FROM INNOVATION

TO

DE-GROWTH INNOVATION

Railway Interiors Expo
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AnsaldoBreda is the manufacturer of rolling stock vehicles belonging to the Finmeccanica Group
It produces in particular:

- Complete trains,
- High speed trains,
- locomotives,
- Double-deck electric multiple units (High Capacity trains - TAF),
- Electric Multiple Units (EMUs),
- Diesel Multiple Units (DMUs),
- Single- and double-deck passenger coaches,
- Heavy and Light rail vehicles,
- Tramways and driverless metro vehicles.

The company is strongly present on foreign markets, in particular: European Union and United States as well as in Eastern Europe and North Africa.

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AnsaldoBreda and the Environment

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Directly from the AnsaldoBreda Environmental Policy, it is reported:

… omission

The continuous improvement commitments in environmental performances will be pursued on the basis of the following principles:

- To design the product by application of the Life Cycle Assessment (LCA) to reduce environmental impacts during:
  - The product manufacturing phase
  - The use, maintenance and disposal by the Customer
- To prefer the use of raw material compatible with the environment and with the workers' health
- To implement a correct waste management which pursues recovery policies of the waste produced
- To check the management of the harmful substances used in processes in order to contain and reduce any fall-out effect on the environment
- To develop a constant, steady cooperation with suppliers to reduce the environmental impact.

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The De-Growth – Definition
from Wikipedia and www.decrescita.it

Degrowth (in French: *décroissance*, in Italian: *decrescita*) is a political and economic ideology advocating a gradual decrease in economic output, with the objective of establishing a new, sustainable relationship between human beings and the environment.

According to de-growth thought, downscaling production is the only solution to the environmental issues currently faced by mankind, as current economic growth is not sustainable over the long term because it depletes natural resources and destroys the environment beyond its capability for regeneration, and because it fails to help populations improve their welfare significantly.

The De-Growth – Definition
from Wikipedia and www.decrescita.it

The theoretical basis of the de-growth rests upon four elements:

1. The functioning of the present economic system essentially depends on non *renewable resources.* In this case, it is not sustainable.

   The promoters of the de-growth base on the idea of the limitation of raw materials, especially of the energy sources. They deduce that this limitation is in contradiction with the Gross Domestic Product (GDP) unlimited growth.

The De-Growth – Definition
from Wikipedia and www.decrescita.it

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2. No evidence of the possibility of separating the economic growth from its ecologic impact growth

3. Wealth generated by the economic system not only concerns goods and services: there are other forms of social wealth, such as the health of ecosystems, the quality of justice, the good relationships between the members of a society, the degree of equality, the democratic character of the institutions, and so on.

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The De-Growth – Definition
from Wikipedia and www.decrescita.it

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4. Generally speaking, the present societies, doped by futile material consumptions (mobile phones, air travels, constant and non-selective use of the car etc.) do not perceive the decline of the most essential wealth such as the quality of life and they underestimate the social outcast reactions, such as violence in the suburbs or resentment against the western people in countries excluded from (or limited in) the western-type economic development

The theory of the sustainable de-growth does not evidently imply the pursuit of the de-growth in itself: on the contrary it proposes as a means to research a better quality of life, by sustaining that the GDP only represents a partial measure of wealth (e.g. a car accident is a GDP increase factor) and that we are urged to stop considering the GDP as the sole indicator, in case we intend to restore all the possible wealth varieties.

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The De-Growth Innovation– Examples – The Wood

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Wood is the best material for the sustainable architecture. In Italy, and especially in South Tyrol, various examples of wooden-framed houses can be seen.

Wood is a living material that breathes with us and enables us to reintroduce nature inside our homes. Wood balances the humidity level of indoor air and acts as a filter by releasing regenerated air.

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The De-Growth Innovation– Examples – The Wood

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The ecological advantages compared with other materials are evident such as the quantity of energy utilized for machining, transporting and assembling each material.

