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Sustainable Wooden Construction

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Agenda 2030

- In 2015, countries adopted the 2030 Agenda for Sustainable Development and its **17 Sustainable Development Goals**.
- In 2016, the **Paris Agreement** on climate change entered into force, addressing the need to limit the rise of global temperatures.

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Source: United Nations. (2015). *Sustainable development goals*. https://www.un.org/development/desa/en/news/sustainable/sustainable-development-goals.html

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Sustainability dimensions

Source: Quora. https://www.quora.com/How-is-sustainable-development-related-to-pollution-and-the-economy

Source: United Nations. (2015). *Sustainable development goals*. https://www.un.org/development/desa/en/news/sustainable/sustainable-development-goals.html

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European Green Deal

The **European Green Deal** will transform the EU into a modern, resource-efficient and competitive economy, ensuring:

- no net emissions of greenhouse gases by 2050
- economic growth decoupled from resource use
- no person and no place left behind.

Source: European Commission. (2019). A European Green Deal. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en

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- The EU's objective, set out in its "Roadmap for moving to a competitive low-carbon economy in 2050", is to reduce emissions by 80–95% on 1990 levels by 2050.

EU 2020 and 2030 Climate and Energy Framework

	GHG EMISSIONS	RENEWABLE ENERGY	ENERGY EFFI-CIENCY	INTER-CONNECTION	CLIMATE FUNDS IN EU-PROGRAMMES	CO_2 FROM:
2020	-20%	20%	20%	10%	2014-2020 20%	
2030	≤ -40%	≥ 32%	≥ 32.5%	15%	2021-2022 25%	Cars -37.5%

"One effective way to improve the atmospheric carbon balance is to use a greater proportion of wood products in place of fossil-based and high embodied energy products, to use wood products with a longer useful life and to increase recycling".

Source: Jeffree, M. (Ed.). (2019). *Wood. Building bioeconomy*. CIB.

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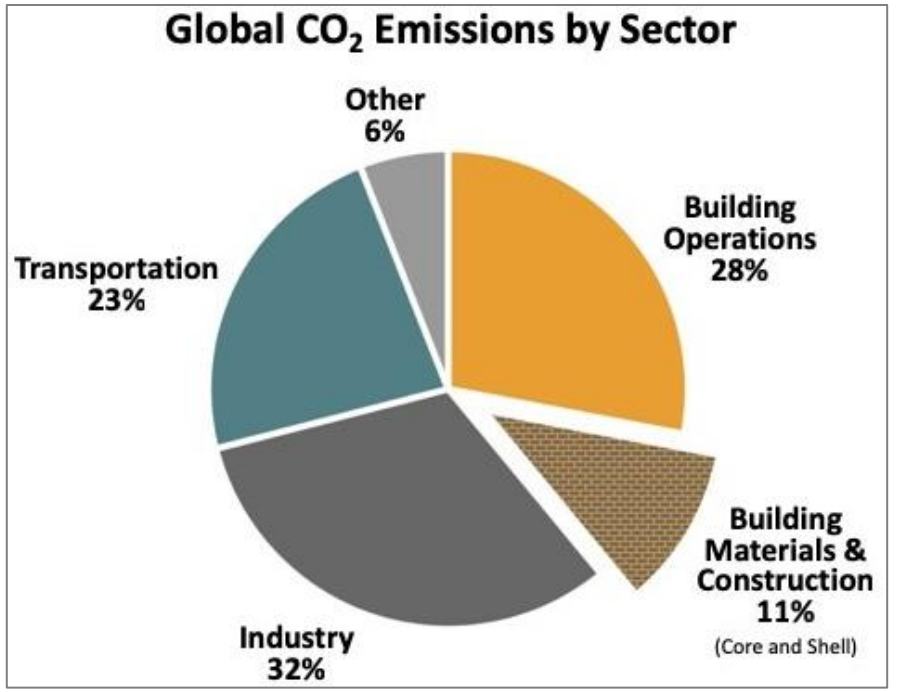
Facts about construction

- The built environment has a significant impact on many sectors of the economy, on local jobs and quality of life.
- Built environment accounts for about **50%** of all extracted material.
- The construction sector produces over **35%** of the EU's total waste generation.
- GHG emissions from material extraction, manufacturing of construction products, as well as construction and renovation of buildings are estimated at **5–12%** of total national GHG emissions.
- **Greater material efficiency could save 80% of those emissions.**



Source: Global Alliance for Buildings and Construction (2018)

Source: European Commission. (2022). *Buildings and construction*. https://single-market-economy.ec.europa.eu/industry/sustainability/buildings-and-construction_en#:~:text=The%20built%20environment%20has%20a,the%20EU's%20total%20waste%20generation

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“As a renewable resource with proven low embodied energy, wood is both an environmentally responsible and a highly practical choice as a construction material” (Coulson, 2014).

