

Statistics

Electricity information: Overview



International
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2017

The following analysis is an overview from the publication *Electricity Information 2017*.

Please note that we strongly advise users to read definitions, detailed methodology and country specific notes which can be found online under *References* at www.iea.org/statistics/topics/electricity/

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ELECTRICITY OVERVIEW

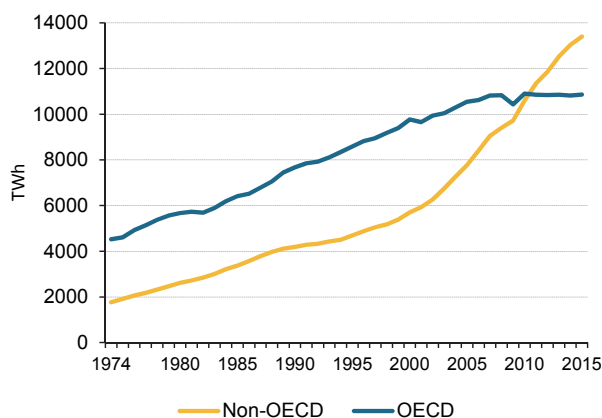
ELECTRICITY SUMMARY

This section presents an overview of global electricity production up to 2015, along with provisional data for 2016 from OECD members.

Production

Between 1974 and 2015, world gross electricity production increased from 6 287 TWh to 24 345 TWh, an average annual growth rate of 3.4%. In 2015, production was 1.7% higher than 2014, the sixth straight year of positive growth after the economic crisis in OECD countries caused a visible decline in global production between 2008 and 2009.

Figure 1: Total gross electricity production

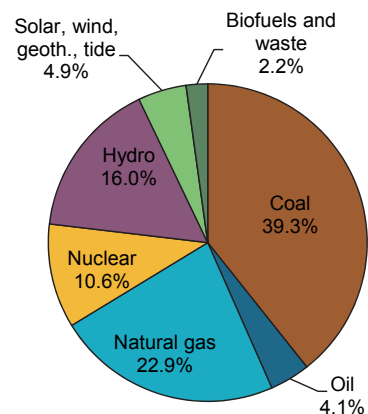


The increasing share of non-OECD countries in total world electricity production reflects the higher average growth rate which has prevailed in the non-OECD regions since 2000. From 1974 to 2000, electricity production has increased at an average annual rate of

4.6% in non-OECD countries, with OECD countries at 3.0%. This trend however changed from 2000 to 2015, with the average annual growth fell to only 0.9% in OECD countries while it grew by 5.9% in non-OECD countries, and consequently, in 2011, non-OECD electricity production exceeded OECD production. This sustained runs of growth continued in 2015, with non-OECD countries accounting for 55.1% of the world electricity generation, almost double its share of 28.1% in 1974.

In 2015, 68.5% of world electricity production was from fossil fuel generating plants. Hydroelectric plants provided 16.0%, nuclear plants 10.6%, geothermal, solar, wind and other sources 4.9%, and biofuels and waste made up the remaining 2.2%.

Figure 2: World gross electricity production, by source, 2015

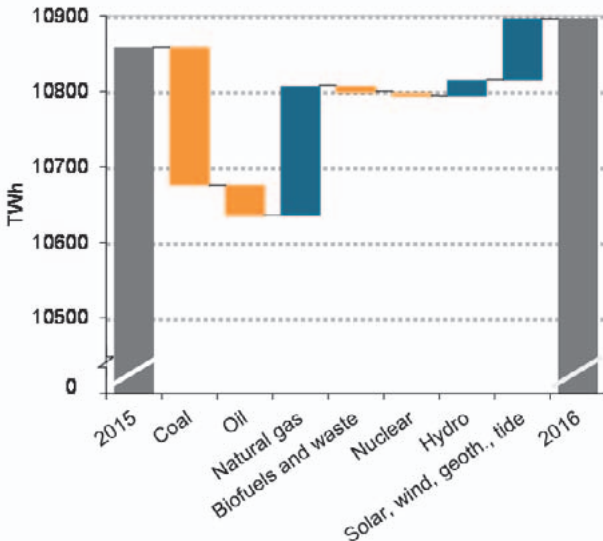


OECD production

Gross electricity production (including generation from pumped storage plants) in the OECD reached 10 964 TWh in provisional 2016 figures, an increase of 0.4% compared to the revised 2015 figure of 10 920 TWh.

