the National Renewable Energy Laboratory's (NREL) electrification future studies (Mai et al. 2018). For states that structure their EERS savings targets with a rolling baseline, the addition of significant new loads from customer EV adoption will increasingly impact baseline electric

[24] The Regulatory Assistance Project recommends that the IRP study period be long enough to incorporate much of the operating lives of any new resource options that may be added to a utility's portfolio (usually at least 20 years) (Wilson and Biewald 2013).

sales, with implications for peak demand and energy savings target setting. Managing these new loads through time-varying rates and managed charging programs will be critical.[25] While we have yet to see states separate out transportation electricity consumption in setting savings goals, this is currently under discussion in some states where policies have been advanced to accelerate the sale of EVs and potentially phase out the sale of gasoline-powered vehicles altogether. In the meantime, states also continue to spur reductions in transportation emissions through other policies, such as adoption of zero-emission vehicle (ZEV) mandates, goals to register a certain number of EVs within a specified time frame, and targets for reducing vehicle-miles traveled. In a handful of cases, specific sub-sector goals for reducing transportation GHGs have been established, including in California, Minnesota, and Oregon.

Fully Value Energy Efficiency as a Grid Resource

Deploying energy efficiency in a way that optimizes its time and locational attributes and best supports renewables integration requires policy tools that accurately capture efficiency's multidimensional value. In addition to establishing an EERS with multiple goals to maximize energy savings and other grid benefits, state policymakers should

- Adopt utility regulatory reforms that account for efficiency's demand flexibility and time value within cost-effectiveness screening practices
- Provide for rate designs and data access in ways that allow customers to respond to clear price signals, thereby shaping and reducing energy use so as to help match it to availability of renewable sources
- Value energy efficiency's reliability benefits in planning and resource analysis

Update Cost-Effectiveness Screening Practices for Energy Efficiency and DERs to Meet Fundamental BCA Principles in the *National Standard Practice Manual*

The selection of well-designed cost-effectiveness screening practices by utilities and utility regulators is critical because these tests are used to shape investment in efficiency programs

[25] Targets may be structured in absolute terms (e.g., as a specified number of MWh saved annually) or in relative terms (e.g., as an established percentage of electricity consumption). For those states expressing targets in relative terms, regulators stipulate either a fixed basis (total retail sales from a specific year) or a rolling basis (a moving year or average among years that changes with each compliance year) for determining savings levels. Where targets are structured on a rolling basis, the absolute amount of electricity savings required to meet targets increases under electrification scenarios. (Gold, Gilleo, and Berg 2019).

and ultimately determine which proposed programs are approved or rejected. Unfortunately, these tests are often designed in a way that undervalues the full range of efficiency benefits. Commonly calculated impacts include avoided costs of generation, transmission, and distribution, but it is increasingly important to measure the time- and location-dependent value of these impacts (and others) based on detailed interval data in order to better capture how they may optimally serve the grid. Just as electricity prices fluctuate according to resource availability in different seasons and hours of the day, so too does the value of reducing electricity use with efficiency. Likewise, efficiency may provide more value in certain locations, such as places with transmission and/or distribution capacity constraints by obviating the need for potential upgrades. Figure 4 depicts an example of how calculated energy efficiency benefits, such as avoided GHG, energy reductions, and T&D capacity improvements, may vary when based on more granular data that better capture savings across seasons or the day.

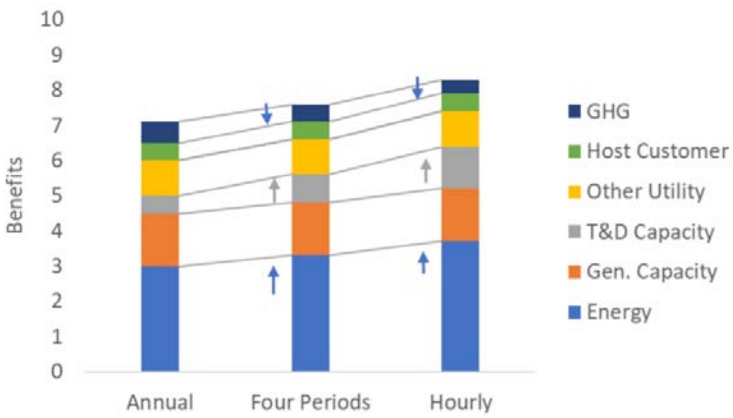

Figure 4. Example of temporal impacts of energy efficiency benefits. Source: NESP 2020.

ACEEE recommends use of the *National Standard Practice Manual* (*NSPM*), which provides a step-by-step process regulators can follow to craft a balanced cost-effectiveness test that reflects state-specific interests and priorities (NESP 2020). Mims Frick and Schwartz (2019) also provides a valuable overview of multiple use cases of the time-sensitive value of efficiency, including cost-effectiveness screening. California and Massachusetts both employ cost–benefit calculators using hourly or seasonal end-use load profiles to provide detailed assessments of cost-effective efficiency measures. The California Public Utilities Commission (CPUC) Avoided Cost Model, developed by E3 and updated in 2020, forecasts long-term marginal costs based on savings profiles for different residential and nonresidential measures (E3 2020a). Since 2013 the Massachusetts Department of Public Utilities has required utilities to include benefit–cost ratio models as part of their three-year efficiency plans. The recently updated 2021 Avoided Energy Supply Costs for New England (AESC) includes such calculations of avoided electricity cost components across the region on an hourly basis (Synapse 2021).

In 2018 the Minnesota Department of Commerce conducted a study to determine how well the state's efficiency cost-effectiveness practices aligned with *NSPM* principles (Synapse 2018; NESP 2018). Known as the Framework Study, it included a review of existing policies and interviews with key stakeholders to develop a recommendation for a new "Minnesota Test" to be used as a primary method for evaluating efficiency cost-effectiveness in the state. This new test should include a range of utility system impacts not currently accounted for, such as improved reliability, reduced risk, avoided RPS costs, avoided costs of environmental compliance, and others. The study also emphasized the need to address the current imbalance in how participant impacts are included; the state's current Societal Cost Test includes participant costs but not participant non-energy benefits (NEBs), contrary to *NSPM* principles.[26] Also recommended was the inclusion of other societal impacts such as those benefiting public health, economic development, and energy security.

Create clear price signals for customers through use of time-varying rates

State policymakers can also work with regulators to prioritize new rate designs that send clear price signals to customers, motivating them to save energy when it's most valuable to the grid—shifting consumption away from hours of peak demand and toward times of high renewable availability. This in turn reduces costs for both utilities and customers. Historically, retail electricity rates for most customers have been flat, which effectively undercharges customers for electricity used during peak hours while forcing other customers to subsidize them. Time-varying rates can address this inequity while also smoothing the load curve. And as technologies such as advanced metering infrastructure continue to evolve and become more widespread, customers and utilities will increasingly be able to respond to more real-time price signals and provide demand flexibility (Perry, Bastian, and York 2019; Gold, Waters, and York 2020).

If well designed, these time-varying rates have been shown to have a particularly sizable impacts on peak demand and a more moderate impact on overall consumption, both of which can lead to customer bill savings.[27] Dynamic rates can take a variety of forms, including opt-in time-of-use (TOU) rates, which vary by time of day and season to align with daily and seasonal variations in power generation costs and market demand, and real-time

[26] The study noted that a balanced consideration of participant impacts in the Minnesota Test could either include both participant costs and benefits, or include neither participant costs nor benefits. Either would be consistent with *NSPM* principles. However, the study recommended the latter given the current lack of clear state policy directives for participant impact inclusion.

[27] ACEEE has identified three important principles for rate design: simplicity, utility revenue stability, and price signals that encourage conservation and energy efficiency (Baatz 2017).

pricing, in which customer rates vary in real time in tandem with wholesale market rates. A 2017 ACEEE study reviewing 50 observations across 6 dynamic pricing pilots found average peak demand reductions of 16% and average reductions in consumption of 2.1% (Baatz 2017).[28] TOU rates can increase costs for low-income customers in certain cases, but these risks can be avoided through careful design, customer education, and bill protection guarantees that ensure participants will pay no more than under their standard cost-of-service rates (Folks and Hathaway 2020).

These customer savings and grid optimization benefits are even more pronounced when TOU rates are paired with solar, batteries, and EV charging, which can further increase savings and provide additional value streams. ACEEE's review of more than a dozen integrated programs offering efficiency combined with solar plus battery storage systems—known as EE/Solar+—found that these programs have the potential to amplify energy and GHG savings, DR capabilities, and grid flexibility (Srivastava et al. 2020). Energy efficiency improvements reduce building energy loads, allowing customers to install smaller, less costly solar+ systems. Solar+, in turn, can offer additional savings: for the customer when combined with time-varying rates, and for the utility by avoiding expenses associated with generation and T&D, expected to cost $50–80 billion per year nationwide for the next 10 years (Dyson et al. 2015). These projects can also offer further grid and reliability benefits when located on congested parts of the grid (Relf, York, and Kushler 2018).

Rate design and managed charging programs also have the potential to leverage EV demand on the grid. According to NREL's Electrification Futures Study, by 2050 EVs could contribute to as much as a 33% increase in energy use during peak demand (Mai et al. 2018). However, through rate design and managed charging programs, utilities can offset potential added costs from peak demand through optimal load-shifting, while at the same time increasing revenues from growing EV sales (Frost, Whited, and Allison 2019). In the coming years, bidirectional electricity flow between the grid and EVs during charging could also enable vehicle-to-grid services of distributed storage, generation service, and frequency regulation (Jacobson 2015).

RMI's *Regulatory Solutions for Building Decarbonization* offers several recommended approaches for designing rates in a way that delivers demand flexibility and improves cost-effectiveness for customers. This includes prioritizing analysis of potential equity impacts of electric rate charges to avoid situations in which a shift to time-varying rates causes electricity to become unaffordable for those most in need. The RMI report further

[28] Technology was involved in 16 of the 50 observations, among which the average reduction in peak demand was 23% and the average reduction in overall consumption was 1.35% for the control group (Baatz 2017).

recommends that time-varying rates incorporate significant peak-to-off-peak ratios that are large enough to encourage beneficial load shifting. Utilities and policymakers should also be cautious in using fixed charges to offset volumetric electric rates, a practice that may incentivize electrification, but at the expense of reducing customer incentives to save energy or install solar power. Additionally, they should limit demand charges, which can penalize customers for energy use spikes without actually shaping load profiles to grid needs; instead, they should prioritize time-varying rates that encourage beneficial load shifting (RMI 2020).

UPDATE PLANNING PROCESSES TO VALUE ENERGY EFFICIENCY'S RISK, RELIABILITY, AND RESILIENCE BENEFITS

Several recent extreme weather events have highlighted critical power grid vulnerabilities and potential risks to human life and the economy when resource planning fails to prepare for and protect against supply-demand constraints. These include California's 2020 heat wave, which prompted rolling blackouts across the state, and the week of record-low temperatures in Texas in February 2021, which led to generation failures and energy shortages, resulted in more than 200 deaths, and caused damages estimated in the hundreds of billions of dollars (California ISO 2020; Watson, Cross, and Jones 2021; Texas DSHS 2021).[29]

These events demonstrate the frequent inadequacy of existing infrastructure to ensure grid reliability and resilience. Energy efficiency has a central role to play in strengthening planning efforts, which should value and recognize efficiency's ability to reduce demand and increase reserve margin, offsetting otherwise needed generation. Efficiency also functions as a vital T&D resource by reducing the need for traditional grid upgrades to handle increased power flows (Relf, York, and Kushler 2018). This value depends on the amount, timing, and location of energy savings and can unlock additional optimization benefits when considered in tandem with the locational benefits of other DERs, such as storage.

These reliability benefits have several important long-term implications for states as they look to accelerate deployment of renewable energy resources. Despite the growing number of clean energy and climate pledges by states, utilities and investors still have more than $70 billion planned for investments in new gas-fired power plants through 2025. Such investments run the risk of becoming underutilized or stranded as other, lower-cost clean

[29] Figures updated as of July 13, 2021, by the Texas Department of State Health Services reported 210 deaths related to the state's February 2021 winter storms; however, other unofficial reports have suggested a higher death toll.

energy portfolios render them uneconomic before the end of their useful lives, adding unnecessary costs to utilities and consumers (Dyson, Engel, and Farber 2018).

A variety of state policy actions are available to states to capture the full reliability benefits of energy efficiency. These include:

- **Incorporating the full value of reliability benefits within cost-effectiveness testing.** As of 2020, only Arizona, Massachusetts, and Rhode Island included reliability as a direct utility-system impact that could be quantified in their primary cost-effectiveness tests (Relf and Jarrah 2020; NESP 2019).
- **Using geographically targeted energy efficiency as a non-wires alternative (NWA) to address T&D system needs and relieve congestion.** Several states, like California, New York, and Maine, have established incentives or mandates for utilities to consider NWAs before approving new T&D projects. Through the rate oversight process, state regulators can also encourage utilities toward non-wires procurements when they prove cost effective (Hausman 2020).
- **Supporting adoption of EVs as distributed energy resources.** With targeted rates and managed charging, utilities can deploy EV charging at beneficial times and on demand, helping to make more efficient use of variable renewable resources. In early 2021, ACEEE found that only 11 states were offering managed charging programs and pilots, indicating there is strong potential for utilities to build out more opportunities for customers to participate in EV demand management (Howard et al. 2021).

Address regulatory barriers to integrated DSM

A 2018 study estimated that residential demand's flexibility potential will be 88 gigawatts by 2023 (Wang 2018). Integrated EE/DR programs offer the opportunity to acquire this flexibility at low cost by adding demand response functionality at a time when a customer is installing an efficiency technology. Such technologies include smart thermostats and Wi-Fi–enabled water heaters, refrigerators, clothes dryers, and air conditioners in homes, and lighting, energy management control systems, refrigeration/cooling equipment, and cooling storage in commercial buildings. Doing so enables a customer to respond to time-varying rates or demand response signals that are already offered or may be added in the future. However, such integrated programs are scarce, with EE and DR often administered separately as fairly siloed resources (York, Relf, and Waters 2019).

California is an example of a state where regulators are refining policies to develop and promote integrated DSM in a way that positions them to maximize achievement of potential savings and co-benefits while reducing transaction costs. In D.18-05-041, the California PUC directed that a set amount of the IOUs' integrated DSM budget focus on the integration of energy efficiency and demand response and laid out several principles to follow in pursuing this, including identifying additional co-benefits (decreased customer transaction costs or equipment costs, and minimized duplication of outreach and marketing efforts, for example) as well as positive interactive effects, such as increased load reductions (CPUC 2018).

Standardize reporting protocols for energy savings

To achieve these goals, contributions from energy efficiency in support of emissions reductions must be transparent and clearly articulated, with regular tracking and reporting of contributions from energy efficiency progress. Without this, efforts to refine programs, optimize resource allocation, and coordinate stakeholder activities become more difficult as the contribution of energy efficiency toward goals is less easily understood.

New York State has steadily refined its tracking efforts through its online Clean Energy Dashboard, which originated in January 2016 when the New York State Department of Public Service (DPS) directed the New York State Energy Research and Development Authority (NYSERDA) to develop and implement a publicly accessible dashboard that would track key performance metrics of all consumer-funded clean energy activities. This became available online in the summer of 2019 and is intended to improve transparency while minimizing the administrative burdens and costs associated with reporting (NY Utilities 2019). The dashboard reports energy and demand savings and avoided GHG emissions for both utility and other NYSERDA programs, including savings from building codes and standards, benchmarking, and lead-by-example policies that together are intended to meet the state's 185 TBtu savings goal.[30] Both annual and lifetime savings for energy and GHGs are reported by utilities on a quarterly basis and differentiated by already acquired savings and savings expected in the future from committed funds or planned budgets.[31]

[30] The dashboard displays utility data from filings also posted on the NY Department of Public Service energy efficiency docket (15-00990/15-M-0252). The underlying dashboard data can also be downloaded from the Open NY data platform.

[31] For more information on reporting lifetime savings, see Gold and Nowak (2019).

