Life Cycle Assessment of wooden windows with wax-treated frames

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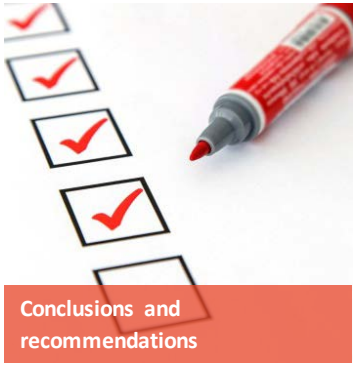
About the project

Goal and scope

System boundaries & LCI

The studied products

LCIA Results



Conclusions and recommendations

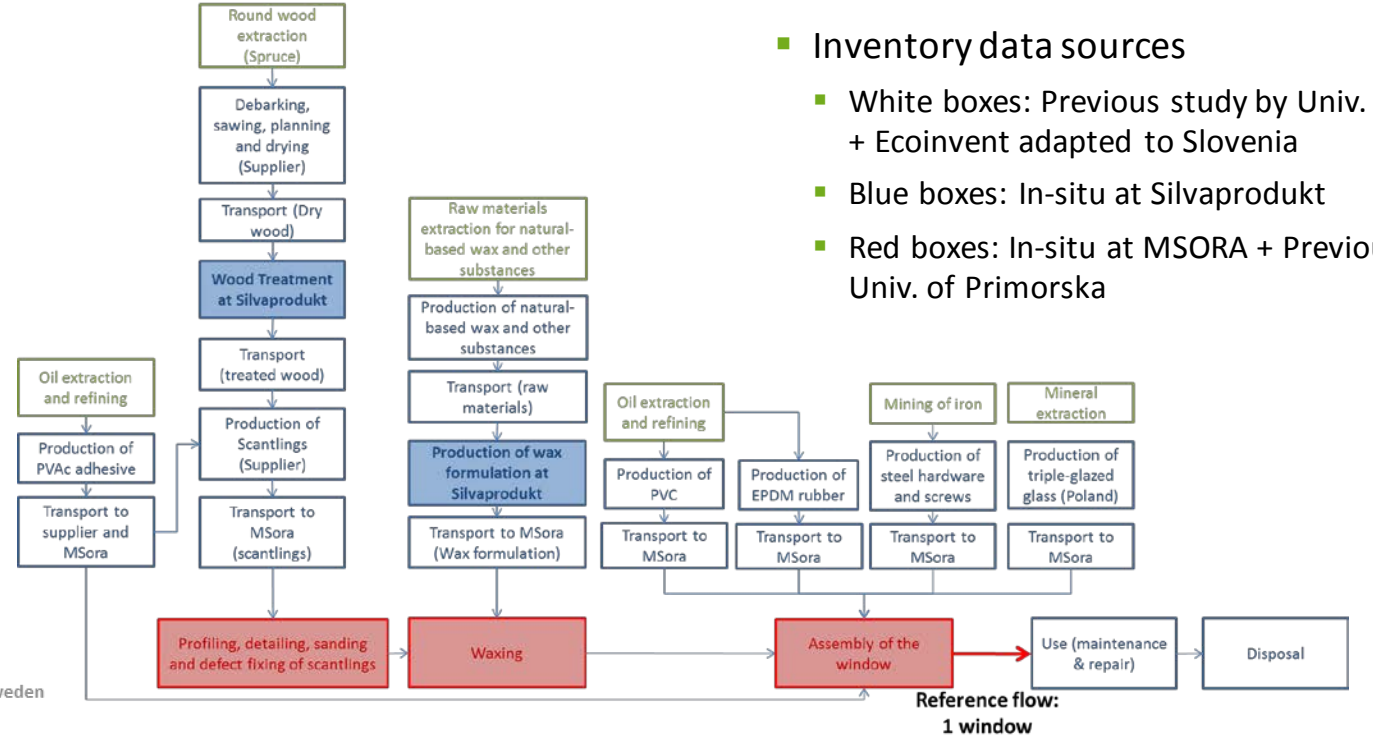
The project - WINTHERWAX

- Aim
  - Develop high-efficiency wax coating for thermally modified spruce window
  - Test windows and façade elements in natural and artificial environments
- Main
  - MSORA (window manufacturer) and Silvaprodukt (thermal modification and wax)
  - Subcontractors from Slovenia, Sweden, Germany and Spain
- One test box in each country

LCA: Goal and scope

- Goal
  - Study the environmental effects of the wax coating process developed in WINTHERWAX
- Intended audience
  - R&D teams in WINTHERWAX partners
- Intended use
  - Create knowledge about the environmental impacts from the technology developed
  - Provide input for decision-making in further technology development
- Functional unit
  - One window measuring 1.23 x 1.48m with a U-value of 0.66 W/m^2K used for 40 years.

