ACEEE Policy Brief
American Council for an Energy-Efficient Economy

An Energy Efficiency and Clean Electricity Standard

Managing Demand Is Key to a Cheaper and More Equitable Carbon-Free Electric Grid

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KEY FINDINGS

- Energy efficiency is needed to meet carbon-free electricity goals because it helps lower costs, integrate variable resources, ensure that all communities benefit from the transition to a carbon-free grid, and offset added demand as we electrify energy uses.
- An Energy Efficiency and Clean Electricity Standard (EECES), as proposed by President Biden, is a critical policy tool to achieve a carbon-free electric grid.
- Efficiency performance standards have a strong track record: States with such a standard on average deliver four times the level of electricity savings (1.2% new savings per year) relative to those without (0.3%).
- Ramping up energy savings now is important because fossil fuels still account for roughly three-fifths of utility-scale electricity generation in the United States.
- Most states use separate savings and supply targets to ensure both savings and supply are used to clean the grid, but a joint target also could work.

Rapidly decarbonizing the power sector is a fundamental strategy to confront the climate crisis; we need to slash pollution from power plants while also electrifying vehicles, buildings, and parts of industry. President Biden's American Jobs Plan includes a federal Energy Efficiency and Clean Electricity Standard (EECES), a pillar of the goal to achieve 100% carbon-pollution-free power by 2035.[1]

This policy brief explains why demand management in general, and energy efficiency in particular, are critical components of any plan to achieve a carbon-free grid. We describe why an Energy Efficiency Resource Standard (EERS) or similar performance standard for efficiency programs is essential for a low-cost, equitable clean energy transition, how we can learn from the experience of the many states that already have such a policy, and what options we have to embed an EERS in a federal EECES.

Why We Need Energy Efficiency to Achieve a Carbon-Free Grid

There are two complementary ways to transform the grid to be carbon-free: demand management and clean supply. Demand management includes energy efficiency, which reduces electric loads while providing the same services to the economy, as well as demand response or demand flexibility, which shifts load away from peak times, and sometimes into particular times of day, to help integrate variable renewable resources such as wind and solar. These tools, along with rooftop solar, storage, and electrification, must be scaled up to build a carbon-free energy system that benefits everyone.

In the near term, the United States must double down on energy saving and energy management efforts to provide immediate reductions in emissions, as fossil fuels account for roughly 60% of utility-scale electricity generation in the United States.[2] By reducing the need for fossil generation, efficiency investments will reduce greenhouse gas emissions around the country, with the greatest impact where the grid is most carbon-intensive. As the U.S. power sector shifts toward a fully carbon-free grid, demand-side measures will have an increasingly important role, albeit an evolved one. With the addition of more renewables to the electrical system, grid planners will increasingly select energy efficiency options that can avoid using fossil fuels at critical times—i.e., when renewables are scarce and at times of peak demand. Energy efficiency can also allow us to minimize growing winter peaks and lower the cost of electrification for customers by reducing heating and cooling needs. Now and in an increasingly decarbonized economy, energy efficiency can reduce costs, improve comfort and resilience, and help ensure that the electric grid remains reliable and that clean energy benefits everybody.

ENERGY EFFICIENCY REDUCES UTILITY COSTS, INCLUDING COSTS TO INTEGRATE RENEWABLE RESOURCES

The cost of utility-scale renewable energy resources has fallen dramatically over recent decades, with wind and solar costs declining by 70–90% between 2009 and 2019.[3] However, energy efficiency remains one of the lowest-cost resources on average across the country compared with unsubsidized supply-side resources (see figure 1). The U.S. Department of Energy recently found that there is enormous potential for demand-side resources to save money, with possible savings of $100–200 billion from energy efficiency in buildings and demand flexibility between 2021 and 2040.[4]

