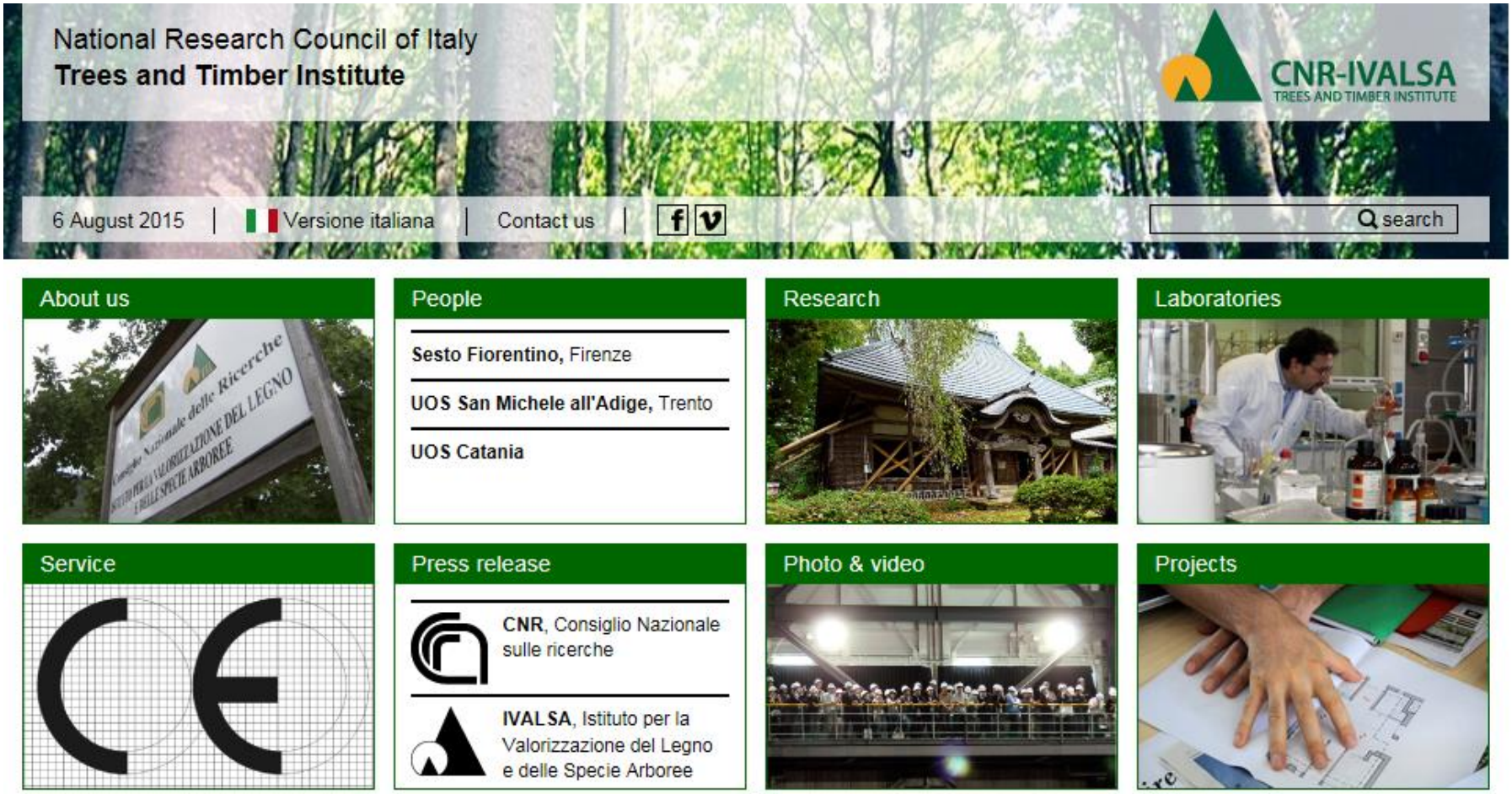

Design of wood wool cement board by Life Cycle Assessment method

M. Marra, S. Guercini, E. Sgorlon

COST FP1303 Performance of bio-based building materials

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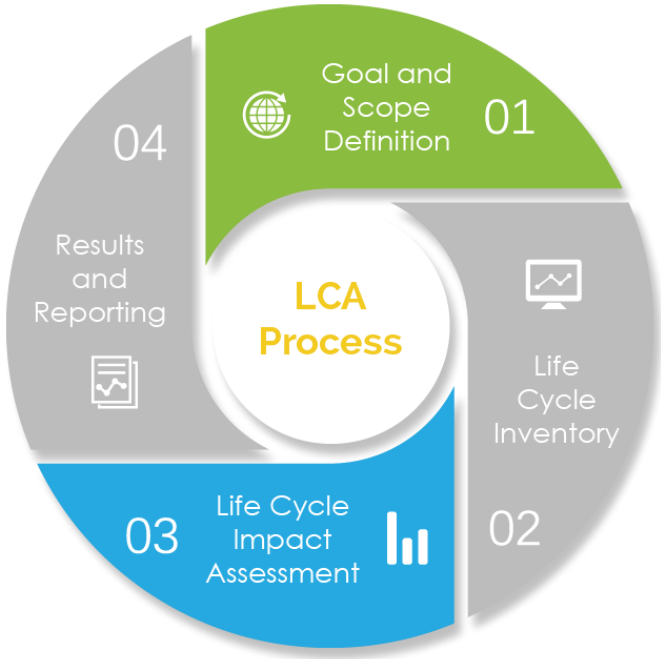
Life Cycle Assessment

Life Cycle Assessment is a method
to evaluate the environmental burdens associated with a product,
by identifying and quantifying materials and energy used and wastes released to the environment.

