



The Edison Foundation

INSTITUTE for
ELECTRIC INNOVATION

Report

Energy Efficiency Trends in the Electric Power Industry (2008-2018)

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Prepared by:
Adam Cooper
Mike Shuster
Lorraine Watkins

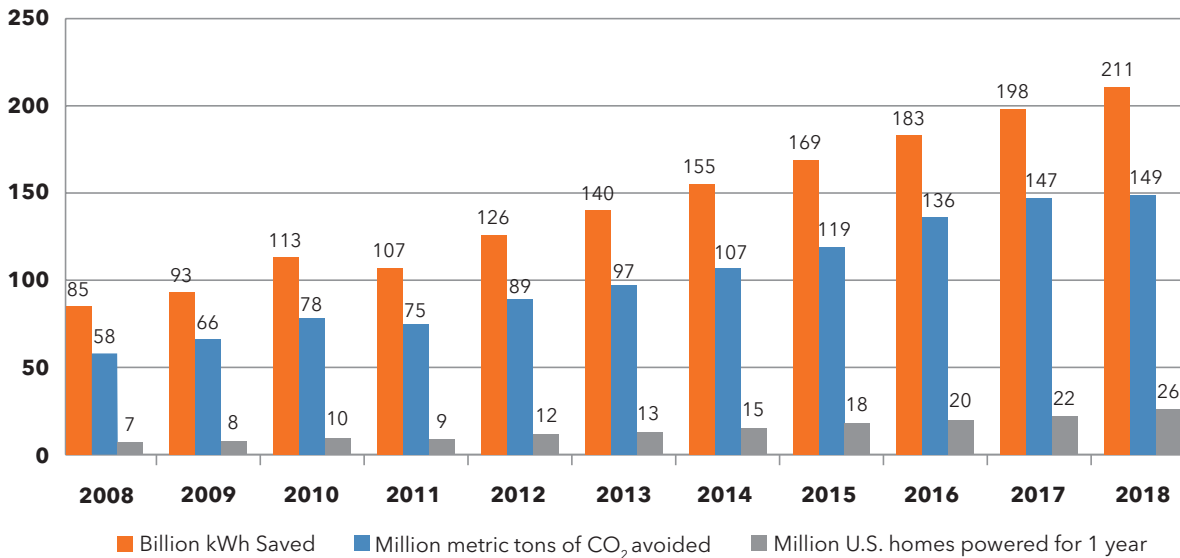
EXECUTIVE SUMMARY

Energy efficiency (EE) programs are a win-win, helping customers to save energy and electric companies to reduce their carbon emissions.¹ For several decades, electric companies have supported their customers' interest in energy efficiency by providing incentives and information that lower the cost of purchasing energy-efficient appliances and devices and encourage energy management through energy efficiency and demand response programs.

According to the most recent information, electric company customer-funded EE programs (i.e., both efficiency and demand response programs) saved 211 terawatt-hours (TWh) of electricity in 2018, up from 198 TWh in 2017.²

- EE savings grew 36 percent between 2014 and 2018, from 155 TWh saved in 2014 to 211 TWh in 2018.
- In 2018, EE programs avoided the generation of 149 million metric tons of carbon dioxide.³
- In 2018, EE programs saved enough electricity to power 26 million U.S. homes for one year.⁴

Figure 1. U.S. Energy Efficiency Savings and Carbon Dioxide (CO₂) Emissions Avoided (2008-2018)



Over 10 years, customer-funded EE program expenditures more than doubled, increasing from \$3.4 billion in 2008 to \$7.2 billion in 2018. A 2018 report from Lawrence Berkeley National

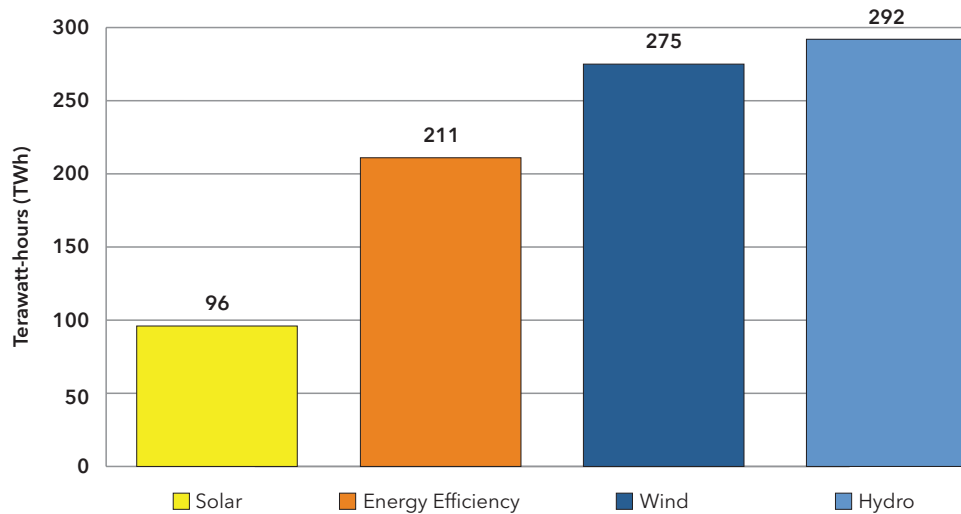
1. For the purposes of this report, the electric power industry includes investor-owned electric companies, public power utilities, electric cooperatives, and federal utilities. We use the term 'electric companies' in this report to encompass all of these industry segments.
2. Details on how energy efficiency program savings are calculated can be found on page 11.
3. U.S. Environmental Protection Agency. Greenhouse Gas Equivalencies Calculator: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>
4. Ibid.