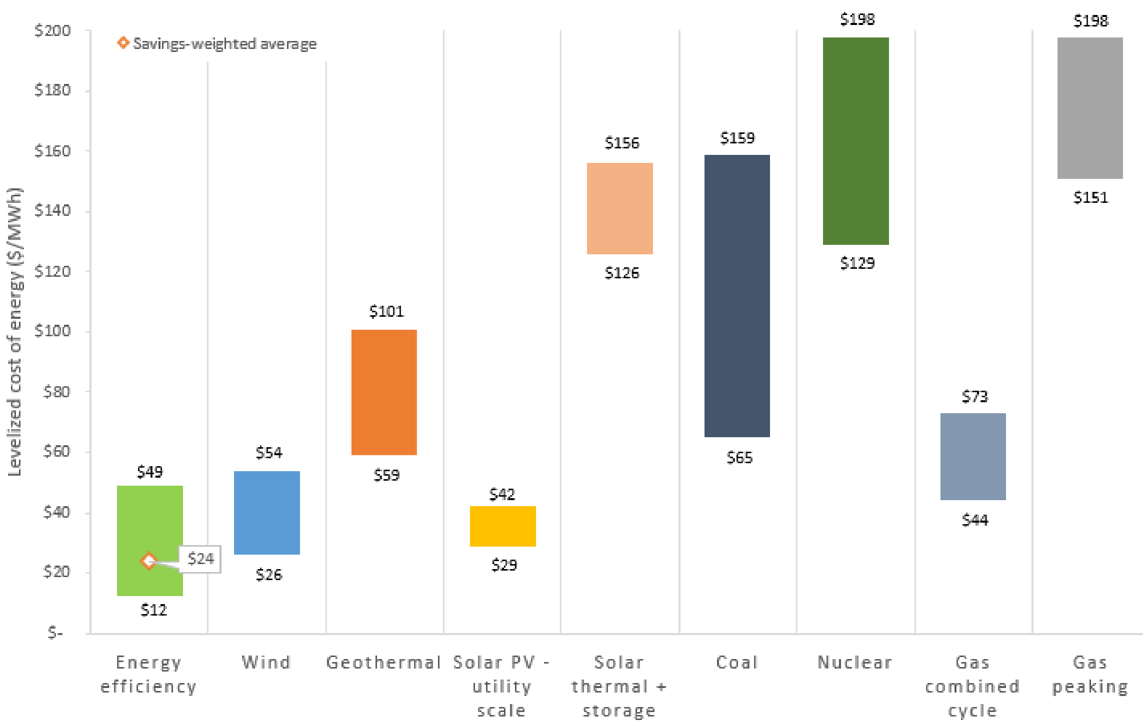

Figure 1. Levelized cost of energy efficiency for programs in 2018, compared with unsubsidized supply-side resources. Wind depicted in the graph is onshore wind.[5]

As renewable generation increases, demand-side resources can also help to optimize and reduce costs associated with integration of renewable energy resources into the grid. In 2019, the Rocky Mountain Institute (RMI) found that clean energy portfolios that include wind, solar, storage, energy efficiency, and demand flexibility cost less than 90% of proposed gas capacity.[6] Demand-side solutions play a critical role: While wind, solar, and storage resources would deliver $3.5 billion in customer savings, the inclusion of efficiency and demand flexibility in utilities' portfolios would add another $25.5 billion, nearly an order of magnitude more. According to RMI, including demand-side resources accelerates the opportunity for clean energy to replace proposed new gas plants by eight years, on average, by helping to meet the energy, capacity, and flexibility needs of the grid at lower cost. Capturing the opportunity from energy efficiency and demand flexibility now is crucial to accelerate adoption of renewables and avoid the need to build new gas plants.

Energy efficiency can also support accelerated retirement of existing fossil plants, especially high-cost gas peaking and coal plants. There is ample additional opportunity to use efficiency to retire these plants, as utilities across the United States continue to operate coal plants at a loss when lower-cost, cleaner resources, including energy efficiency, are available.[7] In 2018 alone, customers faced $350 million in costs from these uneconomic practices in just one region, the midwestern MISO grid.[8]

DEMAND-SIDE MANAGEMENT WILL ALLOW US TO ELECTRIFY MORE OF THE ECONOMY

Widespread electrification of homes, businesses, transportation, and portions of industry is a crucial component of the nation's efforts to address the greenhouse gas (GHG) pollution that fuels climate change. Dramatic electrification will also increase electricity consumption by as much as 50–67% by 2050, depending on the electrification scenario and assumptions about complementary energy efficiency; estimates are even higher for economy-wide deep decarbonization scenarios.[9] By reducing electricity consumption,[10] energy efficiency can minimize the risk that large-scale electrification will result in major build-outs of new generation, transmission, and distribution assets, including new natural gas power plants, which increase costs and stranded asset risks for ratepayers.

