BENCHVALUE
French case study

VIENNA

23/10/2019

Benchvalue: French case study

- **Choice of building**
  - Stakeholder meeting December 2017, phone conference January 2018
- **Data collection at Arbonis company on :** FCBA
  - glulam manufacturing (environmental, economic and social)
  - Building description
- **Competing buildings modelling:** Université de Limoges
  - Luc JOURNE - Mathieu JARRY (IUT d'Egletons), internship under the direction of Nicolas Sauvat of IUT d'Egletons, University of Limoges
- **Environmental comparison of buildings:** FCBA
  - Junaid ISHTIAQ (IUT d'Evry), internship under the direction of Estelle Vial of FCBA
- **Social and economic comparison of buildings :** EFI FCBA
  - Specific data collection by Armand Clopeau from EFI
  - National data collection by Anne-Laure Levet from FCBA
- **Data modelling in the TOSIA tool :** EFI
  - Data modelling and input – Armand Clopeau from EFI

Stakeholder interaction day in Limoges – 15 May 2019 (1)

- Question: Douglas fir Douglas fir use in construction:
  an opportunity for Europe and the bioeconomy, a challenge for France?
- Organized by UNILIM
- Main results:

Assets

- The French Douglas fir wood resource
  is renewable, abundant and local,
  f Douglas
  hich now
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  rability of the
  ,
  of wood is

www.fcba.fr

Stakeholder interaction day in Limoges – 15 May 2019 (2)

Challenges and opportunities

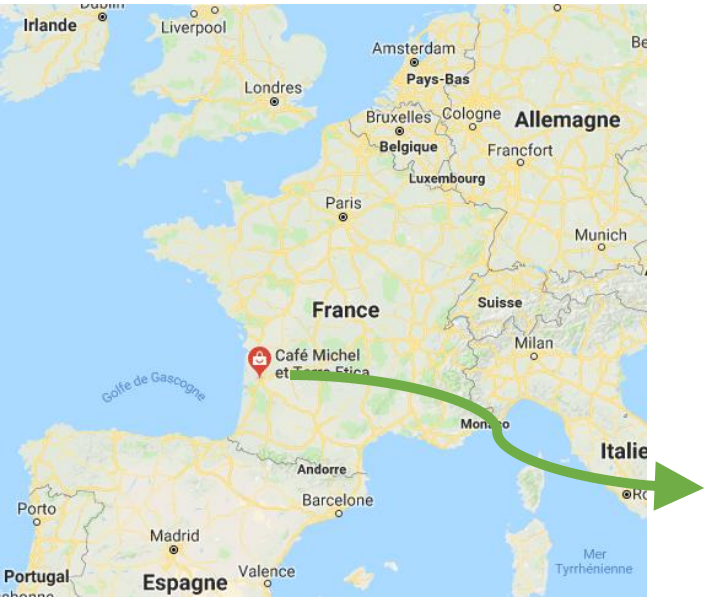
- In the future, it is foreseen that the construction market will be more open to wood, that the environmental issues will gain priority,
- The other materials lobby will be stronger,
- new uses of wood will be developed and that the productivity of the French wood industry will increase.

✔ Recommandations:

- Develop the resource by having a strong plantation national and regional policy,
- Communicate more on the performance of wood construction as a sustainable material (renewable, low carbon, local etc.),
- Further structure the forestry-wood sector to avoid internal conflicts and provide more resources to ensure that wood properties are recognized in standard and legislations,
- Develop production capacity to face market development, invest in more efficient processes and profit from the digital transformation,
- Develop employment, research, innovation and education in the forest and forest products sector.

Presentation of the case study

- Owner: Café Michel (coffee roaster)
- Project manager : Alphatech Ingénierie
- Timber structure : ARBONIS
- Building received in 2017
- Built in spruce but possibility to model it in douglas
  - Interesting comparison possible between local douglas and imported spruce



