In 2020, the carbon footprint of household consumption decreased during lockdowns

During the first lockdown, greenhouse gas (GHG) emissions declined significantly, not only emissions produced by households directly but also those contained indirectly in the goods and services they consume. This reduction is probably due mainly to the fall in household consumption, and to a lesser degree to a change in the consumption structure. The second lockdown would appear to have resulted in a similar trend, although on a smaller scale. Lastly, the rebound in consumption in summer 2020 would appear to be accompanies by a return to a similar level of household GHG emissions to that before the crisis, reflecting the unsustainable nature of changes that occurred during lockdown.

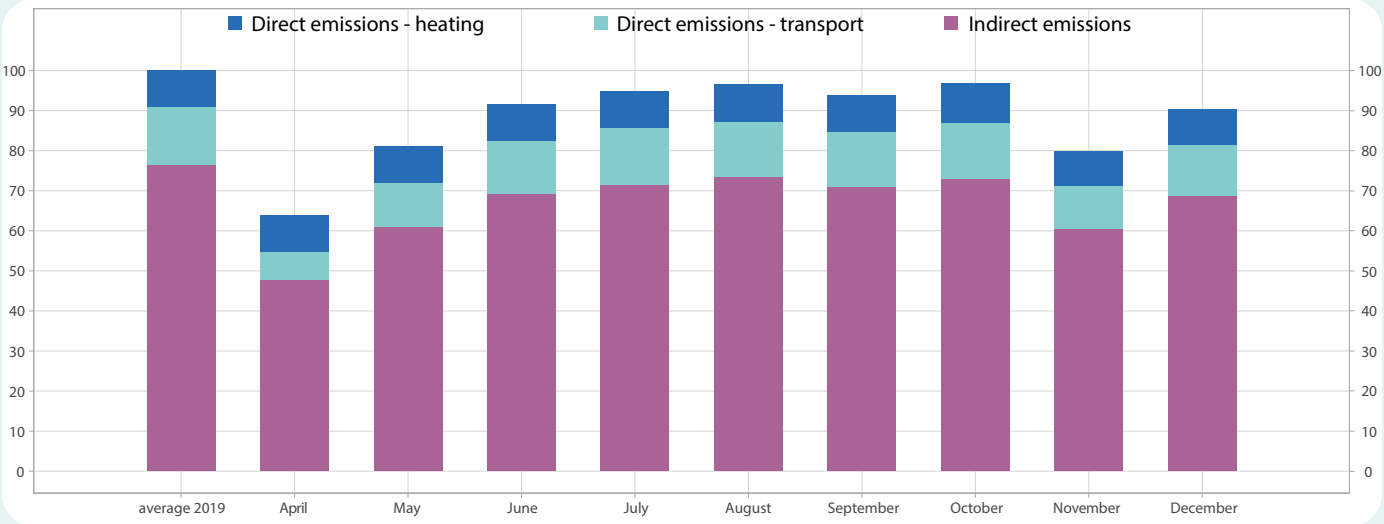
The decrease in travel as a result of the Covid-19 epidemic has had the effect of reducing air pollution in France and in Europe[1] and also greenhouse gas (GHG) emissions associated with transport. This effect was particularly noticeable during the periods of lockdown put in place in spring in various countries, as was the case in France from March to early May. In addition, the decline in household consumption led to a reduction in their indirect GHG emissions, i.e. those associated with all the goods and services that households consume. Ultimately, lockdown resulted in a reduced carbon footprint.

The carbon footprint corresponds to the amount of greenhouse gas[2] emitted, in France or abroad, to satisfy a country's final demand (household consumption and public administrations, investment, etc.). It includes direct household emissions (mainly related to fuel combustion for travel and gas or fuel oil for heating) and indirect emissions, resulting from the production of consumed goods (emissions associated with intermediate consumptions and their production itself). These indirect emissions therefore depend on the volume of goods and services consumed, but also on their carbon content. For example, the consumption of diesel emits GHGs directly into the atmosphere (via fuel combustion), but the diesel supplied at petrol stations also has a carbon content, taking into account the emissions resulting from the extraction and refining of petroleum, and emissions due to intermediate consumption, such as transporting the fuel to the service station. If we consider the consumption of catering services, this does not emit GHGFs directly as such, but does emit them indirectly via the carbon content of these services (emissions linked to cooking food, the carbon content of the foodstuffs themselves, etc.). Indirect emissions can be emitted in France just as well as abroad, if the consumed good is imported or if imported intermediate consumption is involved in its production.

