

Statistics report

# Electricity Information

Overview

2020

**lea**

# Electricity introduction and highlights

This overview summarises the key messages from the *Electricity Information* data set. It is the result of a yearlong team effort by colleagues in the Energy Data Centre of the International Energy Agency in coordination with representatives in OECD member countries and in other countries worldwide, providing the definitive set of energy data for the world. These data are used not only by IEA analysts but also by energy ministries, businesses, journalists, students and many others.

Some of the main messages from the overview are:

- Between 1974 and 2018, world gross electricity production<sup>1</sup> increased from 6 298 TWh to 26 730 TWh, an average annual growth rate of 3.3%. In 2018, production was 3.9% higher than in 2017.
- From 2010 to 2018, electricity production in the non-OECD countries increased at an average rate of 4.8%, compared with 0.3% in OECD countries. However, trends differ across countries and regions.
- In terms of capacity, between 2010 and 2018, the growth rate in OECD countries was 1.9% (slower than in previous decades). However, unlike the preceding periods, the majority (91.0%) of the increase in capacity was driven by growth in solar (+26.1%) and wind (+11.0%) as OECD countries accelerated their investments in renewable energy generating infrastructure.
- In 2019, generation from total combustible fuels accounted for 57.1% of total OECD gross electricity production; nuclear plants: 18.0%; hydroelectric plants: 13.2%; wind: 7.6%; solar: 3.3%; and geothermal, tidal and other plants: 0.8%.

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<sup>1</sup> 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.

- In 2018, 71.7% of non-OECD electricity production was generated from combustible; 18.3% was provided by hydroelectric plants; 4.7% by nuclear plants; 3.4% by wind; 1.6% by solar; and 0.2% by geothermal, tidal and other sources.<sup>2</sup>
- In 2018, across the OECD as a whole, electricity consumption by industry rose by 0.3% (+10 TWh), consumption in commercial and public services grew by 0.9% (+29 TWh), while consumption in the residential sector increased by 3.0% (+88 TWh).
- Non-OECD countries' share of world electricity final consumption has been experiencing sustained growth, increasing from 27.0% in 1974 to 56.4% in 2018. In 2018, final consumption of electricity in non-OECD countries was 12 587 TWh, an increase of 5.7% over 2017.

Please note that the timeframes for different data sets vary throughout this overview. When discussing the world, only data through 2018 are available. For OECD countries, supply data are available through 2019 while consumption and capacity data are available through 2018.

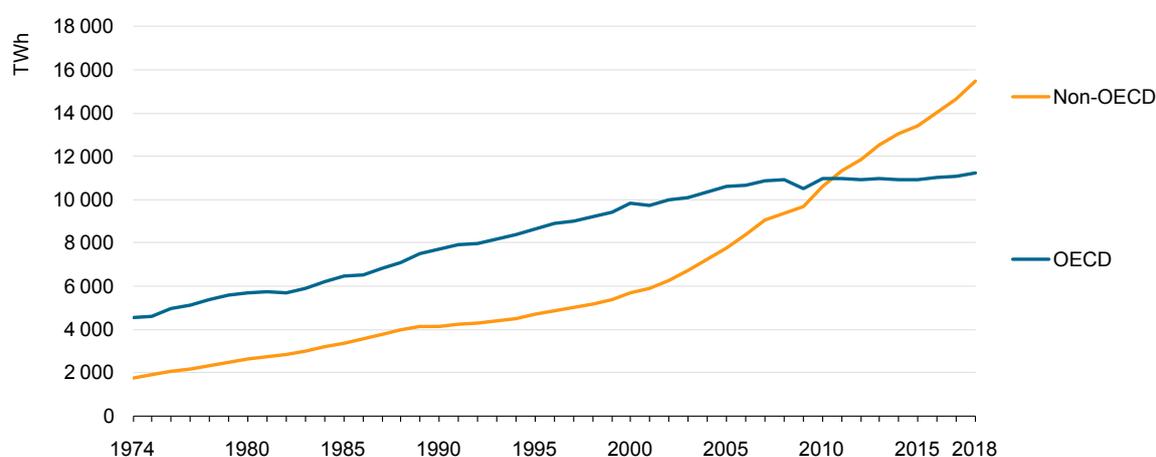
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<sup>2</sup> Due to rounding, figures may not add up to exactly 100%.

# Production

Between 1974 and 2018, world gross electricity production increased from 6 298 TWh to 26 730 TWh, an average annual growth rate of 3.3%. In 2018, production was 3.9% higher than 2017. 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.

## Total gross electricity production, 1974-2018



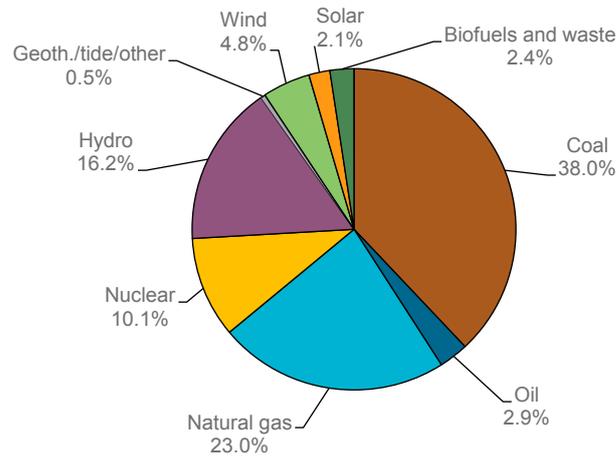
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In 2018, non-OECD countries' share of production reached 58.0% of world electricity generation, more than double the share they held in 1974 (28.0%), reflecting the higher average growth rate which has prevailed in the non-OECD countries since then. 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. From 2010 to 2018, electricity production in the non-OECD countries increased at an average rate of 4.8%, compared with 0.3% in OECD countries. 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.

