ODYSSEE-MURE

Impact of COVID pandemic on energy efficiency in the EU: A quantitative assessment

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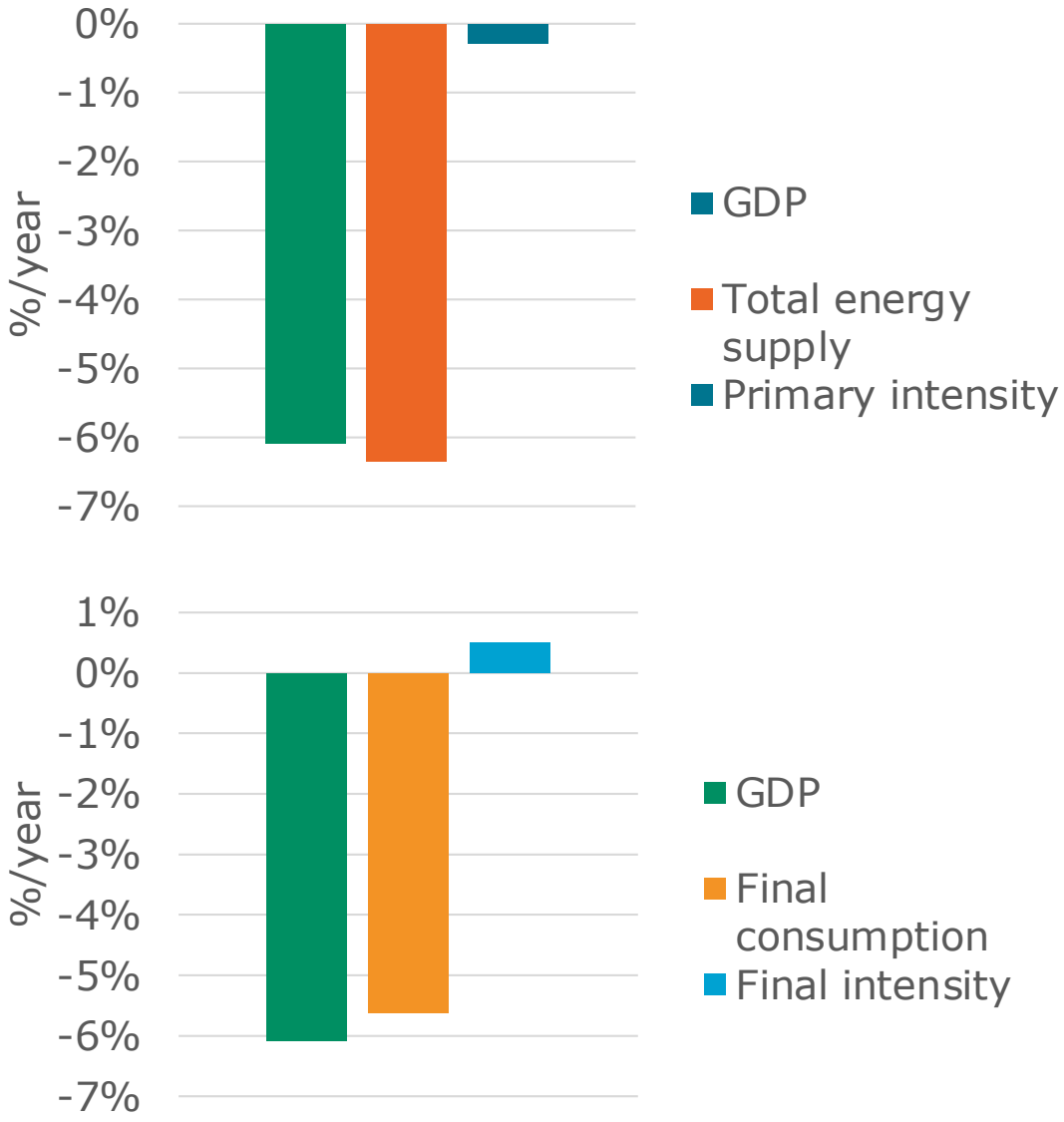
Outline

- Energy consumption
- What can we say on energy efficiency?
- Conclusions
- Annex: GDP variation by sector

Total energy supply and final consumption in 2020

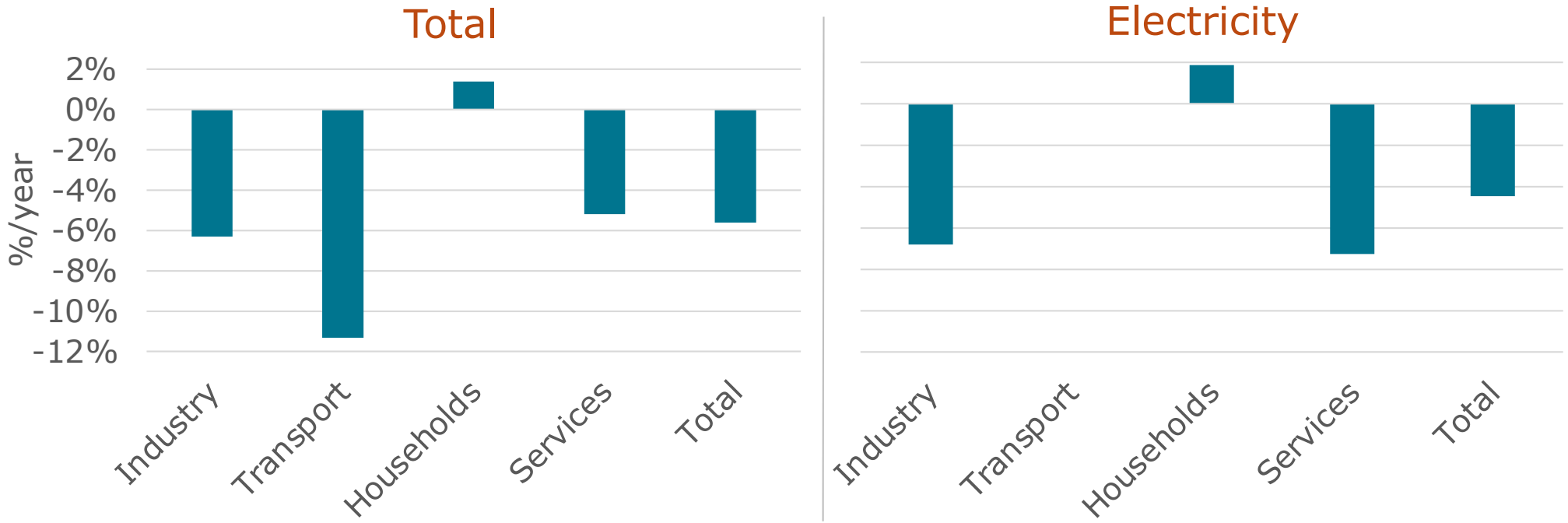


Consumption and intensity at normal climate.
Source: Enerdata estimates

- Drop by 6% of TES in 2020 compared to 2019.
- Stronger reduction than for final consumption due to an increased penetration of hydro, solar and wind with 100% efficiency in the power mix (+ 4 points in 2020).
- Final consumption variation slightly lower than GDP contraction resulting in an increasing final intensity (+0.5%), after 6 years of regular decrease.
- Primary and final consumption are estimated to be 6% under the targets for 2020.

