Leveraging Evaluated Energy Efficiency Savings for GHG Reduction

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ABSTRACT

There have been great improvements in deploying energy efficiency (EE) measures and projects across the US and European Union (EU) over the past few decades. EE has mostly been deployed in the US to meet kWh savings goals, while in the EU, EE is deployed to reduce greenhouse gas (GHG) emissions. But a chasm exists in the US in leveraging evaluated EE for GHG reduction goals even though this is possible today. EE can be used to reduce demand and GHG across the US. There should be an established approach in the US for leveraging evaluated EE savings for GHG reduction given the substantial number of EE programs deployed. An established deployed EE GHG reduction approach through EE would hasten the adoption of such standards across the states. This paper provides important research on using evaluated EE savings for lowering GHG, verifying carbon and GHG units through the Verified Carbon Standard Program (VCS) and similar voluntary carbon programs, and other models to hasten EE adoption. Various pros and cons of these approaches will be outlined with specific examples. A specific focus on the EU's deployment of EE for GHG reduction will be used as a model for counting EE savings in the US – this will focus on leveraging EE for GHG goals among other similar accepted approaches and methods.

This paper shows that modeling deployed EE across energy transmission systems leads to GHG reductions, and once EE is deployed for GHG savings, tracking systems are needed to count and track the GHG savings. Additionally, state and regional GHG reduction models are discussed in detail to provide the reader with an understanding of how our current EE structures can be modified to capture EE GHG savings across states and regions.

Carbon Metrics and Achieving Climate Goals

EE is used mostly in the US for energy and demand reduction. In the EU, EE is mostly deployed to reduce GHG and carbon.[1] While in the US, GHG or carbon reduction is not tracked, except for CA and the RGGI states (Regional Greenhouse Gas Initiative)[2]. The EU directive to reduce GHG by 20% by 2020 and 32.5% by 2030 is a key difference – each EU nation decides how to adopt the EU EE directive. (Molina & Relf, Cost of Saved Energy 2018) There are no national energy goals in the US and each city and state sets its own goals and standards. This lends itself to a patchwork of policy and efforts to improve energy performance and reduce GHG. EU models can be leveraged in the US so states use EE for demand savings and GHG reduction.

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[1] The underlying legal basis for this is Article 194 of the Treaty on the Functioning of the European Union (TFEU).
[2] RGGI is a cooperative effort to reduce CO2 emissions from power generation. RGGI states include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, Vermont, and Virginia. RGGI detail can be found here: www.rggi.org

EE program and portfolio development in the US requires a paradigm shift to transition away from energy savings goals towards carbon reduction goals. A main shift will be moving away from energy savings goals and towards carbon reduction and GHG goals. These goals should be set by state legislatures and implemented by state commissions or similar regulatory bodies. This change needs to happen during the EE planning process in to establish goals, identify inputs to cost-benefit calculations, and design performance incentives. Such changes can drive program design by signaling to utilities, program administrators, and other parties how to align their portfolios with state climate policy. Such design and requirements are not used across most states – today it occurs only in California and handful of east coast states. (NEEP 2021)

EE savings goals in the US mostly focus on first-year or near-term energy savings since this approach is easier to implement, define, measure, and plan programs. Illinois is a good example of a state that has moved to counting savings over multiple years by implementing cumulative persisting annual savings (CPAS). CPAS was recently expanded by statewide legislation in September 2021 for ComEd and Ameren Illinois (Clean Energy Jobs Act (CEJA) - SB1718/HB 804). Nationally, Illinois is an exception. Annual savings goals favor EE measures with high first-year savings that may not continue to add savings over multiple years. There are four metrics outlined by NEEP that can be used to move toward incorporating climate and decarbonization policy into EE program goals - this also helps move EE programs toward greater EE savings. (NEEP 2021) The metrics are:

- **GHG Goals.** This approach is the most direct way to lower GHG emissions and a clear way to implement a GHG emissions goal for utilities or companies. EE companies and programs are directed to meet specific GHG goals which have no link to EE energy savings goals.
- **Total System Benefit (TSB) Goals.** The goal is to reach a dollar value that translates to savings and load shape of an energy efficiency resource. This is done by using hourly values for energy, capacity, and GHG compliance costs. California PUC adopted this metric based on its ability to target "high value" load reduction and longer-duration energy savings.
- **Lifetime Energy Savings Goal.** Lifetime goals typically do not account for carbon, although shifts EE focus to long-term energy savings (i.e., longer expected useful EE measure lives) – this serves as step toward GHG reduction, but not a full-fledged carbon or GHG policy.
- **Fuel Neutral GHG and Energy Savings Goals.** This is similar to lifetime savings and does not count or carbon impacts. This approach typically incorporates a fuel neutral savings goal approach by moving carbon generation off the system and moves a region or state to a carbon free system by a set date.