Building description

- **1800 m² + 200 m² of mixed timber concrete floor**

Possibility of extension

Concrete fire wall

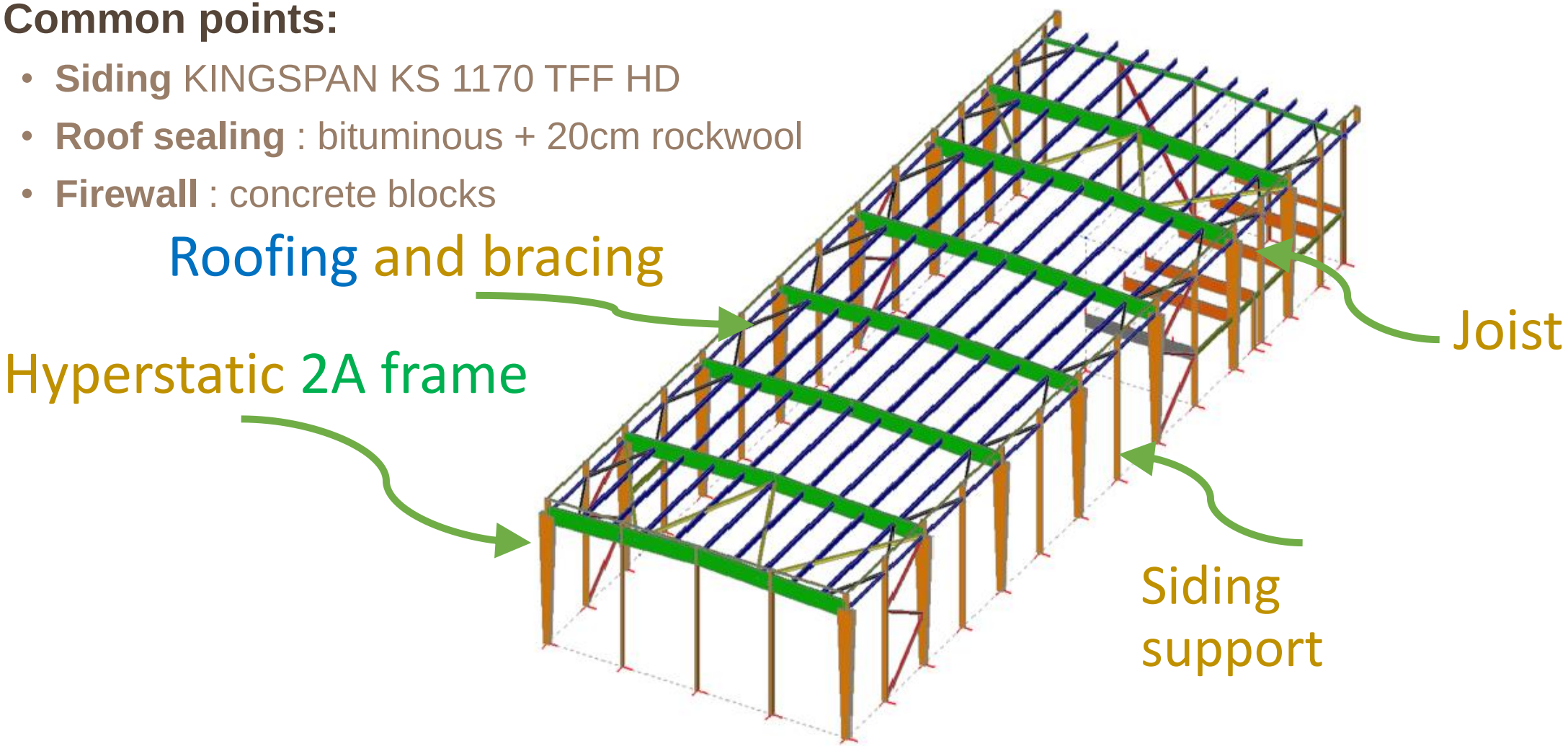
Office : 2 levels => 386 m²

Workshop : 1 level => 1663 m²

Storage : 1 level => 167,5 m²

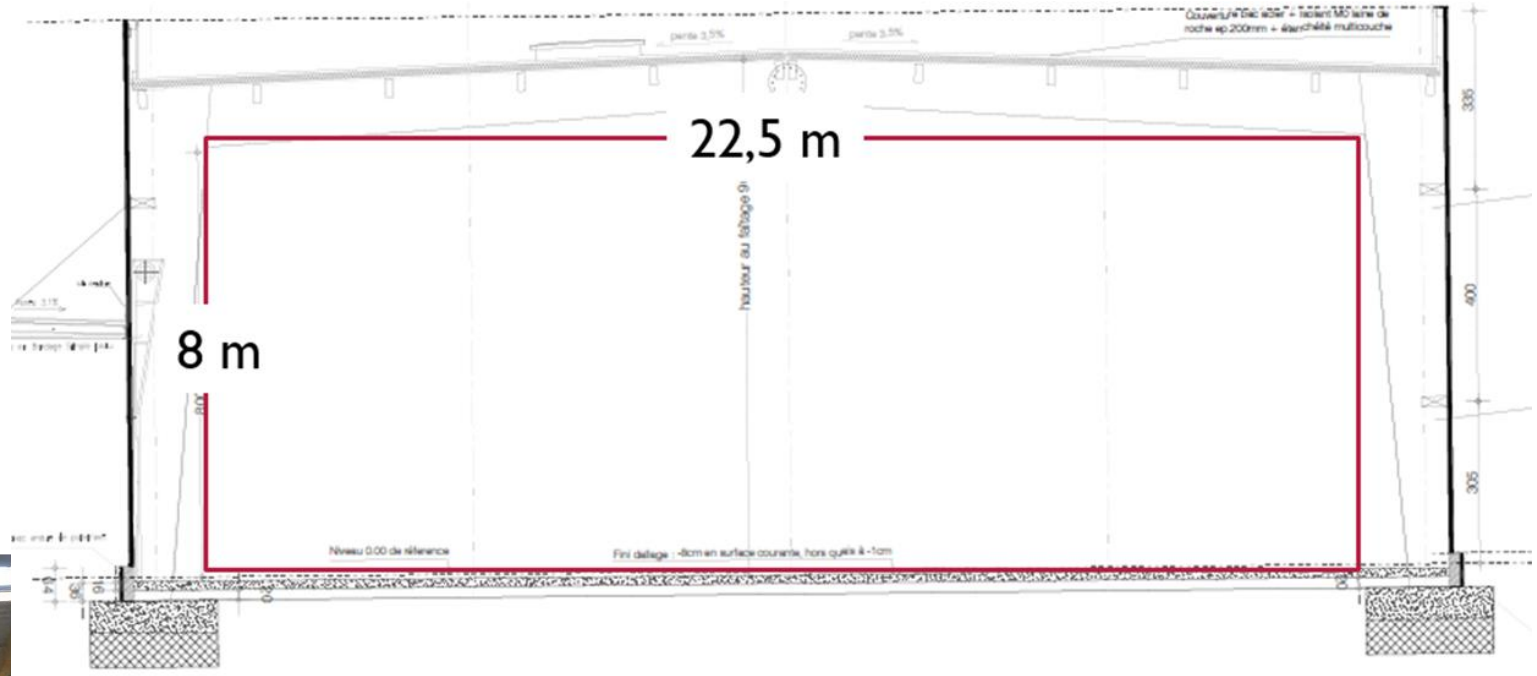
Building description

- **188 m3 of spruce GL28h**
- **Common points:**
  - **Siding** KINGSPAN KS 1170 TFF HD
  - **Roof sealing** : bituminous + 20cm rockwool
  - **Firewall** : concrete blocks



