HiBiWood

CLT Production, Planning and Design

Johanna Kairi

Business Development Manager Austria

THE RENEWABLE MATERIALS COMPANY

- Stora Enso and Division Wood Products
- Products by Stora Enso
  - CLT / CLT rib panels
  - Digitools
  - Manuals
- Stora Enso’s reference projects

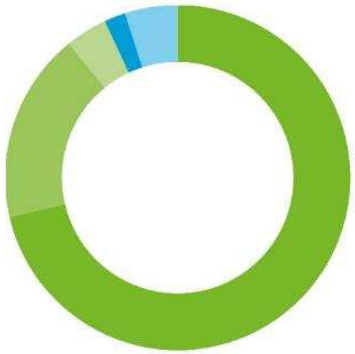

Everything
that's made
from fossil-based
materials today
can be made from a
tree tomorrow.
Milk
Fresh & Fun
Safe packaging
Home delivery
Every box counts
JOGHURT
storaenso

Stora Enso in brief

Sales in 2020
EUR 8.6 billion

Sales in
50
countries

Sales by destination

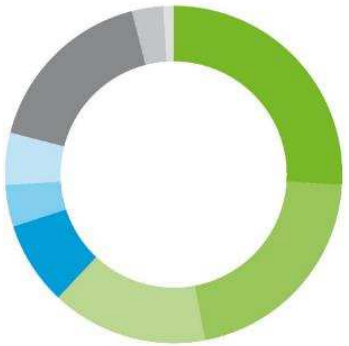


- Europe 72%
- Asia Pacific 18%
- North America 4%
- South America 2%
- Other 5%

Employees
23 000

Shares listed on Nasdaq in Helsinki and Stockholm

Personnel by country[1]



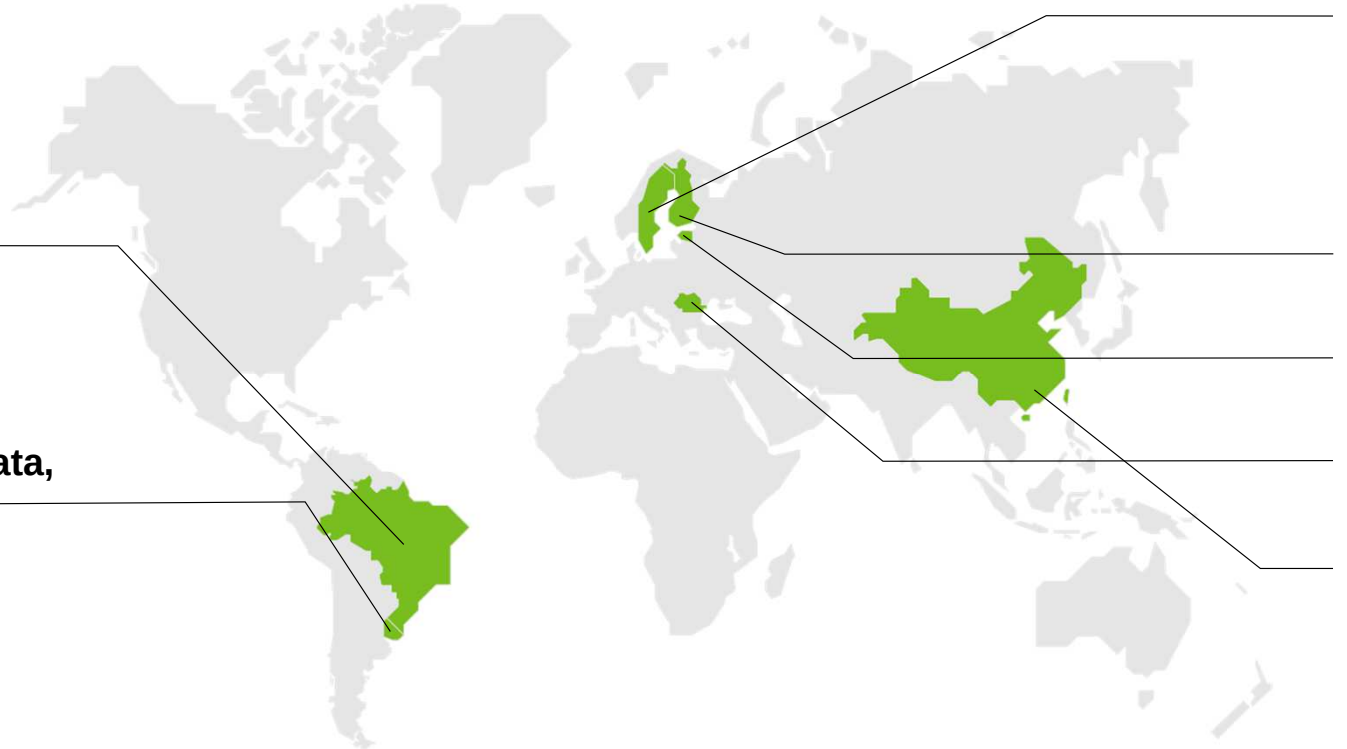
- Finland 26%
- Sweden 21%
- China 15%
- Poland 8%
- Germany 4%
- Russia 5%
- Other Europe 17%
- Brazil and Uruguay 3%
- Other countries 1%

[1] Including 50% of the employees at Veracel in Brazil and Montes del Plata in Uruguay.

Financial figures are based on full year 2020 result

One of the world’s biggest private forest owners

Total forest asset value in balance sheet EUR 7.3 billion



Veracel,
Brazil
112 000 ha
of forest land

Montes del Plata,
Uruguay
135 000 ha
of forest land

Swedish forests
1 398 000 ha
of forest land

Tornator
259 000 ha
in Finland

28 000 ha
in Estonia, and

5 000 ha
in Romania

Guangxi,
Southern China (leased)
81 000 ha
of forest land

Our divisions

Packaging Materials

Share of Group sales **36%**

Share of Group operational EBIT **62%**

Packaging Solutions

Share of Group sales **7%**

Share of Group operational EBIT **5%**

Biomaterials

Share of Group sales **14%***

Share of Group operational EBIT **1%**

Wood Products

Share of Group sales **16%**

Share of Group operational EBIT **18%**

Forest

Share of Group sales **24%**

Share of Group operational EBIT **25%**

Paper

Share of Group sales **23%**

Share of Group operational EBIT **–6%**

Financial figures are based on full year 2020 result
* of which internal sales 14%

Recent announcements

Stora Enso
114,640 followers
9h •

Our pilot plant for producing bio-based carbon materials from lignin has started operations. Pilot production of Lignode® by Stora Enso, wood-based carbon for batteries, is currently being ramped up. By converting lignin separated from wood into carbon-based anode materials, the synthetic and non-renewable graphite material can be replaced. Read more: https://hubs.li/H0SL0XF0

#biobased #renewablematerials

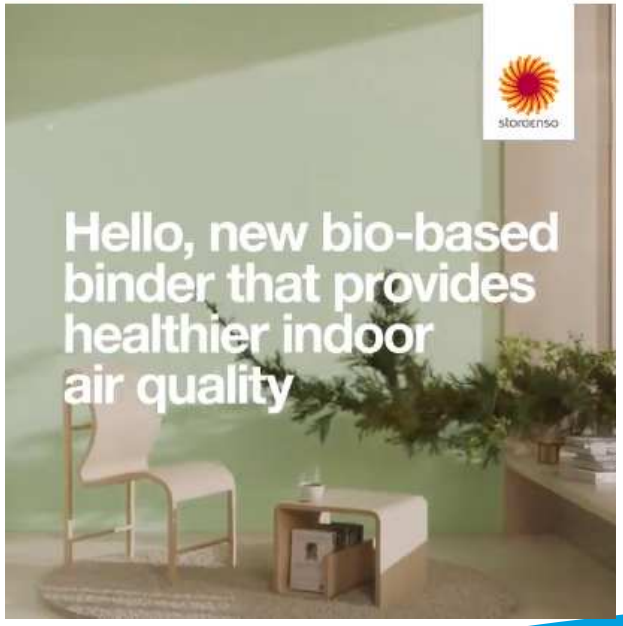
Stora Enso's pilot plant for producing lignin-based carbon materials for batteries is now operational

storaenso.com • 2 min read

Biomaterials for a renewable future
5,580 followers
1mo •

Potentially harmful chemicals aren't always visible but are still widely present in our homes as part of the binding agents in furnishings, inner walls and insulation. By using a bio-based alternative, you still get all the technical qualities of traditional binders, but with the benefits of being safe - and from renewable sources. NeoLigno by Stora Enso is a fully bio-based binder without formaldehyde and isocyanate, providing a safer and healthier indoor environment. Talk to us if you are ready to make the switch. Read more: https://hubs.li/H0Q3pct0

#biobased #renewablematerials



Stora Enso
114,640 followers
1d •

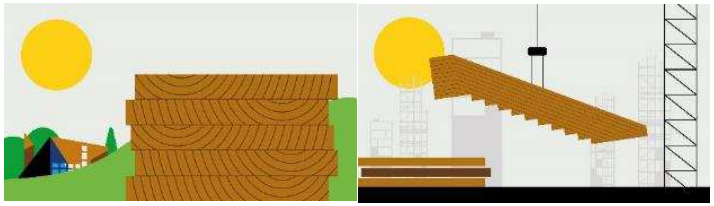
A truly circular future requires collaborative effort. In an innovative joint project with Tetra Pak, we will triple the recycling capacity of beverage cartons in Poland via a new large-scale recycling system at our Ostrołęka production unit. We will further improve recycling in Europe by processing carton from neighboring countries.

Stora Enso and Tetra Pak join forces to triple the recycling capacity of beverage cartons in Poland

storaenso.com • 3 min read

Stora Enso Wood Products:
The leading provider of sustainable building solutions

Two focus areas:

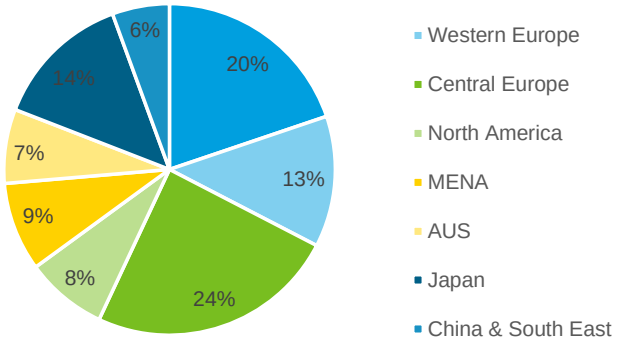


Traditional wood products

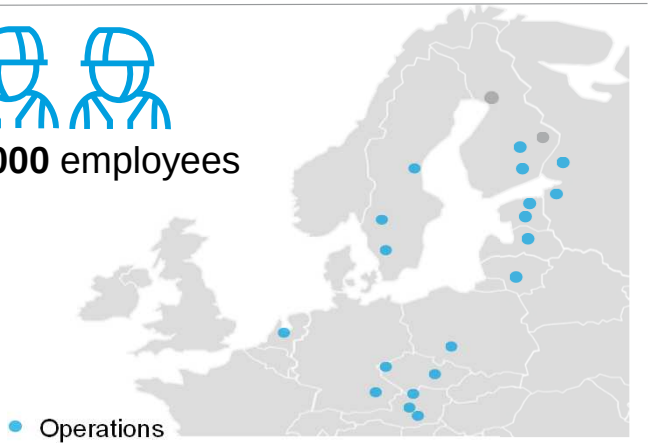
Building Solutions

17 European units:	Production capacity
17 saw mills	5 720 000 m^3
3 CLT mills	270 000 m^3
1 LVL mill	75 000 m^3
7 pellet mills	520 000 tonnes

