statistics

Electricity information: Overview

IEA

2019

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Please note that we strongly advise users to read definitions, detailed methodology and country specific notes which can be found at http://wds.iea.org/wds/pdf/ele_documentation.pdf.

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ELECTRICITY OVERVIEW

Electricity summary

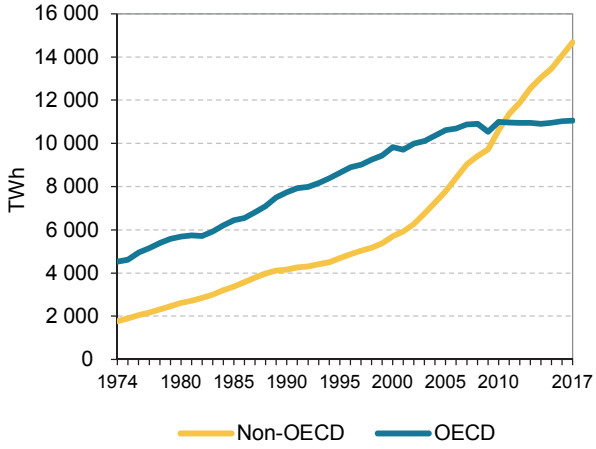
This section presents an overview of global electricity trends up to 2017, along with provisional data for 2018 from OECD members and other countries for which official data are available.

Production

Between 1974 and 2017, world gross electricity production (including pumped hydro)[1] increased from 6 298 TWh to 25 721 TWh, an average annual growth rate of 3.3%. In 2017, production was 2.5% higher than 2016. Year-on-year, global electricity production has grown each year continuously since 1974, except for between 2008 and 2009, when the global financial crisis caused an appreciable decline in production.

In 2017, non-OECD countries' share of production reached 57.0% of world electricity generation, more than double the share they held in 1974 (28.0%), reflecting the higher average growth rate which has prevailed in the non-OECD countries since then. From 1974 to 2000, electricity production increased at an average annual rate of 4.6% in non-OECD countries, compared with 3.0% in OECD countries. However, the respective growth rates diverged even further following the turn of the century, with annual production growth between 2000 and 2010 averaging just 1.1% in OECD countries, compared with 6.4% in non-OECD countries. While growth rates in both groups of economies fell after 2010, the divergent paths persisted. As a consequence, in 2011, non-OECD electricity production surpassed OECD production for the first time, and its share of production has continued to increase since then.

Figure 1: Total gross electricity production



In 2017, generation from combustible fuels[2] accounted for 66.8% of total world gross electricity production (of which: 64.5% from fossil fuels; 2.3% from biofuels and waste[3]), hydroelectric plants: 16.3%; nuclear plants: 10.2%; wind: 4.4%; solar: 1.8%; and geothermal, tidal, and other sources: 0.5%.

1. Throughout this analysis electricity production figures include production from pumped storage hydro. This is in contrast to the *Renewables Information* and *World Energy Balances* publications, which exclude pumped storage generation from production figures.

