European Automobile Manufacturers Association

Design for X
Evolutionary Steps

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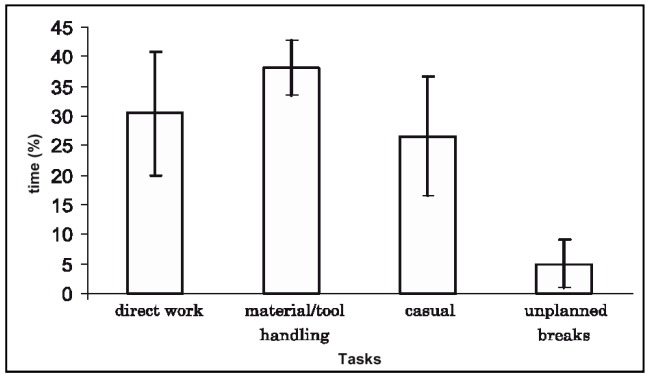
Evolution of DfX – Example: vehicles

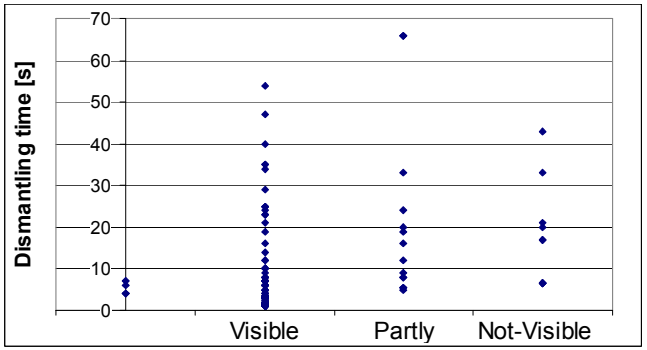
- **Early 90es – Design-for-Disassembly (Accessibility, type & number of fastener, parts marking etc.)**

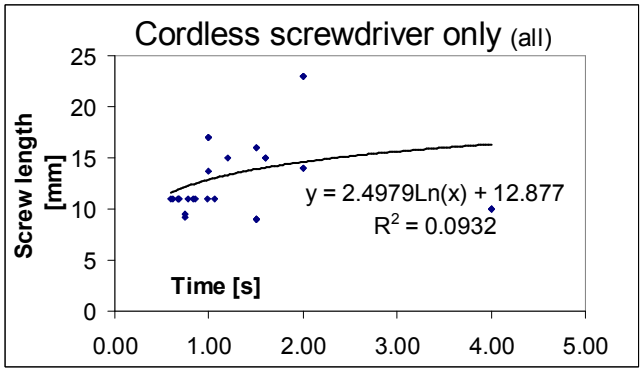
Initiatives of Manufacturers

- Dismantling information
- **IDIS (International Dismantling Information System) – Initiative started in the mid ‘90ies – International consortium of 24 OEM’s – it was developed to meet the legal obligations of the EU ELV directive**
- **Enables identification of component and hazardous materials for dismantling and promotes the environmentally sound treatment of ELV’s, safely and economically.**
- **www.idis2.com**

Impact of DfDismantling !?







- 70 % of real world dismantling time not linked to type of design **[Kazmierczak et al 2005]**
- **Remaining 30 % mainly weak potential impacts.**
- **EU funded SEES project made comprehensive analysis of design parameters (visibility, accessibility, fastener type etc.) and dismantling time (475 dismantling actions analysed)**
- **SEES found** no significant correlation between design parameters and dismantling time **(besides number of previous parts).**

Source: EU funded SEES project (TU Berlin (project coordination), Ford et al.)