Comparison between production of a cubic meter of wooden with Cement, Steel and Aluminum

Wood:	From 8 to 30 kWh,
Cement:	From 150 to 200 kWh
Steel:	From 500 to 600 kWh
Aluminum:	up to 800 kWh

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The De-Growth Innovation– Examples – The Wood

As far as energy consumption of house residents is concerned, engineers are clear: "

Insulation of wood entails a 40/50% saving of the energy need with respect to concrete.

In order to reach the same heat insulation value of a 10 cm-wooden wall, a brick wall should be 54 cm thick.

A 100 gross sqm house allows a material saving leading to benefit of an approximately 7-8 sqm of usable surface.

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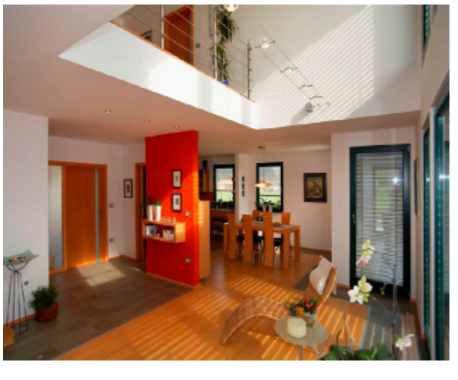
The De-Growth Innovation – Examples – The Wood



Life of the product: a research of the Technische Universität in Braunschweig demonstrated that a wooden house, adopting suitable solutions, lasts 100 years at a minimum, like other houses built with heavier materials. A builder releases an averagely thirty-year warranty on a wooden prefabricated building, versus a ten-year warranty on a traditional concrete building.

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The De-Growth Innovation – Examples – The Wood

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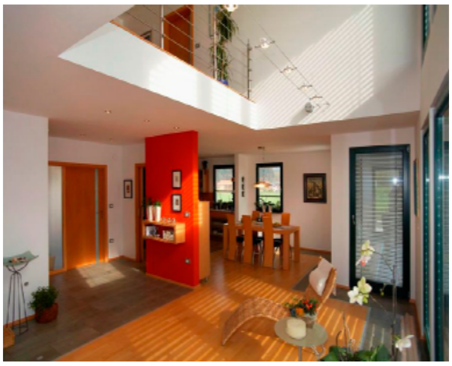

Fire: spontaneous combustion starts at a temperature exceeding 300°; on the contrary steel, constituting the floor supporting reinforcing bars, expands at a temperature of 200°. In case of fire, the risk of a reinforced concrete-floored house falling down is higher than a wooden house.

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The De-Growth Innovation – Examples – The Wood

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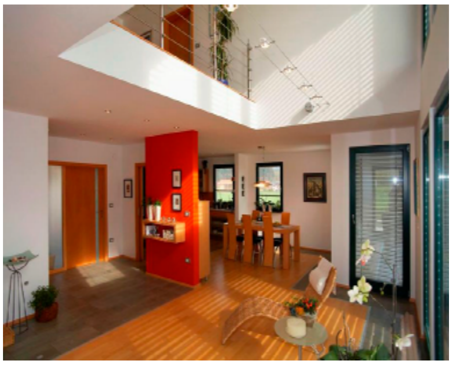

The test carried out in 2008 in Japan at the Building Research Institute of Tsukuba gave evidence that a building with a wooden supporting structure can resist a big fire by assuring the standards of the inhabitants and the rescue team for all the time.

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The De-Growth Innovation– Examples – Green Roofs

Originally, green roofs were conceived for a simple practical necessity. Ground and turf were laid on the birch peel lying on the roof: the peel had the function of a waterproof barrier, while ground had the purpose of hold the peel tight.

The realization of green coverings is a historically consolidated tradition in many Scandinavian and European countries.

Green roof art school - Singapore

The De-Growth Innovation– Examples – Green Roofs

In Italy green roofs date back to the ancient population inhabiting the peninsula (Etruscans and Romans). In addition green roofs had notable precursors i.e. architectural works nowadays universally recognized as true works of art: superb dwellings built in the XV century, such as Villa dé Medici and Palazzo Piccolomini of Pope Pio II had gardens on the roof.

