Study on WEEE recovery targets, preparation for re-use targets and on the method for calculation of the recovery targets

Final Report

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Disclaimer

Acknowledgments

We would like to express our gratitude to all persons providing valuable data, arguments and feedback for this study. Special thanks thereby go to the WEEE TAC members, all stakeholders involved in the interviews regarding re-use/preparation for re-use targets and the WEEE Forum as well as Eucolight and their member organisations and representatives.

Abstract

Directive 2012/19/EU on waste electrical and electronic equipment entered into force on 13 August 2012 introducing inter alia new recovery and recycling & preparation for re-use targets as well as six 'collection-oriented' WEEE categories ('EU6'), which shall replace the former ten 'product-oriented' categories ('EU10) from 2018 on. Considering the changes in legislation, the new WEEE Directive in its Article 11(6) asks the Commission to present a report specifically on:

1) the re-examination of the recovery targets referred to in Annex V, Part 3;
2) the examination of the possibility of setting separate targets for WEEE to be prepared for re-use; and on
3) the re-examination of the calculation method referred to in Article 11(2) with a view to analysing the feasibility of setting targets on the basis of products and materials resulting (output) from the recovery, recycling and preparation for re-use processes.

This study supports the Commission in meeting the requirements of Article 11(6). Results of this study showed that the new recovery targets to be applied from 2018 onwards (based on EU6) maintain a similar level of ambition compared to the ones introduced from 2015 onwards (based on EU10). Additionally, an implementation of separate re-use/preparation for re-use targets faces several difficulties but re-use/ preparation for re-use generally should be promoted due to its overall benefits. Finally, output-/material-based targets are not yet recommendable due to an only limited database for assessing the feasibility of such targets accompanied by only limited benefits compared to a further enforcement of selective treatment and increasing collection rates.

In summary, no review of the new WEEE Directive is proposed by the project team but alternative recommendations are presented.

Executive Summary

Directive 2002/96/EC on waste electrical and electronic equipment ('former WEEE Directive') entered into force in 2002 introducing obligations for separate collection including collection targets, standards for treatment as well as recovery and recycling rates, specifically applied to ten 'product-oriented' categories of WEEE ('EU10'). After practical experiences with this Directive, the Commission published a proposal for recasting of the WEEE Directive in 2008. Following intensive discussions, the Directive 2012/19/EU ('new WEEE Directive') entered into force on 13 August 2012 introducing inter alia new recovery and recycling & preparation for re-use targets as well as six 'collection-oriented' WEEE categories ('EU6'), which shall replace the EU10 categories from 2018 onwards. Considering the changes in legislation, the new WEEE Directive in its Article 11(6) asks the Commission to present a report specifically on:

1) the re-examination of the recovery targets referred to in Annex V, Part 3;
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This study supports the Commission in meeting the requirements of Article 11(6). Summarized results of this study for the three aforementioned tasks are presented in the following paragraphs.

Re-examination of the recovery targets referred to in Annex V, Part 3

To address the first task, a comparative analysis of the recovery targets set out in Part 2 of Annex V (based on EU10 categories in Annex I) and the recovery targets set out in Part 3 of Annex V (based on EU6 categories in Annex III) of the new WEEE Directive is conducted. The aim of the comparison is to identify any differences in recovery targets as regards the level of ambition due to the change of referenced WEEE categories (from EU10 to EU6) as it is foreseen by Annex V of the new WEEE Directive for 15/08/2018. Additionally it is assessed whether any identified differences have significant impacts.

The recovery and recycling targets set out in Part 2 of Annex V (for EU10) and in Part 3 of Annex V (for EU6) of the Directive are mapped and compared **on an absolute basis**. This is done using the UNU-KEY[1] classification (cf. [EC UNU 2014]). The large majority of products at the UNU-KEY level do not face any change in absolute recycling and recovery targets in the transition from EU10 to EU6 categorisation. For the few that do, the change is mostly in the range of -5% to +5%, which is classified as not significant by the project team. For only a few selected products, the change in absolute targets is higher than 5%, ranging between 10% and 25%. Moreover, the few products affected by the transition from EU10 to EU6 categorisation form a very small fraction of the overall WEEE stream, and thus have a negligible impact on the overall recovery and recycling rate of the EU6 categories.

To examine if the reclassification of the products from EU10 to EU6 has any consequence on the **overall mass to be recycled**, a theoretical test is conducted for

[1] The 54 UNU-KEY categories establish a comprehensive classification method, which aims to establish relationships between various existing classification lists (e.g. former and new WEEE Directive, WEEE Forum classification, etc.)

one tonne of WEEE per UNU-KEY. Current recycling targets (2015 values, Part 2 of Annex V) during the transition phase and recycling targets that become applicable in 2018 are applied for each product at UNU-KEY level. It is assumed that the target is met and the target mass recycled per tonne of product is calculated. Furthermore, the mass balance of recovery targets are also tested on a practical level, comparing the mass balance under EU10 and EU6 categorisations. Therefore, the estimated WEEE generated ('WG') in 2018 for each UNU-KEY (cf. [EC UNU 2014]) is applied to the recovery targets for 2015 and 2019.

Table 1: Summary Table: Mass balance comparison

	Theoretical Mass Balance		Practical Mass Balance (WG 2018)	
	Overall change in recovery target	Overall change in recycling & re-use target	Overall change in recovery target	Overall change in recycling & re-use target
EU10 2015 versus EU10 2018	6.4%	7%	6.5%	7.3%
EU10 2018 versus EU6 2018	-0.1%	-1.9%	-0.8%	-2.9%

The theoretical and practical mass balance calculations suggest the resulting recycling and recovered mass under both EU10 and EU6 clustering is nearly the same and any minor differences are statistically insignificant (cf. Table 1). Therefore, it is concluded that on a mass balance basis, there is no change in the level of ambition.

Changing the classification of products has also an impact at the material level, on the **average material composition** of different product clusters (EU10 versus EU6). Such changes might have an impact on the recovery performances. Product composition changes over time and collection rate might vary along the same category of products (either in EU10 or in EU6 clustering). For those reasons the analysis of the targets is based on few fundamental assumptions, e.g. a simplified product composition at UNU-KEY level is considered. Key representative materials are among others basic metals (e.g. iron, copper and aluminium), precious metals (e.g. gold, silver and palladium), plastics, glass or other materials. Also WEEE Generated per each UNU-KEY as predicted for 2018 (taken from [EC UNU 2014] is taken into account and simplified material compositions for the EU10 and EU6 clustering are conducted. Despite some identified differences in the material composition of EU10 and EU6 clustering, the new clustering of products into six 'collection-oriented' categories is much closer to the reality of collection and treatment operations compared to the former ten 'product-oriented' categories.

As a next step, the **impacts** of the newly introduced categorisation and corresponding recovery targets are assessed. The change to new recovery targets maintains a similar level of ambition in terms of environmental benefits while simplifying reporting, thereby reducing administrative burden and facilitating better legal compliance. However, the new targets, based on mass recovery only, do not represent a strong enough incentive to recover strategic materials mentioned in the EU raw material strategy.

To finally assess whether the ambition level of the target is achievable for Member States, the **performance** on future 2018 recycling and recovery targets under the new EU6 categorisation is estimated based on the current performance of those Member States. This means transforming the current performances reported by Member States and benchmark them with the expected rates in 2018. The result is that both recycling and recovery targets for EU6 categories are likely to be achieved.

For individual Member States, the targets for some categories may still not be achieved. However, distance to target is less than 5% for most Member States and most categories, suggesting that the difference cannot be considered as statistically significant in relation to the ambition level of the target.

The overall **conclusion** is that, the new targets to be applied from 2018 onwards (referenced to EU6) maintain a similar level of ambition compared to the targets introduced from 2015 onwards (referenced to EU10) in the new WEEE Directive. Despite the level of ambition is similar and no change of targets is proposed, critical points or relevant elements for further investigation have been revealed and presented in chapter 2. Key findings are summarized again below:

- The mass of material recycled and recovered is first and foremost influenced by the amount collected and processed. The revised collection targets have a far greater influence on the final material recovered than the recycling and recovery targets.
- Despite new targets being more or less equivalent to old ones, they are still not addressing some of the key aspects of raw material strategy and eco-efficiency of recycling, particularly taking into account that weight based targets are not triggering recovery of material which are contained in small quantities when the economic value is not a strong enough driver.
- From an administrative burden perspective the application of new targets (Part 3) should be enforced starting with the beginning of a calendar year (either 2018 or 2019).

Examine possibility of setting separate targets for WEEE to be prepared for re-use

The new WEEE Directive (in particular Annex V, Part 2 and 3) provides combined targets for preparation for re-use and recycling per WEEE category. Member States and involved stakeholders (e.g. collective schemes for WEEE) can thus reach the targets by favouring recycling over preparation for re-use. The option of preparing for re-use might be neglected. This section aims to conduct an analysis and provide recommendations on the feasibility and practicability of setting separate targets for "preparation for re-use" for one or more specific WEEE categories identified in Part 3 of Annex V (referred to six categories of Annex III) of the WEEE Directive.

In order to reach this target, firstly a **context analysis** is conducted. Definitions of re-use and preparation for re-use from the WFD and interpretations from Member States, are reviewed. Member States' representatives (TAC members for WEEE) and experts from the re-use and preparation for re-use sector have been contacted in order to collect their points of view on the definitions and occurring issues on the concepts. Based on these targeted interviews seven country markets (BEL, DNK, DEU, FRA, IRE, NLD, ESP) for re-use/preparation for re-use have been further assessed and displayed in the report. The overall result is that there are different forms of organisations for the management of WEEE and practices for re-use and preparation for re-use in the EU. This makes the assessment of the potential for re-use in the EU difficult. In general, re-use and preparation for re-use is not well developed at EU level; with few exceptions at Member State level. This information basis is further extended via a literature review to highlight **obstacles and drivers** for a development of a market for re-use/ preparation for re-use. Relevant factors are displayed in Table 2.

Table 2: Obstacles vs. Drivers for re-use and preparation for re-use

Obstacles for preparation for re-use	Drivers for preparation for re-use
▪ Access to the waste streams by re-use facilities and quality of materials collected ▪ Design of the products and availability of spare parts ▪ Lack of appropriate logistics ▪ Costs for municipalities ▪ Resistance from producers ▪ Consumer perception toward re-use ▪ Legislative framework (no separate target on preparation for re-use) ▪ Expertise required for preparation for re-use ▪ Restrictions on trans-boundary shipments ▪ Unfair competition (notably from re-use organisations which do not respect quality standards)	▪ Quality control for re-use ▪ Security standards ▪ Open dialogue between manufacturers and re-use organisations ▪ Commitment of local authorities towards re-use ▪ Policies favouring social activities and funding ▪ Marketing of second-hand products ▪ Education for people involved in re-use and refurbishment

After the context analysis, the **feasibility of setting a separate target** for preparation for re-use is discussed. Therefore, it is necessary to assess the scope of a potential target. Thereby, it becomes obvious that many activities can be related to re-use (e.g. exchange/sale/etc. of EEE via internet or P2P) and many stakeholders are involved at different stages of re-use and preparation for re-use (e.g. households, municipalities, re-use centres, charity organisations, collective schemes, etc.). Additionally, many activities leading to re-use are not covered by the WEEE Directive since the electronic products never reach the 'waste' status within these activities. Hence, the scope of preparation for re-use can be seen as very limited in comparison with re-use in general.

The next step is to identify the **quantities of EEE/WEEE re-used and prepared for re-use** in the EU. Due to the potential overlap in definitions between preparation for re-use and re-use, the broad term "re-use and preparation for re-use" is used in the study. More than 70,000t of WEEE were reported by Member States to Eurostat as being re-used and prepared for re-use in the EU in 2012. This represents 2% of WEEE collected in the EU28. The re-use and preparation for re-use rates achieved by Member States as well as further studies dealing with potential markets on re-use/preparation for re-use in EU Member States are presented in the main report.

The **opportunities and threats** that may arise from the implementation of a specific target for preparation for re-use are identified and summarised in Table 3 below.

Table 3: Opportunities vs. Threats for a specific target on preparation for re-use

Opportunities	Threats
▪ Resource savings ▪ High potential for job creation ▪ Consumer demand	▪ Risk of double counting (WEEE might be collected and prepared for re-use several times) ▪ Difficulties to report the flows (distinguish waste/ non-waste) ▪ Costs for changing the organisation of the sector (ensuring proper storage, transportation, etc.) ▪ Unavailability of spare parts to prepare WEEE for re-use at an affordable price ▪ Lack of data to estimate the real potential of re-use ▪ Distortions to reach the target and producers taking ownership of re-use ▪ Design of products improving unequally ▪ Requirements for re-use organisation to comply with the same obligations as producers ▪ Inability of some Member States to reach the target

With opportunities and threats identified, the **impacts** of the activities related to re-use/preparation for re-use are briefly discussed. Regarding economic impacts, several studies demonstrated that the re-use of appliances could generate significant revenues and bring savings to the economy by limiting unemployment. Due to positive effects on job creation and to the provision of low cost household appliances to low income families, the re-use of equipment has positive social impacts as well. Possible environmental impacts from re-use are related to an avoidance of manufacturing new EEE. However, energy consumption should be taken into consideration since new appliances usually are more efficient than re-used older equipment.

Concluding, the above analysis highlighted the difficulties of implementing a target. At the same time the clear economic, social and environmental benefits the sector would bring if developed are presented. As it is not exclusively recommended to propose separate targets regarding preparation for re-use, selected other options than setting a target to promote re-use are suggested below:

- Increase public awareness as regards re-use services and benefits. WEEE that have a potential for re-use should be brought back directly by the consumer to the re-use organisation (or collected by the latter by households) to ensure the re-use potential is preserved. Repairing before the product becomes waste should also be strongly promoted and need to be facilitated already in the product's design phase (eco-design). A strong observation of the study is that more actions need to be put in place to prevent waste, as the potential of re-use of WEEE once it reaches a collection site may be limited.
- If the product finally becomes waste, access to WEEE by re-use organisations need to be granted, either by collective schemes or directly by municipalities or other operators such as retailers. Today, the practice shows that a lot of re-use organisations do not have access to WEEE at the early stage of collection.
- Define a clear methodology to measure rates of preparation for re-use.
- In the future, if a target is considered, it should take into account (1) the differences in development of approved re-use centres and network in Europe and (2) the differences in the amounts of reusable products which are discarded in the Member States. Another option would be to consider that all used EEE or WEEE

collected by re-use centres are waste, in order to facilitate the tracking of flows and monitor the achievement of a potential target on the output of these facilities. However, this option needs to be further considered since it involves redefining of re-use and preparation for re-use activities.

Re-examine the method for calculation of recovery targets

This section is dedicated to the re-examination of the calculation method of recovery targets referred to Article 11(2) of the new WEEE Directive which is currently based on input data for WEEE entering the recovery or recycling/preparing for re-use facility (input-based approach). Purpose of this chapter is to examine the possibility of setting output-based recovery targets, i.e. on the basis of products ('recovery/ recycling efficiency') and/or materials resulting from recovery, recycling and preparation for re-use.

Several information sources have been assessed or contacted in order to analyse available output-related data from recovery/ recycling facilities. Thereby the first aim is to screen **available data on Member State level** taking into consideration information from:

- EUROSTAT

  In publicly accessible data sources (EUROSTAT), no explicit information on output-related data from recovery/ recycling/ preparing for re-use is available.

- Member States' Implementation Reports for WFD and WEEE

  From available Reports of Member States on the Implementation of the former WEEE Directive for the reporting period 2010-2012, no information on output-related data can be retrieved.

- National WEEE legislation

  An obligation to keep records on output data is missing in national regulations of some Member States. National laws including such obligations are only recently transposed which makes actual data availability unlikely.

- TAC members for WEEE

  Most of the contacted TAC members for WEEE indicate that records for WEEE amounts sent for recycling are kept and reported to EUROSTAT, which supports the assumption that in certain cases still input data is recorded.

After the analysis of potential data available on Member State level, a stakeholder consultation is conducted to identify **available output data apart from the Member States**. Thereby the initial focus is drawn on European associations. As WEEELABEX/CENELEC[2] standards specifically refer to output fractions from recovery/recycling process, the assumption is that organisations and facilities applying these standards may be able to provide output data which is not available on Member States level. Hence members of the WEEE Forum and Eucolight that report according WEEELABEX/CENELEC standards (and often use the WEEE Forum's RepTool as a reporting software) have been contacted systematically to request exemplary data. Twelve compliance schemes provided data excerpts indicating which type of data is kept, how their reporting structure looks like and which definitions are used.

[2] WEEELABEX is a voluntary industrial standard covering major parts of the WEEE treatment chain which served as a basis for the development of official CENELEC standards (e.g. EN 50625-1 on collection, logistics, treatment requirements for WEEE)

Contacted collective schemes understand "Recycling Input" as the amounts of untreated WEEE entering the first treatment facility. This amount often is the same as the overall collected amounts of WEEE. Differences between 'Collection Output' and 'Treatment Input' may occur when appliances are prepared for re-use or re-used and thus not enter the treatment processes. The majority of the collective schemes provide an average material composition per WEEE category which often is categorized into ferrous metals, non-ferrous metals, minerals (incl. glass and cement), plastics and other (e.g. printed circuit boards or fluorescent powder). Amounts considered as "Recycling Output" are displayed mainly based on the WEEELABEX definitions for final use (e.g. Material recycling, energy recovery, thermal disposal or landfill disposal). For some collective schemes in particular the combination of material fractions and classification for final use is possible on an indicative basis. Hence one can derive conclusions e.g. on the share of plastic fractions that are recycled or (thermally) disposed. This may be the basis for an approximation to output-based/material-based recycling/recovery targets.

With 100% 'Treatment Input' as a reference, the ferrous metal fraction which is (material) recycled ranges between 31.0% and 59.6%, non-ferrous metal fractions vary between 3.4% and 8.1%. Referring to the absolute ferrous and non-ferrous metal fractions it can be said that almost all metal fractions are material recovered and not disposed (again 31.0% to 59.6% for ferrous metals or respectively 3.4% to 8.1% for non-ferrous metals). Also mineral fractions are mainly recycled, only showing a slight amount (0.9% - 2.0%) going into disposal. In the case of the plastics fraction this looks a little different. Still the majority is recycled but also a remarkable share is sent to energy recovery (2.1% - 6.0%). The share of disposed fractions mainly can be related to the not further classified fraction ("Other").

At level of the collective schemes reporting according WEEELABEX/CENELEC standards, no further statement is made on 'recycling efficiency' meaning how much of e.g. the ferrous metals fractions is actually transferred into a new product. Thus, this data do not necessarily have to be considered as output-based data referring to recycling efficiency but approximates strongly to output-based/ material-based data due to the harmonised standards.

Concluding, no change of the calculation method of recovery/ recycling/ preparing for re-use targets is proposed. The reason therefore is that almost no data on output-related fractions/ material fractions is available on Member State level and only a limited database exists apart from Member State level, e.g. at collective schemes relying on the WEEELABEX/ CENELEC standards. Selected key findings are:

- An enforcement of reporting on selective treatment and de-pollution according to Annex VII to the Directive (e.g. in line with CENELEC) shall be prioritised over introducing new material-based recycling targets from an environmental perspective.
- Material-based targets, for material fractions where already data is recorded (e.g. ferrous or non-ferrous metals) may only have a limited influence on actual recycling practices. The reason therefore is that these valuable materials are already almost completely recycled due to their economic value.
- Further the strict implementation, enforcement and monitoring of WEEE collection targets has a large influence on actual recycling/ recovery, as WEEE entering the collection schemes is usually entering the recovery cycle with high reasonable recycling/recovery rates. Therefore, the influence on actual recycling/ recovery from achieving high collection rates is estimated to be higher than the influence from replacing input-based recovery targets with output-based recovery targets.

Résumé

La Directive 2002/96/CE relative aux déchets d'équipements électriques et électroniques (ancienne « Directive DEEE »), entrée en vigueur en 2002, a introduit l'obligation de collecte séparée des DEEE et fixé des objectifs de collecte, de recyclage et de valorisation et des normes de traitement pour les DEEE, applicables à dix catégories d'équipements orientées « produits » c'est-à-dire correspondant à des groupes de produits aux caractéristiques identiques ('UE10'). Pour prendre en compte les différents retours d'expérience suivant la mise en place de la Directive, la Commission a publié une proposition de refonte de la Directive en 2008. Après d'intenses discussions, la Directive 2012/19/UE (« nouvelle Directive DEEE ») est entrée en vigueur le 13 Août 2012 introduisant de nouveaux objectifs de préparation en vue du réemploi, de recyclage et de valorisation ainsi que six catégories de DEEE, orientées cette fois-ci « collecte », c'est-à-dire regroupant des catégories de DEEE susceptibles d'être collectées ensemble via des canaux de collecte identiques ('UE6'). Ces catégories doivent remplacer les 10 précédentes catégories à partir de 2018. Compte tenu des changements dans la législation, la nouvelle Directive DEEE demande à la Commission, dans son article 11 (6), de présenter un rapport spécifique sur:

1) le réexamen des objectifs de valorisation fixés à l'annexe V, partie 3, de la nouvelle Directive ;

2) l'évaluation de la possibilité de mise en place d'un objectif distinct pour la préparation en vue du réemploi des DEEE; et sur

3) le réexamen de la méthode de calcul fixée à l'article 11 (2) de la Directive, afin d'analyser la faisabilité de la mise en place d'objectifs de préparation en vue du réemploi, recyclage et valorisation basés sur les produits et matériaux résultant des opérations de préparation en vue du réemploi, recyclage et valorisation (calcul du taux de recyclage et de valorisation sur la base des matériaux obtenus en sortie des centres de traitement, plutôt que sur la base des produits et matériaux entrants).

La présente étude permet à la Commission de répondre aux exigences de l'article 11 (6) de la Directive. Les principaux résultats de cette étude pour les trois missions mentionnées ci-dessus sont présentés dans les paragraphes suivants.

Réexamen des objectifs de valorisation fixés à l'annexe V, partie 3, de la nouvelle Directive

Pour réaliser cette première tâche, une analyse comparative des objectifs de valorisation définis dans l'annexe V, partie 2, de la nouvelle Directive DEEE (fixés par catégorie de l'annexe I soit pour 10 catégories) avec les objectifs de valorisation définis dans l'annexe V, partie 3, de la Directive (fixés par catégorie de l'annexe III soit pour 6 catégories), a été menée. L'objectif de cette comparaison était d'identifier les potentielles différences d'ambition entre les nouveaux objectifs de valorisation et les anciens, dues à la redéfinition des catégories de la nouvelle Directive (passage de 10 à 6 catégories). Il est effet mentionné dans l'annexe V de la nouvelle Directive DEEE qu'une telle comparaison doit être réalisée avant le 15/08/2018. Cette analyse a également cherché à évaluer si les différences identifiées entre les objectifs étaient significatives.

Les objectifs de recyclage et de valorisation fixés en partie 2 de l'annexe V de la nouvelle Directive (pour 10 catégories) et en partie 3 de l'annexe V (pour 6 catégories) ont été cartographiés et comparés. Pour cela, la classification « UNU-KEY » a été utilisée (cf. [CE UNU 2014]). La grande majorité des produits, tels que classés par l'UNU-KEY, n'ont ainsi pas vu leur objectif de recyclage et de valorisation évoluer

lors de la transition de 10 à 6 catégories. Pour les rares dont c'est le cas, l'évolution est le plus souvent de l'ordre de -5% à +5%, ce qui a été considéré comme non significatif. Pour seulement quelques produits sélectionnés, l'évolution est supérieure à 5 %, et varie entre 10 % et 25 %. En outre, les quelques produits affectés par le passage de 10 à 6 catégories constituent une très petite fraction du flux de DEEE collecté en général, et auront donc un impact négligeable sur le taux global de recyclage et de valorisation atteint.

Pour évaluer si le changement de catégories pourra avoir une incidence sur la quantité de DEEE à recycler ou valoriser pour atteindre les objectifs, un test théorique a été réalisé pour chaque catégorie de produit définie par la classification UNU-KEY, sur la base d'une tonne de DEEE collectée. Les objectifs de recyclage et de valorisation actuels (fixés en partie 2 de l'annexe V) et les objectifs qui deviendront applicables en 2018 ont été appliqués à chaque « UNU-KEY ». Le test a ensuite pris l'hypothèse que les objectifs sont atteints en 2015 et 2018 et calculé la masse de matière recyclée et valorisée par tonne de DEEE collectée pour chaque UNU-KEY. Les DEEE par UNU-KEY ont ensuite été répartis dans les 10 ou les 6 catégories pour estimer la quantité de DEEE à recycler et valoriser pour chaque catégorie afin d'atteindre les objectifs. Enfin, la quantité totale de DEEE à recycler ou valoriser pour atteindre les objectifs a été calculée par rapport à la quantité de DEEE qui sera générée en 2018.

Table 4: Comparaison en termes d'évolution des quantités de DEEE réutilisées, recyclées et valorisées en fonction des objectifs

	Évolution théorique des quantités recyclées et valorisées par tonne de DEEE collectée		**Évolution des quantités totales recyclées et valorisés (sur la base des gisements projetés en 2015 et 2018)**	
	Évolution générale de l'objectif de valorisation	Évolution générale de l'objectif de recyclage/préparation en vue du réemploi	Évolution générale de l'objectif de valorisation	Évolution générale de l'objectif de recyclage/préparation en vue du réemploi
EU10 2015 versus EU10 2018	6.4%	7%	6.5%	7.3%
EU10 2018 versus EU6 2018	-0.1%	-1.9%	-0.8%	-2.9%

Ces calculs suggèrent que les quantités de DEEE à réutiliser, recycler et valoriser sont pratiquement identiques que les objectifs se basent sur la classification en 10 ou en 6 catégories et toutes les différences sont statistiquement insignifiantes (cf. tableau 1). Par conséquent, il est estimé que le changement de catégories n'a pas d'impact sur le niveau d'ambition des objectifs.

Le changement de classification des EEE a par contre un impact au niveau de la composition moyenne en matériaux des différents groupes de produits (UE10 par rapport à UE6). Ces modifications peuvent avoir un impact sur les performances de valorisation des acteurs. La composition des produits évolue au fil du temps et le taux de collecte peut également varier selon les catégories de produits (UE10 ou UE6). Pour ces raisons, la comparaison des objectifs s'est basée sur quelques hypothèses fondamentales. Une composition moyenne simplifiée par produit UNU-KEY a par exemple été utilisée et a permis d'obtenir la composition moyenne des 10 et 6 catégories de la Directive. Les principaux matériaux sont les métaux de base (par exemple, le fer, le cuivre et l'aluminium), les métaux précieux (par exemple l'or, l'argent et le palladium), les plastiques et le verre. La quantité de DEEE estimée

comme générée en 2018 par UNU-KEY a également été utilisée (tiré de [CE UNU 2014]. Malgré quelques différences identifiées de composition entre les classifications EU-10 et EU-6, la nouvelle composition des six catégories, se rapprochant davantage des flux de collecte, est beaucoup plus proche de la réalité que les anciennes dix catégories axées sur la composition des produits mis sur le marché.

Dans un second temps, les **impacts** de la nouvelle classification et de ses objectifs de valorisation ont été évalués. Le passage à de nouveaux objectifs de valorisation semble maintenir un niveau similaire d'ambition en termes de bénéfices environnementaux tout en simplifiant le processus de déclaration, réduisant ainsi la charge administrative des acteurs de la filière ce qui favorise également leur mise en conformité avec la réglementation. Cependant, les nouveaux objectifs, si l'on se base sur les quantités de DEEE à valoriser uniquement, n'encouragent pas suffisamment la valorisation des matériaux stratégiques mentionnés dans la stratégie de l'Union européenne sur les matières premières.

Pour évaluer enfin si les objectifs sont atteignables par les États membres, les performances actuelles déclarées par les États membres ont été extrapolées jusqu'en 2018 et comparées avec les objectifs à atteindre pour les 6 catégories applicables en 2018. Cette analyse a mis en évidence que les objectifs de recyclage et de valorisation pour les 6 catégories de DEEE sont atteignables au niveau européen. Au niveau des États membres, les objectifs pour certaines catégories peuvent cependant ne pas être atteints. L'écart entre la performance attendue des États membres et l'objectif est cependant inférieur à 5 % pour la plupart des États membres et la plupart des catégories. Cette différence ne peut pas être considérée comme significative et ne contredit pas le niveau d'ambition de l'objectif.

La conclusion générale est que les nouveaux objectifs applicables à partir de 2018 (selon les 6 catégories) maintiennent un niveau d'ambition similaire aux objectifs de 2015 (selon les 10 catégories). Malgré ce niveau d'ambition similaire et bien qu'aucun changement d'objectif ne soit proposé ici, des points critiques ou des éléments à approfondir ont été identifiés et sont présentés dans le chapitre 2 du présent rapport. Les principales conclusions sont résumées ci-dessous :

- La quantité de matériaux recyclée et valorisée est d'abord et avant tout influencée par la quantité de DEEE collectée et traitée. Les objectifs de collecte révisés auront ainsi une influence beaucoup plus grande sur le matériau final récupéré que les objectifs de recyclage et de récupération.

- Bien que les nouveaux objectifs soient plus ou moins équivalents aux anciens, ils ne répondent toujours pas à certains enjeux clés de la stratégie européenne relative aux matières premières et aux objectifs d'efficacité du recyclage. Cela est particulièrement vrai s'il l'on prend en compte le fait que les objectifs sont fixés en poids, ce qui n'encourage pas la valorisation de matériaux contenus en petites quantités dans les DEEE, lorsque leur valeur économique n'est pas suffisamment intéressante.

- Pour atténuer la charge administrative associée aux nouveaux objectifs (Partie 3), ces derniers devraient être mis en place au début de l'année civile (soit 2018 ou 2019).

Évaluation de la possibilité de fixer des objectifs distincts pour la préparation en vue du réemploi des DEEE

La nouvelle Directive DEEE (en particulier l'annexe V, partie 2 et 3) fixe des objectifs communs pour la préparation en vue du réemploi et le recyclage des DEEE. Les États membres et les parties prenantes concernées (par exemple les éco-organismes) peuvent ainsi atteindre les objectifs en favorisant le recyclage par rapport à la

préparation en vue du réemploi. L'objectif de cette partie était d'analyser la faisabilité de la mise en place d'un objectif distinct pour la « préparation en vue du réemploi » pour une ou plusieurs catégories de DEEE identifiées dans la partie 3 de l'annexe V (6 catégories de l'annexe III) de la Directive DEEE.

Afin d'atteindre cet objectif, une **analyse du contexte** a été menée. Les définitions des concepts de réemploi et préparation en vue du réemploi et les interprétations des États membres ont été examinées. Des représentants des États membres et des experts du réemploi et de la préparation en vue du réemploi ont été contactés afin de recueillir leurs points de vue sur les définitions et les questions éventuelles qui se posent lorsque l'on étudie la mise en œuvre d'un objectif spécifique pour la préparation en vue du réemploi. À la suite de ces entretiens, sept pays (Allemagne, Belgique, Danemark, Espagne, France, Irlande, Pays-Bas) ont fait l'objet d'une analyse spécifique dans le rapport afin d'illustrer les différents types d'organisation du secteur dans les États membres. En effet, une comparaison entre ces pays montre des formes d'organisations pour la gestion des DEEE et des pratiques de réemploi et préparation en vue du réemploi très différentes. Cette réalité rend difficile l'évaluation du potentiel de réemploi des DEEE dans l'Union européenne. De manière générale, la préparation en vue du réemploi n'est pas très développée au niveau de l'UE; à quelques exceptions près au niveau des États membres.

À la suite de cette analyse, une revue bibliographique a été réalisée pour mettre en évidence les **obstacles et les leviers de développement** d'un marché pour le réemploi ou pour la préparation en vue du réemploi dans les États membres. Ces facteurs sont présentés dans le tableau 2.

Table 5: Obstacles et leviers de développement pour le réemploi et la préparation en vue du réemploi

Obstacles pour le réemploi	Leviers pour le réemploi
▪ Accès au flux de déchets par les acteurs du réemploi et de la préparation en vue du réemploi et qualité des matériaux collectés ▪ Conception des équipements et disponibilités des pièces de réparation ▪ Moyens logistiques peu ou pas adaptés ▪ Coûts pour les collectivités ▪ Opposition des producteurs d'équipements ▪ Perception des consommateurs vis-à-vis du réemploi ▪ Cadre législatif (pas d'objectif distinct pour le réemploi et la préparation en vue du réemploi) ▪ Compétences requises pour les activités de réparation et préparation en vue du réemploi ▪ Restrictions sur les transferts transfrontaliers ▪ Concurrence déloyale (notamment venant des structures qui ne respectent pas les normes de qualité des produits)	▪ Contrôles de qualité pour la préparation en vue du réemploi ▪ Mise en place de normes de sécurité ▪ Dialogue ouvert entre les fabricants et les structures de réemploi ▪ Engagement des autorités locales envers le réemploi ▪ Politiques publiques en faveur des activités sociales ▪ Marketing des produits de seconde main ▪ Formation des personnes impliquées dans le réemploi et la réparation

Après l'analyse du contexte, la **faisabilité d'un objectif distinct pour la préparation en vue du réemploi** a été évaluée. Dans un premier temps, il était nécessaire d'évaluer le périmètre d'un objectif sur la préparation en vue du réemploi. Cette analyse a montré que de nombreuses activités peuvent être liées au réemploi (par exemple, l'échange ou la vente d'équipements d'occasion sur internet) et de nombreux acteurs sont impliqués à différents stades du réemploi et de la préparation

en vue du réemploi (par exemple, les ménages, les municipalités, les acteurs de la réparation, les associations de l'économie sociale et solidaire, les éco-organismes, etc.). Enfin, de nombreuses activités permettant le réemploi d'équipements ne sont pas couvertes par la Directive DEEE puisque les produits électriques et électroniques n'atteignent jamais le statut de « déchets ». Par conséquent, la portée d'un objectif spécifique pour la préparation en vue du réemploi peut être considérée comme très limitée en comparaison du réemploi (lorsque le produit n'a pas encore acquis le statut de déchet) en général.

L'étape suivante a consisté à identifier **les quantités d'EEE ou de DEEE réemployées ou préparées en vue du réemploi dans l'UE**. En raison du chevauchement potentiel dans les définitions entre le réemploi et la préparation en vue du réemploi, le terme général « réemploi et préparation en vue du réemploi» est utilisé dans l'étude.

Plus de 70 000 t de DEEE ont été reportées par les États membres sur Eurostat comme ayant été réemployés ou préparées en vue du réemploi dans l'UE en 2012. Cela représente 2 % des DEEE collectés dans les 28 États membres de l'UE. Les quantités de DEEE réemployées et préparées en vue du réemploi par les États membres ainsi que d'autres études portant sur le potentiel de réemploi et de préparation en vue du réemploi des DEEE dans les États membres de l'UE sont présentés dans le corps du présent rapport.

Les **opportunités et menaces** liées à la mise en place d'un objectif spécifique pour le réemploi et la préparation en vue du réemploi ont été identifiées et sont résumées dans le tableau 3 ci-dessous.

Table 6: Opportunités et menaces pour la mise en place d'un objectif de préparation en vue du réemploi

Opportunités	Menaces
▪ Gestion efficace des ressources ▪ Fort potential de creation d'emplois ▪ Demande des consommateurs	▪ Risques de double comptage (les DEEE peuvent être collectés et réutilisés ou préparés au réemploi plusieurs fois) ▪ Difficultés à suivre les flux (distinguer les produits des déchets) ▪ Coûts pour changer l'organisation du secteur (meilleur stockage, transport pour préserver le potentiel de réemploi, etc.) ▪ Indisponibilité des pièces de rechange pour réparer les DEEE à un prix abordable ▪ Manque de données pour estimer le potentiel réel de réemploi ▪ Distorsions pour atteindre l'objectif et les producteurs d'équipements s'appropriant le réemploi aux dépends des structures de l'économie sociale et solidaire ▪ Meilleur conception des produits par une minorité de producteurs ▪ Exigences de conformité pour les produits de seconde main identiques aux obligations des fabricants (trop lourdes pour de nombreux acteurs du réemploi et de la préparation en vue du réemploi) ▪ Incapacité de certains États membres à atteindre l'objectif

Après l'identification des opportunités et des menaces associées à la mise en place d'un objectif de préparation en vue du réemploi, les **impacts** des activités de réemploi / préparation en vue du réemploi ont été brièvement analysés. En ce qui concerne les impacts économiques, plusieurs études démontrent que le réemploi des appareils pourrait générer des revenus importants et entraîner des économies significatives en limitant le chômage. En raison des effets positifs sur la création d'emplois et la possibilité pour les familles à faible revenu de s'équiper en appareils ménagers à faible coût, les impacts sociaux liés au réemploi sont également importants. Enfin, les bénéfices environnementaux des activités de réemploi et préparation en vue du réemploi sont liés aux impacts évités pour la fabrication de nouveaux équipements. Toutefois, la consommation d'énergie des équipements de seconde main doit être prise en considération, car les nouveaux appareils mis sur le marché sont généralement plus efficaces énergétiquement que les équipements réemployés aujourd'hui.

Pour conclure, l'analyse ci-dessus a permis de mettre en évidence les difficultés de la mise en œuvre d'un objectif distinct pour le réemploi ou la préparation en vue du réemploi. Les avantages économiques, sociaux et environnementaux évidents du secteur ont cependant été présentés. Il n'est ainsi pas recommandé de mettre en place un objectif distinct pour le réemploi ou la préparation en vue du réemploi, mais d'autres options afin de promouvoir le réemploi sont suggérées ci-dessous:

- Sensibiliser le grand public au secteur du réemploi et aux avantages du réemploi. Les DEEE qui ont un potentiel de réemploi devraient être apportés directement par l'utilisateur final à une structure de réemploi (ou collectés par ces derniers directement auprès des ménages) afin que le potentiel de réemploi des équipements soit préservé. La réparation des équipements avant que ceux-ci ne deviennent des déchets devrait également être fortement encouragée et doit être facilitée dès la phase de conception du produit (éco-conception). Un constat très fort de l'étude est que davantage d'actions doivent être mises en place pour prévenir la production de déchets en amont, puisque le potentiel de réemploi des DEEE une fois qu'ils ont atteint un site de collecte est très limité.
- Si le produit devient finalement un déchet, l'accès aux DEEE par les organisations spécialisées dans le réemploi doit être accordé, par les éco-organismes ou directement par les municipalités ou les distributeurs par exemple. Aujourd'hui, beaucoup d'organisations spécialisées dans le réemploi et la préparation en vue du réemploi n'ont pas accès aux DEEE lors des phases amont de la collecte.
- Définir une méthodologie claire pour mesurer les taux de réemploi et de préparation en vue du réemploi.
- Dans l'avenir, si un objectif est considéré, il devra prendre en compte (1) les différences de développement des réseaux spécialisés dans le réemploi et la préparation en vue du réemploi en Europe et (2) les différences en termes de quantités de DEEE réemployables collectées par les États Membres. Une autre option serait de considérer que tous les EEE ou DEEE collectés par les structures spécialisées dans le réemploi sont des déchets, afin de faciliter le suivi des flux et le calcul du taux de réemploi par rapport à un objectif basé sur le nombre d'équipements réemployés par ces structures. Cependant, cette option doit être étudiée plus en détails, car elle implique de changer les définitions des activités de réemploi et de préparation en vue du réemploi dans la réglementation.

