

Life Cycle Assessment (LCA): environmental footprint as a decision-making instrument in technical procurement

Life Cycle Assessment (LCA), in German 'Ökobilanz', is a standardised method for assessing the environmental impacts of a product or process across its entire life cycle. For technical buyers, the LCA is increasingly becoming a mandatory instrument: it forms the basis for product footprints, CSRD reporting and supplier requirements. Those who systematically audit suppliers for LCA data reduce emissions risks and make procurement decisions comparable.

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Key facts at a glance

- 01 The LCA captures environmental impacts along the entire life cycle – from raw material extraction through to disposal or recycling.
- 02 The methodological framework is provided by ISO standards 14040 and 14044, with the phases of goal and scope definition, inventory analysis, impact assessment and interpretation.
- 03 Typical impact categories are CO2 footprint (GWP), primary energy demand, water consumption and acidification.
- 04 In practice, supplier data quality is the biggest challenge; it often ranges from primary data to industry average values.
- 05 For buyers, the LCA serves as a benchmark in supplier selection, target costing and sustainability reporting.
- 06 Product carbon footprints can only be credibly reported using reliable LCA data from suppliers.

Definition: Life Cycle Assessment

A Life Cycle Assessment is a systematic analysis of the environmental impacts of a product, service or process across the entire life cycle. The assessment typically covers raw material extraction, manufacturing, transport, use and the end-of-life phase.

Distinction from the carbon footprint

The carbon footprint often considers only greenhouse gas emissions, whereas the LCA evaluates several impact categories simultaneously – such as water consumption, resource use and ecotoxicity. The Product Carbon Footprint (PCF) is thus a partial subset of the LCA. For buyers, this means: those who request only CO₂ figures get an incomplete picture. In practice, it is advisable to require a full LCA for A-components and a PCF as the minimum standard for the rest of the range.

Legal and normative classification

The methodological foundations are set out in ISO 14040 and ISO 14044. In addition, the EU's Product Environmental Footprint (PEF) categories, industry guides such as EN 15804 in construction, and reporting obligations, for instance under the CSRD, all have an impact on procurement. Whether and to what extent a company must comply with LCA obligations depends on the individual case and should be legally reviewed. Important for buyers: statements made to customers about environmental impacts are deemed business decisions and must be verifiable.

Methods and procedure: the four phases of the LCA

A reliable LCA follows a four-stage process that is bindingly described in ISO 14040. The quality of the result stands and falls with the precision of the goal and scope definition and the data basis.

Goal and scope definition and system boundaries

First, the purpose, functional unit and system boundary are defined. The functional unit ensures comparability: not 'one housing', but 'one assembly with a defined protection rating over 10,000 operating hours'. The system boundary determines whether a cradle-to-gate (up to factory gate), cradle-to-grave (including use and disposal) or cradle-to-cradle (with closed-loop recycling) approach is taken. Buyers should explicitly specify these parameters in the specification for supplier data; otherwise quotations and LCAs are not comparable.

Inventory analysis and impact assessment

In the inventory analysis, all input and output flows are recorded: energy sources, intermediate products, emissions, waste and water flows. This is followed by the impact assessment, which translates these flows into categories such as Global Warming Potential, acidification potential or eutrophication. In practice, companies work with LCA software and databases for standard materials, while primary measured data from energy-intensive processes is preferentially included. The conversion key – in particular the electricity mix of the country of manufacture – often influences results more strongly than process differences.

Interpretation and critical review

The interpretation connects the results to the original question and identifies hotspots and uncertainties. For published or customer-facing assessments, an independent critical review is customary. Buyers should always scrutinise results with regard to the underlying data sources and assumptions: two suppliers with an identical CO₂ value can have very different levels of data quality. A documented supplier rating model with a sustainability block helps to assess these differences systematically.

Relevance for technical procurement

For buyers, the LCA is not an end in itself but a decision-making instrument: it influences supplier selection, cost analysis, risk assessment and customer enquiries. The benefit arises above all where environmental impacts measurably flow into procurement decisions.