Green roof art school - Singapore

In most of Italy this practice has gradually disappeared while in Germany, Switzerland, Austria and Northern Italy (on the borderlines with these countries) the green roofs have come to the forefront in the last 30 years (source: www.geometri.cc)

The De-Growth Innovation– Examples – Green Roofs

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Tokio's Imperial Hotel

During the last 10 years, in Germany, 10% of the new roofs are green; in Japan, Tokyo municipality requests for any 600 sqm building to have a green covering of at least 20%.

Even in Italy, although late with respect to the other European countries, the interest towards the green roofs is more and more increasing; Bolzano is the leader, the first city to promote the use of eco-coverings.

At regional level, Emilia Romagna is the region with the majority of green roofs: Reggio Emilia, Rimini and Faenza.

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The De-Growth Innovation– Examples – Green Roofs

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Tokio's Imperial Hotel

Among the capitals of region: Milan's municipality council introduced the roof gardens topics in the updates of the Building Code, promoting their utilisation, wherever possible, on all the flat coverings.

In Turin it is mandatory to adopt green house fronts or roofs in case the building interventions imply volumetric variations for which it is impossible to destine 20% of the ground to green roofs; in the end, in Venice green roofs represent the requirements entitling to the reduction of the urbanisation charges.

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The De-Growth Innovation– Examples – Green Roofs

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- Environmental advantages: green roofs fight against buildings overheating; in absorbing heat, green roofs assure a considerable power saving since they limit the utilisation of air conditioning devices and other cooling equipment; in addition they filter polluted air, improving its quality. They also limit the rain flooding risks: the roof gardens highly increase rain water absorption, alleviating the cities sewer systems.

Chicago's City Hall

- Economic advantages: for each temperature degree diminished, the power demand for air conditioning and cooling is reduced by 5%. According to some surveys, green roofs last twice longer than traditional roofs.

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The De-Growth Innovation– Examples – Green Roofs

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Vancouver's Fairmont Waterfront Hotel

- Food production: green roofs can be exploited for small agricultural productions. On the roof of the Fairmount Waterfront hotel in Toronto, flowers and vegetables are grown, allowing to save approximately 30,000 Canadian dollars per year on flowers and vegetables purchasing

Social advantages: green roofs offer a good acoustic insulation and a green oasis.

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Case History

Problem: railway vehicle environmental impact reduction

Solution: re-discovery of obsolete solutions in modern key

Functionality with respect of the standard

Environmental impact reduction

Case History

Reduction of plastic materials and synthetic fabric use in the vehicles internal fitting

Local transport “TAF” internal fitting (operation since 1997)

Solution already applied in the past (wooden seats and metal components)

FS “centoporte” coach (years of operation: 1930-1988)

The De-Growth Innovation– Railway Examples

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Case History

Evolution trend

Metal handles and supports

Wooden seats

Fabric seats

Headrest, armrest and supports in plastics

Minimal presence of fabric on the seats replaced by aluminium

Metal supports

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The De-Growth Innovation– Railway Examples

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Case History

Evolutionary trend analysis

Wooden and metal internal fitting

Massive presence of plastics and synthetic tissue

Significant reduction in the use of plastics

Return to the past

Low environmental impact

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Case History

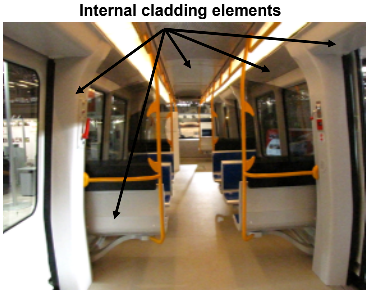
Environmental performance comparison per passenger unit
internal fitting of “Metro Copenaghen” – “Metro Brescia”

Metro Brescia
(end of project: 2008)

All aluminium components

Internal cladding elements

Passenger seats



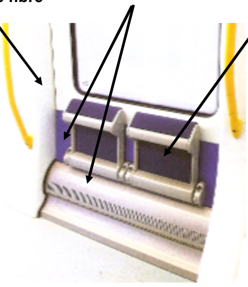
Metro Copenaghen
(end of project: 1999)

