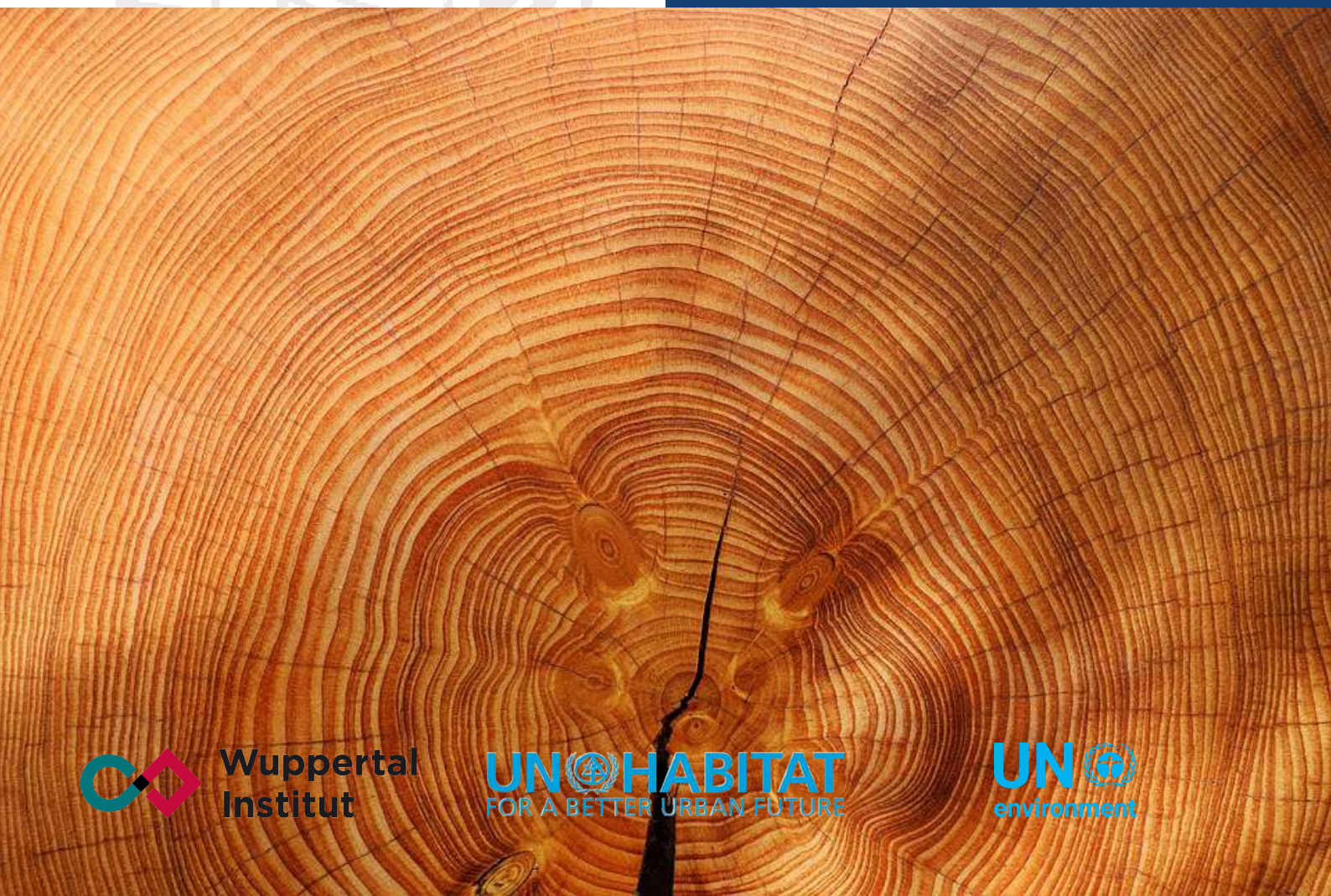
Urban Pathways

FACTSHEET on
Wood as
a building material
2018



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In brief

The building and construction sector is one of the main contributors to global GHG emissions. According to the IPCC's fifth assessment report, the building sector is responsible for 6.4% of direct and 12% of indirect GHG emissions (IPCC, 2014). This is mostly due to embodied energy in concrete and steel, i.e. the energy that was used for the production of these materials. If energy consumption for heating and hot water is also considered buildings even consume approximately 40% of the total energy used and contribute roughly 30% of total GHG emissions. Another pressing issue is the diminishing availability of abiotic building materials such as sand or gravel in many regions with high building activities. Moreover, building and construction waste is one of the heaviest and most voluminous waste streams.

Substitution of carbon-intensive cement and steel in the construction sector with wood from sustainably managed forests can be an approach to tackle these issues. The use of wood as building material has a long tradition in many parts of the world. Due to its wide availability and affordability, wood was widely used as a building material before abiotic materials such as stone, brick, concrete and steel replaced it. Today, sophisticated wood constructions are rediscovered in many cities and even used for modern high-rise buildings. Governments and city administrations can support the use of timber in architecture.