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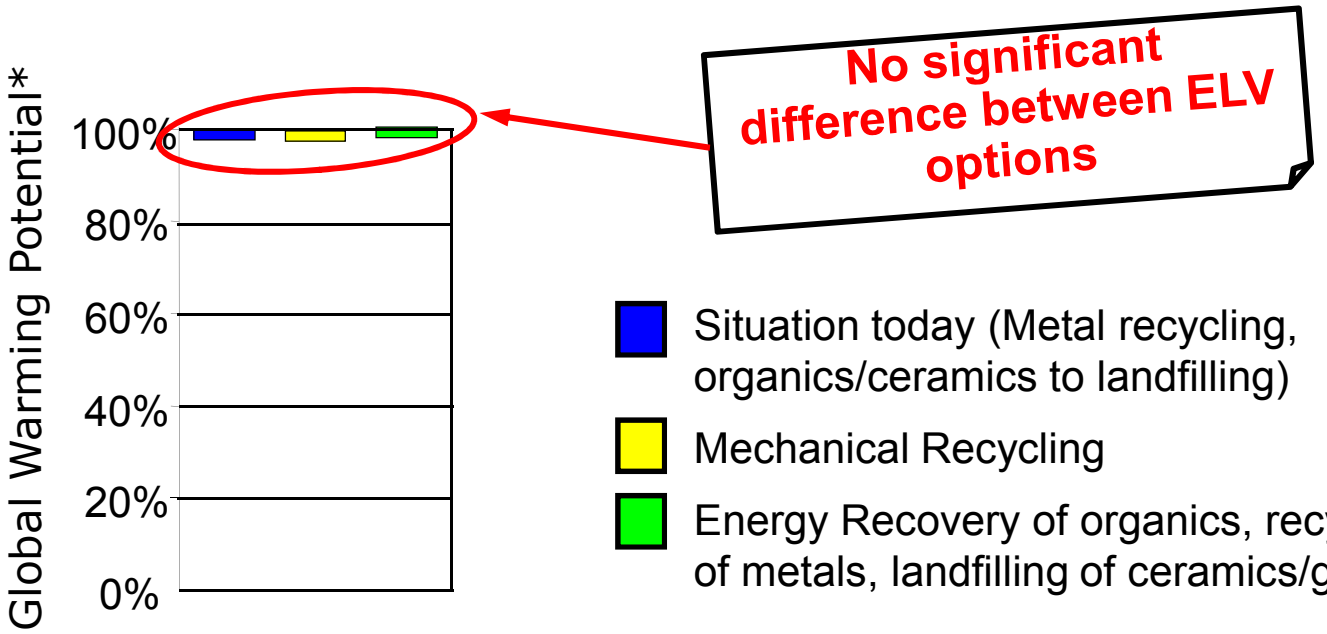
What are the impacts of ELV technology variation on the overall environmental profile?



Answer: No significant environmental difference between different EOL technologies

Similar results for other environmental impacts & resource depletion

* Similar for other environmental impact

Source: EU funded, ISO14040 reviewed LCA LIRECAR

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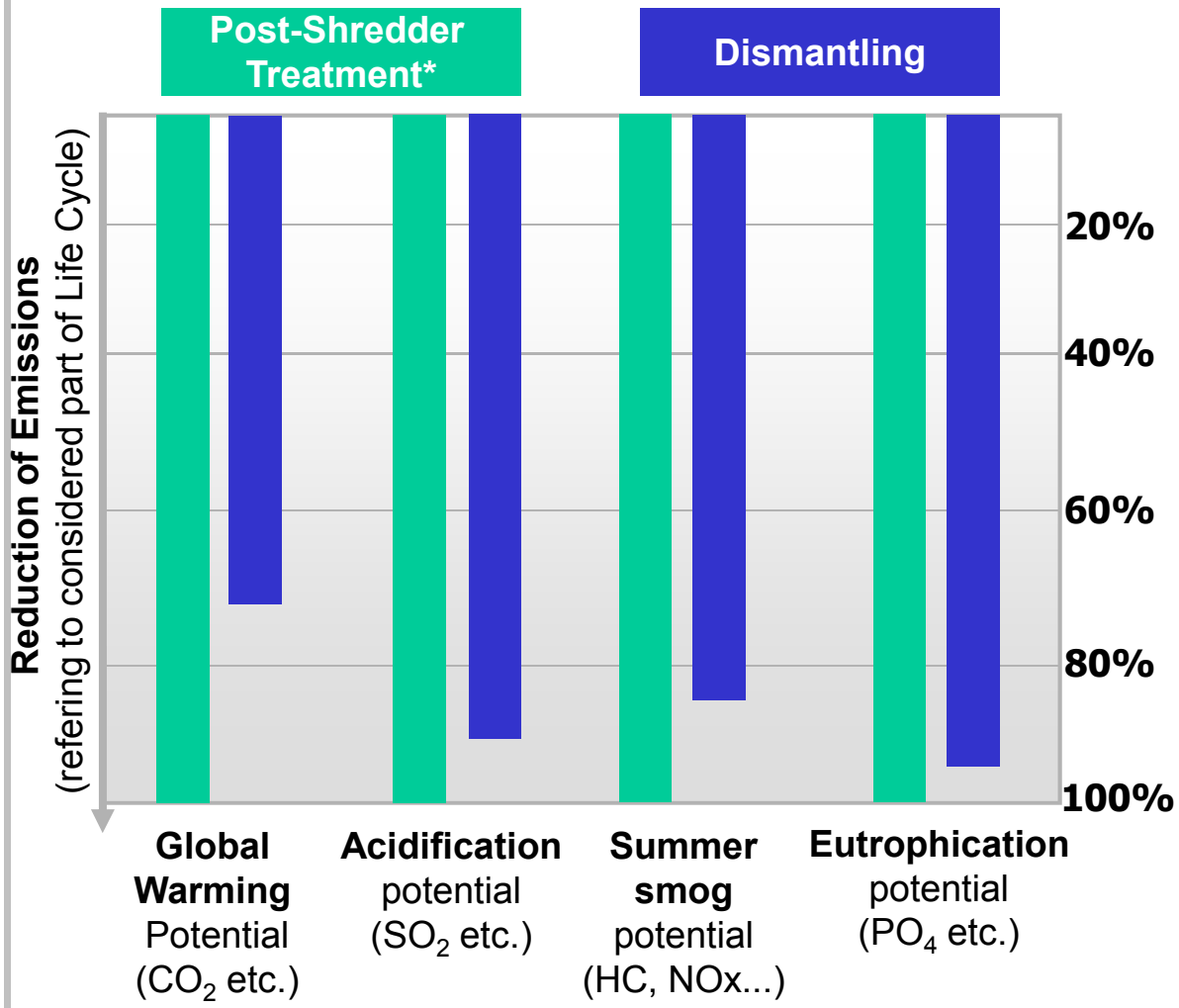
  - Post-Shredder Treatment (i.e. infrastructure/non-design solution) is environmentally favourable !!

