Cradle to Cradle® Innovations - Rethinking the way we make things – An innovation, system and business path towards a circular economy

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Cradle to Cradle® Design defines and develops cyclable products.

In regard to differentiation to conventional recycling the quality level of the raw materials remains throughout multiple product lifecycles and only purely "assessed safe chemicals" are used.

The products are developed according the model to maintain the quality of raw materials over multiple life cycles taking the production processes, the use and the reutilization into account.

This means: No waste, all ingredients are considered as nutrients.

The right materials are integrated in defined cycles (metabolism; biological or technical) at the right time and place.

The 3 Cradle to Cradle® principles:

Cycle: Waste = Food

Energy: use of renewable resources

Diversity: respect diversity

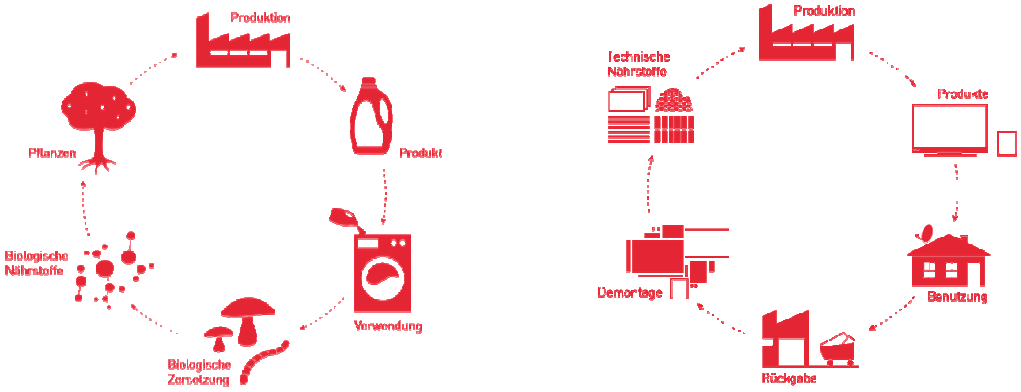
Nature as a model

Nature as a model reflects ongoing developments in a Cradle to Cradle® product: Flourishing trees in spring are only apparently redundant. From a few blossoms new trees are growing. All blossoms not used for growth, fall to the ground and become nutrients.

Cradle to Cradle® Products reach a new quality dimension and distinguish themselves through high economic value as well as modest, ideally with no environmental damage. They achieve high consumer friendliness and are credentials of a paradigm change towards consumer behaviour and in the industrial production.

Cradle to Cradle® Design defines not only form, functionality and ingredients of a product. The goal is to strive for a new dimension in quality and safety in endless cycles.

The 2 Systems: biological and technical cycles



Consumer Goods in the biological cycle

Consumer Goods (natural fibres, cosmetics, detergents, etc.) are designed so that they can be used in biological cycles over and over again. They decompose to organic nutrients and promote biological nutrients and systems such as plant growth. The renewable raw materials are in turn the basis for new products.