The eco-profile resulting from LCA can help to identify and evaluate opportunities to improve environmental performances of the product assessed.



Wood Wool Cement Board

What's WWCB?

Wood Wool Cement Board

WWCB is a building material.

The main characteristics are:

- **Acoustic performance**
  - noise absorption
  - sound insulation

Wood Wool Cement Board

WWCB is a building material.

The main characteristics are:

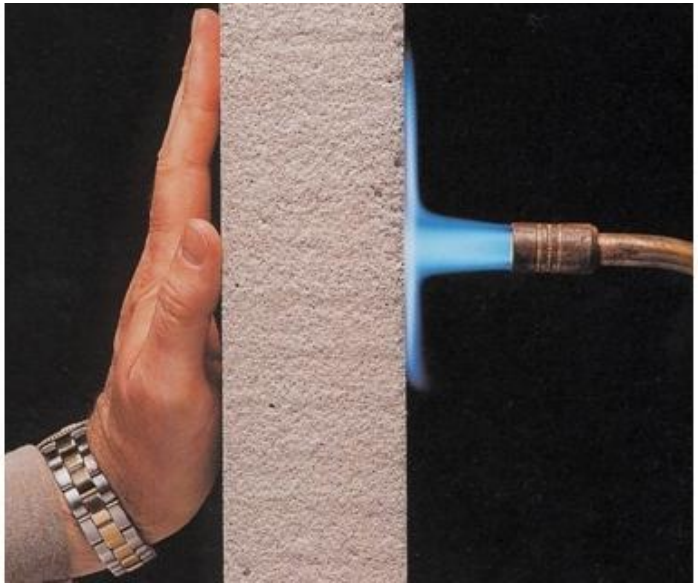
- Acoustic performance
- **Thermal properties**
  - heat accumulation
  - thermal insulation

Wood Wool Cement Board

WWCB is a building material.

The main characteristics are:

- Acoustic performance
- Thermal properties
- **Fire resistance** Euroclass Bs1 fire reaction

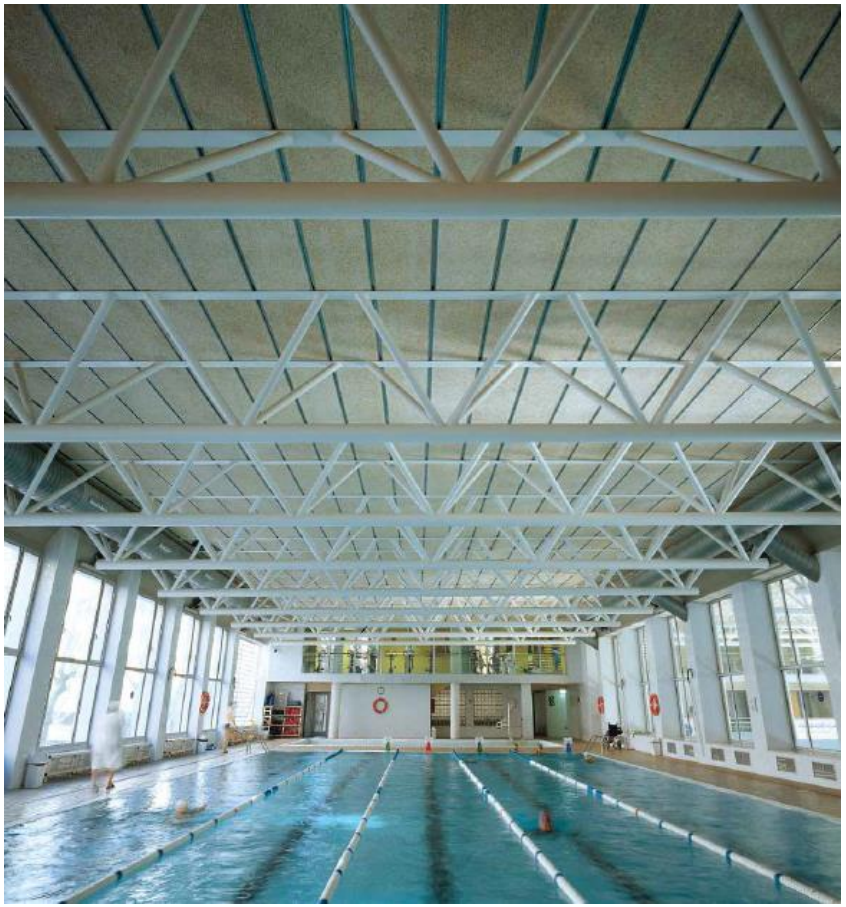


Wood Wool Cement Board

WWCB is a building material.

