



**InnoRenew CoE**

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# Regenerative sustainability and timber buildings

## Trends and considerations in CLT Construction

InnoRenew CoE 1<sup>st</sup> International Conference  
Timber - A healthy future for sustainable buildings

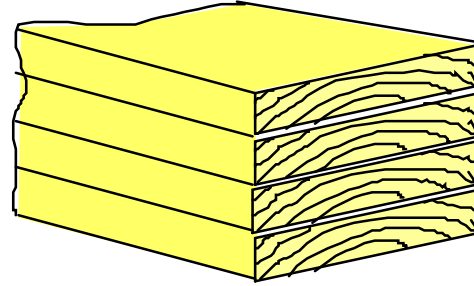
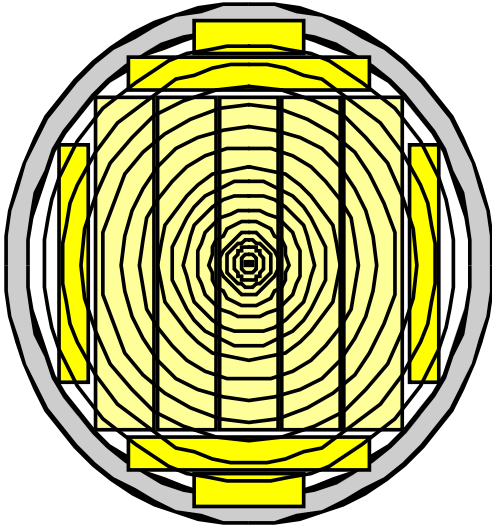
Iztok Šušteršič

Koper, 07. 03. 2019

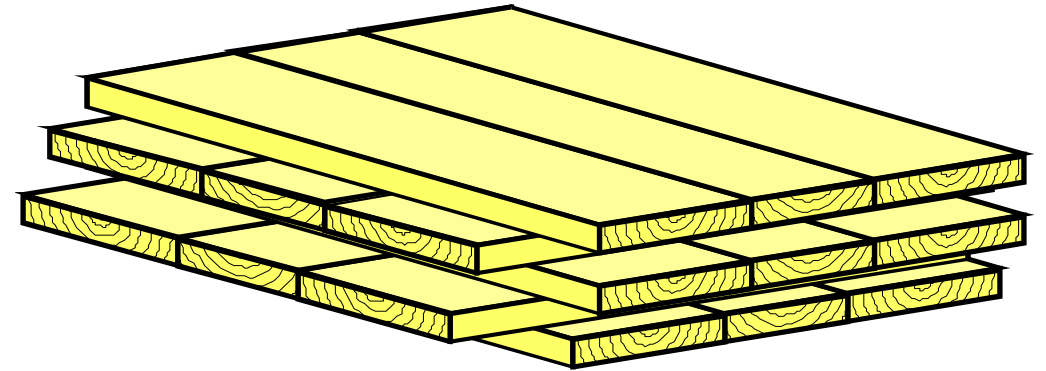




# ABC of CLT



GL = Glue-Lam

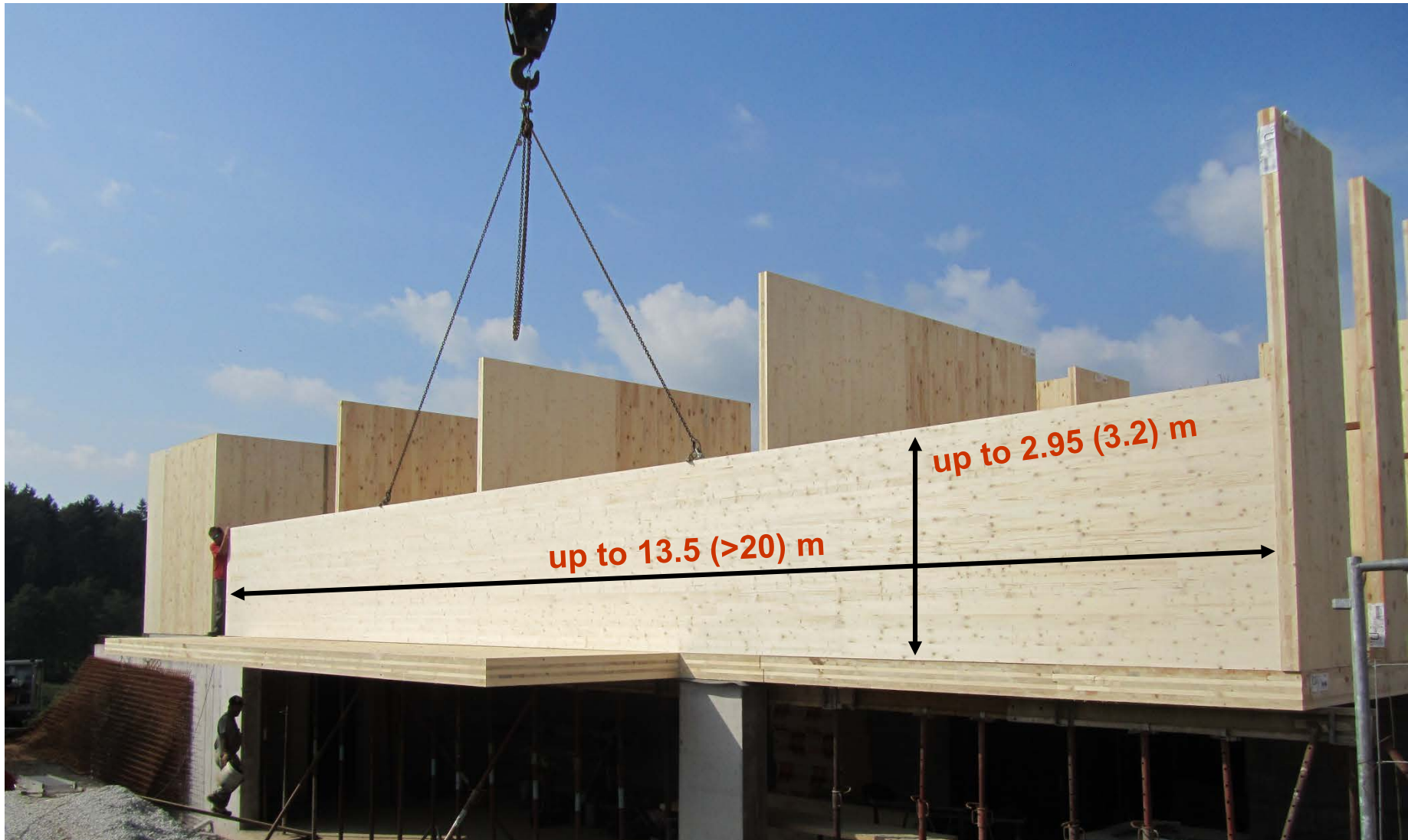


XL = Cross-Lam (CLT)