Components made of various materials

Phenolic resin with glass fibre

Aluminium

Fabric



The De-Growth Innovation– Railway Examples

Case History

Environmental performance comparison per passenger unit
Internal fitting “Metro Copenaghen” – “Metro Brescia”

1 Environmental impact assessment

- Entire life cycle analysis
  - Raw materials extraction
  - Processes
  - End of life
- Environmental impacts analysed
  - Resource consumption
    - Natural
    - Energetic
    - Water
  - Waste production
  - Potential impact
- Environmental impact calculation
  - Software Boustead Model

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The De-Growth Innovation– Railway Examples

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

1.1 Material resources consumption (kg)

Internal fitting "Metro Copenaghen"		Internal fitting "Metro Brescia"	
Bauxite	Total 32	Bauxite	Total 29
Air		Air	
Fe		Fe	
Other		Other	

Metro Brescia advantage: 8%

1.2 Energetic resources consumption (MJ)

Internal fitting "Metro Copenaghen"		Internal fitting "Metro Brescia"	
Oil	Total 1.314	Oil	Total 992
Hydro		Hydro	
Gas		Gas	
Other		Other	

Metro Brescia advantage : 24%

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

1.3 Water resource consumption (l)

Internal fitting "Metro Copenaghen"		Internal fitting "Metro Brescia"	
Unspecified	Total 1.817	Unspecified	Total 357
Public supply		Public supply	
Sea		Sea	
Other		Other	

Metro Brescia advantage : 80%

1.4 Waste production (kg)

Internal fitting "Metro Copenaghen"		Internal fitting "Metro Brescia"	
Mixed industrial	Total 133	Slags and ash	Total 37
Waste returned to mine		Waste returned to mine	
Mineral waste		Mineral waste	
Other		Other	

Metro Brescia advantage : 72%

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

1.5 Potential environmental impacts

POTENTIAL ENVIRONMENTAL IMPACTS	Metro Copenaghen	Metro Brescia	Metro Copenaghen	Metro Brescia	Best solution advantage
GWP, "Global Warming Potential" (kg $CO_2$100 eq)	5,611 · 10	2,947 · 10			47%
ODP, "Ozone Depletion Potential" (CFC-11 eq)	$1,6 \cdot 10^{-5}$	$4 \cdot 10^{-7}$			97,5%
AP, "Acidification Potential" (kg SO_2 eq)	$5,412 \cdot 10^{-1}$	$2,522 \cdot 10^{-1}$			53%
EP, "Eutrophication Potential" (kg PO_{43} eq)	$2,247 \cdot 10^{-1}$	$5,53 \cdot 10^{-5}$			100%
POCP, "Photochemical Ozone Creation Pot" (kg C_2H_4 eq)	$5,42 \cdot 10^{-2}$	$3,239 \cdot 10^{-2}$			40%

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

1.6 Total mass and recyclable percentage

	Total mass		recyclable mass %	
	Value (kg)	Advantage with respect to the worst solution	Value (kg)	Advantage with respect to the worst solution (recyclable Delta %)
Metro Copenaghen	17,37	/	81,23	/
Metro Brescia	10,81	38 %	98,35	17,11

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

2.1 Considerations on Metro Brescia vehicles energy consumption between two different interiors: "Brescia" type – "Copenaghen" type

Mass reduction vehicle equipped with "Brescia"type interiors (n° of passenger: 431)

2.827 kg

Linear extrapolation energy consumption per mass unit known total consumption and mass (105.100.320 MJ and 59.357 kg)

Energy consumption reduction vehicle equipped with "Brescia" type interiors with respect to "Copenhagen" type ones

5.005.620 MJ
(4,546%)

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The De-Growth Innovation– Railway Examples

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

2.2 Avoided impacts from energy reduction "Brescia" type interiors assessment

2.2.1 Material resources consumption (kg)

Avoided impacts from the energy consumption reduction	
Biomass	8.292
Fe	44
Limestone	9
Other	11
Total	8.356

