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IMPACT ASSESSMENT

Reducing Marine Litter: action on single use plastics and fishing gear

Accompanying the document

Proposal for a Directive of the European Parliament and of the Council on the reduction of the impact of certain plastic products on the environment

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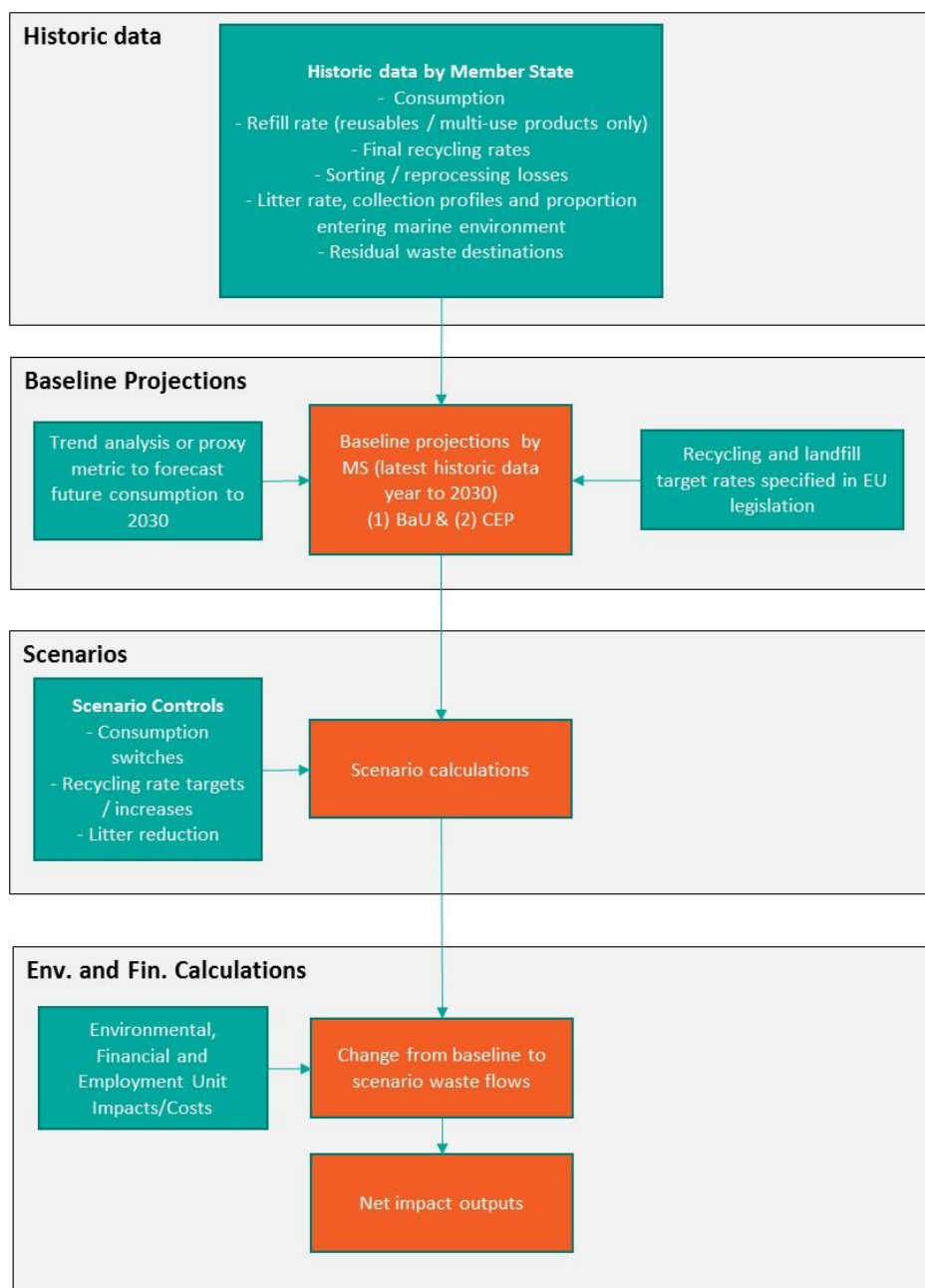
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ANNEX 4: ANALYTICAL METHODS

1 SINGLE-USE PLASTICS

The main model used was developed by Eunomia, and reflects the core flow of calculations that are calculated for each Member State. The following overview highlights the basic model flow used to generate our calculations. These have been calculated for each Member State, Item and Type.



Litter calculations (baseline and scenarios)



The model includes the following impact categories:

1. Greenhouse gas emissions:
 - a. Manufacturing
 - b. Refill Schemes
 - c. Recycling
 - d. Incineration
 - e. Landfill
2. External costs:
 - a. Manufacturing
 - b. Refill Schemes
 - c. Recycling
 - d. Incineration
 - e. Landfill
 - f. Land based litter
 - g. Marine litter
3. Financial costs:
 - a. Consumer's Purchases
 - b. Retailer Sales
 - c. Producer Turnover
 - d. Retailer Turnover
 - e. Producer Profit
 - f. Retailer Profit
 - g. Refill Schemes
 - h. Consumer's Washing
 - i. Recycling
 - j. Mixed Waste Treatment
 - k. Litter Clean-up
 - l. Business Administration
 - m. Waste-Water Treatment Costs
4. Employment:
 - a. Manufacturing
 - b. Refill Schemes

- c. Recycling
- d. Mixed Waste Treatment
- e. Litter Clean-Up

2 FISHING GEAR

The analysis (see annex 7) follows a stepwise approach

- Estimation of the amount of fishing gear used annually
- Estimation of the current level of waste both through lost fishing gear and through port waste management
- An estimation of the effectiveness of the different policy options
- Costs related to handling, recycling and landfilling along with a fixed cost for the scheme in question

The quantified costs are supplemented by a qualitative and distributional analysis.

ANNEX 5: REGULATORY FRAMEWORK

Marine litter has been recognised as a problem, which led over the years to the development of a policy framework ranging from water and marine policy, to waste and product policy to measures under the Common Fisheries Policy. Parts of this framework have focused on the different pathways and aiming to reduce entry in the sea from waste or sewage systems or from sea based sources. The main horizontal piece of legislation is the Marine Strategy Framework Directive, which has the most explicit focus on marine litter and reducing its impacts. However, it does not link well to efforts to reduce specific items (rather leaving the scope and ambition of measures up to Member States). Agenda 2030 adopted by the United Nations General Assembly in September 2015 includes the target *"By 2025 prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution."*¹ The indicative target to reduce marine litter by 30% was adopted by the Commission in 2014, as part of the Circular Economy package and endorsed by the Council. This target emphasised the need to galvanise action, but again did not properly link to specific measures.

Overall, the policy framework is wide – reflecting the wide range of sources, means of release and pathways – but there is a gap at present between the problems identified, their drivers and the objectives and measures that can effectively target specifically the sources of marine litter.

1 WATER AND MARINE POLICY

Directive 2008/56/EC (the Marine Strategy Framework Directive "MSFD") is the only EU legal instrument tackling marine litter explicitly and directly. It does not regulate specific human activities but is to ensure good environmental status of the marine environment. It cannot therefore ensure reduction of litter on beaches and at sea on its own, but it provides a valuable contribution through assessment and monitoring as well as through measures against marine litter.

The MSFD requires Member States to achieve Good Environmental Status (GES) by 2020 for all eleven MSFD descriptors. One of these descriptors (descriptor 10) focuses on marine litter, stating that GES is achieved only when "properties and quantities of marine litter do not cause harm to the coastal and marine environment". Member States provided in 2012 their assessment and determined GES and targets for marine litter, while in 2014 they reported on their monitoring activities.

The Member State measures confirm that litter is an 'emerging' pressure on the marine environment, receiving widespread attention. The Directive has led to an improved understanding of macro- and micro-litter, notably from plastics. Sources of marine litter have been mostly attributed to the following human activities: tourism and recreational activities, urban waste, industrial activities, shipping, and commercial fishing.

There are positive aspects related to monitoring (appropriate coverage and frequency of monitoring litter on the beach, satisfactory degree of consistency in monitoring programmes in most marine regions, links to international and regional standards), but also areas that need urgent improvement. For instance, litter monitoring in the seabed and water surface and monitoring of micro-litter is far from adequate. There is no systematic and comparable

¹ Transforming our world: the 2030 agenda for sustainable development; sustainabledevelopment.un.org/; A/RES/70/1

monitoring of the impact of litter on marine animals and nature; localisation and extent of human activities generating marine litter are often not covered by the monitoring programmes in place. Also, there are no agreed baselines or thresholds for litter and micro-litter, which makes the monitoring of progress towards good environmental status difficult. This will also affect the EU's ability to meet internal (7th Environment Action Programme to 2020, Circular Economy action plan) and international commitments (see below and Annex 5).

Member States had to submit by March 2016 Programmes of Measures for reaching Good Environmental Status (GES) by 2020.

A preliminary analysis shows that the Programme of Measures (PoMs) submitted by the 23 Coastal Member States² focused on a variety of general actions including fishing for litter initiatives, beach cleaning activities and awareness raising, improvement of port reception facilities, extended producer responsibility, deposit schemes, and more. Most Member States also proposed a number of specific measures targeting ALDFG, highlighting the importance of the issue in national decision-making. Many countries aim to improve the collection of lost and abandoned fishing gear. For example, in Croatia fishers need to collect marine waste that is collected in their nets, store it in the prepared sacks and place it in PRFs. Countries also target the prohibition of certain equipment, as well as the redesigning of products to prevent ghost fishing (i.e. increasing selectivity of fishing gear in Bulgaria). Under the MSFD, countries like Spain, Malta and Belgium are exploring the creation of a market for plastic waste from fishing gear, while Estonia and Poland target regulation on marking, tagging and electronic reporting systems. Besides awareness raising campaigns for the wider population, Ireland, France, Malta and Spain are developing specific trainings and education programmes aiming to sensitize fishers and seafarers to the issue of marine litter and the key role they could have in solving the challenge.

Member States draw on the existing EU legislation, as well as on international agreements and regional action plans to fight marine litter³. The Commission supports technically and financially the implementation of such plans developed under the Regional Seas Conventions and encourages Member States to use them for more efficient coordination of their national efforts to fight marine litter. The submitted measures on marine litter included beach cleaning and awareness raising campaigns; while these have a modest direct impact on reducing the pressure, they also raise awareness. Targeted measures for beach litter, such as by limiting the wide consumption of single-use plastics, or for the reduction of microplastics and of litter from aquaculture were however underdeveloped. Most Member States consider that they cannot estimate when good environmental status for litter will be achieved.

Overall, it seems difficult to reach the 30% marine litter reduction indicative target set in the Circular Economy Package or evaluate progress towards its achievement without additional measures.

In April 2017, a revised Commission Decision was adopted: Good Environmental Status (GES) should be determined on the basis of amounts, while threshold values will have to be established at Union or other levels (regional/sub-regional) for litter and microlitter on beaches/water column/seafloor, for litter ingested by marine animals and for adverse effects (entanglement, other types of injury or mortality or health effects, of the species concerned due to litter). Setting thresholds for litter quantities and impacts at the appropriate geographic

² The analysis of PoMs did not cover Slovenia.

³ Regional action plans exist for the North-east Atlantic, Baltic and Mediterranean regions, while the one for the Black Sea is being developed.

level will also enable the setting of targets and monitoring of progress towards their achievement. Moreover, it will allow for better evaluation of the effectiveness of measures.

EU funding is also being deployed to understand and combat the rise of marine litter⁴, supporting global, national and regional action — for example, in November 2017, the Commission launched a call for proposals for €2 million to tackle the problem of marine litter⁵.

Directive 2006/7/EC concerning the management of bathing water quality requires visual checks for pollution such as plastic, rubber or any other waste. When such pollution is found, adequate management measures need to be taken. For Blue Flag beaches, there are also requirements on managing litter.

Directive 91/271/EEC concerning urban waste-water treatment (UWWTD) has the objective to protect the environment from the adverse effects of urban waste-water discharges and discharges from certain industrial sectors and concerns the collection, treatment and discharge of waste-waters. Whilst the UWWTD has improved the quality of discharges over the years, there are still cases of plastic and other litter entering the environment through the sewage network, for example, through Continuous Storm Overflows (CSOs). Micro plastics are either not completely captured in the treatment plants or accumulate in the sludge – part of it being reused in agriculture with a clear risk of releases of micro plastics back to the environment. The Commission is evaluating the UWWTD, and this is an issue that will be considered⁶.

Through its legislative proposal for a review of the **Drinking Water Directive**⁷ the Commission is promoting access to tap water for EU citizens, therefore reducing packaging needs for bottled water (bottles are a frequently found item, but it is often difficult to tell what was in the bottle). At the same time, the proposal includes the obligation to monitor the presence of micro plastics in the drinking water when there is a risk and to take remedial actions in case of potential danger for human health

The **Water Framework Directive** requires Member States to adopt programmes of measures to achieve good environmental status of the water bodies. This legislation does not oblige Member States to take measures against litter in surface waters, but if they do, they should report those measures.

The Fertilizers Regulation concerns the issue of contaminating the soil and, from there, freshwater rivers/basins through the wash-out of remnants from plastic items used in agriculture (the so-called “other polymers than nutrient polymers”).

⁴ For instance, in the Arctic Region, the Circular Ocean INTERREG project is testing new opportunities for reusing old fishing nets, including a material to remove pollutants from water (<http://www.circularocean.eu/>). In the Baltic Sea Region, the BLASTIC project maps potential litter sources in urban areas and monitors litter levels in the aquatic environment (<https://www.blastic.eu/>). Both projects are supported by the European Regional Development Fund.

⁵ Under the overarching ‘Sustainable Blue Economy’ call: <https://ec.europa.eu/easme/en/information-day-blue-growth-calls-under-emff>.

⁶ https://ec.europa.eu/info/law/better-regulation/initiatives/ares-2017-4989291_en

⁷ COM(2017) 753 final

2 WASTE AND PRODUCT POLICY

Directive 2008/98/EC (the Waste Framework Directive) requires that waste be managed without endangering human health and harming the environment, and in particular without risk to water, air, soil, plants or animals. It sets the basic concepts and definitions related to waste management and contains broad objectives on prevention and waste management. It establishes the "waste hierarchy" as the framework for waste management with waste prevention (ie: reduced generation of waste) as the preferred option. The Directive introduces and implements the principles of "polluter pays" and the "extended producer responsibility (EPR)". The Directive requires that Member States adopt waste management plans and waste prevention programmes.



The revision of the Waste Framework Directive⁸ (agreed and awaiting adoption by the co-legislators in summer 2018) will provide for additional measures that will contribute to the prevention of litter. These measures consist of: (1) increase of the recycling targets for municipal waste including for plastic packaging; (2) new rules on extended producer responsibility schemes that will require fees paid by the producers to be linked with the "re-usability" and "recyclability" of the products ("modulated fees") and that will allow producers to be charged for prevention measures, such as prevention campaigns, and the clean-up of litter; (3) measures aiming to halt the generation of marine litter as a contribution to UN Sustainable Development Goal 14 to prevent and significantly reduce marine pollution of all kinds; (4) measures to prevent and reduce litter from products that are the main sources of littering notably in the natural and marine environments; and (5) information campaigns to raise awareness about waste prevention and littering; (6) the requirement on the Member States to revise their waste prevention programmes to reflect the objectives on the prevention of (marine) litter and their waste management plans to provide for measures to combat and prevent all forms of littering and to clean up all types of litter. Member States will also be required to coordinate their different plans and measures on litter that are required under international and EU water legislation that envisage specific action to tackle litter in the aquatic environment (Regional Seas Conventions, Directive 2008/56/EC and Directive 2000/60/EC) and waste legislation that tackles land based litter.

Where single use items would qualify as packaging, **Directive 94/62/EC on packaging and packaging waste** sets targets for the recovery and recycling of packaging waste and essential requirements for placing packaging on the market. The revision of the Packaging and

⁸ COM(2015)595 final.

Packaging waste Directive⁹ (that should be adopted by the co-legislators in summer 2018) envisages new rules: a new target of 55% recycling of plastic packaging waste by 2030, ban on landfilling of separately collected waste and introduce EPR obligation and establish minimum requirements for EPR schemes. In practice, in order for Member States to achieve these targets they would need to improve separate collection, sorting and recycling. The area and methods to improve separate collection are, in line with the construct of the EU waste Directives and the principle of subsidiarity, decided upon by the Member States. Some SUP are considered as packaging if they contain a product (e.g. cups filled with a beverage at the point of sale): drinks bottles, caps and lids; crisp packets and sweet wrappers; plastic bags; food containers including fast food; cups. However, the same SUPs may also fall outside the definition of packaging if it is being sold separately (e.g. a pack of empty cups that can be used for filling by the consumers themselves). As a result, the same product is subject to different legal acts and measures.

The **Plastic Bags Directive (EU) 2015/720** amended Directive 94/62/EC on packaging and packaging waste to promote reduction of the consumption level of lightweight plastic carrier bags. Member States can choose which measures to put in place to achieve a consumption rate of below 40 bags per person per year by 2025, including the use of economic instruments such as pricing, taxes and levies and marketing restrictions such as bans that are proportionate and non-discriminatory, and national reduction targets.

The EU **Plastics Strategy** includes a series of actions to transform the way products are designed, produced, used, reused and recycled in the EU. Under the new plans, all plastic packaging on the EU market should be recyclable by 2030, and the intentional use of microplastics in products should be restricted through REACH. The European Chemicals Agency is indeed preparing a restriction dossier concerning **microplastic particles intentionally added to preparations, such as cosmetics, detergents, paints** for both professional and consumer use. ECHA is also preparing a restriction dossier regarding the use of oxo-degradable plastics, which are designed to degrade into particles and have uses as agricultural films, rubbish bags and other packaging.

New efforts will increase the profitability of recycling for business. There is support for innovation with an additional €100 million financing for developing smarter and more recyclable plastics materials, for developing renewable feedstock for plastics, for improving bio-degradation processes, for making recycling processes more efficient, tracing and removing hazardous substances and contaminants from recycled plastics.

The strategy also commits the Commission to the establishment of a clear regulatory framework for plastics with biodegradable properties. Biodegradable and compostable plastics are developed in response to the high level of plastic leakage into our environment. Targeted applications, such as using compostable plastic bags to collect organic waste separately, have shown positive results; and biodegradability standards exist (for plastic mulches¹⁰) or are being developed for other specific applications. However, most currently available plastics labelled as biodegradable generally degrade under specific conditions only, which may not always be easy to find in the natural environment, and can thus still cause harm to ecosystems. Biodegradation in the marine environment is particularly challenging. It is important to ensure that consumers are provided with clear and correct information, and to make sure that biodegradable plastics are not put forward as a solution to littering.

⁹ COM(2015)596 final

¹⁰ CEN standard EN 17033 for 'Plastics – Biodegradable mulch films for use in agriculture and horticulture – Requirements and test methods'

The **General Product Safety Directive** (GPSD) 2001/95/EC ensures that only safe products are made available on the market. The GPSD applies in the absence of other EU legislation, national standards, Commission recommendations or codes of practice relating to safety of products. The GPSD establishes obligations to both businesses and Member States' authorities. Businesses should place only products which are safe on the market, inform consumers of any risks associated with the products they supply. They also have to make sure any dangerous products present on the market can be traced so they can be removed to avoid any risks to consumers.

Food Contact Material through Commission Regulation (EC) No 282/2008 on recycled plastic materials and articles intended to come into contact with foods.

The set of criteria for products and services under the EU **Ecolabel** and **Green Public Procurement** promote reusable and/or recyclable items and packaging.¹¹

3 FISHING GEAR AND SHIPPING

Fisheries Control Regulation¹² (EC) No 1224/2009 of November 2009 establishes a Community control system for ensuring compliance with the rules of the common fisheries policy. It addresses ALDFG in so far as it requires the mandatory marking of gear as well as the retrieval of gear in the event of loss and the notification of the loss in case retrieval is not possible.

