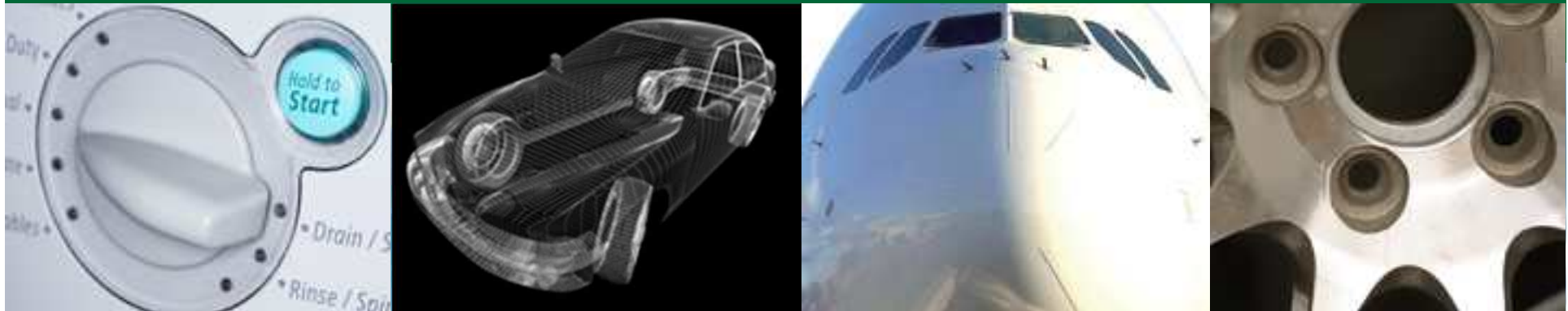


E m I T
CONSORTIUM

LSD
L S D I G I T A L

Environmental Materials Information Technology



www.emitconsortium.com

www.lsdigital.co.kr

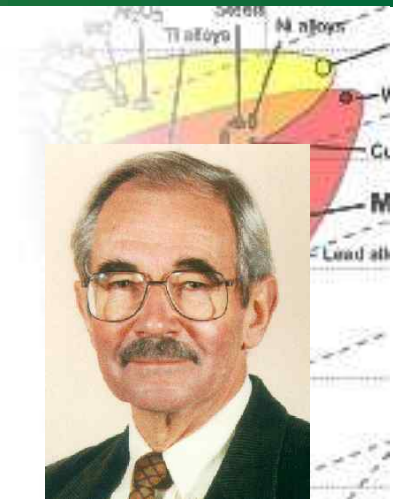
Granta's Materials background

- **Granta's history**

- **Founded in 1994(in korea 2008)**
- **Professor Mike Ashby, University of Cambridge**
- **Technology firsts include**
 - ▶ **Materials selection technology (Ashby charts, performance indices, cost per unit of function...)**
 - ▶ **Integrated materials data management for the full materials data lifecycle (with the MDMC)**
 - ▶ **Software-based teaching of materials engineering**

- **Ownership**

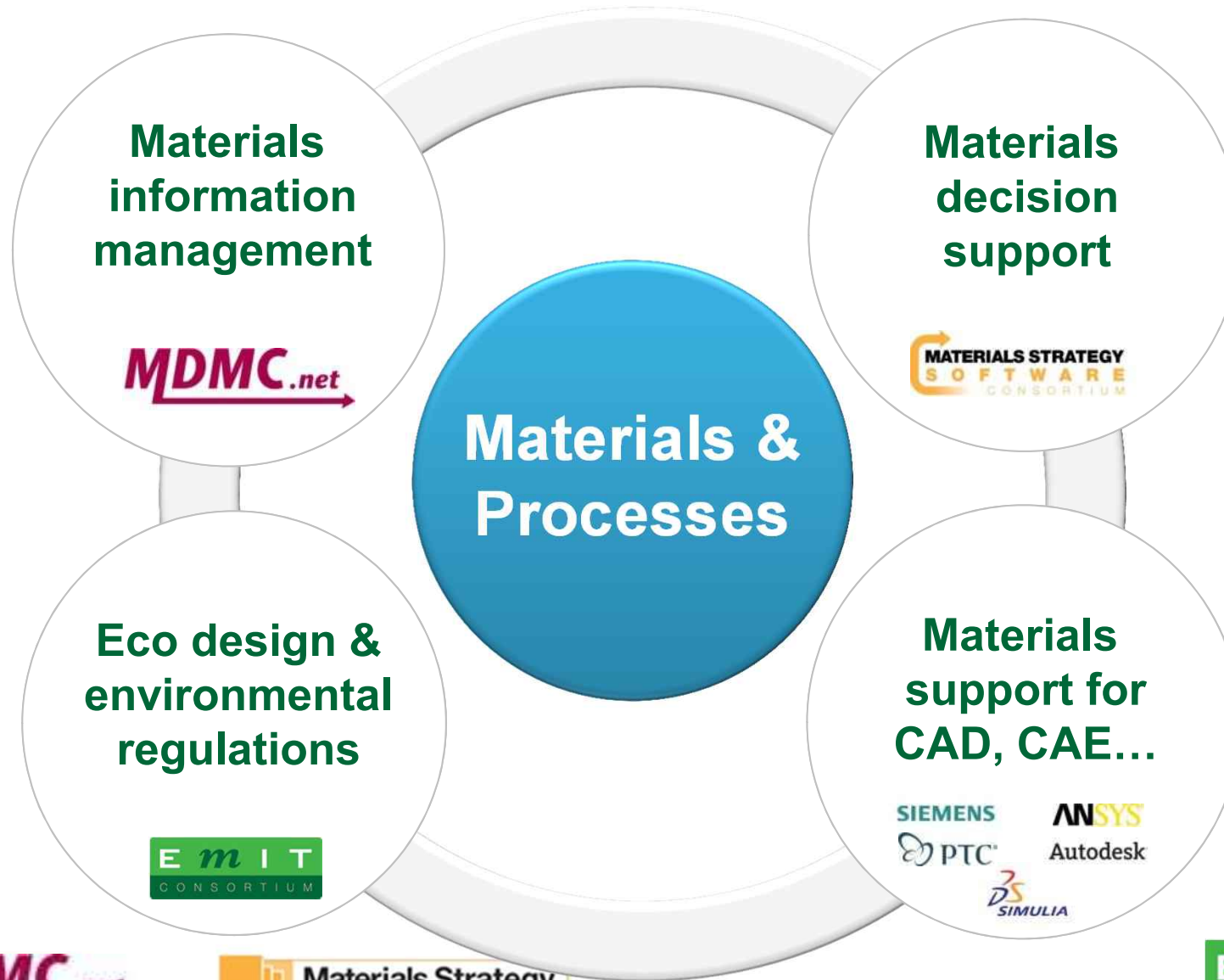
- ▶ **Founders & employees**
- ▶ **University of Cambridge**
- ▶ **ASM International – the world's largest professional society for materials engineers (~40,000 members)**



The materials information technology experts



Partnership with customers



Partnership with customers

Two key current focus areas:

Today's topic

Eco design for low energy, low carbon footprint...

Restricted substance regulations (e.g., REACH)

Drivers for Uni(Eco) Design of company today

- 환경규제 준수
- 혁신과 성장
- 고객과 관련 이해관계 보고
- 소재 및 자원의 가용성
- Cost

UK carbon label goods sales 'pass £2bn-a-year mark'

By Mark Kinver
Science and environment reporter, BBC News

Sales of products carrying labels that show the goods' carbon footprint are set to pass £2bn a year, say the scheme's operators.

The Carbon Trust, which oversees the accreditation programme, says nine out of 10 UK households bought a carbon-labelled product in the past 12 months.

Launched in 2007, the scheme covers more than 90 brands and 5,000 products, including pasta, bread and shampoo.

Critics question whether such schemes change people's purchasing behaviour.



The New York Tim

China Still Bans Rare Earth to Japan



David Gray/Reuters

The rare earth metal lanthanum is poured into molds at the Jinyuan smelting workshop near the town of Damao in China.

By KEITH BRADSHER
Published: November 10, 2010

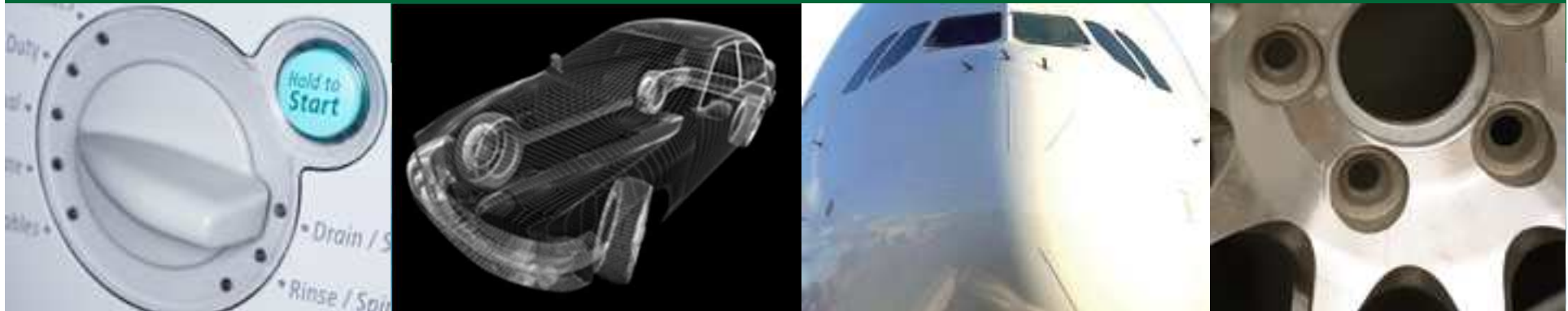
HONG KONG — The Chinese government is continuing to block shipments of crucial strategic minerals to Japan, according to industry executives, analysts and a Japanese official.



