# Scoping study to assess the feasibility of further EU measures on waste prevention

Final Report

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Report for **DG ENV**

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# Abstract

Waste prevention and reduction contribute to protecting the environment and human health. Recent European policies have set framework conditions for implementing national waste prevention programmes and measures. Yet, waste generation is still increasing throughout Europe, both for total waste and key waste streams.

Reducing waste requires a radical shift in production, consumer behaviour and reuse performance. This scoping study sets out to propose new waste policy measures to reduce waste generation in Europe. It considers trends in waste generation, explores enablers and barriers for waste prevention, and identifies best practice examples with upscaling opportunities based on desktop research and stakeholder consultation. This study covers all waste streams except food and packing waste.

The analysis of the waste streams results in a prioritisation of the following: tyre waste, end-of-life vehicles, waste electrical and electronic equipment, construction and demolition waste, textile waste and municipal waste.

The proposed measures for waste prevention include setting targets for waste reduction and preparation for reuse, introducing extended producer responsibility for additional waste streams, product traceability requirements and bans on the destruction of certain products. The initial assessment shows the expected effects of the proposed measures, quantitatively with regard to waste reduction and qualitatively with regard to environment and employment.

# Résumé

La prévention et la réduction des déchets contribuent à protéger l'environnement et la santé. Les politiques européennes récentes ont établi un cadre pour les programmes et mesures nationales de prévention des déchets. Néanmoins, la production totale et des principaux flux de déchets continuent d'augmenter en Europe.

Réduire les déchets exige un changement radical dans la production, le comportement des consommateurs et la réutilisation. Cette étude propose de nouvelles mesures pour réduire les déchets en Europe. Elle examine les tendances en matière de production de déchets, facteurs favorables et obstacles à la prévention des déchets. Elle identifie de bonnes pratiques transposables à plus grande échelle à partir de recherches documentaires et consultations des parties prenantes. Cette étude couvre tous les flux de déchets hormis les déchets alimentaires et d’emballage.

L’analyse des flux de déchets conduit à la priorisation suivante: déchets de pneus, véhicules hors d'usage, déchets d'équipements électriques et électroniques, déchets de construction, déchets textiles et déchets municipaux.

La prévention comprend la fixation d’objectifs de réduction des déchets et de préparation à la réutilisation, une responsabilité élargie des producteurs pour des flux de déchets supplémentaires, la traçabilité et des interdictions de destruction de certains produits. L'évaluation initiale projette les effets des mesures proposées quantitativement pour la réduction des déchets et qualitativement pour l'environnement et l'emploi.

# Executive Summary

## Background

Waste generation in EU-27 increased from 2,210 million tonnes in 2010 to 2,340 million tonnes in 2018 (+6 %). Without policy interventions, it is expected that the EU-27 Member States (MS) will be confronted with **further waste increases of up to 3,190 million tonnes in 2035** (+36 % compared to 2018). The European Commission has already set framework conditions for establishing national waste prevention programmes and measures. While all EU-27 MS implemented waste prevention programmes, more ambitious measures are needed to effectively reduce waste.

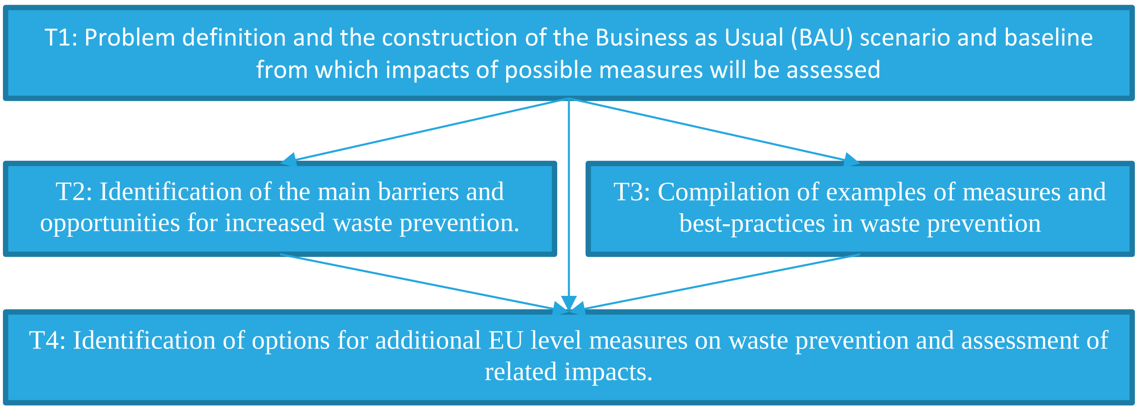
## Objective, scope and methodology

The aim of the study is to provide an assessment in support of waste policy and to achieve waste prevention. The assessment provides the basis for the European Commission's work in considering future additional measures at EU level, including setting targets for waste reduction, in order to significantly reduce waste generation.

The **EU-27 Member States** form the spatial scope of this study. The temporal coverage includes past trends on waste generation from 2004 to 2018, and future trends up to 2035. The study covers all waste streams in line with the Waste Statistics Regulation, except packaging and food waste. The latter are included in the presentation of waste data series on waste generation but were not specifically addressed in the analysis of the report.

The aforementioned aim was converted into four tasks as displayed in Figure 1.

### Figure 1 Tasks performed to identify waste prevention measures




The aim of Task 1 was to **define the problem and construct a baseline**, by establishing trends in waste generation (past trends: 2004-2018 based on Eurostat data) and the expected increase (up to 2035 based on linear trend modelling and refined by taking account of drivers for waste generation) for 30 waste streams which cover the entire waste generation in EU Member States. A multi-criteria approach was applied in order to identify those waste streams which are most problematic with regard to waste generation taking into account the following: magnitude in terms of mass, increase in waste generation, lack of decoupling between waste generation and economic development, relevance in terms of EU-27 Member States affected and their relevance for critical raw material recovery.

By applying the multi-criteria approach, six waste streams (tyres, vehicles, construction and demolition waste, textiles, WEEE and municipal solid waste) were identified which would benefit most from waste prevention measures at the EU level.

The aim of Task 2 was to **identify factors which support or hamper waste prevention**. With respect to the identified priority waste streams, the current and envisaged legislation was reviewed. Key barriers and opportunities for waste prevention were identified through literature screening and stakeholder consultation. The consultation included an online survey with 88 participants and two stakeholder workshops. The compiled list of barriers and opportunities was considered for establishing a long-list of potential waste prevention measures in Task 4.

The aim of Task 3 was to **identify good and best practice examples in waste prevention** across Europe. By means of a review of the relevant literature and stakeholder consultation, about 300 individual examples were identified which were then clustered on the basis of similarities. As a consequence, 68 distinctive examples for waste prevention were obtained which were assessed with regard to effectiveness, costs, sustainability over time, transferability to other sectors and waste types, and transferability to other EU Member States. As a result, 15 distinctive good and best practice examples were identified. Each example was described in detail, including the location of implementation, addressed waste streams, a comprehensive description of the measure and its effectiveness, an assessment of the transferability to other sectors and/or Member States and the success factors.

The aim of Task 4 was to **identify viable policy measures**. In a first step, a long list of 98 potential measures was drawn up, containing the measures to overcome barriers for waste prevention (Task 2), the measures identified in the good and best practice examples for waste prevention (Task 3) and measures put forward by stakeholders in the consultation process. These measures were assessed as to whether they could be implemented in the waste policy area and, secondly, whether implementing these measures would violate one of the viability criteria provided in the Better Regulation Tool #17 (legal feasibility, technical feasibility, previous policy choices, coherence with other EU policy objectives, effectiveness and efficiency, proportionality, relevance). The assessment resulted in 26 viable measures, which were described in detail. Finally, an initial assessment was carried out for the viable measures, taking into account the Better Regulation Tool #19. The quantitative waste reduction potential of each viable measure was estimated where possible, along with quantitative and/or qualitative descriptions of relevant environmental and social impacts.

# Results

## The baseline

The total waste generation in EU-27 increased from 2,249 million tonnes in 2004 to 2,338 million tonnes in 2018, which is a 4% increase in total waste generation. Over the same period, the population increased by 3.2 % and gross domestic product increased by 17.3 %. Waste generation increased at a faster rate than EU-27 population growth for 15 out of 30 waste streams. For 12 out of 30 waste streams, waste generation increased at a faster rate than GDP growth. By applying the multiple-criteria analysis developed in Task 1, the following six waste streams were identified as problematic in terms of waste generation, making them priority candidates for additional waste prevention measures at EU level: **End-of-Life tyres** (ELT); **End-of-Life vehicles** (ELV); **Construction and demolition waste** (CDW) – including mineral CDW, soils and non-packaging metallic, plastics and glass waste from C&D activities; **Textile waste** (TXT); **Waste from electrical and electronic equipment** (WEEE); **Municipal waste** (MSW) - including residual municipal solid waste, non-packaging metallic plastics and glass waste from households (excluding packaging and food waste due to the scope of this study).

These six waste streams represented 1,004 million tonnes in 2018, which was about 43 % of total waste generation in the EU-27 (see Table 1). The projected trends in waste generation vary among the waste streams and range from an increase of +5 % to +74 % by 2035.

### Table 1 Past and projected trends of identified priority waste streams

| Priority waste stream | Past trend | | Future trend | |
|---|---|---|---|---|
| | 2010 | 2018 | 2035 | 2035 rel. 2018[3] |
| | Tonnes | Tonnes | Tonnes | % |
| **End-of-Life tyres** | 2,340,000 | 2,970,000 | 3,540,240 | +19.2%[1] |
| **End-of-Life vehicles** | 8,490,000 | 8,990,000 | 11,345,380 | +26.2%[1] |
| **Construction & demolition waste** | | | | |
| **mineral waste** | 277,230,000 | 303,170,000 | 374,718,120 | +23.9%[1] |
| **soils** | 383,280,000 | 468,600,000 | 814,426,800 | +73.8% |
| **Municipal solid waste[4]** | 221,995,000 | 219,856,000 | 231,508,368 | +5.3%[2] |
| ***of which textile waste*** | *1,960,000* | *2,170,000* | 3,215,940 | *+48.2%[1]* |
| ***of which WEEE*** | *4,160,000* | *5,320,000* | 7,916,160 | *+48.8%* |
| **Total** | **893,335,000** | **1,003,586,000** | **1,435,538,908** | **+12.3%** |

Notes: Past trend data are based on Eurostat data. Future trend data are based on linear trend modelling; “1” refined projections, taking account of drivers for waste generation; “2” relative increase calculated for municipal solid waste excluding separate collected textiles and WEEE. “3” Rate of change, without additional measures, “4” noting that food and packaging waste are excluded by the scope of this study and no measures on those sub streams were assessed.

The study also sought to quantify the effects of current waste prevention measures on waste reduction. Despite national waste prevention programmes and monitoring frameworks in EU-27 MS, evidence on the effectiveness of waste prevention measures was very limited and an estimation on the effects of current waste prevention measures on EU level was handicapped by data availability.

Furthermore, the achievement of quantitative reduction targets set at EU-Member State level was assessed, namely targets for municipal solid waste (Bulgaria, Italy, Latvia and Slovakia) and for hazardous waste (Bulgaria and Latvia). In addition, the waste prevention effectiveness of the identified good and best practice examples for waste prevention were analysed, insofar as data were available. The analysis provided results on the effectiveness of single measures implemented in EU Member States, ranging from specific achievements in waste reduction to evidence for changes in consumer behaviour.

## Key factors for successful implementation of measures

This study identified the current socio-economic and legal barriers to waste prevention, as well as good and best practice examples in EU Members States to reduce waste generation. Based on that, the following key factors were identified for successful implementation of waste prevention measures: **Legally binding requirements** instead of voluntary agreements, and consistent enforcement; **sustainable financing** of waste prevention measures by establishing markets, new business models, tax incentives, providing funds (public funds, funds established under extended producer responsibility); **regular monitoring and evaluation** of waste prevention measures including data collection and reporting routines; **public institutions as frontrunners** in sustainable procurement, taking account of waste prevention criteria; **broad regional coverage** of waste prevention measures; **consolidation and formalisation of community engagements** through the establishment of networks and umbrella organisations; **packages of waste prevention measures** instead of individual measures.

## Additional waste prevention measures at EU level

As a result of the assessment of the long list of waste prevention measures addressing the waste streams that are most problematic, the following measures were identified as candidates for being implemented at EU level:

It is suggested that **waste reduction targets** be introduced for 4 out of 6 waste streams (TXT, CDW, WEE, MSW). A **reuse target** is suggested for tyres, and a **remanufacturing target** for end-of-life vehicles. These type of targets enable flexibility in the development and implementation of national waste prevention measures at EU Member State level. It is also suggested that the role of **EPR systems** be strengthened by establishing a harmonized system across Europe (ELT, TXT), that minimum requirements be set for modulated fees (ELT, TXT), and that EPR fees be used for financing reuse and preparation for reuse (WEEE). A new **legislative framework** is suggested for the remanufacturing sector (ELV) as well as the expansion of the scope of the ELV directive to all vehicles. **New legally binding rules** are suggested to lay down minimum requirements for the preparation for reuse (WEEE), to harmonise product/waste definitions across the EU (ELT) and to reduce sales of short-lifetime products (MSW). It is suggested that **existing legislation is amended** to enable product traceability (ELT), that application of pre-demolition audits be widened to enhance reuse (CDW), and that the destruction of unsold products (TXT) be banned. **New standards** are suggested on quality assurance in the remanufacturing sector (WEEE). The study suggests to further explore the feasibility of introducing a target for the preparation for reuse (WEEE) and to explore opportunities for enhanced source separation and collection (WEEE). Last but not least, this study suggests that **guidance notes should be issued** for the development of national communication programmes with the aim of enhancing the retreatment of tyres (ELT), the removal of components from ELV and the reuse of soil (CDW) as well a **promotional activities** to enhance reuse and repair channels (MSW).

## Initial assessment of impacts with a focus on waste reduction

The principle of the Better Regulation Tool #19 was used to initially identify and assess the impacts of the viable waste prevention measures. In the following, a summary on the key impact areas which were selected for the assessment is given, noting that a wide range of positive effects in the context of waste reduction were identified via the screening. **Impacts on the environment** were evident for all of the measures identified for the key waste streams, illustrated by e.g. emissions savings, higher quality of natural resources (water, soil, air etc.) or more efficient use of resources (e.g. raw material savings). **Social impacts** could be identified for selected measures only, e.g. shown by changes in employment by job creation or changes in working conditions.

The impact on reducing waste was assessed quantitatively for those measures where data was available. The overall **waste reduction potential of the proposed measures** was estimated by scaling up the waste prevention effects of individual measures to the EU level. The cumulative potential for reducing waste is estimated to be 243 million tonnes within the period 2018-2035, which represents approximately 2.3 % of the cumulative waste generation without additional policy interventions (see Table 2).

### Table 2 Projected waste generation and reduction potentials

| Waste generation | 2035 | | | Cumulative 2018-2035 | | |
|---|---|---|---|---|---|---|
| | BAU scenario (Tsd. Tonnes) | Reduction potential (Tsd. Tonnes) | Reduction potential (relative) | BAU scenario (Tsd. Tonnes) | Reduction potential (Tsd. Tonnes) | Reduction potential (relative) |
| End-of-Life tyres | 3,540 | -1,697 | -47.9 | 58,592 | -15,275 | -26.1% |
| End-of-Life vehicles | 11,345 | -899 | -7.9% | 183,018 | -8,091 | -4.4% |
| Construction & demolition waste (mineral waste) | 375,628 | -14,833 | -3.9% | 6,109,179 | -166,891 | -2.7% |
| Textile waste | 3,216 | -410 | -12.7% | 48,473 | -3,858 | -8.0% |
| WEEE | 7,916 | -1,643 | -20.8% | 120,509 | -14,789 | -12.3% |
| Municipal solid waste[3] (excl. separate collected textiles and WEEE) | 220,336[1] | -4,689[2] | -2.1% | 3,888,138[1] | -33,893[2] | -0.9% |
| **Total** | **621,981** | **-24,172** | **-3.9%** | **10,407,909** | **-242,797** | **-2.3%** |

Notes: “1” = The number excludes separate collected textiles and WEEE. “2” = The reduction potential considers only two measures, namely furniture waste and advertising mail reductions only. “3” noting that food and packaging waste are excluded by the scope of this study and no measures on those sub streams were assessed.

It is noted that the estimated **waste reduction potential of 243 million tonnes** for the period 2018 to 2035 is on the conservative side. The effect of certain waste prevention measures, such as promoting the reuse of excavated soils, was not estimated due to a lack of data. It is also worth noting that food and packaging waste prevention measures are excluded from this study as they are the subject of other ongoing studies.

Looking to 2035, the highest reduction compared to the BAU scenario in applying the additional measures could be calculated for end-of-life tyres with 33.6 %, followed by WEEE with 20.8 % and textile waste with 12.7 %.

# Conclusions

## Waste prevention across policy areas

This study explored viable measures for waste prevention, which can be implemented through EU waste policy. The identified waste prevention measures, if implemented, are expected to result in 2.3 % cumulative reduction of the generation of selected waste streams in the time period 2018 – 2035, compared to a BAU scenario. Respectively, in 2035 the generation of these waste streams would be 3.8 % lower than in the BAU scenario. Yet, total waste generation in 2035 of the waste streams covered by the assessment would still increase by 12.3 % compared to 2018. From this, it can be concluded that waste policy alone cannot fully exploit the potential of waste reduction. To give an example: The business model of car-sharing, when adopted widely, will reduce the number of vehicles and, consequently, the number of ELVs more effectively than waste policy measures alone. Therefore, it is proposed to implement waste prevention measures in other policy areas too, in order to benefit from the synergistic effects of bundled measures.

## EU Member State activities

This study has identified six priority waste streams which should be addressed by additional waste prevention measures at EU-level. In addition to this six streams, four waste streams should be targeted with waste prevention measures by individual countries only, because they generate more than 50% of the respective waste stream in the EU (calculated on a mass per capita basis). The waste streams are dredging spoils (NL), vegetable waste (AT, BE, DE, NL, DK), industrial effluent sludges (BE, BG, IT, SI, SK) and chemical waste (EE).

## Monitoring the effectiveness of waste prevention measures

With respect to WFD Article 9 (3) and (4), EU Member States shall monitor and assess the implementation of the waste prevention measures and reuse activities. Monitoring the effectiveness of waste prevention measures is currently not applied commonly. For this reason, evaluations and data on the effectiveness of waste prevention measures are largely missing. This makes it very difficult to identify best practice examples, improve waste prevention measures and assess the waste prevention performance in Europe. To improve data availability for evidence-based decision making, the implementing act for monitoring the progress of waste prevention measures according to WFD Article 9 (7) should be applied as soon as possible. As a result, indicators for monitoring the effectiveness of waste prevention measures to protect the environment and human health, as well as indicators for monitoring the efficiency of each waste prevention measure will be defined.

# Contents

# 1.0 Introduction

## 1.1 Background

EU waste legislation has driven major improvements in waste management, in particular in the treatment of waste by promoting the application of best available techniques and imposing minimum treatment standards. The share of waste disposed of in landfills has decreased in the last few decades but still makes up almost 50% of all treatment methods.[1] Although recycling extends the life of some materials, energy is expended in the process and there are inevitable losses of material, and products are often recycled into lower quality products.

Despite improvements in waste management, total waste generation is not decreasing in absolute terms. In general, it is fair to say that there has been an emphasis on end-of-life treatment of waste, rather than prevention at source or reuse/preparing for reuse. It is also true to say that to date, the greatest emphasis has been placed on municipal waste, particularly on packaging and food waste. Commercial and industrial waste have received limited attention, aside from construction and demolition waste, although even here there is far greater potential for waste prevention.

Waste prevention can be achieved in several ways, including:

- by extending a product's life through better design (durability, repair, and upgrade of products);
- by preventing waste at the source in manufacturing, construction, and commercial operations (process improvement and efficiency);
- by alternative consumption and production patterns which promote sharing, reuse, and preparing for reuse (including refurbishment and remanufacture) activities.

Several actions have been initiated at the European level for introducing policies that can contribute to waste prevention, covering both product and waste policies. Recent developments include the European Green Deal[2] and the new Circular Economy Action Plan[3], and the revision of the Waste Framework Directive[4] in 2018, which put in place provisions with a stronger focus on waste prevention. More specifically:

- The new Circular Economy Action Plan announces a revision of EU legislation on specific waste streams as well as a sustainable product policy initiative, both of which are expected to contribute significantly to waste prevention.
- The EU aims to put forward waste reduction targets for specific streams as part of a broader set of measures on waste prevention in the context of a review of Directive 2008/98/EC.

[1] European Parliament (2017): Towards a circular economy – Waste management in the EU.
[2] EC (2019): The European Green Deal, COM(2019) 640 final.
[3] EC COM/2020/98 final: A new Circular Economy Action Plan For a cleaner and more competitive Europe.
[4] EC 2008/98/EC: Waste Framework Directive.

- The revised Waste Framework Directive, which reconfirms waste prevention as the top priority according to the waste hierarchy and as the preferred option for tackling the waste problem, has also paved the way for a more effective application of EPR and modulated fees to drive eco-design (for improved reusability, reparability, and durability).

In addition, the European Commission is working on a sustainable product policy framework. It aims to explore to what extent EU policies affecting products already contribute to the transition to a circular economy, and where there is potential for a stronger contribution, for example through more consistent implementation across different policy instruments, better synergies between policy interventions or better coverage of products by policy instruments.[5] As part of this, the Eco-design Directive, which already defines minimum market entry requirements for energy-related products, will be revised and extend the scope to non-energy related products.

All this shall serve the objective to significantly reduce total waste generation and halve the amount of residual (non-recycled) municipal waste by 2030, and the Commission will examine the feasibility of setting additional waste prevention measures.

## 1.2 Objectives and tasks

The aim of this study is to provide an environmental and techno-economic assessment to support decision-making on European waste prevention measures. In particular, the assessment is aimed at supporting the European Commission's work to consider additional measures, including the setting of waste reduction targets for specific streams.

With regard to waste prevention measures, the objective of this study is to provide input by:

- analysing the adequacy and effectiveness of waste prevention measures currently taken at EU and national level to limit waste generation;
- identifying the main obstacles to an effective implementation of current waste prevention measures at national and EU level, and ways to overcome them;
- developing options for additional waste prevention measures at EU level, in particular the setting of waste reduction targets;
- identifying and quantifying as far as possible the economic, social and environmental impacts linked to the different options, on the basis of quantitative and qualitative evidence and an estimation of the costs (including administrative costs) and benefits and how they will be distributed. The assessment shall include a life cycle perspective to avoid shifting burdens associated with waste prevention.

The analysis also aims to take into account recent developments in waste policy in the EU, especially with regard to waste prevention and its link to the circular economy, such as design and life extension, reuse, reparability, remanufacturing and new/circular business models. Stakeholder consultations including online workshops and a targeted questionnaire

[5] EC (2020) Sustainable products initiative and EC (2019): Sustainable Products in a Circular Economy - Towards an EU Product Policy Framework contributing to the Circular Economy, SWD(2019) 91 final.

survey have been conducted to enrich the data, and validate the interim findings. The study specifically builds on four different tasks:

1) Task 1: Problem definition and the construction of a Business as Usual (BAU) scenario with baseline;
2) Task 2: Identify the main barriers to and opportunities for increased waste prevention;
3) Task 3: Examples of measures and best practices in waste prevention;
4) Task 4: Identification of options for additional EU level measures on waste prevention and assessment of related impacts.

## 1.3 Scope

The scope of this study covers the EU27 Member States (geographical coverage), the time period 2004-2035 (temporal coverage) and covers all waste apart from food and packaging waste. Details regarding the scope are given Table 1.

The focus for identifying and assessing relevant waste prevention measures in terms of their potential to scale up to EU level was laid on those measures which can be addressed by the waste policy area.

### Table 1 Scope of the study

| | | |
|---|---|---|
| **Geographical coverage** |  **EU-27** | The study covers 27 European Member States, including Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden. |
| **Temporal coverage** | The past trends of waste generation are analysed for the time period 2004 to 2018, which is – at the time of this study - the latest year of data records in European waste statistics[6]. The projections of waste generation cover the time period from 2019 to 2035. | |

[6] https://ec.europa.eu/eurostat/web/waste/data/database

| | |
|---|---|
| **Waste types** | All waste types apart from packaging and food waste are covered.<br><br>Waste which is resulting from waste treatment (such as sorting residues) is defined as "secondary waste"[7]. This study covers waste at each stage in the life cycle, including primary and secondary waste.<br><br>The waste stream categorisation system chosen for assessment is in line with the waste categories of the EU Waste Statistics Regulation (waste categories as defined in Section 2 of the EU Waste Statistics regulation). Including the total waste stream, the categorisation for analysis follows 32 specific waste streams. |

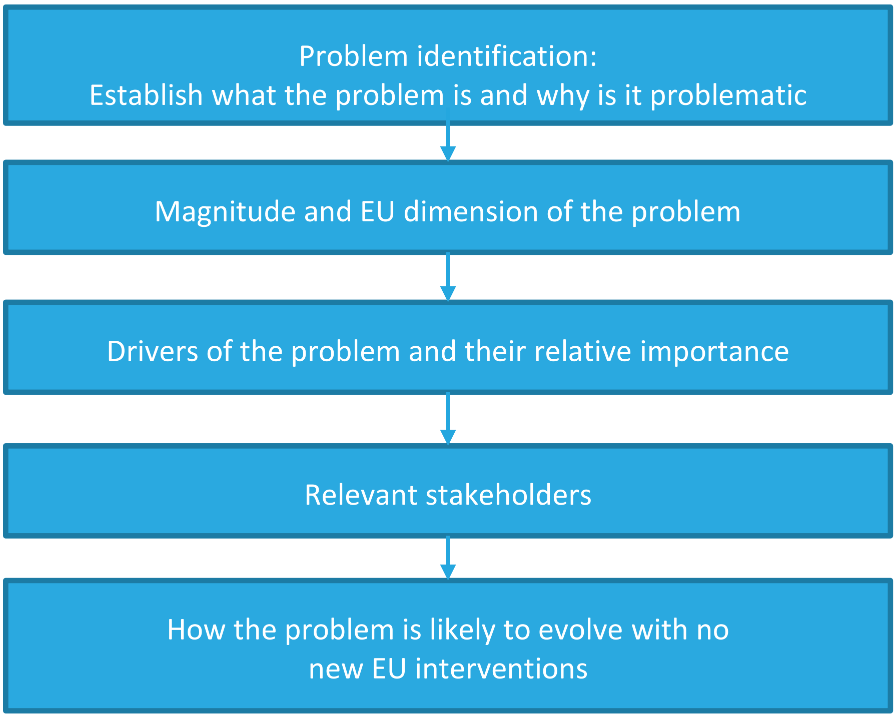
[7] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Secondary_waste

# 2.0 Establishing the business-as-usual scenario (Task 1)

## 2.1 Methodology to define the problem

From a methodological point of view, the European Commission Better Regulation Toolbox Tool #14 “How to analyse problems”[8] provides the framework which has been applied to problem analysis in this study. Figure 2-1 below outlines the steps which will be followed in this study. The stakeholder analysis was conducted throughout the whole project, by two workshops and a written online consultation (see chapter 0).

**Figure 2-1: Framework for problem definition as set out in the Better Regulation Toolbox #14.**




*Source: EC Better Regulation Toolbox #14*

In establishing what the problem is and why it is considered as problematic, for each waste stream, we considered whether:

- an increase in waste generation was observed for the time period 2004-2018:

  In the 7th Environment Action Programme (EAP), targets are set for absolute and per capita waste reduction (excluding major mineral waste), to be achieved by 2020. Therefore, for the purposes of this study, an increase in

[8] https://ec.europa.eu/info/files/better-regulation-toolbox-14_en

waste generation is considered as problematic. It should be noted that an increase in waste generation does not necessarily go hand in hand with proportional adverse impacts on the environment and human health.

- an absence of / slow progress in decoupling between economic growth and waste generation was observed for the time period 2004-2018:

  By the end of 2013, decoupling waste generation from economic growth was aimed for in the majority of the national waste prevention programmes of the EU Member States, although it was found that "quantitative targets and corresponding monitoring schemes are often lacking."[9] Insufficient decoupling of waste generation from economic development is considered as a problem in the context of this study.

- a significant increase in waste generation can be expected by 2035 (if no further measures are taken):

  In the EU Circular Action Plan, the European Commission proposes a significant reduction in total waste generation and a 50 % reduction in the amount of residual municipal waste generated, to be achieved by 2030. Therefore, an increase in waste production by 2035 is considered as a problem because it generates more pollution and this is contrary to EU policy like zero pollution.

- national waste prevention measures have already been taken in the past, but there is a significant lack of knowledge on their effectiveness:

  Waste prevention aims to reduce environmental and human health impacts and to conserve natural resources. According to the EEA's outlook beyond 2020, "the effectiveness of many of the waste prevention measures in the programmes can currently not be assessed for the EU and Europe as a whole". Within this study, the effectiveness of waste prevention measures was assessed for several best practice examples on the basis of information gained from literature and key contacts of the specific initiatives (please see Appendix A.2.2). In any way, the effects of waste prevention measures cannot be observed for all measures due to a lack of data, which is considered as a problem in the context of this study.

The identification of the problem is based on an analysis of waste generation trends and projections for all waste streams generated in the EU-27, with a focus on waste composition and volumes. For this purpose, data was collated into a database, resulting in a time series for waste generation (2004 – 2018) and projections for future waste generation (up to 2035), covering 32 different waste streams (total waste plus 31 specific waste streams).

Information on the establishment of the database used to analyse the waste generation trends and projections for all waste streams is provided in Appendix A.1.1.

[9] https://www.eea.europa.eu/publications/waste-prevention-in-europe-2017

## Analysing the problem areas considering the past and future trends

The aim of the analysis is to understand and assess the current situation in terms of trends and projections, and in particular the adequacy and effectiveness of current waste prevention measures at EU and national level. Three steps are carried out as followed.

In a **first step**, the trends in waste generation were analysed based on the data series by answering the following questions (see results in chapters 2.2.1.1, 2.2.1.2 and 2.2.1.3):

- Which waste streams show a significant increase or decrease in the amounts of waste generated? (assessment of trends in waste generation, volumes in tonnes)
- Which waste streams show decoupling of waste generation from economic and population growth? (assessment of trends in waste generation compared to GDP growth and population, volumes and GDP per capita)
- Increase in waste generation between 2004 and 2018 higher than GDP growth (2014 = 100 %) and/or population – no decoupling
- Increase in waste generation between 2004 and 2018 smaller than GDP growth (2014 = 100 %) and/or population – relative decoupling
- Decrease in waste generation – absolute decoupling of waste generation from economic growth and population
- What are the major sources (economic activities) responsible for the generation of specific waste streams?
- For which waste stream can we expect a significant increase in waste generation by 2035?

The **second step** addresses the effectiveness of implemented waste prevention measures in EU-27 Member States and if (positive or negative) effects can be identified. Therefore, following steps were conducted (see results in chapter 2.2.1.4):

- Analysing the national Waste Prevention Programmes and their waste stream coverage
- Identifying challenges for assessing the effectiveness of waste prevention measures
- Verifying selected quantitative waste prevention targets in EU-27 Member States
- Summing up key findings

The **third step** provides a synthesis of the previous two steps. In order identify the waste streams that meet the criteria for being categorised as problematic, the synthesis highlights waste streams that show:

- a significant increase in waste generation (more 1.5% annually from 2004-2018)
- no clear decoupling between waste generation and GDP growth and/or population for the period 2004 – 2018
- an expected significant increase in waste generation (more 1.5% annually from 20018-2035)

The result of the above problem identification is shown in chapter 2.2.1.5.

Identified waste streams which were problematic in terms of their past and future trends were subsequently analysed in the context of their EU magnitude and drivers having influence on waste generation (see chapter 2.2.2 and chapter 2.2.3).

## Identifying drivers for waste generation

The identification of the drivers for waste generation was carried out to identify the reasons for the increase or decrease in waste generation over the time period 2004 – 2018, and to assess whether the drivers will have an impact on future waste generation if no additional measures were taken.

In general, economic development and population growth are the main drivers for the overall increase of waste generation[10], this context was analysed in a **first step**.

The established time series on waste generation (unit: kg/capita) were – for each waste stream – compared to GDP trend (GDP Chain linked volumes (2015), Euro per capita)[11] relative to the year 2004 (2004 =100%). Pearson's correlation coefficient between waste generation and GDP development was included as a first measure of coupling to screen potential relationships and identify decoupling effects (see description on the Pearson's correlation coefficient in Appendix A.1.1.3). Data requirements (e.g. linearity, outliers) were visually checked prior to analysis (see Appendix A.1.1).

Furthermore, the cumulative increase of waste generation in the time period 2004-2018 was compared to the cumulative increase of GDP and population in 2004-2018 (for results, see Figure 2-4).

In the analysis of trends in waste generation, any coupling or de-coupling of waste generation from economic development and population growth was identified and is explained for each waste stream in the Appendix A.1.1 to this report.

In a **second step**, additional drivers for the increase or decrease of waste generation in the time period 2004-2018 were identified. The drivers and their relative influence varies considerably between different waste streams. A summary of the identified drivers can be found in chapter 2.2.3.

The identification of additional drivers for specific waste streams was based on a review of available literature (see references to literature in the analysis of the waste streams in the Appendix A.1.1).

Finally, the **Business as Usual (BAU) scenario** reflects on projections of waste generation up to the year 2035 if no additional measures for waste prevention are taken (see chapter 2.2.5).

[10] See reference manual on strategic waste prevention published by the OECD (ENV/EPOC/PPC(2000)5/FINAL), https://www.oecd.org/env/waste/wasteprevention.htm

[11] Eurostat data are calculated as chain-linked volumes (i.e. data at previous year's prices, linked over the years via appropriate growth rates).

## 2.2 Problem definition and the construction of the business-as-usual scenario

### 2.2.1 Problem identification

#### 2.2.1.1 Trends in absolute waste generation (2004 to 2018)

Despite improvements in waste management, total waste generation in the EU-27 is not decreasing in absolute terms.

Total waste generation in the EU-27 increased from in 2.248 billion tonnes generated in 2004 (5,196 kg per capita) to 2.337 billion tonnes (5,238 kg per capita) in 2018, corresponding to a + 3.9 % increase in the total amounts reported (a + 0.8 % increase in kg per capita)[12].

Looking at the reference year 2018, a large part of the generated waste (approx. 1.52 billion tonnes, or 65.25 % of the total) is comprised of major mineral waste (with a very low hazardous content in the specific fractions)[13]:

- Soil waste (469 million tonnes, with a share of 2 % hazardous waste, 20.05 % of total waste generated),
- Mineral waste from construction and demolition (303 million tonnes, with a share of 4 % hazardous waste, 12.97 % of total waste generated),
- Dredging spoils (77 million tonnes, with a share of 1 % hazardous waste, 3.29% of total waste generated),
- Other mineral waste (676 million tonnes, with a share of 3 % hazardous waste, 28.93 % of total waste generated)[14].

Waste from mining and quarrying is covered in the waste stream covering major mineral waste, specifically "other mineral waste".[15]

Approximately 144 million tonnes (6.18 %) of the total waste, comprises waste from waste treatment activities, classified as secondary waste (with a low hazardous content in all specific fractions):

[12] Eurostat: Data extracted on 30/4/2021 from [ESTAT]. Data source and methodology: Increase calculated comparing 2018 to 2004.

[13] It is noted that the construction and demolition waste statistics lack of consistency and comparability among EU Member states. For instance, some countries misclassify "soil" and "mineral waste". Further details are given in Deloitte (2017) Study on Resource Efficient Use of Mixed Wastes, Improving management of construction and demolition waste – Final Report. Prepared for the European Commission, DG ENV.

[14] The waste stream "Other mineral waste" covers specific entries: "Asbestos wastes"; "Waste of naturally occurring minerals"; and "Various mineral wastes" and consists of blasting material and grinding bodies, casting cores and moulds as well as linings and refractories from all thermal processes. The waste stream "Other mineral waste" is analysed in detail in Appendix A.1.2.28.

[15] As mining waste is not covered by the WFD it is not taken into account for detailed analysis. Exclusion from scope of WFD: waste resulting from prospecting, extraction, treatment and storage of mineral resources and the working of quarries covered by Directive 2006/21/EC of the European Parliament and of the Council of 15 March 2006 on the management of waste from extractive industries.

- Sorting residues (90 million tonnes, with a share of 5 % hazardous waste, 3.84 % of total waste generated),
- Mineral waste from waste treatment and stabilised waste (45 million tonnes, with a share of 15 % hazardous waste, 1.95 % of total waste generated),
- Sludges and liquid waste from waste treatment (9 million tonnes, with a share of 15 % hazardous waste, 0.39 % of total waste generated).

All other waste generated in the EU-27 in 2018 amounted to approximately 553 million tonnes (28.57 %) and cover key waste streams as shown in Figure 2-2.

### Figure 2-2: Waste generated in EU-27 (excluding major mineral and secondary waste)


*Source: Eurostat and Umweltbundesamt*

The share of hazardous waste within the specific waste streams of Figure 2-2 show the following picture for 2018:

- 100 % for waste containing PCB, spent solvents and used oils as those are classified as hazardous per se;
- 96 % for Batteries and accumulators wastes;
- 78 % for discarded vehicles;
- 73 % for chemical wastes;
- 58 % for health care and biological wastes;
- 53 % for discarded equipment;
- 49 % for acid, alkaline or saline wastes;
- 19 % for industrial effluent sludges.
- 11 % for combustion wastes;
- < 4 % for all other waste streams.

Decreasing the hazardousness of waste needs to be addressed most prominent in the run-up of waste generation by measures which are implemented in the context of product policies, e.g. restriction and/or limitation of substances in selected applications.

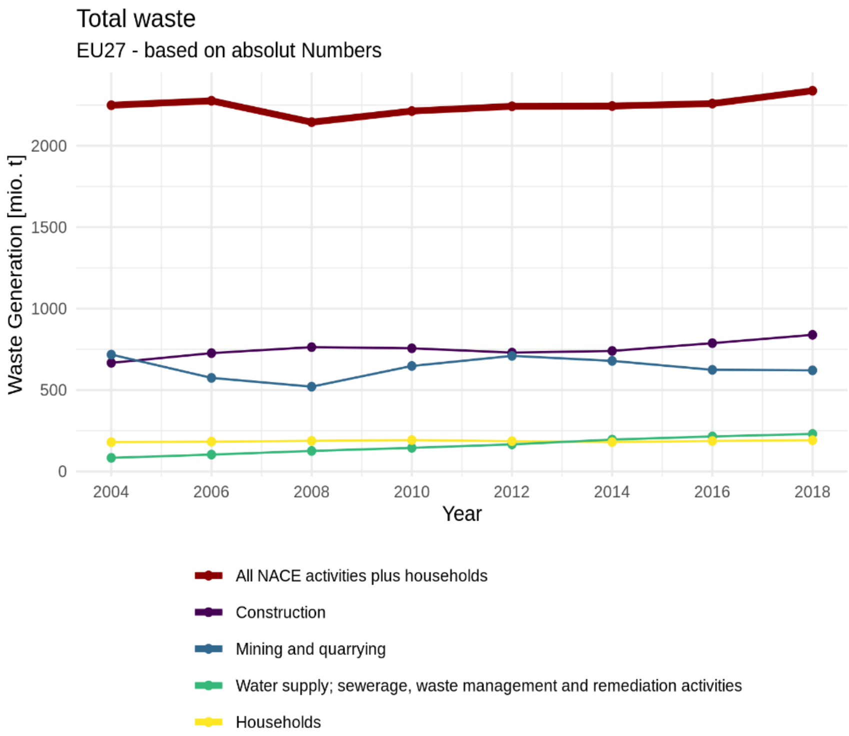
With regard to the sources of waste[16], the construction sector generated the highest waste volumes in 2018, accounting for 35.9 % (835 million tonnes) of the total waste generated, followed by mining and quarrying at 26.7 % (621 million tonnes).

The manufacturing sector generated 10.6 % of total waste generation, the water supply, sewerage, waste management and remediation sector 9.9 %, and the household sector 8.2 %.

The remaining sectors individually contributed to a minor extent: the service sector accounted for 4.6 % of total waste generation, while the contributions of the electricity, gas, steam and air conditioning supply sector and the agriculture, forestry and fishing sector were lower at 3.4 % and 0.9 % respectively.

The following chart shows the overall trend in total waste generation for the four main sources of waste generation for the time period 2004 to 2018.

### Figure 2-3: Total waste generation (million tonnes) by economic activity (showing the four major sources of total waste generation), 2004 – 2018



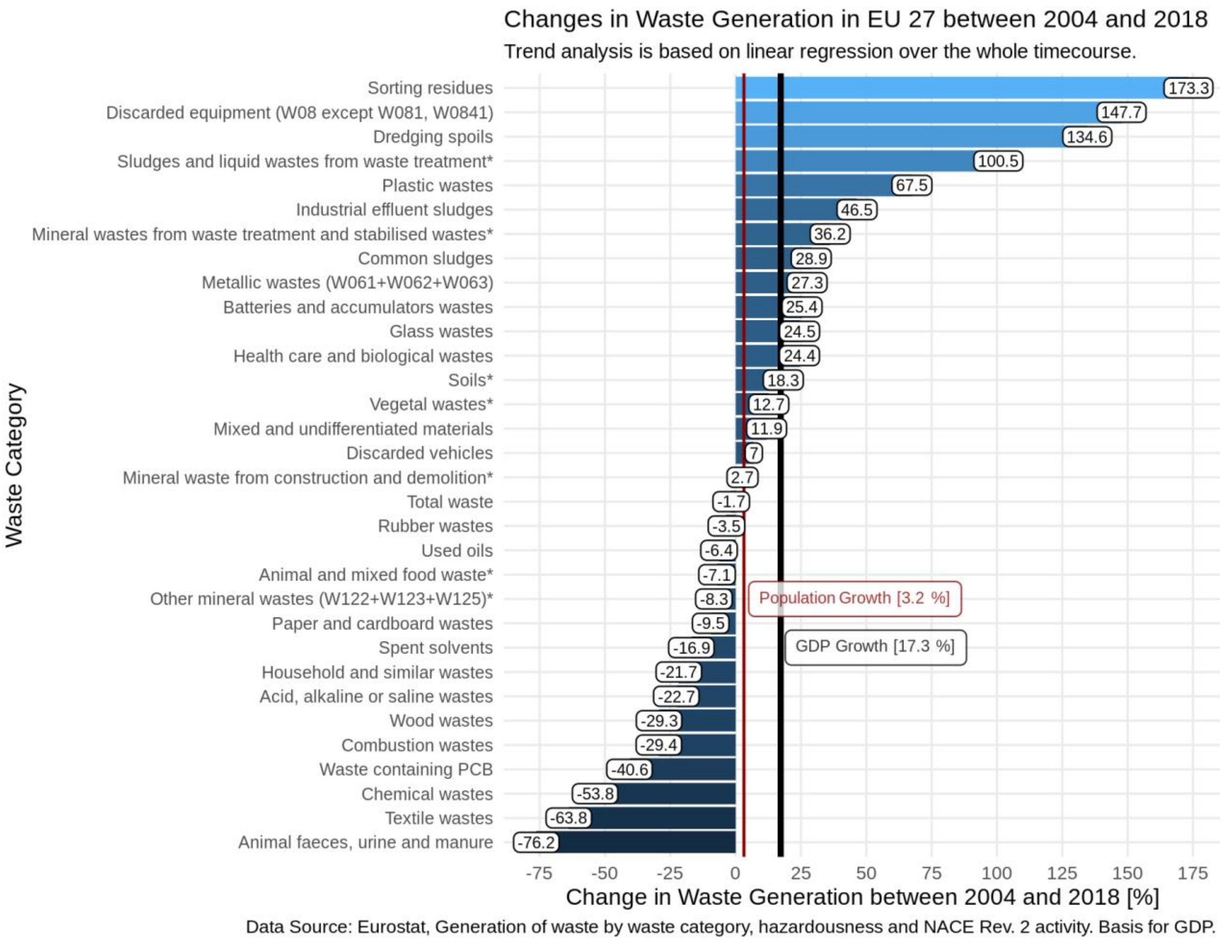

*Source: Eurostat and Umweltbundesamt*

[16] Economic activities according to the groupings as defined under Section 8.1 of the Waste Statistics Regulation.

"Total waste" generation shows a slight increase for the period 2004 – 2018 from 2.249 million tonnes in 2004 to 2.338 million tonnes in 2018 (+ 89 million tonnes). The decrease in waste generation between 2006 and 2008 is caused by the extraordinarily high waste generation amounts of "Total Waste" reported by Romania for the years 2004 and 2006, included under the economic activities "Mining and quarrying" and "Electricity, gas, steam and air conditioning supply".

Figure 2-4 shows the development of waste generation in the EU-27 analysed by waste stream, including the cumulative increase or decrease for each waste category for the period 2004 to 2018.

### Figure 2-4: Changes in waste generation in the EU-27 by waste stream (2004-2018)




** For specific waste streams (soils, mineral waste from construction and demolition, vegetal waste, mineral waste from waste treatment and stabilised waste, animal and mixed food waste as well as sludges and liquid waste from waste treatment) data for 2004, 2006 and 2008 are not available due to different aggregation levels in respective reporting periods. For those categories increase / decrease was calculated with starting year 2010.*

*Source: Eurostat and Umweltbundesamt*

Four waste streams (sorting residues, discarded equipment, dredging spoils, and sludges and liquid waste from waste treatment) show that waste generation doubled during the period 2004 - 2018. Waste categories that have been addressed by European and national waste prevention policies in the last few years because of a rising trend are: plastic waste (+

67.5%), mineral waste from construction and demolition (26.0 %) and battery and accumulator waste (+ 25.4 %).

Several waste categories show a marked decline during the period 2004 – 2018, for example animal faeces, urine and manure; chemical waste; combustion waste; wood waste; and household and similar waste.

Trends for the period 2004 to 2018 and major sources of specific waste streams are presented in Appendix A.1.2 to this report. For an analysis of these trends, it should first be considered that there have been slight changes in the categorisation of single activities and waste categories within and across different sectors of Eurostat data when comparing the reporting years 2008 and 2010. Further, some data are available from 2010 only.

Detailed analysis on the trends of each waste stream is provided in the Appendix A.1.2 and an overview and a comparison for all different waste streams is provided in the synthesis of the problem identification task (see chapter 2.2.1.5).

#### Key data source and data reliability[17]

The key data source for establishing the trends in waste generation were the Member State´s data on waste generation and waste treatment reported to EUROSTAT in the context of Regulation on waste statistics (EC) No. 2150/2002, amended by Commission Regulation (EU) No. 849/2010. The information on waste generation has a breakdown in sources (19 business activities according to the NACE classification and household activities) and in waste categories (according to the European Waste Classification for statistical purposes). All values are measured in tonnes of waste and in kg per capita, based on the annual average of the population. It is however important to note that data collection methods of the Member States may vary. The general options are: surveys, administrative sources, statistical estimations or some combination of methods. Due to this, differences in the data quality between Member States occur.

The Member States conduct the data collection and describe their sources and methods in a quality report. Eurostat checks the comparability of data between countries for each waste stream and sector and discusses issues of comparability with the countries. Validation is carried out constantly, related reports are not published as a rule. The comparability of data across countries is fairly high for most sectors and waste types. However, some problems in comparing data across countries still arise due to the differences in coverage, e.g. for mineral wastes and sub streams different definitions are applied throughout the countries which leads to varying coverage. It is stated in the latest validation report from Eurostat that a statistical investigation of major mineral waste would require additional efforts.[18]

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[17] Information on the data quality of the waste statistics reported to Eurostat can be found at: Waste generation and treatment (env_wasgt) (europa.eu)

[18] EC (2020): Report on statistics compiled pursuant to Regulation (EC) No 2150/2002 on waste statistics and their quality: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0054&qid=1642174731982&from=EN

### 2.2.1.2 Progress in relative decoupling between waste generation and economic development (2004 to 2018)

The gross domestic product (GDP)[19] at market prices is an indicator for a nation´s economic situation. It reflects the total value of all goods and services produced less the value of goods and services used in their production. GDP (chain linked volumes 2015) in the EU-27 increased by 17.3 % over the period 2004 to 2018 (calculated from linear regression analysis), amounting to 25,122 Euro per capita in 2004 and 29,316 Euro per capita in 2018.

GDP can be used to measure decoupling of waste generation from economic development. In addition to GDP, population growth has been considered and compared to waste generation trends (see Figure 2-4).

Where appropriate, additional economic indicators have been used to analyse relative decoupling effects for specific waste streams:

- Final consumption expenditure of households (expenditure incurred for the direct satisfaction of individual or collective needs by private households)[20];
- Gross Value Added (GVA) for the construction sector[21];
- Gross Value Added (GVA) for the manufacturing sector;
- Data on products placed on the market (e.g. for EEE, portable batteries and accumulators, new registrations/sales of passenger cars).

For specific waste streams, related trends are provided in the Appendix A.1.2.

Figure 2-5 shows the development of total waste generation (kg/capita) compared to economic development (GDP) and the population growth in the EU-27. The trend is provided relative to the data 2004 showing the total amount (ALL NACE activities plus households) and amount generated in the four major sectors of generation.

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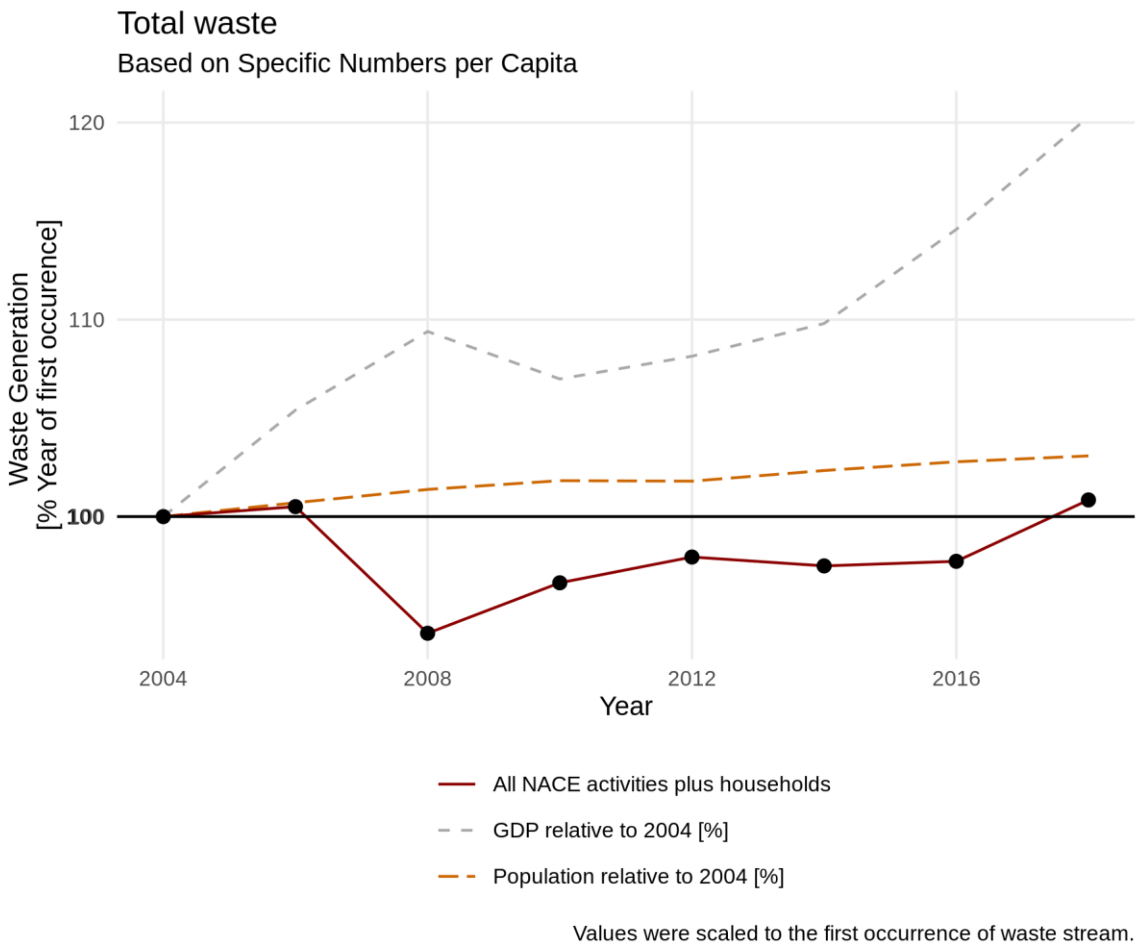
[19] https://ec.europa.eu/eurostat/web/products-datasets/-/teina010 expressed as real GDP.
[20] https://ec.europa.eu/eurostat/web/products-datasets/-/tec00134
[21] https://ec.europa.eu/eurostat/web/products-datasets/-/teina416_r2

**Figure 2-5: Waste generation and decoupling in the EU-27**




*Source: Eurostat*

Over the period 2004 - 2018, relative generation of total waste (kg per capita) remained rather stable, with only a slight increase (0.8 %), while GDP/capita increased by 17.3 %, and the EU's population by 3.2 %.

It appears that the economic crisis of 2008 had a significant effect on the trend in total waste generation showing a decrease from 2006 to 2008, followed by a stable increase throughout the upcoming period from 2008 to 2018.

The effects of decoupling waste generation from economic development are analysed by waste stream for the period 2004 to 2018 in the Appendix A.1.2. For an analysis of these trends, it has to be considered that there have been slight adaptations in the categorisation of single activities and waste categories within and across different sectors of Eurostat data when comparing the reporting years 2008 and 2010. Some data are available from 2010 only.

An overview and comparison for all different waste streams is provided in the synthesis of the problem identification task (see chapter 2.2.1.5).

#### 2.2.1.3 Projections for absolute waste generation up to 2035

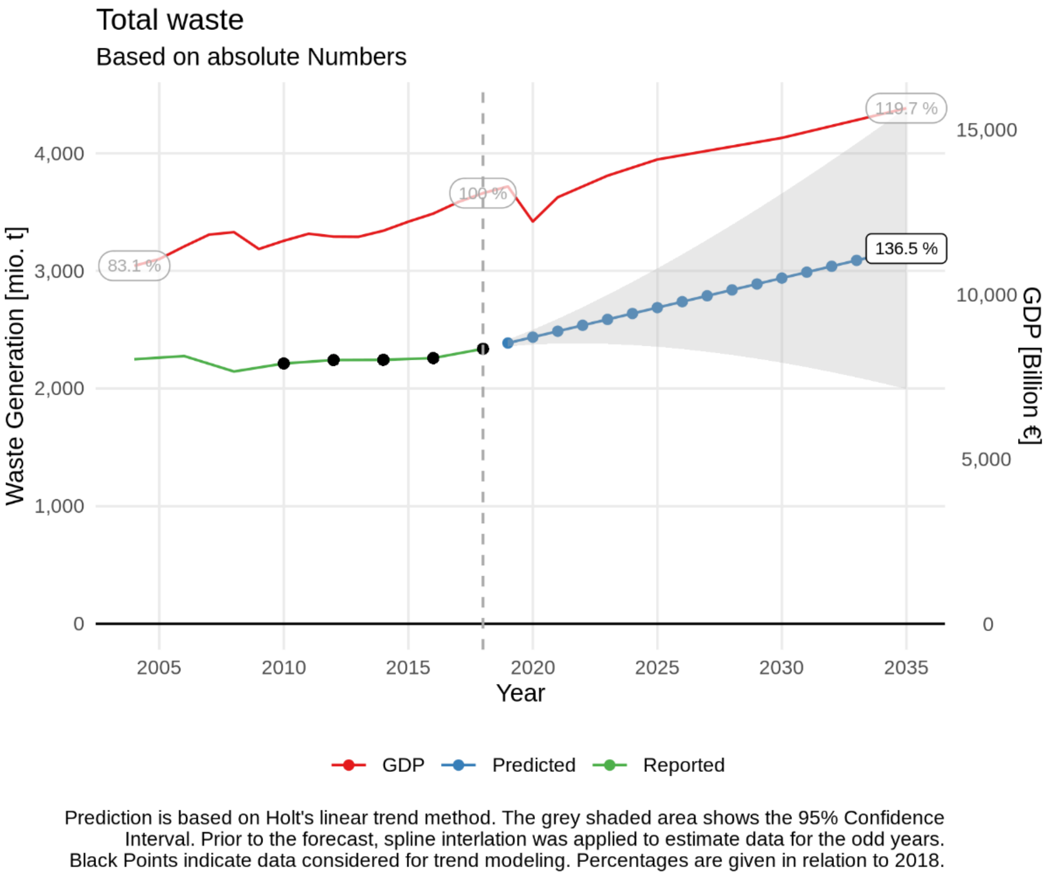
In general, economic development and population growth are the main drivers of waste generation, and this is taken into account when establishing projections. Concerning economic growth, we have assumed that the trends of the previous years will be continued, and that the economy will recover from the economic downturn caused by the Covid-19 crisis in the next few years (cf. Appendix A.1.1.2).

### Linear trend model for all waste streams

For all waste streams, waste generation was projected up to 2035, using linear trend modelling and taking into account past trends from 2004 to 2018. Before producing the forecast, outliers were identified and eliminated, and interpolation was performed to fill in the gaps in reporting for the odd years of the time series. A description on the applied methodology for the linear trend model is provided in Appendix A.1.1.2.

The results for total waste generation are shown in the following graph (see Appendix A.1.2 for individual waste streams).

### Figure A 1: Projections calculated using a linear trend model for total waste generation in the EU-27




*Source: Eurostat and Umweltbundesamt*

Total waste generation shows a past trend towards relative decoupling from GDP over the period 2004 to 2018. Using a linear trend model for calculating projections up to 2035, for the future trend this results in an increase of 36.0 %[22] in 2035 compared to 2018 (with an

[22] The magnitude of increase was validated by comparing the projections of the total waste with the absolute projection summing up all single waste streams.

average increase of 2.1 % per year). GDP growth in the EU-27 is projected to be 19.7 % in 2035 compared to 2018 (with an average increase of 1.1 % per year). So the future trend is expected to show no decoupling from GDP.

As shown by the linear trend model applied for the single waste streams, the stronger increase in the future is related to waste streams with high volumes which show greater increase in waste generation than GDP to 2035, such as: Soils with +73.8% increase by 2035 compared to 2018 (plus 346 million tonnes in 2035) and mineral waste from construction and demolition with +23.6% increase by 2035 compared to 2018 (plus 144 million tonnes in 2035). See also projections on single waste streams in Appendix A.1.2.

### Re-fined projections for selected waste streams

Those waste categories which are key priorities with view to the new Circular Economy Action Plan were considered for a re-fined projection:

- Municipal waste
- Mineral fraction from construction and demolition waste[23]
- Batteries and accumulators waste
- Discarded equipment (including WEEE)[24]
- Discarded vehicles (including ELV)[25]
- Textile waste
- Rubber waste (including end-of-life tyres)

To fine-tune the projection provided by the linear trend model and to assess future trends for the selected waste categories more in detail, selected indicators were considered:

- Trends in waste generation in the past in total volumes generated (tonnes) and specific amounts generated in the Member States (kg/capita)
- Trends in European economic development covering past trends in the gross domestic product (GDP) at market prices (chain linked volumes) and related future trends up to 2035, as well as past trends in the turnover index for specific sectors
- European population trends in the past; including future trends up to 2035
- Indicators related to specific sectors and/or product/waste streams, such as products placed on the market (units, tonnes), product lifetime (average number of years), installed power generation capacity (GW) and stock in use (units)

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[23] Non-mineral materials from construction activities are addressed within other ESTAT categories covering recyclables such as “metal wastes” or “glass wastes”.

[24] The waste stream “Discarded vehicles” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of all types of end-of-life vehicles. The ESTAT category “discarded vehicles” cover fully the end-of-life vehicles as defined by Directive 2000/53/EC. In 2021 about 316 million units were in use, of which 271 million (86%) are covered and 46 million (14%) are not covered by the Directive on end-of life vehicles. It is unknown to which extend reported data include vehicles not covered by the Directive.

[25] The waste stream “Discarded equipment” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of discarded electrical and electronic equipment (e.g. small and large household equipment, IT equipment, electric tools), and fluorescent tubes. The equipment, not covered by the WEEE Directive but reported under the Waste Statistics Regulation is seen as negligible (see chapter A.1.3.7).

- Trends in increased source separation and recycling activities of specific waste streams due to obligations defined in EU waste legislation.

In the context of re-fining, the indicator and data series were checked for data gaps and trends in individual Member States in order to eliminate implausible peaks before calculating the estimate. As the economic situation varies widely across the EU-27, waste generation varies from country to country. Fluctuations in some countries, are much higher than for the EU-27 overall. In some cases it seems that the database for the national reporting is changing all the time, making it difficult to compare the values of the time series between countries. Consequently, projections were re-calculated on a country-by-country basis for the selected categories streams. An overview of the results for the selected waste categories for the period up to 2035 is provided in Appendix A.1.2.

#### 2.2.1.4 Effectiveness of waste prevention measures

This section assesses which waste categories are covered by the EU-27 Member State´s WPPs and how effective existing measures have been. It also maps the current challenges for assessing the effectiveness of waste prevention measures from a European perspective, maps quantitative waste prevention targets across the Member States, and evaluates the achievement of six quantitative waste reduction targets in Europe.

##### Waste Framework Directive, Waste prevention programmes and waste categories covered

The European Waste Framework Directive (2008/98/EC) lays down measures "to protect the environment and human health by preventing or reducing the generation of waste …". In other words, the WFD aims to protect the environment and human health, and one key instrument to achieve this is the prevention or reduction of waste. The WFD lays down a legal obligation for European Union (EU) Member States to implement waste prevention programmes by 12 December 2013. In 2018, the revision of the WFD strengthened the requirements to establish waste prevention measures on national level (see Article 9).

By now, all EU-27 Members States have implemented waste prevention programmes and an overview of these programmes is given in 27 individual country fact sheets (one per EU country). The EEA publishes the latest available fact sheets on their homepage[26]. At the time of this study, 14 factsheets were published in 2016 and 13 in 2019[27]. It is expected that the factsheets for 2021 will be updated at beginning of 2022. As they were not available for this study, this study compiled current and best practice waste prevention measures by screening national reports and websites (see chapter 4.0). The waste prevention programmes from the Member States address the single waste/product streams differently, and an overview is given by Appendix 0.

##### Challenges for assessing the effectiveness of waste prevention measures

The aforementioned country fact sheets and annual reviews compile the facts about waste prevention in Europe including waste prevention targets, waste categories and sectoral coverage, indicators, monitoring frameworks and, last but not least, waste prevention

[26] https://www.eea.europa.eu/themes/waste/waste-prevention/countries
[27] https://www.eea.europa.eu/themes/waste/waste-prevention/countries

measures. However, these reports do not specifically assess the effectiveness of waste prevention measures and programmes against the overall aim of the WFD, which is the protection of environmental and human health. Even if the EU Member States implemented a wide range of waste prevention measures, evidence on the effectiveness of the measures is missing at European level and only poorly available at Member States level. Therefore, due to a lack of quantitative targets and related data on monitoring, a comprehensive assessment for all measures is not currently possible.

This lack of knowledge about the effectiveness of measures in terms of waste reduction is also highlighted in the EEA's Environmental Indicator Report 2018: "… the effectiveness of many of the waste prevention measures in the programmes can currently not be assessed for the EU and Europe as a whole"[28].

Within this scoping study, this issue was addressed by gathering available information on the effectiveness and efficiency of selected measures already implemented in the Member States (see also chapter 4.3 and Appendix A.2.2).

### Monitoring of the implementation and the effectiveness of waste prevention measures

The Member States lay focus on assessing the implementation of the single measures in order to identify the need for further uptake in terms of the WPP reviews. Calculating the detailed impact/effects of the single measure in relation to waste reduction is carried out in certain cases only, which is confirmed by the analysis of single examples within this study.

Based on Article 9 (3) of the WFD, varying approaches are taken by the Member States to assess the implementation and effectiveness of single waste prevention measures

- starting from qualitative assessment counting if or how many actions have been taken in the past period,
- ending up in conducting financed studies for specific assessment.

If assessment reports for the implementation of regulatory measures are conducted by the legal body, those are not accessible and public available as a rule and in many cases therefore cannot be analysed.

Identified examples of measures from Member States giving information on their effectiveness are presented in the descriptions of best practice examples in chapter 4.3 and Appendix A.2.2. , exemplified by the following:

- Introduce (obligatory) funding of waste prevention/reuse/repair for producer responsibility organisations (PROs) operating under EPR: The example from France is proven to be effective in supporting reuse centres and reuse networks having direct impact on the generation of waste. A list of all projects which are or have been funded, including a short description, is published continuously (see more details in chapter 4.3).
- Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, and refurbished goods: The example from Austria is proven to be effective in promoting repair of household appliances and other

[28] https://www.eea.europa.eu/airs/2018/resource-efficiency-and-low-carbon-economy/waste-generation

products at regional company level. Lower Austria (region with about 1.7 million inhabitants) paid out a total of 0.56 million € from July 2019 until May 2020. Over this period over 7,700 electrical devices were repaired (see more details in chapter 4.3).

In Table 4-4 of chapter 4.2.3 the full list of best practice examples is given indicating for which of those information on their effectiveness could by gathered. A detailed description of the best practice examples is given in Appendix A.2.2.

The adaption of an Implementing Act (according to Article 9 (7) of the WFD, still awaited) to establish indicators to measure the overall progress in the implementation of waste prevention measures may bring benefit in a more common application of harmonized indicators. This will support and enable a more comprehensive and harmonised approach to the assessment of the implementation and the effectiveness of single measures by Member States.

### Quantitative waste prevention targets in the EU-27 Member States

Based on the 7$^{th}$ Environment Action Programme and the latest waste prevention country fact sheets[29], quantitative targets were identified in 15 of the 27 EU-27 Member States (Figure 2-6). Of the 15 facts sheets, 9 were published in 2016 and therefore include targets to be met before 2021 and 6 were published in 2019, including targets to be met beyond 2021.

### Figure 2-6: Definition of quantitative waste prevention targets in the EU-27 Member States

| EU-27 Member State | Quantitative Targets | Data source |
|---|---|---|
| **All EU-27 Member States** | yes | EEA Environmental Indicator Report 2018 |
| **Austria** | no | Country fact sheet 2019 |
| **Belgium** | yes | Country fact sheet 2019 |
| **Bulgaria** | yes | Country fact sheet 2016 |
| **Croatia** | yes | Country fact sheet 2019 |
| **Republic of Cyprus** | no | Country fact sheet 2019 |
| **Czech Republic** | no | Country fact sheet 2019 |
| **Denmark** | no | Country fact sheet 2016 |
| **Estonia** | yes | Country fact sheet 2016 |
| **Finland** | yes | Country fact sheet 2019 |
| **France** | yes | Country fact sheet 2016 |
| **Germany** | no | Country fact sheet 2019 |
| **Greece** | no | Country fact sheet 2016 |
| **Hungary** | no | Country fact sheet 2016 |
| **Ireland** | no | Country fact sheet 2016 |
| **Italy** | yes | Country fact sheet 2016 |
| **Latvia** | yes | Country fact sheet 2016 |

[29] https://www.eea.europa.eu/themes/waste/waste-prevention/countries

| EU-27 Member State | Quantitative Targets | Data source |
|---|---|---|
| **Lithuania** | no | Country fact sheet 2016 |
| **Luxembourg** | n. d. | Country fact sheet 2019 |
| **Malta** | yes | Country fact sheet 2019 |
| **Netherlands** | yes | Country fact sheet 2016 |
| **Poland** | yes | Country fact sheet 2016 |
| **Portugal** | yes | Country fact sheet 2016 |
| **Romania** | yes | Country fact sheet 2019 |
| **Slovakia** | yes | Country fact sheet 2019 |
| **Slovenia** | no | Country fact sheet 2019 |
| **Spain** | yes | Country fact sheet 2016 |
| **Sweden** | no | Country fact sheet 2019 |

*Notes: n. d. = not defined.*

### Effectiveness of waste reduction measures in the EU and selected EU countries

To assess the effectiveness of waste prevention measures, this report focuses on targets that were defined and should have been met in the past (before 2021). Targets that should have been achieved before 2021 are presented in the waste prevention country fact sheets, which were released in 2016 and in the 7th Environment Action Programme. Based on these, quantitative targets were identified in 15 of the 27 EU-27 Member States (Figure 3-6). As shown in Figure 3-6 fact sheets from 2016 with quantitative targets are available for 9 countries, namely Bulgaria, Estonia, France, Italy, Latvia, the Netherlands, Poland, Portugal and Spain. These 9 countries have defined 38 different targets for individual waste categories (see Appendix 0). Of these 39 targets, 17 targets can be assessed based exclusively on Eurostat waste statistics, 15 require Eurostat waste statistics and additional data sources and 7 rely exclusively on data sources beyond Eurostat waste statistics. One target, defined by the Seventh Environment Action Programme, covers all EU-27 Member States and can be evaluated based on Eurostat waste statistics.

For this report, quantitative targets regarding municipal solid waste and hazardous waste have been selected and waste generation and GDP statistics from Eurostat has been used to establish if the targets were achieved or not.

- Municipal solid waste: There are 7 targets, of which 5 have been assessed and 2 have been not assessed, because the targets lack a reference year or are set beyond 2021.
- Hazardous waste: There are 2 targets that have been assessed.

Failure to achieve a target indicates that the waste prevention measures were insufficient to meet the target and that further measures would be necessary to tackle these waste categories in the future.

- The **Seventh Environment Action Programme (7th EAP)** states that, by 2020, absolute and per capita waste generation (excluding major mineral waste) should be in decline. The amount of waste generated in the EU increased by 7.5

% in absolute amounts and by 5.7 % per capita between 2010 and 2018[30]. Based on trend projections, there is a risk that waste generation will continue to increase.

- **Bulgaria** set itself a target to reduce municipal solid waste generation per capita between 2011 and 2020. Waste generation in 2011 was 554 kg/cap and a linear regression between 2011 and 2018 (latest available data) shows an annual decrease of 15.5 kg/cap/yr. Waste generation in 2018 was 407 kg/cap. Based on the past trend, it is very likely that the target will be met by 2020.
- **Bulgaria** set a target to decrease hazardous waste generation per GDP unit between 2010 and 2020. Based on Eurostat data, the mass/GDP ratio was 356 t/Euro unit in 2010 and 239 t/Euro in 2018. Based on the trend analysis, it can be expected that the target was met in 2020.
- **Italy's** target was a 5 % reduction in the ratio of generated municipal solid waste (MSW) to gross domestic product unit (GDP) by 2020, reference year 2010. With respect to total waste generation and GDP current prices, the ratio was 0,0497 in 2010 and 0,0597 in 2019 (latest available data), which is a 20 % increase. There is a risk that the target will not be met by 2020.
- **Latvia's** target was to generate not more than 400 kg per capita and 650 kt in total of municipal solid waste by 2020. Based on Eurostat data, waste generation in 2019 was 439 kg/cap and 840 kt in total, respectively. With respect to the past trends, there is a risk that the targets will not be met by 2020.
- **Latvia**'s target was to generate no more than 50 kt of total hazardous waste by 2020[31]. Based on Eurostat data[32], waste generation in 2014, 2016 and 2018 was 104 kt, 66 kt and 77 kt, respectively. There is a risk that the target will not be met by 2020.
- **Slovakia**'s target was to reduce mixed municipal solid waste between 2010 and 2016. According to the waste prevention fact sheet, the target was achieved[33]. The waste reduction targets for other categories (e.g. bio-waste, paper, packaging, construction and demolition waste, hazardous waste and waste from the mining industry) were not achieved.

## Key findings

- Effectiveness describes the relationship between the goal actually achieved and the goal as it has been defined. With respect to the aim of the WFD, which is the protection of environment and human health, a complete assessment on the

[30] Eurostat (2021). Generation of waste by waste category, hazardousness and NACE Rev. 2 activity. Waste category "Waste excluding major mineral waste". 2010: 1720 kg/cap, 758670000 t; 2018: 1818 kg/cap, 811990000 t/a.
[31] EEA (2016). Waste prevention country fact sheet: Latvia.
[32] Eurostat (2021). Generation of waste by waste category, hazardousness and NACE Rev. 2 activity. Waste category "Total waste, hazardous".
[33] EEA (2019). Waste prevention country fact sheet: Slovakia. https://www.eea.europa.eu/themes/waste/waste-prevention/countries/slovakia-waste-prevention-fact-sheet/view

effectiveness of waste prevention measures in Europe is currently not available. Only examples in selected Member States show activities from Member States on a detailed assessment (see chapter 4.3). This hinders (i) the transfer and upscaling of successful national measures in a European-wide context, and (ii) the development of future waste prevention policies on the national and European level. Against this background, the current lack of effectiveness assessments has to be considered as problematic and has been included in the problem definition in section 2.2.1.5.

- Waste prevention fact sheets are available for each EU-27 Member State. Of these fact sheets, 14 were published in 2016 and 13 in 2021. With respect to the 2016 series, 9 out of 14 include quantitative waste prevention targets to be met before 2021. With respect to the 2019 series, 6 out of 13 include quantitative waste prevention targets beyond 2021.
- Regarding the EU-27 Member States and the individual waste categories, 38 quantitative targets had been defined and should have been met before 2021. Of these 38 targets, 17 can be evaluated based on Eurostat waste generation data; the evaluation of the other 21 targets requires additional data sources such as GDP data and national product and waste statistics.
- Targets for the reduction of waste are based on a broad range of indicators (tonnes of waste, kg of waste per capita, kg of waste per GDP, kg of waste per product sales), and this hampers comparability.
- This report presents an evaluation of the achievement of 7 different targets that were to be met before 2021. With respect to (mixed) municipal solid waste, Bulgaria and Slovakia are likely to meet, or have already met the target, whereas there is a risk that the EU-27 wide target and Latvia’s and Italy’s target will not be met. With respect to hazardous waste, Bulgaria will likely achieve the target and there is a risk that Latvia will miss its target.

#### 2.2.1.5 Synthesis problem identification

In order to establish what the problem is and why it is considered to be problematic, following problem areas were identified:

**Problem area 1: Trends in waste generation, decoupling from economic development and future projections of generated amounts**

- Trends in absolute waste generation with respect to the period 2004-2018: An increase in absolute waste generation by more than 1.5% annually has been observed for the period 2004 to 2018 for 15 of 31 waste streams (see also Table 2-1 and chapter 2.2.1.1). These waste streams are classified as problematic due to their substantial increase in the last few years.
- Progress in decoupling between waste generation and economic development (expressed by GDP) in the period 2004 to 2018: Absolute decoupling of waste generation from GDP has been observed for 14 of 31 waste streams (showing a decrease), and relative decoupling for 3 of 31 waste streams (showing an increase but lower than GDP). For 14 waste streams no decoupling from GDP has been identified (see also chapter 2.2.1.2). These waste streams are classified as problematic due to their stronger increase compared to GDP growth in the last few years.

- Projections of absolute waste generation by 2035: The outlook on absolute waste generation reveals an increase for 14 of 31 waste streams. The most dominating increases are expected for waste streams such as waste batteries and accumulators, discarded equipment or plastic waste. These waste streams are classified as problematic, especially as the EC Communication on May, 12 2021 suggests that absolute waste generation should be significantly reduced by 2030.

The following assessment table summarises the analysis and shows which of the ESTAT 31 waste streams (plus municipal waste and waste from renewable energy infrastructure) are seen as problematic, fulfilling one of the following criteria:

- a strong absolute increase in generation in the past (>1.5% yearly increase in the past years) indicated by '**↗**' in the first column;
- no decoupling from economic development indicated by '**-**' in the second column; or
- a strong absolute increase in generation in the future up to 2035 (>1.5% yearly increase in the past years) indicated by '**↗**' in the third column.

Details on the analysis are presented by waste stream in Appendix A.1.2 to this study.

## Table 2-1: Assessment of individual key indicators for each waste category

| | **Absolute trends in waste generation (2004-2018)** | **Progress in decoupling between waste generation and economic development (2004-2018)** | **Projections for absolute waste generation up to 2035** |
|---|---|---|---|
| ***ESTAT categories:*** | | | |
| *Household and similar waste (residual municipal solid waste)* | ↘ | + | ↘ (m) |
| *Metallic waste* | ↗ | - | ↗ (m) |
| *Plastics waste* | ↗ | - | ↗ (m) |
| *Glass waste* | ↗ | - | → (m) |
| Paper and cardboard waste | ↘ | + | ↘ (m) |
| Wood waste | ↘ | + | ↘ (m) |
| *Textiles waste* | ↘ | + | ↗ (m, s) |
| *Discarded vehicles (including ELV)* | → | ± | ↗ (m, s) |
| *Discarded equipment (including WEEE)* | ↗ | - | ↗ (m, s) |
| *Batteries and accumulators waste* | ↗ | - | ↗ (m, s) |
| *Rubber waste (including end-of-life tyres)* | ↘ | + | ↗ (m, s) |
| *Mineral waste from construction and demolition waste* | ↗ | - | → (m, s) |
| *Vegetal waste* | ↗ | - | ↗ (m) |
| *Common sludges* | ↗ | - | → (m) |
| *Industrial effluent sludges* | ↗ | - | → (m) |
| *Health care and biological waste* | ↗ | - | → (m) |
| Mixed and undifferentiated materials | → | ± | → (m) |
| Animal and mixed food waste | ↘ | + | ↘ (m) |
| *Chemical waste* | ↘ | + | ↗ (m) |
| Animal faeces, urine and manure | ↘ | + | ↘ (m) |
| Acid, alkaline or saline waste | ↘ | + | ↘ (m) |
| Used oils | ↘ | + | ↘ (m) |
| Spent solvents | ↘ | + | ↘ (m) |
| Waste containing PCB | ↘ | + | ↘ (m) |
| *Soils* | ↗ | - | ↗ (m) |
| Combustion waste | ↘ | + | ↘ (m) |
| *Dredging spoils* | ↗ | - | ↗ (m) |

| | Absolute trends in waste generation (2004-2018) | Progress in decoupling between waste generation and economic development (2004-2018) | Projections for absolute waste generation up to 2035 |
|---|---|---|---|
| Other mineral waste | ↘ | + | → (m) |
| *Sorting residues* | ↗ | - | ↗ (m) |
| *Mineral waste from waste treatment and stabilised waste* | ↗ | - | ↗ (m) |
| *Sludges and liquid waste from waste treatment* | ↗ | - | ↗ (m) |
| ***Waste categories analysed in addition to ESTAT categories:*** | | | |
| *Municipal waste** | → | ± | → (s) |
| *Waste from renewable energy infrastructure** | | | ↗ (m) |

***Waste streams in BOLD: One of the indicators is assessed to be problematic or waste streams are identified being problematic according to the ToR (indicated by *)***

*n. c. not calculated*
*(m) projected using a linear trend model for waste streams, showing either clear positive nor negative decoupling from GDP trend. Prior to the forecast, spline interpolation for the odd years between the reported years was conducted, thus "prolonging" the time series.*
*(s) refined projections for selected waste categories .*
** "Municipal waste" and "Waste from renewable energy infrastructure" were analysed in addition to the ESTAT waste streams as requested by the ToR. Those two waste streams comprise specific amounts of other analysed ESTAT waste streams.*

| | | | |
|---|---|---|---|
| **Legend** | ↗... Waste streams with strong absolute increase (>1.5% yearly increase in the past years)<br><br>→... Waste streams with moderate absolute increase (>0% and <1.5% yearly increase in the past years)<br><br>↘... Waste streams with absolute decrease (<0% yearly increase in the past years)<br><br>See Appendix and chapter 2.2.1.1. | -... Waste streams with no decoupling (compared to GDP)<br><br>±... Waste streams with relative decoupling (compared to GDP)<br><br>+... Waste streams with absolute decoupling (compared to GDP)<br><br>See Appendix and chapter 2.2.1.2. | ↗... Waste streams with strong absolute increase (>1.5% yearly up to 2035)<br><br>→... Waste streams with moderate absolute increase (>0% and <1.5% yearly up to 2035)<br><br>↘... Waste streams with absolute decrease (<0% yearly up to 2035)<br><br>See Appendix and chapter 2.2.1.3. |

## Problem area 2: Effectiveness of waste prevention measures

Effectiveness describes the relationship between the result actually achieved and the goal as it has been defined. The strategic goal of the Waste Framework Directive (WFD) is to protect environmental and human health, and waste prevention and reduction measures are key instruments to achieve this goal. Based on the reviews carried out in this study, the effectiveness of national waste prevention programmes and measures regarding the WFD aim, has so far been assessed to minor extent only, both at the level of the EU-27 Member States and at the European level. This lack of periodical assessments complicates the identification of enablers of and barriers for applying waste prevention measures, as well as lessons learned in improving, transferring and upscaling waste prevention measures. In conclusion, the lack of information on effectiveness assessment is considered to be problematic in view of evidence-based decision and policy making.

In Table 4-4 of chapter 4.2.3 the full list of best practice examples is given indicating for which of those information on their effectiveness could by gathered. A detailed description of the best practice examples is given in Appendix A.2.2.

The implemented national waste prevention programmes (WPPs) vary in terms of waste category coverage, measures, evaluation and monitoring frameworks, indicators and targets. Targets, namely quantitative waste reduction targets, have been defined in 15 EU-27 Member States.

From a methodological point of view, these targets are operational targets, subordinated to the WFD's strategic goal for the protection of the environment and human health. Whether the achievement of the waste reduction targets (operational targets) contributes to the protection of the environment and human health (strategic target), cannot be established due to a lack of evidence and is therefore considered as problematic.

The broad range of target definitions meets the national needs but hampers comparative effectiveness assessments across the EU-27 Member States and is therefore considered as problematic.

Even if target achievement has not been assessed for the all waste categories within the scope this study, further waste prevention measures would support the reduction of waste generation.

#### Waste streams that fulfil the criteria of the problem identification:

Based on the two problem areas assessed in the context of the ESTAT waste streams, the following 20 waste streams (plus municipal waste and waste from renewable energy infrastructure[34]) have been identified as problematic and have been further analysed to determine the magnitude of the problem at EU level, including the drivers of waste generation:

- Household and similar waste (residual municipal solid waste)
- Metallic waste
- Plastics waste
- Glass waste
- Textiles waste
- Discarded vehicles (including ELV)[35]

[34] "Municipal waste" and "Waste from renewable energy infrastructure" were analysed in addition to the ESTAT waste streams as requested by the ToR. Those two waste streams comprise specific amounts of other analysed ESTAT waste streams.

[35] The waste stream "Discarded vehicles" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of all types of end-of-life vehicles. The ESTAT category "discarded vehicles" cover fully the end-of-life vehicles as defined by Directive 2000/53/EC. In total about 316 million units were in use, of

- Discarded equipment (including WEEE)[36]
- Batteries and accumulators waste
- Rubber waste (including end-of-life tyres)
- Mineral waste from construction and demolition waste[37]
- Vegetal waste
- Common sludges
- Industrial effluent sludges
- Health care and biological waste
- Chemical waste
- Soils
- Dredging spoils
- Sorting residues
- Mineral waste from waste treatment and stabilised waste
- Sludges and liquid waste from waste treatment

### 2.2.2 Magnitude and EU dimension of the problem

The magnitude and EU dimension of the problem per waste streams, was addressed by considering the aspects:

- Do we observe the problem in the majority of the EU-27 Member States?
- Is the amount of waste generated relevant in comparison to other waste streams?
- Does the waste stream contain critical raw materials?

The assessment was carried out on those 20 ESTAT waste streams (see chapter 2.2.1), which fulfil the criteria of the problem identification, i. e. waste streams

- with significant absolute increase in the past (>1.5% annual increase) and/or
- with no decoupling of waste generation from development of GDP in the past years and/or
- with a projected significant absolute increase (>1.5% annually) up to 2035

#### 2.2.2.1 Do we observe the problem in the majority of the EU-27 Member States?

For each waste stream, the top five countries with the highest waste generation per capita of the respective waste stream were identified (see Figure 2-7) and compared in their relation to the remaining EU-Member States.

This allows us to indirectly assess whether the generation is mainly driven by only one Member State (like dredging spoils from Netherlands) or more Member States (e.g. Sludges

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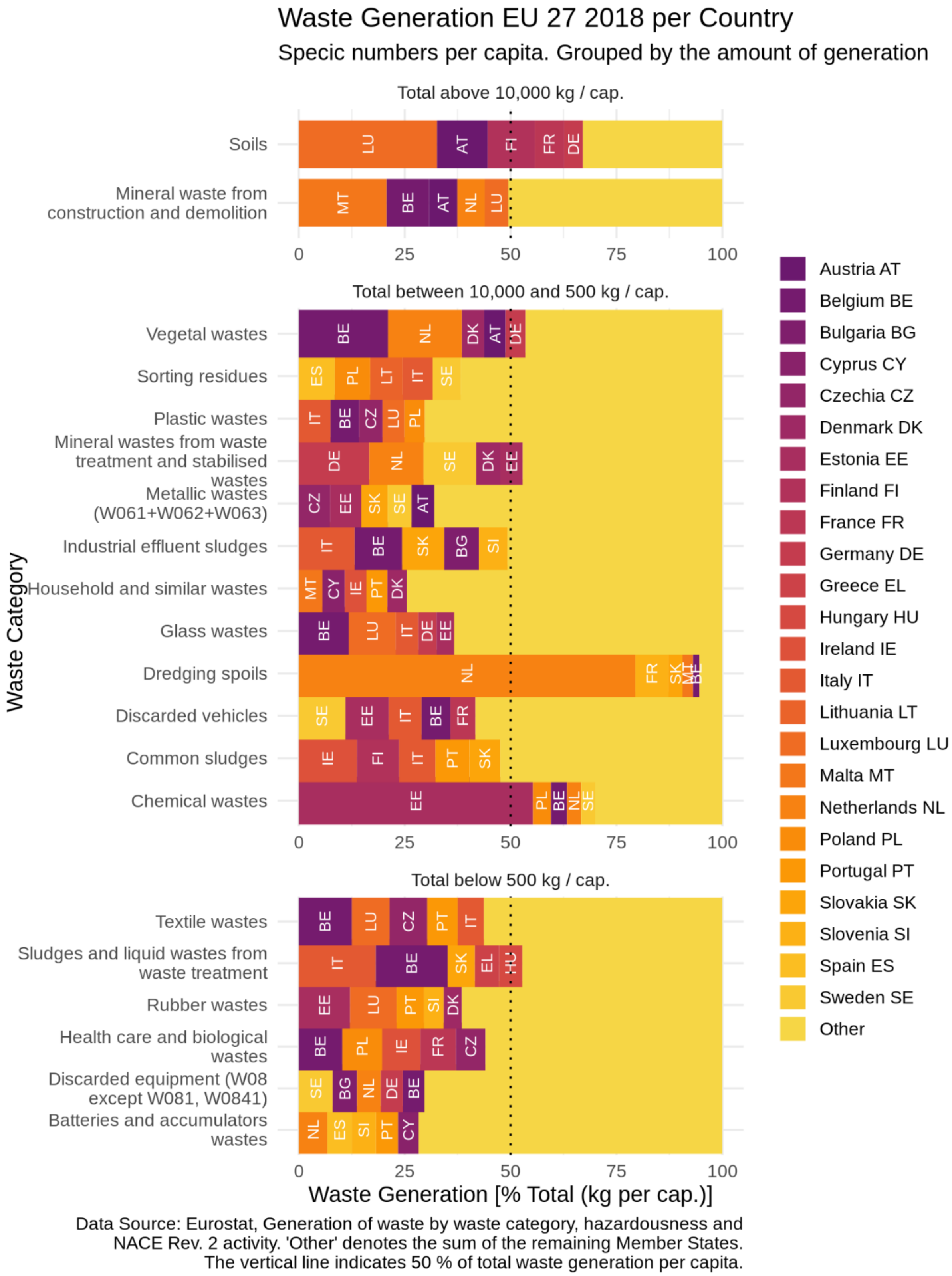
which 271 million (86%) are covered and 46 million (14%) are not covered by the Directive on end-of life vehicles. It is unknown to which extend reported data include vehicles not covered by the Directive.

[36] The ESTAT category "discarded equipment" covers fully the waste electrical and electronic equipment (WEEE) as defined by Directive 2012/19/EU. The equipment, not covered by the WEEE Directive but reported under the Waste Statistics Regulation is seen as negligible (see chapter A.1.3.7).

[37] Non-mineral materials from construction activities are addressed within other ESTAT categories covering recyclables such as "metal wastes" or "glass wastes".

and liquid waste from waste treatment by Italy and Belgium), so that waste prevention actions on Member State level would be more appropriate. In case the remaining category “Other” is large, and the top-five are rather equally distributed, it is highly likely that a specific waste stream is relevant for the majority of EU-27 Member States (e.g. Household and similar waste), so that facilitating the waste prevention for this stream would most benefit from targeted EU-level action.

## Figure 2-7: Waste generation (kg/capita) per waste category in EU-27 Member States (2018).

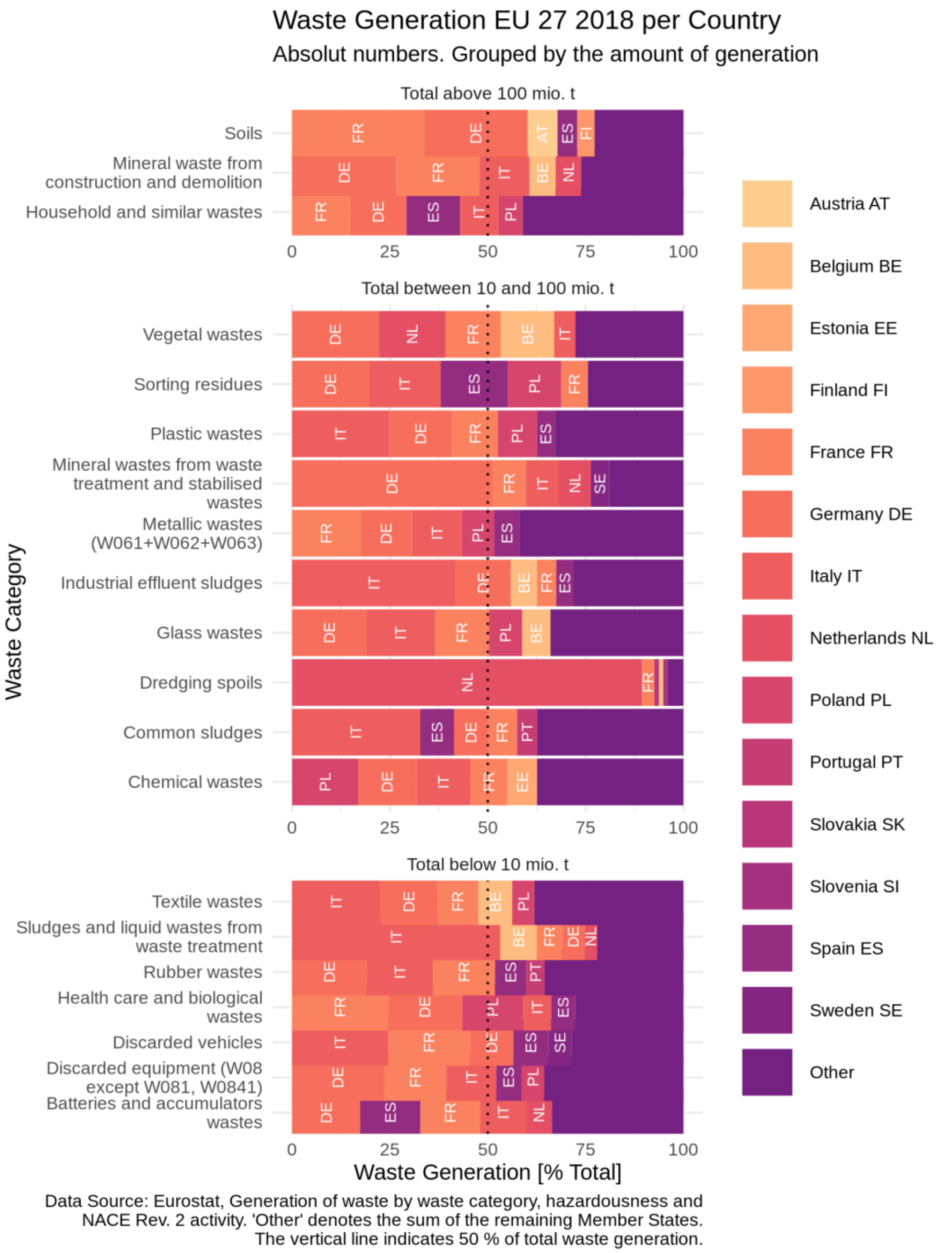



*Source: Eurostat and Umweltbundesamt*

### 2.2.2.2 Is the amount of waste generated relevant in comparison to other waste streams?

The magnitude of the problem was assessed quantitatively in terms of amounts of waste generated, and based on this, the waste streams were grouped. Group 1: over 100 million tonnes, Group 2: Between 10 million and 100 million tonnes, Group 3: below 10 million tonnes. The magnitude of the problem was ranked highest for waste streams with an annual waste generation (2018) in EU-27 higher than 100 million tonnes, and lowest for waste streams with an annual waste generation (2018) lower than 10 million tonnes. Unlike the analysis per capita as above, the absolute waste generation numbers are dominated by larger Member States, such as France, Germany and Italy. Please see Figure 2-8.

**Figure 2-8: Waste generation per waste category per EU-27 Member State in 2018.**



*Source: Eurostat and Umweltbundesamt*

#### 2.2.2.3 Does the waste stream contain critical raw materials?

According to the Waste Framework Directive, waste prevention measures to be taken by the Member States shall specifically target products containing critical raw materials. The 2020 list of critical raw materials, as published by the European Commission, consists of 30 entries.

Waste prevention in these areas may relieve the pressure related to availability of sources of these critical raw materials for the manufacturing of certain products.

The following waste streams were identified as relevant with regard to their content of critical raw materials[38,39,40,41,42,43]:

- Waste electrical and electronic equipment: contains Sb, Be, Bi, Co, Ga, Ge, Hf, In, Li, Mg, P, Sm, Si, Sr, Ta, Ti, Tu, V, platinum-group metals, natural graphite, natural rubber, fluorspar and rare earth elements, in varying quantities and concentrations.
- End-of-Life vehicles: contain Co, Ga, In, Li, Mg, Nb, Pd, Pt, Rh, natural graphite and rare earth elements, in varying quantities and concentrations.
- Waste batteries and accumulators: contain Sb, Co, Ga, In, Li, Mg, Nb, P, Si, Ta, Ti, fluorspar, natural graphite and light rare earth elements, in varying quantities and concentrations.
- Waste tyres: contain natural rubber as an important constituent.
- Waste from renewable energy infrastructure: contains Co, Ga, Ge, In, Li, Mg, Nb, Si, Sr, Ti, V, borates, platinum-group metals, natural graphite and rare earth elements), in varying quantities and concentrations.

The magnitude of the problem was assessed qualitatively, with waste streams containing critical raw materials being regarded as relevant in terms of the EU dimension of the problem.

### Table 2-2: Assessment of Magnitude and EU dimension of the problem

| Waste streams, which are regarded as problematic in terms of waste generation *(a)* | EU dimension in terms of affected Member States*(b)* | Magnitude in terms of generated waste volumes*(c)* | EU dimension in terms of critical raw materials*(d)* |
|---|---|---|---|
| ***ESTAT categories:*** | | | |
| *Household and similar waste* | ++ | *** | |

[38] EC (2018): Report on Critical Raw Materials and the Circular Economy, see http://publications.europa.eu/resource/cellar/d1be1b43-e18f-11e8-b690-01aa75ed71a1.0001.01/DOC_1

[39] EC (2021): Raw Materials Information System, JRC foresight study for CRMs in strategic technologies and sectors in the EU (2021), available at: https://rmis.jrc.ec.europa.eu/?page=crm-list-2020-e294f6

[40] Huisman et al. (2017): Prospecting Secondary Raw Materials in the Urban Mine and mining waste (ProSUM), Final Report.

[41] Blengini et al (2020): Study on the EU's list of Critical Raw Materials (2020), Final Report.

[42] Bobba et al (2020): Critical Raw Materials for Strategic Technologies and Sectors in the EU, A Foresight Study.

[43] Geology.com: REE – Rare Earth Elements – Metals, Minerals, Mining, Uses (1.4.2021), see https://geology.com/articles/rare-earth-elements/

| Waste streams, which are regarded as problematic in terms of waste generation [(a)] | EU dimension in terms of affected Member States[(b)] | Magnitude in terms of generated waste volumes[(c)] | EU dimension in terms of critical raw materials[(d)] |
|---|---|---|---|
| *Metallic waste* | ++ | ** | |
| *Plastics waste* | ++ | ** | |
| *Glass waste* | ++ | ** | |
| *Textiles waste* | ++ | * | |
| *Discarded vehicles* | ++ | * | x |
| *Discarded equipment* | ++ | * | x |
| *Batteries and accumulators waste* | ++ | * | x |
| *Rubber waste* | ++ | * | x |
| *Mineral waste from construction and demolition waste* | ++ | *** | |
| *Vegetal waste* | + | ** | |
| *Common sludges* | ++ | ** | |
| *Industrial effluent sludges* | ++ | ** | |
| *Health care and biological waste* | ++ | * | |
| *Chemical waste* | + | ** | |
| *Soils* | + | *** | |
| *Dredging spoils* | - | ** | |
| *Sorting residues* | ++ | ** | |
| *Mineral waste from waste treatment and stabilised waste* | + | ** | |
| *Sludges and liquid waste from waste treatment* | + | * | |
| ***Waste categories analysed in addition to ESTAT categories:*** | | | |
| *Municipal waste* | ++ | *** | |
| *Waste from renewable energy infrastructure* | n. a. | n. a. | x |

**n. a. … not assessed**

**Legend:**

[(a)] **Waste streams, which are regarded as problematic in terms of past and future trends on waste generation,**

- ***with a strong absolute increase in the past ( >1.5% average increase per year) and/or***
- ***with no decoupling of waste generation from development of GDP in the past years and/or***
- ***with a projected strong absolute increase (>1.5% yearly) up to 2035,***

[(b)] **EU dimension in terms of affected Member States:**

**- …..** ***Low EU Dimension of affected Member States (the waste generation/capita of the single Member State with highest waste generation/capita exceeds 70 % of total waste generation per waste stream and capita***

**+ …..** ***Medium EU Dimension of affected Member States (the waste generation/capita of the 5 Member States with highest waste generation/capita comprise of more than 50 % of total waste generation per waste stream and capita)***

**++ ….** ***High EU Dimension of affected Member States (the waste generation/capita of the 5 Member States with highest waste generation/capita is lower than the 50 % of total waste generation per waste stream and capita)***

[(c)] **Magnitude in terms of generated waste volumes:**

****** ... More than 100 million tonnes of waste generated in 2018 (High EU Magnitude)***
***** … Between 10 and 100 million tonnes of waste generated in 2018 (Medium EU Magnitude)***
**** …. Below 10 million tonnes of waste generated in 2018 (Low EU Magnitude)***

[(d)] **EU dimension in terms of critical raw materials:**

***x ….. Waste stream may contain critical raw materials (High EU Dimension)***

*Source: Umweltbundesamt*

With regard to the magnitude and EU dimension of the problem, the following waste streams are not regarded as of high concern, either because of the low number of affected Member States or because of a 'medium' number of affected Member States combined with a 'low' or 'medium' magnitude in terms of generated waste volumes:

- Vegetal waste
- Dredging spoils
- Mineral waste from waste treatment and stabilised waste
- Sludges and liquid waste from waste treatment
- Chemical waste

After removing these five waste streams, the remaining 15 waste streams were further assessed for whether the drivers for waste generation can be influenced by waste prevention measures.

### 2.2.3 Drivers of the problem and their relative importance

This section describes the main social, economic and technological factors which have been driving an increase of the waste generation, across the different waste streams.

Generally, economic development and population growth are the main drivers for the overall waste generation increase. An increase of household income goes hand in hand with a consumption increase in the households.

#### 2.2.3.1 Identification of relevant drivers for increased waste generation of selected waste streams

On the level of waste streams, the following drivers for the waste generation increase in the period 2004 – 2018 were identified:

- Drivers affected by the EU climate ambition for 2030 and 2050
- Drivers affected by changes in lifestyle
- Drivers affected by changes in product design
- Drivers effected by changes in prices and costs
- Drivers affected by changes in waste management and wastewater management practices

#### 2.2.3.2 Drivers affected by the EU climate ambition for 2030 and 2050

##### Shift to sustainable and smart mobility

One of the measures to achieve the shift to sustainable and smart mobility is the production and deployment of sustainable alternative transport fuels and, simultaneously, of zero- and low-emission vehicles[44]. At national level, limiting the average $CO_2$-emissions of new car fleets, together with measures to promote e-mobility, such as subsidies, resulted in growing sales of e-vehicles. While in 2010 only 700 new e-cars[45] were registered in Europe, 550,000 were registered in 2019.[46] Further, sales of e-bikes have risen continuously in the recent years. In 2016, around 1.7 million e-bikes were sold in Europe, increasing to over 2.6 million in 2018, and to 3.6 million in 2019[47].

The age of passenger cars currently averages 11.5 years in the EU, ranging between 6.5 and 16 years across Member States[48]. Average lifespans of cars vary from 8.0 to 35.1 years, with a mean of 18.1 years in Western and 28.4 years in Eastern European countries[49].

A 90% reduction in transport emissions by 2050 is defined as a goal, which means that the transition period is significantly longer than the average remaining life span of passenger cars in the EU.

Therefore, it is assumed that the replacement of the current vehicle fleet with low emission vehicles will not speed up the generation of end-of-life vehicles.

The shift to sustainable transport requires measures to increase the capacity of railways and inland waterways[50], which will require large-scale construction work and sector specific emphasis in new infrastructure. Related waste streams generated in terms of infrastructure renovation and conversion are expected to increase.

This means that a further increase in the generation of waste electrical storage systems (i.e. accumulators), e-vehicles, WEEE (e-bikes) as well as construction and demolition waste from upgrading the infrastructure (capacity of railways and inland waterways) is to be expected.

### Shift to renewable energy production

The EU is committed to reducing its greenhouse-gas emissions by 55% by 2030 and to become climate-neutral by 2050.[51] Massive investments are to be made over the next few

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[44] Baird, D., Great Britain, and Environment Agency (2008): The use of substitute fuels in the UK cement and lime industries, Bristol: Environment Agency.

[45] Battery electric vehicles and plug-in hybrid electric vehicles.

[46] EEA (2020): Indicator assessment “New registrations of electric vehicles in Europe” (EU-27 plus IS, NO and UK). Available at: https://www.eea.europa.eu/data-and-maps/indicators/proportion-of-vehicle-fleet-meeting-5/assessment

[47] https://de.statista.com/statistik/daten/studie/1107790/umfrage/absatz-von-e-bikes-in-europa/#:~:text=Erneuter%20Rekordwert%20beim%20Absatz%20von,Millionen%20elektrisch%20unterst%C3%BCtzte%20Fahrr%C3%A4der%20verkauft.

[48] Average age of the EU vehicle fleet, ACEA 2019

[49] M. Held, N. Rosat, G. Georges, H. Pengg & K. Boulouchos, Held, M., Rosat, N., Georges, G. et al., Lifespans of passenger cars in Europe: empirical modelling of fleet turnover dynamics, Eur. Transp. Res. Rev. 13, 9 (2021).

[50] Baird, D., Great Britain, and Environment Agency (2008): The use of substitute fuels in the UK cement and lime industries, Bristol: Environment Agency.

[51] EC (2020): Stepping up Europe’s 2030 climate ambition - Investing in a climate-neutral future for the benefit of our people.

years for clean energy supply across the economy [52]. The capacity for wind power will need to increase from the 2018-level of 180 GW to 351 GW in 2030, corresponding to a capacity doubling[53]. In order to provide sufficient capacity of photovoltaic systems to achieve the envisaged reduction of greenhouse-gas emissions, an increase from the currently installed 130 GW to 600 GW in 2030, which corresponds to an annual increase of about 16% until 2030, is envisaged.[54]

This means that waste from wind turbines and waste photovoltaic panels and accumulators used for stationary storage systems is expected to increase significantly in the next years, as well as construction waste generated during civil works for renewable energy supply infrastructure (e.g. wind turbine foundations; buildings housing electrical switchgear as well as possibly spares and maintenance facilities[55]).

#### Energy efficiency and renovation demand of buildings

Currently, the annual renovation rate of the building stock varies from 0.4 to 1.2% in the EU Member States. This rate will need to at least double, in order to reach the EU energy efficiency and climate objectives.

Due to an ageing building stock in many EU countries, a demand exists for renovation as well as improvement of the energy efficiency of buildings. (In almost all Member States, the share of the residential building stock erected after 2000 is below 25%[56]).

Several insulation materials can be used to reduce energy use in new buildings (near-zero-energy buildings) as well as in retrofitting/refurbishment (renovation) projects. The most common types of materials used for insulation of buildings include mineral (e.g. stone or glass) wool and plastic foams (e.g. polyurethane, polystyrene, etc.)[57]

The increased use of insulation materials in construction and renovation entails the generation of a new waste stream when further renovation or demolition follows in the future.

### 2.2.3.3 Drivers affected by changes in product design

#### Decreased service life of products (low durability, reparability, reusability)

The technical service life, until a product becomes defective, particularly of electrical and electronic products has significantly shortened compared to former decades.

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[52] EC (2019): The European Green Deal. COM(2019) 640 final.

[53] EC (2020): Commission notice Guidance document on wind energy developments and EU nature legislation.

[54] Jäger-Waldau, A., et al (2020): How photovoltaics can contribute to GHG emission reductions of 55% in the EU by 2030; Renewable and Sustainable Energy Reviews Volume 126, July 2020.

[55] https://www.wind-energy-the-facts.org/infrastructure.html

[56] https://ec.europa.eu/energy/eu-buildings-factsheets_en, supplemented with an own assessment based on the Construction Production (volume) index Construction Production (volume) index, Eurostat 2020.

[57] Competitive landscape of the EU's insulation materials industry for energy-efficient buildings, JRC 2018.

A German study (2016)[58] shows that the average service life of large household appliances which have been replaced due to a defect shortened from 2004 to 2012/2013 by one year and currently amounts to 12.5 years. The percentage of large household appliance replacements due to a defect accounted for 57.6% in 2004 and 55.6% in 2012 among the total product replacements. The proportion of large household appliances which have been replaced within less than 5 years after purchase due to a defect increased from 3.5% to 8.3% of total replacements between 2004 and 2012[59].

According to a recent study published by the European Environment Bureau[60] the main causes for decreasing service life duration are: deficient mechanical and electronic robustness, software-induced reasons (including peripheral devices becoming obsolete), high repair costs as well as trends and desire for new functionalities (including socio-demographic factors, such as moving to a new apartment). Further, there is little or unreliable information on durability and reparability at the time of purchasing a product.

The amount of electrical and electronic equipment (EEE) placed on the market increased from less than 7.3 million tonnes in 2013 to 9.0 million tonnes in 2017, an increase of 24.1 %[61].

### Rapid changing of clothing lines and fashion trends

Fast fashion — the rapid changing of clothing lines and fashion trends — promotes increased consumption and reduces the life span of clothing. Between 1996 and 2018, clothing prices in the EU dropped by over 30 % in real terms. Since 2000, Europeans have purchased more pieces of clothing but spent less money in doing so[62]. Increased consumption of clothing will lead to increased generation of textile waste from households.

### Poor quality of consumer products

Due to their affordability and fast turnover cycles, less focus is being put on the quality of consumer products, causing shorter life-times, e.g. for textiles.[63] This in turn, decreases the potential for re-use and repair of the items after their first use. The use of cheaper and low quality materials for the production e.g. as seen for furniture hampers the product durability, reusability of components and repairability of the product and subsequently increase the generation of related waste streams.

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[58] https://www.umweltbundesamt.de/en/publikationen/einfluss-der-nutzungsdauer-von-produkten-auf-ihre-1; Umweltbundesamt 2016

[59] https://www.umweltbundesamt.de/en/publikationen/einfluss-der-nutzungsdauer-von-produkten-auf-ihre-1, Umweltbundesamt 2016

[60] EEB (2019), Coolproducts don’t cost the earth - full report

[61] Waste statistics - electrical and electronic equipment - Statistics Explained, Eurostat 2021.

[62] Textiles in Europe's circular economy, Briefing no. 10/2019, European Environment Agency 2019.

[63] ETC/WMGE (2019): Textiles and the environment in a circular economy.

### 2.2.3.4 Drivers affected by changes in lifestyle

#### Decrease of average household size

From 2010-2020, the total number of households in the EU increased by 7.2 % higher than the rate of population growth in the same time period (2%)[64]. The underlying cause is that in all EU Member States except Luxembourg, Denmark and the Netherlands, a decrease in the average number of persons per household was recorded[65]. The rising demand for dwellings drives the construction of new residential buildings[66], and consequently construction waste generation and, with a time lag, of demolition waste. The rising demand of buildings & infrastructure is also reflected by a continuous increase of excavated soil. Next, residences need to be furnished and supplied with household equipment which will become waste after the service life of the products. The consumption expenditure for furniture and household textiles; household appliances; glassware and tableware as well as household utensils; tools and equipment (including for the garden where available) has increased by 17% between 2010 and 2019 (last available data)[67], which reflects the increased demand.

This means that a further increase in the generation of construction and demolition waste and waste from household equipment is to be expected.

#### Increase of online trade

Consumers have changed their purchasing habits, increasingly abandoning stationary trade to the benefit of online shopping. E-commerce is the fastest growing retail market segment in Europe[68].

In 2019, the domestic parcel traffic in Europe amounted to roughly 6.5 billion parcels handled, compared to approximately 4.2 billion parcels in 2012[69]. Beside higher amounts of purchased products, the packaging material most often used in online retail is paper and cardboard[70]. This trend is reflected in the rising volumes of paper and cardboard packaging waste, which increased by 15% between 2012 (27.7 million tonnes) and 2018 (31.8 million tonnes)[71].

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[64] Own calculation. Data source: Eurostat, Population change - Demographic balance and crude rates at national level, data retrieved in June 2021

[65] Household composition statistics - Statistics Explained (Eurostat 2021)

[66] https://ec.europa.eu/environment/eussd/pdf/Resource%20efficiency%20in%20the%20building%20sector.pdf, Resource efficiency in the building sector, Ecorys (2014)

[67] Own calculation. Data source: Eurostat, Final consumption expenditure of households by consumption purpose, data retrieved in June 2021

[68] Online Shopping Trends In Europe, Digital Marketing Community 2016

[69] European courier, express and parcels market - statistics & facts, Statista 2021

[70] FachPack 2018: Onlinehandel beschäftigt Verpackungs- und Logistikhersteller https://www.euwid-verpackung.de/news/markt/einzelansicht/Artikel/fachpack-2018-onlinehandel-beschaeftigt-verpackungs-und-logistikhersteller.html, EUWID Verpackung 2018

[71] Data source: Eurostat Packaging waste by management operation, data retrieved in June 2021, Umweltbundesamt.

However, 2020 presented a year of major disruption due to the Covid-19 crisis, with economic growth severely affected across Europe, while online retail increased significantly, in particular during lockdown periods. The impact on the parcel market has been complex, with a decrease in the business-to-business (B2B) segment, and significant increases in the business-to-customer (B2C) segment. Further market growth is expected after 2020[72]. Consequently, the European Paper Packaging Market is expected to increase at an average rate of revenue growth of 4.5% in the next five years (2021 - 2026)[73].

This means that a further increase in the generation of paper and cardboard waste is to be expected.

### Decrease of first-use service life of products

A German study (2015)[74] shows that the average first-use service life of large household appliances declined slightly between 2004 and 2012/2013 from 14.1 to 13.0 years. Almost one third of the replaced large household appliance were still functional. In 2012/2013, the proportion of devices replaced due to a desire for a better device, although the old device was still fully functional, was 30.5% of the total product replacements.

Smartphones, TV sets, vacuum cleaners and washing machines are rarely used until they reach their designed service life end[75].

The decrease of first-use service life of products will contribute to a further increase of waste from electrical and electronic equipment.

### Upgrade of technical infrastructure at households

Available data show that the number of EEE items used per household has increased[76]. The main reasons are increasing household incomes in combination with consumption trends (fashion, status symbols, the wish to possess a better device etc.) triggered by intensive sales promotion and increased availability via online sales platforms. In 2017 on average, EU households spent 5% of their total expenditure on electrical and electronic products[77]. To possess at least one washing machine, refrigerator, cooking device or TV per household is quite common in the EU. However, there are other types of household devices, such as dishwashers and washer dryers, where the market is not yet saturated.

The demand for new appliances equipped with rechargeable batteries, such as cleaning robots, mowing robots, drones etc. has increased significantly in recent years. The highest sales figures are achieved by household robots. These include vacuum-cleaners and floor

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[72] European Parcels Market Insight Report 2020 - Apex Insight (apex-insight.com)

[73] Europe Paper Packaging Market | Growth, Trends, Forecasts (2020 - 2025), Mordor Intelligence

[74] https://www.umweltbundesamt.de/en/publikationen/einfluss-der-nutzungsdauer-von-produkten-auf-ihre-1, Umweltbundesamt 2016

[75] Electronics and obsolescence in a circular economy, Eionet Report - ETC/WMGE 2020/3

[76] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Waste_statistics_-_electrical_and_electronic_equipment

[77] Household composition statistics - Statistics Explained (Eurostat 2021)

cleaning robots, lawn mower robots and entertainment robots. At the same time, in the two main segments - vacuum-cleaner robots and toy robots, unit prices have been decreasing for years.[78]

The upgrade of the technical infrastructure in households will contribute to a further increase of waste from electrical and electronic equipment as well as from batteries and accumulators.

### Status symbol and living standards

Products that become status symbols range from handbags to vehicles and homes. Status symbols are key drivers for consumption at special events such weddings[79] and investments such as cars[80]. Especially among young people, the car is losing its role as a status symbol[81]. The car has moved down in hierarchy of staging[82]. In contrast to cars, items that gain more attraction are mobile phones. Drivers are changing lifestyles including mobility, work, social life and news consumption.

Next to status symbol, income and living standards play a significant role for consumption and waste production. The World Bank found that global per capita waste generation ranges from 0.11 to 4.54 kg per day[83]. Next, the World Bank found a “positive correlation between waste generation and income level”. High-income countries cover only 16% of the global population but generate about 34% of entire municipal solid waste.

This means that the change of status symbols effects the decrease/increase of specific waste flows and the level of living standards, especially in transition countries, where likely more waste will be produced than today.

## 2.2.3.5 Drivers effected by changes in prices and costs

### Decreasing prices for consumer products

Increased affordability and cheaper prices of many consumer products, like textiles, WEEE, and toys, are often associated with lower product quality, and reduced durability of these products. Final consumption expenditure of households (incl. clothing and footwear), reported by Eurostat, shows that the share of these product categories, compared to the

[78] https://computerwelt.at/news/service-roboter-boom-verkaufszahlen-steigen-weltweit-um-32-prozent/#:~:text=Dazu%20geh%C3%B6ren%20Staubsauger%2D%20und%20Bodenreinigungsroboter,auf%205%2C7%20Milliarden%20Dollar

[79] Mann, B., Sahni, S.K. (2015). Exploring the Drivers of Status Consumption for the Wedding Occasion. International Journal of Market Research 57(2):179-202. https://doi.org/10.2501%2FIJMR-2015-017.

[80] Barth, L. (2017). Cars as status symbols. https://www.consumerreports.org/cro/news/2007/12/cars-as-status-symbols/index.htm

[81] World Bank. Trends in Solid Waste Management. https://www.handelsblatt.com/auto/nachrichten/auto-als-statussymbol-so-beliebt-wie-eine-waschmaschine/3655496.html

[82] https://www.zukunftsinstitut.de/artikel/statussymbol-auto-interview/

[83] https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html

total household expenditure, has decreased by 10% over the past 10 years[84]. At the same time, the prices e.g. of clothing has risen at a slower pace (+3% in the period 1996-2012), compared to the total harmonized indices of consumer prices (+60 %). E.g., this indicates a drop in the cost of clothing by about 36%, relative to the aggregate consumption basket of EU consumers[85]. The drop in prices is a result of a dramatic shift of clothing production being moved from Europe to mainly Asia. Today, 87% of clothing consumption in Europe is imported from countries where production is based on low costs with respect to both, primary materials and production processes, pushing down total price levels. This effects the quality of products and hampers reuse and repair activities resulting in an increase of waste generation.

#### Higher cost of repair and refurbishment compared with new purchases

In the majority of the EU Member States, transport and labour costs are high, making any significant repair and refurbishment expensive. One of the top ranked arguments not preparing products was the high price of repair, followed by the preference to get a new product and the feeling that the old product was obsolete or out of fashion[86]. Consequently, new products might be more convenient for consumers than second-hand ones, showing higher waste generation throughout the entire product chain.

Nevertheless, there are examples where success is feasible, e.g. showing that repair activities are taken up to higher extend throughout the years, e.g. in Germany, the number of large household appliances replaced within the first five years of their service due to a defect increased from 3.5 % in 2004 to 8.3 % in 2013[87].

### 2.2.3.6 Drivers affected by changes in waste management and wastewater management practices

#### Strengthening source-separation and separate collection of recyclable waste streams

Separate collection of recyclable waste fractions increased significantly in the last decades, resulting in increasing amounts in the respective waste streams, such as source separated plastic waste, paper and cardboard waste, metal waste and glass waste.

Separate collection of specific waste streams will further increase until 2035, stipulated by European waste legislation[88] requiring Member States to introduce or increase the separate collection of specific waste streams, and/or to achieve higher recycling targets.

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[84] Eurostat. Final consumption expenditure of households by consumption purpose (COICOP 3 digit) https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_co3_p3&lang=en

[85] EEA (2014) Environmental indicator report 2014. Environmental impacts of production-consumption systems in Europe.

[86] European Parliament (2019): Briefing Paper on consumers and repair of products.

[87] https://www.umweltbundesamt.de/en/publikationen/einfluss-der-nutzungsdauer-von-produkten-auf-ihre-1

[88] Directive 2008/98/EC on waste, Directive 94/62/EC on packaging and packaging waste, Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment, Directive 2012/19/EU

This means that a further increase of the amounts of recyclable waste streams is to be expected.

### Reducing the amount of municipal waste being landfilled and increasing pre-treatment and recovery

In the EU-27, the generation of municipal waste (both in terms of total amounts and kg/capita) has been increasing since 2004. However, the amount of municipal waste being landfilled has been decreasing[89]. This trend has been driven, on one hand, by the recycling targets defined in European Waste Legislation, and on the other, by the legal provisions of the Landfill Directive[90] aiming at reducing the landfilling of municipal waste[91,92].

In order to meet these targets, preparatory waste treatment must be performed, by which secondary waste is generated.

This means that a further increase in the generation of secondary waste from the waste management sector is to be expected.

### Improving wastewater treatment

Collection and treatment of urban wastewater has improved over the last decade in the EU, with compliance rates of 95% for collection, 88% for secondary (biological) treatment, and 86% for enhanced treatment (removal of phosphorus and nitrogen[93]), resulting in increasing waste amounts from wastewater treatment.

Still, an amount of urban wastewater corresponding to 6.6 million population equivalents (1%) is not collected, over 37 million population equivalents (6%) of the wastewater collected are not sufficiently treated to meet secondary treatment standards, while nearly 32 million population equivalents (8%) do not meet the enhanced wastewater treatment standards. Improvement of wastewater treatment is needed in some Member States to comply fully with Articles 3, 4 and 5 of the Urban Wastewater Directive[94].

Along with pollutant discharge from urban wastewater treatment, industrial pollutant release to water bodies is another pressure element for European waters. Direct pollutant

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on waste electrical and electronic equipment (WEEE), Directive 2000/53/EC on end-of-life vehicles, Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators

[89] Report on the implementation of EU waste legislation, including the early warning report for Member States at risk of missing the 2020 preparation for reuse/recycling target on municipal waste, COM(2018) 656 final

[90] Directive 1999/31/EC on the landfill of waste

[91] Article 5(2) of the Landfill Directive obliges Member States to reduce landfilling of municipal biodegradable waste to a maximum of 75 % by 2006, 50 % by 2009 and 35 % by 2016, compared to a 1995 baseline.

[92] Article 5(5) of the revised Landfill Directive (Directive (EU) 2018/85042) requires Member States to reduce the landfilling of municipal waste to a maximum of 10 % by 2035, and it introduces a ban on the landfilling of separately collected waste, including biodegradable waste.

[93] Tenth report on the implementation status and programmes for implementation (as required by Article 17 of Council Directive 91/271/EEC, concerning urban waste water treatment), COM(2020) 492 final

[94] Council Directive concerning urban waste water treatment (91/271/EEC)

releases to water from industrial activities (by mass) have decreased.[95] Efforts towards improving wastewater treatment will increase in the future, as indicated in the EU Action Plan 'Towards Zero Pollution for Air, Water and Soil'[96].

This means that a further increase in the waste generation from urban and industrial wastewater treatment is to be expected.

#### 2.2.3.7 Drivers which can be influenced by waste prevention measures

Table 2-3 summarises the main drivers for a waste generation increase, and indicates those which can be influenced by waste prevention measures.

**Table 2-3: Main drivers for the increase of waste generation identified throughout the analysis**

| | Driver can be influenced by waste prevention measures (yes/no) | |
|---|---|---|
| | yes | no |
| **Drivers affected by the EU climate ambition for 2030 and 2050** | | |
| Shift to sustainable and smart mobility | x | |
| Shift to renewable energy production | x | |
| Energy efficiency and renovation demand of buildings | x | |
| **Drivers affected by changes in product design** | | |
| Decreased service life of products (low durability, reparability, reusability) | x | |
| Rapid changing of clothing lines and fashion trends | x | |
| Poor quality of products | x | |
| **Drivers affected by changes in life style** | | |
| Decrease of average household size | | x |
| Increase of online trade | x | |
| Decrease of first-use service life of products | x | |
| Upgrade of technical infrastructure at households | x | |
| Status symbol and living standards | | x |
| **Drivers affected by changes in prices and costs** | | |
| Decreasing prices for consumer products | | x |
| Higher costs for repair and refurbishment compared with new purchases | x | |
| **Drivers affected by changes in waste and wastewater management** | | |
| Strengthening source-separation and separate collection | | x |
| Reducing the amount of municipal waste being landfilled | | x |
| Improving wastewater treatment | | x |

### 2.2.4 Stakeholder involvement

Identifying relevant stakeholders is an important step within the problem definition (see Better Regulation Toolbox #14[97]) to help target the consultation and prepare the analysis of

[95] Industrial waste water treatment - pressures on Europe's environment, EEA 2018
[96] the EU Action Plan 'Towards Zero Pollution for Air, Water and Soil', COM(2021) 400 final
[97] https://ec.europa.eu/info/sites/default/files/file_import/better-regulation-toolbox-14_en_0.pdf

problem drivers. The stakeholder list identified within the project covers stakeholders who are affected by the problem and those whose behaviour causes it (see stakeholder list in Appendix **Error! Reference source not found.**), they comprise:

- Industrial representatives (associations and companies) covering consumer and producer organisations
- NGOs
- Representatives from the European Commission and the European Environmental Agency
- Member State's representatives (environmental ministries and agencies)

The list was identified taking into account the whole value chain of product/waste streams as well as the different types of product/waste covered by the analysis.

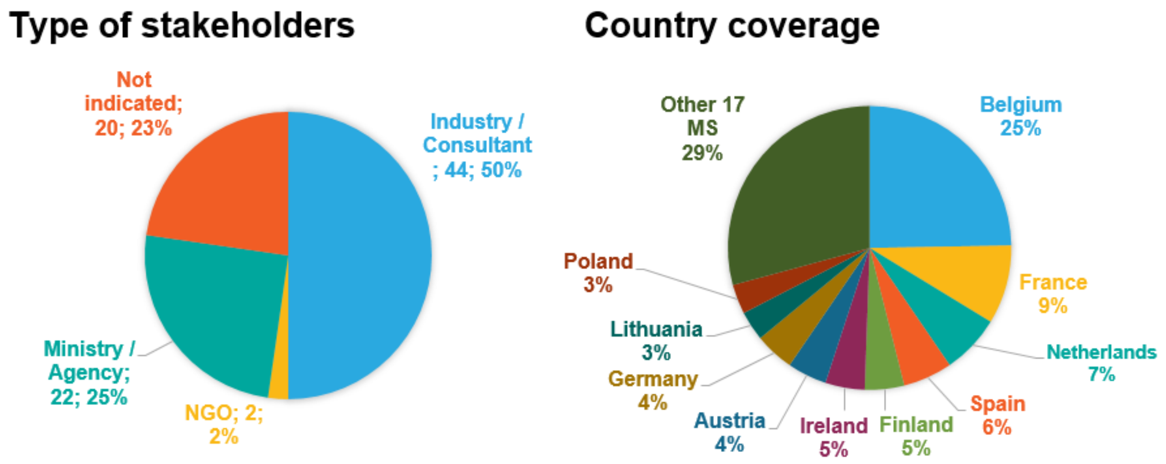
The stakeholders were involved in the process via stakeholder workshops and a written consultation:

- 1st stakeholder workshop: 9 March 2021
- Written consultation: Duration from 1 August to 20 September 2021
- 2nd stakeholder workshop: 20 September 2021

The 1st workshop held in March 2021 specifically aimed to present the preliminary findings from the analysis on the problem definition, including the data on waste generation by specific waste streams.

The template for the written consultation is provided in Appendix 0. Figure 2-9 gives an overview on the type of stakeholders participating in the written consultation including their country coverage.

**Figure 2-9: Overview on stakeholder participation in the written consultation**




Results from the written consultation were taken up for the assessment of Task2 and Task3. Figure 2-13 in chapter 2.3 provides an overview which waste streams the stakeholders ranked highest according to the need for further EU level intervention.

The 2nd workshop held in September 2021 specifically aimed to present the preliminary findings on the identification of best practice examples on waste prevention measures which have potential for EU-wide uptake.

### 2.2.5 Key waste streams benefiting from EU waste prevention measures

The business-as-usual (BAU) scenario (baseline scenario) describes the projected situation of waste generation out to 2035, if no additional waste prevention measures are taken on the categorised waste streams. The BAU scenario was developed on the basis of an analysis of past waste generation trends (cf. chapters 2.2.1.1 and 2.2.1.2) as well as future waste generation projections considering projected development of GDP and population (cf. chapter 2.2.1.3) and the effects of analysed drivers identified in chapter 2.2.3.

Trends and projections are presented in detail in the Appendix A.1.1, including information on the composition of the waste stream, whether it is hazardous or non-hazardous as well as information on the sources of waste generation (economic activities, or households).

For all waste streams, an overview of past and projected waste generation (quantity in tonnes), and trends in past and projected waste generation (increase/decrease in %, from 2004 – 2018, and from 2018 – 2035) is provided (see Appendix A.1.2 as done for all categorised ESTAT waste streams).

#### Stepwise approach

1) In order to identify the key waste streams that would benefit most from targeted EU level action on waste prevention, problematic waste streams (with regards to the problem definition cf. chapter 2.2.1, results cf. chapter 2.2.1.5) were assessed in terms of their magnitude and EU dimension of the problem (cf. chapter 2.2.2).
2) Waste streams which are relevant in terms of the magnitude and EU dimension of the problem were further assessed to consider whether the drivers for waste generation could be influenced by waste prevention measures. By this means, candidate waste streams for waste prevention measures at the EU level were identified. Those waste streams are subject to assessment carried out in Task2 (see chapter 3.0) and Task 3 (see chapter 4.0) of the study.

In Figure 2-10, the steps of waste stream analysis are shown, in relation to the number of waste streams addressed within the steps (cf. also chapter 2.2.1 to 2.2.3).

### Figure 2-10: Steps conducted to identify key waste streams which benefit most from targeted EU level waste prevention action

**Problem identification:**
**Establish what the problem is and why is it problematic**

31 ESTAT waste streams + total waste
(full coverage of waste generated in EU-27)

- ➔ **20 ESTAT waste streams for which a problem was identified**
- ➔ **11 ESTAT waste streams not indicated to be problematic (see chapter 2.2.1)**

↓

**Magnitude and EU dimension of the problem**

20 ESTAT waste streams for which a problem was identified

- ➔ **15 ESTAT waste streams relevant with regard to magnitude and EU dimension**
- ➔ **5 ESTAT waste streams not relevant with regard to magnitude and EU dimension (see chapter 2.2.2)**

↓

**Problem evolvement with no new EU interventions**

15 ESTAT waste streams plus "municipal waste" and "waste from renewable energy infrastructure" having magnitude and EU dimension (see chapter A.1.3)

- ➔ **9 ESTAT waste streams plus "municipal waste"* which may benefit from additional EU-wide prevention measures**
- ➔ **6 ESTAT waste streams plus "waste from renewable energy infrastructure"* which do not benefit from additional EU-wide prevention measures**

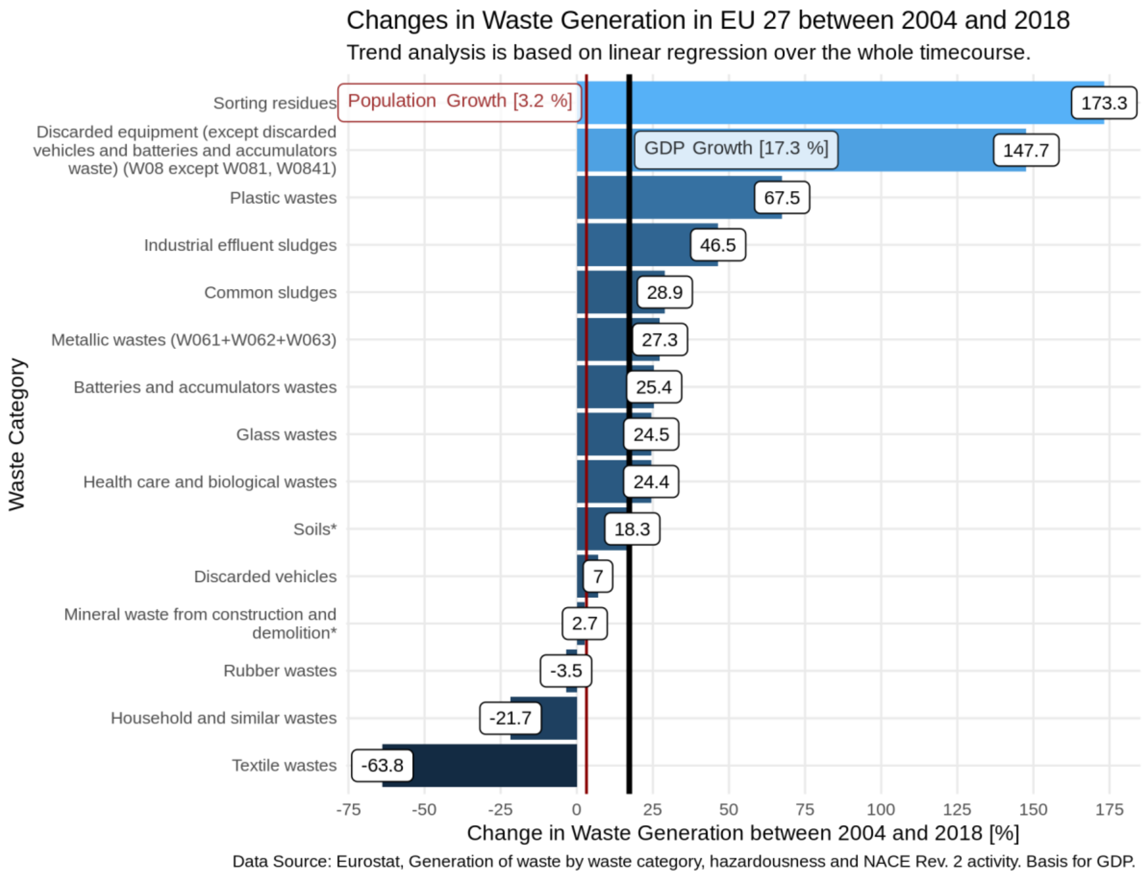
*Source: Umweltbundesamt*

** "Municipal waste" and "Waste from renewable energy infrastructure" were analysed in addition to the ESTAT waste streams as requested by the ToR. Those two waste streams comprise specific amounts of other analysed ESTAT waste streams.*

#### 2.2.5.1 BAU scenario for waste streams which fulfil the criteria of the problem definition and are relevant in terms of magnitude and EU dimension

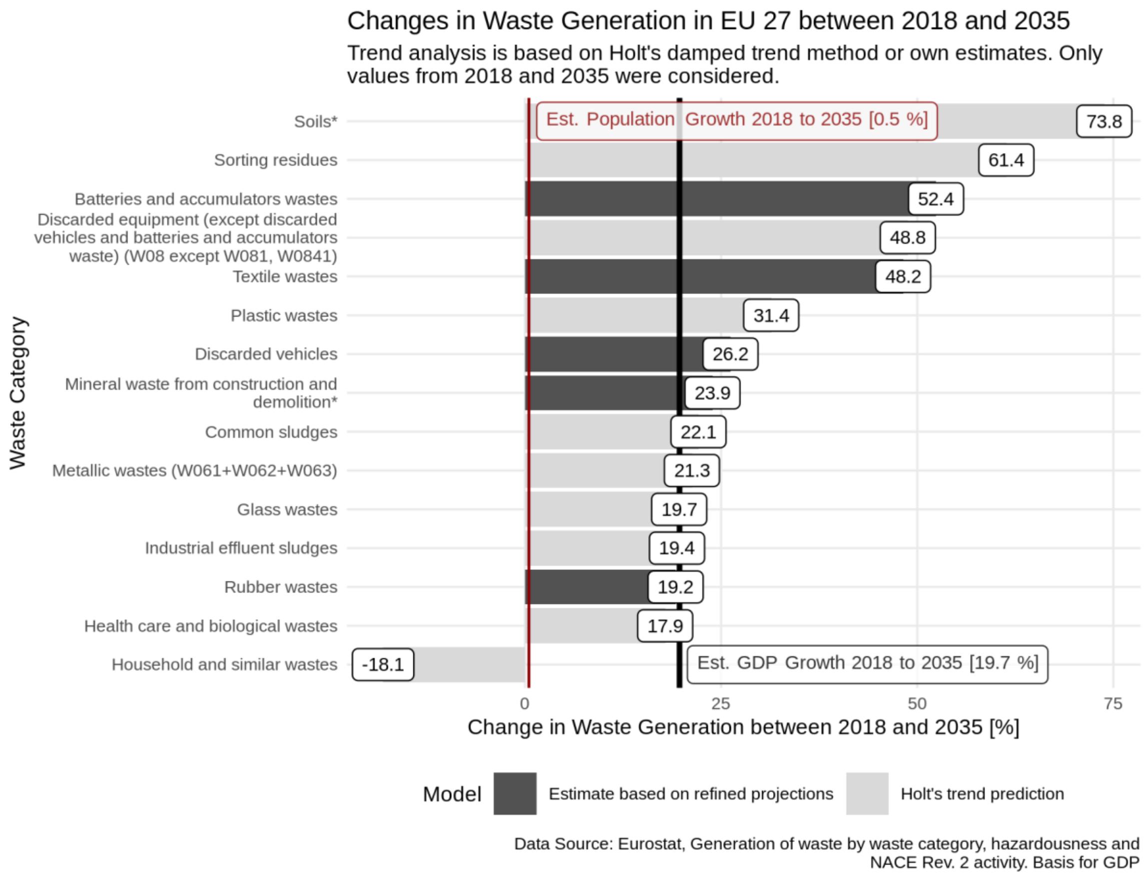
An overview for the analysed 15 ESTAT waste streams on the trends of past and projected waste generation (increase/decrease in %, from 2004 – 2018 and from 2018 – 2035) is provided in the following two figures.