Modeling Deployed EE Shows Significant GHG Reductions

The benefits of deployed EE can be seen by modeling deployed EE and assessing the GHG savings. Transmission modeling of EE savings shows corresponding GHG reductions. This leads to the idea that EE measures, programs, and portfolios can be leveraged to reduce GHG – this appears to be imperative to meet local and national GHG reduction goals. Modeling EE across regions shows significant carbon reduction is a likely outcome.[3] Pennsylvania, New Jersey Maryland (PJM) transmission grid[4] and the State of California were chosen for examples in this paper to show how EE would aid in reaching future climate goals. This analysis focuses on PJM territory and California for comparative purposes, geographical diversity, and the ability to access data accessibility. This analysis also highlights the impacts of increased EE penetration and quantifies resulting reductions in carbon. The goal is to develop a framework to understand potential EE improvements and move toward greater deployed EE, reducing energy demand, lower GHG, while also improving overall system efficiency through reduced system congestion allowing more efficient energy flow through California and PJM. (Neumann 2017)[5]

The analysis leverages a production cost software model (e.g., PROMOD) to assess how: (i) varying levels of additional EE lowers GHG and potentially relieves interfaces, and (ii) the impact on total system cost to serve customers is potentially lowered.[6] Key findings show:

- **EE drives overall cost reductions** (i.e., consumer costs) **and reduces GHG -** EE is shown to reduce costs (in the order of billions of dollars) and reduces GHG
- **More EE means less absolute demand for natural gas**, but gas makes up slightly larger percentage of total generation because EE pushes out additional fossil fuels[7]
- **Coal retirements occur in all regions**, most significant retirements in the Eastern US
- **Renewables added to meet RPS in early years** - significant solar in California approximately one-third of generation in 2030 - significant wind in Midwest and Texas (one-(fifth to a quarter of generation in 2035) which are fed into the PJM transmission grid

EE Modeled Across PJM and CA

PROMOD software produces results that analyze variations in carbon emissions of high and low model scenarios. This shows carbon reduction of installed EE displaces carbon generation in

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[3] A greenhouse gas (or GHG for short) is any gas in the atmosphere which absorbs and re-emits heat, and thereby keeps the planet's atmosphere warmer than it otherwise would be. The main GHGs in the Earth's atmosphere are water vapor, carbon dioxide (CO_2), methane (CH4), nitrous oxide (N2O) and ozone. CO_2 is the primary GHG emitted through human activities. In 2019, CO_2 accounted for about 80% of all US GHG emissions.

[4] PJM (Pennsylvania, New Jersey, and Maryland) is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia. www.pjm.com

[5] Our reference cases use same assumptions for EE as each of the forecast regions (PJM and CA) Note, this is not CAISO which includes PGE, SGE and large utilities – our CA data is the entire state. Variables include: (i) Rate of EE adoption over time, (ii) Amount of EE compared to new generation, and (iii) Generation, T&D, Renewables, etc. was constant except for EE deployment; Capacity factor for EE = 50% - for every MW of EE (not every MW is running each hour of the year); Three levels of EE penetration modeled: low/med/high case.

[6] PROMOD modeling was used which uses a detailed hourly chronological market model that simulates the dispatch and operation of the wholesale electricity market. It replicates the least cost optimization decision criteria used by system operators and utilities in the market while observing generating operational limitations and transmission constraints.

