C2C in the building sector: frequently asked questions

Frequently Asked Questions C2C

General

The focus on "Cradle to Cradle" (C2C) has gained momentum in the Netherlands and Flanders since October 2006, after the airing of 'Tegenlicht', a documentary containing inspiring testimonials.
Thanks to C2C, since the end of the 1990s, companies across the world have begun marketing innovative products and services that make a positive contribution to society and the environment. There are currently three hundred products and services that have been C2C certified in various sectors including textiles, cleaning and beauty products, packaging, office consumables, electronic goods, interior and building products.
Over the past few years, C2C has also inspired a number of government initiatives. In Flanders, this involved the transitional arena on sustainable material management 'Plan C', The Environmental & Energy Technology Innovation Platform (MIP) and the Flemish C2C Platform. In the Netherlands, C2C forms the backbone of the sustainable development strategy in the province of Limburg. On a European level, the Interreg IV project 'C2CNetwerk' ensures that the experiences of ten regions within the sphere of eco-effective projects are exchanged and that collective reflection processes are encouraged on C2C-inspired action plans as part of a sustainable raw materials strategy. Flanders, represented by the Public Waste Agency of Flanders (OVAM), is an active participant in this network. The Flemish Institute for Technological Research (VITO) and the Belgian advice and study bureau Sustenuto have elaborated the theoretical context for this network.
In 2010-2011, on behalf of OVAM and the Government of Flanders' department of Environment, Nature and Energy (LNE), VITO conducted research into the opportunities and limitations of the current C2C concept in the building sector, via the TWOL study "Milieuverantwoord bouwen op wijkniveau – materialengebruik en Cradle to Cradle" (Sustainable building at a neighbourhood level – materials use and Cradle to Cradle). In consultation with several key stakeholders, the study also led to policy recommendations for Flanders (OVAM/LNE). In addition to a review of the literature, VITO also conducted interviews with building producers, designers, building principals, project developers and C2C experts in order to chart the practical aspects of C2C in the building sector. The conclusions of this investigation can be found in this booklet in the form of answers to several frequently asked questions. The matrix below provides a summary of the questions. Categorisation has been made on the basis of the theme and the type of stakeholder.

	THEME	STAKEHOLDER			
		designer	principal	Building producent	government
A	**Philosophy**				
A.1	What does the C2C philosophy involve?	✔	✔	✔	✔
A.2	On which basic principles is the C2C philosophy based?	✔	✔	✔	✔
A.3	Which typical concepts are used within C2C?	✔	✔	✔	✔
A.4	What can the C2C philosophy offer within the building sector?	✔	✔	✔	✔
A.5	What are the C2C challenges within the building sector?	✔	✔	✔	✔
B	**Building Materials**				
B.1	What is C2C certification?	✔	✔	✔	✔
B.2	What is the current range of C2C certified building products?	✔	✔	✔	✔
B.3	To what extent does current C2C certification fulfil the C2C philosophy?	✔	✔	✔	✔
B.4	What can C2C certification offer?	✔	✔	✔	✔
B.5	What are the latest developments/challenges with regard to C2C certification?	✔	✔	✔	✔
B.6	What are the primary stumbling blocks for applying for a C2C certificate?	✔	✔	✔	✔
B.7	How can the C2C certification criteria be exceeded?	✔		✔	
C	**Sample Projects**				
C.1	What can a CC2C approach offer at a building level?	✔	✔	✔	✔
C.2	What are the major differences between C2C and other approaches to sustainable building?	✔	✔	✔	✔
C.3	How can the C2C approach be used?	✔	✔	✔	✔
C.4	What are the primary challenges for using C2C as an approach?	✔	✔	✔	✔
C.5	Does C2C offer the answer to sustainable construction at building and neighbourhood level?	✔	✔	✔	✔

✔ different answer each stakeholder
✔ **common answer for the stakeholders**

A. C2C-philosophy

A.1 What does the C2C philosophy involve?

ALL

Cradle to Cradle (C2C) is a design paradigm and a business model starting from the **eco-effectiveness** concept – created by the chemist Michael Braungart and the architect William McDonough. As a response to the negative effects of the current 'reduction' approach of eco-efficiency (cf. "doing more with less") – with primary focus on reducing environmental impact of production processes within the linear model 'raw material - waste' – the two founding fathers of C2C propose a positive agenda for designing and manufacturing products and services in which the synergy between economic and social objectives are forcefully promoted.
The practical conversion of the eco-effectiveness approach is provided via several design principles that form the basis of the C2C paradigm.

