“Strategies for a Climate-Neutral Building Stock”
Applied Eco-Balance and Best Practice

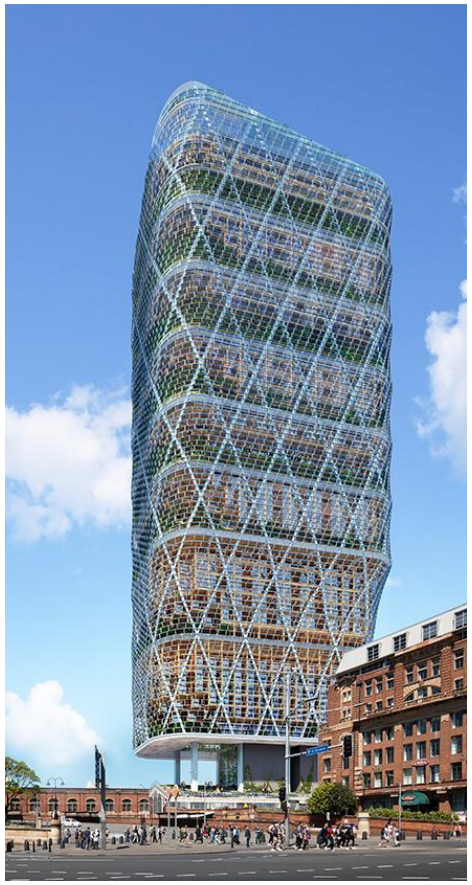
Practice and Challenges of Decarbonized Design

OBAYASHI MAKE BEYOND
TRANSCENDING THE ART AND SCIENCE OF MAKING OF THINGS

Sho Ito

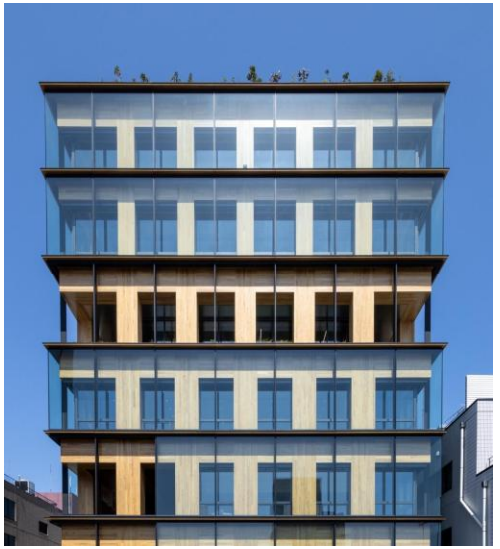
MAKE BEYOND

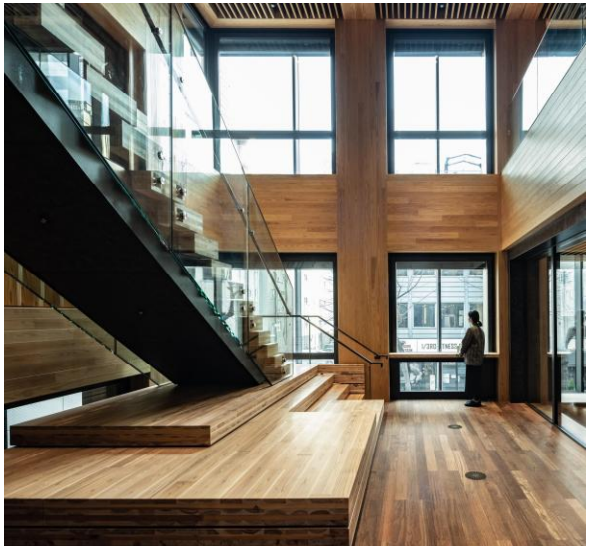
TRANSCENDING THE ART AND SCIENCE OF MAKING OF THINGS



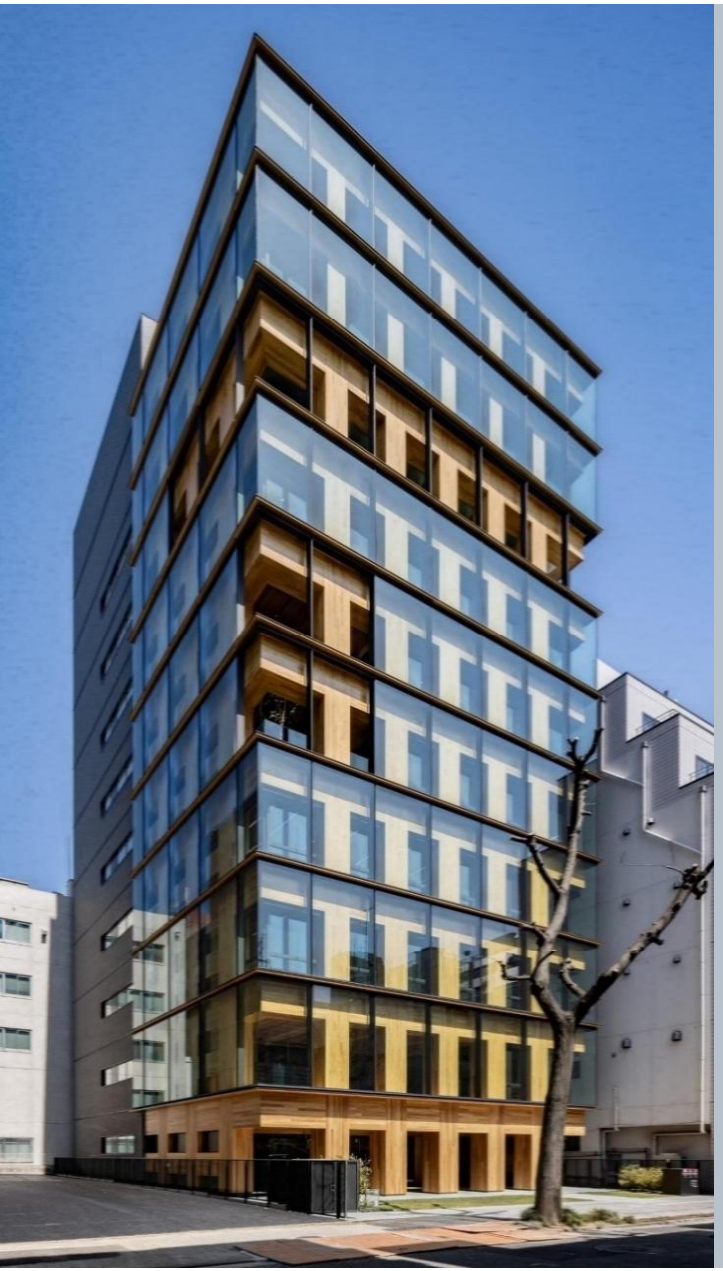
OBAYASHI

Sustainable Design



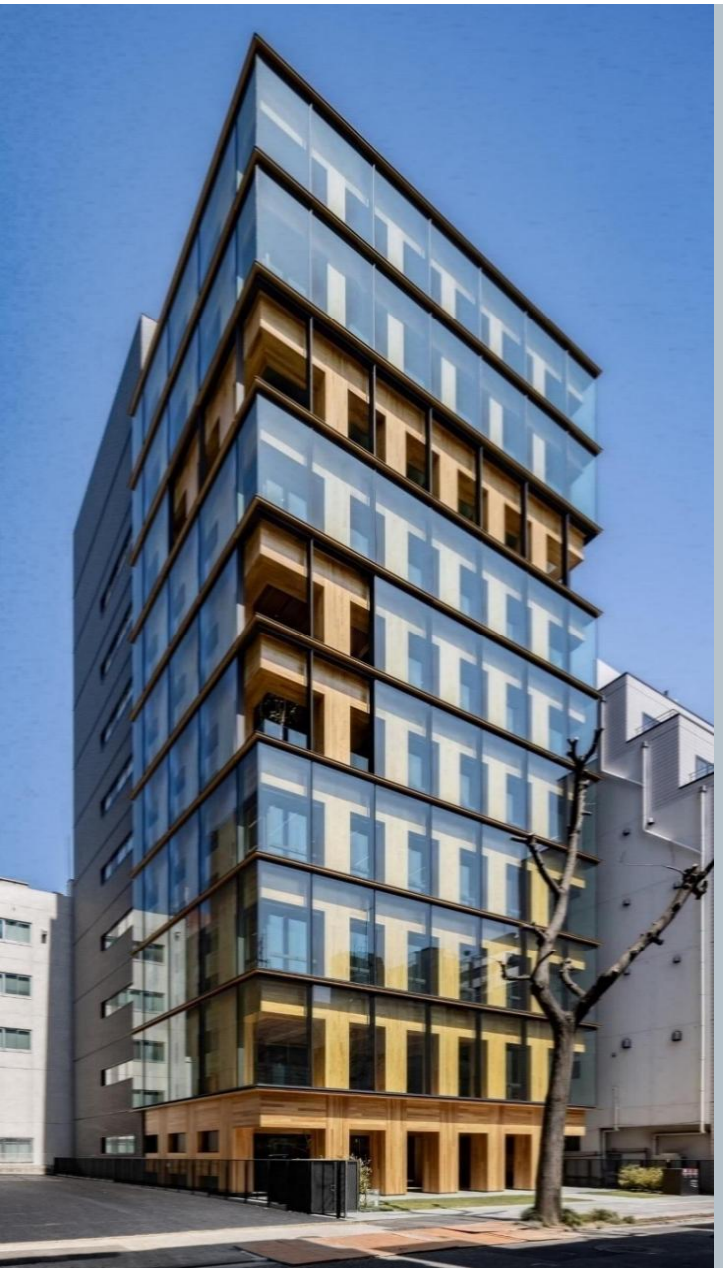


2006 - present : Obayashi Corporation
2013 - 2015 : Ingenhoven Architects
2004 - 2006 : Graduate School of Engineering, Kyoto University