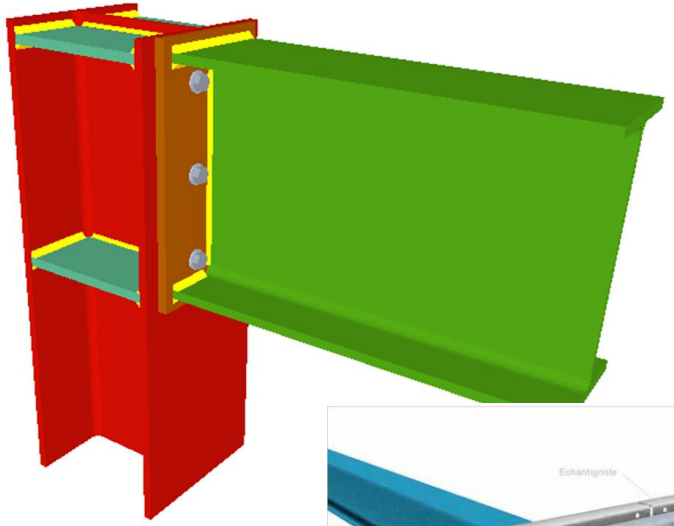
Modelling hypothesis

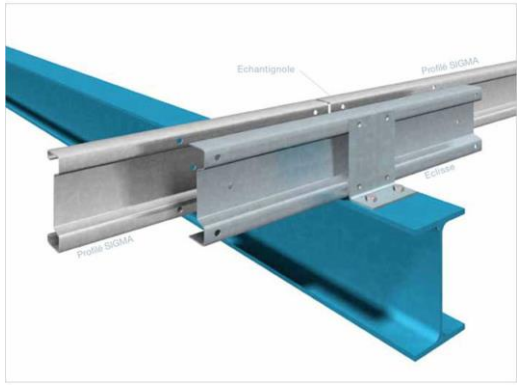
- Fire resistance: 60 min
- Geographic areas:
  - Seismic : zone 1
  - Wind : zone 1
  - Snow : zone A2
- Internal volume



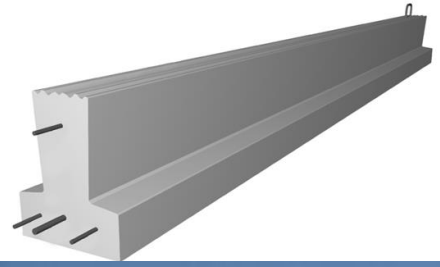
Modelling hypothesis

- Steel structure
- Eurocode 3
- Euro profil catalogue





- Concrete structure
- Eurocode 2
- Precast concrete (ACOB – Association Française des Constructeurs de Charpentes en Béton)



Modelling results

Material	Mass (t)					Volume (m3)
	Frame	% frame	Roofing	% roofing	Total	Total
Timber	27,7	40%	19,0	27	69,7	151,6
Steel	30,9	47%	18,4	28	66,2	8,5
Concrete	102,9	45%	91,4	40	229,2	91,7

Benchmarking

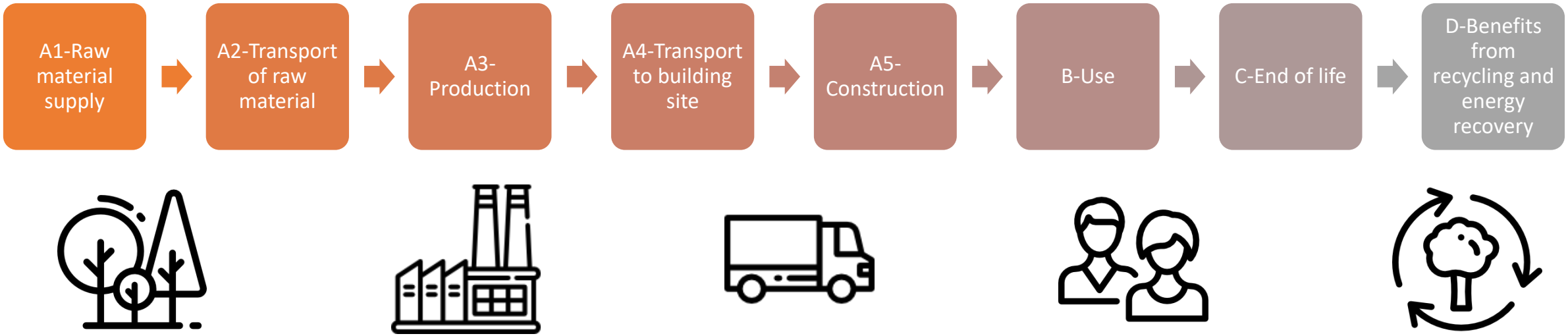
Indicators covered

	Indicator	Scandinavian spruce wooden building	Local Douglas wooden building	Steel building	Concrete building
Environment	Greenhouse gas emissions	Specific	Specific	Specific and generic	Specific and generic
	Carbon stock	Specific	Specific	Specific and generic	Specific and generic
	Energy use	Specific	Specific	Specific and generic	Specific and generic
Social	Employment	Specific and generic	Specific and generic	Generic	Generic
	Wages and salaries	Specific and generic	Specific and generic	Generic	Generic
	Occupational safety and health	Specific and generic	Specific and generic	Generic	Generic
Economic	Production cost	Specific and generic	Specific and generic	No data	No data
	Value added rate	Generic	Generic	Generic	Generic
	Import rate	Specific and generic	Specific and generic	Generic	Generic

