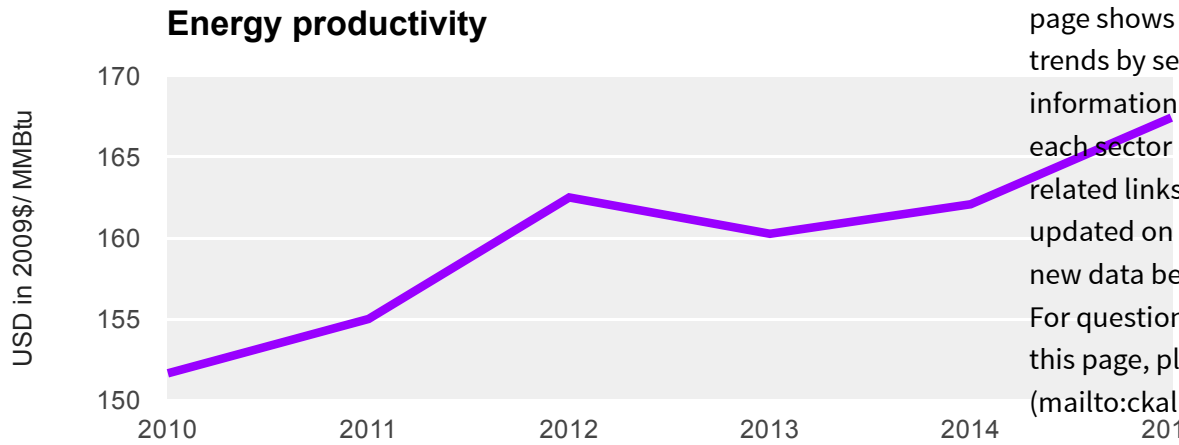
Tracking energy efficiency performance in the United States

National-level metrics



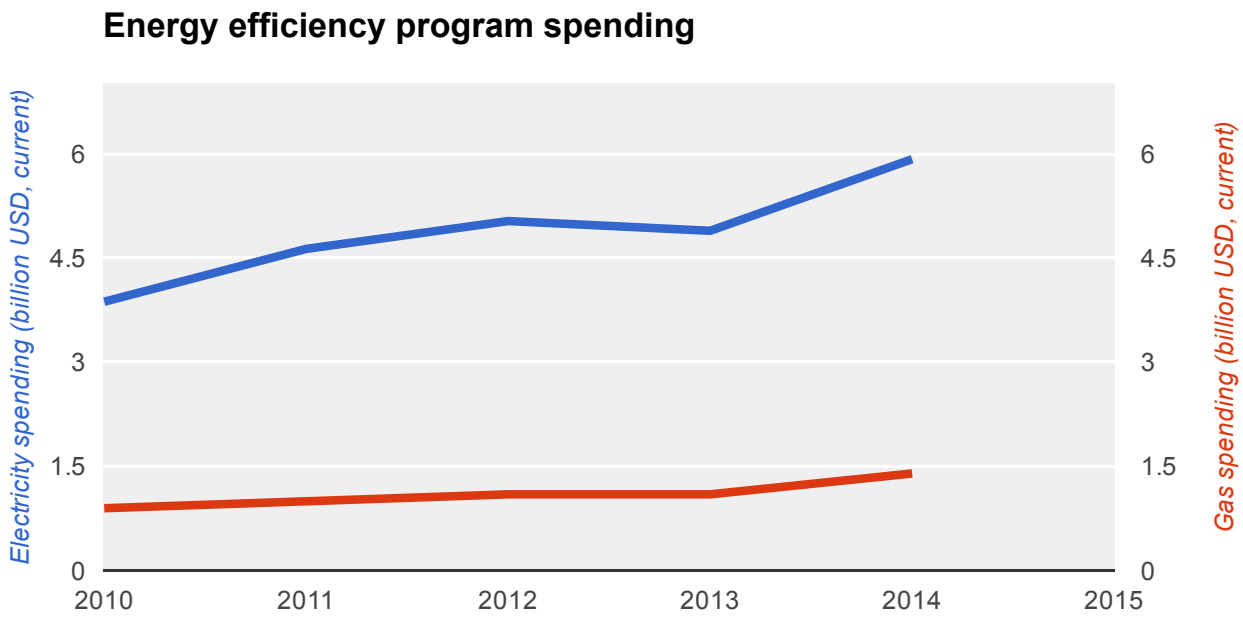
Welcome to ACEEE's national indicators of energy efficiency in the United States. This web page shows energy efficiency trends by sector. More information on ACEEE's work in each sector can be found in the related links. The page will be updated on a yearly basis as new data become available. For questions or feedback on this page, please email us here (mailto:ckallakuri@aceee.org).

Source: ACEEE analysis of *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/) data, EIA.

Energy productivity is a simple and easily measurable metric. Productivity is the amount of service or useful work produced by a unit of energy. At the national level, energy productivity is gross domestic product (GDP) per unit of total primary energy (http://www.eia.gov/tools/glossary/index.cfm?id=p) consumed by the country. This broad metric may be affected by economic factors (such as the amount of manufacturing), climate, access to energy, and other conditions, as well as by efficiency. President Obama announced a goal, now supported by a Department of Energy (DOE) initiative (http://www.energy2030.org/), to double energy productivity over 2010 levels by 2030. Note that energy productivity is the inverse of energy intensity, which is the energy consumed per unit of work done. We can track energy efficiency using either of these two metrics.