Final energy consumption by sector in 2020

- Final consumption dropped by 5.6% in 2020 and electricity consumption by 4.5%.
- Transport was the most impacted sector, due to lock down and travel restrictions (-11%).
- Services registered the highest decrease in electricity consumption (-7%) due to massive teleworking and temporary closure of many public-access establishments (shops, bars, restaurants, etc.).
- Households was the only sector consumption with an increase in consumption with people staying longer at home (+1.4% for total, +1.9% for electricity).

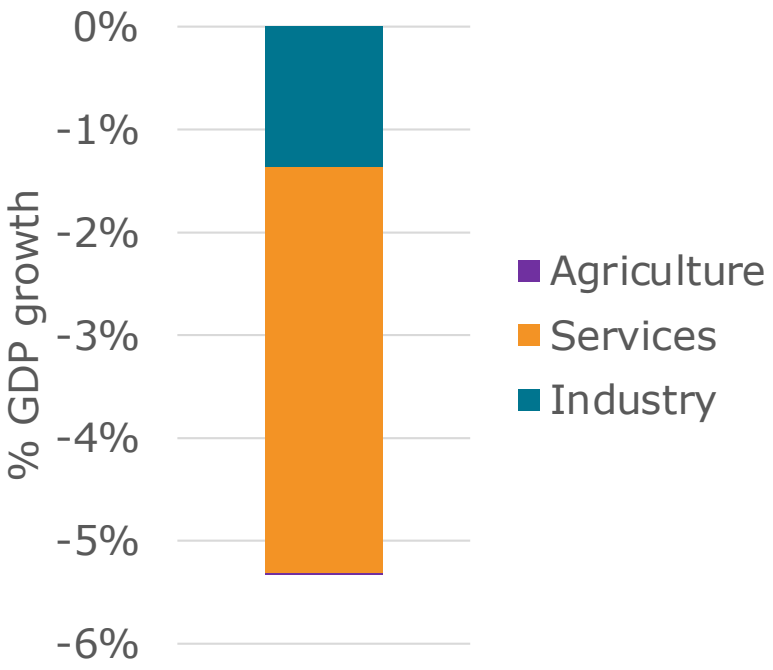


Source: Enerdata estimates, EU27; international air transport excluded; households and services at normal climate

Contribution of sectors to energy consumption and GDP variation in 2020 (EU)

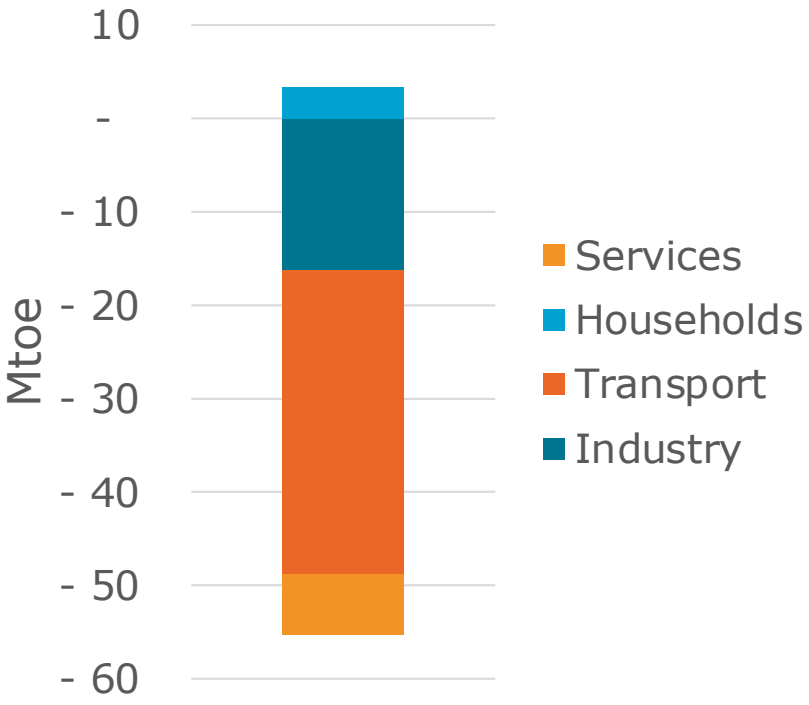
- Transport is responsible for 60% of the reduction in final consumption variation.
- Services explain only 12% of the final consumption decrease while they contributed to 2/3 of the GDP contraction.

- **Contribution of sectors to GDP contraction in 2020**



Source: Eurostat

Contribution of sectors to final consumption reduction (Mtoe)



