InnoRenew CoE

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Wood construction

Main challenges of Slovenia's biggest timber building - InnoRenew CoE

Iztok Šušteršič, PhD, BSc. Civ. Eng.

Research group leader of sustainable building with renewable materials - InnoRenew CoE

Assistant Professor - University of Primorska, Slovenia

Zoom, 17. 06. 2022

InnoRenew CoE – private not-for-profit research institute based in Izola, Slovenia.

Founded in 2017 by:

Fraunhofer WKI

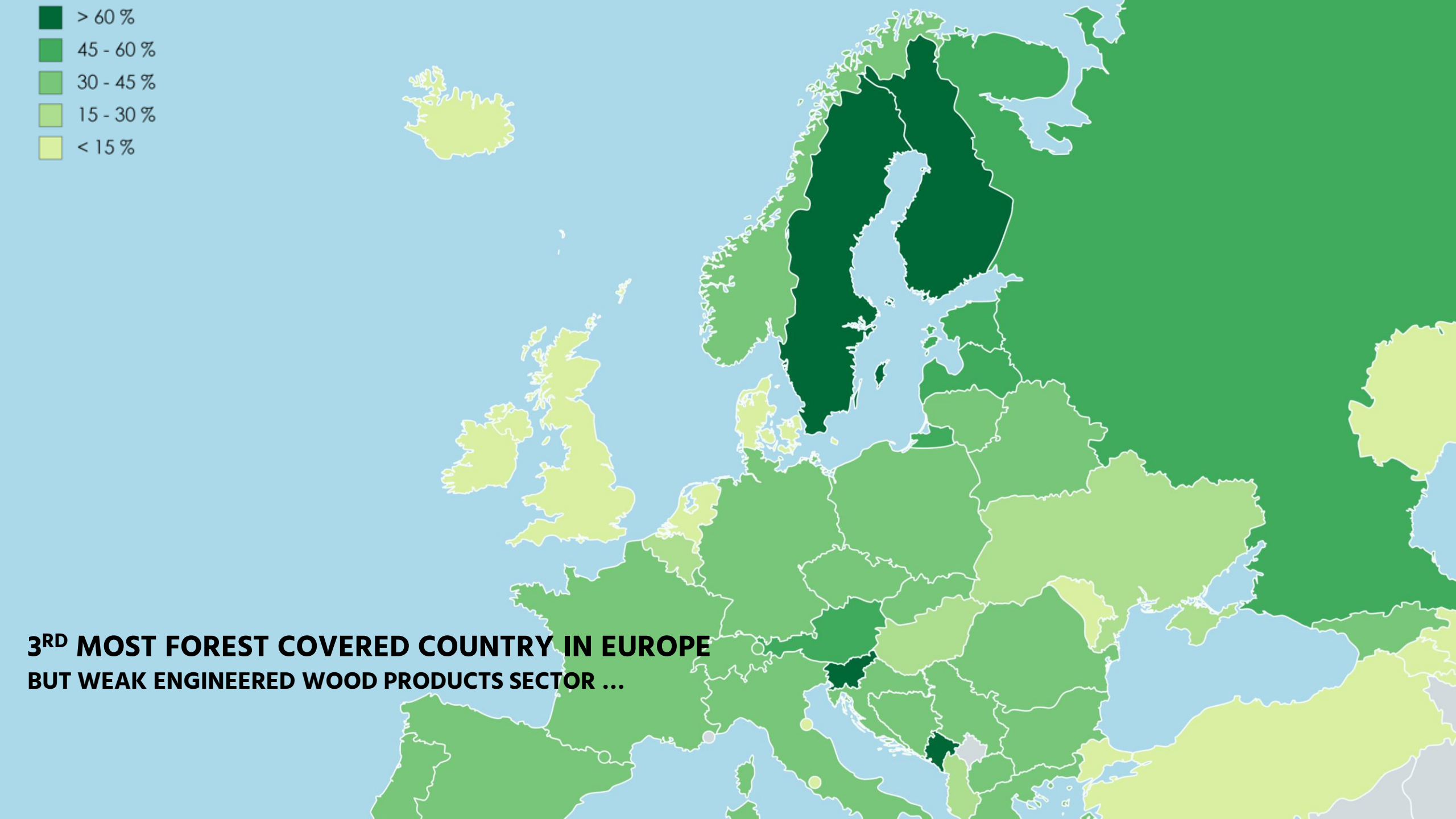
UNIVERZA NA PRIMORSKEM

ZAG ZAVOD ZA GRADBENIŠTVO SLOVENIJE SLOVENIAN NATIONAL BUILDING AND CIVIL ENGINEERING INSTITUTE

Zavod za varstvo kulturne dediščine Slovenije
Institute for the Protection of Cultural Heritage of Slovenia

Our core focus is creating **better built environments** – for people and for the environment – **using renewable materials.**

Renewable materials at InnoRenew include forest and agricultural materials (primary, residues, side-streams, fractions) and are used for a variety of end products, ranging from buildings, to treatments, to sunscreen. **Recovered materials** fit our efforts to support the **Circular Economy**.



3RD MOST FOREST COVERED COUNTRY IN EUROPE

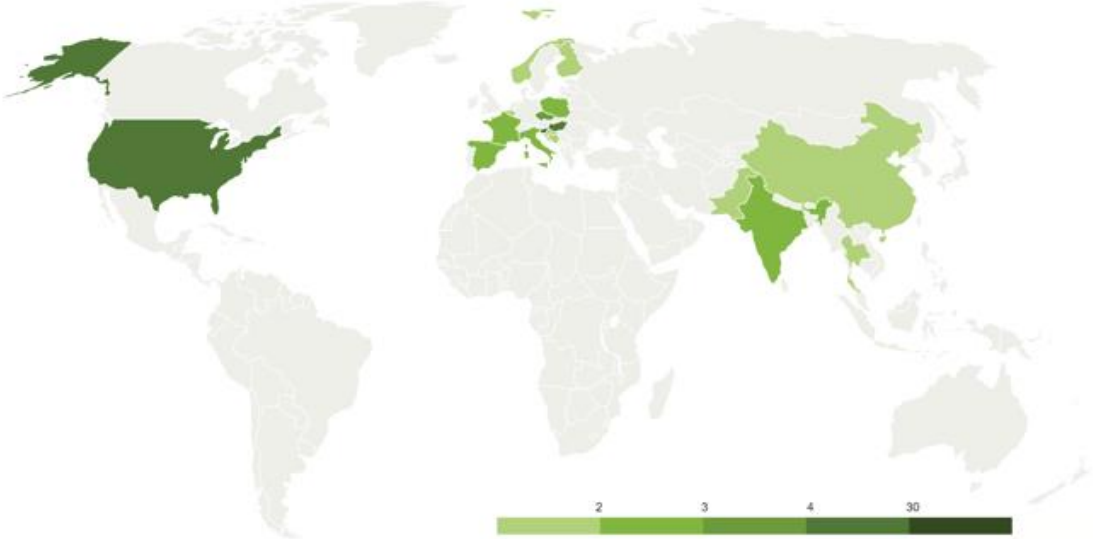
BUT WEAK ENGINEERED WOOD PRODUCTS SECTOR ...

InnoRenew CoE has an international outlook and employs researchers from around the world.

