Quality Standards for Circular Design

Design Criteria for Sustainable Development

designaustria®

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FiberEUse

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What is the ambition of this manual?

The transition to a circular economy is a system change, which calls for a rethinking of linear processes in favor of recyclable products and product service systems. In order to ensure a sustainable development on economic, social, and ecological levels, the United Nations have agreed to reach a total of 17 Sustainable Development Goals (SDGs) by 2030. The responsibility to implement these goals resides equally with both designers and manufacturers. Designers mediate between all actors involved in the development process and can thereby create transparency. For this information exchange to be successful, we provide designers and manufacturers with comprehensible standards and tips to help realize the sustainability goals.

Designers
acquire orientation for the realization of recyclable products and product service systems, receive support in the search for more detailed information, and take first steps toward implementing the standards. All design sectors are addressed here: Functioning material loops require the involvement of graphic and interaction design to organize information and interactions along the complete value chain. Sharing concepts in product and textile design offer new usage possibilities and forms of material use and procurement.

Manufacturers
receive criteria and inspiration related to potential circular economic models, which are to be addressed and fulfilled in collaboration with designers.

Circular Design
In circular design ecodesign strategies are combined with the aim of keeping as many resources as possible in closed loops and transferring them quickly and efficiently from a state of uselessness to a state of use. Hence, knowledge about sustainability standards becomes a decisive innovation tool.

Contents

Notes
A very personal and confidential manner of addressing the designers and manufacturers was chosen to express the collaborative and trusting atmosphere in times of the system change.

These symbols serve as signposts through the respective requirements for ecologically and socially sustainable design:


Definition


Keywords, Reference Sources


Tips


Requirement fulfilled? Check it

What do we want to achieve?

linear	→	circular

Designers

design as marketing	“beta version” principle
centralization	decentralization
patents, copyrights	Creative Commons
dependency on fashions and trends	independency from fashions and trends
products with short lifespans, new models	resilient products with long lifespans, updates, modularity
end of life reuse, recycling, and extension of the product life cycle are not planned	closed loop reuse is planned, all resources remain in a closed loop

Consumers / Users

consumers (passive)	prosumers (active)
global and cheap – cost-effective production, supported by e-commerce	local and available – local production, skills, and resources
owning	using
quick death not reparable	long life reparable
no service	service friendly

linear	→	circular

Manufacturers

product = source of added value	functionality/using = source of added value
globalized production – cost-effective production, labor power, resources, and transportation	"global/local" principle – globalized knowledge generation, local production and distribution
products without service, new products follow profit logic	product service systems, considering users' needs
end of life reuse, recycling, and extension of the product life cycle are not planned	closed loop repair, reuse, and remanufacturing are essential aspects of the circular model

Policymakers

costs – production – efficiency	qualification – quality – resources
global structures (outsourcing)	glocal structures (insourcing)
promoting the economy	promoting individuals
responsibility of the manufacturer only on occasion	responsibility of the manufacturer is the rule
regulation of resources	resources as common good

IDRV according to *Circular by Design. Products in the Circular Economy,* EEA Report No. 6/2017

How do we start?

The following thoughts and principles can be discussed for one's own project work in the spirit of ecological sustainability.

Purpose
Is the design of a service or system possible?
Can the design of a product be avoided?
How useful is the purchase of a product?

Service Units
How can one successfully design service and utilization units?
Which services does the product provide?

Personal Attitude
How can I refine my attitude, my awareness toward ecologically sustainable concepts and systems, and share it with other actors?

Information and Research
How and where do I find information and figures related to the environmental aspects of my project?
Are there existing environmental declarations on comparable products and services?
How do I inform users and educate them in the resource-efficient use of a product or service?

Optimizing Use
Which requirements apply regarding service life, intensity of use, life cycle, and disposal scenarios?
Do the rules and standards correspond with the actual use?
Where do I find information about the existing rules and standards?

Resilience
How do products and services become resilient and independent from external factors like short-lived fashions and trends?

Preparations

☐ **1. Sketch out the product life cycle**

Where does it comes from? Where does it go?
Which resources does your product/service consume?
Which requirements apply for this product/service category?
Disassemble products to understand functions and processes.

☐ **2. Work from the future to the present**

Sketch out the ideal usage scenario and break it down into the real possibilities.

☐ **3. Prioritize possibilities**

Create new contexts instead of products.
Select appropriate design strategies.

☐ **4. Identify the impact**

Illustrate the impacts of your own actions.
How do the materials affect the environment (soil, air, water)?
Which influences does your design have on society?

☐ **5. Recognize hurdles and barriers**

Clarify the limitations of your actions:
What effects can I provoke? Where do I need help?

☐ **6. Plan next steps**

Who do I want to collaborate with in the future?