Post-Shredder Treatment (PST) vs. dismantling / mechanical Recycling



- **VW-SiCon-Process is a process where no dismantling is necessary & mainly feedstock recycling is done**
- **This SiCon-Process results in more environmental credits compared to a dismantling & mechanical recycling.**
- **Sensitivity analysis demonstrates that this advantage remains also for bigger facilities (longer transport distances).**
- **Note: This advantage is mainly due to better yields**

Source: ISO14040 reviewed LCA study of VW

* Sicon

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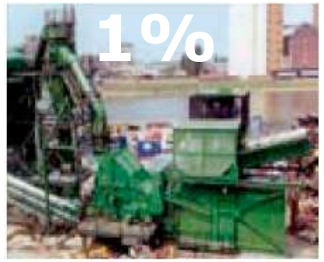
- **Mid 90es – Df Recycling (DfD + material complexity / compatibility, recycled content)**
  - Life Cycle Assessment studies show minor effect of recycling for non-metals !!
  - Real world time measurements showed no significant impact of DfD/design on dismantling times !!
  - Post-Shredder Treatment is environmentally favourable !!
- **Late '90es – Design-for-Environment (DfE) (Life Cycle Thinking based, decreasing DfD/R content due to development above)**
  - Life Cycle Assessment studies show minor effect of material selection / dominance of already regulated use phase.

Revision ERP Scope: What life cycle phase could be significant looking at vehicles?

Materials & Parts

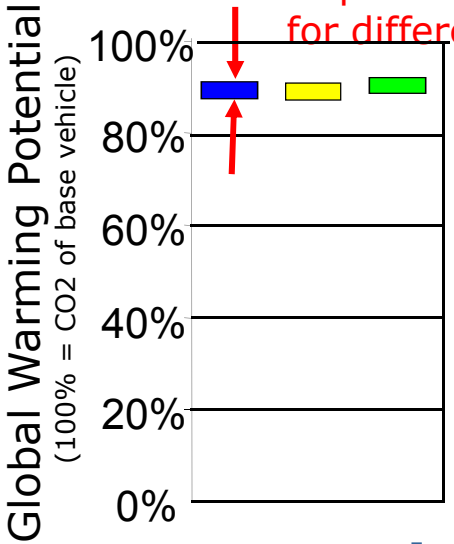
Manufacture and Assembly

Vehicle Use



End of Life

Impact of material differences (max-min) → Eco-design impact for different materials (7 completely different lightweight strategies)



- Situation today (Metal recycling, organics/ceramics to landfilling)
- Mechanical Recycling
- Energy Recovery of organics, recycling of metals, landfilling of ceramics/glass

* Similar for other environmental impact;
Source: EU funded, ISO14040 reviewed LCA LIRECAR

Use phase dominant / no significant impact of individual components, materials even if covering whole vehicle

…however this and all other phases are well covered by existing COM legislation

- **Manufacturing/design phase, for example:**
  - IED (industrial emissions directive)
  - End of Life Vehicle Directive (substances, parts marking, information obligations etc.)
  - Batteries Directive
  - RRR directive (recyclability)
  - REACH
  - ETS Directive