% with respect to total life cycle vehicle with"Copenaghen" interiors:
2%

2.2.2 Energy resources consumption (MJ)

Avoided impacts from the energy consumption reduction	
Oil	5.262.508
Gas	5.235.239
Coal	1.892.846
Other	3.102.759
Total	15.493.352

% with respect to total life cycle vehicle with"Copenaghen" interiors:
4,43%

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Case History

Environmental performance comparison per passenger unit
Internal fitting "Metro Copenaghen" – "Metro Brescia"

2.2 Avoided impacts from energy reduction "Brescia" type interiors assessment

2.2.3 Water resources consumption (l)

Avoided impacts from the energy consumption reduction	
Unspecified	160.696
Public supply	788
Sea	201
Other	313
Total	161.998

% with respect to total life cycle vehicle with"Copenaghen" interiors:

1,41%

2.2.4 Waste production (kg)

Avoided impacts from the energy consumption reduction	
Waste returned to mine	12.872
Slags and ash	6.307
Regulated chemicals	1.686
Other	- 2.516
Total	18.349

% with respect to total life cycle vehicle with"Copenaghen" interiors:

0,84%

Case Study

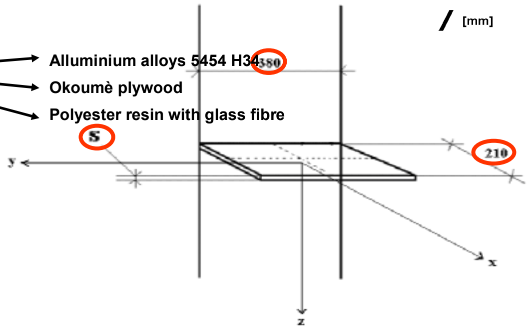
Functional and environmental performances comparison between materials
for the construction of a small passenger table

1. Analysis process

Comparison made with same performances between
- Alluminium alloys 5454 H34
- Okoumè plywood
- Polyester resin with glass fibre

1.1 Given the geometry and two dimensional parameters, the thickness "s" of the table and the related environmental data are detected in the three cases

1.2 Analysis and comparison of environmental performance of materials through Boustead Model



Case Study

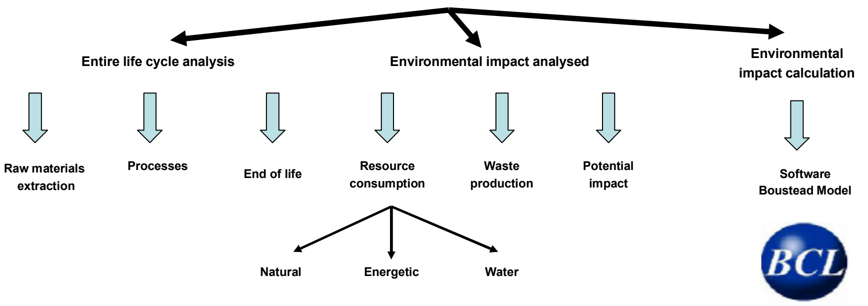
Functional and environmental performances comparison between materials for small passenger table construction

Sizing results	Yield strength (σ_{sn}) [MPa]	Density [kg · m^{-3}]	Minimum thickness (s) [mm]	Minimum mass [kg]
Aluminium alloys 5454 H34	235	2,67 · 10^3	3,68	0,79
Okoumè plywood	33	0,52 · 10^3	9,83	0,41
Composite material	196	2,58 · 10^3	4,03	0,83

Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2 Analysis and comparison of environmental performance



The De-Growth Innovation– Railway Examples

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Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2.1 Material resources consumption (kg): environmental indicator n°1

Aluminium alloy 5454 H34		Okoumè plywood		Polyester resin with glass fibre	
Bauxite	3,119	Fe	$9,5 \cdot 10^{-5}$	Sand (SiO2)	$2,74 \cdot 10^{-1}$
Air	0,363	Limestone	$2 \cdot 10^{-5}$	N2	$1,95 \cdot 10^{-1}$
Sodium chloride	0,064	Air	$8 \cdot 10^{-6}$	Air	$1,79 \cdot 10^{-1}$
Other	0,084	Other	$2 \cdot 10^{-5}$	Other	$2,53 \cdot 10^{-1}$
Total	3,630	Total	$1,43 \cdot 10^{-4}$	Total	$9 \cdot 10^{-1}$