**Figure 2-11: Past trends on waste generation 2004-2018 for 15 relevant ESTAT waste streams (see Appendix for detailed trend analysis)**




*Source: Eurostat and Umweltbundesamt*

## Figure 2-12 Future trends on waste generation 2018-2035 for 15 relevant ESTAT waste streams (see Appendix for detailed trend analysis)




*Source: Eurostat and Umweltbundesamt*

For those problematic waste streams relevant in terms of magnitude and EU dimension, a summary of the assessment of waste generation trends and of related drivers is provided (see Appendix A.1.3 as done for 15 ESTAT waste streams plus “municipal waste” and “waste from renewable energy infrastructure”).

The chapter summarises the results out of the assessment for:

- waste streams which fulfil the criteria of the problem definition, relevant in terms of magnitude and EU dimension of the problem
- waste streams which fulfil the criteria of the problem, not being relevant in terms of magnitude and EU dimension of the problem
- waste streams, for which no problem was identified in terms of their past and future trends of waste generation

The assessment applied on the 15 ESTAT waste streams (cf. Appendix A.1.3) resulted in the following summary table:

## Table 2-4 Identified ESTAT waste streams which may benefit from additional EU-wide prevention measures

| ESTAT waste streams | Identified to benefit from additional EU-wide prevention measures | Uptake for further assessment within the study |
|---|---|---|
| **Municipal waste (including household and similar waste)** | Yes | **Municipal waste**<br>→ Including household and similar waste (residual municipal solid waste)<br>→ Including non-packaging metallic, plastics and glass waste from households<br>→ Excluding packaging waste and food waste |
| **Textile waste** | Yes | **Textile waste** |
| **Discarded vehicles (including ELV)** | Yes | **End-of-Life vehicles according to Directive 2000/53/EC** |
| **Discarded equipment (including WEEE)** | Yes | **Waste from electrical and electronic equipment (WEEE) according to Directive 2012/19/EU** |
| **Rubber waste (including end-of-life tyres)** | Yes | **End-of-Life tyres** |
| **Mineral waste from construction and demolition and soils** | Yes | **Construction and demolition waste**<br>→ Mineral C&D waste<br>→ Soils<br>→ Including non-packaging metallic, plastics and glass waste from C&D activities |
| **Plastic waste** | Yes, sub-fractions in other waste streams | See above |
| **Metallic waste** | Yes, sub-fractions in other waste streams | See above |
| **Glass waste** | Yes, sub-fractions in other waste streams | See above |

| ESTAT waste streams | Identified to benefit from additional EU-wide prevention measures | Uptake for further assessment within the study |
|---|---|---|
| **Batteries and accumulators waste, Common sludges, Health care and biological waste, Industrial effluent sludges, Sorting residues, Waste from renewable energy infrastructure** | No | Not relevant |

The identified six waste streams “municipal waste”, “textile waste”, “end-of-life vehicles (ELV)”, “waste from electrical and electronic equipment (WEEE)”, “end-of-life tyres” and “construction and demolition waste” were subject to assessment carried out in Task2 (see chapter 3) and Task 3 (see chapter 4) of the study.

“Batteries and accumulators waste”, “common sludges”, “health care and biological waste”, “industrial effluent sludges”, “sorting residues” and “waste from renewable energy infrastructure” were excluded from further assessment based on the concluding summary taken on those waste streams (cf. Appendix A.1.3).

#### 2.2.5.2 BAU scenario for Waste streams which fulfill the criteria of the problem definition, but are not relevant in terms of magnitude and EU dimension

The 5 ESTAT waste streams indicated in Table 2-5 are not relevant in terms of magnitude and EU dimensions. They show lower quantities (each lower than 100 million tonnes) based on the assessment they may not benefit from EU wide measures (see chapter 2.2.2).

**Table 2-5 Waste streams identified being not relevant for further assessment within the study – Part 1**

| | 2004 | 2010 | 2018 | 2035 | Past trend | Trend 2018 - 2035 (linear trend model) | Remark |
|---|---|---|---|---|---|---|---|
| **Vegetal waste** | Not reported | 44,750,000 | 52,150,000 | 80,343,341 | +34.3% (2010-2018) | +54.1% | *Medium EU Dimension of concerned Member States, Medium magnitude in terms of generated waste volumes* |

| | 2004 | 2010 | 2018 | 2035 | Past trend | Trend 2018 - 2035 (linear trend model) | Remark |
|---|---|---|---|---|---|---|---|
| **Dredging spoils** | 34.060.000 | 58,910,000 | 76,870,000 | 110,461,796 | +134.6% (2004-2018) | +43.7% | *Low EU Dimension of concerned Member States, Medium magnitude in terms of generated waste volumes* |
| **Mineral waste from waste treatment and stabilised waste** | Not reported | 33,920,000 | 45,760,000 | 64,327,743 | +36.2% (2010-2018) | +40.6% | *Medium EU Dimension of concerned Member States, Medium magnitude in terms of generated waste volumes* |
| **Sludges and liquid waste from waste treatment** | Not reported | 4,870,000 | 8,700,000 | 10,180,000 | +100.5% (2010-2018) | +98.7% | *Medium EU Dimension of concerned Member States, Low magnitude in terms of generated waste volumes* |
| **Chemical waste** | 28,000,000 | 17,080,000 | 17,530,000 | 25,468,278 | -53.8% (2004-2018) | +45.3% | *Medium EU Dimension of concerned Member States, Low magnitude in terms of generated waste volumes* |

The five waste streams accounted for 8.6 % of the total waste generation in 2018. For more details on the specific waste streams please see Appendix A.1.2 to this study. Those waste streams will not be pursued further in this study.

### 2.2.5.3 Waste streams identified being not problematic in the context of the problem definition of this study specifically in terms of their past and future trends in waste generation

The following 11 ESTAT waste streams do not meet one of the criteria (see chapter 2.2.1):

- strong absolute increase in the past ( >1.5% annually) and/or

- no decoupling of waste generation from development of GDP in the past years and/or
- a projected strong absolute increase (>1.5% annually) up to 2035

### Table 2-6 Waste streams identified being not relevant for further assessment within the study – Part 2

| | 2004 | 2010 | 2018 | 2035 | Past trend | Trend 2018 - 2035 (linear trend model) |
|---|---|---|---|---|---|---|
| **Paper and cardboard waste** | 43,620,000 | 42,620,000 | 42,830,000 | 39,712,488 | -9.5% (2004-2018) | -7.3% |
| **Wood waste** | 62,790,000 | 56,200,000 | 48,830,000 | 39,533,622 | -29.3% (2004-2018) | -19.0% |
| **Mixed and undifferentiated materials** | 34,330,000 | 42,420,000 | 38,280,000 | 42,203,471 | +11.9% (2004-2018) | +10.2% |
| **Animal and mixed food waste** | Not reported | 22,940,000 | 22,520,000 | 20,952,222 | -7.1% (2010-2018) | -7.0% |
| **Animal faeces, urine and manure** | 33,260,000 | 12,440,000 | 12,970,000 | 6,719,500 | -76.2% (2004-2018) | -48.2% |
| **Acid, alkaline or saline waste** | 6,710,000 | 5,790,000 | 5,680,000 | 5,095,736 | -22.7% (2004-2018) | -10.3% |
| **Used oils** | 3,780,000 | 3,560,000 | 3,940,000 | 3,918,141 | -6.4% (2004-2018) | -0.6% |
| **Spent solvents** | 2,500,000 | 2,740,000 | 2,170,000 | 1,944,878 | -16.9% (2004-2018) | -10.4% |
| **Waste containing PCB** | 50,000 | 60,000 | 40,000 | Phased out | -40.6% (2004-2018) | Phased out |
| **Combustion waste** | 150,610,000 | 118,350,000 | 113,030,000 | 83,763,942 | -29.4% (2004-2018) | -25.9% |
| **Other mineral waste** | Not reported | 734,980,000 | 676,120,000 | 767,313,739 | -8.3% (2010-2018) | +13.5% |

The eleven waste streams accounted for 41.3% of total waste generation in 2018. For more details on the specific waste streams please see Appendix A.1.2 to this study. Those waste streams will not be pursued further in this study.

## 2.3 Conclusions

The results of the analysis performed for the problem definition are based on the assessment of the magnitude and EU dimension of the problem and the assessment of the extent to which the drivers for waste generation can be influenced. In consequence the BAU scenario for the different waste streams were established allowing to identify key waste streams that would benefit most from targeted EU level action to facilitate waste prevention.

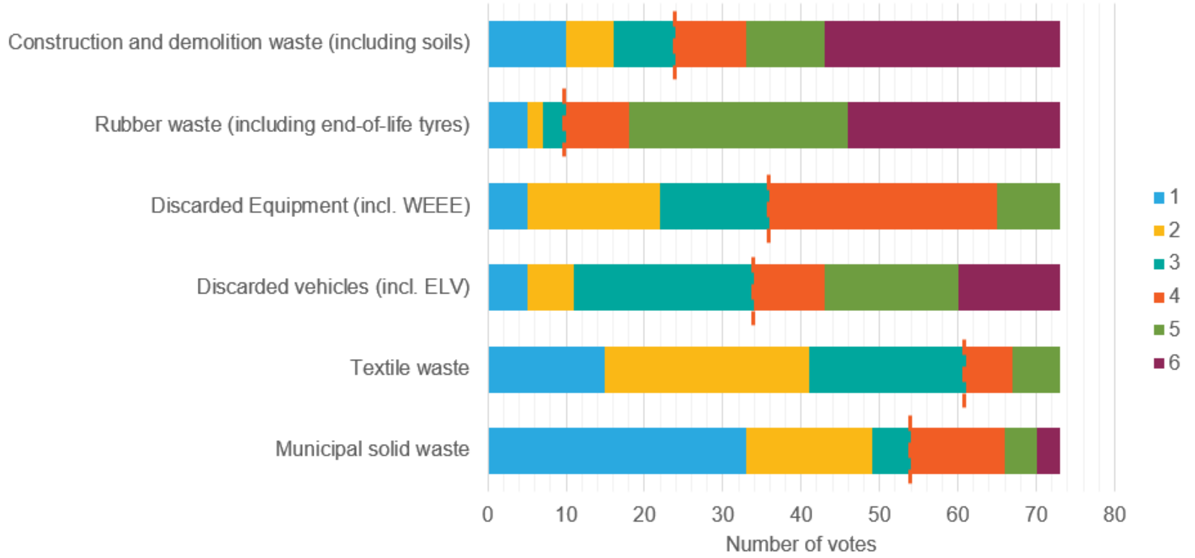
The identified waste streams are (see also summary table in chapter 2.2.5.1):

- Municipal solid waste
  - → Including household and similar waste (residual municipal solid waste)
  - → Including non-packaging metallic, plastics and glass waste from households
  - → Excluding packaging waste and food waste
- Textile waste
- Discarded vehicles
  - → End-of-Life vehicles according to Directive 2000/53/EC
- Discarded equipment
  - → Waste from electrical and electronic equipment (WEEE) according to Directive 2012/19/EU
- Rubber waste
  - → End-of-Life tyres
- Construction and demolition waste
  - → Mineral C&D waste
  - → Soils
  - → Including non-packaging metallic, plastics and glass waste from C&D activities

The identified waste streams were fed into the written consultation process asking for related best practice examples (see chapter 4.0), key barriers to and opportunities for increasing their waste prevention (see chapter 3.0). The identified waste streams were ranked by the stakeholders as shown in Figure 2-13, according to their need for EU level waste prevention measures: 1 = highest need, 6 = lowest need. Note: packaging waste and food waste is out of scope of this study. Regarding the number of times stakeholders ranked them amongst the top 3 priorities, the following can be summarised: textile waste was given highest priority, followed by municipal solid waste and discarded equipment (including WEEE).

The stakeholder list and information who voted on the waste streams can be found in Appendix **Error! Reference source not found.**.

## Figure 2-13 Need for EU level measures – stakeholder view




*Need for EU level waste prevention measures: 1 = highest need, 6 = lowest need.*

# 3.0 Main barriers to and opportunities for increasing waste prevention (Task 2)

## 3.1 Purpose of the task

The purpose of this task was to identify the main opportunities for, and barriers to, scaling up waste prevention activities (including legislative measures and consumer behaviour) that could be applied within EU Member States and at EU level in future.

## 3.2 Methodology

**Task 2 consisted of two steps:**

1) The first step was to collect evidence of barriers to, and opportunities for, implementing measures for different waste streams and related product categories. This was done by undertaking a literature review and assessing the evidence in respect of several **approaches** that can promote waste prevention, including **extending product life-time through product design, repair, reuse, remanufacturing, and circular business models.**

   The stocktaking exercise and the findings of the literature review revealed a number of socio- economic barriers and opportunities.

   The findings were fed into the stakeholder consultation, the aim of which was to gather input and feedback on the completeness and relevance of the findings. Feedback from the stakeholders was taken into account when further exploring the opportunities and barriers (see stakeholder involvement in Appendix 0).
2) The second step consisted of **identifying and analysing shortcomings in the current legal provisions and policies in light of the evolution of the broader policy landscape**.
   To identify the shortcomings, this step mapped the current and envisaged legal provisions and benchmarked it against the waste prevention approaches indicated above. The identified shortcomings were reviewed in the light of the socio, economic, logistical and technological barriers and opportunities from step 1.

The analysis was carried out for those waste streams which were identified in the problem definition of chapter 2.3, namely: end-of-life tyres, end-of-life vehicles, construction and demolition waste, textile waste, waste electrical and electronic equipment and municipal solid waste.

In the following paragraph, an introduction is provided on the waste prevention approaches considered to perform the two steps as of above. The results of these two steps are presented in chapter 3.3.

### Waste prevention approaches in a circular economy

Waste prevention encompasses all actions that prevent products, substances or materials from becoming waste. Waste prevention can be achieved in several ways, including:

1) Extended product lifetime through product design
2) Repair
3) Reuse
4) Remanufacturing
5) Circular business models

One first, important approach to preventing waste generation is to **improve product design** to enable product life extension**.** Products can be designed to last longer or to be easily repaired or remanufactured. This makes products possible to remain in the economy for longer, which can, in turn, decrease the volume of discarded products and thus decrease the generation of waste. For instance, promoting repair is an important approach to increasing waste prevention but, without proper design requirements to make products repairable, the promotion of repairs alone would not be sufficient.

**Repair** includes operations for fixing broken or faulty parts so that the improved version can be used with the product´s original function[98], as well as making "cosmetic" changes to the appearance of a product, such as cleaning, changing the fabric, painting or refinishing[99]. Current product design either does not allow easy repair (e.g., products with many components glued or sealed together) for products such as EEE[100], or requires broad skills to be able to repair many brands and keep up, e.g., with vehicle technology[101], or manual skills which might not always be available (e.g., to repair clothes or shoes)[102]. In addition, in many parts of the EU, transport and labour costs for electronics, furniture and textiles are high, making any significant repair and refurbishment costly. Particularly in those cases where the cost of new products is low relative to the cost of labour, repair is often not profitable, such as in the case of textiles[103]. In general, economies of scale and economic incentives are needed to make repair and refurbishment viable[104].

**Reuse** means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived[105], whereas **preparing for reuse** means "checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused

[98] J. Potting, M. Hekkert, E. Worrell and A. Hanemaaijer (2017). "Circular Economy: Measuring innovation in the product chain," PBL Netherlands Environmental Assessment Agency, The Hague)
[99] EMF (2013). Towards the circular economy, Ellen MacArthur Foundation, Cowes, United Kingdom.
[100] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019
[101] 2020 Challenges For Independent Auto Repair Shops & Technicians (automotiveresearch.com)
[102] Eionet Report (2019). Textiles and the environment in a circular economy.- ETC/WMGE 2019/6
[103] EMF (2017 b). Ellen MacArthur Foundation. A new textiles economy: Redesigning fashion's future. http://www.ellenmacarthurfoundation.org/publications).
[104] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019
[105] J. Potting, M. Hekkert, E. Worrell and A. Hanemaaijer (2017). "Circular Economy: Measuring innovation in the product chain," PBL Netherlands Environmental Assessment Agency, The Hague)

without any other pre-processing”[106]. This distinction is important because preparing for reuse belongs to the realm of waste management (facilities, infrastructures and collection procedures), whereas reuse is part of waste prevention. Reuse includes different Consumer-to-Consumer and Business-to-Consumer (C2C and B2C) activities, including individual sales at flea markets and online.

**Remanufacturing** is a comprehensive and rigorous industrial process by which a previously sold, worn, or non-functional product or component is returned to a "like-new" or "better-than-new" condition and warranted in performance level and quality[107]. This process includes a quality assurance procedure and potential enhancements or changes to the components[108] [109]. The structure of the remanufacturing sector is mainly determined by industrial players and durable capital goods, and activities to promote remanufacturing are currently undertaken on a sector-by-sector basis, especially in the aerospace, automotive, heavy duty and off-road (HDOR) equipment, EEE, machinery and medical equipment, and on smaller sectors such as (office) furniture, rail (rolling stock) and marine sectors. Remanufacturing is an undervalued part of the industrial landscape and an underestimated sustainable industry (EC, 2019)[110]. Often confused in the literature and common understanding, remanufacturing is not the same as "recycling" or "repairing”.

Innovative, **circular business models** can also contribute to waste prevention. These include, for instance, **sharing** and **leasing**, to promote the more intensive use of otherwise under-utilised consumer assets. Prominent examples of sharing economy business models often cited in the literature are Airbnb, Uber, Car-to-Go, where private owners can share their assets (such as houses) with others for a payment. **The sharing and collaborative economy** also offers an opportunity for the same product (such as EEE, clothes, books, toys, home appliances such as drills, etc.) to be utilised by many users. In a broad sense, it is possible to share anything, to which access is enabled by pooling resources, products or services. In redistribution markets, peer-to-peer matching or social networks allow re-ownership’ of a product through different modalities (reselling, donating, borrowing, etc.)[111]. New CE business models of the ‘performance economy’ such as **Product-Service Systems (PSS**), which promote the leasing of products, services or performance instead of direct consumer

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[106] European Parliament (2008). DIRECTIVE 2008/98/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 19 November 2008 on waste and repealing certain Directives (Waste Framework Directive). https://eur-lex.europa.eu

[107] Remanufacturing Industries Council. Available at: What is Remanufacturing? (remancouncil.org), last retrieved on 29.10.2021

[108] EEA (2018). Waste prevention in Europe: policies, status and trends in reuse in 2017

[109] J. Potting, M. Hekkert, E. Worrell and A. Hanemaaijer (2017). “Circular Economy: Measuring innovation in the product chain,” PBL Netherlands Environmental Assessment Agency, The Hague)

[110] EC (2019) Study: Methodology for the reporting of reuse of products and rules for the reporting of reusable packaging Final Report.

[111] Adapting to the Sharing Economy Magazine: Winter 2015 – MIT SLOAN Management Review Thiago Gonzalo Gonzales Wong. Available at: Adapting_to_the_Sharing_Economy-with-cover-page-v2.pdf (d1wqtxts1xzle7.cloudfront.net)

ownership, could facilitate high-value retention options. PSS typically combine a physical product with a service component while ownership remains with the supplier[112] PSS can be transformative and positively contribute to waste prevention, if producers and suppliers move from selling goods to providing services, and in this way decrease their own and their consumers' environmental and carbon footprint by keeping products in use for longer and making the same product 'cascade' from one use to the next via multiple consumers[113,114]. It can be argued that PSS can also help counter the effects of economic obsolescence (if the costs of repair are comparable to a new device), since consumers have access to a function rather than owning the products. However, PSSs need to ensure that products effectively cascade from one use to the next and are kept in use for as long as possible in order to make a significant contribution to waste prevention[115]. In addition, there are many product categories where PSSs are not commonly used, and uncertainties about how to move from product to service selling make many producers reluctant to adopt PSSs[116].

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[112] OECD (2019). "Business Models for the Circular Economy - Opportunities and Challenges for Policy," OECD Publishing, Paris, 2019

[113] A. Bartl (2014). Moving from recycling to waste prevention: a review of barriers and enables. Waste Management & Research 2014, Vol. 32(9)

[114] R. Antikainen, R. Baudry, A. Gössnitzer, T. Karppinen, M. Kishna, F. Montevecchi, F. Müller and R. Uggla (2021). CIRCULAR BUSINESS MODELS: PRODUCT-SERVICE SYSTEMS ON THE WAY TO. A CIRCULAR ECONOMY. European Network of the Heads of Environment Protection Agencies (EPA Network) - Interest Group on Green and Circular Economy.

[115] I. Oehme, L. Olsson, A. Nissinen, F. Montevecchi, H. Unnerstall, C. Rotzetter (2018). NOTE on Service Life of Products Countering Obsolescence. Discussion paper. European Network of the Heads of Environment Protection Agencies (EPA Network) - Interest group on Green and Circular Economy

[116] R. Antikainen, R. Baudry, A. Gössnitzer, T. Karppinen, M. Kishna, F. Montevecchi, F. Müller and R. Uggla (2021). CIRCULAR BUSINESS MODELS: PRODUCT-SERVICE SYSTEMS ON THE WAY TO. A CIRCULAR ECONOMY. European Network of the Heads of Environment Protection Agencies (EPA Network) - Interest Group on Green and Circular Economy

# 3.3 Identified opportunities and barriers, and legal shortcomings

## 3.3.1 End-of-Life tyres

### 3.3.1.1 EU legal context

Requirements for newly manufactured tyres are specified in the Type-approval requirement Regulation (2019/2144)[117], and in the Tyre Labelling Regulation (EU 2020/740)[118], which provide consumers across Europe with essential labelling information on efficiency, safety, and noise by detailing the tyres' rolling resistance, wet grip, and external rolling noise.[119]

As regards waste tyres, the Directive on the landfill of waste (1999/31/EC)[120] prohibits the acceptance of waste tyres on landfills, and the Directive on end-of-life vehicles (2000/53/EC)[121] requires appropriate storage for used tyres. The Waste Framework Directive also applies to waste tyres with general provisions such as in Article 9 on waste prevention (although it does not specifically address waste tyres).

### 3.3.1.2 Technical, legal and socio-economic barriers and opportunities

#### Design for extended product lifetime

Technical barriers are important for the durability and quality of tyres. Currently, **no formal durability test standards** on the useful life of tyres are **available**. Technical limitations make it difficult to fully model and test the use phase of a tyre, so that, at the moment, it is not possible to guarantee a particular tyre life[122]. An increased life span of a tyre has been found to be the most important criterion in consumers' purchasing decisions[123], and could have a direct impact on waste prevention.

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[117] Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) No 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166

[118] Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009

[119] https://www.etrma.org/key-topics/tyre-regulations/

[120] Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste

[121] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles

[122] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

[123] Including the Commission's own Impact Assessment on the tyre labelling (2008)

A **minimum standard** as a comparative indication of tyre wear rate would be helpful to eliminate some poor-quality new tyres from the EU market[124]. Durability of tyres could be also improved in terms of greater use of more hard-wearing tyre compounds and synthetic oils, for example[125].

Further socio-economic opportunities exist in **raising consumer awareness and improving the annual car inspection** process so tyres are not discarded before they reach the minimum tread depth. This would keep tyres in use for longer, and improve their value for customers[126].

At EU level, the Type-approval requirement Regulation (2019/2144)[127] specifies that the process of adapting the requirements imposed on tyres should ensure that tyre performance is also adapted to the technical progress and to promote the idea that tyres should meet the requirements throughout their life and not be replaced prematurely. However, there are currently no provisions to guarantee minimum durability of tyres. For instance, the Tyre Labelling Regulation (EU 2020/740)[128] currently does not include the tyre abrasion rate which would directly impact waste generation. The Commission is however currently working towards an impact assessment for measures to tackle microplastics from tyres (and other sources). This may well include a tread wear abrasion standard.

### Reuse and repair

Reuse involves the direct sale of a tyre whose tread is still deep enough for safe use[129]. The sale of part-worn tyres concerns tyres which have previously been fitted to another vehicle

[124] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

[125] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

[126] Kieran Campbell-Johnston, Martin Calisto Friant, Kaustubh Thapa, Dirkjan Lakerveld, Walter J.V. Vermeulen (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective, Journal of Cleaner Production, Volume 270, 2020, 122042, ISSN 0959-6526, ttps://doi.org/10.1016/j.jclepro.2020.122042.
(https://www.sciencedirect.com/science/article/pii/S0959652620320898)

[127] Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) No 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166

[128] Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009

[129] Kieran Campbell-Johnston, Martin Calisto Friant, Kaustubh Thapa, Dirkjan Lakerveld, Walter J.V. Vermeulen (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy

which are removed and sold second-hand. Barriers for reuse and repair are mostly socio-economic, so that many ELV car tyres would be perfectly safe for reuse but there is a **lack of regulation and control** over their sale[130] . Also, **part-worn tyres raise safety concerns in consumers due to a lack of knowledge of the tyre history.** Further, there is a very limited market in part-worn tyres due to a **lack of consumer confidence**, although people are happy to buy a used car and not replace the tyres[131]. The statistics show that in the course of repair operations, 25 to 75% of tyres prematurely fail due to mechanical damages to the carcass (punctures and cuts) that require local repair. In most cases, a timely and qualified repairs allow to continue using this tyre. One of the most effective methods to repair automobile tyres that have localized damage is vulcanization[132].

Currently, the Waste Framework Directive sets generic provisions for waste prevention (Article 9) and the adoption of reuse and repair measures, which also apply to waste tyres, but there is no specific legal provision at EU level targeting the reuse and repair of tyres.

### Remanufacturing

A big technical opportunity for remanufacturing tyres relates to the **retreading of tyres**, which includes some standardised industrial operations to recoat used tyres to prolong their usage. The process of retreading tyres certainly presents an opportunity since it saves up to 80 % of the material of a tyre.[133] A tyre can be retreaded twice during its life-cycle, which means that a tyre can be used up to three times, thus presenting a considerable potential for waste prevention[134]. In principle, if every tyre were retreaded twice, we would see a 53% reduction in rubber use.

However, the retreading of tyres currently faces different socio- economic barriers. The retreading of tyres is currently **used mostly for truck tyres** and not for passenger car tyres. There is a **persistent view among consumers that retread tyres are sub-standard** compared to 'from-new' manufactured tyres. This currently **limits interest in retreads for passenger car vehicles**, as well as the cost-conscious budget tyre market, which is extremely

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perspective, Journal of Cleaner Production, Volume 270, 2020, 122042, ISSN 0959-6526, https://doi.org/10.1016/j.jclepro.2020.122042. (https://www.sciencedirect.com/science/article/pii/S0959652620320898)

[130] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

[131] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Econom ENV.F.l/FRA/2014/0063 Final Report

[132] Orysenko O.V. et al (2018). THE AUTOMOBILE TIRES VULCANIZATION METHOD REPAIR PROCESS EXPERIMENTAL INVESTIGATION. ACADEMIC JOURNAL. Industrial Machine Building, Civil Engineering. DOI: https://doi.org/10.26906/znp.2018.50.1059

[133] G. Debo, V. Wassenhove, Tire recovery: the RetreadCo case, in: Managing Closed-Loop Supply Chains, Springer book series, Part 5, 2005, pp. 119–128.

[134] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

competitive, compared to the cost of remanufactured tyres[135]. Additionally, barriers related to the **costs of re-treated tyres** compared to new ones**,** can negatively influence consumers' choices. Customers less subject to short-term cash constraints and able to plan over the longer term thus tend to remain loyal to retreaded tyres, whereas consumers subject to short-term cash tend to opt for non-retreadable tyres. Considering, however, the respective lifetimes of the two options, the cost differences are significantly narrower[136].

The trend over the last decade shows that the sale of retreaded truck tyres is continuing to fall in Europe, while replacement with new and sales of OEM (Original Equipment Manufacturer) truck tyres are increasing. If this trend continues, and given the wide availability of low-cost single-use imported tyres there is no reason why the dynamics should change, the demand for natural rubber and other virgin materials will continue to grow. **Design for retreadable new tyres with subsequent standards for retreading** provides an opportunity to promote tyre retreads and their popularity among consumers. Retreaded tyres might also be promoted through financial instruments, such as VAT reductions, to make them more appealing to consumers[137]. Finally, requirements in the form of **"product passports**" (for instance embedded in the tyre as a chip), potentially embedded in the tyre itself, would provide tyre retreaders and recyclers with clear information on the composition of a tyre[138].

In the EU legislation, there is currently no requirement that addresses the demand or supports a wider use of retreaded tyres. The Tyre Labelling Regulation (EU 2020/740)[139] empowers the Commission to: "*adopt delegated acts in accordance with Article 14 in order to supplement this Regulation by introducing new information requirements for re-treaded tyres in the Annexes, provided that a suitable testing method is available*"[140]. The deadline for issuing delegated acts, if suitable testing methods are available, is 26 June 2022. This means that due to a lack of suitable current testing methods, the Tyre Labelling Regulation has omitted the retreaded tyres from the labelling requirements, but empowers the EC to introduce new information requirements for re-treaded tyres.

The adoption of EU-wide legal provisions for the inclusion of **labelling requirements for retreaded tyres** (subject to reliable testing methods) is expected to stimulate the use of

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[135] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

[136] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report

[137] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report.

[138] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report.

[139] Regulation (EU) 2020/740 of the European Parliament and of the Council of 25 May 2020 on the labelling of tyres with respect to fuel efficiency and other parameters, amending Regulation (EU) 2017/1369 and repealing Regulation (EC) No 1222/2009.

[140] Ibid., Article 13, (2).

retreaded tyres (passenger vehicle and truck tyres), and reduce the consumption of new tyres, by making the retreaded tyres subject to the same requirements as the new ones.

### Circular Business Models

Alternative business models are available for tyres, such as **tyre leasing,** which is possible from a technical perspective. While most of the larger manufacturers already offer tyre lease arrangements for vehicle fleets, there is potential for further growth in the tyre sector. In this instance, the tyres remain in the manufacturer's ownership throughout their use [141]

Digitalisation also offers interesting opportunities and unleashes the possibility of having predictive maintenance for tyres. For instance, vehicle telemetry systems, which are becoming common in modern vehicles, can allow the tyre condition to be tracked (e.g., through accelerometer data indicating pothole and kerb impacts) and addressed in time in order to prevent tyre failure and the premature discarding of tyres. **Product-Service- System (PSS) models could integrate predictive maintenance in their service concept**, and hence allow service/replacement schedules to be automated and the suitability for retreading to be assessed. However, automated data collection and processing to allow predictive maintenance would require access to telemetry data from the vehicle manufacturers, which raises a number of data protection and access challenges[142]**.**

Currently, no EU legal provisions directly address the adoption of circular business models for tyres.

[141] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report.
[142] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report.

**Table 3-1 Summary of existing provisions and the identified technical, legal and socio-economic barriers and opportunities – end-of-life tyres**

| | Opportunities | Barriers |
|---|---|---|
| **Legal** | Labelling requirements for retreaded tyres<br>The EU legislation already specifies that:<br>• performance of tyres should also promote longer useful lifetime (Type-approval requirement Regulation (2019/2144)[143])<br>• to promote reuse and repair (Waste Framework Directive (Article 9))<br>• labelling for retreaded tyres (Tyre Labelling Regulation (EU 2020/740))<br>• A Delegated act introducing new information requirements for re-treaded tyres is expected in 2022. | Tyre wear and abrasion rates not in the current legislation<br>Lack of regulation and control over part-worn tyres, consumers' confidence in part-worn tyres<br>Tyre Labelling Regulation leaves the retreaded tyres out of the labelling requirements |
| **Socio-economic** | Raising consumer awareness on annual inspection for minimum thread depth<br>Leasing of tyres | Safety concerns over retreaded tyres<br>Perception of consumers for retreaded tyres<br>Cost of retreaded tyres<br>Retreaded tyres mostly applied to trucks rather than to passenger cars |
| **Technical** | Minimum standards of tyre wear and abrasion rates<br>Product passports for tyres<br>Design for retreadable tyres<br>Product-Service- System (PSS) models integrating predictive maintenance | Technical limitations for durability test standards and guarantee minimum life of tyres |

[143] Regulation (EU) 2019/2144 of the European Parliament and of the Council of 27 November 2019 on type-approval requirements for motor vehicles and their trailers, and systems, components and separate technical units intended for such vehicles, as regards their general safety and the protection of vehicle occupants and vulnerable road users, amending Regulation (EU) 2018/858 of the European Parliament and of the Council and repealing Regulations (EC) No 78/2009, (EC) No 79/2009 and (EC) No 661/2009 of the European Parliament and of the Council and Commission Regulations (EC) No 631/2009, (EU) No 406/2010, (EU) No 672/2010, (EU) No 1003/2010, (EU) No 1005/2010, (EU) No 1008/2010, (EU) No 1009/2010, (EU) No 19/2011, (EU) No 109/2011, (EU) No 458/2011, (EU) No 65/2012, (EU) No 130/2012, (EU) No 347/2012, (EU) No 351/2012, (EU) No 1230/2012 and (EU) 2015/166

## 3.3.2 End-of-Life vehicles

### 3.3.2.1 EU legal context

A number of legislative instruments currently address ELV. The following provisions are relevant for waste prevention:

- The ELV Directive (2000/53/EC) [144]
  - → Underlines the importance of waste prevention (Article 4) and states that Member States shall encourage the design of new vehicles in a way so that the dismantling, reuse and recycling are facilitated (Article 4 (2b))
  - → Underlines the importance of the reuse and recovery of ELVs, setting out that MS shall take the necessary measures to encourage the reuse of components which are suitable for reuse (Article 7)
  - → Sets targets on reusability, recoverability and recyclability of ELVs and requires that economic operators ensure that new vehicles placed on the market are reusable and/or recyclable to a minimum of 85 % by weight per vehicle; and reusable and/or recoverable to a minimum of 95 % by weight per vehicle (Article 7 (2b))
  - → On the basis of a proposal from the Commission, the European Parliament and the Council shall establish targets for reuse and recovery and for reuse and recycling for the years beyond 2015
- Directive 2005/64/EC[145] supports the ELV Directive and requires that economic operators ensure that new vehicles placed on the market are reusable and/or recyclable to a minimum of 85 % by weight per vehicle; and reusable and/or recoverable to a minimum of 95 % by weight per vehicle (Annex I).
- Commission Decision 2003/138/EC[146] obliges producers to use component and material coding standards to facilitate the identification of those components and materials which are suitable for reuse and recovery

In addition, the Commission Decision 2005/293/EC[147] lays down rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in the ELV Directive. In addition,

[144] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles

[145] Directive 2005/64/EC of the European Parliament and of the Council of 26 October 2005 on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability and amending Council Directive 70/156/EEC, amended by Directive 2009/01/EC

[146] Commission Decision 2003/138/EC of 27 February 2003 establishing component and material coding standards for vehicles pursuant to Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles

[147] Commission Decision 2005/293/EC of 1 April 2005 laying down detailed rules on the monitoring of the reuse/recovery and reuse/recycling targets set out in Directive 2000/53/EC of the European Parliament and of the Council on end-of-life vehicles

Directive (EU) 2018/849 imposes an obligation on the Commission to "*review the ELV Directive, by 31 December 2020, and to this end, shall submit a report to the European Parliament and the Council, accompanied, if appropriate, by a legislative proposal*". In March 2021, the Commission published an evaluation report on the ELV Directive[148]. As a result of the evaluation, and subject to public consultation on the revision of EU rules on end-of-life vehicles, it is expected that the Commission will issue a legislative proposal in 2022.

At policy level, the 2020 Circular Economy Action Plan includes ELVs among the key product value chains. Although not legally binding, the CEAP could play a role in improving the framework conditions for a circular economy for vehicles, as it envisages linking design issues to end-of-life treatment through the revision of the ELV Directive[149].

#### 3.3.2.2 Technical, legal and socio-economic barriers and opportunities

##### Design for extended product lifetime

Technical barriers and opportunities can be identified. As regards the design for dismantling, the increasing number of costly components might be problematic since dismantlers do not currently have experienced of such components and the markets for them are not yet developed[150]. In order to develop more circular vehicles, opportunities are offered through **design for easier disassembly and reuse of parts and component for different purposes** (e.g., remanufacturing)[151]. Cars increasingly feature costly components (battery, high voltage management systems and other components) which can **generate dismantling income** and may generate income for the dismantlers, creating a business opportunity[152].

In EU legislation, provisions for the appropriate design of vehicles are provided in the ELV Directive (2000/53/EC). Specifically, the ELV Directive states: "*the design and production of new vehicles which take into full account and facilitate the dismantling, reuse and recovery, in particular the recycling, of end-of-life vehicles, their components and materials (*Article 4 (2a). This supposedly contributes to the construction of vehicles that better satisfy circular economy criteria and through proper design, promote a longer utilisation of parts and components of the vehicles. However, the evaluation report[153] of the ELV Directive concluded that: "the provisions of the ELV Directive encouraging the design of new vehicles to facilitate their dismantling and recycling, as well as the use of recycled materials, are not

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[148] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1912-End-of-life-vehicles-evaluating-the-EU-rules

[149] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles

[150] EC (2020b) Supporting the Evaluation of the Directive 2000/53/EC on end-of-life vehicles. Final Report.

[151] The Circular Economy Applied to the Automotive Industry - Ellen MacArthur Foundation - New car search (automotorescontemporaneos.com)

[152] EC (2020b) Supporting the Evaluation of the Directive 2000/53/EC on end-of-life vehicles. Final Report.

[153] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1912-End-of-life-vehicles-evaluating-the-EU-rules

sufficiently detailed, specific and measurable, and as such had a very limited impact on the design and manufacturing of new vehicles".

In addition, there are no legal provisions on performance and durability requirements for components used in manufacturing new vehicles, and finally, the scope of the ELV Directive is limited to "M1" and "N1" categories of vehicles, as defined by Annex IIA to Directive 70/156/EEC. It omits significant numbers of vehicles (e.g., motorcycles and large trucks) from the scope of its provisions on how these vehicles should be designed and treated at the end of their life.

### Reuse and repair

Socio-economic barriers can be evidenced for reuse and repair measures. As regards the car reuse market, despite the fact that there is a flourishing and relatively well-established market in the EU, the trade of used cars within the EU is beyond the means[154]. One barrier relates to consumers' trust in second-hand products. This is due to the fact that **potential buyers do not know about the condition of the car**. However, if customers were informed about the quality of the car with reasonable assurance, the incentive to buy would be greater and the use of existing products would likewise be more intensive[155]. Gathering and accessing information about the quality and status of vehicles will be increasingly possible thanks to the solutions offered by the digitalization of electronic components in vehicles, with the provision of enhanced data about status, potential failures and the need for maintenance, etc., possibly overcoming consumers' lack of trust[156].

As regards repairs, technical barriers prevail. According to independent automotive repair shops, the biggest challenges to the repairs shops and their technicians include finding time for hands-on training (42.6 %), staying up-to-date with advances in diagnostics (31.6 %), keeping up with advances in vehicle technology (31.1 %) and finding good, knowledgeable and motivated technicians (29.2 %)[157]. Technicians will be increasingly challenged with having **broad enough skills to be able to repair all types of vehicles** including older, newer, foreign and electric vehicles.[158] The **improved design of vehicles to be suitable for easy**

[154] Wiltz, H., Berg, H. (2017). The Digital Circular Economy: Can the Digital Transformation Pave the Way for Resource-Efficient Materials Cycles?. International Journal of Environmental Sciences & Natural Resources, Volume 7 Issue 5- December 2017.
[155] Wiltz, H. , Berg, H. (2017). The Digital Circular Economy: Can the Digital Transformation Pave the Way for Resource-Efficient Materials Cycles?. International Journal of Environmental Sciences & Natural Resources, Volume 7 Issue 5- December 2017.
[156] Wiltz, H. , Berg, H. (2017). The Digital Circular Economy: Can the Digital Transformation Pave the Way for Resource-Efficient Materials Cycles?. International Journal of Environmental Sciences & Natural Resources, Volume 7 Issue 5- December 2017.
[157] 2020 Challenges For Independent Auto Repair Shops & Technicians (automotiveresearch.com)
[158] 2020 Challenges For Independent Auto Repair Shops & Technicians (automotiveresearch.com)

**dismantling** will make remanufacturing, and development of remanufacturing operations at the component and sub-component level easier[159].

In the EU legislation, Annex I of Directive 2005/64/EC requires that: "*vehicles belonging to category M1 and those belonging to category N1 shall be so constructed as to be: reusable and/or recyclable to a minimum of 85 % by mass, and reusable and/or recoverable to a minimum of 95 % by mass*". The ELV Directive (2000/53/EC) [160] sets targets on reusability, recoverability and recyclability of ELV. Finally, Commission Decision 2003/138/EC obliges producers to use component and material coding standards to facilitate the identification of those components and materials which are suitable for reuse and recovery. However, the recovery and recycling targets set in the ELV Directive are linked to the overall weight of vehicles. This does not provide an incentive for the recycling and recovery of materials other than metals, which, in turn, results in the waste of glass and plastics, and even critical raw materials.

### Remanufacturing

Advanced remanufacturing technologies for cars can result in up to 80 % recovery of older parts and components in some cases. Other than being 30-50 % less expensive, the remanufactured parts have the same quality guaranteed and are submitted to the same quality control tests as new parts[161]. As series of tests can ensure that the remanufactured end product has the same emissions and quality as a new assembled unit[162].

However, technical barriers can be identified. In the past few years, **engines have gradually become harder to remanufacture** due to their complexity, and discussion with producers to enable easier remanufacturing is necessary as a **high level of mechatronic skills will be required from technicians** to perform the remanufacturing operations[163]. **Large volumes of automated/semi-automated disassembly plants** will help to overcome the economic and technical barriers associated with remanufacturing vehicles and need for advanced mechatronic skills. This shall go hand-in-hand with the development of specialist diagnostic, processing and testing equipment to support disassembly, service, repair, refurbishment and remanufacturing operations to guarantee safety and compliance of the parts[164].

Currently, the EU legislation does not set specific requirements for the remanufacturing of ELV and their component parts. A legislative proposal is expected in 2022 to extend the scope of the ELV Directive to also include remanufacturing.

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[159] Optimat (2013). Remanufacture, refurbishment, reuse , and recycling of vehicles: Trends and opportunities. Reference No J2432/OPT/001/12

[160] Directive of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles

[161] The Circular Economy Applied to the Automotive Industry - Ellen MacArthur Foundation - New car search (automotorescontemporaneos.com)

[162] Remanufacturing in the automotive industry (ellenmacarthurfoundation.org)

[163] Optimat (2013). Remanufacture, refurbishment, reuse , and recycling of vehicles: Trends and opportunities.

[164] Optimat (2013). Remanufacture, refurbishment, reuse , and recycling of vehicles: Trends and opportunities.

## Circular Business Models

Circular Business Models have become popular for vehicles through so-called shared mobility systems. The concept is that, through intense shared use of car and decreased car ownership, the number of cars required will decrease. Data would suggest that the global car fleet could be reduced by a third if sharing schemes were widely adopted[165]. This is also a clear economic opportunity, and, as of today, 55 billion Euros have been invested in ride-sharing start-ups. This has been possible, in particular, thanks to the rise of online platforms that offer a highly customisable, real-time and affordable car-sharing experience[166].

Different economic and business opportunities arise, and car-sharing models can be identified which already have a certain market penetration, including **ride-hailing (sharing a journey), carpooling services** (e.g.) Blabla car[167]), **pay-per-use mobility packages** (e.g., Car2Go), **mobility as a service models** (e.g., Uber), each one integrating different modes of mobility according to individual needs[168].

As regards, the lifetime of shared cars, the usage intensity and service life of vehicles is expected to change dramatically as a result of electrification and car sharing. Whereas, on the one hand, the number of owned vehicles will decrease[169], autonomous, and, in particular, shared vehicles, will be used more intensively and will need to be replaced more often, resulting in rising sales figures [170]. As a result, a technical limitation arise so that the **shared cars will have to be replaced much sooner** – even though their active lifetime mileage will increase[171].

At EU level, alternative business models for shared mobility are not covered by the EU legislation for waste and waste prevention. It can be argued that the right policy area to address this issue is not the waste policy area (but rather the mobility policy area. However, through the further establishment of shared mobility models, benefits can also be obtained in terms of a reduced number of vehicles per person, and, consequently, of generated waste in terms of ELV.

[165] Transport & Environment (2017). Does car sharing really reduce car use? Internet Article available at: Does car sharing really reduce car use? - Campaigning for cleaner transport in Europe | Transport & Environment (transportenvironment.org), retrieved on 27.10.2021

[166] Transport & Environment (2017). Does car sharing really reduce car use? Internet Article available at: Does car sharing really reduce car use? - Campaigning for cleaner transport in Europe | Transport & Environment (transportenvironment.org), retrieved on 27.10.2021

[167] PricewaterhouseCoopers (2018). Five trend transforming the Automotive Industry. Retrieved from : five-trends-transforming-auto-industry.pdf (pwccn.com) on 27 October 2021

[168] McKinsey&Company2019. RACE 2050 – A VISION FOR THE EUROPEAN AUTOMOTIVE INDUSTRY.

[169] Transport & Environment (2017). Does car sharing really reduce car use? Internet Article available at: Does car sharing really reduce car use? - Campaigning for cleaner transport in Europe | Transport & Environment (transportenvironment.org), retrieved on 27.10.2021

[170] Optimat (2013). Remanufacture, refurbishment, reuse, and recycling of vehicles: Trends and opportunities. Prepared with support from The Scottish Government

[171] Optimat (2013). Remanufacture, refurbishment, reuse , and recycling of vehicles: Trends and opportunities. Prepared with support from The Scottish Government

**Table 3-2 Summary of existing provisions and the identified technical, legal and socio-economic barriers and opportunities – ELVs**

| | Opportunities | Barriers |
|---|---|---|
| **Legal** | In the EU legislation, the ELV Directive (2000/53/EC) [172] addresses:<br>Waste prevention and the importance of design for dismantling, reuse (Article 4 (2b)<br>- Reuse of parts and components (Article 7)<br>- Targets on reusability and recovery (Article 7(2b))<br>Commission Decision 2003/138/EC sets out rules to facilitate the reuse of materials and components.<br>A legislative proposal on remanufacturing is expected in 2022 | The ELV Directive omits a significant number of vehicles from its scope<br>The evaluation report of the ELV Directive concluded that the provisions encouraging more circular design of new vehicles are not sufficient<br>No legal provision on durability requirements for components<br>The ELV Directive does not include separate targets for reuse of specific material components |
| **Socio-economic** | - | Poor knowledge of the conditions of the car from second-hand buyers |
| **Technical** | Improved design for easier disassembly and reuse of parts and component for different purposes<br>Improved design of vehicles to be suitable for easy dismantling<br>Establishment of automated/ semi-automated disassembly plants for remanufacturing of vehicles | Broad enough skills to be able to repair all types of vehicles<br>Engines have gradually become harder to remanufacture, high level of mechatronic skills required<br>Shared cars will need to be replaced more often due to intense usage |

[172] Directive of the European Parliament and of the Council of 18 September 2000 on end-of life vehicles

### 3.3.3 Construction and demolition waste

#### 3.3.3.1 EU legal context

The Waste Framework Directive (2008/98/EC) is the main legislative act that sets out legal provisions on waste from construction and demolition activities and the prevention of waste. It requires MS:

- to reduce waste generation in processes related to industrial production, extraction of minerals, manufacturing, construction and demolition, taking into account best available techniques" (Article 9)
- to take measures to promote selective demolition in order to enable removal and safe handling of hazardous substances and facilitate reuse and high-quality recycling by selective removal of materials, and to ensure the establishment of sorting systems for construction and demolition waste at least for wood, mineral fractions (concrete, bricks, tiles and ceramics, stones), metal, glass, plastic and plaster (Article 11 (1))
- by 2020, the **preparing for reuse, recycling and other material recovery**, including backfilling operations using waste to substitute other materials, of non-hazardous construction and demolition waste excluding naturally occurring material defined in category 17 05 04 in the list of waste shall be increased to a **minimum of 70 % by weight** (Article 11, 2b)
- Member States should ensure the establishment of sorting systems for construction and demolition waste at least for wood, mineral fractions (concrete, bricks, tiles and ceramics, stones), metal, glass, plastic and plaster (Article 11, 1).

If found appropriate, the Commission may propose a legislative proposal by the end of 2024 on targets for preparing for reuse for CDW.

#### EU policy context

Construction and building is one of the key product value chains identified in the CEAP (2020).

In February 2020, the Commission published guidance on circular economy principles for the design of buildings[173]. The document, which was written together with industry, Member States and other stakeholders, focusses on durability, adaptability (with a focus on replacement and refurbishment), and waste reduction (use of different construction methods to encourage recovery for reuse). In 2021 that document was followed up by a study that examined national and regional policies for circular economy in buildings, and proposed EU level policy action[174].

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[173] https://ec.europa.eu/docsroom/documents/39984

[174] https://op.europa.eu/en/publication-detail/-/publication/86c67cd0-0f83-11ec-9151-01aa75ed71a1/language-en/format-PDF/source-230073893

As part of the first EU Circular Economy Package, the Commission issued in 2018 the "Guidelines for the waste audits before demolition and renovation works of buildings"[175], a non-binding document that provides guidance on assessment of construction and demolition waste streams prior to the demolition or renovation of buildings and infrastructures, the so-called "waste audit".

In addition, Green Public Procurement (GPP) also has a key role to play in the EU's efforts to become a more resource-efficient economy, even though it is a voluntary instrument. The development of GPP criteria for the Design, Construction and Management of Office Buildings and the separate criteria for Road Design, Construction and Maintenance include waste-related criteria[176]. For example, for office buildings, the GPP comprehensive criteria require a site waste management plan to be prepared prior to the commencement of work on-site, which includes identifying opportunities for waste prevention; whilst the roads GPP criteria focusses more on pre-demolition audits.

Furthermore, the EU Ecolabel[177] encourages producers of construction products to generate less waste and $CO_2$ during the manufacturing process, and encourages companies to develop products that are durable, easy to repair and recycle[178].

Consideration of circularity is also increasingly relevant to the question of deep renovation of the building stock to reduce its energy consumption. The Renovation Wave strategy[179] calls for at least doubling the annual rate of building renovation to meet climate targets. Given that this increased activity might also use more resources and generate more waste, the strategy foresees action to minimise this, including developing a roadmap to reduce the whole life cycle greenhouse gas emissions of buildings by 2050. Additionally, the Commission's proposal for a revision of the Energy Efficiency Directive[180] includes, under Article 6, a requirement for public authorities to renovate 3% of their buildings' floor space each year. They would be allowed to count demolitions and reconstructions towards this target, but only if the sustainability were to be demonstrated through a life cycle assessment.

[175] https://ec.europa.eu/growth/content/eu-construction-and-demolition-waste-protocol-0_en
[176] European Parliament (2017). Green Public Procurement and the EU Action Plan for the Circular Economy . Authors: Christian NEUBAUER, Mervyn JONES, Francesca MONTEVECCHI, Christian NEUBAUER, Hanna SCHREIBER, Angelika TISCH, Birgit WALTER. Available at: Green Public Procurement and the EU Action Plan for the Circular Economy - Think Tank (europa.eu)
[177] https://ec.europa.eu/environment/ecolabel/
[178] https://www.ecolabel.dk/da/aktuelt/nyheder/2020/11/miljoemaerkede-byggematerialer-boomer
[179] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en
[180] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0558

### 3.3.3.2 Technical, legal and socio-economic barriers and opportunities

#### Design for extended product lifetime

**Mostly technical opportunities exist for waste prevention. Design for disassembly (DfD)** can help to facilitate the reuse of construction products[181], but also help to **design buildings for adaptable use** such as the repurposing of a commercial into a residential building, using modular building solutions to downsize a home or an office, or supporting house sharing and mixed functionality[182]. In this way, the service life of built works can be extended, and the date of eventual end-of-life pushed back. Regular maintenance and repair is also important to ensure long lifetimes.

Prefabrication can also facilitate disassembly as well as leading to improved resource efficiency. An example of this is replacing in-situ concrete with precast concrete. This offers opportunities associated with **light weight precast concrete**, and have become increasingly common due to the advantages offered in terms of quality and cost control, safety and efficiency: using precast concrete products can save 20 %–50 % of the waste that would otherwise be generated through more conventional construction methods, and it can limit the waste sent to landfill to less than 1 % of the total processed material[183].

Digital tools and collaborative design processes supported by **Building Information Modelling (BIM)**[184] can also facilitate reuse and recycling of building components and material. BIM platforms can bring together the entire supply chain and enable the end-customer to know what is in the building, and what the building and its components have been used for, enabling high data availability and unlocking opportunities for further reuse. Furthermore, digital building logbooks can serve as a single repository of all relevant data, including product data[185].

#### Reuse and repair

The reuse of construction products poses some economic barriers. Direct reuse of construction products at the end of their first life is very limited in scale and only in particular niches. Furthermore, there is only a **small market for excess/ over- ordered construction products** (such as windows or doors) to be made available for reuse at the end

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[181] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[182] Hatje Cantz, Social housing rethought (2016); R. Moore, Alejandro Aravena: the shape of things to come, the Guardian (10 April 2016)

[183] WRAP (2017). Waste Reduction Potential of Precast Concrete Manufactured Offsite, Mtech Consult Ltd, Wrap

[184] Ellen MacArthur Foundation, Towards the circular economy (2013) p. 16; M. Honicet et al., Data- and stakeholder-management framework for the implementation of BIM-based material passports, Journal of Building Engineering (2019)

[185] https://op.europa.eu/en/publication-detail/-/publication/40f40235-509e-11eb-b59f-01aa75ed71a1/language-en/format-PDF/source-search

of their life[186], whereas opportunities exist to set up **marketplaces where construction products are available for exchange**, such as Enviromate and Recipro[187].

Technical opportunities exist to promote the reuse of prefabricated elements, such as **precast concrete**, can help to prevent waste generation, but they need to be designed to allow disassembly. Many precast concrete components or other modular elements can still be fully functional even when the building or structure reaches the end of its life, creating an opportunity for reuse[188]. Innovations which can support repair include **self-healing concretes**[189]. There is an opportunity around promoting research and development of new repair focussed technologies. This could further build and expand the existing standards, such as the "European Concrete Repair Standards EN1504 series and EU  marking for concrete repair products"[190].

As regards steel, the reuse of permanent steel works systems is not a common practice[191]. For structural steel elements, the most significant circular economy potential relates to a move up the waste hierarchy from recycling to reuse, especially for the relocation of building components and the reforming of ship plates and line pipes[192].

Opportunities to reuse construction products are also unlocked by the adoption of **building materials passports**. Currently, building material passports are hardly widespread in residential buildings and are mostly common for commercial buildings[193]. The complexity of constructions makes it difficult to pinpoint which products were used in a building to make them available for reuse. Materials passports can form part of the dataset that would sit within an overall **Digital Building Logbook**, together with other relevant data such as permits, cadastre, energy performance certificates and data from a BIM model. However, costs and need for available resources are associated to the update of such passports and logbooks.

However, reuse can be also understood at the level of the building rather than individual construction products, in other words the reutilisation and **repurposing of existing buildings for alternative uses.** This avoids the demolition and reconstruction processes, considerably

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[186] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[187] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[188] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[189] https://www.theguardian.com/sustainable-business/2015/jun/29/the-self-healing-concrete-that-can-fixits-own-cracks

[190] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[191] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[192] http://ec.europa.eu/environment/integration/research/newsalert/pdf/315na4_en.pdf

[193] BMU (2019). Wertschätzen statt Wegwerfen Konzepte und Ideen zur Abfallvermeidung.

contributing to waste prevention. For example, redundant commercial and public buildings can be converted into new and more adaptable spaces including housing or offices instead of demolishing an old building and constructing a new one. Modular design will support this practice[194].

The Waste Framework Directive imposes obligations on the Member States to take measures to promote selective demolition in order to enable removal and safe handling of hazardous substances and facilitate reuse (Article 11); and sets the targets for **preparing for reuse, recycling and other material recovery** to a **minimum of 70 % by weight** (Article 11, 2b).

### Remanufacturing

A reclamation industry exists for some construction products, for example timber. However, Today in Northern and Western Europe, only 1% of building elements are reclaimed and reused following their first application[195]. Technical opportunities exist relating to **remanufacturing and reuse of treated timber products** in new buildings, but also for other uses such as temporary shelters for displaced families during disaster or emergency situations. To unlock these opportunities, improved building design, e.g., which takes into account design for disassembly, is necessary[196]. A barrier could be however represented by harmful chemicals, as Volatile Organic Compounds, used to treat wood.

The EU legislation currently supports the recovery of materials through selective demolition in the Waste Framework Directive (Article 11), including wood. The Principles for Buildings Design[197] focuses on adaptability with a focus on replacement and refurbishment for possible future changes in use of buildings. The low amounts of reclaimed material might pose the question as to whether the current legislative framework can stimulate remanufacturing of materials from the Construction &Demolition sector.

### Circular Business Models

Technical opportunities for circular approaches in construction include flexible use of space, so that it can be used for multiple purposes including at different times, , and as a consequence, fewer buildings need to be constructed and less Construction &Demolition waste will be generated. This includes, for instance, **accessing residential space through shared-use schemes** such as temporary home-sharing with visitors and tourists through online platforms (e.g., Airbnb), which could, in turn, decrease the need to increase the hotel infrastructure capacity (EMF 2019b).

**Accessing commercial space through shared-use schemes is also increasing**, so that businesses are increasingly making use of shared offices and co-working spaces. For this type

[194] EMF (2019). Circular economy in cities. Factsheet for Buildings, residential and commercial. Available at: 1_Buildings_Planning_Mar19.pdf (ellenmacarthurfoundation.org)

[195] EU. Interreg Project: CRBE - Facilitating the circulation of reclaimed building elements in Northwestern Europe. Summary of the project. Available at: https://www.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/#tab-1

[196] Chuck Yu (2013). Remanufacture and Reuse of Building Products for Modern Construction. Journal Indoor Built Environ 2013;22;6:849–85

[197] European Commission (2021). Circular economy principles for building design.

of building, opportunities are being created through improved design features such as movable interior walls which make possible additional uses of a space. For example, these walls can allow a space to be reconfigured for the needs of different users at different times of day, and make possible different rental models of the space (e.g., as an office space during the day, and as a restaurant at night) (EMF 2019b. Flexible use of spaces can also be relevant for public buildings, such as schools, which are only used during certain periods of the day and of the year.

Currently, EU legislation on construction and demolition waste does not address circular or alternative business models such as these.

**Table 3-3 Summary of existing provisions and the identified technical, legal and socio-economic barriers and opportunities – C&D waste**

| | Opportunities | Barriers |
|---|---|---|
| **Legal** | Waste Framework Directive (2008/98/EC) on prevention of waste<br>• reduce waste generation in processes related to construction and demolition (Article 9 f)<br>• target on preparing for reuse, (Article 11, 2b)<br>• selective demolition (Article 11 (1) | Sustainable circular design remains mostly a voluntary measure (e.g., GPP criteria)<br>The reuse of construction products and repurposing of existing buildings is not a focal point of the current EU legislation<br>The low amounts of reclaimed material such as timber, suggest the current legislative framework is inadequate to stimulate remanufacturing of materials from C&D. |
| **Socio-economic** | Accessing residential and commercial spaces through shared-use schemes | small market for excess/ over- ordered materials products<br>The current EU legislation does not address circular or alternative business models for C&D waste |
| **Technical** | Prefabricated elements<br>Building Information Modelling (BIM)<br>Design for disassembly (DfD) and adaptable use<br>Modular products using self-healing materials<br>Building Material Passports and Digital Building Logbooks<br>Repurposing of existing buildings for alternative use<br>Remanufacturing and reuse of treated timber products | Costs for implementing maintaining measures such as Building Information Modelling Building Material Passports and Digital Building Logbooks |

### 3.3.4 Textile waste

#### 3.3.4.1 EU policy context

The Waste Framework Directive (2008) is the main legislative act that sets out legal provisions on textile waste, requiring that *"Member States shall take measures to prevent waste generation, and at least encourage the reuse of products and the setting up of systems promoting repair and reuse activities;* and *encourage the design, manufacturing and use of products that are resource-efficient, durable, reparable, re-usable and upgradable"* (Article 9).

General provisions (Article 11, WFD) require MS to take measures to promote preparing for reuse activities, notably by encouraging the establishment of and support for preparing for reuse and repair networks, and by promoting the use of economic instruments, procurement criteria, quantitative objectives or other measures of e.g. textile waste. Textile waste is included in the targets for preparation for reuse and recycling of municipal waste for 2025, 2030 and 2035. By 31 December 2024, the Commission shall consider the setting of preparing for reuse and recycling targets for textile waste (Article 11, para. 6 WFD), and Member States shall set up separate collection by 1 January 2025 (Article 11, para. 1 WFD).

The additional legislation on textiles focusses mostly on qualitative waste prevention through the restrictions on the use of chemical substances (REACH Regulation) and a voluntary ecolabel criterion adopted for textile products[198] and footwear[199], limiting the use and emissions of pollutants throughout their lifetime. EC decisions establishing ecolabel criteria are adopted in a voluntary fashion and include textile products[200] and footwear[201], with the latter targeting, inter alia, the durability of footwear.

In the EU strategies, the European Green Deal[202], the Circular Economy Action Plan[203] (CEAP) and the Industrial Strategy[204] identify textiles as a priority sector in which the EU can pave the way towards a carbon-neutral, circular economy, while also announcing an **EU Strategy on Textiles**[205]. With regard to waste prevention, the Strategy for textiles shall make the textile sector fit for the circular economy. The forseen actions include to boost the EU

[198] COMMISSION DECISION of 5 June 2014 establishing the ecological criteria for the award of the EU Ecolabel for textile products
[199] COMMISSION DECISION (EU) 2016/1349 of 5 August 2016 establishing the ecological criteria for the award of the EU Ecolabel for footwear
[200] COMMISSION DECISION of 5 June 2014 establishing the ecological criteria for the award of the EU Ecolabel for textile products
[201] COMMISSION DECISION (EU) 2016/1349 of 5 August 2016 establishing the ecological criteria for the award of the EU Ecolabel for footwear
[202] COM (2019) 640
[203] COM (2020) 98
[204] COM (2020) 102
[205] VTT TECHNICAL RESEARCH CENTRE OF FINLAND'S CONTRIBUTION TO EUROPEAN COMMISSION'S FEEDBACK REQUEST CONCERNING THE ROADMAP FOR AN EU STRATEGY FOR SUSTAINABLE TEXTILES

market for sustainable and circular textiles, including production processes, design, new materials, new business models, and sustainable lifestyles.

### 3.3.4.2 Technical, legal and socio-economic barriers and opportunities

#### Design for extended product lifetime

Socio-economic barriers can be identified. **Consumer obsolescence** and the associated speed of change (fast-fashion trends), as well as **short-lived and low quality clothes** which do not allow for prolonged product use and reuse, are often mentioned as barriers to waste prevention of textiles[206,207]. Currently, clothing items across various categories are being kept by consumers for half as long as they used to be 15 years ago[208]. Although cheaper production is sometimes achieved by reducing the quality of clothes, there are also significant opportunities to increase their durability, which are cost-neutral and profitable. Many customers, for instance, value high-quality, durable clothes, but a **lack of clear information** on the quality, or on the proper maintenance of clothes, prevents the full value capture[209]. There are clear business opportunities to **make durable clothes more attractive** where quality is a key concern for customers, such as for wardrobe staples, non-seasonal styles, functional clothing (for instance, coats, jumpers, jeans, socks, and intimate wear). Creating **common quality labelling** for durability, for instance, would allow customers to better judge the value of their purchases[210].

In general, clothing design and production typically do not consider the circularity of clothes to facilitate reuse, refurbishment or recycling[211]. Opportunities include **clear labels and guides** with information to advice consumers on issues such as product durability and recyclability e.g. repair instructions or washing and storing tips to reduce wear and tear[212]. **Offering warranties to repair or replace any product or component that fails** also demonstrates a high commitment to durability and increases consumers' trust and engagement[213]. Finally, opportunities exist to prevent textile waste generation include banning the destruction of unsold textiles, e.g., in retail clothing[214].

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[206] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future. http://www.ellenmacarthurfoundation.org/publications).
[207] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report
[208] Eionet Report (2019). Textiles and the environment in a circular economy.- ETC/WMGE 2019/6
[209] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future.
[210] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future.
[211] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report
[212] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report
[213] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future.
[214] Non-paper of Belgium regarding the EU Strategy for Sustainable Textiles. Input from the wide stakeholder consultation from the Public Waste Agency of Flanders (OVAM) received on Sept 2021.

In EU legislation, there are currently **no design requirements** for an extended lifetime and durability of textiles. Addressing the durability and quality of textiles in legislation would unlock many possibilities for reuse, repair and re-circulation (e.g. through circular business models). Having EU-wide rules that address aspects such as quality, recyclability, durability and reparability of textiles would help to keep clothes in use for a longer time.

**Including textiles into the Ecodesign Directive** could help the textile industry to improve design and address fast-fashon trends and the poor quality of some textiles through new design principles and sustainable design guidelines, more in line with a circular economy. An example of such guidelines is, for instance the Jeans Redesign Guidelines, formulated as a voluntary measure co-developed with representatives from brands, manufacturers, fabric mills, collectors, recyclers and academics, to define a starting point for the industry to design and produce jeans in accordance with the principles of a circular economy[215]. In order to apply the circular economy principle in production, instruments might also include specific targets and requirements for material durability that are applicable to products and their consumption.

In EU legislation, no provisions to counter product and consumer obsolescence or to prevent the destruction of unsold goods were identified.

### Reuse and repair

Socio-economic opportunities can be evidenced. There is currently a **big market potential for second-hand clothing** and for the **online resale market** which is growing more than four times faster than the traditional second-hand store market (35 % per year versus 8 % per year)[216]. In the Business to Consumer segment, **clothing resale** (e.g., where customers are incentivised to bring their old clothes back) could move from a fringe to a mainstream activity. It could also allow brands to attract new customers and, by making it clear to customers that their clothes still have value, incentivise them to bring used clothes back[217]. However, one of the main barriers to the reuse of clothes is **consumer perception of second-hand textiles as being of lower quality**, which reduces reuse of textiles[218].

As far as repairs are concerned, consumers are often reluctant to repair textile products, especially clothes, due to **lack of time and availability of skills**. Especially in those cases **where the cost of new clothing is low relative to the cost of labour, repair and services are often not profitable or attractive to consumers[219]**. Whether textiles can be reused or repaired also depends on how accessible reuse and repair services are, so that taking an item to a repair shop and collecting it afterwards can also be seen as inconvenient, and is

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[215] EMF (2021). The Jeans Redesign Guidelines. Last retrieved on 29.10.2021 from [The Jeans Redesign (ellenmacarthurfoundation.org)]
[216] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future
[217]Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future.
[218] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report
[219] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future

therefore only attractive to certain consumers such as elderly people[220]. **Making repair more attractive and accessible** seems to be key for certain product categories like textiles. **Large-scale adoption of clothing repair and restyling services** could significantly increase clothing utilisation. Retailers could provide repair and other services in-store, for example, in collaboration with third parties, or form partnerships with repair and restyle providers based in local communities[221]. Increased **awareness on the environmental and economic benefits of** longer-term use are also key, linked to convenient systems for easily identifying and accessing second-hand and repair shops. At the same time, do-it-yourself (DIY) and repurposing skills, such as sewing, mending and darning, can be revalued and practical courses made accessible[222].

In EU legislation, the WFD **promotes the reuse and repair of textiles**, but it leaves it to the MS to select and implement the most suitable measures. Currently, 18 MS have included clothing and textiles in their WPPs. Examples of specific measures include a reuse target on textiles and reduced taxation on the repair of clothes in Sweden (where the VAT rates are 50% lower for repair services for items like clothes and shoes)[223]; and indicators on textile consumption and reuse as in Denmark and in the Czech Republic[224]. Available data suggest that even in countries where buying second-hand clothing is relatively popular, such as Denmark, second-hand clothes do not exceed 9 % of total purchases. In other countries, this share is typically below 5 %[225]. This raises the question of whether, the current waste legislation is able to fully capture the potential for reuse and repair of textiles by leaving the implementation of measures up to the Member States, or whether further and more specific measures (such as economic instruments or EU-wide targets) should be adopted at EU level. Also, textiles are not yet separately collected in all MS. Therefore, many textiles that could potentially be reused are ending up in the mixed waste.

### Remanufacturing

Technical barriers for remanufacturing can be evidenced. Experts in the textile industry have suggested that **remanufacturing by definition cannot be undertaken on textiles at a postconsumer level**, but would work on post-industrial textiles and carpet flooring. For post-consumer fabrics, it might be more efficient and practical to find alternative resource efficiency methods than remanufacturing[226]. More and more companies are already

[220] Eionet Report (2019). Textiles and the environment in a circular economy.- ETC/WMGE 2019/6
[221] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future
[222] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion's future.
[223] Eunomia (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy ENV.F.l/FRA/2014/0063 Final Report
[224] EEA (2018). Waste prevention in Europe — policies, status and trends in reuse in 2017. EEA Report No 4/2018.
[225] EEA (2018). Waste prevention in Europe — policies, status and trends in reuse in 2017. EEA Report No 4/2018.
[226] APSRG. (2014). Remanufacturing - Towards a Resource Efficient Economy. Retrieved from http://www.policyconnect.org.uk/apsrg/research/report-remanufacturing-towardsresource-efficient-economy-0

**remanufacturing unused post-industrial and pre-consumer textiles** from factories to create new garments using patchwork methods[227].

Remanufacturing of textiles is not specifically addressed in EU legislation. In order to unleash the potential for remanufacturing of textiles, focusing on post-industrial and pre-consumer textiles, a consistent terminology would be necessary. In EU legislation, textiles are classified as follows in the different reference documents. The NACE and PRODCOM classifications of industrial products provides a broad list of product categories based on textile fibres.

According to the waste statistics regulation (EC 2150/2002), “textile wastes” comprises among other worn clothing, miscellaneous textile waste (e.g. waste from composite materials (impregnated textiles, elastomer, plastomer) or waste from unprocessed and processed textile fibres) and leather waste.

Textile waste comprises two entries in separately collected municipal waste fractions (20 01 10 clothes, and 20 01 11 textiles). Waste from the leather, fur and textile industries are classified separately.

### Circular business models

New business models such as short-term clothing rental seem to provide an appealing business opportunity when garments can be worn more often than a customer is able or willing to do. Opportunities include the development and scaling-up of **subscription models and rental subscription**, which are suitable not just for luxury and one-off occasions, but also for ‘fast-fashion’ items and everyday clothing. For instance, rental models for baby clothes and maternity wear have already been successfully introduced by many companies[228].

Other models include the sale of **highly durable clothes with a warranty and the right to repair**, where customers specifically select high-quality, durable garments with increased personalisation. For all these models, refocussed marketing – using the vast experience and capacity that brands and retailers have – and optimised logistics are key enablers for stimulating the growth of the sector[229].

Currently, EU legal provisions do not yet promote the adoption of circular business models for textiles. In parallel, although there have been many experiments within the textile production and consumption system, most initiatives lack the transformative capacity to create significant disruption of the existing system[230]. To achieve real impact beyond mere optimisation of the *status-quo*, circular business models need to scale and achieve significant market penetration[231]. In this sense, the EU legal requirements do not yet seem able to stimulate the scaling-up and wider adoption of circular business models for textiles. Instruments such as GPP criteria might be a useful tool to stimulate their wider adoption, so

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[227] APSRG. (2014). Remanufacturing - Towards a Resource Efficient Economy. Retrieved from http://www.policyconnect.org.uk/apsrg/research/report-remanufacturing-towardsresource-efficient-economy-0

[228] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion’s future

[229] Ellen MacArthur Foundation (2017). A new textiles economy: Redesigning fashion’s future

[230] Buchel, S., Roorda, C., Schipper, K. and Loorbach, D., 2018, The transition to good fashion, DRIFT.

[231] Eionet Report (2019). Textiles and the environment in a circular economy.- ETC/WMGE 2019/6

that high purchase volumes of public procurement would encourage producers to move to sustainable production and enhance the market uptake of those services on a broader scale.

**Table 3-4 Summary of existing provisions and the identified legal shortcomings in the light of the identified barriers and opportunities – textile waste**

| | Opportunities | Barriers |
|---|---|---|
| **Legal** | By 2024, the Commission shall consider the setting of preparing for reuse and recycling targets specifically for textile waste (Article 11, par. 6 WFD).<br>By 2025, MS to set up separate collection systems (Article 11, par. 1 WFD) | Product design to enhance the durability and quality of textiles is currently not included in the Eco-Design Directive<br>The general provisions might not offer the right stimulus to fully capture the potential for reuse and repair in the EU<br>EU legislation currently not fit to promote the adoption, scaling-up and wider uptake of circular business models |
| **Socio-economic** | Make durable clothes more attractive to consumers, common quality labelling<br>Large-scale adoption of clothing repair and restyle services<br>Raising awareness in consumers on repair and reuse<br>Subscription models and rental subscription for clothes | Consumer obsolescence, short-lived and low-quality clothes<br>Consumers perception of lower quality for second-hand clothes<br>Cost of labour, repair of textile |
| **Technical** | Remanufacturing unused post-industrial and pre-consumer textiles | Low separate collection of textile waste |

## 3.3.5 Waste electrical and electronic equipment

### 3.3.5.1 EU legal context

EEE and WEEE are regulated in a number of documents in the EU regulations. The most relevant provisions contributing to waste prevention can be summarised as follows:

The WEEE Directive (2012/19/EU)[232] stipulates that MS shall contribute to sustainable production and consumption by, as a first priority, the prevention of WEEE and, in addition, by the reuse (…) of such wastes so as to reduce its disposal (Article 6), take appropriate measures in accordance with the Ecodesign requirements to facilitate the reuse and

[232]Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

treatment of WEEE (Article 4), and the preparation for reuse of WEEE (Article 15); and pave the way for the adoption of EN standards for the **preparation for reuse** of WEEE.

The Waste Framework Directive stipulates generic provisions that also apply to WEEE, stating that MS shall take measures to prevent waste generation including for reuse and repair (Article 9d, e):

Finally, the Ecodesign Directive (2009/125/EC)[233] lays down EU-wide rules for improving environmental performance for energy-related products, placing emphasis on the possibility of extending the lifetime of products, the availability of spare parts, modularity, upgradability, and reparability for several product groups.

It is also worth mentioning that, at policy level, electronics and ICT are among the key product groups, for which the CEAP proposes key actions to:

- foster and enhance the EU's policy on sustainable products under the Ecodesign Directive so that devices are designed for energy efficiency and durability, reparability, upgradability, maintenance, reuse and recycling;
- promote the implementation of a 'right to repair' with a focus on electronics and ICT as a priority sector, including a right to update obsolete software;
- introduce regulatory measures on chargers for mobile phones and similar devices, including the introduction of a common charger, improving the durability of charging cables, and incentives to decouple the purchase of chargers from the purchase of new devices.

#### 3.3.5.2 Technical, legal and socio-economic barriers and opportunities

##### Design for extended product lifetime

A mix of technical and socio-economic barriers can be identified to extended product durability of EEE, such as **product obsolescence** (of material, components, and software), but also **psychological obsolescence** (which stimulates the desire for new products)[234]. Consumer obsolescence also encourages the purchase of new models which may offer only minor improvements on existing models. As regards product obsolescence, there is the potential for a significant increase in the operating lifetimes of different product groups. For instance, for smartphones, television, washing machines and vacuum cleaners, the designed or the desired lifetime is at least 2.3 years longer than the actual lifetime[235]. Technical opportunities also exist to counter psychological obsolescence. First, some EEE such as user devices (i.e., smartphones) can be designed in such a way that they stimulate attachment

[233] DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products.
[234] I. Oehme, L. Olsson, A. Nissinen, F. Montevecchi, H. Unnerstall, C. Rotzetter (2018). NOTE on Service Life of Products Countering Obsolescence. Discussion paper. European Network of the Heads of Environment Protection Agencies (EPA Network) - Interest group on Green and Circular Economy
[235] EEA (2020). Benefits of longer-lasting electronics

and **emotional durability**[236][237], making users feel increasingly attached to their devices[238]. In addition, for small personal devices such as smartphone, laptops, etc., it has also been proposed that users are more attached to their data than to the devices themselves, and that opportunities might arise from a paradigm shift in the consumer's focus from the device to the data – so that the consumer would be more willing to use second-hand or refurbished devices. Cloud computing can play an important role through **dematerialising** and transferring capabilities from consumer hardware to the cloud, and reduce the sense of risk users may have from used or refurbished devices, which will in the end prolong the use of electronic devices[239].

In the EU legislation, the WEEE Directive (2012/19/EU)[240] stipulates that MS "shall take appropriate measures so that the Ecodesign requirements facilitating reuse and treatment of WEEE established in the framework of Directive 2009/125/EC are applied and producers do not prevent, through specific design features or manufacturing processes, WEEE from being reused, unless such specific design features or manufacturing processes present overriding advantages, for example, with regard to the protection of the environment and/or safety requirements" (Article 4).

Furthermore, the Ecodesign Directive (2009/125/EC)[241] lays down EU-wide rules for improving environmental performance for energy-related products. It requires that, among the parameters for evaluating the potential for improving the environmental aspects of a product, the possibility of extending the lifetime of products be considered, including a minimum guaranteed lifetime, minimum time for availability of spare parts, modularity, upgradeability, and reparability for several product groups including refrigerators, including such with a direct sales function (e.g. fridges in supermarkets); washing machines; dishwashers; electronic displays (including TVs); welding equipment; and light sources and separate control gears (Annex a)

However, it has been noted that **most electronic products are not yet designed for circularity**, and circular solutions which allow for reparability, upgradability and refurbishment of WEEE so far have been very limited[242,243]. The **lack of more prescriptive legislative requirements on a "design for circularity**" might be indicated also as a main legal barrier to improved product

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236 Mugge, R. (2017). A consumer's perspective on the circular economy. In J. Chapman (Ed.), Routledge Handbook of Sustainable Product Design (1st ed., pp. 374-390). (Routledge Handbooks). Routledge - Taylor & Francis Group..

237 Thorsteinsson and Page (2014). User attachment to smartphones and design guidelines. International Journal of Mobile Learning and Organisation (IJMLO), Vol. 8, No. 3/4, 2014.

238 EMF (2018). Circular Consumers Electronics

239 EMF (2018). Circular Consumers Electronics

240 Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

241 DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products

242 EMF (2018). Circular Consumers Electronics

243 EEA (2020). Benefits of longer-lasting electronics

durability, reusability, upgradability and reparability. The revision of the Ecodesign Directive is expected to boost product sustainability and waste prevention (see previous chapter).

Finally, the current EU legislation on EEE and WEEE **does not address issues on countering product or psychological obsolescence**, e.g. no specific requirements are included in the new regulations for manufacturers to continue updating software throughout the lifetime of a product. Thus, although still within its designed lifetime, a product may become prematurely obsolescent due to lack of functionality.

### Reuse and repair

A mix of technical and socio-economic barriers can be identified. For consumers, concerns on the **performance and price risk of used (and refurbished) devices** are two of the main barriers hindering their willingness to opt for second-hand devices. In addition, **data safety concerns** can lead people to store their devices in their homes indefinitely[244]. The **fast pace of technical change** is also a barrier which hinders reuse of EEE[245]. Supporting users when buying and selling devices by building trust and transparency would help users see the real value in used (and refurbished) devices. Opportunities include **improving transparency of pricing, product specifications, condition and traceability.** This can be achieved by supporting users in reselling their devices by providing them with price estimates, product information, specifications and condition, and certified refurbishment and remanufacturing activities[246].

Repair seems to be limited by several technical barriers, first because **the design does not allow easy repair** (e.g., through bundled and integrated components). The result is that electronics which could be repaired are often discarded[247]. The work of reuse and repair centres is also currently hindered by **the lack of access to, and the cost of, spare parts,** and a **lack of access to service manuals,** software and hardware, to perform proper repairs: currently, refurbishment has technical limitations and remains a largely manual process, and the amount of time that can be invested in each device is limited reuse[248].

However, socio- economic opportunities are presenting themselves as repair services for electronics are growing within the EU, both for business to business and end consumers[249]. Research shows, for instance, that up to 50 % of users would be willing to have used or refurbished products under the right conditions, indicating growing trends in **consumer willingness to use a refurbished or second-hand small device**. Some buyer categories such as ‘techies’ or ‘fashion-oriented’ users, may not be interested in them under any

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[244] EEA (2020). Benefits of longer-lasting electronics
[245] EMF (2018). Circular Consumer Electronics
[246] EMF (2018). Circular Consumer Electronics
[247] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019
[248] EMF (2018). Circular Consumers Electronics
[249] EEA (2020). Benefits of longer-lasting electronics

circumstances, however these groups only represent part of the market[250,251]. Technical opportunities can also be identified. **Ease of disassembly and repair** is another core criterion for waste prevention. Disassembly criteria should cover a wider range of products and should in particular be suitable for those products which are most often discarded prematurely, such as smartphones, laptops and other types of consumer electronics. Opportunities arise through the **standardisation of components,** which might allow easier access to spare parts to facilitate repair[252]. **Material passports** can keep information about the material composition and design together with products throughout their use, to allow for the highest-value retention and recovery and, further down the line, reuse[253]. Repair of electronics can also be increased through **digitalisation and AI in devices for improved product repair and predictive maintenance**. Hardware components can be monitored to detect how optimally the device is being used, and whether it is no longer able to supply the desired functions, to allow for quick identification and repair or substitution[254].

Waste prevention of WEEE through repair and reuse is already substantially addressed in the EU legislation, initially through the WEEE Directive. The WEEE Directive (2012/19/EU)[255] stipulates that MS shall take the necessary measures to ensure that producers provide information free of charge about preparation for reuse and treatment in respect of each type of new EEE placed for the first time on the Union market within one year after the equipment is placed on the market (Article 15). Pursuant to Article 8(5) of the WEEE Directive, in 2013, the Commission requested the European standardisation organisations[256] to develop state of the art European standards for the treatment, including preparing for reuse, of WEEE. Subsequently, the Standard “EN 50614: 2020 - Requirements for the **preparing for reuse** of WEEE” was prepared. The WEEE Directive also introduces targets for preparing for reuse and recycling.

However, the EU targets introduced by the WEEE Directive do not distinguish between “preparing for reuse” and “recycling”, which does not incentivise reuse or give it a higher priority than recycling, as evidenced by the low amounts of WEEE reported to be prepared for reuse (of the amounts of EEE placed on the market). Besides, regulations have been traditionally focussed on controlling e-waste flows instead of enabling a circular economy, **so that EEE items which have still value for reuse or repair but are classified as ‘waste’ can encounter legislative barriers**[257]**.**

Secondly, reuse and repair of WEEE are promoted through the Waste Framework Directive, stipulating that MS shall promote waste prevention and at least (Article 9):

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250 EEA (2020). Benefits of longer-lasting electronics
251 EMF (2018). Circular Consumers Electronics
252 EMF (2018). Circular Consumer Electronics
253 EMF (2018). Circular Consumer Electronics
254 EMF (2016). INTELLIGENT ASSETS: UNLOCKING THE CIRCULAR ECONOMY POTENTIAL
255 Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)
256 European Commission, 24 January 2013 “*Mandate to the European Standardisation Organisations for standardisation in the field of WEEE*”: https://ec.europa.eu/environment/pdf/waste/weee/m518%20EN.pdf
257 EMF (2018). Circular Consumer Electronics

- (d) encourage the reuse of products and the setting up of systems promoting repair and reuse activities, including in particular for electrical and electronic equipment, or
- (e) encourage, as appropriate and without prejudice to intellectual property rights, the availability of spare parts, instruction manuals, technical information, or other instruments, equipment or software enabling the repair and reuse of products without compromising their quality and safety;

Reuse and repair of WEEE are also promoted through the revised Ecodesign Directive, that requires producers to **make most spare parts and repair manuals available to professional repairers only**, which is intended to regulate fair access to service parts and tools. The drawback of these regulations is that the repair costs in EU countries are higher than the relatively low prices of newly purchased appliances. In addition, the new regulations stipulate that spare parts should be provided within 15 working days. For some of the products covered by the legislation such as washing machines and refrigerators, this relatively long delivery time may lead many consumers to replace these products rather than repair them. In addition, current legislation still **does not completely prohibit spare parts in bundles**, which means that repairers might be required to replace a larger part instead of a faulty part, which again encourages replacement rather than repair.

### Remanufacturing

Technical limitations exist for remanufacturing. In general, there is still a **considerable qualitative difference between the remanufactured and the new product** in terms of efficiency and sophistication of the manufacturing, especially with regard to some EEE small appliances such as smartphones or other personal devices[258,259]. This is partially reflected in the **negative perceptions of consumers associated with remanufacturing**, and the misconception about the term (often confused with refurbished or upgraded), which has caused the market demand for remanufactured products to remain limited[260].

Technical opportunities exist for **large electrical appliances to be designed for remanufacturing** due to the inherent material and metal value within them, and since there is little emotional value attached to them (in comparison to smaller devices such as mobile phones)[261]. However, **remanufacturing might not be the best option for small personal electronics** such as mobile phones and tablets, as well as other handheld devices such as hairdryers or kettles, first because their design specifications do not easily allow for disassembly, secondly because the low value of the products might lead to a net loss rather

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[258] EMF (2018). Circular Consumers Electronics

[259] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[260] All-Party Parliament (2014). Triple Win: The Economic, Social and Environmental Case for Remanufacturing.. A report by the All- Party Parliament Sustainable Resource Group and the All- Party Parliamentary Manufacturing Group. London, December 2014

[261] All-Party Parliament (2014). Triple Win: The Economic, Social and Environmental Case for Remanufacturing.. A report by the All- Party Parliament Sustainable Resource Group and the All- Party Parliamentary Manufacturing Group. London, December 2014

than a financial gain when attempting remanufacture, making it the facto not an attractive option for remanufacturers; and, thirdly, due to fast-paced technical development, so that consumers enjoy buying new products as they become available. Finally, the energy and time it could take to remanufacture these products might exceed the value of the remanufactured product[262].

From a technical perspective**, increased automation in disassembly and refurbishment processes** can increase the number of products which can be treated and make the remanufacturing process more efficient[263].

At present, EU EEE and WEEE legislation does not address the issue of enabling remanufacturing and high-quality recycling, but a revision of the Ecodesign Directive is envisaged, with the aim of extending its scope beyond the current "energy-related products" and including remanufacturing and high-quality recycling.

### Circular Business Models

Circular business models, in which the manufacturer retains ownership and responsibility for the product, have started to be applied to some devices such as smartphones, laptops and modems, which have led to high rates of recovery and reuse for these products. However, logistics processes for circular business models for EEE are often hindered by economic barriers such as **difficulties in generating a stable and predictable flow of returned products**[264]**.**

Technical opportunities seem to arise hand in hand with the **increased digitalisation and uptake of "intelligent asset" technologies** such as the Internet of Things, predictive maintenance and Big Data Analysis, which can unlock great optimisation of material and components. Such technologies can be paired with innovative business models which offer additional services to provide e.g. repair and maintenance of different devices and appliances[265]. In addition, intelligent asset value drivers allow **increased access to advanced knowledge about the assets' location, condition and availability,** making flows of returned products more predictable and manageable[266]. In any case, circular business models need to be **developed hand in hand with better design for circularity** to include reusability and reparability[267].

Currently, the EU legislation does not directly address the promotion of circular business models for WEEE.

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[262] All-Party Parliament (2014). Triple Win: The Economic, Social and Environmental Case for Remanufacturing.. A report by the All- Party Parliament Sustainable Resource Group and the All- Party Parliamentary Manufacturing Group. London, December 2014
[263] EMF (2018). Circular Consumer Electronics
[264] EMF (2018). Circular Consumer Electronics
[265] EMF (2016). INTELLIGENT ASSETS: UNLOCKING THE CIRCULAR ECONOMY POTENTIAL
[266] EMF (2016). INTELLIGENT ASSETS: UNLOCKING THE CIRCULAR ECONOMY POTENTIAL
[267] EMF (2018). Circular Consumer Electronics

## Table 3-5 Summary of existing provisions and the identified technical, legal and socio-economic barriers and opportunities – WEEE

| | Opportunities | Barriers |
|---|---|---|
| **Legal** | The EU legislation:<br>• The WEEE Directive (2012/19/EU)[268] already lays a basis for producers to provide information on preparation for reuse (Article 15), and for development of Standard "EN 50614: 2020 - preparing for reuse of WEEE<br>• WDF provides general provisions on reuse and repair, availability of spare parts and information (Article 9)<br>There is an opportunity to address the Ecodesign Directive to make spare parts and repair manuals available. | Lack of more prescriptive legislative requirements for "design for circularity"<br>WEEE Directive makes no distinction between "preparing for reuse" and "recycling"; and EEE items that still have value for reuse or repair are classified as 'waste'<br>Ecodesign Directive: spare parts available to professional repairers only<br>Remanufacturing and circular business models of WEEE are not yet addressed in the EU legislation |
| **Socio-economic** | Improving transparency of pricing, product specifications, condition, and traceability<br>Improve emotional durability of personal devices. | Consumer Obsolescence<br>performance, price and data privacy concerns of used, repaired devices<br>negative perceptions of consumers for remanufactured products<br>difficulties in generating a stable and predictable flow of returned products |
| **Technical** | Stimulating "emotional durability" in small personal devices<br>dematerialisation from device to data<br>standardisation of components and spare parts for easy repair, material passports<br>increased automation in disassembly and refurbishment processes<br>increased digitalisation and uptake of "intelligent asset" technologies | Product obsolescence<br>design does not allow easy repair, the lack of access to, and the cost of spare parts and service manuals<br>Lack of design for circularity<br>remanufacturing is not suitable for small devices |

[268]Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

### 3.3.6 Municipal solid waste

#### 3.3.6.1 EU policy context

The main element of EU legislation regulating waste prevention of MSW is the Waste Framework Directive[269]. The WFD establishes the waste hierarchy, giving priority to waste prevention, followed by preparing for reuse, recycling, other recovery, and lastly, disposal (Article 4). The WFD also requires Member States to take measures to prevent waste generation. The majority of these measures have an effect on municipal waste generation and shall, at least:

- encourage the design, manufacturing and use of products that are resource-efficient, durable (including in terms of life-span and absence of planned obsolescence), reparable, re-usable and upgradable (Article 9 b).
- encourage the reuse of products and the setting up of systems promoting repair and reuse activities, including in particular for electrical and electronic equipment, textiles and furniture, as well as packaging and construction materials and products (Article 9 d)
- encourage, as appropriate and without prejudice to intellectual property rights, the availability of spare parts, instruction manuals, technical information, or other instruments, equipment or software enabling the repair and reuse of products without compromising their quality and safety (Article 9 e);
- develop and support information campaigns to raise awareness about waste prevention and littering (Article 9 m)

MS are also required to establish waste prevention programmes setting out at least the measures listed above (Article 29, WFD). The EU Commission shall also create a system for sharing information on best practice regarding waste prevention and shall develop guidelines in order to assist the Member States in the preparation of the Programmes. The Commission shall also examine the feasibility of setting other waste prevention measures, including waste reduction targets for specific streams as part of a broader set of measures on waste prevention in the context of a review of Directive 2008/98/EC.

Regarding MSW the CEAP includes:

- providing high-quality, functional and safe products, which last longer and are designed for reuse, repair, and high-quality recycling.
- promoting a new range of sustainable services, product-as-service models and digital solutions.
- revision of EU consumer law to promote availability of repair services, spare parts and repair manuals.
- further strengthening consumer protection against premature obsolescence.
- establishing a ‘right to repair’.

[269] Waste Framework Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

A particular impact on municipal waste prevention is expected from the sustainable product policy initiative, widening the Ecodesign Directive beyond energy-related products, including improving product durability, reusability, upgradability and reparability, incentivising product-as-a-service or other models.

#### 3.3.6.2 Technical, legal and socio-economic barriers and opportunities

##### Design for extended product lifetime

Socio-economic barriers prevail and for many products**, consumer obsolescence, which** is often responsible for products being discarded despite the old one still functioning, thus decreasing the lifetime of products[270]. This is true for many product categories that land in MSW such as WEEE, textiles, toys[271][272]). Technical opportunities shall be exploited to improve **product design** for countering material and consumer obsolescence, by ensuring that circularity of material and components is considered at the design phase to enhance direct reuse, repair, refurbishment and remanufacturing,[273]. This would in turn enhance the overall durability and usefull life of products.

The WFD requires Member States to take measures that, among others, encourage the design, manufacturing and use of products that are resource-efficient, durable (including in terms of life-span and absence of planned obsolescence), reparable, re-usable and upgradable (in Article 9 b). It seems, however, that this provision might not, on its own, be sufficient alone to guarantee that products are designed in an appropriate way.

##### Reuse and repair

There has been a **growing second-hand market for reuse, donating or reselling many white goods** (textiles, WEEE, furniture, toys, books, etc.) in Europe, which is taking place through online and offline channels[274][275]. However, economic barriers exist since the **price differential between new and used or repaired** and refurbished products is often not significant enough to drive more sustainable purchasing behaviour. In many parts of the EU, transport and labour costs for e.g. electronics, furniture and textile sectors are high, making any **significant repair and refurbishment costly**. This is coupled with poor awareness of the availability and benefits of sustainable options, for both domestic and commercial

[270] Prakash, S.; Liu, R; Schischke, K.; Stobbe, L.; Timely replacement of a notebook under consideration of environmental aspects – life cycle analysis using the data basis of the EuP preparatory study, ProBas, and Ecoinvent; Öko-Institut e.V. in Kooperation mit Fraunhofer IZM; 2011

[271] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[272] Eunomia 2019. Towards a sustainbale product policy

[273] OECD (2019) “Business Models for the Circular Economy - Opportunities and Challenges for Policy,” OECD Publishing, Paris, 2019

[274] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[275] EC (2019) Study: Methodology for the reporting of reuse of products and rules for the reporting of reusable packaging Final Report.

purposes[276]. As regards repair, consumers are rarely given guidance on how to repair products, in order to prolong and extend the product lifespan. In general, economies of scale and economic incentives are needed to make repair and refurbishment viable[277]. **Making repairs more economically attractive to consumers** for many product categories such as WEEE, textiles, sport equipment, furniture, etc., seems to offer opportunities, as already implemented in several EU MS[278][279].

At EU level, the waste prevention of MSW through repair and reuse is addressed in the Waste Framework Directive[280]. MS are required to take measures to promote preparing for reuse activities, notably by encouraging the establishment of and support for preparing for reuse and repair networks and activities for different waste streams (Article 9 d, e).

The WFD also requires that, by 2025, that preparing for reuse and the recycling of municipal waste shall increase to a minimum of 55 % by weight. Such targets are increased to 60% by 2030 and 65% by 2035[281]. However, targets introduced by the WFD, and WEEE Directive do not distinguish between “preparing for reuse” and “recycling”, which does not incentivise reuse as a higher priority than recycling. Establishing reuse targets for municipal waste is provided as a possibility under the WFD. It is also questionable as to how far the current EU policy framework can make reuse and repair practices of white goods and other products which generally land in MSW, more appealing or economically attractive to consumers.

The Commission shall adopt implementing acts to establish indicators to measure the overall progress in the implementation of waste prevention measures and adopt an implementing act to establish a common methodology to report on the reuse of products. By 31 December 2024, the Commission shall examine data on reuse provided by Member States with a view to considering the feasibility of measures to encourage the reuse of products, including the setting of quantitative targets.

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[276] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[277] EUNOMIA (2019). Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy, Eunomia for DG Env. 2019

[278] RREUS (2017). RREUSE position on VAT. Last retrieved on 29.10.2021 from: RREUSE-position-on-VAT-2017-Final-website_1.pdf

[279] EMF (2017 b). Ellen MacArthur Foundation. A new textiles economy: Redesigning fashion’s future. http://www.ellenmacarthurfoundation.org/publications).

[280] Waste Framework Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives

[281] MS may postpone the deadlines for attaining the preparing for reuse and recycling targets for household and similar waste by up to five years provided that Member State:(a) prepared for reuse and recycled less than 20 % or landfilled more than 60 % of its municipal waste generated in 2013 as reported under the Joint Questionnaire of the OECD and Eurostat

### Remanufacturing

No information was found in the literature on remanufacturing of MSW as such. This is probably due to the nature of the remanufacturing operations, and the sectors and products in which they can be used, so that it does not make sense to talk about remanufacturing of MSW and the sorted fractions such as metals, glass, paper and plastic. For other waste streams of MSW, such as bulky waste and furniture, no indications of remanufacturing practices were found, as many operations actually take the form of refurbishment[282], upholstering and repair. Another waste stream included in MSW, for which remanufacturing is applicable, is WEEE, as also analysed in this report.

### Circular Business Models

**The sharing and collaborative economy** provides the opportunities to have the same product utilised by many users such as EEE, clothes, books, toys, home appliances such as drills, etc. In a broad sense, sharing can be anything to which access is granted through pooling of resources, products or services. In redistribution markets, peer-to-peer matching or social networks allow the re-ownership of a product through different methods (reselling, donating, borrowing, etc.)[283]. These models can positively contribute to waste prevention if producers and suppliers move from selling goods to providing services, and in that way decrease their own and their consumers' environmental and climate footprint by keeping products in the economy for longer by  having the same product used in cascade by multiple consumers[284,285]. However, **PPS are not common for many product categories and uncertainties around how to move from product to service selling** deter many producers from adopting PPS[286].

In current EU legislation, circular business models are not addressed. There is an opportunity for EU legislation to further support such models and their scaling up, especially in view of the many markets, and logistical uncertainties around them, e.g. through GPP practices. Table 3-6 Summary of existing provisions and the identified legal shortcomings in the light of the identified barriers and opportunities.

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[282]Furn 360 (2018) [Circular economy in the furniture industry - 11092018 (europa.eu)]

[283] Adapting to the Sharing Economy Magazine: Winter 2015 – MIT SLOAN Management Review Thiago Gonzalo Gonzales Wong. Available at: [Adapting_to_the_Sharing_Economy-with-cover-page-v2.pdf (d1wqtxts1xzle7.cloudfront.net)]

[284] A. Bartl (2014). Moving from recycling to waste prevention: a review of barriers and enables. Waste Management & Research 2014, Vol. 32(9)

[285] R. Antikainen, R. Baudry, A. Gössnitzer, T. Karppinen, M. Kishna, F. Montevecchi, F. Müller and R. Uggla (2021). CIRCULAR BUSINESS MODELS: PRODUCT-SERVICE SYSTEMS ON THE WAY TO. A CIRCULAR ECONOMY. European Network of the Heads of Environment Protection Agencies (EPA Network) - Interest Group on Green and Circular Economy.

[286] R. Antikainen, R. Baudry, A. Gössnitzer, T. Karppinen, M. Kishna, F. Montevecchi, F. Müller and R. Uggla (2021). CIRCULAR BUSINESS MODELS: PRODUCT-SERVICE SYSTEMS ON THE WAY TO. A CIRCULAR ECONOMY. European Network of the Heads of Environment Protection Agencies (EPA Network) - Interest Group on Green and Circular Economy

**Table 3-7 Summary of existing provisions and the identified legal shortcomings in the light of the identified barriers and opportunities – municipal solid waste**

| | Opportunities | Barriers |
|---|---|---|
| **Legal** | Waste Framework Directive already encourages the design of durable, reparable, re-usable and upgradable products (In Article 9 (b).<br><br>Waste Framework Directive already promotes reuse activities, establishment of and support for preparing for reuse and repair networks (Article 9 d, e)<br><br>Waste Framework Directive already sets that the preparing for reuse and the recycling of municipal waste shall be increased to a minimum of 55 % by weight in 2025 | The current EU provisions might not be sufficient to guarantee that products are design in an appropriate way.<br><br>Targets introduced by the Waste Framework Directive, and WEEE Directive do not distinguish between “preparing for reuse” and “recycling”<br><br>The promotion of reuse and repair is not addressed in the Eco-Design Directive<br><br>Circular business models are not addressed in the Waste Framework Directive |
| **Socio-economic** | Growing second-hand market for reuse, donating white goods<br><br>Making repair more economically attractive to consumers for many product categories normally landing into municipal solid waste | Consumer obsolescence<br><br>Consumer acceptance and engagement<br><br>Costs of repair compared to new products |
| **Technical** | There are opportunities for many product categories to extend product durability through improved product design<br><br>Reuse and repair will facilitate new circular business models centred around sharing and renting garments | Uncertainties around how to shift from selling a product to selling a service to enable circular business models |

## 3.4 Conclusions

Several barriers and opportunities can be identified for the different approaches to address waste prevention (extended product lifetime through product design, repair, reuse, remanufacturing and circular business models).

For each of the waste streams; the main legal, technical and socio-economic barriers and opportunities were identified through the literature and legal review (see chapter 3.3) and the stakeholder consultation (see Appendix A.3.0). Key conclusions are compiled here:

### End-of-Life tyres

Retreading of tyres offers promising opportunities to address waste prevention of tyres. The main socio-economic barriers to retreading are however related to the cheap prices of lower-quality tyres, and lack of consumer trust for retreaded tyres. Technical opportunities might help to address the barriers, such as minimum standards of tyre wear and abrasion rate, product passports and improved design for retreadable tyres.

Currently, there are no legal provisions at EU level addressing the prevention of waste tyres through retreading, or labelling for wear rate; or aimed at supporting circularity aspects of the tyre life- cycle (with the exception of the Type Approval Regulations which specify minimum standards for market entry). Also, the Tyre Labelling Regulation does not extend to retreaded tyres out of the labelling requirements due to a lack of suitable, current testing methods.

The reuse and repair of tyres is in general subject to the concerns of consumers about safety, which are currently not adequately addressed in the EU legislation. Other opportunities to address waste prevention include the leasing of tyres, and raining consumers awareness on maintenance of tyres, e.g. through annual inspection, so that useful life is prolonged.

### End-of-Life vehicles

Technical barriers to waste prevention are associated with the difficulties and skills required for dismantling, repairing and remanufacturing old vehicles.

Mostly technical opportunities can help to improve design to increase dismantling, disassembly, and remanufacturing of ELV. Opportunities also exist for increased mobility-as-service models (car sharing, car-pooling, etc.)

Although the ELV Directive encourages designs for new vehicles, which facilitate their dismantling and recycling, as well as the use of recycled materials, the provisions set out in the Directive are not sufficiently detailed and, therefore, limit the impact on the design and manufacturing of new vehicles. In addition, there are no separate targets for reuse, and the ELV Directive does not include separate targets for reuse of specific material components.

### Construction and demolition waste

Different technical opportunities exist to address waste prevention, including the promotion of market spaces and information (e.g. through building passport, Building Information Modelling) and selective demolition offer opportunities to increase C&D reuse, repair and remanufacturing. Opportunities also exist to improve the life and use of building, e.g. through design for buildings for adaptable and flexible use, and repurposing of buildings for alternative use. Some of the measures might also incur into cost barriers. Economic barriers for C&D materials and components include especially a lack of markets for excess or reused products.

Currently, the WFD mainly focusses on CDW recycling and does not set targets for the reuse and selective demolition in the C&D sector. The reuse and repurposing of existing buildings are also not a focal point of current EU legislation, whereas sustainable circular design remains mostly a voluntary measure (e.g., GPP criteria).

### Textile waste

Barriers to the waste prevention of textile products are mostly associated to socio-economic barriers, associated with material obsolescence and consumers' obsolescence, paired with low consumers' perception on the quality of second-hand clothes, and the perceived inconvenience of second-hand or repaired textile wastes. Also, low separate collection of textile is hampering the potential for reuse.

In EU legislation, different provisions address the waste prevention, reuse and repair of textiles. However, there is currently no design requirement for an extended lifetime and durability of textiles or their maintenance, nor are there any targets and requirements for material durability, for repair and for remanufacturing, or for circular business models. Hence, the current provisions might not offer the right stimulus to fully grasp the potential for reuse and repair.

Socio-economic opportunities exist to make reuse and repair more attractive to consumers through a large-scale adoption of clothing repair and restyle services, and to supporting the scaling-up of alternative and sharing business models for clothing. Provisions to increase reuse are already laid down in the WFD, such as reuse targets to be considered by the European Commission by 2024. Also EU Strategy on textiles will closely look at some of these aspects, such as the promotion of product-as-service in the textile industry. Concerning remanufacturing, there is potential to further explore the concept for post-industrial and pre-consumers. However, a lack of a homogeneous definition for textile, and especially in the view of increasing remanufacturing, might hamper this opportunity.

### Waste electrical and electronic equipment

A mix of socio- economic and technical barriers to waste prevention seem largely related to product, material and consumers' obsolescence. The findings would suggest a vicious circle where products are not designed in a circular way and are cheap, which means they do not last for very long and are therefore unsuitable for further repair, reuse, remanufacturing or sharing amongst multiple users. A lack of information and a lack of trust in products which are not brand new, paired with the low price of new products, does not provide the right incentive for a more circular use of products. In addition, repairing and re-manufacturing require skills, access to material, components and know-how which are often not available.

Several technical opportunities can be identified related to the standardization of components, and increased accessibility to information and instructions on the products, e.g. through material passports, and increased digitalization, that might in turn counter product and material obsolescence. Opportunities exist also to improve the design to increase lifetime and emotional durability of EEE, such as increasing information on the status of the product and its specification (which will also be stimulated by increasing digitalization and AI).

The EU legislation already promotes the provision of information on preparation for reuse and standards for reuse in the WEEE Directive (2012/19/EU)[287], whereas the legislation does not address issues on countering product or psychological obsolescence, nor the promotion of circular business models. In addition, in the WEEE Directive there is no distinction between "preparing for reuse" and "recycling", and EEE items that still have value for reuse or repair ending in the waste management system are classified as 'waste'. Opportunities can be identified to further address the availability of spare parts and repair manuals available in the Ecodesign Directive.

### Municipal solid waste

Socio-economic barriers to waste prevention are associated to consumer obsolescence and product obsolescence for many products and white goods (including WEEE and textiles), but

[287] Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE)

also their design and price, which means products are less durable and unsuitable for repair, reuse or share. Costs of new products compared to repaired ones plays also a role in the acceptance of consumers.

Socio-economic opportunities can be identified by making repair, in general, more attractive to consumers for different product categories and increasing their interest in circular business models such as PSS. The Waste Framework Directive already provides a good basis for reuse and repair.

In terms of considering municipal waste prevention, it should be noted that this comprises many different waste fractions resulting from the use of various products and goods. The lack of legislative requirements in terms of “design for circularity” is currently the main legal barrier to improved durability, reusability, upgradability and reparability of products. The revision of the Ecodesign Directive is expected to become the main driving force in terms of product sustainability and waste prevention. Measures to support increased product durability and to counter premature obsolescence, which could be key drivers to supporting waste prevention are very limited at present, as well as waste prevention targets for specific product categories. In addition, the current provisions on reuse and repair as set out in the WFD, might not be sufficient alone to address the attractiveness of such measures to consumers.

# 4.0 Examples of measures and best practice in waste prevention (Task 3)

## 4.1 Purpose of the task

The main purpose of Task 3 was to identify best practice examples that have been demonstrated to effectively incentivise waste prevention activities, and which could be replicated by others. The analysis and assessment carried out in Task 3 was focused on the waste streams identified in Task 1, namely: municipal waste, textile waste, end-of-life vehicles (ELV), waste from electrical and electronic equipment (WEEE), rubber waste (including end-of-life tyres) and construction and demolition waste.

## 4.2 Methodology

For the identification of best/good-practice examples in waste prevention in EU Member States, the following steps were undertaken:

(1) Compilation of examples of waste prevention measures in EU Member States.
(2) Clustering similar examples of waste prevention measures.
(3) Selection of 20-25 best/good practice examples based on the development of a methodology and its application to the clustered waste prevention measures / initiatives (from step 2)

Each of these steps is discussed in detail in the following sections.

### 4.2.1 Compilation of examples for waste prevention measures in Member States

In order to identify case study examples of waste prevention in the Member States, a literature survey was performed. Key information sources included:

- Reports on the status of waste prevention in Europe published by the European Environment Agency[288];
- Country fact sheets on waste prevention prepared by the European Environment Agency[289];
- Best practice examples published on the European Circular Economy Stakeholder Platform[290];
- Sectoral information such as Best Environmental Management Practices (BEMPs) for specific sectors established under EMAS[291];
- National circular economy strategies and waste prevention programmes.

[288] E.g. https://www.eea.europa.eu//publications/waste-prevention-in-europe-2017
[289] https://circulareconomy.europa.eu/platform/
[290] https://www.eea.europa.eu/themes/waste/waste-prevention/countries
[291] https://susproc.jrc.ec.europa.eu/activities/emas/waste_mgmt.html

In addition, a written consultation with stakeholders was performed in order to identify possible additional measures and further details about those measures/initiatives (see chapter 0 and Appendix 0 “Questionnaire for written consultation”).

This led to a list of around 300 individual examples of waste prevention measures.

### 4.2.2 Clustering similar examples of waste prevention measures

The list of around 300 examples of waste prevention measures was the starting point to cluster similar measures. Two examples of clustering are given in Table 4-1.

**Table 4-1: Illustration of how individual case study examples were clustered in a waste prevention measure / initiative**

| Examples of measures/initiatives for waste prevention in EU Member States | Measure/Initiative |
|---|---|
| 1) Local reuse centre/platform for building components in Bremen, Germany | Establishing reuse centres/platforms for building components |
| 2) German reuse centre/platform for building components | |
| 3) Austria-wide reuse centre/platform for building components | |
| 1) Online registration services to reduce unwanted mail in the UK | Organizing awareness raising among citizens (Promoting unsubscribing for unwanted paper advertising) |
| 2) Distribution of stickers for mailboxes to stop unaddressed mail from being delivered in Austria (so called “No”-Stickers) | |
| 3) Stickers for mailboxes explicitly giving consent for unaddressed mail in Amsterdam (so called “Yes”-Stickers) | |

For each measure/initiative the following information was compiled:

- A short description and information on the individual practice examples
- The targeted waste stream(s);
- Type of measure (regulatory, information-based, economic instrument, voluntary agreement);
- Whether the focus of the measure/initiative is on qualitative or quantitative waste prevention;
- Location and context;
- Scale (national, regional, local, sectoral);
- Main mechanism of the measure:
  - → longer lifetimes of products/buildings through increased durability
  - → Stimulating reuse, repair, remanufacturing
  - → Stimulating alternative business models and reuse/sharing schemes
  - → Prevention of unintended overconsumption (e.g. avoiding medical waste through unit dispensing of medication)

- → Material efficient production (Reducing the generation of offcuts and residues through relevant techniques)
- → Market restrictions on products for which more sustainable alternatives exist
- → Horizontal (integrated approaches, such as strategies and programs including several policy measures)

- Implementation status (most of the examples covered are planned / have just been launched / are ongoing or have been completed); and
- References to further information

### 4.2.3 Selection of good/best practice examples

The selection of good/best practice examples is based on a multi-criteria assessment including:

a. the definition of five relevant criteria;
b. a qualitative assessment of each measure / initiative against the five criteria and
c. their ranking based on the assessment results.

The top 20-25 ranked measures represent the good/best practice examples. It should be noted that a detailed description of each good/best practice example is the starting point for the development of future policy options under Task 4.

**a) Definition of criteria**

Table 4-2 presents the five criteria used for assessing the measures / initiatives, alongside an explanation of the rationale for applying the criteria, and the scale used in assessing each of them.

**Table 4-2: Criteria for the assessment of measures/initiatives.**

| Criterion | Scale |
|---|---|
| **Effectiveness of the measure:** The aim is to prioritize measures which achieve a significant effect in terms of waste prevention without any substantial unintended negative consequences. | **Effective measures** (green): There is evidence[292] that the measure either (a) led to a reduction in the volumes of waste generated (per inhabitant, per production unit, etc.) and/or (b) led to less adverse impacts of the generated waste on the environment and human health and /or to a reduction of hazardous substances in products and materials, respectively in waste. (C) In addition it was considered if a measure led to improvements of indirect waste prevention indicators, including an increased number of reuse shops, increased turnover in reuse, increased number of eco-labelling certificates issued, etc.<br><br>**Measures / initiatives where there is no evidence on impacts** (ni). Measures, where no effectiveness assessments are available, but relevant waste prevention potentials were estimated are indicated by **P**. |

[292] Either the measure/initiative is captured by a regular monitoring system and there are reporting mechanisms (definition of indicators, monitoring intervals etc.), or other assessments of the measure's/initiative's effectiveness were made.

| Criterion | Scale |
|---|---|
| **Cost of the measure:**<br>The rationale is that the focus is on measures where the costs of a future implementation at EU level (including administrative burdens) are expected to be low. | **Low Cost measures** (green): Measures where the costs and efforts (administrative burden) of a potential implementation at the EU level are expected to be comparatively low. Comparatively low costs and efforts are assumed for measures whose implementation at EU level would most likely require only the inclusion of a few very specific extra elements (e.g. an additional waste reduction target in the Waste Framework Directive) in existing pieces of EU legislation/regulations.<br><br>**Higher cost measures** (red): Measures where the costs and efforts of a potential implementation at the EU level are expected to be comparatively high. Comparatively high costs and efforts are assumed inter alia for measures that need more than simple amendments to existing waste legislation in order to be implemented at EU level. This includes for instance the development of mandatory EPR schemes for new product categories (such as textiles) or the development of technical standards (e.g. quality criteria for specific refurbished goods, and criteria for durability and reparability for specific products) |
| **Sustainability of the measure over time:**<br>The sustainability of a measure over time highly depends on the type of instrument through which it is implemented and on its longevity. | **Highly sustainable measures** (green): At least one example exists where the measure has been made legally binding. It is assumed that prior to adopting such a measure positive experiences with pilots etc. were made and the responsible authorities have come to the conclusion that the measure was viable.<br><br>**Sustainable measures** (orange): Voluntary measures, with examples of measures that have been applied for more than 5 years<br><br>**Less sustainable measures** (red): Voluntary measure/initiative that has been applied for less than 5 years or only as a pilot scheme. |
| **Transferability of the measure to other sectors and waste types:**<br>The focus is on those measures which can be applied to different waste types and sectors without major adaptations. | **Highly transferable measures** (green): Measures/initiatives that have already been implemented across several product categories or sectors. Clear potential for the measure to be applied to other waste streams. An example is the setting of reduction targets for waste streams.<br><br>**Measures with limited transferability** (red): Measures/initiatives that have been implemented for a specific product category, waste stream or sector only, for example obligatory pre-demolition audits of buildings to check them for reusable components. Measures with limited or no potential to be transferred to other waste types. |

| Criterion | Scale |
|---|---|
| **Potential transferability to other Member States for scaling up the approach:**<br>The aim is to prioritise measures which can easily be transferred to other Member States. | **Highly transferable measures** (green): The measure/initiative has already been implemented in several countries. An example is the setting of waste reduction targets.<br><br>**Measures with a potential for transferability** (orange): The measure/initiative has been implemented in one country only but there are no apparent reasons for not transferring it to other countries. Examples include:<br>• Introducing a legal ban on unaddressed advertising material and printed matter containing mineral oils: this measure has only been found in France, but does not depend on the specific situation in France and thus could be implemented in other Member States too<br>• Introducing reuse criteria in certification schemes for sustainable buildings: only the certification system of the German Sustainable Building Council has been found to include specifications for reuse. However, building certification systems are applied internationally and reuse specifications could thus be included in other Member States as well.<br>• Economic measures stimulating reuse (e.g. vouchers for consumers) might require adaptation (e.g. the value of the vouchers) in countries with highly divergent labour costs and/or virgin and reuse markets)<br>• Preparing for reuse targets for specific waste streams might require adaptation in countries with divergent reuse markets |

### b) Assessment of the five criteria for each measure / initiative

For most of the measures / initiatives quantitative data are not available. Therefore, a qualitative assessment was carried out based on information which is publicly accessible (see column "Reference" in Annex A.3.1.)

The five criteria are assessed for each measure / initiative. Each measure/initiative covers multiple individual waste prevention examples as exemplified in Table 4.1. A fact-finding mission during the project showed that the assessment of the individual examples is handicapped by the limited availability of primary data and the absence of evaluation and monitoring reports. Limited information is the main barrier for a systematic assessment of waste prevention measures. Therefore, the assessment in this report section is based on qualitative expert judgement on the potential effectiveness, the costs, the sustainability, and the transferability and the scalability of the measures.

### c) Ranking of measures/initiatives

The assessed measures / initiatives are ranked according to the frequency of the assessed "green", "orange" and "red" criteria. This will enable identification of the good/best practice examples.

A summary of the assessment of the individual indicators for each measure/initiative of the long list and a shortlisted good/best practice examples are presented in chapter 4.3.2.

## 4.3 Results

### 4.3.1 Examples of measures for waste prevention in EU Member States

Overall, more than 300 examples of measures for waste prevention were identified by means of a literature survey, which were then clustered into 68 waste prevention measures/initiatives. An overview of the type of the identified measures/initiatives, together with information on the targeted waste streams, is provided in Table 4-3. The full list of measures is provided in Table 4-4. Details for each example of measures are provided in Appendix **Error! Reference source not found.** "*Examples of measures for waste prevention*".

**Table 4-3: Overview of identified measures/initiatives for waste prevention**

| | Targeted waste stream | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type of prevention measure / initiative** | **WEEE** | **ELV** | **C&D waste (incl. soils)** | **Rubber waste (incl. end-of-life tyres)** | **Textiles waste** | **Municipal waste** | **Other / un-specified** | **Total** |
| Regulatory | 8 | 3 | 5 | 3 | 5 | 15 | 2 | 26 |
| Information based | 10 | 6 | 8 | 6 | 7 | 10 | 7 | 18 |
| Economic | 2 | 2 | 1 | 0 | 2 | 5 | 0 | 6 |
| Voluntary (agreements) | 1 | 2 | 2 | 1 | 2 | 1 | 1 | 4 |
| Operational | 3 | 4 | 5 | 2 | 2 | 8 | 2 | 14 |
| ***Total*** | ***24*** | ***17*** | ***21*** | ***12*** | ***18*** | ***39*** | ***12*** | **68** |

In addition to the waste-specific waste prevention measures, measures that affect all waste types (horizontal measures) have been identified as follows:

- promoting knowledge transfer / training / guidance related to remanufacturing and reuse,
- organising awareness raising campaigns on waste prevention and the circular economy for the general public,
- providing funding for waste prevention / reuse / repair for producers operating under EPR schemes,
- organizing environmental business consultations on waste prevention,
- considering waste prevention aspects in GPP guidelines / practices.

As these horizontal measures do not focus on the selected waste streams, assessing their quantitative effects is challenging, even if they can be considered effective because of their indirect effects.

### 4.3.2 Selection of good/best practice in waste prevention

The selection of good/best practice examples follows the approach in chapter 4.2. The results are presented in Table 4-4. An explanatory note on the colours red, green and orange is given in Table 4-2. It should also be noted that the justification for the assessment results is provided for each indicator in Appendix A.2.1 "*Assessment of measures/initiatives for waste prevention*".

**Table 4-4: Assessment of the identified measures / initiatives for waste prevention. Note: The measures/initiatives indicated in bold letters are comparably highest ranked[293].**

| | **Waste prevention measure / initiative** | Effectiveness | Cost | Sustainability over time | Transferability to other sectors and waste types | Transferability to other Member States |
|---|---|---|---|---|---|---|
| **Horizontal measures** | | | | | | |
| 1 | Emphasize waste prevention (especially as regards durability) in the context of action plans / networks aiming at making textiles sustainable | ni | | | | |
| 2 | Introduce a reduction target for C&D waste | ni | | | | |
| 3 | Introduce a reduction target for MSW | ni | | | | |
| 4 | Introduce a reduction target for total waste | ni | | | | |
| 5 | Introduce obligatory waste management schemes for businesses which must contain information on planned and implemented waste prevention measures | ni P | | | | |
| 6 | Introduce obligatory product labelling (info on whether useless packaging is avoided, info on reparability) in the context of EPR | ni | | | | |
| 7 | Introduce waste prevention criteria in public procurement criteria and making them legally binding | ni P | | | | |
| **8** | Introduce (obligatory) funding of waste prevention/reuse/repair for producer responsibility organisations (PROs) operating under EPR schemes | | | | | |
| **9** | Promote unsubscribing of unwanted paper advertising | | | | | |
| 10 | Organize awareness raising campaigns and information exchange on CE and waste prevention - in general | ni | | | | |

[293] For the detailed description of good/best practice examples see Appendix A.2.2. , in some cases related topics were merged, e.g. legally binding measures to reduce unsolicited mail and related voluntary approaches.

| | | |
|---|---|---|
| 11 | Promote knowledge transfer/training/guidance on waste prevention in the building sector | ni P |
| 12 | Promote knowledge transfer/training/guidance on reuse | ni P |
| 13 | Provide information on best practice in waste prevention in sector specific templates for obligatory waste management schemes | ni |
| 14 | Promote the development of sector specific guidance on best practice examples in waste prevention (apart from those linked to BEMPs under EMAS) | ni P |
| 15 | Organize environmental business consultations (including financial support) on possibilities to reduce waste | ni |
| 16 | Include waste prevention criteria (e.g. durability) in Ecolabels | ni |
| 17 | Introduce "pay as you throw" schemes for household waste | |
| 18 | Set up public funding for waste prevention initiatives | ni |
| **Longer lifetimes of products/buildings through increased durability** | | |
| **19** | Extend the legal guarantee (product warranty) of products | ni |
| 20 | Introduce a legal ban on using planned obsolescence practices | ni |
| **21** | Durability requirements for (consumer) goods | ni P |
| **Material efficient production** | | |
| **22** | Waste prevention action plan and eco-design action plan for manufacturers of specific products in the context of extended producer responsibility | ni |
| 23 | Promote increased off-site manufacturing of building components | ni P |
| 24 | Promote practices/tools to prevent waste when designing buildings | ni |
| **Prevention of unintended overconsumption** | | |
| 25 | Introduce mandatory unit dispensing for medication | |
| **Stimulating alternative business models and reuse/sharing schemes** | | |
| 26 | Support the implementation of car sharing | |
| 27 | Establish platforms/networks to collect and distribute non-expired medicines | ni |
| 28 | Promote Leasing and "Pay per service unit" models | ni |
| **29** | Promote sharing platforms | ni P |
| 30 | Introduce reuse criteria in certification schemes for sustainable buildings | ni |
| **31** | Include procurement for repair, reuse and remanufacturing in GPP guidelines | |
| 32 | Introduce reuse targets, e.g. for WEEE | ni |
| **33** | Introduce/enable tax reduction for accredited reuse centres (reduced VAT) | ni P |
| 34 | Introduce the obligation for manufacturers to provide 3D printing files for product parts that are not available on the market any more | ni |
| **35** | Introduce obligatory consumer information on durability reparability, spare parts and on the duration of computer and phone operating software updates | ni P |
| **36** | Introduce obligatory pre-demolition audits of buildings to check them for reusable components | ni P |
| 37 | Introduce the obligation for manufactures of construction materials and products to set up schemes that allow free pick-up of materials/components after the demolition of a building. | ni |
| **38** | Introduce a ban on destroying unsold new products. | ni P |
| 39 | Establish reuse centre/platforms for building components | ni |

| | | |
|---|---|---|
| 40 | Promote reverse logistics and sale of used vehicle components | ni |
| 41 | Promote reverse logistics, remanufacturing and resale of medical equipment | ni |
| 42 | Implement measures to improve the collection of reusable items from households | ni |
| 43 | Promote the establishment of reverse logistics of consumer products (furniture, books, toys…) by brands | ni P |
| 44 | Introduce reverse logistics and reuse of school books | ni P |
| 45 | Promote the establishment of quality standards for preparing for reuse and the refurbishing of used electrical and electronic equipment | ni |
| **46** | Promote the establishment of quality standards for remanufacturing processes | ni P |
| 47 | Promote the establishment of quality standards for the process of collection and reuse of textiles waste | ni |
| **48** | Promote the establishment of quality standards for used goods (UEEE, furniture, sports and leisure equipment) | ni |
| **49** | Promote the establishment of quality standards for refurbished office equipment | ni P |
| 50 | Promote knowledge transfer/training/guidance on remanufacturing | ni |
| 51 | Promote the provision of online repair guidance for electrical and electronic equipment | ni |
| 52 | Investigate the reuse/repair potential for specific product groups | ni |
| 53 | Promote the establishment of inventories of materials/components in buildings | ni |
| 54 | Introduce direct economic support to reuse centres (e.g. bonus per reused tonne of goods, subsidies for start-ups) | |
| 55 | Introduce a bonus scheme for using reused parts in car repairs to be adopted by insurance companies | ni |
| 56 | Introduce bonus schemes for reusing wheelchairs from health insurance | ni |
| **57** | Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, refurbished and retreaded goods. | |
| **Phasing out of specific products for which more sustainable alternatives exist** | | |
| 58 | Apply the substance restrictions of the ELV Directive for vehicles not within the scope of the Directive | ni |
| 59 | Introduce a weight based default tax on textiles with tax reductions for textiles not containing harmful substances | ni |
| **60** | Extend obligations and restrictions on the marketing of single-use products | |
| 61 | Introduce a legal ban on putting on the market products containing micro- and nanoplastics | |
| 62 | Introduce a legal ban on non-rechargeable products | |
| **63** | Establish a (legal) framework stipulating a reduction of advertising mail | |
| 64 | Introduce a legal ban on the systematic printing of cash till and credit card receipts | |
| 65 | Introduce modulated taxes for cars based on fuel consumption/pollution and engine power | ni P |
| **66** | Waste prevention criteria for events (including establishing criteria to phase out non-reusable) | ni P |
| 67 | Promote the switch from paper to digital mail in administration | ni |

| | | | | | | |
|---|---|---|---|---|---|---|
| 68 | Organize awareness raising campaigns for consumers (switching from non-reusable to reusable products) | ni | | | | |

Notes: "ni" = no information (lack of data); "**P**" = no effectiveness assessments, but relevant waste prevention potentials were estimated.

### 4.3.3 Good/best practice examples in waste prevention

For the description of good/best practice examples in waste prevention, the identified measures/initiatives were clustered into 15 topics. Table 4-5 provides information on identified Member State examples per priority waste streams.

Detailed descriptions of the individual topics are provided in Annex A.2.2 including the following aspects:

- location and context of the measure / policy actions taken
- description of measures / policy actions taken
- brief assessment of the costs and effects of the measure
- assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach
- references to further information

**Table 4-5: Good/best practice examples in waste prevention.**

| | | Examples identified in MS | Municipal waste | Textile waste | Discarded vehicles | Discarded equipment | Rubber Waste | C&D waste |
|---|---|---|---|---|---|---|---|---|
| **1** | Waste prevention action plan and eco-design action plan for manufacturers of specific products in the context of extended producer responsibility (EPR) | FR, BE | | | | | | |
| **2** | Durability requirements for (consumer) goods including obligatory consumer information | FR, UK, Nordic countries | | | | | | |
| **3** | Extend obligations and bans on single-use products | ES, FR | | | | | | |
| **4** | Introduce obligatory funding of waste prevention/reuse/repair for producer responsibility organizations (PROs) operating under EPR schemes | FR, AT | | | | | | |
| **5** | Introduce a ban on destroying unsold new products. | DE, FR | | | | | | |
| **6** | Introduce direct economic support to reuse centers (bonus per reused tonne of goods, subsidies for start-ups) | BE, NL, AT, FR | | | | | | |

| | | Examples identified in MS | Municipal waste | Textile waste | Discarded vehicles | Discarded equipment | Rubber Waste | C&D waste |
|---|---|---|---|---|---|---|---|---|
| **7** | Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, refurbished and retreaded goods. | AT, BE, NL | | | | | | |
| **8** | Extend the legal guarantee (product warranty) of products | FR | | | | | | |
| **9** | Introduce/enable tax reduction for accredited reuse centers (reduced VAT) | SE, BE, IE, LU, MT, NL, PL, SI | | | | | | |
| **10** | Establish a (legal) framework stipulating a reduction of advertising mail | FR, NL, UK, AT, ES | | | | | | |
| **11** | Waste prevention criteria for events | AT, Tallinn, Vilnius, Kiel, EU | | | | | | |
| **12** | Promote sharing platforms | Several MS | | | | | | |
| **13** | Promote the establishment of quality standards for remanufacturing | AT, UK, USA, EU | | | | | | |
| **14** | Include procurement for repair, reuse and remanufacturing in GPP guidelines | IT, SE, DK, NO, UK, BE, NL | | | | | | |
| **15** | Introduce obligatory pre-demolition audits of buildings | AT, BG, CZ, FI, FR, HU,LU, NL | | | | | | |

### 4.3.4 Key success factors of measures and initiatives to reduce waste generation

The detailed review of the 15 good/best practice examples (c.f. Table 4-5) showed **7 key factors for the success** of the measures. These 7 factors are presented in the following paragraphs.

#### Legally binding requirements instead of voluntary agreements, and consistent enforcement

The 2020 EU circular economy action plan contains a provision for a ban on the destruction of unsold functional, durable goods. France has already introduced such a ban (see Appendix

A.2.2.5 Introduce a ban on destroying unsold new products). The corresponding law[294] and decree[295] came into force in January 2021. During the development of the French law, a voluntary industry commitment was considered as well.[296] However, ultimately, a regulatory framework was considered to be more likely to guarantee the effect of the measure.

Information from initiatives promoting unsubscribing unaddressed advertising mails by citizens (see Appendix A.2.2.10. *Establish a (legal) framework stipulating a reduction of advertising mail*) illustrate also the importance of appropriate enforcement. A crucial factor for the success of campaigns using stickers either giving explicit consent ("Yes" stickers) or refusing ("No" stickers) the delivery of unaddressed mail is that the provisions are properly enforced. Those companies not accepting citizens' right to refuse unaddressed mail have to be fined appropriately. The municipality of Amsterdam has set up a website to report the receipt of unwanted printed matter. Following such a report, the advertiser will be contacted and given two weeks to prevent unwanted distribution again. If there is another report, authorities will draw up an official report, on which the advertiser may give its opinion. If, after this violation, there is a further unwanted delivery to the address, the municipality will impose a penalty of 500 Euros per mail.[297]

To ensure good practice during the repair and remanufacturing process and increase consumer confidence in repaired products, a number of standards and guidelines have been published inter alia in Austria[298] , at the European level BS[299], in the UK/Scotland[300] and in the USA[301] (see Appendix A.2.2.13 *Promote the establishment of quality standards for remanufacturing processes*). The standards and guidelines identified are not legally binding, and thus their effect depends on the voluntary commitment of reuse operators. Therefore, requiring repair operators to follow these standards could help to ensure overall quality of repaired goods across the EU and thus further encourage reuse.

Several initiatives have been launched in the context of *Durability requirements for (consumer) goods including obligatory consumer information* (see Appendix A.2.2.2). Examples include the introduction of a mandatory repair score in France giving information

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[294] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759/
[295] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000042753962
[296] https://www.legifrance.gouv.fr/contenu/Media/Files/autour-de-la-loi/legislatif-et-reglementaire/etudes-d-impact-des-lois/ei_art_39_2020/ei_trep1902395l_cm_10.07.2019.pdf
[297] https://www.vang-hha.nl/nieuws-achtergronden/2018/factsheets/factsheet-invoering/
[298] Guideline to determine the end-of-waste status in the preparation for reuse process; Meissner et al. (2019): Reuse of products: Guideline to determining the end-of-waste status in the preparation for reuse. Österreichisches Ökologie-Institut, Wien.
[299] E.g. EN 50614:2020; https://www.en-standard.eu/bs-en-50614-2020-requirements-for-the-preparing-for-re-use-of-waste-electrical-and-electronic-equipment/
[300] PAS 141:2011, https://shop.bsigroup.com/products/reuse-of-used-and-waste-electrical-and-electronic-equipment-ueee-and-weee-process-management-specification
[301] https://remanstandard.us/

to the consumer on how repairable a product is[302]. The Ministry of Ecological and Inclusive Transition, ADEME and the actors in the sector are working on a simple index (a score out of 10). This score will evolve in 2024 into a broader durability score, taking account of reparability but also robustness and the ability to evolve. Potential eco-design requirements for textiles and furniture including criteria for durability were elaborated by the Nordic Council of Ministers in 2018[303] and under WRAP (UK) Design for Longevity and Clothing Longevity Protocol that was launched in 2013[304].

Relevant for the success of such initiatives is, however, that they will be integrated in future binding minimum requirements regarding durability of consumer goods under Eco-Design Directive.

### Sustainable financing of waste prevention measures by establishing markets, new business models, tax incentives, and providing funds

A good practice examples for sustainable finance is to *Introduce (obligatory) funding of waste prevention/reuse/repair for producers under EPR schemes* (see Appendix A.2.2.4). Austrian legislation[305] stipulates that PROs must allocate at least 0.5 % of the licence fees collected annually to funding waste prevention projects. In France, EPR schemes will have to financially support all those involved in reuse activities, including waste sorting, repair and recycling centres, etc., through the creation of so-called “Solidary Reuse Funds”. In particular, this concerns producers of products likely to be reused, in particular EEE, furniture, textiles, footwear, toys, sports and leisure articles as well as DIY and garden items. The fund is to be provided with the resources necessary to achieve the reuse objectives, with a minimum of at least 5 % of the licence fees set.[306]

In a number of Member States or regions including Flanders, the Netherlands, Austria and France reuse centres receive direct economic support to finance their operation (see Appendix A.2.2.6 *Introduce direct economic support to reuse centers (bonus per reused tonne of goods, subsidies for start-ups).* Often, social enterprises, which include repair services, are supported for their activities in terms of social employment. For instance, costs for the employment and training of employees are incurred by the public.

