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Designing CO₂ Neutral Cities and the Role of Mass Timber

Connecting People, Products & Technology, 84th MLB AGM

June 7, 2023 - Saint John, NB



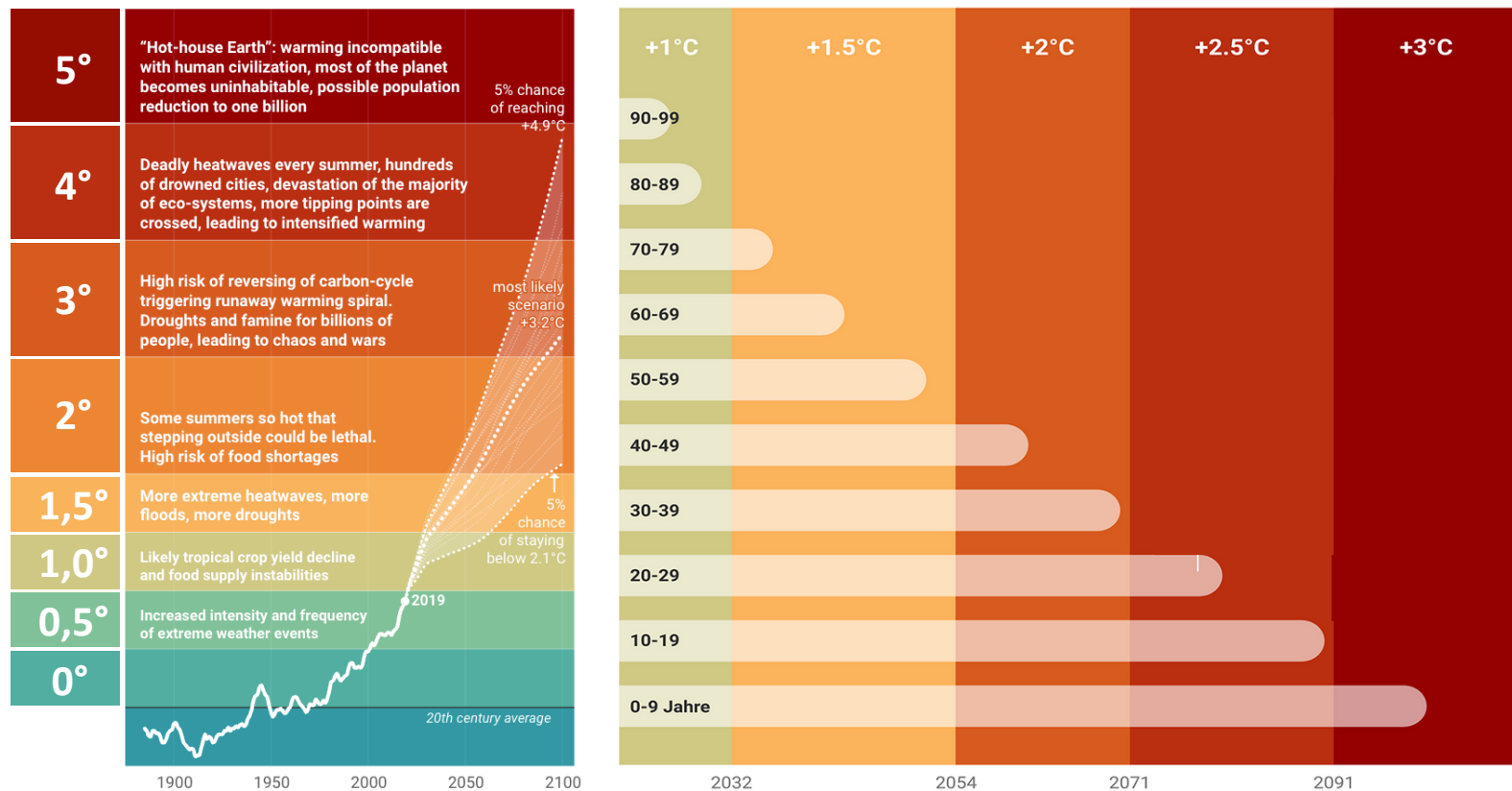
PART 1

Physics Behind Climate Change



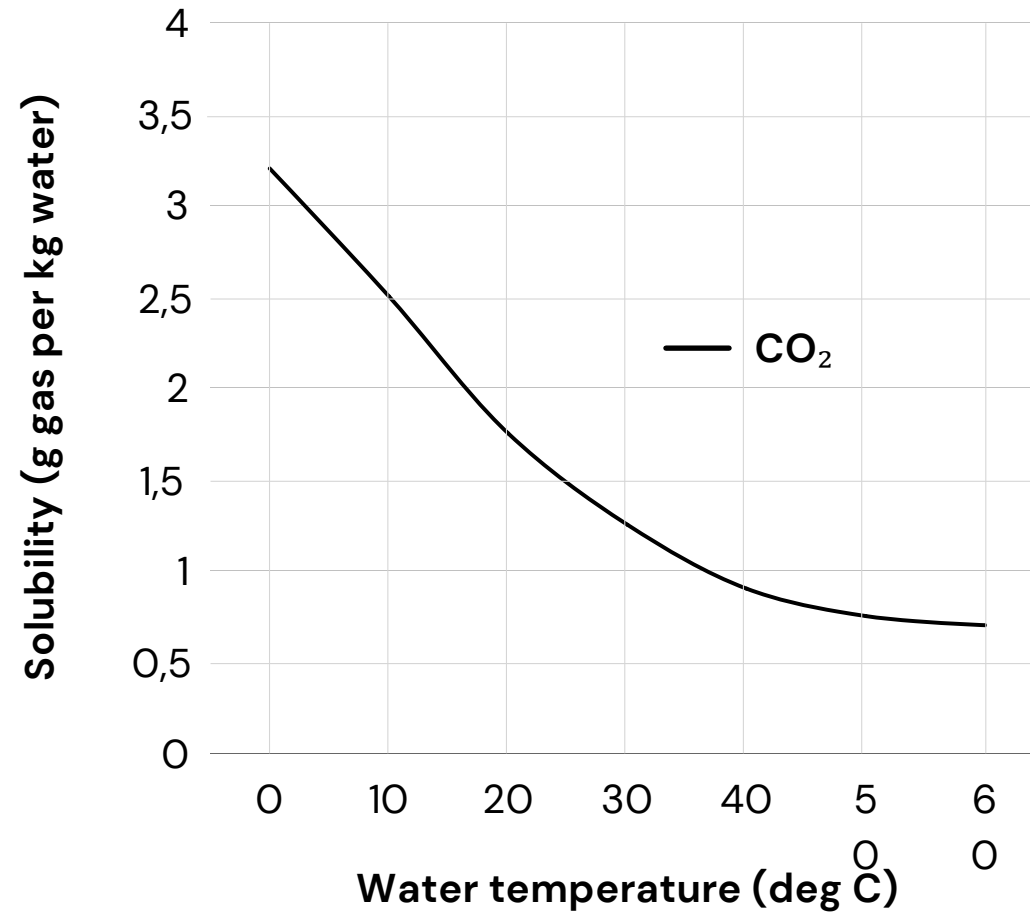
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Statistically-based Climate Projections



Source: Raftery, A.E., Zimmer, A., Frierson, D.M.W., Startz, R., & Liu, P. (2017). Less than 2 °C warming by 2100 unlikely. Nature Climate Change, 7, 637-641. doi:10.1038/nclimate3352

Solubility of CO_2 in Water



Source: "Gases Solubility in Water" chart provided by [Engineering Toolbox](#)