1 The Centre for Research on Energy and Clean Air (CREA) calculated that in April 2020, air pollution by nitrogen dioxide (NO2), a pollutant emitted by power plants and diesel engines, was 37% lower in Europe and 44% lower in France than in April 2019.
"11,000 air pollution-related deaths avoided in Europe as coal, oil consumption plummet", CREA, April 2020
2 These are mainly carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O), with the amounts emitted expressed as carbon dioxide equivalents.

► 1. Carbon footprint of household consumption

base 100 in 2019



Note: GHG emissions for the months of 2020 are shown against the average monthly emissions for 2019.
How to read it: in April 2020, direct and indirect emissions from household consumption were at 64% of their average monthly level for 2019, with 48 pts for indirect emissions, 9 pts for direct emissions related to heating and 7 pts for direct emissions related to transport.
Source: SDES, comptes nationaux, INSEE caluation

The restrictive health measures in place in France since March have limited households' activities and consumption choices, resulting in changes in the volume of the basket of goods and services and in its composition, which in turn alters the carbon footprint of French households. In this Focus, the aim is to estimate the change between April and December 2020[3] in direct household emissions and indirect emissions linked to their consumption: thus it is not the entire carbon footprint (notably, household investment, general government consumption and investment are excluded from the analysis) however, the scope here does represent most of it (73% in 2019).

The carbon footprint of household consumption decreased by almost 36% in April 2020

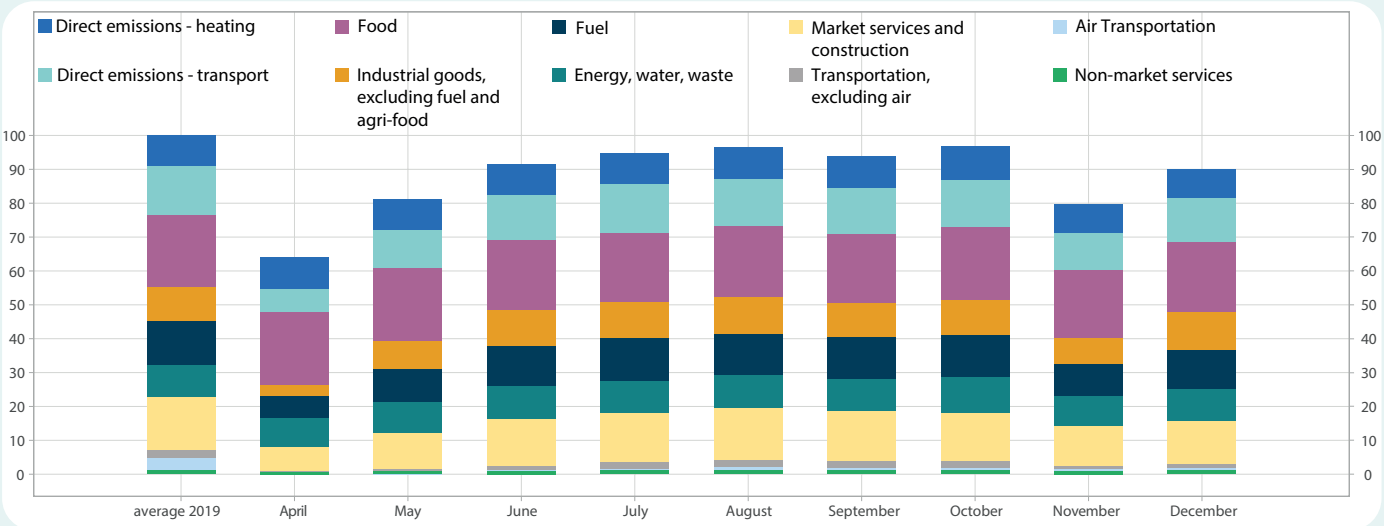
In 2019, the carbon footprint of household consumption was made up of 76% indirect emissions, with direct emissions related to transport and housing accounting for 15% and 9% respectively (► **Figure 1**). Concerning indirect emissions, they were mainly related to food (21% of total emissions in 2019), purchase of fuel (13%), consumed manufactured goods (10%), electricity and heat consumption (9%) and services, whether market or non-market (► **Figure 2**). The relative size of these different contributions is based on both the scale of the volumes consumed and the carbon content of the different products: thus, while spending on fuel in 2019 represented 4% of household consumption, the high carbon content of fuel resulted in a much larger proportion of emissions due to its production and transport (indirect emissions); conversely, although market and nonmarket services make up a large proportion of household consumption (almost half in 2019), their low carbon content is the reason for their much lower contribution to indirect emissions.