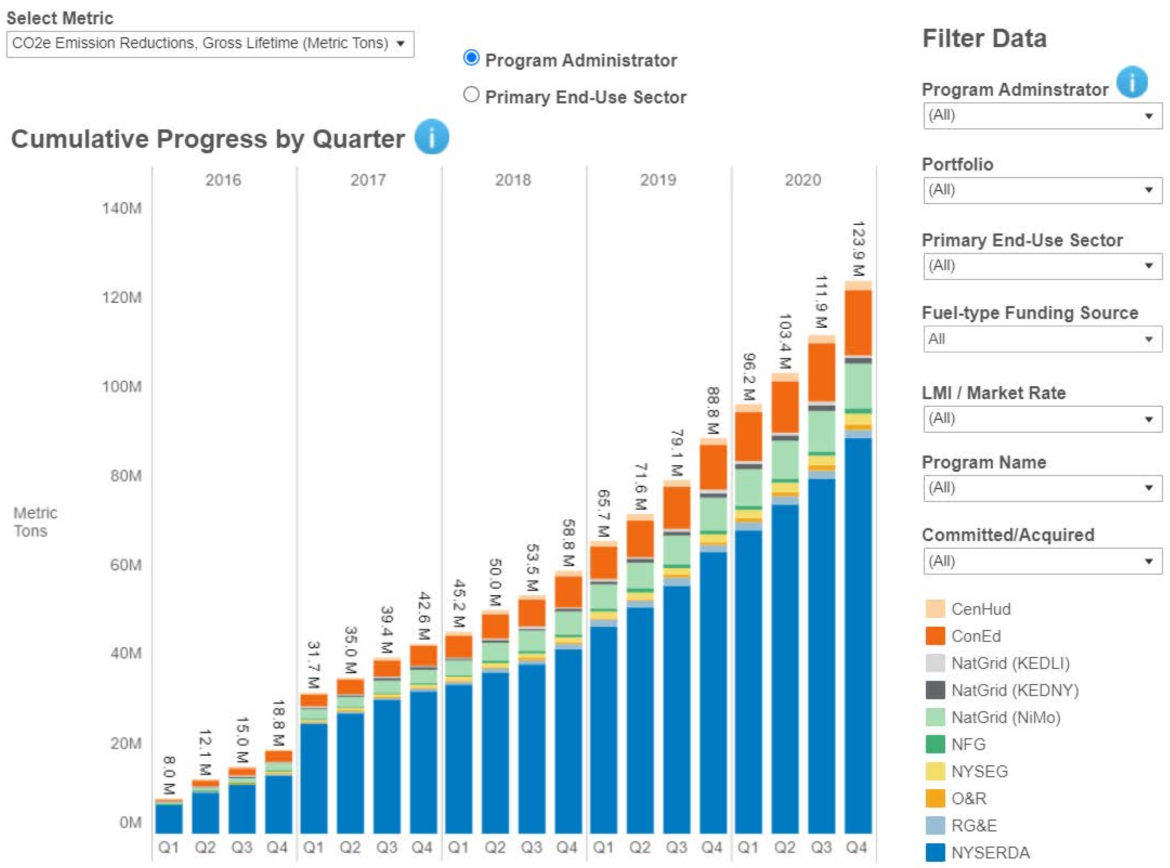

Figure 5. NYSERDA clean energy dashboard

In Massachusetts, the Mass Save Data portal also serves as a strong model for detailed and accessible tracking of year-to-date performance of utility energy efficiency. The portal includes information related to participants, expenditures, annual and lifetime energy savings, electric capacity savings, CO_2e emissions reductions, and benefits; it tracks these at the sector, program, initiative, and measure levels. The database has also been expanded with the addition of a geographic tab that tracks savings data at the county, town, and zip code levels.[32]

In Virginia, the Department of Mines, Minerals, and Energy has worked with the University of Virginia to develop the Virginia Clean Economy Progress dashboard, an interactive website designed to enable policymakers, stakeholders, and the general public to follow the progress made toward achieving each of the clean energy targets outlined in the VCEA

[32] The Mass Save Data portal can be accessed at masssavedata.com/public/home.

(DMME 2021).[33] Efforts to track contributions of energy efficiency toward these goals are ongoing as part of an open proceeding (Case No. PUR-2019-00201) with the State Corporation Commission investigating opportunities to strengthen evaluation, measurement, and verification (EM&V) of new efficiency programs offered by Dominion per the VCEA. Among other things, this process has yielded a recommendation to develop a separate standardized quarterly dashboard and annual summary for reporting energy investments and savings to expand transparency. Ensuring that utilities regularly report annual savings in a consistent manner using standardized reporting protocols with agreed-upon terms and definitions will provide a foundational basis for progress tracking and empower stronger coordination and information sharing among stakeholders in order to improve programs. The proceeding was ongoing as of June 2021.

ENERGY EFFICIENCY POLICIES THAT SUPPORT ELECTRIFICATION AND EMISSIONS REDUCTION GOALS

Beyond the supportive value of energy efficiency to aid the cost-effective transition to a 100% carbon-free electric grid, discussed in the previous section, energy-saving measures are also critical to support electrification. Transportation, encompassing both individual vehicles and transportation systems as a whole, currently accounts for roughly 29% of economy-wide GHG emissions and offers among the largest decarbonization opportunities. Utilities and policymakers must also address space and water heating, especially in regions of the country relying heavily on natural gas furnaces or delivered fuels like oil and propane. These account for 585 million tons of CO_2 emissions each year, one-tenth of total U.S. emissions (EPA 2021). Achieving zero carbon goals will require fully electrifying these end uses, shifting away from carbon-emitting fuels to instead leverage the power grid as its carbon-intensity diminishes over time.

As discussed, EVs offer an enormous opportunity to transform the grid and strengthen the economics of clean energy. And with individual vehicles being the largest source of GHGs in the U.S.—even exceeding the electric power sector—EVs also stand to play a critical role in reducing emissions and achieving state climate goals (Howard et al. 2021). Of the almost 30% of U.S. GHG emissions contributed by transportation, 59% is from light-duty vehicles and 23% from medium- and heavy-duty trucks. Research has found that electrification can lead to reductions in light-duty GHG emissions of 36–50% by 2050; for heavy-duty vehicles, the projected reduction is 22–43% by 2050 (EPRI 2015; Mai et al. 2018). EVs currently

[33] The Virginia Clean Economy Progress dashboard can be accessed at cleanenergyva.dmme.virginia.gov/.

account for only approximately 2% of the American vehicle market, so ambitious state action is needed to ramp up sales and build the necessary charging infrastructure, especially in states like California and Massachusetts, which have called for phasing out the sale of all fossil fuel–powered vehicles by 2035.[34] However, in the near term, given the current limited market share of EVs, accounting for fewer than 1% of the 250 million cars and light trucks on U.S. roads, it is also critical to expand and strengthen a broad range of other policies and measures to reduce vehicle ownership and usage (Milovanoff, Posen, and MacLean 2020; Plumer, Popovich, and Migliozzi 2021).

Electrifying current fossil fuel uses within the buildings sector is also a critical pathway to decarbonizing the U.S. economy. However, traditionally structured utility efficiency policies, which focus on fuel-specific electricity and natural gas savings and frequently neglect overall fuel savings, can impede electrification by undervaluing total savings benefits from fuel-switching measures like transitioning a home from a propane furnace to an electric heat pump. In this example, a heat pump installation may result in increased electricity consumption but nonetheless may deliver net overall energy savings due to reduced use of fossil fuel, as well as lowered GHG emissions and customer bill savings. In order to design policies that appropriately capture and target the full value of these programs, regulators must update accounting practices to consider savings on a holistic, fuel-neutral basis and to take into account other customer and health benefits. Without considering these all-fuel savings, energy efficiency policies can actually discourage some energy-efficient measures that might support decarbonization efforts.

In the sections below, we describe a menu of supportive policies to address the almost 70% of emissions currently produced by uses outside the U.S. power sector. [35] Efforts focus on slashing transportation emissions as well as reforming efficiency policies to incentivize and remove barriers to achieving holistic, systems-level energy and GHG savings across these sectors and economy-wide. They include policies to

- Reduce transportation sector emissions through acceleration of vehicle electrification and EV sales as well as adoption of policies to support grid integration of EVs and

[34] EV sales were on a strong upward swing prior to the COVID-19 pandemic, increasing 81% in 2018 relative to 2017 (Mock, Yang, and Tietge 2020; Loveday 2019).

[35] In 2019, emissions of carbon dioxide by the U.S. electric power sector accounted for about 31% of total U.S. energy-related CO_2 emissions (EIA 2021b). It should be noted that these emissions decreased by 11% in the U.S. in 2020, primarily due to the effects of the COVID-19 pandemic (EIA 2021e).

increase availability of charging infrastructure. Policies must also reduce VMT through investment in public transit and adoption of land use plans that supports transit-oriented development and multimodal transportation options.

- Redefine energy efficiency and organize policies around a holistic, systems-level view of energy savings, including its full range of energy and non-energy benefits. This includes updating utility rules governing incentive structures and cost-effectiveness screening to strengthen incentives and remove barriers to decarbonization through a broader range of efficiency options.

Table 8 offers a summary of these policies.

Table 8. Energy efficiency policies supporting electrification and state emissions reduction goals

Policy areas	Specific policies and sub-policies
Strengthen transportation electrification targets and investment.	• Set ZEV mandates and binding targets for light-duty and heavy-duty EV adoption. • Adopt California's Zero Emissions Vehicle Program to spur automakers to produce ZEVs and plug-in hybrids available for purchase. • Offer on-the-hood rebates and other incentives for the purchase of EVs and associated charging infrastructure to address barriers created by upfront costs. • Establish policy direction to encourage utility and third-party investment in EV charging infrastructure.
Reduce combustion vehicle emissions with carbon abatement goals and policies.	• Set quantitative targets for reducing vehicle-miles traveled and transportation sector emissions. • Establish policies to reduce dependence on personal vehicles through smart-growth planning principles and public transit investment.
Define energy efficiency to encompass all energy savings.	• Shift to an all-fuels metric or fuel-neutral goal measured in energy savings or avoided carbon to capture savings from efficient fuel switching in buildings and industry. • Set additional sub-targets for electricity energy efficiency.
Clarify utility fuel-switching rules.	• Lift prohibitions on incentives supporting beneficial fuel-switching technologies. • Develop guidance describing conditions under which funds may be used toward fuel switching. • Account for fuel savings (including unregulated fuels) and avoided carbon emissions in cost-effectiveness screening.

Policy areas	Specific policies and sub-policies
Prioritize policies and programs that reduce natural gas end uses.	• Adopt strengthened appliance standards for gas-related products. • Fund robust natural gas DSM programs, especially weatherization and building envelope improvements that reduce energy use regardless of fuel source. • Refine program cost-effectiveness tests to accurately value system costs and benefits from measures reducing natural gas consumption.
Adopt advanced energy efficiency codes and standards that support state decarbonization goals.	• Strengthen building energy codes and stretch codes to include provisions supporting zero-energy and zero-energy-ready construction. • Adopt building energy performance standards to target and track incremental efficiency improvements in existing buildings.
Strengthen industrial sector efficiency.	• Include large customers in utility or statewide energy efficiency offerings through strengthened coordination and/or energy-saving self-direct programs. • Promote information sharing and collaborative forums. • Connect industrial facilities to technical assistance.

Strengthen Transportation Electrification Targets and Investment

The transportation sector is the largest source of GHG emissions in the U.S.—even exceeding the electric power sector—and electric vehicles stand to play a critical role in reducing emissions and achieving state climate goals (Howard et al. 2021). Even a battery electric vehicle charged on a dirty grid is cleaner over its lifetime than an internal combustion vehicle, although GHG savings naturally increase as the grid becomes less carbon-intensive; when a cleaner grid is paired with emissions-optimized charging, these benefits increase further.

ZEV mandates and binding targets for light-duty EV adoption that are tied to emissions reduction targets are among the highest-impact policies states can adopt to meaningfully advance EVs (Morrison, Veilleux, and Powers 2018; Lutsey et al. 2015; Cattaneo 2018). These targets, both binding and nonbinding, have been introduced in the states through varying means including legislation and executive orders. ACEEE research recognized 17 states that had adopted or signaled an intent to adopt a light-duty EV deployment target as of early 2021 (Howard et al. 2021). Examples include New Jersey's S-2252, passed in 2020 and intended to meet the governor's goal to have 330,000 electric cars on the state's roads by 2025. The State Zero-Emission Vehicle Programs memorandum of understanding (MOU), in which 10 states have committed to having 3.3 million ZEVs on their collective roadways by 2025, has also served as an important catalyst of adoption.

California's Zero-Emission Vehicle Program has also been a primary driver increasing the market share of EVs in select states. Currently administered by 12 states accounting for more than 30% of new car sales in the U.S., the program requires automakers to produce and deliver a certain number of ZEVs and plug-in hybrids, the number increasing each year, with goals for 12–15% of sales by the 2025 model year (Leard and McConnell 2020).[36] Since 2020 additional states, including Pennsylvania and Virginia, have also moved to advance ZEV programs modeled on California's.

While light-duty EVs are expected to reach upfront cost parity with gasoline vehicles by the end of the decade, in the near term, the relatively high upfront costs of EVs means states and utilities also have an important role to play in offering incentives that remove financial barriers to adoption for many customers (Eisenstein 2019). These can include tax credits or rebates beyond those currently offered by the federal government. Utilities can also coordinate with state and local governments to create effective incentive packages. This coordination can help improve affordability of EVs for all customers, across all communities, by covering both new and used vehicles and setting conditions on vehicle price or purchaser income (Khan and Vaidyanathan 2018).

But consumer adoption of EVs can ramp up only to the extent that charging infrastructure is in place to support it. According to sales forecasts, publicly accessible charging infrastructure across the U.S. must grow between four and sixteen times 2017 levels by 2025 to meet expected EV market growth and deployment goals (Smith 2020; Cooper and Schefter 2018). States can support the deployment of charging infrastructure by several means, including adopting building codes with EV-ready or EV-capable provisions, offering incentives toward the installation of charging units, and passing legislation or utility orders requiring utilities to file plans for investment in EV charging infrastructure.[37]

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[36] In addition to California, these states are Colorado, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont, and Washington.

[37] ACEEE's *State Transportation Electrification Scorecard* highlights progress and policies by states on a number of fronts to scale up adoption of EVs and the necessary charging infrastructure. The North Carolina Clean Energy Technology Center also provides quarterly updates of state regulatory and legislative actions to speed EV adoption (NCCETC 2020).

Virginia illustrates how a state can take some of its first major steps toward expanding vehicle electrification with a multipronged effort to expand incentives, make critical utility reforms, and adopt strengthened clean car standards. Among other things, the state has earmarked $82 million (of $93.6 million in Volkswagen settlement funds received) for transportation electrification projects, including electric school buses, and has worked to develop an EV charging network through the provider EVgo, an effort now in its second year. The state passed a Clean Cars bill in March 2021 adopting standards to increase the fuel efficiency of cars sold and to implement a ZEV program modeled after California's.

The state is also investigating utility reforms to enable greater vehicle electrification. Virginia's State Corporation Commission sought information on clean energy in the transportation sector through a recent docket opened in the spring of 2020 (Case No. PUR-2020-00051). The commission plans to use this information, as well as more on grid modification, integrated storage, and distributed energy resources, to better understand transportation and its impact on the grid and to determine the best approaches that could be used by electric utilities regarding the transportation sector (C. Bast, Chief Deputy and T. Ballou, Air Data Analysis & Planning Director, Virginia Department of Environmental Quality, pers. comm., November 30, 2020; A. Christopher, Director, Energy Division, Virginia Department of Mines, Minerals, and Energy, pers. comm., November 30, 2020).

Reduce combustion vehicle emissions with carbon abatement goals and policies

Even as EV adoption ramps up in coming years, these policies do relatively little to address the millions of ICE vehicles that will remain on the roads for decades to come. Under a medium-growth forecast, EPRI has projected 2.2 million EV sales by 2030, resulting in a total of 14 million EVs on the road, or only 5% of the fleet. Under the same scenario, in 2050 only about 30% of light-duty vehicles on the road would be EVs (Leard and McConnell 2020; U.S. DRIVE 2019). This highlights the importance of continuing to prioritize policies limiting use of vehicle fossil fuel through VMT targets and transportation sector emissions savings goals, and other supportive policies like incentives to strengthen access to public transit and improve land-use planning to reduce dependence on personal vehicles.

ACEEE's *2020 State Energy Efficiency Scorecard* recognizes eight states and DC for having formally adopted VMT or transportation sector emissions goals.[38] For example, Oregon has

[38] These are DC, California, New York, Massachusetts, Maryland, Oregon, Vermont, Washington, and Minnesota.

passed region-specific per capita GHG reduction goals of 17–21% by 2035 from auto travel (ACEEE 2020b). In 2019 the Minnesota Department of Transportation (MnDOT) released *Pathways to Decarbonizing Transportation in Minnesota*, which outlines paths to attain an 80% emissions reduction or a 100% emissions reduction in the transportation sector by 2050. The plan includes a strong focus on spurring EV adoption, which has advanced with the May 2021 approval of a Clean Car program modeled on California's tailpipe and ZEV standards. However, these standards are expected to result in EV sales comprising only 6–8% of light-duty vehicle sales in the near term. This highlights the importance of other policies to address remaining ICE vehicles, such as curbing vehicles-miles traveled through VMT targets and prioritizing transit investment and walkable communities (Move Minnesota 2020).