The provisions on the marking of fishing gear (Article 8 of Fisheries Control Regulation and implementation rules Articles 8 to 17 of Commission Implementing Regulation (EU) No 404/11¹³) apply to EU vessels when fishing with passive gears and beam trawls in EU waters, and to fishing aggregating devices (FADs). They are in line with the international codification system of the International Maritime Organisation (IMO) and the International Convention for the Prevention of Pollution from Ships (MARPOL), and the related provisions adopted in international fora (RFMOs). Article 48 of Fisheries Control Regulation requires fishing vessels to have on board equipment to retrieve lost gear. It also requires the master of the fishing vessel that lost gear or part of gear to attempt to retrieve it as soon as possible. If the lost gear cannot be retrieved, the master shall inform the competent authority of its flag state, which shall then inform the competent authority of the coastal state, within 24 hours of the following:

- The external identification number and the name of the fishing vessel;
- The type of lost gear;
- The time when the gear was lost;
- The position where the gear was lost, and
- The measures undertaken to retrieve the gear.

An analysis conducted as part of the evaluation of the Control Regulation found that one Member State, Portugal, recorded an average of 100 incidents per year between 2010 and 2014 whereas the others reported 8 between them. Authorities from Bulgaria, Germany,

¹¹ Examples include the Ecolabel criteria for tourism and the Green Public Procurement criteria for food and catering restrict the use of single-use plastics in catering.

¹² <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:343:0001:0050:EN:PDF>

¹³ Commission Implementing Regulation (EU) No 404/2011 of 8 April 2011 laying down detailed rules for the implementation of Council Regulation (EC) No 1224/2009 establishing a Community control system for ensuring compliance with the rules of the Common Fisheries Policy (OJ, L 112, 30.04.2011, p 1)

Denmark, Finland, France, Ireland, Lithuania, Malta, Poland, Romania, Sweden and the United Kingdom reported no incidents over the five years.

Regarding gears retrieved by competent authorities but not reported as lost, the competent authorities may recover the cost from the master of the fishing vessel that lost the gear.

Under Article 48(5) of Fisheries Control Regulation, a Member State may exempt vessels of less than 12 metres length overall flying its flag from having on board recovery equipment, if they operate exclusively within the territorial sea of the MS and never spend more than 24 hours at sea from the time of departure to the return to port.

The above provisions will be reinforced. In the 2018 Commission is preparing a proposal to for amendment of the Fisheries Control System, which will by introduce information on lost gears into the electronic reporting obligations by masters of fishing vessels.

Furthermore, the structural support tool for the Common Fisheries Policy, the **European Maritime and Fisheries Fund (EMFF)**, may provide financial support for the recovery of litter and gear from the sea. Such support can come for action that is either part of fishing activities, (i.e. bringing litter that is caught in the nets while fishing back ashore - so called "passive" fishing for litter), or as part of specific retrieval and recovery actions of waste and/or lost and abandoned gear ("active" fishing for litter). Over the seven year period 2014-2020, 14 Member States plan a total of 108 such projects supported with around €22 million from the EMFF. In the proposal for the revision of the EU Fisheries Control System the European Commission will introduce amendments to the reporting measures for operators which lose fishing gear in order to identify areas of concentration of lost fishing gear and to facilitate its retrieval. The information reported to the Commission as part of the monitoring of implementation is limited to the number of operations and the planned EU and national contributions. Authorities are not obliged to collect or report information on the operations such as direct results or impacts.

The improvement of waste handling infrastructure and management processes on vessels and at ports is also eligible for support under the EMFF. As are other measures to reduce the impact of fishing on ecosystem such as innovation in catch handling, storing, processing and marketing processes¹⁴.

In addition to the EMFF, other EU funding programmes (Horizon 2020, Life, ERDF etc.) also finance actions for the prevention, reduction and retrieval of marine litter via actions under shared management with Member States.

The Commission also directly finances action to understand and combat the rise of marine litter,¹⁵ via the EMFF, for example, via a call for proposals for €2 million launched in November 2017¹⁶. The received proposals are currently being evaluated.

Illegal fishing activities may contribute to ALDFG, however, the **IUU Regulation**¹⁷ does not include any specific provisions on accidental loss, deliberate abandonment or reporting and retrieval of gear. These actions are not covered by the definition of IUU fishing activities.

¹⁴ EMFF, Articles 38.1c, 39, 40.1a and 43.1

¹⁵ For instance, in the Arctic Region, the Circular Ocean INTERREG project is testing new opportunities for reusing old fishing nets, including a material to remove pollutants from water (<http://www.circularocean.eu/>). In the Baltic Sea Region, the BLASTIC project maps potential litter sources in urban areas and monitors litter levels in the aquatic environment (<https://www.blastic.eu/>). Both projects are supported by the European Regional Development Fund.

¹⁶ Under the overarching 'Sustainable Blue Economy' call: <https://ec.europa.eu/easme/en/information-day-blue-growth-calls-under-emff>.

Within the CFP, a number of sea basic specific regulations contribute to the sustainable management of fisheries resources and in particular the selectivity of the fishing gear. The provisions in these regulations do not target potential loss or abandonment of fishing gear or releases of material into the marine environment or their potential environmental impacts in terms of marine pollution or ghost fishing.

The proposal to merge and update the various existing **technical regulations** into a single legal text that is currently under discussion by the co-legislator¹⁸ does not foresee the introduction of these issues.

Directive 2000/59/EC on port reception facilities for ship generated waste and cargo residues (“PRF Directive”)

The Directive aims to reduce all discharges of waste from ships at sea, including from fishing vessels and recreational craft. To this end, it requires MS to provide for adequate port reception facilities, and ships to deliver their waste to these facilities before departure from the port. It also requires MS to set up cost recovery systems, which must provide no incentive for ships to discharge their waste at sea; this is achieved by requiring part of the fee charged to ships to be an indirect fee, i.e. to be paid irrespective of delivery. The current Directive also requires 25% minimum target for inspections of the mandatory delivery requirement, as well as the development of waste reception and handling plans for ports and advance waste notification from ships.

In 2018, the European Commission adopted a proposal for a new PRF Directive (as part of the Commission’s Circular Economy Package), seeking further alignment with the MARPOL Convention with a special focus on addressing marine litter from sea-based sources. Through a mix of incentive and enforcement measures, the proposed Directive should result in maximising garbage delivery from ships to waste reception facilities in ports. The charges for bringing litter ashore, including fished-up litter, will be independent of the amount. Reporting and inspection obligations for fishing vessels and small recreational craft have been brought more in line with other vessels. The proposal will improve the adequacy of port reception facilities, in particular their operation in accordance with EU waste legislation, including the obligation for separate collection of waste from ships. Voluntary and national measures

In the context of an ongoing pledging call there are already a number of voluntary initiatives by industry that complement and help deliver on policy objectives, such as;

- Several supermarkets have committed to having no packaging for their own brands in the near future, or to organize the collection of plastic bottles by refunding the consumers bringing back their plastic wastes, or to substitute plastic packaging by other materials;
- The fishing industry has committed to a number of marine litter collection initiatives, either voluntarily or with EMFF support¹⁹. Business initiatives like e.g. ECOALF (<https://ecoalf.com/es/>) combine recycling plastics and marine litter with high added value design and manufacturing of apparel and clothing in Europe. Examples also exist for aquaculture where e.g. shellfish producers clean up their production areas.
- In Iceland, a fisheries association organises the sale of end-of-life gear to recycling company and claims that they achieve a recycling rate of 90%.

¹⁷ Council Regulation (EC) No 1005/2008

¹⁸ COM(2016) 134

¹⁹ Fame report on EFF and EMFF supported projects

- Major plastic resins producers have committed to reduce significantly pellets losses occurring during the transport or handling of resin pellets ("Operation Clean Sweep").
- The cosmetics industry has committed to eliminate the use of microbeads in rinse-off products and is today reaching a level of 82% of substitution.
- Around 1,400 voluntary commitments were registered and announced at The Ocean Conference for implementation of Sustainable Development Goal 14 (SDG 14) in 2017. To facilitate collaboration and networking amongst different actors in support of SDG 14, the United Nations has launched nine thematic multi-stakeholder Communities of Ocean Action.
- At the Our Ocean conference in Malta 103 commitments (worth almost EUR 3 billion) out of a total of 437 (worth EUR 7.2 billion) targeted marine pollution and plastics, focussing on prevention and innovation. Commitments were from 29 states, with around 10% from the private sector some of which pledging 100% recyclability of packaging (including Werner & Mertz, Unilever, M&S, PepsiCo, The Coca-Cola Company,).

With regard to measures at national or local level the choice of measures is left to Member States administrations - in line with the **principle of subsidiarity**. There is a wide range of measures available and effectively piloted and proven but applied in a relatively uncoordinated way. For example, a number of Member States have refundable deposit schemes for bottles. Targeted deposit schemes can help reduce littering and boost recycling, and have already helped several countries achieve high collection rates for beverage containers.²⁰ In Germany 98 per cent of cans and plastic bottles are recycled; the Netherlands 95 per cent; whereas countries with no deposit scheme usually only recycle around half.

Similarly, Italy will ban non-biodegradable cotton bud sticks (ban to come into force from 1/1/2019) and microplastics in cosmetics ("cosmetici da risciacquo ad azione esfoliante o detergente contenenti microplastiche", from 2020). France has notified the Commission of its intention to ban plastics-made cotton bud sticks from 2020, and Scotland is consulting on this issue with an intention to introduce a ban.

4 INTERNATIONAL POLICY CONTEXT

The EU is a Contracting party to the Barcelona, OSPAR and HELCOM Conventions for the protection of the marine environment in the Mediterranean, the Northeast Atlantic and the Baltic respectively. The Commission, representing the EU in these Conventions has supported the adoption and implementation of action plans to combat marine litter in these marine regions. The Commission also supports financially and technically the development of such an action plan in the fourth European marine region, the Black Sea²¹. Regular meetings take place for the coordination of the regional activities against marine litter among themselves, and with the implementation of MSFD at EU and national level.

In 2015, UN member countries adopted the **2030 Agenda for Sustainable Development**, which includes 17 Sustainable Development Goals (SDGs)²². The EU and its Member States

²⁰ The five best performing Member States with deposit schemes for PET bottles (Germany, Denmark, Finland, the Netherlands and Estonia) reached an average collection rate for PET of 94% in 2014.

²¹ Action Plan for the Mediterranean: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/decision_21_7_marine_litter_mediterranean.pdf

Action Plan for the Atlantic: http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/atlantic_mlrp_brochure.pdf

Action Plan for the Baltic : http://ec.europa.eu/environment/marine/good-environmental-status/descriptor-10/pdf/baltic_regional_action_plan_marine_litter.pdf

²² <https://sustainabledevelopment.un.org/post2015/transformingourworld>

are committed to the 2030 Agenda and to driving forward its implementation²³. Several of the Sustainable Development Goals and associated targets are of particular relevance to marine litter. Meeting the objectives of the 2030 Agenda and its SDGs will require commitment at local, regional and global levels, including through partnerships with relevant stakeholders. The EU can play an important role in fostering such co-operation.

The **United Nations Environment Assembly** (UNEA) has consistently highlighted marine plastic debris and micro-plastics amongst the issues of global importance. At the second UNEA session (UNEA-2) in 2016, resolution UNEP/EA.2/Res.11 on marine plastic litter and micro-plastics was adopted. In this resolution, governments requested an assessment by the United Nations Environment Programme (UNEP) of the effectiveness of relevant international, regional and sub-regional governance strategies and approaches to combat marine plastic litter and micro-plastics, taking into consideration the relevant international, regional and sub-regional regulatory frameworks. The resolution called for identification of possible gaps as well as options for addressing these gaps. The session of the United Nations Environment Assembly held in Nairobi on 4-6 December 2017 (UNEA-3), addressed the theme 'Towards a pollution-free planet'. UNEA-3 adopted a resolution on marine litter micro-plastics building on the above-mentioned UNEP assessment²⁴. The resolution established an Ad Hoc Open Ended Expert Group to further examine the barriers to, and options for, combating marine plastic litter and micro-plastics from all sources, especially land based sources.

Moreover, UNEP has launched initiatives to address specifically the impacts of plastic waste entering the sea from land. The **Global Programme of Action for the Protection of the Marine Environment from Land-based Activities** (GPA), the **Global Partnership on Marine Litter** (GPML)²⁵, and **Clean Seas**, a global campaign to eliminate major sources of marine litter: microplastics in cosmetics and the excessive, wasteful usage of single-use plastic by the year 2022. Under Clean Seas, governments are urged to pass plastic reduction policies; targeting industry to minimize plastic packaging and redesign products; and calling on consumers to change their throwaway habits²⁶.

Concerning plastic waste and other types of waste discarded from ships, the **International Maritime Organisation** (IMO) has developed action to address the issue, in particular by further regulating the discharges of garbage from ships in the context of the MARPOL Convention²⁷. Annex V to MARPOL prohibits the discharge of all types of garbage into the sea from ships, except in the cases explicitly permitted under the Annex (such as food waste, cargo residues, cleaning agents/additives that are not harmful to the marine environment). Garbage from ships includes all kinds of food, domestic and operational waste, and comprises all plastics as well as fishing gear. Annex V applies to all types of ships operating in the marine environment, including fishing vessels and recreational craft.

²³ Council conclusions 'A sustainable European future: The EU response to the 2030 Agenda for Sustainable Development' (General Affairs Council, 20 June 2017); 'Next steps for a sustainable European future – European action for sustainability' (COM(2016) 739)

²⁴ UNEP (2017), Combating marine plastic litter and micro-plastics: An assessment of the effectiveness of relevant international, regional and subregional governance strategies and approaches

²⁵ <https://www.unep.org/gpa/what-we-do/global-partnership-marine-litter>

²⁶ Ten countries have joined the campaign with far-reaching pledges eg Indonesia has committed to slash its marine litter by 70 per cent by 2025; Uruguay will tax single-use plastic bags and Costa Rica will take measures to dramatically reduce single-use plastic through better waste management and education

²⁷ [http://www.imo.org/en/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-\(marpol\).aspx](http://www.imo.org/en/about/conventions/listofconventions/pages/international-convention-for-the-prevention-of-pollution-from-ships-(marpol).aspx)

Under the **Basel Convention**²⁸, Parties have adopted a number of measures including an Environmentally Sound Management (ESM) toolkit that they can use in shaping their national policies to ensure a sound management of waste, so contributing to achieving the SDGs. The ESM toolkit consists of practical manuals on waste management and fact sheets covering specific waste streams; and guidance for developing efficient strategies on waste prevention²⁹. It includes incentives to encourage private sector investments, training materials, checklist for self-assessment of national capacity, pilot projects, ESM criteria and case studies on the promotion of ESM in the informal sector.

Parties under the **Convention on Biological Diversity** have adopted decision XIII/10 to prevent and mitigate the potential adverse impacts of marine debris on marine and coastal biodiversity and habitats³⁰. The decision invites Parties and other governments to consider extended producer responsibility for providing response measures where there is damage or sufficient likelihood of damage to marine and coastal biodiversity and habitats from marine debris.

Both the G7 and the G20 have addressed the issues of resource efficiency and marine litter. The **G7 Action Plan to Combat Marine Litter**³¹ commits G7 members to priority actions and solutions to combat marine litter and stresses the need to address land- and sea-based sources, removal actions, as well as education, research and outreach. A similar approach has recently been adopted by the G20 through the **G20 Action Plan on Marine Litter**³², where the G20 recognised the urgent need for action to prevent and reduce marine litter in order to preserve human health and marine and coastal ecosystems, and mitigate marine litter's economic costs and impacts.

In February 2018, the FAO Technical Consultation adopted the Report and the **Voluntary Guidelines on the Marking of Fishing Gear** by consensus that are expected to be endorsed at the next COFI meeting in July 2018. The Guidelines include indications to implement a gear marking system; to control and enforce it; to report on and encourage recovery of ALDFG; to improve commercial traceability of fishing gear marking; to encourage research, awareness raising and capacity development; and guidance on the special requirements of developing States and small scale fisheries. An Annex on a Risk Based Approach to assist relevant authorities in determining the appropriateness or otherwise of implementing a system for marking fishing gear is part of the guidelines. It is expected that FAO will be requested to develop a comprehensive global strategy to address ALDFG and to encourage States to develop ALDFG action plans.

The EU is a Member to 16 **Regional Fisheries Management Organisations (RFMOs)** who are in charge of the long-term conservation and management of world fish stocks, as well of the adoption of technical measures regulating each fishery. The discard of plastic residues at sea is already forbidden by the International Convention for the Prevention of Pollution from Ships (MARPOL) which also includes fishing vessels. However, MARPOL does not cover all Regional Fisheries Management Organisations (RFMOs) nor the prohibition to dispose plastics at sea is established and monitored by all RFMOs. The European Commission promotes the revision or update of the relevant provisions of the Regional Fisheries

²⁸ Basel Convention on the Control of Transboundary movements of Hazardous Wastes and their Disposal.

²⁹ <http://www.basel.int/Implementation/CountryLedInitiative/EnvironmentallySoundManagement/Overview/tabid/3615/Default.aspx>

³⁰ <https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-10-en.pdf>

³¹ https://www.g7germany.de/Content/EN/_Anlagen/G7/2015-06-08-g7-abschluss-eng_en.html

³² https://www.g20.org/Content/DE/_Anlagen/G7_G20/2017-g20-marine-litter-en.html?nn=2186554

Management Organisations (RFMOs), including extending to all RFMOs the prohibition on the disposal of plastics at sea.

As part of the efforts to step of international ocean governance, bilateral agreements are currently being prepared with seven priority countries, i.e. Canada, USA, China, Japan, Australia, New Zealand, and Indonesia. These **ocean partnerships** seek to improve coordination and cooperation for better ocean management and will cover concerted actions on marine litter.

National measures are also being put in place worldwide. For example, Taiwan as part of its "Sea Waste Management Platform" has an ambitious 12-year timeline Tuesday to eliminate four types of single-use plastics—takeaway beverage cups, drinking straws, shopping bags and disposable tableware. For example, in 2020, free plastic straws will be banned from all food and beverage establishments; from 2025, plastic straws for carryout will be banned and customers will need to pay a fee to use them; in 2030, a ban on the use of plastic straws at all establishments in Taiwan.

5 CHANGES IN REGULATORY POLICY UNDER THE BASELINE OPTION 1

Option 1 covers the current regulatory framework that includes measures and policies at EU level that have been recently adopted or proposed by the Commission. Section 5.2.1 describes the changes under the baseline succinctly, and here they are set out in more detail.

This option entails an increased focus in the existing legislation on items already covered today in separate collection schemes (e.g. packaging such as beverage bottles, bags) and on fishing gear. It also includes the general expected changes in consumption for single use plastics items.

The measures included in this option include:

- Measures on waste management, including measures those of the recently revised Waste Framework Directive and Packaging and Packaging Waste Directive (that will enter into force in 2020, when Member States will have to transpose these amendments):
 - The Packaging Directive, as amended, will re-focus the prevention objectives on re-use of packaging, however, the substantial obligation will merely require Member States to “encourage” the reuse of packaging. More ambitious and concrete measures in the Packaging Directive are envisaged only with regard to one SUP item - plastic bags. Due to the general ambition of the obligations and the flexibility for Member States to choose the measures, the impact of these measures is difficult to envisage for other SUP items. The fit for purpose of the essential requirements for packaging for purpose to facilitate separate collection and recyclability in view of the circular economy objectives is already challenged in the EU Plastics Strategy and their review is envisaged in 2020.
 - The Packaging Directive, as amended, will establish higher recycling targets – 50% by 2025 and 55% by 2030 for plastic packaging.³³ These would require Member States to improve their separate collection in terms of both capture and quality of the collected material and divert that waste from landfill and incineration to recycling. However, the attainment of this goal would largely depend not on the provision of infrastructure and services because these already cover the Member States territories but on some improvements in those systems

³³ Not to be confused with the reduction targets proposed in this Impact assessment for certain items.

and the effective participation of citizens in separate collection. There are no straightforward solutions to improve that significantly in a short time period and it usually requires a complex set of "carrot and stick" regulatory measures and economic incentives. Also, increase in recycling rates could be achieved without in depth efforts to reduce littering or extending or improving separate collection close to water bodies where the waste loads have large seasonal variations.