[7] Natural gas is used for base-load generation as coal is retired to reduce overall GHG.

both California and PJM. Figure 1 shows that EE displaces 9,000 and 700 tons of carbon in PJM and 390 and 510 tons of carbon in California in 2025 and 2030, respectively. This is primarily based on the expectation of coal retirements being replaced by natural gas and renewable additions. In California, EE displaces the equivalent of inefficient combustion turbine generation in 2025 and combined cycle generation by 2030. California has less carbon reduction modeled than PJM since it already has lower emissions/MWh output – there are no coal plants today in California and many ore renewable resources. Further, in California, increasing EE from 3.8% to 11.5% of total statewide resources reduces system cost to serve load by 3% in 2025 and 5% in 2030. Similarly, by increasing EE from 1.7% to 6.5% of total penetration in PJM, it reduces system cost to serve load by at least 3.0% (2025 = 3.6%, 2030 = 3.0%).

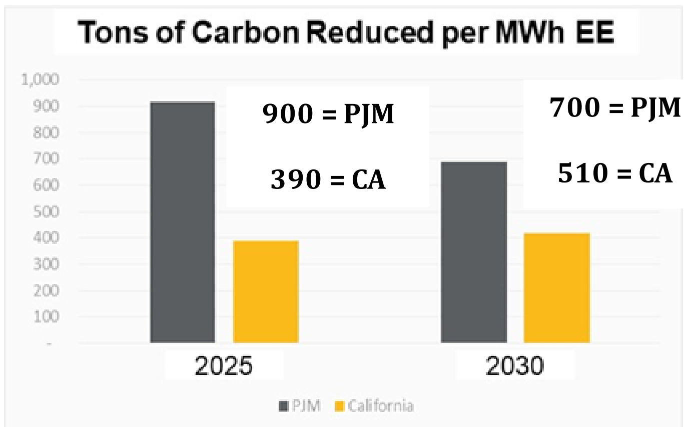


Figure 1: Modeling of Carbon Reduction per Deployed EE

Importantly, Table 1 shows PJM costs savings of $1.3 Billion based on analysis of the estimated low and high case PROMOD modeling. In California, savings are nearly $1 Billion, even with overall system GHG and congestion in California is lower at this time since significant renewables are already deployed across the California system. When converted to a percentage of total cost to serve load for each system, increasing EE penetration in PJM by 3.4% of total demand results in system cost reductions of 3.6% in 2025 and 3.0% in 2030.

Modeled Costs Savings of Deployed EE in 2025 and 2030

	PJM Cost Savings (2014 dollars)	California Cost Savings (2014 dollars)
2025	$1,309,204,480	$488,086,000
2030	$1,517,684,440	$827,530,000

Table 1: PJM Cost Savings vs. CA Cost Savings

Methodology of Tracking GHG Reduction from Deployed EE

Given that we know GHG reduction occurs from deploying EE, there is a need to implement reliable GHG tracking to measure GHG reduction. To help track GHG reduction from deploying

EE, various tools can be used that are already reliably leveraged used in the energy industry today. Below are a few examples.

Long-Range Energy Alternatives Planning System (LEAP) is an econometric model which was developed by the Stockholm Environment Institute and Boston University. LEAP is used as an energy environment modeling tool which is based on scenario analysis which assesses energy demand, environmental impacts, and costs and benefits. The models are primarily used for national and municipal mid-term to long-term energy and environmental planning. But it's mainly a scenario-based energy simulation model platform for data structuring, energy balance development, supply and demand scenario planning, related emission estimation, and alternative policy evaluation. In addition, it can be used to predict mid-term to long-term energy supply and demand at a social scale under the influence of various driving factors, and to quantify air pollutants and greenhouse gas emissions related to energy circulation and consumption. LEAP's accounting functions allows users to account for how energy is produced, supplied and consumed while considering demographic and economic data considering and various related energy factors. Comparisons between predicted outcomes, energy savings, and GHG emission reductions are an important feature. (Korean State Energies Analysis 2020)

Verified Carbon Standard (VCS) is a voluntary GHG program tracking system that is used in the energy industry today. The VCS Program is the predominant voluntary GHG tracking program. Verra is a non-profit that manages use of VCS – Verra states that "nearly 1,700 certified VCS projects have collectively reduced or removed more than 630 million tonnes of carbon and other GHG emissions from the atmosphere". Governments and corporations are moving toward reducing carbon footprints through energy efficiency, renewables, and related efforts. VCS can be used to access carbon markets to aid in reaching GHG reduction goals. Carbon markets can offset emissions by retiring carbon credits generated by projects that are reducing GHG emissions elsewhere. The VCS Program can help bring credibility to emission reduction efforts by tracking efforts. Projects are certified against VCS Program stringent rules and requirements and project managers can be issued tradable GHG credits which are Verified Carbon Units (VCUs). VCUs can be sold on the open market and retired to offset emissions. Verra develops and administers the VCS program.[8] (Korean State Energies Analysis 2020)

New Models and GHG Reduction

Given the need to capture great GHG savings, new state models are needed. The following outlines regulatory and policy EE structures in the US and EU that have successfully moved states and regions to greater GHG savings. These models are strong examples of state and regional cooperation for GHG reduction.