70 Employees
(58 FTE)

46 % women and
54 % men

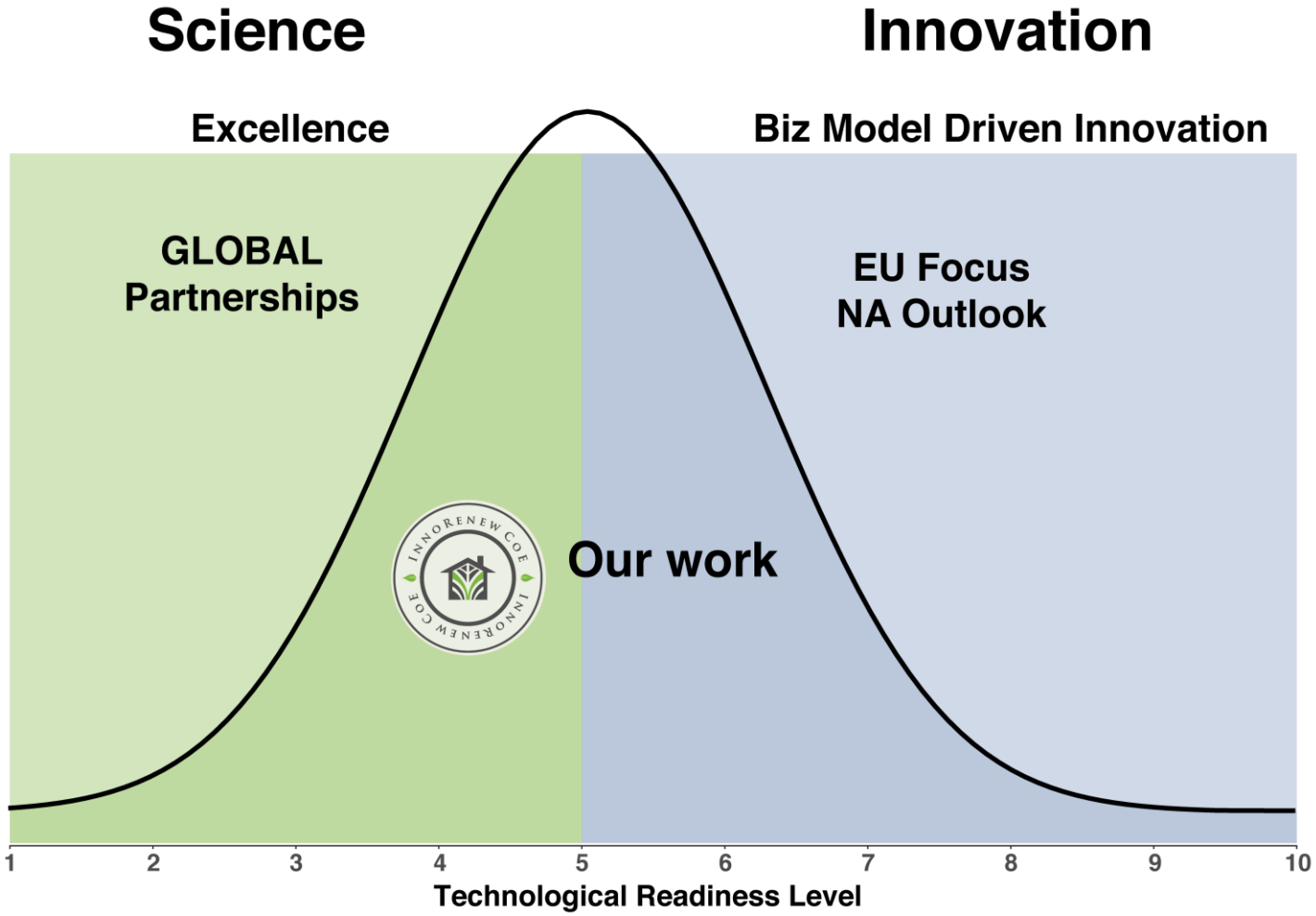
44 % international
employees
(17 countries)



Horizon 2020 Framework Programme of the European Union; H2020 WIDESPREAD-2-Teaming: #739574

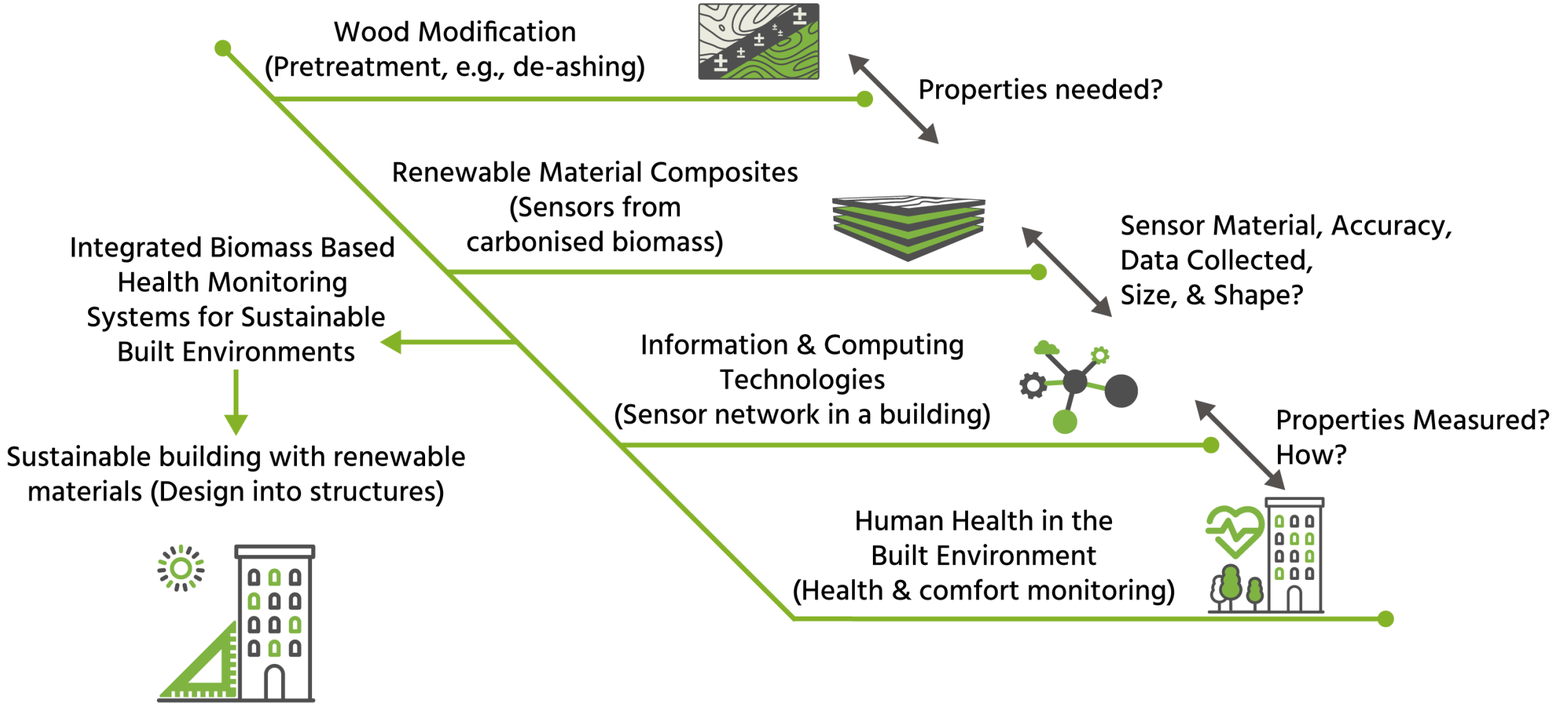
39 running projects
Over 400 international partners

We **increase innovation and investment readiness** all actors in wood-related sector through **fundamental and applied research**.



Interdisciplinary structure

How can renewable materials be used to monitor human health within the built environment?



CONSTRUCTION PROCESS VIDEO LINK

In-house building design by researchers

Architecture:	Eva Prelovšek Niemelä, Aarne Niemelä
Structural design:	Iztok Šušteršič, Sašo Vozel
HVAC:	Rudi Grahek, Robert Krese
Laboratory technology:	Matthew Schwarzkopf, Jakub Sandak, Rok Prislan
Restorative design:	Mike Burnard
Building Monitoring:	Michael Mrissa, Anna Sandak, Jakub Sandak, Mike Burnard, Andreja Kutnar, Iztok Šušteršič, David B. DeVallance, Miklos Kresz

A total of ≈ 1000 m3 of timber used
≈ 870 m3 for load bearing construction

Basic data

Size:

8.194 m2 (gross)

1.361 m2 roof terrace

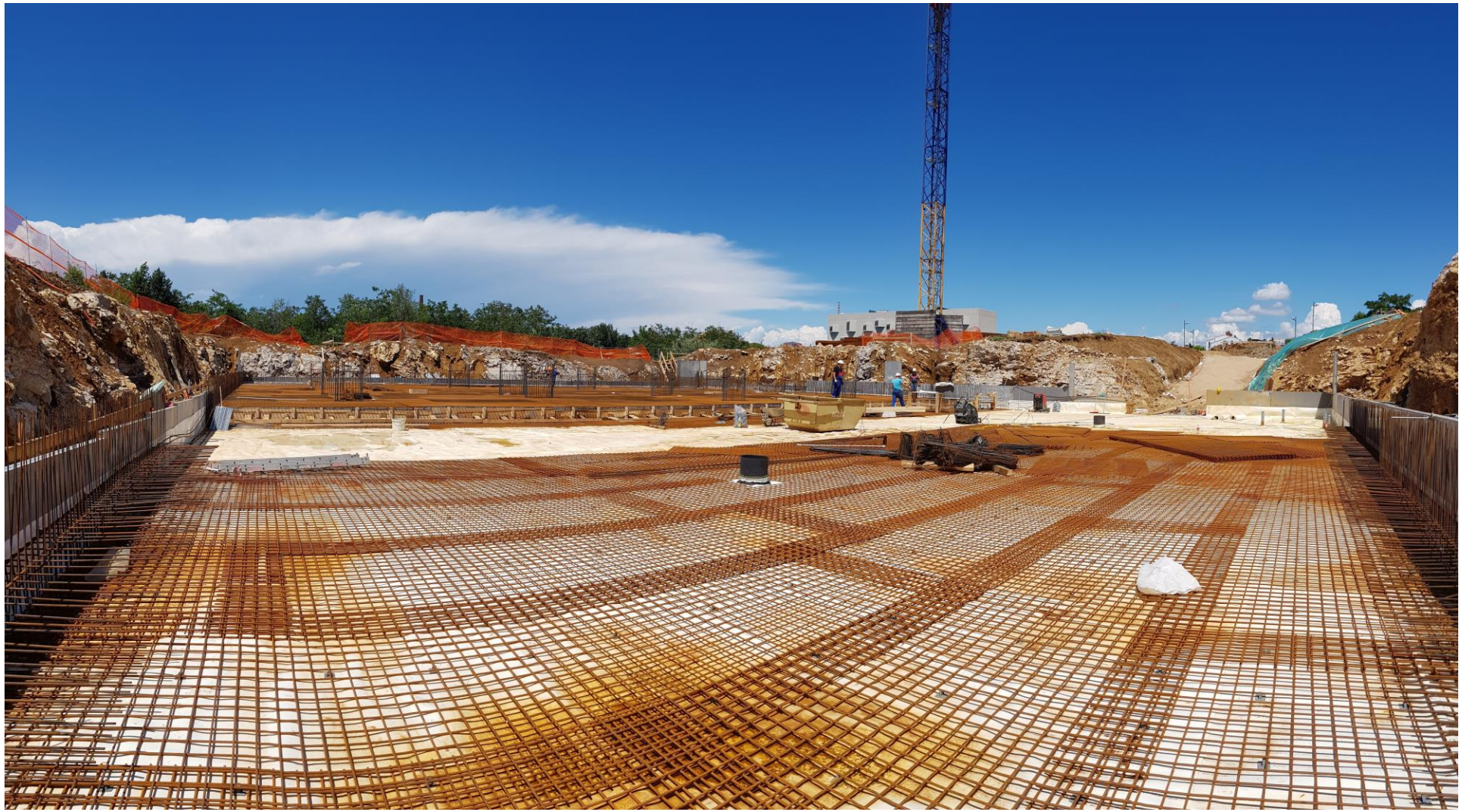
10 research labsoratories:

