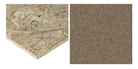
CONSTRUCTION MATERIALS

Siberian dark Larch cladding

Siberian Larch is a popular, durable, and cost-effective cladding material especially in the cold regions.
It's resistant to weather, pests, and diseases, making it an ideal choice for outdoor use. Its stability and affordability make it a practical option for many projects.

OSB



Latvia is a significant global exporter of OSB (Oriented Strand Board), ranking 3rd worldwide and 2nd in Europe.

OSB is a strong, durable, cost-effective, and environmentally friendly construction material, made from sustainably sourced wood. It is resistant to moisture, making it suitable for outdoor projects, and is easy to install and work with.

Rock wool

Rock wool is the preferred insulation material for external applications in Bombyx tools due to its excellent performance in achieving low U values and minimal contributions to the Global Warming Potential (GWP).

Exterior wall insulation is crucial for improving energy efficiency, reducing CO2 emissions, and cutting heating or cooling costs, as exterior walls are where heat loss or gain is most common in buildings.

Pine wood

Pine, the most common tree type in Latvia, is a vital component of the wooden industry. It is a renewable resource known for its cost-effectiveness, strength, and durability. Additionally, pine is easy to work with and boasts an aesthetic, natural design

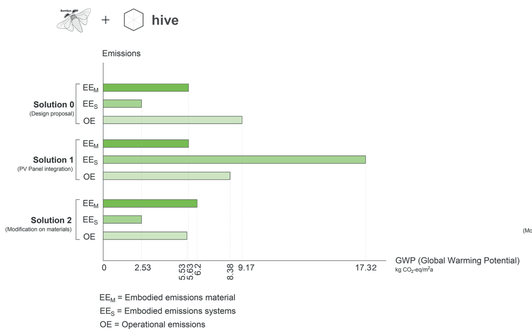
Glass wool

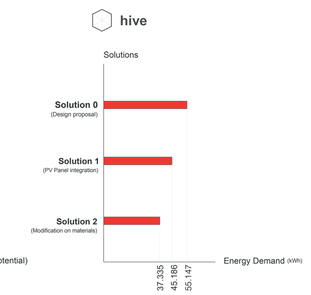
Glass wool is the preferred choice for cavity insulation in Bombyx tools, thanks to its emphasis on low U values and reduced Global Warming Potential (GWP).
It is made from recycled glass and sand, making it fire-resistant, resistant to vermin and rot, and resistant to moisture absorption. Its exceptional thermal properties also help reduce heating and air-conditioning costs.

Birch plywood

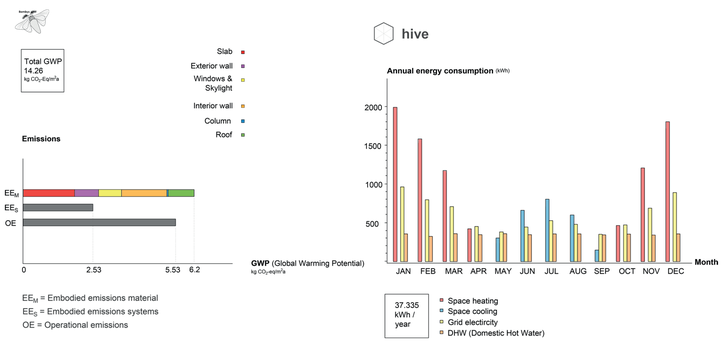
Latvia has experienced a rapid increase in the number of young birch trees stands. The country is the second-largest exporter of birch plywood in Europe, highlighting the prominence of birch as a fine-grained, easy-to-work-with wood with excellent strength and water-resistant qualities, making it suitable for both interior and exterior projects.