[8] Verra develops and manages standards that are globally applicable and advance action across a wide range of sectors and activities. www.verra.org

California

In July 2017, California's state legislature passed assembly bill (AB) 398 to reauthorize and extend until 2030 the state's economy wide GHG reduction program. The bill sets a new GHG target of at least 40% below the 1990 level of emissions by 2030. As of 2015, about 86% of California's GHG emissions were related to the consumption of energy. The California Energy Commission leads the state in establishing rules and regulations for implementing energy efficiency, specifically for appliance efficiency regulations, building energy efficiency, energy supplier reporting and state energy management. An executive order from California's governor targets an 80% reduction from 1990 levels by 2050. A large portion of the reductions are expected to come from energy efficiency. California's emissions cap-and-trade program, launched in 2013, is one of the major policies the state is using to lower its greenhouse gas emissions. In 2015, the California Air Resource Board (CARB) recommended tightening the program, which would reduce the number of available emissions credits.

A significant recent California carbon reduction example is the Sacramento Municipal Utility District (SMUD) adoption of a new EE metric which moves away from energy savings goals to avoided carbon. The SMUD board voted to change the metric by which it measures the progress of its EE investments making it the first entity in the US to do so. A goal is to encourage building electrification. SMUD was quoted as stating "[w]ith carbon as our new measuring stick, helping our customers go all-electric will be as important as helping them use less energy," said Rachel Huang, director of Energy Strategy, Research and Development. This was accepted in SMUD's Integrated Resource Plan with a goal of net zero emissions by 2040.

Illinois

As noted, Illinois's Governor, J.B. Prtizker, signed the CEJA into law in September 2021 placing the state on a path to a zero carbon by mid-century. The law (i) ensures EE and renewables continue to be a key resource, key low-income EE options and requirements are included in the law, (ii) provides significant subsidies to ensure the Exelon Dresden and Byron nuclear power plants continue operating as clean, zero emission base generation, and (iii) ensures two large municipal coal plants are completely clean or on a path to decommissioning by 2035.

Regional Greenhouse Gas Initiative (RGGI)

RGGI is the first mandatory market-based program in the US to reduce GHG. The RGGI states implemented a new cap reduction trajectory of 30% over the period 2020 to 2030. The CO_2 cap represents a regional budget for CO_2 emissions. RGGI states auction most CO_2 allowances, and the proceeds are invested in EE, renewables, and other beneficial resources. (www.rggi.org) EE is the largest portion of RGGI investments, equal to 38% of investments. Recent investments in EE funded projects are anticipated to save consumers over $1.2 billion on energy bills – this provides benefits to more than 115,000 households and 1,200 businesses. This also projected to avoid releasing 1.4 million short tons of CO_2 pollution. (RGGI Report 2018)

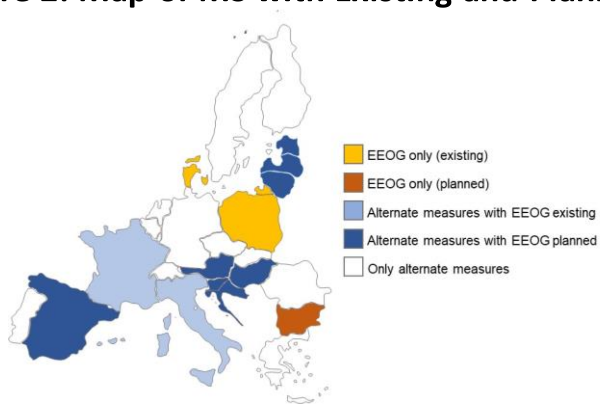
European Union

The EU deploys EE to meet climate and energy goals since it recognizes that reaching those goals without EE is expensive and problematic. In the EU, deployed EE focuses on decarbonization in the power, heating, and transportation sectors. EE is leveraged since the EU recognizes that substantial renewable energy would be needed to reach GHG goals and it's more expensive than EE. The EU will have to decrease energy use by approximately 17% by 2030 compared to 2015 levels. EU energy use will have to continue to decrease by at least one third by 2050 to achieve its decarbonization goals. (European Energy Transition 2030: The Big Picture)

