C2C inspired building: City Hall Venlo

ABSTRACT

City Hall Venlo's design is a paramount example of applying the Cradle to Cradle design principles on building scale. City Hall Venlo is being recognized for many innovations; this building is designed for its users and residents, culture and place, and is designed to anticipate future innovations and continuous improvements at all scales. This case study describes how the dream of a C2C inspired building has been translated into practice, how the process evolved and the benefits it has brought so far.

OVER THE TIME PERIOD OF 40 YEARS, THE VENLO MUNICIPALITY WILL HAVE REALIZED A RETURN ON INVESTMENT OF AROUND 17 MILLION EURO

Starting Points

- Location Venlo, The Netherlands
- 13.500 m2
- 620 work places, for 900 employees
- Additional 2.000 m2 in next-door Nedinsco building
- 400 parking lots (3 stories)
- Total budget € 62 million
- Cradle to Cradle inspired
- Design + Building process within 5 years

Location Maaswaard, Venlo, The Netherlands

HOW IT STARTED

Venlo decided in 2007 to build their city hall as a shining example of Cradle to Cradle design to residents and businesses. The creation of a pleasant and healthy workplace for employees of the municipality of Venlo has been the central theme: a building that will create a comfortable and healthy working environment, combined with sustainable innovation. The new city hall will be an icon at the river Meuse that proudly refers to the agriculture and logistics traditions of the city of Venlo. It is a building, which exudes what the municipal organisation wants to be: open, transparent and accessible.

The programme of requirements consists of a 3-layer public parking garage with 400 parking lots and a total office floor space of 13,500m2. The capital costs are estimated at 62 million euros, additionally with the highest possible application level of Cradle to Cradle within the fixed budget. The design and realisation of the city hall is planned within 5 years, with the realization in 2015. The starting points, together with the Cradle to Cradle ambition, are translated in the programme of requirements. The programme of requirements is the blueprint for the design and construction of the building.
Venlo City Hall is one of the first and few building developments within the Netherlands with defined Cradle to Cradle ambitions.

Organization of American States

Closed Looped Cycle Production in the Americas

C2C EXPO LAB
ENJOYING DEVELOPMENT

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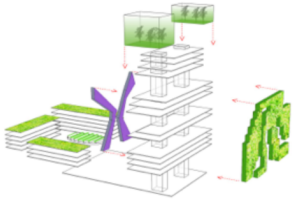
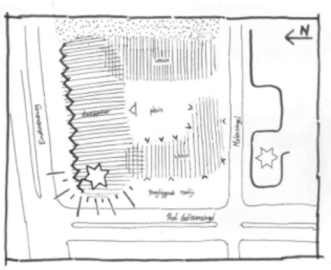
SELECTION OF DESIGN TEAM

The programme of requirements was the basis for the European architectural tender procedure. Venlo chose another order than normally is followed during a tender. Usually, a client asks for a design. In contrast, Venlo asked architects to present their vision on the assignment, with special attention to Cradle to Cradle.

The five best visions that met the requirements were invited to a kick-off meeting with trailblazers ('frontrunners') in the field of Cradle to Cradle. In addition to the co-founder of Cradle to Cradle (Prof. Dr. Braungart and McDonough+Partners), these trailblazers inspired and challenged the five remaining architects to translate the C2C principles to their final vision.
After the kick-off meeting, these five remaining architectural firms got two weeks to complete their final vision on the assignment for the design of Venlo City Hall. After that, the commission assessed the submitted visions based on the selection criteria.





Out of more than 50 candidates, the project has been awarded Kraaijvanger Architects. The important elements of the vision were (1) a living green facade that cleans the indoor and outdoor air of the building, (2) the use of appropriate materials which can be recycled after they have been used and (3) the generation of more renewable energy by the building than the building will use.

Because the advisors, such as building manager and installation advisor, were selected based on their vision on Cradle to Cradle, the design team started with the right mindset on Cradle to Cradle design. After all advisors were selected the design process took off in spring 2009.

DESIGN PROCESS

The design team started the preliminary design phase with a pressure cooking session (design studio) and workshops which lasted a week. The pressure cooking initiated the integral design process, in which the different disciplines strengthened, rather than hampered, each other. Besides the general project team meetings, all the different stakeholders within the design team came together every month to monitor the continuity and synergy between the disciplines. The meetings were used to examine what the contribution of the market could be to realize the city of Venlo's requirements and ambitions for this building. These market consultations have also been used to encourage the producers in the building industry to innovative product development, based on the Cradle to Cradle approach.