System boundaries – Cradle-to-grave



- Inventory data sources
  - White boxes: Previous study by Univ. of Primorska + Ecoinvent adapted to Slovenia
  - Blue boxes: In-situ at Silvaprodukt
  - Red boxes: In-situ at MSORA + Previous study by Univ. of Primorska

Studied products

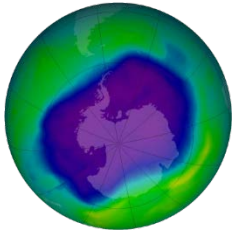
Nature Optimo XLT	WINTHERWAX
Thermally modified spruce treated with synthetic coating	Thermally modified spruce treated with natural-based wax
All other components assumed to be the same	
U-value of 0,66 W/m²*K, and dimensions of 1,23x1,48m	
Service life of 40 years	
Requires coating maintenance	Does not require coating maintenance

LCA – Impact categories (CML baseline)

Global warming potential (GWP)

Acidification potential (AP)

Ozone Depletion Potential (ODP)

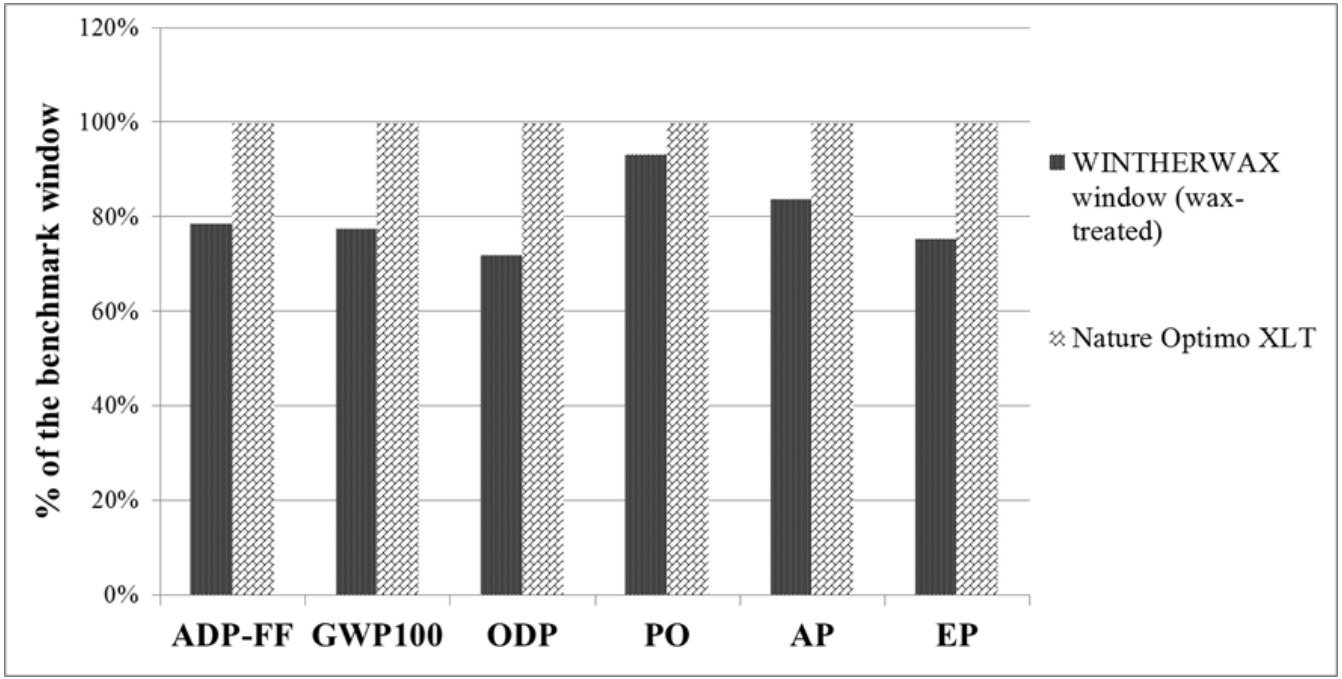


Eutrophication Potential (EP)

