Circular and Regenerative Design

11th July 2023
2.00 – 3.30PM CET
Via Zoom

Organised by:

University for the Creative Arts
Business School for the Creative Industries
The Centre for Sustainable Design®

Webinar aims:

- Share state-of-the-art knowledge on regenerative and circular design practices for different product categories.
- Identify gaps in current conceptualization and design practices.
- Identify challenges and opportunities in the implementation of regenerative and circular design for products.
- Identify strategies and policies to support the uptake of regenerative and circular design practices and business models.

Speakers

- Professor Martin Charter, Director, The Centre for Sustainable Design (®), Business School for the Creative Industries, University for the Creative Arts (UCA)

- Dr. Patrick Schröder, Senior Research Fellow, Chatham House, and PhD Researcher at The Centre for Sustainable Design ®, UCA

- With interventions by:

  > Dr. Jan Konietzko, Maastricht Sustainability Institute, School of Business and Economics, Maastricht University
  > Dr. Solange Blaszkowski, Director Standardization Environment at Philips
  > Dr. Daniel Christian Wahl, Author of Designing Regenerative Cultures

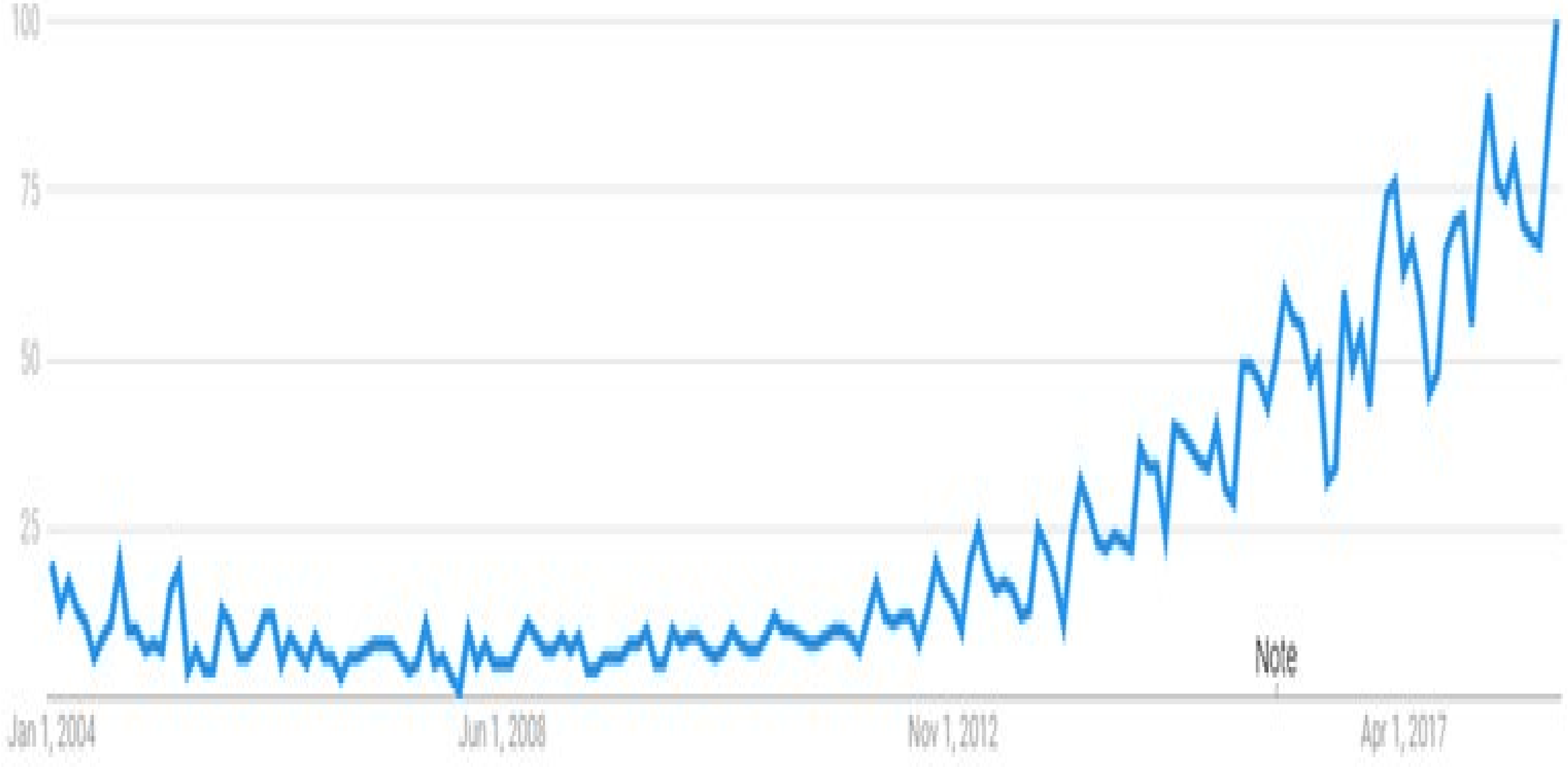
SDGs and Circular Economy

University for the Creative Arts

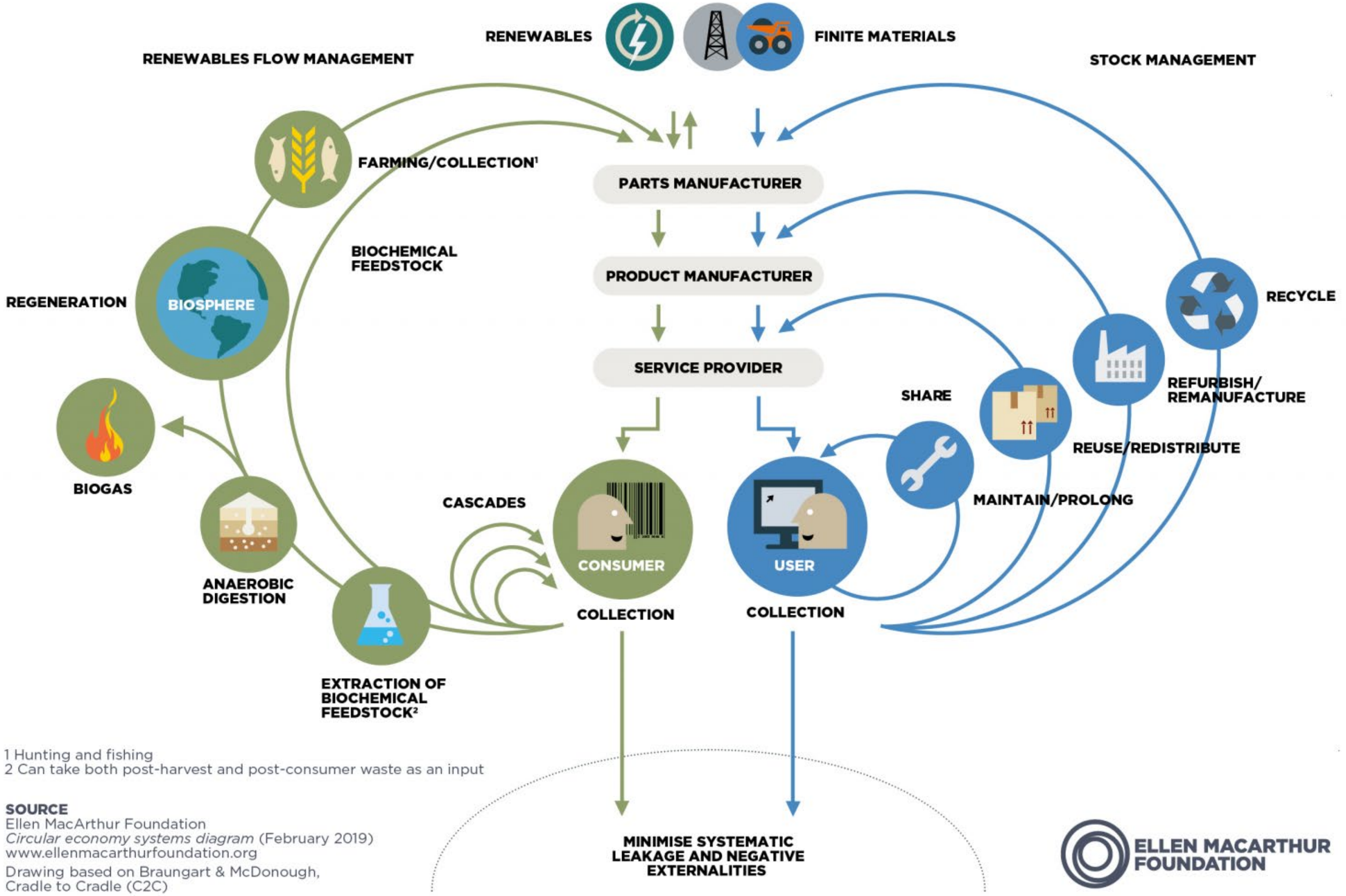
Business School for the Creative Industries

The Centre for Sustainable Design®

Google Trends: Circular Economy

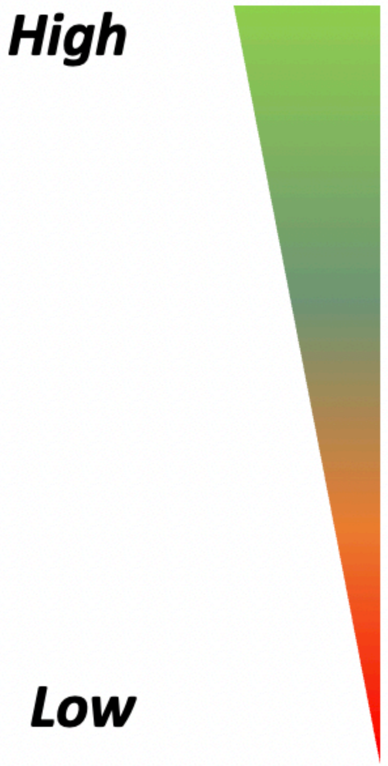


EMF model – biological and technical systems



Levels of circularity: 10 R’s

Order of priority



***Refuse*:** prevent the use of raw materials

***Reduce*:** decrease the use of raw materials

***Redesign*:** renew product with a view to circularity principles

***Reuse*:** use product again (as second-hand)

***Repair*:** maintain and repair product

***Refurbish*:** revive product

***Remanufacture*:** make new from second-hand product

***Re-purpose*:** reuse product but with another function

***Recycle*:** salvage material streams with highest possible values

***Recover*:** incinerate waste with energy recovery

Source: J Cramer

Big picture – small picture

Within a Circular Economy what would products look like within different systems

- Technical
- Biological
- Hybrid

Is Circular Design just part of Ecodesign? – need to consider the overall context e.g. energy, water & materials – need to consider all trade-offs

