Recent trends in energy efficiency in the EU

Lead authors: *Bruno Lapillonne, Laura Sudries, Estelle Payan (Enerdata)*

Reviewers: *Draft*

Legal Notice: Responsibility for the information and views set out in this paper lies entirely with the authors.

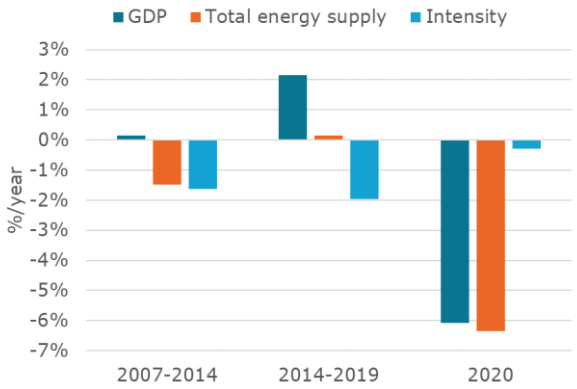
Key questions

- **How to interpret the energy efficiency trends in the EU for the past five years?**
- **What is the impact of COVID-19 in 2020?**

Stable total energy supply from 2014 to 2019

The EU total energy supply at normalised climate conditions[1] has been relatively stable between 2014 and 2019, although GDP increased by 2.2% per year with the return to economic growth (Figure 1). In 2020, with the COVID-19 pandemic, both GDP and total energy supply dropped by more than 6%. The primary energy intensity (i.e. the ratio between total energy supply and GDP) has decreased slightly more rapidly over 2014-2019 (2%/year) than over 2007-2014 (+0.35 pts). In 2020, this declining trend was stopped. Primary consumption is estimated to be 6% under the EU's 2020 target.

Figure 1: EU total energy supply and primary intensity[2]

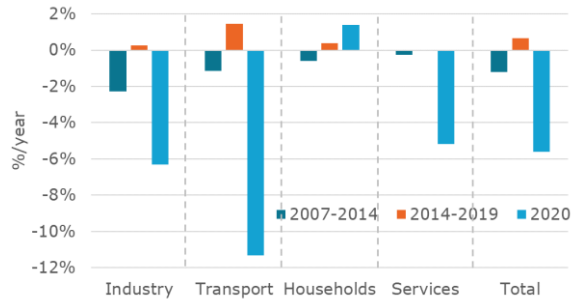


Source: ODYSSEE.

A higher progression of final consumption

Final consumption has grown by 0.7% per year between 2014 and 2019, in sharp contrast to the stability of total energy supply (Figure 2). The transport sector experienced the highest growth (1.4% per year), while industry consumption grew the least (0.3% per year). Final consumption dropped by 5.6% in 2020, with transport consumption falling by 11% due to lockdown and travel restrictions. Households were the only sector with an increase in consumption as people stayed longer at home (+1.4%). Services registered the highest decrease in electricity consumption (-7%) due to massive teleworking and the temporary closure of many public-access establishments.

Figure 2: EU final consumption trends by sector[3]



Source: ODYSSEE.

[1] See methodology of climate corrections at https://www.odyssee-mure.eu/faq/

[2] Source: ODYSSEE, based on Eurostat; 2020: Enerdata estimates. Data at normal climate. EU27 (without the UK).

[3] Source: 2000-2019: based on Eurostat; 2020: Enerdata estimates. Consumption at normal climate. International aviation excluded.

The ODYSSEE-MURE project is funded by Horizon 2020
The sole responsibility for the content of this document lies with the authors. It does not necessarily reflect the opinion of the European Union. Neither the EACI nor the European Commission are responsible for any use that may be made of the information contained therein.

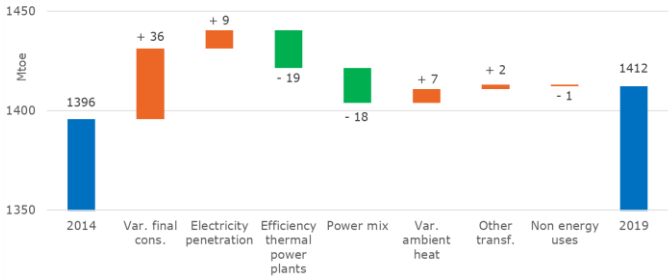
Horizon 2020
European Union funding
for Research & Innovation

The lower progression of the EU total energy supply between 2014 and 2019 compared to the final consumption (17 Mtoe, compared to 36 Mtoe) (Figure 3) is mainly explained by changes in the power mix, with:

- A higher share of renewables and a lower share of nuclear and thermal, which improved power generation efficiency[4];
- An improved efficiency of thermal power plants, thanks to a shift from coal to gas.

These two effects have reduced the increase in total energy supply by 18 Mtoe and 19 Mtoe respectively.

