



MalsoVi Project: Vacuum Insulation Materials, Innovative Approach for Windows in Construction and Renovation

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Presentation

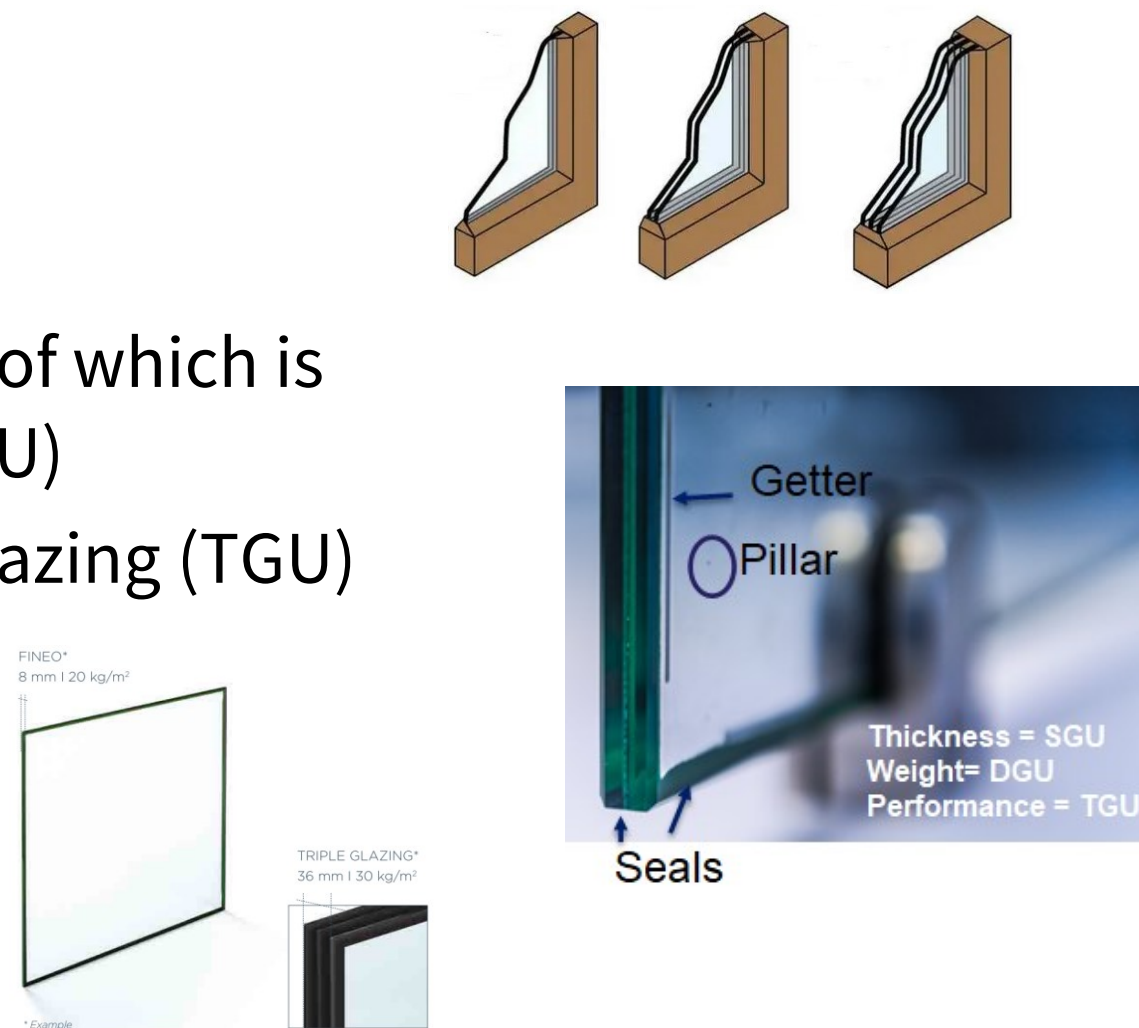
The building sector is responsible for almost 40% of greenhouse gases (GHG) emissions in Europe and 50% of energy consumption. This underlines the need to develop new solutions to support the strategy of reducing the energy needs of housing.

The objective of the **MalsoVi project (GreenWin n°8653)** is to offer the construction and renovation market for the residential and commercial (tertiary) segment:

- A **vacuum glazing** (tempered FINEO) demonstrating the same or better energy efficiency than triple glazing but with the same weight as double glazing and the thickness of single glazing.
- A **wooden window** equipped with this FINEO and using a minimum of materials while guaranteeing the best performance over a maximum extended life span.

