

Life Cycle Assessment in railway industry

3-4 november 2011

TRANSPORT |

ALSTOM

Agenda

1st topic

Eco-design Framework

2nd topic

Ecodesign Metier

3rd topic

Improvement Axis

4th topic

Ecodesign on Rolling Stocks : Exemple

Eco-design Framework

Eco-Design

Integration of environmental parameters in design product to control and reduce its environmental impacts

To

Design products conform to customers expectations and reducing environmental impact on its life cycle as far as possible

Eco-design Framework : Main Steps



Analysis

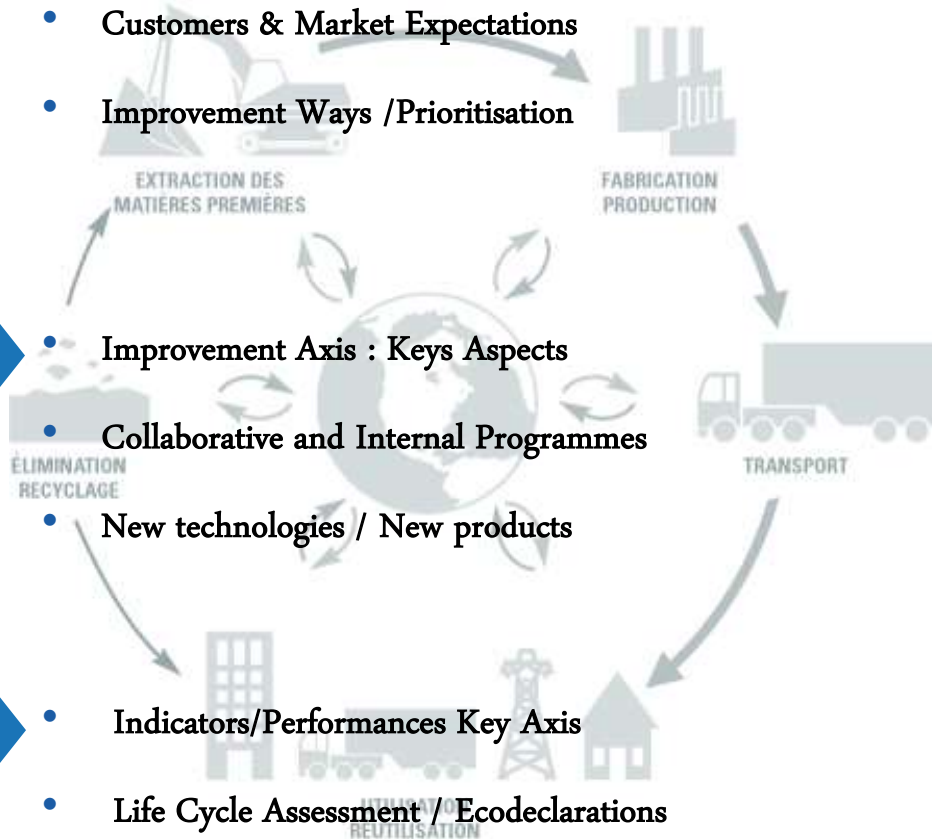
- Environmental Analysis on Life Cycle / Life Cycle Assessment
- Customers & Market Expectations
- Improvement Ways / Prioritisation

Planning -Improvement

- Improvement Axis : Keys Aspects
- Collaborative and Internal Programmes
- New technologies / New products

Check & Justify

- Indicators/Performances Key Axis
- Life Cycle Assessment / Ecodeclarations



September 2010

ECO-DESIGN POLICY



In agreement with Alstom's general EHS policy and the UITP charter on sustainable development signed in 2004, Alstom Transport undertakes to support the respect of the environment in the development of all its products and to be a leading player in the railway market in meeting the needs of sustainable mobility. This eco-design policy covers all product lines of Alstom Transport.