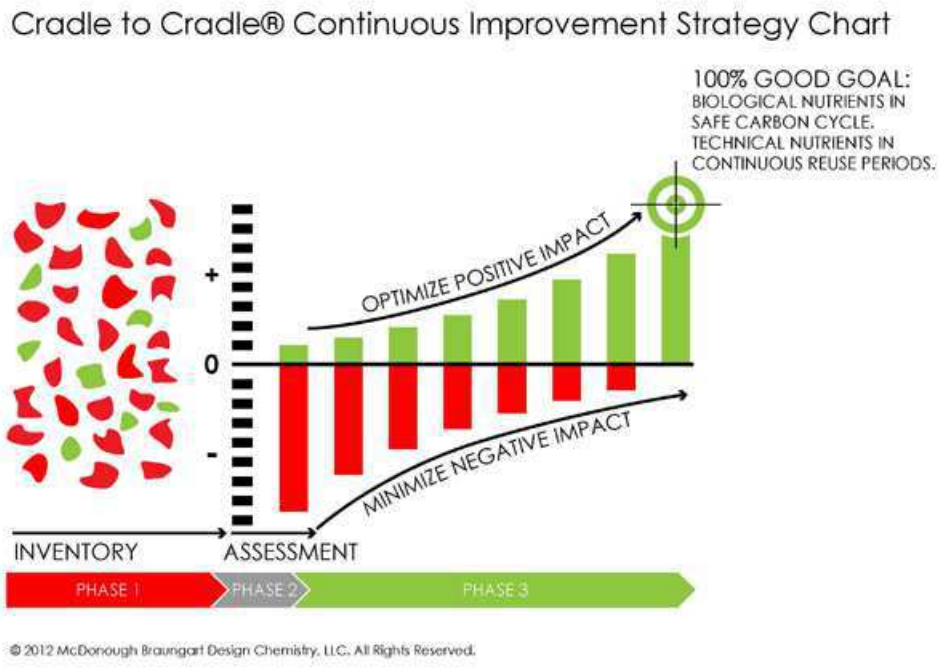
Service Products in a technical cycle

Service Products (TV sets, cars, synthetic fibres, etc.), the so-called technical nutrients, are separated to enable the production of new commodities after fulfilling their initial function. The users / consumers purchase only the relevant services, e.g. Television. The materials remain the property of the manufacturer, which retains them through collection and re-enters them into the technical cycle.

ABX-X Methodology: Identifying the best Materials

ABC-X Categorization: The ABC-X Categorization assesses on one hand the materials and illustrates on the other side opportunities for optimization. Herewith the ingredients are assessed and categorized.

Category	Description
A	The material is ideal from a Cradle to Cradle perspective for the product in question.
B	The material supports largely Cradle to Cradle objectives for the product.
C	Moderately problematic properties of the material in terms of quality from a Cradle to Cradle perspective are traced back to the ingredient. The material is still acceptable for use.
X	Highly problematic properties of the material in terms of quality from a Cradle to Cradle perspective are traced back to the ingredient. The optimization of the product requires phasing out this ingredient or material.
GREY	This material cannot be fully assessed due to either lack of complete ingredient formulation, or lack of toxicological information for one or more ingredients.
Banned	BANNED FOR USE IN CERTIFIED PRODUCTS This material contains one or more substances from the Banned list and cannot be used in a certified product.



Topics Discussions

Cradle to Cradle® requires a "Paradigm Change" in relation to today's predominant "Cradle to Grave" approach. Away from linear thinking towards a thinking in cycles. On numerous committee's lively discussions are taking place around the world. Here are some complementary topics about Cradle to Cradle®.

Sustainability

		Cradle to Cradle®	Sustainability
Perspective		Cradle to Cradle	mainly Cradle to Grave
Orientation		Environmental quality goals to reach	Problems to reduce, avoid, minimize,
Method		Circularity, Cradle to Cradle, Back- and fore-casting loop	mainly linearity, mainly Cradle to Grave, forecasting
Indicators		Qualitative prior to quantitative	Quantitative
Environmental Impact		Maximization of the positive effectss for humans, environment and maintaining the quality of raw materials	Things are countable. Goal in reducing negative impacts
Emphasis	Profit		
	People		
	Planet		
	Pleasure		