# ABC of CLT





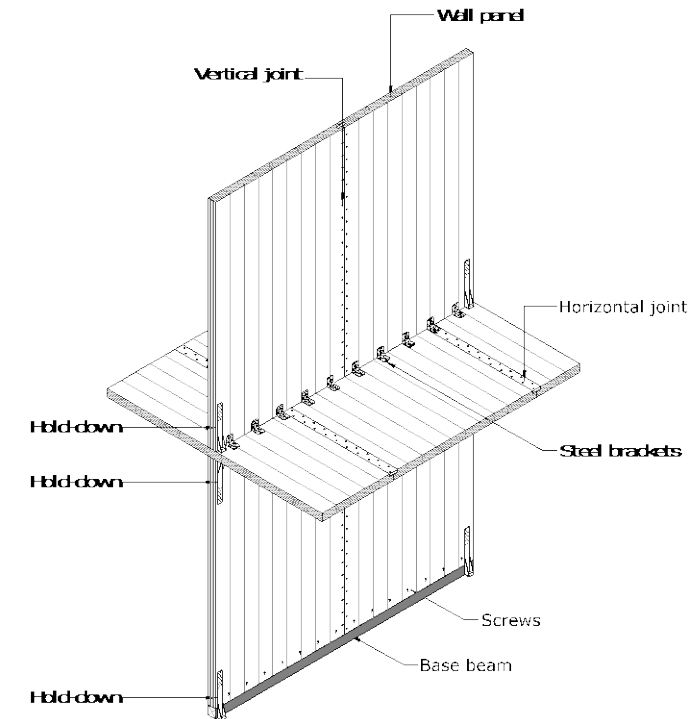
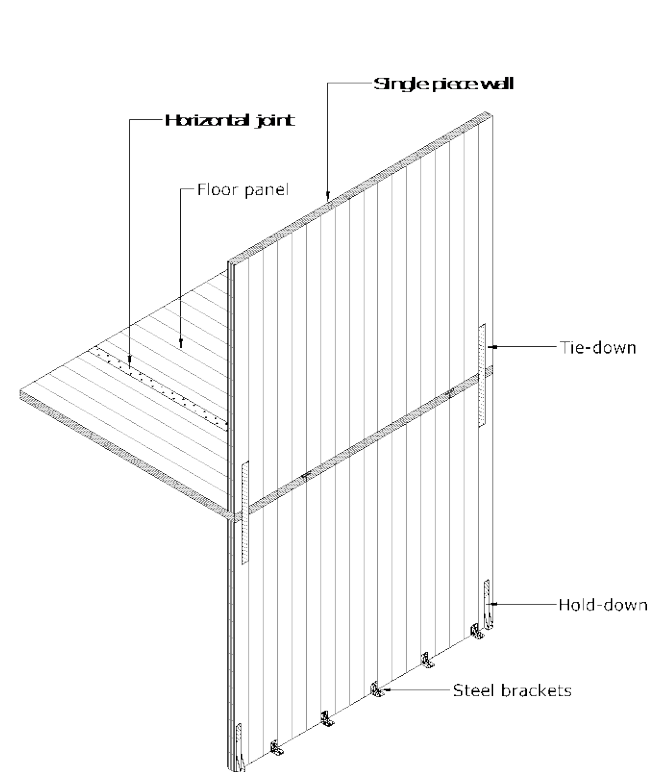
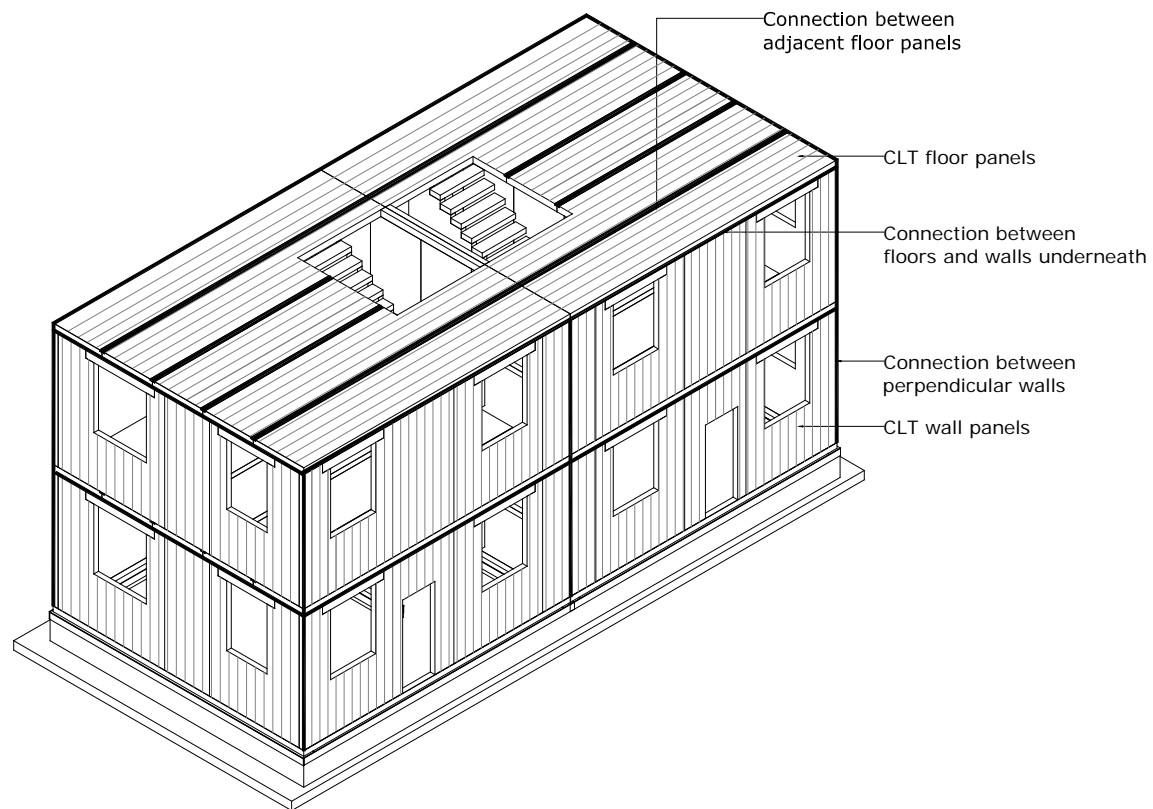


# ABC of CLT





# ABC of CLT







2009  
8 storey  
London, UK



2011

8 storey

Växjö, SE





2013  
9 storey  
Milan, IT





2013  
9 storey  
Milan, IT





2013  
10 storey  
Melbourne, AUT





2017  
10 storey  
London, UK





2017  
10 storey  
London, UK





2016  
17 storey  
Vancouver, CAN



2019/2020  
24 storey  
Vienna, AT







2018  
18 storey  
Brumunddal, NOR









ŠARTELJ

ŠLOPS

KLOČNE













# CLT ISSUES

- ACOUSTICS



# CLT ISSUES

- ACOUSTICS
- FIRE (!?)



- This CLT specimen survived almost 100 minutes of exposure in a standardized test reaching nearly 1000°C. The unexposed side of the specimen remained at less than 50°C for the entire test.



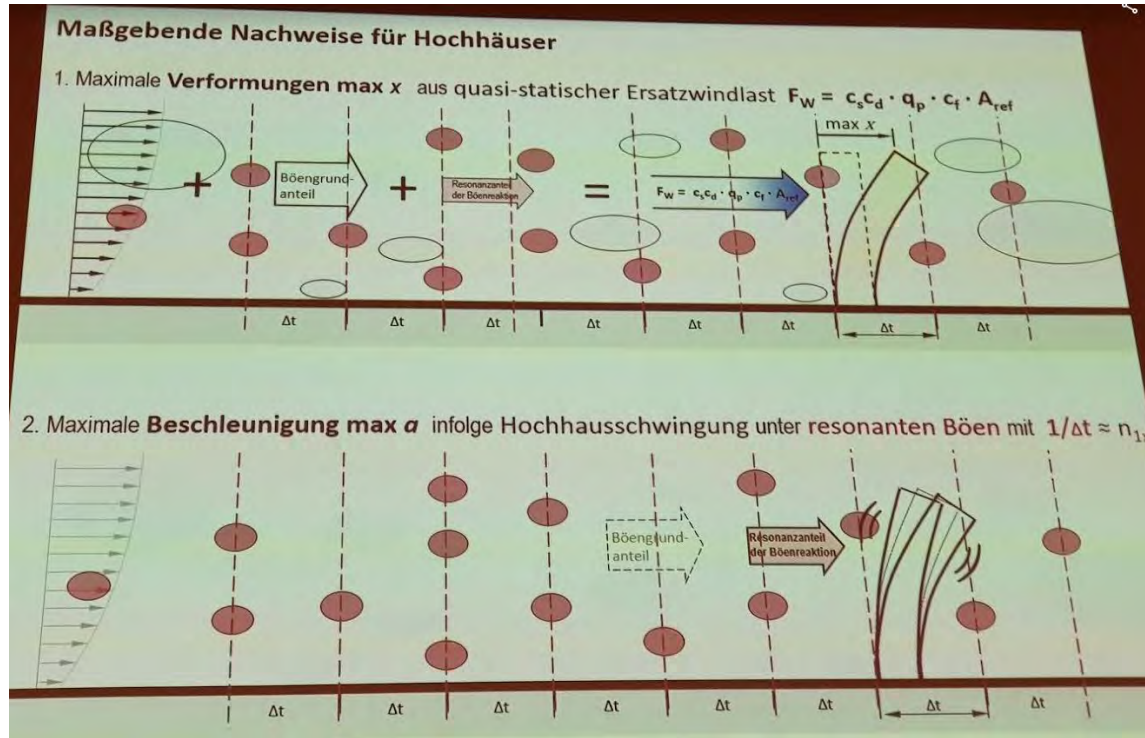


# CLT ISSUES

- ACOUSTICS
- FIRE (!?)
- RESISTANCE TO MOISTURE







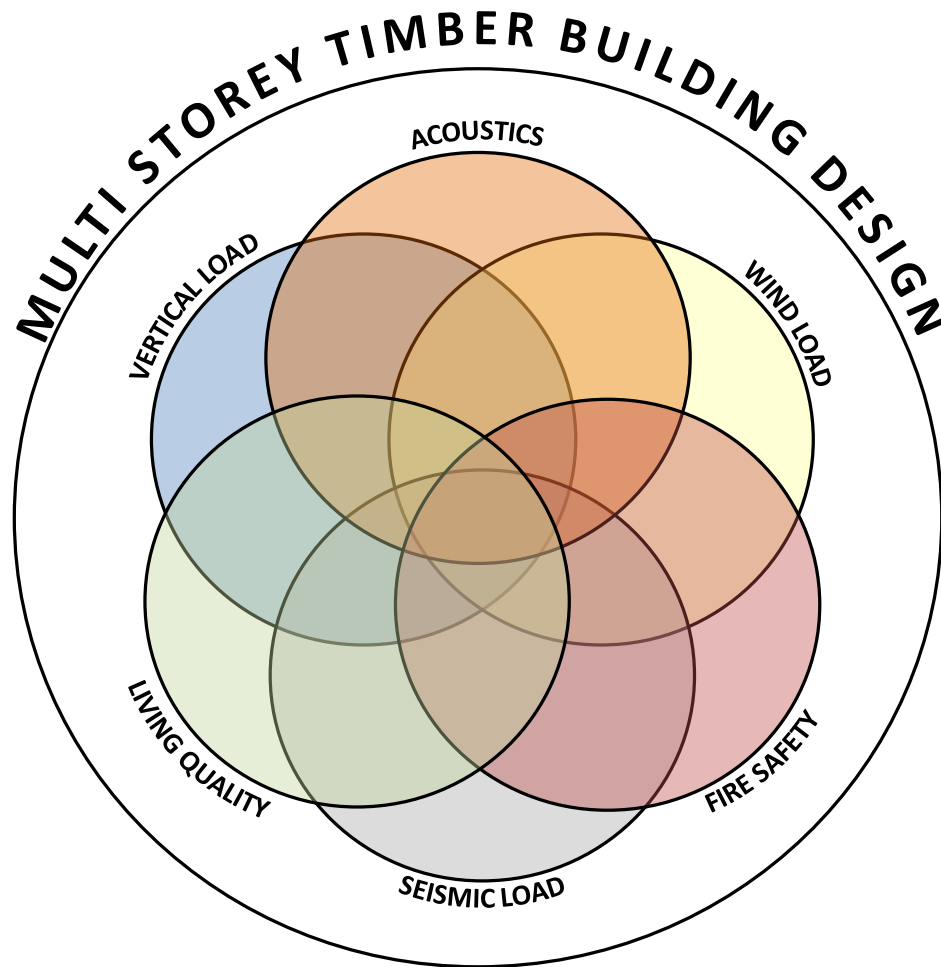
- ACOUSTICS
- FIRE (!?)
- RESISTANCE TO MOISTURE
- WIND