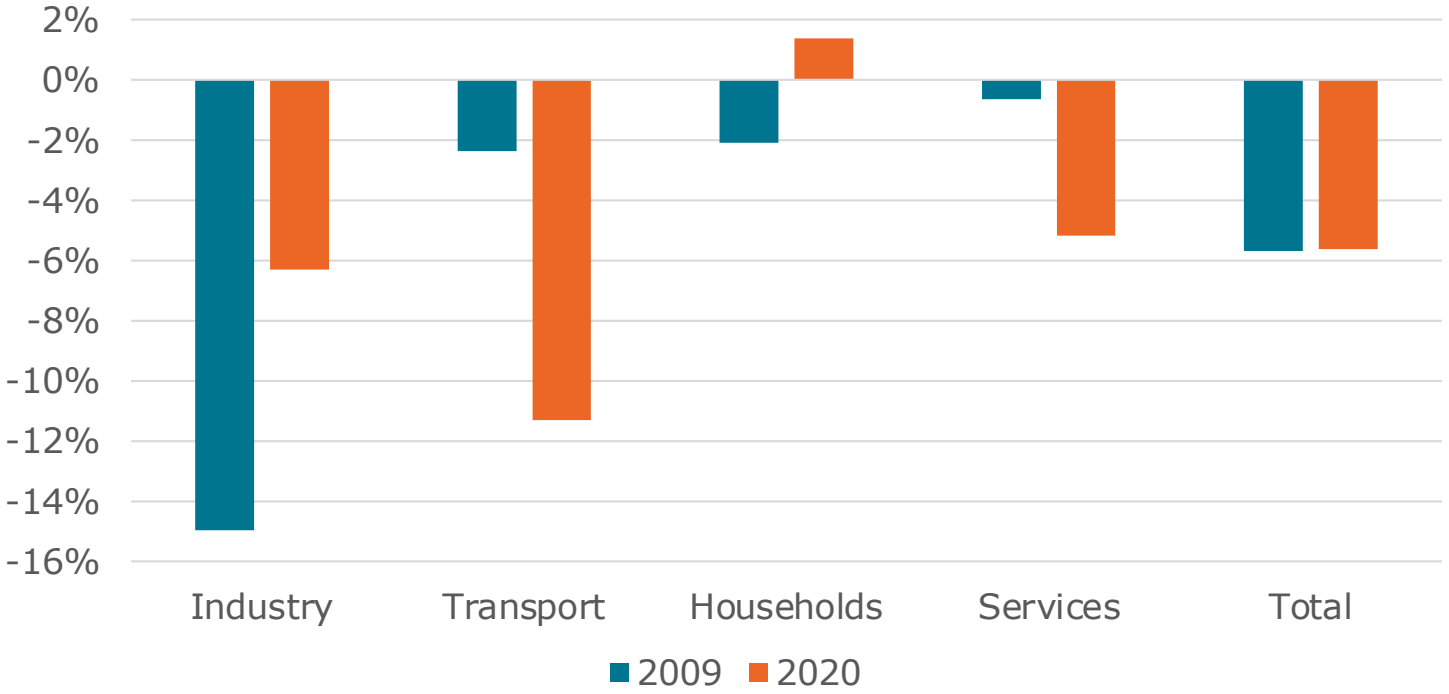
*Source: Enerdata estimates; h*ouseholds and services at normal climate

From one crisis to the other: 2020 vs 2009

While the reduction in final consumption is similar to that of 2009 (-6%), the impact by sector is very different.

- Transport was much more impacted than in 2009 crisis (-11% in 2020 vs only -2% in 2009). Same for services consumption.
- In contrast, industry and households consumption were less impacted:
  - Industry consumption fell by only 6% against 14% in 2009
  - Households registered a consumption increase in 2020

Final consumption variation by sector: 2020 vs 2009



Source: 2009 ODYSSEE; 2020 Enerdata estimates; Households and services at normal climate.

Energy efficiency in a period of recession: some reminders

- 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 lower use of industrial capacities, or lower load factor for trucks, leading to an increase of indicators of specific consumption and a lower "efficiency", not from a technical viewpoint but from an operational viewpoint.

- This led in ODYSSEE to the development of a technical energy efficiency index, following the first deep recession in 2009: this technical ODEX considers that technical energy efficiency does not deteriorate and implies freezing the indicators used to measure energy efficiency at sub-sector or end-use level, if these indicators increase.

- In 2020, specific consumption generally increased in transport and services as they were the most impacted sectors. The same applies also for households but for other reasons. This justifies well the use of the technical ODEX

What can we say about energy efficiency in 2020?

- Assuming a constant technical ODEX in a period of recession was justified until now but has some limits: indeed, in reality in most sectors and end-uses, energy efficiency continues to improve in a period of recession, such as in 2020: new equipment (cars, appliances etc..) sold in 2020 or new buildings continued to be more efficient than in 2019.

- What may have changed is the volume of new equipment and buildings in 2020 (car sales have decreased by 25%), which mechanically resulted in lower overall energy efficiency gains for new equipment and buildings.

- In addition, energy efficiency is also strongly linked to existing policy measures (e.g regulation for cars and appliances, support to retrofitting of buildings), which means that it is less sensitive to a crisis.

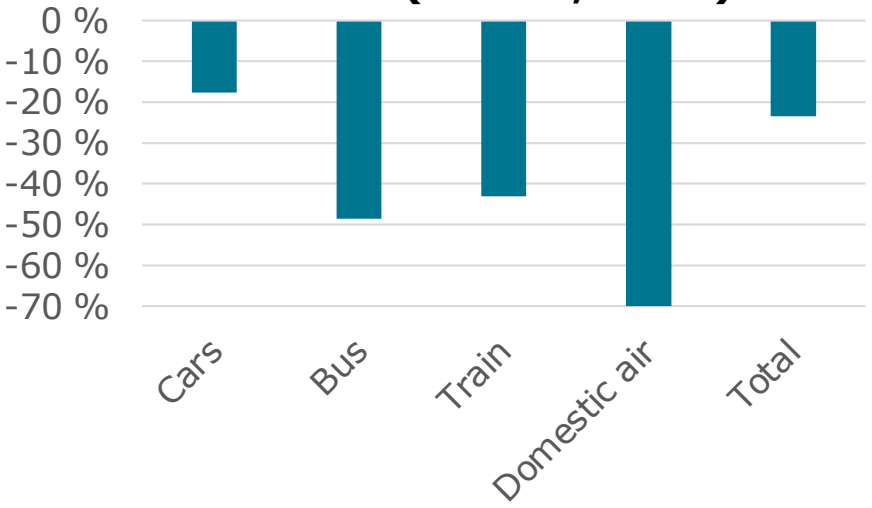
- For instance, renovation of social buildings jumped in 2020 in Denmark (x4) and France (+60%) and increased slightly in Sweden, Germany, Finland and Austria* and new cars continue to be more efficient and

**Source: France: ANAH; other countries :State of housing in eu 2021; Housing europe (association of social housing)*

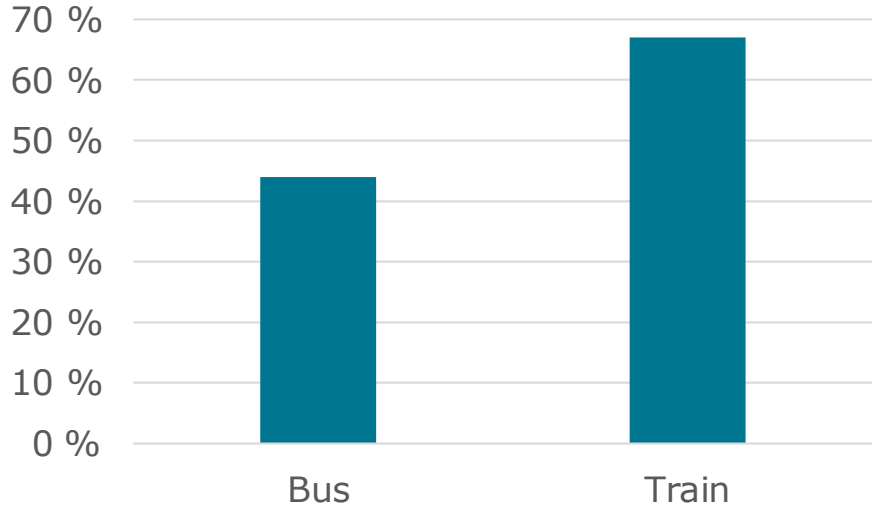
What can we say about energy efficiency in 2020: case of passenger transport in France?

