Energy Efficiency Impact Report

Energy Efficiency in Utilities

Highlights

Cost-effective Programs

Energy efficiency can be considered a highly cost-effective utility resource: the ratio of lifetime costs to energy production is often cheaper than for nuclear, coal, natural gas, and in many cases for wind and solar energy generation.

Primary Energy Provider

Electricity and natural gas utilities are the primary energy provider for most consumers in residential, commercial, and industrial sectors. In this role, utilities, especially where incentivized by decoupling, incentives, or energy efficiency resource standards have managed energy efficiency programs for consumers that have resulted in some of the largest savings of any subnational energy efficiency policy tool.

Tripling Savings

Since 2006, spending on and savings from electricity efficiency programs have more than tripled. Since 2011, spending on natural gas efficiency programs has increased by 25% while their energy savings have nearly doubled.

Advanced Metering

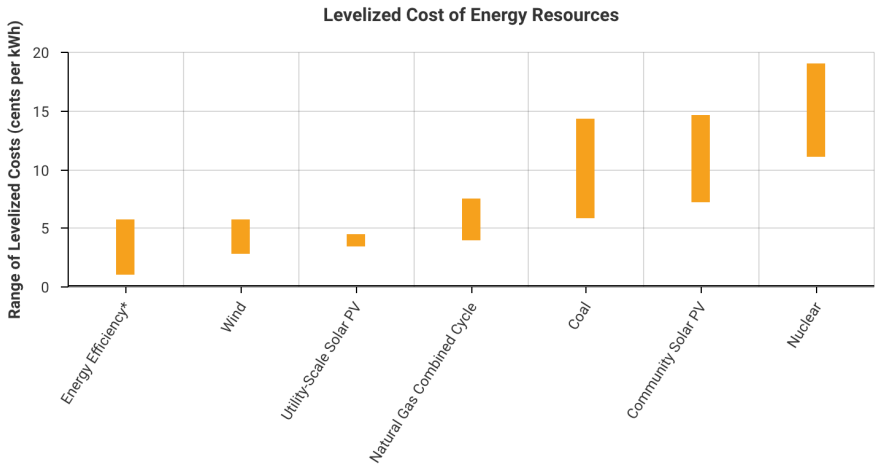
One enabler of a more flexible and responsive grid is the rapid deployment of advanced metering infrastructure. Smart meter installations, which were an emerging technology in 2008, have reached more than 50% of the installed meter base today.

Demand Response Programs

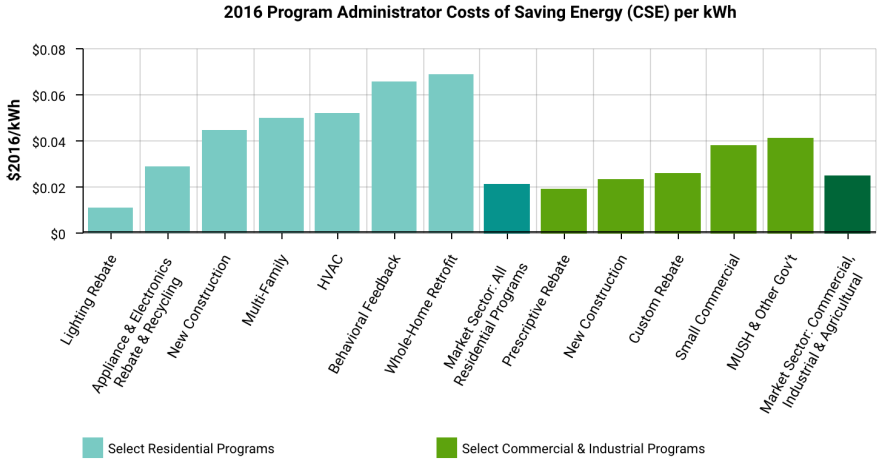
Demand response programs contributed 12.2 GW in peak demand savings in 2017. These savings were primarily driven by the industrial sector, but the residential and commercial sectors have enormous potential for growth.

12 Energy Efficiency is a Low-Cost Resource

Energy efficiency is a cost-effective, reliable, zero-carbon resource



*Sources: ACEEE (2018), Does Efficiency Still Deliver the Biggest Bang for Our Buck? A Review of Cost of Saved Energy for US Electric Utilities; Lazard (2018), Levelized Cost of Energy Analysis – Version 12.0 *Notes: Energy Efficiency program portfolio data from Molina and Relf 2018. Represents costs to utilities or program administrators only, including shareholder performance incentives if applicable. All other data from Lazard 2018 Unsubsidized Levelized Cost of Energy Comparison.*



Source: Hoffman, I.M., C.A. Goldman, S. Murphy, N. Mims Frick, G. Leventis, and L.C Schwartz (2018). The Cost of Saving Electricity Through Energy Efficiency Programs Funded by Utility Customers: 2009–2015. LBNL. Reprinted with permission.