- Extension of extended producer responsibility schemes (EPR schemes) to all packaging by 2025. This is unlikely to lead to reduced marine litter as EPR schemes are established in most Member States for household packaging that represents half of the top 10 SUP items. The amendments to the Waste Framework Directive will set minimum requirements for EPR schemes that will contain requirements to facilitate the recyclability of products through the modulation of producers' fees. The new minimum requirements for EPR schemes will make it more explicit that Member States can require EPR schemes to contribute to waste prevention, including through prevention campaigns or clean-up of litter. However, this is not part of a minimum requirement for cost coverage and is therefore likely to remain a measure outside the scope of EPR apart from the couple of Member States that have already taken some small steps in this direction. It is not possible to calculate exactly by how much the quantities of marine litter will be reduced as a result of these measures, because these provisions have a much longer transposition deadline, namely 2023, and even by that date it would still be too early to see the impact of those measures. Also, improved recyclability of products does not necessarily lead to more performant separate collection or phase-out of some SUP for which good alternatives exist in other materials or as re-usable products. With regard to prevention objectives for EPR schemes, as this is not required but allowed under the minimum requirements, this would depend on the Member States initiative to go beyond the EU minimum requirements. Considering that the minimum requirements for EPR schemes will already increase the producers' financial responsibility for the waste management it is likely that further extension of that responsibility would not be an easy policy objective for the Member States to agree on with the producers and producer organisations.
- New prevention objectives requiring Member States to take measures (a) aiming to halt the generation of marine litter as a contribution to UN SDG 14 to prevent and significantly reduce marine pollution of all kinds; (b) to take appropriate measures to prevent and reduce litter from products that are the main sources of littering notably in the marine environment; and (c) to organise information campaigns to raise awareness about waste prevention and littering. With regard to point (a), while these new provisions require Member States to take measures to tackle marine litter, that obligation is formulated in such a way ("measures that shall aim to") that does not require Member States to actually achieve or demonstrate the attainment of that objective. Similarly, under point (b) the provision introduces significant flexibility to Member States with regard to the products they may choose to target and the measures to do that, including the explicit reference that market restrictions are measure that Member States can consider. As described in section 3.1.2. this may lead to scattered policies and measures that would also have an impact on the fragmentation of the internal market.
- The requirement on the Member States to revise their (a) waste prevention programmes to reflect the objectives on the prevention of (marine) litter and (b) waste management plans to provide for measures to combat and prevent all forms

of littering and to clean up all types of litter (not limited to land based litter). Member States will also be required to coordinate these plans and measures on litter with other plans and measures that they are required to adopt under international and EU water legislation to tackle litter in the aquatic environment³⁴. It is not possible to calculate by how much the quantities of marine litter will be reduced exactly as a result of this obligation, in particular, because it is a more procedural requirement with no measurable outcome.

- Marine Strategy Framework Directive (MSFD), Urban waste water treatment Directive and Water Framework Directive:
 - Under the MSFD, Member States had to adopt measures to address marine litter by 2016. However, on the basis of the information contained in the programmes of Measures submitted (in 2016) by the Member States, it is not possible to calculate by how much the quantities of marine litter will be reduced. The Commission's assessment of the measures shows that the most common type of measures reported by Member States include beach clean-ups and 'fishing for litter'. These are costly downstream measures, as opposed to upstream measures to improve waste management and prevention, and that do not prevent the littering at source. Therefore, they have a modest impact on reducing the pressure, but they do raise awareness. However, wide application by Member States of such measures would signal the need for harmonisation at EU level, in particular in view of shifting focus to more effective upstream measures. In fact, targeted measures for beach litter, such as by limiting the proliferation of single-use plastics, or for the reduction of microplastics and of litter from aquaculture were scarcely present in Member States' programmes of measures under the MSFD. Some Member States have taken measures to limit the use of certain plastics in view of its impact on the marine environment, but have not reported them as part of their programme of measures.
 - The Urban waste water treatment Directive provides minimum requirements for the infrastructure for the collection and treatment of urban waste water and quality criteria for the treatment. However, this Directive is not effective concerning the requirements on capture and treatment of storm water overflows and concerning microplastics, which are not covered by the directive. This is in particular an issue for flushable items such as plastic cotton bud sticks and sanitary applications for which the pathway into the sea is through sewage systems. The Water Framework Directive requires Member States to adopt programmes of measures to achieve good ecological status (GES) of the water bodies; however, this legislation does not specifically require action against marine litter or as criteria against which GES should be assessed. However improvements in its implementation should be expected as a result of the new requirement to coordinate these programmes with those under the MSFD and Waste Framework Directive.
- Port Reception Facilities:
 - Introducing a 100% indirect fee for garbage from ships, as well as passively fished waste, and including fishing vessels and recreational craft in the indirect fee regime direct fee based on weight by 100% indirect fee, therefore abolishing disincentive to bring back fished up waste ashore. However, there is no compensation for the inconvenience of sorting and storing the waste on board, some of which will not be from the vessel concerned.

³⁴ Regional Seas Conventions, Directive 2008/56/EC and Directive 2000/60/EC

- Requiring port reception facilities to effectively implement the waste hierarchy in the context of management of waste from ships, including separate collection of waste from vessels in port in view of further reuse/recycling. The obligation to collect and subsequently treat waste would fall on the ports and their fees would increase unless compensated by other sources such as the extended producer responsibility scheme adopted for products.
- Dedicated enforcement regime for fishing vessels over 100 GT (minimum 20% inspection target)
- Fisheries Control Regulation:
 - Full implementation of the current requirements to mark gear (Article 8)³⁵ to carry retrieval equipment on board, to retrieve lost gear or to report its loss in case it cannot be retrieved (Article 48). A planned revision will introduce daily electronic reporting for all vessels and remove the exemption of small vessels from the obligation to carry retrieval equipment.
- European Maritime and Fisheries Fund (EMFF)
 - 2014-2020: 108 operations to support the removal of litter from the sea included in authorities' operational programmes will be fully implemented. Other planned operations targeting marine litter will equally be implemented including those aimed at infrastructure improvements at ports and community led local development, as well as Maritime Policy.
 - Post 2020: It is envisaged, in line with the plastic strategy, to make marine litter a funding priority under the new programming period.
- The FAO voluntary Guidelines on the Marking of Fishing Gear adopted in February 2018 are expected to be endorsed in July 2018 and subsequently implemented.

Finally, the implementation of the actions included in the EU Plastics Strategy and the Communication on the interface between chemical, waste and product legislation are also to be included. In particular, the EU actions listed in Annex I of the Plastics Strategy, as well as the implementation of the options in the Interface communication. This includes new harmonised rules to ensure that by 2030 all plastic packaging placed on the EU market can be reused or recycled in a cost-effective manner. This should also address the challenging segment of 30% of plastic packaging part such as multilayer film and small-format packaging. The Strategy also fosters investment and innovation in the value chain towards circular solutions.

³⁵ Detailed requirements are included in the Control Implementing Regulation

ANNEX 6: DETAILED ANALYSIS OF MEASURES FOR SINGLE USE PLASTICS

1 Product measure matrix

To determine the range of policy measures to be modelled in the analysis a product-measure matrix was developed. It allows identifying a range of key measures, and the items for which the application of a given measure was deemed relevant. All feasible measures were then modelled for each item to calculate their impact.

In what follows, we start with a description of the key measures selected: these measures were developed throughout the course of the study, including during the development of the Plastics Strategy, and are reflecting also the consultation with industry stakeholders and the wider public. Second, a review of the potential alternative single-use non-plastic (SUNP) and multi-use (MU) items is provided to identify where feasible alternative options exist in the market. Then, a summary of the feasibility, by product and measure, is presented. Finally, the product-measure matrix is displayed to summarise the measures to be modelled for each item.

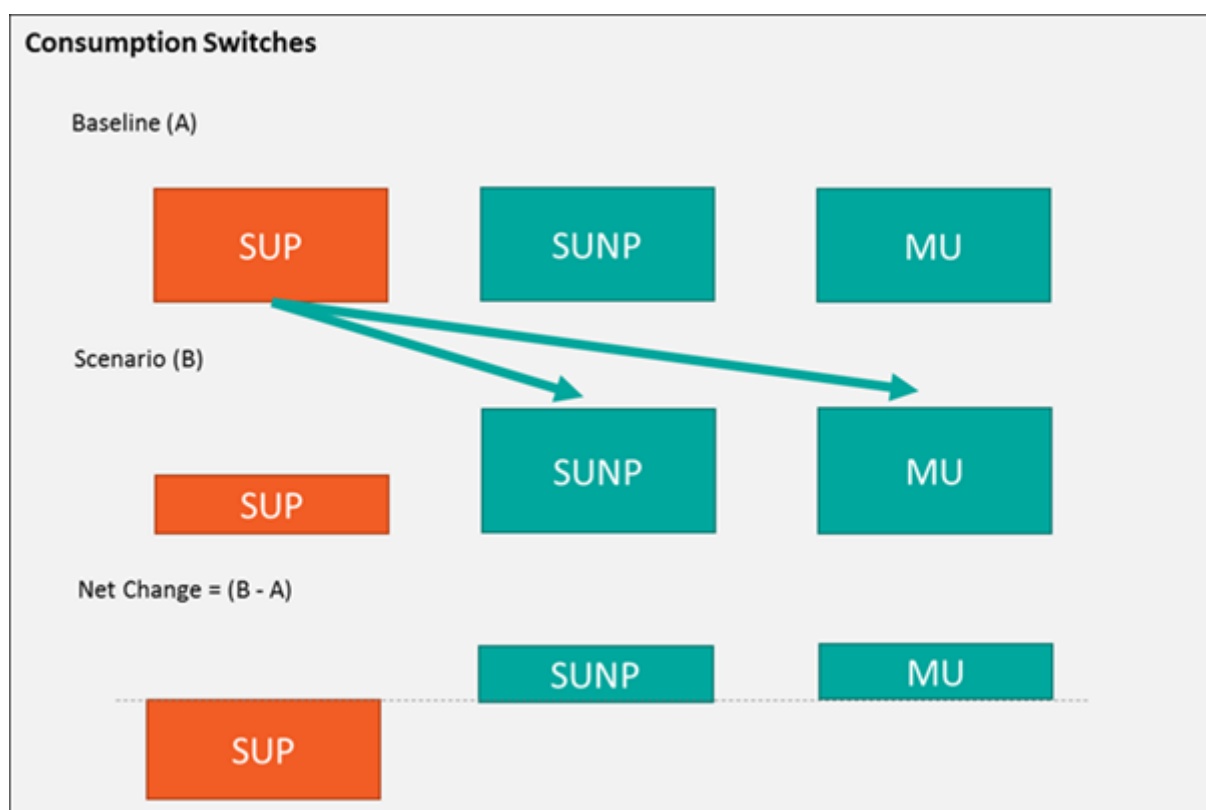
1.1 Link to model

The assessment in this report anticipated the need to evaluate the impact of the deployment of a range of measures used to address the issue of single use plastics (SUPs) being washed onto beaches, and hence, into the ocean. Whilst some measures were expected to affect the rate at which these items might be ‘intercepted’ before they reached the ocean, others were expected to affect the level of consumption of the SUP items under consideration.

The method used for the analysis was as follows:

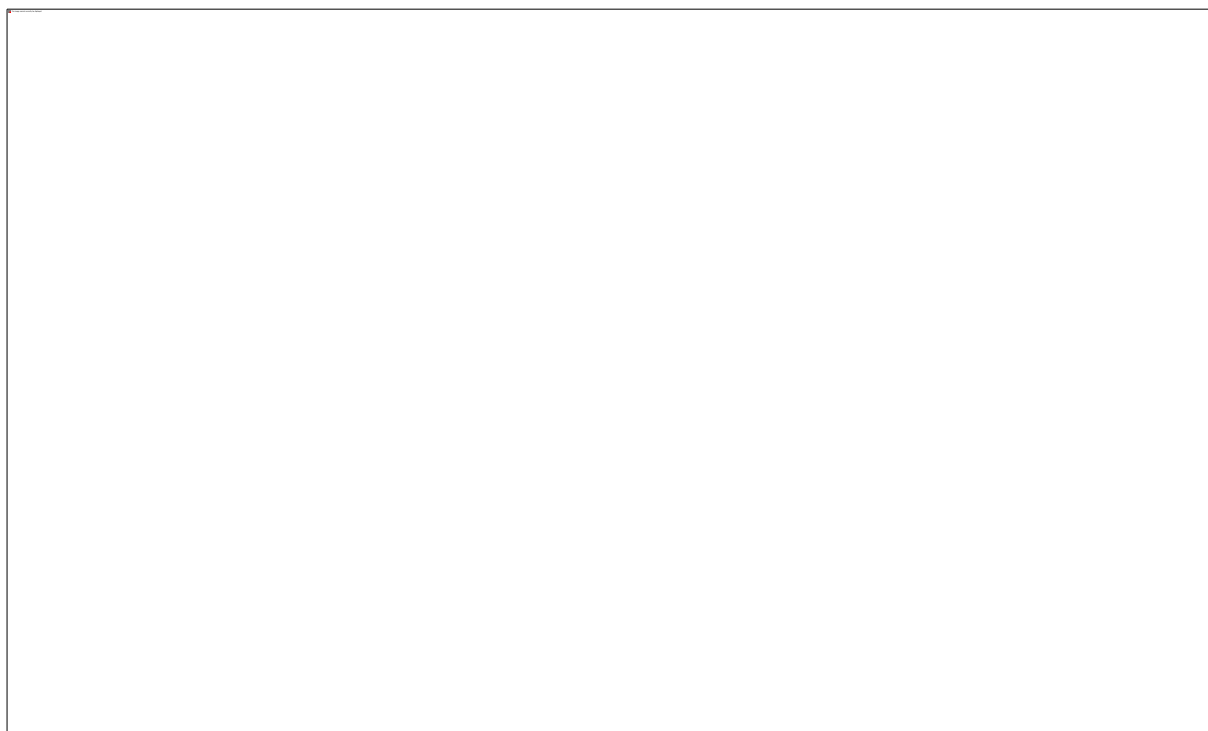
- Analysis was undertaken to identify the top ten SUP items, based on count, in beach litter surveys;
- For each of these, consider the market for the SUP item and its direct substitutes in terms of:
 - The market share for the SUP item itself;
 - The market share for the competing single-use non-plastic (SUNP) items where the term SUNP is effectively shorthand for single use items that are believed to biodegrade in the marine environment, and hence, which are believed to be less problematic if they reach the marine environment (see also below); and
 - The market share for multi-use (MU) (i.e. reusable / refillable) items.
- The way in which the market for a given item is affected by policies already firmly planned, and likely to have an effect in the near future, was modelled. The shift in market shares was considered, as well as the anticipated change in the fate of the different items (see below).
- The policy measures being considered as feasible measures were considered to have an impact on the market for a given items in terms of the shift away from SUPs and into SUNPs and MU items. This is depicted in Table 11.

Figure 1: Schematic of Modelling of Switches in Response to Measures



- The effect of these changes in consumption have a range of different economic and environmental impacts. As the market shares of SUPs, SUNPs and MU items shifts, some producers lose, while others gain. The effect on retailers and the HoReCa sector was also considered, these being linked also to the effects on consumers (which were also identified). In some cases, the measures are also likely to call forward innovation, in terms of substitutes and in terms of the scaling up of business models for MU alternatives. Although this represents a potential opportunity for EU businesses, and one that they may have at global scale (given the rapidly growing awareness of this issue), it was not possible to quantify them in the study (being, as they are, uncertain);
- In terms of the consumption related elements, life-cycle assessment for the SUP, SUNP and MU items was used to model the change in resource use, greenhouse gas emissions and emissions of other pollutants. In addition, the change in the consumption effectively translates into the quantity of material that suffers a given fate (or is managed in a given way). The impacts of these changes were also estimated, including the impacts associated with changes in the quantity of litter.
- Finally, as well as modelling the impact of all feasible measures on each of the items, 4 Options were modelled, which are based on a selection of different measures applied to the different items, each intending to indicate an upward step in the level of ambition in respect of outcomes. Critical, here, was the expected impact on the flow of SUPs into the marine environment.

Figure 2: Material Fates



Research has been undertaken through deployment of a range of methods including: literature reviews of existing research; review of inputs made under the public consultation; one-to-one interviews with a number of stakeholders; workshops involving Commission officials, and external stakeholders; and desk-based research.

In order to develop a bespoke, quantitative model through which to assess the costs and benefits, data from the Joint Research Centre (JRC) were used to confirm the single use plastic (SUP) items that should be taken forward in this study. Selection of these included consideration of the top 10 items, by item count, found littered on beaches, as well as variations by regional sea. In order to develop the model, it was necessary to seek specific data related to the chosen items. To this end, in addition to desk based data gathering, market data reports were purchased, giving the study team significant data on the SUP items identified.

The approach has been to consider the suitability of the different SUPs to be addressed by different types of measures (in a shorter or longer time scale), taking into account the nature of the product, and the ease of substitution by existing alternatives. The elaboration of the measures kept in mind the matters of feasibility of the application of different measures, matters of subsidiarity and any legal issues likely to arise.

Finally, the analysis has considered a range of economic, social and environmental impacts building on the ongoing study. Further work was undertaken to understand better the externalities associated with litter, both when it is first dropped (usually on land, sometimes at sea), and once it has been transported to the beach / sea. In addition, relevant life cycle inventory data for the SUP items, and their most likely single use non-plastic (SUNP) and multiple use (MU) substitutes was examined.

The baseline has been modelled to 2030 – which reflects the date of targets in related legislation. The baseline scenario includes all existing European laws and policies, and those

which are agreed and will come into effect over the period being considered. The implementation of the measures deemed relevant to address each item were each modelled over the same time horizon.

1.2 Description of measures

To determine the range of policy measures to be modelled in the analysis a product-measure matrix was developed to identify a range of key measures and which products could be feasibly covered by them. Firstly, a description of the key measures selected is given – taking into account consultation with industry stakeholders. Secondly, a review of the potential alternative SUNP and MU items is provided to identify where feasible options exist in the market. Thirdly, a summary of the feasibility, by product and measure, is given, and, finally, the product-measure matrix is presented.

The following is a summary description of the individual measures being analysed in the Impact Assessment. It is noted that, despite modulation of fees being raised by stakeholders, this has not been included in the list of measures as modulation of fees according to the potential for an item to be littered or not would be very difficult to determine.

