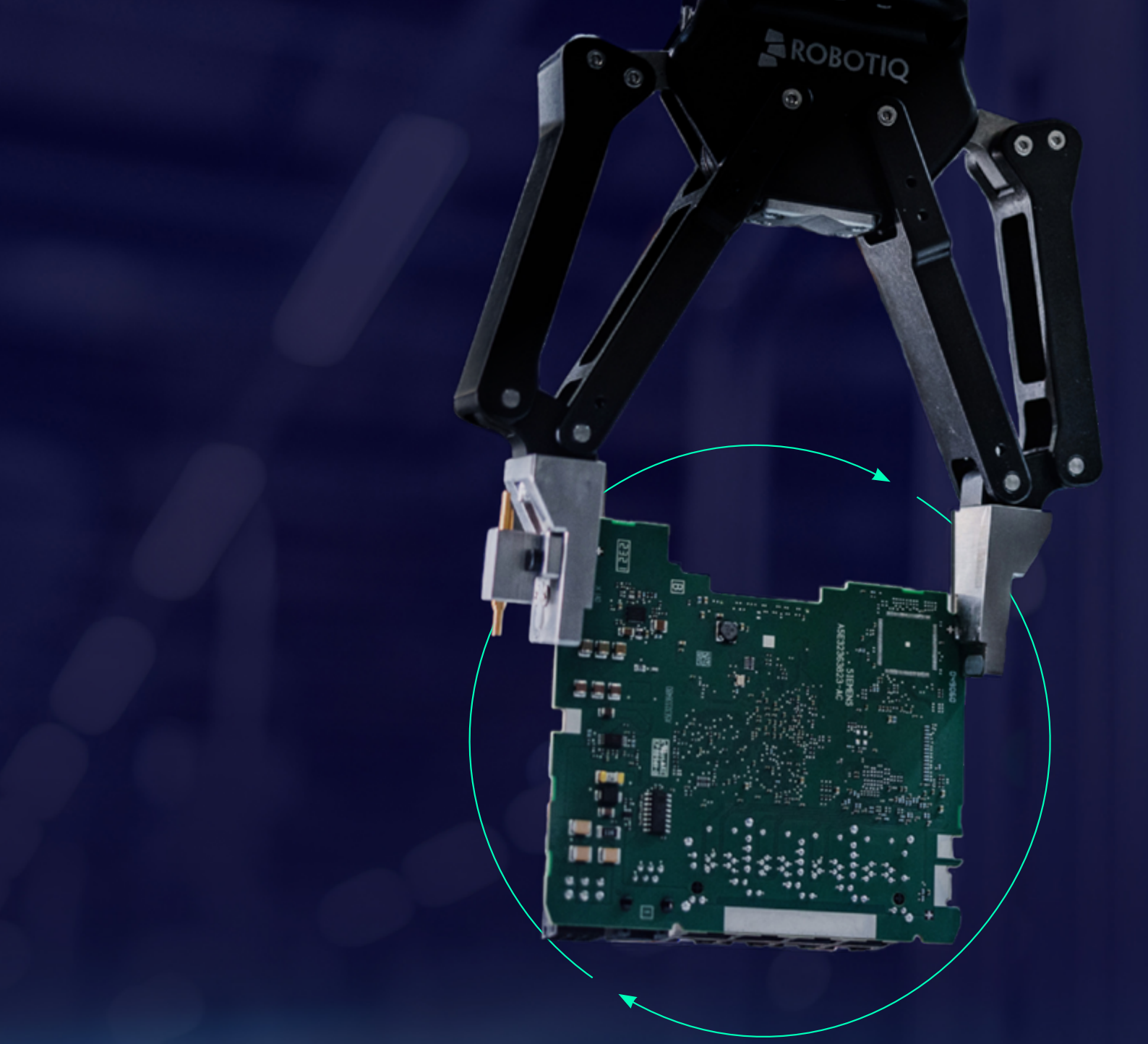


WHITEPAPER

Ecodesign: The foundation of circularity

SIEMENS

What is Ecodesign?

Ecodesign is a lifecycle-wide design discipline that integrates environmental considerations directly into technology design decisions – across hardware, software, and services – from the outset. The core objective is to **reduce resource consumption and environmental impacts across the full lifecycle**, while maximizing the value and utility of components, materials, and services at every stage of use.

Critically, most environmental impacts are determined before a product or solution is ever produced or deployed: around 80% of lifecycle environmental impact is influenced by design decisions.[1] That makes Ecodesign decisive – a primary lever for reducing impacts across the portfolio lifecycle.

Ecodesign also matters because circularity – which reduces the need for new resource extraction and waste generation – cannot be retrofitted downstream. If hardware, software, and services are not designed to use fewer resources, last longer, and retain value, then efforts later in the value chain are limited to incremental efficiency gains. Circular outcomes – such as durability, repairability, reuse, refurbishment, and high-quality recycling – depend on upstream choices: what materials are used, how products and services are designed, what information is available, and how systems are maintained, updated, and returned.



At Siemens, Ecodesign principles are applied across the portfolio – spanning hardware, software, and services. For physical products, Ecodesign addresses environmental impacts across the full value chain, including material selection and material efficiency, the use of secondary and low impact materials, energy efficiency, and the avoidance of substances of concern. Ecodesign for software addresses environmental impacts related to energy and resource use across development and operation, taking in software architecture, algorithms, and data management – all of which influence computing demand and associated electricity consumption. And for services, Ecodesign is of course present in the entire lifecycle, supporting improved operation, optimization, and extended use of customer assets.

