

# 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 36% of CO<sub>2</sub> emissions in Europe and 40% of energy consumption. This underlines the need to develop new solutions to support the strategy of reducing the energy needs of housing.

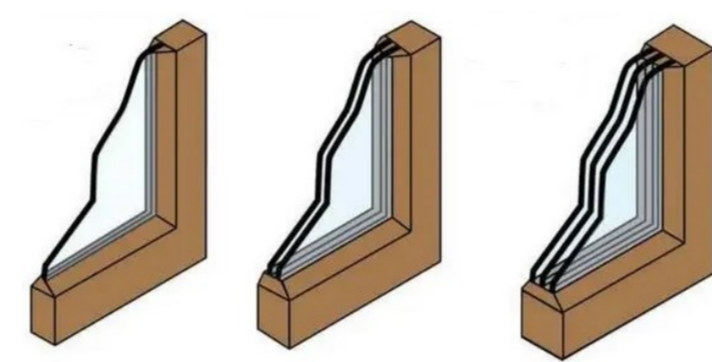
The objective of the **MalsoVi project (GreenWin n°8653)** is to offer the construction and renovation market for the residential and commercial (tertiary) segment:

→ 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 (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/(m<sup>2</sup>.K) → ≡ Triple glazing (TGU)
- ✓ 15% more natural light than triple glazing
- ✓ <https://www.fineoglass.eu>



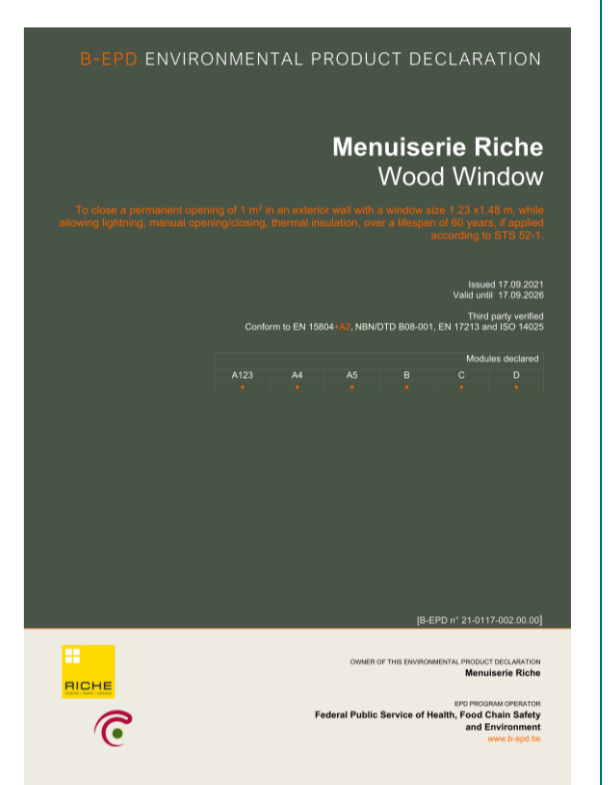
### Limitations

- ✓ **Warping** 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 B-EPD (Belgian EPD)

✓ <https://www.chassisriche.be>

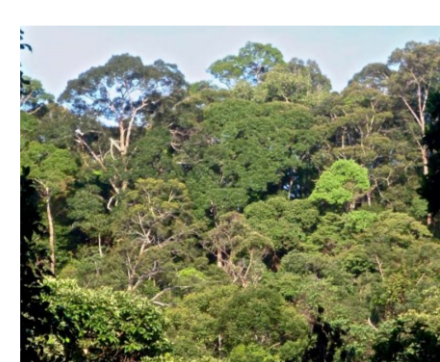
### MalsoVi response & Project objectives

- ✓ FINEO without size limitation, lower production cost, lower CO<sub>2</sub> footprint, wider range of functionalities
- ✓ Wooden frame design suitable for FINEO
- ✓ Final product = Wood window 80 mm with FINEO glazing



### LCA of Wood windows

- ✓ Menuiserie Riche: Raw material for window = Glued laminated timber
- ✓ **Hard wood**
  - Meranti – Malaysia (MY)
  - Sipo – Cameroun (CM)
  - Oak – Europe (EU)
- ✓ **Soft wood**
  - Larch – Russia (RU)
  - Pine – Europe (EU)
  - Spruce – Europe (EU)