2. Combustible fuels refer to fuels 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.

3. Waste includes industrial waste, and renewable and non-renewable municipal waste.

Figure 2: World gross electricity production, by source, 2017

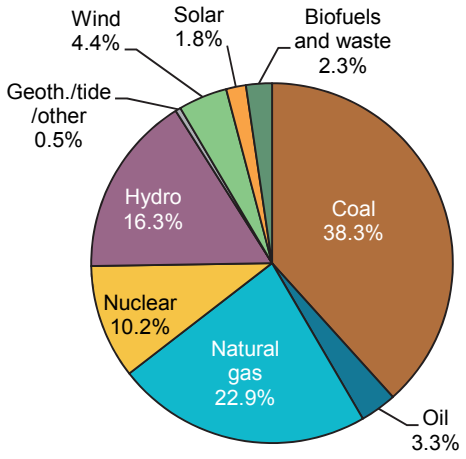
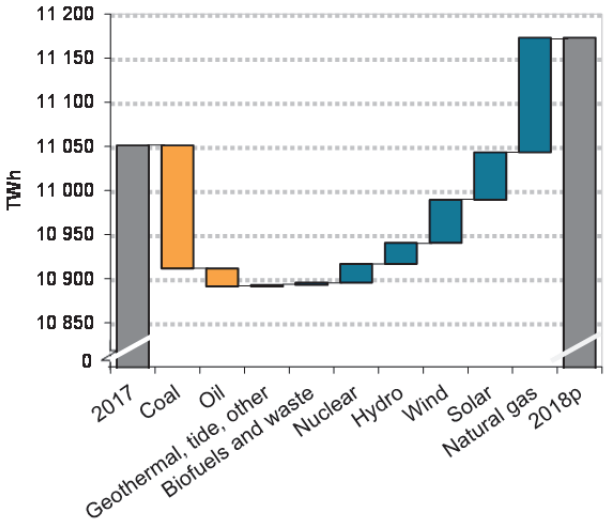


Figure 3: OECD gross electricity production variation, 2017-2018p



OECD production

Based on provision data, gross electricity production in the OECD reached 11 173 TWh in 2018, an increase of 1.1% over 2017.

Between 2017 and 2018, there was a slight fall (-0.5%) in electricity production from fossil fuels, the sixth consecutive annual decrease, with lower output from coal (-4.6%) and oil (-9.0%) offsetting increased production from natural gas (+4.4%). Variations in weather conditions and the recommencement of electricity production at some nuclear reactors in Japan contributed to modest increases in output from nuclear (+1.1%) and hydro plants (+1.6%), while wind (+7.0%) and solar (+19.8%) showed robust growth.

In 2018, generation from total combustible fuels accounted for 58.6% of total OECD gross electricity production (of which: 55.3% from fossil fuels; 3.3% from biofuels and waste[4]); nuclear plants: 17.7%; hydroelectric plants: 13.4%; wind: 6.7%; solar: 2.9%; and geothermal, tidal and other plants: 0.8%.

In terms of shares of overall OECD electricity generation, 2018 saw the share of output from natural gas reach 27.9%, surpassing that of coal (25.6%) for the first time. At 27.0%, the combined share of output from renewables and waste also surpassed that of coal, while nuclear supplied under one fifth of total generation (17.7%).

Figure 4a: OECD gross electricity production, by source, 2018p

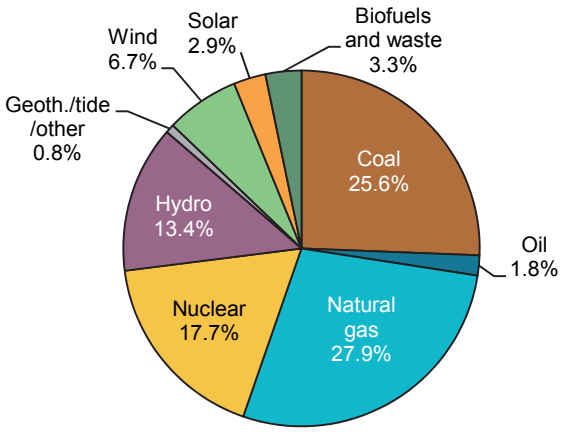
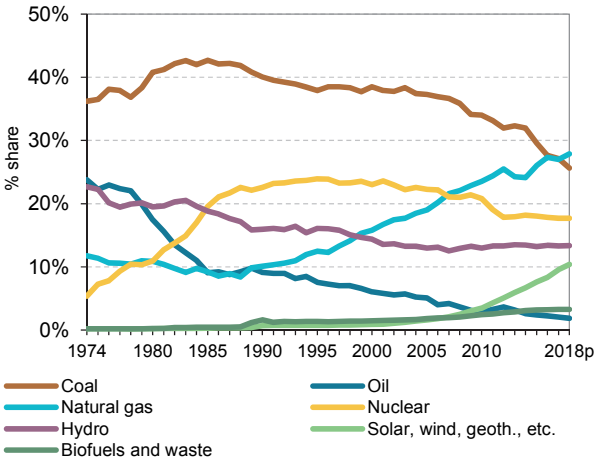


