



ANALYSIS

Energy Intensity Indicators: Highlights

[Home](#) » [Data & Tools](#) » [Energy Intensity Indicators](#) » Energy Intensity Indicators: Highlights

This page highlights the major changes in the overall energy intensity for the United States, as well as summarizing changes in energy intensity for major sectors.

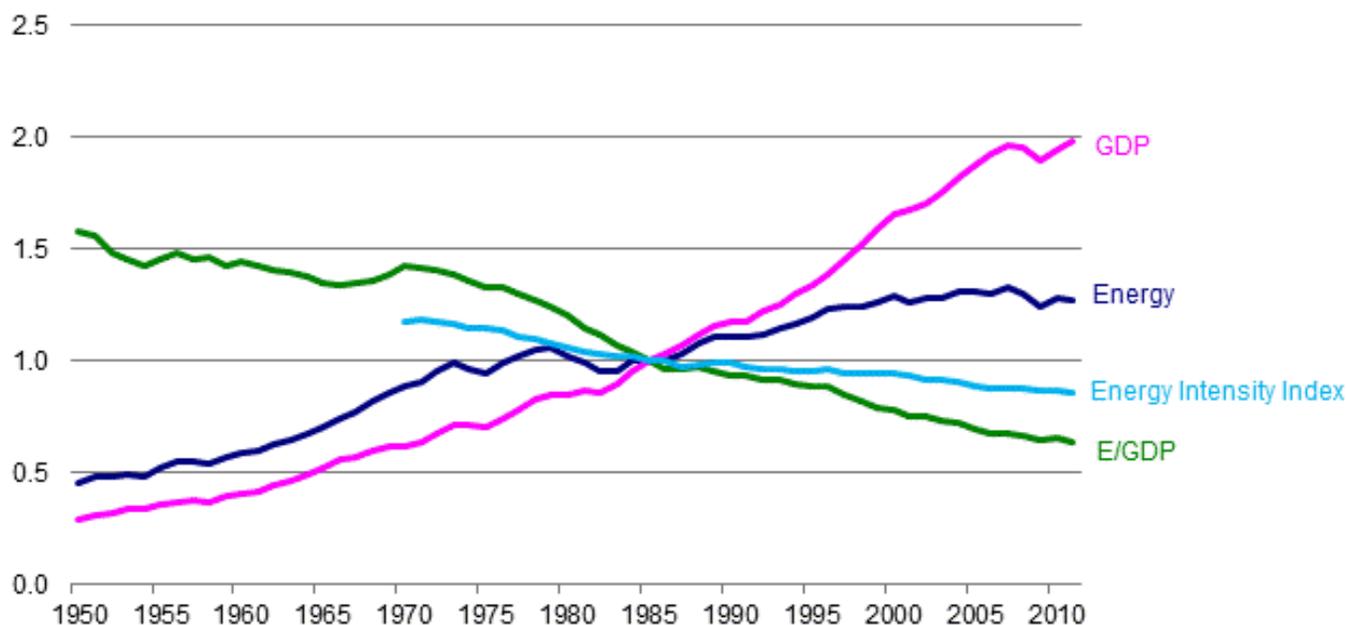
ECONOMYWIDE ENERGY INTENSITY

Figure H1 below reports total energy use, GDP, and two alternative indexes to reflect overall changes in U.S. energy intensity, the first based on the energy-GDP ratio, and the second built up as part of the DOE-EERE system of energy intensity indicators.

- **Activity:** The nation's GDP increased by about 250% (~3.8% per year) between 1950 and 1985, and roughly doubled from 1985 to 2011 (~2.7% per year). Implicit in the EERE system of energy intensity indicators is an alternative economywide index of output or activity, one that could be calculated as a weighted average of the sector-level activity indexes. However, this index is not explicitly calculated, and thus is not shown in Figure E1.
- **Energy Use:** Total U.S. energy consumption, as measured by the Energy Information Administration, grew by 120% between 1950 and 1985 (~2.3% per year), and only by 38% between 1985 and 2011 (~0.7% per year). As explained in [Terminology and Definitions](#), the

system of economic indicators excludes energy used as a material. This adjustment reduces total energy use by about 8%. However, the adjustment has negligible impact on trends in energy consumption. Between 1985 and 2011, total energy consumption based upon the official EIA data increased by 0.71% per year, and adjusted series of energy consumption increased by 0.73% per year.