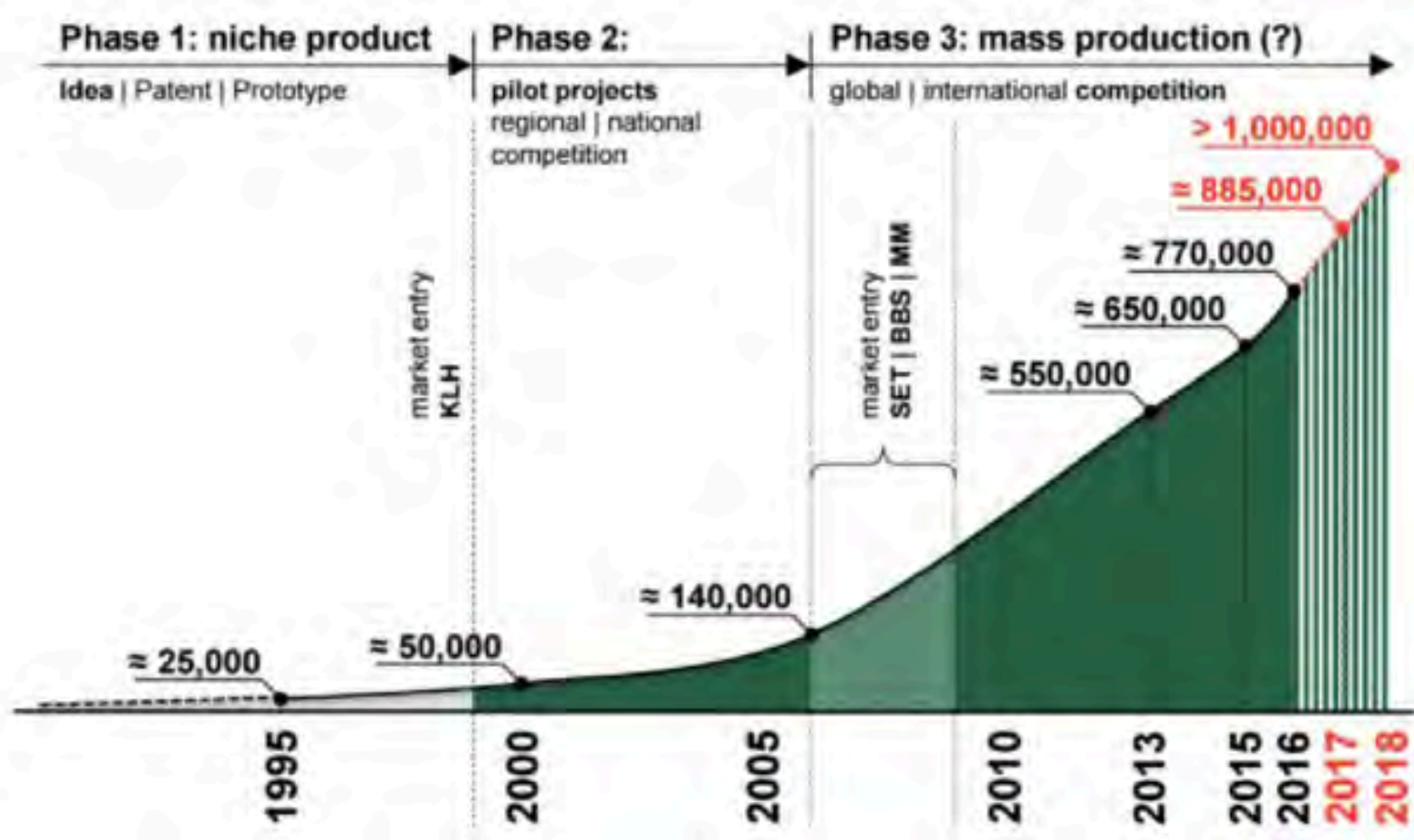
# CLT ISSUES



- ACOUSTICS
- FIRE (!?)
- RESISTANCE TO MOISTURE
- WIND

ALL THE ABOVE AND MORE ...

# NATURAL RESOURCES



Source: Gerhard Schickhofer, 2017





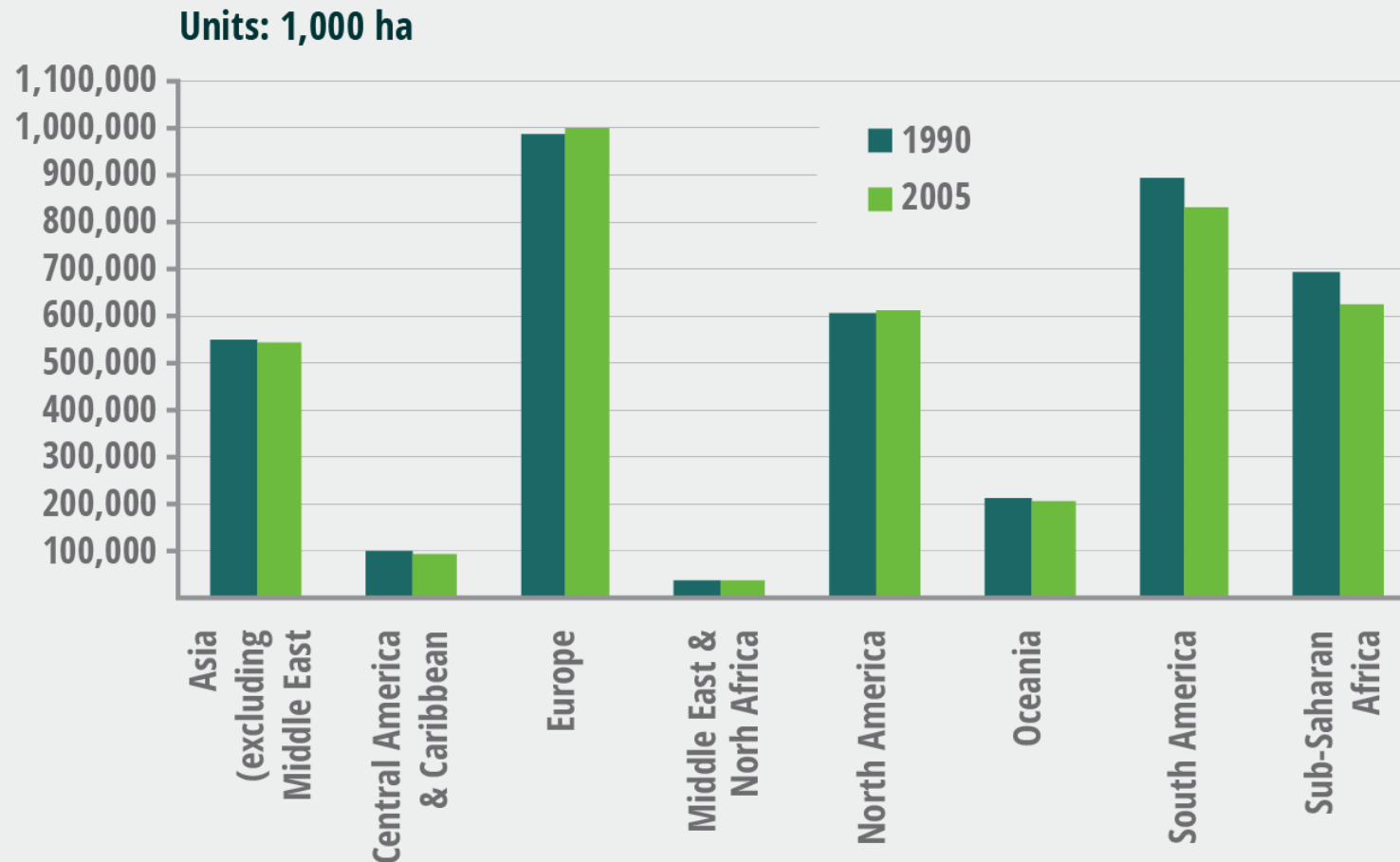


# NATURAL RESOURCES





# NATURAL RESOURCES



Source: Earth Trends Query ([www.earthtrends.org](http://www.earthtrends.org)). Forest coverage in South America has declined by almost 60 million ha in 15 years. In North America and Europe, forest cover increased by almost 4 and 12 million ha respectively in the same time-period.