Figure 4b: Share of OECD gross electricity production, by source, 1974-2018p



4. Waste includes industrial waste, and renewable and non-renewable municipal waste.

Non-OECD production

In 2017, gross electricity production in non-OECD countries reached 14 670 TWh, an increase of 4.2% over 2016. This was significantly above the growth observed in the OECD (0.3%) over the same period. While complete statistics are not available for all non-OECD countries for 2018, provisional data for the People's Republic of China (hereafter, "China"), show that gross electricity generation reached 7 112 TWh in 2018, a 7.2% increase over 2017.

In 2017, 72.3% of non-OECD electricity production was generated from combustible fuels (of which: 70.7% from fossil fuels; 1.6% from biofuels and waste); 18.6% was provided by hydroelectric plants; 4.6% by nuclear plants; 2.9% by wind; 1.2% by solar; and 0.2% by geothermal, tidal and other sources.[5]

Having followed an upward trend since the early 1980s, the share of coal in non-OECD electricity generation peaked at 48.6% in 2013. Since then, coal's share has declined slightly, with coal accounting for 46.8% of generation in 2017. This decline is in part due to the rapid growth of renewables, albeit from a small base. Wind's share of generation has risen from 1.6% in 2013, to 2.9% in 2017, while the share of solar has increased from 0.2% to 1.2%.

Figure 5a: Non-OECD gross electricity production, by source, 2017

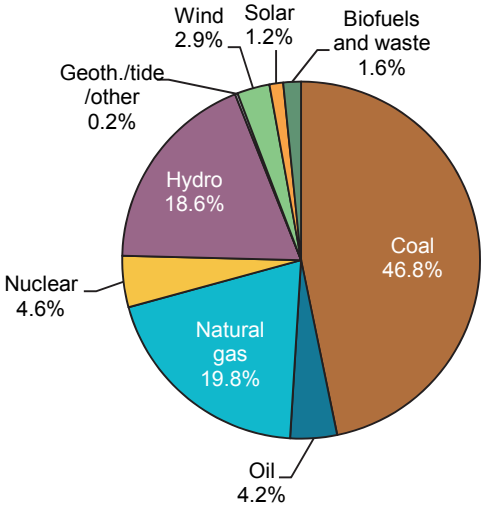
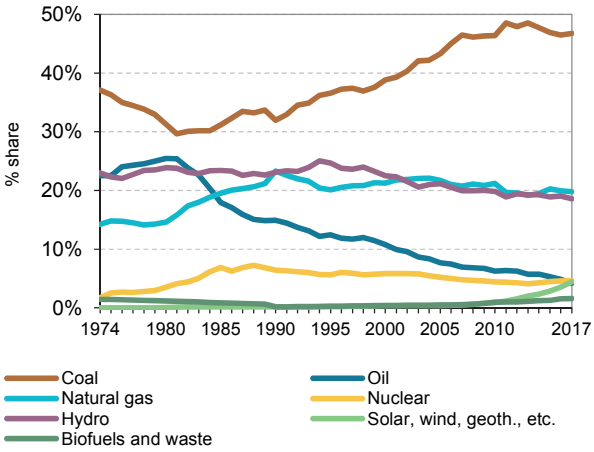


Figure 5b: Share of non-OECD gross electricity production, by source, 1974-2017



OECD capacity

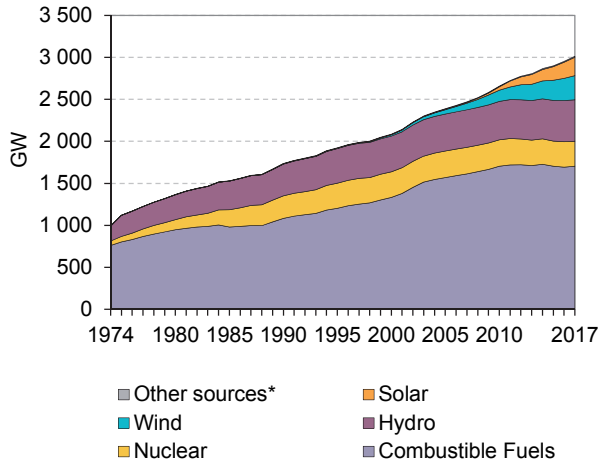
Official final capacity data are available only for OECD countries and up to the end of 2017.