« I ask Operations Management members to set up an organization which enables the respect of these commitments :

- *Set up a continuous improvement program for the environmental performance of our product.*
- *Set up progress plans for controlling and reducing the environmental impact of our products all along their life cycle by:*
 - *reducing energy consumption,*
 - *using clean & recyclable materials*
 - *reducing noise levels and vibrations*
 - *limiting fluid and / or particle emissions,*
 - *taking into account the needs of landscape integration.*

Each Alstom Transport manager is responsible for the enforcement of this Eco-Design Policy. I encourage all employees to support these principles »

Jean-Louis RICAUD
Chief Operating Officer

OUR COMMITMENT FOR ENVIRONMENT-FRIENDLY PRODUCTS

- **Promote** the manufacturing of its products in ISO 14001 certified sites, internally, at suppliers' and sub-contractors'.
- **Design and manufacture** all products with a view to controlling and reducing their impact on the environment **all along their life cycle.**
- **Reduce** our contribution to environmental impacts & global warming.
- **Inform** our customers of the application of this Eco-Design Policy.
- **Manage** environmental aspects in a pro-active way, cooperating with all stakeholders.
- **Respect and anticipate** all legal and regulatory requirements.

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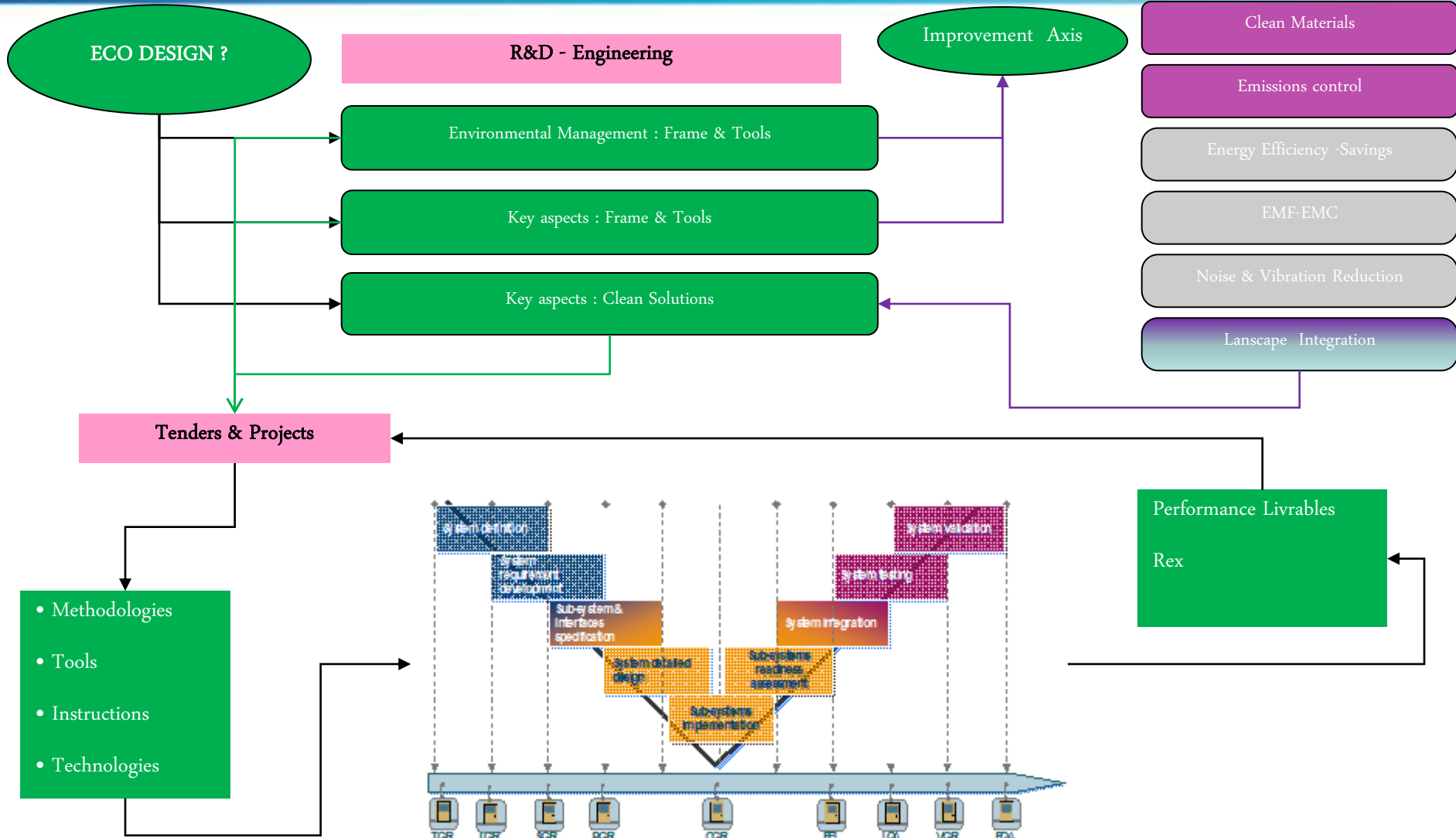
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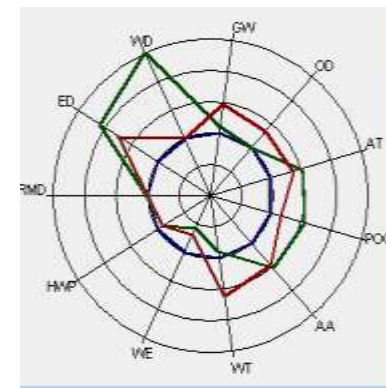
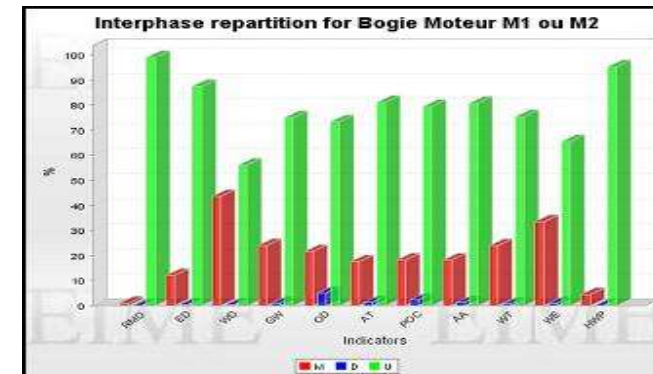
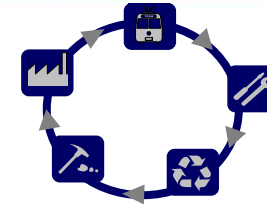
Eco-design Metier