Environmental indicators

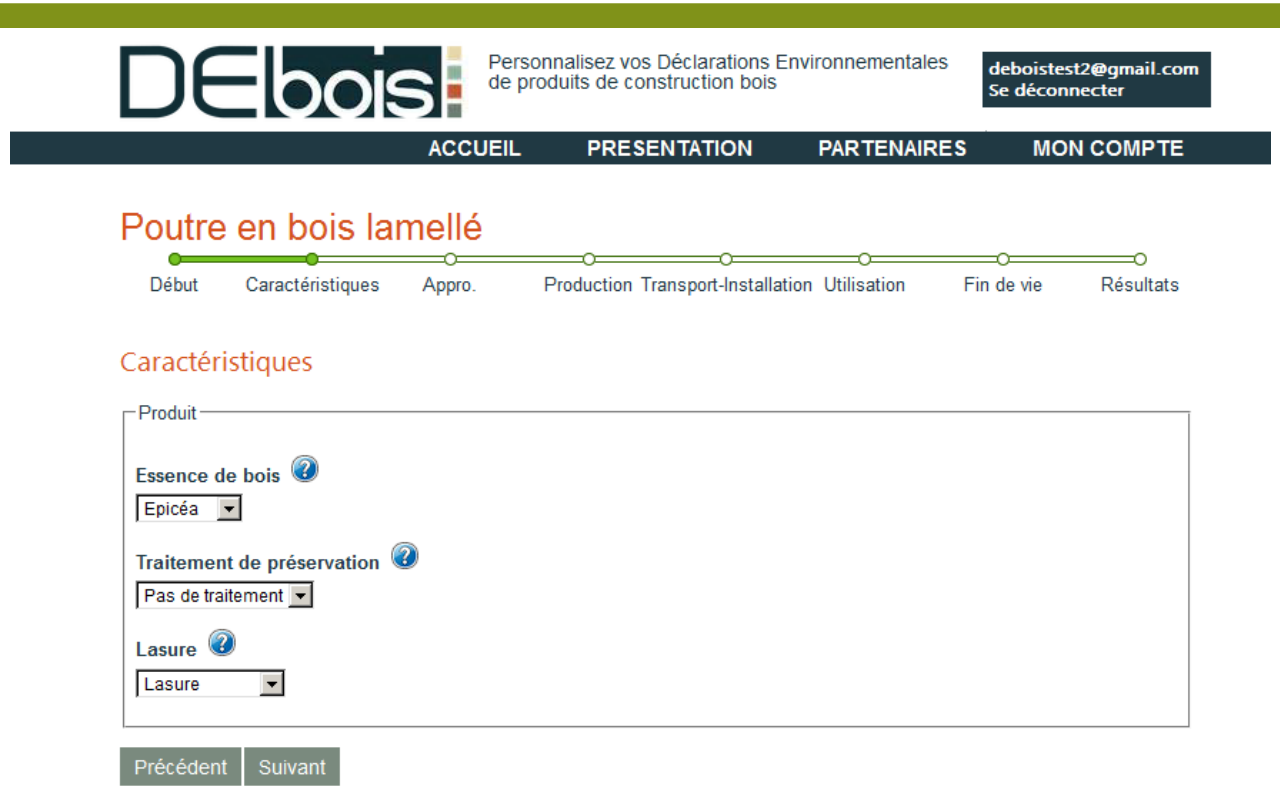
Methodology framework

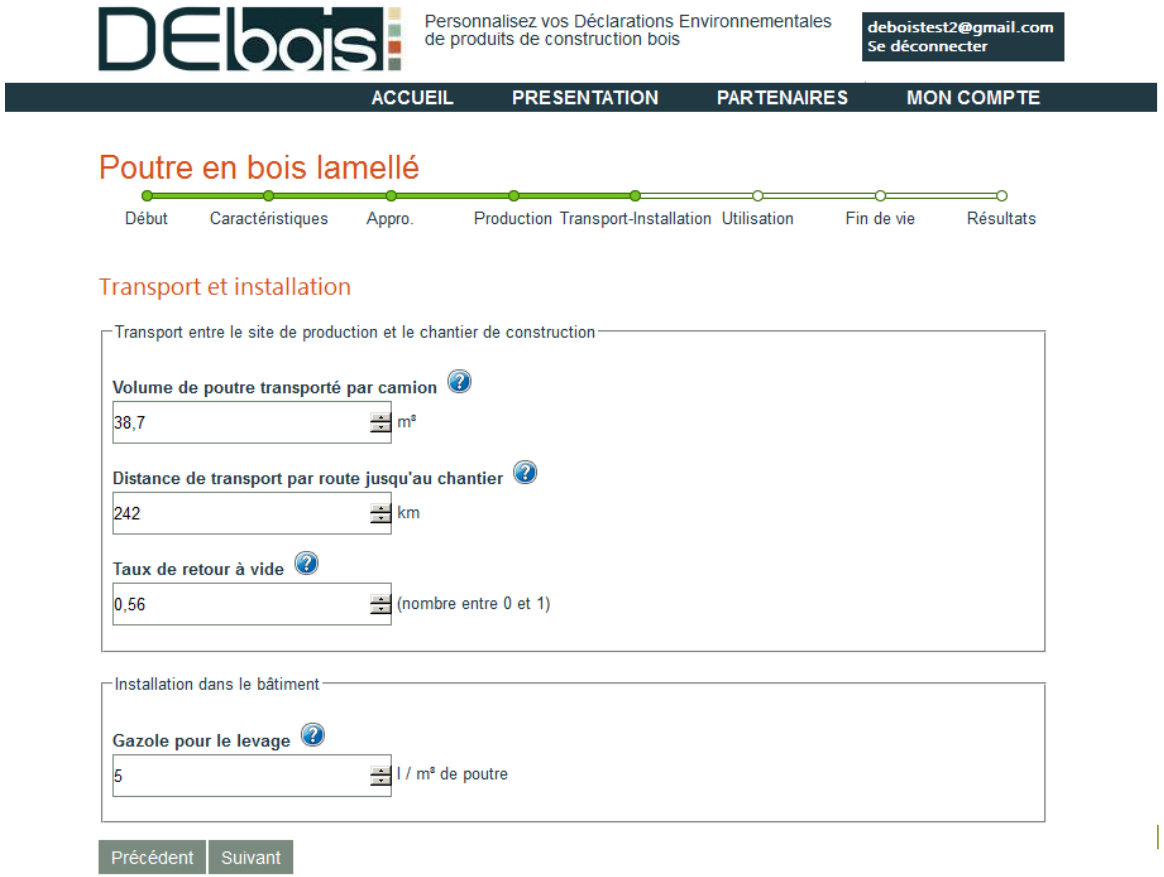
- **Based on European standard for construction products environmental declaration (EPD) – EN 15804 A1: 2014**