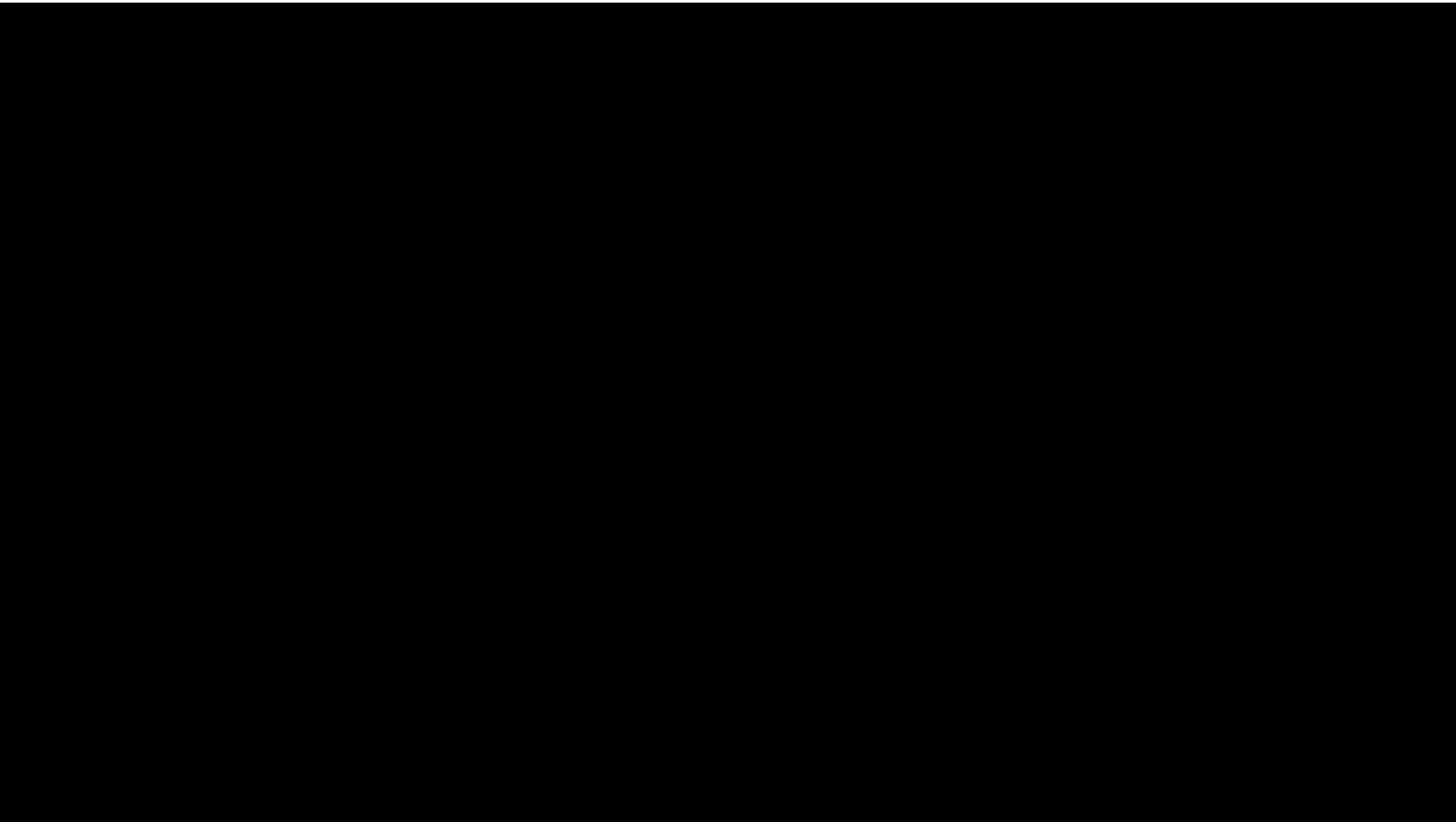


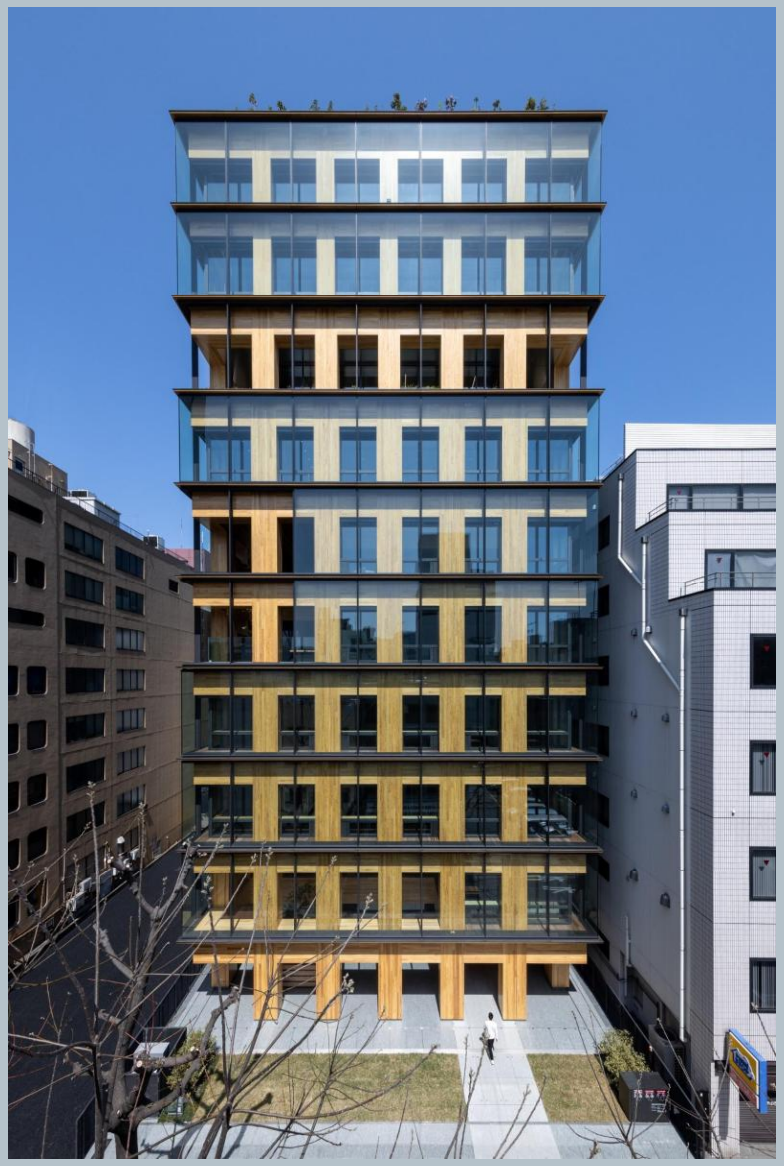
All Timber

All the main structural component are made of timber



1. Overview of Port Plus
2. Results of LCA in Port Plus
3. LCA Issues from the Designer’s Perspective





- **Site area**

  565㎡

- **floor area**

  350㎡

- **Total floor area**

  3,500㎡

- **Structure**

  11 stories above ground, 1 story underground

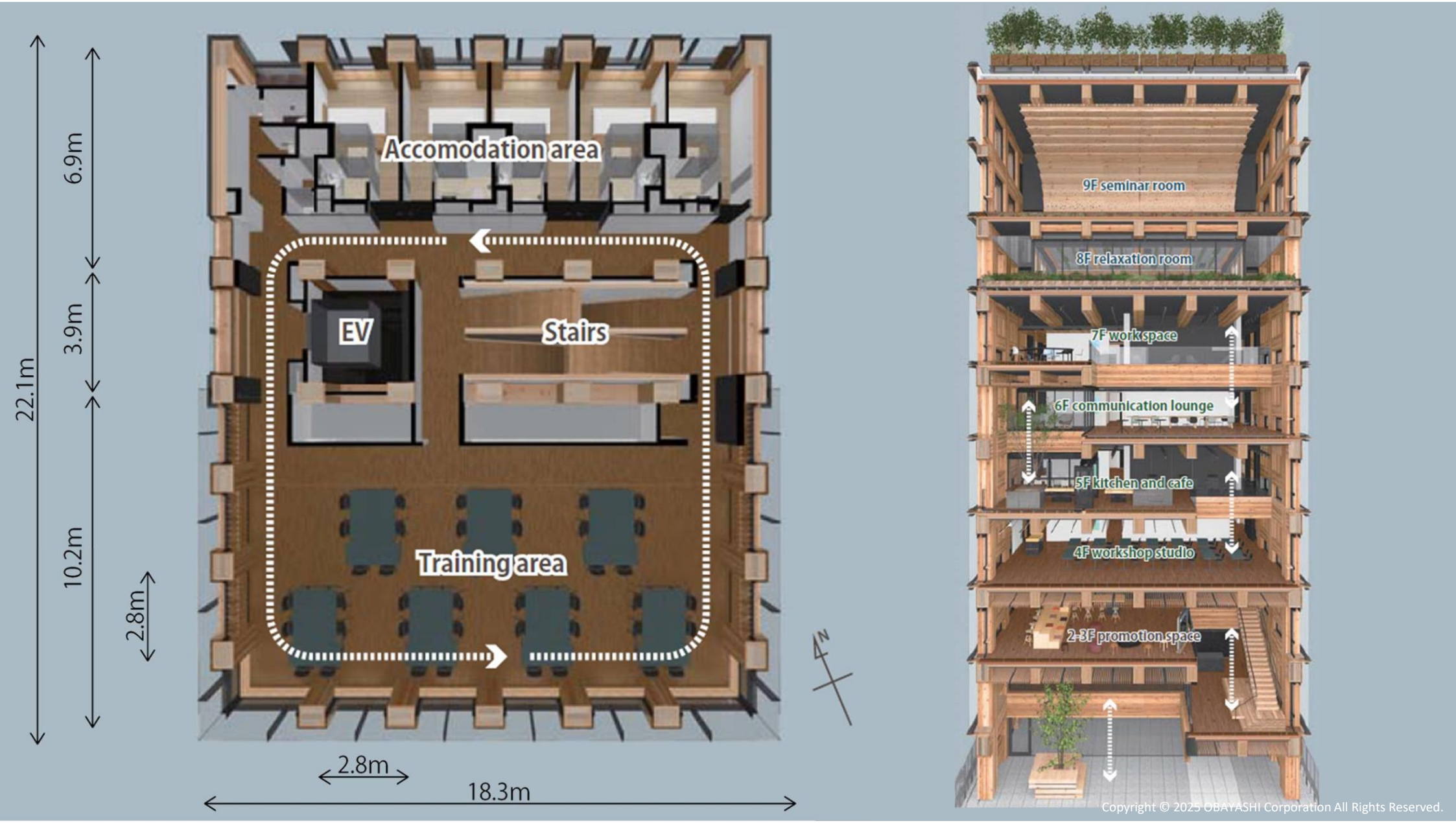