A.2 On which basic principles is the C2C philosophy based?

ALL

Products and services that follow the eco-effectiveness body of thought fulfil three natural principles:

Waste equals food: in imitation of natural material reuse cycles, biological and technological "nutrients" belonging to the C2C products and C2C services are reused as nutrients for (other) natural and/or human production processes.

Use of current solar income: in imitation of the way in which living organisms work, use is made of day-to-day solar energy and other forms derived from this, such as biomass, wind, water and geothermal energy, to support production processes and also provide heating, electricity and daylight in buildings.

Celebrate diversity: in imitation of a multiplicity of healthy (complex) eco-systems, various forms of variety-based systems such as biodiversity, social-cultural and conceptual diversity, are promoted and combined.

A.3 Which typical concepts are used within C2C?

ALL

Eco-effectiveness – "doing the right things": Eco-effectiveness provides a spacious paradigm for finding targeted solutions for several social and, principally, ecological problems. In contrast to the reduction approach within eco-efficiency strategies, C2C allows unfettered consumption and short lifecycles on the condition that the quality of the materials (within C2C approach: nutrients) are retained (via recycling) or improved (via up-cycling) and the products and services do not cause any damage to man or the environment.

Eco-efficiency – "doing more with less": Eco-efficiency strategies focus on reducing the environmental impact of human activities, without allowing the (socio) economic value thereof to reduce. Within the sphere of material management, this corresponds to dematerialisation efforts as a result of consuming less. According to the godfathers of C2C, eco-efficiency techniques only strive to reduce effects without providing any real alternatives to linear "cradle to grave" material streams. Thus, the majority of the co-called recyclable materials are reused in lesser applications (cf. down-cycling) and toxic substances remain in circulation as a result of attempts to extend the lifecycles of products (and services).

Up-cycling: See eco-effectiveness
Down-cycling: See eco-efficiency
Re-materialisation: See eco-effectiveness
Dematerialisation: See eco-efficiency
Consuming more: See eco-effectiveness
Consuming less: See eco-efficiency
Useful life: See eco-effectiveness
Life-expectancy: See eco-efficiency

Biological nutrients: Materials that flow through biological metabolism become known as biological nutrients. These are biodegradable materials that do not cause damage to the living systems after use and can be passed back to nature for biological processes. Biological nutrients may have a natural source but also contain synthetic materials such as biopolymers that are safe for human and natural systems. According to McDonough and Braungart, biological nutrients are ideal for consumption products, or products that are gradually used up during their usage periods such as textiles, brake discs, the soles of shoes and so on.

Technological nutrients: A technical nutrient is defined, within the C2C context, as a material (often a polymer or mineral) that has the potential to be safely reused in a closed, industrial reuse cycle. Within this technological metabolism it is, however, important that the quality of the technical nutrients is maintained or upgraded throughout the numerous cycles of manufacture, recuperation and reuse. The negative effects of down-cycling are therefore avoided! McDonough and Braungart are of the opinion that technical nutrients are suitable for use as service products or sustainable products that provide users with a service. The forefathers of C2C propose disconnecting the ownership and the use of a service product: the product remains (to a certain extent) the property of the producer but there is an intention to reuse the technological nutrients and the customers can thus call upon a service without having to bear the material responsibilities themselves.

Consumption product: See biological nutrients

Service products: See technological nutrients

Integral chain management: In addition to the design of C2C products, the chain management of the nutrients must also be assured. Integral chain management ensures cooperation between various economic actors in order to combine material resources, professional knowledge and purchasing power in order to recuperate technical nutrients, transform and sell them.

Material bank: Integral chain management is distinctive insofar as it involves the creation of a central materials bank. Within the C2C context, this type of materials bank would retain ownership of the technical nutrients and lease these to producers who would transform the materials and, in turn, provide them to customers in the form of services.

X-list: the X-list is a collection of toxic substances that may never be used in C2C products and services.

P-list: the P-list is a collection of substances that are safe for use in C2C products and services.

A.4 What can the C2C philosophy offer within the building sector?

DESIGN Research has shown that designers primarily use C2C as a paradigm for stimulating innovation. In consultation with the principal, a personal interpretation is often based on the C2C philosophy and combined with elements from other approaches such as sustainable building.