In 2017, the OECD countries reported 3 013 GW of total installed capacity, a 2.0% increase over 2016. The total capacity consisted of 1 704 GW of plants fired by fossil and other combustible fuels, 492 GW of hydroelectric power (including pumped storage capacity), 298 GW of nuclear power, 288 GW of wind, 219 GW of solar (of which: 4 GW was solar thermal) and 11 GW of geothermal, tidal, wave, ocean, and others combined. Overall, 60 GW of generating capacity was added in 2017, with the largest absolute growth seen in solar PV (26 GW; 13.8%), wind (24 GW; 8.9%) and hydro (2 GW; 0.5%). This more than offset the modest decline in nuclear capacity (-4 GW; -1.3%).

Between 1974 and 2000, total generating capacity in the OECD increased at an average annual rate of 2.9% driven mainly by increases in nuclear (7.0%), hydroelectric (3.4%), and combustible fuels (2.2%). Between 2000 and 2010, capacity increased at an average rate of 2.4%, driven mainly by combustible fuels (2.5%), and wind (24.2%), while nuclear (0.3%) and hydro (0.7%), grew at far lower rates. Between 2010 and 2017, the growth in capacity slowed to 1.8%. However, unlike the preceding periods, the majority (93.5%) of the increase was driven by growth in solar (27.5%) and wind (11.6%) capacity as countries began to invest in renewable energy generating infrastructure. An increase in capacity was also observed for hydro (1.1%) over this time period, while combustible fuel-fired capacity remained flat (0.0%) and nuclear declined (-0.7%).

5. Due to rounding, figures may not add up to exactly 100%.

Figure 6: OECD net electrical capacity by source



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

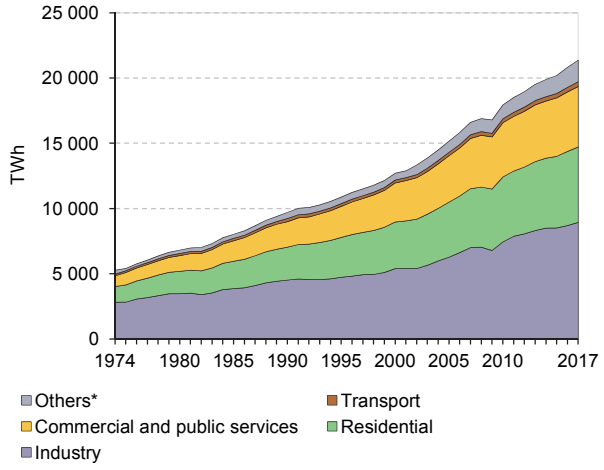
Consumption

In 2017, world electricity final consumption reached 21 372 TWh, 2.6% above the 2016 figure. This compares with an average growth rate of 3.3%, observed between 1974 and 2017.

OECD consumption

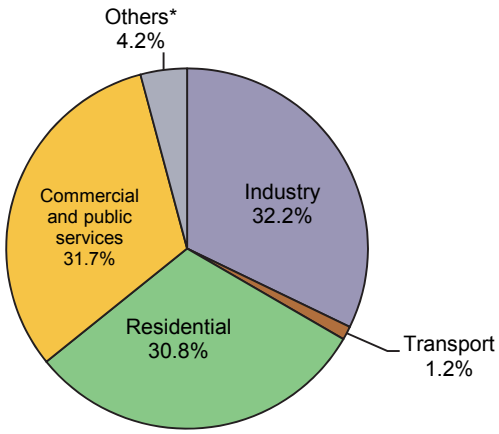
In 2017, OECD electricity final consumption was 9 518 TWh, 0.2% higher than in 2016. Although consumption data for 2018 are not yet available, as noted above, provisional data show that gross electricity production (including pumped hydro) in the OECD was 11 173 TWh in 2018, a 1.1% increase on 2017.