- Characterisation lab.
- Microscopy lab.
- Kemijski lab.
- Physical testing lab.
- Human health research lab.
- High power computing lab.
- Acoustic research lab.
- Composites lab.
- Workshop
- Living lab

Construction

Gradnja

Construction



Construction

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Construction

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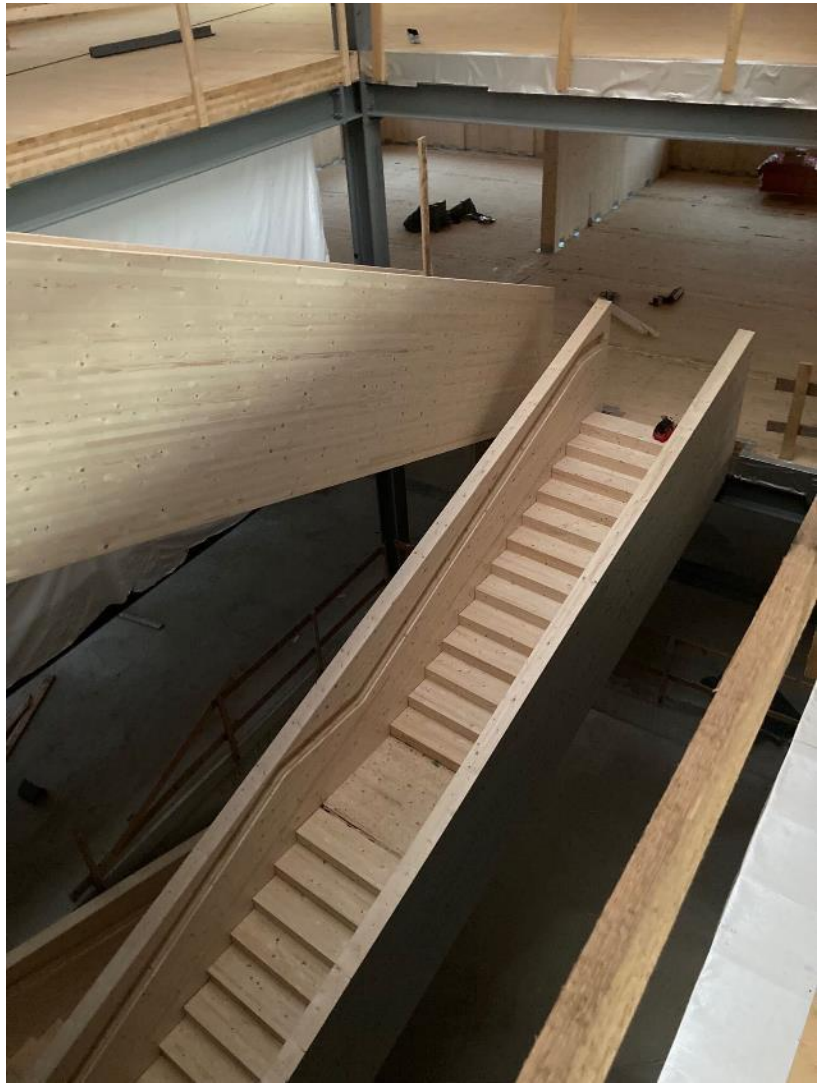

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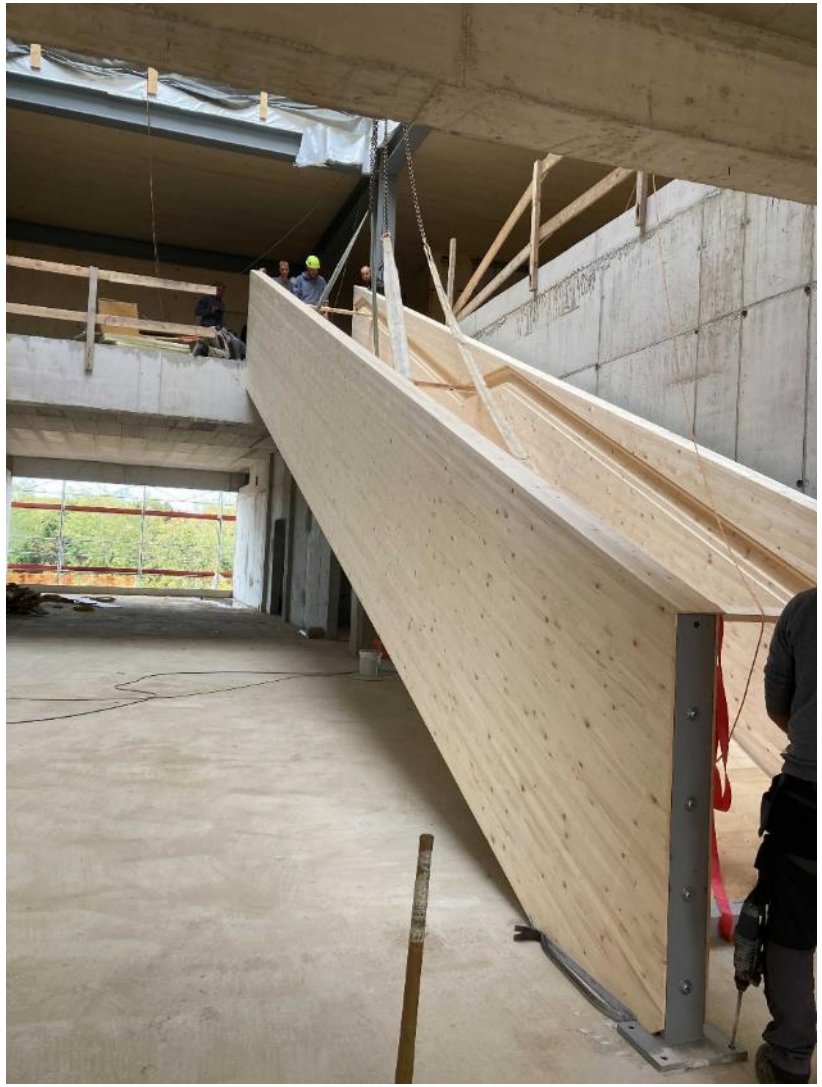