Réexamen de la méthode de calcul des objectifs de valorisation

Cette tâche a été consacrée à la réévaluation de la méthode de calcul des objectifs de valorisation fixés à l'article 11 (2) de la nouvelle Directive sur les DEEE qui est actuellement basée sur les données d'entrée des installations de traitement des DEEE

(approche input-based). L'objectif de ce chapitre était d'examiner la possibilité de fixer des objectifs de valorisation basés sur les résultats des installations de traitement, soit sur la base des produits (efficacité des processus de recyclage/de valorisation) et/ou des matériaux issus des activités de préparation en vue du réemploi, de recyclage ou de valorisation. Plusieurs sources d'information ont été évaluées ou contactées afin d'analyser les données disponibles concernant les produits et matériaux générés en sortie des installations de traitement. Ainsi le premier objectif était de détecter les données disponibles au niveau des États membres en prenant en considération les sources suivantes :

- EUROSTAT
  Dans les sources de données accessibles au public (EUROSTAT), aucune information explicite sur les données en sortie des installations de préparation en vue du réemploi, recyclage ou valorisation, n'est disponible.
- Rapports de mise en œuvre de la Directive cadre déchets et Directive DEEE par les États membres

  Dans les rapports des États membres sur la mise en œuvre de l'ancienne Directive DEEE pour la période 2010-2012, aucune information n'est fournie sur les produits et matériaux issus de la préparation en vue du réemploi, du recyclage ou de la valorisation.
- Législation nationale DEEE

  Une obligation de suivi des données en sortie des installations de traitement est manquante dans certaines réglementations nationales des États membres. Les lois nationales instaurant de telles obligations sont par ailleurs récentes, ce qui limite la disponibilité de ces données.
- Membres du TAC (Technical Advisory Commitee) pour les DEEE

  La plupart des membres du TAC contactés indiquent que les quantités de DEEE envoyées au recyclage sont suivies et transmises à Eurostat, ce qui soutient l'hypothèse que, dans certains cas, les données en entrée des installations sont toujours les données suivies.

Après l'analyse des données disponibles au niveau des États membres, une consultation d'acteurs a été réalisée afin d'identifier les données de sortie disponibles en dehors des données des États membres. Les données des associations européennes ont été étudiées dans un premier temps. Les normes WEEELABEX / CENELEC se réfèrent spécifiquement à des fractions en sortie du processus de recyclage / valorisation, une hypothèse était donc que les organisations et les installations qui appliquent ces normes peuvent être en mesure de fournir des données de sortie non disponibles au niveau des États membres. Ainsi les membres du WEEE Forum Eucolight qui déclarent selon les normes WEEELABEX / CENELEC (et utilisent souvent RepTool du WEEE Forum comme logiciel de reporting) ont été contactés afin de recueillir systématiquement des données. Douze éco-organismes ont fourni des données indiquant le type de données suivies par les installations, ainsi que des informations sur leur système de reporting et les définitions utilisées.

Les éco-organismes contactés associent les "flux de recyclage en entrée" aux quantités de DEEE collectées entrant dans une première installation de traitement. Ce volume est souvent le même que le volume total de DEEE collecté. Des différences entre les « flux de collecte» et les « flux de traitement en entrée » peuvent survenir lorsque les appareils sont préparés au réemploi ou réutilisés et n'entrent pas dans le processus de traitement. La majorité des éco-organismes fournissent une composition moyenne en matériaux par catégorie de DEEE qui est souvent constituée de métaux ferreux, métaux non-ferreux, minéraux (verre et ciments notamment), plastiques et

autres (par exemple, cartes de circuits imprimés ou poudre fluorescente). Les volumes considérés comme des "flux de recyclage en sortie" sont principalement déclarés selon les définitions du WEEELABEX et correspondent aux débouchés finaux (par exemple, recyclage des matériaux, valorisation énergétique, élimination thermique ou mise en décharge). Pour certains éco-organismes, un rapprochement entre les matériaux et les types de débouchés est possible. Ainsi il est possible de tirer par exemple des conclusions sur la part des fractions plastiques qui sont recyclées ou éliminées. Cette analyse peut être la base de la méthode de calcul des objectifs de recyclage et de valorisation estimés à partir des matériaux en sortie des installations de traitement.

Sur la base du « flux de traitement en entrée », la fraction composée des métaux ferreux recyclée représente 31,0 % à 59,6 %, alors que les fractions métalliques non ferreuses recyclées représentent entre 3,4 % et 8,1 %. En considérant les quantités de métaux ferreux et non ferreux dans le flux entrant (encore 31,0 % à 59,6 % pour les métaux ferreux ou respectivement 3,4 % et 8,1 %, pour les métaux non ferreux)., on peut estimer que la quasi-totalité des métaux sont recyclés et non pas éliminés De même, les fractions minérales sont essentiellement recyclées, avec seulement une faible quantité (0,9% - 2,0% du flux total en entrée) éliminée. Dans le cas des matières plastiques, les exutoires sont différents. La majorité reste recyclée mais une part significative est valorisée énergétiquement (2,1% - 6,0% du flux total en entrée). Les matériaux éliminés correspondent principalement à la fraction non encore classée («Autres»).

Au niveau des éco-organismes déclarant selon les normes WEEELABEX / CENELEC, aucune autre déclaration n'est faite sur « l'efficacité du recyclage », par exemple, la quantité de métaux ferreux effectivement recyclée sous la forme d'un nouveau produit. Ainsi, ces données ne doivent pas nécessairement être considérées comme des données basées sur les résultats des installations de traitement et mesurant l'efficacité des processus recyclage, mais comme des données « matériaux » disponibles grâce aux normes harmonisées.

En conclusion, il n'est pas proposé de changement dans la méthode de calcul des taux de préparation en vue du réemploi/recyclage/valorisation. La raison est que très peu de données sont disponibles sur les fractions/matériaux produits par les processus de traitement au niveau des États membres et seulement une base de données limitée existe en dehors des données des États membres, provenant notamment des éco-organismes utilisant les normes WEEELABEX / CENELEC. Les principales conclusions sont :

- Le respect de l'obligation de déclaration des activités de traitement et de dépollution conformément à l'annexe VII de la Directive (en ligne avec le CENELEC) est prioritaire sur l'introduction de nouveaux objectifs de recyclage axés sur les matériaux en sortie des installations de traitement, d'un point de vue environnemental.
- Des objectifs précis par matière, pour celles déjà suivies (par exemple, les métaux ferreux ou non ferreux) peuvent n'avoir qu'une influence limitée sur les pratiques de recyclage actuelles. La raison est que ces matériaux sont déjà presque entièrement recyclés en raison de leur valeur économique.
- En outre, la stricte mise en œuvre et le suivi des objectifs de collecte des DEEE a une influence capitale sur le recyclage et la valorisation des DEEE, étant donné que les DEEE collectés entrent habituellement dans le processus de traitement et atteignent des taux de recyclage et valorisation élevés. Par conséquent, l'influence sur le recyclage et la valorisation de taux de collecte élevés est estimé comme plus importante que le remplacement d'objectifs basés sur les intrants des centres de traitement par des objectifs de valorisation basés sur les fractions sortantes.

Abbreviations

'former WEEE Directive'	Directive 2002/96/EC on waste electrical and electronic equipment
'new WEEE Directive'	Directive 2012/19/EU on waste electrical and electronic equipment
B2B	Business to business
B2C	Business to consumer
BREF	Best Available Techniques Reference Document
BRFs	Brominated Flame Retardants
CA	Public Civic Amenity
CFC/HCFC	Chlorofluorocarbon/ Hydrochlorofluorocarbon
CRT	Cathode ray tubes
EC	European Commission
EEE	Electrical and electronic equipment
EERA	European Electronics Recyclers Association
EWC	European Waste Catalogue
FEE	Federation of Electricity and Electronics
IT	Information Technology
LCD	Liquid Crystal Display
LED	Light-emitting diode
MS	Member States
N.A.	Not Available
N.D.	No Data
OEM	Original Equipment Manufacturer
P2P	Peer to Peer
PCB	Polychlorinated biphenyl
POM	Products placed on the market
PRO	Producer Responsibility Organisation
PUR Foam	Polyurethane foam
RC	Recycling Centres
TAC	Technical Adaptation Committee
TV	Television
WEEE	Waste electrical and electronic equipment
WEEELABEX	WEEE label of excellence
WG	WEEE Generated
WFD	Waste Framework Directive (2008/98/EC)

Country codes

AUT	Austria
BEL	Belgium
BGR	Bulgaria
CHE	Switzerland
CYP	Cyprus
CZE	Czech Republic
DEU	Germany
DNK	Denmark
EST	Estonia
ESP	Spain
FIN	Finland
FRA	France
GRC	Greece
HUN	Hungary
HRV	Croatia
IRL	Ireland
ITA	Italy
LTU	Lithuania
LUX	Luxembourg
LVA	Latvia
MLT	Malta
NLD	Netherlands
NOR	Norway
POL	Poland
PRT	Portugal
ROU	Romania
SWE	Sweden
SVN	Slovenia
SVK	Slovakia
GBR	United Kingdom

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1 Background and objective of the study

1.1 General and legal background

Electrical and electronic equipment (EEE) is a very fast developing sector of the modern industry and its products are overall present in the daily life. Continuous changes in equipment features and capabilities cause tremendous increase of the EEE production and sales, and decrease of the equipment's use lifetime, due to consumers' demands and preferences towards latest design and modern products. Subsequently, the ever-increasing quantity of waste electrical and electronic equipment (WEEE) has become a serious social problem and threat to the environment. EEE includes various substances, which pose high risks to the environment and human health, therefore proper management of WEEE has become one of the priority areas for taking actions and measures to ensure proper and sustainable management on the European scale.

Directive 2002/96/EC of the European Parliament and of the Council on waste electrical and electronic equipment ('former WEEE Directive') first aimed to address this waste flow, having as purpose is according to its Article 1,

> *as a first priority, the prevention of waste electrical and electronic equipment (WEEE), and in addition, the re-use, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste. It also seeks to improve the environmental performance of all operators involved in the life cycle of electrical and electronic equipment, e.g. producers, distributors and consumers and in particular those operators directly involved in the treatment of waste electrical and electronic equipment.*

Inter alia, the Directive introduced obligations for separate collection including collection targets, standards for treatment as well as recovery and recycling rates, specifically for the diverse categories of WEEE.

The Directive applied to the ten categories of WEEE (see Table 7) as specified in Annex IA of former WEEE Directive.

After entering into force in 2003 and a few years of implementation and practical experiences with the Directive, a number of technical, administrative and legal difficulties and space for improvement have been identified, among this

- Lack of clarity on the products covered and their categorisation – different interpretation of the WEEE categorisation made in Member States.
- Perception that the uniform collection target of 4 kg/capita/year would not reflect the economies of individual Member States and lead to sub-optimal/too ambitious targets
- The different producer registration requirements among Member States would cause unnecessary administrative burdens for economic actors, and can lead to registration within 27 different registration schemes
- Missing targets for re-use of whole appliances in WEEE 2002/96/EC
- Lack of coherence with other relevant key legal documents of EU waste management which had been revised in the meantime (e.g. Waste Framework Directive 2008/98/EC, Waste Shipment Regulation (EC) No 1013/2006).

In 2008, the Commission published a proposal for **recasting of the WEEE Directive**. After intensive discussions, the new WEEE Directive 2012/19/EU entered into force on 13 August 2012.

1.2 Key features of the new WEEE Directive

Directive 2012/19/EU of the European Parliament and of the Council on waste electrical and electronic equipment ('new WEEE Directive') **entered into force on 13 August 2012 and it had to be transposed into national law by 14 February 2014**. It lays down in Article 1:

> *measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste from electrical and electronic equipment (WEEE) and by reducing overall impacts of resource use and improving the efficiency of such use in accordance with Articles 1 and 4 of Directive 2008/98/EC, thereby contributing to sustainable development*

Key elements of the new WEEE Directive comprise (besides the recovery and recycling targets as discussed more in detail below):

- **Two implementation periods** have been introduced reflecting the widening of the Directive' scope. The period of six years between 13 August 2012 and 14 August 2018 is regarded as a ***transitional period***. During this period the scope of the new Directive will remain identical to the scope of the former Directive (referring to 10 categories of EEE, as listed in Annex I of new WEEE), with inclusion of photovoltaic panels, and transitional exclusions as of Article 2(3).
- From 15 August 2018 onward, the new WEEE Directive will extend its current restricted scope to an ***"open scope"***. Any equipment which falls under definition of EEE (Article 3 (1)(a)), must be included in one of the **six new categories**, set out in Annex III of new WEEE Directive (see Table 8). Under the open scope of the new WEEE Directive, EEE is only out of scope if explicitly mentioned in Article 2(3) and (4).
- Further, new **ambitious collection targets** are laid down in the new WEEE Directive. From 2016, the minimum collection rate shall be 45 % of the average weight of EEE placed on the market in the three preceding years in that Member State. From 2019, the minimum collection rate to be achieved annually shall be 65 % of the average weight of EEE placed on the market in the three preceding years in the Member State concerned, or alternatively 85 % of WEEE generated on the territory of that Member State. The new targets shall ensure improved collection of WEEE.
- The new WEEE Directive provides Member States the tools to **fight illegal shipments of WEEE** more efficiently, and introduces implementing acts towards the harmonisation of registration and reporting requirements for EEE producers.

1.3 Recovery and preparation for re-use and recycling targets

The old WEEE Directive referred to recovery and recycling targets in Article 7(2), and did not specifically request the re-use of whole appliances. However, a significant amount of re-useable products enters the waste flows due to consumer preferences to "new and better". In order to tackle the issue of re-use of whole appliances, the new WEEE Directive underlines in recital 29 that the information on *inter alia*, the rates of preparation for re-use, including as far as possible **preparation for re-use of whole appliances** are necessary to monitor the achievement of the Directive's objectives. Article 6 (2) of the new WEEE Directive specifically requests that Member States facilitate access to collected ready to be prepared for re-use WEEE:

> *"In order to maximise preparing for re-use, Member States shall promote that, prior to any further transfer, collection schemes or facilities provide, where appropriate, for the separation at the collection points of WEEE that is to be*

prepared for re-use from other separately collected WEEE, in particular by granting access for personnel from re-use centres."

Article 11 of the new WEEE Directive deals with **recovery and recycling targets**. The provision reads in relevant extracts:

1. Regarding all WEEE separately collected in accordance with Article 5 and sent for treatment in accordance with Articles 8, 9 and 10, Member States shall ensure that producers meet the minimum targets set out in Annex V.

2. The achievement of the targets shall be calculated, for each category, by dividing the weight of the WEEE that enters the recovery or recycling/preparing for re-use facility, after proper treatment in accordance with Article 8(2) with regard to recovery or recycling, by the weight of all separately collected WEEE for each category, expressed as a percentage.

Preliminary activities including sorting and storage prior to recovery shall not count towards the achievement of these targets.

3. In order to ensure uniform conditions for the implementation of this Article, the Commission may adopt implementing acts establishing additional rules on the calculation methods for the application of the minimum targets. Those implementing acts shall be adopted in accordance with the examination procedure referred to in Article 21(2).

4. Member States shall ensure that, for the purpose of calculating these targets, producers or third parties acting on their behalf keep records on the weight of WEEE, its components, materials or substances when leaving (output) the collection facility, entering (input) and leaving (output) the treatment facilities and when entering (input) the recovery or recycling/ preparing for re-use facility.

Member States shall also ensure that, for the purposes of paragraph 6, records on the weight of products and materials when leaving (output) the recovery or recycling/preparing for re-use facility are kept. (…)

The development of the targets in comparison with those contained in the former WEEE Directive are depicted in Table 8. Table 7 provides an overview of recovery and recycling/preparing for re-use targets in the *transitional period*.

Table 7: Recovery and recycling/preparing for re-use targets according to Directive 2002/96/EC (Ar. 7(2)) and Directive 2012/19/EC (Annex V) during the transitional period

		Recovery targets %		Preparation for re-use and recycling targets %	
EEE Categories		By 14.8.2015	15.08.2015 – 14.08.2018	By 14.8.2015	15.08.2015 – 14.08.2018
1	Large household appliances	80	85	75	80
2	Small household appliances	70	75	50	55
3	IT and communication equipment	75	80	65	70
4	Consumer equipment and photovoltaic panels	75	80	65	70
5	Lighting equipment	70	75	50	55
5a	Gas discharge lamps	N.A.	N.A.	80	80

6	Electrical and electronic tools (with the exception of large stationary industrial tools)	70	75	50	55
7	Toys, leisure and sports equipment	70	75	50	55
8	Medical devices (with the exception of all implanted and infected products)	70*	75	50*	55
9	Monitoring and control instruments	70	75	50	55
10	Automatic dispensers	80	85	75	80

* as of 13.08.2012

In the next table an overview of recovery and recycling/preparing for re-use targets under the open scope period is given.

Table 8: Recovery and recycling/preparing for re-use targets according to Directive 2012/19/EC from 15 August 2018

EEE Categories		Recovery %	Preparing for re-use and recycling %
1	Temperature exchange equipment	85	80
2	Screens, monitors, and equipment containing screens having a surface greater than 100 cm 2	80	70
3	Lamps	N.A.	80
4	Large equipment (any external dimension more than 50 cm)	85	80
5	Small equipment (no external dimension more than 50 cm)	75	55
6	Small IT and telecommunication equipment (no external dimension more than 50 cm)	75	55

The application of Article 11 causes several challenges in practice:

- Recovery targets, as calculated according to Article 11(2), are included **up to 85 %**
- All recovery and preparing for re-use/recycling targets are to be referred to as **input based targets**; calculated based on WEEE that ***enters*** the recovery or recycling/preparing for re-use facility. However, in practice it appears that the data on treated amounts may have included items outside of the scope of WEEE. For example, in the past, a shredder operator might have had great difficulty in identifying which proportions of his outputs were attributable to WEEE input [UNU, 2009]. Therefore, Article 11(6) of the new Directive requires the re-examination of the calculation method referred to in Article 11(2) with a view to analyse the feasibility of setting targets on the basis of products and materials resulting (output) from the recovery, recycling and preparation for re-use processes.
- The new WEEE Directive refers to **preparation for re-use** as important step in WEEE treatment, and thus follows the waste hierarchy principle of the WFD where "preparing for re-use" is defined as "checking, cleaning or repairing recovery operations, by which products or components of products that have become waste

are prepared so that they can be re-used without any other pre-processing" (Article 3(16) of WFD). Recital 20 of the new WEEE Directive states in this context that the priority should be given to preparation for re-use of WEEE and its components, sub-assemblies and consumables than recovery. Further, recital 21 indicates:

> *"The recovery, **preparation for re-use** and recycling of WEEE **should be counted towards the achievement of the targets laid down in this Directive** only if that recovery, preparation for re-use or recycling does not conflict with other Union or national legislation applicable to the equipment. Ensuring proper preparation for re-use, recycling and recovery of WEEE is important for sound resource management and will optimise supply of resources".*

Moreover, the WEEE Directive provides in Article 6 for Member States to maximise preparing for use, by promoting where appropriate for the separation at the collection points of WEEE that is to be prepared to re-use, in particular by granting access for personnel from re-use centres.

While the EU waste hierarchy makes clear distinction between re-use (non-waste stage) and preparing for re-use (waste stage), it does not include the separate targets reinforcing waste prevention i.e. re-use and preparation for re-use activities. Instead, preparation for re-use is combined with recycling targets (Article 11, WFD), despite lower position of recycling in waste hierarchy, and completely different definition including different level of preparation and processing[3].

- Also, **joint targets for both preparation for re-use and recycling** are included in new WEEE Directive (Annex V, part 2 and 3). Due to this combined approach, Member States might only increase their recycling efforts in order to reach prescribed targets, which is of lower priority in waste hierarchy than preparation for re-use. Therefore, Article 11 (6) of WEEE Directive 2012/19/EU call on investigations of possibility of setting the separate targets for WEEE to be prepared for re-use, followed by the legislative proposal, if appropriate.

1.4 Objective

Considering these challenges, the WEEE Directive in its Article 11(6) asks the Commission to present a report specifically on:

4) the re-examination of the recovery targets referred to in Annex V, Part 3;
5) the examination of the possibility of setting separate targets for WEEE to be prepared for re-use; and on
6) the re-examination of the calculation method referred to in Article 11(2) with a view to analysing the feasibility of setting targets on the basis of products and materials resulting (output) from the recovery, recycling and preparation for re-use processes.

This report shall, if appropriate, be accompanied by a legislative proposal.

The project report will be organised in the three abovementioned indicated parts. This report will lay the basis for the reports and possible legislative proposals required from the Commission in accordance with Article 11(6) of the new WEEE Directive.

[3] 'recycling' means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations; Article 3(17) WFD.

2 Re-examination of the recovery targets referred to in Annex V, Part 3

2.1 Purpose and objective

The chapter examines the ambition level of the recovery targets applicable to different EEE categories set out in Part 2 and Part 3 of Annex V of the new WEEE Directive due to change in EEE categories from existing ten "product oriented" categories of Annex I (EU10) to new six "collection oriented" categories of Annex III (EU6). As recycling and recovery targets are contingent on the mass and material composition of the individual categories, the change in categorisation can affect the overall mass as well as the material composition of the new categories. The change in recycling and recovery target requirements can be relevant for example for EU10 categories that now include screens and displays, including the difficulty to recycle CRT glass fraction. With the new EU6 categories having a separate category for displays and screens, different recycling and recovery targets will apply to the rest of the products. Important to note is also that the material composition of category will change, with CRT based screens replaced by the LCD and LED technologies.

This section presents a comparative analysis of the recovery targets set out in Part 2 of Annex V (for the ten categories in Annex I) and the recovery targets set out in Part 3 of Annex V (for the six categories in Annex III). The aim of the comparison is to identify any differences in recovery targets as regards the level of ambition due to the change in EEE categories from the existing ten to the new six categories and to establish whether any differences identified have significant impacts.

In sections 2.3-2.6 the differences in recovery targets with respect to the level of ambition are identified and compared based on different criteria, namely:

- Absolute value: If, and by how much, is there any change in the absolute value of the recovery and recycling target for a particular category
- Mass balance: How the re-categorisation affects the mass balance from recovery
- Simplified material composition: How the re-categorisation affects the composition at the material level of each category
- Other relevant criteria including environmental impact, legal compliance, raw material strategy and administrative burden of recording and achieving targets in Annex V, Part 3 under EU6 categorisation
- Recycling and recovery performance: How the re-categorisation would change the performance of Member States

Finally, in section 2.7, a brief assessment of the impacts of the new recovery targets on selected criteria is presented.

2.2 Methodology and data sources

In order to examine the recovery targets and the impacts of the transition from EU10 to EU6 categories, several datasets are needed, including data on current treatment efficiency, current and future projections on expected WEEE volumes and their material composition. These were taken from various sources, as mentioned below:

- **UNU-KEYS:** The classification of "UNU-KEYs" has been developed by the United Nations University (UNU) and is openly available to the public. It is organised based on three essential perspectives: product type, waste

management and legislative relevancy. This classification list is divided into 54 categories by linking all possible WEEE items (about 660 product types in all) to various conventional categorisations. The UNU-KEYs is a classification that can establish relationships between the previously described classifications, thereby harmonising available data sources. Additionally, a link between statistical codes has been developed [Wang et al. 2012], aligning the classifications applied in trade statistics (PRODCOM), custom authorities (CN codes) and national statistical offices. This categorisation enables consistent performance comparison between regions and compliance schemes. Most of the UNU-KEYs align with one or more PRODCOM and CN codes enabling a relationship with harmonised and internationally accepted statistical data. UNU-KEYs are able to address various classification methods, such as the EU6 and the EU10 categories, as well as the WEEE Forum classification and the PRODCOM codes. By using the UNU-KEYs, it is possible to convert results among different classification methods.

The UNU-KEYs were also used in the study on collection rates of WEEE and possible measures to be initiated by the Commission as required under Article 7 of the new WEEE Directive.

- **Data on WEEE Generated (WG):** Future projections of WG are necessary to know the available input for recycling and recovery. WG estimates from the Article 7 study are used, where WG is defined as:

  > **WEEE Generated** in a Member State corresponds to the total weight of discarded products (waste) as a result of consumption within the territory of that Member State in a given reporting year, prior to any activity (collection, preparation for re-use, treatment, recovery (including recycling) or export) after discarding.

  In the report [EC UNU 2014], WG in a specific year is calculated by a collective sum of discarded products that were placed on the market in all historical years multiplied by the appropriate lifespan distribution. UNU-KEYs are used as the minimum product type clustering level for the calculations.

- **Eurostat data:** Eurostat collates official data reported by Member States, usually based on National Registers data. Data used are:
  - *Collection performance*: Collection of WEEE, by country, year and EEE-Category (per EU10), in tonnes, percent and number.
  - *Recycling and Recovery performance*: Treatment of WEEE, by country, year, EEE-Category (per EU10) and treatment type, in tonnes and kg per inhabitant.

- **Material composition**: A simplified material composition of WEEE per UNU-KEY, focussing on key metals (Fe, Al & Cu), precious metals (Ag, Au, Pt), plastic and glass is used, combining data on material composition of EEE and WEEE from several sources, namely [Wang 2014], [WRAP 2012], [WRAP 2013] studies on material composition, WEEE review study [EC UNU 2008], and annual reports from producer compliance schemes such as [SWICO 2014] and [EL-KRETSEN 2013].

2.3 Comparing the targets in absolute value

The recovery targets set out in Part 2 of Annex V (for EU10) and in Part 3 of Annex V (for EU6) of the Directive are mapped and compared on an absolute basis. This is done using the UNU-KEYs classification. In Appendix I of this document, the

corresponding categories under EU10 and EU6 for each UNU-KEY are provided in detail.

Table 9: Change of categories from Annex I to Annex III

Product categories	Annex I – EU10	Annex III – EU6
Large household appliances	1	1, 4, 5
Small household appliances	2	5
IT & telecommunications equipment	3	2, 4, 6
Consumer equipment (& photovoltaic panels)	4	2, 5
Lighting equipment	5	3, 5
Electrical & electronic tools	6	4, 5
Toys, leisure and sports equipment	7	4, 5, 6
Medical devices	8	4, 5
Monitoring & control instruments	9	4, 5
Automatic dispensers	10	1, 4

The 54 UNU-KEYs were mapped to both Annex I and Annex III categories, and their accompanying targets for recovery and recycling outlined in Annex V Parts 1, 2 and 3 are compared.

As seen in Figure 1, change in recovery target ranges from -10% to +10% in the transition from Part 2 to Part 3 targets. Compared to recovery target for most products (per UNU-KEYs) increased from 2015 (Annex V, Part 1), most products see an increase in recovery target in 2018 (Annex V, Part 3) seen in grey bars. However, there are only a few products with different targets between Annex V, Part 2 and Part 3, seen in blue bars. Twelve products face a reduction in the recovery target under Annex V, Part 3. Similarly, six products face an increase in recovery target.

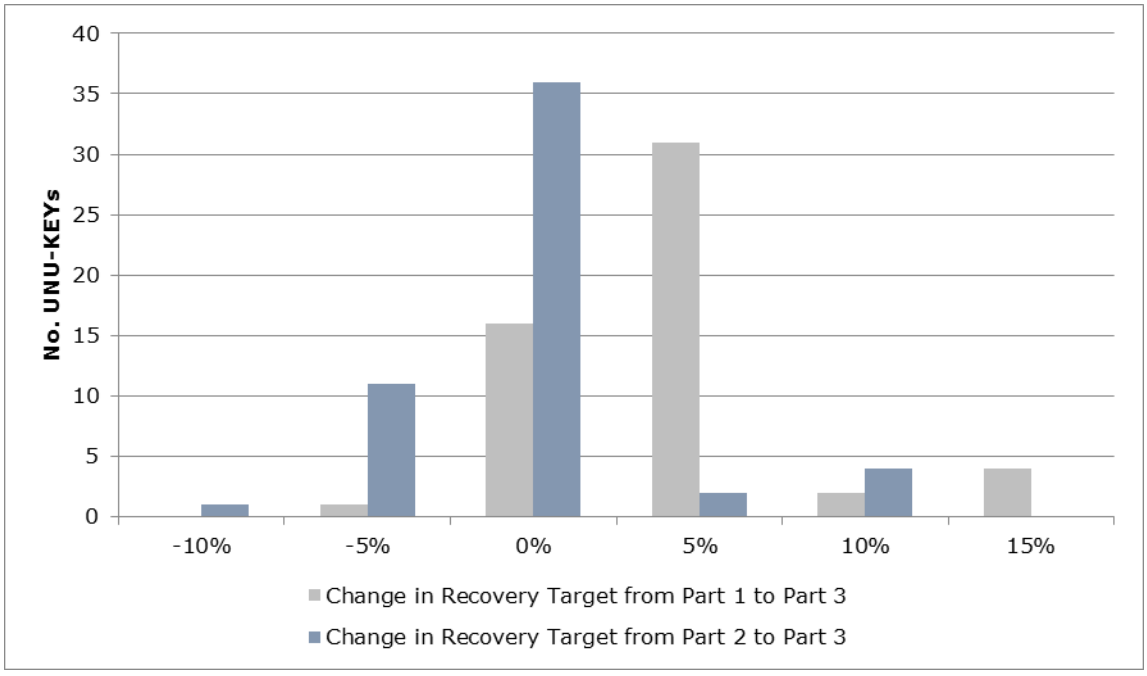


Figure 1: No. of UNU-KEYs with change in absolute recovery targets

The variation in absolute recycling targets between Part 2 and Part 3 is much greater than for recovery targets, mainly ranging from -25% to +25%. However, only a few products are affected by changes in targets due to the transition from EU10 to EU6 categories. Twelve product categories face an absolute reduction in recycling targets in the open-scope period starting from 2018, with six product keys facing an increase of 5-10%.

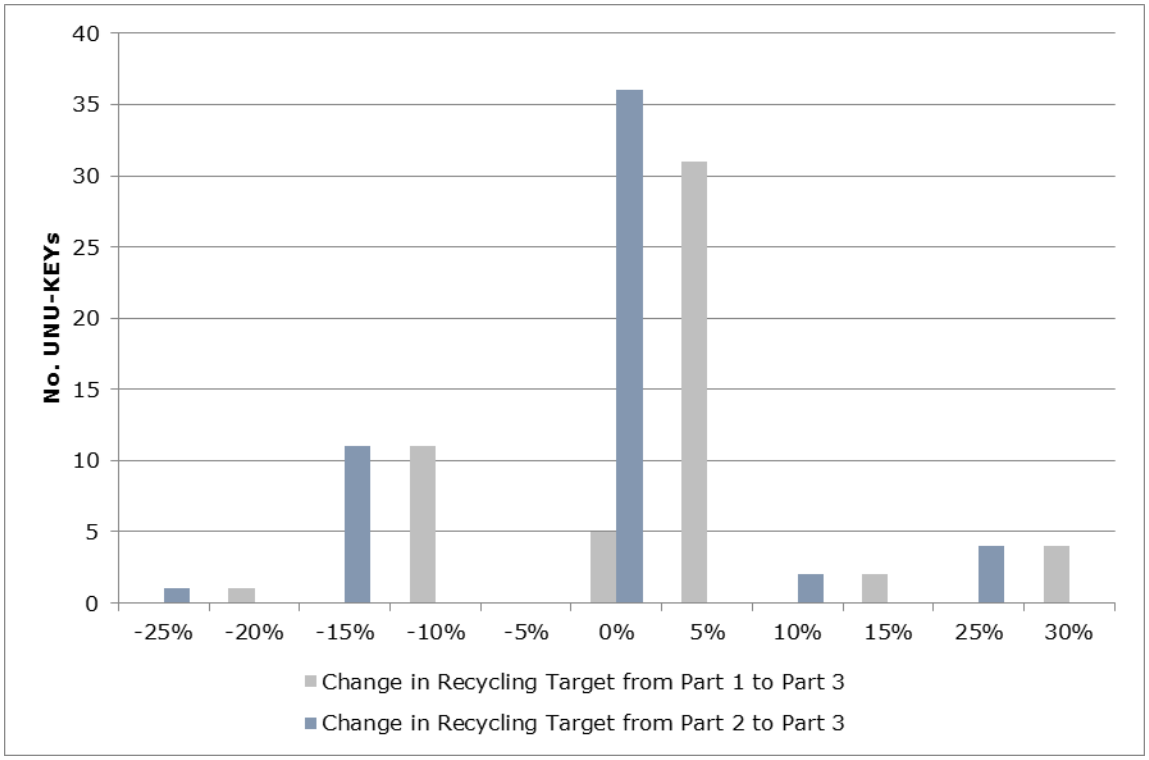


Figure 2: No. of UNU-KEYs with change in absolute recycling targets

Selected product categories with variations in their recycling and recovery rates are listed below. A full overview for all 54 UNU-KEYs is presented in Appendix I of this report.

Table 10: Product categories with changes in targets

UNU-KEY	Product Category	EU10	EU6	Change in Recovery Target from Part 2 to Part 3	Change in Recycling Target from Part 2 to Part 3
0002	Photovoltaic Panels (incl. converters)	4	4	5%	10%
0114	Microwaves (incl. combined, excl. grills)	1	5	-10%	-25%
0301	Small IT (f.i. routers, mice, keyboards, external drives & accessoires)	3	6	-5%	-15%
0302	Desktop PCs (excl. monitors, accessoires)	3	6	-5%	-15%
0304	Printers (f.i. scanners, multifunctionals, faxes)	3	6	-5%	-15%
0305	Telecom (f.i. (cordless) phones, answering machines)	3	6	-5%	-15%
0306	Mobile Phones (incl.	3	6	-5%	-15%

UNU-KEY	Product Category	EU10	EU6	Change in Recovery Target from Part 2 to Part 3	Change in Recycling Target from Part 2 to Part 3
	smartphones, pagers)				
0307	Professional IT (f.i. servers, routers, data storage, copiers)	3	4	5%	10%
0401	Small Consumer Electronics (f.i. headphones, remote controls)	4	5	-5%	-15%
0402	Portable Audio & Video (f.i. MP3, e-readers, car navigation)	4	5	-5%	-15%
0403	Music Instruments, Radio, HiFi (incl. audio sets)	4	5	-5%	-15%
0404	Video (f.i. Video recorders, DVD, Blue Ray, set-top boxes)	4	5	-5%	-15%
0405	Speakers	4	5	-5%	-15%
0406	Cameras (f.i. camcorders, photo & digital still cameras)	4	5	-5%	-15%
0602	Professional Tools (f.i. for welding, soldering, milling)	6	4	10%	25%
0703	Leisure (f.i. large exercise, sports equipment)	7	4	10%	25%
0802	Professional Medical (f.i. hospital, dentist, diagnostics)	8	4	10%	25%
0902	Professional Monitoring & Control (f.i. laboratory, control panels)	9	4	10%	25%

The large majority of products at the UNU-KEY level do not see any change in absolute recycling and recovery targets in the transition from EU10 to EU6 categorisation. For the few that do, the change is mostly in the range of -5 to +5%, which is not significant. For only a very selected few products, the change in absolute targets is higher than 5%, ranging between 10% and 25%.

Moreover, the few products affected by change in targets, they form a very small fraction of the overall WEEE stream, and thus have a negligible impact on the overall recovery and recycling rate of the EU6 categories.

In conclusion, it can be said that the recycling and recovery targets in Annex V, Part 2 and Part 3 have more or less the same level of ambition in terms of absolute value.

2.4 Comparing the targets on mass balance

To examine if the reclassification of the products from EU10 to EU6 has any consequence on the overall mass to be recycled, a theoretical test is conducted for one tonne of WEEE per UNU-KEY. Current **recycling targets** (2015 values, Part 2 of Annex V) during the transition phase and recycling targets that become applicable in 2018 are applied for each product at UNU-KEY level. It is assumed that the target is met and the target mass recycled per tonne of product is calculated. The results are then clustered in EU10 and EU6 categorisations (Table 11).

Table 11: Theoretical mass balance of recycling and re-use targets under Annex V Parts 1-3

EU10: 2015		EU10: 2018		EU6: 2018	
Category	**Recycled to target [tonnes]**	**Category**	**Recycled to target [tonnes]**	**Category**	**Recycled to target [tonnes]**
1	9.75	1	10.4	1	4.80
2	2.50	2	2.75	2	3.50
3	5.85	3	6.30	3	4.00
4	5.85	4	6.30	4	11.20
5	5.00	5	5.10	5	9.90
6	1.00	6	1.10	6	3.30
7	1.50	7	1.65		
8	1.00	8	1.10		
	1.00	9	1.10		
10	1.50	10	1.60		
TOTAL	**34.95**		**37.40**		**36.70**

The results show that under the EU6 categorisation, the overall mass recycled could be slightly lower with only a -1.9% difference between the EU10 and EU6 clustering in 2018 (Annex V, Part 2 and 3). This difference is not significant enough to suggest a substantial change of the level of ambition as it is within the bounds of standard deviation.

The increase in ambition is reflected rather in the transition period from 2015 to 2018, when the theoretical mass to be recycled would increase by 7%.

Table 12: Change in recycling & re-use target (theoretical mass balance)

Overall change in recycling target (theoretical mass balance)	
EU10 2015 – EU10 2018	7.0%
EU10 2018 – EU6 2018	-1.9%

The same exercise is conducted for the **recovery targets in 2018**, with 1 tonne of WEEE per UNU-KEY.

Table 13: Mass balance of recovery targets under Annex V Parts 1-3

EU10: 2015		EU10: 2018		EU6: 2018	
Category	**Recovered to target [tonnes]**	**Category**	**Recovered to target [tones]**	**Category**	**Recovered to target [tonne]**
1	10.40	1	11.05	1	5.10
2	3.50	2	3.75	2	4.00
3	6.75	3	7.20	3	0.00
4	6.75	4	7.20	4	11.90
5	1.40	5	1.50	5	13.50
6	1.40	6	1.50	6	4.50
7	2.10	7	2.25		
8	1.40	8	1.50		
9	1.40	9	1.50		
10	1.60	10	1.70		
TOTAL	**36.70**		**39.15**		**39.00**

The results show an almost identical recovery volume under both categorisations in 2018, with the difference being only at -0.4% higher in EU10 as compared to EU6.