PRINCIPAL Research has shown that the principal or project developer primarily use C2C as a paradigm for stimulating innovation. In consultation with the designer, a personal interpretation is often based on the C2C philosophy and combined with elements from other approaches such as sustainable building. In addition, C2C stimulates healthier and more valuable building work in the long term. This often demands extra investments of time and finances in the short term and behavioural changes by the user(s).

BUILDING PROD Research has shown that building producers primarily use C2C as a paradigm for stimulating innovation. It provides a possible solution to the stricter environmental and safety requirements to which products and services must adhere. In addition, it is used as an (extra) sales argument in order to raise the significance of the product or service.

GOVERNMENT The C2C philosophy provides the building sector with an opportunity to take the initiative in relation to achieving a sustainable society. Given the fact that (more) construction is not a punishable offence according to the C2C philosophy, it offers the building sector a form of continuity (within the sphere of employment opportunities and investments). As a result of the scope of the building sector and the fact that C2C transcends this, the government will have to play a facilitative/mediatory role in order to arrive at the necessary multi-disciplinary collaboration and knowledge-exchange.

A.5 What are the C2C challenges within the building sector?

ALL

Given the fact that the C2C movement was principally started from the perspective of product development, it can still be regarded as in the development phase. There are currently no (clear) solutions to several pressing questions within the building sector.

- Not all objectives are immediately achievable. C2C provides no concrete solution for existing infrastructure and buildings. The current residential heritage largely comprises existing buildings with a certain life-span. This is where future sustainable benefits are to be found!
- According to David MacKay ("Sustainable Energy – without the hot air"), we are nowhere near proving that we could utilise all the renewable energy sources in order to change fully to using renewable energy. For example, is there sufficient land/ground to accommodate the infrastructure for generating solar energy, geothermal energy, wind and water power alongside the cultivation of crops (for biological nutrients). According to MacKay, this is not the case in the UK.
- Also, the Dutch TNO researcher André Diederen questions the unlimited consumption message that goes with C2C. In his book "Global Resource Depletion – Managed Austerity and the Elements of Hope" (2010), he suggests that current consumption behaviour will not permit a complete transfer to renewable energy. In addition to the land that is required (see above), renewable technologies such as windmills and turbines, PV panels and solar power stations will require the use of rare materials that are not sufficiently available on the earth or cannot be obtained in an economically viable manner.
- C2C has been primarily developed for (industrial) producers and does not necessarily apply to architects. There are no clear design rules or a C2C manual for architects or engineers. The manifesto "Cradle to Cradle in Architecture" (2009) and the publication "Cradle to Cradle for the built environment" (2010) by D. Mulhall and M. Braungart do provide general guidelines however.
- The replacement of products by services and the recovery of old products require a different approach to logistics and transport. In addition to technical product innovations, this also demands the necessary innovations in a societal context.

B. C2C certificate for building materials

B.1 What is C2C certification?

ALL

In 2005, McDonough Braungart Design Chemistry (MBDC) started issuing C2C certificates to products that had been designed according to the Cradle to Cradle™ Design principles. The C2C certificate has a wide-ranging approach via five evaluation modules – those being the impact of materials on man and the environment, the reusability of materials, the use of renewable energy, water usage and waste and social responsibility – and four certification levels – those being basic, silver, gold and platinum. The four certification steps aim to lower the entry threshold.
In this sense, C2C certification is more all-encompassing than other similar environmental labels and certification systems.

B.2 What is the current range of C2C certified building products?

ALL

In 2010 over 300 products had been C2C certified, the majority of which came from the United States. The number of C2C certificates in the Belgian building market is currently negligible. On the other hand, several European building producers are also moving towards C2C certification. It must be noted that it is primarily building products with technical nutrients that aim to achieve a C2C certificate. Despite the fact that many building products with biological nutrients are compostable by nature and are healthy for man, few producers of this type of material apply for a C2C certificate.

B.3 To what extent does current C2C certification fulfil the C2C philosophy?

ALL Some of the requirements that correspond with the lower C2C certification levels are hard to reconcile with the principles of the C2C philosophy. For such an essential C2C feature, i.e. the closure of reuse cycles, the criteria are set notably low. It is only the Platinum level - which has so far not been achieved by any (building) products – that actually requires the closure of reuse cycles. Despite the low entry threshold for producers, the gap between philosophy and the low certification levels could become damaging in the long-term for the credibility of the C2C label, given that the consumer (in this case a principal and/or designer) is insufficiently aware which criteria correspond to which level.