Supplier selection and award

In tenders, the LCA can be anchored as an evaluation criterion alongside price, quality and delivery capability. A transparent approach is a points system in which LCA data quality, PCF transparency and improvement measures form a weighted segment. This works like a supplier rating model with a sustainability-based component. Also practically relevant are the consolidation of several suppliers into a bidding consortium for joint data collection, or low-cost country sourcing with an LCA review of transport routes. It is important that requirements are formulated in a verifiable manner and remain the basis for negotiation rounds.

Costs and target costing in interplay

Environmental impacts cause and avoid costs: carbon prices, energy procurement, disposal and future border adjustment mechanisms are increasingly factored into total costs. In target costing, a target CO₂ value per functional unit can be defined in the same way as target costs. Variance analyses – comparable to deadline variance analysis in schedule management – show which assemblies deviate from the target path and where development or supplier effort is needed. Material substitutions to reduce raw material price volatility can also be supported by LCA arguments when a secondary material is economically and ecologically advantageous.

Interface to planning and logistics

LCA data has an impact beyond procurement: transport decisions, batch sizes and inventories influence the footprint. Frequent partial deliveries with low unit weight increase transport costs and emissions per unit. Automatic procurement and Material Requirements Planning (MRP) can be parameterised so that fewer, consolidated orders are generated. Whether consolidated procurement is economically and ecologically better depends on the individual case and can be tested using scenario calculations.

Important KPIs and figures relating to the LCA

Environmental impacts become measurable. For procurement, a small, stable set of key figures is worthwhile, serving both supplier management and reporting obligations.

Key figures at product and procurement level

At product level, the CO2 footprint per functional unit, primary energy demand and the water footprint dominate. At procurement level, the share of LCA-audited suppliers, the share of recycled intermediate products and the degree of supply chain transparency complete the picture. The degree of transparency indicates how much of the procurement volume is based on primary data rather than industry averages – a quality indicator often underestimated in practice. Values must always be interpreted in the industry and product context; blanket targets are rarely sensible.

Data quality as a success factor in its own right

An LCA is only as good as its data. Buyers should measure the share of suppliers with validated primary data and systematically expand it. A three-tier classification is helpful: documentation available, plausibility checked, externally validated. Building up this data pool requires deadlines in order management and clear escalation paths, such as a penalty clause for repeatedly missing or implausible evidence. It remains important: key figures are steering instruments, not legal proof.

Risks and controls in the LCA process

The greatest risks lie in data deficiencies, accusations of greenwashing and contradictory supplier statements. Clear control mechanisms in the procurement process significantly reduce these risks.

Typical sources of error

Common problems are inadequate documentation of system boundaries, outdated emission factors, unsuitable functional units and the use of secondary data without information on its origin. Added to this is the allocation error: assigning recycling shares one-sidedly to the producer of intermediate products or to the downstream user distorts the result considerably. Buyers should therefore request, alongside the result value, a brief method description and data origin in enquiries. These requirements belong in the specification of the tender.

Control and verification mechanisms

Effective controls include a standardised data request form, sample checks by internal specialist departments and external validation for critical products. Within the framework of procurement KYC – the verification processes for supplier identity and integrity – the sustainability data section can be integrated. For risk countries and risky intermediate products, a child labour risk assessment complements the purely environmental LCA with social aspects. Supply chain resilience also benefits: those who know their intermediate product tiers recognise both types of risk – ecological and supply-related.

Contractual anchoring

LCA requirements should be contractually secured: update obligations in the event of process changes, evidence obligations at audits and defined sanctions for false statements. An appropriately chosen contract term allows adjustments without straining the relationship. In practice, it has proved worthwhile to introduce LCA obligations in stages – starting with A-items from the ABC-XYZ analysis – and to tighten requirements as data maturity increases.

Current developments: digitalisation and reporting obligations

The LCA is moving from a specialist topic into everyday procurement. Drivers are reporting obligations, customer requirements and digital data exchange along the supply chain.

