Consumption and the environment in Europe's circular economy

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Contents

Acknowledgements 4
1 Introduction 1
2 Household consumption in Europe 3
2.1. Household consumption *versus* household expenditures 3
2.2. Consumption trends in Europe 4
2.3. The global dimension of European consumption – trade 11
3 Impacts of European consumption 13
3.1. Footprint of European consumption 14
Material use 15
Emissions to air 19
Greenhouse gas emissions (climate change) 26
Water use 29
Land use 31
3.2. Social impacts 33
4 Exploring conditions for sustainable consumption 34
4.1. Why do we consume? 34
Internal drivers for consumption: needs and desires 34
External drivers for consumption at different levels 36
Rebound effects and lock ins 38
4.2. Living well within the limits of the planet 39
5 Pathways towards more circular and sustainable consumption in Europe 43
5.1. EU Policy context 43
5.2. The contribution of a circular economy to sustainable consumption 45
Consuming less 46
Consumption shifts 46
Circular product design 47
5.3. Beyond efficiency improvements 47
Sufficiency 49
Mind shifts 50
6 References 53
Annex 1 The scope of household consumption and the calculation methodology 53

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1 Introduction

Europe and the world face unprecedented sustainability challenges, including biodiversity loss, climate change, depletion of resources and pollution. Many of these challenges are caused directly or indirectly by unsustainable consumption.

Citizens and countries strive for economic growth and increased wellbeing. Economic and population growth has come with an increase in global consumption, resulting in rising resource use and emissions. The Organisation of Economic Development and Co-operation (OECD) expects global consumption of materials such as biomass, fossil fuels, metals and minerals to double by 2060 (OECD, 2019), while annual waste generation is expected to increase from 2 billion to 3.4 billion tonnes by 2050 (Kaza et al., 2018). Today, societies across the world are witnessing a rapid increase in middle- or high-income consumers, adopting high consumption lifestyles. At the same time, this growth in consumption and production induces unprecedented overexploitation of natural resources, emissions and generation of waste, resulting in significant environmental, climate and social impacts (Wiedmann et al., 2020). As consumption levels continue to rise, it is questionable how long efficiency increases will be successful in compensating for consumption growth. Furthermore, high-income countries use 10 times as many materials per person as low-income ones – as well as there being equivalent inequalities in consumption between sectors of society within countries (Akenji et al., 2021; Gore, 2021).

In 2020, the European Commission proposed a progressive policy package in the form of the European Green Deal, with ambitious objectives that aim to protect the environment and mitigate climate change (European Commission, 2019b). As part of the Green Deal, the EU Circular Economy Action Plan (CEAP) highlights the potential of the circular economy to contribute to reducing Europe's consumption footprint, decoupling economic growth from resource use and its impacts. The CEAP presents a set of related initiatives that aim to make sustainable products, services and business models the norm (European Commission, 2020b). Several initiatives on key product value chains have been published thus far, including for plastics, textiles and food (European Commission, 2018, 2020a; EC, 2022). In May 2022, the 8th Environment Action Programme (8EAP) entered into force, aiming to guide European environmental policy making towards the Green Deal's ambitions, achieving the Sustainable Development Goals (SDGs) and significantly decreasing the EU's material and consumption footprints to bring them within the 2050 vision of "*living well, within the planetary boundaries*" (European Parliament, 2022).

Production systems play an important role in shaping consumer demand, as they define the types of products placed on the market and the marketing strategies used to encourage consumption (EEA, 2022b). It is clear that product design is influential in rendering the production and consumption of products more energy and resource efficient and circular (EEA, 2022d; ETC/CE, 2022). The development of design guidelines is a key policy tool to support such changes. In March 2022, the European Commission proposed the Regulation on Ecodesign for Sustainable Products (ESPR), which extends the EU Eco-design Directive beyond its narrow scope of energy-related products (European Commission, 2022f). The ESPR's ambition is to ensure that all products placed on the EU market are designed with resource efficiency, carbon neutrality and circularity in mind, building on the expertise and methodological work on the Environmental Footprint (European Commission, 2021) and Consumption Footprint (Sala and Sanye, 2022) undertaken by the Joint research Centre (JRC). An important element of the ESPR is the introduction of digital product passports to improve transparency and enable information provision to consumers about products' environmental sustainability.

This report takes a European consumption perspective and calculates different footprints of European consumption following a different approach from the European Commission and JRC. It aims to explore internal and external drivers of consumption behaviour and how consumption can be changed to ensure a good life for all within the planetary limits. Many indicators to assess sustainable consumption and production have been defined, such as the Ecological Footprint' (Wackernagel and Rees, 1996) and the

Consumption Footprint (Sala and Sanye, 2022). In addition, many frameworks have been developed that propose boundaries to consumption, such as planetary boundaries (Steffen et al., 2015), safe operating space (Rockström et al., 2009), safe and just space for humanity (Raworth, 2012), consumption corridors (Fuchs et al., 2021; Di Giulio and Defila, 2021; Di Giulio and Fuchs, 2014; Blättel-Mink et al., 2013), wellbeing economy (Fioramonti et al., 2022; Sennholz-Weinhardt et al., 2021) and the doughnut (Raworth, 2012). Currently, with a focus on climate change impacts, considered one of the most urgent ecological crises, these concepts have been further elaborated into the 1.5-degree lifestyle approach through which people can live well while causing so few emissions that global warming is kept below 1.5 °C (Akenji et al., 2021). This provides an holistic understanding of behavioural components which address both individual and systemic elements, acknowledging the need for changes leading to overall emissions reductions, especially by high-consuming groups, in such sectors as housing, food and transport (Newell et al., 2021).

These frameworks and many studies point to the fact that major lifestyle and consumption shifts – and ultimately probably reduced consumption – will be needed to achieve significant reductions in environmental pressures and greenhouse gas emissions both in Europe and globally (Wiedmann et al., 2020; Alfredsson et al., 2018; Fuchs et al., 2016). Neither environmental policies nor economic and technology-driven efficiency gains alone are likely to be sufficient to overcome effects of increased consumption and production in the long run, due to the combined effects of population and economic growth . Efficiency improvements need to be combined with shifting consumption towards more circular and sustainable alternatives, including sufficiency approaches. Such transformations will inevitably involve profound changes in dominant production and consumption practices, technologies, infrastructure and policies.

This report takes a European consumption perspective and is built up as follows. Chapter 2 analyses past and current trends in EU consumption. Based on these figures, footprints of environmental and, to some extent, social pressures of consumption in Europe are presented in Chapter 3. Chapter 4 discusses the drivers of consumption behaviour and what sustainable consumption patterns could look like, including the potential contribution of a circular economy. Finally, Chapter 5 provides a brief overview of pathways and potential policy options that could steer consumption in a sustainable direction.

2 Household consumption in Europe

2.1. Household consumption versus household expenditures

This chapter focuses on trends in **household consumption** in Europe. When looking at the trends, it is important to define what is regarded as household consumption. In statistics, it is a part of Europe's so-called domestic final consumption which includes consumption expenditures by households, non-profit institutions serving households (NPISH) and governments, as well as investments composed of gross fixed capital formation, changes in inventories and changes in valuables.

Expenditures by households obviously include all goods and services bought by households directly, such as energy, insurances and expenditures at supermarkets/shops. Governmental consumption expenditures cover the provision of services to the community by governments, including education, health, the justice system, defence and the police. Since these services also serve households, they are taken into consideration in this analysis. Furthermore, expenditure NPISH, for example, sports clubs, unions, churches, charities, etc., can be attributed to households. Investments, such as in infrastructure, machinery and equipment, typically have no link or at least no direct link to current household consumption and therefore are not included in this analysis. There is, however, one exception to this: investments by households in dwellings, i.e., a part of the gross fixed capital formation category ([1]), including the construction of new houses and major renovations.

Following the above argument, **this report interprets household consumption in Europe more broadly than just consumption expenditure by households; it also includes consumption expenditure by NPISH and governments – as far as that is linked to consumption by households – as well as investment in dwellings by households** ([2])**.** This scope is more closely related to the concept of apparent consumption used by the Joint Research Centre (JRC) in its work on the basket of products indicators (Sala and Sanye, 2022). The intention of apparent consumption is to estimate the total use of a product group for any purpose within the territory. It is defined as production plus imports minus exports and is typically calculated for product groups. The JRC's Consumption Footprint has a full bottom-up approach (process-based lifecycle assessment) and considers the impacts of the consumption of citizens in the areas of food, mobility, housing, household goods and appliances. While this has considerable similarities to this study, the scope is not completely the same – for example, the JRC's Consumption Footprint excludes the direct use of services by households ([3]).

This report distinguishes **six consumption domains,** or areas of consumption, when looking at household consumption:

- food – food, drink, and hotels and restaurants, etc;
- clothing and footwear;
- housing – dwellings, heating, hot water and electricity, including investment in dwellings by households;
- mobility;
- household goods and services – household equipment, appliances, and information and communications technology (ICT); and
- services – health, education, finance and recreation.

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1 Investment in dwellings, as a part of total investment in construction, as a part of gross capital formation.

2 See Annex 1 for more detail and examples of the definition of household consumption in this report.

3 Services in the value chain of products are included in both approaches, for example, transport services are covered in mobility, but the top-down method used in this report also includes the direct consumption of services by households such as health, education, insurances, etc.

These consumption domains follow the COICOP classification ([4]) and are aggregated to ensure comprehensive analysis and easy comparison between a limited number of large consumption domains in Europe. More details on the definition of the scope and the aggregated consumption domains can be found in Annex 1.

It should be noted that the **scope of mobility is different from the scope of transport** as often referred to in other indicators. In this report, mobility is one of the household consumption domains, which covers the purchase of vehicles; their maintenance and repair, including servicing and parts; passenger transport services, for example, public transport and taxis; and the transport of goods, including postal and courier services. The consumption domain does not, at least not directly, consider freight transport, which is part of most supply networks, but is only indirectly linked to all consumption domains.

Box 1 Terminology

To support the interpretation of the remainder of this chapter, some terminology with regard to household consumption expenditure requires clarification.

Household consumption expenditure can be expressed in **current prices**: those indicated at a given moment in time (nominal value and show the real out-of-the pocket expenditure.

Household consumption expenditures can be expressed in **constant prices**: constant prices are corrected in real value, i.e., corrected for changes in prices in relation to a base line or reference date. Constant prices can be compared over time to show, for example, changes in **consumption volumes**, and are often expressed in chain-linked volumes.

In the next paragraphs, trends in household consumption expenditure is presented in current prices. The increases in **household consumption expenditure (in current prices)** can be explained mainly by three factors:

- **population increases**;
- increases in **consumption volumes** of goods and services, i.e., buying more articles. For environmental considerations volume is key together with shifts in what specifically constitutes that volume; and
- **increases in prices** due to inflation and consumption of (on average) more expensive articles within the different consumption domains, such as bigger and more expensive cars.

Having defined what is included in household consumption, consideration can be given to the results of the analysis.

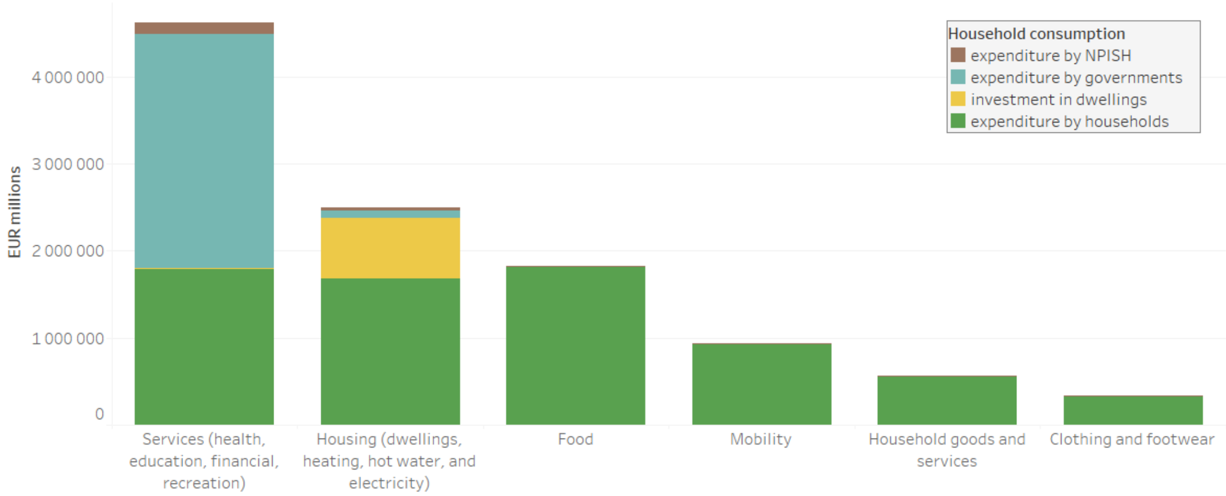
2.2. Consumption trends in Europe

Error! Reference source not found. shows European household consumption (EU27) by consumption domain, differentiating expenditure by households, governments and NPISH and investment in dwellings. As can be seen, most originates directly from household expenditure. Still, within the consumption domain of services, the provision of services by governments to households, such as healthcare, education or public parks, is greater than direct expenditure by households themselves. Also, in the housing consumption domain the impact of the investment in dwellings, i.e., the construction of houses, is an important category. The food; mobility; household goods and services; and clothing and footwear;

[4] Classification of Individual Consumption According to Purpose (COICOP). In this classification, consumption domains consist of certain product groups, but are not one-on-one related to specific material categories. For example, textiles products are included in category CPA03 'clothing and footwear' and as well in CPA05 'furnishings, household equipment and routine household maintenance'. This is a different classification as used in (EEA, 2022d), where all textiles products were grouped in one category 'textiles'.

consumption domains are mainly made up of direct expenditure by households, such as the purchase of groceries, car fuel, consumer electronics and clothing.

Figure 2-1 Total household consumption by entity, EU27, 2018, EUR millions current prices



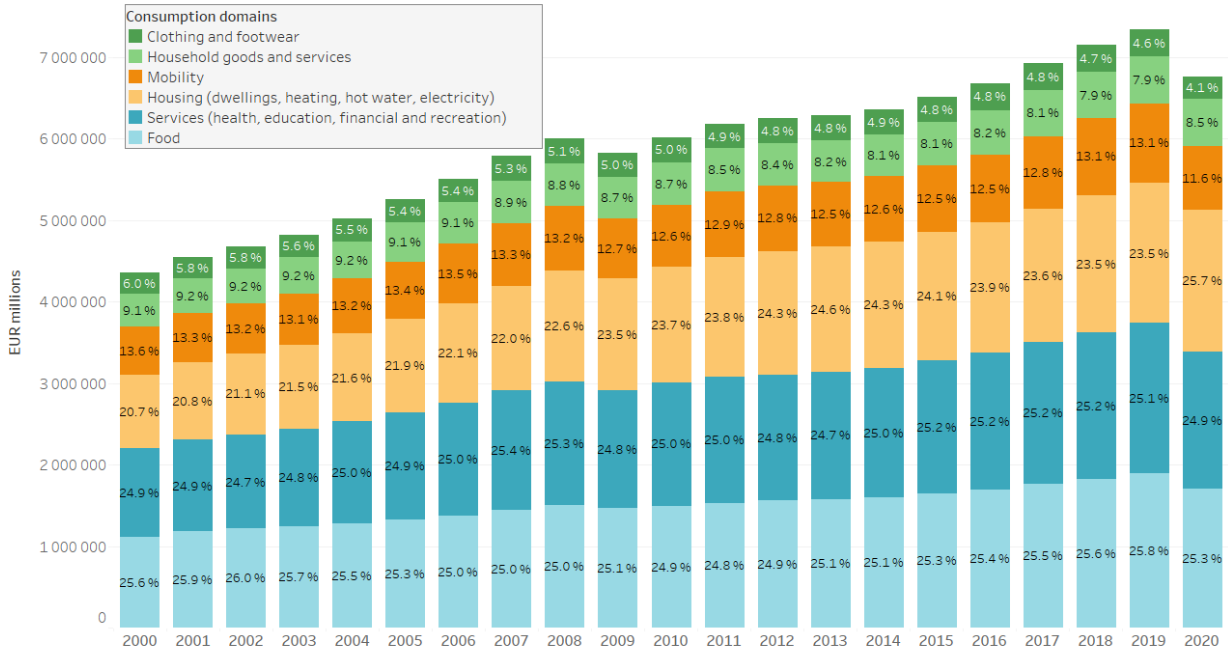
Note: 2018 data are used to avoid the slightly distorted 2020 data due to COVID-19.
Source(s): Eurostat - Final consumption expenditure of households by consumption purpose (COICOP 3-digit) [nama_10_co3_p3];
Eurostat – use table at purchasers' prices [NAIO_10_CP16_custom_3461377]; Eurostat - General government expenditure by function (COFOG) [GOV_10A_EXP_custom_3462005].

Consumption of households in Europe has changed significantly over time, both in total volume and in purchases across and within each of the consumption domains. Figure 2-1 shows trends in household consumption expenditure in the EU27 for 2000–2020.

Total EU27 **household expenditure** increased by 69 % between 2000 and 2019, from EUR 4.3 trillion ([5]) to EUR 7.3 trillion (Figure 2-2) and then dropped by 8 % between 2019 and 2020, mainly as a result of the COVID-19 pandemic (Box 2). The steady increase of total European household consumption can only to a small extent be explained by the growing European population, which increased by just 4 % in the same period. The main reason is the increase in average per-person expenditure of European households, which increased by 59 % between 2000 and 2019. Note that the graph shows current prices, meaning inflation has an important effect (see Figure 2-4).

5 Trillion = 10^{12}

Figure 2-2 Total household expenditure by consumption domain, EU27, 2000–2020, EUR millions current prices and per cent



Source: Eurostat - Final consumption expenditure of households by consumption purpose (COICOP 3-digit), EU27 [nama_10_co3_p3].

The three consumption domains responsible for about three quarters of European households' expenditure in 2019 ([6]) are food, 26 %; services, 25 %; and housing, 24 %. Each of these three consumption domains represents about a quarter of total expenditure, a share that remains fairly stable over the studied 20-year period, even with different inflation levels (explained below). The share of household expenditure on housing, however, shows a slight increase, from 21 % in 2000 to 24 % in 2019. While overall shares of each consumption domain stay relatively constant, it is important to note that many changes may have occurred within the consumption domain themselves, for example, a shift from a meat-heavy diet to more vegetable-based food consumption. These internal shifts are not visible on this aggregated level.

6 2019 is used as 2020 data is impacted by the COVID-19 pandemic.

Box 2 COVID-19 pandemic impacts on consumption

Globally, the COVID-19 pandemic has had a strong short-term effect on consumption behaviour in almost all consumption domains across Europe. Changes have been seen in habits and ways of living, such as travelling, shopping, sports, seeing and meeting friends and family, remote work, and so on. A major cause of the changes was the restrictions and stay-at-home measures imposed by governments in response to the pandemic, that acted either as a trigger or imposed a direct change. Changes have included shifts to buying from local traders and service providers, as well as a shift to digital services such as streaming.

The effect of the COVID-19 pandemic and the associated measures is also reflected in Figure 2-2. Other than for housing and household goods and services, expenditure dropped significantly. Expenditure on mobility and clothing and footwear decreased more than average, even to a level below that of 2000. Part of the expenditure on food, namely for hotels and restaurants, and for services, more specifically recreation activities such as sports and travel, decreased significantly as well.

The effects of the COVID-19 pandemic differ across various demographic factors such as age and income (Deloitte, 2020). Households with higher incomes generally showed larger changes in behaviour. The older parts of the population also changed their behaviour more often, as they faced more severe restrictions and limits to movement than the rest of the population, since they were regarded as a high-risk group. As such, they often had to avoid public places and restaurants due to higher infection risks. Shopping services and deliveries were used more. And of course the consumption of medical goods such as protective wear and face masks, also increased during the pandemic (EEA, 2021d; ETC/WMGE, 2021b).

According to the European Commission's New Consumer Agenda, the COVID-19 pandemic changed people's consumption and mobility patterns in the short term, but some may last (European Commission, 2020c). The confinement measures strengthened the use of digital technologies, which allowed the purchase of goods and services which were not accessible due to the restrictions, such as platforms for e-commerce, streaming services and remote co-working environments. Observed trends in Europe include buying more locally, booking travel less in advance and using on-line services more often. Some changes may be temporary and short term, linked to the health situation, for example, using public transport or going to the cinemas less frequently. On the other hand, use of digital technologies may become the new normal or more of a structural change for the long term, including increasing online purchases of food or accessing more online streaming services at home, including for cultural and sport events. Changed consumption patterns have led to a surge in the use of single-use packaging and plastic-based personal protection equipment and high increase of the generation of waste personal protection equipment (EEA, 2021d; ETC/WMGE, 2021b).

The following paragraphs examine the specific reasons for increases observed in the six consumption domains.

The household consumption expenditure increased between 2000 and 2019 in all domains, with a highest increase in housing expenditure, 92 %; followed by services, 70 %; food, 69 %; mobility, 62 %; household goods and services, 46 %; and clothing and footwear, 29 %. These increases, in current prices, can be explained both by an increase in consumption volumes, 26 % (Figure 2-3) and an increase in prices of 34 % (Figure 2-4). The changes in prices (Figure 2-4) are the combined effect of changes in the composition of goods and services within a consumption domain, for example, a shift from the consumption of meat to vegetables, and price changes in individual products. For the services, clothing and footwear and household goods and services domains the increase in consumption volume, respectively 43 %, 21 % and 47 % is higher than the increase in average price of products, respectively 27 %, 7 % and -19 %. This means, the consumption volume increased more than the average price per item within these domains. For the other domains, housing, food and mobility, the opposite is true. The increase in prices is greater than the increase in the consumption volume, meaning the price increase of the average item is higher than the increase, or even decrease, in the consumption volume.

The increased expenditure on **food**, up by 69 % in 2019 relative to 2000, is largely due to higher prices for goods and services within this category: prices rose by 59 % in the period, while the consumption volume was 10 % higher. The increase in prices shows both the effects of inflation and changing consumption pattern.

The largest increase is for the **housing** domain, with expenditure rising 92 % between 2000 and 2019. The two parameters that drove this are an increase in consumption volume of 24 % and prices climbing by 55 %. In other words, on average consumers bought 24 % more and the average article became 55 % more expensive. The housing domain includes, amongst other things, building maintenance and repair and general services – water, electricity, gas and other fuels. Spending on this household consumption totalled some EUR 1.7 billion in 2019. In comparison investment in new housing and major renovations, was EUR 700 billion in 2019, up from EUR 500 billion in 2000 ([7]), an increase of 40 %.

The increase in expenditure on **clothing and footwear** of 29 % is largely the result of increase in consumption volume, 21 %, rather than of increased prices of goods and services, which only rose by 7 % between 2000 and 2019.