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[302] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759, Article 72.

[303] http://norden.diva-portal.org/smash/get/diva2:1221509/FULLTEXT01.pdf

[304] Cooper, Tim & Claxton, Stella & Hill, Helen & Holbrook, K & Hughes, M & Knox, A & Oxborrow, Lynn, Development of an Industry Protocol on Clothing Longevity, 2014, https://www.researchgate.net/publication/313479105_Development_of_an_Industry_Protocol_on_Clothing_Longevity

[305] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20002086

[306] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759/, Article 26

To support the sharing economy (see Appendix A.2.2.12, *Promote sharing platforms*) in general, the city of Amsterdam has developed a proactive approach to support new initiatives through funding by the relevant city department.[307]

### Regular monitoring and evaluation of waste prevention measures including data collection and reporting routines

Research within this study revealed that data collection on the effectiveness of waste prevention measures/initiatives is rarely conducted.

Monitoring and reporting routines were introduced under the measure *Mandatory waste prevention plans for producers under EPR* (see Appendix A.2.2.1). France made the setup of such plans legally binding; in Flanders a policy agreement with producers under EPR was made. In both cases producers, or the respective PROs, must report on the planned and implemented actions. In France, evaluation of these plans is needed every five years.

Another example is linked to the measure *Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, refurbished* and retreaded goods (see Appendix A.2.2.7). In Austria, where several provinces have implemented a repair bonus/subsidy to be used by citizens for repair services, the number of repairs, the amount of funding paid out and the type of product are recorded.

The financial support received by reuse centres in Flanders (described in the measure *Introduce direct economic support to reuse centers (bonus per reused tonne of goods, subsidies for start-ups)*, see Appendix A.2.2.6), is connected to the obligation to annually report on the amounts and types of products that are repaired to the public waste management authority. This support therefore acts as an incentive to enable proper monitoring of reuse and repair activities.

Several case studies – often at municipality level - were identified linked to the measure *Establish a (legal) framework stipulating a reduction in advertising mail* (see Appendix A.2.2.10). Several of them (France[308], Utrecht[309], Vienna[310]) include estimates on the achievable reduction of paper waste by banning the delivery of unsolicited mail and/or permitting delivery on demand only.

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[307] https://ellenmacarthurfoundation.org/circular-examples/shaping-a-sharing-economy-amsterdam

[308] ADEME (2007) Le gisement des emballages ménagers en France, Evolution 1994/2006. Agence de l'Environnement et de la Maîtrise de l'Energie, France

[309] https://www.030magazine.nl/politiek/810-even-wennen-met-nieuw-ja-nee-stickerbeleid

[310] Wassermann G. et al (2004) Werbung auf Wunsch - Modellversuch zur Erprobung von Maßnahmen gegen die Zustellung unerwünschten Werbematerials (Advertising on request - model experiment for trialling measures against unsolicited advertising), on behalf of the Initiative Waste Prevention in Vienna, Austria

In addition, ongoing projects, funded by the EU Intereg programme (https://interreg.eu/), relating to the measures *Include procurement for repair, reuse and remanufacturing in GPP guidelines (*see Appendix A.2.2.14*)* and *Introduce obligatory pre-demolition audits of buildings to check them for reusable components (*see Appendix A.2.2.15*)* make attempts to gain data about the actual effects of waste prevention measures. ProCirc[311] takes a transnational approach to support circular procurement, including waste prevention aspects, in the key sectors of construction, IT, textiles and furniture in the North Sea Region. An overview on the actual effects (tonnes of waste prevented, tonnes of virgin materials saved) of 50 GPP pilot projects funded so far was made[312]. The project FCRBE (Facilitating the Circulation of Reclaimed Building Elements in Northwestern Europe)[313] aims to increase the amount of reclaimed building elements in circulation by +50% by 2032 compared to a current reuse rate of building elements of 1% and performs respective data collection.

### Public institutions as frontrunners in sustainable procurement, taking account of waste prevention criteria

Good practice as regards the measure *Include procurement for repair, reuse and remanufacturing in GPP guidelines (*see Appendix A.2.2.14) was identified in Italy. Italy obliges all public authorities to apply waste prevention criteria into calls for tenders and contracts. The Italian Code for Public Contracts[314] sets mandatory environmental sustainability criteria including the waste prevention criteria: efficiency and savings in the use of resources, reduction in the use of hazardous substances and quantitative reduction in waste products. Public procurement minimum environmental criteria are thus introduced for 11 product/service categories, such as furnishing, building work, electronics, textiles, catering, energy services, building management services, etc. Another example is Sweden, where a range of advanced approaches are used including: an internet based GPP tool with criteria for 60 product groups, Life cycle costing (LCC) tools including guidelines and web education, education and support (helpdesk) for public procurement officers and tenderers as well as monitoring by the Environmental Protection Agency. The National Agency for Public Procurement[315] provides contracting authorities with a number of spreadsheet-based LCC tools available for download on its website.

[311] https://northsearegion.eu/procirc/
[312] https://northsearegion.eu/media/13244/circpro-annex.pdf
[313] https://www.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/
[314] Legislative Decree 50/2016, as modified by legislative decree n. 57/2017
[315] https://www.upphandlingsmyndigheten.se/en/

### Broad regional coverage of waste prevention measures.

Experiences from waste prevention projects, such as ProcCirc[316], show that transnational, collaborative approaches are a success factor. The collaboration across national borders profits from current knowledge levels, gaps and needs in EU-27 Member States. This cross-border collaboration allows to upscale best practices and develop robust guidelines.

### Consolidation and formalisation of community engagements through the establishment of networks and umbrella organisations.

Almost all of the initiatives described within the measure *Promote sharing platforms* (see Appendix A.2.2.12) have started privately, without originating out of a specific government measure. However, the role of public authorities in supporting the sharing economy includes:[317]

- Enhancement of visibility through communication campaigns or labelling;
- Funding and incubators for innovative projects;
- Adaptation of regulations to benefit new models;
- Encouragement of public authorities to implement best practices.

Important factors behind the success of the reuse centres in Flanders include[318] a federation of reuse centres as a driving force behind the development of the reuse policy and a strong collaboration between regional and local governments and the federation, driving the professionalization and recognisability of the reuse centres.

### Package of waste prevention measures instead of individual measures

Based on the analysis of measures in the Member States, the importance of introducing a bundle of measures to achieve a specific goal is demonstrated by measures specifically aiming at increased repair and reuse of consumer goods. Following examples are given:

- Introduce (obligatory) funding of waste prevention/reuse/repair for producers under EPR schemes (see Appendix A.2.2.4),
- Introduce direct economic support to reuse centers (bonus per reused tonne of goods, subsidies for start-ups) (see Appendix A.2.2.6),
- Introduce/enable tax reduction for accredited reuse centres (reduced VAT) (see Appendix A.2.2.9),
- Include procurement for repair, reuse and remanufacturing in GPP guidelines (see Appendix A.2.2.14) and
- Promote the establishment of quality standards for remanufacturing processes (see Appendix A.2.2.13).

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[316] https://northsearegion.eu/procirc/

[317] Demailly et al. (2014): The sharing economy: make it sustainable. Institut du développement durable et des relations internationals (IDDRI), Paris.

[318] OVAM (2015): How to start a Reuse Shop? An overview of more than two decades of reuse in Flanders. https://ovam.be/sites/default/files/atoms/files/2015_Folder-Kringloop-engels_LR.pdf

Awareness-raising activities as an accompanying measure are also very important to inform the population about their opportunities, e.g. to receive subsidies for using repair services or about the availability of repair/reuse services in their vicinity.

### 4.3.5 Effectiveness and costs of best practice examples on waste prevention

The main findings regarding information on the **effectiveness** and **costs** of the identified best practice examples are summarised below.

#### Design and production phase

The following best practice examples are linked predominantly to the design and production phase:

- Obligatory waste prevention and eco-design action plans for manufacturers of specific products in the context of EPR (see Appendix A.2.2.1)
- Durability requirements for (consumer) goods including obligatory consumer information (see Appendix A.2.2.2)
- Extension of obligations and bans on single-use products (see Appendix A.2.2.3)
- Extending the legal guarantee (product warranty) for products (see Appendix A.2.2.8)

It was not possible to identify comprehensive **cost** information for these measures within this study: either in terms of administrative costs (e.g., to set up action plans and to elaborate durability requirements), or in terms of adjustment costs (e.g., caused by the need to adapt products), or in terms of enforcement costs for administrations, or in terms of cost savings, e.g., for consumers due to longer service lives of products. On the one hand, this is due to the fact that some initiatives are quite recent, such as obligatory waste prevention action plans for manufacturers, and, on the other hand, due to the far-reaching nature of the requirements: many products, many manufacturers, many retailers, many consumers, etc., are affected.

It was also only possible to identify limited information regarding the **benefits**, in particular the waste reduction potential, of these measures. Estimates on the effects of longer lifetimes of textiles were made by WRAP 2018[319]. A 10 % longer lifetime of textiles (i.e., 3 months) would lead to 9 % less waste. A 33 % longer lifetime of textiles (i.e., 9 months) would lead to 22 % less waste.

#### Consumption phase

The following best practice examples are linked predominantly to the consumption phase:

- Introduce (obligatory) funding of waste prevention/re-use/repair for producers under EPR (see Appendix A.2.2.4)
- Introduce a ban on destroying unsold new products (see Appendix A.2.2.5)
- Introduce direct economic support to reuse centres (see Appendix A.2.2.6)
- Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, refurbished and retreaded goods (see Appendix A.2.2.7)

[319] WRAP, Design for Longevity Guidance on increasing the active life of clothing, 2013.

- Introduce/enable tax reduction for accredited reuse centres (see Appendix A.2.2.9)
- Establish a (legal) framework stipulating a reduction of advertising mail (see Appendix A.2.2.10)
- Include procurement for repair, reuse and remanufacturing in GPP guidelines (see Appendix A.2.2.14)
- Waste prevention criteria for events (see Appendix A.2.2.11)

Very little information regarding the **costs** of these measures was identified.

Those who bear the direct **costs** of financial measures are either the public administrations (in the case of tax reductions or subsidies issued by administrations) and, indirectly, the citizens or – in the case of obligatory funding of waste prevention, etc. under EPR – the producers of products regulated under EPR and, indirectly, the consumers buying the products concerned. In addition, the "Promote sharing platforms" measure (see Appendix A.2.2.12) often includes direct financial elements, e.g., subsidies to support launching such platforms.

As regards the **benefits,** it can be concluded that an assessment of the waste reduction actually achieved is not available for any of the examples. Benefits are usually evidenced through indirect indicators such as an increasing number of reuse centres, an increase in goods collected for reuse, or an increase in turnover of reuse shops.

As regards the (recurring) costs of obligatory funding of waste prevention/re-use/repair under EPR, the following information was identified: A) the total volumes actually spent by packaging and EEE PROs in Austria, and b) estimates for the newly implemented "Solidarity Reuse Funds" in France. In Austria, €0.11 per capita is spent annually by the packaging PROs and €0.006 per capita by the EEE PROs. Whilst the projects funded by the Austrian PROs are considered in the implementation assessment of waste prevention measures in the national waste prevention programme, no assessments are carried out of the effectiveness of individual projects. The overall costs of the "Solidarity Reuse Funds" – to be established under EPR for a variety of product types – are currently estimated by the French Government to be between €0.30 and €1.44 per capita per year. As the French funds have not yet been implemented, the actual effects on reuse and waste prevention are unknown.

As regards a ban on destroying unsold new products, it is estimated that, of the €140 billion goods consumed yearly by households in France, around €800 million constitute residual unsold goods, of which around €630 million are destroyed and €140 million are donated.[320] Unsold goods can be donated VAT-free. Furthermore, the disposal taxes are planned to increase significantly by 2025 to €10/t more than the cost of recycling, ensuring that disposal will always be the costlier option for companies.

[320] https://www.legifrance.gouv.fr/contenu/Media/Files/autour-de-la-loi/legislatif-et-reglementaire/etudes-d-impact-des-lois/ei_art_39_2020/ei_trep1902395l_cm_10.07.2019.pdf

As regards direct economic support to reuse centres in the form of subsidies by public administrations, information was identified for Flanders and the Netherlands. Both have a considerable history in establishing reuse networks. A distinction does, however, have to be made between one-off costs (start-up subsidies) and recurring costs. Recurring costs include ongoing environmental subsidies for reuse centres, e.g., based on the number of inhabitants in the service area or a tonnage fee for the collection of reusable goods[321].

In 2017, around 48 % of the revenues of the Flemish reuse centres came from subsidies (around €55 million). Only a small part (7 %) of the overall funding was provided as an environmental subsidy which was intended to support the Flemish waste prevention policy and reporting activities. The remaining 93 % came from financial support related to social employment (40 % and 75 % of salaries of eligible personnel).[322] The environmental subsidy for start-ups paid by the Flemish government rose from €12,447 in 1995 to €24,790 between 1997 and 2004 (i.e., divided over 4 years). From 2012 onwards, the municipalities have been in charge of environmental subsidies for reuse centres. The documented effects of the programme are: a) a steady increase in the amount of collected goods in the Flemish reuse centres from 2,500 tonnes in 1995 to almost 66,000 tonnes in 2014, and b) an increase in shop turnover from €12.3 million in 2001 to €45.4 million in 2014[323].

In the context of CEAP, the Netherlands have set the objective of having a nationwide network of circular craft centres by 2030[324]. To achieve this, the Ministry of Infrastructure and Water Management has been offering subsidies to municipalities, since 2019, to start such centres which must include facilities such as reuse shops, waste recycling centres, social enterprises and repair workshops, etc. A total budget of €1 million per year is available for use in preparing for, and executing, such centres. A reuse centre can receive up to €50,000 which can amount to 50 % of the costs incurred.[325] In 2019, 10 circular craft centres were supported with a total budget of €500,000 while, in 2020, this number increased to 22 centres and €1 million.[326]

As regards funds to encourage citizens to use repair services, information was collected from Austria and a German province (Thuringia), where similar concepts are being implemented. However, the information about the sums spent by them is patchy. For example, an Austrian province with about 1.7 million inhabitants paid out a total of €0.56 million from July 2019 to

[321] OVAM (2015): How to start a Re-use Shop? An overview of more than two decades of re-use in Flanders. https://ovam.be/sites/default/files/atoms/files/2015_Folder-Kringloop-engels_LR.pdf; https://navigator.emis.vito.be/mijn-navigator?woId=44314

[322] De Schamphelaere et al. (2017): De Kringwinkelsector in 2017. https://ovam.be/sites/default/files/atoms/files/2017SectorrapportKringwinkels.pdf

[323] OVAM (2015): How to start a Re-use Shop? An overview of more than two decades of re-use in Flanders. https://ovam.be/sites/default/files/atoms/files/2015_Folder-Kringloop-engels_LR.pdf

[324] https://hollandcircularhotspot.nl/wp-content/uploads/2019/09/Circular-Economy-Implementation-Programme-2019-2023.pdf

[325] https://zoek.officielebekendmakingen.nl/stcrt-2020-46388.html

[326] https://circulairambachtscentrum.nl/programma/

May 2020. During this period, over 7,700 electrical devices, weighing 230 tonnes, were repaired. Washing machines, dishwashers, coffee machines and smartphones were the most popular repairs. Another province with 1.9 million inhabitants provided €1.6 million from 2021 to 2022. During the first 2 weeks following the launch of the repair subsidy in Thuringia in June 2021, repairs of predominantly household appliances were subsidised to the tune of €19,000. In Austria, a nationwide repair bonus for EEE, totalling €130 million, will be launched in 2022 and will be divided up over the period 2022-2026.

Due to reduced tax rates for accredited reuse centres, governments suffer tax revenue losses, in addition to higher administrative and enforcement costs. The impact of a reduced VAT rate on increased reuse and repair (and, ultimately, waste reduction) depends on the extent to which the tax reduction is passed on to consumers and the impact of a price reduction on demand. In general, studies on the effects of a VAT reduction on the consumption of merit goods (i.e., goods and services, for which a reduced rate is allowed to promote these goods and services for social and environmental objectives) are scarce.[327] One factor favouring a VAT reduction on repair services is the fact that repair services are labour-intensive, which is generally taxed heavily in the EU, while taxes on resources (and, thus, primary products) are generally lower, making repair services comparatively more expensive.[328]

Several case studies estimating the reduction potential for waste paper through measures stipulating a reduction in advertising mail were identified. Depending on the local context and the specific initiatives performed, a waste reduction potential between 13 and 55 kg per household per year was estimated. [329, 330, 331, 332, 333]

Some information was identified about the waste reduction potential of repair, reuse and remanufacturing in GPP guidelines. An overview of the actual effects of 50 pilot projects

[327] European Parliamentary Research Service (2021), VAT gap, reduced VAT rates and their impact on compliance costs for businesses and on consumers. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/694215/EPRS_STU(2021)694215_EN.pdf

[328] Dalhammer et al. (2020), Promoting the Repair Sector in Sweden. https://lucris.lub.lu.se/ws/portalfiles/portal/77933910/Promoting_the_repair_sector_in_Sweden_2020_IIIEE.pdf

[329] https://link.springer.com/article/10.1007/s10163-014-0261-y?sa_campaign=email/event/articleAuthor/onlineFirst

[330] https://circulareconomy.europa.eu/platform/sites/default/files/anti-waste_law_in_the_daily_lives_of_french_people.pdf

[331] Wassermann G. et al (2004) Werbung auf Wunsch – Modellversuch zur Erprobung von Maßnahmen gegen die Zustellung unerwünschten Werbematerials (Advertising on request – model experiment for trialling measures against unsolicited advertising), on behalf of the Initiative Waste Prevention in Vienna, Austria

[332] https://circulareconomy.europa.eu/platform/sites/default/files/anti-waste_law_in_the_daily_lives_of_french_people.pdf

[333] https://www.030magazine.nl/politiek/810-even-wennen-met-nieuw-ja-nee-stickerbeleid

funded within the Interreg North Sea Region project ProCirc[334] so far[335] reveals that 20,000 tonnes of waste were prevented by mainly reusing and refurbishing products which would normally be wasted, and that 800,000 tonnes of virgin materials and 10,000 tonnes of CO2 were saved. Information also exists on the effects of individual pilot projects. For instance, the city of Malmö started circular procurement of furniture in 2017. This led to 10 % of reused furniture in 2019 and to 15 % in 2020. In addition, collaboration with suppliers improved.

When organising green events instead of conventional events, reducing giveaways and other consumables reduces costs on the one hand, while the positive marketing effect of a green event label can increase revenues. On the other hand, reusable systems for, e.g., tableware might be more expensive than single-use alternatives. Case studies have shown that using sustainability criteria for events can lead to waste reduction. Examples are a total waste generation of 0.46 kg per person and day and a source separation rate of 47 % during a "green festival" in Portugal, compared to averages of 2.8 kg per person and day and 32 % source separation at UK festivals.[336]

### Waste phase

The following best practice examples are linked predominantly to the waste phase:

- Promote the establishment of quality standards for remanufacturing (see Appendix A.2.2.13)
- Introduce obligatory pre-demolition audits of buildings (see Appendix A.2.2.15)

No **cost** information was identified for those measures, either in terms of administrative costs (such as the costs incurred by the regulating bodies in developing standards and guidelines and keeping these up-to-date and the administration costs incurred in developing detailed requirements for obligatory pre-demolition audits of buildings), or in terms of adjustment costs (repair operators might need to adjust processes to comply with such standards and guidelines; costs of certifying compliance with the standard; construction companies and building owners will have to adjust demolition processes), or in terms of enforcement costs, or in terms of costs for waste disposal, in the event of increased volumes of hazardous waste arising when pre-demolition audits are performed.

[334] https://northsearegion.eu/procirc/news/pathways-to-circular-procurement/
[335] https://northsearegion.eu/media/13244/circpro-annex.pdf
[336] See e.g., Martinho et al. (2018): Solid waste prevention and management at green festivals: A case study of the Andanças Festival, Portugal. Waste Management 71:10-18 https://www.sciencedirect.com/science/article/pii/S0956053X17307687;
Bosser Carenys, M. (2021): Environmental implications of zero-waste music festivals. https://dspace.library.uu.nl/handle/1874/404711
Pladerer, C. (2009): Von der Abfallvermeidung zur nachhaltigen Veranstaltungsorganisation. https://www.wenigermist.at/uploads/2010/04/254_Pladerer_OekoInstitut_Abfallmanagement_bei_Sportveranstaltungen_2009.pdf

Regarding the **benefits**, some estimates for the waste reduction potential are available from an ongoing Interreg project "FCRBE – Facilitating the Circulation of Reclaimed Building Elements in Northwestern Europe"[337]. It is expected that the amount of reclaimed building elements for reuse can be increased by +50 % by 2032. The starting point is a reuse rate of building elements in Northwestern Europe of 1 %. A study relating to improving management of C&D waste published in 2016[338] concluded that the levels of hazardous CDW vary considerably between Member States with mandatory pre-demolition audits regarding hazardous components.

Given a) the inhomogeneity of the available information on costs and effects of the identified measures, b) the widely differing scope of the initiatives, and c) the lack of effectiveness assessments in many cases, it is concluded that a comprehensive appraisal and comparison of the full costs and benefits of the waste prevention measures are neither feasible nor appropriate.

[337] https://www.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/

[338] https://ec.europa.eu/environment/system/files/2021-01/resource_efficient_uses_mixed_waste_Final_Report.pdf

# 5.0 Identification of options for additional EU-level waste prevention measures and assessment of related impacts (Task 4)

## 5.1 Purpose of the task

The purpose is to conduct an initial assessment of the impacts of identified policy measures. It includes the following sub-tasks:

- Task 4.1: Develop a methodology for identifying and assessing possible policy options for EU-level measures
- Task 4.2: Identify a set of possible EU-level measures to achieve an absolute reduction in the generation of key waste streams
- Task 4.3: Assess, for each identified option, the expected impacts up to 2035

## 5.2 Methodology

Task 4.1 aims to deliver an agreed methodology for identifying and assessing policy measures that lead to a reduction in waste generation. To achieve the aim, the Better Regulation Tool (BRG) #17 "How to identify policy options"[339] is applied as follows:

1. **Construction of a baseline** from which the waste reduction effects of the policy measures will be assessed (see Task 1, chapter 2.2).
2. **Compilation of a wide range of policy measures (long-list)** (T4.2) based on
    1. existing best practice examples in EU Member States that can be scaled up and/or transferred to other EU Member States with the help of further EU measures (see Task 3), and
    2. the ability to tackle key barriers in waste prevention (Task 2.1) and to reduce the gap between what is required for the Circular Economy Action Plan (CEAP) and current/envisaged legal provisions (Task 2.2), and
    3. the waste prevention measures as defined in the ToR Task 4 description, and
    4. discussions with stakeholders.[340]
3. **Identification of the most viable policy measures in the waste policy area** by grouping the measures from the "long-list" into three categories depending on their feasibility of implementation in the waste policy area as well on the viability of the measure (see Figure 5-1). The viability of each measure in the waste policy area is evaluated based on 8 criteria (see Table 5-1). If one of the 8 criteria is not fulfilled, the measure is not further considered and classified as "rejected measure".

[339] European Commission (2021). Better regulation toolbox. 24.9.2021, https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en

[340] Workshop on "Scoping study to assess the feasibility of further EU measures on waste prevention", 20 September 2021, online, organised by Eunomia and EAA.

**Figure 5-1: Identification of the most viable measures.**

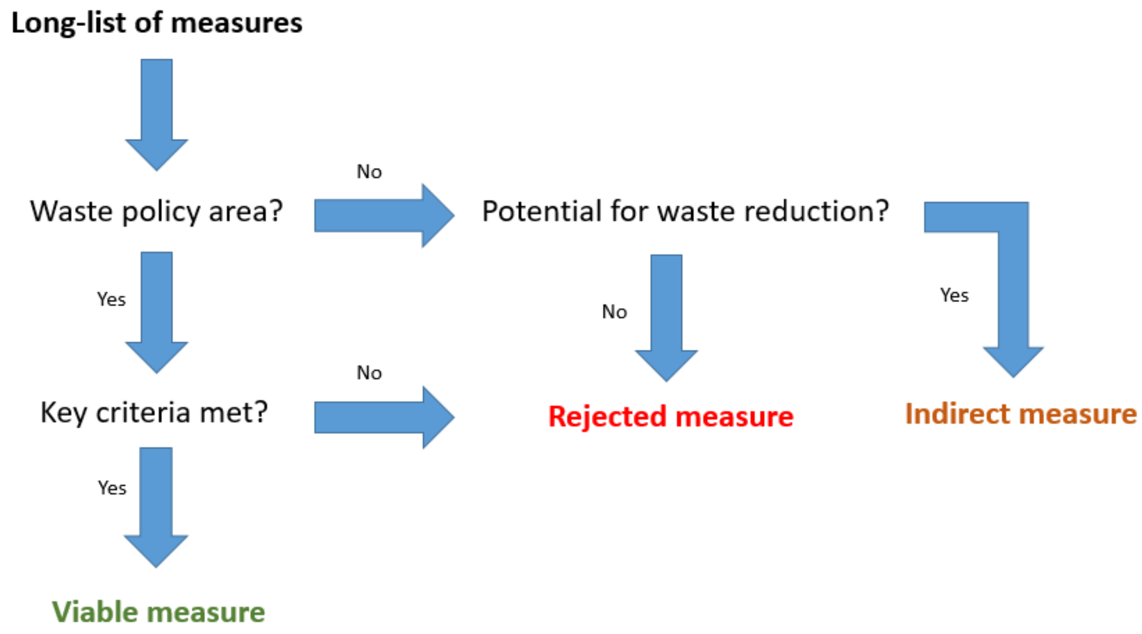


**Table 5-1: Selection criteria to identify the viability of policy measures according to Better Regulation Tool #17**

| N° | Definition |
|---|---|
| 1 | Legal feasibility: Options should respect the principle of conferral. They should also respect any obligation arising from the EU Treaties (and relevant international agreements) and ensure respect of fundamental rights. Legal obligations incorporated into existing primary or secondary EU legislation may also rule out certain options. |
| 2 | Technical feasibility: Technological and technical constraints may not allow for the implementation, monitoring and/or enforcement of theoretical options |
| 3 | Previous policy choices: Certain options may be ruled out by previous Commission policy choices or mandates by EU institutions. |
| 4 | Coherence with other EU policy objectives: Certain options may be ruled out early on due to poor coherence with other general EU policy objectives |
| 5 | Effectiveness and efficiency: It may already be possible to show that some options would incontrovertibly achieve a worse cost-benefit balance than some alternatives. |
| 6 | Proportionality: Some options may clearly restrict the scope for national decision-making over and above what is needed to achieve the objectives satisfactorily. |
| 7 | Political feasibility: Options that would clearly fail to garner the necessary political support for legislative adoption and/or implementation could also be discarded. |
| 8 | Relevance: When it can be shown that two options are not likely to differ materially in terms of their significant impacts or their distribution, only one should be retained. |

4. **Provision of details for each viable measure** including a justification for selecting the measure, a description of the measure, a suggestion for implementation at EU level and the type of measure. The outcomes of this step are presented in chapter 5.3.
5. **Initial assessment of expected impacts arising from waste prevention measures** based on BRT #19 "Identification/screening of impacts"[341] including the following steps:
    1. Quantitative assessment of the waste reduction potentials of viable measures if data were available, otherwise qualitatively.
    2. Selection of other significant impact categories from Table 5-2, initial assessment of impacts of policy measures and classification of each policy measure according to the relative effect of each measure.

The results of the initial assessment of impacts are presented in chapter 5.4.

**Table 5-2: Overview of key impacts to be screened regarding relevance by waste stream as key outcome of the initial impact assessment.**

| Economic | Social | Environmental |
|---|---|---|
| Macroeconomic environment | Employment | The climate |
| Competitiveness, trade and investment flows | Working conditions | Efficient use of resources (renewable & non-renewable) |
| Operation/conduct of SMEs | Income distribution, social protection and social inclusion (of particular groups) | Quality of natural resources/fighting pollution (water, soil, air, etc.) |
| Regulatory burdens on business | Public health & safety and health systems | Biodiversity including flora, fauna, ecosystems and the services they provide and landscapes |
| Increased innovation and research | Job standards and quality | Reducing and managing waste |
| Technological development/Digital economy | Education and training, education and training systems | Minimising environmental risks |
| Third countries and international relations | Crime, terrorism and security | Protecting animal welfare |
| Functioning of the internal market and competition | Preserving the cultural heritage/multilingualism | International environmental impact |
| Energy independence | Governance and good administration | |

[341] European Commission (2021). Better regulation toolbox. 24.9.2021, https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en

| Economic | Social | Environmental |
|---|---|---|
| Deeper and fairer economic and monetary union | | |
| Consumers and households | | |
| Property rights | | |
| Public authorities (and budgets) | | |
| Economic and social cohesion (specific regions and sectors | | |
| Impacts on developing countries | | |
| Sustainable development | | |
| Fundamental Rights (Dignity, Freedoms, Gender equality, equality of treatment and opportunities, non-discrimination, rights of persons with disabilities, Solidarity, Citizens' Rights, Justice) | | |

## 5.3 Policy measures

This chapter considered the “long-list” of policy measures and identifies the most viable ones. In detail, the 98 policy measures are categorised into selected, indirect and rejected measures as described in Appendix 0 and Appendix A.5.2. Measures which address the waste policy field, which are feasible and are likely to have an effect on waste reduction were selected as **“viable measures”**. Measures which have an effect on waste reduction, but require actions beyond the waste policy area (“**indirect measures**”) were not selected, and measures which were regarded as not being feasible were rejected (**“rejected measures”**).

**In total, 26 measures were selected** across all waste types and for each of the six waste streams (Table 5-3). With respect to the methodology, all measures meet the criteria for classifying viable measures (see chapter 5.2, point 3).

The following sub-chapter presents the individual viable policy measures.

### Table 5-3: Number of viable policy measures

| Waste stream | Counts |
|---|---|
| End-of-Life tyres | 5 |
| End-of-Life vehicles | 4 |
| Construction and demolition waste | 5 |
| Textile waste | 3 |
| WEEE | 6 |
| Municipal solid waste | 3 |
| **Total** | **26** |

It is noted that the “indirect measures” are set out in Appendix 0 and the “rejected measures” are set out in Appendix 0.

### 5.3.1 End-of-Life tyres

The following measures were selected, because they can be implemented through EU waste policy, are feasible and bring about quantitative waste reduction.

- **M1: Introduction of** retreading **targets for tyres**
- **M2: Introduction of EPR fees for tyres placed on the market for the first time**
- **M3: Establishment of national communication programmes on part-worn tyres**
- **M4: Harmonisation of product/waste definition of tyres sent for retreading**
- **M5: Enabling digital traceability of individual tyres (RFID)**

#### M1: Introduction of retreading targets for tyres

Justification: There are two reasons for introducing targets.

- Firstly, on the demand side, one key driver for purchasing a tyre is the lifetime (c.f. chapter 3.3.1.2). Even though producers do not label the durability, the opportunity of lifetime extension through retreading indicates to the consumer a high quality of the tyre, longer lifetimes and resource savings.
- Secondly, there is a potential for enhancing the reuse of tyres. With respect to commercial tyres, about 29 % are retreaded before entering the market (mean value from 2007-2016)[342]. With respect to car tyres, the market for retreading has steadily decreased in the last 15 years[343]. In principle, truck tyres can be retreaded 2-3 times and car tyres can be retreaded at least once[344]. Therefore, there is a potential for increasing the number of retreads in Europe.
- Thirdly, setting a target allows EU Member States to implement measuring along the entire value chain, including, for instance, product design and labelling, take-back systems and financial incentives.

Description: Against this backdrop it is suggested that a retreading target for tyres be set in the EU. In addition to setting this target, lifetime extensions of part-worn tyres through second-hand purchases should also be encouraged.

Implementation: Amendment of EU Waste Framework Directive with regard to the following:

- Set an EU-wide minimum target for retreading worn tyres (retreading rate), for instance the number of retreaded tyres compared with the number of new tyres placed on the market.
- Provision of a methodology to calculate the retreading rate.

[342] Rijken, Tim van der (2018). Retreading in Europe. Global Retreading Conference 2018, The Tire Cologne 2018. Retrieved on 11 November 2021 from https://bipaver.org/wp-content/uploads/2017/10/The-role-of-retreading-in-Europe-GRC2018.pdf

[343] Rijken, Tim van der (2018). Retreading in Europe. Global Retreading Conference 2018. The Tire Cologne 2018. Retrieved on 11 November 2021 from https://bipaver.org/wp-content/uploads/2017/10/The-role-of-retreading-in-Europe-GRC2018.pdf

[344] Kraiburg-Austria (2021). New life for tyres!. Retrieved on 11 November 2021 from https://www.kraiburg-austria.com/en/tyres-retreading/retreading-techniques/

- Definition of a monitoring framework in order to evaluate the effectiveness of waste prevention measures on waste reduction.

Measure type: Regulatory measure

### M2: Introduction of EPR fees for tyres placed on the market for the first time

Justification: Requiring EPR fees to be paid the first time a new tyre is placed on the market will create an incentive for retreading of tyres (EPR fees would not be required to be paid each time a tyre is retreaded). With respect to tyres, the EU Member States have different policy mechanisms for managing used and waste tyres in place. The variety of mechanisms include EPR, free market, and government responsibility financed through tax. In the majority of Member States (20 out of 27), an EPR system is in place. Free market systems operate in Austria, Switzerland, Germany and the UK, and government responsibility systems can be found in Denmark and Croatia.[345] Other measures such as environmental taxes and charges have been placed on tyres in Sweden (1997), Hungary (1995), Bulgaria (2014) and Latvia (2002). In Denmark, a levy-based system to incentivise tyre collection and recycling has been placed since 1995. Since 2017, the Danish Ministry of Environment has reimbursed tyre collectors on the basis of the recycling percentage achieved.

Description: An obligatory EPR fee is proposed for tyres placed on the market for the first time. Increasing the upfront cost of tyres will help to encourage consumers to use tyres until they genuinely need replacing due to tread wear and, as retreading becomes more widespread, to opt for retreaded tyres which will not incur the EPR fee. In addition, EU MS without an EPR system for tyres should be encouraged to establish an EPR system.

Implementation: It is proposed that EPR for tyres becomes mandatory in the EU MS by way of an amendment of the Waste Framework Directive. In addition, it is suggested that a directive for end-of-life tyres which lays down the requirements for sustainable management of end-of-life tyres including obligatory EPR fees be introduced.

Measure type: Regulatory measure

### M3: Establishment of national communication programmes on part-worn tyres

Justification: The implementation of the waste prevention measures across EU MS would benefit from a coordinated communication programme at EU level. The suggested measure is not a waste prevention measure in itself, but does support the market penetration of measures 1-2 and 4-5.

Description: The proposed policy measure at EU level is to establish European guidelines, which aim to support the Member States in developing their national communication strategies on the waste prevention of tyres. The strategy should increase consumer

[345] Global Recycling (2019). Tire Recycling Riding On. Retrieved on 11 November 2021 from https://global-recycling.info/archives/2883; ETRMA (?).
Circular Economy. Retrieved on 11 November 2021 from https://www.etrma.org/key-topics/circular-economy/

confidence in part-worn tyres and introduce national measures such as financial incentives (eco-vouchers) to buy part-worn tyres as a second-hand purchase or following retreading.

Implementation: It is proposed that a team of experts be set up to develop European guidelines and assist the MS to implement national communication programmes for tyre waste prevention measures.

Measure type: Promotion activity

### M4: Harmonisation of product/waste definition of tyres sent for retreading

Justification: During the stakeholder consultation stage of this project, a company reported that EU Member States have different approaches to the status of tyres sent for retreading. It was mentioned that these national differences hamper transnational shipping of tyres and, therefore, the reuse potential of tyres in Europe.

Description: The proposed measure focusses on the establishment and harmonisation of the status of tyres sent for retreading within EU Member States.

Implementation: The following activities are suggested:

- Conducting a JRC (Joint Research Centre) study in order to develop standards to assess the status of tyres sent for retreading.
- Integration of the new standard into the Waste Framework Directive.

Measure type: Research & innovation, regulatory measure

### M5: Enabling digital traceability of individual tyres (RFID)

Justification: One key barrier to retread tyre sales is the "safety concern of consumers due to a lack of knowledge of the tyre history" (c.f. chapter 3.3.1.2). One option to document the history is digital traceability of individual tyres. In practice, tyres are required to have markings on their sidewall. This includes technical data regarding the tyre and its performance[346]. A unique identification of tyres and their retreading details (e.g. retreadable, number of previous retreads, retreading company and plant, retread date) would provide consumers with key information to assess and consider retreads by manufacture. For instance, all tyres for use in the US have the DOT code which indicates the company, plant, date of production and so on. Each retreaded tyre is given a new retread DOT number in addition to the original DOT number. The original DOT number has 11 digits and the retread DOT number has 13 digits[347]. Although the DOT code is used worldwide,

[346] Oponeo (2022), Complete Guide to Car Tyre Markings. Retrieved on 10 January 2022 from https://www.oponeo.co.uk/blog/how-to-read-tyre-markings
[347] Cohn, Al (2014). Explaining truck tire sidewall markings. Retrieved on 10 January 2022 from https://www.fleetequipmentmag.com/explaining-truck-tire-sidewall-markings/.

there is no standard or legal requirement to put retreading information on the tyre sidewall and to track the fate of tyres in a European-wide information system.

Description: The traceability of tyres allows the technical performance and retreading interventions to be tracked over time. From a technical point of view, knowledge of the tyre's history is of particular interest for manufacturers and purchasers[348]. Traceability could be guaranteed through Radio-Frequency Identification (RFID) chips in combination with a cloud-based database, which could be accessed by certified manufacturers and which would be updated regularly. It is suggested that a mandatory DOT number be introduced for tyres placed on the European market.

Implementation: The following amendments are suggested:

- Defining the information requirements to characterise retreaded tyres in the EU Tyre Label Regulation (EC/1222/2009).
- Establishing an EU-wide database for recording the data based on EU Tyre Label Regulation (EC/1222/2009) and tracing the fate of tyres.
- Amending the Waste Framework Directive to make it mandatory for tyre manufacturers to use the database.

Measure type: Regulatory measure

### 5.3.2 End-of-Life vehicles

The following measures were selected, because they can be implemented through EU waste policy, are feasible and bring about quantitative waste reduction.

- **M1: Expansion of the scope of the ELV Directive to all vehicle categories**
- **M2: Introduction of a legal framework for remanufacturing of vehicles and components**
- **M3: Definition of remanufacturing targets for vehicles and vehicle components**
- **M4: Definition of criteria to enable removal of vehicle components from end-of-life vehicles**

#### M1: Expansion of the scope of the ELV Directive to all vehicle categories

Justification: The evaluation of the ELV Directive in 2021 identified the scope in terms of vehicle types as a limiting factor to enhancing the waste prevention and treatment

[348] ETRTO (2019). Retreaded tyres: Impact of casing and retreading process on retreaded tyres labelled performance. European Tyre and Rim Technical Organisation (ETRTO). Retrieved on 12 November 2021 from https://www.etrma.org/wp-content/uploads/2019/11/etrto-research-on-casing-and-process-impact-on-retreaded-tyres-labelled-performances-does-for-publication.pdf

performance of end-of-life vehicles[349]. Specifically, the Directive on end-of-life vehicles (2000/53/EC) defines the terms "vehicle" and "end-of-life vehicle" as follows.

- The term "**vehicle**" means "any vehicle designated as category M1 or N1 defined in Annex IIA to Directive 70/156/EEC[350], and three wheel motor vehicles as defined in Directive 92/61/EEC, but excluding motor tricycles".
- "**End-of-Life vehicle**" means "a vehicle which is waste within the meaning of Article 1(a) of Directive 75/442/EEC".

Against this backdrop, the Directive on end-of-life vehicles excludes buses and coaches (vehicles designed and constructed for the carriage of passengers and comprising more than eight seats in addition to the driver's seat), trucks (vehicles designed and constructed for the carriage of goods and having a maximum mass exceeding 3.5 tonnes), and two-wheel motorcycles, mopeds and small scale e-scooters.

Europe's fleet size distribution is 242 million passenger cars, 28 million light commercial vehicles (up to 3.5 tonnes), 6 million medium and heavy commercial vehicles (over 3.5 tonnes), 0.7 million buses (2019 data)[351], about 27 million motorcycles, 11 million mopeds and 0.4 million other vehicles (2019 data)[352] and about 360,000 small-scale e-scooters (2021 data)[353]. **In total units, about 316 million are in use, of which 271 million (86 %) are covered and 46 million (14 %) are not covered by the Directive on end-of-life vehicles.** The plausibility of the estimate is confirmed by the EC evaluation document which reports that, in 2017, about 48 million units were not covered by the ELV Directive[354]. **In terms of mass, about 19 % (94 million tonnes) are not covered by the Directive.**

Consequently, about 19 % of the entire vehicle mass is potentially not treated according to requirements as laid down in the ELV Directive and is also not subject to measures on reuse, which is a priority area addressed in the ELV directive.

Description: Against this backdrop, **it is suggested that legislative scope be expanded to cover all** vehicle categories**.**

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349 EC (2021). Commission staff working document evaluation of Directive (EC) 2000/53 of 18 September 2000 on end-of-life vehicles (SWD/2021/0060 final). Online: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52021SC0060

350 Council Directive of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers. Online: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:01970L0156-20070712&from=EN. Accessed: 12 November 2021.

351 ACEA (2021). Vehicles in use in Europe. Online: https://www.acea.auto/files/report-vehicles-in-use-europe-january-2021-1.pdf. Retrieved on 12 November 2021.

352 ACEA (2021). Vehicles in use in Europe. European Automobile Manufacturers (ACEA). Retrieved on 12 November 2021 from https://www.acem.eu

353 O'Brien, Oliver (2021). European update: 360,000 e-scooters available across the continent. Zag Group. https://zagdaily.com. Retrieved on 9 November 2021.

354 EC (2021). Commission staff working document evaluation of Directive (EC) 2000/53 of 18 September 2000 on end-of-life vehicles (SWD/2021/0060 final). Online: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:52021SC0060

Implementation: It is suggested that the scope of the Directive on end-of-life vehicles (2000/53/EC) be expanded to, firstly, all vehicle categories according to Annex IIA of Directive 70/156/EEC and, secondly, to all motorcycles, mopeds and small-scale scooters.

Measure type: Regulatory measure

### M2: Introduction of a legal framework for remanufacturing of vehicles and components

Justification: The policy review found a lack of current legal provisions for vehicle remanufacturing in the EU and announcements of legislative proposals in 2022 (c.f. Table 3-2). Rematec, which is a platform for remanufacturing, analysed the impact of EU vehicle end-of-life regulations on remanufacturing[355]. They found that the ELV and WEEE Directive push manufacturers towards design for recycling, dismantling and depollution, but not necessarily towards remanufacturing. Remanufacturing, in contrast to recycling, extends the lifetime of vehicles and their parts and therefore reduces material consumption and waste generation, respectively. The European automotive remanufacturing industry reclaims about 35 million parts per year[356]. Therefore, in view of quantitative waste reduction, the replacement and remanufacturing of vehicles and their parts should be prioritized over recycling. However, no EU legislation currently addresses replacement/remanufacturing during the vehicle's use phase.

Description: Against this backdrop, the measure suggests that opportunities be explored in order to strengthen remanufacturing in the ELV legislation, on the one hand, and that a legal framework for remanufacturing of vehicles and parts in Europe be introduced, on the other hand.

Implementation: Such a framework could include the following key elements:

- Remanufacturing targets for vehicles and their parts (see M3)
- Design requirements for remanufacturing
- Quality assurance: The framework should allow the EC to make standards on remanufacturing and reuse mandatory. Examples of existing standards are:
  - → Remanufactured automotive parts. Specification for a process control system (PAS 3100:2014)[357]

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[355] Rematec (2016). The impact of EU vehicle end-of-life regulations on remanufacturing. Online: https://www.rematec.com/blogs/impact-of-eu-regulations-on-remanufacturing/. Retrieved on 12 November 2021

[356] Lange, U. (2017). Ressourceneffizienz durch Remanufacturing - Industrielle Aufarbeitung von Altteilen. Zentrum Ressourceneffizienz. Retrieved on 12 November 2021 from https://www.ressource-deutschland.de/fileadmin/user_upload/downloads/kurzanalysen/VDI_ZRE_Kurzanalyse_18_Remanufacturing_bf.pdf

[357] European Standards (2014). Remanufactured automotive parts. Specification for a process control system. Online: https://www.en-standard.eu/pas-3100-2014-remanufactured-automotive-parts-specification-for-a-process-control-system/

→ Guides for the Rebuilt, Reconditioned and Other Used Automobile Parts Industry[358]

→ Certification programme and labelling. Example: Manufactured Again[359]

- Introduction of a provision to provide information for ELV dismantlers and remanufacturers: Existing platforms such as IDIS (International Dismantling Information System)[360] should be promoted and access to information should be provided to dismantlers and remanufacturers.

Measure type: Regulatory measure

### M3: Definition of remanufacturing targets for vehicles and vehicle components

Justification: The ELV Directive prioritises waste prevention and reuse over recycling, recovery and disposal. However, the defined targets do not consider a differentiation between reuse and recovery within the targets. Consequently, the targets can be achieved without reuse as long as recycling and recovery volumes are sufficiently generated. However, reuse and remanufacturing result in lifetime extensions and therefore enable waste reduction. From a quantitative waste prevention perspective, reuse and remanufacturing of vehicles and their components should be prioritised over recycling and recovery.

Description: The measure suggests the introduction of a minimum target for reuse and remanufacturing, which will probably help to reduce waste volumes.

Implementation: It is proposed that **a minimum target be set for remanufacturing vehicles** (trucks and passenger cars) **and specific components** (e.g., seats) as well as **new remanufacturing legislation (see M3)**. Setting a minimum target for remanufacturing should be combined with a legal framework for remanufacturing vehicles (see M3) and requests for additional initiatives, e.g., in administration. This probably includes an increase in service-oriented business models for vehicles (e.g., bin lorry fleets), improved availability of information on the reuse and reparability of spare parts to be provided by the manufacturers and consideration of remanufactured vehicles and components in procurement strategies.

Measure type: Regulatory measure

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[358] Federal Trade Commission (2014). Guides for the Rebuilt, Reconditioned and Other Used Automobile Parts Industry. Online: https://www.federalregister.gov/documents/2014/07/14/2014-16339/guides-for-the-rebuilt-reconditioned-and-other-used-automobile-parts-industry

[359] MERA (2021). Certification. The Association for Sustainable Manufacturing. Online: https://www.manufacturedagain.com/

[360] IDIS (2021). International Dismantling Information System (IDIS). Online: https://www.idis2.com/

### M4: Definition of criteria to enable removal of vehicle components from end-of-life vehicles

Justification: The reuse of vehicle components, e.g., for embedded electronics and plastics, is often hindered by a lack of design for selective dismantling and guidance for dismantling practices before shredding (c.f. Table 3-2). The reuse of vehicle components requires their removal from vehicles during dismantling as an important first step[361] . The removal is a short-term opportunity, taken by the ELV dismantler. The removal opportunity needs to be considered in the design phase of the part and the vehicle, respectively.

Description: To enhance the reuse of parts, it is suggested that guidelines be developed, which define criteria to increase removability of components, especially embedded electronics and plastics, from end-of-life vehicles.

Implementation: The guidelines could be produced by a research & innovation project with a focus on technical feasibility and stakeholder consultation in the vehicle and waste management sector. The measure is linked to M2 and M3 as remanufacturing also depends upon, and would incentivise, the ability to readily remove components from the vehicle.

Measure type: Guidelines

## 5.3.3 Construction & demolition waste

The following measures were selected, because they can be implemented through EU waste policy, are feasible and bring about quantitative waste reduction.

- **M1: Introduction of a C&D waste reduction target**
- **M2: Strengthen the reuse of building components by mandatory pre-demolition audits**
- **M3: Implementation of guidelines for reuse of soil**
- **M4: Integration of reuse aspects in site management plans**

### M1: Introduction of a C&D waste reduction target

Justification: A waste reduction target at EU level gives the MS freedom of flexibility to introduce waste prevention measures, taking account of national circumstances and needs. In detail, construction & demolition waste is the second largest waste flow in the EU. Waste generation has been continuously rising since the first year of recording in 2010 and, despite minimum recycling targets, landfilling is still practiced today. With respect to waste prevention, some EU MS have introduced a reduction target for C&D waste. There is currently no EU-wide reduction target. The introduction of such a target would establish a common playing field in the EU.

[361] Optimat (2013). Remanufacture, refurbishment, reuse and recycling of vehicles: trends and opportunities. Retrieved on 12 November 2021 from https://www.gov.scot/publications/remanufacture-refurbishment-reuse-recycling-vehicles-trends-opportunities/pages/9/

Description: It is suggested that C&D waste reduction targets be defined. In addition, it is suggested that two separate reduction targets, one for construction waste and another for demolition waste be defined. The setting of preparing for reuse and recycling targets for construction and demolition waste as well, and its material-specific fractions is addressed in an ongoing study conducted by the EC´s JRC in Seville[362]. The study results are expected in the first quarter of 2022.

Implementation: It is suggested to amend the Waste Framework Directive and introduce a waste reduction target. Taking the long lifespans of building structures, components and materials into account, it is suggested to introduce a less ambitious target by 2035 and more ambitious targets beyond 2035..

Measure type: Regulatory measure

### M2: Strengthen the reuse of building components by mandatory pre-demolition audits

Justification: Pre-demolition audits were classified as best practice examples for waste prevention (c.f. 5, #15). In detail, the European Commission published "guidelines for the waste audits before demolition and renovation works of buildings". At EU level, the audits are voluntary, but 10 Member States have set mandatory requirements for pre-demolition audits (Austria, Belgium – Flanders, Czech Republic, Finland, France, Hungary, Luxemburg, Netherlands, Romania and Sweden)[363].

Description: It is proposed that a pre-demolition audit becomes mandatory for buildings above a certain size. It is additionally proposed that the guidelines for pre-demolition audits also include guidance to inventory reusable materials and components. For instance, the NWE Interreg project "Facilitating the Circulation of Reclaimed Building Elements (FCRBE)"[364] has developed guidelines to assess the reuse potential at the construction site, which could be integrated into mandatory pre-demolition audits.

Significant effects on waste reduction are expected if the identification of the reclaimable components is linked to the inclusion of reuse in site management plans (see M5) and an obligation to address reclamation markets, site reuse, site-to-site reuse and/or donation. Under current circumstances, demolition activities are relatively inexpensive and take place under heavy time pressure. Incorporating selective dismantling and reclaiming of components into the workflow will probably require additional logistics, budgets and time.

One barrier, which would limit the possibility of reclaiming materials in addition to the technical performance, is the presence of hazardous materials in construction products. As

[362] JRC team: Davide Tonini, Elena Garbarino, Ioannis Antonopoulos (JRC-WASTE-RESEARCH@ec.europa.eu)
[363] Basuyau, V. (2016). Closing the loop –An EU action plan for the Circular Economy: Construction and Demolition. Construction Products Europe - Resource efficiency workshop, 22 November 2016, Brussels. Retrieved on 12 November 2021 from https://www.construction-products.eu/application/files/5215/2481/6267/20161123090156-2016_11_22_resource_efficiency_workshop_1_dg_growth.pdf

[364] NWE Europe (2021). FCRBE - Facilitating the circulation of reclaimed building elements in Northwestern Europe. Retrieved on 12 November 2021 from http://www.nweurope.eu/fcrbe

each building and infrastructure have their own characteristics, and experiences of the reuse potential are currently limited, it is difficult to estimate the waste reduction potential across all the EU MS. Nevertheless, obligatory pre-demolition audits and the consideration of reuse are key enablers to enhance waste prevention.

Implementation: Amending the Waste Framework Directive through mandatory pre-demolition audits.

Measure type: Regulatory measure

### M3: Implementation of guidelines for reuse of soil

Justification: According to Eurostat, excavated soil represents the biggest waste stream by volume in the EU. About 80 % of the excavated soils are not contaminated and are available for reuse[365]. Against this backdrop, the EU Circular Economy Action Plan strives to "increase the safe, sustainable and circular use of excavated soils"[366]. One of the regulatory barriers in most countries is the lack of guidelines for reusing soils[367].

Description: It is proposed that European guidelines be developed for the reuse of soil based on existing guidelines in, e.g., France[368], Switzerland[369] and Scotland[370]. The guidelines should specifically address the monitoring of reused soil, e.g., by means of a harmonised database structure for recording all movements of excavated soil (within and outside the waste regime). The implementation of harmonised guidelines will provide a uniform playing field for all actors across Europe. However, the guidelines need to be supported by additional measures such as criteria for classifying excavated soil as a by-product in line with Article 5 of the WFD to overcome regulatory, organisational, logistic and economic barriers.

Implementation: The following measures are suggested:

- Developing guidelines which are applicable in all EU Member States.
- Mandatory use of the guidelines by amending the Waste Framework Directive.

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365 Simon, F. (2021). Excavated soils: The biggest source of waste you've never heard of. Retrieved on 12 November 2021 from https://www.euractiv.com/section/circular-economy/news/excavated-soils-the-biggest-source-of-waste-youve-never-heard-of/

366 EC (2021). Buildings and construction. Retrieved on 12 November 2021 from https://ec.europa.eu/growth/industry/sustainability/buildings-and-construction_hu

367 Halo, S. E. et al. (2021). The Reuse of Excavated Soils from Construction and Demolition Projects: Limitations and Possibilities. Sustainability, 13(11), 6083. https://doi.org/10.3390/su13116083

368 Coussy, S. et al (2020). Guide de valorisation hors site des terresexcavées issues de sites et sols potentiellement pollués dans des projets d'aménagement. Retrieved on 12 November 2021 from https://www.ecologie.gouv.fr/sites/default/files/guide_valorisation_tex_ssp.pdf

369 BAFU (2001). Reuse of excavated soil (Guideline).

370 Natural Scotland (2010). Regulatory guidance: Promoting the sustainable reuseof greenfield soils in construction. Retrieved on 12 November 2021 from https://www.sepa.org.uk/media/154233/reuse_greenfield_soils_construction.pdf

Measure type: Guidelines, regulatory measure

### M4: Integration of reuse aspects in site management plans

Justification: A site waste management plan (SWMP) is required before a construction project starts. The content of such a SWMP was regulated in the UK in 2008 and includes, for instance, an indication of the expected waste volumes which, it is expected, will be generated at the site, and the anticipated waste management actions for each waste type including reuse, recycling and disposal.

Description: It is proposed that site waste management plans be required for each construction and demolition activity above a certain size. In the case of construction work, EU guidelines for reuse of materials left over during construction need to be developed based on best practice guidelines that already exist[371]. In the case of demolition activities, the SWMP needs to follow the pre-demolition auditing (see M2). In this sense, the SWMP is a necessary supporting measure for strengthening the reuse channel of construction elements, from identification to removal, storage, preparation for reuse and delivery to sales platforms, site use, site-to-site use or donation.

Implementation: The following measures are suggested:

- Making SWMP mandatory through the amendment of the Waste Framework Directive.
- Supporting the implementation by the development and provision of guidelines including operational recommendations to reclaim reusable items.

Measure type: Guidelines, regulatory measure

## 5.3.4 Textile waste

The following measures were selected, because they can be implemented through EU waste policy, are feasible and bring about quantitative waste reduction.

- **M1: Introduction of EPR with modulated fees, based on the quality of textiles**
- **M2: Introduction of a reduction target for textile waste**
- **M3: Ban on destruction of unsold clothes**

### M1: Introduction of EPR with modulated fees, based on the quality of textiles

Justification: An EPR scheme for textiles was identified as a best practice example (c.f. 5 #1) as well as measures to enhance product durability (c.f. 5 #2). With respect to the latter, the

371 https://www.zerowastescotland.org.uk/sites/default/files/Improving%20waste%20management%20on%20construction%20site%20%E2%80%93%20best%20practice%20guide_0.pdf

low-quality textiles were identified as a key barrier for waste prevention (c.f. Table 4-5). Against this backdrop, the quality of textiles should be considered for the determination of modulated fees in an EPR system. It is noted that France is the only EU Member State which has already introduced eco-modulation levels[372], which could serve as an example for EU-wide adoption. EPR will mean the up-front cost of purchase of clothing is higher than it otherwise would be, encouraging consumers to keep using clothes for longer. Eco-modulation in respect of quality/durability should encourage a shift towards longer lasting items.

Description: It is suggested that EPR be introduced for textiles with modulated fees in Europe. Financial contributions can be calculated on a rate per item. The more environmentally sustainable an item is, the lower the contribution. One key element could also be the lifetime of the textiles, which is influenced by the quality of the textiles. Eco-weightings can also be placed on clothing, home textiles and footwear which meet certain durability criteria (meaning they should last longer) or contain recycled fibres[373].

Implementation: The following measures are suggested:

- Conducting a study to develop an operational concept for earmarked, modulated EPR fees in the textile sector.
- Introducing EPR with modulated fees in Europe through the amendment of the Waste Framework Directive.

Measure type: Regulatory measure.

### M2: Introduction of a reduction target for textile waste

Justification: A waste reduction target at EU level gives the MS freedom of flexibility to introduce waste prevention measures, taking account of national circumstances and needs. A reduction target for textile waste is in line with the current draft EU strategy for sustainable textiles, which highlights target setting to step up reuse[374].

Description: It is suggested that a reduction target be introduced for textile waste. It will probably trigger the adoption of measures, e.g., to stimulate activities in the reuse sector, or to enhance the introduction of further requirements such as ecodesign within product policies. It is noted that the EU requirement for the separate collection of textile waste will lead to higher amounts of reported textile waste in the coming years, which needs to be considered when setting reduction targets in relation to a selected reference year. In addition, reduction targets could also be established in such a way as to set a maximum per capita amount of generated textile waste in 2035, which must not exceed the per capita amounts generated by 2025 (by way of example).

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[372] EcoTLC (2020). *Annual report 2019*. Retrieved on 12 November 2021 from https://refashion.fr/pro/sites/default/files/fichiers/ECO_TLC_EN_BD.pdf

[373] EURIC. 2020. EuRIC Position on EPR Schemes for Textiles. Available at: EuRIC - Position papers - EuRIC Position on EPR Schemes for Textiles (euric-aisbl.eu)

[374] EC (2021), EU strategy for textiles- Ref. Ares(2021)67453 - 05/01/2021

Implementation: Amending the Waste Framework Directive by introducing a waste reduction target for textiles.

Measure type: Regulatory measure.

### M3: Ban on destruction of unsold clothes

Justification: The ban on destroying unsold new products was identified as a best practice example (c.f. 5 #5). In detail, unsold clothes are generated by two phenomena:

1) The COVID-19 pandemic-driven lockdowns in brick-and-mortar shops resulted in unsold clothes. Estimates for Germany suggest that there were about 500 million unsold, surplus winter clothes by the end of January 2021. Before the pandemic, the consultant company Hachmeister + Partner and others estimated that about 10 % - 20 % of offered textiles are not sold[375]. Greenpeace warned that the final fate of these clothes is unknown, but there is evidence that significant quantities are destroyed[376].
2) The online trade is confronted with package returns. Estimates for Austria show about 46 million package returns in 2020, which equates to about 5 packages per citizen and about 1/3 of all packages which were delivered to customers[377].

Examples of handling unsold clothes in Member States already exist, such as in France (see Appendix A.2.2.5). The French example could be a starting point for introducing EU-wide measures to ban the destruction of unsold clothes.

Description: It is suggested that a ban on destruction of unsold clothes be introduced. This would prevent brand-new products from becoming waste and being landfilled or incinerated, and should also stimulate the donations of unsold clothes. This measure should be paired with other policies to promote the donation of unsold durable goods to consumers with limited financial resources. Both the 2020 EU circular economy action plan and the sustainable product policy[378], which was being developed for publication in the fourth quarter of 2021, contain recommendations on a ban on the destruction of unsold functional durable goods.

Implementation: Amending the Waste Framework Directive by considering a ban on the destruction of unsold clothes within the framework of Extended Producer Responsibility.

Measure type: Regulatory measure.

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[375] https://www.welt.de/wirtschaft/article203216646/Bekleidung-Hunderte-Millionen-Textilien-fabrikneu-vernichtet.html

[376] https://www.greenpeace.de/publikationen/x01391-greenpeace-flyer-warenvernichtung.pdf

[377] Greenpeace (2021). Online-Konsumrausch in Zeiten von Corona: Greenpeace-Analyse zur Zerstörung von retournierter Kleidung und Elektronik im Online-Handel.

[378] EC (2021). Sustainable products initiative. Retrieved on 12 November 2021 from https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

### 5.3.5 Waste electrical and electronic equipment

The following measures were selected, because they can be implemented through EU waste policy, are feasible and bring about quantitative waste reduction.

- **M1: Introduction of an EU-wide waste reduction target for WEEE for specific EEE categories**
- **M2: Reassessment of a possible EU-wide target for preparation for reuse of collected WEEE**
- **M3: Introduction of minimum requirements for the preparation for reuse of WEEE**
- **M4: Development of standards for quality assurance in remanufacturing**
- **M5: Improvement of collection of WEEE by exploring options at EU level to incentivise take-back, return or selling back of mobile phones, tablets, laptops and chargers**
- **M6: Introduction of obligatory funding of waste prevention/reuse/repair for producers**

#### M1: Introduction of an EU-wide waste reduction target for WEEE for specific EEE categories

Justification: A waste reduction target at EU level gives the Member States the flexibility to introduce waste prevention measures, taking account of national circumstances and needs. For instance, it will trigger a) the adoption of additional waste prevention measures at MS level, e.g., measures stimulating the reuse sector and b) enhance the introduction of already envisaged requirements such as, for example, durability requirements in the context of the Ecodesign Directive (product policy).

Description: It is proposed that targets specific to the EEE categories pursuant to Annex III, WEEE Directive be developed.

The EEE categories 4 “Large equipment” and 6 “Small IT and telecommunication equipment” are most relevant in terms of volumes. Furthermore, there are several types of devices including washing machines and washer dryers where relevant ecodesign requirements have already been laid down. The development of waste reduction targets could start with these EEE categories. The development should consider a) studies[379] investigating changes in average actual lifetimes/first use durations of specific appliances in previous years, b) the ongoing developments as regards ecodesign criteria related to durability and reparability

[379] For instance: EEA (2020): *Europe´s consumption in a circular economy*: the benefits of longer lasting electronics. Briefing No. 02/2020, German Environment Agency (2016): Einfluss der Nutzungsdauer von Produkten auf ihre Umweltwirkung: Schaffung einer Informationsgrundlage und Entwicklung von Strategien gegen „Obsoleszenz“, Retrieved on 12 November 2021 from https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_11_2016_einfluss_der_nutzungsdauer_von_produkten_obsoleszenz.pdf, EC (2019): Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy. Final Report.

and c) any information about increased repair and renting activities. In Belgium, for instance, a repair rate of WEEE of 20 %, as required by the Belgian Waste Prevention Programme, would potentially reduce WEEE generation by 0.5 kg per capita[380]. Furthermore, Belgium aims to divert 10 % from EEE purchases into the rental of these products, which potentially reduces WEEE by 0.2 kg per capita[381].

To monitor the achievement of possible WEEE reduction target(s), a similar approach to that for the collection targets could be used. The WEEE Directive sets a target for the separate collection of WEEE, which can either be complied with by achieving a yearly collection of 65 % of the average weight of EEE placed on the market in the three preceding years, or alternatively by achieving a collection of 85 % of WEEE generated on the territory of that Member State. This approach suggests a direct correlation between EEE volumes placed on the market and WEEE generation. It is thus suggested that the WEEE reduction target be formulated as a reduction target for volumes of EEE placed on the market, as data gathering is more robust.

Such a reduction target for WEEE generation (respectively for EEE placed on the market) could either be an overall reduction in relation to a selected reference year in a Member State or the setting of a maximum per capita amount.

<u>Implementation</u>: The following activities are suggested:

- Conducting a study to develop category-specific waste reduction targets, taking into account the ongoing activities in the field of ecodesign requirements.
- Amending the WEEE Directive by including category-specific waste reduction targets.

<u>Measure type</u>: Regulatory measure

### M2: Reassessment of a possible EU-wide target for preparation for reuse of collected WEEE

<u>Justification</u>: Currently, the WEEE Directive sets recovery and recycling targets for WEEE. The amounts of separately collected WEEE, which are *prepared for reuse*, contribute to the recycling target. Although, from a formal point of view, *preparation for reuse* does not reduce waste generation, it does reduce the amounts of waste which ultimately have to be treated and disposed of. In addition, preparation for reuse potentially substitutes virgin products and therefore reduces waste generation down the road.

In 2015, the EC conducted a study[382] examining the possibility of setting separate preparation for reuse targets for WEEE. Separate preparation for reuse targets were not recommended, because of the following reasons: on the one hand, the available data

[380] EEA (2019). Belgium waste prevention country fact sheet. Retrieved on 12 November 2021 from https://www.eea.europa.eu/ds_resolveuid/fc16cf4ef0494a178be0162dd2b64706
[381] EEA (2019). Belgium waste prevention country fact sheet. Retrieved on 12 November 2021 from https://www.eea.europa.eu/ds_resolveuid/fc16cf4ef0494a178be0162dd2b64706
[382] Seyring, N. et al. (2015). Study on WEEE recovery targets, preparation for reuse targets and on the method for calculation of the recovery targets. Retrieved on 12 November 2021 from https://ec.europa.eu/environment/pdf/waste/weee/16.%20Final%20report_approved.pdf

indicated that preparation for reuse accounts for only a small percentage compared to reuse of EEE and, on the other hand, many different forms of organisations for the management of WEEE and practices for reuse and preparation for reuse in the EU were in place. Instead, it was suggested that reuse be promoted by increasing public awareness, enabling access to WEEE by reuse organisations, and defining a methodology to measure preparation for reuse rates. However, the authors clearly indicated socio-economic and environmental benefits of preparation for reuse.

Meanwhile, Spain and the Walloon region (Belgium) have set such preparation for reuse targets. In Spain, since 2018, 3 % of collected WEEE category 4 (large equipment) and 4 % of collected WEEE category 6 (small IT and telecommunication equipment) must be prepared for reuse[383]. In Wallonia, a preparation for reuse rate of 2 % has been required since 2020. Meanwhile, WEEE reporting under the WEEE Directive[384] also requires reporting of volumes prepared for reuse.

Given these developments, it is suggested that the introduction of a preparation for reuse target be re-assessed for WEEE, taking into account the experiences of Spain and Wallonia.

Description: Separate preparation for reuse targets should be developed for individual WEEE categories and should take into account the economic disparities in Europe, for instance by considering the amounts of reusable items which are disposed of in Member States.

Implementation: The following activities are suggested:

- Conducting a study to re-assess possible separate preparation for reuse targets for WEEE
- Amending the WEEE Directive by adding separate preparation for reuse targets for WEEE.

Measure type: Regulatory measure

### M3: Introduction of minimum requirements for the preparation for reuse of WEEE

Justification: Directive 2012/19/EU Article 8(5) defines that “the Commission may adopt implementing acts laying down minimum quality standards based in particular on the standards developed by the European standardisation organisations”. In 2020, the European Committee for Electrotechnical Standardization (CENELEC) published a standard on

[383] Spanish legislation on waste of electric and electronic equipment (WEEE): Royal Decree 110/2015 of 20 February. Retrieved on 12 November 2021 from https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/temas/prevencion-y-gestion-residuos/spanishlegislationonwasteofelectricandelectronicequipmentsweeeroyaldecree1102015of20february_tcm30-170359.pdf

[384] Commission Implementing Decision (EU) 2019/2193 laying down rules for the calculation, verification and reporting of data and establishing data formats for the purposes of Directive 2012/19/EU of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE).

"Requirements for the preparing for reuse of waste electrical and electronic equipment" (EN 50614). As of today, France, the Netherlands, Ireland, Slovenia and Luxembourg have made the standard mandatory[385].

It is expected that such requirements will contribute to high-quality preparation for reuse leading to increased acceptance of reuse, which would help reduce waste amounts.

Description: The recent study on quality standards for the treatment of waste electrical and electronic equipment (WEEE)"[386] suggests specific/selected additional minimum treatment requirements for WEEE in the European WEEE legislation based on EN 50614 and national legal provisions of relevance. The study proposes the following key requirements:

- Preparing for reuse facilities shall have a management system in place for all activities performed in the fields of health, safety, environment and quality.
- Preparing for reuse facilities shall identify and document the origin of WEEE and downstream operators that receive WEEE and/or used EEE for remarketing.
- Preparing for reuse facilities shall prepare and document a mass balance once a year.

We propose that the Commission lay down technical and administrative minimum requirements for preparation for reuse in the WEEE legislation, taking into account the results of the aforementioned study.

Implementation: Implementing Act to the WEEE Directive laying down additional minimum requirements for preparing for reuse of WEEE.

Measure type: Regulatory measure

### M4: Development of standards for quality assurance in remanufacturing

Justification:

"Remanufacturing" is defined in multiple ways, for example, as "a process of bringing used products to "like-new" functional state with matching warranty"[387] or as "the rebuilding of a product to specifications of the original manufactured product using a combination of reused, repaired and new parts"[388]. In any case, remanufacturing reuses components and

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[385] WEEE Forum (2019). Making standards mandatory for WEEE treatment. Online: https://weee-forum.org/projects-campaigns/mandatory-standards/

[386] Tesar, M. et al (2021). Study on quality standards for the treatment of waste electrical and electronic equipment (WEEE). Retrieved on 12 November 2021 from https://doi.org/10.2779/69374

[387] Matsumoto, M., Ijomah, W. (2013) Remanufacturing. In: Kauffman J., Lee KM. (eds) Handbook of Sustainable Engineering. Springer, Dordrecht. https://doi.org/10.1007/978-1-4020-8939-8_93

[388] Johnson, McCarthy (2014) Product recovery decisions within the context of Extended Producer Responsibility. Journal of Engineering and Technology Management. Vol 34. https://doi.org/10.1016/j.jengtecman.2013.11.002 cited by: Wikipedia contributors. (2021, October 30). Remanufacturing. In Wikipedia, The Free Encyclopedia. Retrieved 18:55, November 4, 2021, from https://en.wikipedia.org/w/index.php?title=Remanufacturing&oldid=1052618790

materials and therefore reduces waste generation. Currently, however, remanufacturing accounts for less than 2 % of EU manufacturing turnover[389].

Providing warranties for remanufactured products can generate a key benefit in public procurement processes and improves consumer acceptance. In the EU, several quality assurance activities for remanufactured products in the car, airspace and toner cartridge industry are in place[390]. However, an EU-wide specification on remanufacturing processes such as the American National Standard for Remanufacturing (ANSI RIC001.1-2016) does not exist, nor is a remanufacturing quality certification system operated in the EU.

Description: Development of EU-wide specifications on remanufacturing and a possible EU-wide quality certification system – possibly taking account of the following existing standards:

- Microsoft Approved Refurbishers Scheme (MAR),
- ICER (Industry Council for Electronic Equipment Recycling) Accreditation Scheme for Refurbishers,
- The British standard PAS 141,
- DoD 5220.22-M method for data erasure and other data sanitisation standards such as NIST 800-88 Clear and NIST 800-88 Purge,
- The Australian/New Zealand Standard 5761: 2005 In-service safety inspection and testing – Second-hand electrical equipment prior to sale,
- The Australian/New Zealand Standard 5762: 2005 In-service safety inspection and testing – Repaired electrical equipment,
- The Australian/New Zealand Standard 4701: 2000 Requirements for domestic electrical appliances and equipment for reconditioning or parts recycling,
- DIN 33870 series, DIN 33871-1 and the Nordic Ecolabel for remanufactured toner cartridges.

Implementation: It is suggested that the Commission mandate the establishment of quality standards for EEE remanufacturing processes and for remanufactured EEE products.

Measure type: Guideline/standard

### M5: Improvement of collection of WEEE by exploring options at EU level to incentivise take-back, return or selling back of mobile phones, tablets, laptops and chargers

Justification: About 60 % of European WEEE is not collected through official take-back systems. On the one hand, there is a risk that the remaining volumes are being subjected to improper treatment, with adverse effects on the environment and human health. On the

[389] EC (2019): Support of the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy. Final Report.
[390] Kang, H.-Y. et al (2016). Comparative Analysis on Cross-national System to Enhance the Reliability of Remanufactured Products. Procida CIRP 40, 280-284. http://dx.doi.org/10.1016/j.procir.2016.01.121

other hand, WEEE which is not collected by official take-back systems is not available for state-of-the-art preparation for reuse within the EU, which would contribute to less waste disposal.

Description: Against this backdrop, it is suggested that existing take-back mechanisms be improved for WEEE in order to increase the volumes of separately collected WEEE. A study commissioned by the EC is currently exploring options for EU-wide return schemes of mobile phones, tablets and other small electrical and electronic equipment [391]. Study results are expected in early 2022.

Implementation: Implementing the study results.

### M6: Introduction of obligatory funding of waste prevention/reuse/repair for producers

Justification: Sustainable finance is a factor in the success of waste prevention activities (c.f. chapter 4.3.4). EPR schemes and budget allocation to waste prevention measures were classified as best practice examples (c.f. 5, #4). Obligatory funding of waste prevention/reuse/repair by EEE producers/importers under EPR schemes is one option to enable financial sustainability.

Description: Mandatory funding through EPR schemes, as introduced in Austria and France, is considered good practice in waste prevention (see Appendix A.2.2.4). A certain proportion of the producer fee under EPR is allocated to encourage waste prevention activities including promoting networks for physical reuse, preparation for reuse and remanufacturing centres with full geographical coverage, repair vouchers for malfunctioning EEE products, innovative return or selling back systems (see M5), research into enhanced reuse and remanufacturing and awareness-raising campaigns.

It is suggested that the possibility of such a funding concept be assessed at EU level. It is considered important that detailed rules be laid down, e.g., which types of activities are to be financed, how the effects of the measures are to be monitored. Such a monitoring system can also be used to optimise the activities based on a cost-effectiveness ratio. Furthermore, the different stages of implementation of reuse, repair, etc. in the Member States have to be considered.

Implementation: The following activities are suggested:

- Conducting a study to assess the possibilities of requiring producers of EEE to finance waste prevention activities at EU level.
- Amending the WEEE Directive to include requirements setting out the framework for financing waste prevention activities by producers.

Measure type: Regulatory measure

[391] Study on options for EU-wide return schemes of mobile phones, tablets and other small electrical and electronic equipment

### 5.3.6 Municipal solid waste

Municipal solid waste covers a wide range of distinct products including, for instance, EEE, textiles, furniture and packaging. The measures in this chapter address the following waste fractions:

- Non-packaging paper and cardboard, glass, metals, plastics, and wood waste
- Furniture
- Residual municipal solid waste

The other fractions are excluded due to the following reasons: textile waste and waste electrical and electronic equipment are addressed in detail in previous chapters 5.4.1. and 5.4.5., packaging waste (relevant shares of paper and cardboard, glass, metals, plastics and wood) and food waste (relevant shares of bio-waste) are beyond the scope of this study (see chapter 1.3), and waste batteries and accumulators were not classified as a priority waste stream (see chapter 2.2.5).

The following policy measures are geared towards restrictions of products on the market as well as enhanced reuse and repair activities.

- **M1: Introduction of mandatory residual MSW reduction targets**
- **M2: Introduction of measures for short-lifetime products similar to single-use plastic items**
- **M3: Promotion and support of repair cafes, sharing platforms and special boxes for households to collect reusable items**

#### M1: Introduction of mandatory residual MSW reduction targets

Justification: The Circular Economy Action Plan specifies a 50 % reduction target for residual municipal waste by 2030[392]. There are also examples in Member States, e.g., in Slovakia where a target was set to reduce residual municipal solid waste between 2010 and 2016. According to the waste prevention fact sheet, the target was achieved[393]. Further examples of specific fractions are presented in chapter 2.2.1.4. However, an EU-wide reduction target for residual municipal solid waste is currently not legally binding.

Description: It is proposed that a legally binding reduction target be introduced for residual MSW. The fulfilment of the target is mainly triggered by a major push towards source separation and separate collection of specific fractions such as paper and cardboard, glass, metals, plastics, bio-waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators. It is supposed that the target setting will lead to a decrease in the residual municipal solid waste. Knowing that source separation is not a waste prevention measure, the fulfilment of the target will be supported by the adoption of additional upstream measures, e.g., to stimulate activities in the reuse sector for source

[392] EC (2020). Circular economy action plan.
[393] EEA (2019). Waste prevention country fact sheet: Slovakia. https://www.eea.europa.eu/themes/waste/waste-prevention/countries/slovakia-waste-prevention-fact-sheet/view

separated fractions, or to enhance the introduction of further requirements such as eco-design within product policies.

Implementation: Amending the Waste Framework Directive by defining a reduction target for residual MSW.

Measure type: Regulatory measure.

### M2: Introduction of measures for short-lifetime products similar to single-use plastic items

Justification: The Single-Use-Plastics (SUP) Directive[394] has had an important impact on selected plastic products. The directive covers key elements such as consumption reduction targets, and marketing. In addition, the framework conditions are set for selected items, for higher uptake on separate collection, introduction of EPR schemes and awareness-raising. Two examples, namely the Balearic Islands and France, were identified, where restrictions on placing specific single-use products on the market – extending beyond those regulated under Directive (EU) 2019/904 – have been adopted (see Appendix A.2.2.3). Finally, the SUP Directive can be used as a starting point to introduce a short-lifetime product directive that covers selected items beyond plastic.

Description: It is suggested that a directive for short-lifetime products similar to the Single-Use-Plastics Directive be introduced. The directive's scope of application could include specific product groups and short-lifetime items such as single-use razors, non-reusable and non-refillable printer cartridges and toners, fast fashion textiles, glow sticks, fireworks and disposable grills.

Implementation: Introducing a legal provision for short-lifetime products (beyond plastic), referred to as the single-use product directive.

Measure type: Regulatory measure.

### M3: Promotion and support of repair cafes, sharing platforms and special boxes for households to collect reusable items

Justification: Key instruments to implement reuse activities cover the establishment of repair cafes, sharing platforms and special boxes for households to collect reusable items such as furniture, toys, books and other valuable household products. These reuse activities are established for a broad variety of product groups, are financed in different ways and, as a consequence, cover several types of business models. Examples exist in several Member States (e.g., Austria[395]; Germany[396]). Finally, there are a wide range of local/regional best practice examples which can be transferred to other regions and scaled up to national level.

[394] DIRECTIVE (EU) 2019/904 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 June 2019 on the reduction of the impact of certain plastic products on the environment.
[395] RepaNet (2021). Website. Retrieved on 12 November 2021 from https://www.repanet.at/
[396] Pro Ruhrgebiet (2021). KUER.Start-ups: ReUse and Trade GmbH. Online: https://kuer.nrw/kuer-start-ups-reuse-and-trade-gmbh/. Retrieved on 12 November 2021.

Description: Support will therefore be established at EU level by giving guidance to the Member States regarding establishing repair cafes and sharing platforms, e.g., by defining minimum technical requirements and certification/quality assurance schemes. This will, as a consequence, provide benefits to affected operators who fulfil defined conditions, e.g., by providing financial support (see example on the reduction of VAT on repair services in Austria in Appendix A.2.2.9). The guidance may also cover general aspects of possible ways of establishing reuse activities for household products and sharing concepts throughout the EU Member States (e.g., examples from France, Germany and the Netherlands, see Appendix A.2.2.12).

Implementation: Guidance to be established at EU level based on the best practice examples for both reuse and sharing networks and single establishments, covering aspects such as technical minimum requirements, quality aspects and viable financial schemes.

Measure type: Guidance document.

### 5.3.7 Relevance of cross-cutting measures

Looking at the viable measures, there is a set of cross-cutting measures at EU level within the waste policy area, which will probably result in a reduction in the waste quantities of several other additional waste streams in addition to those selected. Examples are:

- EU-wide reduction target for specific waste streams;
- EU-wide preparing for reuse targets for certain product groups
- Ban on destruction for certain product groups (e.g., in combination with a landfill ban and/or incineration ban/tax);
- Mandated regulatory waste prevention audits for businesses, e.g., as a four-yearly equivalent to the Energy Savings Opportunity Scheme (ESOS) for energy, taking into consideration the 'True Cost of Waste';
- Awareness raising and support for businesses, e.g., subsidised consultancy; support for waste prevention at source in commercial and industrial settings.

These measures may be enforced and implemented by establishing minimum requirements in the Waste Framework Directive providing EU Member States and other stakeholders with a certain amount of flexibility when deciding how a waste reduction can be achieved.

The cross-cutting measures can be targeted at a broad range of product and waste streams, respectively. Some of them are addressed in the waste stream related assessment (see chapter 5.4). With a view to focussing on the six identified key waste streams, the cross-cutting measures were identified as candidate measures for waste types extending beyond the six waste streams, but which were not covered in general by the initial assessment of impacts.

## 5.4 Initial assessment of impact of waste prevention policy measures

The expected outcome of Task 4.3 is an initial assessment of expected economic, social and environmental impacts to enable the Commission to identify measures that could be taken forward and assessed in the context of an impact assessment.

## 5.4.1 End-of-Life tyres

### 5.4.1.1 Waste reduction potential

#### Calculating the reduction potential

Quantitative waste reduction focusses on two reuse options for tyres. One option is the reuse of part-worn tyres as a second-hand purchase (without retreading) and the second option is the reuse of tyres after retreading.

- **Reuse of part-worn tyres as second-hand purchase:** There is currently little data available on the reuse of part-worn car tyres. It was not possible to find evidence of the reuse of tyres within the EU. A recent study of the EPR system for tyres in the Netherlands (RecyBEM) shows that, in 2017, about 30 % of the total tyres collected were exported to Eastern Europe and beyond[397]. The fate of the tyres, such as product reuse and recycling, may be known to the Producer Responsibility Organisation (PRO) only and are not published. However, an analysis of the Australian market on the fate of exported used tyres shows only a minority share of reuse applications[398]. With respect to this study, the **waste reduction potential of rubber tyres is estimated at about 84,000 tonnes**, based on the following assumptions:
  - → In 2018, 2.97 million tonnes of rubber waste were generated. Considering that 94.3 % of all tyres placed on the market are for cars (OE tyres + replacements)[399], about 2.80 million tonnes of the rubber tyres arising originate from car tyres.
  - → The additional reuse potential of part-worn tyres is such that if all tyres were used to their fullest (first-life) potential. In this study, it was assumed that additional reuse potential generates a 3 % reduction in the amount of waste tyres from cars.

- **Reuse of part-worn tyres after retreading**: Truck tyre retreading is an established activity in Europe, but in principle retreading could also take place for car tyres. It is noted that the following text includes the term “rubber tyre”. The rubber tyre consists of rubber/elastomer, carbon black, textile and additives. It does not include the wheel rim which is made of steel.

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[397] Campbell-Johnston, K. et all (2020). How circular is your tyre: Experiences with extended producer responsibility from a circular economy perspective. Journal of Cleaner Production (270) 10: 122042. https://doi.org/10.1016/j.jclepro.2020.122042

[398] Randell, P. et al (2020). Used tyres supply chain and fate analysis. Tyre Stewardship Australia (TSA). Retrieved on 12 November 2021 from https://www.tyrestewardship.org.au/wp-content/uploads/2020/06/Used-Tyres-Supply-Chain-and-Fate-Analysis-1.pdf

[399] van der Rijken, Tim (2018). Retreading in Europe. Global Retreading Conference 2018. The Tyre Cologne 2018. Retrieved on 12 November 2021 from https://bipaver.org/wp-content/uploads/2017/10/The-role-of-retreading-in-Europe-GRC2018.pdf

The estimated **reduction potential of rubber tyre from trucks is about 320,000 tonnes**, based on the following assumptions:

- → In 2018, about 18.9 million tyres were put on market[400], of which about 4.1 million (latest available data, from 2016) [401] were retreaded beforehand. So, the additional potential for retreads is therefore about 14.8 million tyres.
- → In principle, a truck tyre is retreaded 1-3 times[402]. For this study, an average of 2 times is used for the calculation of the reduction potential. Retreading a tyre saves 80 % of the rubber tyre which would be used for a new tyre. The rubber tyre saving is (0.8 * 2/3) = 53 % relative to the counterfactual measure of buying three single-use tyres.
- → A truck tyre weighs 52 kg on average[403]. It is composed of about 77 % rubber tyre (41 % rubber/elastomer, 23 % carbon black, 5 % textile, 8 % additives) and 23 % steel[404].

The estimated **reduction potential of rubber tyre from cars is about 1,300,000 tonnes**, based on the following assumptions:

- → In 2018, the total number of car tyres placed on the market was 316 million items[405]. The retreading business for car tyres has declined over the last 15 years and, in 2018, the overall market share in Europe was less than 1 % of the aftermarket, but with differences in individual markets[406]. According to an Austrian retreading company, retreads make up 12 % of the market in Switzerland and the Netherlands, 10 % in Germany and over 20 % in Scandinavia[407]. For this study, it was assumed that all 306 million items are available for retreading.

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[400] https://www.etrma.org/wp-content/uploads/2020/01/20200121-2019-market-apppraisal-FINAL.pdf
[401] van der Rijken, Tim (2018). Retreading in Europe. Global Retreading Conference 2018. The Tyre Cologne 2018. Retrieved on 12 November 2021 from https://bipaver.org/wp-content/uploads/2017/10/The-role-of-retreading-in-Europe-GRC2018.pdf
[402] Kraiburg-Austria (2021). New life for tyres!. Retrieved on 12 November 2021 from https://www.kraiburg-austria.com/en/tyres-retreading/retreading-techniques/
[403] Retrieved on 12 November 2021 from https://www.survivaltechshop.com/tire-weight/
[404] Mohamad Syamir Senin et al (2016). Analysis of Physical Properties and Mineralogical of Pyrolysis Tires Rubber Ash Compared Natural Sand in Concrete material. OP Conf. Ser.: Mater. Sci. Eng. 160 012053. Retrieved on 12 November 2021 from https://iopscience.iop.org/article/10.1088/1757-899X/160/1/012053
[405] https://www.etrma.org/wp-content/uploads/2021/01/20210121_Tyre-sales-2020_PR1.pdf
[406] van der Rijken, Tim (2018). Retreading in Europe. Global Retreading Conference 2018. The Tyre Cologne 2018.
[407] Kraiburg-Austria (2021). Retreads and their place on the market. Retrieved on 12 November 2021 from https://www.kraiburg-austria.com/en/tyres-retreading/retreading-techniques/

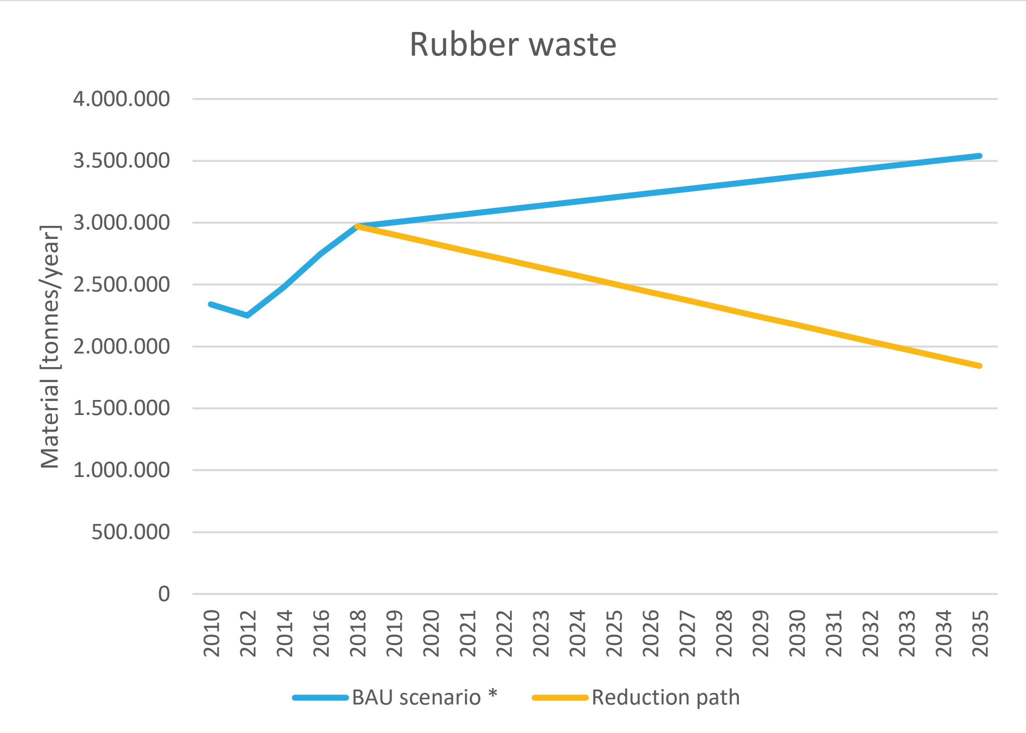
- → In principle, a car tyre is retreaded once[408]. Retreading a tyre saves 80 % of the rubber tyre which would be used for a new tyre. So, the rubber tyre saving is (0.8 * 1/2) = 40 % relative to the counterfactual measure of buying two single-use tyres.
- → A car tyre weighs 12 kg in average[409]. It is composed of about 85 % rubber tyre (45 % rubber/elastomer, 25 % carbon black, 5 % textile, 11 % additives) and 23 % steel[410].

- **Reusing tyres produces the following savings:** In summary, the total reduction potential of rubber tyre through second-hand purchases without retreading is 84,000 t/yr, from retreading truck tyres it is 320,000 tonnes and from retreading car tyres it is 1,300,000 tonnes. The total saving is 1.7 million tonnes, which is about 57 % of 2.97 million tonnes rubber waste generation in 2018.

The suggested reduction pathway (see Table 5-2) is based on the technical reduction potential (57 %) and the lead times for legal provisions on targets and the capability of businesses to implement appropriate reuse measures. It is noted that other measures in addition to retreading, for instance, an increase in car sharing and, therefore, a reduction in car ownership, will help to achieve the reduction target.

[408] Kraiburg-Austria (2021). Retreads and their place on the market. Retrieved on 12 November 2021 from https://www.kraiburg-austria.com/en/tyres-retreading/retreading-techniques/
[409] Valeski, B. (2021). Average Tire Weight (With 10 Examples). https://www.survivaltechshop.com/tire-weight/
[410] Mohamad Syamir Senin et al (2016). Analysis of Physical Properties and Mineralogical of Pyrolysis Tires Rubber Ash Compared Natural Sand in Concrete material. OP Conf. Ser.: Mater. Sci. Eng. 160 012053. Retrieved on 12 November 2021 from https://iopscience.iop.org/article/10.1088/1757-899X/160/1/012053

### Figure 5-2: Waste reduction pathway of rubber waste (including end-of-life tyres)




### Table 5-4: Reduction potential for end-of-life tyres

| | Cumulative waste generation 2018-2035 (million tonnes) [1] | Cumulative reduction potential from BAU 2018-2035 (million tonnes)[1] |
|---|---|---|
| BAU scenario up to 2035 | 59 | |
| Reduction pathway by reuse of car tyres without retreading & reuse of car and truck tyres after retreading | 43 | 15 |

"1" noting that the cumulative perspective sums up each year between 2018-2035.

### Contribution of individual policy measures to quantitative waste reduction

It is expected that the quantitative reuse target (M1) will drive the reduction of tyre waste, and that measures M2-M5 will help to maximise the number of reused tyres.

### Table 5-5: Relevance of policy measures to waste prevention of tyres

| | Quantitative waste reduction |
|---|---|
| M1: Introduction of **retreading** targets for tyres | +++ |
| M2: Introduction of EPR fees for tyres placed on the market for the first time | + |

| | Quantitative waste reduction |
|---|---|
| M3: Establishment of national communication programmes on part-worn tyres | + |
| M4: Harmonisation of product/waste definition of tyres sent for retreading | ++ |
| M5: Enabling digital traceability of individual tyres (RFID) | + |

### 5.4.1.2 Additional impacts

The selected single measures were analysed below according to whether they have direct, indirect or no effect on identified impact categories (see Toolbox #19).

**Table 5-6: Initial impact assessment results of policy measures to reduce rubber waste of tyres. Notes: "I" = indirect effect, "D" = direct effect, "N" = no effect.**

| Indicator | Measure | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|
| | 1 reuse targets | 2 EPR fee | 3 communication | 4 harmonised criteria | 5 digital traceability | |
| **Reducing and managing waste** | | | | | | The effects on waste reduction are described in chapter 5.4.1.1. |
| **Third countries and international relations** | I | I | I | D | N | The imports of tyres to Europe steadily increased from 8 % in 2007 to 20 % in 2016. It is expected that imports will decline with increasing number of retreads in Europe. |

| Indicator | Measure | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|
| | 1 reuse targets | 2 EPR fee | 3 communication | 4 harmonised criteria | 5 digital traceability | |
| **Economics** | I | I | N | I | I | Purchasing new tyres is a trade-off between more expensive high-quality tyres which allow multiple retreads or less expensive low-quality tyres that potentially cannot be retreaded even once. With respect to truck tyres, Bandag reports that "the cost of a retread tyre is usually between 30 and 50 percent of the comparable new tyre price"[411]. Retreading can therefore save costs compared to new purchases. As purchasers will probably optimise costs over the entire tyre lifetime, the EPR fee limitation to new tyres (not being retreaded beforehand) will help tip the financial balance towards high-quality tyres with multiple retreading options. |
| **Employment** | I | D | N | I | N | Direct effects on employment are identified in the tyre shredding and retreading business. According to ETRMA, "European retreading activities employ 30,000 people mostly in SMEs across the value chain[412]." About 7 people are therefore employed per 1,000 retreaded tyres[413].<br><br>As retreading activities are at a comparably low level today, especially since less than 30 % of truck tyres are retreaded, it can be expected that this measure will generate additional jobs in the tyre remanufacturing sector. |

[411] Bandag (2021). Busting the myth: Retread costs and fleet savings. Bridgestone Americas Tire Operations. Retrieved on 12 November 2021 from https://www.bandag.com/en-us/resources/retread-costs-savings
[412] ETRMA (2021). Circular Economy. Retrieved on 12 November 2021 from https://www.etrma.org/key-topics/circular-economy/
[413] Taking into account that 4.3 million tyres were retreaded in 2018 (https://www.etrma.org/wp-content/uploads/2019/10/20200326-Statistics-booklet-2019-Final-for-web-upload.pdf).

| Indicator | Measure | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|
| | 1 reuse targets | 2 EPR fee | 3 communication | 4 harmonised criteria | 5 digital traceability | |
| **Efficient use of resources** | I | I | N | I | N | Material sourcing for tyre production can be problematic, since natural rubber is classified as a critical raw material (CRM) for the EU[414]. Natural rubber production worldwide in 2019 amounted to over 13.6 million tonnes[415]. Natural rubber production from the rubber tree is on the rise and is expected to be the leading cause of deforestation in mainland Southeast Asia in the near future[416]. Globally, about 756,000 tonnes of natural rubber were used for tyres and tubes in 2019/20[417].<br>The reuse of tyres and, therefore, rubber decreases the need for primary rubber. |
| **Environmental impact** | I | I | I | I | D | In general, it is assumed that a decrease in end-of-life tyres reduces impacts on environmental and human health in the upstream and downstream phases.<br>Based on a life-cycle study by the Michelin group, a retreaded tyre, compared to a low-end non-retreadable tyre, saves 24 % of $CO_2$ emissions[418].<br>In addition, enhanced tyre reuse reduces the amount of end-of-life tyres arising each year, and thus reduces the impacts associated with end-of-life management. |

[414] EC JRS (2021). CRM list 2020. Retrieved on 12 November 2021 from https://rmis.jrc.ec.europa.eu/?page=crm-list-2020-e294f6

[415] Statistia (2021). Natural rubber production worldwide from 2000 to 2020. Retrieved on 12 November 2021 from https://www.statista.com/statistics/275387/global-natural-rubber-production/

[416] FERN (2018). FERN Rubber Briefing. Retrieved on 12 November 2021 from https://www.fern.org/fileadmin/uploads/fern/Documents/Fern%20Rubber%20briefing.pdf

[417] Statista (2021). Consumption of natural rubber worldwide from 2016/2017 to 2020/2021, by end use

[418] Ernst & Young (2016). The socio-economic impact of truck tyre retreading in Europe Retrieved on 12 November 2021 from https://rechile.mma.gob.cl/wp-content/uploads/2019/06/3.-ARNEC3-201611-ey_retreading.pdf

### 5.4.2 End-of-Life vehicles

#### 5.4.2.1 Waste reduction potential

##### Calculating the reduction potential

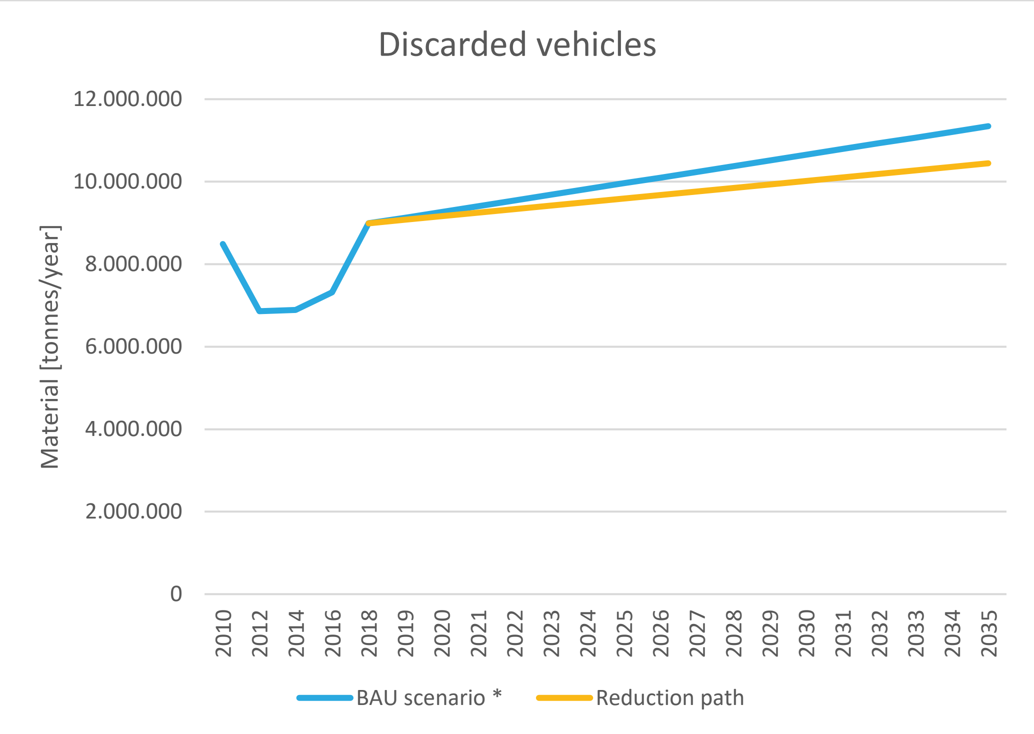
The waste reduction potential is estimated based on lifetime extensions of vehicles as follows:

- The total number of vehicles in use is 316.5 million (see M1).
- As regards vehicle type-specific weights, this results in a total mass of 490 million tonnes.
- The average lifetime of a car is 12 years[419] and the assumption of a lifetime extension of 2 years results in material savings. Therefore, the waste reduction potential is estimated at 14 %, which is about 70 million tonnes per year.

The suggested reduction pathway (see Table 5-7) is based on the technical reduction potential estimated above (14 %). When considering a reduction target, a time period needs to be allowed, specifically for introducing the legal provisions for setting a target and for establishing the capability of businesses to implement appropriate measures. Therefore, **a reduction target of 10 %, compared to ELVs generated in 2018, to be achieved by 1. January 2035 would seem to be appropriate**. It is noted that additional measures such as an increase in car sharing (which reduces car ownership) and a modal shift to walking, cycling and public transport (which may reduce the need to purchase a private car) will help to achieve the reduction target. As these upstream measures will probably contribute to further waste reductions, increasing the target to a minimum of 25 % should be considered.

[419] AARP (2018). How Today's Cars Are Built to Last. Retrieved on 12 November 2021 from https://www.aarp.org/auto/trends-lifestyle/info-2018/how-long-do-cars-last.html

### Figure 5-3: Waste reduction pathway of ELVs




*BAU scenario based on refined projection.

### Table 5-7: Reduction potential for end-of-life vehicles

| | Cumulative waste generation 2018-2035 (million tonnes)[1] | Cumulative reduction potential from BAU 2018-2035 (million tonnes)[1] |
|---|---|---|
| BAU scenario up to 2035 | 183 | |
| Reduction pathway considering lifetime extensions of vehicles | 175 | 8 |

“1” noting that the cumulative perspective sums up each year between 2018-2035.

### Contribution of individual policy measures to quantitative waste reduction

It is expected that the measures M-1 to M4 will contribute to the reduction pathway to various extend (Table 5-8).

### Table 5-8: Relevance of policy measures to waste prevention of WEEE

| | Quantitative waste reduction |
|---|---|
| M1: Expansion of the scope of the ELV Directive to all vehicle categories | + |
| M2: Introduction of a legal framework for remanufacturing of vehicles and components | ++ |

| | Quantitative waste reduction |
|---|---|
| M3: Definition of remanufacturing targets for vehicles and vehicle components | +++ |
| M4: Definition of criteria to enable removal of vehicle components from end-of-life vehicles | + |

### 5.4.2.2 Additional impacts

**Table 5-9: Initial impact assessment results of policy measures to reduce ELV. Notes: "I" = indirect effect, "D" = direct effect, "N" = no effect.**

| Indicator | Data on the magnitude of the impact | | | | |
|---|---|---|---|---|---|
| | **M** 1 | **M** 2 | **M** 3 | **M** 4 | |
| **Environmental impact** | I | I | I | I | The European Association of Automotive Suppliers (CLEPA) identified a CO2 reduction potential through remanufacturing of 400,000 tonnes in the EU-27[420]. It is noted that the temporal scope of the reduction potential is not given in the study.<br>Annually, about 3.4 to 4.7 million ELVs are illegally exported from the EU[421]. Without knowing their final fate, it is likely that improper ELV management poses significant risks for human health and the environment. Reducing the number of ELVs in Europe may also reduce the number of vehicles with unknown whereabouts and associated risks. |
| **Functioning of the internal market and competition** | N | I | D | N | The minimum targets for remanufacturing will probably expand the market share of service-based business models for vehicles. In addition, it will probably trigger a shift from the OE manufacturers (which might also remanufacture) to other sectors, including independent remanufacturers. |
| **Economic** | I | I | I | I | Based on individual case studies, the following evidence of possible cost savings through remanufacturing of vehicles is provided: |

[420] Parker, D. et al. (2015). Remanufacturing Market Study. Retrieved on 12 November 2021 from https://www.remanufacturing.eu/assets/pdfs/remanufacturing-market-study.pdf
[421] Kitazume, C., Kohlmeyer, R. and Oehme, I. (2020) Effectively tackling the issue of millions of vehicles with unknown whereabouts. Umweltbundesamt

| Indicator | Data on the magnitude of the impact | | | | |
|---|---|---|---|---|---|
| | M 1 | M 2 | M 3 | M 4 | |
| | | | | | • A regional police service in England reported a saving of over £100,000 in 2011/12 through using reused vehicle components[422]<br>• In 2015, the US launched the "Federal Vehicle Repair Cost Savings Act", which encourages federal agencies to use remanufactured parts in vehicle repairs. In the run-up to the legislation, in 2013, the Government Accountability Office (GAO) estimated that the use of remanufactured parts could save up to 20 %[423]. Surprisingly, the Congressional Budget Office in 2015 estimated that "the legislation would have no significant budgetary effect because we do not expect that it would significantly change existing procedures for repairing vehicles"[424]. |
| **Job creation** | I | I | I | I | The automotive remanufacturing sector handles about 5 million parts and employs 32,000 people, which equates in 1,094 components per employee. Assuming an increase in remanufacturing in the aftermarket from 55 % to 80 %[425], this would potentially create about 14,500 jobs. |
| **Consumers and households** | I | I | I | I | In 2020, BBE Automotive found that consumers offer to bring their own used spare parts to car repair shops[426]. About 60 % of car repair shops accept the used parts and use them. The case study provides evidence of consumer acceptance of used automotive parts. |

[422] Optimat (2013). Remanufacture, refurbishment, reuse and recycling of vehicles: trends and opportunities. Retrieved at 12 November 2021 from https://www.gov.scot/publications/remanufacture-refurbishment-reuse-recycling-vehicles-trends-opportunities/pages/9/

[423] MEMA (2015). MEMA celebrates the Senate passage of The Federal Vehicle Repair Cost Savings Act. Online: https://www.vehicleservicepros.com/distribution/parts-distributor/industry-news/article/21187963/mema-celebrates-the-senate-passage-of-the-federal-vehicle-repair-cost-savings-act. Accessed 12 November 2021.

[424] Congressional Budget Office (2015). S. 565, Federal Vehicle Repair Cost Savings Act of 2015 https://www.cbo.gov/publication/50038. Retrieved on 12 November 2021.

[425] Weiland, F. J. (2016). Make-New-Again by Remanufacturing, Rebuilding or Refurbishing. APRA Symposium, Birmingham.

[426] BBE Automotive (2020). Einbauservice von Werkstätten -Wenn Kunden Autoteile mitbringen. Retrieved on 12 November from https://www.bbe-automotive.de/images/PressePDF/Presse2020/Teileeinbau.pdf

### 5.4.3 Construction & demolition waste

#### 5.4.3.1 Waste reduction potential

The five viable measures have the potential to contribute to waste reduction.

Introducing a **C&D waste reduction target at EU level** would probably initiate waste prevention measures along the entire value chain of construction: for instance, building design for reusability and disassembly, shifts from mineral intensive to lightweight and modular constructions, extending the service life of works through adaptable usage concepts, prioritisation of maintenance over demolition and so forth. These measures need to be taken during the upstream and use phase, but major effects on waste reduction are expected to arise only after 2035, because of the time span between the implementation of waste prevention measures and the construction and renovation/demolition of buildings and infrastructure. Against this backdrop, the effects on waste reduction caused by measures during the upstream and use phase are not considered within the temporal scope (until 2035) of this study. Beyond 2035, it is assumed that measures to reduce soil-sealing[427], re-size transport infrastructure, increase resource efficiency and decarbonisation of the construction industry will reduce material consumption. For instance, decreasing the current ready-mixed concrete production from 0.5 $m^3$ (1.2 tonnes) per capita in 2017[428] by 20 % to 0.4 $m^3$ (0.96 tonnes) per capita from 2030 onwards, and constant EU population of about 500 million in this period[429], and average lifetime of concrete products of 80 years, will decrease the CDW arising by 120 million tonnes per year from 2110 onwards. The 120 million tonnes present about 40 % of the reported mineral waste from construction and demolition arising in 2018.

In the **waste policy area, waste reduction can be achieved by reusing and remanufacturing of building components and materials**. To date, it has not been possible to measure these activities across the MS, because neither Eurostat nor national data take account of reuse, nor do they distinguish between preparation for reuse and recycling. Therefore, it is not possible to provide evidence on the effects of current reuse and remanufacturing measures on waste reduction. At the same time, several concepts have been proposed to measure "reuse" and the NWE Interreg project Circulation of Reclaimed Building Elements (FCRBE)[430] has developed guidelines for assessing the reuse potential at site-specific level. However,

[427] Measures against soil-sealing are announced in the EU Circular Economy Action Plan. Online: https://ec.europa.eu/environment/strategy/circular-economy-action-plan_de. Retrieved on 12 November 2021.

[428] ERMCO (2018). Ready-mixed concrete industry statistic: Year 2017. European Ready Mixed Concrete Organization (ERMCO).

[429] The EU-27 population in 2021 is 447 million people and is expected to be 449 people in 2030. Data retrieved from Eurostat on population and demography: https://ec.europa.eu/eurostat/, 13 January 2022.

[430] NWE Europe (2021). FCRBE - Facilitating the circulation of reclaimed building elements in Northwestern Europe. Retrieved on 12 November 2021 from http://www.nweurope.eu/fcrbe

there are various estimates and practical case studies specifically targeting reuse and remanufacturing[431, 432, 433, 434]. The cited literature covers a few examples of the reuse of building components and materials and the relevance of local enablers and barriers. Upscaling the current data to EU level is fraught with uncertainties and was therefore not performed in this study. Against this backdrop, the waste reduction potential is estimated on a quantitative basis for the largest mineral waste fractions, namely concrete, ballast, bricks, stones and gypsum as follows.

### Mineral fractions

- Concrete: Concrete is delivered as a prefabricated building component (fixed on site) or as a ready-mixed material (poured into a shuttering formwork on-site). The reuse potential of concrete elements is limited to elements which can be easily dismantled by selective demolition activities. This might include face elements and pavements and might become challenging for structural elements such as walls and slabs. With respect to the latter, 9 real-life pilot buildings were constructed with the help of TU Berlin in the 2000s[435]. Indeed, reusing concrete elements will probably require a well-defined preparation for reuse step in order to deliver tailor-made elements to the application in a new building. **The reduction potential for concrete in CDW, as estimated in this study[436], is about 5.3 million tonnes per year (2 % of total mineral waste in CDW)**.
- Ballast: Ballast is used in railways to stabilise the sleepers. During maintenance, fine course ballast fraction are removed and the remaining ballast is reused on site for the same purpose. The railway operators specify maximum reuse of track ballast to save new ballast purchases and transport. Therefore, it is assumed that there is no an additional potential for reusing ballast in Europe.

[431] Satu, H. (2019). Architectural potential of deconstruction and reuse in declining mass housing estates. Retrieved on 12 November 2021 from http://urn.fi/URN:NBN:fi:tty-201905291749

[432] Satu, H. et al. (2019). Reusing concrete panels from buildings for building: Potential in Finnish 1970s mass housing. Resources, Conservation and Recycling (101), pp 105-121. https://doi.org/10.1016/j.resconrec.2015.05.017

[433] Jaillon, L. (2009). Quantifying the waste reduction potential of using prefabrication in building construction in Hong Kong. Waste Management 29/1, pp. 309-320.

[434] Kleemann, F. (2019). Waste Prevention in the Prefabricated Building Sector. Applied Mechanics and Materials (887), p. 361. https://doi.org/10.4028/www.scientific.net/AMM.887.361

[435] Asam, C. (2008). Recycling prefabricated concrete components – a contribution to sustainable construction . In: SB07 Portugal: Sustainable Construction, Materials and Practices: Challenge of the Industry for the New Millennium, Rotterdam. Retrieved on 12 November 2021 from https://www.irbnet.de/daten/iconda/CIB11828.pdf

[436] The waste reduction potential through preparation for reuse is estimated as follows. The European per capita production of 0.5 $m^3$ ready-mixed concrete (RMC)[436] is multiplied by 2.4 tonnes/$m^3$ (the density of RMC) and 446 million European inhabitants, which results in 535 million tonnes RMC per year. With respect to the material inputs in the construction sector, it is estimated that about 90 % are used to build up the material stock in society and about 10 % arise in CDW flows (53 million tonnes). From this volume, it is assumed that 10 % are available for preparation for reuse activities

- Bricks: The EU REBRICK project explored the market possibilities for reused bricks in Europe, and the project coordinator Gamle Mursten, which runs a brick reuse company in Denmark, estimated the reclamation potential as 43 million bricks in Denmark and 1,000 million in the EU (+UK)[437]. With a specific weight of 2,826 kg/brick, the **total savings in the EU would be about 2.8 million tonnes per year (1 % of total mineral waste in CDW).** It is noted that a study in United Kingdom found that the volume of reclaimed bricks increased from 420,000 t in 1998 to 847,800 t in 2007, which is about 300 million bricks and 10 % of bricks in CDW in 2007[438].
- Stones: Stones can be reclaimed from roads and bridges, buildings and agriculture. In the UK, reclaimed stones decreased from 1,100,000 tonnes in 1998 to 573,700 tonnes in 2007[439]. No further data on reclaimed stones in EU countries was found in the literature. It is assumed that, on average, 0.75 million tonnes of stones are reclaimed in the UK each year. Using the national CDW generation volumes as a weighting factor produces 4.6 million tonnes of reclaimed stones in the EU. Given the lack of evidence of the technical reuse potential, an increase in reclamation by a factor of 2 is assumed. **The additional potential is therefore 4.6 million tonnes of reclaimed stones (1 % of total mineral waste in CDW).**
- Gypsum: For building components, gypsum is mostly used in plasterboards. Due to the difficulties associated with reuse, it is expected that a ban on gypsum disposal at sanitary landfills (M4) would lead to more gypsum-to-gypsum recycling and plasterboard sent to cement kilns, because cement includes about 5 % gypsum per weight. **Consequently, a gypsum waste reduction potential was not considered**.

### Soils and excavation materials

Eurostat reports an increase in the amount of soil arising from 380 million tonnes in 2010 to 810 million tonnes in 2018. It is noted that the process of accounting for excavated soil varies greatly across the EU MS, meaning that data probably cannot be compared across MS and over time (c.f. chapter 2.2.1.1 on “key data source and data reliability”). The practice of reusing and disposing of unpolluted soil also vary across Europe, as a result of different reuse guidelines in EU Members States and local settings regarding supply & demand and transport costs during a construction project[440]. Taking Austria in 2016 as an example shows that 30.3 million tonnes of soil were excavated and classified as waste, of which 18.4 million tonnes were landfilled, 6.9 million tonnes were used as a recultivation layer in agriculture or as backfilling material underground, and 5 million tonnes were used for landscape design and dams[441]. The point is that soil, which is excavated and not destined for disposal, is not

[437] Personal communication, 5. November 2021

[438] Kay, T. (2007). Pushing reuse. Towards a low-carbon construction industry. BioRegional. Retrieved on 12 November 2021 from https://library.uniteddiversity.coop/z_unfiled_stuff/PushingReuse.pdf

[439] Kay, T. (2007). Pushing reuse. Towards a low-carbon construction industry. BioRegional. Retrieved on 12 November 2021 from https://library.uniteddiversity.coop/z_unfiled_stuff/PushingReuse.pdf

[440] Halo, S. E. et al. (2021). The Reuse of Excavated Soils from Construction and Demolition Projects: Limitations and Possibilities. Sustainability, 13(11), 6083. https://doi.org/10.3390/su13116083

[441] Bernhardt, A. et al. (2016). Aushubmaterialien: Materialien zur Abfallwirtschaft. Umweltbundesamt. Online: https://www.umweltbundesamt.at/fileadmin/site/publikationen/REP0589.pdf. Retrieved on 12 November 2021.

officially reported and therefore not accounted for in waste statistics. In addition, it is difficult to estimate the quantity of “reusable” soil because reuse refers to materials which have been in use beforehand. If the soil was subject to anthropogenic use before it was excavated (with or without being intended for disposal) is not reported.

Against this backdrop, it is currently not possible to assess the entire reduction potential from reused soil in Europe. It is proposed that the EC commissions **a study that elaborates a definition regarding the “reuse” of soil (and rocks) and a corresponding accounting framework**, which integrates the findings into the proposed standard for the reuse of soil in Europe.

### Non-packaging metals, glass, plastics and metals

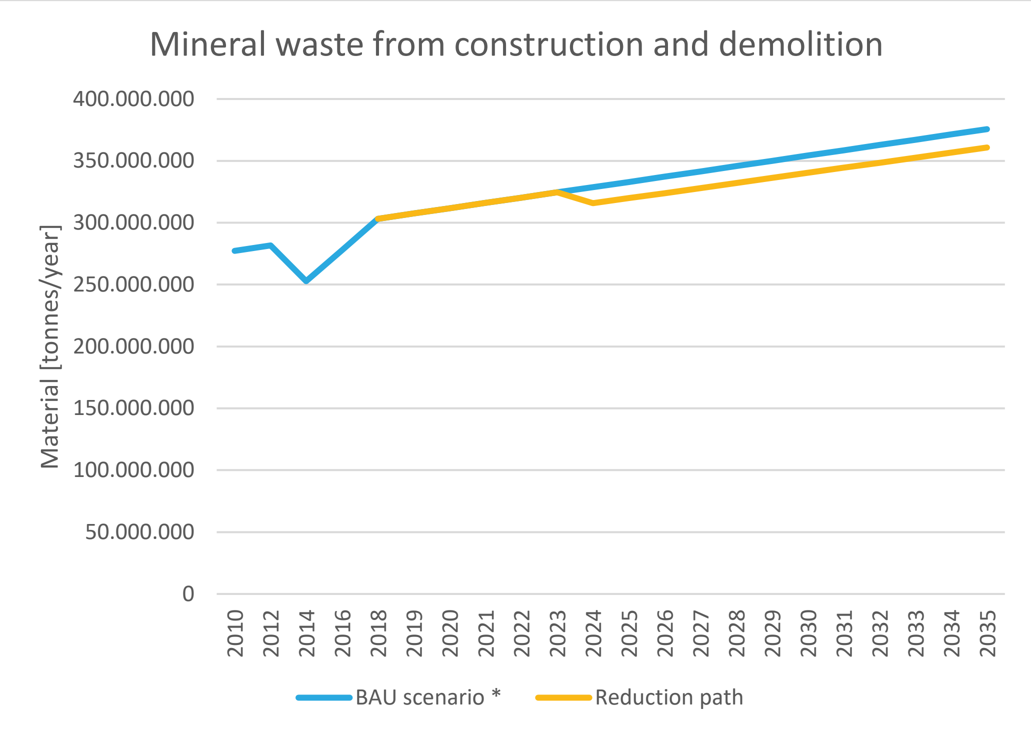
The setting of preparing for reuse and recycling targets for construction and demolition waste and its material-specific fractions is addressed in an ongoing study which is being conducted by the EC´s JRC in Seville[442]. Study results are expected in the first quarter of 2022. It is expected that this study will also estimate the reduction potential for non-packaging metals, glass, plastics and metals. Against this backdrop, the reduction potential is not assessed in this study.

### Calculating the reduction potential

Figure 5-4 shows the waste reduction pathway based on the estimations above. With respect to total mineral waste generation, about 4 % (13 million tonnes) of the waste can be reduced (concrete waste 2 %, brick waste: 1 %, stone waste 1 %). It is noted that the estimation of the waste reduction potential is based on measures that can be implemented by waste policy. Waste policy, in contrast to other policy areas, has limited opportunities to drastically reduce C&D waste. More effective measures need to focus on the reduction of material consumption through, e.g., lightweight instead of mineral construction, and lifetime extensions of buildings and infrastructure. As calculated above, a 20 % reduction of ready-mixed concrete production equals about 120 million tonnes per year, which represents a total mineral C&D waste reduction of about 40 % in the long term. It is also noted that the effects of the ready-mixed concrete reduction on waste reduction will only show themselves about 80-120 years after production decrease, due to the lifetime of buildings and infrastructure.

[442] JRC team: Davide Tonini, Elena Garbarino, Ioannis Antonopoulos (JRC-WASTE-RESEARCH@ec.europa.eu)

## Figure 5-4: Waste reduction pathway of mineral waste from construction and demolition




## Table 5-10: Reduction potential for C&D waste

| | Cumulative waste generation 2018-2035 (million tonnes)[1] | Cumulative reduction potential from BAU 2018-2035 (million tonnes)[1] |
|---|---|---|
| BAU scenario up to 2035 | 6,109 | |
| Reduction pathway by preparation for reuse activities | 5,942 | 167 |

“1” noting that the cumulative perspective sums up each year between 2018-2035.

### Contribution of individual policy measures to quantitative waste reduction

It is expected that the quantitative reduction target (M1) will drive the reduction of construction and demolition waste, and measures M2-5 will help contribute, to varying degrees, to achieving the goal.

## Table 5-11: Relevance of policy measures to waste prevention of construction materials

| | Quantitative waste reduction |
|---|---|
| M1: Introduction of a C&D waste reduction target | +++ |
| M2: Strengthen the reuse of building components by mandatory pre-demolition audits | +++ |

| | Quantitative waste reduction |
|---|---|
| M3: Implementation of guidelines for reuse of soil | + |
| M4: Integration of reuse aspects in site management plans | ++ |

#### 5.4.3.2 Additional impacts

The proposed measures potentially reduce the generation of construction and demolition waste. The reduction will probably have effects on the following impact categories.

**Table 5-12: Initial impact assessment results of policy measures to reduce construction & demolition waste. Notes: "I" = indirect effect, "D" = direct effect, "N" = no effect.**

| Indicator | Measure | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|
| | M 1 | M 2 | M 3 | M 4 | M 5 | |
| **Reducing and managing waste** | | | | | | The effects on waste reduction are described in chapter 5.4.3.1. |
| **The climate** | I | I | I | I | I | The reduction of CDW will probably reduce greenhouse gas (GHG) emissions. As regards concrete, the production of one ton of concrete emits about 1 ton of CO2[443]. Reclaiming 5 million tonnes of concrete would save about 5 million tonnes of $CO_2$ emissions. Reclaiming bricks saves about 0.22 kg $CO_2$- equiv. per brick[444] compared to the production of a new brick. Reclaiming 1,000 million bricks therefore saves 620,000 tonnes CO2-equiv. emissions. In general, GHG savings might be generated if reusing soil reduces the transport distance between the point of excavation and usage. This mainly depends on regional supply and demand dynamics. Due to data availability, GHG saving were not estimated in this study. |
| **Efficient use of resources** | I | I | I | I | I | The reduction of CDW will probably be achieved by extended building lifetimes, which also reduces the need for primary raw materials for replacing old buildings. This will potentially also slow down the need for new pits extraction sites and therefore reduces land reclaiming take in the mining sector. |

[443] https://en.wikipedia.org/wiki/Environmental_impact_of_concrete
[444] Kay, T. (2007). Pushing reuse. Towards a low-carbon construction industry. BioRegional. Retrieved on 12 November 2021 from https://library.uniteddiversity.coop/z_unfiled_stuff/PushingReuse.pdf

| Indicator | Measure | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|
| | M 1 | M 2 | M 3 | M 4 | M 5 | |
| **Job creation** | I | D | N | N | I | About 5.2 million persons were employed in the building construction industry in EU-28 in 2019[445]. As reuse and preparation for reuse is potentially more labour intensive, additional jobs are expected in the planning, construction and dismantling of buildings and infrastructure. |

### 5.4.4 Textile waste

#### 5.4.4.1 Waste reduction potential

The three identified measures have the potential to contribute to waste reduction.

The achievement of the **waste reduction target** requires tangible waste prevention measures such as the reuse of textiles.

However, not all textiles are suitable for reuse, given the definition of textiles, which includes a variety of products (clothes, carpets and furniture, etc.). As regards clothes, their reusability depends on their quality and price, compared with new clothes. Attempts to calculate the volume of textiles which can be reused suggest that 45 % of post-consumer textile waste could be worn as second-hand clothing, while 30 % can be cut up and used as industrial rags, and 25 % cannot be used[446]. Other studies suggest that approximately 65 % of the collected clothes can be reused or recycled in some form[447], whereas the remaining 35 % has to be disposed of or sent for incineration. This suggests that between 45 and 65 % of the clothes placed on the market might be suitable and have the potential for reuse and could contribute to potential waste prevention targets. It is also useful to consider that in Commission Implementing Decision (EU) 2021/19 of 18 December 2020, the EC lays down a common methodology and a format for reporting on reuse. This will provide data on reuse activities and subsequently allow the effects of reuse activities on waste reduction to be assessed.

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[445] Statista (2021). Total number of employed persons in the building construction industry in the European Union (28 countries) from 2008 to 2019. Online: https://www.statista.com/statistics/763219/total-employed-persons-in-building-construction-industry-eu/

[446] Alcin-Enis I., Kucukali-Ozturk M., Sezgin H. (2019) Risks and Management of Textile Waste. In: Gothandam K., Ranjan S., Dasgupta N., Lichtfouse E. (eds) Nanoscience and Biotechnology for Environmental Applications. Environmental Chemistry for a Sustainable World, vol 22. Springer, Cham. https://doi.org/10.1007/978-3-319-97922-9_2

[447] NORDEN (2013). Prevention of Textile Waste. Material flows of textiles in three Nordic countries and suggestions on policy instruments. Authors: Naoko Tojo, Beatrice Kogg, Nikola Kiørboe, Birgitte Kjær and Kristiina Aalto. http://dx.doi.org/10.6027/TN2012-545

As regards the **ban on unsold products (deadstock)**, whereas it is unclear whether this would stimulate a reduction in production (since large quantities of unsold products are generally linked to overproduction, multiple seasonal sales and, more generally, to economies of scale), it would prevent new clothes from being landfilled or incinerated (assessed as having a medium effect on quantitative reduction, see Table 5-14). There is little data on the scale of clothing which is destroyed even though it has never been sold, since companies tend not to disclose this information. The available data would suggest that this is indeed a practice especially among large companies. One famous luxury brand allegedly destroyed more than $28 million worth of products in just one year[448].

However, generating a positive impact on waste prevention very much depends on what is done with the deadstock. One possible option is to redirect it towards donation and reuse[449].

As regards the **EPR modulated fees**, the effects on waste prevention of eco-modulated fees are more difficult to calculate (assessed as having a medium effect on quantitative reduction, see Table 5-14).

### Calculating the reduction potential

The following assumptions were made in calculating the reduction potential by introducing future reuse activities for Clothes & Shoes:

- Share of post-consumer textile waste: 97 % of total textile waste[450];
- Share of clothes & shoes: 43 % of total textile waste[451];
- Increase of reused clothes & shoes from 0 % in 2024 to 55 %[452] in 2030;
- The average lifespan of clothes varies between 2.2 and 5 years[453], with certain clothing items only being kept by consumers for half as long as they were 15 years ago[454]. For the calculations made in this study, an average lifespan of clothes & shoes

[448] Andrew Ellson. Luxury brands including Burberry burn stock worth millions. Newspaper article published in "The Times" on 19. July 2018. Retrieved on 04.11.2021 from: https://www.thetimes.co.uk/article/luxury-brands-burning-stock-worth-millions-zxxscjcmj

[449] However, unsold clothes might be also sold by the producers through discount shops and outlets, hence contributing further to overconsumption of clothes and just postponing the generation of waste. The effects are not yet well enough documented in the literature to be able to draw conclusions on this.

[450] Environment Agency Austria (2021): Generation and treatment of textile waste in Austria

[451] Environment Agency Austria (2021): Generation and treatment of textile waste in Austria

[452] Alcin-Enis I., Kucukali-Ozturk M., Sezgin H. (2019) Risks and Management of Textile Waste. In: Gothandam K., Ranjan S., Dasgupta N., Lichtfouse E. (eds) Nanoscience and Biotechnology for Environmental Applications. Environmental Chemistry for a Sustainable World, vol 22. Springer, Cham. https://doi.org/10.1007/978-3-319-97922-9_2

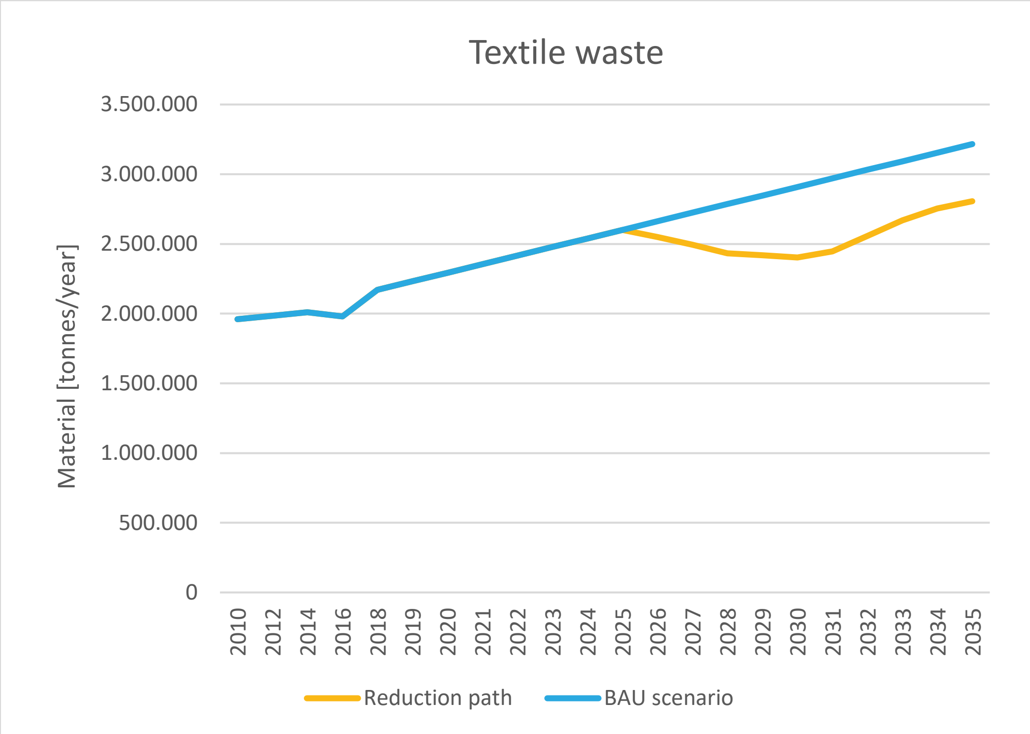
[453] Gray, S., 2017, Mapping clothing impacts in Europe: the environmental cost, WRAP, Banbury.

[454] ETC/WMGE (2019): Textiles and the environment in a circular economy. Available at: https://www.eionet.europa.eu/etcs/etc-wmge/products/etc-reports/textiles-and-the-environment-in-a-circular-economy

of four years was assumed (more than 30 % of clothes in Europeans' wardrobes have not been used for at least one year[455]).

- Extending lifetimes of reused clothes & shoes by 4 years, equal to the lifespan of new clothes & shoes[456];
- Reuse activities can substitute new products placed on the market and thereby reduce primary raw material consumed. It is assumed that 50 % of reused textiles will replace textiles first placed on the market from 2030 forward.

### Figure 5-5: Waste reduction pathway potential for textile waste




The reduction path shows 2,806,238 million tonnes in 2035, which is an increase of 22 % compared to the 2,170,000 million tonnes of textile waste in 2020. Consequently, this does not result in an absolute reduction, but a reduction compared to the BAU scenario (cumulative reduction of 3 million tonnes of textile waste).

### Table 5-13: Reduction potential for textile waste

| | Cumulative waste generation 2018-2035 (million tonnes)[1] | Cumulative reduction potential from BAU scenario 2018-2035 (million tonnes)[1] |
|---|---|---|
| BAU scenario up to 2035 | 49 | |

[455] European Parliament (2019): Environmental impact of the textile and clothing industry - What consumers need to know, Briefing.
[456] It is noted that reused clothes and shoes enter the waste phase with a four-year time lag considering that only reusable Clothes & Shoes are sent to reuse activities.

| | | |
|---|---|---|
| Reduction pathway by introducing future reuse activities for Clothes & Shoes | 45 | 4 |

### Contribution of individual policy measures to quantitative waste reduction

Setting a target for waste reduction (M2) will provide the framework for quantitative reduction to be supported by other measures within the waste policy area (M1, M3), but also by up-stream measures in the product policy context.

### Table 5-14: Relevance of policy measures to waste prevention of textiles

| | **Quantitative waste reduction** |
|---|---|
| M1: Introduction of EPR with modulated fees, based on the quality of textiles | + |
| M2: Introduction of a reduction target for textile waste* | +++ |
| M3: Ban on destruction of unsold clothes | ++ |

**The fulfilment of targets is very much dependent on the success of accompanying measures upstream, which address the production and consumption phase.*

#### 5.4.4.2 Additional impacts

The increasing generation of textile waste is linked to textile over-production and over-consumption, which have key social and environmental impacts. Negative impacts particularly occur during the production phase but, in some cases, in connection with end-of-life treatment[457]. Although the environmental impacts of textiles are difficult to estimate due to the diversity of the impact categories and the long and complex value chains, the following can be summarised.

Below, key impact categories have been identified and the selected single measures are analysed based on whether they would have direct, indirect or no effect on identified impact categories (see Toolbox #19). The identified impact categories are based on an initial screening in the context of the analysis of the BAU scenario.

[457] Arisa & Sympany (2020). Textile recycling unravelled – Exploring post- and pre-consumer textile recycling value chains in Panipat, India. Retrieved on 12 November 2021 from https://arisa.nl/wp-content/uploads/TextileRecyclingUnravelled.pdf

**Table 5-15: Initial impact assessment results of policy measures to reduce textile waste. Notes: "I" = indirect effect, "D" = direct effect, "N" = no effect.**

| Indicator | Measure | | | Data on the magnitude of the impact |
|---|---|---|---|---|
| | 1 EPR / modulated fee | 2 reduction/reuse target | 3 ban on unsold clothes | |
| **Reducing and managing waste (environmental impact category)** | | | | The effects on waste reduction are described in chapter 5.4.4.1. |
| **Efficient use of resources (environmental impact category)** | D | I | N | Textile production is particularly resource-intensive, and the textile sector represents the fourth highest pressure category for use of primary raw materials and water (after food, housing and transport)[458]. Clothing, footwear and household textiles purchased by EU households in 2017, represent a demand of an estimated 675 million tonnes, 1,321 kg per person, on primary raw materials. This includes fossil fuels, fertilisers, minerals and metals used for production facilities; and biomass, excluding water, with 85 % of the primary material consumption taking place outside Europe. |

[458] ETC/WMGE (2019): Textiles and the environment in a circular economy (Eionet Report - ETC/WMGE2019/6). European Environment Agency.

| Indicator | Measure | | | Data on the magnitude of the impact |
|---|---|---|---|---|
| | 1 EPR / modulated fee | 2 reduction/reuse target | 3 ban on unsold clothes | |
| **Environmental impact: quality of natural resources/fighting pollution (water, soil, air, etc.) & climate (environmental impact categories)** | D | I | I | The textile sector ranks as the second highest for land use and the fifth highest for greenhouse gas emissions. Recent research shows that the global fashion industry produced around 2.1 billion tonnes of GHG emissions in 2018, amounting to 4 % of the total emissions globally[459]. About 20 % of global water pollution is caused by textile dyeing and finishing. The production of clothing, footwear and household textiles consumed in the EU generated total emissions of approximately 334 million tonnes CO2-eq worldwide in 2017, the equivalent of 654 kg CO2-eq. per European citizen.[460] |
| **Working conditions (social impact category)** | I | I | N | The system of producing, consuming and disposing of textiles is highly globalised and comprises long and complex value chains. In the past decades, the production of clothing has moved outside of the EU, mainly to Asia[461], where standards for environmental protection and working conditions are usually less strict. During both the production and end-of-life treatment phases, many workers are offered a poor working environment, with child labour, long working weeks, low pay, unsafe production processes and regular use of hazardous substances[462]. |

[459] McKinsey & Company, Global Fashion Agenda (2020): *Fashion on climate.*
[460] Kant, R. (2012). Textile dyeing industry an environmental hazard, Natural Science 4(1), 22–26. http://dx.doi.org/10.4236/ns.2012.41004.
[461] European Parliamentary Research Service (2019). Environmental impact of the textile and clothing industry. What consumers need to know. Author: Nikolina Šajn Members' Research Service PE 633.143 – January 2019. Last retrieved on 03.11.2021 from: Environmental impact of textile and clothes industry (europa.eu)
[462] ETC/WMGE (2019): Textiles and the environment in a circular economy (Eionet Report - ETC/WMGE2019/6). European Environment Agency.

| Indicator | Measure | | | Data on the magnitude of the impact |
|---|---|---|---|---|
| | 1 EPR / modulated fee | 2 reduction/reuse target | 3 ban on unsold clothes | |
| **Impacts on developing countries (cross-horizontal impact category)** | I | I | I | End-of-Life clothing is sometimes exported to developing countries, causing issues in terms of pressures on the local production of clothing and final disposal of waste clothing with poor local waste management systems. Shipped textile waste eventually ends up being treated in poor waste management systems, adding to existing waste dumping and littering problems. This has led many developing countries to ban the import of textile waste[463] |

## 5.4.5 Waste electrical and electronic equipment

### 5.4.5.1 Waste reduction potential

The waste reduction potential of the measures described above basically results from an overall average life-time extension of EEE and their shared use.

