How standards can support a sustainable circular economy

The WEEE Directive review

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Executive summary

ECOS welcomes a comprehensive assessment of the WEEE Directive to overhaul e-waste rules in the European Union and put an end to the e-waste tsunami. For this review, the EU must tackle two key challenges: effectively recovering valuable resources from electronic equipment, and preventing, mitigating, and reversing environmental harm caused by resource consumption and electronic waste.

The European WEEE standards from the European Committee for Electrotechnical Standardisation (CENELEC) however do not help meet these European strategic objectives as they do not adequately support product and component recovery, just material recovery through end-of-life WEEE management. These standards are also unevenly applied throughout EU Member States.

Updating the WEEE Directive would benefit from establishing minimum requirements for sustainable, circular WEEE recovery. European standards, once revised to address current sustainability and circularity needs, and made legally binding, can offer detailed guidance for meeting these requirements consistently throughout the EU.

Europe's sustainable and circular needs

The number of electronic devices on the EU market nearly doubled, soaring by over 98% between 2013 and 2022. This sharp increase is driving an e-waste crisis. The EU should take bold and immediate action to mitigate the environmental damage caused by Europe's growing dependence on electronics.

Since the entry into force of the WEEE directive in 2012, the challenges in dealing with EEEs have grown and considerable technical developments have taken place so that the current WEEE Directive is no longer fit for purpose. In particular, the main focus on end-of-life throughout the directive is no longer appropriate. It is also essential to address electronics rich in Critical Raw Materials (CRM) to improve their return and recovery, especially valuable resources for the circular economy, and extend its scope, such as to wind turbines. **The WEEE Directive should therefore be fundamentally revised, expanded and updated.**[1] It is expected to be one of the cornerstones of the new European Circular Economy Act.

For this purpose, the European Commission has launched a study to support the impact assessment and technical assessment for the review of Directive 2012/19/EU on waste electrical and electronic equipment (WEEE), led by a consortium of NORION Consult, 3drivers, UNITAR, and Ricardo PLC. This paper aims to give input to **the role of standards** for this assessment.

The twin challenges are to identify and implement effective actions for **conserving resources** for present and future generations and for **preventing, mitigating and reversing damage to the environment** resulting from resource use and waste generation.

The WEEE Directive and its supporting standards need to contribute to these aims in a more direct and impactful way by focussing directly on three objectives:

- increase the recovery of functional electrical and electronic products and components.
- increase the range, volumes and quality of materials recovered from WEEE.
- improve the sustainability of e-waste recovery through sound environmental management.

Supporting sustainable circular economy in WEEE standards

The review of the WEEE Directive should develop a set of minimum requirements based on the **concept of sustainable circular WEEE recovery**. The associated European standards series 50625X and the European reuse standard 50614 from CENELEC[2] can provide detailed directions for the implementation of these minimum requirements, **once updated and extended to fit today's sustainability and circularity needs**.

The following four key points should be considered for ensuring sustainable circular WEEE recovery:

- The WEEE Directive lays down ambitious minimum requirements to prevent and reduce the environmental impacts associated with WEEE recovery operations, by **ensuring sustainable and circular resource management**. They are supported by a credible and independent environmental management system and accompanying reporting and traceability requirements.
- The European Commission requests EN 50625 series standards and EN 50614 to be **updated and considered binding minimum WEEE quality standard in EU legislation for ensuring harmonised and robust implementation of its minimum requirements**. They should also be **freely accessible** and available in all the official languages of the EU, especially for SMEs, such as preparation for reuse operators[3]. For example, mandatory cautious and thorough extraction of refrigerants and foam propellants from Temperature Exchange Equipment (TEE) in recovery facilities and strict transport rules to ensure fewer leaks during transit[4]. The European standards should accordingly be revised to set out systematic normative requirements and guidance for environmental management.
- **CEWASTE normative requirements[5]** – and further standards depending on the waste stream – are integrated in a revised WEEE Directive to define requirements for treatment, collection, logistics and recovery of products and components containing CRMs.
- The draft international standard **IEC/FDIS 63395 on the Sustainable Management of E-waste**, in which ECOS has been closely involved since 2021 (publication expected in 2025), is used as a horizontal framework for the European standard update.

Completing WEEE management by sustainable and circular resource management

The current WEEE Directive is a product of its time and as such is rooted in waste management thinking, with no consistent attention given to the need for sound environmental management by WEEE recovery operators or to the achieving the best environmental outcome by increasing the circularity of product and component as well as materials to reduce demand for new EEEs.

A move to a sustainable circular economy requires a complementary approach from the notion of managing waste: sustainably managing resources. It involves a focus on **resource conservation, waste prevention and reduction, resource recovery and circularity and environmental impact reduction**.