During the design process, the translation of the Cradle to Cradle philosophy proved to be a challenge. To put extra emphasis on the Cradle to Cradle-ambitions, the largest part of the design team decided to follow a Cradle to Cradle training. Prof. Dr. Michael Braungart's institute organized and facilitated a 4-day during training. The training did not only encourage the design team, but also made clear that focus should be made in the project.

Because it is not yet possible to realize a 100% Cradle to Cradle building, a focus on a specific number of aspects becomes crucial. In the case of Venlo City Hall, four aspects in which the Cradle to Cradle ambitions are reflected were selected. First, how can the building enhance indoor and outdoor air quality, and use climate change gases to enhance air quality?

Second, how can the building and its site produce more renewable energy that the building will use? Third, how can applied materials be appropriate for a biological or technological cycle, without the loss of quality? And finally, how can the building improve water quality, so the water becomes healthy for biological metabolisms? The four C2C-themes can be defined as:

Enhance Air and Climate Quality
The aspect of air is translated in the following desired results:
- Improving outdoor air quality with the building;
- Improving indoor air quality with the building;
- Increasing biodiversity with the building;
- Aesthetically appropriate in its environment;
- Increasing labour productivity.

Integrate Renewable Energy
The aspect of energy is translated in the following desired results:
- The building uses only renewable energy;
- There is more renewable energy produced by the building than is used;
- There is the possibility to integrate innovative energy solutions during time;
- Energy-Efficiency has been applied to integrate renewable energy rather than reduce fossil fuels;
- The energy system is (physical and virtual) visible;

Define Material and their Intended Pathway
The aspect of materials is translated in the following desired results:
- Materials are appropriate for a biological-or technological cycle;
- Cradle to Cradle certified products are selected and applied;
- Residues are raw materials for new products;
- Products and materials have an added value for users and the environment;

Enhance Water Quality
The aspect of water is translated in the following desired results:
- The building enhance water quality;
- Nutrients are extracted from the (waste)water;
- The water system (physical and virtual) is visible.

Thereafter, the desired results and KPI's constituted the basic requirements for roadmaps. A roadmap describes the development of the building and selected elements for future innovations and improvements. The roadmaps contain the milestones and performance indicators of the new city hall.
The defined C2C-ambitions and roadmaps were embedded in the organization of Venlo, as a determined framework for further development of the project. The daily organization and the city council unanimously agreed with the C2C ambition document proposed process.

THE DESIGN - C2C INSPIRED ELEMENTS

The main challenge was still to translate the defined C2C-ambitions of the project into practice. Each decision is weighted to what extension a solution contributed to the defined C2C-theme's and roadmaps of the project city hall.

One of the desired results is to enhance indoor and outdoor air quality with the building. The baseline made clear that indoor air quality in average buildings is poor with an adverse effect on productivity and amount of sick-days. Beside, the outdoor air quality around a busy arterial road needs improvements. For that reason, the integral design contains elements to create a healthy, pleasant and safe indoor- and outdoor air quality. Therefore, a greenhouse is situated at the top as 'green lungs' of the building. The greenhouse purifies the outdoor air with functional living green, before it will enter the building. The purified air will enter the different floors, after a piping system in the floors have created the comfortable temperature. A vide structure, from ground floor till rooftop, provides a natural ventilation flow.

Beside, the vide encourages interaction between departments and boost the use of stairs. On top of the vide structure, a solar chimney is situated. The solar chimney will heat up by the sun, warm air rises, and a natural air flow is created. On average, the indoor air quality in buildings is 4 to 8 times worse then outside, based on European studies. The goal of this building is to enhance the outdoor air quality. So before the indoor air will leave the building, the air is guided through a green wall. The green wall has a surface of 2,200m2 in total, unique in Europe. Together with green roofs, the façade will enhance the outdoor air quality in a radius of 500m. Calculated by the Technical University Eindhoven and TNO.