Compared to the pre-crisis level (2019), the carbon footprint of household consumption would appear to have fallen by 36% in April 2020 and by 19% in May (► **Figure 3**). From June to August, household consumption returned to a level close to the pre-crisis level and transport restrictions were relaxed, and so GHG emissions would appear to have moved nearer to their 2019 average, before declining slightly in September and October, then more significantly in November with the second lockdown.

More specifically, direct emissions associated with housing would seem to have remained stable overall in 2020, since residential energy consumption was not much affected by the health crisis, probably because of favourable climate conditions in 2020. However, with the decline in travel during lockdown, direct emissions associated with transport would appear to have experienced a 52% decrease in April then 25% in May, before returning in the summer to a level similar to 2019, then falling again in November with the second lockdown. The decline in travel also appears to have resulted in fewer indirect emissions related to fuel production, thus representing the main

3 This Focus covers only April to December 2020, the period most affected by the health crisis and which has been the subject of household consumption estimates in the different Economic Outlooks published since the crisis began.

► 2. Carbon footprint of household consumption with details of indirect emissions by product



Note: GHG emissions for the months of 2020 are shown against the average monthly emissions for 2019.
How to read it: on average per month in 2019, food and coking-refining represented 21% and 13% respectively of the carbon footprint of household consumption.
Source: SDES, comptes nationaux, INSEE calculations

contribution to the total reduction in indirect emissions. The other consumption items that contributed to the decline in indirect emissions are manufactured products and transport services, especially air transport.

The carbon content of goods and services consumed explains their respective contribution to the carbon content of household consumption

The disparities in the contributions of consumed products to the change in the carbon footprint of household consumption can be explained by their weight in household consumption and by the GHG emissions associated with their production (carbon content): the greater the weight of a product in consumption or the higher its carbon content, the more a decrease in consumption of this product will lead to a significant drop in the carbon footprint of household consumption. ► **Figure 4** shows the drop in consumption by product according to their carbon content, for April 2020, to better illustrate the weight of these two components. The size of the circles is proportional to the greenhouse gas emissions related to the production of goods and services in 2019.

The coking-refining and air transport sectors are on the right-hand side of the graph, characterised by a high carbon content, and consumption in these branches saw a significant drop during the first lockdown (of 52% and 100% respectively compared to the pre-crisis level): these sectors therefore made a major contribution to reducing the carbon footprint of household consumption. Conversely, household food consumption increased only slightly during lockdown, but as this sector also has a high carbon content, emissions related to the production of these foods therefore lessened the overall decline in emissions (► **Figure 4**).

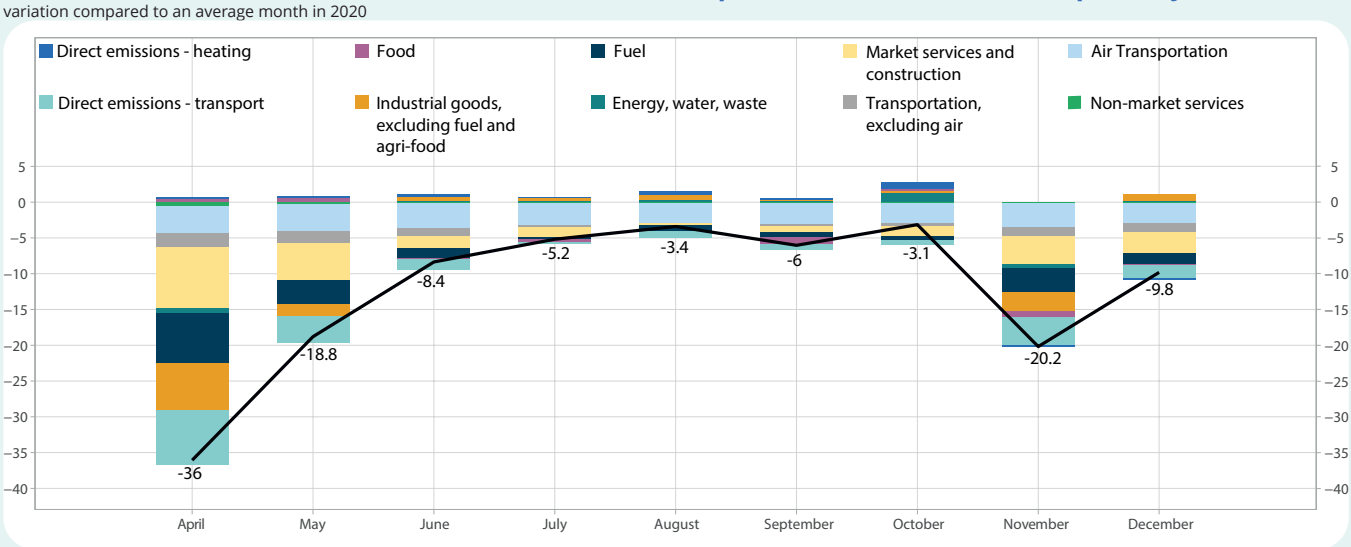
The change in the carbon footprint of household consumption between June and October reflects the rebound in consumption, before it fell once again in November due to the second lockdown