Between 2015 and 2016, there was a decrease in electricity production from fossil fuels, the fourth consecutive year of generation decrease by these fuels. Notable types of fossil fuels driving this decrease are coal (-7.1%), and oil (-7.0%). There were also declines seen in nuclear electricity generation (-0.8%), as several OECD nuclear power plants underwent maintenance. Meanwhile, electricity from natural gas (+5.8%) and those from renewable sources such as wind (+7.7%) and solar (+19.2%) registered robust growth. Hydro-electricity rebounded in 2016 (+1.9%), following sharp generation declines seen in 2015, a year marked by an exceptionally strong El Niño weather phenomenon bringing severely dry conditions.

Figure 3: OECD gross electricity production variation, 2015-2016p



In 2016, total combustible fuel¹ plants accounted for 60.8% of total OECD gross electricity production (made up of 57.8% from fossil-fuel-fired plants and 3.2% from biofuels and waste plants), nuclear plants 18.1%, hydroelectric plants 12.9%, and geothermal, solar, wind and other plants at 8.2%.

1. Combustible fuels refer to fuel that are capable of igniting or burning, i.e. reacting with oxygen to produce a significant rise in temperature. Fuels included are: coal and coal products, oil and oil products, natural gas, biofuels including solid biomass and animal products, gas/liquids from biomass, industrial waste and municipal waste.

Figure 4a: OECD gross electricity production, by source, 2016p

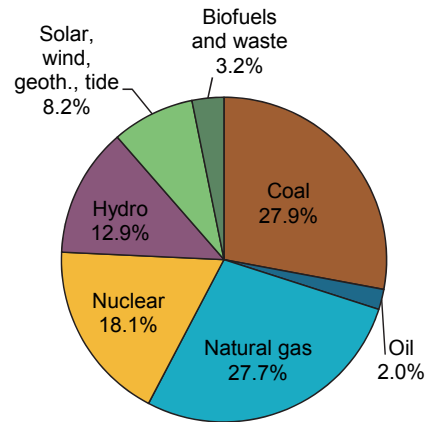
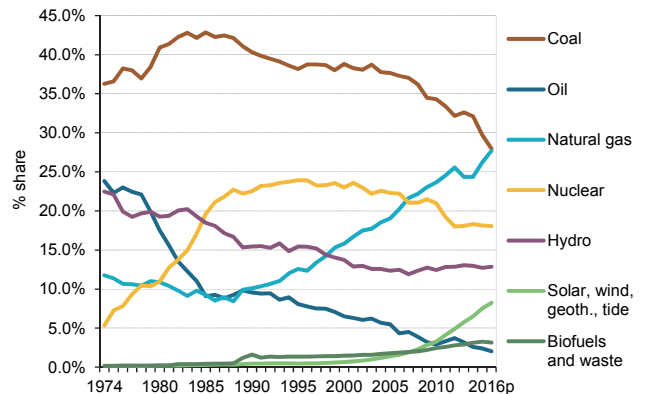


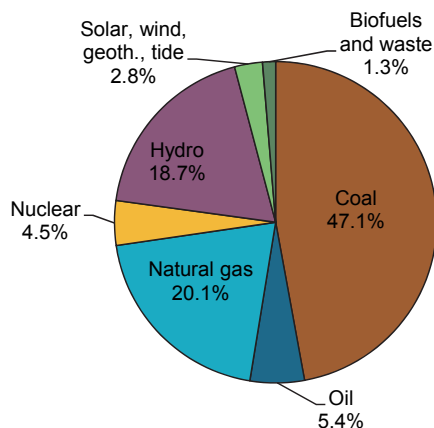
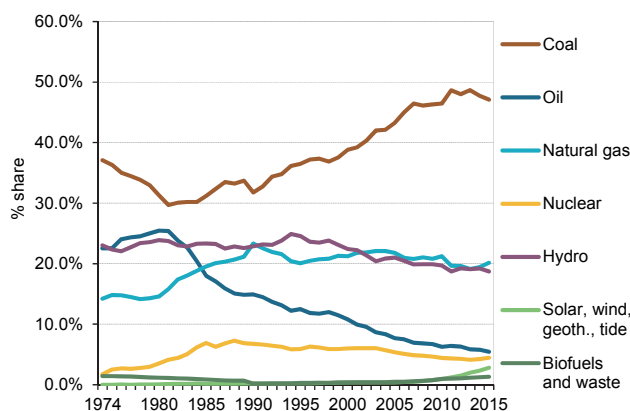
Figure 4b: OECD gross electricity production, by source, 1974-2016p