ACEEE resources

Linking energy efficiency to economic productivity (//aceee.org/research-report/e13f)
35 years of energy efficiency (//aceee.org/energy-efficiency-united-states-35-years-and)

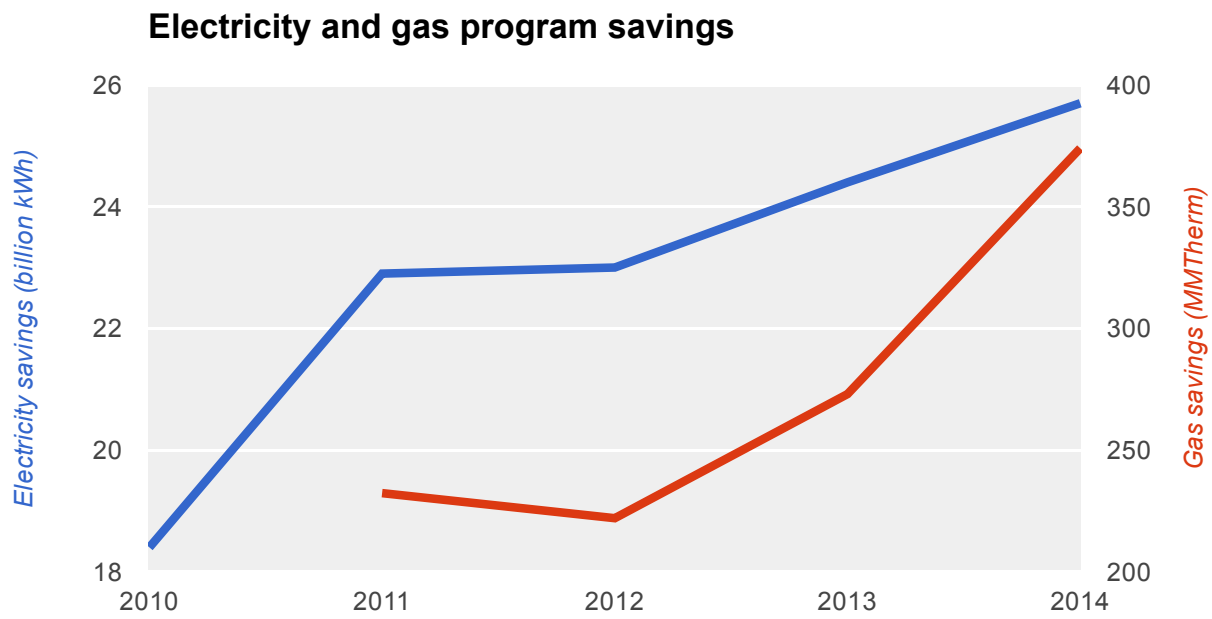


Source: ACEEE State & Local Policy Database (http://database.aceee.org)

Energy efficiency programs require upfront costs. Among a number of financing strategies (//aceee.org/topics/energy-efficiency-financing), small charges levied on customer utility bills are the single largest source of funding for US energy efficiency programs. Administered by utilities or contracted to third parties, these energy efficiency programs involve customers in projects ranging from simple lighting replacements to whole-building retrofits. The graph shows annual customer-funded expenditures on US electricity and natural gas efficiency programs.

ACEEE resources

State ratepayer-funded programs (http://database.aceee.org/state/customer-energy-efficiency-programs)
Utility programs (http://database.aceee.org/state/utilities-summary)
ACEEE *State Scorecard* (//aceee.org/state-policy/scorecard)



Sources: Natural gas, *2015 State Energy Efficiency Scorecard (//aceee.org/research-report/u1509);* Electricity, ACEEE State & Local Policy Database (http://database.aceee.org)

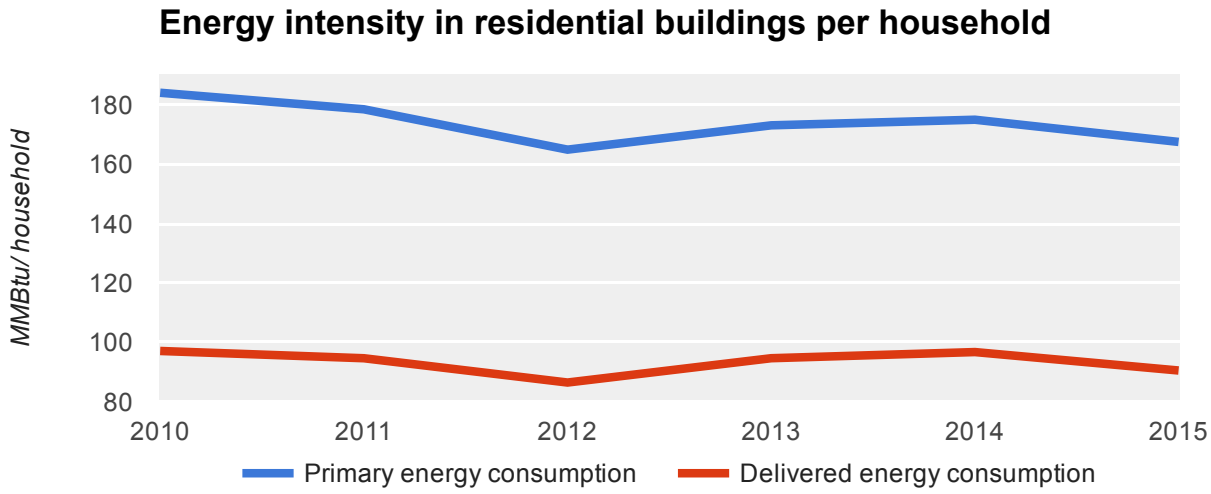
Ratepayer-funded energy efficiency programs have saved billions of kilowatt-hours (kWh) for customers over the years. This indicator looks at electricity and natural gas savings from these efficiency programs, aggregated at the national level. The graph represents first-year energy savings from efficiency programs in

each year as reported in our state scorecards (//aceee.org/state-policy/scorecard). The SEE Action Network led by the Environmental Protection Agency (EPA) and DOE also provides resources (https://www4.eere.energy.gov/seeaction/topic-category/evaluation-measurement-and-verification) to measure the benefits of energy efficiency.