Non-exhaustive List of CE or Circularity Definitions

Definition	Source
Circular economy	
an economy where wastes are recycled into resources, either through a technological feedback mechanism or through a natural ecosystem feedback mechanism, so that the stock of resources is constant or increasing over time.	Pearce and Turner (1990)
economy that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles	BSI 8001 (2017)[8]
economic system that systemically maintains a circular flow of resources, by regenerating, retaining or adding to their value, while contributing to sustainable development Note: as the terms in the definition and the definition are meant to be broad, definition of technical cycle and biological cycle are included in subsidiary terms that relate back to the definition of circular flow of resources that are embedded in the definition	ISO TC 323/WG 1[9]
an economic model wherein planning, resourcing, procurement, production and reprocessing are designed and managed, as both process and output, to maximise ecosystem functioning and human well-being	Moraga et al. (2019)[10] (a wider definition)

Definition	Source
an economic system that replaces the "end-of-life" concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations	Saidani et al. (2019), citing Kirchherr et al. (2017)
A circular economy aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimising the generation of waste. The fewer products we discard, the less materials we extract, the better for our environment.	Eurostat[11], noting that this is not a proper definition. However, it emphasises the goal of a CE.
A circular economy is a systemic approach to economic development designed to benefit businesses, society, and the environment. In contrast to the "take-make-waste" linear model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources.	EMF[12]
Circularity	
a state of a specified system, organization, product or process where resource flows and values are maintained whilst benefiting sustainable development	Working draft of ISO 59020:2021 (ISO TC 323/WG 3), note that this is a working definition as at April 2021
approach to promote the responsible and cyclical use of resources	Moraga et al. (2019) (general definition given at the beginning of the introduction)
the ability to conserve both the quantity and the quality of the material	Bracquené et al. (2020)

Source: Bachmann, T.M., Corrêa Hackenhaar, I., Horn R., Charter M., Gehring F., Graf R., Huysveld S., Alvarenga R., *Critical Evaluation of Material Criticality and Product-Related Circularity Approaches* (2021).

Horizon 2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

BS8001: 2017

Framework for implementing the principles of the circular economy in organizations. Guide

UK Superbrands 2017

INVESTORS IN PEOPLE

By Royal Charter

← Technical Committees

ISO/TC 323

Circular economy

About

Secretariat: AFNOR

Committee Manager: Mme Mélissa De Medeiros

Chairperson (until end 2025): Mrs Catherine Chevauche

ISO Technical Programme Manager [TPM]: Ms Monja Korter
ISO Editorial Manager [EM]: Ms Sanjali Jain

Creation date: 2018

Scope

Standardization in the field of Circular Economy to develop frameworks, guidance, supporting tools and requirements for the implementation of activities of all involved organizations, to maximize the contribution to Sustainable Development.

Excluded:

- Aspects of Circular Economy already covered by existing committees.

Note: In parallel, the ISO TC 323 works in cooperation with existing committees on subjects that may support Circular Economy.

Quick links

Work programme
Drafts and new work items

Business plans
TC Business plans for public review

Working area
Working documents (user account required)

ISO Electronic applications
IT Tools that help support the standards development process

TC323: Six Standards in Development

- ISO/DIS 59004: Circular Economy – Terminology, Principles and Guidance for Implementation
- ISO/DIS 59010: Circular Economy — Guidance on the transition of business models and value networks
- ISO/DIS 59020: Circular economy — Measuring and assessing circularity
- ISO/CD TR 59031: Circular economy – Performance-based approach – Analysis of cases studies
- ISO/CD TR 59032.2: Circular economy - Review of business model implementation
- ISO/CD 59040: Circular Economy — Product Circularity Data Sheet

Material efficiency standards

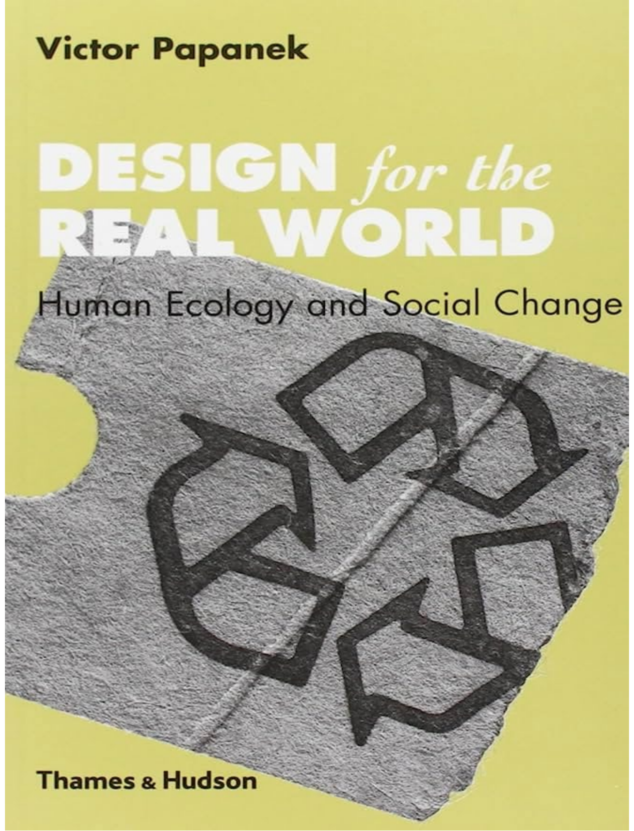
Reference	Title
EN 45552:2020	General method for the assessment of the durability of energy-related products
EN 45553:2020	General method for the assessment of the ability to remanufacture energy-related products
EN 45554:2020	General methods for the assessment of the ability to repair, reuse and upgrade energy-related products
EN 45555:2019	General methods for assessing the recyclability and recoverability of energy-related products
EN 45556:2019	General method for assessing the proportion of reused components in energy-related products
EN 45557:2020	General method for assessing the proportion of recycled material content in energy-related products
EN 45558:2019	General method to declare the use of critical raw materials in energy-related products
EN 45559:2019	Methods for providing information relating to material efficiency aspects of energy-related products

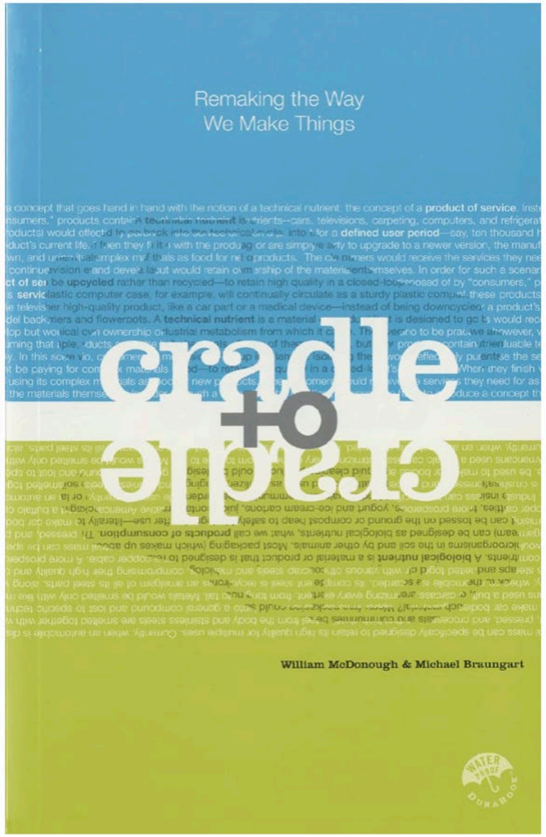
Material efficiency CEN-CENELEC standards* developed under standardisation mandate M/543, published between 2019 and 2020. (compiled by (Barkhausen et al., 2022)

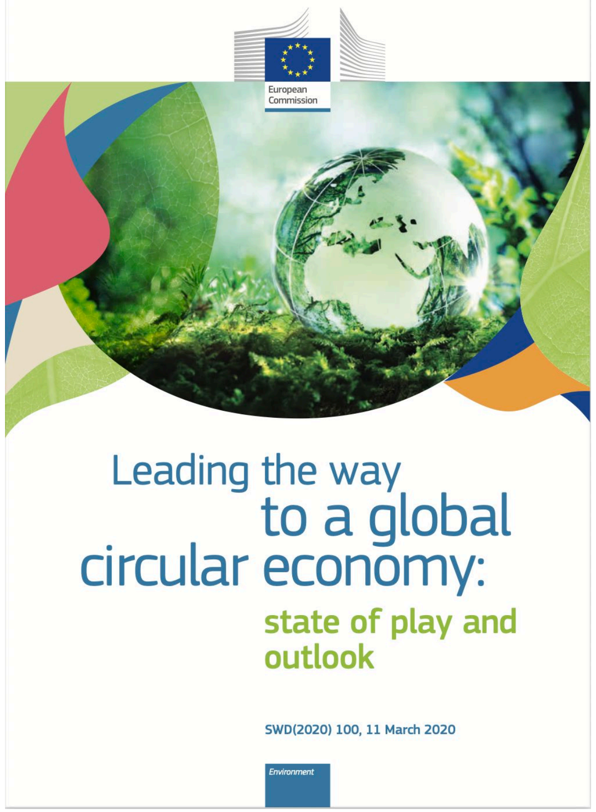
Defining and standardizing circular design

- CEN/CLC/JTC 10/WG 8 - Circular Design
- CEN TC 466 – Circularity and Recyclability of Fishing Gear & Aquaculture Equipment
- CENELEC Technical Committee 21X on Secondary Cells and Batteries (CLC/TC 21X).
- CEN Technical Committee 249 on ‘Plastics’ (CEN/TC 249).
- Etc.

