

Dual-LCA Infographics

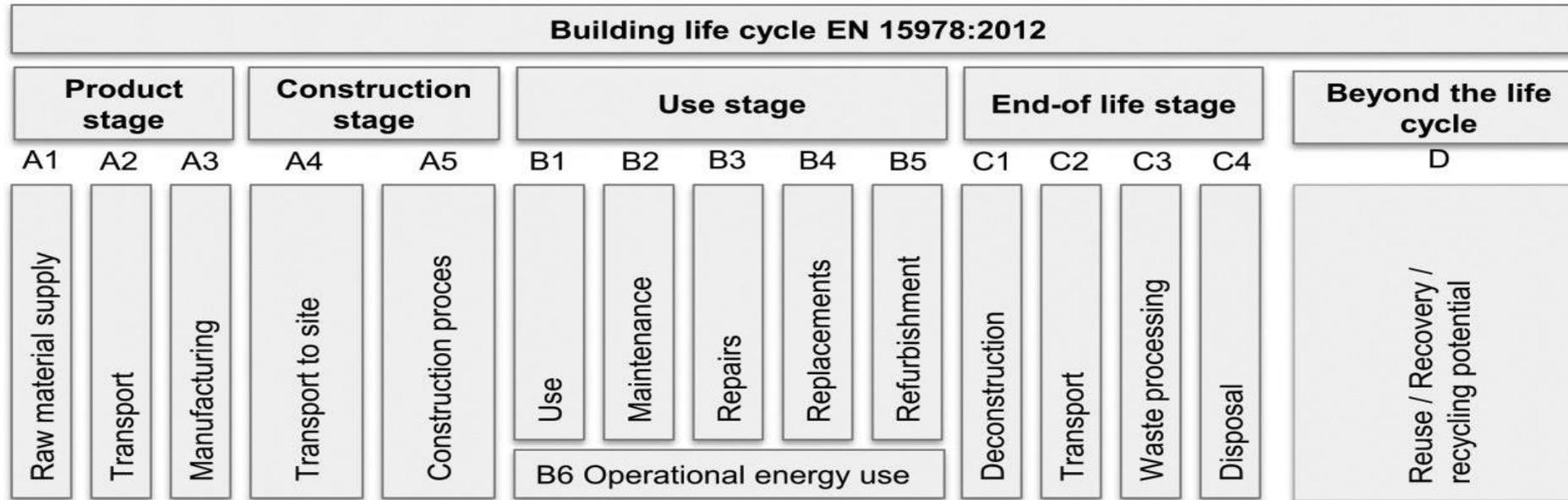
Note:

This report is written in conjunction with and funded by the HOME for the future project (LIFE20/GIE/NL/001073).

FSC Netherlands and FSC Denmark are working on an ambitious initiative to increase the amount of wood from sustainably managed forests in social housing. HOME for the future is part of the EU LIFE programme. FSC collaborates with Centrum Hout, Lister Buildings, TBI Woonlab, TU Delft and VIA University College. The initiative is co-funded by the Precious Forests Foundation.

The project encompasses a variety of activities: improve the position of wood as a building material in legislation, increase the knowledge about building with wood in the construction sector, produce life cycle assessments (LCAs) and product cards (EPDs) that are added to the National Environmental Database. Furthermore, we develop tools to better map the costs and climate benefits of building with timber.