Mjøsa Tower, Brumunddal, Norway

Source: Voll Arkitekter (2019)

Brock Commons Tallwood House, Vancouver, Canada

Source: Arch Daily (2022)

HoHo Wien, Austria

Source: SIGA (2022)

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Construction with timber = Sustainable construction?

Metropol Parasol, Seville, Spain

Source: Besista. https://besista.com/en/category/timber-construction/

Source: Quora. https://www.quora.com/How-is-sustainable-development-related-to-pollution-and-the-economy

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Environmental perspective

- Natural, environmentally friendly, ecological
- Carbon neutral
- Renewable, reusable, recyclable
- Non-toxic
- Durable
- Green
- **Locally sourced**
- Sustainable

Source: Wood and Sustainable Building © FWPA 2011

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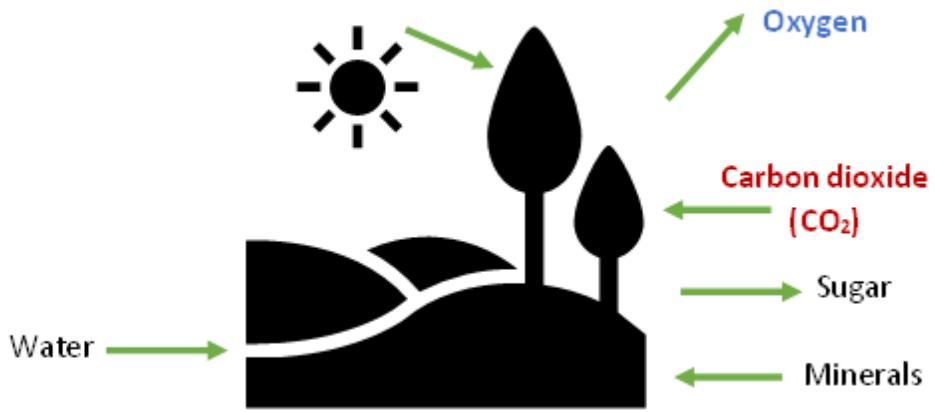
- Each 1 m^3 of wood grown by a tree holds 0.9 tonnes of CO_2 'sequestered' from the atmosphere (European Commission, 2018).
- The total so-called 'biogenic' carbon stored in the forests of Europe is estimated at almost 13 billion tonnes. This total is growing at 167 million tonnes per annum.



Photosynthesis process

Source: Jeffree, M. (Ed.). (2019). *Wood. Building bioeconomy*. CIB.