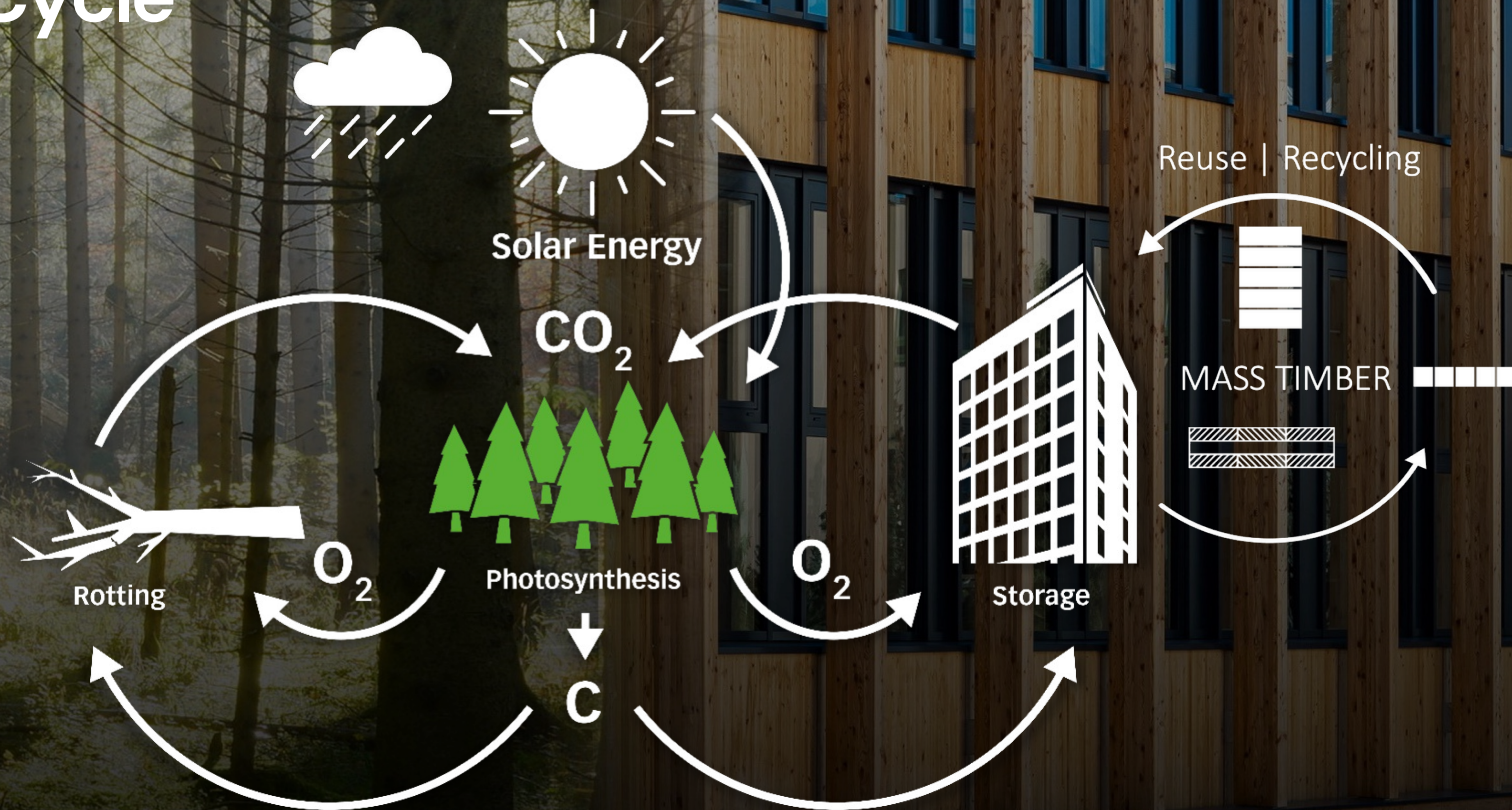
PART 2

CO₂ in Forests: Nature's Carbon Cycle



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CO₂ Cycle



The photosynthesis process removes CO₂ from the atmosphere and converts it into carbon, C, and oxygen, O₂, with the addition of solar energy and water. 1 m³ of wood consists of about 50 % carbon C, 1 m³ of spruce laminated timber has a density of about 450 kg/m³.