In 2018, generation from combustible fuels<sup>3</sup> accounted for 66.3% of total world gross electricity production (of which: 63.9% from fossil fuels; 2.4% from biofuels and waste<sup>4</sup>), hydroelectric plants: 16.2%; nuclear plants: 10.1%; wind: 4.8%; solar: 2.1%; and geothermal, tidal, and other sources: 0.5%.

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### World gross electricity production, by source, 2018



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<sup>3</sup> 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.

<sup>4</sup> Waste includes industrial waste, and renewable and non-renewable municipal waste.

# OECD Production

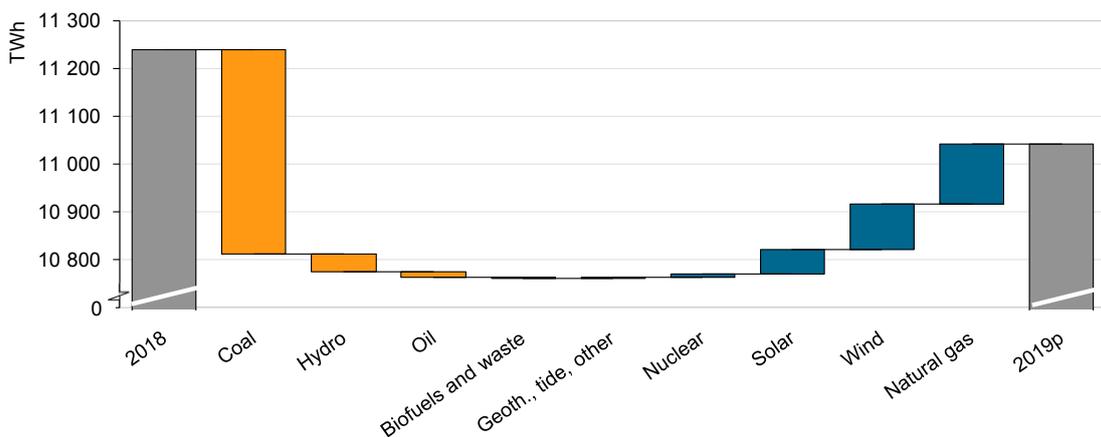
Based on provisional data, gross electricity production in the OECD was 11 041 TWh in 2019, a decrease of 1.8% over 2018.

Between 2018 and 2019, there was a sizeable decline (5.0%) in electricity production from fossil fuels, with lower output from coal (-14.6%) and oil (-5.0%) offsetting increased production from natural gas (+4.0%). Variations in weather conditions contributed to a modest fall in output from hydro plants (-2.6%), while output from nuclear plants increased slightly (+0.4%). Generation from wind (+12.5%) and solar (+16.4%) showed robust growth.

In 2019, generation from total combustible fuels accounted for 57.1% of total OECD gross electricity production (of which: 53.7% from fossil fuels; 3.4% from biofuels and waste<sup>5</sup>); nuclear plants: 18.0%; hydroelectric plants: 13.2%; wind: 7.6%; solar: 3.3%; and geothermal, tidal and other plants: 0.8%.

In terms of shares of overall OECD electricity generation, 2019 saw the share of output from natural gas (29.6%) continue to increase, having surpassed that of coal (22.4%) for the first time in 2018. At 28.3%, the combined share of output from renewables and waste was also higher than that of coal, while nuclear supplied under one fifth of total generation (18.0%).

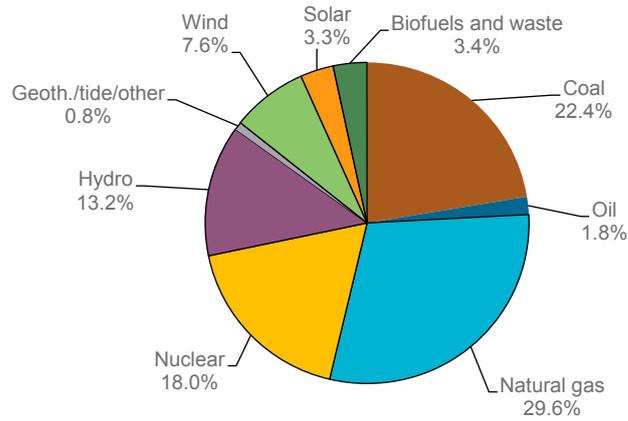
OECD gross electricity production variation, 2018-2019p