Data and tool used for the comparison

- **EPDs from the INIES database**
  - The INIES database corresponds to the French national EPD program and is owned by Alliance HQE GBC
- **There is a link between INIES and specific EPD calculators developed by french industries to personnalise EPDs (distance to construction site, dimensions of I beam, etc.)**
  - https://www.save-construction.com for the steel industry
  - http://www.snbpe.org/developpement_durable/calculette for the concrete industry
  - www.DE-bois.fr for the wood industry developed by FCBA
- **EPDs are extracted as xml from either INIES or specific calculators and used in software tools to calculate the environmental impact of the buildings**


DEbois
Personnalisez vos Déclarations Environnementales de produits de construction bois
deboistest2@gmail.com
Se déconnecter
ACCUEIL
PRESENTATION
PARTENAIRES
MON COMPTE
Poutre en bois lamellé
Début
Caractéristiques
Appro.
Production
Transport-Installation
Utilisation
Fin de vie
Résultats
Caractéristiques
Produit
Essence de bois
Epicéa
Traitement de préservation
Pas de traitement
Lasure
Lasure
Précédent
Suivant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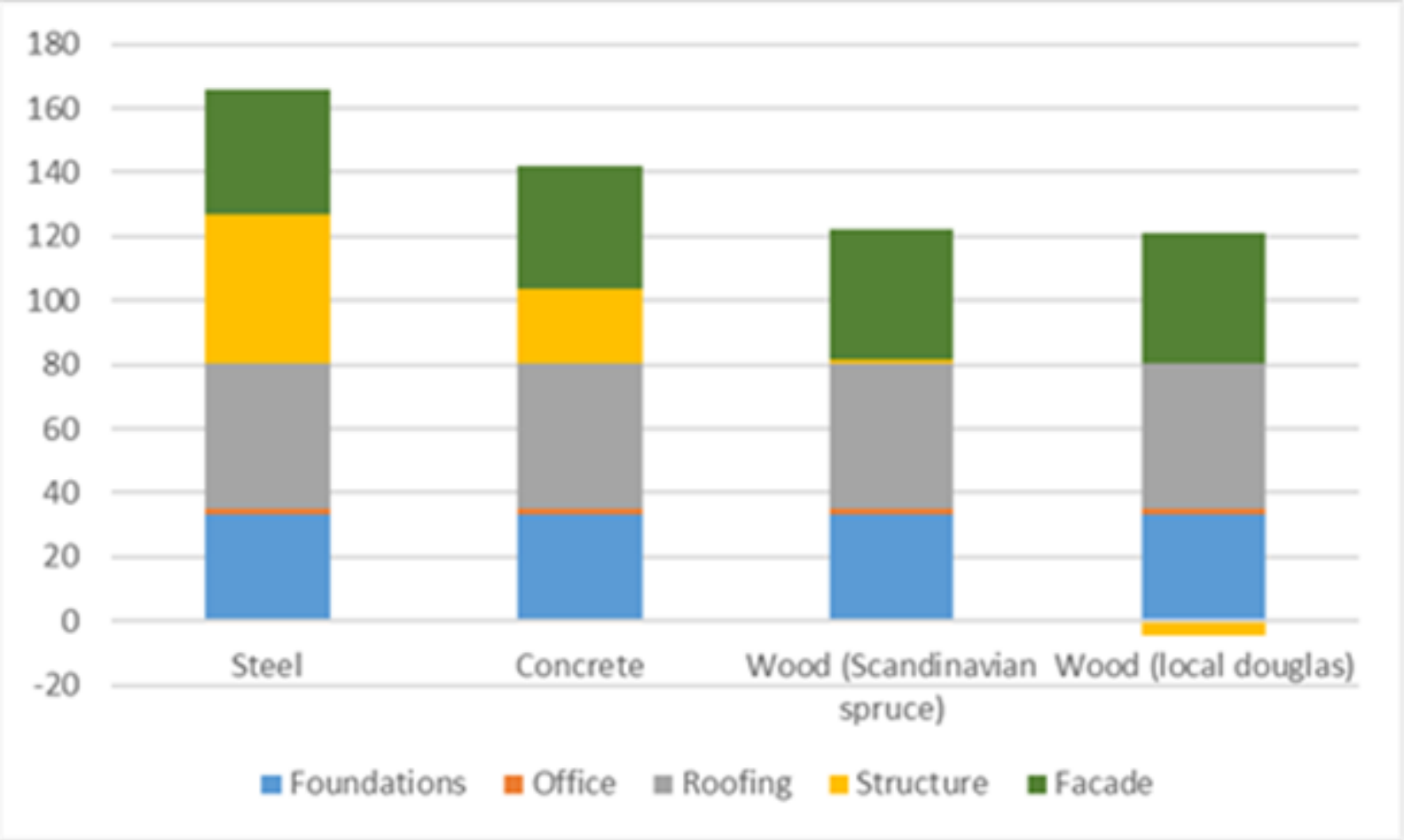
Résultats
Transport et installation
Transport entre le site de production et le chantier de construction
Volume de poutre transporté par camion
38,7
m³
Distance de transport par route jusqu'au chantier
242
km
Taux de retour à vide
0,56
(nombre entre 0 et 1)
Installation dans le bâtiment
Gazole pour le levage
5
l / m³ de poutre
Précédent
Suivant