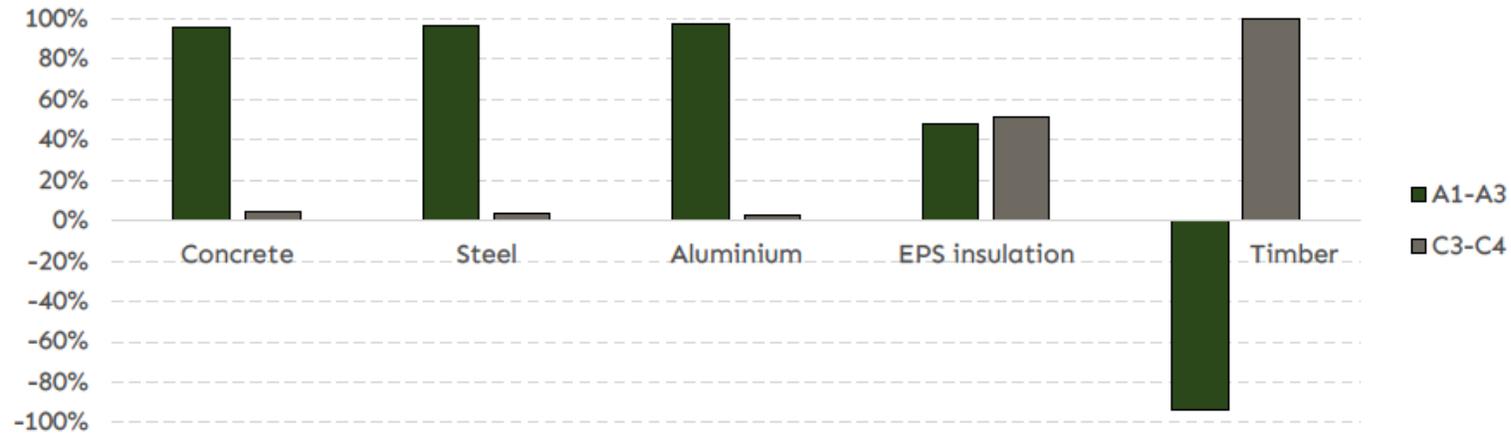
LCA calculation method



Life cycle of a building, EN 15978:2012

An LCA for a building includes materials and energy use from the whole life cycle of the building for different life stages. The phases and modules of a full life cycle is described by the European Standard EN 15978:2012 and is shown above. The life cycle includes the stages Product, Construction, Use and End-of-life. Each stage is divided into several modules such as extraction of raw materials, transportation, fabrication, operational use, maintenance, replacements, waste treatment and disposal. The duration of the life cycle is called the reference study period (RSP) and is typically 50 years. Most LCA-methods (BR18, DGNB, Level(s), etc.) includes only a selection of the modules and evaluate the environmental impact as the sum of the included stages/phases but does typically not look at when the environmental impact occurs.

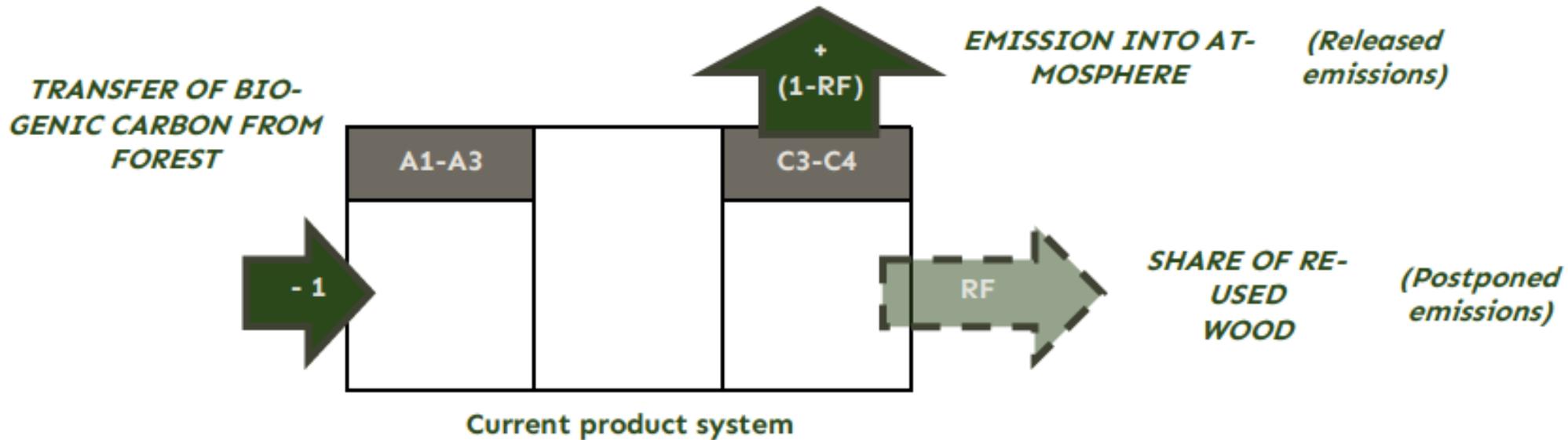
Distribution of climate impact for different materials



Minimize upfront CO₂ emissions without overspending materials

The timing of climate impact between production (A1-A3) and end-of-life (C3-C4) for different types of materials are shown above. The figure is showing the relative climate impact but not the actual level of climate impact of the material types. The flux of biogenic carbon according to EN 16485 is shown in Figure 3. With these figures in mind, wood and other biogenic materials is the only material type that may be considered with a negative contribution at the start of a life cycle and will remain so until end-of-life. Wood-based materials can therefore be considered as a carbon sink (if timber products originate from managed and certified forestry) until the building or building material is disassembled and disposed of, and it is interesting to investigate at what time during its lifetime a building is net positive in terms of CO₂ emissions.