Global customer base



4 000 employees



100%

of wood is traceable and from sustainable sources

EUR 1.4 billion
sales 2020

-12%
2020 vs. 2019

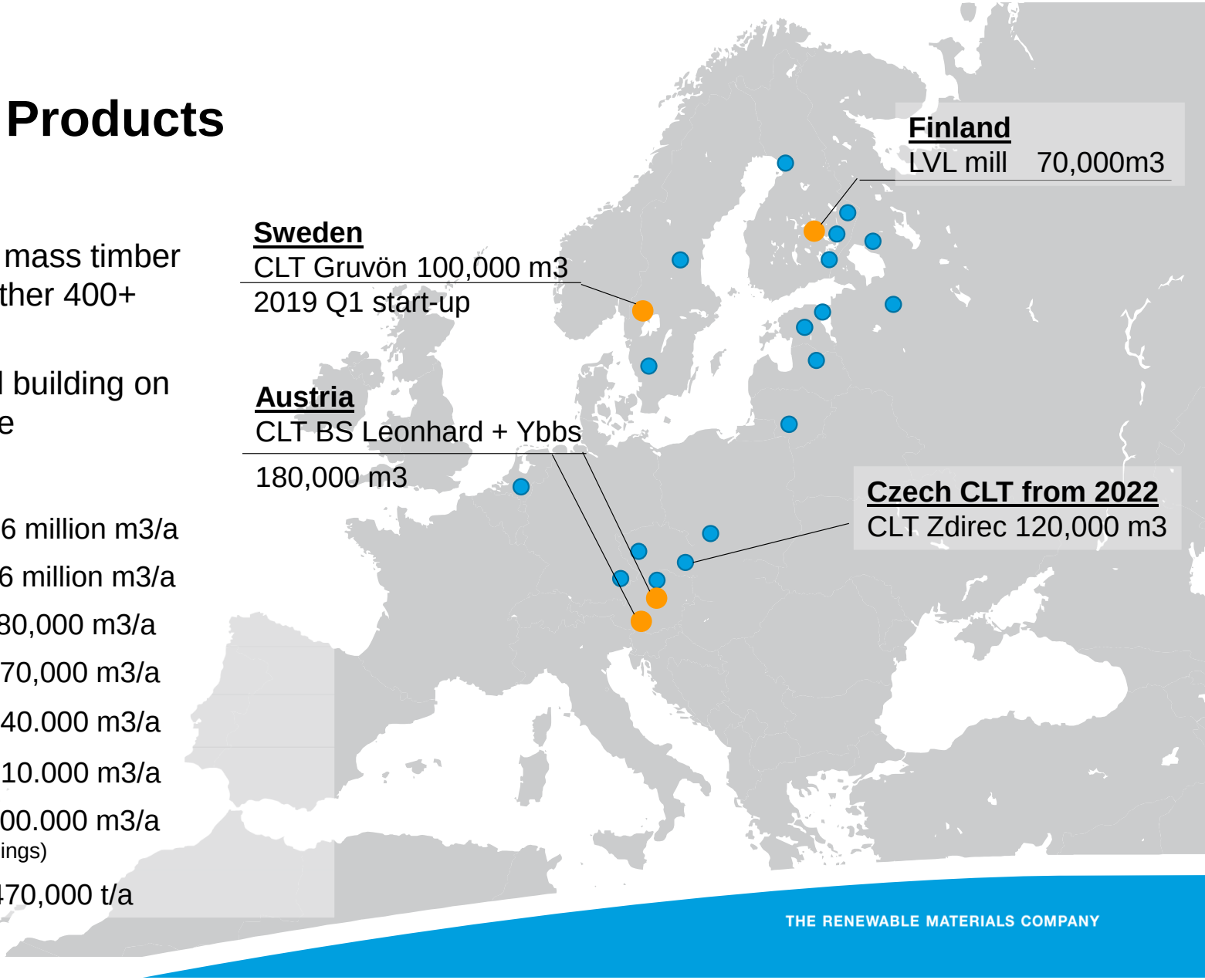
9 % Operational EBIT 2020 vs. 2019

ROOC 19.1% in 2020 (target > 20%)

Stora Enso Wood Products
Manufacturing platform

- A platform of 350 MEUR in mass timber building components – another 400+ MEUR in light framing
- Further expansion potential building on existing manufacturing base

Capacity		
	Sawing	5.6 million m3/a
	Planing	2.6 million m3/a
	CLT	280,000 m3/a
	LVL	70,000 m3/a
	Glulam	340.000 m3/a
	KVH	310.000 m3/a
	Components (windows, doors, mouldings)	200.000 m3/a
	Pellets	470,000 t/a



Stora Enso Mass Timber Components

Broad portfolio of components for all building styles

LVL (Laminated Veneer Lumber)

CLT (Cross Laminated Timber)

LVL Rib Panels

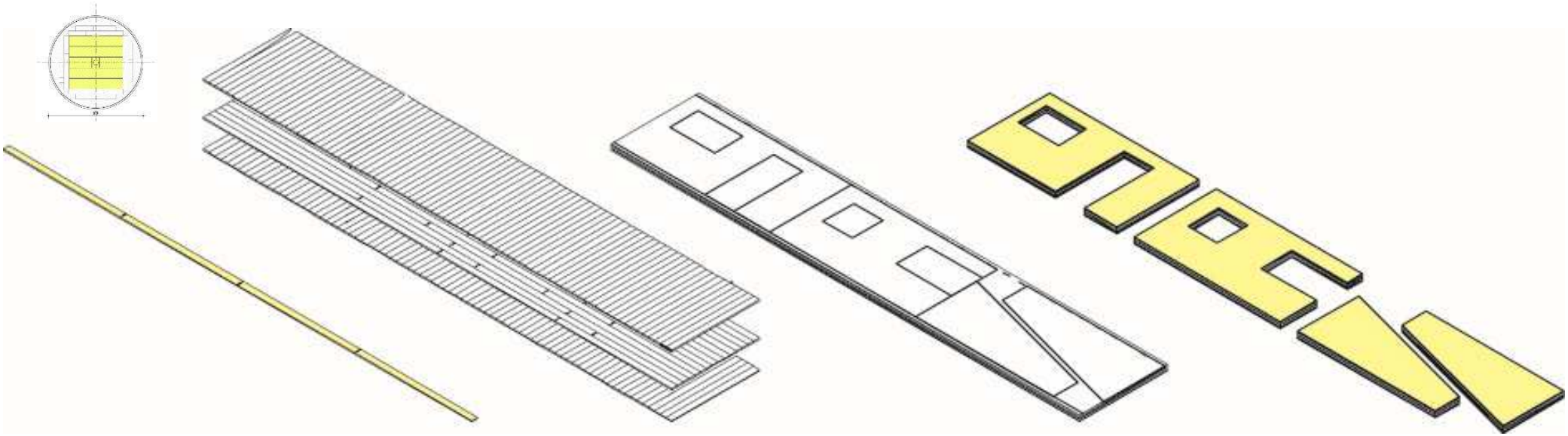
LVL-G

CLT Rib Panels

Video of the CLT Production

https://www.youtube.com/watch?v=vmweXAJS_VY

From log to large panel



Endless fingerjoint of boards

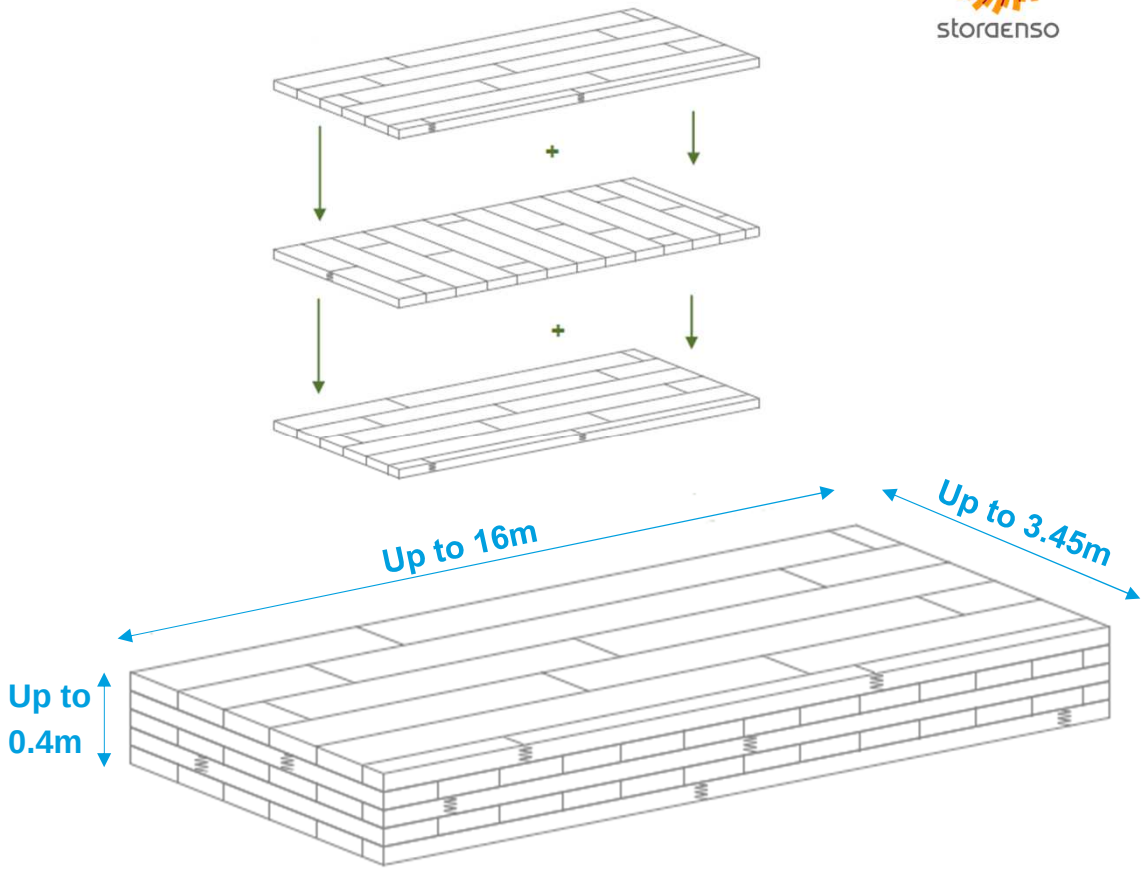
Placement of layers and glue.

Pressure on large plates of CLT.

Dimensioning and detailing by CNC.

CLT by Stora Enso
Material Characteristics

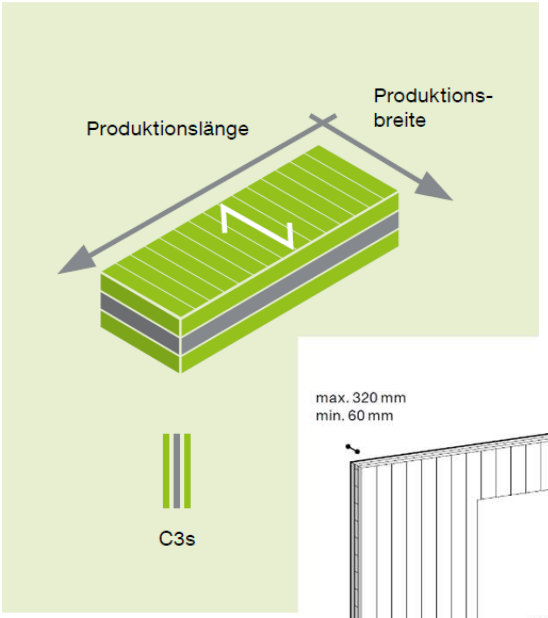
- **Max. produced dimensions**
  - 16m in length and 3.45m in width;
  - Standard chargeable widths 2.25m, 2.45m, 2.75, 2.95, 3.25m & 3.45m.
- **Thickness**:60mm up to 400mm
- **Layers**: 3-7 layers all edge glued
- **Quality**: 3 levels – non visual, industrial visual and Highest Visual
- **Sanding:** All panels sanded both sides
- **Finger joints:** Hidden on visual surface
- **CNC Processing:** Vast range of CNC cutting & milling available
- **Glues:** Formaldehyde Free glue that is less than 1% of the mass of the panel – suitable for bio mass boilers

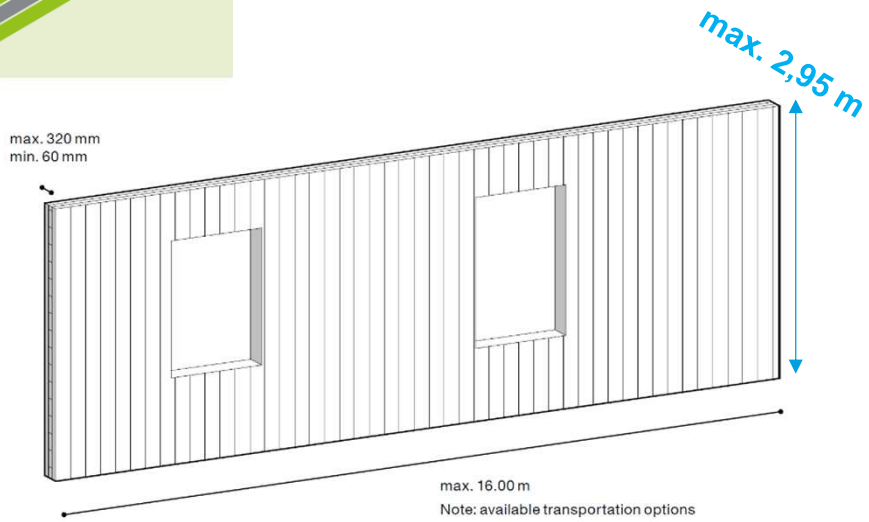


C-Panels (Walls)

C-Platten
Die Faserrichtung der Decklagen verläuft immer parallel zu den Produktionsbreiten.

Stärke [mm]	Plattentyp [–]	Lagen [–]	Plattenaufbau [mm]						
			C***	L	C***	L	C***	L	C***
60	C3s	3	20	20	20				
80	C3s	3	20	40	20				
90	C3s	3	30	30	30				
100	C3s	3	30	40	30				
120	C3s	3	40	40	40				
100	C5s	5	20	20	20	20	20		
120	C5s	5	30	20	20	20	30		
140	C5s	5	40	20	20	20	40		
160	C5s	5	40	20	40	20	40		

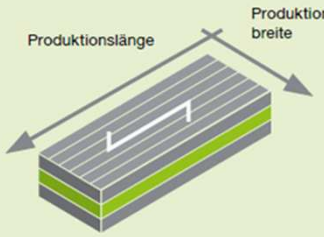


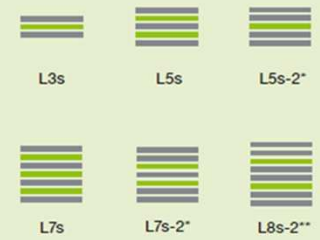


L-Panel (Floors)

L-Platten
Die Faserrichtung der Decklagen verläuft immer rechtwinkelig zu den Produktionsbreiten.

