

Recyclability Assessment: Systematically Testing Products for Circularity Capability

The recyclability assessment is the systematic examination of the extent to which a product, assembly or material can be properly returned to the material cycle after use. For technical buyers, it is increasingly becoming an integral part of supplier evaluation, specifications and compliance evidence, because legal requirements such as the EU Ecodesign Regulation and the Batteries Regulation demand circularity capability. Assessing recyclability early avoids later additional costs in take-back, disposal and material substitution. The term overlaps with related concepts such as the recyclability index, circularity capability and Design for Recycling.

Key facts

- The recyclability assessment examines material composition, disassembly capability and the technical and economic availability of recycling routes.
- It is typically based on bills of materials, material safety data sheets, assembly and joining process descriptions and composite material analyses.
- The result is frequently a percentage recyclability value, supplemented by justifications for proportions that cannot be returned to the cycle.
- Relevant in Europe are above all the Ecodesign Regulation, the Batteries Regulation, packaging rules and, increasingly, customer requirements in B2B.
- In procurement, the assessment is anchored in specifications, supplier requirements, life cycle costing and supplier evaluation.
- Limitations arise from missing secondary raw material markets, composite materials and incomplete supplier data.

Definition: recyclability assessment

The recyclability assessment is a structured analysis that determines what proportion of a product can be technically and economically recycled after use. It differs from mere recycled content use: it is not the use of secondary material that is examined, but the circularity capability of the end product. The assessment addresses the challenges along the entire life cycle, from the material mix via assembly through to take-back logistics.

Distinction from sustainability metrics

Recyclability is not the same as the carbon footprint or the share of recycled content in the product. A component can consist of one hundred per cent secondary material and still be non-recyclable, for example with permanently bonded material composites. The assessment therefore provides its own metric, which is incorporated into sustainability and procurement reporting as a supplement, not a replacement. In practice, many companies combine both perspectives to avoid redundancies in data maintenance.

Legal framework in the EU

While packaging and battery law already prescribe binding recyclability rates, the Ecodesign Regulation establishes circularity requirements step by step for many product groups. The specific thresholds and methods depend on the product category and are defined by delegated acts. Companies should therefore not extrapolate individual percentage requirements indiscriminately, but should examine the relevant product regulation on a case-by-case basis. For industrial products outside the regulated categories, the assessment is frequently treated as a customer requirement or voluntary commitment.

Methods and approach of the recyclability assessment

The process usually follows a multi-stage scheme: data collection, material analysis, disassembly evaluation and final classification. Depending on the objective, an internal checklist, an industry-standard calculation model or an external audit is used. What is decisive is that the method is reproducible and comprehensibly documented towards customers and certifiers.

Data basis: bill of materials and material specifications

The starting point is the structured bill of materials with complete material, grade and surface specifications. Missing information on purchased parts is in practice the most common cause of unassessable product proportions. Procurement can ensure transparency here through standardised request forms in supplier management and clear requirements in the specification. It is also sensible to request material data sheets already during bidder communication, rather than only at series release.

Disassembly and joining process evaluation

Recyclability depends heavily on whether materials can be separated. Screwed, plugged or dissolved joints can typically be dismantled well, whereas bonded or overmoulded composites can hardly be dismantled at all. The assessment therefore classifies joining processes according to separability and proposes design alternatives, such as detachable connections instead of bonding. This is where the interface with design arises: Design-for-Recycling recommendations should ideally be implemented before series release.

Availability of recycling routes

Technical separability is of no use if there is no recovery option. The assessment therefore checks whether facilities and sales channels exist in the relevant market for the material in question. For exotic alloys, composite films or coated plastics, such routes are frequently lacking. The evaluation is based on sector knowledge and the experience of recyclers, not on generic percentage figures from data sheets.

Key KPIs and metrics of the assessment

To keep results comparable, companies work with a manageable number of metrics. A typical combination is mass share, classification rate and a documented justification ratio for non-assessable proportions. The KPIs should be collected consistently across product families and suppliers.

Recyclability rate

The core metric is the percentage mass share that can be fed into real recovery. In practice, typical target values vary widely depending on industry and material structure: simple metal assemblies achieve almost fully recyclable values, complex electronics considerably less. More important than the absolute value is the comprehensible definition of the calculation method, so that figures remain

comparable between suppliers. Customers are therefore increasingly requesting methodology descriptions together with the metric.

Data availability and residual shares

Supplementary KPIs are the proportion of assessable items in the bill of materials and the mass share of unclassified materials. High residual shares indicate data gaps or problematic composites, not necessarily poor circularity capability. Managers should read both figures together, otherwise there is a risk of a positive metric with low informative value at the same time. In supplier reports, it has proven effective to present both values as trends across several periods.

Risks and controls in the procurement process

Anyone who demands recyclability but does not verify it carries quality, compliance and reputational risks. Incorrect or excessive recyclability claims can become legally relevant as misleading environmental representations. Clear responsibilities, documented verification steps and effective controls along the supply chain are therefore required.

Data gaps and "green" self-declarations

A common risk is certification-like self-declarations from suppliers based on incomplete assumptions. Sample audits, reconciliation with safety data sheets and demanding a methodology reference instead of mere percentages help here. In particularly critical categories, involving external auditors is worthwhile. Procurement should document results in supplier management and check them again during requalification.