E m I T
CONSORTIUM

LS D
L S D I G I T A L

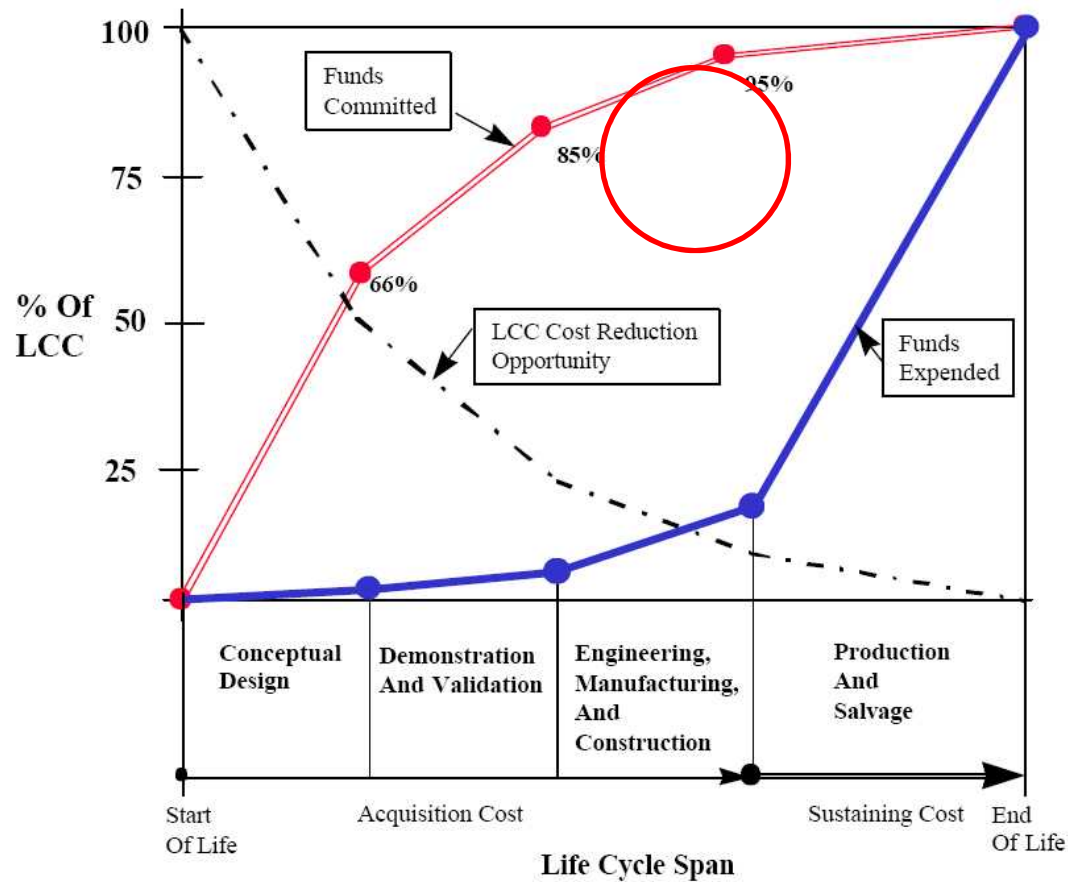
EMIT Consortium



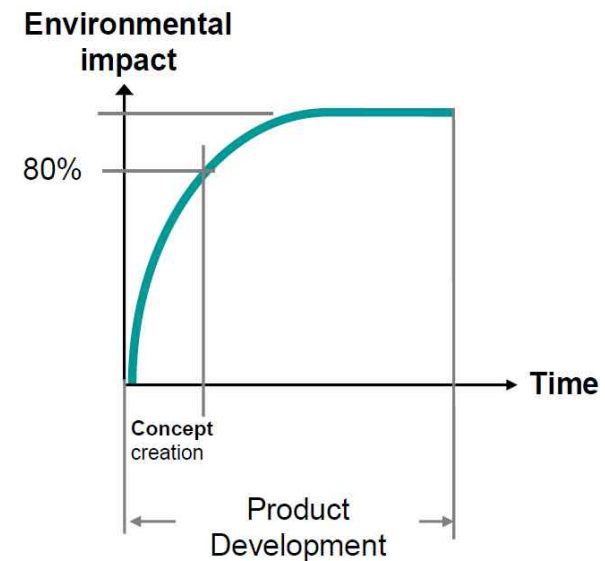
www.emitconsortium.com

www.lsdigital.co.kr

Project Funding Trends by Commitment and Expenditure of Lifecycle Cost (LCC)

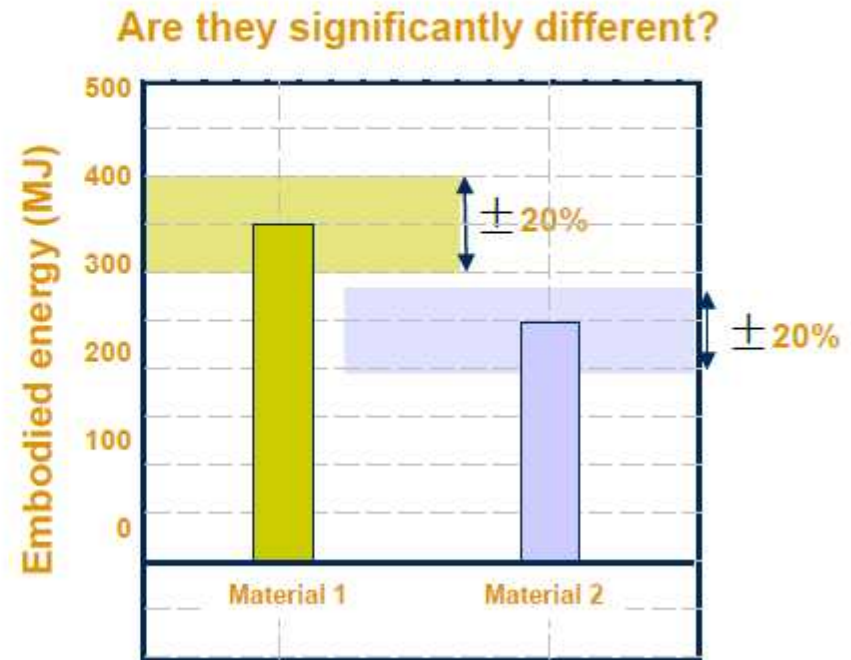
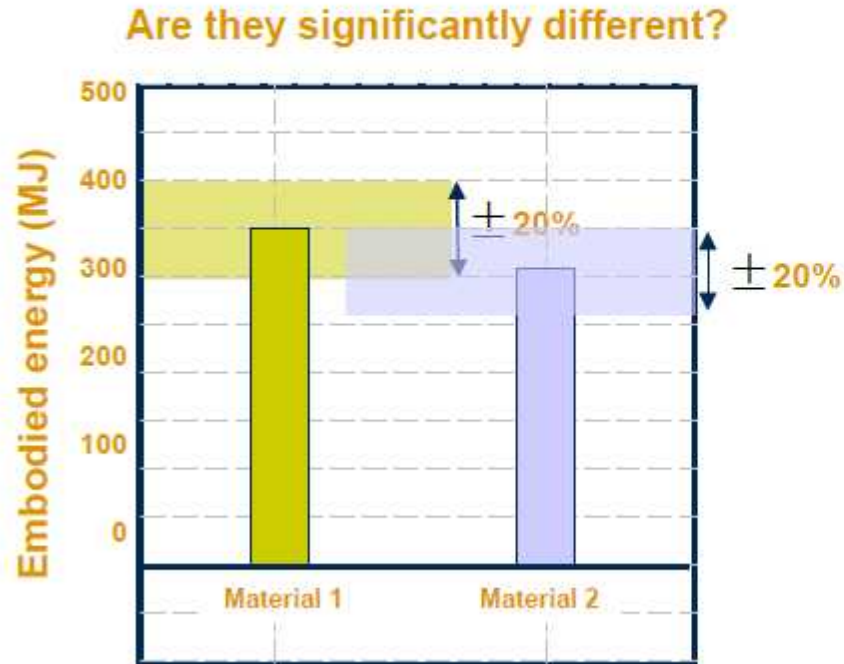


85% of life cycle costs and environmental impact is built-into products during design



Recognising low data precision

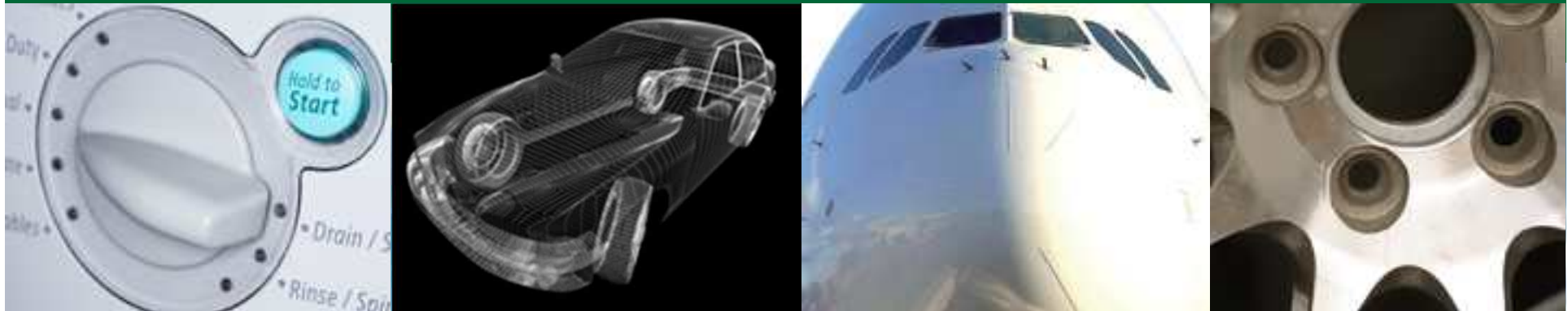
Data precision $\pm 20\%$



Tip #2

Imprecise data can support precise design decisions

Restricted Substances



Restricted Substances - Introduction



- **A wave of hazardous/restricted substances regulations:**

- COSHH, WEEE/RoHS, Seveso, REACH, ...
- 30 different regulations in Granta's database (so far)
- EU, UK, USA
- Regulations are continuously evolving