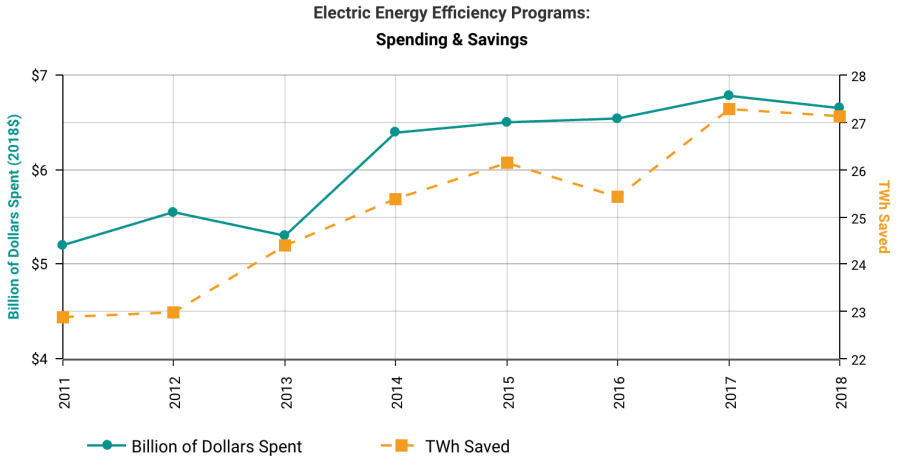
To meet electricity demand, as well as state energy or emissions reduction requirements, utilities can save a kilowatt-hour (kWh) through energy efficiency or generate a kWh. Thus, it is informative to consider energy efficiency as an energy resource: one that is distributed, zero-carbon, and often the most affordable option to satisfy energy needs relative to other generation technologies.

Utilities and other program administrators develop and implement a diverse portfolio of program types that target all customers and sectors using a variety of strategies. Each program type provides a unique level of savings at a specific cost, which can be quantified through several approaches, including the levelized total cost of saved electricity and levelized program administrator cost of saved electricity.

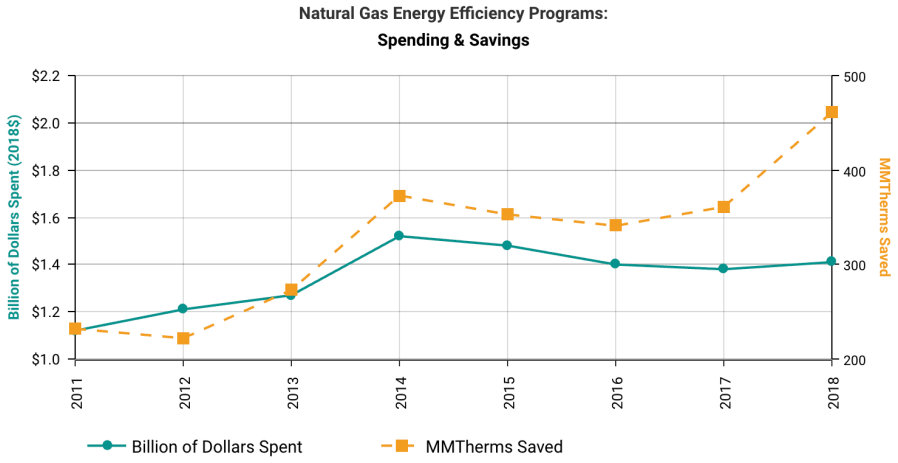
Lawrence Berkeley National Laboratory considered the levelized program administrator cost of saved electricity for a variety of utility customer-funded efficiency program types from 2009 to 2015, finding that costs ranged from residential lighting rebate programs ($0.011 cents/kWh) to whole-home retrofits ($0.069/kWh). In addition to specific programs, the report also provides market sector-wide estimates (i.e. savings-weighted average cost of saved electricity values), by quantifying savings-weighted averages across the residential ($0.021/kWh, excluding low-income consumers) and commercial, industrial, and agricultural sectors ($0.025/kWh).[1, 2]

13 Utility Programs Spending and Savings

Utility investments in energy efficiency continue to grow, achieving 18% more electricity savings and 98% more gas savings than in 2011



Source: ACEEE (2019), The State Energy Efficiency Scorecard



Source: ACEEE (2019), The State Energy Efficiency Scorecard

1 LBNL notes that programs for low-income consumers had Program Administrator CSE of approximately $0.105/kWh, due to the fact that program participants have lower participant contributions than other program types, and often require repair work to be completed before energy efficiency measures could be installed.