Data used for the wooden building

- **Wood supply:**
  - **Nordic spruce: 2200 km by boat and 850 km by truck**
  - **Douglas: 374 km by truck from sawmill to Arbonis in Chemillé**

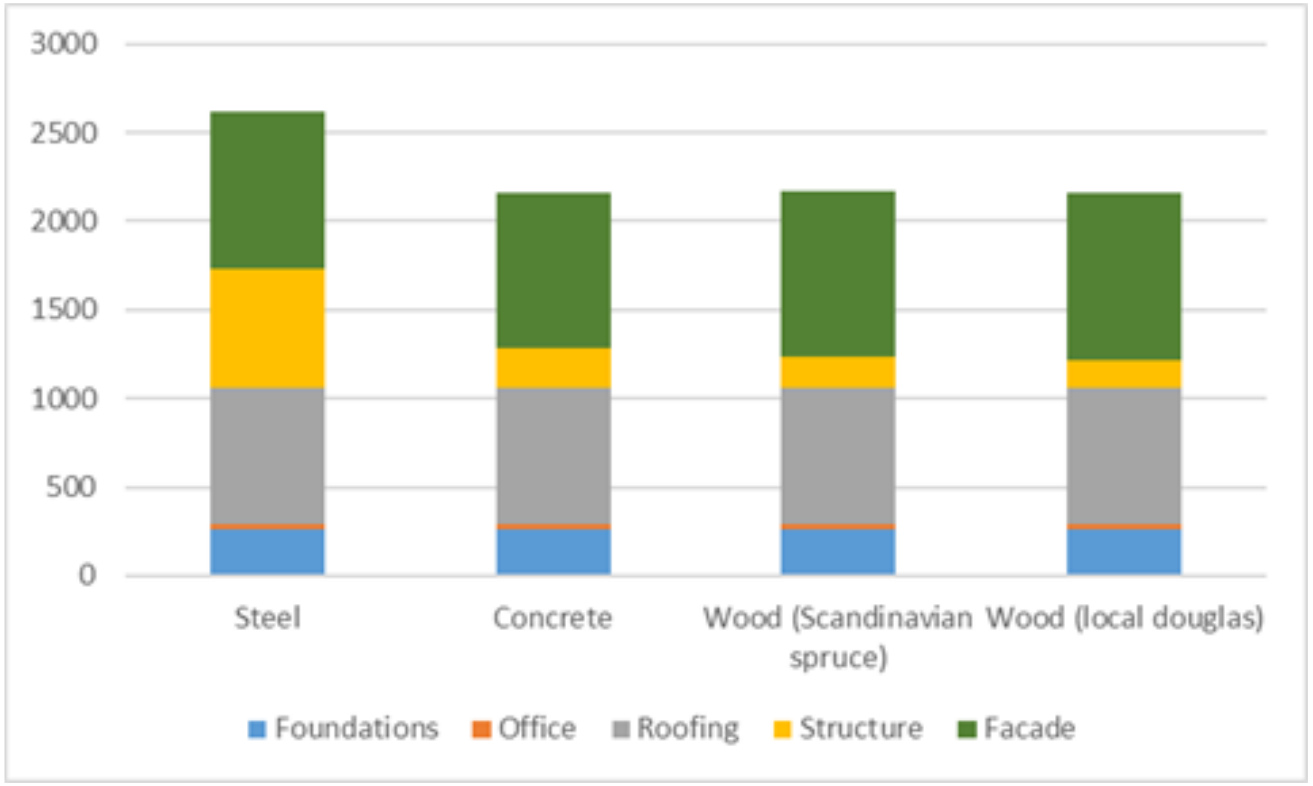
Component	Quantities	Data used	
Concrete slab	185 tonnes	Thickness 0,10 m C20/25 XC1 CEM I	Foundations
Glulam beam	151 m3	EPD obtained from DE-bois based on Arbonis process data	Structure
Fire proof wall for office	310 m²	Concrete blocks	Structure
Steel roof decking and mineral wool	1790 m²	EPD from INIES (steel sandwich panel with rock wool - thickness between 100 and 240 mm)	Roofing
Bituminous membrane	1790,7 m2	EPD from INIES Roofing bituminous membrane - two ply	Roofing
Steel sandwich panels	1924 m2	EPD from INIES (steel sandwich panel with PIR/PUR insulation - thickness between 30 and 80 mm)	Facade

GHG Results



Results for the climate change indicator for the life cycle of the building including the benefits of recycling and energy recovery (A-D) in t eq. CO_2 per square meter of building