DESIGN ALTERNATIVES





SELECTED DESIGN (Solution 2)



Final design material selection

BILL of QUANTITY (BoQ)

Material group (Bombyx tool, default material database)	Material (Bombyx tool, default material database)	Layer Impact (thickness in meters)	Component Impact (RSP and RSL years)	Element Impact (Surface area in meters)
Slab				
Birch plywood	Wood and wooden materials	Plywood/Multiplex, PF-bound, wet area	0.018	50, 10	
Glass wool	Thermal Insulation	Glass wool, Isover (20 kg/m3)	0.09	50, 25	
Joists from Pine wood	Wood and wooden materials	Solid wood spruce/fir/ larch, air-dried, rough	0.15	50, 50	234
OSB	Wood and wooden materials	OSB plate, PF-bound, wet area	0.009	50, 25	
Exterior Wall				
Birch plywood	Wood and wooden materials	Plywood/Multiplex, PF-bound, wet area	0.015	50, 10	
Rock wool	Thermal Insulation	Rock wool, (30 kg/m3)	0.05	50, 25	
Glass wool	Thermal Insulation	Glass wool, Isover (20 kg/m3)	0.20	50, 25	
Studs from Pine wood	Wood and wooden materials	Solid wood spruce/fir/larch, chambered, planed	0.20	50, 50	110
OSB	Wood and wooden materials	OSB plate, PF-bound, wet area	0.015	50, 25	
Larch cladding	Wood and wooden materials	Solid wood spruce/fir/larch, chambered, planed	0.020	50, 25	
Windows &Skylights				
	Window frame: wood-aluminium Window glazing: insulating triple glazing, Ug value: 0.6 W / m2K, thickness 40 mm Frame percentage, 10		50, 25	64
Interior wall				
Birch plywood	Wood and wooden materials	Plywood/Multiplex, PF-bound, wet area	0.015	50, 10	
Glass wool	Thermal Insulation	Glass wool, Isover (20 kg/m3)	0.10	50, 50	
Studs from Pine wood	Wood and wooden materials	Solid wood spruce/fir/larch, chambered, planed	0.10	50, 50	150
Birch plywood	Wood and wooden materials	Plywood/Multiplex, PF-bound, wet area	0.015	50, 10	
Column				
Column from Pine wood	Wood and wooden materials	Plywood/Multiplex, PF-bound, wet area	0.20	50, 50	42
Roof				
Birch plywood	Wood and wooden materials	Solid wood spruce/fir/larch, air-dried, rough	0.015	50, 50	
Glass wool	Thermal Insulation	Glass wool, Isover (20 kg/m3)	0.20	50, 25	
Rafters from Pine wood	Wood and wooden materials	Solid wood spruce/fir/larch, air-dried, rough	0.15	50, 50	246
OSB	Wood and wooden materials	OSB plate, PF-bound, wet area	0.015	50, 25	
Larch cladding	Wood and wooden materials	OSB plate, PF-bound, wet area	0.020	50, 25	

Final design system selection

System groups (Bombyx tool, default material database)	System (Bombyx tool, default material database)	Building Services (ERA, RSP and RSL)
Heating		
Radiators	Heating systems	Heat emission via radiators	210 m2, 50, 25
Ventilation		
Decent-ralized ventilation	Ventilation systems	Single room ventilation, window model 10-30 m3/h, without assembly	210 m2, 50, 25
Electricity		
Electrical installation	Electrical systems	Electrical installation, housing	210 m2, 50, 25

*The selection process for materials does not consider the breather membrane and vapor control layer.

The chosen material for the project and the default materials available in Bombyx are visually distinguished using different colors.

LCA RULES

Goal & Scope =

The primary objective is to find **a design balance between energy consumption and environmental impact.** This involves assessing emissions from materials, systems, and operational usage, with a focus on reducing both **embodied emissions, operational emissions and energy demand**.

The assessment includes **A1-A3**, and **B6** modules; these components contribute to a substantial share (70-90%) of the environmental impact in residential buildings.

A reference service period of **50 years** has been decided upon.

LCI = (hive)

The assessment includes various **building elements** such as the slab, exterior wall, windows, skylights, interior wall, columns, and roof. Foundations, terraces, shading devices, and doors are not included. In addition, building systems such as electrical, heating, and ventilation systems are also included in the assessment.

The databases used include Bauteilkatalog, Eco Komposit and KBOB.

LCIA = (hive)

GWP

Green House Gas (GHG) emissions in kg CO_2-eq per m_2 per year, called as Global Warming Potential (GWP) is defined as impact category.

Interpretation =

Solutions 1 and 2 align with the original design proposal (Solution 0) and aim to enhance it. Solution 1 involves adding PV panels to the roof, while Solution 2 explores modifications to building elements like insulation and window types.