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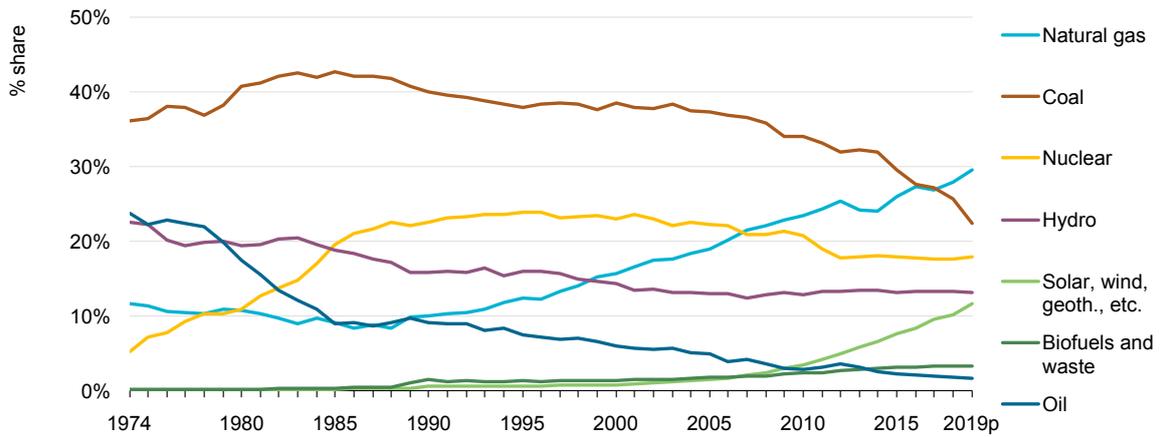
<sup>5</sup> Waste includes industrial waste, and renewable and non-renewable municipal waste.

### OECD gross electricity production, by source, 2019p



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### Share of OECD gross electricity production, by source, 1974-2019p



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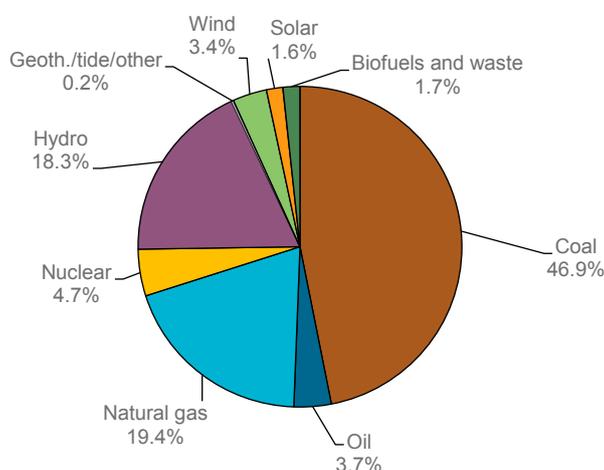
## Non-OECD Production

In 2018, gross electricity production in non-OECD countries reached 15 492 TWh, an increase of 5.6% over 2017. This was significantly above the growth observed in the OECD (1.6%) over the same period. While complete statistics are not available for all non-OECD countries for 2019, provisional data for the People’s Republic of China (hereafter, “China”), show that gross electricity generation reached 7 519 TWh in 2019, a 4.7% increase over 2018.

In 2018, 71.7% of non-OECD electricity production was generated from combustible fuels (of which: 70.0% from fossil fuels; 1.7% from biofuels and waste); 18.3% was provided by hydroelectric plants; 4.7% by nuclear plants; 3.4% by wind; 1.6% by solar; and 0.2% by geothermal, tidal and other sources.<sup>6</sup>

Having followed an upward trend since the early 1980s, the share of coal in non-OECD electricity generation peaked at 48.6% in 2011. Since then, coal’s share has declined slightly, with coal accounting for 46.9% of generation in 2018. 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 0.9% in 2011, to 3.4% in 2018, while the share of solar has increased from 0.04% to 1.6%.

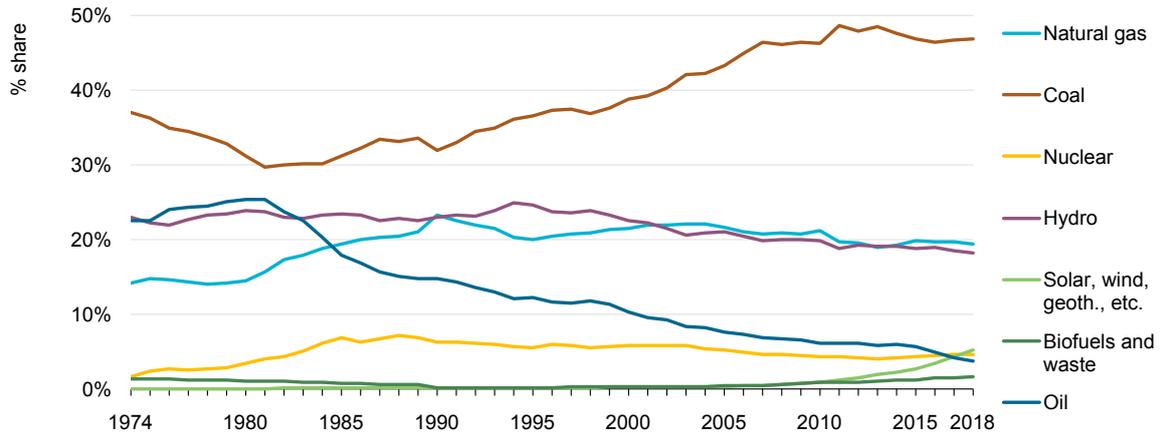
### Non-OECD gross electricity production, by source, 2018