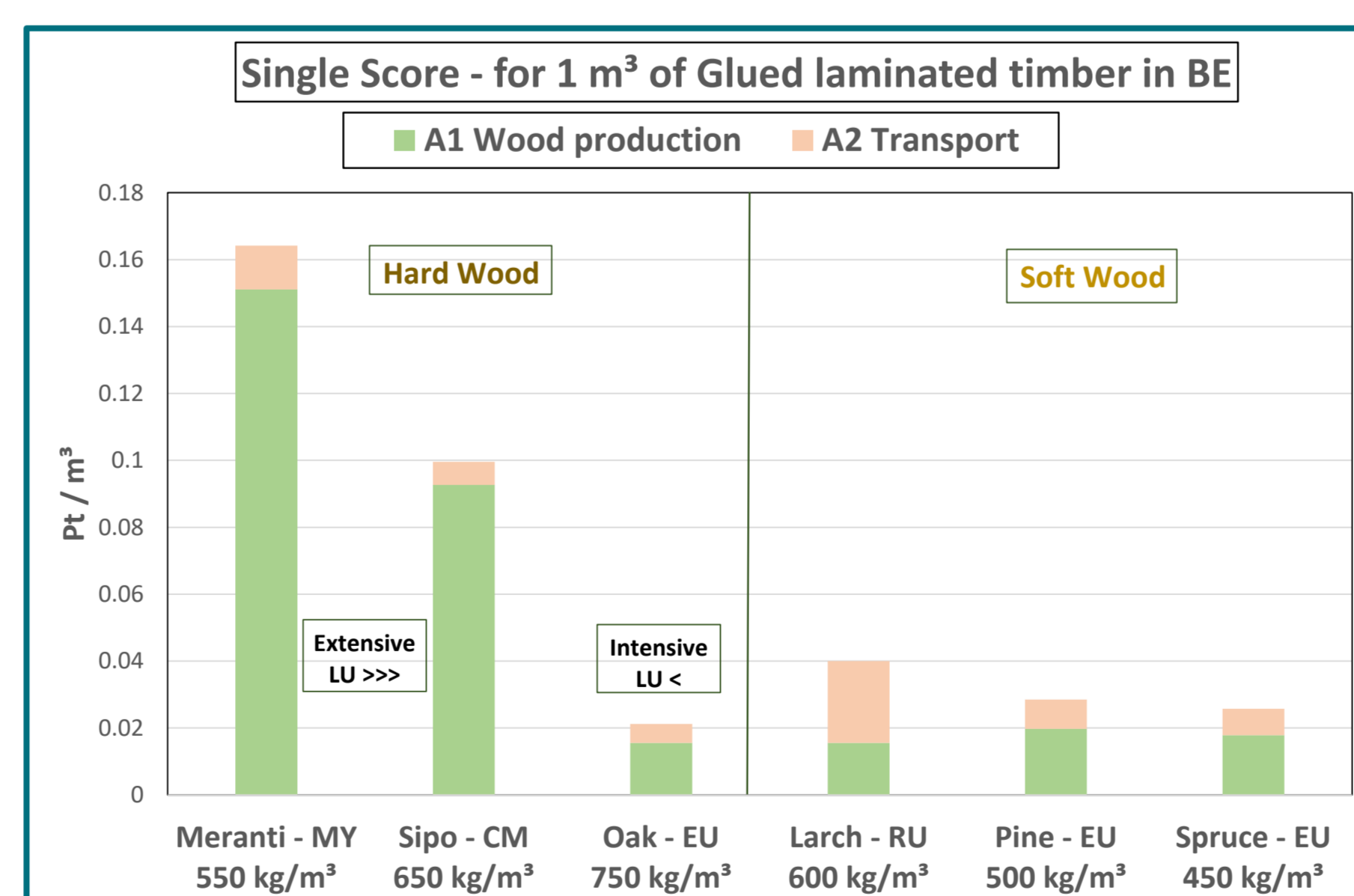
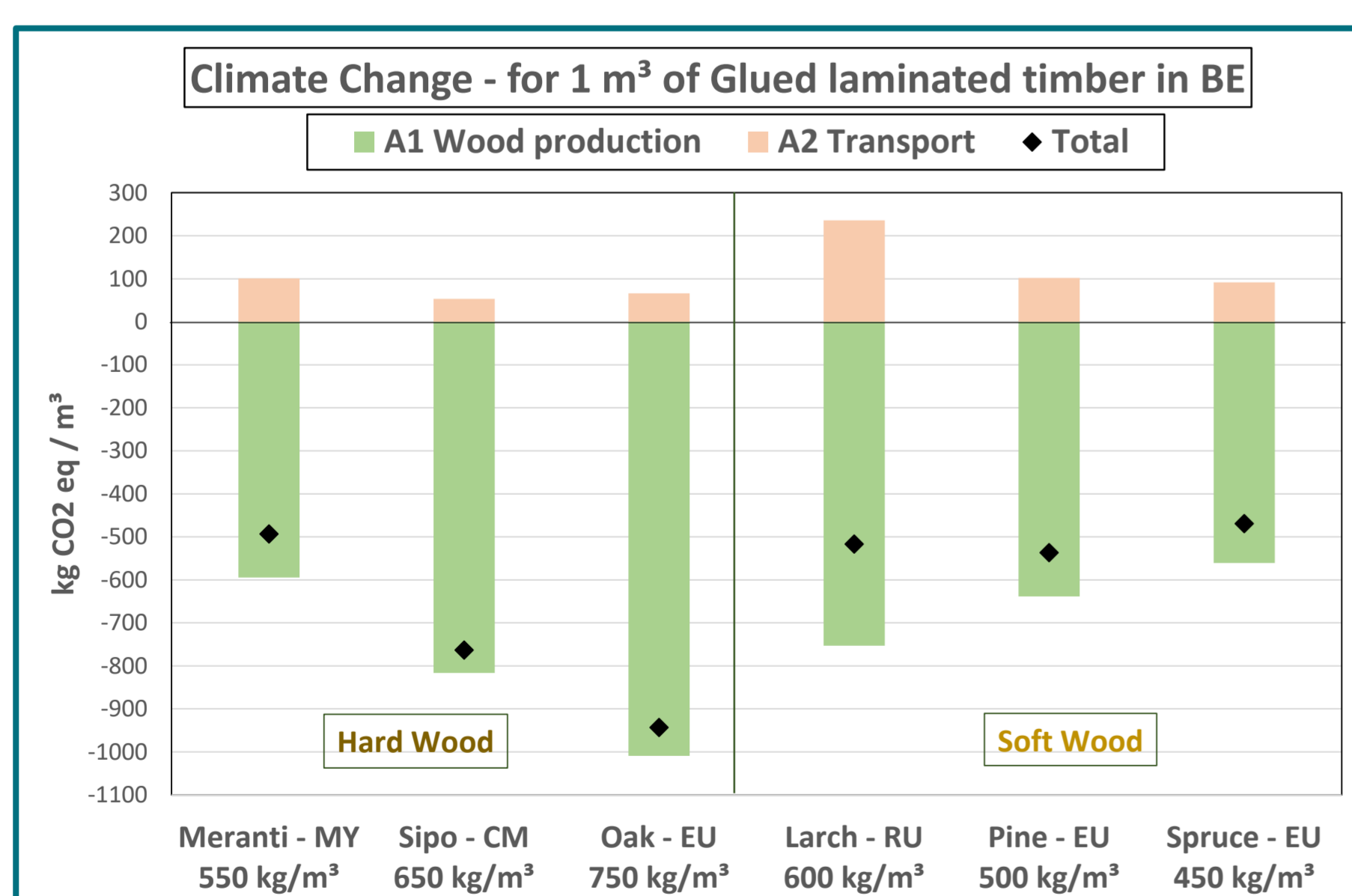
### Preliminary study → Wood choice (ecodesign)