The main characteristics are:

- Acoustic performance
- Thermal properties
- Fire resistance
- **Internal and external use**
  - low dilatation coefficient
  - mould and fungi resistance



Wood Wool Cement Board

WWCB is a building material made from wood wool and cement.

LCA. Goal and scope

Goal was to identify the environmental impacts related to WWCB production.

Scope was to develop and improve the product design.

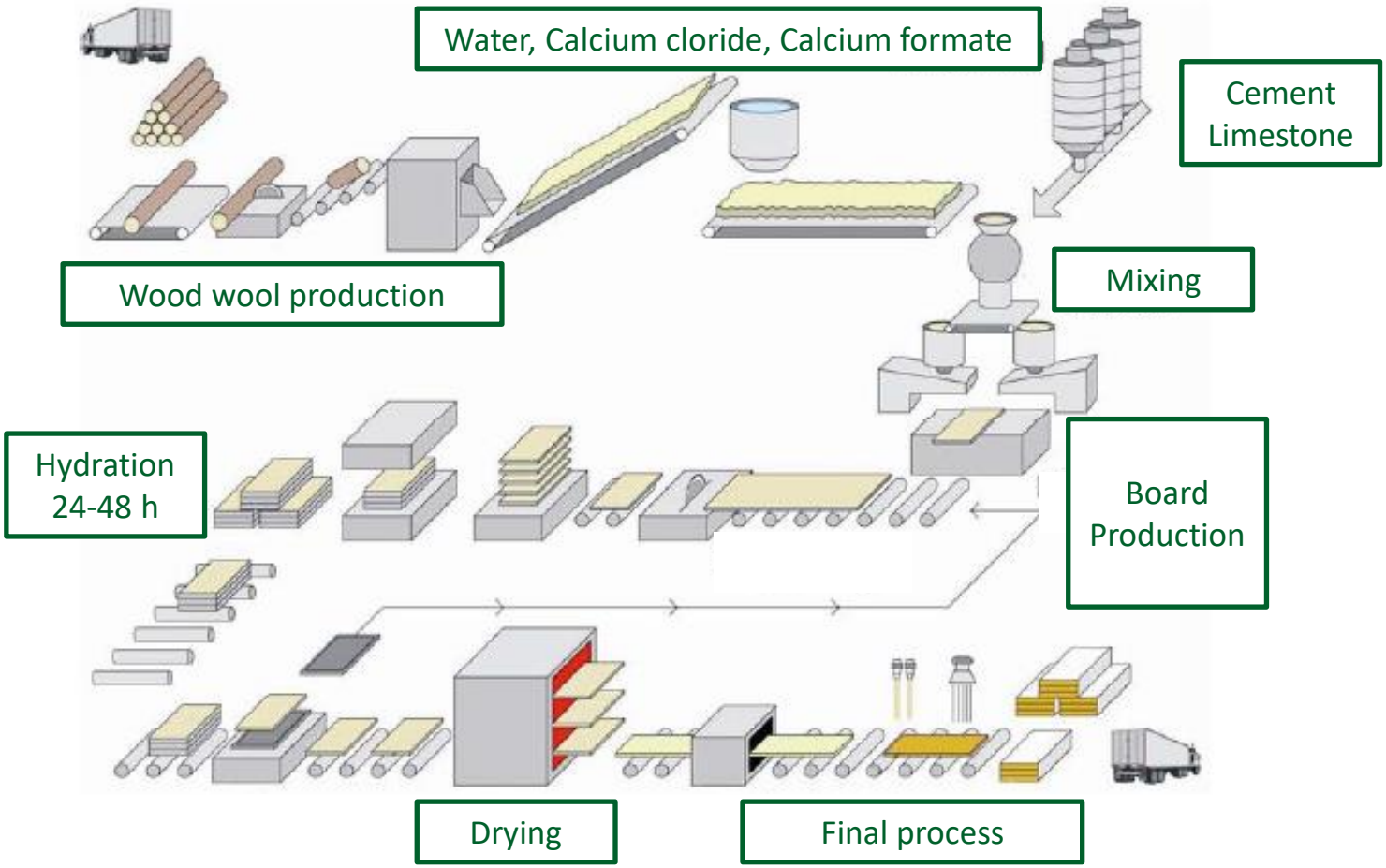
LCA has quantified the benefits of:

- short supply chain,
- recycled timber of building demolition,
- different energy sources.