ACEEE resources

ACEEE *State Scorecard* (//aceee.org/state-policy/scorecard)
Multiple benefits of energy efficiency (//aceee.org/blog/2015/06/why-everyone-benefits-energy)
Future EM&V (//aceee.org/research-report/ie1503)

Buildings

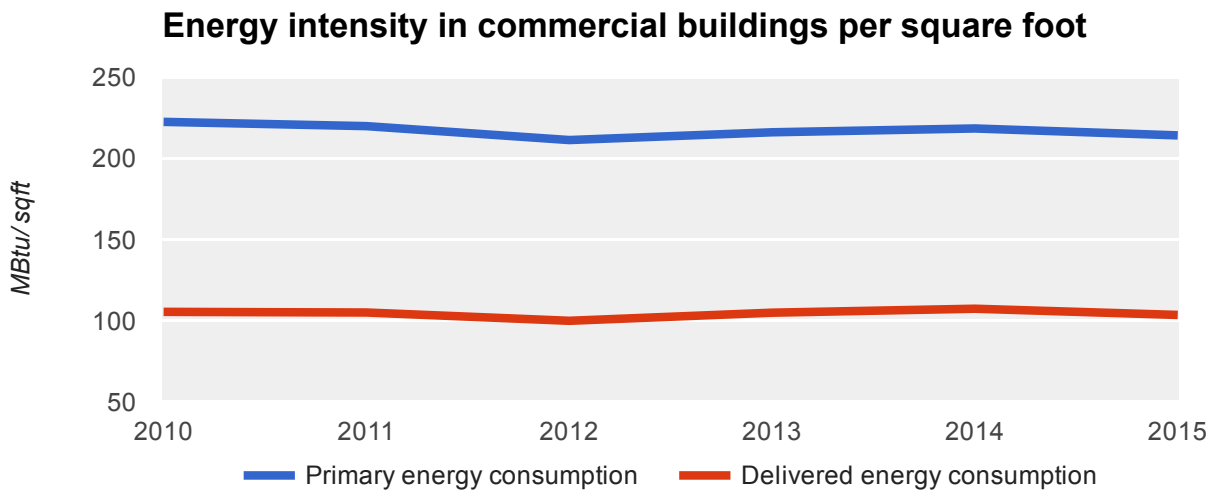


Source: ACEEE analysis of *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/) data, EIA.

One way to measure energy efficiency in residential buildings is to evaluate the total *primary energy or source energy* consumed per household. Primary energy includes the energy consumed by buildings along with the losses incurred in the generation, transmission, and distribution of that energy. *Delivered or site energy* is the energy consumed by buildings on site, as reflected by a utility bill. About 50% (http://buildingsdatabook.eren.doe.gov/ChapterIntro2.aspx?2#1) of the energy used in residential buildings goes toward space heating, cooling, and water heating, which are largely influenced by climate and the size of the house. The graph shows primary and delivered energy per household in residential buildings.

ACEEE resources

Buildings program (//aceee.org/about/programs/buildings)
International Scorecard (//aceee.org/portal/national-policy/international-scorecard)

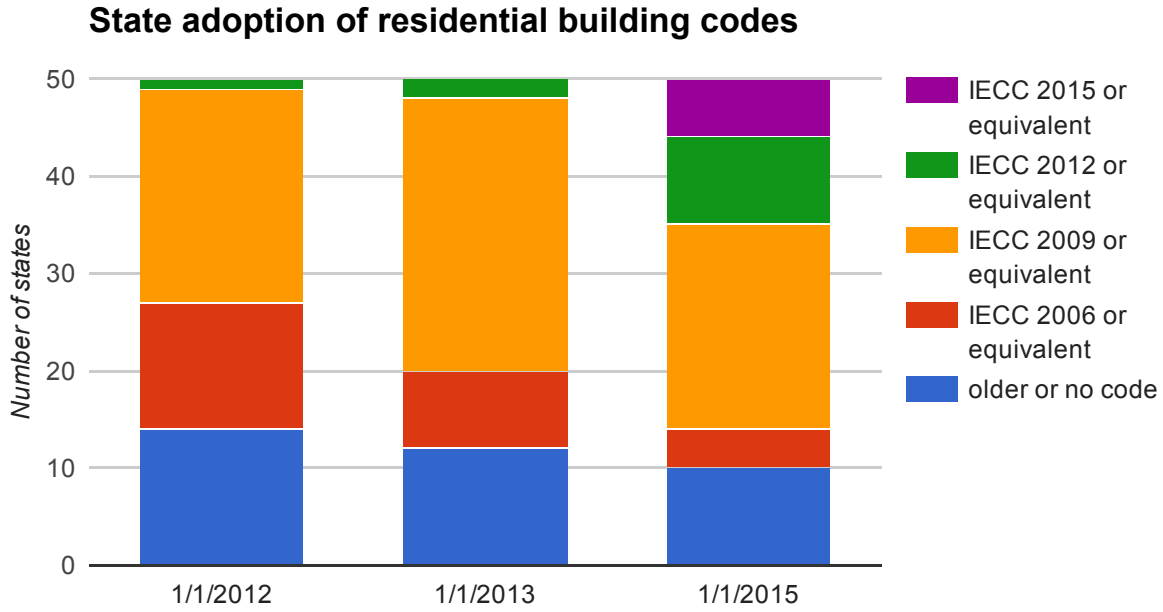


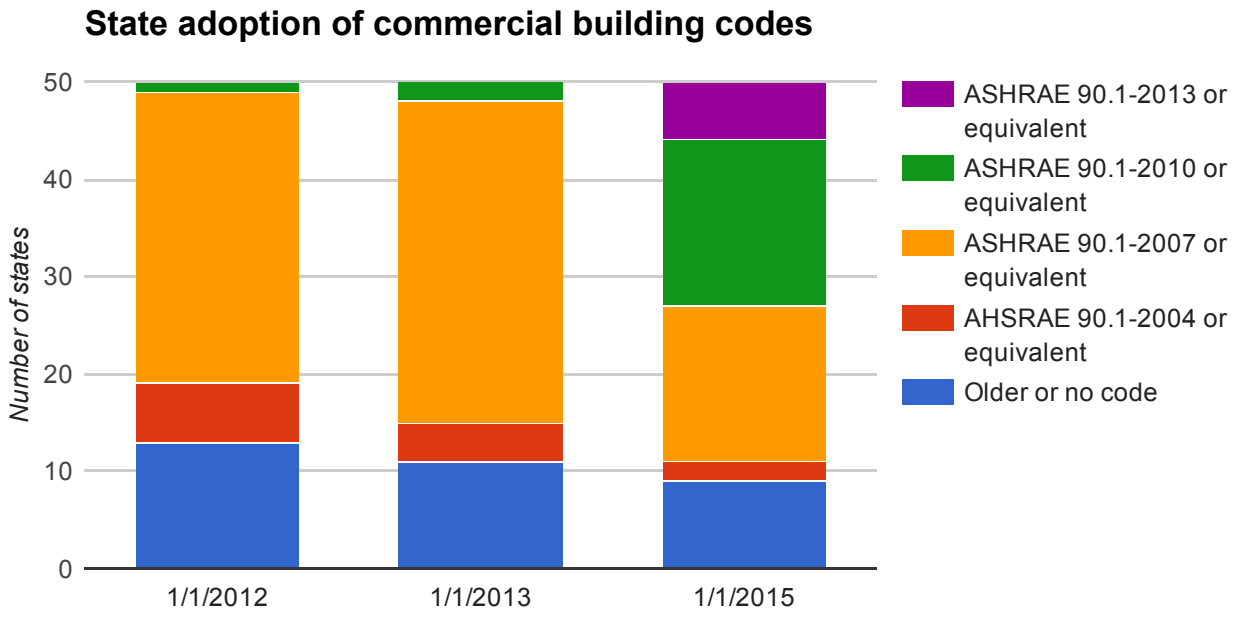
Source: ACEEE analysis of data in *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/), EIA. Commercial sector floor area from *Annual Energy Outlook (http://www.eia.gov/forecasts/aeo/data/browser/),* EIA. Floor area for 2014, 2015 are projections and not actual data.