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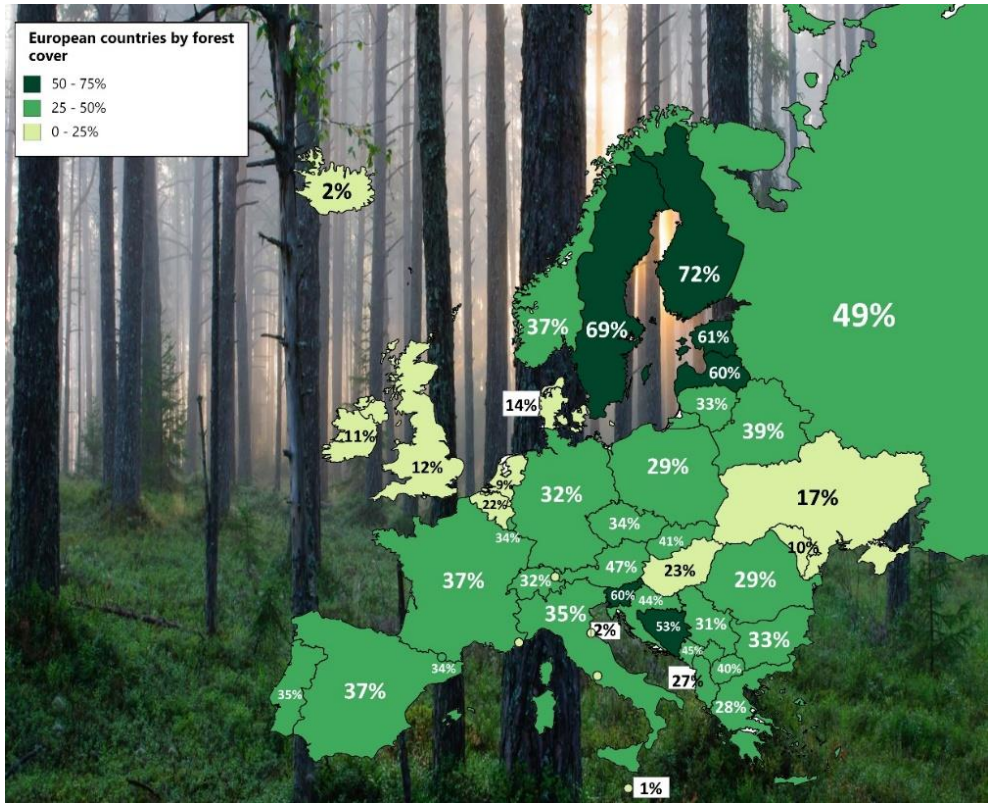
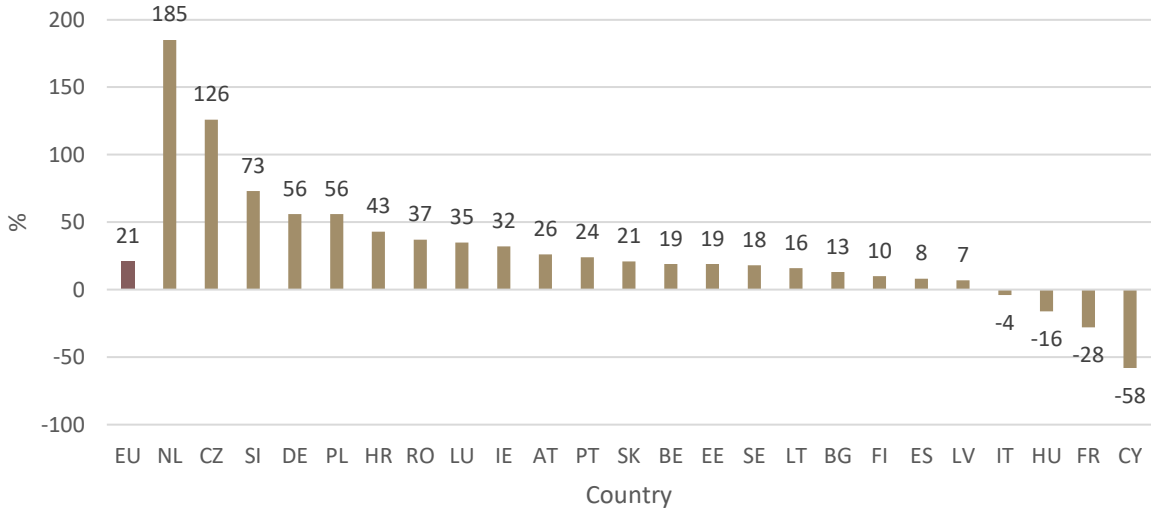
Forest resources



Forest map of Europe, based on CIA World Factbook 2011 (Wikimedia Commons)



Change of roundwood production in the EU, 2000–2020

Source: Eurostat (2022)