- Energy Intensity Index:** The economywide energy intensity index shows a decline of about 14% in 2011 as compared to 1985. By comparison, an intensity index based on the energy-GDP ratio showed a reduction of about 35% over the same period. The EERE energy intensity index is designed to be a more accurate measure of underlying energy efficiency change because it excludes a variety of factors unrelated to energy efficiency. The (EERE) economywide energy intensity index is based upon an energy-weighted average for four major end-use sectors. The weights are based on shares of source energy and vary over time. For example, in 2010, the weights are: residential (22.1%), commercial (19.6%), industrial (25.9%), and transportation (30.1%). (As discussed in the 2014 comprehensive report, the weights reflect shares for specific years, and so the percentages for earlier years would be slightly different—generally there have been increasing shares for both the commercial and transportation sectors at the expense of the industrial sector).
- Changes due to factors unrelated to efficiency improvements:** The energy intensity index seeks to remove a myriad of structural factors pertaining to the composition of GDP and geographic shifts in population. The energy-GDP ratio has a major "apples and oranges" problem: household activity related to energy used in buildings and in personal vehicles is not measured or included in the GDP, but the corresponding energy is included.



 **Figure H1. Energy Use, GDP, and Energy Intensity Indexes, 1950-2011**

ENERGY INTENSITY INDEXES FOR MAJOR SECTORS

Energy intensity indexes for each of the four end-use sectors (transportation, industrial, residential, and commercial) are shown in Figure H2 below. Note that the electricity-producing sector is not shown in this graphic, because the generation and transmission losses associated with the production of electricity by the utility sector have been allocated to the end-use sectors; in other words, these graphics use source energy, rather than delivered energy (see [Terminology and Definitions](#)). In this case, energy intensity in the commercial sector was about 8% higher in 2011 than it was in 1985, but the trend shows falling energy intensity over the last decade. Energy intensity in the residential sector has declined by about 9% over the same period. The decline in energy intensity was greatest in the industrial sector, falling by 19% over the 1985-2011. During the same period, the energy intensity of the transportation sector declined by 17%. More complete discussions of the trends in energy consumption, activity, and the energy intensity indexes for these sectors can be obtained by selecting any of the following: residential, commercial, industrial, transportation, and the electric power sector.