Eco-design Metier



- Normative
 - ISO 14001
 - ISO 14040 & ISO 14021-25
- Tools
 - Life Cycle Assessment : EIME®
 - Instructions :
 - 9 Operational Instructions
 - 1 Standard Specification : DTRF150650
 - 2 Design Review Checklists
 - Data management : in PDM PLM
 - Environmental Product Declaration
- Priorities
 - Policy and Framework Deployment
 - Life Cycle Assessment : improve use and easiness
- Programmes
 - Internal : Improvement & coupling PDM/PLM
 - Collaboratives :
 - LCA Model integration in design optimisation
 - UNIFE LCA TG (PCR 2009: 05 (495)-Label)



Bleu : huile minérale
Rouge : huile silicone
Vert : Ester (Midel)

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Ecodesign on Rolling Stocks : Exemple

Improvement Axis : Clean Materials



Priorities

- Materials “without” dangerous substances (SVHC) - REACH
- Renewable Materials –Biomaterials/ Long life duration & Recyclable
- Low Impactive & Sober regarding Energy, Raw material and water (LCA)



Actions

- Engineering Instructions and Check Lists
- REACH Project
- Referential on Recyclability & Valorisability
- Integration LCA in design choices



Solutions

Halogen Free Solutions
CrVI free solutions
Water based Paints

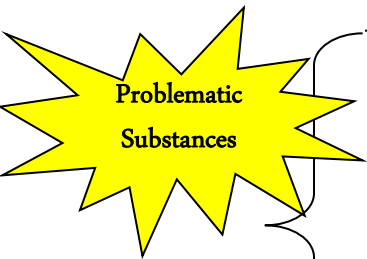
Green Floor
Biodegradable Oils
Light Materials & Assemblies

Recyclability = 85 à 90 %
Valorisability = 90 à 98 %

Improvement Axis : Clean Materials



PRIORITY 1 : REACH



Restriction on the marketing and the use

Prohibited

Autorisation, June 2008/Fev 2011/Fev 2013

Prohibited unless

Communication (2008) & Notification (2011) :

Prohibited unless

Registration :

Information follow up

Annexe XVII

Submitted Autorisation :
6 Annex XIV : 14

Candidates Substances:
(46 puis 300 puis ??)