State of the art – FINEO glazing (AGC)

- ✓ Vacuum insulating glazing
- ✓ Minimal glass **thickness** 7.7 mm → Single glazing (SGU)
- ✓ 0.1 mm of vacuum enclosed between **2 sheets of glass**, one of which is coated with a low-emissivity layer → Double glazing (DGU)
- ✓ **Thermal insulation** coefficient = 0.7 W/(m².K) → Triple glazing (TGU)
- ✓ 15% more natural light than triple glazing
- ✓ <https://www.fineoglass.eu>



Limitations

- ✓ **Warp** phenomenon (bimetal effect) ⇒ **Limited size** (1.5 x 2.5 m)
⇒ Historical building market ≠ Sustainable renovation and new construction
- ✓ Long processing at **high t°** ⇒ Production **cost €** >> TGU

State of the art – Menuiserie Riche

- ✓ Woodworking expertise
- ✓ Long time involvement in terms of and sustainable development:
 - Choice of raw materials
 - Design and manufacture of the products
 - Integration of energy (wood waste to energy), acoustic and thermal performance
 - Economy of materials, recyclability of materials and reduced environmental impacts

- ✓ Edition of a Belgian EPD [B-EPD n° 21-0117-002.00.00]

- ✓ <https://www.chassisriche.be>



MalsoVi response & Project objectives

- ✓ FINEO: tempered, without size limitation, lower production cost, lower CO₂ footprint, wider range of functionalities
- ✓ Wooden frame design suitable for FINEO
- ✓ Final product =
Wood window 80 mm with FINEO glazing



Wood window

- ✓ Raw material for window = Glued laminated timber (Glulam) or board
- ✓ **Modular design** with removable parts for maintenance and extended service life (→ no need to replace the whole frame)
- ✓ Combination of ≠ wood species (hard ↔ soft) & glulam ↔ board depending on the part (frame/casement/thickness)
- ✓ **Hard wood**
 - Meranti – Malaysia (MY)
 - Sipo – Cameroun (CM)
 - Oak – Europe (EU)
 - Accoya** (NZ/EU): chemically modified pine (acetylation) → ≥ exotic hard wood
 - Heat treated Ash** (EU) → durability class 1



- ✓ **Soft wood**
 - Larch – Russia (RU)
 - Pine – Europe (EU)
 - Spruce – Europe (EU)



Design tool: Window 1.23 x 1.48 m – Primary data: FINEO & Wood frame

Excel file with rapid evaluation of environmental impacts for 1 window (in accordance with EULA for ecoinvent data/results – extra licence)

- ⇒ Technical constraints (hard wood/soft wood) + **client's choice** (species, finishing)
- ⇒ Test of different design → Climate Change & Single Score
- ✓ **A1:** Raw materials (wood, FINEO or DGU/TGU glazing, finishing, other materials)
- ✓ **A2:** Transport of raw materials to Belgium
- ✓ **A3:** Transformation (wood processing, finishing, window assembling)
- ➔ **Selection** of wood type, finishing, glazing / combinations ⇒ Impact evaluation

Type of Wood	Meranti - MY	Sipo - CM	Oak - EU	Larch - RU	Pine - EU	Spruce - EU	Accoya	HT Ash	Total	
Density kg/m³	550	650	750	600	500	450	515	680		
Frame gross part 1 - soft	0	0	0	0	1	0	0	0	1	glulam
Frame gross part 3 - hard - basic	0	0	1	0	0	0	0	0	1	solid wood
Frame gross part 4 - hard (removable)	0	0	1	0	0	0	0	0	1	solid wood
Frame gross part 5 - hard (removable)	0	0	1	0	0	0	0	0	1	solid wood
Casement gross part 2 - soft	0	0	0	0	1	0	0	0	1	glulam

hard - average density kg/m³	629
soft - average density kg/m³	517
Weight of wood per window	
Wood - wet	23.35
hard	8.85
soft	13.00

Finishing	
Wood stain - standard	1
Opaque paint	0
Wood stain - natural	0
Basic protection	1

Glazing	FINEO 4/4	FINEO 4/5	FINEO 5/5	Double Glazing	Triple glazing
size (m²) - for 1 window 1.23 x 1.48 m	0	0	1	0	0

A1 Glazing - for 1 m² of glazing	CC kg CO2 eq/m²	Single score Pt/m²	Weight kg/m²
Glazing (FINEO classical) - for 1 m²			
A1 FINEO 8 (4/4 mm)	47.04	4.57E-03	20
A1 FINEO 9 (4/5 mm)	50.94	4.84E-03	22.5
A1 FINEO 10 (5/5 mm)	54.83	5.12E-03	25
A1 Double glazing (4/4) (EI 3.9.1)	34.02	3.247E-03	20
A1 Triple glazing (4/4/4) (EI 3.9.1)	54.87	4.923E-03	30