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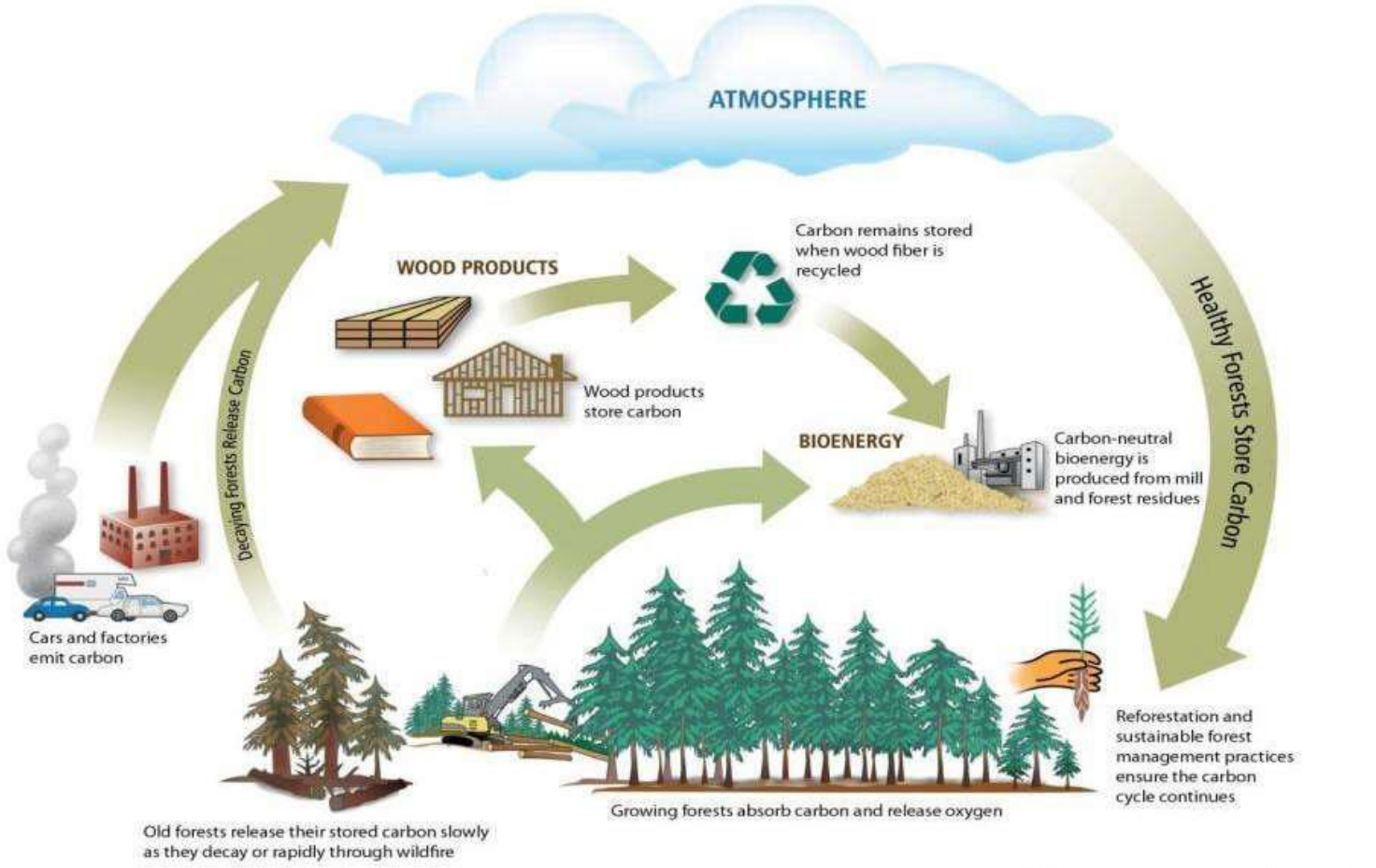
Sustainable Forestry Carbon Cycle



Adapted from California Forest Products Commission

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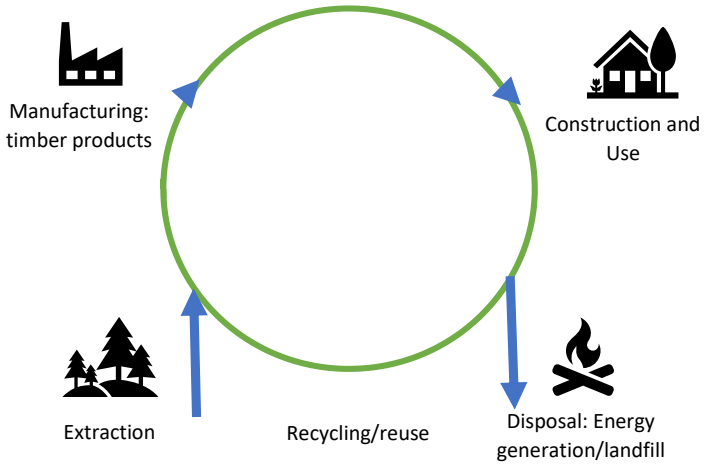
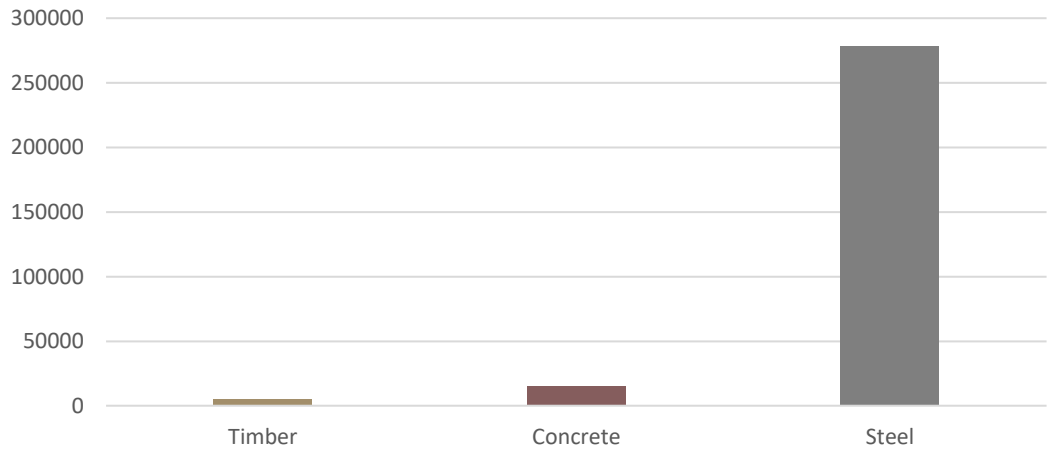
Embodied energy