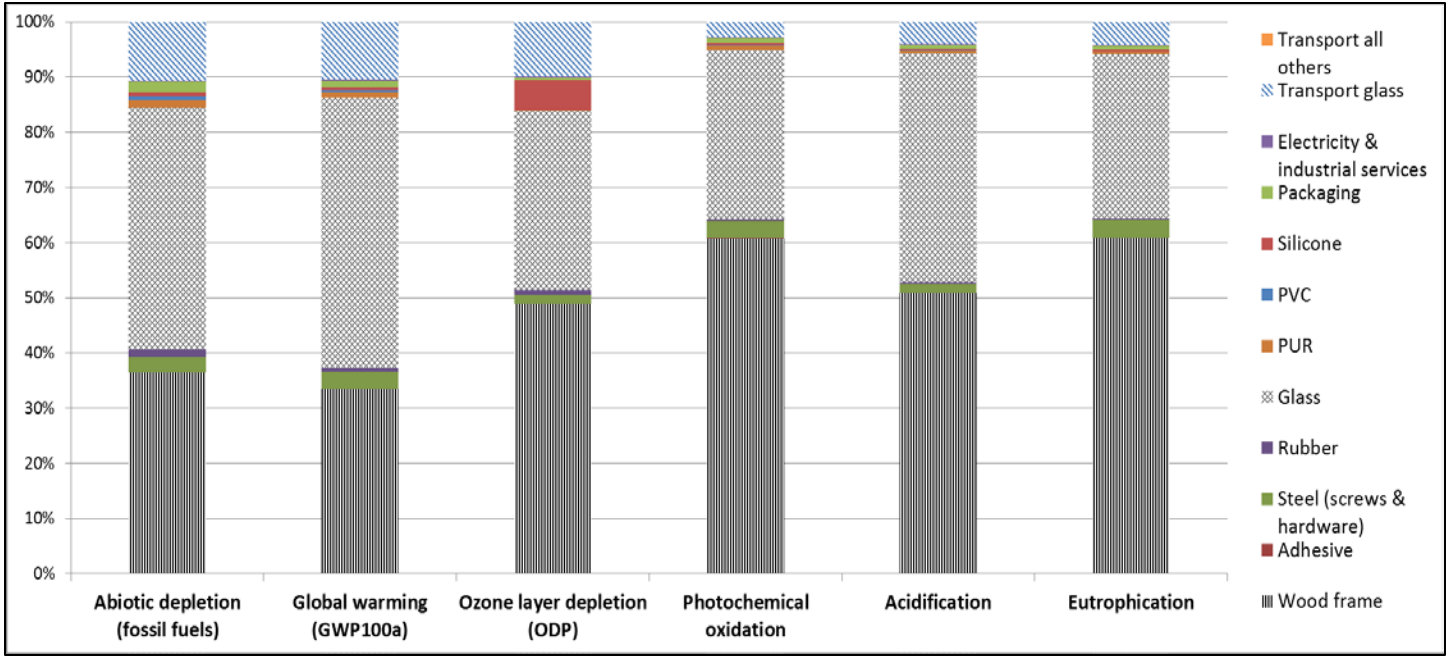
Abiotic depletion potential (ADP)

Photochemical oxidation (PO)

Results – Cradle-to-grave



Contribution analysis – cradle-to-gate



Conclusions

- The WINTHERWAX (wax-treated) window has lower environmental impacts than the benchmark (synthetic coating)
  - Coating used and the maintenance of the benchmark key differences
- Environmental hotspots for the wax-treated window
  - Manufacturing of the glass - highest contributor
  - Wax-treated wood - second highest
  - Transport of glass (Poland) - worth noting
  - Thermal treatment - Hotspot for production of wood profiles

Recommendations to R&D teams

- To prioritize the following processes to decrease the environmental impacts of the window:
  - Manufacturing of the glass
  - Production of wood profiles
  - Heat treatment of these profiles
- To model these processes with more detail in future LCA studies
  - Improve the quality of the results
  - Supplier involvement is greatly advised