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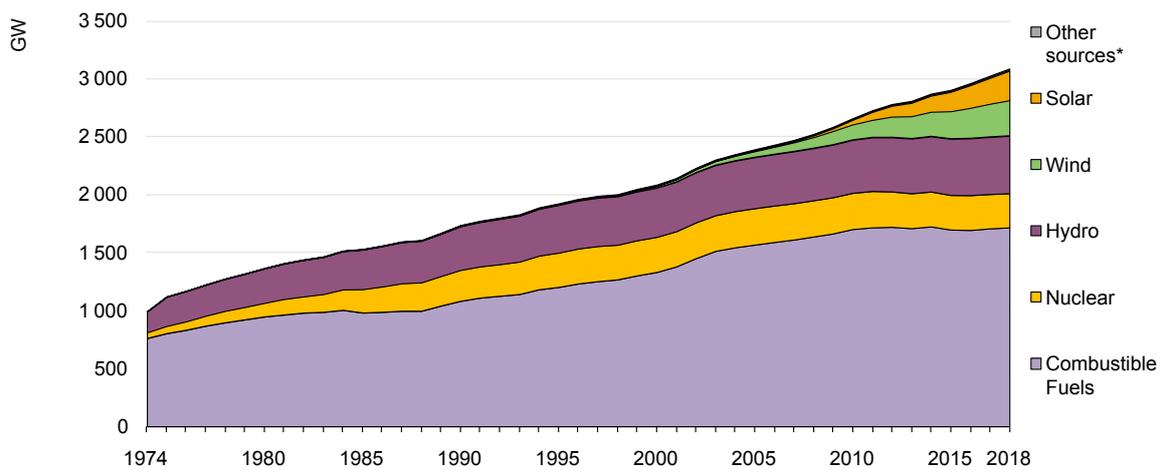
<sup>6</sup> Due to rounding, figures may not add up to exactly 100%.

### Share of non-OECD gross electricity production, by source, 1974-2018



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### OECD net electrical capacity, by source, 1974-2018



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

## OECD Capacity

Official final capacity data are available only for OECD countries up to the end of 2018.

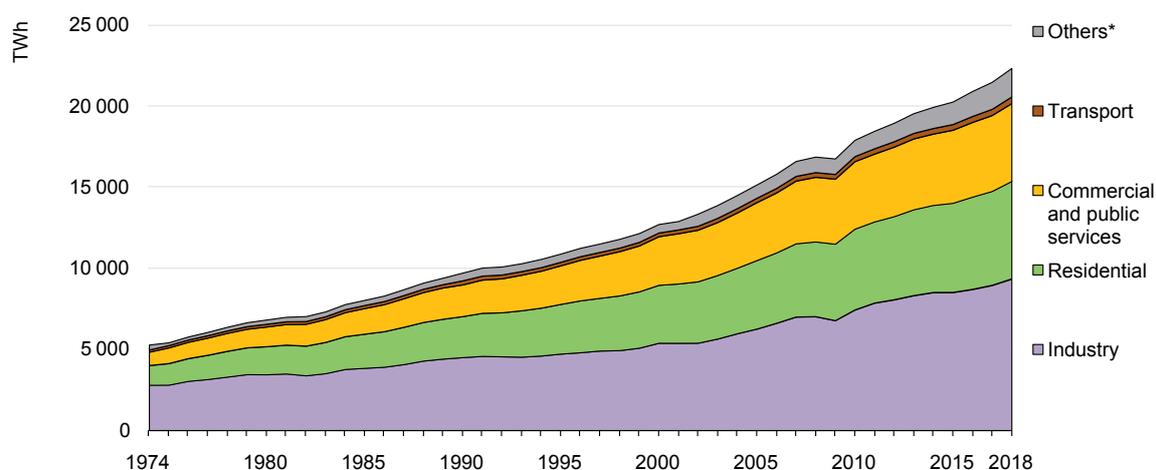
In 2018, the OECD countries reported 3 085 GW of total installed capacity, a 2.0% increase over 2017. The total capacity consisted of 1 719 GW of plants fired by fossil and other combustible fuels, 496 GW of hydroelectric power (including pumped storage capacity), 295 GW of nuclear power, 308 GW of wind, 255 GW of solar (of which: 4 GW was solar thermal) and 11 GW of geothermal, tidal, wave, ocean, and others combined. Overall, 62 GW of net additional generating capacity was added in 2018, with the largest absolute growth seen in solar PV (32 GW; +14.3%), wind (21 GW; +7.3%) and combustible fuels (9 GW; +0.5%). This more than offset the modest decline in nuclear capacity (2 GW; -0.8%).

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 2.5%, 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 2018, the growth in capacity slowed to 1.9%. However, unlike the preceding periods, the majority (91.0%) of the increase was driven by growth in solar (+26.1%) and wind (+11.0%) capacity as countries accelerated their investments in renewable energy generating infrastructure. An increase in capacity was also observed for hydro (+1.0%) over this period, while combustible fuel fired capacity remained flat (+0.1%) and nuclear declined (-0.7%).

# Consumption

In 2018, world electricity final consumption reached 22 315 TWh, 4.0% above the 2017 figure. This compares with an average growth rate of 3.3%, observed between 1974 and 2018.

## World electricity final consumption, by sector, 1974-2018



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

## OECD consumption

In 2018, OECD electricity final consumption was 9 728 TWh, 1.8% higher than in 2017. Although consumption data for 2019 are not yet available, as noted above, provisional data show that gross electricity production (including pumped hydro) in the OECD was 11 041 TWh in 2019, a 1.8% decrease on 2018.