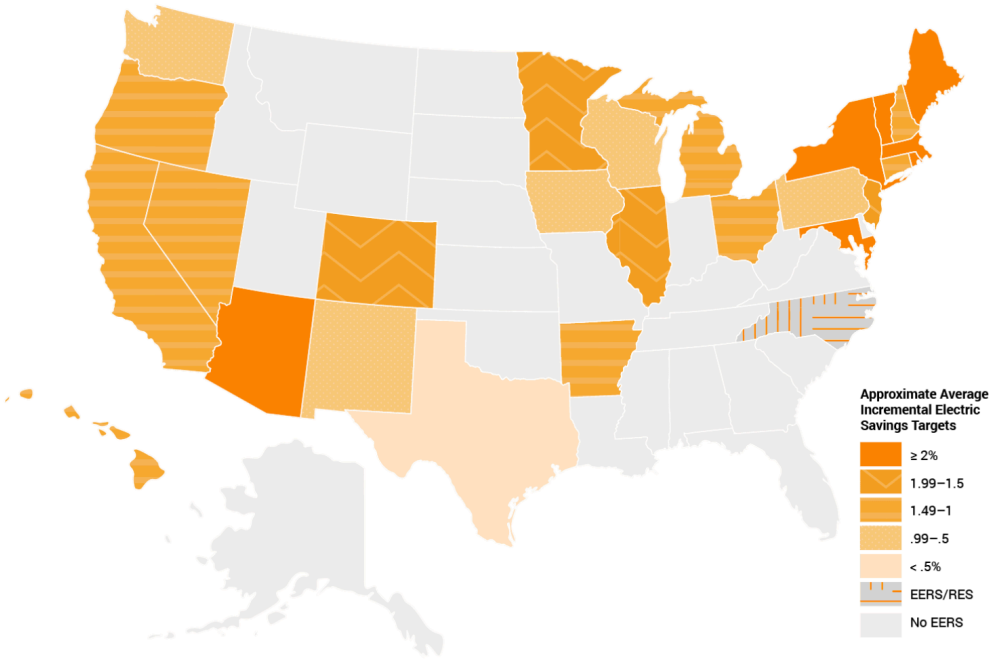
2 Hoffman, I.M., C.A. Goldman, S. Murphy, N. Mims Frick, G. Leventis, and L.C Schwartz (2018), The Cost of Saving Electricity Through Energy Efficiency Programs Funded by Utility Customers: 2009–2015. LBNL.

Electric and natural gas utilities, as the main providers of energy for households and businesses, invest significant resources in programs that boost energy efficiency. Since 2011, new investments in both electric and natural gas energy efficiency programs have increased by more than 25%, leading to an 18% increase in energy efficiency incremental savings in electricity and a 98% increase in incremental savings in natural gas. When compared to 2006, energy efficiency programs today are generating more than triple the incremental savings in electricity.[3]

14 Energy Efficiency Resource Standards

The majority of states are implementing energy efficiency resource standards, and have seen 4x increases in energy savings

State Energy Efficiency Resource Standards (EERS)
May 2019



Approximate Average Incremental Electric Savings Targets (2015–2020)			
Arizona	*2.10%*	*Nevada*	*1.10%*
Arkansas	*1.20%*	*New Hampshire*	*1.30%*
California	*1.30%*	*New Jersey*	*1.50%*
Colorado	*1.70%*	*New Mexico*	*1.00%*
Connecticut	*1.10%*	*New York*	*2.00%*
Hawaii	*1.40%*	*North Carolina*	*0.40%*
Illinois	*1.70%*	*Oregon*	*1.30%*
Iowa	*0.90%*	*Pennsylvania*	*0.80%*
Maine	*2.40%*	*Rhode Island*	*2.50%*
Maryland	*2.00%*	*Texas*	*0.20%*
Massachusetts	*2.70%*	*Vermont*	*2.40%*
Michigan	*1.00%*	*Washington*	*0.90%*
Minnesota	*1.50%*	*Wisconsin*	*0.70%*