- **Construction Period**

  March 2020 – March 2022

- **Subsidy of approx. 330 million yen :**

  Sustainable Building Leadership Project

  Demonstration Project for Building Utilizing CLT

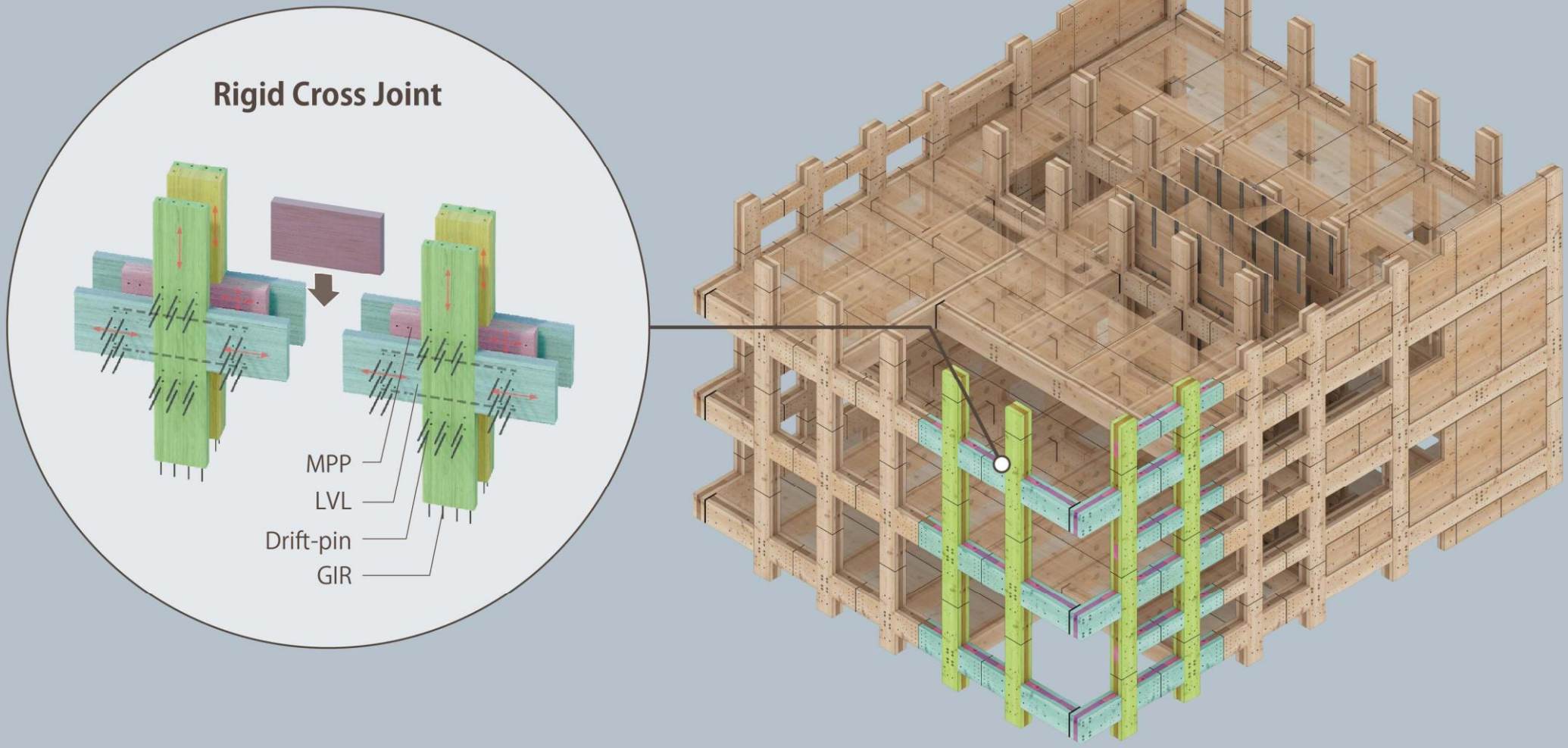


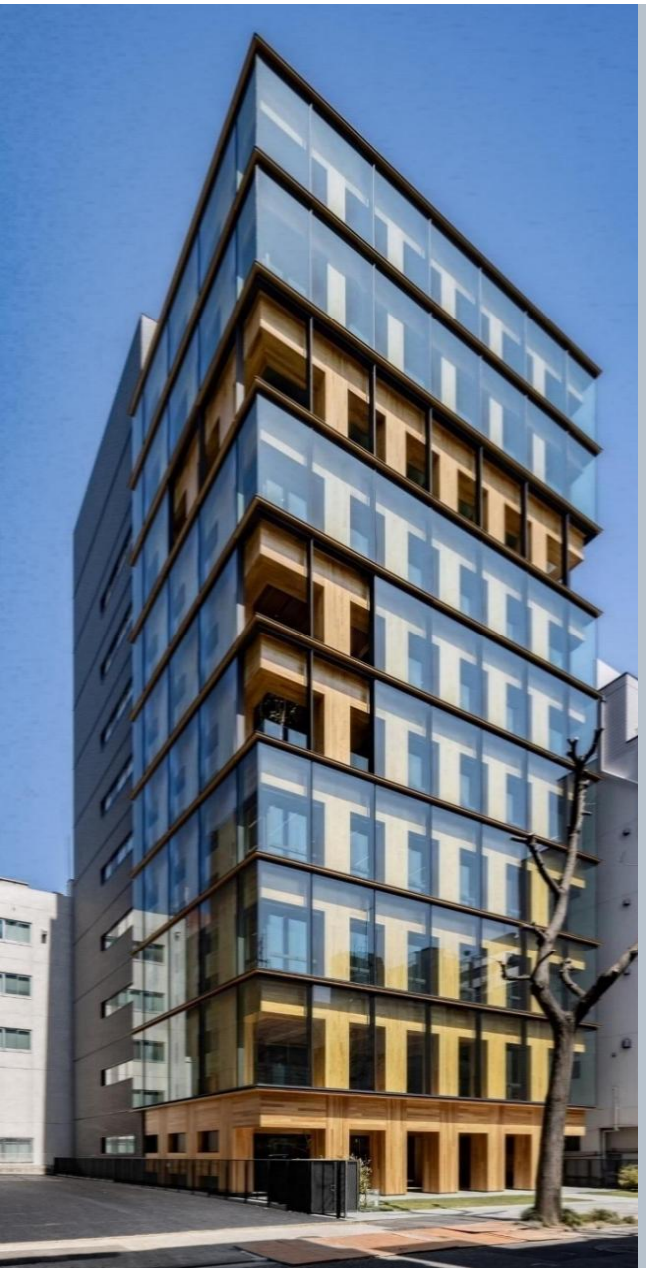
Challenges in realizing all timber high-rise building

Earthquake Resistance

×

Fire Resistance





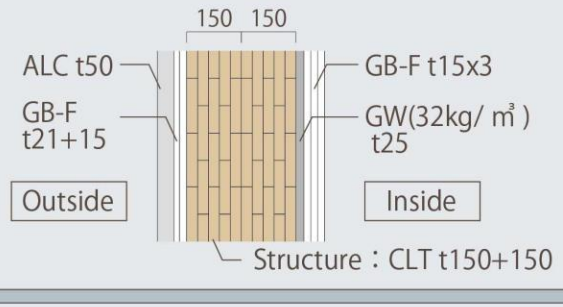
Challenges in realizing all timber high-rise building