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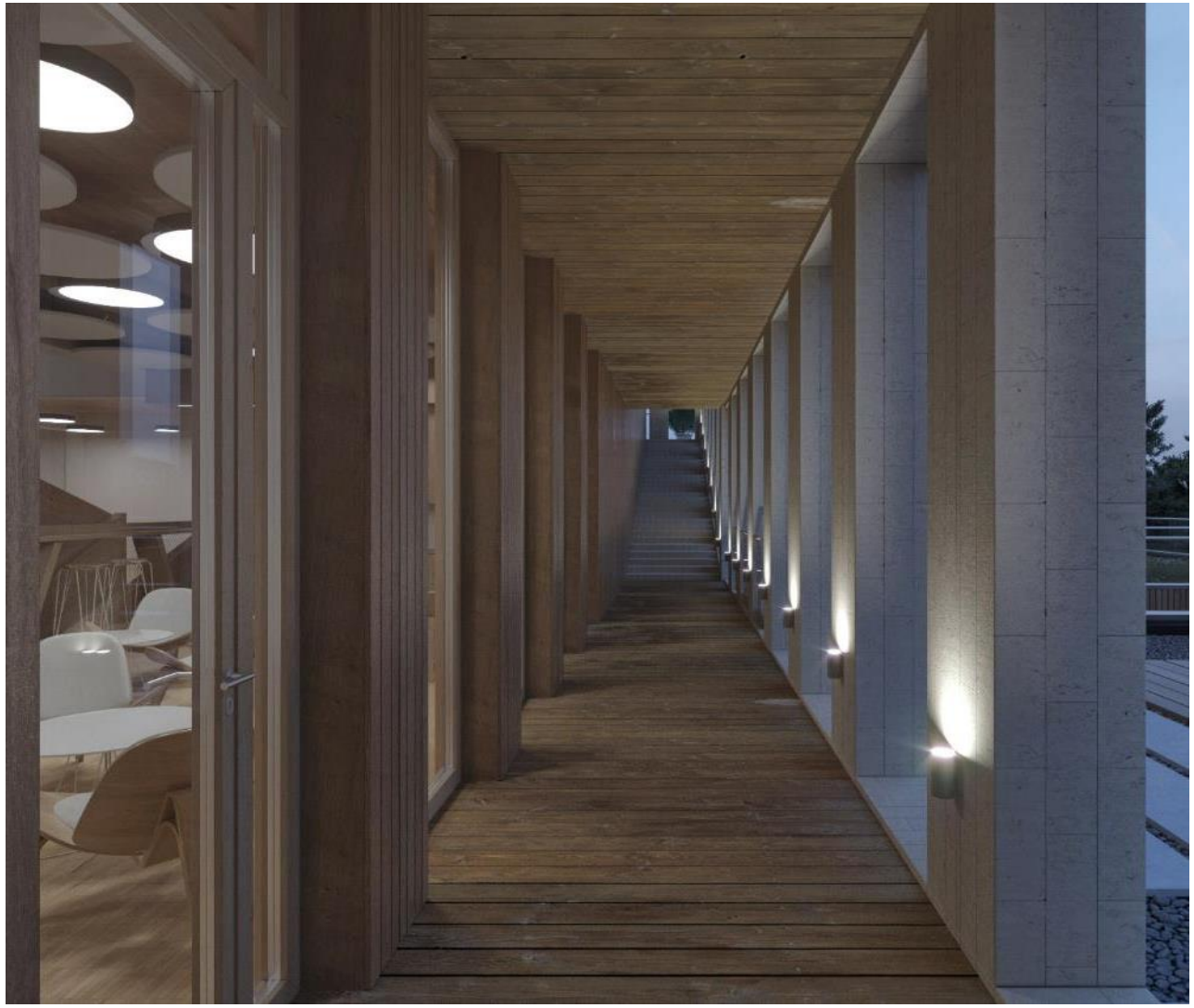

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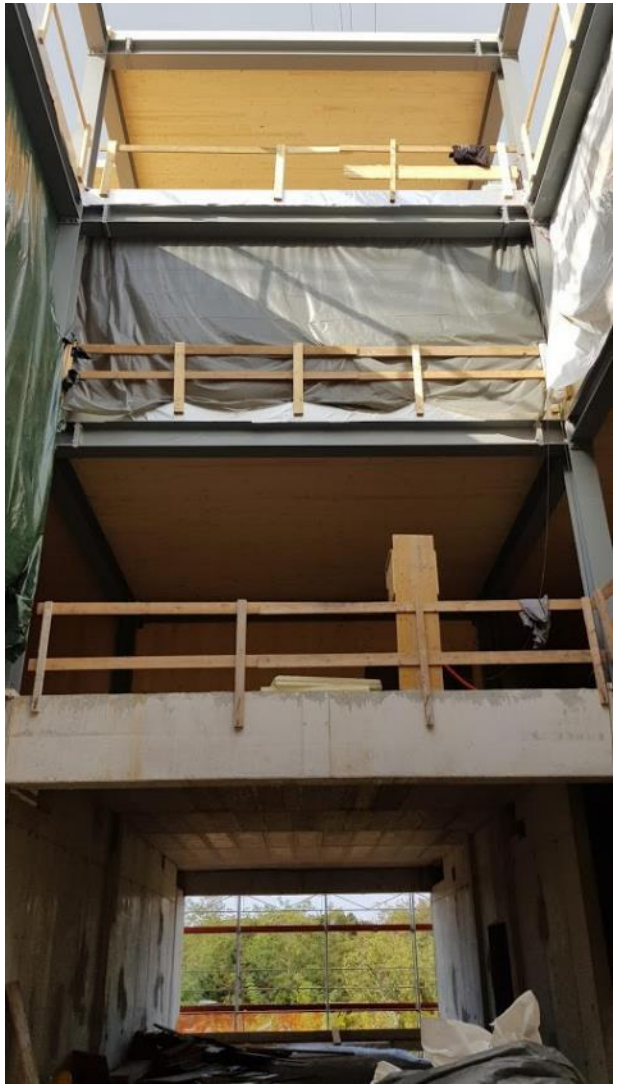
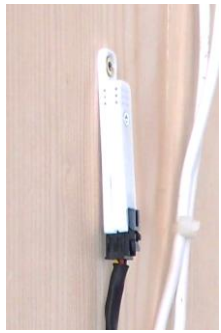


Monitoring

Monitoring of the building structure and environment:

- *32x Humidity and temperatures in envelope*
- 4x WMC on CLT construction
- 22x WMC/T/RH on possibly wet spots in the interior (toilets, kitchens, baths, technical rooms)
- 24x Weather Doze response sensors on 4 building sides, wooden lamellas, 4x wooden facade
- 2x Flat roof leakage sensor system
- 12x Indoor environment quality sensors IAQ_04
- 9x Outdoor microclimate sensors
- 2x IR Camera
- 9x Acceleration and vibration monitoring



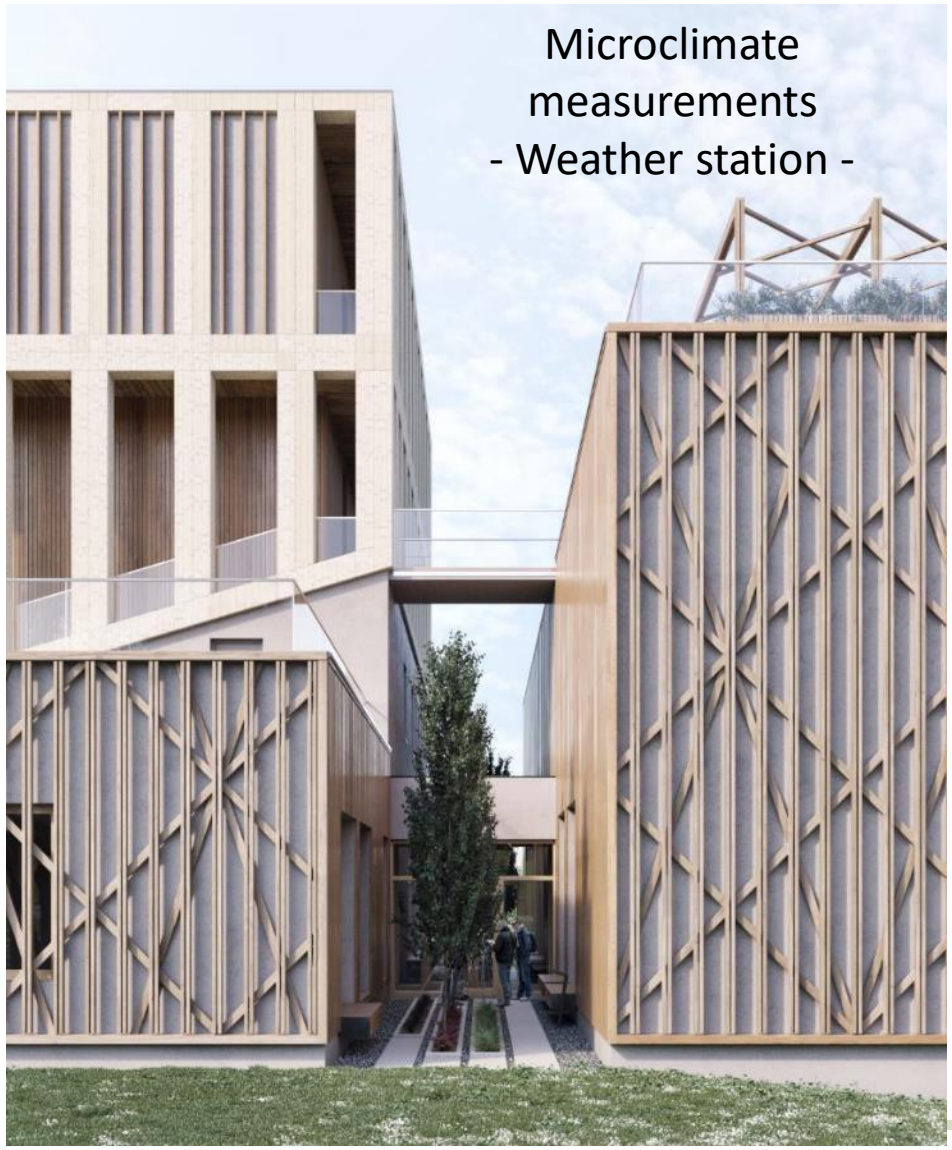
Monitoring

Monitoring of facades:

- Wood ageing (colour, surface, gloss, cracks, chemical changes, erosion)
- Strength
- Heat transfer, moisture
- Doors, windows

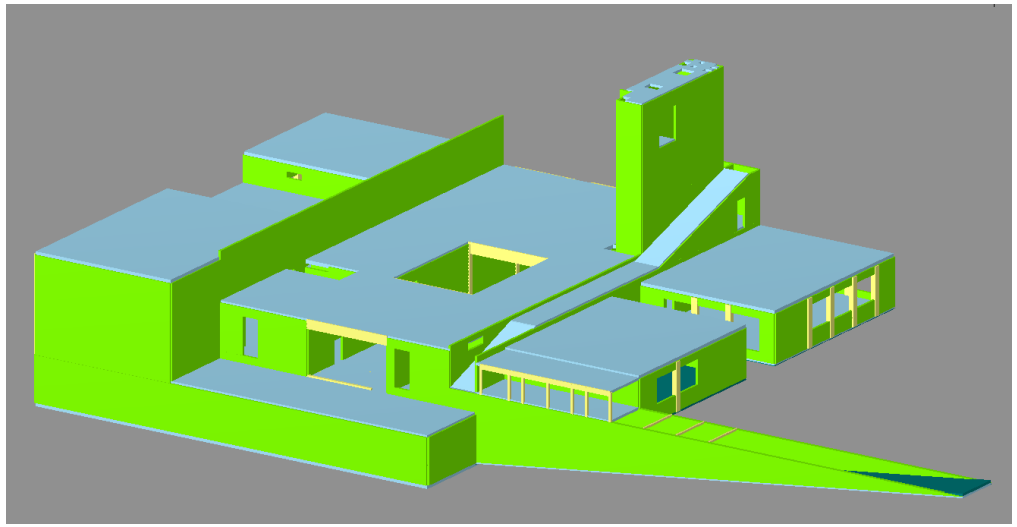
All monitoring data (also weather station data) is being recorded in BIM libraries