Factory	- Northeast Italy
	- 100.000 m^3/year
Data quality	- 2 years on-site measurement
	- Ecoinvent v3.1 and JRC ILCD database
Method	- ISO 14040
	- LCIA: ReCiPe Midpoint (H) v1.12
	- Functional unit: mass, 1 kg WWCB
	- System boundary: cradle-to-gate

LCA. Goal and scope

- System boundary

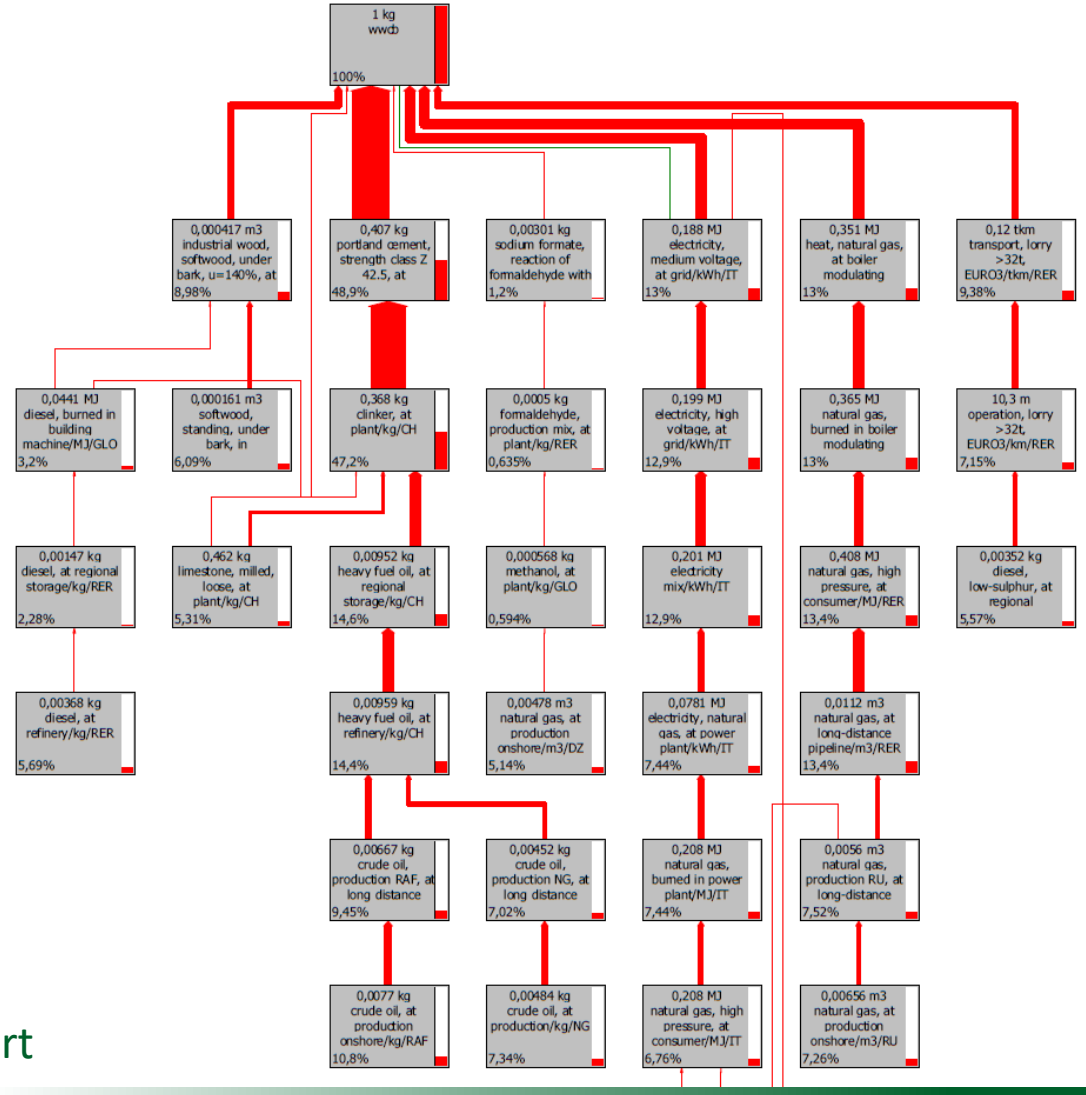


LCI

- Life Cycle Inventory inputs, outputs and impact indicators were quantified using functional unit

Inputs		Outputs	
Water, groundwater consumption	0,28658 kg	Methanol	0,00627 g
Industrial wood, softwood, under bark, u=140%, at forest road	0,41731 dm^3	Dimethyl formamide	0,00208 g
Portland cement, at plant	0,40647 kg	2-Butoxyethanol acetate	0,00170 g
Limestone, milled, loose, at plant	0,14997 kg	Benzene, ethyl-	0,00015 g
Sodium formate, at plant	0,00301 kg	Isopropyl acetate	0,00055 g
Calcium chloride, $CaCl_2$, at plant	0,00319 kg	Acetone	0,00050 g
Alkylbenzene, linear, at plant	0,00095 kg	Ethanol	0,00029 g
Packaging, corrugated board, at p.	0,00053 kg	Heptane	0,03156 g
Packaging film, LDPE, at plant	0,00014 kg	Particulates, unspecified	0,01094 g
Electricity, medium voltage, at grid	0,05505 kWh	Wood, sawdust	0,01566 kg
Heat, natural gas, at boiler >100kW	0,35113 MJ	Rejects	0,01450 kg
Transport, lorry >32t, EURO3	120,4 kgkm	Packaging waste	0,00003 kg