- Energy efficiency in transport is measured in terms of energy consumed per unit of traffic (koe/pkm or tkm).
- For public passenger transport (train, metro, bus), lock down and sanitary measures have led to a sharp reduction in traffic and load factors, and thus in unit consumption per pkm.
- In France, for instance, it is estimated that the passenger traffic has dropped by 24%, i.e. 3 times faster than GDP (elasticity of 3).
- Unit consumption per pkm has increased by 44% for buses and 67% for rail.

Variation of passenger traffic (France, 2020)



Variation of unit consumption (koe/pkm) (France, 2020)

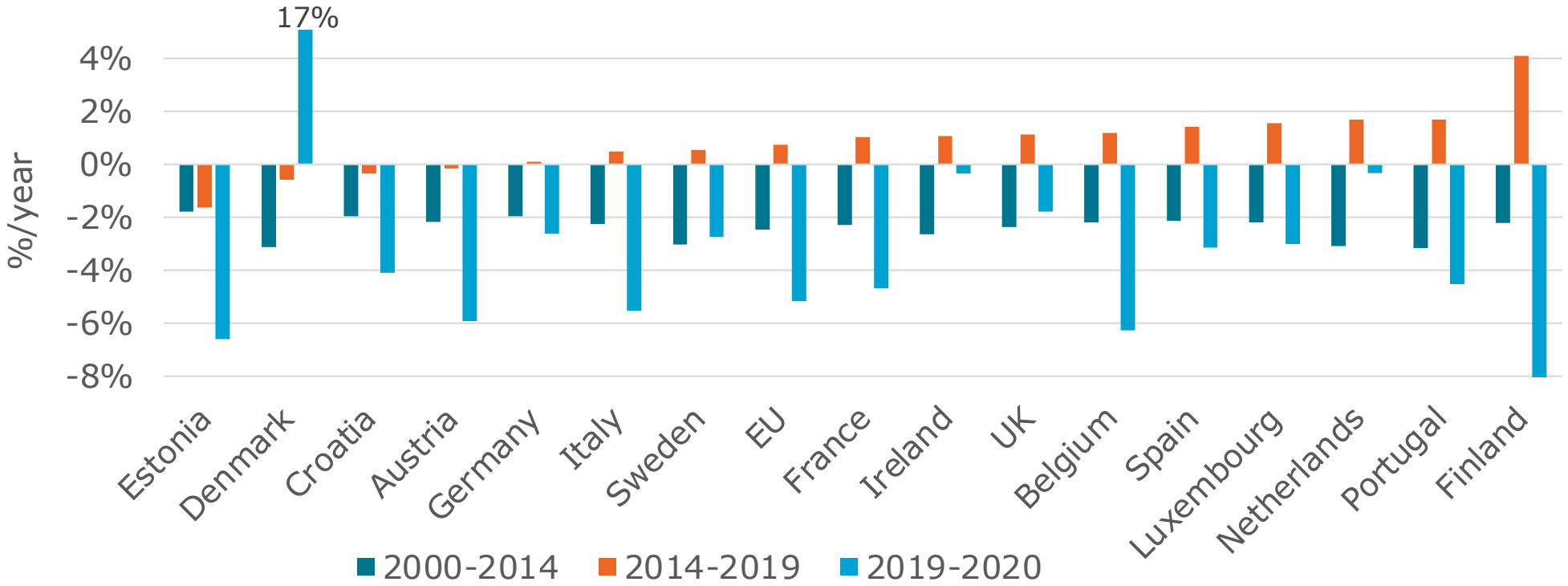


Source: compte des transports, bilan circulation, own estimates (preliminary)

Energy efficiency of new thermal cars improved in 2020

- The specific consumption of new diesel and gasoline cars has decreased again in 2020 in most countries, and quite significantly in some of them.
- This marked a net reversal of the trend 2014-2019, when this specific consumption increased in most countries and at EU level, due to two main factors: a decrease in diesel shares (from 56% in 2012 to 34% in 2019 at EU level) and a growing share of SUV (from 25 to ~40%).

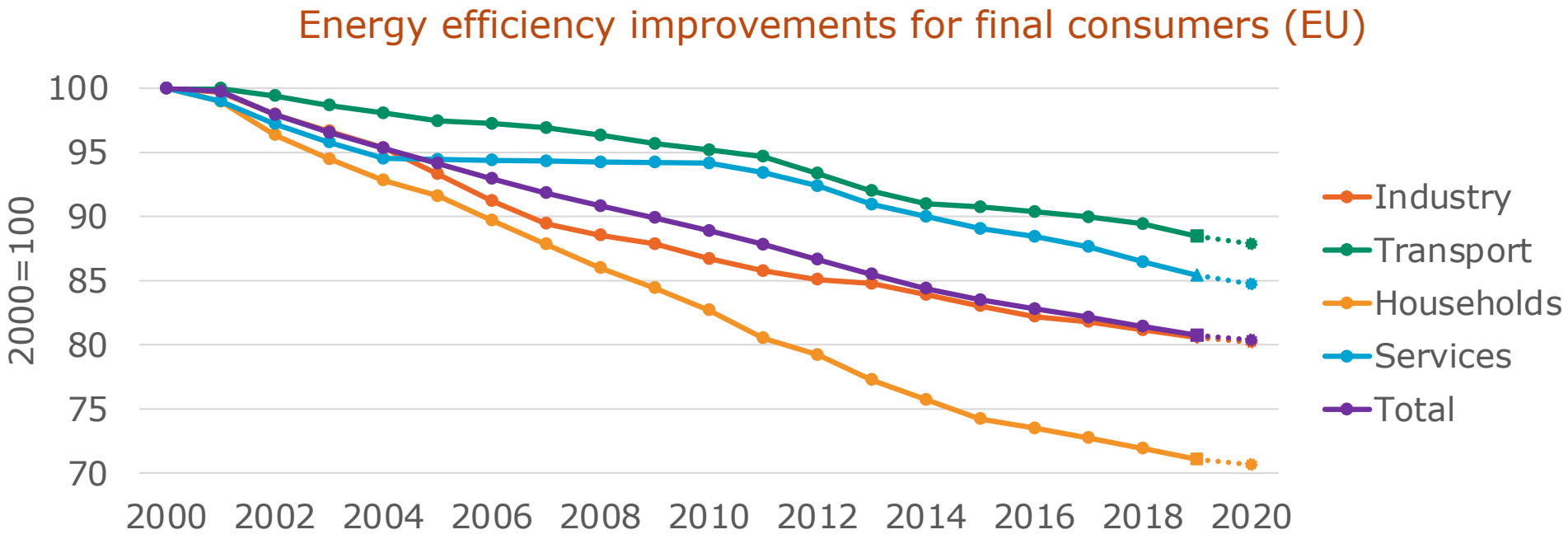
Test-cycle values for diesel and gasoline cars* (l/100 km)