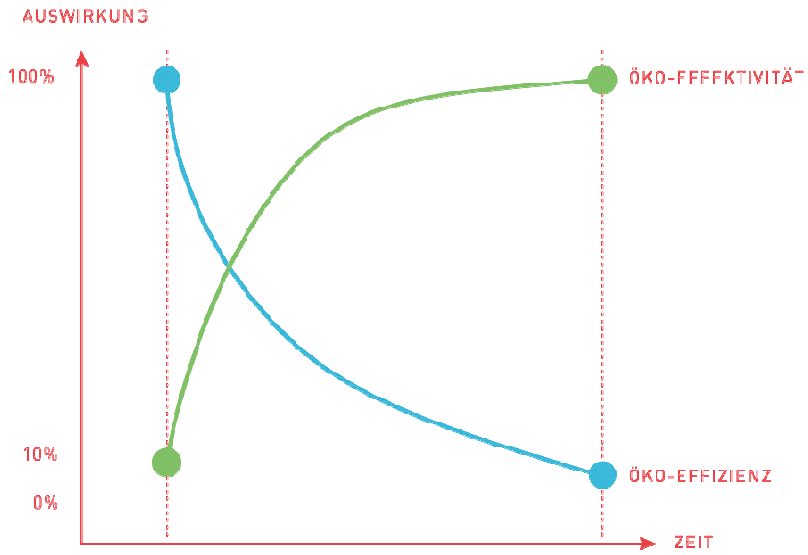
Life Cycle Assessment

	Cradle to Cradle®	LCA – Life Cycle Assessment
What is it?	Innovation framework, Business concept (Circular Economy), but maintaining the quality of raw materials	Method for measuring the environmental impact of products over the entire lifecycle
Philosophy	It is possible to design products with a positive impact on people, the environment and economic profit (the three P's)	„All" products pollute, they all require extraction of raw materials and there is always some form of waste left over
Approach	Eco-effectiveness: developing a product with positive qualities. The process is part of the ultimate goal.	Eco-efficiency: doing more with less. Improving the ratio between economic value and environmental impact. The aim is to measure the result, not the process
Design support	Use the 3 guiding principles to establish a clear direction: waste = food, renewable energy, Respect diversity	Use hot spots to set priorities for improvements.
Environmental impact	Maximization of positive effects on people, their environment and the future availability of high quality raw materials.	LCA is used as a measuring instrument in eco-design, whereby hot spots (life cycle elements with the biggest – negative – environmental impact) are identified so that designers can set priorities for improvements.
Ecological footprint	Develop a positive beneficial footprint.	Measure the footprint and let designers decide how to handle with it.

Eco-Efficiency versus Eco-Effectiveness

The terms "eco-efficiency" and "eco-effectiveness" are often lumped together. However, a world of difference separates them: Primarily eco-efficiency quantifies,

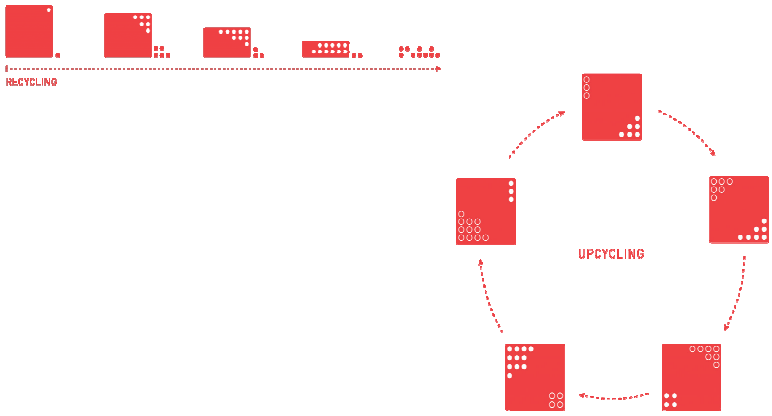
defines problems to be reduced (e.g. greenhouse gas emissions) and eco-effectiveness qualifies in addition (e.g. use of carbon dioxide as nutrient).



Recycling — Upcycling

Maintaining the quality of materials and to integrate them into product design over multiple live cycles, remains to be an enormous challenge.

The conventional recycling mostly ends in down cycling, whereas inevitable residues remain and decreased quality occurs. Cradle to Cradle® however searches for strategies, how materials can remain in closed loops without loosing the quality of the materials.



Circular Economy

The circular economy approach analyses the economics of recycling within a value added chain with the result to generate the recovered material as recycling revenues of materials in a mass material stream.

Cradle to Cradle® defines a quality preserving as well as an economical sound cycling revenue in the added value chain. The material reutilization of cyclable Cradle to Cradle® products enables to generate ideally revenues close to the acquisition price of materials. In case additional processing or cleaning costs occur, the material expenses are in any case lower than the market price.

Differentiation: Quality equal Quantity

Cradle to Cradle® Design transmits the principle "Quality equal Quantity" to industrial systems.

Materials together with material flows are designed to be beneficial and useful for the regeneration and conservation of biological and technical resources.

This approach liberates from the present obligation to diminish, reduce or slow down the need to negative environmental impacts.