Laboratory found EE programs continue to be very cost-effective, delivering energy savings at a cost of roughly 2.5 cents per kilowatt-hour (kWh) over the lifetime of the investment.⁵

Similar to renewable energy resources, energy efficiency programs reduce CO₂ emissions and are an important part of the U.S. energy mix. Figure 2 shows that:

- EE programs in 2018 saved more than twice the amount of electricity generated by solar resources in 2018.

Figure 2. Energy Efficiency Programs Saved More Energy than Solar Generated in 2018



It is widely recognized that supportive regulatory frameworks are key to expanding the electric power industry’s already large commitment to EE. Homes and businesses that take advantage of EE programs benefit from them.

- States with regulatory frameworks that support electric company investments in EE programs tend to be leaders in savings.
- In total, 34 states have approved fixed-cost recovery mechanisms—18 states have revenue decoupling, and 16 have lost revenue adjustment mechanisms (see Table 1).
- In total, 29 states have performance incentives in place.

More details on the regulatory frameworks by state are provided in the second half of this report.

Table 1. Summary of State Regulatory Frameworks in 2018

Energy Efficiency Incentive Mechanisms		Number of States	Pending
Fixed-Cost Recovery Mechanisms	Lost Revenue Adjustment	16	0
	Revenue Decoupling	18	1
Performance Incentives		29	2
Energy Efficiency Resource Standard (EERS)		27	0

5. Lawrence Berkeley National Laboratory. The Cost of Saving Electricity Through Energy Efficiency Programs Funded by Utility Customers: 2009-2015. June 2018.

INTRODUCTION

Historically a product of public policy with varying levels of participation, EE programs now are viewed by the electric power sector as an essential element in an ever-expanding set of service offerings – high efficiency lighting, smart thermostats, dynamic rates, energy management, renewable energy, storage, and more – to meet the expectations of electric customers who live in an on-demand, service-centric world. For customers, this is the beginning of a new era of options and control over their energy supply and use. Increasingly, customers are gaining access to technology that gives them the ability to tailor energy use to their personal needs and wants.

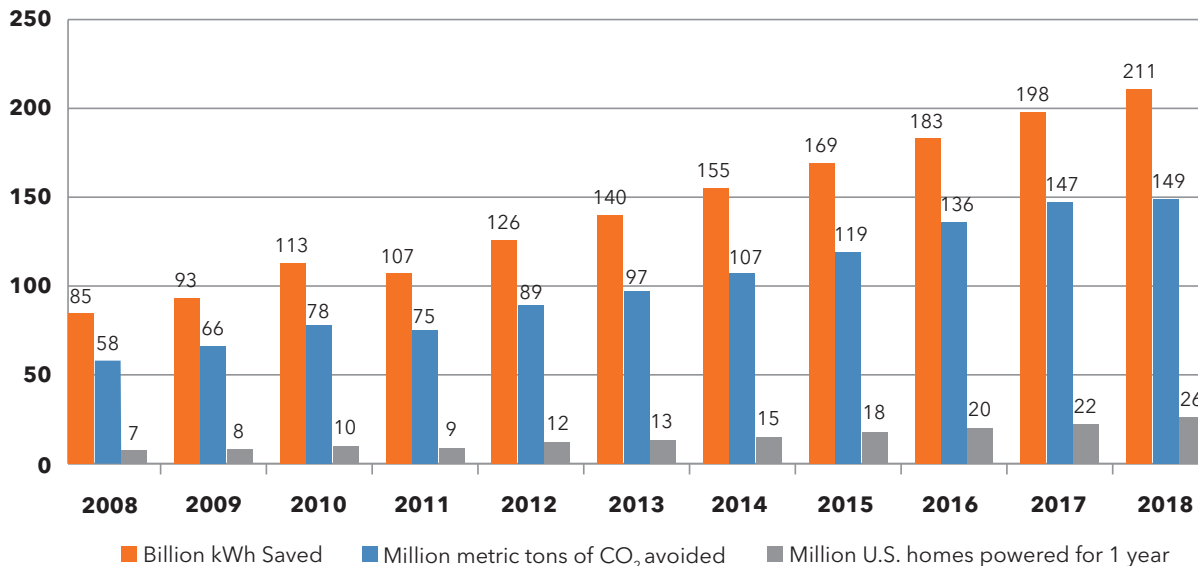
The goal of EE programs is to produce energy and capacity savings that benefit customers, electric companies, and society as a whole. For several decades, electric companies have supported their customers' interest in energy efficiency by providing incentives and information that lower the cost of purchasing energy-efficient appliances and devices and encourage energy management through energy efficiency and demand response programs.

