



CRADLE TO CRADLE

for recyclable, flexible and healthy
buildings that retain their value



NEW WAYS OF BUILDING FOR THE FUTURE

Construction has undergone enormous changes in recent decades. Since the 1990s many principals have made energy efficiency a priority, but are using increasing quantities of materials to achieve this. However, in the long term we face a shortage of raw materials, not of energy. The Cradle to Cradle approach solves this problem and brings a new level of quality to buildings.

Together we are finding the answers of how to build for the future – for project developers, investors, private and public clients, users, tenants, manufacturers of building products, architects, specialist planners and consultants.

42.4 BILLION TONS

ARE CONSUMED BY THE CONSTRUCTION INDUSTRY WORLDWIDE EACH YEAR. IN EUROPE, ONLY 12 PERCENT OF ALL MATERIALS USED IN THE CONSTRUCTION INDUSTRY COME FROM SECONDARY SOURCES.

ABOUT US

Professor Dr. Michael Braungart
co-inventor of the Cradle to
Cradle design concept,
founder of EPEA and professor
at Leuphana University of
Lüneburg, Germany.



Much has changed in recent decades thanks to the environmental debate. However, an eco-efficiency mindset alone will not deliver solutions for raw materials shortages and the problem of waste. Being less damaging is still a long way from being good enough. We now need to make positive use of the environmental debate to improve quality and promote innovation. The Cradle to Cradle concept enables us to follow the example of nature and close material cycles. A product that becomes waste is a bad product. A building that ends up as demolition waste is simply of poor quality.

Cradle to Cradle is not so much an environmental or moral issue as one of quality, innovation and economy. The construction industry offers a special opportunity in terms of addressing resources and health. Drees & Sommer is the perfect partner for us, because the company understands both project and material management. Our common focus is on creating healthy buildings with excellent indoor air quality, the recovery of nutrients and materials along the promotion of biodiversity.

Let us work together to build buildings like trees and cities like forests – buildings with a truly environmentally friendly footprint!

Sincerely,
Michael Braungart

The merger with EPEA is a logical consequence of our joint work so far and underlines our holistic approach. We refer to this as the 'blue way': always combining economy and environmental compatibility. Thanks to the support and the extensive knowledge of materials of our EPEA colleagues we can offer our clients, primarily in Europe, comprehensive advice on circular products, besides our real estate projects. In doing so we reinforce our pioneering role in sustainability, strengthen the Cradle to Cradle concept and create the basis for new business models in the circular economy.

Sincerely,
Peter Möslle



Dr. Peter Möslle, Partner at
Drees & Sommer and EPEA
Managing Director

Drees & Sommer has been collaborating with the former EPEA International Umweltforschung GmbH since 2019. After five years of a close partnership in advising builders and investors, Drees & Sommer and Professor Dr. Michael Braungart have joined forces under the new corporate name EPEA GmbH – Part of Drees & Sommer.

The aim is to introduce Cradle to Cradle design principles for the circular economy in all industrial sectors. Along with providing solutions to global challenges such as plastic waste in the oceans, progressive climate change and the decline in biodiversity can be addressed.



Since its formation in 1987 by Professor Dr. Michael Braungart, EPEA has evolved into a globally active innovation partner for environmentally compatible products, processes and buildings. The Cradle to Cradle principle is at the heart of this activity. When applied to the construction industry, this involves designing all constructions, facilities and construction products in such a way that the quality of their components is preserved. As a result, buildings become raw material repositories that release their building materials at the end of their service life for further use.