Table 1: Short-listed Measures

Scenario	Description
Information campaigns	Information campaigns could be targeted at consumers with a range of aims depending upon the nature of the item. For example, campaigns might a) aim to improve consumers' understanding of the impacts of littering with the objective of reducing litter rates, or b) aim to reduce the incidence of sanitary items flushed down toilets and drains, or c) focus on broader impacts of marine plastics, with the aim of encouraging consumers to take up available SUNP alternatives, or start using MU items, instead.
Mandatory labelling	Whilst information campaigns may have a general, population-wide character, mandatory labelling of widely littered items could help deliver messages more directly to consumers. The effectiveness of such a measure depends on how clearly the message is conveyed, and how much of an impact the message has on those who currently litter the labelled items.
Voluntary actions, Voluntary commitments and pledges	A range of measures could be taken by industry which require no specific legal instrument. Voluntary agreements (VAs) are generally those actions taken by industry to bring about changes without the need for changes in policy. At a European level, voluntary agreements typically involve a specific industrial sector, or category of producers, and some formal recognition can be given through gaining approval from the European Commission. Voluntary commitments and pledges, on the other hand, might be made by individual companies, and are usually made independently. The types of approach that could be considered (and one or more of these could be included in a given VA) are a) improvements in anti-littering messages on packaging, b) switching material use to alternatives which are demonstrated to degrade in the marine environment, c) supporting the provision of street/beach bin infrastructure, d) supporting litter clear up campaigns, e) implementing refill/reuse schemes in the HoReCa sector, f) agreeing to offer discounts for those using own coffee cups, or g) funding the sorts of campaigns mentioned above.
Specific Requirements on Product Design	Product design measures could be taken to reduce the propensity for certain items to be littered. For example, bottle lids could be tethered to bottles. Bottle lids are found more frequently than bottles in litter counts, suggesting they are either more frequently littered or captured by litter clean-up services less effectively. In addition,

Scenario	Description
	cups could potentially be designed to integrate sipping lids. Another potential design change could be to integrate straws into drinks containers, rather than selling such items separately. Evidence suggests that smaller items are less frequently collected in litter clean-up processes than larger items (see Annex 3). Moreover, it could be speculated that smaller items are also littered more frequently as consumers see smaller items as less impactful. Designers could also be required to take into account behavioural insights insofar as these help to minimise the likelihood of SUPs (and other items) being littered. The aim of design measures is to eliminate or reduce the likelihood of items being litter (e.g. by integrating smaller items with larger ones, by changing product interaction, by eliminating need for components/items).
Setting enhanced technical standards for Waste water treatment works (WWTW) and Combined sewer overflows (CSOs)	A range of sanitary items are flushed down drains by consumers, such as cotton buds, wet wipes and sanitary towels. Smaller items may pass through screens at WWTWs or, along with larger items, be flushed out into the rivers and seas through combined sewer overflows during overflow events. This measure implies requiring the implementation of measures believed likely to reduce the flow of SUP items into rivers, and hence, to oceans. In this measure, the costs would fall upon the water utilities and the measures would become integrated within standards under the UWWTD, or similar mechanism (see below for an equivalent measure where the SUP producers pay for the changes). Consultation with private operators in the water industry suggests a range of options which would mitigate flows of these items through this pathway: 1. Control at source; 2. Build bigger sewer systems including with larger overflow tanks; 3. Take surface water out of combined sewers; and 4. Reducing screen size from 6mm to 3mm, and install more screens at CSOs and WWTWs. Point 1 is the focus of the information campaigns indicated above. Points 2 and 3 require expensive civil engineering, although taking these actions would have wider environmental and efficiency benefits, and would have to be implemented over perhaps decades. Point 4 could target specific problem areas in the sewer network, but would still result in significant infrastructure changes.
EPR for flushed items	An EPR scheme for improperly flushed items could be introduced with the intention of a) recovering the costs of some / all of the measures identified in Points 1-4 in the previous measure (described above), and b) influencing the design of what is flushed into the WWTW. In this latter regard, fees could be modulated based upon the likelihood of their continuing to cause problems in the waste water treatment network once the measures have been implemented.
EPR – full cost coverage of litter	Currently there are very few instances where, under extended producer responsibility, producers pay for the costs of clean-up of litter. Two examples can be found in Belgium and the Netherlands. ³⁶ Under the principle of extended producer

³⁶ In the Netherlands, packaging producers already make a financial contribution towards litter prevention activities, via the Producer Responsibility Organisation Afvalfonds Verpakkingen. This PRO, which is the single packaging PRO in the Netherlands, then provides funding to Stichting Nederland Schoon to undertake activities to prevent and address packaging litter, including by organising activities aimed at the Dutch public, schools, municipalities and businesses. It is understood that, Afvalfonds Verpakkingen provides financial support of €5.5m per annum to Nederland Schoon (€0.29 per inhabitant), which accounts for 100% of the budget of Nederland Schoon. In Flanders, it is understood that producers pay €9.6 million annually to fund a national litter prevention programme (€1.50 per inhabitant). Fost Plus (the producer responsibility organization for packaging waste in Belgium), FEVIA (the Belgian food industry association) and COMEOS (the Belgian federation for commerce and services), signed an “open agreement” with Flemish environment minister Joke Schauvliege to

Scenario	Description
collections	responsibility (EPR), the full costs of managing a product at end of life ought to be covered, and this might be assumed to include the cost of cleaning up any items that are littered on land and on beaches. This measure places that burden upon producers, such that those currently operating street, highway and beach cleansing services are compensated. In this case, however, we assume that, in line with the emerging proposal for a revision of the WFD, producers are required to cover 80% of litter clean-up costs. There would need to be a method to discern the required standard of cleanliness to which streets, etc. would need to be cleaned of litter (effectively establishing the overall costs of clean-up). The approach to distributing the costs to producers would be to set up transparent funding formulas that estimated the cost of clean-up based upon the relative proportion of a given item within the total amount collected. However, it should be noted that some items, such as cigarette filters, will be under-represented in the collected wastes as often small items are left on the ground by street sweepers. This would need to be factored into any methodology.
Specified sales restrictions	This measure envisages that regulations are enacted that restrict the sale of SUP items in various locations. Examples might be to ban the sale of SU items at all major events (possibly supported by deposit refunds for cups / glasses, etc.), such as conferences or festivals. Other approaches that could be taken include: • Implementing regulations to restrict the sale of any SUP (or any single use) cutlery, straw, stirrer or drinks cup for use on-site i.e. single use items would only be made available for on-the-go consumption. Most food service outlets that serve on-site and for on-the-go consumption ask the customer if they are eating in or taking out. Those which state eating in would use washable MU cutlery and drinks cups (this measure could also be extended to e.g. the means of delivering food to customers, ensuring MU plates are used wherever possible). • Restricting the sale of drinks bottles for on-site consumption where refillable alternatives could be made available (e.g. tap water, soda streams etc). • Restrict the sales of straws and stirrers by nudging consumers into not using them by requiring drink service establishments to only give out straws and stirrers if specifically requested by the consumer i.e. not by default, and not placing them in places where they are essentially freely available (on the basis that the ease with which they are made available supports their over-consumption).
Measures for adoption by public authorities, including Green Public Procurement	Public authorities have specific competences and influence that can be bought to bear in order to reduce the flow of SUPs into the marine environment. Typically, public authorities may give consent to major public events: they also have significant spending power through their procurement of goods and services. Key examples of the actions that public authorities could take include: • Eliminating / reducing procurement of SUPs; • Requiring the use of MU items at events over which the public authority has some means of control (e.g. issuing licenses). They may also be able to influence the actions of franchisees on property which they own.

invest €9.6 million annually in the fight against litter. This does not appear to cover costs associated with managing litter, and the basis upon which this figure was agreed upon is not clear. In San Francisco, USA, the municipal authorities have implemented a scheme whereby the manufacturers of cigarettes pay the municipal authorities the relative cost of clean-up of dropped filters. In this case the proportion is 50% by count, and so the companies pay this share of the total cost.

Scenario	Description
DRS	A deposit refund system on one-way beverage containers provides a clear economic incentive for consumers to return their empty containers, including plastic bottles, to return points. Moreover, any bottles that are initially littered have a relatively high economic value so are picked up by others and returned, and so, ultimately, avoid ending up in the marine environment. DRSs also achieve very high capture rates, so recycling levels can reach over 90%. ³⁷ DRS is not guaranteed to be implemented by Member States to reach the 55% target. This target can be met today through existing higher performing kerbside schemes and residual waste sorting at lower cost. Moreover, with the target for all packaging to be recyclable by 2030, this would decrease the necessity for implementing DRS solely to help meet the target, though Member States could implement for other reasons, such as litter reduction or resource efficiency or increasing recycled content.
Consumption levies	For the purposes of describing this measure ‘levies’ are considered to be any economic instrument implemented at the Member State level that increases the cost of SUP items placed on the market, and incentivise non-use, or substitution by SUNP and MU items. The exact nature of the instruments cannot be determined here, but the overarching principles and estimated effects can be considered in the spirit of a scenario analysis. Charges and levies are only likely to be effective for some items, and not others. For example, the demand for sanitary towels, for example, is very inelastic, as they are considered essential, not luxury, goods. There are, however, some convenience and use barriers that may limit a large shift to reusable items (further market research would be needed to confirm or deny this). Alternative economic instruments, such as EPR for improperly flushed items are likely to be more appropriate (these are modelled in the measure above). Cigarettes are also very demand inelastic, and so additional price increases would result in limited changes in demand, if the price differential of alternatives was not significant.
Reduction targets (SUP)	Reduction targets would set legally binding reductions in consumption from a base year. Data related to the consumption of relevant items would have to be reported to the national governments. Targets are assumed to be as a percentage of the total consumption, but per capita targets could also be set as is the case under the plastic carrier bags Directive.
Reduction targets (all SU)	As above.
Ban (of SUP items)	This measure would see complete market bans on the sale of certain SUP items by a given year. Bans would have to be regulated to ensure products are not being sold after the date of implementation.
Ban (of all SU items)	This measure would see complete market bans on the sale of certain SU items by a given year. Bans would have to be regulated to ensure products are not being sold after the date of implementation.

³⁷ Eunomia on behalf of the European Commission, ‘Options and Feasibility of a European Refund System for Metal Beverage Cans’ Final Report, November 2011.

1.3 Availability of Alternatives

Cigarette Filters



Plant-derived cellulose filters could be used as an alternative, such as the RAW Biodegradable Slim Filter Tips, although according to anecdotal evidence the draw is not exactly the same as normal plastic based filters. However, there may be room for innovation. Additionally, it has been argued that cigarettes should be sold without filters (such as filterless Gauloise-type cigarettes), as the filters do not have a demonstrable effect on health outcomes. Given that these could then be used with re-usable filters, this maintains choice for consumers.

Drink Bottles



Networks of water fountains in cities, tourist areas and at beaches (or any other high traffic area) can be installed, along with running of information campaigns, in order to avoid the need for bottles at all. Fountains are available in most cities, but not at the level of density where consumers can quickly find them.

To enable and encourage consumers to use refillable bottles, mobile applications can be developed to indicate to consumers where the nearest available refill points are, to ensure they are used. Producers could install soda machines for use with



refillables bottles, rather than selling single use plastic bottles. Consumers would then bring refillable bottles to the outlet and purchase the volume of drink they require for their bottle. Food and drink retailers can sell water from refillable bottles, rather than selling single use plastic bottles. Many small cafes take this approach already and do not sell plastic water bottles at all.

Cotton Bud Sticks



There are companies that produces reusable sticks for cleaning ears, which are according to the supplier are more efficient and safer than cotton buds. In fact, many medical professionals do not recommend the use of cotton buds. Alternatively, paper stemmed (single use) and wood substitutes are now commercially available and indeed are the market norm in eg the USA.

Wet Wipes



Non-plastic alternatives to wet wipes used for personal care, for example make-up removal, already exist in the form of cotton pads or balls. Moreover, reusable alternatives to using wet wipes could include washable handkerchiefs or specially designed wipes, such as washable cloth Baby Wipes. Lotions (such as soaps, anti-bacterial gels, or make-up removal creams) could be applied to these wipes to achieve the desired result.

Sanitary Towels

Non-plastic alternatives for sanitary towels are not currently known. However, reusable sanitary towels, sanitary pads or menstrual pads are already available from a number of producers. These items are washable and reusable, and are usually made entirely of cotton, or of a mix of cotton or bamboo fibre with a waterproof poly-urethane layer.



Cutlery

Currently, there are 2 different situations where single use cutlery might be used, where food and drink establishments provide them to customers:

- use on the premises, mainly to save costs of washing reusable cutlery; or
- taking out with food which cannot be hand eaten for consumption on the go.

The latter is the most relevant to littering, whereas both relate to over-consumption of material.



Metal cutlery is the clear alternative and the majority of establishments make use of this approach. Therefore, washable items should be implemented for all eat-in sales. For take-out sales, reusable cutlery could be a clear alternative if consumers brought their own, and knew which outlets allowed this.



If single use items are necessary, then wood alternatives could be used, and are very common already through large stockists.

Straws and Stirrers



For many drinks, straws and stirrers are not needed at all, and could be eliminated, especially if certain drinks containers with detachable straws could be adapted to include integrate drinking spouts etc. Re-useable straws and stirrers are also available made out of glass or metal. Another option could be to innovate packaging design to build-in 'straws' to the pack itself, rather than have a separate disposal straw that could be littered.



If consumers found some disposable option necessary, wooden stirrers are commercially available. For straws, paper or bamboo alternatives are also very common and highly available.

Drinks Cups

Currently, there are 2 different situations where single use drinks cups might be used, where food and drink establishments provide single use cups to customers:

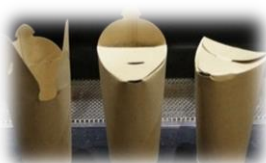
- drink on the premises, mainly to save costs of washing reusable cups; or
- taking out drinks for consumption on the go.

The latter is the most relevant to littering, whereas both relate to over-consumption of material.

Crockery is a clear MU alternative and many establishments already make use of this approach.

Take-away beverage sales for consumption on the go can readily be sold in reusable cups, which are now very well known. Moreover, some enterprises are also offering reusable cup clubs, which collect and return them to retailers. The Freiburg Cup scheme is a city based scheme that has been piloted along these lines, with 72 venues participating as of March 2017. The cup has a €1 deposit associated and it can be returned to any participating venue. At least 14,000 cups are in use. Deposit refund arrangements for ceramic mugs can also often be found in markets.

For customers where a reusable cup is not an option, then any single use beverage containers should be plastic free. Some paper cups that are classified as compostable, have a water proof layer as they are lined with plant-based Polylactic Acid (PLA). However, composting is only likely to work under industrial conditions, and the plastic may not fully degrade under other conditions – such as the marine environment. Consequently, SUNP alternative is not included in the analysis as lined cups are required for coffee to ensure the mechanical strength is maintained even when filled with very hot liquid for a certain length of time.



Regarding the lids, the design of the coffee cup itself could be changed to integrate a sipping spout, eliminating the need for separate lids altogether.

Food Containers

Currently, there are 3 different situations where single use food containers might be used, where food establishments provide single use containers to customers:

- to eat the food on the premises, mainly to save costs of washing reusable containers or plates;
- collecting food for consumption at home; or
- taking out food for consumption on the go.

The latter is the most relevant to littering, whereas all relate to over-consumption of material.

Crockery is a clear MU alternative and the majority of eat in establishments make use of this approach already. Eating take-away food on site might not always be possible with crockery, but reusable containers would be an obvious alternative (washable tiffins or multi-compartment trays).



For food markets and portable take-away outlets, portable washing stations can be hired to undertake the task of washing the reusable containers customers use to eat the food. In 2011, Vienna introduced an obligation to use reusable items at events with more than 1,000 people, where more than 500 people are attending in venues recognised as “permanent” by the Viennese MunicipalityMunicipality, or which are held on property owned by the Viennese MunicipalityMunicipality.

Alternatively, companies could provide a reusable container service to the street vendors: some companies do this, and each box can be used up to 2-300 times before it is eventually recycled. However, to ensure a high return rate for the boxes, a deposit refund type scheme might be needed.

For at home consumption of take-away meals, reusable containers can be used. These are already widely used in environmentally focused establishments, rather than single use plastics containers which are used by the majority. Consumers can purchase a metal tiffin, for example, for around €15-20 and take this to the takeaway outlet when they go to pick up the meal. They then wash it at home ready for the next visit. Or they could just bring a regular Tupperware-type box.

Where consumers are visiting take-away outlets and want to eat out ‘on-the-go’ the potential for utilising reusable containers is diminished. However, if this were not possible, then non-plastic containing single use containers are an alternative. Cardboard containers without plastic liners or biodegradable bagasse clamshells are already available at commercial scale.

In supermarkets, non-reheatable food to eat on the go is commonly served in single serve plastic packaging, so it will be important to ensure that standards and regulations are consistent for all food-to-go vendors – whether they are cafes and restaurants or supermarkets.

1.4 Feasibility of the Measures

For each product and measure, the rationale for the level of feasibility and a description of what the measures are trying to achieve – where relevant – are given (see Table 2 to Table 12). Some simplification of the list of measures has been made relative to what is included in the table above (see Table 1). The ‘Specified Sales Restrictions’, and ‘Measures for Adoption by Public Authorities, including Green Public Procurement’ have been merged into one category (‘Sales Restrictions / Measures for Adoption by Public Authorities’). The measures included in this category are expected to be the type of measures that would be used to implement a reduction target (if such targets were introduced) and hence are not carried forward to the modelling stage. In addition, the two categories on EPR (‘EPR for flushed items’ and ‘EPR – full cost coverage of litter collections’) have been merged into ‘EPR’.

Also, as indicated in Impact Assessment a range of related measures related to SUPs are in place or are due to be implemented in the next few years. However, there are no pilot studies for the items under consideration to evaluate feasibility. The technical feasibility is assessed here, with the economic feasibility within the Impact Assessment itself.

Table 2: Cigarette Butts

Measure	Feasibility and Aims
Information campaigns	Feasible. The aims of the campaign would be to inform smokers on the impacts of dropping cigarette butts, not only on beaches but also on land as many are washed into drains, and subsequently into the sea. This would include information on the packs themselves.
Mandatory labelling	Feasible. Labelling on packs of cigarettes, and on packs of filters.
Voluntary agreements, Voluntary commitments and pledges	Feasible. A voluntary agreement could be considered by the tobacco industry to reduce the plastic content in filters over time, which would convey towards the wider public that the tobacco industry is willing to contribute to marine litter solutions.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Not feasible. Although, in theory it might be possible to introduce bans on smoking outside in public places and/or on beaches.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and NSUP alternatives.
Reduction targets (SUP)	Feasible. Alternatives are available, e.g. non-plastic filters
Reduction targets (all SU)	Not feasible. Reducing cigarette consumption or filter use overall goes beyond the scope of tackling the marine litter issue.
Ban (of SUP items)	Not feasible. MU alternative does not exist.
Ban (of all SU items)	Not feasible. MU alternative does not exist.

Table 3: Drinks bottles, caps and lids

Measure	Feasibility and Aims
Information campaigns	Feasible. The aim would be to run information campaigns to incentivise consumers to use water fountains, refillable bottles and other alternatives to the consumption of single-use bottles, as well as to ensure caps and lids are not littered. In addition, targeted campaigns for the HoReCa sector to install water fountains and soda streams in outlets, or to run refill schemes, and for municipalities to install water fountains in public spaces.
Mandatory labelling	Feasible. There may be issues with some very small bottles (e.g. miniatures sold in mini-bars), but otherwise, the measures could be readily adopted.
Voluntary agreements, Voluntary commitments and pledges	Feasible. Voluntary agreements could focus on reducing the use or sale of single-use plastic drinks bottles, switching to alternatives (including bottles made of other materials, or reusable bottles), or installing refillable schemes.
Specific Requirements on Product Design	Feasible. Design features could be incentivised or obliged to ensure that caps and lids are mechanically fixed to bottles (through tethers, for example) in order to reduce the incidence of littering.
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. Drinks bottles are already subject to EPR fees in Member States, which could be further extended to ensure the fees cover a larger share of the costs incurred through the lifecycle. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. A similar scheme could be implemented for drinks bottles, caps and lids.
Implement DRS	Feasible. A number of EU Member States have already implemented a DRS for beverage containers. Several of them are achieving over 90% collection and recycling rate.
Sales restrictions / measures for adoption by public authorities	Feasible. Regulations could ban (public) venues from selling single-use drinks bottles for consumption on/off-site (see, for example, California), and public authorities could mandate the use of refillables at events under their influence.
Consumption levies	Feasible. Drinks bottles are a well-defined category of SUPs to which levies could be applied relatively straight-forwardly from a technical point of view (e.g. see current deposit refund systems for dinks bottles). The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. There are alternatives that can be used in different contexts (see above: refillable bottles, bottles made of alternative materials, water fountains, etc.).
Reduction targets (all SU)	Feasible. Reusable alternatives exist (see above).
Ban (of SUP items)	Feasible. Both non-plastic single-use and multi-use alternatives exist (see above).
Ban (of all SU items)	Feasible. Multi-use alternatives exist (see above).