Commercial buildings include office, retail, education, storage, services, food sales, religious worship, and healthcare buildings. While these range widely (https://www.eia.gov/consumption/commercial/reports/2012/energyusage/) in their energy consumption, heating, lighting, and cooling take close to half of the energy consumed by all commercial buildings. We express energy efficiency in these buildings as energy used per unit of floor area (called energy use intensity or EUI). We can report EUI either for primary or delivered energy. As discussed above, primary energy includes energy consumed by buildings along with losses in the generation, transmission, and distribution of that energy. Delivered or site energy is the energy consumed by buildings on site, as reflected by a utility bill. The graph displays both primary and delivered energy per unit of floor area in commercial buildings.

ACEEE resources

Buildings program (//aceee.org/about/programs/buildings)
International Scorecard (//aceee.org/portal/national-policy/international-scorecard)





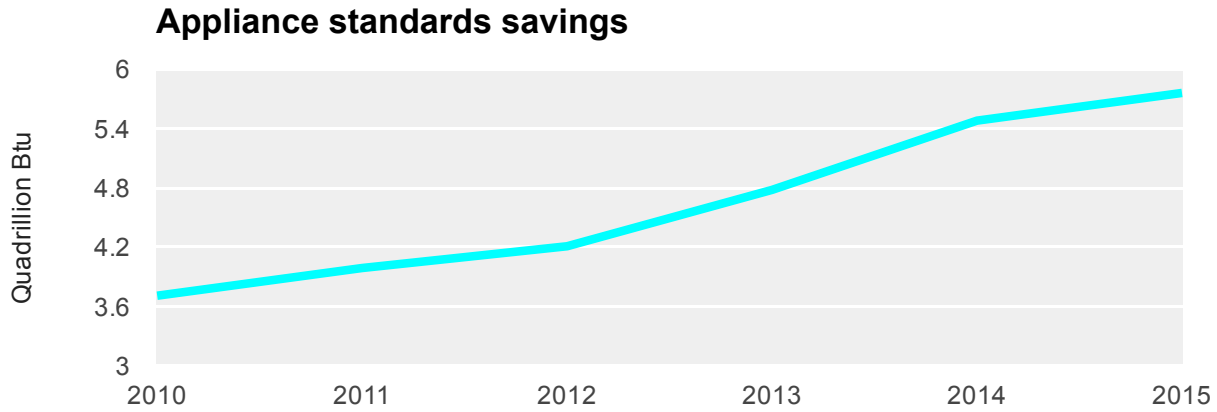
Source: Building Codes Assistance Project 2012 (http://energycodesocean.org/resource/bcap-2012-annual-report), 2013 (http://energycodesocean.org/resource/bcap-2013-annual-report) annual reports, 2015 code status (http://bcap-energy.org/code-status)

Model energy codes establish the minimum energy standards for the design and construction of new buildings. Thus they facilitate and standardize building energy efficiency practices. From 1992 through 2012, these codes saved over $44 billion dollars (http://energy.gov/sites/prod/files/2014/05/f15/saving_with_building_energy_codes.pdf) in energy costs through the avoided use of 4 quads (http://energy.gov/sites/prod/files/2014/05/f15/saving_with_building_energy_codes.pdf) of energy. A quad is a quadrillion British thermal units (Btu). By way of comparison, 4 quads is more than all the energy consumed by Australia in 2013 (http://www.iea.org/sankey/#?c=Australia&s=Balance). Energy codes are specified by ASHRAE (https://www.ashrae.org/resources--publications/bookstore/standard-90-1), IECC (http://publicecodes.cyberregs.com/icod/iecc/), or state and local governments, and are revised periodically. The graphs show the number of US states with updated building codes in 2012, 2013, and 2015 for residential and commercial buildings.

ACEEE resources

Building codes (//aceee.org/topics/building-codes)
Advanced building energy codes (//aceee.org/policy-brief/advanced-building-energy-codes)
Building codes and the Clean Power Plan (//aceee.org/white-paper/building-codes-111d)