This paper uses **Ecodesign** as the umbrella term for this lifecycle-wide discipline. It explores why Ecodesign has become a prerequisite for circularity, future readiness, and scalable sustainability impact – and how we operationalize it systematically across the portfolio.

At Siemens, Ecodesign is operationalized through two closely linked frameworks:

Robust Eco Design (RED) is Siemens' standardized and mandatory approach for systematically embedding Ecodesign into hardware, software and service development across the portfolio. It integrates environmental criteria into early design decisions, providing a consistent framework for applying Ecodesign at scale and forming the foundation for measurement, targets, and transparency.

Siemens EcoTech builds on this foundation by making the results of Ecodesign transparent to customers. It is a customer-facing information framework that communicates how hardware products meet defined environmental criteria, enabling clearer comparison, more informed purchasing and engineering decisions, and greater transparency across the value chain.

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[1] The Ellen MacArthur Foundation (2022) An introduction to circular design...

Why design matters in the planetary crisis

Humanity is facing a convergence of environmental pressures that are no longer isolated or incremental. Climate change, biodiversity loss, and pollution are increasingly recognized as mutually reinforcing challenges that destabilize ecosystems, disrupt economies, and threaten long-term societal well-being. Together, they form what the United Nations describes as the triple planetary crisis[2] – a systemic challenge that cannot be addressed through single issue solutions or downstream fixes alone. **These crises reinforce one another**: a warming climate accelerates habitat loss, pollution weakens the regenerative capacity of ecosystems, and biodiversity loss reduces nature's ability to regulate climate and sustain essential resources.

A common thread across these crises is the way natural resources are extracted, processed, used, and discarded. Resource extraction and processing of materials, fuels, and food account for more than half of global greenhouse gas emissions and over 90% of biodiversity loss and water stress.[3] This exposes the structural limits of the traditional linear "take-make-waste" economy, which depends on continuous input of virgin resources and generates growing volumes of waste and pollution over time, degrading ecosystems and accelerating both climate change and biodiversity loss.

In a world of finite resources and increasing environmental constraints, incremental efficiency gains within linear systems are no longer sufficient. Improving individual processes or products can slow the rate of degradation, but it does not address the underlying model that drives resource depletion and environmental impact. Continuing along conventional growth pathways therefore increases exposure to physical risks, supply constraints, regulatory pressure, and long-term economic instability.

Circularity has emerged as a system-level response to these challenges. For industries, translating circularity into measurable business outcomes requires a systematic Ecodesign approach. At Siemens, this role is fulfilled by Robust Eco Design (RED), which operationalizes circularity across hardware, software and services. By reducing dependence on virgin materials, keeping resources in use for longer, and designing out waste and pollution, circular systems help lower emissions, mitigate pressure on ecosystems, and improve resilience across value chains. Crucially, however, circularity does not start at end of life. Choices around materials, architectures, interfaces, software efficiency, upgrade paths, and information availability shape environmental performance across the entire lifecycle. When circularity is not designed in from the outset, it cannot be reliably achieved downstream – only functioning if hardware, software, and services are designed to enable circular outcomes in the first place. This is where design becomes decisive.

The policy landscape

At the same time, external pressures are accelerating the need to act upstream. **Across markets, regulation is increasingly expanding from end-of-life controls toward upstream requirements** – because policymakers recognize that environmental impact is largely determined at the design stage.

As one of the systemic responses to the triple planetary crisis, circularity is increasingly reflected in multilateral agendas and supports objectives in frameworks such as the Paris Agreement and the Kunming-Montreal Global Biodiversity Framework. The UN's 17 Sustainable Development Goals provide a universal framework, emphasizing responsible consumption and

[2] United Nations (2022). What is the Triple Planetary Crisis?

[3] Global Resources Outlook 2024

production, climate action, and innovation. Trade-related policy discussions are evolving, with the World Trade Organization hosting structured discussions on environmental sustainability and circularity, reflecting growing recognition among participating WTO members that trade can support environmental and climate objectives.

Multilateral cooperation is expanding through initiatives such as the Global Alliance on Circular Economy and Resource Efficiency, which aims to address knowledge and governance gaps and advance global circularity efforts. For businesses, the relevance of circularity is reinforced by ongoing efforts to develop harmonized frameworks that enable companies to measure, manage, and report on circularity impacts, including initiatives such as the Global Circularity Protocol (GCP), representing an important step toward greater global consistency and accountability in corporate circularity measurement and reporting.

In the EU, this shift is most clearly visible in the Circular Economy Action Plan[4], which is geared toward changing consumption patterns to prevent waste generation from the beginning of the value chain. That includes promoting design to make goods and services more durable, reusable, upgradable, and repairable. Manufacturers are encouraged to make products more energy- and resource-efficient and to raise their share of recycled content. This direction is now hardening into binding product policy. The EU's Ecodesign for Sustainable Products Regulation (EU) 2024/1781 (ESPR) establishes a framework for setting Ecodesign requirements across a much broader range of products and enables new information and transparency mechanisms across value chains.[5]

An important feature of the EU's approach is the growing role of digitalization in enabling circularity. For example, the Digital Product Passport (DPP), introduced under the ESPR, represents a key enabler of transparency across value chains. By introducing standardized information on product composition, repairability and recyclability to be shared digitally, the DPP supports circular product design, more informed purchasing decisions, and more efficient information flows between economic actors.