(!) **The role of life cycle assessment (LCA)**

Whether and to what extent the abovementioned strategies have an effect on the environmental balance of a product or service can only be determined with the help of effect categories – the figures derived from the results of an LCA. Different tools can be used for a general estimate and the comparison of environmental impacts.

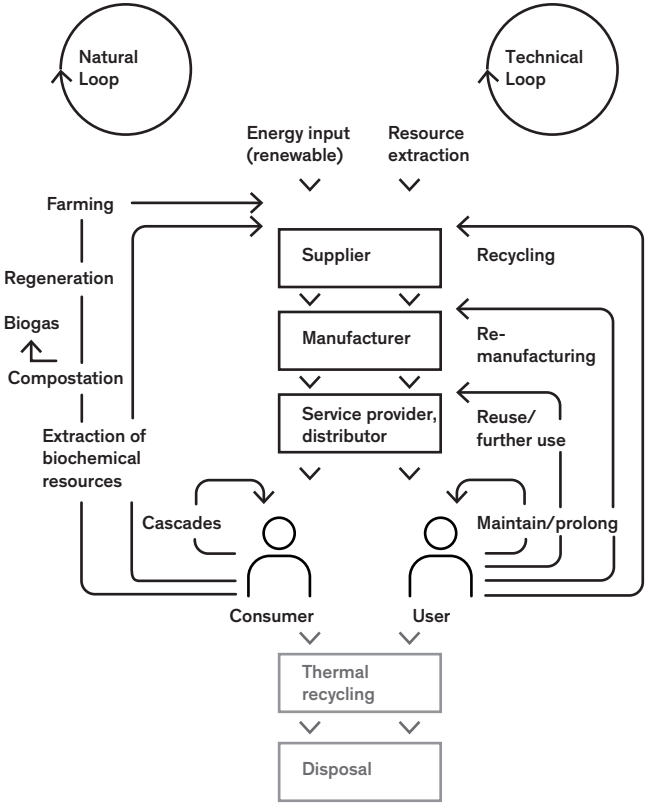
Tools

checklists	reminders
material categories (Ecolizer)	overview, simple analysis
(material) databanks	raw numeric values
LCA software	precise analysis process

Circularity Potential

Thinking in loops

Linear economic models – from the cradle to the dump – are being replaced by planned closed loops. Following this concept, there is no longer any waste. Natural loops are created for natural materials – for example, compostable packaging. Technical products and components are routed into technical loops – like with smartphones. External impacts – such as emissions – are taken into consideration throughout the complete life cycle.



IDRV according to the Ellen MacArthur Foundation, 2015

Circular Design, Circular Economy, Closed Loop, Zero Waste

- *Circular Design Guide* – Ellen MacArthur Foundation and IDEO: circulardesignguide.com
- *EcoDesign Toolkit* – German Environmental Administration and BMUB: ecodesignkit.de
- *Criteria Matrix* – German Ecodesign Award and IDZ Berlin: bundespreis-ecodesign.de

- Life Cycle Assessment (LCA)
- Environmental Product Declaration (EPD)
- Material Circularity Indicator
- Cradle to Cradle
- The Austrian Ecolabel

Loops should have the following characteristics:

effective: more benefit, less resources needed
→ increased resource productivity

consistent: use and sustain materials and services of existing ecosystems (technical and natural)

sufficient: absolute reduction of resource usage through changes in behavior and decreased demand

Generally speaking, circulation in a loop without additional external energy or processing aids is impossible. It is important to identify these flows of materials. A distinction is made between emissions in the air, water, and soil and effects on biodiversity.

First Steps
Decide for a technical or natural loop.
Avoid disposal of your product.
Develop at least two methods of recirculation.
Take responsibility for the return of products.

Lifespan

Determine the optimal product lifespan

Designers define the service life of products and services. The technical lifespan of all components accounts for the real service life and intensity of use.

- **Long lifespan / durability**: guarantees the longest possible usage that corresponds with the usage context
- **Emotional product bonding**
- **Short lifespan:** only aspired if ecologically justifiable and particularly circular

Product Life, Product Durability, Product Use Cycle

- Product Category Rules → see EPD
- Premature obsolescence
- The Product-Life Institute

Create incentives for longer use

Besides the technical service life, a high appreciation and bond with the product on the user's side should be attained in order to extend the real service life – regardless of trends and fashions. Generally speaking, the assumption holds that the cumulative expenditure of energy and resources is amortized with a longer lifespan. In rare cases do other factors achieve a better environmental impact. For example, one forgoes reparability when using materials made of carbon fiber but attains a more efficient product.

First Steps

Research the average service life.
Define an appropriate product lifespan.
(Design a low-maintenance product.)