From June until October, indirect emissions related to household consumption are expected to gradually return to a level closer to the 2019 average. The remaining difference is driven mainly by indirect emissions linked to air transport, which would appear to be staying very far below their pre-crisis level. In addition, emissions linked to fuel consumption also appear to be still in decline, as the upswing in travel was only gradual. However, emissions related to manufactured goods would appear to have increased slightly, due to the rebound in consumption that started as the first lockdown ended (► **Figure 3**).

In November, the second lockdown would seem to have resulted in a 20% drop in indirect emissions linked to household consumption compared to the level in 2019, almost half as much as in April. The main reason for this

► 3. Contributions to the reduction of the carbon footprint of household consumption by branch

variation compared to an average month in 2020



How to read it: in April 2020, direct emissions related to transport contributed 8 points to the 36% total decline in the carbon footprint of household consumption, while the coking-refining branch and the rest of manufacturing industry contributed 7 and 6 points respectively.
Source: SDES, comptes nationaux, INSEE calculations

difference is that the autumn lockdown was less strict than that in the spring, resulting in a smaller drop in consumption. Specifically, indirect emissions linked to air transport would appear to have decreased less than in April, but it was above all the decline in the consumption of manufactured goods that led to a smaller drop in indirect emissions than in spring (contribution of –2% in November compared to the 2019 average). Direct emissions linked to transport and indirect emissions linked to fuel production would appear to have declined less than in April, with fuel consumption down 27% in November, against 52% in April.

In December, as in May and June, the return to consumption would appear to have resulted in an increase in the carbon footprint of household consumption compared to November, bringing it to 10% below the 2019 average level. ●

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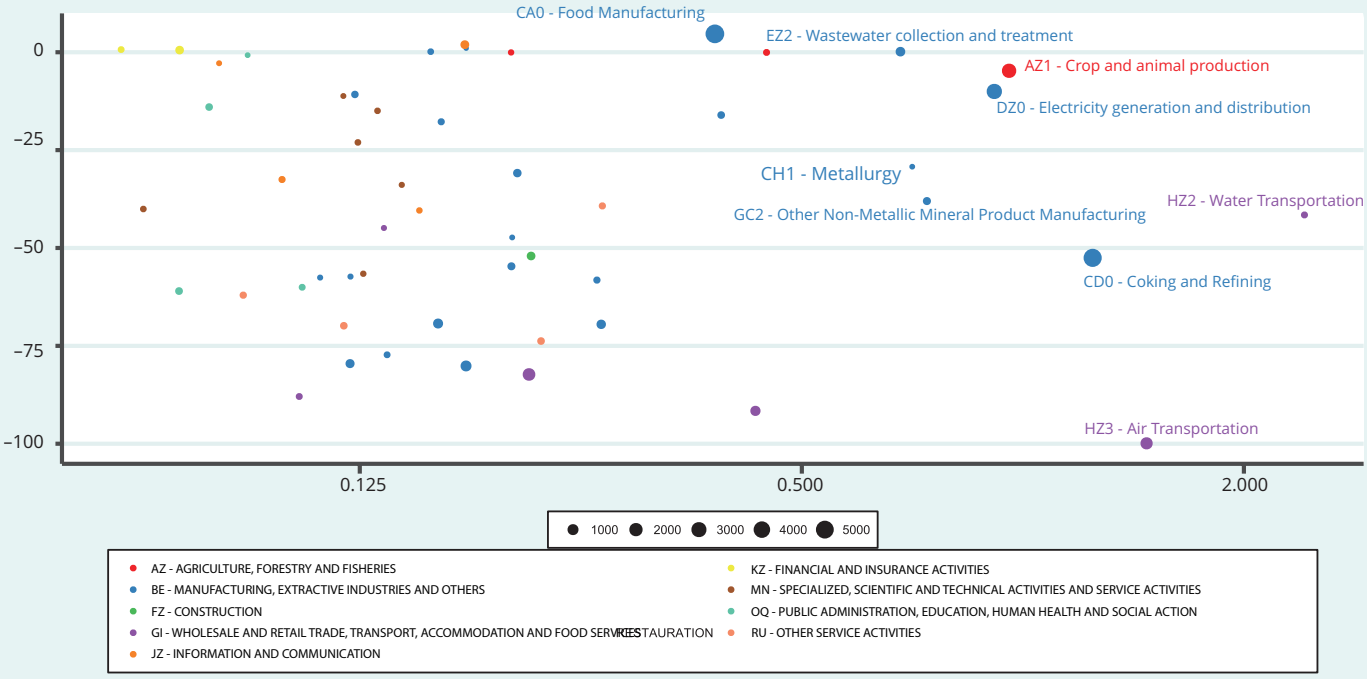
► 4. Carbon content of different products (in grams of CO2 per euro consumed, logarithmic scale, x-axis) and estimated loss of consumption in April compared to the pre-crisis level (y-axis)