In addition, a range of EU legislation – from product- and waste-focused legislation such as the Waste Framework Directive 2008/98/EC, Packaging and Packaging Waste Regulation (EU) 2025/40, Right to Repair Directive (EU) 2024/1799 and Battery Regulation (EU) 2023/1542, to corporate sustainability frameworks including Corporate Sustainability Reporting Directive (EU) 2022/2464, the EU Taxonomy (EU) 2020/852 and Corporate Sustainability Due Diligence Directive (EU) 2024/1760 – promote sustainable design, waste reduction, transparent sustainability reporting and responsible management of impacts across operations and supply chains.

Beyond Europe, other regions are advancing their frameworks. Africa is strengthening its focus on circular economy approaches through regional initiatives and strategies, including the Continental Circular Economy Action Plan (2024-2034) and the African Circular Economy Alliance. China integrates circularity into strategic planning through resource efficiency laws. In the United States, the Environmental Protection Agency leads efforts to reduce waste and and to increase the national recycling rate to 50% by 2030, supporting both environmental health and economic growth.

As requirements become more lifecycle-based and more data-driven, compliance and competitiveness increasingly depend on the ability to integrate Ecodesign requirements upstream, and generate consistent, comparable, credible product-level information. That is why 'Ecodesign as a system' becomes a market access and differentiation issue – not just a sustainability ambition. It enables companies to respond more effectively to customer requirements, digital product passport expectations, lifecycle transparency demands and emerging circular procurement criteria, thereby creating tangible competitive advantages.

Taken together, these dynamics reshape the role of design. **Design is no longer confined to form, function, or cost optimization. It becomes a strategic lever for addressing systemic environmental challenges, managing risk, and enabling circular value creation at scale**. Ecodesign is the mechanism that translates these pressures into actionable, lifecycle-wide design decisions – providing the foundation on which circularity, compliance, and measurable impact can be built.

[4] EU Circular Economy Action Plan

[5] Ecodesign for Sustainable Products Regulation

Ecodesign and circularity: turning principles into practice

Circular economy principles, particularly the three core principles defined by the Ellen MacArthur Foundation (eliminating waste and pollution, circulating products and materials, and regenerating nature)[6], deliver meaningful impact when they are translated into concrete design decisions. In practice, these principles are applied through circular strategies such as the 10R framework (e.g. reduce, reuse, repair, refurbish, remanufacture and recycle), which provide a structured way to retain value, minimize resource use, and avoid waste.

Ecodesign provides the critical link between these principles and their practical implementation. It operationalizes circularity by embedding resource efficiency (reduce), lifetime extension (reuse, repair, refurbish), and value recovery (remanufacture, recycle) directly into the design of hardware, software, and services. Because a large share of environmental impacts are determined at the design stage, Ecodesign is a decisive lever for enabling circular outcomes across the lifecycle.

Ecodesign takes a lifecycle-wide perspective. It addresses how resources are selected, how hardware, software and services are used and maintained over time, and how value can be preserved or recovered at end of life. Circularity cannot be achieved reliably downstream if these aspects are not considered upstream. Ecodesign ensures that circular economy principles are applied where they have the greatest influence: at the point of design.



Siemens' approach to resource efficiency and circularity

At Siemens, Ecodesign is embedded within a broader sustainability framework that defines resource efficiency and circularity as a dedicated impact area. This focus area is part of our sustainability target framework, which sets the direction for how we deliver measurable sustainability impact across our portfolio, operations, and value chains. Within the resource efficiency & circularity impact area, we focus on delivering value for customers, the environment, and society by decoupling growth from resource consumption. This is achieved by equipping industries with technologies that extend asset lifecycles while enhancing performance, availability, and utilization.

Across operations, products, and people, we aim to decrease our environmental footprint and secure our supply chain by designing for circularity, optimizing resource use, eliminating waste, as well as conserving water and biodiversity. Ecodesign provides the practical means to translate this ambition into concrete design requirements and development decisions. Through our DEGREE framework, we set ambitious targets: achieving RED across 100% of our relevant hardware, software, and service portfolio by 2030.

We are ideally positioned to empower industries to transition from linear to circular. Our circularity approach is structured around three complementary dimensions: creating circular products, embracing circular business practices, and empowering customer circularity. The framework for this approach is introduced on the following page, with further details on the approach and its contribution to our overall sustainability impact provided in the Siemens Impact 2025 publication.[7]

[6] Ellen MacArthur Foundation (2024). Circular economy principles.

[7] Siemens Impact 2025

Doing more with less for our customers, planet and society

Through Siemens' **circularity approach**, we empower industries to transition from linear to circular. Circularity thinking will generate more value, reduce costs, open new business opportunities, keep resources in use as long as possible and make our supply chains more resilient.