# NATURAL RESOURCES



There is a high availability of wood for construction in Europe, where less than two-thirds of the wood available annually is used each year:

490 Mio m<sup>3</sup> of wood are taken from 776 Mio m<sup>3</sup>.

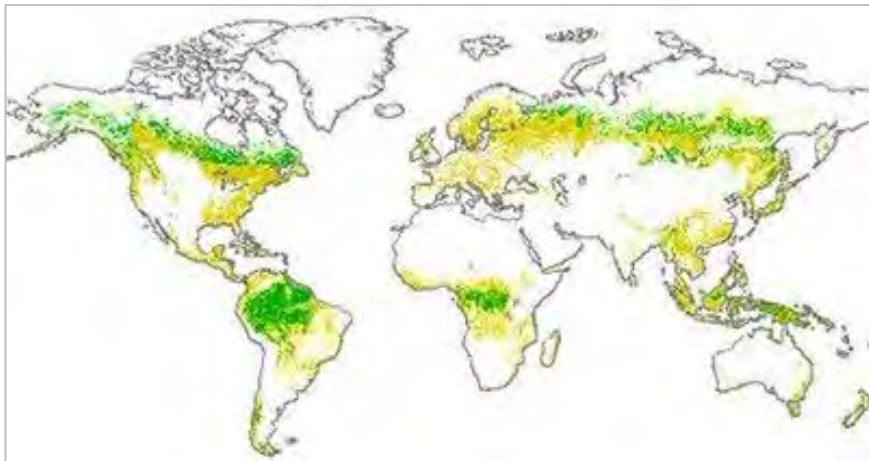
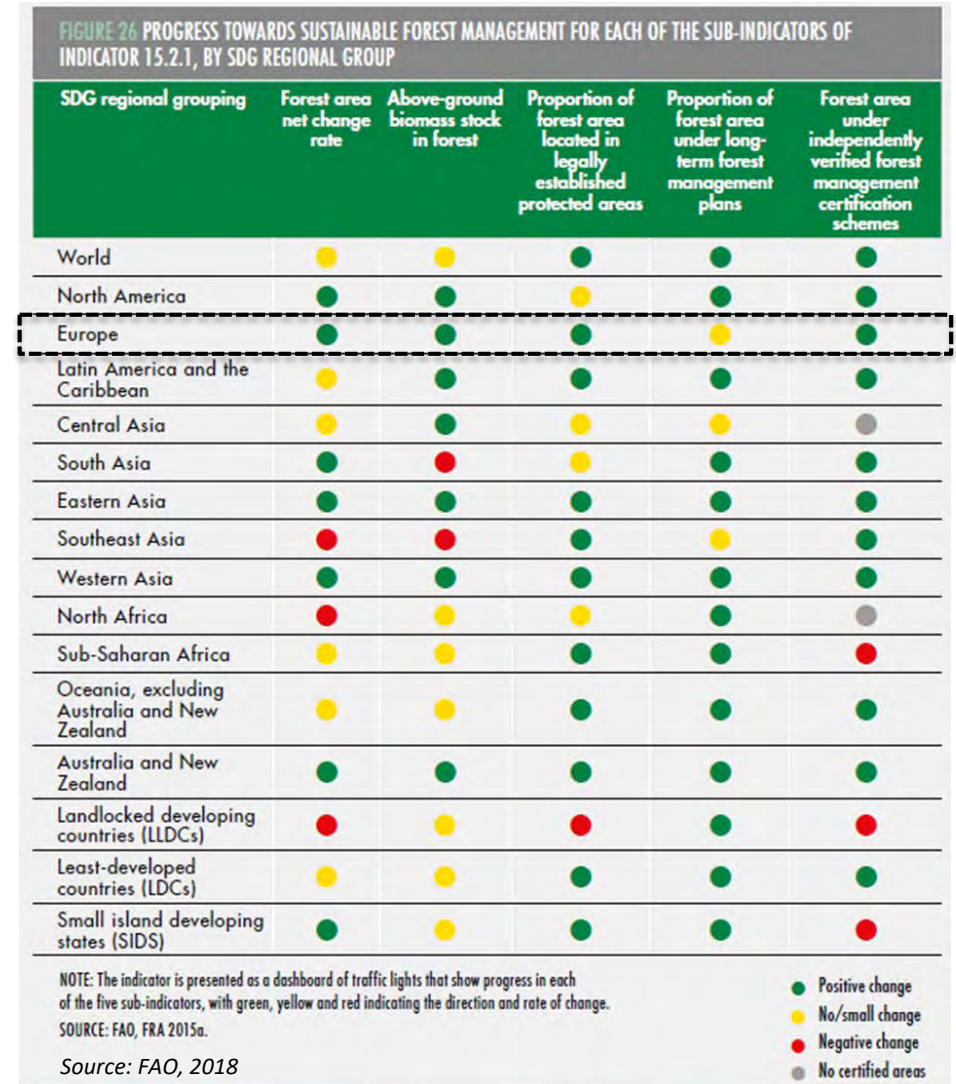
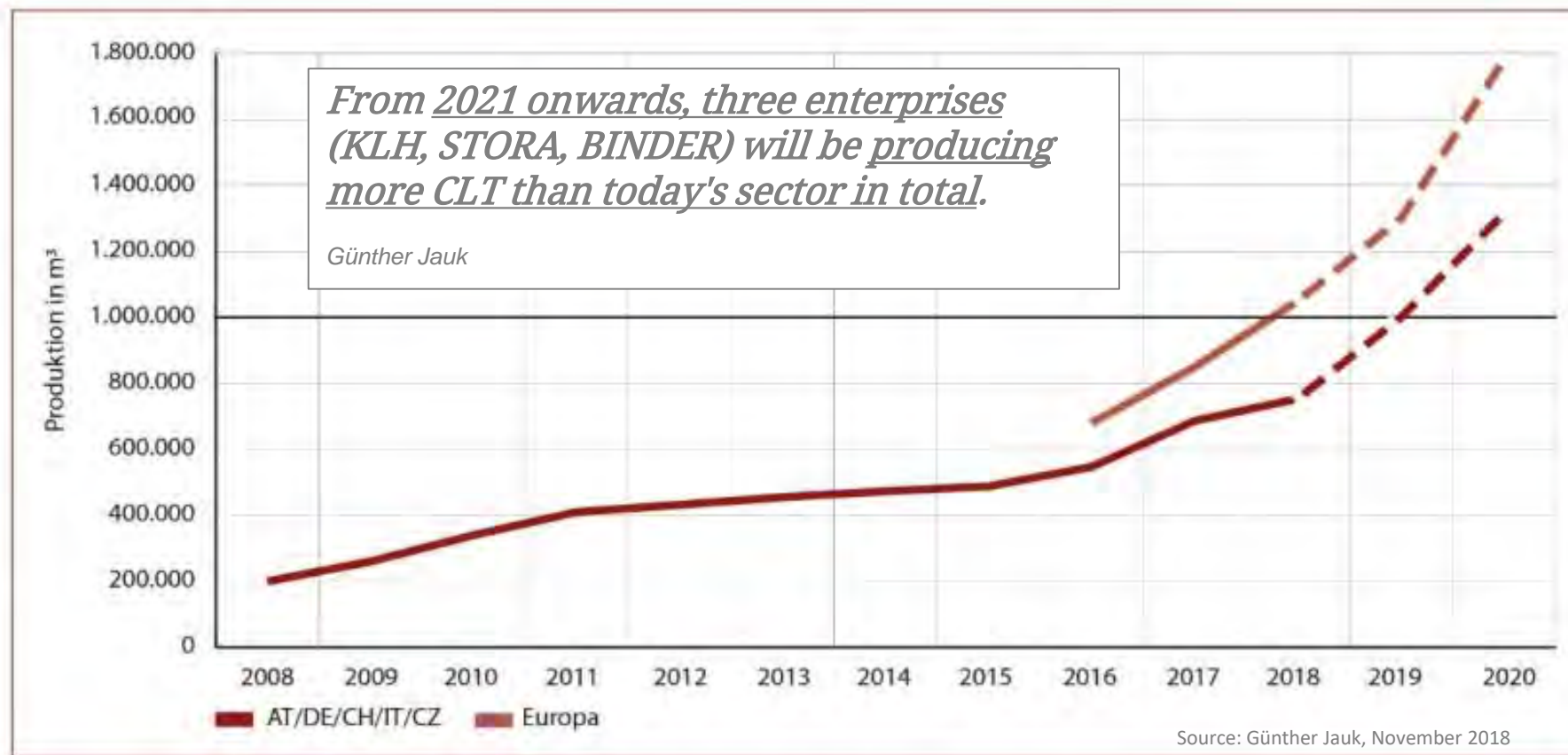


Image: LEED for Homes (2008)



# NATURAL RESOURCES

A CLT building uses double the amount of wood ( $0,3 \text{ m}^3/\text{m}^2$ ) for the floor area provided compared to light timber frame ( $0,15 \text{ m}^3/\text{m}^2$ )!