EU electrification investment will only be limited by reducing overall energy demand in buildings, industrial and transport sectors and increasing efficiencies of appliances - EE is seen as a key strategy to ensure cost-effective decarbonization. Modelling from the European Commission, final electricity demand and gross electricity generation only rise slightly (by 8.5% and 6.9%, respectively) between 2015 and 2030 due to efficiency measures. With large decarbonization scenarios, electricity consumption increases by 50%, while electricity generation increases more than twofold compared to 2015 due to cleaner forms of generation (i.e., solar, hydrogen). (European Energy Transition 2030: The Big Picture)

Central to the Energy Efficiency Directive (Directive) are Energy Efficiency Obligation Schemes (EEOS). The EED has led to increased EEOS across the EU member states – at least 17 member states plan to implement or have already implemented an obligation scheme and approximately 40% of the proposed savings from Article 7 of the Directive are expected to be generated by EEOS. This makes EEOS the most important policy instrument in terms of energy savings. Four Member States (MS) have notified EEOS as the only policy instrument for Article 7 (two MS have notified existing schemes: Denmark and Poland, and two MS have notified planned schemes: Bulgaria, Luxembourg). The Figure 2 map below illustrates the current status of implementation of EEOS across the EU. (Study Evaluating National Policy Measures & Methods to Implement Article 7)

Figure 2: Map of MS with Existing and Planned EEOS



Source: Study Evaluating the National Policy Measures and Methodologies to Implement Article 7 of the EED at p. 16

New State Structures and GHG Reduction

New state regulatory structures are needed to foster EE deployment and corresponding GHG reduction. Each state controls it's regulatory structure and US EE is deployed across numerous states, but not all states. Wide EE adoption is limited by each state's internal policies, regulations, local or political concerns or simply limited interest in reducing energy consumption. Approximately 25 states have limited, or no EE savings goals focused on reducing energy use. Numerous states have no carbon or GHG reduction goals or policies. None of those energy goals are leveraged nationally, and a limited number of states count EE savings for reducing carbon or GHG. California and RGGI states are tracking GHG reduction attributed to EE energy savings through state sponsored EE initiatives. EE focus in the US has been and continues to be energy demand reduction so that new generation supply is not required. The state-by-state approach is disjointed and precarious since politics has led to drastically altered policies (i.e., OH and IN). (Gunn, Neumann - Regulatory Regimes 2014, 2016, 2018, 2020)

A very good alternative to the state-by-state US approach is the EU's model for deployed EE. The EU model could be used in the US for states to implement programs and policies for GHG reduction. The EU focuses on reducing energy use and waste and reducing GHG as well as reducing carbon levels through deployed EE. EU goals are mandated across EU states, there is a unified approach with rules that allow each MS to implement plans to reach individual MS goals. The goals appear to be working. EE measures are used to achieve energy supply needs, cut GHG, and promote EU economic competitiveness. (European Parliament: Fact Sheet on EE in the EU). EE is an imperative resource to reduce GHG in the EU. A minority of the 30 US EE states view EE as an imperative resource (e.g., CA, IL, MA, MI, MN, NH, NY, VT). (Neumann – IEPPEC 2020). The US could look to the EU model to implement EE programs, policies, and regulations for GHG reduction, this would require national energy legislation or similar broad policy. The barrier to date has been national coordination of energy policy and the absence of national energy legislation. Other examples of new state approaches to EE policies are outlined below. Key outcomes of cooperative approaches can be used to further GHG reductions – key benefits are reduced regulatory burden, utility program cooperation and consensus building across utility and consumer parties.