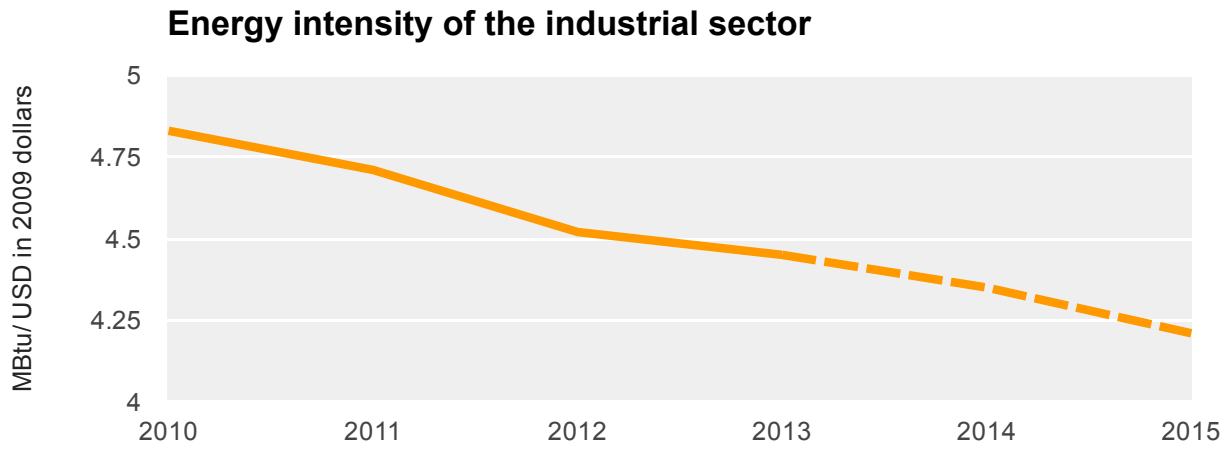
Appliances and equipment performance standards



Source: Appliance Standards Awareness Project (http://www.appliance-standards.org/)

Efficiency performance standards for appliances, equipment, and lighting have saved the United States a total of 55 quads of primary energy cumulatively since 1987. Savings in 2015 alone were 5.76 quads. In comparison, the United States consumed about 98 quads (http://www.eia.gov/beta/MER/index.cfm?tbl=T01.01#/?f=M) of primary energy in 2015. Performance standards ensure that all products sold in the country meet a minimum level of efficiency. The United States has set standards for more than 60 products (http://energy.gov/sites/prod/files/2016/01/f28/Appliance%20Standards%20Fact%20Sheet%201%2026%202016.pdf) that are expected to save consumers $1.9 trillion (http://energy.gov/eere/buildings/appliance-and-equipment-standards-program) on their energy bills cumulatively by 2030. The graph shows annual savings from appliance standards in recent years.

Industry



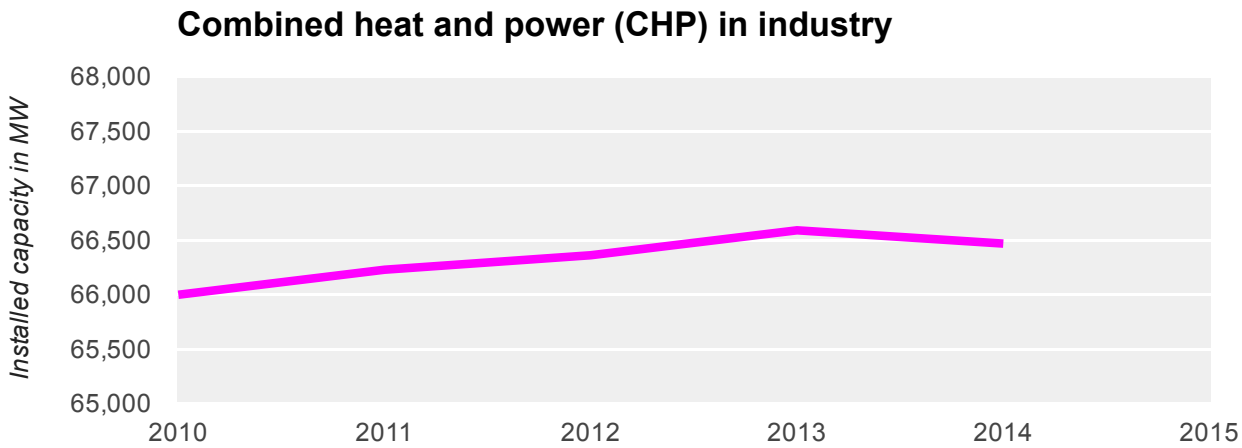
Source: *Annual Energy Outlook* (http://www.eia.gov/forecasts/aeo/data/browser/), EIA. Values for 2014, 2015 are projections and not actual data.

The US industrial sector (http://www.census.gov/econ/other.html) includes manufacturing, agriculture, mining, and construction. *Energy intensity* is the energy consumed per each dollar of goods produced by industry. A number of factors influence (http://energy.gov/eere/analysis/energy-intensity-indicators-industrial-source-energy-consumption) industrial energy intensity, including the

type of manufacturing, industry structure, and energy efficiency. As the graph shows, US industrial energy intensity has been improving steadily. A lower number indicates that less energy is needed per dollar of goods produced.

ACEEE resources

Industrial energy efficiency programs (//aceee.org/topics/industrial-energy-efficiency-programs)
Smart manufacturing (//aceee.org/research-report/ie1403)
Summer Study on Energy Efficiency in Industry (//aceee.org/conferences/2010/ssi)



Source: ACEEE analysis of ICF data

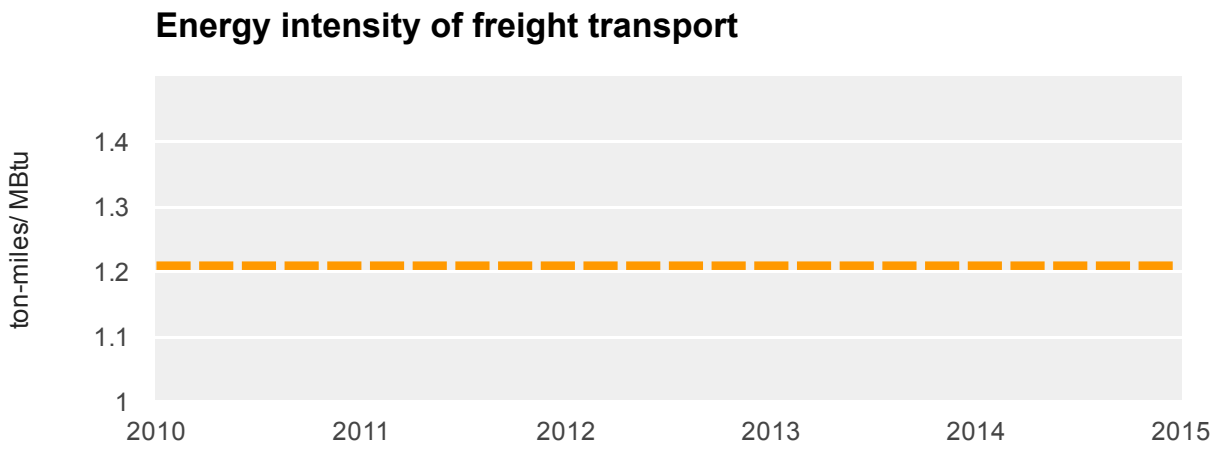
Heat is a byproduct when a power plant burns fuel to produce electricity. This heat is typically released into the environment as waste. But a CHP facility (also called a cogeneration facility), captures the waste heat and uses it to heat or cool nearby buildings and industrial processes. Industries currently represent over 80% (//aceee.org/blog/2016/02/brief-history-chp-development-united) of all installed CHP capacity in the United States. Some hospitals, universities, and large office and housing complexes also use CHP to generate part of their electricity and heat on site. The total CHP installed capacity dipped in 2015 because some plants were closed.