- ✓ Creation of specific data for Glued laminated timber (≡ "A1" in EN152804+A2) ⇒ Adaptation of Ecoinvent background data
- ✓ Transport ("A2"): primary data
- ✓ Climate Change (CC): Characterisation EN15804+A2:2019
  - Biogenic carbon / CO<sub>2</sub>: "manual" calculation → 0.5 kg C/kg wood (DM) ; Humidity = 13%
- ✓ Single Score (SS): normalisation & weighting factors EF 3.0 ⇒ Detection of transfer of impacts
- ✓ **FU = 1 m<sup>3</sup> of Glued laminated timber**



### Preliminary LCA Results

- ✓ CO<sub>2</sub> sequestration by wood
  - ☺ Hard wood : **Oak**: density, intensive forest, European
  - ☺ Soft wood: **Pine/Spruce**: transport ; **Larch** ≡ for CC cf. density



| Item   | Brut (forest)    | Net (gate)       |
|--|------------------|------------------|
| Frame (m²) (brut incl. losses 6% cutting)        | 0.04101          | 0.01865          |
| Casement (m²) (brut incl. losses 6% cutting)     | 0.04101          | 0.01865          |
| Glass holder (m²) (brut incl. losses 6% cutting) | 0.001654         | 0.001654         |
| <b>Total (m²)</b>                                | <b>8.367E-02</b> | <b>3.895E-02</b> |