Solution 1 results in a significant increase in system embodied emissions, although it helps reduce energy consumption. On the other hand, Solution 2 achieves the goal of reducing total emissions while also leading to lower energy consumption compared to other solutions.

CONSTRUCTION PROCESS AND MATERIAL EMISSIONS

Construction Stage 1, slab frame:

0.31 kg CO^2-eq/m^2a

Construction Stage 2, addition of exterior wall frame:

0.47 kg CO^2-eq/m^2a

Construction Stage 3, addition of interior wall frame and column:

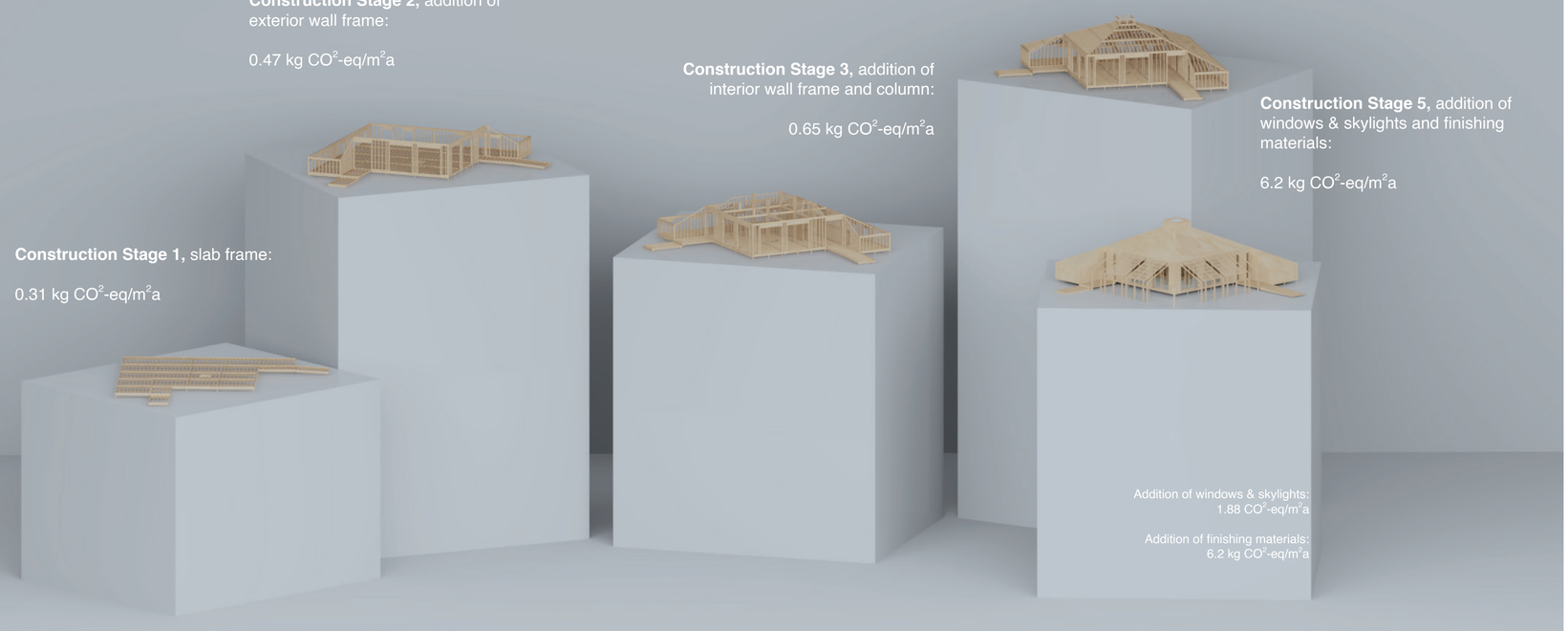
0.65 kg CO^2-eq/m^2a

Construction Stage 4, addition of roof frame:

1.05 kg CO^2-eq/m^2a

Construction Stage 5, addition of windows & skylights and finishing materials:

6.2 kg CO^2-eq/m^2a



Addition of windows & skylights:
1.88 CO^2-eq/m^2a

Addition of finishing materials:
6.2 kg CO^2-eq/m^2a