- **Embodied energy:** all the energy that is required to produce a material or product, including harvesting, mining, manufacturing and transport.



Timber life cycle



Embodied Energy in Construction Materials, MJ/ m^3

Source: Timber Queensland (2022)

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Carbon footprint

- **Carbon footprint** is the total amount of greenhouse gases (GHG) (including carbon dioxide and methane) that are generated by our actions.
- On an individual building level, **>90% of GHG emissions** can be saved for manufacturing and construction when using wood as the main construction material without considering the CO_2 -storage effect of wood (European Commission, Directorate-General for Energy, 2011).

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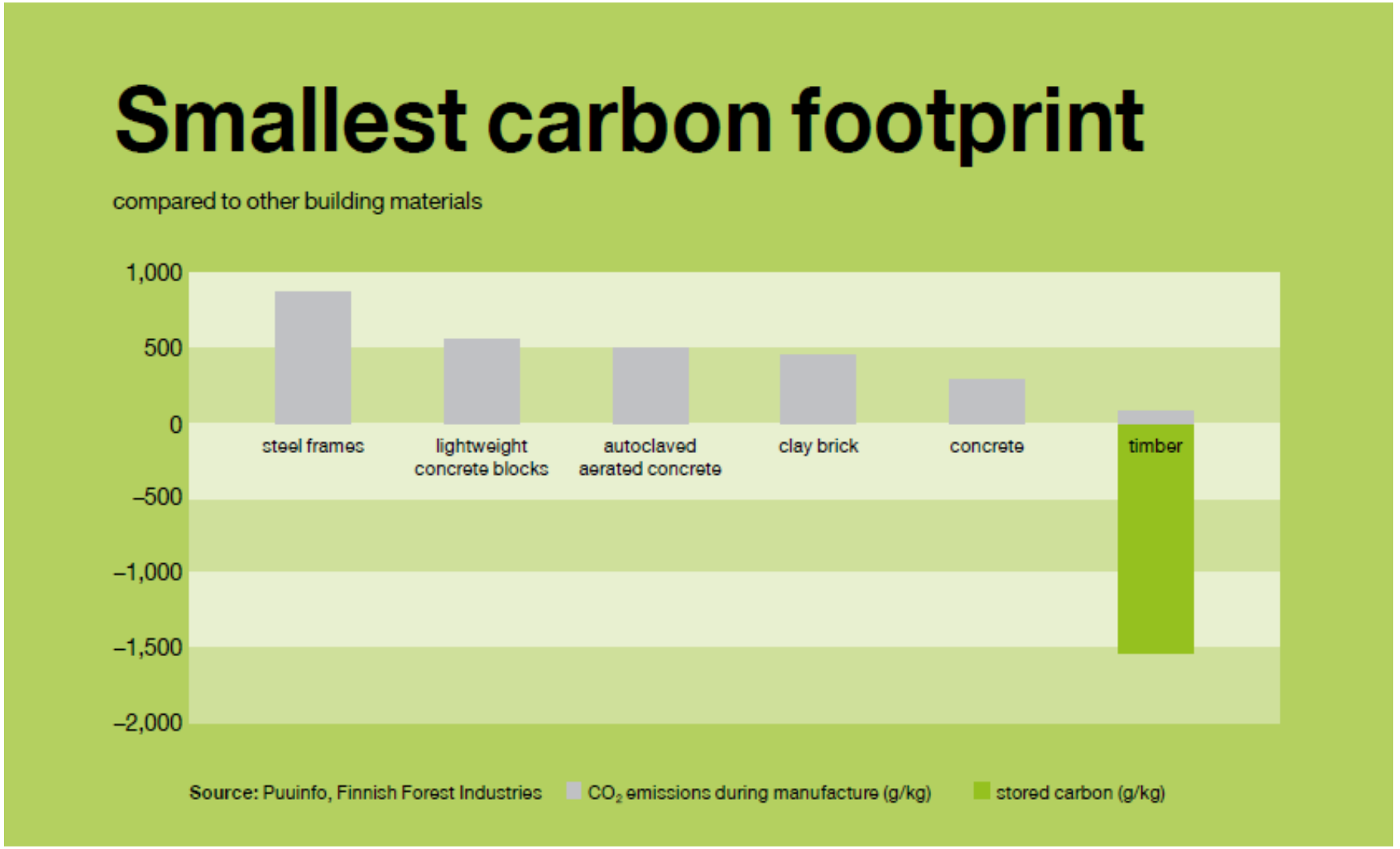