Source: ACEEE (2019), The State Energy Efficiency Scorecard

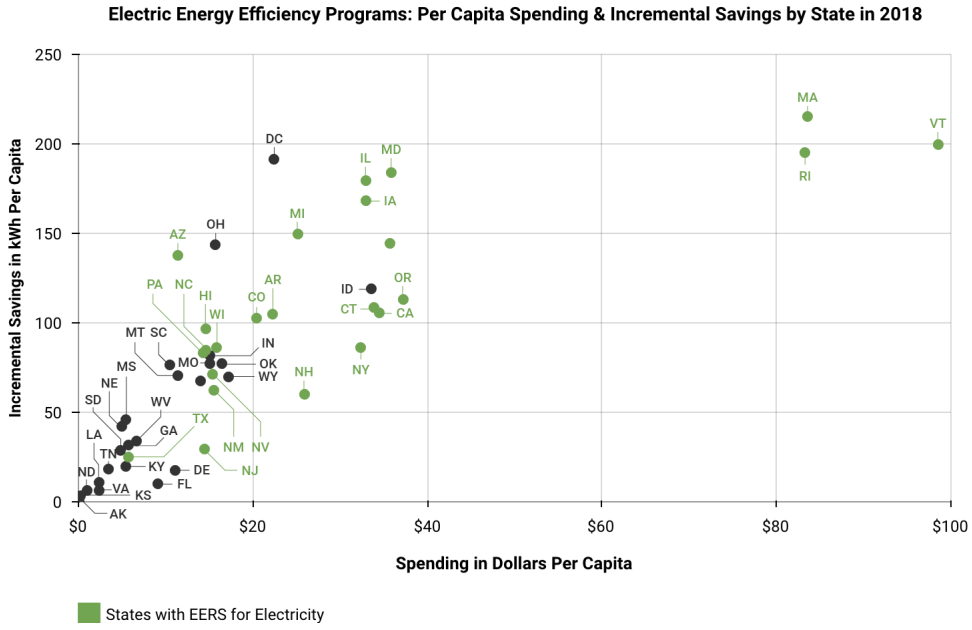
3 ACEEE (2019), The State Energy Efficiency Scorecard

An energy efficiency resource standard (EERS) is a state-level energy efficiency mandate, similar to a renewable portfolio standard (RPS), that requires an electric and/or natural gas utility to achieve a targeted level of energy savings from energy efficiency measures. As of 2019, 26 states have EERS policies in place. In 2017, states with EERS saved on average more than four times as much electricity as those that did not have targets (1.3% of retail sales compared to 0.3%).[4]

The strongest EERS requirements are in Massachusetts and Rhode Island, which require more than 2.5% new savings annually.[5] Massachusetts and Rhode Island are also among the top 3 states for most utility investment in energy efficiency programs.[6]

15 Utility Programs Spending and Savings Per Capita

States that invest in utility energy efficiency programs save more for customers

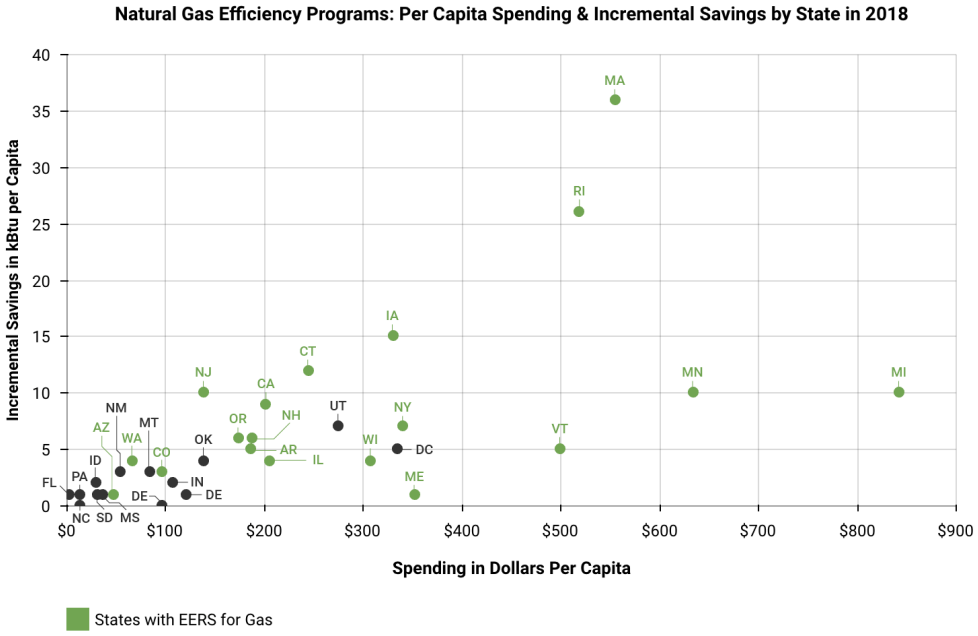


Source: ACEEE (2019), The State Energy Efficiency Scorecard

4 ACEEE (2019), State Energy Efficiency Resource Standards (EERS) May 2019

5 ACEEE (2017), Energy Efficiency Resource Standard (EERS)

6 As measured by spending on energy efficiency programs per capita.



Source: ACEEE (2019), The State Energy Efficiency Scorecard

While different states have different efficiency opportunities depending on their climate, geography, and economy, there is a clear trend that states that incentivize energy efficiency by EERS or other policies typically realize the greatest benefits from utility (ratepayer-funded) energy efficiency programs.[7]