Advantage over the worst solution :
Plywood 100%
Composite 75%

1.2.2 Energy resources consumption (MJ): environmental indicator n°2

Aluminium alloy 5454 H34		Okoumè plywood		Polyester resin with glass fibre	
Hydro	Total 111	Wood	Total 8,97	Gas	Total 42,59
Oil		Oil		Oil	
Gas		Gas		Coal	
Other		Other		Other	

Advantage over the worst solution :
Plywood 92%
Composite 62%

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Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2.3 Water resources consumption (l): environmental indicator n°3

Aluminium alloy 5454 H34		Okoumè plywood		Polyester resin with glass fibre	
Public supply	Total 31,519	Public supply	Total 0,04645	Public supply	Total 40,31
Unspecified		Unspecified		Unspecified	
Sea		Sea		Sea	
Other		Other		Other	

Advantage over the worst solution :
Plywood 100%
Aluminium 22%

1.2.4 Waste production (kg): environmental indicator n°4

Aluminium alloy 5454 H34		Okoumè plywood		Polyester resin with glass fibre	
Waste returned to mine	Total 4,893	Waste returned to mine	Total 0,01798	Slags and ash	Total 0,166
Mineral waste		Wood waste		Mineral waste	
Slags and ash		Regulated chemicals		Unregulated chemicals	
Other		Other		Other	

Advantage over the worst solution:
Plywood 100%
Composite 97%

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Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2.5 Potential environmental impacts: environmental indicators n°5-9

POTENTIAL ENVIRONMENTAL IMPACTS CALCULATION	Aluminium alloy 5454 H34	Okoumè plywood	Polyester resin with glass fibre
GWP, "Global Warming Potential" (kg $CO_2$100 eq)	0,3501	-0,362	1,77
ODP, "Ozone Depletion Potential" (CFC-11 eq)	$4 \cdot 10^{-9}$	$1 \cdot 10^{-11}$	$2 \cdot 10^{-7}$
AP, "Acidification Potential" (kg SO_2 eq)	$2{,}934 \cdot 10^{-2}$	0,00301	0,006
EP, "Eutrophication Potential" (kg PO_{43} eq)	$1 \cdot 10^{-6}$	$6 \cdot 10^{-8}$	$3 \cdot 10^{-5}$
POCP, "Photochemical Ozone Creation Pot" (kg C_2H_4 eq)	0,003577	$4 \cdot 10^{-4}$	$8 \cdot 10^{-4}$

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Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2.5 Potential environmental impacts: environmental indicators n°5-9

POTENTIAL ENVIRONMENTAL IMPACTS COMPARISON	Aluminium alloy 5454 H34	Okoumè plywood	Polyester resin with glass fibre	Advantage with respect to the worst solution
GWP, "Global Warming Potential" (kg $CO_2$100 eq)				Plywood 120 % Aluminium 80 %
ODP, "Ozone Depletion Potential" (CFC-11 eq)				Plywood 100% Aluminium 98%
AP, "Acidification Potential" (kg SO_2 eq)				Plywood 90% Composite 80%
EP, "Eutrophication Potential" (kg PO_{43} eq)				Plywood 99,8% Aluminium 97%
POCP, "Photochemical Ozone Creation Pot" (kg C_2H_4 eq)				Plywood 89% Composite 78%

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Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2.6 Total mass and recyclable percentage at life end : environmental indicators n°10-11

MASS AND RECYCLABLE PERCENTAGE	Total mass		Recyclable mass	
	Value (kg)	Advantage with respect to the worst solution	Value (kg)	Advantage with respect to the worst solution (recyclable Delta %)
Aluminium alloy 5454 H34	0,79	5 %	0,79	99 %
Okoumè plywood	0,41	51 %	0,328	79 %
Polyester resin with glass fibre	0,83	/	0,00259	/