Reparability and Modularity

Create universal comprehensibility

Preferably use standardized connections and components. The product should be comprehensible for as many people as possible. At least experts should be able to perform repairs, extension, and disassembly.

- **Reparability:** If necessary, the product can be opened without destroying it, the individual components are accessible and can be replaced
- **Modularity:** Components can be replaced, extended, or updated
- **Disassembly:** The use of different materials and connections is reduced, non-detachable connections are a taboo

Modular Design, Design for Repair/Reuse, Maintenance

- EU Ecodesign Directive
- Repair networks: IFIXIT, makezine, R.U.S.Z., and DRZ Vienna

Additionally, attention should be paid to the following points:

Open interfaces allow adaptation to technical innovations. Replacement parts should be available not only from the manufacturer. The manufacturer assumes a broader manufacturing responsibility (guarantees and warranties should be adjusted to the actual lifespan). The possibilities to repair and maintain are an incentive for a longer product use cycle. Attention should be paid to usability and product safety standards and regulations.

First Steps

Provide a usage and repair manual.
Design all components and wear parts exchangeable.
Repair costs are proportionate to the new price.

Energy Use

Increase efficiency per energy unit

Energy efficiency is the relationship between the energy output and input. Effective use of energy sources increases economy and reduces its environmental consumption. Energy from renewable energy sources is preferred. A distinction is made between thermal and electrical energy. Less is better.

Renewable Energy, Energy Output/Input, Energy Efficiency

- Energy providers: intelligent utility meters
- Measure energy use, kWh / service unit
- EU Energy Efficiency Directive
- EU Ecodesign Directive

Use energy efficiently

The EU energy label provides information about the energy consumed during usage; the cumulative energy expenditure (CEE) describes it over the entire life cycle. A longer lifespan has a positive effect on the CEE, as does the use of recycled materials. Intelligent and customizable control systems facilitate a more efficient use of energy.

Thermal energy: Residual heat can be further used in later process steps – for instance, district heating.

First Steps

Use renewable energy resources exclusively.
Reduce the energy consumption per service unit.
Create incentives to reduce energy consumption.
Enable feedback about real energy consumption.

Material Use

Increase efficiency per material unit

Material efficiency refers to the relationship between the resulting product and the employed raw materials. The material use is optimized over the complete life cycle in terms of its impacts on health and the environment. Waste materials are avoided and fed back into the loop. The use of new, non-renewable resources is reduced.

Zero Waste, Reuse, Renewable Resources, Second Life

- Material flow chart, materials journey mapping
- Wuppertal Institute, material input per service unit
- Factor 4, Club of Rome
- Factor 10, Institute of Sustainable Economies

Additionally, attention should be paid to the following points:

When selecting materials, attention should be paid to the origin, environmental impacts, and production conditions. Renewable resources are preferred. Complex composite materials should be avoided; materials should be able to be separated according to type and be marked as such. Reparability should be guaranteed.

Avoid problematic substances: Substances and materials should not have an adverse effect on health or the environment. Hazardous substances and materials should be reduced and marked as such in all cases.

First Steps

Replace resources with recyclates.
Mark the materials used.
Reduce materials used per service unit.

Design of Services

Offer product-service systems

Service units and business models should be conceived and organized so that services and products can be made available to as many people as possible. In this way, on the one hand, resource efficiency increases, and on the other, it facilitates products of a higher quality with improved serviceability.
In this context the advantages of the digital age can be applied expediently and strategically.

PSS, User-Centered Design, Storytelling, Social Innovation

- Service design thinking
- User experience design
- Delft Design Guide
- Human-Centered Design Kit, IDEO
- DESIS Network, Design for Social Innovation and Sustainability

Think in systems and contexts

Systems and services must already be thought about in the design process – for example, the return of products for recycling, remanufacturing, or reuse. Manufacturers and service providers work together closely.

Intensity of use: Products for sharing concepts are used considerably more intensively over the same time frame.

First Steps

Compare the actual use of the product in relation to the non-use.
Replace or extend the product with a service.

Certifications and Labels

The introduced standards should be established in the work of designers and manufacturers. In order to emphasize their importance, the ecological and social sustainability features of a product can be marked with the following label types pursuant to ISO 14020:

Type I (ISO 14024) Environmental Labelling
E.g.: EU Ecolabel, Austrian Ecolabel, Blue Angel
These certifications are made in the framework of an independent review by a third party. Products with one of these labels have better environmental performance than comparable products.

Type II (ISO 14021) Self-Declared Environmental Claims
E.g.: Recycling code
This certification is made by the manufacturers themselves. They stipulate criteria for a comparison. Products that bear this label exhibit an improvement in terms of environmental aspects – for instance, in comparison to previous models.