Creating circular products

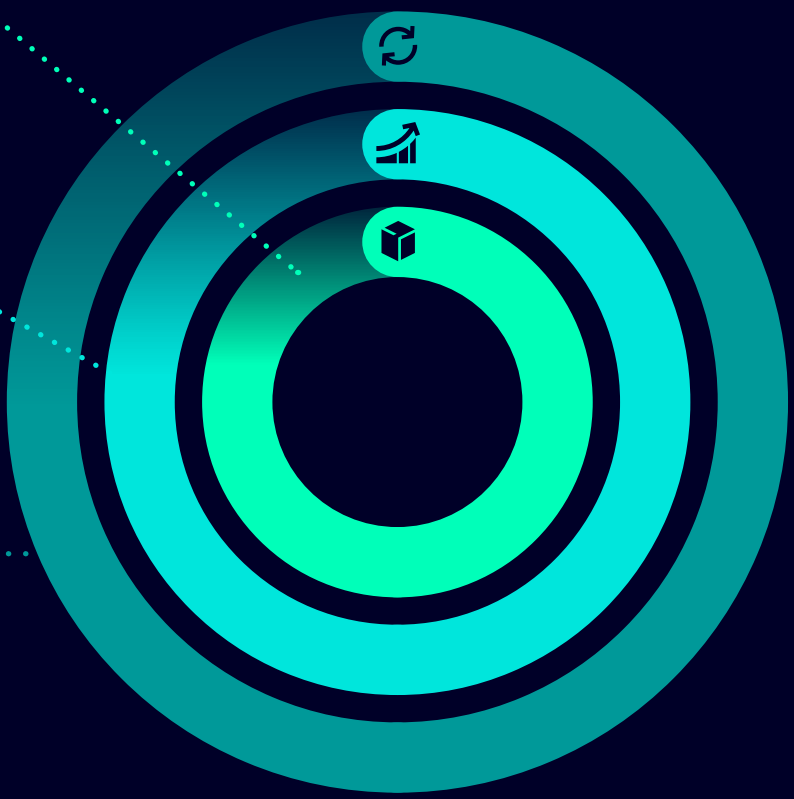
We design for sustainable materials, optimal use, and value recovery. We optimize secondary material use and increase supply chain resilience. Our commitment to improving production efficiency helps minimize resource consumption.

Embracing circular business

We aim to enhance and preserve value through lifetime-extending services and the reuse of products and components. By closing the loop, we effectively recover value.

Empowering customer circularity

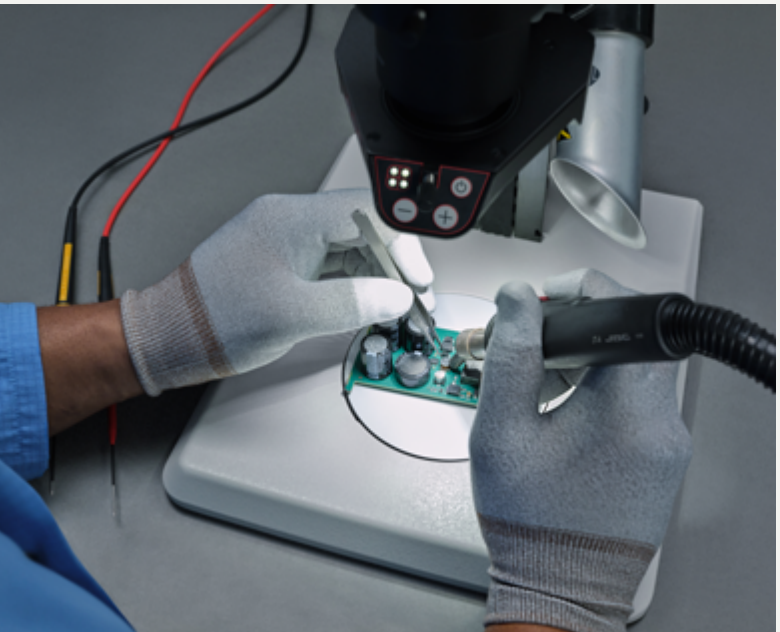
We enable the creation of circular products with our software portfolio. We provide solutions for optimized, resource-efficient customer operations and generate value through innovative business models, agreements, and partnerships.



Robust Eco Design: Siemens' mandatory approach

In 2020, we introduced RED – a dedicated, holistic and mandatory Ecodesign approach to our development processes.

With RED, we aim to identify ways to achieve the same or greater customer value, while consuming less energy and fewer resources, minimizing the dissemination of non-natural substances into the environment, and managing the required technical and biological resources in a circular loop. RED applies Ecodesign systematically across all lifecycle phases and processes, aiming to make the hardware, software, and service lifecycles more environmentally compatible.



Portfolio-wide application

Starting in 2021, we began implementing RED primarily across our hardware products, establishing a strong foundation. Since then, we have expanded our efforts to include software and services, establishing dedicated Ecodesign targets as well as introducing Siemens EcoTech to showcase the implemented Ecodesign criteria towards our customers. The RED approach provides a systematic foundation for integrating Ecodesign into our portfolio development, enabling us to define environmentally beneficial Ecodesign specifications. **Our target is to achieve RED across 100% of our relevant hardware, software, and service portfolio by 2030**. RED is based on the IEC 62430:2009 standard for Environmentally Conscious Design for Electrical and Electronic Products, which defines the requirements and procedures to integrate environmental aspects into design and development processes.

Hardware

For physical products, Ecodesign addresses environmental impacts across the full value chain. This includes material selection and material efficiency, the use of secondary and low impact materials, and the avoidance of substances of concern. Design choices also influence energy efficiency during operation, which is often a dominant contributor to lifecycle impacts.

Ecodesign further addresses durability, repairability, and upgradability, which are essential for extending product lifetimes and retaining value in use. Considerations such as product durability and longevity, and ease of maintenance are therefore integrated into design decisions. At end of life, Ecodesign determines whether products can be reused, refurbished, or recycled effectively, and whether materials can be recovered in high quality. By addressing these aspects at the design stage, Ecodesign enables circular value flows rather than linear disposal pathways.

Software

Ecodesign for software addresses environmental impacts related to energy and resource use across development and operation. Software architecture, algorithms, and data management influence computing demand and associated electricity consumption, making resource-efficient design increasingly relevant.

Design choices also affect lifecycle aspects such as updates, data storage, and long-term resource use. A lifecycle-oriented approach to software design therefore supports reducing overall resource consumption. In addition, software can contribute to improved lifecycle performance of technical systems by enabling monitoring, optimization, as well as updates and upgrades.