ACEEE resources

CHP (//aceee.org/topics/combined-heat-and-power-chp)
State CHP Toolkit (//aceee.org/sector/state-policy/toolkit/chp)
State and Local Database (http://database.aceee.org/)

Deploying CHP locally (//aceee.org/sector/local-policy/toolkit/chp)

Transport

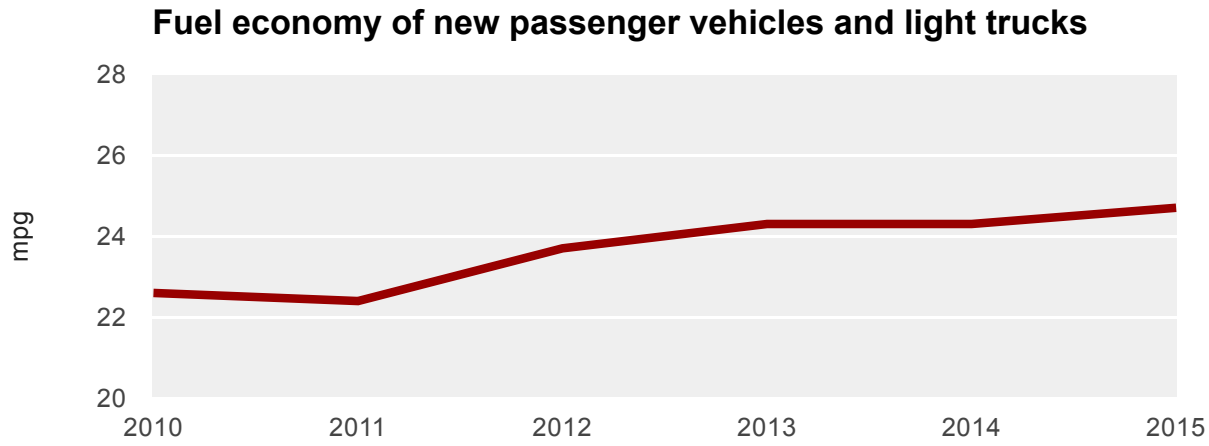


Source: ACEEE analysis of *Freight Analysis Framework (http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm)* data, DOT and *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/) data, EIA. Data for 2011-2014 are not presently available.

How far and what quantity of goods we transport per unit of fuel is an indicator of how efficiently we move goods around the country. We express the energy intensity of domestic freight as the energy consumed per ton-mile of goods transported. Freight trucks, railroads, and waterways carry most of the freight in the United States, with tractor trucks alone accounting for about 50% (http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/FF%26F_complete.pdf) of all ton-miles transported. The metric accounts for trucks, rail, and domestic shipping only; it excludes air freight, international marine transport, single-unit trucks, and pipelines. Data sources for this metric are currently under revision; we will update it when new data become available.

ACEEE resources

Freight trucks (//aceee.org/topics/freight)
Heavy duty vehicles (//aceee.org/topics/heavy-duty-vehicle-fuel-efficiency)

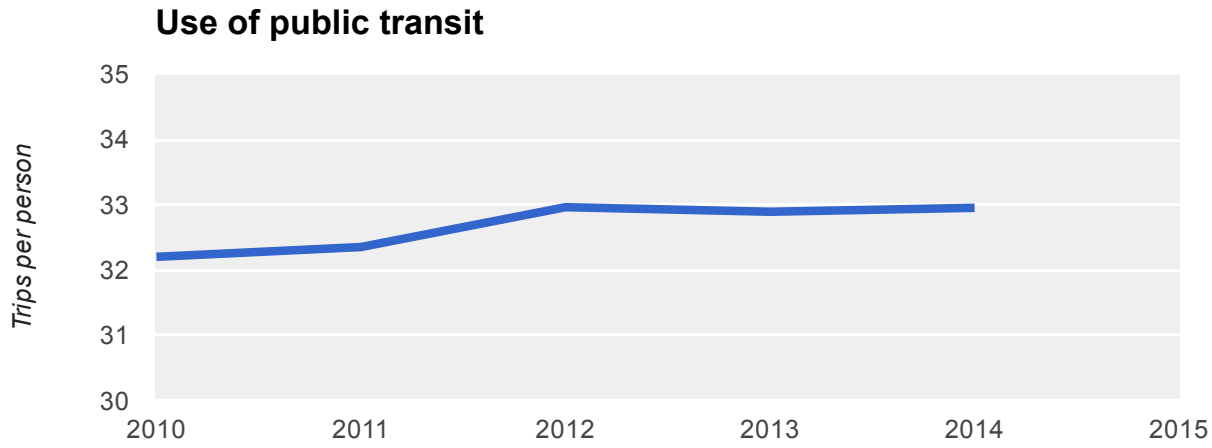


Source: Fuel economy trends report (https://www3.epa.gov/fueleconomy/fetrends/1975-2015/420r15016.pdf)

Fuel economy measures how far cars and light trucks can travel on each gallon of fuel. Small gains in average miles per gallon lead to large savings nationally. Thanks to regulation and improved technology, the fuel economy of the average vehicle has been on the upswing since the mid-2000s after decades of stagnation. The fuel economy of diesel, gasoline, electric, and hybrid vehicles differs greatly (http://www.eia.gov/forecasts/aeo/data/browser/#/?id=113-AEO2015&region=0-0&cases=ref2015&start=2012&end=2015&f=A&linechart=ref2015-d021915a.3-113-AEO2015&sourcekey=0). The graph shows the average fuel economy of all new passenger cars and light trucks sold in a given year. The fuel economy numbers differ from automaker standards compliance levels; they are adjusted to reflect real-world performance.

