

Impacts of COVID-19 on single-use plastic in Europe's environment



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The COVID19 pandemic is having immense effects on societies across the world. It has caused millions of deaths worldwide and challenged our health systems and economies. The pandemic - and responses to it, involving lockdowns, use of personal protection equipment, and stay-at-home measures - has far reaching health and economic consequences. This briefing deals with the less visible impacts on our environment and climate originating from changed use of single use-plastics because of the pandemic.

Key messages

1 The responses to COVID-19 have resulted in increased use of products such as masks, gloves and certain types of packaging made from long-lasting single-use plastics, causing additional greenhouse gas and other emissions. Some of these materials end up littering land and marine environments across Europe, potentially harming ecosystems and animals.

2 In the light of the pandemic, there is a need to rethink single-use plastic production, consumption and waste management practices in Europe to make our society better prepared for the continued impacts from this pandemic and for the potential impacts of future pandemics and other disruptive events.

The COVID-19 pandemic and single-use plastics

The COVID-19 pandemic is a complex, disruptive event with many impacts beyond those related to health and our economies. Handling it is very complex, as the impact of the response to the first wave of COVID-19 on single-use plastic reveals:

- More masks, gloves and certain types of packaging made of single-use plastic need to be managed as waste or are being littered and causing additional greenhouse gas and other emissions.

- Imports and production of face masks and gloves have increased in the EU.

- Production of the EU plastic packaging industry decreased more rapidly during the first months of COVID-19 due to the slowdown in our economies.

- The increase in e-commerce during lockdowns is likely to have increased the volume of plastics used in e-commerce packaging in the EU.

- Restaurants have shifted to take-away and food deliveries during lockdowns, increasing the use of single-use plastic food containers. At the same time, lockdowns may have reduced overall sales of on-the-go snacks, food and drinks, reducing the need for plastic for that purpose.

This briefing provides an overview of the environmental and climate impacts of single-use face masks and gloves used for COVID-19 protection, and plastic packaging used for e-commerce and take-away food deliveries, from April to September 2020. It identifies the need for further knowledge and action to reduce these impacts now and in any future events.

The briefing is underpinned by a report from the EEA's European Topic Centre on Waste and Materials in a Green Economy (ETC/WMGE): [Impact of COVID-19 on single-use plastics and the environment in Europe](#).

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1. Face masks and gloves

One effect of the responses in Europe to the COVID-19 pandemic has been the increase in the use of personal protective equipment, such as face masks and gloves, in medical setting and by citizens.

The increase in the use of such equipment can be measured by the volumes of COVID-19-related medical supplies imported into Europe. Imports are used as a proxy indicator because there are no data on the use of face masks and other personal protective equipment in Europe, and its capacity to produce these items was limited at the time.