Table 4: Cotton bud sticks

Measure	Feasibility and Aims
Information campaigns	Feasible. Campaigns could focus on informing consumers about the impacts of flushing cotton buds down the drain or dropping on the ground when outdoors. Particularly using striking images such as the sea horse holding onto a cotton bud, which won a National Geographic photo competition.
Mandatory labelling	Feasible. The labelling would need to take place on packs of buds. This means that where buds are made openly available for consumers (in hotels, for example), the ability to influence through labelling would be lost.
Voluntary agreements, Voluntary commitments and pledges	Feasible. Large manufacturers and retailers of cotton buds are already taking voluntary initiatives to switch away from using plastic cotton buds to paper, so voluntary agreements to switch to non-plastic alternatives would seem highly feasible.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Feasible. BAT to require minimum size of screen on inlet works at WWTW (6mm screen may be too large if cotton buds pass through end on, so might not capture all – smaller screens may not be feasible). Any by-pass from storm overflows should also be screened. Screens should be automated to reduce maintenance burdens. Actions should aim to capture large number of cotton buds flushed down toilets.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for cotton bud sticks.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. Green public procurement could be used to this end.
Consumption levies	Feasible. In this case though, the principle would be more based on cost recovery / demand reduction. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. As noted above under voluntary commitments reducing the plastic cotton bud stems is very feasible, and already occurring to a high extent in some Member States.
Reduction targets (all SU)	Feasible. Reusable alternatives do exist (U-Tips, for example) so reductions target would be feasible, but some consumers may still demand single use options.
Ban (of SUP items)	Feasible. As noted above, switching from plastic cotton bud stems to other materials is very feasible, and already occurring to a high extent in some Member States.
Ban (of all SU items)	Feasible. Reusable alternatives exist.

Table 5: Crisp packets & sweet wrappers

Measure	Feasibility and Aims
Information campaigns	Feasible. The aim of such campaigns would be to target on-the-go consumers at point of sale, in order to inform about the potential impacts of littering and provide information on the location of litter bins that could be utilised.
Mandatory labelling	Feasible. Labelling on packets and wrappers is rather straight-forward for larger items, while more complicated for small packaging (due to size and existing labelling requirements).
Voluntary agreements, Voluntary commitments and pledges	Feasible. The aims of any voluntary agreement are not entirely clear at this stage, but could cover increasing the collection of littered packets or innovating to reduce the plastic content.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for crisp packets and sweet wrappers.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Not feasible. Unlikely to be possible to restrict the sales of crisp packets or sweet wrappers by location.
Consumption levies	Feasible. In this case though, the principle would be more based on cost recovery / demand reduction. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Not feasible. No tried and tested SUNP alternative exists (although some companies are seeking to develop non-plastics alternatives, e.g. foil and paper packaging).
Reduction targets (all SU)	Not feasible. No tried and tested SUNP alternative exists (although some companies are seeking to develop non-plastics alternatives, e.g. foil and paper packaging).
Ban (of SUP items)	Not feasible. Lack of alternatives. No MU packaging formats exist for these foodstuffs.
Ban (of all SU items)	Not feasible. Lack of alternatives. No MU packaging formats exist for these foodstuffs.

Table 6: Sanitary Towels

Measure	Feasibility and Aims
Information campaigns	Feasible. Aim to inform consumers of the impacts and stop flushing sanitary items down toilet systems.
Mandatory labelling	Feasible. The labelling would be required on packs being sold, and preferably, on individual items where these are individually packaged. The approach to individual labelling would make it far more likely that the label's message would be conveyed irrespective of whether the consumption was through retail, or other means.
Voluntary agreements, Voluntary commitments and pledges	Feasible. There may be the potential for voluntary agreements to be put in place where manufacturers look to reduce the plastic content of sanitary towel products.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Feasible. BAT to require minimum size of screen on inlet works at WWTW (6mm screen should be sufficient). Any by-pass from storm overflows should also be screened. Screens should be automated to reduce maintenance burdens. Aim to capture large number of towels flushed down toilets.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for sanitary towels.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. Green Public Procurement approach could be used to this end.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. SUNP are not widely available, but reusable sanitary towels, sanitary pads or menstrual pads are already on the market, as well as other reusable products having the same purpose. However, the market share for this approach may not be significant in the short term.
Reduction targets (all SU)	Feasible. Similar reasoning as above, given the availability of multi-use items.
Ban (of SUP items)	Not feasible. While alternatives exist, their market share is currently limited and due to the related sensitivity, it remains unclear how feasible scaling would be.
Ban (of all SU items)	Not feasible. As above.

Table 7: Wet Wipes

Measure	Feasibility and Aims
Information campaigns	Feasible. Aim to inform consumers of the impacts and stop flushing down toilet systems.
Mandatory labelling	Feasible. The labelling would be required on packs being sold, and preferably, on individual items where these are individually packaged. The approach to individual labelling would make it far more likely that the label's message would be conveyed irrespective of whether the consumption was through retail, or other means.
Voluntary agreements, Voluntary commitments and pledges	Feasible. There may be the potential for voluntary agreements to be put in place where manufacturers look to reduce the plastic content of sanitary towel products.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Feasible. BAT to require minimum size of screen on inlet works at WWTW (6mm screen should be sufficient). Any by-pass from storm overflows should also be screened. Screens should be automated to reduce maintenance burdens. Aim to capture large number of wipes flushed down toilets.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for wet wipes.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. Green Public Procurement approach could be used to this end.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. Non-plastic single-use and multi-use alternatives, like cotton and wool, were the precursor product to many wet wipes applications today. These and other non-plastic alternatives (including bamboo) are already on the market. There are also other MU alternatives to using wet wipes (e.g. washable handkerchiefs, anti-bacterial gels).
Reduction targets (all SU)	Feasible. SUNP and MU alternatives are already on the market.
Ban (of SUP items)	Feasible. SUNP and MU alternatives are already on the market.
Ban (of all SU items)	Feasible. SUNP and MU alternatives are already on the market.

Table 8: Cutlery

Measure	Feasibility and Aims
Information campaigns	Feasible. Campaigns could focus on giving consumers information about the impacts, and also encouraging them to ask to reusable cutlery at local food establishments they frequent. Other aims could be to target the HoReCa sector itself and provide information to them about the alternatives and costs/benefits (particularly CSR) from reducing reliance on SUP cutlery, or single-use items at all.
Mandatory labelling	Feasible. Limited to specific circumstances though as the labelling approach would only be effective where purchases were being made of bulk items (or packaged sets). To the extent that much of the consumption is through HoReCa, and free of charge, because the labelling of individual items is not deemed feasible, much of consumption would not be affected
Voluntary agreements, Voluntary commitments and pledges	Feasible. Agreements could be put in place in the HoReCa sector to reduce the reliance on single-use cutlery in food sale establishments, or from the manufacturers of cutlery to switch to other materials. In addition, voluntary agreements to charge consumers for any SU items used could be adopted.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for cutlery.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. Restricting the sale of SUP, or any single-use, cutlery item for use on-site would be a measure to this end (i.e. single use items would only be available for on-the-go consumption). Moreover, use of SU(P) items could be restricted through procurement policy by public authorities.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. SUNP and MU alternatives are already widely available.
Reduction targets (all SU)	Feasible. SUNP and MU alternatives are already widely available.
Ban (of SUP items)	Feasible. SUNP and MU alternatives are already widely available.
Ban (of all SU items)	Feasible. SUNP and MU alternatives are already widely available.

Table 9: Straws and Stirrers

Measure	Feasibility and Aims
Information campaigns	Feasible. There are already many campaigns targeting the reduction in use of plastic straws, by providing information about the impacts and alternatives.
Mandatory labelling	Feasible. Limited to specific circumstances though as the labelling approach would only be effective where purchases were being made of bulk items (or packaged sets). To the extent that much of the consumption is through HoReCa, and free of charge, because the labelling of individual items is not deemed feasible, much of consumption would not be affected
Voluntary agreements, Voluntary commitments and pledges	Feasible. Many companies are already replacing plastics straws with paper alternatives on a voluntary basis.
Specific Requirements on Product Design	Feasible. The aim of any minimum requirements measure related to straws would be to seek to innovate packaging design to build-in 'straws' to the pack itself, rather than have a separate disposal straw that could be littered .
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for straws and stirrers.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. Restricting the sale of SUP, or any single use, straw/stirrer item for use on-site would be a measure to this end (i.e. single use items would only be available for on-the-go consumption). Moreover SU(P) items could be restricted through procurement policy by public authorities.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. SUNP and MU alternatives are already widely available.
Reduction targets (all SU)	Feasible. SUNP and MU alternatives are already widely available.
Ban (of SUP items)	Feasible. SUNP and MU alternatives are already widely available.
Ban (of all SU items)	Feasible. SUNP and MU alternatives are already widely available.

Table 10: Food containers (including fast food containers)

Measure	Feasibility and Aims
Information campaigns	Feasible. The aims of any information campaigns would be to help consumers understand the issue and decide to take their own containers to restaurants and fast food outlets, and to help local businesses understand the impacts and alternatives for investing in reusable box schemes (particularly if implemented at the city level).
Mandatory labelling	Feasible. Clearly, where consumers are buying from retail, then the packs of containers would also be suitable for labelling.
Voluntary agreements, Voluntary commitments and pledges	Feasible. Voluntary agreements could target suppliers and users of SUP food containers to switch to non-plastic alternatives, and/or for local food establishments to offer discounts for consumers bringing their own containers or setup communal reusable box schemes.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for food containers
Implement DRS	Not relevant, only relates to drinks bottles.
Consumption levies	Feasible. More likely to lead to substitution (by SUNPs and MU) where SUP items are filled at the point of sale.
Sales restrictions / measures for adoption by public authorities	Feasible. Restricting the sale of SUP, or any single-use, food container for use on-site would be a measure to this end (i.e. single use items would only be available for on-the-go consumption). Moreover SU(P) food containers could be restricted through procurement policy by public authorities.
Reduction targets (SUP)	Feasible. SUNP and MU alternatives are already widely available.
Reduction targets (all SU)	Feasible. SUNP and MU alternatives are already widely available.
Ban (of SUP items)	Feasible. SUNP and MU alternatives are already widely available.
Ban (of all SU items)	Feasible. SUNP and MU alternatives are already widely available.

Table 11: Cups and cup lids

Measure	Feasibility and Aims
Information campaigns	Feasible. Campaign aims would be to help incentivise consumers to use their own reusable cups and for beverage outlets to think about offering their own branded cups and what benefits they might achieve from this, in terms of reduced financial costs or increased CSR.
Mandatory labelling	Feasible. In particular for SUP cups, as the measure might be slightly more difficult for lids. However, the labelling on the cup could draw attention also to the need to take responsibility for the lid. Clearly, where consumers are buying from retail, then the packs of cups / lids would also be suitable for labelling.
Voluntary agreements, Voluntary commitments and pledges	Feasible. A range of voluntary agreements could be imagined. Firstly, for retailers to offer discounts for consumers bringing their own cups, or to offer reusable cups for sale in all stores, or to stop using single use cups at all. Secondly, manufacturers of cups could set up voluntary agreements to phase out the plastic content of the cups and lids over time.
Specific Requirements on Product Design	Feasible. Some innovation in minimum requirements might be possible, particularly around integrating sipping lids into the cups rather than having separate items, as shown by a winner of the Ellen MacArthur Foundation's innovation prize.
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for cups and cup lids
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. Restricting the sale of SUP , or any single-use, cup / lid for use on-site would be a measure to this end (i.e. single use items would only be available for on-the-go consumption). Moreover SU(P) items could be restricted through procurement policy by public authorities.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. Reusable alternatives are clearly available. However, regarding potential SUNP alternatives, most cups would still have a plastic liner that ensures the mechanical strength of the alternative outer material (e.g. cardboard) does not degrade through water infiltration.
Reduction targets (all SU)	Feasible. Reusable alternatives are available, though demand for on-the-go consumption of beverages is strong so the extent of any reduction might be limited.
Ban (of SUP items)	Feasibility. Reusable alternatives are already widely available , while SUNPs could be a viable alternative soon, assuming the liner challenge gets solved.
Ban (of all SU items)	Feasible. Reusable alternatives are already widely available, while SUNPs could be a viable alternative soon, assuming the liner challenge gets solved.

Table 12: Balloons and Balloon Sticks

Measure	Feasibility and Aims
Information campaigns	Feasible. Campaign aims would be to discourage balloon releases, and encourage the use of alternatives to SUP sticks
Labelling	Feasible. Limited to packs of balloons and sticks, unlikely to be feasible for single items (although possible to have labelling that appears on balloons once inflated).
Voluntary measures	Feasible. A range of voluntary agreements could be imagined: eliminating SUP balloon sticks; voluntary information campaigns; seeking to ensure products were not made available at / for mass release events.
Specific Requirements on Product Design	Not feasible. No potential litter reduction design features were found.
Setting enhanced technical standards for WWTW and CSOs	Not relevant, items are not flushed.
EPR	Feasible. San Francisco, for example, has implemented a scheme in which the fee for cigarette manufacturers includes a component for the costs relating to litter which is based on the proportion of cigarette butts in litter counts. Similar measures could be implemented for balloons and balloon sticks.
Implement DRS	Not relevant, only relates to drinks bottles.
Sales restrictions / measures for adoption by public authorities	Feasible. In particular, in terms of limiting the licensing of mass releases at events, and through general licensing of events. If public authorities purchase balloon sticks, they could seek to procure alternatives to SUPs.
Consumption levies	Feasible. The levy would be set such that a differential existed between SUP and non-SUP alternatives.
Reduction targets (SUP)	Feasible. Mainly limited to balloon sticks. There are fewer obvious SUP alternatives to balloons but that does not necessarily prevent implementation of reduction targets.
Reduction targets (all SU)	Feasible. See above.
Ban (of SUP items)	Feasible. Mainly limited to balloon sticks, as lack of alternatives make it less likely to be feasible for balloons.
Ban (of all SU items)	Feasible. See above.

1.5 Product-Measure Matrix

The table below shows a summary of the feasibility of the products and measures under consideration. The colour coding is as follows:

- Feasible = Green
- Not feasible = Grey

Table 13: Measure-Feasibility matrix

Product	Information campaigns	Labelling	Voluntary agreements, Voluntary	Specific Requirements on Product Design	Setting enhanced technical standards for	EPR	Sales restrictions / measures for adoption	DRS	Consumption levies	Reduction targets (SUP)	Reduction targets (all SUP)	Ban (of SUP items)	Ban (of all SUP items)
Cigarette filters													
Drinks bottles													
Cotton bud sticks													
Crisp packets and Sweet wrappers													
Wet wipes													
Sanitary towels													
Cutlery													
Straws and Stirrers													
Drinks cups and lids													
Food containers													

Items outside the quantified analysis of the impact assessment

Items outside of the Top Ten commonly found in marine litter are listed below, along with some alternatives.

- Strapping bands: alternatives could include metal strapping for heavy loads, or reusable polyester bands with buckles for smaller goods. String could be used for light goods.
- Shotgun cartridges: cartridges with paper cases exist, and were used historically.
- Cigarette lighters: MU cigarette lighters are very common and would make a clear alternative.
- 4/6 pack yokes, six-pack rings: yokes and rings could be dispensed of altogether and packs of 4 to 6 could be packaged in cardboard, as are larger packs.

- Lolly sticks: paper and wood lolly sticks are already readily available and could be used as an alternative to plastic.
- Tobacco pouches / plastic cigarette packaging: there is a question as to whether these items are SUP, but they still do appear in beach litter counts so could be targeted. Pipe smokers often have tobacco cases or pouches, so multi-use alternatives could be foreseen.
- Nappies: reusable baby nappies are already widely used as are washable incontinence pants.
- Plastic bags: given the switch in consumer behaviour brought about by measures in place from Member States or in response to the Plastic Bags Directive, no further analysis was undertaken.

The above shows that there are many SUNP and MU alternatives for the other SUP items that appear in beach litter counts. Policies at the Member State level could also target these items in order to further reduce the amount of SUP litter entering the marine environment.

1.6 Key model Data

The support study (Eunomia et al) sets out the key model data. This includes the current levels of consumption for each item and type and the compound annual growth rate (CAGR) is provided. Growth forecasts indicate that the consumption of nearly all SUP items are projected to increase out to 2030. The only items that are expected to decrease are cigarette butts and plastic cotton buds.

Table 16 shows the current recycling rates determined through a step-by-step assessment of the parameters of existing waste collection systems, and the physical characteristics of the items in question. Recycling of these items is very low for most, with the exception of beverage bottles and food containers.

Table 14: Baseline recycling assumptions for specific single-use items.

Item	Item class	Final Recycling Rate
Cigarette butts	SUP	0%
	SUNP	0%
Drinks bottles, Caps and lids	SUP	52%
	SUNP	61%
Cotton bud sticks	SUP	1%
	SUNP	1%
Crisps packets / sweets wrappers	SUP	0%
	SUNP	9%
Wet-wipes	SUP	0%
	SUNP	39%
Sanitary towels and tampons	SUP	0%
	SUNP	-
Cutlery	SUP	1%
	SUNP	10%
Straws	SUP	0.6%
	SUNP	10%

Item	Item class	Final Recycling Rate
Stirrers	SUP	0%
	SUNP	10%
Drinks cups and cup lids	SUP	1.5%
	SUNP	10%
Food containers including fast food packaging	SUP	5%
	SUNP	10%

Finally, the littering rates calculated in the model are presented below. These indicate that rates vary by item. It should be noted that the data underpinning these estimates is very scarce and so should be considered indicative only.

Table 15: Littering rates of different items

Item	kg/capita littered	Tonnes littered	Consumption, EU 28, tonnes	SUP littering rate	SUNP littering rate	MU littering rate	Found in Marine Environment (tonnes)
Cigarette filters	0.014	2,416	7,531	32.1%	32.1%	-	121
Drinks bottles	0.37	187,388	2,703,641	6.9%	6.9%	0.0%	9,369
Cotton buds	0.00	1,337	9,547	14.0%	14.0%	0.0%	67
Crisp packets	0.02	4,370	117,045	3.7%	3.7%	-	219
Sweet wrappers	0.00	4,370	138,965	3.1%	3.1%	-	219
Wet wipes	0.00	14,793	47,720	31.0%	31.0%	0.0%	740
Sanitary towels	0.00	25,767	122,698	21.0%	21.0%	0.1%	1,288
Cutlery	0.00	959	206,605	0.46%	0.5%	0.0%	48
Straws	0.005	2,771	88,450	3.1%	3.1%	0.0%	139
Stirrers	0.00	213	139,252	0.2%	0.2%	0.0%	11
Drinks cups & lids	0.16	39,865	302,417	13.2%	13.2%	0.0%	1,993
Food containers	0.11	27,820	544,382	5.1%	5.1%	0.0%	1,391

For the single-use plastic items considered here, the total tonnage of items dropped as litter is estimated to be 270,174 tonnes, while the tonnage of items flushed sums to 41,896 tonnes. Of a total of 312,070 tonnes of items, the amount then entering the marine environment is calculated to be 15,604 tonnes. This takes into account the proportion of improperly flushed items removed during waste water treatment.

1.7 Assumptions

This section considers the key assumptions that were made to model the future effects of the various scenarios being assessed.

Note, a x% reduction indicates a reduction of x% of the baseline figure, whereas a figure of 'x percentage points' indicates an absolute reduction in the rate for consumption switches, and the absolute rate for the fates (for example, 70% indicates a recycling rate of 70% was modelled).