ACEEE resources

Car and light trucks (//aceee.org/topics/car-and-light-truck-fuel-economy)
ICT in personal travel (//aceee.org/research-report/t1401)



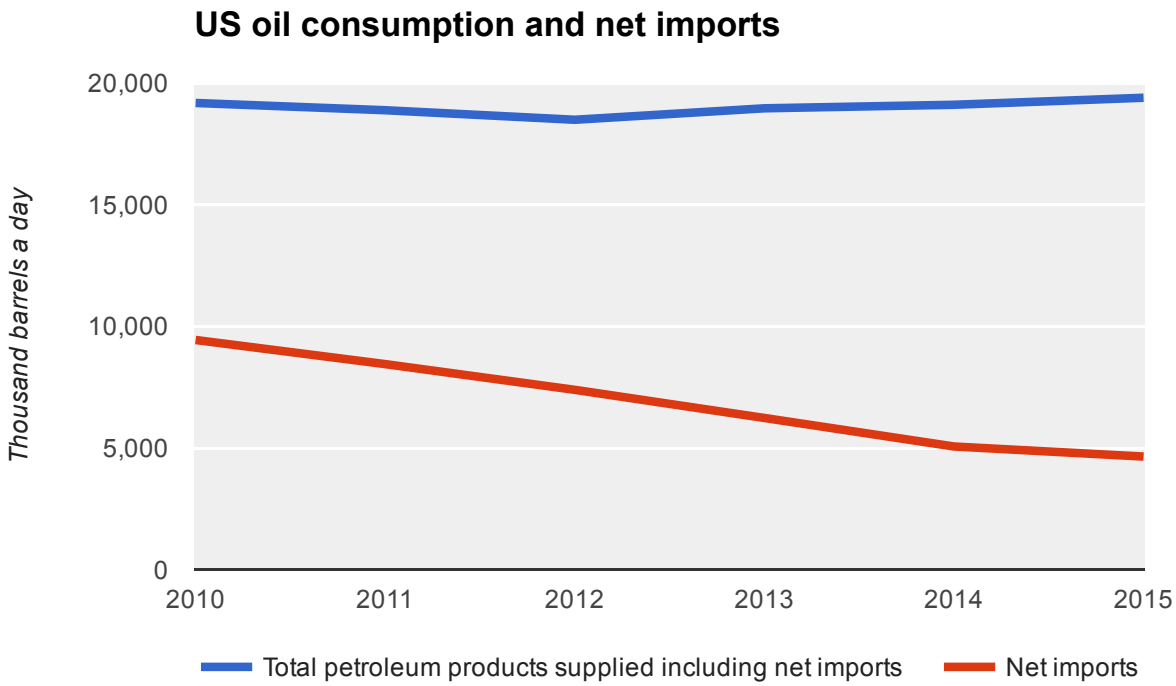
Source: DOT (http://www.ntdprogram.gov/ntdprogram/data.htm)

When we use it well, public transportation is generally more energy efficient than passenger cars. Large groups of people can ride together instead of everyone driving their own car to the same destination. The number of public transportation trips in the United States has been increasing by millions in recent years, generally because of changes in demographics and population as well as a better use of public transportation. The graph shows the number of recorded trips taken on public transportation vehicles per capita in the United States.

ACEEE resources

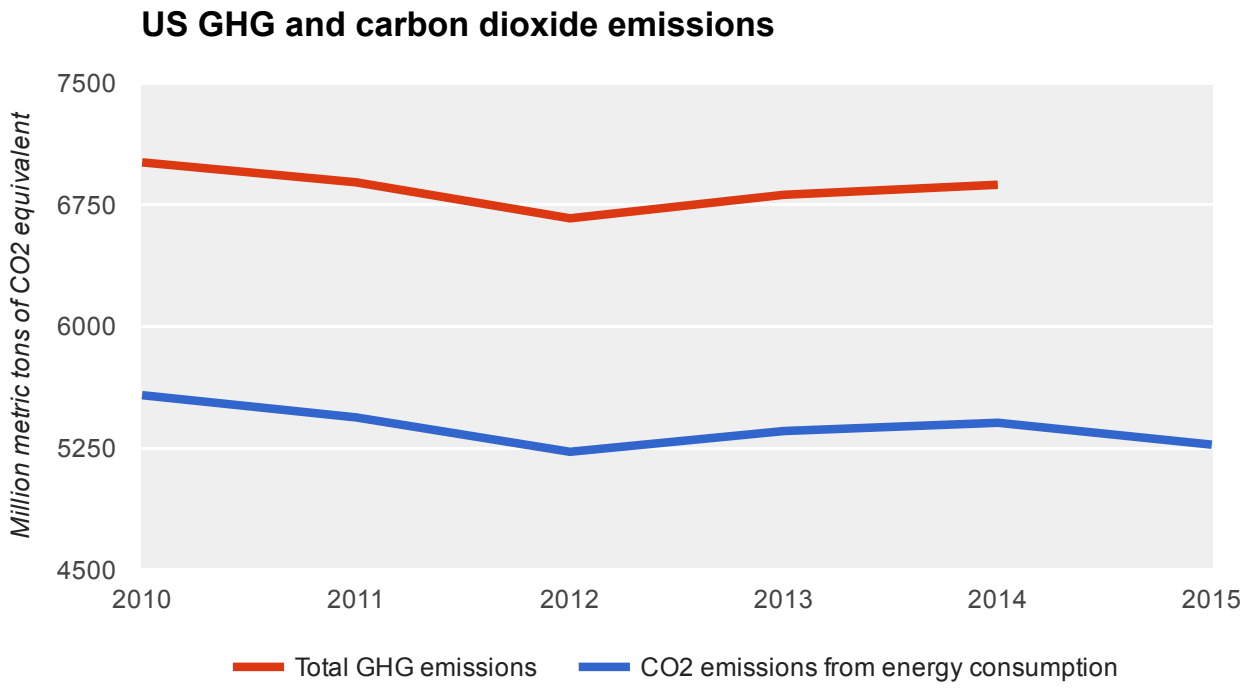
2015 City Scorecard (//aceee.org/research-report/u1502)
2015 State Scorecard (//aceee.org/sites/default/files/publications/researchreports/u1509.pdf)

Other related metrics



Source: *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/), EIA.