Comparing each U.S. state's annual per capita spending on efficiency programs (including residential, commercial, and industrial programs) and the per capita incremental energy efficiency savings provides a measure of each state's utility efficiency program impact regardless of the state's size.

On this basis, EERS states stand out: Vermont, Rhode Island, Massachusetts, Maryland, Illinois, Iowa, and Minnesota all dedicate significant investment to efficiency programs and experience significant savings.[8] However, note that energy savings are self-reported and may not be comparable, and that some states include spending on efficiency of non-regulated fuels such as propane under electricity spending, but the fuel savings under natural gas.

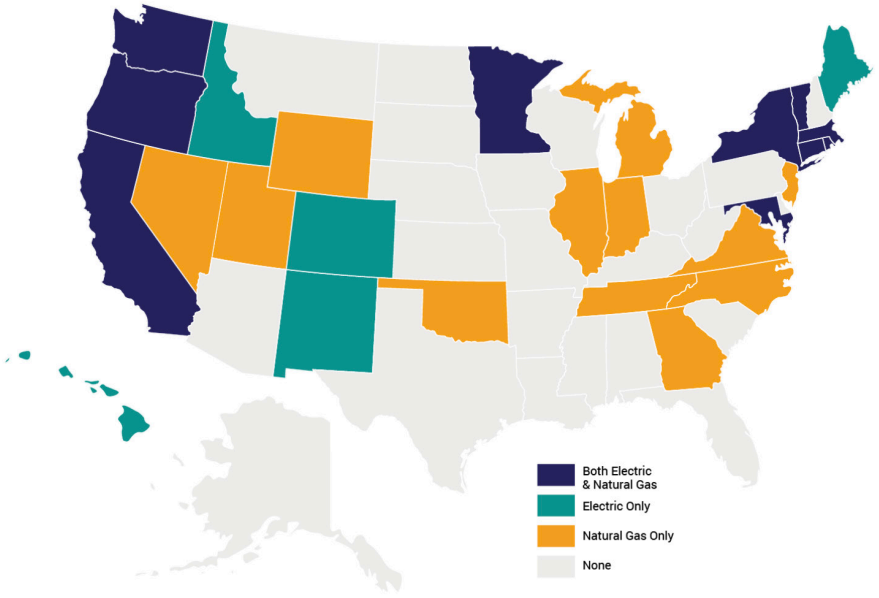
7 States with electric energy efficiency resource standards are highlighted in green on the scatter plot. State-level total spending and savings data are self-reported, and may include differences in methodology. Energy efficiency programs also apply to different combinations of residential, commercial, or industrial customers, such that the kWh savings per capita is not intended as a measure of residential energy efficiency savings, but a generalized measure of energy efficiency benefits.

8 On a total spending/savings basis (data not shown), California, Massachusetts, New York and Illinois host the largest programs and gain the most total energy savings.

16 Decoupling and Shareholder Incentives

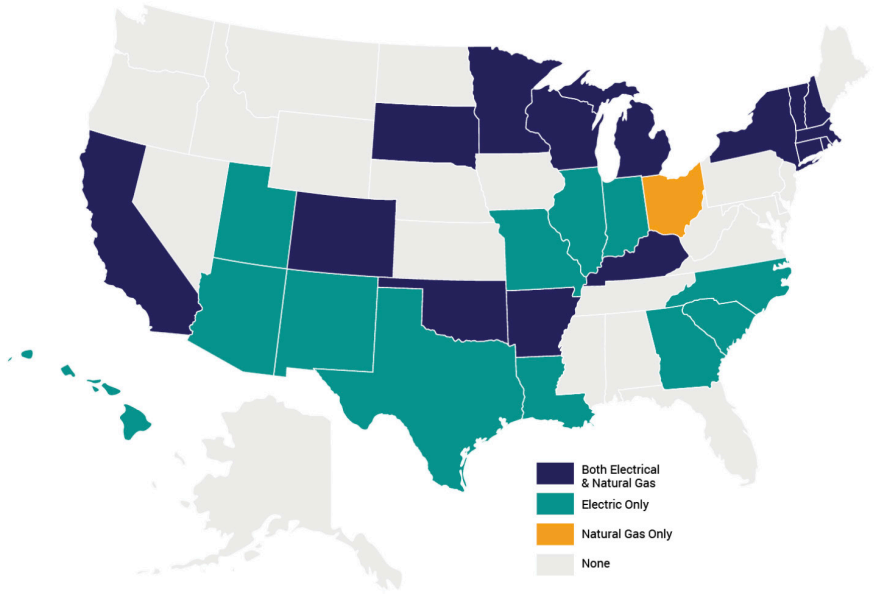
Decoupling and shareholder incentives encourage utilities to implement energy efficiency