Non-OECD production

While complete statistics are not available for electricity production in all non-OECD countries for 2016, comprehensive data are available for 2015. Gross electricity production in 2015 in non-OECD countries was 13 425 TWh, an increase of 2.8% on the 2014 levels. In contrast, OECD countries posted a marginal growth of 0.4% in their gross electricity production for the period 2014-15.

In 2015, 73.0% of non-OECD electricity production was generated from fossil fuels, 1.3% from biofuels and wastes, 18.7% was provided by hydroelectric plants, 4.5% by nuclear plants and 2.8% by geothermal/solar/wind energy.

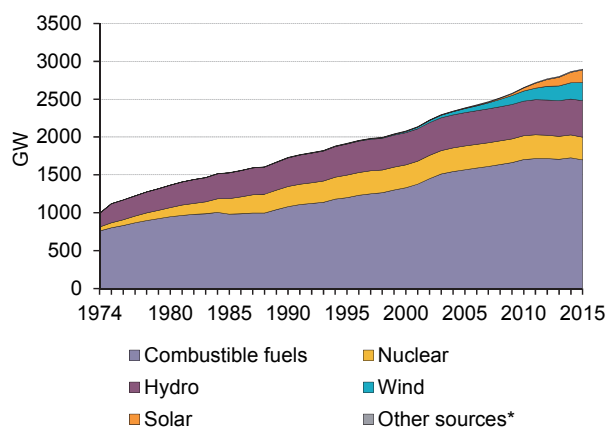
Figure 5a: Non-OECD gross electricity production, by source, 2015**Figure 5b: Non-OECD gross electricity production, by source, 1974-2015**

OECD capacity

Official capacity data are available only for OECD countries and up to the year 2015.

In 2015, the OECD countries reported 2 896 GW of total installed capacity, a 1.1% increase from 2014. The total capacity consisted of 1 697 GW of plants fired by fossil and other combustible fuels, 300 GW of nuclear power, 483 GW of hydroelectric power (including pumped storage capacity), 239 GW of wind, 166 GW of solar (of which 162 GW is solar photovoltaic) and 11 GW of geothermal, tide/wave/ocean and others combined. A total of 31.5 GW capacity was added in 2015 with the biggest growth seen in solar PV (28.7 GW; 21.6%), wind (24.5 GW; 11.5%), and geothermal (0.4 GW; 5.3%) technologies, offsetting the decreases experienced in nuclear (-2.5 GW; -0.8%) and combustible fuels (-27.6 GW; -1.6%).

The total generating capacity in the OECD increased at an average annual rate of 2.9% between 1974 and 2000, with nuclear, hydroelectric and combustible fuel capacity increasing at an average annual rate of 6.9%, 3.4%, and 2.2%, respectively. By comparison, between 2000 and 2015, the total generating capacity increased at an average annual rate of 2.2%, with nuclear experiencing a very slight decrease (-0.1%), hydroelectric and combustible fuels rising by 0.9%, and 1.7%, respectively. However, during this period, there were substantial additions of solar PV and wind capacity, posting record gains at an average annual rate of 44.0% and 20.3% respectively, as many countries began to invest in renewable energy infrastructures.

Figure 6: OECD net electrical capacity by source

* includes geothermal, tide, wave, ocean, chemical heat and other non-specified (e.g. fuel cells) sources of electricity production.

The slower overall growth of total capacity additions is partly attributable to economic change, which has resulted in the growth of less energy intensive service industries as well as the migration of energy intensive industries away from the OECD region. The OECD-wide pattern of electric power capacity and production conceals large differences between countries. These differences reflect different resource endowments and economics of electricity generation, as well as different policy approaches taken by countries.