EU Commission: Circular Economy Strategy
Closing the loop - An EU action plan for the Circular Economy

The European Commission adopted an ambitious **Circular Economy Package, which includes revised legislative proposals on waste** to stimulate Europe's transition towards a circular economy which will boost global competitiveness, foster sustainable economic growth and generate new jobs.
The Circular Economy Package consists of an EU Action Plan for the Circular Economy that establishes a concrete and ambitious programme of action, with measures covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials. The annex to the action plan sets out the timeline when the actions will be completed.
The proposed actions will contribute to **"closing the loop" of product lifecycles through greater recycling and re-use, and bring benefits for both the environment and the economy**.
The **revised legislative proposals on waste** set clear targets for reduction of waste and establish an ambitious and credible long-term path for waste management and recycling. Key elements of the revised waste proposal include:

- A common EU target for recycling 65% of municipal waste by 2030;
- A common EU target for recycling 75% of packaging waste by 2030;
- A binding landfill target to reduce landfill to maximum of 10% of all waste by 2030;
- A ban on landfilling of separately collected waste;
- Promotion of economic instruments to discourage landfilling;
- Simplified and improved definitions and harmonised calculation methods for recycling rates throughout the EU;
- Concrete measures to promote re-use and stimulate industrial symbiosis - turning one industry's by-product into another industry's raw material;

- Economic incentives for producers to put greener products on the market and support recovery and recycling schemes (i.e. for packaging, batteries, electric and electronic equipments, vehicles).

Circular Economy for Business

The Ellen MacArthur Foundation works in education, business innovation and analysis to accelerate the transition to a circular economy. www.ellenmacarthurfoundation.org

The Nethlands take the lead

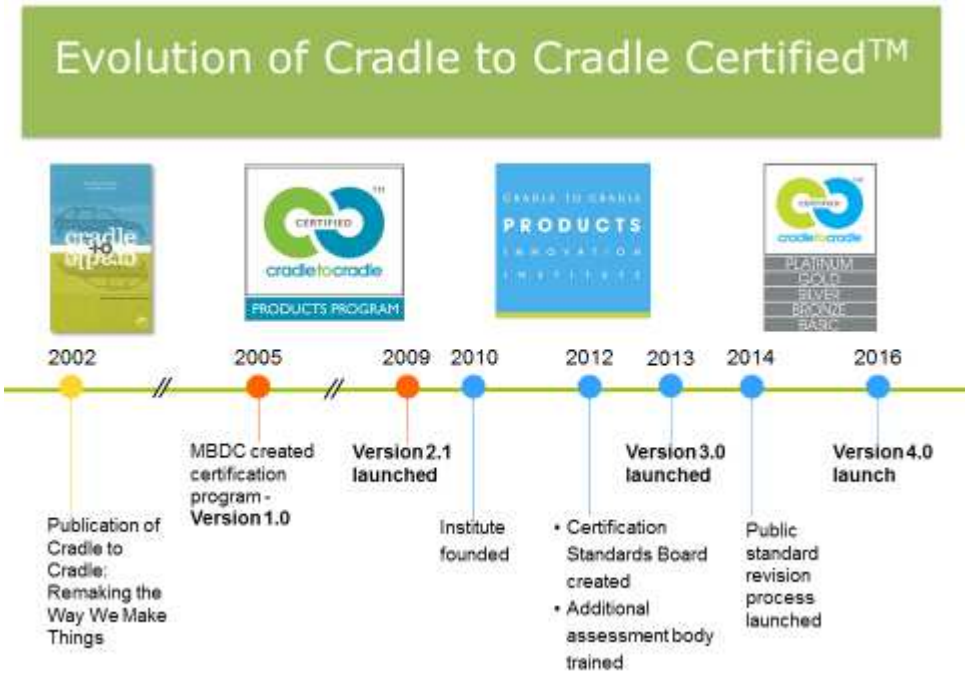
The enthusiasm for Cradle-to-cradle (C2C) started in 2006 following a documentary sent on Dutch television. The wide spread interest for Cradle-to-cradle which followed, was not only limited to designers, developers and politicians but spread throughout the region, peaking in the town of Venlo where everyone from local business people to local bar-staff began their own initiatives. Since then, Limburg has adopted Cradle-to-cradle as their-own vision for regional growth and engine of innovation.