- The focus of EE programs is to reduce energy consumption while increasing energy input productivity [e.g., fewer kilowatt-hours (kWh) in exchange for equal or improved output].
- The focus of demand response (DR) programs is to reduce peak energy demand when the wholesale price of electricity is relatively high or for power system reliability reasons.

2018 ENERGY EFFICIENCY SAVINGS

In 2018, EE programs saved 211 terawatt-hours (TWh) of electricity, enough to power 26 million U.S. homes for one year, and avoided the generation of 149 million metric tons of carbon dioxide (see Figure 3). The energy savings from EE programs is equivalent to 5.5 percent of total end use electricity consumption in 2018.

Figure 3. U.S. Energy Efficiency Savings and Carbon Dioxide (CO₂) Emissions Avoided (2008-2018)



Of the total 211 TWh saved in 2018, 30 TWh are incremental energy savings from either new programs or new participants in existing programs in 2018. Estimates of energy savings are developed based on the following:

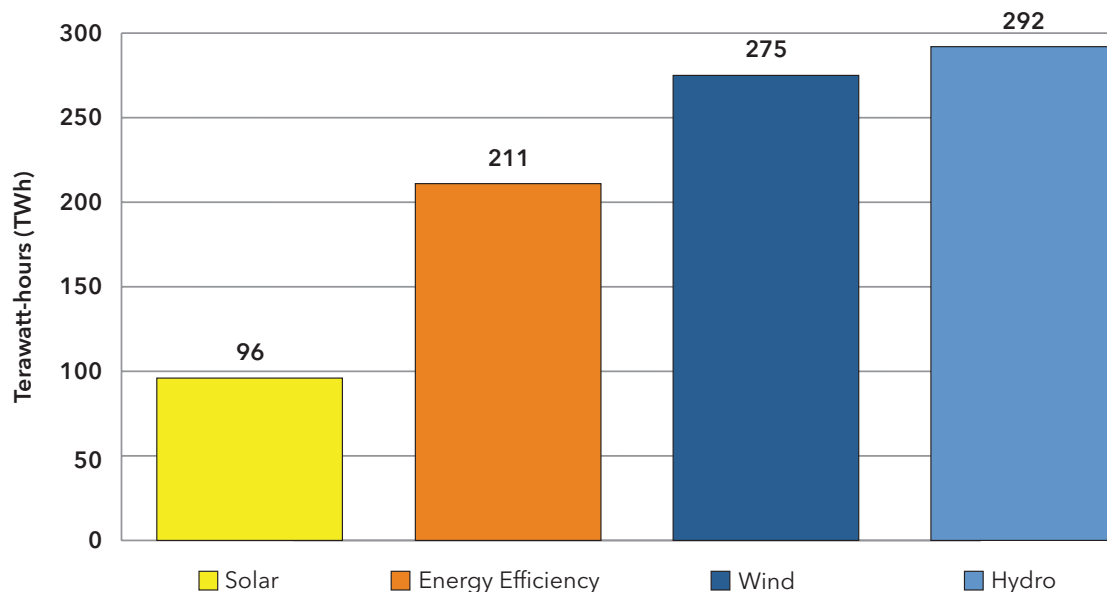
- Energy savings due to past program participation, which continue to deliver measurable and verifiable savings (e.g., a high-efficiency refrigerator installed in 2015 continues to save energy in 2018).
- Energy savings due to customer participation in new programs (e.g., in 2018, an electric company offers a brand new LED product rebate, and a customer purchases and installs an LED lamp).
- Energy savings due to new participants in an existing program (e.g., in 2018, an electric company continues to offer rebates for high-efficiency refrigerators, and a customer utilizes the rebate to purchase an eligible refrigerator).

Energy efficiency programs are cost-effective ways to manage energy use. A 2018 report from Lawrence Berkeley National Lab found that electric company customer-funded energy efficiency programs that reported results during 2009-2015 delivered energy savings at a cost of roughly 2.5 cents per kWh saved over the lifetime of the investment.⁶

Similar to renewable energy resources, EE programs reduce carbon dioxide emissions and are an important part of the U.S. energy mix. Figure 4 shows that:

- EE programs in 2018 saved more than twice the amount of electricity generated by solar resources in 2018.
- EE programs saved about 77 percent of the electricity generated by wind resources in 2018.