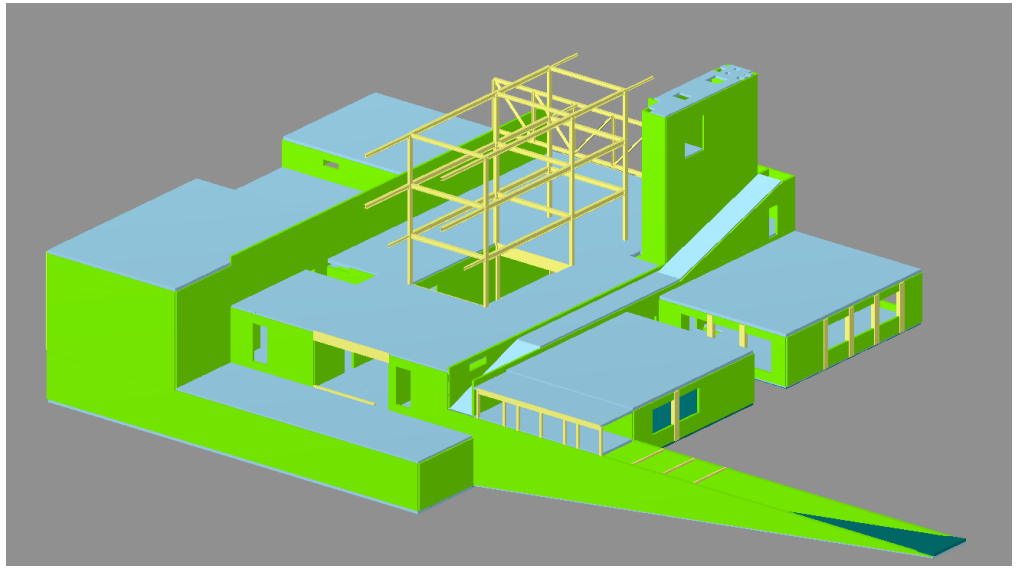
Monitoring

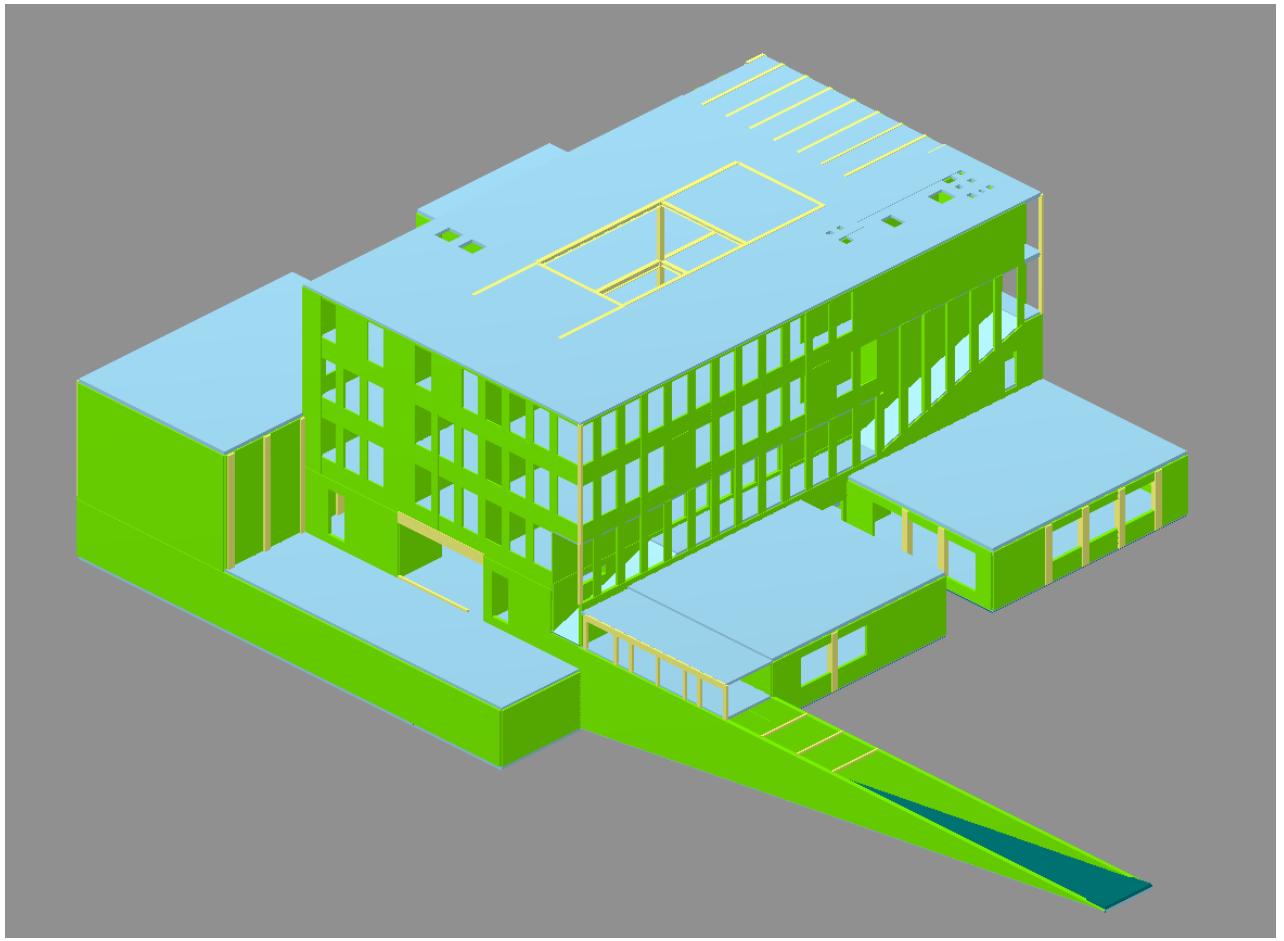

Microclimate
measurements
- Weather station -


Microclimate measurements
- greenery, green roofs -

Modeling







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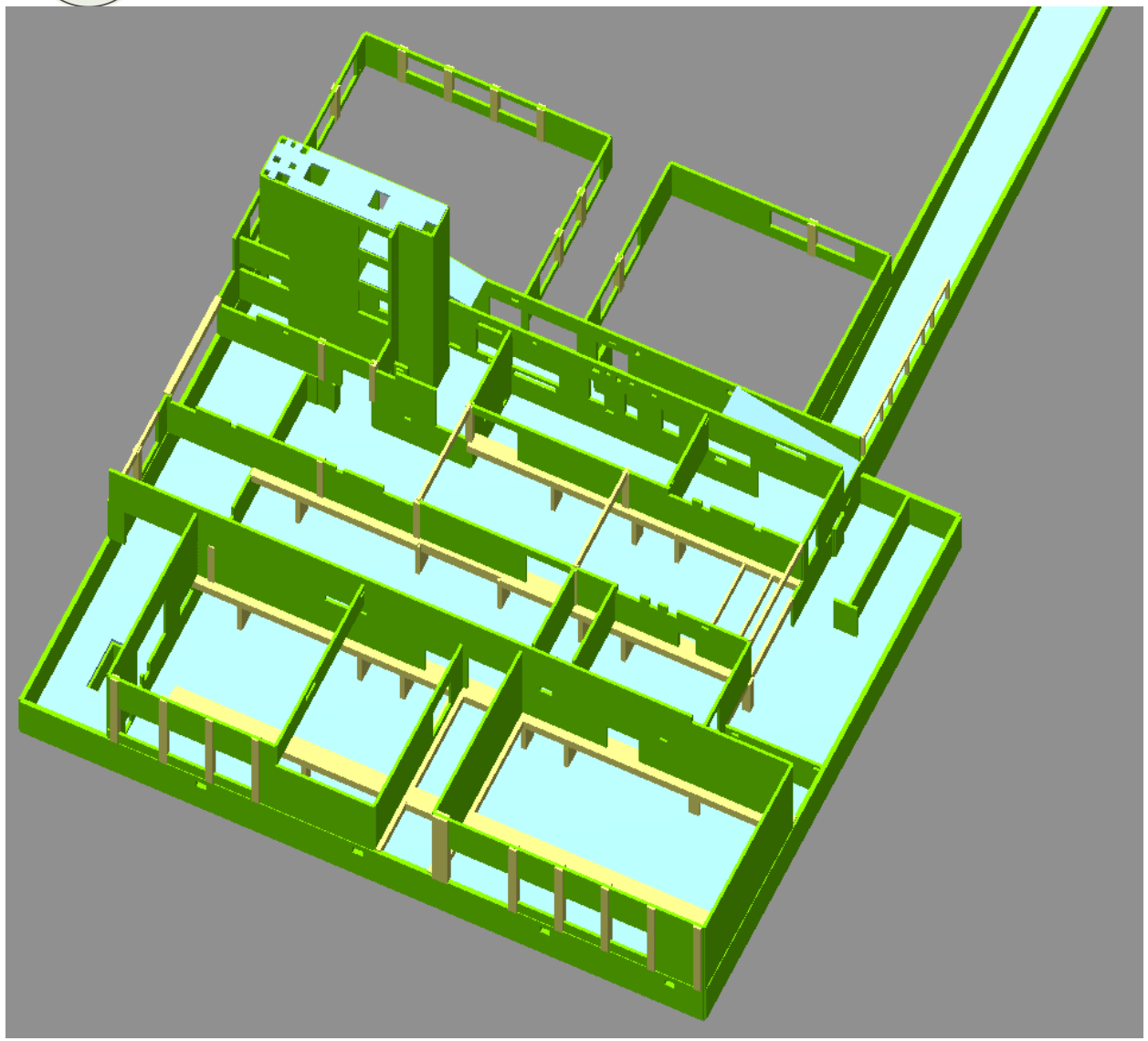
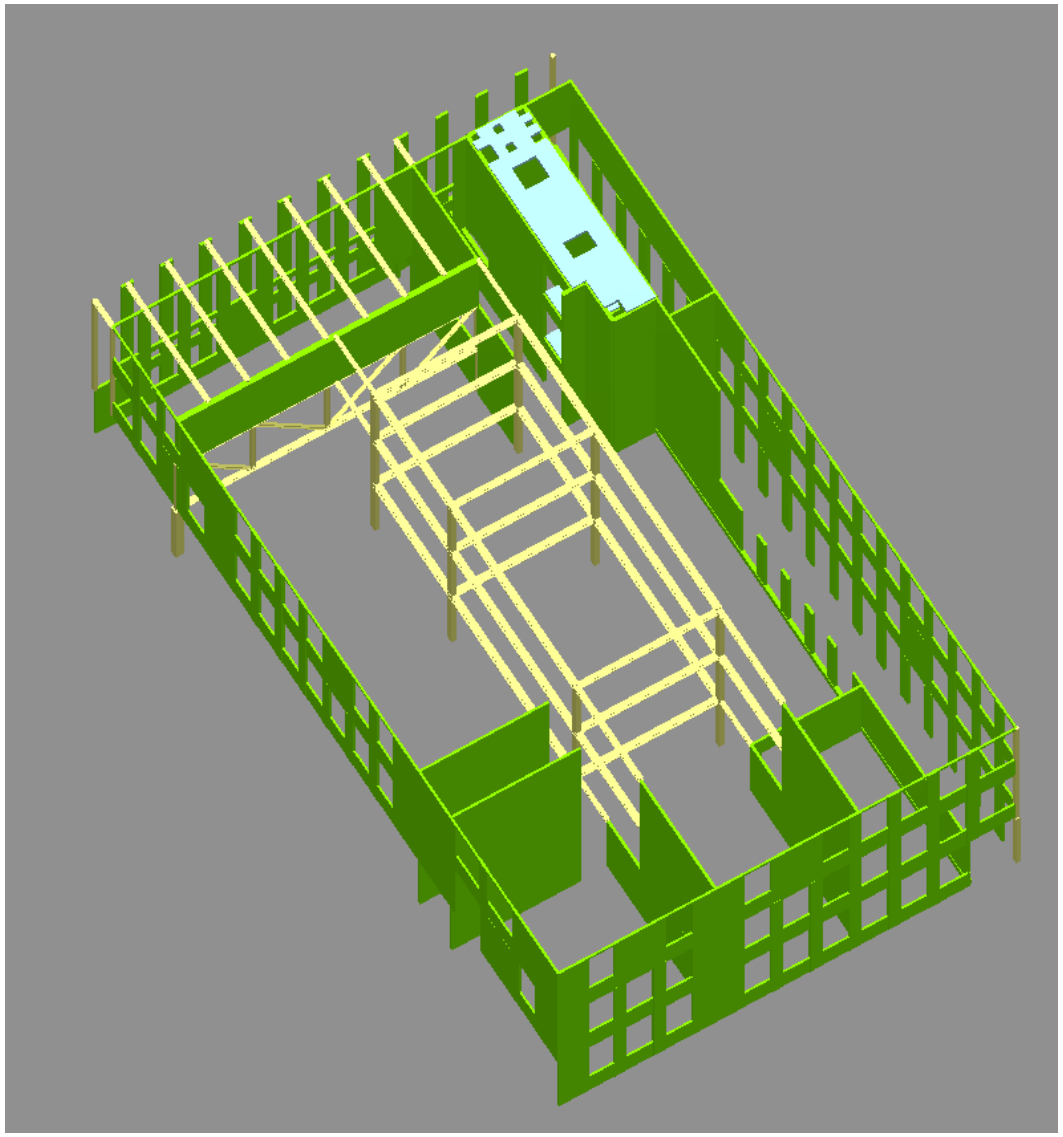
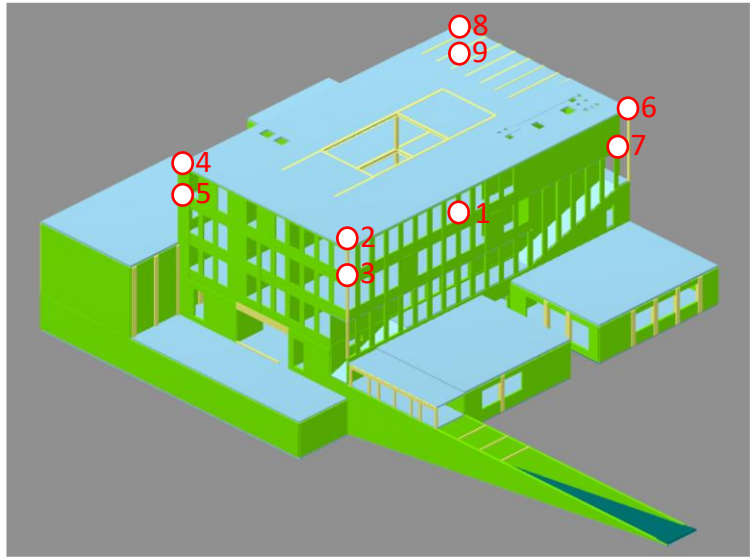
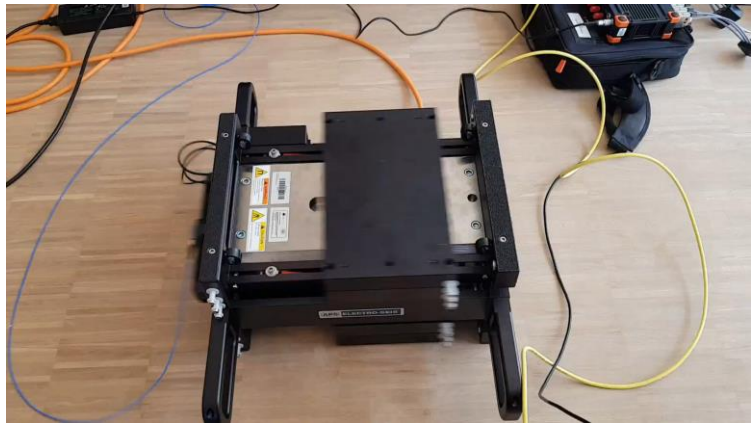