Stärke [mm]	Plattentyp [–]	Lagen [–]	Plattenaufbau [mm]						
			L	C	L	C	L	C	L
60	L3s	3	20	20	20				
80	L3s	3	20	40	20				
90	L3s	3	30	30	30				
100	L3s	3	30	40	30				
120	L3s	3	40	40	40				
100	L5s	5	20	20	20	20	20		
120	L5s	5	30	20	20	20	30		
140	L5s	5	40	20	20	20	40		
160	L5s	5	40	20	40	20	40		
180	L5s	5	40	30	40	30	40		
200	L5s	5	40	40	40	40	40		
160	L5s-2*	5	60	40	60				
180	L7s	7	30	20	30	20	30	20	30
200	L7s	7	20	40	20	40	20	40	20
240	L7s	7	30	40	30	40	30	40	30
220	L7s-2*	7	60	30	40	30	60		
240	L7s-2*	7	80	20	40	20	80		
260	L7s-2*	7	80	30	40	30	80		
280	L7s-2*	7	80	40	40	40	80		
300	L8s-2**	8	80	30	80	30	80		
320	L8s-2**	8	80	40	80	40	80		





* Decklagen bestehen aus zwei Längslagen.
** Decklagen sowie die innere Lage bestehen aus zwei Längslagen.
*** Bei C-Platten ist die Schleifrichtung quer zur Faser.

Produktionsbreiten: 245 cm, 275 cm, 295 cm
Produktionslängen: von Mindestproduktionslänge 8,00 m per Verrechnungsbreite bis max. 16,00 m (Abstufung in 10-cm-Schritten)

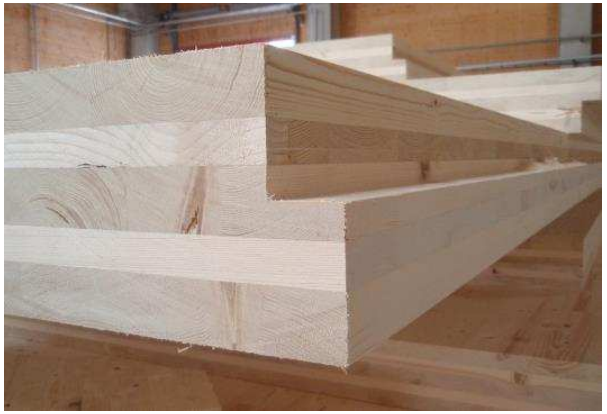
CLT by Stora Enso
Surface qualities and special surfaces

Visible quality

Non-visible quality

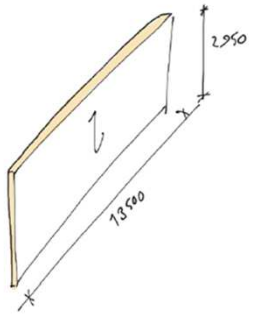
Industry quality

Many CNC possibilities

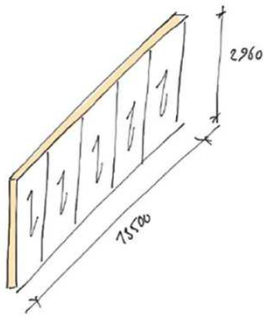




Splitting panels
Waste reduction Vs Construction Speed

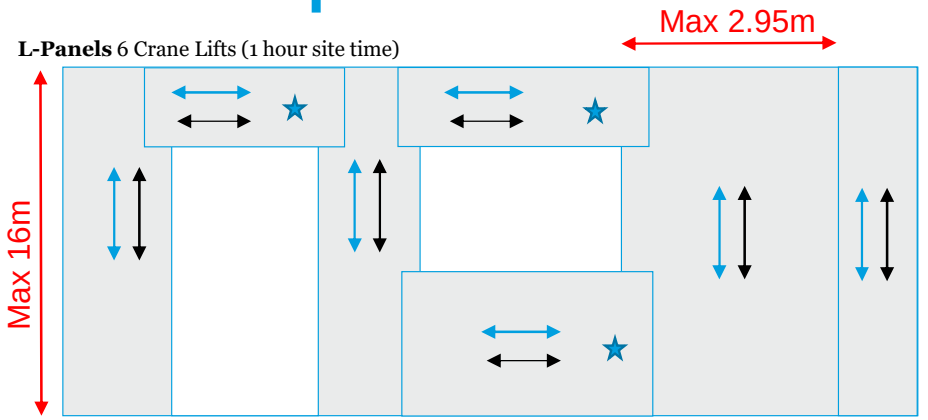
- Area = 39,825m2
- Install = ~150€



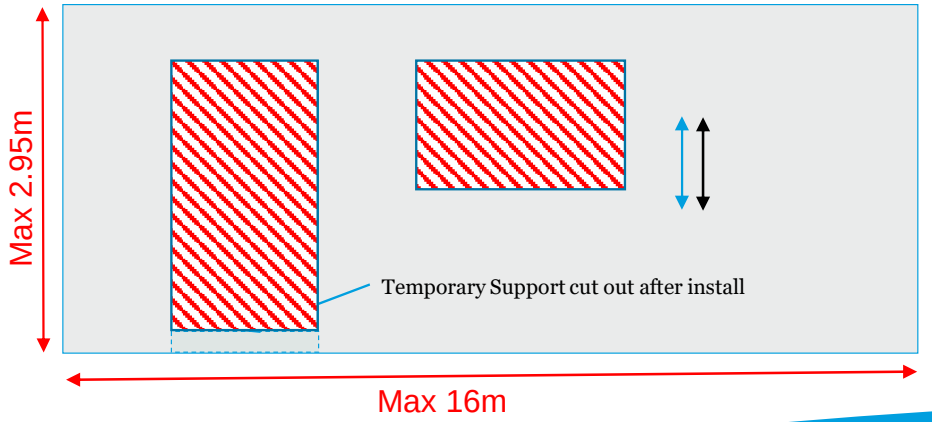
- Area = 39,96m2
- Install = ~ 500€ **(+250…300%)**



L-Panels 6 Crane Lifts (1 hour site time)



C- Panel 1 Crane Lift (20 minutes site time, 5 x faster but slightly increased waste)



Engineering Span

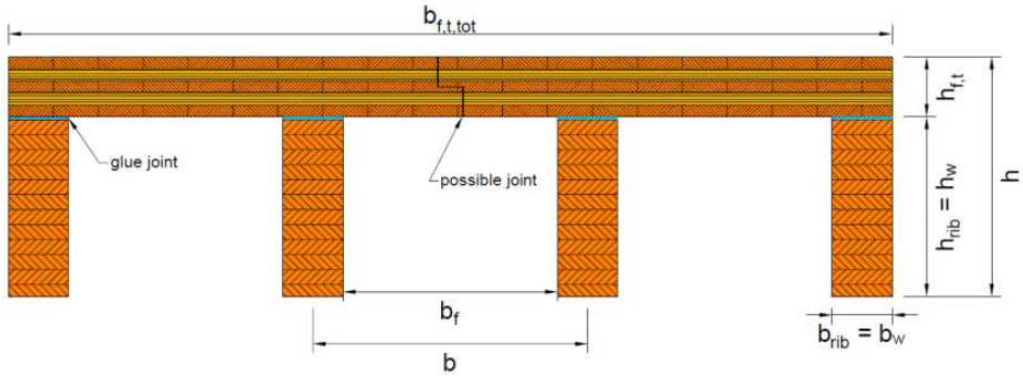
Timber grain Direction

Waste / offcut

★ For large openings where visual panels require a vertical grain, C panels can be used, but cannot be wider than 2.95m.

CLT rib panel by Stora Enso
Material Characteristics

Anwendung	Decken- und Dachelemente
Maximale Abmessungen*	Breite: 0,8–2,45 m Länge: 6,0–12,0 m Ideal für Spannweiten ab 6 m
Höhe*	220 mm bis 580 mm
Zertifizierung	ETA-Bewertung und CE-Kennzeichnung. Auf Anfrage auch mit PEFC™-Zertifizierung erhältlich.
Klebstoffe	PUR
Oberflächenqualität	Sichtqualität/Nichtsichtqualität
Nutzungsklasse	1 und 2 nach EN 1995-1-1
Brandverhalten	CLT-Rippendeckenelemente können für Feuerwiderstandsklassen REI 30 bis REI 90 produziert werden.



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Internet www.etadanmark.dk

Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

European Technical Assessment ETA-XX/YYYY

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

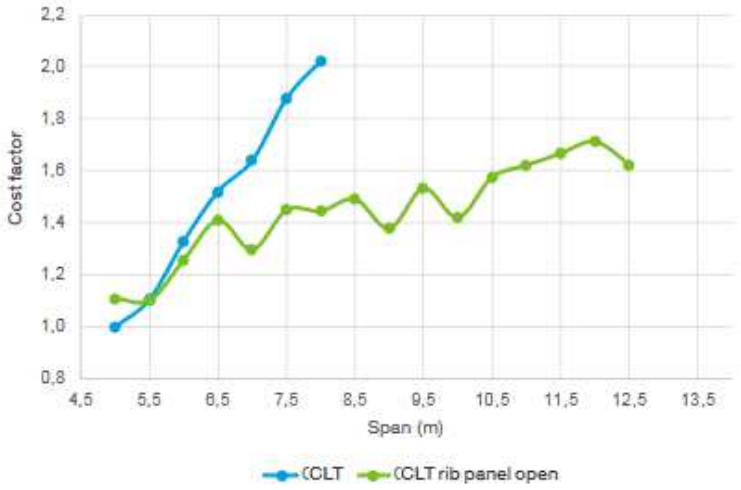
Trade name of the construction product:	Stora Enso CLT Rib Panels
Product family to which the above construction product belongs:	Prefabricated wood-based loadbearing stressed skin panels
Manufacturer:	Stora Enso Wood Products Oyj Kanavaranta 1 FI-00160 Helsinki Internet www.storaenso.com
Manufacturing plant:	Stora Enso Wood Products
This European Technical Assessment contains:	23 pages including 4 annexes which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	Guideline Nr 019 for European Technical Approval of Prefabricated wood-based loadbearing stressed skin panels, November 2004, used as EAD
This version replaces:	

CLT Rib Panels by Stora Enso
Structural design manual

https://www.storaenso.com/en/products/wood-products/massive-wood-construction/rib-panels

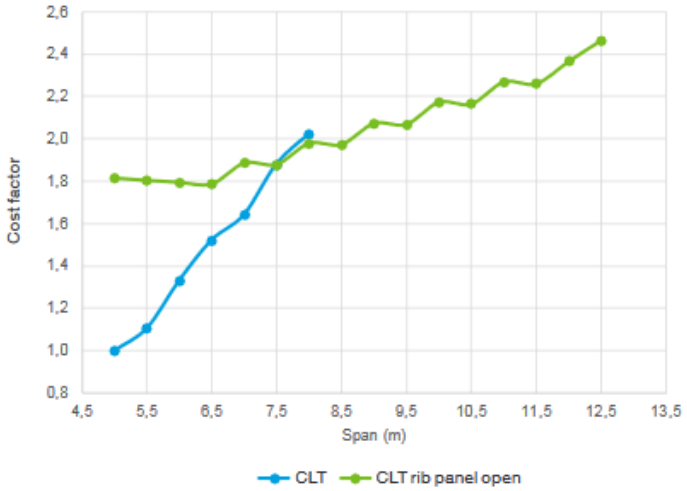
What´s a good span regarding efficiency?