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, 2017



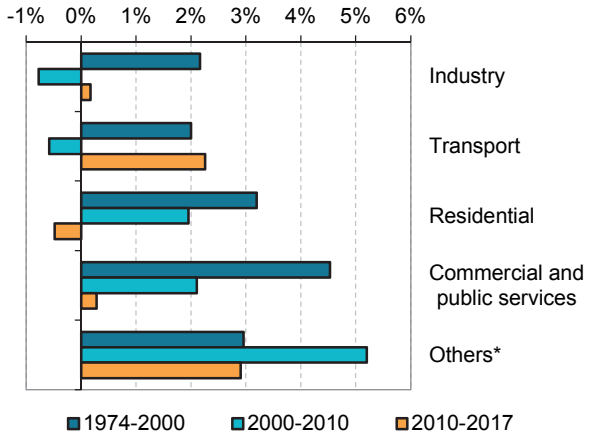
* includes agriculture and forestry, fishing, and other non-specified.

Much of the growth in OECD electricity consumption since 1974 has taken place in the commercial and public services, and residential sectors. The combined share of electricity consumption in these sectors increased from 48.4% in 1974 to 62.5% in 2017. Although the absolute amount of electricity consumed in industry increased from 1 874 TWh in 1974 to 3 062 TWh in 2017, industry's share of electricity consumption in the OECD fell from 48.7% in 1974 to 32.2% in 2017. By comparison, the share of electricity consumed by the commercial and public services sector rose from 19.7% in 1974, to 31.7% in 2017, while the share residential sector grew from 28.7% to 30.8%. However, this trend is not observed consistently across all OECD countries. For instance, although it has fluctuated over time, in 2017, industry's share of final electricity consumption in Austria (1974: 48%; 2017: 47%) and Mexico (1974: 54%; 2017: 54%) was at a similar level to 1974.

In 2017, industry was the largest end-use sector for electricity consumption across the OECD as a whole, but its share of consumption has been in long-term decline. Across the OECD, economic restructuring and improvements in energy efficiency in energy intensive industries led to lower growth in electricity demand in industry between 1974 and 2017, compared with the growth rates observed in the residential, and commercial and public services sectors. Although, as of 2017, industry remains the sector with the highest final consumption of electricity, at 32.2%, industry's share of consumption is only marginally greater than that of the commercial and public services (31.7%), and residential sectors (30.8%).

In 2017, across the OECD as a whole, electricity consumption by industry rose by 0.8% (+25 GWh), consumption in commercial and public services grew by 0.2% (+5 GWh), while consumption in the residential sector declined by 1.0% (-28 GWh).

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

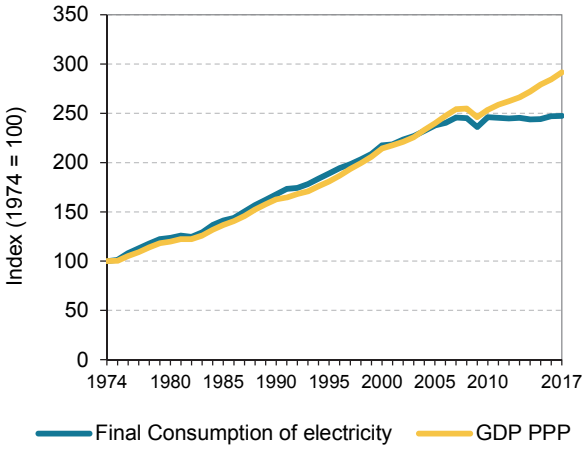


* includes agriculture, forestry and fishing.