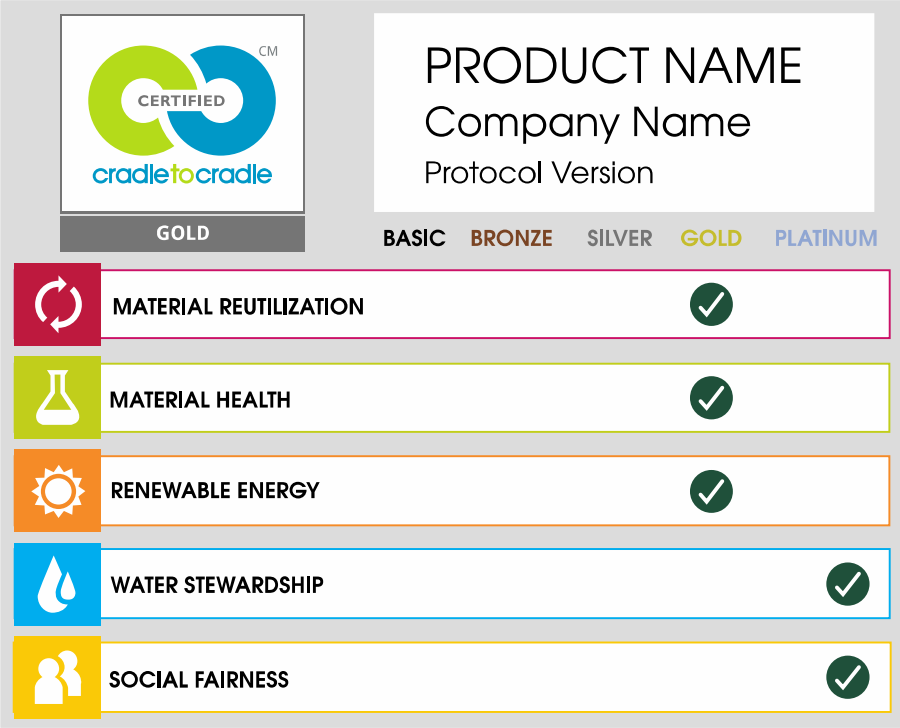
Cradle to Cradle Certified™ Certification

Cradle to Cradle Products Innovation Institute, California.

The Institute's goal is to support and accelerate the transformation of the products and the industry along the way. The Cradle to Cradle Products Innovation Institute is a "non-profit U.S. organization" for the global certification of all Cradle to Cradle® products. The C2CPII aims to do the following tasks:

- Certification audit
- Certificate award
- Training, auditing partners
- Development of certification standards
- Public database of preferred chemicals
- Internationalization of certification





www.c2ccertified.org

PROJECT CASE STUDIES

Chemical Industry

Transforming from a passive role into an active role in financing the assessment of positive list of chemicals and disseminate the positive defined chemicals according Cradle to Cradle into the supply chain. Some Chemical companies like Tanatex Chemicals have done this, now we can move on faster.

Tanatex Chemicals

TANATEX believes that C2C is the next generation environmental guiding principle as it is the only alternative for prolonged use of scarce global raw materials.
TANATEX is at the moment (2011) the only textile chemicals supplier with a complete C2C system approach. The EPIC3 system and its underlying products have received an official 'Quality Statement' from EPEA Switzerland and EPEA Int. Umweltforschung stating that these products can be used without any problems in certification of C2C end-articles.

Dystar – Textile Dyes Material Health Certification

DyStar® Group is a solution provider, offering customers across the globe a complete range of colorants, auxiliaries and services. The DyStar Group has offices, competence centers, agencies and production plants in over 50 countries to ensure the availability of expertise in all important markets. With a heritage of more than a century of product development and innovation for the textile and leather industry, DyStar has developed into new markets and now in addition serves the paper, plastic and many other specialty chemical industries.

Textile Industry

Still the largest in the world, the supply chain is extremely complex and large, some pioneer companies have proven Cradle to Cradle works.

Climatex AG – Climatex Switzerland

The first worldwide Cradle to Cradle Product since 1993. Origin by Rohner Textil AG and Albin Kälin, today Climatex AG, Switzerland. The product is used as seat cover in the AIRBUS A 380.