Table 16: Approach to modelling the scenarios

Scenario	Approach to Modelling
Information campaigns	Without broader policy changes, information campaigns might be limited in their affect. The segment of society which may be most amenable to changing their behaviour may be that with environmentally positive attitudes, but they may also already have altered their own behaviour. The following changes are modelled under this scenario for all items: ■ Littering / flushing rate decreases by 2%, 5% and 10% by 2020, 2025 and 2030 respectively; ■ Littering collection rates remain at baseline level; ■ Recycling rates remain at baseline levels; and ■ Consumption switches from SUP to SUNP and MU by 5 percentage points each by 2030 (where alternatives already exist e.g. all except, MU cigarette filters, SUNP sanitary towels, SUNP drinks cups and SUNP/MU crisp packets/sweet wrappers), and by 2 percentage points for MU sanitary towels only as rates are currently higher than the other items.
Voluntary actions	Voluntary actions are most effective where there is a back-stop of policy intervention if agreements are not effective in delivering change. VAs are more likely to be effective where they align with the commercial and reputational outlook of businesses, for example, where non-plastic alternatives are already in place, and the measures taken result in limited, or negative costs, and improved public image. The following changes are modelled under this scenario: ■ Littering / flushing rate decreases by 2%, 5% and 10% by 2020, 2025 and 2030 respectively; ■ Litter collection rate increases by 5% for all non-flushed items – they magnitude of the change is less than the litter reduction rate as increased collection implies a change in cost rather than just behaviour, which would limit the change; ■ Recycling rates remain at baseline levels; ■ Consumption switches from SUP to SUNP by 10 percentage points each for cotton buds, straws, stirrers, food containers and cutlery (items were producers are more likely to target campaigns, as already existing public support); and ■ Consumption switches from SUP to MU by 5 percentage points each for straws, stirrers, cutlery, drinks bottles, drinks cups and food containers (items where consumers can make switches to MU items from well-understood easy to use alternatives).
Essential Requirements on Product Design	This measure is modelled focusing on the specific items being targeted. The key changes modelled are: ■ The unit weight of plastic bottles increase by 2% in order to estimate the increased material requirement from the leashes. Material requirements for integrated lids or straws may not change, and currently there are few examples so no change in unit weight is modelled;

Scenario	Approach to Modelling
	■ Littering rates reduced by 5% by 2030 for all items assuming that some consumers stop littering; ■ Collection rates increase by 5% by 2030 for plastic bottles to represent the increased collection of the caps themselves, by 25% for cup lids, assuming there are limits to how many consumers may purchase integrated lid versions, and by 50% for straws assuming there are market limitations where straws are not sold with beverages; ■ Recycling rates for plastic bottles increase by 1% to represent minor increases in recycling of caps which would also be collected alongside bottles, other items remain at baseline levels; and ■ Item types remain at baseline consumption levels.
BAT for WWTW and CSOs	This measure would affect a limited range of items that are flushed down drains, e.g. cotton buds, wet wipes and sanitary towels, and also cigarette butts that are washed down surface water drains in periods of rainfall. It was assumed that this measure would target BAT for the water treatment industry, and additional screening would be implemented to reduce leakage into the environment. The following changes are modelled under this scenario for all items: ■ Improperly flushed items collection rate increases by 50% for sanitary towels and wet-wipes and 25% for cotton buds by 2030 (the latter is deemed lower as cotton buds could still passed through 3mm screens end on).
EPR for improperly flushed items	As per scenario above but costs fall on producers, not water companies.
EPR – full cost coverage of litter collections	In terms of the modelling for this analysis, we take the estimated total contribution of the top ten items in terrestrial litter and beach litter into account. For floor litter, by weight, this is estimated at around 15%. Litter surveys do not use categories with enough disaggregation to be able to identify the contribution of all items modelled in this study, however, some further disaggregation is available. To model this measure the following assumption has been made. In order to half the amount of litter currently not collected, the unit cost of litter clean-ups would have to double. The following changes are modelled under this scenario for all non-flushed items: ■ Litter collection rate increases to a level equivalent to capturing 50% of the remaining uncollected litter (e.g. Litter Rate = Litter Rate + (100% – Litter Rate) x 50%) by 2030 (10% by 2020 and 30% by 2025). ■ Litter clean-up costs double.
Sales restrictions (inc. events, GPP)	The magnitude of the effect from this measure would depend upon the proportion of the market which serviced events or public sector institutions, as well as the amount of drinks and food items sold for consumption on-site versus on-the-go. The scale of the public sector can be significant in some countries and is not likely to be trivial in any. The approach taken is: ■ Consumption switches from SUP to MU by 25% each for straws, stirrers, cutlery, drinks bottles and drinks cups by 2030; and ■ An overall reduction in consumption of 25% of straws and stirrers by 2020. No change to littering or recycling rates are modelled.
Implement DRS	Three primary effects are modelled due to implementation of a DRS. Firstly, recycling rates are assumed to increase to 90%. ³⁸ Secondly, the initial litter rate

³⁸ <http://infinitum.no/english/the-deposit-system>

Scenario	Approach to Modelling
	will decrease as consumers return the containers to the DRS. Finally, the litter collection rate will increase as some littered bottles will be picked up and returned to the DRS to claim the deposit value. It is assumed that DRS are implemented over the period to 2025. The following changes are therefore modelled under this scenario for plastic beverage bottles only: ■ Recycling rate increases to 90%; ■ Litter rate reduces to 80% of the baseline level; and ■ Litter collection rate increases by 50%. The overall outcome regarding litter is that littering is reduced by 90% compared to baseline levels, with only 10% of what was littered still remaining in the terrestrial or entering the marine environment. In terms of the modelling, the costs shown are the net costs to business – this has been reduced by income to business from unclaimed deposits, which could be taken as a cost for consumers.
Consumption levies	The measure was modelled by assuming a levy at the point of consumption was put in place for these items: ■ Cutlery ■ Straws ■ Stirrers ■ Cotton buds ■ Drinks cups / lids ■ Drinks bottles ■ Food containers To simplify the approach to modelling of this measure, it was assumed that a similar charge to those implemented on carrier bags might be implemented on the items considered here, as for carrier bags. The level of the charge is up to around €0.10 in many Member States, so this is added for items which are currently given away at the point of sale for free, or are integrated into products with a low unit cost. For the items sold as integral packaging to the food/drink product being sold (drinks cups, drinks bottles and food containers) the consumer feels the overall cost of the product + packaging, and so the levy would need to be higher to have a similar effect – consequently, a more significant charge of €0.25 was modelled. The price-demand relationship has also to be determined to assess the effects of the various charges on demand. Unlike the carrier bag impact assessment, there was no country wide example to base the likely effects upon (e.g. the Irish carrier bag levy). It has been assumed that those items which are currently given away for free and not integrated into the purchased product (cutlery, straws and stirrers), the price effect is in line with that for carrier bags, i.e. an 80% reduction for a €0.10 charge. For cotton buds, the level of the levy would be lower (a €0.01 charge would double the cost of the product, for example), but given the upcoming availability of alternative non-plastic alternatives, it is assumed that the levy would result in a 95% reduction in consumption of SUNP cotton buds is achieved. For drinks cups, evidence from a study in Wales suggests that consumers take the price increase relative to the product price into account, and so the demand reduction is less significant.³⁹ We have used the figure from this study to model the reduction of 30% consumption of SUP drinks cups, drinks bottles and food containers in response to a €0.25 charge. The nature of the

³⁹ Eunomia contributed to the report ‘Disposable Packaging: Coffee Cups’ published by the House of Commons’ Environmental Audit Committee, December 2017.

Scenario	Approach to Modelling
	alternative could either be MU if the consumer decides to switch to a reusable product to avoid the levy, or SUNP if the retailers switch material use, also to avoid consumers having to pay the levy (which would reduce demand for their products). The timing of introduction of the levies is assumed to be the following, giving additional time for some items to develop alternatives and behaviours to adapt: ■ Cutlery – 2020 ■ Straws – 2020 ■ Stirrers – 2020 ■ Cotton buds – 2020 ■ Drinks bottles – 2025 ■ Food containers – 2025 ■ Drinks cups / lids – 2030 The % reduction of SUP relates to a consumption switch to SUNP and MU, these vary depending on item type (see below). In addition, for straws and stirrers, the total level of consumption of those items is reduced by 50% as consumers decide they no longer need the items at all. No change to littering or recycling rates are modelled.
Reduction targets (SUP)	Reduction targets are set differently depending on the existence of SUNP alternatives. The % reduction of SUP relates to a consumption switch to SUNP and MU, these vary depending on item type (where MU alternatives are available). In addition, for straws and stirrers, the total level of consumption of those items is reduced by 50% as consumers decide they no longer need the items at all. No change to littering or recycling rates are modelled.
Reduction targets (all SU)	Reduction targets are set differently depending on the existence of MU alternatives. In addition, for straws and stirrers, the total level of consumption of those items is reduced by 50% as consumers decide they no longer need the items at all. No change to littering or recycling rates are modelled.
Ban (of SUP items)	The approach to modelling bans is to assumed a 100% reduction of the consumption of SUP items, where MU alternatives exist that could be adopted by the whole market (some items, such as sanitary are excluded as it is assumed not all users would shift to MU). The period for the reduction is set between 2 and 12 years depending on item. This relates to the current availability of alternatives, time needed for behaviour change (i.e. a shift to an unfamiliar approach) and the likely time innovation might need to take to deliver new approaches. No change to littering or recycling rates are modelled.
Ban (of all SU items)	As above, but a complete switch from SUP and SUNP to MU by the given years.

The model has the following limitations:

- Market data was not available for all countries so had to be estimated using GDP per PPP.
- Fates factors averaged for all of the EU in some cases.
- Forecasts are based on expert judgement as pilot studies / trials / countrywide examples or evaluations are not available for these products-measures.
- Input data is of variable quality.

- The approach to assessing welfare costs is straightforward and not fully comprehensive, given the number of items needing to be assessed.
- Evidence and impacts on marine wildlife still being understood.
- Cannot value water and land use, and so compare these impacts in monetary terms against the rest of the costs and benefits.

1.8 Life Cycle Analysis

Products bring about impacts not just from their manufacturing, but also from the sourcing of raw materials for their production, their usage and end-of-life, as well as due to logistics for transportation. Also alternatives to single-use plastics need to consider the full life-cycle impacts. Life-cycle analysis (LCA) was performed for nine widely-used single-use plastics products (SUPs) and their single-use non-plastic alternatives (SUNPs), as well as reusable alternatives (multi-use; MU), with the aim of answering the following question:

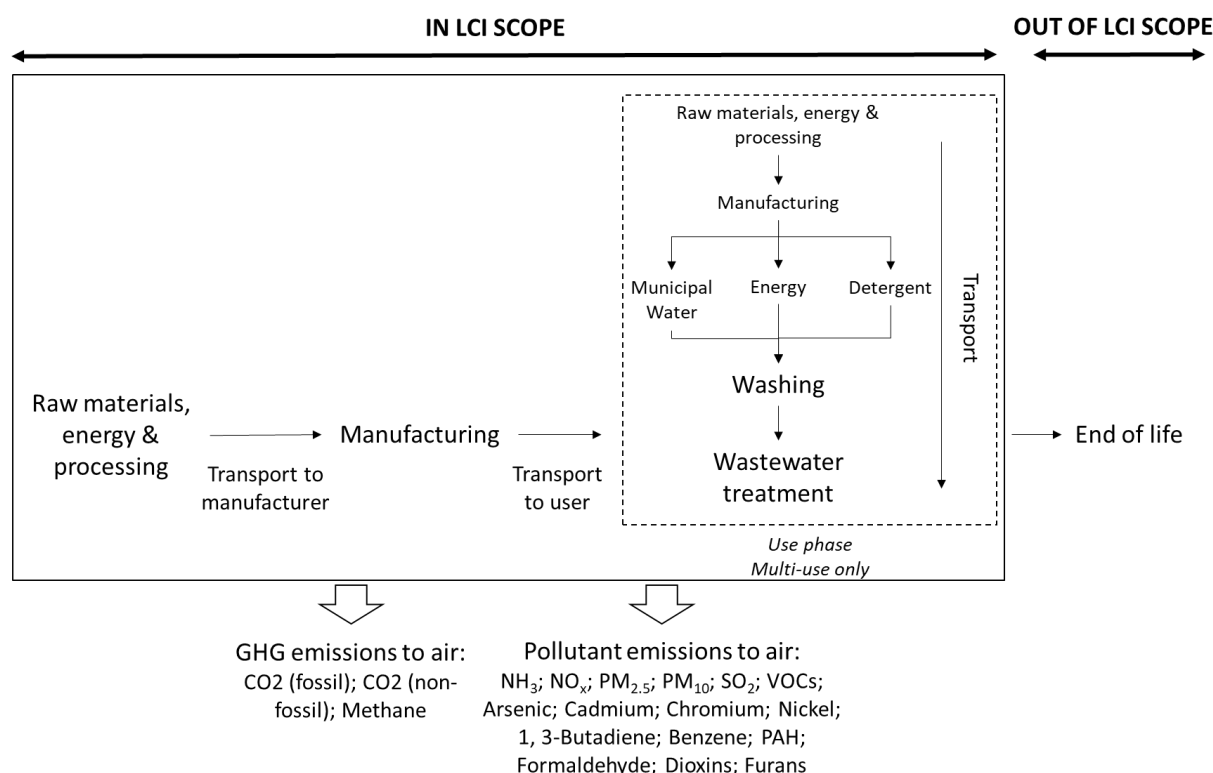
“If single-use plastics products were replaced by either single-use non-plastics alternatives or multi-use items, what would the impact be on greenhouse gas and air pollutant emissions?”

The life-cycle study involved building life-cycle inventories of the single-use plastics and their alternatives. CO₂, CH₄ and sixteen types of air pollutants were considered. The life-cycle inventories of the product systems under consideration supplement the analysis of plastics & their alternatives end-of-life, thus contributing to the overall life-cycle view of the Impact Assessment.

Methodology

Functional unit - one use of a product in question or of its alternative(s). For single-use plastic and non-plastic items, this equates to the production of 1 item. For multi-use items, this is the production of 1 item divided by its number of reuses, plus the burdens of 1 wash cycle.

Figure 3. System boundaries of the of the life cycle inventories and emissions considered



Data sources & system boundaries - The life-cycle inventories compiled are based on Ecoinvent v3.4 for both foreground and background data (Wernet et al., 2016). End-of-life treatment is excluded from the LCI scope due to end-of-life fates being considered separately in the Impact Assessment model. Figure 3 illustrates the system boundary of all products considered, as well as the emissions included in the compilation of their life-cycle inventories.

In total, twelve products & their potential alternatives were considered for modelling. In choosing the reference products for each product category the most widely used products have been selected. The criteria for selection of plastics alternatives were that:

- The materials of which SUNP items are composed avoid the generation of microplastics
- Alternative products meet the same function as the plastic products that they substitute in terms of properties that the materials ensure.
- Multi-use items need to ensure that use of single-use plastics is avoided.
- Alternatives need to satisfy broadly the same market.

Washing and reusability of multi-use items - datasets were compiled from Ecoinvent data. Due to the reusability of multi-use items, their burdens up to and including the manufacturing stage would be small and the product system would thus be dominated by its use (washing).

Use of the life cycle inventory

The life-cycle inventory compilation was fed into the model. As the compiled life-cycle inventories are fed into the general Impact Assessment model, they should not be interpreted

in isolation with respect to preference of SUP, SUNP or MU items. While care has been taken in the selection of reference products & alternatives, life-cycle assessment studies do not account for all possible characteristics of particular items. What is more, the preference for certain items over others may lie with characteristics that have not been accounted for in this work.

2 Impacts of the options

The modelling below shows the magnitude of impacts that would be likely to take place.

2.1 Changes in the Baseline

Firstly, the key changes under the baseline from 2018 to 2030 are presented to understand against what parameters the scenarios be being assessed against. The main changes relate to national policies regarding tackling cotton buds, and cutlery / drinks cups in France.

Table 17: Change in Consumption under the Baseline (2018 to 2030)

Item	SUP	SUNP	MU
Cigarette filters	0%	0%	0%
Drinks bottles	0%	0%	0%
Cotton buds	-24%	25%	-1%
Crisp packets / sweet wrappers	0%	0%	0%
Wet wipes	0%	0%	0%
Sanitary towels	0%	0%	0%
Cutlery	5%	-3%	-2%
Straws	0%	0%	0%
Stirrers	0%	0%	0%
Drinks cups and lids	1%	0%	-1%
Food containers	-2%	2%	0%

The next table shows the main changes in the way the items are managed under the baseline.

Table 18: Change in Waste Management Routes under the Baseline (2018 to 2030)

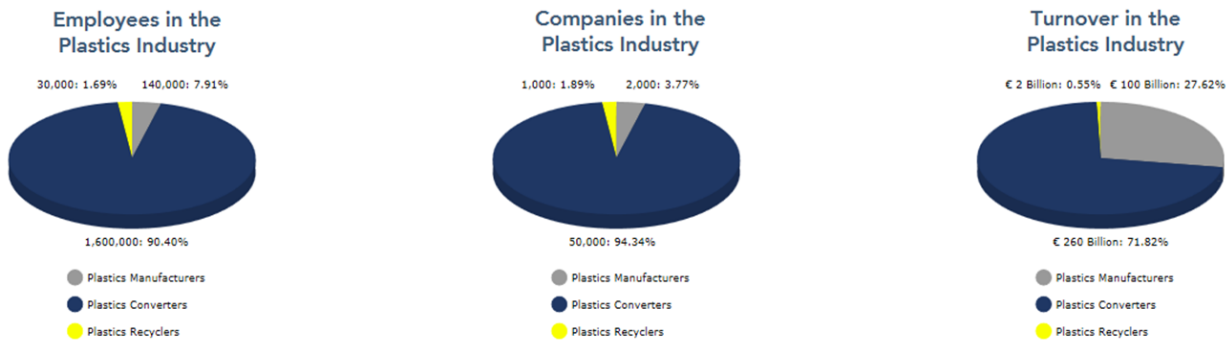
Item	Recycling	Incineration	Landfill	Litter - remains in terrestrial	Litter - remains in marine
Cigarette filters	0.0%	30%	-29%	-0.37%	-0.37%
Drinks bottles	9.0%	-4%	-5%	-0.05%	-0.05%
Cotton buds	-0.4%	21%	-20%	-0.12%	-0.12%
Crisp packets / sweet wrappers	0.0%	35%	-35%	-0.06%	-0.06%
Wet wipes	0.0%	28%	-28%	-0.05%	-0.05%
Sanitary towels	0.0%	23%	-23%	-0.27%	-0.27%
Cutlery	0.0%	20%	-20%	-0.18%	-0.18%
Straws	4.7%	18%	-22%	0.00%	0.00%
Stirrers	4.8%	17%	-22%	-0.02%	-0.02%
Drinks cups and lids	-0.3%	19%	-19%	0.00%	0.00%
Food containers	4.7%	17%	-22%	-0.10%	-0.10%

The changes assume relatively minimal changes in littering behaviour, and reflect the fact that the main change deemed likely to occur as a result of the implementation of the Baseline policies is a shift away from landfill due to the landfill reduction target in 2035. Because many of the items are so difficult to recycle because of their small size, for many items, the principle shift in the Baseline option 1 is away from landfill and into incineration. For some items, such as drinks bottles and food containers, the increase in the packaging recycling targets, as well as the requirement for recyclability, lead to increases in recycling. Some reductions in littering are also seen from various policies.

2.2 EU – global production

Whilst it is not possible to look at the EU – global split in modelling terms, it is possible to provide some complementary discussion of the EU-global market. Overall, production seems to be largely outside of the EU. Half of plastics production is located in Asia and 19% in Europe. In terms of employment and turnover plastic converters are more significant in the EU economy.

Table 19: EU and global production



(source EUPC)

Placing on the EU market of SUP items has increased rapidly over recent years. Whilst detailed production data is not available specifically for SUP (or products identified as most likely to be littered), the preliminary analysis suggests that most of these are produced outside Europe. Europe's positive trade balance in plastics and plastic products tends to be in higher added-value and more durable products. In 2016 about 7.4% of demand for plastic by EU plastics converters was for PET, which tends to be used for drinks bottles; about 19.3% was for PP which is used for food containers, sweet wrappers and caps (but also for automotive parts, pipes, bank notes and other uses). Nearly 40% of EU plastics converters demand was related to packaging of all types.