Ecodesign & Circular Concepts







ISO/IEC Ecodesign Standards: Overview

- ISO/TR 14062:2002: Environmental management — Integrating environmental aspects into product design and development (Withdrawn)
- IEC 62430:2019: Environmentally conscious design (ECD) — Principles, requirements and guidance (Edition 2)
- ISO 14006:2020: Environmental management systems — Guidelines for incorporating ecodesign (Edition 2)

ISO/IEC Ecodesign

Systematic approach that considers **environmental aspects** (3.2.7) in **design and development** (3.2.1) with the aim to reduce adverse **environmental impacts** (3.2.8) throughout the **life cycle** (3.2.4) of a **product** (3.2.3)

Note 1 : Other terminology used worldwide includes “environmentally conscious design (ECD)”, “design for environment (DfE)”, “green design” and “environmentally sustainable design”.

CEN/CENELEC - Circular Product Design Core Principles 1

The main core principles that lead to a circular designed product are:

• Circular economy becoming part of the environment, social, and governance (ESG) policy of the organization, ensuring management understanding and early contribution and commitment of all relevant business functions.

• Considers the whole life cycle of the product taking a “life cycle thinking” approach.

• Based on circular categories chosen by the organization for the product, product designs are optimized following the strategies to narrow, slow and close the loops.

• Create and promote sustainable circular systems (e.g., reverse logistics, repair systems, etc.) that enable product and material recirculation and support customers to close the loop.

• Lastly, managing trade-offs is the solution to achieve a circular product design, and so helping organizations with difficult decisions e.g., durability vs. using less material.

Adoption of these principles can lead to circular designs that contribute to avoid adverse environmental impacts.

Source: CEN-CENELEC/JTC 10 2023
Method to achieve circular designs of products

CEN/CENELEC - Circular Product Design Core Principles 2

CIRCULAR PRODUCT ATTRIBUTES	CIRCULAR CATEGORIES													
	Use less Narrow the material flows					Facilitate reuse Slow down the material flows						Use again Close the material flows		
	Physical to Virtual	Multiple functions	Lease & Share	Use less materials	Longer Life	SW update	HW maintenance	HW or SW Upgrade	Repair	Refurbish	Reuse	Remanufacture	Parts recovery	Recycling & recycled content
1. Ability to clean, sterilize and restore aesthetic state			High		High		Some	Some	Some	High	Some	High	Some	
2. Ability to guarantee digital security	High	High	High							High	High	High	High	
3. Ability to operate safely when given longer lifetimes			High					Some		High	High	High	High	Some
4. Ability to assess and track performance			Some			High	High	High	High	High	High	High	High	
5. Ability to disassemble and reassemble					High	Some	High	High	High	High		High	High	
6. Ability of users to accept used products			High							High	High	High	Some	Some
7. Forward and backward compatibility and use standardized parts	High	High	Some		High	Some		High	High	High		High	High	
8. Modular design		Some	Some				Some	High	High	High		High	High	
9. Parts durability and reliability		High	High	High	High					High	High	High	High	
10. Potential for adaptability and flexibility		Some	High		High	High		High		Some	High	Some		
11. Potential for product attachment and emotional durability by users					High	Some	Some	Some	Some					
12. Use of sustainable materials				High										High
13. Ability for materials to be separated and recycled														High
14. Potential for material minimization				High										
15. Potential for digitalization	High	High	Some			Some	Some							

High relevance — Some relevance — Minor to no relevance

Source: CEN-CENELEC/JTC 10 2023
Method to achieve circular designs of products

ORIENTING

Assessing Product Circularity in Practice: Insights from Industry

Lilian Sanchez-Moreno & Martin Charter

University for the Creative Arts

University for the Creative Arts

Business School for the Creative Industries

The Centre for Sustainable Design®

Horizon 2020 European Union Funding for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

Table 1: Multilevel Awareness Descriptor

Circularity Strategy Stage	Description
Level 1 / *Basic*	Company has started to research, explore CE strategies but has not yet defined a product and/or company strategy. 1-2 years' experience within the remit of circularity.
Level 2 / *Intermediate*	Company has started to implement CE strategies but has not yet integrated CE indicators and metrics. 2-3 years' experience within the remit of circularity.
Level 3 / *Advanced*	CE trailblazers or 'advanced' CE companies with 4+ years' experience in developing company and product level CE strategy and has started to implement some CE indicators and metrics.

Source: authors' adaptation of WBCSD 2018 report and ZBIA model by Charter, M., & Tischner, U. *Sustainable Solutions: Developing Products and Services for the Future*. Greenleaf (2001).

Horizon 2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

Findings

1.Defining Circularity: highlights the multiple meanings identified for circularity amongst interviewees - at a product level – and how PC is being considered and implemented within industry;

2. Measuring Circularity: highlights how companies are currently measuring PC or considering PC measurements, indicators, and metrics *vis-à-vis* available product circularity tools and methods.

3. Barriers Identified for the Implementation and assessment of PC : highlights the existing PC barriers across sectors and exploring potential solutions to overcome the barriers identified.

Horizon 2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

Defining Circularity

- The understanding of **how to implement circularity** and what this entails **is fragmented**.
- The **concept of CE** at a product level **varies** depending on the **type of product and industry.**
- **At a product level**, the most **common focus areas** for addressing circularity, **are the use of recycled content and biobased materials, and design for disassembly.**
- For **interviewees with 'basic' and 'intermediate' PC awareness levels**, **circularity** appeared to be mainly used to **refer to the use of recycled materials.**
- The more **'advanced' companies'** have **started to move beyond** a focus on recycling as a means towards circularity **by differentiating for example, '*Material sustainability initiatives'*, from *'circularity initiatives'* and appear to be assigning a hierarchy to circularity strategies.**
- Few companies interviewed appeared to use the term eco-design.
- Where eco-design was recognized as a practice in companies, **PC aspects were considered separately to eco-design,** despite being inherently aligned with eco-design strategies.
- The **interviews revealed the emergence of new concepts and terminology such as circular by design' and 'circular-ready design'.**

Horizon 2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

Measuring Product Circularity

- From the 21 companies interviewed, only **(2)** claimed to **measure circularity** at a product and/or business level **using existing external frameworks**. (Ellen MacArthur Foundation's Circulytics / MCI tool)

- From the (19/21) companies that do not measure circularity using either the EMF's MCI, Circulytics or the WBCSD's CTI tool **(6) companies stated that they measure PC using internal frameworks**. This includes **developing internal and product specific PC tools** or **assessing** aspects of **PC within standard LCA's** or **qualitative checklists** within the D&D processes.

- **Challenges identified** by interviewees familiar with the EMF's **MCI and/or WBCSD's CTI** are the use of a **single score system and the way in which the system boundaries are defined.**

- **(7/21)** stated that they were **exploring** the possibility of **measuring circularity beyond recycled inflows and outflows and focusing on the use phase.**

- **Challenges highlighted are: the extensive number of frameworks, tools and methodologies** available **that often provide limited guidance of users about the benefits of one over the other.**

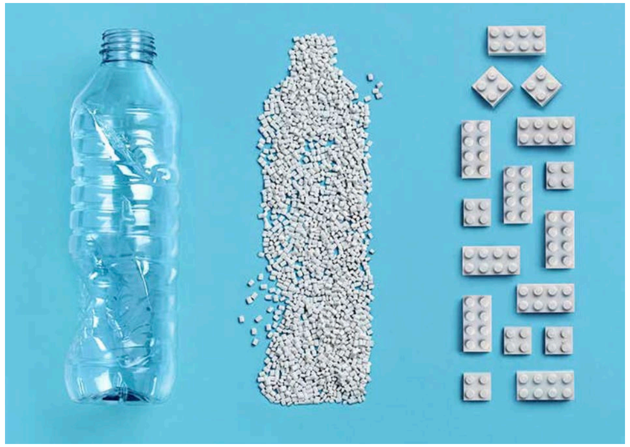
Horizon 2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

Barriers Identified for Implementing Product Circularity

1) Cost associated with material substitution, development of new infrastructure and business models.

2) Maintaining functionality, product performance and consumer expectations. For example, when the replacement of existing materials, or design for disassembly is not possible due to functionality, health or safety requirements.



3) Aesthetics of sustainability (customer/market demands). For example, consumer willingness to accept aesthetic/external product changes associated with sustainability interventions such as increasing the use of recycled material, shift to vegan leathers, or biobased materials.

Horizon 2020
European Union Funding
for Research & Innovation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 958231

Circular and regenerative design

Bio-sphere/
Biological nutrients

Regenerative design practices :

Living systems (no waste by design);
Self-healing properties;
Renewable bio-based materials;
Create net positive impact on natural systems
Etc.

↔

Techno-sphere/
technical nutrients

Circular design practices:

'Design out' waste;
Design for modularity, reuse, recycling, repairability, refurbishment;
Recycled content;
Durability and long lifetime;
'Second life'

What is regenerative design?