Earthquake Resistance

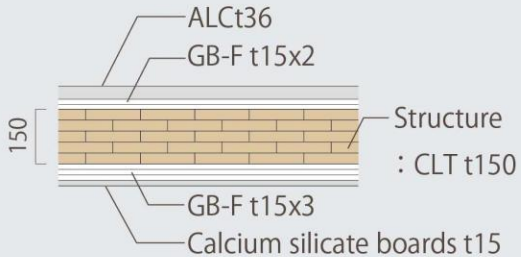
×

Fire Resistance

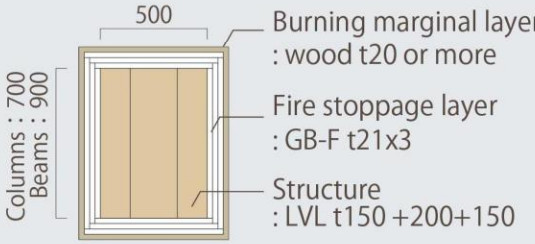
Exterior wall

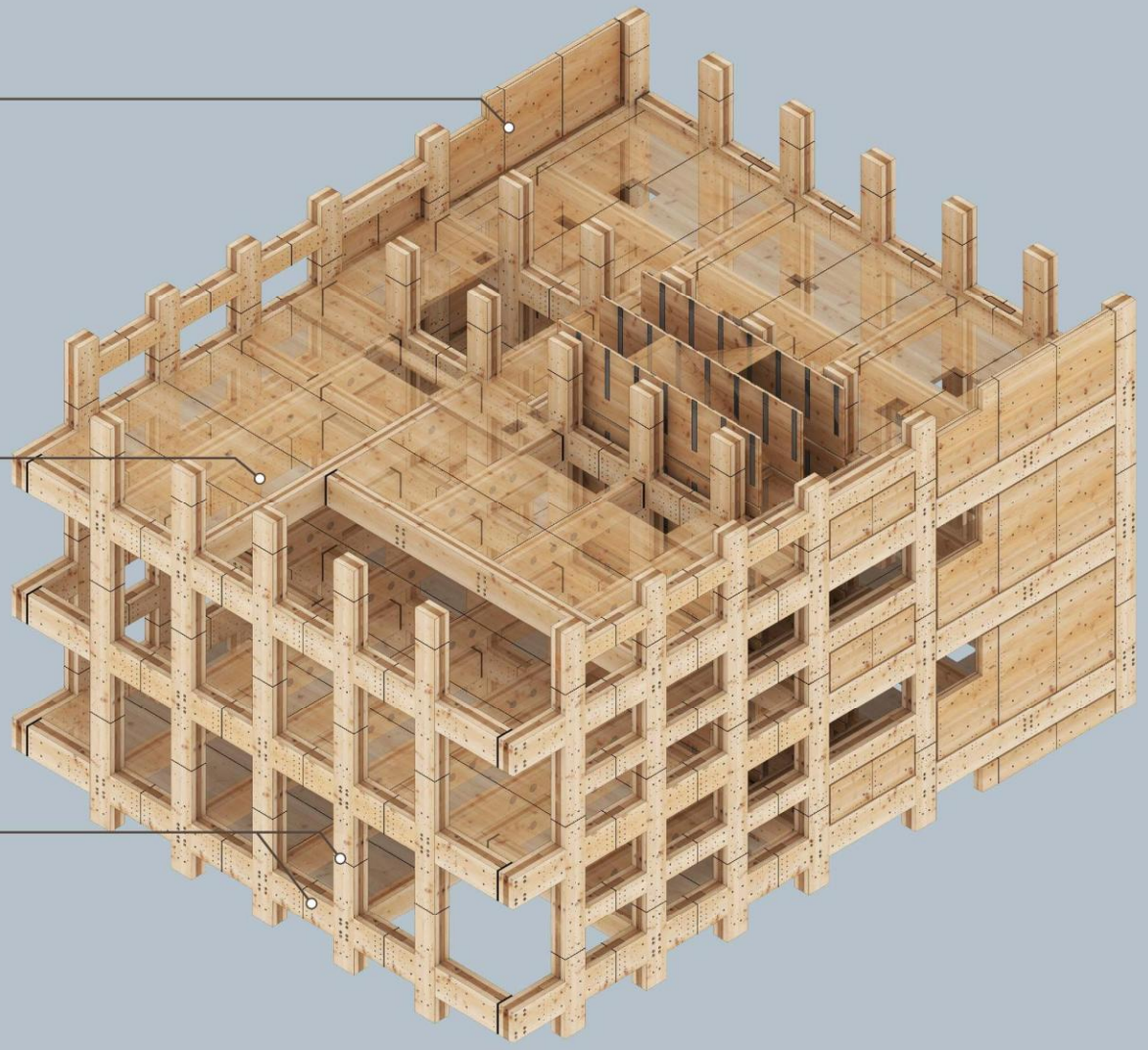


Floor



Columns and beams - Omega wood -





3,350 t-CO2
Carbon Offset in Port Plus

CO_2 Reduction

1,700t CO_2

Compared with steel structure

*Approximate value by One Click LCA

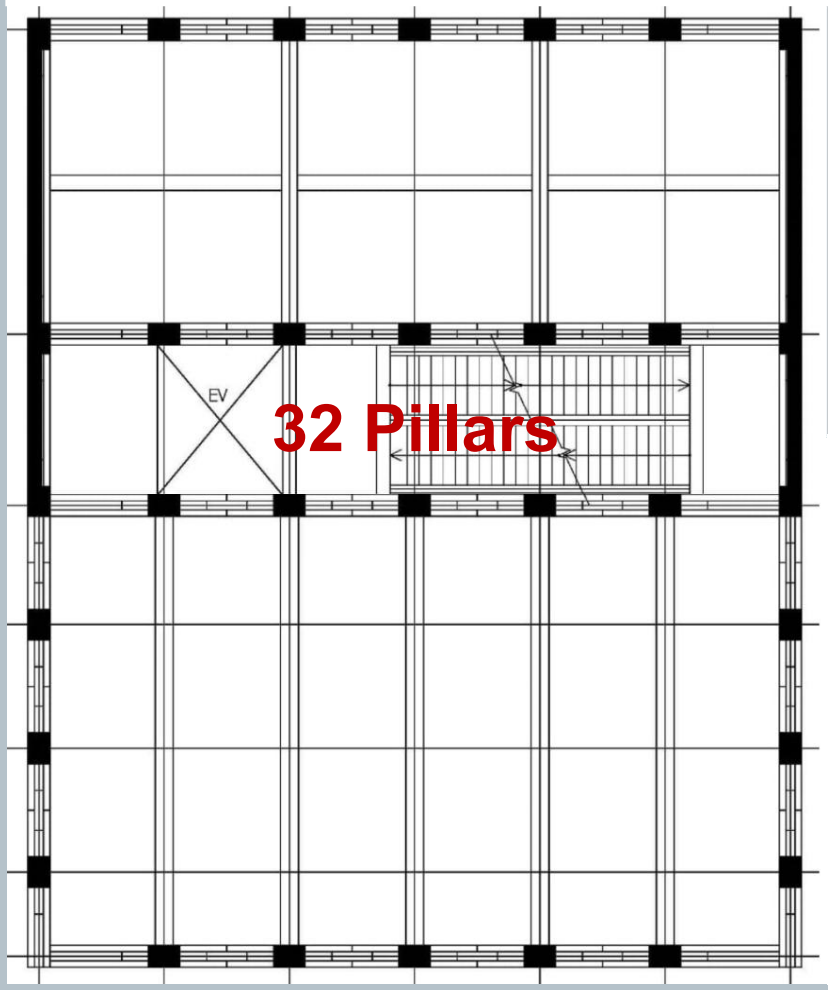
+

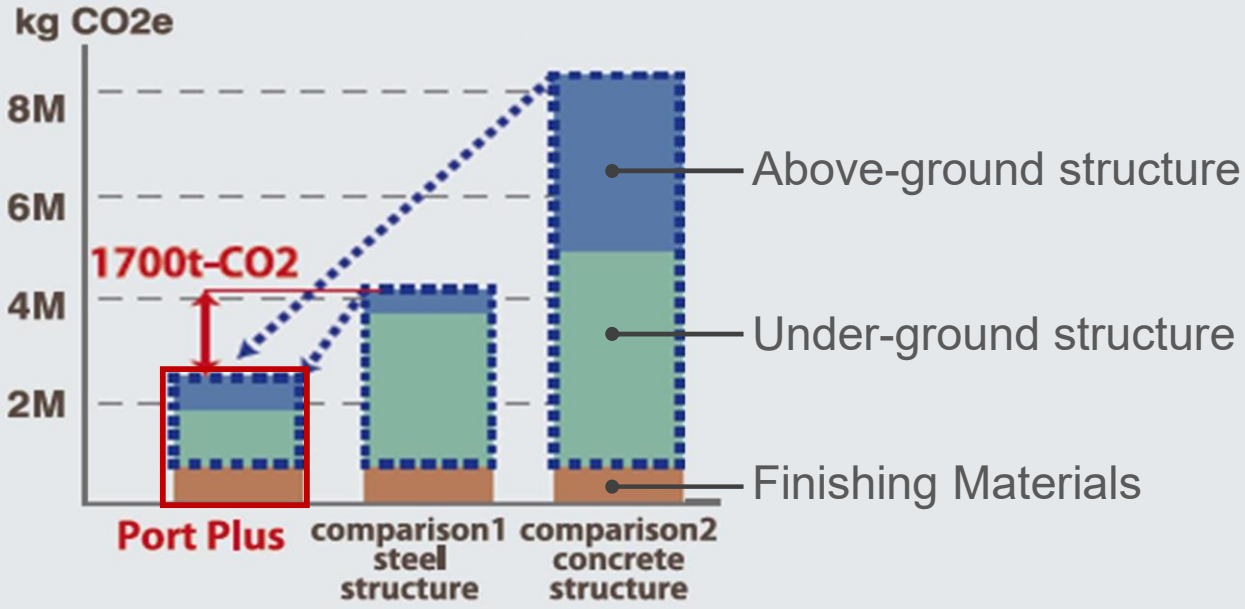
Biogenic carbon storage

1,650t CO_2

*Simple trial calculation by a calculation sheet released by the Forestry Agency

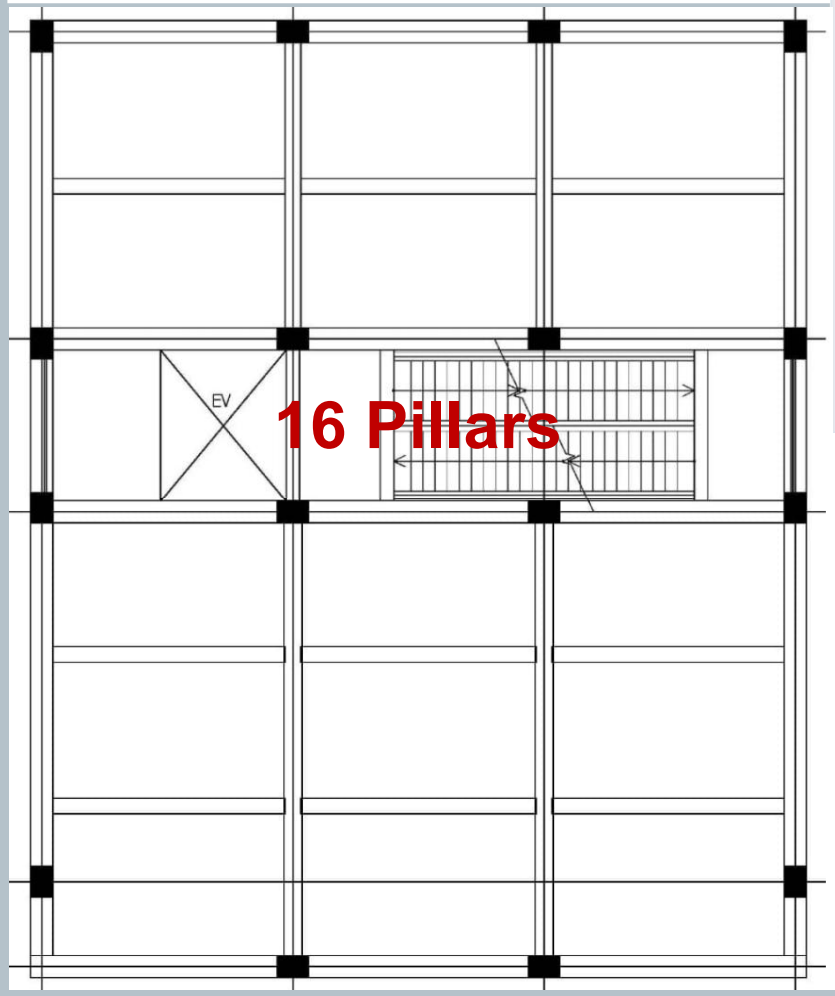
Port Plus
All Timber Structure

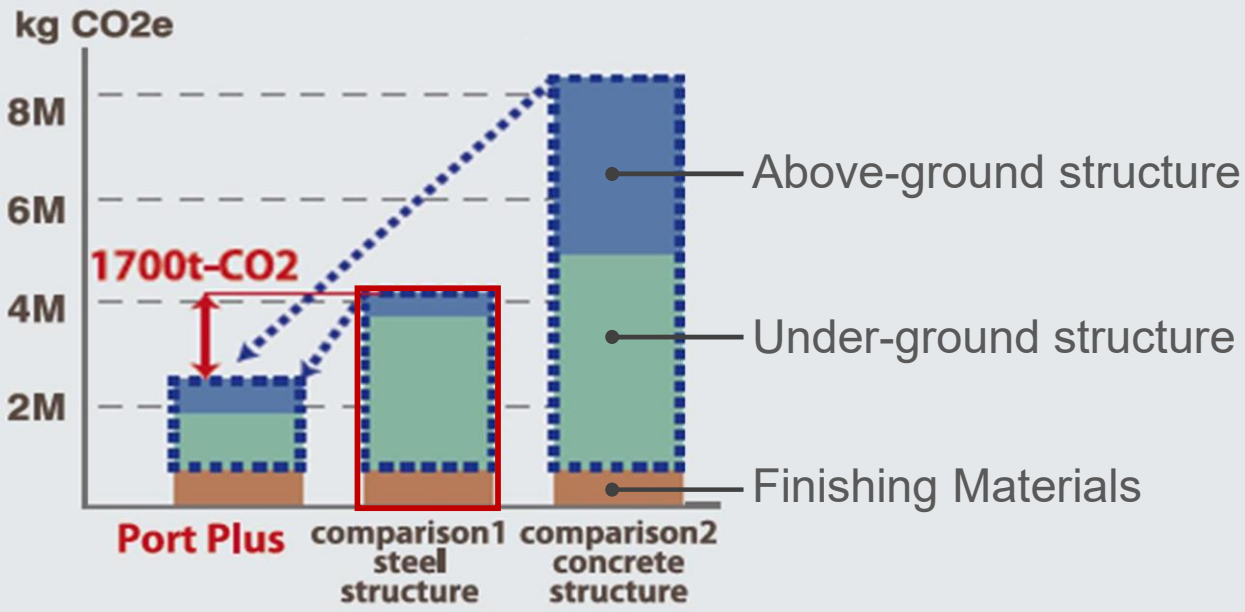




* Construction priod : 23.5 months
* with short-stroke seismic isolation system
* Main column size（timber）: □700×500mm
  Main beam size（timber） : □900×500mm
* Slab & roof thickness（timber）: 150mm
* Floor height : 4000mm