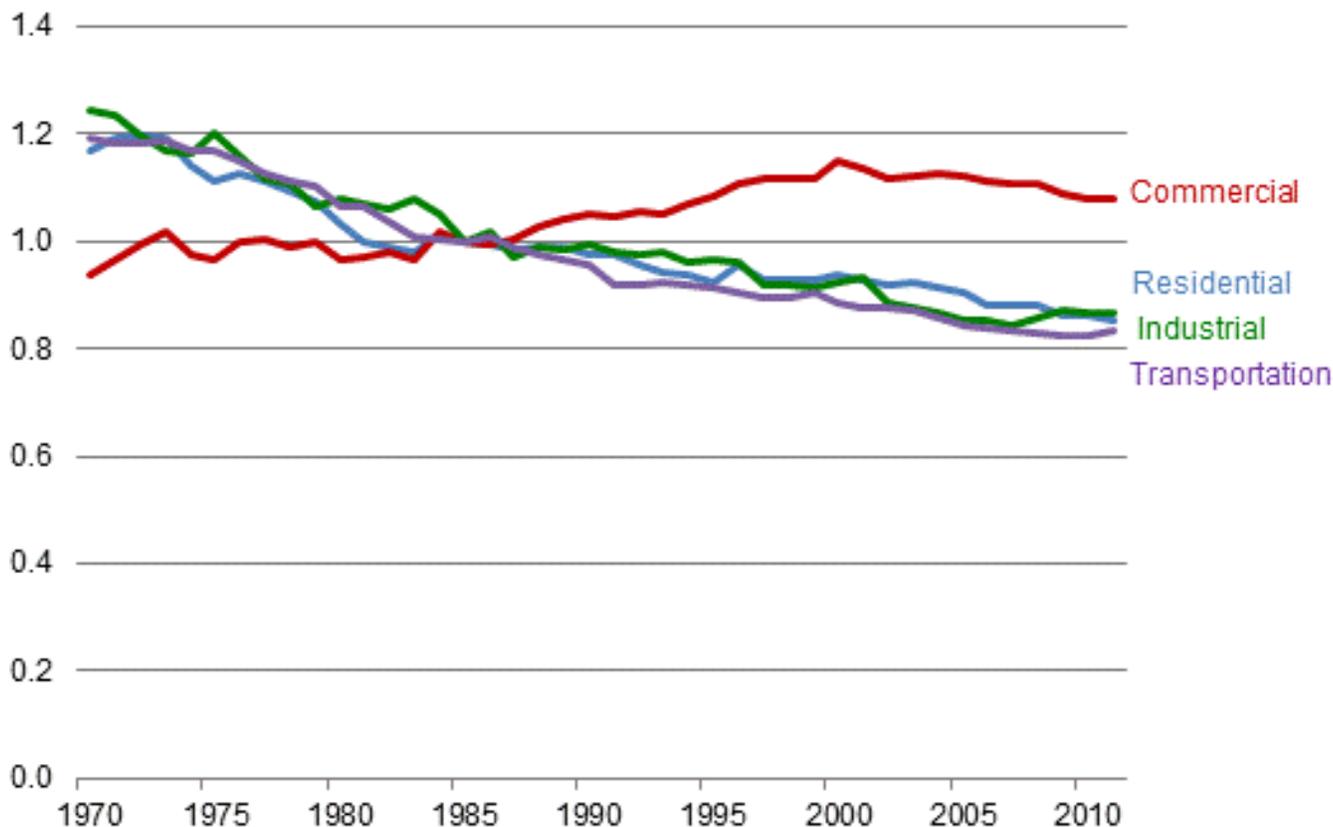


 Figure H2. Source energy intensity indexes by major end-use sector, 1970-2011 (adjusted for improvements in electricity generation and transmission efficiency)

The following table summarizes the percentage changes in the energy intensity indexes since 1985 for the major aggregate sectors. In addition, the right-most column shows the change in the overall energy intensity for the electric power sector, where energy intensity reflects changes in the amount of energy (in British thermal units, Btu) per kilowatt-hour of electricity generation. The decline in this intensity index has occurred almost entirely since 2000.

More complete discussions of the trends in energy consumption, activity, and (source) energy intensity indexes for these sectors can be obtained by selecting any of the following: [residential](#), [commercial](#), [industrial](#), [transportation](#), or the [electric power sector](#). Summary comparisons of the changes in energy intensity using alternative definitions of energy (i.e. delivered energy and source energy with and without the adjustment for changes electricity generation efficiency) are shown on a separate page – [Alternative Measures by Type of Energy](#). Complete information related to the indexes for all three definitions of energy can be obtained from the downloadable spreadsheet available from trend data.

Table H1. Percentage Change in Intensity Indexes for Major Sectors, 1985-2011

ECONOMYWIDE		MAJOR END-USE SECTOR (SOURCE ENERGY INTENSITY*) (PERCENT CHANGE FROM 1985)				ELECTRICITY
Simple E/GDP Ratio	Intensity Index	Transportation	Industrial	Residential	Commercial	Electric Power Sector
-35%	-14%	-17%	-14%	-15%	+8%	n/a

* **Note:** This information applies to the four end-use sectors shown above, and includes electricity losses attributed to each of these sectors. For purposes of constructing the energy intensity indexes based on source energy, an adjustment has been made to account for improvements in the generation efficiency of the electric power sector (see [Alternative Measures by Type of Energy](#) for more detailed discussion). The end-use sector unaffected by the adjustments is the transportation sector, which uses so little electricity that losses are too small to notice.

DECOMPOSITION OF ECONOMYWIDE INTENSITY INDEX

Figure H3 displays a decomposition of the economywide energy intensity index into the separate contributions from the four major end-use sectors as compared to the electric power sector. The methodology used to construct the energy intensity indicators can be employed to make an exact accounting between these separate influences. In essence, the contribution from the electric power sector incorporates the reduction in the ratio of electricity losses in generation and transmission to the quantity of electricity sold to end users.

The key result is that from 1985 to 2011 reductions in (source) energy intensity in the end-use sectors contributed to about a 12% reduction in the economywide intensity index, and improvements in electric generation efficiency contributed another 2% to the decline in that index. The sum of these two percentage changes is equal to the total percentage reduction in intensity shown in Figure H1. (The product of these two index elements is exactly equal to the economywide index above.) The improvements in overall electricity generation efficiency in the past decade are responsible for about 15% of the total intensity changes since 1985. More discussion of developments in the electric power sector can be found [here](#).