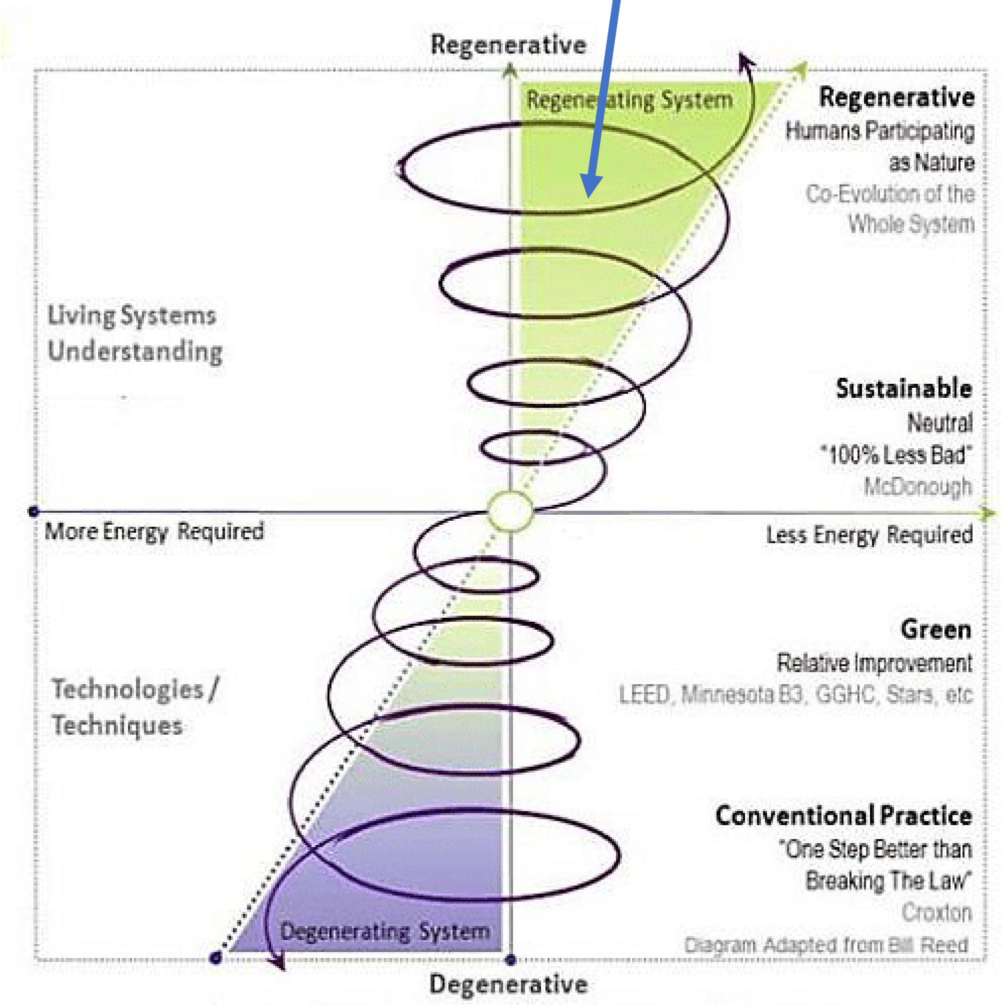
"By design I mean conceiving and shaping complex systems"

*"**Regenerative design means replacing the linear system** of throughput flows with cyclical flows at sources, consumption centers and sinks."*

"A regenerative system provides for continuous replacement, through its own functional processes, of the energy and materials used in its operation."
John Lyle, Regenerative Design for Sustainable Development 1993

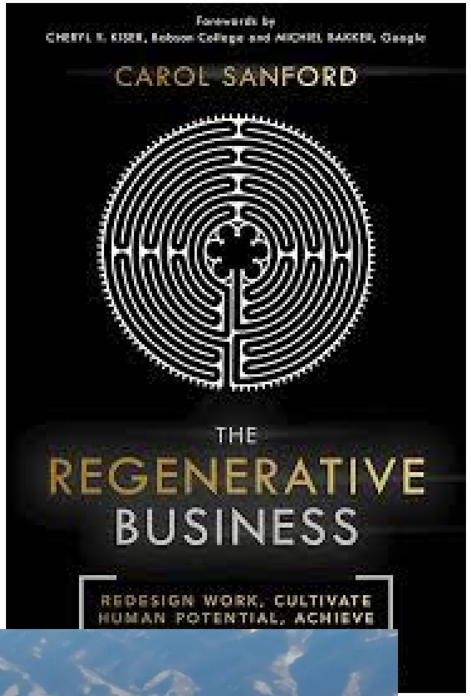
Royal Institute of British Architects (2021) defines regenerative design as: *'…a system of technologies and strategies, based on an understanding of the inner working of ecosystems that generates **designs to regenerate rather than deplete underlying life support systems** and resources within socioecological wholes.'*

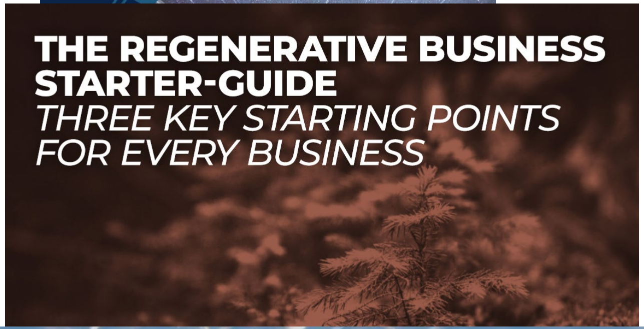
How to measure the positive impact of regenerative materials, products and processes?



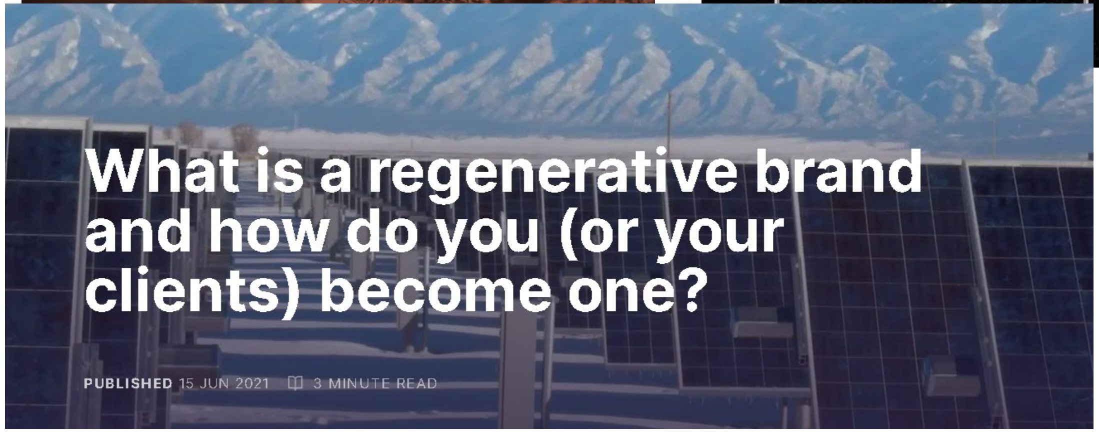

THE REGENERATIVE
BUSINESS


A COMPASS FOR JUST
AND REGENERATIVE BUSINESS
Produced by
FORUM FOR THE FUTURE
In partnership with
wbcsd


CAROL SANFORD
THE
REGENERATIVE
BUSINESS
REDESIGN WORK, CULTIVATE
HUMAN POTENTIAL, ACHIEVE


THE REGENERATIVE BUSINESS
STARTER-GUIDE
THREE KEY STARTING POINTS
FOR EVERY BUSINESS

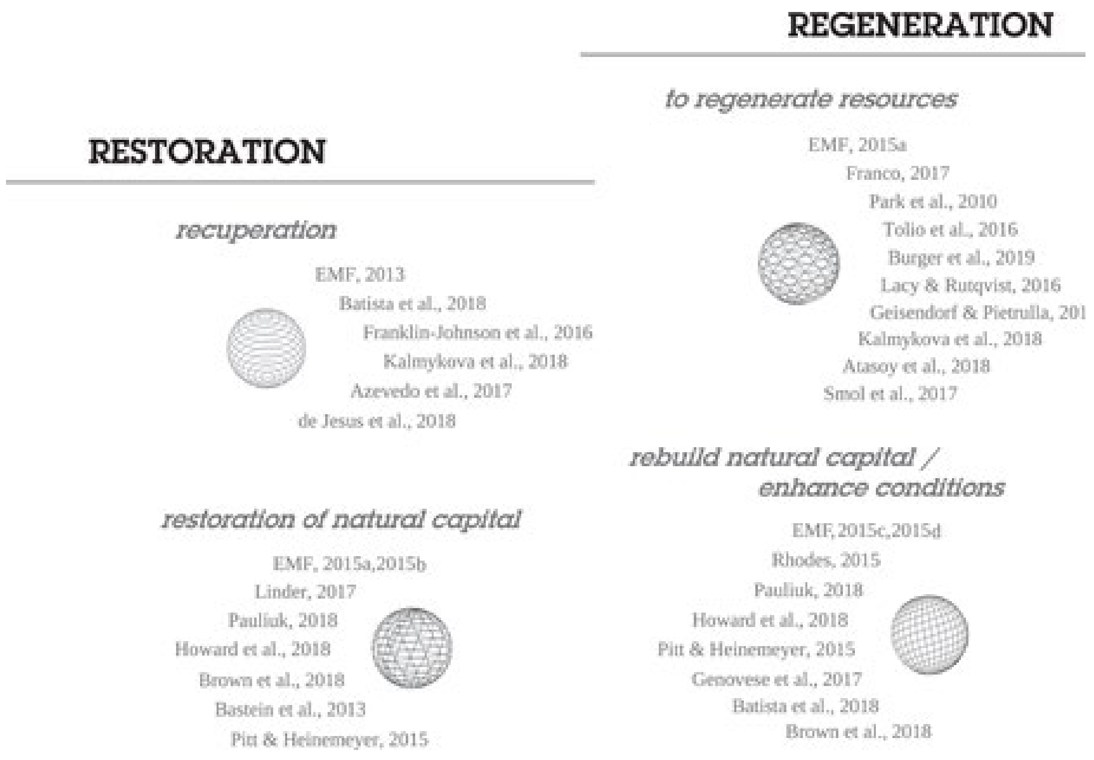

TAZO
REGENERATIVE
BUSINESS AS USUAL IS KILLING OUR PLANET AND WE NEED EVERY BRAND AND EVERY CORPORATION TO RADICALLY REIMAGINE THEIR MEANS OF PRODUCTION TO GET US ON TRACK TO A BETTER FUTURE™
TAZO


What is a regenerative brand
and how do you (or your
clients) become one?
PUBLISHED 15 JUN 2021 3 MINUTE READ

Distinguishing between restorative and regenerative practices in the circular economy

- Restoration is a better-defined concept than regeneration, although it needs conceptual re-enforcement relative to the biological/ecological aspects of the circular economy.
-> Restoration ecology, a well-established branch of ecological research.