In comparison, the change in recovery performance is more ambitious in the transition from Part 1 to Part 2 targets, with a 6.4% increase between 2015 and 2018.

Table 14: Change in recovery target (theoretical mass balance)

Overall change in recovery targets (theoretical mass balance)	
EU10 2015 – EU10 2018	6.3%
EU10 2018 – EU6 2018	-0.4%

The theoretical comparison is done considering one tonne of WEEE per UNU-KEY. However, in practice, WG mass is different for each product for each country. Therefore, to examine whether the level of ambition of the recovery target is higher or lower in reality, the recovery rate per product is applied to the estimated WG in 2018 at the UNU-KEY level for each country (using WEEE Generated of each Member State at the UNU-KEY level from [EC UNU 2014]), and assuming a collection rate of 100%, across all UNU-KEYs.

It is important to highlight that there is a difference between WEEE Generated (WG) and WEEE Collected in reality. For the purpose of assessing the ambition however, we have not based our calculation on WEEE Collected, as at Member States level different alternatives might be enforced to meet the collection target (either applying individual collection targets or one general target). The specific breakdown of products and categories of WEEE collected might indeed influence the results. The assessment of the equivalence of the targets, however, has been done considering an ideal scenario where *all* WEEE generated are collected.

The overall results of the mass balance comparison on recycling targets for EU-28 Member States is shown in Table 15 below:

Table 15: Mass balance on WG in 2018 for recycling and re-use targets under Annex V Parts 1-3

EU10: 2015		EU10: 2018		EU6: 2018	
Category	**Recycled [kt]**	**Category**	**Recycled [kt]**	**Category**	**Recycled [kt]**
1	3,632	1	3,874	1	1,360
2	571	2	628	2	941
3	835	3	899	3	162
4	958	4	1,032	4	2,565
5	365	5	385	5	1,490
6	116	6	128	6	399
7	57	7	63		
8	19	8	20		
9	56	9	62		
10	31	10	33		
TOTAL	**6,640**		**7,124**		**6,918**

Similar to the decrease in recycled mass seen in the theoretical calculation with one tonne, there is a slight decrease in recovered mass under EU6 as compared to EU10 in 2018. Some products show an increase in recovered mass towards achieving recycling target, others show a decline, resulting in an overall reduction of 207 kt suggesting a 2.9% reduction on the overall mass balance in the transition from Part 2 to Part 3 for the EU28. However, between 2015 and 2018, there is a healthy increase in the ambition of target mass recycled, increasing by over 7%.

Table 16: Change in recycling & re-use target (practical mass balance)

Overall change in recycling targets (practical mass balance)	
EU10 2015 – EU10 2018	7.3%
EU10 2018 – EU6 2018	-2.9%

The mass balance of recovery targets are also tested on a practical level, comparing the mass balance under EU10 and EU6 categorisations. For this, the estimated WG in 2018 for each UNU-KEY is applied to the recovery targets for 2015 and 2018. The mass to achieve recovery targets at the European level is shown below for EU10 and EU6 clustering under old and new targets.

Table 17: Mass balance on WG in 2018 for recovery targets under Annex V Parts 1-3

EU10: 2015		EU10: 2018		EU6: 2018	
Category	**Recovered [kt]**	**Category**	**Recovered [kt]**	**Category**	**Recovered [kt]**
1	3,874	1	4,117	1	1,445
2	799	2	856	2	1,075
3	963	3	1,027	3	-
4	1,106	4	1,179	4	2,726
5	284	5	304	5	2,032
6	163	6	174	6	544
7	80	7	86		
8	26	8	28		
9	79	9	84		
10	33	10	35		
TOTAL	**7,407**		**7,891**		**7,822**

As in the theoretical calculation, the recovered mass under EU6 clustering is negligibly lower, by 69 kt, representing only a difference of -0.9%, as compared to EU10 clustering. On the contrary the increase from 2015 to 2018 is approximately 6.5%.

Table 18: Change in recovery target (practical mass balance)

Overall change in recovery target (practical mass balance)	
EU10 2015 – EU10 2018	6.5%
EU10 2018 – EU6 2018	-0.9%

The deviations between EU10 and EU6 when applying the WEEE generated estimations for 2018 shows a slight decrease in the total mass recovered or recycled. This is mainly linked to the changes of targets for selected UNU-KEYs, as detailed in Table 10. Differences are mainly linked to those categories that in the transition from Part 2 to Part 3 of Annex V have seen a decrease in the recovery and recycling targets (mainly part of the former category 3 and 4 moved not into category 5 and 6 in EU6 clustering). The absolute value of such decrease might anyway be affected by the real collection rate achieved in those categories, particularly for those products.

Table 19: Change in mass balance at UNU-KEY level

UNU-KEY	Product Category	Change in Recovery Mass Balance EU10 – EU6 [%]	Change in Recycling Mass Balance EU10 – EU6 [%]
0002	Photovoltaic Panels (incl. converters)	6%	13%
0114	Microwaves (incl. combined, excl. grills)	-13%	-45%
0301	Small IT (f.i. routers, mice, keyboards, external drives & accessoires)	-7%	-27%
0302	Desktop PCs (excl. monitors, accessoires)	-7%	-27%
0304	Printers (f.i. scanners, multifunctionals, faxes)	-7%	-27%
0305	Telecom (f.i. (cordless) phones, answering machines)	-7%	-27%
0306	Mobile Phones (incl. smartphones, pagers)	-7%	-27%
0307	Professional IT (f.i. servers, routers, data storage, copiers)	6%	13%
0401	Small Consumer Electronics (f.i. headphones, remote controls)	-7%	-27%
0402	Portable Audio & Video (f.i. MP3, e-readers, car navigation)	-7%	-27%
0403	Music Instruments, Radio, HiFi (incl. audio sets)	-7%	-27%
0404	Video (f.i. Video recorders, DVD, Blue Ray, set-top boxes)	-7%	-27%
0405	Speakers	-7%	-27%
0406	Cameras (f.i. camcorders, foto & digital still cameras)	-7%	-27%
0602	Professional Tools (f.i. for welding, soldering, milling)	12%	31%
0802	Professional Medical (f.i. hospital, dentist, diagnostics)	12%	31%
0902	Professional Monitoring & Control (f.i. laboratory, control panels)	12%	31%
Total impact		-1%	-3%

In any calculation or modelling process, uncertainty is inevitable. This is because the collected data for each variable could potentially deviate, or because missing parameters had to be estimated. Usually, when the data of a variable is not 100 per cent accurate or certain, it can introduce errors to the estimation. For the mass balance, there are several dimensions, which can introduce errors or large confidence intervals in the estimation of recycled mass:

- WG data for 2018 is estimated based on quantity and mass of EEE put on the market (PoM) and lifespan profiles, all of which also themselves based on estimated averages of product weight and product lifespan. Thus there are several degrees of variability, and slight changes in any of the variables can impact the overall mass balance of WG and therefore also target mass balance.
- Most importantly, WG is different from WEEE Collected. For many countries, WG might vary substantially from amount collected due to intrinsic low collection volumes, cherry picking, complementary flows outside reported data and other local dynamics.

Thus, given the degrees of variability, the change in categorisation from EU10 to EU6 shows no statistical increase or decrease at the collection category level. Higher

changes of mass balance at the individual product level might occur for only a very small selection of UNU-KEYs due to their clustering from EU10 to EU6.

In summary, in terms of mass balance, the following criteria were checked to examine any change in the level of ambition of the recycling and recovery targets between Annex V, Part 2 and Part 3:

- Change in targets at the theoretical level
- Change in targets at the practical level

Table 20: Summary Table: Mass Balance Comparison

	Theoretical Mass Balance		Practical Mass Balance (WG 2018)	
	Overall change in recovery target	Overall change in recycling & re-use target	Overall change in recovery target	Overall change in recycling target
EU10 2015 versus EU10 2018	6.4%	7%	6.5%	7.3%
EU10 2018 versus EU6 2018	-0.1%	-1.9%	-0.8%	-2.9%

The theoretical and practical mass balance calculations suggest the resulting recycling and recovered mass under both EU10 and EU6 clustering is nearly the same and any minor differences are statistically insignificant. Therefore, it is concluded that on a mass balance basis, there is no change in the level of ambition.

2.5 Comparing the targets at the material level

Changing the classification of products has also an impact at the material level, on the average material composition of different product clusters (EU10 versus EU6). Such changes might have an impact on the recovery performances.

Product composition changes over time and collection rate might vary along the same category of products (either in EU10 or in EU6 clustering). For those reasons the following analysis is based on few fundamental assumptions:

- A simplified product composition at UNU-KEY level is considered, clustering different UNU-KEY according to the EU10 and EU6 classification. For each UNU-KEY representative materials are considered: Iron (Fe), copper (Cu) and aluminium (Al) as basic metals; gold (Au), silver (Ag) and palladium (Pd) for precious metals; plastics, glass and other materials. Other materials might include minor metals, wood, rubber, oil, hazardous substances like CFC/HCFC, or mercury. While not specifically analysed, materials or elements included in the "Others" are disposed and, in some cases, also recovered and recycled.
- The composition is assumed to be valid for 2018, when the shift from EU10 to EU6 takes place. The material composition is also assumed constant over time. General trends in production of new electronics might eventually result in:
    - Lower concentration of precious metals
    - Increase in the plastic fraction and
    - Gradual decrease in glass content due to phase out of cathode ray tubes (CRT) appliances. Though largely phased out from the market, considerable amounts are still expected in the waste stream (Figure 3) due to disposal of current stock or CRTs.

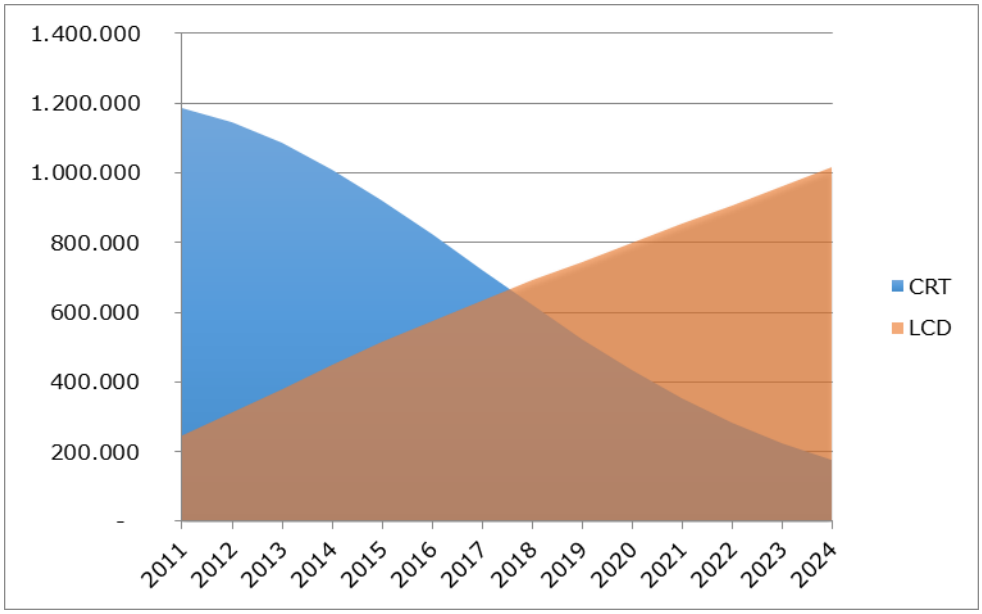


Figure 3: Trends for CRT and LCD WEEE arising (EU28), in tonnes.

The analysis considers as first step the theoretical changes assuming same amount of waste generated for each UNU-KEY (equal to one ton).

Table 21 and Table 22 below show the resulting composition when one ton of each UNU-KEY is collected and grouped according to the ten product categories; for precious metals, due to lower amount, three digits are used. Category 5 has been split in 5a (lamps) and 5b (luminaires).

Table 21: Simplified material composition [t] for the EU10 clustering; 1t of WEEE Generated per each UNU-KEY

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	7.0	0.6	1.1	0.000	0.000	-	1.8	-	2.4	13
2	1.5	0.3	0.1	0.000	0.000	-	2.3	-	0.8	5
3	1.8	0.3	0.2	0.002	0.001	0.000	3.2	0.6	2.8	9
4	2.2	0.3	0.8	0.004	0.000	0.000	2.0	1.5	2.3	9
5a	0.1	0.0	0.9	-	-	-	0.8	2.6	0.6	5
5b	0.8	0.2	0.6	-	-	-	0.4	-	0.0	2
6	1.0	0.2	0.1	-	-	-	0.6	-	0.0	2
7	0.4	0.1	0.1	-	-	-	1.7	-	0.7	3
8	0.6	0.1	0.2	-	-	-	0.3	-	0.8	2
9	0.6	0.1	0.2	-	-	-	0.3	-	0.8	2
10	0.7	0.1	0.1	-	-	-	0.3	-	0.8	2
Tot.	**17**	**2**	**4**	**0.006**	**0.001**	**0.000**	**14**	**5**	**12**	**54**
%	**31%**	**4%**	**8%**	**0.011%**	**0.002%**	**0.000%**	**26%**	**9%**	**23%**	

Table 22: Simplified material composition [%] for the EU10 clustering; 1t of WEEE Generated per each UNU-KEY

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	54%	5%	8%	0.000%	0.000%	0.000%	14%	0%	18%	100%
2	29%	5%	2%	0.000%	0.000%	0.000%	47%	0%	17%	100%
3	20%	4%	2%	0.020%	0.007%	0.001%	36%	7%	31%	100%
4	24%	3%	9%	0.044%	0.003%	0.001%	22%	16%	25%	100%
5a	3%	0%	18%	0.000%	0.000%	0.000%	15%	52%	12%	100%
5b	41%	10%	28%	0.000%	0.000%	0.000%	20%	0%	2%	100%
6	50%	12%	7%	0.000%	0.000%	0.000%	30%	0%	1%	100%
7	12%	5%	4%	0.000%	0.000%	0.000%	56%	0%	23%	100%
8	30%	4%	8%	0.000%	0.000%	0.000%	17%	0%	42%	100%
9	30%	4%	8%	0.000%	0.000%	0.000%	17%	0%	42%	100%
10	35%	3%	5%	0.000%	0.000%	0.000%	15%	0%	41%	100%

In Table 23 and Table 24 each UNU-KEY has been grouped according to the 6 collection categories. The total amount of material does not change, but as expected, the average composition per category is changing.

Table 23: Simplified material composition [t] for the EU6 clustering; 1t of WEEE Generated per each UNU-KEY.

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	2.7	0.3	0.2	0.000	0.000	-	1.2	-	1.6	6
2	1.2	0.1	0.1	0.000	0.000	0.000	1.3	1.4	0.9	5
3	0.1	0.0	0.9	-	-	-	0.8	2.6	0.6	5
4	5.6	0.2	1.3	0.003	0.000	-	1.3	0.7	3.8	13
5	5.9	1.3	1.6	0.001	0.000	0.000	6.2	-	4.1	19
6	1.2	0.3	0.1	0.002	0.000	0.000	3.1	-	1.3	6
Tot	**17**	**2**	**4**	**0.006**	**0.001**	**0.000**	**14**	**5**	**12**	**54**
%	**31%**	**4%**	**8%**	**0.011 %**	**0.002 %**	**0.000 %**	**26%**	**9%**	**23%**	

Table 24: Simplified material composition [%] for the EU6 clustering; 1t of WEEE Generated per each UNU-KEY.

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	45%	6%	3%	0.000%	0.000%	0.000%	20%	0%	26%	100%
2	24%	3%	3%	0.006%	0.003%	0.001%	26%	27%	18%	100%
3	3%	0%	18%	0.000%	0.000%	0.000%	15%	52%	12%	100%
4	43%	2%	10%	0.023%	0.000%	0.000%	10%	6%	29%	100%
5	31%	7%	9%	0.005%	0.001%	0.000%	32%	0%	21%	100%
6	20%	5%	2%	0.026%	0.008%	0.002%	51%	0%	21%	100%

But WEEE Generated is varying per each UNU-KEY and the analysis above need to take into account the forecast of WEEE Generated per each UNU-KEY. Assuming a collection rate of 100% across all UNU-KEYs, the impact of different waste generation patterns for each UNU-KEY in 2018 (using WEEE Generated from [EC UNU 2014]), is assessed. The analysis considers the material composition for each UNU-KEY at waste generation level. This might differ from the actual mass balance that can result at each individual recycling plant, as complementary flows and leakages might affect in different ways, at national and local level, the streams. Those dynamics are hard to predict or to trace and they are more linked to enforcement of legal provisions and

monitoring rather than to the target setting mechanism. Therefore they are not taken into account. In the tables below, data for WG in 2018 – when the shift to new collection category takes place – is used. The tables show the result of such calculations under the assumptions previously explained.

Table 25: Simplified material composition for the EU10 clustering; WEEE Generated estimations for 2018 (kt)

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	2,800	199	276	0.002	0.000	-	715	-	853	4,843
2	402	63	41	0.005	0.001	-	466	-	169	1,141
3	356	39	24	0.100	0.035	0.010	438	148	278	1,284
4	514	62	63	0.276	0.020	0.010	296	318	221	1,474
5a	-	-	21	-	-	-	23	135	23	203
5b	302	71	18	-	-	-	13	-	1	405
6	127	13	11	-	-	-	79	-	2	232
7	6	5	2	-	-	-	82	-	20	114
8	12	0	3	-	-	-	3	-	19	37
9	30	6	8	-	-	-	31	-	37	112
10	15	2	2	-	-	-	8	-	15	42
Tot	**4,565**	**461**	**470**	**0.382**	**0.056**	**0.020**	**2,153**	**601**	**1,640**	**9,889**
%	**46%**	**5%**	**5%**	**0.004 %**	**0.001%**	**0.000 %**	**22%**	**6%**	**17%**	

Table 26: Simplified material composition for the EU10 clustering; WEEE Generated estimations for 2018 (%)

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	58%	4%	6%	0.000%	0.000%	0.000%	15%	0%	18%	100%
2	35%	6%	4%	0.000%	0.000%	0.000%	41%	0%	15%	100%
3	28%	3%	2%	0.008%	0.003%	0.001%	34%	11%	22%	100%
4	35%	4%	4%	0.019%	0.001%	0.001%	20%	22%	15%	100%
5a	0%	0%	11%	0.000%	0.000%	0.000%	11%	67%	11%	100%
5b	75%	18 %	4%	0.000%	0.000%	0.000%	3%	0%	0%	100%
6	55%	5%	5%	0.000%	0.000%	0.000%	34%	0%	1%	100%
7	5%	4%	1%	0.000%	0.000%	0.000%	71%	0%	18%	100%
8	32%	1%	8%	0.000%	0.000%	0.000%	7%	0%	51%	100%
9	27%	6%	7%	0.000%	0.000%	0.000%	27%	0%	33%	100%
10	37%	4%	4%	0.000%	0.000%	0.000%	18%	0%	37%	100%

Table 27: Simplified material composition for the EU6 clustering; WEEE Generated estimations in 2018 (kt)

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	981	87	46	0.000	0.000	-	423	-	163	1.699
2	334	40	36	0.066	0.028	0.013	326	414	194	1.344
3	-	-	21	-	-	-	23	135	23	203
4	1,724	66	249	0.208	0.000	-	341	51	775	3.207
5	1,264	239	103	0.043	0.010	0.003	711	-	392	2.710
6	261	28	15	0.065	0.018	0.005	329	-	93	726
Tot	**4,565**	**461**	**470**	**0**	**0**	**0**	**2,153**	**601**	**1,640**	**9,889**
%	**46%**	**5%**	**5%**	**0.004%**	**0.001%**	**0.000%**	**22%**	**6%**	**17%**	

Table 28: Simplified material composition for the EU6 clustering; WEEE Generated estimations for 2018 (%)

Cat	Fe	Cu	Al	Ag	Au	Pd	Plastics	Glass	Other	Total
1	58%	5%	3%	0.000%	0.000%	0.000%	25%	0%	10%	100%
2	25%	3%	3%	0.005%	0.002%	0.001%	24%	31%	14%	100%
3	0%	0%	11%	0.000%	0.000%	0.000%	11%	67%	11%	100%
4	54%	2%	8%	0.006%	0.000%	0.000%	11%	2%	24%	100%
5	47%	9%	4%	0.002%	0.000%	0.000%	26%	0%	14%	100%
6	36%	4%	2%	0.009%	0.003%	0.001%	45%	0%	13%	100%

Figure 4 and Figure **5** give a more realistic picture of the impact of the new collection category clustering, considering the WEEE Generation patterns of each individual UNU-KEY, aggregated at EU level. The main elements already highlighted in the analysis with same amount of WEEE generated remains valid, but is important to highlight that:

- The total amount of Iron (Fe) resulting from the former category 1 (Large Household Appliances) is with the EU6 clustering spread over the new categories 1, 4 and 5 mainly. In particular the split of "Temperature Exchange Equipment" and "Large Equipment" is playing a key role. In addition, some products containing a significant amount of Iron are ending up in "Small Equipment" category anyway.
- For non-ferrous metals (copper and aluminium) the main shift is to the new categories 4 and 5.
- The case of precious metals is showing higher concentration of silver in category 4 and in category 2 for gold and palladium. The second is mainly linked to the presence of those metals in LCD screens, now grouped into one category while previously reported into two different ones (IT and Consumer Electronics).
- The main difference can be seen for glass: the higher concentration is in new category "Screens, monitors and equipment containing screens having a surface greater than 100cm^2", as the amount contained in lamps is minor.
- Plastics are becoming more and more a crosscutting material, with a significance presence in many products belonging to different collection categories anyway.

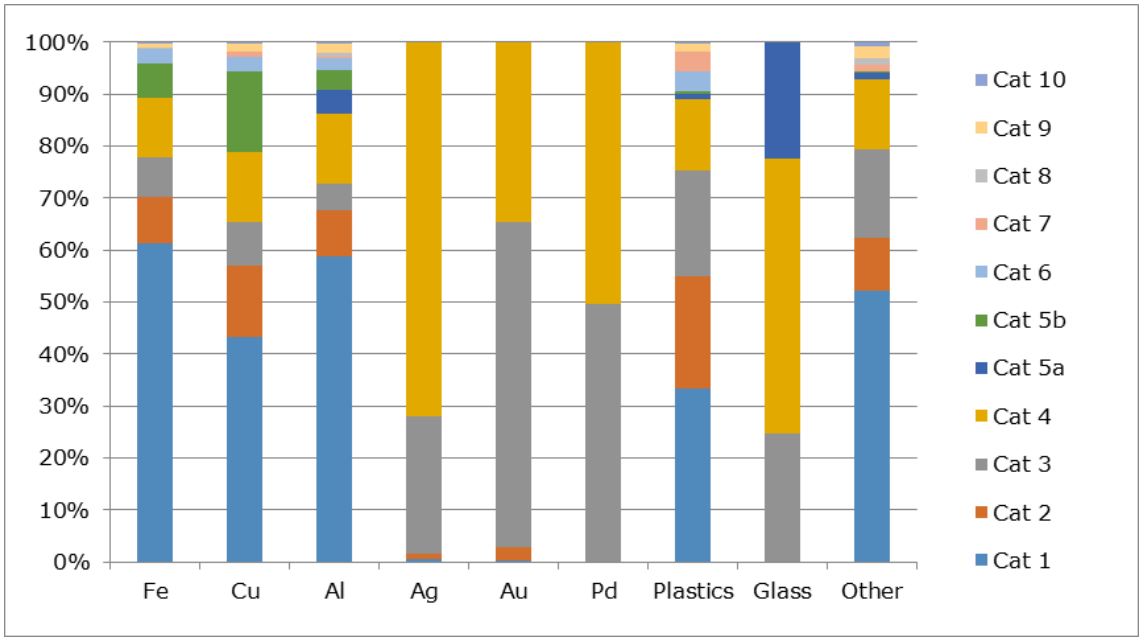


Figure 4: Presence of key materials across different product categories (2018 WEEE Generated amount per each UNU-KEY); 10 product categories

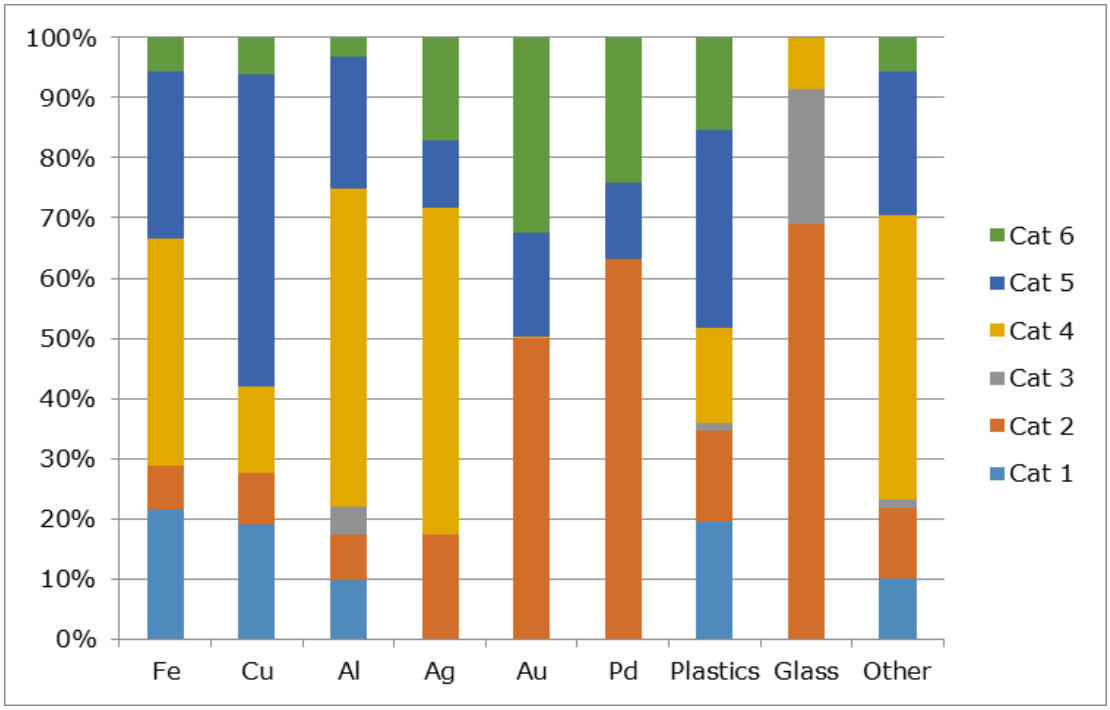


Figure 5: Presence of key materials across different product categories (2018 WEEE Generated amount per each UNU-KEY); 6 collection categories

Despite the differences (both looking at the theoretical calculations assuming 1t on WEEE Generated per UNU-KEY, or the specific 2018 WEEE Generated estimations), highlighted above, the new clustering of products into 6 "collection oriented" categories rather than the former 10 "product oriented" categories is much closer to the reality of collection and treatment operations.

2.6 Considerations on consequences and impacts of setting new recovery targets

The following paragraph analyses how the transition from the old clustering to the new one might impact looking at four different aspects:

- Environmental impacts
- Legal compliance with the target itself and its achievability by industry
- Compliance with raw material strategy of EU
- Administrative burden in reporting performances along the chain

2.6.1 Environmental impacts

From an environmental perspective the new recovery target (in the Part 2 and Part 3 formulation) have been compared with the 2015 ones, considered as baseline scenario. The environmental impacts of collecting, treating and recycling WEEE is most closely linked to the avoidance of material production due to recycling. Only the simplified material composition of Table 26 and Table 28 has been taken into account. The scenarios have therefore been compared in terms of the carbon dioxide (CO_2) emissions they could each avoid by recycling the maximum amount of materials included in WEEE. Three scenarios are compared, using WEEE Generated data for 2018:

- Recycling rate of 2015
- Recycling rate of 2018 under EU10 clustering
- Recycling rate of 2018 under EU6 clustering

In all the three scenarios the results has been calculated at UNU-KEY level and displayed in Table 29 below in EU10 and EU6 format allowing cross-comparison. The totals are the same, in each scenario, but the contribution of different categories is different, depending on the quantities of WG in each category and on the material composition and thus the impact on CO_2 emissions.

Table 29: Mt of CO_2 avoided with recycling of 100% of WEEE Generated in 2018

Mt CO2 avoided	2015 Recovery Target (EU10)	2018 Recovery Target (EU10)	2018 Recovery Target (EU6)
Category			
1	-11.2	-12.0	-11.7
2	-2.0	-2.1	-2.1
3	-2.6	-2.7	-2.4
4	-2.8	-3.0	-2.7
5	-1.0	-1.1	-1.2
6	-0.4	-0.5	-0.6
7	-0.2	-0.2	-0.2
8	-0.0	-0.0	-0.1
9	-0.2	-0.2	-0.2
10	-0.1	-0.1	-0.1
Total	**-20.4**	**-21.9**	**-21.3**

Mt CO2 avoided	2015 Recovery Target (EU10)	2018 Recovery Target (EU10)	2018 Recovery Target (EU6)
Category			
1	-3.9	-4.2	-4.2
2	-2.3	-2.5	-2.5
3	-0.2	-0.3	-0.4
4	-7.1	-7.6	-7.8
5	-5.1	-5.5	-5.0
6	-1.7	-1.9	-1.5
Total	**-20.4**	**-21.9**	**-21.3**

Enforcing the 2018 targets would lead, as expected, to a slight increase of the environmental benefits resulting from the increase in material recovered and recycled. When clustering the targets according to the EU6 clustering system, the benefits estimated in the table (according to EU10) are slightly lower for the 2018 targets. This is mainly due to the lower amount of material recovered, as already discussed previously.

2.6.2 Legal compliance

The definition of new recovery targets linked to the six "collection oriented" categories rather than the former ten "product oriented" categories might influence the compliance aspects. Figure 6 and Figure 7 display the breakdown of material composition according to Table 26 and Table 28 and the relevant recycling target; Category 5 has been split in 5a (lamps) and 5b (luminaires). The analysis is carried out considering the recycling target in particular, as more linked to the recovery operations done in pre-processing facilities while recovery activities might include also other options, according to the Waste Framework Directive definitions.

The potential impact of re-use is not considered, as in such a case the entire weight of the appliance should be taken into account, and no longer the individual material fractions.

Also, the analysis assumes that the entire amount of WEEE Generated is treated, not factoring for different return rates or cherry-picking effect that might influence the actual material composition of the waste stream at each individual recycling plant.

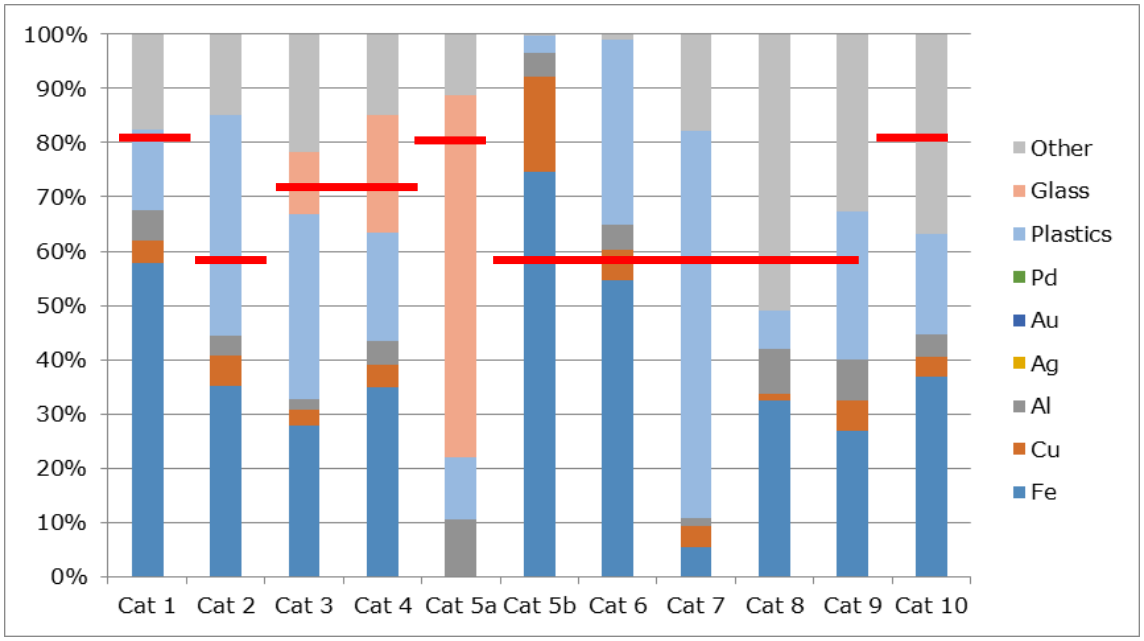


Figure 6: Material composition and recycling targets for EU10 clustering

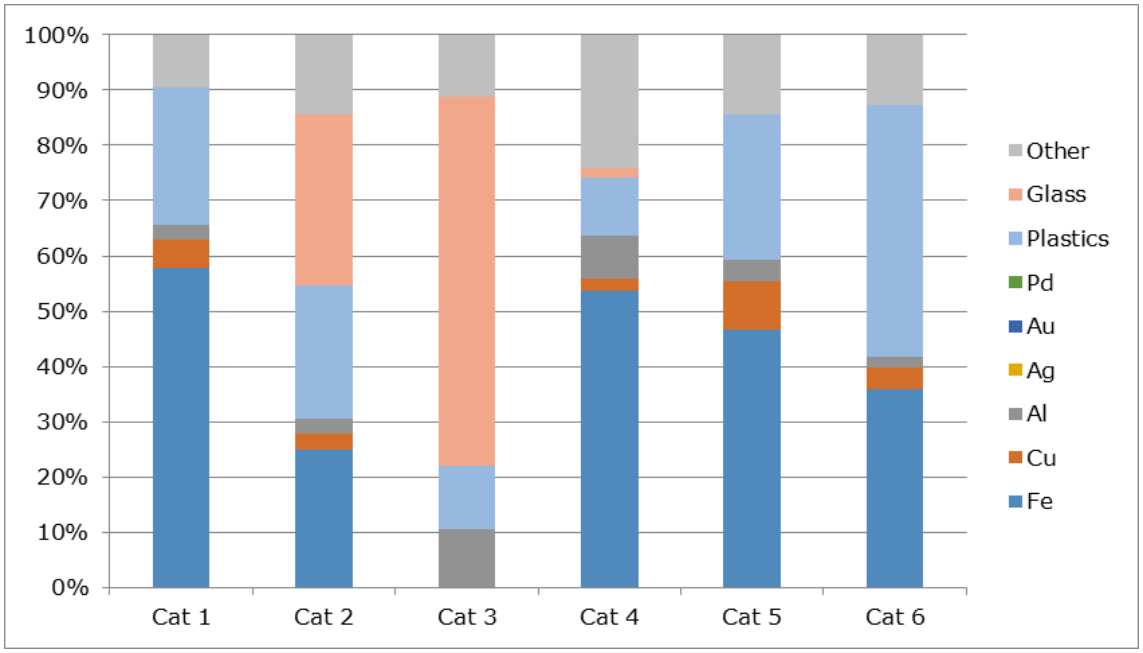


Figure 7: Material composition and recycling targets for EU6 clustering

At the operational level for the treatment and processing industry, the EU6 categorisation is closer to the way waste streams are processed in practice than the EU10 categorisation. The compliance aspects are discussed in more details taking into account the 6 "collection oriented" categories rather than the 10 "product oriented" categories.

For each category, the different fractions are listed and the compliance implications are qualitatively discussed.

Table 30: Material composition and compliance aspects for Category 1

Cat 1	Simplified Composition	Cumulated	Compliance Aspects: Recycling target: 80%
Fe	57.70%	57.70%	Usually one of the main target fractions. No particular difficulties in metal recovery. Losses might occur mainly due to cross-contamination of other fractions.
Cu	5.20%	62.90%	Usually one of the main target fractions. No particular difficulties in metal recovery. Losses might occur mainly due to cross-contamination of other fractions (mainly plastics, as non-ferrous metals).
Al	2.70%	65.60%	Usually one of the main target fractions. No particular difficulties in metal recovery. Losses might occur mainly due to cross-contamination of other fractions (mainly plastics, as non-ferrous metals).
Plastics	24.70%	90.30%	Usually without Brominated Flame Retardants (BFRs).
Glass	0.00%	90.30%	
Ag	0.000006%	90.30%	
Au	0.000002%	90.30%	
Pd	0.00%	90.30%	
Other	9.70%	100.00%	CFC/HCFC as well as contaminated oil, PCB capacitors, PUR foam are the main hazardous substances to dispose of according to Annex VII.
Total	**100.0%**		

Table 31: Material composition and compliance aspects for Category 2

Cat 2	Simplified Composition	Cumulated	Compliance Aspects: Recycling target: 70%
Fe	25.80%	25.80%	As in Cat 1.
Cu	3.00%	28.80%	As in Cat 1.
Al	2.80%	31.60%	As in Cat 1.
Plastics	24.50%	56.10%	A share of the plastics fraction might contain BFRs and should be removed according to Annex VII requirements. BFR mainly contained in TV housing and monitor & TV sets (Wager et al, 2010).
Glass	29.60%	85.70%	
Ag	0.005024%	85.71%	Presence and recovery of precious metals, in different concentration, is neglectable from a compliance perspective, given the mass.
Au	0.002150%	85.71%	Presence and recovery of precious metals, in different concentration, is neglectable from a compliance perspective, given the mass.
Pd	0.000968%	85.71%	Presence and recovery of precious metals, in different concentration, is neglectable from a compliance perspective, given the mass.
Other	14.29%	100.00%	Hazardous components listed in Annex VII should be disposed of accordingly. For this category mercury contained in backlights and LCDs are main elements of concerns.
Total	**100.0%**		

Table 32: Material composition and compliance aspects for Category 3

Cat 3	Simplified Composition	Cumulated	Compliance Aspects: Recycling target: 80%
Fe	0.00%	0.00%	As in Cat 1.
Cu	0.00%	0.00%	As in Cat 1.
Al	12.50%	12.50%	As in Cat 1.
Plastics	10.90%	23.40%	
Glass	66.70%	90.10%	
Ag	0.00%	90.10%	As in Cat 1.
Au	0.00%	90.10%	As in Cat 1.
Pd	0.00%	90.10%	As in Cat 1.
Other	9.90%	100.00%	Hazardous components listed in Annex VII should be disposed of accordingly. For this category, mercury and other heavy metals are the main elements of concerns.
Total	**100.0%**		

Table 33: Material composition and compliance aspects for Category 4

Cat 4	Simplified Composition	Cumulated	Compliance Aspects: Recycling target: 80%
Fe	53.60%	53.60%	As in Cat 1.
Cu	2.00%	55.60%	As in Cat 1.
Al	7.80%	63.40%	As in Cat 1.
Plastics	10.40%	73.80%	Usually without BFRs.
Glass	1.50%	75.30%	Mainly from PV panels.
Ag	0.005986%	75.31%	As in Cat 1.
Au	0.000003%	75.31%	As in Cat 1.
Pd	0.00%	75.31%	As in Cat 1.
Other	24.69%	100.00%	Hazardous components listed in Annex VII should be disposed of accordingly.
Total	**100.0%**		

Table 34: Material composition and compliance aspects for Category 5

Cat 5	Simplified Composition	Cumulated	Compliance Aspects: Recycling target: 55%
Fe	46.00%	46.00%	As in Cat 1.
Cu	8.80%	54.80%	As in Cat 1.
Al	4.30%	59.10%	As in Cat 1.
Plastics	26.30%	85.40%	Approximately 30% might contain BFRs. Particularly in IT housings [Waeger et al. 2010]. This fraction should be handled appropriately.
Glass	0.00%	85.40%	
Ag	0.001629%	85.40%	As in Cat 1.
Au	0.000368%	85.40%	As in Cat 1.
Pd	0.000102%	85.40%	As in Cat 1.
Other	14.60%	100.00%	Hazardous components listed in Annex VII should be disposed of accordingly. Appliances of this category might include batteries, PCB containing and other capacitors and toner cartridges.
Total	**100.0%**		

Table 35: Material composition and compliance aspects for Category 6

Cat 6	Simplified Composition	Cumulated	Compliance Aspects: Recycling target: 55%
Plastics	35.80%	35.80%	Might contain BFRs. Particularly in IT housings [Waeger et al, 2010].
Fe	3.90%	39.70%	As in Cat 1.
Other	2.00%	41.70%	Hazardous components listed in Annex VII should be disposed of accordingly. For this category might include batteries, PCB containing and other capacitors.
Cu	45.40%	87.10%	As in Cat 1.
Al	0.00%	87.10%	As in Cat 1.
Ag	0.009017%	87.11%	As in Cat 1.
Au	0.002539%	87.11%	As in Cat 1.
Pd	0.000678%	87.11%	As in Cat 1.
Glass	12.89%	100.00%	
Total	**100.0%**		

As already pointed out in [EC UNU 2008], the rationale behind recycling and recovery targets is to have an incentive for optimising material recovery, on a weight basis. However, the general appropriateness of these targets should be accompanied by incentives for the inputs and outputs of treatment processes as well as other environmental considerations than recycling of kg's alone. These other conditions are:

- Loss of low concentration but highly valuable materials (environmentally and economically), which will be addressed in particular in the following chapter
- The control over toxic substances, health and safety and
- General optimisation of secondary material streams to downstream processes.