Figure 3: Drivers of EU total energy supply variation[5]



Source: ODYSSEE; final consumption excludes ambient heat from heat pumps, whereas it is included in total energy supply.

Energy efficiency progress is slowing down

At the EU level, energy efficiency of final consumers, as measured by ODEX[6], improved by an average of 0.7% per year between 2014 and 2019, which is a net slowdown compared to 1.2% per year over 2000-2014 (Figure 4).

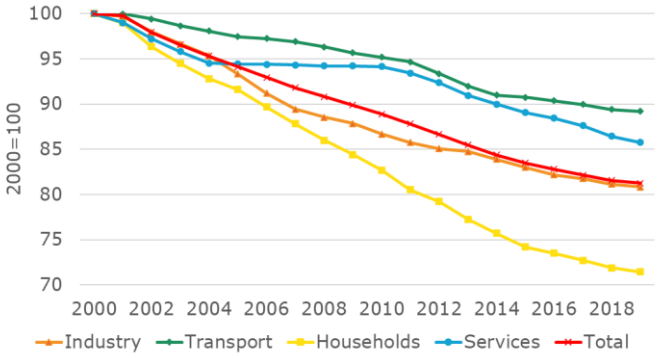
Energy efficiency progress has been the strongest for households, even if it has also slowed down since 2014 (to 1.1% per year, twice lower than over 2000-2014). This overall trend can be explained by the introduction of the many regulations affecting buildings and appliances.

In industry, the pace of energy efficiency improvements has been halved since the financial crisis (0.8 % per year since 2007, compared to 1.6 % per year before).

Transport sector lagged behind (0.4% per year since 2014, twice less than over 2007-2014) because the efficiency of cars was no longer improving due to the penetration of SUVs, and a reverse trend was observed for dieselisation.

In services, energy efficiency improvements accelerated since 2010.

Figure 4: Energy efficiency index for final consumers (EU)



Source: ODYSSEE; international aviation excluded.

Around 200 Mtoe of energy savings in 2019

Energy efficiency improvements led to significant energy savings, with an estimated 196 Mtoe saved in 2019 compared with 2000 (Figure 5). These savings represent the sum of the additional annual energy savings by sector and are equivalent to 21 % of final energy consumption. In other words, without these savings, the final energy consumption would have been 21% higher in 2019. Because of the slowing pace

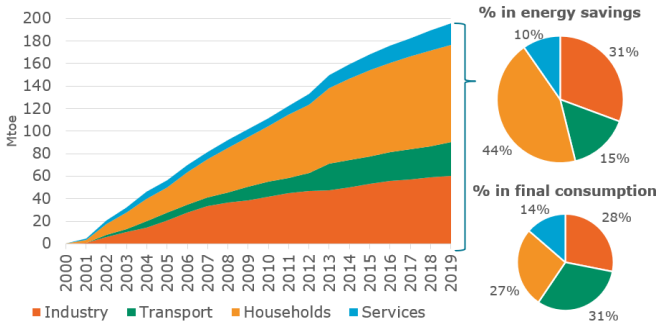
[4] Renewables are assumed to have an efficiency of 100%, compared to 33% for nuclear and 40-50% for thermal.

[5] For more information on this decomposition of consumption, see: www.indicators.odyssee-mure.eu/decomposition.html

[6] ODEX is the indicator used in the ODYSSEE-MURE project to measure the energy efficiency progress by sector and for all final consumers. For each sector, the index is calculated as a weighted average of indices of specific consumption by sub-sector, end-uses or transport modes. For more information on ODEX: https://www.indicators.odyssee-mure.eu/odex-indicators-database-definition.pdf

of energy efficiency improvement, the annual additional savings have been regularly decreasing from an average volume of 11.6 Mtoe per year over 2000-2007 to 11.1 Mtoe per year over 2007-2014 (divided by 2 in industry) and 7.3 Mtoe per year since 2014. Since 2014, these savings have been halved for transport and households.

Figure 5: Energy savings and final consumption by sector (EU)



Source: ODYSSEE; international aviation excluded.

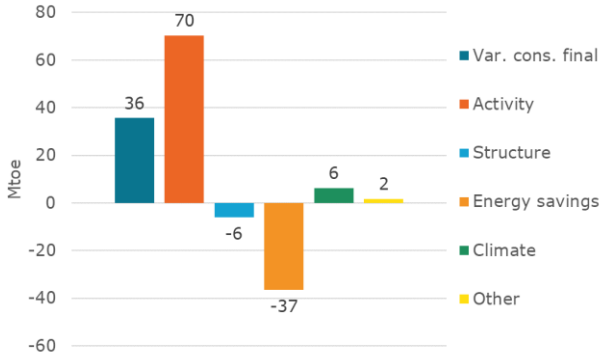
Households are responsible for almost half of the savings (44 %) and are overrepresented compared to their share in final consumption (27%) (Figure 5). Industry contributed to 31% of these savings. The share of savings in transport is twice lower than its share in consumption (respectively 15% and 31%). The significance of households' savings is mainly explained by the importance of policy measures implemented in that sector, in particular in EU regulation.