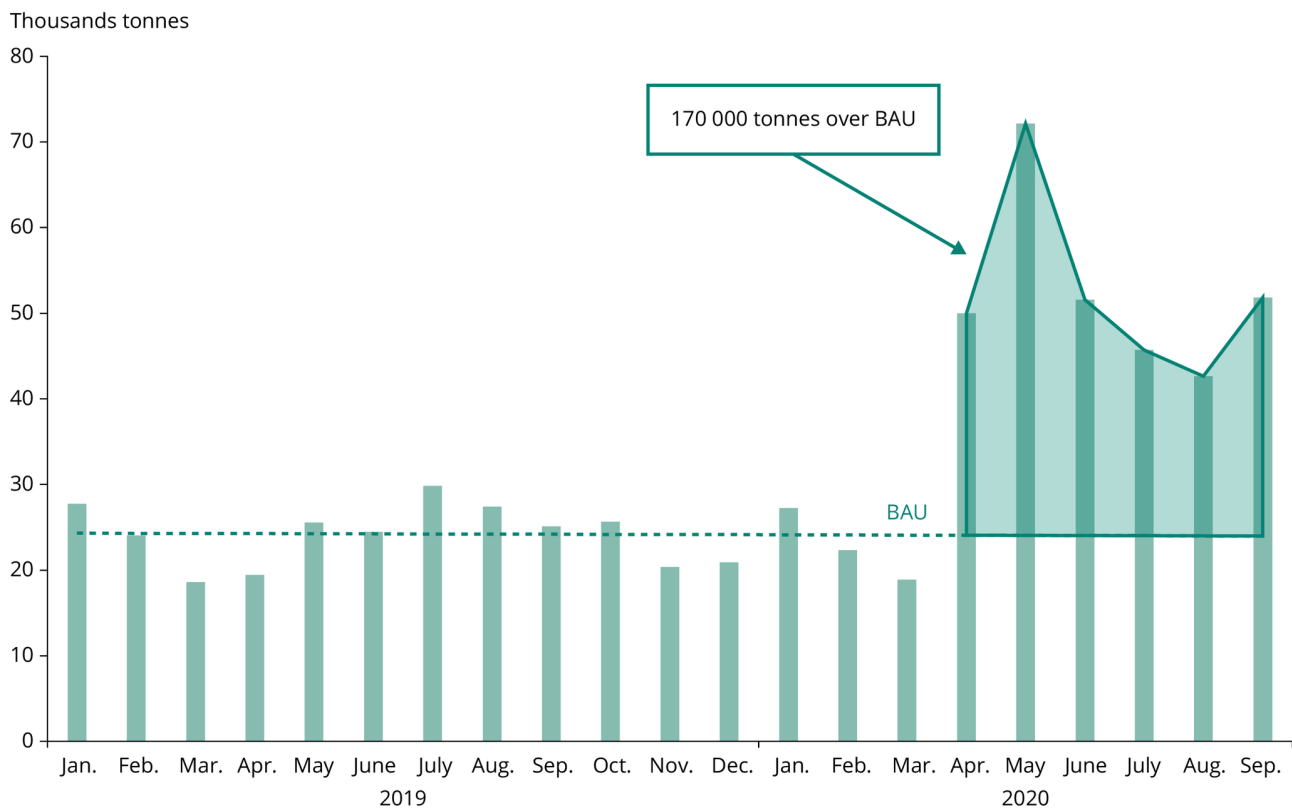
Production and import

The World Health Organization (WHO, 2020), the European Centre for Disease Prevention and Control (ECDC, 2020) and governments across Europe have required or recommended that citizens use face masks at some point during the pandemic. Before the COVID-19 pandemic, France and Germany were the only EU countries with a sizeable share of the global production and exports of face masks (7 % and 2 % of global exports in 2017, respectively).

Figure 1 shows that imports of face masks into the EU more than doubled compared with business as usual before the pandemic, and this increase occurred while EU production was also increasing. Assuming an average face mask weight of 2.7 grams, this corresponds to an average additional import of 0.75 face masks per person per day for the EU population.

Figure 1 Face mask imports to the 27 EU Member States from the rest of the world, January 2019 to September 2020

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Note: Business-as-usual (BAU) level is calculated as the best fit regression line for monthly import data between January 2019 and February 2020, i.e. the 14-month period immediately preceding the arrival of COVID-19 in Europe.

Source: Graph by PlanMiljø, Oeko-Institut and IDEA Consult using data from Eurostat data set DS-1180622 for product code B1 face masks (excluding paper masks).

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International healthcare organisations have not recommended that the general public use gloves as a preventive COVID-19 measure (WHO, 2020; ECDC, 2020). Nevertheless, during the first European wave of the COVID-19 pandemic from April to September 2020, additional imports of these gloves to the 27 EU Member States (EU-27), over and above business-as-usual levels, totalled 105 000 tonnes, representing an 80 % increase.

Environmental impacts

Increased use of single-use face masks and gloves during the COVID-19 pandemic has environmental and climate impacts. These relate to resource extraction, production, transport, waste handling and littering. Impacts during the production stage mainly arise in exporting countries outside Europe, whereas those related to waste and littering arise in Europe.

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Although European countries have chosen different waste management strategies to handle face masks and gloves (Tsukiji et al., 2020), most countries have advised their citizens to dispose of single-use face masks and gloves in mixed municipal solid waste, which is typically incinerated, although landfilling is still common practice in some regions in Europe.