2019: States with Decoupling or LRAM for Electricity and/or Natural Gas



Source: ACEEE (2019), The State Energy Efficiency Scorecard

2019: States with Performance Incentives for Electricity and/or Natural Gas



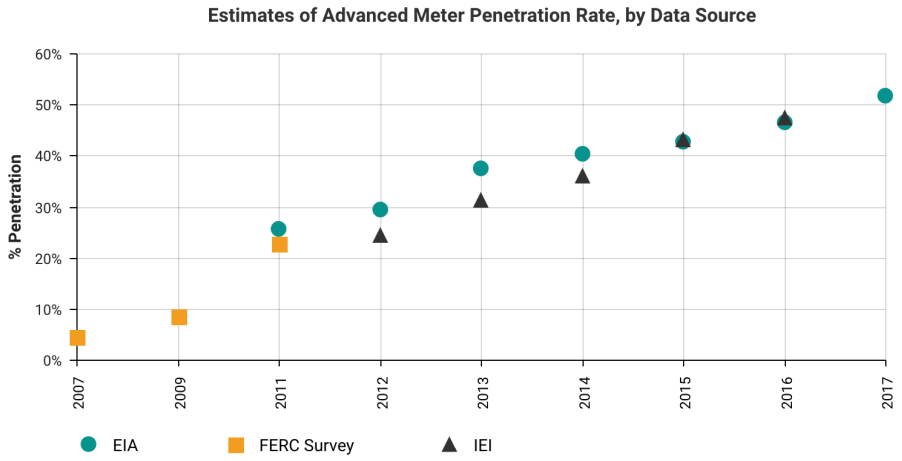
Source: ACEEE (2019), The State Energy Efficiency Scorecard

Traditional utility regulation has tied ("coupled") utility sales to profits: i.e., more sales results in more profits.[9] This is a direct disincentive to energy efficiency, and it can be corrected with specific policies, such as Decoupling and the Lost Revenue Adjustment Mechanism (LRAM).

Performance incentives can complement those strategies by rewarding savings from energy efficiency programs. All of the top 10 states for electricity savings deploy at least one of these strategies to incentivize energy efficiency – decoupling, LRAM, or performance incentives – and eight use performance incentives in concert with a decoupling or LRAM strategy.[10]

17 Smart Meters

Smart meter installations have surpassed 50% of the installed meter base



Source: FERC (2019), 2018 Assessment of Demand Response and Advanced Metering. Includes data from EIA Form EIA-861, FERC Surveys, and Edison Foundation Institute for Electric Innovation (IEI).

Electricity generation presents varying costs, both financial and in terms of emissions, that depend on the time of day, weather, and other factors, such as a downed power plant or disrupted power lines. However, most consumers pay flat rates for electricity, insulating them from these challenges that result from high-demand periods and disincentivizing energy-efficient behaviors that could help stabilize the grid.

Grid modernization technologies that enhance the responsiveness of the grid and enable greater communication between consumers and utilities are evolving rapidly, and utilities are preparing for the increasing role that they may play in their operations. One such example is in advanced metering infrastructure (AMI).