Figure 4. Energy Efficiency Programs Saved More Energy than Solar Generated in 2018



6. Lawrence Berkeley National Laboratory. The Cost of Saving Electricity Through Energy Efficiency Programs Funded by Utility Customers: 2009-2015. June 2018.

2018 ENERGY EFFICIENCY EXPENDITURES

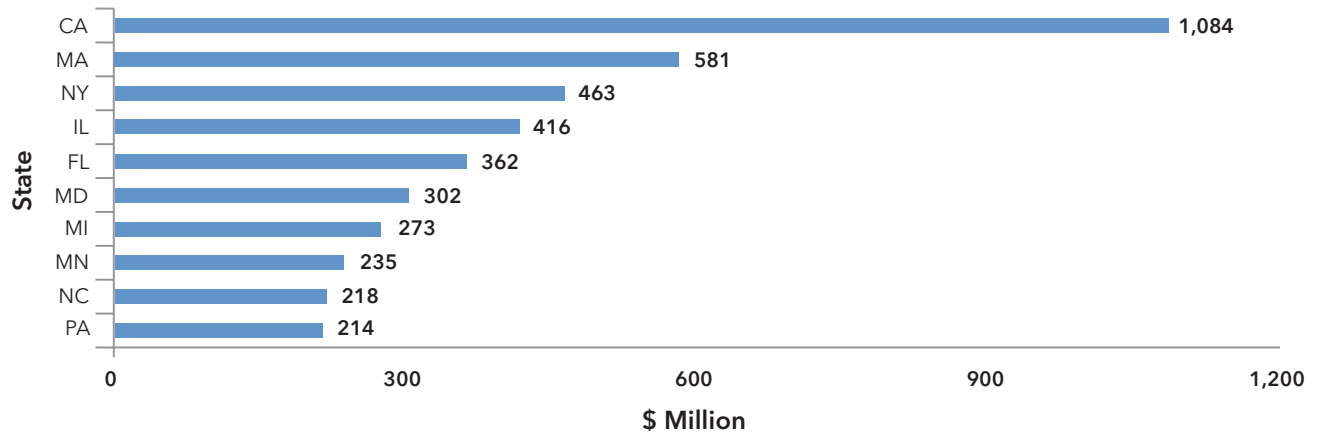
Table 2 shows EE program expenditures of \$7.2 billion in the United States in 2018, approximately the same amount spent as in 2017, marking the fifth year in a row that energy efficiency program expenditures exceeded \$7 billion. With energy efficiency resource standards in half of all U.S. states and with more than 30 states with regulatory frameworks that support electric company investments in EE, IEI believes that expenditures are likely to exceed \$9 billion by 2025.

Electric companies – encompassing investor-owned electric companies, public power utilities, electric cooperatives, and federal utilities – are the largest providers of EE programs in the United States, with program-related expenditures of \$6.5 billion, comprising 90 percent of the \$7.2 billion in EE expenditures nationwide. Third-party administrators deliver the remaining 10 percent.

Table 2. U.S. Customer-Funded Energy Efficiency Expenditures (2008-2018)

	Total	Electric Power Industry	Third-Party Administrator	Electric Power Industry Share of Total	Total Expenditure Year-Over-Year
2008	\$3,395,273,063	\$3,009,521,643	\$385,751,420	89%	
2009	\$3,776,011,406	\$3,312,287,327	\$458,110,923	88%	11%
2010	\$4,831,868,289	\$4,271,690,924	\$560,177,365	88%	28%
2011	\$5,711,276,703	\$4,914,350,762	\$796,925,941	86%	18%
2012	\$5,861,218,593	\$5,244,287,814	\$616,930,779	89%	3%
2013	\$6,440,303,000	\$5,811,865,000	\$628,438,000	90%	10%
2014	\$7,285,637,000	\$6,589,178,000	\$696,459,000	90%	13%
2015	\$7,232,937,000	\$6,490,523,000	\$742,414,000	90%	-1%
2016	\$7,513,376,000	\$6,613,805,000	\$899,571,000	88%	4%
2017	\$7,245,596,000	\$6,524,207,000	\$721,389,000	90%	-4%
2018	\$7,200,750,018	\$6,479,369,530	\$736,881,000	90%	-1%

Figure 5 shows the 10 states with the largest 2018 EE expenditures. These 10 states accounted for 58 percent of U.S. electric EE expenditures in 2018. California leads the states with \$1.08 billion in EE expenditures, with Massachusetts second (\$581 million), and New York third (\$463 million).