Littering of single-use face masks and gloves is a visible side-effect of their increased use. Although they can be unintentionally lost in the environment, a survey in July 2020 revealed that 5 % of people in France (i.e. over 2 million) admitted throwing away their masks on public roads (Connexion, 2020). Littered masks and gloves are found on streets, in rivers, on beaches, along coasts and in the sea (Adyel, 2020; Canning-Clode et al., 2020). Experts warn that fish and birds can ingest soft and flexible plastics. Animals can also become physically entangled (Hirsh, 2020). Face masks and gloves are now included as items to report in marine litter monitoring (OSPAR, 2020), e.g. using the EEA Marine Litter Watch app.

Discarded face masks and gloves can break down into smaller pieces under the influence of weathering, ultraviolet radiation and abrasion, causing microplastic pollution (Aragaw, 2020). Microplastics can be released from the degradation of the outer layer (polypropylene) and inner layer (polyethylene) fabrics making up single-use face masks (Fadare and Okoffo, 2020).

Assessing the quantitative impacts of single-use face masks on the environment and climate is not straightforward, because the variety of designs and material combinations makes it difficult to derive an average composition. In an attempt to estimate the greenhouse gas emissions from face masks, we have used the material composition of a three-layered single-use face mask made of polypropylene as described by Allison et al. (2020). This is a typical medical face mask meeting the requirements of European Standard EN 14683:2014.

Greenhouse gas emissions related to the manufacture, transport and waste treatment of single-use face masks range from 14 to 33.5 tonnes of carbon dioxide equivalent (CO₂e) per tonne of masks^[1], depending on the masks' composition. Production and transport account for the largest share^[2]. As these masks are mainly produced in China, a large part of these emissions take place outside Europe.

As a result of the increased consumption of face masks in Europe, an additional 2.4-5.7 million tonnes of CO₂e, above the business-as-usual level, has been emitted in the 6-month period from April to September 2020 (+118 %). Additional CO₂ emissions are to be expected in the period after that. Other impacts from single-use face masks (e.g. human toxicity potential, acidification potential) show the same trend.

Impacts of single-use versus reusable face masks

Studies have been undertaken comparing the environmental and climate impacts of single-use and reusable face masks. It is important to note that these studies did not consider the functionality or

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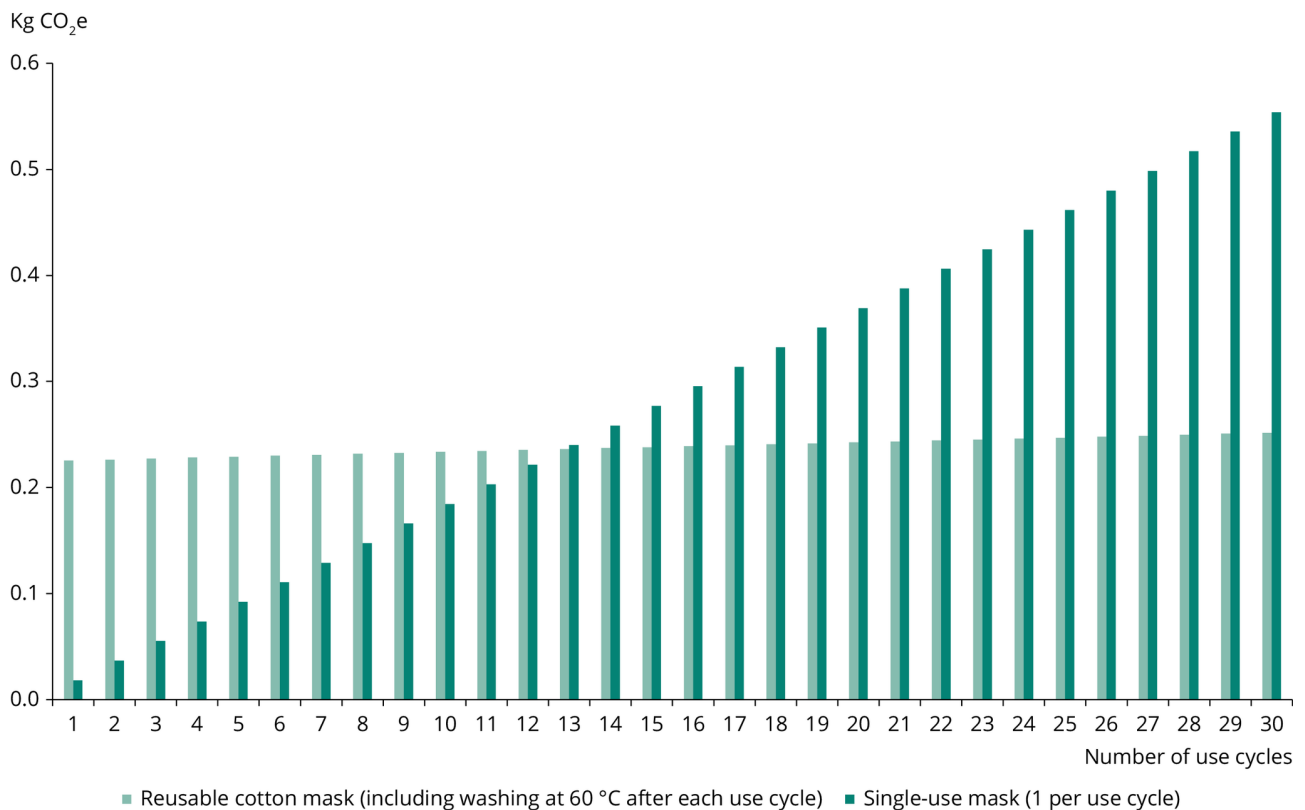
effectiveness of these reusable masks in preventing virus spread or into their compliance with WHO guidelines. It can be assumed that the reusable masks do not provide the same level of protection as the approved single-use masks — the performance of personal protective equipment must always be a primary consideration.