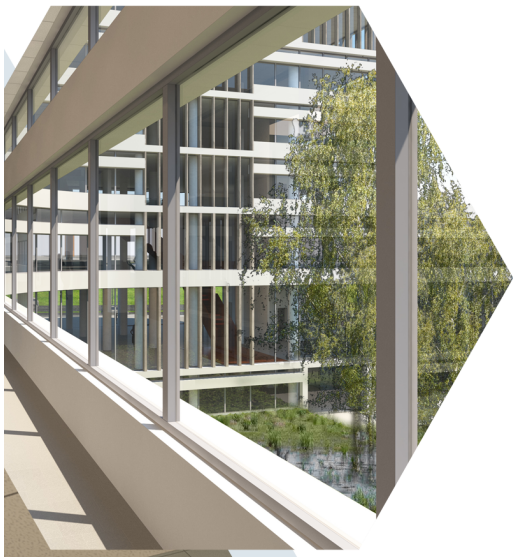
Another important cycle in the building that can be distinguished, is the water cycle. Five water streams are divided: (1) rainwater, (2) drinkingwater, (3) grey water such as residual water from sinks, (4) black water, which can be subdivided in brown-, and yellow water such as redidual water from toilets.
The roofs, covered with green, collect rainwater for watering the green wall and flushing toilets. Generally, every person uses 127,5 litre per day. Thereof, only 4,5 litres needs to have the quality of drinking water. The other 123 litres will be covered in the building with lower quality (no drinking water). The grey water is collected in a biological system with reed, a so-called hylofyt filter. This system filters the grey water. Among others, the filtered grey water can be reused for flushing toilets in the black water stream.
To create a continuous black (brown and yellow) water cycle, the project team wanted to integrate algae systems. However, on this scale it was not yet profitable. So, the roadmap takes such a system into account for the upcoming years. The design can anticipate on future innovations and does not hamper innovative developments in the future.

Subsequently, the ultimate goal of the city council is to generate more renewable energy than the building will use. The programme of requirements prescribe a energy-efficiency of 50% lower then the national requirements, plus a Energy Label of A+.
Various solutions are integrated to generate renewable energy. Beside, breakthrough efficiency solutions are integrated, to reduce the need of energy and give possibility for new innovative energy solutions. In total, 1,000m2 photovoltaic cells will be incorporated in the south façade to produce electric energy. As a wink to both cycles of Cradle to Cradle, the north (green) façade is designed as biological façade. The south façade is designed as technical façade. In addition to the electric energy, thermal energy is produced by geothermal energy and 25m2 solar water heaters. The total design needs no gas connection. Current solutions will generate approximately 50-60% of the total energy demand. Breakthrough efficiency, awareness of the users and new techniques will have to increase that number.

The specification prescribes a maximum number of available Cradle to Cradle certified products on the market. Beside, the project encourages other businesses to innovate. A internal check for Cradle to Cradle potential boosts producers as first step to Cradle to Cradle certification, and gives the principal an better understanding of the quality of the used product. During the design and realization process, the city hall project incited different product certifications. Agreements are already been made about take-back systems after the use time of the products.

During the design process, the question was arising what the possibilities are for the furniture of the building. The tender process for the interior, which started with a market consultation, made clear the substantial benefits. The tender requested Cradle to Cradle certified products to a maximum, but also included the reversal take-back system of the product after 10 years and the financial residual value of these products. As a result, a maximum number of products that are in line with the Cradle to Cradle design protocol will be used, all materials can return to their suppliers and a significant guaranteed financial residual value is defined.

Another discussion that took place during the design process is how the level of sustainability could be measured. Numerous costly standards measure the overall score of a sustainable building. However, they do not tell (precisely) to what extend the defined C2C-ambitions of the project are realized.
As result, a custom real-time monitoring system is foreseen. This monitoring system will measure the set KPI's for all four of the C2C-themes. Such as, how much renewable energy is produced and what is the consumption?



Or, what is the indoor- and outdoor air quality in numbers as temperature, fine dust, CO2 or humidity? From 'measure to know' towards 'measure to develop'. The design anticipates for innovations in the future, will not hamper new developments. The monitoring system monitors the performances and makes adjustments to the defined C2C-ambitions possible.

BUSINESS CASE

As mentioned, Venlo deems Cradle to Cradle an economic principle. Focussed on the four aforementioned selected aspects, the project team started to examine what the economic added value of sustainable innovation and Cradle to Cradle solutions might be. Various potential solutions that could help to achieve the defined goals, were assessed based on investment, operational costs and total cost of ownership. In the end the bundle of solutions that would contribute to the achievement of the outlined goals, as well as save and earn money during the defined use time of the building, were translated into business cases. Compared to a traditional situation/case, the business cases indicated that an additional investment of 3,4 million euros, will bring a net result of 16,9 million euros after the defined use time of 40 years, with a return on investment of 11,5%. A safe and earn matrix proved that investments in Cradle to Cradle elements are profitable. Even after year 1, the exploitation costs are lower in the C2C business case, compared to a situation without the Cradle to Cradle elements.

In time of an economic crisis, the municipality should decrease their budgets with 40 million euro. Instead of cutting the budget of city hall, the abovementioned business case was presented to the council. Where they expected substantial savings, the project team asked for an additional investment, rather than cutting in the fixed budget. With the well-founded calculation of the Total Cost of Ownership (TCO), the council anonymously agreed with the proposed save and earning matrix.