Method #1 – Re-use



The biogenic carbon “balance” used for Method 1

The stored biogenic carbon is only partially released ($100\% - RF$) and the biogenic carbon of the re-used parts is postponed and disregarded in the calculation of the building’s climate impact during the lifecycle. In this method the contribution from wood-based materials to the climate emissions is typically net-negative for a Re-use factor above 20%.

The LCA method Method 1 – Re-use is used to estimate the climate impact including the construction stage and the potential reductions in climate impact connected to the re-reuse of timber-based building materials beyond the lifecycle reference period. This method does not comply with the standardized requirement of biogenic carbon balance for a product system according to EN 15978 and EN 16485. Despite of this, the analysis is still valid in terms of estimating when and if a building has building net-positive climate impact connected to re-use of wood-based materials.

Method #1 + #2 – Dual-LCA calculation

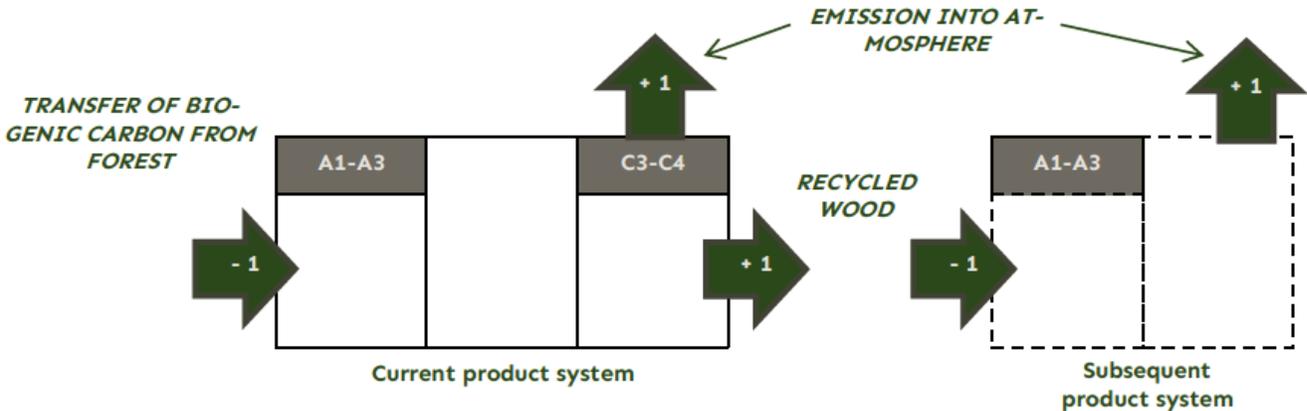


Figure 3 Biogenic carbon balance where carbon neutrality may be assumed (EN 16485, Figure 1)