- Regeneration is a symbolic/evocative term with little practical application in the context of circular systems except in the case of certain agricultural practices.



"The key question is how biological materials enter the economy and then return to the biosphere in a manner that is either restorative or regenerative."

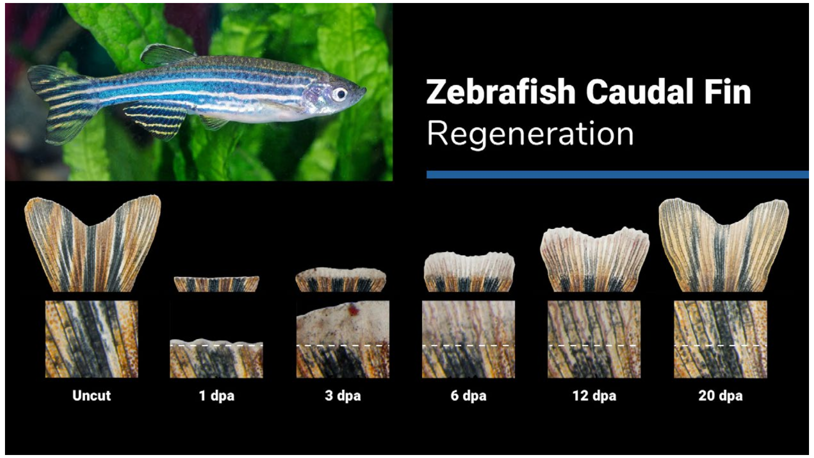
Morseletto, P. 2020. Restorative and regenerative: Exploring the concepts in the circular economy. Journal of Industrial Ecology

How do biological systems regenerate?

Regeneration is the natural process of replacing or restoring damaged or missing cells, tissues, organs, and even entire body parts to full function in plants and animals.

All living organisms have some ability to regenerate as part of natural processes to maintain tissues and organs.

Stem cells play an important role in regeneration because they can develop into many different cell types in the body and renew themselves millions of times, something specialized cells in the body—such as nerve cells—cannot do.

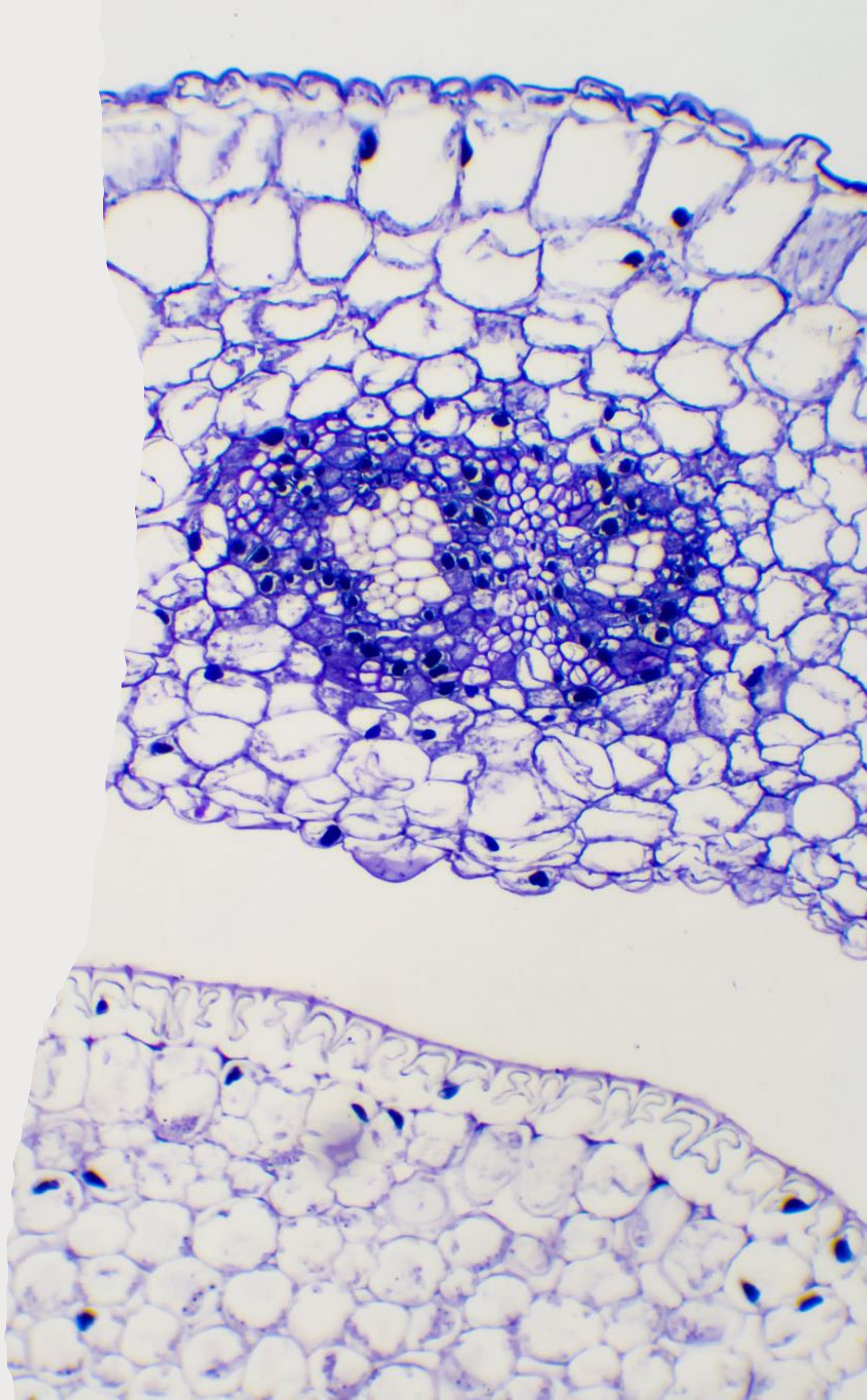


https://nigms.nih.gov/education/fact-sheets/Pages/regeneration.aspx

Regenerative design principles

Defining characteristics living systems as:

1. Self-Regenerative ability is not located in any one place, it is nodal or decentralised
2. Life is dependent on the interconnected relationships of all parts of the cell
3. Life is a holistic (emergent) property of all “parts” of the cell and relationships between the parts
4. Each “part” is also a self-regenerative (autopoetic) system so the cell as one whole is made up of other wholes within it, each able to regenerate themselves.