THE BENEFITS

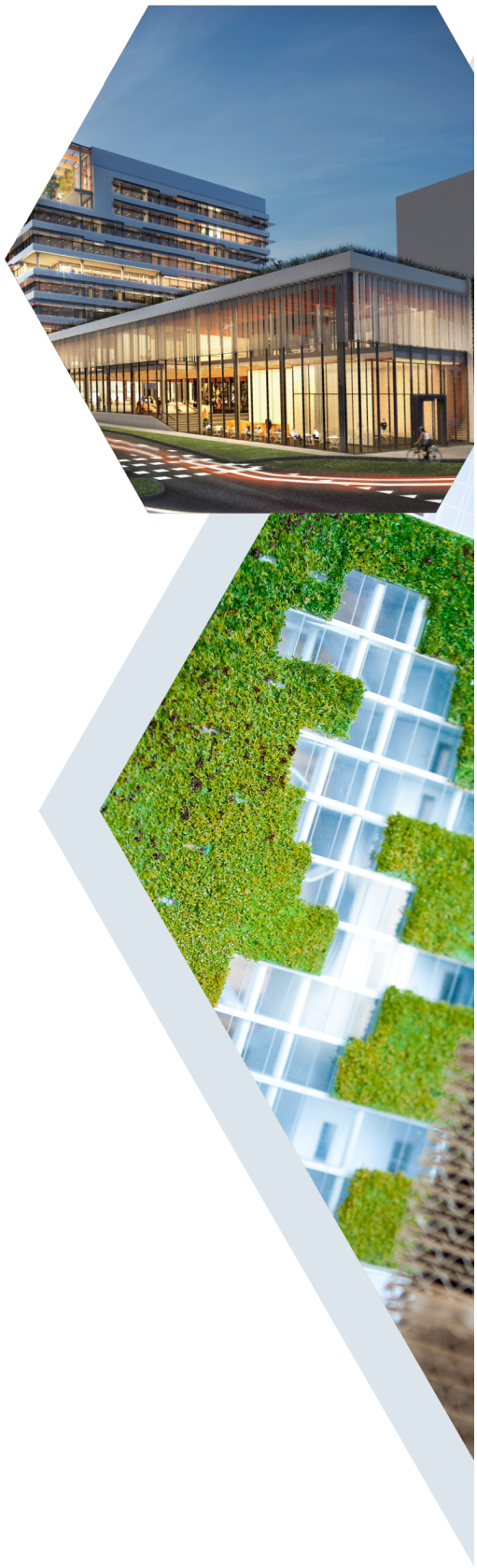
The project is still under construction and will be completed mid-2015, the following benefits will be realized:

- Positive business case of 16,8 million euro's in 40 years and a return on investment of 11,5%
- The building will purify the outdoor air quality in a radius of 500m. Universities and scientific institute (Technical University Eindhoven and TNO) have investigated that City Hall will have a positive effect on its environment.;
- A numerous number of Cradle to Cradle Certified products will be used;
- The building will generate renewable energy, filter and infiltrate water and purify air quality;
- Because of Venlo's C2C-ambitions for this project, several companies have certified their products;
- Arrangements have been made for reversal of products (take-back);
- Both national and international attention for the project during events, magazines and other media;
- The process encouraged the internal organization of Venlo, with a result that circular models are more and more integrated in (governmental) projects and policy;
- Cradle to Cradle is already part for the facility management of the building (e.g. toilet paper, soaps, etc).

LESSONS LEARNED

In line with the strategic vision 2030 of Venlo, the municipality wants to encourage other (local) governments, businesses and organizations to start innovating according to the principles of Cradle to Cradle and the circular economy. Therefore, Venlo wants to share the gained knowledge and experience based on open-innovation. Some key lessons learned in the project city hall Venlo are:

- A good start is essential. The sooner the principles of a performance economy are involved, the bigger the positive impact will be on your project;
- Embed the circular model into policy and make use of it during the process;
- Select the perfect team and make sure that they are in the right mindset and are willing to invest in a good result;
- Point stakeholders on their responsibilities;
- Make clear what the consequences are of decisions that do not contribute to the Cradle to Cradle-ambitions;
- Bring focus in your project (from the very beginning) and monitor continuously the agreed path;
- Define your C2C-ambitions into measurable and practical goals. Focus on 3 – 5 C2C elements in your building;
- Accept: a 100% Cradle to Cradle building does not exist yet;
- Make the Cradle to Cradle ambitions visible in the design and the realisation;
- Take the differences in life cycles into account. Among others, the use time of the construction is much longer than for example your furniture;
- Focus on the Total Cost of Ownership and substantiate the benefits it will bring during the use and exploitation phase;
- You need courage and vision on political and organizational level, as in your project team.



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