# USE OF HARDWOODS

## MAIN STOCK



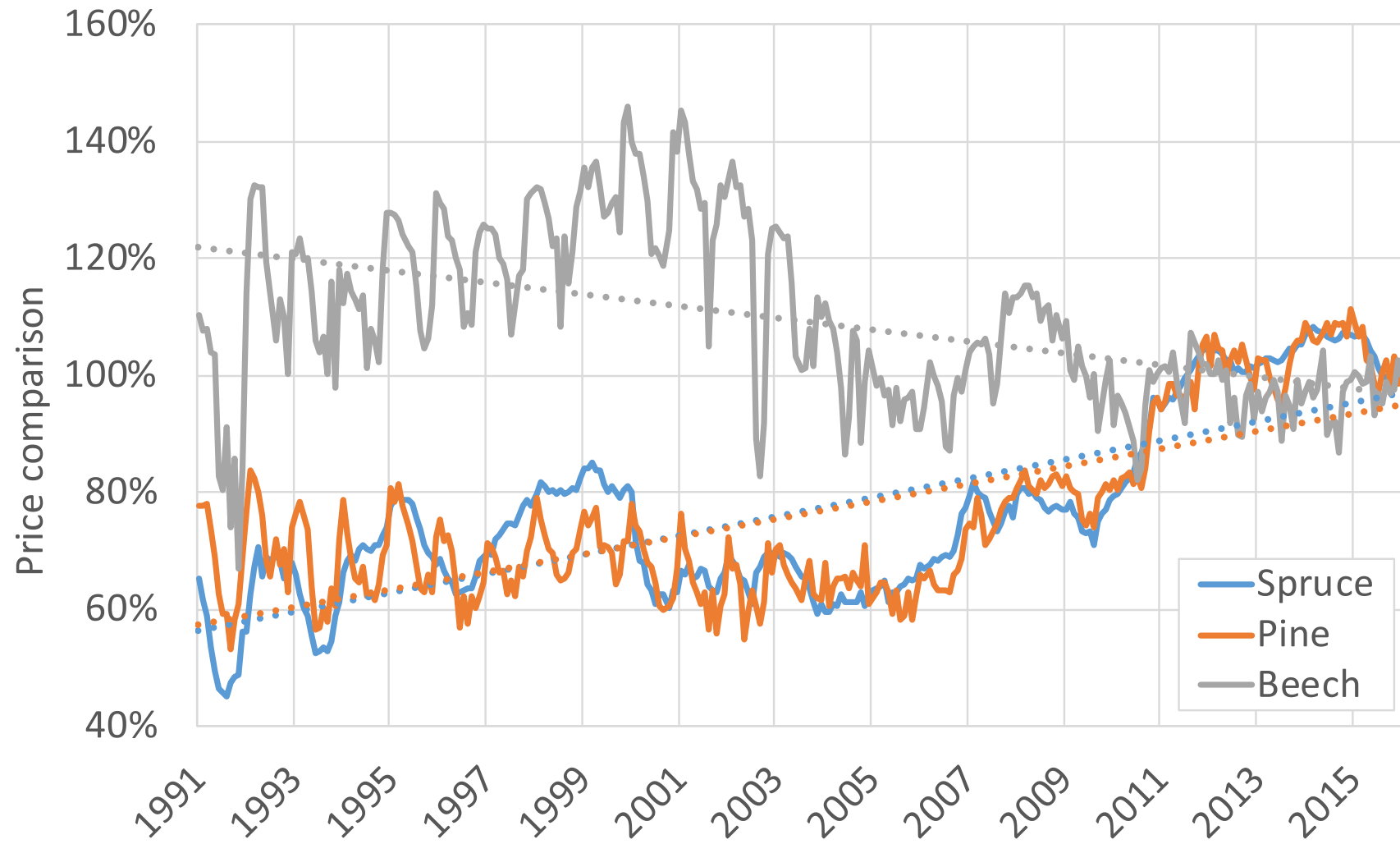
## YOUNG TREES



Source: Garman association of sawmilling industry



# USE OF HARDWOODS



Source: Federal Statistical Office, Germany



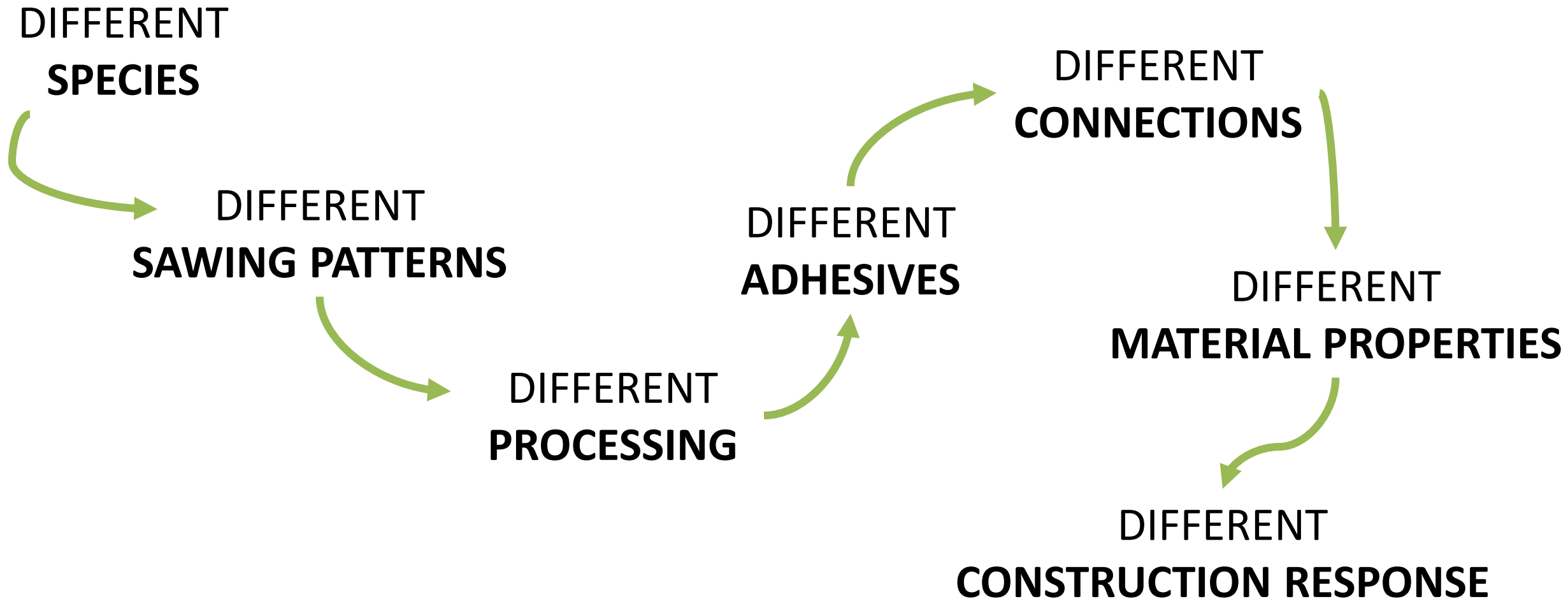


# USE OF HARDWOODS





# USE OF HARDWOODS

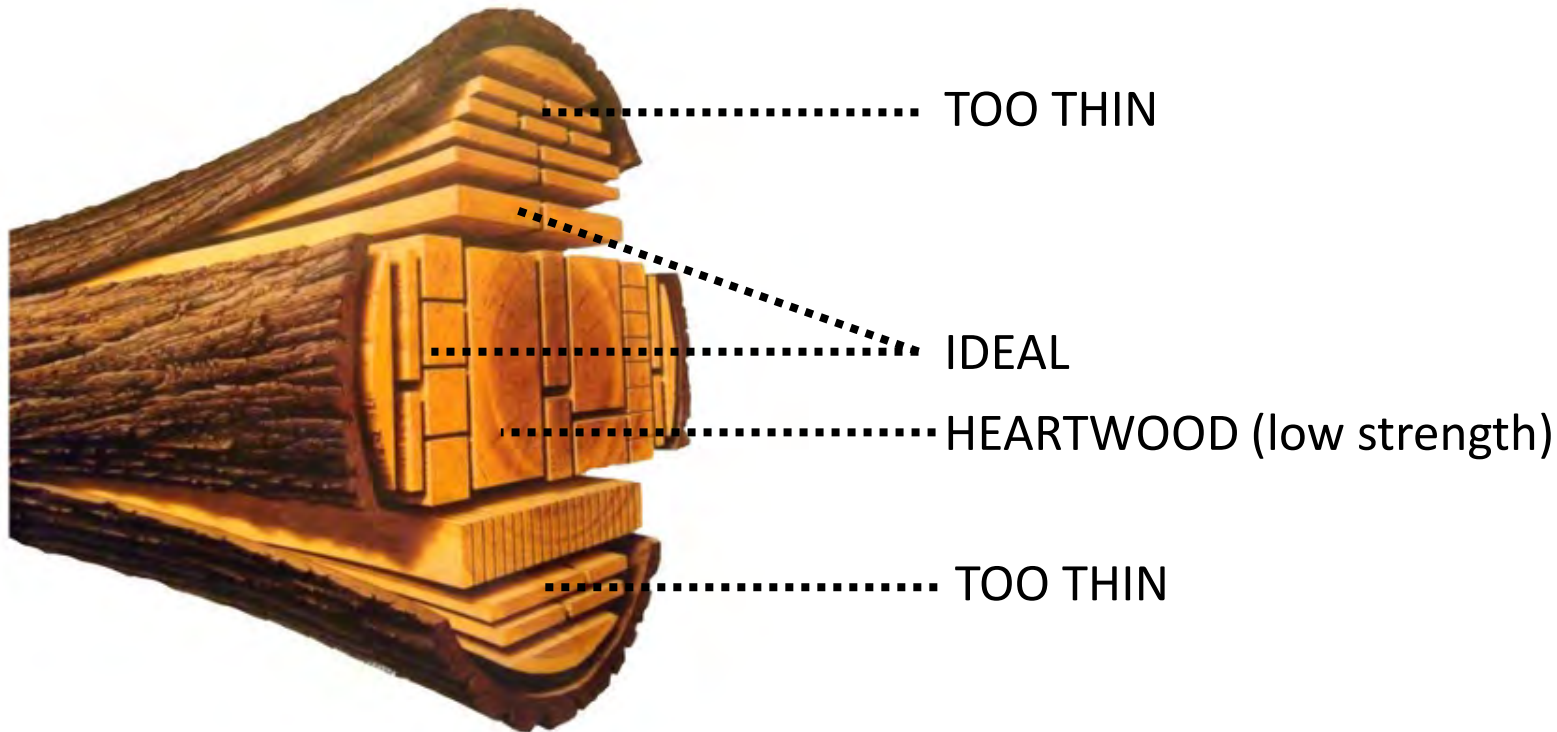


Changing timber species influences the complete production-design chain ...