Often these policies are supported by smart-growth policies that integrate transportation and land-use planning in order to increase transportation system efficiency, as well as by statutes committing dedicated revenue streams to public transit projects. States are also exploring market-based mechanisms to reduce sector emissions, such as the Transportation and Climate Initiative (TCI), which would place a cap on emissions from transportation fuels and require distributors to purchase allowances based on the carbon content of those fuels. The revenue would then be invested in more efficient, equitable, low-carbon modes of transportation (Ceres 2020).

DEFINE ENERGY EFFICIENCY TO ENCOMPASS ALL ENERGY SAVINGS

Previous ACEEE research has found that state policies to support beneficial electrification in buildings and industry are fairly scarce but rapidly emerging in several areas of the country, particularly in areas with high use of delivered fuels (propane and fuel oil) where the economics of electrification are more favorable than when displacing natural gas (Nadel 2020, 2018). However, ACEEE has also found that outside these regions, policies to enable and support fuel-neutral savings are generally still in their infancy across most of the U.S. More than half of states have no relevant policy in place, creating regulatory uncertainty for electrification, and at least another 10 explicitly prohibit fuel-switching measures (Berg, Cooper, and Cortez 2020).

As states adjust energy efficiency goals to align with emerging climate priorities, ACEEE recommends a multiple-goal approach that includes both fuel-neutral targets and resource-specific targets where appropriate (Gold, Gilleo, and Berg 2019). An EERS that includes multiple goals enables a state to track, prioritize, and balance the diverse array of benefits that efficiency affords.

A handful of states, including New York and Massachusetts, have incorporated an all-fuels metric or fuel-neutral goal (measured in MMBtus) in an effort to promote the full range of potential energy savings associated with switching from fossil fuel to electrified end uses, enabling them to prioritize those measures that save the most energy and emissions overall. Traditional, siloed approaches that measure individual fuel savings separately may track positive savings for unregulated fuels and negative savings for electricity but may not recognize the aggregate total energy savings across fuels. This means electrification can conflict with achievement of electric savings targets structured on a rolling basis, or in some cases directly violate state regulations that narrowly define energy efficiency as a reduction in electricity consumption. However, adopting a multi-fuel metric measured in MMBtus or avoided carbon—and revising performance incentives to align with it—can promote fuel switching, allow utilities to claim savings and incentives from such measures, and ultimately encourage adoption.[39]

Considerations for refining all-fuels savings measurements

It should be noted that transitioning to an "apples-to-apples" all-fuels accounting of savings is not straightforward and requires agreement on an approach that accurately captures and compares measures' benefits and their progress toward state policy goals. These considerations include

Site versus source comparisons: In some cases, a simple, common energy metric like customer meter–level energy savings may suffice for tracking purposes. However, to more accurately capture the carbon benefits of certain technologies such as combined heat and power (CHP), regulators in some states, like Massachusetts, have prioritized a closer consideration of source (generation-level) energy savings. Source energy savings account for plant losses and line losses that occur on the supply side before electricity reaches the customer. This can provide a more accurate comparison of savings for resources, like CHP, that act more like a generation asset and thus should be compared with the electricity-producing generation fuels that are displaced (Molina et al. 2020). These site-to-source calculations should also take steps to

[39] In 2017 Massachusetts amended its Residential Conservation Service (RCS) regulation to define "fuel neutral reward" to allow financial incentive or rebates "regardless of the fuels being used in the building, that facilitates the implementation of Program Measures," in effect enabling fuel-switching programs. For more information on how fuel-switching rebates are administered in practice within an optimization framework, see the Energy Optimization Model developed by Massachusetts utilities in 2018 for residential programs, which estimates the costs and benefits associated with a variety of efficiency measures that use electric heat pumps and natural gas heating equipment to displace the consumption of delivered fuels. The utilities have used this model to develop prescribed savings values used for energy efficiency measures that involve fuel switching.

ensure an accurate accounting of the conversion efficiency of clean energy resources by adopting a low Btu/kWh heat rate for the portion of the grid served by renewable generation, as California has done through recent updates to its three-pronged test for fuel substitution (CPUC 2019). New York, however, has opted for a statewide site savings approach, noting the challenges of calculating and updating primary energy savings amid increasing penetration of renewable generation (NYSERDA 2018).

Average versus marginal heat rates: Given daily fluctuations in electric load and renewable generation, grid stability currently relies on marginal power plants (often fueled by natural gas) that can quickly ramp up to meet demand. The carbon intensity of these plants, which tend to be deployed at periods of peak demand and low renewable output, means that the carbon reduction value of energy efficiency varies by time and location. This is important to consider when modeling energy efficiency potential. For example, Massachusetts program administrators considered both an average heat rate approach and a marginal heat rate approach but recommended using the latter, given lower volatility and uncertainty concerns (Molina et al. 2020).[40] These calculations should also account for future improvements to the carbon intensity of the grid from continued growth in renewables by estimating not just short-run but also long-run marginal emissions to more accurately capture lifetime benefits from fuel substitution measures (Cunningham and Borgeson 2018).

In addition to a fuel-neutral goal, ACEEE also recommends additional resource-specific goals and other targets that may align with policy objectives. While a fuel-neutral approach has the benefit of offering flexibility to achieve added energy savings and emissions reductions, it also carries the risk of failing to encourage all lowest-cost strategies. For example, a single-fuel utility may be incentivized to reduce other forms of energy while building its own load. However, meeting climate goals requires policymakers to maximize achievement of all available options, including resource-specific energy efficiency, beneficial electrification, and decarbonization of grid supply. Maintaining resource-specific goals alongside broader fuel-neutral targets can ensure that utilities do not neglect measures that reduce use of the fuels they sell and thus miss out on potential GHG reductions (Gold, Gilleo, and Berg 2019). For

[40] The heat rate is the amount of energy used by an electrical generator/power plant to generate 1 kWh of electricity. It is a measure of a power plant's efficiency. The marginal heat rate pertains to the particular marginal generation unit displaced, whereas the average heat rate is calculated across the entire electric generation fleet and doesn't account for hourly or seasonal variations in source BTU consumption.

example, in New York the adjustment to a fuel-neutral 185 TBtu savings goal is an ongoing process that regulators are refining while the state continues to maintain resource-specific savings targets for electricity (3% by 2025) and natural gas (1.3% by 2025), formalized in a January 2020 Public Service Commission (PSC) order (NY PSC 2020). Regulators acknowledge that the electricity sub-target will need to be adjusted in the future to account for increased electricity sales from beneficial electrification activities (NY PSC 2018).

SET ADDITIONAL SUB-TARGETS FOR BUILDING DECARBONIZATION GOALS

Adoption of an all-fuels savings metric is just one approach to goal-setting that states are taking to accelerate decarbonization. States like New York and others have also adopted sub-targets and carve-outs to further drive energy and carbon savings and to meet other policy goals.

New York's heat pump sub-target of 3.6 TBtus of savings by 2025 was established in a January 2020 PSC order to speed market transformation and promote rapid customer adoption of heat pumps. This sub-target is included within the state's broader all-fuels savings goal of 185 Tbtus.[41] As mentioned, the state also maintains a separate electric goal that importantly nets out increased consumption from heat pumps to avoid conflict between electricity savings targets and beneficial electrification (NY PSC 2018). The heat pump sub-target is also encompassed within a wider statewide framework across utilities, with NYSERDA providing complementary efforts that support market-enabling development of workforce, supply chain, and consumer demand. The PSC order specifies that these targets are subject to future updates based on revised potential savings for heat pump technologies, expected adoption rates, and incentive levels necessary to influence customer decisions (NY PSC 2020).

Maine's LD 1766, signed in 2019, sets a goal of installing 100,000 heat pumps by 2025. The legislation also requires the Maine State Housing Authority to include information on targets and budgets related to the heat pump goal in its annual planning process for low-income weatherization programs. In December 2020, Governor Janet Mills released Maine's new statewide climate action plan, which outlines additional clean heating and cooling goals beyond the state's 2025 target for 100,000 heat pumps, including a 2030 goal for 130,000 homes to be equipped with one or two heat pumps and an additional 115,000 homes to

[41] Utility-specific savings targets for both electricity and natural gas have also been established by the state DPS.

have a whole-home heat pump system. The plan also calls for at least 15,000 new heat pumps in income-eligible households by 2025.[42]

While Massachusetts has already incorporated all-fuels MMBtu goals to support its new energy optimization approach, legislation signed in 2021 went further to strengthen the state's climate goals. In addition to new energy efficiency provisions, the law (S.9), An Act Creating a Next-Generation Roadmap for Massachusetts Climate Policy, adopted a new 2050 net-zero emissions target, with incremental five-year targets and subsector performance goals. It strengthens and refines the statewide emissions target to include five-year GHG reduction goals for six sectors: electric power, transportation, commercial and industrial buildings, residential buildings, industrial processes, and natural gas distribution and service (Massachusetts General Court 2021). While these are legally binding targets, the final law allows some leniency to underperform in certain sectors as long as aggregate statewide emissions goals are met. As of early summer 2021, program administrators were working to adjust the draft efficiency plans for 2022–2024 to meet specific GHG reduction goals to be required of each three-year plan going forward, per the legislation (Mass Save 2021).

The law also introduces additional technology adoption benchmarks for electric vehicles, charging stations, solar technology, energy storage, air-source and ground-source heat pumps, and anaerobic digesters. Other important provisions include a call to develop and adopt a municipal opt-in net-zero stretch energy code as an appendix to the state building code that jurisdictions can choose to implement. The legislation also adopts appliance efficiency standards for 17 residential and commercial products.

Clarify Utility Fuel-Switching Rules

While few states have yet to establish or reform energy efficiency targets to incorporate fuel-neutral savings, some state regulators are clarifying rules and guidelines regarding conditions in which fuel-switching incentive programs are permitted. A May 2020 ACEEE policy brief found close to a dozen states that discourage or prohibit fuel switching or substitution programs, limiting options available to those states to address emissions from space and water heating. Almost 30 states have no policy in place, though 8 of these (and DC) allow incentives for fuel-switching measures on a case-by-case basis (Berg, Cooper, and Cortez 2020). Often these states allow utilities to offer rebates for switching from oil, propane, and natural gas appliances to electric heat pumps but permit utilities to claim

[42] For more information, please see the website of the Maine Climate Council at climatecouncil.maine.gov/

savings, offer rebates, or collect performance incentives based only on the savings between a baseline heat pump and a more efficient installed unit, rather than the whole range of fossil fuel savings.

A small but growing number of states have updated and expanded how efficiency is defined in statutes and utility rules in order to permit state and utility incentives for electrification measures that provide multi-fuel savings and carbon reductions. States of note include Massachusetts, which under H. 4857 (2018) expanded the list of eligible measures that efficiency plans may include, adding energy storage, renewable energy, and strategic electrification that results in cost-effective reductions in GHG emissions. In California in 2019, CPUC established the Fuel Substitution Test to update previous cost-effectiveness guidance that had posed a barrier to fuel substitution and electrification efforts. The new guidance provided clarification on how to demonstrate that building measures meet two criteria: not increasing total energy consumption and not adversely impacting the environment when compared with the baseline measure using the original fuel. It also applies cost-effectiveness screening at the portfolio level, as with efficiency measures, and requires that the "new fuel" (typically electricity) customers fund the programs (CPUC 2019).[43]

Minnesota is among the most recent states to realign its approach to energy efficiency with the intent of scaling up beneficial electrification efforts. In May 2021 the state passed the Energy Conservation and Optimization Act, strengthening its energy efficiency resource standard with higher savings targets and also expanding the scope of measures to be funded by the Conservation Improvement Program, the suite of ratepayer-funded efficiency offerings administered by energy utilities. Specifically, the law allows cost-effective load management and fuel-switching measures if such measures result in a net decrease in source energy consumption on a fuel-neutral basis. However, to address concerns regarding the legislation's impact on propane interests, the law limits the degree to which fuel switching can count toward savings goals. Specifically, for municipal and cooperative utilities, fuel-switching measures may contribute 0.55% savings towards their 1.5% goal; however, these utilities cannot spend more than 0.55% of gross retail energy sales each year on fuel switching until 2026. For investor-owned utilities this spending limit is 0.35% of energy sales through 2026 (MN State Legislature 2021). The state's Department of

[43] The guidance does not address unregulated fuel switching from wood and propane.

Commerce is currently determining next steps for implementation of the new statutory requirements.

New York, which approved updated fuel-switching rules in 2018, has been revising cost-effectiveness screening practices for the past several years and serves as an example for other states in earlier stages of the process. Per a January 2020 order, regulators have worked to revise heat pump savings estimation approaches for inclusion in the state *Technical Resource Manual* and is conducting a statewide heat pump EM&V study to be completed by June 2022 in an effort to further refine savings estimation approaches. The state DPS also directed the initiation of a performance management and improvement process (PM&IP) to increase transparency in planning, facilitate knowledge sharing, and maximize performance of the energy efficiency and building electrification portfolios (New York DPS 2021). On the basis of stakeholder feedback, DPS staff have developed work plans to further investigate a range of priority issues, including better aligning the state's fuel-neutral goal with desired carbon benefits and improving benefit–cost analyses (New York DPS 2021). In addition, NYSERDA plans to undertake a statewide energy efficiency and electrification potential study, to be completed in 2022, which will address multiple fuel types (electricity, natural gas, oil, and propane).

Prioritize policies and programs that reduce consumption in natural gas end uses

All economic sectors use natural gas, which accounted for 43% of U.S. fossil fuel consumption in 2020 (EIA 2021f). While COVID-19-related disruptions have reduced natural gas use in the short term, EIA projections anticipate growing consumption through 2050, driven by exports and industrial use, with other sectors increasing slowly or staying flat (EIA 2021c). While natural gas emits about half as much CO_2 as coal and 30 percent less than oil, modeled pathways to carbon neutrality all call for a drastic reduction in natural gas use in coming years. For example, Larson et al. (2020) found that U.S. natural gas consumption must decline between 50% and 100% by 2050 to achieve net-zero emissions by mid-century.

There has been ongoing debate on the role of natural gas energy efficiency in the context of electrification. Some even question whether to fund natural gas efficiency, arguing that it promotes continued use of fossil fuel heating at a time when the focus should be on shifting to efficient electric appliances. But natural gas energy efficiency has a critical role to play in decarbonization efforts and should coexist with beneficial electrification efforts (Kushler and Witte 2020). This is important for several reasons, one being that investments in weatherization and building envelope improvements deliver immediate reductions and pave the way for electrification by reducing costs and energy use regardless of heating fuel source (Kushler and Witte 2020). In addition, the current economics of gas-to-electric heat pump conversions are not as favorable as oil and propane equipment replacements or new construction (Billimoria et al. 2018; Nadel 2018; Reeves et al. 2018; Mosenthal and McDonald 2020). Given the abundance of buildings currently using natural gas space heating, it is critical that state energy policy pursue natural gas energy efficiency measures, prioritizing weatherization and building envelope improvements.

Considerable opportunities remain to expand natural gas efficiency policies and programs. Past ACEEE analysis has found economic and achievable savings averaging about 1% of gas sales each year through 2030, with the largest opportunities in the industrial sector, consistent with findings from other studies (Nadel 2017; Nelson et al. 2018; Optimal Energy 2019). Major state policy pathways to achieve greater natural gas savings include adoption of strengthened appliance standards (as discussed further in the following section) for gas-related products like furnaces, boilers, and water heaters; for hot water–consuming products such as clothes washers and dishwashers; and for showerheads and faucets.[44] Utility-funded natural gas DSM programs are another key driver of savings, accounting for $1.3–1.5 billion annually in utility spending. Yet there are opportunities in many states to better promote efficiency in the natural gas sector with policies that encourage greater utility investment. For example, as of 2021 only 19 states have established an EERS requiring utilities to deliver specific levels of natural gas savings. And less than half of states have established utility performance incentives for natural gas efficiency programs (Berg et al. 2020). Utilities and regulators can also address cost-effectiveness challenges posed by low natural gas prices by appropriately structuring benefit–cost tests to value system benefits and costs as well as environmental and non-energy benefits, and using a low-risk discount rate (Kushler and Witte 2020).

Several states have taken major legislative action in 2021 to prioritize natural gas efficiency in support of decarbonization goals. In Colorado, this includes a raft of bills that promote building electrification and require natural gas utilities to strengthen efficiency programs and reduce GHG emissions by specific levels. For example, SB21-264 now requires gas distribution utilities to file a clean heat plan with the state PUC, including strategies to deliver 4% GHG emissions reductions by 2025 and 22% by 2030 through the use of clean heat resources. HB21-1238 establishes a process to set natural gas savings targets

[44] Analysis by the Appliance Standards Awareness Project of potential savings from a suite of 19 recommended appliance standards included 7 that together would deliver 164 Tbtus of annual natural gas savings by 2035 if adopted by 2023. These include new standards for commercial dishwashers, fryers, ovens, steam cookers, faucets, gas fireplaces, and showerheads (ASAP 2020).

paralleling a similar process already in place for electric DSM programs; it also updates methods for determining cost-effectiveness by incorporating social costs of GHGs (carbon dioxide and methane) and adjusting discount rates to accurately value the future gas savings benefits to ratepayers. Additionally, SB21-246 will directly promote building electrification by requiring energy savings targets for programs that replace fossil fuel–based heating with energy-efficient electric equipment through a model similar to existing DSM programs.