Trigema – Germany

Cradle to Cradle Innovator Award 2014

1200 employees manufacture sports and leisurewear 100% Made in Germany. Being a manufacturer in an environmentally conscious country such as Germany, TRIGEMA strives for innovation. TRIGEMA was therefore the first company within the apparel industry to embrace Prof. Braungart's Cradle-to-Cradle® (C2C) idea. Since 2006, the collection features biodegradable textiles such as T-Shirts, Polo-

Shirts, Sweat-Shirts and Sweat-Pants, manufactured strictly according to C2C standards.

Lauffenmuehle – Germany

Cradle to Cradle Innovator Award 2015

A breakthrough in textile innovation for Corporate Wear; Work Wear; Hygiene & Healthcare: After years of intensive research and technical optimization, Lauffenmuehle is now offering an innovative yarn and textile concept with excellent technical performance and safe for biological systems.

Textile innovation: Up to now mainly Cotton/Polyester blends are used in the industry, which in Cradle to Cradle is a no go especially in terms of down cycling. The breakthrough innovation in infinito® yarns and reworx® textiles consists of a blend of cellulosic fibers deriving from FSC certified wood with fibers made of biodegradable synthetic polymers deriving from oil not from plants which are suitable for food. All raw materials, ingredients, chemicals and dyes are safe for biological systems and are Cradle to Cradle^{CM} certified at gold level. The technical performance of the textiles is complying with standards of industrial laundry for Work Wear.

Take-Make-Use-Regenerate: infinito® yarns / reworx® textiles are safe for biological systems, offer a climate control function, are suitable for industrial laundering with excellent performance results for easy care, light fastness, high abrasion and pilling resistance. The product is designed and qualified to be used for work wear as well as for other high performance textile products and applications.

infinito® yarns / reworx® textiles are Cradle to Cradle^{CM} certified at gold level: After use and more than 50 cleaning cycles the products will be collected and forwarded to an industrial composting facility where the textiles will safely transform to humus - which then means living space for other organisms: new life is generated.

Lauffenmuehle textile innovation. Cradle to Cradle certified infinito® yarns / reworx® textiles are produced in Germany by Lauffenmuehle GmbH & Co. KG, a fully vertically integrated textile manufacturer - with more than 175 years of experience in producing yarns and textiles.

RÖWA Mattresses – Germany

The breakthrough innovation of special yarns and Textiles are implemented for mattresses together with the core Natural Talalay: Textiles are safe for a biological cycle, climate control function, easy care, light fastness, light stability, high abrasion and pilling resistance, technical performance. Mattress core, natural latex is designed for a technical cycle.

Wolford – Austria

Wolford's ecological commitment goes even further and also covers the protection of natural resources. As part of the smart-textiles branch network, the company is

working on the development of a cradle-to-cradle lingerie line. This so called COIN (Cooperation Innovation) project is supported by the Austrian Research Promotion Agency and designed to promote cooperation between companies and research institutions for the efficient translation of know-how into innovative products.
The project involves the development of lingerie products with biodegradable raw materials that can be recycled or disposed in an environmentally neutral manner. It includes ten Vorarlberg textile companies that produce the individual lingerie components – from bands to clasps. Wolford has taken the leading role in this consortium because it not only develops these types of materials, but plans to market future products under its own brand name.

INDONESIA: Textile Projects in Developing Countries

A feasibility report outlining how the successful implementation of the pilot project for the textile and apparel industry in Indonesia can demonstrate the benefits Cradle to Cradle® may achieve: economical, ecological and social benefits. Several contacts and meetings took place with the Ministry of Industry, the Center for Textile, the Textile School, numerous factories belonging to the textile industry, central actors and stakeholders in Indonesia, as well as the delegates of SECO at the Swiss Embassy in Indonesia.

JAPAN: IANT International Association Natural Textiles

In textile culture in Japan is from ancient times.