Illinois Programs and the Stakeholder Advisory Group (SAG)

A statewide approach through the Illinois SAG has led to joint utility EE programs and consistent Illinois Commerce Commission (ICC) policy. Large investor-owned utilities in Illinois required by law to offer cost-effective EE programs are Ameren Illinois, Commonwealth Edison Co. (ComEd), Peoples Gas Company, North Shore Gas Company and Nicor Gas (Utilities). The ICC originally required joint programs energy efficiency utility orders, and this was later required by the update to the state energy efficiency law (Future Energy Jobs Act - Senate Bill 2814). The ICC also ordered each utility (ca. 2008) to actively participate in the Illinois Stakeholder Advisory Group (SAG) so that there are consistently applied and agreedupon performance metrics for measuring portfolio and program performance. The SAG oversees all elements of EE policy, including, but not limited to net-to-gross frameworks, EE utility planning, discrete policy issues and TRM oversight and updates.

Arkansas Statewide

A permanent statewide collaborative in Arkansas was established in 2006. The original expectation was that it would change over time as the issues evolved. This group was called Parties Working Collaboratively (PWC) which initially focused on a narrow set of issues – the role grew as the state public utility commission and participants saw regulatory and oversight value in the collaborative model. The objective of the group is to forge consensus around issues and incorporate those areas of agreement into the projects undertaken by the PWC. Arkansas PWC was established to talk through start-up issues when designing EE programs. Filings presented to the commission are reduced to a consensus filing by the PWC, supplemented by dissenting opinions from the parties, if any. The process involves actively engaging stakeholders early in the planning process to critically examine the myriad of issues present in developing energy efficiency programs and managing their evolution.

California

California offers specific Statewide Programs for residential, commercial, and industrial (C&I) customers. In 2008, the California Public Utilities Commission (CPUC) adopted the state's first Long Term Energy Efficiency Strategic Plan (Strategic Plan), presenting a single roadmap to achieve maximum energy savings across all major groups and sectors in California. This Strategic Plan for 2009 to 2020 is the state's first integrated framework of goals and strategies for saving energy, covering government, utility, and private sector actions, and holds energy efficiency to its role as the highest priority resource in meeting California's energy needs.

Massachusetts

Massachusetts created its joint-statewide effort and published the Joint Statewide Three Year Electric and Gas Energy Efficiency Plan (Three Year Plan" - 2019). The largest utilities in the Commonwealth are included (National Grid, NSTAR, Columbia Gas of Massachusetts, Western Massachusetts Electric, Cape Light Compact, Berkshire Gas, New England Gas Company and Unitil, Blackstone Gas Company). The goal of the Three-Year Plan is "[t]o achieve the GCA's (MA Green Communities Act) mandate for a sustained and integrated statewide energy efficiency effort. implementation, regulation and evaluation".

New Hampshire

New Hampshire also has a statewide planning, implementation and evaluation approach for electricity and natural gas programs. The most recent plan is the CORE Energy Efficiency

Programs (New Hampshire Two Year Plan) filed by Granite State Electric Company d/b/a Liberty Utilities, New Hampshire Electric Cooperative, Inc., Public Service Company of New Hampshire and Unitil Energy Systems, Inc. and Energy North Natural Gas, Inc. d/b/a Liberty Utilities and Northern Utilities, Inc. referred to as the "NH CORE Utilities".

Wisconsin

Wisconsin's Focus on Energy is a consortium approach to delivering EE programs across the state. Focus on Energy is Wisconsin utilities' statewide EE and renewable resource offerings operational since 2001. It is funded by the state's investor-owned energy utilities (as required by Wis. Stat. § 196.374(2)(a)) and participating municipal and electric cooperative utilities. It should be noted that the utilities do not manage programs – all implementation is outsourced by Focus on Energy. Participating utilities include the largest utilities, municipal utilities as well as cooperatives.

Conclusion

Deploying EE across more US states would accelerate US GHG reduction goals. Modeled examples of deployed EE show significant GHG reduction that results from demand reduction. Efforts to move beyond traditional, case-by-case state regulatory commission oversight are important to coordinate leveraging EE for GHG reduction. Fostering development of statewide EE program oversight and development will require incremental state regulatory changes and new ideas for cooperation between utilities, stakeholders, municipalities, and stakeholders. Cooperative approaches can also be applied to leverage EE programs for carbon and GHG reduction. Like the EU, California and the RGGI states recognized EE as a resource to reduce demand and GHG. Other US states should consider adopting similar GHG goals and standards like California or RGGI. EU's model to use EE to meet lower GHG goals is impressive and could be central to any national US energy policy. Given that the US does not have any national energy policy today, implementing the concepts and models set forth here would be a great step forward.

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