Expenditures in the **mobility** domain rose by 62 %, the result of a 43 % increase in the price of goods and services, and a smaller one of 14 % in consumption volume ([8]). Nonetheless, this rise is considerable and larger than population growth, meaning that consumers bought more per person in 2019 than i2000. The increase in prices is, however, more pronounced. These can go up due to inflation and different taxes but also due to changes in the basket of products purchased. Within this domain, people may, for example, have bought bigger, more expensive cars with more features, and/or are driving more, and thus consuming more fuel.

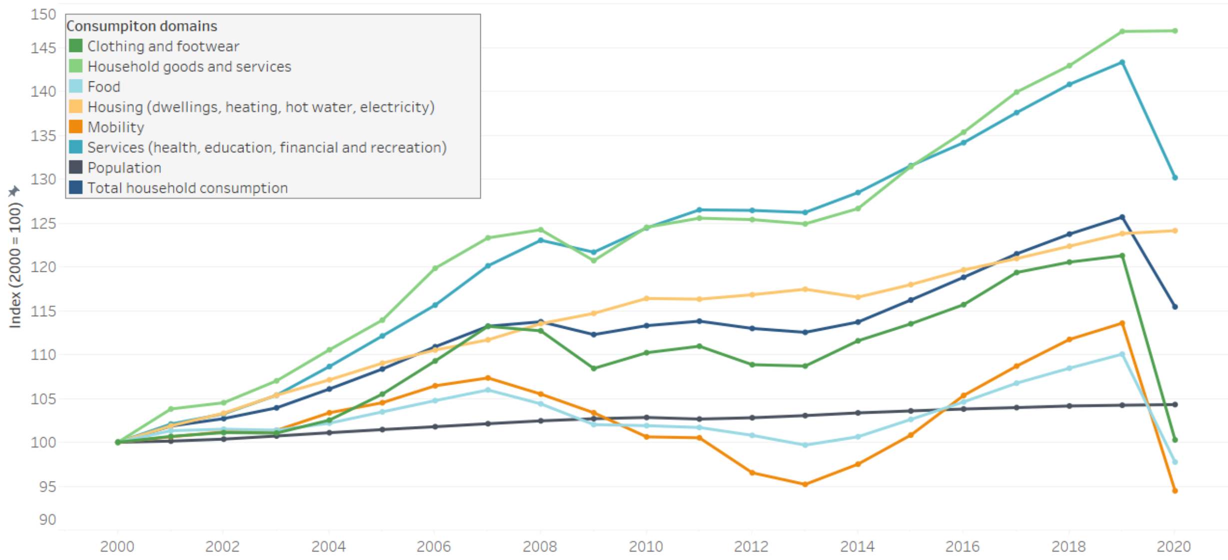
The increase in expenditure on **household goods and services** of 46 % is entirely due to an increase in the volume of consumption of 47 % as prices within this domain fell considerably, by 19 %. On average consumers bought 47 % more but the average article was 19 % cheaper.

Within the **services** domain the increase of 70 % is due to a 43 % increase in volume and a 27 % increase in prices. On average people bought 43 % more and the average was 27 % more expensive

[7] Source: Eurostat - Gross fixed capital formation by AN_F6 asset type [nama_10_an6].

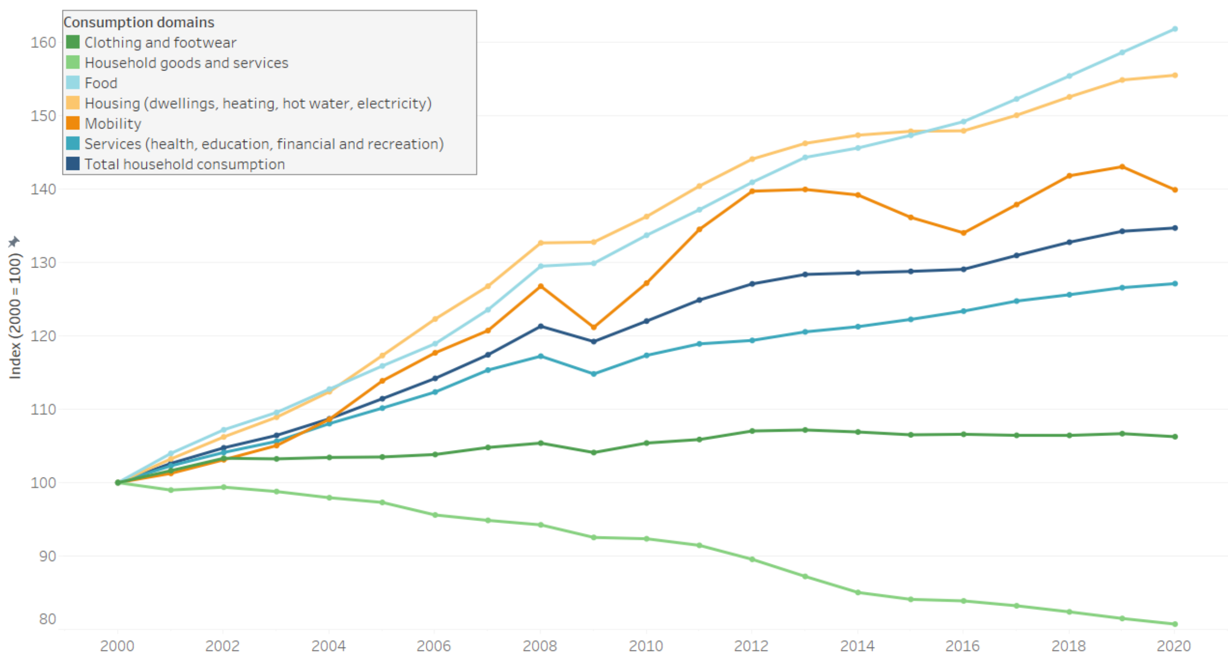
[8] Due to the different scope of **mobility** in this report, these values cannot be compared directly with other transport-related indicators that, for example, refer to passenger and freight volumes.

Figure 2-3 Consumption volumes by domain, EU27, 2000–2020, indexed chain-linked volumes[7] at constant prices (2000 = 100)



Source: Eurostat – Final consumption expenditure of households by consumption purpose (COICOP 3-digit), EU27 [nama_10_co3_p3].

Figure 2-4 Household expenditure, EU27, 2000–2020, indexed values (2000 = 100)

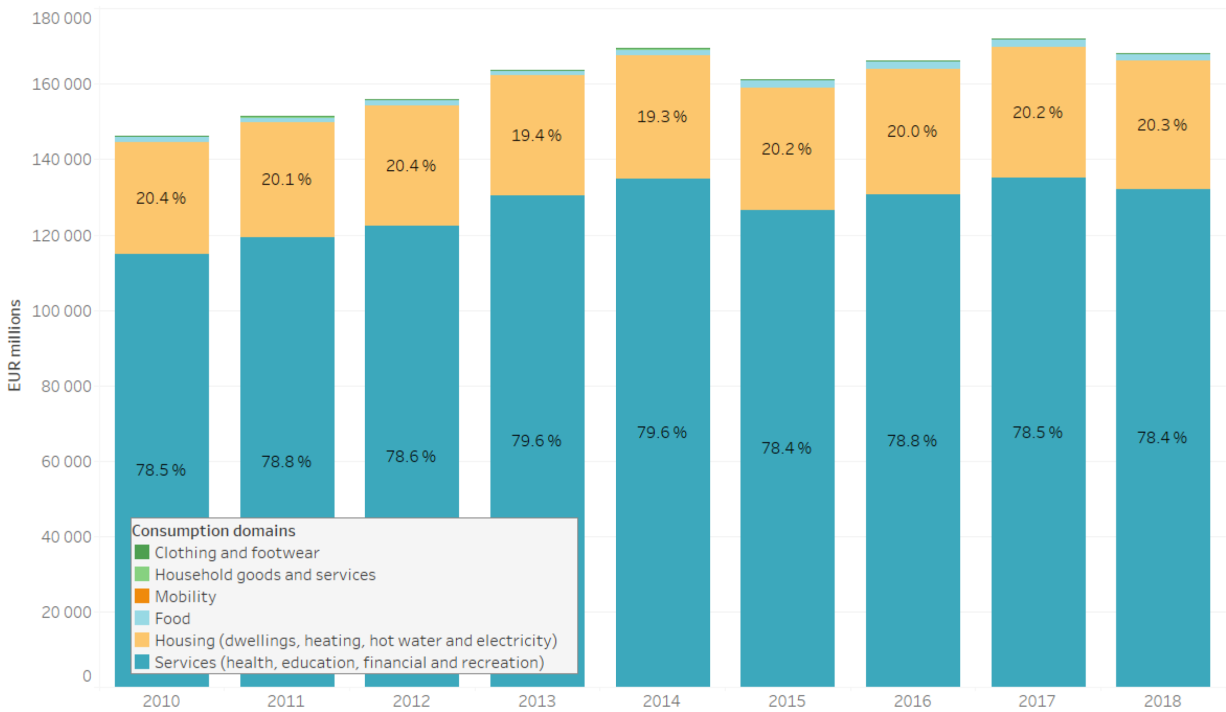


Source: Eurostat - Final consumption expenditure of households by consumption purpose (COICOP 3-digit), EU27 [nama_10_co3_p3].

7 The chain-linked volume series is a series of economic data from successive years, put in constant terms by computing the production volume for each year in the prices of the preceding year, and then chain linking the data to obtain a time series from which the effects of price changes have been removed.

Expenditure by NPISH increased slightly between 2010 and 2018 ([9]), from EUR 146 billion to EUR 168 billion (Figure 2-5). Almost 80 % of this expenditure can be attributed to the services domain, for example cultural and educational services. About 20% is connected to the housing domain.

Figure 2-5 Total expenditure by domain by non-profit institutions serving household, EU27, 2010–2018, current prices, EUR billion ([10]) and per cent



Source: Eurostat – use table at purchasers' prices [NAIO_10_CP16_custom_3461377], EU 27, however, data for Bulgaria and Malta are missing, as well as 2018 data for Austria.

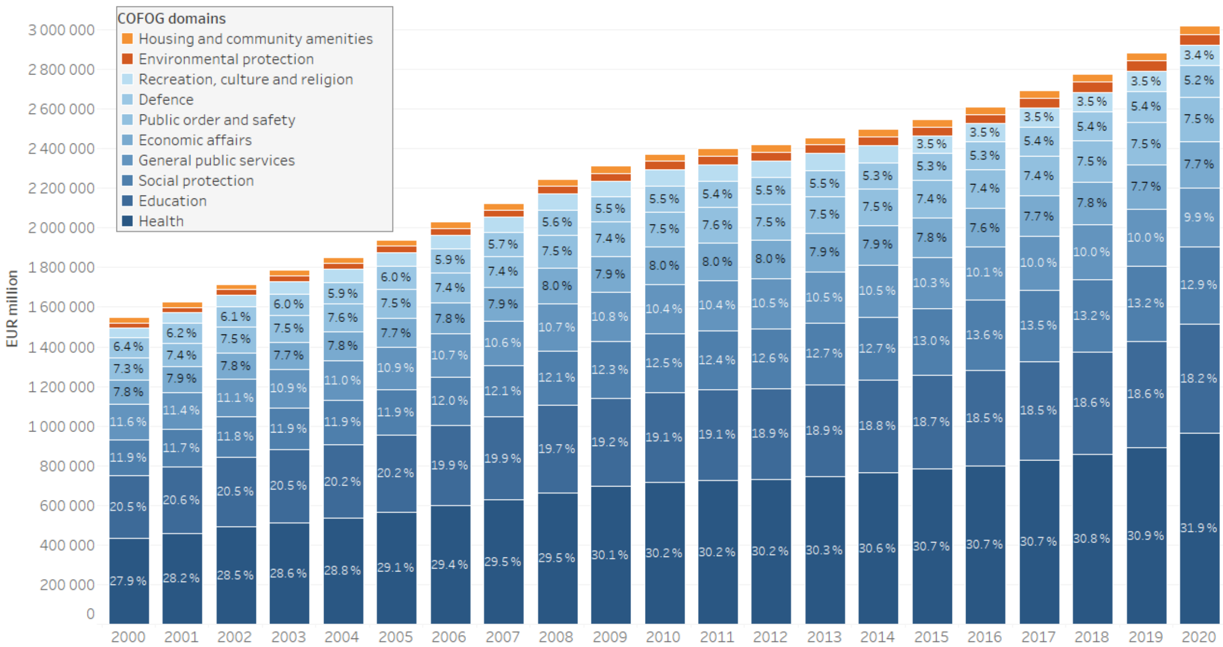
Expenditures by government is allocated to functions based on the Classification of the Functions of Government (COFOG). This is different from the consumption domains used in this report, which are based on the COICOP. Most of the functions in the COFOG are linked to the services domain, except for the COFOG housing and community amenities and environmental protection domains, for example, waste collection services, both which are attributed to housing.

Figure 2-6 shows expenditure by government function in current prices, providing more detail on what these include. In 2019, 31 % of the expenditure is related to health services and 19 % to education. Around 60 % of expenditure by governments is linked to the individual, for example, medicines and social housing, and 40 % to society as a whole, for example, defence, police and street lightning.

9 Member States data for 2019 onwards are currently incomplete

10 Billion = 10^9

Figure 2-6 Total government expenditure by Classification of the Functions of Government function, EU27, 2000–2020, current prices, EUR billion and per cent



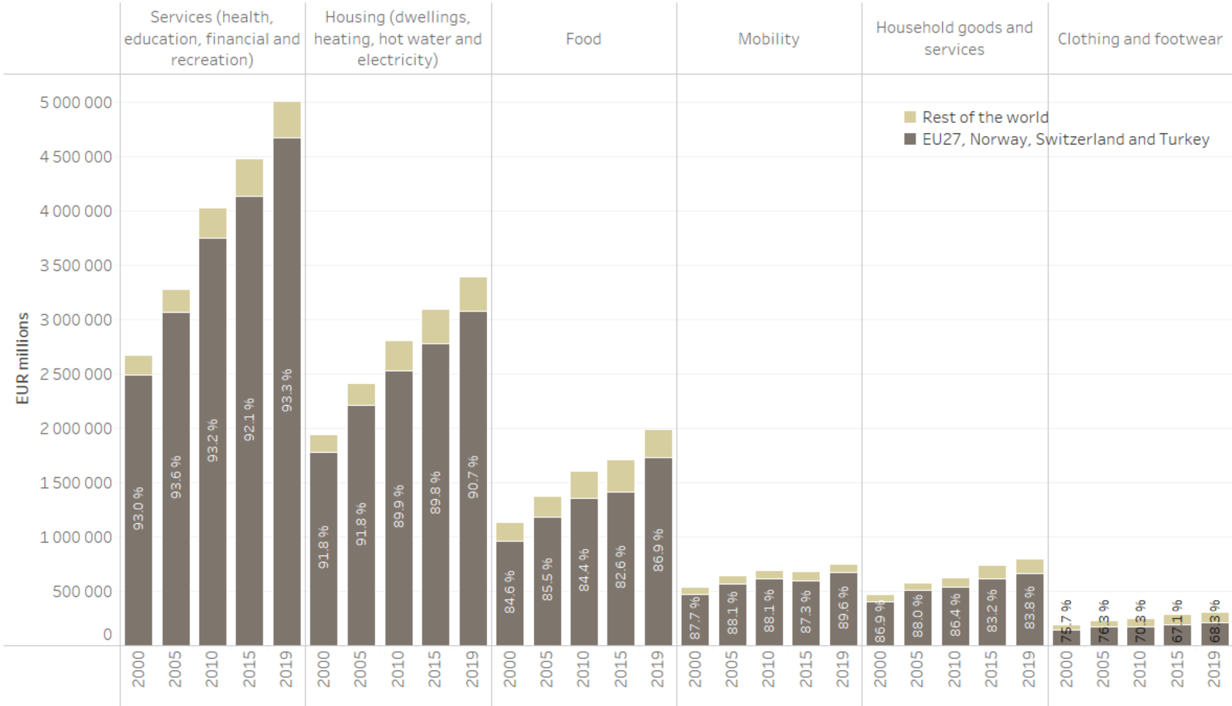
Source: Eurostat – general government expenditure by function (COFOG), EU27 [GOV_10A_EXP_custom_3462005].
Note: categories in blue are linked to the services consumption domain and the those in orange to the housing domain.

2.3. The global dimension of European consumption – trade

European consumption, and including household demand of goods and services, is highly dependent on trade with the rest of the world. Looking at the share of the value chain ([8]) located in- and outside Europe based on the value added, 7 % of production activities for services, 9 % for housing, 13 % for food, 10% mobility, and 16% for household goods and services and food, produced to meet European demand take place outside Europe. European household consumption of clothing and footwear relies even more on global value chains with 32 % of added value originating outside Europe (ETC/WMGE, 2019). Since 2000, the non-European share in terms of value added has steadily increased for all consumption domains (Figure 2-7). These are based on monetary values which are difficult to compare between regions as, for example, prices for labour vary significantly between countries, which influences the added value of sectors.

[8] Share of value added created by the different activities in the value chain. It is estimated via same method used throughout Chapter 3. See Chapter 3 and Annex 1 for more information on the calculation methodology.

Figure 2-7 Share of consumption, EU27, Norway, Switzerland plus Turkey and rest of the world, 2010-2019, value added, EUR billion and per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Europe's growing consumption has impacts beyond its borders due to goods and services being produced elsewhere before being imported (EEA, 2022e; ETC/CE, 2022). The environmental impacts of this are analysed and discussed in Chapter 3.

3 Impacts of European consumption

European consumption causes significant pressures and impacts on the environment, both within Europe itself and abroad. The overall (global) environmental pressures and impacts are captured using a footprint perspective and include pressures and impacts caused by all production and consumption activities along the entire value chain of goods and services consumed in Europe, irrespective of where they occur.

Consumption-based accounting is used as this reflects pressures and impacts associated with a population's consumption, regardless of the origin products and services. Various initiatives use consumption-based accounting to calculate the footprint of European consumption, such as the Consumption Footprint Assessment Framework of the European Commission (European Commission, 2022d) and EEA's consumption footprint indicator (EEA, 2022c).

Box 3 Methodologies

There are different approaches to calculating footprints related to consumption/consumption-based accounting:

- top-down approach, based on input-output modelling, which is used in this report;
- bottom-up approach, based on representative products, which is applied by the JRC for their Consumption Footprint platform;
- hybrid approach based on representative products for import and export flows and based on statistics for domestic data.

In this report, a top-down approach was chosen, because it starts from a macro perspective, Europe in a global context, and as such is considered to give a comprehensive picture at EU an aggregated level ([9]). The approach comes with some limitations, such as the impossibility of drawing conclusions on a product level. In the specific context of this report, comprehensiveness was more important than that level of detail. The environmentally extended multi-regional input-output (EE-MRIO) model EXIOBASE was used to allocate emissions and resource use to consumption domains.

Calculations are based on the EXIOBASE v.3.8.2 model (Stadler et al., 2021), which contains full data up to 2015 and modelled data up to 2020, as full data are not yet available. To match with the actual 2020 consumption data from Eurostat, the EXIOBASE data are adjusted according the consumption data from Eurostat. The full methodology is described in Annex 1. It is important to note that the results need to be considered as orders of magnitude and indicative trends, rather than as absolute quantities due to modelling choices and some data uncertainty. Consumption related emissions, for example, are calculated from data on production emissions combined with monetary flows for the supply, use and international trade of goods and services. Some data become available with a significant time delay, which is solved by nowcasting ([10]), for example, assuming the coefficient, for example pressure per unit of output, being constant, when possible.

The environmental pressures discussed in this report are taken directly from the EXIOBASE extension tables in terms of resource use and emissions and not converted into environmental impacts. This implies that the Environmental Footprint method of the European Commission, or any other lifecycle impact assessment method, is not used. This was done to remain consistent with previous EEA publications (EEA, 2022e, 2019; ETC/CE, 2022; ETC/WMGE, 2019; EEA, 2014a, 2005). The reason for choosing these pressures was a combination of data availability and relevance. A consequence of using EXIOBASE as the basis for the top-down approach is the lack of data for emissions to water. The pressures reported here, however, are considered the most relevant from a policy perspective and are responsible for more than 80 % of EEA's consumption footprint indicator (Europe's consumption footprint indicator, 2022).

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9 This report does not aim to compare individual countries, instead it focuses on Europe as a whole.

10 Nowcasting is a way of calculating results for recent years, based on a limited/incomplete set of data.

In the following paragraphs the footprint of European household consumption is assessed and discussed for several environmental pressures, namely material use, air emissions, greenhouse gas emissions (climate change), and water and land use.

3.1. Footprint of European consumption

As previously explained, footprints are calculated from a consumption-based accounting perspective. This means that the yearly consumption of European households, following the scope as discussed in Chapter 2, is taken as a starting point and environmental pressures are included for all upstream activities related to that consumption. Household consumption is again split in the six consumption domains to assess their relative contributions and to identify the most important contributors to different environmental pressures. This type of assessment, focusing on specific consumption domains, has already been used in previous studies, such as the textiles reports published by the EEA (EEA, 2022e, 2019; ETC/CE, 2022; ETC/WMGE, 2019), and the Consumption Footprint studies published by the European Commission and JRC (Reale et al., 2019; Castellani et al., 2019, 2017a, 2017b; Baldassarri et al., 2017).

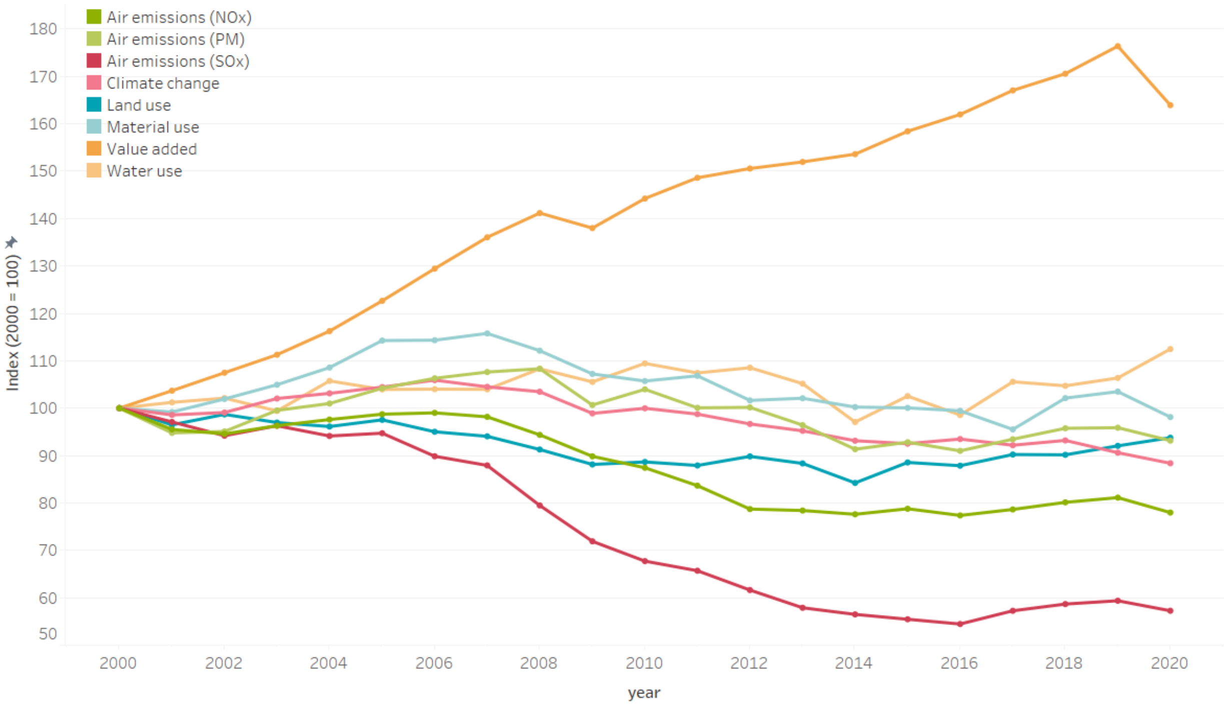
This report compares its results with those of the JRC's Consumption Footprint studies, that use a different footprint calculation methodology (European Commission, 2022d, 2021).