Services

Ecodesign for services refers to service offerings as independent value propositions, with environmental impacts arising from both their delivery and their influence on customer applications.

Depending on the service model, digital and service-based offerings can support improved operation, optimization, and extended use of customer assets.

Integrating environmental considerations into service design therefore enables both more resource-efficient service delivery and positive effects in customer use contexts.

Enabling early stage, environmentally informed design decisions

RED is a systemic and robust approach to developing a circular and resource-efficient hardware, software, and service portfolio. It is centered on the systematic application of Ecodesign across all relevant lifecycle stages, with the aim of reducing environmental impacts, extending product and system lifetimes, and retaining the value of products, components, and materials for as long as possible. **By integrating circularity principles from the earliest design stages, RED supports the minimization of material and energy consumption, the reduction of losses across value chains, and the recovery, reuse, refurbishment, and recycling of resources at end of life**.

The RED methodology involves classifying portfolio into homogenous hardware, software and service families, where each is assessed against three predefined maturity phases: application perspective, solid foundation, and dematerialization, forming the basis for Siemens EcoTech.

Application perspective: From an application perspective, RED starts at portfolio level by defining the relevant hardware, software and service portfolio elements and structuring it into hardware, software and service families that together cover the vast majority of business relevance. For these hardware, software and service families, environmental challenges are analyzed and Ecodesign requirements are systematically identified and prioritized based on legislation, customer expectations, market trends and internal standards. This application-oriented approach ensures that hardware and software products and services are optimized according to their specific use cases, markets and regulatory environments, helping to identify and focus on the most relevant environmental improvement levers. It enables the consistent application of Ecodesign where it creates the greatest environmental impact and business value, while providing the foundation for subsequent lifecycle assessments (LCAs) and implementation.

Solid foundation: We assess the environmental impacts of hardware, software and service families using LCAs and environmental statements (e.g. claims, labels and declarations) to support the identification of potential improvements. This establishes a factual and objective baseline against which environmental improvements can be identified and prioritized. An LCA, conducted in accordance with ISO 14040 and ISO 14044, evaluates the environmental impacts of goods and services, either during selected stages or all stages of their lifecycle, ranging from resource extraction, manufacturing, distribution, and use to waste management, disposal, or transition to further use. Based on these assessments, environmental statements provide quantified information, including general information, details on material composition and substances of concern, descriptions of the lifecycle stages and reference scenarios applied, and key environmental indicators derived from the LCA results. Where applicable, they may serve as input for ISO 14025-compliant Environmental Product Declarations (EPDs).

Digitalization is the foundation for scaling RED across our portfolio. Our integrated digital LCA solution harmonizes how environmental data is collected, calculated and communicated across the organization. It automates data inputs and calculations, ensures methodological consistency across all business units and service offerings, and creates a common basis for environmental transparency at scale. The tool also automatically generates environmental statements that translate complex LCA results into clear, comparable outputs, supporting external communication.

Dematerialization: This phase translates the identified environmental improvement opportunities into concrete Ecodesign measures that reduce environmental impacts and resource consumption while enabling circularity. We explore and identify environmental design alternatives, analyze results, and integrate feasible options into refined design specifications for our offerings. Ecodesign principles are embedded in these alternatives and incorporated into the Product Lifecycle Management process to support the dematerialization phase.

Siemens EcoTech builds on these three phases of RED, providing customers with transparent, structured product-level environmental information in a standardized two-page Siemens EcoTech Profile (SEP). Read more about Siemens EcoTech on page 10.

Ecodesign criteria

For hardware products, our approach is based on **12 Ecodesign criteria**, shaped by legal requirements and stakeholder expectations, that are grouped into three stages of a product's lifecycle:

- **Sustainable materials**: Focusing on low carbon and secondary (recycled) materials, minimizing material use, optimizing packaging, and avoiding substances of concern.
- **Optimal use**: Emphasizing energy efficiency, product durability and longevity, and ease of updating or maintenance.
- **Value recovery**: Prioritizing repairability, upgradability, ease of disassembling (incl. recyclability statements), and recyclability.

This approach ensures that our hardware products are designed for efficiency, resource conservation, and minimal environmental impact.

While Ecodesign criteria for hardware are already well established, initial criteria have been introduced for software and services, with further development ongoing.

Application perspective

Relevant Ecodesign criteria are identified and prioritized from stakeholder expectations.

Solid foundation I

Environmental impacts are quantified through LCA prior to defining any design optimizations.

Dematerialization

Selected Ecodesign aspects are integrated into the design choices.

Solid foundation II

Impacts are re-assessed and documented via environmental statements

Siemens EcoTech Profile

Environmental information is provided to customers in a standardized two-page Siemens EcoTech Profile (SEP)

Applicable to:
- Hardware
- Software and services

Case: SIMATIC IPC BX-54A

Siemens EcoTech framework case example:

Industrial box PC

The SIMATIC IPC BX-54A is an ultra-compact Industrial Box PC designed to deliver high-performance computing in tight spaces. It is purpose-built for harsh automation and AI-heavy environments, making it ideal for visual quality control and inspection tasks. SIMATIC IPC BX-54A meets the Siemens EcoTech criteria across low carbon materials, substances of concern, packaging, minimum material use, durability/ longevity, repairability, maintenance possibility/updatability, and upgradability.