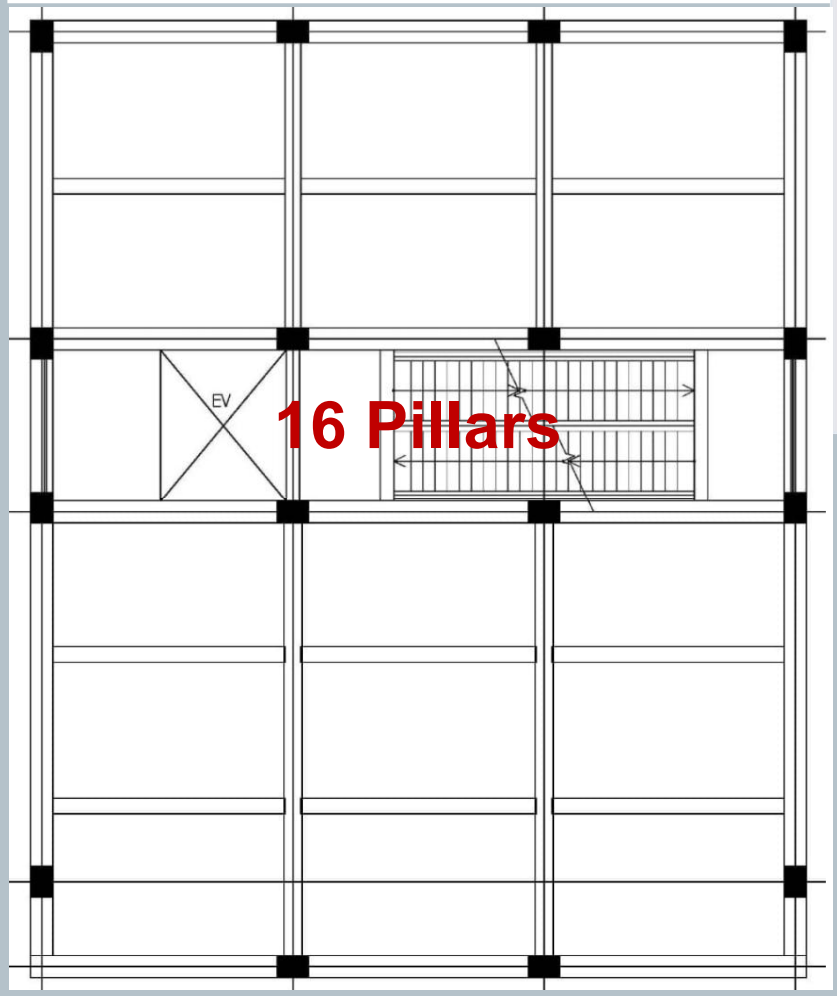
Comparison 1
Steel Structure

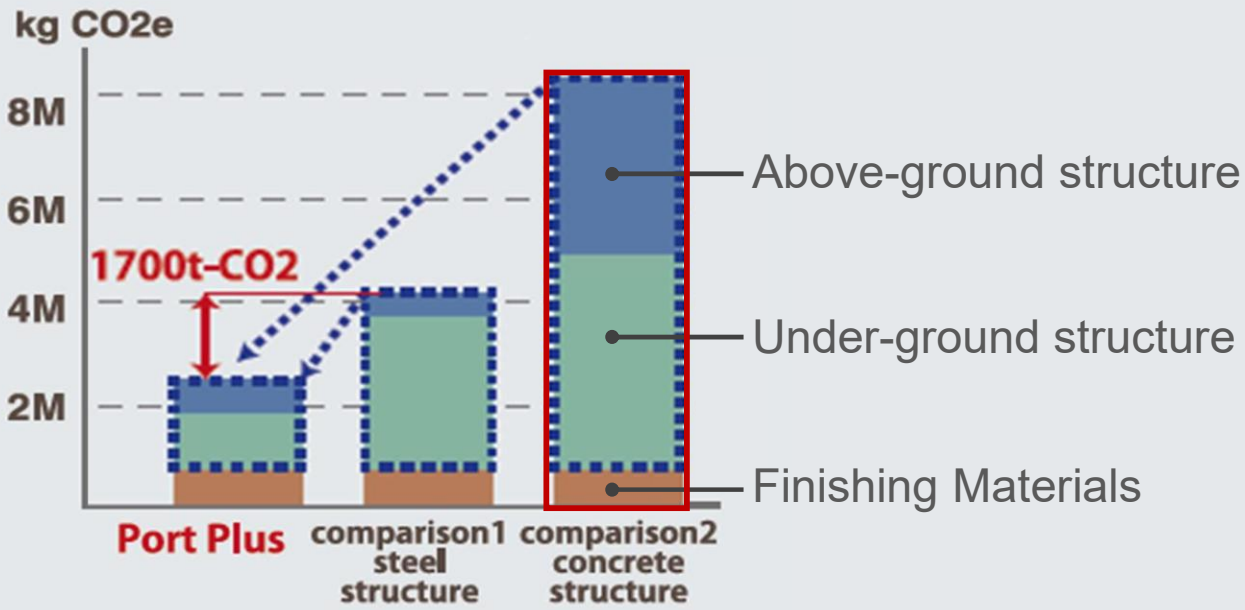




* Construction priod : 21.0 months
* with short-stroke seismic isolation system
* Main column size（steel）: □550×550mm
  Main beam size（steel） : H700×300mm
* Slab & roof thickness（Concrete） : 210mm
* Floor height : 4000mm

Comparison 2
Concrete Structure





* Construction priod : 32.5 months
* with short-stroke seismic isolation system
* Main column size（concrete）: □850×850mm
  Main beam size（concrete） : □900×500mm
* Slab & roof thickness（Concrete）: 210mm
* Floor height : 4000mm

Amount of wood used

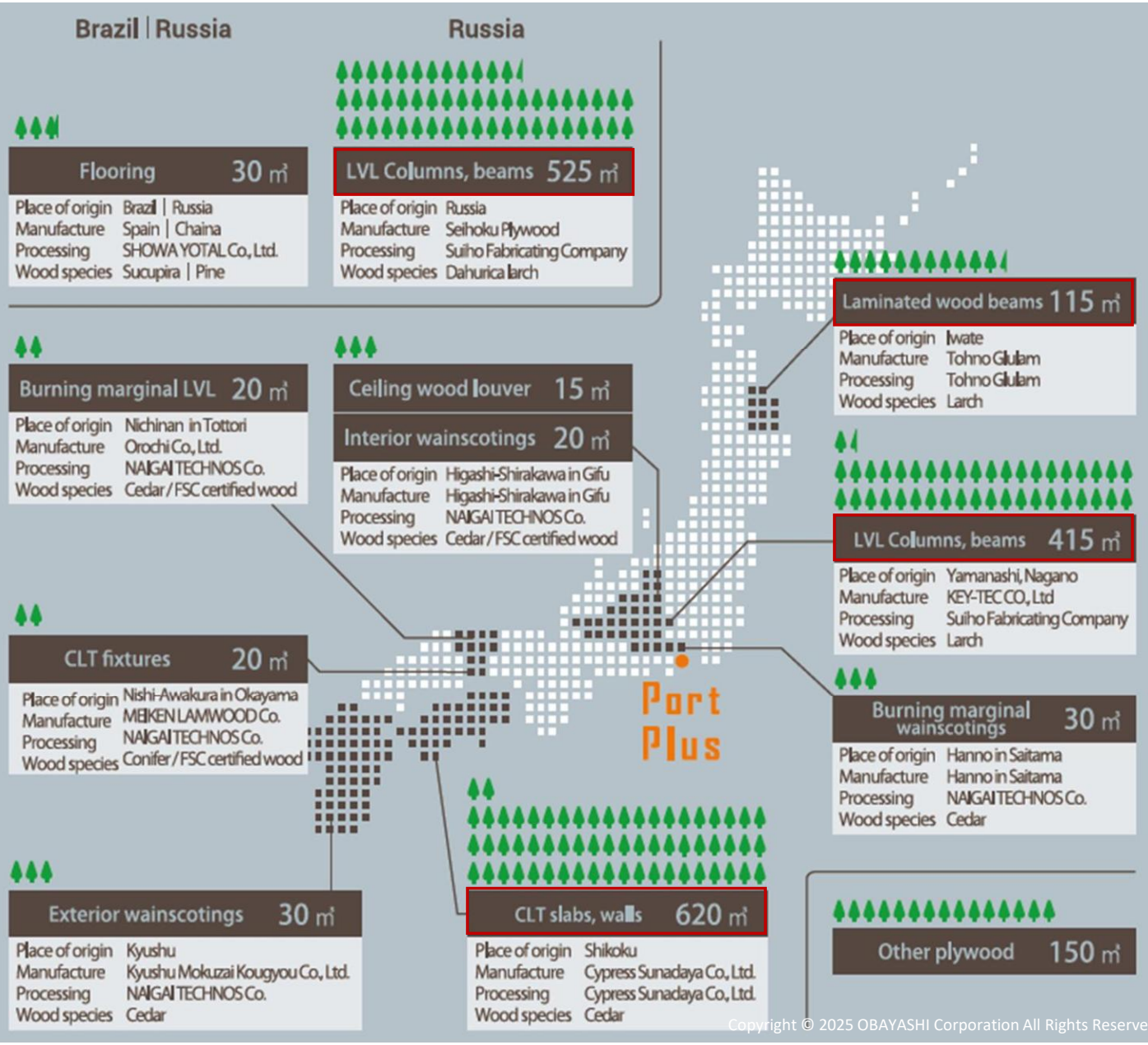
1,990 ㎥

Structure : 1,675 ㎥
Interior material : 315 ㎥

Biogenic carbon storage

1,650t CO_2

*Simple trial calculation by a calculation sheet released by the Forestry Agency



3,350 t-CO2
Carbon Offset in Port Plus

CO_2 Reduction

1,700t CO_2

Compared with steel structure

*Approximate value by One Click LCA

+

Biogenic carbon storage

1,650t CO_2

*Simple trial calculation by a calculation sheet released by the Forestry Agency

Why a Life Cycle Assessment at Port Plus?

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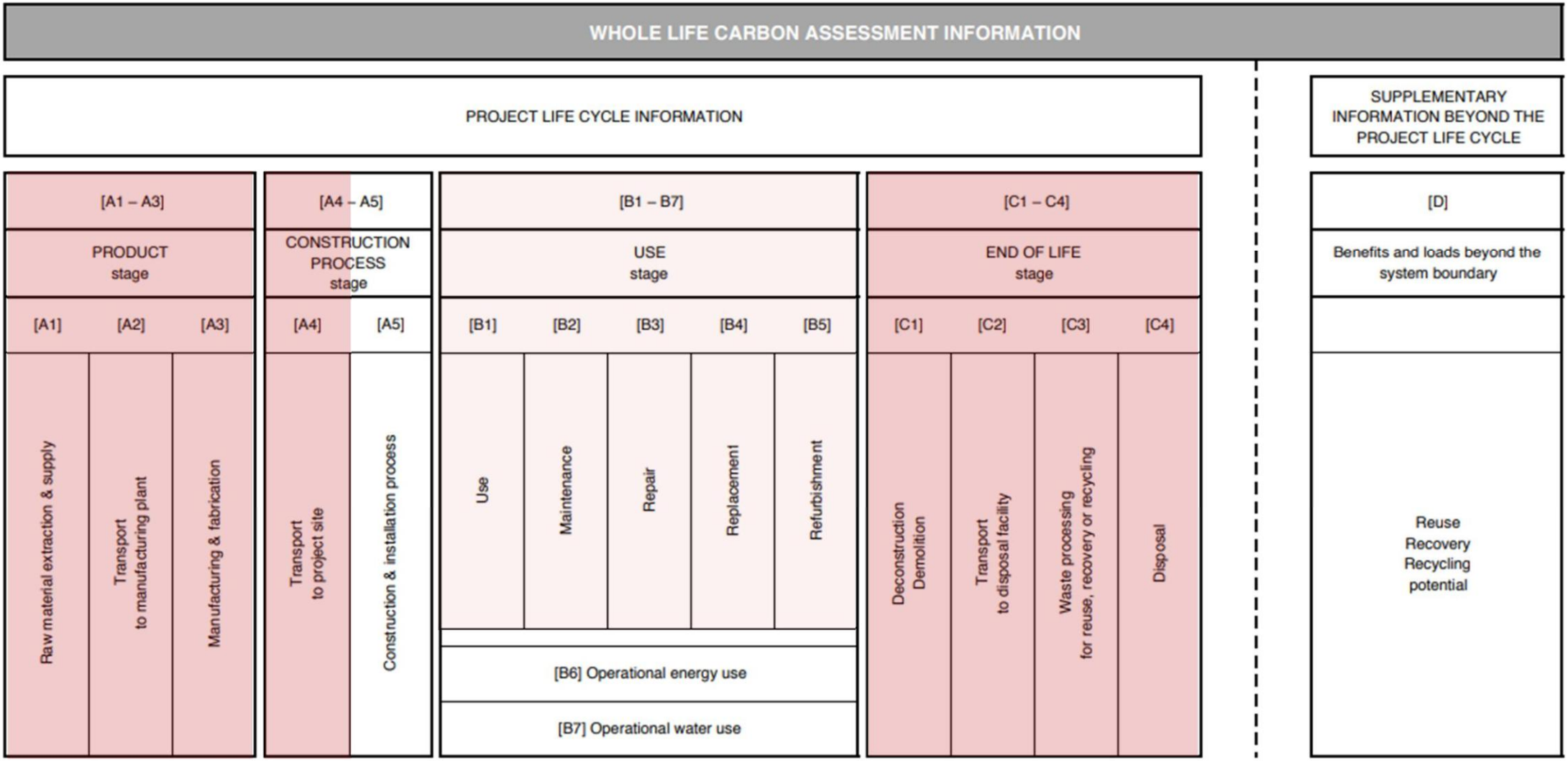
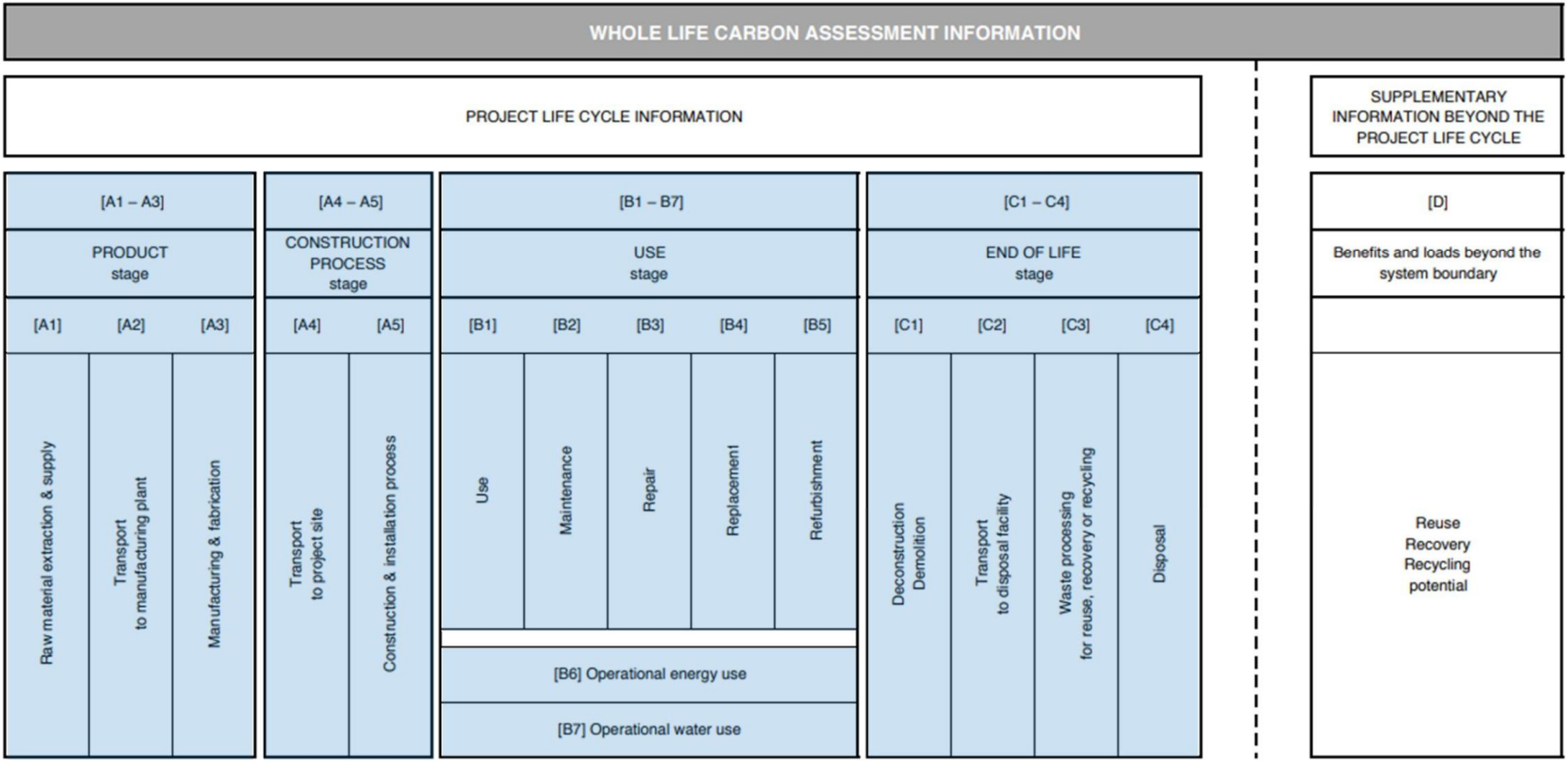
One Click LCA