Policymakers are also looking toward ways to engage natural gas utilities in decarbonization efforts by promoting exploration of emerging measures and technologies that may go beyond typical gas efficiency programs in reducing GHGs. Minnesota's Natural Gas Innovation Act (NGIA), signed in June 2021, for example, establishes a new regulatory framework whereby natural gas utilities can implement and recover costs from a broader range of "innovative resources" that reduce or avoid GHG emissions, including biogas, renewable natural gas, hydrogen or ammonia produced using carbon-free electricity, carbon capture, strategic electrification, district energy, and energy efficiency (MN State Legislature 2021b). Innovation plans filed by utilities must include a forecast of projected capital and fuel investments and carbon emissions to enable the state PUC to properly evaluate their merits. The legislative session also produced several other important efficiency-related initiatives. In addition to the transformative fuel-switching provisions of the ECO Act, as discussed in an earlier section, the legislature authorized creation of a new Minnesota Efficient Technology Accelerator (META), a market transformation program to be modeled after a similar initiative run by the Northwest Energy Efficiency Alliance (NEEA). META will function in coordination with the ECO Act, working with technology manufacturers and equipment installers to support emerging and innovative efficient technologies and address barriers to adoption.

ADOPT ADVANCED ENERGY EFFICIENCY CODES AND STANDARDS THAT SUPPORT STATE DECARBONIZATION GOALS

Meeting ambitious emissions goals will also require strengthening codes for new and existing construction to minimize energy waste in the existing building stock and ensure that buildings constructed now and in the future do not result in new emissions. Momentum is growing across the United States for construction of zero-energy and zero-energy-ready buildings (ZEBs), designed to be highly energy efficient and equipped with connections to support solar or renewable energy to meet any remaining load. ACEEE has found that zero-energy new buildings are a key ingredient in efforts to use efficiency to cut U.S. energy use and greenhouse gas emissions in half by 2050 (Nadel and Ungar 2019). ZEBs also include a wide range of valuable non-energy benefits, including improved health and comfort, improved occupant productivity, and strengthened resiliency (Pande et al. 2019).

While current national model building energy codes have a long way to go, organizations like ASHRAE and Architecture 2030 have established goals to make zero energy the standard for new buildings by 2030. A number of states have also taken important steps to incrementally advance codes in the direction of net zero. For example, Oregon's Executive Order 17-20 requires zero-energy-ready home equivalency by 2023 (Oregon Office of the Governor 2017). California has established requirements that all new residential construction be built to net-zero standards starting in 2020, with a similar net-zero goal for new commercial construction for 2030. The state's 2019 codes for low-rise residential buildings were the first in the nation to require rooftop PV for new construction. The state is now pivoting to code requirements for low-GHG buildings, using metrics that will focus design and construction on decarbonization and demand flexibility to integrate with California's evolving clean energy grid (CEC 2020).

Some states, including California and Massachusetts, have increased efforts to advance stronger codes by leveraging utility resources and expertise toward code development, code training for building officials, and other technical resources to support code compliance. Minnesota has moved in this direction as well through its recent *Codes & Standards (C&S) Roadmap*, which would create a pathway for utilities to claim savings from C&S-related support activities in the future (MN Department of Commerce 2021; N. Minderman, Policy and Strategy Consultant, and S. White, Manager DSM Strategy & Policy, Xcel, pers. comm., January 21, 2021). Such a program could also support efforts to advance state building energy codes to reach net zero, as was also recommended in a December 2020 Minnesota Department of Commerce report targeting achievement of a net-zero commercial energy code by 2036 (DLI and MN Dept of Commerce 2020).

Though more common among cities, building energy performance standards (BEPS) have started to be required by Washington State to target incremental savings in existing buildings, and Colorado recently followed suit with HB 1286, 2021 legislation requiring annual energy reporting for large buildings and development of a performance standard to reduce GHG emissions from these structures 20% by 2030 (CO General Assembly 2021). These standards, typically based on commercial buildings' energy use intensity, help to capture the ongoing energy consumption of existing buildings. This can help ensure that buildings are being operated efficiently and, if not, can identify adjustments and investments that will improve energy performance. Cities that have adopted such requirements include New York City, Washington, DC, Boulder, and St. Louis. Some jurisdictions are also supplementing energy consumption metrics with carbon and GHG emissions metrics. For instance, New York City's Climate Mobilization Act requires buildings of more than 25,000 square feet to cut their carbon emissions by 40% from 2005 levels by 2030 and by more than 80% by 2050. This legislation includes sizable fines for failure to meet the requirements (New York City Council 2019).

Strengthen Industrial Sector Efficiency

Accounting for 40% of U.S. GHG emissions, the industrial sector is especially in need of immediate decarbonization solutions if the United States is to meet its climate goals. The sector consumes more energy than any other end-use sector, and its energy use is projected to grow nearly twice as fast as any other end-use sector's between 2020 and 2050 (EIA 2021a). Energy efficiency has a major role to play in decarbonizing manufacturing facilities, with analysis by ACEEE estimating it has the potential to cut 15% of industrial emissions through fairly simple and inexpensive modifications to industrial facilities, like strategic energy management and smart manufacturing (Nadel and Ungar 2019). Industrial energy efficiency also saves more energy per program dollar than any other customer segment, thus representing a major lost opportunity for many states (ACEEE 2019b).

Addressing this sector has been a challenge for policymakers in many states due to a variety of barriers, including the failure of traditional utility business models to incentivize efficiency, policies allowing large industrial customers to opt out of ratepayer-funded efficiency programs, high upfront costs and competitive risk associated with large capital projects, and lack of detailed energy consumption data and in-house technical expertise at many industrial facilities (DOE 2015; Whitlock, Elliott, and Rightor 2020). But states are uniquely suited to improve and strengthen availability of existing efficiency resources for industrial customers, support the introduction of new ones, and coordinate and connect stakeholders to increase technical assistance and knowledge sharing. Several strategies and examples are included below.

Foster collaborative opportunities between large customers and utilities to identify energy savings: Industrial energy efficiency is often an area of untapped potential for states because even though it is among the lowest-cost sources of energy efficiency, many large customers opt out of participating in ratepayer-funded programs. As of 2021, more than a dozen states allow large customers to opt out of programs, and some, such as Illinois, exempt large customers altogether (Berg et al. 2020). Regulators can work with utilities to design inclusive policies that tailor programs to the unique needs of these customers through measures like prescriptive and custom incentives and provision of technical assistance (SWEEP 2021). In cases where such utility resources are unavailable, policymakers should consider opportunities to enable these customers to self-direct efficiency funds. Vermont, for example, offers several self-direct options, including an Energy Savings Account Program that allows customers that pay an Energy Efficiency Charge (EEC) in excess of $5,000 per year to use a portion of their EEC to self-administer energy efficiency projects in their facilities (Vermont DPS 2021).

Promote information sharing and collaborative forums: State energy offices can also work with industry and stakeholders to facilitate knowledge sharing through workshops and working groups that tackle energy issues like improving data access and identifying technical and policy barriers (ACEEE 2019b). To help industrial organizations in the state improve energy performance through behavioral changes at their operations, the Colorado Energy Office launched the Colorado Industrial Strategic Energy Management program in early 2019. Through educational workshops and energy coaching, the program helps participants establish energy management system elements such as policies, teams, and employee engagement processes that yield facility-wide savings.

Connect industrial facilities to technical assistance: State energy offices can also provide direct technical assistance to manufacturing and industrial facilities, connect them to existing resources, or provide supplemental state funding to expand the strength of such resources. Through the Department of Energy-Funded Industrial Assessment Centers (IACs), teams located at 35 universities around the country conduct energy assessments to identify opportunities for improving energy efficiency, reducing waste, and increasing productivity through changes in processes and equipment (DOE 2021). There are opportunities to leverage state and local funds to further strengthen IAC resources, expand their footprint, and reach additional customers with energy assessments. States can also ensure that industrial facilities are connected to additional federal resources, including the U.S. Department of Energy's 50001 Ready program, which helps facilities establish an energy management system, and CHP Technical Assistance Partnerships, regional services that help facilities overcome barriers to combined heat and power adoption.

ENERGY EFFICIENCY POLICIES THAT ADVANCE EQUITABLE DECARBONIZATION

In addition to the many important grid benefits of saving energy described above, efficiency also provides a wide-ranging abundance of other benefits supporting local economies and workforces, the environment and air quality, and customer health and comfort. However, these impacts are often overlooked and neglected in efficiency policymaking and planning, resulting in lost opportunities to maximize their value, to see that they extend to those most in need, and to address economic, health, and pollution inequities. Successful climate policy must take deliberate steps to highlight these benefits, better understand how they are distributed among customers, and make sure they reach historically marginalized communities. This is important given that increasing customer participation is critical to achieving a full clean energy transition, and customer motivation goes beyond energy bill savings. This section describes these challenges and policy opportunities, which are listed in Table 99.

Table 9. Energy efficiency policies advancing equity in clean transportation and buildings

Policy areas	Specific policies and sub-policies
Policies to address transportation burdens	• Make EVs accessible to all through rebates, goals, and funding streams targeting low-income, economically distressed, and environmental justice (EJ) communities. • Incorporate spending carve-outs or funding adders for low-income, economically distressed, and EJ communities in state and utility EV planning. • Encourage access to EV charging infrastructure and clean, affordable public transit for high-need communities through development incentives and planning processes that encourage siting in underserved areas.
Policies to address household energy burdens	• Establish stakeholder processes to better understand low-income sector needs. • Set minimum spending/savings goals for energy efficiency programs serving low-income and marginalized households. • Offer enhanced fuel-switching incentives for low-income customers, and pilot alternative rate designs and/or rate protection solutions. • Develop equity-related metrics and reporting frameworks. • Leverage efficiency programs to remedy health inequities by valuing avoided health costs in program screening. • Identify opportunities for expanded health–energy partnerships that jointly deliver efficiency, health, and safety by braiding funding streams, increasing participation, and expanding services to reduce deferral rates.

Policies to address transportation burdens

Low-income and environmental justice communities have long suffered from structural inequities in land use and transportation planning decisions. These communities also face disproportionately higher transportation costs, with research showing that average spending on transportation among low-income households within metropolitan areas can be as high as 30% of household income, compared with 20% for the larger population (Haas et al. 2006). Gasoline cost burdens for low-income households are more than three times larger than for higher-income households (Vaidyanathan, Huether, and Jennings 2021). Low-income individuals are also more likely to live in areas with higher exposure to air pollution from transportation and industrial sources and are likely to have less access to high-quality and frequent transit options (Valentine 2020; Spieler 2020). The impacts of COVID-19 have exacerbated these inequities as these communities suffer from higher rates of asthma, are less likely to be able to work from home, and are more likely to rely on public transportation to get to work. These inequities are further complicated by pandemic-driven reductions in ridership from COVID-19 and falling revenues that have prompted transit agencies to consider drastic cuts in services (Citizens Utility Board 2020; Anderson 2016; Goldbaum and Wright 2020). The race among states to electrify and decarbonize the transportation sector has enormous implications for these communities, with the potential to correct these imbalances or further exacerbate injustices.

The potential societal benefits of electrification have been well documented, and given the air pollution impacts disadvantaged communities face, they stand to gain substantially from transportation decarbonization initiatives. However, if these policies are not designed with a clear understanding of the issues facing low-income and EJ communities and deliberate measures to provide redress, there's a severe risk that many will be left further behind (Huether 2021). Risks include rising electricity costs if EV rate designs push higher costs onto those who cannot afford EV ownership. Inequitable policies also risk excluding these households from EV deployment measures or incentives by failing to account for affordability challenges that may prohibit their participation (Howard et al. 2021).

ACEEE's *State Transportation Electrification Scorecard* highlights state progress on best-practice policies addressing these customers. These include investment carve-outs, goals, and funding streams intended to help increase uptake of EVs among certain households and neighborhoods. For example, New York's EV Make-Ready Initiative, which aims to deploy more than 50,000 EV charging stations by 2025, includes $206 million set aside to benefit low-income and economically distressed communities (Office of the Governor of New York 2020). In addition to income-eligible rebates, states can offer swap programs to facilitate replacement of ICE vehicles with EVs or other clean energy mobility solutions. Clean Cars 4 All is a program offered to lower-income California drivers to replace an older, high-polluting car with a zero- or near-zero-emission vehicle.

States can also encourage public charging station development in high-need areas with discounts for local residents that stand to benefit the most in terms of health and affordability (Citizens Utility Board 2020). California's 2018 statewide transportation electrification plan, for example, has motivated the state's IOUs to integrate equity considerations within EV investment decisions. San Diego Gas & Electric (SDG&E), for example, includes a goal of deploying 25% of electric vehicle supply equipment (EVSE) in low-income and disadvantaged communities.

Ensuring access to clean, affordable public transit is also critical. ACEEE's *State Energy Efficiency Scorecard* recognizes states' efforts to mitigate the impacts that sprawl has had in geographically isolating low-income communities and separating them from efficient and accessible transportation. Policy options include providing incentives to developers who set aside a fixed percentage of low-income housing in transit-served areas. Similarly, proximity to transit services is a key measure states should consider in disbursing federal low-income tax credits to qualifying property owners, ensuring that low-income communities are served by a variety of transportation alternatives (Berg et al. 2020).

Policies to address household energy burdens

The unique energy challenges faced by low-income households and marginalized communities have been well documented by ACEEE and others (Drehobl and Ross 2016; Drehobl, Ross, and Ayala 2020; Ma et al. 2019). Due in part to systemic economic and social exclusion, such customers often live in older, poorly insulated homes with aging, inefficient heating systems (Cluett, Amann, and Ou 2016). These customers also often reside in rental properties, where they tend to have little control over energy-related decisions like purchasing efficient heating/cooling systems and weatherization measures, let alone other advanced energy upgrades such as solar or storage.[45]

Without inclusive policies that consider these customers in clean energy plans and remove barriers to program access, states risk stranding historically underserved households and regions while failing to meet their climate goals. Implementing plans without concern for equity also risks exacerbating unequal energy burdens. For example, as efficient heat pump technology becomes increasingly popular and cost competitive relative to fossil fuel heating, customers unable to easily electrify would remain dependent on natural gas as per-unit delivery costs increase alongside electrification-driven reductions in overall gas sales (Shipley et al. 2021).

Policies to strengthen participation in energy efficiency programs among low-income customers have been in place for years. These have begun to evolve more recently as states have increasingly embraced equity as a priority and in many cases have introduced new

[45] As a result, 67% of low-income households spend more than 6% of their income on their energy bills, compared with 25% of all households nationally. However, ACEEE research has also found that low-income weatherization and energy efficiency retrofits can reduce household energy burdens by 25% on average (Drehobl, Ross, and Ayala 2020).

opportunities for stakeholder participation, information exchange, and performance metrics to track progress. Roughly 20 states across the country have set savings goals or minimum required levels of spending on low-income energy efficiency programs through state legislation, regulations, or commission orders (Berg et al. 2020). Most states have also adopted adjustments to utility program cost-screening rules that recognize the additional benefits that efficiency delivers to income-qualified customers, either by specifically calculating non-energy benefits, approximating their value through multiplicative adders, or providing cost-effectiveness screening exemptions.

States and utilities are also taking additional steps to ensure that the benefits of efficient electrification extend to all customers, such as offering enhanced fuel-switching incentives to income-qualified customers. Examples include the Colorado Weatherization Assistance Program's recent pilot to install air-source heat pumps, which will support building electrification for income-qualified homeowners, both now through direct install and in the future once its impacts are better understood. The program is also intended to help build heat pump expertise across the state and support electrification workforce development. In Maine, low-income customers qualify for a higher heat pump rebate under the Affordable Heat Initiative than the standard Home Energy Savings Program rebate (Efficiency Maine Trust 2020).

