

## ☰ Topic Page: [Energy efficiency](#)

Definition: **efficiency** from *Merriam-Webster's Collegiate(R) Dictionary*

 [pronunciation](#)

(1633) **1** : the quality or degree of being efficient **2 a** : efficient operation **b** (1) : effective operation as measured by a comparison of production with cost (as in energy, time, and money) (2) : the ratio of the useful energy delivered by a dynamic system to the energy supplied to it **3** : efficiency apartment



Image from: [At the USDA-ARS Conservation and Production... in Encyclopedia of 20th Century Technology](#)

### Summary Article: **Energy Efficiency**

From *Encyclopedia of Global Studies*

When the world speaks about energy, invariably it speaks about energy supplies. The World Energy Council, the most representative body of the energy industry, organizes the World Energy Congress every 3 years, representing the energy supply industry. Energy policy on national levels tends to circle around energy supply options under the assumption that there will be an ever-growing energy demand.

The energy efficiency agenda, by contrast, is relatively new. It began in the mid-1970s after the oil price shock of 1973 and is seeing a strong revival since about 2006, again after oil prices soared. Also, enhanced concerns about global warming emerged after the near simultaneous publications of the Stern Review, the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, and Al Gore's book and film *An Inconvenient Truth*. Efficiency increases can serve as an appropriate answer to both global warming concerns and oil prices. However, in the public as well as among energy experts, the favorite answer is still a fuel switch to nonfossil fuels, such as renewable energies and nuclear energy. Energy efficiency remains the undervalued agenda.

The main reason for this state of affairs is that people are accustomed to the historical experience that economic growth accompanies the growth of energy consumption. This tenet was empirically well founded during the industrial revolution. Only since the mid-1970s has humanity seen some kind of decoupling of economic growth from energy consumption. The most important pioneer of decoupling was Amory Lovins who as early as 1977 wrote *Soft Energy Paths*, making energy efficiency the core of his scenarios without nuclear energy and with much less coal. After years of high energy prices, projections even by the energy industry were corrected downward, coming ever closer to Lovins's bold low energy scenarios. Based on Lovins's groundbreaking work, evidence was accumulated proving that at least a factor of four should be available in the increase of energy efficiency worldwide.

A major factor in the increase of energy efficiency should be the perspective for humankind. Assuming an increase of world population to 9 billion and a doubling of average levels of economic prosperity by 2050 (both rather cautious assumptions), a tripling of energy consumption should be expected unless energy efficiency grows by a similar order of magnitude. In the absence of this increase of energy efficiency, ecological nightmares of global warming, nuclear chaos, or both can be expected.

However, technological advances in energy efficiency will not suffice. As prosperity grows, people have a tendency to consume ever more energy even if efficiency is growing. This holds in particular

during phases of low energy prices, as was the case between 1983 and 2005. During this period, all efficiency gains were overcompensated by additional consumption. This phenomenon is often referred to as the rebound effect, the Jevons paradox, or the Khazzoom-Brookes postulate. Figure 1 shows the development in the United States from 1970 to 2007.

Striking efficiency gains have been achieved in several sectors. Lighting with light-emitting diodes (LEDs) is at least twice as efficient as compact fluorescent lamps and 10 times as efficient as incandescent bulbs. Low energy houses need up to 90% less heating energy, using super insulation and heat exchange ventilation. Hybrid cars, combining an electric motor with a combustion engine, more or less doubled the fuel efficiency to 50 miles per gallon from 25. But even such success stories are much too small and too weak to keep energy consumption from growing.

In the context of global studies, these policy questions have to be answered: How can global warming be curbed, how can the ultimate scarcity of fossil fuels be overcome, and how can major conflicts about energy resources be avoided?

Three strategies to increase energy efficiency are as follows:

1. Efficiency standards such as the Swedish building code of 1975 updated several times, or the banning of inefficient technologies such as incandescent light bulbs, plasma TV screens, or gas-guzzling automobiles
2. A carbon dioxide emissions trading system, with a view of putting a price tag on carbon-containing fuels (first introduced in the European Union)
3. Direct steering of energy prices, by direct regulation (possible in countries like China) or by energy taxation, as has been done in Scandinavian countries and Germany

Price signals can be assumed to also address the rebound effect. Preferably they should be internationally agreed on, so as to discourage the migration of industries into low energy price countries.

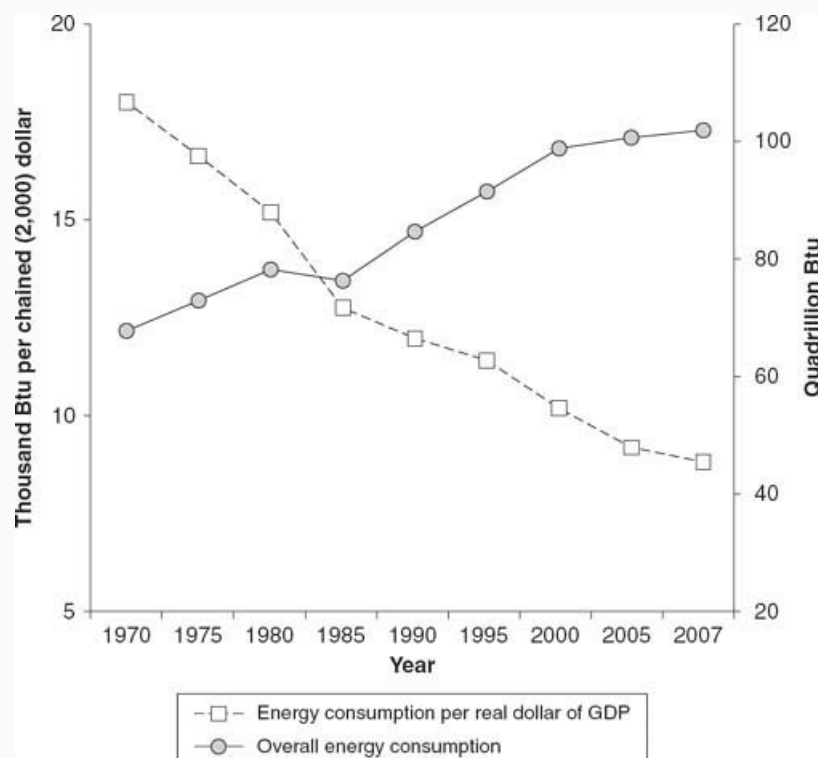


Figure 1 Energy efficiency gains do not prevent people from consuming more energy.

Source: Based on data from Energy Information Administration (2008); Rubin & Tal (2007).

Ultimately it can be expected that energy productivity (the amount of economic value per unit of energy input) can grow as much as labor productivity has grown in the course of the industrial revolution, that is, 20-fold. Technologically, this is feasible, and under a regime of slowly but predictably increasing energy prices, it will also be economically feasible. In addition, such revolutionary increase of energy productivity could greatly alleviate the excessive use of fossil fuel, which harms the environment, and make inexpensive energy available to all.

### See also:

Global Environmental and Energy Issues, Global Warming, Greenhouse Gases, Natural Gas, Production and Innovation Networks, Global

### Further Readings

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von Weizsäcker, Ernst Ulrich

### APA

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Von Weizsäcker, E. U., & Weizsäcker, V. (2012). Energy efficiency. In H. K. Anheier, & M. Juergensmeyer (Eds.), *Encyclopedia of global studies*. Thousand Oaks, CA: Sage Publications. Retrieved from [https://search.credoreference.com/content/topic/energy\\_efficiency](https://search.credoreference.com/content/topic/energy_efficiency)

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