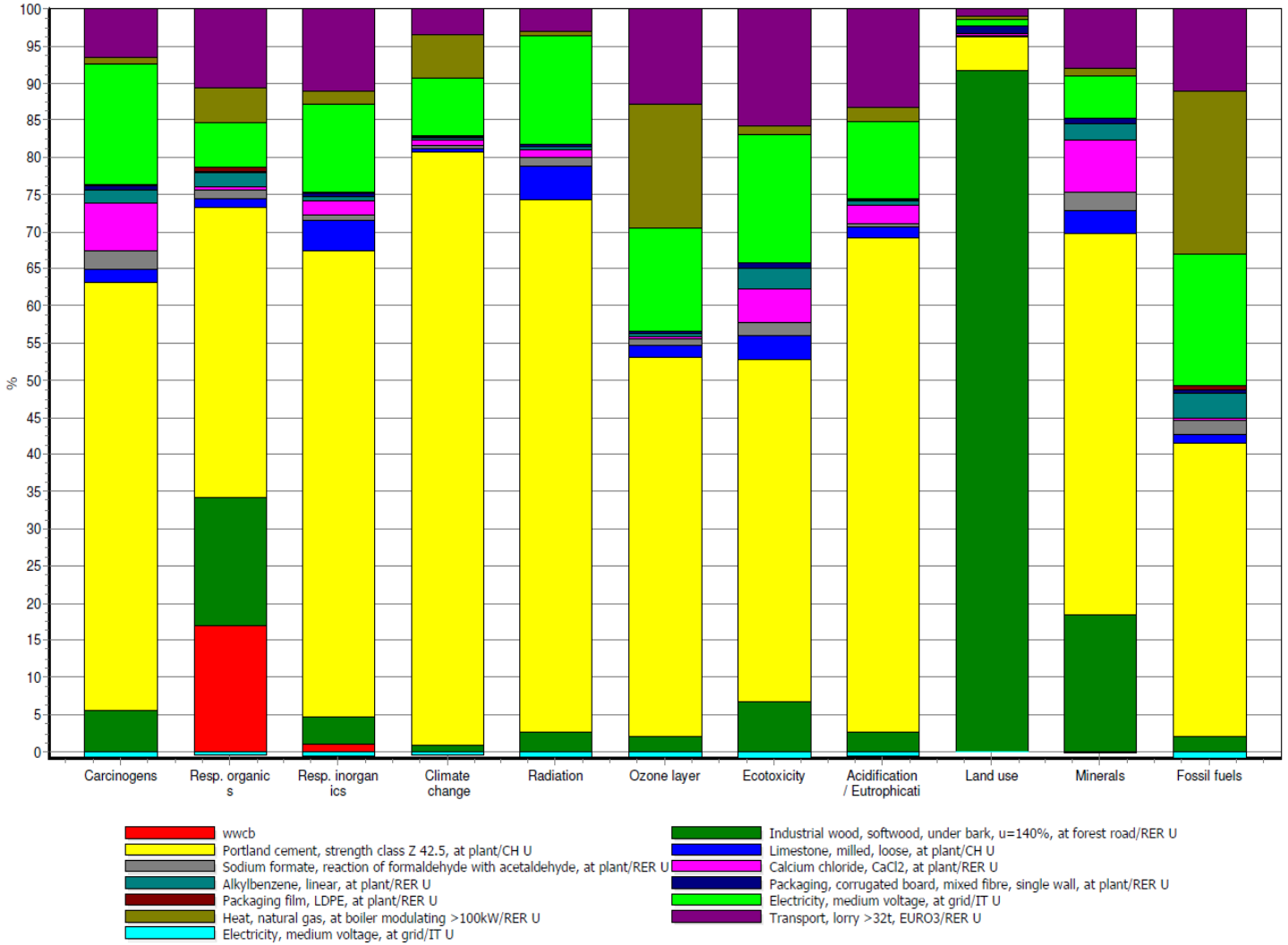
LCI. Network flow chart



SimaPro flow chart

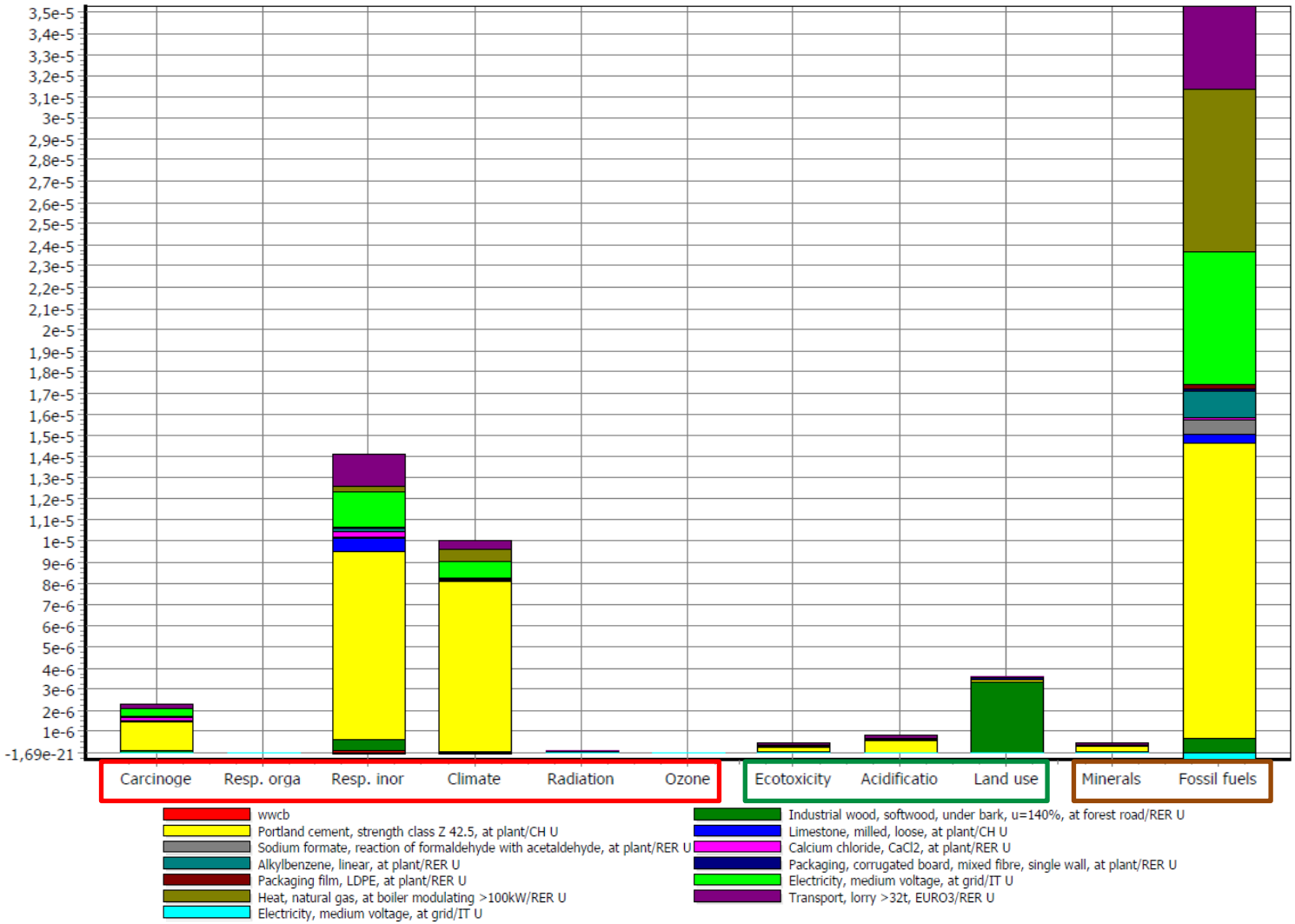
LCIA. Characterization. Midpoint

Impact category