Reporting obligations and customer requirements

Companies within the scope of European sustainability reporting regulations need reliable figures from the value chain. Whether and from when such obligations apply in individual cases should be legally reviewed. In parallel, industrial customers increasingly demand PCF values in enquiries, sometimes as an award-relevant criterion. Buyers who systematically build up their own LCA data are able to act faster here than organisations that have to request values from suppliers afresh with every enquiry.

Data exchange and standards

Cross-industry formats for PCF exchange and digital product passports facilitate the transfer of data between suppliers and buyers. This reduces the effort per supplier relationship, especially for highly complex components with many tiers. Nevertheless, a critical review remains necessary: standards harmonise formats, but not automatically the quality of the underlying data. A pragmatic approach is to define validity periods for supplier data and to link updates to feedback from requalification or process changes.

Typical metrics

Metric	Typical value
CO2 footprint per functional unit	industry-dependent <i>Only meaningful in comparison with reference products or target values</i>
Proportion of suppliers with validated primary data	typically 20–50% after the first survey <i>Target direction: continuously increasing; benchmark for data quality</i>
Proportion of recycled intermediate products	commonly 10–60% depending on material class <i>significant differences between industries, e.g. metals vs. plastics</i>
Degree of transparency of procurement volumes	ideally > 80% with documented data origin <i>Proportion of volume with known system boundaries and sources</i>

Practical example: mechanical engineering company introduces LCA criteria

A medium-sized mechanical engineering company with around 500 employees is increasingly receiving customer enquiries with mandatory PCF disclosures. Procurement develops a three-stage approach: first, procurement volumes are segmented using an ABC-XYZ analysis to concentrate data collection on the highest-volume and most critical items. In parallel, the 40 most important suppliers are confronted with a standardised data request form and classified by data quality. For one power-intensive assembly, two suppliers with fully documented cradle-to-gate assessments are compared.

- Segmenting the product range by procurement volume and criticality before data requests
- Standardised LCA data form with system boundary, functional unit and data origin
- Integration of a sustainability block into the supplier rating model with a weighting of 10 per cent
- Anchoring of update obligations and evidence consequences in framework agreements

Conclusion

The Life Cycle Assessment has become an action-relevant instrument for technical buyers – not least due to reporting obligations and customer requirements. What matters is less complex models than clear system boundaries, verifiable supplier data and consistent anchoring in enquiries, contracts and supplier evaluation. Those who systematically build up LCA data across critical items gain comparability, reduce emissions risks and can deploy environmental arguments credibly in negotiation rounds. The limitations of the method – in particular data uncertainties and allocation questions – should be communicated openly. Combined with social risk assessments, this produces a holistic picture of the supply chain.

Frequently asked questions

? What is a Life Cycle Assessment in simple terms?

A Life Cycle Assessment (LCA), or environmental footprint analysis, measures the environmental impacts of a product across its entire life cycle – from raw material extraction through to disposal. It follows the methodological framework of ISO 14040 and 14044. The outcome is key figures such as the CO2 footprint per functional unit, supplemented by energy, water and further impact categories.

? Which ISO standard applies to the LCA?

The relevant standards are ISO 14040 (principles and framework) and ISO 14044 (requirements and guidelines). They define the four phases of goal and scope definition, inventory analysis, impact assessment and interpretation. In addition, product group-specific category rules apply, for example in construction or the electronics sector.

? What is the difference between an LCA and a CO2 footprint?

The CO2 footprint captures only greenhouse gas emissions, usually as Global Warming Potential in kg CO2 equivalents. An LCA goes further, considering additional impact categories such as water, energy and resource consumption. The carbon footprint is therefore a subset of the more comprehensive life cycle assessment.

? How do you request LCA data from suppliers?

A proven approach is a standardised form with a defined functional unit, system boundary, reference year, data origin and a brief method description. The requirements belong in the specification of the enquiry so that offers remain comparable. For critical items, a sample check or external validation of the information is recommended.

? What does an LCA for a product cost?

The cost depends heavily on product complexity, data availability and the desired level of accuracy. In practice, simplified screening assessments involve considerably less effort than complete, externally verified assessments. With suppliers, the effort can be reduced through standardised forms and by drawing on existing industry datasets. Concrete project budgets should be calculated on a case-by-case basis.

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