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SUSTAINABILITY 26 September 2025 | 6 min read

The ecological footprint of building your home: why a timber house can store more CO_2 than it emits

A home's carbon footprint is decided at two moments: when it is built and every year it is lived in. We analyse both with data and show why a sustainable house can end up fixing more CO_2 than it generates.

The carbon footprint, also called the ecological footprint, is, according to the Optimot, the total amount of greenhouse gas emissions associated with the life cycle of a person, a product, a service or an organisation. It is an indicator that translates the environmental impact of what we manufacture, consume or inhabit into a single figure.

The concept emerged in the early 2000s, promoted by the oil company BP. At first it drew criticism, because some read the term as a strategy by polluting companies to shift responsibility onto citizens and to build the narrative that pollution is everyone's responsibility in equal measure. Either way, the concept is now firmly established: certifications and standards exist to measure and control it across the manufacture of products and services in every sector.

In construction, this value allows the impact of building a house to be assessed from two different angles:

- The impact of building the house.
- The impact of living in that house each year.

The ecological footprint of building your home

The first coefficient defines the pollution associated with the act of building the home itself. Many factors enter the calculation, such as machinery, transport and site processes, but the most decisive one relates to the materials used.

Some materials carry a very high carbon footprint. Among the structural ones, concrete stands out, with 215 kg of CO_2 eq for every m^3 produced. Aluminium and glass are other common materials with a high environmental cost.

In the article The CO_2 pyramid we set out the most polluting materials and the full list of their footprints. Structural timber, by contrast, absorbs 680 kg of CO_2 eq for every m^3 produced during its growth and manufacturing process. In other words, timber has an ecological footprint of -680 kg of CO_2 eq per m^3, a negative footprint that sits 895 kg of CO_2 eq/m^3 below that of concrete.

It is worth putting concrete figures to this. A house of around 150 m^2 built to traditional criteria can involve, from its concrete structure alone, the emission of more than 50 tonnes of CO_2 eq (roughly 250 m^3 of concrete at 215 kg/m^3). That amount is equivalent, approximately, to the emissions of a car driven for fifty years.

If that same house is raised using sustainable construction criteria, with natural materials such as certified timber, the result changes dramatically. For a home of these dimensions, around 80-100 m^3 of structural timber may be used, fixing and storing more than 60 tonnes of CO_2 eq. Building the house not only stops emitting, it becomes a carbon reservoir. By the time it is finished, the house has already made a positive contribution to the planet.

Building a sustainable house or an Eskimohaus represents a paradigm shift compared with conventional construction. Using natural materials with a negative carbon footprint greatly reduces the ecological footprint of the works, to the point where it can become negative: the construction itself fixes more pollution than it generates. This effect, which may come as a surprise, was explained in detail in our article CO_2 reduction, published in late 2024. Timber construction work is the starting point of this balance.

The ecological footprint of comfort in your home

The second coefficient measures the carbon footprint of maintaining the home's comfort conditions year after year. A sustainable house that barely needs energy to guarantee interior comfort will have a very small associated footprint compared with a traditional house.

This factor is decisive because the useful life of a home is counted in decades or centuries, so the accumulated impact of comfort becomes very large over time. Climate control is today the largest single consumption in the homes of our country, representing between 40 % and 60 % of energy use. A sustainable house achieves a reduction of around 70 % in the consumption and pollution associated with maintaining the interior temperature.

The long-term comparison is revealing. According to the IDAE, a conventional house consumes on average around 8,000 kWh a year for climate control and electricity, which amounts to around 2.5 tonnes of CO_2 eq each year. Over a fifty-year period, the figure rises to 125 tonnes of CO_2 eq.

A sustainable, passive or Eskimohaus house reduces that energy consumption by between 70 % and 90 %. Instead of 8,000 kWh a year, it needs around 2,000. The difference is considerable: over fifty years it saves around 100 tonnes of CO_2 eq, the equivalent of planting more than 5,000 trees.

Sustainable houses, a legacy of great value

When the two factors are combined, the footprint associated with construction and the footprint associated with use, the overall balance is clear. Not only are emissions avoided, they are actively reversed. Every house built to these criteria removes CO_2 from the atmosphere and prevents future emissions, becoming part of the solution to climate change.

These figures have a very concrete everyday translation:

- Living in a sustainable house can mean paying up to 80 % less on energy bills each month.
- It brings a healthy environment, with quality air, stable temperature and natural thermal comfort.
- It cares for the planet and contributes to a habitable future, in the direct and indirect environment, in the present and the future.

Building consciously is not only a profitable option: it is an opportunity. A house can be much more than a place to live, it can be a positive mark on the world.

> A well-conceived house stops being a source of emissions and becomes a carbon store and a saving that renews itself every year of its useful life.

Calculation based on the paper **Carbon Impacts of Engineered Wood Products in Construction**, by Hongmei Gu, Prakash Nepal, Matthew Arvanitis and Delton Alderman (DOI: 10.5772/intechopen.99193).