Such build-out is most likely to be needed to meet demand at peak times. Increased use of electric heating—vital for reducing greenhouse gas emissions—is projected to cause peak electricity demand to shift from summer afternoons to winter mornings in a number of regions.[99] Even in areas that typically have their highest power needs in the summer, surges in electric demand during increasingly frequent extreme cold weather events can contribute to fuel price spikes or service interruptions, as in the recent Texas outages. ACEEE research finds that better-sealed buildings, higher-performing heat pumps, grid-connected water heating, and other measures can all contribute to dramatic reductions in winter peak demand, enabling electrification of key sectors—such as heating—at lower cost.[11]

In addition, energy efficiency measures such as insulation, duct sealing, and other envelope improvements allow smaller electric systems to be installed when electrifying, reducing the costs of electrification. Decreasing the size of a new heat pump from 5 tons to 3 tons of heating and cooling capacity can lower the cost of a new heat pump system by close to $3,000, making electrification more affordable.[12]

ENERGY EFFICIENCY CAN ENSURE THAT CLEAN ENERGY BENEFITS EVERYBODY

While increasingly low-cost renewables may be able to lower system costs and eventually rates, many people, especially renters, cannot directly benefit from them. They may live in multifamily housing or in remote or underserved communities with more difficult access to rooftop solar power, or may lack the authority, funds, or credit to invest in these technologies. With efficiency, there are opportunities to address these challenges and provide immediate and direct bill savings for homes and businesses regardless of location or income.

Efficiency measures can also directly improve the health and comfort of residents by addressing housing inadequacies that may pose health risks.[13] Examples include improving ventilation and insulation and sealing leaky doors and windows, which can reduce indoor air pollution, moisture, and mold and provide protection against extreme temperatures. Programs that provide on-site energy work can also address basic safety concerns such as the need for carbon monoxide detectors and handrails.[14] In addition, with fewer drafts and better-insulated walls, people inside homes can feel more comfortable and workers can be more productive, alert, and healthy.[15]

Why We Need a Federal EERS or an EECES

The utility sector is especially critical to implementing energy efficiency, as electric and natural gas utilities deliver most electricity and natural gas efficiency programs in the United States. These programs, funded by utility customers through utility rates and statewide public benefits funds (and run by state agencies or contractors in a few states), help customers use efficient technologies and practices and thereby reduce their energy waste. These programs have grown much larger over the past 20 years, driven by strong investment and the establishment of robust energy savings targets in an increasing number of states. In 2019, total spending for electric efficiency increased over the previous year by about 2.9%, to $6.8 billion; in addition, natural gas programs spent $1.5 billion in 2019.[16]

STATE EERS POLICIES HAVE BEEN CRITICAL TO UTILITY BILL AND CARBON SAVINGS

An energy efficiency resource standard (EERS), a binding multiyear savings target for utilities, is among the most effective policies states have adopted for driving high and consistent levels of utility sector savings. An EERS can complement a clean energy standard (CES) or renewable electricity standard (RES), or it can be integrated into either one. As of this writing, 27 states and Washington, DC have adopted an electric EERS. Nineteen states also maintain an EERS for natural gas.[17] **Error! Reference source not found.**2 provides a map of state EERS electric savings targets and their relative strength in terms of new savings each year as a percentage of annual retail electric sales.

The powerful influence of an EERS in building successful efficiency programs is well established. ACEEE research finds that states with these standards deliver an average of four times the level of electricity savings (1.2% new savings per year) relative to states without an EERS (0.3%), according to the most recent utility data, from 2019.[18] Savings from states with an EERS also account for 80% (22 million MWh) of nationwide utility program electricity savings. All 20 states (and Washington, DC) reporting the highest levels of electric utility savings in 2019 have adopted an EERS, and 23 of the top 25 rankings in ACEEE's annual *State Energy Efficiency Scorecard* are occupied by EERS states (including the District of Columbia).[16] A 2019 Brattle Group study of factors influencing savings levels of utility programs found that having an EERS and dedicated efficiency funding had the largest impact on program performance, followed by ratemaking structures that ensure a utility is not financially harmed by reducing its sales and that reward a utility for effective programs.[19]

Importantly, an EERS offers regulatory certainty for utilities and the contractors, manufacturers, and retailers that make up the energy efficiency workforce and supply network. By establishing multiyear goals, an EERS enables utilities to include efficiency within long-range capital planning (integrated resource plans), ensuring a consistent commitment to efficiency as a foundational energy resource and the use of efficiency to reduce other capital needs.