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 62.6% in 2018. Although the absolute amount of electricity consumed in industry increased from 1 874 TWh in 1974 to 3 084 TWh in 2018, industry's share of electricity consumption in the OECD fell from 48.7% in 1974 to 31.7% in 2018. By comparison, the share of electricity consumed by the commercial and public services sector rose from 19.7% in 1974, to 31.5% in 2018, while the share residential sector grew from 28.7% to 31.1%. However, this trend is not observed consistently across all OECD countries. For instance, although it has fluctuated over time, in 2018,

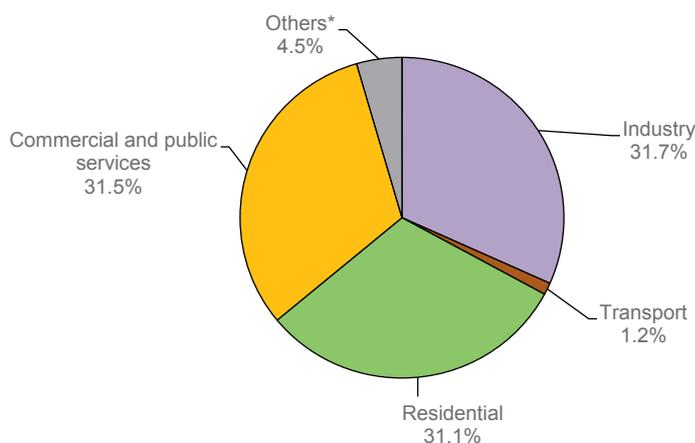
industry’s share of final electricity consumption in Austria (1974: 48%; 2018: 45%) and Mexico (1974: 54%; 2018: 53%) was at a similar level to 1974.

In 2018, 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 2018, compared with the growth rates observed in the residential, and commercial and public services sectors. Although, as of 2018, industry remains the sector with the highest reported final consumption of electricity, at 31.7%, industry’s share of consumption is only marginally greater than that of the commercial and public services (31.5%), and residential sectors (31.1%).

In 2018, across the OECD as a whole, electricity consumption by industry rose by 0.3% (+10 TWh), consumption in commercial and public services grew by 0.9% (+29 TWh), while consumption in the residential sector increased by 3.0% (+88 TWh).

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**OECD electricity final consumption, by sector, 2018**

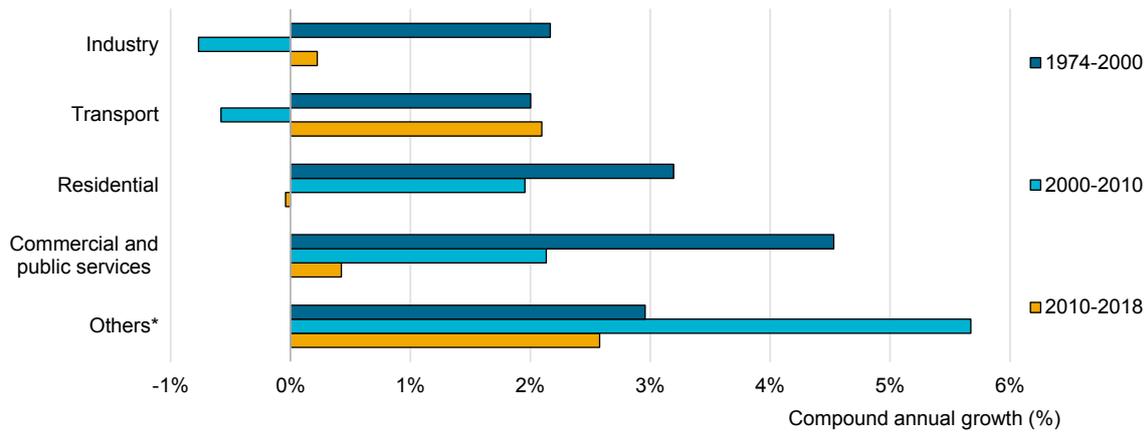


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\* includes agriculture and forestry, fishing, and other non-specified.

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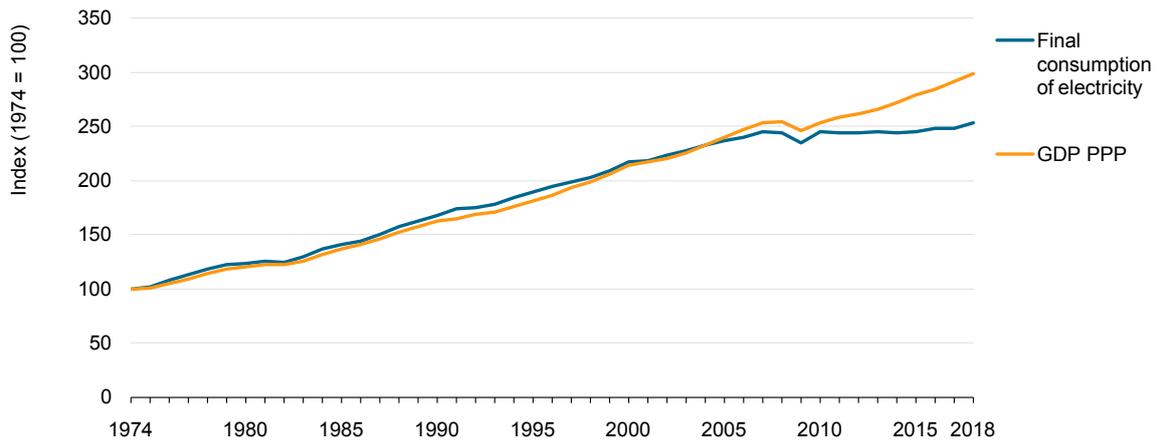
### OECD average annual growth rate in electricity final consumption by sector



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\* includes agriculture, forestry and fishing.

### OECD final consumption of electricity, and Gross Domestic Product (GDP PPP)\*



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\* GDP based on 2015 USD PPP.