Which LCA tool was used?

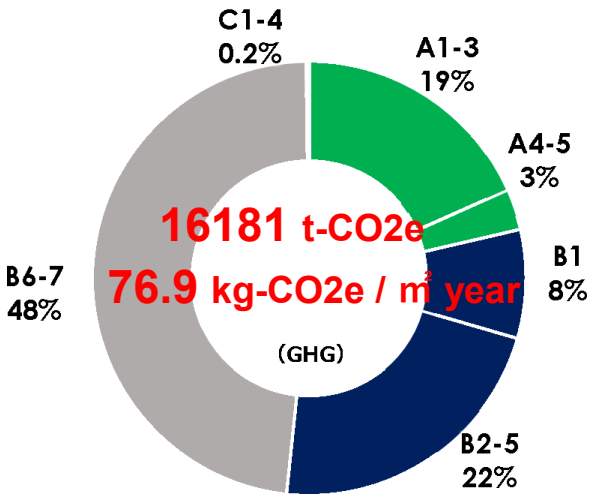
Stage calculated by **One Click LCA**

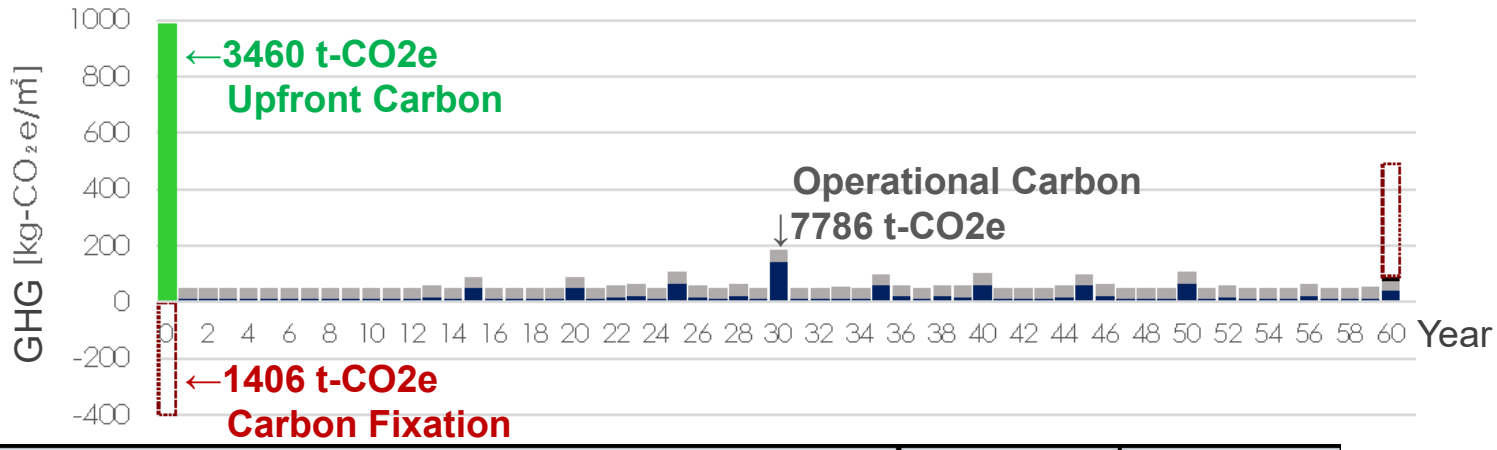


Stage calculated by **J-CAT**



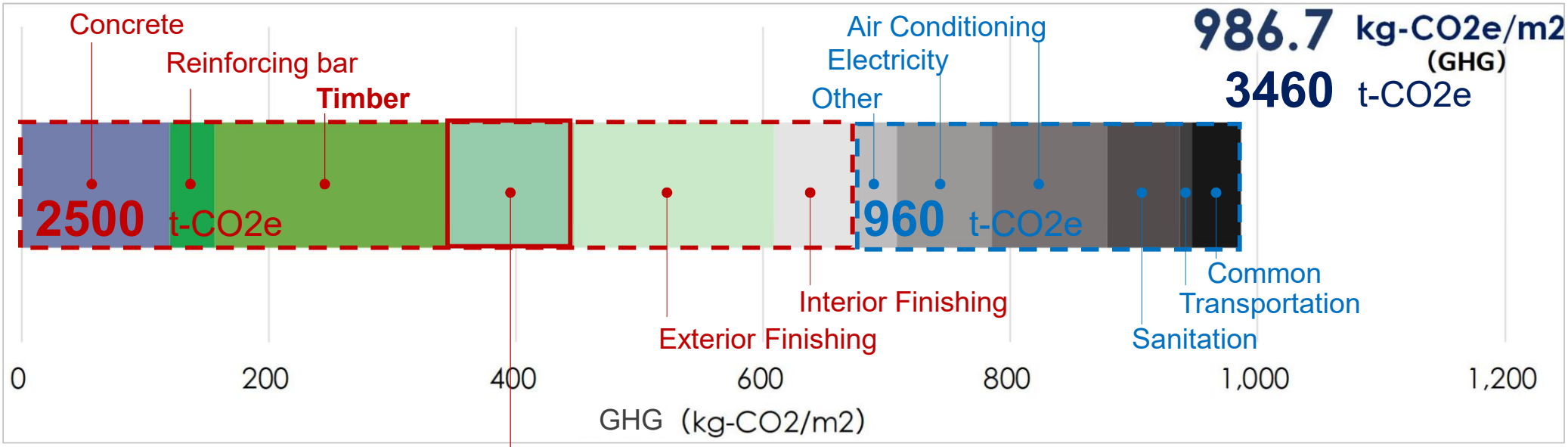
Results of LCA by **J-CAT**





kg-CO2e / m² year	stage					Total	Ratio
	Product	Construction	Use		End of Life		
	A1-A3	A4-A5	B1-B5	B6-B7	C1-C4		
Architecture	10.3	1.5	2.3	0.0	0.2	14.3	18.6%
Electric & Solar	1.2	0.1	2.8	37.0	0.0	54.6	71.0%
Air Conditioning	1.5	0.1	6.4		0.0		
Sanitation	0.9	0.0	3.9		0.0		
Transportation	0.2	0.0	0.5		0.0		
Common	0.0	0.7	0.7			1.3	1.7%
Maintenance			0.4			0.4	0.5%
CFC leak			6.2			6.2	8.1%
Total	14.1	2.3	23.3	37.0	0.2	76.9	100.0%
Ratio	18.3%	3.1%	30.3%	48.1%	0.2%	100.0%	

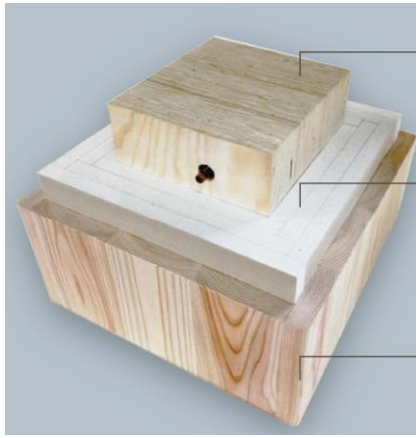
Analysis of Upfront Carbon



Fire-proof Layer : Gypsum Boards

10% of total upfront carbon

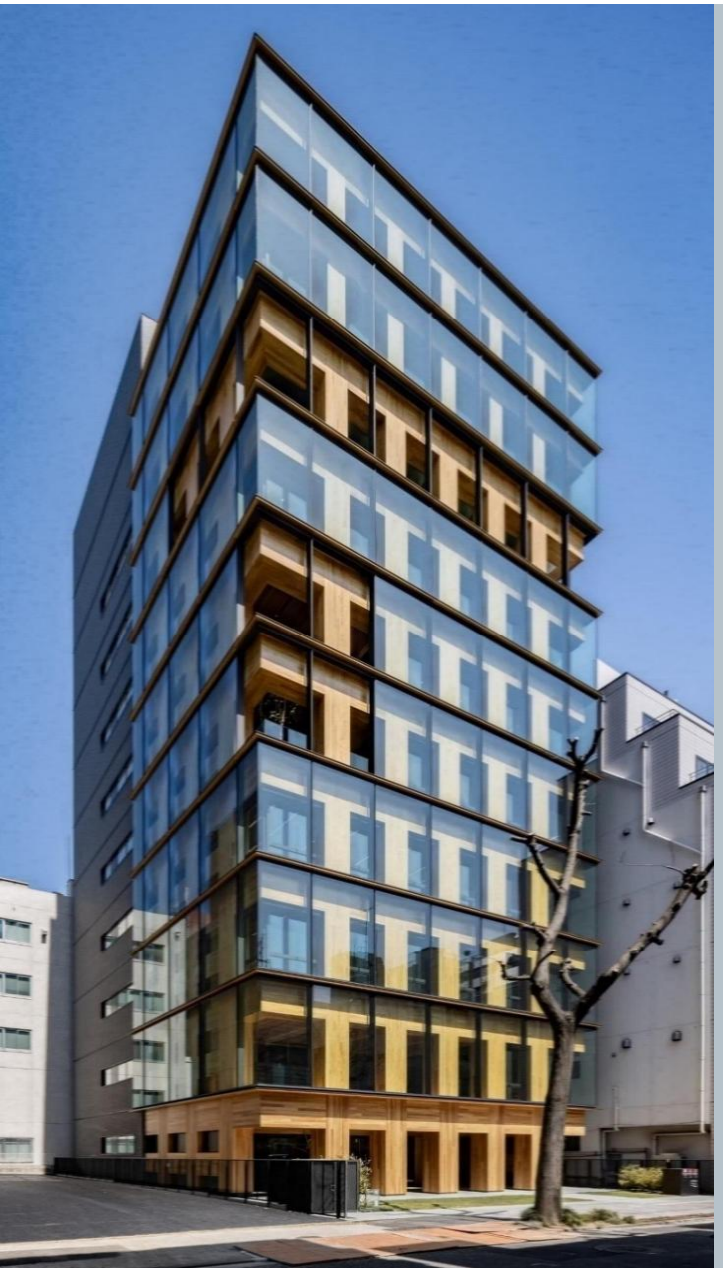
* Gypsum Boards : 72 kg CO2e /㎡



Structure : Timber

Fire-proof layer :Gypsum Boards

Burning marginal layer : Timber



LCA Issues from the Designer’s Perspective

1. Development of EPDs for building materials, leading to carbon pricing
2. Decarbonization decisions support for clients in the SD phase
3. Evaluation of decarbonization after End of Life (C1-C4) Stage