The remaining end-use sectors, transport (mainly rail), agriculture and forestry (mainly irrigation pumps) and fishing, are relatively small consumers of electricity. However, within the transport sector, road transport, has recently experienced strong growth in electricity consumption (2017: 14%), with the sector posting double-digit growth rates each year since 2012, underlining the increasing electrification of the transport sector, as electric vehicles gain market share across OECD countries, in particular in Europe. For instance, in Norway, the global leader in terms of market share, 46% of new cars sold in 2018 were electric (IEA, 2019). The next highest market shares were recorded in Iceland (17%) and Sweden (8%). However, whilst growing, electricity used in road transport represents just 0.06% of OECD total road transport energy use, and only 0.08% of OECD final consumption of electricity.

Between 1974 and 2000, final electricity consumption in the OECD increased more or less in line with GDP:[6] However, some decoupling has been observed since the early 2000s - in particular, following the rebound in GDP growth after the financial crisis. From 2008 to 2017, electricity consumption across the OECD increased by just 0.9%, despite 14.3% growth in GDP.

Figure 10: OECD final consumption of electricity, and Gross Domestic Product (GDP PPP)*

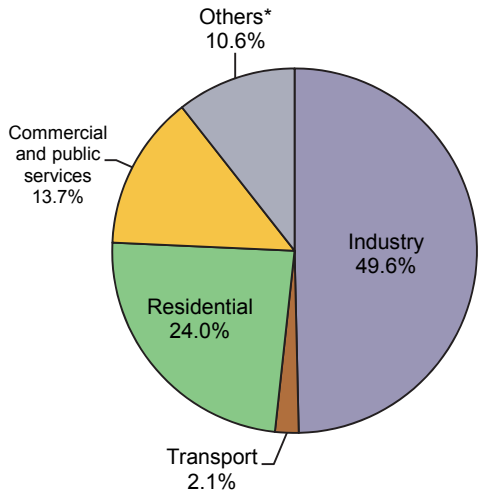


* GDP based on 2010 USD PPP.

Non-OECD consumption

In 2017, final consumption of electricity in non-OECD countries was 11 854 TWh, an increase of 4.6% over 2016. Between 1974 and 2017, electricity final 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 27.0% in 1974 to 55.5% in 2017.

Figure 11: Non-OECD electricity final consumption by sector, 2017

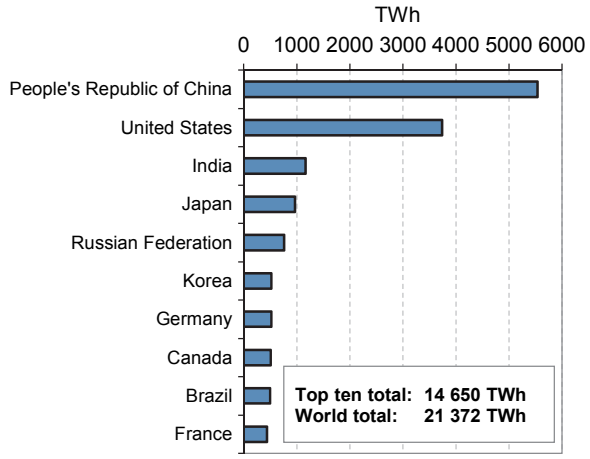


* includes agriculture and forestry, fishing, and other non-specified.

6. In this chapter, GDP refers to GDP using purchasing power parities.

In 2017, the four largest non-OECD consumers of electricity were China, India, the Russian Federation and Brazil, which together represent 67.2% of all non-OECD electricity final consumption (or 37.2% of global consumption). Among these countries, China has the largest share, at 46.7% of total non-OECD consumption. Electricity use outside the OECD is dominated by industrial demand which accounts for half of final electricity consumption.