A possible **WEEE reduction target** will probably initiate waste prevention measures along the entire value chain of EEE. Lifetime extensions through design for reparability and increased durability, warranty extensions, software update and faster delivery of spare parts. In addition, measures promoting enhanced repair, reuse, remanufacturing and sharing of EEE will be initiated.

A possible EU-wide **preparation for reuse target, legally binding requirements for preparing for reuse of WEEE (e.g., on the basis of EN 50614) and possible standards for quality assurance in remanufacturing only** address activities in the end-of-life phase of EEE. Possible **obligatory funding of waste prevention/reuse/repair for producers** will possibly also focus on measures linked to the end-of-life phase.

[463] Niinimäki, K., Peters, G., Dahlbo, H., Perry, P., Rissanen, T., Gwilt, A. (2020) *The environmental price of fast fashion*. Nature Reviews Earth & Environment 1, 189–200; Watson, D., Palm, D., Brix, L., Amstrup, M., Syversen, F., Nielsen, R. (2016) Exports of Nordic Used Textiles. Fate, benefits and impacts. TemaNord 2016:558.

## Calculating the reduction potential

It is difficult to predict the WEEE reduction potential up to 2035, as there are many overall influencing factors such as digitalisation, economic development, etc., and reciprocal effects of waste prevention measures (repair, increased durability) are likely. The following information illustrates some aspects of the waste reduction potential.

Data on volumes of reused WEEE is collected on a voluntary basis in the context of the WEEE reporting obligations under the WEEE Directive. According to EEA (2018) the available data shows that reuse of WEEE corresponds to 0 to 1.3 % of the amounts of EEE placed on the market. A repair rate of WEEE of 20 %, as required by the Belgian Waste Prevention Programme, is expected to reduce WEEE generation by 0.5 kg per capita[464]. National examples of preparation for reuse targets identified in this study, namely Wallonia (2 % reuse target) and Spain 3 % (large appliances) and 4 % (small IT and telecommunication appliances), are comparably less ambitious.

Diverting 10 % from the EEE purchases into the rental of these products would reduce WEEE generation by 0.2 kg per capita[465] in Belgium.

There are strong indications that EEE products have tended to exhibit decreasing durability in recent years. Case studies of four different electronic product groups (smartphones, washing machines, vacuum cleaners and televisions) revealed that all of them have average actual lifetimes which are at least 2.3 years shorter than either their designed or desired lifetimes[466]. According to EC (2019) even though the average first use duration of white goods such as washing machines, dryers and refrigerators is approximately 13 years, an increasing number of appliances fail within the first five years of their service life: the number of large household appliances being replaced within the first five years of their service life due to a defect increased from 3.5 % in 2004 to 8.3 % in 2013[467]. According to the updated EU Preparatory Study for Washing Machines and Washer Dryers[468], the average expected product lifetime of washing machines and washer dryers (i.e., first useful service life of a machine replaced due to a defect) of 12.5 years has decreased compared to the typical former value of approximately 15 years. With respect to The Netherlands, it was

[464] EEA (2019). Belgium waste prevention country fact sheet. Retrieved on 12 November 2021 from https://www.eea.europa.eu/ds_resolveuid/fc16cf4ef0494a178be0162dd2b64706

[465] EEA (2019). Belgium waste prevention country fact sheet. Retrieved on 12 November 2021 from https://www.eea.europa.eu/ds_resolveuid/fc16cf4ef0494a178be0162dd2b64706

[466] EEA (2020): *Europe´s consumption in a circular economy*: the benefits of longer lasting electronics. Briefing No. 02/2020

[467] EC (2019): Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy. Final Report.

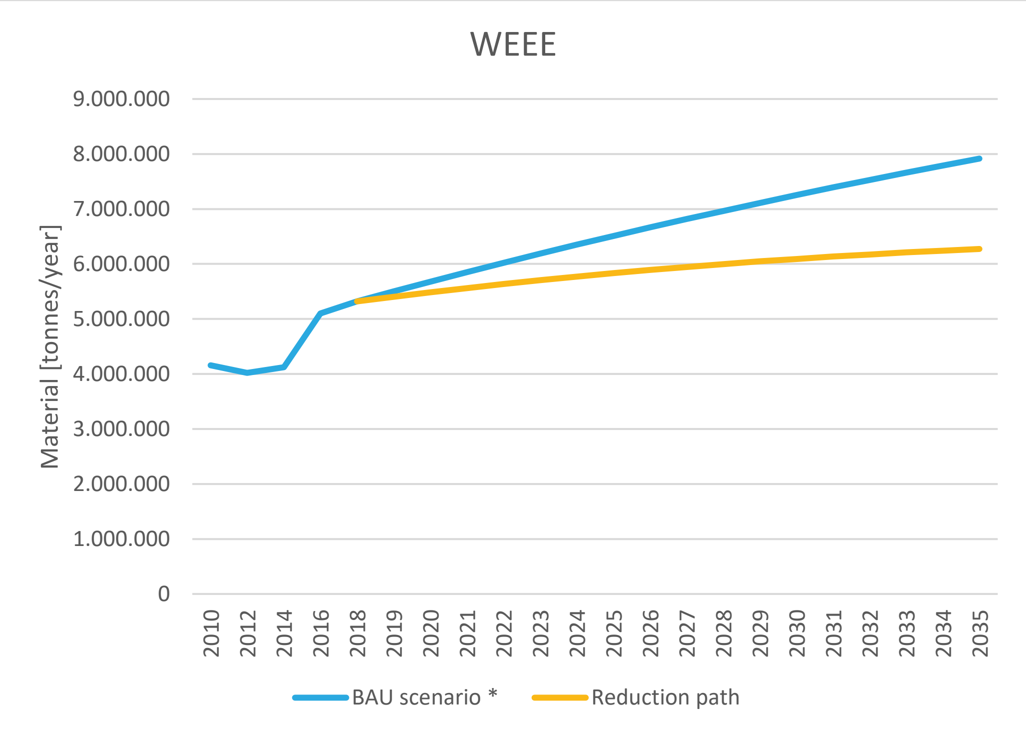
[468] JRC (2017): *Follow-up of the preparatory study for Ecodesign and Energy Label for household washing machines and household washer dryers*, Final report. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC108583/jrc108583_wash_explanatory-notes_20171206_final_clean.pdf

found that the median lifetime of all EEE categories, except for lamps, decreased between 2000 and 2006[469]. The highest decrease (-20 %) was found for consumer electronics and accessories.

Currently, remanufacturing accounts for less than 2 % of EU manufacturing turnover[470].

In order to estimate the reduction potential, it was assumed that the combination of the measures listed above leads to an average lifetime extension of 25 % for EEE products by 2035, caused by increased durability, repair, remanufacturing and reuse. It is assumed that the observed reduction of product lifetimes can at least be reversed. First use durations of 15 years should be technically feasible. The effects of enhanced sharing and non-consumption on waste reduction are considered to be comparably lower and were not addressed specifically.

## Figure 5-6: Waste reduction pathway of WEEE.




*Notes: * = Based on collected WEEE volumes, which is about 40 % of total WEEE volumes.*

[469] Wang et al. (2013) in: EC (2019): Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy. Final Report.
[470] EC (2019): Support for the upcoming Commission Initiative towards an EU product policy framework supportive of Circular Economy. Final Report.

### Table 5-16: Reduction potential for WEEE

| | Cumulative waste generation 2018-2035 (million tonnes)[1] | Cumulative reduction potential from BAU 2018-2035 (million tonnes)[1] |
|---|---|---|
| BAU scenario up to 2035 | 121 | |
| Reduction pathway by measures along the entire value chain | 106 | 15 |

"1" noting that the cumulative perspective sums up each year between 2018-2035.

### Contribution of individual policy measures to quantitative waste reduction

It is expected that the quantitative reduction target will drive the reduction of WEEE, and measures M2-6 will help to achieve the goal to various extents.

### Table 5-17: Relevance of policy measures to waste prevention of WEEE

| | Quantitative waste reduction |
|---|---|
| M1: Introduction of an EU-wide waste reduction target for WEEE for specific EEE categories | +++ |
| M2: Reassessment of a possible EU-wide target for preparation for reuse of collected WEEE | ++ |
| M3: Introduction of minimum requirements for the preparation for reuse of WEEE | ++ |
| M4: Development of standards for quality assurance in remanufacturing | ++ |
| M5: Improvement of collection of WEEE by exploring options at EU level to incentivise take-back, return or selling back of mobile phones, tablets, laptops and chargers | ++ |
| M6: Introduction of obligatory funding of waste prevention/reuse/repair for producers | ++ |

## 5.4.5.2 Additional impacts

The proposed measures potentially reduce the generation of WEEE. The reduction will probably have effects on the following impact categories.

**Table 5-18: Initial impact assessment results of policy measures to reduce WEEE. Notes: "I" = indirect effect, "D" = direct effect, "N" = no effect.**

| Indicator | Measure | | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|---|
| | 1 reduction target | 2 target preparation for reuse | 3 legally binding prep. for reuse | 4 standards re-manufacturing | 5 take back | 6 funding | |
| **Reducing and managing waste** | | | | | | | The effects on waste reduction are described in chapter 5.4.5.1. |
| **The climate** | I | N | I | N | N | I | As regards climate impacts, there is a relationship between GHG emission and product lifetime. The European Environment Agency found that the average actual lifetime of four selected EEE product groups is at least 2.3 years shorter than the designed or desired lifetime[471]. Lifetime extension of 1 year of all washing machines, notebooks, vacuum cleaners and smartphones would save around 4 million tonnes annually by 2030[472]. |
| **Minimising environmental risks** | I | N | I | I | I | I | About 60 % of European WEEE is not collected through official take-back systems, which might indicate improper treatment and therefore risks for human and environmental health. It can be assumed that they are not treated in accordance with standard requirements and thus are neither properly de-polluted, nor recycled to such an extent, that the recycling targets of the WEEE Directive would be met, nor would the hazardous fraction be dealt with appropriately.<br>The proposed measures will probably reduce the generation of WEEE and therefore decrease the potential of waste to be sent for improper treatment within and beyond the EU. |

[471] Bachér, John; Dams, Yoko; Duhoux, Tom; Deng, Yang; Teittinen, Tuuli; Mortensen, Lars Fogh (2020). Electronics and obsolescence in a circular economy (Eionet Report - ETC/WMGE 2020/3). European Environment Agency.
[472] EEB (2019) Coolproducts don't cost the earth - full report. European Environmental Bureau (EEB). Online: www.eeb.org/coolproducts-report

| Indicator | Measure | | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|---|
| | 1 reduction target | 2 target preparation for reuse | 3 legally binding prep. for reuse | 4 standards re-manufacturing | 5 take back | 6 funding | |
| **Functioning of the internal market and competition** | I | I | D | D | I | I | There are differences in preparation for reuse across EU Member States and potential exports to countries without legal standards. The market disruption potentially results in lower qualities of second-hand products across Europe. The proposed measure on legally binding requirements for reuse of WEEE (M2) will remove market disruptions and provide a uniform and level playing field for the WEEE aftermarket in Europe. |
| **Consumers and households** | I | I | I | I | D | I | A Eurobarometer survey in 2011[473] shows that 68 % of EU citizens said that they are willing to buy second-hand items including electronic equipment. It is expected that the media presence of climate change and resource efficiency will affect consumption behaviour changes and increase the demand for second- hand purchases. |

[473] The Gallup Organization (2011). Attitudes of Europeans towards resource efficiency (Flash Eurobarometer Series #316). Online: https://ec.europa.eu/environment/resource_efficiency/haveyoursay/past_consultations/eurobarometer_march2011_en.htm

| Indicator | Measure | | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|---|
| | 1 reduction target | 2 target preparation for reuse | 3 legally binding prep. for reuse | 4 standards re-manufacturing | 5 take back | 6 funding | |
| **Job creation** | I | I | D | N | I | I | The **waste reduction potential is inter alia driven by enhanced preparation for reuse** and remanufacturing activities. Data on the job creation potential is available:<br>• Preparation for reuse would generate 35 jobs per 1,000 tonnes of WEEE compared with 7 jobs if it was dismantled prior to recycling[474].<br>• Refurbishment creates about 200 jobs per 1,000 tonnes of ICT equipment compared with 15 for recycling[475].<br>• Reuse activities create 60-140 jobs per 1,000 tonnes of WEEE[476].<br>• Proper WEEE pre-treatment creates 0.5-2.9 jobs per 1,000 tonnes of large household appliances, CRT/LCD/LED screens, microwave ovens, and mixed waste[477].<br>Based on the previous studies, the range of jobs created is estimated to be 35-200 additional FTEs per 1,000 tonnes of WEEE prepared for reuse. **With respect to the reduction potential of about 820,000 tonnes per year (14 million cumulative reduction potential divided by 17 years, see chapter 5.4.5.1), the job creation potential ranges between 29,000 and 160,000 jobs**. It is noted that in Spain more than 4,700 direct jobs are associated with WEEE preparation for reuse[478]. |

[474] Seyring, N. et al. (2015). Study on WEEE recovery targets, preparation for reuse targets and on the method for calculation of the recovery targets. Retrieved on 12 November 2021 from https://ec.europa.eu/environment/pdf/waste/weee/16.%20Final%20report_approved.pdf

[475] RReuse (2015). Better access needed to millions of discarded re-usable goods says EU study. Online: https://rreuse.org/better-access-needed-to-millions-of-discarded-re-usable-goods-says-eu-study/

[476] RReuse (2021). Briefing: Job creation in the reuse sector: Data insights from social enterprises. Retrieved on 12 November 2021 from https://www.rreuse.org/wp-content/uploads/04-2021-job-creation-briefing.pdf

| Indicator | Measure | | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|---|
| | 1 reduction target | 2 target preparation for reuse | 3 legally binding prep. for reuse | 4 standards re-manufacturing | 5 take back | 6 funding | |
| **Efficient use of resources** | I | N | I | I | I | I | Regarding the overall environmental benefits of increased reuse, it has to be mentioned that apart from waste reduction, the replacement rate of items is in particular relevant; i.e., the extent to which the acquisition of reusable goods prevents the acquisition of new goods, which saves raw materials, etc. A recent Belgian study estimated replacement rates of about 28 % for EEE.[479] That means that in 28 % of all acquisitions of second-hand EEE the acquisition of new EEE is prevented. This study also showed that, compared with other product categories such as furniture, baby goods or toys, the percentage of EEE items from second-hand sources is lowest (about 10 % of EEE items in households are from a second-hand source).<br><br>Material savings in the entire value chain, including resource extraction, can be estimated with the Total Material Requirement (TMR) indicator. With respect to EEE reuse, the saving potential in the EEE catchment area of companies in Flanders and North Rhine-Westphalia ranges between 10 and 21 kg per capita[480]. Assuming a similar consumption and reuse pattern in the entire EU, this results in total material savings of about 4 to 9 million tonnes. |

[477] McMahon, K. (2021). Estimating job creation potential of compliant WEEE pre-treatment in Ireland. Resources, Conservation and Recycling (166), 105230. https://doi.org/10.1016/j.resconrec.2020.105230

[478] Fabrellas, Begoña (2015). First national target for WEEE preparation for reuse: Spanish Royal Decree 110/20 15 of 20 February on waste and electrical and electronic equipment. EU Seminar: Reuse targets: why they matter and how to make them work. 20 April 2015.

[479] CE Circular Economy Policy Research Center (2020). Reuse. The understudied circular economy strategy. CE Center Publication No 13. https://ce-center.vlaanderen-circulair.be/en/publications/publication/13-reuse-the-understudied-circular-economy-strategy

[480] Gries, Nadja von (2020). Ressourceneinsparpotenziale der „Vorbereitung zur Wiederverwendung“ von Elektro- und Elektronikaltgeräten. Doctoral Thesis. Kassel University. http://dx.doi.org/doi:10.17170/kobra-202007091434

| Indicator | Measure | | | | | | Data on the magnitude of the impact |
|---|---|---|---|---|---|---|---|
| | 1 reduction target | 2 target preparation for reuse | 3 legally binding prep. for reuse | 4 standards re-manufacturing | 5 take back | 6 funding | |
| **Third countries and international relations** | I | I | I | N | I | I | Import dependencies: In 2017, about 21 kg/cap of EEE products were placed on the market in the EU, of which about 60 % (12 kg/cap) was produced within the EU and 40 % (9 kg/cap) was imported[481]. However, EU production depends on global supply chains for intermediate products and raw materials. The EU EEE component and mineral dependence on third countries could be reduced by waste prevention activities, which effectively keep EEE products in the EU product loop. |

## 5.4.6 Municipal solid waste

### 5.4.6.1 Waste reduction potential

The three identified measures have the potential to contribute to waste reduction.

As regards setting a mandatory **target for residual municipal solid waste**, this will subsequently lead to a decrease of this waste stream. This is mainly triggered by a major push for source separation and separate collection of specific fractions, showing a shift of related amounts from the residual MSW. Knowing that source separation is not a waste prevention measure, the fulfilment of the target will be supported by the adoption of additional upstream measures, e. g., to stimulate activities in the reuse sector for source separated fractions, or enhance the introduction of further requirements such as eco-design within product policies. These effects cannot be quantified.

With regard to the measures to **establish similar requirements to those laid down in the Single-Use Plastics Directive** on other single-use items, the example of advertising mail, usually made of paper, is given. A study published by the French Environment Agency (Ademe) in 2006, noted that advertising material received by households generates 10.3 kg of waste per inhabitant per year, and the prevention potential per household was estimated to be 24 kg per year. For France it is estimated, that 18 billion printed products, i.e., 800,000

[481] Bachér, John; Dams, Yoko; Duhoux, Tom; Deng, Yang; Teittinen, Tuuli; Mortensen, Lars Fogh (2020). Electronics and obsolescence in a circular economy (Eionet Report - ETC/WMGE 2020/3). European Environment Agency.

tonnes of paper, could be prevented. According to the study, 25 % of paper consumption for advertising uses corresponds to addressed advertising in mailboxes, and 51 % corresponds to unaddressed advertising (the remaining paper consumption used for commercial catalogues being 13 % - and other kinds of advertising materials being 11 %).

For the Brussels region, a study published in 2010 demonstrated that campaigns including stickers and accompanying enforcement actions led to a reduction in prevention potential of about 5 kg per household and year. A study performed by the City of Utrecht estimated that approximately 13 kg per household and year could be prevented by switching from a policy where delivery of unaddressed mail is permitted mail as long as “No” stickers are used to a policy where delivery of unaddressed material is permitted only on demand.

In addition to the reduction of waste paper, banning the delivery of unaddressed mail also contributes to reduced indirect emissions related to distribution activities among households.

As regards the measure to **promote and support repair cafes, sharing platforms and special boxes** for households to collect reusable items, various examples for furniture, books and toys are analysed below.

Furniture waste in the EU accounts for more than 4 % of the total municipal solid waste stream[482]. Reuse of furniture via reuse centres and networks is already established and usually carried out, together with other waste streams such as WEEEs or textile waste. Centres collect the bulky waste through different schemes including civic amenities sites, bulky waste collection centres or via kerbside collection, and through a variety of approaches which often involve charities and social enterprises. They organise the pathway from repair to redistribution through sales channels for second-hand goods[483]. Flanders, for instance, has operated a very successful reuse scheme for the past 20 years, the Flemish network of reuse centres, which account for 11 % to 19 % of total reuse for different waste streams, including furniture, where per capita levels of reuse are reported to be 14.9 kg per year[484]. The only example of Extended Producer Responsibility on furniture worldwide is in France, known as Éco-mobilier (for domestic furniture) and Valdelia (for professional furniture).

A study conducted by the EEA[485] estimates a maximum potential for reuse of furniture by implementing policy packages[486] of 2,097,962 tonnes.

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[482] EEB (2017) Circular economy opportunities in the furniture sector.
[483] URBANREC_D6.1 _ Guidelines_3.pdf (urbanrec-project.eu)
[484] https://ce-center.vlaanderen-circulair.be/en/publications/publication/13-reuse-the-understudied-circular-economy-strategy
[485] European Environmental Bureau (EEB) by Eunomia Research & Consulting Ltd.: Circular economy opportunities in the furniture sector: https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2019/05/Report-on-the-Circular-Economy-in-the-Furniture-Sector.pdf
[486] The maximum potential is related to full mandatory implementation of: EPR for take back, with preparing for reuse and recycling targets, and with a modulated fee or an IPR approach; Eco-design measures on

DG Enterprise and Industry[16] estimated that the domestic sector accounts for 82 % of furniture consumption, with the remaining 18 % being associated with B2B (business to business) consumption[487]. Around 28 % of the world's furniture is manufactured within the European Union.

For books, public libraries represent a widely known and used initiative for sharing. More recently, so-called libraries of things offer objects such as kitchen appliances, electric appliances, tools and toys, ensuring access to these items, which are often rarely used, without the need to buy them[488]. Following the opening of the first library of things in Berlin in 2010, over 25 similar initiatives have been started across EU cities.[489]

As regards toys, in terms of weight, plastics are estimated to account for 72 to 76 % of toy materials[490,491]. An estimated 32 % of discarded toys now include some sort of electronic or electric component (mainly in early childhood toys, small-sized vehicles and electronic board games); in weight terms, this represents roughly 12 % of all toy waste, with batteries, accumulators and circuit boards accounting for up to 1.5 %[492].

One of the few available attempts to quantify discarded toys estimates around 21.5 million units per year in the UK[493,494]. Considering an average weight of 1.1 kg per toy[495] and given

durability, repair and recyclability or a mandatory warranty period of five years to drive durability and reparability.

487 Furn36 (2017). CIRCULAR ECONOMY IN THE FURNITURE INDUSTRY: OVERVIEW OF CURRENT CHALLENGES AND COMPETENCES NEEDS. The Project (Project 2017-1-BE01-KA202-024752) has been funded with support from the EC. Available at: Circular economy in the furniture industry - 11092018 (europa.eu)

488 Baden, et al. (2020): Access Over Ownership: Case Studies of Libraries of Things. Sustainability 12, 7180. doi:10.3390/su12177180

489 Jaik (2018): Nutzen statt Besitzen in Leihläden lokal gestalten. In: Franz HW., Kaletka C. (eds) Soziale Innovationen lokal gestalten. Sozialwissenschaften und Berufspraxis. Springer VS, Wiesbaden. doi:10.1007/978-3-658-18532-9_7

490 Solé, M., Watson, J., Puig, R. and Fullana-i-Palmer, P. (2012) Proposal of a new model to improve the collection of small WEEE: a pilot project for the recovery and recycling of toys, *Waste Management & Research*, Vol. 30, No. 11, pp. 1208-1212, https://doi.org/10.1177/0734242X11434563

491 Pérez-Belis, V., Bovea, M. D. and Gómez, A. (2013) Waste electric and electronic toys: Management practices and characterisation, *Resources, Conservation and Recycling*, Vol. 77, pp. 1-12, https://doi.org/10.1016/j.resconrec.2013.05.002

492 Muñoz, I., Gazulla, C., Bala, A., Puig, R. and Fullana, P. (2009) LCA and ecodesign in the toy industry: case study of a teddy bear incorporating electric and electronic components, *The International Journal of Life Cycle Assessment*, Vol. 14, pp. 64-72, https://doi.org/10.1007/s11367-008-0044-6

493 Hackney Council (2018) *Hackney launches Toys Gift Appeal 2019*, Accessed 2 December 2020, https://news.hackney.gov.uk/hackney-launches-toys-gift-appeal-2019/

494 East Sussex County Council (2014) *Facts and figures about rubbish and recycling*, Accessed 2 December 2020, https://www.eastsussex.gov.uk/environment/rubbishandrecycling/factsandfigures/

495 Envirotoy (2020) *Toys that pollute the ocean*, Accessed 2 December 2020, https://www.envirotoy.co.uk/toys-that-pollute-the-ocean/

that the UK represented around 18 % of the EU-28 toy market[496], toy waste generation in the EU-27 could be around 108,000 tonnes per year. The relative importance of this waste stream probably differs between Member States, as statistics on the number of toys bought per child per year vary between 10 in Spain to 21 in France or 23 in Germany[497].

In fact, approximately 60 % of toys on the market each year are newly developed products[498]. STEM (science, technology, engineering and maths) toys represent the fastest growing segment in the toy market[499]. Reuse of toys is already established through sharing platforms at Member State level.

### Calculating the reduction potential

The following assumptions were made in calculating the reduction potential through introducing future restrictions on advertising mail (addressing paper reduction in the residual municipal solid waste) and promoting reuse activities for furniture:

- A maximum reuse potential of 2 million tonnes of furniture was assumed, based on a study conducted by the EEA[500], assuming a constant increase between 2025 and 2030, and assuming the full implementation of specific policy packages[501].
- It was assumed that restrictions on advertising mail and a per capita reduction potential of 6 kg[502] would occur during the time period 2025 to 2030.
- A 50 % reduction target for residual municipal solid waste is already proposed in the Circular Economy Action Plan.
- Additional reduction potentials are gained by the measures set on textiles (see chapter 5.4.1 and WEEE (see chapter 5.4.5).

[496] The Toy Fair (2020) Hard year for toy industry but the UK still remains the largest toy market in Europe https://www.toyfair.co.uk/hard-year-for-toy-industry-but-the-uk-still-remains-the-largest-toy-market-in-europe/

[497] Asociación Española de Fabricantes de Juguetes (2020) *Información del sector: Datos sociodemográficos*, Accessed 2 December 2020, https://www.aefj.es/paginas/datos-sociodemograficos

[498] Toy Industries of Europe (2013) *The European Toy Industry: Facts and Figures 2013*, Accessed 8 December 2020, https://law.resource.org/pub/eu/toys/guidance/the_european_toy_industry_-_facts_and_figures_-_january_2013-4.pdf

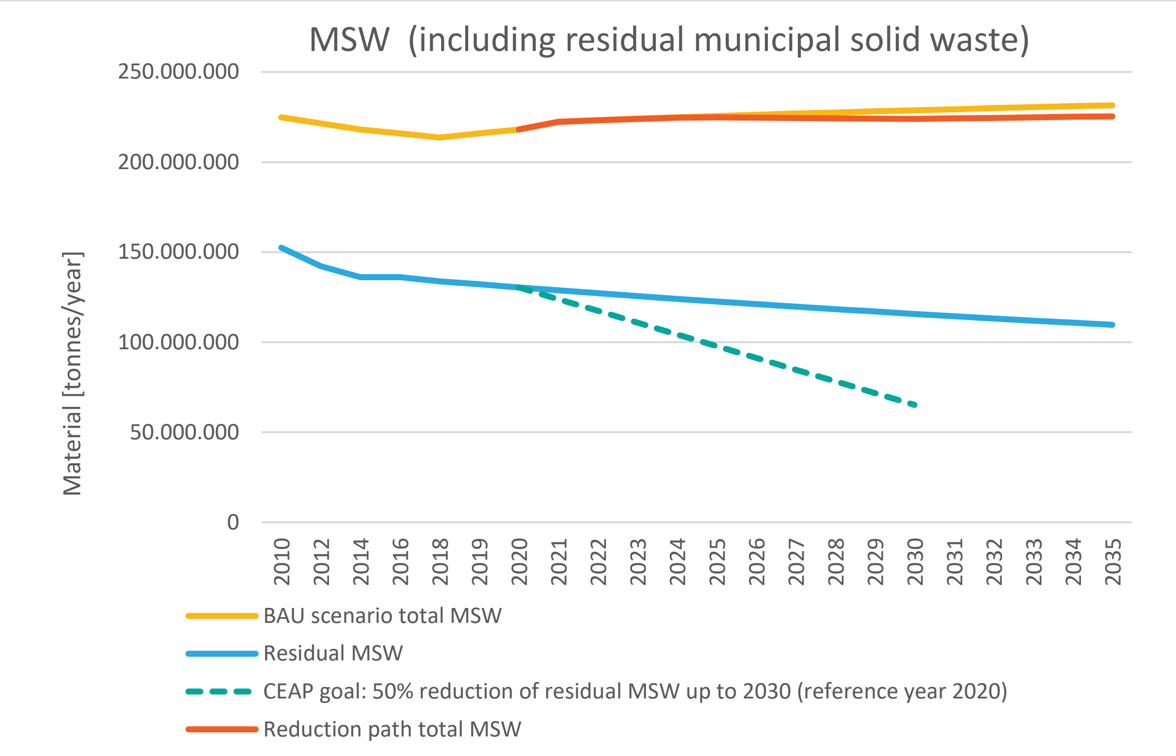
[499] Technavio (2020) *Toys Market in Europe by Product, Distribution Channel, and Geography - Forecast and Analysis 2020-2024*, Accessed 2 December 2020, https://www.technavio.com/report/toys-market-analysis-in-europe-industry

[500] European Environmental Bureau (EEB) by Eunomia Research & Consulting Ltd.: Circular economy opportunities in the furniture sector: https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2019/05/Report-on-the-Circular-Economy-in-the-Furniture-Sector.pdf

[501] The maximum potential is related to full mandatory implementation of: EPR for take-back, with preparing for reuse and recycling targets, and with a modulated fee or an IPR approach; ecodesign measures on durability, repair and recyclability or a mandatory warranty period of five years to drive durability and reparability.

[502] Average out of three case studies conducted in France and Belgium.

#### Figure 5-7: Waste reduction pathway potential for MSW




The CEAP defines a goal for reduction of residual MSW of 50% by 2030. It is expected that the Member States will work towards this goal mainly by increasing the source separation of recyclables (such as plastics, metals, glass, paper and cardboard), waste prevention activities might contribute to minor extent only. This effects in a shift of individual waste streams within the total MSW. Consequently, the measure "M1: Introduction of mandatory mixed residual MSW reduction targets" was not considered for calculating the reduction path for total MSW. The reduction potential is calculated considering the following two measures only: "M2: Introduction of measures for short-lifetime products similar to single-use plastic items" and "M3: Promotion and support of repair cafes, sharing platforms and special boxes for households to collect reusable items".

#### Table 5-19: Reduction potential for MSW

| | Cumulative waste generation 2018-2035 (million tonnes)[2] | Cumulative reduction potential from BAU scenario 2018-2035 (million tonnes)[2] |
|---|---|---|
| BAU scenario up to 2035 | 3,888 | |
| Reduction potential by reuse of furniture | | 11 |
| Reduction potential by restriction of advertising mail (paper) | | 23 |
| Reduction potential textiles (see chapter 5.4.1) | | *4* |

| | Cumulative waste generation 2018-2035 (million tonnes)[2] | Cumulative reduction potential from BAU scenario 2018-2035 (million tonnes)[2] |
|---|---|---|
| Reduction potential WEEE (see chapter 5.4.5) | | *15* |
| **Total[1]** | **3,854** | **34** |

"1" noting that=Food and packaging waste are excluded by the scope of this study and no measures on those sub streams were assessed.

"2" noting that the cumulative perspective sums up each year between 2018-2035.

### Contribution of individual policy measures to quantitative waste reduction

Setting a target for waste reduction (M1) will provide the framework for quantitative reduction to be supported by other measures within the waste policy area (M2, M3), but also by up-stream measures in the product policy context.

### Table 5-20: Relevance of policy measures to waste prevention of MSW

| | Quantitative waste reduction |
|---|---|
| M1: Introduction of mandatory residual MSW reduction targets | +[1] |
| M2: Introduction of measures for short-lifetime products similar to single-use plastic items | +++ |
| M3: Promotion and support of repair cafes, sharing platforms and special boxes for households to collect reusable items | ++ |

"1" noting that this measure will mainly push a shift to increased source separation and therefore contribute to waste reduction to minor extent.

### 5.4.6.2 Additional impacts

Several household products are linked to over-production and over-consumption, which have key social and environmental impacts.

Below, key impact categories have been identified and the selected single measures have been analysed according to whether they would have direct, indirect or no effect on identified impact categories (see Toolbox #19).

The screening focusses on impacts connected to selected key fractions from municipal solid waste: non-packaging paper and cardboard, glass, metals, plastics and wood waste; furniture; and residual municipal solid waste. These are the focal point here, because other key fractions are addressed in the assessments of specific waste streams in this study (cf. chapter 5.4.1 on textile waste or chapter 5.4.5 on WEEE) or are excluded by scope (cf. chapter 2.3, excluding packaging waste and food waste specifically).

**Table 5-21: Initial impact assessment results of policy measures to reduce textile waste. Notes: "I" = indirect effect, "D" = direct effect, "N" = no effect.**

| Indicator | Measure | | | Data on the magnitude of the impact |
|---|---|---|---|---|
| | 1 reduction target MSW | 2 address single-use items | 3 promoting reuse activities | |
| **Reducing and managing waste (environmental impact categories)** | | | | The effects on waste reduction are described in chapter 5.4.6.1. |
| **Efficient use of resources (environmental impact categories)** | N | I | N | Between 2010 and 2018, the **final consumption expenditure of households** increased by 75 %.[503] This is in line with an increased demand on resources for the production of consumed products in the household sector.<br>The **furniture sector** represents a €84 billion market that equates to an EU-28 consumption of approx. 10.5 million tonnes of furniture per annum.[504] Due to the rapid growth in the sector, there is a potential tension between wood supply for furniture and the critical importance of preserving forest ecosystems to address the climate crisis. |

503 EUROSTAT Website https://ec.europa.eu/eurostat/ (consumption expenditure)

504 Data from Eurostat, National Statistical Offices, National Furniture manufacturers associations, cited in the EU Furniture Market Situation Report (2014).

| Indicator | Measure | | | Data on the magnitude of the impact |
|---|---|---|---|---|
| | 1 reduction target MSW | 2 address single-use items | 3 promoting reuse activities | |
| **Environmental impact: quality of natural resources/fighting pollution (water, soil, air etc.) & climate (environmental impact categories)** | D | I | N | Considerable environmental impacts are related to the waste phase and the management of **residual municipal solid waste** in the EU. In 2018, 24 % of all municipal waste generated in the EU was still landfilled[505]. In the EU, 26 % of methane emissions come from the waste management sector.[506]<br><br>In addition, leachate generated from landfill poses a risk to groundwater – specifically, organic compounds may decrease the oxidation-reduction potential and increase the mobility of toxic metals.<br><br>As regards **specific single-use items** such as plastic confetti, large quantities have been found in the environment recently and remain in the soil for years. They clog sewers and pollute water, resulting in the need for additional clean-up activities[507]. Littering of single-use items cause harm specifically to the coastal and marine environment.<br><br>A study conducted by the EEA[508] estimates a maximum potential for net carbon reduction by implementing selected policy packages[509] on **furniture** of 5,713,542 tonnes CO2 eq. in total. |

[505] Eurostat, env_wasmun.
[506] EC (2020). EU strategy to reduce methane emissions. Online: https://ec.europa.eu/energy/sites/ener/files/eu_methane_strategy.pdf. Accessed 12 November 2021.
[507] Ministère de la Transition écologique (2020). The anti-waste law in the daily lives of the French people: What does that mean in practice? Online: https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf. Accessed 12 November 2021.
[508] European Environmental Bureau (EEB) by Eunomia Research & Consulting Ltd.: Circular economy opportunities in the furniture sector. Online: https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2019/05/Report-on-the-Circular-Economy-in-the-Furniture-Sector.pdf. Accessed 12 November 2021.
[509] The maximum potential is related to full mandatory implementation of: EPR for take-back, with preparing for reuse and recycling targets, and with a modulated fee or an IPR approach; ecodesign measures on

| Indicator | Measure | | | Data on the magnitude of the impact |
| --- | --- | --- | --- | --- |
| | 1 reduction target MSW | 2 address single-use items | 3 promoting reuse activities | |
| **Employment (social impact category)** | N | N | I | A study conducted by the EEA[510] estimates a maximum potential for additional jobs through implementing selected policy packages[511] on **furniture** of 157,347 additional jobs. The furniture sector employs approximately 1 million European workers, mostly from the SME sector[512].<br>The European **toys** manufacturing industry is made up of approx. 5,600 companies, 99 % of which are SMEs, which directly employ around 60,000 workers, with an extra 130,000 in occupations related to the overall supply chain[513]. Even though toy imports are significantly larger than exports (€9.10bn and €1.91bn in 2016, respectively), any policy intervention aimed at reducing toy waste is likely to have an impact on the European toy manufacturing sector. |

## 5.5 Conclusions

The aim of chapter 5.0 is to identify viable waste prevention measures, which can be implemented in the waste policy area. In addition, an initial assessment of impacts was

durability, repair and recyclability or a mandatory warranty period of five years to drive durability and reparability.

510 European Environmental Bureau (EEB) by Eunomia Research & Consulting Ltd.: Circular economy opportunities in the furniture sector: https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2019/05/Report-on-the-Circular-Economy-in-the-Furniture-Sector.pdf

511 The maximum potential is related to full mandatory implementation of: EPR for take-back, with preparing for reuse and recycling targets, and with a modulated fee or an IPR approach; ecodesign measures on durability, repair and recyclability or a mandatory warranty period of five years to drive durability and reparability.

512 Data from Eurostat, National Statistical Offices, National Furniture manufacturers associations, cited in the EU Furniture Market Situation Report (2014).

513 Toy Industries of Europe (2017) *The European Toy Industry: Facts and Figures 2017*, Accessed 2 December 2020, https://www.toyindustries.eu/wp-content/uploads/2018/01/TIE-EU-Toy-Sector-Facts-and-Figures-FINAL.pdf

carried out on the identified viable measures in order to estimate the potential for waste reduction.

Firstly, the **identification of viable measures started** with the compilation of a list of measures, covering:

- measures to overcome existing barriers for enhanced waste prevention;
- measures providing best practice examples for waste prevention in Europe;
- measures revealed via stakeholder consultation procedures.

The compilation resulted in 98 distinctive measures for the 6 priority waste streams (see Table 5-22) across all implementation areas (e.g., product policy, waste policy). Only those measures which can be implemented in the waste policy area were taken forward to the identification step. Those measures which met the 8 criteria according to Better Regulation Tool #17[514] were classified as "viable". Finally, 26 viable measures were identified for the six priority waste streams (c.f. Table 5-22).

## Table 5-22: Compilation of viable waste prevention measures at EU level

| Waste stream | Measure |
|---|---|
| **End-of-Life tyres** | M1: Introduction of retreading targets for tyres |
| | M2: Introduction of EPR fees for tyres placed on the market for the first time |
| | M3: Establishment of national communication programmes on part-worn tyres |
| | M4: Harmonisation of product/waste definition of tyres sent for retreading |
| | M5: Enabling digital traceability of individual tyres (RFID) |
| **End-of-Life vehicles** | M1: Expansion of the scope of the ELV Directive to all vehicle categories |
| | M2: Introduction of a legal framework for remanufacturing of vehicles and components |
| | M3: Definition of remanufacturing targets for vehicles and vehicle components |
| | M4: Definition of criteria to enable removal of vehicle components from end-of-life vehicles |
| **Construction & demolition waste (mineral waste)** | M1: Introduction of a C&D waste reduction target |
| | M2: Strengthen the reuse of building components by mandatory pre-demolition audits |
| | M3: Implementation of guidelines for reuse of soil |
| | M4: Integration of reuse aspects in site management plans |
| **Textile waste** | M1: Introduction of EPR with modulated fees, based on the quality of textiles |
| | M2: Introduction of a reduction target for textile waste |
| | M3: Ban on destruction of unsold clothes |
| **WEEE** | M1: Introduction of an EU-wide waste reduction target for WEEE for specific EEE categories |
| | M2: Reassessment of a possible EU-wide target for preparation for reuse of collected WEEE |
| | M3: Introduction of minimum requirements for the preparation for reuse of WEEE |

514 Criteria: Legal feasibility, technical feasibility, previous policy choices, coherence with other EU policy objectives, effectiveness and efficiency, proportionality, political feasibility and relevance.

| | |
|---|---|
| | M4: Development of standards for quality assurance in remanufacturing |
| | M5: Improvement of collection of WEEE by exploring options at EU level to incentivise take-back, return or selling back of mobile phones, tablets, laptops and chargers |
| | M6: Introduction of obligatory funding of waste prevention/reuse/repair for producers |
| **Municipal waste** | M1: Introduction of mandatory residual MSW reduction targets |
| | M2: Introduction of measures for short-lifetime products similar to single-use plastic items |
| | M3: Promotion and support of repair cafes, sharing platforms and special boxes for households to collect reusable items |

Having identified the most viable measures, the following conclusions can be drawn:

- This study has identified viable measures, some of which are already defined in the new Circular Economy Action Plan (CEAP). This study goes beyond the CEAP approach because it suggests making these measures legally binding, and provides comprehensive descriptions and estimates on waste reduction. By doing so, this study supports the CEAP and provides further input into the EC's work to implement the CEAP measures.
- The aim of the proposed measures in the waste policy area is to reduce waste generation. The potential of reducing waste has been estimated for several individual measures, thus illustrating the importance of the waste policy area. Nevertheless, it is not possible to unlock the full reduction potential, because the effects of waste policy measures on design, production and consumer behaviour are limited. Measures in additional policy areas are required in order to exploit the full potential to reduce waste. For instance, the product policy area needs to be addressed, specifically in terms of achieving waste prevention and waste reduction targets.
- Best practice examples of measures already implemented in the Member States (c.f. 5) provide detailed knowledge, and can potentially be transferred to other Member States or be scaled up at EU level.

In addition, Better Regulation Tool #19 "Identification/screening of impacts" was used to **initially assess the impacts of waste prevention measures** on each of the 6 waste streams. One key impact is the reduction of waste generation during the period 2018-2035 which is shown in the following Table 5-23, taking account of the identified viable measures for the different waste streams. The table presents two different views on the reduction potentials covering the reduction potential for a specific reference year 2035 (see left block) and the cumulative reduction potential for the timespan 2018-2035 (see right block).

## Table 5-23: Calculated reduction potentials

| Waste generation | 2035 | | | Cumulative 2018-2035 | | |
|---|---|---|---|---|---|---|
| | **BAU scenario (Tsd. Tonnes)** | **Reduction potential (Tsd. Tonnes)** | **Reduction potential[4] (relative)** | **BAU scenario (Tsd. Tonnes)** | **Reduction potential (Tsd. Tonnes)** | **Reduction potential[5] (relative)** |
| End-of-Life tyres | 3,540 | -1,697 | -47.9 | 58,592 | -15,275 | -26.1% |
| End-of-Life vehicles | 11,345 | -899 | -7.9% | 183,018 | -8,091 | -4.4% |
| Construction & demolition waste (mineral waste) | 375,628 | -14,833 | -3.9% | 6,109,179 | -166,891 | -2.7% |
| Textile waste | 3,216 | -410 | -12.7% | 48,473 | -3,858 | -8.0% |
| WEEE | 7,916 | -1,643 | -20.8% | 120,509 | -14,789 | -12.3% |
| Municipal solid waste[3] (excl. separate collected textiles and WEEE) | 220,336[1] | -4,689[2] | -2.1% | 3,888,138[1] | -33,893[2] | -0.9% |
| **Total** | **621,981** | **-24,172** | **-3.9%** | **10,407,909** | **-242,797** | **-2.3%** |

Notes:
"1" = The number excludes separate collected textiles and WEEE. The total MSW generation is 231,486 Tsd. tonnes.
"2" = The reduction potential considers only two measures, namely furniture waste and advertising mail reductions only.
"3" = noting that food and packaging waste are excluded by the scope of this study and no measures on those sub streams were assessed.
"4" = relative reduction in 2035 = comparing BAU scenario and reduction potential in 2035 (in absolute terms).
"5" = reduction potential = comparing BAU scenario and reduction potential for the total time span considered (2018-2035).

Based on the screening and initial assessment of the impacts, the following conclusion can be drawn:

- With respect to the proposed measures which affect six priority waste streams, the **cumulative reduction potential during the period 2018-2035 was projected to be 243 million tonnes**. This equates to about 2.3 % of the cumulative waste generation for the six waste streams during this period (10,408 million tonnes). It is noted that the estimated reduction potential needs to be interpreted as the minimum potential for two reasons. Firstly, the proposed measures are limited to the waste policy area at EU level. A wide range of barriers for reducing waste can only be addressed by additional policy areas and at national level without EU interventions. Secondly, data availability was a limiting factor for estimating the reduction potential of individual measures (e.g., reduction potential for soil). For these measures, it was suggested that soft instruments (e.g., guidelines instead of legal requirements) be used in order to take incremental steps towards reducing waste and increasing the current knowledge level on waste generation, waste composition and appropriate intervention points along the value chain.
- In addition to the impact on waste generation, **this study also considered the social and environmental impacts** of waste prevention measures. The initial assessment of impacts on the environment (e.g., emissions savings), employment (e.g., job creation) and the use of resources (raw material savings) indicates a wide range of positive effects which facilitate sustainable development. Nevertheless, a full impact assessment study is required to obtain a full picture of all the impacts.

# Appendices

# A.1 Appendix
# Analysis on the BAU scenario

# A.1.0 Analysis on the BAU scenario

## A.1.1 Establishment of the data base for problem definition

### A.1.1.1 Time series for waste generation (2004 – 2018)

The time series for waste generation (unit: tonnes and kg/capita) have been established for the period 2004 – 2018[515]. The times series allow for an identification of trends in waste generation in general, and for an identification of waste generation trends for each waste stream.

Most of the data used for establishing the time series for waste generation came from the statistical data on waste generation, as reported by Member States under the reporting obligation of the EU Waste Statistics Regulation[516]. The data used for the waste stream "municipal waste" came from the data reported under the specific Eurostat reporting requirements. Data are published on the Eurostat webpage[517].

The time series cover the total amount of waste generated in the EU. The waste stream categorisation system is in line with the waste categories of the EU Waste Statistics Regulation (waste categories as defined in Section 2 of the EU Waste Statistics regulation). Where in the EU Waste Statistics Regulation a waste category is split into "hazardous" and "non-hazardous", these two sub-categories have been aggregated for the purposes of this study to show the trend for the entire waste stream.

Trends in waste generation were established for 32 waste streams, which represents the entire waste generation of the EU-27. An overall time series for the aggregated total waste and 31 ESTAT waste streams was also developed. According to the reporting obligations, the waste streams are considered to be non-overlapping. The following table shows which types of waste are included in each of the waste streams:

[515] Data series back to 1995 are only available for municipal waste. To allow comparability between the waste streams, trends were analysed basically for 2004 to 2018, earlier data were only considered for casual analysis.
[516] REGULATION (EC) No 2150/2002 on waste statistics
[517] Statistics on waste generation, Municipal waste by waste management operations, EUROSTAT

## Figure A - 2 Waste streams for which trends in waste generation were established

| No. | Waste stream | Hazardousness (Hazardous and/or non-hazardous waste) |
|---|---|---|
| **0** | Total waste | hazardous and non-hazardous |
| **1** | Spent solvents | hazardous |
| **2** | Acid, alkaline or saline waste | hazardous and non-hazardous |
| **3** | Used oils | hazardous |
| **4** | Chemical waste | hazardous and non-hazardous |
| **5** | Industrial effluent sludges | hazardous and non-hazardous |
| **6** | Sludges and liquid waste from waste treatment | hazardous and non-hazardous |
| **7** | Health care and biological waste | hazardous and non-hazardous |
| **8** | Metallic waste[518] | non-hazardous |
| **9** | Glass waste | hazardous and non-hazardous |
| **10** | Paper and cardboard waste | non-hazardous |
| **11** | Rubber waste | non-hazardous |
| **12** | Plastic waste | non-hazardous |
| **13** | Wood waste | hazardous and non-hazardous |
| **14** | Textile waste | non-hazardous |
| **15** | Waste containing PCB | hazardous |
| **16** | Discarded equipment (excluding discarded vehicles, batteries and accumulators waste) | hazardous and non-hazardous |
| **17** | Discarded vehicles | hazardous and non-hazardous |
| **18** | Batteries and accumulators waste | hazardous and non-hazardous |
| **19** | Animal and mixed food waste | non-hazardous |
| **20** | Vegetal waste | non-hazardous |
| **21** | Animal faeces, urine and manure | non-hazardous |
| **22** | Household and similar waste | non-hazardous |
| **23** | Mixed and undifferentiated materials | hazardous and non-hazardous |
| **24** | Sorting residues | hazardous and non-hazardous |
| **25** | Common sludges | non-hazardous |
| **26** | Mineral waste from construction and demolition | hazardous and non-hazardous |
| **27** | Other mineral waste | hazardous and non-hazardous |
| **28** | Combustion waste | hazardous and non-hazardous |
| **29** | Soils | hazardous and non-hazardous |
| **30** | Dredging spoils | hazardous and non-hazardous |
| **31** | Mineral waste from waste treatment and stabilised waste | hazardous and non-hazardous |

[518] “Metallic waste” comprises the waste categories “metal waste, ferrous”, metal waste, non-ferrous” and “metal waste, mixed ferrous and non-ferrous”. The aggregation was necessary for establishing the trend back to 2004, because the more detailed waste categories were only introduced in the year 2010, by Commission Regulation (EU) No 849/2010 amending REGULATION (EC) No 2150/2002 on waste statistics.

In addition to waste volumes, the presence of hazardous waste[519] within the waste streams was analysed, based on the amounts of hazardous and non-hazardous waste reported by the Member States to Eurostat.

Time series were also established for waste generation split by economic activity (as defined under Section 8.1 of the Waste Statistics Regulation) related to each waste stream, providing time series for the four most relevant economic activities (with regard to waste generation of the waste stream). These time series distinguish between waste generated by the manufacturing sector ("industrial waste") and waste generated by the service sector ("commercial waste"), and they help to identify drivers of waste generation as well as the reasons for changes in waste generation trends. The analysis can be found in Appendix A.1.1.

#### A.1.1.2 Projections for waste generation until 2035

A step-by-step approach was followed for the projections of waste generation.

The first step was to apply a linear trend model for those waste streams that show correlations between the development of economic indicators and population growth in the past (2004-2018) followed by a second step to refine the linear projections.

The estimate for economic growth is that the economy will recover from the economic downturn caused by the Covid-19 crisis in the next few years, as also reflected by the Spring 2021 Economic Forecast by Eurostat[520]:

- "Historic drop in activity was recorded in the first part of 2020; another setback in late 2020 whereby the decline in activity in late 2020 was far milder than the downturn in the first half of 2020.";
- "The latest Commission survey results suggest that activity in the EU economy has already moved up a gear in recent months. The economic activity is set to accelerate in the third quarter 2021. Growth is then forecast to remain solid in the last quarter of 2021, bringing EU GDP back to its pre-crisis level earlier than previously projected";

[519] See the hazardous properties listed in Annex III of the EU Waste Framework Directive (2008/98/EC on waste), such as "HP1 explosive", "HP4 Irritant" or "HP7 Carcinogenic".
[520] https://ec.europa.eu/info/business-economy-euro/economic-performance-and-forecasts/economic-forecasts_en

- "The EU's public investment-to-GDP ratio is forecast to rise to almost 3.5% in 2022, up from 3% in 2019, and back to its highest value since 2010".

### Step one: Linear projections of waste generation for waste streams by linear trend modelling

The dataset for the time series analysis is the EUROSTAT dataset on waste generation by waste category[521]. The dataset was modified by a) identifying and removing outliers and b) by filling data gaps in reporting waste generation data of odd years by interpolation.

The waste generation data are available for the last 10/15 years and are used to forecast waste generation over a period of 15 years (2020-2035). The past waste generation is not only a relatively short time series to use in forecasts; the input data are also biased by flaws in waste reporting and are driven by phenomena such as the economic crisis in 2008 and different economic performances in EU Member States. Without taking all influencing factors into account, the prediction of waste generation assumes the perpetuation of past trends, which justifies the selection of a robust, linear trend model for forecasting waste generation. The Holt's linear trend method was selected, because it results in a linear trend without seasonal influences. The method involves a forecast equation basically combining two smoothing equations (one for the level and one for the trend)[522]:

$$\hat{y}_{\mathrm{t+h|t}} = \mathrm{l}_t + hb_t$$

Equation 1: Forecast equation

$$\mathrm{l_t} = \alpha \mathrm{y}_t + (1 - \alpha)\,(\mathrm{l_{t-1}} + \mathrm{b}_{t-1})$$

Equation 2: Level equation

$$\mathrm{b_t} = \beta\,(\mathrm{l_t} - \mathrm{l}_{t-1}) + (1 - \beta)\mathrm{b}_{t-1}$$

Equation 3: Trend equation

[521] Eurostat (2021). Dataset "Generation of waste by waste category, hazardousness and NACE Rev. 2 activity", retrieved from https://ec.europa.eu/eurostat/databrowser/view/env_wasgen/default/table?lang=en.

[522] Hyndman R, Athanasopoulos G (2021). Forecasting: Principles and Practice 2nd edition. Chapter 7.2. Trend methods, https://otexts.com/fpp2/holt.html

With $l_t$ being an estimate of the level at time t and $b_t$ the trend at time t. α is the smoothing parameter for the level (0≤β≤1), β is the smoothing parameter for the trend (0≤β≤1) and h denote the forecasted time steps ahead.

For the forecast, the result of the level equation gives the average between the observation $y_t$ and the forecast result one time step ahead. The trend $b_t$ at time point t is the weighted average between the level equation and its result one time point ahead ($l_t$-$l_{t-1}$) and the previous estimate of the trend ($b_{t-1}$). The forecast function in this model thus includes a level part ($l_t$), from where the forecast starts and a trend part linearly depending on h ($hb_t$), thus the name: linear trend method.

The Holt's forecasting model is implemented within the R package "forecast" and considers uncertainty ranges in time series forecasts[523]. In detail, waste categories with data records from 2004 onwards were forecasted with Holt's damped trend method [524] and waste categories with data records starting later than 2004 were forecasted with Holt's linear trend method[525].

The damped trend method has been shown to produce more accurate results than the classical linear trend, but has stricter data requirements. When applying Holt's method, the linear smoothing method is extended by an additional trend equation. In the damped trend method, a dampening parameter (typically between 0.8 and 0.98) is included which "dampens" the trend. This has been shown to increase model accuracy in general. Even if, as in the case of the rather short time series investigated here, the difference between the two methods is small, the model of the damped method seems more accurate.

The projections of waste generation up to 2035 (volumes in tonnes), as established by this model, are summarised for total waste generated in EU-27 in chapter 2.2.1.3 and provided for each waste stream in the Appendix.

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[523] Hyndman R, Athanasopoulos G, Bergmeir C, Caceres G, Chhay L, O'Hara-Wild M, Petropoulos F, Razbash S, Wang E, Yasmeen F (2021). forecast: Forecasting functions for time series and linear models. R package version 8.15, https://pkg.robjhyndman.com/forecast.

[524] Everette S. Gardner, Jr., Ed. Mckenzie, (1985) Forecasting Trends in Time Series. Management Science 31(10):1237-1246. https://doi.org/10.1287/mnsc.31.10.1237

[525] Charles C. Holt (2004) Forecasting seasonals and trends by exponentially weighted moving averages, International Journal of Forecasting, 20(1):5-10. https://doi.org/10.1016/j.ijforecast.2003.09.015

### Step two: Refined projections for selected waste streams

Policy measures addressed in the Green Deal and the Circular Economy Action Plan[526] were taken into account to identify waste streams where projected amounts needed to be refined. The new Circular Economy Action Plan focuses on certain product categories especially with a view to increase practices such as reuse, repair, refurbishment, product durability and new business models, which are intended to contribute to waste prevention. With this in mind, the following waste streams were selected for refined projections: municipal waste; waste from renewable energy infrastructure; textile waste; mineral waste from construction and demolition; batteries and accumulators waste; waste electrical and electronic equipment (WEEE); end-of-life vehicles (ELVs) & end-of-life tyres[527]. For those waste streams, the future trends of the linear trend model were manually re-calculated and additional indicators were addressed. The Green Deal and the Circular Economy Action Plan provide for several measures for which it is not yet possible to assess whether quantitative assumptions on their impact up to 2035 are correct or not. Related effects projected in connection with upcoming changes on the recycling targets or source separation were taken into account where possible (see calculations in the Appendix for the specific waste streams).

The following indicators were used to refine the linear projections and to estimate the amounts of waste expected to be generated in 2035:

- Trends in waste generation in the past, in total volumes generated (tonnes) and specific amounts of waste generated (kg/capita),
- Trends in European economic development covering past trends in the gross domestic product (GDP) at market prices (chain linked volumes) and related future trends up to 2035, as well as past trends in the turnover index for specific sectors (Eurostat Data Centre),
- European population trends in the past; including future trends up to 2035 (Eurostat Data Centre),
- Indicators (and their past and future trends) related to specific sectors and/or product/waste streams, such as the products placed on the market (units, tonnes), product lifetime (average number of years), installed energy capacity per type (GW) and stock in use (units) (Eurostat Data Centre and literature),

[526] EC (2020). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM(2020) 98 final.

[527] The Circular Economy Action Plan has identified topics for which additional measures (not yet included in the BAU scenario developed in this study) are envisaged, among them municipal waste; waste from renewable energy infrastructure; textile waste; mineral waste from construction and demolition; batteries and accumulators waste; WEEE; end-of-life vehicles (ELVs) & end-of-life tyres. Refined projections were made for those waste streams.

- Trends in increased source separation and recycling activities of specific waste streams due to obligations defined in EU waste legislation.

The refined waste generation projections for selected waste streams (volumes in million tonnes) up to 2035 and specific considerations for selected waste streams are included in the Appendix to this report.

#### A.1.1.3 Identification of decoupling effects

Pearson's correlation coefficient was used as a first measure of coupling to screen potential relationships and identify decoupling effects between waste generation and GDP development. The Pearson correlation coefficient is a parametric measure of linear relationship between two pairs of continuous variables[528]. It was applied to identify coupling and de-decoupling effects for the waste generation trends from GDP within the analysis presented in Appendix A.1.2.

### A.1.2 Detailed analysis of past and future trends of each Waste Stream

The Appendix provide the detailed analysis for the problem identification within the study, for all the 31 ESTAT waste streams plus "municipal waste" and "waste from renewable energy infrastructure"[529], with each section structured in the following manner:

- Composition of the waste stream
- Trends in waste generation and major sources
- Development of waste generation (kg/capita) compared to economic development and development of population in EU 27
- Projections

[528] https://libguides.library.kent.edu/SPSS/PearsonCorr, retrieved on 14.1.2022

[529] "Municipal waste" and "Waste from renewable energy infrastructure" were analysed in addition to the ESTAT waste streams as requested by the ToR. Those two waste streams comprise specific amounts of other analysed ESTAT waste streams.

### A.1.2.1 Household and similar waste

#### Composition of the waste stream

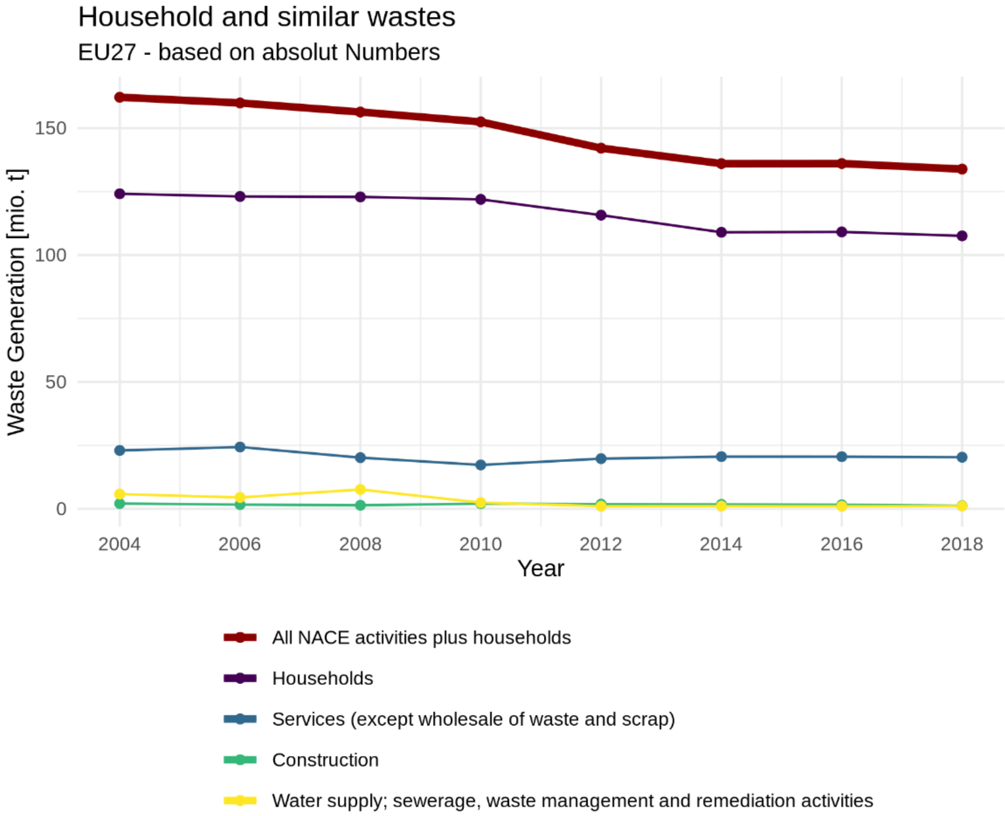
The waste stream "Household and similar waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of mixed municipal waste, bulky waste, street cleaning waste, kitchen waste, and household equipment.

It includes street-cleaning residues and waste from markets. It does not include separately collected waste fractions (like glass, paper, metal, plastic, electronic equipment, batteries and accumulators as well as biodegradable waste) or household and similar waste containing dangerous substances.

This waste stream includes only non-hazardous household waste.

#### Trends in waste generation and major sources

**Figure A - 3 Generation of household and similar waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of household and similar waste are displayed), 2004 – 2018**




*Source: Eurostat*

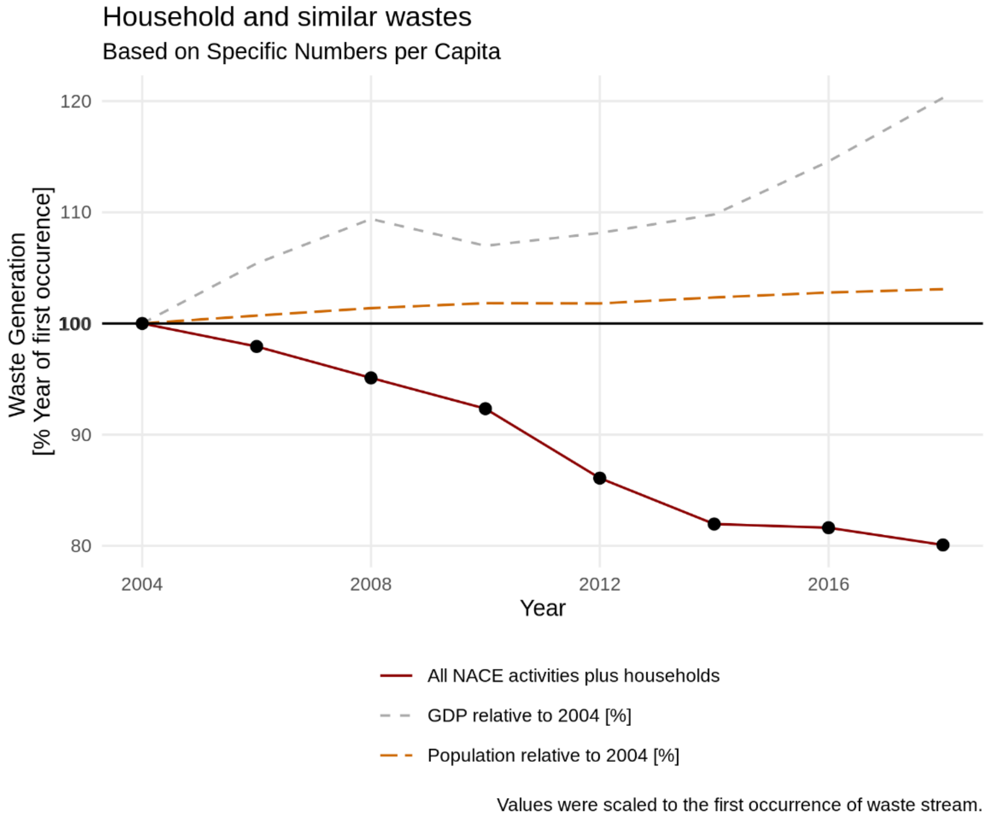
In the observation period 2004 – 2018, the generation of "Household and similar waste" indicates a decrease from 162.2 million tonnes in 2004 to 133.9 million tonnes in 2018 (-28.3 million tonnes). The strongest decrease occurred from 2010 to 2014 (- 16.5 million tonnes).

This trend is closely related to the trend of the major source for the generation of this waste stream the economic activity "Households". In 2018, 80 % of household and similar waste were generated within this economic activity. "Household and similar waste" comprises the mixed municipal waste. The decrease in the past decade is believed to be strongly related to source-separation established in the Member States on specific sub-fractions , such as plastics, metals, glass, paper and cardboard waste.

Other relevant sources are the economic activities "services (except wholesale of waste and scrap)", "construction", and "water supply; sewerage, waste management and remediation activities", together responsible for 17 % of the household and similar waste generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 4 Decoupling effects on household and similar waste generation in EU-27



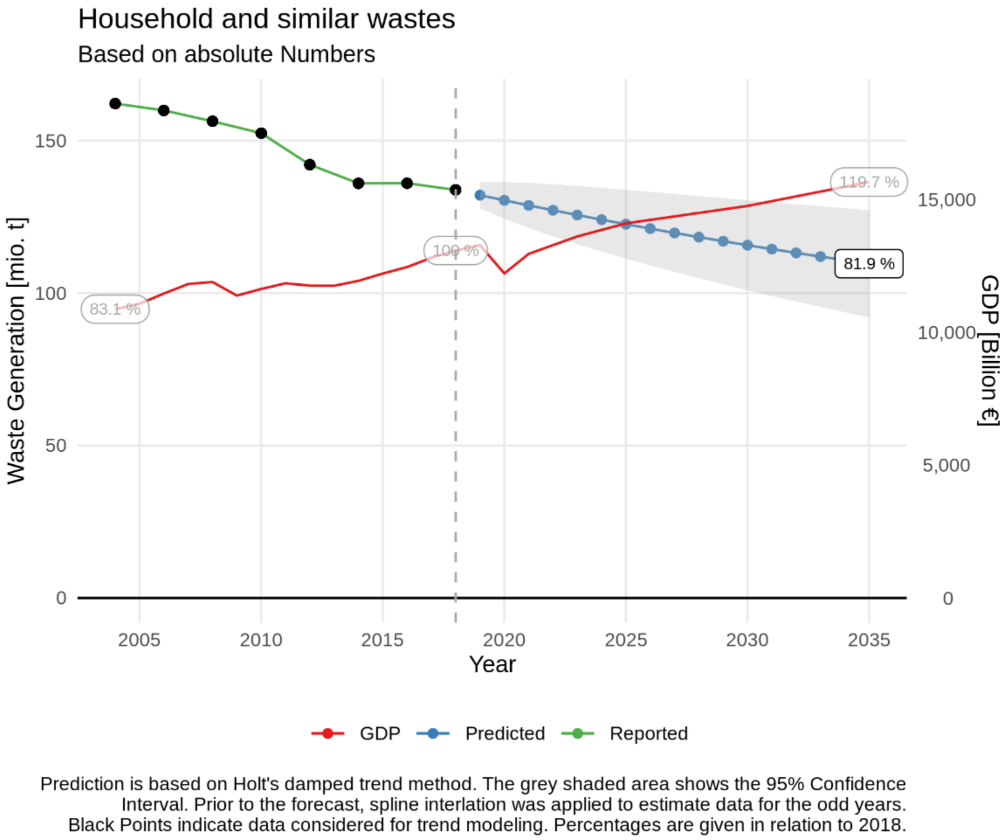

*Source: Eurostat*

In the period 2004 - 2018, the generation of household and similar waste (kg/per capita) decreased by -21.7 % (-1.55% annually over 14 years, calculated by linear regression), while an increase of GDP/capita occurred, indicating a very clear decoupling from the GDP trend.

The data do not show any significant effect of the economic crisis year 2008 on the trend of household and similar waste generation.

## Projections (by a linear trend model)

### Figure A - 5 Projections calculated by a linear trend model for household and similar waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "Household and similar waste" shows a clear decoupling from the GDP trend in the past period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -18.1% in 2035 compared to 2018, or on average -1.1% per year. As "household and similar waste" covers residual municipal solid waste, source-separated municipal waste sub-fractions , such as plastics, metals, glass, paper and cardboard, and textiles are expected to further increase in the period until

2035 due to stricter requirements defined in the EC waste legislation (cf. e.g. effects for metals in Appendix A.1.2.2, plastics in Appendix A.1.2.3).

The projected increase of EU-27 GDP is 19.7% compared to 2018, respectively 1.1% per year on average.

### A.1.2.2 Metallic waste

#### Composition of the waste stream

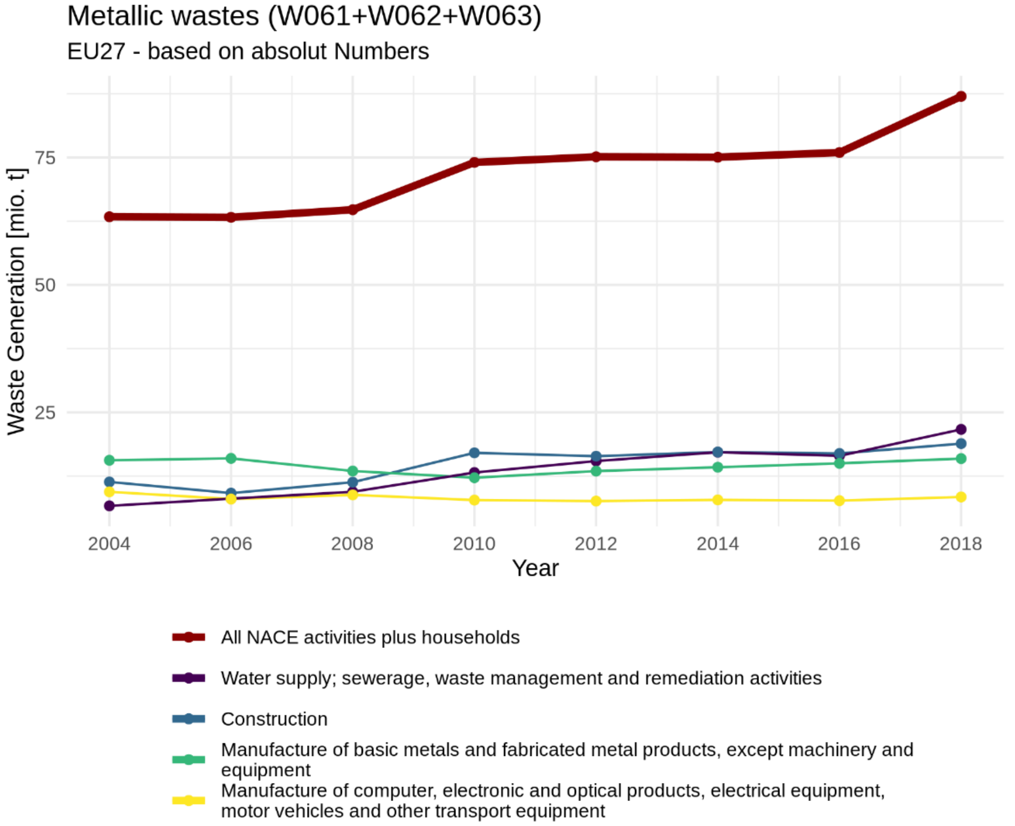
The waste stream "Metallic waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) includes ferrous metals (like iron, steel) and alloys, non-ferrous metals (like aluminium, copper, zinc, lead, tin) and alloys as well as mixtures of ferrous and non-ferrous metals (like iron, steel, aluminium, copper, zinc, lead, tin) and alloys.

It includes mill scales and cables without dangerous substances. It does not include metal compounds and oxides, grinding, honing and lapping sludge containing oil, metallic packaging containing a dangerous solid porous matrix (e.g. asbestos) including empty pressure containers, batteries, end-of-life vehicles, spent catalysts, mercury containing waste, cables containing oil, coal tar and other dangerous substances or waste containing silver from photographic processes.

The waste stream "metallic waste" is entirely composed of non-hazardous waste types.

## Trends in waste generation and major sources

### Figure A - 6 Generation of metallic waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of metallic waste are displayed), 2004 – 2018




*Source: Eurostat*

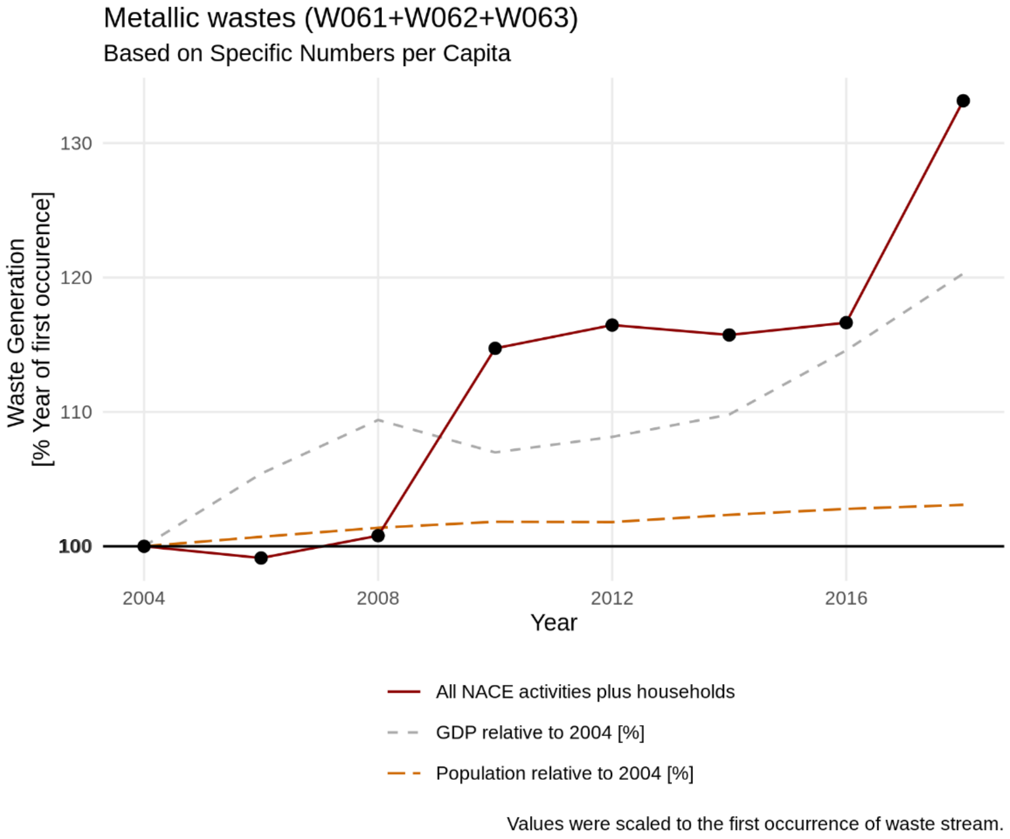
In the observation period 2004 – 2018, the generation of "Metallic waste" shows an increase from 63.4 million tonnes in 2004 to 87.0 million tonnes in 2018, with the strongest increases occurring between 2008 and 2010 (+ 9.3 million tonnes) as well as 2016 and 2018 (+ 11.0 million tonnes).

Major source for generation of metallic waste is the economic activity "Water supply; sewerage, waste management and remediation activities", where in 2018, 25 % of the metallic waste were generated.

Other relevant sources are the economic activities "Construction", "Manufacture of basic metals and fabricated metal products, except machinery and equipment" and "Manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment", together responsible for 50 % of metallic waste were generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 7 Decoupling effects on metallic waste generation in EU-27



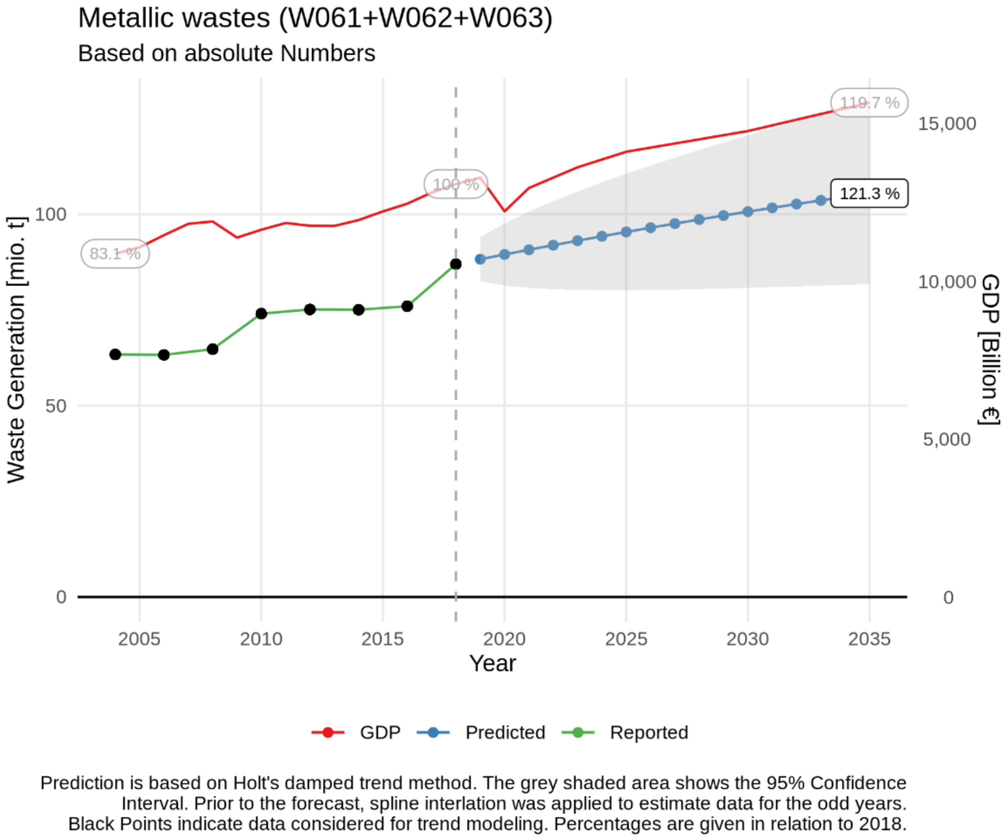

*Source: Eurostat*

In the period 2004 - 2018, the generation of metallic waste (kg/per capita) increased by roughly 27.3% (1.95% annually over 14 years, calculated by linear regression), while also GDP/capita increased slightly. This shows no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of metallic waste generation.

## Projections (by a linear trend model)

### Figure A - 8 Projections calculated by a linear trend model for metallic waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "Metallic waste" shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 21.3% compared to 2018, respectively 1.3% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.3 Plastic waste

### Composition of the waste stream

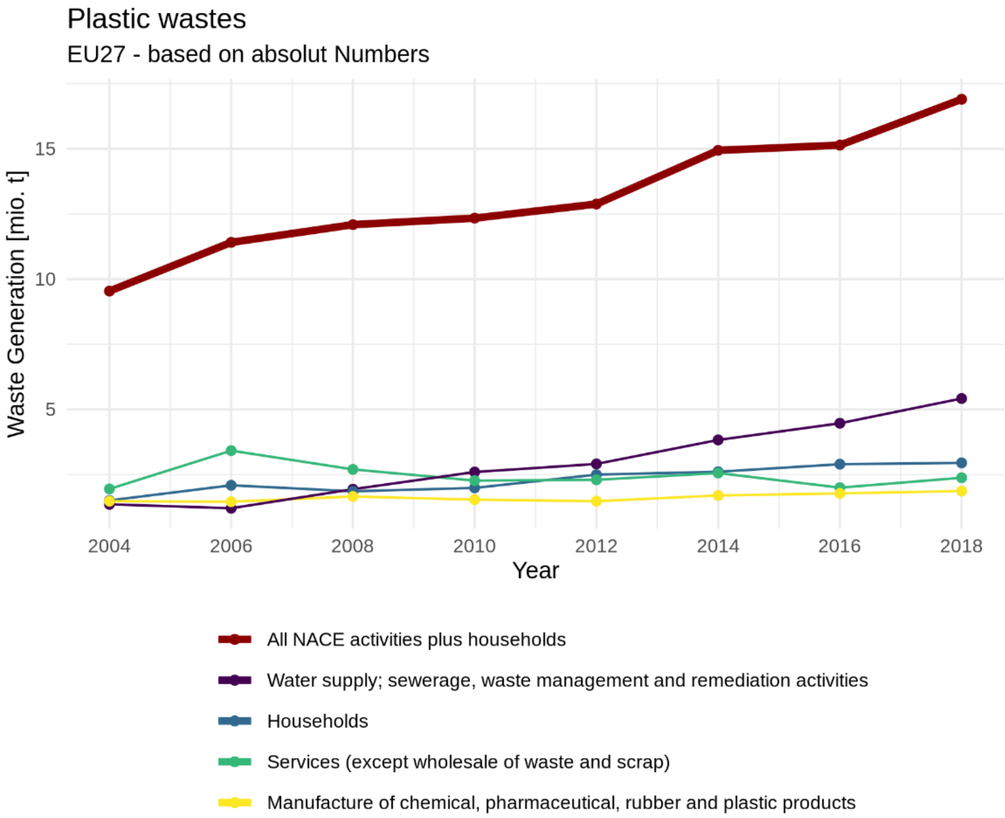
The waste stream "Plastic waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of plastic packaging, plastic waste from plastic production and processing as well as plastic waste from sorting and separation processes and separately collected plastic waste.

It includes plastic waste from agriculture, horticulture, aquaculture, forestry, hunting and fishing as well as from dismantling of end-of-life vehicles. It does not include mixed plastic waste, insulation materials from construction and demolition, contaminated plastic waste, textile waste containing synthetic fibres or a fluff-light fraction.

Plastic waste are non-hazardous.

## Trends in waste generation and major sources

### Figure A - 9 Generation of plastic waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of plastic waste are displayed), 2004 - 2018




*Source: Eurostat*

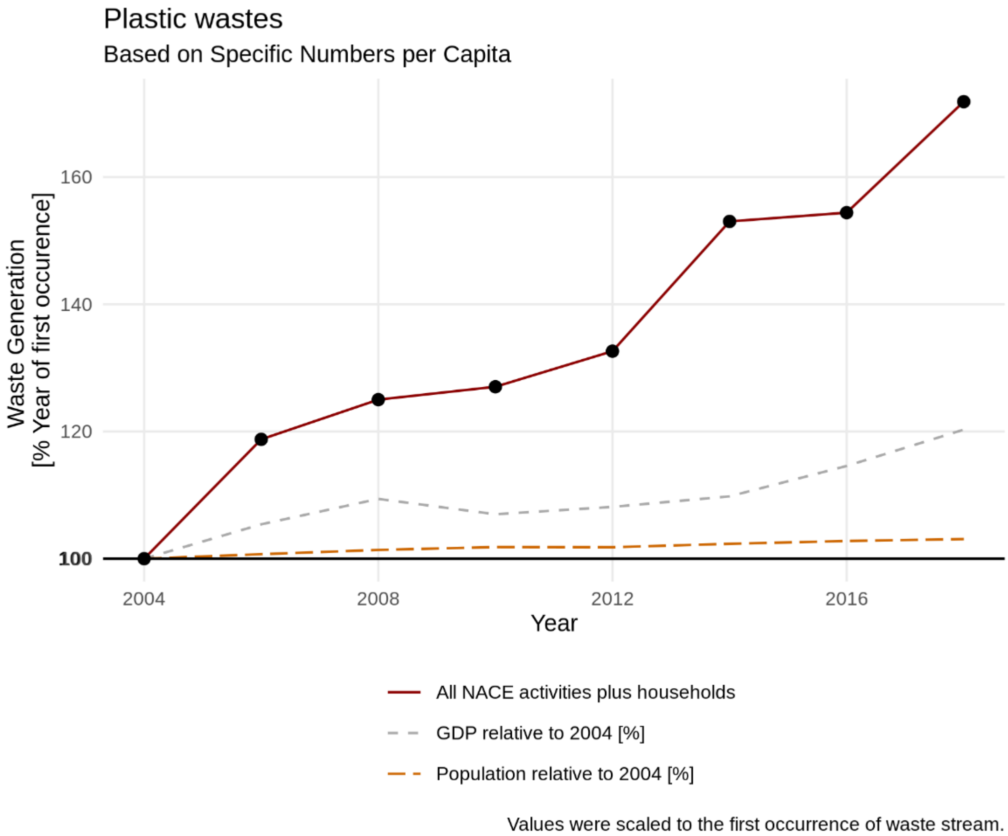
In the observation period 2004 – 2018, the generation of “Plastic waste” shows a continuous increase from 9.5 million tonnes in 2004 to 16.9 million tonnes in 2018 (+ 7.4 million tonnes), being more intensive from 2004 to 2006 (+ 1.9 million tonnes), 2012 to 2014 (+ 2.1 million tonnes) and 2016 to 2018 (+ 1.8 million tonnes).

Major source for generation of plastic waste is the economic activity “Water supply; sewerage, waste management and remediation activities” where in 2018, 32 % of the plastic waste were generated. This economic activity indicates a continuous increase since 2006.

Other relevant sources are the economic activities “Households”, “Services (except wholesale of waste and scrap)” and “Manufacturing of chemical, pharmaceutical, rubber and plastic products" together responsible for 43 % of plastic waste were generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 10 Decoupling effects on plastic waste generation in EU-27



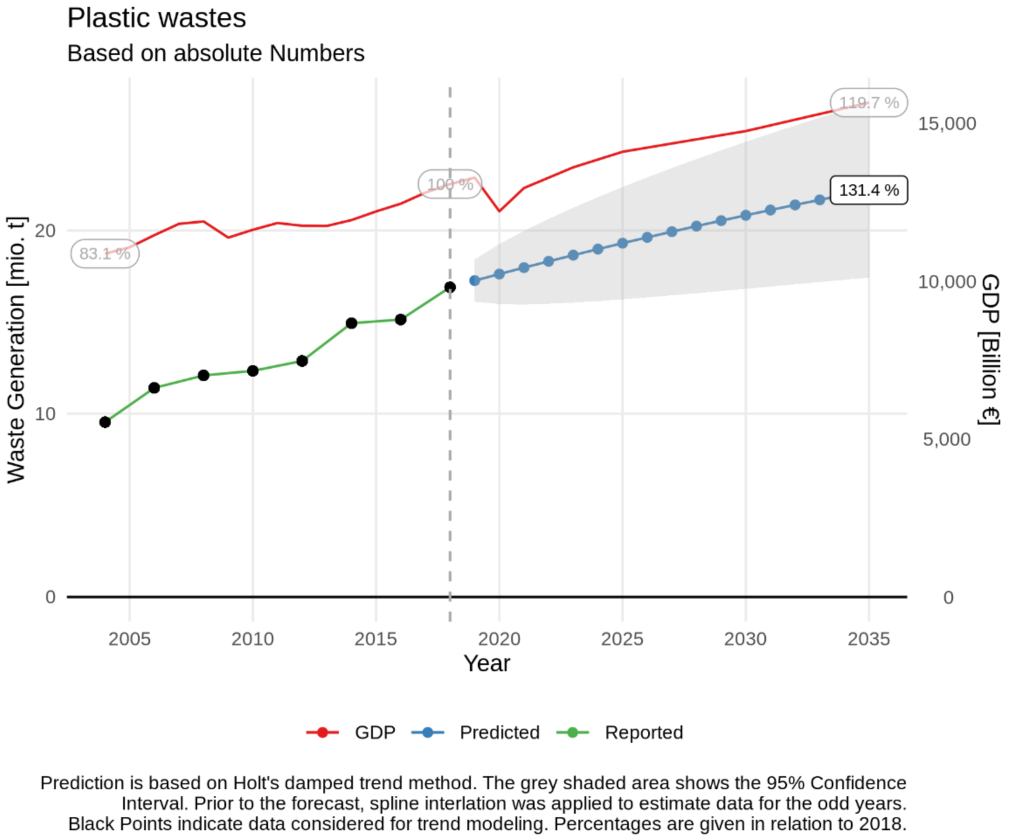

*Source: Eurostat*

In the period 2004 - 2018, the generation of plastic waste (kg/per capita) increased strongly by about 67.5%, (4.82% yearly over 14 years, calculated by linear regression), while GDP/capita also increased slightly. This indicates no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of plastic waste.

### Projections (by a linear trend model)

### Figure A - 11 Projections calculated by a linear trend model for plastic waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category “Plastic waste” indicates no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 31.4% compared to 2018, respectively 1.8% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.4 Glass waste

### Composition of the waste stream

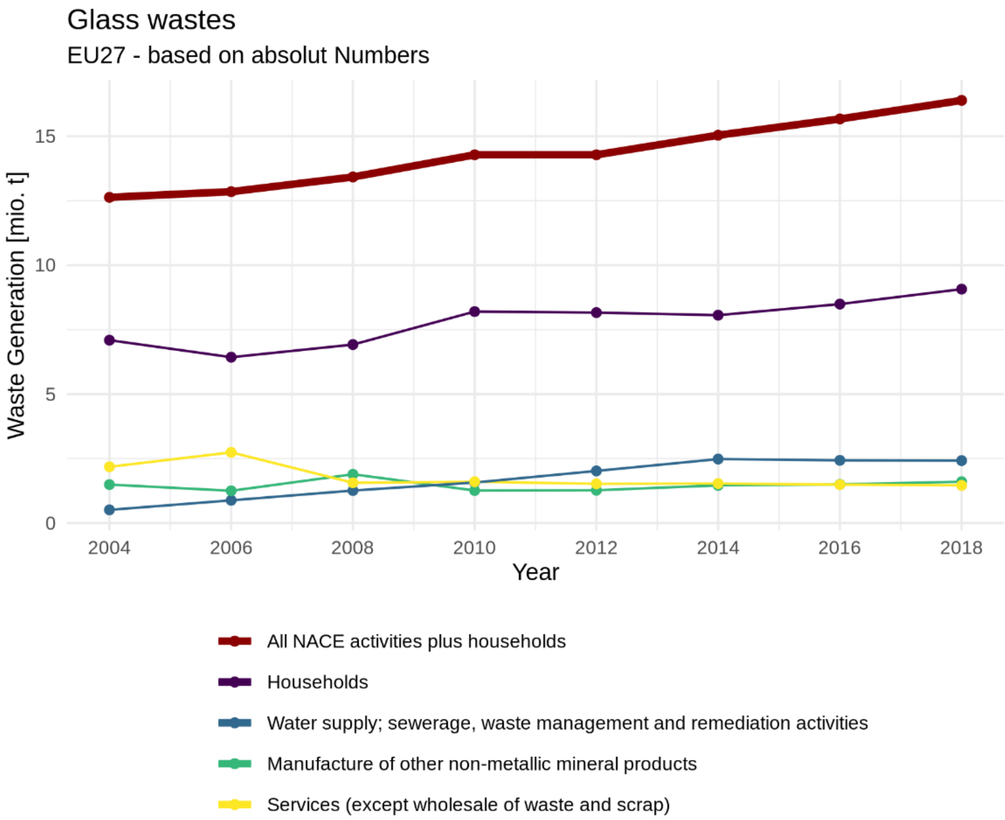
The waste stream “Glass waste” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) comprises waste glass packaging, glass waste from production of glass and glass products as well as waste glass from sorting and recycling processes.

It includes glass powder and fine particles from production of glass and glass products. It does not include mixed glass waste from construction and demolition, glass-based fibrous materials or glass-polishing and grinding sludges.

Glass waste is hazardous in case of glass powder (particle size relevant) and when containing heavy metals.

## Trends in waste generation and major sources

### Figure A - 12 Generation of glass waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of glass waste are displayed), 2004 - 2018




*Source: Eurostat*

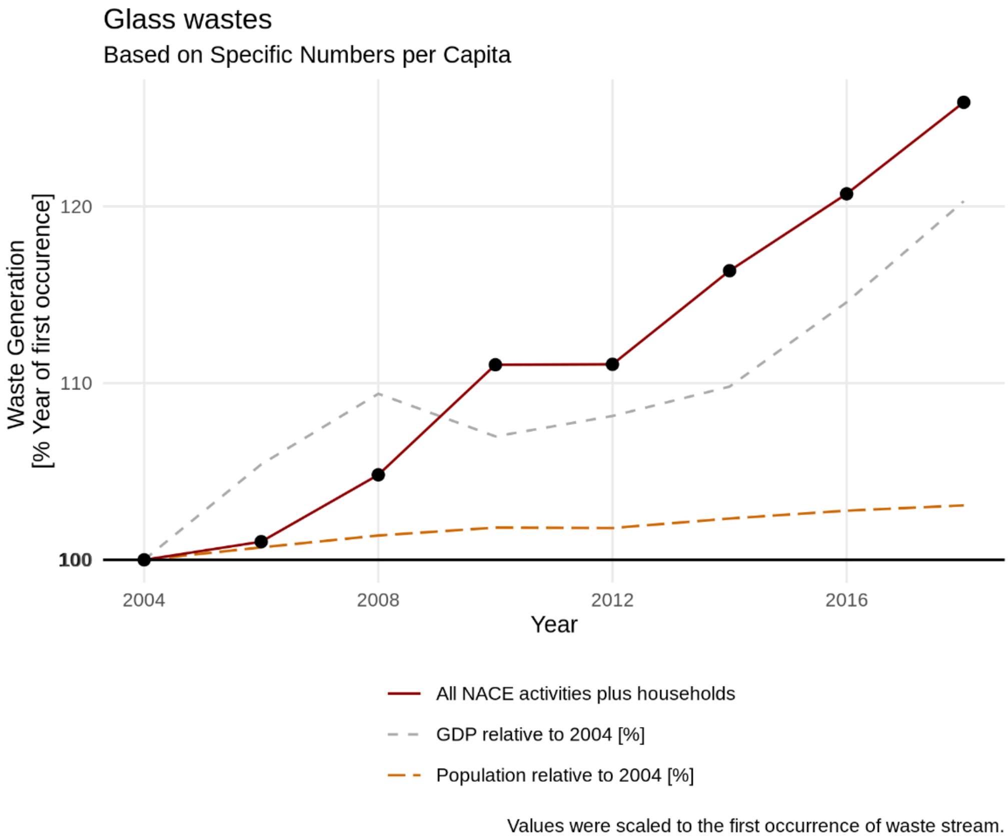
In the observation period 2004 – 2018, the generation of “Glass waste” shows an almost continuously increase from 12.6 million tonnes in 2004 to 16.4 million tonnes in 2018.

Major source for generation of glass waste is the economic activity “Households” where in 2018, 55 % of the glass waste were generated.

Other relevant sources are the economic activities “Water supply; sewerage, waste management and remediation activities”, “Manufacture of other non-metallic mineral products” and “Services (except wholesale of waste and scrap)”, together responsible for 33 % of glass waste were generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 13 Decoupling effects on glass waste generation in EU-27



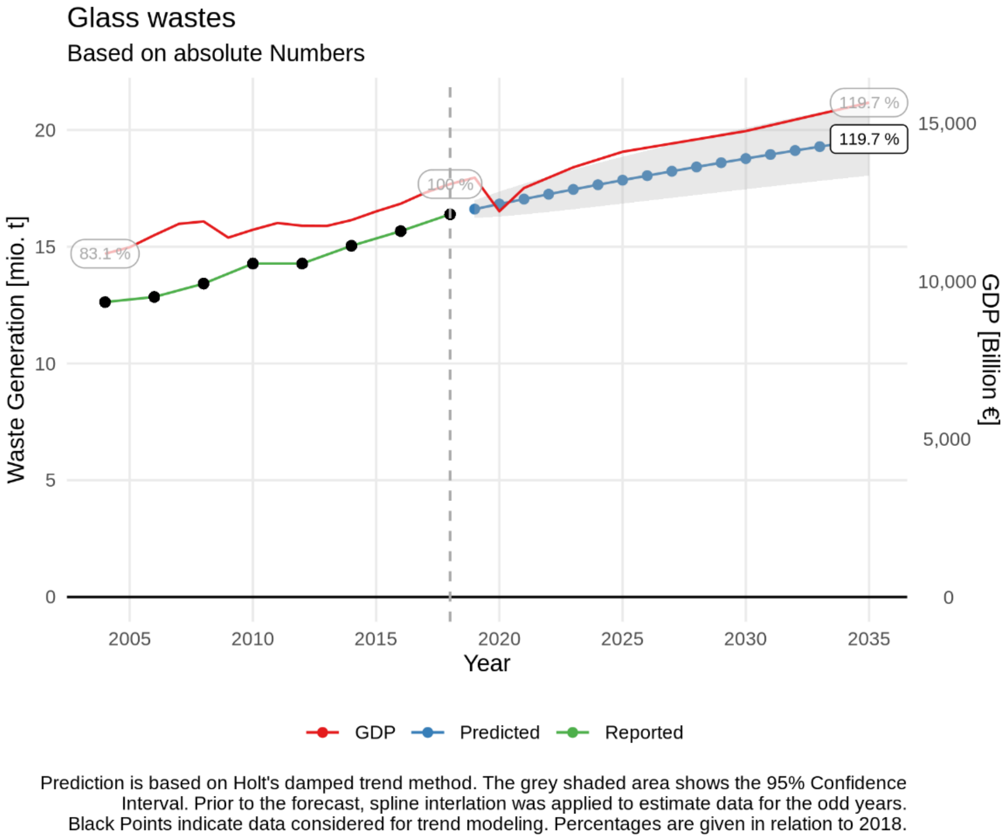

*Source: Eurostat*

In the period 2004 - 2018, the generation of glass waste (kg/per capita) increased by about 24.5% (1.75% annually over 14 years, calculated by linear regression), while GDP/capita also increased slightly. This indicates no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of glass waste.

## Projections (by a linear trend model)

### Figure A - 14 Projections calculated by a linear trend model for glass waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category “Glass waste” shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 19.7% compared to 2018, respectively 1.2% per year on average.

The projected increase of EU-27 GDP is 19.7% compared to 2018, respectively 1.1% per year on average.

### A.1.2.5 Paper and cardboard waste

### Composition of the waste stream

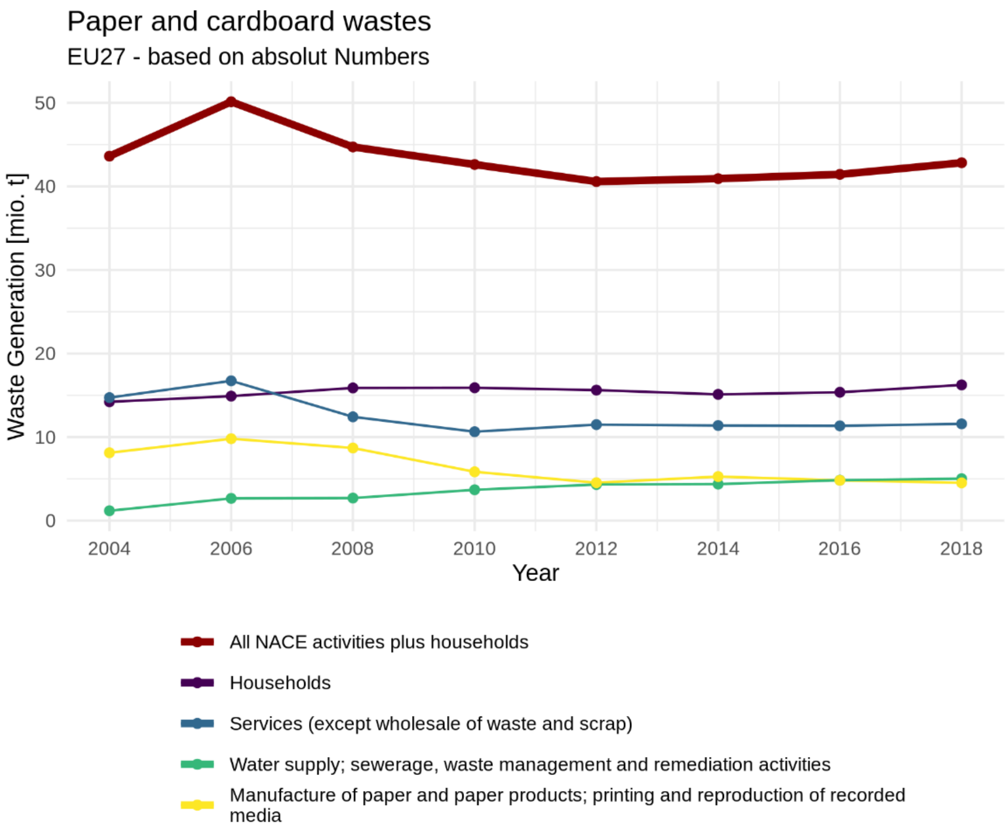
The waste stream “Paper and cardboard waste” (as defined in Section2 – Waste Categories of the EU Waste Statistics Regulation) comprises paper and cardboard waste from sorting and separate collection.

It does not include mechanically separated rejects from pulping of waste paper and cardboard, waste from sorting of paper and cardboard destined for recycling, or fibre, filler and coating sludges from pulp, paper and cardboard production.

Paper and cardboard waste is non-hazardous.

## Trends in waste generation and major sources

### Figure A - 15 Generation of paper and cardboard waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of paper and cardboard waste are displayed), 2004 - 2018




*Source: Eurostat*

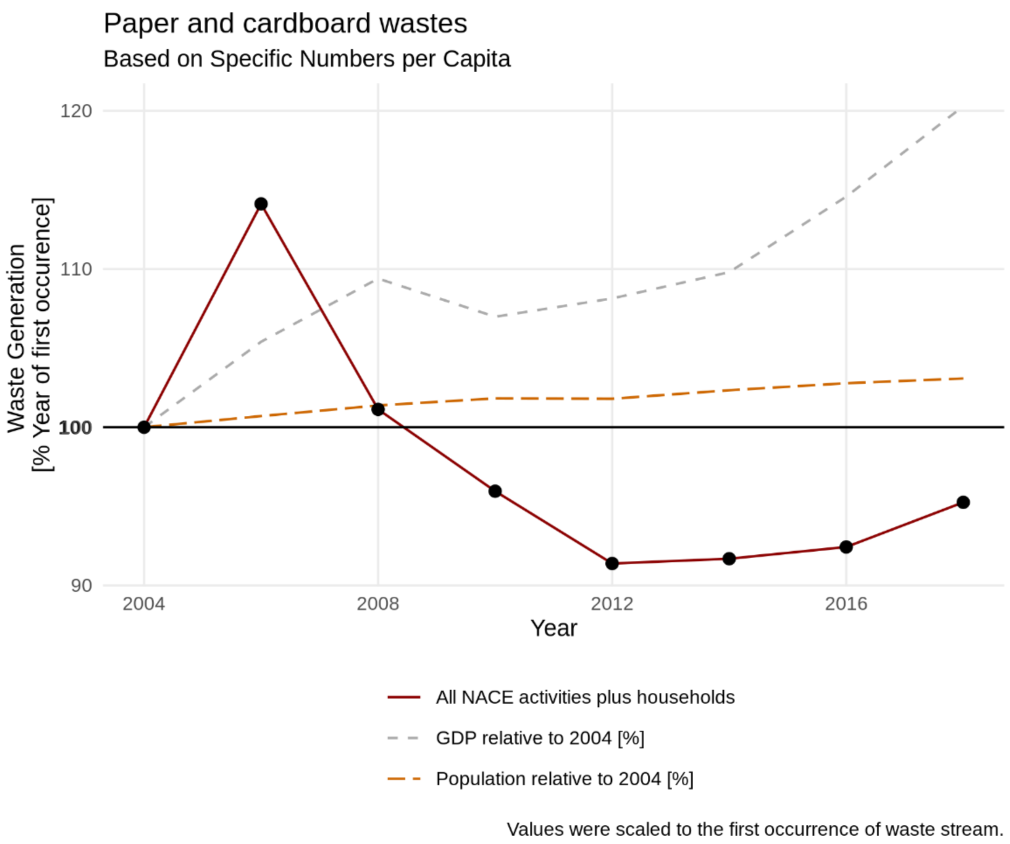
In the observation period 2004 – 2018, the generation of “Paper and cardboard waste” indicates a slight decrease from 43.6 million tonnes in 2004 to 42.8 million tonnes in 2018. A peak is observed in 2006of about 6.5 million tonnes higher than the waste generation in 2004. Several Member States reported data in 2006 higher than in 2004 and 2008.

Major source for generation of paper and cardboard waste is the economic activity “Households”. In 2018, 38 % of paper and cardboard waste were generated by this economic activity.

Other relevant sources are the economic activities “Services (except wholesale of waste and scrap)”, “Water supply; sewerage, waste management and remediation activities”, and “Manufacture of paper and paper products; printing and reproduction of recorded media", together responsible for 49 % of paper and cardboard waste were generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 16 Decoupling effects on paper and cardboard waste generation in EU-27



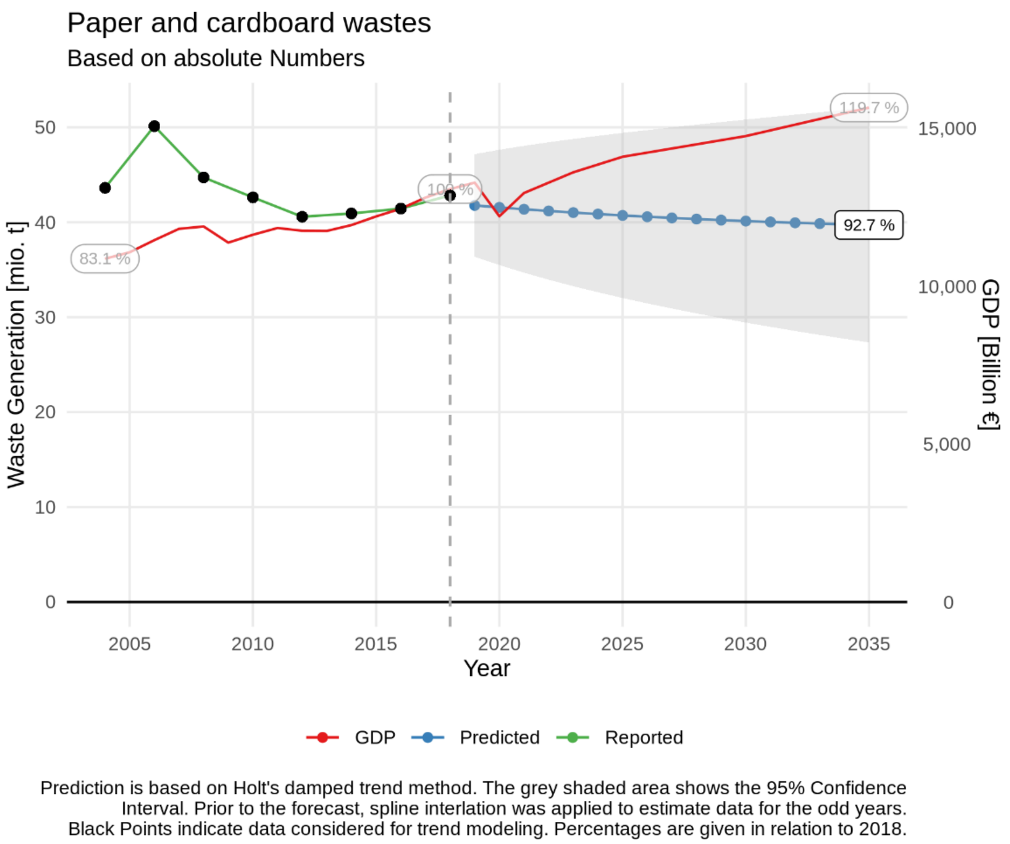

*Source: Eurostat*

In the period 2004 - 2018, the generation of paper and cardboard waste (kg/per capita) decreased slightly by about -9.5 % (-0.68% annually over 14 years, calculated by linear regression), while an increase of GDP/capita occurred, showing an absolute decoupling from the GDP trend.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of paper and cardboard waste.

## Projections (by a linear trend model)

### Figure A - 17 Projections calculated by a linear trend model for paper and cardboard waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "Paper and cardboard waste" shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -7.3% in 2035 compared to 2018, respectively -0.4% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.6 Wood waste

### Composition of the waste stream

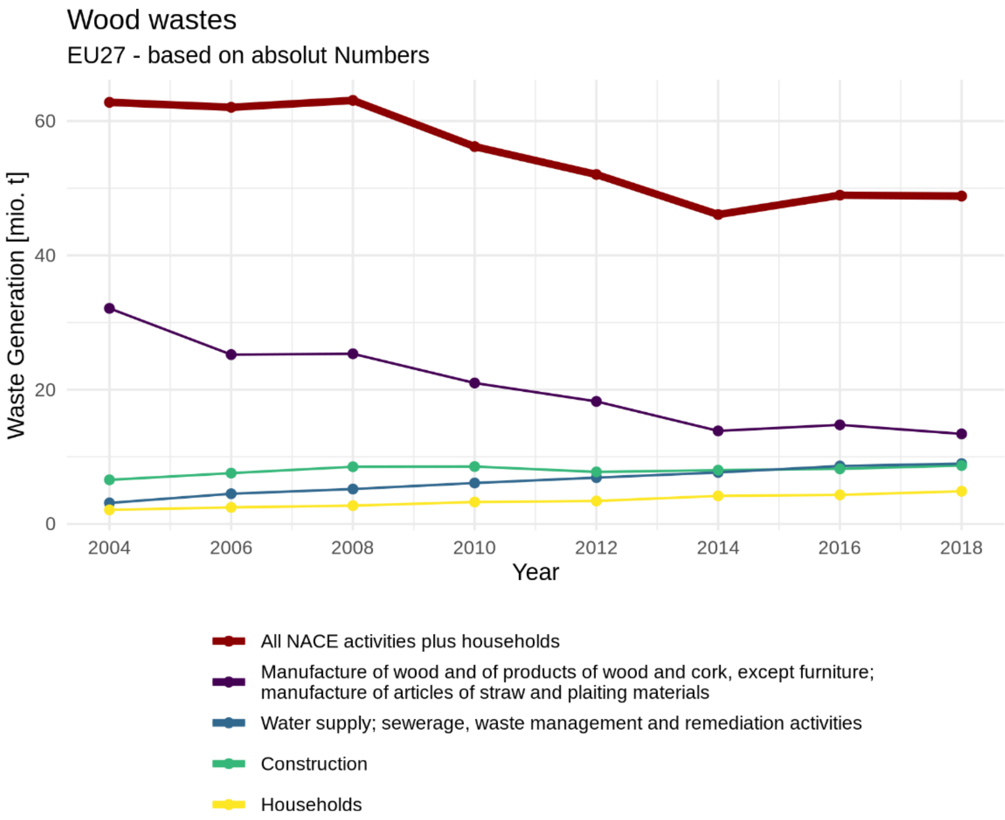
The waste stream "Wood waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of wooden packaging, sawdust, shavings, cuttings, waste bark, cork and wood from production of pulp and paper, wood from construction and demolition of buildings and separately collected wood waste.

It does not include mixed waste containing wood or PCB containing wood.

Wood waste is hazardous waste when containing hazardous substances, like Hg or tar-based wood preservatives. In 2018, only 4 % of the amount of wood waste generated by the EU-27 were hazardous waste.

### Trends in waste generation and major sources

### Figure A - 18 Generation of wood waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of wood waste are displayed), 2004 - 2018




*Source: Eurostat*

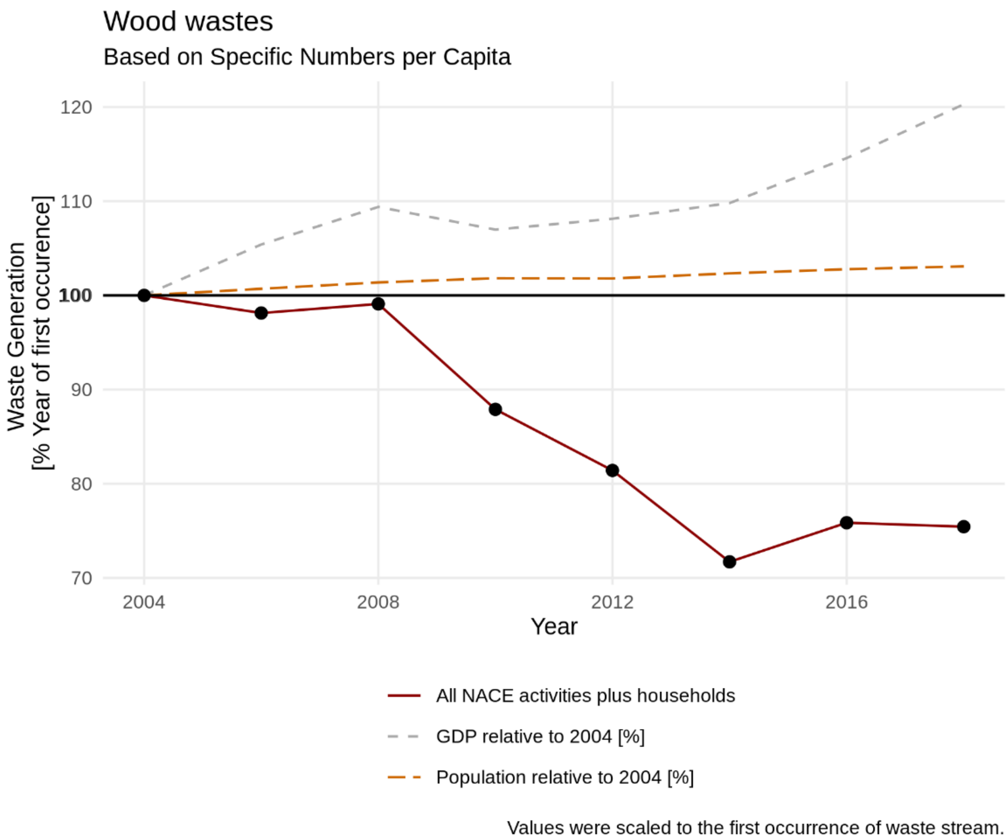
In the observation period 2004 – 2018, the generation of "Wood waste" shows a decrease from 63.0 million tonnes in 2004 to 48.8 million tonnes in 2018 (- 14 million tonnes), with the strongest decrease in 2008 – 2014 (- 17 million tonnes).

This trend is closely related to the trend of the major source for generation of wood waste, which is the economic activity "Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials". In 2018, 27 % of the wood waste were generated by this economic activity.

Other relevant sources are the economic activities "Water supply; sewerage, waste management and remediation activities", "Construction" and "Households", together responsible for 46 % of wood waste were generated in 2018. All three economic activities indicate a slight increase of wood waste generation in the period 2004 – 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 19 Decoupling effects on wood waste generation in EU-27



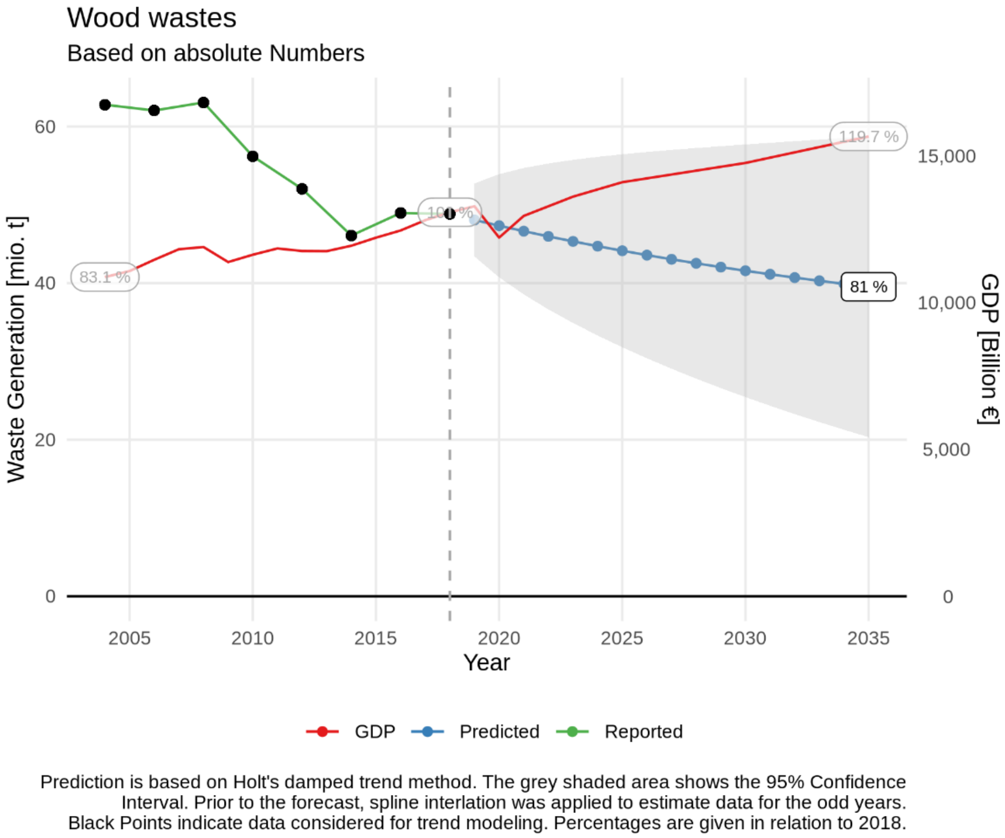

*Source: Eurostat*

In the period 2004 - 2018, the generation of wood waste (kg/per capita) decreased by -29.3 % (-2.09% annually over 14 years, calculated by linear regression), while an increase of GDP/capita occurred, indicating an absolute decoupling from the GDP trend.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of wood waste.

### Projections (by a linear trend model)

### Figure A - 20 Projections calculated by a linear trend model for wood waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "wood waste" shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -19.0% in 2035 compared to 2018, respectively -1.1% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.7 Textile waste

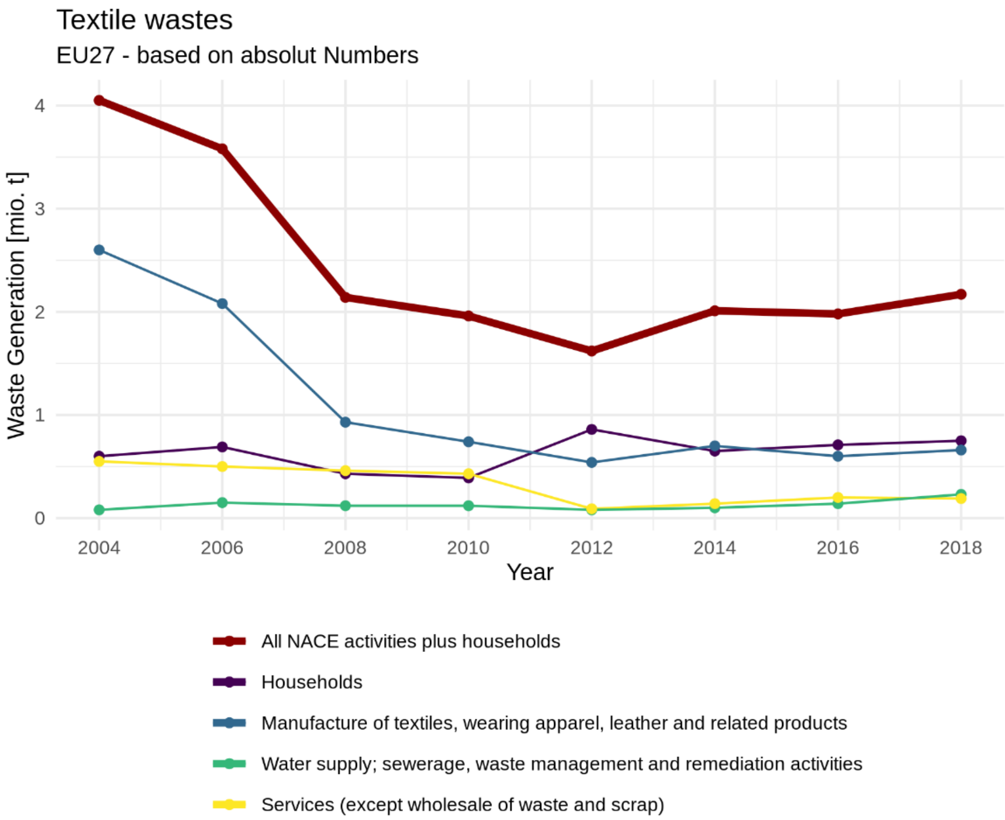
### Composition of the waste stream

The waste stream "Textile waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of textile packaging, cast-off clothes and textiles, fibre preparation and processing waste, leather waste and waste tanned leather. It further includes separately collected textile and leather waste but it does not include leather and textile waste within mixed waste streams.

The waste stream “Textile waste” is entirely composed of non-hazardous waste types.

## Trends in waste generation and major sources

### Figure A - 21 Generation of Textile waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of textile waste are displayed), 2004 - 2018




*Source: Eurostat*

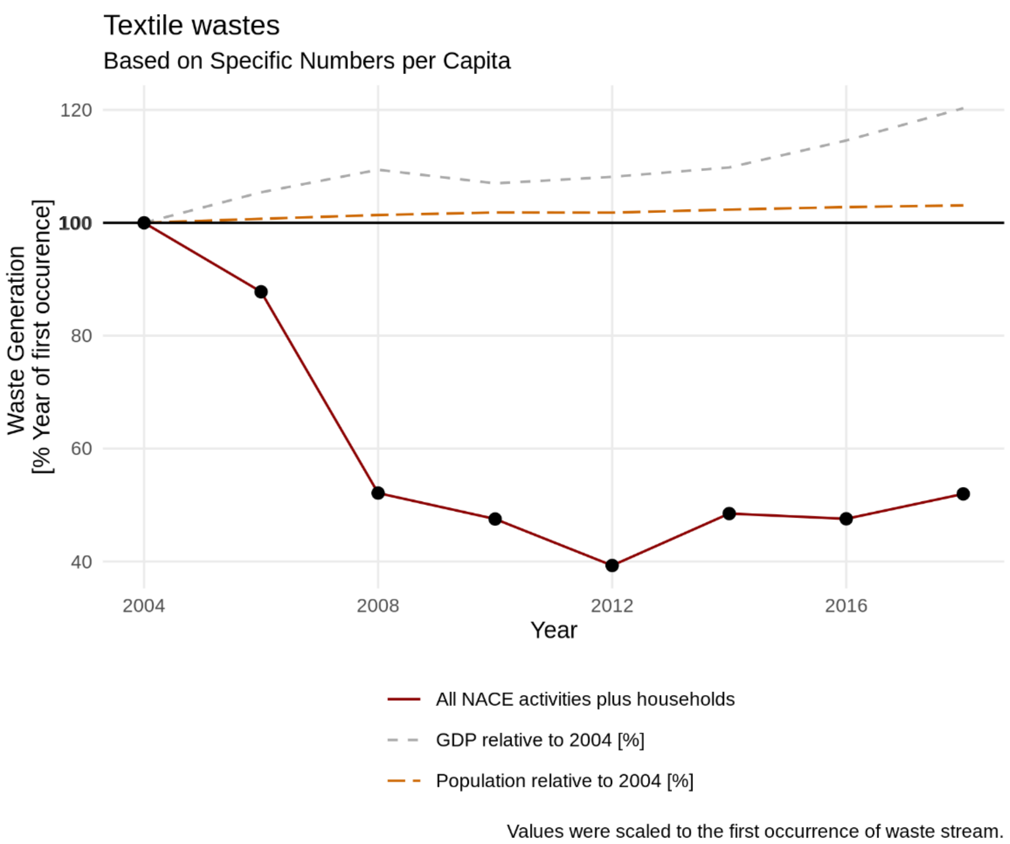
The overall generation of „Textile waste” shows a decrease from 4.1 million tonnes in 2004 to 2.2 million tonnes in 2018 (- 1.9 million tonnes), with the most significant decrease occurring in the period 2006 – 2008 (- 1.4 million tonnes), partly induced by a strong waste generation decrease reported by Belgium, Portugal and Italy within the economic activity “Manufacture of textiles, wearing apparel, leather and related products”, which may be indicative of textiles manufacture moving outside the EU.

In the recent years this trend is closely related to the trend of the second most relevant source of generation of textile waste, being the economic activity “Manufacture of textiles, wearing apparel, leather and related products”. This activity, together with the major source “Households”, generate 65 % of the textile waste in 2018. An increase can be observed in “Households”, most likely thanks to efforts towards enhancing separate collection and sorting of textile waste. Further, a peak in 2012 is observed within this economic activity (+ 0.5 million tonnes), induced by extraordinarily intensive waste generation reported by France within this economic activity and year.

Other relevant sources are the economic activities “Water supply; sewerage, waste management and remediation activities”, and “Services (except wholesale of waste and scrap)”, together responsible for 19 % of textile waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

#### Figure A 22 Decoupling effects on textile waste generation in EU-27 2004 - 2018



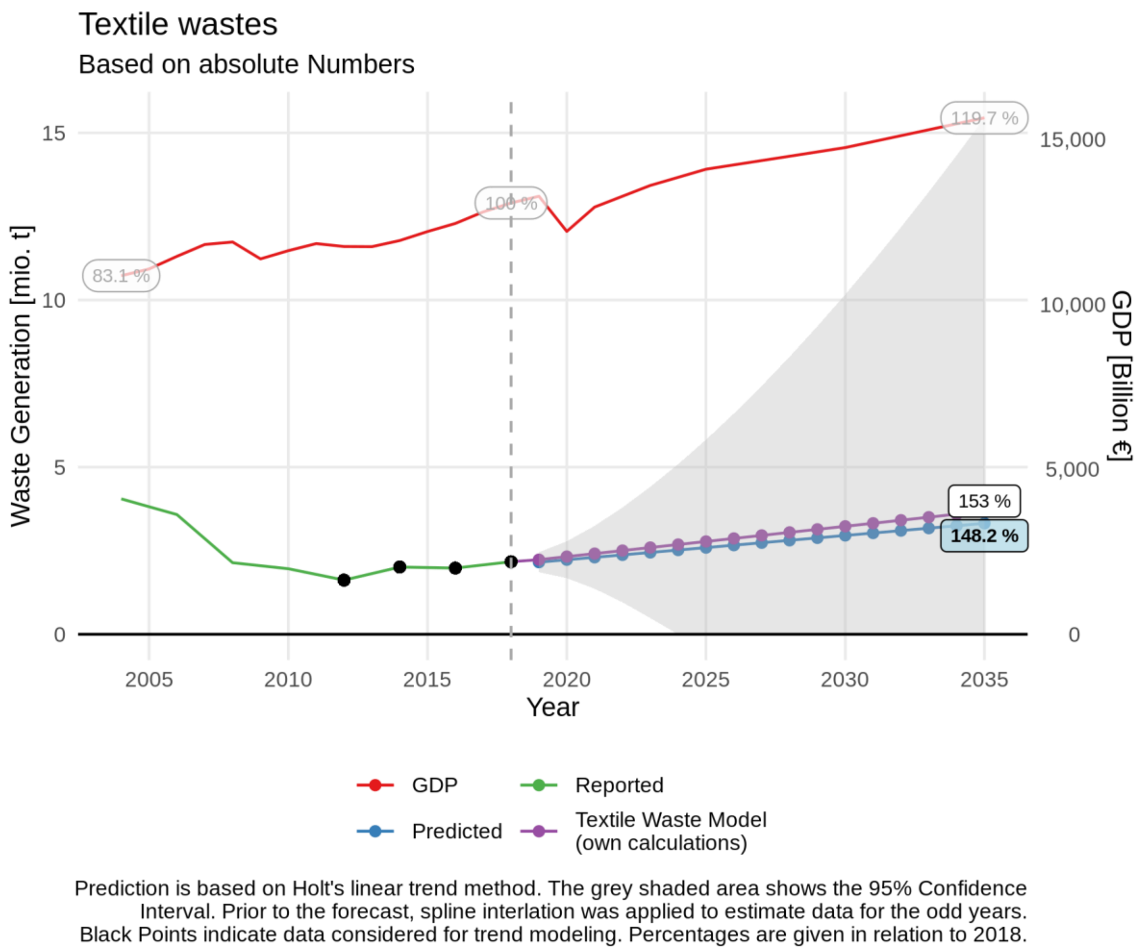

*Source: Eurostat*

In the period 2004 - 2018, the generation of textiles waste (kg/per capita) decreased by -63.8% (-4.56% annually over 14 years, calculated by linear regression), while an increase of GDP/capita occurred, indicating an absolute decoupling from the GDP trend. The significant overall decrease relates to a decrease in the manufacturing sector in the period from 2004 to 2012. Considering the period 2012 to 2018 only, an increase is indicated due to increasing amounts generated by the household sector.

2008 as the economic crisis year accelerated the decrease in the generation of textile waste observed since 2004. This was compensated in 2012 – 2014 by an increase more intensive than growth of GDP/capita and population.

## Projections (by a linear trend model, refined by Umweltbundesamt)

### Figure A - 23 Projections calculated by a linear trend model and refined projection for textile waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model results in an increase of the "textile waste" generation by 53% compared to 2018, respectively 3.1% per year on average. For those calculations, reported data from 2004 to 2010 were not considered for the projections, as those show a strong decrease in the manufacturing sector.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

The predictions derived from the linear trend model indicate that the waste generation of "textile waste" will increase more intensively than EU-27 GDP.

In refining the projections, the following was taken into account:

The average of EU-27 amounts to 4.8 kg/cap. The amount of textile waste generated per capita in 2018 ranges between 0.1 kg/cap in Latvia and 17.5 kg/cap in Belgium. For 2018, other countries with more than 10 kg/cap are the Czech Republic, Luxembourg and Portugal. 20 countries show specific values below the EU-27 average, e.g. Sweden and Greece with values of roughly 1 kg/cap.

According to the Ellen MacArthur Foundation (2017)[530], clothing production worldwide has approximately doubled between 2000 and 2015, driven by a growing middle-class population across the globe and increased per capita sales in mature economies. The latter rise is mainly due to the 'fast fashion' phenomenon, with quicker turnaround of new styles, increased number of collections offered per year, and – often – lower prices. However, the market development differs worldwide. According to the Global Fashion Agenda (2019)[531], the apparel and footwear industry grew between 4 to 5 % in the last two years. Projections through 2023 show annual growth of approximately 5%, largely driven by increasing demand in Asia-Pacific and developing countries.

Regarding sales of textiles and clothing in the EU-27, the index of the deflated turnover for „Retail sales of textiles, clothing, footwear and leather goods in specialized stores"[532] increased by on average 0.6 % annually between 2011 and 2018. This index varies among Member States. Nine countries show, on average, a low annual decrease, and 12 MS an increase (highest in Poland with 16% annually). Six Member States did not report data.

According to Research and Markets (2021)[533] it is expected that the apparel manufacturing market will recover from Covid-19, as the reason for the crisis is not fundamental weakness in the market or the global economy. Data from Eurostat (2021)[534] indicate a decrease of about 25% for "retail trade volume of textile, clothes, footwear" for 2020, compared to 2019. This sharp drop is not taken into account for the projection of future textile waste generation, as a quick recovery of the market is assumed.

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530 Ellen MacArthur Foundation (2017) A new textiles economy: Redesigning fashion's future, http://www.ellenmacarthurfoundation.org/publications

531 Global Fashion Agenda (2019), Boston Consulting Group, and Sustainable Apparel Coalition: Pulse of the fashion industry

532 Turnover and volume of sales in wholesale and retail trade - annual data, Eurostat

533 Research and Markets (2021) Apparel Global Market Report 2021: COVID-19 Impact and Recovery to 2030

534 Eurostat (2021) EU, 27 - Development of retail trade volume according to product groups January to November 2020; https://ec.europa.eu/eurostat/statistics-explained/images/1/18/EU-27%2C_development_of_retail_trade_volume_according_to_product_groups%2C_January_to_November_2020_F1.png

The introduction of a separate collection of textiles is expected to lead to an increase in textile waste. The Commission has proposed a comprehensive EU Strategy for Textiles, based on input from industry and other stakeholders. The strategy will aim at strengthening industrial competitiveness and innovation in the sector, boosting the EU market for sustainable and circular textiles, including the market for textile reuse, addressing fast fashion, and driving new business models.

The refined projection calculated for "Textile waste" within this project is based on the development of the index for „textiles, clothing, footwear and leather goods in specialized stores" from 2011 to 2018 in the individual Member States and the projections of the population development.