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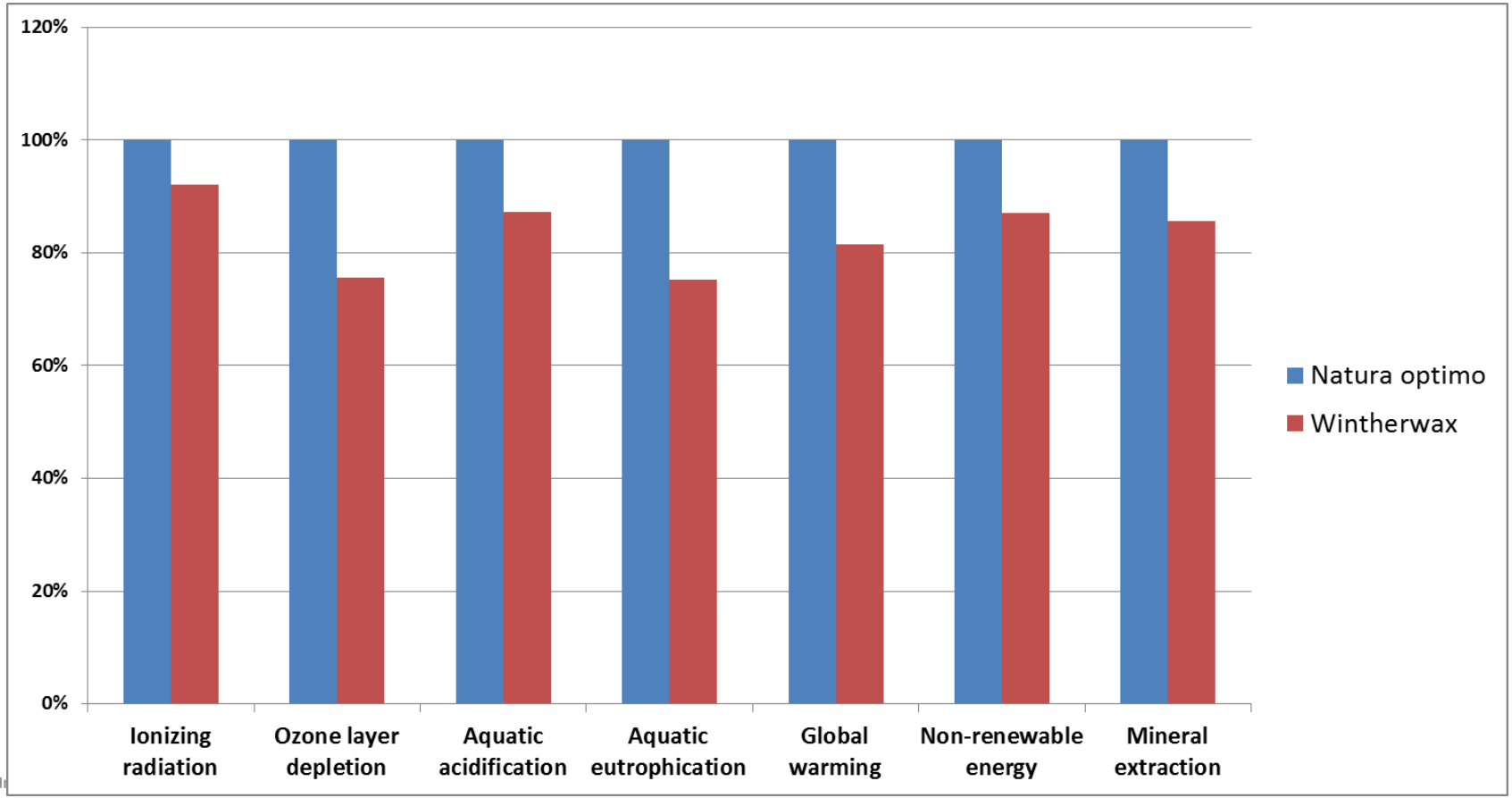
120%
100%
80%
60%
40%
20%
0%
Ionizing radiation
Ozone layer depletion
Aquatic acidification
Aquatic eutrophication
Global warming
Non-renewable energy
Mineral extraction
Natura optimo
Wintherwax

ReCiPe Midpoint (Europe H)