In contrast to the increasing consumption volumes and expenditure reported in Figure 2-3, Figure 3-1 shows that for most environmental pressures induced by European household consumption follow a fluctuating, but overall downward trend between 2000 and 2019/2020, the only exceptions being water and material use. Value added ([11]) has increased over the same period.

This means that decoupling seems to be have been achieved as environmental pressures either grow at a slower rate than the economic activity that is causing it, relative decoupling or decline while economic activity grows, absolute decoupling. The reduction starts from 2007 for most pressures, while before 2007 they steadily rose or remained stable. For most pressures, the largest reduction happened between 2007 and 2012, and after which they slow. Others, however, such as nitrogen oxide (NO_X) emissions, material use and land use, remain stable or even increase slightly after 2012. The fact that the reductions occur despite an increase in overall consumption levels implies that the environmental pressure per unit of production of goods and services consumed by European households has fallen. Nevertheless, the scale and rate of decoupling is too small if we are to reach the level at which we can operate and consume within the limits of our planet (Figure 4-1 in Chapter 4).

[11] Value added is a measure for household consumption expenditure as every euro spent on a product by final consumption equals one euro of summed value added across the globally dispersed production network.

Figure 3-1 Environmental pressures of household consumption, EU27, Norway, Switzerland and Turkey, 2000– 2020, value added at current prices indexed (2000 = 100)



Note: NO_X nitrogen oxides; PM particulate matter; SO_X sulphur oxides

Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

For most consumption domains, the majority of environmental pressures occur within Europe, although the share occurring outside Europe is also significant. While almost 90 % of added value is created in Europe (Figure 2-7), 50–60 % of the environmental pressures in terms of water, material and land use and around 70 % of greenhouse gas and other air emissions occur in Europe. This illustrates that it is especially the low-value and high-pressure activities that are taking place outside Europe. These shares remained constant between 2000 and 2020, meaning that the overall reduction of environmental pressure is happening both within and outside Europe.

There are large differences in the environmental pressures exerted by the consumption domains. This is further explained in the following sections, in which each environmental pressure is discussed in more detail.

Material use

The material use of consumption in Europe as defined in this report corresponds to the material footprint and includes all types of primary materials used in production, , such as fossil fuels, chemicals, fertilizers, minerals and metals and all building materials used for the construction of dwellings, irrespective of whether those activities taking place in or outside Europe. Materials required for transport and retail are also included. Recycled materials are not included. The material use impact is solely based on the weight of the extracted materials.

To produce all goods and services purchased by EU households in 2020, an estimated total of 6.1 billion tonnes of raw materials were used. As results for 2020 were influenced by consumption behaviour during the Covid-pandemic, the results for 2019 are relevant to mention as well, when an estimated 6.5 billion tonnes of raw materials were used, amounting to 14.5 tonnes per person.

Material use increased between 2000 and 2007. From 2008 onwards – following the economic downturn – and a slight decrease is observed, with small fluctuations between 2017 and 2020. Compared to 2000, material use linked to European household consumption was about 4 % higher in 2019, while in 2020 a reduction of 2 % compared to 2000 can be observed. So, although European households spent 69 % more money in 2019 relative to 2000, the related material use rose only slightly. It will be interesting to monitor how this trend will evolve in the coming years.

According to 2019 data, roughly 41 % of the material footprint is attributable to housing, 26 % to food and 20 % to services The contribution of the other consumption domains is much lower and roughly at the same level, around 4–6 %, throughout 2000–2019 (Figure 3-2).

Between 2000 and 2019, an overall reduction in material use is seen for housing and mobility. Material use related to services and clothing and footwear, however, is increased, while the material use for food and household goods and services remained more or less stable.

The material use of **housing** is mainly caused by the minerals and metals used for the construction of dwellings and by the, mainly fossil, materials used for the generation of energy for heating, lighting, etc.

The fairly constant material use related to **food** is largely due to the consumption of biomass and the resources needed to produce food such as fertilisers and energy.

The rather significant material use of **services** is due to the aggregation of different consumption domains in one. Half of the impact comes from material use related to government expenditure required to provide health, educational and other services to households.

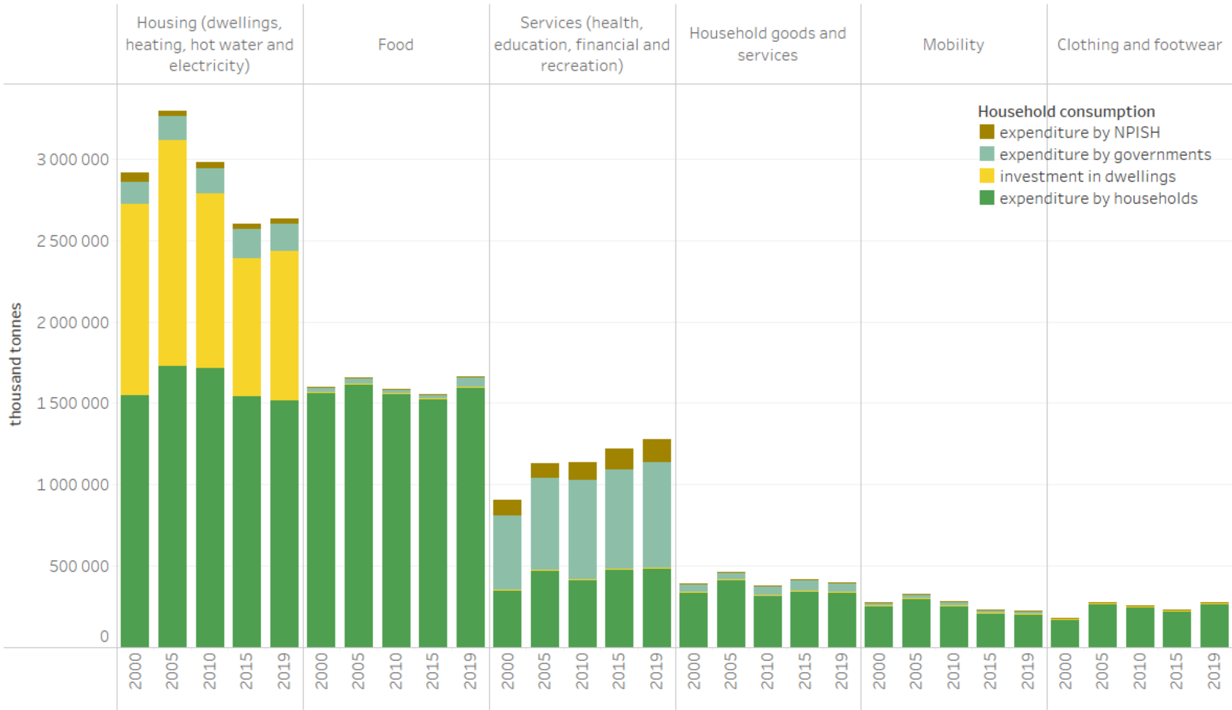
The material use for **mobility ([12])** purposes includes materials such as metals for producing cars and buses, including such components as batteries, and fossil fuels for driving. Materials required for the construction of roads and railways are not taken into account.

Material use for **household goods and services** relates mainly to metals and fossil fuels use in the manufacture of plastics and as energy for production processes and transportation. The trend for material use linked to household goods and services has remained more or less stable over time.

Material used **clothing and footwear** includes all types of materials used for these products, such as biomass – cotton, wool, etc.; fossil resources for synthetic fibres – polyester, etc.; and as energy for production and transportation. The trend in material use for clothing and footwear is increasing.

12 The relative importance of mobility seems lower than expected as, in comparable studies, mobility shows up as one of the three most important consumption domains. This is, however, a consequence of grouping the consumption domains in six instead of twelve categories, through which mobility is kept as an individual consumption domain and the others are aggregated.

Figure 3-2 Raw material use of household consumption by consumption domain and expenditure categories, EU27, Norway, Switzerland and Turkey, 2000–2019, thousand tonnes

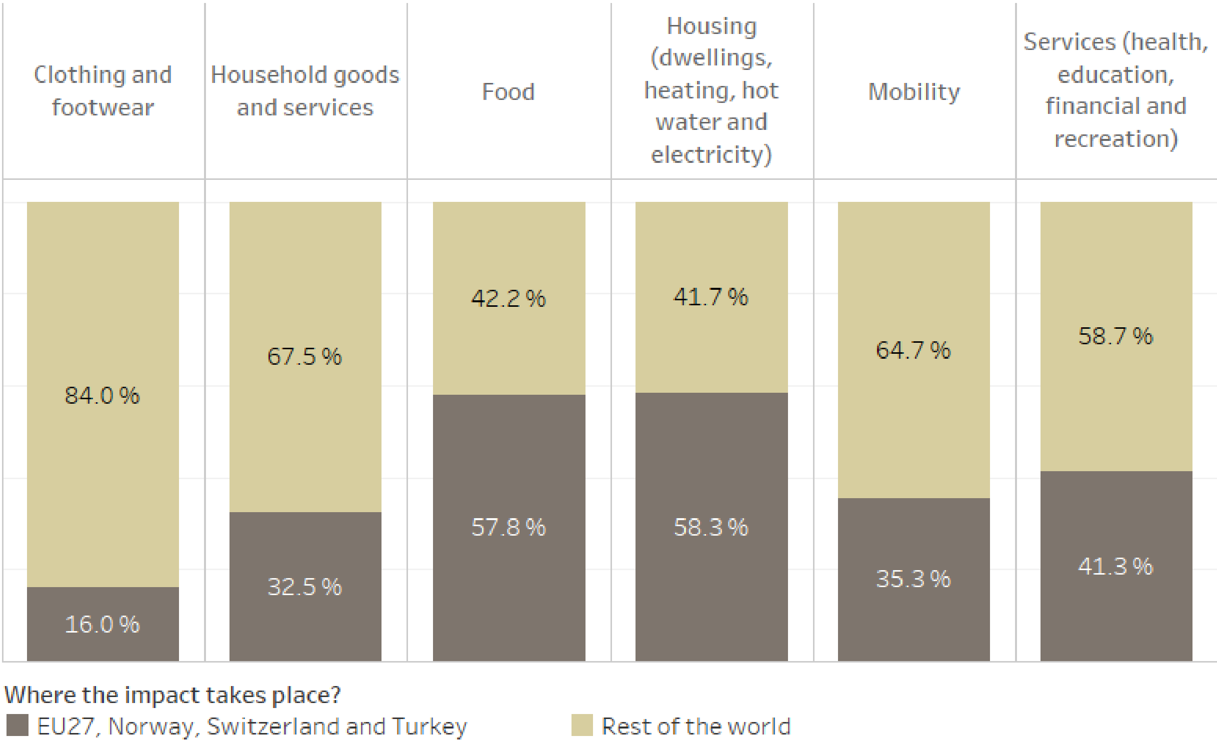


Note: Values represent yearly pressure for respective year

Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Overall, 50 % of these primary materials are produced or extracted in Europe, showing the global nature of value chains and the high dependency of European consumption on imports. Consumption domains which rely relatively more on primary materials produced or extracted outside Europe are clothing and footwear, 84 %; household goods and services, 67 %; mobility, 65 %; and services, 59 % (Figure 3-3). Materials frequently used for these purposes, such as cotton and leather for clothing and footwear but also metals used in electronic appliances and cars, are typically cultivated or mined outside of Europe. Furthermore, a large part of the fossil resources used for material, plastics used in different types of household goods and services, synthetic fibres for clothing, or energy purposes, European production of clothing and footwear and household goods and services, are imported to Europe. On the other hand, materials used for the construction of dwellings are mainly bulky and heavy materials, which are often more locally sourced to avoid costly transportation.

Figure 3-3 Share of material use in household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Box 4 Comparing material use results with the EU-JRC Consumption Footprint

The conclusions based on the material use pressure indicator are in accordance with the conclusions following from the assessments based on the EU-JRC Consumption Footprint focusing on the resource use impact indicators. The EU-JRC Consumption Footprint shows a reduction of 2 % in mineral and metals resource use between 2010 and 2018. For fossil resources, there is a 1 % increase is shown.

It is important to point out that the EU-JRC Consumption Footprint is not only based on the weight of materials used, but also on their scarcity. When including the scarcity of materials, other consumption domains are identified as the major contributors. While housing is the most important consumption domain when looking at mass flows, housing contributes only for 5 % to minerals and metals resource use, taking into account material scarcity. This can be explained by the fact that housing mainly requires abundantly available minerals, such as sand, clay and cement. Appliances, part of the household goods and services consumption domain in this report, and mobility are responsible for, respectively, 51 % 26 % of minerals and metals resource use due to the use of scarce metals and minerals in these products. Looking at fossils resource use, housing is the most important consumption domain, 37 %, followed by mobility, 26%, due to the importance of fossil fuels for energy purposes in both domains.

Source: EC-JRC Consumption Footprint Platform (2022c)

The material footprint as discussed here only encompasses primary materials. When more recycled materials are used in an economy, this positively affects the material footprint as fewer primary materials are required to produce the goods and services consumed by European households.

The Circular Material Use Rate (CMUR) indicator gives an idea of the use of recycled materials in an economy, as it represents the circularity of an economy and refers to the share of the total amount of material used that is accounted for by recycled waste. This indicator is published annually by Eurostat and the EEA (EEA, 2022a). Even though the total CMUR in the EU increased from 10.8 % in 2010 to 12.8 % in 2020, it is still considered to be low. The CMUR is highest for metals, 25.3 %, and the lowest for fossil energy materials, 3.2 %, which is logical given the nature of both type of materials.

Emissions to air

The production of goods and services for European household consumption causes different types of emissions to air. The assessment in this report includes emissions of nitrogen oxides (NO_X), sulfur oxides (SO_X) and particulate matter (PM) ([13]), which are allocated to the six consumption domains as presented in Figures 3-4 to 3-6.

To produce all the goods and services purchased by European households in 2020, an estimated 12.1 million tonnes of NO_X, 9.0 million tonnes of SO_X and 4.7 million tonnes of PM were emitted worldwide. In 2019, this was a bit higher – 12.6, 9.3 and 4.8 million tonnes respectively, equivalent to 28, 21 and 11 kilograms (kg) per person respectively. All three types of emissions fell between 2000 and 2020 – the emissions reductions of NO_X, more than 20 %, and SO_X, more than 40 %, were very significant, while PM emissions decreased by just 7 %.

The reduction of **NO_X emissions** occurred in almost all consumption domains. The highest reduction is achieved in mobility, 34 % between 2000 and 2019, mainly due to a reduction in direct NO_X emissions from vehicles' tailpipes, which account for 60 % of NO_X emissions related to mobility ([14]).

Emissions of NOx related to housing, food and clothing and footwear decreased 16–19 % between 2000 and 2019. These emissions typically occur during the combustion of fossil fuels and thus the reduction is mainly related to improvements in combustion processes.

Additionally, direct NO_X emissions from chimneys, responsible for 13 % of NO_X emissions related to housing, fell by 40 % between 2000 and 2019, relatively more than the emissions occurring in the production chain. One reason for this was improved combustion technologies and a fuel switch. Emissions from the production of electricity used for heating and lighting are allocated to housing, and here, too, significant improvements in technology and fuel mixes occurred.

The NO_X emissions related to investments in dwellings, 17 % of the emissions linked to housing, are indirect ones that occur during the production of construction materials and during the construction works.

Because of the importance of housing (31%), mobility (21%) and food (20%) in the total NO_X emissions induced by EU household consumption, improvements in the production network and technologies in these domains have a significant effect on the total.

[13] PM emissions include both emissions of PM_{10}, particles with a diameter of 10 microns or less, and $PM_{2.5}$, particles with a diameter of 2,5 microns or less.

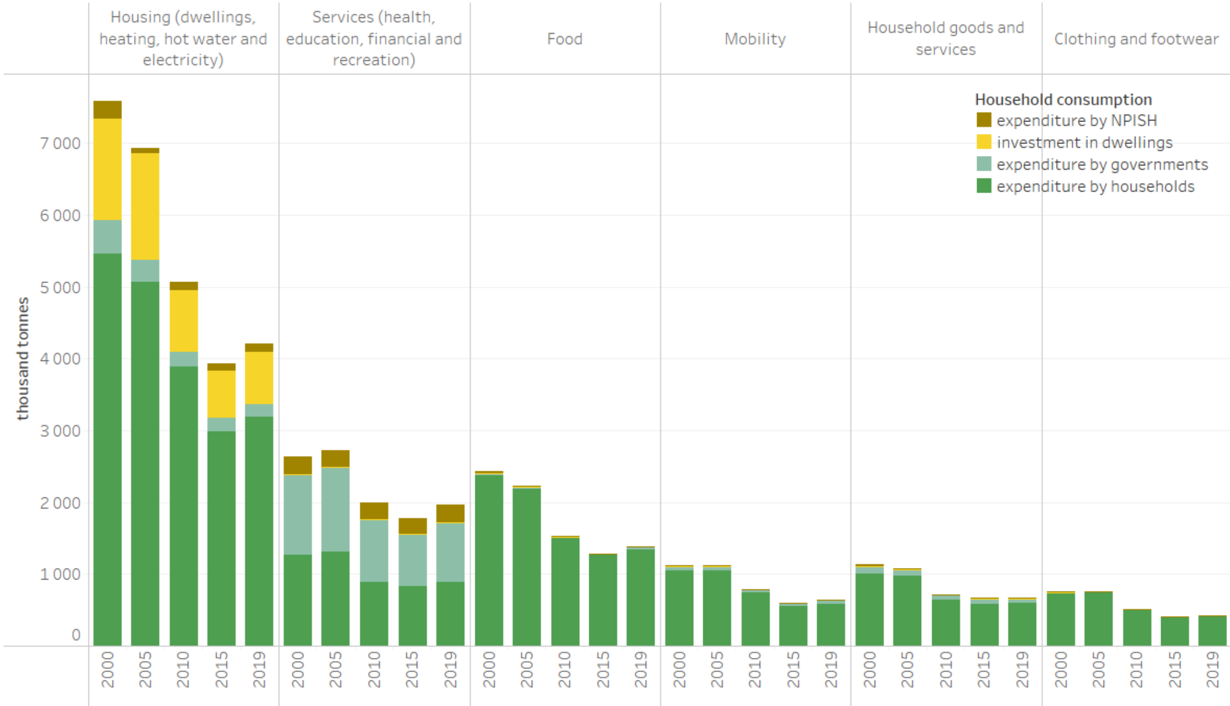
[14] Due to the different scope of mobility in this report, these values cannot be directly compared to other air quality indicators that refer to transport.

Figure 3-4 Footprint of nitrogen oxides emissions to air from household consumption by expenditure category, EU27, Norway, Switzerland and Turkey, 2000–2019, thousand tonnes

Note: Values represent yearly pressure for respective year.
Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Emissions of **sulfur oxides (SO_X)** related to European household consumption fell by more than 40 % between 2000 and 2019. As for the NO_X emissions, a reduction of 41–45 % occurred across all consumption domains, except for mobility, for which the reduction was 25 %. One of the reasons for the reduction of SO_X emissions was a fuel switch in energy-related sectors. Because SO_X emissions related to housing, 45 %, were far more important than for any other consumption domain, its reduction contributes greatly to the overall reduction. In 2019 services accounted for 21 % of the SO_X emissions, food for 15 % and the shares for mobility, household goods and services, and clothing and footwear were only 5–7 % each.

Figure 3-5 Footprint of sulphur oxides emissions to air from household consumption by expenditure category, EU27, Norway, Switzerland and Turkey, 2000–2019, thousand tonnes.

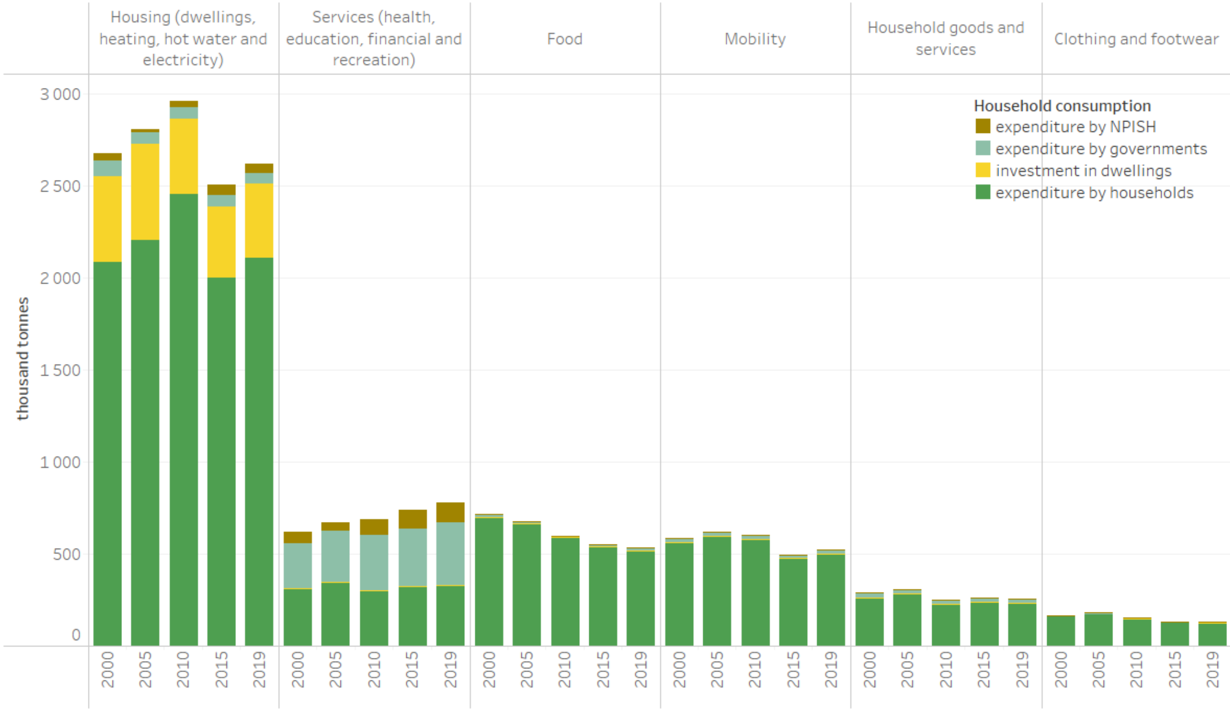


Note: Values represent yearly pressure for respective year
Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

In 2019, 54 % of emissions of **particulate matter (PM)** caused by European household consumption were related to housing. More than half of these emissions were directly released from chimneys for domestic heating. Services contribute 16 %; food 11 %, mobility 11 %, of which half were tailpipe emissions from vehicles ([15]), household goods and services 5 % and clothing and footwear 3 %. Between 2000 and 2019, PM emissions caused by European household consumption have decreased across all domains except services.