- **Failing to keep up has \$\$\$ implications:**

- Extensive “fire-fighting” assessments at very short notice
- Failure to get products approved
 - ▶ Expensive late-stage modifications or materials substitutions
- High clean-up costs



- **REACH – major business implications for many industries**



LSU
LSDIGITAL
MATERIAL INTELLIGENCE



E m I T
CONSORTIUM

Restricted Substances Reference Database

- **Europe**
- EC Regulation 2037/2000 (Ozone Depletion)
- EU Directive 1996/82/EC (Seveso II)- **EU Directive 2003/105/EC**
- EU Directive 1999/13/EC (Solvent Emissions Directive - VOC)- **Directive 2004/42/EC**
- EU Directive 2000/53/EC (ELV)
- EU Directive 2002/95/EC (RoHS)
- EU Directive 2002/96/EC (WEEE)
- EU Directive 2005/32/EC (EuP)
- EU Proposed Directive COM2004(320)
- ASD/SAE-STAN 9536
- REACH
 - - **Annex XIV - Authorisation List**
 - - **Annex XV - SVHCs**
 - - **Annex XVII – Restrictions**
 - - **EINECS list**
 - - **ELINCS list**
 - - **Pre-registration**
 - - **Registry of intentions**
- **USA**
- **Clean Air Act (CAA)**
 - - **Ozone-Depleting Substances Pro**
 - - **US Air Toxics Regulations (NESHAP)**
- **CERCLA/SARA/EPCRA**
 - - **EPCRA, Section 302, EHS TPQ**
 - - **EPCRA, Section 313 TRI**
 - - **EPCRA, Section 304, EHS RQ**
- **National Toxicology Programm (NTP) - Report on Carcinogens (RoC)**
- **National Waste Minimization Program - Priority Chemicals**
- **Persistent Organic Pollutants List (POP)**
- **Severely restricted pesticides, Prior Informed Consent (PIC)**
- **US Department of Homeland Security (DHS) - Chemicals of Concern (CoC)**
- **US EPA 33/50 Program (EPA 17 materials)**
- **Asia**
- **China RoHS**

The important questions

Critical business questions:

What restricted/hazardous substances are used in your products?

Either in materials, or in their processing?

What current legislation on restricted substances affects your products?

In your country? Abroad?

What future legislation will affect your products?

Associated information questions:

What are all the materials that all your products are made from?

What processes are used to manufacture and maintain each component?

What restricted substances are used in each material and/or process?

➔ **What materials information technology solution is needed to answer these questions?**

Inside the Restricted Substances Database

10만개
소재정보

- MaterialUniverse
 - Ceramics and glasses
 - Hybrids: composites, foams, natural materials
 - Metals
 - Polymers
 - Elastomers
 - Thermoplastics
 - Thermosets
 - Allyl Diglycol Carbonate
 - Epoxy
 - MF (Melamine Formaldehyde)
 - PF (Phenol Formaldehyde)
 - PI (Polyimide)
 - Polyester
 - PUR (Polyurethane)
 - UF (Urea Formaldehyde)

소재 공정 별
정보

규제물질 정보

- Restricted Substances
 - 0-9
 - A
 - [A mixture of 4-\[\[bis-\(4-fluorophenyl\)met](#)
 - [A mixture of N-\[3-hydroxy-2-\(2-methylac](#)
 - [Abamectin \[71751-41-2\]](#)
 - [Absorption oils, bicyclo arom. and heter](#)
 - [Acenaphthene \[83-32-9\]](#)
 - [Acenaphthylene \[208-96-8\]](#)
 - [Acephate \[30560-19-1\]](#)
 - [Acetaldehyde \[75-07-0\]](#)
 - [Acetaldehyde, trichloro- \[75-87-8\]](#)
 - [Acetamide \[60-35-5\]](#)
 - [Acetamide, N-\(2-methylphenyl\)-, reactio](#)
 - [Acetate, S,S'-bis\(octylmercapto\)-, dibutyl](#)
 - [Acetic acid \[64-19-7\]](#)

국제환경법규

- Legislations
 - EU Directives
 - [EC Regulation 2037/2000 on substances](#)
 - [EU Directive 1996/82/EC \(Seveso II\)](#)
 - [EU Directive 1999/13/EC \(Solvent Emissio](#)
 - [EU Directive 2000/53/EC \(ELV\)](#)
 - [EU Directive 2002/95/EC \(RoHS\)](#)
 - [EU Directive 2002/96/EC \(WEEE\)](#)
 - [EU Directive 2005/32/EC \(EuP\)](#)
 - [EU Proposed directive COM2004\(320\)](#)
 - [Framework Directive EU 96/62/EC](#)
 - [Proposal Directive relating to restrictions c](#)
 - [REACH \(Registration, Evaluation and Auth](#)
 - International Protocol
 - US Directives

Contents of the Restricted Substances table

Hydrazine
Legislation-EH&S Database > Restricted Substances Table

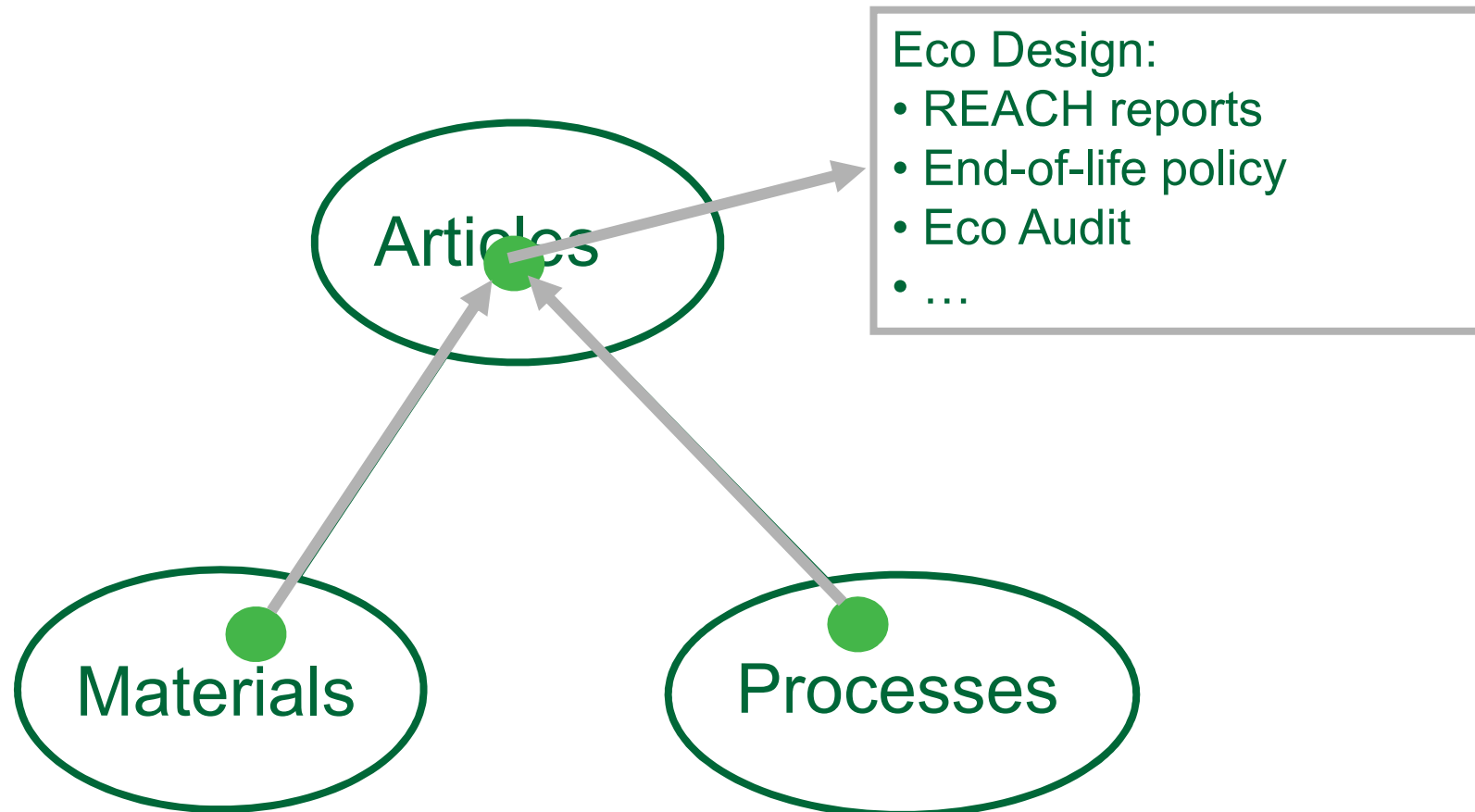
Click on a heading to show/hide the section. Sections: [Show](#) | [Hide](#)