A3 Transformation - for 1 m³	Unit	Amount	CC kg CO2	Single score
A3 Transformation - for 1 m³	p	1	46.40	2.960E-03
Pine (soft) - Oak (hard)				
TOTAL A1 for 1 window of glulam/solid wood	p	1	33.20	1.146E-02
TOTAL A2 for 1 window of glulam/solid wood	p	1	7.58	6.140E-04
TOTAL A3 for 1 window of glulam/solid wood	p	1	46.40	2.960E-03
TOTAL A1-A3 for 1 window of glulam/solid wood with glazing	p	1	87.17	1.503E-02
TOTAL A1 for 1 frame of window of glulam/solid wood	p	1	39.09	4.706E-03
TOTAL A2 for 1 frame of window of glulam/solid wood	p	1	7.32	5.935E-04
TOTAL A3 for 1 frame of window of glulam/solid wood	p	1	46.40	2.960E-03
TOTAL A1-A3 for 1 frame of window of glulam/solid wood without glazing	p	1	14.63	8.259E-03
Glazing	p	1	72.29	6.752E-03

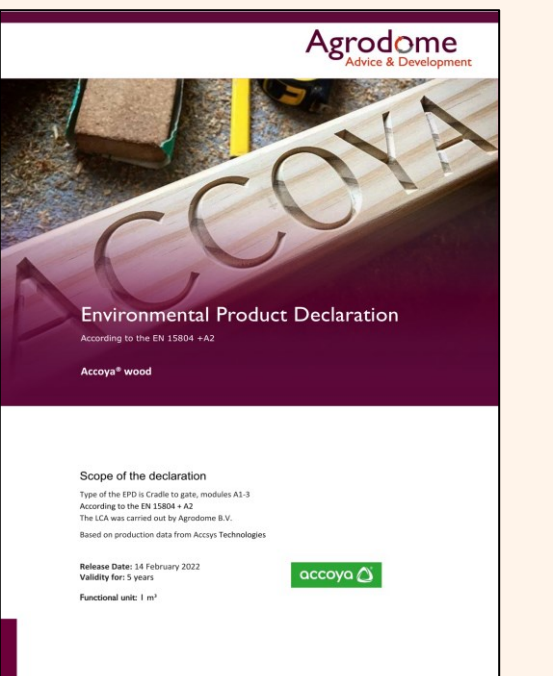
Inventory

Wood (glulam/board) (A1)

SimaPro

ecoinvent

- ✓ Creation of specific data for Glued laminated timber (glulam)
⇒ Adaptation of ecoinvent background data
- ✓ Accoya: data from EPD (type III)
- ✓ Heat treated ash: primary data (provider)
- ✓ **Transport (A2):** primary data



Glazing (A1, A2)

- ✓ **FINEO**
 - Primary data for float glass 4 and 5 mm (AGC)
 - Primary data for "standard" FINEO processing (classical/not tempered) (AGC) (EPD type I)
- ✓ **Double- and Triple-glazing:** ecoinvent 3.10.1 background data



Currently, FINEO has **EPD type I** which was achieved through **Self-evaluation**

Window: additional raw material for assembly (A1, A2) and processing (A3)