15 Due to the different scope of mobility in this report, these values cannot be directly compared to other air quality indicators that refer to transport.

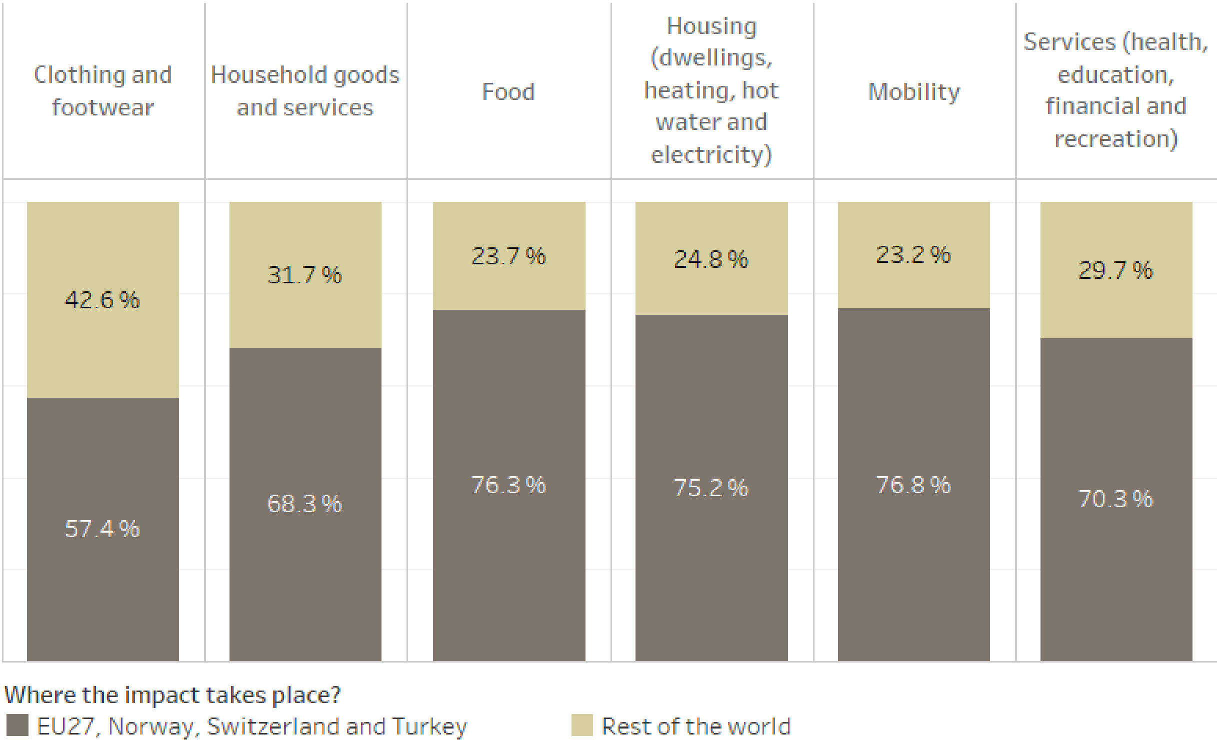
Figure 3-6 Footprint of particulate matter emissions to from household consumption by expenditure category, EU27, Norway, Switzerland and Turkey, 2000–2019, thousand tonnes



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).
Note: Values represent yearly pressure for respective year

Figure 3-7 shows that, on average, 77 % of the **NO_X emissions** caused by EU household consumption occurred in Europe, but differences exist between consumption domains. For clothing and footwear, 57 % of NO_X emissions were released in Europe, for household goods and services and services this share was 70 %, for food and housing 76–78 %, and for mobility 90 %. The large share of emissions released in Europe for housing and mobility is due to the fact that these are mainly direct emissions.

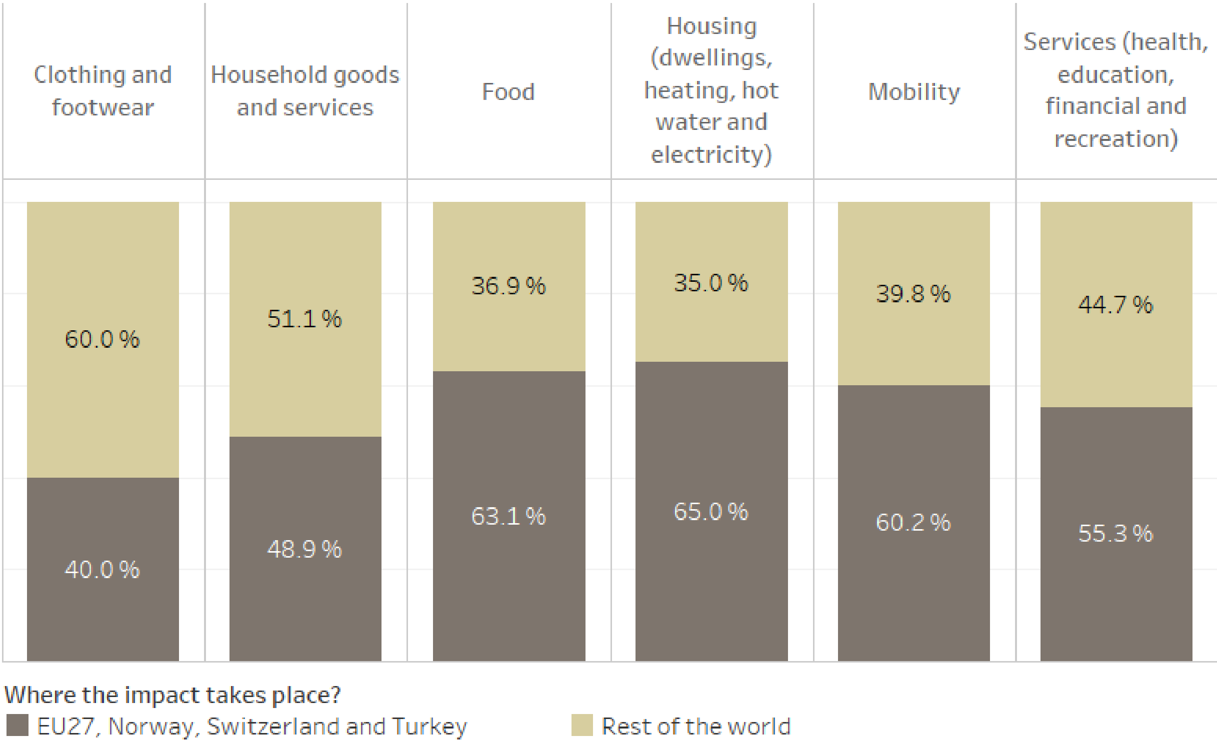
Figure 3-7 Share of nitrogen oxides emissions resulting from household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

The share of **SO_X emissions** that occur in Europe was on average 60 %. The share for food and mobility was 60 % in each domain, for housing it was relatively more at 70 %, while for services it was 55 %, household goods and services 50 %, and clothing and footwear 40 % (Figure 3-8).

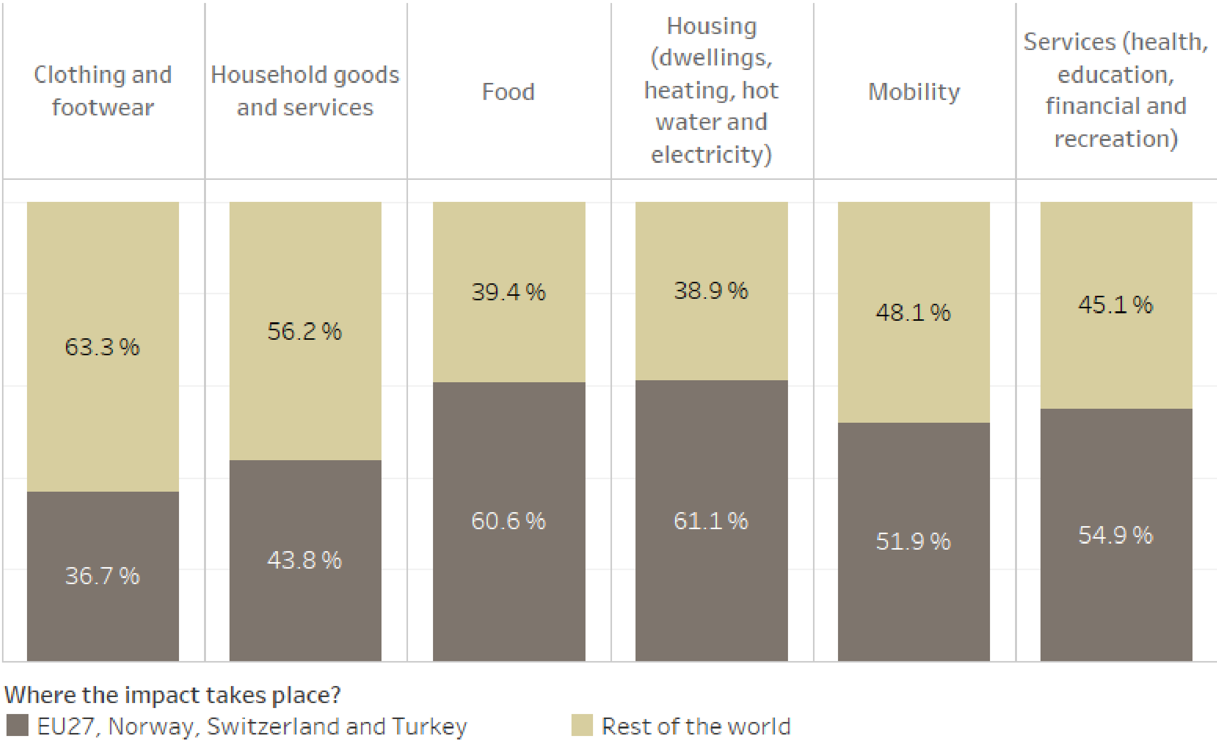
Figure 3-8 Share of sulphur oxides emissions from household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Seventy per cent of **particulate matter** emissions were released in Europe, with differences between consumption domains. Only 37% of the PM emissions related to clothing and footwear occur in Europe, 44 % for household goods and services and 55 % for services (Figure 3-9).

Figure 3-9 Share of PM emissions from household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Box 5 Comparing emissions to air results with the EU-JRC Consumption Footprint

Comparing these conclusions with assessments based on the EU-JRC Consumption Footprint is not straightforward, as the EU-JRC Consumption Footprint provides an assessment in terms of environmental impact and does not focus only on these three types of emissions. Nitrogen oxides and SO_X emissions contribute to acidification, photochemical ozone formation, PM and eutrophication. Other emissions, however, are relevant to these environmental impacts as well. Photochemical ozone formation seems more representative for NO_X and SO_X than acidification, as the latter is largely affected by other agricultural emissions. Nonetheless, other emissions, such as non-methane volatile organic compounds (NMVOC), also contribute to photochemical ozone formation. Particulate matter is defined as a specific environmental impact category, to which NO_X and SO_X also contribute. Of the emissions reported here, only NO_X contribute to eutrophication.

The consumption footprint for PM shows an increasing trend, and thus does not confirm the trend of the PM emission footprint discussed in this report. The photochemical ozone formation impact of European household consumption decreased slightly, but much less than the trend as discussed in this report. Eutrophication increases – only a small amount for freshwater eutrophication but significantly for marine and terrestrial eutrophication – according to the calculations in the Consumption Footprint Platform and as such is different from the results for NO_X emissions in this report.

Mobility at 31 %, food 26 % and housing 23 % are the most important consumption domains for photochemical ozone formation. This corresponds to the conclusions reported here, although the order of importance is different. Eutrophication is dominated by the food domain, responsible for more than 80 % of marine and terrestrial eutrophication, and to a lesser extent by housing and household goods for freshwater eutrophication. This is different from the hot spots for NO_X emissions in this report, which again emphasises the importance of taking all relevant emissions into account when calculation impacts.
Source: EC-JRC Consumption Footprint Platform (2022c)

Greenhouse gas emissions (climate change)

In 2020, the production of goods and services consumed by European households generated total greenhouse gas emissions of 4.9 billion tonnes of carbon dioxide equivalent (CO_2-eq). As results for 2020 were affected by changes in consumption during the Covid-pandemic, 2019 emissions of 5.0 billion tonnes CO_2-eq., equivalent to 11 tonnes CO_2-eq. per person should be taken into consideration. Looking at the trend between 2000 and 2020 (Figure 3-1), a decrease in greenhouse gas emissions from 2006 onwards can be observed, while consumption levels increased. Compared to the level in 2000, greenhouse gas emissions were 9 % lower in 2019 and 12 % lower in 2020, and this despite a 69 % increase in household consumption expenditure.

Housing is responsible for the largest volume of greenhouse gas emissions among household consumption domains, contributing 40 % of the total greenhouse gas emissions in 2019. These emissions are mainly caused by energy consumption for heating, hot water and lighting. Of these, 17 % are direct emissions released by fuel combustion for heating. Greenhouse gasses are also emitted during the production of construction materials and the construction of dwellings and, to a lesser extent, by government activities related to housing. The greenhouse gas emissions related to housing reduced by 13 % between 2000 and 2019. The direct greenhouse gas emissions showed an even larger reduction of 25 % in same period (Figure 3-10). Improvements in technology and fuel switching ([16]) contributed to this reduction – for example, policies encouraging insulation, increased efficiency of heating/cooling systems and increased use of solar panels.

Food, the second highest consumption domain, contributes 22 % to total greenhouse gas emissions induced by European household consumption. Contrary to housing, no significant reduction occurred between 2000 and 2019 – just a 4 % reduction. Animal products such as meat, milk, cheese and eggs account for 40 % food related greenhouse gas emissions. Other food products, including cooked meals, contribute for almost 25 % and beverages, alcoholic and non-alcoholic drinks are responsible for nearly 10 %. Hotels and restaurants contributed 13 % in 2019, but this dropped in 2020 due to the Covid pandemic.

The greenhouse gas emissions related to services are responsible for 17 % of total greenhouse gas emissions. Almost half of these are caused by government expenditure and mainly related to services such as health and education. The remainder come from household activities related to health service as well as recreation and culture. Between 2000 and 2019 greenhouse gas emissions caused by services increased by 9 %.

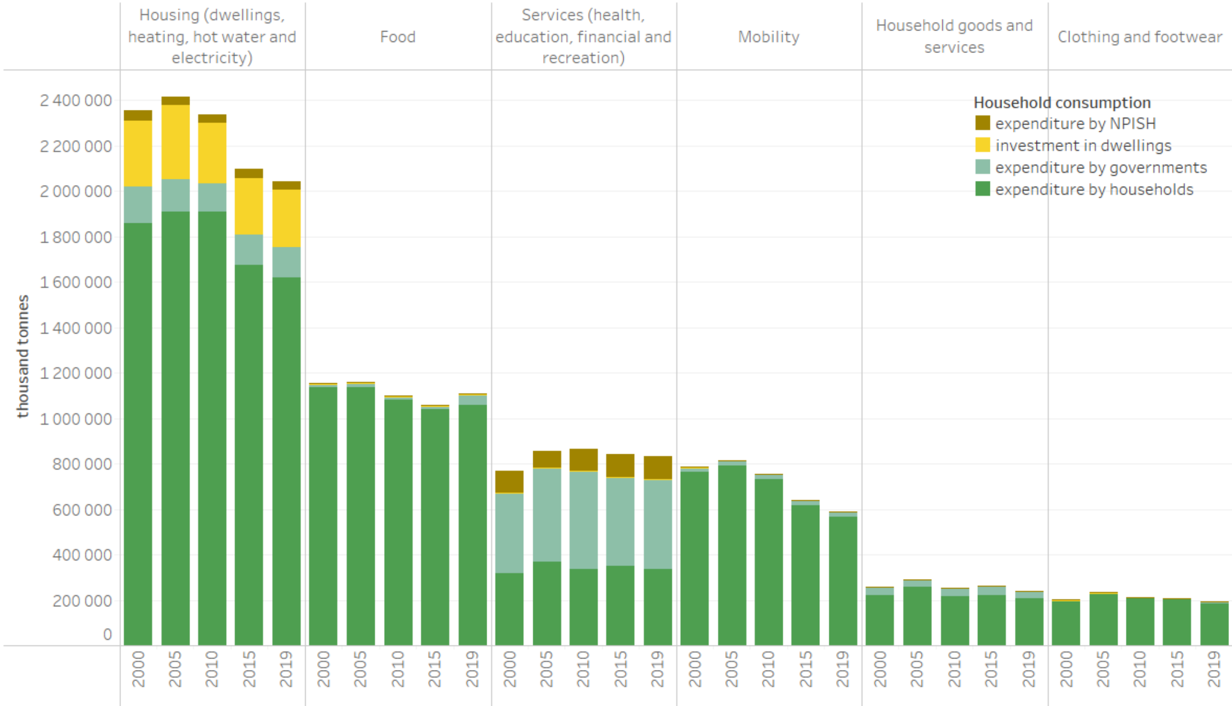
Greenhouse gas emissions related to mobility fell by 25% between 2000 and 2019 and accounted for 12 % of the greenhouse gas emissions from European households. Of these, 63 % are directly emitted when driving cars – these direct emissions also fell by 25% in the same period ([17]). More efficient vehicle technology and technology switches such as to electric and hybrid vehicles contribute to this emission reduction.

Household goods and services and clothing and footwear are each responsible for 5 respectively 4 % of these greenhouse gas emissions, with both contributions falling between 2000 and 2019 by 8 % and 4 % respectively. The impact of household goods and services is dominated by such furnishings as household textiles and carpets, and multimedia products, while the contribution of clothing is double of that of footwear.

[16] Confirmed by Eurostat Energy Balance data

[17] Due to the different scope of mobility in this report, these values cannot be directly compared with other inventory indicators of greenhouse gases from transport.

Figure 3-10 Climate impacts of household consumption by expenditure category, EU27, Norway, Switzerland and Turkey, 2000–2019, million tonnes of carbon dioxide equivalent ([18])



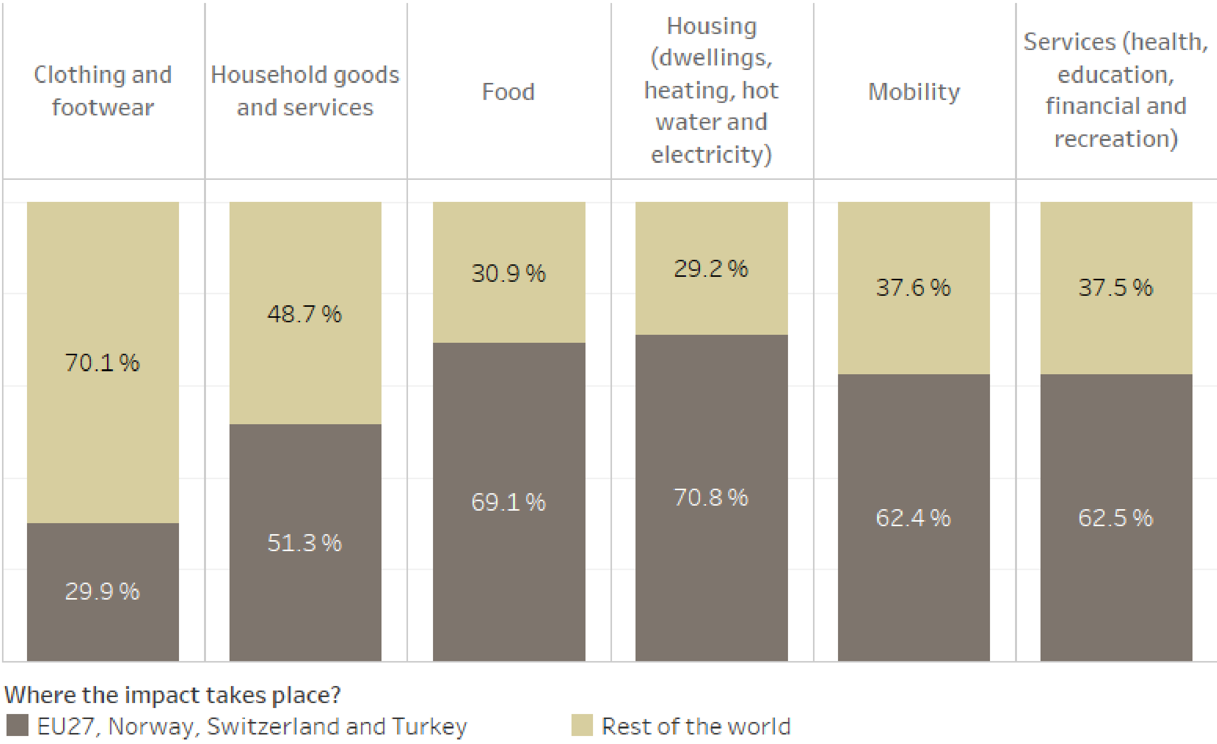
Note: Values represent yearly pressure for respective year
Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

About 30 % of the greenhouse gas emissions related to European household consumption are estimated to be released outside Europe. There are, however, huge differences between consumption domains. While the shares of greenhouse gas emissions which occur outside Europe caused by mobility, 14 %, and housing, 24 %, are quite low, the share of clothing and footwear is 70 % and household goods and services 50 % ([19]) (Figure 3-11). The direct emissions due to fuel combustion in the housing and mobility domains obviously take place in Europe. The fact that production chains for clothing and footwear and household goods and services are more globally dispersed explains the high non-European share of emissions from these consumption domains. This illustrates the dependence of Europe on imports from abroad and the accompanying greenhouse gas emissions released there.

18 Due to the different scope of the consumption domain Clothing and Footwear compared to the EEA's *Textiles and the environment: the role of design in Europe's circular economy* report (EEA, 2022e) and the aggregation of other consumption domains such as Services, the ranking is slightly different. Nevertheless, the conclusions from the textiles report are confirmed.

19 Data refer to 2019 but remain stable over the period 2000-2019.

Figure 3-11 Share of climate change impacts of household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Box 6 Comparing greenhouse gas emissions with the EU-JRC Consumption Footprint

For greenhouse gas emissions a more straightforward comparison with the results of the EU-JRC Consumption Footprint is possible as both methods express the impact in the same unit (billion tonnes CO_2-eq.). The differences between the top-down method applied in this report and the bottom-up method applied by the EU-JRC remain, as well as the related difference in scope.