This approach can be facilitated by implementing **the best environmental outcome principle**, as laid down in IEC/FDIS 63395. It aims at delivering the best environmental outcome from a lifecycle perspective by **generally prioritising waste prevention and extending product life through product and component recovery over material recovery (recycling)**, energy and other forms of recovery and disposal, in line with article 4 of the EU Waste Framework Directive (WFD).[6]

All aspects of the resource recovery system, including collection, handling, transport and storage, should be designed in such a way that maximises the range, quantity and quality of products, components and materials to be recovered and prevents and minimises potential environmental impacts arising from recovery operations.

A critical step in achieving the best environmental outcome is the systematic application of **a 'recovery pathway methodology'** that assesses the **recovery potential** of collected WEEE and facilitates the determination of **the recovery pathway**, i.e. the types and the sequence of processes required to recover products, components and materials from WEEE collected.

Using this methodology, WEEE that is suitable for product recovery via refurbishment, repair and remanufacturing can be identified immediately after collection and physically routed towards suitable operators. Where WEEE is not deemed suitable for the recovery of functional products, it will then be considered for component and material recovery and routed towards the appropriate recovery operations.

The 'recovery pathway methodology' concept could be enshrined in the WEEE Directive review and detailed in a mandated European standard.

The waste terminology of the WEEE Directive could be completed to describe the different types of recovery, namely recovery of resources as functioning products and components or as materials:

- **Product recovery**: application of processes with the aim of recovering functional products from WEEE for their subsequent re-use.
- **Component recovery**: application of processes with the aim of recovering functional components from WEEE for their subsequent re-use.
- **Material recovery**: application of processes with the aim of recovering materials from WEEE, in line with the EU WFD.[7]

In line with the 'best environmental outcome' approach outlined above, we also propose the following two terms to be introduced:

- **Recovery potential**: Potential of WEEE to be recovered as products, components or materials,
- **Recovery pathway**: Type and sequence of processes applied to recover products, components and materials from WEEE collected.

WEEE minimum requirements and how European standards can support them

Using the conceptualisation of sustainable circular WEEE recovery, a set of minimum requirements to support its practical implementation should be enshrined in a revised WEEE Directive. These can be related to each stage of the recovery process flow as detailed above.

In the table 1 below, we propose a set of requirements to achieve the **twin goal of increasing WEEE recovery and preventing and reducing environmental impacts**. We also indicate where we see a role for European standards from CENELEC, whose review or development could be mandated by the European Commission. IEC/FDIS 63395 (under finalisation) provides further details upon which the proposed European standard can be based.

Table 1: Proposed minimum legislative requirements and associated standards

Minimum legislative requirements	Associated standards and their proposed content
Collection and logistics: system design, handling, transport, sorting and storage	
1. WEEE is to be collected separately from other waste streams. 2. WEEE is not to be mixed with other types of waste within the same container or receptacles. 3. WEEE is to be sorted from non-EEE waste prior to or at the point of collection. 4. WEEE is to be sorted into WEEE types prior to treatment as soon as practicable and to be kept separate throughout all process steps. 5. Collection, handling, transport and sorting of WEEE is to be undertaken with due care and using suitable containers, packaging and equipment so as to prevent the release of hazardous substances into air, water, or soil, as a result of damage and/or leakage. 6. Storage facility design that ensures that: • WEEE is to be stored separately from other waste • WEEE that is suitable for subsequent recovery is stored separately and in such a way that does not reduce its product recovery potential • WEEE containing hazardous substances is stored in a way that prevents the release of these substances and the emission to air, water or soil in case of accidental release. 7. Collection, handling and sorting of WEEE is to be undertaken with due care to prevent any damage to the WEEE collected that could adversely affect subsequent recovery of functioning products, components or materials. 8. WEEE is not to be crushed or compacted prior to treatment. 9. Formal partnerships between collection organisations and suitable product recovery organisations, e.g. refurbishers, repairers, or remanufacturers, are to be established to facilitate product recovery.	Detailed guidance on methodologies for • collection system design • handling • transport • sorting • storage

Minimum legislative requirements	Associated standards and their proposed content
Identification, classification and deciding the recovery pathway	
10. A list of relevant attributes (e.g. type of WEEE, presence of hazardous substances or radioactive material, recovery potential) is to be established and maintained up to date. 11. The list of attributes is to be consistently applied in the identification of WEEE and in the determination of the recovery pathway. 12. An appropriate recovery pathway methodology to facilitate the identification of WEEE suitable for product recovery as well as component and material recovery is to be applied to each inbound WEEE delivery. 13. Recovery pathway decisions for each inbound WEEE delivery is to be recorded in alignment with relevant regulatory requirements and the recovery organisation's own traceability system. 14. When deciding the recovery pathway, a more thorough assessment (e.g. LCA according to ISO 14040 and ISO 14044) is to be conducted where taking a lifecycle perspective does not provide sufficient evidence for defining the best environmental outcome. 15. Visual inspection, checking or initial functionality testing is to be undertaken at the point of collection, at a collection facility, at a logistics facility or on arrival at the recovery organisation's facilities to establish the recovery potential of incoming WEEE. 16. Functional WEEE is to be routed towards product recovery through refurbishment. 17. If the WEEE item is not functional, the reason for non-functioning is to be identified. Where the fault can be identified and is deemed to be repairable, the WEEE item shall be routed toward product recovery through repair. 18. Where the fault cannot be identified, the WEEE item shall be routed towards product recovery through remanufacturing of products or components or towards component recovery through refurbishment.	Recovery pathway methodology IEC/FDIS 63395 (under finalisation) provides further details upon which a European standard can be based. Identification criteria checklist