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 (2018: 26%), with the sector posting 32% compounded average annual growth since 2012. This underlines 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, 56% of new cars sold in 2019 were electric (IEA, 2020). The next highest market share was recorded in Iceland (22%), while market share in the Netherlands rose from 6% in 2018 to 15% in 2019. However, whilst growing,

electricity used in road transport represents just 0.07% of OECD total road transport energy use, and only 0.10% of OECD final consumption of electricity.

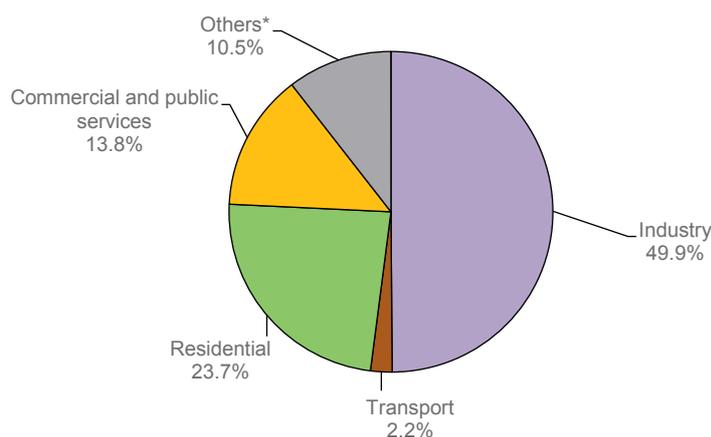
Between 1974 and 2000, final electricity consumption in the OECD increased more or less in line with GDP.<sup>7</sup> However, some decoupling has been observed since the early 2000s - in particular, following the rebound in GDP growth after the financial crisis. From 2008 to 2018, electricity consumption across the OECD increased by just 3.5% in total, despite 17.2% growth in GDP.

## Non-OECD consumption

In 2018, final consumption of electricity in non-OECD countries was 12 587 TWh, an increase of 5.7% over 2017. Between 1974 and 2018, 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 56.4% in 2018.

In 2018, the four largest non-OECD consumers of electricity were China, India, the Russian Federation and Brazil, which together represent 67.4% of all non-OECD electricity final consumption (or 38.0% of global consumption). Among these countries, China has the largest share, at 47.8% of total non-OECD consumption. Electricity use outside the OECD is dominated by industrial demand, which accounts for half of final electricity consumption.

### Non-OECD final consumption electricity, by sector, 2018.

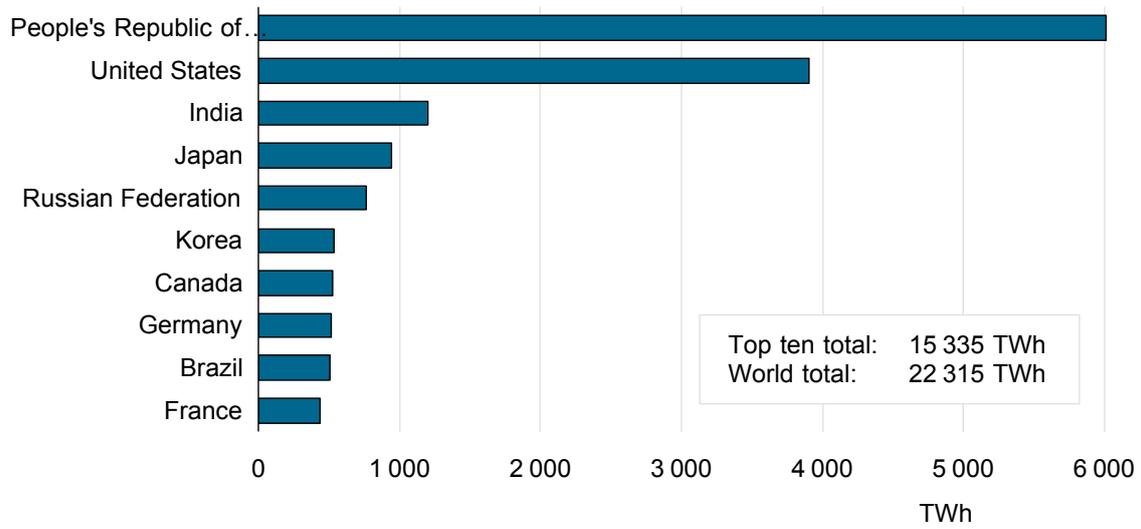


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\* includes agriculture and forestry, fishing, and other non-specified.

<sup>7</sup> In this chapter, GDP refers to GDP calculated using 2015 USD prices and purchasing power parities.

### Top 10 electricity-consuming countries, 2018.



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# Trade

Electricity trade between neighbouring countries has become much more common in recent years. However, several factors can lead to differences between the reciprocal imports and exports (both absolute and net) reported by trading partners. For instance, often when reporting electricity flows, countries use electricity trade as a “balancing” item. In addition, the transmission and distribution line losses associated with trade flows are difficult to determine. Furthermore, countries balance electricity flows on the grid in real time, but report aggregated data on an annual basis.

## OECD electricity trade

In the OECD, imports of electricity grew from 89 TWh in 1974 to 491 TWh in 2019, representing an average annual growth rate of 3.9%, compared to the 2.0% growth in overall electricity supply. In 1974, imports represented 2.0% of OECD electricity supply, while in 2019 this share had grown to 4.5%. OECD exports of electricity grew from 81 TWh in 1974 to 490 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 2019 they were 4.4%.