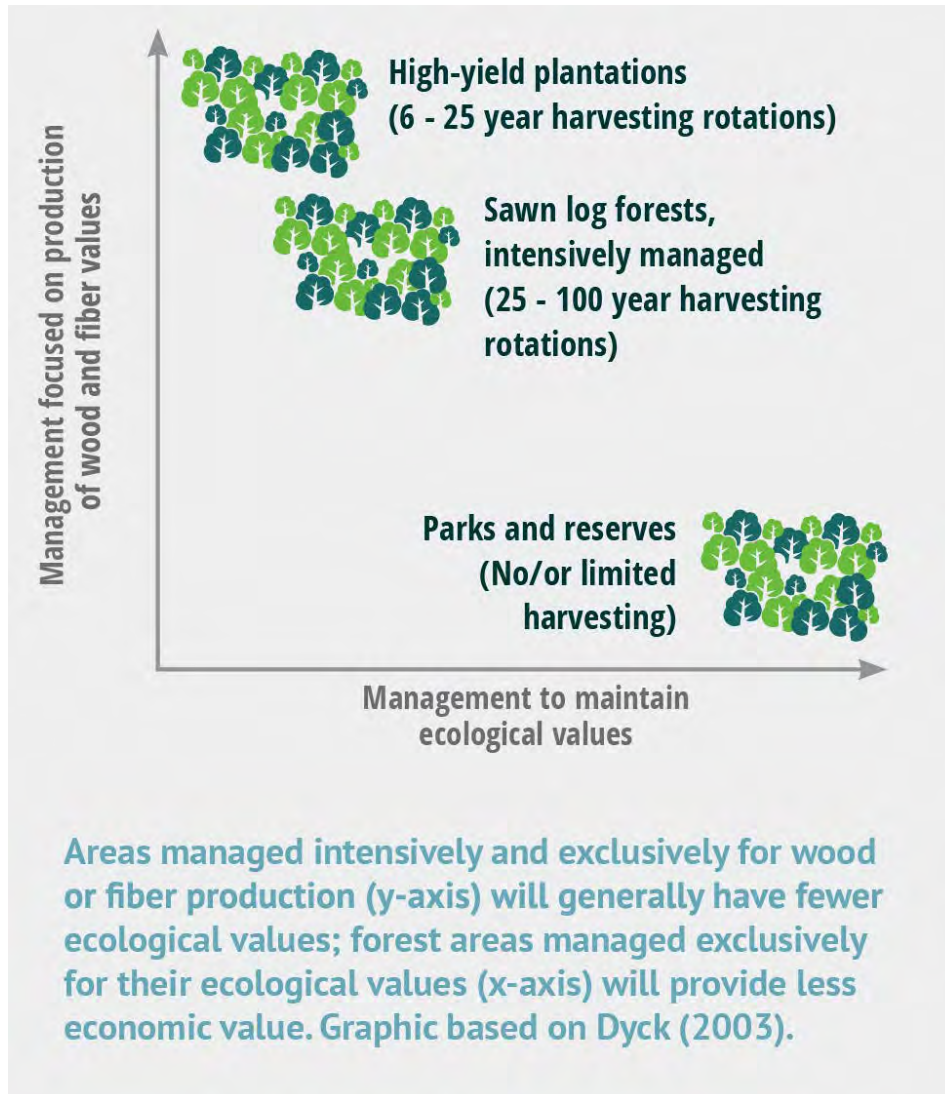


# USE OF NON-STANDARD WOOD

- Lower value (e.g. side boards from sawn timber processing)
- Low grade species (under-utilised within the construction sector)
- Forest resources currently not entering the processing chain.



# USE OF PLANTATION WOOD



**Spruce CLT walls are under-utilised in most one-family houses.**







# DEVELOP MORE EFFICIENT ELEMENTS

## CROSSLAM GOES ON A DIET ...





# DEVELOP MORE EFFICIENT ELEMENTS



**DO NOT INCREASE THE PRICE!!!**

Material consumption

+

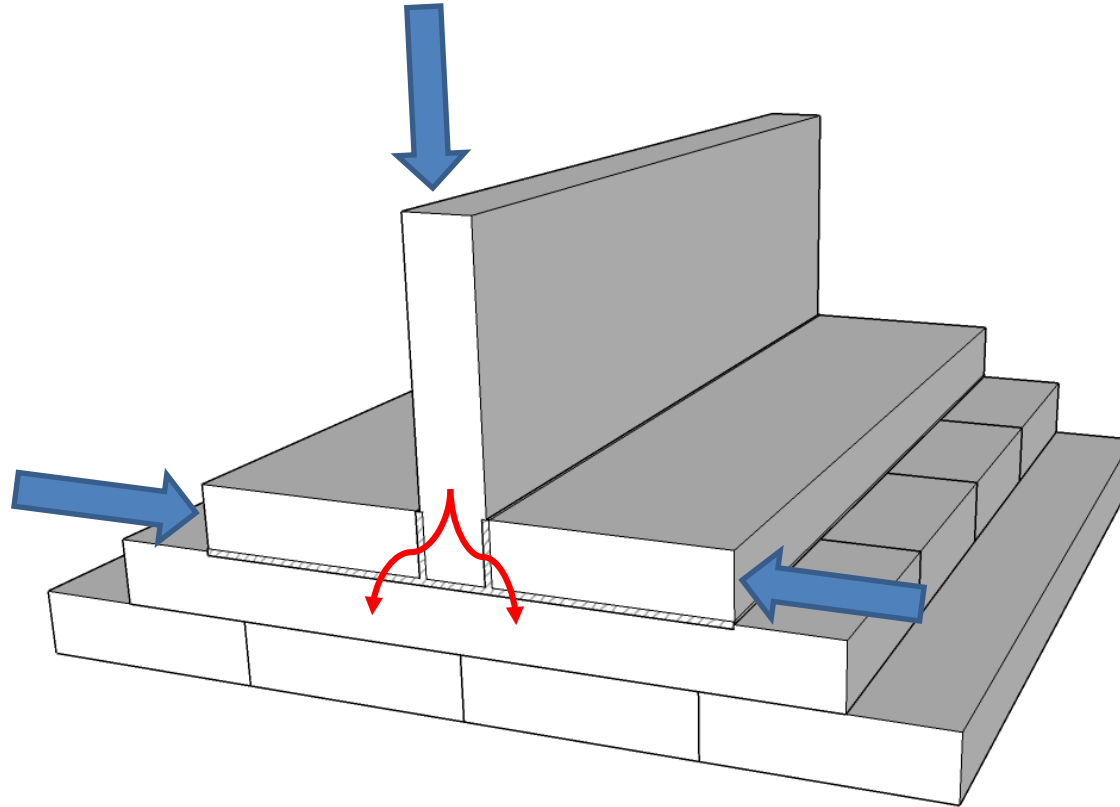
- Robustness
- Fire safety
- Seismic safety
- Versatility

**OPTIMAL CONSTRUCTION ELEMENT**





# DEVELOP MORE EFFICIENT ELEMENTS

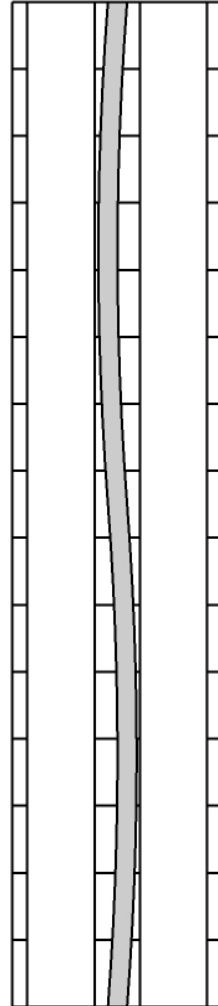


Develop a one step production procedure ...