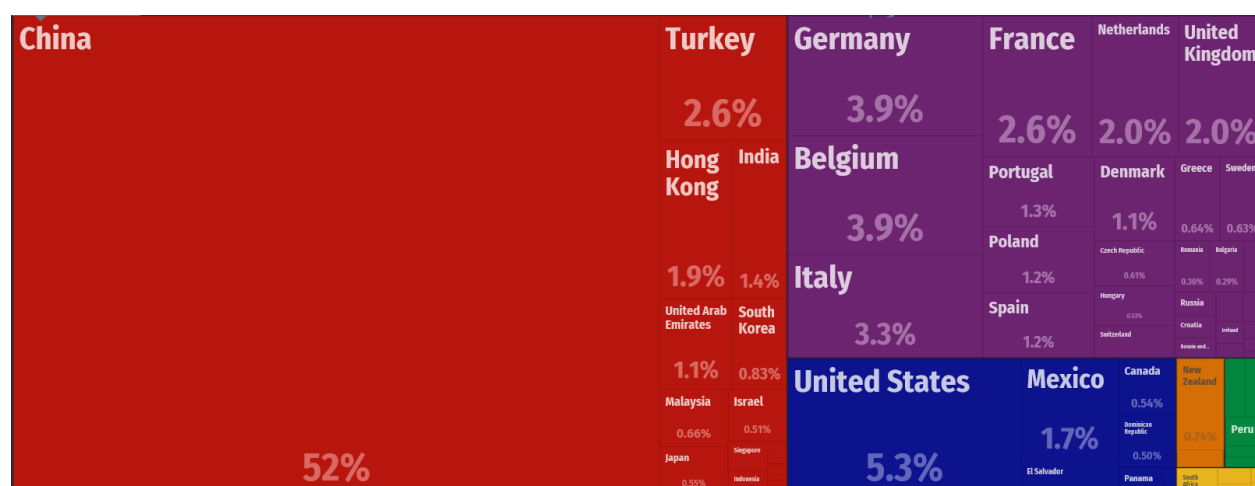
There is no comprehensive and detailed information available on what proportion of the products put on the market by EU and non-EU plastics converters is composed of the items identified as most likely to be littered. The sector is generally expanding rapidly, for example global rigid plastic packaging consumption will rise at an annual rate of 3.7% from 52.9 million tonnes in 2017 to 63.4 million tonnes in 2022⁴⁰, the possibilities to divert from production of low-value disposable SUP products to other markets is therefore clear. Although production of SUP items has increased rapidly over recent years, these products are also by definition low-value and therefore have relatively high volume and low profit

⁴⁰ <https://www.smitherspira.com/industry-market-reports/packaging/the-future-of-rigid-plastic-packaging-to-2022>

margins. Higher value products for construction, insulation, agriculture, automotive, telecommunications and electronics industries tend to be made with other types of plastic (PE, PVC, PUR, PS and others) which account for more than 70% of EU demand from plastics converters (source Plastics Europe).

Data is available on the exports and imports of certain SUPs, for example in respect of plastic table and kitchenware, China accounted for more than 50% of global exports, and EU Member States for just over 25%. Table 22a-d show this data.⁴¹

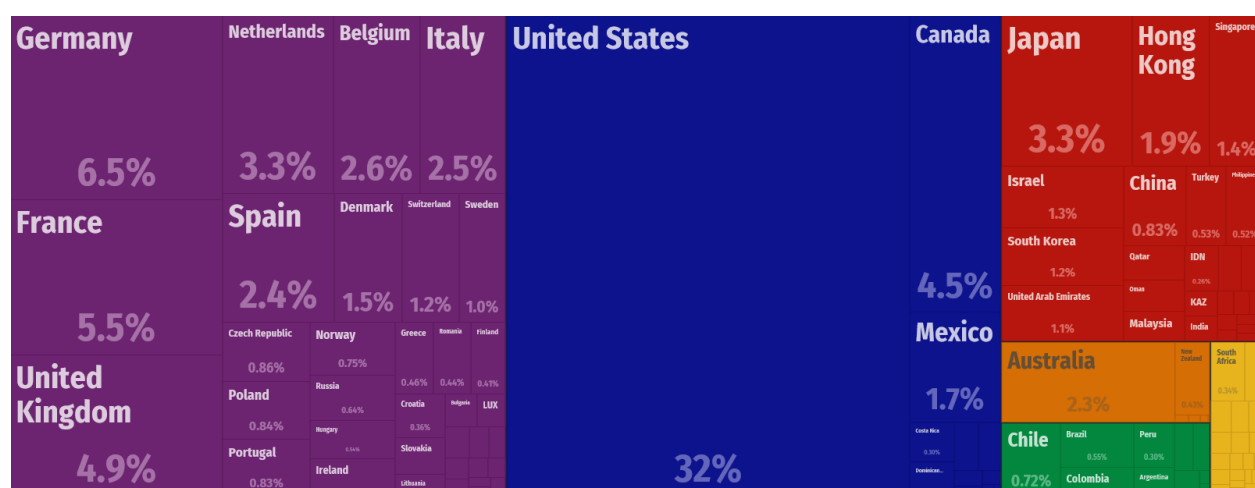
Table 20: Exports | Global – EU country splits



source: <https://atlas.media.mit.edu/en/profile/hs92/392410/>

The EU accounted however for about 40% of global imports.

Table 21: Imports | Global – EU country splits

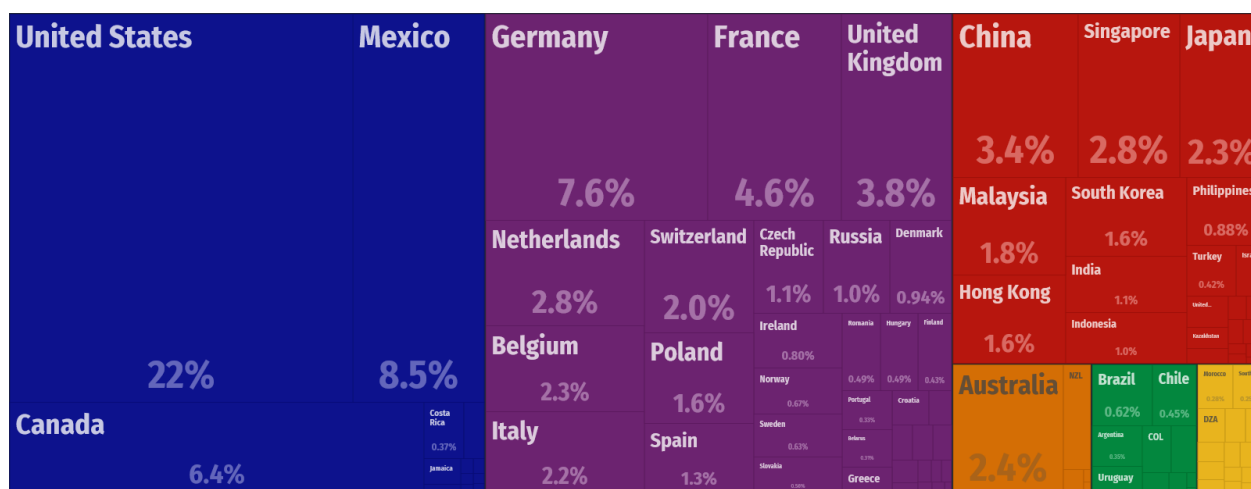


Data on which countries export plastic articles for goods conveyance or packing (2016) reveals that the EU is more present, with about 31% of global export markets.

⁴¹ source: <https://atlas.media.mit.edu/en/profile/hs92/392410/> and https://atlas.media.mit.edu/en/visualize/tree_map/hs92/import/show/all/392390/2016/

[illegible]

Table 23: Exports Conveyance/packaging | Global – EU country splits



Empirical research backs up the notion that the vast majority of SUP supplies originate outside the EU, and principally in Asia. An internet search for suppliers of plastic stirrers by location reveals 127 suppliers located in the EU, compared with 214,112 in China, 4,982 in Honk Kong and 1025 in Vietnam. Industry estimates on balloon sticks suggest that more than 50% come from China, but that between 50 and 75% of balloons on the EU market (total market of about €540m p.a.) are manufactured in the EU.

For each individual product, a ladder was created setting out the effectiveness of different feasible measures and their costs (see Eunomia report).

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progressively more ambitious measures – in terms of the impact they have on SUPs entering the marine environment – as one moves through these options, these being:

- Option 2a lowest impact
- Option 2b medium impact
- Option 2c medium-high impact
- Option 2d highest impact

The choice of measures under each option are indicated below.

Table 24: SUP product-measure matrix with modelled measures in each sub-option (2a to 2d)

Product	Information campaigns	Voluntary action	Label	EPR ~ cost of litter	Product Design	DRS for beverage containers	Reduction targets					Ban (of SUP items)	Best practices for WWTW
							25% by 2030	30% by 2025	50% by 2030	50% by 2025	80% by 2030		
Cigarette filters	a/b/c/d	a/b/c/d	d	b/c/d				d					
Drinks bottles	a/b/c/d	a/b/c/d		b/c/d	b/c/d	d							
Cotton bud sticks	a	a	a									b/c/d	
Crisp packets	a/b/c/d	a/b/c/d		b/c/d									
Wet wipes	a/b/c/d	a/b/c/d	a/b/c/d	b/c/d				c/d					d
Sanitary towels	a/b/c/d	a/b/c/d	a/b/c/d	b/c/d			d						
Cutlery	a/b	a/b		b				b				c/d	
Straws	a/b	a/b		b				b				c/d	
Stirrers	a/b	a/b		b				b				c/d	
Drinks cups & lids	a/b/c/d	a/b/c/d		b/c/d				b/c		d			
Food containers	a/b/c/d	a/b/c/d		b/c/d				b/c		d			
Balloons	a/b/c/d	a/b/c/d	a/b/c/d	b/c/d									
Balloon sticks	a/b/c/d	a/b/c/d	a/b/c/d	b								c/d	

Notes:

- The colour coding is as follows: Feasible (technically) = Green; Not feasible = Grey.
- Labels refer to which sub-option the measures are in. For example, for cigarette filters information campaigns are part of sub-options 2a, 2b, 2c and 2d whilst EPR for the cost of litter is not in option 2a but is in sub-options 2b, 2c and 2d. A reduction target for cigarette filters is part of option 2d, but it would be up to the Member State how this was met (with, for example, nudging policies used)
- Balloons and balloon sticks appear in the table, but were not explicitly modelled in the main assessment.

2.4 Model outputs

Table 25: Option 2 Model Outputs (2030) – Sub option 2a

Item	Measure	Reduction in marine plastics, kt	Reduction in marine plastics, million items	Marine litter reduction - % of SUP by weight*	Marine litter reduction - % of SUP by count*	Change in GHGs, million tonnes	Change in external costs (litter), € million	Change in external costs (LCA), € million	Change in external costs (total), € million	Change in manufacturing related land use, km2	Change in material demand, kt
Cigarette filters	Info. campaign + voluntary action	-0.01	-692.77	-0.1%	-10.1%	0.00	-€ 18	€ 0.001	-€ 18	0.00	0
Drinks bottles	Info. campaign + voluntary action	-1.58	-42.85	-10.6%	-0.6%	-0.92	-€ 3,394	-€ 96	-€ 3,490	-2.97	-34.88
Cotton buds	Info. campaign + voluntary action + labelling	-0.00	-11.90	0.0%	-0.2%	-0.00	-€ 33	€ 0.01	-€ 33	-0.00	-0.01
Crisp packets and sweet wrappers	Info. campaign + voluntary action	-0.06	-10.76	-0.4%	-0.2%	-0.00	-€ 129	-€ 0.004	-€ 129	0.00	0
Wet wipes	Info. campaign + voluntary action + labelling	-0.13	-114.16	-0.8%	-1.7%	-0.00	-€ 655	-€ 1.7	-€ 657	13.25	2.55
Sanitary towels	Info. campaign + voluntary action + labelling	-0.19	-30.36	-1.3%	-0.4%	-0.01	-€ 967	-€ 1.1	-€ 968	-0.03	-3.87
Cutlery	Info. campaign + voluntary action	-0.01	-4.94	-0.1%	-0.1%	-0.06	-€ 31	€ 0.5	-€ 30	-0.13	-19.71
Straws	Info. campaign + voluntary action	-0.04	-101.51	-0.3%	-1.5%	-0.05	-€ 99	-€ 5	-€ 104	0.04	-14.89
Stirrers	Info. campaign + voluntary action	-0.00	-5.43	0.0%	-0.1%	-0.11	-€ 6	-€ 2.8	-€ 9	-0.21	17.97
Drinks cups and lids	Info. campaign + voluntary action	-0.38	-27.33	-2.6%	-0.4%	-0.03	-€ 875	-€ 8	-€ 883	-0.73	-20.07
Food containers	Info. campaign + voluntary action	-0.35	-17.51	-2.4%	-0.3%	-0.10	-€ 908	€ 1.6	-€ 907	3.27	-24.39

*% reductions are calculated relative to the total marine litter of these ‘top ten’ items only.

Item	Measure	Change in consumer costs, € million	Change in retailer turnover, € million	Change in producer turnover (SUP), € million	Change in producer turnover (SUNP), € million	Change in producer turnover (MU), € million	Business compliance costs, € million	Information costs, € million	Commercial washing and refill scheme costs, € million	Change in waste management costs, € million	Change in employment, Thousand FTEs
Cigarette filters	Info. campaign + voluntary action	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 0.001	0.0
Drinks bottles	Info. campaign + voluntary action	-€ 2,800	-€ 2,800	-€ 1,573	€ 167	€ 6	€ -	€ 102	€ -	€ 5	-7.1
Cotton buds	Info. campaign + voluntary action + labelling	€ 0.0	€ 0.0	-€ 1	€ 1	€ 0.024	€ -	€ 16	€ -	-€ 0.47	0.004
Crisp packets and sweet wrappers	Info. campaign + voluntary action	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 0.01	0.0001
Wet wipes	Info. campaign + voluntary action + labelling	-€ 8	-€ 8	-€ 41	€ 37	€ 0.06	€ -	€ 58	€ -	€ 2.50	-0.041
Sanitary towels	Info. campaign + voluntary action + labelling	-€ 185	-€ 192	-€ 100	€ -	€ 4	€ -	€ 28	€ -	-€ 0.27	-1.1
Cutlery	Info. campaign + voluntary action	-€ 49	-€ 49	-€ 414	€ 389	€ 0.35	€ -	€ 14	€ 26	-€ 0.60	0.69
Straws	Info. campaign + voluntary action	-€ 146	-€ 146	-€ 292	€ 215	€ 3.4	€ -	€ 42	€ -	-€ 0.71	0.04
Stirrers	Info. campaign + voluntary action	-€ 512	-€ 512	-€ 346	€ 89	€ 0.46	€ -	€ 46	€ 88	€ 1.09	-1.2
Drinks cups and lids	Info. campaign + voluntary action	-€ 127	-€ 127	-€ 73	€ -	€ 10	€ -	€ 102	€ 15	-€ 0.54	-0.5
Food containers	Info. campaign + voluntary action	€ 144	€ 144	-€ 291	€ 354	€ 9	€ -	€ 102	€ 209	€ 25	5.3

Table 26: Option 2 Model Outputs (2030) – Sub option 2b

Item	Measure	Reduction in marine plastics, kt	Reduction in marine plastics, million items	Marine litter reduction - % of SUP by weight*	Marine litter reduction - % of SUP by count*	Change in GHGs, million tonnes	Change in external costs (litter), € million	Change in external costs (LCA), € million	Change in external costs (total), € million	Change in manufacturing related land use, km2	Change in material demand, kt
Cigarette filters	EPR – full cost of litter	-0.03	-2,627.74	-0.2%	-38.4%	0.00	-€ 25	€ 0.003	-€ 25	0.00	0
Drinks bottles	EPR – full cost of litter + Specific design requirements	-1.07	-29.19	-7.2%	-0.4%	0.08	-€ 2,089	€ 44	-€ 2,046	1.78	63.73
Cotton buds	Ban (of SUP items)	-0.01	-59.66	-0.1%	-0.9%	-0.00	-€ 61	€ 0.88	-€ 60	-0.08	-0.26
Crisp packets and sweet wrappers	EPR – full cost of litter	-0.23	-40.80	-1.5%	-0.6%	-0.00	-€ 177	-€ 0.01	-€ 177	0.00	0.00
Wet wipes	EPR – full cost of litter	-0.13	-114.16	-0.8%	-1.7%	0.00	-€ 532	€ 0.006	-€ 532	0.00	0.00
Sanitary towels	EPR – full cost of litter	-0.23	-37.31	-1.6%	-0.5%	0.00	-€ 840	€ 0.02	-€ 840	0.00	0.00
Cutlery	EPR – full cost of litter + Reduction targets (SUP)	-0.04	-13.91	-0.2%	-0.2%	-0.26	-€ 70	-€ 2.3	-€ 73	-0.44	-65.69
Straws	EPR – full cost of litter + Reduction targets (SUP)	-0.13	-329.71	-0.9%	-4.8%	-0.35	-€ 332	-€ 33	-€ 365	-0.51	-87.22
Stirrers	EPR – full cost of litter + Reduction targets (SUP)	-0.01	-17.63	-0.1%	-0.3%	-0.56	-€ 24	-€ 43	-€ 67	-1.29	-72.49
Drinks cups and lids	EPR – full cost of litter + Reduction targets (SUP)	-1.58	-112.83	-10.6%	-1.7%	-0.60	-€ 3,352	-€ 99	-€ 3,452	-7.31	-200.74
Food containers	EPR – full cost of litter + Reduction targets (SUP)	-0.99	-49.65	-6.7%	-0.7%	-0.33	-€ 1,976	€ 5	-€ 1,971	10.91	-81.31

*% reductions are calculated relative to the total marine litter of these ‘top ten’ items only.

Item	Measure	Change in consumer costs, € million	Change in retailer turnover, € million	Change in producer turnover (SUP), € million	Change in producer turnover (SUNP), € million	Change in producer turnover (MU), € million	Business compliance costs, € million	Information costs, € million	Commercial washing and refill scheme costs, € million	Change in waste management costs, € million	Change in employment, Thousand FTEs
Cigarette filters	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 4	0.0
Drinks bottles	EPR – full cost of litter + Specific design requirements	€ 1,258	€ 1,258	€ 629	€ -	€ -	€ -	€ 102	€ -	€ 535	2.3
Cotton buds	Ban (of SUP items)	€ 0	€ 0	-€ 29	€ 29	€ 0.5	€ -	€ -	€ -	€ 0.4	0.1
Crisp packets and sweet wrappers	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 30	0.0
Wet wipes	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 58	€ -	-€ 36.7	0.0
Sanitary towels	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 28	€ -	-€ 67.7	0.0
Cutlery	EPR – full cost of litter + Reduction targets (SUP)	-€ 197	-€ 197	-€ 1,360	€ 1,260	€ 1.2	€ -	€ 14	€ 87	-€ 4.1	2.4
Straws	EPR – full cost of litter + Reduction targets (SUP)	-€ 2,188	-€ 2,188	-€ 1,458	€ 359	€ 6	€ -	€ 42	€ -	-€ 13	-5.7
Stirrers	EPR – full cost of litter + Reduction targets (SUP)	-€ 3,159	-€ 3,159	-€ 1,730	€ 149	€ 0.8	€ -	€ 46	€ 147	-€ 6	-9.1
Drinks cups and lids	EPR – full cost of litter + Reduction targets (SUP)	-€ 1,265	-€ 1,265	-€ 728	€ -	€ 95	€ -	€ 102	€ 150	-€ 24	-4.0
Food containers	EPR – full cost of litter + Reduction targets (SUP)	€ 480	€ 480	-€ 970	€ 1,179	€ 30	€ -	€ 102	€ 697	€ 26	17.8

Table 27: Option 2 Model Outputs (2030) – Sub option 2c

Item	Measure	Reduction in marine plastics, kt	Reduction in marine plastics, million items	Marine litter reduction - % of SUP by weight*	Marine litter reduction - % of SUP by count*	Change in GHGs, million tonnes	Change in external costs (litter), € million	Change in external costs (LCA), € million	Change in external costs (total), € million	Change in manufacturing related land use, km2	Change in material demand, kt
Cigarette filters	EPR – full cost of litter	-0.03	-2,627.74	-0.2%	-38.4%	0.00	-€ 25	€ 0.003	-€ 25	0.00	0
Drinks bottles	EPR – full cost of litter + Specific design requirements	-1.07	-29.19	-7.2%	-0.4%	0.08	-€ 2,089	€ 44	-€ 2,046	1.78	63.73
Cotton buds	Ban (of SUP items)	-0.01	-59.66	-0.1%	-0.9%	-0.00	-€ 61	€ 0.9	-€ 60	-0.08	-0.26
Crisp packets and sweet wrappers	EPR – full cost of litter	-0.23	-40.80	-1.5%	-0.6%	-0.00	-€ 177	-€ 0.01	-€ 177	0.00	0
Wet wipes	Reduction targets (SUP)	-0.50	-450.72	-3.3%	-6.6%	-0.03	-€ 1,873	-€ 17	-€ 1,890	132.51	25.51
Sanitary towels	EPR – full cost of litter	-0.23	-37.31	-1.6%	-0.5%	0.00	-€ 840	€ 0.02	-€ 840	0.00	0
Cutlery	Ban (of SUP items)	-0.05	-17.94	-0.3%	-0.3%	-0.56	-€ 117	-€ 7	-€ 125	-0.88	-131.39
Straws	Ban (of SUP items)	-0.15	-371.50	-1.0%	-5.4%	-0.47	-€ 417	-€ 43	-€ 460	-0.44	-112.04
Stirrers	Ban (of SUP items)	-0.01	-19.87	-0.1%	-0.3%	-0.72	-€ 28	-€ 46	-€ 73	-1.64	-42.54
Drinks cups and lids	EPR – full cost of litter + Reduction targets (SUP) - high	-1.58	-112.83	-10.6%	-1.7%	-0.60	-€ 3,352	-€ 99	-€ 3,452	-7.31	-200.74
Food containers	EPR – full cost of litter + Reduction targets (SUP) - high	-0.99	-49.65	-6.7%	-0.7%	-0.33	-€ 1,976	€ 5	-€ 1,971	10.91	-81.31

*% reductions are calculated relative to the total marine litter of these ‘top ten’ items only.