The order of magnitude of the carbon footprint of EU household consumption as determined by EU-JRC is comparable to the one calculated in this report: 4.1 and 4.9 billion tonnes CO_2-eq, respectively. The difference can partly be explained by the more extensive scope of the top-down approach used in this report. There is, however, a difference in the trend of the greenhouse gas emissions. Where the top-down approach shows a reduction between 2010 and 2020, the EU-JRC Consumption footprint shows an increase in greenhouse gas emissions related to household consumption in Europe. The EU-JRC results show that food, 40 % in 2020, is the largest contributor to climate impacts, followed by housing, 24 %, and mobility, 20 %. Food is also responsible for the increase in the greenhouse gas emissions, emissions related to the other consumption domains either decreased (housing) or remained stable (household goods and appliances). The impact of mobility increased slightly between 2010 and 2019 but fell in 2020, probably because of the Covid pandemic.

Source: EC-JRC Consumption Footprint Platform (2022c)

Water use

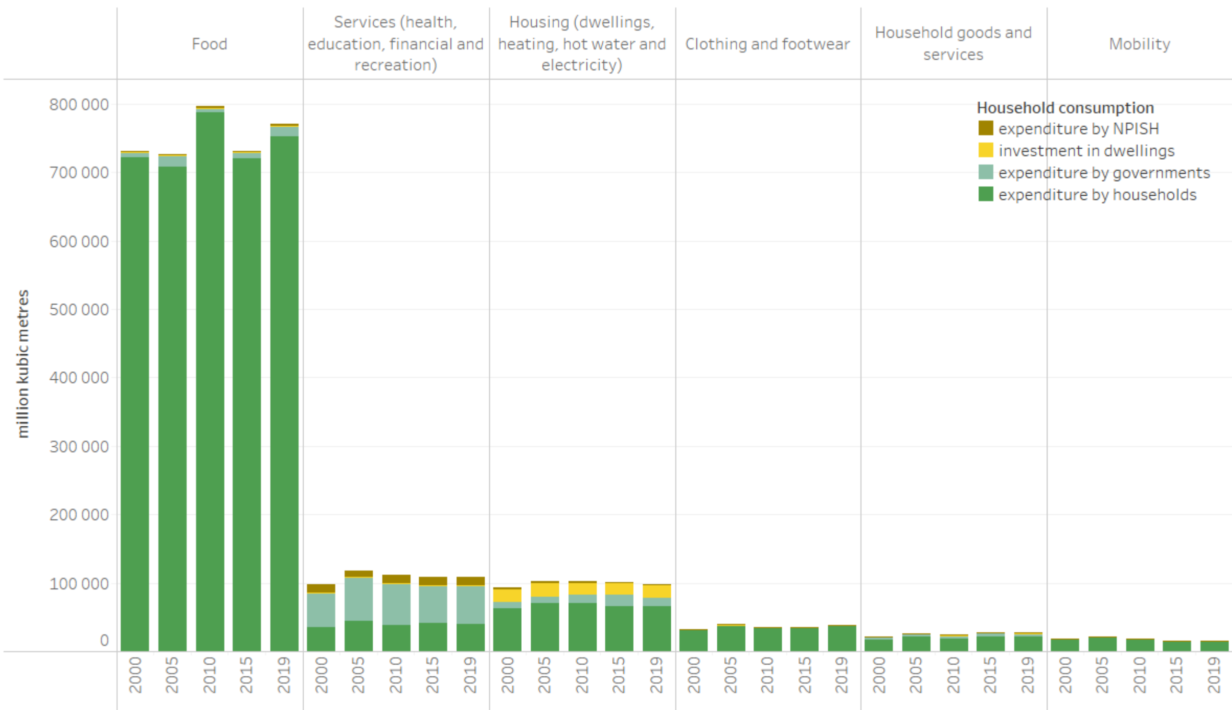
When looking at water use as an environmental pressure, a distinction is made between blue water, that is surface or groundwater that is consumed in industrial processes or household use or evaporated during irrigation, and green water, rain water stored in the soil, typically used to grow crops (Hoekstra et al., 2012). It can be argued that the use of green or blue are just different types of pressure. In this report, the analysis of water use is based only on amounts of water used. Additionally, the impact of water use depends on regional conditions, which are not considered in this assessment.

To produce all the goods and services consumed by EU households in 2020, about 1.1 trillion cubic metres (m^3) of water were required. In 2019 this was slightly less, 1.06 trillion m^3, amounting to 2 000 m^3 per person. Almost 90 % of this is green water, and this share is comparable in all consumption domains, within a range of 82–90 %. In contrast to the other pressure indicators considered, the consumption of water increased slightly from 2000 onwards, by 6 % in 2019, much less than household expenditure over the same period.

The majority of water use is for the production of food, 73 %, and much less for the other consumption domains – in 2019, 10 % for services, 9 % for housing, 4 % for clothing and footwear, 3 % for commodities and 1 % for mobility. Typically, water is used for agricultural activities, such as irrigation, as well as in food processing sectors. Most of the water use is related to the cultivation of fodder crops, oil crops and cereals, but a significant share is used to cultivate fruit and vegetables, followed by the production of meat and cereal products.

Other than for mobility, the water use related to all consumption domains increased between 2000 and 2019. The most significant increase in water use occurred in household goods and services and clothing and footwear, 24 % and 22 % respectively, followed by services. Water use related to food and housing increased by 5 % in the same period (Figure 3-12).

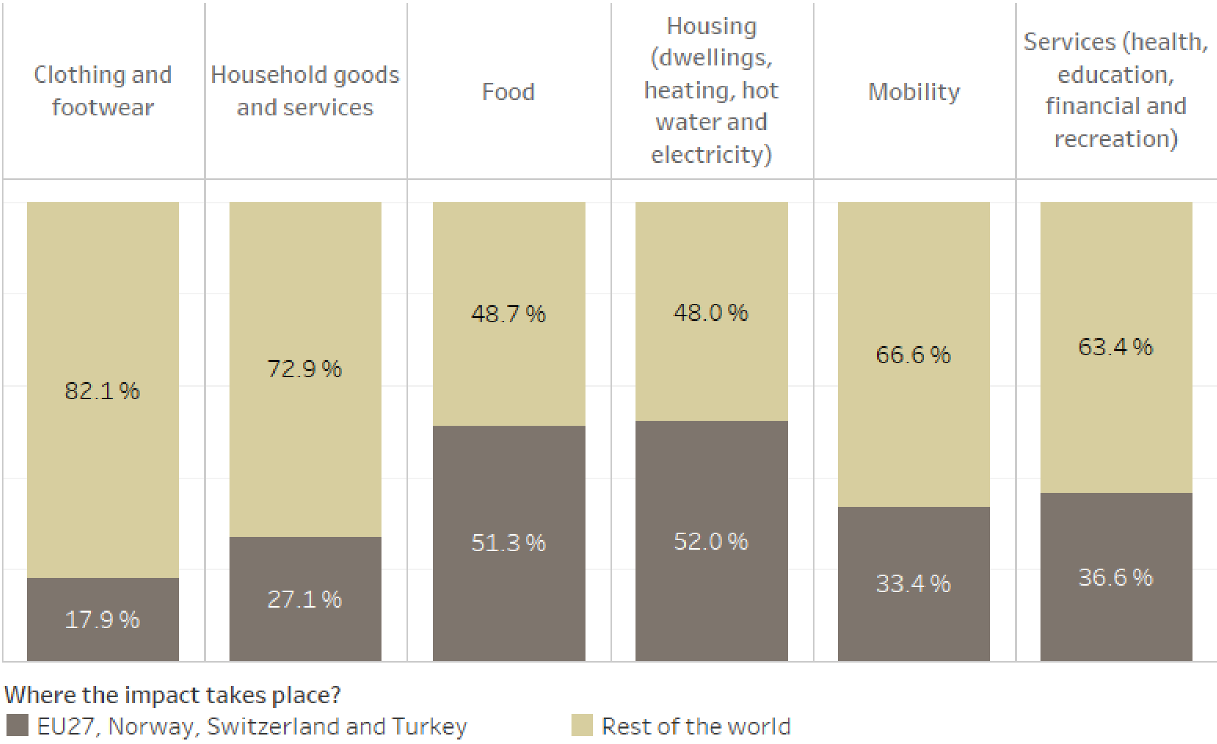
Figure 3-12 Water use by expenditure category, EU27, Norway, Switzerland and Turkey, 2000–2019, thousand cubic metres



Note: Values represent yearly pressure for respective year
Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Just over half of the water required for the production of goods and services for European household consumption is used outside Europe – 52 % outside and 48 % inside Europe. This share has remained constant over time and is largely determined by the water use for food, 51 % outside Europe. For clothing and footwear, 82% of the water is used outside Europe, household goods and services, 73 %, services, 64% and mobility, 66 % (Figure 3-13). For clothing and footwear this is due to the fact that textiles fibres, such as cotton, are mostly produced outside Europe and their cultivation is very water intensive.

Figure 3-13 Share of water use for household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Box 7 Comparing water use with the EU-JRC Consumption Footprint

These conclusions are in accordance with the assessments based on the EU-JRC Consumption Footprint, which also shows an increase in water use between 2010 and 2020, 7 %. An important difference is that the EU-JRC Consumption Footprint is not only based on the volume of water used, but also takes the water scarcity of regions into account. The impact indicator results complement the results of the water use pressure indicator.

Food is identified as the most important consumption domain in terms of water use, 62 %, followed by housing, 25 % and household goods, 10 %.

Source: EC-JRC Consumption Footprint Platform (2022c)

Land use

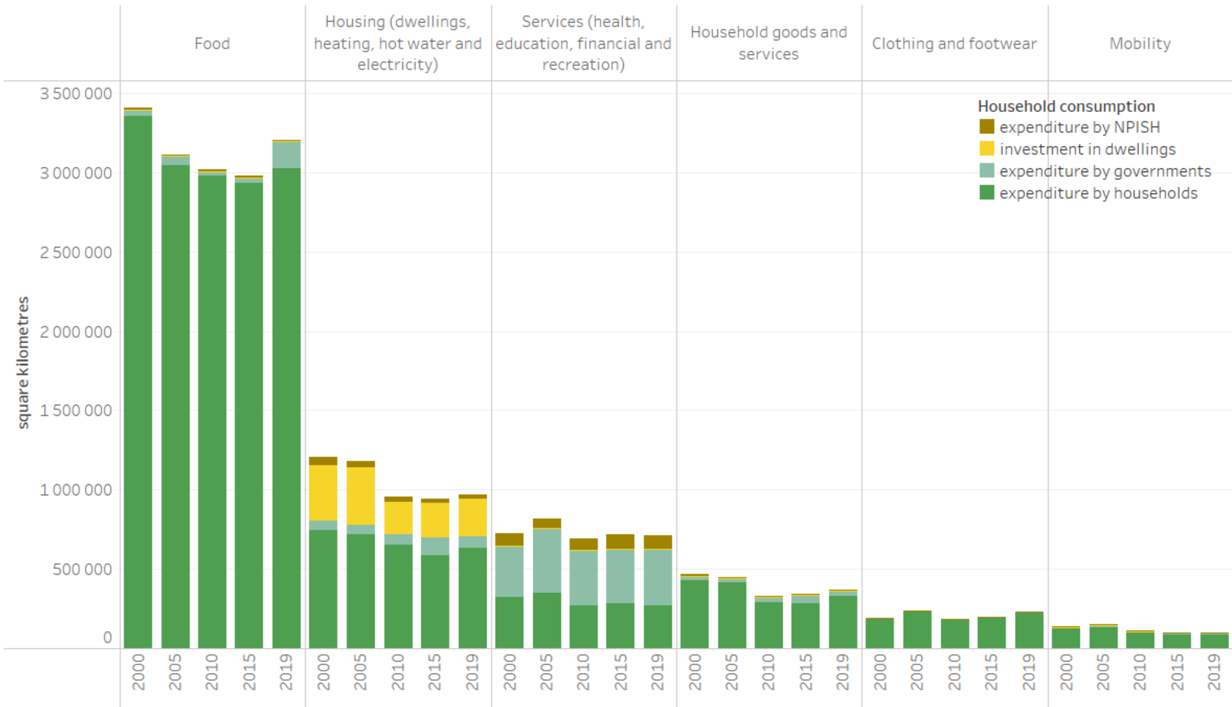
Land use as defined here includes crop land, permanent pasture, forestry land and other land uses. The land use caused by European household consumption is the area of land indirectly used in the production chains of the goods and services that are consumed. This includes, for example, agricultural land for the cultivation of food, but excludes the land occupied for transport and industry infrastructure as this is not considered to be related to household purchases but is seen more as an investment.

The land use in the supply chain of goods and services consumed by European households in 2020 was estimated at 5.7 million square kilometres (km^2). For comparison, at 2019 consumption levels, an estimated 5.6 million km^2 of land was used, equivalent to 1.2 hectares per person. Land use dropped considerably between 2000 and 2014, -16 %, and from then onwards increased, although the level in 2020 which was still 6 % lower than in 2000.

In 2019, food was responsible for 57 % of land use followed by 17 % for housing and 13 % for services. The share of the other consumption domains is much lower. Land use for food is mainly permanent pasture for meat and meat products such as milk and cheese, and cropland for other food and feed products. The cropland for fruit and vegetables also had a significant share.

The land used for housing refers to all land required to produce the building materials, such as forest land producing wood. Land use for household goods and services refers, for example, to forest land required for producing wooden furniture. Other than for clothing and footwear, an increase of 20 %, the land use for the other consumption domains decreased between 2000 and 2019 (Figure 3-14).

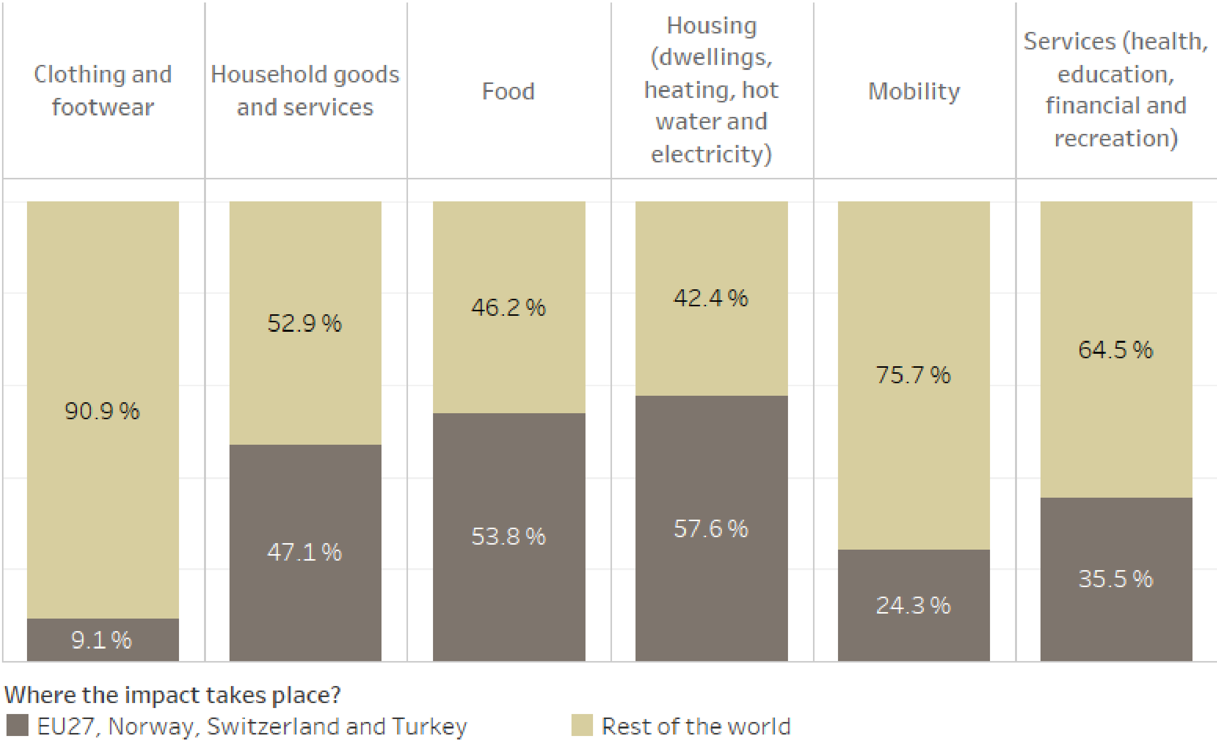
Figure 3-14 Land use by expenditure category, EU27, Norway, Switzerland and Turkey, 2000–2019, millions square kilometres



Note: Values represent yearly pressure for respective year
Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Forty-eight per cent of this land use takes place in Europe itself. This share remained constant over time and was mainly dominated by land use related to food. Consumption domains such as clothing and footwear, 90 %, and mobility, 76 % are responsible for relatively more land use outside of Europe (Figure 3-15), for example the cropland required for the cultivation of such natural fibres as cotton.

Figure 3-15 Share of land use for household consumption, EU27, Norway, Switzerland plus Turkey and the rest of the world, 2019, per cent



Source: ETC CE own elaborations based on EXIOBASE v3.8.2 (see Annex 1).

Box 8 Comparing land use with the EU-JRC Consumption Footprint

As for water use, the land use category as defined in the EU-JRC Consumption Footprint addresses the impact due to land occupation and transformation, while this report looks at land use as a pressure indicator. The EU-JRC Consumption Footprint shows an increase in the land use impact related to EU household consumption between 2010 and 2020. Food, 64 %, is identified as the major contributor to land use, with meat products being responsible for half that impact. Household goods contribute 19 % to land use followed by 10 % for housing.

The conclusions following from the EU-JRC Consumption Footprint, based on impact, differ slightly from the conclusions of this report, based on pressure, specifically regarding the overall trend of land use related to EU household consumption. Both analyses identify food as the major contributing consumption domain. The contribution of the other consumption domains are not totally comparable as different categories are defined; nevertheless, the relevant land use impact of housing is illustrated by both.

Source: EC-JRC Consumption Footprint Platform (2022c)

3.2. Social impacts

Apart from environmental effects, consumption also has social impacts, related to wealth, employment and wellbeing. As the focus of this report is on environmental effects, this section briefly discusses the social impacts related to the consumption of goods and services in the EU. A major challenge in defining social impacts, however, is the lack of quantitative data on a global level. There are no official reports of national accounts for social effects such as there are for environmental effects. Knowledge is often a result of non-governmental organisations (NGOs) or international organisations such as the United Nations or the OECD that have collected and published data and information. Therefore, in this section the social impacts are described qualitatively.

The SDG 12 (United Nations, 2015) addresses the challenges of sustainable consumption and production in terms of inequality, poverty and sustainability, such as the high cost of energy to heat homes creating energy poverty. Social aspects of consumption relate to equality and social justice of having access to consumption goods. Globally, inequality in consumption volumes of low- and high-income groups has been increasing, with high income countries consuming over 13 times more than low-income ones in 2017 (Akenji et al., 2021). Efficiency increases that decrease consumption in some domains are being mitigated by increased per person consumption in high-income groups, while low-income groups have, in many cases, reduced their consumption levels (Akenji et al., 2021; Oxfam, 2020).

Transitioning to systems with fair impacts requires appropriate governance approaches and multi-level stakeholder involvement (EEA, 2019). Best practice is informative; for example, climate policies in EU Member States have proven to positively affect the health of vulnerable groups in society through building retrofits (EEA, 2021b).

Outside Europe, industries and supply chains for producing and delivering goods and services have the potential to have positive social impacts, for instance by creating jobs in producing countries. Nonetheless, negative social impacts also occur, for instance through a lack of regulations around employment and working conditions. In many cases, goods and services are produced outside the EU, and social impacts then relate to the impacts created in the producing countries, so called spill-over effects. In a study of these in the Nordic region, Fråne et al. (2021) state that the food, electronics and clothing sectors offer social benefits to developing countries, with high impacts on such social aspects as wealth, employment, transfer of knowledge, innovation and development in local communities. These impacts can also, however, be negative as regulations, such as on working conditions and minimum wages, often differ and are less stringent than EU standards. Social effects are thus apparent across entire value chains.

According to the Global Compact progress report (UN Global Compact and DNV GL, 2020) only 17 % of signatories (companies) apply the Ten Principles of the UN Global Compact on human rights, labour, environment and anti-corruption to suppliers.

Based on the Worldwide Governance Indicators, which give an overview of the level of risks related to governance in producing countries, it is clearly shown that there are risks in many of the countries producing food, electronics and clothing. Major issues, for example in the production of goods in the clothing industry, concern extremely low wages, and inappropriate or life-threatening working conditions.

Increased efforts are needed to mitigate social effects of European consumption on producing countries. Due diligence relates to the process of creating binding rules for business on human rights, striving for better and equal conditions of employment, health, knowledge transfer, etc. The demand from watchdogs, companies and consumers for laws making due diligence on human rights mandatory has grown and, in early 2022, the EU adopted a proposal for a Directive enforcing such due diligence (European Commission, 2022b; Swedwatch, 2021; OECD, 2018).

4 Exploring conditions for sustainable consumption

As was shown in Chapter 2, European consumption expenditure and volumes increased between 2000 and 2019. While the volume increase for food and mobility was limited, it was much more marked for commodities and services. The environmental impacts related to European household consumption between 2000 and 2019 have, however, followed a predominantly downward trend, with the exception of water and material use (Chapter 3). This means that decoupling impacts from consumption growth seems to have been achieved for all impact categories, in a relative sense for water and material use, but in absolute terms for land use, greenhouse gas and air emissions. The decoupling is most marked in 2007–2012, while the decrease in environmental impacts has stagnated since 2012.

While these numbers paint a somewhat positive and promising picture of the effectiveness of EU efforts to reduce the environmental impacts from consumption, care should be taken. As consumption levels continue to rise, it is questionable how long efficiency increases will be successful in compensating for consumption growth. It is also unlikely that full decoupling of economic growth from resource use and environmental pressures can be achieved in the long run (EEA, 2021c). On the other hand, the EU policy objective around consumption, as this is expressed in the 8th Environmental Action Programme (8EAP) calls for a significant reduction in the EU consumption footprint to bring European consumption-related impacts within planetary boundaries (EU, 2022). Moreover, to achieve sustainable consumption, does the increase in consumption-related impacts need to stop, impacts have to significantly be reduced to a level that is sustainable in the long run. This will require substantial transformations in production and consumption systems.

Changing consumption trends is, however, very difficult, as consumption patterns fulfil important individual and social functions that are central to modern life. To transition towards more sustainable and circular consumption in Europe, it is therefore necessary to understand why Europeans consume the way they do and what kind of more sustainable alternatives can be provided that still address the functions that current consumption fulfils.