$$450 \text{ kg/m}^3 \times 50 \% = 225 \text{ kg C}$$

$$225 \text{ kg C} \times 3.67^* = 825 \text{ kg CO}_2 / \text{m}^3$$

*mass ratio: CO₂/C = 44/12



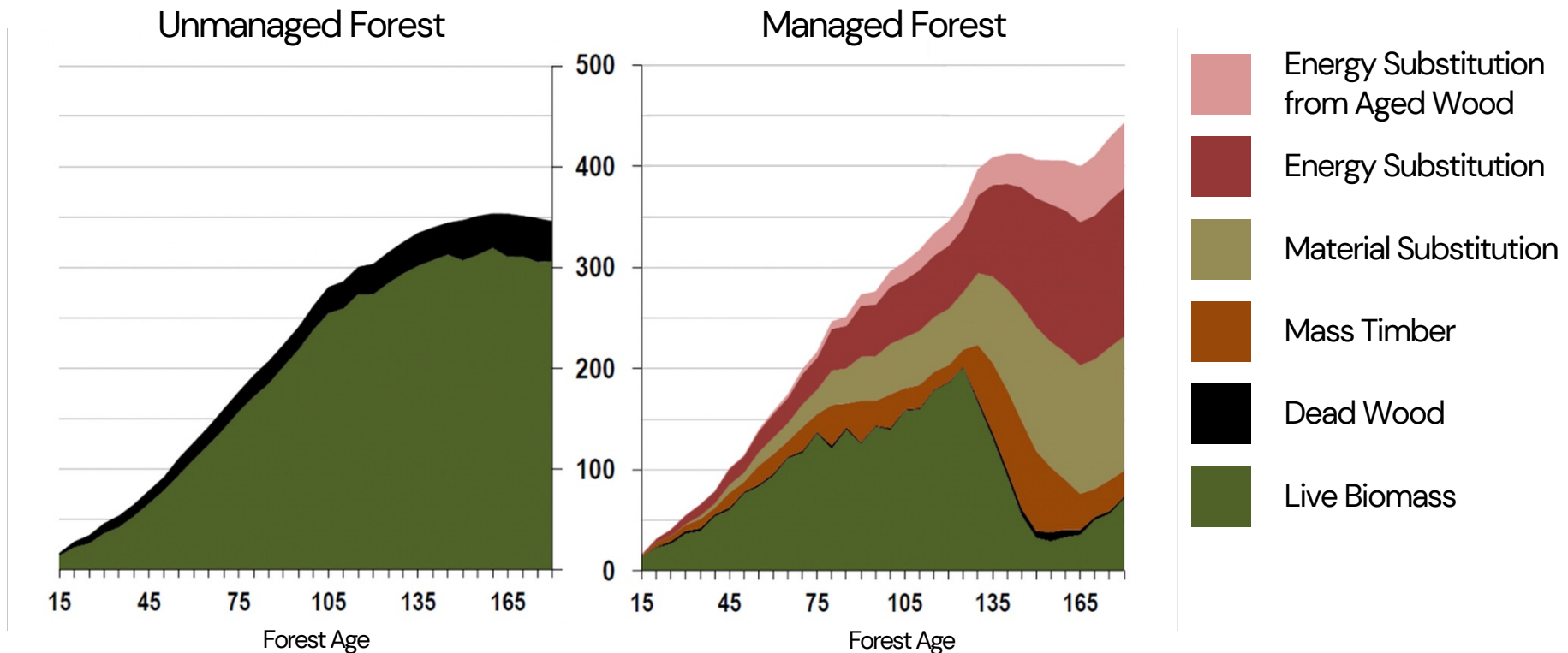
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Comparison of Climate Impact in tC / ha