- **Use phase for example:**
  - CO2 Regulations (limits, labelling, etc.)
  - Emission regulations (Euro standards, etc.)
  - Exterior Drive-by Noise limits
  - Fuel Quality Directive
  - Renewable Energy Directive

- **End-of-Life phase, for example:**
  - End of Life Vehicle Directive (recycling targets)
  - Batteries Directive
  - Waste Oil Directive

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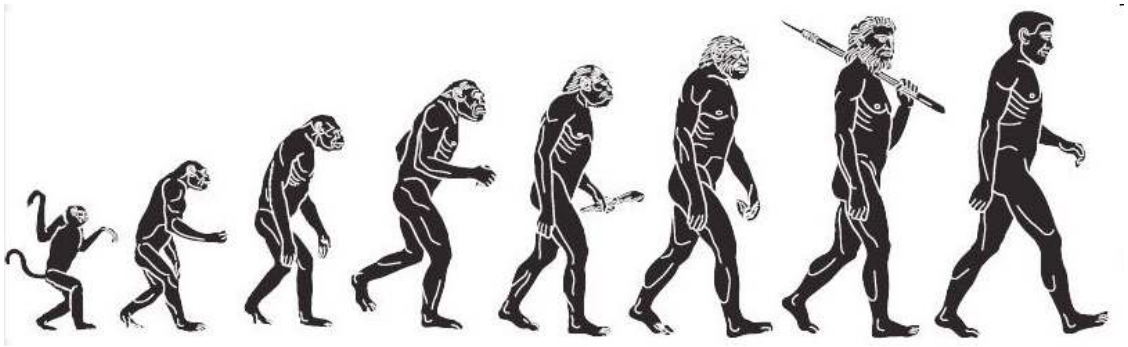
- **Starting 2000: Design-for-Sustainability**
  (balancing with customer costs, safety, etc.)

Conclusion

- **Long history of eco-design actions in automotive industry with high effort. However, Design-for-Dismantling/Recycling/Environment actions do not significantly change the life cycle.**

- **Infrastructure measures / Truly integrated approach often superior (e.g. for recycling no design changes necessary because PST can treat material mxi).**

- **Biggest leverage with action referring directly to use phase – but this is already regulated**

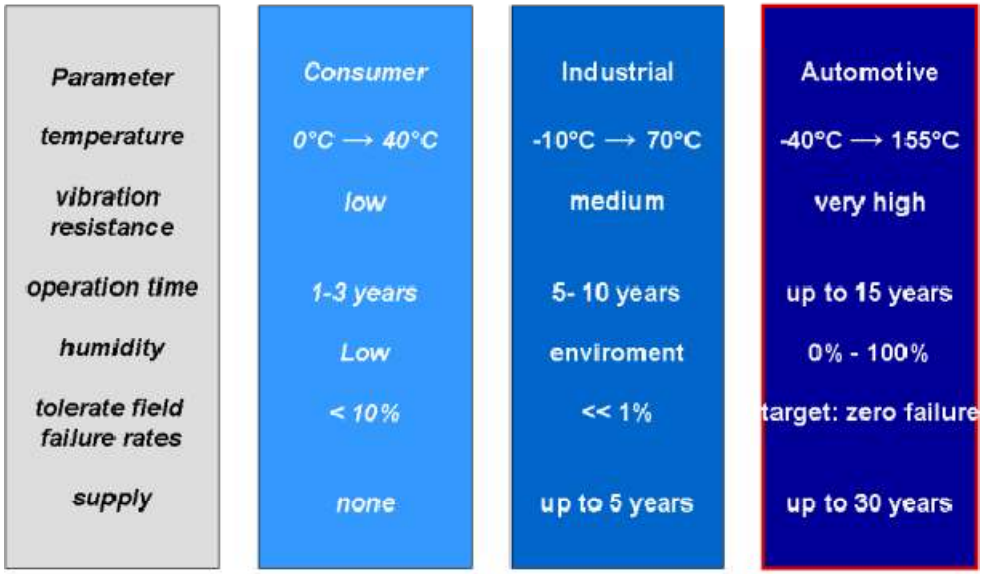


Back-up – Also parts of vehicles already well covered

• Type Approval of vehicles is complex and includes individual subsystems (e.g. lightening, air-conditioning etc.) but also impact of all parts (e.g. recyclability)

• Additional legislation is already in place for specific parts covering sufficiently all aspects (various regulations on tyres, mobile air-conditioning, substance restrictions, etc.)

•Technical requirements for components in the automotive environment are often more aggressive than for other areas (see example for electronics as discussed when looking at substance restrictions of the End-of-life Vehicle directive)



→ automotive energy-using/related components might slow down progress on implementing measures for other areas