Simplified life cycle assessment studies were performed by Allison et al. (2020) and Schmutz et al. (2020), comparing the environmental impacts of single-use and reusable masks. Schmutz et al. (2020) compared the environmental impacts of a single-use surgical face mask (made of polypropylene) and a two-layered cotton face mask. They found that the climate impact of both types of masks is dominated by their material composition and production process, whereas waste incineration makes a minor contribution (transport was not included in the study). Increasing the number of times the cotton mask is reused improves its environmental performance. However, if reusable masks are hand-washed, the impact of washing becomes significant and may flip the overall environmental impact in favour of single-use masks (Allison et al., 2020).

Figure 2 compares the greenhouse gas emissions of a reusable cotton mask (including production, washing at 60 °C between uses and waste incineration) with those of a single-use surgical mask that is replaced after each use (including production and waste incineration) over 30 uses. The tipping point is around 13 uses, implying that a cotton mask should have a minimum lifespan of 13 uses to have a lower impact than using an equal number of single-use masks. After 30 uses, almost 90 % of the overall impact of the cotton mask can be attributed to its production, 10 % to its washing and 0.2 % to its waste incineration. For the single-use masks, 63 % of the impact is linked to their production and 37 % to their incineration. Transport of the masks was not included in the simulation.

Figure 2 Greenhouse gas emissions associated with using a reusable cotton mask (including washing) and single-use surgical masks

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Source: Calculations and graph by VITO, based on Schmutz et al. (2020).

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2. COVID-19 and single-use plastic packaging