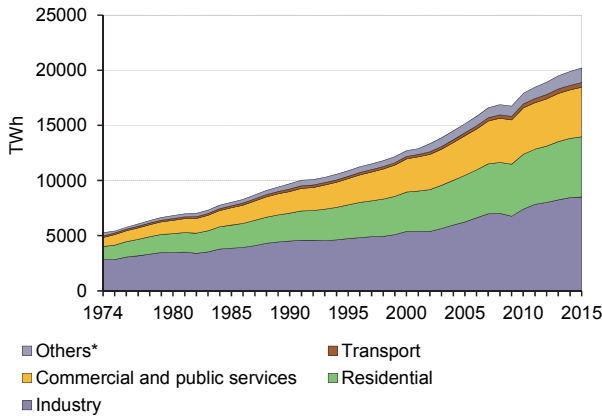
Consumption

The world total final electricity consumption in 2015 reached 20 200 TWh, an increase of 1.6% over the 2014 figure. The average growth rate of electricity final consumption in the world since 1974 was 3.4%.

OECD consumption

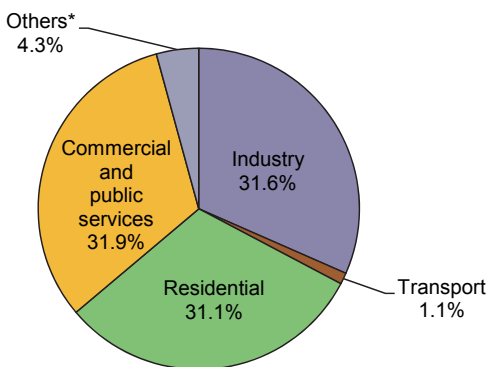
In 2015, total final electricity consumption was 9 397 TWh, an increase of 0.5% compared to 2014. Provisional data for 2016 show gross supply of electricity in the OECD was 10 885 TWh, a 0.4% increase compared to 2015.

Figure 7: World electricity final consumption by sector



* includes Agriculture and forestry, fishing, and other non-specified.

Figure 8: OECD electricity final consumption by sector, 2015



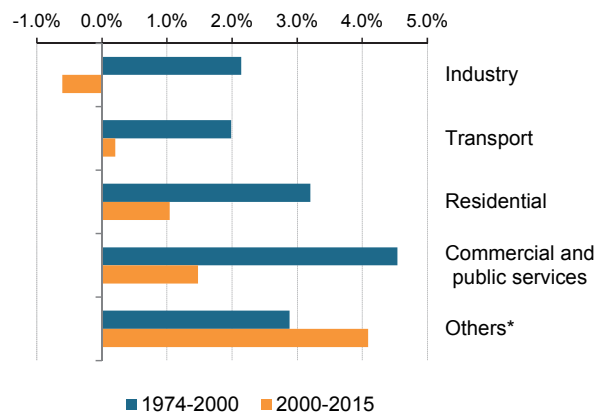
* includes Agriculture and forestry, fishing, and other non-specified

Much of the growth in OECD electricity consumption since 1974 has taken place in the residential and commercial/public service sectors. The combined share of total consumption of the residential and commercial/public service sectors increased from 48.4% in 1974 to 63.0% in 2015. Although the amount of electricity consumed in industry increased from 1 874 TWh in 1974 to 2 970 TWh in 2015, its share of total electricity consumption in the OECD fell from 48.7% in 1974 to 31.6% in 2015, yielding, for the most part, towards the residential sector's

increase in share. Some OECD countries show different consumption patterns, however. In Korea, for example, 53% of electricity was consumed in the industry sector in 2015, and only 12.9% in the residential sector. New Zealand also saw its consumption in the residential sector decline from 47% in 1974 to become 32% in 2015, manifesting a shift towards greater consumption in the commercial/public services, to the expense of the share previously occupied by the residential sector.