Figure 5. 2018 Energy Efficiency Expenditures – Top 10 States

To provide some sense of the relative magnitude of spending, it is important to consider spending on energy efficiency in both absolute terms and in relation to the state's share of the nation's total population and electricity consumption. Table 3 shows 2018 energy efficiency expenditures, population by state, and the state's relative share of U.S. energy efficiency expenditures, population, and electricity consumption.

Seven states – California, Connecticut, Hawaii, Maryland, Massachusetts, Rhode Island, and Vermont – have 2018 energy efficiency expenditure shares that are at least double their share of U.S. electricity consumption. Energy efficiency programs in these states have delivered substantial cumulative energy savings, thus lowering the per-capita consumption of electricity. This is reflected (in part) by the fact that, in these seven states, the percent of U.S. electricity consumption is significantly lower than the percent of U.S. population.

Table 3. Summary of U.S. Customer-Funded Energy Efficiency Efforts by State

State	2018 Energy Efficiency Expenditures (\$Millions)	2018 U.S. Population*	% of Total 2018 U.S. Energy Efficiency Expenditures	% of U.S. Population	% of 2018 U.S. Electricity Consumption
AK	\$0.1	737,438	0.0%	0.2%	0.2%
AL	\$63.6	4,887,871	0.9%	1.5%	2.3%
AR	\$119.2	3,013,825	1.7%	0.9%	1.3%
AZ	\$93.0	7,171,646	1.3%	2.2%	2.0%
CA	\$1,084.3	39,557,045	15.1%	12.1%	6.6%
CO	\$63.5	5,695,564	0.9%	1.7%	1.5%
CT	\$121.3	3,572,665	1.7%	1.1%	0.7%
DC	\$17.6	702,455	0.2%	0.2%	0.3%
DE	\$14.9	967,171	0.2%	0.3%	0.3%
FL	\$362.0	21,299,325	5.0%	6.5%	6.2%

State	2018 Energy Efficiency Expenditures (\$Millions)	2018 U.S. Population*	% of Total 2018 U.S. Energy Efficiency Expenditures	% of U.S. Population	% of 2018 U.S. Electricity Consumption
GA	\$63.1	10,519,475	0.9%	3.2%	3.6%
HI	\$31.1	1,420,491	0.4%	0.4%	0.2%
IA	\$164.6	3,156,145	2.3%	1.0%	1.3%
ID	\$29.2	1,754,208	0.4%	0.5%	0.6%
IL	\$415.9	12,741,080	5.8%	3.9%	3.7%
IN	\$110.0	6,691,878	1.5%	2.0%	2.7%
KS	\$9.6	2,911,505	0.1%	0.9%	1.1%
KY	\$73.0	4,468,402	1.0%	1.4%	2.0%
LA	\$22.5	4,659,978	0.3%	1.4%	2.4%
MA	\$581.1	6,902,149	8.1%	2.1%	1.4%
MD	\$301.5	6,042,718	4.2%	1.8%	1.6%
ME	\$37.6	1,338,404	0.5%	0.4%	0.3%
MI	\$273.3	9,995,915	3.8%	3.1%	2.7%
MN	\$234.5	5,611,179	3.3%	1.7%	1.8%
MO	\$117.2	6,126,452	1.6%	1.9%	2.1%
MS	\$39.8	2,986,530	0.6%	0.9%	1.3%
MT	\$16.9	1,062,305	0.2%	0.3%	0.4%
NC	\$218.1	10,383,620	3.0%	3.2%	3.6%
ND	\$23.0	760,077	0.3%	0.2%	0.5%
NE	\$19.1	1,929,268	0.3%	0.6%	0.8%
NH	\$36.1	1,356,458	0.5%	0.4%	0.3%
NJ	\$175.6	8,908,520	2.4%	2.7%	2.0%
NM	\$46.3	2,095,428	0.6%	0.6%	0.6%
NV	\$46.3	3,034,392	0.6%	0.9%	1.0%
NY	\$462.6	19,542,209	6.4%	6.0%	3.9%
OH	\$213.7	11,689,442	3.0%	3.6%	4.0%
OK	\$103.2	3,943,079	1.4%	1.2%	1.7%
OR	\$160.4	4,190,713	2.2%	1.3%	1.3%
PA	\$214.2	12,807,060	3.0%	3.9%	3.9%
RI	\$87.8	1,057,315	1.2%	0.3%	0.2%
SC	\$183.8	5,084,127	2.6%	1.6%	2.1%
SD	\$8.8	882,235	0.1%	0.3%	0.3%