Energy savings have offset half of the activity effect over 2014-2019

To allow an easy analysis of the driving factors behind the energy consumption trend, the ODYSSEE-MURE project developed a decomposition tool[7] separating the impacts of the main drivers on the energy consumption variation between two years.

The final energy consumption was 36 Mtoe higher in 2019 than in 2014 (Figure 6). Economic and population growth ("activity"[8]) contributed to raise the final consumption by 70 Mtoe. Energy savings (covering energy efficiency improvements, as presented above) offset around half of this activity effect and contributed to lower consumption by 37 Mtoe. Structural effects, i.e. changes in the GDP distribution by sector (mainly between industry and services) and industrial branches, and modal shift in transport, contributed to slightly decrease the final consumption by 6 Mtoe. The climate effect, measuring the impact of average temperature variation between the two years, contributed to raise the consumption by around 6 Mtoe.

Figure 6: Drivers of final energy consumption variation at EU level between 2014 and 2019



Source: ODYSSEE; international aviation excluded.

What can we say about energy efficiency in 2020?

In general, energy efficiency deteriorates in periods of deep recession in productive sectors (industry, services and freight transport): indeed, energy consumption does not follow the reduction in economic activities because of a lower use of industrial capacities or a lower load factor for trucks, leading to an increase of indicators of specific consumption and a lower "efficiency", not from a

[7] www.indicators.odyssee-mure.eu/decomposition.html

[8] Including changes in appliances' ownership and larger dwellings.

technical viewpoint but from an operational viewpoint.

The same applied in 2020 for public passenger transport (train, metro, bus), as lockdowns and sanitary measures have led to a sharp reduction in traffic and load factors[9]. This explains why the energy intensity stopped decreasing in 2020.

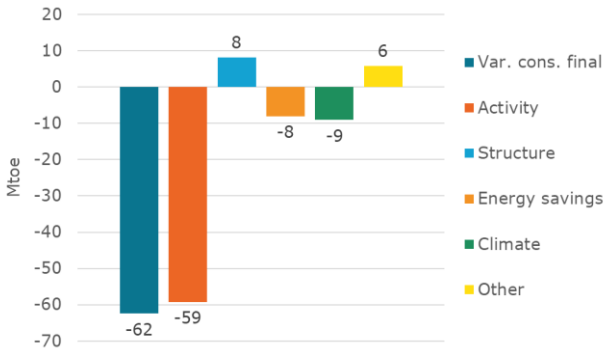
Energy efficiency has continued to improve as new equipment (cars[10], appliances, etc.) sold in 2020 or new buildings continued to be more efficient than in 2019 because of existing regulations. What may have changed is the volume of new equipment and buildings in 2020 (e.g. car sales have decreased by 25%), which mechanically resulted in lower overall energy efficiency gains for new equipment and buildings compared to previous years.

In addition, energy efficiency is also strongly linked to existing policy measures (e.g. support to retrofitting of buildings), which means that it is less sensitive to a crisis. For instance, the renovation of social buildings jumped in 2020 in Denmark (multiplied by 4) and France (60% increase) and increased slightly in Sweden, Germany, Finland and Austria[11].

Preliminary estimates from ODYSSEE show that the efficiency of final consumers increased by around 0.5% in 2020 (compared to 0.7% per year over 2014-2019), of which 0.4% for industry and 0.6% for households and transport.

These estimates indicate that in 2020, almost all the decrease of the final consumption is due to the contraction of activity related to the COVID-19 pandemic, while energy savings contributed to a reduction in consumption of 8 Mtoe (Figure 7).

Figure 7: Drivers of final energy consumption variation at EU level in 2020[12]



Source: ODYSSEE; international aviation excluded.

For further reading or information, please visit http://www.odyssee-mure.eu/

[9] In France, for instance, the unit consumption per pkm has increased by 44% for buses and 67% for rail, due to the very low load factors (source: Compte des transports, Bilan circulation, own estimates (preliminary)).

[10] The specific consumption of new diesel and gasoline cars has decreased again in 2020 in most countries, and quite significantly in some of them, which marks a net reversal of the trend 2014-2019.

[11] Source: France: ANAH; other countries: State of housing in EU 2021; Housing Europe (association of social housing).

[12] Source: Enerdata preliminary estimates based on "Early estimates" from ODYSSEE (https://www.odyssee-mure.eu/publications/other/early-estimates-methodology.html)