Typical residential example
Dead load = 1.5 kN/m² | Live load = 2 kN/m² | (R0)

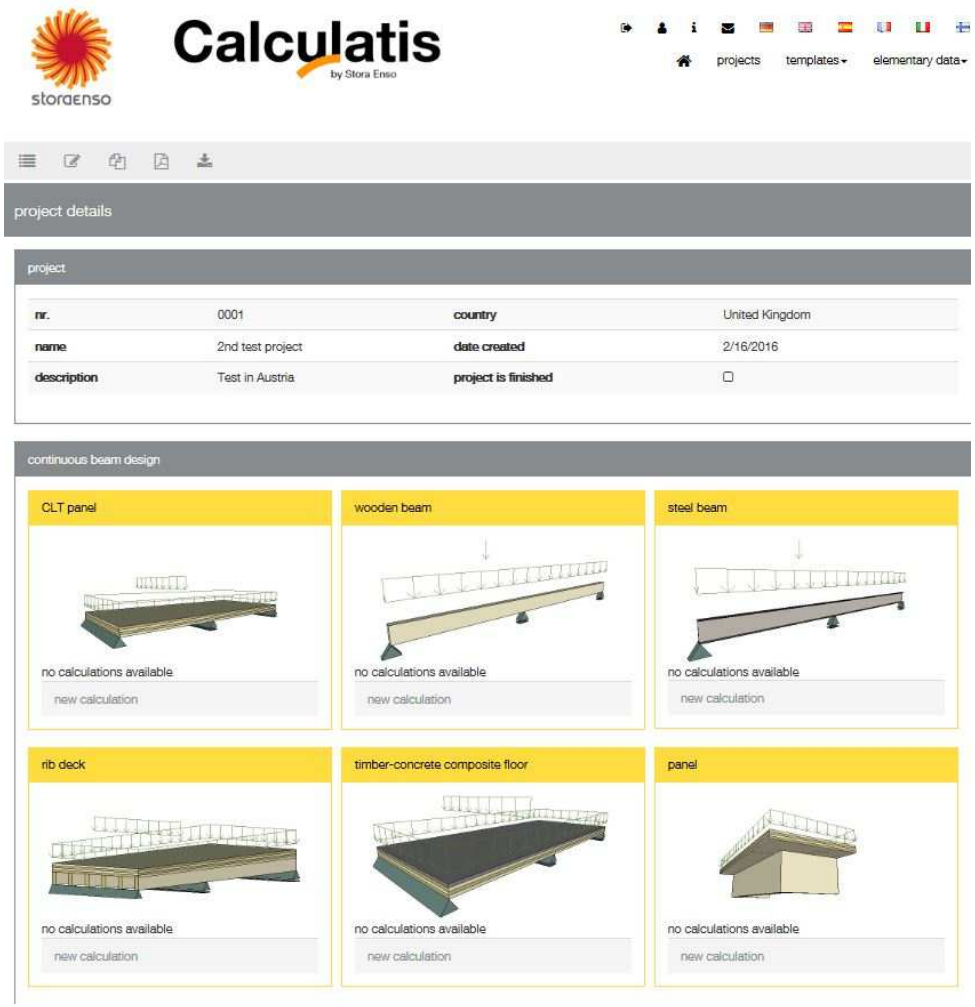


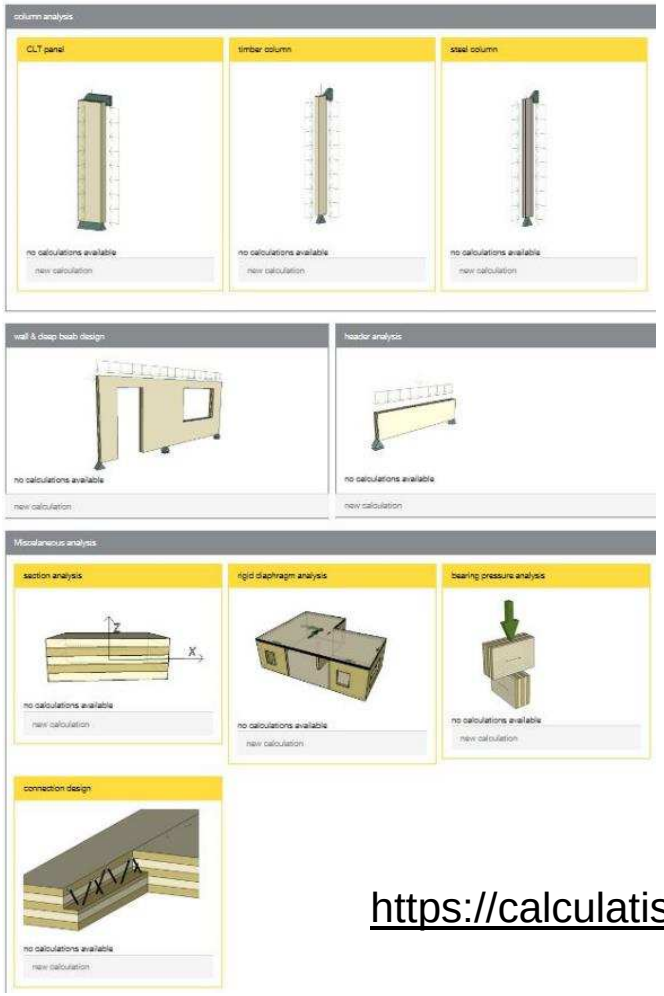
In residential buildings, CLT rib panels are competitive from approximately 5,5 m onwards, including transport

Typical office example
Dead load = 2 kN/m² | Live load = 4 kN/m² | (R60)



In office buildings, CLT rib panels are competitive from approximately 7,5 m onwards, including transport

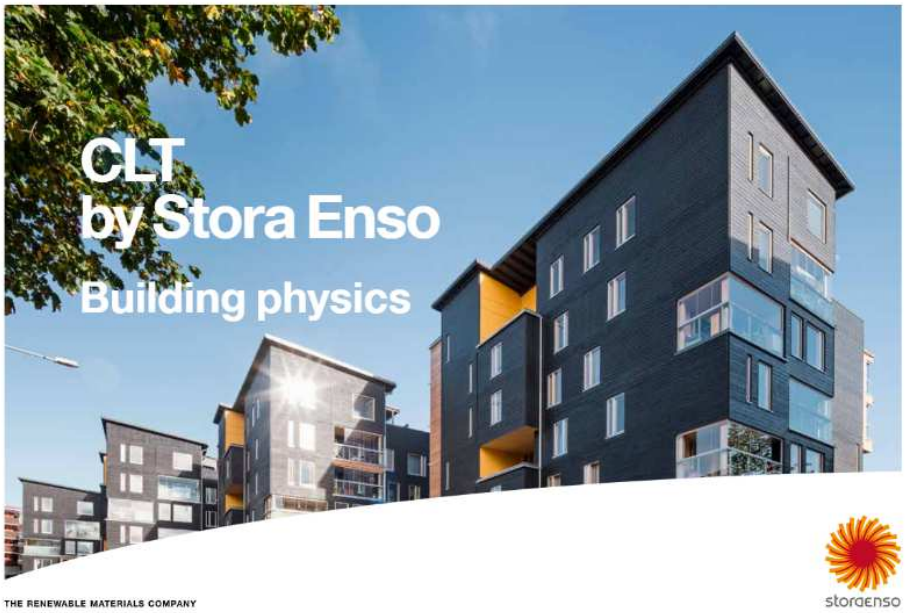


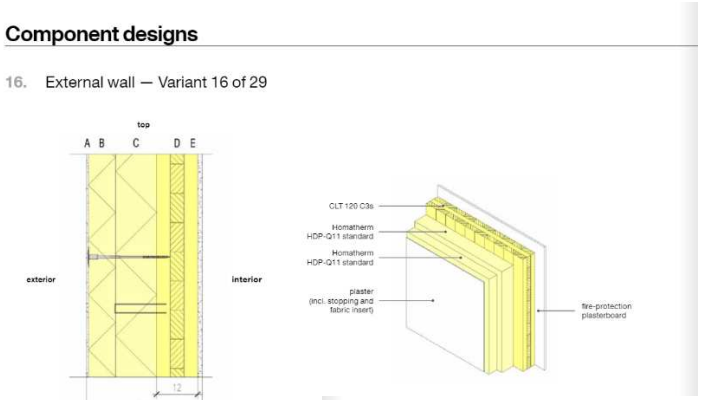


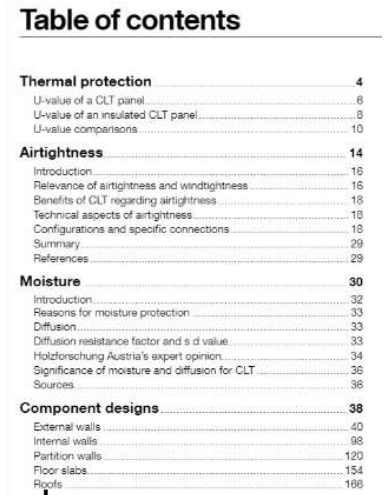
storaenso

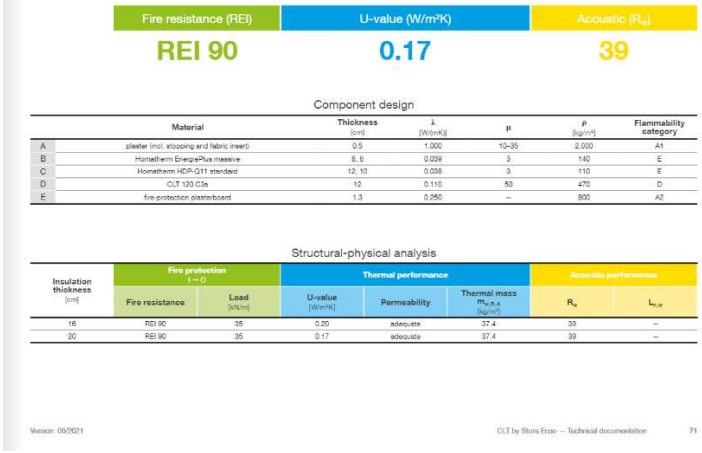
https://calculatis.storaenso.com/

Supporting material for planning



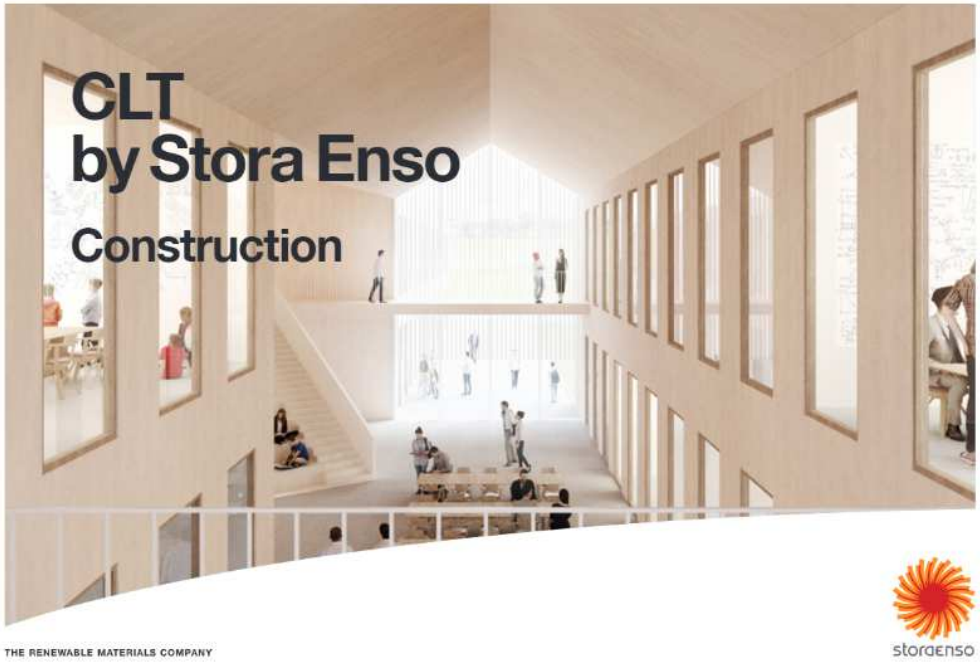






https://www.storaenso.com/en/products/wood-products/massive-wood-construction/clt/brochures-and-downloads

Supporting material for planning



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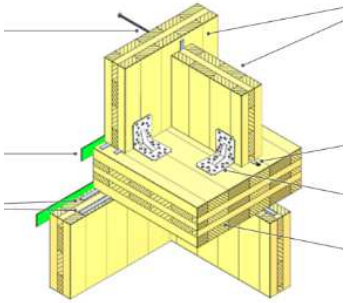


https://www.storaenso.com/en/products/wood-products/massive-wood-construction/clt/brochures-and-downloads

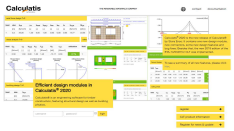
Building Solutions' Digital tools, products & services

Focus on value creation & differentiation

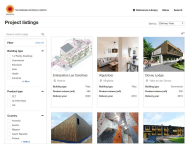
Sustainable sourcing
Investor / Property developer
Designer
Material supplier
Manufacturing
Trader
Logistics
Construction company
Building owner
Living
Facility Manager
Upkeep / Renovations
Property sales

Plan	Build	Live	Re-use

Websites, handbooks
Information sharing



Calculatis
Timber design software



Reference Library
for Stora Enso projects

Track & Trace Logistics
tracking delivery information and condition online

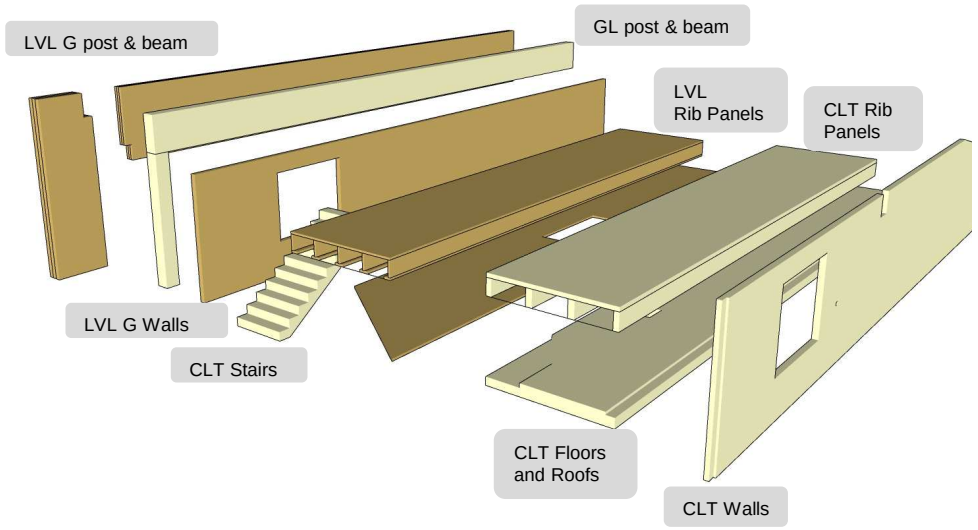
CLT360+
installation assistant

Wiiste sensor
for internal moisture of wooden structures

RFID sensors
as leakage guards

https://www.storaenso.com/en/products/wood-products/massive-wood-construction/clt/design-tools