People handed over the techniques with ancestors' wisdoms together with its basic spirit and forms to the next generations. The techniques of dyeing and weaving are the fruits of ancestors' age-long wisdoms. In the old days, all the fabrics were produced from the life of plants, flowers and insects in Nature. The fabrics are produced using the natural life with men's techniques. The Ceremony: Senshoku-do, is the form to hand down the sympathetic reaction between Nature and Man for many years to come. Mr. Akihiko Izukura organized the wisdoms of spinning, dyeing and weaving into "8 Ceremonial Methods of Dyeing and Weaving"
http://www.iant-jp.com/senshoku-do/senshoku-do_e.html

FROSCH – Werner&Mertz – Germany and Austria

Cradle to Cradle Innovator Award 2015

together with

green care PROFESSIONAL Werner&Mertz – Germany + Austria

Cradle to Cradle Innovator Award 2015

Since 2013 Werner & Mertz has had its FROSCH brand and industrial consumer line green care PROFESSIONAL certified by the demanding Cradle to Cradle® process. Werner & Mertz was the first company in the cleaning industry in Europe to receive Cradle to Cradle Certified™ Gold for the Frosch Citrus Shower & Bath Cleaner. In the same year,

11 green care PROFESSIONAL products also received the GOLD certification. Today a total of 18 products bear the highly coveted distinction.

Bauwerk Parkett, Wooden Parquet– Switzerland

Lighthouse Bauwerk Parkett: The entire Bauwerk Parquet Production in Switzerland is Cradle to Cradle Certified™, demonstrating the implementation of the Cradle to Cradle® Concept in industrial production.
C2C Certified™ Gold: Cleverpark Silente, Multipark Silente
C2C Certified™ Bronze: Formpark, Silverline, Trendpark, Megapark, Cleverpark, Multipark 9.5, Studiopark, Villapark, Formpark mini, Objekt Langstab

GIROFLEX, Office Chairs – Switzerland

In continuation of its long tradition, in 2010 Giroflex decided to adopt the «Cradle to Cradle» systematic approach of eco-effective action. Cradle to Cradle aims to break through the dilemma of finite resources through complete recycling of materials at the end of the product life without a loss of quality. To this end raw materials are circulated in technical and biological cycles. Energy and material consumption are steadily reduced. Less wear and short distances also contribute to more environmentally friendly production. The comprehensive sustainability of the Giroflex chair models since brought to market is confirmed by the Cradle to Cradle certificate.

HOCHTIEF, Buidling Industry – Switzerland

A vision for the future: Cradle to Cradle® in buildings and within facility management:

DNA OF A BUILDING (Raw Materials Bank, Value Agreement on Raw Materials)

- Inventory of all built in Raw Materials and Products
- Include Cycle-ability in planning
- Assure preservation of Raw Material Quality
- Modular Construction for a good Separability of Materials (Planning – Building Use – Renovation – Back-building)
- Presentation of the economic consideration and advantages for investors

GOOGLE PORTICO – Healthy Building Materials Platform – United States

Google's Healthy Materials Program was created to identify the healthiest products and materials for every Google building around the world.

In 2014, Google tested the beta version of the Healthy Materials database. Google asked a lot of questions and made key improvements to make it easier for project teams and manufacturers to upload product information. Now Google is launching Portico, a streamlined online portal for all parties involved in the drive for healthy, innovative buildings. It all starts with manufacturers entering product information into Portico, the Google Healthy Materials Database.
Transparency benefits everyone in the design/build ecosystem. Google's Healthy Materials Program evaluates all building products and materials through a rigorous screening process based on industry recognized standards that value transparency and material health. Products that meet these criteria are eligible to be specified and procured for Google design and construction projects around the globe.

ELECTRONIC GOODS – Business Case e-Recycling – Switzerland

Now resources (end-of-life appliances) are collected and recycled with ever greater efficiency by the SENS e-recycling system. We are taking a step further with the Cradle-to-Cradle® concept, over and beyond sustainability:

Losses occur from when the products are in the cradle, so to speak, i.e. when they are manufactured, and waste and emissions accrue unavoidably at the "grave" if the resources are not recovered effectively after the products are used.

Increasing the effectiveness of resources; in future Cradle to Cradle® electronic goods are defined with «safe chemistry» and put the materials to positive use (e.g. using carbon dioxide as a foodstuff). No problematic materials from the material cycle will be in the products any more. How can this be done?

The aim of the Cradle-to-Cradle® approach is to preserve raw materials and other resources in their original quality over several lifecycles. Product design is geared towards the selection of materials, with due regard for the aim of preserving their quality over several life-cycles. Raw materials are selected, treated and processed accordingly. In some areas, the material costs may prove to be more expensive (on short run) than with conventional products. This provides businesses (on long run) with a safeguard against rises in the prices of raw materials and assures them of raw material quality.