Following data sets were considered when calculating the refined projections:

- Waste generation by waste category; Textile waste generation 2004 – 2018, for EU-27 MS provided by Eurostat for EU-27 MS;
- Index of deflated turnover: Turnover and volume of sales in wholesale and retail trade - annual data [sts_trtu_a];
- "Population on 1 January – total", provided by Eurostat, for the period 2004 to 2020 in EU member countries provided by Eurostat for EU 27 MS;
- "Population on 1st January by age, sex and type of projection", provided by Eurostat, for the years 2020 - 2035 in EU member countries; provided by Eurostat for EU 27 MS;
- Gross domestic product at market prices Chain linked volumes (2015), million Euro for the years 1995-2019, provided by Eurostat for EU 27 MS.
- Source separation of textile waste from municipal waste and related obligations foreseen in the WFD will continue the increasing trend of textiles waste reported to be generated by the household sector in the future, assuming stronger increase by doubling up to 2035 for those reported data from households.

For the refined projection, an increase of "Textile waste" until 2035 by 48.2% in EU-27 could be calculated (2.84% in annual average) mainly due to an increase due to additional obligations towards source separation for textile waste which will lead to a boost and additional increase, assuming up to doubling of the reported separate collected amounts by households until 2035.

#### A.1.2.8 Discarded vehicles

##### Composition of the waste stream

The waste stream "Discarded vehicles" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of all types of end-of-life vehicles.

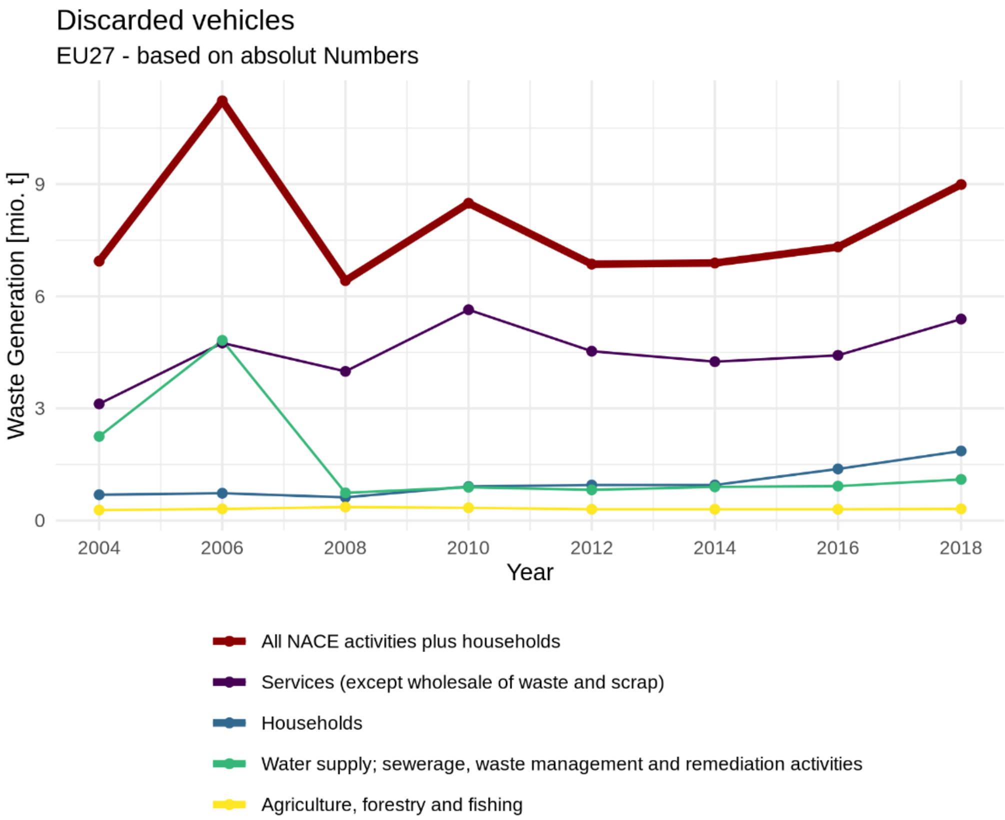
It does not include discarded components of end-of-life vehicles, batteries and accumulator waste, PCB containing components (e.g. capacitors) or used tyres.

Discarded vehicles are hazardous waste when containing dangerous substances, e.g. cooling liquids, engine oil or fuel, or chlorofluorocarbons from the air condition. Roughly, 80 % of the amount of discarded vehicles generated by the EU-27 in 2018 presented hazardous waste.

The ESTAT category "discarded vehicles" cover fully the end-of-life vehicles as defined by Directive 2000/53/EC. In 2021 about 316 million units were in use, of which 271 million (86%) are covered and 46 million (14%) are not covered by the Directive on end-of-life vehicles. It is unknown to which extend reported data include vehicles not covered by the Directive.

## Trends in waste generation and major sources

### Figure A - 24 Generation of discarded vehicles (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of discarded vehicles are displayed), 2004 - 2018




*Source: Eurostat*

In the observation period 2004 – 2018, the generation of "Discarded vehicles" indicates an increase from 6.9 million tonnes in 2004 to 9.0 million tonnes in 2018 (+ 2.1 million tonnes). Two peaks (2006 and 2010) are observed. The peak in 2006 is about 4.3 million tonnes higher than the waste generation in 2004, and 4.8 million tonnes higher than the waste generation in 2008. The peak in 2010 is about 2.1 million tonnes higher than the waste generation in 2008, and 1.6 million tonnes higher than the waste generation in 2012. Both peaks are caused by comparably high amounts of “spent solvents” data reported by Italy for these years. The amount of discarded vehicles generated in 2006 might be regarded as a statistical outlier.

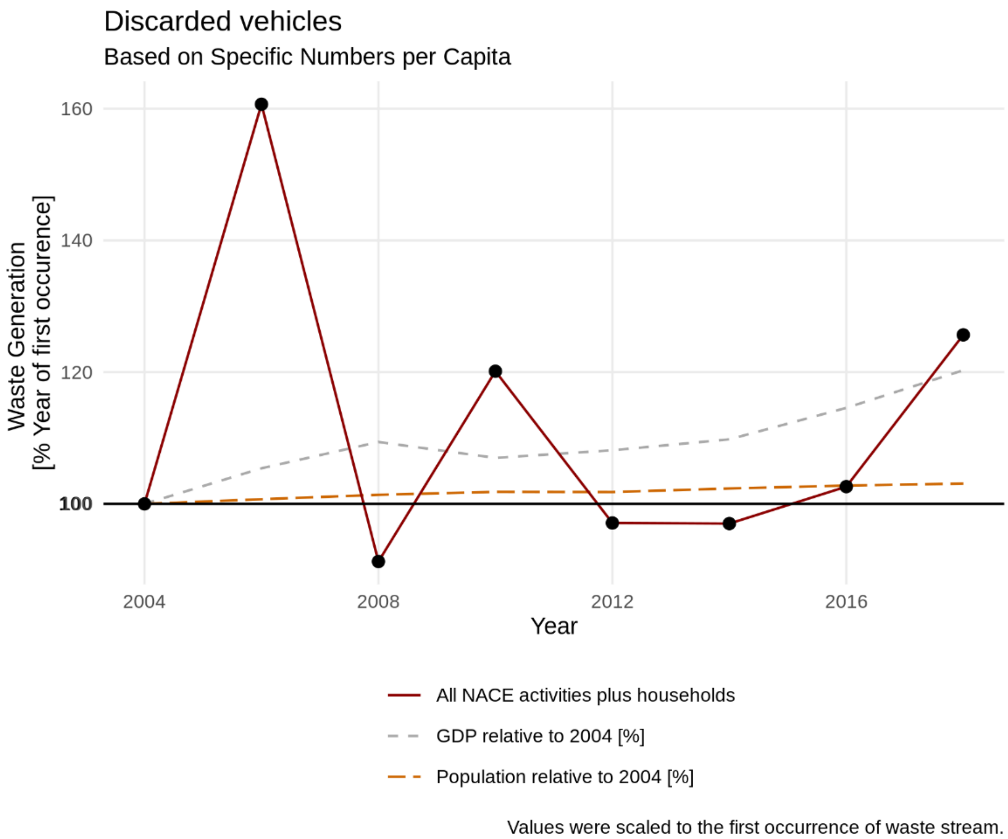
In 2018, 60 % of the “discarded vehicles” amount were generated by the major source for this waste category, “Services (except wholesale of waste and scrap)”. The peaks in 2006 and 2010 are observed also in this economic activity. Regarding the total waste generation in “discarded vehicles”, also within this economic activity data reported by Italy produced these peaks.

The whole economic activity “Water supply; sewerage, waste management and remediation activities” is strongly influenced by comparably high waste generation reported by Italy, amounting to 57 – 92 % of the waste generation within this economic activity within the period 2004 – 2008.

In other relevant sources altogether 36 % of the “discarded vehicles” amount were generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 25 Decoupling effects on discarded vehicles generation in EU-27



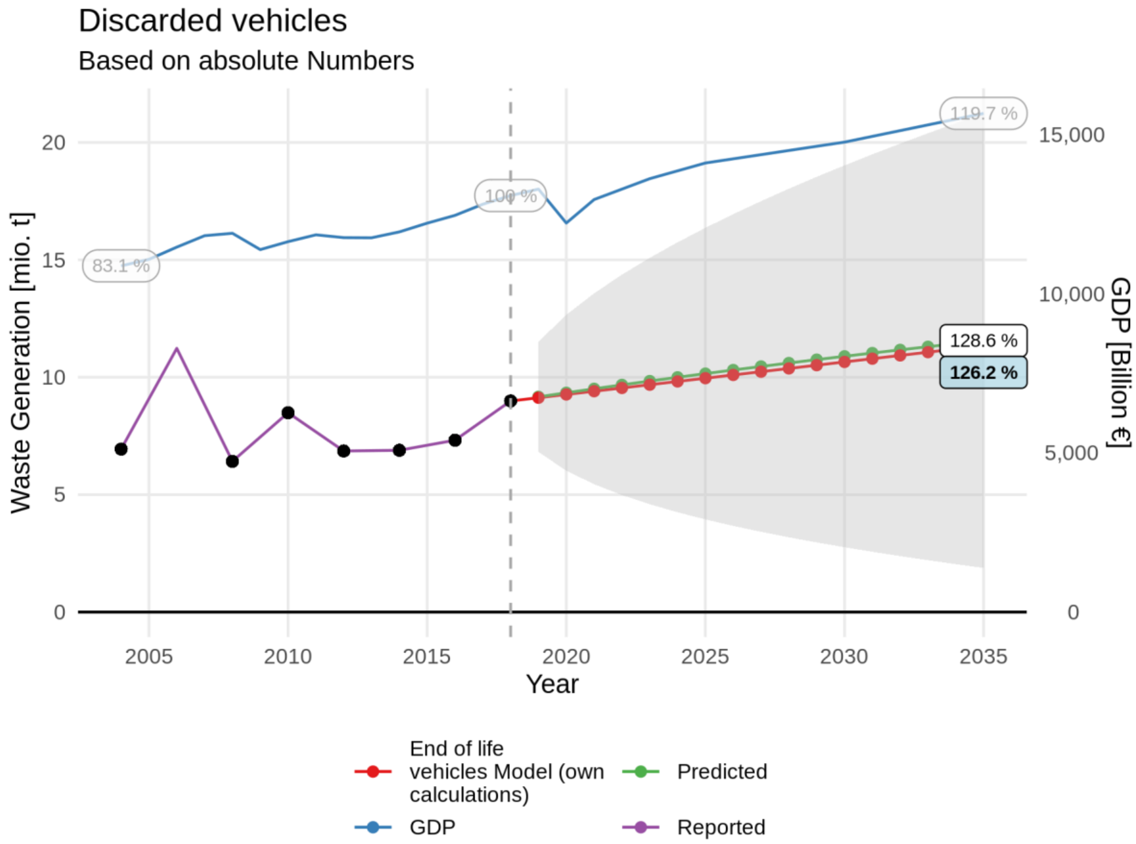

*Source: Eurostat*

In the period 2004 - 2018, the generation of discarded vehicles (kg/per capita) increased by about 7.0%, (0.50% annually over 14 years, calculated by linear regression), while the GDP/capita also increased. This indicates a relative decoupling from the GDP trend in the period 2004-2018.

Due to the peaks in 2006 and 2010, an effect born by the economic crisis year 2008 on the trend of waste generation of discarded vehicles is hardly noticeable.

## Projections (by a linear trend model, refined by Umweltbundesamt)

### Figure A - 26 Projections calculated by a linear trend model and refined projection for discarded vehicles generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model results in an increase of the generation of “discarded vehicles” by 28.6% compared to 2018, respectively 1.7% per year on average. For those calculations, reported data from 2006 were not considered for the projections, as those are interpreted as an outlier.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

In refining the projections, the following was taken into account:

In the EU-27, the number of cars increased from 2004 to 2021 on average by 26 % (2021: about 245 million cars, estimated, based on Eurostat data). However, the increase varies significantly within the MS: from less than 10 % in Latvia, France and Greece, up to 84% in Poland and 95% in Slovakia.

As pointed out by Williams et al. (2020)[535] there is a significant difference between the number of vehicles left the stock and the number of vehicles reported as ELVS or reported as export: *“In 2017, 11.21 million light commercial vehicles below 3.5 tonnes total mass (category M1) and passenger cars (category N1) left the stock of registered vehicles. Of these, 6.57 million were reported as ELVs and 0.87 million were reported as exports of used cars to non-EU countries. Therefore, the whereabouts of 3.77 million vehicles, which left the stock of registered vehicles, are unknown.”*

According to PWC (2018)[536], the car of the future is electrified, autonomous, shared, connected and yearly updated = “eascy”. In respect of the number of cars in the stock, the trend “shared” will have an important influence. PWC (2018) estimates that the vehicle inventory in Europe will drop from 280 million vehicles to 200 million vehicles in 2030. But: as autonomous and shared forms of mobility have faster renewal rates, the sales of new cars will increase by about 30% until 2030.

Management of ELVs is currently not specifically addressed in European legislation on waste prevention. Within the current review of the ELV Directive, however, aspects linked to waste prevention such ecodesign, reuse and reparability requirements are under discussion. Furthermore, the EU’s policy for establishing a more sustainable transport system[537] is expected to have a considerable impact on car ownership, thus preventing waste from ELVs.

The refined projection calculated for “Discarded vehicles” within this project assumes that the number of ELVs increases according to the number of cars (with a time lag of 14 years corresponding to the average age of ELVs).

Following data sets were considered when calculating the refined projections:

- Statistic “End-of-Life vehicles - reuse, recycling and recovery, totals”, provided by Eurostat, for the period 2009 to 2018 in EU member countries
- “Passenger cars per 1 000 inhabitants”, provided by Eurostat, for the period 2009 to 2018 in EU member countries
- “Population on 1 January – total“, provided by Eurostat, for the period 2004 to 2020 in EU member countries
- “Population on 1st January by age, sex and type of projection”, provided by Eurostat, for the year 2021 in EU member countries
- Average age of ELVs in MS of 14 years (Eurostat 2019)

[535] Williams, R., Keeling, W., Petsinaris F., Baron, Y., Mehlhart, G. 2020 Supporting the Evaluation of the Directive 2000/53/EC on end-of-life vehicles

[536] PWC (2018) Five trends transforming the Automotive Industry

[537] “Sustainable and Smart Mobility Strategy – putting European transport on track for the future”, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, COM/2020/789 final

For the refined projection, an increase of “ELV” until 2035 by 26.2% in EU-27 could be calculated (1,54% in yearly average).

### A.1.2.9 Discarded equipment (including WEEE)

#### Composition of the waste stream

The waste stream “Discarded equipment” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of discarded electrical and electronic equipment (e.g. small and large household equipment, IT equipment, electric tools), and fluorescent tubes.

It includes single-use cameras with and without batteries, components removed from electrical and electronic equipment as well as components removed from end-of-life vehicles (e.g. brake pads, oil filters, tanks for liquefied gas, air bags). It does not include discarded vehicles, batteries and accumulator waste as well as PCB-containing components, e.g. capacitors.

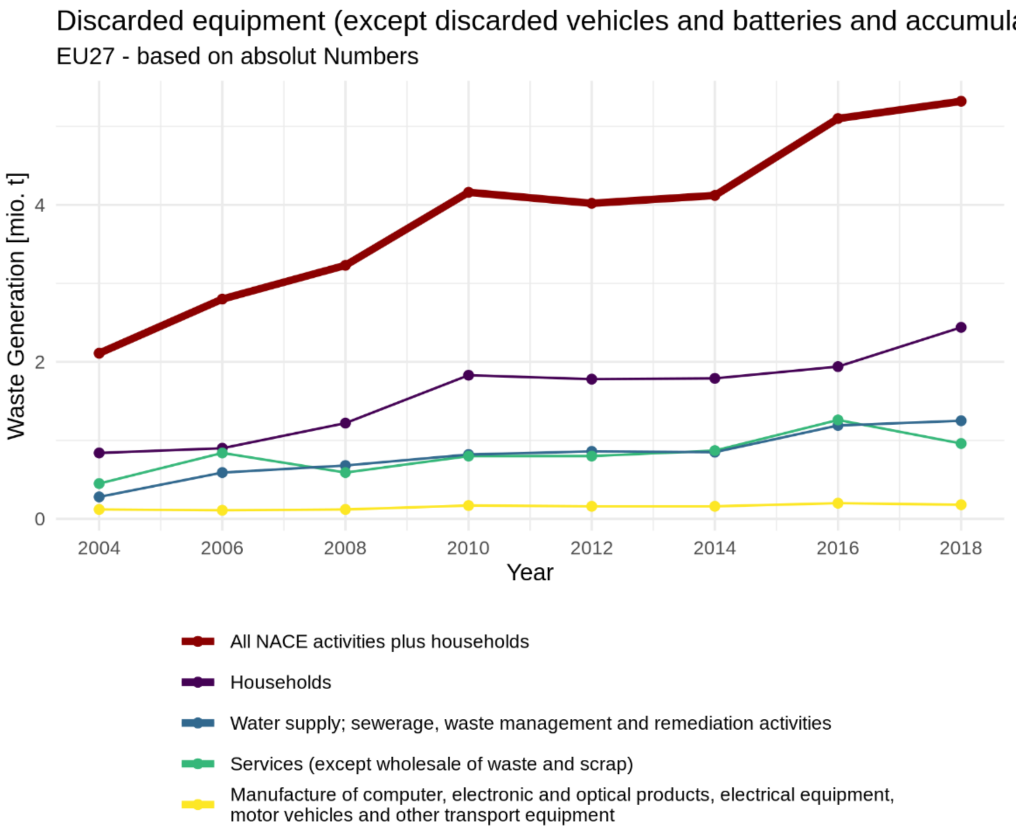
“Discarded equipment” is hazardous waste when containing dangerous substances (e.g. heavy metal, esp. mercury, chromate, lead, chlorofluorocarbon, oil or explosives). According to reporting by the Member States, roughly 50 % of the discarded equipment amount generated by the EU-27 in 2018 was hazardous waste.

The ESTAT category “discarded equipment” covers fully the waste electrical and electronic equipment (WEEE) as defined by Directive 2012/19/EU. The equipment, not covered by the WEEE Directive but reported under the Waste Statistics Regulation is seen as negligible[538].

[538] EC (2016): Study on WEEE collection rates.

## Trends in waste generation and major sources

### Figure A - 27 Generation of discarded equipment (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of discarded equipment are displayed), 2004 - 2018




*Source: Eurostat*

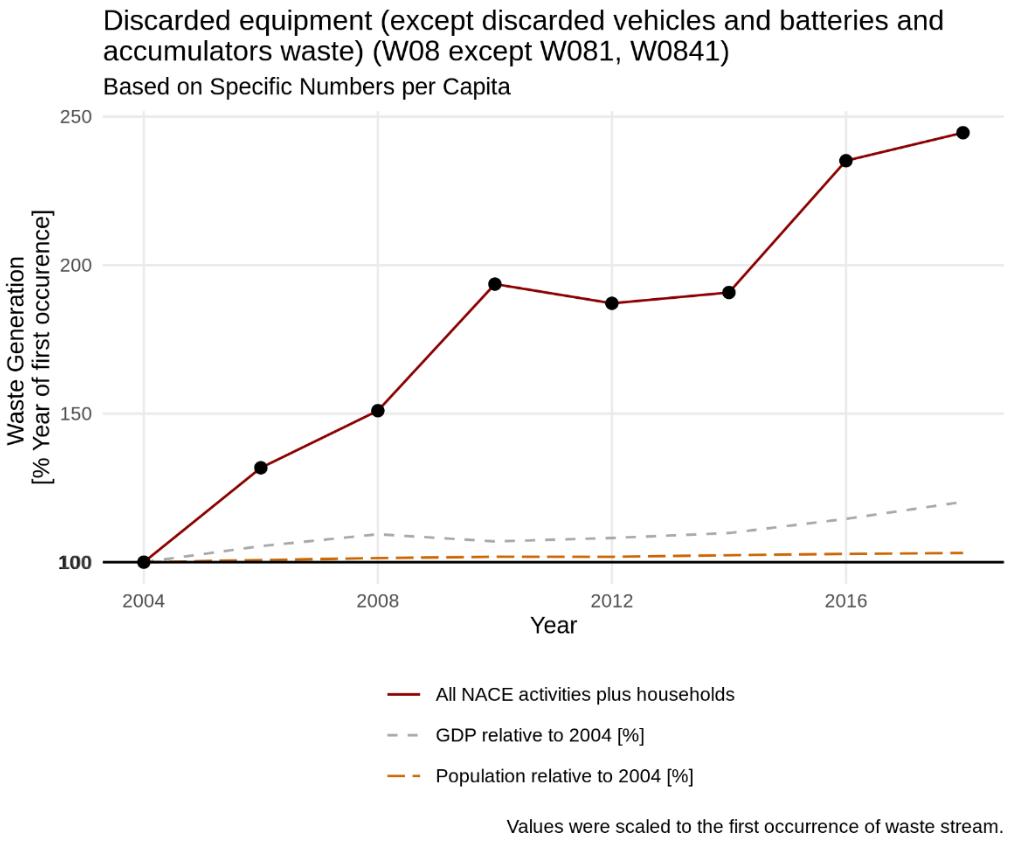
In the observation period 2004 – 2018, the generation of "Discarded equipment" shows an increase from 2.1 million tonnes in 2004 to 5.3 million tonnes in 2018 (+ 3.2 million tonnes).

Major source for the generation of discarded equipment is the economic activity "Households", where in 2018 about 46 % of the discarded equipment were generated.

Other relevant sources are the economic activities "Water supply; sewerage, waste management and remediation activities", "Services (except wholesale of waste and scrap)" and "Manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment", together responsible for 45 % of the discarded equipment that was generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 28 Decoupling effects on discarded equipment generation in EU-27



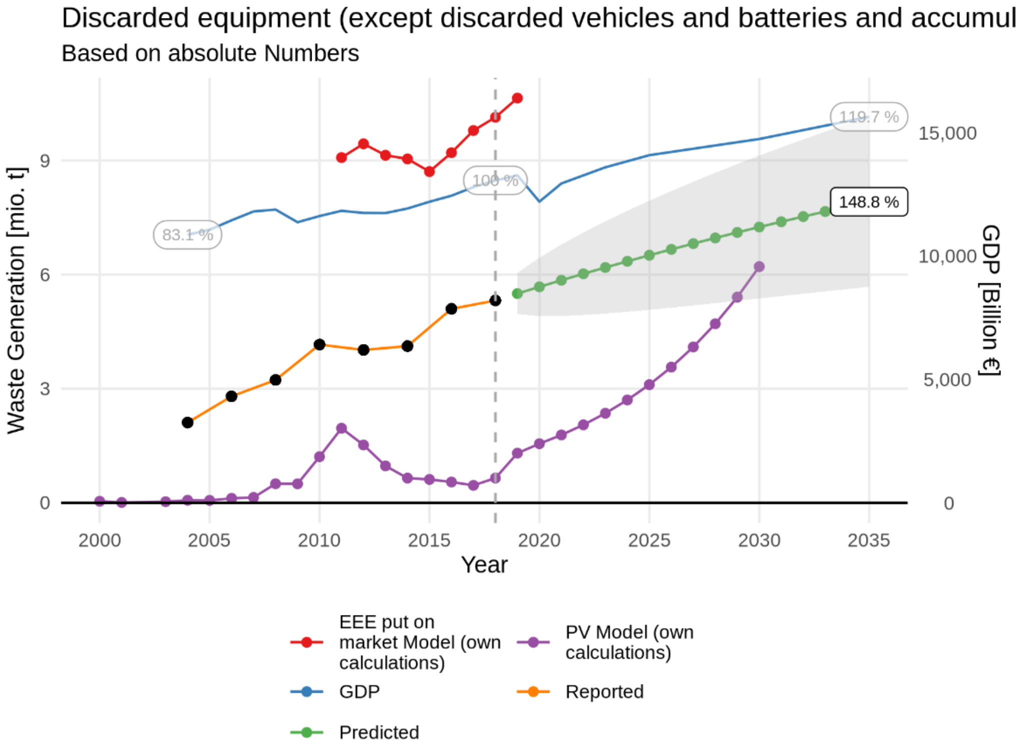

*Source: Eurostat*

In the period 2004 - 2018, the generation of discarded equipment (kg/per capita) significantly increased by about 147.7%, (10.55% annually over 14 years, calculated by linear regression), while also GDP/capita (slightly) increased. This indicates no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of discarded equipment waste generation.

## Projections (by a linear trend model, refined by Umweltbundesamt)

## Figure A - 29 Projections calculated by a linear trend model and refined projection for discarded equipment generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model results in an increase of the generation of "discarded equipment" by 48.8% compared to 2018, respectively 2.9% per year on average.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

The predictions derived from the linear trend model indicate that the waste generation of "Discarded equipment" will increase much more intensively than EU-27 GDP.

EUROSTAT has published data on the generation of discarded equipment for the time series from 2004 to 2018 in the context of the EC Waste Statistics Regulation (with data available every two years). These data reflect the amounts collected by official take-back systems in the Member States and account for only about 40% of the actual WEEE generation estimated in relevant literature (more than 10 million tonnes annually[539]). A study conducted by the EC (EC 2014[540]) indicates projections of WEEE generation for EU-28 beginning with 9.5 million tonnes in 2014, increasing to 9.9 million tonnes in 2020 and ending up at 10.4 million tonnes in 2024. The recent global e-waste monitor had estimated more than 12 million tonnes in 2020 for the EU[541]. Based on the WEEE generation available for 2010, EC 2014 identified the highest relative growth potential until 2024 for lamps, followed by temperature exchange equipment, small equipment, large equipment, screens/monitors and small IT.

Forecasting the volume of WEEE generated is even more challenging. General estimates are, however, available from the UN recent future e-waste scenarios[542] indicating an increase of WEEE generated by a factor of 1.5 in 2050 compared to 2020 for the OECD countries.

In refining the projections, the following was taken into account:

- The amount of EEE placed on the market per capita in 2018 ranges between 10.2 kg/cap in Romania and 30.4 kg/cap in Denmark. The average of EU-27 amounts to 21.8 kg/cap. Countries show different trends in the quantities of EEE per capita placed on the market between 2009 and 2018. Six of them show a strongly decreasing trend (more than 10 % decrease[543]), 6 show a generally stable trend (between – 4% and plus 6.5%), and 18 countries indicate an increase of more than 10%. The strongest increase is reported for Hungary with 86% (Eurostat).
- For detailed projections of the quantities of EEE placed on the market, the current equipment of the households would have to be considered, as well as assumptions for the development of the GNP in the individual Member States. Waste generation will increase by 2035, as the quantities of EEE placed on market have been increasing for years. In particular, devices initially placed on the market in the last few years and increasing strongly in

[539] Huisman et al. (2015). Countering WEEE Illegal Trade (CWIT). https://www.cwitproject.eu/wp-content/uploads/2015/09/CWIT-Final-Report.pdf

[540] STUDY ON COLLECTION RATES OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) POSSIBLE MEASURES TO BE INITIATED BY THE COMMISSION AS REQUIRED BY ARTICLE 7(4), 7(5), 7(6) AND 7(7) OF DIRECTIVE 2012/19/EU ON WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE): October 2014.

[541] Baldé et al. (2017): The global e-waste monitor.

[542] Parajuly, K., et al. (2019). Future E-waste Scenarios; StEP (Bonn), UNU ViE-SCYCLE (Bonn) & UNEP IETC (Osaka). https://wedocs.unep.org/bitstream/handle/20.500.11822/30809/FutEWSc.pdf?sequence=1&isAllowed=y

[543] partly probably due to data quality of reporting

terms of volume. Above all, photovoltaic (PV) modules, will increasingly reach the waste management sector, whereby having a major impact towards the end of the projection period up to 2035, due to their long service life amounting to around 25 years.

- WEEE is one of the fastest growing waste streams in Europe. The materials that make up this a waste stream are manifold its material composition is changing rapidly. Key actions proposed by the Circular Economy Action Plan (2020)[544] address WEEE, namely the envisaged "Circular Electronics Initiative[545]" and the "Review of the Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment[546] and guidance to clarify its links with REACH and Ecodesign requirements".

Refined projections were calculated for "e-bikes" and "PV panels" only:

- For e-bikes, assuming a 10-year service life and a weight of 20 kg per e-bike (without battery), the waste amount can be estimated at about 5,400 t in 2018. This waste will increase to approx. 174,000 t by 2035[547].
- The annual expansion of photovoltaics in the EU-28 from 2000 to 2019 was not uniform, with a peak in 2011 of 22 GW of installed power. Accordingly, the amount of waste PV panels entering the waste management sector will vary in the future[548]. For 2020 to 2030, an increase from the current 130 GW to 600 GW was assumed. According to Jäger-Waldau et al. 2020 for this capacity, a GHG emission reduction of 55% can be achieved in the EU (EU-28) in 2030, in combination with other measures. Per kW peak, a weight of 100 kg was assumed for 2000 and decreasing linearly to 80 kg by 2020. These quantities will be waste with a time lag of 25 years.

The amount of EEE placed on the market is shown in the table above, indicating a strong increase in the past 5 years. Given the lifetimes service life duration for various EEE, ranging from a few years to up to 25 years for specific appliances, the WEEE generation will increase with the respective time lag.

[544] EC (2020). COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS A new Circular Economy Action Plan For a cleaner and more competitive Europe. COM(2020) 98 final.

[545] https://www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-circular-electronics

[546] DIRECTIVE 2011/65/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the restriction of the use of certain hazardous substances in electrical and electronic equipment

[547] Mordor Intelligence (2021): Europe E-bike Market - Growth, Trends, COVID-19 Impact, and Forecasts (2021 - 2026)

[548] Jäger-Waldau, A., et al (2020): How photovoltaics can contribute to GHG emission reductions of 55% in the EU by 2030; Renewable and Sustainable Energy Reviews Volume 126, July 2020.

### A.1.2.10 Batteries and accumulators waste

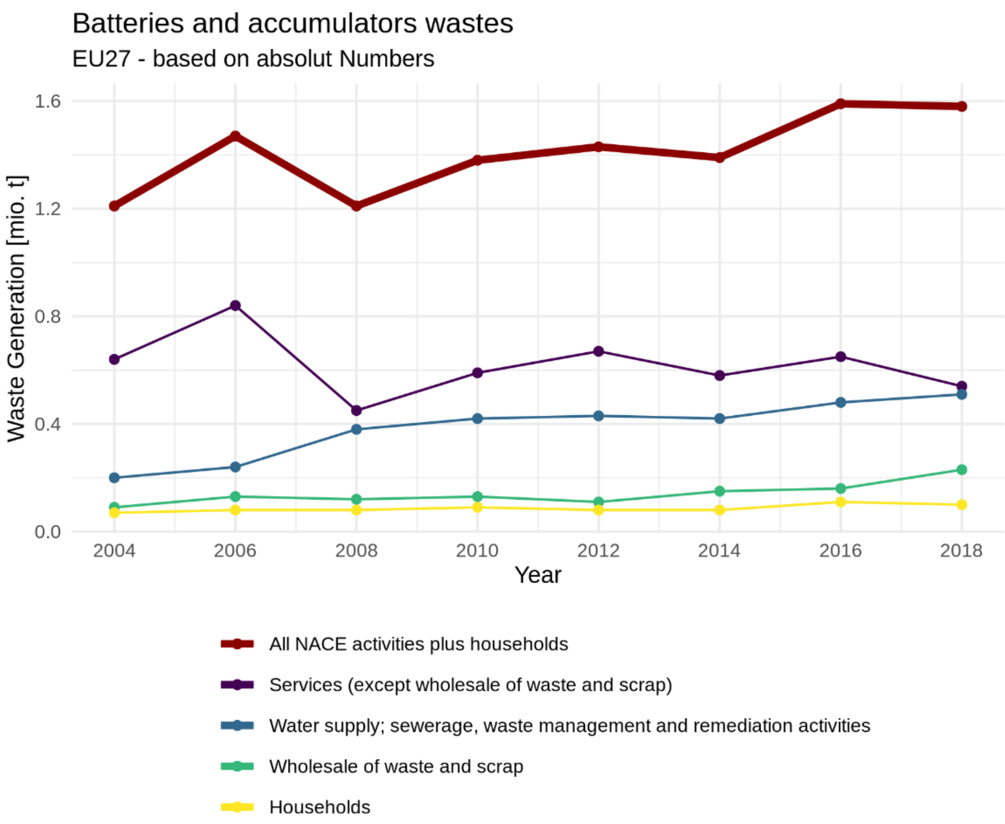
#### Composition of the waste stream

The waste stream "Batteries and accumulators waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of various batteries and accumulators. It does not include single-use cameras containing batteries.

Batteries and accumulators waste is hazardous waste when containing dangerous substances, e.g. nickel, cadmium, mercury, lead and unsorted batteries. In 2018, 96 % of batteries and accumulators waste generated by the EU-27 was hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 30 Generation of batteries and accumulators waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of batteries and accumulators waste are displayed), 2004 - 2018**




*Source: Eurostat*

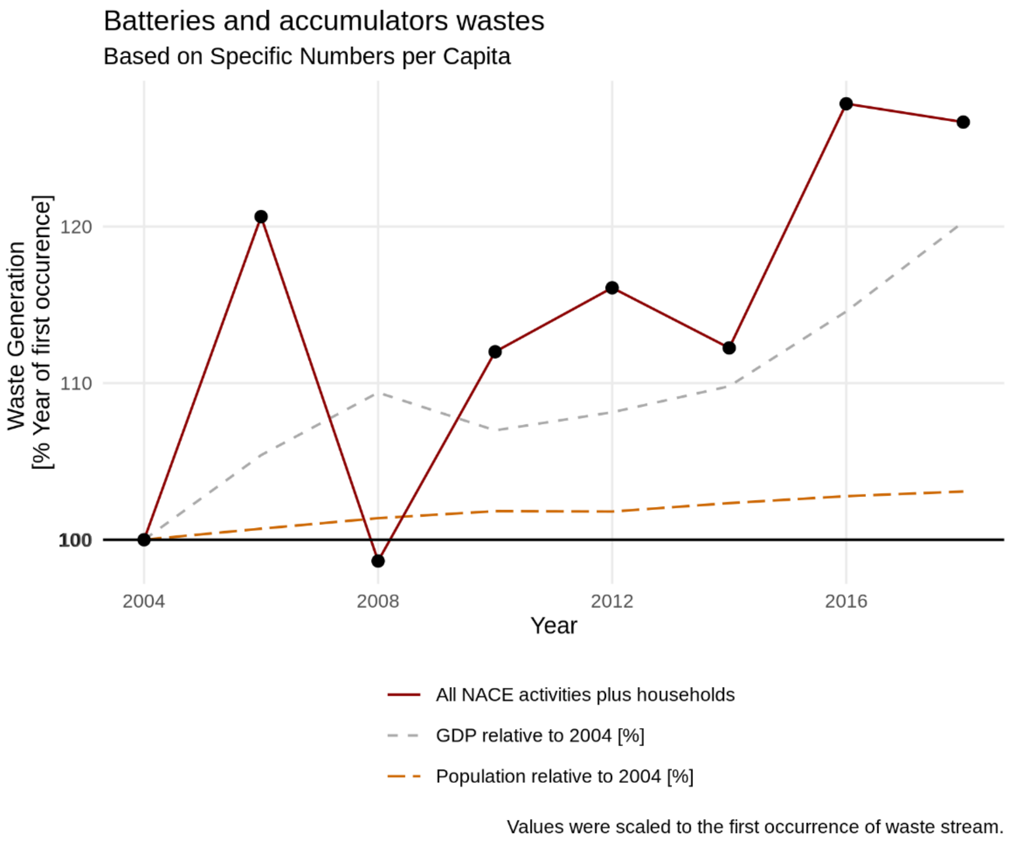
In the observation period 2004 – 2018, the generation of "Batteries and accumulators waste" shows an increase from 1.2 million tonnes in 2004 to 1.6 million tonnes in 2018 (+ 0.4 million tonnes). The most significant increase is observed between 2008 and 2016

(+ 0.4 million tonnes), while from 2016 to 2018, a slight decrease is indicated. A peak occurs in 2006 of about 0.3 million tonnes higher than the waste generation in 2004 or 2008. The peak is caused by a comparably high amount of batteries and accumulators waste data reported by Portugal. The amount of waste generation of batteries and accumulators waste in 2006 might be regarded as a statistical outlier. The entire trend as well as the peak in 2006 is reflected also in the major source for generation of batteries and accumulators waste, i.e. the economic activity “Services (except wholesale of waste and scrap)”. The peak is also within this economic activity and is caused by data reported by Portugal.

In 2018, this economic activity, together with the second most relevant economic activity, “Water supply; sewerage, waste management and remediation activities”, contributed to the generation of 66 % (Services (except wholesale of waste and scrap): 34 %, Water supply; sewerage, waste management and remediation activities: 32 %) of batteries and accumulators waste. Other relevant sources are the economic activities “Wholesale of waste and scrap” and “Households”, responsible together for 21 % of batteries and accumulators waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 31 Decoupling effects on batteries and accumulators waste generation in EU-27



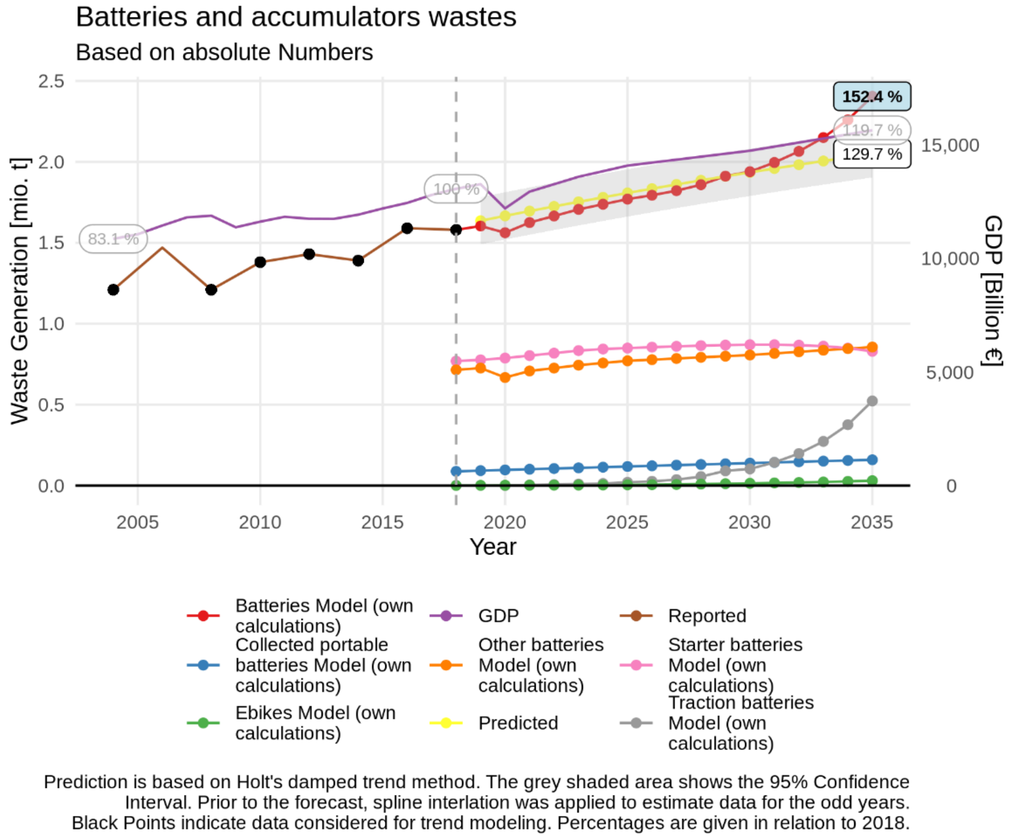

*Source: Eurostat*

In the period 2004 - 2018, the generation of “batteries and accumulators waste” (kg/per capita) increased by about 25.4%, (1.81% annually over 14 years, calculated by linear regression), while also GDP/capita increased slightly. This indicates no decoupling from the GDP trend in the period 2004-2018.

Due to the peak in 2006, an effect of the economic crisis year 2008 on the trend of waste generation of batteries and accumulators waste is hardly noticeable.

## Projections (by a linear trend model, refined by Umweltbundesamt)

### Figure A - 32 Projections calculated by a linear trend model and refined projection for batteries and accumulators waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model results in an increase of the generation of “batteries and accumulators waste” by 29.7% compared to 2018, respectively 1.8% per year on average. The peak in 2006 was not considered for calculating the projections as it is related to reporting of one Member State only.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

In refining the projections, the following was taken into account:

- The national reporting on waste batteries and accumulators shows significant fluctuations in time. The amount of waste batteries and accumulators generated per capita in 2018 ranges between 0.4 kg/cap and 6.5 kg/cap (data for Sweden not considered with 24.5 kg/cap in 2018, reported data interpreted as an error). The average of EU-27 amounts to 4.0 kg/cap.
- For the projection of the waste stream “batteries and accumulators”, the stream was subdivided into five groups: “portable batteries and

accumulators", "starter batteries of passenger cars and light commercial vehicles below 3.5 tonnes", "traction batteries of electric cars", "accumulators of e-bikes" and "others" (which includes industrial batteries and accumulators). For all five groups separate projections were calculated.

- For "portable batteries and accumulators", the increase of collected batteries per capita and the increase of the collection rate in the preceding years was considered. For these time series, a consolidated data set was produced (removal of values not plausible).
- For "starter batteries and traction batteries", the development of the stock of passenger cars and light commercial vehicles was considered. An increasing number of the stock and an increase of the share of electric cars impacts the number of starter batteries and of traction batteries. For the development of the car stock, the goal proclaimed in the Green Deal of 30 million zero emission cars in the EU in 2030 (which is about 10 % of the car stock) was considered.
- For "accumulators of e-bikes", the number of e-bikes sold in the past and a forecast by Mordor Intelligence 2020[549] were used.
- Volumes of batteries and accumulators placed on the market are growing rapidly due to an increase in sales of consumer goods requiring independent power supply (portable power), e.g. mobile phones, toys, notebooks. The European Commission has proposed a new Batteries Regulation[550] which aims to ensure that batteries placed on the EU market are sustainable and safe throughout their entire life cycle.

Following data sets were considered for calculating the projections:

- Statistic "Generation of waste batteries and accumulators", provided by Eurostat, for the period 2004 to 2018 in EU member countries
- "Population on 1 January – total", provided by Eurostat, for the period 2004 to 2020 in EU member countries
- "Population on 1st January by age, sex and type of projection", provided by Eurostat, for the year 2021 in EU member countries provided by Eurostat, for the period 2004 to 2018 in EU member countries

[549] Mordor Intelligence (2021) Europe E-bike Market - Growth, Trends, COVID-19 Impact, and Forecasts (2021 - 2026)
[550] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020, COM(2020) 798/3

- "Gross domestic product at market prices" for the period 2004 to 2019 in EU member countries
- Stock of passenger cars and light commercial vehicles (Williams et al 2020[551], EC 2020, COM 2020[552])
- Number of e-bikes sold (Statista 2021a[553], Statista 2021b[554]; Mordor Intelligence 2021, ECF 2020[555])

For the refined projection, the consolidated amount of batteries and accumulators waste in 2018 results in 1,573,000 tonnes. Out of this, the largest fraction is represented by starter batteries of passenger cars and light transport vehicles (about 48.8 %), followed by the fraction "others" (45.5%). Portable batteries and accumulators amount to 5.6%. Batteries from e-bikes and traction batteries for cars were negligible in 2018.

The refined projections indicate an increase of "batteries and accumulators waste" until 2035 by 52.2% in EU-27 (3.07% in annual average).

As the fraction "others" (which includes industrial batteries and accumulators) will increase more strongly (by 20%) than starter batteries of cars (increase by 8%), this fraction will be the largest one in 2035 with a share of 35.7% of the total amount. Starter batteries will amount to 34.6%, and traction batteries to 21.8 % (about 523,000 t with a strongly increasing tendency). Portable batteries and accumulators will increase by 81% representing 6.6% of the total amount. Accumulators of e-bikes will amount to 1.3% only; even this flow shows a very significant increase between 2018 and 2035 by more than 3,000%.

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[551] Williams, R., Keeling, W., Petsinaris F., Baron, Y., Mehlhart, G. (2020) Supporting the Evaluation of the Directive 2000/53/EC on end-of-life vehicles

[552] COM (2020) 562 final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Stepping up Europe's 2030 climate ambition Investing in a climate-neutral future for the benefit of our people

[553] Statista (2020a) Number of electric bicycles sold in the European Union (EU) from 2006 to 2016, (in 1,000 units)

[554] Statista (2020b) Number of electric bicycles sold in the European Union (EU) from 2013 to 2016, by country; https://www.statista.com/statistics/397772/electric-bicycle-sales-volume-in-the-european-union-eu-by-country/

[555] ECF European Cyclists' Federation (2020) The European e-bike market is booming, latest industry figures show – and there is potential for more; https://ecf.com/news-and-events/news/european-e-bike-market-booming-latest-industry-figures-show-%E2%80%93-and-there

### A.1.2.11 Rubber waste

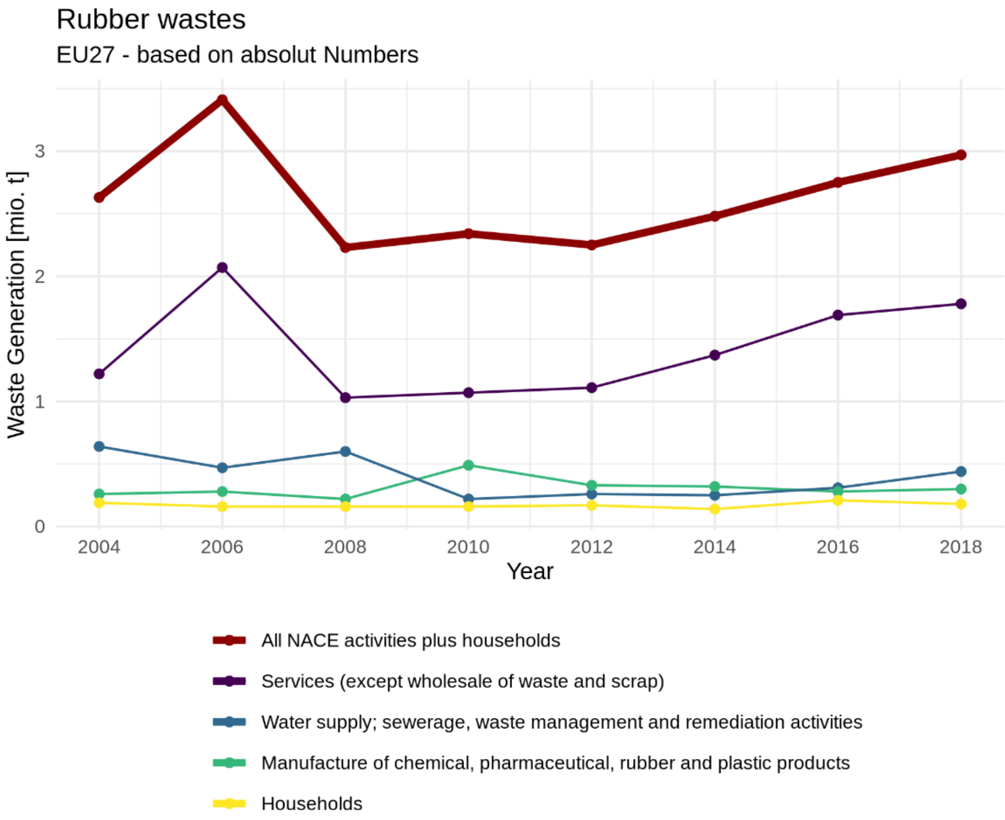
#### Composition of the waste stream

The waste stream “Rubber waste” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) encompasses end-of-life-tyres. It includes none of the other waste types containing rubber, or plastic and rubber.

Rubber waste are non-hazardous.

#### Trends in waste generation and major sources

**Figure A - 33 Generation of rubber waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of rubber waste are displayed), 2004 - 2018**




*Source: Eurostat*

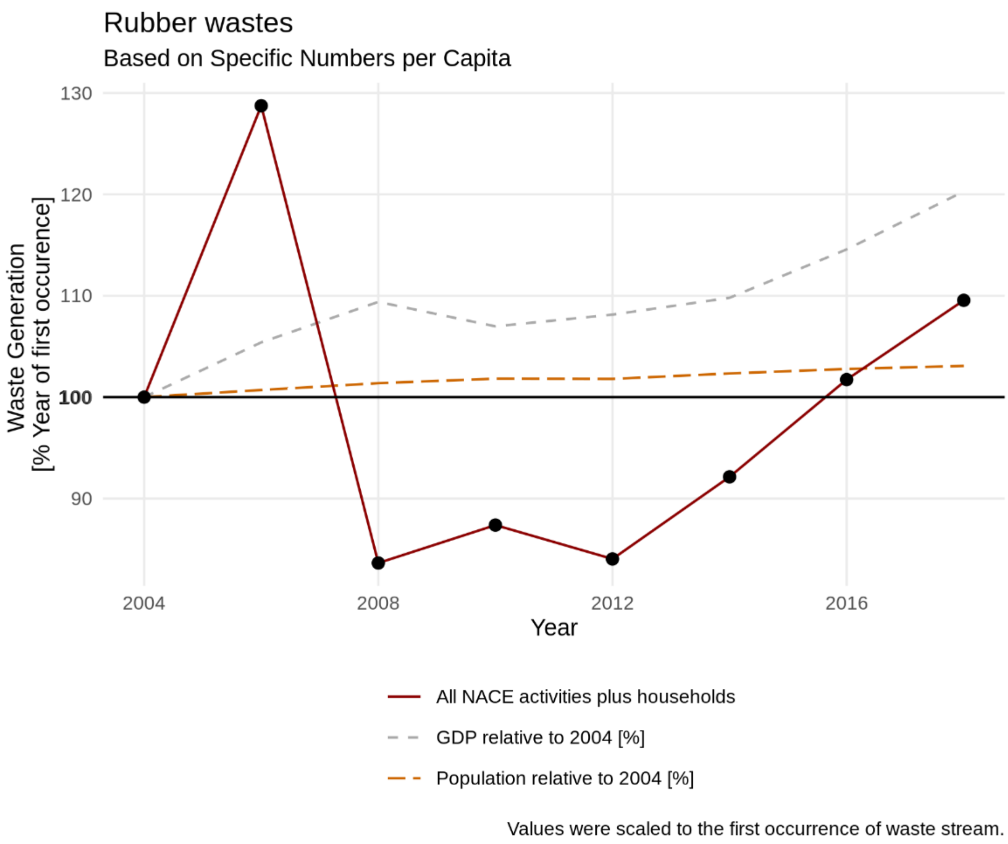
In the observation period 2004 – 2018, the generation of “Rubber waste” indicates a slight increase from 2.6 million tonnes in 2004 to 3.0 million tonnes in 2018. A peak occurs in 2006, exceeding by about 0.8 million tonnes the waste generation in 2004, and by 1.2 million tonnes the waste generation in 2008. The peak is caused by a comparably high amount of rubber waste data reported by Portugal for the year in question. The amount of generation of rubber waste in 2006 might be regarded as a statistical outlier. From 2012 to 2018, a continuous increase of the rubber waste generation is observed (+ 0.7 million tonnes).

The entire trend as well as the peak in 2006 is observed also in the major generation source for rubber waste, i.e. the economic activity "Services (except wholesale of waste and scrap)". In 2018, 60 % of the rubber waste were generated by this economic activity.

Other relevant sources are the economic activities "Water supply; sewerage, waste management and remediation activities", "Manufacture of chemical, pharmaceutical, rubber and plastic products" and "Households", together responsible for 31 % of the rubber waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 34 Decoupling effects on rubber waste generation in EU-27

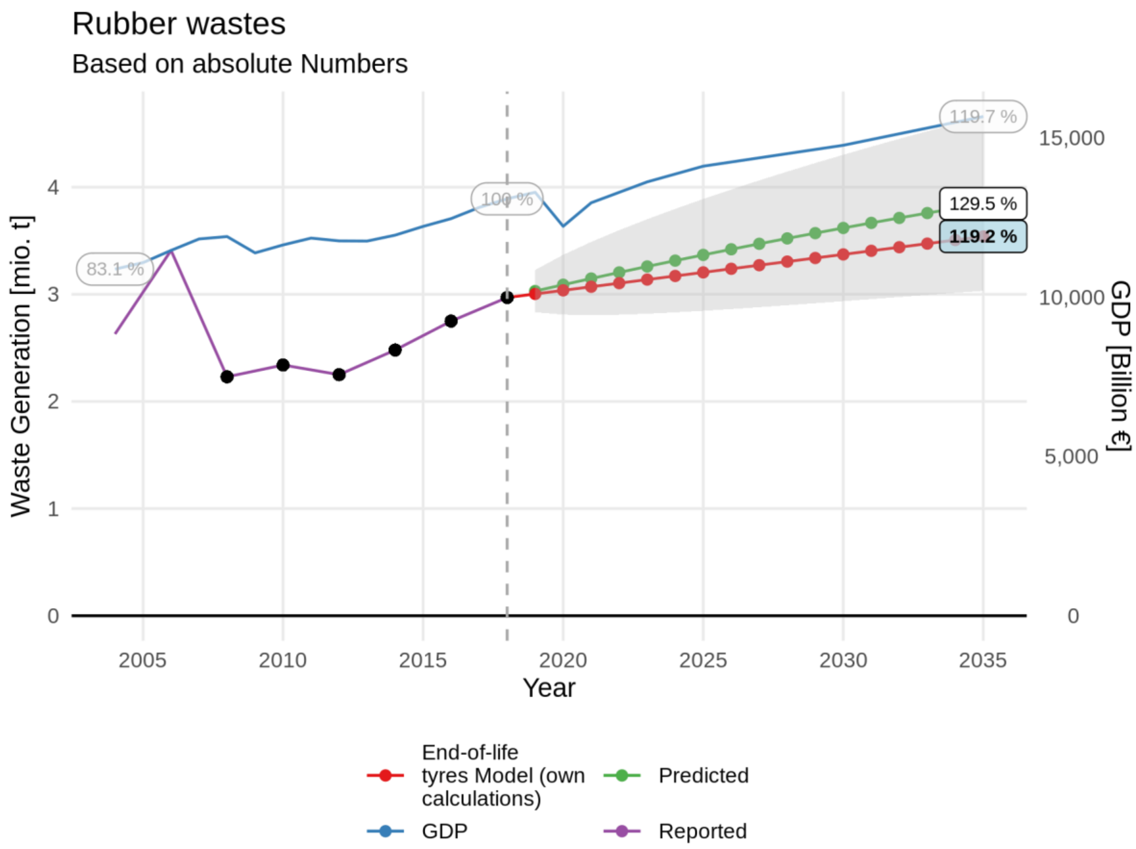



*Source: Eurostat*

In the period 2004 - 2018, the generation of rubber waste (kg/per capita) decreased by about -3.5% (0.25% annually over 14 years, calculated by linear regression), whereas GDP/capita increased. This shows an absolute decoupling from the GDP trend in the period 2004-2018. A peak of rubber waste generation occurs in 2006, caused by data reported by Portugal. Further, a strong decrease from 2006 to 2008 is indicated in the trend of rubber waste generation, which might be an effect of the economic crisis in 2008.

### Projections (by a linear trend model, refined by Umweltbundesamt)

**Figure A - 35 Projections calculated by a linear trend model and refined projection for rubber waste generation in EU-27**




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model results in an increase of the generation of “rubber waste” by 29.5% compared to 2018, respectively by 1.7% per year on average. For this, reported data beginning with 2008 were considered for calculating the projections, as previous data show peaks by one Member State.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

The predictions derived from the linear trend model indicate that the waste generation of “rubber waste” will slightly decrease, whereas the EU-27 GDP is increasing.

In refining the projections, the following was taken into account:

- The amount of rubber waste generated per capita in 2018 ranges between 0.2 kg/cap in Finland and 26.6 kg/cap in Estonia. The average of EU-27 amounts to 6.6 kg/cap. Countries with more than 10 kg/cap in 2018 are Slovenia, Portugal and Luxembourg.
- ETRMA (2020)[556] provides data on the generation of end-of-life tyres in Europe for EU-27 of 2,704,400 t. This represents around 91% of the rubber waste generated in the EU-27, as published by Eurostat for 2018, showing that end-of-life tyres dominate the rubber waste. Information on other rubber waste, e.g. from general rubber goods, is not available. Therefore the focus in the analysis is laid on end-of-life tyres.
- Management of end-of-life tyres is currently not specifically addressed in European legislation on waste prevention. Within the current review of the ELV Directive, however, aspects linked to waste prevention such ecodesign, reuse and reparability requirements are under discussion. Furthermore, the EU's policy for establishing a more sustainable transport system[557] is expected to have a considerable impact on car ownership, thus preventing waste from tyres.
- Following data sets were considered for calculating the refined projections:
- Amount of end-of-life tyres in 2018, provided by ETRMA (2020),
- Increase of freight transport on road (expressed in tonne-kilometres) and passenger transport on road (expressed in passenger-kilometres), provided in EC (2020)[558],
- Share passenger car end-of-life tyres of total end-of-life tyres (TU Chemnitz).

For the refined projection, an increase of "end-of-life tyres" until 2035 by 19.2% in EU-27 could be calculated (1,03% in yearly average).

[556] ETRMA European Tyre & Rubber Manufacturers Association, (2020) Europe – 91% of all End of Life Tyres collected and treated in 2018; https://www.etrma.org/library/europe-91-of-all-end-of-life-tyres-collected-and-treated-in-2018/

[557] "Sustainable and Smart Mobility Strategy – putting European transport on track for the future", COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, COM/2020/789 final

[558] EC (2020) COMMISSION STAFF WORKING DOCUMENT Accompanying the document COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Sustainable and Smart Mobility Strategy – putting European transport on track for the future {COM(2020) 789 final}

### A.1.2.12 Mineral waste from construction and demolition

#### Composition of the waste stream

The waste stream "Mineral waste from construction and demolition" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of concrete, bricks, gypsum waste from construction and demolition, insulation materials, mixed construction waste, as well as track ballast.

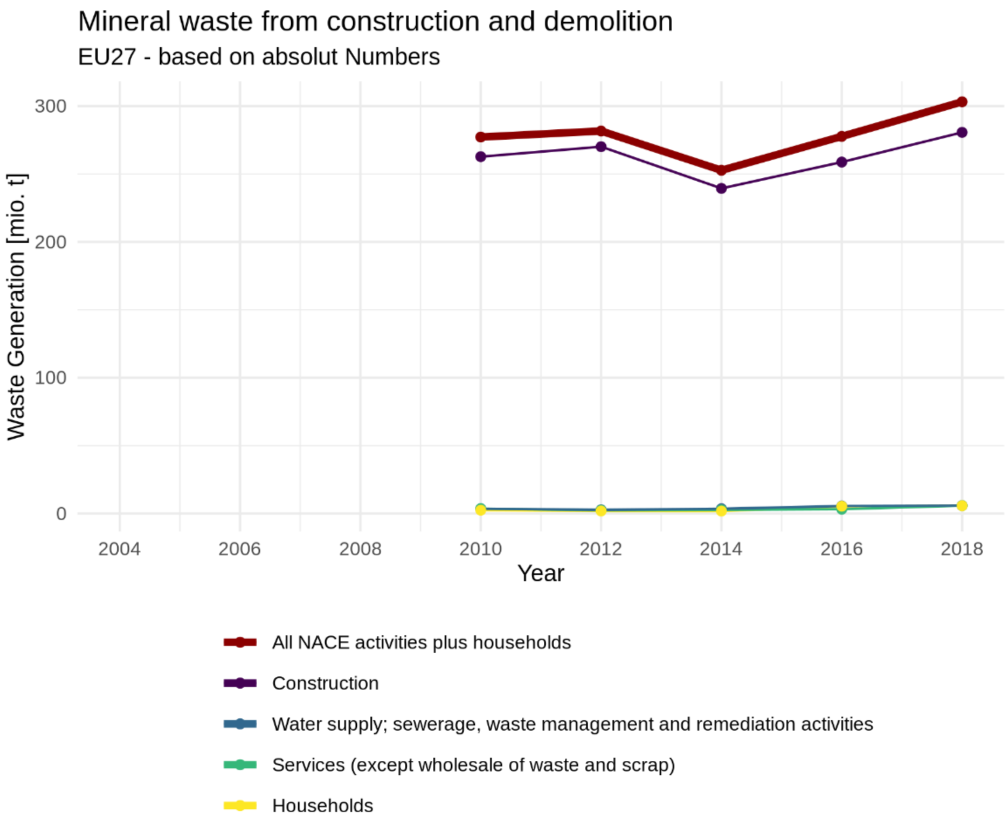
It includes waste hydrocarbonised road-surfacing material (asphalt). It does not include solid waste from soil remediation, soils and stones, insulation and construction materials containing asbestos, PCB containing waste, or pure and sorted fractions of glass.

Mineral waste from construction and demolition is hazardous waste in case of containing oil, heavy metals, coal tar, or organic pollutants. In 2018, only 4 % of mineral waste from construction and demolition was generated by the EU-27 were hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 36 Generation of mineral waste from construction and demolition (million tonnes), total amount and waste generation by economic activity**

## (absolute amounts for the four major sources of mineral waste from construction and demolition are displayed), 2010 - 2018




*Source: Eurostat*

In the observation period 2010 – 2018, the generation of "Mineral waste from construction and demolition" shows an increase from 277.2 million tonnes in 2004 to 303.2 million tonnes in 2018 (+ 25.9 million tonnes).

This trend is closely related to the trend of the major source for the generation of this waste,i.e. the economic activity "Construction". Over the entire period, this economic activity shows a very high share (93 – 96 %) in the waste stream "Mineral waste from construction and demolition". In 2018, 93 % of the mineral waste from construction and demolition were generated by this economic activity.

The next three most significant sources are the economic activities "Water supply; sewerage, waste management and remediation activities", "Services (except wholesale of waste and scrap)", and "Households", together responsible for 6 % of mineral waste from construction and demolition was generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

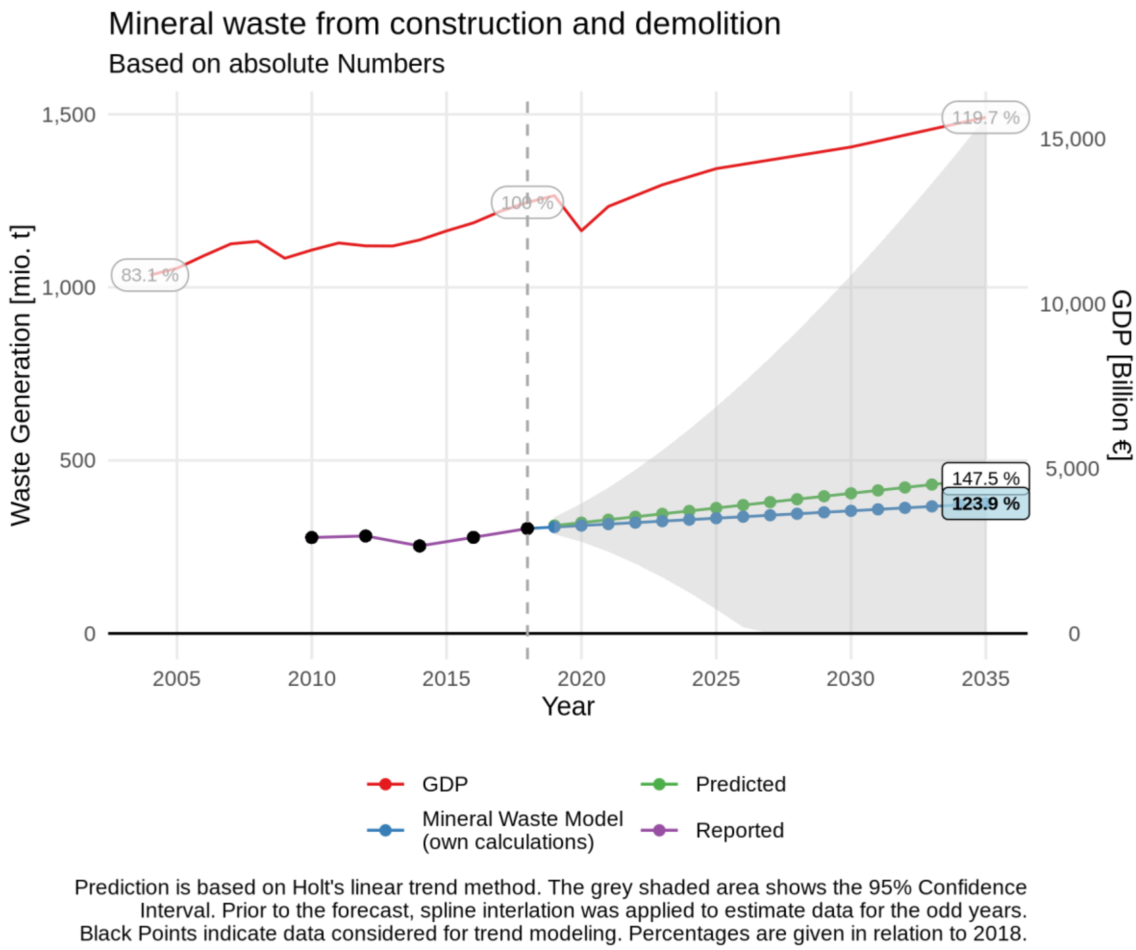
### Figure A - 37 Decoupling effects on mineral waste from construction and demolition generation in EU-27


*Source: Eurostat*

In the period 2010 - 2018, the generation of mineral waste from construction and demolition (kg/per capita) increased by 26.0% (3.25% annually over 14 years, calculated by linear regression), while GDP/capita also increased slightly. This shows no decoupling from the GDP trend in the past period 2010-2018.

### Projections (by a linear trend model, refined by Umweltbundesamt)

### Figure A - 38 Projections calculated by a linear trend model and refined projection for mineral waste from construction and demolition generation in EU-27




*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 47.5% compared to 2018, respectively 2.8% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

The predictions derived from the linear trend model indicate that the waste generation of “mineral waste from construction and demolition” will increase more intensively than the EU-27 GDP.

In refining the projections, account was taken of the following:

On national Member States level, Eurostat data on generated mineral C & D waste show a more diverse picture. Several Member States show a doubling of the generation per capita in the period 2010 to 2018 (Croatia, Estonia, Latvia, Sweden, Lithuania, Malta). Others show a considerable decrease by more than 15 % in 2018, based on 2010 data (Romania, Greece, Ireland, Finland). Thus, a trend on EU-27 level entails a re-calculation of the trends per Member State, eliminating non-plausible data for selected Member States and reference years.

According to the corrections and interpretations applied on generated amounts of mineral C&D waste for 2010 to 2018 on Member State level, for the refined projections it was assumed that:

- a stable annual development for future C & D waste increase: Bulgaria, Greece, Luxembourg, Netherlands, Romania, in particular due to unstable and decreasing trends;
- a strong annual increase (higher than 7 % based on data 2018): Denmark, Croatia, Cyprus, Estonia, Lithuania, Sweden;
- a smooth increase depending on their past trends: all other Member States.
- There are several initiatives ongoing at European level to promote circularity in the construction sector: The European Renovation Wave Strategy[559] emphasises the importance of circular approaches to the renovation of buildings, alongside energy efficiency improvements. In addition, the New European Bauhaus initiative[560] is looking at creative solutions to deliver more sustainable buildings.
- In accordance with Directive (EU) 2018/851 amending Directive 2008/98/EC on Waste, the Commission shall by the end of 2024 consider the setting of further preparing for reuse and recycling targets for construction and demolition waste.

Following data sets were considered for calculating the refined projections:

- Past trends on “generation of mineral waste from construction and demolition” (EUROSTAT - Generation of waste by waste category, hazardousness and NACE Rev. 2 activity [env_wasgen]);
- Past trends on “generation of waste by construction sector” (EUROSTAT reporting according to the EC Waste Statistics Regulation - Generation of waste by waste category (env_wasgen));
- “Population on 1 January – total“, provided by Eurostat, for the period 2004 to 2020 in EU member countries and estimations to 2035;

[559] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en
[560] https://europa.eu/new-european-bauhaus/about/about-initiative_en

- “Gross domestic product (GDP)” – Indicator for a nation´s economic situation (EUROSTAT, GDP Chain linked volumes (2015) EU-27, million EUR).

The refined projection indicates an increase of “mineral construction and demolition waste” until 2035 by 23.6% in EU-27 to 372 million tonnes (1.39% in annual average).

The future trends for waste from construction and demolition will closely relate to the economic growth and population development which were considered in the projection, but will be also influenced by further relevant aspects to be taken into account for more specific calculation out of the scope of this study, such as changes and trends in building sector (new and alternative materials, changes in living and housing styles), population density as well as and household size.

### A.1.2.13 Vegetal waste

#### Composition of the waste stream

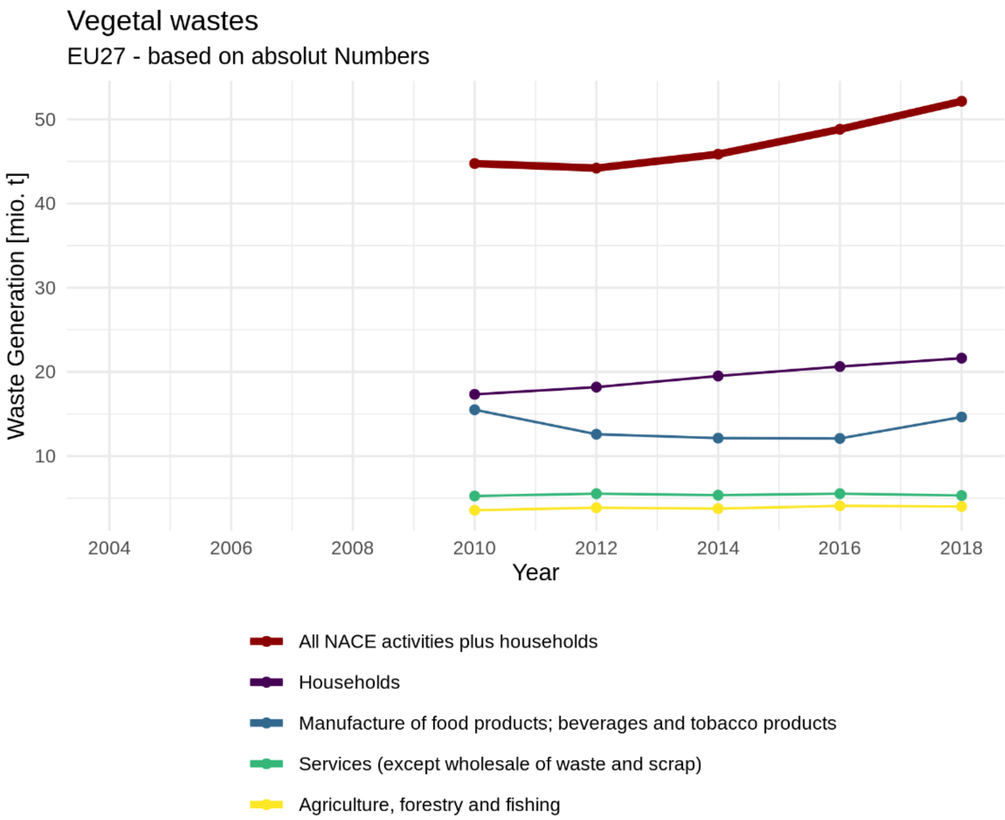
The waste stream “Vegetal waste” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) includes vegetal waste from food preparation and products, including sludges from washing and cleaning.

It includes waste from solvent extraction, from spirit distillation as well as green waste. It does not include animal and mixed waste from food preparation and products, wood waste (like bark and cork), sludges from on-site effluent treatment from food preparation/processing, or soil from cleaning and washing beet.

Vegetal waste are non-hazardous.

## Trends in waste generation and major sources

### Figure A - 39 Generation of vegetal waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of vegetal waste are displayed), 2010 - 2018




*Source: Eurostat*

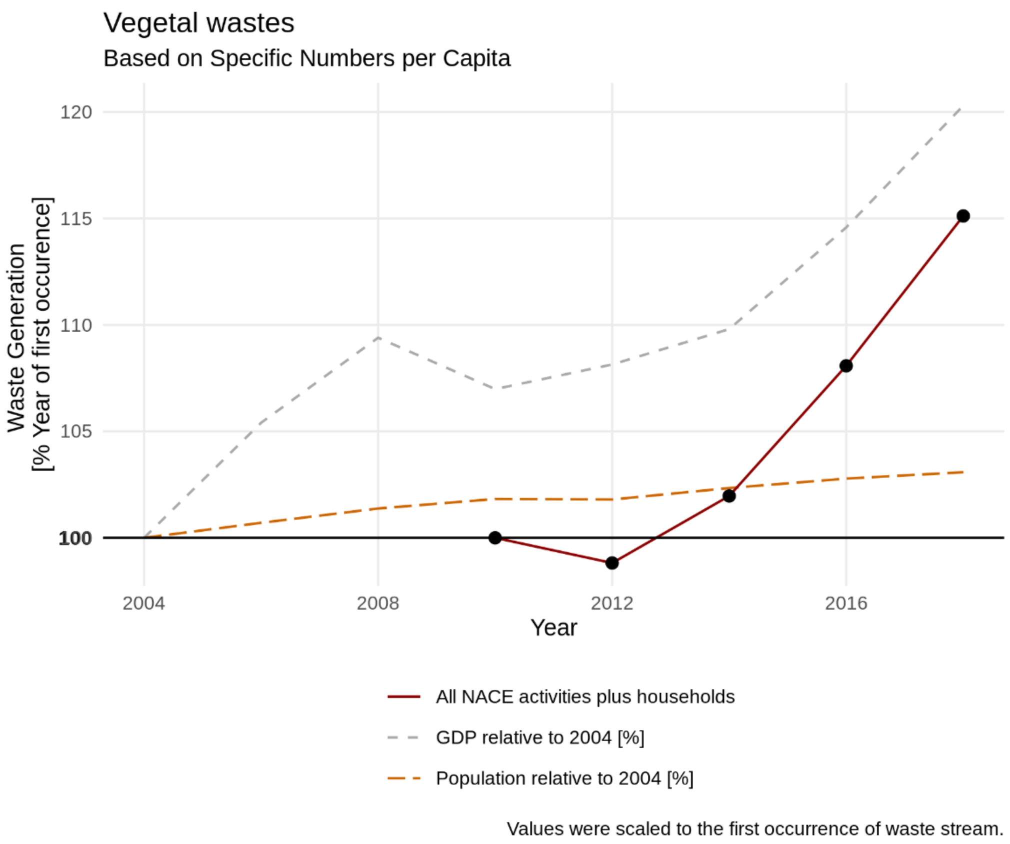
In the observation period 2010 – 2018, the generation of “Vegetal waste” indicates an increase from 44.8 million tonnes in 2010 to 52.2 million tonnes in 2018 (+ 7.4 million tonnes).

Major source for generation of vegetal waste is the economic activity “Households”, where in 2018, 41 % of the vegetal waste were generated.

Other relevant sources are the economic activities “Manufacture of food products; beverages and tobacco products”, “Services (except wholesale of waste and scrap)” and “Agriculture, forestry and fishing”, together responsible for 46 % of the vegetal waste generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 40 Decoupling effects on vegetal waste generation in EU-27

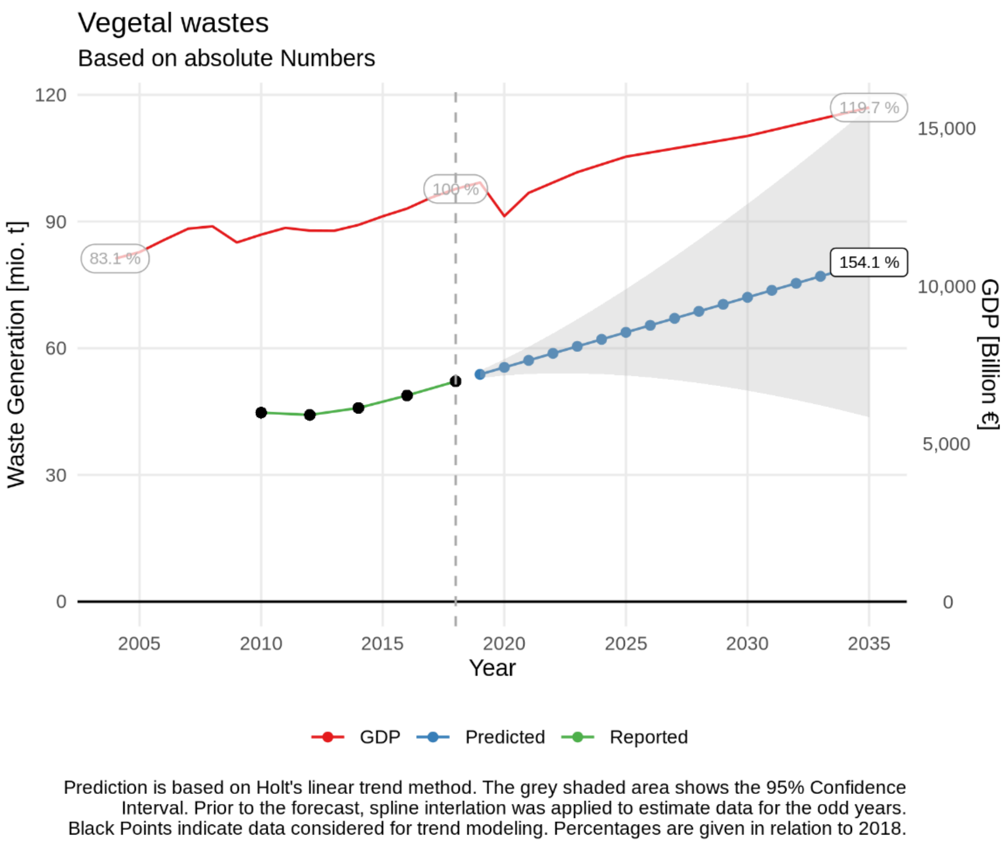



*Source: Eurostat*

In the period 2010 - 2018, the generation of vegetal waste (kg/per capita) increased by about 34.3%, (4.29% yearly over 8 years), while the GDP/capita increased more slightly. This shows no decoupling from the GDP trend in the period 2010-2018.

## Projections (by a linear trend model)

### Figure A - 41 Projections calculated by a linear trend model for vegetal waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The category "Vegetal waste" shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 54.1% compared to 2018, respectively 3.2% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.14 Common sludges

### Composition of the waste stream

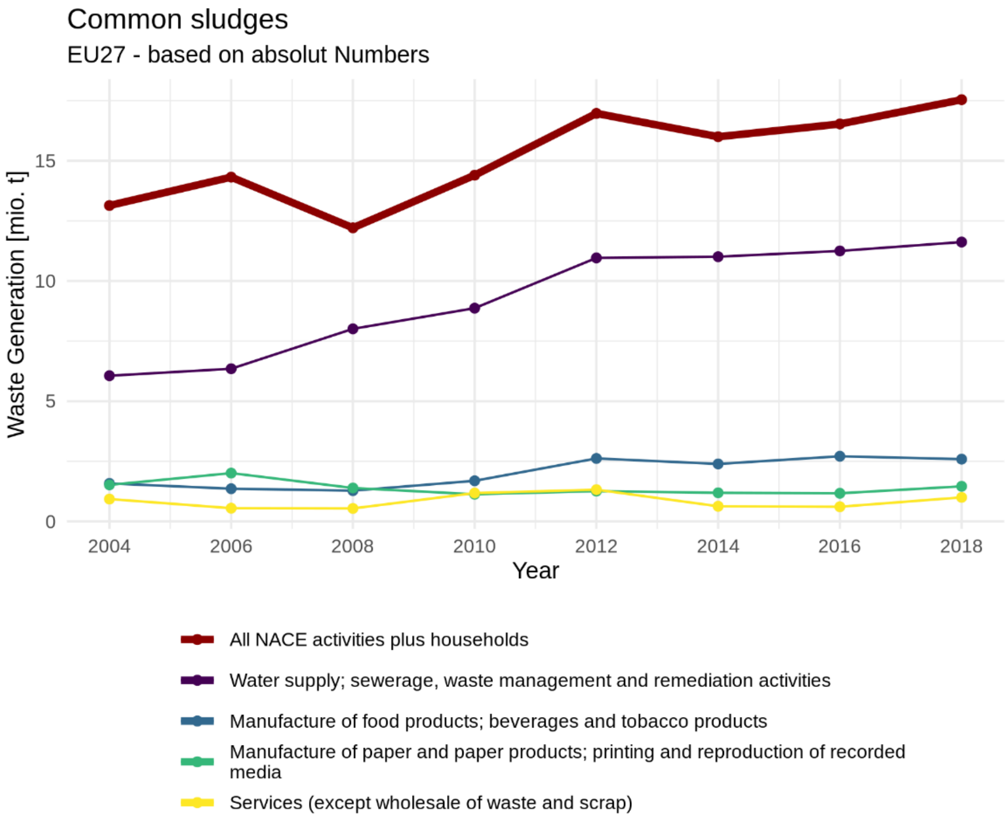
The waste stream "Common sludges" (as defined in Section 2 –Waste Categories of the EU Waste Statistics Regulation) is composed of wastewater treatment sludge from municipal sewerage water and organic sludge from food preparation and processing.

It includes boiler-feed water sludges, water purification sludge, sludges from on-site effluent treatment in the paper industry as well as cesspit contents. It does not include all hazardous sludge types, inorganic sludges from industrial wastewater treatment, sludges containing paint, varnish, inks, adhesives, resins and sealants, oil sludges, sludges from gas treatment, solvents containing sludges, fibre rejects, fibre-, filler- and coating-sludges from mechanical separation of wood and paper, sludges from decarbonising, solutions and sludges from regeneration of ion exchangers, or sludges from waste treatment.

All common sludge types are non-hazardous.

### Trends in waste generation and major sources

### Figure A - 42 Generation of common sludges (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of common sludges are displayed), 2004 - 2018




*Source: Eurostat*

In the observation period 2004 – 2018, the generation of "Common sludges" indicates an increase from 13.1 million tonnes in 2004 to 17.5 million tonnes in 2018 (+ 4.4 million tonnes).

The most intensive increase is observed between 2008 and 2012 (+ 4.8 million tonnes), followed by a slight decrease. A peak occurs in 2006, exceeding by about 1.2 million tonnes the waste generation in 2004, and by 2.1 million tonnes that in 2008.

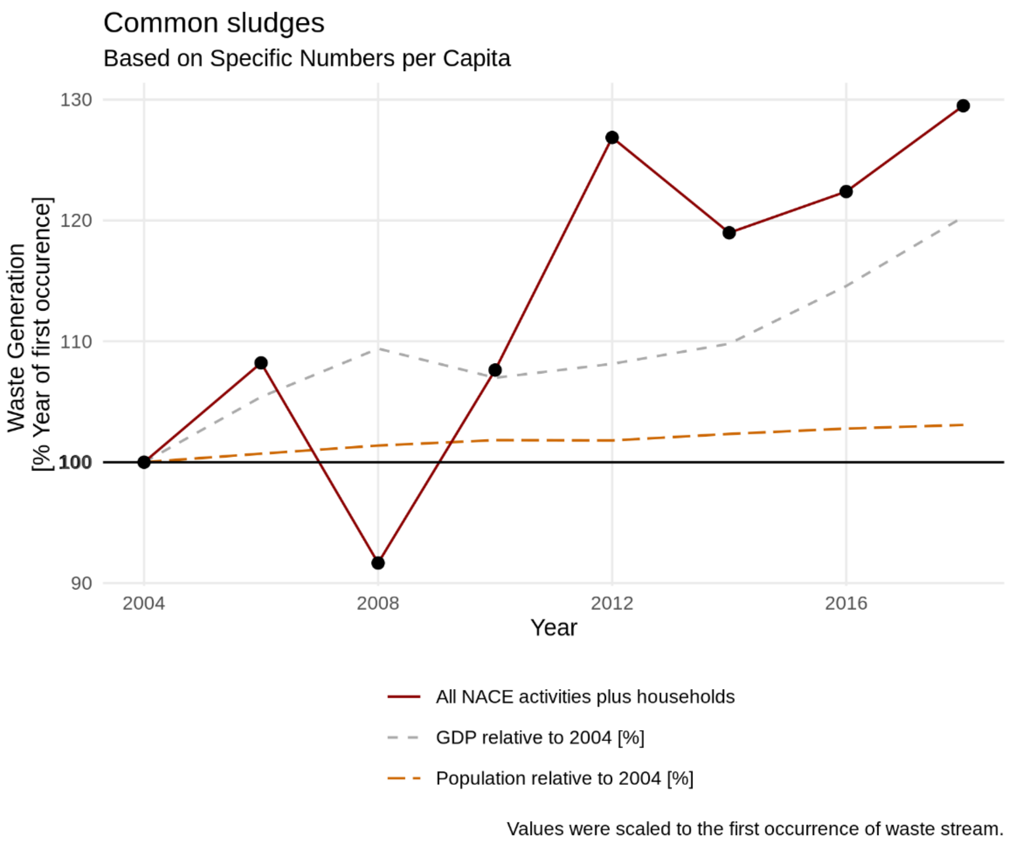
The strong increase in the generation of common sludges between 2008 and 2012 is caused by extraordinarily high common sludge data reported by Belgium for 2010, and by extraordinarily high data reported for the period2012 to 2018 by Italy. The peak in 2006 is caused by a comparably high amount of common sludges reported by Poland.

The significant generation in 2012 to 2018 is also reflected in the major source for generation of common sludges, i.e. the economic activity "Water supply; sewerage, waste management and remediation activities". In 2018, 66 % of the common sludges were generated by this economic activity.

Other relevant sources are the economic activities "Manufacture of food products; beverages and tobacco products", "Manufacture of paper and paper products; printing and reproduction of recorded media" and "Services (except wholesale of waste and scrap)", together responsible for 29 % of the common sludges generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 43 Decoupling effects on common sludges generation in EU-27




*Source: Eurostat*

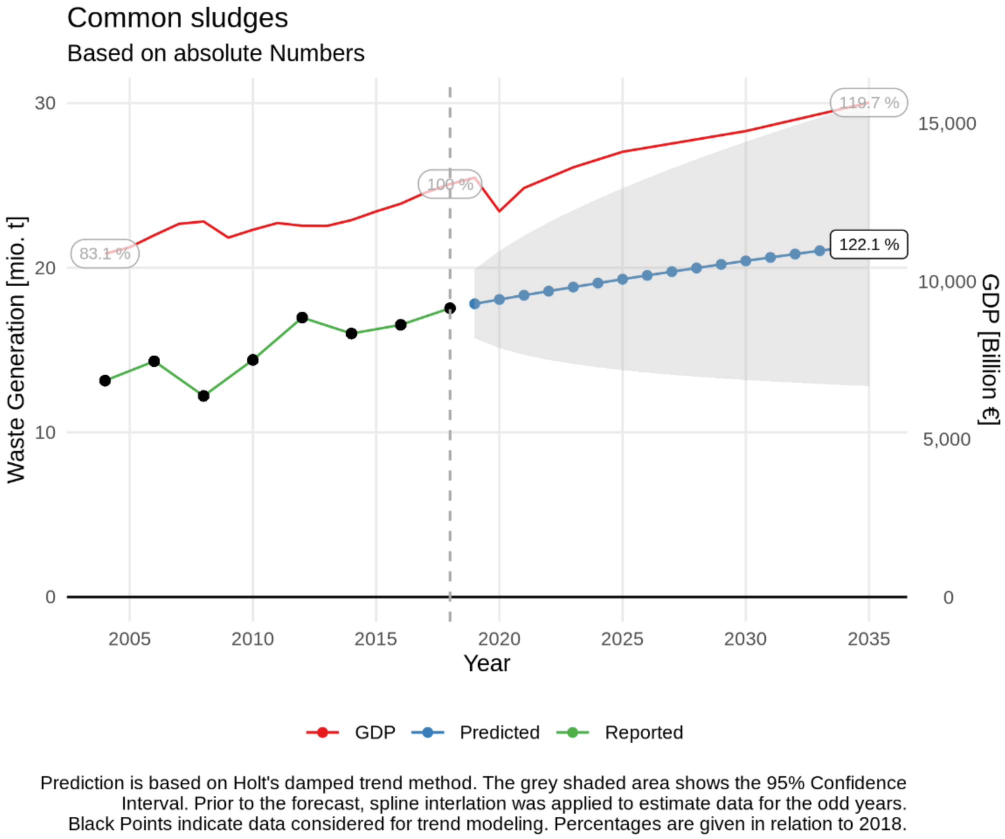
In the period 2004 - 2018, the generation of common sludges (kg/per capita) increased by 28.9 % (1.95% annually over 14 years, calculated by linear regression), while the

GDP/capita increased slightly. This indicates no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of generation of common sludges.

## Projections (by a linear trend model)

### Figure A - 44 Projections calculated by a linear trend model for common sludges generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The category "Common sludges" shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 22.1% compared to 2018, respectively 1.3% per year on average.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

#### A.1.2.15 Industrial effluent sludges

##### Composition of the waste stream

The waste stream “Industrial effluent sludges” (as defined in Section 2 –Waste Categories of the EU Waste Statistics Regulation) includes sludges and solid residues from industrial wastewater treatment, solid and liquid waste from soil and groundwater remediation as well as boiler cleansing sludges. Further, it includes waste from cooling water conditioning and cooling columns as well as drilling mud.

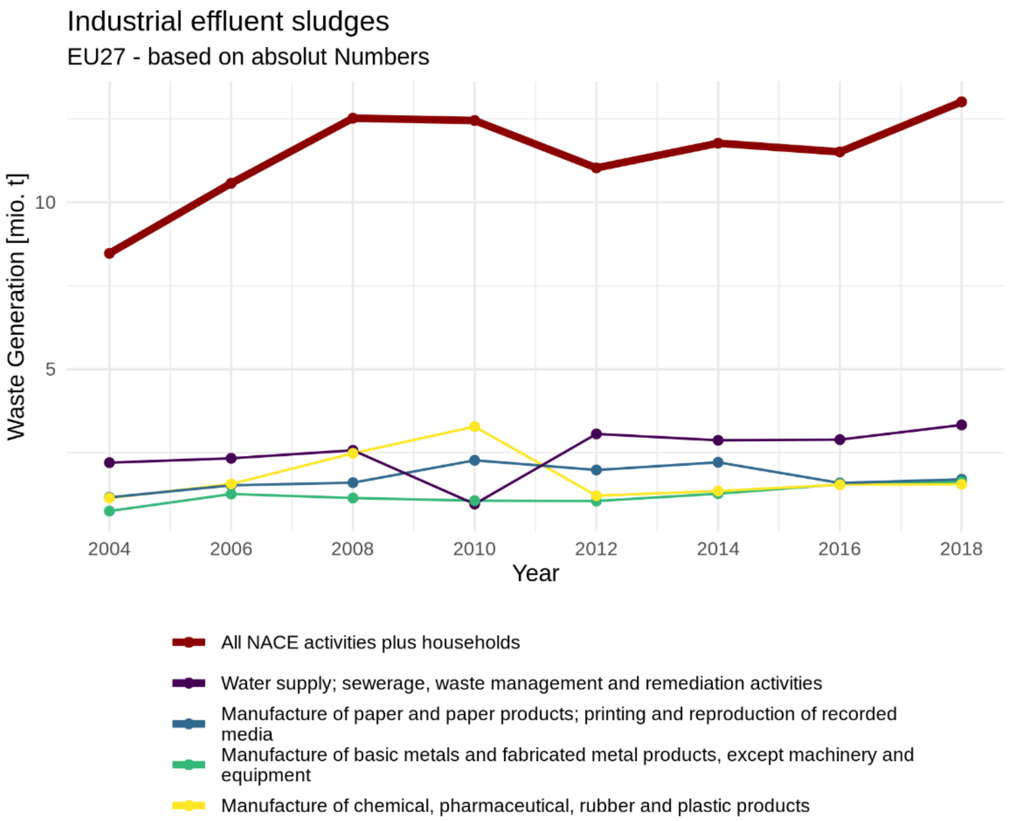
It further includes de-inking sludges, sludges with low oil and metal content, steam degreasing waste, as well as grease- and (mineral) oil-containing sludges from oil/water separators. It does not include metal and oil containing sludges, sludges from municipal waste-water treatment, grease and oil containing sludges from oil/water separators containing edible oil, sludges from the production of printing inks, paints dyestuff, varnish an sealants, sludges from food preparation or sludges and liquid waste from waste treatment.

Industrial effluent sludges are hazardous waste when containing oil and heavy metals. Roughly 20 % of the amount of industrial effluent sludges generated by the EU-27 in 2018 were classified as hazardous waste.

##### Trends in waste generation and major sources

**Figure A - 45 Generation of industrial effluent sludges (million tonnes), total amount and waste generation by economic activity (absolute amounts for**

**the four major sources of industrial effluent sludges are displayed), 2004 - 2018**




*Source: Eurostat*

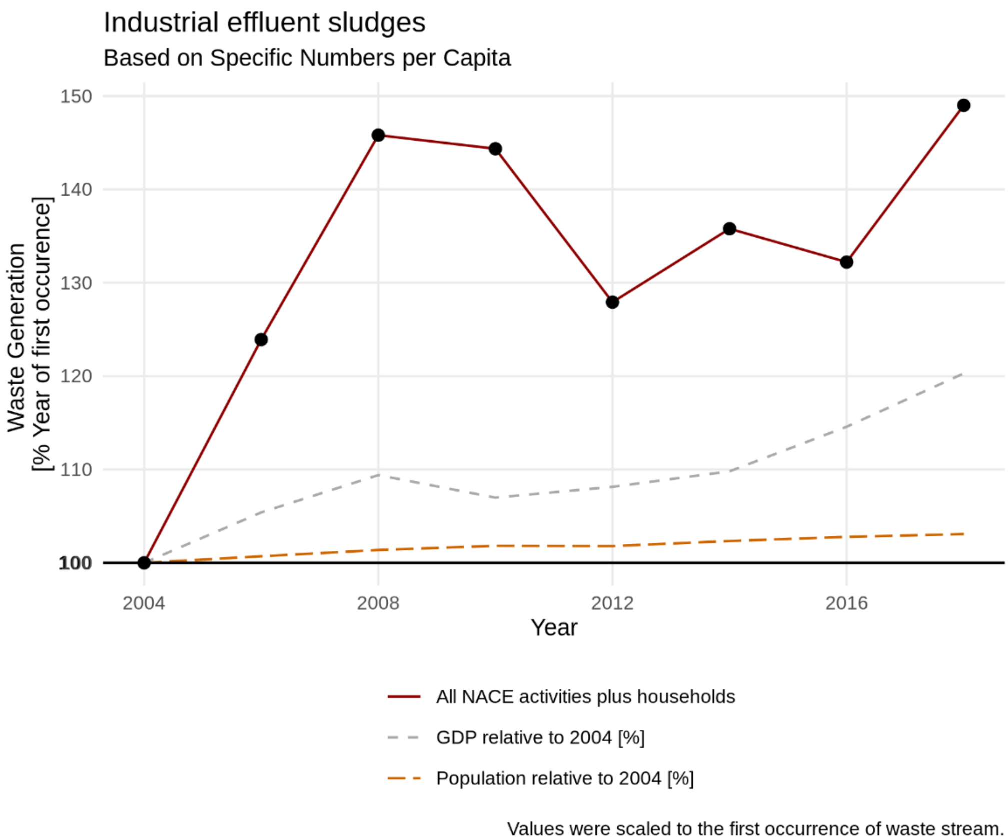
In the observation period 2004 – 2018, the generation of „ Industrial effluent sludges" shows a significant increase from 8.5 million tonnes in 2004 to 13.0 million tonnes in 2018 (+ 4.5 million tonnes). The most intensive increase occurred in the period 2004 – 2008 (+ 4.0 million tonnes) and again from 2016 to 2018 (+ 1.5 million tonnes).

Major generation source for industrial effluent sludges is the economic activity "Water supply; sewerage, waste management and remediation activities", where in 2018, 26 % of the industrial effluent sludges were generated. The trend of this economic activity follows closely the trend of waste generation data reported by Italy contributing to 39 – 78 % of the total EU data of this economic activity within the period 2004 – 2018. The significant drop observed in 2010 is also due to low waste generation reported by Italy for the same year.

Other relevant sources are the economic activities "Manufacture of paper and paper products; printing and reproduction of recorded media", "Manufacture of basic metals and fabricated metal products, except machinery and equipment" and "Manufacture of chemical, pharmaceutical, rubber and plastic products", together responsible for 38 % of the industrial effluent sludges generated in 2018. The peak observed in the economic activity "Manufacture of chemical, pharmaceutical, rubber and plastic products" in the period 2008 to 2010 is caused by the high waste generation reported by Italy for this period.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 46 Decoupling effects on industrial effluent sludges generation in EU-27



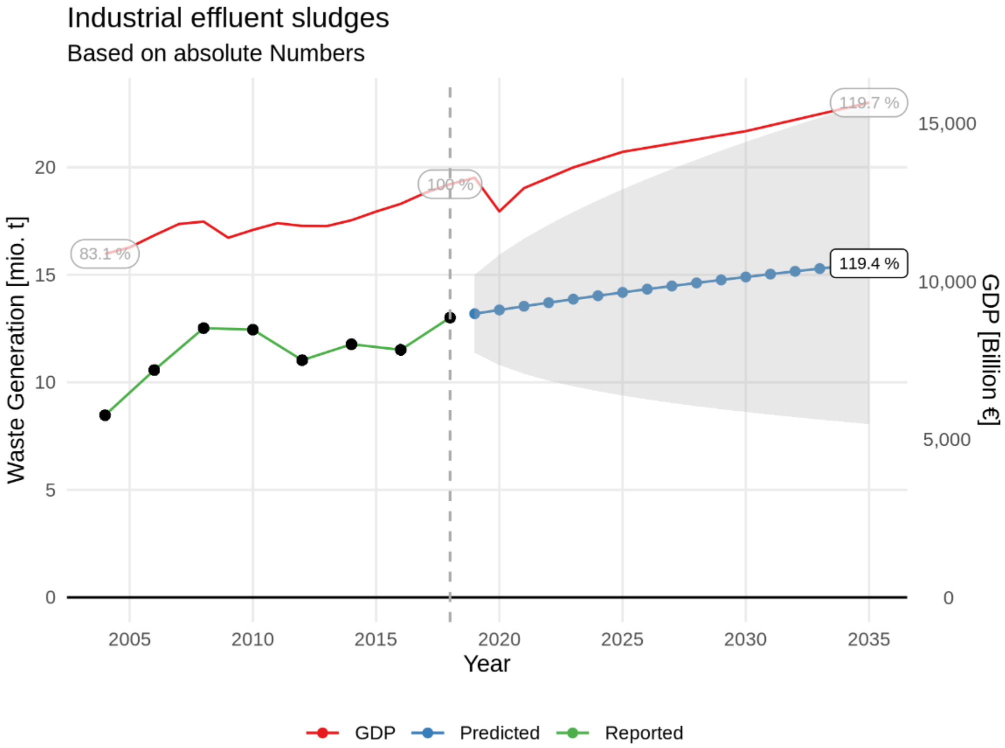

*Source: Eurostat*

In the period 2004 - 2018, the generation of industrial effluent sludges (kg/per capita) increased by 46.5 % (3.32% annually over 14 years, calculated by linear regression), while GDP/capita slightly increased. This indicates no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of industrial effluent sludges.

## Projections (by a linear trend model)

### Figure A - 47 Projections calculated by a linear trend model for industrial effluent sludges generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

The waste category "Industrial effluent sludges" shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 19.4% compared to 2018, respectively 1.1% per year on average.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.16 Health care and biological waste

### Composition of the waste stream

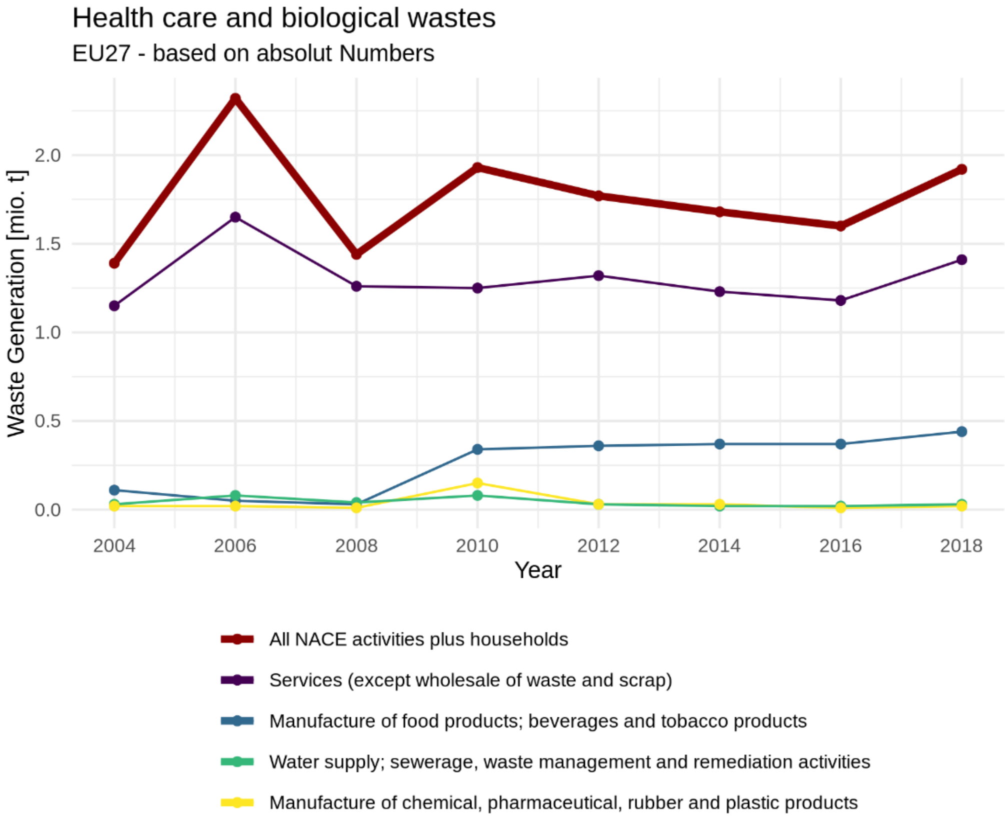
The waste stream "Healthcare and biological waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) comprises only biological waste from healthcare for animals and humans (such as body parts and organs).

It includes sharps from health care, plaster casts, clothing and diapers from hospitals. It does not include chemicals from hospitals and laboratories or off-specification products, like medicines.

Health care and biological waste is hazardous waste when infectious or due to presence of, e.g. cytotoxic and cytostatic drugs. Roughly 60 % of the amount of health care and biological waste generated by the EU-27 in 2018 was hazardous waste.

## Trends in waste generation and major sources

### Figure A - 48 Generation of health care and biological waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of health care and biological waste are displayed), 2004 - 2018




*Source: Eurostat*

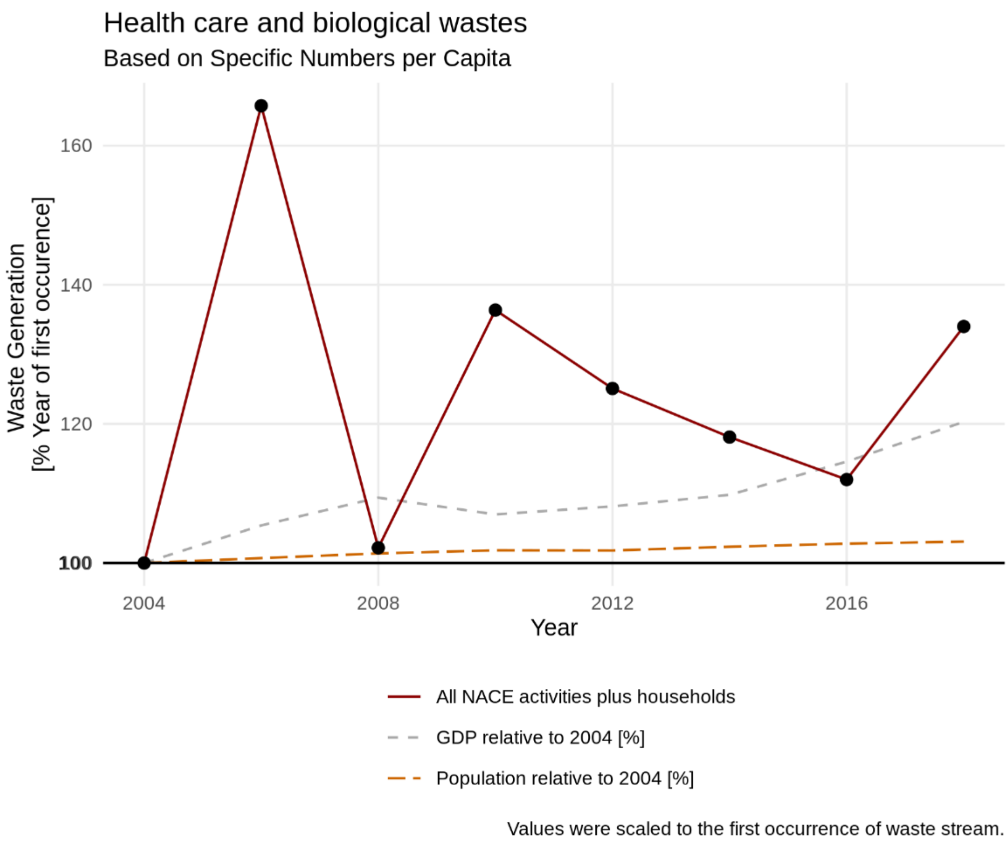
In the observation period 2004 – 2018, the generation of „ Health care and biological waste" shows a slight increase from 1.4 million tonnes in 2004 to 1.9 million tonnes in 2018. A peak occurs in 2006, exceeding by about 0.9 million tonnes the waste generation in 2004 and in 2008. The peak is mainly caused by data reported by Spain, Croatia and Portugal. The significant increase from 2008 to 2010 is caused by an increase of the waste generation reported by France (+ 0.3 million tonnes) in the economic activity "Manufacture of food products; beverages and tobacco products".

This peak is also observed in the major source for healthcare and biological waste generation, i.e. the economic activity "Services (except wholesale of waste and scrap)". In 2018, 73 % of the healthcare and biological waste was generated within this economic activity.

Other relevant sources are the economic activities "Manufacture of food products; beverages and tobacco products", "Water supply; sewerage, waste management and remediation activities", and "Manufacture of chemical, pharmaceutical, rubber and plastic products", together responsible for 26 % of the healthcare and biological waste generated in 2018. The significant increase of the economic activity "Manufacture of food products; beverages and tobacco products" is caused by the high waste generation reported by France, accounting for 91 to 95 % of the EU waste generation within this economic activity in 2010 to 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 49 Decoupling effects on health care and biological waste generation in EU-27



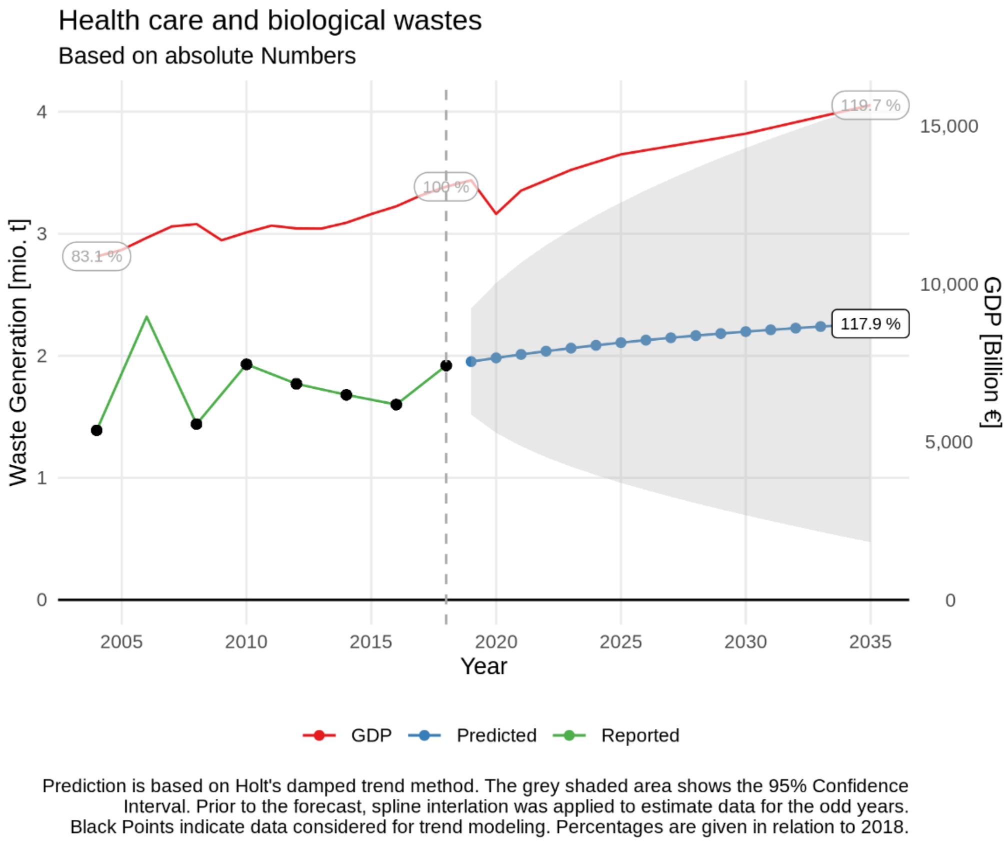

*Source: Eurostat*

In the period 2004 - 2018, the generation of healthcare and biological waste (kg/per capita) increased by 24.4 % (1.74% annually over 14 years, calculated by linear regression), while the GDP/capita increased slightly. This indicates no decoupling from the GDP trend in the period 2004-2018.

Seemingly, the economic crisis year 2008 significantly decreased the generation of health care and biological waste in 2008, which was compensated in the following reporting period. In relation to the entire observation period, the economic crisis year 2008 did not significantly impacted the waste generation of health care and biological waste.

## Projections (by a linear trend model)

### Figure A - 50 Projections calculated by a linear trend model for health care and biological waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

Calculating a projection to 2035 by a linear trend model results in an increase of the "Health care and biological waste" generation by 17.9% compared to 2018, respectively 1.1% per year on average. For this, reported data beginning with 2010 were considered for calculating the projections, as data before show high fluctuations.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

It is noted that the effects of the COVID pandemic on waste generation was not considered during this study, but it is very likely that waste statistics for 2020/21 (which are currently not available), may see a steep increase of health care and biological waste generation.

### A.1.2.17 Mixed and undifferentiated materials

#### Composition of the waste stream

The waste stream "Mixed and undifferentiated materials" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of unspecific waste and mixed waste.

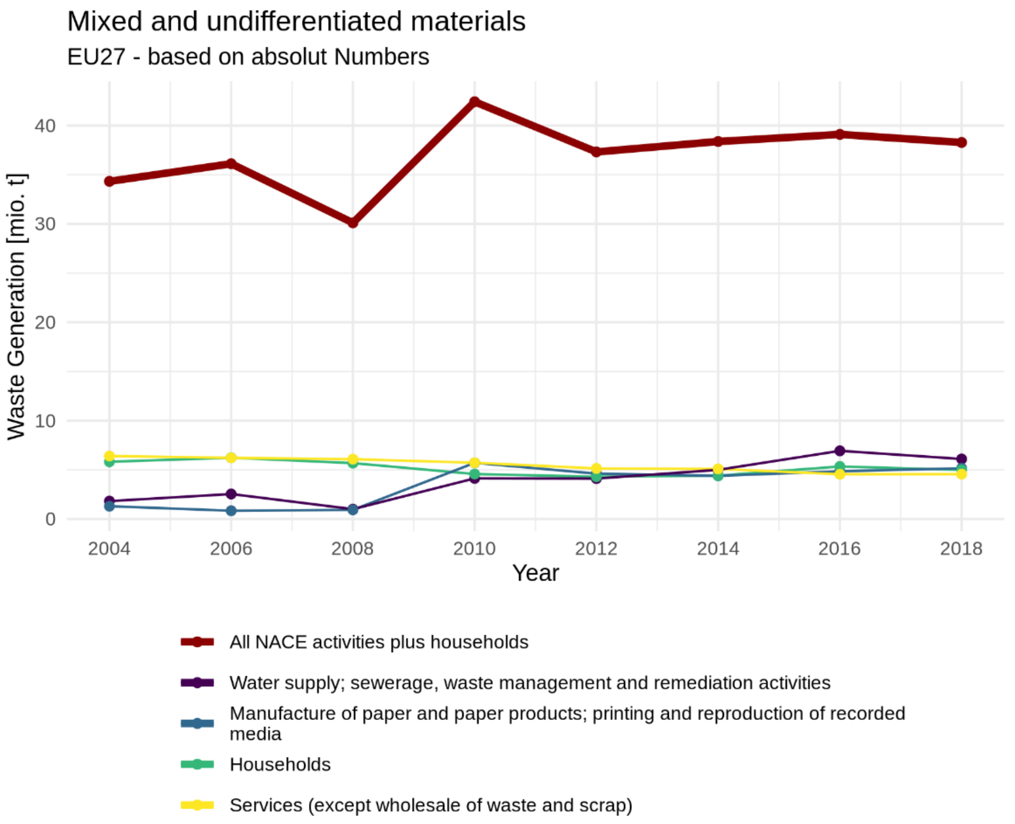
It includes mixed and composite packaging, welding waste, screenings from wastewater treatment, mechanically separated rejects from pulping of waste paper and cardboard, waste from sorting of paper and cardboard, photographic film and paper, waste containing silver from photographic processes, amalgam waste from dental care, cables (containing oil, coal tar and other dangerous substances), metal waste contaminated with dangerous substances. It does not include wood preservatives not otherwise specified, oil waste not otherwise specified, municipal waste not otherwise specified.

Mixed and undifferentiated materials are hazardous waste when containing heavy metals or organic pollutants, e. g. oil. Only 2 % of the amount of mixed and undifferentiated materials generated by the EU-27 in 2018 were hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 51 Generation of mixed and undifferentiated materials (million tonnes), total amount and waste generation by economic activity (absolute**

**amounts for the four major sources of mixed and undifferentiated materials are displayed), 2004 - 2018**




*Source: Eurostat*

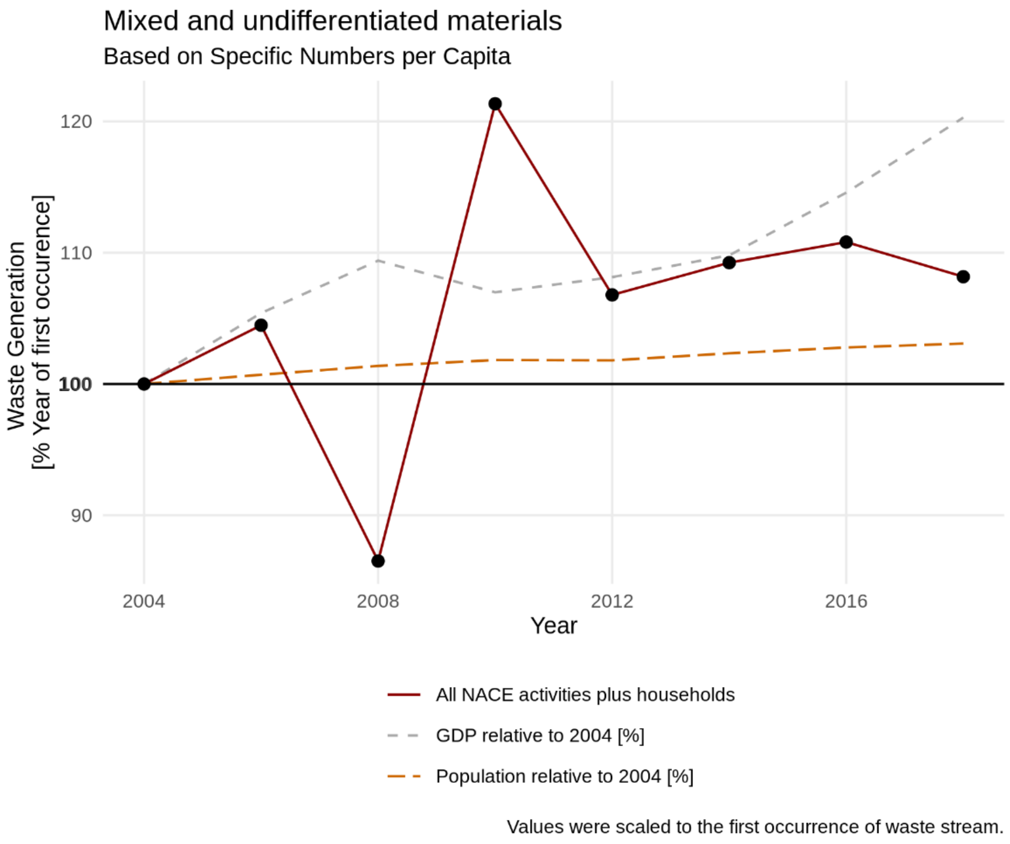
In the observation period 2004 – 2018, the generation of "Mixed and undifferentiated materials" shows an increase from 34.3 million tonnes in 2004 to 38.3 million tonnes in 2018 (+ 4.0 million tonnes). The trend indicates a strong decrease from 2006 to 2008 (- 6.0 million tonnes) as well as from 2010 to 2012 (- 5.1 million tonnes) each, and a strong increase from 2008 to 2010 (+ 12.3 million tonnes).

The strong increase from 2008 to 2010 is also identified in the two major sources for generation of mixed and undifferentiated materials, i.e. the economic activity "Water supply; sewerage, waste management and remediation activities" and "Manufacture of paper and paper products; printing and reproduction of recorded media".

In 2018, 16 % of the mixed and undifferentiated materials were generated by the economic activity "Water supply; sewerage, waste management and remediation activities", and 13 % by "Manufacture of paper and paper products; printing and reproduction of recorded media". Other relevant sources are the economic activities "Households" and "Services (except wholesale of waste and scrap)",together responsible for 25 % of mixed and undifferentiated materials generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 52 Decoupling effects on mixed and undifferentiated materials generation in EU-27



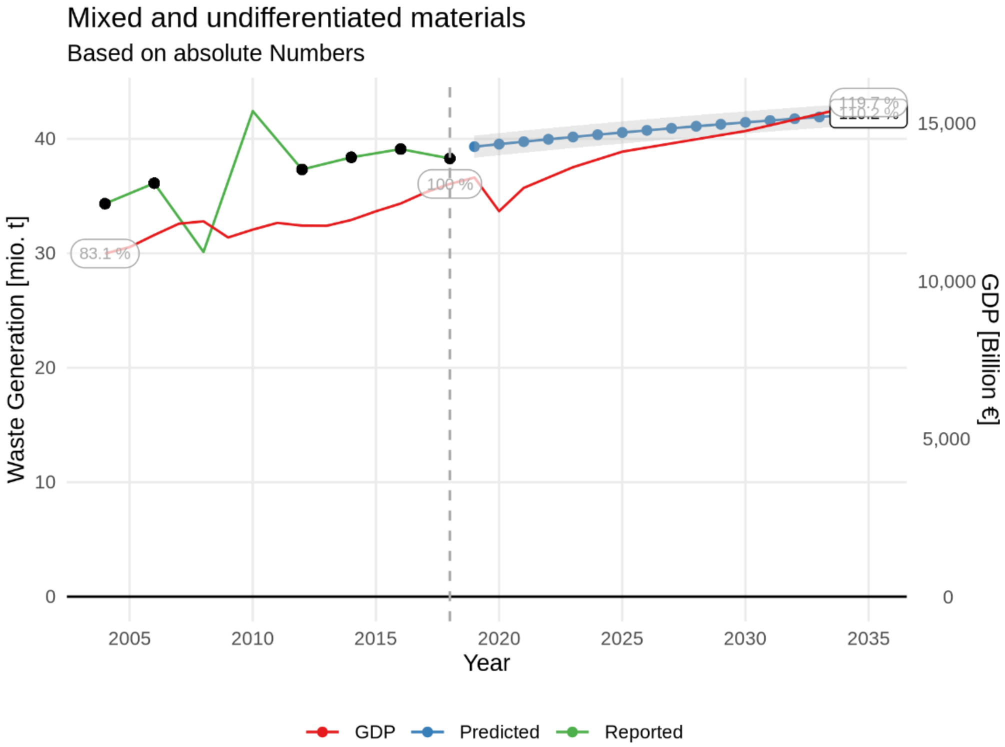

*Source: Eurostat*

In the period 2004 - 2018, the generation of mixed and undifferentiated materials (kg/per capita) increased by about 11.9% (0.85% annually over 14 years, calculated by linear regression), while GDP/capita increased slightly. This shows a relative decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of mixed and undifferentiated materials.

## Projections (by a linear trend model)

### Figure A - 53 Projections calculated by a linear trend model for mixed and undifferentiated materials generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

The waste category "Mixed and undifferentiated materials" shows a relative decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 10,2% compared to 2018, respectively 0.6% per year on average.

The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.18 Animal and mixed food waste

### Composition of the waste stream

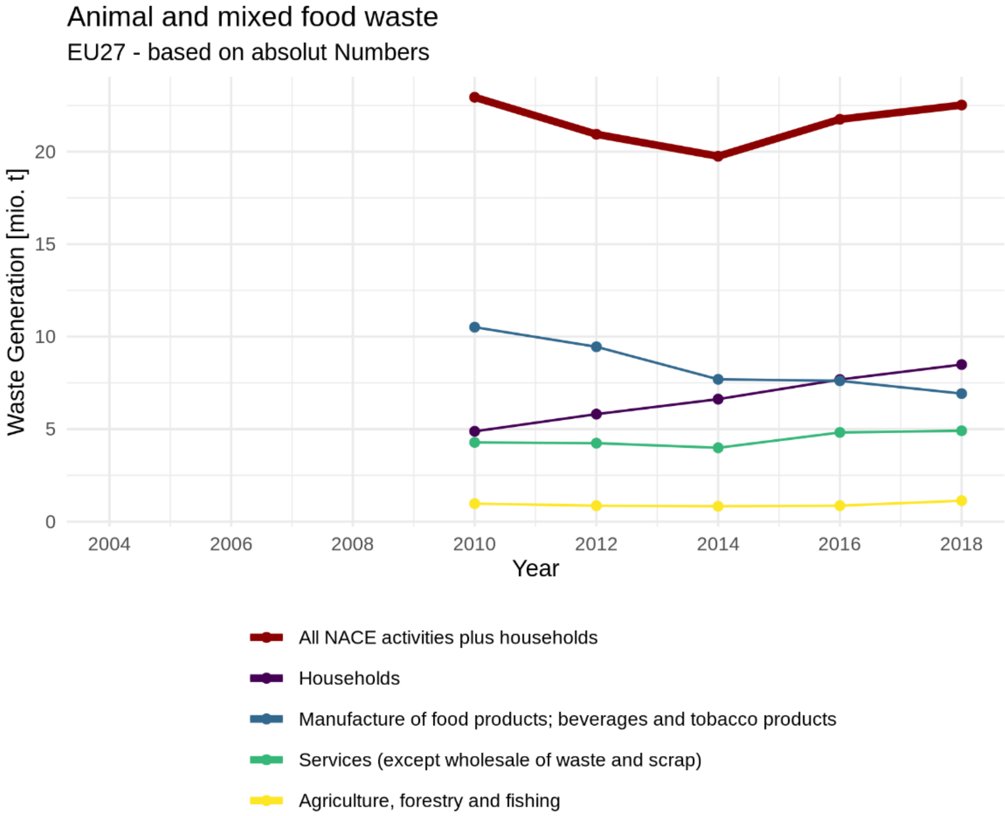
The waste stream "Animal and mixed food waste" (as defined in Section 2 –Waste Categories of the EU Waste Statistics Regulation) is composed of animal waste from food preparation and products (including sludge from washing and cleaning) as well as mixed waste from food preparation and products (including biodegradable kitchen/canteen waste; edible oils and fats).

It includes waste from preserving agents. It does not include vegetal waste of food preparation and products, animal waste from leather processing (e.g. fleshings and lime split waste) or sludge from on-site effluent treatment from food preparation/processing.

Animal and mixed food waste from food preparation and products is non-hazardous.

## Trends in waste generation and major sources

### Figure A - 54 Generation of animal and mixed food waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of animal and mixed food waste are displayed), 2010 - 2018




*Source: Eurostat*

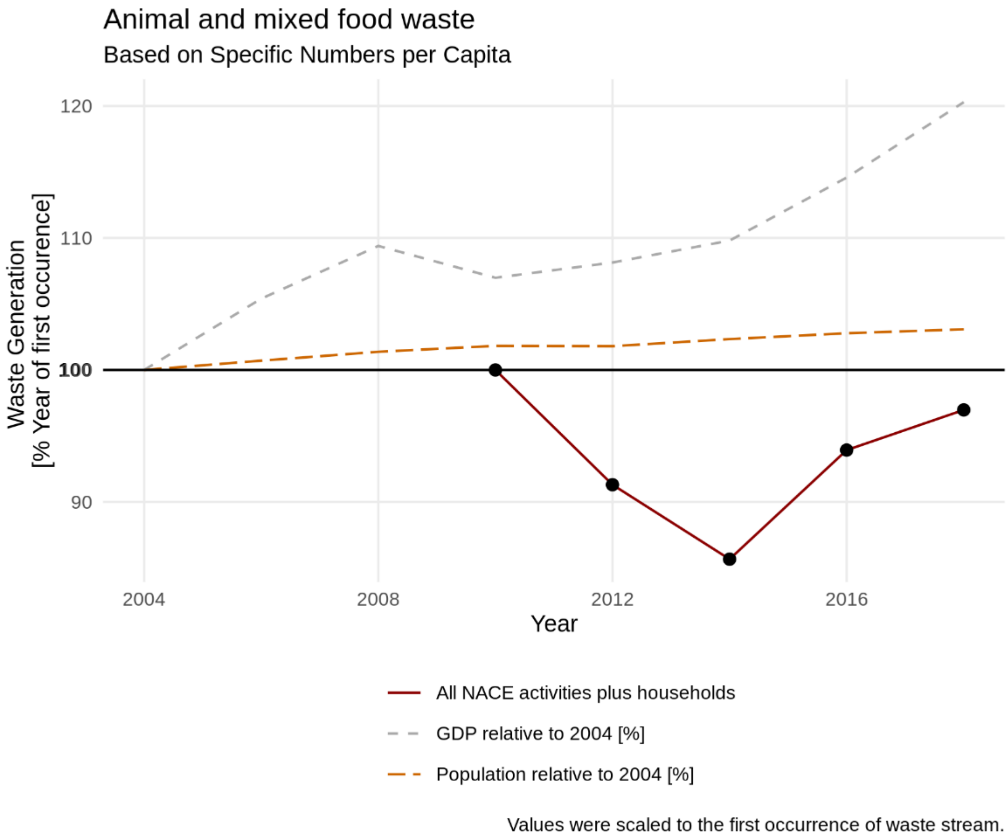
In the observation period 2010 – 2018, the generation of "Animal and mixed food waste" shows a slight decrease from 22.9 million tonnes in 2010 to 22.5 million tonnes in 2018 (- 0.4 million tonnes). The trend indicates a decrease in the period 2010 to 2014 (-3.2 million tonnes), most likely caused by a strong decrease within the economic activity "Manufacture of food products; beverages and tobacco products". In the period 2014 to 2018, an increase can be observed (+ 2.8 million tonnes), most likely caused by a strong increase within the economic activity "Households".

Major source for animal and mixed food waste generation is the economic activity "Household", indicating a continuously increasing trend since 2010, and responsible for 38 % of the animal and mixed food waste generated in 2018.

Other relevant sources are the economic activities "Manufacture of food products; beverages and tobacco products", "Services (except wholesale of waste and scrap)" and "Agriculture, forestry and fishing", together responsible 56 % of the animal and mixed food waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 55 Decoupling effects on animal and mixed food waste generation in EU-27

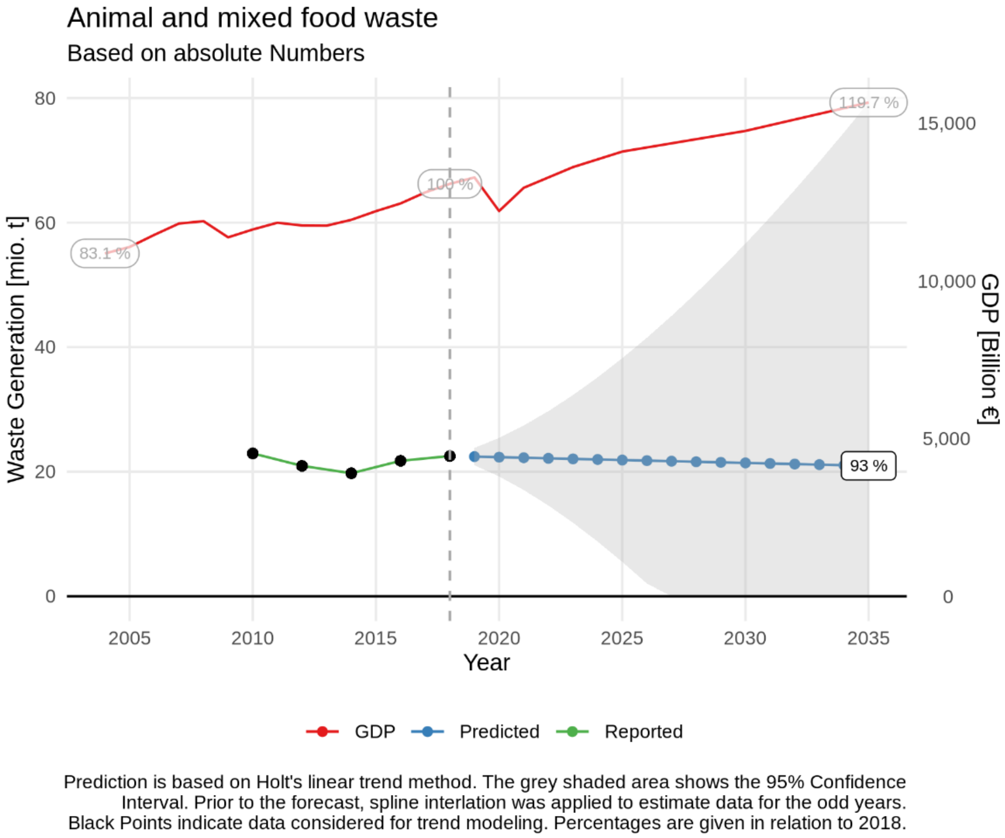



*Source: Eurostat*

In the period 2010 - 2018, the animal and mixed food waste generation (kg/per capita) decreased by about -7.1% (-0.71% annually over 8 years, calculated by linear regression), while the GDP/capita increased slightly. This indicates an absolute decoupling from the GDP trend in the period 2010-2018.

## Projections (by a linear trend model)

### Figure A - 56 Projections calculated by a linear trend model for animal and mixed food waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "Animal and mixed food waste" shows an absolute decoupling from the GDP trend in the period from 2010 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -7.0% in 2035 compared to 2018, respectively -0.4% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.19 Chemical waste

### Composition of the waste stream

The waste stream "Chemical waste" (as defined in Section 2 –Waste Categories of the EU Waste Statistics Regulation) is composed of spent chemical catalysts (used for flue and exhaust gas cleaning in the chemical and petrol industry), chemical preparation waste (including off-specification products and waste, such as agrochemicals, medicines, paint, dyestuff, pigments, varnish, inks and adhesives, including related sludges; preservatives, brake and antifreeze fluids, waste chemicals, unused explosives and waste ammunition, mixed chemicals from laboratories and chemical waste mixed for treatment) and a wide variety of other chemical waste (e.g. chemical deposits and residues, chemical reaction residues as well as spent filtration and absorbent materials).

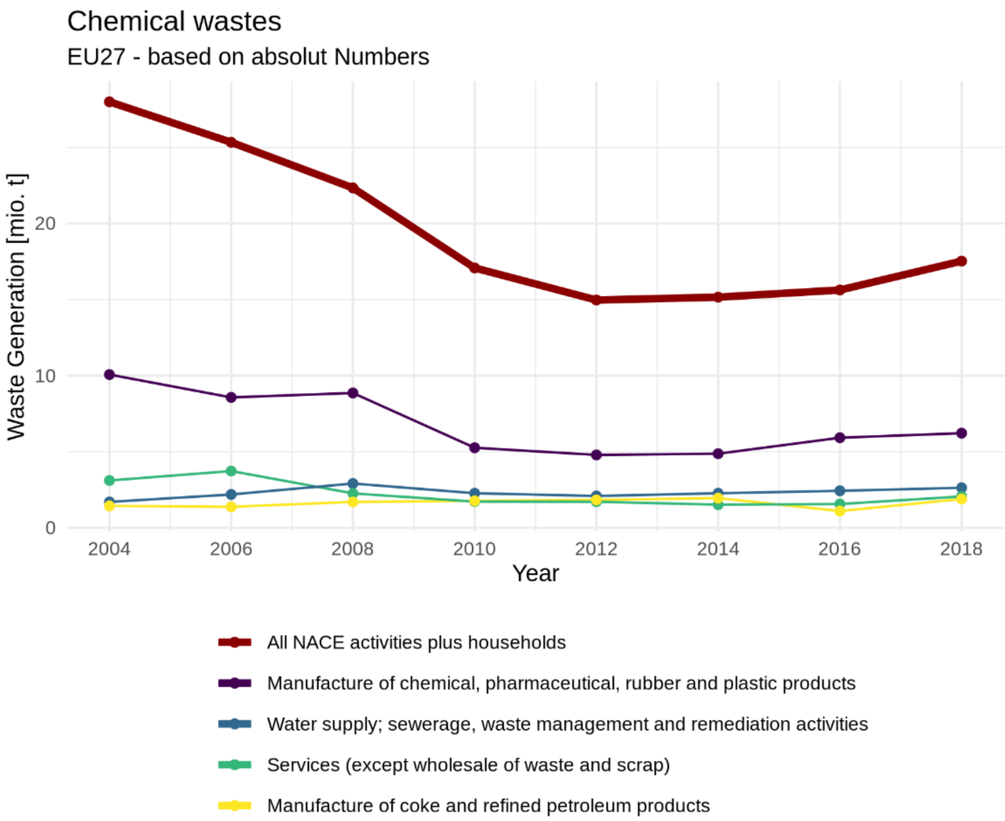
It includes gases in pressure containers, mixed photo-chemicals, contaminated packaging material, waste containing mercury, ion exchange resins, waste binders from casting, waste printing toner and detergents.