Building Concepts by Stora Enso



Best performing combinations of prefab components and their applications

https://www.storaenso.com/en/products/wood-products/building-concepts

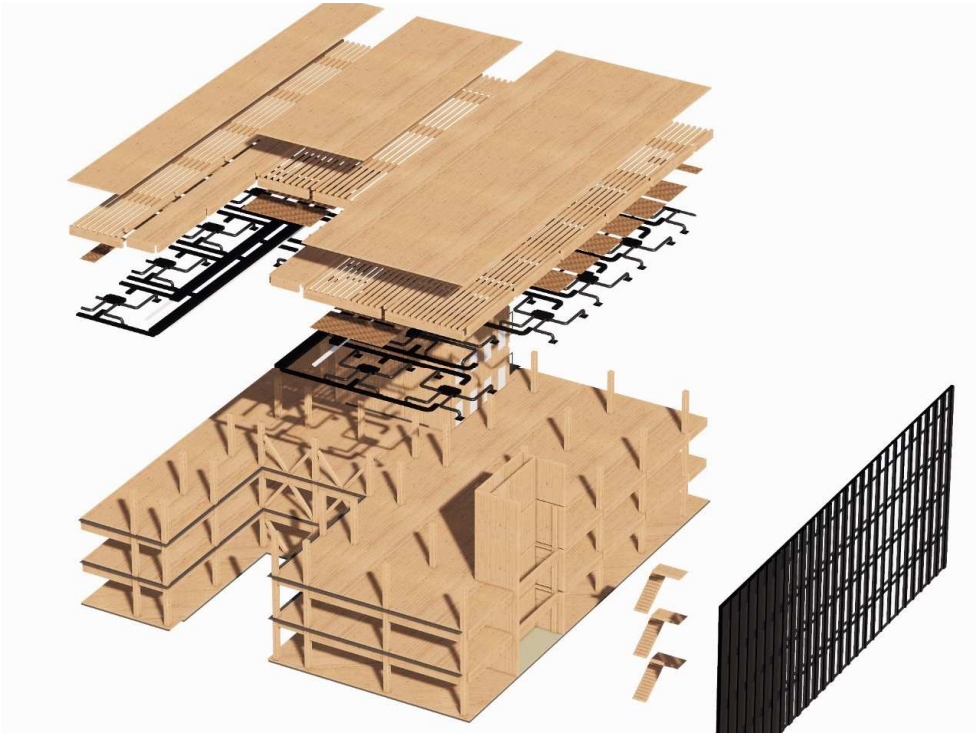
The concept in a nutshell
main parts and pieces- and best combinations

Building Products and applications supplied by Stora Enso ready to install and just in time (JIT):

- Columns and beams: LVL G or Glulam
- Floors: CLT, and CLT or LVL Rib Panels
- Cores: CLT or LVL G
- Roof: CLT, and CLT or LVL Rib Panels
- Stairs: prefabricated CLT elements

Considerations for other trades and building parts:

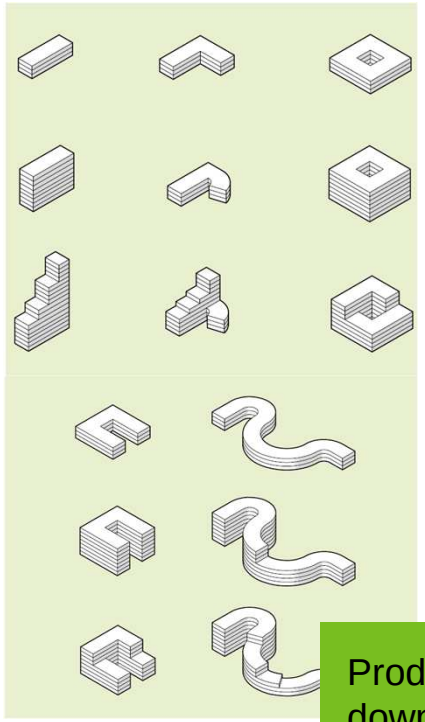
- MEP Services: efficient routing avoiding intersections with the structure
- Facades: non-load bearing envelopes



Stora Enso Design Manual | Scott Brownrigg

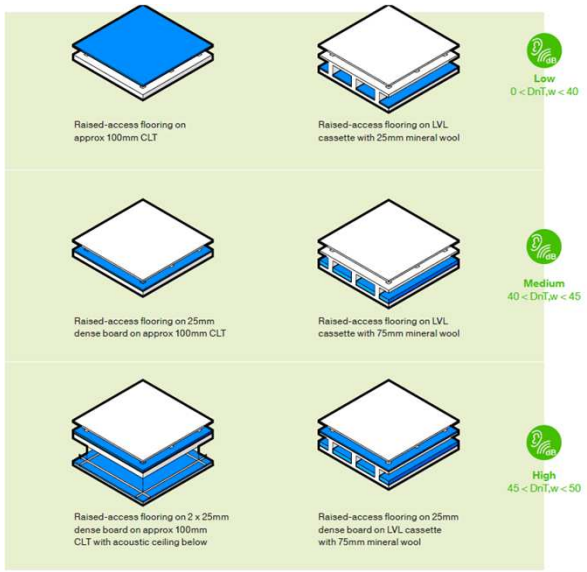
The concept in a nutshell
basic guidance for all planners

Architecture

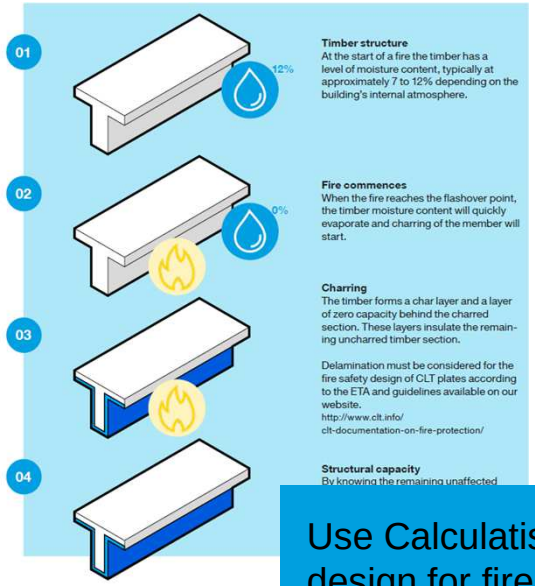


Prodlib to download our BIM Objects

Acoustics



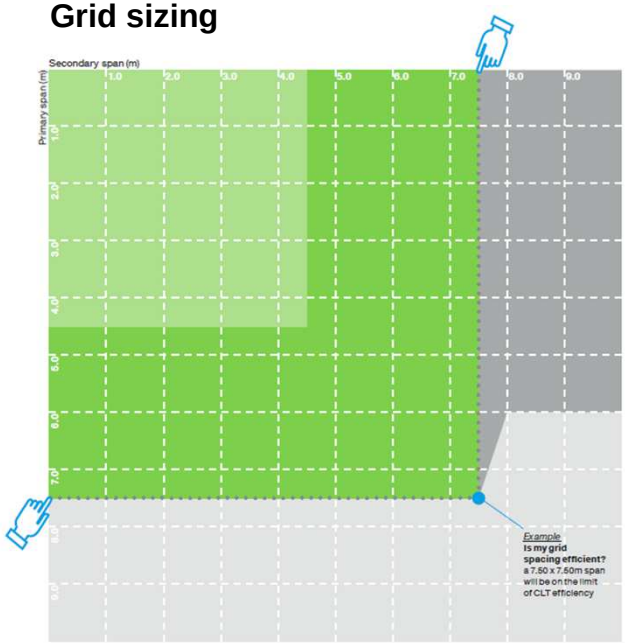
Fire



Use Calculatis to design for fire resistance and compartmentation

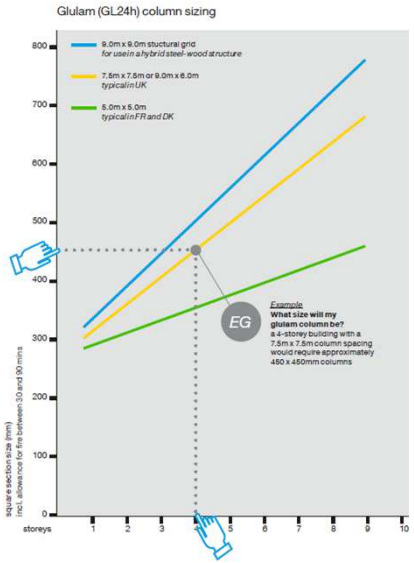
Design guidance in simple diagrams

Grid sizing



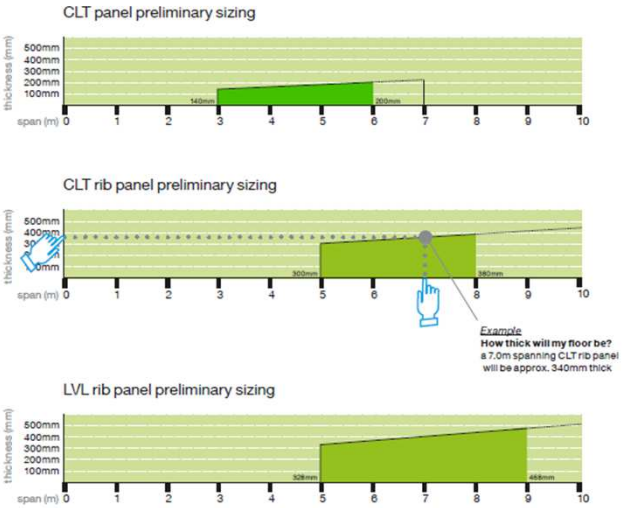
Supports the grid selection according in relation to cost efficiency

Column preliminary sizing



Provides indicative dimensioning for columns in different building materials.

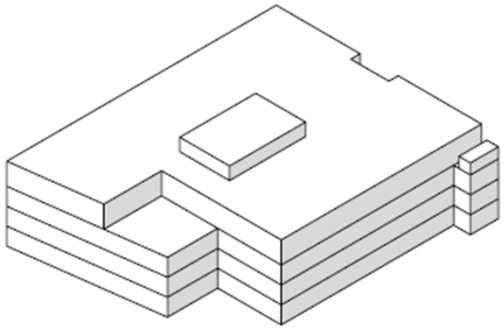
Selection of floor panels



Supports the choice between materials for floor applications in relation to the element depth, and provides indicative dimensions.

Case studies
to most relevant building types

Study 1_ 4-storey- doughnut-shaped layout



10.000 m² divisible floor plate

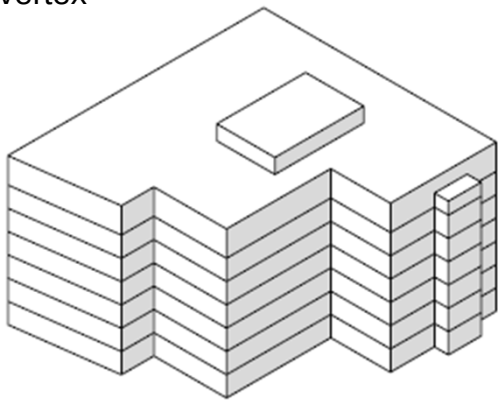
Grid 7.5+7.5+3 m service zone

Centralized mechanical ventilation system

Glulam and CLT Rib Panel frame

Stiffening CLT core and K-Bracing in the facade

Study 2_ 7-Storey-L-shaped with core in vertex



13.000 m² divisible floor plate

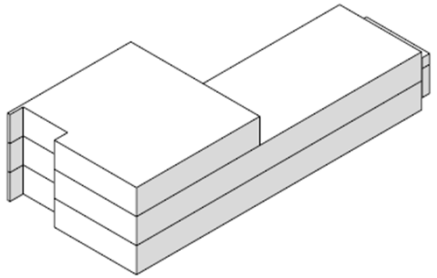
Grid 7.5+7.5+3 m service zone

Centralized mechanical ventilation system

LVL G and Rib Panel frame

Stiffening concrete core and K-Bracing in the Facade

Study 3_ 3-Storey- linear with offset core



1.900 m² divisible floor plate

Grid 9 x 6 m

Centralized mechanical ventilation system

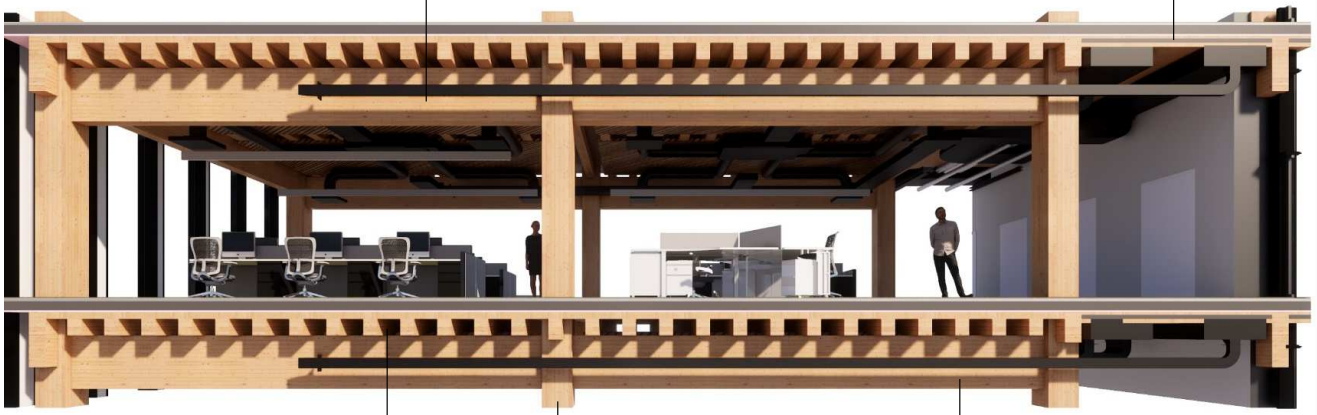
Glulam and CLT Rib panel Frame

CLT walls elements on the external walls as lateral bracing

Case study 2 | 7-storey- L-shaped
basic architecture and service distribution

Secondary distribution lines
between main structure

Service and circulation zone around core
3.0 m span with CLT, no down stand beam
main service distribution