- absolute



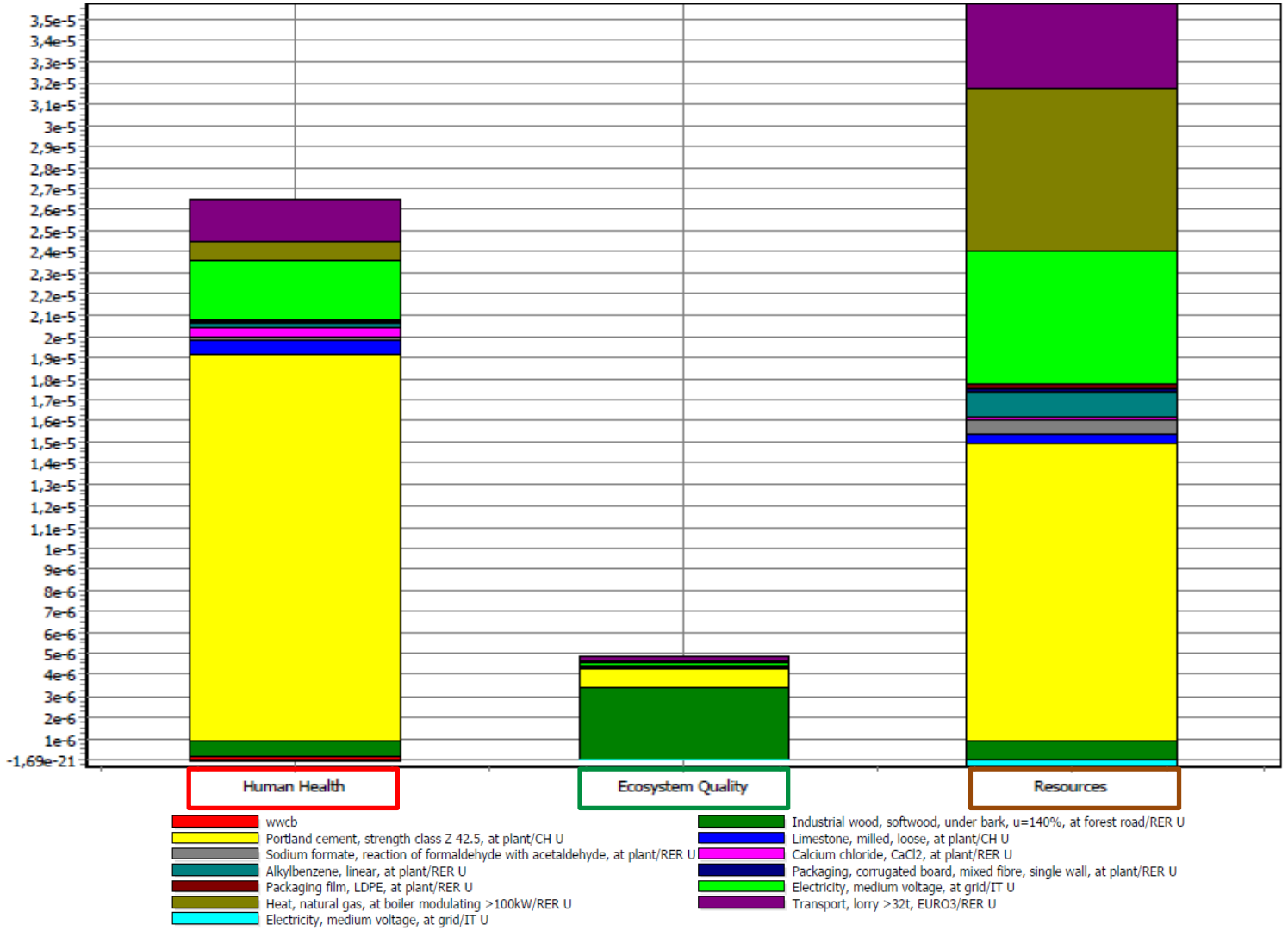
LCIA. Normalization. Midpoint

Impact category
- relative



LCIA. Normalization. Endpoint

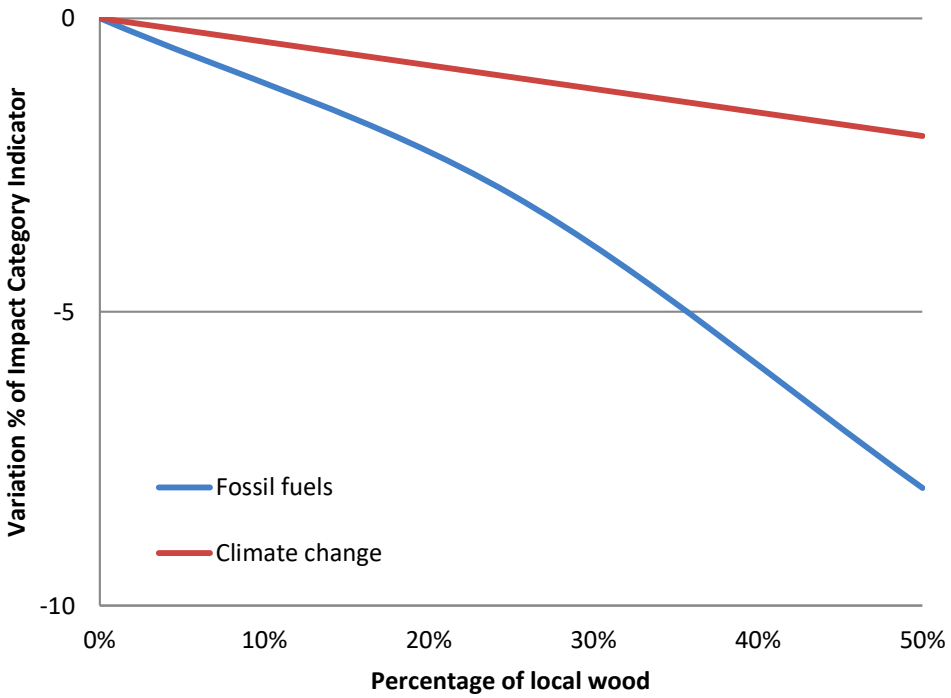
- 3 Damage category



Sensitivity analysis

Short supply chain

- A careful management of the supply sources produces a reduction of all environmental impact categories.