For all metal dominated material fractions, the environmental and economic optimisation goes hand in hand as long as decontamination and particularly the requirements of Annex VII are enforced. This is particularly the case for appliances

containing CFC/HCFC (EU6 category 1 – Temperature Exchange Equipment): control over the CFC is the first environmental priority and recycling will take place more or less by itself after the CFC removal step.

For other products the enforcement of Annex VII requirements is also crucial, and in particular for:

- LCD screens and proper and safe removal of mercury (Hg) backlights; same count for Hg containing lamps in category 3.
- Smaller products, mainly ending up in category 5 and 6, and the resulting mixed plastics: the presence of BFR's as well as various plastic types present might affect the achievability of the target from a compliance perspective but more importantly the BFR containing fractions should be dealt appropriately. Presence of BFR plastics might also be relevant for category 2.

From a compliance perspective EU6 category 2 (Screens, monitors and equipment containing screens having a surface greater than 100cm^2), with the presence of lead-containing glass, have one of the most critical elements. Figure 8 shows how the content of lead containing glass, mainly from cone of CRT is varying over time, compared to the total amount of material of the waste arising in the category.

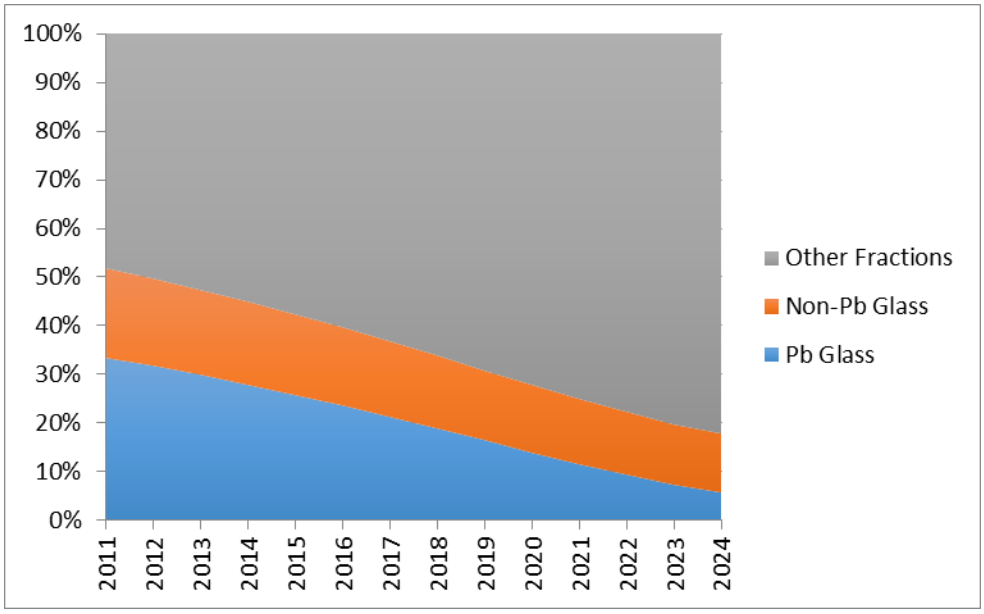


Figure 8: Evolution of Lead-containing glass in category 2 "Screens, monitors and equipment containing screens having a surface greater than 100cm2" over time for EU28 in tonnes

2.6.3 Raw material strategy

Recovery and recycling targets in particular play also a crucial role when it comes to strategic development of EU policy for critical raw materials. Already in 2010 an expert group working of the Raw Materials Supply Group chaired by the European Commission identified 14 metals[4] as critical for EU economy. In the 2011 Communication on raw materials[5], the Commission formally adopted such initial list; in addition committed to monitor the potential inclusion of other materials and identified priority actions, which also resulted in specific funding track – the new Horizion2020 research-funding scheme. In 2013 the initial list was updated and includes now 20 materials[6].

Many of those elements are widely used by the electronic industry, but in the majority of cases in very limited quantities (ppm) in individual products. This means that, despite their criticality, a weight based recycling target does not represent a trigger for their recovery.

- Some of the precious metals are recovered because of their economic value, but from a legal compliance perspective, the recycling target does not create a binding instrument to ensure a proper recovery for some of those materials.
- Although the recovery targets as set out in Article 11 and Annex V of the Directive are calculated on the basis of weight of WEEE entering the recycling or recovery facility and not on the basis of weight of materials coming out of the facilities, from a resource management perspective for some key metals it would be interesting to investigate how the potential losses, as a result of sub-standard treatment in the end-processing phase, can be minimized.
- A good example tackling those aspects in particular for copper and the precious metal containing fractions is provided by the new EERA and EuroMetaux Standard on End-Processing [EERA 2014]
- The standard provides guidance on how to calculate the recycling and recovery rate considering the alternative operations for different fractions. This could increase consistency on how the performances of different plants are calculated and reported (see Table 36)
- The standard sets minimum recycling and recovery rate as acceptance criteria for the plant. This means that minimum recovery and recycling technical capability should be a key driver.
- The standard sets minimum recycling efficiency for some of the elements included in the fractions accepted by the plant. This represents the most relevant step forward as limiting the potential dissipation and losses in the process and create a level playing field for development of new technologies as well. For Cu, Au, Ag and Pd recycling efficiency shall be at least 90% (based on 100% input).

[4] Antimony, Indium, Beryllium, Magnesium, Cobalt, Niobium, Fluorspar, PGMs (Platinum Group Metals), Gallium, Rare earths, Germanium, Tantalum, Graphite and Tungsten.

[5] COM (2011)25 of 2 February 2011

[6] Antimony, Indium, Beryllium, Borates, Chromium, Magnesium, Magnesite, Phosphorate rock, Coking coal, Cobalt, Niobium, Fluorspar, PGMs (Platinum Group Metals), Gallium, REEs (Heavy & Light), Silicon Metal, Germanium, Graphite and Tungsten

Table 36: Guidance on recovery and recycling calculations defined by EERA and EuroMetaux standard for end-processing [EERA 2014]

Material	Characteristic	Classification
Metals	Recycling as metal	R
	Used as reducing agent in the process	R
	Used as a fuel in the process through an oxidising reaction	ER
	Captured in slag for use	R
	Captured in slag for disposal	LD
	Captured in another waste stream	LD
Plastics/Organic compounds	Used as reducing agent in the process	R
	Used as a fuel in the process	ER
	Energy not used	TD
	Used as plastics	R
Inorganic compounds	Used as flux in the process	R
	Captured in slag for use	R
	Captured in slag for disposal	LD
R: Recycling ER: Energy Recovery TD: Thermal Disposal LD: Landfill/Underground disposal		

Such an approach could be expanded to other fractions and critical metals, being in line with the strategic directions of the European Commission to save and use resources to the best possible extent.

2.6.4 Administrative burden

Current reporting is applying the ten "product oriented" categories since 2006 and will apply this system probably until 2018. Operations however, particularly when it comes to material recovery in pre-processing facilities, are already aligned with the new six "collection oriented" categories. This is mainly linked to the specific technological approaches when it comes to the treatment phase of WEEE:

- Former category 1 (large household appliances) is usually split; collection and treatment operations are done separately for cooling and freezing appliances and other large household appliances (category 1 and 4 according to the new classification).
- Screens an monitors from Categories 3 and 4 are usually collected and treated in one single stream (category 2 according to the new classification).
- Lamps are collected and treated in one individual stream (the new category 3).
- The remaining products belonging to other categories are usually collected in one single stream. With the new classification they will mainly end up either in category 5 or in category 6. The main news might be represented by the creation of a new "collection oriented" category 6 (Small IT and Telecommunication equipment), which, in many Member States, was not previously used.

The transition from EU10 to EU6 is thus much closer to the reality of take back operations. This can indeed increase the consistency in data reporting and limit the administrative burden of artificially split the amount processed according to waste streams back to product categories.

This might also increase consistency in data reporting and solve some of the data inconsistency aspects that current reporting highlighted: Under EU10 some WEEE classified in different categories, though actually treated together, were subject to different recovery and recycling targets. This in practice was hard to track, measure and report back given that treatment operators usually report recycling performances

according to waste streams. They are indeed treating waste received according to streams that are technology driven and not on the basis of the EU10 clustering. Reporting performances back to EU10 level is usually done with artificial methods and backward and calculations.

Table 37 shows the actual ten "product oriented" categories and the current recycling targets; the third column of the table shows how, in practice, products belonging to each category might be treated.

For instance a printer (having a recycling target of 70% under EU10 Category 3), hairdryer (50% under EU10 Category 2), and a microwave (80% under EU10 Category 1), despite belonging to different product categories, are usually treated in the same line with similar recovery performances of the different material fractions.

Table 37: Recycling targets for different appliances falling in same collection and treatment stream

Category (EU10 clustering)	Recycling target (2015 - 2018)	Actual treatment stream
Cat 1	80%	Stream: Cooling and freezing Stream: Large household appliances Stream: Small household appliances
Cat 2	50%	Stream: Small household appliances
Cat 3	70%	Stream: Small household appliances Stream: Screens *Possibly Small IT in the future*
Cat 4	70%	Stream: Small household appliances Stream: Large household appliances for PV panels Stream: Screens *Possibly Small IT in the future*
Cat 5	80%	Stream: Small household appliances Stream: Lamps
Cat 6	50%	Stream: Large household appliances Stream: Small household appliances
Cat 7	50%	Stream: Large household appliances Stream: Small household appliances
Cat 8	50%	Stream: Large household appliances Stream: Small household appliances
Cat 9	50%	Stream: Large household appliances Stream: Small household appliances
Cat 10	80%	Stream: Cooling and freezing Stream: Large household appliances

This means that the transition from EU10 to EU6 provides a simplification which is affecting recyclers or producers, which are the entities responsible for the primary reporting, but might also have positive effects at Member State level, when consolidating and checking for data consistency.

The change to new recovery targets maintains a similar level of ambition in terms of environmental benefits while simplifying reporting thereby reducing administrative burden and facilitating better legal compliance. However, the new targets, based on mass recovery only, do not represent a strong incentive to recover strategic materials according to the EU raw material strategy.

2.7 Current performances of Member States

To assess whether the ambition level of the target is achievable for Member States, the performance on future 2018 recycling and recovery targets under the new EU6 categorisation is estimated based on the current performance of those Member States. This means transforming the current performances reported by Member States and benchmark them with the expected rates in 2018.

For this, as a first step the figures for collection, recycling and recovery performance in tonnes reported by each Member States to Eurostat in EU10 categorisation are disaggregated to the 54 UNU-KEYs. Most recent reported data has been used, generally 2012. In cases where no figures for 2012 are available, the last available dataset is used for the Member State, normally 2010. For Italy, Croatia and Malta no Eurostat data on current recycling and recovery performance was found, therefore they are excluded from the calculations.

Afterwards, the recovered and recycled amounts (in tonnes) are re-clustered as EU6 categories, transformed into percentage and compared with the target performances for recycling and recovery for 2018.

The result of this calculations show that at European level (excluding the countries where no data was available), both the recovery and recycling targets in Annex V, Part 3 for EU6 categories will be achieved (see Table 38).

Table 38: Overall European performance on recovery and recycling & re-use targets in Annex V, Part 3 based on current performance [%]

Category	Recovery Target: Annex V, Part 3	Overall EU Performance	Recycling Target: Annex V, Part 3	Overall EU Performance
1	85%	85%	80%	80%
2	80%	87%	70%	80%
3	N.D.	N.D.	80%	93%
4	85%	86%	80%	80%
5	75%	88%	55%	80%
6	75%	82%	55%	77%

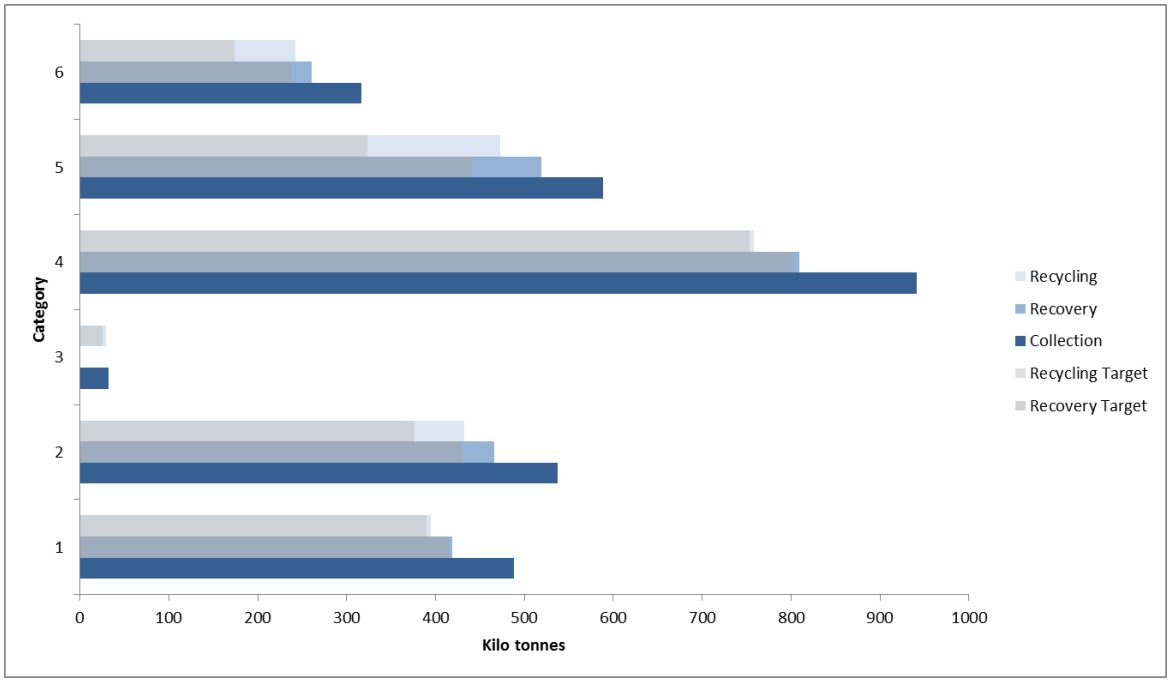


Figure 9: Overall European performance on recovery and recycling & re-use targets in Annex V, Part 3 based on current performance [kilo tonnes]

Even when the targets are achieved on European level, there are differences in performance between the Members States, and not all Member States achieve the targets. Of the 25 Member States for which data was available, ten Member States achieve the recovery targets for EU6 categories, and ten achieve the recycling targets for all EU6 categories. However, only seven Member States achieve both recovery and recycling targets for all EU6 categories. Based on current performance, most Member States, however, would not meet recovery and recycling targets for all 6 categories. In general, it can be assumed, that most of the countries perform better on recycling & re-use targets than on recovery targets.

Table 39: Recovery performance EU6-2018

Recovery Performance 2018 against Annex V, Part 3 targets based on current performance						
	CAT1	CAT2	CAT3	CAT4	CAT5	CAT6
AUT			na			
BEL			na			
BUG			na			
CYP			N.A.			
CZE			N.A.			
DEU			N.A.			
DNK			N.A.			
EST			N.A.			
ESP			N.A.			
FIN			N.A.			
FRA			N.A.			
GRE			N.A.			
HRV	No data	No data	N.A.	No data	No data	No data
HUN			N.A.			
IRL			N.A.			
ITA	No data	No data	N.A.	No data	No data	No data
LTU			N.A.			
LUX			N.A.			
LVA			N.A.			
MLT	No data	No data	N.A.	No data	No data	No data
NLD			N.A.			
POL			N.A.			
PRT			N.A.			
ROU			N.A.			
SWE			N.A.			
SVN			N.A.			
SVK			N.A.			
GBR			N.A.			

Table 40: Recycling performance EU6-2018

Recycling Performance 2018 against Annex V, Part 3 targets based on current performance						
	CAT1	CAT2	CAT3	CAT4	CAT5	CAT6
AUT						
BEL						
BUG						
CYP						
CZE						
DEU						
DNK						
EST						
ESP						
FIN						
FRA						
GRE						
HRV	No data	No data	No data	No data	No data	No data
HUN						
IRL						
ITA	No data	No data	No data	No data	No data	No data
LTU						
LUX						
LVA						
MLT	No data	No data	No data	No data	No data	No data
NLD						
POL						
PRT						
ROU						
SWE						
SVN						
SVK						
GBR						

Where targets are not achieved, the distance to target is <5% for most Member States and most categories, suggesting that the difference cannot be considered as statistically significant.

Detailed recovery and recycling performance at Member State level for each EU6 category is given in Appendix II.

Taking a category level perspective, EU6 Category 1 and Category 4 have the lowest target achievement. This is reflecting current underperformance in the achievement of targets for EU10 of Category 1 (Large Household Appliances), as the products from EU10 Category 1 are split between EU6 Category 1 and 4. Coupled with the low rates of recycling and recovery of EU10 Categories 8, 9 and 10 for many Member States,

the EU6 categorisation accumulates those deficits. However, as mentioned before, the deficit to reach the targets of the six categories are for most of the Member States less than 5%, therefore on a category level the deficits to target are not considered significant.

Table 41: Recovery and recycling performances of Member States according to EU6 clustering

Number of MS achieving target		
	Recovery	Recycling
CAT1	14	16
CAT2	19	21
CAT3	not applicable	19
CAT4	14	17
CAT5	23	25
CAT6	19	24

The assessment exercise also highlights important aspects for the implementation and particularly the monitoring and enforcement of the recovery and recycling targets:

- Data quality and proper reporting: while in most countries data on collection and recovery performance is available until 2012, there are still several countries for which only data from 2010 or even earlier is available. For three Member States, no performance data is available. In addition, for some countries the Eurostat data on recycling or recovery performances expressed as percentage is not matching with the data reported in tonnes for the same year.
- In [EC UNU 2014] the difficulties faced by Member States in meeting collection target has been analysed in detail. Analysis shown that 22 countries will have to double or triple the quantities of WEEE collected in order to reach the collection targets. These countries will have to significantly increase their collection efforts or completely change the way collection is organised. Among the main elements identified as potential barrier to meet the collection targets are enforcement and inspection practice as well as the unaccounted streams. Despite recovery and recycling target being expressed as percentage over the amount collected, it's clear that proper enforcement and tracking of flows are fundamental also to ensure a proper reporting of recovery performances; and this has also a relevant impact on to the increase of data quality.

Taking into account the current performance of EU Member States, it can be concluded, that the targets in Annex V, Part 3 have an equal level of ambition, being neither more nor less ambitious than the targets in in Annex V, Part 2. Fundamentally, however, Member States should substantially increase the efforts to ensure targets are met, even where they are currently compliant.

Accumulating actual performance data of Member States to EU level, it can be concluded that both recycling and recovery targets for EU6 categories are likely achieved. For individual Member States, the targets for some categories may still not be achieved. However, distance to target is less than 5% for most Member States and most categories, suggesting that the difference cannot be considered as statistically significant in relation to the ambition level of the target.

2.8 Conclusions

The chapter investigated how the transition to the new target mechanism (EU6) might affect the level of ambition for the recovery and recycling of WEEE collected in EU28 and influence performances of Member States and industry.

For that, the different criteria taken into account and the conclusions reached are summarised in Table 42. In few cases, as highlighted in the table below, despite the level of ambition is similar, critical points or relevant elements for further investigation are marked.

The overall conclusion is that, the new targets to be applied from 2018 onwards (reported under EU6) maintain a similar level of ambition compared to the targets introduced from 2015 onwards (reported under EU10) in the new WEEE Directive.

Table 42 : Overview of level of ambitions of new targets against selected criteria

Dimensions of Analysis	Level of ambition of recovery and recycling target of Part 3 compared to Part 2 of annex V	Comments
Absolute value of targets	Similar	Only few product categories at UNU-KEY level impacted with changes in targets for recovery and recycling due to transition from EU10 to EU6.
Mass Balance based on WEEE generated at year 2018 (WG2018)	Similar	Practically, mass recovered and recycled is slightly lower, but the change is not statistically significant. The decrease is mainly linked to the decrease of recovery and recycling target for some UNU-KEYs and particularly for the transition from IT and Consumer Electronic product categories (in EU10) to Small Equipment and Small IT (in EU6).
Material composition of waste streams	Similar	Some shifts of material theoretically occur, but no significant changes in practice given the EU6 clustering are much closer to the common operations at collection and treatment level.
Environmental Impact	Similar	No significant changes in environmental performance resulting from re-categorisation. The slight decrease shown in Table 29 is mainly linked to a lower amount of material processed.
Legal compliance	Similar	Critical aspects for compliance with weight based targets remains the presence of Pb-containing glass in Category 2 and the presence of BFR plastics mainly concentrated now in Category 2, 5 and 6. Proper enforcement of Annex VII requirements (and disposal of certain hazardous fractions) should anyway prevail, from an environmental perspective, over the achievement of the mass based recycling target.
Raw Material Strategy	Similar	None of the mass based recovery and recycling target could foster the recovery of critical metals (except those already recovered for their economic value). No eco-efficiency aspects are taken into account currently in the downstream channelling of critical fractions.
Administrative burden	Decrease	Simplifies and streamlines reporting, in line with on-ground processing by treatment operators. Positive effects at Member State level, when consolidating and checking for data consistency.
Recovery & Recycling Performance of Member States	Similar	Overall, at the EU level, the recovery and recycling targets are achievable, though there are large variations between countries, some of which achieve targets, and others which under current performance would not achieve compliance.

As general remarks should also be considered that:

- It is suggested to enforce the new recovery and recycling target from the beginning of the year (1st January 2018 or 1st January 2019) as usually reporting period cover a calendar year. This would simplify the reporting process and reduce administrative burden considering that stakeholders have to use different reporting framework in the course of one single year.
- Currently the recycling and preparation for re-use targets are considered together. This poses some potential challenges in enforcing at operations level the target; Despite from a final reporting from Member States might be easier to consolidate the absolute data on weight basis, it's practically more difficult to enforce at operations level. Producers and Compliance Schemes are usually enforcing recycling targets at treatment operator's level. But in the large majority of cases, those operators are not preparing for re-use any appliance and their performances might only be checked against recovery and recycling.
- The mass of material recycled and recovered is first and foremost influenced by the amount collected and processed. The revised collection targets have a far greater influence on the final material recovered than the recycling and recovery targets.

3 Examination of the possibility of setting separate targets for WEEE to be prepared for re-use

3.1 Purpose and objective

In the current context of decreasing resources, growing pressure on the environment and social inequalities, there is a need to move from the linear model "produce, consume, throw" to a circular economy, where 'nothing is wasted, everything is transformed'. In this perspective, the EU introduced a waste hierarchy where waste prevention is to be favoured over preparation for re-use, itself to be favoured over recycling, to be favoured over recovery and as a last treatment option disposal. Preparation for re-use is at the top of the pyramid because it ensures the product recovers its maximum potential, with a minimum use of resources. The new WEEE Directive (in particular Annex V, Part 2 and 3) yet provides combined targets for preparation for re-use *and* recycling per WEEE category. Member States and involved stakeholders (e.g. collective schemes for WEEE) can thus reach the targets by favouring recycling over preparation for re-use. As a consequence the option of preparing for re-use might be neglected.

This task aimed to conduct an analysis and provide recommendations on the feasibility and practicability of **setting separate targets for "preparation for re-use"** for one or more specific WEEE categories identified in Part 3 of Annex V (referred to six categories of Annex III) of the WEEE Directive.

To reach this objective, this task of the project has been divided in four major working steps:

1) Context analysis: review of the definitions, overview of the practices in seven Member States and analysis of the drivers and obstacles for preparation for re-use
2) Assessment of the feasibility of implementing separate targets
3) Analysis of the economic, social and environmental impacts of preparation for re-use
4) Conclusion and recommendations

3.2 Context analysis

3.2.1 Definitions

The Waste Framework Directive defines "re-use" as any operation by which **products or components that are not waste** are used again for the same purpose for which they were conceived. On the other hand, "preparation for re-use" is described as checking, cleaning or repairing operations, by which **products or components of products that have become waste** are prepared so that they can be re-used without any other pre-processing".

Re-use and preparation for re-use can thus be distinguished by the status of the product: non-waste for re-use; waste for preparation for re-use. This distinction is really important since products not considered as waste are not covered by the new WEEE Directive. As a consequence, the Directive may only implement targets on **preparation for re-use**.

However, in reality, both products which can be re-used directly or which require further preparation for re-use operations before re-use are handled by the same stakeholders, and the distinction between the two may be very difficult in practice.

In addition, Member States have interpreted slightly differently the definitions. For some Member States, re-use is the act of putting an EEE again on a market for the same purpose for which it was conceived, regardless of the origin of the EEE (waste or non-waste, whether it has been repaired or not, etc.) while some Member States have distinguished two activities: one is the management of products and the other the management of waste. France for instance went beyond the two original definitions by defining three types of operations:

- "Réemploi": any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.
- "Réutilisation": any operation by which products or components that have become waste are used again.
- "Préparation à la réutilisation": any operation consisting in checking, cleaning or repairing with the objective of recovery, by which products or components of products that have become waste are prepared so that they can be re-used (in the French meaning of reutilisation) without any other pre-processing.

In other words, some Member States will use the term "re-use" throughout the life of the product, while others will limit it to the upstream. It can be questioned whether the two concepts are "mutually exclusive", such as in France where the term used for placing back a product on the market is different when the product has become waste, or if preparation for re-use is just a step prior to re-use. This last interpretation would tend to be the correct one, since the definition of preparation for re-use in the Waste Framework Directive makes re-use the final objective of preparation for re-use: "*checking, cleaning or repairing operations, by which products or components of products that have become waste are prepared* ***so that they can be re-used*** *without any other pre-processing*".

The differences of interpretation amongst Member States will have an impact on tracking the flows. Some countries will tend to focus on the output of re-use centres for example (and report everything to the EC as re-used), while others will pay greater attention to the origin of the EEE (the input) and whether it comes from waste collection points or not. Similarly, some Member States may require facilities that prepare WEEE for re-use to have permits for the management of waste. If this is not applied by all Member States or all stakeholders in the market, there is a risk that illegal activities emerge.

A questionnaire was sent to representatives of Member States in order to gather their point of view on the definitions. Only two Member States out of fifteen did not see any issue with the definitions of "re-use" and "preparation for re-use". Member States raised questions such as:

- How should the activities of refurbishment, maintenance, life extension activities, be considered?
- Can the re-use of parts and components of WEEE be considered as re-use?
- If whole WEEE appliances are prepared for re-use, do they gain the status "end of waste"?
- Should the amount of WEEE which has undergone preparation for re-use be considered in the collection targets of WEEE?
- Should the WEEE prepared for re-use and EEE re-used be considered as placed on the market under producer responsibility principle?
- How will it be possible to assess the amount of re-use when EEE that are not waste do not appear in the statistics?

Those Member States which mentioned in the questionnaire that they were working on the question of re-use and preparation for re-use were contacted again. In parallel, experts of the re-use and preparation for re-use sector were identified. The list of persons interviewed is available in Appendix III. The information collected through the interviews made it possible to identify different types of organisation of the re-use and preparation for re-use sector in the EU. These learnings are presented in the next section.

It should be noted that due to the potential overlap in definitions between preparation for re-use and re-use, as described above, most Member States report on quantities of EEE/WEEE re-used, without specifying if the products have actually become waste and were prepared for re-used. The term re-use as used by Member States can thus potentially include the re-use of EEE and WEEE prepared for re-use. For the purpose of the study, we tried to make it clear in the following sections whether the figures or statements referred to products or waste. When not possible, the broad term "re-use and preparation for re-use" was used. More information on the origin of the flows would need to be reported by Member States.

3.2.2 Member States' approaches and practices related to WEEE preparation for re-use

Seven countries were contacted in order to discuss their current considerations regarding re-use and preparation for re-use: Belgium, Denmark, France, Germany, Ireland, the Netherlands and Spain. These countries were partly selected based on their responses to the questionnaire (if they had reported to be currently discussing the opportunities of preparation for re-use and supplied a contact person). It is the cases of Denmark and the Netherlands. Others were contacted because experts (found on the internet or suggested by the persons interviewed) were identified in these Member States.

The following boxes summarize the key characteristics of these markets.

Country	 - Flanders (Belgium)
Organisation of the sector	The sector is very well organised in Flanders. Komosie, the Flemish network of non-profit organisations involved in recovery activities and energy-cutting activities, has collected and re-used/prepared for re-use textile, furniture, WEEE, etc. (everything that could be re-used in a house) for 20 years. It benefits from a partnership with OVAM, the waste management authority in Flanders, which approves every re-use centre. The region is divided in 31 areas, each with its own re-use centre required by the law VLAREMA. These centres collect EEE and WEEE from households through voluntary drop-off or thanks to their collection services but also from companies and municipalities. The latter pay them for the collection and preparation for re-use. Re-use centres are divided in two types: centres that pre-select reusable products (selective collection); these centres do not need a permit for transport and storage of waste; and centres that collect everything (integral collection) and need a permit. WEEE is mostly collected through integral collection (containers at collection sites,

	retailers, etc.). 20,532 tonnes of (W)EEE were collected by Komosie in 2013 (50% small electronics, 20% TV, 13% cooling equipment, 17% large white goods) and 3,542 tonnes were re-used or prepared for re-use (17% of the total collected). With its other waste streams, Komosie reach a re-use and preparation for re-use rate of 45% overall.
Current state of discussions on preparation for re-use	Flanders implemented a 5kg/capita target for re-use to be reached by 2015, all product and waste streams mixed. The target is based on the output of re-use centres. The target could be raised by 7kg/capita in 2020. OVAM released a guide of good practices to distinguish products that could be re-used and those that should be considered as waste and prepared for re-use (if they meet specific conditions) or discarded. It defines criteria for different categories of EEE based on the general condition of the appliance, its energy consumption and the intention of re-use. A product with no market demand for second hand products (such as CRT screen) or consuming too much energy should be considered as waste and discarded. These criteria can be used by re-use and preparation for re-use centres to assess the potential of re-use of any product or waste. They shall also meet these criteria in order to put a second hand product available on the market. In addition, it can be used by authorities in charge of inspecting exports of used EEE to better identify waste from second hand products. Komosie implemented a quality management system for products to be prepared for re-use (ex: testing of temperature for cooling appliances). It also develops an "ecoscore" where the energy consumption of appliances is measured and displayed on a scale. Products with a higher consumption are sold cheaper in the shops of the Komosie network.
Position on target	Flanders aims to raise its re-use objective and is currently discussing with the Wallon and Brussels regions to improve the reporting of the quantities of waste prepared for re-use.
Key figures	Belgium reported the re-use and preparation of re-use of 4,068 tonnes of WEEE in 2012 on the basis of Commission Decision 2005/369/EC. The quantities re-used and prepared for re-use by the network of Komosie are not taken into account.

Country	 - Denmark
Organisation of the sector	A few social organisations re-use EEE in Denmark but do not do any preparation for re-use activities in order to put WEEE back on the market. WEEE is not accessible to these entities. They solely rely on donations. A more professional market for re-use of EEE, where consumers can sell their used EEE for resale, is under development. Typically products such as smartphones, tablets and high-grade electronic equipment are re-used. Also the consumer-to-consumer market for used EEE seems to be on a rise.
Current state of discussions on preparation for re-use	Denmark launched in 2014 a study assessing different scenarios to develop preparation for re-use. It intends to answer questions such as: Who could be responsible for preparation for re-use? What should be the conditions to meet? Is there a demand for EEE re-used and is preparation for re-use always to be favoured over other treatment options? Finally, can preparation for re-use be profitable? Initiatives to extend the lifetime of EEE are also part of the government's national strategy of waste prevention. In that context test on preparation for re-use potential of collected WEEE is under way and also a lifecycle-analysis of re-use vs. recycling of WEEE.
Position on target	According to the Danish Ministry of Environment, Denmark has not implemented a specific target for preparation for re-use, notably because of the lack of specific target in the Directive. When there is no target a specific target in Denmark requires a visibility on how it could be achieved and what the potential for re-use of WEEE is.
Key figures	No WEEE is reported as re-used or prepared for re-use in Denmark on Eurostat on the basis of Commission Decision 2005/369/EC. But the yearly reporting to the producer register DPA-System is made ready for reporting "prepared for re-use", according to the Danish Ministry.

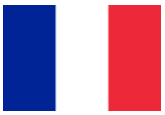
Country	 - Germany
Organisation of the sector	Some local initiatives to prepare for re-use WEEE, run by social enterprises, have emerged in cooperation with municipalities (ex: city clean in Hamburg). **However there is an important competition between re-use centres and municipal waste companies hindering preparation for re-use and its wider application**. Today, municipal waste companies get money from the sale of WEEE to recyclers and there is a high demand for energy recovery, making preparation for re-use not a priority according to Bag Arbeit e.V., the Association of Employment and Training Enterprises in Germany[7]. Direct re-use of used EEE (before the product become waste) is however well developed in Germany, for example through companies offering re-use services in the B2B sector (ex: re-use of computer bulks).
Current state of discussions on preparation for re-use	The German Environmental Agency (UBA) carried out a study in 2010 to assess the opportunities to professionalise the preparation for re-use sector, notably through the implementation of a quality label and development of a mobile testing facility in order to test the potential of re-use of appliances on collection sites. The study found out that testing at the collection site is economically advantageous if quantities of appliances are rather limited in volume and not too many large appliances need to be tested in the same day.
Position on target	According to the association Bag Arbeit e.V, a target would be the only mean to develop preparation for re-use in Germany. However the market makes it difficult for this type of treatment to be competitive today, given the other treatment options. The project created the basis for the decisions that have to be made by a future certification institution (in charge of awarding a potential label), including quality, testing and implementing measures of quality labelling [UBA 2012].
Key figures	Germany reported the re-use and preparation for re-use of **11,845 tonnes of WEEE in 2012** on Eurostat on the basis of Commission Decision 2005/369/EC, ranking second in the EU (based on reported data from Member States). It is mostly due to re-use in the B2B sector.

[7] Bag Arbeit e.V. was initiator and founding member of the Reuse-Network, Brussels. It has has about 400 member organisations and among them more than 60 enterprises dealing with re-use and recycling of mainly WEEE, textiles, furniture and household goods

Country	 - Spain
Organisation of the sector	In Spain, a network of re-use centres is well implemented and has been operating for 20 years (some of their members for more than 45 years). **AERESS re-uses and prepares for re-use 5 to 6% of the EEE/WEEE it collects every year (419t)**. No distinction is made between what is re-used directly and what is prepared for re-use (waste and non-waste). All centres from the network belong to the social economy. They collect WEEE from municipalities, households and distributors and some have contracts with collective schemes. The 5 to 6% of re-use and preparation for re-use rate achieved therefore corresponds to the quantities of EEE re-used and WEEE prepared for re-use from all these sources.
Current state of discussions on preparation for re-use	The draft of the legislative text transposing the 2012/19/EC Directive includes a specific target for preparation for re-use. Initially proposed at 5% of WEEE collected, it has decreased to 2 or 3% and it applies only to two categories (4 and 6). Some regions are particularly willing to develop preparation for re-use. Catalonia published a guide for the development of activities of re-use and preparation for re-use in the collection centres and other public establishments of the region.
Position on target	**Spain is the first country to implement a specific target for preparation for re-use for WEEE**. However, it is not entirely clear if re-use centres will have full access to the waste stream, from the municipalities, distributors, logistics platform or sorting centres. In addition, AERESS expressed concern that recycling companies with dismantling capacities focus on the re-use of spare parts to reach the target, at the expense of the re-use of whole appliances. Finally, the target is to be fulfilled only with whole appliances.
Key figures	Spain reported the re-use and preparation for re-use of 351t of WEEE in 2012 on Eurostat on the basis of Commission Decision 2005/369/EC. AERESS reported 419t of WEEE re-used and prepared for re-use in 2013 which avoided the emission of 1,675t of CO_2, equivalent to 800 cars on the road, or 233,000 trees absorbing the same amount of CO_2 in a year. It employs 1,746 persons, from which 105 are directly related to WEEE re-use and preparation for re-use.