New York State has also taken important steps to strengthen its delivery of programs to low- and moderate-income (LMI) communities in recent years, driven in part by efforts to greatly scale up efficiency to support zero-carbon goals. A 2018 Accelerated Efficiency Order directed the development of a statewide coordinated LMI portfolio, requiring that at least 20% of efficiency funding be allocated to LMI activities, with 40% of those funds going toward multifamily programs (NY PSC 2018). Additionally, in mid-2020 a new statewide framework was introduced to invest $880 million through 2025 to improve access to energy efficiency and clean energy measures among LMI and multifamily customers, including building electrification measures, and to support further research and analysis of institutional barriers for LMI communities. The framework also includes stronger customer outreach and engagement and a new, web-based customer hub platform anticipated in 2021, NY Energy Advisor, to provide streamlined access to LMI programs. Performance metrics will measure progress—including not just energy and carbon savings but also annual and lifetime bill savings and customer awareness of portfolio initiatives to support the Climate Leadership and Community Protection Act—while ensuring that its goals are reached in a just and equitable manner.

The COVID-19 pandemic has highlighted how adverse living conditions can disproportionately affect communities of color. According to the Centers for Disease Control and Prevention, Black Americans are almost three times more likely than white Americans to be hospitalized for COVID-19 and almost twice as likely to die from it (CDC 2021b). These disparities underscore the well-documented array of health risk factors that communities of color experience at higher rates, including discrimination, barriers to health care access leading to higher rates of preexisting health conditions, occupational risks, and lower housing quality and stability (CDC 2021a).

Housing, health, and energy efficiency are deeply intertwined, and energy-saving programs can help directly address housing inadequacies that may pose health risks (Hayes, Kubes, and Gerbode 2020). Improving ventilation and insulation and sealing leaky doors and windows can reduce indoor air pollution, moisture, and mold as well as infiltration by pests and can provide protection against extreme temperatures. Programs providing these benefits can also address basic safety concerns such as the presence of radon and the need for smoke and carbon monoxide detectors and handrails.

While program administrators are increasingly recognizing the health benefits of efficiency, inclusion of these benefits in utility programs' cost-effectiveness tests is not standard practice, posing a significant barrier to implementation.[46] According to conservative estimates by ACEEE, existing weatherization programs could save more than $228 million in avoided health harms over just one year—and $2.9 billion over 10 years—through incorporation of just a few health-focused interventions, specifically efforts to reduce asthma, hypothermia, and heat stress (Hayes, Kubes, and Gerbode 2020).

Improved quantification of these types of benefits in program planning and screening—which notably would accrue disproportionately to more vulnerable, high-risk groups—could empower administrators to work with the health sector to expand the reach of programs and use resources more effectively. Highlighting these benefits can also expand their appeal to a wider audience and increase participation by both low-income households and other customers as well (Hayes, Kubes, and Gerbode 2020). It can also help bring resources to address the critical structural, health, and safety issues that can disqualify certain homes from receiving weatherization services and contribute to high deferral rates. These deferred homes and their owners—often those most in need of help—are denied services due to the exact same unsafe conditions they need help addressing. Recognizing these barriers, some

[46] As of 2018, ACEEE research found that only nine states account for participant health benefits in cost-effectiveness tests, most of which have done so through a generic multiplicative "adder" to approximate health/safety benefits (ACEEE 2018).

states have stepped up resources to provide added support for homes with structural issues. For example, in Massachusetts, Mass Save ratepayer-funded programs provide about $1 million annually to the Low-Income Energy Affordability Network (LEAN) specifically for weatherization barriers (Bourguet and Faesy 2020). And the Minnesota ECO Act allows a portion of utility energy efficiency funds to be spent on pre-weatherization measures, such as asbestos remediation and updating of old wiring.

Conclusions and Recommendations

As the list of states adopting 100% clean energy and emissions reduction targets continues to grow, strategically employing energy efficiency in a comprehensive way that reduces power sector electricity consumption and peak demand, supports electrification of fossil fuel end uses, and equitably extends clean energy benefits to all customers will be critical to delivering cost-effective GHG savings.

Our review highlights diverse policy examples from states such as Minnesota, New York, and Virginia that have demonstrated growing efforts to expand energy efficiency programs in support of state climate plans and in certain cases fully align them as part of an integrated statewide strategy. These efforts include policies that expand savings targets and improve and refine measurement and tracking of efficiency's grid and customer benefits. They also include critical updates to antiquated utility rules that may impede or fail to fully serve efforts to achieve maximal multi-fuel savings and carbon reductions made possible by beneficial electrification. States are also working to strengthen inclusion of marginalized communities through equity-focused planning that makes it easier for historically overlooked customers to participate in, contribute to, and enjoy the benefits of a clean energy transition. For additional state policy discussion, see the state profiles appearing in Appendix B.

At the same time, it has been well documented that utilities and states are not currently on track to meet their climate goals, meaning there are important opportunities for energy efficiency to help advance progress and move states closer to reaching their climate targets (EDF 2020; Romankiewicz, Bottorff, and Stokes 2021). States, utilities, and regulators should review existing policies and assess the degree to which efficiency has been integrated and incentivized as a core strategy and least-cost resource within the power sector to reduce long-range supply investment costs. Pairing efficiency with renewables, storage, and demand response will provide additional opportunities to improve cost-effectiveness by reducing measure costs and optimizing grid value during periods of peak demand. Doing so will be essential to help mitigate costs and challenges associated with the projected increase in grid demand from strategic electrification of the buildings and transportation sectors.

To maximize the potential for energy efficiency to support decarbonization efforts within an optimized framework, we offer the following recommendations:

ENERGY EFFICIENCY POLICIES SUPPORTING A CES

- Define and stipulate the priority role of energy efficiency within CES and emissions reduction standards. Consider requirements to support CES and emissions reduction goals with all cost-effective energy efficiency.
- Harmonize and coordinate efficiency goals with those described in the CES. The majority of states reviewed have established a stand-alone EERS distinct from their CES. This approach offers accounting simplicity and the flexibility to separately adjust savings targets, criteria, and metrics as conditions change. States can also combine efficiency and clean energy requirements into a unified GHG or clean energy standard or encompass them within a single policy by establishing resource-specific sub-targets.
- Set complementary policies to advance energy efficiency in state policy and support other strategic state priorities such as reducing seasonal peak demand, lowering costs, improving grid flexibility and reliability, reducing carbon and other air pollutant emissions, and strengthening market penetration of beneficial technologies like energy-efficient heat pumps.
- Strengthen and standardize progress-reporting practices to ensure they are transparent, publicly accessible, and aligned with state renewable energy and GHG reduction goals.
- Establish and adequately fund an energy efficiency resource standard, setting multiyear utility savings targets. Incorporating a multiple-goal framework within an EERS can enable policymakers to target and track progress toward additional state priorities.
- Recognize that most utilities have a very different inherent interest regarding electrification versus customer energy efficiency, and ensure that electricity savings goals and business model reforms are in place to adequately incentivize utilities to pursue ambitious customer energy efficiency.
- Ensure that utilities fully identify and value energy efficiency as a grid resource in potential studies and integrated resource planning processes, to accurately quantify achievable savings and peak demand reductions. Pair this with updates to cost-effectiveness screening practices that align with the *NSPM*, and create clear price signals for consumers through time-varying rates or compensation mechanisms. Studies should consider time and locational impacts and high-electrification scenarios to maximize avoided costs of system-wide and local generation,

transmission, and distribution. Consider opportunities for pairing efficiency with demand response, storage, and renewables to improve cost-effectiveness.

ENERGY EFFICIENCY POLICIES TO SUPPORT EMISSIONS REDUCTION GOALS

- Support strong EERS policies to promote immediate and cost-effective emissions reductions in the buildings sector.
- Strengthen transportation electrification planning and investment with binding statewide targets and consumer incentives for EV adoption. Support EV charging infrastructure build-out by establishing policy directions to encourage utility and third-party investment.
- Set targets to reduce VMT through policies like smart growth principles and transportation emissions goals.
- Define energy efficiency with an expanded scope that encompasses all savings achieved, including those resulting in net GHG reduction benefits from efficient fuel-switching measures like electrification. Support fuel-neutral goals with guidance clarifying acceptable conditions under which funds can be used toward fuel switching.
- Prioritize policies and programs that reduce natural gas consumption, including beneficial electrification, appliance standards, DSM program investment, and refinement of cost-effectiveness tests to accurately value the present and future benefits of reducing natural gas use.
- Adopt advanced energy efficiency codes and standards to accelerate high-efficiency construction like net-zero and zero-energy-ready buildings. Ensure that programs to install heat pumps in existing buildings include efforts to ascertain that the buildings are energy efficient.
- For programs and other efforts to weatherize homes and buildings, integrate efforts to install heat pumps in existing buildings where appropriate (e.g., when current cooling and heating equipment needs replacement).
- Support efforts to strengthen industrial sector efficiency by fostering collaborative opportunities between large customers and utilities and connecting industrial facilities to technical assistance. Expand programs focused on industrial efficiency savings to include broader decarbonization opportunities such as use of heat pumps and other electrification technologies; renewable energy; green hydrogen; and carbon capture, utilization, and storage.

Energy efficiency policies to support equitable decarbonization

- To bring about a clean energy transition that meets 100% of goals, extend participation and resulting benefits to all customers, including historically underserved and marginalized communities.
- Adopt policies that reduce transportation burdens among low-income and disadvantaged households by expanding and improving access to clean transportation. These policies include rebates, goals, and funding streams to make EVs and public transit more accessible for these communities.
- Adopt policies that reduce household energy burdens. Extending program benefits to historically marginalized households can be achieved by creating spending and savings carve-outs within EERS goals and offering enhanced incentives for low-income customers.
- In utility planning processes, integrate stakeholder engagement and analysis that prioritizes community needs and establishes equity-related metrics and reporting frameworks to ensure accountability.
- Prioritize opportunities to leverage efficiency programs that remedy health inequities by valuing avoided health costs in program screening, building health–energy partnerships, and expanding services to reduce deferral rates.

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Appendix A. Relevant State Legislation and Executive Orders

Arizona

- Clean electricity standard: ACC Docket No. RU-00000A-18-0284. *Formal rulemaking ongoing as of June 2021*.
- Emissions reduction: EO 2005-02. documentcloud.org/documents/4953196-Arizona-Executive-Order-2005-02.html.

California

- Clean electricity standard: SB 100. leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180SB100.
- Emissions reduction: EO B-55-18. www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf.

Colorado

- Clean electricity standard: SB 19-236. leg.colorado.gov/bills/sb19-236.
- Emissions reduction: HB 19-1261. leg.colorado.gov/bills/hb19-1261.
- Emissions reduction: HB 19-1313. https://leg.colorado.gov/bills/hb19-1313.

Connecticut

- Clean electricity standard: EO 3. portal.ct.gov/-/media/Office-of-the-Governor/Executive-Orders/Lamont-Executive-Orders/Executive-Order-No-3.pdf.
- Emissions reduction: PA 08-98. www.cga.ct.gov/2008/act/pa/2008pa-00098-r00hb-05600-pa.htm.

Delaware

- Emissions reduction: EO 41. archivesfiles.delaware.gov/Executive-Orders/Markell/Markell_EO41.pdf.

District of Columbia

- Clean electricity standard: B22-094. lims.dccouncil.us/downloads/LIMS/40667/Signed_Act/B22-0904-SignedAct.pdf.
- Emissions reduction: Sustainable DC 2.0 Plan. www.sustainabledc.org/wp-content/uploads/2019/04/sdc-2.0-Edits-V5_web.pdf.

Florida

- Emissions reduction: EO 07-127. www.fsec.ucf.edu/en/media/enews/2007/pdf/07-127-emissions.pdf.

Hawaii

- Clean electricity standard: HB 2182. www.capitol.hawaii.gov/session2018/bills/HB2182_CD1_.htm.
- Emissions reduction: HB 2182. www.capitol.hawaii.gov/session2018/bills/HB2182_CD1_.htm.

Louisiana

- Emissions reduction: EO JBE 2020-18. gov.louisiana.gov/assets/ExecutiveOrders/2020/JBE-2020-18-Climate-Initiatives-Task-Force.pdf.

Maine

- Clean electricity standard: LD 1679. legislature.maine.gov/bills/getPDF.asp?paper=SP0550&item=1&snum=129.
- Emissions reduction: LD 1679. legislature.maine.gov/bills/getPDF.asp?paper=SP0550&item=1&snum=129.
- Emissions reduction: EO 10. www.maine.gov/governor/mills/sites/maine.gov.governor.mills/files/inline-files/Executive%20Order%209-23-2019_0.pdf.

Maryland

- Emissions reduction: SB 323. mgaleg.maryland.gov/2016RS/chapters_noln/Ch_11_sb0323T.pdf.

Massachusetts

- Emissions reduction: S. 9. malegislature.gov/bills/192/S9.

Michigan

- Emissions reduction: ED 2020-10. www.michigan.gov/whitmer/0,9309,7-387-90499_90704-540278--,00.html.

Minnesota

- Emissions reduction: Minnesota Statue 216H.02. www.revisor.mn.gov/statutes/cite/216H.02.

Nevada

- Clean electricity standard: SB 358. www.leg.state.nv.us/App/NELIS/REL/80th2019/Bill/6651/Text.
- Emissions reduction: SB 254. www.leg.state.nv.us/App/NELIS/REL/80th2019/Bill/6431/Text.

New Hampshire

- Emissions reduction: EO 2007-3. www.des.nh.gov/organization/divisions/air/tsb/tps/climate/action_plan/documents/nhcap_final.pdf.

New Jersey

- Clean electricity standard: EO 28. nj.gov/infobank/eo/056murphy/pdf/EO-28.pdf.
- Emissions reduction: N.J.S.A. 26:2C-37. www.nj.gov/dep/enforcement/docs/air/Air%20Pollution%20Act.pdf.

New Mexico

- Clean electricity standard: SB 489. www.nmlegis.gov/Sessions/19%20Regular/final/SB0489.pdf.
- Emissions reduction: EO 2019-003. www.governor.state.nm.us/wp-content/uploads/2019/01/EO_2019-003.pdf.

New York

- Clean electricity standard: SB 6599. legislation.nysenate.gov/pdf/bills/2019/S6599.
- Emissions reduction: SB 6599. legislation.nysenate.gov/pdf/bills/2019/S6599.

North Carolina

- Emissions reduction: EO No. 80. files.nc.gov/governor/documents/files/EO80-%20NC%27s%20Commitment%20to%20Address%20Climate%20Change%20%26%20Transition%20to%20a%20Clean%20Energy%20Economy.pdf.

Oregon

- Clean electricity standard: HB 2021 (2021). https://olis.oregonlegislature.gov/liz/2021R1/Downloads/MeasureDocument/HB2021/Enrolled.
- Emissions reduction: HB 3543 (2007). https://olis.oregonlegislature.gov/liz/2007R1/Downloads/MeasureDocument/HB3543/Enrolled.

Pennsylvania

- Emissions reduction: EO 2019-01. www.oa.pa.gov/Policies/eo/Documents/2019-01.pdf.

Puerto Rico

- Clean electricity standard: SB 1121. aeepr.com/es-pr/QuienesSomos/Ley17/A-17-2019%20PS%201121%20Politica%20Publica%20Energetica.pdf.

Rhode Island

- Clean electricity standard: EO 20-01. governor.ri.gov/documents/orders/Executive-Order-20-01.pdf.
- Emissions reduction: §42-6.2-2. webserver.rilin.state.ri.us/Statutes/TITLE42/42-6.2/42-6.2-2.HTM.

Vermont

- Emissions reduction: HB 688. legislature.vermont.gov/bill/status/2020/H.688.

Virginia

- Clean electricity standard: HB 1526. lis.virginia.gov/cgi-bin/legp604.exe?201+sum+HB1526.
- Emissions reduction: SB 94. lis.virginia.gov/cgi-bin/legp604.exe?201+sum+SB94.

Washington

- Clean electricity standard: SB 5116. lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bills/Session%20Laws/Senate/5116-S2.SL.pdf.
- Emissions reduction: RCW §70.235.030. apps.leg.wa.gov/rcw/default.aspx?cite=70.235.020.
- Emissions reduction: SB 5126 (Washington Climate Commitment Act). lawfilesext.leg.wa.gov/biennium/2021-22/Pdf/Bills/Session%20Laws/Senate/5126-S2.SL.pdf?q=20210602132539.

Wisconsin

- Clean electricity standard: EO 38. content.govdelivery.com/attachments/WIGOV/2019/08/16/file_attachments/1268023/EO%20038%20Clean%20Energy.pdf.

Appendix B. State Profiles

The following section provides an overview of current climate policies in several geographically contrasting states. It also reviews current strategies policymakers have established to deploy efficiency in support of climate goals and discusses opportunities to improve and better coordinate energy-saving solutions with respect to these goals.

NEW YORK

New York has long shown leadership in driving utility sector energy efficiency programs, first adopting an energy efficiency resource standard in 2008 and in recent years greatly strengthening savings targets in support of net-zero climate goals. The state has consistently ranked in the top 10 of ACEEE's *State Energy Efficiency Scorecard* and since 2016 has ranked in the top five on three occasions.