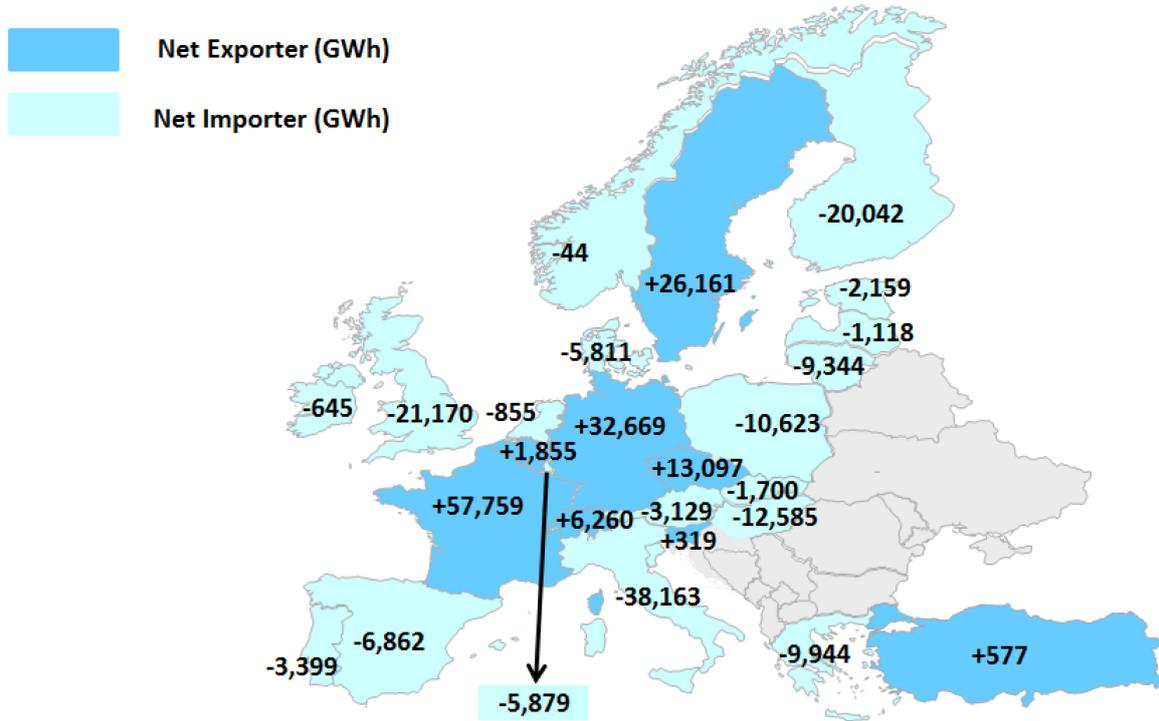
Substantial trade in electricity occurs in OECD Europe, principally between OECD countries, and in OECD Americas. In OECD Europe, electricity imports grew at an average annual rate of 4.0% between 1974 and 2019. In OECD Americas, total imports increased by an average annual rate of 3.2% between 1974 and 2019.<sup>8</sup>

Electricity trade can be used to compensate for fluctuations in domestic generation, such as in Norway in 2019 where hydroelectric production decreased due to lower rainfall. To compensate for this loss in supply, Norway, a net exporter of electricity since 2010, increased its imports by 4.0 TWh, and decreased its exports by 6.2 TWh, thus, increasing supply by 10.2 TWh. In this way, Norway was able to balance three-quarters of the decrease in production from hydro (13.7 TWh) using trade alone.

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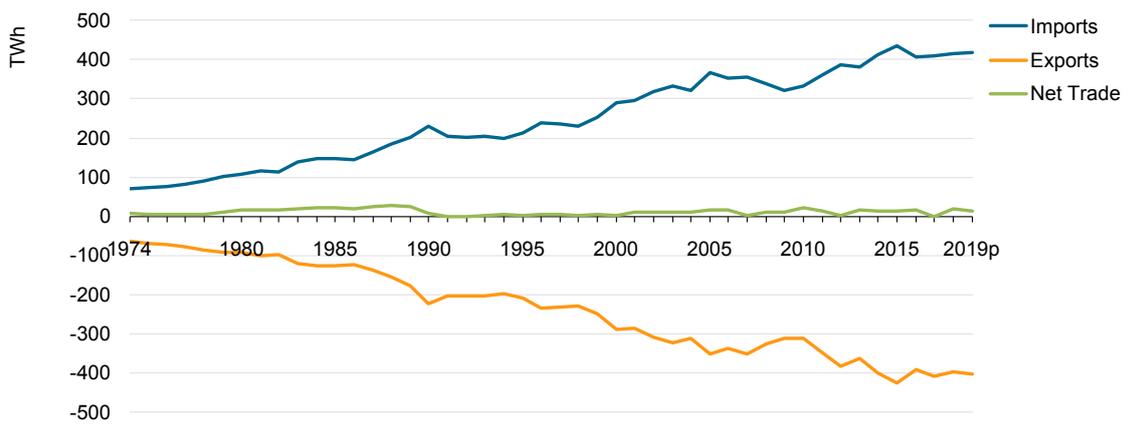
<sup>8</sup> Electricity trade data for OECD Americas are subject to revision. Work to reconcile trade data for OECD Americas is an ongoing aspect of the North America Trilateral.

OECD Europe net electricity importers and exporters of electricity (GWh), 2019p.