Non renewable energy results



Results for the total use of non renewable primary resources for the life cycle of the building including the benefits of recycling and energy recovery (A-D) in MJ per square meter of building

Carbon storage

Results for the biogenic carbon content of the building in t eq. CO2 per m²

Social indicators

Number of working hours

- Specific data from Arbonis company on glulam production and building site
- No specific data for concrete and steel building
- National data for sawn timber production:
  - Number of working hours much higher in France as compared to Sweden

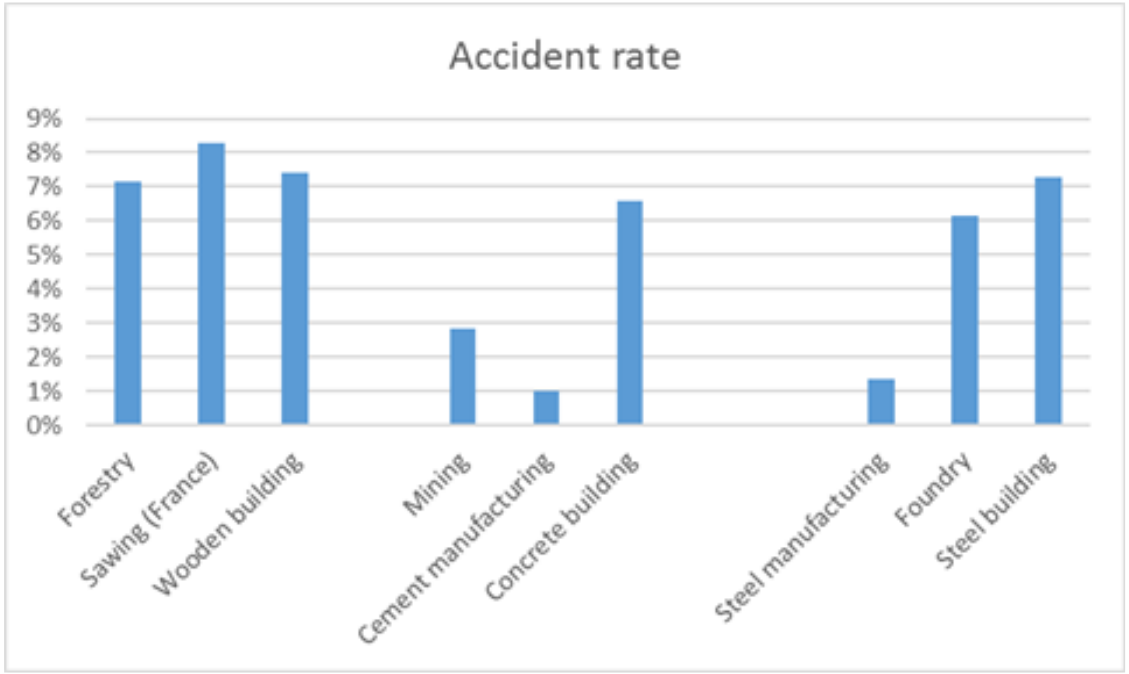
		Scandinavian spruce		Douglas	
		in hours for the building	in hours per m3 of glulam	in hours for the building	in hours per m3 of glulam
A1	Forest resources management	15	0,08	ND	ND
	Felling	53	0,28	ND	ND
	Transport to sawmill	17	0,09	ND	ND
	Sawing	93	0,49	525	2,8
A2	Transport to France	ND	ND	ND	ND
A3	Glulam manufacturing	1 240	6,60	1 240	6,6
A4	Transport to Building site	28	0,15	28	0,1
A5	Building site	1 202	6,39	1 202	6,4

Hourly wages

- **Specific data from Arbonis company on glulam production and building site**
- **National data for construction/industry :**
  - **Average wages are lower in the wood construction industry as compared to other materials. This is mainly due to the fact that sawmills are much smaller companies as compared with the cement and steel manufacturing companies**

Accident rate

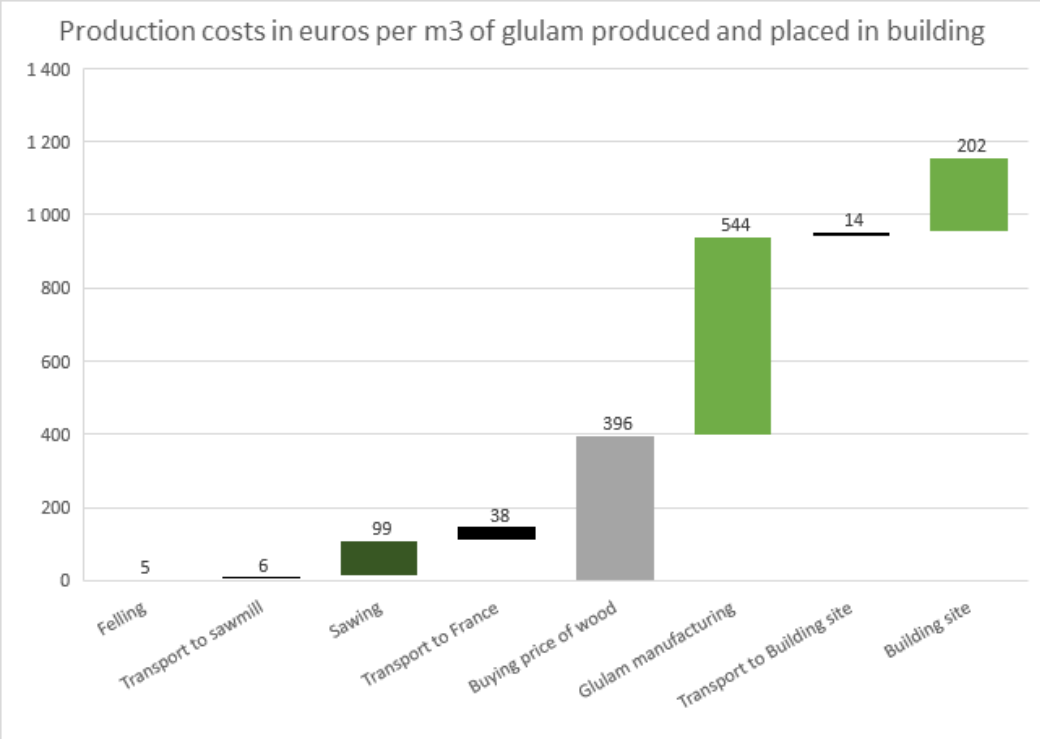
- **Specific data from Arbonis company on glulam production and building site:**
  - **No accident at the Arbonis factory and at the building site**
- **National data for construction/industry:**
  - **The accident rate is the same in the construction sectors for the three types of building. The accident rate in the sawing and forestry industry is higher than in the mining, cement manufacturing and steel manufacturing sectors.**