The state's approach to scaling up clean energy and energy efficiency has been undergoing a dramatic transformation since the introduction of the state's signature energy policy, Reforming the Energy Vision, with a focus on reframing the state's utility business model to better leverage markets and private capital. This has included ramping up clean energy targets in recent years, most notably in the state's Climate Leadership and Community Protection Act (CLCPA), signed into law in 2019 by Governor Andrew Cuomo. The CLCPA established ambitious economywide GHG emissions reduction targets as well as a CES calling for 100% carbon-free electricity by 2040 (New York State Assembly 2019). The state's emissions reduction goal is 100% by 205, with an interim target of 40% reduction by 2030, relative to a 1990 baseline year.

Importantly, this law also codified the statewide energy efficiency target of 185 TBtus of total annual savings in 2025, expressed in site Btus and covering buildings and industry.[47] This goal had previously been set forth in the state's *New Efficiency: New York* white paper, which found that energy efficiency could deliver nearly one-third of the GHG emissions reductions needed to meet the state's 40% by 2030 goal (NYSERDA 2018).[48] The state's 2015 Energy Plan also established a 2030 total annual energy savings goal of 600 TBtus, expressed in

[47] "Site energy" is the amount of heat and electricity consumed by a customer as reflected on their bill; it does not include losses. "Source energy" accounts for the total amount of raw fuel required to serve that customer, including all transmission, delivery, and production losses.

[48] This translates to a reduction of more than 22 million metric tons of CO_2e annually by 2025.

source energy. These state energy savings goals were in part informed by a statewide efficiency potential study completed in 2014 (NYSERDA 2014).

EXISTING ENERGY EFFICIENCY POLICIES SUPPORTING CLIMATE GOALS

New York's efforts to align its goals for energy efficiency with those for achieving a 100% clean energy sector and eliminating GHG emissions have been among the most strongly coordinated of any state and offer a valuable model for others. Specific policy improvements of note are described in the subsections below.

ADDITION OF A FUEL-NEUTRAL SAVINGS GOAL WITH HEAT PUMP CARVE-OUT

The state's adjustment to a fuel-neutral 185 TBtus is an ongoing process that regulators are refining while the state continues to maintain resource-specific savings targets for electricity (3% by 2025) and natural gas (1.3% by 2025), recently formalized in a January 2020 PSC Order (New York PSC 2020). A key pillar of the state's fuel-neutral approach is the inclusion of a 3.6 TBtu heat pump savings target (a carve-out from the 185 TBtu goal) to be delivered through a statewide heat pump program that began in April 2020, coordinated between NYSERDA and electric utilities with funding coming from electric ratepayers (New York PSC 2020). The Order includes an interim review to provide an opportunity to adjust targets upwards if more cost-effective potential is found through in-field experience or potential studies (New York PSC 2020). These steps represent a critical evolution in the state's approach to capturing and funding energy and GHG savings, especially those that can be achieved by extending programs to provide fuel-switching electrification measures to customers who rely on delivered fuels (e.g., oil or propane).

STRENGTHENED GOAL TRACKING WITH A PUBLICLY ACCESSIBLE CLEAN ENERGY DASHBOARD

New York has also strengthened its methods of tracking progress toward goals with the 2019 introduction of a publicly accessible Clean Energy Dashboard, which reports energy and demand savings and avoided GHG emissions for both utility and other NYSERDA programs as listed in Figure 6, below. These include many state programs, such as building codes and standards, benchmarking, and lead-by-example policies, that altogether are intended to meet the state's 185 TBtu savings goal.[49] Both annual and lifetime savings for

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[49] The dashboard displays utility data from filings also posted on the NY DPS energy efficiency docket (15-00990/15-M-0252). The underlying dashboard data can also be downloaded from the Open NY data platform.

energy and GHGs are reported by utilities on a quarterly basis and differentiated by already acquired savings and those expected in the future from committed funds or planned budgets. The New York State DPS has since updated efficiency reporting guidance for utilities, such as the April 2021–issued *System Energy Efficiency Plan Annual Report Guidance* (NYS DPS 2021).

HARMONIZED EFFICIENCY AND ELECTRIFICATION THROUGH COORDINATED UTILITY PLANNING

Enabled by the new fuel-neutral MMBtu utility goal, New York has redoubled efforts to capture fossil fuel savings from fuel-switching measures that reduce consumption of unregulated fuels like propane and fuel oil. However, work is ongoing to refine savings estimates and cost-effectiveness calculations of heat pump measures. Specifically, the January 2020 Order directed staff to finalize revisions to heat pump savings estimation approaches for inclusion in the state *Technical Resource Manual* and also called for a statewide heat pump EM&V study to be completed by June 2022, in an effort to further refine savings estimation approaches.

In addition to the interim review process specified in the January 2020 Order, the DPS directed the initiation of a performance management and improvement process (PM&IP) to increase transparency in planning and facilitate knowledge sharing, ultimately to maximize performance of the energy efficiency and building electrification portfolios and improve scale, costs, and outcomes as well as clarity and predictability for market participants (New York DPS 2021). The PM&IP convenes stakeholders to identify areas of improved and critical market feedback. On the basis of the feedback provided, DPS staff have developed work plans to further investigate a range of priority issues, including better aligning the TBtu goal with desired carbon benefits and improving benefit–cost analyses (New York DPS 2021). In addition, NYSERDA plans to undertake a statewide energy efficiency and electrification potential study to be completed in 2022; this will address multiple fuel types (electricity, natural gas, oil, and propane) and will help inform the interim review process and resulting updates to efficiency initiatives.

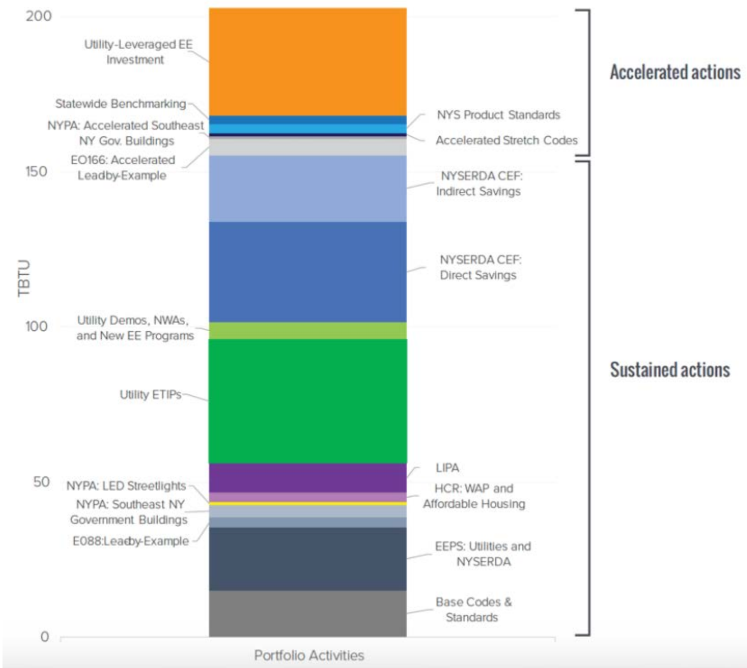

Figure 6. New York State energy efficiency activities—total TBtu savings by 2025 (cumulative annual, 2015–2025)
Source: NYSERDA. 2018. New Efficiency: New York.

Policies to curb transportation emissions and strengthen EV adoption

New York has adopted a wide range of policies aimed at reducing transportation emissions and accelerating market penetration of EVs. In 2005 the state adopted California's Low-Emission Vehicle (LEV) standards; this has aligned New York's clean car rules with commitments to strengthen emissions standards for criteria pollutants and GHGs for new passenger vehicles through model year 2025. New York has also adopted California's ZEV program, which requires increasing sales of plug-in hybrid, battery electric, and fuel-cell vehicles from 2018 to 2025. The state also offers rebates for ZEVs through NYSERDA's Drive Clean Rebate program.

New York and nine other states signed an MOU committing to coordinated action to implement their state ZEV programs and to achieve at least 3.3 million ZEVs (in total) operating on their roadways by 2025. New York's portion of that commitment is 850,000. Each state must report annually on the number of registered ZEVs, the number of public electric vehicle charging stations and hydrogen fueling stations, and available information regarding workplace fueling for ZEVs.

In addition, to help meet state ZEV goals, New York has developed a comprehensive strategy to incentivize EV ownership and make it more convenient. This has included the following:

- The Charge NY initiative is helping to get more plug-in hybrid and battery-powered cars on the road by supporting the installation of charging stations throughout the state and offering a Drive Clean Rebate of up to $2,000 for the purchase of a new electric car. As of 2020, more than 25,000 rebates had been approved, with rebates issued in every county in the state.
- The EVolve NY initiative is administered by the New York Power Authority. The authority has committed $250 million to expand public fast charging along key transit corridors (in concert with private and public partners), create new charging hubs in major cities and airports, and establish EV-friendly model communities that will encourage residents to transition to driving electric vehicles.

In February 2019 the state PSC established the DCFC Per-Plug Incentive Program to provide up to $31.6 million to support the deployment of approximately 1,075 new publicly accessible fast charging (DCFC) plugs. In 2020 the DPS announced a plan to establish a Make Ready program to support bringing power to locations that will be installing EV charging by covering up to 90% of the costs to ready a site for EV charging. The DPS also proposed that utilities incorporate EV charging scenarios into their annual capital planning processes to encourage thoughtful siting of charging infrastructure (NY Governor 2020).

STRENGTHENING CODES AND STANDARDS

In July 2019 NYSERDA published the NYStretch Energy Code–2020, the state's first voluntary, locally adoptable stretch energy code. It goes beyond the minimum requirements of the Energy Conservation Construction Code of New York State (ECCCNYS) to provide 10–12% more savings. This is achieved through stronger provisions regarding efficiency of the building envelope and lighting and by requiring connections and compatibility enabling renewable energy installations and electric vehicle charging (NYSERDA 2020). NYSERDA is promoting and supporting local adoption in dozens of jurisdictions throughout the state; it also worked with the State University of New York Construction Fund to pass a directive that all construction on its campuses must meet NYStretch provisions (ACEEE 2021).

IMPROVING LOW-INCOME PROGRAM ACCESS

The Climate Leadership and Community Protection Act (CLCPA) includes provisions to ensure that disadvantaged communities receive at least 35% of the benefits associated with the state's clean energy investments and sets a goal for 40% of the benefits from a broader set of investments to accrue to these groups as well. The CLCPA also established a Climate Justice Working Group, responsible for setting criteria for defining disadvantaged communities.

In the January 2020 Order authorizing efficiency programs through 2025, the DPS directed utilities to allocate a minimum of 20% of new energy efficiency budgets to energy efficiency initiatives for low- to moderate-income customers. It also called on utilities and NYSERDA to develop a statewide LMI portfolio and an approach to better align their respective initiatives to strengthen effectiveness and impact. In mid-2020 a new policy framework was announced to invest $880 million through 2025 to improve access to energy efficiency and clean energy solutions for LMI households. The initiative also expands ongoing efforts to advance building electrification via research and analysis of institutional barriers for LMI communities (New York Office of the Governor 2020a, 2020b).

NYSERDA is also investing more than $108 million to train more than 40,000 workers and strengthen education and training systems to build the clean energy workforce. Many initiatives will target incumbent workers, but the state is prioritizing support of future workforce needs and increasing opportunities for unemployed, underemployed, and disadvantaged workers. Disadvantaged workers include but are not limited to those residing in low- and moderate-income communities, underrepresented populations including women and people of color, and disconnected youth (ACEEE 2021).

The state's Workforce Development and Training Investment Plan (March 2020) calls for $38 million to train and develop the clean heating and building electrification workforce. This includes a new career pathway training program for new workers from priority populations; new building electrification training programs; increased training capacity for designers, installers, technical sales staff, and associated professional service workers; and increased incentives for companies hiring new heat pump workers. Operating in partnership with businesses, training providers, and communities, this investment will provide training support for more than 14,000 building industry professionals, helping meet the labor needs associated with NY Clean Heat goals to bring about long-term transformation in how buildings are heated and cooled (ACEEE 2021).

Opportunities

Since 2018, New York has adopted some of the most ambitious climate and energy efficiency targets in the nation, and it continues to develop a robust policy framework aimed to achieve these targets while also ensuring that low-income and disadvantaged households have opportunities to participate.

As identified in the state's PM&IP 2020 Forum, utilities and NYSERDA are working with stakeholders to identify and prioritize strategies to strengthen efficiency and electrification programs. These include improving analysis of the carbon benefits of efficiency measures and considering the establishment of specific carbon reduction goals to better align programs with climate objectives. The PSC has also identified the opportunity to incorporate building shell upgrades and weatherization into heat pump deployment for right-sizing equipment, in turn alleviating concerns regarding impacts to winter peak demand that can affect utility system costs (Molina et al. 2020). The PM&IP has also called for improved calculation of non-energy benefits in benefit–cost analyses to better understand the value proposition of programs (New York DPS 2021).

Other opportunities are also available to bolster efficiency efforts statewide. In 2020 Energy and Environmental Economics (E3), at the request of NYSERDA, conducted a strategic analysis of the state's decarbonization opportunities and explored additional measures needed to reach the state's 2030 and 2050 emissions targets. It showed that a mix of buildings measures including electric heat pumps, significant investment in efficient insulation and building shells, and flexible loads could reduce sector energy demand 55–59% by 2050 and cut sector GHG emissions 85–93%. Looking beyond the state's 2025 savings target of 185 TBtus—as well as the 2030 achievable savings potential of 600 TBtus assessed in the state's 2015 efficiency potential study—policymakers will want to harmonize future targets with these achievable pathways for reducing building demand on track to meet GHG targets. Pairing this approach with a statewide building energy performance standard, similar to that currently in place for Washington State, can spur building owners to make measurable improvements to reduce energy consumption over time. New York City, for example, has set emissions caps requiring buildings larger than 25,000 square feet to cut carbon emissions at least 40% by 2030 and 80% by 2050.

The E3 report also acknowledged that despite clean car standards and other policies listed above, transportation emissions account for 36% of New York's GHG pollution, and levels have risen 25% since 1990. While transportation electrification is critical to slashing emissions from the sector, an estimated 53% of light-duty vehicles sold in New York in 2020 will still be on the road in 2035, so policies must also reduce fuel consumption in existing ICE vehicles, which will continue to dominate the roads for years to come (Synapse 2019). Analysis from E3 as well as Synapse and the Sierra Club have found that a significant reduction in VMT will be necessary in the coming decades. E3 modeled VMT reduction scenarios of 3% by 2030 and 9% by 2050 as part of its analysis of policies needed to meet carbon neutrality by mid-century. Synapse and Sierra Club modeled a more ambitious goal to cut VMT of light-duty vehicles by 7.5% in total between 2020 and 2035 in service of a recommended interim goal of reducing motor vehicle emissions 55% from 1990 levels by 2035. New York State previously (in 2008) adopted a VMT reduction target aimed at a 10% decrease in 10 years. Currently no VMT target is in place, though state infrastructure agencies are required to ensure that public infrastructure projects are consistent with relevant smart growth criteria, pursuant to the state's 2010 Smart Growth Public Infrastructure Policy Act.

VIRGINIA

Historically, Virginia has hovered around the middle of the state rankings in ACEEE's annual *State Energy Efficiency Scorecard*, placing 25th in the most recent iteration and typically reporting savings below the national average. However, recent legislation has established new spending and savings requirements that have the state poised to usher in a new era of efficiency (ACEEE 2020a).

Virginia's Clean Economy Act (VCEA), signed into law in 2020 by Governor Ralph Northam, establishes a road map to a 100% carbon-free electricity grid by 2050. It requires that all electricity sold, not including nuclear energy, eventually come from renewable sources, with specific targets of 2045 for Dominion Energy and 2050 for Appalachian Power. It also increases investment in energy efficiency programs that serve low- to moderate-income customers from 5% to 15% of total program spending (ACEEE 2020b). In addition, the VCEA sets renewable portfolio standard targets that Dominion and Appalachian Power must accomplish in order to reach their 100% clean electricity goals on time (W. Cleveland, senior attorney, Southern Environmental Law Center, pers. comm., December 15, 2020). Also in 2020 Virginia passed SB 94, formally calling for a new state energy plan that will identify actions to achieve a net-zero carbon economy by 2045 for all sectors, including electricity, transportation, buildings, agriculture, and industry. And in 2021 the state enacted SB 1282, which requires state regulators to conduct a statewide GHG emissions inventory every four years.

Existing Energy Efficiency Policies Supporting Climate Goals

Virginia has not historically prioritized energy efficiency policies; however, changes in the state's political leadership in recent years have invigorated efforts to support its climate pledge as a member of the U.S. Climate Alliance and reduce emissions through a suite of new legislation and programs.