General Information	
Chemical Abstracts Service No (CAS No)	302-01-2
EINECS No	206-114-9
Molecular formula	H4N2
Common formula	(H2N-NH2)
Synonyms Amerzine; Diamide; Diamine; Diamine, hydrazine base; Hidrazina (Spanish); Hydrazine base; Hydrazyna (Polish); Levoxine; Mannitol mustard; Oxytreat 35; SCAV-OX; SCAV-OX 35%; SCAV-OX II; Ultra Pure; hydrazine anhydrous	
Colour of the substance	colourless
Smell of the substance	ammoniacal odor
Last Updated	27 May 2004
EH&S	
Classification Category	Probable Carcinogen (Cat 2)
Environment	Dangerous for environment
Health	Toxic
Risk Phrases	45-10-23/24/25-34-43
Safety Phrases	53-45 Note E
Uses	
Typical uses A number of different reducing agents have been used in preparing electroless nickel baths, including sodium hypophosphite, aminoboranes, sodium borohydride, and hydrazine. Hydrazine Baths. Hydrazine has also been used to produce electroless nickel deposits. These baths operate at 90 to 95 °C (195 to 205 °F) and 10 to 11 pH. Their plating rate is approximately 12 m/h (0.5 mil/h). Because of the instability of hydrazine at high temperatures, however, these baths tend to be very unstable and difficult to control. Reducing agent for many transition metals and some nonmetals (arsenic, selenium, tellurium), as well as uranium and plutonium; corrosion inhibitor in boiler feedwater and reactor cooling water; waste-water treatment; electrolytic plating of metals on glass and plastics; nuclear fuel reprocessing; redox reactions; polymerization catalyst; shortstopping agent; fuel cells; blowing agent; scavenger for gases; drugs and agricultural chemicals (maleic hydrazide); component of high-energy fuels; rocket propellant. Because of its strong reducing capabilities, hydrazine is used as an intermediate in chemical synthesis and in photography and metallurgy. It is also used in the preparation of anticorrosives, textile agents, and pesticides, and as a scavenging agent for oxygen in boiler water. Hydrazine is widely used in pharmaceutical synthesis. It is also used as a rocket fuel. Hydrazine and its derivatives have numerous commercial applications. It was used initially as rocket propellant. During World War II, it was used as a fuel for rocket-powered fighter planes. However, the most important applications of hydrazine and its	

- **General Information:** Reference No (CAS and EINECS), Formulas, Synonyms & Trademarks, Color and Smell, Last Update
- **EH&S:** Environmental, Health and Safety Impacts
- **Uses:** Typical process & use
- **Alternative substances:** Information on possible alternative substances
- **Sources:** Web sites and book references

Key Issue: Material-Product Linkage

Most aspects of Eco Design require information about articles, materials and processes, simultaneously.



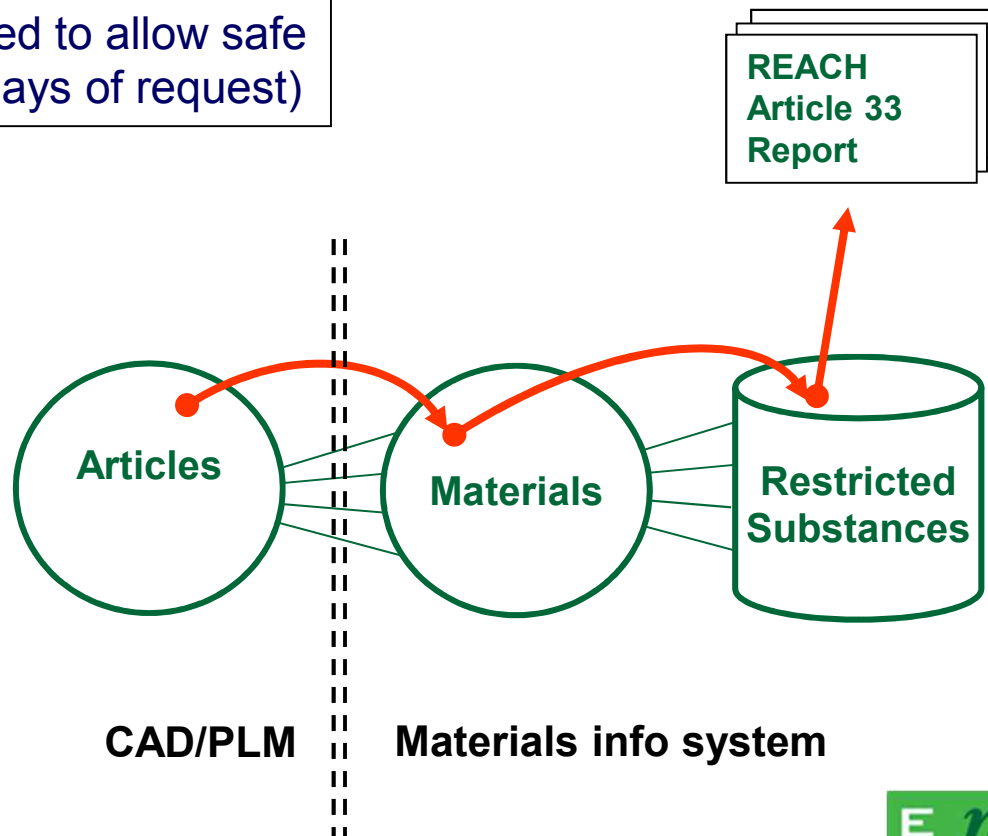
In engineering enterprises, information about products is stored in a BoM in a CAD, PLM or ERP system

Example - REACH Article 33 Compliance

REACH Article 33: Any supplier of an article containing substances of very high concern (SVHC) has to provide the recipient of the article with the minimum amount of information required to allow safe use of the article (within 45 days of request)

Generating Article 33 reports on existing products quickly = \$\$\$

Generating prototype Article 33 reports at the design stage and avoiding REACH issues altogether = \$\$\$\$\$\$\$\$\$\$!



Enter Item ID to Search

Quick Links **Customize**

- Home
- My Worklist
- My Saved Searches
- My Links

Open Items

History

- A1200/A;1-Rear Assy

- Getting Started
- My Teamcenter
- PSE
- Schedule Manager
- CAE SE
- Validation
- Granta MI**
- StructureMap Builder