Industry has been the most significant end-use sector for electricity consumption for many years. However, it has since experienced a general long term decline. It is now around the same size as the commercial and public services and residential sectors. The restructuring of OECD economies and improvements in efficiency in energy intensive manufacturing and processing industries led to relatively low growth rates in the industry sector electricity consumption since 1974, compared to the residential and commercial and public services sectors. In 2015, the OECD industrial electricity consumption decreased by 0.5%, the fourth year in a row, with the largest decreases seen in the machinery sector (-11.1%); while the paper, pulp and printing sector witnessing a healthy rebound, posting the largest growth among the various industry sub-sectors at 12.7%

Figure 9: OECD average annual growth rate in electricity final consumption by sector



* includes Agriculture, forestry and fishing

Among the different consumption sectors, the transport (mainly rail), agriculture (mainly irrigation pumps) and fishing sectors are relatively small consumers of electricity. For 2015 however, road transport started to experience very accentuated growth rates, with the sector gaining by more than a double (102%) in a span of a single year. These

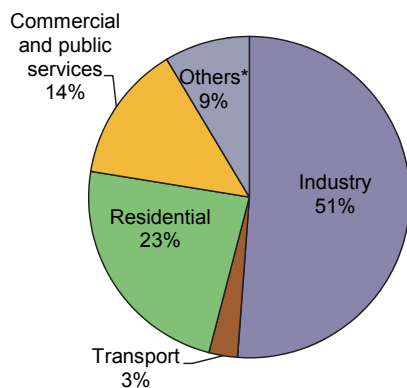
growths further underline the increasing electrification of the transport sector, as OECD countries increase their uptake of electric vehicles.

Non-OECD consumption

In 2015, final electricity consumption in non-OECD countries was 10 803 TWh, an increase of 2.7% from 2014. Between 1974 and 2015, final electricity consumption increased at an average annual rate of 5.1%. Non-OECD countries' share of world electricity final consumption has been experiencing sustained growth, increasing from 27.1% in 1973 to 53.5% in 2015.

The four highest non-OECD consumers of electricity in 2015, namely the People's Republic of China, India, the Russian Federation and Brazil, represent 66.3% of all non-OECD electricity consumption. Among these countries, China occupies the largest share, at 45.1% of total non-OECD consumption.

Figure 10: Non-OECD electricity final consumption by sector, 2015



* includes Agriculture and forestry, fishing, and other non-specified

Notable differences exist in the rate of transmission and distribution losses between OECD and non-OECD countries. In 2015, 9.6% of electricity supply for non-OECD countries were forfeited due to these losses, while 6.3% were recorded for OECD countries. Total transmission and distribution losses can reach as much as 25% of the electricity supply in some non-OECD countries such as Haiti, Congo, Honduras, Paraguay, Myanmar and Iraq, underscoring the significant divide in the electricity infrastructure between the two groups.

Trade

Electricity Trade between neighbouring countries has become much more common in recent years. Exchanges based on differences in national production costs are economically efficient, and fluctuations in load can be balanced by exchanges with neighbouring countries with different load profiles. Such exchanges reduce the overall reserve margins needed by diversifying the potential sources of supply. Surplus capacity in a neighbouring region can result not only from simple differences in load timing, but also from differences in climate (e.g. seasonal peaks or renewable resources), economic structure, or the timing of forced and scheduled unit outages.

Often when reporting electricity flows, countries use electricity trade as a “balancing” item. This leads to considerable variation in import and export data. In addition, the transmission and distribution line losses between net importers and net exporters are difficult to determine. Both of these factors lead to differences between reported net imports and net exports in trading countries.

OECD electricity trade

In the OECD, imports of electricity grew from 88 TWh in 1974 to 488 TWh in 2016, representing an average annual growth rate of 4.3%. OECD exports of electricity grew from 81 TWh in 1974 to 511 TWh in 2016, with the average annual growth rate standing at 4.7%.