TODAY'S BUILDINGS ARE TOMORROW'S RESOURCES

The challenge and our solution

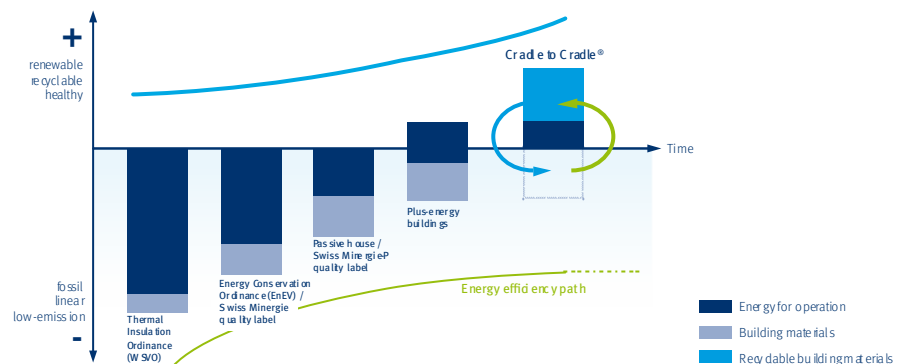
Construction in Europe accounts for almost 50 percent of raw material consumption. At the same time, the construction industry is responsible for almost 60 percent of waste generated. As our planet has only limited natural resources, companies are increasingly focusing on the issue of resource scarcity. According to one study, 85 percent of companies in both the construction industry and manufacturing industry are already suffering as the result of rising commodity prices.

It is remarkable that – even now – companies regard the commodity issue as far more urgent than the 'issue of the century': energy. All forecasts point to even fiercer competition for raw materials. Furthermore, many of the materials in use today contain hazardous substances. Particularly in the case of building materials, this is doubly whammy: it represents a growing challenge for product manufacturers and planners – and ultimately for principals too.

From efficiency to effectiveness

Although the huge efforts made in the field of energy efficiency in recent years are reducing consumption, they do not represent a long-term solution. This is because the efficiency gains in operation are generally the result of massive additional investment in building materials that have to be produced and disposed of at the expense of the environment. The commonly used composite thermal insulation system is a good example of this.

To ensure an adequate supply of resources for long-term growth, we need to move from the linear efficiency path to a circular economy with renewable energy sources and recyclable material flows. The reimagining of our industry is motivated above all by the aspiration to higher quality standards and more value added. The Cradle to Cradle method is the scientific basis for the implementation of a circular economy in the construction and real estate industries.

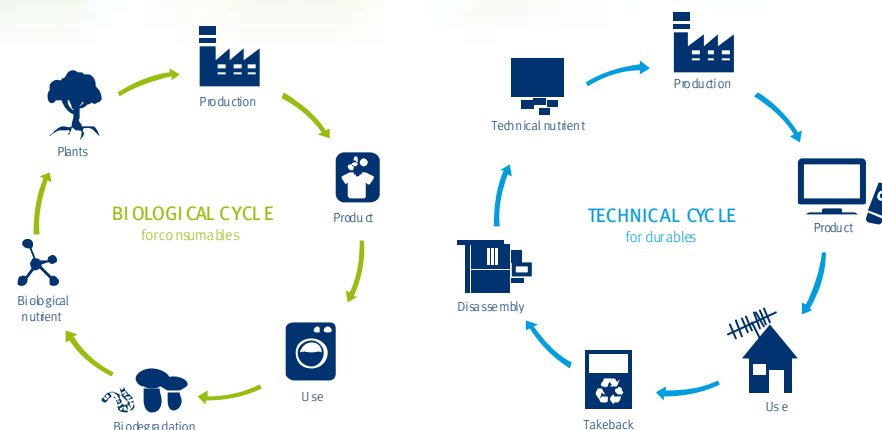


THE CRADLE TO CRADLE CONCEPT

The Cradle to Cradle concept developed by German chemist Michael Braungart offers a solution. Cradle to Cradle describes the principle of two continuous cycles:

Consumables are biodegradable and go back into the natural nutrient cycle. At the end of their service life, durable goods are separated into the individual raw materials and returned to the technical cycle. Material quality is maintained, so that 'downcycling' (loss of quality) is avoided.