Type III (ISO/TR 14025) Environmental Declarations
E.g.: EU Energy Label, Environmental Product Declaration (EPD)
This certification is based on the results of an eco-balance and comprises environmental data and information about the complete life cycle of the product. The review of various criteria enables a differentiated product comparison.

IDRV according to M. Hora, 2015 and ISO 14020

Certification, Ecolabels, Greenwashing

- Label overview: bewusstkaufen.at
- globalecolabelling.net

First Steps

Research appropriate labels for your product or service.
Make a list of possible criteria when there is no label.

How do we want to work?

Make progress in society

Design decisions have a significant influence on who uses the product and how. In circular design the principles of reuse and social interaction are intrinsic to all product life cycles. Not only ecological but also socially sustainable and participative design strategies are important. Production processes are developed that take social values into account, create possibilities for further education, and facilitate social exchange.

linear	→	circular
(copyright) protected design		open design (Creative Commons)
author and brand design		participative design, codesign, open source design
dominance of expert knowledge		cooperation between experts and amateurs
predetermined design process		dynamic design process
hierarchical organizational structure		self-organization and consensus principle
regulation of knowledge and technologies		open access to knowledge and technologies
sell knowledge		share knowledge
centralization of knowledge and production		decentralization of knowledge and production
globalized mass production		local, personalized production
private property		majority ownership
humans dominating nature		humans cooperating with nature

IDRV according to *Commons – für eine neue Politik jenseits von Markt und Staat*, eds. Silke Helfrich and Heinrich Böll Foundation, 2014

Social/Open Design, Commons-based Peer Production

- Social Design: socialdesign.de
- Open Design: intrastructures.net
- Creative Commons: creativecommons.org
- Impact Assessment: wirkung-lernen.de

Create socially sustainable structures

Commons are created, maintained, and used as a community. Land and property, resources, water, and even knowledge can be viewed as commons. Material common goods are defined as “rival” commons; their availability is limited and thus disputed. Knowledge commons are immaterial and thereby considered “non-rival”. They grow through increasing participation.

Principles of commoning: Social, adaptable structures, which allow for creativity and improvisation, are needed to administer rival or non-rival commons. There has to be an active group of people that safeguards the continued existence of the respective commons according to collectively stipulated rules. This collective action is called “commoning”.

First Steps

Implement at least two of the changes in the linear to circular list and initiate the system change.
Promote cooperation instead of competition.

Innovation Factors

Self-assessment and evaluating one's own actions are tools for situating your position within the system change from linear to circular modes of production and living.
The introduced standards are by no means intended as limiting stipulations, rather innovation factors for informed actors. They are incentives and possibilities to think about design differently.

Be honest!

For evaluation and self-assessment

Designer:

Design:

Are the following categories fulfilled?	not fulfilled	partially fulfilled	completely fulfilled
Circularity Potential	☐	☐	☐
Lifespan	☐	☐	☐
Reparability, Modularity	☐	☐	☐
Energy Use	☐	☐	☐
Material Use	☐	☐	☐
Design of Services	☐	☐	☐
Certification and Labels	☐	☐	☐

IDRV — Institute of Design Research Vienna
The IDRV is a non-profit association that makes an independent academic contribution to the growing field of design studies. Since its founding in 2008, the non-university institute has been developing disciplinary and interdisciplinary strategies of knowledge production and communication with a focus on research in the field of socially and ecologically sustainable design.
www.idrv.org

designaustria
designaustria is a knowledge and interest platform for design. Through its knowledge transfer, publicity work, exhibitions, and numerous events, designaustria is committed to designers and entrepreneurs, raises a broader awareness for design in society, and highlights the benefits of design in society and economy.
www.designaustria.at

Sustainability Experts designaustria
The experts platform gathers and networks all initiatives, actors, resources, and available know-how about sustainable design in Austria. “Learning-by-Sharing” with a greater goal: responsible actions toward ecological and social sustainability. The expert group was initiated by IDRV.

FiberEUse
A H2020 research project funded by the European Union since June 2017, collaborating with 20 partners from 7 EU countries to support industry in the transition to a circular economy model for composites.
www.fibereuse.eu

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Quality Standards for Circular Design

"The circular economy will boost the EU's competitiveness by protecting businesses against scarcity of resources and volatile prices, helping to create new business opportunities and innovative, more efficient ways of producing and consuming. It will create local jobs at all skills levels and opportunities for social integration and cohesion. At the same time, it will save energy and help avoid the irreversible damages caused by using up resources at a rate that exceeds the Earth's capacity to renew them in terms of climate and biodiversity, air, soil and water pollution."

Closing the loop – An EU action plan for the circular economy
European Commission, 2015

Federal Ministry
Republic of Austria
Sustainability and Tourism