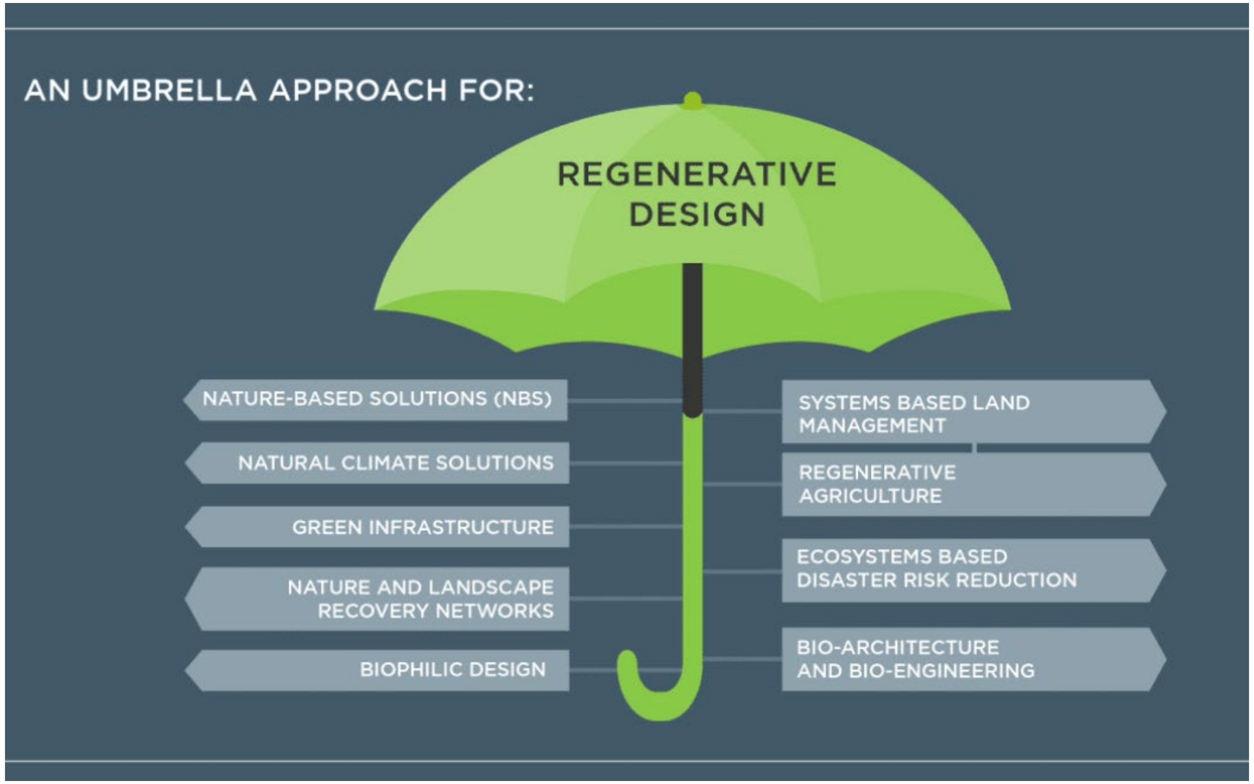


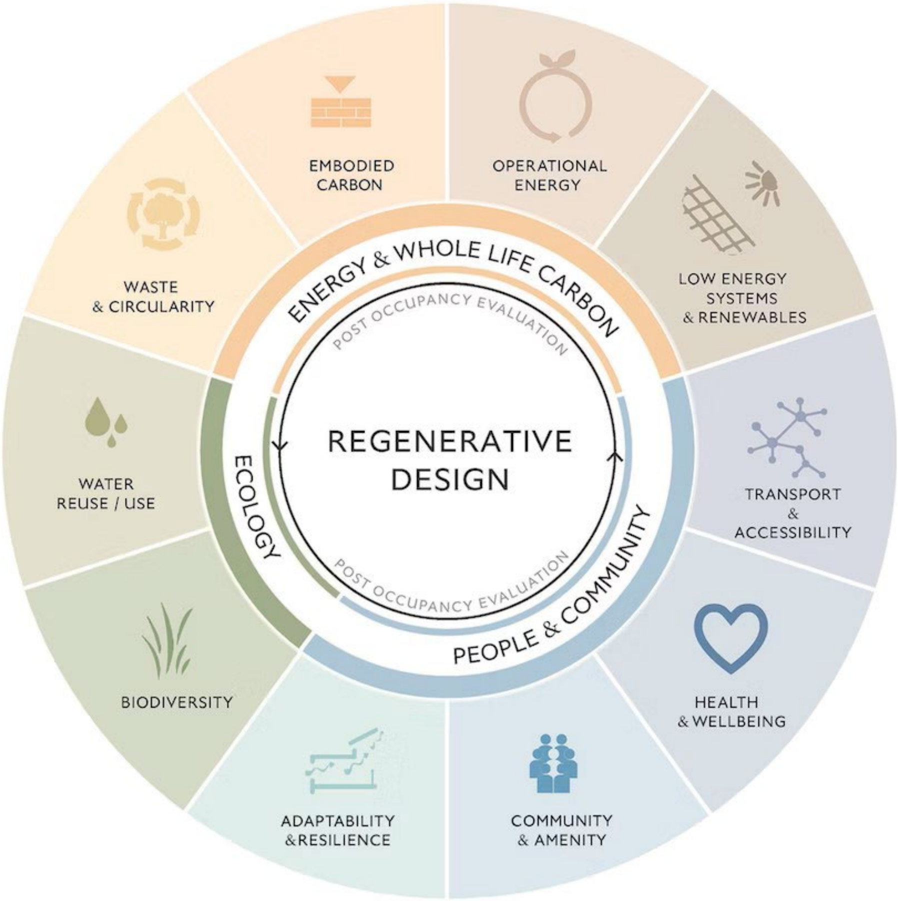
Emerging standardization in regenerative agriculture and agroforestry

Standard Criteria	Criteria Measurement	Description of Measure	Criteria Threshold
1. Integration	Presence of trees, shrubs, and other woody perennials.	Annuals have an essential early successional role to play in agroforestry, while the long-term structure of the system emphasizes both woody and herbaceous perennials.	$\geq$40% cover by trees/shrubs, allowing transition time from open field. Individual practices (e.g., windbreak) may require higher cover for acceptable resource conservation functionality.
2. Density	Woody perennials per unit area.	This measure ensures continuous soil cover for erosion control, capture of nutrients, and weed suppression.	$\geq$5 woody perennials per 100 m^2 (1080 ft^2), plus herbaceous cover and mulch.
3. Multistory	Layers occupied in the agroforest structure and root systems.	Based upon five potential vegetation layers (emergent, upper canopy, lower canopy layer or understory, shrub, and herbaceous) occupied per unit area.	$\geq$2 woody perennial layers per 200 m^2 (2160 ft^2), plus the herbaceous layer and mulch.
4. Multiple species	Number of woody perennial (tree, shrub, palm, etc.) families, genera, species, and varieties.	A measure of biodiversity intentionally planted or protected in the agroforest.	$\geq$8 plant families, genera, species, and/or varieties of woody perennials per 100 m^2 (1080 ft^2) present throughout the life of the agroforest. Pure or contiguous clumps not to exceed 3 trees or 10 shrubs/vines of a single species. Different clumps of the same species to be separated by minimum 3 times their maximum canopy diameter.

Source: Elevitch et al. 2018

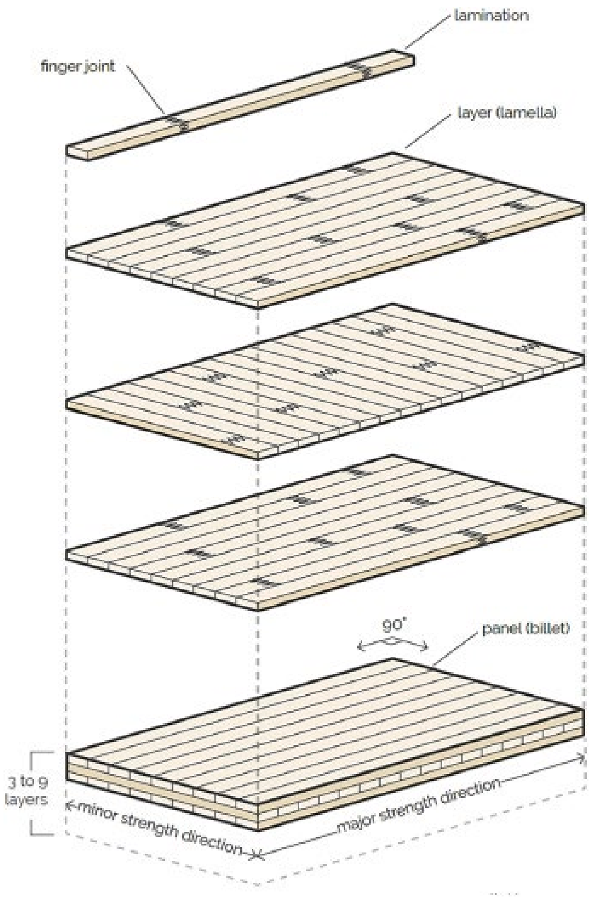
Regenerative design frameworks in architecture





https://rskgroup.com/insights/progressing-regenerative-design/

Combined circular and regenerative design in building and construction



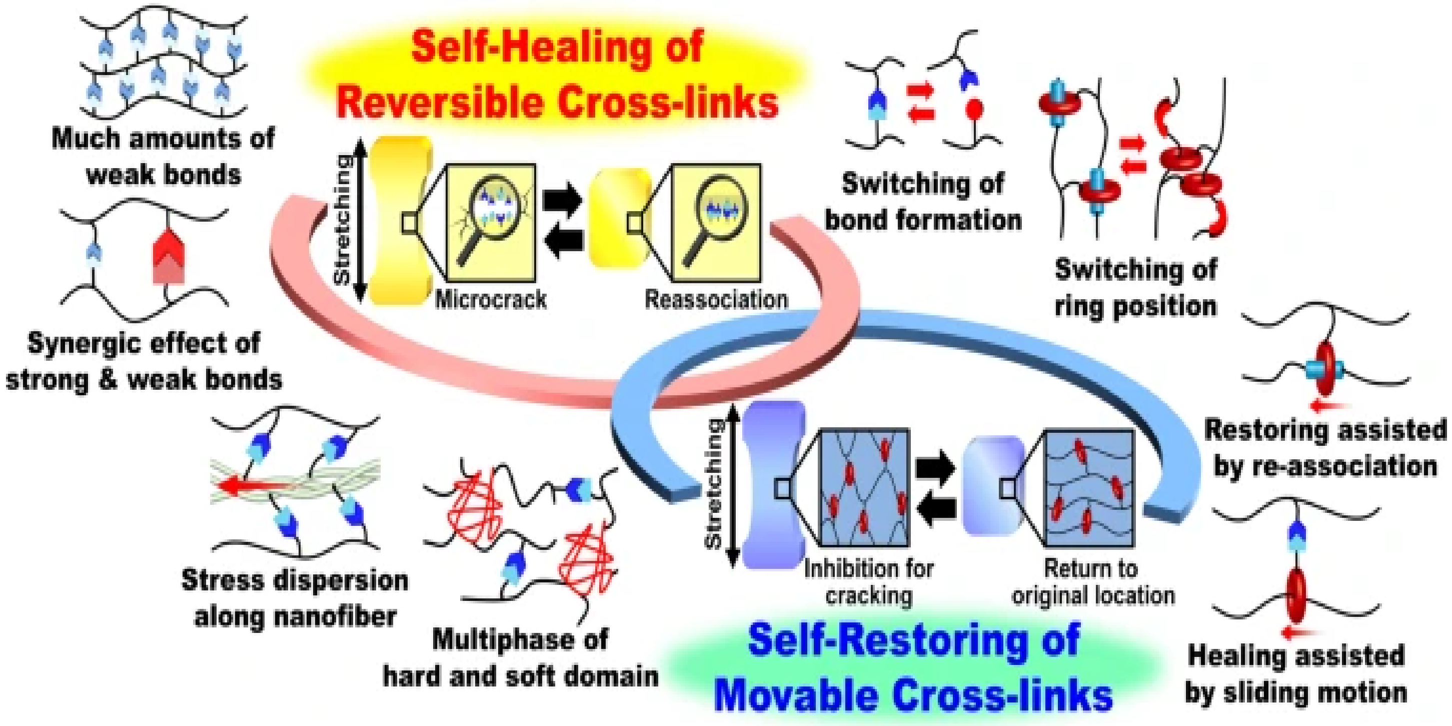
Modular construction with cross-laminated timber (CLT)