It does not include amalgam waste, organic solvents, acid, alkaline and salt, motor oil, developer and fixer solutions, waste contaminated, ion exchange resins from waste water treatment except from chemical surface treatment and bio-chemical catalysts, as these are considered within other waste categories.

Roughly 70 % of the amount of chemical waste generated by the EU-27 in 2018 were hazardous waste.

## Trends in waste generation and major sources

### Figure A - 57 Generation of chemical waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of chemical waste are displayed), 2004 - 2018




*Source: Eurostat*

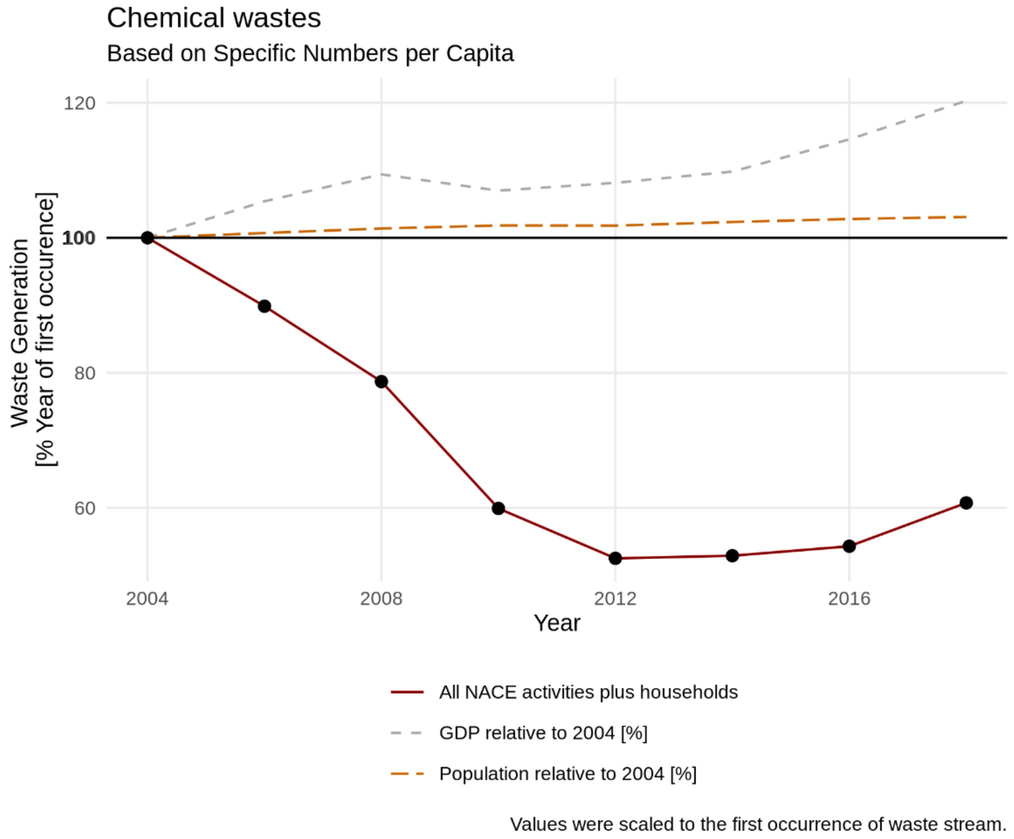
In the observation period 2004 – 2018, the „chemical waste" generation indicates a significant decrease from 28.0 million tonnes in 2004 to 17.5 million tonnes in 2018 (- 10.5 million tonnes). The time series show that the decrease occurred in the period 2004 – 2012, while since 2012 a slight increase of the chemical waste generation in the EU-27 can be observed. The most significant decrease is observed in 2008 – 2010 (- 5.3 million tonnes).

Major source for generation of chemical waste is the economic activity "Manufacture of chemical, pharmaceutical, rubber and plastic products", responsible for 35 % of the chemical waste generated in 2018. Regarding also the total chemical waste generation, this economic activity indicated a significant decrease in the period 2004 – 2012, followed by a slight increase.

Other relevant sources are the economic activities "Water supply; sewerage, waste management and remediation activities", "Services (except wholesale of waste and scrap)" and "Manufacture of coke and refined petroleum products", together responsible for 38 % of the chemical waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

**Figure A - 58 Decoupling effects on chemical waste generation in EU-27**




*Source: Eurostat*

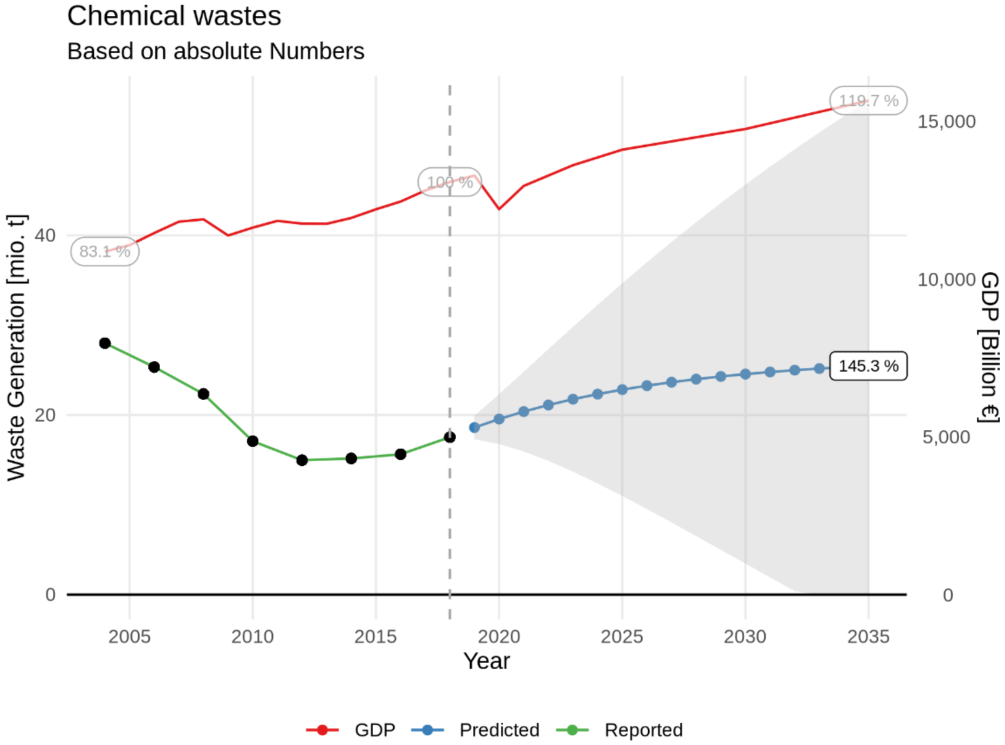
In the period 2004 - 2018, the chemical waste generation (kg/per capita) decreased significantly by roughly -53.8% (-3.84% annually over 14 years, calculated by linear regression), while the GDP/capita and population slightly increased, indicating full decoupling from the GDP trend.

Between 2016 and 2018, an increase by 10% of the per-capita waste generation can be observed; future years will confirm or not a trend reversal.

Seemingly, the economic crisis of the year 2008 entailed a decrease in the chemical waste generation in the period 2008 – 2009.

## Projections (by a linear trend model)

### Figure A - 59 Projections calculated by a linear trend model for chemical waste generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

The category “chemical waste” shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 45.3% in 2035 compared to 2018, respectively 2.6% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.20 Animal faeces, urine and manure

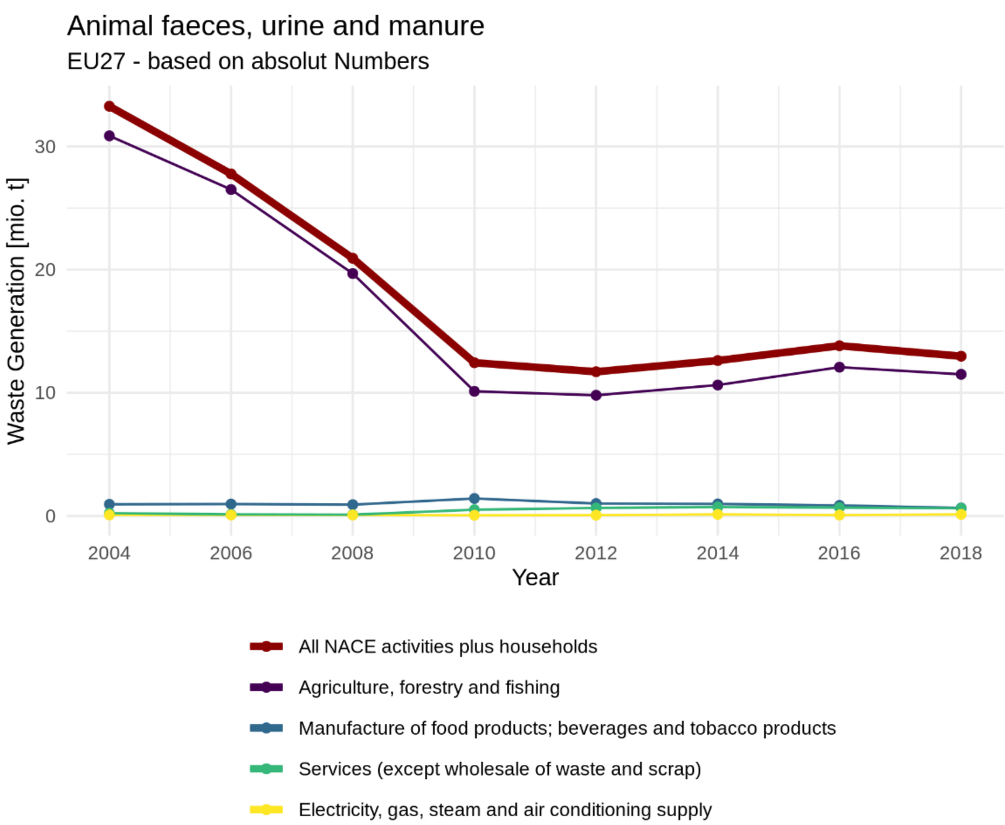
#### Composition of the waste stream

The waste stream "Animal faeces, urine and manure" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of slurry and manure including spoiled straw. It includes effluents collected separately and treated off-site. It does not include effluents treated on-site.

Animal faeces, urine and manure are non-hazardous.

#### Trends in waste generation and major sources

#### Figure A - 60 Generation of animal faeces, urine and manure (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of animal faeces, urine and manure are displayed), 2004 - 2018




*Source: Eurostat*

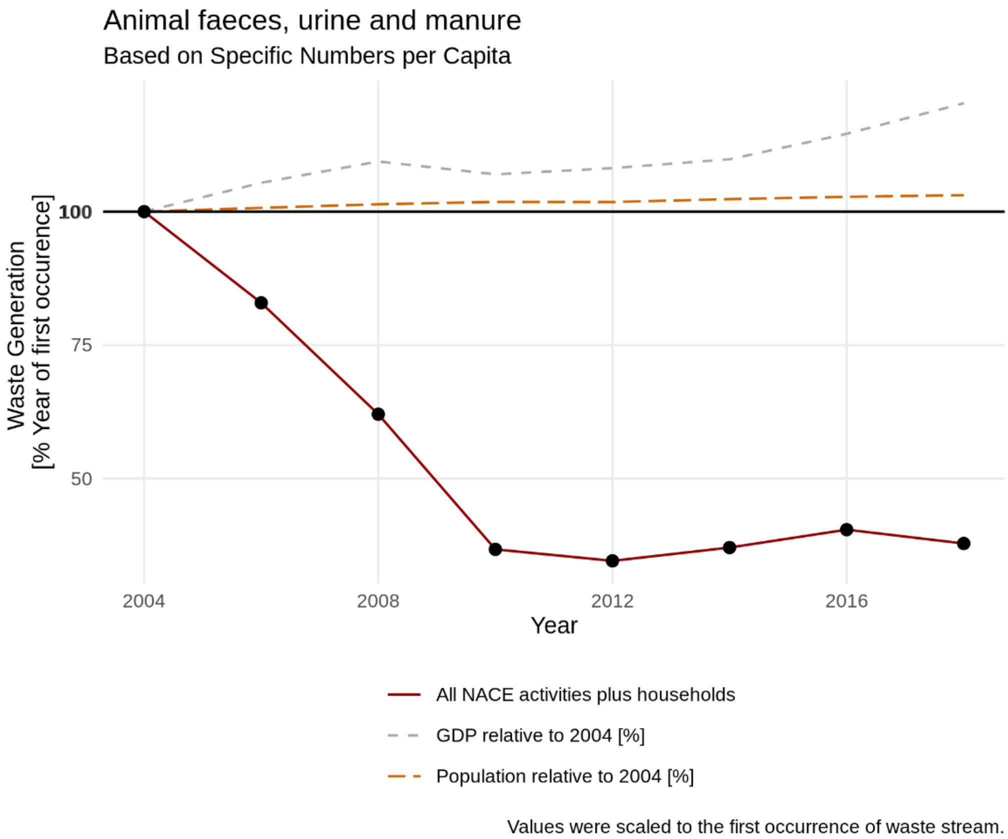
In the observation period 2004 – 2018, the generation of "Animal faeces, urine and manure" shows a significant decrease from 33.3 million tonnes in 2004 to 13.0 million tonnes in 2018 (- 20.3 million tonnes). The most intensive and nearly entire decrease occurred in the period 2004 to 2010 (- 20.8 million tonnes), while in the period 2010 to 2018, the trend proved to be rather stable,  despite a slight increase between 2012 and 2016. The strong decrease in the period 2004 to 2010 is caused by high waste generation reported by Spain, Greece and Romania.

The trend of animal faeces, urine and manure generation is closely related to the trend of the major source for its generation, i.e. the economic activity "Agriculture, forestry and fishing". In 2018, 87 % of the animal faeces, urine and manure were generated within this economic activity.

Other relevant sources are the economic activities "Manufacture of food products; beverages and tobacco products", "Services (except wholesale of waste and scrap)" and "Electricity, gas, steam and air conditioning supply", together responsible for 11 % of the animal faeces, urine and manure generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

#### Figure A - 61 Decoupling effects on animal faeces, urine and manure generation in EU-27



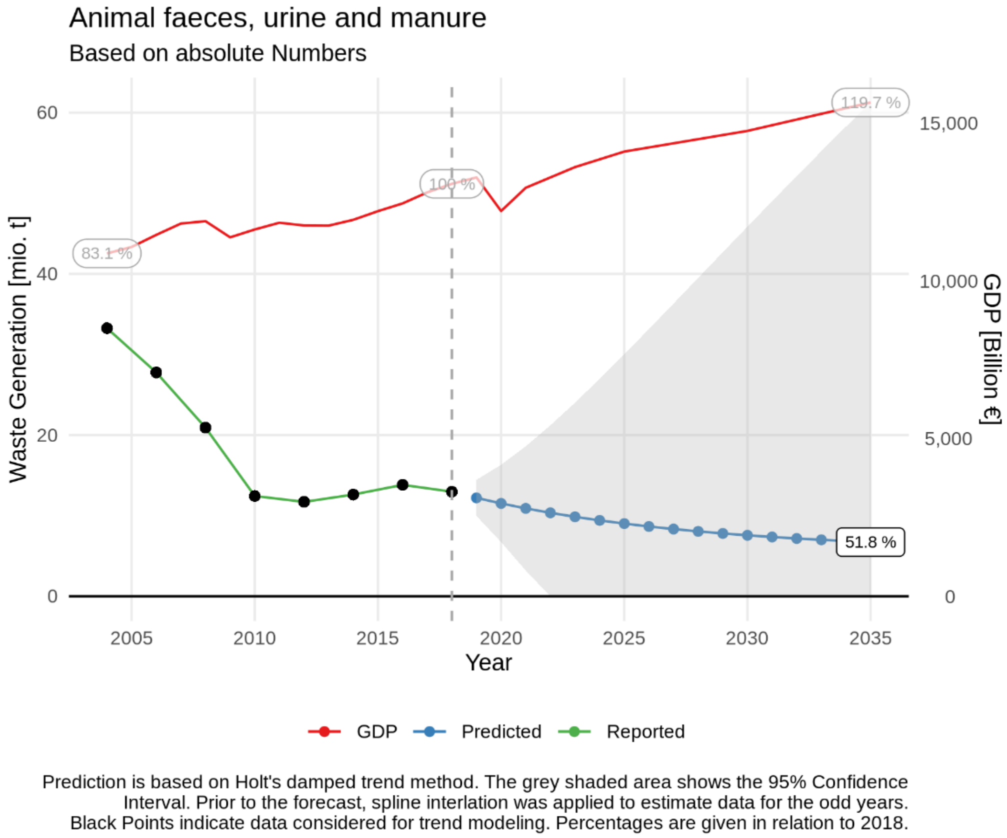

*Source: Eurostat*

In the period 2004 - 2018, the generation of “animal faeces, urine and manure” (kg/per capita) decreased significantly by about -76.2 % (-5.44% annually over 14 years, calculated by linear regression), while the GDP/capita increased, an absolute decoupling from the GDP trend could be observed.

Due to the strong decrease in animal faeces, urine and manure generation, starting already in 2004, an effect of the economic crisis year 2008 on the trend of waste generation is hardly noticeable.

## Projections (by a linear trend model)

### Figure A - 62 Projections calculated by a linear trend model for animal faeces, urine and manure generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category “animal faeces, urine and manure” shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -48.2% in 2035 compared to 2018, respectively -2.8% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.21 Acid, alkaline or saline waste

#### Composition of the waste stream

The waste stream “Acid, alkaline or saline waste” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) includes inorganic acids (e.g. hydrochloride-, sulphuric-, phosphoric-, nitric-acids), alkaline (e.g. calcium-, ammonium-, sodium-hydroxide) and inorganic salts mainly from the manufacturing of acids or alkaline and salt slags or solid salts.

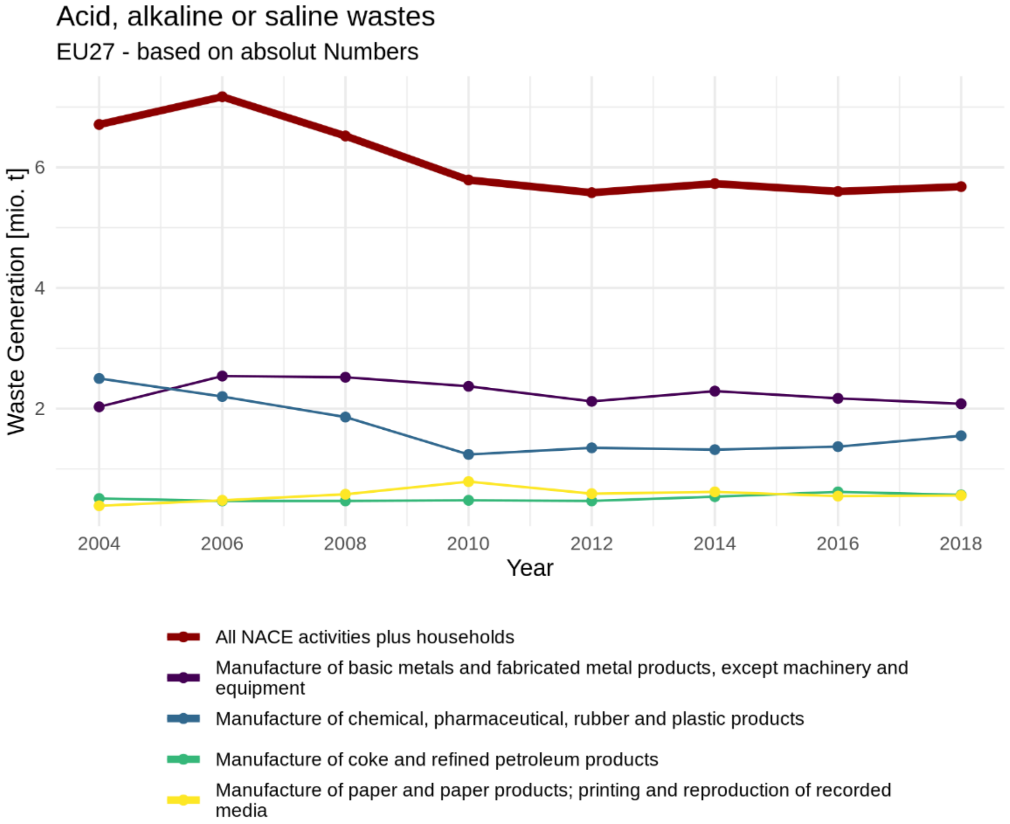
It includes bleach and fixer solutions, etching solutions; developer solution, water-based degreasing liquids, lime mud, metallic oxides, flux and saline waste from hydrometallurgical processes and hot galvanising. It does not include tanning liquors, green liquors, oil containing acids, acid tars, aqueous washing liquids and mother liquors and desalted sludges considered within other waste categories.

In general, acids and alkalis are hazardous waste except lime mud and degreasing waste without hazardous substances (like oil, heavy metals or cyanides). Saline waste is hazardous when containing hazardous substances, such as heavy metals, arsenic or mineral oil. Roughly 50 % of the amount of acid, alkaline or saline waste generated by the EU-27 in 2018 were hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 63 Generation of Acid, alkaline or saline waste (million tonnes), total amount and waste generation by economic activity (absolute amounts**

**for the four major sources of Acid, alkaline or saline waste are displayed), 2004 - 2018**




*Source: Eurostat*

The overall generation of „Acid, alkaline or saline waste" shows a decrease from 6.7 million tonnes in 2004 to 5.7 million tonnes in 2018 (-1.0 million tonnes).

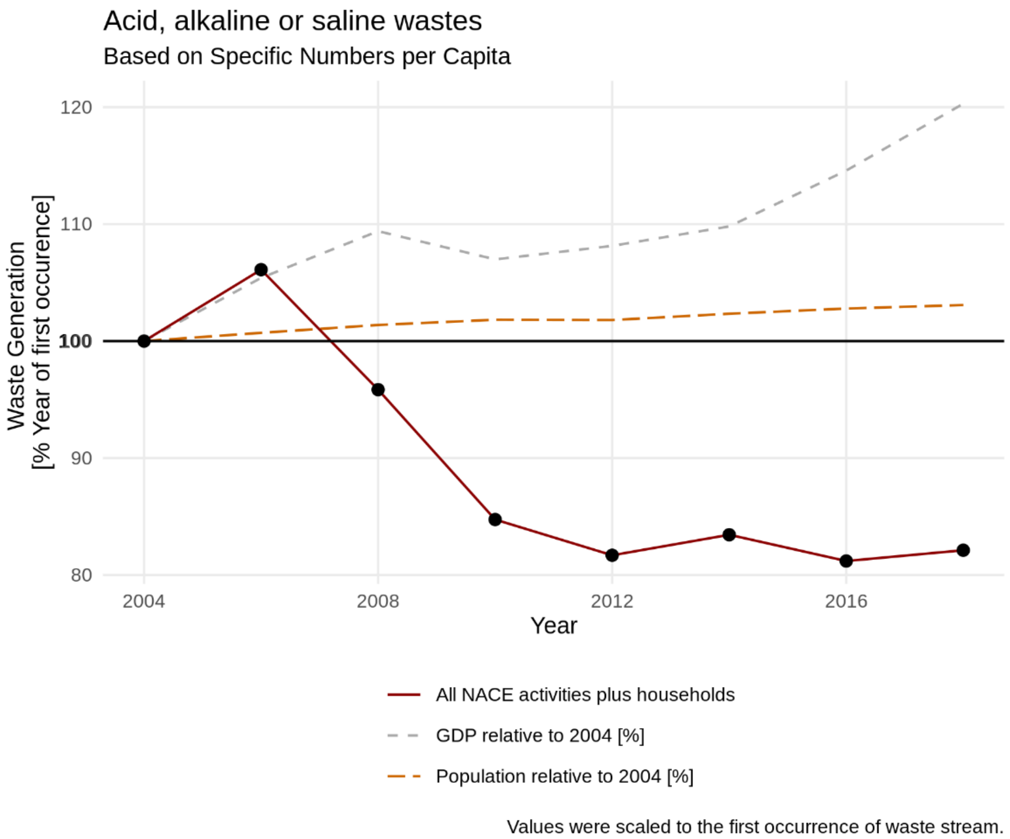
Major sources for the acid, alkaline or saline waste generation are the economic activities "Manufacture of basic metals and fabricated metal products, except machinery and equipment" and "Manufacture of chemical, pharmaceutical, rubber and plastic products", responsible for 37 %, respectively 27 %, of the acid, alkaline or saline waste generated in 2018.

Waste generation within the economic activity "Manufacture of chemical, pharmaceutical, rubber and plastic products" indicated a significant decrease in the period 2004 -2010 (- 50 %), followed by a slight increase in 2010 -2018 (+ 25 %).

Other relevant sources for generation of acid, alkaline or saline waste are the economic activities "Manufacture of coke and refined petroleum products" and "Manufacture of paper and paper products; printing and reproduction of recorded media", together responsible for 20 % of the acid, alkaline or saline waste generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 64 Decoupling effects on acid, alkaline or saline waste generation in EU-27



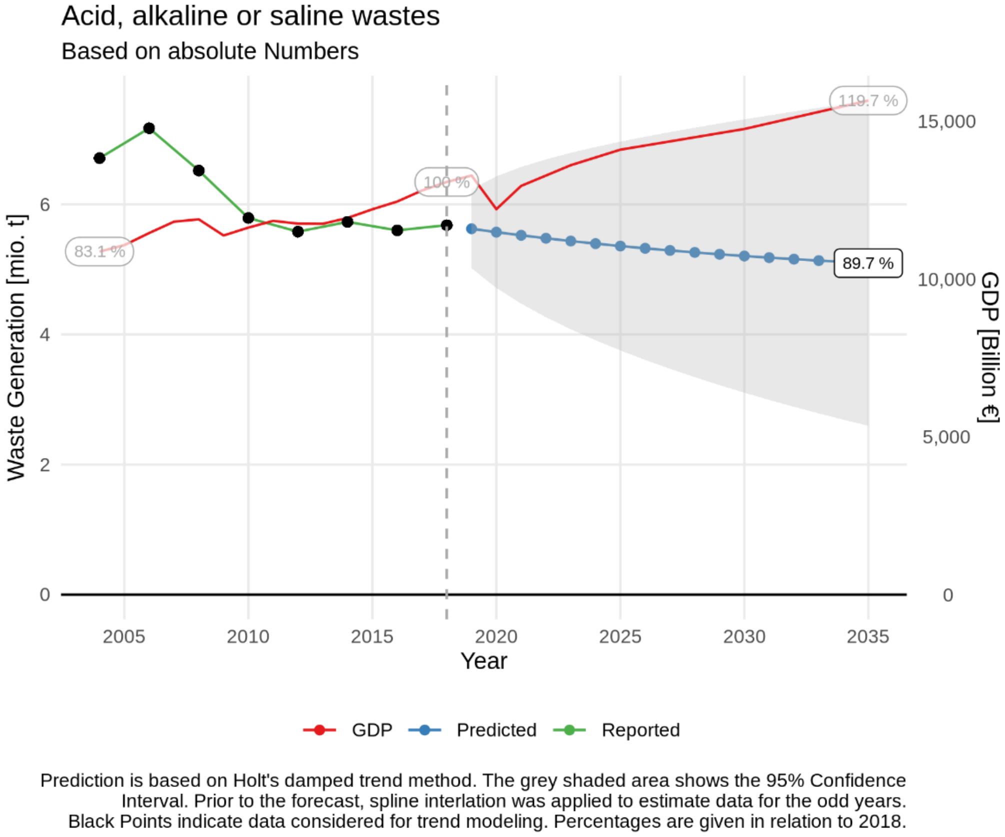

*Source: Eurostat*

In the period 2004 - 2018, the generation of “acid, alkaline or saline waste” (kg/per capita) decreased significantly by about -22.7 % (-1.62% annually over 14 years, calculated by linear regression), while the GDP/capita increased, indicating an absolute decoupling from the GDP trend.

Seemingly, the economic crisis year 2008 did not evoke a significant effect on waste generation of acid, alkaline or saline waste.

## Projections (by a linear trend model)

### Figure A - 65 Projections calculated by a linear trend model for acid, alkaline or saline waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The category "acid, alkaline or saline waste" shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -10.3% in 2035 compared to 2018, respectively -0.6% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.22 Used oils

### Composition of the waste stream

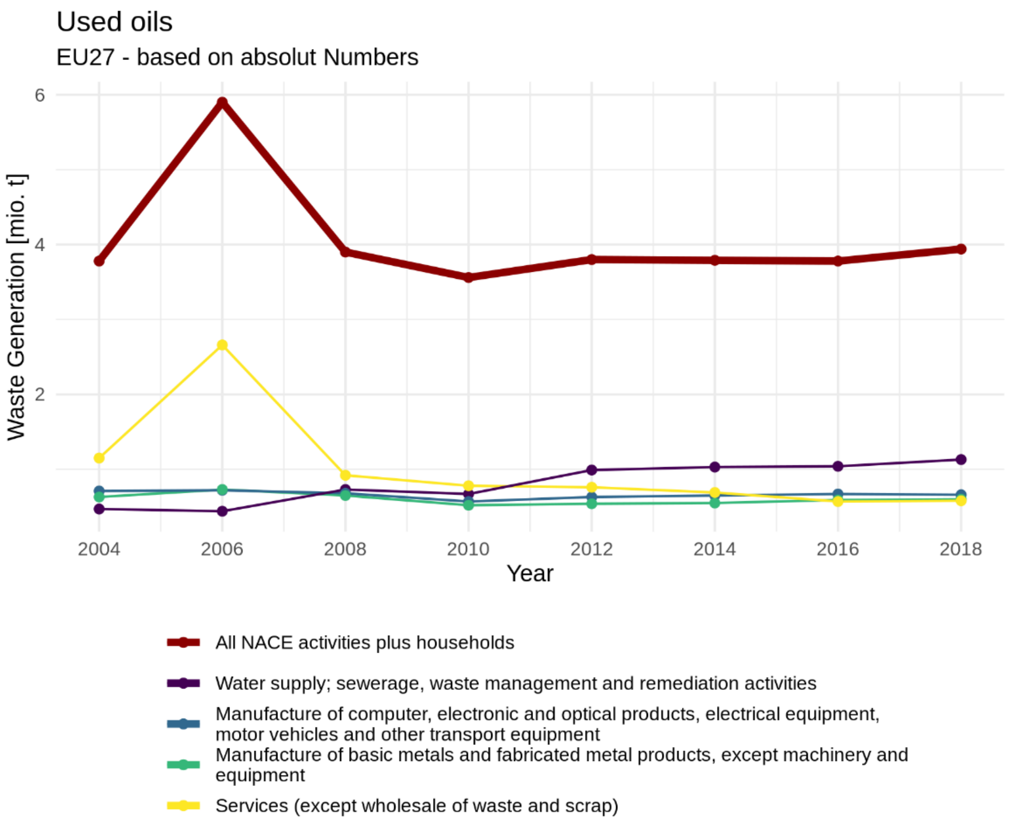
The waste stream "Used oils" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of mineral-based, synthetic oils and biodegradable engine oils. It comprises engine, gear, hydraulic and lubricating oils, oils for insulation and heat transmission as well as emulsions from metal surface shaping and residues from tank cleaning.

It includes oil from oil/water separators, disperse and rosin oil, fat and wax from mechanical engineering and metal sludge (grinding, honing and lapping sludge) containing oil. It does not include bilge oils, edible oils and fats, liquid fuels, oil-containing drilling mud and waste, oily sludges, waste from cooling-water treatment containing oil and concentrates from separation.

The waste stream is composed entirely of hazardous waste types.

## Trends in waste generation and major sources

### Figure A - 66 Generation of used oils (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of used oils are displayed), 2004 - 2018




*Source: Eurostat*

The overall generation of „Used oils" indicates a slight increase from 3.8 million tonnes in 2004 to 3.9 million tonnes in 2018 (+ 0.2 million tonnes).

The peak in 2006 reflects the high amounts of used oils reported by Portugal for the same year, originating from the economic activity "Services (except wholesale of waste and scrap)” (Portugal reported within this economic activity 1.58 t in 2012, compared to roughly 0.02 tonnes in 2004 -2006 and 2010 – 2018). Data for total used oil generation exceeds by about 2 million tonnes the waste generation in 2004 and 2008. The amount of used oil waste in 2008 might be regarded as a statistical outlier.

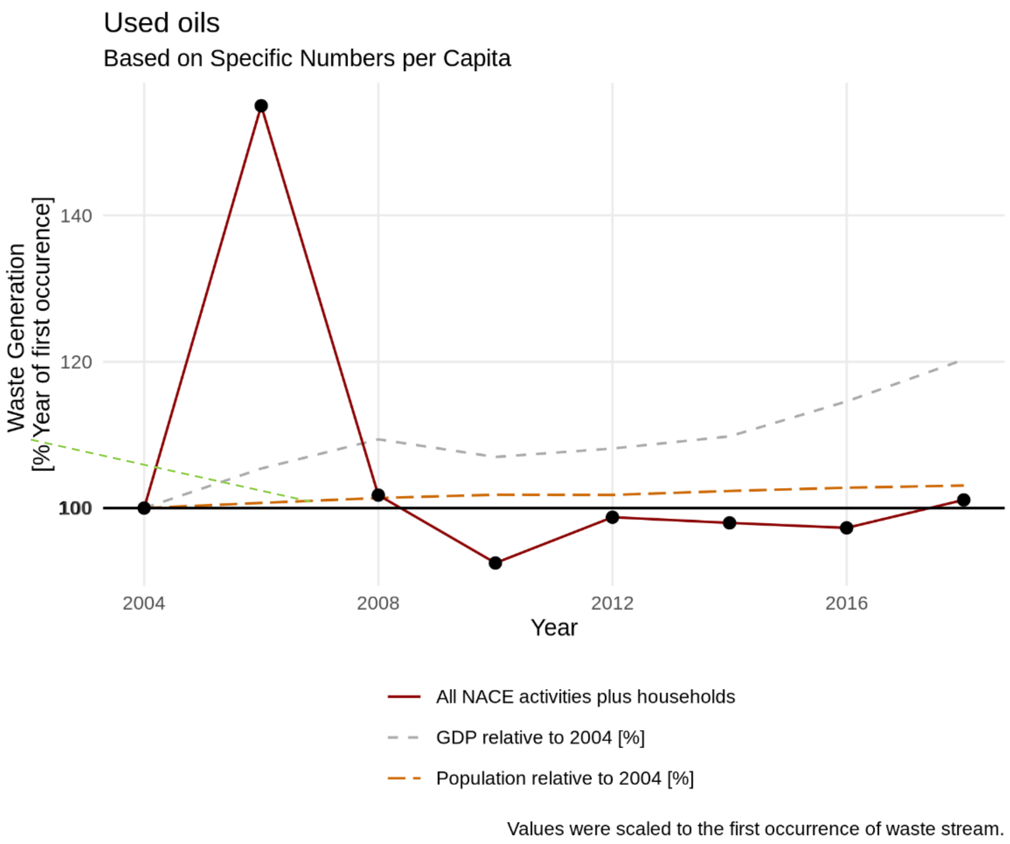
Major source for the used oils generation is the economic activity “Water supply; sewerage, waste management and remediation activities”, responsible for 29 % of the used oils generated in 2018.

Other relevant sources are the economic activities “Manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment”, “Manufacture of basic metals and fabricated metal products, except machinery and equipment” and “Services (except wholesale of waste and scrap)”, together responsible for 47 % of the used oils generated in 2018.

The economic activity “Services (except wholesale of waste and scrap)” halved the generation of used oil in the period 2004 -2018, but this decrease was compensated by an increase of the used oils generation in “Waste collection, treatment and disposal activities; materials recovery”. This shift is observed in the majority of the Member States, notably in the 4 Member States generating 2/3 of the used oil waste.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 67 Decoupling effects on used oils generation in EU-27



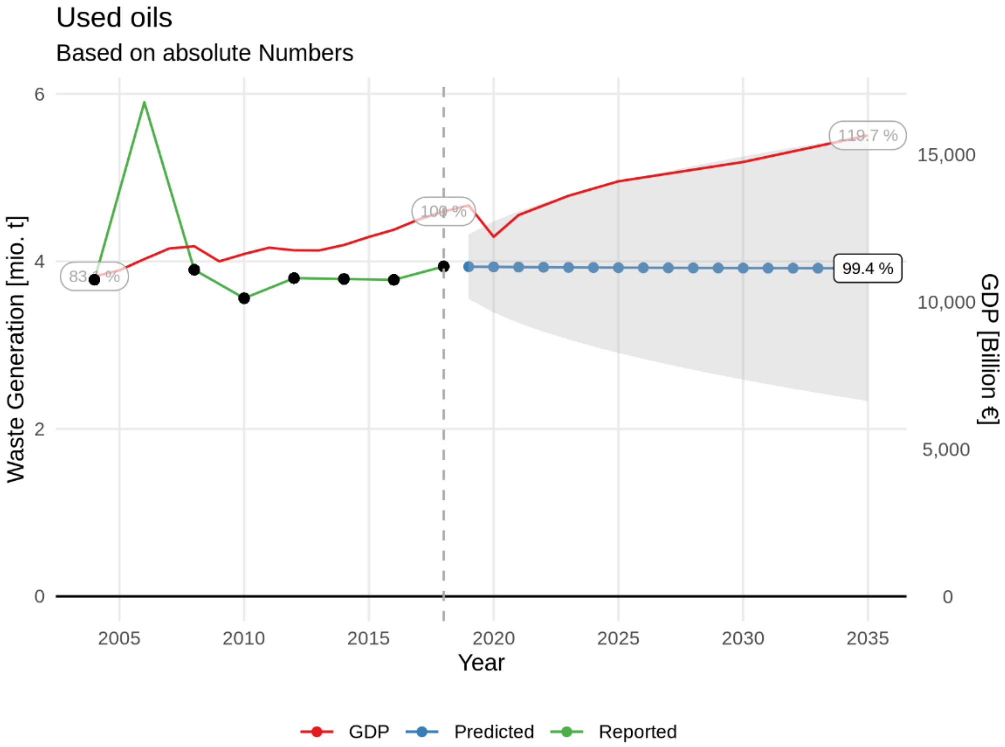

*Source: Eurostat*

In the period 2004 - 2018, the generation of “used oils” (kg/per capita) decreased by about -6.4 % (-0.46% annually over 14 years, calculated by linear regression), while an increase of the GDP/capita occurred, indicating an absolute decoupling from the GDP trend.

Seemingly, the economic crisis year 2008 lead to an abrupt decrease in the used oil generation in 2009, which was compensated in the following reporting period. In relation to the entire observation period, the economic crisis year 2008 did not significant impacted the used oils generation.

## Projections (by a linear trend model)

### Figure A - 68 Projections calculated by a linear trend model for used oils generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

The waste category “used oils” shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -0.6% in 2035 compared to 2018. The reported data from 2006 were not considered for calculating the projections, as those indicate a significant peak for one Member State only.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.23 Spent solvents

### Composition of the waste stream

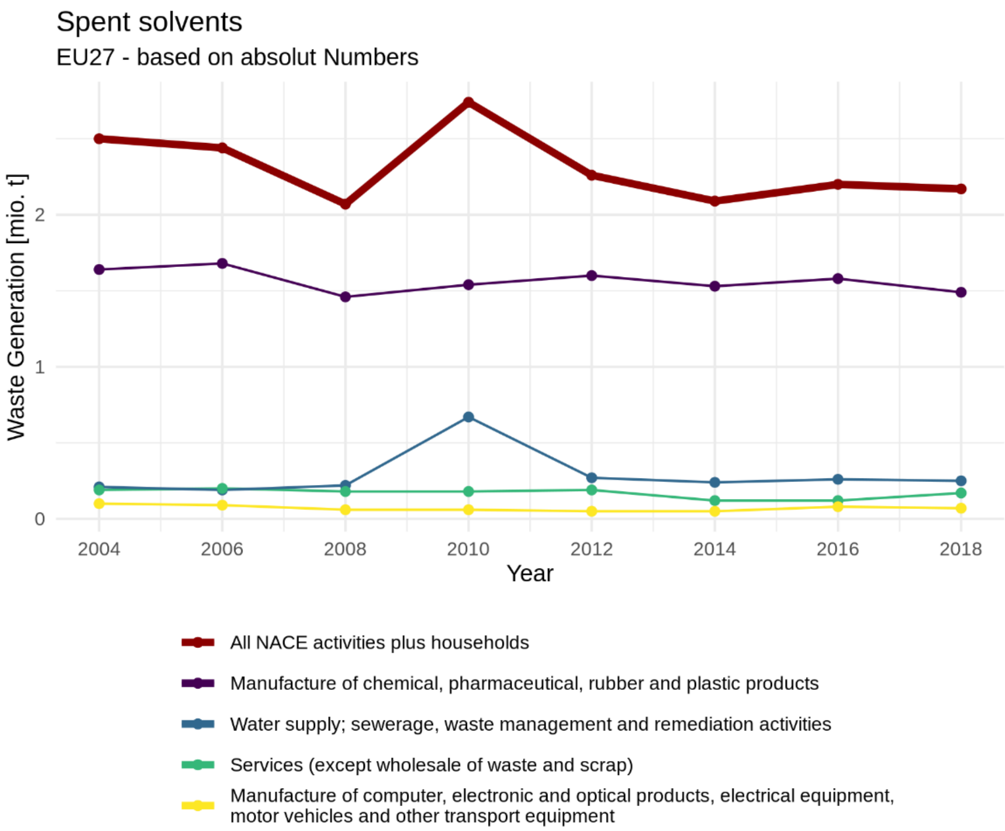
The waste stream “Spent solvents” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of hydrocarbons, fluoro-carbons, chlorinated hydrocarbons, organic solvents (halogenated and non-halogenated), including organic washing liquids, organic mother liquors, and organic fluorinated refrigerants.

It includes organic solvents from the separate collection (e.g. households) as well as sludges and solid waste containing organic solvents. It does not include water-based solvents, washing liquids and mother liquors, nor other waste containing organic solvents categorised as chemical waste.

The waste stream consists entirely of hazardous waste types.

### Trends in waste generation and major sources

### Figure A - 69 Generation of Spent solvents (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of spent solvents are displayed), 2004 - 2018




*Source: Eurostat*

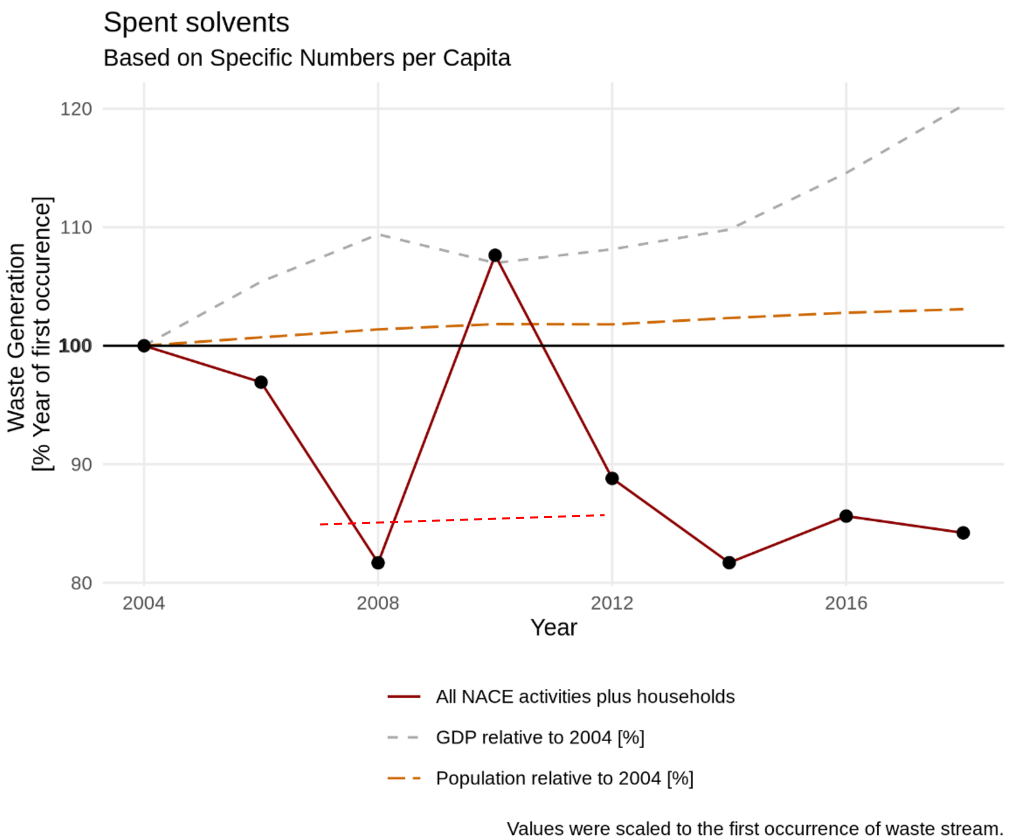
A peak occurred in 2010, exceeding by about 0.7 million tonnes the waste generation in 2008, and by 0.5 million tonnes the waste generation in 2012. The peak is caused by a comparably high amount of spent solvents reported from Ireland for the same year and originates from the economic activity "Manufacture of chemical, pharmaceutical, rubber and plastic products". The amount of spent solvents generated in 2010 might be regarded as a statistical outlier.

Major source for generation of spent solvents is the economic activity “Manufacture of chemical, pharmaceutical, rubber and plastic products”, responsible for 69 % of the spent solvents generated in 2018.

Other relevant sources are the economic activities “Water supply; sewerage, waste management and remediation activities”, “Services (except wholesale of waste and scrap)” and “Manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment”, together responsible for 23 % of the spent solvents generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 70 Decoupling effects on Spent solvents generation in EU-27



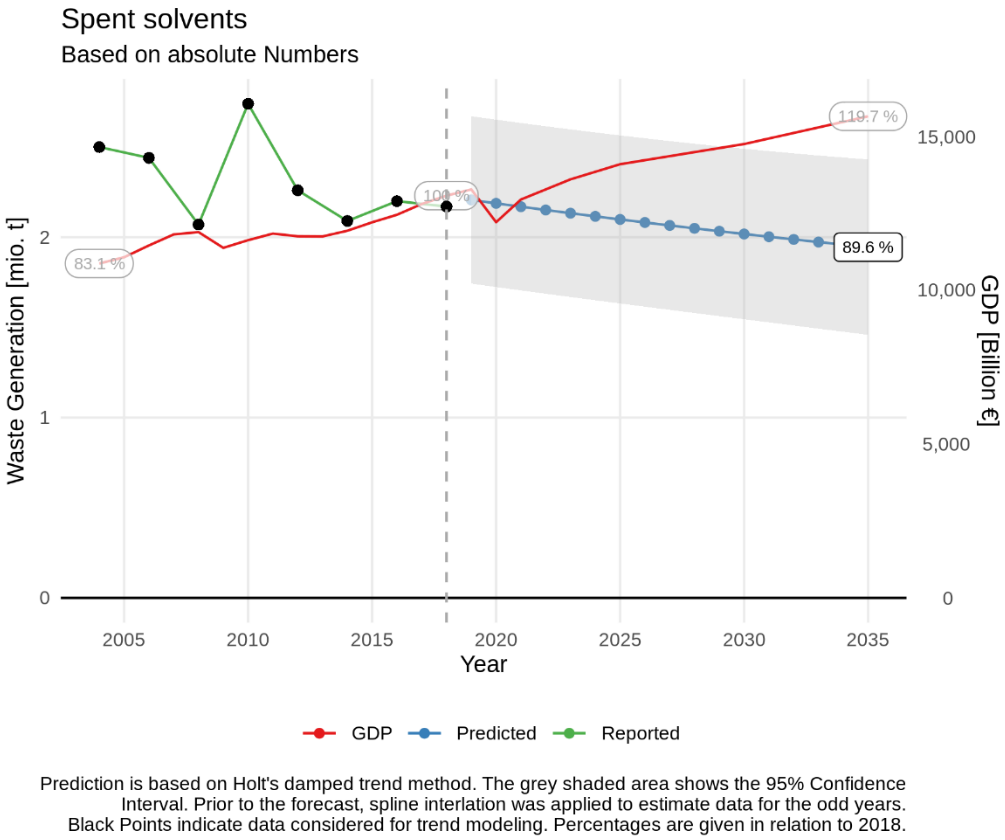

*Source: Eurostat*

In the period 2004 - 2018, the generation of “spent solvents” (kg/per capita) decreased strongly by about -16.9 % (-1.21% annually over 14 years, calculated by linear regression), while an increase of the GDP/capita occurred, indicating an absolute decoupling from the GDP trend.

Seemingly, the economic crisis year 2008 did not evoke a significant effect on the generation of spent solvents.

## Projections (by a linear trend model)

### Figure A - 71 Projections calculated by a linear trend model for spent solvents generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The category "spent solvents" shows an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -10.4% in 2035 compared to 2018, respectively -0.6% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.24 Waste containing PCB

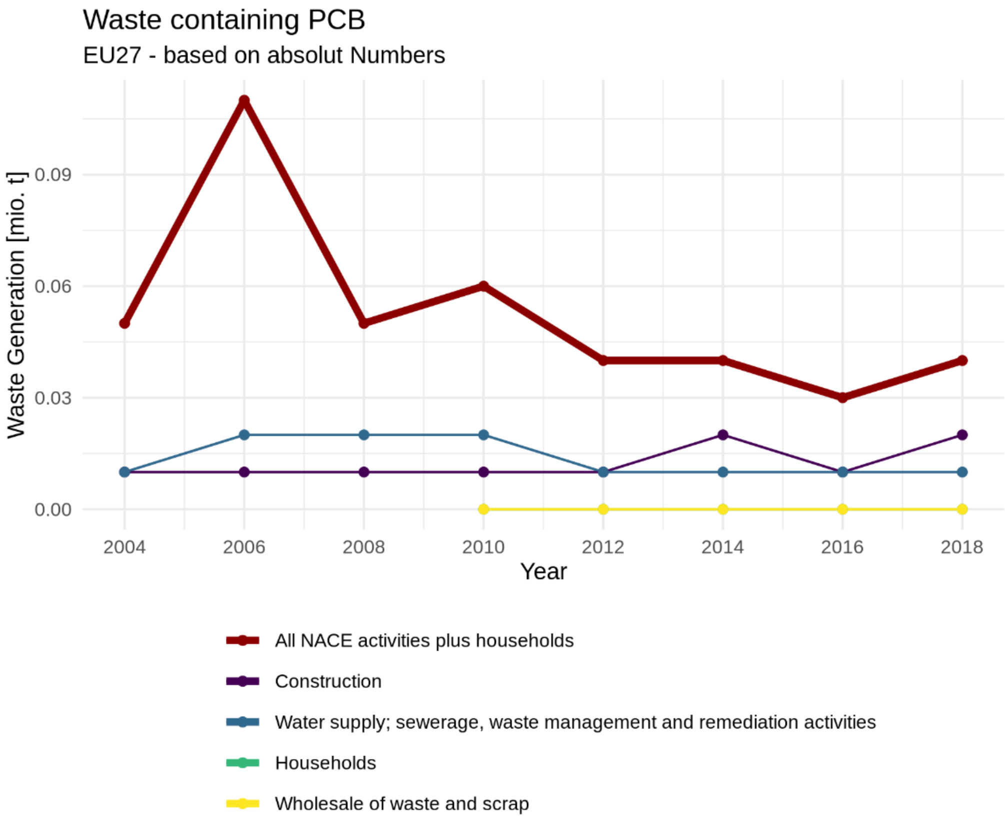
#### Composition of the waste stream

The waste stream "Waste containing PCB" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of oil-containing PCB (e.g. hydraulic oil, insulation and heat transmission oil from (old) transformers), PCB-containing components from (old) post-consumer products (esp. capacitors), and construction and demolition waste containing PCB (e.g. sealants resin-based flooring).

The waste stream is entirely composed of hazardous waste types.

#### Trends in waste generation and major sources

#### Figure A - 72 Generation of waste containing PCB (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of waste containing PCB are displayed), 2004 - 2018




*Source: Eurostat*

In the observation period 2004 – 2018, the generation of "Waste containing PCB" shows a slight decrease from 50 000 tonnes in 2004 to 40 000 tonnes in 2018 (- 10 000 tonnes). Two major peaks occur, in 2006 and in 2010. The generation of waste containing PCB in

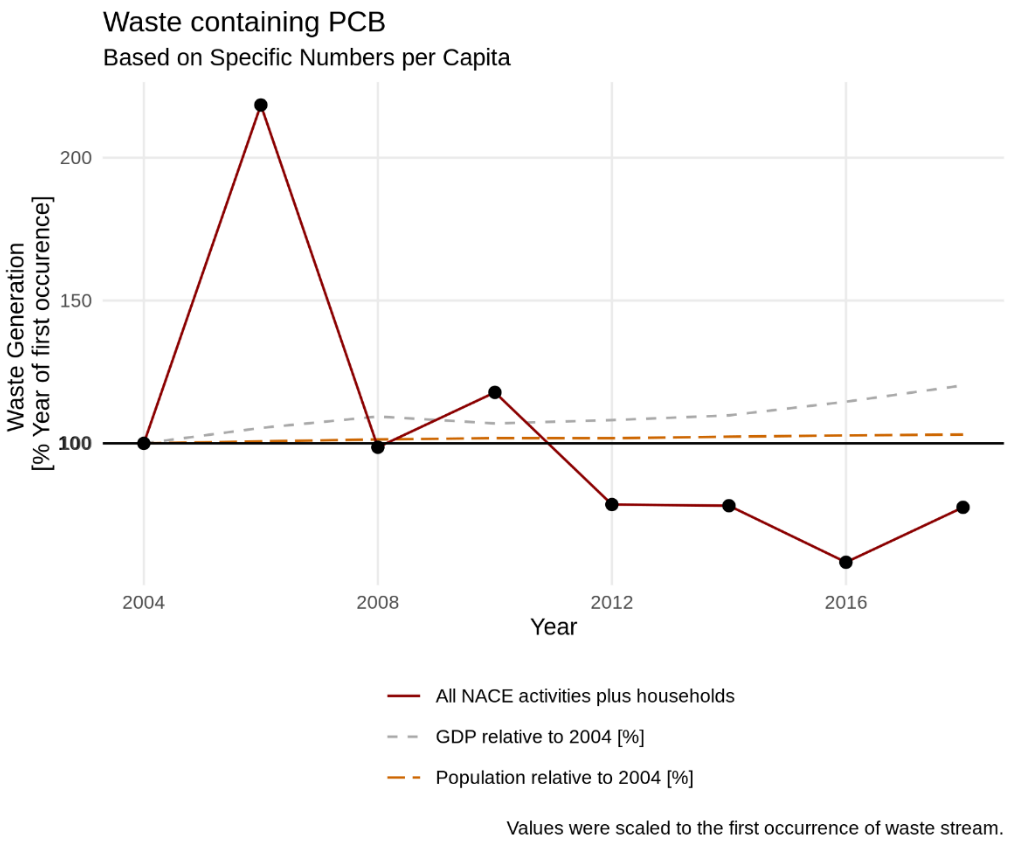
2006 exceeds by 50 000 tonnes the values in 2004 and 2008. This peak reflects the high amounts reported by Italy. The generation of waste containing PCB in 2010 exceeds by 10 000 tonnes the one in 2008 and by 20 000 tonnes that in 2012. This peak reflects the high amounts reported by France. The amounts of waste containing PCB generated in 2006 and in 2010 might be regarded as statistical outliers.

Major source for the generation of PCB-containing waste is the economic activity "Construction", responsible for 50 % of the waste containing PCB generated in 2018. In the period 2014 to 2018, the trend of this economic activity is strongly influenced by waste generation data reported by Denmark, ranging between 41 to 60 % of the EU waste generation within this economic activity and period.

Another relevant source is the economic activity "Water supply; sewerage, waste management and remediation activities", responsible for 25 % of the PCB-containing waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 73 Decoupling effects on waste containing PCB generation in EU-27



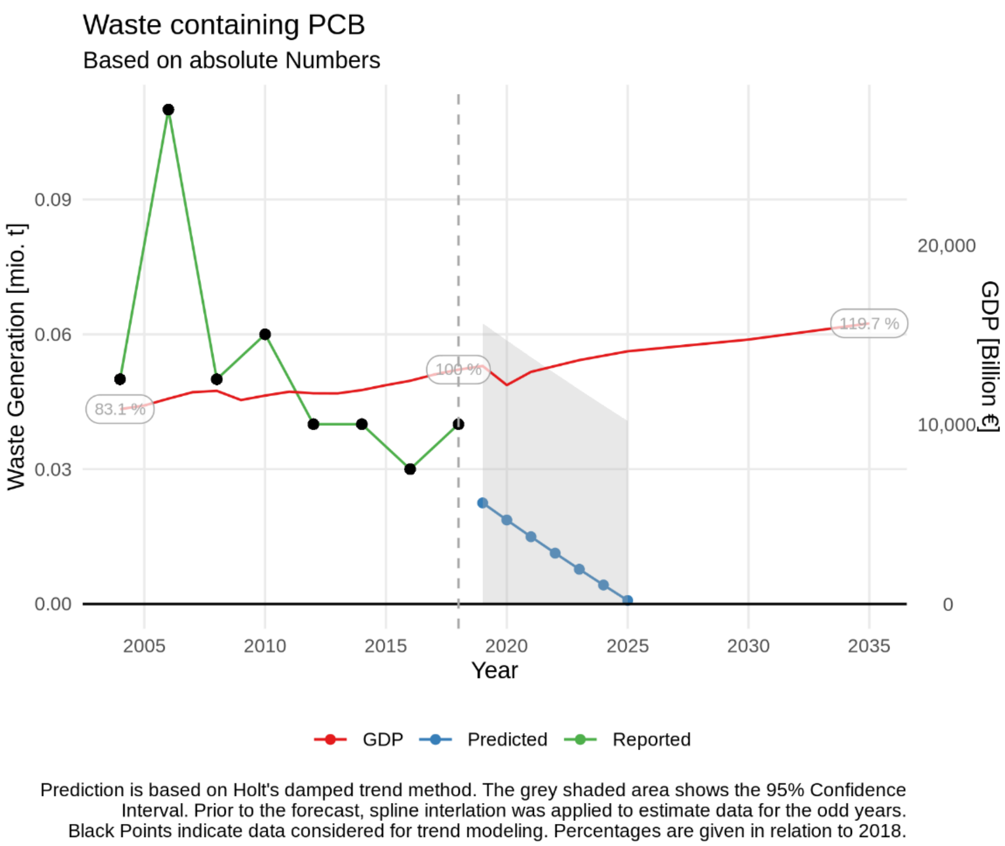

*Source: Eurostat*

In the period 2004 - 2018, the generation of "waste containing PCB" (kg/per capita) decreased by about -40.6 % (-2.39% annually over 14 years, calculated by linear regression), while an increase of the GDP/capita occurred, showing an absolute decoupling from the GDP trend.

Seemingly, the economic crisis year 2008 did not evoke a significant effect on the waste generation trend for waste containing PCB.

## Projections (by a linear trend model)

### Figure A - 74 Projections calculated by a linear trend model for waste containing PCB generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The category "waste containing PCB" indicates an absolute decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a complete decrease and phasing-out of this waste stream.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.25 Soils

#### Composition of the waste stream

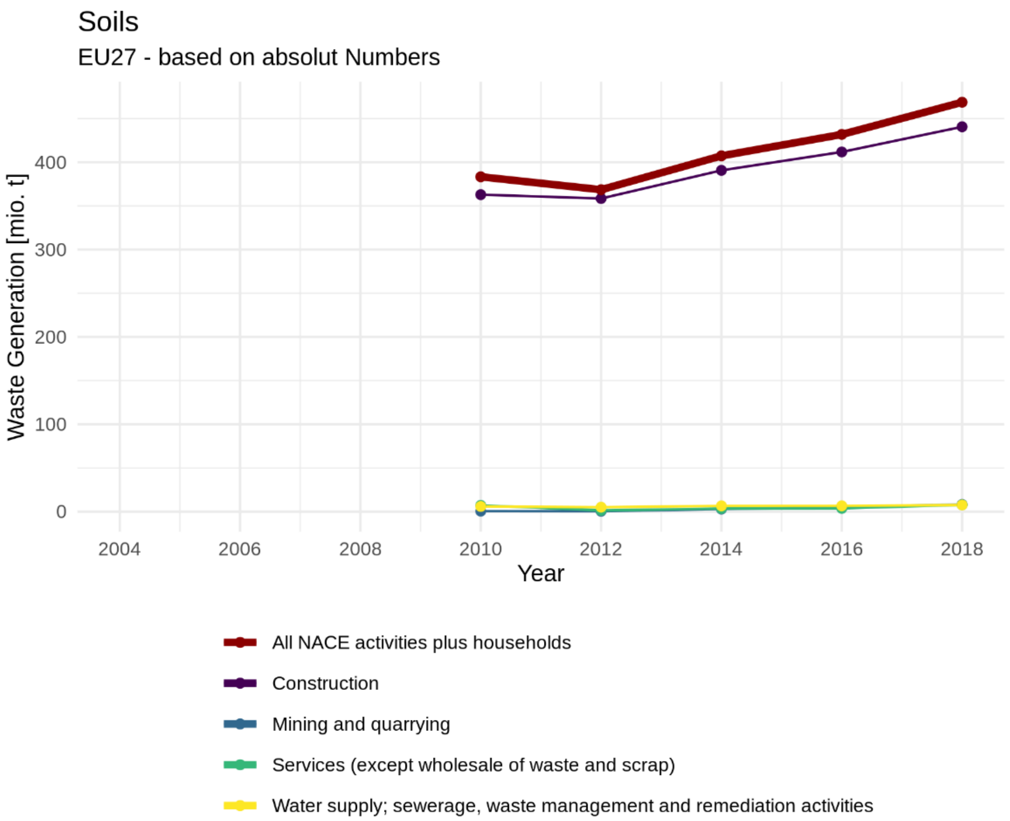
The waste stream "Soils" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) includes soil and stones including excavated soil from contaminated sites.

It includes oil spills. It does not include dredging spoils, track ballast, tailings, rocks, gravel from mining and quarrying, or soil from cleaning and washing beet.

Soil is hazardous waste when containing oil, heavy metals, organic pollutants. In 2018, only 2 % of the amount of this waste category generated by the EU-27 were hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 75 Generation of soils (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of soils are displayed), 2010 - 2018**




*Source: Eurostat*

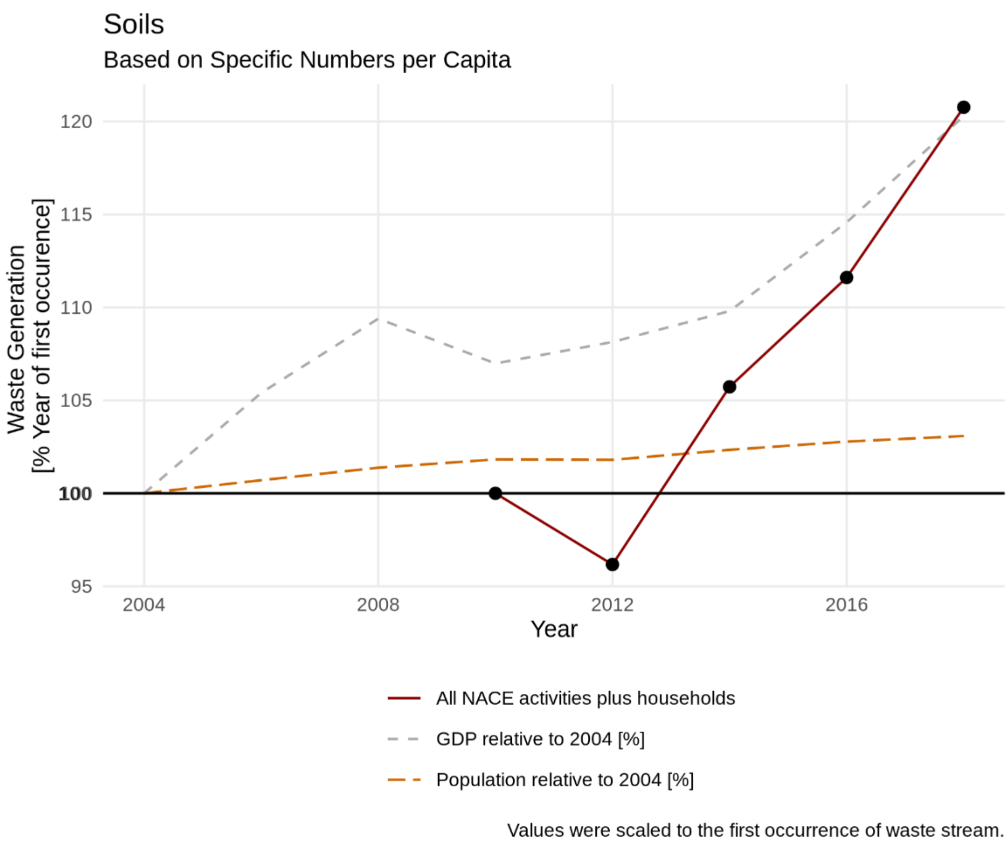
In the observation period 2010 – 2018, the generation of “Soils” indicates an increase from 383.3 million tonnes in 2004 to 468.6 million tonnes in 2018 (+ 85.3 million tonnes). From 2010 to 2012, a slight decrease in the generation of this type of waste is observed, followed by a continuous increase until 2018.

This trend is closely related to the trend of the major source for its generation, i.e. the economic activity “Construction”. Over the entire period, this economic activity indicates a very high share (94 – 97 %) in the waste stream “Soils”. In 2018, 94 % of this type of waste were generated by this economic activity.

The three sources following in terms of relevance are the economic activities “Mining and quarrying”, “Services (except wholesale of waste and scrap)” and “Water supply; sewerage, waste management and remediation activities”, together responsible for 5 % of the amount of “Soils” generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 76 Decoupling effects on soils generation in EU-27

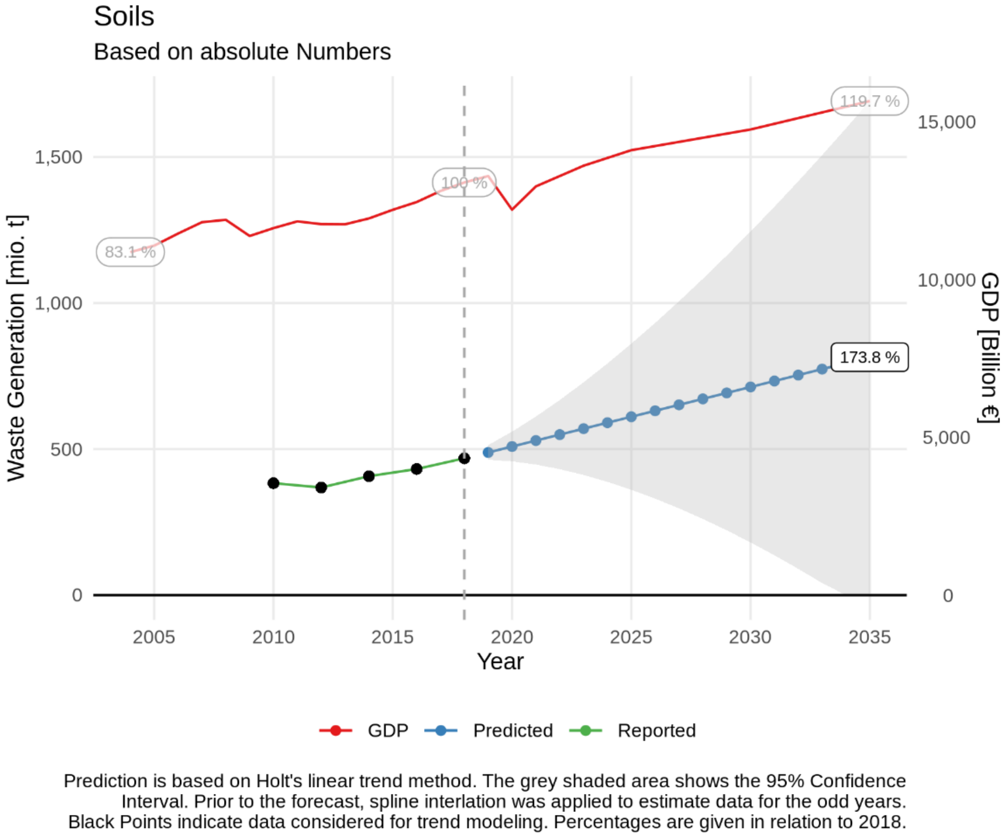



*Source: Eurostat*

In the period 2010 - 2018, the generation of “Soils” (kg/per capita) increased by about 18.3% (2.23% annually over 8 years, calculated by linear regression), while the GDP/capita increased, showing an no decoupling from the GDP trend.

## Projections (by a linear trend model)

### Figure A - 77 Projections calculated by a linear trend model for soils generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category “Soils” shows an no decoupling from the GDP trend in the period from 2010 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 73.8% in 2035 compared to 2018, respectively 4.3% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.26 Combustion waste

#### Composition of the waste stream

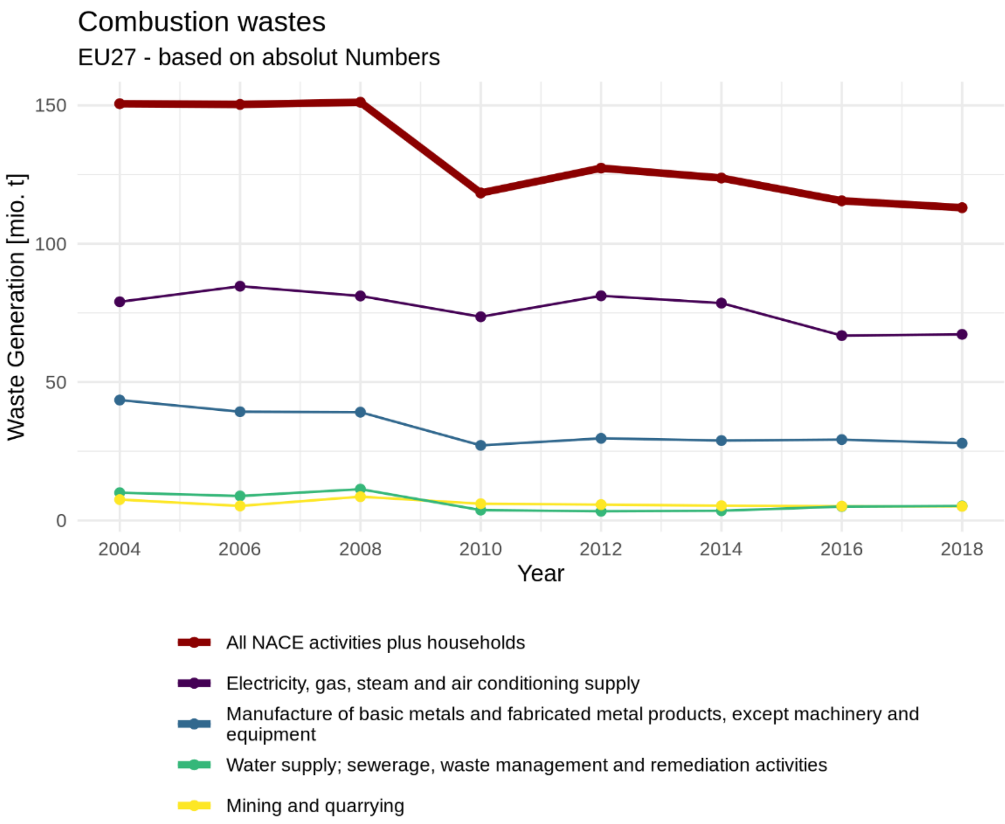
The waste stream "Combustion waste" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) includes waste from flue gas cleaning (desulphurisation sludges, filter dust and cakes, fly ashes, solid waste), slags, drosses, skimmings, boiler dusts and ashes from thermal processes.

It includes waste sands from fluidised beds, zinc ash from hot galvanizing, and boiler dust. It does not include spent activated carbon, flue-gas cleaning residues from vitrification, or pyrolysis waste.

Combustion waste is hazardous waste when containing organic pollutants, oil or heavy metals. In 2018, 11 % of the combustion waste generated by the EU-27 was hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 78 Generation of combustion waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of combustion waste are displayed), 2004 - 2018**



*Source: Eurostat*

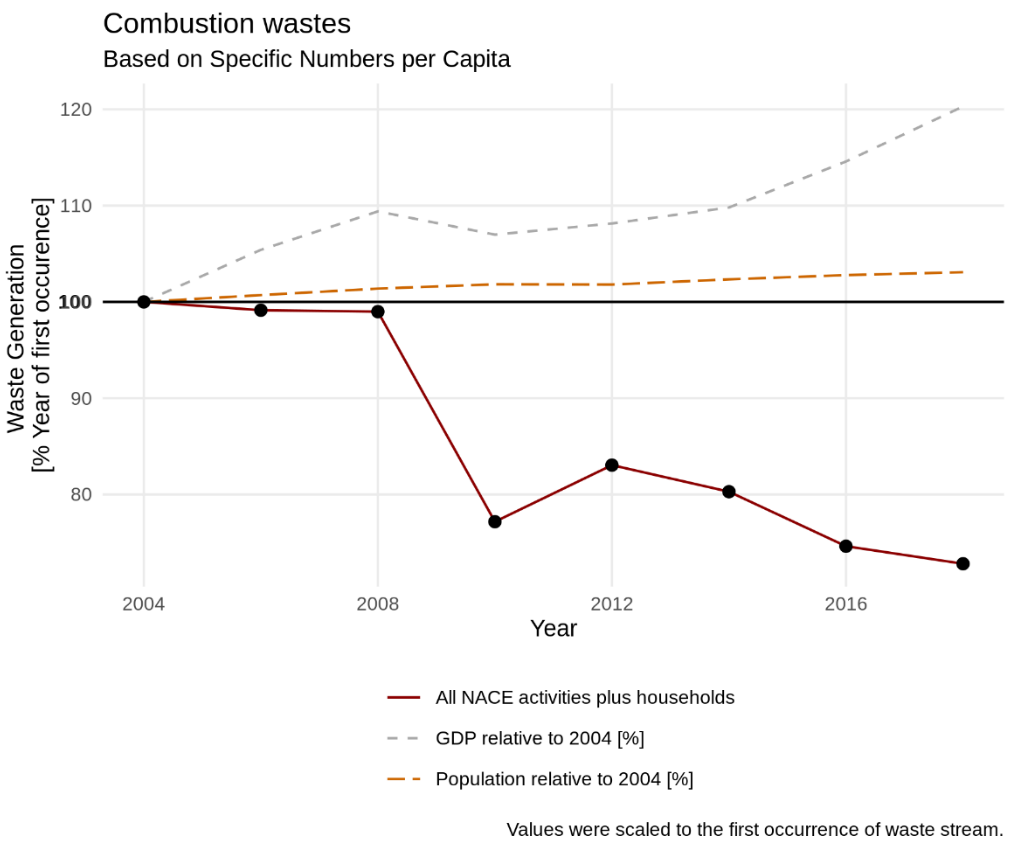
In the observation period 2004 – 2018, the generation of "Combustion waste" shows a decrease from 150.6 million tonnes in 2004 to 113.0 million tonnes in 2018 (- 37.6 million tonnes). The strongest decrease occurred between 2008 and 2010 (- 32.8 million tonnes).

Major source for generation of combustion waste is the economic activity "Electricity, gas, steam and air conditioning supply", responsible for 59 % of the combustion waste generated in 2018.

Other relevant sources are the economic activities "Manufacture of basic metals and fabricated metal products, except machinery and equipment", "Water supply; sewerage, waste management and remediation activities" and "Mining and quarrying", together responsible for 34 % of the combustion waste generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

#### Figure A - 79 Decoupling effects on combustion waste generation in EU-27



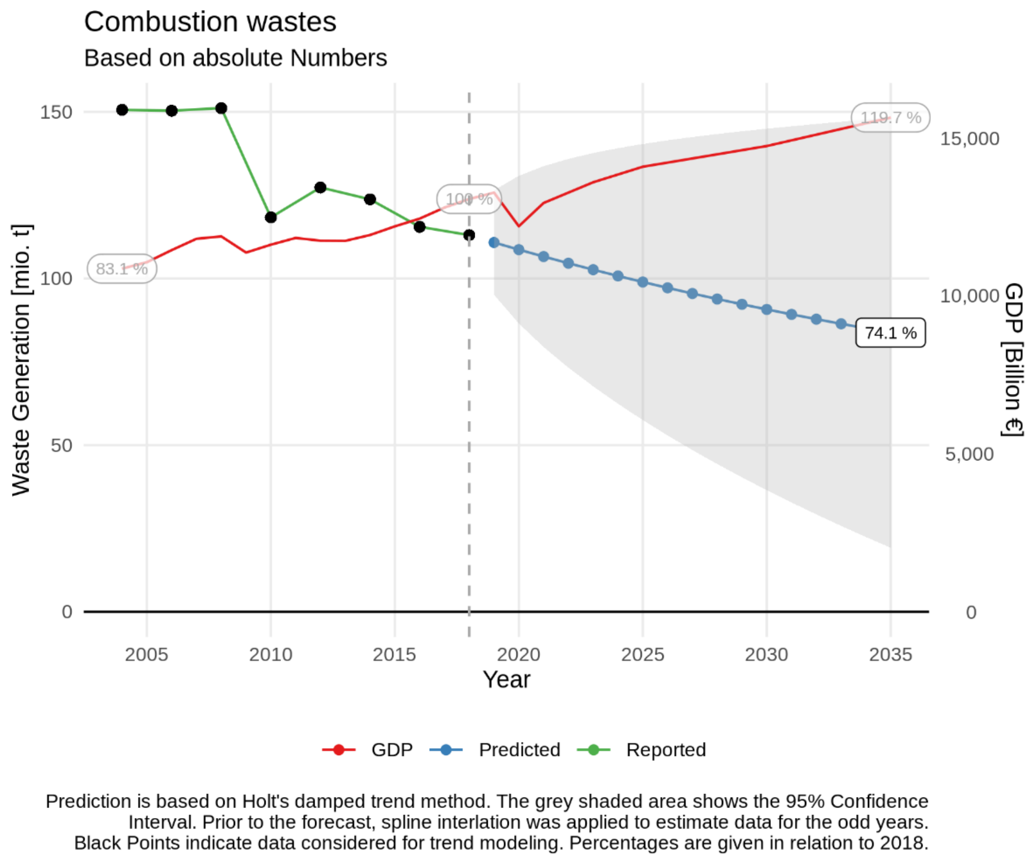

*Source: Eurostat*

In the period 2004 - 2018, the combustion waste (kg/per capita) decreased by about -29.4% (-2.10% annually over 14 years, calculated by linear regression), while an increase of the GDP/capita occurred, showing an absolute decoupling from the GDP trend.

The economic crisis year 2008 led to a strong decline in the combustion waste generation (2008 – 2010). A slight increase occurred (2010 to 2012), but afterwards a decrease followed again.

## Projections (by a linear trend model)

### Figure A - 80 Projections calculated by a linear trend model for combustion waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "combustion waste" shows an absolute decoupling from GDP trend in the past period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in a decrease of -25.9% in 2035 compared to 2018, respectively -1.5% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

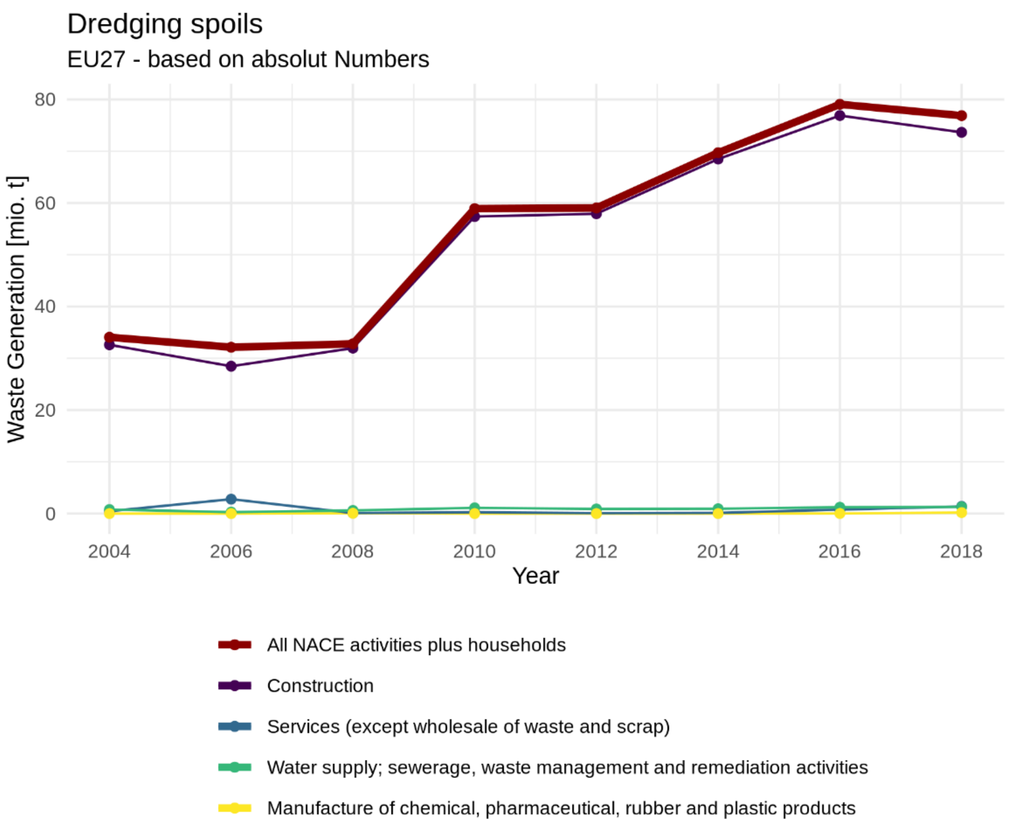
### A.1.2.27 Dredging spoils

#### Composition of the waste stream

The waste stream “Dredging spoils” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is hazardous waste when containing heavy metals or organic pollutants. In 2018, only 1 % of the amount of dredging spoils generated by the EU-27 was hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 81 Generation of dredging spoils (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of dredging spoils are displayed), 2004 - 2018**




*Source: Eurostat*

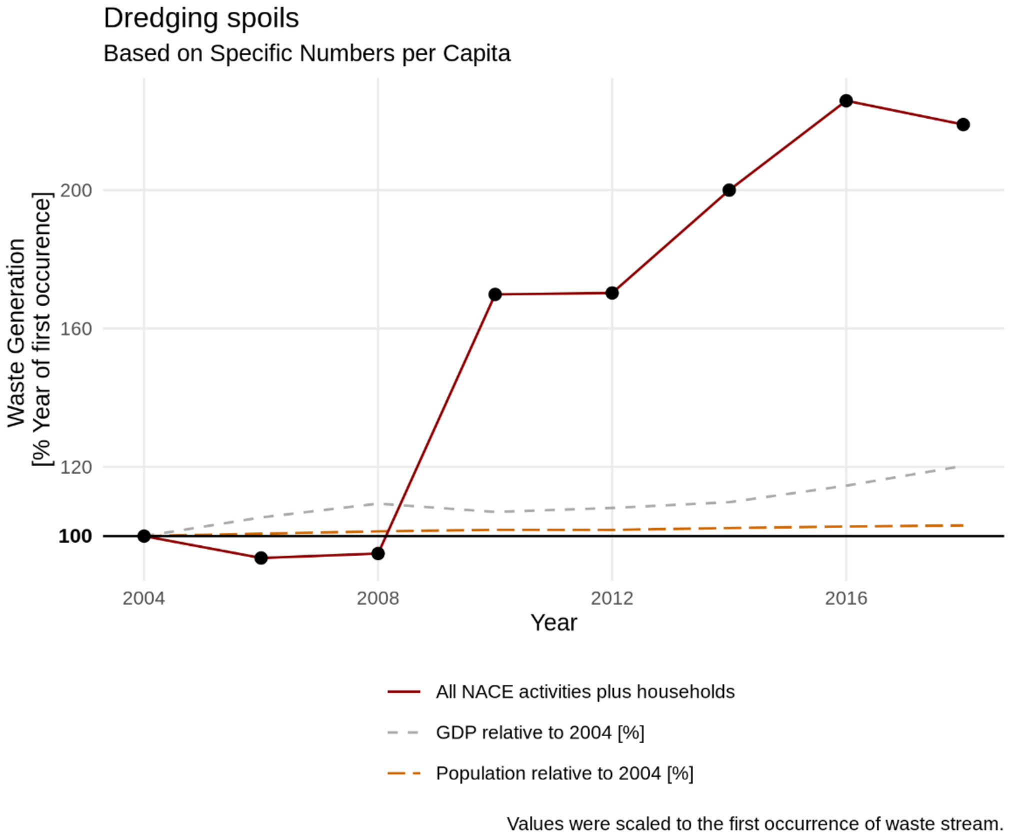
In the observation period 2004 – 2018, the generation of “Dredging spoils” indicates an increase from 34.1 million tonnes in 2004 to 76.9 million tonnes in 2018 (+ 42.8 million tonnes). Two cases of significant increase occurred, from 2008 to 2010 (+ 26.1 million tonnes) and from 2012 to 2016 (+ 20.0 million tonnes). Between 2016 and 2018, a slight increase is observed. This trend is strongly influenced by the extraordinary high amounts reported by the Netherlands. These data account for 75 to 90 % of the dredging spoils generation of the EU-27 within the period 2004 – 2018.

This trend is as well closely related to the trend of the major source for the generation of this waste stream, i.e. the economic activity “Construction”. Over the entire period, this economic activity indicates a very high share (89 – 98 %) in the waste stream “Dredging spoils”. In 2018, 96 % of the dredging spoils were generated by this economic activity. Again, a very high share of the waste generation within this economic activity was reported by the Netherlands (79 – 94 % over the period 2004 – 2018).

The three sources following in terms of relevance are the economic activities “Services (except wholesale of waste and scrap)”, “Water supply; sewerage, waste management and remediation activities” and “Manufacture of chemical, pharmaceutical, rubber and plastic products”, together responsible for 4 % of the dredging spoils generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 82 Decoupling effects on dredging spoils generation in EU-27



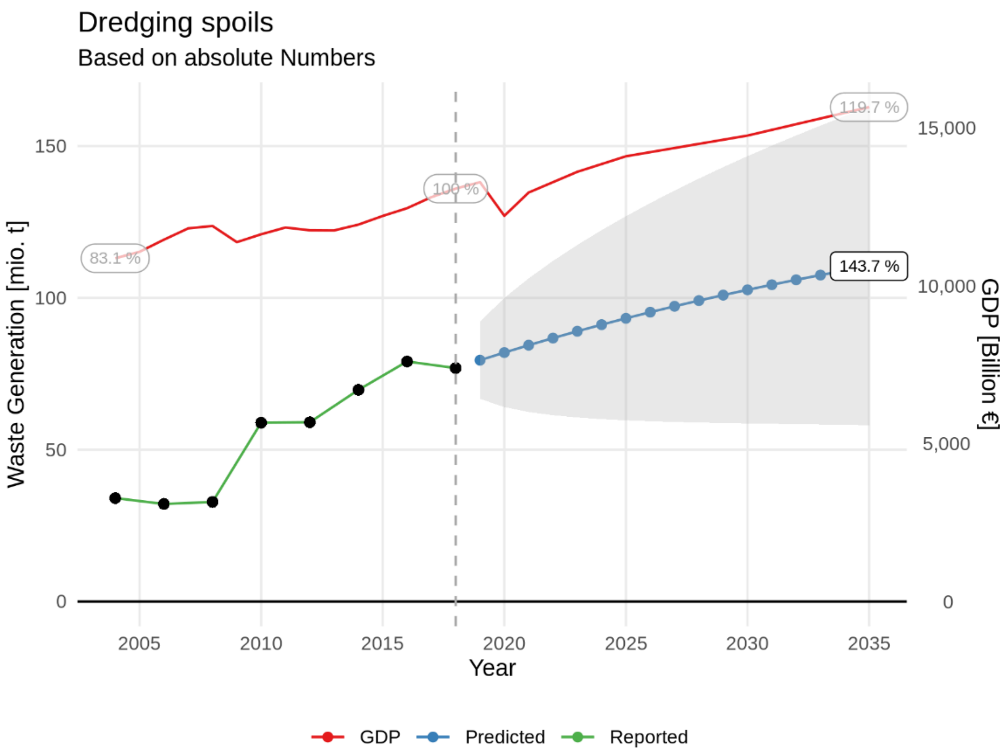

*Source: Eurostat*

In the period 2004 - 2018, the generation of “dredging spoils” (kg/per capita) increased significantly by about 134.6%, (9.61% annually over 14 years, calculated by linear regression), while also the GDP/capita increased slightly. No decoupling from the GDP trend is registered in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of dredging spoils.

## Projections (by a linear trend model)

### Figure A - 83 Projections calculated by a linear trend model for dredging spoils generation in EU-27




Prediction is based on Holt's damped trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

The waste category "Dredging spoils" indicates no decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 43.7% compared to 2018, respectively 2.6% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.28 Other mineral waste

## Composition of the waste stream

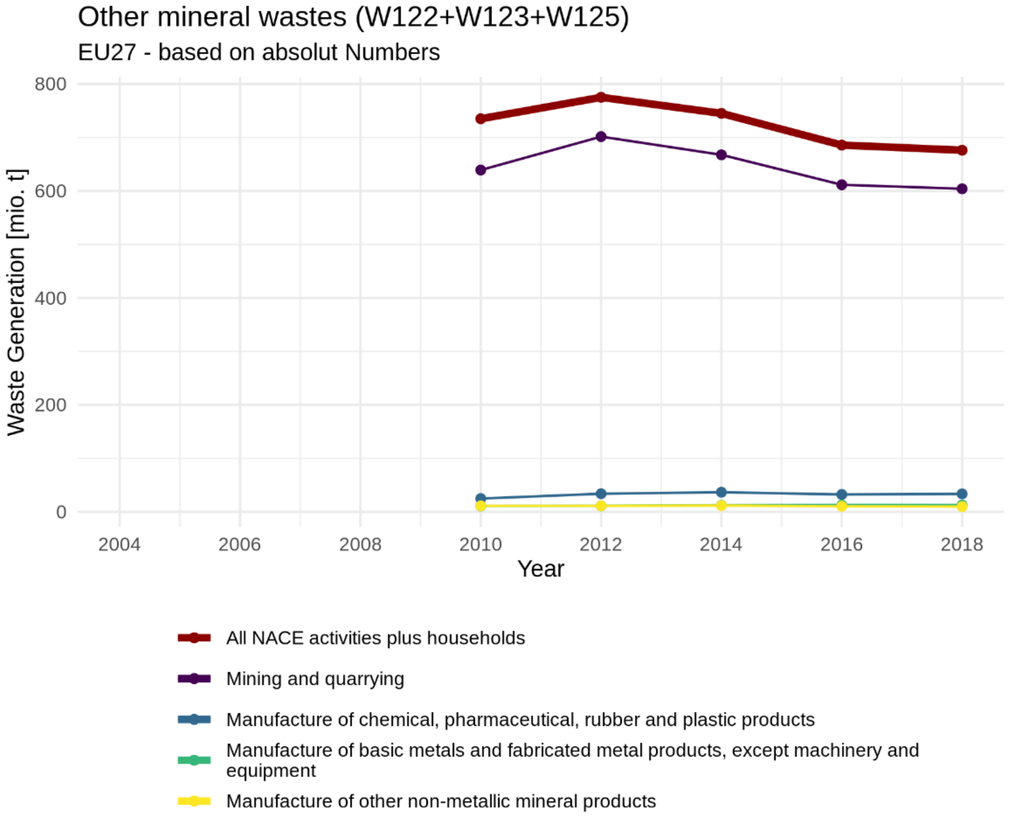
The waste stream “Other mineral waste” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) consists of blasting material and grinding bodies, casting cores and moulds as well as linings and refractories from all thermal processes.

It includes solid waste from soil remediation, alumina, waste binders, and calcium-based reaction waste. It does not include inorganic sludges, salts, or soils and stones.

“Other mineral waste” is hazardous waste when containing asbestos, oil, or heavy metals. In 2018, only 3 % of the amount of the category “Other mineral waste” generated by the EU-27 was hazardous waste.

## Trends in waste generation and major sources

## Figure A - 84 Generation of other mineral waste (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of other mineral waste are displayed), 2010 - 2018




*Source: Eurostat*

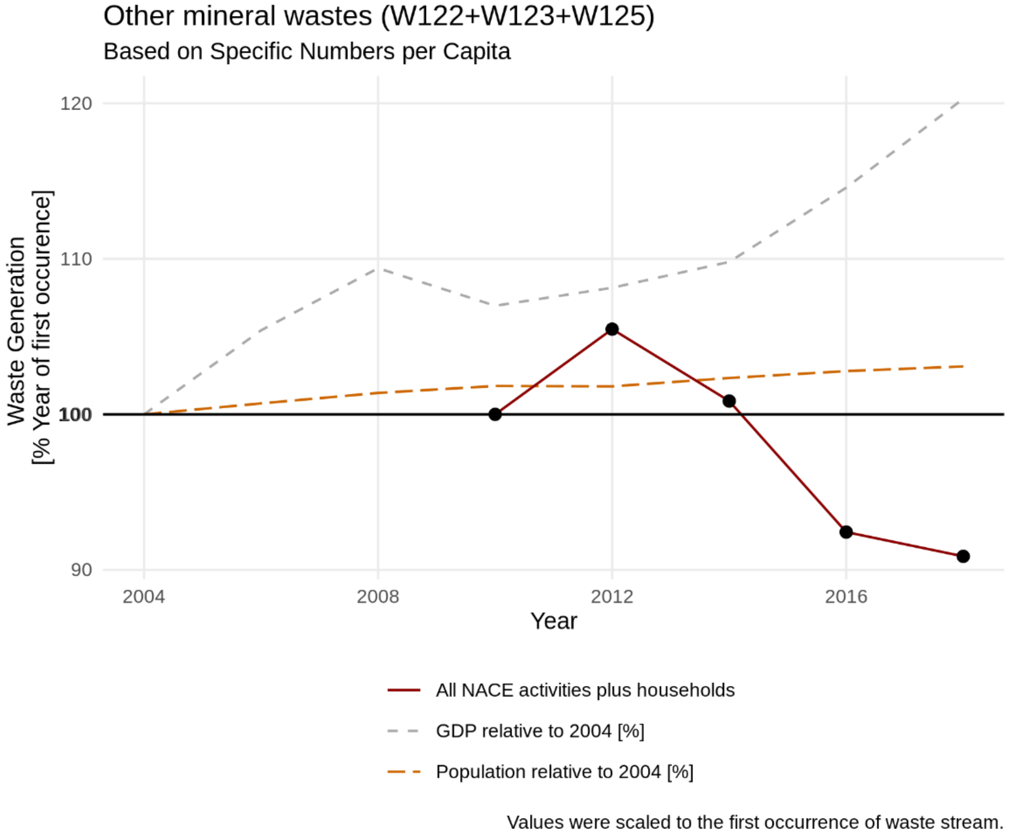
In the observation period 2010 – 2018, the generation of “Other mineral waste” shows a decrease from 735.0 million tonnes in 2004 to 676.1 million tonnes in 2018 (+ 58.9 million tonnes). From 2010 to 2012, an increase in the generation of “Other mineral waste” is observed, followed by a decrease until 2018.

This trend is closely related to the trend of the major source for the generation of this waste type, i.e. the economic activity “Mining and quarrying”. Over the entire period, this economic activity indicates a very high share (87 – 91 %) in the waste stream “Other mineral waste”. In 2018, 89 % of the “Other mineral waste” were generated within this economic activity.

The three sources following in terms of relevance are the economic activities “Manufacture of chemical, pharmaceutical, rubber and plastic products”, “Manufacture of basic metals and fabricated metal products, except machinery and equipment” and “Manufacture of other non-metallic mineral products”, together responsible for 8 % of the “Other mineral waste” generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 85 Decoupling effects on other mineral waste generation in EU-27

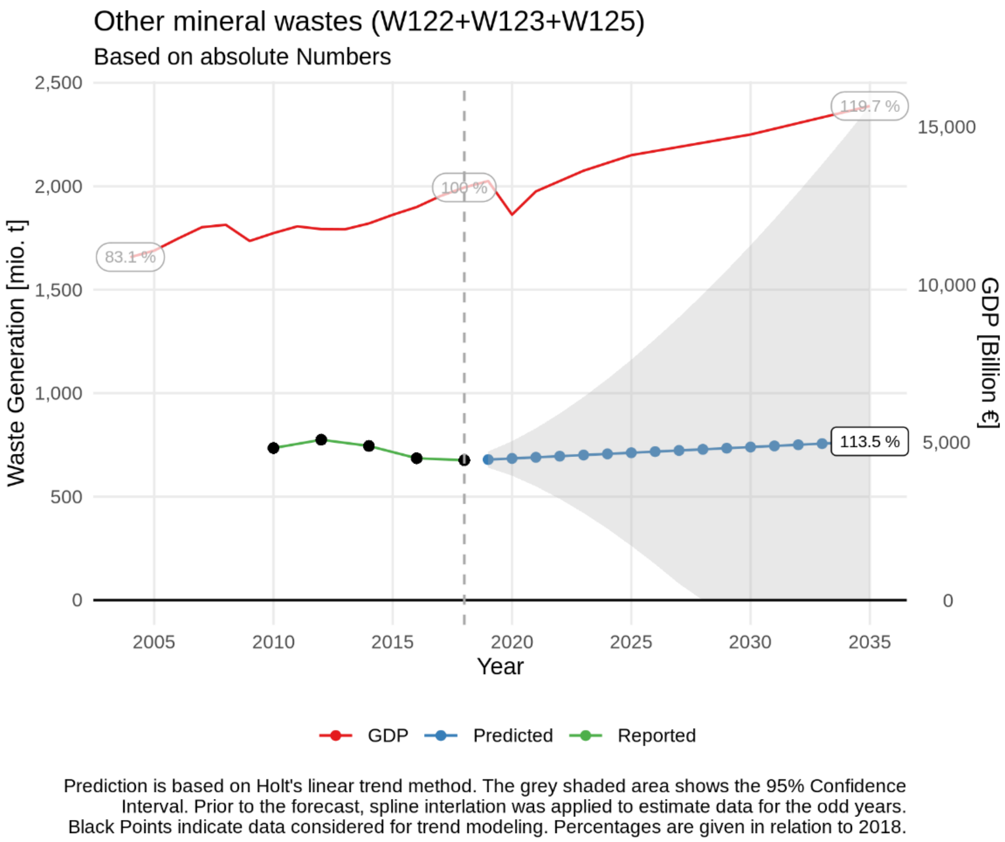



*Source: Eurostat*

In the period 2010 - 2018, the generation of "Other mineral waste" (kg/per capita) decreased by about -8.3% (-1.04% yearly over 8 years, calculated by linear regression), while the GDP/capita increased slightly. This indicates an absolute decoupling from the GDP trend in the period 2010-2018.

## Projections (by a linear trend model)

### Figure A - 86 Projections calculated by a linear trend model for other mineral waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "Other mineral waste" shows an absolute decoupling from the GDP trend in the period from 2010 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 13.5% in 2035 compared to 2018, respectively -0.8% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.29 Sorting residues

#### Composition of the waste stream

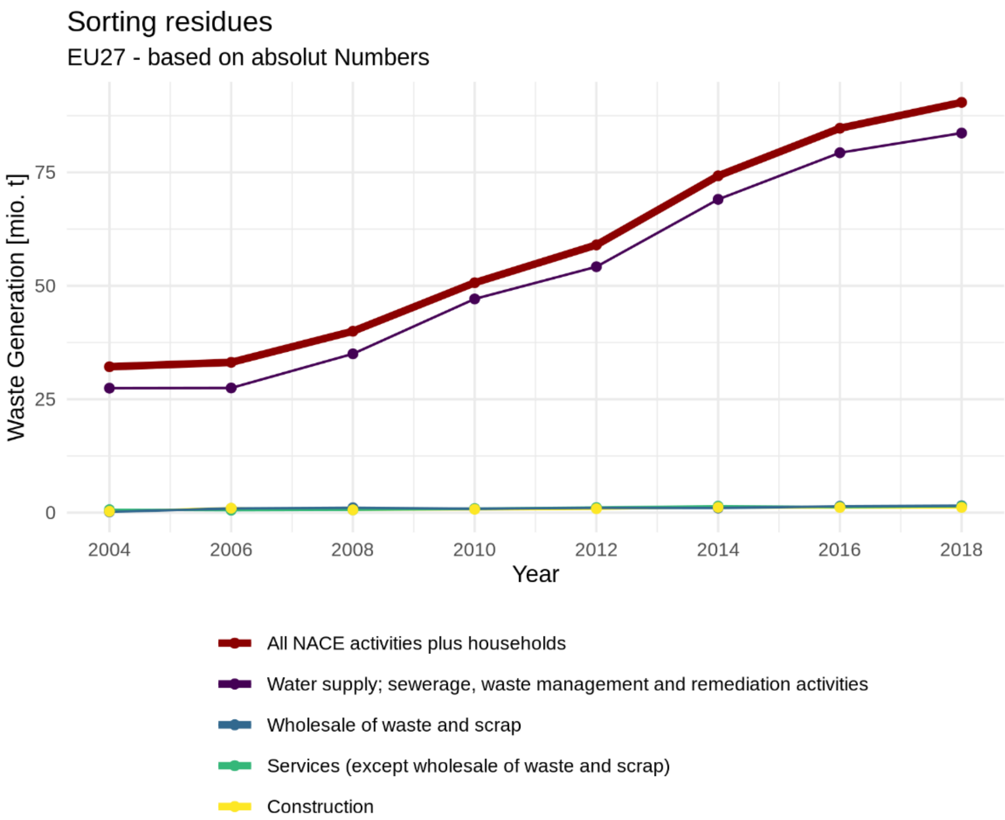
The waste stream "Sorting residues" (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of sorting residues from mechanical sorting processes for waste (like screening, fluff-light fraction), combustible waste (refuse derived fuel), and non-composted fractions of biodegradable waste.

It includes pre-mixed and combustible waste from physico-/chemical waste treatment and off-specification compost. It does not include sorting residues from demolition, or waste from sorting of paper and cardboard in the pulp and paper industry.

Sorting residues are hazardous waste when containing heavy metals or organic pollutants, e.g. oil. Only 5 % of the amount of sorting residues generated by the EU-27 in 2018 were hazardous waste.

#### Trends in waste generation and major sources#

**Figure A - 87 Generation of "Sorting residues" (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of "Sorting residues" are displayed), 2004 - 2018**



*Source: Eurostat*

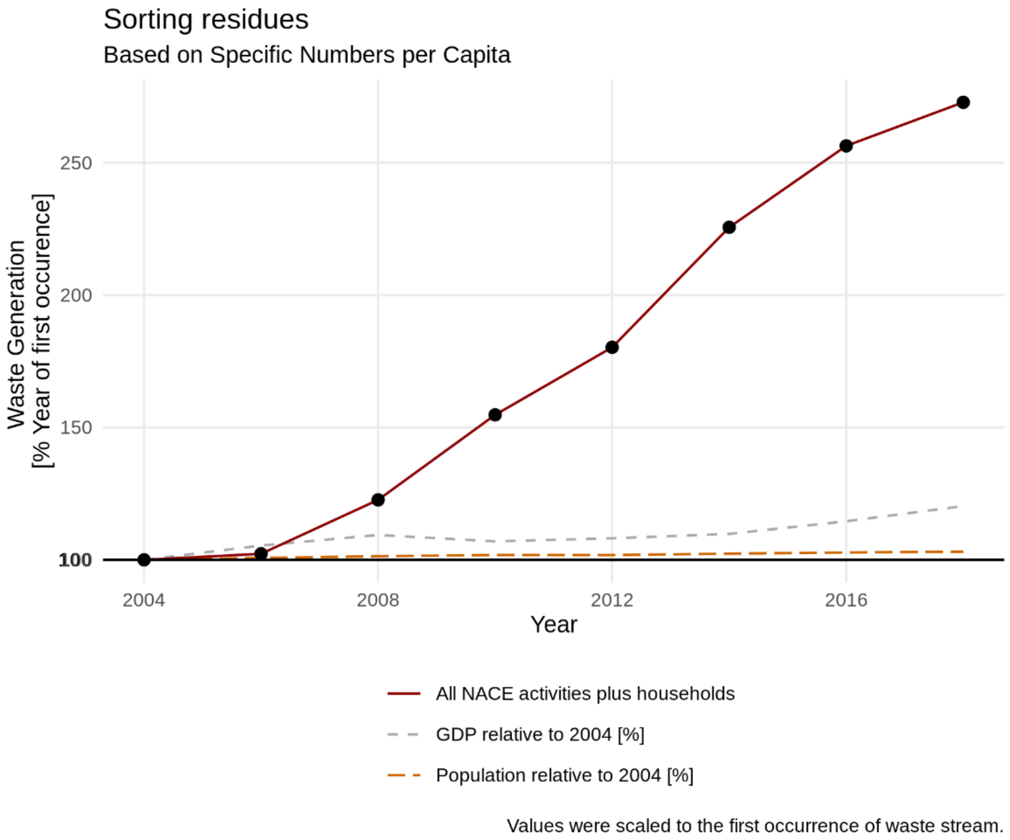
In the observation period 2004 – 2018, the generation of "Sorting residues" shows a continuous increase from 32.2 million tonnes in 2004 to 90.4 million tonnes in 2018 (+ 58.3 million tonnes).

This trend is closely related to the trend of the major source for the generation of this waste type, i.e. the economic activity "Water supply; sewerage, waste management and remediation activities". Over the entire period, this economic activity shows an extraordinary high share (83 – 94 %) in the waste stream "Sorting residues". In 2018, 93 % of the sorting residues were generated within this economic activity.

The three sources following in terms of relevance are the economic activities "Wholesale of waste and scrap", "Services (except wholesale of waste and scrap)", and "Construction", together responsible for 5 % of the sorting residues generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 88 Decoupling effects on sorting residues generation in EU-27



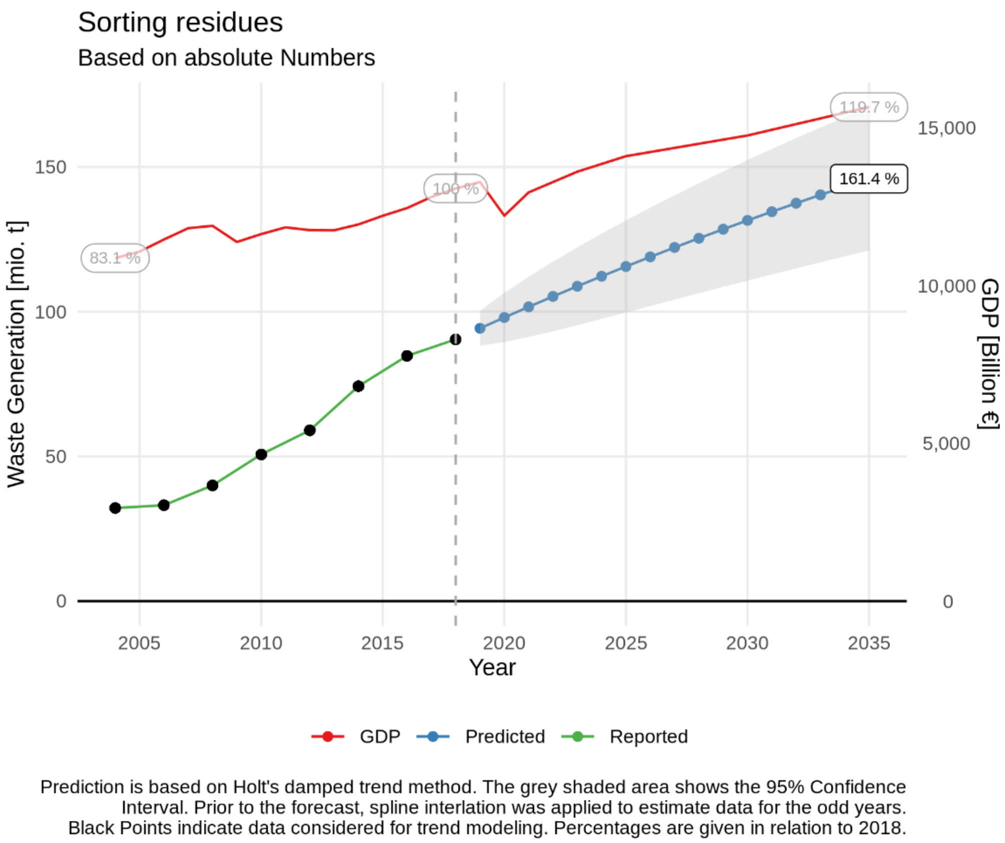

*Source: Eurostat*

In the period 2004 - 2018, the generation of sorting residues (kg/per capita) increased significantly by about 173.3%, (12.38% annually over 14 years, calculated by linear regression), while the GDP/capita increased slightly. No decoupling from the GDP trend is identified in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation sorting residues.

## Projections (by a linear trend model)

### Figure A - 89 Projections calculated by a linear trend model for sorting residues generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category “Sorting residues” indicates no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 61.4% compared to 2018, respectively 3.6% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

### A.1.2.30 Mineral waste from waste treatment and stabilised waste

#### Composition of the waste stream

The waste stream “Mineral waste from waste treatment and stabilised waste” (as defined in Section2 -Waste Categories of the EU Waste Statistics Regulation) is composed of bottom ash and slag from waste incineration and pyrolysis, fly ashes and other waste fractions from flue gas treatment in waste incineration plants as well as solidified, stabilised and vitrified waste from waste treatment.

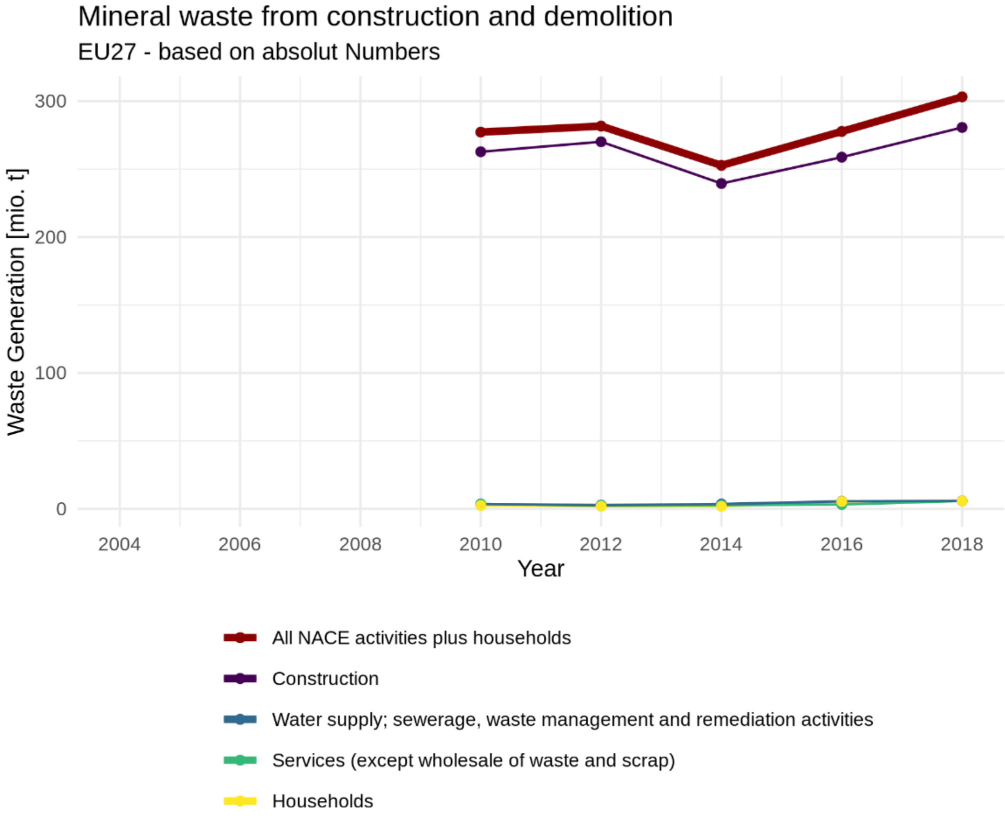
It includes waste from flue-gas cleaning in oil regeneration plants. It does not include slag and ashes from co-incineration of waste in power stations and other combustion plants, spent activated carbon, non-vitrified solid phase, or aqueous liquid waste from vitrified waste tempering.

Mineral waste from waste treatment and stabilised waste is hazardous waste in case of containing organic pollutants or heavy metals. In 2018, only 4 % of the amount of “Mineral waste from waste treatment and stabilised waste” generated by the EU-27 in 2018 were hazardous waste.

#### Trends in waste generation and major sources

**Figure A - 90 Generation of mineral waste from waste treatment and stabilised waste (million tonnes), total amount and waste generation by**

**economic activity (absolute amounts for the four major sources of mineral waste from waste treatment and stabilised waste are displayed), 2010 - 2018**




*Source: Eurostat*

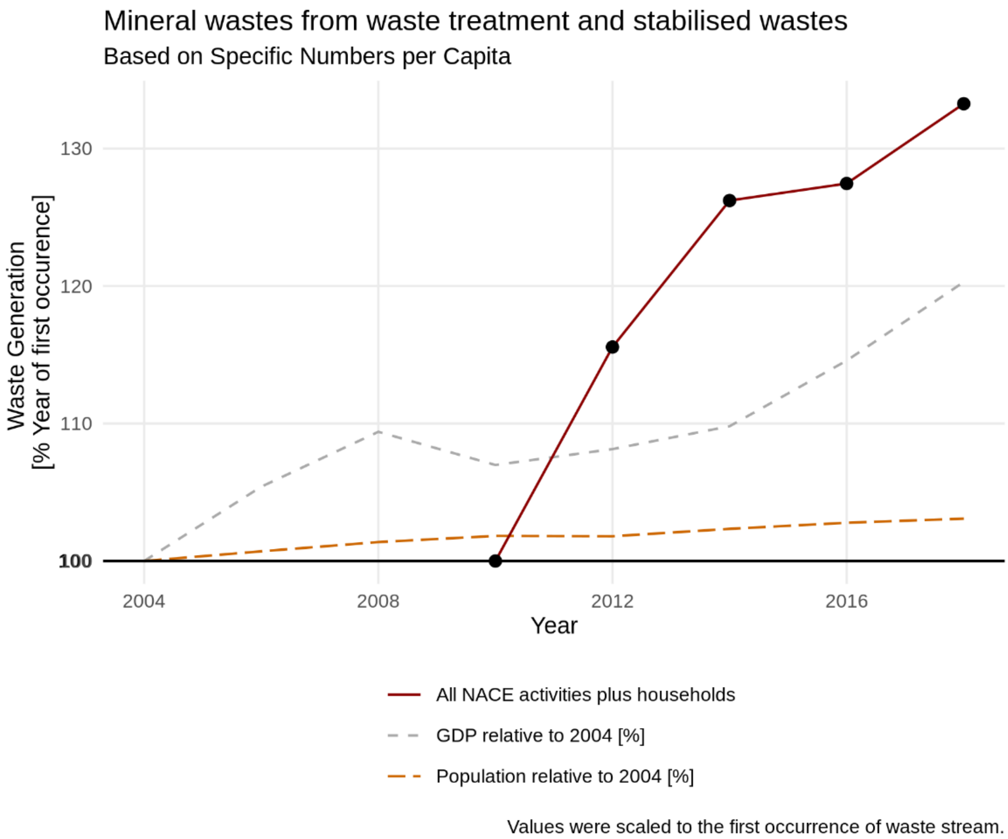
In the observation period 2010 – 2018, the generation of "Mineral waste from waste treatment and stabilised waste" indicates a continuous increase from 33.9 million tonnes in 2004 to 45.8 million tonnes in 2018 (+ 11.8 million tonnes). About half of the waste generation was reported by Germany (54 – 57 % over the time period 2010 – 2018).

Major source for generation of mineral waste from waste treatment and stabilised waste is the economic activity "Water supply; sewerage, waste management and remediation activities", responsible for 75 % of the mineral waste from waste treatment and stabilised waste generated in 2018. Again, about half of the waste amounts generated within this economic activity was reported by Germany (46 – 56 % over the time period 2010 – 2018).

Other relevant sources are the economic activities "Electricity, gas, steam and air conditioning supply", "Services (except wholesale of waste and scrap)", and "Construction", together responsible for 20 % of mineral waste from waste treatment and stabilised waste generated in 2018.

## Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 91 Decoupling effects on mineral waste from waste treatment and stabilised waste generation in EU-27

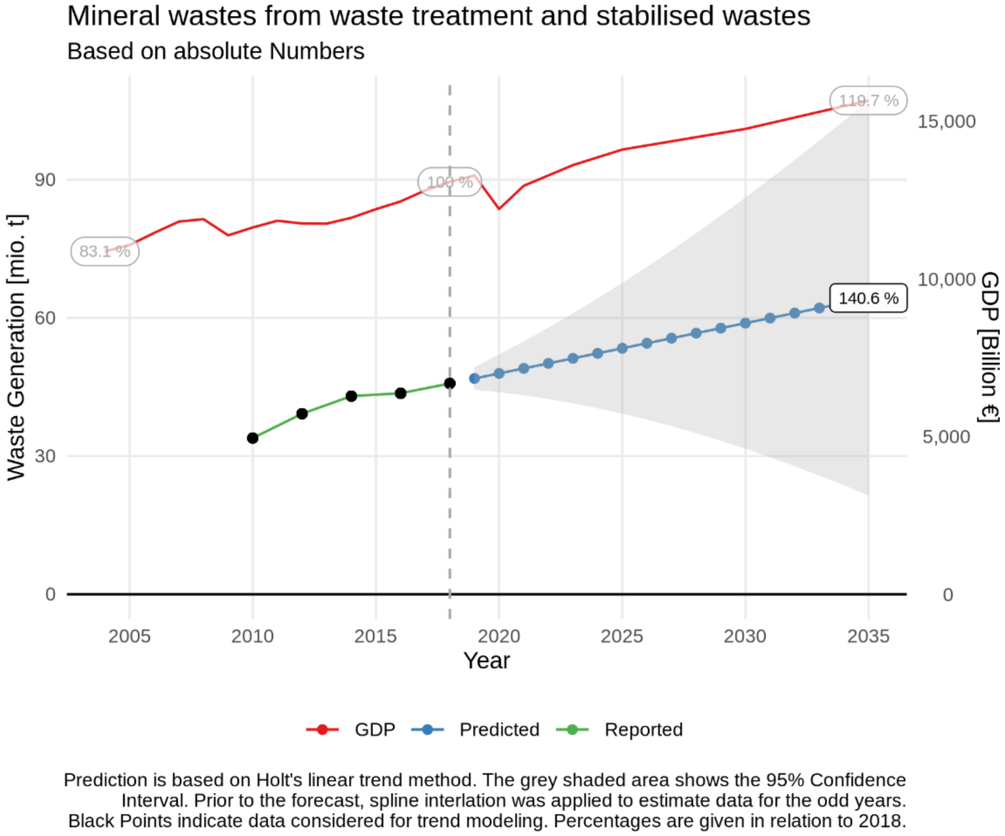



*Source: Eurostat*

In the time period 2010 - 2018, the generation of “Mineral waste from waste treatment and stabilised waste” (kg/per capita) increased by about 36.2% (4.52% annually over 8 years, calculated by linear regression), while the GDP/capita increased slightly. No decoupling from the GDP trend is indicated in the period 2010-2018.

## Projections (by a linear trend model)

### Figure A - 92 Projections calculated by a linear trend model for mineral waste from waste treatment and stabilised waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The category “Waste from waste treatment and stabilised waste” indicates no decoupling from the GDP trend in the period from 2010 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 40.6% in 2035 compared to 2018, respectively 2.4% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

## A.1.2.31 Sludges and liquid waste from waste treatment

### Composition of the waste stream

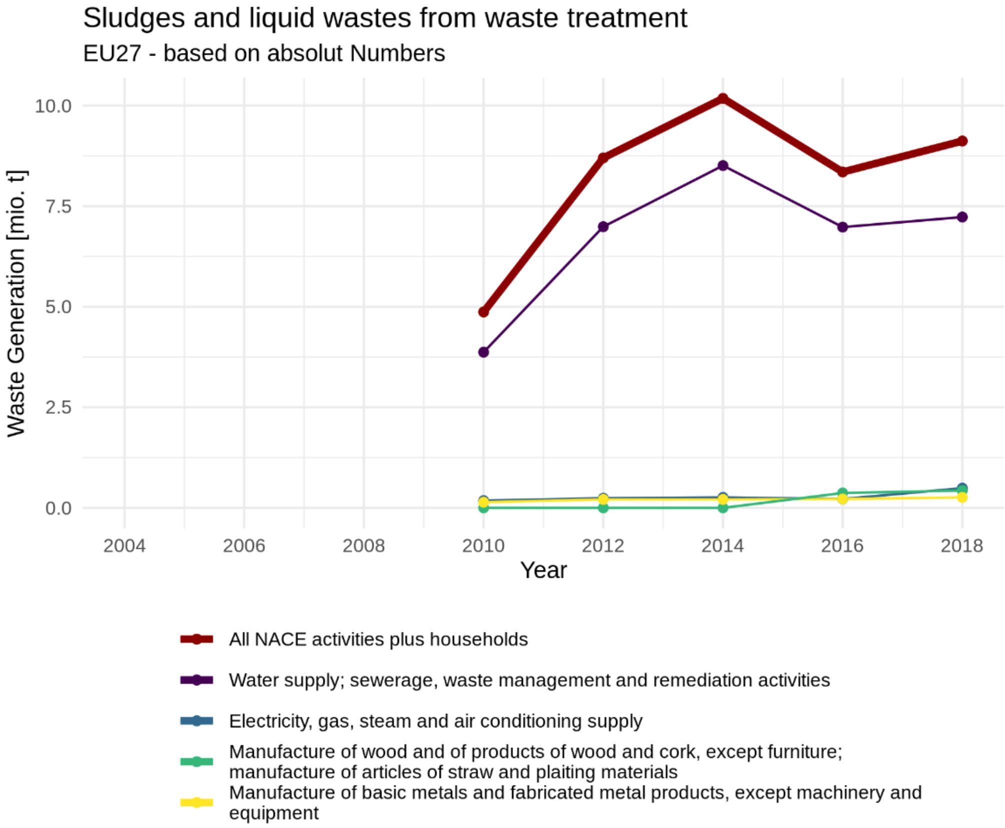
The waste stream “Sludges and liquid waste from waste treatment” (as defined in Section 2 – Waste Categories of the EU Waste Statistics Regulation) is composed of sludges or liquids from physico- or chemical treatments as well as digestate and liquors from anaerobic treatment of organic waste.

It does not include sludges from municipal waste water treatment, sludges from industrial waste water treatment, solid and liquid waste from soil and groundwater remediation or mineral waste from waste treatment.

Sludges and liquid waste from waste treatment is hazardous waste when containing toxic chemical compounds, oil, heavy metals or other dangerous substances. In 2018, 15 % of the sludges and liquid waste from waste treatment generated by the EU-27 were hazardous waste.

## Trends in waste generation and major sources

### Figure A - 93 Generation of sludges and liquid waste from waste treatment (million tonnes), total amount and waste generation by economic activity (absolute amounts for the four major sources of sludges and liquid waste from waste treatment are displayed), 2010 - 2018




*Source: Eurostat*

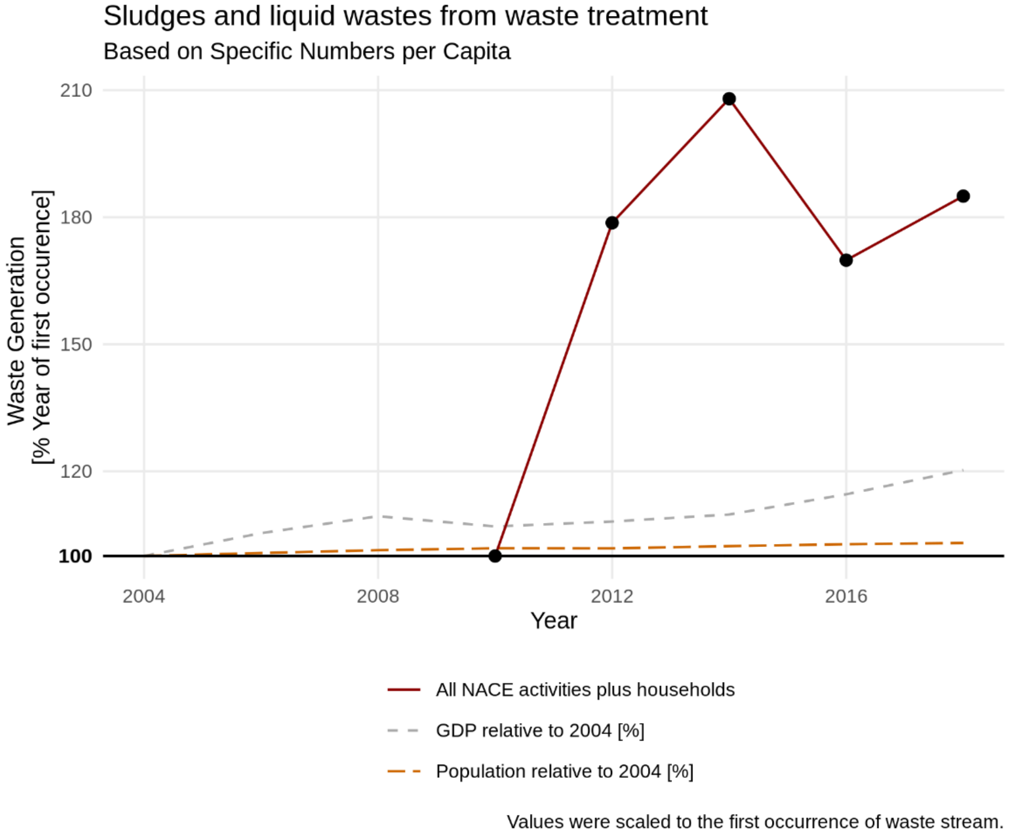
In the observation period 2010 – 2018, the generation of „Sludges and liquid waste from waste treatment" indicates a significant increase from 4.9 million tonnes in 2010 to 9.1 million tonnes in 2018. The highest increase (+ 3.8 million tonnes) occurred in the time period 2010 – 2014, followed by a slight decrease from 2014 to 2016, and by a further increase between 2016 and 2018. The waste generation trend of this waste stream follows closely the data trend of reported by Italy, amounting to 34 – 65 % of the waste generation of the EU within the period 2004 – 2018.

Major source for the generated sludges and liquid waste from waste treatment is the economic activity "Water supply; sewerage, waste management and remediation activities", responsible for 80 % of the amounts generated in 2018. Again, this trend is strongly influenced by data reported from Italy, which amounts to 39 – 71 % of the EU generated amounts within this economic activity in the period 2004 – 2018.

Other relevant sources are the economic activities "Electricity, gas, steam and air conditioning supply", "Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials" and "Manufacture of basic metals and fabricated metal products, except machinery and equipment", together responsible for 13 % of the sludges and liquid waste from waste treatment generated in 2018.

### Development of waste generation (kg/capita) compared to economic development and development of population in EU 27

### Figure A - 94 Decoupling effects on sludges and liquid waste from waste treatment generation in EU-27

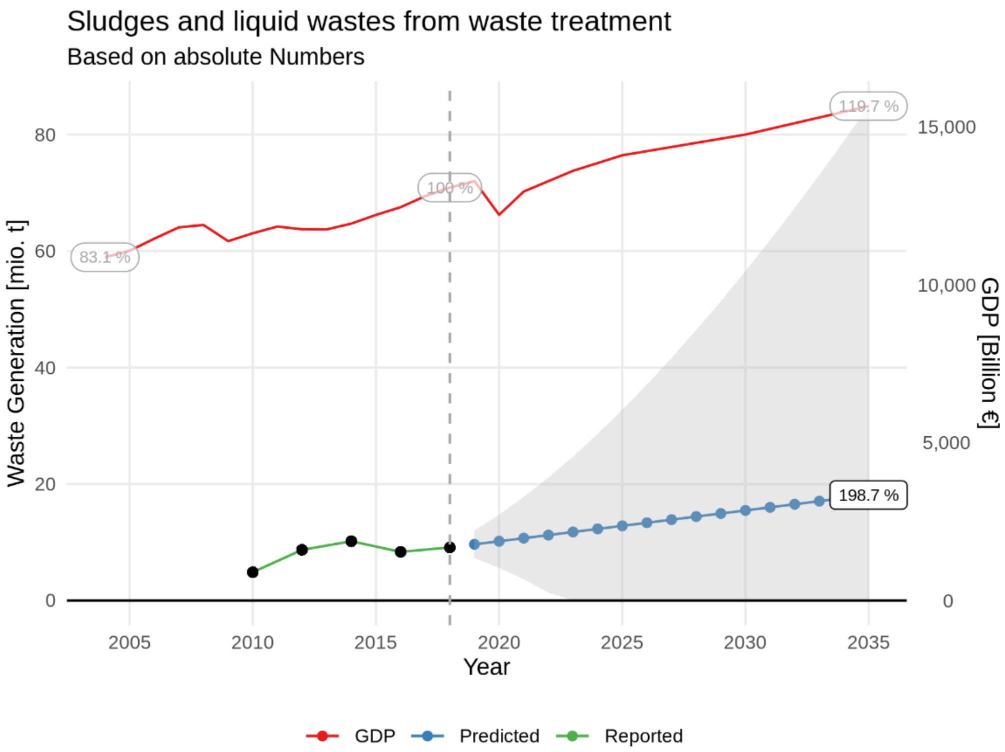



*Source: Eurostat*

In the period 2010 - 2018, the generation of sludges and liquid waste from waste treatment (kg/per capita) increased significantly by about 100.5%, (7.18% annually over 14 years, calculated by linear regression), while the GDP/capita slightly increased. No decoupling from the GDP trend in the period 2010-2018.

## Projections (by a linear trend model)

### Figure A - 95 Projections calculated by a linear trend model for sludges and liquid waste from waste treatment generation in EU-27




Prediction is based on Holt's linear trend method. The grey shaded area shows the 95% Confidence Interval. Prior to the forecast, spline interlation was applied to estimate data for the odd years. Black Points indicate data considered for trend modeling. Percentages are given in relation to 2018.

*Source: Eurostat and Umweltbundesamt*

The waste category "Sludges and liquid waste from waste treatment" indicates no decoupling effect from the GDP trend in the period from 2010 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 98.7% compared to 2018, respectively 5.8% per year on average.

The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

#### A.1.2.32 Municipal Waste

## Composition of the waste stream

Municipal Waste (MW) is defined in the Waste Framework Directive as:

> (a) mixed waste and separately collected waste from households, including paper and cardboard, glass, metals, plastics, bio- waste, wood, textiles, packaging, waste electrical and electronic equipment, waste batteries and accumulators, and bulky waste, including mattresses and furniture;
> (b) mixed waste and separately collected waste from other sources, where such waste is similar in nature and composition to waste from households.

## Trends in waste generation and major sources

A portion of the Municipal Waste (MW) originates from commercial businesses, which encompass a wide range of different types of commercial activities including retail, administration, services, hotels and restaurants. Beside households, MW is mainly generated by small enterprises, of which retail and food service enterprises are assumed the main waste generators.

MW amount statistics usually do not differentiate between waste from households and waste from commercial enterprises. This chapter focuses on waste collected from households as residual waste, bulky waste and separately-collected recyclable waste.

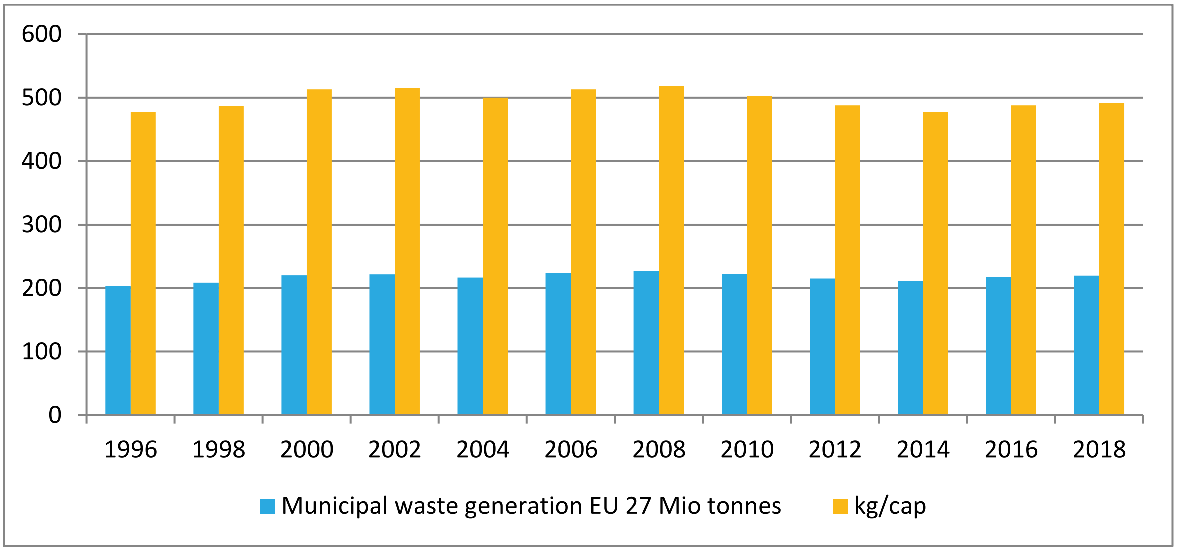
Within municipal waste, efforts undertaken by the Member States on source separation specifically result in an increase of separately collected recyclables (such as plastics, metals, glass, paper and cardboard) and a decrease of mixed municipal waste (see decreasing amounts on waste stream household and similar waste). Although there are hazardous sub-streams, such as WEEE, waste batteries and accumulators and household chemical waste, the major share of municipal waste is non-hazardous. Prevention of municipal waste is already prominently addressed in the Member States´ waste prevention programmes; several countries have adopted reduction targets.[561]

EUROSTAT has published data on the municipal waste generation for time series from 1995 to 2018 in the context of the EC Waste Statistics Regulation and the Municipal Structural Indicator (annual data). The generated MW quantities in the EU-27 evolved from 478 kg/capita in 1996 - peaking with 518 kg/capita in 2008 - to 492 kg/capita in 2018,

[561] EEA Report/4 (2018), Waste prevention in Europe – politics, status and trends in reuse in 2017, https://www.eea.europa.eu/publications/waste-prevention-in-europe-2017.

maintaining a rather constant level over the years. Household and similar waste generated in 2018 represent approx. 5.74 % of the total waste generated in the EU-27.