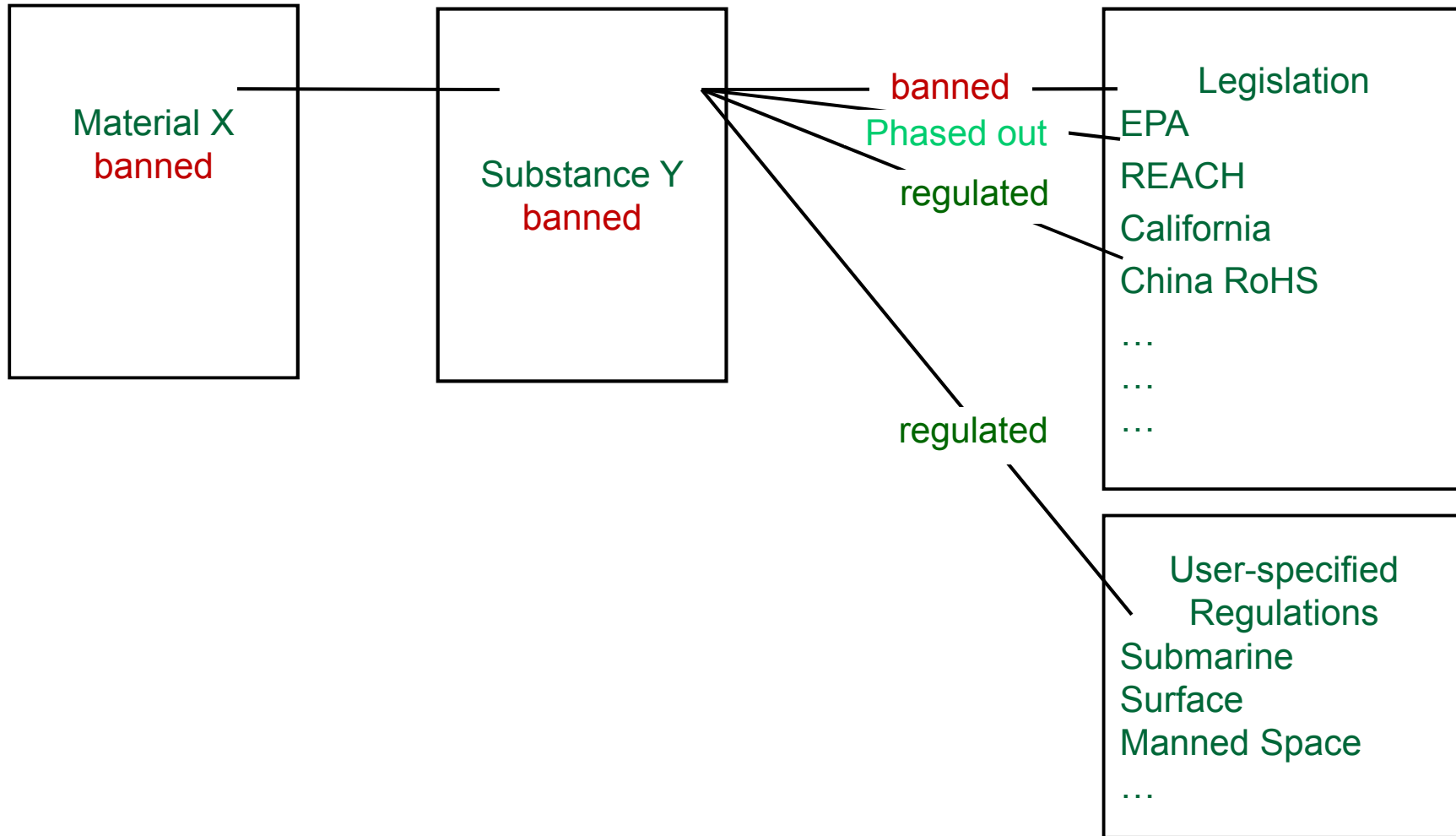
Granta MI integration for Teamcenter

REACH Report

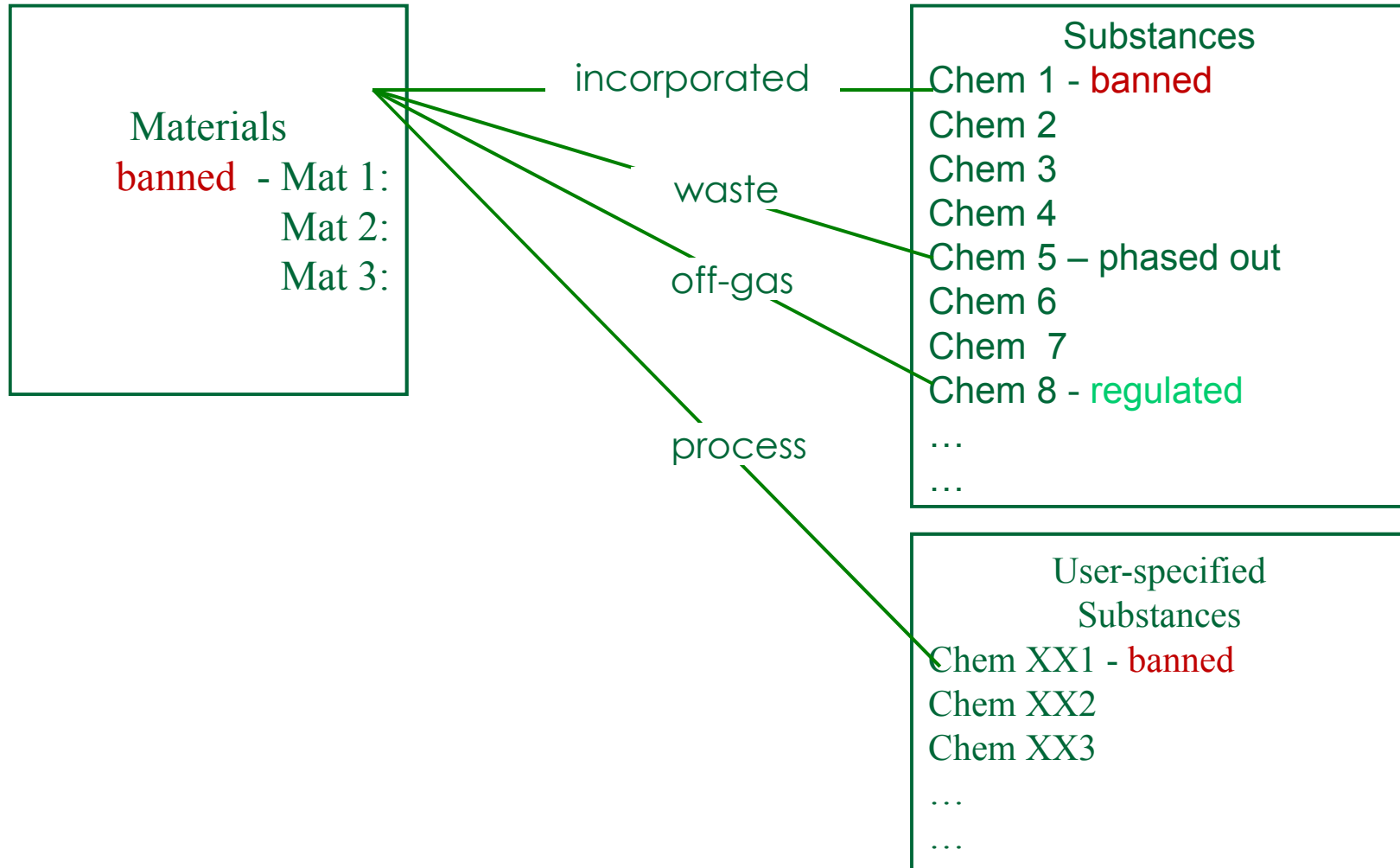
Product structure with materials information

: A1200/A;1-Rear Assy (view) x 1			
: A1100-I/A;1-Wheel Attachment Assy, left (view) x 1			
: A1020-I/A;1-Wheel Assy, left (view) x 1			
: 4851-2/A;1-U-joint x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 4853/A;1-Stub axle x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 2754/A;1-Stub axle pin x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 4354-I/A;1-Stub axle carrier, left x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 5116/A;1-Ball bearing, 5x11x4 x 1		Low alloy steel, AISI 9310 (normalised)	Unregulated
: 1654-1/A;1-Wheel hub x 1			
: 4872/A;1-Wheel x 1			
: 4873-I/A;1-Tyre, left x 1		Cast magnesium alloy (AM50)	Unregulated
: 1747X/A;1-Nut, 4 x 1		Nitrile Rubber (NBR)	Regulated
: A1030/A;1-Upper Camber Rod Assy (view) x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 2742X-1/A;1-Rod end x 1		Low alloy steel, AISI 4037 (tempered @ 205 C, oil quenched)	Unregulated
: 4841-1/A;1-Upper camber rod x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 2553/A;1-Screw, 3x15 CS M (HD) x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 2742X-2/A;1-Hollow ball x 1		Low alloy steel, AISI 9310 (normalised)	Unregulated
: 4850-I/A;1-Suspension arm, rear, left x 1		Epoxy SMC (Carbon Fibre)	To be phased out
: 4838-2/A;1-Suspension screw, 3x40 x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 4838-1/A;1-Suspension screw, 3x26 x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 4260/A;1-Shock Absorber Assy (view) x 1			
: 3767-1/A;1-Shock Cap x 1		Carbon steel, AISI 1015 (normalised)	Unregulated
: 1765/A;1-Silicone diaphragm x 1		Eccosil 4122 (SIL) - Silicone Elastomer	Unregulated
: 3768-2/A;1-Piston head 2-hole (view) x 1		Wrought aluminium alloy, 2519, T87	Unregulated
: 4262T/A;1-Shock shaft x 1		Low alloy steel, AISI 9310 (normalised)	Unregulated
: 3764A/A;1-Body, Ultra Shock x 1		Carbon steel, AISI 1015 (normalised)	Unregulated
: 3769/A;1-Spring pre-load spacer x 1		Low alloy steel, AISI 9310 (normalised)	Unregulated
: 3768-1-1/A;1-Spring retainer, upper (view) x 1		Low alloy steel, AISI 9310 (normalised)	Unregulated
: 2362/A;1-Shock washers x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 3767-2/A;1-Shock bottom x 1		Carbon steel, AISI 1015 (normalised)	Unregulated
: 4267/A;1-Spring x 1		Low alloy steel, AISI 9255 (annealed)	Unregulated
: 2362/A;1-Shock washers x 1		Low alloy steel, AISI 3140 (normalised)	Unregulated
: 3768-1-2/A;1-Spring retainer, lower x 1		Low alloy steel, AISI 9310 (normalised)	Unregulated
: 1942-1/A;1-Rod end x 1		Low alloy steel, AISI 4037 (tempered @ 205 C, oil quenched)	Unregulated

Dynamic EH&S Rating



Source of Restricted Substance



Report Concept

Project: XXXXX
 Print date: XX / XX / XXXX
 User ID:

Summary

Material Name	Material ID	Summary Rating
Material #1	Material ID #1	Banned
Material #2	Material ID #2	Regulated
Material #3	Material ID #3	Unrestricted
Material #4	Material ID #4	Unrestricted
Material #5	Material ID #5	Phased out

Material #1 – Detailed breakdown

Substance Name	CAS	Summary	Legislation 1	Legislation 2	Legislation 3	Category
Subs #1	XXXXX	Banned	Banned	Phased out	Unrestricted	Waste
Subs #2	XXXXX	Restricted	Restricted	Unrestricted	Unrestricted	Incorporated
Subs #3	XXXXX	Restricted	Restricted	Restricted	Restricted	Off-gas
Subs #4	XXXXX	Phased out	Restricted	Unrestricted	Phased out	Incorporated
Subs #5	XXXXX	Unrestricted	Unrestricted	Unrestricted	Unrestricted	Process

Material #2 – Detailed breakdown

Substance Name	CAS	Summary	Legislation 1	Legislation 2	Legislation 2	Category
Subs #1	XXXXX	Regulated	Regulated	Phased out	Unrestricted	Waste
Subs #2	XXXXX	Regulated	Regulated	Unrestricted	Unrestricted	Incorporated
Subs #3	XXXXX	Unrestricted	Unrestricted	Unrestricted	Unrestricted	Off-gas

Template process for Substance Declarations from Suppliers

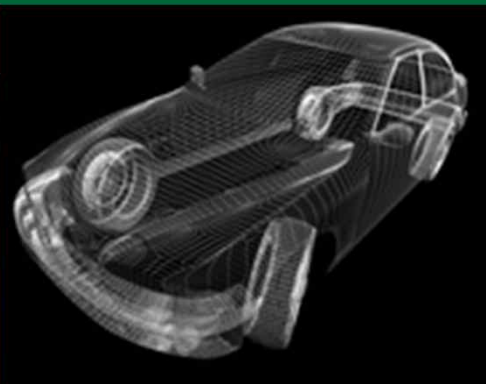
E.g. SAE A9535 Excel template (partial or full declaration for materials and bought-in Components):