An EERS also offers a flexible policy framework that can complement and support other state climate and reliability goals. For example, some states have incorporated season-specific summer and winter goals to reduce peak demand at particular times when heating or cooling demand tends to be highest. Savings achieved during these times can deliver the highest value for reducing the emissions and costs associated with building new generation and transmission and distribution (T&D) infrastructure. Some states have also adopted technology-specific targets, such as for heat pump deployment, to accelerate electrification of home heating in service of state emissions reduction goals.

Thus, in most states, an EERS—in conjunction with renewables or clean supply targets—helps achieve a cleaner grid. More than half of EERS states also 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 reductions goals. This demonstrates that numerous states have recognized the supporting role an EERS serves by guaranteeing a minimum level of energy savings to complement other statewide GHG and clean energy goals. Illustrating this relationship, **Error! Reference source not found.** 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. Dotted states are EERS states with a nonbinding CES (for example, those established by executive orders). The four EERS states (and DC) with a star have adopted a robust renewable portfolio standard of 75% or higher. Additional details are in the table in Appendix A.

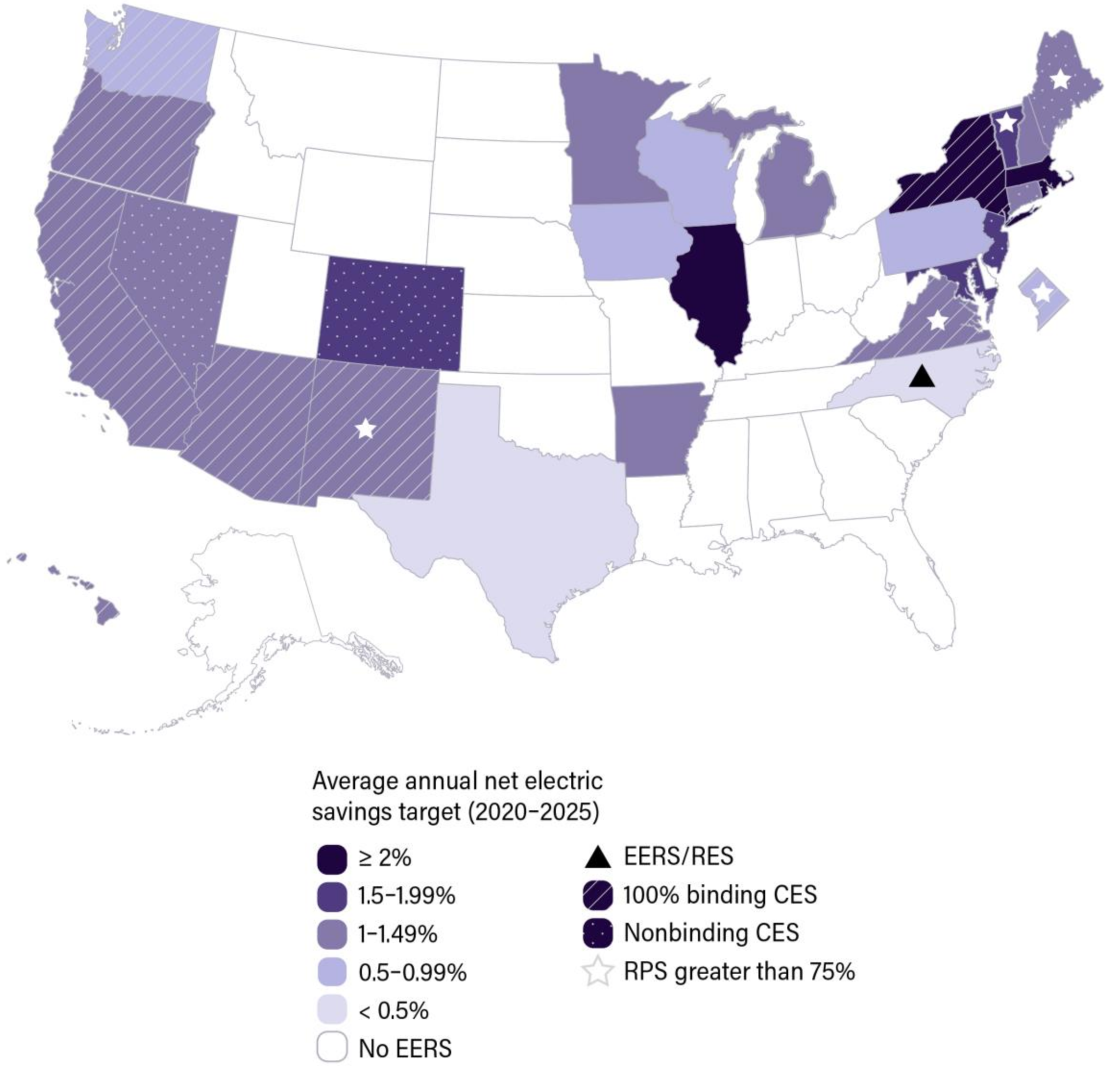

Figure 2. State-level EERS adoptions and clean electricity standards.[20] This figure shows the 27 states (and DC) that have established a binding EERS, identified with color shadings that reflect the stringency of their electric savings targets. Lined overlays show the eight states (and DC) that have also adopted a binding 100% CES. Dotted states are EERS states with a nonbinding CES (e.g., those established by executive orders). The four EERS states (and DC) with a star have adopted a robust renewable portfolio standard of 75% or higher.

The past two decades have shown state EERSs to be a proven mechanism to strengthen efficiency and deliver strong, reliable savings. These targets are also achievable: A 2019 ACEEE analysis found that 80% of states were meeting or exceeding their EERS goals—including states with some of the highest targets—and that all EERS states, save one, were achieving at least 80% of their electric savings goals.[21]

A FEDERAL PERFORMANCE REQUIREMENT WOULD ADD LARGE SAVINGS

Adopting a similar approach at the federal level can extend these savings and associated carbon benefits at a national scale. ACEEE analysis has found that energy efficiency can cut U.S. energy use and GHG emissions in half by 2050, and a national-level EERS would be vital to making this a reality. By ramping up to 2% new electricity savings and 1% new natural gas savings each year by 2025, and maintaining those rates, a national EERS could spur programs to contribute almost 200 million metric tons of CO_2 savings in 2035 beyond what they are doing under state policies, or about one-fifth of achievable GHG savings from efficiency.