It is important, at this point, to also acknowledge that changing consumption patterns alone might not be enough to reduce consumption impacts, if the production systems also do not transform themselves and offer more sustainable products and services to EU consumers. This report, however, focuses on the role of consumption patterns. This chapter explores consumption – including why Europeans consume (Section 4.1), how they can live well within limits of the planet (Section 4.2), and various drivers of consumption behaviour (Section 4.3) – to better understand its patterns and how impacts from consumption can be reduced.

4.1. Why do we consume?

There are many different approaches to explaining consumption. In science related to sustainability, it is important to bring these perspectives together to create a picture that is as accurate as possible and encompasses various scientific disciplines in the best possible way. An integrated understanding of what drives consumption can provide a starting point for behavioural and systemic changes and corresponding strategies, not only focusing on consumers' rational and individual behaviour, but also taking into account social aspects as well as power and agency issues (Michie et al., 2014; Mont et al., 2014).

Internal drivers for consumption: needs and desires

All human beings can be expected to strive for a good life. Nonetheless, depending on whom one asks, people provide different answers of what a good life means. Variables, such as age, class, culture, education, gender, geography, race, and access to social media, and this is just a small selection, play a central role in shaping the concept of a good life for each individual (Fuchs et al., 2021; Etzioni, 2013). This, however, does not mean that the concept of a good life cannot be explained or understood to a certain extent: "*When we look beyond the surface, removing all the varied stylings and decorum, the essence of what we experience as a good life is surprisingly similar, even among individuals living seemingly different lives*" (Fuchs et al., 2021, p. 1; Nussbaum, 2010). We eat because we need to be healthy and not suffer from hunger, we need shelter to be protected from cold and bad weather, etc. For some time, these physical needs were considered as a basis of a hierarchy of needs (Maslow, 2010, 1943). It is now widely recognized, however, that psychological and social needs are equally elemental for people to lead a good life. Such needs include, amongst others, the need for recreation, social recognition, companionship and belonging to some form of community, love, as well as self-realisation (Sen, 2011; Nussbaum, 2010; Jackson, 2006).

To define a good life from a needs perspective, it is essential to distinguish between needs and desires. Fuchs et al. draw the following distinction here:
"*Needs are universal for humans across time and space and, more fundamentally, opportunities for satisfying these needs are a precondition of human flourishing. […] Desires, in contrast, are subjective wishes. They are not crucial to an individual's ability to live a good life. That does not mean that an individual will not enjoy satisfying their desires – only that an inability to satisfy one's desires is no serious impediment to individual flourishing*" (Fuchs et al., 2021, p. 13-14; Sen, 2011). Desires are, for example, eating a copious meal with exotic or exquisite ingredients instead of a more basic, nutritious meal made of local, seasonal produce; or living in a large, modern house with a private garden as opposed to a comfortable, but basic apartment close to a public park. Desires tend to be culturally specific and highly contextual, in contrast to the universal nature of needs and are shaped by the society one lives in.

Additionally, a focus on a needs-based definition of a good life highlights the importance of distinguishing between needs and satisfiers. Needs are ends, while "*satisfiers are what we use to satisfy our needs and desires*" (Fuchs et al., 2021, p. 14). If this is applied to the discussion around consumption, it becomes clear that consumer goods, such as products, services and infrastructures, are not ends in themselves, but means to satisfy needs (and desires). How needs are satisfied differs depending on where an individual lives and what opportunities are available to them. Even though similarities exist when it comes to satisfying physical needs, such as food or shelter, social or psychological needs can be satisfied in many different ways, for example, a trip to a distant location can be one way of fulfilling an individual's need for leisure, while another prefers a walk in a local park, or engage in sports or shopping. Similarly, the human need for affection or belonging can be addressed by joining a social club, being part of a religious group or emphasising the importance of family (Fuchs et al., 2021).

This also leads to differentiating between needs which are usually satisfied by consumer goods and those that can be fulfilled by non-material resources. Increasing consumption is, accordingly, not necessary for everything that makes up a good life. Considering the need for leisure as an example, this can be manifested in a holiday trip, but possibly also in a walk to a nearby forest or a swim in a local lake or public swimming pool. While the latter examples can be satisfied relatively easily with little consumption attached, the holiday trip is usually associated with consumption, which in turn can take on different proportions: a family can travel by train to a nearby location, but they can also make a long-distance trip by plane (Di Giulio et al., 2010; Paech, 2012).

Accordingly, how the pursuit for a good life is concretely shaped and what consumption occurs for this purpose varies greatly. This differentiation allows for an evaluation of satisfiers with regards to their contribution to fulfilling certain needs and the amount of environmental and social resources this fulfilment implies. Such evaluation is a key element in framing the concept of a good life from the perspective of sustainable consumption. Needs are universal, but it is up to societies to decide how and with what resources these will be met. This perspective also reveals how consumption becomes challenging when people are no longer able to distinguish needs from desires and satisfiers (Fuchs et al., 2021).

Bringing these findings together with the data and analyses from Chapter 3 on the question of where the greatest environmental and social impacts of consumption happen, it becomes clear that it is indeed in areas of central physical needs, such as food or housing, that impacts are highest.

But the form of satisfiers is certainly also very important: should citizens live in large, poorly insulated houses or small, modern, energy-efficient apartments? How should homes be heated and from where should the electricity used be generated? What kind of food do we eat, how much of it is animal-based, how much is imported? How much food is wasted? Housing is also a good example of how consumption fulfils a function in areas of need that do not have to be directly linked to material consumption, but often are in consumer societies. A big house, for example, is a status symbol that helps to show who a person is and which kind of social group she/he identifies with (Lüdtke, 1989).

In some instances, consumption satisfies more indirect needs, for example, as a coping mechanism to distract from certain frustrations, examples being emotional shopping or eating behaviour, even though studies have long since shown that these lead to very short-term satisfaction (Schmitt et al., 2021; Sklair, 2012; Cohen, 2004). This adds to the knowledge that consumption growth from a certain high level does not necessarily contribute to increasing wellbeing and can even work against it in some cases (Fuchs et al., 2021; Ehrenstein et al., 2020; DeLeire and Kalil, 2010). Rather, people's expressions of happiness may correlate with the level of trust in a community, social ties, education, health and meaningful employment (Helliwell et al., 2020). This means that here, too, reflecting on consumption patterns can help prioritise what consumption is really needed and beneficial and how it can contribute to wellbeing with the least possible socio-environmental impact. Since planetary boundaries are closely connected to consumption and production, this relationship will be explored more closely in the next section.

External drivers for consumption at different levels

Even when convinced of satisfying needs and desires in a sustainable way, adopting more sustainable consumption behaviour is not always easy or straightforward. This is due to various external driving forces that influence individuals' needs and desires and make them strive for a certain kind of satisfaction. External drivers of consumption can be organised according to several levels that lead from a macro societal perspective to concrete individual consumption behaviour (Schmidt, 2016).

Macro-level factors

There are factors at the macro level of society, such as the political, economic, climatic, cultural and technological background of a country, that act as drivers of consumption. For example, economic and financial systems are closely related to the political legal forces of a country or region and determine how goods and services are produced and consumed and how resources are distributed within societies (Brand, 2008).

Today, the dominant form of economic organisation in the world combines aspects of market and planned economies. Depending on the direction in which a state's system swings more strongly, this will also have an impact on consumption. An example is the use of heating or cooling systems in buildings that, among other factors such as insulation, strongly depends on the regional climate (Yoshida et al., 2021). Commercial forces, or strategies and approaches used by the private sector to produce and promote their products have strong impacts on consumption as well – the evolution of fast fashion is an example of this.

Meso-level factors

On the meso-level, consumers are integrated into organisational structures. People also consume as employees, teachers, students, family members, football-club members, and so on. They thus consume as part of the respective institution in the function they perform (Muster, 2011).

Peer groups also represent an important frame of reference for consumption, because individuals identify themselves with them, the keeping-up-with-the-Joneses phenomenon, and also distinguish themselves from other groups to which they do not belong. In this setting, consumption acquires a symbolic power and serves as a sign of status and mentality (Jäckel, 2011; Flaig et al., 1993; Lüdtke, 1989).

The role of producing companies as a meso-level factor should also be mentioned as they decide on the types of products placed on the market, marketing narratives and the design of products as status symbols (Ascheberg, 2006). In this way, production systems shape consumer demand (EEA, 2022b). Local infrastructural conditions also act as drivers on the meso-level, for example, what shops are there in the area; what information channels and networks are used to advertise products; and are there public transport connections or charging stations for electric vehicles (Fischer and Sommer, 2011).

Micro-level factors

Finally, on a micro-level, consumers have numerous decisions to make at different stages of a product's lifecycle. In a linear business model, their role is mostly reduced to the very function of consumption, while in circular value chain consumer responsibilities involve more active decision making and expand to include, for example, maintenance, repair and the supply of (used) products, thereby opening different avenues of engagement (Zibell et al., 2021).

The literature identifies three main stages at which consumers make decisions: (1) purchase; (2) use; and (3) end of use. At each of these, consumer decisions are deeply connected to macro- and meso-level factors as those are deeply embedded and shaped by the system of production and consumption in which consumers operate, as well as by the individual background of the consumer (Zibell et al., 2021). These include, for example, habits, preferences and personal values, as well as cognitive or physical abilities and educational background. Of course, the individual's disposable income is also particularly relevant (Jäckel, 2011).

External drivers towards circular behaviour are therefore influenced and linked to numerous barriers, lock ins, and other factors, such as advertising and social narratives that consumers face. In an EEA study Zibell et al. (2021) identified that economic factors fit between needs and offerings, while information used for choice, social factors, preferences and beliefs are the driving categories underpinning consumer choices in two main sectors, namely clothing and household textiles, and electronics. For example, perceived risks, environmental awareness and social factors can play a role in determining whether consumers choose to purchase a refurbished, remanufactured, or second-hand product instead of a new one, as well as accessibility to separate collection and disposal infrastructures.

Internal and external factors thus come together in the individual decisions of consumers – the inner striving for a good life is shaped by external factors and conditions at macro, meso and micro levels, so that a concrete demand for certain consumption options (satisfiers) and concrete consumption behaviour, such as whether a product is repaired or a new one bought, result.

Rebound effects and lock ins

Although the different strategies for sustainable consumption seem to offer a wealth of opportunities for consumers to change their consumption patterns and thus reduce environmental impacts, there are some potential barriers linked to changing consumption behaviour, which are widely discussed in literature.

A well-known unintended side effect of consumption changes is rebound. The concept of **rebound effects** originated in the literature on energy efficiency and has since been applied to a wider range of effects, including greenhouse gas emissions related to consumption patterns. A working definition of rebound effects, as proposed by the EU's Directorate General for the Environment is "*increases in consumption due to environmental efficiency interventions that can occur through a price reduction (i.e., an efficient product being cheaper and hence more is consumed) or other behavioural responses*" (Maxwell et al., 2011).

In terms of the magnitude of these effects, some studies point to large percentages. Direct rebound effects, rebound in the same consumption item, are expected to be up to 30 %, while indirect and economy-wide rebound effects, rebound in other consumption items, can exceed 50 % (Akenji et al., 2021).

Another barrier to change is **lock in**. Societal functions, such as housing and mobility, can be fulfilled by different socio-technical systems. Radical changes in these systems, which are needed for environmental problems, require transitions to new socio-technical systems (EEA, 2019). Changing these systems, however, involves multiple actors and shifts in political and technical systems. Policy and social innovation are often incremental within existing paradigms such as the growth paradigm, because of lock in mechanisms (Geels, 2004). Vergragt et al. (2014) have defined several perspectives related to the lock-in effect, ranging from financial benefits due to sunk costs ([24]) and subsidies within unsustainable infrastructure, to institutional rules, both formal and informal, such as power relations prohibiting change from existing institutions. Another perspective concerns current consumerist cultures, where people are locked in to a certain degree by circumstances including work-and-spend lifestyles (Akenji et al., 2021; Sanne, 2002), including economic conditions (Lorek and Spangenberg, 2014). This influences consumer choices and lifestyles and is in fact defined by available infrastructure, products and services, as well as the consumer's community and social networks that are used and referred to as the norm (Akenji and Chen, 2016). The lock in of ordinary consumers to fossil fuels for motor vehicles, for instance, is apparent in the widespread availability of fossil-fuel stations and the lack of electricity-powered alternative vehicles and infrastructure (Akenji et al., 2021).

In behavioural theories, lock-in effects are defined as barriers to consumers making sustainable choices and changing behaviour (Samuelson and Zeckhauser, 1988). Lock ins often occur when the unsustainable choice option is cheaper, for example, buying fast fashion instead of durable fashion; more convenient, for instance, using a car rather than public transport; or more culturally supported, such as meat-based food instead of vegetarian options, than the more sustainable alternative (Lorek et al., 2021).

Consumers having high aspirations for sustainable consumption but taking less action to achieving it, because of a number of social, cultural, economic and psychological lock ins, as well as institutional, legal and infrastructural constraints, is known as the attitude-behaviour gap (Hirsch and Terlau, 2015; Csutora, 2012). Similarly, knowledge of environmental impacts of consumption does not necessarily lead to changes in lifestyle (Barth et al., 2012). Both these knowledge-action and attitude-behaviour gaps show the limits of mere information campaigns (Hirsch and Terlau, 2015). Therefore, while changes in individual consumption patterns are starting to be observed, the emergence of widespread megatrends will require more time, as many individuals are still locked in to a cycle of work and spend (EEA, 2020). The *status quo* or present bias, the difficulty people face in letting go of their routines and habits, also prohibits

[24] Sunk costs: an investment already incurred that cannot be recovered.

behavioural change. In turn, this is affected by existing social norms and social structures, which set the standard of what is normal (Joshi and Rahman, 2015; Zibell et al., 2021).

Several studies point to ways of addressing rebound and lock-in effects, taking account of economic factors, social norms and informed choices, and steering governments through dialogue, collaboration and debate (Akenji et al., 2021; Zibell et al., 2021).

4.2. Living well within the limits of the planet

Current consumption patterns are causing negative environmental and climate impacts and thus put the planet's ecological balance at risk. At the same time, consumption fulfils important individual functions in the pursuit of physical and psychological wellbeing and satisfying social needs, and thus is a key element of a good life. The problem is that the ecological balance can be thrown off course in such a way that this good life is in danger.

As was shown in Chapter 3, decoupling seems to have been achieved between European consumption volumes and their associated environmental pressures and impacts. Absolute and long-term decoupling may, however, not be achievable on a global scale (EEA, 2021c). Furthermore, incremental efficiency gains and decoupling alone are not enough to alleviate the current crises of climate change, resource depletion, biodiversity loss and pollution. Rather, a significant reduction of overall environmental pressures and impacts is needed.

The concept of planetary boundaries brings this dilemma together. Planetary boundaries refer to quantitatively definable limits to the damage of Earth's ecosystems which, if exceeded, would have irreversible consequences for life on Earth ([20]). When boundaries are exceeded, humanity would leave the so-called "*safe operating space*" (Rockström et al., 2009) and living conditions would deteriorate dramatically. If, on the contrary, humanity manages to operate within these boundaries, it will be able to continue to prosper and develop. One example of a boundary that has already been exceeded due to economic activities is the climate system. The amount of greenhouse gases that mankind has released into the atmosphere since industrialisation is so great that the correlation with man-made climate change is evident (Geiges et al., 2019). Figure 4-1 shows the European consumption footprint in comparison with the planetary boundaries. In Europe we are currently not living within our fair share of the planetary boundaries (EEA, 2020).

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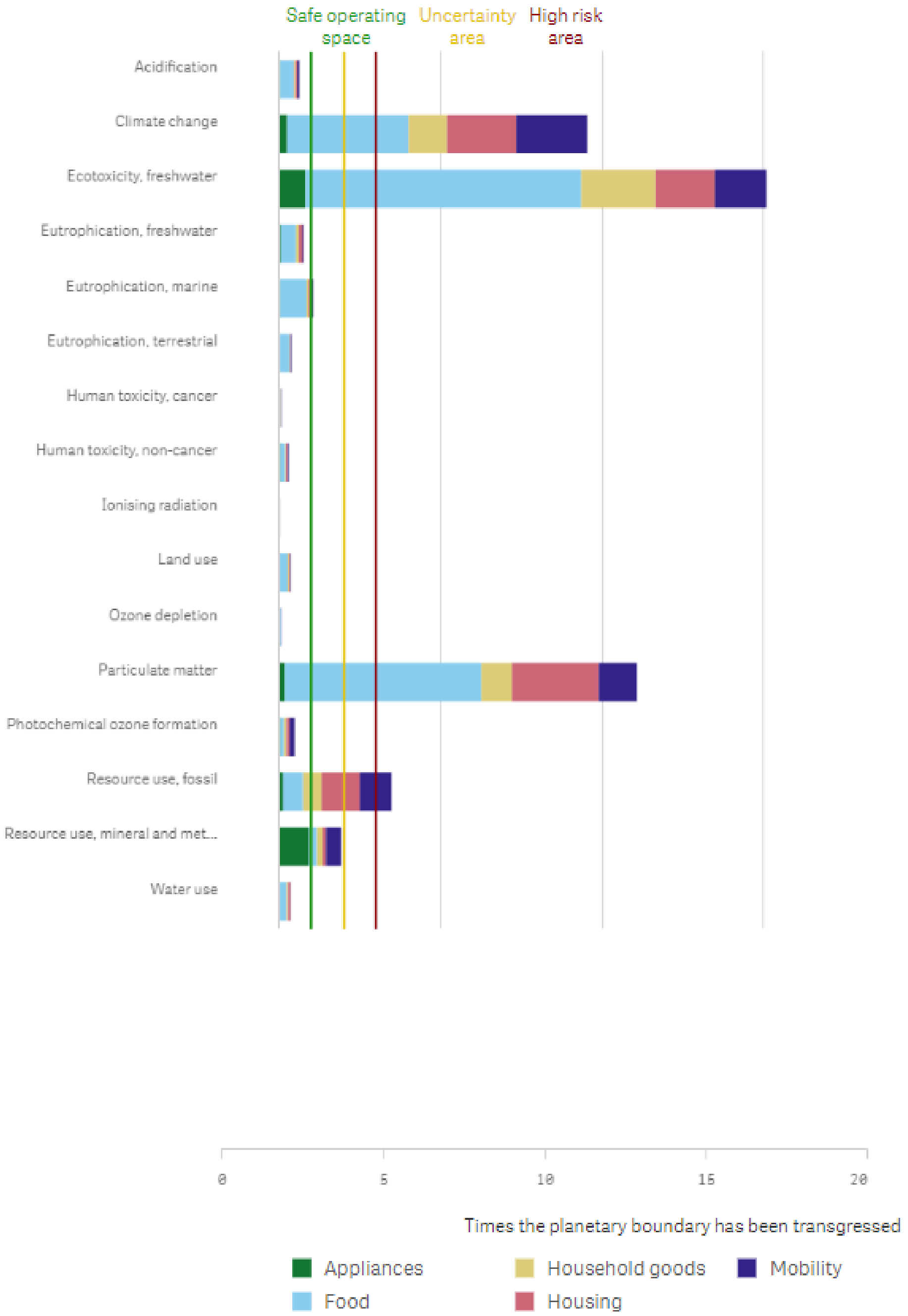
[20] The planetary boundaries, in their revised version by Steffen et al. (2015) include (1) climate change; (2) changes in biosphere integrity (biodiversity loss and extinctions); (3) stratospheric ozone depletion; (4) ocean acidification; (5) biogeochemical flows (phosphorus and nitrogen); (6) land-system change[(7) freshwater use; (8) atmospheric aerosol loading; and (9) introduction of novel entities (chemical substances).

Figure 4-1 Assessment European consumption against planetary boundaries by impact category, EU-27, 2019



Note: some planetary boundaries are still to be defined or are being refined by the JRC, which explains why the planetary boundaries mentioned in this figure differ from those defined by Rockström et al. (2009).

Source: European Commission (2022a), based on JRC assessment

In addition to looking at the effects of human activities on one planetary boundary, it is also possible to analyse how the consumption and production activities of a particular system affect different ones. The current food system, for example, which has proven to be one of the major impact areas of consumption, affects several planetary boundaries, namely climate change, but also biosphere integrity, land-system change, freshwater use, and nitrogen flows (Gerten et al., 2020; Rosenzweig et al., 2020).

Beyond environmental and climate concerns, there is also a social dimension to the planetary boundary approach, acknowledging that there are huge consumption inequalities across the globe and even within

Europe. To include the social dimension, Kate Raworth (2012) added a set of social boundaries, including health, food, water, income, education, resilience, voice, jobs, energy, social equity and gender equality, to the ecologically defined ones. While the planetary boundaries describe the environmental precondition, the outer boundary or ceiling of the safe and just operating space, the social boundaries refer to the social pre-condition, the inner boundary or foundation of sustainable development. The resulting "*safe and just space for humanity*" defines a consumption level that allows all people to satisfy their basic needs in a fair and just way, while ecological boundaries are respected. It is also called the doughnut, due to the shape of the illustration (Raworth, 2012). This new conceptualisation clearly shows how the economic, social and the ecological dimensions of sustainability relate and depend on one another and thus provides an holistic picture of the challenges related to current production and consumption systems. Currently, however, there is not a single country on Earth that is developing within the doughnut – either the ecological limits are being overstretched or the social limits are being undercut (O'Neill et al., 2018).

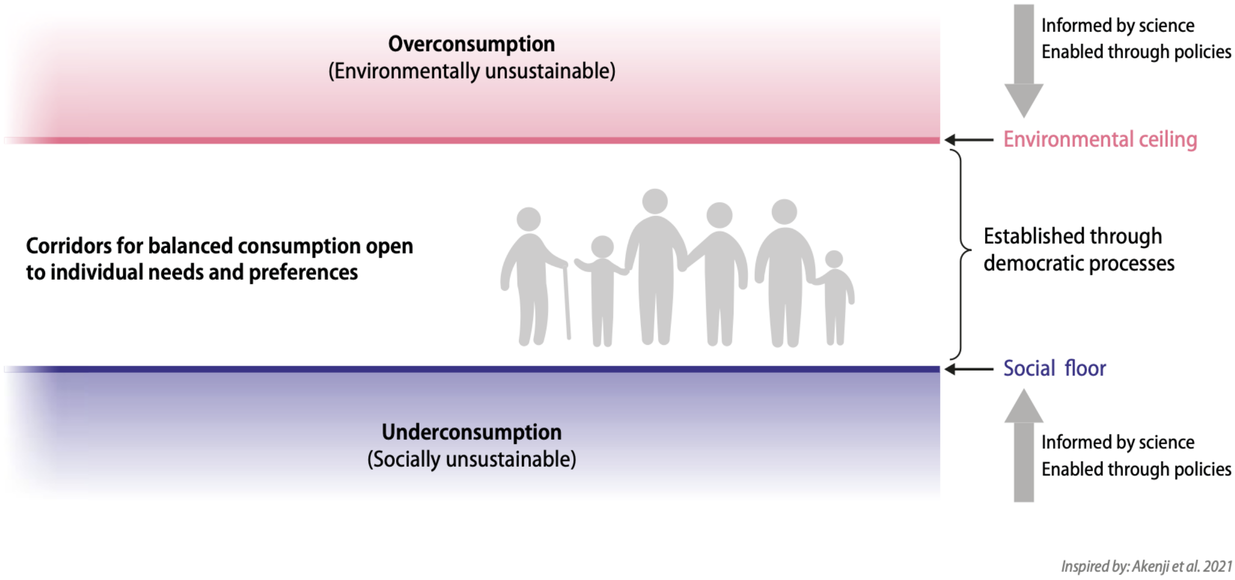
The question of what constitutes a good life has put focus on the wellbeing economy, as opposed to the growth economy measured in gross domestic product (GDP) (Fioramonti et al., 2022; Costanza et al., 2018). The wellbeing economy recognises that economy is embedded in nature and society, defining other human goals rather than institutional ones, such as physical and mental health, good social relations and a healthy natural environment.