"We are planting a second forest in the city!" – Architect Hermann Kaufmann



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PART 3

Timber's Potential: A Path to CO₂ Neutrality



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The Ability of Capturing CO₂

Producing 1 tonne of timer
absorbs a net of approx.
825 kilograms of CO₂



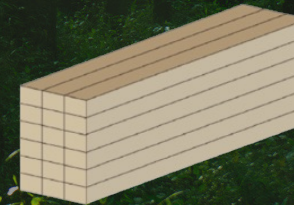
Sequester CO₂ during growth



CO₂ stored within timber



Cross Laminated Timber
(CLT)



Glued Laminated Timber
(Glulam)

Source: Forest Products Association of Canada (FPAC). (2021).
Climate change and sustainable forest management.



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CO₂ Certificates for Sustainable Timber Products



SAWN TIMBER



SURFACED TIMBER



CROSS LAMINATED



GLUE LAMINATED



Minimal impact on
CO₂ emissions



United Nations

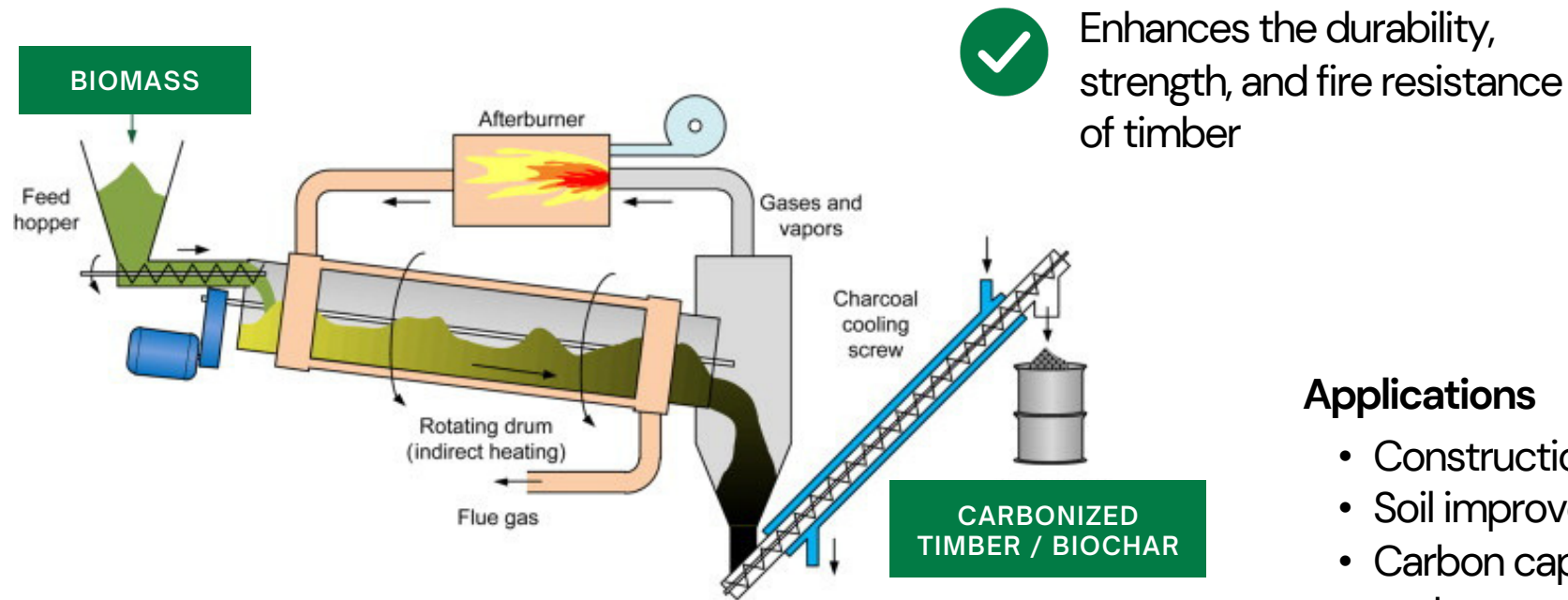
puro·
earth



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Carbonization of Timber

Transformation of wood into carbon-rich material



Applications

- Construction
- Soil improvement
- Carbon capture and storage

Source: "Carbonization of Biomass" illustration provided by [Science Direct](#)