Rib Panels
6 to 9 meter spans

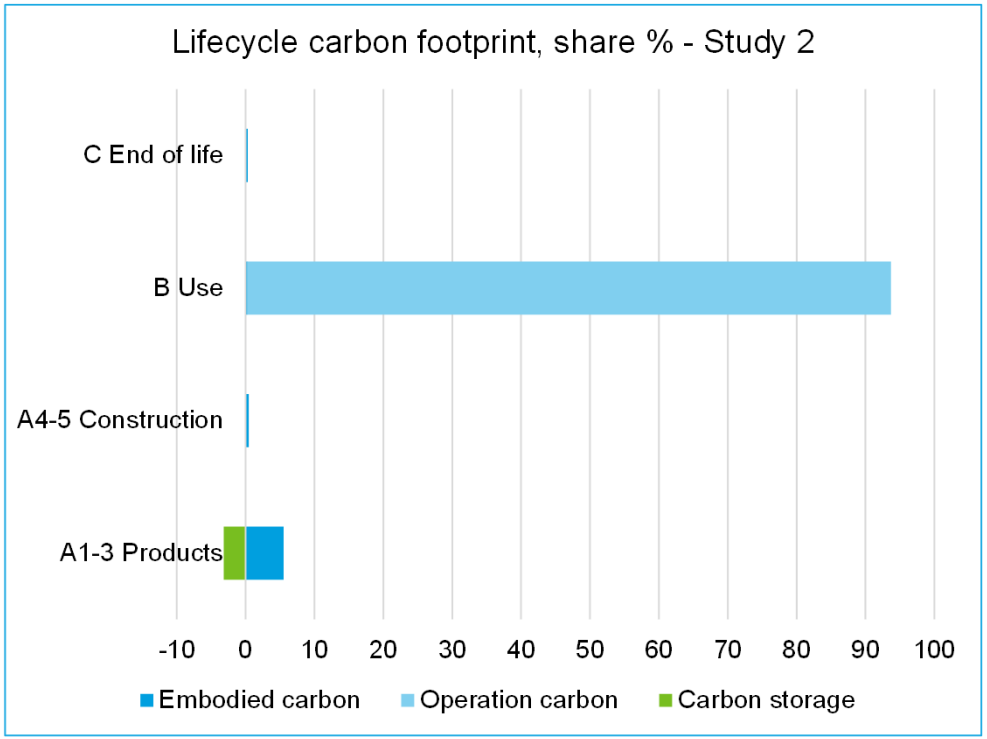
Columns
LVL G or Glulam

Main Beams
LVL G or Glulam
Optium up to 7.5 m

Stora Enso Design Manual | Scott Brownrigg

Case study 2 / Life Cycle Analysis (LCA)
main findings

- The embodied carbon impact of the building is **6 kg CO_2e/m²/a**. With wooden structures embodies carbon emissions can be reduced compared to other building materials **even by 50%.**
- This case study stores **450 tons of carbon** over the life cycle, which implies **1640 tons CO_2** away from the atmosphere, and thereby **offsets 48%** of the total embodied carbon of the building.
- Due to the low embodied energy of the building, app. **93% of its environmental impact comes from operational energy use**. Operational energy use can be tackled with energy efficiency measures.

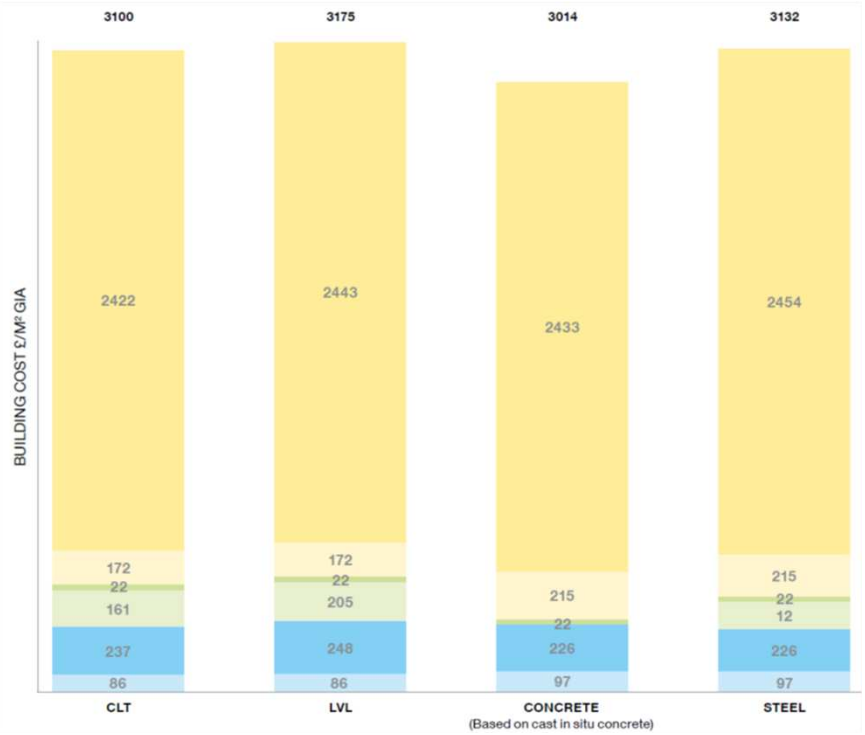


Sustainability Case Study | Stora Enso Building Concepts | Study 2

Case study 2 / Cost analysis
benchmarking common alternatives

- The cost range of these four alternatives studied is at a level of +/- 1.5%. This means they are equivalent, and the relevant different may appear depending on specific project conditions.

- Overall economic benefits by using wood:
  - Possible higher market rent price
  - Lightness can save on foundations and open up new sites
  - Speed of construction for shorter and more predictable sites
  - Reduced logistics, disturbance and space requirement on site through prefabrication
  - Better quality assurance through advanced manufacturing and industrialization



Stora Enso Design Manual | Cost Study (based in London, UK) | Gardiner & Theobald

Stepping up the value-chain
continuously improve core performance

Prefabrication
- 31 wall elements
- 4 weeks at mill & JIT to site

Pre-assambled Fixing-, steel- and lifting - parts…
… to increase site –safety & -efficiency

Stora Enso Wood Products' reference projects

THE RENEWABLE MATERIALS COMPANY

Mohalt 50/50, Trondheim, Norway 2016

Tallest timber building in Scandinavia (at the time)

Total Construction cost - €18M

Timber Build time: 6 Months

GIFA

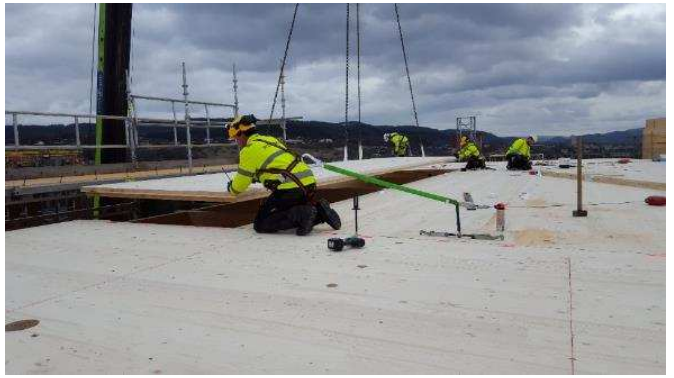
17,500 m²

9 Storeys

4200m³ CLT

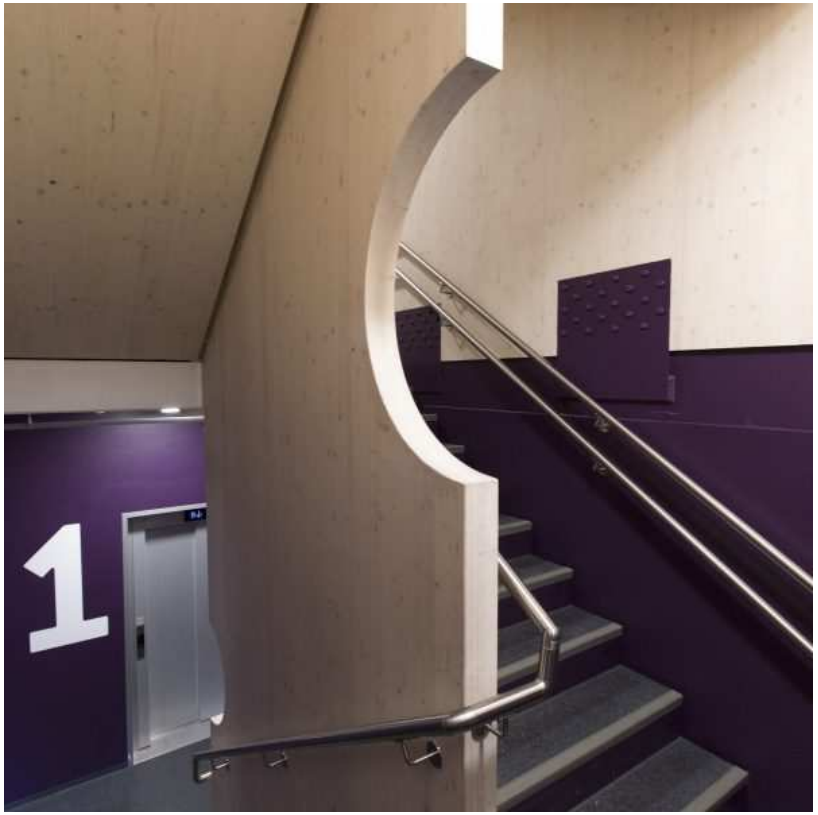
Mohalt 50/50, Trondheim, Norway 2016

Tallest timber building in Scandinavia (at the time)



Mohalt 50/50, Trondheim, Norway 2016

Tallest timber building in Scandinavia (at the time)



Dantebad
Housing over parking area, Munich

Quelle: B&O-Gruppe | Geschäftsbericht 2016

Dantebad: Key figures

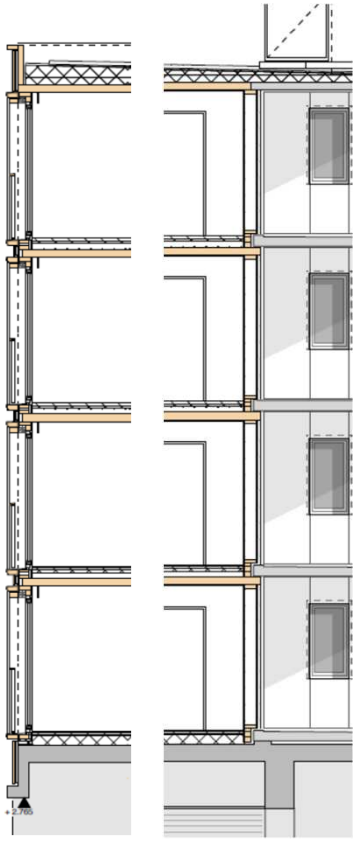
Quelle: B&O-Gruppe | Geschäftsbericht 2016

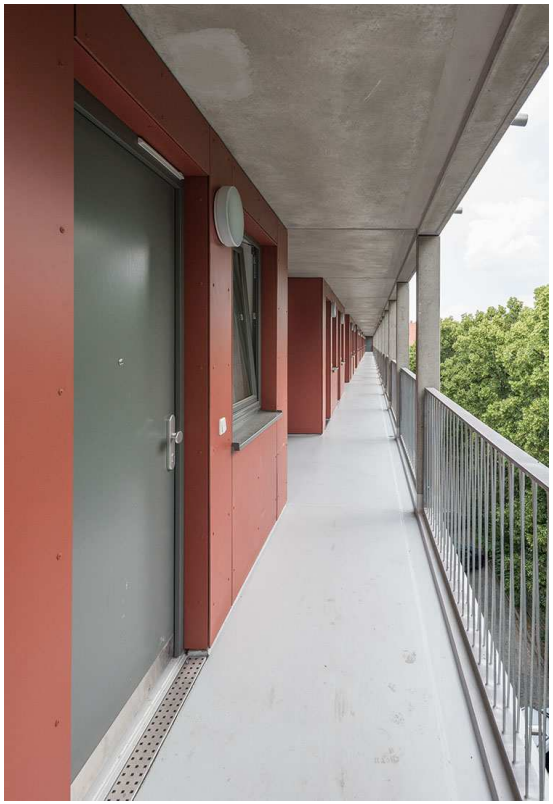
- Bauherr: GEWOFAG
- Architekt: Florian Nagler Architekten
- Statik + Holzbau: Franz Mitter-Mang
- Holzbau: Huber & Sohn
- Generalübernehmer: B&O-Gruppe (Bad Aibling)
- Realisierung: 2016