[22] However, we note that that these projections only include EERS utility program savings. These programs often promote and complement other efficiency initiatives, including market transformation efforts that accelerate availability of new energy-saving technologies and other building efficiency policies, such as appliance standards, building energy benchmarking and standards, and building energy codes. The energy- and GHG-saving influence of an EERS thus extends far beyond the direct savings provided by customer programs.

How to Incorporate Energy Efficiency into an EECES

The sections above have described (1) the importance of energy efficiency and demand management to lowering the cost and increasing the equity of a clean grid, and (2) the power of efficiency performance requirements to achieve those benefits. Here we turn to some of the specific issues surrounding how to combine national efficiency requirements with national clean electricity requirements to maximize GHG reductions.

Should joint or separate targets be used? The most basic issue is whether to set separate but complementary energy savings and clean supply requirements, a combined target, or a single policy with separate sub-targets for efficiency and clean electricity.

- *Separate EERS and CES:* Most states with savings and supply requirements keep them as a separate EERS and CES or renewable energy standard (RES). Keeping separate targets is generally the simplest approach. It ensures that utilities use both demand and supply solutions to meet their goals (utilities may not want to reduce their sales, even if that is the best way to cut emissions). It also maximizes policy flexibility to apply the targets to different utilities, establish different qualifying criteria and metrics, allow different kinds of credit trading, and impose different penalties for noncompliance.
- *Combined EECES target:* A few states have tried combined savings and supply targets (sometimes with carve-outs or limits), and North Carolina still has such a target. A combined target gives utilities greater flexibility to choose the combination of efficiency measures and clean generation options that works best for them and their customers. Since efficiency is available everywhere, a national efficiency standard may compensate for regional differences in availability of clean supplies and enable states to reach higher targets. However, there are significant differences between supply and demand measures; ways to address these differences are addressed below.
- *EECES policy with separate sub-targets for energy efficiency and clean energy:* States often set carve-outs in EERS, CES, and RES to ensure that utilities use new technologies or to get the benefits of

specific sources. A single federal EECES policy could set separate sub-targets for energy efficiency and clean energy (or for utility-scale generation versus customer efficiency and renewables). This structure would create a unified framework that still ensures that demand and supply measures will be taken. It could also allow limited trading of savings and clean generation.