**Source: ODYSSEE from EEA data corresponding to* NEDC cycles to avoid a break in time seri*; only countries with data since 2000 are shown.*

Energy efficiency slowed down again in 2020 according to preliminary estimates

Efficiency of final consumers increased by around 0.5% in 2020 (compared to 0.7%/yr over 2014-2019), of which 0.4% for industry and 0.6% for households and transport.

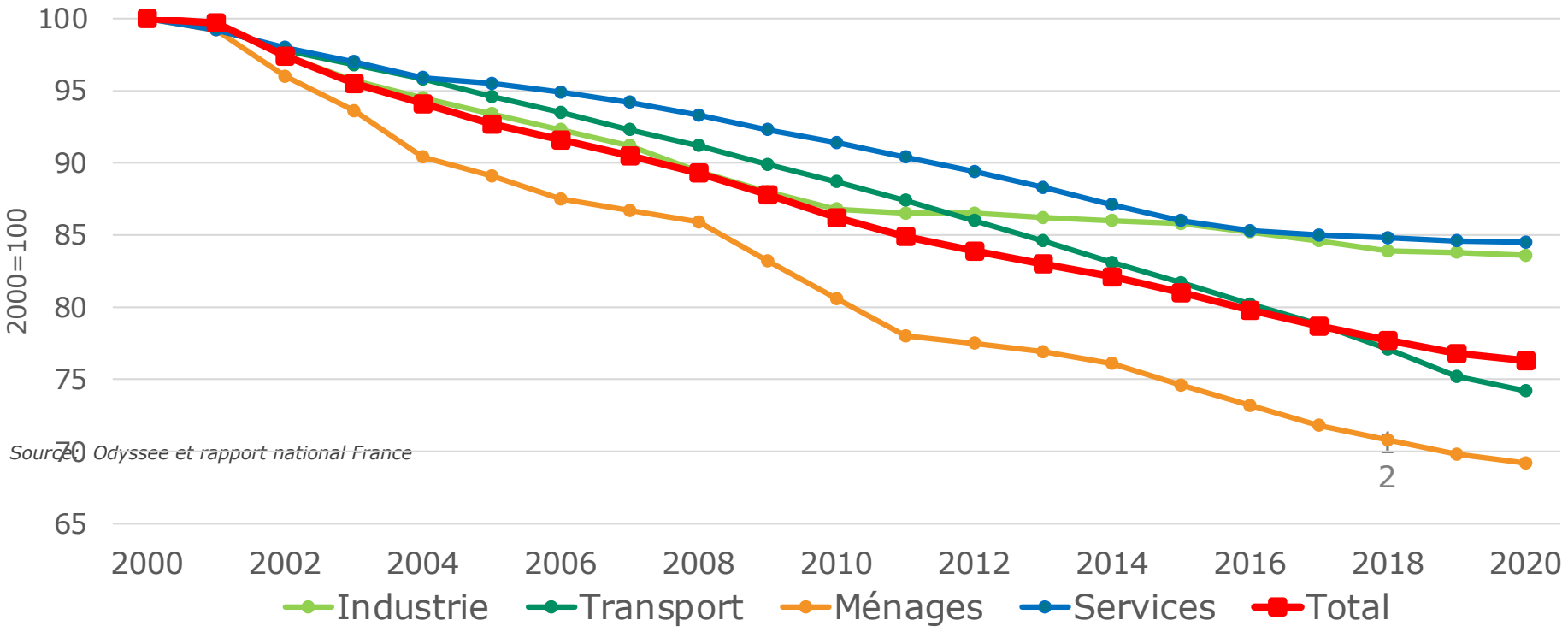


Source: Enerdata preliminary estimates based on "Early estimates" from ODYSSEE (https://www.odyssee-mure.eu/private/methodology-early-estimates.pdf)

The slowing down of energy efficiency is less visible in France

In twenty years, energy efficiency in France has improved by 24% (about 1% per year)(vs -2.1%-3.6% prospective ADEME) The results are contrasted according to the sectors: conclusive in residential (30%) and transport (25%), disappointing in industry and services (15%); More worryingly, we observe in all sectors except transport a slowdown in progress in efficiency since 2016. In 2020, energy efficiency continued to improve in all end sectors by around 0.5% in 2020 (compared to 0.7%/year over 2014-2019), but with significant contrasts depending on the sector (1% in transport, 0.6% in residential and 0.2% in services and industry.