Source: Stora Enso (2019)

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Source: https://derfritz.at/arbeiten/hoho-wien/

- **The carbon saving figures can be substantial.**
- For instance, the 3,600 m^3 of Austrian spruce glulam beams and cross laminated timber panels used in the world's new tallest wood building, the HoHo complex in Vienna, gave a CO_2 saving of 2,800 tonnes compared to an equivalent structure in in steel and concrete.

Source: Jeffree, M. (Ed.). (2019). *Wood. Building bioeconomy*. CIB.

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Other examples

- The city of Helsinki built four similar 5-storey apartment blocks, two in wood, two with concrete. The production of materials used in the timber buildings had a **74% lower carbon footprint**.
- In the Netherlands it was calculated that scaling up the building sector with 10.000 timber (frame) houses could alleviate 10% of the total CO2 emission produced by the building sector, and in a scenario with maximum wood use (including all window frames, doors, roofs, cladding etc.) this could reduce up to 42% (W/E, 2016).

Source: Jeffree, M. (Ed.). (2019). *Wood. Building bioeconomy*. CIB.

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Social perspective

- Public acceptance and appreciation
- Aesthetically pleasing design

Source: Housing.com. https://housing.com/news/fascinating-ways-to-embrace-wood-interior-designs-in-home/

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Well-being benefits

- “Much like indoor plants and green façades, timber itself represents a close link to trees and nature, whether used as cladding on the outside of a building, exposed as structure or finishes inside a building, or used for fittings, furniture or equipment”.
- The well-being benefits of wood in living and working environments have been demonstrated in numerous research studies.

Source: Arup. (2019). *Rethinking Timber Buildings. Seven perspectives on the use of timber in building design and construction.*

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Source:
https://commons.wikimedia.org/wiki/File:Branches_of_a_Tamarind_tree.jpg

- Research points to increased positive feelings and decreased stress, implying reduced risks from depression and impaired immune system functioning, and improved long-term health (Nyrud & Bringslimark, (2010).
- "Just being able to see a tree through a window can be enough to improve hospital post-operative outcomes".

Source: Arup. (2019). *Rethinking Timber Buildings. Seven perspectives on the use of timber in building design and construction.*

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- A Canadian study measured responses of 119 subjects carrying out stress-inducing tasks in an office devoid of wood surfaces, and one featuring wood.
- Observations were based on measurement of pulse rate and skin conductance.
- The study concluded that **wood provides stress-reducing effects** similar to the effect of exposure to nature, well-studied in the field of environmental psychology.

Source: Arup. (2019). *Rethinking Timber Buildings. Seven perspectives on the use of timber in building design and construction.*

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Egglham primary school (Germany)

- Studies have shown that compared to standard classrooms, timber classrooms give pupils a greater ability to concentrate and help to reduce stress and tension.

Source: Stora Enso (2019)

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Economic perspective

- Lower material costs, if locally sourced
- Faster construction, especially due to prefabrication
- Reduced foundation

Modular timber construction

Source: Blumer Lehmann. (2019). *Modular timber construction.* https://www.lehmann-gruppe.ch/en/timber-construction/modular-construction.html

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Conclusion: Building with timber contributes to sustainable construction

Metropol Parasol, Seville, Spain

Source: Besista. https://besista.com/en/category/timber-construction/

Source: Quora. https://www.quora.com/How-is-sustainable-development-related-to-pollution-and-the-economy

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