

## ENERGY INTENSITY

A common way to measure and compare the energy intensity of different countries, and how this changes over time, is to look at the ratio of energy supply to GDP. Energy intensity is sometimes also used as proxy of energy efficiency. However, this use can be misleading as energy intensity depends on numerous elements beyond energy efficiency such as climate, output composition, outsourcing of goods produced by energy-intensive industries, etc.

### Definition

Energy intensity refers to total primary energy supply (TPES) per thousand US dollars of GDP. The ratios are calculated by dividing each country's annual TPES by each country's annual GDP expressed in constant 2005 prices and converted to US dollars using purchasing power parities (PPPs) for the year 2005.

TPES consists of primary energy production adjusted for net trade, bunkers and stock changes. Production of secondary energy (e.g. oil/coal products, electricity from fossil fuels, etc.) is not included since the "energy equivalent" of the primary fuels used to create the secondary products or electric power has already been counted. TPES is expressed in tonnes of oil equivalent.

### Overview

Sharp improvements in the efficiency of key end uses, shifts to electricity, some changes in manufacturing output and consumer behaviour have occurred in many OECD countries since 1971. As a consequence, energy supply per unit of GDP fell significantly, particularly in the 1979-1990 period.

Contributing to the trend were higher fuel prices, long-term technological progress, government energy efficiency programmes and regulations.

Globally the ratio of energy supply to GDP (TPES/GDP) fell less than the ratio of energy consumption to GDP (total final consumption/GDP), because of increased use of electricity. The main reason for this divergence is that losses in electricity generation outweighed intensity improvements achieved in end uses such as household appliances.

Among OECD countries, the ratio of energy consumption to GDP varies considerably. Apart from energy prices, winter weather is a key element in these variations, as are raw materials processing techniques, the distance goods must be shipped, the size of dwellings, the use of private rather than public transport and other lifestyle factors.

### Comparability

Care should be taken when comparing energy intensities between countries and over time since different national circumstances (e.g. density of population, country size, average temperatures and economic structure) will affect the ratios. A decrease in the TPES/GDP ratio may reflect a restructuring of the economy and the transfer of energy-intensive industries such as iron and steel out of the country. The harmful effects of such outsourcing may increase the global damage to the environment if the producers abroad use less energy efficient techniques.

### Sources

- International Energy Agency (IEA) (2015), *Energy Balances of OECD Countries*, IEA, Paris.
- IEA (2015), *Energy Balances of Non-OECD Countries*, IEA, Paris.

### Further information

#### Analytical publications

- IEA (2015), *Energy Technology Perspectives*, IEA, Paris.
- IEA (2015), *Energy Policies of IEA Countries (series)*, IEA, Paris.
- IEA (2015), *Tracking Clean Energy Progress 2015*, IEA, Paris.
- IEA (2015), *World Energy Outlook*, IEA, Paris.
- IEA (2013), *Transition to Sustainable Buildings: Strategies and Opportunities to 2050*, IEA, Paris.

#### Online databases

- IEA World Energy Statistics and Balances.

#### Websites

- International Energy Agency, [www.iea.org](http://www.iea.org).

## Total primary energy supply per unit of GDP

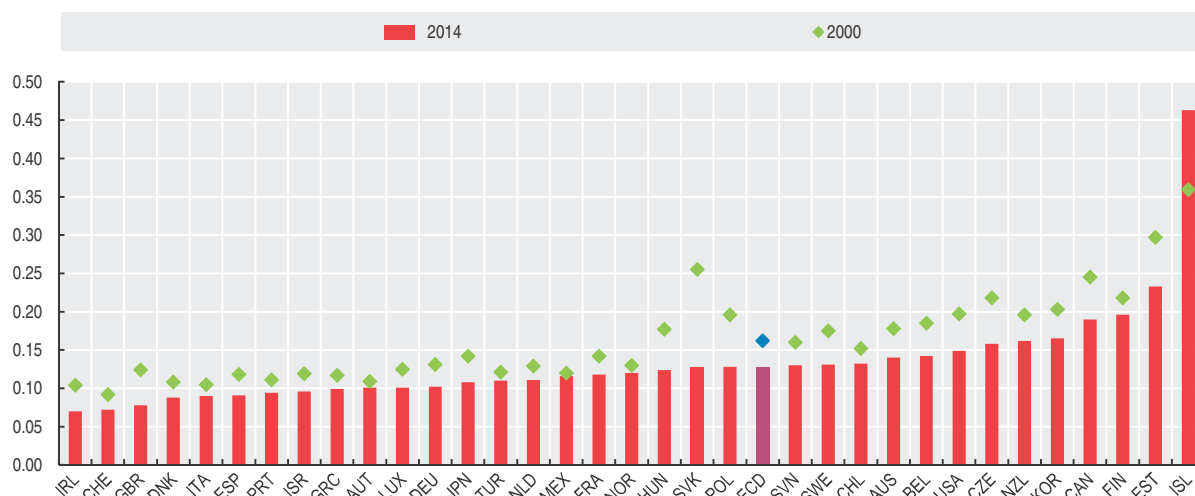
Tonnes of oil equivalent (toe) per thousand 2005 US dollars of GDP calculated using PPPs