Adopting the State's First-Ever EERS via the Virginia Clean Economy Act

The VCEA (2020) established the state's first mandatory EERS, which requires Dominion Energy to achieve 5% energy savings and Appalachian Power to achieve 2% energy savings by 2025, relative to a 2019 baseline. These goals translate to average incremental annual savings of approximately 1.2% over four years; they are anticipated to avoid an estimated seven million metric tons of GHG emissions over the same period and continue to provide avoided emissions into the future as efficiency measures continue to save energy. The legislation also set up a process to potentially strengthen the EERS after 2025, at which point the State Corporation Commission could adjust energy efficiency targets every three years. Utilities will have to prove they are reaching those targets before they can build new fossil fuel plants (ACEEE 2020b). The VCEA also builds upon progress already initiated in response to spending provisions in the state's Grid Transformation and Security Act (GTSA) of 2018 (HB 1558/SB 966), which requires regulated utilities to invest $1.3 billion in energy efficiency by 2028, more than tripling efficiency budgets.[50]

Because the VCEA focuses primarily on decarbonizing the electric sector, opportunities remain for Virginia to align policies with the global 1.5°C warming limit suggested by the IPCC, which Virginia has pledged to support as part of the U.S. Climate Alliance. As of 2017, direct energy use in buildings accounted for about 11.5% of GHGs in the state and the industrial sector accounted for about 11%, according to Virginia's most recent GHG inventory (EIA 2020). Vehicle fuel combustion in the transportation sector accounted for about 47.5% of state GHGs (EIA 2020).

STRENGTHENING BUILDING ENERGY CODES FOR NEW CONSTRUCTION

Virginia's current statewide building energy code, which went into effect in 2018, incorporates efficiency provisions of the 2015 IECC and ASHRAE 90.1-2013 energy codes (ACEEE 2020b). The state is now in the process of reviewing the 2018 IECC energy code (C. Bast, Chief Deputy and T. Ballou, Air Data Analysis & Planning Director, Virginia Department of Environmental Quality, pers. comm., November 30, 2020; A. Christopher, Director, Energy Division, Virginia Department of Mines, Minerals, and Energy, pers. comm., November 30, 2020). Virginia operates under Dillon's Rule, which restricts certain local powers, such as adopting stricter building energy codes, without express legislative permission from the state. As a result, there have been few city-led initiatives to advance building energy efficiency. For example, Arlington has set a goal for carbon neutrality by 2050, with a plan that includes a call for more stringent building energy codes, but the city is limited in what it can do in support of the goal due to state preemption (Arlington County 2019). On the other hand, once the state passes a policy, all cities and local municipalities must adopt it.

[50] The GTSA also updated state code to clarify that efficiency programs will be considered cost effective if they pass three of the four cost–benefit tests, meaning that regulators can no longer reject programs solely on the basis of their failure to pass the Ratepayer Impact Measure (RIM) test, a regressive and misleading test that systematically undervalues energy efficiency.

LAUNCHING EFFORTS TO REDUCE TRANSPORTATION EMISSIONS AND ACCELERATE VEHICLE ELECTRIFICATION

Virginia has adopted several policies to address transportation-related efficiency, including a recently passed bill adopting California's vehicle emissions standards (Boehmer 2021). Other policies in place include devotion of significant funding to transportation efficiency initiatives, integration of transportation and land use planning (through state requirements for local comprehensive plans and the long-range statewide transportation plan VTrans), and adoption of complete streets legislation (ACEEE 2020b). In addition, the state has taken its first major steps toward vehicle electrification, earmarking $82 million of the $93.6 million in Volkswagen settlement funds it received for transportation electrification projects including electric school buses. It is also working to develop an electric vehicle charging network through EVgo, an effort now in its second year, and Volvo is working to add an all-electric line of trucks to its manufacturing facility in Virginia (C. Bast, Chief Deputy and T. Ballou, Air Data Analysis & Planning Director, Virginia Department of Environmental Quality, pers. comm., November 30, 2020; A. Christopher, Director, Energy Division, Virginia Department of Mines, Minerals, and Energy, pers. comm., November 30, 2020).

The state is also investigating utility reforms to better enable vehicle electrification; the State Corporation Commission sought information on clean energy in the transportation sector through a recent docket opened in the spring of last year. The commission plans to use this information, as well as more on grid modification, integrated storage, and distributed energy resources, to better understand transportation and its impact on the grid and to determine the best approaches for electric utilities regarding the transportation sector (C. Bast, Chief Deputy and T. Ballou, Air Data Analysis & Planning Director, Virginia Department of Environmental Quality, pers. comm., November 30, 2020; A. Christopher, Director, Energy Division, Virginia Department of Mines, Minerals, and Energy, pers. comm., November 30, 2020).

Virginia is also a participant in the Transportation and Climate Initiative (TCI), a regional collaboration of 12 northeastern and mid-Atlantic states and the District of Columbia that since 2015 has been exploring market-based policies to reduce transportation-related GHGs, such as a cap-and-invest model similar to the Regional Greenhouse Gas Initiative. Each jurisdiction is free to determine whether and how they will participate in individual projects and working groups (TCI 2021). In December 2020 the TCI released an MOU for participating states that includes a commitment to dedicate at least 35% of each jurisdiction's proceeds to underserved communities (TCI 2020). However, Virginia, along with several other states, has yet to formalize membership by signing onto the MOU.

Opportunities

Given that Virginia regulators and utilities are still in the early stages of updating rules and designing programs in support of the VCEA, it remains to be seen how the state's efficiency efforts will progress in advancing its clean electricity standard. However, there are clear areas of opportunity the state can address to improve the odds of success.

Despite the policies implemented so far, there are still gaps in current methods to achieve the goals listed in the VCEA and to reduce emissions economy-wide, and strengthened energy efficiency policies and programs can help address them. Figure 7 highlights how even under the CES enacted through the VCEA, Virginia is expected to still be relying on some carbon-emitting fuels in 2050. To meet the emissions reduction goal under the Paris Agreement that Virginia has pledged itself to, the state would need to work to significantly lower emissions in sectors beyond just the electric sector.

The VCEA replaces a previous automatic opt-out, applying to 500-kW+ customers, with a process enabling large industrial customers to opt out of utility programs only after demonstrating that they are achieving energy savings through their own internal energy efficiency measures.[51] The law raises the previous eligible customer threshold from 500 kW to 1 MW of demand and directs the commission to set rules for opting out and meeting self-direct guidelines. These rules were promulgated in a January 2021 SCC Order that sets eligibility qualifications for the exemption, such as requirements for customers to demonstrate "measurable and verifiable" energy efficiency savings in the prior five years, to annually report on the status of energy efficiency measures, and to establish a measurement and verification plan conforming to state M&V requirements. With the new rules set to go into place June 30, 2021, the state will need to maintain strong oversight of large customers' efficiency measures to see that they deliver meaningful savings. Regulators should monitor customer efforts and, depending on early results, consider options to bolster savings, including setting minimum savings thresholds and issuing clear guidelines for revoking an exemption if needed (VAEEC 2020). Regulators should also consider successful self-direct models in other states that have encouraged strong program collaboration between large customers and utilities, such as Massachusetts, where an MOU model allows both parties to negotiate and agree to multiyear energy savings goals and incentive levels (Kelly 2016).

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[51] These large customers account for an estimated one-third of the state's total retail load.

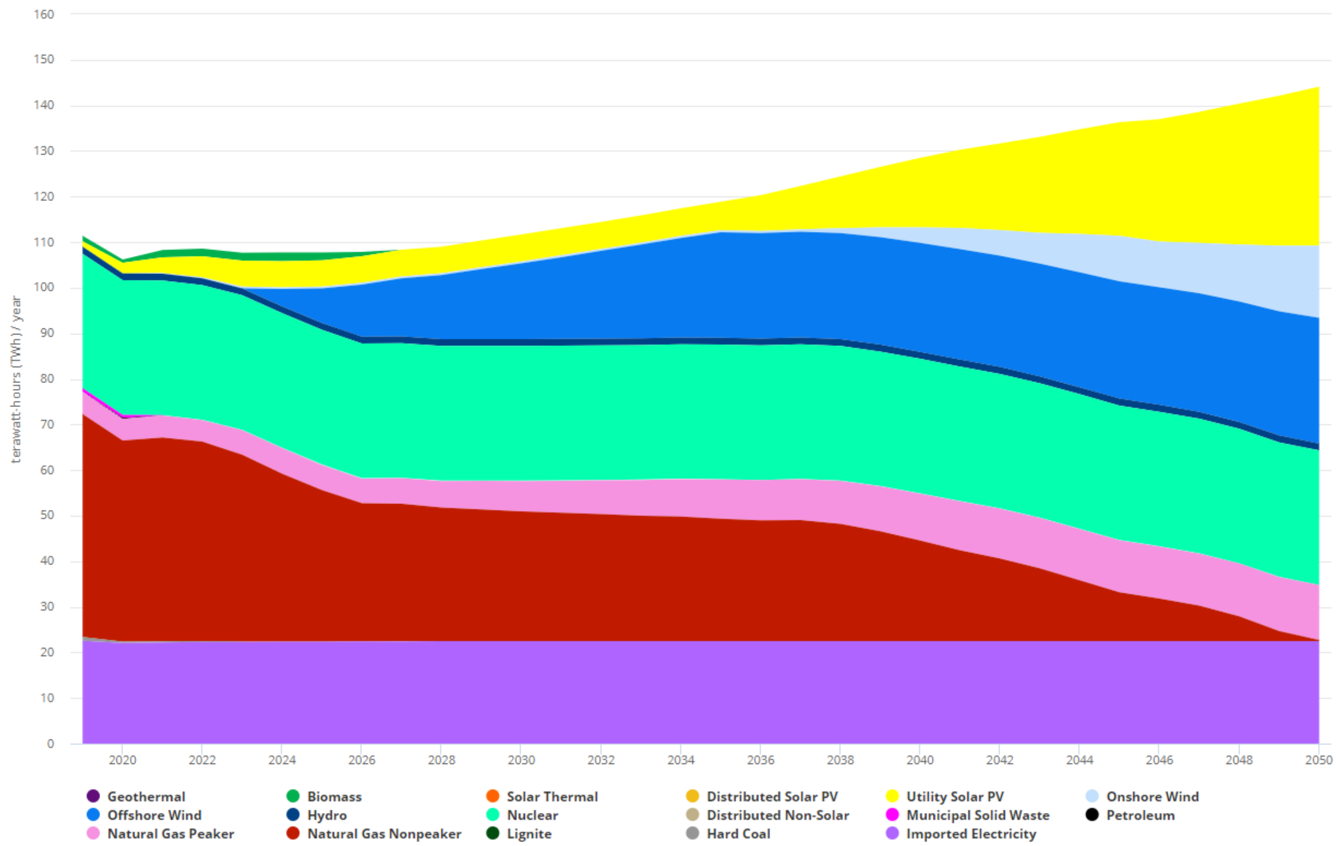

Figure 7. Projected electricity generation by source under Virginia Clean Economy Act provisions. Source: Virginia Energy Policy Simulator (EPS) created by Energy Innovation LLC and Rocky Mountain Institute.

In the buildings sector, there are opportunities to further reduce emissions through building electrification strategies, programs to encourage adoption of energy-efficient heat pumps, and incentives to enable fuel switching where applicable. This is particularly important given the already high rate of building electrification in Virginia, especially in electric space heating (Optimal Energy 2020). New York, Massachusetts, and now Minnesota all offer strong examples Virginia can look toward to step up building electrification by clarifying rules and guidelines regarding conditions in which fuel-switching incentive programs are permitted. Regulators can work with utilities to assess potential savings from building electrification, develop savings estimation approaches, and collaborate in creating a portfolio of building electrification programs.

In addition, updating and advancing Virginia's building energy codes and allowing push codes or measures in buildings by locality would help the state save energy and reduce emissions. The state is in the process of updating the 2018 IECC energy code, but in order to accelerate emissions reductions in the buildings sector, Virginia should look beyond to the 2021 IECC energy code and allow cities and municipalities to move past the state-mandated code.

In the transportation sector, Virginia is in the early stages of addressing opportunities to significantly reduce emissions through vehicle electrification. If the state is to achieve its zero-carbon goals, it will have to continue to build on its current policy momentum and pending clean car rules, especially given that the transportation sector is currently the largest producer of GHG emissions in the state (Lewis, Pollard, and Penniman 2019). Through its participation in the TCI, Virginia requires all new passenger cars and trucks sold to be electric by 2035 and 2045, respectively (Marcacci 2020). Additional legislation signed in early 2021 has set the stage for further planning efforts to slash transportation emissions. HB 2282 directs the SCC to deliver a report by May 2022 detailing utility programs that can accelerate transportation electrification. SB 1223 calls for amendments to the Virginia Energy Plan to include an EV infrastructure needs assessment to support a new transportation sector net-zero carbon target for 2045. These efforts were ongoing as of June 2021.

ACEEE's *State Transportation Electrification Scorecard* identifies several policy gaps Virginia can address to strengthen its efforts. For example, Virginia was among the 10 states ranking last in equity-supporting transportation policies, indicating that opportunities exist to strengthen engagement with low-income, economically distressed, and environmental justice communities. Examples of successful approaches include

- Designing goals and funding streams specifically to increase EV adoption and access to charging infrastructure in low-income and economically distressed communities
- Supporting the purchase of EV school buses to mitigate health impacts from youth exposure to engine particulates
- Developing inclusive processes for equitable policy and program design to ensure accountability

MINNESOTA

Minnesota has long been recognized as an energy efficiency leader among Midwest states, due in large part to strong energy savings delivered by utilities working to meet efficiency targets under the state's 2007 Next Generation Energy Act. Policymakers and advocates have been busy in recent years studying policy options and the energy savings potential of updating utility rules to promote building electrification, which culminated in May 2021 with the passing of the ECO Act, strengthening the state's EERS and lifting a previous prohibition on energy-efficient fuel switching.

While Minnesota had not established a 100% CES as of early 2021, the state has maintained a Renewable Energy Standard (RES), established in 2007, calling on state utilities to obtain 25% of electricity retail sales from renewable sources by 2025, a goal that was met in 2017. A higher renewable target of 30% by 2020 applied to Xcel, the state's largest utility, which met this target in December 2020.[52] Utilities subject to the RES must submit annual compliance filings each year with the state public utilities commission (MN Department of Commerce 2019). In 2013 the legislature adopted an additional Solar Energy Standard for the state's three largest utilities, requiring them to obtain at least 1.5% of their retail sales from solar energy by the end of 2020, with a statewide goal to reach 10% by 2030 (MN 216B.1691, subd. 2f).

The state's 2007 Next Generation Energy Act (NGEA) gave an important boost to its climate efforts by supplementing the 2007 RES with added GHG reduction targets, committing the state to an 80% decrease across all sectors by 2050 relative to 2005 levels (Minnesota Statutes 2008 § 216B.241). This includes interim goals of 15% by 2015 and 30% by 2025. The legislation also requires the Minnesota Department of Commerce (DOC) and the Minnesota Pollution Control Agency (MPCA) to deliver a biennial progress report on GHG targets, including what would be needed to achieve 2050 goals (MPCA 2021b). As of the most recent 2021 report, the state was not on track to meet its goals, with overall GHG emissions declining just 8% between 2005 and 2018. The strongest contributions have come from the power sector, in which emissions have fallen about 29% since 2005 (MPCA 2021a). The industrial, residential, and commercial sectors have fared less well: Together they accounted for a 15% increase in emissions during that time.

In 2018 Xcel, which accounts for roughly 45% of electric sales in Minnesota, went further than the state's 80% goal, announcing plans to achieve 100% carbon-free electricity by 2050 (including an interim target of 80% by 2030), making it the first major U.S. electricity provider to do so. Informed by these goals, in July 2020 the utility filed a draft integrated resource plan (IRP) outlining its 15-year electricity generation plans, including phasing out its coal plants by 2030, in pursuit of these carbon goals (Xcel Energy 2020).

EXISTING ENERGY EFFICIENCY POLICIES SUPPORTING CLIMATE GOALS

Minnesota continues to deliver the highest levels of utility savings in the Midwest and has been a consistent top 10 finisher in ACEEE's *State Energy Efficiency Scorecard*. Proposals to further transform the electricity sector around potentially heightened climate goals still await action in the state legislature, including a potential 100% CES by 2040 and net-zero carbon

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[52] Of the 30% in 2020, at least 25% must be generated by wind energy conversion systems and the remaining 5% by other eligible energy technologies, which include solar, hydroelectric, hydrogen, and biomass (Minnesota Statute 216B.1691).

emissions economy-wide target by 2050. However, in early 2021 the state legislature did mark a major achievement by passing the ECO Act (HF164), lifting a significant barrier to utility efficiency programs' ability to promote beneficial electrification. The new legislation now allows fuel switching on the condition that it results in a net decrease in source energy consumption on a fuel-neutral basis (among other criteria). The bill also includes caps on fuel-switching expenditures in order to gradually phase in the impacts anticipated to the state's propane industry (MN State Legislature 2021).