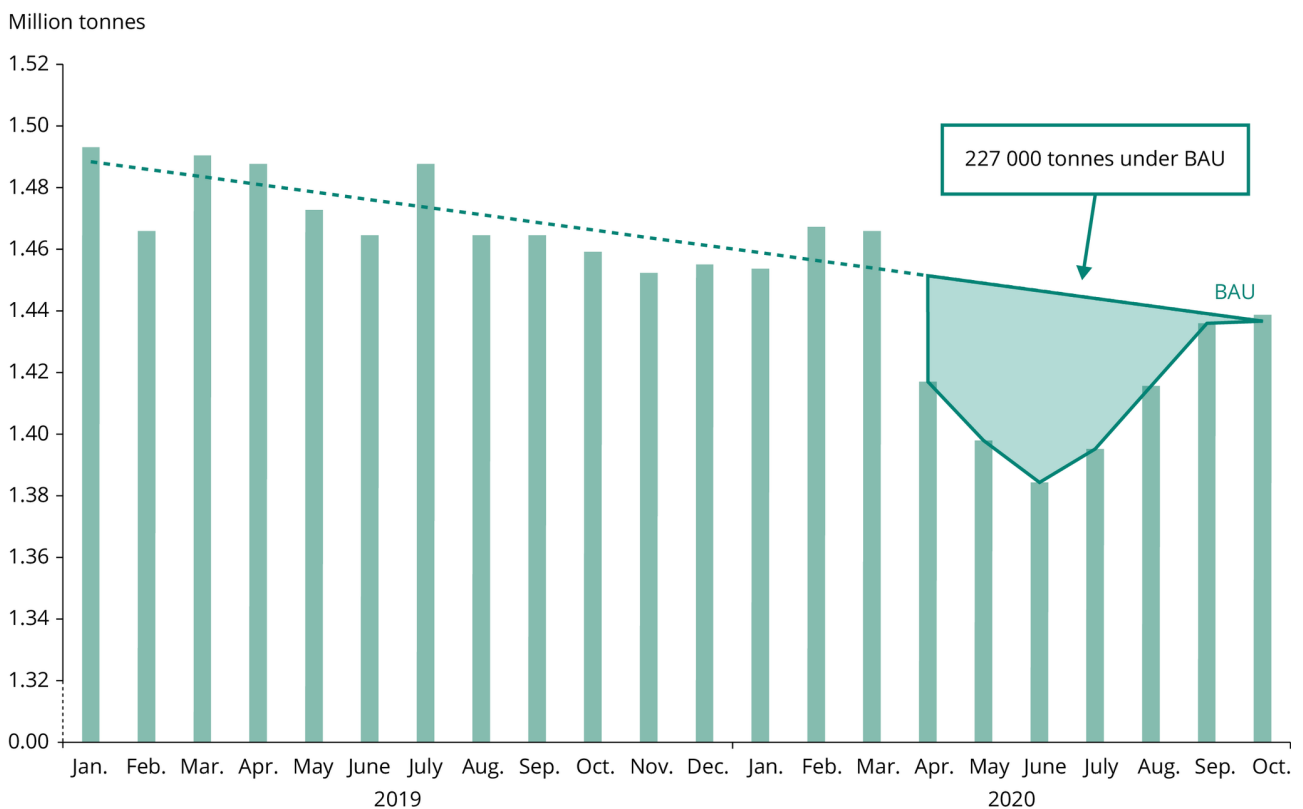
Responses to the COVID-19 pandemic have affected the use of certain types of single-use plastic packaging in Europe. Although the closure of physical shops and financial uncertainty may have reduced consumption (and associated packaging) overall, a growth in online sales of goods can be observed. This is linked to an increase in the use of plastic and other single-use packaging for e-commerce parcel deliveries. The use of single-use plastic packaging for food has also been affected during lockdown. While many restaurants shifted to take-away services, increasing their use of packaging, reduced commuting, travelling and leisure activities may have reduced the demand for on-the-go food and drinks.

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Production and impacts

The production of the EU plastic packaging industry has been gradually decreasing since 2017. During the first wave of the COVID-19 pandemic in Europe, production decreased more rapidly than in previous months (see Figure 3). This reduction amounted to approximately 227 000 tonnes of plastic packaging from April to October 2020 (i.e. the shaded area in Figure 3 representing plastic packaging production in EU-27 beyond business-as-usual levels). By October 2020, production had returned to business-as-usual levels.

Figure 3 Production of plastic packaging in the EU-27 from April to October 2020 compared with business-as-usual levels



Source: Calculations by PlanMiljø, Oeko-Institut and IDEA Consult using Eurostat datasets sts_inpr_m and DS-066341.

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As a result of the overall decrease in plastic packaging production in the EU, about 770 000 tonnes of CO₂e were saved in total between April and October 2020 compared with the business-as-usual level before that period. This is equivalent to the direct CO₂ emissions of 480 000 EU citizens in 2019 (from burning fossil fuels for home heating and transport).

Online shopping (e-commerce)

Most physical shops, apart from those selling essential goods and services, were closed during the strictest periods of lockdown in many countries in Europe during the first wave of the pandemic (OECD, 2020). While consumers switched to online shopping, this only offset losses of sales in physical shops to a limited extent (BBC News, 2020).