1. Development of EPDs for building materials, leading to carbon pricing

EPD®

Environmental Product Declaration

According ISO 14025 and EN 15804+A1 for:

EGO-CLT Cross Laminated Timber wood panel

Programme	*The International EPD® System www.environdec.com*
Programme operator	*EPD International AB*
EPD Registration number	*S-P-01314*
Published	*2018-05-23*
Valid until	*2023-05-18*
Type of EPD	*Cradle-to-grave*
Product Category Rules	*PCR 2012:01 - Construction products and construction services. Ver 2.2 Sub-PCR. Wood and wood-based products for use in construction*

egoin

エコリーフ
タイプⅢ環境宣言（EPD）
登録番号： JR-AC-18003E

JEMAI環境ラベルプログラム
一般社団法人産業環境管理協会
東京都千代田区鍛冶町2-2-1
https://www.jemai-label.jp

安全で快適な住空間を創る
YOSHINO
吉野石膏株式会社
Yoshino Gypsum Co.,Ltd

強化せっこうボード（GB-F）
タイガーボード・タイプ Z 、タイガーボード・タイプ Z-WR
（21mm厚）

Fire-Resistant Gypsum Board (GB-F)
Tiger Board Type Z , Tiger Board Type Z-WR (Thickness:21mm)

算定単位

1㎡

算定対象段階

□最終財　■中間財

製造段階（原料調達・原料輸送・生産）

製品の型式、主要仕様・諸元

型式：

製造工場：千葉第一工場

●強化せっこうボード（GB-F）

厚さmm		21
単位面積当たりの質量 kg/m²		15.0～20.4
比重		0.75～0.95
含水率		2kg下
曲げ破壊荷重 N(kgf)	長さ方向	850(86.7) 以上
	幅方向	320(32.7) 以上
耐衝撃性		くぼみの直径が25mm以下で、かつ、亀裂が貫通しないこと。
耐火性		破断して落下しないこと。
難燃性又は発熱性		難燃1級又は発熱性 1級
熱抵抗 m²·K/W		0.048以上

問い合わせ先

吉野石膏株式会社　品質保証室

http://yoshino-gypsum.com/

電話:03-3890-4111

登録番号	JR-AC-18003E
適用PCR番号	PA-178200-AC-01
PCR名	せっこうボード製品（中間財）
公開日	2018年6月1日
検証合格日	2018年4月27日
検証方式	個品別検証方式
検証番号	JV-AC-18003E
検証有効期間	2023年4月26日
PCRレビューの実施	
認定日	2018年　2月　15日
委員長	神崎　昌之（一般社団法人産業環境管理協会）
第三者検証者＊	
外部検証員	梅原　由美子

ISO14025およびISO21930に従った
本宣言及びデータの独立した検証

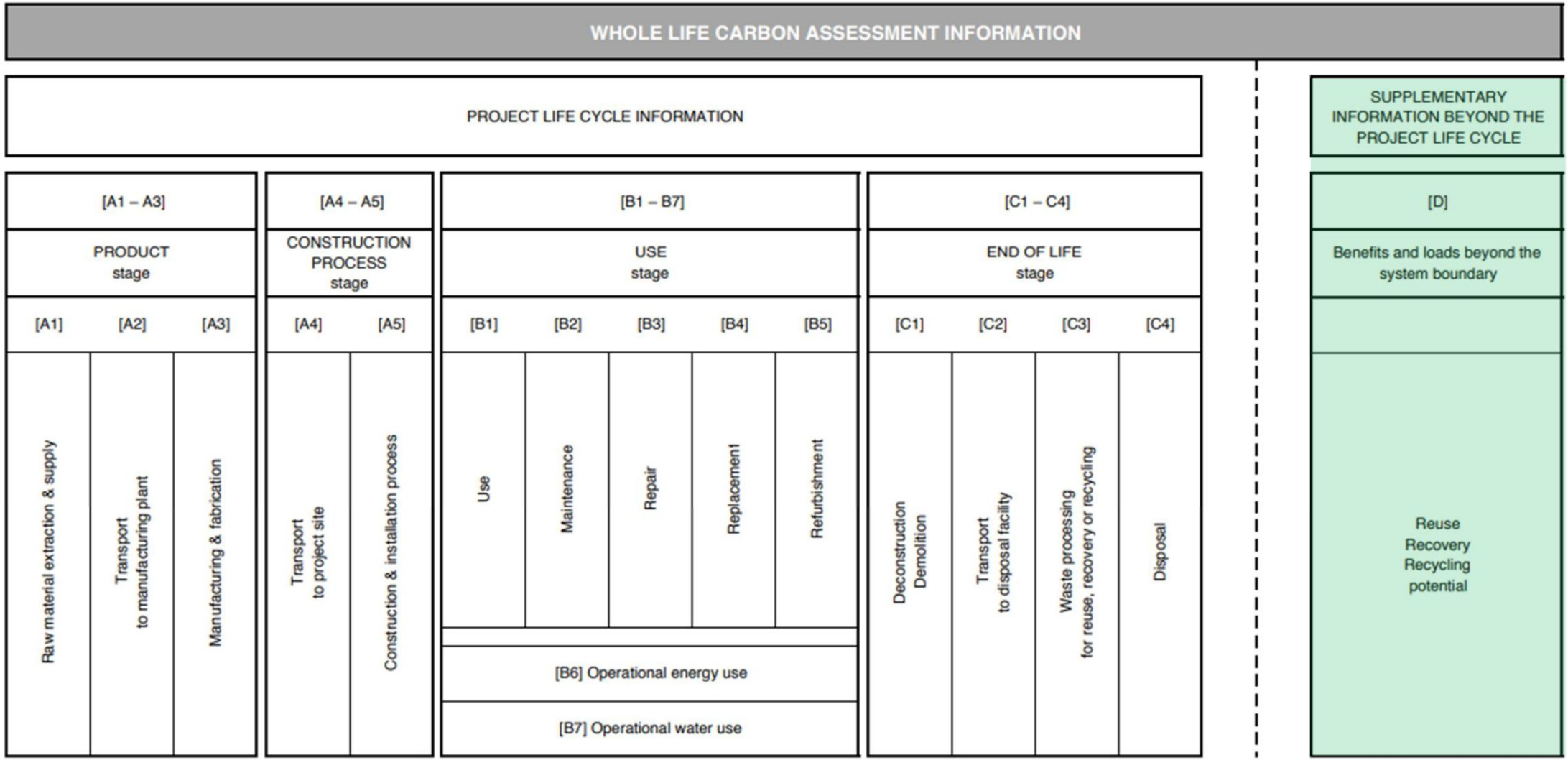
□内部　■外部

登録番号：　JR-AC-18003E

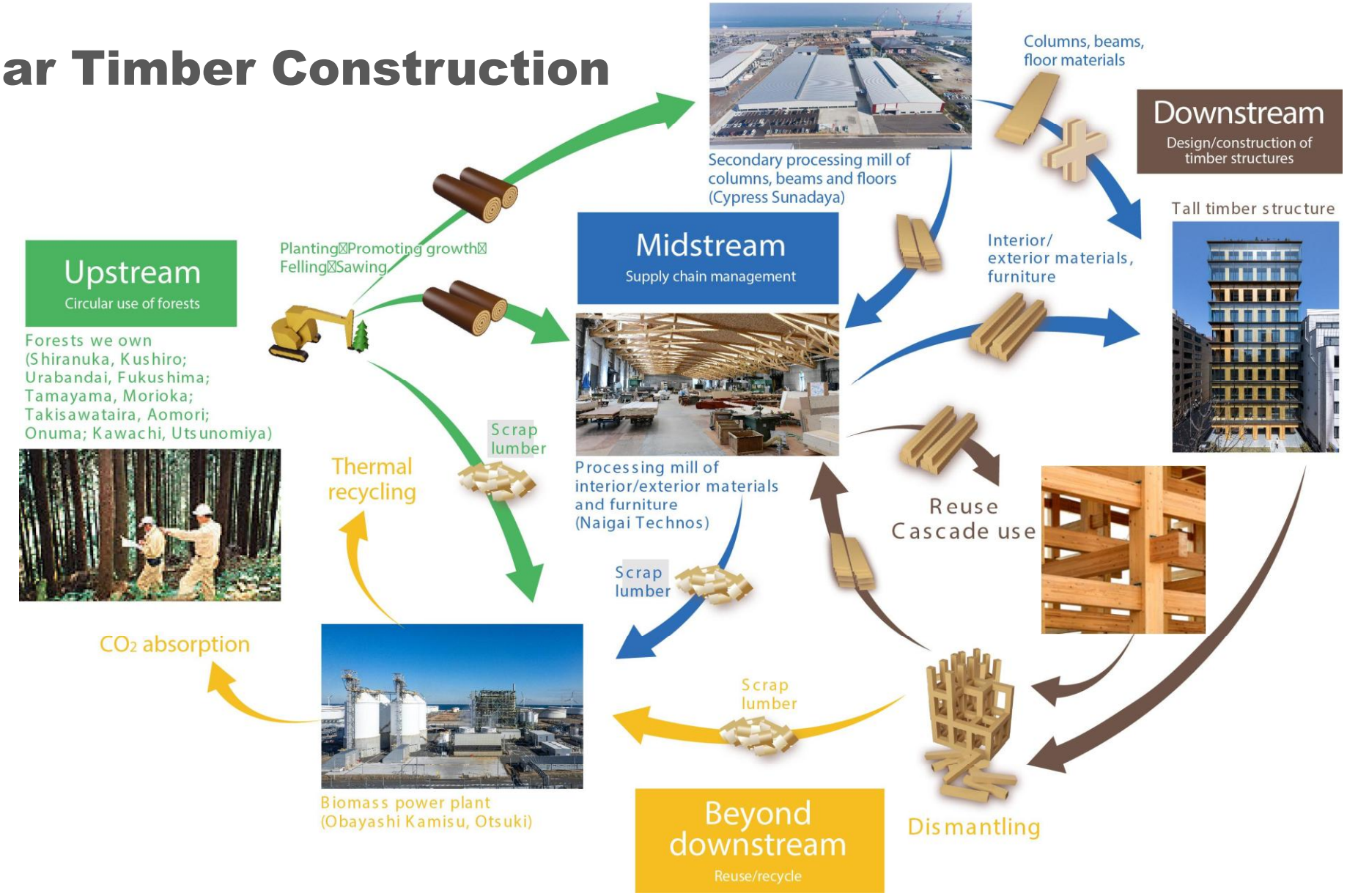
2. Decarbonization decisions support for clients in the SD phase