https://www.sciencedirect.com/science/article/pii/S2352710222004958

Self-healing materials

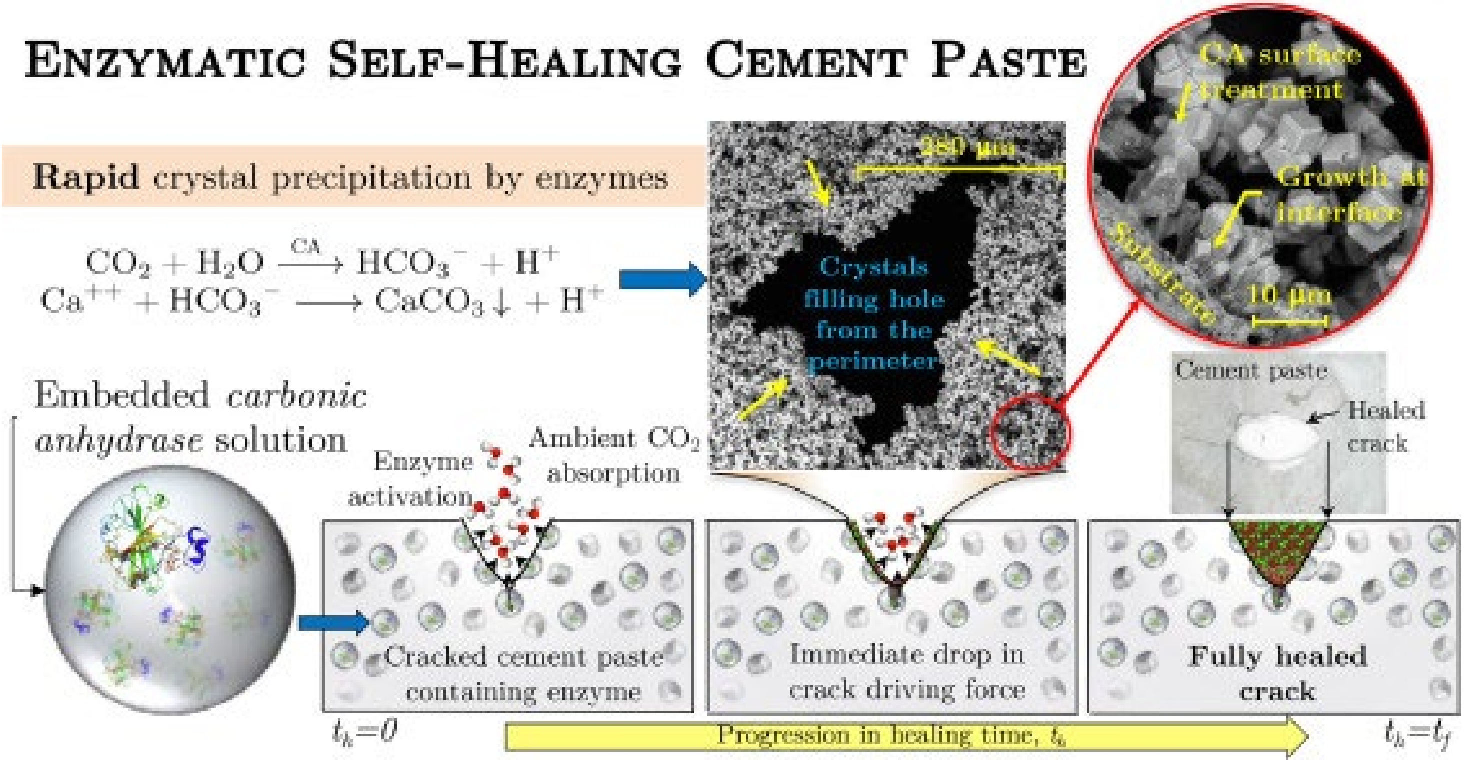
Self-healing materials, when damaged through operational use, can heal micro- and nano-level cracks and restore themselves without compromising their chemical or mechanical properties, prolonging the life of the product. These materials include polymers, metals, alloys or composites, and ceramics.

Inspired by natural processes in the plant and animal world, such as protective or functional coatings, self-healing is accomplished in various ways.

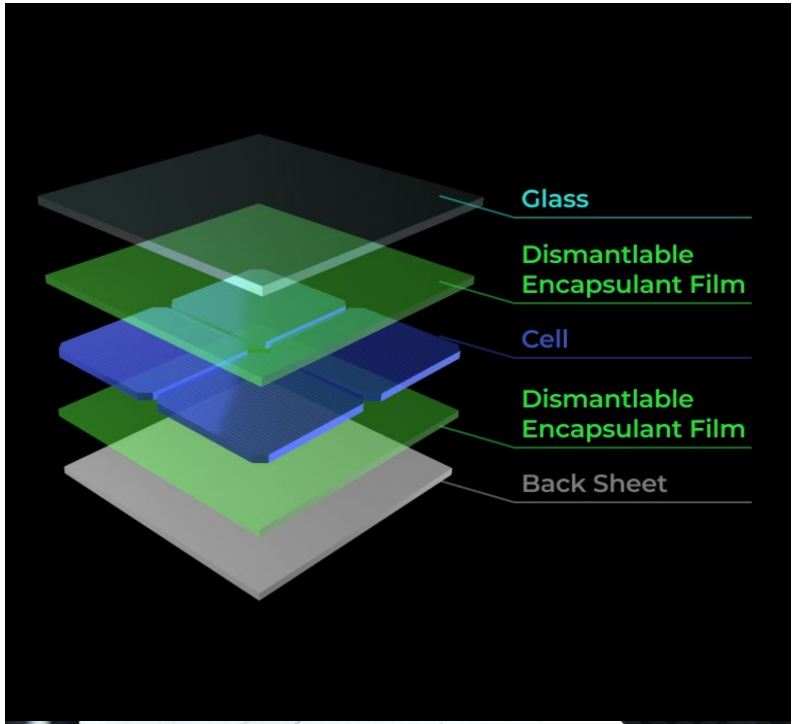


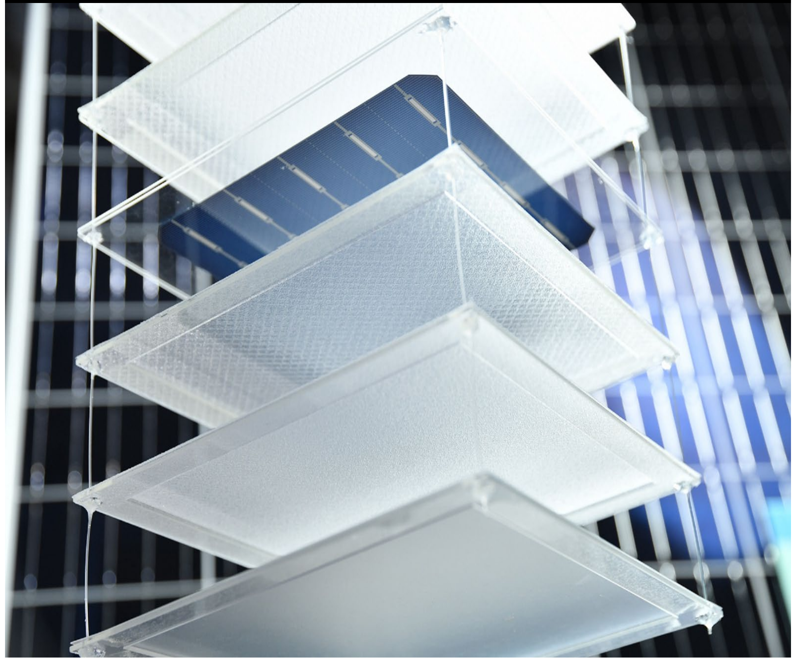
Source: Ikura et al. 2022
https://www.nature.com/articles/s41427-021-00349-1

Self-healing concrete (autogenous healing)