Who would be regulated? In states with electricity restructuring, different companies may own the power plants, sell the power to consumers, and deliver it. Almost all of these states apply their EERS requirements to the companies that deliver the power to customers (local distribution companies); they have a relationship with electricity consumers, have clear geographical boundaries, and mostly have regulated rates. Clean supply standards usually apply to the companies that sell the power (retail providers). However, for 85% of the electricity sold nationwide, the retailer and distributor are the same company, making this less of an issue.

A separate EERS and CES can simply apply to different companies. A combined standard could apply to either the distribution company or the retail provider. But in either case the standard would need to allow the federally regulated utility to count the savings or clean supply the other company had earned to meet state law. The utility should also be able to take credit for savings achieved by state agencies and contractors that implement efficiency programs in some states.

Measurement and verification (M&V): How would we know the savings are real? It is relatively easy to measure clean generation, and clean supply requirements generally count all clean generation, including generation by preexisting sources (while trying to count each kWh only once). It is harder to measure energy savings—the reduction in use compared with the hypothetical use that would have occurred without the efficiency measures—and states with EERSs often count only savings achieved because of the utility programs, excluding what customers would have done anyway (net savings), or at least savings customers achieve beyond business-as-usual efficiency levels. However, much efficiency happens apart from utility programs—as when someone buys an ENERGY STAR® appliance just because it reduces electricity costs. Some of those purchasers will take a rebate if offered one, and it may be hard to separate these purchases from those that were spurred by a utility program.

Still, in many states there are well-developed measurement and verification methods implemented by independent evaluators to meet Public Utility Commission requirements to assess the impact of the approximately $9 billion spent on efficiency programs in the United States each year. The details differ by state, but federal criteria, building on existing national evaluation resources, could bring greater uniformity.[23] Concerns about M&V may be one reason to separate targets for efficiency and clean supply.[24]

Designing a joint clean energy and efficiency target: One MWh of clean electricity supply and one MWh of electricity savings (at a given time and place) should yield the same emissions reductions, but they may not be counted the same way if added together in a joint savings and clean supply target. A joint target that is expressed as a percentage of total generation could double count savings because efficiency decreases the total generation as well as counting toward meeting the target. There could still be emissions when that percentage reaches 100%. But designing a joint target to count savings appropriately is not hard; a few approaches are described in Appendix B.

Credit trading: Clean supply standards generally rely on credit trading in order to include privately owned clean generation and to address regional differences in available resources. Efficiency standards in the states usually focus on utility programs and find no need for trading, and federal EERS proposals have mostly limited interstate trading, in part because of differences in how savings are measured. But efficiency and other demand-side measures are included in some regional transmission markets, and with sufficient M&V criteria and oversight, they could be included in trading.

Alternative compliance payments: A less robust way of supporting efficiency in a supply-side CES would be to use alternative compliance payments (ACPs), fees paid by utilities in lieu of meeting the full standard, for efficiency programs. Even with an efficiency standard, ACPs could be used to fund state or national programs that are more effective at a larger scale than the territory of a single utility or for which savings are hard to measure. With separate demand and supply targets, one could set different ACPs, but EERS ACPs and RES ACPs tend to have fairly similar costs per kWh in the states.

Natural gas target: CES proposals do not include direct use of natural gas.[25] But several states have natural gas efficiency programs and a natural gas EERS. A federal natural gas efficiency performance requirement would reduce natural gas use and could make electrification easier by decreasing the heating and cooling loads that need to be converted to electricity.

EECES under reconciliation: The legislative drafting challenge for how to spur energy savings in a bill that can pass under Senate reconciliation procedures is similar to the challenge for a bill promoting clean supply: how to use spending and revenue in place of standards. Fees for underperformance and payments for overperformance could apply to clean supply targets, energy savings targets, or combined targets. Alternatively, the government could procure both savings and supply (and if procuring clean energy for its own facilities, should ensure that energy is not being wasted by inefficient buildings). However, it may be more difficult to legislate detailed M&V specifications for energy savings; these would likely need to be delegated to an agency rulemaking.

Complementary policies: While a performance standard (EERS) has been the most effective approach to spur utility energy efficiency programs, there are complementary policies that are mutually reinforcing and magnify savings. Many of these policies are most effective at the federal level, including research and development investments, efficiency labels for products and buildings, and appliance and equipment efficiency standards. These and other efficiency strategies should be included along with an EERS or EECES in a suite of policies to achieve a cost-effective, equitable, carbon-free grid.