| Type of Wood           | Meranti - MY     | Sipo - CM        | Oak - EU         | Larch - RU       | Pine - EU        | Spruce - EU      | Total            |
|------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Density kg/m³          | 550              | 650              | 750              | 600              | 500              | 450              |                  |
| Frame brut             | 100%             | 0%               | 0%               | 0%               | 0%               | 0%               | 100%             |
| Casement brut          | 0%               | 0%               | 0%               | 100%             | 0%               | 0%               | 100%             |
| Glass holder brut      | 0%               | 0%               | 0%               | 0%               | 100%             | 0%               | 100%             |
| <b>Total brut (m²)</b> | <b>4.101E-02</b> | <b>0.000E+00</b> | <b>0.000E+00</b> | <b>4.266E-02</b> | <b>0.000E+00</b> | <b>0.000E+00</b> | <b>8.367E-02</b> |
| Frame net              | 100%             | 0%               | 0%               | 0%               | 0%               | 0%               | 100%             |
| Casement net           | 0%               | 0%               | 0%               | 100%             | 0%               | 0%               | 100%             |
| Glass holder net       | 0%               | 0%               | 0%               | 0%               | 100%             | 0%               | 100%             |
| <b>Total net (m²)</b>  | <b>1.865E-02</b> | <b>0.000E+00</b> | <b>0.000E+00</b> | <b>2.030E-02</b> | <b>0.000E+00</b> | <b>0.000E+00</b> | <b>3.895E-02</b> |

| A1 - Production (based on "brut" wood) | Unit      | Amount           | CC kg CO2 eq      | Single score Pt |
|--|-----------|------------------|-------------------|-----------------|
| Meranti - MY                           | m³        | 4.101E-02        | -2.437E+01        | 6.195E-03       |
| Sipo - CM                              | m³        | 0.000E+00        | 0.000E+00         | 0.000E+00       |
| Oak - EU                               | m³        | 0.000E+00        | 0.000E+00         | 0.000E+00       |
| Larch - RU                             | m³        | 4.266E-02        | -3.213E+01        | 6.627E-04       |
| Pine - EU                              | m³        | 0.000E+00        | 0.000E+00         | 0.000E+00       |
| Spruce - EU                            | m³        | 0.000E+00        | 0.000E+00         | 0.000E+00       |
| <b>total</b>                           | <b>m³</b> | <b>8.367E-02</b> | <b>-5.650E+01</b> | <b>6.86E-03</b> |

| A2 - Transport to BE | Unit      | Amount           | CC kg CO2 eq     | Single score Pt  |
|----------------------|-----------|------------------|------------------|------------------|
| Meranti - MY         | m³        | 4.101E-02        | 4.141E+00        | 5.377E-04        |
| Sipo - CM            | m³        | 0.000E+00        | 0.000E+00        | 0.000E+00        |
| Oak - EU             | m³        | 0.000E+00        | 0.000E+00        | 0.000E+00        |
| Larch - RU           | m³        | 4.266E-02        | 1.007E+01        | 1.045E-03        |
| Pine - EU            | m³        | 0.000E+00        | 0.000E+00        | 0.000E+00        |
| Spruce - EU          | m³        | 0.000E+00        | 0.000E+00        | 0.000E+00        |
| <b>total</b>         | <b>m³</b> | <b>8.367E-02</b> | <b>1.421E+01</b> | <b>1.594E-03</b> |

| TOTAL A1-A2 for 1 window of glued laminated timber | Unit | Amount | CC kg CO2 eq | Single score Pt |
|--|------|--------|--------------|-----------------|
|  |      |        | <b>-42.9</b> | <b>8.44E-03</b> |

### Design tool: Excel file with rapid evaluation – in development

⇒ Technical constraints (hard wood/soft wood) + client's choice (species)

- ✓ **A1:** Production of glued laminated timber/type of wood
- ✓ **A2:** Transport of glued laminated timber to BE/type of wood
- ✓ Choice of wood type / combinations ⇒ Impact evaluation: CC & SS

| Name - input in the model              | CC - kg CO2 eq/m³ | Single score Pt/m³ |
|--|-------------------|--------------------|
| A1 Glued laminated timber - for 1 m³   | -5.944E+02        | 1.511E-01          |
| A1 Meranti - MY                        | -8.166E+02        | 9.270E-02          |
| A1 Sipo - CM                           | -1.009E+03        | 1.556E-02          |
| A1 Oak - EU                            | -7.530E+02        | 1.553E-02          |
| A1 Pine - EU                           | -6.389E+02        | 1.977E-02          |
| A1 Spruce - EU                         | -5.608E+02        | 1.785E-02          |
| A2 Transport - Origin to BE - for 1 m³ | 1.010E+02         | 1.314E-02          |
| A1 Meranti - MY                        | 5.325E+01         | 6.860E-03          |
| A1 Oak - EU                            | 5.583E+01         | 5.638E-03          |
| A1 Larch - RU                          | 2.360E+02         | 2.451E-02          |
| A1 Pine - EU                           | 1.019E+02         | 8.728E-03          |
| A1 Spruce - EU                         | 9.173E+01         | 7.855E-03          |

### Project and Partnership

- ✓ **2 years project** - started on June 1<sup>st</sup> 2022
- ✓ **10 WP**
- ✓ **5 partners:** AGC – Menuiserie Riche – MateriaNova – Cenaero – ULiège
- ✓ **Funded by The Walloon Region and supported by GreenWin**