Country	 - Ireland
Organisation of the sector	The re-use of EEE is done mostly by re-use centres in the B2B business. They buy materials (mostly IT equipment) from companies and refurbish it. Some charity shops and re-use centres also rely on donations but to a lesser extent. They do not have access to the WEEE stream.
Current state of discussions on preparation for re-use	The Ministry of Environment of Ireland has defined criteria for the approval of re-use centres. The latter will have to comply with quality standards and have reporting obligations. Some re-use centres specialised in the re-use of IT equipment from the B2B business are likely to be interested in being approved for the re-use of other type of equipment. In 2013, a study was conducted to investigate how preparation for re-use could work in practice. 'Rehab recycle', a company specialised in recycling services with a branch specialised in the re-use of equipment from the B2B sector, partnered with a compliance scheme, and conducted a trial to assess the reusability of WEEE collected through municipalities, retailers and voluntary drop-off. At the end of the trial, the collective scheme gave 'Rebab recycle' a month to sell the equipment. The re-use organisation refused to sign the contract with such a condition; therefore the refurbished machines still belong to the collective scheme and the equipment hasn't been put back on the market yet.
Position on target	According to 'Rehab recycle' and a researcher from the University of Limerick, a target, even a small one, would be necessary to encourage preparation for re-use. Retailers, compliance schemes and recyclers would yet be very reluctant because of the fear of competition of re-used products with primary products and loss of revenue from recycling.
Key figures	Ireland reported the re-use and preparation of re-use of 360t of WEEE in 2012 on Eurostat, on the basis of Commission Decision 2005/369/EC, mostly thanks to its B2B activities.

Country	 - The Netherlands
Organisation of the sector	Re-use is very well developed in the Netherlands. Approved re-use centres have contracts with municipalities. Some are social organisations, while other are classical businesses. The municipalities or the re-use centre collect WEEE by households or the WEEE is discarded by the holder at collection points. The holders sort the WEEE and check if it can be re-used, and the re-use centre judges as a second step as well. If not, it is transported to a recycling facility. The concept of re-use is also very well implemented in the Holland culture. *Marktplaats.nl* is a website where consumers exchange products. The website is widely used by the population. Furthermore there is a wide spread refurbishment sector which focuses on B2B equipment, mainly IT.
Current state of discussions on preparation for re-use	There is no discussion today in the Netherlands regarding a possible target on preparation for re-use of WEEE, as the sector is already well organised.
Position on target	'Wecycle', the organisation in charge of WEEE collection and treatment on behalf of EEE producers, estimate that the Netherlands would not have any issue to reach a target, for instance 5% of collection, if it was implemented. The only question would be how to register it.
Key figures	The Netherlands reported the re-use and preparation for re-use of 475t of WEEE in 2012 on Eurostat on the basis of Commission Decision 2005/369/EC.

Country	 - France
Organisation of the sector	There are three large networks of re-use centres in France (Emmaus, Envie, Réseau des ressourceries) but also a high number of facilities implemented at the local level (almost 2,000 players according to ADEME, the French Environmental Agency). These organisations rely on donations and sometimes on partnerships with the collective schemes. The ones that benefit from a contract with a collective scheme get access to the WEEE collected through municipalities and distributors, and report on the quantities of WEEE they actually repair and put again on the market. 'Eco-systemes', one of the French collective scheme estimated that around 20% of what is collected today is given for preparation for re-use, and 20% of it is actually re-used.
Current state of discussions on preparation for re-use	No specific target for preparation for re-use is discussed today. The French Environmental Agency (ADEME) is very active on the promotion of re-use and preparation for re-use. It released a significant number of studies these last years: on the amount of facilities in the sector, its organisation and the trends for the future, the attitude of French people toward re-use and preparation for re-use, etc.
Position on target	According to 'Eco-systemes', there is a need to clarify first the difference between re-use and preparation for re-use and define a way to report on these activities to be sure that Member States count the same flows. A target would also raise economic questions as a large amount of what is collected today is not reusable due to the damages during handling (except WEEE collected by distributors). This means that the players would need to be subsidised which make it a less interesting option than recycling.
Key figures	France reported the re-use and preparation for re-use of 9,568 t of WEEE in 2012 on the basis of Commission Decision 2005/369/EC.

The information collected shows that the ideal organisation of the re-use and preparation for re-use sector is still unclear for many Member States. There is a need for a clearer legislative framework. These case-studies yet highlighted best practices that seem to be clearly beneficial and that should be promoted.

In Flanders, re-use and preparation for re-use is advanced because it relies on a strong network of both social organisation and businesses specialised in re-use. They are approved by the Waste Management Agency and have to comply with a code of good practices, which vary depending if they select products on collection or collect everything without distinction. It is thus the only region where it is possible to track the different flows that are the closest possible to waste and non-waste. However, the network has been operating on twenty years and on a limited region. It can be questioned whether other Member States could put in place similar initiatives. The Netherlands are also successful in the area of re-use because products with a potential of re-use are sorted at the source by the consumers themselves. Consumers bringing

back products to a collection site sort equipment depending on its potential of re-use. To some extent, this also solves the problem of identifying waste from non-waste EEE and enables the preservation of the re-use potential of the equipment.

It is therefore possible to classify Member States in three categories (based on the seven analysed):

- Member States that have a target in place: Belgium (Flanders), Spain
- Member States that do not have a target but are well advanced: the Netherlands (according to Wecycle). It should be mentioned that the quantities of WEEE re-used reported on Eurostat by the Netherlands lead to a re-use and preparation for re-use rate of less than 1% compared to the quantities of WEEE collected, therefore either the Member State is less performing than expected or the quantities reported are underestimated. According to the persons interviewed, Austria would also be in this category.
- Member States that have implemented initiatives more or less successful, however they are waiting for a clearer framework: Denmark, Ireland, France, Germany (this latter according to Bag Arbeit e.V). It should be mentioned that the quantities of WEEE re-used by Germany reported on Eurostat are high compared to other Member States (2% compared to WEEE collected), however this would be mainly due to re-use in the B2B sector.

There are different forms of organisations for the management of WEEE and practices for re-use and preparation for re-use in the EU. This makes the assessment of the potential for re-use in the EU difficult. In general it can be noted, that re-use and preparation for re-use is not well developed at EU level; with few exceptions at Member State level. The next section aims to analyse why re-use and preparation for re-use is yet not well developed.

3.2.3 Drivers and obstacles for preparation for re-use today

Information collected through the interviews and a literature review (for references see chapter 6) aims to highlight the diversity of factors that hinder the development of a re-use and preparation for re-use market today, and others that facilitate it. Obstacles and drivers can be legal, organisational, economic or even environmental, and are summarised in the table below. They are also described in more details in the following paragraphs. It is likely that this list is not exhaustive as the influencing factors may vary depending on the local, regional or national contexts and the stakeholders involved.

Table 43: Obstacles vs. Drivers for re-use and preparation for re-use

Obstacles for preparation for re-use	Drivers for preparation for re-use
▪ Access to the waste streams by re-use facilities and quality of materials collected ▪ Design of the products and availability of spare parts ▪ Lack of appropriate logistics ▪ Costs for municipalities ▪ Resistance from producers ▪ Consumer perception toward re-use ▪ Legislative framework (no separate target on preparation for re-use) ▪ Expertise required for preparation for re-use ▪ Restrictions on trans-boundary shipments ▪ Unfair competition (notably from re-use organisations which do not respect quality standards)	▪ Quality control for re-use ▪ Security standards ▪ Open dialogue between manufacturers and re-use organisations ▪ Commitment of local authorities towards re-use ▪ Policies favouring social activities and funding ▪ Marketing of second-hand products ▪ Education for people involved in re-use and refurbishment

Obstacles

- **Access to the waste stream and quality of materials collected**

Article 6 of the WEEE Directive implies that:

"*Member States shall ensure that the collection and transport of separately collected WEEE is carried out in a way which allows optimal conditions for preparing for re-use, recycling and the confinement of hazardous substances.*

In order to maximise preparing for re-use, Member States shall promote that, prior to any further transfer, collection schemes or facilities provide, where appropriate, for the separation at the collection points of WEEE that is to be prepared for re-use from other separately collected WEEE, in particular by granting access for personnel from re-use centres".

The practice shows however that today a **lot of re-use organisations do not have access to WEEE at the early stage of collection.**

In addition, WEEE is not always collected in a way that preserves the potential of re-use of the equipment. A trial study carried out in Ireland in order to identify the reusability of WEEE showed, that the quality of materials brought at the trial site was very low. The majority of the equipment displayed creases [Rehab 2015].

The collection model from retailers (i.e. material collected on pallets and wrapped in an attempt to reduce potential damage during transport), lends itself to providing raw material in better quality for re-use. However, a study carried out by StEP on the barriers and success factors of re-use, showed that today retailers can take back the appliances straight to the scrap dealers, thus decreasing the quality of WEEE available to re-use organisations [StEP, 2015].

Early segregation of products is necessary to avoid damages of the equipment at collection sites or during transportation, due to manipulation, weather or theft.

- **Design of the products and availability of spare parts**

RREUSE, the network of the re-use centres in Europe, carried out a study to identify the obstacles for the repair of fridges, dishwashers and washing machines [RREUSE 2013]. It identified the following issues:

- Rapid change of product design and difficulty in access to spare parts: lack of interoperability of key components across different brands and even within brands is making repair difficult. When replacing an electronic board for example, it must be from the same make and model of the original appliance. The cost of spare parts may also far exceed production costs. For example retail prices of timers for dishwashers are often much higher than production costs, but are critical components of the appliance. The length of time that spare parts are available to purchase also significantly impacts the potential repair of a given product. In addition, sometimes only a full set of spare parts can be purchased when only a single part is needed.
- Increasing lack of access to repair and service manuals, software and hardware for re-use and repair centres. Repair and service manuals used to be widely available from the manufacturer to re-use and repair centres. Today, however, approved re-use and repair centres/networks often have to pay high prices for this information if they are not the direct after sales service providers of the manufacturers. In addition, large household appliances are now often fully operated by electronic control boards. If there is a problem, the appliance can be hooked up to a laptop using relevant hardware and tested with fault diagnosis software. However, this software and hardware is often only available to the after sales service providers of the manufacturers and not to all approved re-use and repair centres/networks. Lack of access to such tools and information significantly hinders repair.
- Increasing difficulty to disassemble products for repair. Increasing difficulty in separating individual components from the casing or in accessing key parts in the interior of appliances hinders replacement and repair and therefore renders many appliances without re-use potential. If it is not possible to open the outer case of a product without breaking it, the re-use potential of the products is completely lost.

All the above issues result in **repair activities being very costly, resulting in a high rate of direct replacement with a new model**.

- **Lack of appropriate logistics**

A study was carried out in Ireland in 2013 to understand bulky waste activity and the scope to increase re-use at Public Civic Amenity (CA) and Recycling Centres (RC) [Rx3 2013]. Bulky waste is considered as municipal items that are too large to fit in the regular waste collection unit and typically include furniture, certain categories of WEEE, mattresses, bicycles, etc. CA and RCs were surveyed to indicate whether they would be willing to implement re-use (or preparation for re-use)[8] systems.

The majority of respondents indicated that they preferred an option where equipment is collected on-site and then distributed to re-use organisations. A large number of respondents indicated that they did not foresee re-use (or preparation for re-use) happening at their site. The main reasons for not considering re-use were lack of staff, space and illegal waste activities. It is interesting to mention, that in the previous survey of 2010 some council indicated that they were not interested in re-use for

[8] Often the term 're-use' is mentioned by literature/ stakeholders and it is not clearly distinguished between re-use and preparation for re-use.

various reasons but have since overcome those barriers and have implemented re-use initiatives at their CA/RC sites.

- **Costs for municipalities**

In the Irish study, most of the CA and RCs declared that they would be interested in re-use but they would prefer a solution where items for re-use are segregated by CA/RC staff and collected by a third party re-use specialist for sale off-site. This option is considered low cost and least effort, a shipping container, marketing and communication, and education and awareness could be acquired for €2,250 per year for a CA/RC[9]. Including a third party re-use specialist is also the most common method of CA/RC re-use observed in Northern Ireland and the Republic of Ireland to date.

The other option, where items are segregated and sold on-site by a site operator is a much more complex and capital intensive selection, with capital cost in the region of €75,000 (for CA/RC, including re-use shed fixtures and fittings, tools and equipment, etc.) and €105,000 operating cost (for re-use organisations at CA/RC, including rent of premises (5000 sq ft or 464 m^2), staffing, vehicle maintenance and running costs, etc.). This option is more likely to be preferred on sites that have a throughput of 5,000 tonnes or more, as the sales from the shop on-site can fund the running costs and any additional staff required to manage the shop. In the case where a re-use initiative is not feasible at a CA/RC, a local authority can opt for a comprehensive re-use communications initiative. This could be as simple as listing different re-use organisations, charity shops, websites, regular car boot sales and encouraging people to consider re-use rather than recycling or disposing of an item [rx3, 2013].

- **Resistance from producers**

According to [WRAP 2015], some producers may not be in favour of re-use as if the product is not prepared to be re-used/ repaired in order to be re-used according to the quality standards of the brand this may affect their brand reputation. Questions arise when a product that has been prepared for re-use is placed again on the market, as to whom is responsible for the end of life of the equipment (producer responsibility principle) and liable in case of incidents or defection, notably if the brand was not removed of the equipment after preparation for re-use. This may put new obligations on the re-use facilities, for example to register as producers. Another question is the financing of preparation for re-use. Today collective schemes finance the collection and transportation of WEEE for recycling but few of them finance preparation for re-use, which goes opposite to the waste hierarchy.

Manufacturers may also fear that these products hinder people to buy new products.

- **Consumer perception toward re-use**

Many consumers still see used products as low quality products. At the same time there is a lack of awareness of the availability of high quality second hand equipment and on information where people can buy it. Cheap products available on the market also do not encourage consumers to buy second hand products [StEP 2015]. The

[9] Considering the acquisition (€1,500) or rent (€150 for delivery + €20/week) of a shipping container of 40 ft (12 meters) per year, plus marketing costs for on-site signage (€250) and publicity material (€500) per year. Transportation costs are not included. They would depend on the size and number of items being collected and the number of collections per year. According to the study, driver costs would be in the order of €25,000 per year but the driver would not be employed full time collecting re-use items from CA\RCs. Some re-use organisations use a courier to collect bulky waste, with cost ranging from €25-50/£20-40 per collection.

WRAP surveyed in 2011, 594 residents from 5 different sites disposing WEEE at Household Waste Recycling Centres, to know the reasons for disposal [WRAP, 2011]. Consumer equipment was the category of WEEE most commonly brought to the sites; one third (33%) of WEEE was consumer equipment such as DVD recorders, video recorders and televisions. It was followed by small household equipment (22%), large household appliances and IT and telecommunications equipment (14% each). "It's not working/it's broken" was the first reason to dispose of the product (51%) followed by "I just don't want it anymore" (24%) and "I'm replacing the item with a newer version" (22%). The main reasons for not repairing broken WEEE were: "because it's cheaper to replace rather than repair the item (or it's too costly to repair) (47%); "the item is beyond repair (31%), "I just don't want it anymore" (12%) and "it didn't occur to me that repair was an option (7%). Respondents were asked if they were aware of any other options for getting rid of WEEE. 82% said they were not aware of any other disposal routes.

The study highlighted a need to raise people awareness to other disposal options. Bringing WEEE directly to re-use organisations for instance would ensure that the re-use potential of WEEE is preserved.

- **Legislative framework**

Today, the legislative framework does not favour re-use and preparation for re-use since there are no specific obligations/ targets on preparation for re-use. However, the new WEEE Directive introduces joint recycling/ preparation for re-use targets.

The blur distinction between re-use and preparation for re-use, as seen in part 3.2.1, also prevent some Member States to implement actions.

- **Expertise required for preparation for re-use**

IT equipment re-use requires expertise that social organisations in the preparation for re-use field may not have. Re-use and preparation for re-use may be limited to large appliances as refrigerators, washing-machines, etc. for these players [StEP 2015].

- **Restrictions on transboundary shipments**

In the B2B business, re-use organisations face significant barriers to export products that require testing according to Dataserv, a re-use organisation in UK specialised in the re-use of IT assets from companies [StEP, 2015]. A boundary shipment within the EU of products classified as hazardous waste "because it contains some CRTs" can take from three weeks up to two years before the final permission to move the material is received. This would be largely because Environmental Agencies do not complete the paperwork in a timely manner [StEP 2015].

On the other hand, the export of products that could be prepared for re-use directly in the Member States hinders the development of the re-use sector in some Member States. The existing re-use organisations in the Member States may lack supply which may prevent them to systemise their processes, gain a specific expertise through experience or achieve economies of scale.

- **Unfair competition**

The presence of a high number of companies not respecting quality standards (for example in the UK) potentially damages the image of the sector and decreases the stream of re-use organisations that have established procedures in place.

Other obstacles were identified by [Kissling et al 2013]. The researchers interviewed organisations specialised in the preparation for re-use of IT equipment or large household equipment, profit and non-profit organisations, with headquarters in Europe, Africa, North and South America. They identified barriers for re-use and then

asked the participants to rank them. The following figure presents the average overall ranking calculated based on all respondents' individual rankings.

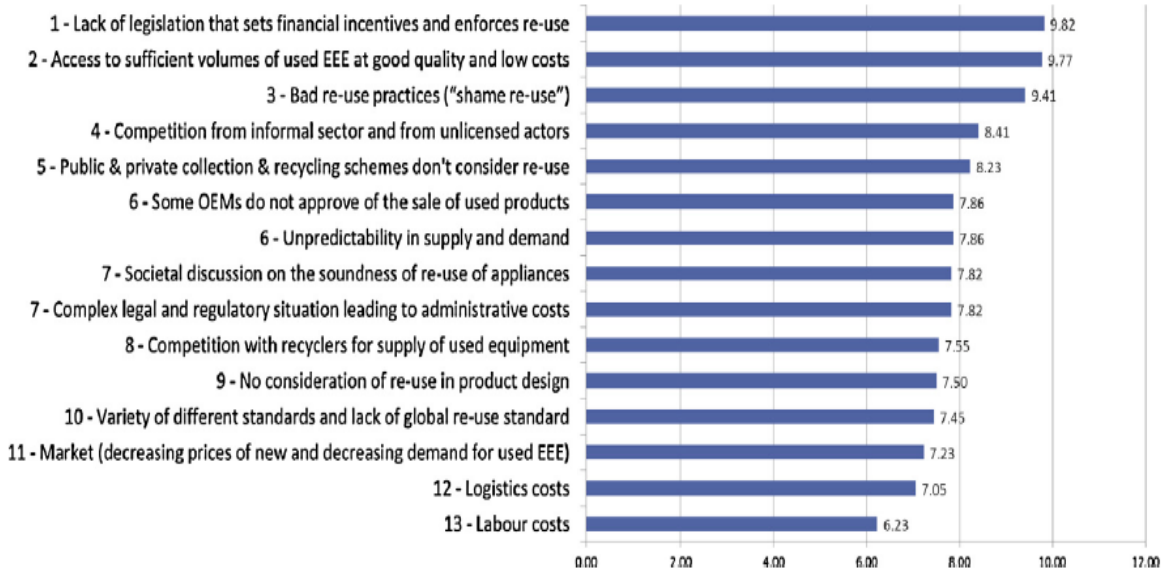


Figure 10: Barriers for re-use and preparation for re-use in order of importance [Kissling et al 2013][10]

While these obstacles explain that re-use is not widespread today, drivers were identified in the countries where re-use is more advanced and represent solutions to these obstacles.

Drivers

- **Quality control for re-use**

Quality control during the re-use process was quoted by many stakeholder interviewed through the course of the study as a key success factor for re-use activities, and is mentioned also extensively in the literature. Second hand products ready to be re-used must be proved environmentally beneficial, safe and fully functional to be relevant against the purchase of new products. In countries where re-use is advanced the development of standards for preparing for re-use of WEEE has increased the reliability of the sector. UK developed the PAS 141 standards[11] and Belgium promotes a code of good practices[12], both setting procedures regarding the visual inspection, handling, tracking, segregation and storage of WEEE to be prepared for re-use in order to ensure safety, functionality and data protection during all step of the process

[10] OEM stands for Original Equipment Manufacturer.

[11] Publicly Available Specifications (PAS) 41 is a process management specification for the re-use of used and waste electrical and electronic equipment (UEEE, WEEE): http://www.wrap.org.uk/content/pas-141-re-use-standard

[12] OVAM, the Public Waste Agency of Flanders, published a code of good practices in 2012:
http://www.eera-recyclers.com/sites/default/files/Code%20of%20good%20practice%20for%20the%20re-use%20of%20%28W%29EEE%20%28OVAM%2C%2025.10.2012%29.pdf

[StEP2015]. CENELEC standards regarding re-use are also being currently developed, and it is likely that more countries will adopt such quality standards for preparation for re-use. The Netherlands, France, Ireland and Belgium would already be ready to make it compulsory for re-use organisations to comply with these standards, according to a representative of CENELEC [CENELEC 2015].

For many stakeholders interviewed, the certification of re-use organisation complying with re-use standards is the solution to ensure that the quantities of EEE re-used and WEEE prepared for re-use get reported.

Warranties on products that are placed on the market as second hand products (re-use) or after preparation for re-use operations are also critical to promote the quality of these products and are often quoted as an opportunity to build consumer confidence in second hand products while forcing players carrying out "shame re-use" to disappear.

- **Open dialogue between manufacturers/collection schemes and re-use organisations**

One of the main barriers identified regarding re-use is the reluctance of manufacturers, collective schemes and recyclers to see re-use as beneficial. The good dialogue that exists in Belgium between collective schemes, re-use organisations and the government yet shows that cooperation is possible. In Belgium, re-use centres have access to intermediary consolidation points, select goods that can be re-used and are then mainly responsible for the transportation of WEEE to recycling facilities. Producers do not see re-use as a competition, as they do not target the same market. The most important is that end-of-life equipment get reported to the competent authorities. Some producers even collaborate with the re-use sector to organise education and training of people working at re-use centres and make available to them spare parts through an online platform, free of charge. The platform is also available to retailers and consumers but they have to purchase spare parts [WRAP 2015].

FEE (Federation of Electricity and Electronics), the federation representing producers of white goods (i.e. large appliances as refrigerators, washing machines, etc.) in Belgium mentioned, that another success factor of the re-use sector in the country is that FEE can forecast the potential markets for re-use each year and supply the difference between the demand and the EEE that will be re-used [StEP, 2015].

- **Commitment of local authorities towards re-use**

Local authorities can favour re-use by giving access to re-use organisations to their public amenity sites.

They could be even more committed by requiring in their contract with collective schemes that a specific percentage (e.g. 5%) of the waste collected be re-used and by buying second hand products for themselves, ensuring both supply and demand [CENELEC 2015]. Partnerships already exist between re-use centres and municipalities.

In UK, re-use organisations have access to public amenity sites and are able to "cherry pick" the equipment they can prepare for re-use [WRAP 2015].

In Austria, operators of collection sites have to separately collect those whole WEEE appliances which are to be delivered to preparation for re-use at least two times per year and have to either:

1 - Prepare them for re-use themselves; or

2 - Handle it over to a re-use facility for WEEE which fulfils the obligations of paragraph 11(3) on the basis of a contract at least two times per year.

Not-for-profit re-use facilities, like social economic enterprises, are to be preferred. The handling of the equipment must be free of charge if it can be guaranteed that this WEEE is actually prepared for re-use. [RREUSE, 2015]

The Irish study suggests going further the existing partnerships by developing a Re-use Protocol to assist in particular Civic Amenity Sites/Recycle Centres (CA/RC owners) and operators but also the re-use organisations [rx3 2013]. This would establish a framework of rules and should be developed in cooperation with both sectors, using their experience and provide the sectors with a simple list of steps to assist in setting up a re-use initiative. It should also include information for local authorities who are not in a position to implement their own re-use initiative but who wish to inform the public about other local initiatives.

- **Policies favouring social activities and funding**

It is generally found that re-use organisations are located in areas where there is a market demand for the low cost goods they produce and where employment and rehabilitation opportunities are created in the local community helping people break the poverty cycle and provide a better life for themselves.

The Irish study recommended that existing funding is maintained and additional funding is made available to support CA/RCs and re-use organisations that partner together for re-use initiatives [rx3 2013].

In Belgium, people willing to setup a re-use shop are helped by Komosie (network of re-use organisation), which provide assistance and guidance on initial steps to take, but also by laws which make easier for them to operate (such as reduced VAT). However, a right balance is necessary to ensure that businesses can operate in the re-use sector as well [StEP 2015].

- **Marketing**

In UK, the re-use organisation Bryson mentioned that the improvement in the manner in which refurbished second hand appliances are presented dramatically influenced consumer demand [StEP 2015]. While its outlet used to look like "a charity shop", consumers are now led to a showroom where they can view second hand products looking almost as good as new on offer. This makes it possible to target first time buyers and mainstream consumers and mitigates the "social stigma" towards used products. In Belgium, Komosie, the network of re-use organisation has developed a brand and a communication plan, highly contributing to its success. A quality label called "Revisie" for electronic appliances has also been developed to build consumer confidence in used products. In the area of B2B re-use, environmental services such as carbon offsetting proposed by re-use organisations can seduce companies.

- **Security standards**

In the case of IT equipment and B2B re-use, a success factor for re-use activities is the ability to prove that sensitive data from clients is handled properly. The compliance with information security standards such as ISO/IEC 27002 by re-use organisations reassures these specific types of clients [WRAP 2015].

- **Education for people involved in re-use and refurbishment**

OVAM, the regulatory body in Belgium identified the education of peopled involved in the re-use and refurbishment as one of the main success factor of the re-use sector in Belgium. The re-use of white goods in the country could be attributed to the training of people according to standard procedures [StEP 2015].

[Kissling et al 2013] identified other success factors that could favour the development of the re-use and preparation for re-use sector. They asked organisations specialised in the re-use and preparation for re-use sectors to rank them. The following figure presents the average overall ranking calculated based on all respondents' individual rankings.

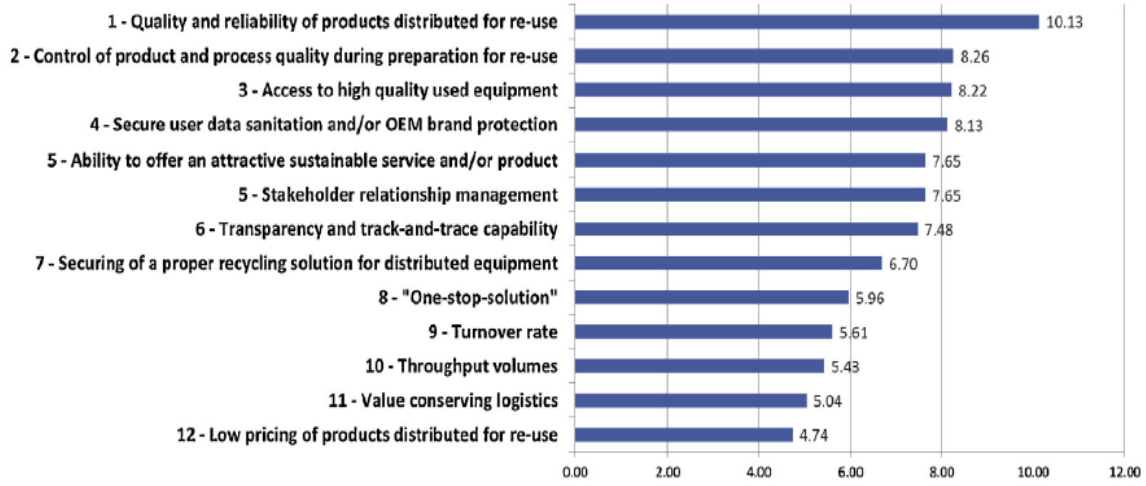


Figure 11: Success factors for re-use and preparation for re-use in order of importance [Kissling et al 2013]

3.3 Assessment of the feasibility of setting separate re-use targets

3.3.1 Flow of the sector and scope of a potential target

Before setting a target, it is necessary to clearly define the scope of the target. The following figure shows the many activities that can be related to re-use.

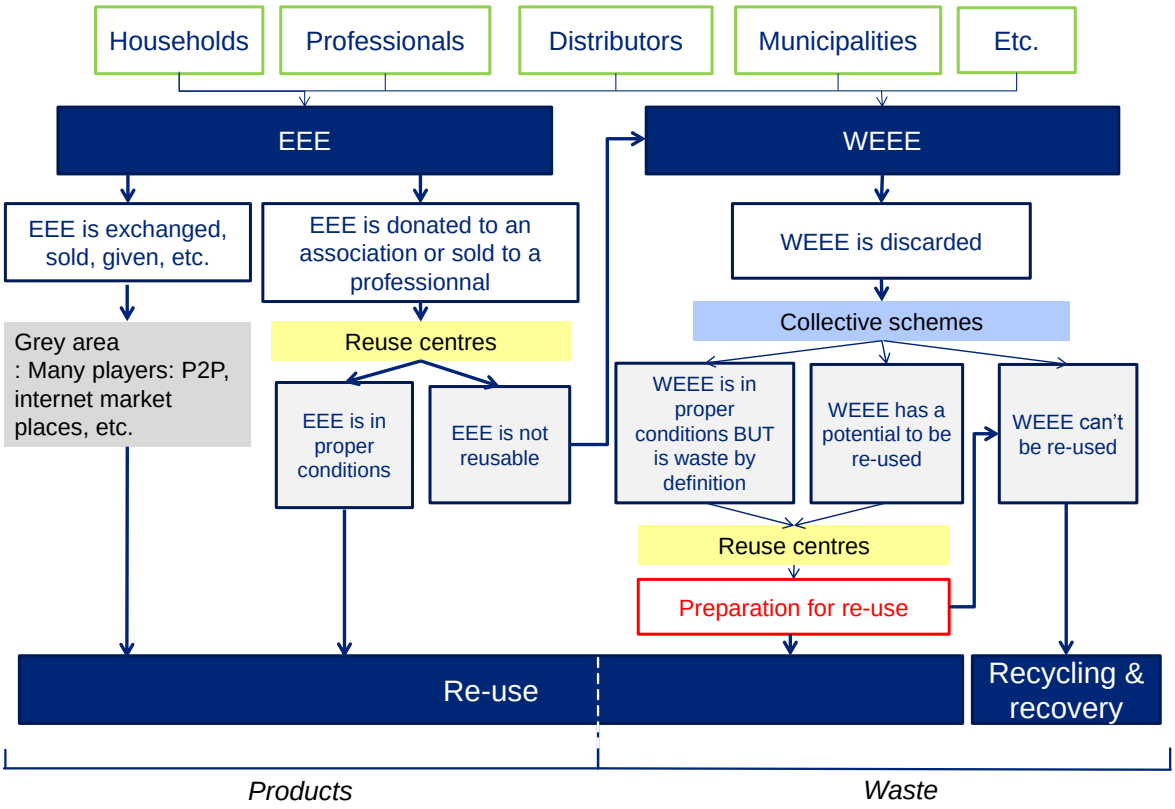


Figure 12: Flows of the re-use and preparation for re-use sector.

The figure shows that there are many stakeholders involved in re-use and preparation for re-use, and that many activities leading to re-use are not covered by the WEEE Directive. The scope of preparation for re-use can be seen as very limited in comparison with re-use: Only when used EEE are discarded and can be considered as waste and when they have a potential for re-use. Preparation for re-use should also be carried out only by facilities authorised for the management of waste.

A question that arises when looking at the scope of a preparation for re-use target is: Would it be relevant to put a target on preparation for re-use compared to prevention activities?

The next sections look at the quantities of WEEE prepared for re-use and re-used today compared to its potential, and the opportunities and threats associated with the introduction on a target on preparation for re-use.

3.3.2 Quantities of WEEE re-used and prepared for re-use in the EU and potential for re-use and preparation for re-use

More than 70,000t of WEEE were reported as re-used and prepared for re-use in the EU in 2012 on Eurostat on the basis of Commission Decision 2005/369/EC. It is noted that reporting of separate data on re-use/preparation for re-use is voluntary for Member States. Ten Member States did not report any quantity re-used and prepared

for re-use. However, this information is not considered as reliable, because of the high number of Member States that did not declare anything, while their market has some capacities, but also because there is no transparency on the activities that are actually considered as re-use and preparation for re-use among Member States.

2% of the WEEE collected in the EU28 is currently reported as re-used and prepared for re-use under Eurostat. The re-use and preparation for re-use rates achieved by the Member States are presented below.

Table 44: Quantities of WEEE collected and reported re-used and prepared for re-use in 2012

	WEEE collected	WEEE re-used and prepared for re-use	Re-use and preparation for re-use rate
Austria	77,402	1,248	2%
Belgium	116,458	4,068	3%
Bulgaria	38,431	292	1%
Croatia	16,187	0	0%
Cyprus	2,514	42	2%
Czech Republic	53,685	0	0%
Denmark	76,200	0	0%
Estonia	5,465	0	0%
Finland	52,972	557	1%
France	470,556	9,568	2%
Germany	690,711	11,845	2%
Greece	37,235	0	0%
Hungary	44,262	0	0%
Ireland	41,177	360	1%
Italy	497,378	-	-
Latvia	4,694	37	1%
Lithuania	14,259	0	0%
Luxembourg	5,010	0	0%
Malta	1,506	0	0%
Netherlands	123,684	475	0%
Poland	175,295	791	0%
Portugal	43,695	33	0%
Romania	23,083	0	0%
Slovakia	22,671	0	0%
Slovenia	9,430	30	0%
Spain	157,994	351	0%
Sweden	168,612	0	0%
United Kingdom	503,611	41,630	8%
TOTAL	**3,474,177**	**71,327**	**2%**

According to the experts interviewed, a significant part of the quantities re-used and prepared for re-use would come from the B2B sector. As used EEE supplied by companies to other companies specialised in refurbishment is often not reported in the framework of the WEEE Directive, this adds additional uncertainty to the current figures. More information on how these quantities were reported is needed.

A study carried out in the province of Upper Austria identified that 18% of discarded appliances from public waste collection points had a potential to be re-used [Meissner et al, 2014]. This figure would tend to demonstrate the re-use and preparation for re-use activities are underexploited.

In the UK, it is estimated that 7% of WEEE separately collected at Household Waste Recycling Centres is re-used and prepared for re-use today (40,650 tonnes), while it is estimated that approximately 23% could be re-used and prepared for re-use with only a small amount of repair (31% in weight). Large WEEE items would have a re-use potential of 49% [WRAP 2011a].

It is not possible to estimate fully the re-use potential of household waste since household waste are also collected at retail shops and on demand. However, equipment collected through retailers is usually in a better state. For instance, if a consumer buys a freezer, the retailer can deliver and take back the old freezer and transport it in proper conditions that can ensure the non-damage of the EEE. The re-use potential of 23% in items and 31% in weight might therefore be underestimated for household WEEE in UK.

If households from other Member States were throwing similar equipment and in a similar condition, almost 1 million tonnes of WEEE would have the potential to be re-used every year in the EU (Household WEEE collected in the EU in 2012 equalled 3,019,727 tonnes).

However, it is unlikely to be the case. In Member States where the average wages are much lower, consumption patterns are different. The European average of usage for large household appliances is 8-10 years, while in Romania for instance the duration is 13-17 years [Ciocoiu et al 2011]. When it reaches its end-of-life, this equipment has thus a much lower re-use potential. A report by the European Commission in 2014 collected information on the lifespan of WEEE in the EU and identified that the lifespan of appliances in Member States where no data is available could be retrieved from the lifespan of the same equipment in Member States with similar socioeconomic conditions. Countries were grouped into the following clusters [European Commission, 2014].

Table 45: List of Member States by stratum

	Purchasing Power rage (IMF 2013 data)	Countries								
Stratum 1	> 35.784 Int$	AT FR	NL LU	IE	SE	BE	DK	DE	UK	FI
Stratum 2	23.068 -30.289 Int$	ES	SI	CY	EL	CZ	MT	PT	SK	IT
Stratum 3	13.396 -22.747 Int$	PL	HU	EE	HR	LT	LV	BG	RO	

For cooling and freezing equipment, the study made a distinction between cold and hot climate countries.

In France, 1% only of the WEEE collected from households was re-used and prepared for re-use in 2012. However it represents 1/10 of the quantities that were given to re-use organisations. This is because the products were not repairable or obsoletes (for example CRT screens) [ADEME 2013].

In Ireland, during the trial of the potential reusability of large household equipment delivered at the recycling plant, 61% of the 1,693 machines that made it through initial screen and functionality testing over the 30-week testing period were never re-

used. Of the 778 machines (i.e. 39%) that were deemed suitable for re-use over this period, 23% of this equipment was directed for systems re-use while 16% was directed for harvesting of spare parts [Rehab 2015].

The potential of WEEE re-use in UK might therefore be too optimistic compared to the situation in other Member States. There seems to be a need to study how the re-use potential of equipment can be preserved when collected for the first time.

3.3.3 Opportunities and threats for a specific target on preparation for re-use

The opportunities and threats that may arise from the implementation of a specific target for re-use are summarised in the table below and detailed in the following paragraphs.

Table 46: Opportunities vs. Threats for a specific target on preparation for re-use

Opportunities	Threats
▪ Resource savings ▪ High potential for job creation ▪ Consumer demand	▪ Risk of double counting ▪ Difficulties to report the flows ▪ Costs for changing the organisation of the sector (ensuring proper storage, transportation, etc.) ▪ Unavailability of spare parts to prepare WEEE for re-use at an affordable price ▪ Lack of data to estimate the real potential of re-use ▪ Distortions to reach the target and producers taking ownership of re-use ▪ Design of products improving unequally ▪ Requirements for re-use organisation to comply with the same obligations as producers ▪ Inability of some Member States to reach the target

Opportunities

- **Resource savings**

Today, a lot of items are prematurely scrapped. According to RRE-USE, around 25% of WEEE thrown is reusable. Another study estimates that around 40% of discarded large kitchen appliances that enter the waste stream would still be in working order [WMW 2015]. According to the WRAP, 23% of all the WEEE collected at recycling centres could have been either sold on straight away, or re-sold after repair and refurbishment [WRAP 2011b].

This represents a significant waste on an environment, social and economic perspective.

- **Potential for job creation**

Preparing for re-use this equipment would create jobs and ensure resource preservation. According to RRE-USE, 1,000 tonnes of WEEE prepared for re-use would create 35 jobs compared to 7 jobs if it was dismantled. Other benefits of re-use and preparation for re-use are presented in section 3.4 describing the environmental, social and economic impacts of the re-use sector.

- **Demand for second-hand products**

In 2012, 98% of French declared having already "practiced re-use", meaning they have already either donated or purchased second-hand products [ADEME 2012].

Factors impacting this phenomenon are the economic crisis, the desire to change one's habit (spend less, consume better) and reduce one's environmental footprint and the arising of new technology (e.g. online sellers).

At the same time, a Eurobarometer survey shows that almost 50% of Europeans would be willing to buy second hand EEE [Eurobarometer 2011].

Threats

- **Lack of data**

Today, data is missing on the real quantities of WEEE that could be re-used and prepared for re-use in the EU and the economic feasibility of changing logistics to ensure that the potential for re-use of WEEE is preserved. It would require changing most of the collection structures and implement procedures to test early the equipment.