# DEVELOP MORE EFFICIENT ELEMENTS

## ... and use standard lamellas as input material.

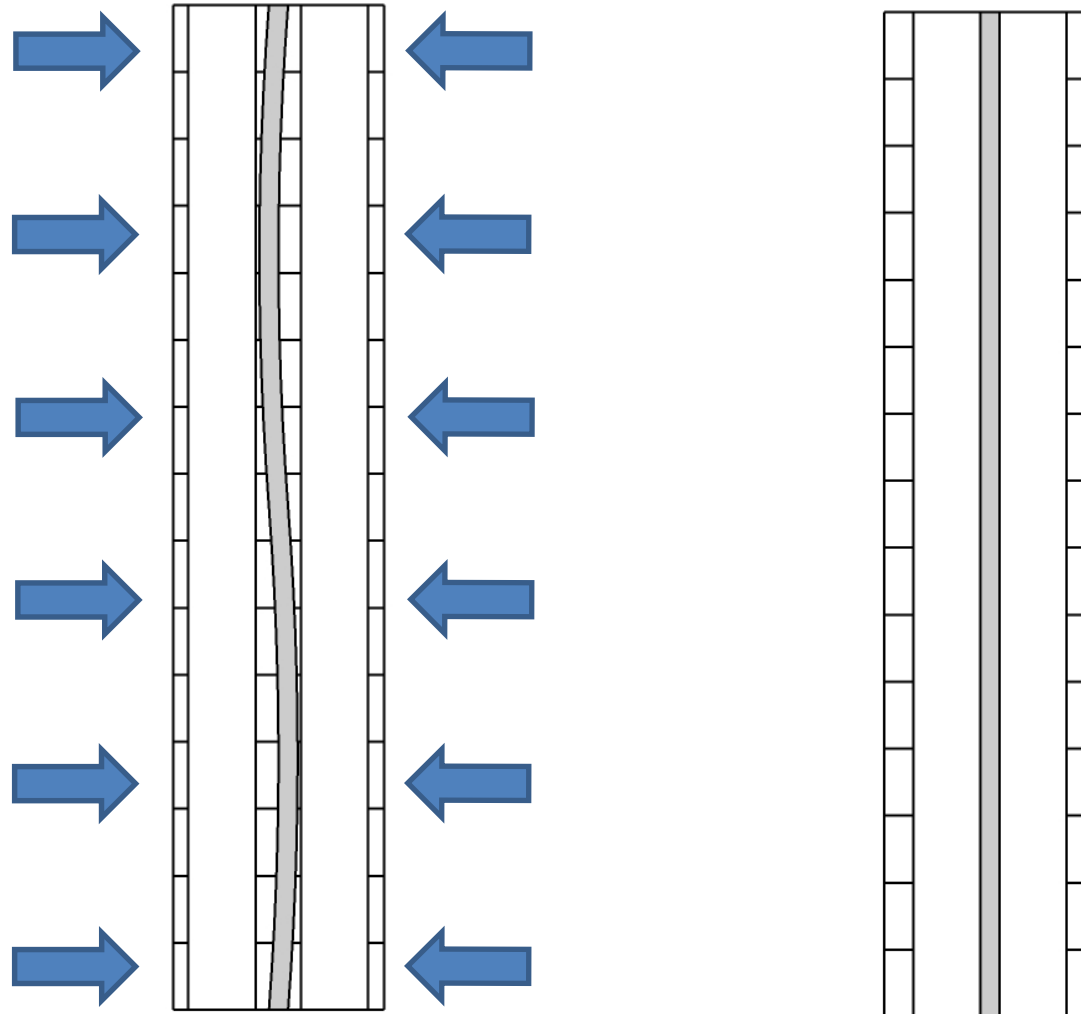






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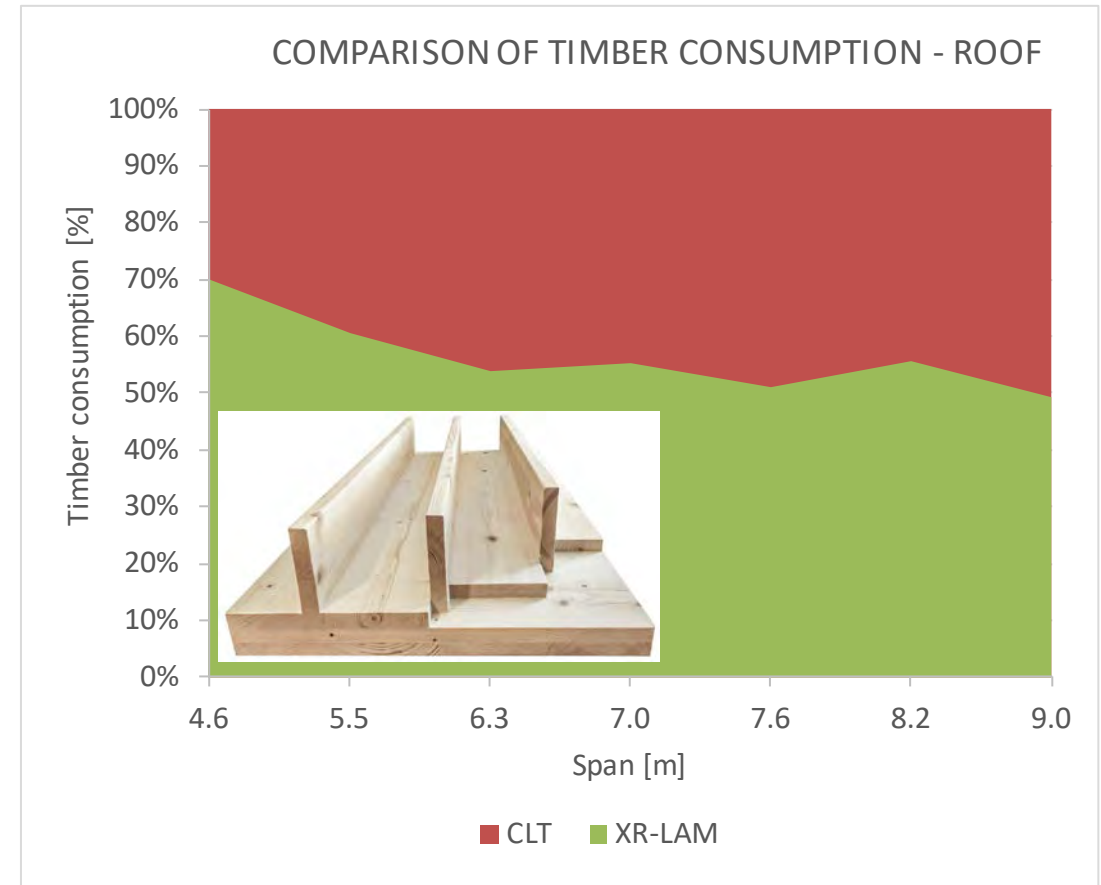
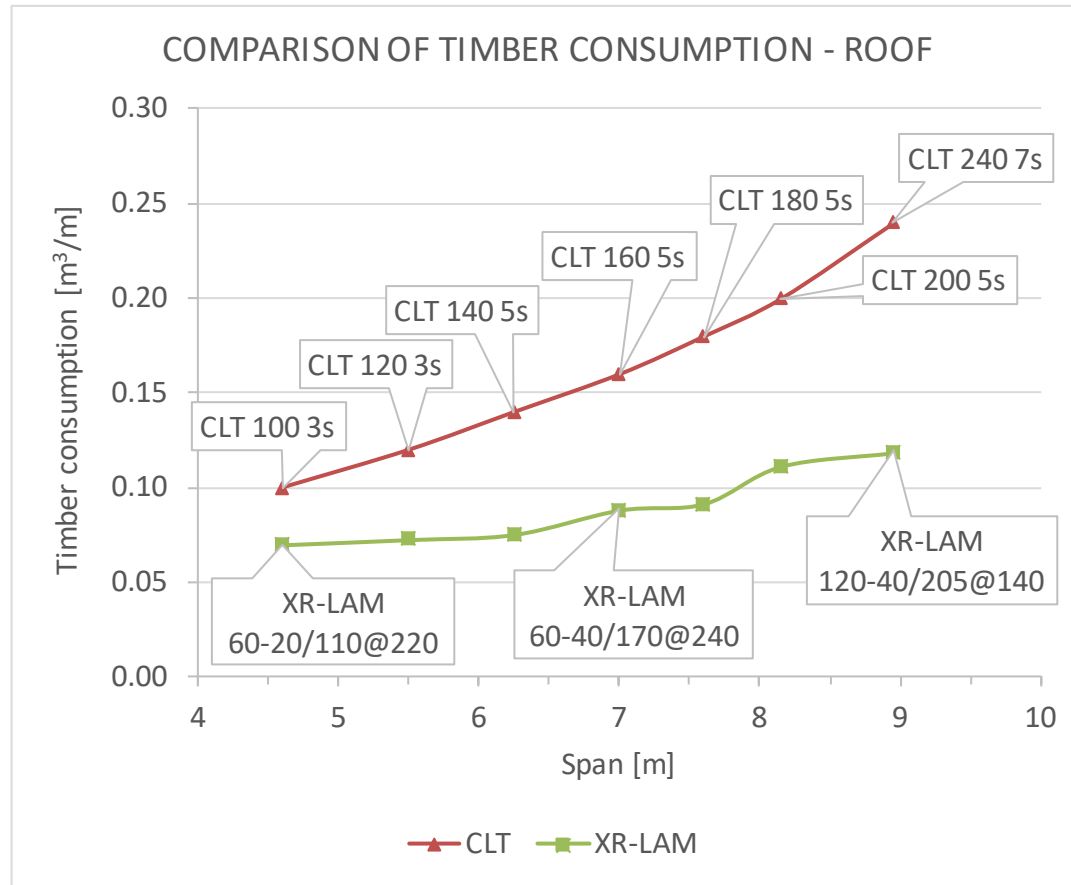