If, according to the Brundtland Commission (1987), the goal of sustainable development is to achieve a good life for all, it is necessary to analyse exactly who needs what to live a good life against the background of these limits. While many people in developing countries certainly need to increase their consumption levels in some areas to meet basic needs, for example with regard to sufficient and healthy nutrition, individual needs look different between and even within countries. Changes in predominant lifestyles, especially in high-consuming societies, will determine whether a good life can be achieved while staying within the environmental and social planetary boundaries, and meeting the commitments of the Paris Agreement (Akenji et al., 2021). It has been estimated that to reach the global average per person emissions level by 2030 consistent with limiting global heating to 1.5 ºC, the per person consumption emissions of the richest 10 % of the global population should be reduced to about a 10 % of their current levels, while those of the poorest 50 % could still increase by two to three times their current level (Oxfam, 2020; Akenji et al., 2021).

Such reflections on consumption within the safe and just space have led to the concept of sustainable consumption corridors (Fuchs et al., 2021; Di Giulio and Defila, 2021; Di Giulio and Fuchs, 2014; Blättel-Mink et al., 2013) This concept "*can be a good starting point to define criteria of sustainable consumption. Such corridors would be defined by minimum standards, allowing every individual to live a good life, and maximum standards, ensuring a limit on every individual's use of natural and social resources in order to guarantee access to a sufficient level of resources (in terms of quantity and quality) for others in the present and in the future*" (Di Giulio and Fuchs, 2014, p. 184), thus, operating within the planetary boundaries. Additionally, linking lifestyles changes to climate change impacts is also increasing the understanding of connections between those societal, environmental and economic aspects. An example is the 1.5-Degree Lifestyle approach which examines greenhouse gas emissions and potential reductions using consumption-based accounting, which covers both direct emissions and those embodied in goods imported in a country (Akenji et al., 2021). This approach enables the implementation of a more holistic analytical perspective, addressing a cluster of activities in targeted areas, such as reducing consumption of meat and dairy products, switching to renewable energy sources, and reducing car use and air travels (Newell et al., 2021).

Within these minimum and maximum standards, consumers do not have to be told exactly how much they may consume, but they can be challenged to rethink their consumption habits and even to change them in some areas and consume in a more conscious way, for example by choosing sustainably produced alternatives, or avoiding waste as much as possible using products for longer, sharing and reusing.

Figure 4-2 Consumption corridors for a sustainable and fair spaces for all



Source: Future Earth et al. (2021, p. 29)

5 Pathways towards more circular and sustainable consumption in Europe

Achieving more circular and sustainable consumption in Europe is a challenging endeavour. It will require action from governments, industry and consumers.

This chapter gives a brief overview of the current policy framework related to consumption (Section 5.1). Then it explores pathways to further strengthen the trend towards more sustainable consumption (Section 5.2) and some interesting entry points to rethinking consumption patterns in a more fundamental way (Section 5.3).

5.1. EU Policy context

The following section briefly describes recent policy initiatives with particular relevance to sustainable consumption.

First, the internationally agreed 2030 Agenda for Sustainable Development, including 17 **SDGs,** was adopted in 2015 by the UN and its member countries. Its aim is to provide a comprehensive global policy framework and shared blueprint for addressing global challenges, such as poverty, inequality and sustainability in a global partnership (United Nations, 2015). The SDG that is most concerned with sustainable consumption is SDG12 Sustainable Consumption and Production. This goal has 11 specific targets aimed at enhancing resource efficiency, decoupling and reducing of waste to be achieved by technological development, knowledge sharing and capacity building, in collaboration with private companies, public sector as well as individual citizens.

In 2019, the European Commission adopted the **European Green Deal**, with ambitious objectives to protect the environment and mitigate climate change. These include the achievement of climate-neutrality by 2050, the improvement of biodiversity and a shift to a resource-efficient and competitive circular economy (European Commission, 2019b). In May 2022, the **8th Environment Action Programme (8EAP**) entered into force (EU, 2022), aiming to align European environmental policy making with the Green Deal's ambitions, the SDGs and significantly decrease the EU's material and consumption footprints and bring them within the 2050 vision of "*living well, within the planetary boundaries*".

The second **EU circular economy action plan (CEAP),** published in 2020, following the first CEAP in 2015, highlights the potential of a circular economy to contribute to reducing Europe's consumption footprint, decoupling economic growth from resource use and its impacts. It presents a set of related initiatives that aim to establish a strong and coherent product policy framework that will make sustainable products, services and business models the norm. Key product value chains being addressed as a matter of priority are food, electronics and ICT, textiles, batteries and vehicles, packaging, plastics and buildings (European Commission, 2020b).

As a result of the CEAPs, several product-specific policies have been launched.

In 2018, **A European Strategy for Plastics in a Circular Economy** was published (European Commission, 2018) addressing the design, use and recycling of plastics in Europe. Among other goals, it aspires to achieve a circular economy for plastic packaging by 2030, in which all plastic packaging on the EU market will either be reusable or recyclable. For other plastics, higher recycling rates should be achieved by improving the collection of plastic waste and the traceability of chemicals that may hinder recycling, developing quality standards for sorted and recycled plastics and by developing a European market for recycled plastics. Furthermore, the **Single-Use Plastics Directive** aims to reduce the use and environmental impact of certain types of plastic products and to promote the transition to a circular economy, through market bans and waste management obligations, labelling and awareness raising, and design requirements (European Commission, 2019a).

In May 2020, the **Farm to Fork Strategy** was launched to contribute to the creation of a fair, healthy and environmentally sustainable food system (European Commission, 2020a). It addresses issues of European food security and affordability, as well as environmental impacts related to food production and supply. More concretely, it aims to cut the use of pesticides, fertilisers and antibiotics and to increase the share of organic agriculture and aquaculture. In terms of consumption habits, it aims to support consumers in making healthy and sustainable food choices by the introduction of harmonised labelling, tax incentives for sustainable foods and targets to reduce food waste, by, for example, a revision of standards for best-before and use-by dates.

Similarly, in March 2022, the **EU Strategy on Sustainable and Circular Textiles** was published (EC, 2022). This includes an ambitious 2030 vision on circular textiles, as well as many initiatives to make textiles more circular and sustainable, such as design requirements, extended producer responsibility (EPR) schemes, a potential ban on the destruction of unsold or returned textiles, information requirements in the form of product passports, a harmonisation of green claims and measures to boost the reuse and recycling of textile waste.

In the domain of housing and the built environment, the **New Bauhaus Initiative** aims to combine sustainability with aesthetics and inclusion (European Union, 2022) and the proposed revision of the **Construction Product Regulation** aims to improve the sustainability performance of construction products in line with climate and sustainability goals, as well as accelerate the uptake and deployment of digital technologies (European Commission, 2022e).

It is clear that product design has an important role to play in making the production and consumption of products more sustainable (EEA, 2022d; ETC/CE, 2022). By creating more energy and resource efficient products, the need for primary energy and material resources can be reduced, contributing to the objectives of the Green Deal. Additionally, designing for circularity can ensure higher product quality, longer lifetimes, better use of materials, phasing out of hazardous chemicals and better options for reuse, repair and recycling. This makes circular design an important prerequisite for enabling more sustainable consumption and circular business models. The development of ecodesign requirements is a key policy tool to support such changes.

In March 2022, the European Commission proposed a **Regulation on Ecodesign for Sustainable Products (ESPR)**, which, among other things, extends the EU Ecodesign Directive beyond the scope of energy-related products to a wide range of products (European Commission, 2022f). The ESPR's ambition is to ensure that all products placed on the EU market are designed with sustainability objectives in mind, including resource efficiency, carbon neutrality and circularity. It also sets legal requirements on the provision of information to consumers and transparency about products' environmental sustainability through the introduction of digital product passports and by setting information requirements for communicating to consumers through a digital product passport or labels. This will build on the JRC's expertise and methodological work on the consumption footprint, circular economy strategies and carbon and environmental footprints (Sala and Sanye, 2022) .

Some countries also have taken national initiatives to move towards sustainable consumption (Box 9).

Box 9 Country initiatives to move towards sustainable consumption

Sweden is the first country worldwide to set ambitious new goals on consumption-based climate impacts, which include spillover effects, or, in other words, the impact of the production of goods and services produced abroad (Statens Offentliga Utredningar, 2022). Environmental impacts, such as greenhouse gas emissions, are typically measured based on 'production', which is sometimes referred to as territorial emissions. The Intergovernmental Panel for Climate Change (IPCC) guidelines on national emissions accounting are based on production-based emissions in contrast to consumption-based emissions. Consumption-based greenhouse gas emissions, sometimes called Consumption-Based Carbon Footprint (CBCF), allocate all emissions from the entire value chain to the final. These consumption-based climate goals are to be met in 2045 and follow up on the consumption-based measurements that Sweden and some other countries have started reporting to the European Commission. Setting these goals on the impact of consumption will clarify the magnitude of changes that are needed and guide policymakers in the right direction for framing and supporting sustainable lifestyles and fair consumption spaces.

The **German** Federal Government adopted the National Programme for Sustainable Consumption in 2016. This will oversee the implementation of the Agenda 2030, with a particular focus on SDG12 Responsible consumption and production, and "*promote sustainable consumption from the niche to the mainstream*". The programme focuses on six areas of consumption – mobility, food, housing and household, office and work, clothing, and tourism and leisure. Cross-cutting issues such as education, consumer information and research are addressed as well. A Competence Centre and a National Sustainable Consumption Network were established to support the programme.

An addition, in 2021 the Programme was strengthened by a set of new measures for the six priority consumption areas mentioned and some quantified targets. Examples include halving the consumption-based greenhouse gas emissions by 2030, doubling cycling by 2030, and halving food waste in the same period. The Competence Centre was commissioned to elaborate a set of indicators to measure the success of the Programme (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), Federal Ministry of Justice and Consumer Protection (BMJV), Federal Ministry of Food and Agriculture (BMEL), 2016; Bundesministerium für Umwelt, Naturschutz, nukleare Sicherheit und Verbraucherschutz, 2022; Die Bundesregierung, 2021).

5.2. The contribution of a circular economy to sustainable consumption

Section 5.1 shows that the need for more sustainable and circular consumption has been acknowledged and acted on in many recent EU policy initiatives. In Chapter 3, it was shown that decoupling, at least in a relative sense and in some cases also in an absolute one, has occurred in Europe since 2007, although the impact of reductions has remained the same since 2012, while consumption continues to increase. This contains a risk as efficiencies may reach their limits in preventing a rise in environmental impacts as a result of increasing consumption (IPCC, 2022). Moreover, to stay within the safe space of the planetary boundaries (Steffen et al., 2015) and meet the goal of staying below an increase in global temperatures of 1.5 ºC (Akenji et al., 2021), environmental impacts should not only remain the same but go down drastically. This section provides reflections on the potential of a circular economy to contribute to more sustainable consumption patterns.

A circular economy is an important EU strategy to address resource scarcity, climate change, environmental degradation and biodiversity loss induced by consumption (European Commission, 2020b). In its basic principles, a circular economy aims to keep products and materials in use for as long as possible; it strives to narrow flows by using fewer materials and less energy to create new products; and promotes reuse and recycling strategies to close material cycles. The longer products and materials can be kept in the economy, the less virgin materials and energy will need to be extracted from the environment, while at the same time reducing the environmental pressures related to extraction, emissions and waste generation (EEA, 2016).

Circularity in consumption can be described as maintaining resources, materials and products at their highest possible value by keeping them in use through consecutive cycles of longer use, reuse, refurbishment and recycling, while minimising the generation of waste (European Commission, 2020b). In essence, circular consumption is about either consuming less through, for example, sharing models that reduce the number of products in circulation, through longer life spans, or by consuming differently, for example, through the use of circular products with lower environmental impacts, and the use of renewable or recycled materials in closed material loops in order to reduce material throughput in the economy and its related environmental impacts.

Consuming less

One way to reduce the material use associated with consumption is extend a product's lifespan by enhancing its durability, repairability and upgradability (Konietzko et al., 2020). According to the European Commission's New Consumer Agenda, 85 % of European consumers have indicated that they would like to have better information on durability of a product when making a buying decision, and studies have shown that when durability information is provided, consumers triple the purchase of the most durable versions (European Commission, 2020c). This suggests that further awareness needs to be built, and that businesses need to commit to producing and selling products and services that support long lives. Achieving longer product lives is key to reducing the overall lifecycle climate and environmental impacts of products. Longer lives of products can lead to a less frequent purchases of new products which saves the resources needed for producing them. Apart from physical durability, emotional durability is also key. Products should be designed so that consumers want to keep them because they never get out of fashion or can be easily adapted and upgraded. Product care and attachment are, however, reduced if businesses plan obsolescence by artificially shortening product life spans, hindering repairability or constantly introducing new models and products and urge consumers to replace old ones for the sake of following trends.

Furthermore, circular business models offer opportunities for consumers to reduce their overall consumption in terms of material or product use (EEA, 2021a; ETC/WMGE, 2021a). Collaborative consumption models, for example, allow consumers to participate in sharing or renting, providing temporary access to a product instead of permanent ownership (Luri Minami et al., 2021). As multiple people have access to the product or service, the purchase costs and possible maintenance costs are shared. Also, a switch to a 'service' economy, where consumers are buying a service instead of a product, and producers are responsible for the maintenance of the products, can incentivise brands to offer long-lasting high-quality products. Apart from business initiatives, the expansion of accessible and affordable public services can also reduce the need for private consumption and allow existing and new forms of community-based and shared consumption. Many examples already exist, such as public transport, public swimming pools, libraries, lending services, sports centres, public parks and playgrounds (Bengtsson et al., 2018). To increase consumers' commitment to sharing, businesses need to implement sharing platforms and make them accessible to all parts of the population. Digitalisation has further promoted the adoption of collaborative consumption models by the emergence of a broad range of applications, such as sharing platforms and secondhand marketplaces (Lichtenthaler, 2021). Although it is important to highlight that while the short-term benefits of digitalisation applied to collaborative consumption models, such as decreased use of resources and longer product usage are evident, its long-term effects are still to be assessed – the information technology (IT) infrastructure needed to run these platforms may turn out to be highly resource and energy intensive (Lange et al., 2020).

However, the so-called rebound effect can be a challenge for models that result in cost savings, as in some cases spending less money on certain products (for example if they last longer) can lead to spending money on other goods and services instead (Font Vivanco et al., 2022; Freire González, 2022).

Consumption shifts

Shifting consumption to alternative, more sustainable and less material-intensive options could be a way to reduce environmental effects of consumption. Here, important discussions in literature evolve around the question of whether and to what extent shifting expenditure from one consumption category to another will actually reduce impacts. One example, from Carlsson Kanyama et al. (2021), found that the shift from consumption of food, holidays and furnishings to theoretical, not yet mainstream, alternative less carbon-intensive products and services, such as plant-based products, secondhand furnishings, train-based holidays or staycations at home, could potentially lower greenhouse gas emissions by roughly a third. Another study on reducing spill-over effects from the consumption of luxury goods, food and travel found similar results based on price-elasticity models showing the potential of shifting to alternative types of plant-based food, reducing the number or length of international flights and vacations, as well as using non-motorised vehicles for commuting (Fråne et al., 2021).

Recycling and reuse strategies are also central to the transition to a circular economy. To reduce material throughput, increased reuse and recycling rates are needed in line with EU policy ambitions (EEA, 2021c). Adequate collection schemes, and reuse and recycling infrastructure should be available and accessible and consumers nudged to return their used products for proper waste management. An example cites mobile phones: in European households, millions of old mobile phones and smartphones are stored in drawers, representing a large stock of resources that cannot be reused or recycled. A 2018 survey by Bitkom in Germany found that 59 % of respondents had two or more unused mobile phones at home (Paulsen and Kriegeskotte, 2018). For this reason, the EU has proposed the right to repair, including a right to update obsolete software, and the promotion of take-back options as important enablers of the reuse, repair or recycling of electronic equipment within the Circular Electronics Initiative (EU, 2022) and within the product policy (European Commission, 2022g). Extended producer responsibility schemes are one policy tool which can incentivise producers to design products with lower impact and longer effective lifetimes (ETC/WMGE, 2021a; Pantzar et al., 2018).

Even though industrial recycling and reuse processes often take place out of consumers' sight, consumers, as suppliers of properly separated waste products and materials, have an important responsibility needed to feed high-quality recycling processes. Consumers need to learn to recognise the value in their waste and to feed it back into the value chain in the correct way. Similarly, consumers can enable reuse by participating in formal and informal reuse systems, including passing products on to friends, selling them on secondhand marketplaces, donating them to charity or returning them to take-back and collection schemes.

Circular product design

Product design is key in enabling circular consumption (ETC/CE, 2022). By following ecodesign principles, products can be made to last and to be easily maintainable, repairable, upgradable and recyclable. However, while ecolabels aim to inform consumers and encourage them to make sustainable product choices, product policy has the power to make sustainable products the norm (Lorek et al., 2021). The recently proposed Regulation on Ecodesign for Sustainable Products (ESPR) therefore proposes an elaborate set of design requirements for new products put on the EU market to ensure they fit in a circular economy (European Commission, 2022f).

5.3. Beyond efficiency improvements

Although the need to change consumption patterns has been acknowledged in some EU-wide policy initiatives and progress has been made in decoupling environmental pressures from consumption volumes, many challenges remain. Decoupling economic growth from environmental impacts is a way of increasing economic production without concurrent increases in material resource use, which is an important pathway to reducing the impacts of consumption (UNEP, 2011; OECD, 2001). Research suggests, however, that a focus on incremental adjustments to the current system, relying on 'technofix' solutions and further efficiency improvements, will not be sufficient to make the transition to sustainable consumption (Lorek et al., 2021; Bengtsson et al., 2018). Despite major improvements in efficient processes, delivering a relative and in some cases also absolute decoupling of economic growth and environmental impacts (Chapter 3), absolute reductions have not been achieved for some impacts. Furthermore, efficiency increases may be overtaken over time by both increasing consumption in growing economies and rebound effects (Kurz, 2019), eventually resulting in increased presures. A focus on incremental efficiency improvements alone, termed a weak approach to sustainable consumption (Fuchs and Lorek, 2005), will thus not enough to reduce absolute material resource use and could, at best, postpone environmental impacts. Even in the case of circular economy approaches to consumption, the eventual aim of effectively reducing overall material consumption needs to be born in mind at all times. As such, care is needed not to use circular strategies to fuel economic growth strategies that eventually will lead to increases in material consumption rather than reductions (EEA, 2021c; Kovacic et al., 2019). This calls for rethinking the concepts of growth, progress and wellbeing beyond consumption (EEA, 2021c). While the original idea of green growth ([21]) (OECD, 2011) has found its way into many EU and global policies, some scholars proposed more disruptive concepts such as post-growth ([22]) (Wiedmann et al., 2020) and degrowth ([23]) (Demaria et al., 2013). While is clear that such changes would greatly reduce material consumption, they would require fundamental societal transformations and present many challenges (Büchs and Koch, 2019).

Some scholars argue that the SDGs are too focused on an efficiency approach to sustainable consumption, and that more systemic approaches and goals are needed which also target current consumption levels, and their effects, as well as social justice related to consumption (Bengtsson et al., 2018). More specifically, the current focus on downstream solutions in the SDGs, such as recycling targets, may not be sufficient to fundamentally change consumption patterns and achieve a reduction in overall environmental impacts (Bengtsson et al., 2018). A systemic approach to sustainable consumption could integrate efficiency in technological innovation, and address challenges in consumption levels, such as lock-ins and rebound effects (Bengtsson et al., 2018). What is required for a systemic approach is to specifically address what is consumed, and the drivers to facilitate change in consumption patterns that are often locked in by, for instance, institutional and power relations (Pantzar et al., 2018). For this to happen, conditions for change need to be put in place by including environmental considerations in dominant culture, as well as by reforming institutions and reconfiguring power relationships to overcome those aspects that create lock-ins (Vergragt et al., 2014).

Many authors have suggested that existing policies targeting supply and production should be complemented with ambitious demand-side measures to steer consumption in a sustainable direction (Creutzig et al., 2022; Lorek et al., 2021; Bengtsson et al., 2018; Pantzar et al., 2018). Lorek et al. (2021) states that a sufficiency approach should be included in policy making as a complementary strategy to efficiency and consumption shifts, and that this would involve setting maximum limits to consumption (Figure 5-1). Apart from the consumption ceiling, social and equity aspects should also be considered to allow low-income groups to achieve a fair share in consumption, while high income groups are targeted to reduce their consumption (Lorek et al., 2021). An overview of current policy measures related to sufficiency has been assembled to inform policy making (Best et al., 2022; Energie-Suffizienz, 2022).

Going beyond the focus on material consumption and efficiency approaches, as stated in the previous sections in this report, the notion of wellbeing should be central to understanding the meaning of a good life and how to achieve this. Sustainable consumption strategies consist of a combination of reducing overconsumption, shifting to more sustainable alternatives and improving efficiency as defined in the avoid-shift-improve model (A-S-I) (TUMI et al., 2019; Lorek et al., 2021). This A-S-I logic has been put forward in the European Environment – State and Outlook 2020 (SOER 2020) as it is a simple,

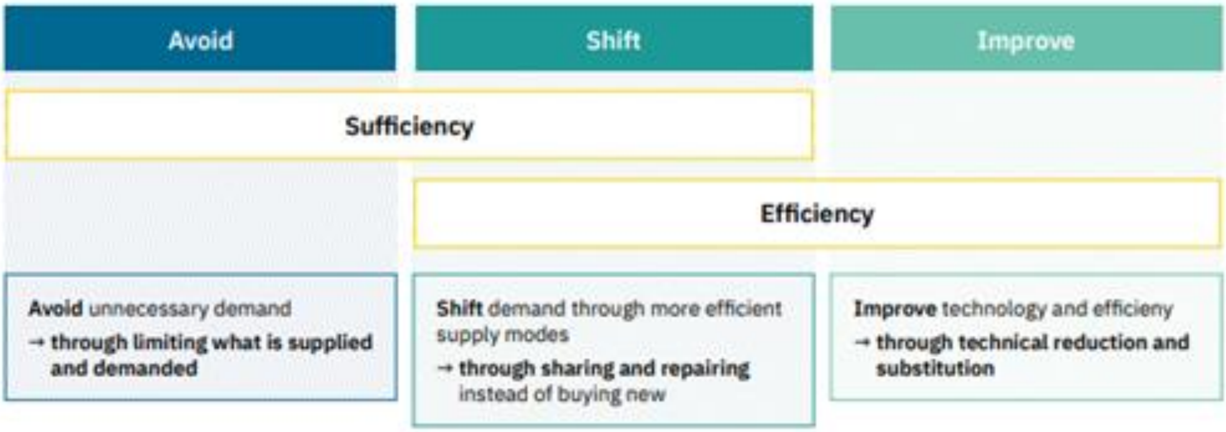
[21] Green growth relies heavily on technological innovation to maintain economic growth while "*ensuring that natural assets continue to provide the resources and environmental services on which our well-being relies*"

[22] the need to decouple wellbeing from economic growth

[23] the need to reduce production and consumption, and define goals other than economic growth

communicable and useful framework to guide policy making for addressing systemic challenges (EEA, 2019; Creutzig et al., 2018).