Substance of Very High Concern (SVHC)
CMR 1 ou 2, PBT / vPvB, equivalent concern

CMR 1&2 : 886; CMR 3 : 231

Dangerous substances acc. directive 67/548/EEC or
CLP Regulation n° 1272/2008

Listed : ~3400

Other Substances : Pre-Registered (More than 70000)

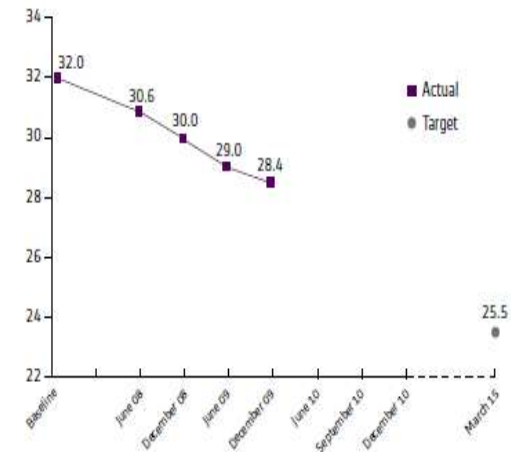
A environment Friendly production

Impact management

- **An efficient management system of impacts** (EHS roadmap) at level group, with a reporting by indicators

Group targets

- **Reduction of the energy intensity and CO2 emissions** by 20% before 2015
- Waste recycling: 80% before 2015
- Water consumption reduction: 20% before 2015 in zones submitted to limitation
- ISO 14001 Certification of all productions sites before 2012
- VOC emissions reduction : 10% before 2015
- SF6 emissions reduction: 3 % per year
- Established by sectors of ecodesign policy



Heavy Investments

- Tarbes renovation : 20 M€
- Construction of a plant in Chennai, India

Ecodesign

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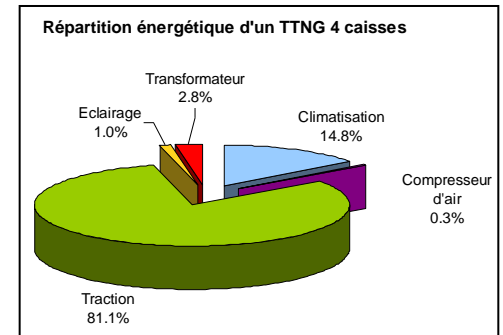
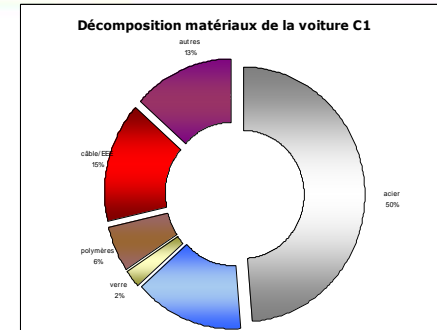
Improvement Axis

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Ecodesign on Rolling Stocks : Example

Ecodesign on Rolling Stocks

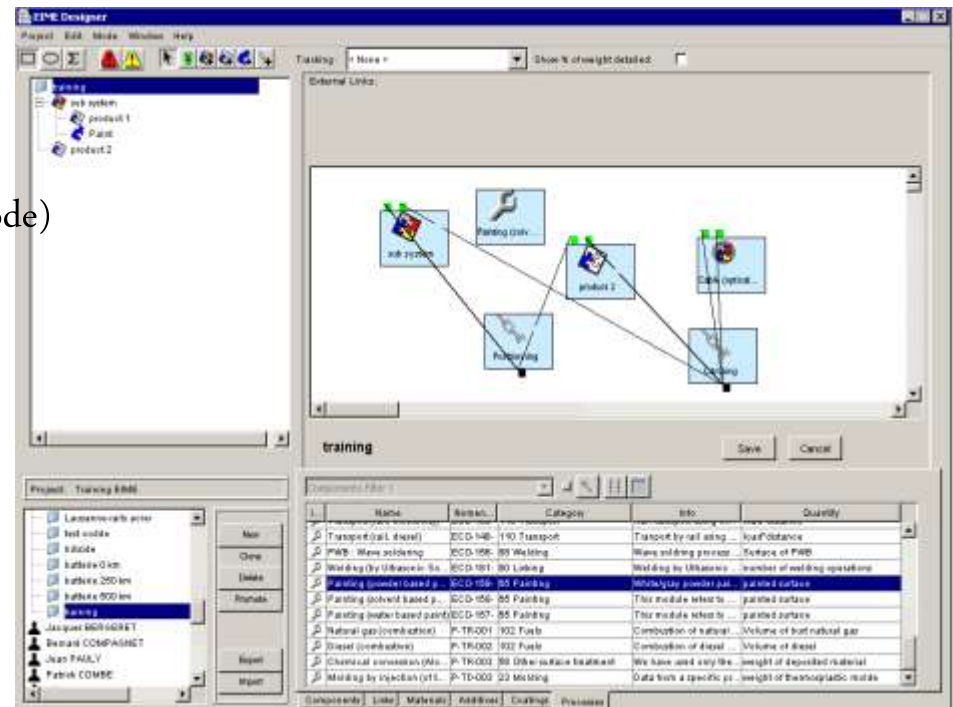
- Use of adapted materials:
 - 89% recyclable
 - 93% valorisable
- Reduction Energy consumption:
 - Electrivalcal : 2,67 Kwh/Km
 - Traction optimised – Reduction starting effort
 - HVAC : 33 % of the time in half power
 - Air production: - 14 %
 - Lighting: -23 %
- Low VCO emissions and particle brake
- Life Cycle Assessment



