

CARBON DIOXIDE BALANCE OF WOODEN STRUCTURES: CIRCULAR ECONOMY IN THE ECOLOGICAL BUILDING INDUSTRY

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• INTRODUCTION

Sustainability is now a key concept in development thinking at all levels. One of the most polluting sectors of our time is the building sectors. Buildings are responsible for significant material and energy consumption in industrial societies. This sector increases the production of toxic emission that contaminate our water, soil and air in massive and radical way. The purpose of this study is to show how the use of wood in construction is an effective way of reducing greenhouse emissions. In fact, one tonne of carbon is absorbed for every cubic meter of wood; this is possible only through new methods, for example reducing the CO₂ emissions produced by the building sector by transforming the way buildings are designed and built. Increasing the use of wood material in construction is a potential option for reducing net CO₂ emission because of the relatively low energy needed to manufacture wood products compared with alternative materials, the storage of carbon in wood building materials, and the increased availability of biofuels from wood by products.

• EXPERIMENTAL

The company studied is a family company called "Prefabbricati di Martelli" located in southern Italy, in eastern Sicily. "Prefabbricati di Martelli" is a company leader in the construction of wooden structures and buildings, which follows the green building principles. A 2000m² factory, a 5000 m² handling and storage area, a CNC system of the last generation, CAD design tools, a certainly confident know-how, a group of competent and up to-date worker, qualified suppliers, expert planners and a series of measures of control able to guarantee the quality of the project answers, make Prefabbricati Martelli a reference point in the sector. The company is specialised in the construction of wooden structures, both in the private and in the public sector. It offers services of advice and design, realises buildings in wood able to guarantee comfort and change the concept of living, putting environmental and social sustainability in the first place. The wood the company uses is sourced from sustainably managed forests.

Company's intervention are represented in these tables:

N° expected light bulbs	Specific Unit Net savings [10 ⁻³ tep/year]	Total Net Specific Savings [10 ⁻³ tep/year]	Equivalent overall CO ₂ Reduction [10 ⁻³ tons/year]
50	4,712	235,6	589

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Cooling capacity kW _f	Province group 3 [10 ⁻³ tep/year/kW _f]	Total net specific saving [10 ⁻³ tep/year]	Overall equivalent of CO ₂ reduction [10 ⁻³ tons/year]
12	3,8	45,6	114

• MATERIAL AND METHODS

To value the impact of the materials used in the sector of the buildings, it is possible to adopt tools such as Carbon Footprint: a measure that expresses in CO₂ equivalent the total of the emissions of greenhouse gases associated with a product, an organisation or a service. Typically, a carbon footprint is calculated by estimating, as already stated, not just the CO₂ emissions that the activity causes, but also any missions of other greenhouse gases (such as methane and Nitrous oxide) and in some cases other types of climate impacts as well, such as vapour trails from aeroplanes. For simplicity, all these impacts are added together and expressed as a single number in terms of carbon dioxide equivalent (CO₂e): the amount of CO₂ that would create the Same amount of warming. In accordance with the Protocol of Kyoto, a carbon footprint considers all six greenhouse gases: Carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (N₂O), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Sulphur hexafluoride (SF₆).

• CONCLUSIONS

Our analysis confirms the results from previous studies that for current conditions wood framed buildings will emit less CO₂ during their life cycle than concrete buildings. The choice of buildings materials influences the production energy, and the wood-framed building required less energy than the functionally identical concrete and steel framed building. Our results showed that wood-framed constructions use low energy. This study suggests that a net reduction of CO₂ emission can be obtained by increasing the proportion of wood-based materials used in building construction, instead of other materials. Certainly, the company could do more to reduce CO₂ emissions in comparison to the buildings object of other studies, but it is not so far from the standards. An important topic for future is to understand the importance of the use of wood in buildings to minimize net CO₂ emission.