# Energy Efficiency: Is the United States Improving?

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## Abstract

This paper is the beginning of an annual effort to examine and characterize the overall state of energy efficiency in the United States and determine whether it has improved, declined, or stayed the same since the previous year. ACEEE has developed a list of 15 indicators that together create a snapshot of energy efficiency across the U.S. economy.

Is the United States moving in the right direction? ACEEE's energy efficiency indicators demonstrate that the United States is becoming more energy efficient, but the improvements we measured are generally modest, indicating that our economy overall has made only moderate progress. Five indicators show some meaningful progress: state energy efficiency program savings; reductions in energy use in residential buildings; standards for fuel economy; building codes; and standards for appliances. Improvements in energy productivity and the reduction of greenhouse gas emissions may reflect other factors so may not be indicators of a long-term trend. Seven indicators showed only small or no improvements and one showed backsliding. To put the nation on the right path, the United States needs to be far more aggressive, embracing meaningful policies and programs that can lead to significant improvements in U.S. energy efficiency.

## Introduction

Energy efficiency is a key to economic prosperity and global competitiveness. The most energy-efficient economies are able to reduce their energy waste and maximize their output, thereby reducing costs and streamlining systems. If the United States hopes to maintain its status as a world leader, energy efficiency must play a vital role in maintaining our economic prosperity. While there has been progress, the United States still has significant steps to take to become truly energy efficient. This paper is the beginning of an annual effort to examine and characterize the overall state of energy efficiency in the United States and determine whether it has improved, declined, or stayed the same since the previous year.

In the *2012 ACEEE International Energy Efficiency Scorecard*, the United States came in a disappointing 9th place out of the 12 largest world economies, with an efficiency score of just 47 out of a possible 100 points. While there are some bright spots, the United States has a long way to go to stop wasting energy and achieve efficiency in all sectors. Time is of the essence. Ultimately, we must make significant progress year after year to be globally competitive and build an energy-efficient economy.

Is the United States moving in the right direction?

The outlook for energy efficiency in the United States is shaped by policy at the national, state, and local levels and can vary dramatically across state lines. While energy efficiency is improving in some states and localities, others lag. The energy economy and policy arena is complex so there is no singular reliable marker or indicator by which to gauge energy efficiency on a national scale. An array of factors must be considered when measuring trends in efficiency. For example, national energy consumption may decrease for reasons other than improved energy efficiency, such as an economic recession. This paper compares results and monitors trends, but we draw no conclusions about the causes for change in any one indicator. We have selected 15 different indicators to provide a comprehensive understanding of the current state of energy efficiency in the United States and to capture the complexity of measuring energy efficiency across the economy. The selected indicators represent major opportunities to reduce energy waste throughout all sectors of the U.S. economy.

## Methodology

Drawing upon the knowledge of subject matter experts, we have developed a list of 15 indicators that together create a snapshot of energy efficiency across the U.S. economy. Data for each indicator were collected from nationally recognized sources when available, such as the U.S. Energy Information Administration (EIA), the International Energy Agency (IEA), and the U.S. Department of Transportation. This information was supplemented by ACEEE staff research. Once the data for each indicator were collected, they were compared to data from the previous year to determine if progress had been made, if the results were the same, or if backtracking had occurred. For each indicator an attempt was made to present data for the year 2012; however, in some cases extrapolations were necessary and these instances have been noted. Results are presented for each indicator individually in the next section. Based on the results, a "Status" is assigned to each indicator as follows:

**Table 1: Status Indicators Key**

| Criteria | Status |
|---|---|
| Progress indicates we are maximizing our energy efficiency potential. |  |
| Some meaningful progress has been made. |  |
| A little progress has been made. |  |
| No progress has been made. |  |
| Backsliding has occurred. |  |

**Table 2. U.S. Energy Efficiency Indicators**

| Indicator | Description | Status | Results |
|---|---|---|---|
| **Electricity and Natural Gas Efficiency Program Budgets** | This indicator looks at 2012 electricity and gas energy efficiency program budgets reported by states. This includes utility and third-party administered programs funded by ratepayers. In recent years national spending has increased significantly. Increasing budgets indicate increasing investment in energy efficiency. |  | Electric Budget: $5,958 million (2012 preliminary estimate)<br>Gas Budget: $1,373 million (2012 preliminary estimate)<br>TOTAL: $7,331 million[1]<br>This total represents an increase of 4% compared to spending in 2011.[2] |
| **Annual Savings from Electricity and Natural Gas Efficiency Programs** | This indicator looks at 2011 electricity (in gigawatt-hours) and natural gas (in million therms) savings due to energy efficiency programs. This includes utility and third-party administered programs funded by ratepayers. Each kWh or therm of savings represents energy that is no longer being wasted. |  | Electric Savings: 22,016<br>GWh (2011)<br>Gas Savings: 19,763 MMtherms (2011)[3]<br>2011 electric savings are an increase of 19% compared to savings achieved in 2010.[4] |
| **Energy Productivity** | Energy productivity is a measure of the amount of economic output in a country per unit of energy consumed—i.e., a higher number indicates greater efficiency. We measured energy productivity by taking 2012 |  | The United States generated $157 of gross domestic product per MMBtu consumed in 2012,[5] and U.S. energy productivity increased by 5% from 2011 to 2012, reflecting meaningful |