Most of the oil reserves in the world exist outside the United States. Although our domestic oil production has been rising, we currently import about 25% of the oil we consume, down from 49% in 2010. Energy efficiency can go a long way to help reduce dependence (https://www.fueleconomy.gov/feg/oildep.shtml) on imports by helping vehicles travel farther on each drop of oil.



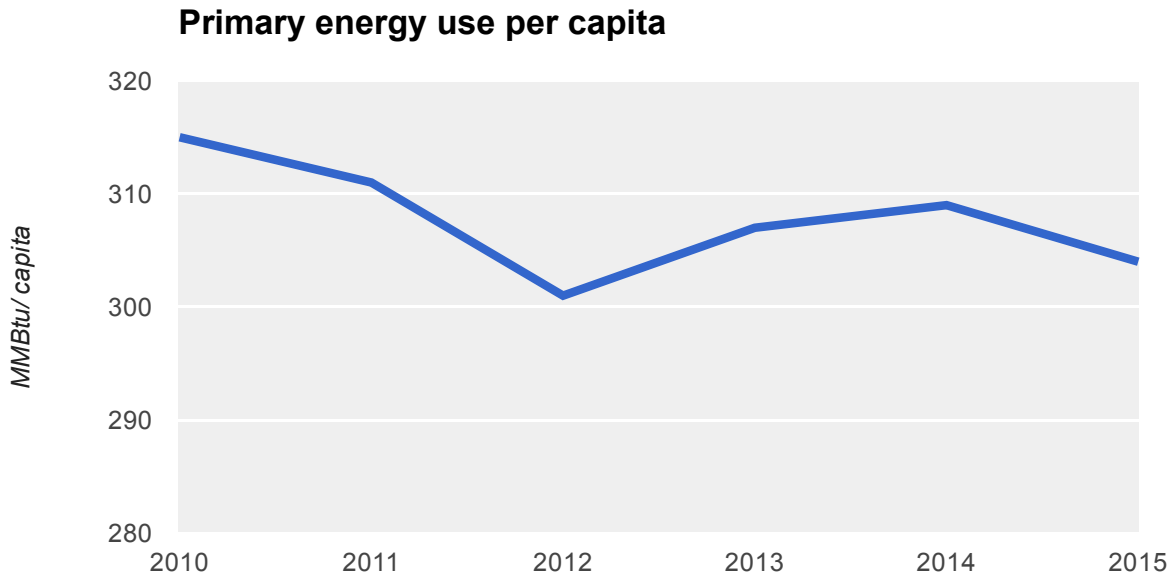
Source: CO2 emissions, *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/), EIA; total GHG emissions, EPA GHG Inventory (https://www3.epa.gov/climatechange/Downloads/ghgemissions/US-GHG-Inventory-2016-Main-Text.pdf)

We released billions of tons of greenhouse gases (GHG) into the atmosphere over the past hundred years, and we continue to release them. Over 77% (https://www3.epa.gov/climatechange/pdfs/usinventoryreport/US-GHG-Inventory-2015-Chapter-Executive-Summary.pdf) of these emissions come from burning fossil fuels to produce energy for heating, cooling, lighting, transportation, industry, and other uses. Improving energy efficiency (//aceee.org/blog/2015/06/35-years-energy-efficiency-progress) in buildings, vehicles, and industrial processes reduces emissions while providing the same or better products and services.

The EPA has a long history (https://www.epa.gov/clean-air-act-overview/progress-cleaning-air-and-improving-peoples-health) of addressing GHG emissions. In 2015, President Obama and the EPA announced the Clean Power Plan (https://www.epa.gov/cleanpowerplan/clean-power-plan-existing-power-plants) (CPP), which aims to reduce carbon pollution by setting the first-ever national carbon emission standards for power plants in all US states. Energy efficiency policies and technologies are proven, cost-effective strategies to help states (//aceee.org/topics/clean-power-plan) meet their CPP targets by reducing energy demand.

ACEEE resources

SUPR2 calculator (//aceee.org/research-report/e1601)
Energy efficiency and the CPP (//aceee.org/energy-efficiency-and-clean-power-plan-steps)



Source: *Monthly Energy Review* (http://www.eia.gov/totalenergy/data/monthly/), EIA.

Energy use per person can vary widely (https://www.eia.gov/state/rankings/#/series/12) with income level, geography, climate, and demographics. The graph shows energy use per capita in the United States in recent years.

Your Energy-Efficient Home

Visit the site (http://smarterhouse.org/)

ACEEE Summer Study on Energy Efficiency in Buildings - 2015

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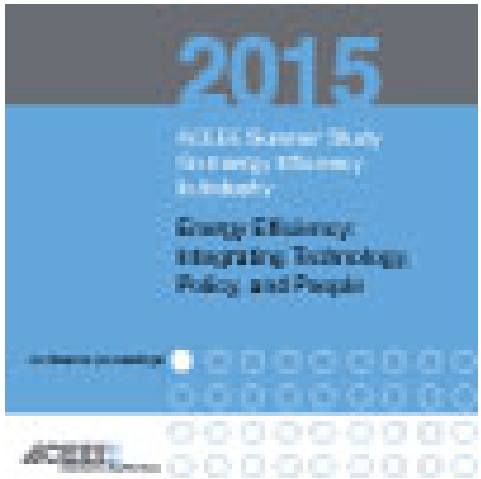

(//aceee.org/index.php)

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Overview / Mission

The American Council for an Energy-Efficient Economy (ACEEE), a nonprofit, 501(c)(3) organization, acts as a catalyst to advance energy efficiency policies, programs, technologies, investments, and behaviors. We believe that the United States can harness the full potential of energy efficiency to achieve greater economic prosperity, energy security, and environmental protection for all its people.

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