B.4 What can C2C certification offer?

BUILDING PROD The 4 certificate levels lead to a low threshold and, as a result, a potentially large market impact. The certificate's intention is that companies grow from a basic to platinum level. Despite full toxicological screening of the building product for every certification level, the product-technical threshold for the achievement of a C2C certificate via this incremental evaluation is extremely low. An improvement route is outlined however and the certificate is valid for just one year. This is all extremely valuable in terms of added value for the stimulation of innovation among producers.

DESIGN The full list of C2C certified (building) products - which can be found on www.mbdc.com – provides a guide to the selection of building products and materials. Given that the number of building products that area available in Belgium/Europe is limited, other selection tools will be required.

PRINCIPAL The full list of C2C certified (building) products - which can be found on www.mbdc.com – provides a guide to the selection of building products and materials. Given that the number of building products that area available in Belgium/Europe is limited, other selection tools will be required.

GOVERNMENT A government cannot impose the use of a "voluntary private label" for public tenders or on their own purchasing activities (cf. green public procurement). There may well be a choice to take on the technical criteria of the quality mark however. In the case of C2C, the latter option is not possible due to the current lack of transparency. The first steps in opening up the evaluation and certification processes have now been taken via the C2C Products Innovation Institute (C2CPII) in the United States and the Berenschot Consultancy in Europe, among other things. The C2CPII is an initiative in the US that initially focuses on the situation in California. There are, however, plans to expand the tasks of C2CPII worldwide.

B.5 What are the latest developments/challenges with regard to C2C certification?

ALL The C2C certificate cannot be regarded as an environmental declaration type I, type II or type III according to the ISO 14020 norm. The C2C certificate is closest to a type I but does not fulfil the requirements of independent, third party certification. There is a need for improved transparency and objectivity from the evaluation and certification procedure. The criticisms of the black-box-level of the C2C certification process and the murky boundary between advice and certification led to the evaluation criteria, provision of advice and certification process gradually being opened up to scrutiny via the creation of the C2C Products Innovation Institute in the US (C2CPII) and the Berenschot Consultancy in Europe, among other things.

B.6 What are the primary stumbling blocks for applying for a C2C certificate?

ALL The producers consulted within the context of this study indicated that the most significant drawbacks to obtaining a C2C certificate are the long procedure involved and the high price. The price for certification depends on the number of components in a product. This can form a substantial barrier for complex products.

B.7 How can the C2C certification criteria be exceeded?

BUIL-DING PROD

Not all ecological effects across the lifecycle are considered during the evaluation procedure. This could lead to products that offer the possibility of closing the reuse cycle and which do not release emissions that are hazardous for man and the environment during the usage phase but which, for example, have an extremely detrimental environmental impact in relation to the extraction of raw materials, production and recycling processes, transport and construction. On the other hand, we note that the C2C certificate determines the potential to close the reuse cycle on the basis of product composition but does not always consider how the reuse cycle can be closed in the context of actual product application. One of the products investigated from the perspective of practical use had no potential in relation to closing the material reuse cycles due to the fact that it chemically binds with the adjoining building elements.
An integral approach must permit the building producer to chart all product phases – before, after and during use of the building.

DESIGN

There is no guarantee that nutrients can be recuperated for several of the C2C products examined as contamination from flows cannot always be avoided. This is primarily down to larger building elements that are difficult to dismantle (comprising various building products). The role of the designer is also significant in order to permit the dismantling, modification and reuse of materials and components during the design phase (cf. Design for Dismantling).

C. C2C sample projects

C.1 What can a CC2C approach offer at a building level?

ALL

The eco-effectiveness principle is one of the strengths of the C2C body of thought. Efforts do not go into being "less damaging" but are applied to designing good buildings and neighbourhoods. This is a very strong point of departure.

DESIGN

Within the projects examined, C2C functions as a paradigm in order to stimulate innovation. The C2C building projects investigated provide their own interpretation by combining elements from C2C philosophy with elements from "sustainable building", "energy-efficient building", "bio-ecological building" and others.

PRINCI-PAL

Within the projects examined, C2C functions as a source of inspiration in order to stimulate innovation. The C2C building projects investigated provide their own interpretation by combining elements from C2C philosophy with elements from "sustainable building", "energy-efficient building", "bio-ecological building" and others.