- **Distortions to reach the target and producers taking ownership of re-use**

Before setting a target, it must be clear how the target will be calculated i.e. which operations can be considered as re-use and preparation for re-use and quantities can account for the achievement of the target. For example, if the original product is replaced at 80%, can this process be considered as preparation for re-use? According to the WRAP, a productivity yield should be implemented to measure the efficiency of the re-use and preparation for re-use process. The Waste Framework Directive defines preparation for re-use as checking, cleaning or repairing operations, by which products or components of products that have become waste are prepared so that they can be re-used without any other pre-processing. If a product that has become waste is replaced by 80% for repairing operations, the full weight of the product should not be counted as prepared for re-use.

It should be mentioned that the WRAP promotes the implementation of actions for circular economy by EEE manufacturers. It is therefore convinced that producers should and will implement reverse logistics in the future. This leads to question such as: If producers take back equipment in one country, that can be considered as waste, from retailers for instance, send it back to their factory in another Member State, will they have to report on re-use? In which country will they have to report it? Will they ensure the maximum components are kept or replace most of it?

Despite these questions being current concerns, it is not feasible today as Annex VI of the WEEE Directive states that shipments are only possible when it is proven that products are not waste and can be directly re-used or when the shipments take place in the framework of a business-to-business transfer agreement and the EEE is under warranty. If the EEE is for professional use, it can also be shipped if a contract has been established for refurbishment of repair, "with the intention of re-use". This therefore limits the reverse logistics that can be put in place by the manufacturers. Another question arising is: Will re-use organisations be able to survive if producers take ownership of re-use?

- **Design of products improving unequally**

According to the WRAP, re-use facilities are already choosing brands at collection sites depending on their re-use potential (easy to dismantle, spare parts easily available, etc.), if a preparation for re-use target is put in place, there is a risk that EEE producers contribute unequally to the achievement of the target [WRAP 2015]. In the Ireland trial, 62% of the large household appliances that went through the visual inspection and functional assessment were from a specific brand. Producers need to be involved to favour the reparability of products. For instance, the vast majority of

repairs for IT equipment are for screens and batteries, so making these more modular and easier to repair would have a "huge impact" on repair rates [Allen 2015].

- **Requirements for re-use organisation to comply with the same obligations as producers**

Manufacturers today have to comply with a high number of regulations when placing a new product on the market, i.e. the RoHS Directive, the Eco-design Directive, waste regulations, etc. A question that arises is: Should re-use facilities have the same obligations when putting a product on the market? According to the CENELEC, it will be impossible for re-use organisation to carry out all the necessary tests and procedures.

- **Inability of some Member States to reach the target**

In the Netherlands, a high quantity of used EEE is exported. In 2010, the export of used EEE is estimated at a minimum of 1.7 kg/inhabitant or 29,000 tonnes for household equipment and 0.9 kg/inhabitant or 15,000 tonnes for EEE from B2B origin. This means that in total 44,000 tonnes will not become WEEE in the Netherlands. Because they are not exported as waste, it won't account in the target while they potentially impact the potential of re-use of the WEEE collected in the Netherlands [Huisman et al 2012]. Illegal shipment of waste, exported as "used EEE", can also be an issue.

In addition, in some countries, the re-use potential of WEEE collected may be very low, due to a tradition of using equipment till its end-of-life. This was further addressed in part 3.3.2.

3.3.4 Conclusion on the feasibility

A lot of pending questions prevent the implementation of a preparation for re-use target today. The achievement of the target will be quite difficult to track unless preparation for re-use is limited to authorisedre-use centres and that the different sources of supplies clearly differentiate what is waste and non-waste. On the other hand, the combined preparation for re-use and recycling target today is not easily measured as well. Different players are responsible for achieving it.

Today mostly re-use organisations prepare WEEE for re-use, but will it be the case in the next years, for example if producers commit to the circular economy?

It is important that the new WEEE Directive request Member States to promote access to WEEE to re-use organisations to ensure more re-use is done today. However it should be considered that waste prevention activities in the future may eventually limit the potential of preparation for re-use of equipment. For example, if companies switch to business models relying on functionality economy. A product might be rented and refurbished when needed till it reaches its end-of-life and have no re-use potential when this occurs.

Priority should be given to eco design and ensuring cooperation between the various players. It is yet true that the WEEE Directive today does not sufficiently promote preparation for re-use over recycling. The next part presents the information that could be collected on the environmental, social and economic impacts of re-use.

3.4 Considerations on consequences and impacts of WEEE prepared for re-use

3.4.1 Economic impacts

In the UK, WRAP estimated that re-use and preparation for re-use of a selection of waste streams brings benefits of £720 Million (more than 1 billion Euros) of savings to the economy by limiting unemployment [RREUSE 2012].

WRAP also estimates that considering that 23% of all the WEEE collected at recycling centres could be either sold on straight away, or resold after repair and refurbishment, the preparation for re-use of WEEE could generate gross revenues of more than £220 million a year (309 million €). After taking account of the costs involved in acquiring the waste items and repairing or refurbishing them, the sector could realise profits of more than £100 million (140 million €).

WRAP's calculations are based on annual totals of 348,000 tonnes of WEEE taken to recycling sites, and a further 149,000 tonnes gathered in bulky waste collections [WRAP 2011b].

The study found out that the resale values vary depending on the categories, with smaller items typically having lower re-use potential but the proportion that is reusable has a higher value than other categories. Large domestic appliances such as washing machines offer good potential value, from re-use, use of parts or from scrap, and make up 61% of the resale value from the bulky waste collections. Fridges and freezers offer particularly good re-use potential if they're still working.

A study by [Zero Waste 2014] aimed at analysing the costs and efficiency of implementing different options to enable preparation for re-use at Household Waste Recycling Centres. It carried out four trials where items were either collected from designated bays at Household Waste Recycling Centres, from lockable containers (items stored undercover in containers locked when necessary by the collection site staff) , brought by the consumer directly at a re-use organisation set up as "designated collection facility" or by bulky uplifts intervention. The option where items are collected from lockable containers proved to be the most beneficial from a cost-benefit perspective since it allowed both to collect a high number of reusable products and to actually prepare them for re-use because their re-use potential was persevered. The results also showed that over a period of at least two years, all the re-use trials were more cost effective than a recycling option. This highlights that re-use is not only a more environmentally preferable option, but it is also more economically advantageous once the initial set up costs (notably for the containers) are paid back [Zero Waste, 2014].

3.4.2 Social impacts

According to RRE-USE, 1,000 tonnes of WEEE prepared for re-use would create 35 jobs compared to 7 jobs if it was dismantled. Other estimates consider that re-use and preparation for re-use has the potential to employ 10 times more people per tonne of material processed than recycling activities [Zero Waste 2012]. UNIDO and Microsoft found that computer re-use creates 296 jobs for every 10,000 tonnes of material disposed every year [WMW 2015].

Flanders, Belgium, has set an employment target of 3,000 Full Time Equivalent (FTE) jobs alongside a re-use and preparation for re-use target of 5 kg material per capita to be achieved by 2015. As a result the re-use and preparation for re-use sector in Flanders provides over 5,000 jobs and discussions about revising this target upwards are underway [RREUSE, 2015].

In addition to employment, the re-use and preparation for re-use sector provides low cost, or free, household goods to low income families. The economic crisis makes this service further necessary. A study showed that enforced deprivation (referring to the inability to afford basic specific goods or services) has increased significantly over the last years from 13.8% in 2008 to 17% in 2009 to over 22.5% in 2010 [CSO 2010]. In 2009, 0.6% of individuals were unable to afford a washing machine, 6.5% of individuals were unable to afford a clothes dryer and 8.6% were unable to afford a dishwasher [EPA, 2013].

3.4.3 Environmental impacts

Re-using EEE (before being waste) and preparing WEEE for re-use provides a greater benefit than recycling WEEE because most of the upstream activities required to manufacture an EEE are avoided. The only upstream activities that might be required are those associated with repair and parts that may be needed to refurbish EEE or WEEE with a potential of re-use.

For example, a second hand iPhone (either coming from direct re-use or after preparation for re-use) retains around 48%of its original value, whereas its value as recyclate is just 0.24% of its original value.

It should be noted that the energy consumption for the preparation for re-use of WEEE compared to the energy used for the manufacturing of new products is critical when looking at the environmental impacts of re-use and preparation for re-use. A report by the Environmental Protection Agency of Ireland analysed the energy consumption of a washing machine, depending on the consumer usage profile (high, medium or low intensity users) of the first and second user in case of the re-use of the washing machine. The study demonstrated that, for all 'A' and 'B'-rated washing machines, there is both an environmental and economic incentive to purchase a refurbished washing machine. However, for 'C'-rated machines, the environmental and economic benefits are seen only for low-intensity users. The study gave as a consequence a rough guideline for sustainable re-use and preparation for re-use: only appliances one energy grade lower than the cheapest available appliance on the market (or higher) should be re-used and prepared for re-used [EPA, 2013].

3.5 Conclusions

Due to a lack of data on the quantities of WEEE that could potentially be re-used in the EU, an impact assessment was not carried out. However, the above analysis highlighted the difficulties of implementing a target (difficulties to track flows given the blur distinction between used EEE and WEEE, need to change the logistics, lack of visibility on what the future of the preparation for re-use sector will be). At the same time the clear economic, social and environmental benefits, which the sector would bring if developed, are presented. As it is not exclusively recommended to propose separate preparation for re-use targets, other options than setting a target to promote re-use are therefore suggested below:

- Make sure that compliance schemes are approved on the condition that they demonstrate how they are promoting re-use.
- Re-use should be prioritised at household waste collection sites. Where the site has sufficient free space, dedicated containers should be used at household collection sites.
- Access to WEEE by re-use organisations need to be granted, either by collective schemes or directly by municipalities or other operators such as retailers.
- Increase public awareness of re-use services and benefits. WEEE that have a potential for re-use should be brought back directly by the consumer to the re-use organisation (or collected by the latter by households) to ensure the re-use potential is preserved. Repair, before the product becomes waste, should also be strongly promoted and need to be facilitated already in the product's design phase (eco-design).
- All re-use centres should report on what goes into the re-use centre (both used EEE destined for direct re-use and WEEE to be prepared for re-use) and what goes out based on mass. It is already an obligation for many in the contracts with collective schemes.
- Define a clear methodology to measure rates of preparation for re-use.
- In the future, if a target is considered, it should take into account (1) the differences in development of approved re-use centres and network in Europe and (2) the differences in the amounts of reusable products which are discarded in the Member States. According to RRE-USE, repair-friendly criteria within the implementing measures of the Eco-design Directive and smart use of taxation (e.g. zero VAT on repair activities to make the sector more competitive) are examples of measures that would be useful beyond the waste legislation and should be supported. Another option would be to consider that both used EEE and WEEE collected by re-use centres are waste, in order to facilitate the tracking of flows and monitor the achievement of a potential target on their output. However, this would imply a different interpretation of waste and thus consideration shall be given to the possible implications of such an interpretation to the implementation of EU waste legislation.

4 Re-examination of the method for calculation of recovery targets

4.1 Purpose and objective

This task is dedicated to the re-examination of the calculation method of recovery targets referred to Article 11(2) which is **currently based on input data** for WEEE entering the recovery or recycling/preparing for re-use facility (input-based approach). Purpose of this chapter is to **examine the possibility of setting output-based recovery targets,** i.e. on the basis of products ('recovery/ recycling efficiency') and/or materials resulting from recovery, recycling and preparation for re-use.

4.2 Analysis of reporting structures and available output information on Member State level

4.2.1 Overview on Member States' reporting procedures

Description of WEEE management procedures

The general processes of WEEE collection and further treatment with regards to the administrative procedures required by the new WEEE Directive are displayed in Figure 13 on the following page. This figure also displays the data requirements according to Art. 11(4):

"Member States shall ensure that, for the purpose of calculating these targets, producers or third parties acting on their behalf keep records on the weight of the WEEE, its components, materials or substances when leaving (output) the collection facility, entering (input) and leaving (output) the treatment facilities and when entering (input) the recovery or recycling/preparing for re-use facility.

Member States shall also ensure that, for the purposes of paragraph 6, records on the weight of products and materials when leaving (output) the recovery/or recycling/preparing for re-use facility are kept."

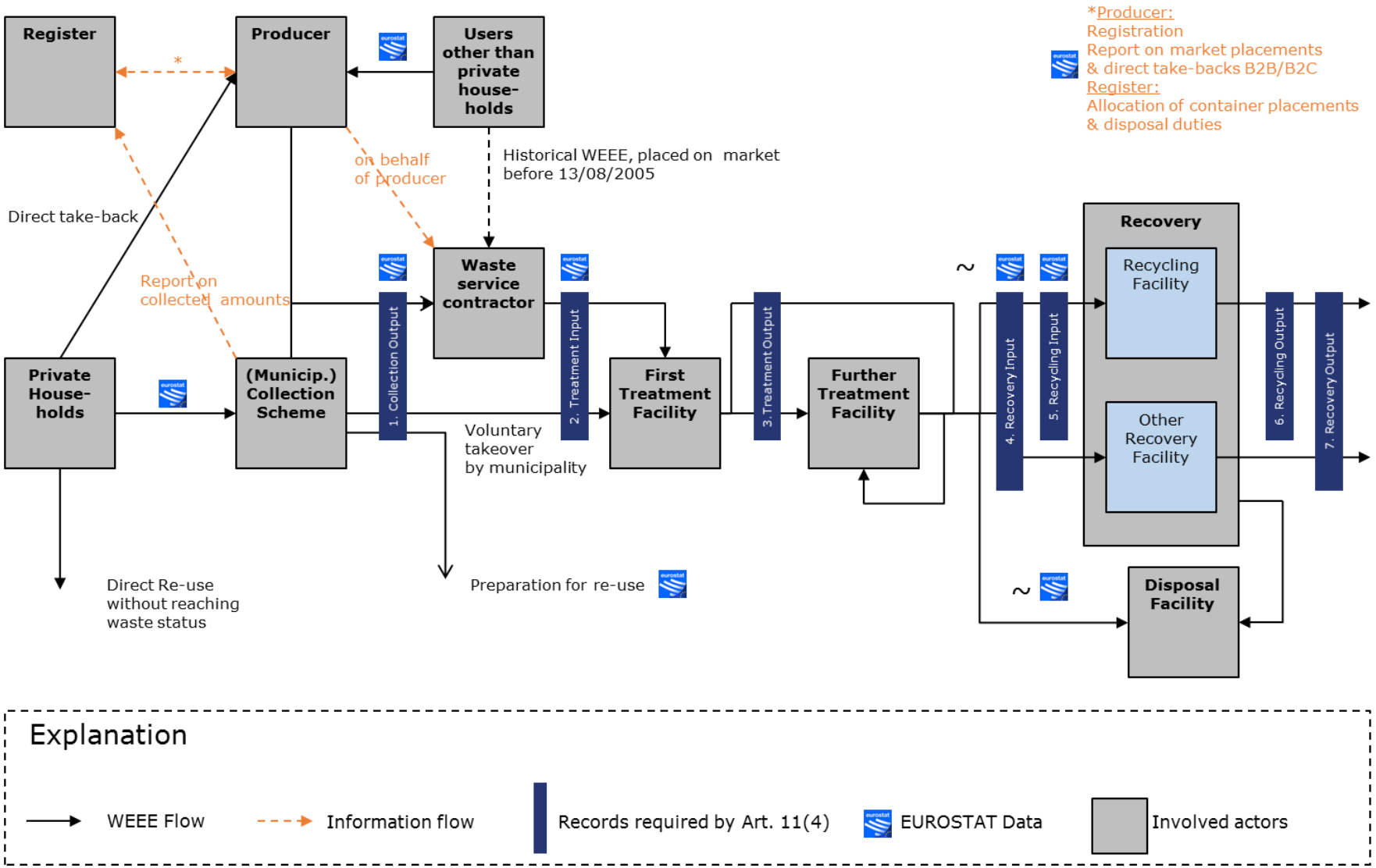


Figure 13: Description of WEEE management procedures based on new WEEE Directive

At the beginning, **producers**, as defined by Article 3(1)(f), need to register themselves at a **national register**, as described in Article 16 of the new WEEE Directive. Quantities of EEE placed on the market (POM) by the producer need to be reported also to this register. After the EEE turned into WEEE, producers are responsible for all WEEE from **users other than private households,** as defined in Article 13. Thereby the only exemption is that the responsibility for proper treatment of historical WEEE, which was placed on the market before 13/08/2005, relies with the 'users other than private households'. By contrast, **private households**, as described in Article 12, have the option to either use a direct take-back system of the producer or hand over their WEEE separately to **(municipal) collection schemes**, as described in Article 5. However, the financial responsibility for the WEEE relies with the producer. After collection but before the first treatment there is the possibility that WEEE is prepared for re-use. Besides, there is the possibility to directly re-use EEE from private households, where EEE does not reach the waste status.

In most EU Member States the collection of WEEE is not exclusively conducted by the municipality but by one or more collective/compliance scheme(s) which are Producer Responsibility Organisations (PRO) for WEEE. Additionally, other (private) waste broker and dealer (not displayed in **Figure 13**) also collect WEEE from households and businesses. This lead to discussions between collective schemes and those broker and dealer since the later focus on WEEE with positive economic values and leave difficult recyclable parts to the collective scheme. Nevertheless such private waste broker and dealer operating outside the PRO often contribute to increasing collection rates [EC EE 2012b].

WEEE amounts collected in (municipal) collection schemes are reported to the national register. Additionally, producers need to report WEEE amounts from direct take-back systems, both B2B and B2C. Depending on the Member State, the register calculates according to a certain algorithm and based on reported data, the allocation of the WEEE containers to the different producers and imposes disposal duties for them. At this point, producers, or third parties acting on their behalf such as **waste service contractors**, pick up the collected WEEE and direct them to a **first treatment facility.** Thereby in many countries also the collective schemes for WEEE (PRO) takes over collection, reporting, transporting and handling duties of producers. Special e.g. for the case of Germany is that municipalities have the possibility to opt WEEE, meaning to voluntarily take over the responsibility for the WEEE from producers.

According to Article 8(1) of the new WEEE Directive all separately collected WEEE, independent from their origin and who is liable, need to undergo "proper treatment". Exemptions are appliances that may directly be re-used after collection. Within the first treatment facility a "proper treatment" according to Article 8 with regard to Annex VII needs to take place, where among others all liquids need to be removed and a first de-pollution takes place. In practice, this first treatment facility can be physically the same as the recovery/recycling facility but e.g. for the case of Germany, first treatment facilities ensuring requirements according Article 8(1) are specifically licensed. Subsequently, the WEEE may pass one or more **further treatment facilities**, before the resulting fractions either reach **recovery facilities** or **disposal facilities.** Whereas recovery facilities either may be **recycling facilities** or **other recovery facilities** (e.g. incineration with energy recovery). Output fractions of these facilities finally are directed to a final use, such as e.g. a copper smelter for recycled copper fractions or final disposal via e.g. landfill or incineration. Nevertheless definitions for recovery/recycling facilities may differ as it will be described in chapter 4.2.2.

At this point it should be mentioned that the described flows of WEEE are as it should be in theory. Practically, several derivations are estimated to occur on the one hand regarding the flows itself and on the other hand regarding the reported amounts. In

the impact assessment from 2008 on the proposed by the Commission Directive on WEEE, it is indicated that approximately 85% of arising WEEE is collected separately. However, only 33% are officially reported. It is further estimated that 50% of actually collected amounts is not treated in line with the requirements for proper treatment according Article 8. The major part of unreported WEEE is illegally shipped to non-EU countries [EC 2008].

4.2.2 Analysis of available output-related data

Several information sources have been assessed or contacted in order to analyse available output-related data from recovery/ recycling facilities as displayed in **Figure 13** (Number 6 and 7.). Thereby the first aim is to screen available data on Member State level taking into consideration information from

- EUROSTAT
- Member States' Implementation Reports for WFD and WEEE
- National WEEE legislation
- TAC members for WEEE

Information from EUROSTAT data

Within this step it is assessed which data publicly available on EUROSTAT can be assigned to the requirements of the new WEEE Directive, Art. 11(4).

Data availability following Article 11(4) of the new WEEE Directive

If EUROSTAT data is available for the data regarding Article 11(4) it is marked in Figure 13 ( ). Furthermore the required data and their correspondents are displayed in the following Table 47.

Table 47: Data required by Art. 11(4) and EUROSTAT correspondents

Data as required according Art. 11(4)	Corresponding EUROSTAT data
1. Collection Output	'Waste collected'
2. Treatment Input	Sum of 'Treated in MS'+ 'Treated in other MS of the EU'+ 'Treated outside EU'
3. Treatment Output	Equal to Treatment Input (see above)
4. Recovery Input	'Recovery'
5. Recycling/Preparing for re-use Input	'Total recycling and re-use'
6. Recycling/Preparing for re-use Output	Not available
7. Recovery Output	Not available

Aforementioned data – except for Cyprus - is reported by Member States in two year intervals and is available at EUROSTAT[13].

[13] Data available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/waste/key_waste_streams/waste_electrical_electronic_equipment_weee

Data availability additional to Article 11(4) of the new WEEE Directive

Within **Figure 13**, data which is available at EUROSTAT additionally to requirements from Art. 11(4) is also marked ( ). In particular, following data is further available:

- 'Products placed on the market'
- 'Waste collected from households/non-households'
- 'Waste treated in MS/in another MS/outside EU'
- 'Direct Re-use' after collection
- Input for disposal facilities can be calculated from EUROSTAT data (difference between 'Waste collected' and 'Recovery')

At this point it should be mentioned that all EUROSTAT data is respondent to the requirements of Art. 16 (4) of the new WEEE Directive and is calculated specifically in each Member State.

*To conclude, in publicly **accessible data sources** (EUROSTAT), no explicit information on output-related data from recovery/ recycling/ preparing for re-use is available.*

Information from Member States' Implementation reports

The latest reports of Member States regarding the implementation of the former WEEE Directive cover the reporting period 2010 to 2012. The implementation reports are based on Commission Decision 2004/249/EC. Reports from AUT, BGR, CZE, DEU, EST, ESP, FIN, FRA, GRC, HUN, ITA, LTU, LVA, MLT, NLD, POL, PRT, SWE, SVN, and SVK, are available. No question of the questionnaire is directly related to input and output data from recovery/ recycling/ preparation for re-use facilities. Following, reports have been screened in detail if other questions cover this issue or Member States did report related issues within their report in any other way (e.g. in general feedback). In particular, Member States usually explained how the new WEEE Directive was or is transformed into national law but do not contain information on output-related data as requested by Art. 11(4) of the new WEEE Directive.

*To sum it up, in available **Reports** of **Member States on the Implementation of** the former WEEE Directive for the reporting period 2010-2012, no information on output-related data can be retrieved.*

Duties according to national legislation

The basic condition for producers recording and reporting data to the Member States, is an inclusion of these duties in national legislation. Hence, the first step is to examine how the recast of the WEEE Directive was transformed into national law. In particular, it is assessed how Article 11(4), on the duty to keep input and output-related records for collection, treatment and recovery or recycling/preparation for re-use, is displayed within the national legislation. Table 48 below provides an overview of the implementation status regarding the new WEEE Directive in the five largest EU Member States (+Austria) and displays whether or not the duty to keep records on "products and materials when leaving (output) the recovery or recycling/preparing for re-use facility" is mentioned within the law.

Table 48: Overview of implementation status of the new WEEE Directive and duty to keep records on output data for selected Member States

MS	National Legislation	Status	Duty to keep records on output data included	Obligation
AUT	193. Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft, mit der die Elektroaltgeräteverordnung geändert wird (EAG-VO-Novelle 2014)	Implemented since 05/08/14	N.A.	N.A.
DEU	Gesetz zur Neuordnung des Gesetzes über das Inverkehrbringen, die Rücknahme und die umweltverträgliche Entsorgung von Elektro- und Elektronikaltgeräten (Elektro- und Elektronikgerätegesetz – ElektroG)	Draft (implementation announced for autumn 2015)	Art. 22(3)	Operator of first treatment facility must prove that all records on the amount of WEEE and its components, materials or substances are kept when 1) entering the first treatment facility 2) leaving the first treatment facility 3) entering the recovery facility 4) **leaving the recovery facility** Operators of further treatment or recovery facilities have to provide operator of first treatment facility with relevant data
GBR	The Waste Electrical Electronic Equipment Regulations 2013	Implemented since 01/01/14	N.A.	N.A.
ESP	Proyecto De Real Decreto Sobre Los Aparatos Eléctricos Y Electrónicos Y Sus Residuos	Draft (30/06//14)	N.A.	N.A.
FRA	Arrêté du 8 octobre 2014 modifiant l'arrêté du 23 novembre 2005 relatif aux modalités de traitement des déchets électriques et électroniques :	Implemented since 01/01/15	Partly Art (5)	Article 5 […] The achievement of the targets shall be calculated, for each category, by dividing the weight of the WEEE that enters the recovery or recycling/ preparing for re-use facility, after proper treatment in accordance with Article 2 with regard to recovery or recycling, by the weight of all separately collected WEEE for each category, expressed as a percentage. Preliminary activities including sorting and storage prior to recovery shall not count towards the achievement of these targets. **The weight of WEEE that enters the recovery or recycling/ preparing for re-use facility shall be understood as the weight of fractions of WEEE which are re-used, recycled and recovered.**

MS	National Legislation	Status	Duty to keep records on output data included	Obligation
				For the calculation of the rates reached by a specific treatment facility, the weight of all separately collected WEEE without preliminary activities such as sorting and storage prior to recovery is calculated as the weight of WEEE entering the treatment facility without taking into account the fractions stored after treatment and before recovery.
ITA	Attuazione della direttiva 2012/19/UE sui rifiuti di apparecchiature elettriche ed elettroniche (RAEE)	Entry into force 28/03/14	Art. 19 (4); (5)	Art. 19 Recovery targets: 4. "The operator of the collection facility has to record the weight of the WEEE and its components, materials and substances in the relevant section of the register referred to in Art. 190(1) of the Decree Legislative 3 April 2006, n. 152, when they exit the collection centre (output)." 5. "The operator of the facility for adequate treatment, recovery, recycling and preparation for re-use of WEEE records on a special section of the register referred to in Article 190, paragraph 1, Legislative Decree 3 April 2006, n. 152, the weight of the WEEE and its components, materials and substances when entering (input) and the weight of the WEEE and its components, materials and its substances or the weight of the products and **materials actually recovered when they exit the treatment facility (output)**."

*An **obligation to keep records on output data** is **missing** in national regulations of some Member States. National laws including such obligations are only recently transposed which makes actual data availability unlikely. The slow/reluctant transposition into law might be explained due to the aspect that the reporting duties are only set for the purpose of re-examining the target calculation and not further defined as the official reporting requirements for EUROSTAT data as defined in Article 16 (4).*

Responses from Technical Adaptation Committee (TAC)

As a next step responsible representatives of each Member State have been contacted. Therefore a number of questions for the meeting of the Committee for the adaptation to scientific and technical progress of EU-Legislation on WEEE (Technical Adaptation Committee – TAC) taking place on 3rd November 2014 were raised:

"Referring to the Article 11(4) and considering the end of the transposition period of Directive 2012/19/EU on 14 February 2014, the questions for representatives of the Member States were:

- Has a collection system for output data of recovery or recycling/preparing for re-use facilities already been implemented?

If the general answer is 'Yes':

- Since which date, data is collected and available?
- How is the collection procedure?
- Is there a possibility to access collected data for the purpose of this project?"

All in all, 15 countries (14 EU + NO) responded to the raised questions. An overview of detailed answers can be found in Appendix IV. Out of the 14 responses by EU Member States, AUT, DNK, EST, FIN, FRA, MLT, NLD, SWE and SVK answered that reports on output-data are kept. DEU and GBR currently do not report data but plan it for the future. BEL and BGR do not keep records for output-related data, although the answer of BGR leaves room for interpretation that only the duty to keep records on output of preparing for re-use facilities is missing. NOR indicates that output-related data is recorded. For all Member States indicating that output data would be available it is uncertain whether output data from treatment facilities (pre-processing) or output data from recovery/ recycling facilities as displayed in **Figure 13** is referred to.

*However, most of the above listed Member States' answers indicate that records for **WEEE amounts sent for recycling are kept and reported to EUROSTAT**, which supports the assumption that in certain cases still input data is recorded.*

In order to clarify some issues, follow-up phone calls with TAC members which provided an answer were held (cf. Appendix IV). Their outcome indicate the following:

- Data might be available on level of facilities but are usually not reported to authorities due to confidentiality. In certain cases (e.g. GBR, FIN) facilities need to keep records on output data, which only needs to be presented to the authority upon request (e.g. during an audit).
- A mixing of material fractions within treatment plants hampers the traceability/ linking of output-related data to the respective input fractions, as sometimes also non-WEEE fractions are handled by facilities.
- It is assumed that non-uniform interpretations of the terms recovery and recycling across Member States cause difficulties in defining which facilities are classified as recovery/recycling facilities. Although Directive 2008/98/EC provides official definitions for recycling and recovery, practical interpretation differs. A specific example may clarify this aspect: Copper smelters usually classify their input of copper fractions from WEEE as recycling but forward parts of their output (e.g. slags) to backfilling which is not included in recycling. Bringing into play differently

interpreted end-of-waste criteria[14], it is also not clarified if the smelter can be classified as 'Recycling Facility' with copper fractions from WEEE as input and a copper-product as output. On the other hand e.g. a dismantling and separating facility could also be classified as a "Recycling Facility" with WEEE components (no matter if already treated or not) as input and separated copper fractions as output.

- In practice, first treatment facility, further treatment facility and e.g. recovery facility may be physically the same facility despite differentiated reporting obligations due to the new WEEE Directive. This hampers a sharp distinction between input and output flows of WEEE between the aforementioned facilities.

4.3 Analysis of reporting structures and available output information apart from Member State level

4.3.1 Overview on reporting structures according to WEEELABEX/CENELEC

After the analysis of potential data available on Member State level, the next step is a stakeholder consultation to identify available output data apart from the Member States. For this report the initial focus is drawn on European associations. National organisations are not systematically contacted. Relevant information gathered from stakeholders can be found in the following paragraphs.

European Electronics Recyclers Association (EERA)

Although the EERA does not keep records on data itself, their statement is that recycling/recovering/preparation for re-use facilities definitely keep records on output data and transmit information to their collective schemes. According to EERA, the majority of collective schemes and treatment facilities use the reporting tool or stick closely to the reporting method created by the WEEE Forum, which will be described in the following paragraph.

WEEE Forum

The WEEE Forum is a European not-for-profit association of 39 electrical and electronic waste collection and recovery systems, mainly producer responsibility organisations.[15] Exemplary members are Recupel (Belgium), El-Kretsen (Sweden) or Asekol (Czech Republic). The forum was founded in 2002 after the first Directive 2002/96/EC on WEEE entered into force. In 2002, the organisation started to develop a standard on treatment of WEEE ('*WEEELABEX*'[16]) and a corresponding reporting tool for treatment results of WEEE ('*WF-RepTool*'[17]) in order to allow users to document treatment results, monitor fractions sent to final uses and eventually facilitate reporting to authorities.

For a calculation of recycling and recovery targets differentiating between input/output data, the WEEELABEX standard and the corresponding tool are considered to be a main source for additional information apart from data available from the Member States. A general description of the reporting methodology according WEEELABEX can be found in the following. Data extracted from the WF-RepTool is presented in chapter 4.3.2.

[14] Examples at: http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=4259
[15] http://www.weee-forum.org/
[16] http://www.weee-forum.org/weeelabex-0
[17] http://www.wf-reptool.org

WEEELABEX and CENELEC standards

The WEEELABEX standard was developed by the WEEE Forum within the LIFE program of the European Commission starting in 2009. Its objectives contain the improvement and harmonisation of collection, sorting, storage, transportation, treatment and disposal of all kinds of WEEE in order to prevent pollution, minimise emissions and maximise the recovery of recyclables. Members of the WEEE Forum and their respective treatment operators compelled themselves to the normative requirements of the available WEEELABEX documents, in particular the standards on collection, treatment and logistics and their respective enforcement procedures as inspections and auditing [WEEE Forum 2013].

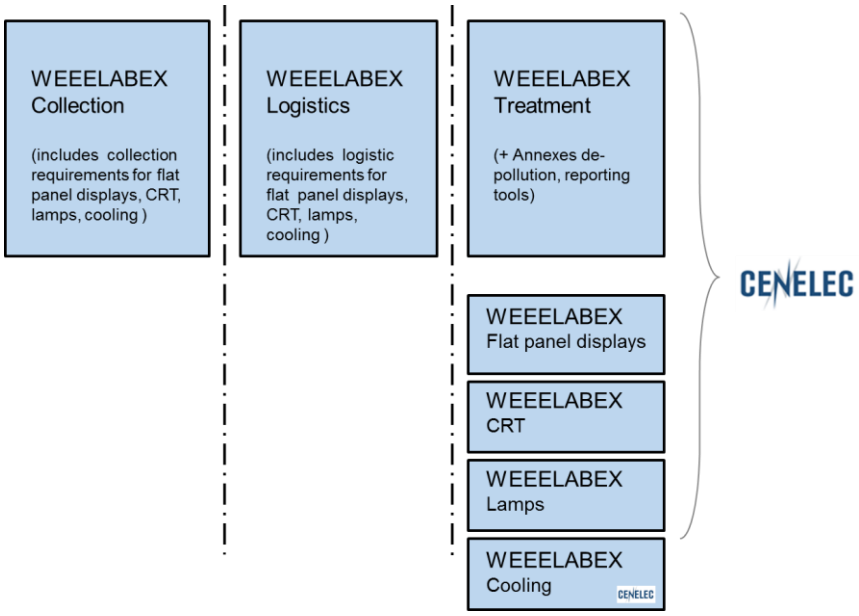


Figure 14: Structure WEEELABEX standard document and CENELEC adaption [WEEE Forum 2011]

Of special interest for this project is the document on normative requirements for WEEE treatment. In particular Annex D is referring to the WEEELABEX calculation method of recycling and recovery rates:

"The recycling and recovery rates shall be calculated:

- *as the percentage of the total of all output fractions, classified as prepared for re-use and recycling in proportion to the total of the input amount of non-treated appliances (recycling rate),*
- *as the percentage of the total of all output fractions, classified as prepared for re-use, recycling and other material recovery or other recovery in proportion to the total of the input amount of non-treated appliances (recovery), and*
- *in accordance with the classification given in clause D.5.*[18]*"*

[18] Clause D.5 refers to the classification model as defined by the WEELABEX standard. Classification follows the definitions of the WEEE Directive (R: Recycling, OMR: Other material backfilling, etc.) and is described further in chapter 4.2.2

To enable this calculation method of recovery/recycling rates, the WEEELABEX standard specifies documentation requirements covering all treatment steps from the first input until the final use of output fractions (cf. Figure 15).

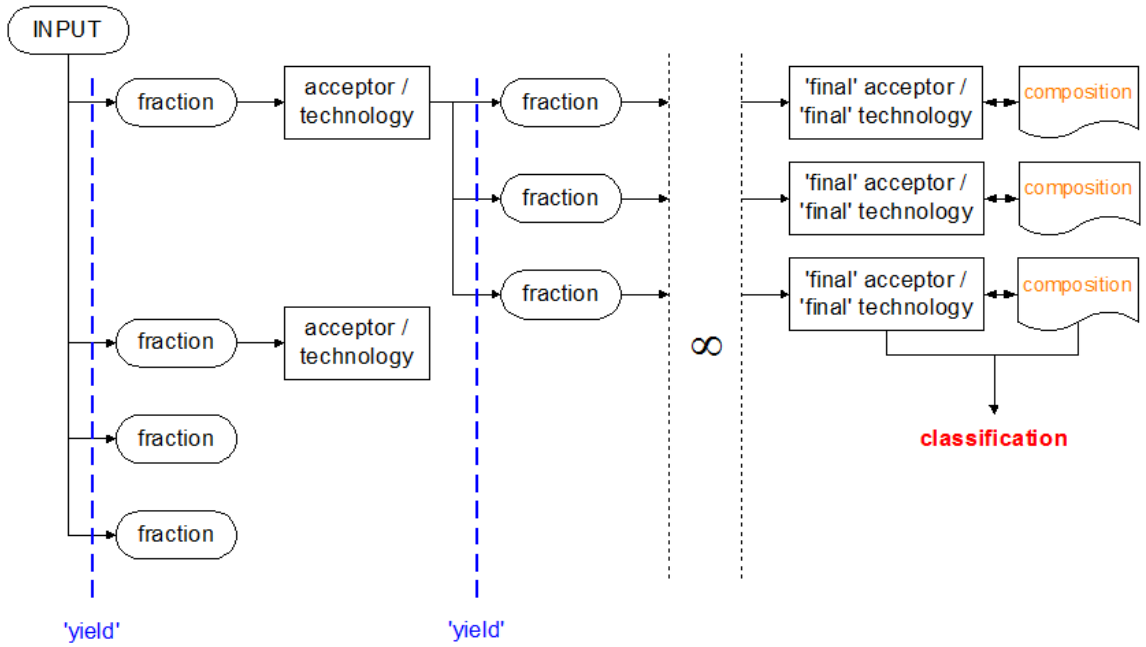


Figure 15: Documentation requirements RepTool - Data structure [WEEE Forum 2014]

The above described WEEELABEX standard served as basis for the development of an official CENELEC standard as it should be requested by the EC according to Art. 8 of the new WEEE Directive. With the establishment of the CENELEC documents, the WEEELABEX standards may be repealed stepwise.

As first document the standard EN 50625-1 on collection, logistics & treatment requirements for WEEE[19] entered into force in March 2014. In line with Figure 14, standard EN 50625-1 provides the general requirements applicable to the treatment of all types of WEEE and will be complemented with additional documents among others regarding specific treatment requirements for (gas discharge) lamps (EN 50625-2[20]), flat panel displays, cathode ray tubes (CRTs), photovoltaic panels and other equipment containing volatile fluorocarbons or volatile hydrocarbons.

The standard document provides relevant information on the following issues alongside the whole WEEE treatment chain:

- Definitions
- Administrative and organisational requirements
- Technical requirements
- Documentation

[19] Available at national standardisation bodies.
[20] EN 50625-2:2014 on treatment requirements for lamps, published on 31/01/2015

With regards to monitoring and calculation of recovery/recycling rates, clear requirements are formulated within the CENELEC standard. Figure 16 displays the relevant WEEE fractions for calculating these targets according the following method:

$$Recycling\ rate = \frac{m_2 + m_6}{m_1}$$

$$Recovery\ rate = \frac{m_2 + m_3 + m_4 + m_6}{m_1}$$

Thereby it is clearly stated that a "determination of recycling and recovery rates shall start with the untreated WEEE and end:

- when the end-of-waste status for fractions is achieved, or;
- with the final recovery or disposal of fractions." [CENELEC 2015].