TR9535SubstanceDeclarationForm_ImportTemplate.xls

TR 9535 - Substance Declaration Form							
1. Requestor Item #	2. Supplier Item #	3. Supplier Item Name					
0	0815-0814	Bondo-stik					
4. Prepared By: *	4a. Preparer's Title	4b. Preparer's Phone	4c. Preparer's Email				
5. Weight of Item, as Delivered, excludes packaging (Actual weight, not shipping weight -)*		5a. Unit (Drop Down (Lbs / Kg))					
<p>Note: Additional requests for information to your suppliers of chemicals beyond MSDS data may be required to accurately complete this Substance Declaration. Not all substances will be identified on an MSDS. Also, proprietary constituents and % composition ranges listed in an MSDS may not be accurate enough for this declaration. We recommend using this same standard format for those requests down your supply chain.</p>							
<p>Please return to Question 24 on the General Information page after completing this page</p>							
6. CAS Number (preferred) Enter number without dashes	7. EC (EINECS or ELINCS) Number (If CAS is not available) Enter number without dashes	8. Chemical Name		9. Weight Percent (For ranges, report typical (mode) value, NOT the range)	10. Will this substance be pre-registered by you between 1 June and 20 Nov 2008? If yes, check the box corresponding to those substances being declared.	11. Registration Number (if available)	12. Is this substance a polymer? Check for yes.
				Total Wt %			
				31.30			
13	143500	Kepone		0.85	<input type="checkbox"/>		<input type="checkbox"/>
14		2000016 Formaldehyde		24	<input checked="" type="checkbox"/>	1112-121_9	<input type="checkbox"/>
15	75014	Vinylchloride		1.57	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
16	1327533	2154814 Diarsenic trioxide		4.88	<input checked="" type="checkbox"/>		<input type="checkbox"/>
17					<input type="checkbox"/>		<input type="checkbox"/>
18					<input type="checkbox"/>		<input type="checkbox"/>
19					<input type="checkbox"/>		<input type="checkbox"/>
20					<input type="checkbox"/>		<input type="checkbox"/>
21					<input type="checkbox"/>		<input type="checkbox"/>
22					<input type="checkbox"/>		<input type="checkbox"/>
23					<input type="checkbox"/>		<input type="checkbox"/>
24					<input type="checkbox"/>		<input type="checkbox"/>
25					<input type="checkbox"/>		<input type="checkbox"/>
26					<input type="checkbox"/>		<input type="checkbox"/>

General Information / Declarable Substances / TR_9536 Detailed CAS List / Full Disclosure

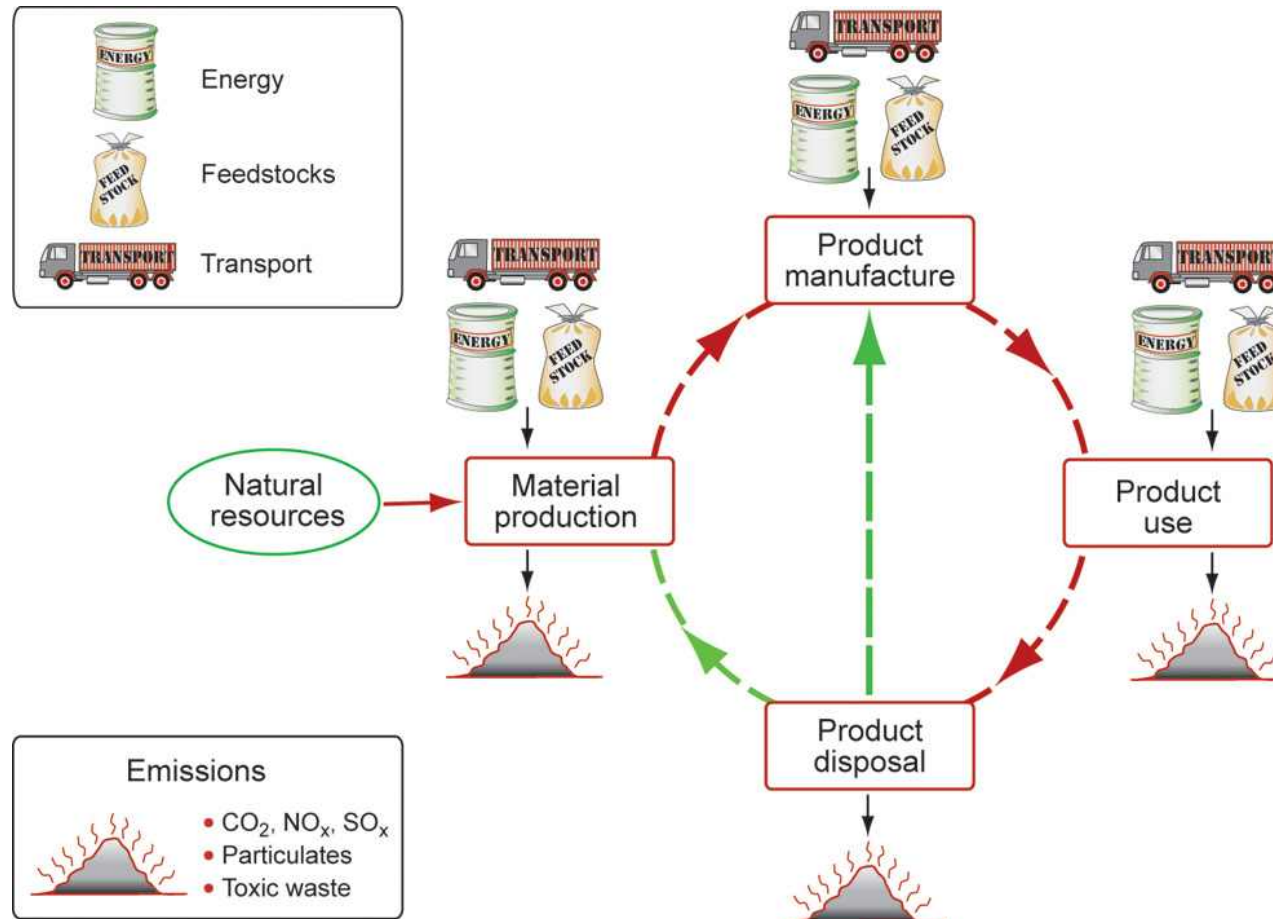
Eco Auditing and Eco Optimization in new product development



Objective

- **Provide a Tool to enable Designers to assess the Environmental Impact of a product during the Design process**
 - Minimize environmental impact
 - Trade-off environmental impact vs cost and performance
 - Comply with legislation (EuP, REACH...)

The material lifecycle



Eco-data

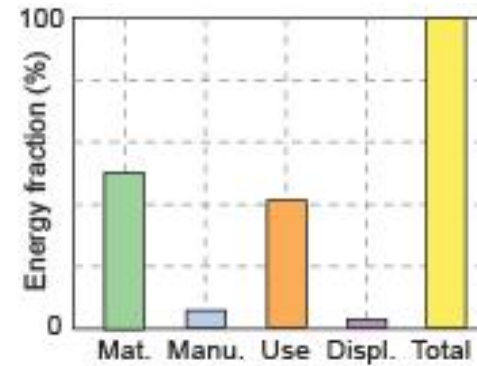
<i>Aluminum cans, per 1000 units</i>		
<i>Resource consumption</i>	▪ Bauxite	59 kg
	▪ Oil fuels	148 MJ
	▪ Electricity	1572 MJ
	▪ Energy in feedstocks	512 MJ
	▪ Water use	1149 kg
<i>Emissions inventory</i>	▪ Emissions: CO ₂	211 kg
	▪ Emissions: CO	0.2 kg
	▪ Emissions: NO _x	1.1 kg
	▪ Emissions: SO _x	1.8 kg
	▪ Particulates	2.47 kg
<i>Impact assessment</i>	▪ Ozone depletion potential	0.2 x 10 ⁹
	▪ Global warming potential	1.1 x 10 ⁹
	▪ Acidification potential	0.8 x 10 ⁹
	▪ Human toxicity potential	0.3 x 10 ⁹

Full LCA *time consuming, expensive* and requires great *detail* –and even then is subject to uncertainty

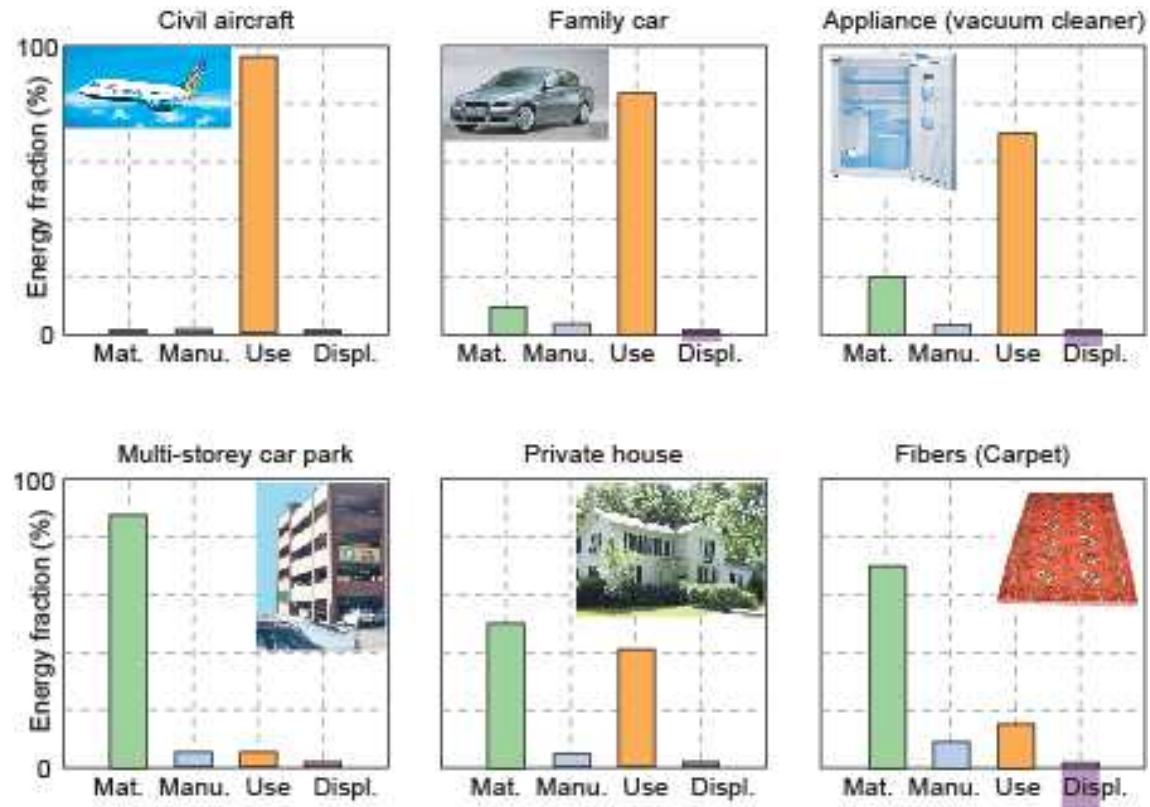
What is a designer supposed to do with these numbers?