All materials are chemically safe and recyclable. There is no waste in the conventional sense – only reusable 'nutrients'. As a result, buildings become raw material repositories that release resources at the end of their service life to become the basis for new products.



Consumables are parts of a biological cycle. As biodegradable products, they become nutrients for new natural raw materials.

Durables are part of a technical cycle. The technical nutrients circulate in closed systems at a consistently high level of quality.

WHAT C2C DESIGN PRINCIPLES MEAN FOR BUILDINGS



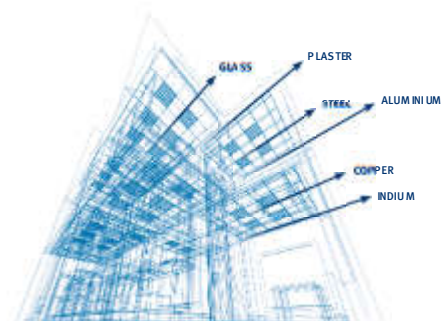
BETTER HEALTH

We spend over 90 percent of our lives in buildings. And it is amazing how little we know about the materials used in their interiors. These materials can contain pollutants that significantly impact our health and wellbeing. The selection criteria for ecological building materials in keeping with the C2C concept go far beyond statutory requirements and ensure an indoor environment that both enhances productivity and inspires. Cradle to Cradle product certification means you can choose materials with confidence thanks to independent testing.



GREATER FLEXIBILITY

Buildings based on the C2C design principle are flexible and repurposable, as possible future conversion is taken into account in the early stages of planning. All materials used are easy to remove and separable by material type – and therefore fully recyclable. This, together with systematic modular design, results in added value that is tangible for users from day one.



GREATER VALUE STABILITY – BUILDINGS AS MATERIAL BANKS

C2C-inspired buildings are renewable and recyclable. Already today they meet the energy standards of the future and act as a repository for valuable raw materials. At the end of their service life or after repurposing of the building, the materials can be fully recycled. The material quality – and, as a result, the value of the raw materials – is maintained, with the result that the buildings have a longer service life and retain their value better than conventional buildings. This creates the basis for alternative procurement models such as leasing or manufacturer takeback.



GREATER POSITIVE CONTRIBUTION TO SOCIETY

Buildings inspired by C2C have a beneficial footprint, for example, by cleaning ambient air or rainwater, or the creation of habitats for plants and animals. Alternatively, they may store raw materials for later use and allow food production on a green roof. This not only has social benefits, but also enhances the visual appeal and interest-factor of the buildings.



POTENTIAL YIELD FOR PROJECT DEVELOPERS, INVESTORS AND PRINCIPALS

In modern buildings, the cost of materials accounts for some 20 to 30 percent of gross construction cost – and is steadily increasing. This is an enormous cost block that is normally lost at the end of the building's service life and on top of which the owner usually has to pay for disposal of the materials.

All experts expect prices for increasingly scarce building materials, such as copper and plastic, to rise sharply in the future as the result of ever-greater global demand.

However, if buildings are designed to allow high-quality recycling of raw materials at the end of their service life, the situation can be turned into a beneficial business model. The building becomes a temporary repository for valuable materials with the potential to benefit from any positive price development.

Our services

- Circular Engineering
 - › Development of key details
 - › Selection of ecological building materials including review for contaminants
 - › Extended component catalogue with material declaration and certification of separability
 - › BIM integration
 - › Material Passport management
- Profitability analysis with assessment of raw material value
- Consulting on takeback and leasing models
- Quick Check to assess potential of existing planning
- Roadmaps for long-term strategies

Your value added

- Buildings as raw material repositories instead of unused capital
- Maximum adaptability and flexibility of use
- Risk provisioning for your property values
- Yield potential and value increase
- C2C as a unique selling proposition
- Healthy and inspiring working environment