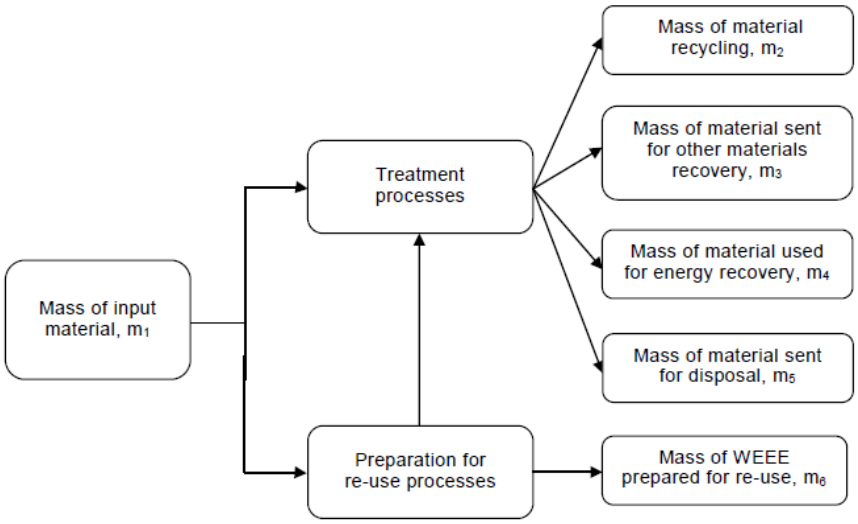


Figure 16: Flow chart showing separate parts of WEEE treatment process as basis for recovery/ recycling rate calculation [CENELEC 2015]

Definitions according to WEEELABEX and CENELEC standard documents specifically refer to output fractions from recovery/ recycling facilities which have achieved end-of-waste status or are finally recovered/disposed. Hence available data according to these standards needs to be assessed further.

4.3.2 Analysis of available output-related data

Initially based on the WEEELABEX standard but also in line with the official CENELEC standard, the commonly used reporting tool of members of the WEEE Forum and EERA is called **'WF-RepTool'** and is amongst others used for calculating recovery/recycling targets according the WEEELABEX/ CENELEC standards.

Within the following chapter its structure, representativeness and potentially available output data shall be assessed.

WF-RepTool: Structure

The RepTool's overall target is on the one hand to achieve comparable results between treatment partners, WEEE systems and countries and on the other hand to determine results of the whole treatment chain (as displayed in **Figure 17**).

Figure 17: Simplified WEEE treatment chain [WEEE Forum 2014]

The main effort behind the RepTool can be related to the four 'WF-RepLists' which harmonise and list the numerous influence factors along the WEEE treatment chains, in particular the four lists contain:

Input fractions

- Regularly updated list of potential input fractions
- Classified according Rep-Tool 'collection codes' which closely follow treatment requirements of WEEE in daily practice

Technologies used

- Regularly updated list of available treatment technologies for WEEE and WEEE fractions
- Differentiation between interim and final technologies

Output fractions

- Regularly updated list of potential output fractions
- Categorisation of output fractions according their type (e.g. material)
- Classification according EWC codes including further sub-codes for more detailed information
- Consideration of requirements of the WEEE Directive (Annex II)

Classification

- List of final (target) 'uses' of WEEE fractions
- Consideration of definitions new WEEE Directive and WFD (in line with CENELEC)

RU app	Preparing for re-use whole appliance
RU comp	Preparing for re-use of a component
R	Recycling
OMR	Other material recovery
ER	Energy recovery
TD	Thermal disposal
LD	Landfill disposal

- Consideration of definitions former WEEE Directive:

RU	Re-use of components
MR	Material recycling
ER	Energy recovery
TD	Thermal disposal
LD	Landfill disposal

- Classification used for calculation of recovery/ recycling rates

Additional remarks:

- When a report is created within the RepTool, the reporter is forced to distinguish between fractions from first treatment and fractions for further treatment and final technologies (e.g. recycling)
- Data belongs to RepTool Users/ WEEE Forum members
- Different reporting possibilities (possibility to report batches, annual/period data per collective scheme or per facility)
- Quality of data regarding plausibility (no control of the individual reporting)

The comprising RepLists for Input fractions, Output fractions, Technologies used and Classification harmonise the reporting structures among different facilities and/or systems.

WF-RepTool: Representativeness

The tool is used by the compliance schemes/ PROs and often these organisations oblige the treatment/recovery facilities under their organisations to also report within this tool or at least report data according RepTool methodology. In general, all members of the WEEE Forum have the possibility to use the RepTool. In practice the current user structure can only be estimated by the WEEE Forum since they only provide the tool whereas usage and data belong to the respective WEEE Forum member (collective schemes). However, the WEEE Forum indicated which schemes and their associated treatment facilities use the RepTool according their information and estimation. It should also be noted that no exact statement on the intensity of usage can be made, in particular how detailed data is reported and if reported data is plausible. Table 49 below provides a summarised and estimated RepTool user structure showing how many schemes and treatment operators report with the help of

the tool. It is completed by a qualitative estimation how the amounts reported within the RepTool cover overall amounts of WEEE of the corresponding EU Member States.

There might be more systems testing or starting to use the tool which are not mentioned yet. In general one need to distinguish who uses the RepTool for reporting: Either only the collective system (treatment operators deliver data but do not report via the RepTool) or also treatment operators report treated amounts via the tool. It should be noted that some systems may share treatment operators (cross border).

Table 49: WF RepTool Users (state of 02/2015)[21]

Country	WEEE systems using RepTool	Country covered (WEEE system volumes)	Who does report?	Number of treatment operators who report
AUT	1	Part	Treatment operators	8
BEL	1	Yes	Treatment operators	10
CHE	2 (3)	Batches for all TO's	Batch auditors	-
DNK	1	Yes	System	-
EST	1	Part	Treatment operators	5
ESP	1 (3)	Most	Systems, treatment operators shall take over 2015	Start with 1
FRA	1	Half	System	-
GRE	1 (2)	High share	Treatment operators	20
IRL	1	Prepare	Target treatment operators	2
ITA	2	High share	Systems and treatment operators	20
NLD	1	Yes	Treatment operators	7
NOR	1	Yes	Treatment operators	5
PRT	1	Half	System, treatment operators shall take over 2015	Open
ROU	1 (2)	Half	Treatment operators	2
SWE	1	Yes	Treatment operators	5
SVN	1	Test	System	-

In 14 of the 28 EU MS the RepTool at least is existent. Approximately four MS (BEL, DNK, NLD and SWE) are fully covered by one collective scheme using the RepTool. In eight MS (AUT, EST, ESP, FRA, GRE, ITA, PRT, ROU) half or more of the WEEE amounts are covered via the RepTool. In IRL and SVN, collective schemes prepared or started to test the tool.

[21] Based on internal WEEE Forum information and estimation

WF-RepTool: Available data

As a next step it needs to be figured out how data is reported in practice within the RepTool and to what extend output-related data is available. Therefore representatives of all 39 collective schemes that are WEEE Forum members[22] (and thus potentially may report data according the WEEELABEX standard) have been contacted via a 'questionnaire' (which can be found in Appendix V). Within the contacting procedure, also EucoLight (European Association of Lightning WEEE compliances schemes) got involved because of an overlap of members.

An overview of contributing collective schemes can be found in Table 50. Out of the 39 members of the WEEE Forum, six collective schemes provided information on input and output data. The exemplary data represents approximately one sixth of WEEE Forum members which are collective schemes reporting according to WEEELABEX/CENELEC standards. Furthermore six collective schemes for lightning equipment/ lamps out of the EucoLight network offered data, which also rely on CENELEC standards. Hence, it can be seen as a substantial share to examine current reporting structures and data availability.

Table 50: Overview on collective schemes contributing input/output WEEE data

WEEE Forum member	Country	Categories covered
Amb3e	PRT	**Collection categories:** ▪ Large appliances ▪ Cooling appliances ▪ Small appliances ▪ Lamps ▪ CRT appliances
Appliances Recycling S.A.	GRE	10 WEEE categories according to new WEEE Directive Annex I
Ecodom	ITA	**Collection categories** ▪ Cooling & Freezing appliances ▪ Large appliances ▪ Monitors and Screens ▪ Small appliance
Eco-systèmes	FRA	**Collection categories:** ▪ Large household appliances ▪ Cooling & Freezing appliances ▪ Screens (CRT & flat screens) ▪ Small household appliances
Recupel	BEL	**Collection categories:** ▪ Large household appliances ▪ Gas discharge lamps ▪ Cooling & Freezing appliances ▪ TV & Monitors ▪ Other small appliances
Remedia	ITA	**Collection categories:** ▪ Large appliances ▪ CFC ▪ CRT ▪ Mixed appliances ▪ Lamps

[22] WEEE Forum member list including an individual factsheet with general information for each scheme available at: http://www.weee-forum.org/about-the-members-of-the-weee-forum

Eucolight member	Country	Categories covered
Ambilamp	ESP	Lamps
Electro Cord	HUN	Lamps
Lightcycle	DEU	Lamps
Recolamp	ROU	Lamps
Recylum	FRA	Lamps
Anonymous	-	-

Received data has been formatted and harmonised. Aggregated data for all WEEE streams and all collective schemes is displayed in Table 51. Individual datasets can be found in Appendix VI. Due to confidentiality reasons only certain individual datasets which are approved by the respective collective schemes are displayed within Appendix VI.

Table 51: Aggregated data (ranges) of input/output data collected from collective schemes reporting to WEEELABEX/ CENELEC

	Collection Output	Reuse*	Treatment Input		Output							
					Total	MR*	P RU	ER	Σ R*	TD	LD	Σ D
All WEEE	101.3%	1.3%	100.0%	Total in ø%	**100.0%**	**80.2%-89.5%**		**0.2%-8%**	**88.3%-92.7%**	**0.7%-0.9%**	**6.6%-10.5%**	**7.3%-11.7%**
				• *Ferrous* ↔	**31.0% - 59.6%**	31.0% - 59.6%			**31.0% - 59.6%**			**0.0%**
				• *Non-Ferrous* ↔	**5.2% - 8.1%**	3.4% - 8.1%			**3.4% - 8.1%**			**0.0%**
				• *Mineral* ↔	**5.8% - 30.3%**	11.2% - 28.3%			**11.2% - 28.3%**			**0.9% - 2.0%**
				• *Plastics* ↔	**18.0% - 23.9%**	11.0% - 20.2%		2.1% - 6.0%	**12.7% - 22.3%**	0.1% - 0.3%	0.5% -2.0%	**0.9% - 2.1%**
				• *Other* ↔	**5.9% - 26.6%**	0.8% - 16.5%		0.1% - 0.9%	**0.8% - 17.4%**	0.5% - 0.6%	4.6% -8.6%	**4.3% - 9.2%**
Large appliances	N.A.	N.A.	100.0%	Total in ø%	**100.0%**	**78.7%-94.6%**		**0%-7.4%**	**86.2%-95.6%**	**0.4%-0.7%**	**6.9%-13.5%**	**4.5%-13.8%**
				• *Ferrous* ↔	**51.1% - 61.7%**	51.1% - 61.7%			**51.1% - 61.7%**			**0.0%**
				• *Non-Ferrous* ↔	**5.0% - 6.1%**	3.9% - 6.1%			**3.9% - 6.1%**			**0.0%**
				• *Mineral* ↔	**1.0% - 23.4%**	0.6% - 22.3%			**0.6% - 22.3%**			**0% - 1.1%**
				• *Plastics* ↔	**9.0% - 28.9&**	6.3% - 13.9%		1.0% - 9.8%	**6.3% - 14.9%**		0% - 0.2%	**0% - 0.5%**
				• *Other* ↔	**3.9% - 22.4%**	0.6% - 14.2%		1.0%	**0.6% - 14.2%**	0.4% - 0.7%	6.8% - 8.7%	**2.3% - 9.4%**
Cooling appliances	N.A.	N.A.	100.0%	Total in ø%	**100.0%**	**81.9%-82.9%**		**6.6%-14.1%**	**89.5%-96.8%**	**0.8%-0.9%**	**2.4%-6.4%**	**3.2%-10.5%**
				• *Ferrous* ↔	**58.1% - 59.0%**	58.1% - 60.5%			**58.1% - 60.5%**			**0.0%**
				• *Non-Ferrous* ↔	**4.7% - 8.1%**	5.7% - 8.1%			**5.7% - 8.1%**			**0.0%**
				• *Mineral* ↔	**1.0% - 21.4%**	1.0%			**1.0%**			**0.0%**
				• *Plastics* ↔	**7.2% - 29.0&**	13.5% - 16.4%		6.6% - 10.8%	**23.0% - 24.6%**	0.2% - 0.4%	0.1% - 4.1%	**0.5% - 6.0%**
				• *Other* ↔	**5.2% - 9.0%**	0.7% - 3.0%		0% - 3.3%	**0.7% - 6.3%**	0.3% - 0.6%	2.3%	**2.6% - 4.5%**
Small appliances	N.A.	N.A.	100.0%	Total in ø%	**100.0%**	**76.1%-92.9%**		**0.01%-7.6%**	**83.6%-93%**	**1.0%-2.6%**	**13.2%-15.4%**	**7.0%-16.4%**
				• *Ferrous* ↔	**40.0% - 50.1%**	29.3% - 50.1%			**29.3% - 50.1%**			**0.0%**
				• *Non-Ferrous* ↔	**10.7% - 14.0%**	5.1% - 13.1			**5.1% - 13.1%**			**0.0%**
				• *Mineral* ↔	**0.0%**	0.6%			**0.6%**			**0.0%**
				• *Plastics* ↔	**27.7% - 31.0%**	18.7% - 39.8%		7.4%	**26.1% - 39.8%**	0.2% - 0.4%	0.2% - 1.2%	**0.4% - 1.6%**
				• *Other* ↔	**7.1% - 16.1%**	0.4% - 12.1%		0% - 0.2%	**0.4% - 12.1%**	0.6% - 2.4%	4.3% - 14.1%	**6.7% - 14.7%**
Lamps	N.A.	N.A.	100.0%	Total in ø%	**100.0%**	**84.4%-95.9%**		**0.1%-1.3%**	**81.4%-96%**			**4%-18.6%**
				• *Ferrous* ↔	**0.9 - 12.0%**	0.9% - 18.8%			**0.9% - 18.8%**			**0% - 2.8%**
				• *Non-Ferrous* ↔	**0.9 - 12.0%**	2.2% - 13.7%			**2.2% - 13.7%**			**0% - 2.8%**
				• *Mineral* ↔	**72.0 - 88.9%**	47.0% - 79.5%			**47.0% - 87.3%**			**0% - 7.5%**
				• *Plastics* ↔	**0.5 - 12.0%**	0% - 9.0%		0.1% - 2.3%	**0.5% - 9.0%**			**0% - 19.0%**
				• *Other* ↔	**1.0 - 14.0%**	0.7% - 88.6%			**0.0% - 88.6%**		0% - 5.9%	**0% - 10.6%**

Data displayed in Table 51 and respectively in Appendix VI is from 2013 since most recent data from 2014 was not uniformly available among the contacted collective schemes. This data excerpt cannot be used to compare collective schemes or indicate future developments or trends but instead shall provide an example on current reporting structures and indicate data availability on the level of collective schemes. Only relative percentages are presented since absolute numbers were not uniformly available throughout the received datasets.

Contacted collective scheme understand **"Recycling Input"** as the amounts of untreated WEEE entering the first treatment facility. This amount often is the same as the overall collected amounts of WEEE. Some collective schemes subtract directly re-used appliances which means that their 'Recycling Input' is the difference between 'Collection Output' and 'Direct Re-use', namely 'Treatment Input'. Summarising, the only difference for collective schemes between WEEE amounts considered as 'Treatment Input' and 'Collection Output' is the amount of prepared for re-use or re-used appliances. This is in line with the reporting structures as laid down in the new WEEE Directive (cf. Figure 13).

Within Table 51, 'Treatment Input' is displayed relatively as 100%. WEEE categories used for reporting as 'Recycling Input' differ between the collective schemes. The three differently used input categories are (cf. with Appendix VI):

- Data according ten categories as laid down in Annex I of the new WEEE Directive
- Data according six categories as laid down in Annex III of the new WEEE Directive
- Collection categories used in practice

In general, data was provided for above mentioned input categories and for all WEEE treated by the collective scheme. In case data has been only reported for input categories and NOT for all WEEE treated, a weighted average of respective percentages from input categories with regards to the treated amounts has been used to indicate percentages for all WEEE treated.

Most collective schemes provided an **average material composition** for all WEEE or according reported categories. Harmonised material fractions are (cf. dark grey vertical columns in Table 51/Appendix VI):

- Ferrous metals
- Non-Ferrous metals
- Mineral (incl. glass and cement)
- Plastics
- Other

As an example, the ferrous metal fraction for all WEEE ranges between 31.0% and 59.6%, the non-ferrous fraction between 5.2% and 8.1%, the mineral fraction between 5.8% and 30.3%, the plastics fraction between 18.0% and 23.9% and all other fractions between 5.9% and 26.6% (cf. Table 51)

Please note that this categorisation is used by the majority of the collective schemes. Nevertheless a few collective schemes also further divide, e.g. the non-ferrous metals into aluminium or copper fractions or the minerals into glass and cement. Also the fraction 'Other' varies. Often included in this category are e.g. printed circuit boards or – in the case of gas discharge lamps – fluorescent powder. For the purpose of harmonising received data in order to improve comparability, the above listed five material fractions have been used in Table 51 and Appendix VI.´

Amounts considered as **"Recycling Output"** are displayed mainly based on the WEEELABEX definitions for final use. The used classification is (cf. dark grey horizontal rows in Table 51/ Appendix VI):

- MR: Material Recycling
- P RU: Preparation for re-use
- ER: Energy recovery
- ΣR: Total Recovery
- TD: Thermal Disposal
- LD: Landfill Disposal
- ΣD: Total Disposal

As an example between 80.2% and 89.5% of all WEEE are material recovered in the exemplary dataset (cf. Table 51).

Please note that stated percentages in Table 51/ Appendix VI e.g. for MR (Material Recycling) cannot be seen as official recycling rates since among others the re-used appliances are not included within this MR classification. Moreover, all mentioned percentages shall only indicate current reporting structures and data availability and are not supposed to be used for a judgment of recovery/ recycling performances.

For some collective schemes in particular the combination of material fractions and classification for final use is possible on an indicative basis. Hence one can derive conclusions e.g. on the share of plastic fractions that are recycled or (thermally) disposed. This may be the basis for an approximation to output-based/material-based recycling/recovery targets.

All WEEE

With 100% Treatment Input as a reference, the ferrous metal fraction which is (material) recycled ranges between 31.0% and 59.6%, non-ferrous metal fractions vary between 3.4% and 8.1%. Referring to the absolute ferrous and non-ferrous metal fractions it can be seen that almost all metal fractions are material recovered and not disposed (also 31.0% to 59.6% for ferrous metals or respectively 3.4% to 8.1% for non-ferrous metals. Figure 18 visualises the ranges of average material composition (based on the exemplary individual datasets) and the ranges of percentages classified as material recovered (MR).

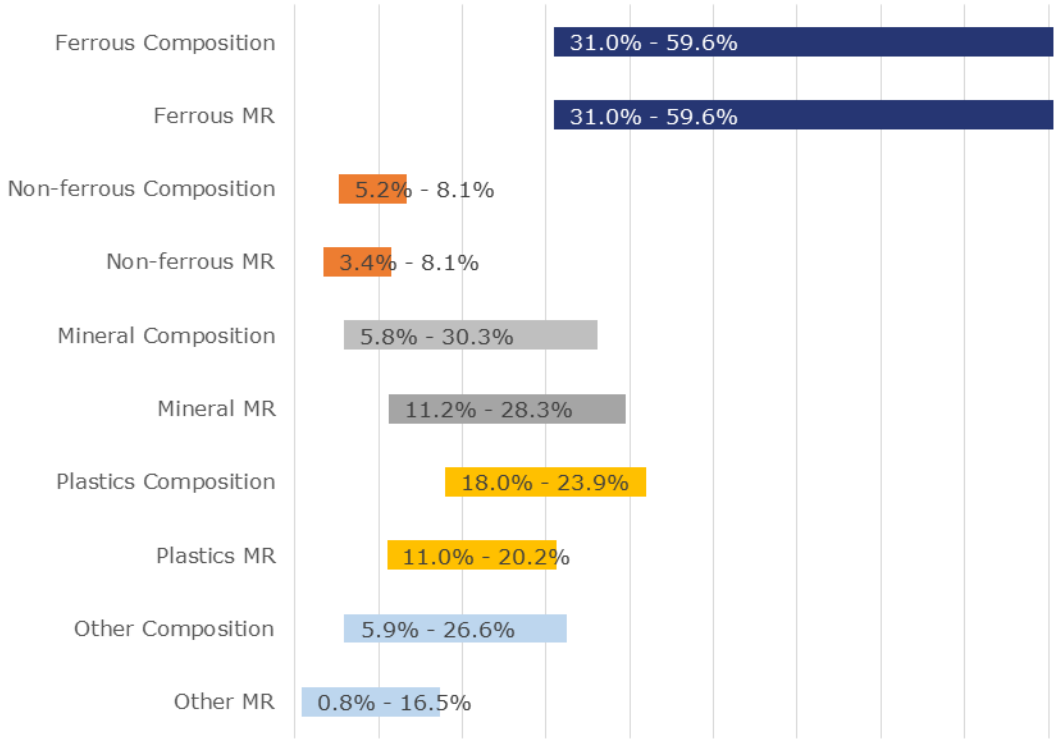


Figure 18: Average composition of all WEEE vs. material recovered (MR) amounts with 100% Treatment Input as reference

Also mineral fractions are mainly recycled, only showing a slight amount (0.9% - 2.0%) going into disposal (cf. Table 51). In the case of the plastics fraction this looks a little different. Still the majority is recycled but also a remarkable share is sent to energetic recovery (2.1% - 6.0%). The share of disposed fractions mainly can be related to the not further classified fraction ("Other").

WEEE categories

In line with the averaged data for all WEEE, the trend is also similar if numbers are broken down to the categories. Ferrous, non-ferrous metals and minerals are almost exclusively classified as recycled. Whereas the plastic fraction is either recycled or energetically recovered. Not further divided output fractions ("Other") mainly account for the disposed fractions.

Please note that the data can only indicate tendencies, since the format, categorisations and still some room for interpretation on the depth of reporting exist between the received individual datasets. In case no percentages are displayed within the tables, the collective schemes did not provide this data. As already described, Table 51 and Appendix VI try to harmonise the individually reported data from collective scheme in the same format. Obviously this leads to the fact that not every cell can be filled with data.

To sum up, WEEELABEX/CENELEC based reporting in practice begins with input into treatment. Thereby treatment input is the difference between collected amounts and re-used appliances. The reporting ends with fractions sent to recycling. At level of the collective schemes no further statement is made on 'recycling efficiency' meaning how much of e.g. the ferrous metals fractions is actually transferred into a new product. Thus data from RepTool do not necessarily have to be considered as output-based data referring to recycling efficiency but approximates strongly to output-based data due to the harmonised standards.

4.4 Considerations on consequences and impacts when changing from 'input-based' to 'output-based' target calculation

Above presented data is seen as significant for displaying current reporting structures and indicating general data availability at the level of collective schemes, which refer to the WEEELABEX/CENELEC standard. Nevertheless, the overall limited data availability in combination with a high share of uncertainty of the presented data hampers a substantial recommendation on output-based and material-based target calculation. Identified obstacles and relevant feasibility aspects for output-based targets ('recovery/ recycling efficiency') and material-based targets will be discussed in this chapter.

4.4.1 Identified obstacles

Potential obstacles for output-based target calculation derived from the analysis of reporting structures and available output information are presented below.

- **No strict differentiation between Recycling Input and Output**

Data from collective schemes using the RepTool is not necessarily more output-related than EUROSTAT, due to the explained fact that WEEELABEX covers data beginning at 'Treatment Input' and ending with materials accounted for recycling. If in fact output from recycling is reported within the RepTool or if fractions send as input for recycling are reported, still heavily depends on the individual reporting from treatment operators.

As already mentioned before, the RepTool technically allows users to distinguish fractions stemming from first treatment, which may be considered as 'Treatment Output' or respectively 'Recycling Input' after a treatment according to Annex VII of the new WEEE. However this possibility is not commonly used on the level of collective schemes. The reason therefore may be that the clear definition of treatment according to Article 8 (in combination with requirements from Annex VII) is transformed recently and not yet transferred into practice. It is often the case, that fractions as input for treatment are mistakenly seen as input for recycling.

Although no strict differentiation of output-related data availability between WEEELABEX data and EUROSTAT data can be made, the conclusion based on the presented exemplary data is, that data reported within the RepTool approximates strongly to output-based data because of the harmonised reporting structures. In practice differently interpreted terms of 'Recycling Input' and 'Recycling Output' lead to different reporting structures also at the level of EUROSTAT. In case major data for Member States reporting is provided by collective schemes using the WEEELABEX methodology (e.g. BEL, NLD and SWE as indicated in Table 49), also the EUROSTAT data is more output oriented. Whereas other Member States account fractions as recycled which in fact only enter into treatment.

- **Depth and quality of downstream monitoring**

The classification of data as input/output data may vary with each report and finally depends on the treatment facilities. The variety can be explained by the depth and quality of monitoring of downstream treatment steps. Usually the treatment steps start with a first treatment (e.g. removal of fluids and selective treatment according Art. 8), followed by a shredding step and further downstream treatment steps as floatation, Xray separation, etc. According to information from Eco-systèmes, the problem is that monitoring of fractions gets the more difficult the more treatment steps have been performed. Although as much batch data and mass balances as possible are quantitatively recorded, often declarations, estimations or hypothetical data are used to finally report recycled fractions (and respective recycling rates).

As a consequence, there is firstly a variety on how deep the downstream treatment process is characterised. Some collective schemes clearly distinguish within their reporting structures between first treatment and further treatment, some may consider the general 'Treatment Input' as 'Recycling Input' as already indicated in the above paragraph.

Secondly, there is a variety on data quality. Some schemes may use estimates or declarative data, some require detailed mass balances or surveyed batch data from their treatment operators. To harmonize the different data qualities, Eco-systèmes suggests the introduction of 'Confidence Factors' alongside the reported recovery/recycling rates. Depending of the depth and quality of gathered data, this factor should help indicating how viable data is and enable a comparison of quantitative rates based on their underlying data reporting method [Eco-systèmes 2015].

- **Non-harmonised data reporting for specific material fractions**

Based on received datasets, the overall impression is that only few collective schemes require their treatment operators to transmit data on specific material fractions, such as copper, aluminium or other materials. It is assumed that for valuable materials this data indeed is kept at least on treatment operator level but it is not reported officially due to confidentiality reasons. Nevertheless the RepTool offers the possibility to report in detail on specific material fractions and some collective schemes submitted these data. The majority relies on the general classification into ferrous metals, non-ferrous metals, minerals, plastics and others as used in Table 51 and Appendix VI. This would support recycling targets for grouped fractions but hampers material specific targets.

- **Missing measurement of 'recycling efficiency'**

Even if specific material fractions, such as aluminium or copper are reported to collective schemes, all available data from WEEELABEX based reporting ends with fractions sent to final treatment technologies. There is no systematically reported data available making statements about the recycling efficiency for e.g. copper fractions sent to a smelter as final treatment technology. The approach of [EERA 2014] as mentioned in chapter 2.6.3, is to introduce recycling efficiency targets. This is understood as a target on how final fractions sent to final treatment technologies are transformed into a product. For certain substances (e.g. non-ferrous metals or other critical raw materials) recycling efficiency targets may be set up, enforcing that a certain weight-percentage of the element in the final fraction sent for treatment is effectively transformed into a product. How this finally can be measured and monitored needs further elaboration.

Summarising the identified obstacles: No plausible data base for a substantial proposal of output-based/material-based recovery/ recycling targets is existent.
A further distribution of harmonised reporting structures (e.g. according the CENELEC standards) would be required and favourable to propose output-based/ material-based targets).

4.4.2 Potential benefits and feasibility aspects

Aspects on benefits and feasibility of output-based target calculation derived from the analysis of reporting structures and available output information are presented below. Potential benefits from output-based/material based targets are mostly related to the replacement of material production from primary sources with recycled materials. On the first hand environmental benefits via a reduction of energy and resource usage due to recycling. On the other hand economic benefits regarding the raw material strategy in securing EU's access on critical raw materials.

- **Benefits from increasing technical efficiency**

By not explicitly referring to output fractions from recovery/ recycling processes, an incentive to increase recycling efficiency via technical improvements may be missing (cf. chapter 2.6.1). Environmental benefits from recycling can only be achieved when treatment and "final" recovery/ recycling has taken place and secondary raw material is available in a quality to allow a replacement of primary raw material. Target definitions exclusively based on input data may hamper recycling by leading to fake recovery/ recycling activities to seemingly improve performances. As the presented data excerpt indicates, data is available only for few material groups. This material fractions (especially ferrous and non-ferrous metals) already are recycled to a high share out of economic reasons and without the incentive of material-based targets. Of course this recovery/ recycling may not be stable since economic circumstances may change and no legally binding target is formulated. For benefits regarding the raw material strategy please also refer to chapter 2.6.3, since aspects formulated there also need to be considered at this point. In particular, EERA and EuroMetaux's standard on end-processing gives insights at this point.

To further support technical efficiency without establishing material-based targets, the Best Available Techniques Reference Document (BREF) for waste treatment could be taken into consideration. Currently the BREF is being developed and the finalisation of the document should be awaited (first draft envisaged in the third quarter of 2015).

- **Benefits via the control of pollutants stemming from WEEE**

Output-based/ material-based targets will not significantly influence the monitoring of de-pollution of WEEE. From an environmental perspective the priority should remain with the enforcement of selective treatment including de-pollution as required according to Annex VII of the new WEEE Directive. In particular the definition difference between treatment and recovery/ recycling should be prioritized over strict mass based recycling targets.

- **Integration of collection into calculation of recovery/ recycling targets**

Referring to data of Table 51/ Appendix VI and in particular to the ranges of material recycling rates, it becomes obvious that once WEEE reaches an officially registered treatment procedure, a substantial part of WEEE fractions will be recycled. Independent from discussions between input and output-related data, at least valuable fractions (e.g. metals, glass) will be recycled out of economic reasons and independent from a recovery/recycling target (cf. Figure 18). In the broader view, the ambitiousness and calculation method of recycling rates will have less impact on the mass of recovered/ recycled fractions than the collection rate. Assuming that WEEE reaching the official collection structures will be very likely further treated, the collection targets have a greater impact on final fractions available for recovery/ recycling. Hence the current definition of recovery/ recycling rates which are based on the collected WEEE amounts can be seen as positive. This way, incentives to not report collected amounts at the level of producers and collective schemes will be

reduced since their recovery/ recycling performance decrease if WEEE amounts will be diverted from official treatment procedures [StEP 2010].

- **Administrative burden on data reporting**

As already presented in chapter 4.2.2 the requirements for Member States to report output data from recovery/ recycling facilities is laid down in Art. 11(4) of the new WEEE Directive. This data is not explicitly kept on Member State level but data may be available on level of the treatment facilities. In particular it may be approximately available at treatment facilities following WEEELABEX/ CENELEC standards. Fostering the distribution of CENELEC standards among treatment operators is considered to have less administrative burden than creating reporting duties on output-related/material-related data on Member State level.

To combine the benefits of output-based targets and consider feasibility aspects, the most promising approach is to further enforce the collection rates of WEEE and the CENELEC standards on WEEE treatment in order to harmonize WEEE treatment and respective reporting. To further support technical recycling efficiency reference to the BREF for waste treatment (currently being developed) can be made.

4.5 Conclusions

Within chapter 4 the current method for calculation of recovery/ recycling targets was assessed. Therefore the availability of output-related data on Member State level and apart from that was regarded in detail.

- The key findings are that there is no significant database for changing the current calculation method of the new WEEE Directive. Other calculation methods (e.g. according WEEELABEX) in practice are not substantially different from the new WEEE Directive's approach and. A plausible database for output-based/ material-based targets does not exist.
- With regards to available data on Member State level it can be summarised that no distinct output data is kept by the Member States. Based on information of TAC members and recovery/ recycling data from EUROSTAT the overall impression is that WEEE amounts send for recycling are kept which leaves room for interpretation whether this refers to input or output based data.
- From an environmental perspective the enforcement of selective treatment according Annex VII of the new WEEE Directive should be prioritized over material-based recycling targets.
- Summarising information of data sources apart from Member State level, in particular data recorded with the WEEE Forum's RepTool based on WEEELABEX/ CENELEC standards, it can be said that this data also do not necessarily has to be considered as output-based. Nevertheless it approximates strongly to output-based data due to the underlying harmonised structures of the standard.
- Material-based targets, for material fractions where already data is recorded (e.g. ferrous or non-ferrous metals) may only have a limited influence on actual recycling practices. The reason therefore is that these valuable materials are already almost completely recycled due to their economic value.
- The most promising approach to benefit from advantages of output-based targets while taking into consideration the current reporting structures and data availability is to tackle non-harmonised reporting structures where different interpretation and practices are used (e.g. different interpretation regarding general treatment (following Art. 8/ Annex VII of the new WEEE Directive) vs. actual recovery/ recycling). To overcome this obstacle and harmonise reporting structures, the focus shall rely on referencing, fostering and enforcing the recently developed CENELEC standards (starting with EN 50625-1) as referred to in Art. 8(5) of the new WEEE Directive. This set of standards may provide clear guidance on all identified obstacles.
- Further, the strict implementation, enforcement and monitoring of WEEE collection targets have a large influence on actual recycling/ recovery, as WEEE entering the collection schemes is usually entering the recovery cycle with high reasonable recycling/recovery rates. The influence on collection rates is estimated to be higher than the change from input to output-based recovery targets.

5 Summarized conclusion

Below you can find summarized conclusions of the study. For more detailed aspects please refer to the corresponding chapters.

Re-examination of recovery targets referred to in Annex V, Part 3

The overall conclusion is that, the new targets to be applied from 2018 onwards (reported under EU 6) maintain a similar level of ambition compared to the targets introduced from 2015 onwards (reported under EU 10) in the new WEEE Directive.

Despite the level of ambition is similar and no change of targets is proposed, critical points or relevant elements for further investigation have been revealed and presented in chapter 2. Key findings are summarized again below:

- The mass of material recycled and recovered is first and foremost influenced by the amount collected and processed. The revised collection targets have a far greater influence on the final material recovered than the recycling and recovery targets.
- Despite new targets being more or less equivalent to old ones, they are still not addressing some of the key aspects of raw material strategy and eco-efficiency of recycling, particularly taking into account that weight based targets are not triggering recovery of material which are contained in small quantities when the economic value is not a driver strong enough.
- From an administrative burden perspective the application of new targets (Part 3) should be enforced starting with the beginning of a calendar year (either 2018 or 2019).

Examination of the possibility for separate preparation for re-use targets

Due to the lack of visibility on the quantities of WEEE that could potentially be prepared for re-use in the EU, the costs of changing the current logistics and the difficulties expected to report flows and distinguish waste from non-waste, no separate preparation for re-use targets are proposed. Nevertheless a promotion of re-use is seen as important and thus other options to foster re-use have been elaborated and are presented in chapter 3. Key findings are summarized again below:

- In order to promote re-use it is important to increase public awareness as regards re-use services and benefits. WEEE that have a potential for re-use should be brought back directly by the consumer to the re-use organisation (or collected by the latter by households) to ensure the re-use potential is preserved. Repair, before the product becomes waste, should also be strongly promoted and need to be facilitated already in the product's design phase (eco-design). A strong observation of the study is that more actions need to be put in place to prevent waste, as the potential of re-use of WEEE once it reaches a collection site is highly compromised.
- If the product finally becomes waste, access to WEEE by re-use organisations need to be granted, either by collective schemes or directly by municipalities or other operators such as retailers. Today, the practice shows that a **lot of re-use organisations do not have access to WEEE at the early stage of collection.**

- All re-use centres should report on what goes into the re-use centre (both used EEE destined for direct re-use and WEEE to be prepared for re-use) and what goes out based on mass.
- Define a clear methodology to measure rates of preparation for re-use
- In the future, if a target is considered, it should take into account: (1) the differences in development of approved re-use centres and network in Europe and (2) the differences in the amounts of reusable products which are discarded in the Member States.

  Another option for the future would be to consider that all used EEE or WEEE collected by re-use centres are waste, in order to facilitate the tracking of flows and monitor the achievement of a potential target on the output of these facilities. However, this option needs to be further considered since it involves redefining of re-use and preparation for re-use activities.

Re-examination of the calculation method for recovery/ recycling targets

No change of the calculation method of recovery/ recycling/ preparing for re-use targets is proposed. The reason therefore is that almost no data on output-related fractions/ material fractions is available on Member State level and only a limited database exists apart from Member State level, e.g. at collective schemes relying on the WEEELABEX/ CENELEC standards.

The available data as well as options to harmonize reporting structures are presented in chapter 4. Key findings are summarized again below:

- The enforcement of CENELEC standard when it comes to guiding the reporting will help in achieving more comparable data and results across EU28 and increase reliability of figures.
- An enforcement of reporting on selective treatment and de-pollution according to Annex VII to the Directive (e.g. in line with CENELEC) shall be prioritised over introducing new material-based recycling targets from an environmental perspective. Material-based targets, for material fractions where data is already recorded (e.g. ferrous or non-ferrous metals) may only have a limited influence on actual recycling practices. The reason therefore is that these valuable materials are already almost completely recycled due to their economic value.
- Further, the strict implementation, enforcement and monitoring of WEEE collection targets has a large influence on actual recycling/ recovery, as WEEE entering the collection schemes is usually entering the recovery cycle with high reasonable recycling/recovery rates. Therefore, the influence on actual recycling/ recovery from achieving high collection rates is estimated to be higher than the change from input to output-based recovery targets.

In general, a future alignment of the WEEE Directive with a potential new Circular Economy package is recommended. In particular regarding the approach to concentrate on eco-design measures (e.g. in the case of re-use) and regarding the long-term perspective on the EU's critical raw material strategy.

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7 Appendices

Appendix I: Change in absolute value of recovery targets

Appendix II: Current recovery and recycling performance for Member States for EU6 categories against Annex 5, Part 3 targets

Appendix III: Stakeholder consultation list for assessing preparation for re-use targets

Appendix IV: Assessment of questions regarding Art. 11(4) WEEE 2 from TAC meeting

Appendix V: Questionnaire output-based recovery/ recycling targets

Appendix VI: Individual datasets collective schemes reporting according WEEELABEX/ CENELEC

Appendix I: Change in absolute value of recovery targets

The table lists the corresponding recycling and recovery targets under Annex V Part 2 and Annex V Part 3 for each UNU-KEY. The change in the absolute value of the target from Part 2 (EU10 2018) to Part 3 (EU6 2018) is also shown, with increase in target highlighted in green and reduction in target highlighted in red colours.

