



The future is full of challenges and opportunities to build sustainable living, working, and recreational spaces. In order to learn more about these topics, Clean Tech Delta organized three events that explored major challenges, innovative solutions and opportunities for the future of the built environment. Below is a summary of the Building Materials session.

**Maarten Schäffner | Witteveen+Bos | Group Leader Carbon Neutral Design and Circular Economy**

The choice for our building materials has a significant impact on our climate, the environment, and on the depletion of raw materials. There are trade-offs between circular design and designs with a lower carbon footprint. For example, demountable constructions often require more materials than traditional constructions, and products that support the energy transition (e.g. solar panels and wind turbines) can cause problematic waste streams. Also, material innovations can in some cases increase the lifespan of materials in projects by a factor of two. However, this sometimes diminishes the flexibility of a public space in the city, which might be changed within 10 years time. At Witteveen+Bos the Life Cycle Analysis (LCA) and Life Cycle Costing (LCC) methods are both used in projects, but these two metrics don't always favor the same process and materials.

These examples demonstrate that there is not *one way* towards a sustainable or circular design. Organizations need to set clear ambitions and goals. You should choose the sustainability/circular indicators you would like to focus on, because it is impossible to implement all the aspects in each project, due to the highly diversified characteristics and needs of each project. Nevertheless, sustainability needs to be part of the DNA of projects and integrated in all the stages, from planning to implementation.

**Mark van Ommen | TNO | Business Developer Circular Economy, Buildings & Infrastructure**

A key study of TNO mapped the material availability from renovation and demolition projects over the coming three decades, compared with the material demand expected, specified per province, and some large cities such as Rotterdam.

In South Holland, there is a supply of 15.000 tons of secondary materials that will become available until 2050, while the demand for secondary building materials in the province is four times as high. In most densely populated Dutch regions, this mismatch exists. There is three times more material demand than available waste material in the Netherlands as a whole. This does not yet take into account the quality of these materials, which will likely make this difference even larger.

This indicates that local reuse and recycling initiatives are still important to develop, but won't be the full answer to the reduction of material pressure in the built environment. Circular design and choice of (biobased) materials are extremely important in the building process over the coming decades. Renovation must be the preferred option over new construction whenever possible.

**Wouter Moorlag | TNO | Cluster Manager Building Innovation**

Wood is an example of a material that could become (again) a key biobased material in the coming decades in the construction sector. The invention of Cross-Laminated Timber (CLT) has increased the opportunity for building with wood again in modern times. CLT has very good loadbearing features and it can replace concrete in many applications. Wood has various advantages over other materials such as concrete. Firstly, it comes from a renewable resource, which is in line with circular principles. Secondly, there is plenty of wood available in Europe, even if you take the growing demand into account. Lastly, wood has excellent characteristics for pre-fabrication and industrialization. Through a continuous innovation process, the loadbearing features are improving. On the other hand, there are also large threats to building with wood. It is currently still (slightly) more expensive than traditional materials like concrete or steel. Only a few percentages of difference make a substantial difference in large projects. Second, the innovation processes to work with CLT are not fully proven on the scale that concrete and steel have been proven in projects and challenges still exist on the construction with these materials. These challenges can be solved, but they are expensive. Thirdly, the market is still immature, and building with wood is still quite new for the relatively conservative construction sector.

TNO is working on solving construction issues around acoustics, moisture, and costs in a triple helix consortium. They aim to help companies to optimize their prefabrication and wood innovation processes.

#### **Ward Massa | StoneCycling | Founder**

StoneCycling makes bricks that consist of 60% upcycled waste. Together with TNO they are currently developing a brick tile that is made of 80% waste, with the ambition to go to 100%. So far, they have upcycled 500.000 kilos of waste in the process.

Most clients buy StoneCycling products because they like the aesthetics of the product and it's often an economic decision too to use the WasteBased Brick, because it helps to raise the profile of the building. The construction industry is quite conservative, and therefore a difficult market to penetrate with innovative products and services. StoneCycling is gaining trust from the construction industry. It is one thing to come up with a product, but it is equally difficult to sell a product when there is no market for it yet. There is a strong need for a better regulation and a government with a long-term vision, to accelerate the transition to circular initiatives such as StoneCycling.

#### **Caroline Kroes | Woonstad Rotterdam | Program Manager Sustainability**

Woonstad is the largest housing corporation in Rotterdam. Like Witteveen+Bos, Woonstad has experienced the trade-offs between circularity and reducing overall GHGs. It is important to take an integral perspective on sustainability in housing projects.

Most of CO<sub>2</sub> emissions are material related, whereas only a quarter is energy related. We have to think about what parts are necessary to deconstruct and what parts should be left in place, by embracing circular principles. A materials study by Repurpose investigated which materials can be mined during the next four years from Woonstad's own project portfolio, based on two key parameters: the potential cost savings of reusing instead of disposing of the materials on the one hand, and the potential CO<sub>2</sub> reduction by keeping the materials in the loop on the other. This analysis resulted in six material streams that are interesting to look at specifically in a circular economy context: concrete, gypsum, stone wool, glass wool, wood and plastic window frames. Woonstad is looking for circular solutions related to these six materials, plus biobased materials, and concepts that tackle both the energy transition and circularity. Woonstad aims to collaborate with innovation suppliers, while at the same time honoring the strict

deadlines and time constraints on housing projects, which can be a barrier to the implementation of innovation in some cases.

### **Willy Spanjer | The Green Village | Program Manager Circular Economy**

The Green Village is a living lab where innovations for the built environment can be developed and experiment with. The living lab provides visibility (it's open to the public) as well as feedback on the application of the innovation (people live on the site).

At The Green Village, theories and innovations can be tested, without many of the risks encountered in the real world. This supports the development and implementation of innovation in the earlier (Technology Readiness Levels) TRL stages. At the Green Village you can make use of the existing infrastructure such as the existing buildings, a data platform, AC/DC net, hydrogen infrastructure. The Green Village as a location is exempt from certain rules and regulations, making it a perfect place for experimentation.

Four important aspects contribute to the possibility of scaling up your innovation according to The Green Village model: technology, business model, regulation and standards, and societal embracement.