Figure 12: Top ten electricity consuming countries, 2017



Trade

Electricity trade between neighbouring countries has become much more common in recent years. 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 89 TWh in 1974 to 490 TWh in 2018, representing an average annual growth rate of 4.0%, compared to the 2.1% growth in overall electricity supply. In 1974, imports represented 2.0% of OECD electricity supply, while in 2018 this share had grown to 4.4%. OECD exports of electricity grew from 81 TWh in 1974 to 480 TWh in 2018, with the average annual growth rate standing at 4.1%. In 1974, exports were 1.8% the size of OECD electricity supply, while in 2018 they were 4.3%.

Figure 13: OECD Europe electricity imports and exports

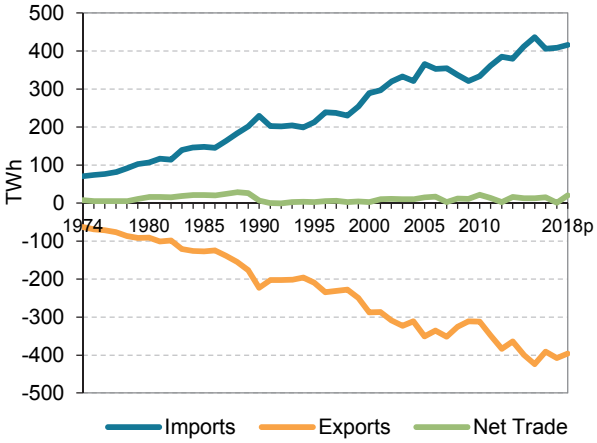
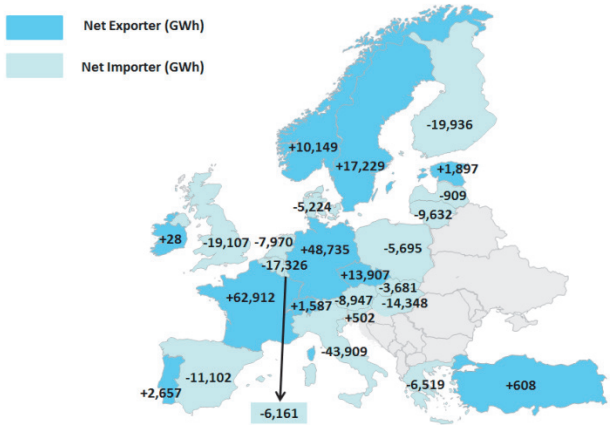


Figure 14: OECD Europe net importers and exporters of electricity (GWh), 2018p*



* 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 4.1% between 1974 and 2018. In OECD Americas, total imports increased by an average annual rate of 3.3% between 1974 and 2018[7].

Electricity trade can be used to compensate for fluctuations in domestic generation, such as in Sweden in 2018 where hydroelectric production decreased due to lower rainfall. To compensate for this loss in supply, Sweden, a net exporter of electricity since 2011, increased its imports by 0.3 TWh, and decreased its

7. Electricity trade data for OECD Americas are subject to revision. Work to reconcile trade data for OECD Americas is an ongoing aspect of the North America Trilateral.

exports by 1.5 TWh, thus, increasing supply by 1.8 TWh. In this way, Sweden was able to balance half of the decrease in production from hydro (3.6 TWh) using trade alone.

Non-OECD electricity trade

Outside of the OECD, there is substantial electricity trade between the Russian Federation, Kyrgyzstan, Turkmenistan, Ukraine and other countries of the former Soviet Union. These countries trade significant quantities of electricity with neighbouring countries such as Belarus, Moldova as well as neighbouring OECD Europe countries. In addition, there is also trade between several neighbouring countries in south eastern Europe, such as Bosnia and Herzegovina, Bulgaria, Croatia, Romania and Serbia.

In South America, electricity produced by large hydro-electric plants in Paraguay is exported to Brazil and Argentina (in 2017, net exports from Paraguay were 43.6 TWh). Electricity trade between Chile and Argentina (small amounts) resumed in 2016 after a break of four years.

