The "HoHo" building in Vienna, Austria

Bioeconomy and wood construction in Austria

For many centuries building with wood was natural and almost self-evident in Austria. The first wooden houses which were made of vertical logs driven into the soil, date back to the Young Stone Age. Log houses have always been, and still are, the typical in rural areas, mainly in farmhouses. Since the beginning of the 20th century, wood has been gradually replaced as a construction material, but recently timber construction is being reinvigorated and becoming popular again.

Austria´s building sector has been implementing multi-layer wood-based construction houses since the mid-1990´s. In light of climate change adaptation, efforts towards energy efficiency have increased on a national level and have gained momentum via the Austrian climate protection initiative "klimaaktiv" that aims to introduce and promote climate friendly technologies and services. It is embedded in the federal climate strategy and fosters market transformation towards energy efficient products and services.

The klimaaktiv building standard is the guiding principle for environmental and energy-efficient design throughout Austria. Several buildings have been assessed via the klimaaktiv standard and allow for comparison along sustainability dimensions, bridging current state of knowledge, practical applications and the legal framework.

The case study

The Austrian Case Study builds upon a showcase project in Vienna, embedded in the lake city of Aspern (part of the 22nd district of the City of Vienna). The "HoHo" (i.e. Holzhochhaus in German) project is to become the world´s tallest wooden high-rise building in the world once it is finalized.

The designers and architects have taken different aspects into consideration:

- Ecological integrity
- Functionality
- Adaptability / flexibility
- Energy efficiency

'As a demonstration project to pinpoint what might be possible with the use of wood in high-rise buildings, the HoHo shall mark a cornerstone to foster increased material use of wood in the building and construction sector at European level (and inspire architects around the globe).

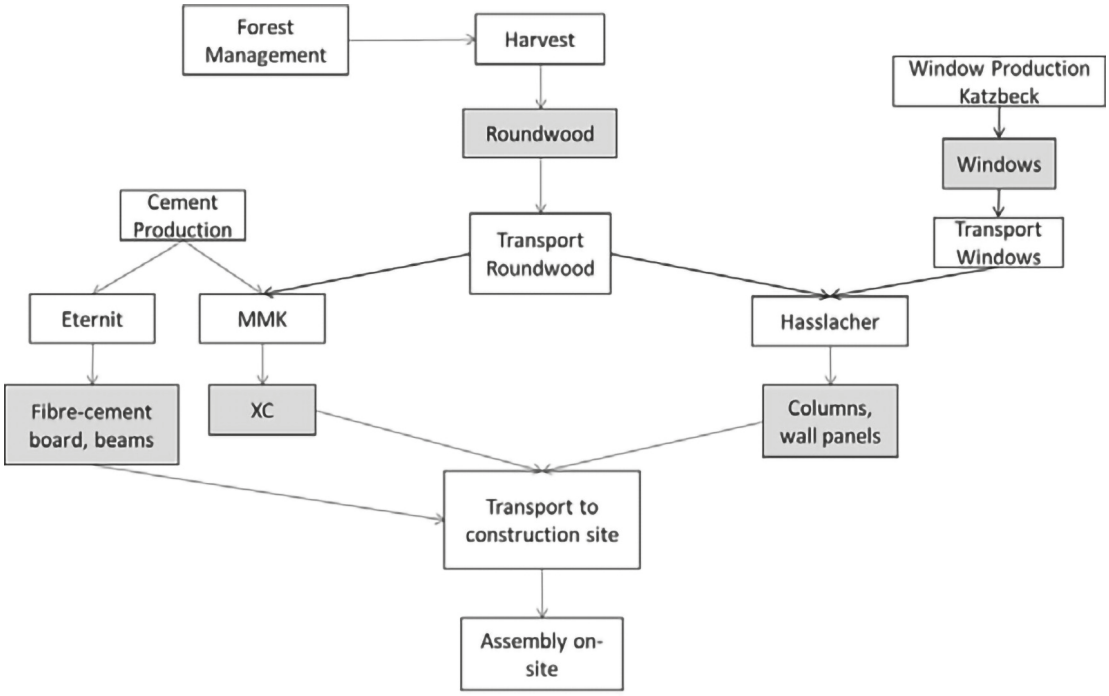
Roughly 3600 m^3 of wood are used in the entire construction, corresponding to 0.6 per mill of Austria's annual surplus timber production. Key to its implementation are innovative products and a high level of prefabrication.