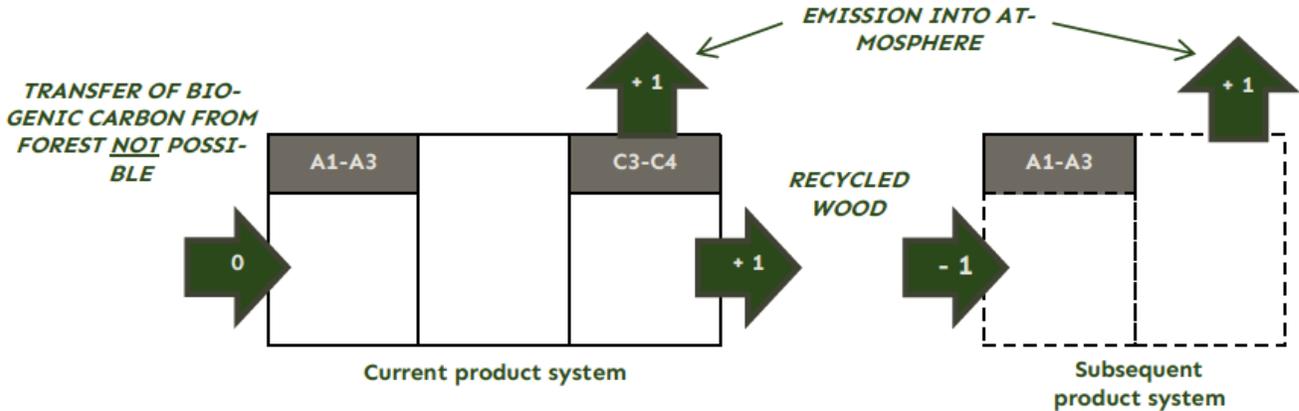
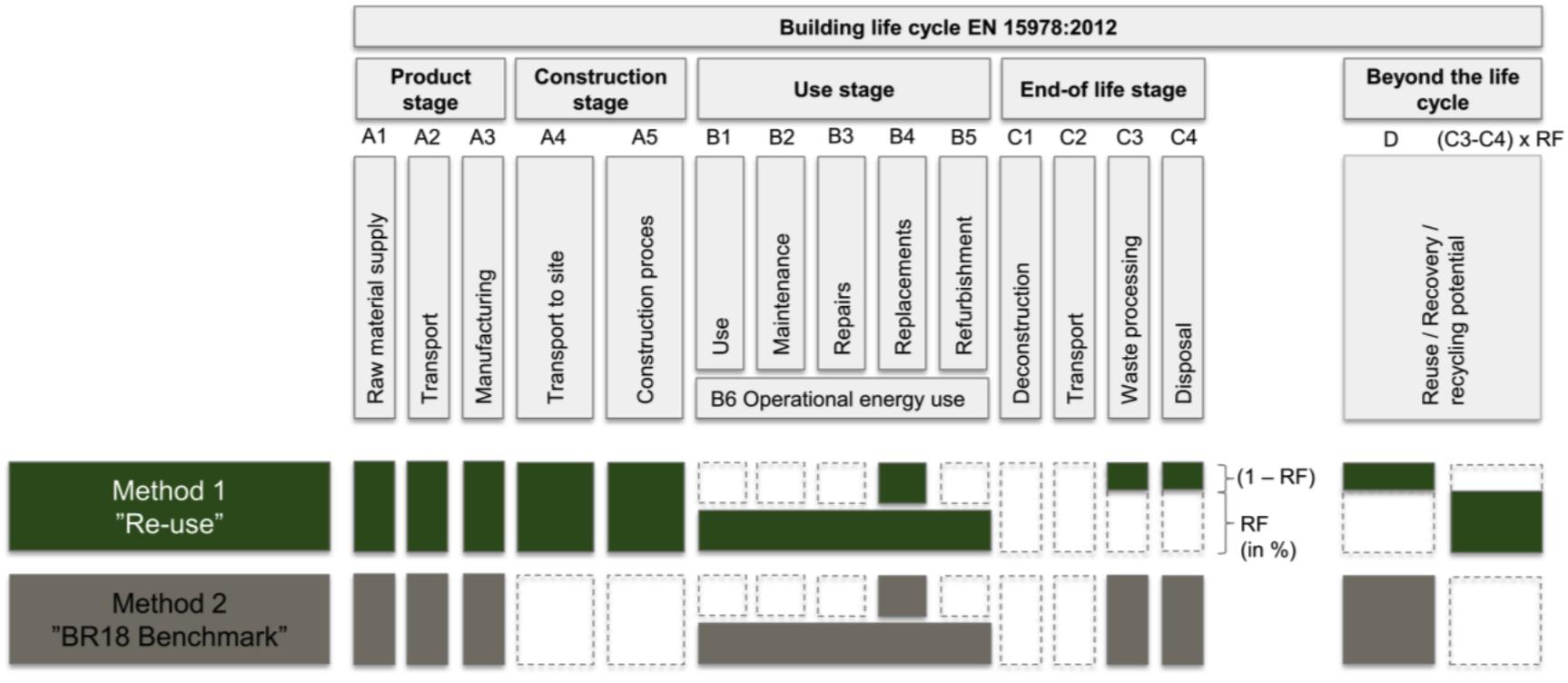


Figure 4 Biogenic carbon balance where carbon neutrality may not be assumed (EN 16485, Figure 2)

The biogenic carbon “balance” used for Method 1
 Ideally a LCA method should be used with the purpose to reduce material use, reduce up-front carbon emissions, and reduce carbon emissions for the whole life cycle of a building. A method that includes the positive effect of postponing climate emissions from biogenic carbon will have an improved result when the quantity of biogenic materials is increased. To reduce the risk of using an excessive number of materials, a second method must be used to control material consumption as well. In this report two LCA methods are used and combined as the Dual LCA method.

Dual LCA Method overview



The included lifecycle modules in the two LCA methods are shown in this figure.

Method 1: The Re-use factor (RF) used for end-of-life emissions from wood-based materials.

Method 2: LCA calculations using Danish building regulations LCA / BR18 benchmark.

When can carbon neutrality be assumed?