> "SIMATIC IPC BX-54A demonstrates how sustainability and industrial performance can go hand in hand. Through resource-efficient design, reduced material use, improved durability, and enhanced repairability, we are helping customers achieve their automation goals while supporting a more circular and sustainable future."
>
> **Neil Ahmad, Product Manager**

Learn more

How SIMATIC IPC BX-54A meets the Siemens EcoTech criteria

Low carbon materials

Substantial reduction in product carbon footprint (cradle-to-gate) by up to 37% compared to predecessor, achieved through optimization of mechanical and electronic components.

Substances of concern

The content of halogenated substances in the printed circuit boards (PCBs) has been proactively reduced, halogen-free PCBs compared to predecessor.

Packaging

The protective insert is made from over 80% recycled plastic. Considerable reduction in box weight by up to 83% and plastic use by up to 51% compared to predecessor.

Minimum material use

Considerable reduction in product weight by up to 65% and volume by up to 83% compared to predecessor, through innovative compact design.

Durability / Longevity

Wider ambient temperature range during operation to extend the area of application and to prolong product life. Lifespan of wearing part (i.e., fan) is prolonged from 3 to 7 years.

Repairability

Reliable repair services and supply of spare parts available in >30 countries. The product design supports easy repairability.

Maintenance possibility / Updatability

Low maintenance requirements through preventive measures. High modularity eases the replacement of key components. Firmware updates are available.

Upgradability

Online software upgrades are available. Hardware upgradability is enabled by a modular design.

Case: SIRIUS 3RW5 -Z R11 Refurbished Soft Starter

Siemens EcoTech framework case example:

Circular soft starter

The circular, low carbon SIRIUS 3RW5 -Z R11 refurbished soft starter is created through a controlled refurbishment process of used soft starters, resulting in a CO_2 emission reduction of typically up to 50 percent compared to a new device through reduced resource consumption. Its modularity allows easy dismantling and repair, with identifiable components for efficient refurbishment. As a smart device, it provides usage and condition data from its first life cycle, enabling targeted remanufacturing for a second.

> "We help to reshape the market and strengthen our Ecodesign and R-strategy across recycling, repair, and refurbishment. The SIRIUS 3RW5 -Z R11 refurbished soft starter helps us prepare for more resilient and circular business models while reducing CO_2 emissions and improving resource efficiency."
>
> **Thomas Brenner, Head of Segment Electrical Products Europe, Middle East and South America**



Learn more

How SIRIUS 3RW5 -Z R11 meets the Siemens EcoTech criteria

Minimum material use
The largest predecessor product* size 6 is now replaced by a smaller, more space-efficient size 5 version.

Energy efficiency
Lower power consumption compared to the predecessor product* and full energy-flow transparency through hybrid switching, integrated bypass and metering.

Packaging
Digital documentation via ID Link saves paper documentation compared to the predecessor product.

Durability / Longevity
High quality, robustness and extended lifetime compared to the predecessor product, based on low wear switching and intrinsic device protection.

Repairability
The modular design enables easy, onsite repair by customers, supported by a comprehensive range of spare parts.

Maintenance possibility / Updatability
Updatable firmware, plus condition monitoring for full transparency of connected equipment status.

Take back scheme to extend product lifecycle
Take back scheme for refurbishment is available.

* Compared to predecessor 3RW44

Our resource efficiency and circularity targets

Through the DEGREE framework, we set ambitious targets: achieving RED across 100% of our relevant hardware, software, and service portfolio by 2030. With this target, we strengthen our commitment reducing the footprint of our offerings.

In addition to this overarching target, we have defined further targets for selected Ecodesign criteria to advance our focus on resource efficiency and circularity. Out of the 12 Ecodesign criteria discussed in the previous chapter, we have identified four that form the basis of our Ecodesign targets. The selection of these four criteria for target setting was informed by market demands, including investor and customer expectations, as well as policy and regulatory drivers, and closely aligns with Siemens' circularity approach.

Substances of Concern

We are committed to phase out selected substances of concern (SoC) in specific applications in 100% of relevant products by 2030. This target reflects our responsibility to protect human health and safety by systematically reducing substance-related hazards, while responding to evolving customer expectations and market requirements. The target also supports our commitment to minimize environmental impact and strengthen operational sustainability across our entire value chain, and supports our aim of increasing recyclability, as these substances can negatively affect material separation, contaminating recycling streams, or reducing the quality of recovered materials. By proactively addressing substances of concern, we aim to strengthen the resilience and future readiness of our product portfolio. This approach supports continuous alignment with emerging chemical safety regulations and international standards.

For existing Siemens-designed parts, we are phasing out lead in steel, aluminum, and copper alloys. Existing parts require substitution checks and phase-out plans. For new Siemens-designed parts, we are phasing out chlorinated and brominated flame retardants in plastic parts and the base material of printed circuit boards. Additionally, selected perfluoroalkyl or polyfluoroalkyl substances (PFAS) – including perfluorobutane sulfonic acid (PFBS) in plastics and potassium-PFBS in contact material – are excluded from use in new designs. New designed parts undergo a SoC assessment to exclude listed substances or provide documented justification for continued use.

Ecodesign criteria	Target 2030
Substances of Concern	Phase out selected substances of concern in specific applications in 100% of relevant products
Secondary Materials	Substitute a share of standard thermoplastics with sustainability-enhanced thermoplastics in 50% of relevant products
Sustainable Packaging	Pursue 100% sustainable product packaging of relevant products
Recyclability	Provide recyclability statements to our customers for 100% of relevant products

Secondary Materials

By 2030, we aim to substitute a share of standard thermoplastics with sustainability-enhanced thermoplastics in 50% of relevant products. We use secondary materials to close material loops, reduce products' carbon footprint, and meet emerging regulatory requirements such as the ESPR. The strategic transition from secondary metals and resins toward sustainable thermoplastics reflects a shift in focus to the material category with the greatest untapped potential for increasing circular content, as significant progress has already been achieved in recycled metals. Thermoplastics represent the largest share of materials where circular content can be effectively implemented and validated.