- Idee: ,,Wir brauchen mehr günstigen Wohnraum – und das schnell”
- 100 Wohnungen (86 Einzelzimmer und 14 2-Zimmer-Wohnungen)
- Vermietungsmodell: EOF (Förderung im Rahmen des Wohnungsbausofortprogramms der LHM, k-Miete < 9,60 €/m²)
- 5 Geschosse = 1 SB + 4 in Holz (GK 4)
- 7 Monate Gesamtbauzeit, davon 2 Monate Holzbau

Quelle: B&O-Gruppe | Geschäftsbericht 2016

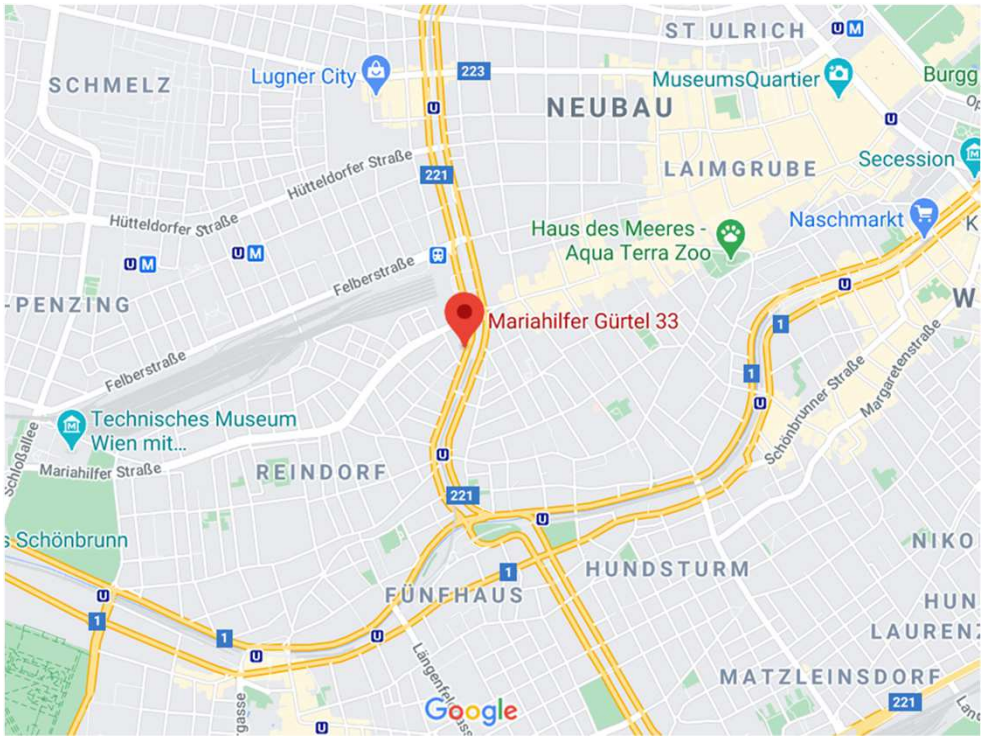
Dantebad, Munich





TheWood Hotel
Mariahilfer Gürtel 33

Foto: TheWood



Google maps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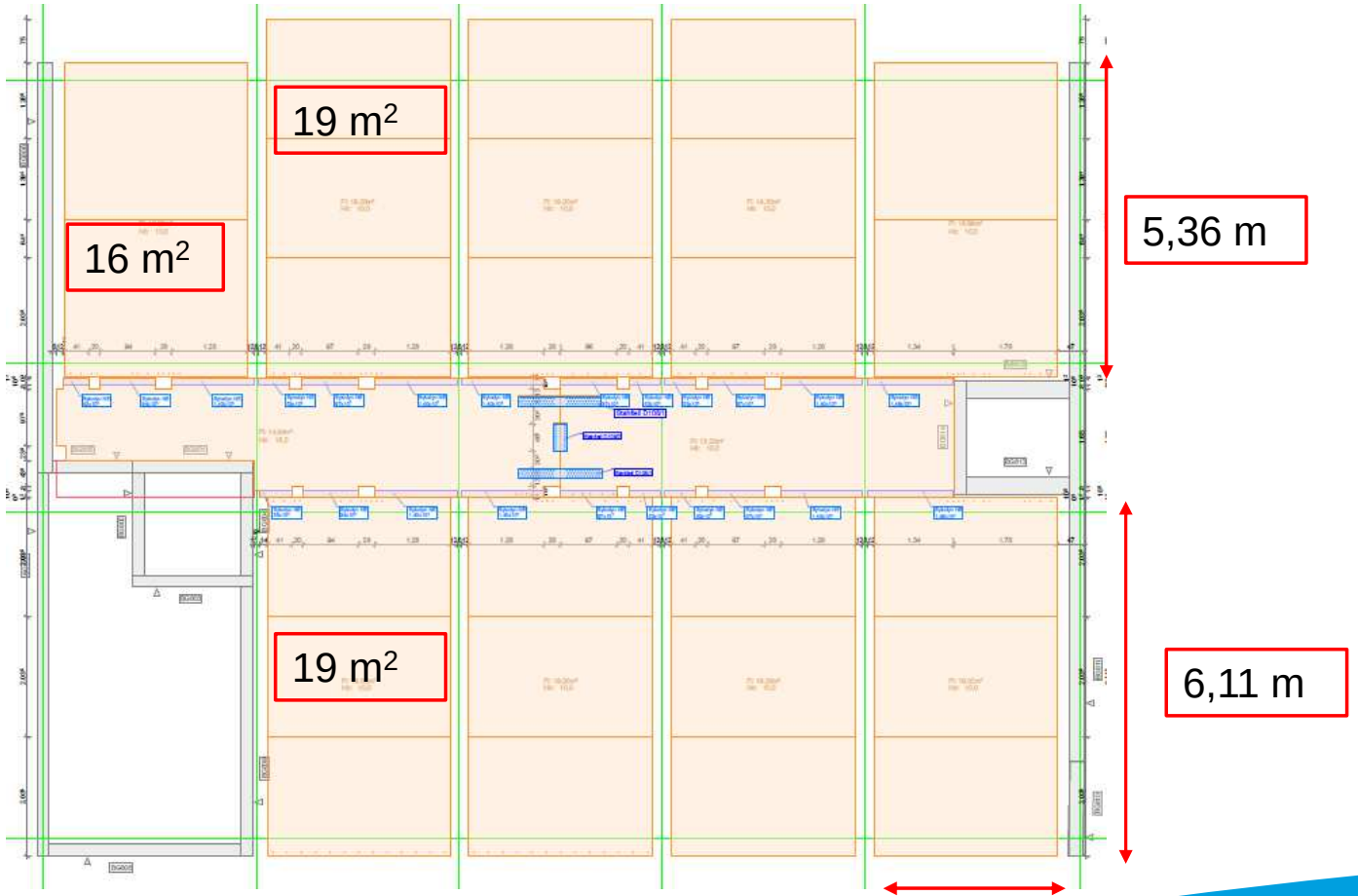
Achtung
Baustelle!

Floor plan

Mariahilfer Gürtel



Innenhof

stora enso

THE RENEWABLE MATERIALS COMPANY

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THE RENEWABLE MATERIALS COMPANY

Building services included

High quality of prefabrication

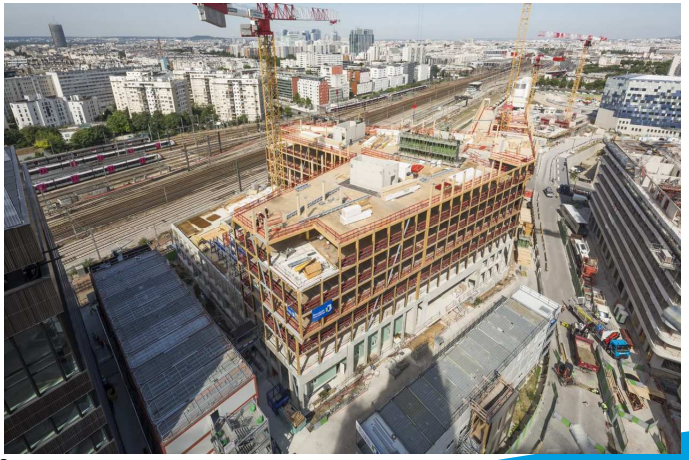
THE RENEWABLE MATERIALS COMPANY

TheWood Hotel

50 moduls
6 Storeys
68 days

Green Office Enjoy, Paris, France

GIFA
16.970 m²
8 Storeys
1.900 m³ CLT

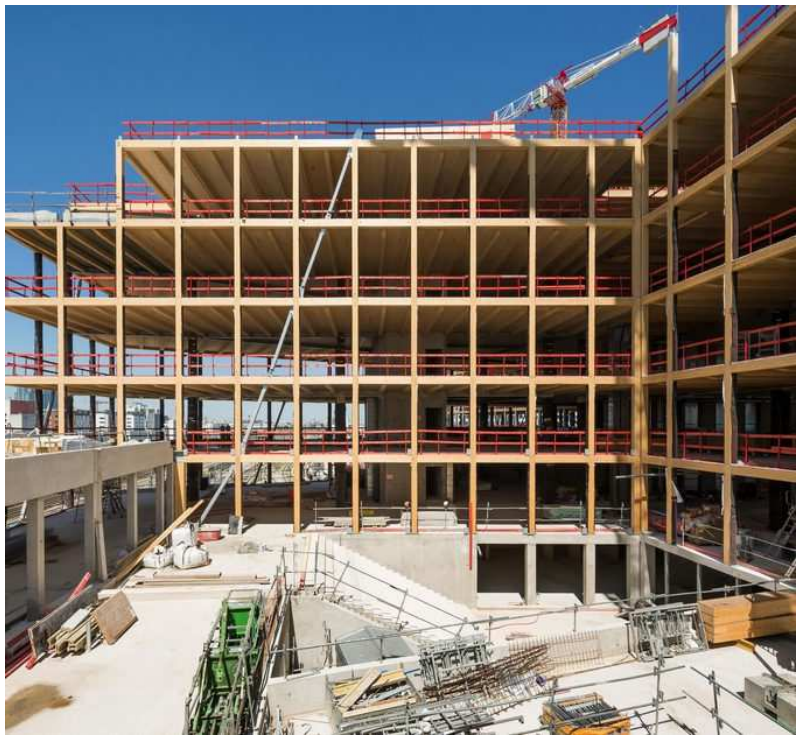


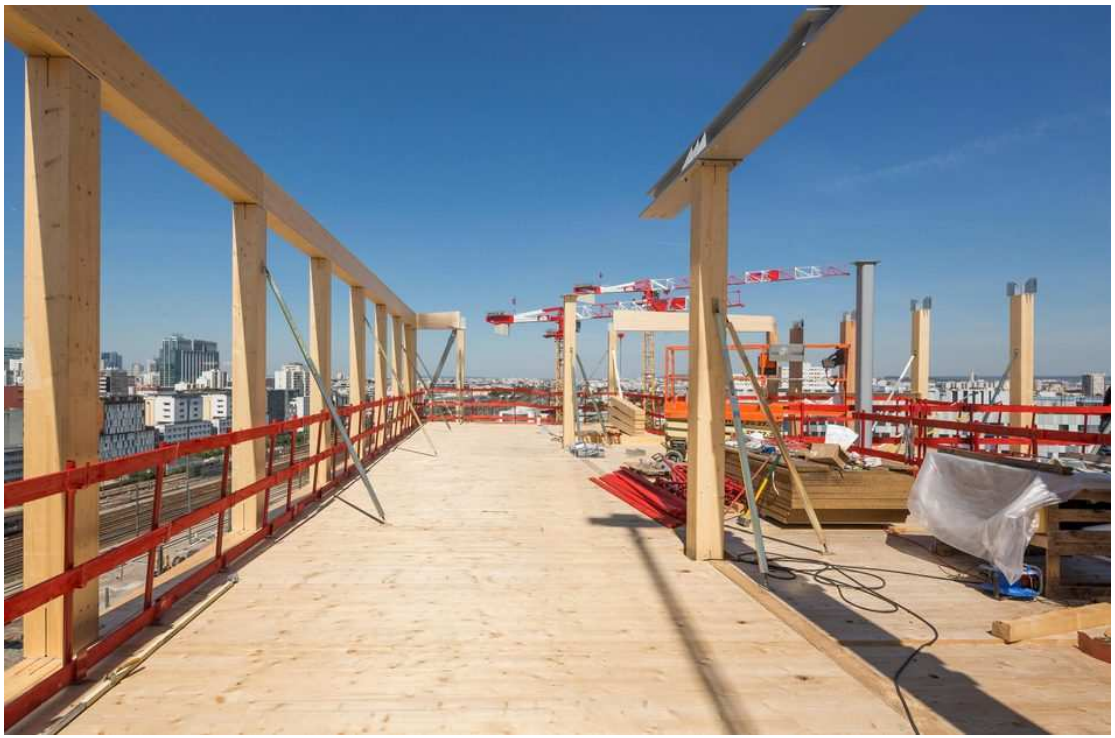
Fotos: Baumschlager Eberle Architekten

Award

BBCA Certificate - Low Carbon Building | L'association pour le développement du bâtiment bas carbone (BBCA), le CSTB et Certivéa