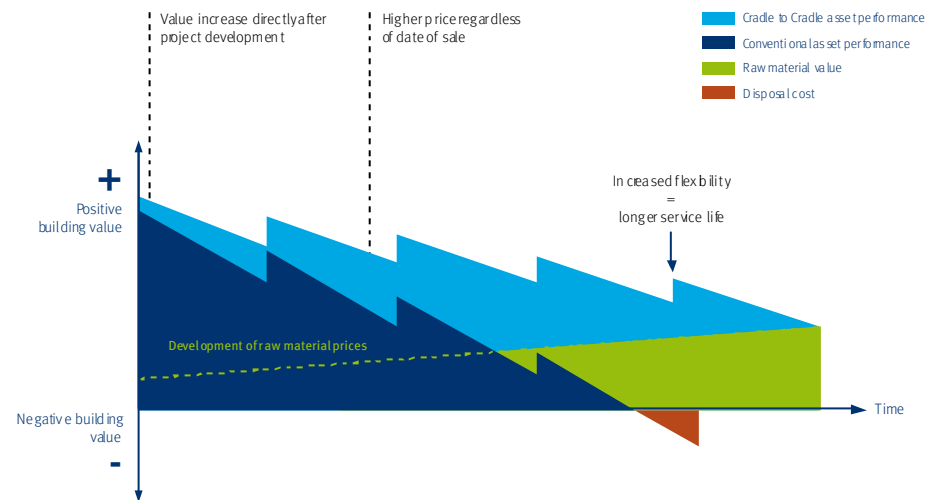
In 2019 INTERBODEN started construction of The Cradle – an office building in wooden hybrid design located in Düsseldorf's old port district known as MedienHafen. The property is to be developed in accordance with Cradle to Cradle principles.

Architects
HPP Architekten GmbH



USD 1 BILLION

ANNUAL SAVINGS POTENTIAL IN MATERIALS ALONE AS THE RESULT OF THE CIRCULAR ECONOMY ACCORDING TO A CALCULATION FOR THE WORLD ECONOMIC FORUM IN DAVOS 2014



Comparison of the asset performance of a conventional property (building fabric without land) with a building designed in accordance with C2C principles

Both buildings fall in value over the years as the quality of the building fabric deteriorates. At some stage, the conventional building may even enter negative territory because the hazardous materials it contains have to be disposed of at considerable

expense. In contrast to that, the residual of the raw materials used in the building designed according to the C2C principles is retained or may even increase in the event of a long-term positive price development.

The value increase is present immediately after project development and at any point when the property is sold. In addition, the building has a longer service life as the result of its adaptability.



C2C Living Showroom

We have established a *Living Showroom* for Cradle to Cradle products in our Stuttgart offices. The formerly gloomy central zone of the building has been completely revitalized based upon C2C principles.

All materials were reviewed to ensure they are contaminant-free and recyclable. Fine-dust-binding carpeting and acoustic absorbers with a air-purifying surface ensure a healthy indoor environment. The living green wall in the background creates atmosphere and humidifies the dry office air. Our newly developed LED daylight ceiling has a dual function: its fabric covering is sound-absorbing.

New approaches were also taken to procurement. The C2C swivel chairs are not only fully recyclable, but also come with a take-back guarantee. At the end of their service life, the manufacturer will take the chairs back, reimburse approximately 20 percent of the purchase price and then recycle them in accordance with C2C principles.

50 %

OF RAW MATERIALS WORLDWIDE
ARE CONSUMED BY THE
CONSTRUCTION INDUSTRY,
WHICH ALSO ACCOUNTS
FOR AROUND 60 % OF WASTE
GENERATION

HEALTH AND FLEXIBILITY FOR USERS AND TENANTS

According to a current study, the average duration of lease contracts for office real estate in Germany is only 5.3 years. Even for buildings under construction, the figure is only 7.8 years. A change of tenant normally goes hand in hand with renovation of the fit-out. In the worst case, walls, floors, ceilings and furniture have to be replaced after the first lease period. This is both economically and ecologically wasteful, as many of the components are discarded in landfills or incinerated instead of being reused, resulting not only in the loss of high-quality raw materials, but also in financial losses.