Minimum legislative requirements	Associated standards and their proposed content
Product and component recovery through refurbishment, repair and remanufacturing	
19. WEEE that has been routed towards one of the product recovery pathways is to be inspected and tested for functionality and safety before and after undergoing the relevant product and component recovery processes. 20. Recovery processes are to be designed to ensure human and environmental health and safety. In particular, the release of hazardous substances is to be prevented and mitigation measures to be put in place to deal with potential accidental releases.	Detailed methodologies for product and component recovery processes through refurbishment, repair and remanufacturing. IEC/FDIS 63395 provides further details.
Material recovery	
21. Material recovery infrastructure, technology and practices is to be designed and maintained to: • be appropriate to the type of WEEE received for material recovery • maximise the types, quantity and quality of materials recovered • minimise risks to human and environmental health and safety during recovery 22. The organisation is to regularly review their operations and strive to maintain state of the art infrastructure, technologies and practices. 23. Dismantling and disassembly is to be given preference over shredding as a first treatment step to maximise the types, quantity and quality of materials recovered and minimize risks to human and environmental health and safety. 24. Materials are to be sorted into different material types at the earliest feasible point and to be kept separate during processing. 25. Dismantling and disassembly is to be undertaken in such a way that prevents the release of hazardous substances into air, water, or soil, as a result of damage and/or leakage and mitigation measures are to be put in place to deal with potential accidental releases. 26. E-waste containing batteries shall be identified and any batteries contained in the e-waste shall be removed in a safe manner in order to avoid explosion, fire and leakage risks. 27. WEEE containing hazardous substances is to be depolluted in accordance with an associated European standard. 28. Depollution effectiveness is to be monitored in accordance with a methodology set out in a European standard.	Depollution effectiveness monitoring IEC/FDIS 63395 provides further details upon which a European standard can be based.

Minimum legislative requirements	Associated standards and their proposed content
Energy recovery and disposal	
29. For any WEEE that cannot be recovered as a product, component or material energy recovery is to be considered as a treatment. 30. Where energy recovery is deemed unsuitable other forms of safe disposal are to be used. 31. Energy recovery is not to be used as a management strategy for WEEE containing hazardous materials unless applicable law requires the use of a specific technology (e.g. hazardous waste landfill or incineration of PCBs). 32. Energy recovery is only to be undertaken by licensed organisations and is to be designed not to have negative effects on environmental and human health and safety. 33. Any WEEE that cannot be recovered as a product, component, material or as energy the organisation is to be sent for other safe disposal. Disposal is deemed to be safe when it can be shown not to have any negative impact on human or environmental health and safety. 34. Disposal is not to be used as a management strategy for e-waste containing hazardous materials unless applicable law requires the use of a specific technology (e.g. hazardous waste landfill or incineration of PCBs). 35. Disposal is only to be undertaken by licensed organisations and is to be designed not to have negative effects on environmental and human health and safety. 36. WEEE containing hazardous substances, materials or mixtures is only to be transferred to facilities that meet applicable legal and regulatory requirements to receive and dispose this type of WEEE. 37. Final disposal of WEEE containing hazardous substances, materials or mixtures is to be in accordance with applicable international and national laws and regulations including the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal.	
Traceability and record-keeping	
38. Traceability data is to be collected and recorded to facilitate the monitoring of the flow of WEEE received and routed towards different recovery pathways or towards disposal.	Detailed requirements for traceability and record-keeping. IEC 63395 provides further details.

Minimum legislative requirements	Associated standards and their proposed content
Monitoring and evaluation of recovery performance	
39. Recovery performance is to be monitored and evaluated to assess the following: • **WEEE flow**: monitoring of the flow of WEEE received through an organisation's WEEE recovery chain • **Recovery efficiency**: monitoring and evaluation of the recovery efficiency achieved for WEEE routed towards product, component or material recovery against recovery effectiveness targets. • **Recovery quality**: monitoring and evaluation of the quality of products, components and material recovered from the organisation's e-waste received	Monitoring and evaluation methodologies to assess: • WEEE flow • Recovery efficiency • Recovery quality IEC 63395 provides further details.
Specific product or WEEE-categories	
40. Product or WEEE-category specific requirements	Product or WEEE-category specific standards to address specific challenges, e.g.: • Guidance on collection and handling of WEEE containing hazardous substances such as lamps, • Identification criteria checklists, • Step-by-step guidance on disassembly, depollution, • Guidance for EEE product manufacturers on features that facilitate product, component and material recovery.

References

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[6] Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. Consolidated text. [Accessed on 23 July 2025].

[7] Directive 2008/98/EC, article 3.15a.