Item	Measure	Change in consumer costs, € million	Change in retailer turnover, € million	Change in producer turnover (SUP), € million	Change in producer turnover (SUNP), € million	Change in producer turnover (MU), € million	Business compliance costs, € million	Information costs, € million	Commercial washing and refill scheme costs, € million	Change in waste management costs, € million	Change in employment, Thousand FTEs
Cigarette filters	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 4	0.0
Drinks bottles	EPR – full cost of litter + Specific design requirements	€ 1,258	€ 1,258	€ 629	€ -	€ -	€ -	€ 102	€ -	€ 535	2.3
Cotton buds	Ban (of SUP items)	€ 0	€ 0	-€ 29	€ 29	€ 0.5	€ -	€ -	€ -	€ 0.4	0.1
Crisp packets and sweet wrappers	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 30	0.0
Wet wipes	Reduction targets (SUP)	-€ 79	-€ 79	-€ 408	€ 368	€ 0.6	€ 36	€ 58	€ -	€ 25	-0.4
Sanitary towels	EPR – full cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 28	€ -	-€ 67.7	0.0
Cutlery	Ban (of SUP items)	-€ 409	-€ 409	-€ 2,712	€ 2,505	€ 2.3	€ -	€ -	€ 174	-€ 8	4.9
Straws	Ban (of SUP items)	-€ 2,431	-€ 2,431	-€ 1,944	€ 718	€ 11	€ -	€ -	€ -	-€ 8	-5.5
Stirrers	Ban (of SUP items)	-€ 4,012	-€ 4,012	-€ 2,306	€ 298	€ 1.5	€ -	€ -	€ 294	-€ 2.1	-11.2
Drinks cups and lids	EPR – full cost of litter + Reduction targets (SUP)	-€ 1,265	-€ 1,265	-€ 728	€ -	€ 95	€ 16	€ 102	€ 150	-€ 24	-4.0
Food containers	EPR – full cost of litter + Reduction targets (SUP)	€ 480	€ 480	-€ 970	€ 1,179	€ 30	€ 18	€ 102	€ 697	€ 26	17.8

Table 28: Option 2 Model Outputs (2030) – Sub option 2d

Item	Measure	Reduction in marine plastics, kt	Reduction in marine plastics, million items	Marine litter reduction - % of SUP by weight*	Marine litter reduction - % of SUP by count*	Change in GHGs, million tonnes	Change in external costs (litter), € million	Change in external costs (LCA), € million	Change in external costs (total), € million	Change in manufacturing related land use, km2	Change in material demand, kt
Cigarette filters	Reduction targets (SUP) + labelling	-0.04	-3,702.73	-0.3%	-54.2%	-0.03	-€ 80	-€ 3.4	-€ 83	24.38	0
Drinks bottles	DRS for beverage containers	-7.55	-205.40	-50.8%	-3.0%	-0.59	-€ 19,578	-€ 33	-€ 19,611	0.00	0
Cotton buds	Ban (of SUP items)	-0.01	-59.66	-0.1%	-0.9%	-0.004	-€ 61	€ 0.9	-€ 60	-0.08	-0.26
Crisp packets and sweet wrappers	EPR – full cost of litter	-0.23	-40.80	-1.5%	-0.6%	-0.0004	-€ 177	-€ 0.014	-€ 177	0.00	0.00
Wet wipes	Standards for WWTW	-0.43	-393.64	-2.9%	-5.8%	0.0004	-€ 122	€ 0	-€ 122	0.00	0.00
Sanitary towels	Reduction targets (SUP)	-0.57	-92.31	-3.8%	-1.4%	-0.10	-€ 2,679	-€ 14	-€ 2,693	-0.41	-48.42
Cutlery	Ban (of SUP items)	-0.05	-17.94	-0.3%	-0.3%	-0.56	-€ 117	-€ 7	-€ 125	-0.88	-131.39
Straws	Ban (of SUP items)	-0.15	-371.50	-1.0%	-5.4%	-0.47	-€ 417	-€ 43	-€ 460	-0.44	-112.04
Stirrers	Ban (of SUP items)	-0.012	-19.867	-0.08%	-0.29%	-0.72	-€ 28	-€ 46	-€ 73	-1.64	-42.54
Drinks cups and lids	Reduction targets (SUP) - high	-1.85	-132.48	-12.5%	-1.9%	-0.97	-€ 4,862	-€ 160	-€ 5,022	-11.69	-321.19
Food containers	Reduction targets (SUP) - high	-1.17	-58.30	-7.8%	-0.9%	-0.52	-€ 2,747	€ 8	-€ 2,739	17.45	-130.09

*% reductions are calculated relative to the total marine litter of these ‘top ten’ items only.

Item	Measure	Change in consumer costs, € million	Change in retailer turnover, € million	Change in producer turnover (SUP), € million	Change in producer turnover (SUNP), € million	Change in producer turnover (MU), € million	Business compliance costs, € million	Information costs, € million	Commercial washing and refill scheme costs, € million	Change in waste management costs, € million	Change in employment, Thousand FTEs
Cigarette filters	Reduction targets (SUP) + labelling	€ 381	€ 381	-€ 718	€ 908	€ -	€ 216	€ 102	€ -	€ 0.9	3.4
Drinks bottles	DRS for beverage containers	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 1,418	4.2
Cotton buds	Ban (of SUP items)	€ 0.4	€ 0.4	-€ 29	€ 29	€ 0.5	€ -	€ -	€ -	€ 0.4	0.1
Crisp packets and sweet wrappers	EPR – cost of litter	€ -	€ -	€ -	€ -	€ -	€ -	€ 102	€ -	€ 30	0.0
Wet wipes	Standards for WWTW	€ -	€ -	€ -	€ -	€ -	€ -	€ 58	€ -	€ 7,733	0.0
Sanitary towels	Reduction targets (SUP)	-€ 2,316	-€ 2,396	-€ 1,254	€ -	€ 55	€ 26	€ 28	€ -	-€ 3.7	-13.2
Cutlery	Ban (of SUP items)	-€ 409	-€ 409	-€ 2,712	€ 2,505	€ 2.3	€ -	€ -	€ 174	-€ 8	4.9
Straws	Ban (of SUP items)	-€ 2,431	-€ 2,431	-€ 1,944	€ 718	€ 11	€ -	€ -	€ -	-€ 8	-5.5
Stirrers	Ban (of SUP items)	-€ 4,012	-€ 4,012	-€ 2,306	€ 298	€ 1.5	€ -	€ -	€ 294	-€ 2.1	-11.2
Drinks cups and lids	Reduction targets (SUP) - high	-€ 2,025	-€ 2,025	-€ 1,165	€ -	€ 152	€ 16	€ 102	€ 239	-€ 23	-6.3
Food containers	Reduction targets (SUP) - high	€ 769	€ 769	-€ 1,551	€ 1,887	€ 49	€ 18	€ 102	€ 1,115	€ 38	28.5

ANNEX 7. ABANDONED, LOST AND OTHERWISE DISCARDED FISHING GEAR: ASSUMPTIONS AND ANALYSIS

The numbers presented here are those used in our analysis. They are not rounded but it should be understood that they are estimates.

1 ANNUAL PURCHASES OF GEAR⁴²

	13941233 - Made-up fishing nets from twine, cordage or rope of man-made fibres (excluding fish landing nets) for EU28		13941235 - Made-up fishing nets from yarn of man-made fibres (excluding fish landing nets) for EU28	
	mass (kg)	value	mass (kg)	value
Exports	4,321,300	€31,180,750	3,785,200	€24,991,800
Imports	6,985,000	€15,639,950	2,680,900	€17,180,900
Production	19,800,000	€113,440,000	5,554,392	€38,255,070
Consumption	22,463,700	€97,899,200	4,450,092	€30,444,170

This gives a total of 26,913,792 kg, worth €128,343,370.

Surveys of litter suggest that netting makes up 14% (Marcus Eriksen, 2014) and 39% (Legambiete) of litter from fishing and aquaculture whereas measurements of the great garbage patch (L. Lebreton, 2018) indicate that 46% of all waste is fishing nets.

For the purposes of this analysis, we assume that fishing nets make up half the mass of all plastic from fisheries and aquaculture and that the cost per tonne of other gear (buoys, traps, pots etc) is the same as for nets.

Thus we estimate that the EU fishing fleet consumes annually 53,827,584kg of fishing gear (nets and other gear) for a total cost of €256,686,740.

2 ANNUAL LOSSES OF GEAR

Iceland has put in place a systematic approach for collecting lost and end-of-life gear paid through their recycling fund. Even with this well-honed approach, losses are 10% and presumably lost at sea. No EU country has such an approach.

There have been a number of estimates of what is lost by EU vessels (Vincent Viool, 2018) On this basis we assume that the average for the EU28 is 20%. This results in an annual loss of gear of 10,766 tonnes.

⁴² Eurostat PRODCOM database

3 EFFECTIVENESS OF FISHING FOR LITTER

Fishing for litter can be divided in two types

- Active, where vessels make special trips to pick up litter
- Passive, where vessels bring litter ashore that they pick up in nets

3.1 Active

For active fishing for litter, a recent study (ICF Consulting Services Limited , 2018) indicated a cost of €818-1,275 per tonne of net retrieved. This may be on the low side because the lower figure is from an annual Norwegian effort which has accumulated experience during annual trips to well-defined areas.

Nevertheless, for our analysis we take €1000 per tonne.

3.2 Passive

Passive fishing for litter involves vessels bringing to shore litter that they find in their nets. This is largely from the sea bottom. Pelagic vessels (ie. those fishing in the water column) pick up very little. OSPAR have analysed the performance of a number of fleets.

	UK	Netherland	Sweden	Germany	EU average (estimate)
Vessels	474	91	33	60	
Tonnes per vessel annum	0.3	3.13	14.88	0.02	0.69
Cost per vessel per annum	€49	€495			€121

Assuming that half the litter is plastic from fishing, we arrive at a cost of €350 per tonne.

4 EFFECTIVENESS OF MEASURES

4.1 European Maritime and Fisheries Fund

Member State authorities have allocated €7,750,000 per year for measures to remove marine litter. While the operational programmes do not contain a precise enough breakdown, using the breakdown of the predecessor 2008-2014 European fisheries Fund and the removal costs for active and passive fishing we can estimate the impact:

	proportion	annual cost to public budget	annual plastic removal (tonnes)
Collection of lost fishing gear / 'fishing for litter'	46%	€ 3,500,000	3,500
Litter collectors/bags on board and in port (renting and transport, purchase)	25%	€ 2,000,000	5,670
Treatment/processing of litter	17%	€ 1,300,000	
Awareness raising among fishers	5%	€ 400,000	
Research related to marine litter	5%	€ 400,000	
Recovering/recycling of plastics	2%	€ 150,000	
total	100%	€ 7,750,000	

This measure is dealing with gear lost over previous years. It will reduce the amount of gear in the sea but not prevent further losses.

4.2 Port Reception Facilities Directive

Number of vessels (EU active large scale fleet)	16,146	vessels
Tonnes per year brought ashore (all material) assuming half the vessels in the fleet participate and 0.69 tonnes/vessel	5,531	tonnes
Tonnes per year saved (fishing gear assumed to be half the plastic)	2,766	tonnes

The revision of the Port Reception Facility will remove financial penalties for vessels that bring their litter back to shore. Assuming that half the large scale vessels of the EU fleet participate, then the revision will result in 2,766 *more* tonnes of fishing gear will be brought back to shore.

4.3 Extended Producer Responsibility

Under Extended Producer Responsibility, plastic litter delivered to ports would be properly separated, processed and transported to appropriate facilities where it would be burnt, recycled or placed in landfill. Taking as a basis a national system that uses a similar approach, Iceland has put in place a system for collecting lost and end-of-life gear paid through their recycling fund. With this approach, losses/discards at sea can be reduced to 10% of gear. No EU country has such an approach. This is indicative of the potential reduction achievable.

This would bring all EU countries almost up to the standard of Iceland which manages to deal with 90% of fishing gear in this way.

Part of the contribution to reduction of losses/discards will come from the revision of the Port Reception Facilities Directive. The additional benefit will be 2,617 tonnes of plastic fishing gear not dumped in the sea.

	tonnes of plastic gear
Residual losses 10%	5,383
Rotal gain compared to baseline	5,383
Gain due to EPR (subtract contribution from Port Reception Facilities Directive	2,617

4.4 Extended Producer Responsibility with return of deposit

This would have a similar benefit to the buy back scheme whereby the Korean Government (Ministry of Maritime Affairs and Fisheries - MOMAF), purchases waste fishing gear returned to port by fishers. This is reported to be "*highly effective in terms of recovery and disposal of gear*" (Graham Macfadyen, 2009) and goes beyond the Icelandic system.

This would reduce the loss of gear to the truly unavoidable 5%.

	tonnes of plastic gear
Further reduction due to deposit	2,691
Inflow after measures	2,691
Mass of fishing gear reaching proper waste management following implementation of Port Reception Facilities Directive and Extended Producer Responsibility with a deposit	95%

The contribution from this measure would be 2,691 tonnes of plastic fishing gear.

5 COSTS

5.1 Overall costs

The costs can be divided between operations (collecting material at ports, sorting it, transporting it and processing it) and administration (monitoring, financing, reporting).

The operational costs were based on costs of the Icelandic Recycling Fund. The administrative costs are based on estimates in a study performed in the framework of this impact assessment (Vincent Viool, 2018)

Operational costs	
Cost per tonne of transport, processing, recycling/incineration/landfill	€200
Tonnes to be treated for EPR production (assumes 10% is lost at sea)	48,445
Operational cost for EPR	€ 9,688,965
Tonnes to be treated for EPR+deposit (assumes 5% lost at sea)	51,136
Extra cost for EPR+deposit	€ 538,276
Administration costs	
EPR operational	€ 1,300,000
EPR set-up	€ 6,360,000
EPR with deposit set-up	€ 19,000,000
EPR with deposit operational	€ 3,900,000

5.2 Impact on fishermen

Cost	
As percentage of gear costs	5.3%
As proportion of revenue	0.20%

5.3 Environmental benefits

Estimates of damage to fishing range from 1% (Mike Van Acoleyen, 2013) to 5% (Bergmann, 2015) of revenue. The cost to tourism is estimated as being between 50,000 kilometres of EU coastline amounted between approximately €194 and 630 million (Mike Van Acoleyen, 2013). And costs to ports are estimated at €30 million each year in this impact assessment.

If we suppose that the amount of litter in the sea amounts to 10 years worth of 15.000 tonnes from land and 10,650 from the sea, then the benefit of removing 1,000 tonnes of litter can be estimated as:

	Lower limit		Upper limit	
	impact	benefit of removing 1000 tonnes	impact	benefit of removing 1000 tonnes
Fishing	€60,000,000	€232,869	€300,000,000	€1,164,347
Ports	€30,000,000	€116,435	€30,000,000	€116,435
Beaches	€194,000,000	€752,944	€630,000,000	€2,445,129
Total	€284,000,000	€1,102,248	€960,000,000	€3,725,910

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ANNEX 8: WHO IS AFFECTED AND HOW?

1 PRACTICAL IMPLICATIONS OF THE INITIATIVE

The preferred option would reduce SUP marine litter by half and reduce litter from fishing and aquaculture entering the sea by a quarter over and above measures already planned. It includes:

- ban of single use plastic versions of cotton bud sticks, plastic balloon sticks cutlery, straws and stirrers;
- reduction targets for single use plastic versions of drinks cups and lids, wet wipes, and food containers: 30% by 2025 and 50% by 2030;
- EPR to contribute to the cost of prevention and cleaning up litter from cigarette filters, drinks bottles, crisp packets and sweet wrappers, wet wipes, sanitary towels, drinks cups and lids, food containers, balloons.
- product design measures for drink bottles related to tethered caps;
- EPR on fishing gear containing plastic to cover cost of monitoring and collection of damaged or end-of-life gear at ports, transport to appropriate destination and final treatment or disposal.

In practical terms, the bans and reduction targets would induce a switch in consumption from single-use plastics either to multi-use alternatives or to single-use non-plastic alternatives. The alternatives for the different SUP items are described in detail in Annex 6. For the other items, information and awareness raising actions aim to reduce littering, and EPR to pay the cost of prevention and cleaning-up when litter still occurs. The specific case of tethered caps is meant to reduce significantly the littering of single caps and lids. For fishing gear, the actions would lead, together with other planned measures, to a reduction of losses of fishing gear at sea to the truly unavoidable.

These shifts in consumption patterns have their reflection in changes in retail patterns and further upstream in production. If a consumer can no longer buy a plastic cotton bud stick, then production (and retail) could shift, for example, to paper cotton bud sticks. In other cases, the shift will be more complex with for example a shift to reusable cups.

2 SUMMARY OF COSTS AND BENEFITS

<i>I. Overview of Benefits (total for all provisions) – Preferred Option</i>		
<i>Description</i>	<i>Amount</i>	<i>Comments</i>
<i>Direct benefits</i>		
Reduction in marine litter (tonnes) from SUP	4,850 tonnes per annum	
Reduction in marine litter (tonnes) from ALDFG	2,617 tonnes per annum	Over and above reductions due to planned initiatives for Port Reception Facilities, Fisheries Control Regulation and European Maritime and Fisheries Fund
Reduction in marine litter (by count) from SUP	Around 50% of total SUP (56% of Top 10 SUP)	
Reduction in GHG	2.63 million tonnes	
Benefit of cleaner seas to fisheries, ports and tourism	€10 million- 30 million per annum	For removal of 10,000 tonnes per annum Estimates vary within this range
Reduction in external costs	11.1 billion Euros	Not financial benefits, but estimated monetary equivalent associated with a range of environmental impacts but in particular disamenity associated with litter on land and in water
Savings for consumers	6.5 billion Euros	Net saving as reduced expenditure on single-use items and switch to multi-use. Estimate includes washing costs for consumers. Does not include any additional inconvenience.

(1) Estimates are relative to the baseline for the preferred option as a whole and provided for SUP and fishing gear separately;

II. Overview of costs – Preferred option						
	Citizens/Consumers		Businesses		Administrations	
	One-off	Recurrent	One-off	Recurrent	One-off	Recurrent
Cigarettes				€102 m pa - Information costs		€4m pa – waste management
Bottles				€102 m pa - Information cost		€535m pa – waste management
Cotton buds						€0.4m pa – waste management
Crisp packets and sweet wrappers				€102 m pa - Information costs		€30m pa – waste management
Wet wipes				€58 m pa - Information costs €36m pa – compliance costs		€25m pa – waste management
Sanitary towels						€25m pa – waste management
Cutlery				€174m pa – commercial washing and refill schemes		€8m pa reduction – waste management
Straws						€8m pa reduction – waste management
Stirrers				€294m pa – commercial washing and refill schemes		€2.1m pa reduction – waste management
Drinks cups and lids				€150m pa – commercial washing and refill schemes €102 m pa - Information costs €16m pa – compliance costs		€24m pa reduction – waste management
Food containers				€697m pa – commercial washing and refill schemes €102 m pa - Information costs €18m pa – compliance costs		€26m pa– waste management
Fishing Gear			€6.3m set-up costs	€9.7m collection, transport. processing €1.3m administration		

(1) Estimates are compared to the baseline