Figure 11: OECD Europe electricity imports and exports

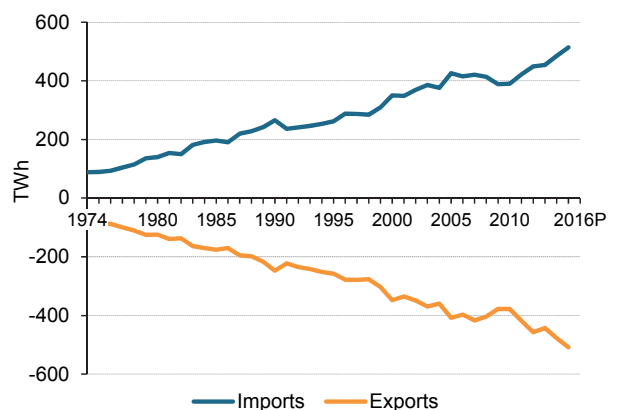
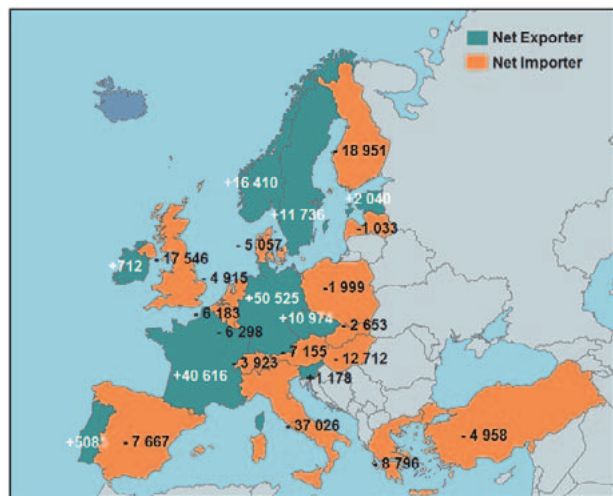


Figure 12: OECD Europe net importers and exporters of electricity (GWh), 2016¹



1. This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Substantial trade in electricity occurs in OECD Europe, principally between OECD countries, and in OECD Americas. In OECD Europe, electricity imports grew at an average annual rate of 4.6% between 1974 and 2016. In OECD Americas, total imports increased by an average annual rate of 3.9% between 1974 and 2016.

Electricity trade can be used to compensate in times of lower generation, such as in Portugal in 2015 where domestic hydroelectric generation were driven down by an exceptionally dry year. To compensate for this loss in supply, Portugal increased its net imports by 1.3 TWh between 2014 and 2015, roughly the same decrease as the net domestic production. When domestic production rebounded in 2016 with the return of favourable hydroelectric production, Portugal saw its exports increase.

Non-OECD electricity trade

When considered as a single entity, non-OECD countries are net importers of electricity. In 2015, these countries reported electricity imports of 238 TWh and electricity exports of 217 TWh, resulting in net imports of 20.5 TWh.

Outside of the OECD, there is substantial electricity trade between Russia, Kyrgyzstan, Turkmenistan,

Ukraine and other countries of the former Soviet Union. These countries export significant quantities of electricity to net importing countries such as Belarus, Moldova as well as in neighbouring OECD Europe countries.

In South America, electricity produced by large hydroelectric plants in Paraguay is exported to Brazil and Argentina (in 2015, net exports from Paraguay were 41.1 TWh).

In Africa, there is significant trade in the southern portion of the continent. South Africa exports a significant amount of power to Zimbabwe. Mozambique, which has been a net electricity importer, became a net exporter in 1998 as a new hydro project came into service. In 2015, net exports of South Africa were 1.6 TWh, and net exports of Mozambique were 2.3 TWh.

In Asia, India imports a significant amount of electricity (5.2 TWh in 2015), a substantial part of which is produced by hydro facilities in neighbouring Bhutan. An increasing amount of electricity trade is also seen in countries lying in the Mekong River Basin, with the People's Republic of China, Lao PDR, and Myanmar acting as net exporters of electricity, chiefly of hydroelectric origin. With significant investments in its power infrastructure in the last decade, and aided in part by its unique geographic position of having the largest number of neighbouring countries, China has transformed itself from being a net importer of electricity in the early 1990s to a major power exporter in the region. In 2015, China's net exports reached 12.4 TWh, nearly five times the quantity since its net exporter status began in 1994.

OECD prices

Average real electricity price in the OECD decreased by 0.4% in 2016 from 2015 levels. Prices for industry increased by 0.2% and prices for households decreased by 0.9%.

Electricity prices for consumers vary widely across OECD countries. Based on available 2016 data, electricity prices for industry were the lowest in Norway (USD 42.41 per MWh), while they were the highest in Italy (USD 185.26 per MWh). Electricity prices for households varied from USD 63.74 per MWh in Mexico to as high as USD 329.71 per MWh in Germany.