Ecodesign on Rolling Stocks

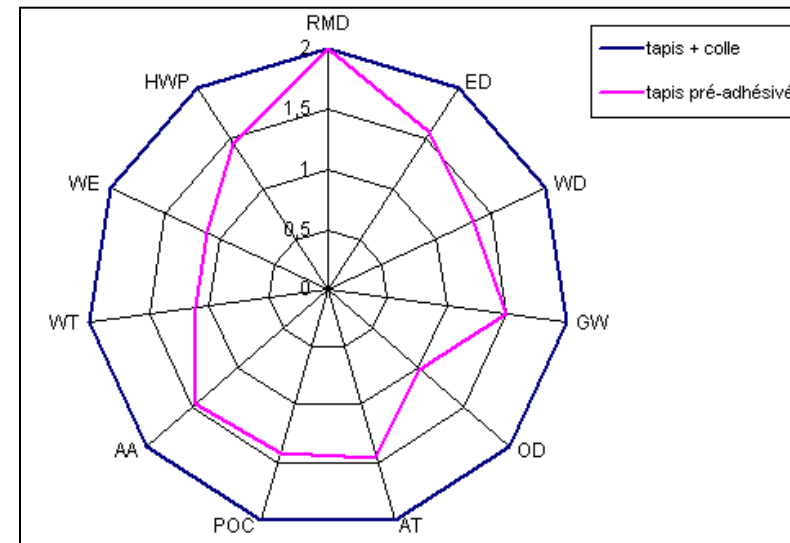
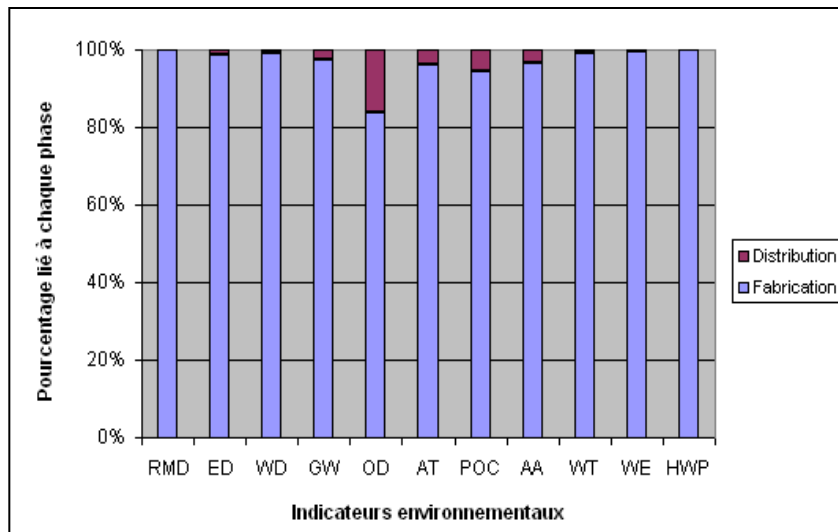
Comparative study on 2 Floor Covering solutions

- Fonctionnal Unit : Covers 1 m²
- Input :
 - Materials type and Qty
 - Life Duration
 - Distribution phase (Distance & Transport Mode)