Economic indicators

Production costs

- Specific data from Arbonis company on glulam production and building site
- The production costs is mainly driven by price of wood and salaries



- Using local douglas fir is slightly more expensive even if less transported
  - To be investigated

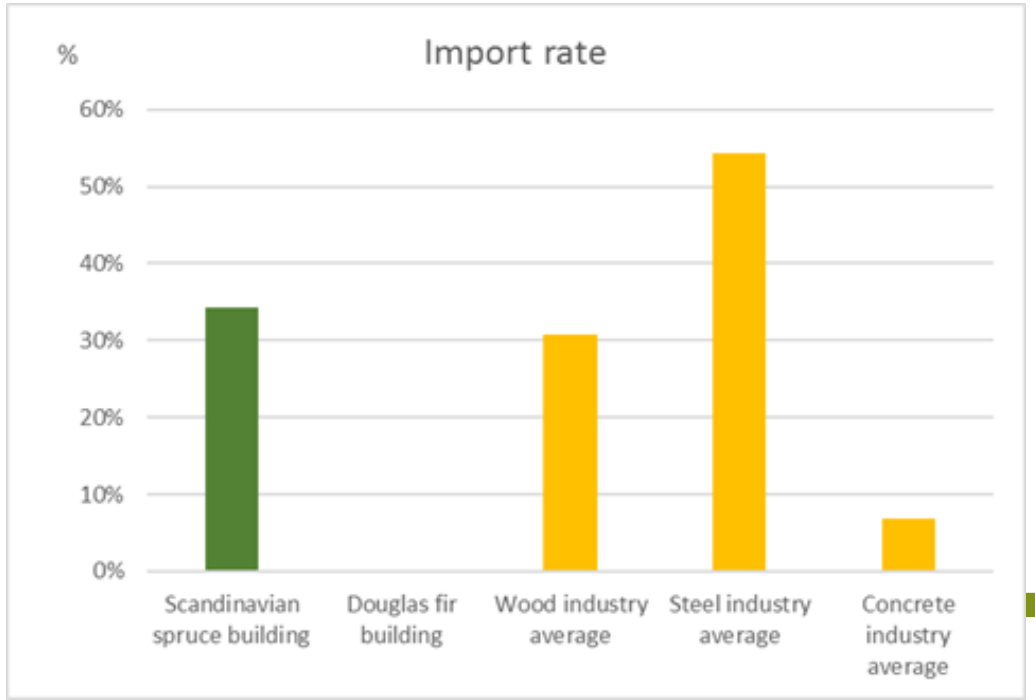
Value added rate

- **No specific data**

- **Generic data for France:**
  - **The added value rates are similar for all three industries, the wood construction industry has a slightly lower value added rate then the other material industry.**

Import rate

- Specific data from Arbonis company on glulam production and building site
- No specific data for the concrete and steel building
- Comparaison of import rates for the 2 wooden building and national construction/industry data:
  - The national import rate is the lowest for the douglas fir wooden building. The concrete building comes next, then the scandinavian spruce building. The steel building has the highest import rate.



Conclusion (1)

- **Environmental indicators:**
  - **The wooden building has a better performance than other the buildings for carbon footprint and carbon storage**
    - Local douglas has a better performance than scandinavian spruce
  - **The wooden building and the concrete building have a better performance than the steel buiding as far as non renewable energy is concerned**
- **Social indicators:**
  - **Social indicators could be calculated for the wooden building**
  - **No data could be collected for the concrete and steel buildings. Mainly national data are used.**
  - **More working hours are needed to produce sawn timber in France as compared to Sweden**
  - **The forestry and sawmill sectors are mainly represented by small and medium entreprises located in rural areas. A possible consequence of this is that wages are lower and accident rates higher than in other industries. On the otherhand, SME have a positive impact on the national industrial fabric and generate much needed jobs in rural areas.**

Conclusion (2)

- **Economic indicators:**
  - The production costs could not be collected for the concrete and steel buildings. For the wooden building, the production costs are driven by the price of wood and the salaries,
  - The reason why the douglas fir wood price is slightly higher than the imported sawn timber is to be investigated further. This may be due to the fact that french sawmills are smaller than their swedish competitors,
  - The national import rate is the lowest for the douglas fir wooden building (0%). The scandinavian spruce building has a significant part of its production cost that stays in France (1- import rate = 65%).
  - The added value rates are similar for all three industries, the wood construction industry has a slightly lower value added rate then the other material industry.