It allows us the flexibility to choose products based on customer and market demands, such as the local availability of environmentally feasible substitutes, varying recycling infrastructure maturity, and local regulatory frameworks. This is supported by leveraging scientific evidence on market conditions where thermoplastics demonstrate established recycling processes with economic and technological viability. This approach enhances resource efficiency and creates environmental value through optimized material utilization.

We implement this target by identifying relevant products with more than 25% thermoplastics content, prioritizing those with the highest potential to increase secondary material use, and assessing the feasibility of alternative materials.

Doing so also supports meeting customer expectations and preparedness for relevant regulatory requirements, including the EU Packaging and Packaging Waste Regulation and the EU Regulation on Deforestation-free Products (EU) 2023/1115. It contributes to reducing regulatory risks related to resource use and represents an opportunity for circular material management.

Recyclability

We aim to provide recyclability statements to our customers for 100% of relevant products by 2030. These statements support higher recycling and recovery rates of utilized materials and improve circularity by providing recyclers with critical information to maximize material recovery and ensure the proper handling of hazardous components. Consideration of recyclability is integrated at the design stage of the product lifecycle management.

Our recyclability statements are established based on applicable international standards, such as ISO 20887 and IEC TR 62635:2012. Additionally, take-back initiatives are implemented to facilitate material recovery, contributing to improved quality and availability of secondary materials and thus reducing reliance on primary raw materials. This supports our customers to reduce waste and contribute to maximizing material recovery during the end-of-life treatment of products, driving the transition to resource circularity.

Sustainable Packaging

By 2030 we pursue 100% sustainable product packaging of relevant products. We promote sustainable forestry practices, minimizing waste, and supporting environmentally conscious recycling processes, aiming to source paper products from certified sustainable forestry such as Forest Stewardship Council (FSC) and/or Programme for the Endorsement of Forest Certification (PEFC) and to select optimized packaging solutions. Through this target, we aim to lower the carbon footprint of product packaging while supporting circular material flows.



Siemens EcoTech: making impact transparent

Businesses must understand and improve the environmental performance of products to scale sustainability impact. To support this objective, we introduced Siemens EcoTech, an environmental product performance framework designed to reduce the environmental footprint of products and enable more sustainable industry and infrastructure.

Built on the RED approach and aligned with our circularity framework, **Siemens EcoTech provides transparent, product-specific environmental performance information** based on environmental statements and other verified lifecycle data. By making relevant environmental information visible and comparable, Siemens EcoTech helps establish trust, promotes informed decision-making, and enables customers to better understand the sustainability characteristics of our products.

Through this transparency, Siemens EcoTech empowers customers to make more sustainable choices while supporting their own sustainability and circularity goals.

Every product within the Siemens EcoTech framework comes with a SEP – a detailed product sheet outlining key environmental information. This ensures maximum transparency regarding the materials, design, use phase and end-of-life of our products. The assessing methodology of Siemens EcoTech is externally validated by TÜV Rheinland according to ISO standards 14020 & 14021.

The framework provides a comprehensive set of criteria across three dimensions covering the entire product lifecycle. Products which are part of the Siemens EcoTech framework must meet mandatory requirements and fulfill at least one criterion in each dimension of the Siemens EcoTech framework by proving its performance compared to an existing norm, standard, or predecessor product. Siemens EcoTech utilizes the Ecodesign criteria of RED grouped into three stages of a product's lifecycle. The Siemens EcoTech criteria align with those defined in our RED framework, with the only additional requirement being available take-back-schemes. Additionally, products must provide an environmental statement, be compliant with current substance regulations, and be manufactured in facilities powered by 100% renewable electricity.

Siemens EcoTech in practice

To illustrate how RED translates into transparent, product-level information for customers, the following examples show how Siemens EcoTech builds directly on RED in practice.

Spanning different application areas – from industrial computing and fire safety to motor control and power supply – they reflect the breadth of our products within the Siemens EcoTech framework and demonstrate how Ecodesign criteria are applied, assessed and communicated in a standardized way.



Case: Sinteso Nova/Cerberus Nova Detectors

Siemens EcoTech framework case example:

Advanced fire detection

Sinteso Nova and Cerberus Nova detectors are the next generation of fire safety. Featuring ASAplus™ technology, they detect fires accurately, minimize false alarms, and enable continuous self-monitoring with Disturbance-Free Testing (DFT). Fully IoT-enabled and compatible with Building X Fire applications, they support real-time remote monitoring and predictive maintenance. Backward compatible with existing infrastructure, they allow step-by-step modernization without replacing existing bases or panels – making them ideal for buildings where safety and operational reliability are critical, from hospitals to data centers.



> "The launch of our Sinteso Nova and Cerberus Nova fire detection portfolio is a game-changer in ensuring all alarms are accurate as best as possible. By moving from periodic checks to continuous, data-driven, self-supervising systems, we're laying the foundation for truly human-centric, autonomous buildings. By automating testing, delivering real-time insights, and enabling remote action, these solutions protect people while freeing up staff to focus on strategic priorities. This shift isn't just about innovation – it's about smarter, safer, and more efficient operations."
>
> **Peter Nebiker, Head of Fire Safety portfolio**
> **Siemens Buildings**

Learn more

How Sinteso Nova and Cerberus Nova meet the Siemens EcoTech criteria

Secondary materials
The product's plastic parts contain a considerable share of secondary material compared to its predecessor.