Life Cycle Visualizer | JOCOTAI

3. Evaluation of decarbonization after End of Life (C1-C4) Stage



Circular Timber Construction



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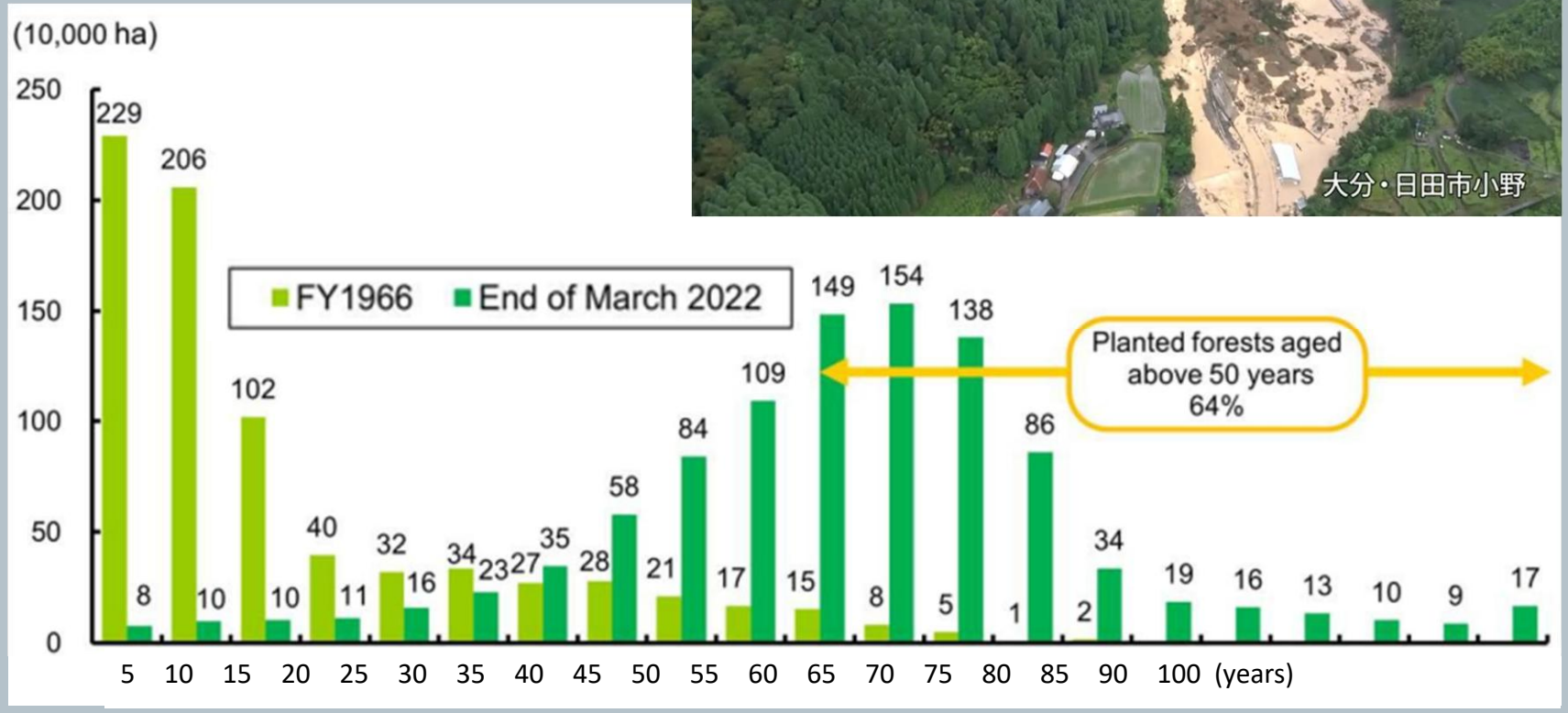
Appendix

Requirement to use **“MORE”** wood in mid or high-rise buildings

Area of planted forest age

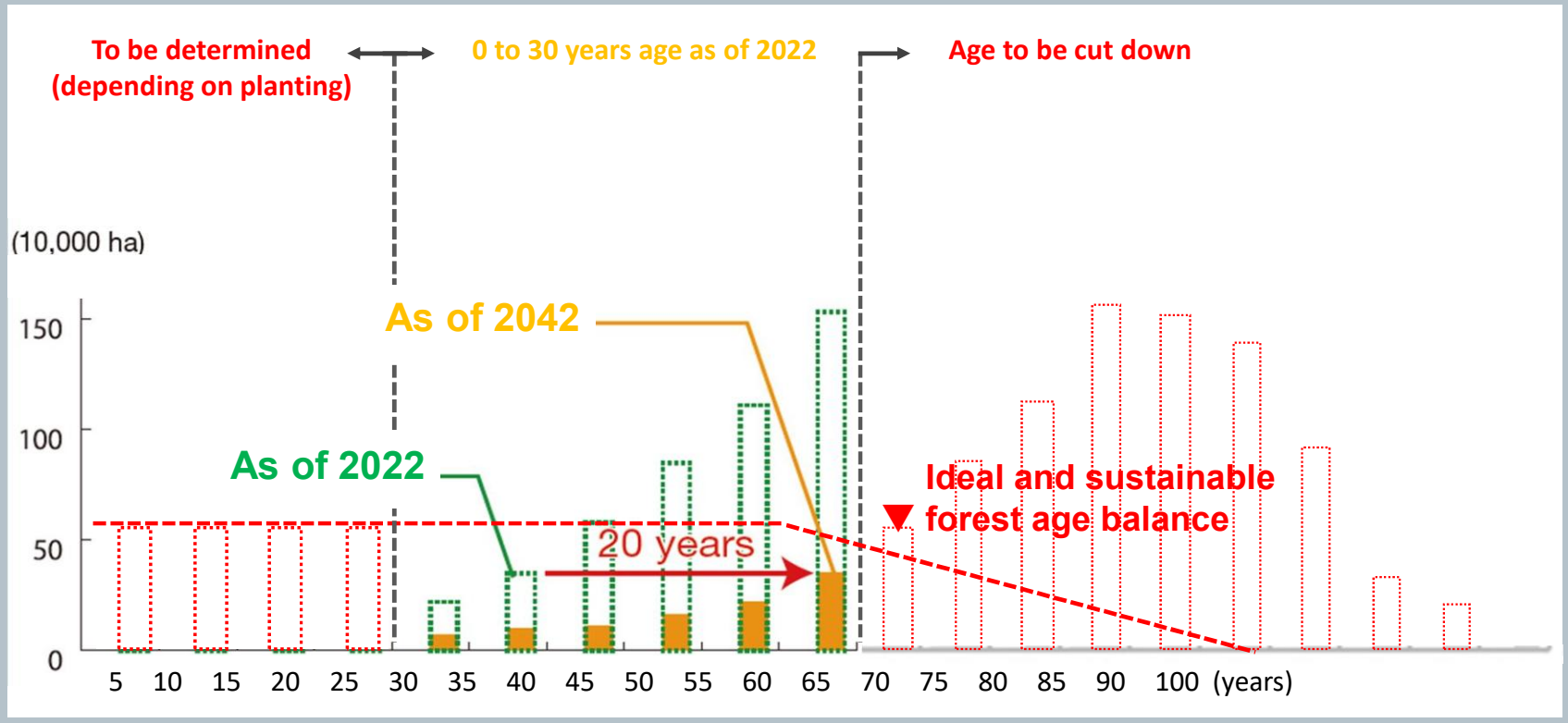


Requirement to keep wood in buildings **“LONGER”**

▼

DfD | Design for Deconstruction

Area of planted forest age as of 2042



Wood “Grand Ring” of the EXPO 2025

OsM | Offsite Manufactured

▼

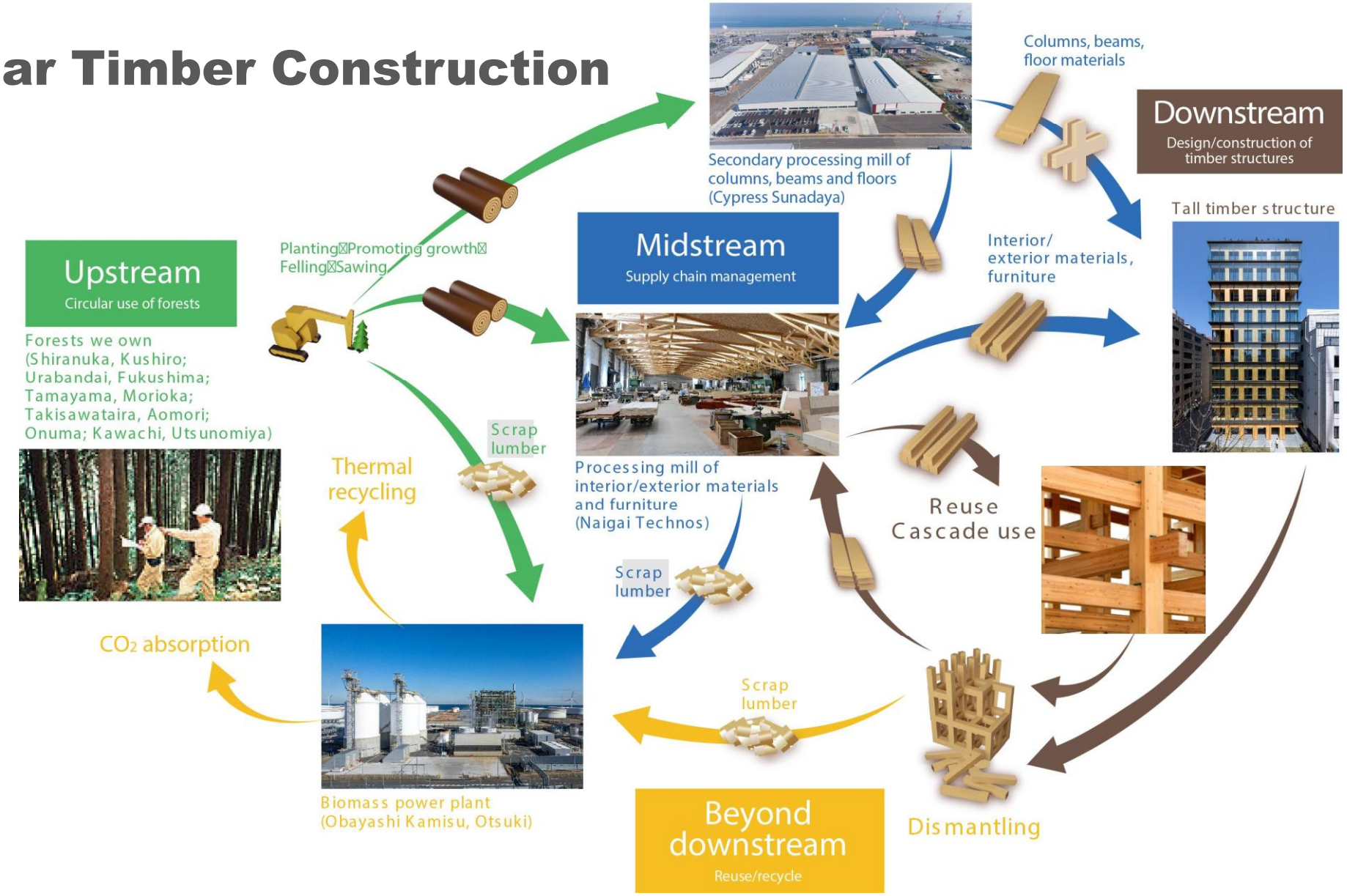
DfD | Design for Deconstruction

▼

EoL | End of Life Scenarios

BaMB | Building as Material Bank

Circular Timber Construction



Circular Timber Construction Report

—Mass timber strategy and quantitative analysis for “more” and “longer” use of wood—

Yosuke Komiyama (Kyoto University)

Sho Ito, Shun Takayama, and Mari Ota (Timber Design and Construction Department, Obayashi Corporation)

March 2023

Table of Contents

https://www.obayashi.co.jp/woodvision/pdf/circular-timber-construction_report_eng_ver.pdf