Modeling and in-situ measurements

- Ambiental vibrations measuremens:





DynaTTB
Dynamic Response of Tall Timber Buildings under Service Load

Waste wood analysis

- Analysis of wood waste generated on the construction site (amount of it, type of waste, proportions, etc.)
- Minimizing the burned waste (recycle/reuse within other projects)
- Comparison with the LCA study

Waste wood analysis

375 m3 of wood for formwork

Waste wood is approximately 1,4 %

Total amount of wood used for building = 1347,1 m3

Waste wood is approximately 0,4 %

3 main categories

Solid wood - group A

Wood composites - group B

Other parts (I-joist, little pieces, etc.) – group C

4 sub-categories

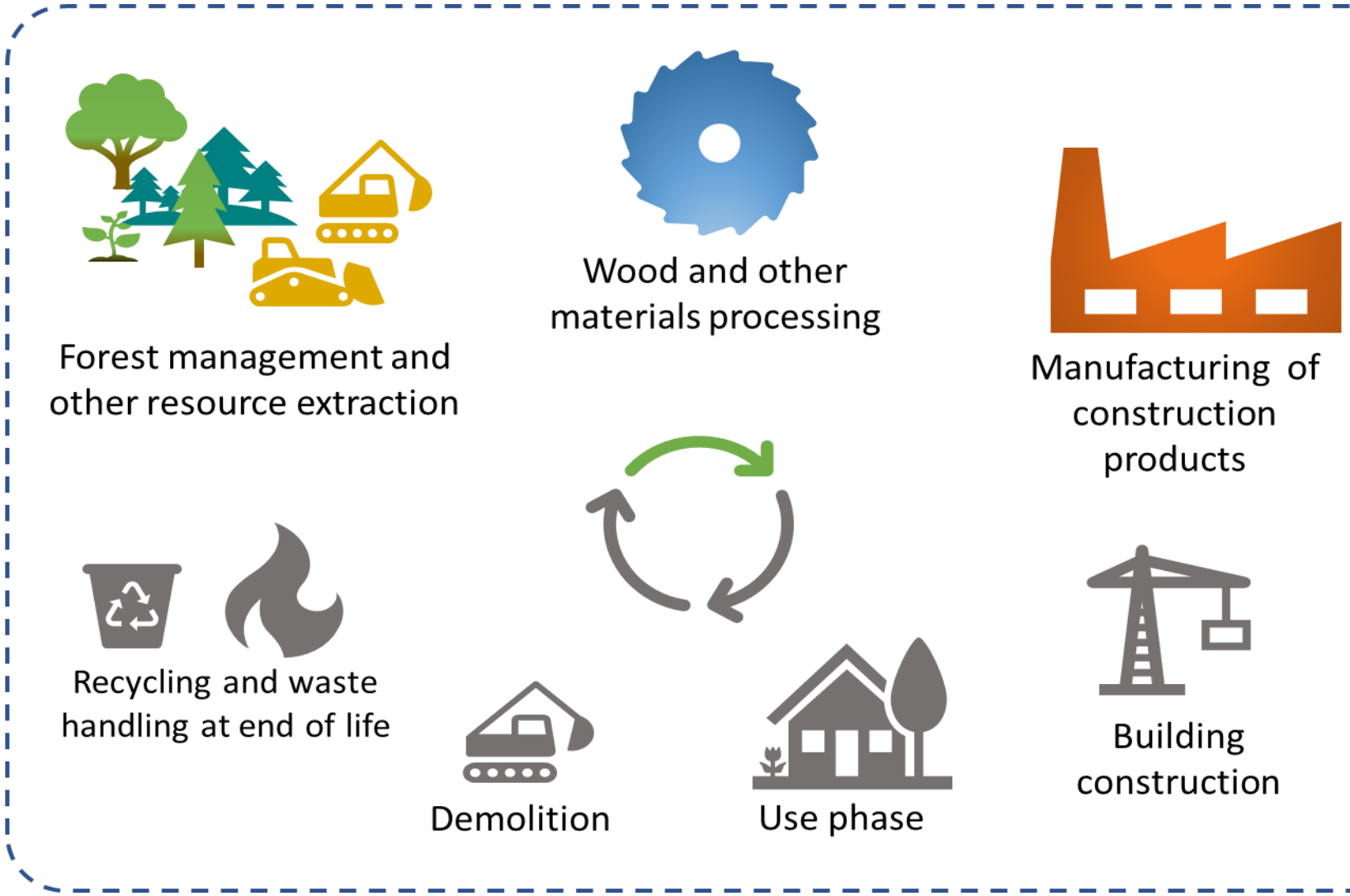
Clean and uncontaminated wood – subgroups A1, B1

Present metals (screws, nails, staples, etc.) – subgroups A2, B2

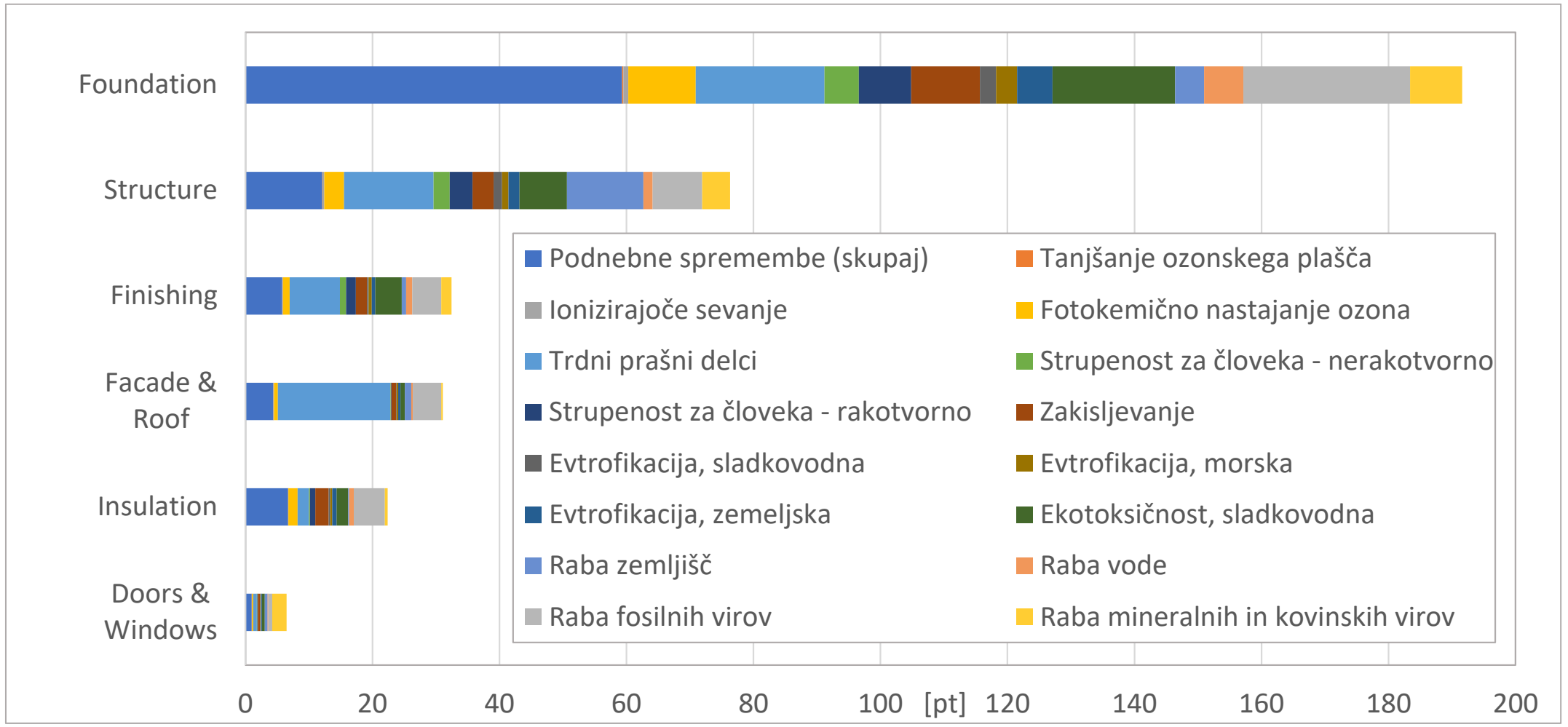
Present contaminators (adhesives, insulation, concrete, impregnators etc.) – subgroups A3, B3