Cost risks from additional requirements

Higher recyclability may mean disassembly-equivalent designs, more expensive materials or additional testing. Without corresponding value, a price disadvantage arises compared with competitors who handle the requirements more loosely. Life cycle costing covering product and take-back obligations as well as pointing out possible customer benefits are helpful. Where the additional requirement remains economically disproportionate, a clear configuration and transfer of risk in the contract is preferable.

Contractual controls and commissioning

Contractual partners should record recyclability requirements with acceptance criteria, documentation obligations and updates in the event of design changes. For changes to the material mix or joining process, a change notification with re-assessment is needed, comparable to change control for business-critical specifications. Unverified changes can reduce the recyclability rate unnoticed. These obligations belong in framework agreements, not merely in one-off request letters.

Current developments and outlook

The recyclability assessment is evolving from a voluntary reporting topic into a regulated procurement criterion. Drivers include ecodesign requirements, take-back obligations, AI-supported sorting analysis and customer demand for circularity capability. For buyers, the focus is thus shifting from the mere material statement towards the supply chain and evaluation within the procurement process.

Regulatory densification

With the Ecodesign Regulation and the battery and packaging rules, binding circularity requirements are

emerging for more product groups. Suppliers from non-EU countries are affected by these requirements through the product liability of their EU customers. Companies are therefore increasingly building recyclability into supplier audits and qualification catalogues. In the long term, a documented recyclability rate can be expected to become as much a matter of course as a company standard or a REACH declaration.

Digitalisation of the assessment

Material databases, automated bill of materials analyses and digital product passports considerably accelerate the assessment. This allows changes in the material mix to automatically affect the recyclability rate. In practice, digitalisation does not replace engineering expertise, but reduces routine effort in data collection and updating. Small suppliers need clear, simple format specifications in order to participate.

Procurement integration

Recyclability is increasingly being anchored as a procurement criterion in tenders, for example as a requirement field alongside price and delivery capability. In supplier selection, it can be incorporated into the evaluation together with total cost, availability and carbon footprint. Anyone who anchors it there systematically avoids later individual negotiations and creates incentives for circularity-capable designs as early as the bidding phase.

Typical metrics

Recyclability rate: depending on industry, typically 60–95 %

Mass share with a real recovery route; methodology description is mandatory

Bill of materials data availability: > 95 % assessable items

Proportion of mass with a complete material declaration

Unclassified residual share: < 5 % of product mass

High values indicate data gaps or problematic material composites

Re-assessment rate for changes: 100 % of material-relevant changes

Every material or joining process change triggers a re-assessment

Practical example

A mid-sized mechanical engineering company was asked by a major key customer to provide verifiable evidence of a recyclability rate for an assembly. Until then, only unstructured material data existed and there was no methodology description. Within one quarter, the company built up a repeatable assessment process.

- Bill of materials clean-up: missing material data for purchased parts were requested via a standard form in supplier management.
- Joining process analysis: three bonded material composites were converted to detachable screw and plug-in connections, significantly reducing disassembly effort.
- Metric definition: the recyclability rate was defined with a uniform methodology description and documented residual shares.
- Anchoring: from now on, every material or design change triggers an automatic re-assessment in the change management process.

Conclusion

The recyclability assessment combines sustainability requirements with classic procurement tasks such as data quality, supplier management and cost evaluation. It only works if methodology, data basis and controls are bindingly defined and updated across the product life cycle. Buyers should anchor the assessment early in specifications, tenders and supplier evaluation, rather than treating it as a downstream reporting topic. Anyone who builds a reproducible process meets regulatory and customer requirements and at the same time identifies hidden material and disassembly costs. The assessment thus becomes a genuine lever for life cycle costing and competitiveness, rather than mere compliance evidence.

Frequently asked questions

What is a recyclability assessment?

A recyclability assessment systematically examines what proportion of a product can be technically and economically recycled after use. It considers material composition, disassembly capability and the existence of real recovery routes. The result is typically a percentage recyclability rate plus documented justifications for any proportions that cannot be assessed.

How is the recyclability rate calculated?

The usual approach is a mass-based calculation: each item in the bill of materials is assigned to a category (recyclable, conditionally recyclable, non-recyclable, unknown) and weighted. The percentage share of recyclable mass gives the rate. A written methodology description is essential so that figures remain comparable between products and suppliers.

Is recyclability required by law?

For some product groups in the EU, yes – for example packaging and batteries with specific rate requirements. The Ecodesign Regulation is gradually extending circularity requirements to further categories. For regulated industrial products, the assessment is frequently a customer requirement; the specific legal position should always be checked for the relevant product category.

Who carries out the recyclability assessment?

In practice, it is often carried out by an interdisciplinary team from design, materials management and environmental affairs, or by an external service provider with audit competence. Procurement provides the data basis, requests supplier information and anchors requirements contractually. Clear allocation of responsibility and documented verification steps are crucial.

What is the difference between recyclability and recycled content?

The recycled content measures how much secondary material goes into a product. Recyclability describes how well the product itself can be returned to the cycle after use. Both metrics are independent of each other and complement one another in sustainability reporting.

What role does procurement play in recyclability?

Procurement secures the data basis, makes recyclability requirements binding in specifications and tenders, and evaluates suppliers accordingly. It calculates the costs of additional requirements through life cycle costing and monitors changes through contractual update obligations. This turns the assessment from a paper exercise into a manageable procurement criterion.