Conclusion

Providing reliable electricity requires matching electric generation to electric demand at every moment. Providing clean electricity will require that delicate match in large part using intermittent wind and solar power. That task becomes far more feasible if one manages electric demand as well as supply. Along with its role in integrating variable resources, energy efficiency has been shown in states around the country to help lower costs, ensure that all communities benefit, and offset added demand as we electrify energy uses. An energy efficiency and clean electricity standard should include performance requirements (or a set of fees and payments) for energy efficiency as well as for clean supply. The two components can be structured in various ways to be mutually reinforcing. Together they can spur a reliable, cost-effective, equitable, and clean electricity grid.

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Appendix A: EERS, CES, and emissions reduction goals in the states

Table A1. Clean electricity standards and emissions reductions goals among EERS states

State	Clean electricity standard	Emissions reduction goal	EERS	
			Approx. electric savings target (2020–2025)	Approx. % electric retail sales covered
Massachusetts	—	100% by 2050 (S 9)	2.7%	85%
New York*	100% by 2040 (SB 6599)	100% by 2050 (SB 6599)	2.0%	100%
Rhode Island	100% by 2030 (EO 20-01)	80% by 2050	2.0%	99%
Illinois	—	—	2.0%	89%
Vermont	—	80% by 2050 (HB 688)	1.7%	98%
Colorado	100% by 2050 (SB 19-236)	90% by 2050	1.7%	56%
New Jersey	100% by 2050 (EO 28)	80% by 2050	1.6%	100%
Maryland*	—	40% by 2030 (SB 323)	1.6%	97%
Minnesota*	—	80% by 2050 (MN Statute § 216H.02)	1.4%	97%
Hawaii	100% renewable energy by 2045 (HB 2182)	100% by 2045 (HB 2182)	1.4%	100%
New Hampshire	—	80% by 2050 (EO 2007-3)	1.3%	100%
California*	100% by 2045 (SB 100)	100% by 2045 (EO B-55-18)	1.3%	73%
Virginia	100% by 2050 (HB1526)	—	1.2%	87%
Oregon*	100% by 2040 (HB2021)	75% by 2050 (HB 3543)	1.2%	61%
Arkansas	—	—	1.2%	50%
Connecticut	100% by 2040 (EO 3)	80% by 2050 (PA 18-82)	1.1%	93%
Nevada	100% by 2050 (SB 358)	100% by 2050 (SB 254)	1.1%	88%
Arizona*	100% by 2070**	—	1.1%	56%
Maine*	RPS of 80% by 2030, goal of 100% by 2050 (LD 1494)	80% by 2050 (LD 1494), 100% carbon neutral by 2045 (EO 10)	1.0%	100%
Michigan	—	100% carbon neutral by 2050 (ED 2020-10)	1.0%	100%
New Mexico	100% by 2045 (SB 489)	45% emissions reduction by 2030 (EO 2019-003)	1.0%	69%
Iowa*	—	—	0.9%	75%
District of Columbia	100% by 2032 (DC Act 22-583)	100% by 2050 (nonbinding)	0.8%	100%
Wisconsin	100% by 2050 (EO 38)	—	0.7%	100%
Washington*	100% by 2045 (SB 5116)	Net-zero emissions by 2050 (SB 5126)	0.7%	83%
Pennsylvania	—	80% by 2050 (EO 2019-01)	0.6%	96%
North Carolina	—	40% by 2025 (EO No. 80)	0.4%	100%
Texas	—	—	0.2%	74%

*For states reporting electric savings on a gross basis, a net-to-gross adjustment was applied to make them comparable with states reporting net savings. **Clean electricity standard approved by Arizona Corporation Commission in May 2021; formal rulemaking is ongoing.

Appendix B: Joint Target—Ensuring 100% Is 100%

The most obvious way to express a joint savings and clean supply target is as a percentage:

$$Target = \frac{Clean\ generation + Energy\ savings}{Total\ generation}$$

However, energy savings not only would be counted as clean energy in the numerator but also would decrease total generation in the denominator. When the percentage reaches 100%, there could still be emissions, as illustrated in the text box (right).