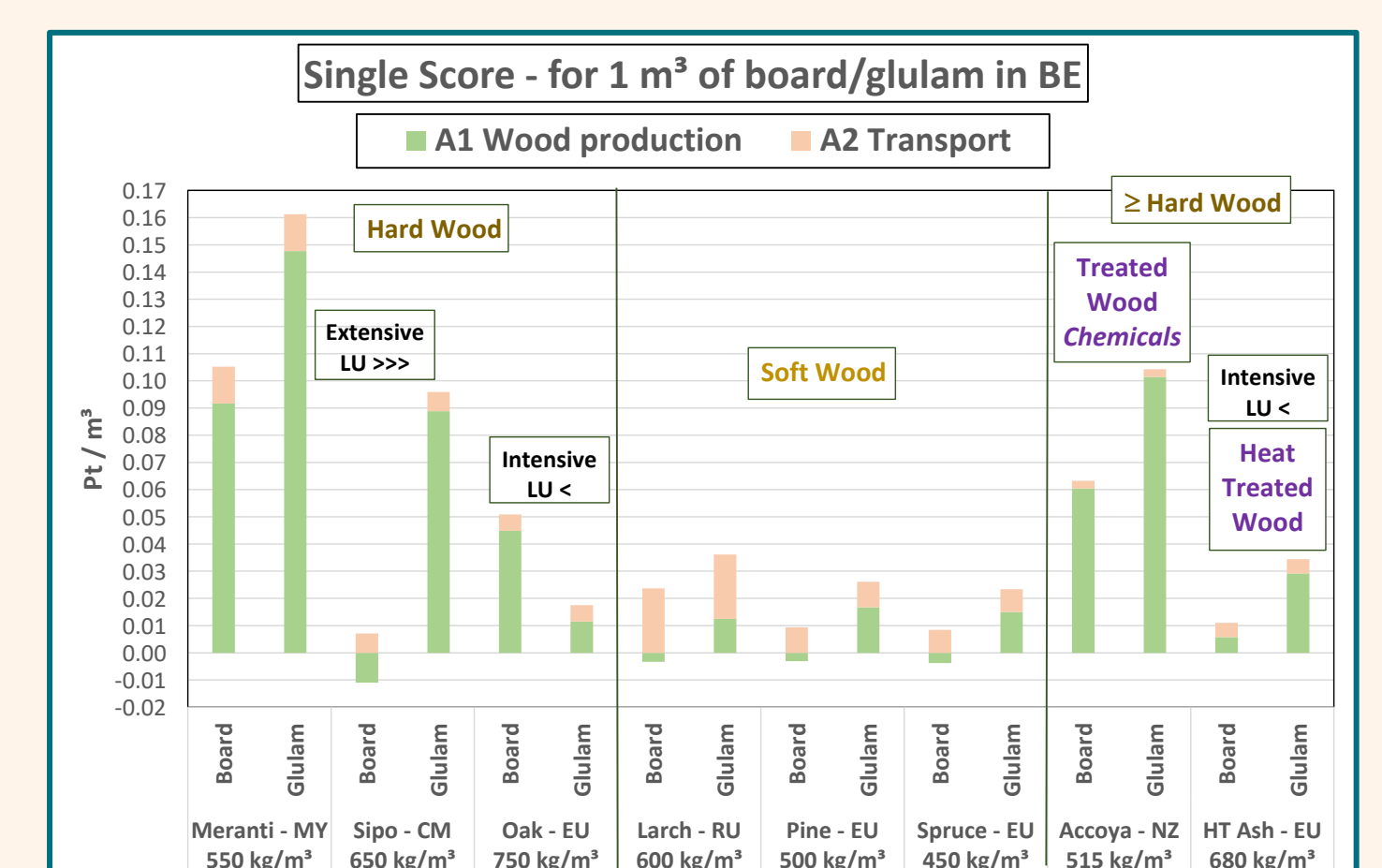
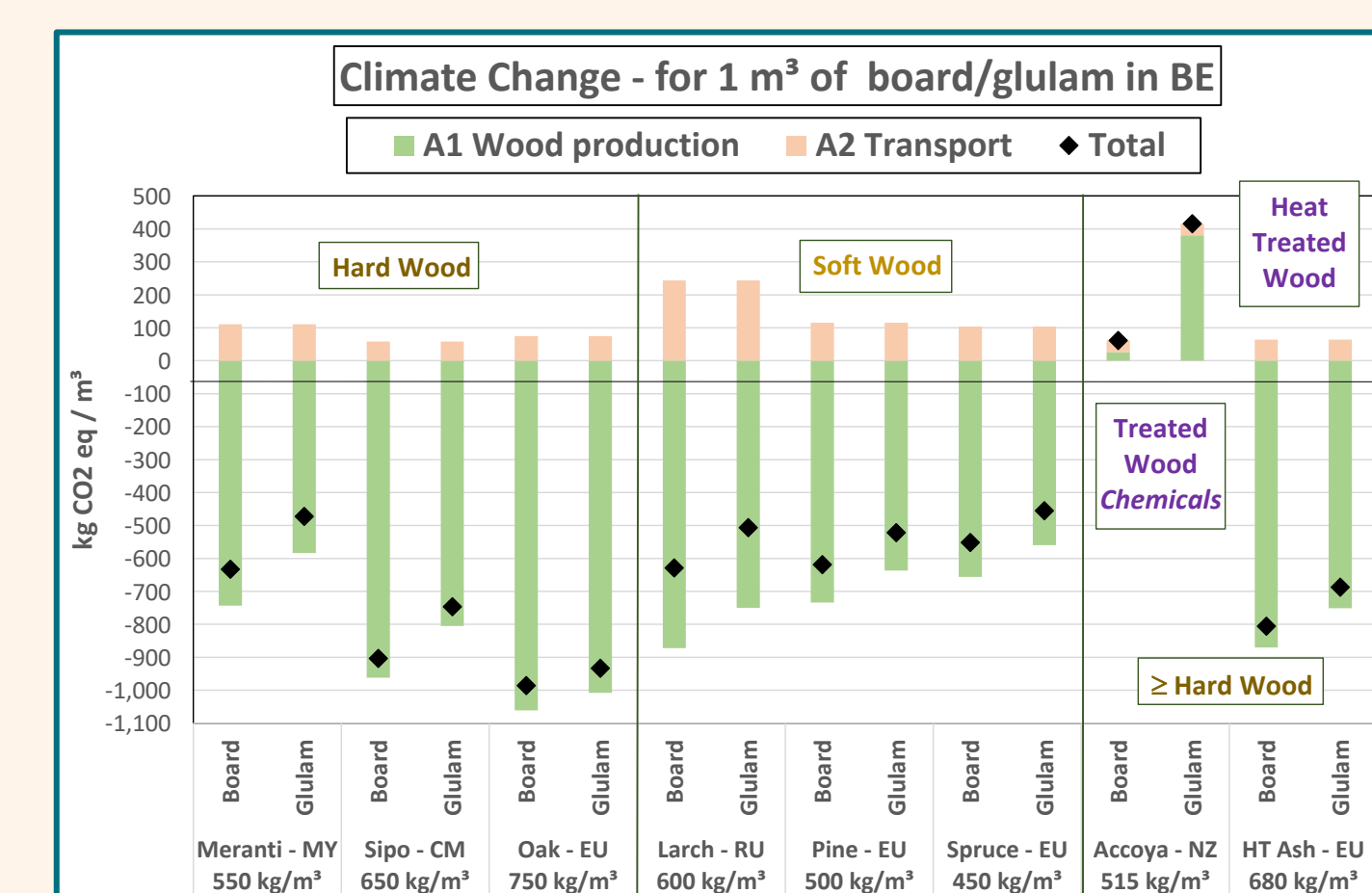
- ✓ Primary data (Menuiserie Riche)