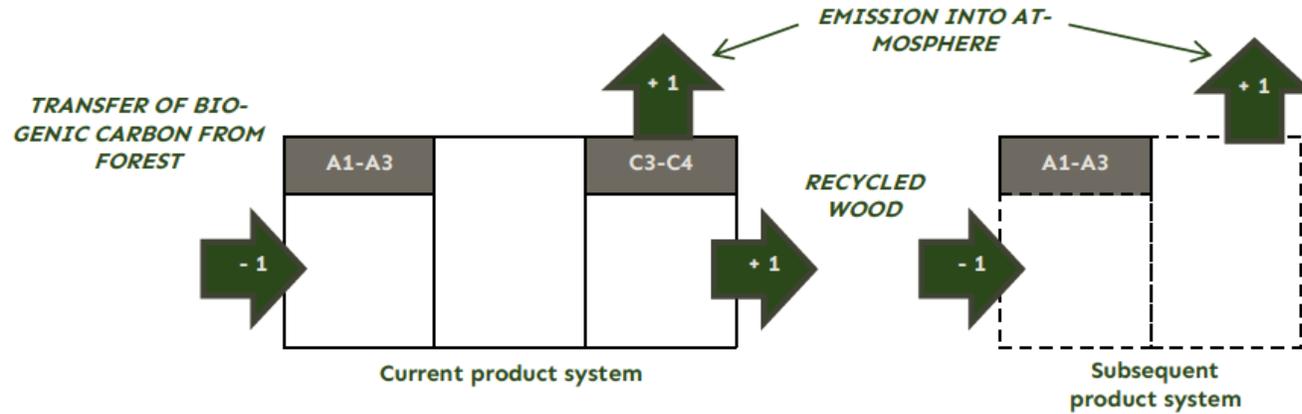


Figure 3 Biogenic carbon balance where carbon neutrality may be assumed (EN 16485, Figure 1)

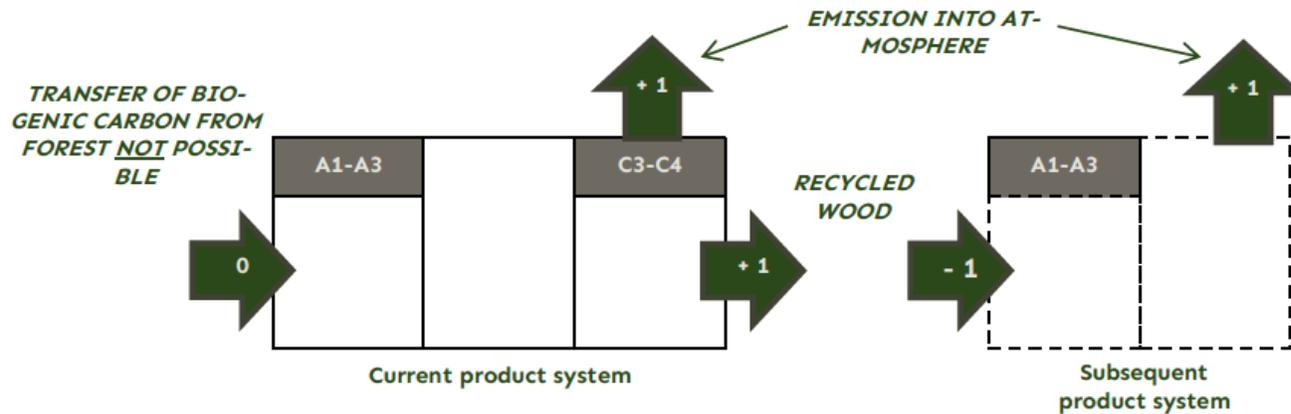


Figure 4 Biogenic carbon balance where carbon neutrality may not be assumed (EN 16485, Figure 2)

The biogenic carbon “balance”

To test the impact of sustainable forestry an addition to the Danish BR18 benchmark LCA was calculated to investigate what the results would be if the wood-based materials in the projects did not originate from a sustainably managed forestry scheme (i.e. not FSC-, PEFC-certified).

In this case the biogenic carbon sequestered during growth of the trees may not be considered as a negative contribution in the product stage but should still be released at end-of-life. In the extreme case this leads to considerable increase of CO₂e-emissions at +4,5-5,7 kg CO₂e/m²/yr. With this addition two of the case projects would go from a climate impact in the lower end of the scale to a level where they would not comply with the limit value for new buildings in Denmark at 12 kg CO₂e/m²/yr.

In other words:

Sequestered biogenic carbon can be included as a negative contribution if the wood comes from sustainably managed forestry.

So if the wood is not from a sustainably managed forest, the sequestered biogenic carbon cannot be counted as a negative contribution — meaning that only wood sourced from responsibly managed forestry can be credited with reducing the overall carbon footprint in the LCA calculations (BR18 + EN16485)



LIFE20/GIE/NL/001073

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