Eco-auditing – the idea

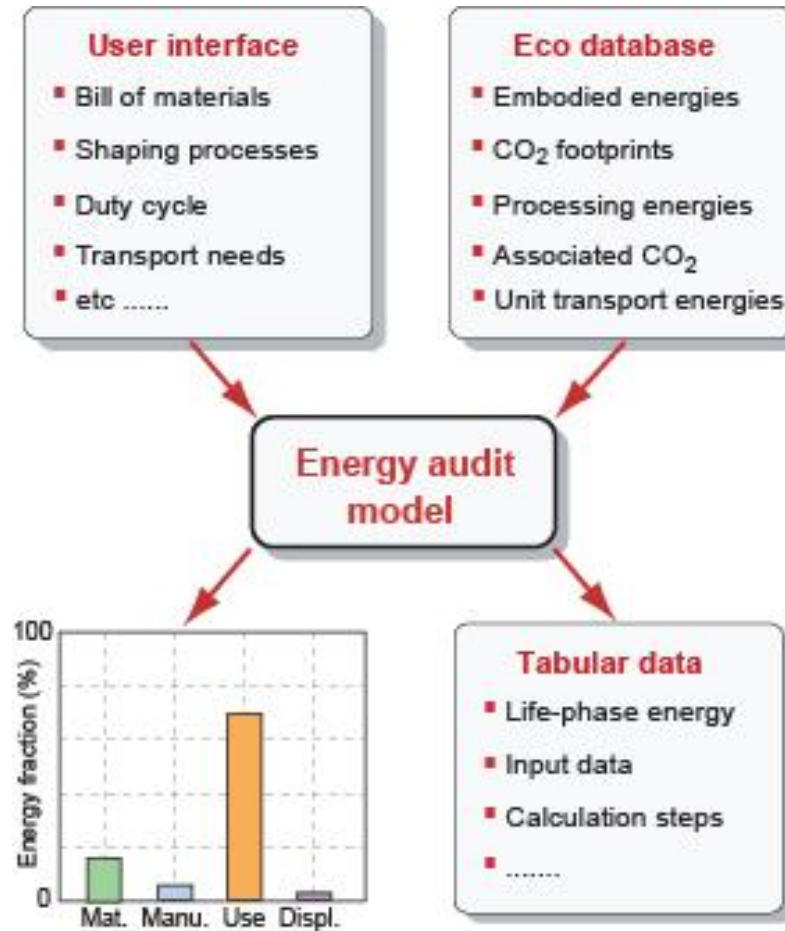
Product or
Product Design



Eco-auditing – in practice



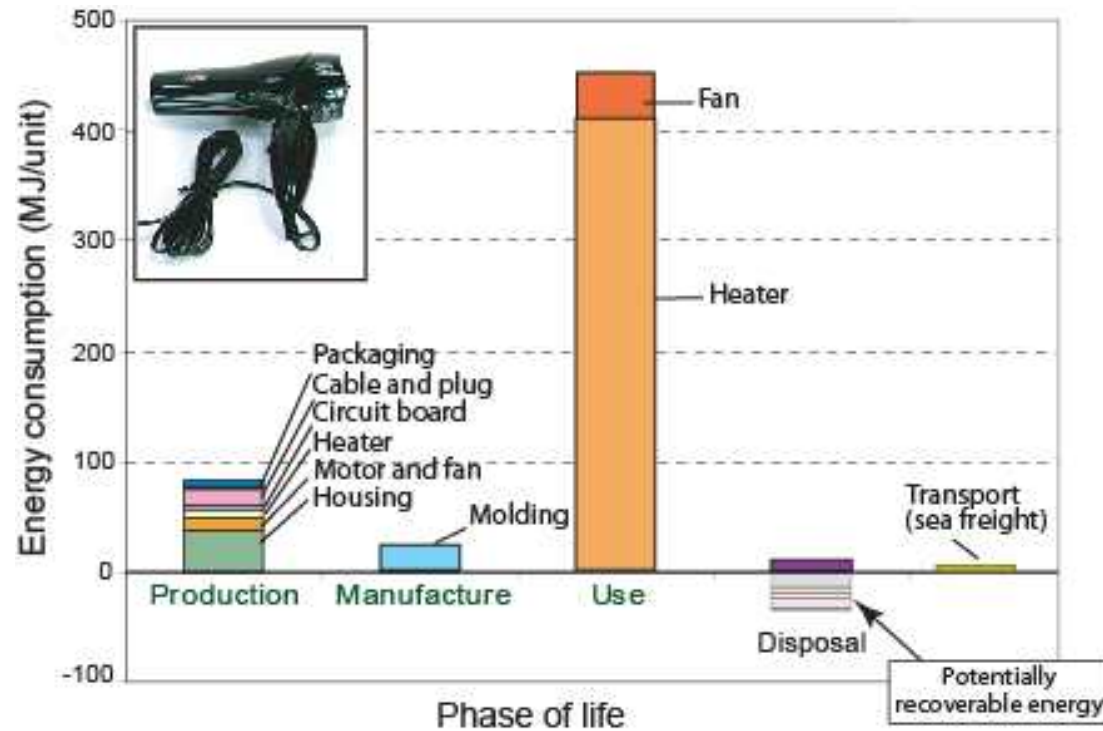
The Eco Audit software tool



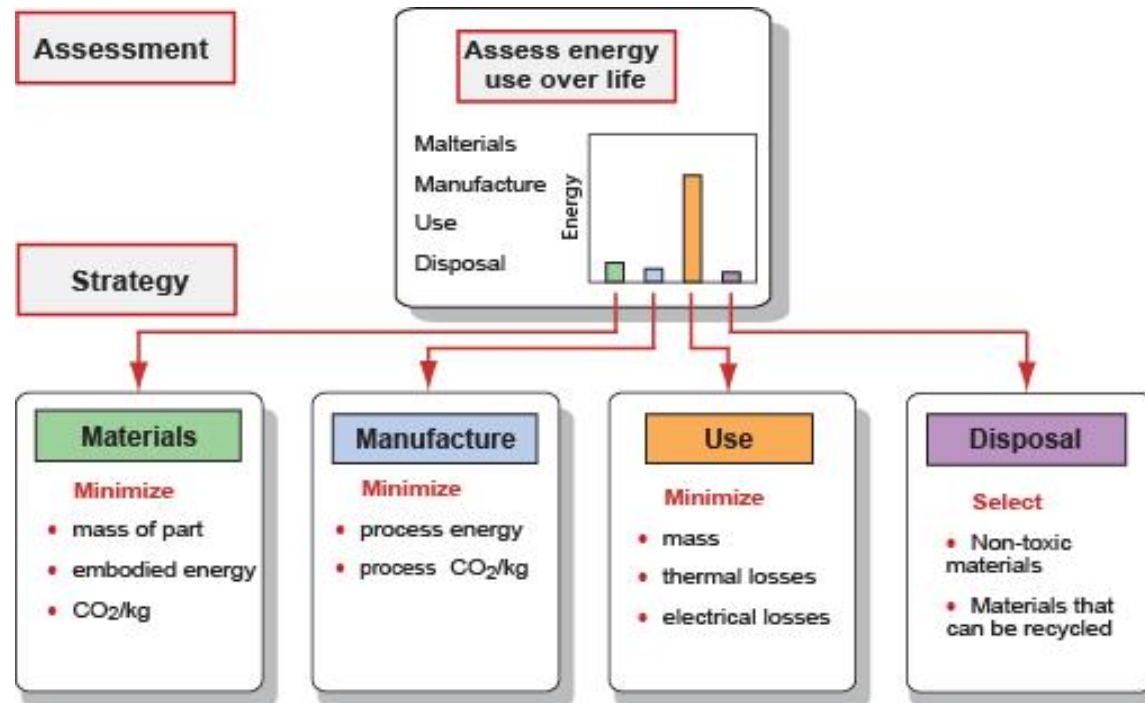
Validation – a hair dryer (an EuP)



Typical output



Target the phase(s) that matter



Case Study: Packaging 1

Packaging performs at least 5 functions :

Protection: packaging extends product life by protecting foodstuffs and controlling the atmosphere that surrounds them

Security: tamper-proof packaging protects the consumer.

Information: pack information identifies the product, its sell-by date (if it has one) and gives instructions for use.

Affiliation: brands are defined by their packaging.

Presentation: packaging “presents” the product in much the same way that clothing presents the wearer.



Case Study: Packaging

Question.