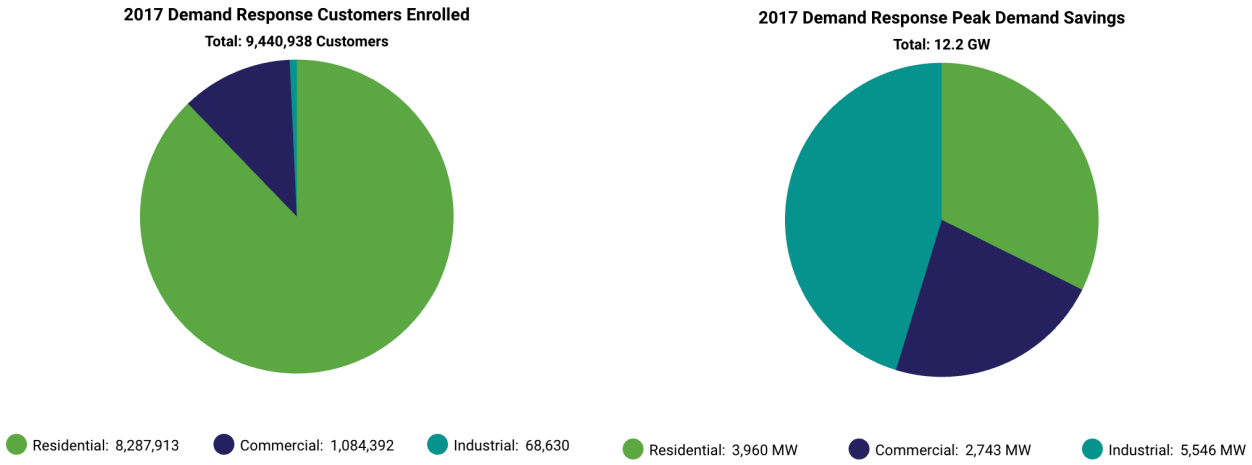
9 Under traditional regulation, utilities may have an incentive to increase sales between rate cases.

10 Top 10 states for absolute electricity savings: CA, IL, NY, MI, OH, MA, WA, AZ, NC, MN.
States with Electric Decoupling or LRAM: CA, CT, HI, MA, MN, NY, RI, VT, AK, CO, DC, KY, NH, OK, SD, AZ, IN, MD, NM, NC, OH, OR, WA, ID, LA, ME, MS, MO, NV, SC, KS;
States with Electric Performance incentives: CA, CT, HI, MA, MN, NY, RI, VT, AK, CO, DC, KY, MI, NH, OK, SD, AZ, GA, IL, IN, NM, NC, UT, WI, LA, MO, SC, TX;
States with Gas Decoupling or LRAM: CA, CT, MA, MN, NY, RI, VT, AK, CO, KY, MI, NH, OK, SD, AZ, GA, IL, IN, MD, NC, OR, UT, WA, MS, NV, NJ, TN, VA, WY;
States with Gas Performance incentives: CA, CT, MA, MN, NY, RI, VT, AK, CO, DC, KY, MI, NH, OK, SD, OH, WI

Such technology is the foundation for a more responsive energy system, allowing customers to alter their energy use to reflect grid conditions, and generating data that would allow energy efficiency program implementers to better design energy efficiency programs including demand response, measurement and verification, and peak hour savings.[11] While one component of this system – smart meters – was uncommon before 2008, they have grown rapidly in the last decade, now surpassing 50% of the total installed stock of meters in 2017.

18 Demand Response

Demand response saved 12.2 GW in peak demand energy savings in 2017. If scaled up significantly, it could save 20% of peak load in 2030



Source: EIA (2019), Monthly Energy Review

Demand response is a tool that allows electricity demand to be more flexible, which enhances the energy efficiency and reliability of the grid, responds to unexpected shortages and periods of high peak demand, and supports the greater incorporation of intermittent renewables.

The main entities involved in demand response programs are utilities, end-users, and in many cases, load aggregators, which enable the bundling of demand response capabilities for wholesale and retail markets. In 2017, industrial users were the primary demand response participants: although the industrial sector made up only 0.7% of demand response participants by number, it was responsible for 45% of peak demand savings in 2017. In contrast, the residential sector accounted for 88% of participants in demand response programs, and only 32% of peak energy savings.

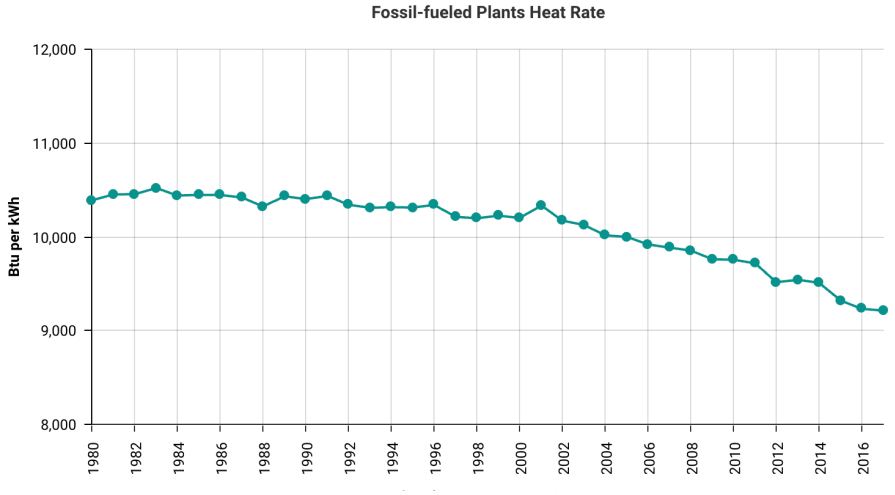
However, the potential for demand response is likely much higher: a recent study from the Brattle Group estimates that if real-time demand response programs and investments were scaled-up significantly, they could potentially provide 200 GW of load flexibility and approximately 20% of forecasted U.S. peak load in 2030, saving more than $15 billion a year in avoided system costs.[12]