The Cradle to Cradle approach offers a flexible alternative, for example in interior finishing.

Our Services

- Modularity and replacement concepts for specific functional areas
- Fit-out according to the C2C principles
 - › Flexible and adaptable interior finishing as a complete package
 - › Selection of ecological building materials including review for contaminants
 - › Material Passport management
 - › Integration of elements with 'beneficial footprint'
- C2C structure catalogue for fit-out trades
- Consulting on leasing and take-back models

Your value added

- Flexible, adaptable buildings designed with repurposing and replacement cycles in mind
- Users and tenants benefit from state-of-the-art buildings and a healthy indoor environment
- Employees work in a productive setting; pollution-free, hypoallergenic rooms with excellent indoor air quality
- Significant image enhancement for users and tenants thanks to healthy workplaces
- Use of building with a unique selling proposition
- Lower costs for change of use or design changes, such as renovation of interior fit-out
- Possible extension of lifecycle



NEW MARKET OPPORTUNITIES FOR BUILDING PRODUCT MANUFACTURERS

Linear business models face an uncertain future in times of limited resources. This makes designing their products to fit in to a circular economy a matter of survival for manufacturers of building products. The Cradle to Cradle principle offers a practical basis for transitioning to the circular economy. This is a mammoth task for many manufacturers, but one which offers huge opportunities with the emergence of a new market environment.

However, the fact that Cradle to Cradle is no longer a niche topic is reflected in the increasing number of manufacturers who rely on recyclable materials that do not pose any threat to human health and have their products certified according to Cradle to Cradle principles. Here EPEA GmbH – Part of Drees & Sommer acts as general assessor, certification is via the independent C2CPII institute.

Our services

- Screening of existing products
- C2C product certification support
- Product optimization and further development in keeping with the C2C philosophy
- Establishment of circular process chains in production and distribution
- Market analysis and profitability analysis for building products

Your value added

- Opening up of new market segments and business models
- Detoxification of the supply chain
- Creation of unique selling propositions for the markets of the future
- Securing high-quality raw materials at calculable prices
- Use of C2C as an innovation driver



Stähle Raum-Systeme – famous for highly flexible partition wall, room-in-room and acoustic systems – is banking on Cradle to Cradle. Together with EPEA and Drees & Sommer, the company has developed the first flexible C2C partition wall system.



Tarkett has been applying Cradle to Cradle principles since 2011. With iD Revolution Tarkett has developed the first modular vinyl floor, which has been awarded the C2C Certified™ Gold Level certificate. 83 percent of the regeneratively designed floor consists of recycled, mineral or bio-based components.



Tarkett

85 %

OF COMPANIES IN THE CONSTRUCTION SECTOR ARE SUFFERING AS THE RESULT OF RISING COMMODITY PRICES



As the first office lamp worldwide, the free-standing luminaire LAVIGQ designed by Waldmann, was awarded the internationally valid Cradle to Cradle Certified™ certificate.



Waldmann W
ILLUMINATION SYSTEMS



With the support of Drees & Sommer, Schüco International KG – one of the market leaders in façade and window systems – has developed the first windows and façades that meet the C2C Certified™ product standard.



SCHÜCO

22 %

IS THE MINIMUM SHARE OF COST FOR MATERIALS IN BUILDING CONSTRUCTION

DIGITAL TOOLS FOR ARCHITECTS, SPECIALIST PLANNERS AND CONSULTANTS

The construction of recyclable and non-toxic buildings requires a radical change in approach to planning. Currently, the replacement cycles of individual elements or the demolition of entire buildings are not taken into consideration in conventional planning processes. Recyclable construction, however, requires these issues to be taken into account in the early stages of development.

Drees & Sommer's Circular Engineering division offers interdisciplinary know-how for planning flexible buildings and infrastructure that can be dismantled and recycled.