[1] Preliminary 2012 ACEEE estimates and Foster et al. 2012.
[2] Gas budgets have increased by an impressive 17%, but the much bigger number—electric spending—has increased by less than 1%.
[3] ACEEE estimates.
[4] This is the first year ACEEE has collected savings for gas energy efficiency programs.
[5] World Bank 2013, EIA 2013b, CIA 2013.

| Indicator | Description | Status | Results |
|---|---|---|---|
| | gross domestic product (in 2010$) and dividing it by 2012 total consumption of primary energy measured in million British thermal units (MMBtu). | | improvement in the past year. |
| **Mandatory Energy Efficiency Resource Standards (EERS)** | This indicator looks at whether the United States has mandatory energy savings goals called Energy Efficiency Resource Standards (EERS). Progress towards an EERS goal is measured, making energy efficiency more tangible and yielding quantifiable results. While the United States does not have a national EERS, it has made significant progress in this area through the adoption of individual state policies. |  | 24 states adopted and funded an Energy Efficiency Resource Standard in 2012. This is the same number of states that had an EERS in 2011.[6] |
| **Greenhouse Gas Emissions** | Greenhouse gases are a byproduct of fossil fuel consumption. When we use less energy to accomplish the same or better results, we reduce those emissions. This indicator is a measure of national carbon dioxide emissions divided by the total U.S. population in the same year. |  | The United States emitted an average of 15 tons of carbon dioxide per person in 2012.[7] This is a 5% improvement from 2011. |

[6] Foster et al. 2012
[7] BoC 2013; EIA 2013b

| Indicator | Description | Status | Results |
|---|---|---|---|
| **Energy Intensity In Residential Buildings** | Energy use in residential buildings per square foot of floor space is a measure of the energy intensity of the building sector. |  | Residential buildings in the United States consumed an average of 105,000 Btu/ft$^2$ in 2012.[8] This is a 6% improvement from 2011. |
| **Energy Intensity in Commercial Buildings** | Energy use in commercial buildings per square foot of floor space is a measure of the energy intensity of the building sector. |  | Commercial buildings in the United States consumed an average of 214,000 Btu/ft$^2$ in 2012.[9] This is a 3% improvement from 2011. |
| **States with Updated Building Codes** | Energy codes for buildings set minimum performance standards for newly constructed buildings, reducing energy waste. States that have "updated" codes are those that have adopted at least the ASHRAE 90.1 2007 and the IECC 2009 national model codes for commercial and residential buildings, respectively.[10] |  | 31 states currently have updated building codes for both residential and commercial buildings.[11] One state updated both its residential and commercial codes to at least ASHRAE 90.1 2007 or IECC 2009 during 2012. Of the 20 states that didn't have updated codes in 2011, 11 updated either their residential or commercial codes during 2012 to at least ASHRAE 90.1 2007 or IECC 2009. |

[8] EIA 2013a
[9] EIA 2013a
[10] ASHRAE 90.1 is a standard developed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers that provides minimum requirements for energy-efficient design for commercial buildings. The International Energy Conservation Code (IECC) is a building code created by the International Code Council establishing minimum design and construction requirements for energy efficiency in residential buildings.
[11] BCAP 2013

| Indicator | Description | Status | Results |
|---|---|---|---|
| **Disclosure of Energy Use in Buildings** | The presence of mandatory labeling (or rating) and mandatory disclosure of energy use creates transparency regarding the energy costs associated with a building, similar to the transparency provided by a miles-per-gallon rating for a vehicle. Disclosure of a building's energy use can assist in recognizing the value of energy efficiency benefits at the time of a purchase or lease. This indicator looks at the amount of floor space (in square feet) that is covered by these policies. |  | Disclosure programs in place in 2012 will impact more than 4 billion square feet of floor space.[12] This is an increase of nearly 245 million square feet. Though progress is being made, this is still only 1% of the total building stock. |
| **Appliance and Equipment Performance Standards** | This indicator determines the cumulative energy savings (in quadrillion Btu) that will result from the adoption of appliance and equipment standards. |  | Standards in place in 2012 will save 3.71 quads.[13] This is a 5% increase from 2011 savings. |
| **Energy Intensity of the Industrial Sector** | This indicator is a measure of the amount of energy consumed per dollar of goods shipped by the industrial sector (in kBtu per dollar, 2005$). A low number indicates that less energy is needed per dollar of output in the industrial sector. |  | In 2012 4.45 kBtu were consumed per dollar of goods shipped by the industrial sector. This is a slight improvement from 2011.[14] |