State	2018 Energy Efficiency Expenditures (\$Millions)	2018 U.S. Population*	% of Total 2018 U.S. Energy Efficiency Expenditures	% of U.S. Population	% of 2018 U.S. Electricity Consumption
TN	\$55.1	6,770,010	0.8%	2.1%	2.7%
TX	\$172.4	28,701,845	2.4%	8.8%	11.0%
UT	\$50.6	3,161,105	0.7%	1.0%	0.8%
VA	\$35.9	8,517,685	0.5%	2.6%	3.1%
VT	\$47.5	626,299	0.7%	0.2%	0.1%
WA	\$183.6	7,535,591	2.6%	2.3%	2.3%
WI	\$174.3	5,813,568	2.4%	1.8%	1.8%
WV	\$11.0	1,805,832	0.2%	0.6%	0.9%
WY	\$11.1	577,737	0.2%	0.2%	0.4%
Total	\$7,200.7	327,167,434			

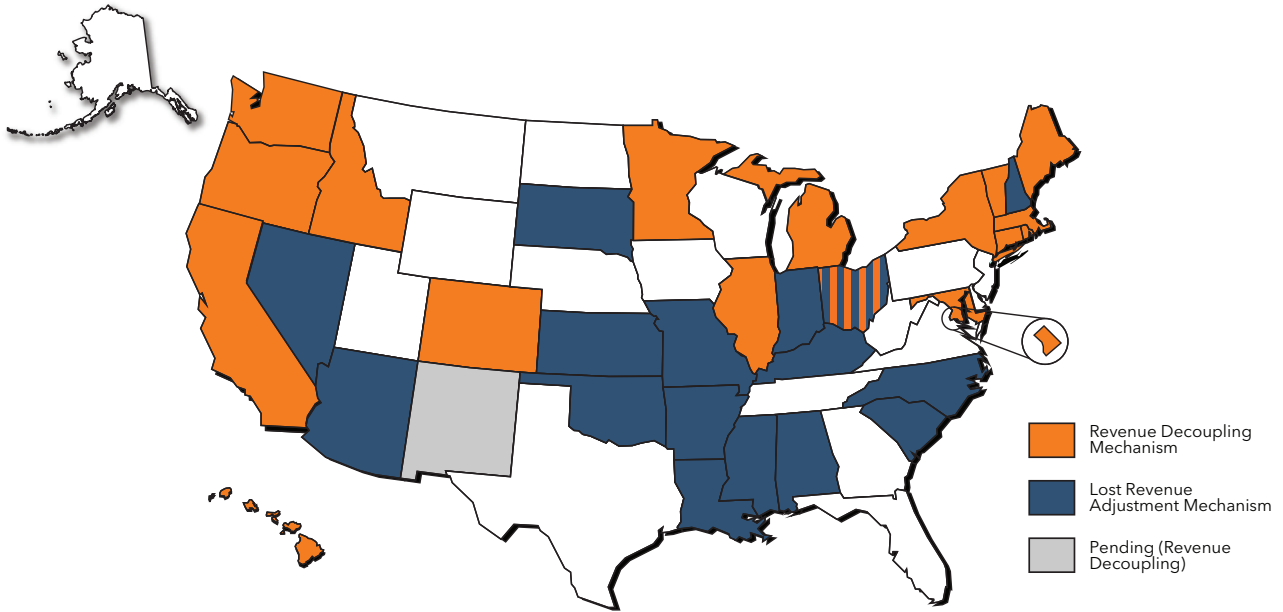
* Source: United States Census Bureau. 2018 National and State Population Estimates. *Table 1. Annual Estimates of the Residential Population for the United States, Regions, States, and Puerto Rico: April 1, 2010 to July 1 2018*: <https://www.census.gov/newsroom/press-kits/2018/pop-estimates-national-state.html>

ENERGY EFFICIENCY REGULATORY FRAMEWORKS

The regulatory environment in each state is a major factor in determining the size of customer-funded energy efficiency programs. Three regulatory mechanisms are critical for aligning incentives for electric companies to treat demand-side resources as financial equivalents to supply-side investments: direct cost recovery, fixed-cost recovery, and performance incentives.