In Africa, there is significant trade in the southern portion of the continent. In particular, South Africa exports a significant amount of power to neighbouring countries such as Zimbabwe, while Mozambique has been a net exporter since 1998. In 2017, net exports from South Africa were 6.6 TWh, while due to a decline in domestic production, exports from Mozambique only marginally exceeded imports in 2017 (+10.9 GWh), compared with net exports of 4.3 TWh in 2016.

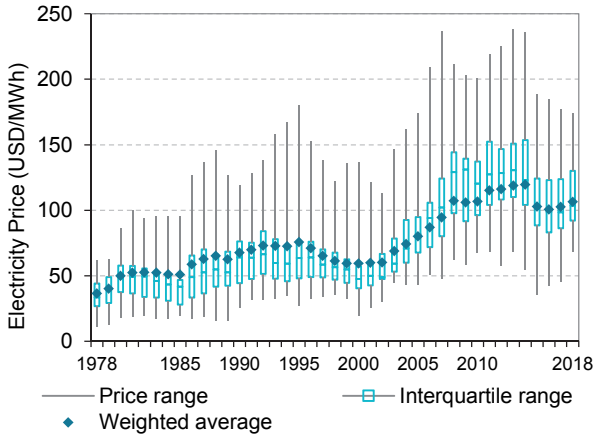
In Asia, India has historically been a net importer of electricity, much of which came from hydro facilities in neighbouring Bhutan, with net imports reaching as high as 5.8 TWh in 2008. However, since 2016, India has been a net exporter (2017: +1.6 TWh). An increasing amount of electricity trade is also seen in countries lying in the Mekong River Basin, with China, the Lao People's Democratic Republic, and Myanmar acting as net exporters of electricity, chiefly of hydro-electric origin. With significant investments in its power infrastructure in the last decade, and aided in part by its status of being the country that shares borders with the highest number of neighbouring countries, China has transitioned from being a net importer of electricity in the early 1990s to a major power exporter in the region. In 2017, China's net exports reached 13.0 TWh, over six times the amount of net exports recorded in 1994, the year China first became a net exporter of electricity.

OECD prices

In 2018, the average real electricity price across OECD countries decreased by 0.6% compared with 2017 levels. This was driven mainly by lower prices for industry (-1.1%), as prices for households remained relatively stable (-0.1%).

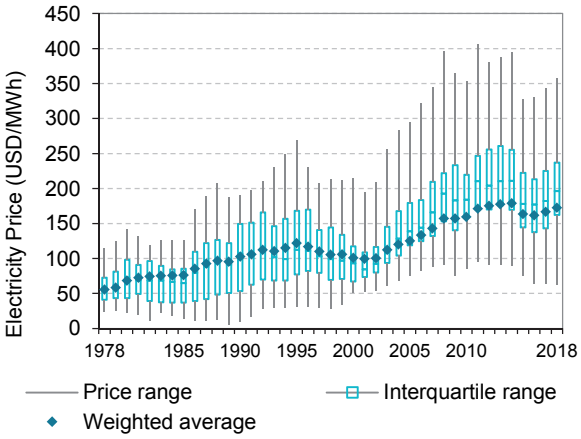
Electricity prices for consumers vary widely across OECD countries. Based on available data, in 2018 the OECD weighted average electricity price for industry was USD 106.50 per MWh. However, prices varied from a low of USD 68.11 per MWh in Norway (36% below the OECD average), to a high of USD 174.39 per MWh in Italy (63.7% above the OECD average).

Figure 15: OECD electricity prices for industry, price range, and OECD weighted average



Based on available data, in 2018 the OECD weighted average electricity price for households was USD 172.33 per MWh. Prices varied from a low of USD 62.91 per MWh in Mexico (63.5% below the OECD average) to a high of USD 357.95 per MWh in Denmark (107.7% above the OECD average).

Figure 16: OECD electricity prices for households, price range, and weighted average



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IEA (2019), *Global EV Outlook 2019*. Retrieved from www.iea.org/publications/reports/globalevoutlook2019/