[12] Burr 2012
[13] ASAP calculation
[14] EIA 2013a

| Indicator | Description | Status | Results |
|---|---|---|---|
| **Combined Heat and Power in Industry** | Combined heat and power systems generate useful thermal energy and electricity or mechanical power in a single, integrated system. CHP systems are generally much more efficient than the separate generation of heat for industrial processes and electricity because heat that is normally wasted in conventional power generation is recovered to meet existing industrial demands. We looked at the percentage of electricity consumed by the industrial sector that is produced by CHP. |  | In 2011, 31% of the electricity consumed by the industrial sector was generated from combined heat and power facilities. This is a decrease of 1.5% from 2010.[15] |
| **Energy Intensity of Freight Transport** | How far and how much we transport per unit of energy is an indicator of how efficiently we are moving goods around the country. This indicator reports ton-miles of goods transported per thousand Btus of energy.[16] |  | In 2011, U.S. freight was transported at an average of 1.13 ton-miles per thousand Btus.[17] This is less than a 1% change from 2010. |
| **Fuel Economy of New Passenger Vehicles and Light Trucks** | The fuel economy of a vehicle indicates how efficiently energy is being used to transport passengers. This indicator reports the average fuel economy (in miles per gallon) of model year 2012 passenger vehicles and light trucks sold in the United States. |  | The average fuel economy of new passenger vehicles and light trucks sold in 2012 was 23.8 miles per gallon.[18] This is an increase of 1.4 miles per gallon from the fuel economy of vehicles sold in 2011. |

[15] WEC 2013
[16] Includes combination trucks, rail, and domestic shipping; excludes air, international marine, straight trucks, and pipeline.
[17] ACEEE calculations primarily using data from U.S. Department of Transportation and Energy Information Administration.
[18] EPA 2013

| Indicator | Description | Status | Results |
|---|---|---|---|
| **Use of Public Transit** | Public transit is generally a more efficient mode of personal transport as compared to cars. Public transit use is measured by looking at the average number of trips per person taken on public transit. |  | In 2012, the number of trips per person was 32.[19] This is the same number of trips per person taken in 2011. |

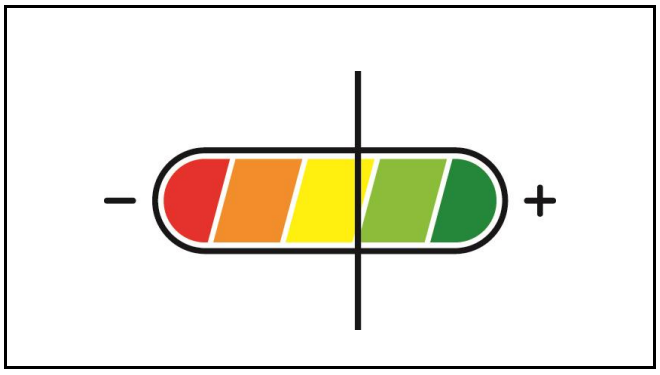
[19] DOT 2012

**Table 3. Summary of U.S. Energy Efficiency Indicators**

| Indicator | Status | Indicator | Status |
|---|---|---|---|
| Electricity and Natural Gas Efficiency Program Budgets | – + | Disclosure of Energy Use in Buildings | – + |
| Annual Savings from Electricity and Natural Gas Efficiency Programs | – + | Appliance and Equipment Performance Standards | – + |
| Energy Productivity | – + | Energy Intensity of the Industrial Sector | – + |
| Mandatory Energy Efficiency Resource Standards (EERS) | – + | Combined Heat and Power in Industry | – + |
| Greenhouse Gas Emissions | – + | Energy Intensity of Freight Transport | – + |
| Energy Intensity In Residential Buildings | – + | Fuel Economy of New Passenger Vehicles and Light Trucks | – + |
| Energy Intensity in Commercial Buildings | – + | Use of Public Transit | – + |
| States with Updated Building Codes | – + | | |

Figure 1 below shows the overall status of all 15 indicators in 2012.