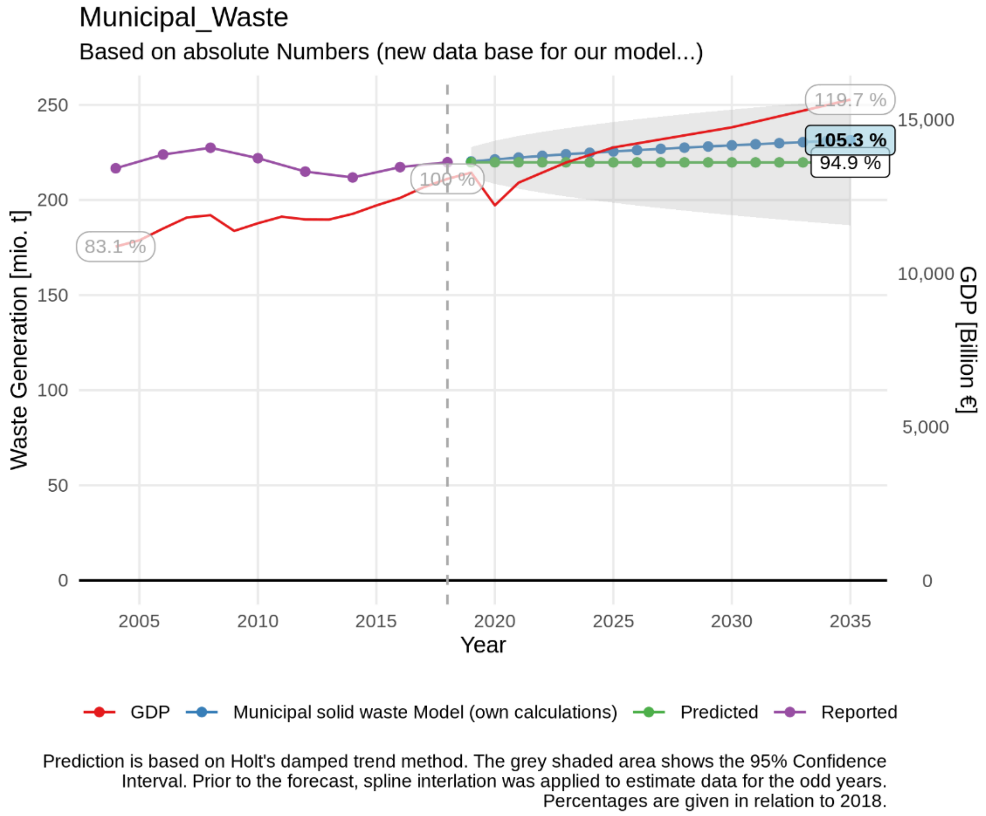
**Figure A - 96 Development of total generation of municipal waste and waste per capita in EU 27 in the period 1996 -2018**




*Source: Eurostat*

## Projections (by linear trend model, refined by Umweltbundesamt)

### Figure A - 97 Projections calculated by a linear trend model for municipal waste generation in EU-27




*Source: Eurostat and Umweltbundesamt*

The waste category "Municipal waste" indicates relative decoupling from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by linear trend model results in a decrease of -5.1% in 2035 compared to 2018, respectively -0.3% per year on average.

The projected increase of the EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year on average.

The total amount of MW generated in the EU27 maintained rather a stable level (biannual fluctuation between 0.7 % and 5.5 %) from 1996 to 2018. In total, the increase between 1996 to 2018 amounted to about 16.6 million tonnes, respectively 8.2 %.

Policy Framework for the BAU Scenario for Municipal Waste:

- Article 11 and Article 20 of the EU Waste Framework Directive[562] require Member States to take the necessary measures designed to achieve the following targets:
    - by 2020, the preparing for reuse and the recycling of waste materials such as at least paper, metal, plastic and glass from households and possibly of other origin as far as these waste streams are similar to the waste from households, shall be increased to a minimum of overall 50 % by weight;
    - by 2025, the preparing for reuse and the recycling of municipal waste shall be increased to a minimum of 55% by weight;
    - by 2030, the preparing for reuse and the recycling of municipal waste shall be increased to a minimum of 60% by weight; and
    - by 2035, the preparing for reuse and the recycling of municipal waste shall be increased to a minimum of 65% by weight.
- Article 11 requires Member States to set up separate collection of waste where technically, environmentally and economically practicable and appropriate to meet the necessary quality standards for the relevant recycling sectors. By 2015 separate collection had to be set up for at least the following: paper, metal, plastic and glass. Article 11 of the WFD as amended by Directive 2018/851 requires Member States to set up separate collection for textiles by 1 January 2025.
- According to Article 5 of the Landfill Directive[563], Member States shall take the necessary measures to ensure that by 2035 the amount of municipal waste landfilled is reduced to 10 % or less of the total amount of municipal waste generated (by weight).

The following data sets were considered for calculating the projections:

- Generation of waste by waste category; Amount of total MSW generated in the period 1996 – 2018, for EU-27 MS
- Gross domestic product at market prices chain linked volumes[564] (2015), million Euro for the period 1995-2019, provided by Eurostat for EU 27 MS
- “Population on 1 January – total“, provided by Eurostat, for the period 2004 to 2020 in EU MS, provided by Eurostat for EU 27 MS

[562] DIRECTIVE 2008/98/EC on waste
[563] COUNCIL DIRECTIVE 1999/31/EC of 26 April 1999 on the landfill of waste, as amended by Directive (EU) 2018/850
[564] For measuring the growth rate of GDP in terms of volumes, the GDP at current prices are valued in the prices of the previous year and the thus computed volume changes are imposed on the level of a reference year; this is called a chain-linked series (https://ec.europa.eu/eurostat/web/products-datasets/-/tec00115&lang=en)

- “Population on 1st January by age, sex and type of projection”, provided by Eurostat, for the period 2020 - 2035 in EU member countries; provided by Eurostat for EU 27 MS
- As the economic situation in the EU-27 Member States is different from one another, differ from each other, varies within the EU 27, the future development of Municipal waste generation is also expected to vary from country to country. In some countries, the fluctuation in reported municipal waste generation is much higher than the EU-27 average. In certain cases, the database of the national reporting appears to have changed repeatedly, so that values in the time series of individual countries can hardly be compared. Therefore, the projection for future municipal waste generation was calculated country by country.

The projection is based on data for the per-capita waste amount, presented for 1996 – 2018. As already stated, for several countries with a high GDP, this indicator indicates a decreasing tendency, typically since 2008 or 2010.

However, countries like the Czech Republic, Croatia, Latvia, Poland, Romania and Slovakia showed a significant increase of waste amounts during recent years, starting form a comparable low level of waste generation per capita. For example, in Romania, the municipal waste generation increased from 251 kg/cap in 2012 to 271 kg/cap in 2018 (EU-27 average 2012: 488 kg/cap, 2018 492 kg/cap).

The projection indicates an increase of the total MW amount generated in the EU 27 from 2018 to 2035 of about 11.6 million t corresponding to 5.3 % (population increase in this period amounts to 0.5 %, increase GDP: 19.7 %).

### A.1.2.33 Waste from renewable energy infrastructure

As waste from renewable energy infrastructure is not indicated by an entry in European and national waste statistics, past trend were not analysed comprehensibly and the focus of the analysis is placed on the future projections.

The waste amount and characteristics are a function of a wide variety of influencing factors, specifically where new future trends are concerned. Influencing factors encompass the population development, economic and technological progress, and necessary responses to changes in the environment, such as the slowdown of climate change. In particular, measures to protect the global climate will require an extensive transformation of our economic systems and therefore entail newly emerging waste streams.

In 2015, the Paris Agreement was adopted. This climate agreement aims at limiting the rise on average global temperature to well below 2°C above pre-industrial levels. Also, additional efforts are to be made towards further limiting the temperature increase to 1.5°C.

The EU and its Member States are among the nearly 190 Parties to the Paris Agreement.

Achieving these goals requires a far-reaching transformation of the economy and society, in particular conversions in the area of energy supply, mobility, thermal insulation of buildings, etc.), but also, for example, through resource conservation.

The EU aims at reducing its greenhouse gas (GHG) emissions by 50 or 55% by 2030 and at achieving climate-neutrality by 2050. As part of its "Green Deal" programme, massive investments are to be made over the next few years in the expansion and research of renewable energy sources and the expansion of the respective energy grid.

In terms of energy supply, a switch to renewable energy sources is absolutely necessary. The potentially usable energy sources or their potentials widely vary in the Member States. Forest-rich areas, areas with high wind potentials on land or in the sea, sun-rich areas, areas with a hydropower potential, geothermal energy, etc. provide for different starting conditions in the Member States. In addition to the theoretical potentials, the economic framework conditions are to be considered, such as subsidies, legal regulations, such as distance rules, political will and acceptance issues (e.g. in regions used intensively for tourism).

This also entails new challenges for waste management and affects both the quality (material composition) and the amount of individual waste streams. Appropriate collection systems and treatment technologies, as well as sufficient treatment capacities, must be made available for the sharply increasing waste streams in the future. In the following, key waste streams are highlighted and discussed in the context of the study.

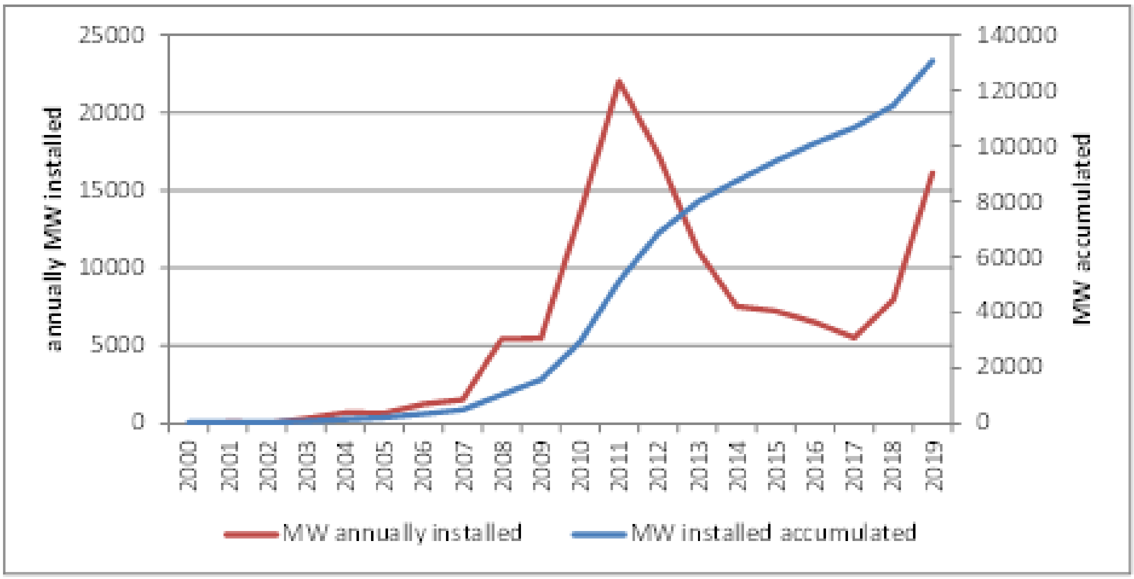
Electricity generation from photovoltaics and/or from wind turbines has increased in many countries in recent years and is expected to increase much more. Since electricity can be generated from sun and wind to varying degrees depending on the season and time of day, energy storage systems, among other things, will also be increasingly needed. Regarding mobility, a rapid shift from internal-combustion engines to electrically-powered cars and light trucks is emerging.

## Projections for generation of waste from photovoltaic systems

In 2019, approximately a capacity of 131 GW (solar energy) installed across the EU-28 existed. The installation of PV systems started in the early 2000s and increased strongly until 2011. A major slump was observed until 2017, followed by again by an increase in newly installed PV systems until 2019[565].

[565] Jäger-Waldau, A., et al (2020): How photovoltaics can contribute to GHG emission reductions of 55% in the EU by 2030; Renewable and Sustainable Energy Reviews Volume 126, July 2020.

**Figure A - 98 Development of installed photovoltaic capacity in the EU**[566]



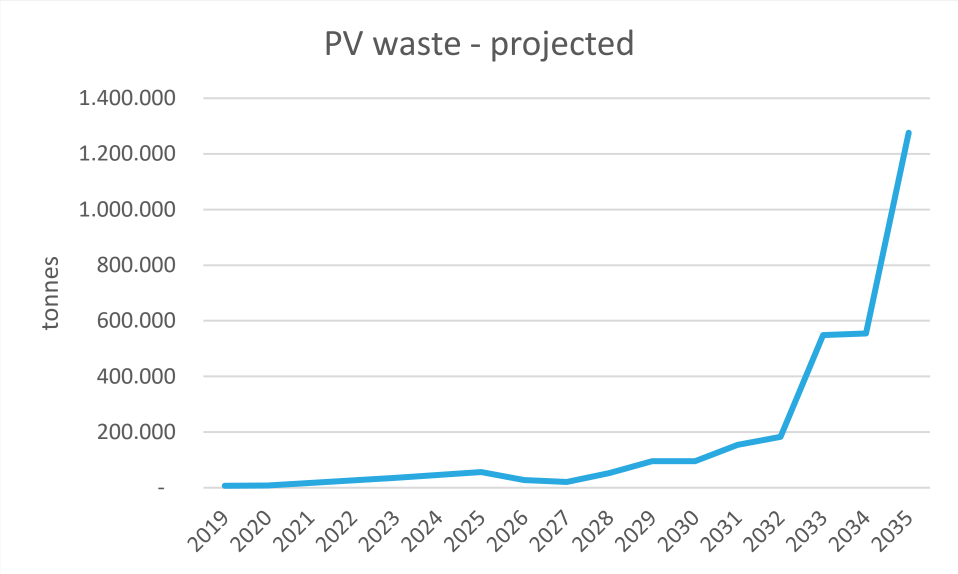

*Source: Umweltbundesamt*

In order to provide sufficient capacity of photovoltaic systems to achieve the envisaged reduction in greenhouse-gas emissions, an increase from the currently installed 130 GW to 600 GW in 2030, which corresponds to an annual increase of about 16% until 2030, is envisaged. On average, photovoltaic systems have a useful life of 25 years. Therefore, the photovoltaic systems installed in recent years will enter the waste management system with a corresponding time lag. Accordingly, we can expect that – on average – the PV capacity installed until 2010 will become waste until 2035.

The respective projections for waste generation until 2035 are shown in the following table resulting in an amount of approx. 1.28 million Tonnes in 2035.

[566] Jäger-Waldau, A., et al (2020): How photovoltaics can contribute to GHG emission reductions of 55% in the EU by 2030; Renewable and Sustainable Energy Reviews Volume 126, July 2020.

## Figure A - 99 Projections for PV waste generation until 2035 in the EU




*Source: Umweltbundesamt*

According to Jansen (2003)[567], there was no generation of PV electricity in the EU in 1995.

Per kW peak, a weight of 100 kg was assumed in 2000, decreasing linearly to 80 kg by 2020. The useful life was assumed to be 25 years. Furthermore, small losses (according to WAMBACH & ROMMEL (2017)[568]) were assumed before the end of the useful life. The estimation results in a waste generation of PV modules in the EU-28 of 1.28 million tonnes.

## Composition of PV Systems

Currently, the majority (over 90 %) is based on solar cells made of mono- or multicrystalline silicon. Further, so-called thin-film technologies are applied for the semiconductors, which are mainly based on the semiconductors CdTe and copper

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[567] Jansen J.C (2003) Policy support for renewable energy in the European Union. A review of the regulatory framework and suggestions for adjustment. ECN-C--03-113.
[568] WAMBACH K., ROMMEL, W. (2017): Neue Werkstoffe; ReSource 4/2017.

indium diselenide (CIS). Amorphous silicon and other technologies play a smaller role(Wambach, Rommel & Kerner, 2017)[569].

In terms of quantity, crystalline PV modules consist mostly of glass (60 - 85 %), aluminum (0 - 20 %), plastic (7 - 10 %), the solar cells (3 - 4 %), and others (2 - 2.5 %; conductors, solders, junction box), as well as small amounts of metals such as copper, tin, lead, silver, aluminium, nickel (Wambach & Rommel 2017)[570].

The valuable materials of a crystalline photovoltaic module from a recycling point of view are: aluminum frame, glass, silicon wafers, copper-containing conductor tracks and connection cables, silver and aluminum as part of the wafer coating, plastics in the back sheet. The aluminum frame and connecting cables can be recovered by upstream disassembly.

Regarding thin-film modules, the semiconductor coating of CdTe and CIS modules contains partly valuable (tellurium, indium, gallium) and partly hazardous substances (cadmium).

According to (BINE 2010, LAGA 2018)[571] CdTe thin-film modules consist of at least 95% glass and about 3.5% polymers. The rest is copper (cables, 1%), cadmium and tellurium (0.07% each), zinc (0.01%), about 0.003% CdS, and other metals with less than 0.01% each.

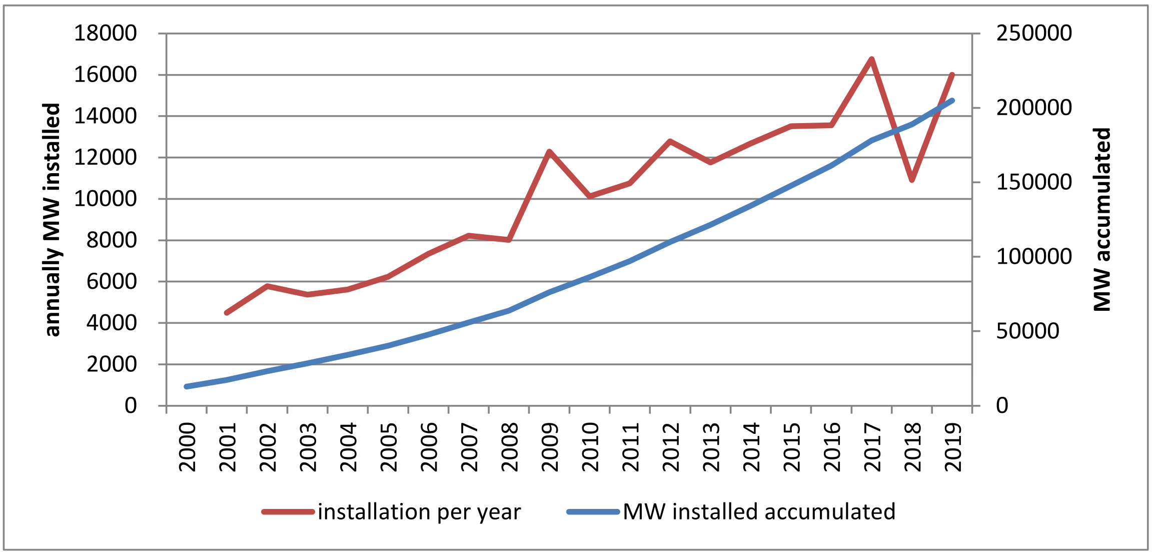
## Projections for Waste from Wind Power Installations

A total of 205 GW of wind power had been installed in the EU by the end of 2019. In 2018, the EU had an installed capacity to produce 160 GW onshore and 19 GW offshore wind energy.

In contrast to photovoltaics, expansion has been relatively steady since 2000. Accordingly, the amount of wind turbines taken out of production will increase.

569 WAMBACH K., ROMMEL, W. (2017): Neue Werkstoffe; ReSource 4/2017.
570 WAMBACH K., ROMMEL, W. (2017): Neue Werkstoffe; ReSource 4/2017.
571 BINE (2010) zitiert in Zeschmar-Lahl et al (2019)

**Figure A - 100 Development of installed wind energy (Wind Europe 2021)[572]**




*Source: Umweltbundesamt*

At national level, however, the expansion may have taken a significantly different course. In Austria, for example, the largest increases occurred in the period from 2003 to 2005, with over 100 new turbines each year, and from 2012 to 2015, again with 98 to 141 turbines annually. In the years 2007 to 2010, on the other hand, practically no new wind power plants were realized.

According to the Commission's long term strategy, the capacity for wind power will need to increase from the 2018 level of 180 GW to 351 GW in 2030, corresponding to a doubling of capacity (EC 2020)[573]. It is anticipated that 263 GW would be installed onshore and 88 GW offshore, which is almost five times the 2018 capacity.

An increase from 180 GW to 350 GW until 2030 means an increase of the capacity by about 5% annually. In the following diagram it is assumed that the same increase will take place until 2035.

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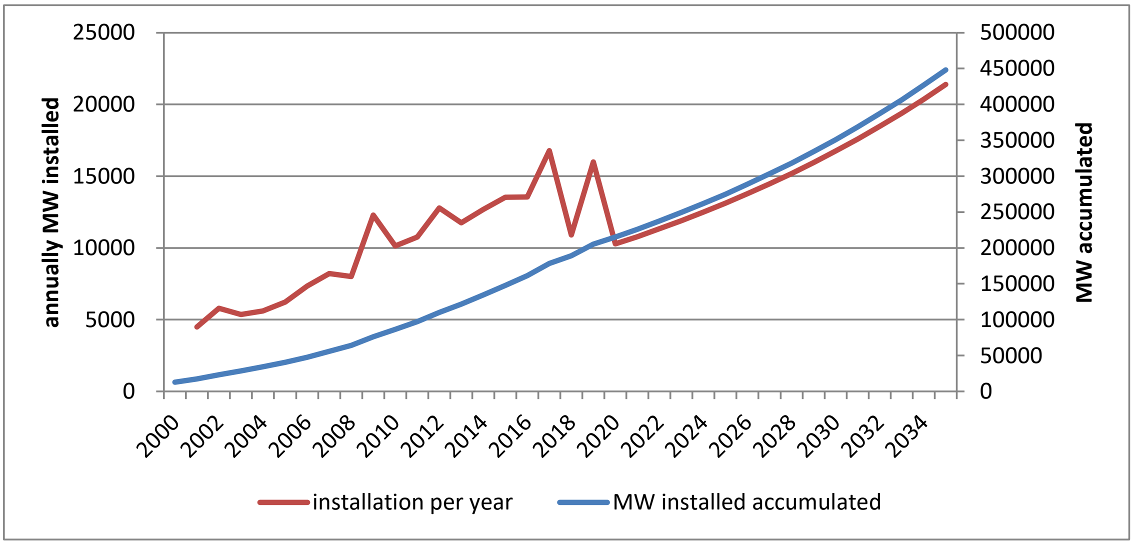
[572] Wind Europe (2021) Wind energy in Europe in 2019 - Trends and statistics https://windeurope.org/data-and-analysis/product/wind-energy-in-europe-in-2019-trends-and-statistics/#presentations

[573] EC (2020) Commission notice Guidance document on wind energy developments and EU nature legislation

## Figure A - 101 Projection of installed wind energy in EU until 2035




*Source: Umweltbundesamt*

On average, wind turbines have a useful life of 20 to 25 years.

Therefore, the wind energy systems installed in recent years will enter the waste management system with a corresponding time lag.

Accordingly, we can expect that – on average – the wind energy capacity installed until 2015 will become waste until 2035.

The respective projections for waste generation until 2035 are as shown in the figure above.

The largest installed onshore turbines in Europe are up to 8 MW (8,000 kW) with rotor diameters of up to 164 m. There are also much smaller plants, e.g. in Austria, the average plant capacity was less than 1.7 MW in 2001. In the years from 2015 onwards, plants of more than 3 MW per plant were mostly built (Source).

In the future, off-shore plants are expected to be installed increasingly. These are typically larger than on-shore turbines. According to Wind Power Monthly (Source), off-shore turbines with around 9.5 MW (9,500 kW) and rotor diameters of 164-167 m are currently being produced or ordered. Larger (10 and 12 MW) turbines are under development with rotor diameters in excess of 190 m[574].

[574] Grimwood, T., (2019) Onshore limits on turbine size could make offshore wind cheaper. [online] UtilityWeek. Available at: https://utilityweek.co.uk/onshore-limits-on-turbine-size-could-make-offshore-wind-cheaper/

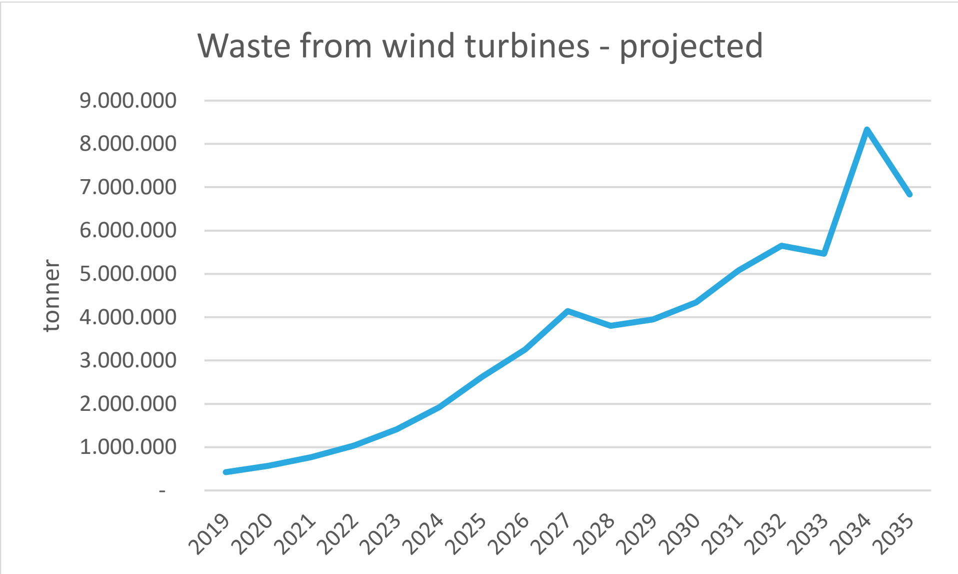
For on-shore turbines with steel towers, it can be roughly estimated that the reinforced concrete foundation account for slightly more than 80% of the mass, the tower about 10%, the nacelle 5%, the rotor blades 2%, and the hub 1.5%. For concrete towers or hybrid towers, the weight of the towers increases.

A 3 MW turbine has a total weight of approximately 2,000 tonnes. As the size of the turbine increases, the weight per MW decreases.

Due to the large variety of turbine sizes, types of towers (steel, concrete, steel plus concrete) and types of foundations (especially for offshore turbines), only a very rough estimate of expected future waste volumes is possible.

Assuming a useful life of 25 years, the installed capacity of about 10.1 GW until 2010 is of interest. Assuming that the plants had a capacity of 3 MW and a weight of 2,000 t per plant, the following projection of waste generation until 2035 can be made resulting in an amount of 6.83 million Tonnes in 2035:

### Figure A - 102 Projections for wind turbine waste generation until 2035 in the EU




*Source: Umweltbundesamt*

The simplified estimate is intended to reflect the magnitude of the expected waste stream in 2035. For the estimation of future waste from wind turbines, assumptions were made in particular about the output of the newly erected turbines. For the foundation, the nacelle and the rotor blades, power-dependent assumptions were made (t/MW), for the tower and the hub, a weight per wind turbine. A repowering, an export of turbine parts or the possible retention of the foundation in the ground were not taken into account.

Based on the assumptions made, the waste produced by wind turbines in 2035 in the EU amounts to 6.83 million tonnes.

Repowering (replacing old turbines with new ones at the same location) is often not possible due to the larger dimensions of new turbines.

Rotor blades are complex products made of composite materials. Most of the rotors consist of a matrix material (thermosetting plastics such as epoxy resin or polyester resin) in which fiber materials are embedded for reinforcement. The fiber material used was and still is predominantly glass fiber (GRP - glass fiber reinforced plastics), and increasingly also carbon fiber (CFRP). Carbon fibers are very light, have a higher mechanical strength and can thus extend the service life of the rotor blades, but are significantly more expensive. Due to the high cost of carbon fibers, glass fibers are used as standard. Carbon fibers are used only partially and in combination with glass fiber in very large rotor blades or in highly stressed rotor blade areas, especially in off-shore turbines with rotor blade diameters of over 100 m.

In addition to the matrix material and the embedded fibers, wood is sometimes used as a construction material, possibly PVC or PU foam and a metallic lightning conductor (PEHLKEN ET AL. 2017)[575].

## Projections for Waste from Traction Batteries

The number of electrically powered passenger cars in the EU-27 has increased since 2010 from just under 5,000 units to a total of around 1.19 million units in 2019. Of these, around 56% were battery electric vehicles (BEVs) and 44% plug-in hybrid electric vehicles (PHEVs). Approximately 70,000 light commercial vehicles (LCVs) were added to the 2019 inventory. The number of BEVs placed on the market has increased exponentially in recent years, while the number of PHEVs increased only linearly between 2016 and 2018.

The EU Sustainable and Smart Mobility Strategy (COM 2020)[576] defines a target of 30 million zero-emission vehicles by 2030. Zero-emission vehicles can be understood to mean BEVs in particular, as well as vehicles with fuel cells, but not PHEVs.

For estimating the quantity of traction batteries, it was assumed that the linear increase for PHEVs will continue. For BEVs and LCVs, an increase to a total of 30 million vehicles

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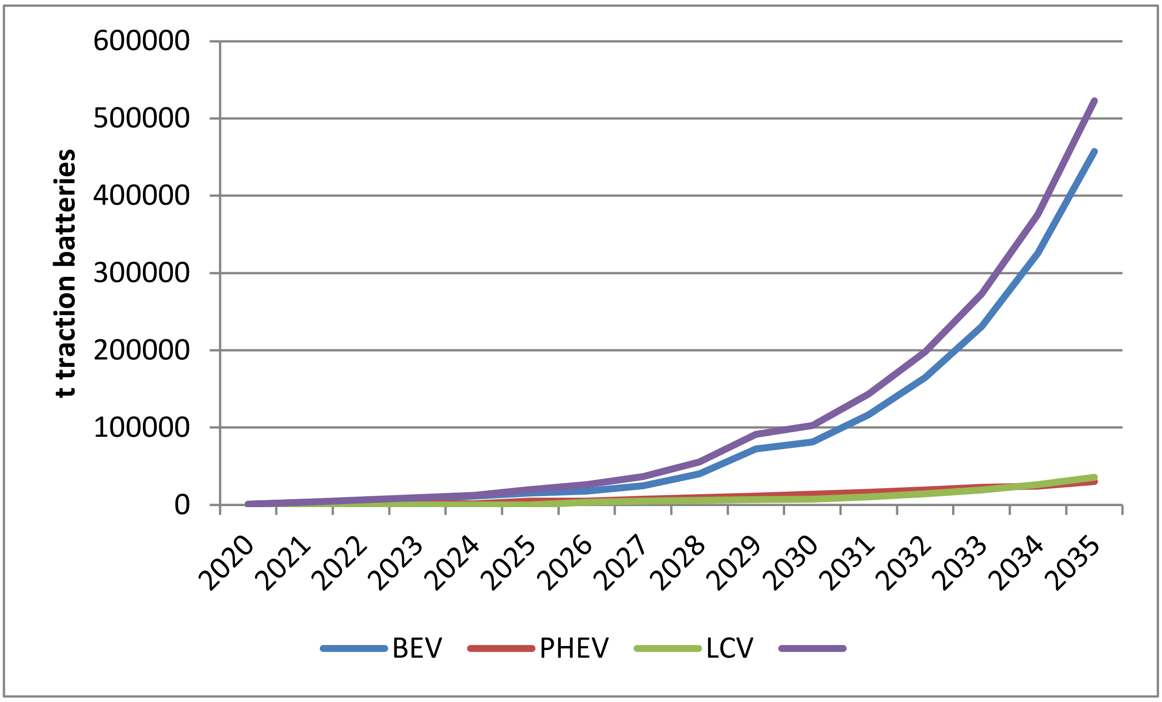
[575] PEHLKEN, A., ALBERS, H., GERMER, F. (2017): Rotorblätter aus Windkraftanlagen – Herausforderungen für das Recycling http://www.vivis.de/phocadownload/Download/2017_rur/2017_RuR_247-260_Pehlken.pdf

[576] COM (2020) 789 final COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Sustainable and Smart Mobility Strategy – putting European transport on track for the future {SWD(2020) 331 final}

by 2030 was assumed. Traction battery weights were assumed to amount to 300 kg/vehicle for passenger cars and LCVs, and to 80 kg/vehicle for PHEVs. The service life was assumed as 10 years.

The estimation results in an amount of traction batteries of about 523,000 t in 2035, approx. 87% of which are traction batteries of BEVs.

## Figure A - 103 Amount of traction batteries 2020 - 2035




*Source: Umweltbundesamt*

The extent to which the calculated amount actually ends up in waste management depends significantly on the extent to which a second life is enabled for the traction batteries. Second life, for example as energy storage for PV systems, can extend the service life by up to 15 years. Accordingly, the quantities of traction batteries entering waste management would be shifted into the future.

With regard to future developments concerning traction batteries, it can be assumed that the installed battery capacities in all vehicle categories will still significantly increase. At the same time, the energy densities in the installed batteries will increase. In

(UMWELTBUNDESAMT, 2017)[577], it is assumed that the current energy densities will increase by a factor of 3 by 2050. The average battery weight in battery electric passenger cars could halve by 2050.

Research is currently performed with regard to the materials used in the batteries. According to UBA (2014)[578], lithium cobalt oxide (LiCoO2) is presently still primarily used as the cathode material. However, new materials, such as nanomaterials made of phosphates of transition metals (LiXPO4 with X = Mn, Fe, Co or Ni) are increasingly employed; lithium manganese phosphate, lithium cobalt phosphate, lithium iron phosphate (LFP) are particularly preferred, , LiNiMnCo-oxide being widely used.

For traction batteries, three main developments are emerging with regard to waste prevention:

Decrease in weight per battery due to technological progress.

Second life of traction batteries shifts the point of generation in waste management .

Increased requirements for recycling, e.g. recovery rates for certain materials.

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[577] UMWELTBUNDESAMT (2017): Krutzler, T., Zechmeister, A., Stranner, G., Wiesenberger, H., Gallauner, T., Gössl, M., Heller, C., Heinfellner, H., Ibesich, N., Lichtblau, G., Schieder, W., Schneider, J., Schindler, I., Storch, A., Winter, R.: Energie- und Treibhausgas-Szenarien im Hinblick auf 2030 und 2050; REP-0628

[578] UBA (2014a): Dubbert, W., Schwirn, K., Völker, D., Apel, P.; Datenblatt Einsatz von Nanomaterialien in der Energiespeicherung

## A.1.3 Assessment on the BAU scenario of 15 ESTAT waste categories

In view of the linkage between “total municipal waste” and the ESTAT waste stream “household and similar waste”, which includes residual municipal solid waste only, both are presented in one chapter (cf. Appendix A.1.3.1). In view of the linkage between the ESTAT waste stream “mineral construction and demolition waste” and the ESTAT waste stream “soils”, which are both strongly related to construction activities[579], both are analysed in one chapter (cf. Appendix A.1.3.10).

### A.1.3.1 Municipal waste (including household and similar waste)

**Figure A - 104 BAU scenario for municipal waste (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 216,685,000 | 221,995,000 | 219,856,000 | 231,468,066 |
| **Relative trends and refined projections [%]** | | | -1.6% (2004-2018) | +5.3% (2018-2035) |

According to the terms of reference of this study, municipal waste including its sub-streams[580] will in any case be subject to the detailed assessment within Task 4. Municipal waste has moderately increased during the past decade and only a slight relative

[579] Even it is stated in the EC report that EWC-Stat data on soils does not allow the identification with certainty whether waste originates from construction and demolition activities it is assumed for this study that the majority of soils generated are related to C&D activities (Resource Efficient Use of Mixed Wastes, Improving management of construction and demolition waste, Final report, October 2017, https://ec.europa.eu/environment/system/files/2021-01/resource_efficient_uses_mixed_waste_Final_Report.pdf).

[580] This includes also residual municipal solid waste as indicated by household and similar waste.

decoupling of waste generation from GDP could be observed, indicating that the measures adopted at the EU and national level – although decelerating further growth – might not be sufficiently effective in reducing municipal waste generation. Although hazardous sub-streams are represented, such as WEEE, waste batteries and accumulators and household chemical waste, the major portion of municipal waste is non-hazardous. Prevention of municipal waste is already prominently addressed in the waste prevention programmes of the Member States; several countries have adopted reduction targets.[581] The projections up to 2035 indicate further moderate growth of the waste amounts per capita by 5.3% (cumulative over the period 2018 – 2035).

The key drivers can be seen in an increase in the demand for specific products, or a decrease in product quality (low durability, low reparability) requiring more frequent replacement of products (see chapter 2.2.3).

Significant efforts have been taken by the Member States towards improving source separation of municipal waste, resulting in an increase of separately collected recyclables (such as plastics, metals, glass, paper and cardboard) and in a decrease of residual municipal solid waste (cf. decreasing amounts of waste stream "household and similar waste").

**Figure A - 105 BAU scenario for household and similar waste (residual municipal solid waste) (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 162,16,000 | 152,460,000 | 133,850,000 | 109,645,150 |
| **Relative trends and projections (linear model) [%]** | | | -21.7% (2004-2018) | -18.1% (2018-2035) |

The Waste Framework Directive, in Article 9, specifies measures Member States shall take to enhance prevention of municipal waste, including promotion of repair, reuse and

581 EEA Report/4 (2018), Waste prevention in Europe – politics, status and trends in reuse in 2017, https://www.eea.europa.eu/publications/waste-prevention-in-europe-2017.

re-manufacturing. A waste prevention target for municipal waste in general has not been defined. The recently adopted methodology to measure reuse[582] within the EU can support the development of future reuse targets for this waste stream.

Waste prevention measures for household and similar waste established in the EU Member States include practices towards promoting reuse and repair of specific product categories such as EEE, textiles or furniture (see identified examples in chapter 4.3). In addition, increasing the awareness of household waste prevention is addressed in the national WPPs. As of 2014, eleven Member States have defined targets for waste prevention of household waste.[583] The household sector and generated key waste streams related to food, packaging, EEE, batteries and accumulators, textiles and furniture are addressed in the vast majority of the national WPPs.

The measures already implemented resulted in a relative decoupling of household waste generation from GDP development, meaning that the amount of household waste generation per capita (EU average) remained stable in the past years.

At the level of ESTAT categories, the analysis of the linkage between measures and waste generation for Member States having introduced WPP measures and those having not implemented measures did not provide a clear picture.

However it is viewed, household waste generation increased in total amounts under the BAU scenario but remained quite stable in terms of per capita values.

Even though this waste stream is showing a stable per capita trend in the analysis on the BAU scenario, the waste stream "Municipal waste (including household and similar waste)" is considered a candidate for the assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction. The key rationale behind this is that the waste stream is downstream of product groups such as EEE, textiles and furniture in the upstream, for which high future increase rates are expected.

#### A.1.3.2 Plastic waste

**Figure A - 106 BAU scenario for plastic waste (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|

582 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32021D0019&rid=3

583 EEA Report/4 (2018), Waste prevention in Europe – politics, status and trends in reuse in 2017, see https://www.eea.europa.eu/publications/waste-prevention-in-europe-2017.

| | | | | |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 9,540,000 | 12,340,000 | 16,900,000 | 22,204,315 |
| **Relative trends and projections (linear model) [%]** | | | +67.5% (2004-2018) | +31.4% (2018-2035) |

The waste stream "plastic waste" is composed of separately collected plastic packaging, plastic waste from production and processing as well as plastic waste from sorting and separation processes. It consists entirely of non-hazardous waste types. "Plastic waste" is one of the so-called "recyclables" waste streams[584].

For the observation period 2004 – 2018, the generation of "plastic waste" shows a continuous increase from 9.5 million tonnes in 2004 to 16.9 million tonnes in 2018 (+ 7.4 million tonnes), with higher annual rates of increase from 2004 to 2006 (+ 1.9 million tonnes), 2012 to 2014 (+ 2.1 million tonnes) and 2016 to 2018 (+ 1.8 million tonnes). The per capita increase was about 67.5%, (4.82% annually over 14 years, calculated by linear regression), a higher rate of increase than GDP per capita (17.3% between 2004 and 2018). This indicates no decoupling from the GDP trend, but on the contrary, stronger growth than GDP in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of plastic waste.

Calculating a projection to 2035 by a linear trend model results in an increase of 31.4% compared to 2018, respectively 1.8% per year in average. The projected increase of EU-27 GDP is 19.7%, compared to 2018, respectively 1.1% per year in average.

A major source for the generation of plastic waste is the economic activity "water supply; sewerage, waste management and remediation activities" where in 2018, 32 % of the plastic waste were generated. This economic activity indicates a continuous increase since 2006. This suggests that pre-treatment of waste (e.g. dismantling of end-of-life vehicles, mechanical pre-treatment of WEEE with the aim of separating recyclables, sorting of mixed waste) is an important source for plastic waste as a separate waste stream.

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[584] Eurostat waste statistics provide data for the aggregate "Recyclables" which consists of metallic waste, glass waste, paper and cardboard waste, rubber waste, plastic waste, wood waste and textile waste.

Other relevant sources are the economic activities "households", "services (except wholesale of waste and scrap)" and "manufacturing of chemical, pharmaceutical, rubber and plastic products", which together accounted for 43 % of plastic waste generated in 2018.

A very large portion of "plastic waste" is plastic packaging (14.8 million tonnes out of 16.9 million tonnes in 2018, or 88%[585]). This suggests that the efforts by Member States to increase recycling of municipal waste and packaging waste will be a major driver for further increasing the volumes of "plastic waste" as a separate waste stream.

Data and projections presented in this study indicate an increase in generation of plastic waste higher that the projected GDP in a BAU scenario for 2035. Additional EU policy intervention aimed at prevention of plastic packaging waste, WEEE and end-of-life vehicles would be most effective in preventing overall generation of plastics waste.

With regard to the analysis on the BAU scenario, the waste stream "Plastic waste" is considered a candidate for assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction.

As a high proportion of generated plastic waste in EU-27 is packaging - which is outside the scope of this study - and secondary waste from pre-treatment, it is proposed to focus future assessment of prevention measures on non-packaging plastic waste, including construction and demolition waste and municipal waste.

### A.1.3.3 Metallic waste

**Figure A - 107 BAU scenario for metallic waste (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 63,370,000 | 74,030,000 | 86,980,000 | 105,486,220 |

[585] Packaging waste by waste management operations, Eurostat, data retrieved in June 2021.

| | | |
|---|---|---|
| **Relative trends and projections (linear model) [%]** | +27.3%<br>(2004-2018) | +21.3%<br>(2018-2035) |

The waste stream "metallic waste" includes ferrous metals (like iron, steel) and alloys, non-ferrous metals (like aluminium, copper, zinc, lead, tin) and alloys as well as mixtures of ferrous and non-ferrous metals (like iron, steel, aluminium, copper, zinc, lead, tin) and alloys. It is entirely composed of non-hazardous waste types. "Metallic waste" is one of the so-called "recyclables" waste streams[586].

For the observation period 2004 – 2018, the generation of "metallic waste" shows an increase from 63.4 million tonnes in 2004 to 87.0 million tonnes in 2018, with the most significant increases occurring between 2008 and 2010 (+ 9.3 million tonnes) as well as 2016 and 2018 (+ 11.0 million tonnes). The increase in specific waste generation (kg/per capita) was about 27.3% (1.95% annually over 14 years, calculated by linear regression), while GDP/capita increased at a slightly lower rate (17.3% from 2004 to 2018).

No decoupling from the GDP trend was identified for the period 2004-2018. The data do not show any significant effect of the economic crisis year 2008 on the trend of metallic waste generation.

Calculating a projection to 2035 by a linear trend model results in an increase by 21.3% compared to 2018, or on average, 1.3% per year. The projected increase of EU-27 GDP is 19.7%, compared to 2018, or on average 1.1% per year.

A major source of metallic waste is the economic activity "water supply; sewerage, waste management and remediation activities", where in 2018, 25 % of the metallic waste was generated. This suggests that pre-treatment of waste (e.g. crushing and sorting of construction and demolition waste, dismantling of end-of-life vehicles,) is an important source for metallic waste as a separate waste stream.

Other relevant sources are the economic activities "construction" (22%, mainly from demolition of reinforced concrete, e.g. reinforcement steel meshes), "manufacture of basic metals and fabricated metal products, except machinery and equipment" (18%) and "manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment" (10%), together accounting for 50 % of metallic waste generated in 2018.

Only a small portion of the "Metallic waste" is metal packaging (3.9 million tonnes out of 87.0 million tonnes in 2018, or 4%[587]). The household sector as a whole does not

[586] Eurostat waste statistics provide data for the aggregate "Recyclables" which consists of metallic waste, glass waste, paper and cardboard waste, rubber waste, plastic waste, wood waste and textile waste.
[587] Packaging waste by waste management operations, Eurostat, data retrieved in June 2021.

contribute much to the generation of "Metallic waste" either. This suggests that the efforts by Member States to increase municipal waste recycling will not be a major driver for further increasing the volumes of "Metallic Waste" as a separate waste stream.

Data and projections presented in this study indicate an increase of the metallic waste generation within the BAU scenario for 2035. The increase is expected to be slightly higher than the projected GDP development. Additional EU policy interventions aimed at prevention of construction and demolition waste and end-of-life vehicles would also be effective in preventing metal waste generated by the construction sector.

With regard to the analysis of the BAU scenario, the waste stream "metallic waste" is considered a candidate for assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction.

It is noted that metal waste includes packaging waste (which is outside the scope of this study) and secondary waste from pre-treatment. In future assessment of prevention measures it is proposed to focus on non-packaging metal waste arising out of construction and demolition waste and municipal waste.

#### A.1.3.4 Glass waste

**Figure A - 108 BAU scenario for glass waste (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 12,630,000 | 14,280,000 | 16,390,000 | 19,611,708 |
| **Relative trends and projections (linear model) [%]** | | | +24.5% (2004-2018) | +19.7% (2018-2035) |

The waste stream "glass waste" comprises waste glass packaging, glass waste from production of glass and glass products as well as waste glass from sorting and recycling processes. Glass waste is hazardous in the case of glass powder (particle size relevant) and when containing heavy metals. "Glass waste" is one of the so-called "recyclables" waste streams.

For the observation period 2004 – 2018, the generation of "glass waste" shows a steady increase from 12.6 million tonnes in 2004 to 16.4 million tonnes in 2018 (+ 3.8 million tonnes). The increase in specific waste generation (kg/per capita) was about 24.5% (1.75% annually over 14 years, calculated by linear regression), while GDP/capita increased at a slightly lower rate (17.3% between 2004 and 2018). This indicates no decoupling from the GDP trend in the period 2004-2018.

The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of glass waste.

Calculating a projection to 2035 by a linear trend model results in an increase of 19.7% compared to 2018, or on average 1.2% per year. The projected increase of EU-27 GDP is 19.7% compared to 2018, or on average 1.1% per year.

A major source of glass waste is the economic activity "households" where in 2018, 55 % of the glass waste was generated. A very large share of the "glass waste" is glass packaging (14.5 million tonnes out of 16.4 million tonnes in 2018, or 89%[588]). This suggests that the efforts by Member States to increase recycling of municipal waste and packaging waste, and probably the efforts to reduce the consumption of single-use plastic products as required by the Directive 2019/904[589] by substituting the plastics packaging material, will be a major driver for further increasing the volumes of "glass waste" as a separate waste stream.

A further relevant source of glass waste is the economic activity "water supply; sewerage, waste management and remediation activities" where in 2018, 18 % of the glass waste was generated. This suggests that pre-treatment of waste (e.g. dismantling of end-of-life vehicles -> windscreens, mechanical pre-treatment of WEEE with the aim of separating recyclables -> screens) is an important source for glass waste as a separate waste stream.

"Manufacture of other non-metallic mineral products" and "services (except wholesale of waste and scrap)" together account for a further 19 % of glass waste generated in 2018.

Data and projections presented in this study indicate an increase of the generation of glass waste for a BAU scenario for 2035. The increase is expected to be slightly higher that the projected GDP development. Additional EU policy interventions aimed firstly at prevention of glass packaging waste, and secondly at prevention of WEEE and end-of-life vehicles, would be most effective in preventing overall waste generation of glass waste.

With regard to the analysis on the BAU scenario, the waste stream "glass waste" is considered a candidate for the assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction.

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[588] Packaging waste by waste management operations, Eurostat, data retrieved in June 2021.

[589] Directive (EU) 2019/904 on the reduction of the impact of certain plastic products on the environment

As a high proportion of generated glass waste in EU-27 is packaging - which is outside the scope of this study - and secondary waste from pre-treatment, it is proposed to focus future assessment of prevention measures on non-packaging glass waste arising from construction and demolition waste and municipal waste.

#### A.1.3.5 Textile waste

**Figure A - 109 BAU scenario for textile waste (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 4,050,000 (not considered for BAU scenario) | 1,960,000 | 2,170,000 | 3,319,327 |
| **Relative trends and refined projections [%]** | | | -63.8%* (2004-2018) | +48.2%* (2018-2035) |

** The huge differences in past trends and future projections are caused by elimination of past reference years and taking into account ongoing initiatives for calculating the future refined projections. See also Chapter in Appendix A.1.2.7 and explanation on the trend model in Chapter 2.2.1.*

Total volumes of textile waste generated in the EU have decreased specifically in the period 2004 to 2010 due to decrease of generated waste amounts in the manufacturing sector, followed by a moderate increase in the past decade (2010 – 2020). However, waste textiles from households (mainly worn textiles) are still not widely collected separately, but end up in residual municipal solid waste (i.e. ESTAT waste category "Household and similar waste"), and information on the share of textile waste in other waste streams is limited[590]. The reported figures therefore do not allow identification of any coupling or decoupling of textile waste generation from economic growth throughout the overall period 2004 to 2018. As Member States are required by the

[590] Köhler A., Watson D., Trzepacz S., Löw C., Liu R., Danneck J., Konstantas A., Donatello S. & Faraca G., 2021. Circular Economy Perspectives in the EU Textile sector, EUR 30734 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-38646-9, doi:10.2760/858144, JRC125110.

Waste Framework Directive to establish separate collection for textiles from 2025 onwards, this is likely to change in the coming years. Also, clothing production has grown strongly over recent years.[591] If no further measures are taken, the projections for 2035 predict a trend of substantial growth.

Although several activities on textile waste are to be launched at EU level in the near future, the existing fast-fashion trend and the prevailing linear consumption and production patterns in the clothing industry are still expected to lead to growing amounts of textiles placed on the European market.

Although quantitative prevention of textiles waste has not yet been addressed specifically in EU legislation, textiles and textile waste are already ranked highly on the EU Agenda, including the CEAP, the EU Green Deal, and the EU Plastics Strategy.

In the CEAP, textiles are addressed as one of the key product value chains. A comprehensive EU Strategy for Textiles is expected in 2021. This strategy will aim at strengthening industrial competitiveness and innovation in the sector, boosting the EU market for sustainable and circular textiles, including the market for textile reuse, addressing fast fashion and driving new business models. [592] On the management of textile waste, the Waste Framework Directive (Art. 11 (1)) requires the Member States to set up separate collection of textiles by the beginning of 2025. Further, Art. 11 (6) of the WFD requires the Commission to consider, by the end of 2024, setting targets for 'preparing for reuse and recycling' for textiles waste.

At national level, several Member States have already addressed textile waste in their WPPs. Sweden has defined a target on reducing hazardous substances in textiles, Denmark has established targets for reducing textile waste and towards a minimum share of second-hand goods in total textile sales. The Netherlands have defined a reduction target regarding the amount of textiles in residual waste[593]. Further information on the related examples can be found in Chapter 4.3.

The projections in this study suggest that the amount of generated textile waste will increase substantially under the BAU scenario until 2035 if no additional waste prevention policies are implemented.

With regard to the analysis on the BAU scenario, the waste stream "textile waste" is considered a candidate for the assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction.

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[591] A study from 2017 has estimated that global production volumes have doubled over the past 15 years, Ellen MacArthur Foundation (2017): A NEW TEXTILES ECONOMY.

[592] EC (2020): A new Circular Economy Action Plan: for a cleaner and more competitive Europe.

[593] EEA (2018): Waste prevention in Europe – policies, status and trends in reuse in 2017.

### A.1.3.6 Discarded vehicles (including ELV)

The ESTAT category “discarded vehicles” covers all the end-of-life vehicles as defined by Directive 2000/53/EC. In 2021 about 316 million units were in use, of which 271 million (86%) are covered and 46 million (14%) are not covered by the Directive on end-of-life vehicles. It is not known to which extent reported data includes vehicles not covered by the Directive.

**Figure A - 110 BAU scenario for discarded vehicles (including ELV) (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 6,940,000 | 8,490,000 | 8,990,000 | 11,559,166 |
| **Relative trends and refined projections [%]** | | | +7.0% (2004-2018) | +26.2% (2018-2035) |

The generation of ELVs[594] has grown during the past decade, a trend which is expected to continue up to 2035. The reported figures show a relative decoupling in the past, but calculated projections indicate no decoupling of end-of-life vehicles from economic development in the period up to 2035. Cars contain hazardous materials and critical raw materials. Significant numbers of used vehicles are leaving the EU, which may cause severe environmental and health impacts when treated under inappropriate conditions. In 2017, the whereabouts of 3.77 million vehicles, which had left the stock of registered vehicles, were unknown[595]. Critical raw materials are lost for the European industry when the end-of-life vehicles are exported outside the EU. Reuse and repair of vehicles is widely applied in the EU. The on-going review of the ELV Directive will look into separate definitions of reuse, repair and remanufacturing[596].

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[594] Respectively ELVs collected by official take-back systems.
[595] Williams, R., Keeling, W., Petsinaris F., Baron, Y., Mehlhart, G. 2020 Supporting the Evaluation of the Directive 2000/53/EC on end-of-life vehicles.
[596] See, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12633-Revision-of-EU-legislation-on-end-of-life-vehicles.

Currently, waste prevention of ELVs is not specifically addressed in European legislation.

Also, the EU policy towards establishing a more sustainable transport system[597], is expected to have a considerable impact on car ownership and thus prevention of ELVs. Examples of measures to be taken include the promotion of car sharing, progressive restrictions on car use in residential and urban areas and the improvement of public transport.

The ELV Directive contains general provisions on many aspects which are directly relevant to build a circular model for the car industry and have a link to waste prevention. However, many of these provisions are not sufficiently detailed, specific and measurable. This is the case for example for provisions in the ELV Directive on the design and production of vehicles to facilitate dismantling and recycling; on the use of recycled materials in new vehicles; or on extended producer responsibility. Currently the ELV Directive 2000/53/EC is being evaluated to include ecodesign, reuse and repairability of ELV.

The EC Sustainable and Smart Mobility Strategy[598] aims to make transport systems as a whole more sustainable. It highlights that the upcoming revision of the Directive on end-of-life vehicles will aim at reducing the overall environmental footprint of the production and dismantling of cars.

Prevention of ELV is addressed in a few Member State's WPPs, including measures to promote ecodesign to facilitate dismantling and recycling at end of life, and the reuse of vehicle parts, as in Spain[599]. New trends such as car sharing, progressive restrictions on driving in residential and urban areas and the improvement of public transport might decrease car ownership and consequently the amount of generated ELV[600]. Further information on the related examples can be found in chapter 4.3.

The past decade has shown increasing trends in generated ELV which are expected to continue under the BAU scenario in the near future with an expected shift to electrification of the car stock.

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[597] EC Sustainable and Smart Mobility Strategy.

[598] EC (2020): Communication on Sustainable and Smart Mobility Strategy – putting European transport on track for the future {SWD(2020) 331 final} (COM (2020) 789 final).

[599] EEA (2018): Waste prevention in Europe – policies, status and trends in reuse in 2017.

[600] Transport and environment (2017). Briefing note. Does sharing cars really reduce car use. Available at: https://www.transportenvironment.org/sites/te/files/publications/Does-sharing-cars-really-reduce-car-use-June%202017.pdf

With regard to the analysis on the BAU scenario, the waste stream "discarded vehicles (including ELV)" is considered a candidate for assessment on additional EU-wide prevention measures bringing benefits in terms of waste reduction.

### A.1.3.7 Discarded equipment (including WEEE)

The ESTAT category "discarded equipment" covers all waste electrical and electronic equipment (WEEE) as defined by Directive 2012/19/EU. The equipment not covered by the WEEE Directive but reported under the Waste Statistics Regulation is seen as negligible[601].

**Figure A - 111 BAU scenario for discarded equipment (including WEEE) (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends* and projections (linear model) [tonnes]** | 2,110,000 | 4,160,000 | 5,320,000 | 7,916,303 |
| **Relative trends and projections (linear model) [%]** | | | + 147.7% (2004-2018) | +48.8% (2018-2035) |

* EUROSTAT has published data on the generation of discarded equipment for the time series from 2004 to 2018 in the context of the EC Waste Statistics Regulation. These data reflect the amounts collected by official take-back schemes in the Member States, which – however - account for only about 40% of the actual WEEE generation[602].

WEEE generation, and WEEE collected by official take-back schemes, has seen a strong increase over the past decade and it has grown faster than GDP. Considerable volumes of used EEE/WEEE are exported out of the EU: Huisman et al. (2015) estimated 1.5 million tonnes - out of a total WEEE generation of around 12 million tonnes in 2012. This may lead to severe environmental and health problems, if inappropriate treatment is

601 EC (2016): Study on WEEE collection rates.
602 Huisman et al. (2015): Countering WEEE Illegal Trade (CWIT), see https://www.cwitproject.eu/wp-content/uploads/2015/09/CWIT-Final-Report.pdf

applied outside the EU. WEEE can contain a variety of hazardous substances, and specific types of WEEE are hazardous waste.

Although important drivers of WEEE growth are currently being tackled by several EU initiatives, such as low durability of many devices, the ongoing digitalization of the EU economy and society and existing consumer trends are still leading to high EEE volumes being placed on the market.

Electronics and information and telecommunication technology (ICT) belong to the key product value chains specifically addressed in the CEAP. In this context, the EC in 2020 announced a *Circular Electronics Initiative* including several activities contributing to quantitative as well as qualitative waste prevention. The planned actions include:

Adopting regulatory measures for mobile phones, tablets and laptops under the Ecodesign Directive, so that devices are designed for durability, reparability, upgradability, maintenance, reuse and recycling and for energy efficiency (Preparatory studies covering also software aspects are ongoing);

Adopting regulatory measures on chargers for mobile phones and similar devices, including the introduction of a common charger, improving the durability of charging cables, and incentives to decouple the purchase of chargers from the purchase of new devices (a preparatory study is ongoing);

Integrating a 'right to repair' with a focus on electronics and ICT, including a right to update obsolete software (Preparatory studies to extend consumer protection legislation on horizontal rights to information/transparency and repair are ongoing);

Improving the collection of WEEE by exploring options at EU level to incentivise take-back, return or sell-back of mobile phones, tablets, laptops and chargers (a preparatory study is ongoing); Review of EU rules on restrictions of hazardous substances in EEE and providing guidance to improve coherence with relevant legislation, including REACH and Ecodesign (review is currently being performed) .

Recently, the European standard EN 50614 "Requirements for the preparing for reuse of waste electrical and electronic equipment" was adopted, which is expected to support high-quality preparation for reuse of WEEE.

At national level, reuse and preparation for reuse, and repair practices for WEEE have progressively been taken up in the EU Member States inter alia by promoting the establishment of reuse networks/platforms and adopting specific preparation for reuse targets for WEEE (Spain and Flanders[603]). There are examples where Member States have introduced obligatory funds to promote reuse activities and waste prevention in the context of EPR. The fees collected are used to fund targeted prevention or reuse initiatives by private or public actors. Individual examples for restricting single-use EEE, such as

[603] EEA (2018): Waste prevention in Europe – policies, status and trends in reuse in 2017.

razors (Balearic Islands) and for banning the destruction of unsold items (France) were identified. Some of these implemented measures are in line with the key requirements of Article 6 of the WEEE Directive. Further information on the related examples can be found in Chapter 4.3.

As long as the above described activities do not show significant reduction of the EEE volumes placed on the market, further WEEE growth until 2035 is to be expected.

With regard to the analysis on the BAU scenario, the waste stream "discarded equipment (including WEEE)" is considered a candidate for assessment of additional EU-wide prevention measures, in particular based on good practice examples implemented in the Member States, such as restricting single-use EEE or banning the destruction of unsold items, that would ensure benefits in terms of waste reduction.

### A.1.3.8 Batteries and accumulators waste

**Figure A - 112 BAU scenario for batteries and accumulators waste**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 1,210,000 | 1,380,000 | 1,580,000 | 2,049,679 |
| **Relative trends and refined projections [%]** | | | + 25.4% (2004-2018) | + 52.2% (2018-2035) |

The generation of battery and accumulator waste[604] has increased strongly in the past decade. Waste generation has grown much faster than GDP. Further strong growth is expected until 2035, in particular due to the strongly increasing demand for batteries for electric road transport vehicles using batteries for traction. This is mainly being driven by EU legislation setting CO2 emission standards for vehicle manufacturers, but also by EU legislation setting Member State minimum targets for public procurement of clean vehicles. Several types of waste batteries and accumulators are classified as hazardous. Hazardous substances contained in batteries can cause adverse environmental and health impacts if the batteries are not collected and treated properly. High energy

[604] Respectively waste batteries and accumulators collected by official take-back schemes.

batteries and accumulators such as many lithium-based accumulators pose a high risk of fire during handling and treatment. For many types of batteries and accumulators, material loops are currently insufficiently closed, due to deficits in collection (portable batteries) and due to the current sub-optimal functioning of recycling markets and/or technological challenges. This is particularly relevant for battery raw materials that are considered critical raw materials, such as cobalt, lithium and natural graphite.

The current regulatory framework covers only the end-of-life stage of batteries (collection, recycling, removal) through the Batteries Directive[605]. As yet there are no legal provisions in the EU (apart from the restriction of hazardous substances), that cover other aspects of the production and use phases of batteries, such as electrochemical performance and durability, GHG emissions, or responsible sourcing. In order to promote circular economy and reduce environmental and social impacts throughout all stages of the battery life cycle, in 2020, a proposal for a Regulation on batteries and waste batteries[606] has been proposed by the Commission. In addition to further requirements that aim to improve the recovery of materials from waste batteries, it proposes the introduction of several key requirements that will contribute to the reduction of waste batteries and accumulators:

Performance and durability requirements for portable batteries for general use and for rechargeable industrial batteries and electric vehicle batteries

Removability and replace-ability of portable batteries

Obligatory labelling to help consumers to make more sustainable choices

Requirements to facilitate repurposing (e.g. as a stationary storage system in combination with PV systems) and remanufacturing of industrial batteries and electric-vehicle batteries including a duty of producers to provide access to the battery management system, so that repurposing operators can determine the state of health of a battery, and an obligation for persons carrying out the repurposing or remanufacturing of batteries to ensure that the examination, performance testing, packing and shipment of batteries and their components is carried out following adequate quality control and safety instructions

The obligation for contracting entities when procuring batteries or products containing batteries to choose batteries with significantly lower environmental impacts over their lifecycle. This refers specifically to durability, the carbon footprint of a battery and the recycled content in a battery.

Rules for future amending restrictions on hazardous substances in batteries.

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[605] Directive 2006/66/EC on batteries and accumulators and waste batteries and accumulators.

[606] Proposal for a Regulation of the European Parliament and of the Council concerning batteries and waste batteries, repealing Directive 2006/66/EC and amending Regulation (EU) No 2019/1020

Although projections indicate a substantial increase of batteries and accumulators waste under a BAU scenario for 2035, it is assumed that the requirements of the proposed Regulation concerning batteries and waste batteries will effectively contribute to waste prevention and no additional EU policy interventions are needed.

A possible additional measure could be a future phase out of non-rechargeable portable batteries, which was evaluated in the preparatory work for the proposal of a Regulation concerning batteries and waste batteries. However, requirements of this type are not included in the proposed Regulation as it was concluded that there is currently not sufficient evidence available to demonstrate the effectiveness and feasibility of such a phase-out.

With regard to the analysis on the BAU scenario and the recently published proposal on EC Batteries Regulation, the waste stream "batteries and accumulators waste" is not considered a candidate for assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction.

### A.1.3.9 Rubber waste (including end-of-life tyres)

**Figure A - 113 BAU scenario for rubber waste (including end-of-life tyres) (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 2,630,000 | 2,340,000 | 2,970,000 | 3,846,315 |
| **Relative trends and refined projections [%]** | | | + 12,9% (2004-2018) | + 19.2% (2018-2035) |

ETRMA (2020)[607] provides data on the generation of end-of-life tyres in Europe for EU-27 of 2,704,400 t in 2018. This represents around 91% of the rubber waste generated in the EU-27, as published by Eurostat for 2018, showing that end-of-life tyres dominate rubber

[607] ETRMA European Tyre & Rubber Manufacturers Association, (2020) Europe – 91% of all End of Life Tyres collected and treated in 2018; https://www.etrma.org/library/europe-91-of-all-end-of-life-tyres-collected-and-treated-in-2018/

waste. Information on other rubber waste, e.g. from general rubber goods, is not available. Therefore the focus in the analysis is laid on end-of-life tyres.

The generation of waste tyres has strongly increased in the past ten years. Waste generation has grown faster than GDP. The amount of waste tyres is expected to continue to grow substantially until 2035. This is to a certain extent triggered by environmental policies, such as the desired shift to e-mobility, which makes vehicles heavier, causing increased tyre abrasion rates. Tyres contain natural rubber, which is considered a critical raw material. There are also concerns about high-quality recycling of waste tyres due to the low demand for secondary rubbers for high-quality applications.

While setting additional rules for high-performance tyres that tackle also tyre abrasion is already planned at EU level, additional measures including measures to promote increased retreading should be evaluated for their waste prevention potential at EU level. Some national examples for such measures were identified (ES, FR).

At the EU level, tyres and waste tyres are regulated in different pieces of legislation, including the Tyre Labelling Regulation[608] (which however does not address the issue of tyre abrasion) and Council Directive 89/459/EEC[609] (which regulates the compulsory conditions for the placing on the EU market of retreaded tyres). Neither regulation is expected to contribute to waste prevention of tyres in its current state.

Options to prevent waste tyres include retreading, a practice applied to casings of spent tyres that have been inspected and repaired, which is especially common for trucks, but less so for passenger vehicle tyres[610]. However, tyre retreading has seen a decline in the past decade[611].The EU market for replacement tyres (substitution of tyres in an old vehicle) increased by 19% in the period 2009-2018[612] [613], indicating an increase in waste generation.

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[608] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0740

[609] Council Directive 89/459/EEC of 18 July 1989 on the approximation of the laws of the Member States relating to the tread depth of tyres of certain categories of motor vehicles and their trailers.

[610] http://www.ambenvironmental.co.uk/tyre-waste-disposal/

[611] EY (2016) The socio-economic impact of truck tyre retreading in Europe. The circular economy of tyres in danger, see https://rechile.mma.gob.cl/wp-content/uploads/2019/06/3.-ARNEC3-201611-ey_retreading.pdf

[612] ETRMA's membership: APOLLO VREDESTEIN, BRIDGESTONE EUROPE, BRISA, COOPER TIRES, CONTINENTAL, GOODYEAR, HANKOOK, MARANGONI, MICHELIN, NOKIAN TYRES, PIRELLI, PROMETEON, SUMITOMO RUBBER INDUSTRIES AND TRELLEBORG WHEEL SYSTEMS. Furthermore, members include Associations in the following countries: Belgium, Finland, France, Germany, Hungary, Italy, the Netherlands, Poland, Spain and the UK.

[613] ETRMA Members' Tyre Sales in Europe (2020): Weaker Market for 2019, see https://www.etrma.org/wp-content/uploads/2020/01/20200121-2019-market-apppraisal-FINAL.pdf

The EC Sustainable and Smart Mobility Strategy[614] states that issues raised by the use of tyres that have to be addressed include noise and microplastics which pollute our waters and seas, and can ultimately enter the food chain. The promotion of high-performing tyres should be enhanced as they reduce energy consumption and emissions (including rolling noise) while maintaining vehicle safety. In the related action plan to this strategy, the development of coherent rules for environmental, energy and safety performance of tyres is envisaged by 2023, possibly also addressing prevention aspects.

Data and projections shown in this study suggest that rubber waste and waste tyres will increase substantially under a BAU scenario and would benefit from additional EU wide waste prevention measures.

With regard to the analysis on the BAU scenario, the waste stream "rubber waste (including end-of-life tyres)" is considered a candidate for the assessment of additional EU-wide prevention measures ensuring benefits in terms of waste reduction.

### A.1.3.10 Mineral waste from construction and demolition and soils

In view of the linkage between the ESTAT waste stream "Mineral construction and demolition waste" and the ESTAT waste stream "soils", which are both strongly related to construction activities[615], these were both analysed within one chapter. Non-mineral materials from construction activities are addressed within other ESTAT categories covering recyclables such as "metal wastes" or "glass wastes" .

#### Figure A - 114 BAU scenario for mineral waste from construction and demolition (see Appendix for detailed trend analysis)

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|

[614] EC (2020): Communication on Sustainable and Smart Mobility Strategy – putting European transport on track for the future {SWD(2020) 331 final} (COM (2020) 789 final).

[615] Although it is stated in the EC report that EWC-Stat data on soils does not allow the identification with certainty whether waste originates from construction and demolition activities it is assumed for this study that the majority of soils generated are related to C&D activities (Resource Efficient Use of Mixed Wastes, Improving management of construction and demolition waste, Final report, October 2017, https://ec.europa.eu/environment/system/files/2021-01/resource_efficient_uses_mixed_waste_Final_Report.pdf).

| | | | | |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | Not reported | 277,230,000 | 303,170,000 | 447,161,181 |
| **Relative trends and refined projections [%]** | | | +26.0% (2010-2018) | + 23.6% (2018-2035) |

**Table 5-24 BAU scenario for soils (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | Not reported | 383,280,000 | 468,600,000 | 814,652,461 |
| **Relative trends and projections (linear model) [%]** | | | +18.3% (2010-2018) | +73.8% (2018-2035) |

The generation of C&D waste and soils has increased moderately over the past decade. Further growth at substantial rates is expected by 2035, closely linked to the expected economic development in the EU. Although landfilled volumes have decreased, because Member States strive to meet the Waste Framework Directive target for preparing for reuse, recycling and other material recovery, large volumes are still landfilled or backfilled.

Apart from mineral C&D waste, there are waste streams from construction and demolition which are hazardous, e.g. insulation materials including fibrous materials or POPs.

Several activities to reduce the generation of C&D waste and its negative impacts have been launched at EU level. Some Member States have legal requirements to promote the reuse of C&D materials, which are considered worth assessing for their scale-up potential under Task 4. An example is the introduction of obligatory collection schemes for C&D waste to be established in the context of EPR for construction materials. This also applies to other measures identified in the national WPPs, for instance measures to promote renovation. The example from Austria calls for the introduction of obligatory pre-demolition audits of buildings regarding reusable components in order to promote reuse and recycling. Further information on the related examples can be found in Chapter 4.3.

At the EU level, construction and demolition waste is addressed in different ways. The Waste Framework Directive (Art. 11 (2)) set a binding target of 70% by weight, by 2020 for preparing for reuse, recycling and other material recovery, including backfilling operations. Addressing the high shares of backfilling in some Member States, the revised WFD stipulates in Art. 11 (6) that the Commission shall consider by the end of 2024 the setting of additional preparing for reuse and recycling targets for C&D waste. As C&D waste is a priority product value chain in the new Circular Economy Plan this will push future uptake to regulate that waste stream at European level. In the new Circular Economy Action Plan, construction and buildings is one of the priority product value chains.

A significant proportion of soil and excavation material has the potential for reuse and recycling, but sometimes requires pre-treatment. Applications include backfilling, restoration and landscaping of land, and landfill cover.

There are several initiatives ongoing at European level to promote circularity in the construction sector: The European Renovation Wave Strategy[616] emphasises the importance of circular approaches to the renovation of buildings, alongside energy efficiency improvements. In addition, the New European Bauhaus initiative[617] is looking at creative solutions to deliver more sustainable buildings. Harmonised rules for the marketing of construction products are established under the Construction Products Regulation[618]. Basic requirements for construction works specify, inter alia, that construction works must be designed and built in such a way that the durability of the construction works is ensured. The proposal for a revision of the Construction Products Regulation is expected to be put forward by the European Commission in 2021 with the intention of better addressing the sustainability and environmental footprint of construction products.

At national level, construction and demolition waste and sub-streams are addressed in most of the Member States' WPPs. As of 2017, all countries covered the construction and demolition sectors in terms of waste prevention or reuse except for Latvia, Poland and Portugal. Measures range from the creation of national websites with regional information on the location and availability of second-hand construction materials, as emphasised by Austria, Bulgaria and Greece; Building Components Exchange (Bauteilbörsen) as in Switzerland and Germany, and the promotion of renovation instead of new construction and increasing the lifespan of buildings with specific targets for the number of buildings that should be renovated, as in France[619,620]. Although this may

[616] https://ec.europa.eu/energy/topics/energy-efficiency/energy-efficient-buildings/renovation-wave_en
[617] https://europa.eu/new-european-bauhaus/about/about-initiative_en
[618] Regulation (EU) No 305/2011 of 9 March 2011 laying down harmonised conditions for the marketing of construction products.
[619] EEA (2018): Waste prevention in Europe – policies, status and trends in reuse in 2017.
[620] EEA (2014). Waste prevention in Europe.

suggest that the construction sector is highly circular, scrutiny of waste management practices reveals that C&DW recovery in practice is largely based on backfilling operations and low-grade recovery, such as using recycled aggregates in road sub-bases, and currently the material streams arising from demolition and renovation works are not suitable for reuse or closed-loop recycling[621]. In France, for instance, mandatory EPR will be introduced for building materials, including requirements to set up schemes for free pick up of materials/components after demolition.[622] Assessments on the effectiveness of single measures are not available and related impacts often are unknown (see further analysis in Chapter 4.3).

The information collected in this study indicates that C&D waste, especially the mineral fraction as well as soils, will likely keep growing substantially under the BAU scenario, suggesting that further measures are needed to address waste prevention. Examples of measures implemented successfully in Member States may serve as best practice. Those measures will be assessed in terms of their potential for possible new EU policy options to strengthen waste prevention.

With regard to the analysis on the BAU scenario, the waste streams "mineral waste from construction and demolition" and "soils" are considered candidates for the assessment on additional EU-wide prevention measures bringing benefit in terms of waste reduction.

### A.1.3.11 Common sludges

**Figure A - 115 BAU scenario for common sludges (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 13,140,000 | 14,400,000 | 17,54,.000 | 21,419,466 |

[621] EEA (2020). Construction and demolition waste: challenges and opportunities in a circular economy. Briefing note. Available at: https://www.eea.europa.eu/publications/construction-and-demolition-waste-challenges

[622] EEA (2014). Waste prevention in Europe.

| | | |
|---|---|---|
| **Relative trends and projections (linear model) [%]** | +28.9%<br>(2004-2018) | +22.1%<br>(2018-2035) |

The waste stream “Common sludges” is mainly made up of sludge from the treatment of municipal sewerage water, cesspit contents, organic sludge from food preparation and processing and sludges from on-site effluent treatment in the paper industry. All common sludge is non-hazardous waste.

For the observation period 2004 – 2018, the generation of “Common sludges” increased from 13.1 million tonnes in 2004 to 17.5 million tonnes in 2018 (+ 4.4 million tonnes). The increase of the specific waste generation (kg/per capita) was about 28.9 % (1.95% annually over 14 years, calculated by linear regression), while the GDP/capita increased only slightly by 17.3%.

No decoupling from the GDP trend was identified for the period 2004-2018. The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of sludges.

Calculating a projection to 2035 by a linear trend model results in an expected increase by 22.1% compared to 2018, respectively 1.3% per year in average. The projected increase of EU-27 GDP is 19%, compared to 2018, respectively 1.1% per year in average.

The major source for generation of common sludges is the economic activity “Water supply; sewerage, waste management and remediation activities”. In 2018, 66 % of the common sludges were generated by this economic activity. “Manufacture of food products; beverages and tobacco products” and “Manufacture of paper and paper products; printing and reproduction of recorded media” account for another 23% of the generation of common sludges.

The generation of this waste stream is mainly driven by improvement of waste water management in Europe. The amount of sewage sludge correlates with population and efficiency of waste water treatment.

Collection and treatment of urban waste water have improved over the last decade in the EU, with compliance rates of 95% for collection, 88% for secondary (biological) treatment, and 86% for more stringent treatment (removal of phosphorus and nitrogen), resulting in increasing amounts of waste from waste water treatment. Still, an amount of urban waste water corresponding to 6.6 million population equivalent (1%) is not collected, over 37 million population equivalent (6%) of the waste water collected is not sufficiently well treated to meet secondary treatment standards, while nearly 32 million population equivalent (8%) do not meet more stringent treatment standards. Improvement in waste water treatment is needed in some Member States to comply fully with Articles 3, 4 and 5 of the Urban Waste Water Directive[623]. In this context it has to be mentioned that the evaluation of the Sewage Sludge Directive 86/278/EEC (SSD) has been conducted in 2020/2021 assessing the criteria of the effectiveness, efficiency, relevance, coherence and EU added-value of the SSD in all Member States.

Nevertheless, the gap to full compliance with requirements of the Urban Waste Water Directive is considered to be sufficiently small to allow the use of the linear trend model for the projection of future generation of "common sludges".

The amount of "common sludges" cannot be influenced by any direct waste prevention measures. On the contrary, an increase of the generation of common sludges is an inevitable consequence of implementing measures for further improving urban waste water treatment.

Data and projections presented in this study indicate an increase under a BAU scenario for 2035. As the generation of "common sludge" cannot be influenced by direct waste prevention measures, no additional EU policies are suggested.

With regard to the analysis on the BAU scenario, the waste stream "Common sludges" is not considered a candidate for assessment of additional EU-wide prevention measures bringing benefit in terms of waste reduction.

### A.1.3.12 Health care and biological waste

**Figure A - 116 BAU scenario for health care and biological waste (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 1,390,000 | 1,930,000 | 1,920,000 | 2,263,680 |
| **Relative trends and projections (linear model) [%]** | | | +24.4% (2004-2018) | +17.9% (2018-2035) |

[623] Council Directive concerning urban waste water treatment (91/271/EEC)

For the observation period 2004 – 2018, the generation of "health care and biological waste" shows a slight increase from 1.4 million tonnes in 2004 to 1.9 million tonnes in 2018. In 2018, 73 % of the healthcare and biological waste was generated within the economic activity "services (except wholesale of waste and scrap)", indicating healthcare waste from human origin. Another 23% is generated in "Manufacture of food products; beverages and tobacco products", indicating healthcare waste from animal healthcare.

The increase of the specific waste generation of healthcare and biological waste (kg/per capita) was about 24.4 % (1.7 % annually over 14 years, calculated by linear regression), while the GDP/capita increased only by 17.3%. This indicates no decoupling from the GDP trend in the period 2004-2018.

Calculating a projection to 2035 by a linear trend model results in an increase of the "Health care and biological waste" generation by 17.9% compared to 2018, or on average 1.1% per year. It is noted that the effects of the COVID pandemic on waste generation were not considered during this study, but it is very likely that waste statistics for 2020/21 (not yet available) will see a steep increase of health care and biological waste generation.

The waste stream "healthcare and biological waste" includes biological waste from healthcare for animals and humans; it includes sharps from health care, plaster casts, clothing, and diapers from hospitals. Although the data and projections presented in this study indicate an increase under a BAU scenario for 2035, this waste stream cannot be influenced by direct waste prevention measures, as it is generated by health care interventions (humans and animal). Additional EU policy are not suggested.

With regard to the analysis on the BAU scenario, the waste streams "Healthcare and biological waste" is not considered a candidate for assessment of additional EU-wide prevention measures.

### A.1.3.13 Industrial effluent sludges

**Figure A - 117 BAU scenario for industrial effluent sludges (see Appendix for detailed trend analysis)**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 8,470,000 | 12,450,000 | 13,010,000 | 15,531,309 |
| **Relative trends and projections (linear model) [%]** | | | +46.5% (2004-2018) | +19.4% (2018-2035) |

For the observation period 2004 – 2018, the generation of “industrial effluent sludges” shows a significant increase from 8.5 million tonnes in 2004 to 13.0 million tonnes in 2018 (+ 4.5 million tonnes). The most intensive increase occurred in the period 2004 – 2008 (+ 4.0 million tonnes) and again from 2016 to 2018 (+ 1.5 million tonnes).

The leading source of industrial effluent sludges is the economic activity “Water supply; sewerage, waste management and remediation activities”, where in 2018, 26 % of the industrial effluent sludges were generated.

In the period 2004 - 2018, the generation of industrial effluent sludges (kg/per capita) increased by 46.5 % (3.32% annually over 14 years, calculated by linear regression), while GDP/capita slightly increased. This indicates no decoupling from the GDP trend in the period 2004-2018.

The waste category “industrial effluent sludges” shows no decoupling effect from the GDP trend in the period from 2004 to 2018. Calculating a projection to 2035 by a linear trend model results in an increase of 19.4% compared to 2018, or on average 1.1% per year.

The waste stream “industrial effluent sludges” includes sludges and solid residues from industrial wastewater treatment, solid and liquid waste from soil and groundwater remediation, and boiler cleaning sludges. It further includes waste from cooling water conditioning and cooling columns as well as drilling mud.

It also includes de-inking sludges, and sludges with low oil and metal content, but not metal- and oil-containing sludges from oil/water separators containing edible oil, steam degreasing waste, or grease- and (mineral) oil-containing sludges from oil/water separators. The waste stream “Industrial effluent sludges” does not contain sludges from the production of printing inks, paints dyestuff, varnish and sealants, sludges from food preparation or sludges and liquid waste from waste treatment.

The data and projections presented in this study indicate an increase under a BAU scenario for 2035. The generation of this waste stream is strongly linked to the treatment of waste or wastewater generated by industrial processes. In the wake of the EU zero pollution ambitions, further efforts for reducing emissions to the environment are expected, resulting in a future increase in the generation of this waste stream. Therefore, no EU policy measures for the prevention of this waste stream are suggested.

The waste stream “industrial effluent sludges” is not considered a candidate for assessment of additional EU-wide prevention measures.

#### A.1.3.14 Sorting residues

**Figure A - 118 BAU scenario for sorting residues**

| | 2004 | 2010 | 2018 | 2035 |
|---|---|---|---|---|
| **Absolute trends and projections (linear model) [tonnes]** | 32,160,000 | 50,680,000 | 90,440,000 | 14,935,441 |
| **Relative trends and projections (linear model) [%]** | | | +173.3% (2004-2018) | +61.4% (2018-2035) |

"Sorting residues" is a so-called "secondary waste", which means that it is not generated by production processes or consumption but rather during waste treatment (recovery and disposal) operations.

For the observation period 2004 – 2018, the generation of "sorting residues" shows a continuous increase from 32.2 million tonnes in 2004 to 90.4 million tonnes in 2018 (+ 58.3 million tonnes). The increase of the specific waste generation (kg/per capita) was about 173.3%, (12.38% annually over 14 years, calculated by linear regression), while the GDP/capita increased only slightly by (17.3%).

No decoupling from the GDP trend was identified for the period 2004-2018. The data do not show any significant effect of the economic crisis year 2008 on the trend of waste generation of sorting residues.

Calculating a projection to 2035 by a linear trend model results in an expected increase by 61.4% compared to 2018, or on average 3.6% per year. The projected increase of EU-27 GDP is 19.7%, compared to 2018, or on average 1.1% per year.

The generation of this waste stream is mainly driven by improvement of waste management in Europe, as Member States have implemented measures for meeting the recycling targets set in European Waste Legislation, and measures for limiting the landfilling of municipal waste to 10% of its generated amount[624,625].

In this regard, the CEAP (2020) puts an emphasis on improving the separate collection of waste. The Commission proposes to harmonise separate waste collection systems, to help citizens, businesses and public authorities better separate waste. The proposal is scheduled to be published in 2023. It will consider

- the most effective combinations of separate collection models,
- the density and accessibility of separate collection points, including in public spaces,
- aspects that facilitate consumer involvement, such as common
- bin colours, harmonised symbols for key waste types, product labels, information campaigns and economic instruments.
- standardisation and the use of quality management systems to assure the quality of the collected waste destined for use in products

In order to attain the recycling and landfill targets, sorting is a common pre-treatment process before recycling or recovery, in which sorting residues are generated.

The amount of sorting residues can be reduced by improvement of the separate collection of recyclables at source, but cannot be influenced by direct waste prevention measures.

With regard to the analysis on the BAU scenario, the waste stream “Sorting residues” is not considered a candidate for assessment of additional EU-wide prevention measures bringing benefit in terms of waste reduction.

### A.1.3.15 Waste from renewable energy infrastructure

[624] Article 5(2) of the Landfill Directive obliged Member States to reduce landfilling of municipal biodegradable waste to a maximum of 75 % by 2006, 50 % by 2009 and 35 % by 2016, compared to a 1995 baseline.

[625] Article 5(5) of the revised Landfill Directive (Directive (EU) 2018/85042) requires Member States to reduce the landfilling of municipal waste to a maximum of 10 % by 2035, and it introduces a ban on the landfilling of separately collected waste, including biodegradable waste.

Waste from renewable energy infrastructure has not been monitored as a specific category in European and national waste statistics, so the past trend can be analysed only qualitatively. The focus of the analysis is on the future projections.

The waste amount and characteristics are a function of a wide variety of factors, which include population development, economic and technological progress, and necessary responses to European climate and energy policy. In particular, measures to protect the global climate will require an extensive transformation of the economic system, in the course of which newly emerging waste streams are to be expected. Appropriate collection systems and treatment technologies as well as sufficient treatment capacities must be made available for the emerging waste streams.

The EU is committed to reduce its greenhouse-gas emissions by 55 % by 2030 and to become climate-neutral by 2050.[626] Massive investments are to be made over the next few years for a clean energy supply across the economy. [627] The capacity for wind power will need to double from the 2018 level of 180 GW to 351 GW in 2030.[628] In order to provide sufficient capacity of photovoltaic systems to achieve the greenhouse gas target, an increase from the currently installed 130 GW to 600 GW in 2030, corresponding to an annual increase of about 16% until 2030, is envisaged.[629] In turn, waste from wind turbines and waste photovoltaic panels and accumulators used for stationary storage systems are expected to increase significantly in the coming years.

Due to long life times, only low amounts of waste from photovoltaic panels, wind power turbines and vehicle battery systems were generated in the past, but waste generation is expected to increase substantially in response to the increasing utilization of renewable energy appliances.

Although the data and projections presented in this study indicate an increase under a BAU scenario for 2035, the generation of this waste stream is to a large extent triggered by current EU environmental policy. Therefore it can hardly be influenced by direct waste prevention measures, and additional EU policy measures for waste prevention are not suggested at this stage.

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[626] EC (2020): Stepping up Europe's 2030 climate ambition - Investing in a climate-neutral future for the benefit of our people.

[627] EC (2019): The European Green Deal. COM(2019) 640 final.
[628] EC (2020): Commission notice Guidance document on wind energy developments and EU nature legislation.

[629] Jäger-Waldau, A., et al (2020): How photovoltaics can contribute to GHG emission reductions of 55% in the EU by 2030; Renewable and Sustainable Energy Reviews Volume 126, July 2020.

With regard to the analysis on the BAU scenario, the waste stream “Waste from renewable energy infrastructure” is not considered a candidate for assessment of additional EU-wide prevention measures bringing benefit in terms of waste reduction.

# A.2.0 Appendix
# Information on identified best practice examples

# A.2.0 Information on identified best practice examples

## A.2.1 Assessment of measures/initiatives for waste prevention

The detailed assessment results for the 68 identified measures/initiatives for waste prevention are provided are provided in the following table.

### Figure A - 119: Assessment results for the 68 identified measures/initiatives for waste prevention

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **1** | Emphasize waste prevention (especially as regards durability) in the context of action plans / networks aiming at getting textiles sustainable[630] | voluntary | 2 | textile waste | DE, UK | sectoral | horizontal | ongoing |
| | Short description: Networks and actions plans to foster sustainable textiles have been established in the past years. Examples include the German "Bündnis für nachhaltige Textilien" or the UK Sustainable Clothing Action Plan (SCAP). | | | | | | | |
| **2** | Introduce a reduction target for C&D waste[631] | regulatory | 2 | C&D waste incl. soils | SE, UK | national | horizontal | ongoing |
| | Short description: Two examples (UK, SE) were identified. | | | | | | | |
| **3** | Introduce a reduction target for MSW[632] | regulatory | 2 | municipal waste | FR, EE, FI, UK, BG, IT, BE, SI | national, regional | horizontal | ongoing |

[630] https://www.textilbuendnis.com/, https://wrap.org.uk/sustainable-textiles/scap
[631] https://gov.wales/sites/default/files/consultations/2018-01/111118constructiondemolitionappraisalen.pdf, https://www.eea.europa.eu/publications/waste-prevention-in-europe-2015
[632] https://www.eu-fusions.org/index.php/country-reports/reports/292-france, https://www.eea.europa.eu/publications/waste-prevention-in-europe-2015, https://www.eea.europa.eu/themes/waste/waste-prevention/countries

| ID | **Prevention measure / initiative** | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
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| | Short description: Examples identified include FR, EE, FI, UK, BG, IT, LV, SK, Ljubljana, the Balearic islands and Flanders. Through its new Waste Reduction and Circular Economy Bill, France wants to achieve a decrease of 15% in municipal solid waste generation per capita and 5% in commercial waste by 2030. The Balearic Islands Waste and Polluted Soils Law (Law 8/2019) sets binding targets to reduce waste generation by 10% by 2021 and by 20% by 2030, compared to 2010. Through its Zero-Waste Strategy, Ljubljana has committed to reduce annual residual waste to 60 kg per person by 2025. Bulgaria set itself a target to reduce municipal solid waste generation per capita between 2011 and 2020. Italy's target was a 5 % reduction in the ratio of generated municipal solid waste (MSW) to gross domestic product unit (GDP) by 2020, reference year 2010. Latvia's target was to generate not more than 400 kg per capita and 650 kt in total of municipal solid waste by 2020. Slovakia's target was to reduce mixed municipal solid waste between 2010 and 2016. Flanders' Implementation waste plan 2016–2022 obliges municipalities to reduce the total quantity of residual waste from households, companies and organisations by 2022. The targets are tailored to the specific profiles of the municipalities, e.g. coastal municipalities are assigned a less stringent target (258 kg per inhabitant) since they produce more residual waste due to tourism than rural municipalities (116 kg per inhabitant) per household per year. The targets are indicative until an evaluation is carried out. If measures taken by municipalities to reduce the total quantity of residual waste are positively evaluated, then they will become binding. If municipalities don't reach their targets, the Flanders Waste Agency will develop instruments to incentivise municipalities to achieve them. | | | | | | | |
| **4** | Introduce a reduction target for total waste[633] | regulatory | 2 | total waste | ES | national | horizontal | ongoing |
| | Short description: Examples identified include: Spain, France and Ljubljana. In Spain, by 2030: Reducing waste by 15% with regard to 2010 waste levels. Through its Zero-Waste Strategy, has committed to reduce annual waste generation to 280 kg per person by 2025. | | | | | | | |
| **5** | Introduce obligatory waste management concepts for businesses, which have to contain information on planned and implemented waste prevention measures[634] | regulatory | 2 | municipal waste | AT | national | horizontal | ongoing |

[633] https://circulareconomy.europa.eu/platform/sites/default/files/espana_circular_2030_executive_summary_en.pdf

[634] https://www.umweltbundesamt.at/fileadmin/site/publikationen/rep0599.pdf; https://www.bmk.gv.at/themen/klima_umwelt/abfall/aws/betriebl_abfallws/leitfaden2003.html

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| | Short description: In Austria, establishing a waste management concept is obligatory for companies where waste is generated and for companies with a staff of more than 20 persons. The waste management concept has to include inter alia a waste relevant description of the company´s activities, whereby a guidance document further specifies that this shall include information on implemented and planned waste prevention measures. Furthermore, guidance on how to establish the waste management concepts is provided. | | | | | | | |
| 6 | Introduce obligatory product labelling (info if useless packaging is avoided, info on repairability) in the context of EPR[635] | regulatory | 2 | municipal waste, WEEE, rubber waste | FR | national | horizontal | ongoing |
| | Short description: One example was identified. France has introduced EPR for a series of products (e.g. ELV, WEE, batteries & accumulators, household packing, pharmaceuticals, tyres, textiles, infectious healthcare waste, furniture, etc). Within the context of EPR, a product label will be introduced to inform consumers about recycled material used in the product, if useless packing is avoided or if the product is repairable. The EPR organizations introduce financial measures (bonus/malus system) to evaluate the manufacturer's product portfolios in order to shift product portfolios towards more recycling material content, less packing use and improved Reparability. In 2021 France implemented a new repair score giving information to the consumer on how repairable a product is when he purchases it. This index will evolve in 2024 in a durability score. | | | | | | | |
| 7 | Introduce waste prevention criteria in public procurement criteria and make them legally binding[636] | regulatory | 2 | municipal waste, textiles waste, WEEE | IT, US | national | horizontal | ongoing |

[635] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf; https://librairie.ademe.fr/dechets-economie-circulaire/4853-preparatory-study-for-the-introduction-of-a-durability-index.html?search_query=ademe+magazine&results=3620
[636] https://ogs.ny.gov/system/files/documents/2019/03/greenpurchasingintroduction.pdf, https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/05/No-time-to-waste_Europes-new-waste-prevent_web.pdf

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| | Short description: Legal requirements for public institutions to incorporate waste prevention criteria for purchases. Two examples were identified: First, New York State's (USA) remanufacturing legislation that requires state agencies to procure recycled or remanufactured products, provided the cost does not exceed a cost premium of 10%. Second, The Italian Code for Public Contracts sets mandatory environmental sustainability criteria. It sets the waste prevention criteria: efficiency and savings in the use of resources, reduction in the use of hazardous substances and quantitative reduction in waste products, as public procurement minimum environmental criteria for 11 product/service categories, such as furnishing, building work, electronics, textiles, catering, energy services, building management services, etc. | | | | | | | |
| **8** | Introduce (obligatory) funding of waste prevention/reuse/repair for producer responsibility organizations (PROs) operating under EPR schemes[637] | regulatory | 2 | several | AT, FR | national | horizontal | ongoing |
| | Short description: Two examples of obligatory funding schemes for PROs to encourage waste prevention, reuse and repair were identified (Austria, France). Further details are provided in Appendix A2.2.4 of the study report. | | | | | | | |
| **9** | Promote unsubscribing unwanted paper advertising[638] | information | 2 | municipal waste | many cases | various | Horizontal | ongoing |
| | Short description: There are plenty of initiatives promoting unsubscribing unwanted advertising mail (e.g. EU, AT, NL, UK)were identified. Further details are provided in Appendix A2.2.10 of the study report. | | | | | | | |
| **10** | Organize awareness raising campaigns and information exchange related to CE and waste prevention - in general[639] | information | 2 | several | SE, AT, FI, IE, EU, many cases | various | horizontal | ongoing |

[637] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf; https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20002086
[638] https://www.eea.europa.eu//publications/waste-prevention-in-europe-2017
[639] https://ewwr.eu/; https://www.naturvardsverket.se/Miljoarbete-i-samhallet/Miljoarbete-i-Sverige/Uppdelat-efter-omrade/Konsumtion-och-produktion/Hallbara-textilier/Samarbete/; http://zerowasteeurope.eu/zerowastecities.eu/; https://www.energialoikka.fi/luokka/materiaaliloikka/; www.circuleire.ie

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| | Short description: Awareness raising through event and campaigns communicate the need for waste prevention and provide practical guidance. One example is Textilsmart in Sweden. Textilsmart is an information initiative with the goal of increasing consumers' knowledge of why today's textile consumption is not sustainable and assisting with tips and facts that inspire more conscious consumption. The campaign is carried out by the Swedish Environmental Protection Agency, the Swedish Consumer Agency and the Swedish Chemicals Agency. Another example regarding awareness raising among municipalities is the initiative "Zero waste cities across Europe" (http://zerowasteeurope.eu/zerowastecities.eu/). Another example comes from established structures in Austria. An essential element of public relations work is the activity of municipal environmental and waste consultants which is organised throughout Austria. The main task of the waste advisors is to advise municipalities, private households, consumers, companies, educational institutions (such as kindergartens, school), local/regional institutions and administrative organizations on sustainable consumer and disposal behaviour. This is achieved by using means of public relations, advice, educational work and optimization of the collection system. The Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology has supported this since 1997 through the "Communication Network with Waste Consultants" project. Approximately 400 waste consultants throughout the whole of Austria belong to the network. It has proven to be a very effective platform and communication hub for waste management matters at regional and municipal level. At the annual "Networking Days", any current issues are discussed and waste consultants are informed of any developments or changes. Their commitment and creativity are appropriately acknowledged at the annual awards ceremony for the waste consultant of the year. The Austrian Association of Waste Consultants magazine "VABÖ-Blatt", which is funded by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology, communicates the latest and most important news. The "VABÖ-Blatt" is published four times a year. Since 2005, the VABÖ has also published regularly an electronic newsletter (VABÖ-Newsletter)., which is able to reach an even wider audience quickly and without any bureaucracy (https://www.vaboe.at/). Waste consultants are employed in waste management associations, also in almost all cities and in some cases in larger municipalities. Information campaigns and awareness-raising can lead to changes in behaviour with regard to waste prevention and sustainable consumption. Waste producers also need expert consultants to help them implement waste prevention measures. Properly trained personnel in businesses (waste officers) and at municipal level (environmental and waste consultants) will help raise awareness among their target groups and encourage them to change their behaviour. The Energy and Material Leap is an online service that encourages all Finns – both communities and individuals – to adopt resource-saving, cleaner and more energy-efficient ways of heating, moving and producing goods and services. The leaps in this service are real actions and solutions that have already made Finland more energy- and material-efficient. When we implement these good examples in every home, municipality and workplace, their impact will multiply. A good energy or material leap is often also economically sensible. In many of the examples in this service, the investment pays back in a few years and the investment yields a hefty return on the investment. So we can save both nature and money at the same time. Anyone can add their good examples to the service. When you tell about your own leap to the users of this service or to your neighbours, friends and colleagues, it will encourage others to take action and our journey towards a carbon-neutral and material-efficient society will be shortened. The Energy and Material Leap service is maintained by the Finnish Environment Institute (SYKE). The development of a pilot version received funding from the Finnish Government's key project KIRA-Digi for boosting the digitalisation of the built environment and construction sector. Later development has been funded by three EU Life-projects: Circwaste, EconomisE and Canemure. Material leap service is partly translated to English, but more practical examples are in Finnish. Visible, co-operative and positive system has brought good results. However, there needs to be a quality control over the examples that are accepted to the service to avoid "not so good" examples to enter the system. | | | | | | | |

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| **11** | Promote knowledge transfer/training/guidance related to waste prevention in the building sector[640] | information | 2,1 | C&D waste incl. soils | AT | sectoral | horizontal | ongoing |
| | Short description: Identified examples include a teaching program and a guidance document on waste prevention in the building sector for undergraduates. | | | | | | | |
| **12** | Promote knowledge transfer/training/guidance related to the reuse sector[641] | information | 2 | several | - | local | horizontal | planned |
| | Short description: Many initiatives. A conference connects stakeholders in the reuse sector. 1 example was identified. | | | | | | | |
| **13** | Provide information on best practice in waste prevention in sector specific templates for obligatory waste management concepts[642] | information | 2 | several | AT | sectoral | horizontal | ongoing |
| | Short description: Possible waste prevention measures were introduced into the sector specific templates for waste management concepts, which are obligatory for businesses whose activities generate waste or which have more than 20 staff. The templates are provided by the regional authority. | | | | | | | |
| **14** | Promote establishing sector specific guidance on best practice examples in waste prevention (apart from those linked to BEMPs under EMAS)[643] | information | 2,1 | several | many cases | sectoral | horizontal | ongoing |
| | No description available. | | | | | | | |

[640] http://www.ecodesign.at/forschungsprojekte/abbau/, http://www.rma.at/sites/new.rma.at/files/Projekt%20InBa%20-%20Skriptum%20f%C3%BCr%20die%20Lehrlingsausbildung%20(Vers.1.6).pdf
[641] http://www.reuseconex.org/
[642] https://www.wien.gv.at/umweltschutz/abfall/muster.html
[643] e.g. https://www.wien.gv.at/umweltschutz/abfall/muster.html

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| **15** | Organize environmental business consultation (incl. financial support) covering possibilities to reduce waste[644] | information | 2 | several | AT | regional | horizontal | ongoing |
| | Short description: In Austria, there are several examples of business consultation programs run by the regional authorities, where businesses can receive support in e.g. the set up waste management plans. These activities usually include possible waste prevention measures. Also, under the topic material efficient production there are examples of such programs, such as in Austria or in Germany. | | | | | | | |
| **16** | Include waste prevention criteria (e.g. durability) in Ecolabels[645] | information | 2 | WEEE, textiles | DE | sectoral | horizontal | ongoing |
| | Short description: A recent evaluation of certification schemes for sustainable textiles performed by ECOS concluded that, after examining them closely, that they their requirements overlook durability, reuse and repair aspects. They are ineffective mainly because they: lack requirements for minimum desired lifespan of products, lack definitions of what 'high-quality fabrics' are, contain only a limited reference to recycled content or natural fibre content of fabrics, marginally address chemical additives and material composition, include no methods to address the problem of microplastics shedding of synthetic fibres. Examples for electrical appliances include for example the criteria established under the ecolabel "Umweltzeichen „Blauer Engel“ . Durability and replacement of batteries in e.g. mobile phones, spare parts are criteria. | | | | | | | |
| **17** | Introduce of "pay as you throw schemes for household waste"[646] | economic | 2 | municipal waste | DE | regional | Horizontal | ongoing |
| | Short description: Waste fees depending on (personal) waste generation rate, briefly called pay-as-you-throw, are used to reduce waste production and therefore facilitate sharing and reuse. | | | | | | | |

[644] https://www.wien.gv.at/umweltschutz/oekobusiness/

[645] https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/abfallvermeidung_wertschaetzen_statt_wegwerfen_bf.pdf; https://www.oneplanetnetwork.org/report-how-ecodesign-can-make-our-textiles-circular

[646] https://www.umweltbundesamt.de/sites/default/files/medien/5750/publikationen/2020_11_09_texte_203_2020_fortschreibung-abfallvermeidungsprogramm.pdf

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| **18** | Set up public funding of waste prevention initiatives[647] | economic | 2 | municipal waste, textiles waste, WEEE, C&D waste incl. soils | UK | regional | horizontal | ongoing |
| | Short description: The UK Innovation in Waste Prevention Fund is a grant scheme which is funded by Defra and managed on its behalf by the Waste and Resource Action Programme (WRAP). It specifically supports communities to take forward innovative waste prevention, re-use and repair activities in their local areas, working in partnership with local businesses, councils, charities and voluntary groups. Projects must address at least one of the following waste prevention priorities: food; textiles; paper and board; furniture and bulky material; plastics; electronic and electrical equipment; construction and demolition; healthcare and chemical. The Scottish Government has ambitions to deliver a circular economy for Scotland. The Government has set out its commitment to move towards a more circular economy. within its national waste strategy, 'Making Things Last' (with similar commitments enshrined within Scotland's national economic strategy). Scotland's Zero Waste Plan has been developed, and is delivered in partnership through Zero Waste Scotland, enterprise agencies and the environmental regulator, SEPA, as well as other actors such as local authorities. Delivery is supported by over £70M of investment, including a Circular Economy Capital Investment Fund to drive capacity within the reuse, repair and remanufacturing sector across Scotland. | | | | | | | |
| **19** | Extend the legal guarantee (product warranty) of products[648] | regulatory | 2 | municipal waste | FR | national | longer lifetimes of products / buildings through increased durability | just launched |
| | Short description: Some Member States apply longer durations of legal guarantee of conformity than specified by EU legislation through national law. Further details are provided in Appendix A2.2.8 of the study report. | | | | | | | |

[647] http://lcrn.org.uk/innovation-waste-prevention-fund/; https://www.zerowastescotland.org.uk/content/circular-economy-investment-fund-and-service
[648] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf

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| **20** | Introduce a legal ban on using planned obsolescence practices[649] | regulatory | 2 | municipal waste, WEEE, textiles waste | FR | national | longer lifetimes of products / buildings through increased durability | just launched |
| | Short description: From 2015, France banned the planned obsolescence practice through the Consumer Code, Article L213-4-1: (1) Planned obsolescence is defined by all the techniques by which a marketer aims to deliberately reduce the life of a product to increase the replacement rate. (2) Planned obsolescence is punished with a sentence of two years' imprisonment and a fine of €300,000. (3).The amount of the fine may be increased, in proportion to the benefits derived from the default, to 5% of the average annual turnover, calculated on the last three annual turnover figures known on the date of the event. | | | | | | | |
| **21** | Durability requirements for (consumer) goods[650] | regulatory | 2 | municipal waste, WEEE, textiles waste | FR, UK, Nordics | national | longer lifetimes of products / buildings through increased durability | planned |
| | Short description: Examples for establishing durability criteria for products were identified for several products and in several Member States (FR, UK, Nordic countries). Further details are provided in Appendix A2.2.2 of the study report. | | | | | | | |
| **22** | Introduce an (obligatory) waste prevention action plan and eco-design action plan for manufacturers of specific products in the context of extended producer responsibility[651] | regulatory | 1,2 | municipal waste, WEEE, textiles waste | FR, NL | national | material efficient production | just launched |

[649] https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/05/No-time-to-waste_Europes-new-waste-prevent_web.pdf
[650] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf, https://www.researchgate.net/publication/313479105_Development_of_an_Industry_Protocol_on_Clothing_Longevity, http://norden.diva-portal.org/smash/get/diva2:1221509/FULLTEXT01.pdf
[651] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
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| | Short description: Two examples were identified. France has introduced an obligatory waste prevention and eco-design action plan for manufacturers under EPR (including for ELV, WEE, batteries & accumulators, household packing, pharmaceuticals, tyres, textiles, infectious healthcare waste, furniture, etc). The Flemish competent authority OVAM has concluded an environmental policy agreement with the producer responsibility organisations for EPR on ELV and Batteries as regards waste prevention action plans. Further information is provided in Appendix A2.2.1 of the main report. | | | | | | | |
| **23** | Promote increased off-site manufacturing of building components[652] | operational | 2 | C&D waste incl. soils | UK | local | material efficient production | completed |
| | Short description: Off-site manufacturing of building components enables material efficient production and reduces material cut-off at the construction site. One practice example was identified (off-site manufacturing of supermarket refits) (UK). | | | | | | | |
| **24** | Promote practices tools to prevent waste during design of buildings[653] | operational | 2,1 | C&D waste incl. soils | UK, NL | sectoral | material efficient production | ongoing |

[652] https://www.wrap.org.uk/sites/files/wrap/Sainsbury%20Full%20case%20study%20FINAL.pdf (link expired)
[653] https://www.wrap.org.uk/sites/files/wrap/Middlehaven%20Hotel%20Construction.pdf, https://www.wrap.org.uk/sites/files/wrap/GG493_final.pdf (links expired); https://www.totem-building.be/; https://www.nweurope.eu/media/10389/factsheet-accord-demonstration-exemplar-charm.pdf

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| | Short description: During the design of buildings, waste reduction potentials are identified. This includes various measures such as alternatives for material and construction selection, measures to reduce construction waste on site and measures to facilitate the reuse/remanufacturing of materials/components after demolition. For instance, the use of a bridge instead of an underpass in UK required less concrete and excavated soil. the 8 examples were identified. In Flanders TOTEM () allows users (focus on architects, designers) to assess the environmental impact of the chosen construction materials (based on 17 indicators) and to adapt choices accordingly. The impact assessment takes a life cycle approach of the materials in the whole value chain. Totem started in 2019. There is no end time. At the moment the tool can be implemented voluntarily by the private sector. It is mandatory for public procurement for buildings in the Flemish region. the tool is being developed further for more frequent use ad possibly mandatory implementation for private sector. TOTEM has 4585 registered users. so far more than 8000 projects were initiated with TOTEM. It can be used for the MAT01 criteria of BREEAM allowing a possible score of 5+ exemplary. It can be used for the MAT02 criterion of GRO (sustainability tool in Flanders). The mandatory character for public procurement of buildings in Flanders contributes to the success. there is a growing awareness of the environmental impact of construction materials. Also the implementation of B-EPD in TOTEM leads more subsectors to the tool. Energy and materials are linked. Environment impact should consider the energy and materials side. a lot of materials can be added to the library to evaluate all types of buildings + infrastructure. users can use the tool for free. The 3 Belgian regions have invested in the deployment, maintenance and further development. Manufacturers invest in B-EPD. At the moment there is no real monitoring of the impacts in place. In the future benchmarking will be implemented, to monitor impacts. | | | | | | | |
| **25** | Introduce mandatory unit dispensing for medication[654] | regulatory | 2 | municipal waste | FR | national | prevention of un-intended over-consumption | ongoing |
| | Short description: France introduced unit dispensing for the sale of medication. For instance, the patient receives 12 pills instead of a package of 20 pills if the medical doctor prescribes 3 pills per day over a period of 4 days. | | | | | | | |
| **26** | Support the implementation of car sharing[655] | operational | 2 | ELV | DE | regional | stimulating alternative business and use models | ongoing |

[654] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf
[655] https://circular-impacts.eu/sites/default/files/D4.2_Case-Study-Carsharing_FINAL.pdf

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| | Short description: Car-sharing is widely used in European Cities. A detailed study of its impacts is available for Germany. As of January 2018, there were 2,110,000 customers registered with 165 car-sharing providers in 677 different German cities and communities. The above studies identify a range of replaced private vehicles due to car sharing of between 3 and 20 cars. Further details are provided in Appendix A2.2.12 of the study report. | | | | | | | |
| **27** | Establish platforms/networks to collect and distribute non-expired medicine[656] | operational | 2 | municipal waste | IT | local | stimulating alternative business and use models | ongoing |
| | Short description: Two examples from Italy were identified, where pharmacies collect unused, non-expired medicine and corporate with social networks to distribute the medicine to vulnerable groups. | | | | | | | |
| **28** | Promote Leasing and "Pay per service unit" models[657] | operational | 2 | several | Global | sectoral | stimulating alternative business and use models | ongoing |
| | Short description: Manufactures offer pay-by-service and leasing opportunities for products such as copy machines, washing machines and lightning systems. Further details are provided in Appendix A2.2.12 of the study report. | | | | | | | |
| **29** | Promote sharing platforms[658] | operational | 2 | several | DE, NL | diverse | stimulating alternative business and use models | ongoing |
| | Short description: Sharing platforms (online and offline) are marketplaces to share products, either B2B (tools e.g.) or for the end consumer (libraries). Further details are provided in Appendix A2.2.12 of the study report. | | | | | | | |

[656] https://circulareconomy.europa.eu/platform/en/good-practices/genoas-municipal-pharmacies-collecting-unused-pharmaceuticals-those-who-need-them

[657] https://ce-center.vlaanderen-circulair.be/en/publications/publication/13-reuse-the-understudied-circular-economy-strategy, https://circulareconomy.europa.eu/platform/en/good-practices/genoas-municipal-pharmacies-collecting-unused-pharmaceuticals-those-who-need-them, https://www.umweltberatung.at/download/?id=Prep-for-Re-Use_end-of-waste-guide_Austria_2019.pdf, http://www.revitalistgenial.at/header/englisch.html, https://www.zerowastescotland.org.uk/revolve

[658] https://circular-impacts.eu/sites/default/files/D4.2_Case-Study-Carsharing_FINAL.pdf, https://www.parksharing.nl/werflink.html

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| **30** | Introduce reuse criteria in certification schemes for sustainable buildings[659] | voluntary | 2 | C&D waste incl. soils | DE | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: One example from Germany was identified: Through its certification system, the German Sustainable Building Council is thus ensuring that material cycles are ready for later reuse or further use in accordance with the cradle-to-cradle philosophy - via new business models as well as responsible and forward-looking product development. | | | | | | | |
| **31** | Include procuring for repair, re-use and remanufacturing in GPP guidelines[660] | voluntary | 2 | several | UK, IT, SE | national | stimulating reuse repair remanu-facturing | completed |
| | Short description: Several examples were identified. Further information is provided in Appendix A2.2.14 of the study report. | | | | | | | |
| **32** | Introduce reuse targets, e.g. for WEEE[661] | regulatory | 2 | WEEE | ES | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Spain has introduced a minimum target for the preparation for reuse that is to be achieved by producers. With effect from 15 August 2018: (i) For large equipment (FR4 in Annex VIII), a minimum target of 3 % compared to large equipment collected. (ii) · For small IT and telecommunication equipment (FR4 in Annex VIII) a minimum target of 4 % compared small IT and telecommunication equipment collected. | | | | | | | |

[659] https://www.dgnb-system.de/en/system/version-2020-international/
[660] https://www.zerowastescotland.org.uk/sites/default/files/Procuring%20for%20Repair%20-Re-use%20Reman%20Guide%20June%202016%20v3.pdf
[661] https://www.rreuse.org/spain-first-eu-country-to-mandate-reuse-of-electrical-goods/; https://rreuse.org/wp-content/uploads/ROYAL-DECREE-110_2015-ON-WEEE.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
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| **33** | Introduce/enable tax reduction for accredited re-use centres[662] | regulatory | 2 | municipal waste | BE, CZ, IE, LU, MT, NL, AT, PL, SI, SE, FR, PT | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Tax reductions on repair services reduces the costs and therefore supports local economy and extends the usage of products. Examples were identified in SE, BE, IE, LU, MT, NL, PL, SI. Further information is provided in Appendix A2.2.9 of the study report. | | | | | | | |
| **34** | Introduce the obligation for manufacturers to provide 3D printing files for product parts that aren´t available on the market any more[663] | regulatory | 1 | municipal waste | FR | national | stimulating reuse repair remanu-facturing | just launched |
| | Short description: Frances introduced a regulation for the 3D printing of parts that are needed for the repair of products. In detail, the manufacturers have to provide a 3D printing file for parts that can be bought on the market any more. | | | | | | | |
| **35** | Introduce obligatory consumer information on durability and reparability, spare parts and on the duration of computer and phone operating software updates[664] | regulatory | 2 | WEEE | FR | national | stimulating reuse repair remanu-facturing | just launched |

[662] https://www.eea.europa.eu//publications/waste-prevention-in-europe-2017, https://portal.research.lu.se/portal/en/publications/promoting-the-repair-sector-in-sweden(fc5c1b73-6c30-469d-a86e-db8a83e2bff7).html, https://ce-center.vlaanderen-circulair.be/en/publications/publication/13-reuse-the-understudied-circular-economy-strategy
[663] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf
[664] https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/05/No-time-to-waste_Europes-new-waste-prevent_web.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| | Short description: In order to fight planned obsolescence, a Reparability index allows the consumer to know whether their product is repairable, difficult to repair or not repairable. France introduced such an obligation. Furthermore it introduced an obligation, that consumers will have all the complete and reliable information, whether the spare parts of the product purchased are available or not, when making a purchase. In addition, in France, the manufacturers, and then the vendors of mobile phones and touchscreen tablet computers, shall be bound by an obligation of information on the period over which the software updates enable a use of the devices that remains "normal". This will guide consumers in their choice during the purchase, and enable them to avoid "cosmetic" updates (mainly evolutionary ones). The latter can slow down the devices or make them prematurely obsolete, encouraging the purchase of new ones when they are only more recent but also often more expensive. Further information is provided in Appendix A2.2.2 of the study report. | | | | | | | |
| **36** | Introduce obligatory pre-demolition audits of buildings regarding reusable components[665] | regulatory | 2 | C&D waste incl. soils | AT, BE, BG, CZ, FI, FR, HU, LU, NL | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Pre-demolition audits are mandatory in in several EU countries (Austria, Flanders, Bulgaria, Czech Republic, Finland, France, Hungary, Luxembourg, Netherlands). Further information is provided in Appendix A2.3.15 of the study report. | | | | | | | |
| **37** | Introduce the obligation for manufactures of construction materials and products to set up schemes that allow free pick up of materials/components after building demolition[666] | regulatory | 2 | C&D waste incl. soils | FR | national | stimulating reuse repair remanu-facturing | just launched |
| | Short description: Under the recently introduced EPR for construction materials in France, the manufactures of construction material and products need to set up schemes that allow free pick up of materials/components after building demolition. | | | | | | | |

[665] https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/05/No-time-to-waste_Europes-new-waste-prevent_web.pdf, https://www.construction-products.eu/application/files/5215/2481/6267/20161123090156-2016_11_22_resource_efficiency_workshop_1_dg_growth.pdf
[666] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **38** | Introduce a ban on destroying unsold new products[667] | regulatory | 2 | municipal waste | FR, DE, BE | national | stimulating reuse repair remanu-facturing | just launched |
| | Short description: Bans or restrictions on the destruction of certain unsold products were adopted or are under consideration in several Member States (FR, DE, BE). Details are provided in Appendix A2.2.5 of the study report. | | | | | | | |
| **39** | Establish re-use centre/platforms for building components[668] | operational | 2 | C&D waste incl. soils | AT, DE, CH, UK, NL, EU | various | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Building material and components are set free during renovation and demolition of buildings. Such materials/components are channelled for reuse/refurbishment/re-manufacturing by online platforms, reuse centers and stores. 9 examples were identified. | | | | | | | |
| **40** | Promote reverse logistics and sale of used vehicle components[669] | operational | 2 | ELV | EU, Global | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Reverse logistics and sale of used vehicle components is widely used. Details for Two practice examples were collected. | | | | | | | |

667 https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf, https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2021/10/Prohibiting-the-destruction-of-unsold-goods-Policy-brief-2021.pdf

668 https://www.btbbasel.ch/de/aktuelles, http://www.bauteilboerse-bremen.de/, https://www.baukarussell.at/, http://www.recycling.or.at, https://youtu.be/BoctjHBNSBg, https://restado.de/, https://carpetrecyclinguk.com/wp-content/uploads/2018/10/Greenstream_Flooring_CIC_Carpet_Tile_Reuse_Case_Study-1.pdf, https://carpetrecyclinguk.com/wp-content/uploads/2018/10/Spruce_Carpets_Carpet_Tile_Reuse_Case_Study-1.pdf, www.werflink.com

669 http://www.premiercore.com/, https://www.coremannet.com

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **41** | Promote reverse logistics, remanufacturing and resale of medical equipment[670] | operational | 2 | WEEE | Global | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Three examples were identified where manufacturers of medical equipment organize reverse logistics, refurbishment/re-manufacturing and sale of their products to give them a second life. This includes, for instance, medical imaging devices. A broad range of healthcare manufactures offer such service, as for instance, Siemens | | | | | | | |
| **42** | Implement measures to improve the collection of reusable items from households[671] | operational | 2 | municipal waste | AT, BE, LI | regional | stimulating reuse repair remanu-facturing | ongoing |

[670] https://www.usa.philips.com/healthcare/articles/refurbished-systems-diamond-select; https://www.gehealthcare.com/products/goldseal---refurbished-systems; https://www.siemens-healthineers.com/at/refurbished-systems-medical-imaging-and-therapy

[671] https://www.re-use.at/; info submitted via stakeholder consultation, https://www.repanet.at/re-use-toolbox/re-use-repathek/repanet-re-use-markterhebung-2019/

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| | Short description: Three practice examples to improve the separate collection of re-useable goods from households were identified. In Austria, a reuse-box is distributed among the households. (RepaNet (Re-Use and Repair Network Austria) supports the establishment of re-use networks in the Austrian federal states. The association is the voluntary interest representation of the re-use companies and networks in Austria. RepaNet is committed to improve the framework conditions for the re-use of used products and to create jobs for disadvantaged people on the labor market in the field of re-use. Respective networks which publish information on re-use acceptance points and re-use companies, have been established in all federal states. At re-use shops, reusable objects are accepted, prepared for further use and sold. For further information:https://www.repanet.at/projekte-2/re-use-netzwerke-in-den-bundeslandern/. Various activities to expand the collection of reusable goods are constantly being carried out. Throughout Austria, there are different collection points/forms for the delivery of intact, usable goods available: e.g. delivery at waste recovery centers, the collection with a ReUse box / ReUse bag, delivery at reuse shops. In addition to electrical appliances (such as DVD players, flat screens, computers and computer accessories, game consoles, etc.), mainly furniture, sports and leisure equipment, clothing, toys, decorative items and other household items are collected. Examples: "ReVital Network Upper Austria": http://www.revitalistgenial.at/ "Re-Use Box Graz": https://www.re-use.at/mesmerize/graz/ "Vienna – 48er Tandler": https://48ertandler.wien.gv.at/site/der-48er-tandler/ "ReVilla" – city of Villach: https://www.revilla.at/ "Konzept Ressourcenpark"/Styria: https://www.abfallwirtschaft.steiermark.at/cms/beitrag/12411881/134969000/; https://www.awv.steiermark.at/cms/dokumente/12712405_170700/52e9bd1c/RP-Leibnitz-Faltblatt-web.pdf ). In Belgium, a new scheme for the collection and reuse of bulky waste was developed and tested in practice. In Lithuania, regional Centers for Bulky Waste have special rooms for things, which are expendable for one person but maybe needed by another person. These things are cleaned, made functional and presented in nice order on shelves. Therefore, these things are attractive to consumers and taken to another home/office/school for second life. | | | | | | | |
| **43** | Promote the establishment of reverse logistics of consumer products (furniture, books, toys…by brands)[672] | operational | 2 | municipal waste | FR, BE, CZ, DE | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Examples include an initiative of IKEA. It implemented a business model for retired furniture. In detail, customers provide a description of their retired furniture, IKEA offers a price at about 30% of the original price and gives the furniture a second life. The IKEA programme is implemented in various countries such as France, Belgium and Czech Republic. Medimops is an example for re-selling of books following the same principle. | | | | | | | |

[672] https://www.druhyzivotnabytku.cz/en

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
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| **44** | Promote reverse logistics and Re-use of school books[673] | operational | 2 | municipal waste | GR, US | regional | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Details for 2 practice examples (GR, US) were identified. Public institutions and initiatives organise a take-back system of textbooks. The textbooks can be retrieved from specialized centers and are open for the general public or for target groups such as pupils and teachers. | | | | | | | |
| **45** | Promote the establishment of quality standards for preparing for re-use and refurbishing of used electrical and electronic equipment[674] | information | 2 | WEEE | EU, UK, US, AT, | sectoral | stimulating reuse repair remanu-facturing | completed |
| | Short description: Four standards for preperation for reuse and refurbishment process for WEEE/UEEE in general and for medical equipment in specific were identified. 1) the UK standard PAS 141:2011, Reuse of used and waste electrical and electronic equipment (UEEE and WEEE). Process management. Specification. 2)the NEMA standard Good Refurbishment Practices for Medical Imaging Equipment. 3) the EN standard "Requirements for the preparing for re-use of waste electrical and electronic equipment" published in 2020, 4.) Guideline for the reuse of WEEE in Austria. Further details are provided in Appendix A2.2.13 of the study report. | | | | | | | |
| **46** | Promote the establishment of quality standards for remanufacturing processes[675] | information | 2 | several | US | sectoral | stimulating reuse repair remanu-facturing | completed |

673 https://www.thenationalherald.com/archive_general_news_greece/arthro/greek_students_asked_to_return_old_textbooks_for_reuse_recycling-45539/, https://www.scarce.org/reuse-center/

674 https://shop.bsigroup.com/products/reuse-of-used-and-waste-electrical-and-electronic-equipment-ueee-and-weee-process-management-specification, https://www.nema.org/Standards/view/Good-Refurbishment-Practices-for-Medical-Imaging-Equipment, https://www.en-standard.eu/une-en-50614-2020-requirements-for-the-preparing-for-re-use-of-waste-electrical-and-electronic-equipment-endorsed-by-asociacion-espa-ola-de-normalizacion-in-april-of-2020/

675 https://www.pierceindustries.com/wp-content/uploads/2017/07/RIC001.1-2016-Specifications-for-the-Process-of-Remanufacturing.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
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| | Short description: This standard defines and provides a benchmark for the process of remanufacturing. Further details are provided in Appendix A2.2.13 of the study report. | | | | | | | |
| 47 | Promote the establishment of quality standards for the process of collection and re-use of textiles waste[676] | information | 2 | Textile waste | SE, NO, FI | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: The Nordic textile re-use and recycling commitment" is a voluntary certification system, which ensures sustainable and transparent handling of used textiles. There are two types of certification: one for collection of textiles aimed for re-use only, and one for collection of both textiles for re-use and textile waste for recycling. | | | | | | | |
| 48 | Promote the establishment of quality standards for used goods (UEEE, furniture, sports and leisure equipment)[677] | information | 2 | municipal waste | AT, UK | various | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Quality criteria for reused goods are determined in guidelines and product labeling programmes. Three examples were identified. First, quality standard for second-hand stores in Scotland. Second, a guideline to determining the end-of-waste status in the preparation for reuse (AT). Third, used electrical appliances, furniture and contents, sports and leisure equipment which are in a good condition are collected, processed and refurbished ("revitalized") and offered for sale get a "ReVital" label. Further details are provided in Appendix A2.2.13 of the study report. | | | | | | | |
| 49 | Promote the establishment of quality standards for refurbished office equipment[678] | information | 2 | municipal waste | Global | sectoral | stimulating reuse repair remanu-facturing | completed |

[676] https://www.norden.org/en/publication/nordic-textile-reuse-and-recycling-commitment-certification-system-used-textiles-and
[677] https://www.umweltberatung.at/download/?id=Prep-for-Re-Use_end-of-waste-guide_Austria_2019.pdf, http://www.revitalistgenial.at/header/englisch.html, https://www.zerowastescotland.org.uk/revolve
[678] https://www.iso.org/standard/34909.html

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
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| | Short description: The ISO/IEC standard 24700:2004 "Quality and performance of office equipment that contains reused components" specifies product characteristics to be used in an declaration of conformity. This demonstrates that a product with reused components (i) is performing like an equivalent product with new components, (ii) continues to meet all the safety and environmental criteria. Further details are provided in Appendix A2.3.13 of the study report. | | | | | | | |
| **50** | Promote knowledge transfer/training/guidance related to remanufacturing[679] | information | 1,2 | several | NL, SG | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Training programmes in the Netherlands help companies to establish a remanufacturing path and the Advanced Remanufacturing and Technology Centre in Singapore is a vital platform to develop and implement new technologies in the remanufacturing sector. | | | | | | | |
| **51** | Promote the provision of online repair guidance for electrical and electronic equipment[680] | information | 2 | WEEE | Global | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: An open-source wiki-based website (https://de.ifixit.com/) providing guidance for repair of electrical and electronic equipment. | | | | | | | |
| **52** | Investigate reuse/repair potential for specific product groups[681] | information | 2 | WEEE | GR, LV, UK | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Research and information is put forward to identify the reuse potential of EEE products. Three examples (UK, LV, GR) were identified. | | | | | | | |

[679] https://www.tudelft.nl/bk/onderzoek/onderzoeksthemas/circular-built-environment/projects/cared, https://www.tudelft.nl/bk/onderzoek/onderzoeksthemas/circular-built-environment/projects/remanpath, https://www.a-star.edu.sg/artc

[680] https://de.ifixit.com/

[681] https://www.eea.europa.eu//publications/waste-prevention-in-europe-2017; https://www.reweee.gr/en; https://www.zerowastescotland.org.uk/research-evidence/reuse-weee-household-waste-recycling-centres

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| 53 | Promote the establishment of inventories of materials/components in buildings[682] | information | 2 | C&D waste incl. soils | DE | sectoral | stimulating reuse repair remanu-facturing | planned |
| | Short description: A German example demonstrates the use of building passports for public buildings. In Austria, currently preparatory work for a material information system of buildings (key materials, data and operational specifications). | | | | | | | |
| 54 | Introduce direct economic support to re-use centers (bonus per reused tonne of goods, subsidies for start-ups)[683] | economic | 2 | municipal waste, textiles waste, WEEE | BE, NL, AT, FR | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Several countries provide direct economic support to re-use centers (NL, BE, AT, FR). Details are provided in Appendix A2.2.9 of the study report. | | | | | | | |
| 55 | Introduce a bonus scheme for using reused parts in car repair by insurance companies[684] | economic | 2 | ELV | NL | sectoral | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: One example (NL) was identified, where a car insurance company introduced a bonus scheme that preferences reused parts in cars. | | | | | | | |

[682] https://www.bamb2020.eu/topics/pilot-cases-in-bamb/new-office-building/, https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/abfallvermeidung_wertschaetzen_statt_wegwerfen_bf.pdf, https://ibroad-project.eu/

[683] https://ce-center.vlaanderen-circulair.be/en/publications/publication/13-reuse-the-understudied-circular-economy-strategy; written input from NL through the questionnaire survey under this project

[684] https://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=search.dspPage&n_proj_id=921&docType=pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **56** | Introduce bonus schemes for reusing wheelchairs und health insurance[685] | economic | 2 | municipal waste | FR | sectoral | stimulating reuse repair remanu-facturing | planned |
| | Short description: France is experimenting with the reimbursement of health insurance costs if preference is given to refurbished against new wheel chairs. Practically speaking, using a pre-owned wheel-chair is less expensive than using a brand-new product. | | | | | | | |
| **57** | Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, refurbished and retreaded goods[686] | economic | 2 | municipal waste | BE, AT, DE | national | stimulating reuse repair remanu-facturing | ongoing |
| | Short description: Several examples where repair services for citizens are subsidised by the public were identified (BE, AT, DE). Further details are provided in Appendix A2.2.7 of the study report. | | | | | | | |
| **58** | Apply the substance restrictions of the ELV Directive for vehicles not under scope of the Directive[687] | voluntary | 1 | ELV | Global | sectoral | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: One example (Toyota) was identified, where the substance restrictions of the RoHS Directive are applied in fork lift trucks. | | | | | | | |

[685] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf
[686] https://circulareconomy.europa.eu/platform/en/good-practices/eco-vouchers-encourage-sustainable-consumption-including-second-hand-and-refurbished-goods, written input to questionnaire survey within the current project.
[687] http://randd.defra.gov.uk/Document.aspx?Document=WR1403-L2-m5-5-Automotive.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **59** | Introduce a weight based default tax on textiles with tax reductions for textiles not containing harmful substances[688] | regulatory | 1 | Textile waste | SE | national | Phasing out of specific products where more sustainable alternatives exist | planned |
| | Short description: Plans being considered by Swedish politicians include a default tax of 40 SEK (US$4) per kilogram of the product's weight, with tax reductions of up to 95 per cent for those that do not contain any harmful chemicals. The proposed tax, due to come into force on 1st April 2021, is outlined in a report, entitled Tax on fashion - to remove harmful chemicals, produced following a government inquiry. | | | | | | | |
| **60** | Extend obligations and restrictions on the marketing of single-use products[689] | regulatory | 2 | municipal waste | FR, ES | national | Phasing out of specific products where more sustainable alternatives exist | just launched |
| | Short description: Initiatives to restrict the marketing of specific single use products going beyond those listed in the EU SUP Directive such as plastic confetti and give aways in restaurants were identified in 2 countries. Further information is provided in Appendix A2.2.3 of the study report. | | | | | | | |

688 https://www.ecotextile.com/2020040725928/dyes-chemicals-news/sweden-reveals-details-of-apparel-chemicals-tax.html

689 https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf, https://www.boe.es/buscar/pdf/2019/BOE-A-2019-5577-consolidado.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **61** | Introduce a legal ban on putting on the market of products containing micro- and nanoplastics[690] | regulatory | 1 | C&D waste incl. soils | ES | regional | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: The Balearic Islands Waste and Polluted Soils Law (Law 8/2019) law prescribes the reduction of toxic products, e.g. prohibiting the use of dangerous cleaning products in public spaces, and prohibiting the sale of products containing microplastics or nanoplastics. | | | | | | | |
| **62** | Introduce a legal ban on non-rechargeable products[691] | regulatory | 2 | WEEE | ES | regional | Phasing out of specific products where more sustainable alternatives exist | just launched |
| | Short description: Ban on certain non-reusable and non-rechargeable products. Non-reusable and non-rechargeable toners and cartridges for printers and photocopiers and models of lighters which cannot guarantee at least 3,000 effective lights will be forbidden. From 2025, distribution and selling of non-rechargeable shaving razors will be forbidden. | | | | | | | |

[690] https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/05/No-time-to-waste_Europes-new-waste-prevent_web.pdf
[691] https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2020/05/No-time-to-waste_Europes-new-waste-prevent_web.pdf

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **63** | Establish a (legal) framework stipulating a reduction in advertising mail[692] | regulatory, voluntary | 2 | municipal waste | FR, NL, UK | national | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: In France the distribution in letterboxes of unrequested advertising leaflets and catalogues for commercial promotion is prohibited. Further details are provided in Appendix A2.2.10 of the study report. | | | | | | | |
| **64** | Introduce a legal ban on systematic printing of cash-till and credit card receipts[693] | regulatory | 2 | municipal waste | FR | national | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: In France there is a ban on the systematic printing of cash-till and credit card receipts, and on the cash machine receipt when money and vouchers are withdrawn. Customers will nonetheless still have the possibility to ask for the printing of a receipt if they wish. | | | | | | | |
| **65** | Introduce modulated taxes for cars considering the fuel consumption/pollution taxes and engine power[694] | regulatory | 2 | ELV | AT | national | Phasing out of specific products where more sustainable alternatives exist | ongoing |

[692] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf; GfK Growth from Knowledge - Onderzoek Reclamefolders, March 2020 (presentation provided through stakeholder consultation)
[693] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf
[694] https://www.bmf.gv.at/themen/steuern/kraftfahrzeuge/Normverbrauchsabgabe-%C3%9Cbersicht.html

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| | Short description: In Austria, for example, the so called "Normverbrauchsabgabe" is higher for cars with higher fuel consumption/pollution and there is a motor related insurance tax. The envisaged effect would also lead to smaller cars which would reduce the ELV volumes. | | | | | | | |
| **66** | Waste prevention criteria for events[695] | operational | 2 | municipal waste | AT, DE, LT, EE, ES | local, regional | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: Several examples of implementing sustainable events were identified. Further information is provided in Appendix A2.2.11 of the study report. | | | | | | | |
| **67** | Promote switching from paper to digital mail by administration[696] | operational | 2 | municipal waste | AT | national | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: Switching from paper to digital mail is widely implemented in the context of digitalization of administration and businesses. Details for one practice example were collected. In Austria, authorities offer online-delivery of mails instead of land-based deliveries. | | | | | | | |

695 https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/abfallvermeidung_wertschaetzen_statt_wegwerfen_bf.pdf; https://www.bmk.gv.at/themen/klima_umwelt/nachhaltigkeit/green_events/initiative.html; https://zerowastecities.eu/wp-content/uploads/2020/12/zwe_report_state-of-zero-waste-municipalities-2020_en.pdf

696 https://www.bmdw.gv.at/Services/ElektronischeZustellung.html

| ID | Prevention measure / initiative | Type | Focus: qualitative (1) / quantitative(2) | Targeted waste stream | Location and context of the measure / policy action taken | Scale of the prevention measure | Main mechanism | Implementation status |
|---|---|---|---|---|---|---|---|---|
| **68** | Organize awareness raising for consumers (switching from non-reusable to reusable products)[697] | information | 2 | municipal waste | UK | various | Phasing out of specific products where more sustainable alternatives exist | ongoing |
| | Short description: There are many examples of such information campaigns. One example identified is an information campaign in the UK to motivate parents to use reusable nappies. | | | | | | | |

## A.2.2 Detailed description of the identified good/best practice examples on measures/initiatives for waste prevention

For the description of good/best practice examples in waste prevention, the identified 68 measures/initiatives were clustered into 15 topics, described in this chapter. Table 4-5 provides a summary on identified Member State examples and priority waste streams for the clustered topics.