The HoHo building, Vienna, Austria

Innovative design and materials used in the HoHo construction project in Vienna, Austria. Photos: Erich Reismann and CETUS Baudevelopment.

Results

According to the HoHo designers, the use of wood avoids around 2800 tons of CO_2 equivalents compared to reinforced concrete construction. In addition, the HoHo Vienna construction method saves some 300 000 megawatt hours of primary energy. A simplified model of the value chain is shown below.



Renewable and non-renewable building material value chains associated with the HoHo building construction.

Substitution factors

As part of the project, the wood content of the value chain was defined for all the processes of wooden and hybrid parts used. Validation of the results for the building level and the national level took place until the formal end of the project. Their publication is depending on the approval of the developers involved in the construction project.

Stakeholder interaction and results of discussions

Three larger interactive stakeholder workshops were organised during the project. In May 2017, during the "Wooden buildings – potentials and challenges for a European bio-economy", the participants, representing researchers and construction professionals,

i. shared insights from recent/current R&D projects,
ii. identified and highlighted good practice examples
iii. actively exchanged knowledge and know-how and
iv. intensified mutual as well as international collaboration.

The second workshop in May 2018 focused on national stakeholders, involving 15 stakeholders from research, wood industry, forest industry, pulp-and paper industry, the Austrian Chambers of Commerce and Agriculture, the Austrian national Environmental Agency (Umweltbundesamt), the wood promotion firms, the Austrian wood competence center WoodKplus and the Austrian Energy Agency. They discussed the state-of-the art of wood use for environmental friendly purposes and identified policy needs for Austria.

A third stakeholder workshop in October 2018. It followed up on the results from the first two ones, refined the results and asked the stakeholder groups for evaluation of policy measures.

Key finding from the workshops was that building with wood is a highly important measure for long lasting material use and substitution of other (fossile based) materials in the bioeconomy. Most importantly, the source of the wood shall be sustainable and the wood flows need to follow strict cascade requirements.

The stakeholders agreed on the following assumptions:

- **All life cycles** have to be chosen to be **large enough**, i.e. the products must be used as long as possible (foremost in the construction sector).
- In contrast to forestry (forest storage), the material use of wood and its contribution to the annual greenhouse gas balance is not directly taken into account in the **annual greenhouse gas reporting**, but only indirectly through industry reporting. When timber is used in wooden products, carbon is transferred the trees to the products. This means that the products work like the trees as a storage. Of course, from a climate perspective, this calculation only makes sense under the condition that logging takes place in the long-term sustainable way (meaning net take-off keeps the scale with growth and resilience and soil recovery is respected). The simplified assumption made formerly (before 2012, Osterburg et al. 2013), that the outflow of carbon from the forest (e.g. through logging) causes an immediate emission. It must not be made any longer.
- The **energetic use** of the renewable raw material wood, provided the sustainable supply, can replace fossil fuels. With a constant amount of wood, **increased use of material, such as in wooden construction, (discussion group B) of raw wood means less potential for energy use**.
- **European climate policy** (EU roadmap towards a low-Carbon economy), focuses in the construction sector, on the energy efficiency of the construction sector and slightly on ecological building materials as such. More specifically, with a focus on passive housing technology in new buildings refurbishing old buildings to improve energy efficiency, substituting electricity and renewables for fossil fuels in heating, cooling & cooking.

In result, building with wood is a measure with high importance for **long-lasting material use and substitution of other (fossil-based) materials** in the bioeconomy. Most importantly, the source of the wood shall be sustainable, and the wood flows need to follow strict cascading requirements.

National recommendations

- **Worldwide example for feasibility**: The case study HOHO building is a national and also international "light tower" project
- **Visibility inspires other projects:** the project with 24 floors makes the possibilities for wooden construction and design visible
- **Best practice in planning**: the case study has overcome a significant number of challenges throughout its planning and building phase and was relying on a consortium of investor firms as well as the support of the administration of the Vienna City Council
- **Hybridity appears to be the future of wooden multi storey buildings**: the future of wooden construction will result in hybrid buildings, these mix timber frame structures with concrete, steel and also aluminum as shown in the case study.

Contributors:
Bernhard Wolfslehner and Alice Ludvig (firstname.lastname@boku.ac.at)

The ERA-NET Sumforest is funded by the EUROPEAN UNION under Grant Agreemnet No. 606803