E-commerce experienced an increase in revenue of 16 % above business-as-usual levels between March and September 2020. Parcel delivery services were also used at an all-time high in 2020: the Deutsche Post DHL Group experiencing an increase of almost 15 % compared with the previous year, corresponding to a total of around 1.8 billion parcels (DHL, 2020). The increase in e-commerce is likely to have led to an increase in the volume of plastics used in packaging, resulting in an estimated 11 400-17 600 tonnes of additional plastic packaging used by the sector due to COVID-19 from March to September 2020.

The environmental and climate impacts of additional single-use plastic packaging for e-commerce include those from its production and transport (greenhouse gas and other emissions) and from handling the additional waste, mainly through incineration.

Food packaging

The restaurant and food services sector was hit hard by the first wave of the COVID-19 pandemic in Europe, because many national authorities put restrictions on sit-in meals or obliged restaurants to close. From March to August 2020, the turnover of the sector, which had grown by 25 % since 2015, was reduced by 45 % compared with business-as-usual levels. On the one hand, the consumption of on-the-go food and drinks is likely to have decreased due to increased working at home and home schooling. On the other hand, many restaurants may have shifted to take-away meals or home deliveries, which may have resulted in an increased use of single-use packaging.

At the time of publishing this briefing, no reliable data are available on the trends in the use of single-use plastic packaging by the food services industry during the COVID-19 pandemic in Europe in 2020. Thus, it is not possible to evaluate the actual environmental impacts due to changes in this part of the single-use plastic packaging market.

3. Further knowledge and options for action

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Collecting data and drawing conclusions about the use of single-use plastics during the 2020 period of the COVID-19 pandemic, and the associated environmental and climate impacts, has been challenging. Not only do different effects point in different directions (as is the case with food packaging), but there is also a lack of detailed data on the use of specific single-use plastic products (e.g. disposable plastic medical equipment, food containers and e-commerce packaging), which makes it difficult to estimate consumption trends.

To enable future assessments, during the current and further waves of the COVID-19 pandemic, and in the event of future pandemics and other disruptive events, we need more knowledge of monitoring the use of specific single-use plastic products.

As can be expected during a health crisis, most research on medical protective equipment, such as masks and gloves, that emerged during the early days of the pandemic primarily focused on their hygienic/protective aspects (Patrício Silva et al., 2021). Once the protective performance of equipment is assured, attention should also be devoted to other issues, namely their environmental and climate (and social) impacts.

Citizens have an important role to play in the adequate disposal of single-use products. Likewise, authorities and businesses have a responsibility to provide adequate disposal options. Box 1 provides an overview of some options for preparing for an uncertain future that affect single-use plastics and the environment.

Box 1 Preparing for an uncertain future

An important lesson from the COVID-19 pandemic is that we should prepare now for potential disruptive events in an uncertain future. This should include strategies to address the environmental and climate impacts of the responses, such as impacts from medical protective equipment and packaging. Our preparations should include the following key areas:

Research: to assess and reduce the potential environmental and climate impacts of future responses further research is needed on, for example:

- alternative materials and product designs.;
- strategies to encourage desirable consumer behaviour related to use, sanitation, collection, safe disposal and the prevention of littering

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the environmental impact of litter in public spaces and nature

- technology options for sanitising reusable products, such as medical equipment

- recycling options for single-use products.

Monitoring: more accurate and timely monitoring of aspects of single-use plastic is needed to facilitate research and guide future policy options, such as:

- specific up-to-date data collection on production, consumption and trade of products

- data collection on littering, including littering from landfills.

Policy: based on improved monitoring and research, policy options should be considered to address the environmental and climate impacts of single-use products including:

- Europe-wide awareness raising and incentives to change behaviour; incentives to adopt and regulation of circular business models; recycling and municipal waste management.

Business: incentives should be developed for and by business to:

- adopt circular models such as reusable packaging for food and other goods, take-back and redistribution systems for reusable packaging, sanitising processes to ensure hygiene and safety, and efficient collection and recycling schemes

- develop packaging from recycled or low-impact materials that can easily be recycled at the end of their life.

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Notes

[1] This corresponds to greenhouse gas emissions of 38-90 g CO₂e per face mask, which is equal to the emissions of a 127-300 m drive in a medium-sized petrol vehicle.

[2] Emissions were calculated based on one example of a single-use face mask (Allison et al., 2020), with varying ear loop composition; the results may differ for other mask types or materials.

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