Our services

- Circular Engineering – right down to the finer detail – as a specialist planning service
 - › C2C structure catalogue for all key trades
 - › Extended component catalogue with certification of separability
 - › Selection of ecological materials, pollution prevention
 - › Drawing up of project-specific positive lists
 - › Consulting on C2C-compliant tender process
 - › Site supervision
- Material Passport management throughout the entire planning and construction process
 - › Identification of interfaces and establishment of processes
 - › Maintenance of the database
 - › Issue of the Material Passport

Your value added

- Innovative network of planners and developers
- Access to know-how for the buildings of tomorrow
- Expertise in recyclable and regenerative design
- Structured basis for the design of flexible, recyclable buildings
- Automated assessment service for German Sustainable Building Council (DGNB), Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) certifications: product-related declaration sheet with the rating of a product corresponding to certification requirements

The new building for the RAG Foundation and RAG AG on the Zollverein coal mine world cultural heritage site was completed in 2017. The project is considered a flagship for sustainable building design with a special focus on Cradle to Cradle principles. It was part of the EU research initiative Buildings as Material Banks and the first project to be provided with a specially developed Material Passport.

Architects: kadawitt feidarchitektur gmbh



The use of sustainable and certified products is promoted by databases and platforms such as the Building Material Scout. All material-related information on products and building materials is collected and structured there. Manufacturers can also have their products rated according to the building certification systems DGNB, LEED and BREEAM.

For builders, architects, planners and construction companies the platform offers the opportunity to obtain information about recyclable and healthy building products, to contact the manufacturers and organize the data management for construction projects. Building Material Passports are created for all construction projects. They provide well-structured information on buildings – for example, the proportion of recycling materials in the building or the percentage of available raw materials.



The Material Passport is a key tool for the planning and construction process. As a logical extension to the familiar building physics component catalogue, it collates and evaluates all the relevant information on the materials and designs used in a project from a building ecology perspective.

As a key instrument for a building's materials management, the Material Passport was the core of the EU research project 'Buildings as Material Banks'. The aim of the project was the development of tools promoting the Cradle to Cradle principles and their practical application.

CUSTOMIZED SOLUTIONS FOR THE PUBLIC SECTOR

Public-sector construction projects are always exemplary. There is demand for innovative sustainability approaches as seldom seen before, concepts that go far beyond energy conservation. Building facades that purify air or bind fine dust, business parks with closed material cycles and new approaches to dealing with waste are just a few examples.

And when it comes to the development of industrial sites, there is the added demand for unique selling propositions with social acceptance. C2C offers broad-ranging potential in this respect.

Our services

- C2C district development
 - › Bi-directional infrastructure concepts that allow utility sharing
 - › Material concepts
 - › Implementation of measures with a 'beneficial footprint'

Your value added

- Increased synergy through utility sharing
- Creating unique selling propositions



The sustainable fire station in the German municipality of Straubenhardt is one of the first C2C public-sector projects in the country. The construction project will be completed in 2020. For Straubenhardt, the new fire station is just the beginning, as the municipality would like to build more sustainable buildings in the future as a trailblazing C2C model region. Architects: wulf architekten gmbh



We are your gateway to Cradle to Cradle and your single source of customized consulting, engineering and management solutions. Why not benefit from the opportunities Cradle to Cradle offers your company and discover the new business models and markets it can open up for you?

Develop future-oriented products for tomorrow's world today.
Become part of our innovative Cradle to Cradle network!

IMPRINT

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SOURCES

CircleEconomy, The Circularity Gap Report 2019 | German Construction Industry Federation (HVB) | TNS Infratest, 2011 World Economic Forum Davos 2014, Report: Towards the Circular Economy | United Nations Environment Program (UNEP) | Federal Statistical Office | Commerzbank, 2011

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Highest standard for eco-effectiveness.
Unique worldwide. Cradle to Cradle® print
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DREES & SOMMER