C.2 What are the major differences between C2C and other approaches to sustainable building?

ALL

From the perspective of the eco-effectiveness approach, the bar is immediately set very high; those involved aim to simply build a building that is good for man and the natural world. In this sense, C2C is distinct in terms of the level of ambition from sustainability evaluation tools in which a rating is ascribed, such as BREEAM and LEED, which are typically characterised by an accessible entry level and strict criteria for higher levels. In addition, C2C building projects are a regular illustration of a broad approach, from a spectrum that covers C2C principles. This is in contrast to more focused forms of sustainable building such as energy-neutral and passive building. Ultimately, C2C projects have a strong focus on the selection of materials and the closure of material reuse cycles.

C.3 How can the C2C approach be used?

ALL

C2C within building demands collaboration within an extensive team of experts and specialists from various domains, from which far-reaching engagement is required.

DESIGN The projects investigated each illustrate a deliberate selection of materials according to the presence of damaging emissions and the potential to close reuse cycles. There is a clear indication that certain materials/ substances are explicitly ruled out due to their (supposed) detrimental impact. This selection takes place on the basis of all possible available and reliable sources, the C2C certificate, but also encompasses other labels and classification systems for building materials.

C.4 What are the primary challenges for using C2C as an approach?

DESIGN PRINCIPAL The most significant stumbling block indicated by those involved was a lack of knowledge and objective, transparent product information. There are currently only a few C2C-certified building materials available in the European market.

DESIGN BUILDING PROD In addition, we have found that the ability to separate and dismantle for the purposes of closing the material reuse cycles is not easy to implement in practice. In this area, there is a gap between the product-technical options and the practical feasibility thereof. The ability to separate must be examined from the perspective of the different life-expectancies and replacement cycles of the elements and components.

BUILDING PROD The "waste equals food" principle leads to very important impulses in the building world in the form of leasing agreements, alternative building methods and increased demand for product innovations from building parties for the benefit of manufacturers and suppliers. In addition, C2C stimulates system innovation towards integral chain management and cooperation between various economic actors in order to combine material resources, professional knowledge and purchasing power for the purposes of recuperating technical nutrients, transforming and selling them.

C.5 Does C2C offer the answer to sustainable construction at building and neighbourhood level?

ALL The current C2C design paradigm was primarily developed at product level. It lacks solutions for typical problems encountered in relation to building and district development. In this sense, C2C is one of the many phases in the transition towards sustainable building.

GOVERNMENT PRINCIPAL So far, C2C has not considered spatial aspects such as land use, accessibility and building density. In addition C2C does not consider the behaviour of residents in terms of raw materials and food consumption, waste production and mobility. Furthermore, the unlimited consumption that, according to the C2C philosophy, will be possible is not yet applicable to our current situation. Other highly ambitious sustainability principles for building projects such as the One Planet Principles (WWF) do take these elements into account.

In addition, there is also a need for guidelines that help us make the existing infrastructure more sustainable. It is known that 80% of constructions in 2030 are already in existence today. To what extent can C2C be used to realise sustainability of our existing buildings and, therefore, be applied to renovations?

References and further information

A. C2C-philosophy

A.1 What does the C2C philosophy involve?

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A.3 Which typical concepts are used within C2C?

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B. C2C certificate for building materials

B.1 What is C2C certification?

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official website for Cradle to Cradle Products Innovation Institute, http://www.c2ccertified.org/

B.2 What is the current range of C2C certified building products?

official website for McDonough Braungart Design Company, www.mbdc.com

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B.3 To what extent does current C2C certification fulfil the C2C philosophy??

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B.5 What are the latest evolutions/challenges with regard to C2C certification?

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B.6 What are the primary stumbling blocks for applying for a C2C certificate?

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B.7 How can the C2C certification criteria be exceeded?

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C. C2C sample projects

C.1 What can a CC2C approach offer at a building level?

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C.3 How can the C2C approach be used?

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C.4 What are the primary challenges for using C2C as an approach?

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C.5 Does C2C offer the answer to environmentally-responsible construction at building and neighbourhood level?

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V.U. Danny Wille, OVAM, Stationsstraat 110, 2800 Mechelen D/2011/5024/50

For more information:

www.ovam.be
info@ovam.be

T: 015 284 284
F: 015 203 275

Public Waste
Agency of Flanders
Stationsstraat 110
B-2800 Mechelen