Note: the size of the circles is proportional to the total emissions per product for an average month in 2019. The sectors of employment-related activities (NZ2, carbon content of 0.028g CO2/€) and real estate activities (LZ0, carbon content of 0.01g CO2/€) have been removed from the graph to improve clarity; their carbon content is low and does not affect the analysis.
Source: SDES, National accounts, INSEE calculations

Methodology box

The carbon footprint of household consumption is estimated by adding together direct household emissions and indirect emissions linked to their consumption. Direct emissions linked to transport are estimated for 2020 by assuming that the change in the amount of GHGs emitted during combustion (direct household emissions) is similar to the change in spending on fuel (coking-refining branch products). Direct emissions linked to housing, comprising mainly the consumption of natural gas and fuel oil for heating, were estimated in 2020 assuming a similar change to that in electricity consumption by Enedis customers in the "residential" sector (*Economic Outlook* 15 December 2020).

Indirect emissions associated with household consumption during the months of April to December are calculated by multiplying the household consumption of each product, estimated for these months, by the carbon content of this product. Since estimates for household consumption are adjusted for seasonal variations and working days, indirect emissions are too.

Carbon content by product is calculated from 2019 data on indirect emissions from the Statistical data and studies service (SDES)[1] of the Ministry of Ecological Transition and final demand data by product (INSEE national accounts).[2] Assuming fixed technology in France and abroad, production of the same good or service results in the same amount of greenhouse gas emissions during the production process. For each product, indirect emissions in 2019 include emissions related to the production of this product, in France or abroad, and especially emissions from all the intermediate consumption used.[3]3 Indirect emissions related to household consumption are then divided by household final consumption by value, to obtain the carbon content of the product, the amount of GHG emissions per euro consumed.

The carbon contents of the different products are then used to estimate the fall in indirect emissions resulting from the drop in consumption, month by month, from the April lockdown to that of November and December, as estimated by INSEE in its *Economic Outlook*. This calculation is performed at level A64 of the aggregate classification (NA).

The change in indirect emissions in 2020 is also broken down according to two effects: the effect resulting from the drop in consumption with an unchanged structure and that resulting from the structure effect. The latter corresponds to the variation in indirect emissions due to change in the structure of consumption. Thus, with an unchanged level of consumption overall, indirect emissions may be lower if consumption has shifted to products with a lower carbon content. August 2020 is a good illustration of this phenomenon, since the structure effect accounts for almost all of the fall in indirect emissions for this month. More specifically, the structure effect in August is mainly explained by a lower consumption of coking-refining products and especially air transport.

Indirect emissions are calculated using the following variables: total consumption Ct, consumption by product pctit (as a percentage of the total) and carbon content by product, carbi. The calculation is shown below:

$$Emp_t = \sum_i C_t * pct_{it} * carb_i$$

.../...