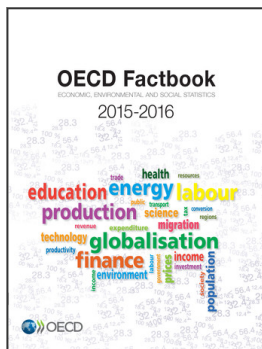
	1971	1990	2000	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Australia	0.21	0.20	0.18	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.14	0.14
Austria	0.16	0.12	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.10
Belgium	0.26	0.19	0.19	0.17	0.16	0.16	0.16	0.16	0.17	0.15	0.15	0.15	0.14
Canada	0.34	0.27	0.25	0.23	0.22	0.22	0.22	0.21	0.20	0.20	0.19	0.19	0.19
Chile	0.18	0.16	0.15	0.14	0.14	0.13	0.13	0.13	0.12	0.13	0.13	0.13	0.13
Czech Republic	0.37	0.28	0.22	0.20	0.19	0.18	0.17	0.17	0.17	0.16	0.16	0.16	0.16
Denmark	0.21	0.13	0.11	0.10	0.11	0.10	0.10	0.10	0.11	0.10	0.09	0.09	0.09
Estonia	..	0.60	0.30	0.23	0.21	0.21	0.22	0.23	0.25	0.24	0.22	0.24	0.23
Finland	0.30	0.24	0.22	0.20	0.21	0.20	0.19	0.20	0.21	0.20	0.19	0.19	0.20
France	0.19	0.16	0.14	0.14	0.14	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12
Germany	0.23	0.17	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11	0.11	0.10
Greece	0.08	0.12	0.12	0.11	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.10	0.10
Hungary	0.24	0.21	0.18	0.16	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.13	0.12
Iceland	0.29	0.34	0.36	0.29	0.35	0.38	0.42	0.46	0.48	0.50	0.48	0.48	0.46
Ireland	0.22	0.15	0.10	0.09	0.08	0.08	0.08	0.09	0.09	0.08	0.08	0.08	0.07
Israel	0.15	0.13	0.12	0.11	0.11	0.11	0.12	0.11	0.11	0.10	0.11	0.10	0.10
Italy	0.14	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09
Japan	0.19	0.13	0.14	0.13	0.13	0.13	0.12	0.13	0.13	0.12	0.11	0.11	0.11
Korea	0.20	0.20	0.20	0.18	0.17	0.17	0.17	0.17	0.18	0.18	0.17	0.17	0.17
Luxembourg	0.51	0.21	0.13	0.14	0.13	0.12	0.12	0.12	0.12	0.12	0.12	0.11	0.10
Mexico	0.11	0.14	0.12	0.13	0.12	0.12	0.12	0.13	0.12	0.12	0.12	0.12	0.12
Netherlands	0.20	0.16	0.13	0.13	0.12	0.12	0.12	0.12	0.13	0.12	0.12	0.12	0.11
New Zealand	0.15	0.20	0.20	0.16	0.16	0.15	0.16	0.16	0.16	0.16	0.17	0.16	0.16
Norway	0.19	0.15	0.13	0.12	0.12	0.12	0.14	0.14	0.15	0.12	0.12	0.13	0.12
Poland	0.36	0.33	0.20	0.18	0.17	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.13
Portugal	0.08	0.10	0.11	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.10	0.09
Slovak Republic	0.33	0.33	0.26	0.21	0.19	0.17	0.16	0.16	0.16	0.15	0.14	0.15	0.13
Slovenia	..	0.17	0.16	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.13
Spain	0.10	0.12	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.10	0.10	0.09
Sweden	0.24	0.21	0.18	0.17	0.16	0.15	0.15	0.14	0.15	0.15	0.15	0.14	0.13
Switzerland	0.09	0.10	0.09	0.09	0.09	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.07
Turkey	0.11	0.12	0.12	0.11	0.11	0.11	0.11	0.12	0.12	0.11	0.12	0.11	0.11
United Kingdom	0.23	0.15	0.12	0.11	0.10	0.10	0.10	0.09	0.10	0.09	0.09	0.09	0.08
United States	0.35	0.23	0.20	0.18	0.17	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.15
EU 28	..	0.16	0.14	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.11	0.11	..
OECD	0.25	0.18	0.16	0.15	0.15	0.14	0.14	0.14	0.14	0.14	0.13	0.13	0.13
Brazil	0.12	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	..
China	1.08	0.58	0.29	0.28	0.27	0.25	0.23	0.23	0.23	0.23	0.23	0.22	..
India	0.25	0.22	0.19	0.16	0.15	0.15	0.15	0.15	0.14	0.14	0.14	0.13	..
Indonesia	0.19	0.14	0.15	0.14	0.13	0.13	0.12	0.12	0.12	0.11	0.11	0.10	..
Russian Federation	..	0.47	0.49	0.38	0.37	0.34	0.33	0.34	0.34	0.34	0.34	0.33	..
South Africa	0.22	0.28	0.28	0.27	0.26	0.26	0.27	0.27	0.26	0.25	0.24	0.24	..
World	0.27	0.22	0.19	0.18	0.17	0.17	0.17	0.16	0.17	0.16	0.16	0.16	..

1 2 <http://dx.doi.org/10.1787/888933336713>

## Total primary energy supply per unit of GDP

Tonnes of oil equivalent (toe) per thousand 2005 US dollars of GDP calculated using PPPs

1 2 <http://dx.doi.org/10.1787/888933335641>



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