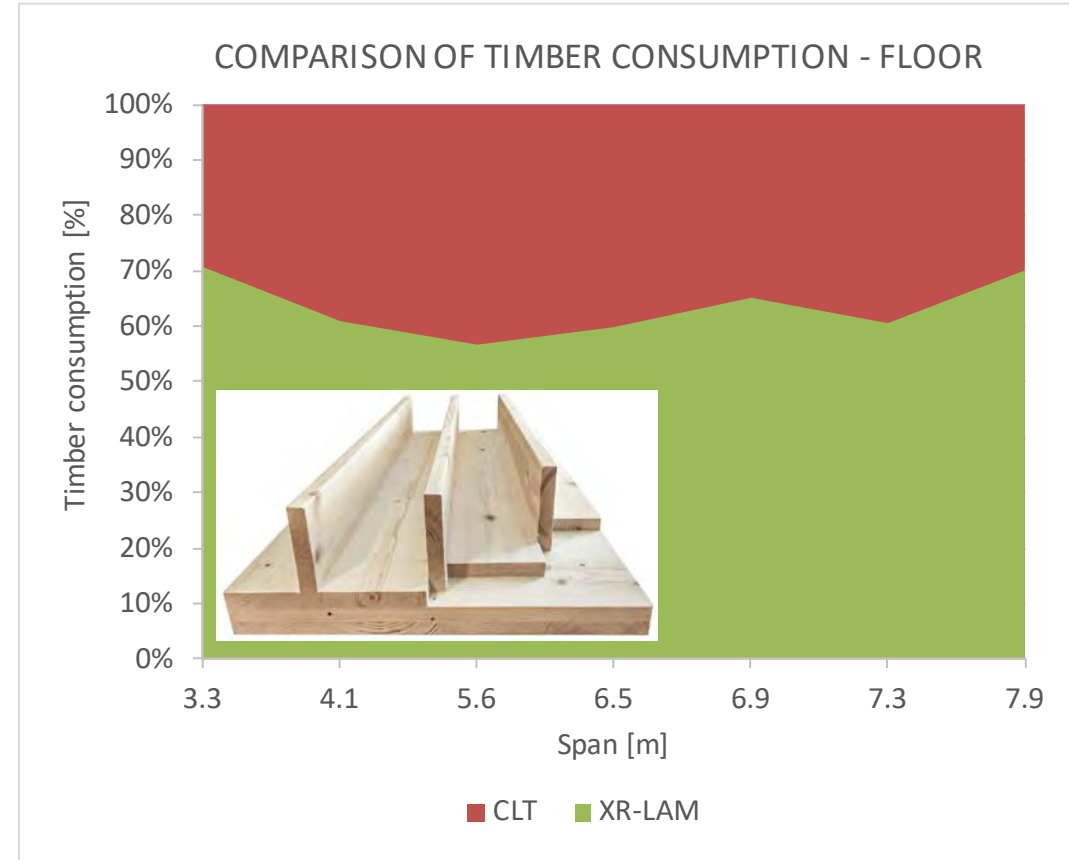
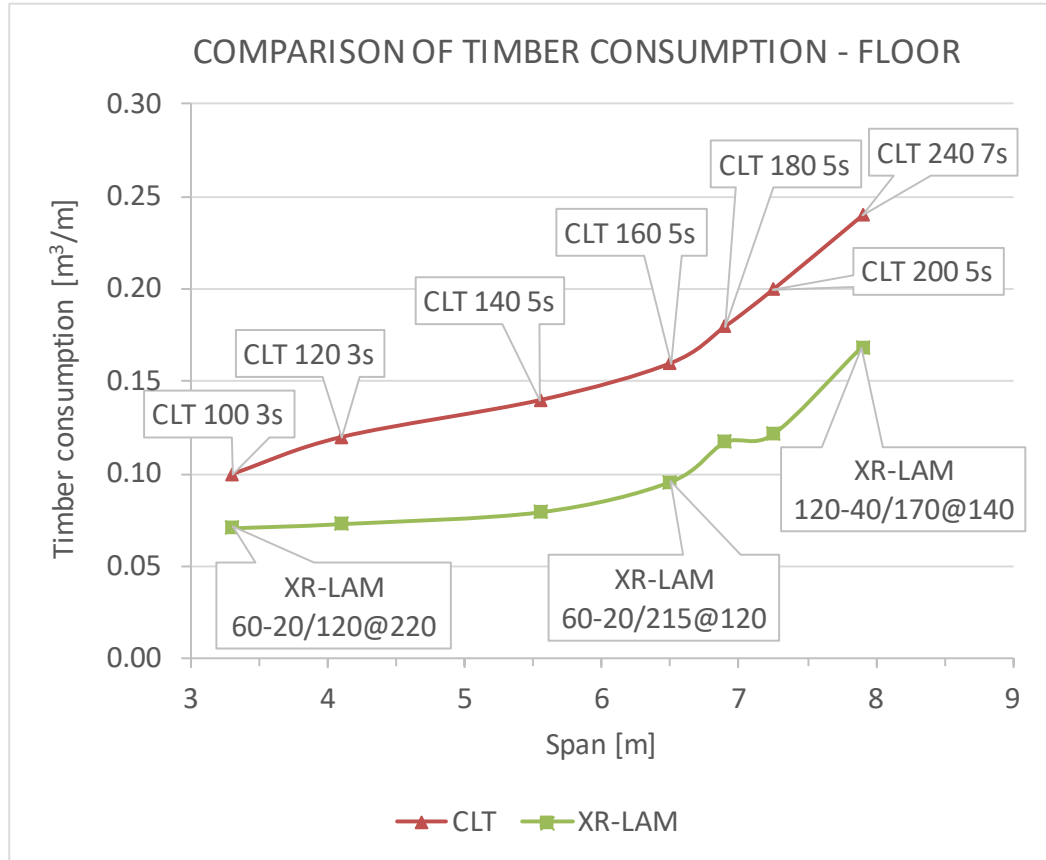
# DEVELOP MORE EFFICIENT ELEMENTS







**For roof plates up to 50% of timber can be saved compared to standard CLT**



**For floor plates up to 40% of timber can be saved compared to standard CLT**





# MODIFY CURRENT PRODUCTION

Make openings during production and don't cut them out afterward. **Reduce waste!**





- **Educate the designers**

- Architects to make designs that suit timber (general concept, spans etc.)
- Structural engineers to optimise the construction (no copy-pasting from RC logic)

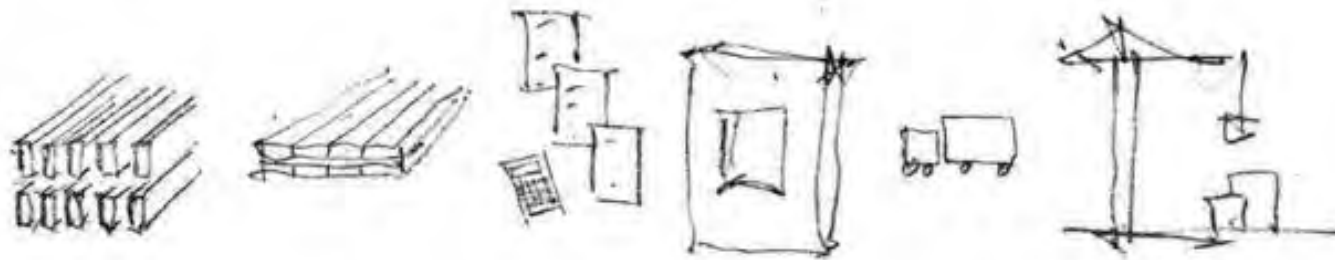
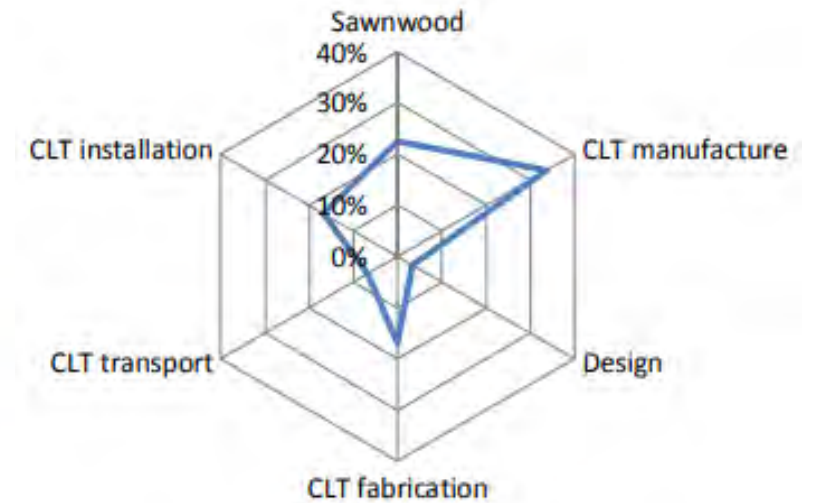
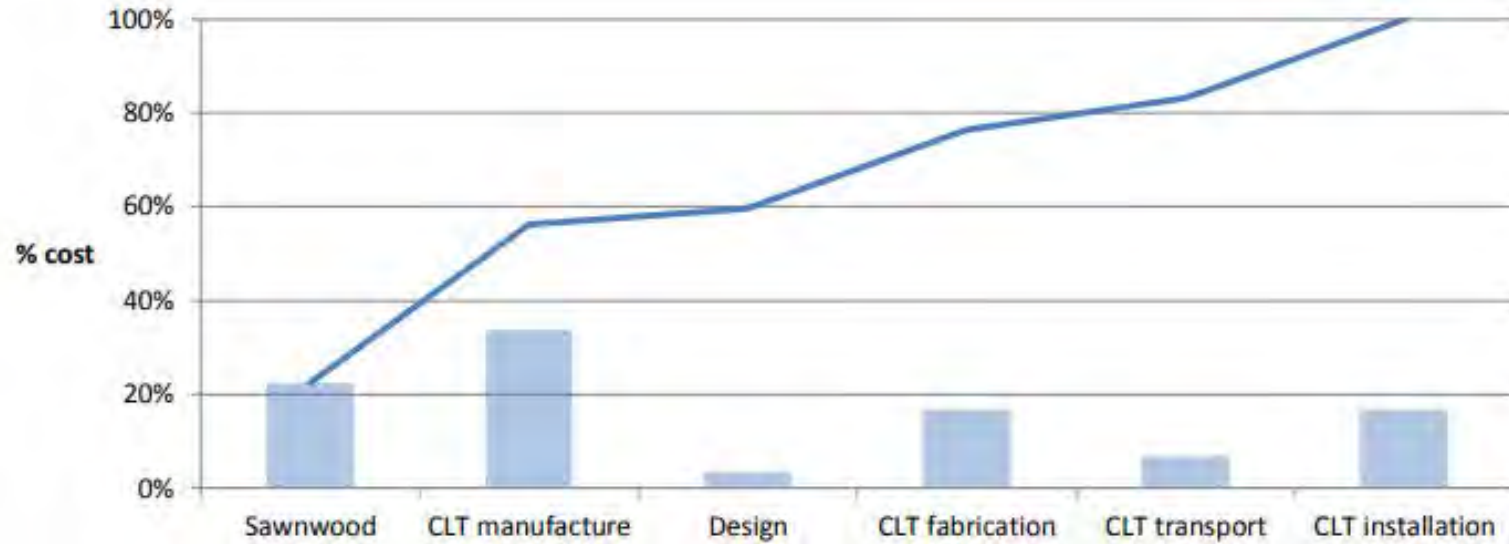
- **Develop new software**

- “Codify”
- Optimise design (reduce time)
- Use of BIM

- **Modify methods** (especially the serviceability)



# MATERIAL vs COST



Source: Smith and Wallworks engineers

## Break the culture of more material for less labor!



## CLT – trends and considerations :

- Overall better performance then other timber systems
- It uses more material but our forests are growing faster then we harvest
- It stores significant amounts of CO<sub>2</sub>
- It is more expensive then other systems but the market demand is high
- It is underutilized for most use-cases (family homes)
- It is usually imported (low local socio-economic value)

**A NEED TO FIND A FUTURE BALANCE BETWEEN CO<sub>2</sub> STORAGE AND FOREST PRESERVATION!**





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# Thank you for your time.