# Construction materials of the future

Dutch carbon emissions are heavily influenced by the built environment. Embracing bio-based materials can revolutionize sustainability, but changing societal views and fostering supply chain collaboration are key to success.

### By Kosma Matysiak

Carbon emissions and their financing have been an important point of attention for financial institutions for a long time. And while we observe sufficient attention being paid to the energy efficiency of the housing stock, expressed by the energy label, the awareness of its total contribution to carbon emission levels still seems to be rather limited. As the energy label focuses primarily on the operational efficiency of the property, it provides only limited information about the total carbon footprint realized throughout the entire lifecycle of the building. The built environment and construction sector are jointly responsible for almost 40% of the Dutch

carbon emissions<sup>1</sup>. If nothing changes, there is a potential risk that the construction sector, with its current contribution to the overall  $CO_2$  emissions, will not be able to comply with the Paris Agreement targets. This is similar to the impact of the nitrogen crisis in the Netherlands. The housing pressure is only contributing to this problem.

The concept of 'embodied carbon' combines carbon emissions produced during the construction phase and throughout the building's lifetime. It might be surprising to the reader that, in the case of recently built housing stock, only around a third of the carbon emissions can be attributed

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to the ongoing energy use. The remaining two thirds stem from (raw) materials like steel and concrete, considering their production process, transportation to and installation at the construction site. With increasingly energy-efficient newly built properties, this ratio is only getting more out of proportion. The statistics speak for themselves - it is difficult to ignore the impact of raw materials used in the construction process for much longer. This is where bio-based construction materials should play a significant role.

## But what exactly are bio-based materials?

Bio-based components could be defined as resources which are naturally grown and are therefore renewable and bio-degradable. Timber is a traditional example of a bio-based material that has been used in the construction industry since before we can even remember. In the past century its popularity has been fading to some extent in favor of contemporary materials like concrete or steel. As industrialized materials were easier to obtain in large quantities and at consistent quality levels, they played a central role in the reconstruction of post-war Europe. These factors are slowly becoming less relevant with engineered wood products. With the ever-growing emphasis on a healthy lifestyle and healthy living conditions, timber is experiencing its renaissance.

Modern production techniques allow constructors to prefabricate selected modules of the house in the factory and assemble them on the construction site or in the factory itself. This approach shortens the timelines of the construction process by using modular assembly techniques and reducing dependency on weather conditions. Additionally, it helps to minimize human error. With the right engineered wood products, it is possible to reach an optimal stiffness of wooden components, going beyond the specification of traditional wooden logs. A limited use of steel and concrete can further reduce

the weight of the structure, depth of foundations, as well as cost and emissions related to construction and transportation. With proper ventilation and moist control, modern wooden constructions could last for at least 100 years.

However, timber is not the only bio-based alternative: fibre crops like flax and hemp allow for good quality isolation materials, and in the future, we could see kombucha and mango leather, or even seashells applied in our homes.

### Supply chain is essential

In the wake of a lack of economies of scale, higher risk and innovation costs involved at the outset, sustainable technology is expected to come at a cost. It is estimated that the construction of bio-based homes could initially be 5%-10% more expensive compared to homes built with conventional materials. This price pick-up, due to higher development and production costs, is expected to level out over time once production techniques become more industrialized and the supply chain is mature and well organized. The economies of scale related to larger scale production, in combination with shorter

project timelines, could bring the overall construction costs closer to par.

To make this possible, all links in the supply chain need to collaborate in finding structural solutions and synergies. It could start with the gradual conversion of traditional farming practices and increased use of responsible forestry, followed by developments of bio-based production factories.

Last but not least, it is time to start challenging the popular societal views (we all still remember the story of Three Little Pigs). As most future homeowners will finance their homes with mortgage loans, it is vital that mortgage originators, as well as financial institutions investing in Dutch residential mortgages, become engaged and open to accepting buildings constructed with bio-based components.

Under the existing framework, there is a clear link between the maximum borrowing capacity and the energy efficiency of the property that allows future owners of energy-efficient homes to benefit from additional amount of the mortgage. Perhaps a similar framework should be established to incentivize borrowers who consciously opt for environmentally friendly bio-based homes?

#### Closing thoughts

The idea that bio-based materials could prevent a large part of future carbon emissions (even excluding the actual storage of carbon in the material during their growth phase) makes them a viable solution to the problem. Measurability of the impact of bio-based buildings could be achieved by using existing indicators. This is particularly interesting for investors, as it could provide an assessable impact on the sustainability profile of their portfolios, aligning with global climate goals.

Embracing bio-based construction materials not only paves the way for a sustainable future but could also offer a holistic solution to carbon emissions, housing shortage, and new business model for farmers and the revitalization of local economies. This makes it an important step toward a greener and more resilient world.

Perhaps it is time to rewrite the story of The Three Little Pigs?

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### **SUMMARY**

The built environment is a relevant driver behind Dutch carbon emissions.

Popular energy label indicators focus on operational efficiency, not on the total carbon footprint.

Bio-based materials offer a sustainable alternative to traditional materials, which contributes to significant carbon savings and healthy living.

Supply chain collaboration is essential to reduce costs and increase the adoption of bio-based materials.

Before bio-based construction can pave the way for a sustainable future the popular societal views have to change.