Minimum material use
The product weight has been reduced compared to its predecessor.

Energy efficiency
The product's power consumption has been reduced compared to its predecessor.

Packaging
Packaging was optimized by using smaller plastic bags with recycled material, increasing density, and removing paper documentation compared to its predecessor.

Maintenance possibility / Updatability
The product supports remote maintenance and offers firmware updates.

Upgradability
New features and functionality can be added to the product using firmware, unlike its predecessor.

Case: SITOP PSU6200

Siemens EcoTech framework case example:

Efficient and long-lasting industrial power supply

SITOP PSU6200 is an industrial 24 V power supply designed for a wide range of applications. Specified for demanding electrical and environmental conditions, it combines energy efficiency of up to 96% with improved surge immunity, maintenance-free operation and more than twice the average lifetime of its predecessor. Its environmental performance extends beyond the use phase: plastic-free, recyclable packaging reduces material impacts, while screw-based connections support efficient, nondestructive disassembly for repair or recycling.



> "As an industrial 24 V power supply, energy efficiency is particularly relevant throughout the use phase. SITOP PSU6200 achieves up to 96% efficiency versus 91.5% for its predecessor and twice the average lifetime, combining efficient power conversion with proven longevity."
>
> **Cedric Bardenhagen, Head of Sustainability, Digital Industries, Automation**

Learn more

How SITOP PSU6200 meets the Siemens EcoTech criteria

Energy efficiency
Highly efficient, ensuring optimal performance and energy savings.

Packaging
Product packaging made from FSC-certified cardboard with over 65% recycled content, offering an improvement on the product's previous incarnation.

Durability / Longevity
Improved surge immunity over its predecessor, ensuring greater reliability and more than double the lifespan. The product is designed for maintenance-free performance.

Substances of concern
The product complies with applicable substance regulations, helping protect people and the environment by avoiding substances of concern.

Ease of disassembly / Circularity instructions
Recycler guide is available for efficient repair or recycling.

Outlook: scaling impact through systems and collaboration

RED is not a one-time intervention or a fixed endpoint. **It is a robust process that must continuously adapt to technological progress, regulatory change, and shifting customer and societal expectations**. As sustainability requirements become more lifecycle-based and data driven, the ability to scale impact increasingly depends on how well Ecodesign is embedded into systems, supported by digital tools, and connected across value chains.



RED as an evolving process

RED is not designed as a one-time achievement, but as a robust framework that ensures environmental considerations are systematically integrated into hardware, software, and service development. While individual products may undergo transformative redesigns, the effectiveness of RED depends on its ability to remain relevant as technologies, environmental priorities, regulations, and customer expectations evolve.

The experience we have gained through RED demonstrates that **lasting impact depends on the robustness of the underlying process**. Assessment criteria mature, methodologies improve, and new areas of environmental relevance emerge over time. RED provides a structured mechanism for incorporating these developments into hardware, software and service development, ensuring that environmental considerations remain embedded from the earliest stages of design through implementation and market deployment.

Regulatory and market expectations are increasingly moving toward greater transparency across the product lifecycle. Requirements such as digitalized product information, standardized environmental disclosures, and traceable lifecycle data reinforce the importance of having a consistent and scalable process for integrating environmental considerations into development. Supported by lifecycle assessments, environmental statements, and digital tools, RED provides the governance and structure needed to respond to these developments in a credible and systematic way.

As transparency requirements continue to evolve, the ability to generate reliable, comparable product-level information will become an increasingly important prerequisite for market access and customer trust. Siemens EcoTech, supported by digitalization, creates the basis for meeting these expectations at scale.

Collaboration across value chains

No company can deliver circularity or sustainability impact in isolation. Ecodesign outcomes are shaped not only by internal design decisions, but also by suppliers, partners, customers, and end-of-life actors. Scaling impact therefore **requires collaboration across value chains, supported by shared standards and transparent information flow**.

By aligning Ecodesign approaches with suppliers and enabling customers to access and use product-level environmental information, companies can amplify impact beyond their own operations. This collaborative dimension is essential for turning individual Ecodesign actions into system-level change.

Closing the loop: from definition to system-level impact

This white paper opened with a simple premise: Ecodesign is a lifecycle-wide design discipline that integrates environmental considerations into hardware, software, and services from the outset, where the greatest leverage lies. The chapters that followed showed how this principle is translated into practice – through RED as a mandatory system, the setting and achievement of Ecodesign targets, and making results transparent and usable for customers with Siemens EcoTech.

As transparency requirements increase, digital tools mature, and collaboration across value chains deepens, **Ecodesign is and remains the foundation on which circularity, compliance, and measurable impact are built**. By embedding Ecodesign systematically and enabling customers to act on it, we help turn early design decisions into lasting sustainability outcomes – closing the loop between intent, implementation, and impact.



Glossary

Abbreviation	Full term
DPP	Digital Product Passport
EPD	Environmental Product Declaration
ESPR	Ecodesign for Sustainable Products Regulation
FSC	Forest Stewardship Council
GCP	Global Circularity Protocol
ISO	International Organization for Standardization
LCA	Life Cycle Assessment
PEFC	Programme for the Endorsement of Forest Certification
PFAS	Per- and Polyfluoroalkyl Substances
PFBS	Perfluorobutane Sulfonic Acid
RED	Robust Eco Design
SEP	Siemens EcoTech Profile
SoC	Substance(s) of Concern

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