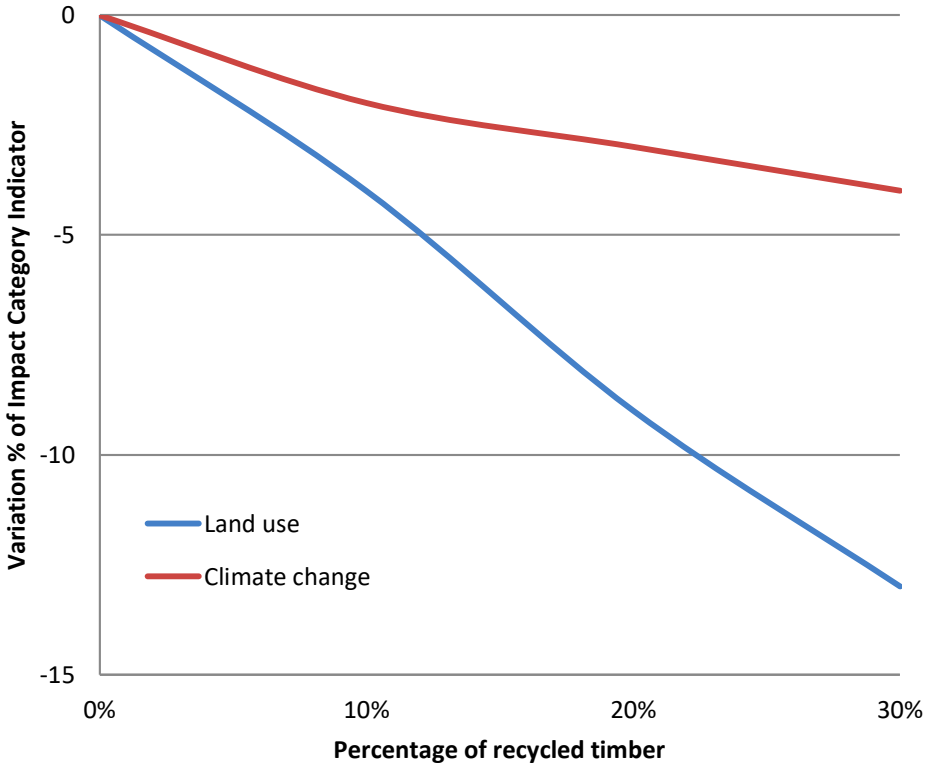
Increasing the amount of local wood from 0 to 50% compare to commercial trade

- decreases the fossil fuel depletion (-8,1% kg crude oil)
- reduces the global warming potential (-2,2% kg CO_{2eq} to air)

Sensitivity analysis

Recycled timber

- Recycling of timber, coming from building demolition collection centre, has contributed to the reduction of different impacts.



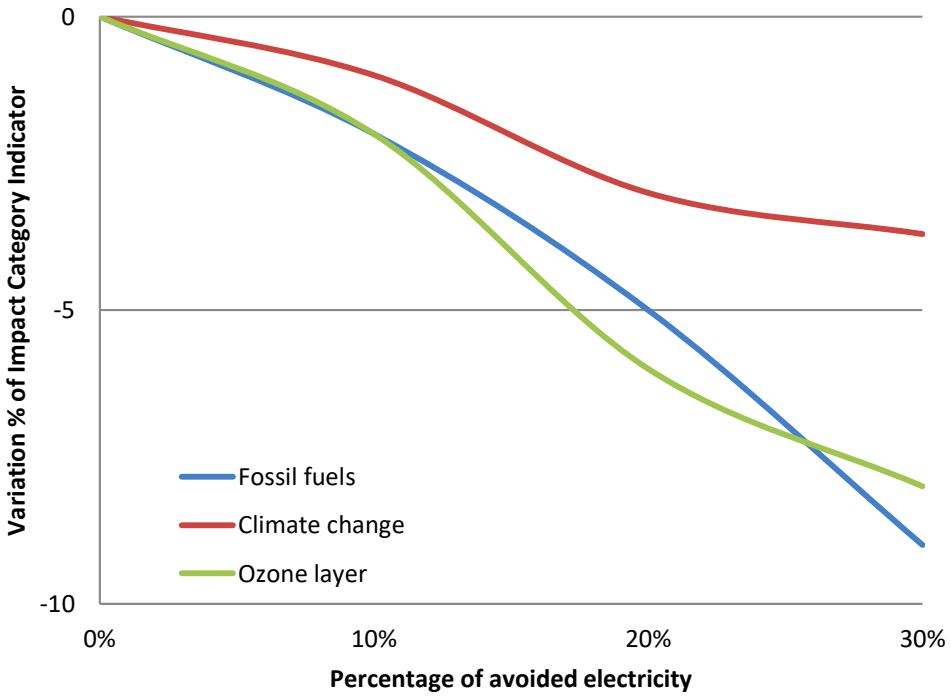
Growing the rate of recycled timber from 0 to 30% compare to virgin wood

- decreases the agricultural land occupation (-13,0% m^2 yr)
- reduces the climate change (-3,8% kg CO_{2eq} to air)

Sensitivity analysis

Avoided electricity

- The avoided production of electrical energy, thanks to self production by photovoltaic cells, has led to an overall environment benefit.



Raising the percentage of self electricity from 0 to 30%

- decreases the fossil fuel depletion (-8,8% kg crude oil)
- reduces the global warming potential (-3,7% kg CO_{2eq} to air)
- decreases the ozone layer depletion (-8,0% kg CFC-11_{eq} to air)

Conclusions

Results have led to identify opportunities to improvement environmental performance of wood wool cement board manufacture through an eco-design approach.

CNR-IVALSA
TREES AND TIMBER INSTITUTE

Thank you

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