Separate supply and savings targets don't have this problem. But there also are multiple ways of setting a joint target that ensures a clean grid. Here are three:

1) Add efficiency back into the baseline generation. If the same measured savings in the numerator are also added to the total generation, the savings do not reduce the denominator and there is no double counting:

$$Target = \frac{Clean\ generation + Energy\ savings}{Total\ generation + Energy\ savings}$$

   At low percentages, this will make little difference, but at high percentages it ensures the savings are counted correctly.
2) Phase efficiency out of the target as the percentage becomes high, perhaps starting 10 years before the 100% target.[26] When all generation must be clean, then every MWh saved is a MWh the utility does not need to generate from clean sources.
3) Express the target in absolute terms (MWh) rather than as a percentage:

$$Target = Clean\ generation + Energy\ savings$$

   Each MWh saved reduces emissions as much as a MWh of clean generation.[27]

Joint Target Example

Suppose a utility that sells 100 TWh of electricity per year builds clean generation to supply 50 TWh and runs programs that reduce demand by 25 TWh. Total generation will be 75 TWh (100 – 25), with 25 TWh of remaining "dirty" generation (75 – 50). So efficiency has reduced the amount of clean energy needed to go carbon-free by 25 TWh, and overall the utility is 75% of the way toward that goal. However, the simple clean supply + savings percentage will be 100% (50+25 / 75), despite the remaining emissions.

Any of the alternative ways to set a joint target would better represent the actual progress:

1) If savings are added back into the denominator, then the percentage will correctly be 75% (50+25 / 75+25).
2) If efficiency is fully phased out of the target at some point, the percentage will be 67% (50 / 75). But 1 TWh of additional efficiency will increase the percentage only 67% as much as 1 TWh of added clean supply.
3) If the target had been set as 100 TWh rather than 100%, the utility would still be 25 TWh from reaching it.

Of course, separate targets would also work, such as 100% clean energy *and* 40% efficiency. In the example, the clean energy and efficiency percentages are 67% and 33%, respectively.

Endnotes

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[19] S. Sergici and N. Irwin, *Energy Efficiency Administrator Models: Relative Strengths and Impact on Energy Efficiency Program Success* (Prepared by The Brattle Group; Boulder, CO: Uplight, 2019). brattlefiles.blob.core.windows.net/files/17632_2019_11_18__brattle-uplight__energy-efficiency-administrator-models.pdf.

[20] ACEEE research supplemented with data from NRDC (Natural Resources Defense Council), "Race to 100% Clean" (2021). nrdcinc.maps.arcgis.com/apps/Cascade/index.html?appid=714cd31f37a64314b8d1e7e502c13c58.

[21] R. Gold, A. Gilleo, and W. Berg, *Next-Generation Energy Efficiency Resource Standards* (Washington, DC: ACEEE, 2019). aceee.org/research-report/u1905.

[22] Nadel and Ungar (2019). This is for EERS without the other efficiency measures in that paper. Savings from other policies would reduce generation, and thus reduce EERS savings to 141 MMT. Please note that our business-as-usual baseline was a slightly modified version of the reference case in the *Annual Energy Outlook 2019* (AEO) that assumed an electric generation mix of 30% renewables in 2035 and 43% in 2050. In a 100% clean electricity standard scenario the electricity savings would reduce costs but not emissions.

[23] For example, see the State and Local Energy Efficiency Action Network (SEEAction) and DOE's Uniform Methods Project: www.energy.gov/eere/about-us/ump-home.

[24] C. Giles, *Next Generation Compliance: Environmental Regulation for the Modern Era, Part 4: Preventing Widespread Violations that Threaten Climate Goals* (Cambridge, MA: Harvard Law School, 2021). eelp.law.harvard.edu/wp-content/uploads/Cynthia-Giles-Part-4-FINAL.pdf.

[25] There are limited lower-carbon gas alternatives. So-called "renewable natural gas" is biogas, or the gaseous product of organic matter derived from anaerobic digestion or gasification. (DOE Alternative Fuels Data Center, afdc.energy.gov/fuels/natural_gas_renewable.html.) "Green" hydrogen is made from water using renewable electricity, and "blue" hydrogen is made from natural gas with carbon capture and sequestration.

[26] Energy efficiency program portfolios have a weighted average measure life of around 10 years; our survey of the 52 largest utilities found a weighted average measure life of 11.25 years. G. Relf et al., *2020 Utility Energy Efficiency Scorecard* (Washington, DC: ACEEE, 2020). aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf.

[27] Actually, the reduction would be a bit more than 1 MWh of central generation. On average, about 6% of electricity generated centrally is lost in transmission and distribution before it reaches the consumer.