Preliminary LCA - Wood

- ✓ **Climate Change (CC):** characterisation EN15804+A2:2019
Biogenic carbon / CO₂: "manual" calculation" → 0.5 kg C/kg wood (DM); Humidity = 13%
- ✓ **Single Score (SS):** normalisation & weighting factors EF 3.1
⇒ Detection of transfer of impacts
- ✓ **FU = 1 m³ of Glued laminated timber or Board**

Results: CO₂ sequestration by wood

- 😊 Hard wood : **Oak**: density, intensive forest, European
Heat treated Ash (EU): CC-HT Ash ≅ CC-Sipo (Cameroun) & SS-HT ash < SS-Sipo
- 😊 Soft wood: **Pine/Spruce**: transport ; **Larch** ≅ for CC cf. density
- 😞 Accoya : chemicals



One wood	Meranti	Pine	Oak	HT Ash	Oak	Sipo	Accoya	HT Ash	HT Ash
Hard wood	Meranti	Pine	Oak	HT Ash	Oak	Larch	Spruce	Pine	Pine
Soft wood	-	Natural	Natural	Natural	Natural	Standard	Standard	Standard	Opaque
Finishing	-	Natural	Natural	Natural	Natural	Standard	Standard	Standard	Opaque
Glazing	FINEO 5/5	FINEO 5/5	FINEO 5/5	FINEO 5/5	FINEO 5/5	FINEO 5/5	FINEO 5/5	FINEO 5/5	FINEO 5/5
Climate change (kg CO2 eq/window)									
Window (all)	97.6	96.15	68.57	84.08	87.66	92.2	116.3	91.48	92.79
Windows (wood)	25.06	23.6	-3.97	11.54	15.12	19.66	43.73	19.94	20.25
Glazing	72.29	72.29	72.29	72.29	72.29	72.29	72.29	72.29	72.29
Single Score (mPt/window)									
Window (all)	22.36	13.87	14.6	14.36	15.43	13.54	15.22	13.99	14.18
Windows (wood)	15.59	7.10	7.83	7.59	8.66	6.77	8.45	7.21	7.40
Glazing	6.75	6.75	6.75	6.75	6.75	6.75	6.75	6.75	6.75

Project and Partnership

- ✓ **2 years project (+ 1)**
started on June 1st 2022
- ✓ **10 WP**

✓ **5 partners:** AGC – Menuiserie Riche – MateriaNova – Cenaero – ULiège

✓ **Funded by The Walloon Region and supported by GreenWin**