Wood Flour – A CO₂ Neutral Solution

Use Cases

Food Industry	Feed	Agriculture	Packaging	Flooring	Leisure	Construction
<ul style="list-style-type: none">• Filtration aid for glucose, start, oils• Fats, liquids	<ul style="list-style-type: none">• Single feed• Mixed feed• Bedding	<ul style="list-style-type: none">• Seed coating	<ul style="list-style-type: none">• Biobased compound for packaging	<ul style="list-style-type: none">• WPC• Linoleum flooring• Biobased materials	<ul style="list-style-type: none">• Fishing	<ul style="list-style-type: none">• Glue, paintings



A photograph of a modern building with a green facade and glass windows. The building is covered in lush green plants, creating a vertical garden effect. The glass windows reflect the surrounding environment.

PART 4

Neutral City Concepts: Pioneering Urban Sustainability



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Addressing the Housing Crisis in California

1,300,000 flats missing
+15,000 flats every day



Source: Data taken from speech given by California State Senator Tony Atkins



The state implemented policies to integrate CO₂ neutral concepts with a focus on affordable and sustainable housing.



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Berlin: A Sustainable Pioneer

Commitment

- Integrate CO₂-neutral concepts into its city planning
- Promote the use of mass timber in urban construction

"Timber has a smaller carbon footprint than most conventional building materials."

– Jonny Klock, Architect

Source: Renderings: Mad Arkitekter



The WoHo tower

Proposed 29-story timber structure in Berlin, Germany, set to become the tallest timber building in Europe.



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Nusantara's CO₂ Neutral City Concept

Carbon neutrality goals

- 30%+ of new buildings to utilize mass timber structure
- Develop and implement sustainable forestry practices



Nusantara to be among world's most sustainable cities.



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HoHo Vienna

Construction and facts

Certification	Rüdiger Lainer + Partner
Total Gross Area	25.000 m²
Stories	24
Height	84 m
Vertical Core	Reinforced Concrete
Posts (800 pcs.)	Up to GL32h as composite component with glued-in steel anchors 400 x 400
Walls (12.400 m²)	HASSLACHER CLT 140 mm 5s Excellent surface spruce 2x coated living room glaze high factory prefabrication
Ceiling (16.000m²)	MM XC® 160 120 (180 120)



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HoHo Vienna

Decarbonization

Certification	LEED Gold-Standard 924 out of 1000 points
Wooden Construction	Positive effects on well-being through visible wood surfaces
Regionality	4.600 m ³ of native spruce grow back in Austria in one hour and 17 min
CO ₂ -Binding	Approx. 3.800 t CO ₂ are tied up for a long time
CO ₂ -Saving	Approx. 2.800 t CO ₂ -equivalent saved



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Innovative Timber Buildings

Goals

- Operate on 100% renewable energy
- Reach net zero emissions



Rocket & Tigerli

30+ stories high
Winterthur, Switzerland



Atlassian

40 stories high
Sydney, Australia



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PART 5

The Construction Industry



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The Problem is the Problem

Construction Industry

- Productivity declined since the 1960s while similar industries grew **1500%**
- Produces **25 – 40% waste**