Energy efficiency progress in France (2000-2020) ODEX

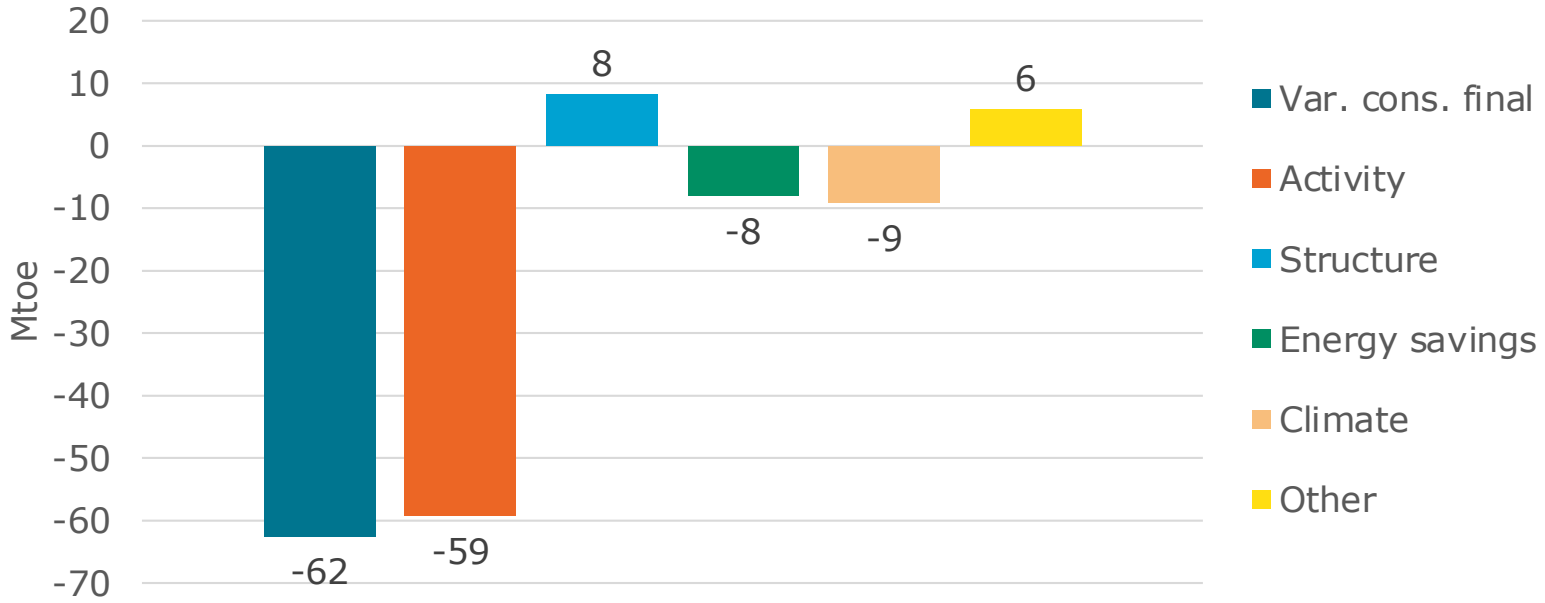


Source: Odyssee et rapport national France

First estimates of the drivers of final consumption variation in 2020 at EU level

- In 2020, final consumption decreased by 62 Mtoe.
- Almost all of this decrease is due to the contraction of activity related to the COVID pandemic.
- Energy savings contributed to a reduction in consumption of 8 Mtoe.

Drivers of final consumption variation between 2019 and 2020

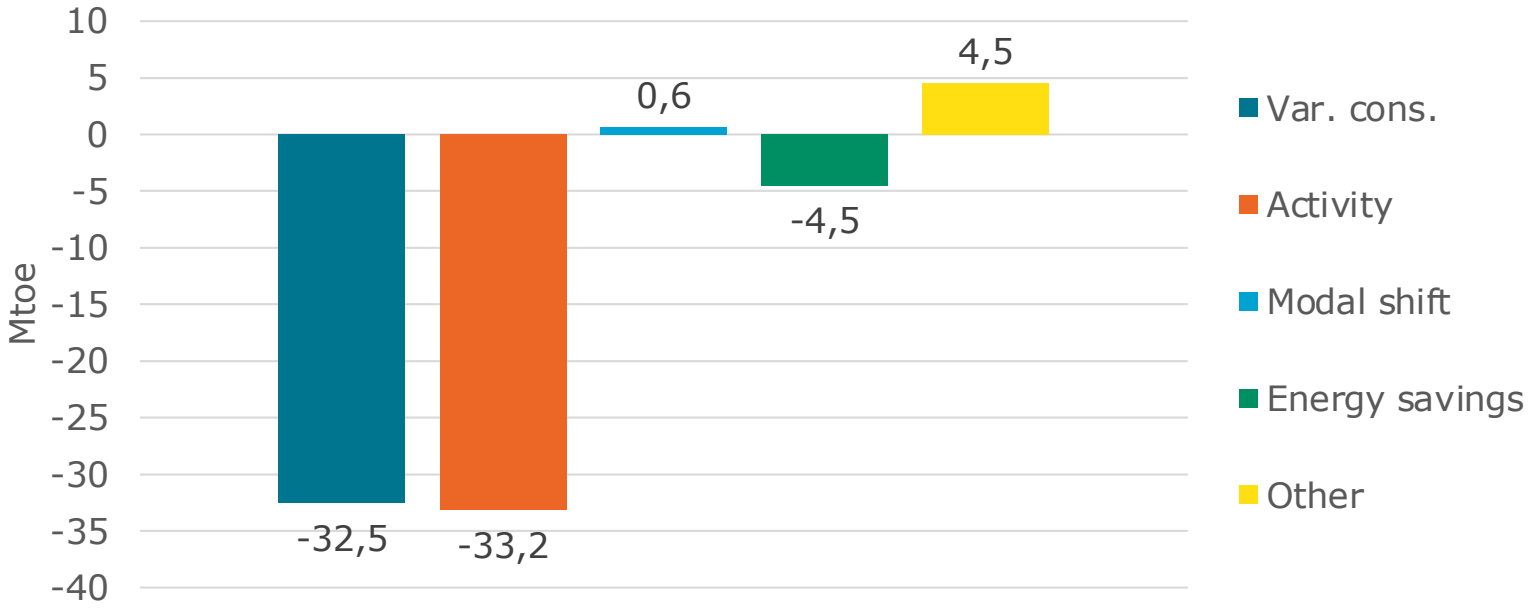


Source: Enerdata preliminary estimates based on "Early estimates" from ODYSSEE

First estimates of the drivers of transport consumption variation at EU level

- In 2020, transport consumption decreased by 33 Mtoe, which is mostly due to the drop in traffic, especially passenger traffic, which in a normal year represent around 60% of the consumption .
- Energy savings is estimated to have contributed to a reduction in consumption of 4.5 Mtoe.
- "Others" factor correspond mainly to increase in specific consumption per unit of traffic due to the reduction in the rate of occupancy in public transport .