Ecodesign on Rolling Stocks

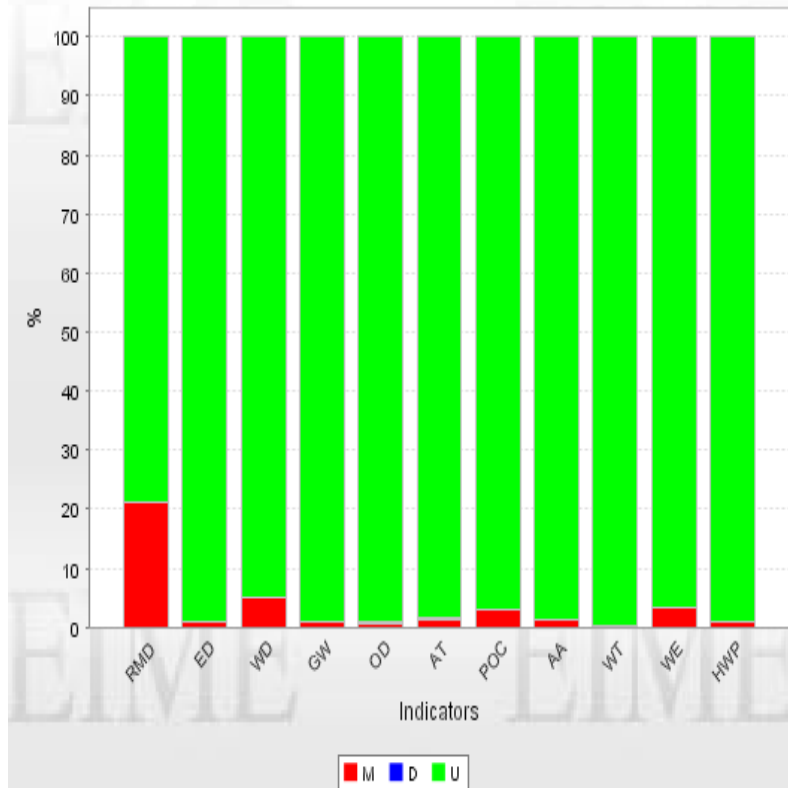
Indicateurs	Abréviation	Unité	tapis + colle				tapis pré-adhésivé			
			S=M+D+U	Fabrication	Distribution	Utilisation	S=M+D+U	Fabrication	Distribution	Utilisation
Raw Material Depletion	RMD	Y-1	1,11E-10	1,11E-10	2,16E-15	0	1,11E-10	1,11E-10	9,47E-16	0
Energy Depletion	ED	MJ	6,70E+04	6,55E+04	1,59E+03	0	5,20E+04	5,13E+04	6,95E+02	0
Water Depletion	WD	dm3	1,13E+04	1,11E+04	1,51E+02	0	7,51E+03	7,44E+03	6,59E+01	0
Global Warming	GW	g ~CO2	2,94E+06	2,81E+06	1,27E+05	0	2,20E+06	2,14E+06	5,57E+04	0
Ozone Depletion	OD	g ~CFC-11	4,86E-01	3,97E-01	8,88E-02	0	2,43E-01	2,04E-01	3,89E-02	0
Air Toxicity	AT	m3	7,55E+08	7,04E+08	5,00E+07	0	5,48E+08	5,26E+08	2,19E+07	0
Photochemical Ozone Creation	POC	g ~C2H4	1,86E+03	1,89E+03	1,89E+02	0	1,32E+03	1,25E+03	7,40E+01	0
Air Acidification	AA	g ~H+	5,74E+02	5,42E+02	3,25E+01	0	4,17E+02	4,02E+02	1,42E+01	0
Water Toxicity	WT	dm3	1,89E+06	1,88E+06	1,56E+04	0	9,40E+05	9,33E+05	6,85E+03	0
Water Eutrophication	WE	g ~PO4	5,02E+02	5,00E+02	2,09E+00	0	2,79E+02	2,78E+02	9,14E-01	0
Hazardous Waste Production	HWP	kg	3,23E+01	3,22E+01	4,67E-02	0	2,33E+01	2,33E+01	2,05E-02	0



Ecodesign on Rolling Stocks

Résultats : Transformateur

Interphase repartition for transfo



Recyclability rate: 32.66%
No dangerous material

Impacts	EIME
RMD (Y^{-1})	4.9593e-11
ED (MJ)	3.8156e7
WD (dm^3)	5.7026e6
GW ($g \sim CO_2$)	1.8005e9
OD ($g \sim CFC_{11}$)	1.5508e2
AT (m^3)	3.49e11
POC ($g \sim C_2H_4$)	6.3844e5
AA ($g \sim H^+$)	2.8668e5
WT (dm^3)	4.3517e8
WE ($g \sim PO_4$)	5.2851e3
HWP (Kg)	2.8718e4

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