Establishing Midwest-leading levels of utility savings via NGEA EERS, with even higher savings expected under 2021 ECO Act

The 2007 NGEA established the state's EERS, which has been the primary policy driver for utility-sector energy efficiency, mandating specific energy savings goals of 1.5% of annual retail sales for electricity and natural gas.[53] Municipal and cooperative utilities are also subject to efficiency requirements, though a 2017 law modified the applicability requirements to exempt small utilities under a certain customer threshold (18 electric cooperatives and 51 municipal electric utilities). About 13% of electric load and gas sales are also exempt from efficiency programs due to the state's opt-out provision for large customers (MN Dept. of Commerce 2018).

In 2013, H.F. 729 went further, declaring energy efficiency to be the preferred energy resource and clarifying that the state goal of saving 1.5% of retail energy sales annually is a floor, not a ceiling (M.S. § 216B.2401). The statewide goal is supported by a broad range of eligible activities in addition to the state's Conservation Improvement Program (CIP), including savings from energy codes and appliance standards, market transformation activities, and efficiency enhancements to each utility's generation, transmission, and distribution infrastructure (M.S. § 216B.2401).

The long-awaited signing of the ECO Act in May 2021 strengthens the state's energy efficiency resource standard and expands the scope of energy-saving measures that can count toward efficiency goals. To start, the new law sets higher utility savings targets, increasing the 1.5% electric savings goal for investor-owned utility programs to 1.75%,

[53] These goals are supported by the electricity and natural gas utilities through the state's long-standing Conservation Improvement Program, a policy framework overseen by the state's Department of Commerce to ensure that ratepayer dollars are used effectively and that energy savings are reported accurately. The department also provides technical assistance to utilities to identify energy-saving opportunities and improve programs (MN Dept. of Commerce 2021).

though it maintains the lower goal for consumer-owned municipal and cooperative utilities subject to CIP requirements.[54] The legislation also increases the overarching statewide energy savings goal from 1.5% to 2.5% of annual retail sales of electricity and natural gas, which encompasses savings from a wide range of policies in addition to utility programs.[55] These include savings from building energy codes, appliance standards, rate design, and other efforts (MN State Legislature 2021). Also, and importantly, while the DOC previously had not tracked or regulated progress toward the broader statewide savings goal, the ECO Act now directs the department to provide reasonable estimations of progress in annual reporting.

The law also allows load management measures that reduce a customer's net annual energy consumption to count toward utility savings goals. These include services that enable customers to shift load to reduce peak demand and lower their energy bills, and measures that enable the utilities to optimize the infrastructure and generation needed to service customers and facilitate the integration of renewable energy (MN State Legislature 2021). The Department of Commerce can now also consider lifetime savings in determining cost-effectiveness, which will provide more flexibility in approving allowable measures.

Finally, the legislation opens a critical door for promoting beneficial electrification by allowing fuel-switching incentives under certain conditions. This will give the state and utilities an important pathway for accelerating adoption of high-efficiency electric heat pumps, the potential savings of which have been a subject of research by the state and clean energy advocates for several years. Additional details are provided in a following section.

CHARTING A COURSE IN UTILITY PLANS FOR STRENGTHENED SAVINGS THAT SURPASS TARGETS

The next decade is poised to usher in an era of increased investment in efficiency among Minnesota utilities as they also pursue their own clean energy and emissions reduction goals. The most recent CIP triennial plans for 2021–2023 filed by the state's electric and

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[54] The gas IOU savings goal remains at a minimum of 1%.

[55] In addition, Minnesota's Natural Gas Innovation Act (NGIA), signed in June 2021, establishes a new regulatory framework whereby natural gas utilities can implement and recover costs from a broader range of "innovative resources" that reduce or avoid GHG emissions, including biogas, renewable natural gas, hydrogen or ammonia produced using carbon-free electricity, carbon capture, strategic electrification, district energy, and energy efficiency (MN State Legislature 2021b).

natural gas IOUs in 2020 show an increase in planned savings for the near future. Xcel Energy, Minnesota Power, and Otter Tail Power have all filed annual savings goals exceeding 2.5% of sales, far surpassing the previous statutory 1.5% target.[56] Among natural gas utilities, Xcel gas also ramped up targets considerably to 1.4%, exceeding previous 1% goals. CenterPoint gas has maintained 1.2% targets, comparable to previous goals. Other gas utilities continue to target the 1% statutory minimum.

These higher targets generally align with the findings of the *Minnesota Energy Efficiency Potential Study: 2020–2029*, released in late 2018 (MN DOC 2018). It found achievable potential savings of close to 2% annually for investor-owned utilities—and potential savings well above 2% under more aggressive program scenarios. The study estimated lower achievable potential savings for cooperatives and municipal utilities. It also found that although federal lighting standards will negatively impact claimable savings, a shift toward other technologies, particularly air-source heat pumps, could eventually make up for the loss even with the state's hitherto restrictive policy framework barring fuel-switching incentives. Lifting this restriction will make available even greater levels of savings.[57]

Looking to the future in its 2020–2034 IRP (Xcel Energy 2019) and 2020 supplement, Xcel charts a path toward its goal of reducing carbon emissions 80% by 2030 and providing 100% carbon-free energy by 2050. The IRP includes plans to retire the utility's coal fleet by 2030, extend nuclear resources, aggressively deploy renewables, and utilize energy efficiency and DR, with the last 20% to be met through technologies that have not yet been developed or deployed economically. These plans, also informed by the DOC's 2020–2029 potential study, project a significant increase in energy efficiency, with savings of 2–2.5% per year.

The IRP notes this is the first resource planning cycle in which Xcel has treated load-modifying resources like efficiency, DR, and distributed generation as competing with supply-side resources in its modeling process. While previous IRPs netted out these resources at an assumed level of adoption, the new plan tested the economic impact of various bundles of efficiency and DR, assuming average costs for a given portfolio. This new modeling approach was the result of a 2019 settlement between Xcel Energy and numerous clean energy stakeholders, such as the Center for Energy and Environment (CEE). The

[56] It should be noted that Xcel's reported electric savings were 2.35% and 1.85% of sales in 2018 and 2019, respectively, indicating that past plans had underestimated potential savings from allocated budgets.

[57] The study did not calculate savings under a fuel-switching scenario.

settlement included an agreement to model bundles of energy efficiency built from data that CEE helped to collect as part of the DOC potential study, in turn resulting in significantly more energy savings than in previous plans (MN CEE 2019).

State agencies eye potential electrification from proposed policy reforms yet await legislative action to move forward

Recent studies have shown the high potential energy and carbon savings from electrifying the state's large segment of propane-fueled homes, though until the ECO Act's recent adoption, utility funding was constrained by a 2005 Minnesota DOC order prohibiting fuel-switching incentives. For example, a 2017 study by the DOC found that heating fuel savings equivalent to 2,600 GWh per year could be achieved by switching existing propane customers to air-source heat pumps while maintaining propane fuels as backup heat (MN DOC 2017). The ECO Act's signing represents the culmination of multiple planning efforts, potential studies, and work by advocates to demonstrate the benefits of making funds available to support energy-efficient fuel switching.

The ECO Act makes a variety of important revisions to the CIP statute, expanding programs to allow cost-effective load management and fuel-switching measures under certain criteria. Specifically, these measures must

- Result in a net reduction in the amount of source energy consumed, measured on a fuel-neutral basis
- Produce a net reduction in GHG emissions over the lifetime of the measure[58]
- Be cost effective from a societal perspective
- Be installed and operated in a manner that improves the consumer-owned utility's system load factor (MN State Legislature 2021)

To address concerns about the bill's potentially dramatic impact on propane interests, the law limits the degree to which fuel switching can count toward savings goals in the near term. For investor-owned utilities, there is a spending limit on eligible fuel-switching measures of 0.35% of energy sales through 2026 (MN State Legislature 2021). For municipal and cooperative utilities, efficient fuel-switching improvements may contribute 0.55% toward the 1.5% annual energy savings goal, and these utilities cannot spend more than 0.55% of

[58] To assess the efficiency of a fuel-switching improvement installed by an electric utility, the reduction in emissions must be measured on the basis of the hourly emissions profile of the electric utility, using the profile in the most recent resource plan approved by the commission (MN State Legislature 2021).

gross retail energy sales each year on fuel switching until 2026.[59] The Department of Commerce is currently determining next steps for implementation of the new statutory requirements. The department must issue new technical guidance to the utilities by March 15, 2022, related to the new criteria before the utilities can implement fuel-switching programs.

STATE AND UTILITY EFFORTS TO SUPPORT ADVANCED ENERGY EFFICIENCY CODES FOR NEW COMMERCIAL CONSTRUCTION

Recent state planning studies funded through CIP Conservation Applied Research and Development grants have looked for opportunities to harness utility efficiency programs to advance future building energy code improvements and appliance standard updates by offering code-related technical assistance to enable utilities to claim savings.

In early 2021 Minnesota published a road map to develop a codes and standards program, similar to other efforts in states like Massachusetts and Rhode Island, in order to further support the state's efficiency resource standard and its GHG reduction goals (MN DOC 2021). The state's December 2020 *C&S Roadmap* study, led by 2050 Partners, would create a pathway for utilities to claim savings from C&S-related support activities in the future. A limited code support program implemented by CenterPoint Energy and Xcel Energy commenced in 2021 with a focus on code compliance related to large, complex commercial construction projects (MN Dept. of Commerce 2020; N. Minderman, Policy and Strategy Consultant, and S. White, Manager DSM Strategy & Policy, Xcel, pers. comm., January 21, 2021). Utility stakeholders are exploring the opportunity to use the *C&S Roadmap* study to expand this into a broader program that could support efforts to advance state building energy codes to reach net zero, as was recommended in a December 2020 building efficiency work group report from the Department of Commerce and Department of Labor and Industry. That report specifically recommends that the state commercial energy code be advanced to achieve net zero by 2036 (DLI and MN Dept of Commerce 2020). The final report includes more than 50 recommendations, such as establishing evaluation protocols for the program, counting C&S program savings potential in the next state energy efficiency

[59] Of the 1.5% savings goal, 0.95% gross annual savings must come from load-reducing efficiency programs and 0.55% can come from net energy savings from either efficient fuel-switching or additional savings from efficiency programs. Munis and coops may go beyond these target levels (1.5% total savings, 0.95% energy conservation savings, 0.55% fuel-switching savings) as long as they meet the 0.95% minimum threshold for savings from traditional energy savings programs and stay within the fuel-switching spending cap of 0.55% of gross revenues.

potential study, and offering menus of compliance support options like code interpretation guidance and training and education.

TRANSPORTATION ELECTRIFICATION EFFORTS

Minnesota has celebrated some important policy achievements to advance vehicle electrification. In 2019 the governor called for creation of the Minnesota Clean Car program, which would adopt California's tailpipe and ZEV standards. While the rules have faced opposition in the state legislature, in May 2021 an administrative law judge approved them, confirming that they are needed and reasonable and comply with administrative law rules. The MPCA expects the standards would apply to vehicles beginning with model year 2025.

According to MPCA analysis, these standards would reduce GHG emissions by approximately 8.4 million tons over the first 10 years of implementation, with GHG savings growing over time to 1.2 million tons annually by 2034 as more low-emission vehicles and EVs are sold. By 2034 this would provide an approximately 3.5% reduction in statewide surface transportation GHG emission levels from 2005 and a 2.7% reduction in overall GHG emissions from transportation (MPCA 2020). Implementation of the standards also would deliver on a major recommendation in the state's 2019 *Pathways to Decarbonizing Transportation in Minnesota* report, which included a host of other proposed actions to grow the state's EV market, including offering EV incentives and increasing funding of EV infrastructure. The report also recommended a policy to evaluate emissions from transportation project construction and operations. The Minnesota Department of Transportation initiated this policy in 2020, along with guidance for transportation staff (MnDOT 2019).

OPPORTUNITIES

Minnesota has long been a standard-bearer for Midwest energy efficiency, and with the ECO Act it now stands at an important turning point as it looks to modernize energy savings programs and unleash their potential to support state decarbonization goals. Plenty of opportunities remain for the state to strengthen these efforts in line with the governor's 2019 Executive Order (19-37) seeking strategies to meet the NGEA goal to reduce emissions 80% by 2050 (MN Office of the Governor 2019). The executive order also called for plans to achieve 100% clean energy by that same year, though the governor and legislators are now seeking to accelerate this target with proposed plans announced in early 2021 for a 100% carbon-free power sector by 2040. The state's recent 2021 GHG inventory showed that the state is not on track to meet emissions goals and that emissions have actually risen since the previous report, highlighting the urgent need to act.

The ECO Act's heightened energy efficiency standard and expansion of the list of efficiency measures that can be counted toward savings goals (including fuel switching and load management) are important and pivotal updates that will allow the CIP program to unlock its potential and align it with state climate efforts. In light of the ECO Act's changes, the Department of Commerce should complete guidance for determining cost effectiveness and emissions savings of electrification measures and continually update protocols on the basis of the latest savings estimates. Development of an action plan was still underway as of early 2021, coordinated by Michaels Energy and funded by U.S. DOE, to determine next steps for policymakers and regulatory agencies to expand electrification in Minnesota where it is determined to be beneficial, including consideration of potential impacts of the ECO Act. The process convened stakeholder meetings and a technical advisory group that met throughout 2020. Key findings and recommendations are anticipated to be out in August 2021 and should inform regulatory updates (Michaels Energy 2019).

In compliance with the NGEA, the Department of Commerce has tracked and reported energy savings and estimated carbon dioxide reductions achieved by CIP programs each year for the two most recent years for which data are available.[60] The ECO Act continues this requirement and includes a call to report capacity savings from CIP as well. But there are opportunities to proactively align efficiency target setting, oversight, and reporting led by the DOC with statewide GHG goal tracking efforts, currently led by the MPCA. Stakeholders described certain advantages and defensive reasoning for maintaining some level of administrative separation between efficiency programs and other state-led climate efforts. While this may have its benefits in certain political climates, Minnesota should also look to examples in New York and Massachusetts, where regulators and utilities are developing and tracking progress toward efficiency targets in a way that directly aligns with their potential to meet climate goals. This includes setting GHG reduction sub-goals for efficiency programs and improving the visibility of results by tracking progress through a publicly accessible online dashboard. With the recently expanded 2.5% savings goal under the ECO Act, Minnesota policymakers should take steps to measure the contribution of existing and potential building energy codes, appliance standards, and other eligible measures that have gone untracked or unregulated.

There are also opportunities to align ECO Act–driven policy updates with ongoing state planning efforts to strengthen codes and standards. The recent 2021 *C&S Roadmap* issued

[60] Historical reports can be accessed here: lrl.mn.gov/mndocs/mandates_detail?orderid=1613

by the DOC offers a range of recommendations that will directly support the act's new savings goals. These include convening a now established C&S Utility Working Group and launching a utility-led statewide C&S program. Doing so should include working with an independent EM&V firm to establish recommended evaluation protocols per the *C&S Roadmap*, and working to include savings potential from C&S program activities in future energy efficiency potential studies.

These efforts should also promote a move toward achieving net-zero construction standards as soon as possible. This would align with recommendations already offered in early 2021 by the state DOC and Department of Labor and Industry to ensure that all new commercial and large multifamily construction is net zero by 2036 (DLI and MN Dept of Commerce 2020). To do so will require quickly making incremental improvements in efficiency amendments and incorporating renewable energy requirements. The Department of Commerce has recommended phasing these in beginning in 2026–2027. The state should work with stakeholders to study the optimal path forward for incorporating combinations of energy efficiency and renewable energy production, keeping in mind cost-effectiveness and stakeholder feedback and with consideration of how much flexibility should be allowed in balancing energy reduction requirements with renewable procurement (DLI and Department of Commerce 2020).

Ample opportunities are also available to accelerate emissions reductions in the transportation sector. Even under the newly adopted Clean Car rules, it's estimated that EVs will be required to make up only about 6.2–7.4% of manufacturers' light-duty vehicle sales in the state during the time frame spanning model years 2025 to 2034, a small fraction of overall light-duty vehicles. Additional steps will need to be taken to reduce emissions from remaining internal combustion vehicles. For example, as pointed out in a 2020 Move Minnesota report, Minnesota has yet to formally establish VMT targets even as statewide VMT continues to climb (Move Minnesota 2020).

ACEEE's *State Scorecard* also recognized opportunities for Minnesota to adopt smart-growth principles with a focus on more efficient integration of transportation and land use. The state has the fifth-most highway lane miles of any state in the country, even though it ranks 22nd in population and 12th in land area (Move Minnesota 2020). Amending funding priorities to elevate transit investment and walkable communities will be critical.