Drivers of transport consumption variation between 2019 and 2020

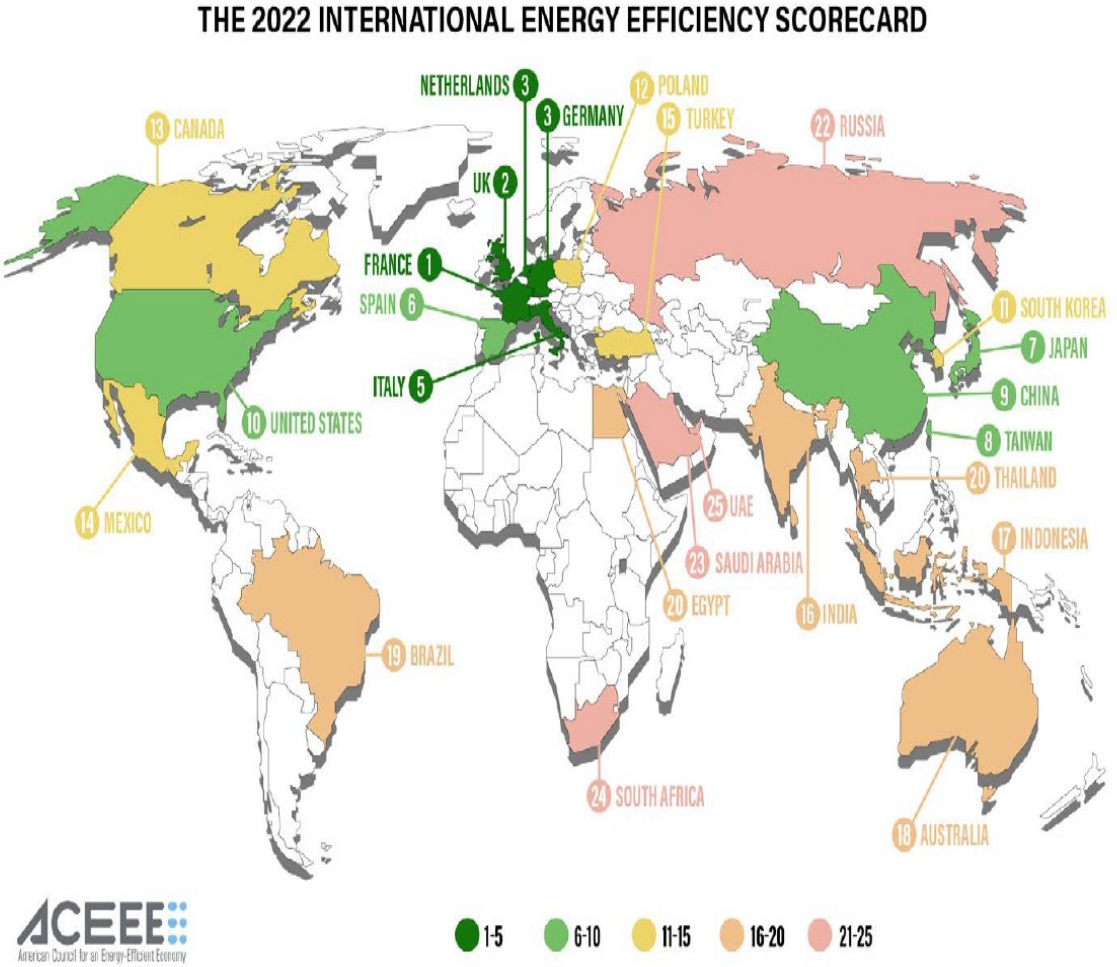


Source: Enerdata preliminary estimates based on "Early estimates" from ODYSSEE

Conclusions (for France)

- Even though France has recorded rather favorable results compared to the European average, there is a worrying slowdown in energy efficiency gains.
- Sectoral results are convincing in housing and transport where France has implemented a set of energy efficiency measures which are bearing fruitful, partly due to the transposition of European directives (EPBD, EED, car standards).
- Conversely, the results are disappointing in industry despite the ETS and the CEEs and in services where there is still a recurring deficit of public energy efficiency measures.
- At the most global level, the pandemic has not significantly changed the diagnosis of energy efficiency carried out in recent years. Energy efficiency continued to improve, but at a slower rate (0.5%), thanks to new equipment, sales of which, however, felt.
- There are significant sectoral differences (1% in transport, 0.6% in residential and 0.2% in services and industry). It is therefore that energy efficiency policies continue to play their role even in times of crisis.
- This is the whole point of regulatory policies that are partially independent of short-term changes in the socio-economic context.
- The other recovery measures (eg support for the renovation of buildings) also played a positive role during this crisis. For example, the renovation of social buildings jumped in 2020 in Denmark (x4) and in France in 2021 (my renov premium X 4.5, 650,000 housing units) and in most European countries.

France is worldchampionship on energy efficiency (ACEEE) and bronze medal at European level (ODYSSEE-ECEEE)



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Annex: GDP variation by sector in 2020

Conclusions

- It is too early to draw conclusions on the impact of the COVID pandemic on energy efficiency in 2020.

- Part of the usual energy efficiency indicators have increased, mainly for non-technical reasons (load factors, operational reasons), which my not be well corrected .

- Indeed, the technical ODEX corrects for this effect but freezes technical efficiency, implying no progress and no additional savings…which is not satisfactory, as it does not correspond to what we can observe for cars, trucks or for dwellings.

- Strong structural effects , especially in transport and services, limited the quality of early estimates that relied mainly on extrapolation.

- Further methodological effort should be devoted in the next project to address this issue, i.e. how to account for technical efficiency in period of recessions, and to improve the early estimates.

General methodology by type of data

- To calculate the key energy efficiency indicators, it is necessary to estimate at year T-1 detailed final consumption data by sub-sector or end-use.
- The methodology depends on the sectors.
- Three types of data are needed for the early estimates:
  - Macro data: population, GDP by sector, primary energy;
  - Final consumption by main sector, which are usually available at that time. If not they can be estimated from monthly data.
  - Sectoral economic drivers (e.g. stock of vehicles, traffic, production, index of production, number of households).

What can we say about energy savings and the drivers of the variation of consumption in 2020?