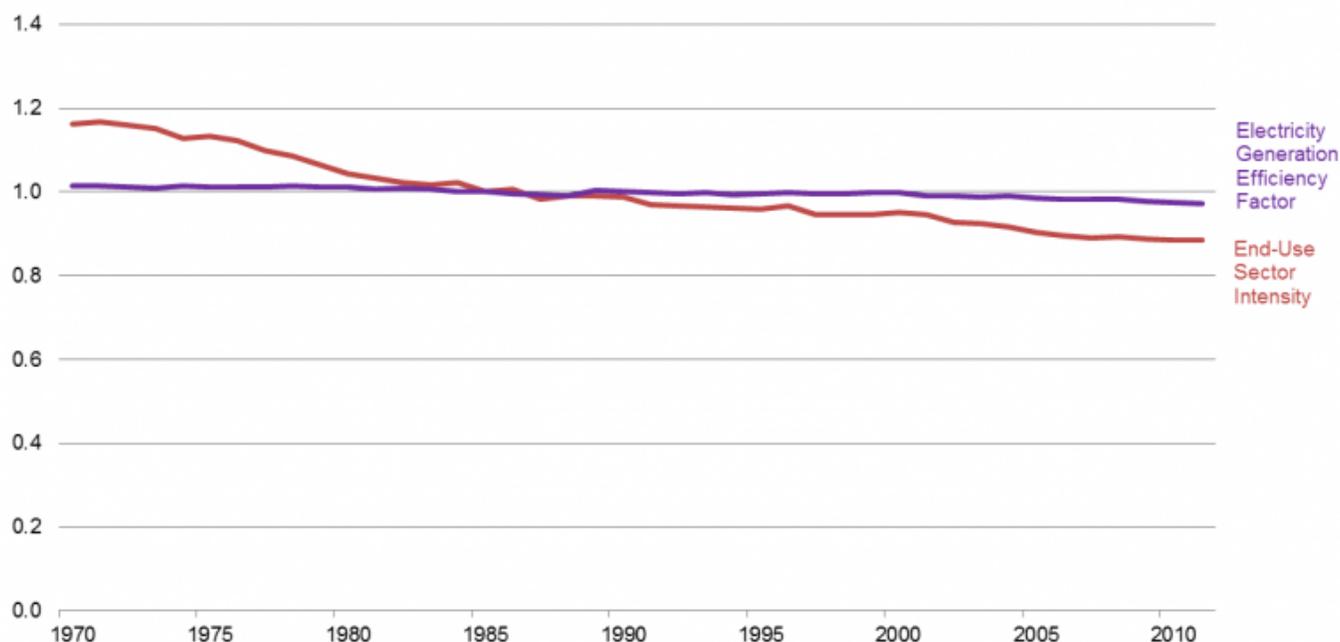


 Figure H3. Decomposition of intensity changes: end-use sectors vs. electric power sector

NATIONAL SYSTEM OF ENERGY INTENSITY INDEXES

The national system of energy intensity indicators presented on this website is intended to reflect to the degree possible underlying changes in energy efficiency throughout the U.S. economy. As part of that effort, the system also seeks to measure the changes in energy intensity that are the result of other explanatory factors unrelated to efficiency improvement. One example of such an explanatory factor is the shift from steel to electronics manufacturing that influences the aggregate energy intensity for manufacturing, but is not indicative of improvements in energy efficiency.

An often used measure of improvement in energy efficiency in the entire economy is to compute the ratio of energy use to gross domestic product (GDP). This indicator has serious shortcomings as it incorporates myriad factors unrelated to energy efficiency changes, as well as the fact that a major portion of energy use in the economy—that used by residential household—does not have a corresponding measure of output included in GDP. As a consequence, the system of energy intensity indicators here provides a more robust measure of changes in energy intensity that are associated with improvements in the efficient use of energy. While this new indicator of energy intensity for the economy as a whole is not a perfect measure of how energy efficiency

has improved, it comes much closer to capturing the influence of efficiency changes than does a measure based only upon a simple ratio of energy to overall GDP.

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