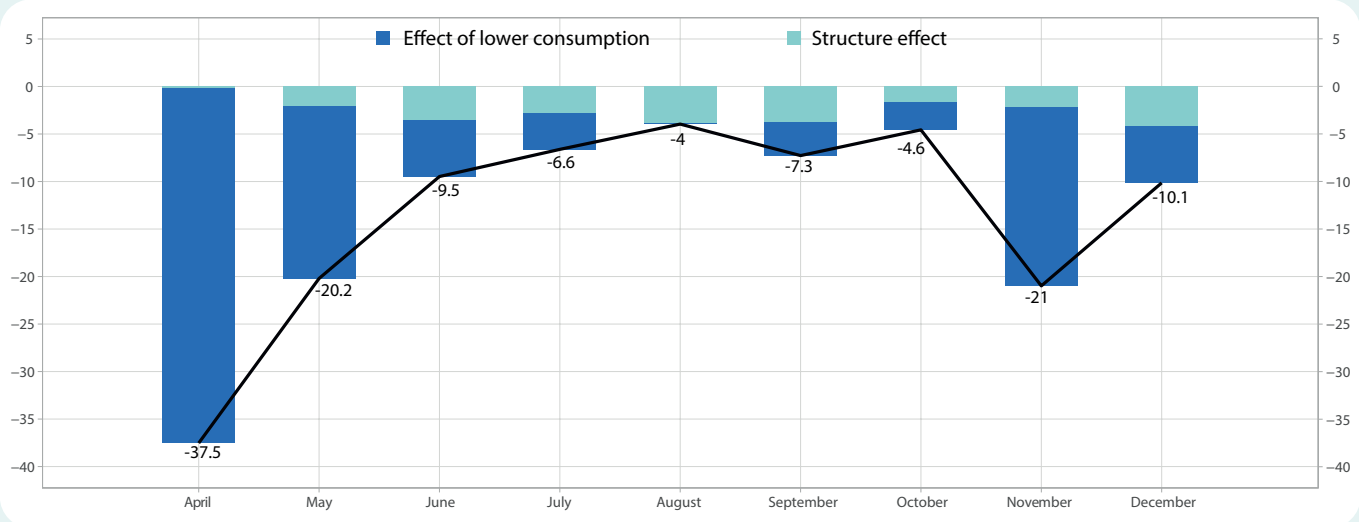
1 "Estimate of carbon footprint from 1995 to 2019", December 2020.
2 As a follow-up to the report by the High Council on Climate in October 2020 on carbon footprints, an assessment of the SDES methodology for calculating the footprint is in progress. This assessment could lead to a revision of the footprint series in autumn 2021. Such a revision could in particular affect estimates of emissions imported from the coking branch, which is of considerable significance in reducing the carbon footprint in the 2020 health context described here. Thus the results presented here could be modified as a result of these revisions.
3 Details of the SDES calculation method can be found in the document "Méthodologie de calcul de l'empreinte carbone de la France" (Methodology for calculating the carbon footprint in France), December 2020, Manuel Baude.

After the calculation, the decline in indirect emissions compared to a reference month in 2019 is broken down into two parts: the drop in consumption compared to 2019 (change in indirect emissions with an unchanged consumption structure) and the structure effect.

$$\%Emp_t = \%C_t + \frac{C_t}{C_{t_0}} \frac{\sum_i (pct_{it} - pct_{it_0}) carb_i}{\sum_i pct_{it_0} carb_i}$$

The drop in indirect emissions during April and May appeared to be greater than that in household consumption. In fact, the decline in consumption during the first lockdown (-31% in April) caused an automatic drop in indirect emissions but was also accompanied by a change in the structure of household consumption, visible from May (–1.7% in May): fuel expenditure also fell significantly, as did the consumption of transport services, especially air transport, while other less carbon-intensive types of spending (food) were much less affected. However, the structure effect seems to play a small part in the decline in indirect emissions in April and May (Figure 5). On the other hand, from June until October, the structure effect contributes much more, if not almost totally, to the drop in indirect emissions: in August in particular, when consumption returned to its pre-crisis level, its structure remained changed compared to 2019, with a lower level of indirect emissions. ●

► 5. Breakdown of the drop in indirect emissions linked to household consumption into decline in household consumption and change in consumption structure



Source: SDES, comptes nationaux, INSEE calculations