**Figure 1. Overall Status of U.S. Energy Efficiency Indicators**

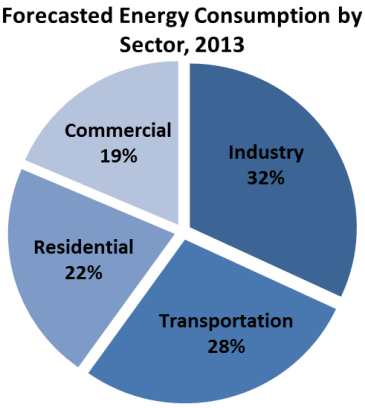



## Discussion

ACEEE's energy efficiency indicators demonstrate that some progress is being made on energy efficiency, particularly state-level savings from efficiency programs, savings from new appliance and equipment standards, building codes, and vehicle fuel economy standards. However, most of the indicators highlight that more work is needed at the national level. Further, we see indications of potential slowing. For example, the good progress that has been

achieved in state-level savings from efficiency programs during the 2010–2011 time period may not continue given the minimal increase in state efficiency program budgets reported in 2012.[20] Unlike many developed nations, the U.S. federal government has adopted neither an energy savings target (EERS) nor a greenhouse gas reduction target, making it difficult to sustain ongoing national progress. While the amount of greenhouse gases emitted per person has declined in the United States, we have long had one of the highest rates in the world.[21] Energy productivity and the energy intensity of the industrial sector have improved moderately, though small improvements from one year to the next are not indicative of a society that has embraced energy efficiency as a principal objective. This trend, of moderate improvements in some areas, still leaves the United States behind the curve. For example, while adoption of building codes has improved in 2012, there are still 19 states that didn't update to at least ASHRAE 90.1 2007 or IECC 2009, leaving a large potential for additional state code improvements. The federal government adopts model codes but could do much more to encourage and incentivize states to improve their buildings. In the transportation sector, the federal government has adopted more aggressive vehicle fuel economy standards, and new vehicles are becoming more efficient, but the passenger vehicle is still one of the most inefficient modes of travel. Use of public transit, a more efficient mode of travel, remains unchanged. The federal government continues to prioritize investments in roads and bridges at the expense of trains and other modes of public transit.

Progress in any one sector of the economy can make a difference, but given the breakdown of energy consumption across the economy, we need progress in all sectors. In 2013, end-use energy consumption in the U.S. industrial sector is forecasted to be 32% of total consumption; the transportation sector will account for 28% of total consumption, while the residential and commercial buildings sectors will consume 22% and 19% of total end-use energy, respectively (EIA 2013a). While energy efficiency can be dramatically improved in each of these sectors, progress has been slow and the evidence indicates that the United States is not doing enough. In countries the world over it has become largely accepted that improving energy efficiency is an essential tool for ensuring economic prosperity and increasing global competitiveness (ECEEE 2013). Japan, Germany, and China are more committed in their national policies and investment in energy efficiency than the United States.[22] As a result, these nations are poised to produce goods and services at a lower cost. More energy-efficient economies are able to reduce their energy waste and maximize their output, thereby reducing costs and streamlining systems. To stay ahead of the curve and




[20] In prior years, states had steadily increased their investment in energy efficiency and in the 2011–2012 time period there was a significant drop off. See Foster et al. 2012.
[21] See CDIAC 2012 ranking the U.S. 12th highest per capita $CO_2$ emissions in the world out of 215 countries.
[22] See rankings in Hayes et al. 2013.

maintain its status as a world leader, the United States must adopt and advance energy efficiency measures throughout all sectors of its economy.

Due to the fragmented nature of U.S. energy policy, multiple agents throughout any sector may be responsible for a change in efficiency. Factors that aren't necessarily controlled by policymakers, such as market prices and technological advances, also play a significant role in how quickly energy efficiency is improved. In spite of this complexity, there are a number of policies that can have a substantial impact on improvements in energy efficiency. For example, the President recently unveiled a Climate Action Plan that outlines a number of actions that can significantly improve our nation's energy efficiency (White House 2013). As we publish this paper, the U.S. Senate may soon vote on the *Energy Savings and Industrial Competitiveness Act of 2013,* a bipartisan piece of legislation that contains provisions to improve building codes and industrial and federal building efficiency efforts (Shaheen-Portman 2013). Additional pending amendments could significantly increase the energy savings achieved (Nadel 2013). These actions, as well as additional needed actions, can make the United States more globally competitive and reduce the cost of living and doing business within its borders.

## Conclusion

The United States is becoming more energy efficient, but the improvements we measured are generally modest, indicating that our economy overall has made only moderate progress. Five indicators evaluating state energy efficiency program savings and reductions in energy use in residential buildings, as well as standards for fuel economy, building codes, and appliances show some meaningful progress. There are also improvements in energy productivity and the reduction of greenhouse gas emissions, but these improvements may reflect other factors and it remains to be seen whether they are indicators of a long-term trend. Of concern, seven indicators showed only small or no improvements and one showed backsliding. As a result, there is tremendous potential for energy efficiency that has yet to be realized. If we continue to reduce energy waste at the current pace, we will not only miss key opportunities to strengthen the economy and improve our global competitiveness, but we put ourselves at risk of backsliding in even more sectors. To put the nation on the right path, we need to be far more aggressive, embracing meaningful policies and programs that can lead to significant improvements in our energy efficiency.

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