		Annex I	Annex III	Annex V Part 2 (EU10 2018)		Annex V Part 3 (EU6 2018)		Change Part 2 - Part 3	
UNU Key	Full name	EU10	EU6	Recovery Target	Recycling Target	Recovery Target	Recycling Target	Recovery from Pa	Recycling from Pa
0001	Central Heating (household installed)	1	4	85%	80%	85%	80%	0%	0%
0002	Photovoltaic Panels (incl. converters)	4	4	80%	70%	85%	80%	5%	10%
0101	Professional Heating & Ventilation (excl. cooling equipment)	1	4	85%	80%	85%	80%	0%	0%
0102	Dishwashers	1	4	85%	80%	85%	80%	0%	0%
0103	Kitchen (f.i. large furnaces, ovens, cooking equipment)	1	4	85%	80%	85%	80%	0%	0%
0104	Washing Machines (incl. combined dryers)	1	4	85%	80%	85%	80%	0%	0%
0105	Dryers (wash dryers, centrifuges)	1	4	85%	80%	85%	80%	0%	0%
0106	Household Heating & Ventilation (f.i. hoods, ventilators, space hea	1	4	85%	80%	85%	80%	0%	0%
0108	Fridges (incl. combi-fridges)	1	1	85%	80%	85%	80%	0%	0%
0109	Freezers	1	1	85%	80%	85%	80%	0%	0%
0111	Air Conditioners (household installed and portable)	1	1	85%	80%	85%	80%	0%	0%
0112	Other Cooling (f.i. dehumidifiers, heat pump dryers)	1	1	85%	80%	85%	80%	0%	0%
0113	Professional Cooling (f.i. large airconditioners, cooling displays)	1	1	85%	80%	85%	80%	0%	0%
0114	Microwaves (incl. combined, excl. grills)	1	5	85%	80%	75%	55%	-10%	-25%
0201	Other Small Household (f.i. small ventilators, irons, clocks, adapter	2	5	75%	55%	75%	55%	0%	0%
0202	Food (f.i. toaster, grills, food processing, frying pans)	2	5	75%	55%	75%	55%	0%	0%
0203	Hot Water (f.i. coffee, tea, water cookers)	2	5	75%	55%	75%	55%	0%	0%
0204	Vacuum Cleaners (excl. professional)	2	5	75%	55%	75%	55%	0%	0%
0205	Personal Care (f.i. tooth brushes, hair dryers, razors)	2	5	75%	55%	75%	55%	0%	0%
0301	Small IT (f.i. routers, mice, keyboards, external drives & accessoire	3	6	80%	70%	75%	55%	-5%	-15%
0302	Desktop PCs (excl. monitors, accessoires)	3	6	80%	70%	75%	55%	-5%	-15%
0303	Laptops (incl. tablets)	3	2	80%	70%	80%	70%	0%	0%
0304	Printers (f.i. scanners, multifunctionals, faxes)	3	6	80%	70%	75%	55%	-5%	-15%
0305	Telecom (f.i. (cordless) phones, answering machines)	3	6	80%	70%	75%	55%	-5%	-15%
0306	Mobile Phones (incl. smartphones, pagers)	3	6	80%	70%	75%	55%	-5%	-15%
0307	Professional IT (f.i. servers, routers, data storage, copiers)	3	4	80%	70%	85%	80%	5%	10%
0308	Cathode Ray Tube Monitors	3	2	80%	70%	80%	70%	0%	0%
0309	Flat Display Panel Monitors (LCD, LED)	3	2	80%	70%	80%	70%	0%	0%
0401	Small Consumer Electronics (f.i. headphones, remote controls)	4	5	80%	70%	75%	55%	-5%	-15%
0402	Portable Audio & Video (f.i. MP3, e-readers, car navigation)	4	5	80%	70%	75%	55%	-5%	-15%
0403	Music Instruments, Radio, HiFi (incl. audio sets)	4	5	80%	70%	75%	55%	-5%	-15%
0404	Video (f.i. Video recorders, DVD, Blue Ray, set-top boxes)	4	5	80%	70%	75%	55%	-5%	-15%
0405	Speakers	4	5	80%	70%	75%	55%	-5%	-15%
0406	Cameras (f.i. camcorders, foto & digital still cameras)	4	5	80%	70%	75%	55%	-5%	-15%
0407	Cathode Ray Tube TVs	4	2	80%	70%	80%	70%	0%	0%
0408	Flat Display Panel TVs (LCD, LED, Plasma)	4	2	80%	70%	80%	70%	0%	0%
0501	Lamps (f.i. pocket, christmas, excl. LED & incandescent)	5	3	0%	80%	0%	80%	0%	0%
0502	Compact Fluorescent Lamps (incl. retrofit & non-retrofit)	5	3	0%	80%	0%	80%	0%	0%
0503	Straight Tube Fluorescent Lamps	5	3	0%	80%	0%	80%	0%	0%
0504	Special Lamps (f.i. professional mercury, high & low pressure sodiu	5	3	0%	80%	0%	80%	0%	0%
0505	LED Lamps (incl. retrofit LED lamps & household LED luminaires)	5	3	0%	80%	0%	80%	0%	0%
0506	Household Luminaires (incl. household incandescent fittings)	5	5	75%	55%	75%	55%	0%	0%
0507	Professional Luminaires (offices, public space, industry)	5	5	75%	55%	75%	55%	0%	0%
0601	Household Tools (f.i. drills, saws, high pressure cleaners, lawn mov	6	5	75%	55%	75%	55%	0%	0%
0602	Professional Tools (f.i. for welding, soldering, milling)	6	4	75%	55%	85%	80%	10%	25%
0701	Toys (f.i. car racing sets, electric trains, music toys, biking compute	7	5	75%	55%	75%	55%	0%	0%
0702	Game Consoles	7	6	75%	55%	75%	55%	0%	0%
0703	Leisure (f.i. large exercise, sports equipment)	7	4	75%	55%	85%	80%	10%	25%
0801	Household Medical (f.i. thermometers, blood pressure meters)	8	5	75%	55%	75%	55%	0%	0%
0802	Professional Medical (f.i. hospital, dentist, diagnostics)	8	4	75%	55%	85%	80%	10%	25%
0901	Household Monitoring & Control (alarm, heat, smoke, excl. screens	9	5	75%	55%	75%	55%	0%	0%
0902	Professional Monitoring & Control (f.i. laboratory, control panels)	9	4	75%	55%	85%	80%	10%	25%
1001	Non Cooled Dispensers (f.i. for vending, hot drinks, tickets, money)	10	4	80%	80%	85%	80%	5%	0%
1002	Cooled Dispensers (f.i. for vending, cold drinks)	10	1	80%	80%	85%	80%	5%	0%

5% Increase in Target
10% Increase in Target
15% Increase in Target
> 20% Increase in Target

5% Decrease in Target
10% Decrease in Target
15% Decrease in Target
> 20% Decrease in Target

Appendix II: Current recovery and recycling performance for Member States for EU6 categories against Annex 5, Part 3 targets

Recovery % based on Current Performance (2012)

	Recovery Target:	Member State Performance for Recovery in 2012 (or 2010 where more recent data not available)																									
Category	Annex V, Part 3	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	NL	PL	PT	RO	SE	SI	SK	UK
1	85%	88.48%	86.88%	87.51%	77.05%	83.40%	94.60%	90.54%	94.66%	71.62%	91.53%	83.41%	98.37%	83.13%	81.66%	No Data	79.28%	96.72%	83.91%	94.05%	88.88%	84.68%	92.88%	90.57%	84.51%	90.16%	78.99%
2	80%	91.32%	83.81%	76.57%	56.67%	80.27%	94.23%	94.33%	94.20%	76.75%	91.94%	82.29%	96.22%	89.57%	89.97%	No Data	76.37%	92.29%	84.67%	95.36%	62.21%	91.02%	87.59%	93.72%	99.15%	89.11%	78.36%
3	0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	No Data	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
4	85%	88.66%	87.80%	86.23%	75.98%	82.14%	94.48%	90.87%	91.03%	71.34%	91.46%	82.39%	98.36%	83.72%	81.88%	No Data	78.73%	95.43%	84.83%	93.79%	84.82%	85.45%	91.76%	90.16%	83.00%	90.15%	78.88%
5	75%	90.21%	76.45%	82.21%	67.94%	82.89%	96.66%	94.30%	73.97%	79.60%	91.35%	82.61%	96.32%	84.56%	89.60%	No Data	78.13%	91.43%	79.89%	94.61%	76.48%	92.22%	87.74%	92.53%	83.00%	86.66%	79.86%
6	75%	90.63%	94.43%	74.43%	57.07%	68.73%	90.81%	94.12%	96.78%	69.64%	89.97%	75.27%	102.51%	89.89%	84.93%	No Data	74.50%	87.39%	89.57%	96.42%	47.03%	91.63%	85.52%	91.46%	87.94%	93.14%	77.79%

Recycling & Reuse % based on Current Performance (2012)

	Recycling Target:	Member State Performance for Recycling in 2012 (or 2010 where more recent data not available)																									
Category	Annex V, Part 3	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	NL	PL	PT	RO	SE	SI	SK	UK
1	80%	81.64%	79.35%	86.69%	77.05%	81.05%	84.78%	78.67%	85.03%	68.49%	88.90%	77.98%	98.37%	82.94%	80.27%	No Data	70.78%	90.74%	83.91%	74.95%	88.37%	83.39%	89.39%	86.34%	78.96%	89.14%	77.84%
2	70%	80.70%	78.61%	75.64%	56.67%	80.72%	83.42%	88.82%	85.43%	68.76%	90.51%	78.57%	96.22%	86.93%	88.57%	No Data	63.95%	86.35%	84.67%	83.87%	61.59%	89.96%	79.94%	83.44%	88.94%	86.83%	77.04%
3	80%	95.59%	92.80%	53.95%	0.00%	89.54%	94.76%	0.00%	67.68%	93.60%	90.12%	89.97%	52.42%	87.85%	90.74%	No Data	64.35%	92.11%	80.00%	92.87%	94.42%	98.68%	89.17%	100.00%	93.94%	92.59%	90.34%
4	80%	80.87%	80.20%	85.45%	75.98%	80.41%	83.93%	79.42%	80.97%	67.61%	89.08%	77.07%	98.36%	83.50%	80.42%	No Data	70.49%	89.15%	84.83%	78.69%	84.36%	84.13%	87.80%	85.31%	77.39%	88.97%	77.72%
5	55%	77.56%	71.53%	81.93%	67.94%	81.26%	83.66%	88.19%	62.19%	68.07%	89.30%	78.05%	96.32%	83.25%	87.66%	No Data	67.90%	84.64%	79.89%	79.87%	75.56%	89.51%	83.43%	81.84%	77.41%	84.19%	78.96%
6	55%	78.06%	87.64%	72.09%	57.07%	77.68%	79.93%	87.00%	88.98%	59.75%	88.85%	71.26%	102.51%	89.45%	82.73%	No Data	64.75%	80.15%	89.57%	84.07%	46.59%	90.42%	76.72%	82.92%	74.95%	91.99%	76.39%

	Recovery Target:	Recovery Performance compared to Target																									
Category	Annex V, Part 3	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	NL	PL	PT	RO	SE	SI	SK	UK
1	85%	3.48%	1.88%	2.51%	-7.95%	-1.60%	9.60%	5.54%	9.66%	-13.38%	6.53%	-1.59%	13.37%	-1.87%	-3.34%	No Data	-5.72%	11.72%	-1.09%	9.05%	3.88%	-0.32%	7.88%	5.57%	-0.49%	5.16%	-6.01%
2	80%	11.32%	3.81%	-3.43%	-23.33%	0.27%	14.23%	14.33%	14.20%	-3.25%	11.94%	2.29%	16.22%	9.57%	9.97%	No Data	-3.63%	12.29%	4.67%	15.36%	-17.79%	11.02%	7.59%	13.72%	19.15%	9.11%	-1.64%
3	0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	No Data	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
4	85%	3.66%	2.80%	1.23%	-9.02%	-2.86%	9.48%	5.87%	6.03%	-13.66%	6.46%	-2.61%	13.36%	-1.28%	-3.12%	No Data	-6.27%	10.43%	-0.17%	8.79%	-0.18%	0.45%	6.76%	5.16%	-2.00%	5.15%	-6.12%
5	75%	15.21%	1.45%	7.21%	-7.06%	7.89%	21.66%	19.30%	-1.03%	4.60%	16.35%	7.61%	21.32%	9.56%	14.60%	No Data	3.13%	16.43%	4.89%	19.61%	1.48%	17.22%	12.74%	17.53%	8.00%	11.66%	4.86%
6	75%	15.63%	19.43%	-0.57%	-17.93%	-6.27%	15.81%	19.12%	21.78%	-5.36%	14.97%	0.27%	27.51%	14.89%	9.93%	No Data	-0.50%	12.39%	14.57%	21.42%	-27.97%	16.63%	10.52%	16.46%	12.94%	18.14%	2.79%

	Recycling Target:	Recycling & Reuse Performance compared to Target																									
Category	Annex V, Part 3	AT	BE	BG	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	NL	PL	PT	RO	SE	SI	SK	UK
1	80%	1.64%	-0.65%	6.69%	-2.95%	1.05%	4.78%	-1.33%	5.03%	-11.51%	8.90%	-2.02%	18.37%	2.94%	0.27%	No Data	-9.22%	10.74%	3.91%	-5.05%	8.37%	3.39%	9.39%	6.34%	-1.04%	9.14%	-2.16%
2	70%	10.70%	8.61%	5.64%	-13.33%	10.72%	13.42%	18.82%	15.43%	-1.24%	20.51%	8.57%	26.22%	16.93%	18.57%	No Data	-6.05%	16.35%	14.67%	13.87%	-8.41%	19.96%	9.94%	13.44%	18.94%	16.83%	7.04%
3	80%	15.59%	12.80%	-26.05%	-80.00%	9.54%	14.76%	-80.00%	-12.32%	13.60%	10.12%	9.97%	-27.58%	7.85%	10.74%	No Data	-15.65%	12.11%	0.00%	12.87%	14.42%	18.68%	9.17%	20.00%	13.94%	12.59%	10.34%
4	80%	0.87%	0.20%	5.45%	-4.02%	0.41%	3.93%	-0.58%	0.97%	-12.39%	9.08%	-2.93%	18.36%	3.50%	0.42%	No Data	-9.51%	9.15%	4.83%	-1.31%	4.36%	4.13%	7.80%	5.31%	-2.61%	8.97%	-2.28%
5	55%	22.56%	16.53%	26.93%	12.94%	26.26%	28.66%	33.19%	7.19%	13.07%	34.30%	23.05%	41.32%	28.25%	32.66%	No Data	12.90%	29.64%	24.89%	24.87%	20.56%	34.51%	28.43%	26.84%	22.41%	29.19%	23.96%
6	55%	23.06%	32.64%	17.09%	2.07%	22.68%	24.93%	32.00%	33.98%	4.75%	33.85%	16.26%	47.51%	34.45%	27.73%	No Data	9.75%	25.15%	34.57%	29.07%	-8.41%	35.42%	21.72%	27.92%	19.95%	36.99%	21.39%

Appendix III: Stakeholder consultation list for assessing preparation for re-use targets

Organisation	Interview
RREUSE	12/12/2014
Eco-systèmes, France	17/12/2014
Ministry of Environment, denmark	06/01/2015
Komosie, Flanders	07/01/2015
Bag arbeit e.V.	12/01/2015
AERESS, Spain	13/01/2015
Rehab Recycle, Ireland	14/01/2015
Wecycle, Netherlands	16/01/2015
SIRRMIET	27/01/2015
Federal Environment Agency (UBA), Germany	04/03/2015
University of Limerick, Ireland	04/03/2015
Really Green Credentials Ltd	12/03/2015
WRAP	12/03/2015

Appendix IV: Assessment of questions regarding Art. 11(4) WEEE 2 from TAC meeting

MS	Contact	Data?	Since	Collection procedure	Accessibility of data	Follow-Up
AT	Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft	Yes	2005	Every person responsible for the treatment has to fill in the data of recovery and recycling/preparing for re-use in the Austrian EDM-System on an annual Basis. (Until 10th of March every year).	Austria submits the data in the annual report to the Europ. Commission via Eurostat.	In Austria, five collective schemes collect and report data. They report amounts sent to recovery/recycling. Output-related data is not reported since fractions from WEEE are mixed with fractions from other waste streams within facilities. Furthermore different end-of-waste criteria or respectively when the transformation of the waste really is calculated as recycling are non-uniform. As an example, Cu fractions sent to a smelter are accounted as recycled. Additionally, no explicit first treatment plants exist. Recovery/recycling facilities fulfill requirements of new WEEE Art. 8
BE	OVAM Belgium	No				
BG	N.A.	No		No, we have not collected data from preparing for re-use facilities.		
CY						
CZ						
DE	Federal Environment Agency (UBA) Germany	No		Neither Article 11 (4) WEEE II nor Article 7 (3) WEEE obligate to collect this data. However, the German draft for the national implementation of the directive 2012/19/EU contains an obligation for the primary treatment plants to collect output data of recovery or recycling/preparing for re-use facilities.		

DK	Ministry of Environment Denmark, Danish Environmental Protection Agency	Yes	For recycled amounts and amounts prepared for re-use - since 2014. Amounts sent to recovery (incl. recycling) (input) have been reported since 2006.	The producers have to report amounts of waste send for treatment and recycled amounts and amounts prepared for re-used. This must be reported to the National Register, which in DK is called DPA-System. The reports to the DPA-System are typically made by the collective schemes. So far no data have been reported on preparation for re-use.	Yes, aggregated data.	All trials to follow-up on available data have not been successful.
EE	Ministry of Environment	Yes	Available are only aggregated data. It is not possible to get data by waste handler. Reports are in place from 1998, modified a bit in 2004. Or is here meant by what date waste handlers have to report. Reports has to be submitted every year by the end of January and aggregated data is available by the end of September the same year.	Every waste handler has to report by the end of the January about their activities (input/output) in last calendar year in special reporting form provided by Ministry of the Environment. Producers and collective schemes have to report quarterly in the similar format as it is provided by Commission Decision 2005/369.	It is possible to get aggregated data, but not by waste handler or producer. It is possible to get reports of collective schemes.	Due to a change in staff, Estonia's Ministry of Environment was not able to provide further information on data.
ES						

FI	Centre for Economic Development, Transport and the Environment for Pirkanmaa	Yes	13th of August 2005	Producer organisations and operators they use keep records of output data and report them national authority (Centre for Economic Development, Transport and the Environment for Pirkanmaa)	Yes. Public records are available from year 2007 on the internet. http://www.ymparisto.fi/fi-FI/Kartat_ja_tilastot/Jatetilastot/Tuottajavastuun_tilastot/Sahko_ja_elektroniikkalaitetilastot	The input data on WEEE is collected in Finnish recycling facilities and reported to the Finnish authorities. The Finnish Waste Act (118 § and 119 §) obligates the recycling facilities to keep records also of the output of the material (type, quality, quantity and origin). Input data is reported annually to the authority, output data is kept on facility level and must be reported to the authorities on request (Finnish Waste Act 122 §)
FR	Eco-systèmes	Yes	Collected since 2008, available via IT since 2013	WF_RepTool is used. Further information in the actual response document.	We agree to share some aggregate data yet there will be no information regarding the identity of the companies (confidential data).	Data from Eco-systemes was included in data collected from Compliance Schemes.
GR						
HR	Croatian Environment Agency	Yes	From 2007 to 2011 for a total amount of treated WEEE (not separately for the recovery and recycling), since 2012 for recovery and re-use/ recycling, while the data on the prep. for re-use (i.e. recycling/ preparing for re-use) will be available from 2015.	Producers, collectors and WEEE treatment operators are required to submit data to the Environmental Protection and Energy Efficiency Fund (Fund) which is obliged to forward collected data annually to Croatian Environment Agency (CEA) which collects, integrates, processes the data and prepares and sends the required reports on EE waste management. In addition, collectors and WEEE treatment operators are required to annually submit data to the Environmental Pollution Register kept by the CEA.	Yes, please contact given address.	

HU						
IE						
IT						
LT						
LU						
LV						
MT	Malta Environment & Planning Authority	Yes	The Competent Authority within Malta has a system in place which aims to collect data on the operations of authorised waste management facilities. Data is available since the year 2009.	In view of its economies of scales, WEEE collected in Malta is either pre-treated locally with the separated fractions being exported for further treatment or exported directly as collected for recovery/recycling operations. The total amounts of Waste Electrical and Electronic Equipment collected/treated are calculated by using data reported by authorised waste management facilities/brokers for WEEE, on quantities of WEEE sent to other Member States or exported outside the Community as well as data on notifications pursuant to the Waste Shipments Regulation (EC) no. 1013/2006 during a particular year. The authorised waste management facilities are obliged by their permit to report to the Competent Authority on a yearly basis about their operations. The data reported is reviewed by the Competent Authority and when necessary a number of revisions are requested, iterating the importance that the amounts reported should reflect the actual amount that have been recovered/recycled by the facilities (overseas or local).	Malta would be in a position to provide the official data as reported to the Commission.	

NL	Wecycle	Yes	2008	Recyclers that are contracted by the compliance scheme Wecycle, are obliged to report these data.	Yes, aggregated data. Data only available for recovery and recycling (not for preparing for re-use).	Wecycle referenced to online available data, which did not include information on recovered/ recycled material fractions.
PL						
PT						
RO						
SE	Naturvardsverket	Yes	The Swedish EEB-system has been online for several years. We are currently upgrading the report function to make it possible for more actors to report. Until now only producers have been able to report but from next reporting period this will also be possible for waste actors. This way we will be able to collect statistics from all streams of waste in Sweden.	The producers, collection schemes and waste actors registries themselves and report sold, collected and treated amounts in the EEB-register (EE and Batteries). Every year from January until the end of mars there is reporting period. The EEB-register can be found at http://eeb.naturvardsverket.se/	Yes	The provided data source did not further clarify the availability of output data.
SI						
SK	Environ	Slovak Republik have not transposed the new WEEE yet. But in the proposal are of course reporting obligations of all players in WEEE management system. Collecting organisation must reported to whom moved to collected WEEE in cooperation with Producer (Compliance scheme), the recycler must report how was each waste stream treated and recycled. Each waste stream finally must have EoW status (according to art 6 of WFD), recovered with any R2 – R11 code, recycled, Re-used or disposed – with D1 code. But actually we have no data according to new WEEE available. We have data according to WEEE1 and this are in Eurostat available. Speaking about WEEE and preparation for Re-use of WEEE, no one pcs. or tone of WEEE was liable to operation of Preparation for Re-use. This operation especially for WEEE is not simple.				

UK	Department for Business, Innovation & Skills	No, but is being worked on		A standard template has been developed for keeping records on material entering and leaving the recovery/recycling facilities. There is no requirement to send a report to the regulatory authority. But the regulator visits each approved recycling company at least once every year to undertake an audit and this data must be available at that inspection. Of course if it is not available or it demonstrates the targets are not being achieved then the regulator has various sanctions that he may choose to impose on the operator.

In addition to the EU-28 available:

MS	Contact	Data?	Since	Collection procedure	Accessibility of data
NO	Environment Agency	Yes, partly	All data on treatment of collected WEEE are reported to the authorities. Some of this information reported are confidential. Since 2008 we have reports from return schemes on waste treated, divided into product groups, some hazardous fractions and also in which country final treatment is carried out. These data might have varying quality as they have not been verified by the authorities.	We are unsure how we should understand this question. WEEE is collected by return schemes, and they are obliged to keep track on were waste is treated, until final treatment. Some information are reported to the authorities, as mentioned above.	Part of data can be made available for the project.

Appendix V: Questionnaire output-based recovery/ recycling targets

Data request for national collective schemes on WEEE

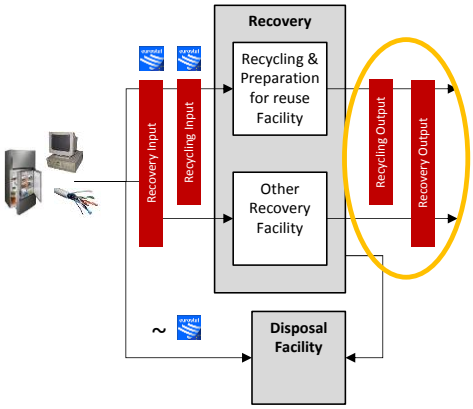
Project

Study on WEEE recovery targets, preparation for re-use targets and on the method for the calculation of the recovery targets

Background of the study

Current recovery quotes (available at EUROSTAT) for EU MS are calculated according Directive 2012/19/EU ("WEEE 2") Art. 11(2):

"The achievement of the targets shall be calculated, for each category, by dividing the weight of the WEEE that enters the recovery or recycling/preparing for re-use facility, after proper treatment in accordance with Article 8(2) with regard to recovery or recycling, by the weight of all separately collected WEEE for each category, expressed as a percentage."



Following an issue paper[1] of the WEEE Forum from 2011, collective schemes for WEEE support a calculation of recovery targets based on output data of recovery facilities over the current calculation method.

- Main task: Re-examination of calculation method – Analysis of feasibility of setting targets on basis of products/materials resulting from recovery, recycling and preparation for re-use processes (output).
- Main challenge: Limited availability of output-based data
- Main contribution: National collective schemes' contribution of indicative data on input and output of recovery/ recycling/ prep. for reuse facilities crucially supports this re-examination.

Request for data: Material flows recovery/recycling/prep. for reuse facilities

A. **INPUT FRACTIONS**: Aggregated data per country/ scheme for recent year(s)**.** Thereby input fractions may look like the following:
   - WEEE categories (10) according WEEE 2 Annex I
   - WEEE categories (6) according WEEE 2 Annex III
   - Collection categories used in practice
   - Please feel free to also provide data not fitting into above mentioned categories.

B. **OUTPUT FRACTIONS**: Aggregated data per country/ scheme for recent year(s). Thereby output fractions may be differentiated according the following:
   - **Final Use** in tons or % (reuse/ preparation for reuse/ recycling/ other recovery/ disposal).
   - **Products/Materials**[2] in tons or %.

[1] Available at: http://www.weee-forum.org/news/weee-forums-views-on-method-of-calculating-recyclingrecovery-rates
[2] Indications such as e.g. majority of recycled amounts are metal fractions, majority of disposal are shredder light fraction, plastic fines, etc. would be sufficient.

Appendix VI: Individual datasets of collective schemes reporting according WEEELABEX/ CENELEC

Eco-systèmes (FRA)

	Collection Output	Reuse	Treatment Input		Output							
					Total	MR	P RU	ER	Σ R	TD	LD	Σ D
All WEEE	101.1%	1.1%	100.0%	Total in %	**100.0%**	80.2%		8.0%	**88.3%**			**11.7%**
				*Ferrous*	**45.1%**							
				Non-Ferrous	**7.4%**							
				Mineral	**5.8%**							
				Plastics	**19.3%**							
				Other	**22.5%**							
Large appliances	101.9%	1.9%	100.0%	Total in %	**100.0%**	78.7%		7.4%	**86.2%**			**13.8%**
				*Ferrous*	**57.0%**							
				Non-Ferrous	**5.0%**							
				Mineral	**14.0%**							
				Plastics	**9.0%**							
				Other	**15.0%**							
Cooling appliances	101.5%	1.5%	100.0%	Total in %	**100.0%**	81.9%		14.0%	**95.9%**			**4.1%**
				*Ferrous*	**59.0%**							
				Non-Ferrous	**6.0%**							
				Mineral	**1.5%**							
				Plastics	**28.0%**							
				Other	**5.5%**							
Screens	100.02%	0.02%	100.0%	Total in %	**100.0%**	84.0%		4.2%	**88.2%**			**11.8%**
				*Ferrous*	**13.0%**							
				Non-Ferrous	**6.0%**							
				Mineral	**0.0%**							
				Plastics	**18.0%**							
				*Other**	**63.0%**	*50%CRT tubes						
Small appliances	100.1%	0.1%	100.0%	Total in %	**100.0%**	78.2%		7.2%	**85.4%**			**14.6%**
				*Ferrous*	**40.0%**							
				Non-Ferrous	**14.0%**							
				Mineral	**0.0%**							
				Plastics	**31.0%**							
				Other	**15.0%**							

Remedia (ITA)

	Collection Output	Reuse	Treatment Input		Output							
					Total	MR	P RU	ER	Σ R	TD	LD	Σ D
All WEEE	100%	0%	100%	Total in %	**100.0%**	89.9%		2.2%	**92.1%**			**7.9%**
				*Ferrous*	**31.0%**	31.0%			**31.0%**			**0.0%**
				Non-Ferrous	**5.9%**	5.9%			**5.9%**			**0.0%**
				Mineral	**30.3%**	28.3%			**28.3%**			**2.0%**
				Plastics	**23.9%**	20.2%		2.1%	**22.3%**			**1.7%**
				Other	**8.9%**	4.5%		0.1%	**4.6%**			**4.3%**
Large appliances	100%	0%	100%	Total in %	**100.0%**	94.6%		1.0%	**95.6%**			**4.5%**
				*Ferrous*	**51.1%**	51.1%			**51.1%**			**0.0%**
				Non-Ferrous	**5.0%**	5.0%			**5.0%**			**0.0%**
				Mineral	**23.4%**	22.3%			**22.3%**			**1.1%**
				Plastics	**15.4%**	13.9%		1.0%	**14.9%**			**0.5%**
				Other	**5.1%**	2.3%			**2.3%**			**2.8%**
Cooling appliances	100%	0%	100%	Total in %	**100.0%**	82.9%		6.6%	**89.5%**			**10.5%**
				*Ferrous*	**58.3%**	58.3%			**58.3%**			**0.0%**
				Non-Ferrous	**6.5%**	6.5%			**6.5%**			**0.0%**
				Mineral	**1.0%**	1.0%			**1.0%**			**0.0%**
				Plastics	**29.0%**	16.4%		6.6%	**23.0%**			**6.0%**
				Other	**5.2%**	0.7%			**0.7%**			**4.5%**
Lamps	100%	0%	100%	Total in %	**100.0%**	97.2%			**97.2%**			**2.8%**
				*Ferrous*	**2.6%**	2.6%			**2.6%**			**0.0%**
				Non-Ferrous	**5.0%**	2.2%			**2.2%**			**2.8%**
				Mineral	**79.5%**	79.5%			**79.5%**			**0.0%**
				Plastics	**0.5%**	0.5%			**0.5%**			**0.0%**
				Other	**12.3%**	12.3%			**12.3%**			**0.0%**
Mixed appliances	100%	0%	100%	Total in %	**100.0%**	94.6%		0.3%	**94.8%**			**5.2%**
				*Ferrous*	**45.3%**	45.3%			**45.3%**			**0.0%**
				Non-Ferrous	**8.1%**	8.1%			**8.1%**			**0.0%**
				Mineral	**0.3%**	0.3%			**0.3%**			**0.0%**
				Plastics	**33.3%**	31.8%		0.3%	**32.0%**			**1.3%**
				Other	**12.9%**	9.1%			**9.1%**			**3.9%**
CRT	100%	0%	100%	Total in %	**100.0%**	90.1%		1.4%	**91.5%**			**8.5%**
				*Ferrous*	**11.5%**	11.5%			**11.5%**			**0.0%**
				Non-Ferrous	**5.0%**	5.0%			**5.0%**			**0.0%**
				Mineral	**55.0%**	51.3%			**51.3%**			**3.7%**
				Plastics	**19.4%**	17.9%		1.2%	**19.1%**			**0.3%**
				Other	**9.2%**	4.4%		0.2%	**4.6%**			**4.6%**

Appliances Recycling S.A. (GRE)

	Collection Output	Reuse	Treatment Input		Output							
					Total	MR	P RU	ER	Σ R	TD	LD	Σ D
All WEEE	100.0%	0.0%	100.0%	Total in %	**100.0%**	89.5%		0.0%	**89.5%**		10.5%	**10.5%**
				*Ferrous*		45.7%			**45.7%**			
				Non-Ferrous		3.4%			**3.4%**			
				Mineral		12.8%			**12.8%**			
				Plastics		12.7%			**12.7%**			
				Other		14.7%			**14.7%**			
Large appliances	100.0%	0.0%	100.0%	Total in %	**100.0%**	86.5%		0.0%	**86.5%**		13.5%	**13.5%**
				*Ferrous*		61.6%			**61.6%**			
				Non-Ferrous		3.9%			**3.9%**			
				Mineral		0.6%			**0.6%**			
				Plastics		6.3%			**6.3%**			
				Other		14.2%			**14.2%**			
Small appliances	100.0%	0.0%	100.0%	Total in %	**100.0%**	86.8%		0.0%	**86.8%**		13.2%	**13.2%**
				*Ferrous*		29.3%			**29.3%**			
				Non-Ferrous		5.1%			**5.1%**			
				Mineral		0.6%			**0.6%**			
				Plastics		39.8%			**39.8%**			
				Other		12.1%			**12.1%**			
IT and telecom.	100.0%	0.0%	100.0%	Total in %	**100.0%**	96.8%		0.0%	**96.8%**		3.2%	**3.2%**
				*Ferrous*		37.4%			**37.4%**			
				Non-Ferrous		3.6%			**3.6%**			
				Mineral		15.5%			**15.5%**			
				Plastics		18.9%			**18.9%**			
				Other		21.4%			**21.4%**			
Cons. Equip. & PV	100.0%	0.0%	100.0%	Total in %	**100.0%**	93.7%		0.0%	**93.7%**		6.3%	**6.3%**
				*Ferrous*		13.6%			**13.6%**			
				Non-Ferrous		0.8%			**0.8%**			
				Mineral		50.5%			**50.5%**			
				Plastics		16.8%			**16.8%**			
				Other		12.1%			**12.1%**			
Lightning equip.	100.0%	0.0%	100.0%	Total in %	**100.0%**	97.0%		0.0%	**97.0%**		3.0%	**3.0%**
				*Ferrous*		18.8%			**18.8%**			
				Non-Ferrous		13.7%			**13.7%**			
				Mineral		47.0%			**47.0%**			
				Plastics		9.0%			**9.0%**			
				Other		8.5%			**8.5%**			
E-Tools	100.0%	0.0%	100.0%	Total in %	**100.0%**	97.3%		0.0%	**97.3%**		2.7%	**2.7%**
				*Ferrous*		49.7%			**49.7%**			
				Non-Ferrous		14.1%			**14.1%**			
				Mineral		0.0%			**0.0%**			
				Plastics		8.8%			**8.8%**			
				Other		24.7%			**24.7%**			
Toys	100.0%	0.0%	100.0%	Total in %	**100.0%**	74.8%		0.0%	**74.8%**		25.2%	**25.2%**
				*Ferrous*		31.8%			**31.8%**			
				Non-Ferrous		1.3%			**1.3%**			
				Mineral		17.9%			**17.9%**			
				Plastics		15.3%			**15.3%**			
				Other		8.4%			**8.4%**			
Medical devices	100.0%	0.0%	100.0%	Total in %	**100.0%**	92.0%		0.0%	**92.0%**		8.0%	**8.0%**
				*Ferrous*		43.5%			**43.5%**			
				Non-Ferrous		28.2%			**28.2%**			
				Mineral		1.7%			**1.7%**			
				Plastics		8.5%			**8.5%**			
				Other		10.1%			**10.1%**			
Monitoring	100.0%	0.0%	100.0%	Total in %	**100.0%**	99.2%		0.0%	**99.2%**		0.8%	**0.8%**
				*Ferrous*		46.1%			**46.1%**			
				Non-Ferrous		4.0%			**4.0%**			
				Mineral		0.0%			**0.0%**			
				Plastics		7.4%			**7.4%**			
				Other		41.8%			**41.8%**			
Automatic dispe	100.0%	0.0%	100.0%	Total in %	**100.0%**	91.8%		0.0%	**91.8%**		8.2%	**8.2%**
				*Ferrous*		42.6%			**42.6%**			
				Non-Ferrous		4.0%			**4.0%**			
				Mineral		0.5%			**0.5%**			
				Plastics		18.2%			**18.2%**			
				Other		26.6%			**26.6%**			

Ecodom (ITA)

	Collection Output	Reuse	Treatment Input		Output							
					Total	MR	P RU	ER	Σ R	TD	LD	Σ D
All WEEE	100.0%	0.0%	100.0%	Total in %	**100.0%**	87.8%		4.9%	**92.7%**	0.7%	6.6%	**7.3%**
				*Ferrous*	**59.6%**	59.6%			**59.6%**			**0.0%**
				Non-Ferrous	**5.2%**	5.2%			**5.2%**			**0.0%**
				Mineral	**11.2%**	11.2%			**11.2%**			**0.0%**
				Plastics	**18.0%**	11.0%		4.9%	**15.9%**	0.1%	2.0%	**2.1%**
				Other	**5.9%**	0.8%			**0.8%**	0.5%	4.6%	**5.1%**
Cooling appliances	100.0%	0.0%	100.0%	Total in %	**100.0%**	82.9%		9.8%	**92.7%**	0.9%	6.4%	**7.3%**
				*Ferrous*	**60.5%**	60.5%			**60.5%**			**0.0%**
				Non-Ferrous	**5.7%**	5.7%			**5.7%**			**0.0%**
				Mineral	**1.0%**	1.0%			**1.0%**			**0.0%**
				Plastics	**28.9%**	14.8%		9.8%	**24.6%**	0.2%	4.1%	**4.3%**
				Other	**3.9%**	1.0%			**1.0%**	0.6%	2.3%	**2.9%**
Large appliances	100.0%	0.0%	100.0%	Total in %	**100.0%**	92.5%		0.2%	**92.7%**	0.4%	6.9%	**7.3%**
				*Ferrous*	**58.9%**	58.9%			**58.9%**			**0.0%**
				Non-Ferrous	**4.7%**	4.7%			**4.7%**			**0.0%**
				Mineral	**21.4%**	21.4%			**21.4%**		0.0%	**0.0%**
				Plastics	**7.2%**	7.0%		0.2%	**7.2%**			**0.0%**
				Other	**7.8%**	0.6%			**0.6%**	0.4%	6.8%	**7.3%**
Small appliances	100.0%	0.0%	100.0%	Total in %	**100.0%**	92.9%		0.0%	**93.0%**	2.6%	4.4%	**7.0%**
				*Ferrous*	**50.1%**	50.1%			**50.1%**			**0.0%**
				Non-Ferrous	**13.1%**	13.1%			**13.1%**			**0.0%**
				Mineral	**0.0%**	0.0%			**0.0%**			**0.0%**
				Plastics	**29.8%**	29.4%			**29.4%**	0.2%	0.2%	**0.4%**
				Other	**7.1%**	0.4%		0.0%	**0.4%**	2.4%	4.3%	**6.7%**