Examples

Timber as a construction material is rediscovered in modern architecture. Since the past decade, the number of wooden buildings in urban areas is increasing along with the technological advances in construction techniques. E3, a multifamily residential building in Berlin built in 2008, was the first seven floor wooden building in Europe. While the frame and the shell are made of wood, the apartments are accessible via free-standing concrete staircase (Design Build, n.d.). More examples for wooden high-rise buildings are the 14 floor apartment complex Treet (The Tree) in Bergen, Norway, completed in 2015 (The Daily Scandinavian, 2017). The Mjøsa Tower in Brumunddal, Norway, with 18 floors and 80 meters height is planned to be completed in 2019 (Ingalls, 2017). Brock Commons Tallwood House, a student residence in Vancouver (Canada) with 18 floors and 53 meters height, was completed in 2017 (naturally:wood, 2017). After completion scheduled for 2018, the HoHo House in Vienna will be one of the tallest wooden buildings in the world with a height of 84 meters. In total it will contain 24 floors, with a hotel, conference rooms, restaurants, flats, and a fitness centre. The Japanese company Sumitomo Forestry announced plans to build a 70 floors 350m skyscraper that consists primarily out of wood by 2041. Beyond residential houses, timber can also be used for industrial, commercial, and public buildings and for structural frames of sport halls or road bridges.

Results

Fostering the use of timber in buildings can have many positive effects. The IPCC suggests that using wood from sustainably managed forests instead of concrete and steel reduces GHG emissions in most cases. Wood-based structures entail 10-20 % less embodied energy than concrete systems (IPCC, 2014, p. 694). Wooden houses are also long-term CO2 storages: for a cubic meter of wood, a tree converts one ton of CO2 and binds 250 to 300 kg of carbon, depending on the tree species.

Moreover, wood as a renewable resource may contribute to securing the availability of raw material. It is biodegradable and can be used in cascades after the building's demolition: first in the form of reuse or material recycling and ultimately for energy recovery. The use of locally sourced timber can strengthen regional value chains and thus contribute to sustainable regional development.

Limiting factors that need to be considered are the availability of sustainably sourced timber and potential land use changes such as the conversion of primary forests into forest plantations with negative impacts on indigenous populations or the state of ecosystems.

Technical considerations

While classical wooden residential buildings normally consist of massive wood, most modern multi-floor constructions use engineered wood products such as cross-laminated timber. These materials are much stronger and highly fire resistant. Together with prefabrication of components these materials reduce costs and construction time on-site.

The application of wood for construction activities critically depends on technical norms and standards for building materials. National and municipal building regulations that allow or prohibit the use of wood in specific applications (e.g. types of buildings, maximum number of floors etc.) often refer to such technical norms and standards.

Policy/legislation

The use of wood as building material can be encouraged through a range of measures. Several governments have already enacted regulations that encourage the use of wood in public buildings. New Zealand and Japan, for example, demand that wood or wood-based products are considered as main structural material for all public buildings up to a certain number of floors.

Municipal authorities can adapt building codes which in many cases still restrict the use of wood. As already mentioned above, technical norms and standards are regularly used as reference and thus play a critical role in this realm. Cities can also tie the granting of public land plots to specific conditions, such as a minimum content of wood in the construction or set up funding programmes to cover (parts of) additional costs for wooden buildings.

Other approaches are campaigns to create awareness among planners, architects, and house owners on the advantages of wooden buildings. Green building certification programmes such as LEED in the USA, DGNB in Germany and GRIHA in India can accentuate the advantages and enhance the positive awareness of wooden houses.

Institutions

National level: Relevant actors on the national level are ministries for infrastructures and buildings, ministries for natural resources (including forests and the environment) and ministries for regional development.

Local level: City level authorities such as city councils, planning institutions including the department for building regulations.
Other relevant actors comprise municipal and private housing companies, chambers of architects, construction companies, public and private banks that provide credits for house-owners, standardisation bodies (that facilitate the development of standards for building materials), forest owners or the timber industry.

Transferability

The uptake potential and the impact of an increased use of wood in buildings (in terms of sustainability) depend on a variety of factors. These include among others the local availability of sustainably sourced timber. Critical issues are the conservation of primary forests, impacts on biodiversity and indigenous land rights, the extent of construction activities and foreseeable scarcities of certain building materials.

Case study: Ecological model settlement, Prinz-Eugen-Park in Munich, Germany

Context

A former military area in Munich is transferred into an ecological model settlement - Prinz-Eugen-Park as the city of Munich is seeking to set a new benchmark in terms of climate protection and sustainable urban development (City of Munich, 2017). The aim of this conversion process is to provide 500 new apartments in plus-energy standard using wooden construction. The building typology comprises five to seven-floor apartments, four-floor town houses and one to three-floor atrium houses. Houses are built by municipal housing associations, building communities and two cooperatives. Construction works began in spring of 2017 and completion of the first apartments is planned for 2018.

In action

New buildings in the Prinz-Eugen-Park model settlement have to use some proportion of wood, and use at least 150kg of renewable material per m2 of living space. In order to maximise substitution of concrete and steel, the proportion of wood in the planned buildings was one award criterion for the allocation of properties among the building design applicants. Timber has to stem from sustainably managed forests and from within a radius of 400km around the construction site. The use of tropical timber is prohibited. In order to cover additional costs of wooden construction (compared to conventional buildings), the city provides a grant of up to 2 Euro per kg of renewable raw materials in buildings. The total budget for the municipal funding programme is 13.6 m Euros (Landeshauptstadt München, n.d.).

Results

The conversion of a former military site into a ecological model settlement is an example for a sustainable urban redevelopment. While it still is a lighthouse project and based on public funding, the

Ecological model settlement Prinz-Eugen-Park (Landeshauptstadt München, Referat für Stadtplanung und Bauordnung)

project proved that the large-scale use of wood in buildings is feasible and that cities can influence their resource consumption patterns through a combination of planning and neighbourhood development, regulation, and financial incentives. The City of Munich estimates that ca. 13.000 t of CO2 will be stored in the wooden components of the buildings. Wood construction method would mitigate 30-60% of GHG missions compared to the conventional construction.

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