11 Todd, A., Perry, M., Smith, B., Sullivan, M., Cappers, P., Goldman, C. (2014), Insights from Smart Meters: The Potential for Peak-Hour Savings from Behavior-Based Programs. LBNL.

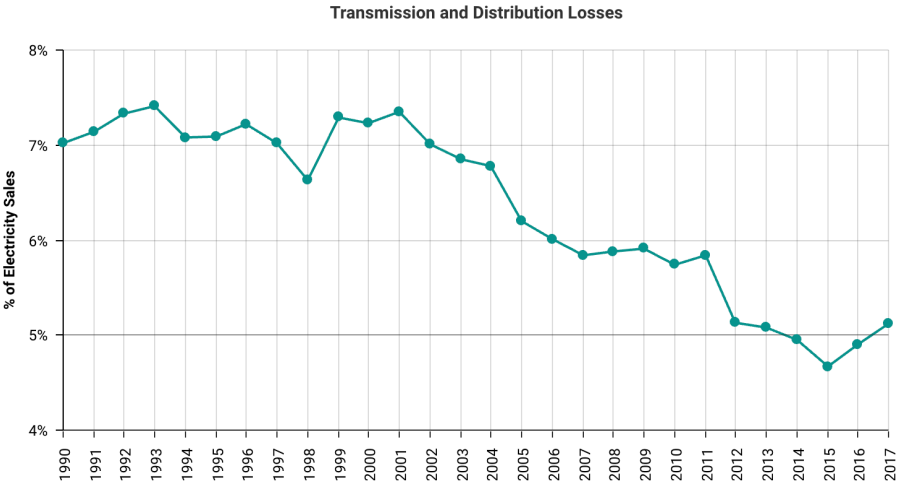
12 The Brattle Group (2019), The National Potential for Load Flexibility

19 Energy Efficiency and Losses in Power Systems

Since 2002, the heat rates at fossil-fueled plants have fallen by 9%, and power transmission and distribution losses fell by 28%



Source: EIA (2019), Monthly Energy Review



Source: EIA (2019), State Electricity Profiles

While end-use is often the focus of energy efficiency programs, there are massive opportunities for greater energy efficiency in power generation, transmission, and distribution systems. Fossil-fuel power plants produced more than 2.6 trillion kWh in 2018, or 60% of U.S. power generation, and 27% of U.S. greenhouse gas emissions.[13,14] These plants have also made gains in thermal efficiency, as measured by their heat rate, which fell by 9% from 2002 to 2017.[15] Improving the heat rate of a typical 500-MW unit by only 1% can amount to fuel savings[16] of greater than $600,000 annually.[17,18]

13 EIA (2018), What is U.S. electricity generation by energy source?

14 EPA (2018), Greenhouse Gas Inventory Data Explorer

15 EIA (2019), Monthly Energy Review

16 The cost of fuel is 60-80% of the overall cost of producing electricity.

17 EPRI (2019), 2019 Heat Rate Improvement Conference Proceedings

18 EPRI (2016), Sustainability of Heat Rate Improvements

Transmission and distribution systems have also seen significant decreases in electricity losses.[19] Losses, while not entirely avoidable, can be costly: in 2017, U.S. losses were estimated at 202.5 TWh, slightly more than the net generation in the state of California in 2018.[20] From 1990 through 2002, the U.S. experienced losses of roughly 7%; however, from 2002–2017, losses fell to roughly 5%. While the U.S. electric transmission and distribution system is now more efficient, some countries have achieved lower levels of losses, including Singapore (2%), Iceland (3%), South Korea (3%), and Germany (4%).[21]

19 PNNL (2016), Electricity Distribution System Baseline Report

20 EIA (2019), Electricity

21 The World Bank (2014), Electric power transmission and distribution losses