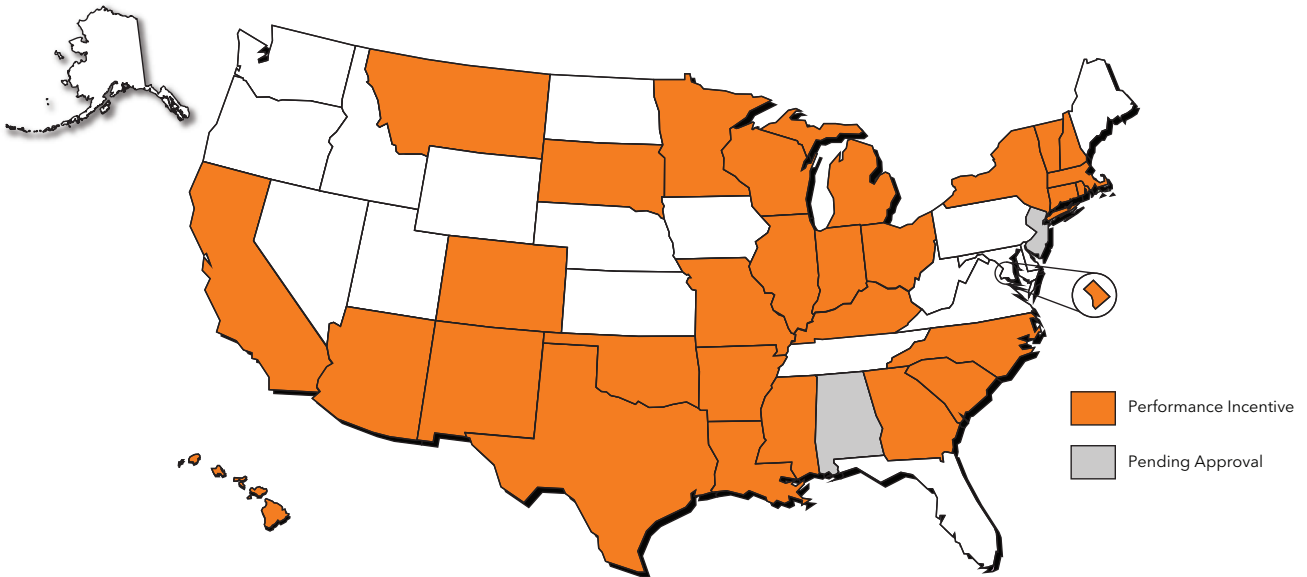
- Direct cost recovery refers to regulator-approved mechanisms for the recovery of costs related to the administration of the efficiency program; implementation costs such as marketing; and the actual cost of product rebates and mid-stream product buy-downs. Such costs are recovered through regulatory rate reviews, system benefits charges, and tariff riders/surcharges.
- Fixed-cost recovery refers to decoupling and lost revenue adjustment mechanisms that assist the electric company in recovering the marginal revenue associated with fixed operating costs. Fixed costs include transmission, distribution, and ancillary services and customer-specific services such as metering and billing. Legacy ratemaking practices tie the recovery of fixed costs to volumetric consumption based on an assumed level of energy sales. The purpose of energy efficiency programs is to reduce the consumption of electricity; decoupling and lost revenue adjustment mechanisms allow for timely recovery of fixed costs. Figure 6 shows fixed-cost recovery mechanisms by state.

Figure 6. Lost Revenue & Decoupling Mechanisms – by State



- Performance incentives reward electric companies for achieving certain energy efficiency program goals and, in some cases, impose a penalty for performance below the agreed-upon goals. Performance incentives allow electric companies to earn a return on their investment in energy efficiency, similar to the return on supply-side investments. Figure 7 shows which states have performance incentives.

Figure 7. Performance Incentives – by State



- Over the past several years, state regulatory frameworks have changed significantly in support of energy efficiency programs. Table 4 shows that 34 states allow for some type of fixed-cost recovery (either decoupling or a lost revenue adjustment mechanism) and that 29 states have performance incentives. In addition, 27 states have enacted long-term (3+ years) energy efficiency savings targets known as Energy Efficiency Resource Standards (EERS).⁷

Table 4. Summary of State Regulatory Frameworks in 2018

Energy Efficiency Incentive Mechanisms		Number of States	Pending
Fixed-Cost Recovery Mechanisms	Lost Revenue Adjustment	16	0
	Revenue Decoupling	18	1
Performance Incentives		29	2
Energy Efficiency Resource Standard (EERS)		27	0

CONCLUSION

The role of energy efficiency as a resource continues to expand in the nation's energy mix. Electric companies continue to innovate and pursue strategies that ensure energy efficiency is a smart business solution that delivers broad-based benefits to customers, including both savings and carbon reduction. By taking a portfolio approach, electric companies are offering easily accessible tried and true programs, such as high-efficiency lighting and HVAC tune ups, to an increasing share of customers, while also increasingly offering programs that achieve deep, comprehensive energy savings in homes and buildings by leveraging data, price signals, and connected technologies to manage energy.

IEI believes that energy efficiency expenditures and savings will continue to grow over the next decade as long as participation in energy efficiency programs remains an easy option for customers. The key issue facing energy efficiency programs and the industry as a whole is whether electric companies, technology companies, and regulators can collaborate to help customers take advantage of new service offerings and unlock value. The regulatory frameworks that support electric company investments in energy efficiency programs have proven successful. IEI believes that carbon benefits will play a key role in the next generation of energy efficiency programs and services.