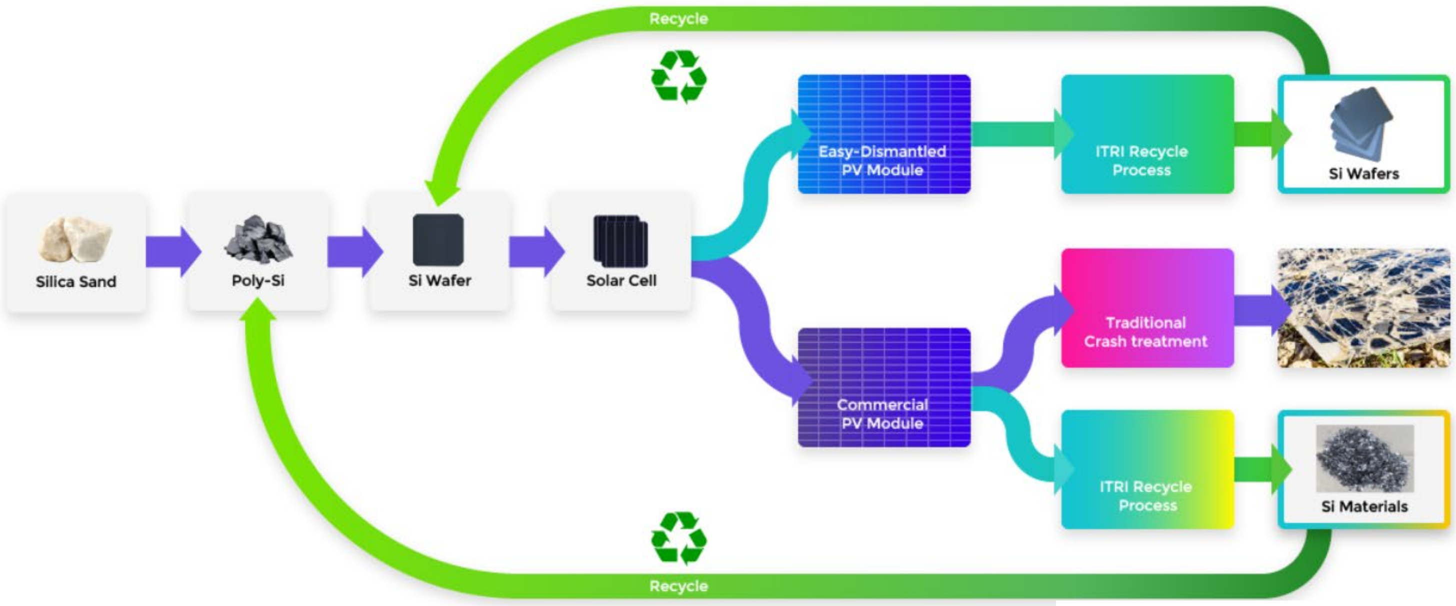


https://www.sciencedirect.com/science/article/pii/S23529407
21001001





Circular design for solar PV panels



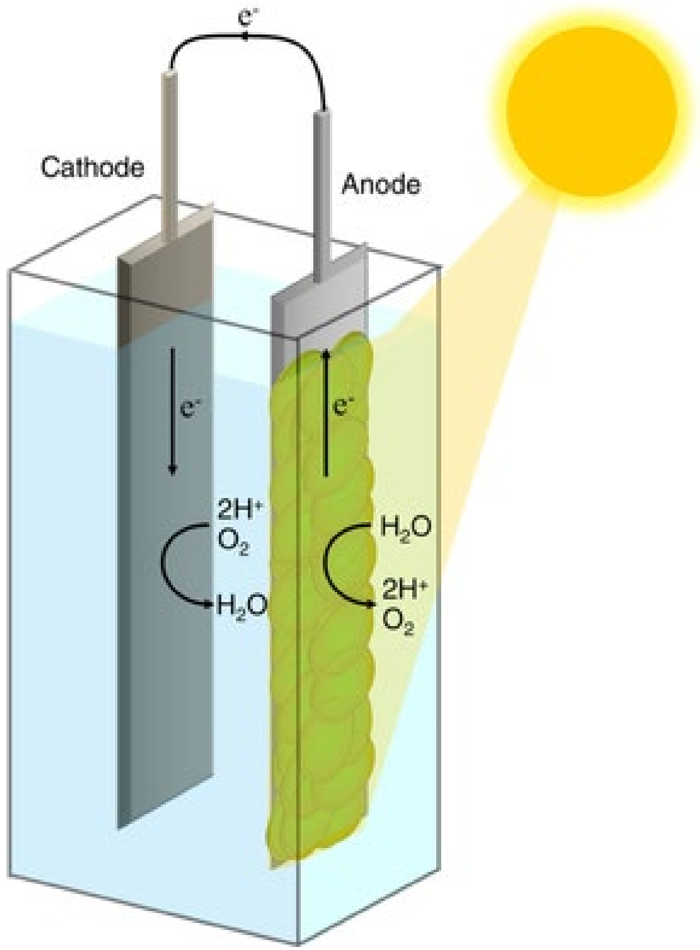
Regenerative biophotovoltaics

Biological photovoltaics, also called biophotovoltaics or BPV, is an energy-generating technology which uses oxygenic photoautotrophic organisms to harvest light energy and produce electrical power.

Biological photovoltaic devices are a type of biological electrochemical system, or microbial fuel cell, and are sometimes also called photo-microbial fuel cells or **"living solar cells"**

Theoretical advantage of biological photovoltaic systems – **efficient self-assembly and self-repair.**

Targeted optimization requires standardization. For scientists to effectively develop and test new systems, a series of standards must be adopted across the field against which new and proposed systems can be measured.

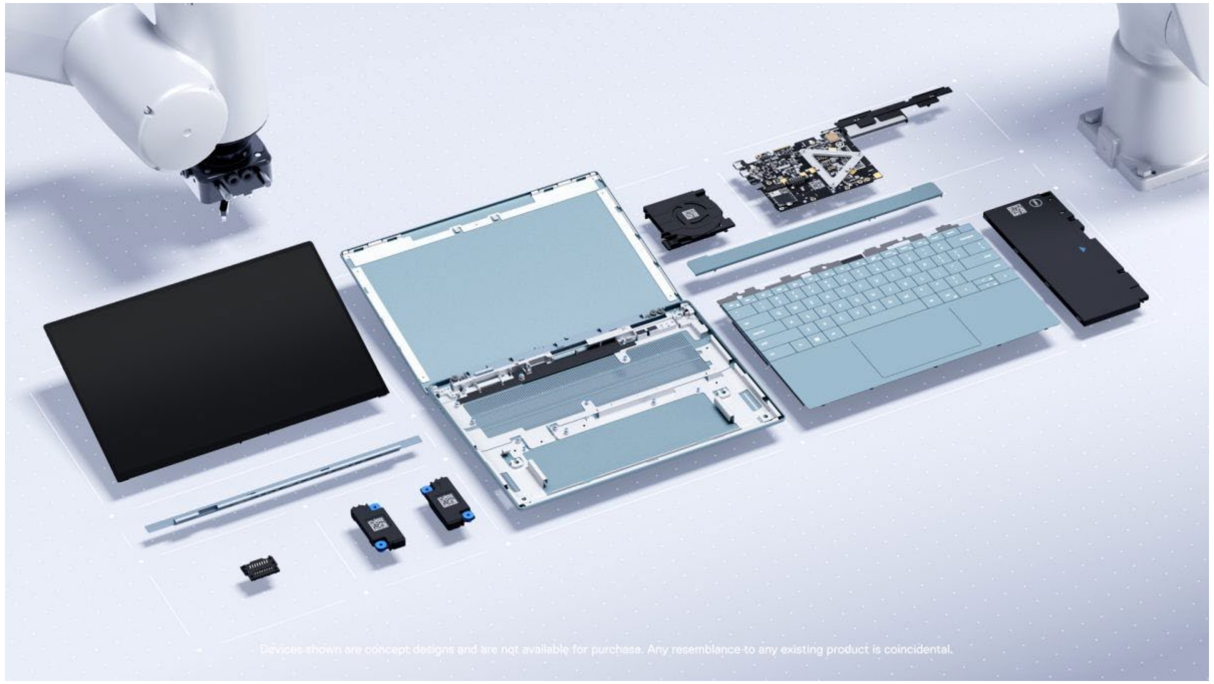


Source: Wey et al. 2019 https://chemistry-europe.onlinelibrary.wiley.com/doi/10.1002/celc.2019 00997

Modular electronics

The Luna design approach by Dell

To enable easier repairs, it aims to simplify disassembly and reassembly processes through design principles such as repairability, modularity, standard tools and fasteners, and a preference for snap fits or uniform screws over adhesives.

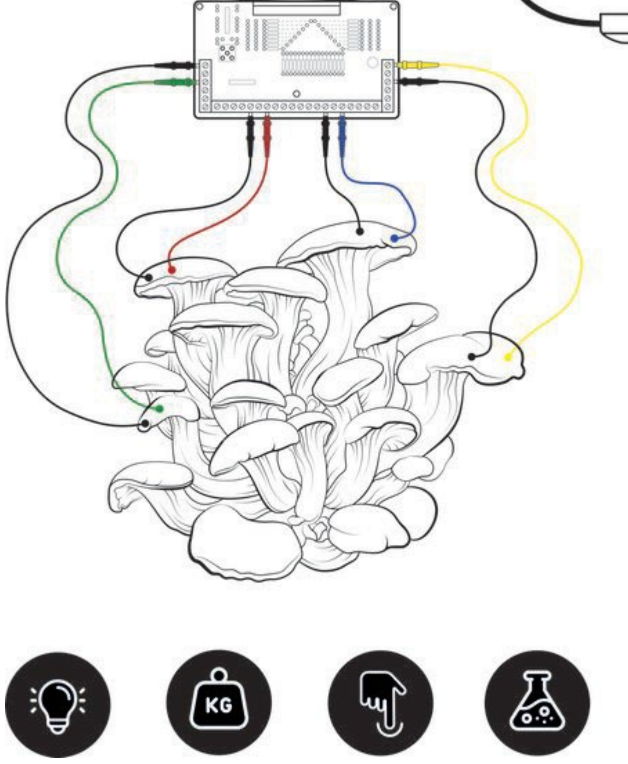


Regenerative design solutions:
bio-based printed circuit board (PCB) is made with flax fiber in the base and a water-soluble polymer as the glue. The flax fiber replaces traditional plastic laminates and the water-soluble polymer can dissolve – meaning recyclers can more easily separate metals and components from the boards

Regenerative electronic devices “Fungal electronics”

Fungal electronics is a family of living electronic devices made of mycelium bound composites or pure mycelium. Fungal electronic devices are capable of changing their impedance and generating spikes of electrical potential in response to external control parameters.

Fungal electronics can be embedded into fungal materials and wearables or used as stand alone sensing and computing devices.



Researchers Evaluate Fungal Electronics Potential

14.1.2022 Reading Time: 5 mins read AA

Fungal Electronics; Image Credit: Adamatzky, A et al., axriv

Source: Adamatzky et al. 2022

Vegan leather

Vegan leather is **artificial, synthetic, or “faux” leather made from agricultural waste products and sustainable biomaterials**. It can also be made from polymers like polyurethane and other recyclable materials. Vegan leather is an alternative to animal leather.

Some hybrid bio-tech leather alternatives , e.g. polyurethane blends less ‘regenerative’ than pure biomaterials.

Towards regenerative & circular product policy

Key product aspects that may be regulated under the Eco-design for Sustainable Product Regulation:

- **Durability**
- **Reliability**
- **Reusability**
- **Upgradability**
- **Repairability**
- **Possibility of maintenance and refurbishment**
- **Presence of substances of concern**

- **Energy use or energy efficiency**
- **Resource use or resource efficiency**
- **Recycled content**
- **Possibility of remanufacturing and recycling**
- **Possibility of recovery of materials**
- **Environmental impacts, including carbon and environmental footprint**
- **Expected generation of waste materials**

End-use products: *Textiles and Footwear; Furniture; Ceramic Products; Tyres; Detergents; Bed Mattresses; Lubricants; Paints and Varnishes; Cosmetic Products; Toys; Fishing Nets and Gears; Absorbent Hygiene Products*

Intermediate products: *Iron and Steel; Non-Ferrous Metals; Aluminium; Chemicals; Plastic and Polymers; Paper, Pulp Paper and Boards; Glass*

Horizontal measures: *Durability; Recyclability; Post-Consumer Recycled Content*

Q&A