Present both metals and contaminators– subgroups A4, B4

LCA – cradle to gate



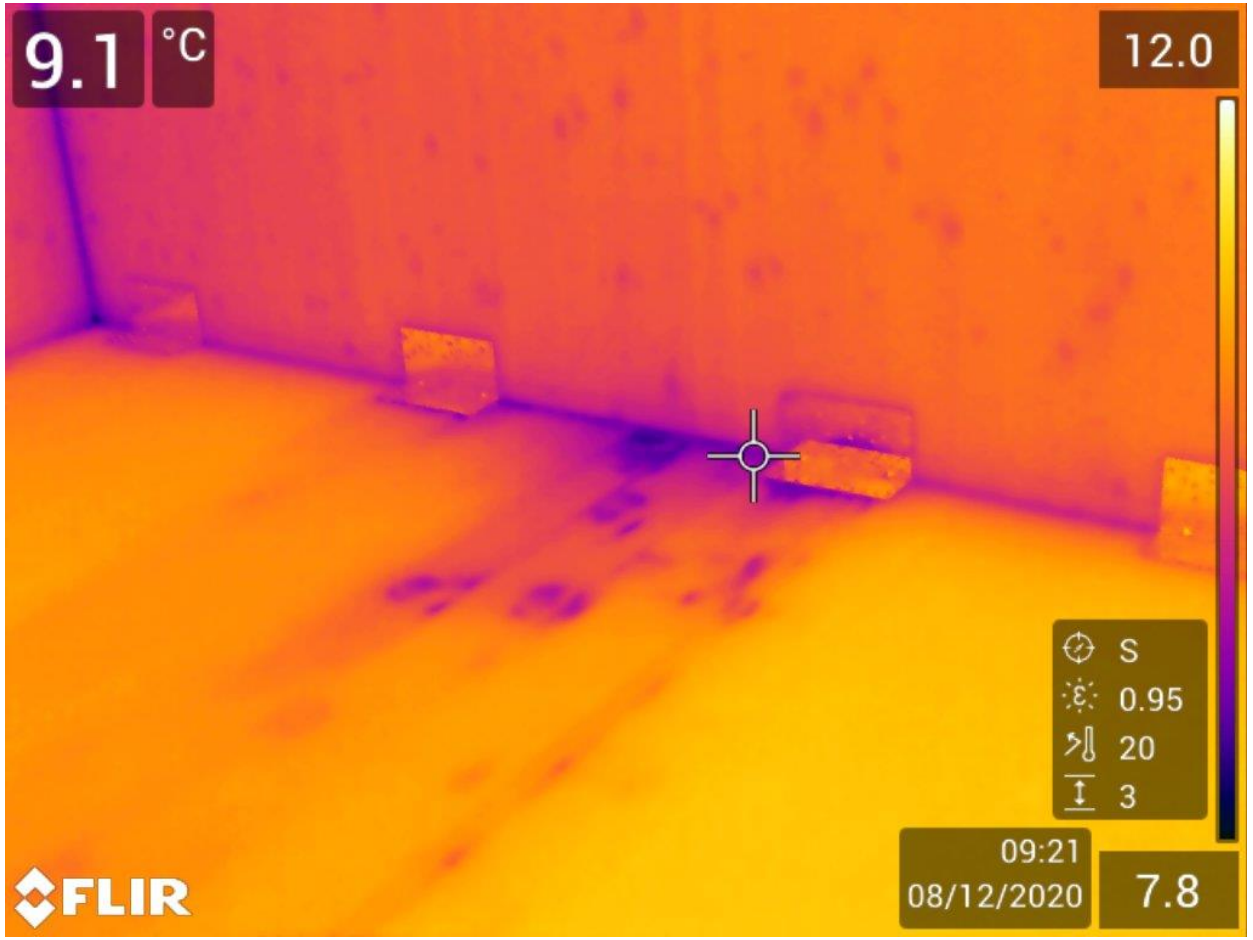
LCA – cradle to gate



Compensating for our CO_2 emissions

Teambuilding event with municipality and national forest agency support – planting 3000 oak trees (local specie) which will store 2647 tons of carbon dioxide in 200 years.

Wood moisture content measurements



Main challenge(s) – wood moisture

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- Water and moisture issue preventions
- General precision necessary for timber constructions (contractors not used to it)
- Covid 19
- Increasing prices
- Long delivery times for certain elements (modified façade wood)
- Public procurement demands

Photo: Miran Kambič

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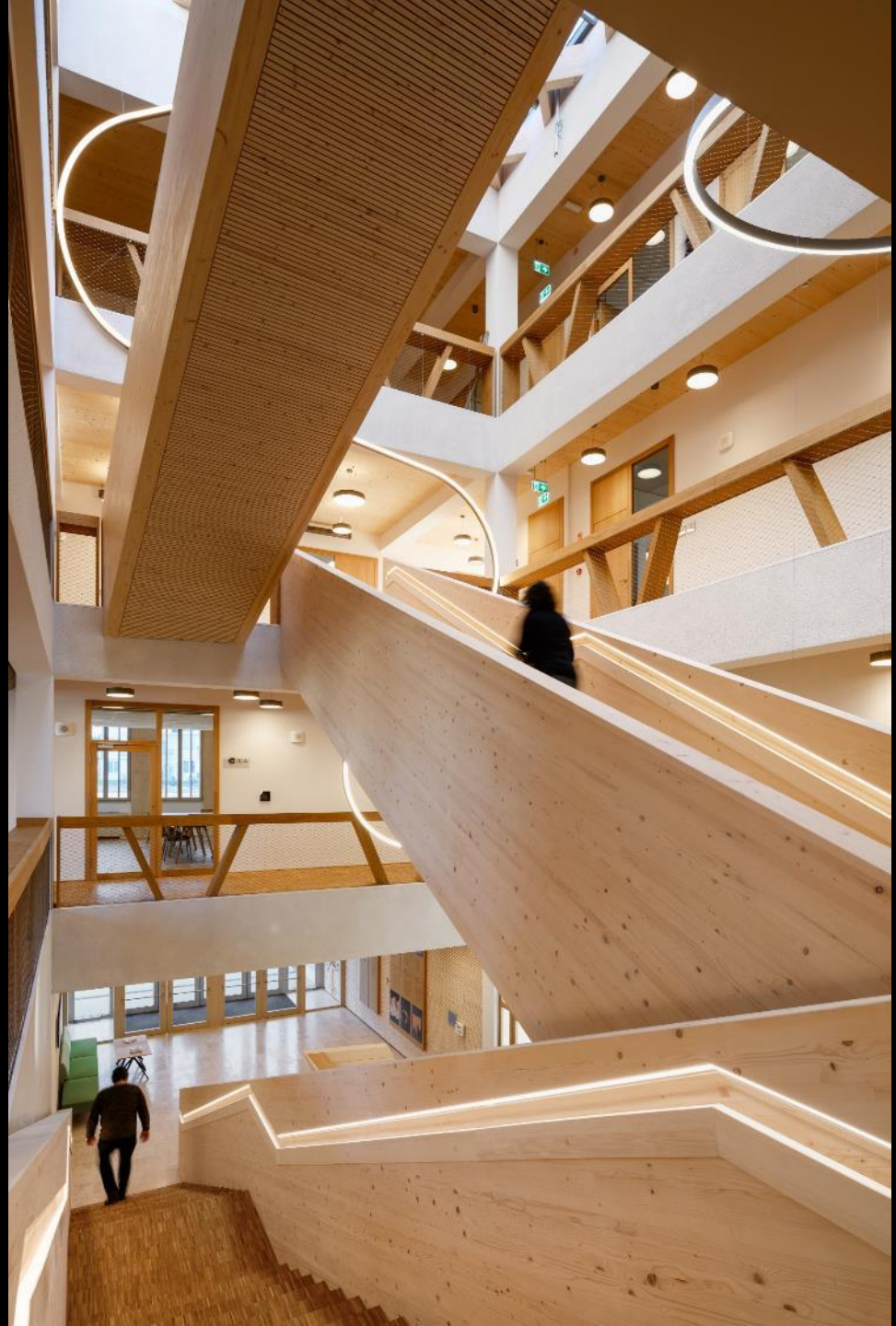

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WOOD RISE 2022

RENOVATION, RESTORATION & REHABILITATION
OF URBAN BUILDINGS USING WOOD BASED TECHNOLOGIES

woodrise2022.eu 6-9th September 2022

Shigeru Ban
Pritzker Prize (2014)

Hans Joachim Schelnhuber
Father of the New European Bauhaus