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OECD Europe electricity imports and exports, 1974-2019p



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## 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 hydroelectric plants in Paraguay is exported to Brazil and Argentina (in 2018, net exports from Paraguay were 42.2 TWh). Electricity trade between Chile and Argentina occurred between 1999 and 2011. It ceased in 2012, before resuming on a smaller scale in 2016. However, electricity trade ceased again in 2018.

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 in 20 of the 21 years since 1998. In 2018, net exports from South Africa were 4.7 TWh, while due to a decline in domestic production, exports from Mozambique only marginally exceeded imports in 2018 (+0.5 TWh), 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 (2018: +3.8 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 hydroelectric 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 2018, China's net exports reached 14.1 TWh, almost seven times the amount of net exports recorded in 1994, the year China first became a net exporter of electricity.

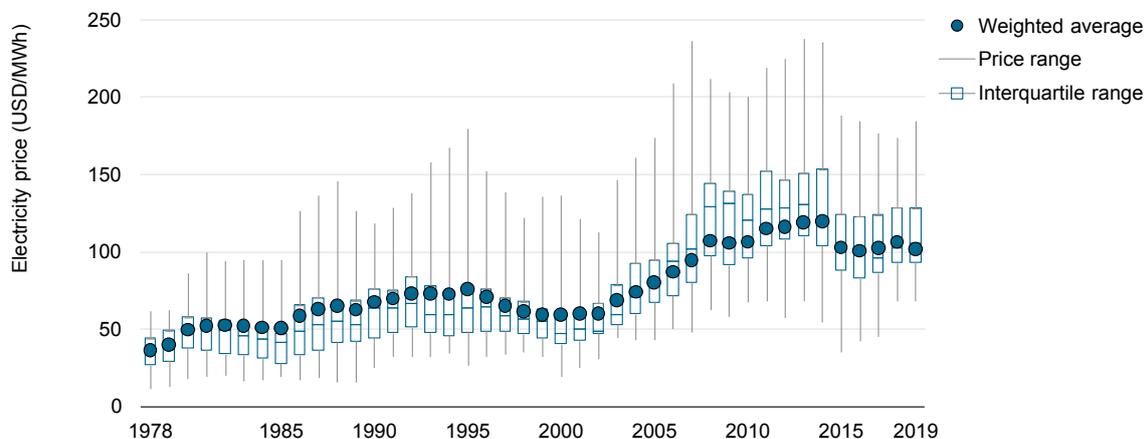
# OECD prices

In 2019, the average real electricity price (including applicable taxes) paid by consumers across OECD countries increased by 1.7% compared with 2018 levels. This was driven mainly by higher prices for industry (+3.1%), as prices for households showed a modest increase (+0.4%).

Electricity prices for consumers vary widely across OECD countries. Based on available data, in 2019 the OECD weighted average electricity price for industry was USD 102.00 per MWh. However, prices varied from a low of USD 68.30 per MWh in the United States (33.0% below the OECD average), to a high of USD 185.10 per MWh in Italy (81.5% above the OECD average).<sup>9</sup>

Based on available data, in 2019 the OECD weighted average electricity price for households was USD 164.98 per MWh. Prices varied from a low of USD 102.40 per MWh in Korea (37.9% below the OECD average) to a high of USD 333.91 per MWh in Germany (102.4% above the OECD average).<sup>9</sup>

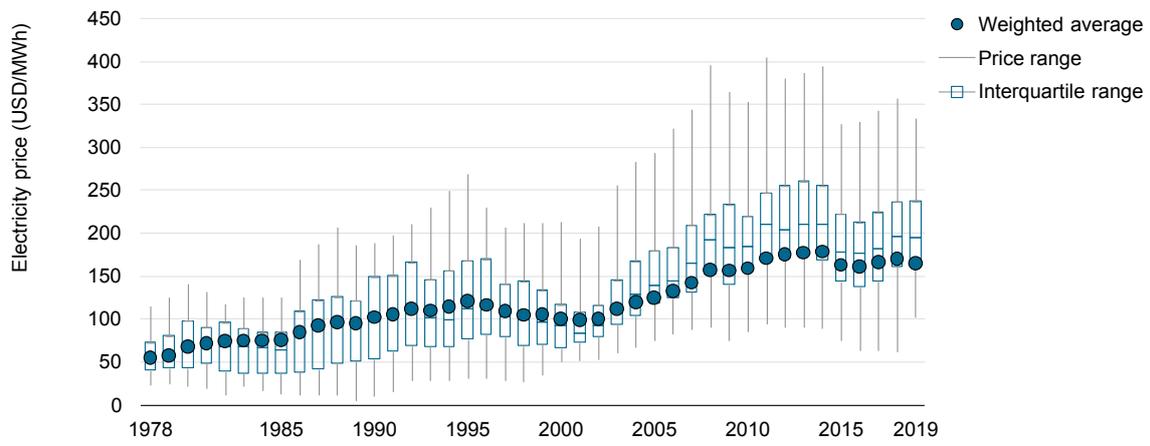
## OECD electricity prices for industry, price range, and OECD weighted average



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<sup>9</sup> The comparisons between OECD prices should be treated with caution as data for some countries are available for 2018 but unavailable for 2019 (industry and households: Japan, Norway, and Mexico; households only: New Zealand). In particular, as Norway had the lowest price electricity price for industry in 2018 (68.11 USD per MWh), while Mexico had the lowest price for households (62.91 USD per MWh).

### OECD electricity prices for households, price range, and OECD weighted average



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# References

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