Owner's Projects

85%

of projects
go over budget

92%

of projects
go over schedule

75%

of projects
go over on both

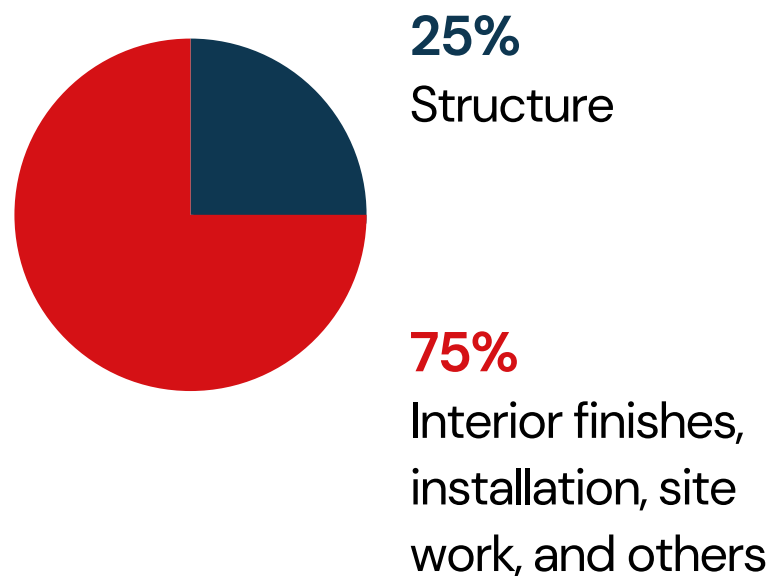


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Issues with Construction Interfaces

Total Construction Cost



Problem

- Interfacing issues between different building components

Solution

- Turnkey solution that inhibit seamless integration and efficient construction



Issues with Construction Standards

Problem

- Lack of consistency
- Fragmented guidelines
- Interoperability changes

Solution

- Eliminating interfaces
- Mega factories

nokera

ZIEGLERGROUP®



Standardization Efforts

Image Source: <https://nokera.com/en/>



Configurators

Image Source: <https://ziegler-construction.com/>



Advanced Technology



PART 6

Looking Ahead: The Path to Carbon- Neutral Future



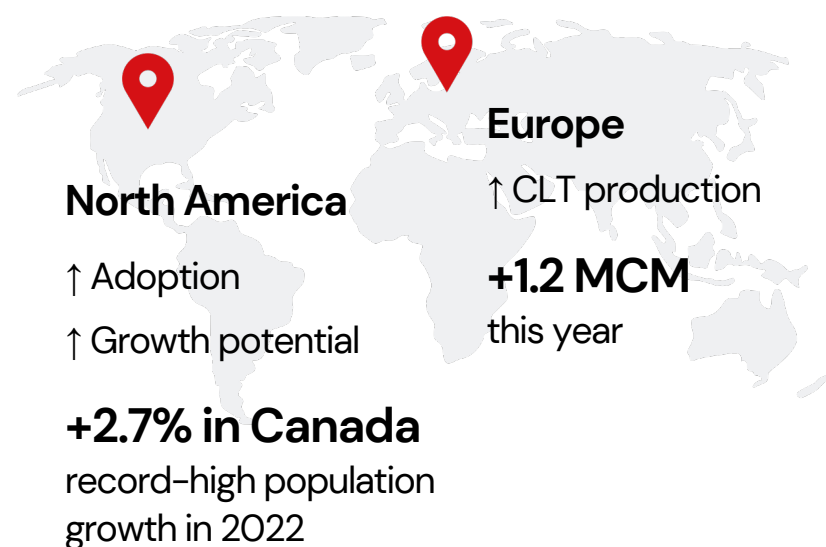
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The Era of Mass Timber Ahead

Urgent Need

- 1.2M hectares of Canadian forests devastated by wildfires
- Significant need to remove low-quality lumber from forests in Middle Europe
- Wood resources anticipated to become scarce in the future
- New species (stress resistant)
- Everything we do now has an impact in 60–70 years

Market Expansion





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Thank you

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