Figure 5-1 The avoid-shift-improve model and its relationship with sufficiency and efficiency approaches



Source: Lorek et al. (2021)

Sufficiency

The idea of aiming towards sustainable consumption and the introduction of thoughts around minimum and maximum levels of consumption is sometimes referred to as sufficiency (Stengel, 2011; Princen, 2005; Linz et al., 2002). There is no agreed definition of the term sufficiency (Jungell-Michelsson and Heikkurinen, 2022) but the idea is to limit unnecessary demand and supply to a level that does not harm the environment (Lorek et al., 2021). While efficiency is about reducing relative impacts, i.e., the impact per product or per unit of consumption, through improving technology but not necessarily about reducing the demand, sufficiency does aim to reduce the absolute level of demand (Spengler, 2016).

Reducing resource consumption will directly reduce environmental impacts, but this strategy is regarded as controversial. In fact, current economic systems encourage unsustainable consumption, as many business models to generate profit for owners and shareholders, such as fast fashion, rely on ever increasing sales. These business models could, however, be turned around to support more sustainable habits that result in less overall consumption of products, such as by improving durability, making use of product-service systems and encouraging collaborative use. Still, policy instruments that discourage consumption, such as taxes or bans on products with significant environmental impacts, can be seen as politically difficult to implement (Pantzar et al., 2018).

Some sociological studies have shown that, beyond a certain threshold, people can increase their wellbeing by reducing consumption (Alexander, 2012). The income-happiness paradox highlights that wellbeing is not affected by economic growth beyond a certain level (Alexander, 2012). Various social movements are experimenting with sufficiency at a micro-level, such as experiments on simpler lifestyles that reduce waste and limit consumption, which aim to decrease environmental impacts (Mossy Earth, 2022). Another option for increasing wellbeing is through optimised productivity – reducing work hours instead of increasing productivity – which can lead to increased social and personal time (Knight et al., 2013). Obvious concerns here revolve around the negative effects of economic decline on wellbeing and risks for widening social gaps and unemployment (Büchs and Koch, 2019).

What will be needed is a value shift away from materialism towards wellbeing. Instead, what is needed is a wellbeing economy that fosters true quality of life factors such as a purposeful life, health care, healthy ecosystems and a stable climate, safe working conditions, education and access to and participation in cultural activities and family life. The pandemic has demonstrated how important true quality-of-life factors are, no matter where people live (Akenji et al., 2021). There is also a crucial need for social justice. People will only accept radical solutions if they are justified and everyone is perceived as bearing a fair share of responsibility (Gampfer, 2014). Moreover, ensuring sustainable lifestyles will fail if efforts are not made to address the extremes of poverty and wealth in society (Akenji et al., 2021).

Mind shifts

The role of consumers in sustainable consumption is far reaching. It is not only about buying more durable and repairable products (Hobson, 2020), it is also about accepting and acknowledging products that have been repaired or recycled as being of equal value. The idea still persists that such products are of inferior quality, even if they have been refurbished to a like-new standard (Polyportis et al., 2022). In addition, older devices are also quickly perceived as being obsolete because there are newer models on the market (Terzioğlu, 2021). The incentive to buy a new model and not have the older one repaired is often larger because repairs are currently expensive (Bovea et al., 2017). There is hope, however, that consumer acceptance is increasing. Recent figures show that the European market for refurbished smartphones grew by 10 % in 2021 compared to 2020 and in Latin America the growth rate was even higher at 29 % (Cardoza, 2022).

Many voices claim that consumers need to move away from trying to do less harm to doing good (Buhmann et al., 2018; McDonough and Braungart, 2013). This idea is further elaborated in the concept of the handprint, a method for assessing positive impacts of consumption, as opposed to the footprint approach that is typically used to assess negative impacts (Box 10).

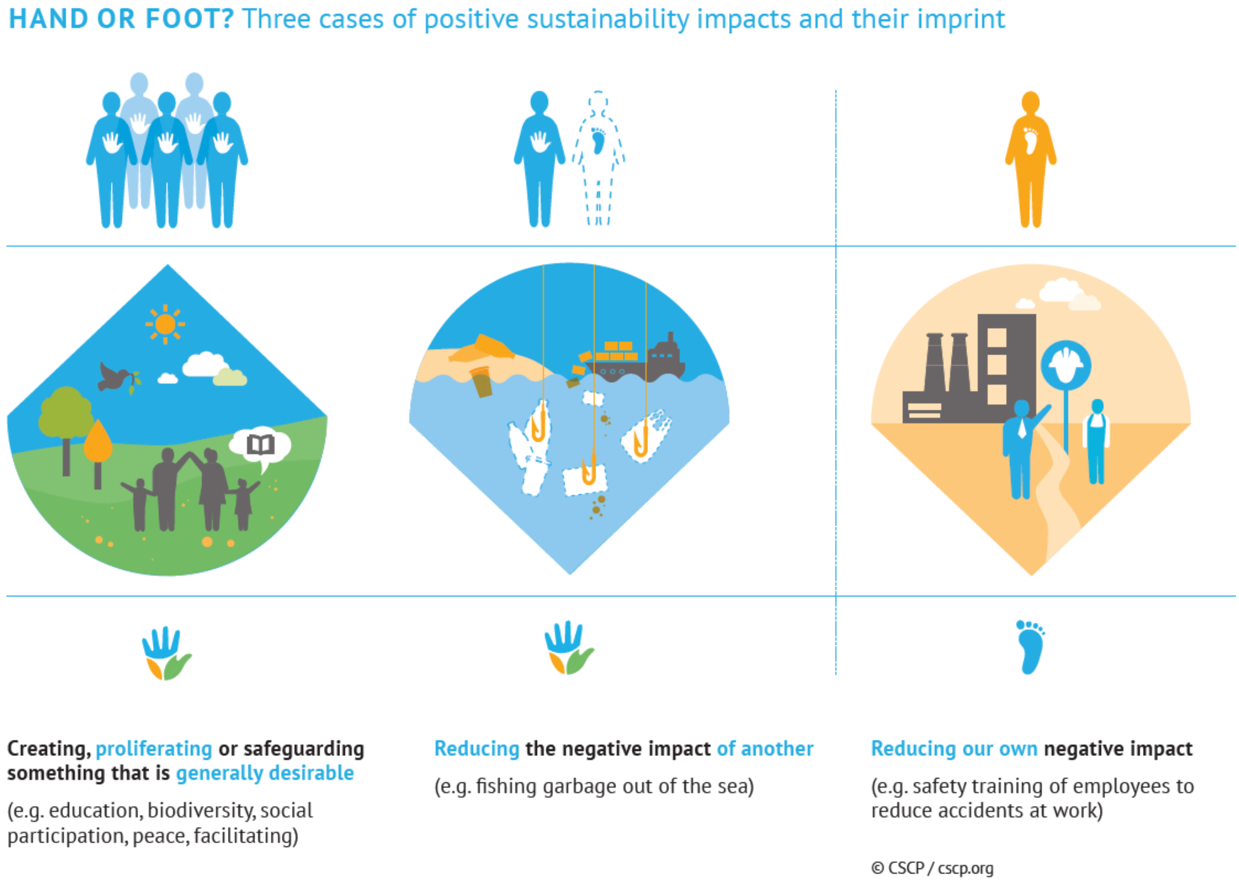
Box 10 The handprint concept

"*The handprint is an innovative and holistic approach to facilitate the measurement, evaluation, and communication of the ecological, economic and social sustainability impacts of products.*" (CSCP, n.d.).

In contrast to the well-known footprint approach that measures negative ecological impacts, the handprint evaluates the impacts of individuals, organisations or countries in all three dimensions of sustainability – ecological, economic, and social – and, in addition, integrates positive aspects. Compared to the footprint, it is thus a more holistic approach to assessing the sustainability of products and lifestyles. It goes beyond the net zero goal of doing no harm to a regenerative system view of adding something good (Gibbons, 2020; Kühnen et al., 2019; Kühnen, et al., 2017).

As Figure 5-2 shows, the handprint can refer to creating, proliferating or safeguarding something that is generally desirable, or it can reduce the negative impact of another activity. Reducing one's own negative impact, in contrast, belongs to the Footprint approach.

Figure 5-2 The handprint concept



Source: CSCP

Looking at different sustainable consumption strategies discussed in Chapter 4, the handprint thus offers an additional, positive perspective and makes the positive impacts of those sustainable strategies visible. An example of a positive, consumption-related ecological effect emerges if a consumer buys, for example, organically produced food. By doing so, he/she supports a farming method that "*goes along with more humus formation, more micro-bacterial activity and increased biodiversity*" (CSCP, n.d.). Looking at the social dimension, a desirable effect is the better health and quality of life of a person who uses a bicycle rather than a car (WHO Europe, 2021).

Another example would be people who engage in repair cafés and not only reduce the footprint of a product by repairing it, but also increase social wellbeing and inclusion by cooperating with others, while at the same time contributing to the transition to a more sustainable and regenerative economic system (Moalem and Mosgaard, 2021; van der Velden, 2021; Pesch et al., 2019). Consumers can also reduce the negative footprint of another by, for example, buying a refurbished smartphone that otherwise would have been disposed of long before its potential lifespan has ended.

Another positive "side-effect" of reuse and repair strategies is the creation of new jobs. RReuse found that, on average, a social enterprise engaged in the reuse sector creates 70 jobs per 1,000 tonnes collected material. For textile reuse, the equivalent is 20–35 jobs, for multi-household-product reuse it is 35–70 jobs and for electronic and electrical equipment reuse 60–140 jobs (RREUSE, 2021). Here, not only do the ones who reuse an item, for example, by buying a repaired product, add to their handprint, but also those who brought a product to a repair service, because they are reducing their own footprint, and at the same time supporting an additional desirable effect – creating jobs.

The Handprint opens up a new dimension of sustainable consumption strategies, because it not only communicates a reduction of something negative, but also creates a view of the positives that can be achieved. Consumers can thus understand how they can participate in a transition of the economic model, create new values and contribute to something bigger. This positive statement is likely to motivate much more than the guilty conscience associated with the footprint. In this respect, it seems to make sense to build the handprint more into the sustainability narrative of the EU’s sustainability goals.

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Annex 1 The scope of household consumption and the calculation methodology

The consumption domains

Six consumption domains, i.e., areas of consumption, are distinguished when looking at household consumption. They are:

- food (including food, drinks and hotels and restaurants);
- clothing and footwear;
- housing (dwellings, heating, sanitary hot water and electricity);
- mobility;
- commodities (household equipment, ICT, recreation); and
- services (health, education, finance, and other).

The consumption domains as defined in this report follow the Eurostat COICOP-classification and are aggregated to ensure comprehensive analysis and easy comparison between a limited number of large consumption domains in Europe. With a focus on household consumption, it is straightforward and common sense to include all goods and services bought by households in the analysis. This includes all expenditure by households, such as energy bills, expenditure at supermarkets, and spending on insurance.

There is also consumption expenditure by governments, which also serves households and as such is taken into consideration in our analysis as well. This category covers the provision of services to the community by governments, for example, education, health, the justice system, defence, and police. The consumption expenditures by governments follow the COFOG-classification. The 10 divisions of the COFOG-classification correspond to two consumption domains as defined in this report: housing and services. Environmental production, housing and community amenities are linked to the housing consumption domain, and general public services, defence, public order and safety, economic affairs, health, recreation, culture and religion, education and social production to the services consumption domain.

Furthermore, expenditure of non-profit institutions serving households (NPISH) can be attributed to households. It covers sports clubs, unions, churches, charities, etc. helping members of the community. Investment in, for example, infrastructure, machinery and equipment has no link or at least no direct link to current household consumption, except for investment by households in dwellings, i.e., a part of the gross fixed capital formation category, and is therefore not included in this analysis. The total volume of expenditure by NPISH is linked to the COICOP classification, using the EXIOBASE-COICOP allocation matrix from JRC (Beylot et al., 2019).

Table A1 The build-up of consumption domains within the scope of the household consumption, 2020 data.

		Household expenditure	Expenditure by NPISH	Expenditure of general government			Gross fixed capital formation (only investment in dwellings)
	COICOP classification	Expenditure ([24]) (EUR billion)	Expenditure ([25]) (EUR billion)	COFOG classification	Examples	Expenditure ([26,27])	Expenditure ([28])
food	01 food and non-alcoholic beverages	1 004.9	0.7				
	02 alcoholic beverages and tobacco	300.0	0.0				
	11 restaurants and hotels	404.4	1.1				
clothing and footwear	03 clothing and footwear	277.0	0.2				
housing	04 housing, water, gas, electricity and other fuels	1 738.6	23.2	environmental production; housing and community amenities	(water) waste management, housing development	97.8	772.7
commodities	05 furnishings, household equipment and routine maintenance of the house	403.1	0.3				
	08 communications	174.6	0.9				
mobility	07 transport	782.3	1.0	(part of economic affairs)			
services	06 health	308.3	29.9	health	medical products, appliances and equipment	963.1	
	09 recreation and culture	530.3	46.9	recreation, culture and religion	cultural services	102.3	
	10 education	63.9	22.5	education	subsidiary services to education	551.1	
	12 miscellaneous goods and services	780.1	57.1	general public services; defense; public order and safety; economic affairs; social protection	general services, public aid, Research and Development	1 305.4	

[24] Eurostat data [nama_10_co3_p3], 2020-data, current prices.
[25] Estimated based on Eurostat data [nama_10_co3_p3], 2020-data, current prices.
[26] Individual consumption expenditure of general government is EUR 1 880.3 billion versus EUR 1 130.6 billion of collective consumption expenditure of general government. From Eurostat data [nama_10_gdp], 2020-data, current prices.
[27] Eurostat data [gov_10a_exp], 2020-data, current prices.
[28] Eurostat data [nama_10_an6], 2020-data, current prices.

Table A1 shows the scope of household consumption per consumption domain, including the build up of consumption expenditure of households, consumption expenditures by NPISH, consumption expenditures of general government and gross fixed capital formation, limited to investment in dwellings.

The detailed COICOP 'Individual consumption expenditure of households' are listed below:

- 01 - FOOD AND NON-ALCOHOLIC BEVERAGES
    - Food
    - Non-alcoholic beverages
- 02 - ALCOHOLIC BEVERAGES AND TOBACCO
    - Alcoholic beverages
    - Tobacco
- 03 - CLOTHING AND FOOTWEAR
    - Clothing
    - Footwear
- 04 - HOUSING, WATER, GAS, ELECTRICITY AND OTHER FUELS
    - Actual rentals for housing
    - Regular maintenance and repair of the dwelling
    - Other services relating to the dwelling
    - Electricity, gas and other fuels
- 05 - FURNISHINGS, HOUSEHOLD EQUIPMENT AND ROUTINE MAINTENANCE OF THE HOUSE
    - Furniture, furnishings and decorations, carpets and other floor coverings and repairs
    - Household textiles
    - Household appliances
    - Glassware, tableware and household utensils
    - Tools and equipment for house and garden
    - Goods and services for routine household maintenance
- 06 - HEALTH
    - Medical products, appliances and equipment
    - Outpatient services
    - Hospital services
- 07 - TRANSPORT
    - Purchase of vehicles
    - Operation of personal transport equipment
    - Transport services
- 08 - COMMUNICATIONS
    - Postal services
    - Telephone and fax equipment and services
- 09 - RECREATION AND CULTURE
    - Audio-visual, photographic and information processing equipment
    - Other major durables for recreation and culture
    - Other recreational items and equipment, gardens and pets
    - Recreational and cultural services
    - Newspapers, books and stationery
    - Package holidays
- 10 - EDUCATION
- 11 - Restaurants and hotels
    - Catering services
    - Accommodation services
- 12 - MISCELLANEOUS GOODS AND SERVICES
    - Personal care
    - Personal effects not elsewhere classified (n.e.c.)
    - Social protection

- Insurance
- Financial services n.e.c.
- Other services n.e.c.

The model EXIOBASE (description from the EXIOBASE-website)

EXIOBASE 3 provides a time series of environmentally extended multi-regional input-output (EE MRIO) tables ranging from 1995 to a recent year (currently 2022) for 44 countries (28 EU Member States plus 16 major economies) and five rest of the world regions. EXIOBASE 3 builds upon the previous versions of EXIOBASE by using rectangular supply-use tables (SUT) in a 163 industry by 200 products classification as the main building blocks. The tables are provided in current, basic prices (EUR million).

EXIOBASE 3 is the culmination of work in the FP7 DESIRE project and builds upon earlier work on EXIOBASE 2 in the FP7 CREEA project and EXIOBASE 1 of the FP6 EXIOPOL project. These databases are available at the official EXIOBASE website.

A special issue of Journal of Industrial Ecology (Volume 22, Issue 3) describes the build process and some use cases of EXIOBASE 3. This includes the article by Stadler et. al 2018 describing the compilation of EXIOBASE 3. Further information (data quality, updates, etc.) can be found in the blog post describing a previous release at the Environmental Footprints webpage.

The original EXIOBASE 3 data series ends in 2011. Additional years are estimated based on a range of auxiliary data, but mainly trade and macro-economic data which (currently) go up to 2022 when including IMF expectations. So, care must be taken in use of the data.

The calculation methodology

The global distribution of pressures and effects related to final the consumption of households have been calculated using an extended multiregional input model based on a modified version of EXIOBASE v.3.8.2 data (Stadler et al., 2021). For this purpose, environmentally extended product-by-product tables were used. The calculation started from the following identities:

$$x = A.x + y \qquad (1)$$

where *x* is the total output vector, *A* the matrix of direct input coefficients (or matrix of technological coefficients), and *y* is the final demand vector. Solving the model for output gives:

$$x = (I - A)^{-1}.y = L.y \qquad (2)$$

with identity matrix *I*, and matrix *L* the Leontief inverse also known as the multiplier matrix or matrix of direct and indirect output requirements per unit produced for final demand. The Leontief model implies the following assumptions: prices are fixed in the short term, input coefficients are constant regardless of output or final demand level changes, structure of the economy is taken to be constant, at least in the reported period.

The direct environmental effects of national production are the result of the sum of the direct effects associated with each unit produced in each industry:

$$E^T = \sum_1^n E_i = \sum_1^n e_i^{int}.x_n = \langle e^{int}\rangle.x \qquad (3)$$

By multiplying the environmental pressure per output unit (measured in physical units per euro worth of output) by the total output of each industry (measured in EUR), defined by equation (2), an environmentally extended input-output model is created:

$$E^T = \langle e^{int}\rangle.x = \langle e^{int}\rangle.(I - A)^{-1}.y \qquad (4)$$

where *eT* is the vector of total environmental pressures associated with the corresponding amounts of the products groups finally used (vector *y*) and *eint* the environmental pressure intensity vector. Each element of *eint* represents the amount of the environmental pressure directly caused by the production of a product group. Each element of *eint* in EXIOBASE is allocated to a sector-region combination, which, for example, allows to derive the EU27 shares in the total footprint.

To develop a time-series dataset of environmental impacts, we applied an adjustment to the EXIOBASE dataset. The material extraction data are overwritten to match at country level with the UNEP Global Material Flows Database. The extensions on domestic extraction used in EXIOBASE are modified to match with the total domestic extraction per material flow type, per year and per country from the UNEP-database. The inner country sectoral distribution available from EXIOBASE remains unchanged.

The end years of the extension tables vary. It means that the extension tables are based on real data till a certain year and then the extension coefficients (i.e. the environmental impact per monetary unit of sectoral output) are kept constant. This means that, after the data series based on real data end, the footprint calculations only capture changes in environmental impacts due to changes in output volumes. Changes in environmental efficiency per unit of output are not captured. The end years of the extension tables are: 2015 for energy, 2019 all greenhouse gases (nonfuel, non-carbon dioxide are nowcasted from 2018), 2013 for material use (but is overwritten using the UNEP-database), and 2011 for most others, land, and water.

Application of the Environmental Footprint

Applying the methodology as described above gives individual results for each environmental extension available from the EXIOBASE dataset.

In a next step, these extensions are translated into resource use or environmental impact categories:

- **Value added**: The sum of the EXIOBASE extension lines taxes less subsidies on products purchased, other net taxes on production, compensation of employees; wages, salaries, and employers' social contributions, and operating surplus. The indicator is expressed in million euros.
- **Climate change**: The estimate for climate change is based on the Environmental Footprint (EF) method v1.02 (10/03/2022, taken from Simapro). The impact category climate change (expressed in kg CO_2-eq.) requires the conversion of different relevant extension lines: Extension line 'CO2 - combustion - air' is multiplied by characterisation factor 1 as this one is already in kg CO_2-eq. Extension line 'CH_4 - combustion - air' is multiplied by 36.8 to convert the kg of CH_4-emissions into kg of CO_2-eq. This characterisation factor is available from the EF-method. A total of 40 extension lines are used to determine the impact category climate change.
- **Land use**: Includes cropland, forest areas, permanent pasture, infrastructure land and other land use. The indicator is expressed in square kilometres.
- **Material use**: Includes biomass, non-metallic minerals, metal ores and fossil energy carriers/materials. The indicator is expressed in kilotonnes.
- **Water use**: Both blue and green water are included. Green water footprint is water from precipitation that is stored in the root zone of the soil and evaporated, transpired or incorporated by plants. It is particularly relevant for agricultural, horticultural and forestry products. Blue water footprint is water that has been sourced from surface or groundwater resources and is either evaporated, incorporated into a product or taken from one body of water and returned to another, or returned at a different time. Irrigated agriculture, industry and domestic water use can each have a blue water footprint. The indicator is expressed in Mm^3.
- **Air emissions (NOx, SOx, and PM)**: Emissions to air for NOx, SOx, and PM are expressed in kilotonnes.

The scope includes both indirect and direct impacts/resource use. The indirect impacts/resource use covers impacts upstream the global production network. It covers impacts from all kind of activities, for example, manufacturing, agriculture and transport. The direct impacts/resource use covers impacts directly generated by households. For example, the burning of fuels for heating houses or driving a car.

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