Green Office Enjoy, Paris, France





Fotos: Baumschlager Eberle Architekten

https://www.baumschlager-eberle.com/en/work/projects/projekte-details/green-officer-enjoy-1/

The Green House, London, UK

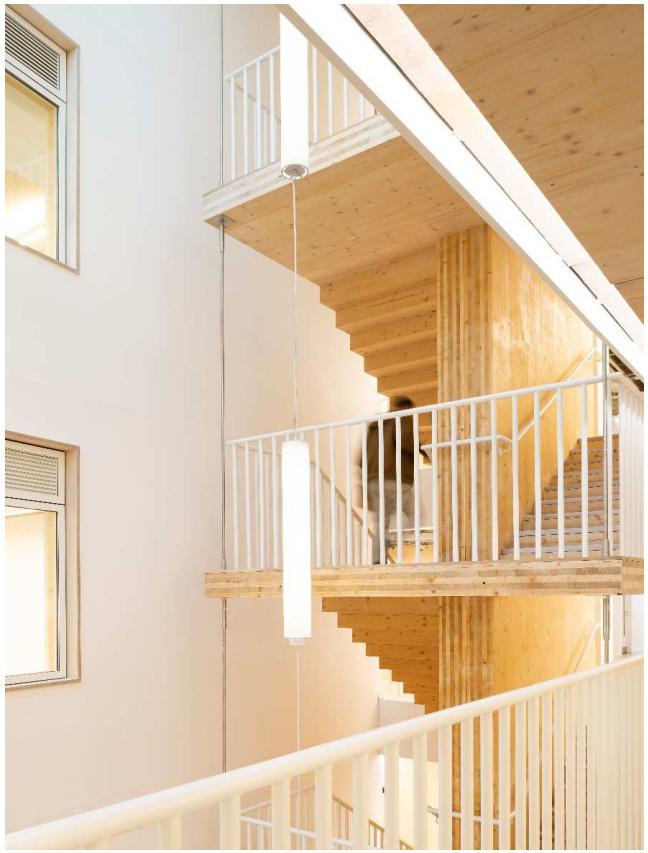
Renovation of existing concrete structure

8 Week Build time
Team of 5 people
Increase of
4.650 m2

https://www.youtube.com/watch?v=KIM3Vq_oe74

The Green House, London, UK

Renovation of existing concrete structure



Wood City, Helsinki, Finland

World’s first fully LVL development Resi & Office

Rendering: Anttinen Oiva Architects

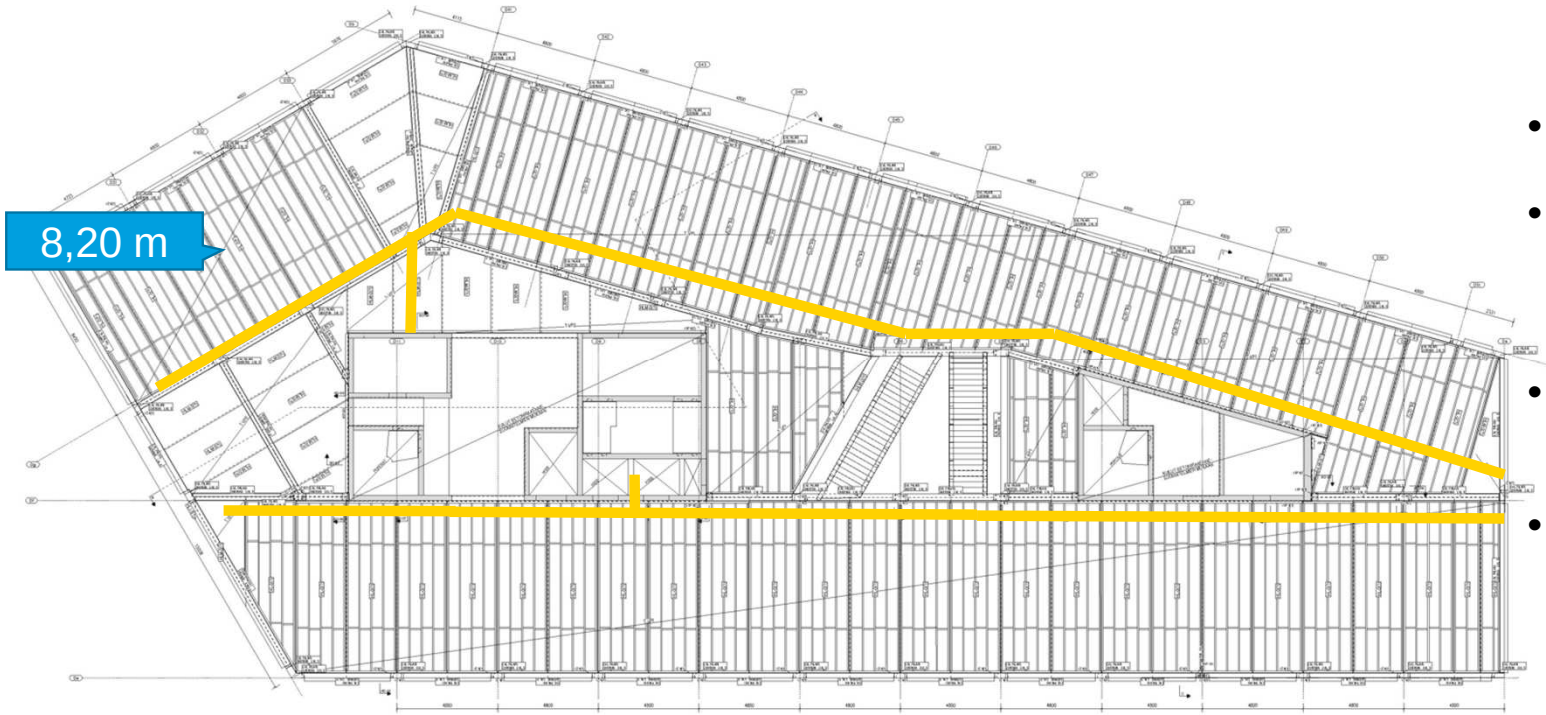
Wood City, Helsinki, Finland

World’s first fully LVL development Resi & Office

GIFA
12.876 m²
8 Storeys
2.575 m³ LVL

https://www.youtube.com/watch?v=yBTIqeKZ62U

Wood City Office
flexibility and long spans = 8,20 m



Structural elements typical groundfloor | SWECO Rakenneteknikka Oy

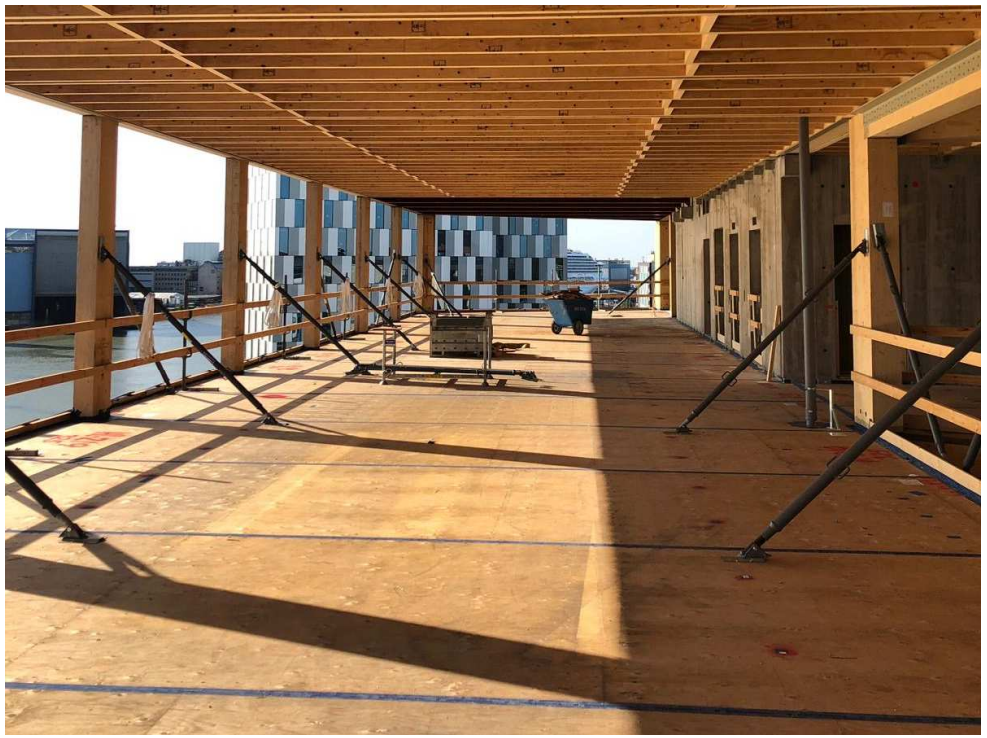
- 8,20 meter free space
- Combination of LVL G columns and beams, massive LVL G floor elements and LVL rib panels
- Building service distribution around core
- Stiffening concrete core

Wood City Office

LVL G posts & beams used in Wood City Office

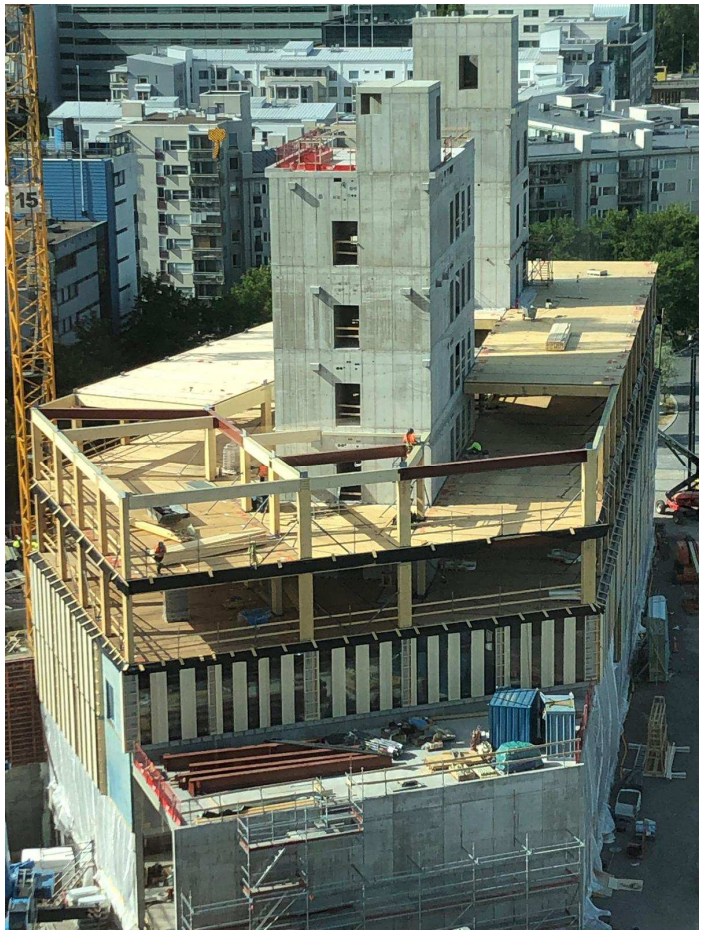
LVL G posts and beams, dimensions 225x600 & 225x450

Wood City, Helsinki, Finland
Worlds first fully LVL development Resi & Office



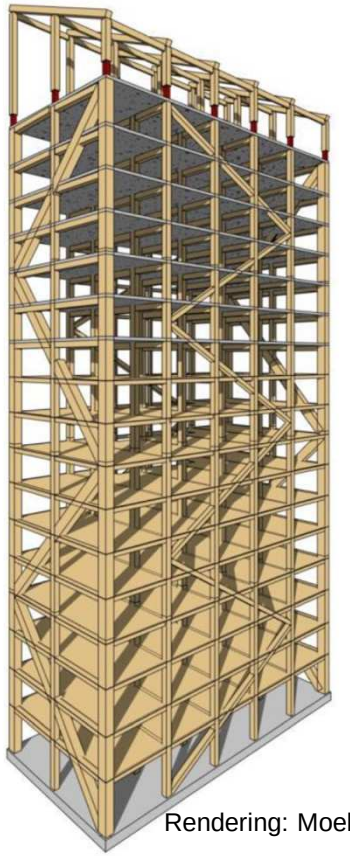
Wood City, Helsinki, Finland

World’s first fully LVL development Resi & Office



Mjöstårnet, Brumenddal, Norway

Currently World's Tallest Timber Building (85.35m)



Rendering: Moelven

GIFA
11.300 m²
18 Storeys
550m³ CLT

https://www.moelven.com/mjostarnet/

Thank you for your attention

johanna.kairi@storaenso.com
www.storaenso.com

THE RENEWABLE MATERIALS COMPANY