7. American Council for an Energy-Efficient Economy. Next-Generation Energy Efficiency Resource Standards. August 2019.

METHODOLOGY

There is diversity in how electric companies estimate and report energy efficiency savings, largely influenced by filing requirements of their respective regulatory bodies. Not all electric companies maintain energy efficiency 'aggregate' or 'annual' program results. In fact, the U.S. Energy Information Administration (EIA) tracks and publishes only 'incremental' and 'lifecycle' impacts. Incremental savings only capture the impacts of new programs and new participants in existing programs for a one-year period (e.g., 2018). Lifecycle savings extend incremental savings over the anticipated useful life of the energy efficiency investment.

Electric companies report energy impacts in 'net' or 'gross' terms. Gross savings are defined as the total change in energy consumption that results from program-promoted actions taken by program participants regardless of the extent or nature of program influence on their actions. Net savings are defined as the change in energy consumption attributable only to the energy efficiency program efforts, separating out exogenous influences on energy consumption, such as customer self-interest, program free riders, and program spillover. This report primarily includes gross energy savings.

To account for differences across the collected information, IEI employs a simple calculation to develop an aggregate estimate of energy savings in 2018. First, a basic decay rate is applied to 2017 aggregate energy savings by major census region to approximate the effect of past program measures reaching the end of their useful life. Second, 2018 incremental savings by region are added.

- 2018 aggregate energy savings equals 2017 aggregate energy savings by region, less the product of the decay rate, plus 2018 incremental savings.

DATA, LIMITATIONS, AND INTERPRETATIONS

Information on program expenditures, impacts, and budgets are in calendar year format. In 2019, the EIA released customer-funded electric efficiency program savings and expenditures data for 2018. This dataset covers 688 companies in the U.S. This includes 678 electric and combined electric and natural gas companies and 10 third-party energy efficiency administrators. From this dataset and past IEI survey efforts, IEI estimated energy savings in 2018.

We encourage participation from all energy efficiency program administrators, their staff, and the respective state commissions. We kindly request that comments or questions regarding the findings contained in this report be sent to Adam Cooper, Senior Director, Research and Strategy at IEI, acooper@edisonfoundation.net.

ENERGY EFFICIENCY REGULATORY FRAMEWORKS - STATE SUMMARY

The table below identifies the states with lost revenue adjustment mechanisms, revenue decoupling, and/or performance incentives in place. Please contact Adam Cooper at acooper@edisonfoundation.net for more details on the mechanics of the state regulatory frameworks and relevant regulatory orders and decisions.

State	Revenue Decoupling	Lost Revenue Adjustment	Performance Incentives
AL		✓	
AR		✓	✓
AZ		✓	✓
CA	✓		✓
CO	✓		✓
CT	✓		✓
DC	✓		✓
GA			✓
HI	✓		✓
ID	✓		
IL	✓		✓
IN		✓	✓
KS		✓	
KY		✓	✓
LA		✓	✓
MA	✓		✓
MD	✓		
ME	✓		

State	Revenue Decoupling	Lost Revenue Adjustment	Performance Incentives
MI	✓		✓
MN	✓		✓
MO		✓	✓
MS		✓	✓*
MT			✓
NC		✓	✓
NJ			✓*
NH		✓	✓
NM	✓*		✓
NV		✓	
NY	✓		✓
OH	✓	✓	✓
OK		✓	✓
OR	✓		
RI	✓		✓
SC		✓	✓
SD		✓	✓
TX			✓
VT	✓		✓
WA	✓		
WI			✓

✓* Indicates state legislation allows for these mechanisms, but no state regulatory commission decision or electric company filing has been approved.

About the Institute for Electric Innovation

The Institute for Electric Innovation focuses on advancing the adoption and application of new technologies that will strengthen and transform the energy grid. IEI's members are the investor-owned electric companies that represent about 70 percent of the U.S. electric power industry. The membership is committed to an affordable, reliable, secure, and clean energy future.

IEI promotes the sharing of information, ideas, and experiences among regulators, policymakers, technology companies, thought leaders, and the electric power industry. IEI also identifies policies that support the business case for the adoption of cost-effective technologies.

IEI is governed by a Management Committee of electric industry Chief Executive Officers. In addition, IEI has a select group of technology companies on its Technology Partner Roundtable.

About the Edison Foundation

The Edison Foundation is a 501(c)(3) charitable organization dedicated to bringing the benefits of electricity to families, businesses, and industries worldwide. Furthering Thomas Alva Edison's spirit of invention, the Foundation works to encourage a greater understanding of the production, delivery, and use of electric power to foster economic progress; to ensure a safe and clean environment; and to improve the quality of life for all people. The Edison Foundation provides knowledge, insight, and leadership to achieve its goals through research, conferences, grants, and other outreach activities.



Institute for Electric Innovation
701 Pennsylvania Avenue, N.W. | Washington, D.C. 20004-2696
202.508.5440 | Visit us at: www.edisonfoundation.net