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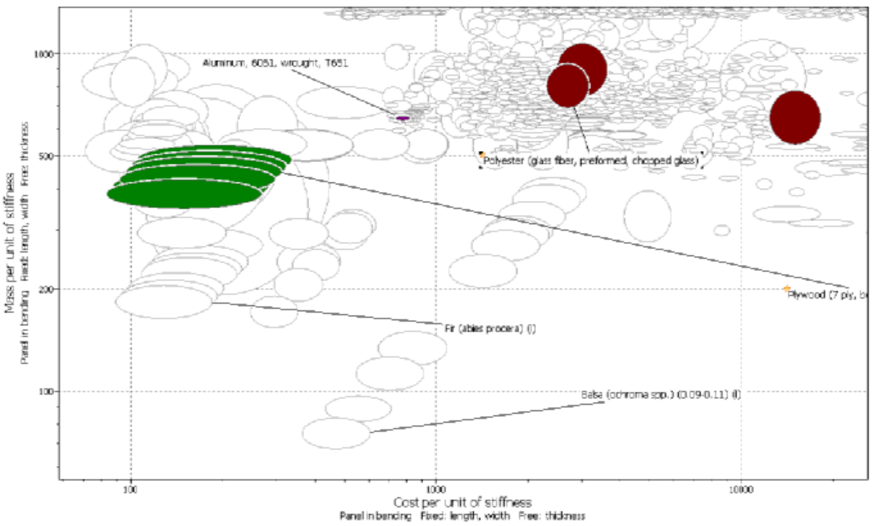
Case Study



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The De-Growth Innovation– Railway Examples

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Case Study

Functional and environmental performances comparison between materials for small passenger table construction

1.2.7 Results analysis and best material selection

BEST MATERIAL SELECTION	ENVIRONMENTAL INDICATORS COMPARISON											
	1	2	3	4	5	6	7	8	9	10	11	Total
Aluminium alloy 5454 H34	/	/	22	/	80	98	/	97	/	5	99	401
Okoumè plywood	100	92	100	99,6	120	100	90	99,8	89	51	79	1020,4
Polyester resin with glass fibre	75	62	/	97	/	/	80	/	78	/	/	392

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The De-Growth Innovation– Railway Examples

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Fire Safety and Environment

Also fire safety requirements and their relative design and constructive solutions, goes in these latest years in a direction oriented to take into account environmental aspects.

These design and constructive solutions regards both **active** and **passive** fire safety measures, and are mainly related to fire suppression/extinguishment measures in terms of active safety measures, and the choice of water based fire protection products as concern the passive measures.

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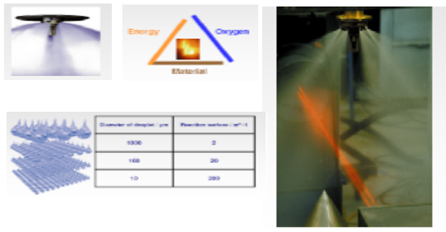
Fire Safety and Environment

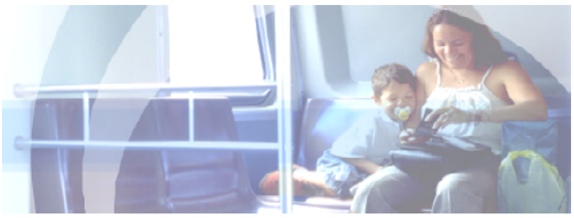
As concern the **active** fire safety measures, also in line with the changing in terms of regulations, the **Halon** based extinguishing agents have been prohibited and superseded by the use of inert gases (as mixtures or single gas) or water mist as extinguishing agents in fire suppression / extinguishment systems, so with an increasing in terms of environmentally friendly products and technologies.

New technologies of fire extinguishing systems by using of water mist



As concern the **passive** fire safety measures, the use of water based fire protection products (intumescent paints) instead of solvent base products, is a process that strongly reduces the emission in atmosphere during the production phase.

Thanks for the attention



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Believe in 3R: *Reduce, Reuse* and *Recycle*