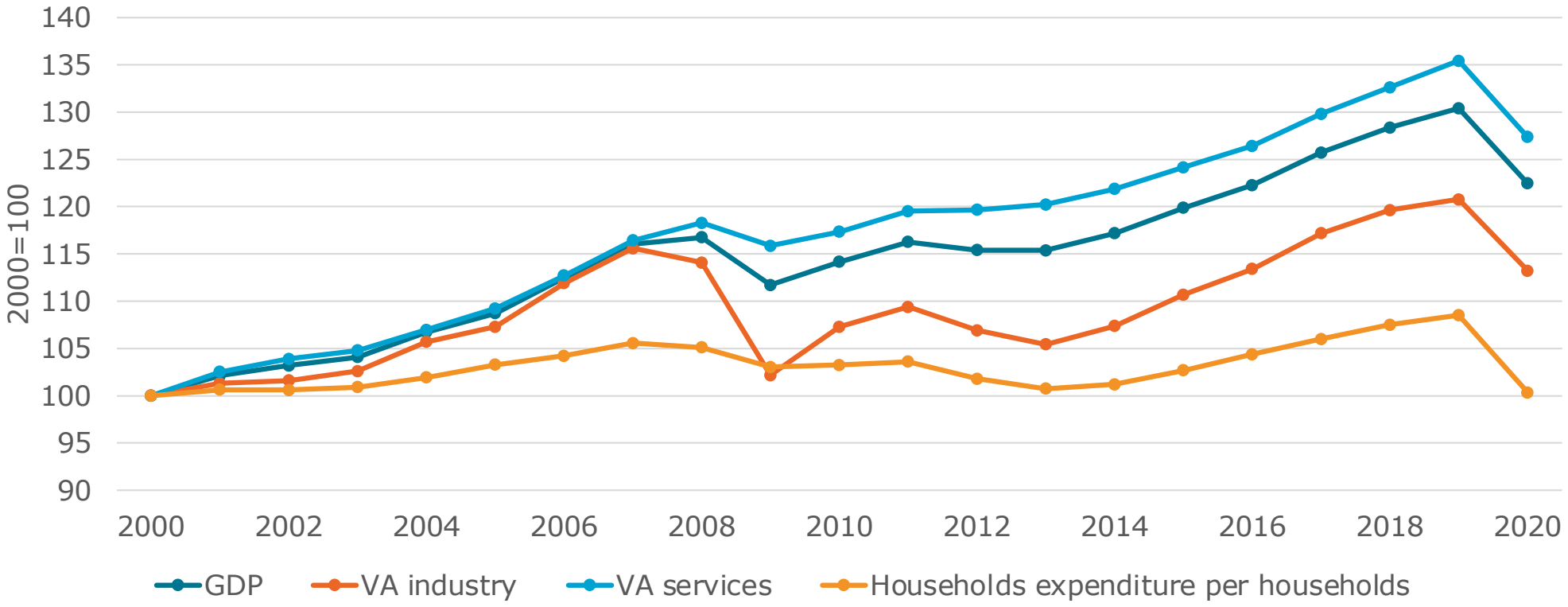
- The methodology developed for estimating the energy efficiency index (ODEX) and consumption decomposition for year n-1 (i.e. 2020 in 2019) is mainly based on trend extrapolation, which means that it works well if the most recent year follows past trends, which is far from being the case in 2020, especially in transport.

- It is possible to adapt the methodology on a case-by-case basis, provided that some data are available for calibration, but this is very time-consuming and goes beyond what could be spent for this task.

- We have done it for the EU only.

Macro-economic impact

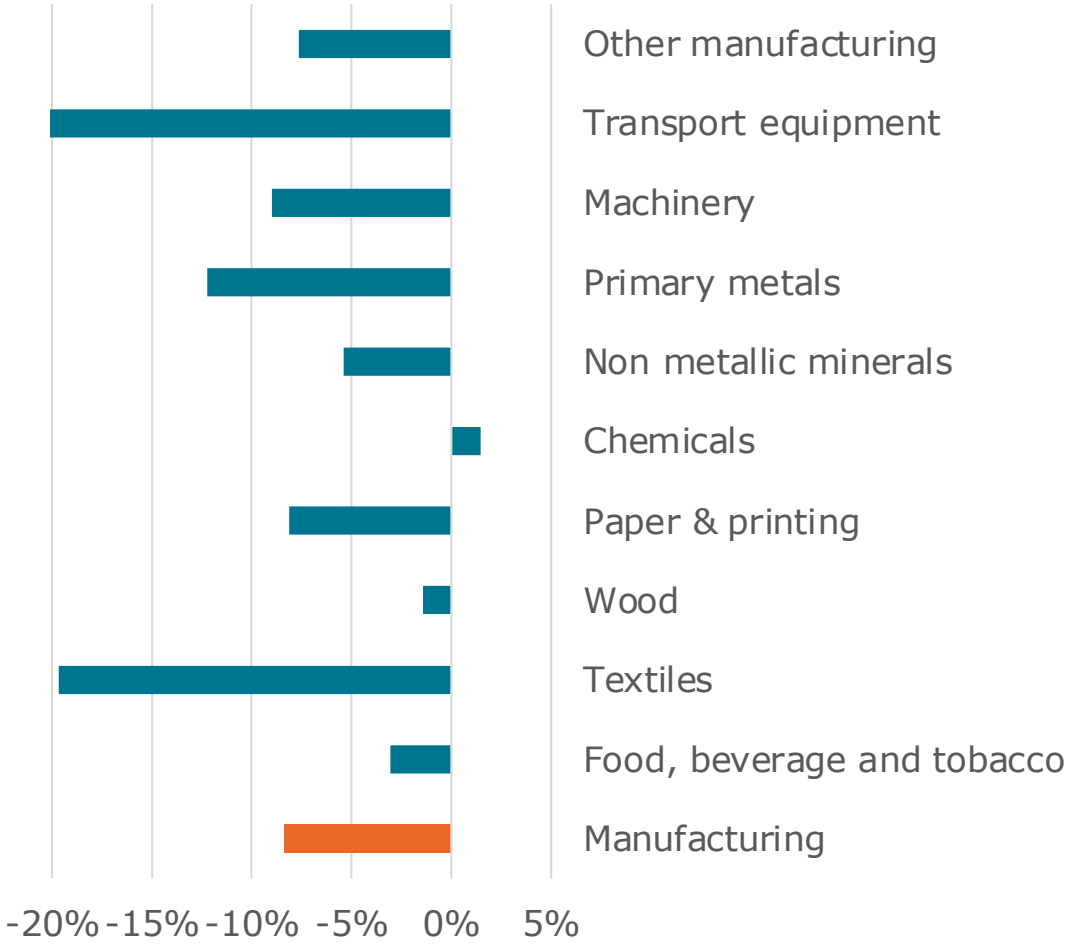
- GDP fell by 6% with similar impact on VA of industry and services
- The recession was 2 points stronger than in 2009 but impacted differently the sectors because of lockdowns : lower impact for industry (-6% in 2020 vs -11% in 2009) while services suffered more (-6% vs -2%) .
- Households expenditures per household decreased by 8% due to lower expenditures on entertainment and transport (lock-down).



Source: Eurostat ; EU27

Manufacturing production impact

2020 trend on Industry Production Index by branch



Source: Eurostat

- Manufacturing production index decreased by 8% in 2020 (against 16% in 2009).
- The impact has been very heteregenous across the manufacturing branches.
- The most impacted branches were transport equipment, textiles (-20% both), and primary metals (-12%).
- Chemicals was the only branch that increased its production (+2%) due to the pharmaceutical industry (+6%)