### A.2.2.1 Waste prevention action plan and ecodesign action plan for manufacturers of specific products in the context of extended producer responsibility

*Information on the location and context of the measures/policy actions taken*

[697] https://www.wrap.org.uk/content/real-nappies-overview

Two examples where measures have been introduced to establish waste prevention action plans and ecodesign action plans for manufacturers of specific products have been identified (in France and Flanders).

*Description of the measures/policy actions taken*

In 2018, the **Flemish** competent authority OVAM concluded an environmental policy agreement with the producer responsibility organisations for EPR on ELV and batteries (all types) including the following waste prevention requirements[698]:

The producer responsibility organisation shall draw up a prevention plan, together with the producer federations containing, as a minimum:

- an overview of the actions planned by the producer responsibility organisation to promote quantitative and qualitative prevention;
- an overview of the individually planned actions by the producers who are members of the producer responsibility organisation, in order to promote quantitative and qualitative prevention;

The producer responsibility organisation has to report annually on the actions undertaken by the PRO and on the actions undertaken by individual producers who are members of this PRO.

In **France,** the "Law relating to the fight against waste and the circular economy" introduced the obligation for producers to draw up a 5-year-prevention and ecodesign action plan for all products under EPR[699]. The aim is, *inter alia*, to reduce the use of non-renewable resources. The implementation of the plans remains in the hands of the producers. These plans are evaluated every five years. The plans can be set up individually or jointly by several producers. This includes an assessment of the previous plan and defines the objectives and the prevention and ecodesign actions which will be implemented by the producer over the next five years. The producer responsibility organisation (PRO) set up by the producers can develop a plan common to all of its members. The individual and joint plans have to be reported to the eco-organisation set up by the producers, which have to publish a summary accessible to the public, after presentation to the representative body of the stakeholders in the sector.

*Information on the costs and effects of the measures*

[698] Information received through the consultation within this study
[699] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759, Article 72.

The examples are quite recent; it was not yet possible to identify any information about costs and effects.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

The measure is considered transferable to any product and waste stream and to other Member States. For EPR covering a narrow range of products (such as tyres), the measure seems more reasonable than for EPR covering many products, such as EEE.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

Both the binding (France) and voluntary (Flanders) approaches introduced requirements to draw up prevention action plans, which are supported by reporting mechanisms. As these requirements have been implemented recently, in-depth conclusions on the effects on waste generation are not yet possible.

#### A.2.2.2 Durability requirements for (consumer) goods including obligatory consumer information

*Information on the location and context of the measures/policy actions taken*

Examples for developing and applying durability requirements for specific products were identified for France, the UK and the Nordic countries.

*Description of the measures/policy actions taken*

In **France**, the Law relating to the fight against waste and the circular economy introduced the following[700]:

In 2021, a repair score giving information to the consumer on how repairable a product is when he/she purchases it was implemented in order to help the consumer make better choices. It should also lead to competition between companies to encourage them to design more durable products. The Ministry of Ecological and Inclusive Transition, ADEME and the actors in the sector are working on a simple index (a score out of 10) affixed directly to the product or its packaging and at the point of sale

[700] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759, Article 72.

(alongside the price of the product, for example). It will be displayed on a number of electric and electronic general consumer products (e.g., smartphones, laptop computers, washing machines and televisions). The work to build the reparability index brings together all the stakeholders (manufacturers, sellers, distributors, NGOs and consumer associations).

The current repair score was implemented in 2021 for 5 types of products (washing machines, TV sets, smartphones, laptop computers and mowers). The scope will be progressively enlarged. This score will evolve in 2024 into a broader durability score, taking account of reparability but also robustness and the ability to evolve.

ADEME has published a "Preparatory Study for the introduction of a "Durability Index"[701], which also includes an action plan with the necessary steps to launch the Durability Index: a) legislative and standards work to be conducted, b) scope of the durability index, c) development of the durability index, d) communication about the durability index, e) introduction of the index.

In the **UK**, the WRAP Design for Longevity and Clothing Longevity Protocol, was launched in 2013[702]. It addresses resource-efficient business models, design for extending clothing life, fibre and fabric selection, consumer behaviour and reuse and recycling. It focusses on four key areas: size and fit, fabric quality, colours, styles and care. The report offers best practices and preferred solutions for each category of clothing, addressing suitable fibre and fabric choice, design and manufacturing, care and repair and reuse and discarding. In 2014, WRAP published a second report: the WRAP Clothing Longevity Protocol[703] which provides guidelines for tests and performance criteria to drive performance levels. The two main tools in the protocol are a checklist to support decision-making for longevity and testing and performance standard guidelines.

The Design for Longevity report provides requirements or recommendations for eight categories. For example, requirements or recommendations for children's wear include in-growth allowance of garments, durable and colourfast fabrics that withstand many washing cycles, fabric finishes to resist staining, multi-functionality of garments, design and manufacturing considering practicality and wear resistance, e.g., through reinforced parts on knees and elbows, spare patches and buttons for repair and large neck openings. It specifies that, in order to achieve longer-lasting garments, it is appropriate to use a testing regime that is more representative of lifetime wear.

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[701] Preparatory study for the introduction of a durability index - The ADEME library

[702] Cooper, Tim & Claxton, Stella & Hill, Helen & Holbrook, K & Hughes, M & Knox, A & Oxborrow, Lynn, Development of an Industry Protocol on Clothing Longevity, 2014, https://www. researchgate.net/publication/313479105_Development_of_an_ Industry_Protocol_on_Clothing_Longevity

[703] https://www. researchgate.net/publication/313479105_Development_of_an_ Industry_Protocol_on_Clothing_Longevity

The protocol's checklist contains questions on product development stages relating to qualitative requirements, e.g., availability of test reports from fabric suppliers or the execution of wearer trials. The test and performance guidelines (Annex 2) provide detailed requirements for five categories of textiles (knitwear, shirts, jeans, socks, t-shirts) and eight core tests: a) dimensional stability to washing/dry cleaning; b) pilling; c) care label wash with visual assessment; d) colour fastness to: washing/dry cleaning, water or perspiration, light, rubbing; e) spirality; f) seam slippage; g) seam strength; h) fusible lamination. For the same garment categories, the protocol contains examples of current and desired wash and wear estimates (e.g., current lifetime or number of washes).

Potential ecodesign requirements for textiles and furniture including criteria for durability were elaborated and published by the **Nordic Council of Ministers** in 2018[704]. The starting point for elaborating the requirements for textiles were existing ecolabel specifications, such as the EU ecolabel and the Nordic Swan, and the EU GPP criteria. The criteria, developed by a cross-disciplinary team, were discussed with stakeholders.

In total, 15 requirements were proposed for textiles covering garments and home textiles with CN 2-digit codes 61, 62 and 63 (part of) produced in, or imported to, the EU. Eleven of them are intended to increase durability of textiles:

- Durability of fasteners: Fasteners should be able to be fastened and unfastened X number of times without failure
- Availability of spare parts: The producer must make spare parts available for X years after the product has been on sale, or alternatively must provide spare parts with the product (e.g., extra buttons, thread of correct colour, replacement zips, etc.)
- Design for disassembly: The product logo, buttons and zips should be removable within X seconds. Seams should be disassembled within X seconds but without reducing durability under normal use and care. Instructions should be provided on how to do this.
- Care and maintenance labelling: The product must be accompanied by information (or link to information) on recommended care and maintenance tips that can prolong the lifetime of the product (and reduce use phase impacts).
- Dimensional changes during washing and drying: Between minus X % and plus X % for woven products and durable non-wovens, and other knitted products.
- Colour fastness to washing: Colour fastness to washing must be at least X (test score) for colour change and at least X (test score) for staining.
- Colour fastness to perspiration (acid, alkaline): Colour fastness must be at least X (test score for colour change and staining).

[704] http://norden.diva-portal.org/smash/get/diva2:1221509/FULLTEXT01.pdf

- Colour fastness to wet rubbing: Colour fastness to wet rubbing must be at least X (test score).
- Colour fastness to dry rubbing: Colour fastness to dry rubbing must be at least X (test score).
- Colour fastness to light: Colour fastness to light must be at least X (test score).
- Resistance to pilling and abrasion: minimum test score of X.

In addition, the following information is given per requirement: a) type of requirement, i.e., threshold, information-based, other; b) rationale for the requirement, c) relevant product types to be addressed by the requirement, d) testing and documentation standards, e) comments on scope, challenges in implementation, potential conflicts and synergies with other ecodesign aspects.

The developed set of requirements was intended to inspire the development of requirements by a future working group under the Ecodesign Directive. Specific thresholds have not yet been elaborated. It seems reasonable to establish different thresholds for different kinds of fibres and different types of products, e.g., relevant requirements for underwear will differ widely from relevant requirements for outdoor jackets.

*Information on the costs and effects of the measures*

Information on the costs of developing durability requirements/scores and the corresponding test methods is not available. Estimates on the effects of longer lifetimes of textiles were made by WRAP 2018[705]. A 10 % longer lifetime of textiles (i.e., 3 months) would lead to 8 % carbon saving, to 10 % water savings and to 9 % less waste. A 33 % longer lifetime of textiles (i.e., 9 months) would lead to 27 % carbon savings, to 22 % water savings and to 22 % less waste.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

For products from a highly global market, such as textiles and clothing, EU-level implementation seems appropriate.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

[705] WRAP, Design for Longevity Guidance on increasing the active life of clothing, 2013.

Binding minimum requirements on durability – to be established under the Ecodesign Directive – seem likely to be much more effective than their use only in ecolabel schemes and GPP.

The success of the criteria developed so far by several initiatives will rely on the outcome of future negotiations between the Ecodesign Directive working group, the European Commission, the textile industry and other important stakeholders.

### A.2.2.3 Extend obligations and restrictions on the marketing of single-use products

*Information on the location and context of the measures/policy actions taken*

Two examples, in the Balearic Islands and France, were identified, where restrictions on placing specific single-use products on the market – extending beyond those regulated under Directive (EU) 2019/904 - have been adopted.

*Description of the measures/policy actions taken*

In 2019, the regional government of the **Balearic Islands** adopted several legal measures intended to reduce waste[706]. *Inter alia*, restrictions on the marketing of specific single-use products were laid down. Marketing of non-reusable and non-refillable printer cartridges, toners and photocopiers, and lighters that do not guarantee a minimum of 3,000 ignitions, were restricted from 2021 onwards. Marketing of single-use razors will be restricted from 2025 onwards. In addition, EPR was introduced for these products.

Recent **French** legislation[707] also restricts the marketing of certain single-use products. The marketing of plastic confetti has been restricted from 2021 onwards; offering plastic toys as gifts at restaurants will be prohibited from 2022 onwards[708].

*Information on the costs and effects of the measures*

[706] Law 8/2019, of February 19, on waste and contaminated soils of the Balearic Islands. https://www.boe.es/buscar/pdf/2019/BOE-A-2019-5577-consolidado.pdf , Article 24.
[707] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759
[708] https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf

In the Balearic Islands, the restrictions for single-use products as described above are expected to help achieve the binding waste reduction targets of 10 % by 2021 and 20 % by 2030, compared with 2010[706].

As regards plastic confetti, large quantities have been found in the environment recently and remain in the soil for years. These large quantities of plastic confetti come at a cost to the environment, including in terms of cleaning: they clog sewers and pollute the water, resulting in additional clean-up costs[709].

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

Although the primary motivation for adopting restrictions on the marketing of certain products in the Balearic Islands was the islands' popularity with tourists, the restrictions are deemed reasonable for other regions and Member States as well.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

The measures are legally binding but too recent to allow for an assessment of the actual effects.

#### A.2.2.4 Introduce (obligatory) funding of waste prevention/reuse/repair for producers under EPR schemes

*Information on the location and context of the measures/policy actions taken*

Two examples of obligatory funding schemes for PROs to encourage waste prevention, reuse and repair were identified (Austria and France).

*Description of the measures/policy actions taken*

709 https://www.ecologie.gouv.fr/sites/default/files/en_DP%20PJL.pdf

In **Austria**, the Waste Management Act (Section 29 (4a) AWG 2002)[710] stipulates that PROs must allocate at least 0.5 % of the licence fees collected annually to funding waste prevention projects. For PROs managing electrical and electronic equipment, this also includes funding the reuse of whole appliances. In the case of EPR for packaging waste, the funding is delegated to a third party[711] which regularly publishes calls for tenders for specific waste prevention projects, inviting companies, NGOs, educational institutions, universities and research institutes to submit project proposals. The aim of these projects must be waste prevention in general, but they can focus on all waste streams, rather than packaging waste only, even though the projects are funded by the producers of packaging.

In **France**, EPR schemes will have to financially support all those involved in reuse activities, including waste sorting, repair and recycling centres, etc., through the creation of so-called "Solidarity Reuse Funds". This will apply to producers of products likely to be reused, in particular EEE, furniture, textiles, footwear, toys, sports and leisure articles as well as DIY and garden items. The fund is to be provided with the resources necessary to achieve the reuse objectives, with a minimum of at least 5 % of the licence fees set. The measure has been adopted in the "Law relating to the fight against waste and the circular economy"[712], Article 62, but the specific implementation in the form of a decree is still pending.

*Brief assessment of the costs and effects of the measures*

In **Austria**, dedicated waste prevention projects of individual businesses and institutions, for example projects to reduce resource use or production waste, are funded. Yearly, a sum of approximately €1 million (€ 0.11 per capita) is available from the packaging PROs, while the EEE PROs provide about €50,000 (€0.006 per capita). This can directly lead to waste prevention at product or business level. Beyond that, funding of more general research studies, or the setting up of networks or awareness-raising measures can have an indirect effect on waste prevention. A list of all projects which are or have been funded, including a short description, is published continuously.[713] For **France**, the French National Agency for the Environment (ADEME) estimated the cost at €200 million per year, while the French government currently estimates the costs to be between €20 and €100 million per year (between €0.30 and €1.44 per capita). The aim of the measure

[710] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20002086
[711] https://www.vks-gmbh.at/abfallvermeidungs-foerderung.html
[712] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy, https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759/, Article 26
[713] https://www.bmk.gv.at/themen/klima_umwelt/abfall/abfallvermeidung/foerderung.html

in France is to help increase the amount of products which are reused, develop reuse networks and create jobs through ongoing support of reuse activities.

The projects funded by the Austrian EPR schemes are considered in the implementation assessment of waste prevention measures in the national waste prevention programme. However, an effectiveness assessment of individual projects has not yet been performed/scheduled.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

In Austria, this type of measure applies to all products and waste types which are covered by an EPR scheme (packaging, batteries, electrical and electronic equipment and vehicles), whereas in France, details as to the mode of operation for the PROs still have to be set out by decree. As EPR is obligatory at EU level for specific products (WEEE, batteries and accumulators, and vehicles), this measure could easily be implemented in all Member States.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

In this case, the regulatory requirement of waste prevention and reuse funding leads to specific projects for waste prevention as well as to the establishment of reuse activities, potentially resulting in a reduction in the consumption of primary products.

#### A.2.2.5 Introduce a ban on destroying unsold new products

*Information on the location and context of the measures/policy actions taken*

Both the 2020 EU circular economy action plan, as well as the sustainable product policy[714], which is being developed for publication in the fourth quarter of 2021, contain a provision for a ban on the destruction of unsold functional durable goods. This ban or similar restrictions on the destruction of certain unsold products has/have already been adopted or is/are under consideration in two Member States (France and Germany).

[714] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en

*Description of the measures/policy actions taken*

In **France**, the law relating to the fight on waste and the circular economy (No. 2020-105[715], article 35 'Struggle for reuse and fight against waste') and the corresponding decree[716], which came into force in January 2021, was the first to introduce a ban on destroying, incinerating or landfilling (with some exceptions) new unsold non-food durable goods. Among others, these include clothes, electronic products, shoes, books and household appliances which must now be donated, reused or recycled. Moreover, sanitary and childcare products must be donated to social organisations and, thus, cannot be recycled. For products currently covered by EPR systems, this ban comes into force no later than 31 December 2021, while for other products the starting date is 31 December 2023. The French environmental code[717] furthermore provides that, in order to prevent the generation of food waste, all large supermarkets and retailers must sign a food donation agreement with charitable organisations, and unsold products which are still fit for consumption cannot be made unfit for consumption.

A similar approach is being considered in **Germany**. Its Circular Economy Law[718] requires, in Sections 23 and 24, that producers and distributors of products must maintain the functionality of their products and ensure that their products do not become waste. Product returns are explicitly mentioned as being part of the focus of this provision, in contrast to the French case, where the focus lies on new unsold products. In addition, Section 25 requires producers and distributors to publish if and how many products are disposed of. However, the implementing act providing details on the precise implementation and on which products will fall under these requirements has not yet been adopted.

In Belgium, the donation of certain unsold goods to charitable organisations is encouraged by extending VAT relief to donated goods[719], thereby ensuring that donating is a cheaper option than destruction or disposal. An explicit ban on the destruction of unsold goods has, however, not been adopted.

*Information on the costs and effects of the measures*

[715] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759/
[716] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000042753962
[717] https://www.legifrance.gouv.fr/codes/section_lc/LEGITEXT000006074220/LEGISCTA000032043245/
[718] http://www.gesetze-im-internet.de/krwg/BJNR021210012.html
[719] http://www.ejustice.just.fgov.be/mopdf/2019/05/06_1.pdf#Page14

In France, it is estimated that, of the €140 billion of goods consumed yearly by households, around €800 million constitute residual unsold goods, of which around €630 million are destroyed and €140 million are donated. Promoting the donation of unsold durable goods will thus increase the availability of these goods for consumers with limited financial resources.[720] With respect to the costs of this measure for companies, the impact assessment of the French law[720] points out that if companies are prohibited from disposing of their unsold products, disposal taxes are no longer due. These disposal taxes are planned to increase significantly by 2025 to €10/t more than the cost of recycling, ensuring that disposal will always be the costlier option for companies. Also, unsold goods can be donated VAT-free.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

The measure has already been implemented for a broad range of products in one Member State. As it is included as a general provision in the framework of the circular economy action plan, the transferability of the measure should be feasible.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

During the development of the French law, a voluntary industry commitment was also considered.[720] However, ultimately a regulatory framework was judged to be more likely achieve a reliable effect.

### A.2.2.6 Introduce direct economic support to reuse centers (bonus per reused tonne of goods, subsidies for start-ups)

*Information on the location and context of the measures/policy actions taken*

In a number of Member States or regions (Flanders, the Netherlands, Austria and France) reuse centres receive direct economic support to finance their operation.

*Description of the measures/policy actions taken*

[720] https://www.legifrance.gouv.fr/contenu/Media/Files/autour-de-la-loi/legislatif-et-reglementaire/etudes-d-impact-des-lois/ei_art_39_2020/ei_trep1902395l_cm_10.07.2019.pdf

In **Flanders**, there is a long history of close cooperation between regional and local governments and reuse centres, run as non-profit social enterprises, ensuring the professional development of the network of reuse centres and high levels of reuse and repair and social employment. Currently, 28 reuse centres and 162 shops exist throughout the region with its 6.5 million inhabitants. In addition to collecting, repairing and selling used goods, the focus lies on offering employment to people who were previously unemployed, are unskilled or have learning disabilities. To receive subsidies, reuse centres must maximise the amount of goods which are reused, ensure employment for long-term unemployed people and operate on a non-profit basis.[721]

In the **Netherlands**, the Circular Economy Implementation Programme 2019-2023[722] has set an objective to have a nationwide network of circular craft centres by 2030. To achieve this, as of 2019, the Ministry of Infrastructure and Water Management has been offering subsidies to municipalities to start such a centre which must include facilities such as reuse shops, waste recycling centres, social enterprises, repair workshops, etc. A circular craft centre is understood as a cluster of such initiatives (which can be already existing or new) at a single site, with the specific intention of achieving high-value product and material reuse. These subsidies are to be used for the preparation and execution of the start-up of such centres.

As in Flanders, **Austria** also supports social enterprises, including many that offer repair services, for their activities in terms of social employment. Under this programme, costs for the employment and training of transitional employees are borne by the public employment service.[723]

In **France**, as mentioned in Section A.2.2.4, PROs finance a fund that supports reuse activities.

*Brief assessment of the costs and effects of the measures*

As of 1995, the Flemish government provided an annual subsidy of €12,447 during four successive years to each reuse centre, provided they helped to support the Flemish prevention and recycling policy and reported their activities annually. From 1997 until 2004, a start-up subsidy for new reuse centres of €24,790 (divided across 4 years) was offered. Municipalities were encouraged to conclude cooperative agreements with reuse

[721] https://emis.vito.be/nl/actuele_wetgeving/20-mei-2005-besluit-van-de-vlaamse-regering-tot-vaststelling-van-de-bijzondere

[722] https://hollandcircularhotspot.nl/wp-content/uploads/2019/09/Circular-Economy-Implementation-Programme-2019-2023.pdf

[723] https://arbeitplus.at/wordpress/wp-content/uploads/2020/12/AMF-22_2020_BRL-SO%CC%88B.pdf

centres and, it was required that every inhabitant would have access to a reuse shop in his/her vicinity by 2001. As of 2012, every municipality has been required to conclude a cooperative agreement with a reuse centre, which includes efforts by the municipality to promote reuse among its inhabitants and defines a subsidy calculated based on the number of inhabitants in the service area and a tonnage fee for the collection of reusable goods.[724] In addition to subsidies for reuse, reuse centres also receive financial support as social employers, in the range of 40% –75 % of the salaries of eligible personnel.[725] All in all, around 48 % of the revenues (€115.6 million in total) of the Flemish reuse centres is provided by subsidies, around €55 million in total, of which 93 % comes from financial support related to social employment and 7 % is provided as environmental subsidies.[726] The amount of goods collected has increased steadily from around 2,500 tonnes in 1995 to almost 66,000 tonnes in 2014, while shop turnover has seen a similar trend from €12.3 million in 2001 to €45.4 million in 2014,[727] confirming the overall success of the collection and reuse through these channels.

In the Netherlands, each centre can receive up to €50,000 which can be up to 50 % of the incurred costs, while the total budget of the programme amounts to €1 million per year.[728] In 2019, 10 circular craft centres were supported with a total budget of €500,000 while, in 2020, this number increased to 22 centres and €1 million. It is not yet known if a subsidy round will take place for upcoming years.[729]

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

The factors behind the success of the reuse centres in Flanders include:[730]

- the strong connection of reuse and social employment,
- the incorporation of the reuse centres into the Flemish waste management policy to ensure that they are embedded in the local waste prevention and management system

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[724] OVAM (2015): How to start a Reuse Shop? An overview of more than two decades of reuse in Flanders. https://ovam.be/sites/default/files/atoms/files/2015_Folder-Kringloop-engels_LR.pdf; https://navigator.emis.vito.be/mijn-navigator?woId=44314

[725] https://www.vlaio.be/nl/subsidies-financiering/subsidiedatabank/collectief-maatwerk-subsidies-voor-kwetsbare-werknemers

[726] De Schamphelaere et al. (2017): De Kringwinkelsector in 2017. https://ovam.be/sites/default/files/atoms/files/2017SectorrapportKringwinkels.pdf

[727] OVAM (2015): How to start a Reuse Shop? An overview of more than two decades of reuse in Flanders. https://ovam.be/sites/default/files/atoms/files/2015_Folder-Kringloop-engels_LR.pdf

[728] https://zoek.officielebekendmakingen.nl/stcrt-2020-46388.html

[729] https://circulairambachtscentrum.nl/programma/

[730] OVAM (2015): How to start a Reuse Shop? An overview of more than two decades of reuse in Flanders. https://ovam.be/sites/default/files/atoms/files/2015_Folder-Kringloop-engels_LR.pdf

- a federation of reuse centres as a driving force behind the development of the reuse policy, and
- a strong collaboration between regional and local governments and the federation, driving the professionalization, including monitoring and quality control, and recognisability of the reuse centres.

In the Netherlands, the financial incentives have led to increased commitment to the successful start-up of the circular craft centres, inspiring further municipalities to implement centres on their own territories as well.

### A.2.2.7 Set up funds to encourage citizens to use repair services including eco-vouchers to purchase repaired, refurbished and retreaded goods

*Information on the location and context of the measures/policy actions taken*

Examples of direct subsidies to encourage citizens to use repair services were identified for Austria, the German region of Thuringia and Belgium.

*Description of the measures/policy actions taken*

In **Belgium**, eco-vouchers were introduced by the social partners through a collective agreement in 2009[731]. These eco-vouchers can be used to purchase environmentally-friendly goods and services listed in an annex to the agreement. This list contains 3 categories: a) Ecological goods & services, b) Sustainable mobility & leisure and c) Reuse, recycling, repair and waste prevention. The eco-vouchers can also be used for purchasing reused, recycled products or products made from recycled or biodegradable materials, second-hand products, repaired goods, rechargeable batteries or eco-friendly lamps. Maintenance and repair costs can also be paid for with eco-vouchers. Every two years, the list of eligible products is evaluated to keep up with ecological developments.

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[731] https://circulareconomy.europa.eu/platform/en/good-practices/eco-vouchers-encourage-sustainable-consumption-including-second-hand-and-refurbished-goods

Eco-vouchers are issued by Belgian firms through a 'Vouchers Issuers Association'[732]. Currently, approximately 1.8 million employees receive such eco-vouchers.

In **Austria,** in recent years, six out of 9 federal provinces (Upper Austria[733], Lower Austria[734], Vienna[735], Carinthia[736], Styria[737] and Salzburg[738]) have introduced a repair bonus/subsity to promote the repair of household appliances and other products by regional companies. Upper Austria started in 2018, with the other federal provinces following in 2019, 2020 and 2021. Usually 50 % of the invoice amount is funded, with a maximum of €100 per household per year. Mostly, repairs of household electronics and white goods are supported as long as funding is available. The bonus can be used at suitable repair companies providing repair services for at least one of 10 designated product categories (clothing, leisure equipment, cameras and accessories, medical aids, IT &T equipment, household equipment and machinery, music instruments, furniture and home textiles, mobility, home and garden. Suitable repair companies can be searched for using the online repair guide at www.reparaturführer.at. Currently, it lists more than 8,000 repair companies all over Austria.

A nationwide repair bonus will be introduced from the first quarter of 2022, using the means provided by the European Recovery and Resilience Facility (RRF), which is intended to support reform and investment projects which contribute to sustainable growth[739].

In Germany, a pilot project, similar to the Austrian repair bonus/subsidy has been launched in one federated state (**Thuringia**)[740]. The vouchers can be used for repairs of electrical and electronic equipment at any repair company. The pilot project run by the Environment Ministry and the consumer protection organisation started in June 2021 and will end in December 2022. Fifty per cent of the invoice amount is funded, with a maximum of €100 per person and year. The invoice has to be a minimum of €50.

Similar programmes are envisaged in further German federated states.

*Information on the costs and effects of the measures*

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[732] VIA | Voucher Issuers Association (viabelgium.be)
[733] https://www.land-oberoesterreich.gv.at/205522.htm
[734] https://www.noe.gv.at/noe/Abfall/Foerd_Reparaturbonus.html
[735] https://www.wien.gv.at/umweltschutz/wienerreparaturbon.html
[736] https://www.ktn.gv.at/Service/Formulare-und-Leistungen/UW-L31
[737] https://www.repanet.at/reparaturpraemie-jetzt-auch-in-der-steiermark and https://www.graz.at/cms/beitrag/10224804/7882683/
[738] https://www.salzburg.gv.at/reparaturbonus
[739] https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en
[740] Startseite | Reparaturbonus Thüringen (reparaturbonus-thueringen.de)

In **Austria,** the available amount of funding is currently limited at federal province level. The demand from citizens is high. The federal provinces have different levels of funding available. For example, Lower Austria (about 1.7 million inhabitants) paid out a total of €0.56 million from July 2019 up to May 2020. Over this period, over 7,700 electrical devices were repaired. This corresponds to a saving of 230 tonnes of electronic waste. Washing machines, dishwashers, coffee machines and smartphones were the most popular repairs. Vienna (about 1.9 million inhabitants) provided €1.6 million from 2021 to 2023. The number of repairs and the amount of funding paid out will be monitored. The type of product was also recorded. The nationwide repair bonus for EEE that will be launched in 2022 has a volume of 130 million Euros (total over the period 2022-2026).

During the first 2 weeks following the launch of the repair subsidy in **Thuringia** in June 2021, 266 invoices for repair of predominantly household appliances were subsidised, amounting to 19,000 Euros. One-fifth of the repair services were performed by independent repair services, more than 50 % by specialised retailers and electricians, while the remainder were carried out by larger retailers and producers´ services.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

The repair subsidies are already in place for a variety of products. The measure itself could be one element of a group of measures at EU level, namely the amendment of the VAT Directive to promote repairs, binding specifications for product design to facilitate repairs of EEE, use of the guarantee and warranty instruments.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

Usually, one of the deciding factors governing whether a product is to be repaired or replaced by a new one is the financial aspect (comparison of repair costs and price for a new product). By funding repairs of household appliances and other products, people are more highly motivated to carry out repairs. Awareness-raising activities as an accompanying measure are also very important to inform the population about the availability of such subsidies and repair services in their vicinity.

#### A.2.2.8 Extend the legal guarantee (product warranty) of products

*Information on the location and context of the measures/policy actions taken*

The legal guarantee of conformity provides that customers may request the repair or replacement of a faulty product within a certain timeframe. EU legislation (Directive

1999/44/EC[741]) stipulates that the minimum duration of this timeframe cannot be less than two years, whereas for second-hand goods, the seller and consumer may agree to a shorter time period of at least 1 year. However, some Member States apply longer periods through national law.

*Description of the measures/policy actions taken*

In **France**, the law relating to the fight on waste and the circular economy (No 2020-105[742], Article 22) extends the duration of the legal guarantee by six months for a product which is repaired under the legal guarantee of conformity. In practice, if a product breaks down during the first 2 years of use and it is repaired, consumers will thus benefit from a total of 2.5 years of legal guarantee. If a product is replaced by a new product under the legal guarantee of conformity, the latter's duration will be reset, again providing 2 years of guarantee. These provisions will enter into force with effect from 1 January 2022.

*Information on the costs and effects of the measures*

This measure is intended to encourage consumers to have their faulty products repaired and, thus, increase the life spans of appliances. As this measure has not yet entered into force, a comprehensive assessment of its costs and effects is not available yet. However, when assessing the costs and benefits of longer lifetimes of products in general, a report for the European Parliament's Committee on Internal Market and Consumer Protection[743] concluded that considering the full spectrum of economic agents, significant potential economic benefits from lifetime extension are to be expected. A rise in economic activity related to increasing the lifetime of products, such as maintenance, repair and R&D, leads to additional economic growth. Additionally, households, social enterprises and small and medium-sized enterprises are expected to most likely gain due to savings made by delaying purchases of new products, and due to opportunities for new business models. However, the manufacturing sector may potentially be affected negatively due to a reduction in sales and revenues.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

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[741] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A01999L0044-20111212
[742] https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759/
[743] Montalvo, C. et al (2016), A Longer Lifetime for Products: Benefits for Consumers and Companies. https://www.europarl.europa.eu/RegData/etudes/STUD/2016/579000/IPOL_STU(2016)579000_EN.pdf

As the legal guarantee is currently already regulated at EU level through minimum requirements, adding the provision for extending the guarantee after repair should be feasible.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

The fact that this measure is enacted through regulatory means rather than voluntary commitments ensures a uniform implementation across regions and sectors, potentially maximizing the effects of the measure.

### A.2.2.9 Introduce/enable tax reduction for accredited reuse centres (reduced VAT)

*Information on the location and context of the measures/policy actions taken*

A number of approaches have been implemented across Member States to reduce taxes for reuse centres or on repairs.

*Description of the measures / policy actions taken*

The most popular measure has been the reduction of VAT on repair services. VAT rates are regulated by Council Directive 2006/112/EC on the common system of value added tax[744], which provides in Article 98 that, for certain goods or services (listed in Annex III), Member States may apply a rate which is lower than their respective standard rates. This list includes minor repairs to bicycles, shoes and leather goods, and clothing and household linen (including mending and alteration). Ten Member States (**BE, CZ, IE, LU, MT, NL, AT, PL, SI, SE**) have applied a lower rate for the repair of all three categories, ranging from 5 to 13.5 %, while Portugal has lowered its VAT rate to 6 % for the repair of bicycles only.[745] Additionally, **France** has exempted the collection and sale of used goods carried out by social enterprises, as these activities are linked to the employment of

[744] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02006L0112-20210701

[745] General information can be found at https://ec.europa.eu/taxation_customs/vat-rates_en, while tables with the VAT rates valid are available from https://ec.europa.eu/taxation_customs/document/download/231d5d92-160f-4a7f-a104-5a87aba97735_en

disadvantaged and disabled persons, so they can be exempted from VAT under Article 132 of Council Directive 2006/112/EC. Similarly, **Belgium** has reduced the VAT rate for the sales of goods and services by social enterprises to 6 %. To incentivise and reduce the cost of repair, **Sweden** has implemented an additional tax incentive. Half of the labour costs of repair and maintenance work on white goods, consumer electronics and IT equipment are tax deductible, provided that they are performed at the owner's home.[746]

*Information on the costs and effects of the measures*

The reduced VAT rates lead to tax revenue losses, in addition to higher administrative and enforcement costs. The impact of a reduced VAT rate depends on the extent to which the tax reduction is passed on to the consumers and the impact of a price reduction on demand. However, studies on the effects of VAT reduction on the consumption of merit goods (i.e. the goods and services for which a reduced rate is allowed because of the associated social and environmental benefits) are scarce.[747] One factor in favour of a VAT reduction on repair services is the fact that repair services are labour-intensive, in view of the fact that in EU countries labour is generally taxed more heavily than commodities, making repair services comparatively more expensive than buying new products.[748] According to a Eurobarometer survey[749], three-quarters of respondents would like to have broken appliances repaired before buying new ones, but cite the difficulty and expense of a repair as a major reason for nevertheless choosing new products. Therefore, the price of repair seems to be a major barrier and a reduction through reduced VAT rates could help to reduce the price difference between repairing products and buying new products.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

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[746] https://www.skatteverket.se/servicelankar/otherlanguages/inenglish/businessesandemployers/declaringtaxesbusinesses/rotandrutwork.4.8dcbbe4142d38302d793f.html

[747] European Parliamentary Research Service (2021), VAT gap, reduced VAT rates and their impact on compliance costs for businesses and on consumers. https://www.europarl.europa.eu/RegData/etudes/STUD/2021/694215/EPRS_STU(2021)694215_EN.pdf

[748] Dalhammer et al. (2020), Promoting the Repair Sector in Sweden. https://lucris.lub.lu.se/ws/portalfiles/portal/77933910/Promoting_the_repair_sector_in_Sweden_2020_IIIEE.pdf

[749] Eurobarometer 388 (2014), Attitudes of Europeans towards waste management and resource efficiency. https://op.europa.eu/en/publication-detail/-/publication/e3932343-3c82-4a5f-8a1a-e22eafd050a6

Reduced VAT rates are already applied across Member States, which shows that this measure is easily transferable geographically. However, the scope of products for which repair services can be offered using a reduced VAT rate is limited, which leaves a potential for broadening the scope of this measure to more waste categories.

### A.2.2.10 Establish a (legal) framework stipulating a reduction in advertising mail

*Information on the location and context of the measures/policy actions taken*

There are many examples of measures to reduce both unaddressed and addressed advertising mail and similar in Member States.

*Description of the measures/policy actions taken*

With regard to the prevention of unaddressed advertising mail, there are initiatives to promote unsubscribing from such mail by citizens in many countries (e.g., AT, ES, UK, NL). Often a concept, where citizens have the right to request that they do not receive such mail by means of "No" stickers on letterboxes, is in place. Companies which do not respect this right can be fined. On the one hand, there are national initiatives (in **Austria**, for instance, a "No sticker" is promoted by the "Umweltberatung"[750] at national level). On the other hand, municipalities often promote unsubscribing from unaddressed mail. Examples are the city of Barcelona which distributed "No stickers" to its citizens, and many municipalities in the Netherlands)
In the **Netherlands**, for many years the standard practice was to use stickers indicating that citizens did not wish to receive either unaddressed printed advertising mail or door-to-door newspapers or both. In recent years, more and more municipalities (e.g., Amsterdam in 2018, Utrecht in 2020[751]) have changed this policy. The new concept specifies that citizens have to explicitly indicate that they wish to receive such material. Companies are not permitted to deliver any unaddressed matter to letter boxes without a sticker affixed.

One example of a ban on unaddressed advertising was identified. In **France,** the distribution of unsolicited advertising leaflets and catalogues for commercial promotion has been prohibited by the Law relating to the fight against waste and the circular

[750] https://www.umweltberatung.at/werbung-einfach-abbestellen-39898
[751] https://www.030magazine.nl/politiek/810-even-wennen-met-nieuw-ja-nee-stickerbeleid

economy[752] (Article 47). The distribution of advertising printed matter on cars has also been banned since the start of 2021.

To prevent unsolicited addressed mail, many countries (DE, AT, BE, DK, ES, NL, UK) additionally have so called “Robinson lists”[753]. By entering their postal addresses into Robinson lists, citizens can request that they do not receive advertising mail. It must be borne in mind, however, that the entries in the Robinson lists are based on voluntary agreements with the advertising industry.

*Information on the costs and effects of the measures*

A literature survey on the waste prevention potential linked to unsolicited advertising mail has been conducted by Puig Ventosa et al (2014)[754]:

- According to a study published by the French Environment Agency (Ademe) in 2006, advertising material received in households generates 10.3 kg of waste per inhabitant per year[755].
- According to a waste prevention guide published by Ademe in 2012[756], the prevention potential per household is estimated to be 24 kg per year. Given the new legal requirements as described above, it is now estimated that 18 billion printed products, i.e., 800,000 tonnes of paper or 30 kg per household and year, could be prevented in France[757].
- A study conducted in Denmark estimated an amount of 55 kg of unsolicited mail received per household in 2009[758].

[752] Law No. 2020-105 of February 10, 2020 relating to the fight against waste and the circular economy; https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000041553759.
[753] https://de.wikipedia.org/wiki/Robinsonliste
[754] https://link.springer.com/article/10.1007/s10163-014-0261-y?sa_campaign=email/event/articleAuthor/onlineFirst
[755] ADEME (2007) Le gisement des emballages ménagers en France, Evolution 1994/2006. Agence de l’Environnement et de la Maîtrise de l’Energie, France
[756] ADEME (2012) Réduire ses déchets et bien les jeter. Agence de l’Environnement et de la Maîtrise de l’Energie, France
[757] https://circulareconomy.europa.eu/platform/sites/default/files/anti-waste_law_in_the_daily_lives_of_french_people.pdf
[758] https://circulareconomy.europa.eu/platform/sites/default/files/anti-waste_law_in_the_daily_lives_of_french_people.pdf

- A survey carried out in Vienna in 2004[759] established a prevention potential of 33 kg per household and year. For the Brussels region, a study published in 2010 demonstrated that campaigns including stickers and accompanying enforcement actions lead to a reduction of a prevention potential of about 5 kg per household and year.
- A study performed by the City of Utrecht estimated that approximately 13 kg per household and year could be prevented by switching from a policy where delivery of unaddressed mail is permitted mail as long as "No" stickers are used to a policy where delivery of unaddressed material is permitted only on demand[760].

According to a study conducted by Ademe, 25 % of paper consumption for advertising uses corresponds to addressed advertising in mailboxes, and 51 % corresponds to unaddressed advertising (the rest of paper consumption being used for commercial catalogues – 13 % - and other kinds of advertising materials - 11 %).

In addition to the reduction of waste paper, banning the delivery of unaddressed mail also contributes to reduced emissions from distribution to households.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

Measures to reduce unsolicited mail are already being implemented in several Member States, indicating that this measure is easily transferable across the EU.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

Available literature reveals that a crucial factor for the success of campaigns using "Yes" or "No" stickers is that the provisions are properly enforced, and that those companies not accepting citizens' right to refuse unaddressed mail are fined appropriately. The municipality of Amsterdam has set up a website to report the receipt of unwanted printed matter. Following such a report, the advertiser will be contacted and given 2

[759] Wassermann G. et al (2004) Werbung auf Wunsch - Modellversuch zur Erprobung von Maßnahmen gegen die Zustellung unerwünschten Werbematerials (Advertising on request - model experiment for trialling measures against unsolicited advertising), on behalf of the Initiative Waste Prevention in Vienna, Austria

[760] https://www.030magazine.nl/politiek/810-even-wennen-met-nieuw-ja-nee-stickerbeleid

weeks to prevent unwanted distribution again. If there is another report, authorities will draw up an official report, on which the advertiser may give its opinion. If, after this violation, there is a further unwanted delivery to the address, the municipality will impose a penalty of 500 Euros per mail.[761]

A recent study[762] conducted in the Netherlands evaluating the effects of the changed sticker policy showed that, under the former policy (delivery of unaddressed mail as long as it was not refused by the application of "No" stickers) 89 % of households wanted to receive unaddressed mail, whereas, under the new policy (delivery of unaddressed material on demand only), only 65 % did.

These findings are similar to the results of the study from Vienna from 2004[759], which revealed that 63 % of the participating households were in favour of banning the distribution of unaddressed advertising, while 47 % did not want to ban the distribution of unsolicited advertising in general. 53 % of the households found it annoying.

Thus, in order to tap the full potential of preventing waste from unaddressed advertising mail and newspapers, banning the distribution of such mail, as in the case of France, seems more effective than voluntary approaches.

#### A.2.2.11 Waste prevention criteria for events

*Information on the location and context of the measures/policy actions taken*

Green or sustainable events are characterised by their efforts to minimise the environmental impacts caused by their organisation, which includes considering waste generation and management. A number of national, regional and local governments have implemented regulations, labels and information services to promote and/or require specific measures to reduce waste generation during public events. Furthermore, ISO 20121[763] provides guidance and best practice to manage events in a socially, economically and environmentally sustainable way.

*Description of the measures/policy actions taken*

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761 https://www.vang-hha.nl/nieuws-achtergronden/2018/factsheets/factsheet-invoering/

762 GfK Growth from Knowledge - Onderzoek Reclamefolders, March 2020 (presentation provided through stakeholder consultation)

763 https://www.iso.org/iso-20121-sustainable-events.html

In **Austria**, several regional authorities have implemented such initiatives. The federal provinces Vienna, Upper Austria and Salzburg require all large events to prepare a waste management concept including waste prevention measures. Additionally, all events above a certain size or which are organised on city property (in the case of Vienna) are required to use reusable beakers, plates and cutlery[764].

Across the EU, similar requirements have been enacted or are planned by several regions and cities, such as **Kiel, Vilnius**, and **Tallinn**, with all banning single-use plastics or non-reusable tableware at either all events, events organised by the authorities or events that take place in municipal areas. In Tallinn, event organisers must now also ensure the sorting of mixed, biodegradable, and packaging waste.[765] In the **Balearic Islands**, refillable drinks, tap water and a deposit return scheme must be offered during all public events.[766]

In addition to the described legal requirements, in **Austria** an ecolabel for "Green events" has been established nationwide,[767] and all federal provinces operate initiatives to promote the organisation of green events, including offering consultation, financial support and renting relevant equipment such as reusable beakers and mobile dishwashers.[768]

Furthermore, the **German** waste prevention programme includes multiple measures to encourage consumers, economic actors and public authorities to organise their events using green event criteria.[769]

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[764] Viennese Waste Management Act:
https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LrW&Gesetzesnummer=20000141
Upper Austrian Waste Management Act:
https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LROO&Gesetzesnummer=20000574
Salzburg Waste Management Act:
https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=LrSbg&Gesetzesnummer=1000112

[765] McQuibban (2020): The state of zero waste municipalities. Zero Waste Cities.
https://zerowastecities.eu/wp-content/uploads/2020/12/zwe_report_state-of-zero-waste-municipalities-2020_en.pdf

[766] http://www.caib.es/sites/institutestudisautonomics/ca/n/llei_82019_de_19_de_febrer_de_residus_i_sols_contaminats_de_les_illes_balears/

[767] https://www.umweltzeichen.at/de/green-meetings-und-events/home

[768] https://www.bmk.gv.at/themen/klima_umwelt/nachhaltigkeit/green_events/netzwerk.html

[769] BMU (2019): Wertschätzen statt Wegwerfen. Konzepte und Ideen zur Abfallvermeidung.
https://www.bmu.de/fileadmin/Daten_BMU/Pools/Broschueren/abfallvermeidung_wertschaetzen_statt_wegwerfen_bf.pdf

Guidelines for sustainable organisation have also been developed for meetings and events held at the European Commission.[770]

*Information on the costs and effects of the measures*

Information on the costs of green events, compared to organising conventional events, is not available. On the one hand, actions such as reducing giveaways and other consumables and reducing the amount of waste needing to be treated do indeed reduce costs, while the positive marketing effect of a green event label can increase revenues. On the other hand, reusable systems for, e.g., tableware might be more expensive than single-use alternatives. Multiple case studies have shown that using sustainability criteria can lead to a reduction of waste generation. Results from these case studies include a total waste generation of 0.46 kg per person and day and a source separation rate of 47 % during a "green festival" in Portugal, compared to averages of 2.8 kg per person and day and 32 % source separation at UK festivals.[771] Elaborating waste prevention criteria and promoting these should therefore contribute to waste prevention. In particular, legal requirements banning single-use products in favour of reusable items should inevitably lead to a significant reduction of the amount of waste produced during events.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

Legal requirements as well as voluntary measures, such as awareness-raising, have already been implemented across multiple Member States, signalling the large potential for transferability.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

Moreover, legal requirements in particular constitute an important factor in significantly reducing waste generation.

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[770] EC (2018): Guidelines on organising sustainable meetings and events at the Commission. https://ec.europa.eu/environment/emas/pdf/other/EC_Guide_Sustainable_Meetings_and_Events.pdf

[771] See e.g., Martinho et al. (2018): Solid waste prevention and management at green festivals: A case study of the Andanças Festival, Portugal. Waste Management 71:10-18 https://www.sciencedirect.com/science/article/pii/S0956053X17307687;
Bosser Carenys, M. (2021): Environmental implications of zero-waste music festivals. https://dspace.library.uu.nl/handle/1874/404711
Pladerer, C. (2009): Von der Abfallvermeidung zur nachhaltigen Veranstaltungsorganisation. https://www.wenigermist.at/uploads/2010/04/254_Pladerer_OekoInstitut_Abfallmanagement_bei_Sportveranstaltungen_2009.pdf

### A.2.2.12 Promote sharing platforms

*Information on the location and context of the measures/policy actions taken*

Across many EU Member States, many initiatives and businesses have been launched that utilise the concept of using instead of owning goods, i.e. in which services instead of products are offered.

*Description of the measures / policy actions taken*

The sharing or collaborative economy includes business models creating open marketplaces for the temporary use of goods or services. The transactions usually do not result in a change of ownership and can be carried out for profit or not-for-profit. The goods or services can be provided by professional actors, in which case the business model involves supplying the goods for temporary usage to consumers. Conversely, the goods or services can be provided by private individuals (peer-to-peer), such that the business model acts as an intermediary and involves facilitating the exchange of these goods or services through a marketplace.

A wide range of examples in the mobility sector has already been established, including the sharing of cars, bicycles, mopeds and electric kick scooters. These services can be station-based, free-floating or peer-to-peer. For car-sharing specifically, the German market, which is the largest in Europe[772], is growing rapidly, although the sector still represents a small share of overall car transport with an estimated 0.1% of total motor-vehicle passenger-km in 2017.[773] In Austria, a similar market share of 0.12% has been estimated.[774] Measures to encourage car-sharing across Member States include waiving or reducing parking permits or fees and providing off-street parking space (e.g. in

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[772] Deloitte (2017): Car Sharing in Europe: Business Models, National Variations and Upcoming Disruptions. https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/CIP-Automotive-Car-Sharing-in-Europe.pdf

[773] Best et al. (2018): Car Sharing in Germany: A Case Study on the Circular Economy. https://circular-impacts.eu/sites/default/files/D4.2_Case-Study-Carsharing_FINAL.pdf

[774] Mosshammer et al. (2019): Sharing Mobility – Gemeinsam Mobil. Österreichs Sharing Community und die Potenziale für Städte und Gemeinden. AustriaTech, Wien. https://www.austriatech.at/assets/Uploads/Publikationen/PDF-Dateien/03251beacc/Mobility-Explored_Sharing-Mobility-032019.pdf

Germany through the Car Sharing Act[775] and in France[776]), and creation of car-pooling lanes and grants (e.g. in France and Italy)[777].

Beyond the mobility sector, public libraries have been a long-established and widespread model for sharing books. More recently, so-called libraries of things offer objects such as kitchen appliances, electric appliances, tools, and toys, giving access to items that are rarely used, without the need of buying them.[778] After the first library of things was opened in Berlin in 2010, over 25 similar initiatives have been started across EU cities.[779] Additionally, rental services offer the use of products for a monthly fee instead of purchasing the item outright. For clothing, multiple initiatives and business models have been started in the past years, among others focussing on jeans[780] or child wear[781]. Further examples include renting headphones,[782] washing machines and dryers.[783]

Platforms intended to connect suppliers and receivers for the rental of items include Werflink[784], which shares and distributes building materials, equipment, resources and storage facilities in the building sector, and Peerby,[785] an app that connects people who need to borrow or rent an item in their neighbourhood.

To support the sharing economy in general, the city of Amsterdam has developed a proactive approach to support new initiatives through funding by the relevant city department.[786]

*Information on costs and effects of the measure*

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[775] https://www.gesetze-im-internet.de/csgg/BJNR223000017.html

[776] https://www.ecologie.gouv.fr/autopartage-en-france

[777] UNECE (2020): Car-sharing and car-pooling study. Geneva. https://unece.org/fileadmin/DAM/trans/doc/2020/sc1/ECE-TANS-SC1-INF-OCT-2020-3e.pdf; Deloitte (2017): Car Sharing in Europe: Business Models, National Variations and Upcoming Disruptions. https://www2.deloitte.com/content/dam/Deloitte/de/Documents/consumer-industrial-products/CIP-Automotive-Car-Sharing-in-Europe.pdf

[778] Baden, et al. (2020): Access Over Ownership: Case Studies of Libraries of Things. Sustainability 12, 7180. doi:10.3390/su12177180

[779] Jaik (2018): Nutzen statt Besitzen in Leihläden lokal gestalten. In: Franz HW., Kaletka C. (eds) Soziale Innovationen lokal gestalten. Sozialwissenschaften und Berufspraxis. Springer VS, Wiesbaden.

[780] https://ellenmacarthurfoundation.org/circular-examples/mud-jeans

[781] https://raeubersachen.de/

[782] https://ellenmacarthurfoundation.org/circular-examples/gerrard-street

[783] https://rusz.at/leistungen/geratemiete/

[784] https://www.parksharing.nl/werflink.html

[785] https://www.peerby.com/

[786] https://ellenmacarthurfoundation.org/circular-examples/shaping-a-sharing-economy-amsterdam

One of the key questions on the effectiveness of sharing models for waste prevention is the extent to which shared goods replace the ownership of these goods. However, the environmental effects of the collaborative economy are complex, as not only direct effects but also indirect effects (e.g. rebound) need to be taken into account. Therefore, only a limited number of relevant studies is available.

It is estimated that the sharing of durable goods such as clothing, vehicles, furniture, telephones, televisions, toys, sporting goods, and tools, could, under the most favourable conditions, lead to a waste reduction of up to 20%.[787] For car sharing, depending on the type of scheme, studies estimate a range of between 3 and 20 cars that are replaced by one car-sharing vehicle.[788]

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

As shown by the examples above, sharing business models have been initiated for a wide range of product types and across Member States, ensuring their transferability.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

Almost all of the initiatives described above have been started privately, without originating out of a specific government measure. However, the role of public authorities in supporting the sharing economy can include:[789]

- Enhancement of visibility through communication campaigns or labelling;
- Funding and incubators for innovative projects;
- Adaptation of regulations to benefit new models;
- Encouragement of public authorities to implement best practices.

787 Demailly et al. (2014): The sharing economy: make it sustainable. Institut du développement durable et des relations internationals (IDDRI), Paris. https://www.iddri.org/sites/default/files/import/publications/st0314_dd-asn_sharing-economy.pdf

788 Best et al. (2018): Car Sharing in Germany: A Case Study on the Circular Economy. https://circular-impacts.eu/sites/default/files/D4.2_Case-Study-Carsharing_FINAL.pdf

789 Demailly et al. (2014): The sharing economy: make it sustainable. Institut du développement durable et des relations internationals (IDDRI), Paris. https://www.iddri.org/sites/default/files/import/publications/st0314_dd-asn_sharing-economy.pdf

### A.2.2.13 Promote the establishment of quality standards for remanufacturing processes

*Information on the location and context of the measures/policy actions taken*

To ensure good practice during the repair and remanufacturing process and increase consumer confidence in repaired products, a number of standards and guidelines have been published in Austria, at the European level, in the UK/Scotland and in the USA.

*Description of the measures / policy actions taken*

The Remanufacturing Industries Council (RIC) in the **USA**, together with industry partners, has developed a standard for remanufacturing in order to promote the understanding and credibility of the remanufacturing industry.[790] The first version of this standard was published in 2016 (RIC001.1-2016)[791], and a revision was published in 2021 (RIC001.2-2021). This standard defines a benchmark for the process of remanufacturing and characterizes the remanufacturing process and the aspects that set it apart from other practices. It is intended to serve as a baseline for additional standards for specific remanufactured products and product groups to be developed in the future.

Four standards focus on WEEE in general or medical equipment specifically. **UK** standard PAS 141:2011[792] was introduced to set out requirements for the process of preparation for reuse. It includes the handling, tracking, segregation, storage and protection of electronic equipment and components. It explains how to prepare for reuse in detail and covers visual inspection, electrical safety and the classification systems of prepared equipment. It was introduced in 2011 but has since been withdrawn. Furthermore, the International Electrotechnical Commission (**IEC**) has developed standard IEC 62309:2004[793], which deals with reassuring customers and manufacturers that they can have products produced using parts that have been used previously (qualified-as-good-as-new parts), without loss of dependability, through checking the reliability and functionality of reused parts and their usage within new products. This is achieved both in the design phase, where potential "qualified-as-good-as-new" parts will be highlighted

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[790] https://remanstandard.us/
[791] https://www.pierceindustries.com/wp-content/uploads/2017/07/RIC001.1-2016-Specifications-for-the-Process-of-Remanufacturing.pdf
[792] https://shop.bsigroup.com/products/reuse-of-used-and-waste-electrical-and-electronic-equipment-ueee-and-weee-process-management-specification
[793] https://webstore.iec.ch/publication/6800

for reuse, as well as in the reuse/recycling phase, in which the selected parts have to pass those criteria prior to their incorporation into other products. **European standard** BS EN 50614:2020[794] includes administrative, organisational and technical requirements for the preparing for reuse process, and assists in quantifying reuse, recycling and recovery rates. Finally, the National Electrical Manufacturers Association (NEMA) in the **USA** has developed a standard[795] which lays out the basic requirements for a refurbishment process for medical electrical equipment which will not change the equipment's original intended use, safety profile, or performance. It specifies the processes, documentation, standards compliance, and quality control measures necessary to ensure the safety and effectiveness of refurbished medical imaging equipment.

For office equipment, **ISO/IEC** standard 24700:2004[796] ("Quality and performance of office equipment that contains reused components") specifies product characteristics to be used in a declaration of conformity, which demonstrates that a product with reused components performs like an equivalent product with new components, and continues to meet all the safety and environmental criteria.

In **Austria**, a guideline[797] was published to determine the end-of-waste status in the preparation for reuse process. Checklists were developed on how to properly inspect, clean and repair a number of product types (furniture, sports equipment, white goods, electronic equipment containing screens, power tools and cameras) and how to implement these steps in practice. These steps are required by the EU waste framework directive, and providing them in the form of practical checklists ensures an efficient workflow in repair facilities and creates legal security.

Quality criteria for reused goods are communicated using product labelling programmes as well. In **Scotland**, Revolve[798] was introduced for second-hand stores that meet high standards in safety, cleanliness and service, giving consumers extra reassurance to shop second-hand first. Certified shops are promoted on the Revolve website and receive training and support to maintain the standard. Similarly, in the **Austrian** region of Upper Austria, ReVital[799] is a brand name for certified quality goods, including electrical

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[794] https://www.en-standard.eu/bs-en-50614-2020-requirements-for-the-preparing-for-reuse-of-waste-electrical-and-electronic-equipment/

[795] https://www.nema.org/Standards/view/Good-Refurbishment-Practices-for-Medical-Imaging-Equipment

[796] https://www.iso.org/standard/34909.html

[797] Meissner et al. (2019): Reuse of products: Guideline to determining the end-of-waste status in the preparation for reuse. Österreichisches Ökologie-Institut, Wien. https://www.umweltberatung.at/download/?id=Prep-for-Reuse_end-of-waste-guide_Austria_2019.pdf

[798] https://www.zerowastescotland.org.uk/revolve

[799] http://www.revitalistgenial.at/header/englisch.html

appliances, furniture including contents, and sports and leisure equipment, which are complete, undamaged, in working order and safe.

*Information on costs and effects of the measure*

For the regulating bodies, costs are incurred for developing standards and guidelines and keeping these up-to-date. For the repair operators, costs could arise from adjusting processes to conform to these standards and guidelines, and from certification of compliance to the standard. Conversely, following standards can help to ensure legal security and good practice, as well as having a marketing value towards consumers. However, comprehensive assessments on the costs and effects of developing standards and guidelines are not available.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

Standards and guidelines for repair have focussed mainly on WEEE, although some other products have been included as well. The transferability across Member States depends on the local reuse and repair sector. If this is highly formalised, standards can be applied readily, while a highly informal repair sector might not be able to follow standards and guidelines or benfit from them.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

The standards and guidelines described above are not legally binding, and thus their effect depends on the voluntary commitment of reuse operators. Therefore, requiring repair operators to follow these standards could help to ensure overall quality of repaired goods across the EU and thus further encourage reuse.

### A.2.2.14 Include procurement for repair, reuse and remanufacturing in GPP guidelines

*Information on the location and context of the measures/policy actions taken*

Most Member States are using GPP tools as voluntary mechanisms. Only Italy has introduced obligatory GPP for public authorities including waste prevention and reuse criteria. At the EU level, GPP criteria are developed for certain products and services[800], which could then influence national, regional and local procurement criteria. Criteria have been developed for the following product categories relevant to the priority waste streams identified by Task 1: computers, monitors, tablets and smartphones, electrical and electronic equipment used in the health care sector, data centres, server rooms and cloud services, furniture, imaging equipment, indoor lighting, office building design and construction, road design construction and maintenance, water based heaters and toilets and urinals. For example, for office buildings the GPP comprehensive criteria (rather than core criteria) require a site waste management plan to be prepared prior to the commencement of work on-site, which includes identifying opportunities for waste prevention; whilst the roads' GPP focuses more on pre demolition audits.

A study published in 2017[801], however, noted that waste prevention aspects including durability and reparability could be enhanced. In the Circular Economy Action Plan, the Commission commits to progressively incorporating such aspects into new and revised GPP criteria.

The Commission also publishes a compilation of GPP good practice[802].

*Description of the measures/policy actions taken*

**Italy** obliges all public authorities to apply waste prevention criteria in calls for tenders and contracts. The Italian Code for Public Contracts[803], in Article 34, sets mandatory environmental sustainability criteria that must be applied by public authorities in public procurement. It sets the waste prevention criteria: efficiency and savings in the use of resources, reduction in the use of hazardous substances and quantitative reduction in waste products, as public procurement minimum environmental criteria for 11 product/service categories, such as furnishing, building work, electronics, textiles, catering, energy services, building management services, etc.

**Sweden** uses a range of approaches including: Internet based GPP tool with criteria for 60 product groups, Life cycle costing (LCC) tools including guidelines and web education, education and support (helpdesk) for public procurement officers and tenderers as well as monitoring by the Environmental Protection Agency. The National Agency for Public Procurement[804] provides contracting authorities with a number of spreadsheet-based

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[800] https://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm
[801]
[802] https://ec.europa.eu/environment/gpp/case_group_en.htm
[803] Legislative Decree 50/2016, as modified by legislative decree n. 57/2017
[804] https://www.upphandlingsmyndigheten.se/en/

LCC tools available for download on its website. Specifically, the Agency has developed one general LCC tool and six product-specific tools, namely for white goods, cars, indoor lightning, outdoor lighting, vending machines, and commercial refrigerators and freezers. The LCC tools were first developed in 2009, and updated with a user-friendly interface in 2016.

**Scotland** has published good practice guidance for reuse, repair and remanufacture for key products (including electrical equipment, textiles, automotive, furniture and construction) in public procurement[805].

A current Interreg **North Sea Region** project – ProCirc[806] - is experimenting to find out how circular economy and procurement can benefit the region. The project takes a transnational approach to support circular procurement, which includes waste prevention aspects, in the key sectors of construction, IT, textiles and furniture. The project started in 2018 and will end in 2022. It funds pilot projects that promote innovative thinking and scalable solutions. Descriptions of the pilot projects are available on the project website[807]. The project consists of 11 public and private organisations from six northern European countries: Belgium, Denmark, the Netherlands, Norway, Sweden and the United Kingdom.

*Information on the costs and effects of the measures*

Every year, over 250 000 public authorities in the EU spend around 14% of EU GDP (€1.9 trillion annually) on the purchase of services, works and supplies[808.] Green Public Procurement (GPP) has the ability to promote sustainable consumption and production by reinforcing the market uptake of products that generate less waste or are non-toxic.

The objectives[809] of the Interreg North Sea Region project ProCirc were, inter alia, to achieve 20% $CO_2$ saved per GPP pilot project, 20% less virgin materials used per GPP pilot project and 25% of waste prevented per pilot. In addition it was envisaged a) to pilot and/or adopt 50 green products, services and processes by the project, b) that 50 enterprises would participate in cross-border, transnational or interregional research projects, c) that 10 research institutions would participate in cross-border, transnational or interregional research projects and d) that 50 organizations/enterprises would adopt new solutions by the end of the project. An review of the actual effects of 50 pilot projects funded so far[810] reveals that 20,000 tonnes of waste were prevented by mainly

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[805] https://www.zerowastescotland.org.uk/sites/default/files/Procuring%20for%20Repair%20-Reuse%20Reman%20Guide%20June%202016%20v3.pdf
[806] https://northsearegion.eu/procirc/
[807] https://northsearegion.eu/procirc/pilot-projects/
[808] https://ec.europa.eu/growth/single-market/public-procurement_en
[809] https://northsearegion.eu/procirc/news/pathways-to-circular-procurement/
[810] https://northsearegion.eu/media/13244/circpro-annex.pdf

reusing and refurbishing products that normally would be wasted, and that 800,000 tonnes of virgin materials and 10,000 tonnes of $CO_2$ were saved.

There is also information on the effects of individual pilot projects. For instance, the city of Malmö started circular procurement of furniture in 2017. This led to 10% of reused furniture in 2019 and to 15% in 2020. This saved about 170,000 tonnes of $CO_2$ each year. In addition, the collaboration with suppliers improved.

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

Tools and guidance developed by different actors, Member States, etc. should be transferable to others.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

One of the lessons learned from the ProCirc project is that transnational approaches with collaborative approaches and connection of procurers are a success factor for creation of the relevant markets.

### A.2.2.15 Introduce obligatory pre-demolition audits of buildings to check them for reusable components

*Information on the location and context of the measures/policy actions taken*

In 2018, the EC published "Guidelines for the waste audits before demolition and renovation works of buildings"[811]. For the moment, these guidelines are not binding; they can be adopted on a voluntary basis. In these guidelines, it is stated that it is the duty of the waste holder to inform themselves about the objects and substances intended to be discarded and their potential hazardous nature and contamination. To do this, it recommends carrying out an inventory of materials and elements present in a building prior to its demolition. This inventory, done by an independent auditor, combines field survey and desk study. It should mention the type and the quantity of the materials and elements that are going to be set free by the demolition. These should be classified under the general waste categories: inert waste, non-inert, non-hazardous waste, and hazardous waste. A more thorough classification can include a reference to

[811] https://ec.europa.eu/docsroom/documents/31521

waste codes and a short description of each element. Although the focus of the audit is to ensure best practice for general waste management, the guidelines also suggest to include in this inventory additional information such as a list of elements recommended for deconstruction and reuse, their location in the building, an assessment of the quality of the elements (presence of impurities), and an assessment of their reusability. It is noted that the accounting of reusable components and materials needs to be combined with a recommendation of the destination of the reusable material, including reclamation markets, site-reuse, site-to-site reuse and/or donations.

The following countries/regions have made such audits mandatory – even though inventories of re-usable items are not in the focus: Austria, Flanders, Bulgaria, Czech Republic, Finland, France, Hungary, Luxembourg and the Netherlands[812]. In the following some examples are described[813].

*Description of the measures/policy actions taken*

**Austria** has introduced the "Recycled Construction Materials Regulation" in 2015[814]. It aims at preventing overall generation of waste and reducing hazardous waste, thus enabling reuse of construction and demolition materials. The regulation sets an obligation to carry out a pre-demolition audit for potentially reusable or hazardous construction components and sets selective demolition requirements. If there is a demand for reusable construction parts/materials, they have to be dismantled in a way that enables reuse, e.g. bricks, stoneware, roof tiles, doors, windows, sanitary objects, radiators and wooden parquets, etc. The regulation also prescribes an audit for hazardous substances that has to be carried out before any demolition work producing above 750 tonnes of waste and if the building's gross volume is larger than 3,500 m³. According to the Regulation, the audit has to be based on the Austrian Standard ÖNORM B 3151 "Dismantling of buildings as a standard method for demolition". It contains the appropriate process chart, which includes the essential steps from the pre-demolition audit to the mechanical deconstruction. Templates to be used for the required

[812] https://www.construction-products.eu/application/files/5215/2481/6267/20161123090156-2016_11_22_resource_efficiency_workshop_1_dg_growth.pdf

[813] The information for Flanders, France and the UK was basically taken (but shortened) from a recent review published by the Interreg project FCRBE; fcrbe_wpt2_d11_20190927-for-publication.pdf (nweurope.eu)

[814] https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20009212

documentation are provided by the Austrian Construction Material Recycling Association[815].

In **France**, there is an obligation to conduct a waste inventory prior to the demolition of a building. It should be completed together with the elaboration of a more general waste management plan. According to the relevant legislation[816] the inventory is mandatory a) for buildings larger than 1.000 m², b) for buildings that have been used for agricultural, industrial or commercial use and c) for buildings in which specific hazardous substances were produced, processed, stored or distributed. The waste assessment should be based on an evaluation conducted on site. It has to specify the nature, quantity and location in the building of the construction materials, products and equipment that are going to be set free by the demolition. The assessor also has to mention the possibilities for onsite reuse. And, when no onsite reuse is possible, the appropriate waste treatment methods for each fraction of the C&D waste stream have to be specified, also on a local level. The waste assessment has to be carried out by a construction professional who is insured for such a mission. This expert has to be impartial and independent from the building owner and all the contractors likely to undertake all or part of the demolition work. After the demolition, the building owner has to produce a summary of all the materials and elements that have been (or are going to be) reused onsite, the waste produced on this occasion, and the recovery methods used for these fractions. However, according to a report published in 2018 by ADEME[817], only about 5% of the demolition operations concerned by the waste inventory actually implement this obligation.

In **Luxembourg**, the legislation[818] includes an obligation to conduct an inventory of materials within a building before demolition, and to organize the collection of separated waste during the demolition phase. The main objective is to promote the

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[815] Österreichischer Baustoff-Recycling Verband, http://brv.at/formulare/
[816] Loi n° 2009-967 du 3 août 2009 de programmation relative à la mise en œuvre du Grenelle de l'environnement (1), art. 46. 'Le rôle de la planification sera renforcé notamment par: l'obligation de mettre en place des plans de gestion des déchets issus des chantiers des bâtiments et travaux publics et d'effectuer un diagnostic préalable aux chantiers de démolition'.
https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000020949548; Décret n° 2011-610 du 31 mai 2011 relatif au diagnostic portant sur la gestion des déchets issus de la démolition de catégories de bâtiments, art. R. 111-46.;
https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000024099263&categorieLien=id;
Arrêté du 19 décembre 2011 relatif au diagnostic portant sur la gestion des déchets issus de la démolition de catégories de bâtiments.
https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000025145228
[817] 1 ADEME. (2018). Mise en œuvre de l'obligation de télédéclaration du formulaire de recolement CERFA 14498 pour certaines operations de démolition.
[818] http://legilux.public.lu/eli/etat/leg/loi/2012/03/21/n1/jo

collection of separated C&D waste. With regard to separated collection, the different materials used in the structure to be demolished must be identified and listed in an inventory. The 2018 National Waste and Resource Management Plan promotes planned dismantling and the elaboration of a deconstruction inventory with quality criteria for materials. The Luxembourg Government provides templates[819] and guides for inventorying construction materials, in order to make an inventory of all materials present within a building prior to demolition/deconstruction.

In **Flanders**, there is an obligation to conduct a pre-demolition plan for the demolition of buildings that are bigger than 1,000 m³ (non-residential buildings) or bigger than 5.000 m³ (residential ones)[820]. This obligation has been introduced by VLAREMA[821], which is the executive order of the Materials Decree[822], a decree that establishes the Flemish regulations on sustainable management of material cycles and waste materials.

*Information on the costs and effects of the measures*

Currently an Interreg project "FCRBE - Facilitating the Circulation of Reclaimed Building Elements in Northwestern Europe"[823] is being conducted, which aims to increase the amount of reclaimed building elements in circulation within its territory by +50%, by 2032. The starting point is a reuse rate of building elements in Northwestern Europe of 1%. Although a large number of elements are technically reusable, they currently end up being recycled by crushing or melting, or are discarded.

A study relating to improving management of C&D waste published in 2016[824] concluded that the levels of hazardous CDW vary considerably between Member States with mandatory pre-demolition audits for hazardous components. Therefore it is not possible to draw any conclusions about the impact of such pre-demolition audits on the amount of hazardous CDW produced.

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[819] https://environnement.public.lu/fr/offall-ressourcen/types-de-dechets/dechets-construction-demolition-dcd/inventaire-dechets-construction.html

[820] Vlaamse Overheid. (2012). VLAREMA, art. 4.3.3.

[821] https://navigator.emis.vito.be/mijn-navigator?woId=43991

[822] https://navigator.emis.vito.be/mijn-navigator?woId=41707

[823] https://www.nweurope.eu/projects/project-search/fcrbe-facilitating-the-circulation-of-reclaimed-building-elements-in-northwestern-europe/

[824] https://ec.europa.eu/environment/system/files/2021-01/resource_efficient_uses_mixed_waste_Final_Report.pdf

*Assessment of transferability to other sectors/types of waste and/or potential transferability to other Member States/for scaling up the approach*

The measure is specific to C&D waste. Steps to scaling up the approach are already being undertaken, for instance, by the mentioned Interreg project (FCRBE)[825], which *inter alia* already developed guidelines to assess the reuse potential at site-specific level, that could be integrated into a requirement of mandatory pre-demolition audits at EU level.

*Information on the factors (including the role of the regulatory and policy framework in place) that have led to reduced waste generation*

The partners participating in the Interreg project FCRBE identified appropriate end-of-waste procedures for components to be reused/prepared for reuse an important issue. Currently, such procedures are unequally developed in the different regional regulatory contexts.

[825] http://www.nweurope.eu/fcrbe

# A.3.0 Appendix Member State's prevention programmes and prevention targets

# A.3.0 Member State's prevention programmes and prevention targets

## A.3.1 Waste prevention programmes and covered waste streams in the EU-27 Member States

Following table gives an overview on which waste streams are covered by the national waste prevention programmes.

### Figure A - 120: Waste categories covered by waste prevention programmes (Data source: Latest country fact sheets of the EU-27 Member States)[826]

| | Household/municipal waste; | Food/organic * | Construction and demolition waste | Packaging * | Waste electrical and electronic equipment /batteries | Other | Paper | Manufacturing waste | Textiles | Bulky waste | Water wastage | Plastics (non-packaging) | Tyres | End-of-Life Vehicles | Waste from sewage treatment | Hazardous waste |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Austria | X | X | X | X | X | X | | X | X | X | | X | | | | X |
| Belgium | X | X | X | X | X | X | X | X | X | | | X | | | | X |
| Bulgaria | X | X | | X | X | X | | X | | | | | | | | X |
| Croatia | X | X | | X | X | | | X | | | | | | | | X |
| Republic of Cyprus | X | X | X | X | X | X | X | X | | X | | X | | | | X |
| Czech Republic | X | X | X | X | X | X | X | X | X | | | X | | | | X |
| Denmark | X | X | X | X | X | | | X | X | | | | | | | |
| Estonia | X | X | X | X | X | X | X | X | | X | | | | | | |
| Finland | X | X | X | X | X | | | | | | | | | | | X |
| France | X | X | X | X | X | X | X | X | | X | | | | | | X |
| Germany | X | X | | X | X | | X | X | | X | | | | | | X |
| Greece | X | X | | X | X | | X | | | | | | | | | |
| Hungary | X | X | X | X | X | X | | | | | | | | | | X |
| Ireland | X | X | X | X | X | X | | X | | X | X | | | | | X |
| Italy | | X | X | X | X | | X | | | | | | | | | X |
| Latvia | X | X | | X | X | | X | X | | | | | | | | X |
| Lithuania | X | X | X | X | X | X | X | X | | X | | | | | | X |
| Luxembourg | X | X | X | X | X | | | X | | X | | | X | X | X | X |
| Malta | X | X | X | X | X | | X | X | X | X | | X | | | | X |
| Netherlands | X | X | X | X | X | X | X | X | | X | | | | | | X |
| Poland | X | X | | X | X | X | | | | | | | | | | X |

[826] https://www.eea.europa.eu/themes/waste/waste-prevention/countries

| | Household/municipal waste; | Food/organic * | Construction and demolition waste | Packaging * | Waste electrical and electronic equipment /batteries | Other | Paper | Manufacturing waste | Textiles | Bulky waste | Water wastage | Plastics (non-packaging) | Tyres | End-of-Life Vehicles | Waste from sewage treatment | Hazardous waste |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Portugal | | | | | | | | | | | | | | | | |
| Romania | | | | | | | | | | | | | | | | |
| Slovakia | | | | | | | | | | | | | | | | |
| Slovenia | | | | | | | | | | | | | | | | |
| Spain | | | | | | | | | | | | | | | | |
| Sweden | | | | | | | | | | | | | | | | |
| Counts | 25 | 27 | 20 | 27 | 26 | 14 | 17 | 21 | 6 | 14 | 1 | 6 | 1 | 1 | 1 | 23 |

*Notes: Out of scope of this study.*

## A.3.2 Waste prevention targets established in the EU-27 Member States

**Figure A - 121: Quantitative waste prevention targets in the EU-27 Member States. Data taken from waste prevention country fact sheets**

| EU Member State | Waste category | Quantitative target | Monitoring based on EU Waste Statistic | Data need beyond EU Waste Statistic | Type of additional data need |
|---|---|---|---|---|---|
| EU-27 Member States | municipal waste | | yes | no | |
| Bulgaria | industrial waste | In 2020 the value of the "industrial waste per unit of GDP" should be less than the value of the same indicators in 2010 | yes | yes | National economic development (GDP) |
| Bulgaria | hazardous waste | In 2020 the value of "hazardous waste per unit of GDP" indicators should be less than the value of the same indicators in 2010. | yes | yes | National economic development (GDP) |
| Bulgaria | municipal waste | In 2020, the value of the "generated municipal waste per inhabitant" indicator should be less than the value of the same indicator in 2011 | yes | no | |
| Estonia | municipal waste | Keep the generation of municipal waste stable from 2020 onwards and until then to keep the growth rate at less than half that of gross domestic product (GDP). Assuming that in | yes | yes | National economic development (GDP) |

| EU Member State | Waste category | Quantitative target | Monitoring based on EU Waste Statistic | Data need beyond EU Waste Statistic | Type of additional data need |
|---|---|---|---|---|---|
| | | coming years GDP will continue to grow at a rate of 3 %, the generation of municipal waste should grow by no more than 1.5 % per annum. | | | |
| Estonia | packing waste | During the same period, the growth rate of packaging waste generation should be less than two thirds that of gross domestic product (GDP) | yes | yes | National economic development (GDP) |
| France | food waste (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | no | yes | National food waste statistic |
| France | construction and demolition waste (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | yes | National statistic on non-mineral waste fractions in C&D waste |
| France | chemicals (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | batteries (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | electrical and electronic equipment (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | furniture (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | no | yes | National furniture waste statistic |
| France | paper (P1) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | household packaging (P2) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | yes | Sector-specific generation of packaging waste |
| France | plastics (P2) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | metals (P2) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | vehicles (P2) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | no | |
| France | textiles (P2) | Reduction target of 7 % per capita (between 2010 and 2020) | yes | yes | National textile waste statistic (full coverage, because Eurostat focuses on separate collected textiles only) |
| Italy | municipal waste | 5 % reduction in the ratio of generated municipal solid waste (MSW) to gross domestic product unit (GDP); as a monitoring measure, the trend in the amount of MSW produced per household will also be considered. Reference year 2010, Target year 2020 | yes | yes | National economic development (GDP) |
| Italy | 2) | 10 % reduction in the ratio of generated special hazardous waste to GDP unit. | yes | yes | National economic development (GDP) |

| EU Member State | Waste category | Quantitative target | Monitoring based on EU Waste Statistic | Data need beyond EU Waste Statistic | Type of additional data need |
|---|---|---|---|---|---|
| Italy | 2) | 5 % reduction in the ratio of generated special non-hazardous waste to GDP unit. | yes | yes | National economic development (GDP) |
| Latvia | municipal waste | No more than 400 kg per capita of Municipal Solid Waste generated by 2020. | yes | no | |
| Latvia | municipal waste | No more than 650 000 tonnes of total MSW generated by 2020. | yes | no | |
| Latvia | hazardous waste | No more than 50 000 tonnes of total hazardous waste generated by 2020. | yes | no | |
| Netherlands | total waste | Total waste generation in 2015 must be no greater than 68 Mt, and that in 2021 it must be no greater than 73 Mt | yes | no | |
| Netherlands | food waste | 20 % reduction in food waste between 2009 and 2015. To achieve this objective, the amount of waste generated needed to be reduced by between 276 kt and 522 kt (between 17 kg and 31 kg per capita). | no | yes | National food waste statistic |
| Netherlands | textile waste | By the end of 2015, the amount of textile waste discarded as residual waste should be 50 % less than in 2011 | no | yes | National statistic on household waste composition |
| Poland | not specified | a constant quantity of waste generated in Poland according to data from the Central Statistical Office (Główny Urząd Statystyczny GUS). Reference year: Not defined, Target year 2020 | no | yes | Waste data from the Central Statistical Office (Główny Urząd Statystyczny GUS) |
| Poland | not specified | A reduced quantity of waste generated in Poland in relation to GDP (kilograms per euro of GDP). Reference year: Not defined, Target year 2020 | yes | yes | National economic development (GDP) |
| Poland | mining waste | A reduced quantity of mining waste in relation to production volume. Reference year: Not defined, Target year 2020 | yes | yes | Production statistic |
| Poland | Residues from thermal processes | A reduced quantity in relation to the amount of energy generated. Reference year: Not defined, Target year 2020 | yes | yes | Energy statistic |
| Poland | not specified | A reduced environmental pressure through an increase in the amount of goods produced in Poland covered by eco-labelling; | yes | yes | Environmental impact assessment of eco-labelling products |
| Poland | mixed municipal waste (household waste) | A reduced quantity in relation to GDP (kilograms per euro of GDP). Reference year: Not defined, Target year 2020 | yes | no | |
| Poland | packing waste | A reduced quantity in relation to the volume of products. Reference year: Not defined, Target year 2020 | yes | yes | Production statistic |

| EU Member State | Waste category | Quantitative target | Monitoring based on EU Waste Statistic | Data need beyond EU Waste Statistic | Type of additional data need |
|---|---|---|---|---|---|
| Poland | food waste | A reduced quantity. Reference year: Not defined, Target year 2020 | no | yes | National food waste statistic |
| Poland | WEEE | Increased reuse. Reference year: Not defined, Target year 2020 | no | yes | National WEEE reuse statistic |
| Portugal | not specified | Up to 31 December 2016, achieving a minimum reduction of waste production per capita of 7.6% by weight relative to the verified value in 2012. | yes | no | |
| Portugal | not specified | Up to 31 December 2020, achieving a minimum reduction of waste production per capita of 10% by weight relative to the verified value in 2012. | yes | no | |
| Spain | not specified | A 10 % reduction on the 2010 figure in the amount of waste produced annually (in tonnes) by 2020 | yes | no | |

*Please note that P1 = Priority 1 waste categories; P2 = Priority 2 waste categories; 2 = Special waste includes, according to Article 184, paragraph 3, of Italian legislative decree 152/2006: waste from agriculture and agro-industry; waste resulting from demolition or construction, and from excavation activities; waste from industrial processes; manufacturing waste; waste resulting from commercial activities; waste resulting from the activities of recovery and disposal of waste, as well as sludge from water treatment; waste arising from sanitary activities.*

# A.4.0 Appendix Stakeholder information and consultation

# A.4.0 Stakeholder information and consultation

## A.4.1 Stakeholder list

Beside the Member States' ministries and environmental agencies, 137 stakeholder institutions (with more than 200 experts) were identified as having key experience on the following waste streams (including related product streams):

a. Municipal waste and household and similar waste
b. Discarded equipment (including WEEE)
c. Discarded vehicles
d. Rubber waste (including end-of-life tyres)
e. Construction and demolition waste
f. Textile waste

Note that the below stakeholder list was correct as of 20 September 2021.

*(O… key stakeholder); (X… experienced in the field)*

**Figure A - 122: Stakeholder list**

| Organization | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| The European Automobile Manufacturers' Association (ACEA) | | | O | | | |
| European Apparel and Textile Organisation (EURATEX); the European Clothing Action Plan (ECAP) | | | | | | O |
| EuPC (European plastic converters) | | | | | | |
| Expra (EPR and recycling) | | | | | | |
| EuRIC - European Recycling Industries' Confederation | X | X | X | X | X | X |
| Euro-commerce; UEAPME- European Association of Craft, SMEs | | | | X | | |
| ECOS – European Environmental Citizens Organisation for Standards | X | X | X | X | X | X |
| Digital Europe (electronics); APPLiA (European appliances) | | O | | | | |
| WEEE Forum | | O | | | | |
| cembureau - The European Cement Association | | | | | O | |
| European construction industry Federation | | | | | O | |
| WEEE Europe AG | | O | | | | |
| *Leefmilieu Brussel | | | | | X | |
| RREUSE - represents social enterprises active in reuse, repair and recycling | | O | | | | |
| Philips | | O | | | | |
| Ellen MacArthur Foundation | X | X | X | X | X | X |
| *ACR+ the network of sustainable cities and regions | O | X | X | X | X | X |
| Composites Europe | O | | | | O | |
| *Municipal Waste Europe | O | X | | | | X |
| Digitaleurope | | O | | | | |
| Apple | | O | | | | |
| Zero Waste Europe | X | X | X | X | X | X |
| *EEB - European Environmental Bureau and BEUC (consumers and the environment) | X | X | X | X | X | X |
| European Tyre Recycling Association | | | | O | | |

| Organization | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| HESUS, Eurotran | | X | | | | |
| ISWA | O | | | | | |
| LafargeHolcim | | | | | O | |
| H&M Europe | | | | | | O |
| C&A Europe | | | | | | O |
| *H&M Europe | | | | | | O |
| *Refashion | | | | | | X |
| Global Fashion Agenda | | | | | | O |
| XXXLutz | O | | | | | |
| Policy Hub | | | | | | X |
| Astri (IT association of recycled textiles) | | | | | | X |
| ECRA (Eur. Carpet and Rug Association) | | | | | | X |
| IWTO (International Wool Textile Organisation) | | | | | | X |
| European Sustainable Business Federation | X | O | | | | O |
| Plastic Change | | | | X | | |
| made.com | O | | | X | | |
| RINKI | X | X | X | X | X | X |
| Tana Oy | O | | | | | |
| Centre for Economic development, transport and the environment | X | | O | | | |
| Finnish Safety and Chemicals Agency | X | X | X | X | X | X |
| Confederation of International Contractors’ Associations (CICA) | | | | | O | |
| Zero Waste France | X | X | X | X | X | X |
| bouygues construction | | | | | O | |
| Ademe (France) | X | X | X | X | X | X |
| Social Cooperative Humana Nova Čakovec | | O | | | | O |
| PRIMARK | | | | | | O |
| Ars ambiente | O | | | | | |
| Rifiuti Zero | X | X | X | X | X | X |
| University of Ferrara | X | X | X | X | X | X |
| ENEA (Italian National Agency for New Technologies, Energy and Sustainable Economic Development) | X | X | X | X | X | X |
| Interstyle | O | | | | | |
| FOOCHI Group | | | | | O | |
| TCH Furniture | O | | | | | |
| Fairphone | | O | | | | |
| Circle Economy | X | X | X | X | X | X |
| CIRCOS- kids & maternity online rental shop | | | | | | O |
| Texperium open innovation centre | | | | | | O |
| *ZERO WASTE | X | X | X | X | X | X |
| ERSAR (Portugal Water and Waste Services Regulation Authority) | X | X | X | X | X | X |
| Agência Portuguesa do Ambiente | X | X | X | X | X | X |
| Ecomold | | | | | | |
| Interseroh d.o.o., | X | X | X | X | X | X |
| Slovak Environment Agency | X | X | X | X | X | X |
| Circular Change | X | X | X | X | X | X |
| RENEWCELL | | | | | | O |

| Organization | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| *Waste and Resources Action Programme (WRAP, UK) | X | X | X | X | X | X |
| Zero Waste Scotland | X | X | X | X | X | X |
| SUEZ | X | X | X | X | X | X |
| *FEAD - Federation of Waste Management and Environmental Services | X | X | X | X | X | X |
| FEDEREC - Federation of recycling operators | X | X | X | X | X | X |
| FERVER - European federation of glass recyclers | | | | | | |
| Federation Internationale de Recyclage | | | | | O | |
| European Demolition Association | | | | | O | |
| Bureau of Int Recycling | X | X | X | X | X | X |
| UEPG- European Aggregates Association | | | | | O | |
| St Gobain | | | | | O | |
| Knauf | | | | | O | |
| Eurima- European Mineral Wool Manufacturers Association | | | | | O | |
| European Aluminium | | | | | | |
| Construction Products Europe | | | | | O | |
| European Furniture Industries Confederation | O | | | | | |
| Hazardous Waste Europe | X | X | X | X | X | X |
| *Plastic Recyclers Europe | | | | | | |
| Kunststoffcluster NÖ | | | | | | |
| Global 2000 | X | X | X | X | X | X |
| PORR AG | | | | | O | |
| Baudirektion Wien - Circular City Vienna | | | | | O | |
| NIMBLE | O | | | | | |
| Baukarrussel | | | | | O | |
| Herwin | O | | | | | O |
| Public Waste Agency of Flanders | X | X | X | X | X | X |
| Bündnis für Nachhaltige Textilien | | | | | | O |
| HUMANA Kleidersammlung | | | | | | X |
| I:Collect GmbH | | | | | | O |
| home24.de | O | | | | | |
| Samsung | | O | | | | |
| *Danish Waste Association | X | X | X | X | X | X |
| Aalborg University | | | | | O | |
| ETO | O | | | | | |
| AERESS (Asociación Española de Recuperadores de Economía Social y Solidariaç) | O | | O | | | O |
| The Interreg MED Green Growth community | X | X | X | X | X | X |
| ACCIONA Construccion | | | | | O | |
| Fundació R Zero | | | | | | |
| MANGO | | | | | | O |
| Toy Industries of Europe (TIE) | X | | | | | |
| TIE | X | | | | | |
| EREK – The European Resource Efficiency Knowledge Centre | X | X | X | X | X | X |
| The European Remanufacturing Network and Remanufacturing Council | | O | O | | | |
| TESLA | | | O | | | |
| CEFIC- European Chemical Industry Council; Cosmetics Europe | X | | | | | |

| Organization | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| IRENA (renewables); Wind Europe; Solar Power Europe | | X | | | | |
| EUCOBAT - chair of Policy Working Group | | | | | | |
| Eurobat and Eucobat (batteries) | X | X | | | | |
| EGARA | | | | X | | |
| *ETRMA - European Tyre and Rubber Manufacturers Association | | | | O | | |
| EURELECTRIC | | X | | | | |
| Eurometaux | | | | | | |
| Ceramie Unie | | | | | O | |
| IMA - Industrial Minerals Association Europe | | O | O | | | |
| CEPE - European Council of the Paint, Printing Ink and Artists' Colours Industry | X | | | | | |
| European Electronics Recyclers Association (EERA) | | O | | | | |
| CLEPA - European Automotive Suppliers | | | O | | | |
| JAMA - Japan Automobile Manufacturers Association | | | O | | | |
| ETRA – European Tyre Recycling Association | | | | O | | |
| *EucoLight - The European Association of lighting WEEE compliance schemes | | O | | | | |
| *ORGALIM | | O | | | | |
| CECED- Conseil Europeen de la Construction d' appareils Domestic/European Committee of Domestic Appliance Manufacturers | | O | | | | |
| Lighting Europe | | O | | | | |
| EPIA (European Photovoltaic Industry Association) | | O | | | | |
| Association of test and measurement equipment manufacturers | | O | | | | |
| COCIR - medical imaging and health ICTs association | | O | | | | |
| *INDITEX - Fashion retailer | | | | | | O |
| EURIC Textiles | | | | | | O |
| *Member State´s Ministries | X | X | X | X | X | X |
| *Member State´s Environmental Agencies | X | X | X | X | X | X |

**Voted on priorisation of waste streams via online consultation.*

## A.4.2 Questionnaire for the written consultation

In the following, a copy of the questionnaire used within the written consultation of this study is given. This was used with the aim to gather relevant stakeholder information, sent on 30 July 2021 to all stakeholders (see A.4.1).



# Waste Prevention Questionnaire

***Note: italic text shows survey instructions***

**Introduction**

This questionnaire relates to a project titled "Scoping study to assess the feasibility of further EU measures on waste prevention". It is being undertaken by Eunomia Research & Consulting Ltd and the Environment Agency Austria (Umweltbundesamt) for the Directorate General for the Environment of the European Commission. It aims to obtain more detailed information from a range of stakeholders on:

- waste prevention measures/initiatives and their impact;
- opportunities for, and barriers to, waste prevention, with a focus on design, repair, reuse and remanufacturing operations, and on new business models based on sharing of products.

The collected information will be used to assess the feasibility of further EU measures on waste prevention based on an analysis of implemented or planned waste prevention measures in the EU Member States for specific waste streams.

*[Click Next]*

**Guidance on completing this questionnaire**

Please answer this questionnaire in English.
This questionnaire contains specific questions on following main sections:

A. Priority waste streams to be considered for future EU level waste prevention measures
B. Waste prevention measures/initiatives identification

C. Barriers to increased waste prevention
D. Opportunities for increased waste prevention

Please provide all documents you are referring to, if available, using the ‘File Upload’ button in each section.

If you have any questions or comments, or would like to provide any additional materials, please do not hesitate to contact our experts via [wasteprevention@umweltbundesamt.at.](mailto:wasteprevention@umweltbundesamt.at)

If you are unable to submit a page, it may be that you have not anwerd a required question, which are marked by an asterisk*.

Please submit the questionnaire by **7 September 2021**

| **Your contact details** | |
|---|---|
| Please provide your full name and your position/role | |
| Please provide you organisation and department | |
| Please provide the Member State in which you work | |
| Please provide your email address | |
| Please provide your phone number | |

*[Click previous or next]*

**Section A: Priority waste streams to be considered for future EU level waste prevention measures**

1. Please rank the following waste streams according to their need for EU level waste prevention measures (1 = highest need, 6 = lowest need).

Note: packaging and food waste is out of scope of this study.

*[Single choice check box]*

- Textiles waste
- Municipal waste
- End-of-Life vehicles waste
- Waste of electrical and electronic equipment
- Rubber waste including end-of-life tyres
- Construction and demolition waste (including soils)

**2.** Please provide the reasoning behind your choices above

*[Click previous or next]*

**Section B: Waste prevention measures/initiatives identification**

Please provide information on relevant waste prevention measures/ initiatives in your country/ region/ institution/ company/ sector, that are:

1. already implemented and considered as successful
2. already implemented and considered not successful
3. planned in the future

**Comment: we welcome the submission of more than 1 measure/ initiative in this questionnaire. Please choose to add another measure at the end of each page.**

Note: packaging waste and food waste is out of scope of the conducted study.

1. The measure/initiative I am describing is [*check box*]:
    - Already implemented and considered as successful
    - Already implemented and considered not successful
    - Planned in the future

*[Click previous or next]*

**Section B: Waste prevention measures/initiatives identification**

| | |
|---|---|
| **1 *Please provide a short title on the described measure/initiative** | *Free text* |
| **2 *Please provide a thorough description of the measure/initiative** | *Free text* |
| **3: If possible, please share any relevant background information, such as feasibility studies or planning documents.** | *File upload feature* |
| **4: *Please indicate which waste streams are affected by the measure/initiative. You may select more than one answer.**<br><br>**Note:** packaging waste and food waste is out of scope of the conducted study.<br><br>. | • Municipal waste<br>• Textile waste<br>• End-of-Life vehicles (ELV)<br>• Waste of Electrical and Electronic Equipment (WEEE)<br>• Rubber waste including end-of-life tyres<br>• Construction and demolition waste (including soils)<br><br>*Multiple choice checkbox (more than one possible)* |
| **5: *Please indicate the type of measure/initiative. You may select more than one answer.**<br><br>. | • Regulatory measure<br>• Measure with guidance character<br>• Information based measure<br>• Voluntary agreement<br>• Economic measure<br>• Operational example<br>• *Other*<br><br>*Multiple choice checkbox (more than one possible) and free text for "other"* |
| **6: *Please indicate who is/was responsible for implementing the measure/initiative. You may** | • Authority level (national/regional/local)<br>• Retailer<br>• NGO |

| | |
|---|---|
| **select more than one answer.**<br>. | • Company level<br>• Sector level (e.g. several companies within a sector, part of an association)<br>• *Other*<br><br>*Multiple choice checkbox (more than one possible) and free text for "other"* |
| **7: What are the key objectives of the measure/initiative?**<br>. | *Free text* |
| **8: What is the geographical coverage of the measure/initiative?** | • National level<br>• Regional level<br>• Local level<br><br>*Multiple choice checkbox (more than one possible)* |
| **9: If the scope of the measure/initiative is national, please provide the member state(s).** | *Multiple choice checkbox of EU member states (more than one possible)* |
| **10: If the scope of the measure/initiative is regional, please provide more detail on the regions covered** | *Free text* |
| **11: If the scope of the measure/initiative is local, please provide more detail on the areas covered** | *Free text* |
| **12: In what year did the past/current implementation period begin?** | *Drop down year selection* |
| **13: In what year did/will the past/current implementation period end?** | *Drop down year selection* |

| | |
|---|---|
| **14:Please provide any comments on the implementation period.** | *Free text* |
| **15: Please provide information about why the measure has been considered successful / not successful**<br><br>Please provide information on how the success of the measure was assessed and what was the rationale for the conclusion on its success. | *Free text* |
| **16: What drove the success / failure of the measure/initiative? You may chose more than one option** | • Funds<br>• Awareness raising activities<br>• Cooperation and information exchange between stakeholders<br>• Binding nature of the measure/initiative<br>• Financial aspects (incentives, penalties, etc.)<br>• Other factors (e.g. technical aspects)<br><br>*Multiple choice checkbox (more than one possible) and free text for 'other'* |
| **17: Please provide more detail on the factors above, and why they led to successful/unsuccessful implementation of your measure/initiative.** | *Free text* |
| **18: What are the key lessons learned?** | *Free text* |
| **19: *Is the measure/initiative considered to be a candidate for EU level uptake?** | • Yes<br>• No<br><br>*Single choice checkbox* |

| | |
|---|---|
| **20: Please explain the rationale behind your answer to question 19** | *Free text* |
| **21: Please provide information on the costs related to the implementation of the measure.** | *Free text* |
| **22: *Has a monitoring system been implemented to evaluate the effects/impacts of the measure/initiative?** | • Monitoring of target achievement<br>• Monitoring of key indicators (qualitative)<br>• Monitoring of key indicators (quantitative)<br>• No monitoring system is in place<br>• Other<br><br>*Multiple choice checkbox and free text for 'other'* |
| **23: If so, please provide details on monitoring indicators and intervals of their measurement. Describe the monitoring system (indicators, monitoring periods and responsibilities etc)** | *Free text* |
| **24: Please upload any documents relatin to the costs and monitoring of implementation of thie measure/initiative** | *File upload* |
| **25: *Would you like to add another relevant waste prevention measure/initiative in your country/region/institution/company/sector?** | • Yes<br>• No<br><br>*Single choice checkbox* |

*[Click previous or next]*

***Note: If you have selected 'yes' to adding another waste prevention measure, all questions under Section B will be asked again.***

**Section C: Barriers to increased waste prevention**

Existing (or potential) waste prevention measures/concepts such as designing increasingly durable and repairable products, repair, reuse and remanufacturing operations, new business models based on sharing and leasing of products, product bans, etc. might not reach their potential (or even be implemented) due to certain legal, economic, technical and social barriers.

Please provide information on the most relevant barriers you observe in your country/ institution/company/sector.

**Comment: More than 1 barrier can be given in the online questionnaire**

If there is not an option to upload files and you woud like to provide additional information, please email the files to wasteprevention@umweltbundesamt.at

*[Click previous or next]*

1. *Please select a waste stream to provide information on the respective barriers and opportunities
    - Municipal waste
    - Textile waste
    - End-of-Life vehicles (ELV)
    - Waste of Electrical and Electronic Equipment (WEEE)
    - Rubber waste including end-of-life tyres
    - Construction and demolition waste (including soils)

*Single choice checkbox*

*[Click previous or next]*

**Barrier (1)**

**Please answer the following questions to describe a barrier that you perceive to be an obstacle to increased waste prevention of [waste stream].**

| | |
|---|---|
| **1. * Please select the key waste prevention categories which are affected by the barriers you wish to describe. You may select up to 3 categories** | • reuse<br>• repair<br>• remanufacturing<br>• circular business models (e.g. sharing schemes)<br>• product design to facilitate waste prevention |
| **2. *Short title of the described key barrier for the selected waste stream** | *Free text* |
| **3. *Please provide a thorough description of the key barrier for the selected waste stream**<br><br>*Please also indicate potential causes of the barrier.* | *Free text* |
| **4. Please upload any relevant background information e.g. feasibility studies, planning documents** | *File upload* |
| **5. *Please indicate the type of the key barrier** | • Regulatory, (e.g. standardisation / Minimum quality criteria)<br>• Technical (dismantling, logistics, etc.)<br>• Financial/economic (incentives, tax breaks, etc.)<br>• Availability of information (on composition, product status, etc.)<br>• Consumer behaviour<br>• Other<br><br>*Multiple choice check box and free text for "other".* |
| **6. *Would you like to add another identified barrier?** | *- For this waste stream*<br>*- For another waste stream*<br>*- No* |

***Note: If you have selected 'yes' to adding another barrier, all questions under Section C will be asked again.***

**Section D: Opportunities to increased waste prevention**

Existing (or potential) waste prevention measures/concepts such as designing increasingly durable and repairable products, repair, reuse and remanufacturing operations, new business models based on sharing and leasing of products, product bans, etc. might not reach their potential (or even be implemented) due to certain legal, economic, technical and social barriers.

Please provide information on the most relevant opportunities you observe in your country/ institution/company/sector.

**Comment: More than 1 opportunity can be given in the online questionnaire**

If there is not an option to upload files and you woud like to provide additional information, please email the files to wasteprevention@umweltbundesamt.at

*[Click previous or next]*

2. *Please select a waste stream to provide information on the opportunities
   - Municipal waste
   - Textile waste
   - End-of-Life vehicles (ELV)
   - Waste of Electrical and Electronic Equipment (WEEE)
   - Rubber waste including end-of-life tyres
   - Construction and demolition waste (including soils)

*Single choice (Checkbox)*

*[Click previous or next]*

**Opportunity (1)**

**Please answer the following questions to describe an opportunity that you see for increased waste prevention of [waste stream].**

| | |
|---|---|
| **1. * Please select the key waste prevention categories which may be impacted by the opportunities you wish to describe. You may select up to 3 categories** | • reuse<br>• repair<br>• remanufacturing<br>• circular business models (e.g. sharing schemes)<br>• product design to facilitate waste prevention |
| **2. *Please provide a short title of the described key opportunity for the selected waste stream** | *Free text* |
| **3. *Please provide a thorough description of the key opportunity for the selected waste stream**<br><br>Please also indicate potential causes of the opportunity. | *Free text* |
| **4. Please upload any relevant background information e.g. feasibility studies, planning documents** | *File upload* |
| **5. *Please indicate the type of the opportunity** | • Regulatory, (e.g. standardisation / Minimum quality criteria)<br>• Technical (dismantling, logistics, etc.)<br>• Financial/economic (incentives, tax breaks, etc.)<br>• Availability of information (on composition, product status, etc.)<br>• Consumer behaviour<br>• Other<br><br>*Multiple choice check box and free text for "other".* |

| | |
|---|---|
| **6. *Would you like to add another opportunity?** | *- For this waste stream*<br>*- For another waste stream*<br>*- No* |

***Note: If you have selected 'yes' to adding another opportunity, all questions under Section D will be asked again.***

**Thank you!**

Thank you for your co-operation and participation. We greatly appreciate your time.

*[Click previous or done]*

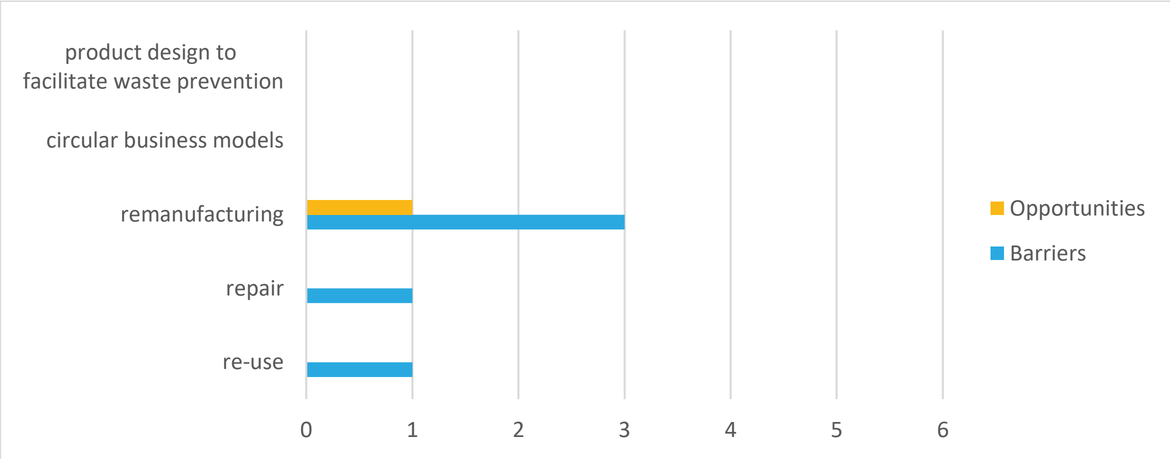
## A.4.3 Stakeholder feedback on drivers and opportunities for improved waste prevention

This section presents a summary of the results from the stakeholder consultation with regard to drivers and opportunities for improved waste prevention for each waste stream.

### A.4.3.1 End-of-Life tyres

The respondents see barriers for waste prevention in the repair, reuse and remanufacturing of rubber waste and tyres. The lack of regulatory measures such as standards and minimum quality criteria were indicated as most prominent barrier in the remanufacturing and retreading of waste tyres. Another issue reported as a barrier is the lack of information on the condition of part-worn and second-hand tyres.

### Figure A - 123: Identified barriers and opportunities per waste prevention approach; type of barriers and opportunities for rubber waste and waste tyres

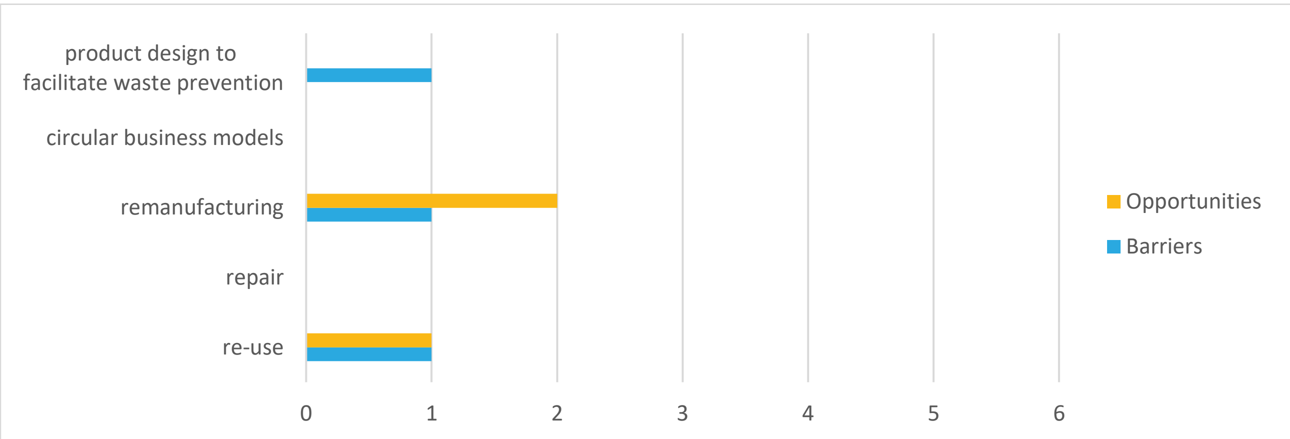



All of the identified barriers and opportunities are also covered in the analysis of the literature for as presented in chapter 3.3.1.

### A.4.3.2 End-of-life vehicles

Opportunities and barriers were identified in the remanufacturing and reuse sectors, indicating that these two might be the most interesting approaches for ELV. It was indicated that the automotive industry uses important shares of plastic materials for the manufacturing of components. These can be recycled and recyclates can be used to make car components (underbody panels, dashboards, bumpers). However, an increasing number of different polymers are being used by the industry, complicating the recycling of such components. If the industry segment is interested in circular economy objectives, the opportunities to increase the use of recycled plastics will have to include principles of design for recycling.

### Figure A - 124:Identified barriers and opportunities per waste prevention approach; type of barriers and opportunities for ELV

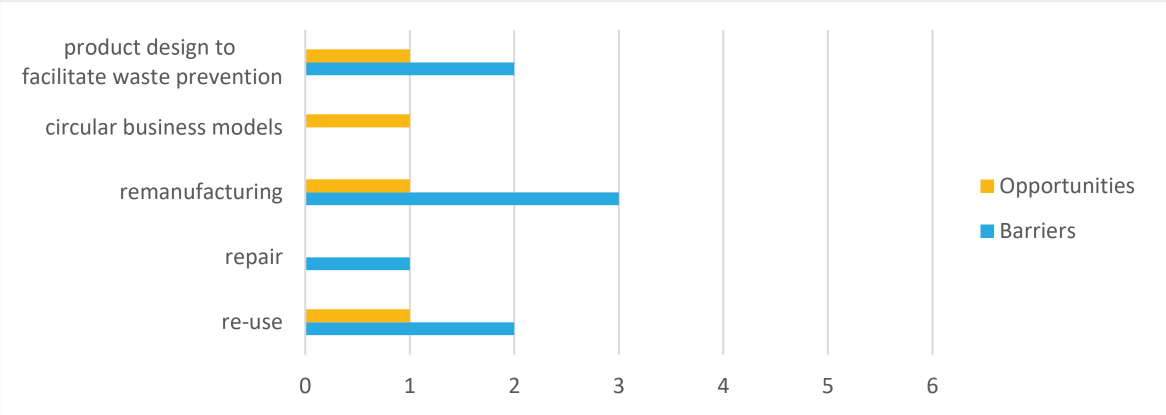


All of the identified barriers and opportunities are also covered in the analysis of the literature for ELV as presented in chapter 3.3.2.

### A.4.3.3 Construction & demolition waste

Barriers for making C&D waste circular include the lobby of gravel and sand producer, who see the recycled material as a big competitor to their sales of virgin gravel and sand. Strict construction standards that do not allow the use of recycled material, were also mentioned. Standards for materials are built into systems (e.g. insurance, fire certification) that may prohibit the reuse/remanufacturing elements. It was then noted that the cost of structured demolishing and separation at source for the different materials are higher than virgin material, limiting the potential of reuse; as well as a lack of knowledge about the availability of secondary materials. A further barrier is that there is still a lack of legislation at EU level that places producer responsibility on the waste producer (the construction company) to collect separately onsite.

**Figure A - 125:Identified barriers and opportunities per waste prevention approach; type of barriers and opportunities for C&D waste.**




All of the identified barriers and opportunities are also covered in the analysis of the literature for C&D waste as presented in chapter 3.3.3.

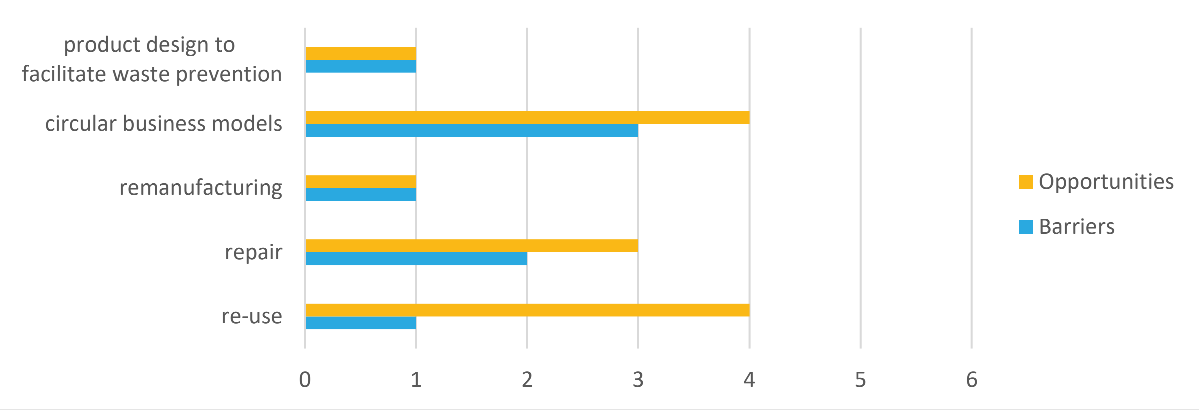
### A.4.3.4 Textile waste

In the textile sector, the respondents see repair, reuse and circular business models as areas with potential opportunities for further development and contribution to waste prevention. Barriers were identified especially for circular business model, and how to scale them up; and repair, especially regarding its appeal to consumers. The acceptance of citizens and engagement of consumers was also more often indicated mentioned as a barrier.

Concerning With regard to the opportunities, it was indicated that reuse and repair will facilitate new circular business models centred around sharing and renting garments;

and that reduced tax for repair on certain products -– shoes and textiles – would also help to promote reuse and repair.

**Figure A - 126: Identified barriers and opportunities per waste prevention approach; type of barriers and opportunities for textile waste**

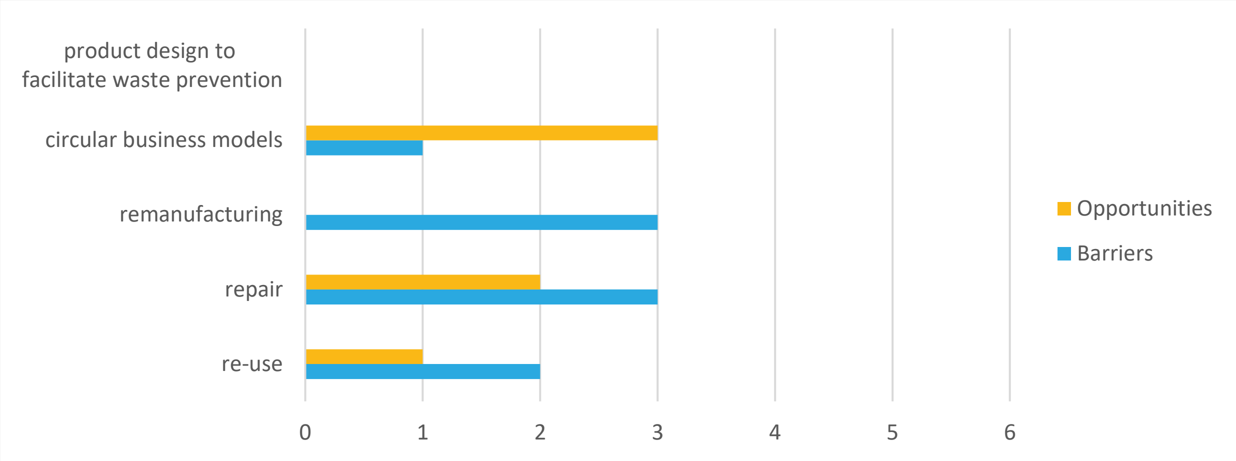



All of the identified barriers and opportunities are also covered in the analysis of the literature for textile waste, as presented in chapter 3.3.4.

### A.4.3.5 WEEE

Several opportunties and barriers were identified by the respondents for WEEE. Circular business models, repair and reuse seem to be the approaches offering the biggest opportunities. The opportunities mentioned included the promotion of repair cafes, the establishment of repair funds to financially support repair activities; and the establishment of wide sharing schemes for small WEEE enabled through a legislative framework. Other opportunities were seen in enhancing product circularity. Among the mentioned barriers, respondents indicated poor access to spare parts. Access to spare parts for repair and refurbishment activities and their often too high cost, compared to their production cost, make repair uneconomical. There is also no government financial support. Finally, consumer obsolescence was indicated as a barrier.

**Figure A - 127: Identified barriers and opportunities per waste prevention approach; type of barriers and opportunities for WEEE.**

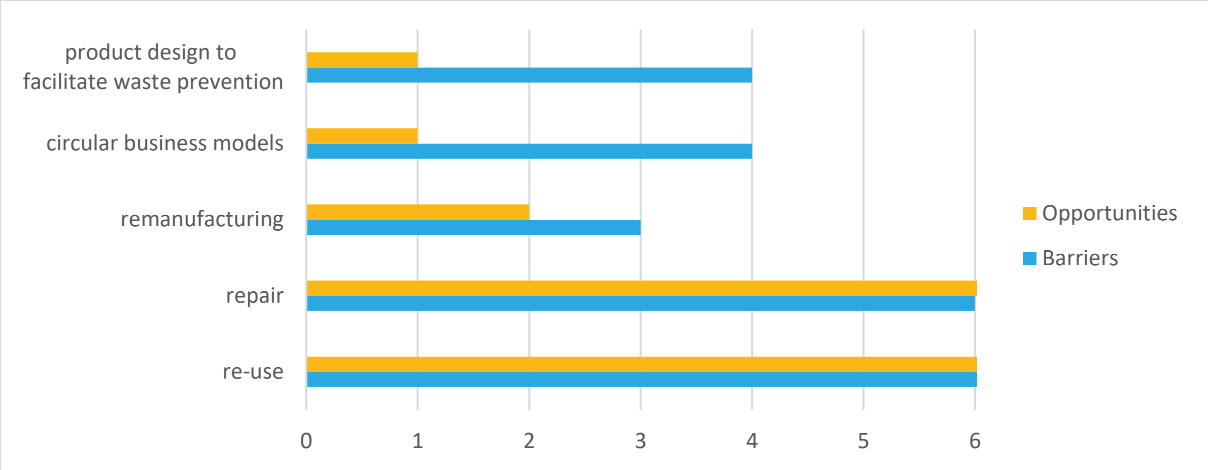



All of the identified barriers and opportunities are also covered in the analysis of the literature for WEEE, as presented in chapter 3.3.5.

### A.4.3.6 Municipal solid waste

Most respondents indicated reuse and repair of MSW as the most interesting areas, both in terms of barriers and opportunities. The most often mentioned barriers were regulatory and financial issues. Waste incineration was also indicated as a disincentive to waste prevention and as a lock-in technology. Other indicated barriers are related to the lack of demand for sustainable products and services from consumers. Legal barriers exist in some MS with regard to the legal status of social enterprises, which are not facilitated to become repair and reuse centres and networks, or to receive financial support whether from government or private investment. Concerning the opportunities, it was indicated that a lot can be done with the bulky waste fraction if products are reusable or reparable, stressing the importance of proper design. Opportunities were indicated for the engagement of the community to change our consumption pattern, and for increased public awareness.

## Figure A - 128:Identified barriers and opportunities per waste prevention approach; type of barriers and opportunities for MSW




All of the identified barriers and opportunities are also covered in the analysis of the literature for MSW as presented in chapter 3.3.6.

# A.5.0 Appendix Identified indirect and rejected measures

# A.5.0 Identified indirect and rejected measures

## A.5.1 Indirect measures

The identification of the most viable policy measures in the waste policy area was carried out by grouping the measures from the "long-list" into three categories depending on their feasibility of implementation in the waste policy area as well on the viability of the measure (see Figure 5-1). Indirect measures are viable measures which need to be addressed by policies beyond the waste policy area.

### A.5.1.1 End-of-life tyres

For tyres, the following measures have an effect on waste reduction but require actions beyond the waste policy area. Synergy effects are listed for each measure.

- **Introduce certification of retreaded tyres to improve consumers' trust in product quality and safety**
    - Policy area: Setting product labels goes beyond the waste policy area.
    - Synergy: The measure can be implemented at EU level and has synergies with the aim of increasing the number of retreaded tyres. There is also a synergy with M5 (see Chapter 5.3.1).
- **Establish criteria for retreaded tyres in the catalogues of EU GPP criteria**
    - Policy area: Setting GPP criteria goes beyond the waste policy area.
    - Synergy: The measure would increase demand for reused and retreaded tyres and thus help to generate the market for retreading.
- **Set minimum standards for retreaded tyres for cars and for lower abrasion of tyres in Type Approval Regulation**
    - Policy area: Specifying standards for new products goes beyond the waste policy area.
    - Synergy: There is a synergy with the introduction of the certification of retreaded tyres and the waste policy, because the minimum standards improve the quality of second-hand products and, thus, contribute to a longer useful life of products.

### A.5.1.2 End-of-life vehicles

For end-of-life vehicles, the following measures have an effect on waste reduction, but require actions beyond the waste policy area. Synergy effects are listed for each measure.

- **Introduce mandatory quality assurance for all second-hand cars by revising the directive on the type-approval of motor vehicles with regard to their reusability, recyclability and recoverability**
    - Synergy: This measure will increase the sale of second-hand cars and is in synergy with the waste hierarchy, which prioritises reuse over recycling and disposal.

- **Legislate on performance and durability requirements for components used in manufacturing new vehicles.**
    - Synergy: This measure will extend the lifetimes of components and therefore reduces the need for new products, which reduces the amount of waste generated subsequently.
- **Define fleetwide weight limits (including e-car pool).**
    - Policy area: This measure aims to reduce the weight of car pools similar to legal limits for GHG emissions of car fleets in Directive (EU) 2019/631. The reduction in weights will probably result in a decrease in waste quantities. However, the measure goes beyond the waste policy area.
    - Synergy: A fleet-wide weight limit would contribute to the reduction of waste amounts.
- **Reduce the ownership rate in EU Member States in favour of car sharing and other modes of transport.**
    - Policy area: This measure goes beyond the waste policy area.
    - Synergy: The reduction in car ownership reduces the volume of cars and, therefore, the quantities of ELV.

### A.5.1.3 Construction & demolition waste

For construction & demolition waste, the following measures have an effect on waste reduction, but require actions beyond the waste policy area. Synergy effects are listed for each measure.

- **Recommendations for architects to avoid future waste during the design of buildings and infrastructure ("Design out waste").**
    - Policy area: This measure goes beyond the waste policy area.
    - Synergy: The measure reduces waste generation, because the recommendations to the planners enhance reusability of building elements and reduces over-ordering of certain types of products.
- **Establish market places where construction material and components (e.g., doors, windows) are offered for reuse.**
    - Policy area: This measure goes beyond the waste policy area.
    - Synergy: The marketplaces balance supply and demand and successful transactions decrease waste volumes.

### A.5.1.4 Textile waste

For textile waste, the following measures have an effect on waste reduction, but require actions beyond the waste policy area. Synergy effects are listed for each measure.

- **Introduction of warranties (right to repair) for clothes.**
    - Policy area: In 2020, Members of the European Parliament called on the Commission to grant consumers a "right to repair". This includes the extension of product warranties, guarantees for replaced parts, provision

of information, and repair and maintenance. To date, the “right to repair” only applies to electronic products, but it might be applied to clothing too. However, this measure goes beyond the waste policy area.
    - Synergy: These measures prioritise reuse over recycling and disposal and are therefore in line with the waste hierarchy.
- **Create incentives for business models to promote reuse of clothes through sharing and use among multiple consumers (e.g., baby clothes, luxury products).**
    - Policy area: Business support goes beyond the waste policy area.
    - Synergies: The measure results in lifetime extensions, reducing the textile throughput in society and, therefore, waste generation.
- **Reduce hazard in textiles by introducing environmental and social considerations into the supply chain.**
    - Policy area: The measure relates to the design phase and goes beyond the waste policy area.
    - Synergy: Synergy with WFD, which strives to decrease the hazard level of waste in the context of qualitative waste reduction.
- **Development of GPP criteria for textiles to support circular/sharing models.**
    - Policy area: Setting GPP criteria goes beyond the waste policy area.
    - Synergy: The measure creates a market for reusable goods and therefore extends their lifetime and reduces waste generation. This is in line with waste prevention.
- **Introduce a legal framework for service contracts for leasing textiles to public institutions.**
    - Policy area: The measure addresses the procurement phase and, thus, goes beyond the waste policy area.
    - Synergy: The measure increases the resource efficiency of textile usage and allows for the optimisation of cleaning, reuse and repair activities downstream.

### A.5.1.5 WEEE

For WEEE, the following measures have an effect on waste reduction, but require actions beyond the waste policy area. Synergy effects are listed for each measure.

- **Speed up the preparation of obligatory minimum requirements for EEE on durability and repairability under the Ecodesign Directive**.
    - Policy area: This measure addresses both hardware and software, enabling longer design lifetimes of specific EEE products (e.g., smartphones). The measure addresses the design phase and goes beyond the waste policy area.
    - Synergy: The measure would result in lifetime extensions and therefore waste reduction.

### A.5.1.6 MSW

For MSW, the following measures have an effect on waste reduction, but require actions beyond the waste policy area. Synergy effects are listed for each measure.

- **Establish a legal framework stipulating that advertising mail is to be delivered on demand only, thus dealing with the distribution of unaddressed advertising mail (leaflets).**
  - Policy area: The measure can be covered in the Postal Service Directive, which goes beyond the waste policy area.
  - Synergies: The implementation of the measure, together with communication plans, will probably reduce amounts of household paper waste.

### A.5.1.7 Measures across all waste types

The following measures have an effect on waste reduction but require actions beyond the waste policy area.

- **Incentives for business models that reduce waste production**
- **Consumer information and labelling, for example regarding reparability, durability and reliability**
- **Green Public Procurement approaches, for example to mandate use of used, refurbished and remanufactured furniture.**
- **Further Minimum Ecodesign Requirements to mandate certain characteristics in particular product groups**

## A.5.2 Rejected measures

The viability of each measure in the waste policy area is evaluated based on 8 criteria (see Table 5-1). If one of the 8 criteria is not fulfilled, the measure is not further considered and classified as “rejected measure”.

### A.5.2.1 End-of-life tyres

For tyres, the following options have been assessed as **not being feasible**. In each case, the criteria against which they were judged to not be feasible, and an explanation for this decision, are stated.

- **Consider differentiated tax levels with respect to external effects (e.g., level of micro plastic pollution).**
  - Policy area: Setting such a tax goes beyond the waste policy area.
  - Legal feasibility: Likely to be challenged as Member States have responsibility for most areas of taxation.
- **Introduce eco-vouchers for retreaded tyres**.
  - Policy area: Introducing such an incentive goes beyond the waste policy area.
  - Legal feasibility: Likely to be challenged as Member States have responsibility for most matters relating to financial incentives.
- **Reduce speed limits on streets (reduce abrasion).**
  - Policy area: The matter of speed limits goes beyond the waste policy.
  - Political feasibility: It is likely that this measure will be strongly opposed, especially if the justification is limited to reducing tyre abrasion.
  - Coherence with other EU policy objectives: This measure could also be included in the Water Framework Directive to avoid emissions of micro-plastic into bodies of water. In addition, it could also take place within the climate policy area, because lower speed limits reduce GHG emissions.

### A.5.2.2 End-of-life vehicles

For end-of-life vehicles, the following options have been assessed as **not being feasible**.

- **Set up training courses for car mechanics focused on rapid changes in diagnostics and vehicle technology.**
  - Policy area: As long as the training is not financed by EPR funds, the education measure goes beyond waste policy.
  - Effectiveness and efficiency: It is likely that this measure will not be very effective in terms of waste reduction, because the influence of mechanics on the lifetime extension of cars is quite limited due to standard procedures in car repair.
- **Regulate the use of second-hand components in vehicle specifications.**

    - Policy area: The measure addresses the product policy area.
    - Legal feasibility: The measure needs be aligned with car and car part manufacturers, which are, in some cases located outside the EU.

### A.5.2.3 Construction & demolition waste

For construction and construction & demolition waste, respectively, the following options have been assessed as **not being feasible**.

- **Research into technology improvements (e.g., self-healing concrete).**
    - Policy area: Research and development to enhance material characteristics goes beyond the waste policy area.
    - Effectiveness and efficiency: The measure addresses only one of several factors required to extend the lifetime of concrete. In addition, the reasons for buildings being demolished and thus generating demolition waste are also driven by economic incentives through building replacements. Thus, even in those cases where the technical structure and performance means that building still has a further useful life, it may be demolished.
- **Replace in-situ concrete with precast concrete, which makes it possible to install more lightweight concrete (decreases tonnages of waste).**
    - Policy area: The measure addresses the building construction phase and goes beyond the waste policy area.
    - Proportionality: The appropriate choice would depend on the specific national and local context.
    - Technical feasibility: Substantial efforts are required to enforce and monitor the use of building components.
- **Design buildings for adaptable use such as the repurposing of a commercial building into a residential building, using modular building solutions to design a home or an office, or supporting house sharing and mixed functionality.**
    - Policy area: The measure addresses the building design phase and goes beyond the waste policy area.
- **Enable access to residential space through shared-use schemes such as temporary home sharing with visitors and tourists through online platforms.**
    - Policy area: The measure addresses the utilisation of private areas and goes beyond the waste policy area.
- **Enable access of commercial space through shared-use schemes.**
    - Policy area: The measures addresses the utilization of private areas and goes beyond waste policy area.
- **Facilitate the use of pre-fabricated building components (e.g. gypsum boards)**
    - Proportionality: The appropriate choice would depend on the specific national and local context.
- **Develop pilot studies which use second-hand building components.**
    - Policy area: This measure stimulates the second-hand market and goes beyond the waste policy area.

- **Introduce teaching programme for waste prevention in the building sector for undergraduates.**
  - Policy area: This measure addresses education and training of undergraduates, which goes beyond the waste policy area.

### A.5.2.4 Textile waste

For textile waste, the following options have been assessed as **not being feasible.**

- **Enhance information for consumers (labelling) on durability of clothes & maintenance practices.**
  - Policy area: Consumer information regarding product characteristics goes beyond the waste policy area.
- **Speed up the elaboration of obligatory minimum requirements for consumer goods as regards the durability of clothes.**
  - Policy area: This measure addresses the design phase and goes beyond the waste policy area.
- **Introduction of tax reductions for second-hand clothes.**
  - Policy area: Setting tax incentives goes beyond the waste policy area.
  - Legal feasibility: Likely to be challenged as Member States have responsibility for most tax-related measures.
- **Introduction of tax break on clothing repairs.**
  - Policy area: Introducing tax incentives goes beyond the waste policy area.
  - Legal feasibility: Likely to be challenged as Member States have responsibility for most tax-related measures.

### A.5.2.5 WEEE

For WEEE, the following options have been assessed as not being feasible.

- **Shorten delivery times for spare parts, where relevant for consumer convenience, e.g., for washing machines.**
  - Policy area: Delivery of spare parts goes beyond the waste policy area.
- **Standardise power-charging utilities for EEE.**
  - Policy area: The measure addresses the ecodesign domain and therefore goes beyond the waste policy area.
- **Allow transparency in the supply chains, especially regarding environmental and social impacts.**
  - Policy area: The measure addresses raw material supply chains and therefore goes beyond the waste policy area.
- **Community tool libraries / peer to peer sharing to allow better utilisation of tools – Member States could be required to establish network of national tool libraries.**
  - Relevance: This measure is covered by a measure which has already been selected (see 5.3.5: Measure - Introduce a legal framework for supporting

repair cafes, sharing platforms and special boxes for households to collect reusable items.)

### A.5.2.6 MSW

For MSW, the following options have been assessed as not being feasible.

- **Elaborate waste prevention criteria for events, going beyond the existing European green public procurement criteria for food, catering services and vending machines.**
  - Policy area: Specifying regulations for green events goes beyond the waste policy area.
  - Legal feasibility: Likely to be challenged as Member States have responsibility for event organisation.
- **Introduce "right to repair" for specific product groups.**
  - Relevance: This measure has been already classified as a "synergy measure" in the WEEE section (chapter 5.3.5) and has been rejected here.
- **Introduce tax reduction for accredited reuse centres (reduced VAT).**
  - Policy area: Introducing tax incentives goes beyond the waste policy area.
  - Legal feasibility: Likely to be challenged as Member States have responsibility for most tax-related measures.

### A.5.2.7 Measures across all waste types

The following measures were defined in the ToR and the reasons for rejecting them are given as followed.

- **EU-wide total waste reduction target**
  - Relevance: Waste prevention measures need to address specific product and/or waste categories. This goes along with the identification of key stakeholders and measures to convince them. Against this background waste-specific reduction targets were already introduced by EU MS and this study builds on that approach and suggest additional waste reduction targets for waste categories not covered today. Introducing a total waste reduction, across all waste categories, in addition to existing and proposed waste-specific targets might be a redundancy. Hence, the total waste reduction target would push the EU MS to focus on the largest waste categories by volume (e.g. CDW), which is already addressed with a reduction target in this study.
- **Business awareness raising measures and support, e.g. subsidised consultancy support for waste prevention at source in commercial and industrial settings**
  - Legal feasibility: There is evidence that such activities already take place. For instance, in the city of Vienna. There might be not be a need for additional EU level measures, because the EU MS can already provide such services.

- **Incentives (e.g. grants) to support innovative circular economy business models, including those where producers maintain ownership (e.g. lease models)**
    - Legal feasibility: Likely to be challenged as Member States have responsibility for most financial support measures.

# A.6.0 Appendix Abbreviations

# A.6.0 Abbreviations

| | |
|---|---|
| BAT | Best Available Technology |
| BAU | Business As Usual |
| CEAP | Circular Economy Action Plan |
| CLV | Chain Linked Volumes |
| C&D | Construction and Demolition |
| EC | European Commission |
| EU | European Union |
| EEE | Electrical & Electronic Equipment |
| ELV | End-of-Life vehicles |
| EPR | Extended producer responsibility |
| GW | Gigawatt |
| ICT | Information and Communications Technology |
| IED | Industrial Emission Directive |
| MS | Member State |
| MW | Municipal Waste |
| MSW | Municipal Solid Waste |
| n. c. | not calculated |
| n. p. | not projected |
| SSD | Sewage Sludge Directive |
| ToR | Terms of Reference |
| WBA | Waste Batteries and Accumulators |
| WEEE | Waste Electrical & Electronic Equipment |
| WFD | Waste Framework Directive |
| WPP | Waste Prevention Programme |

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