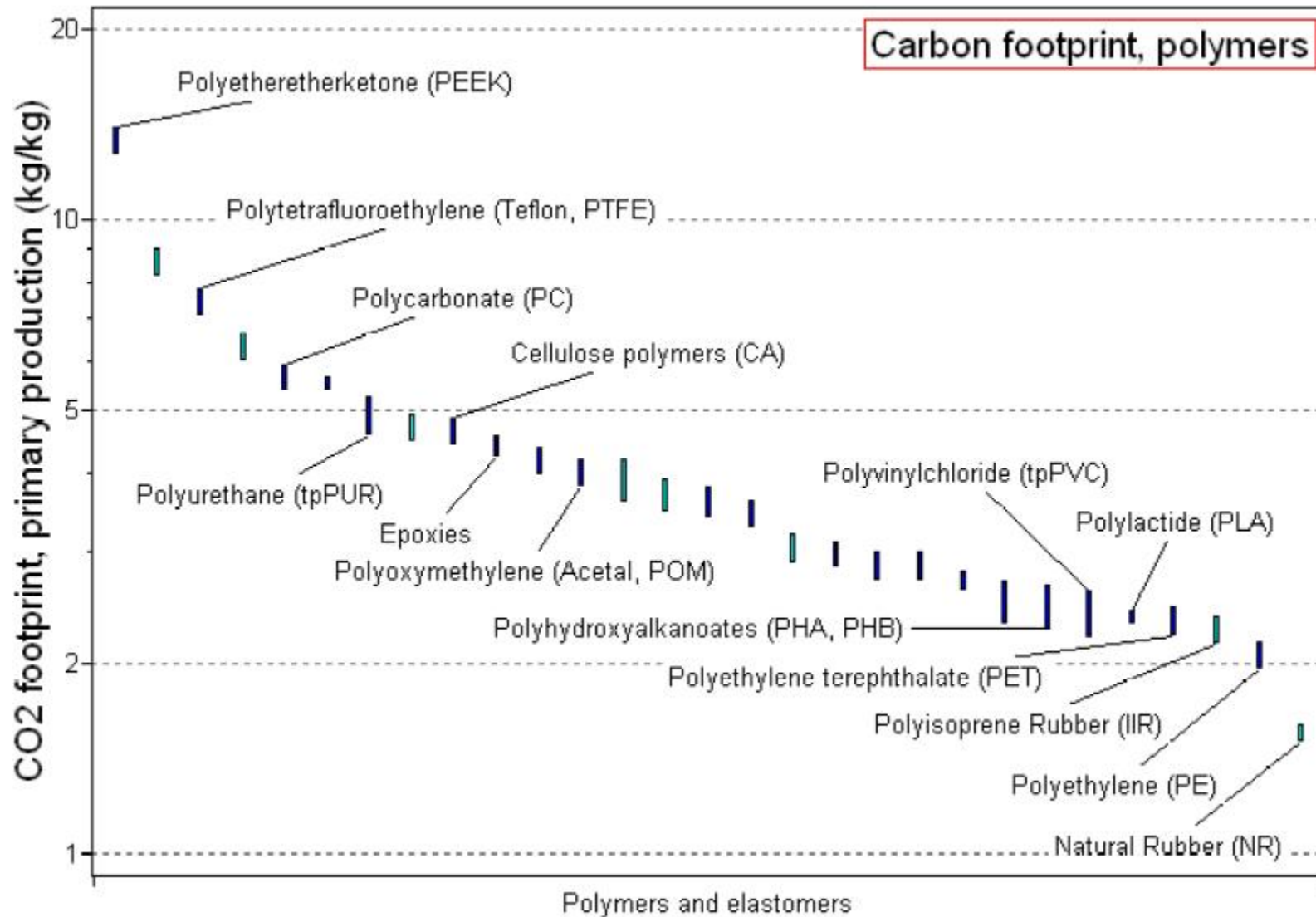
- Are the embodied energies and CO2 footprints of Biopolymers less than those of conventional plastics?
- Watch the video tutorial on plotting charts and make bar charts of embodied energy and CO2 footprint to find out.
- Which polymers are Biopolymers can be found by searching on that term.

Answer.

- A search on "Biopolymer" delivers the 5 materials listed below.
 - The plot of embodied energies for polymers shows that the first four have lower embodied energies than any other polymer or elastomers.
 - The equivalent chart of carbon footprint, below, reveals that CO2 release associated with their production is at the lower end of that for polymers – it is about the same as that polyethylene or PVC on a per Kg basis.
- Natural rubber
 - Polylactide
 - Polyhydroxyalkanoates (PHA, PHB)
 - Starch-based thermoplastics (TPS)
 - Cellulose polymers (CA)



Case Study: Packaging Material Chart



Case Study: Packaging 2

- The table shows the mass of material it takes to produce various types of containers possible for holding a drink.
- Which material consumes the least embodied energy per litre or drink? Use the embodied energy values in CES Edupack DB.

Container type	Material	Mass (grams)
PET 400ml bottle	PET	25
PE 1 liter milk bottle	PE	38
Glass 750ml bottle	Soda-lime glass	325
Al 440ml can	Non-age hardening wrought AL-Alloys	20
Steel 440ml can	Medium carbon steel	45



- How does the ranking change if the contribution of recycling is included? To do so, multiply the energy per liter you just calculated, by the factor

Case Study: Packaging 2

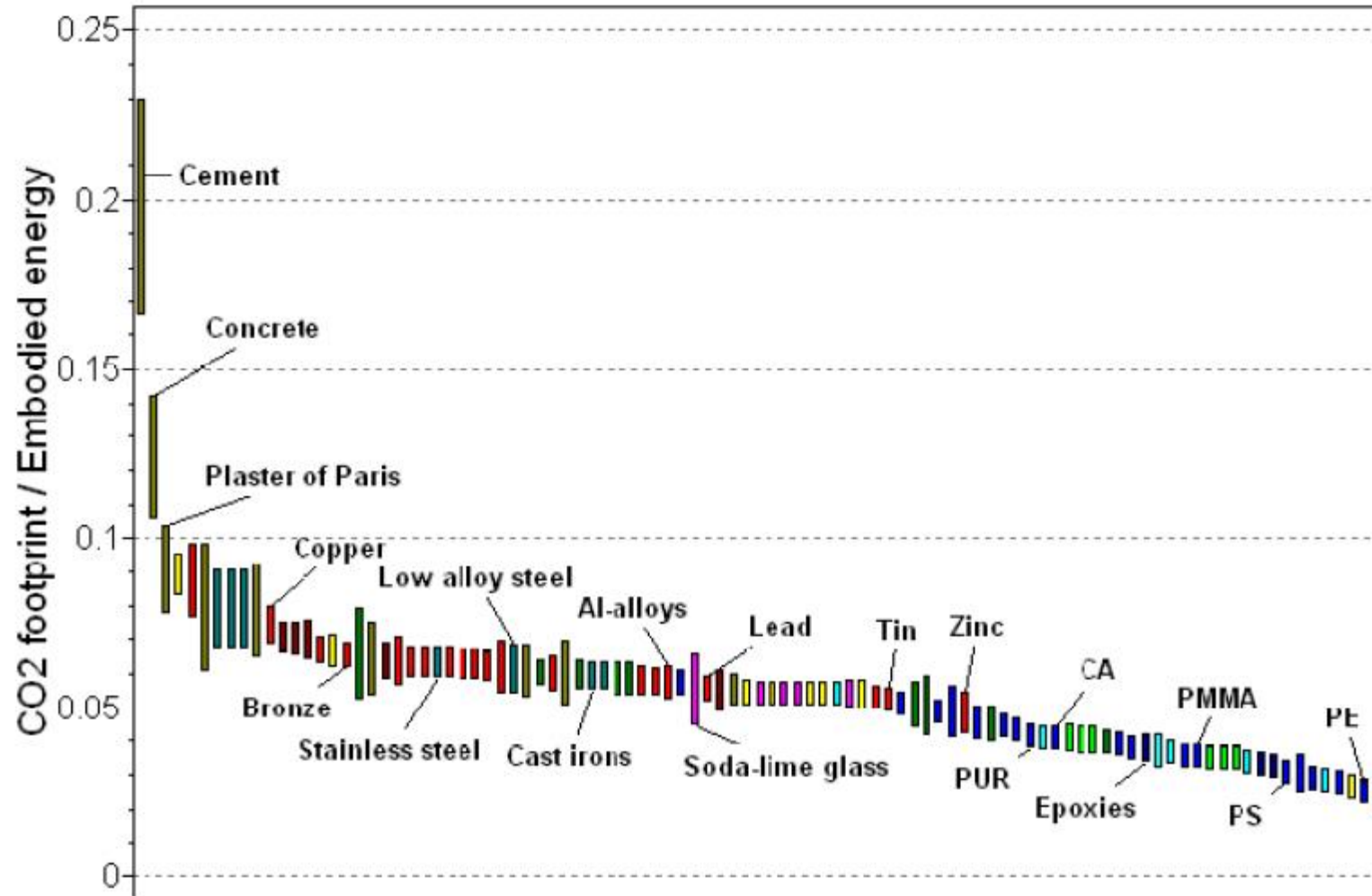
The inclusion of recycled material significantly reduces all the energies. Steel emerges as the best choice, but aluminium remains the most energy-intensive.

Container type	Material	Embodied Energy (MJ/kg)	Recycle Energy (MJ/kg)	Recycle fr. in current supply
PET 400ml bottle	PET	83.7	35.2	0.21
PE 1 liter milk bottle	PE	80.8	34.0	0.084
Glass 750ml bottle	Soda-lime glass	15.4	6.8	0.24
Al 440ml can	Non-age hardening wrought AL-Alloys	207	18.7	0.11
Steel 440ml can	Medium carbon steel	31.9	8.9	0.42

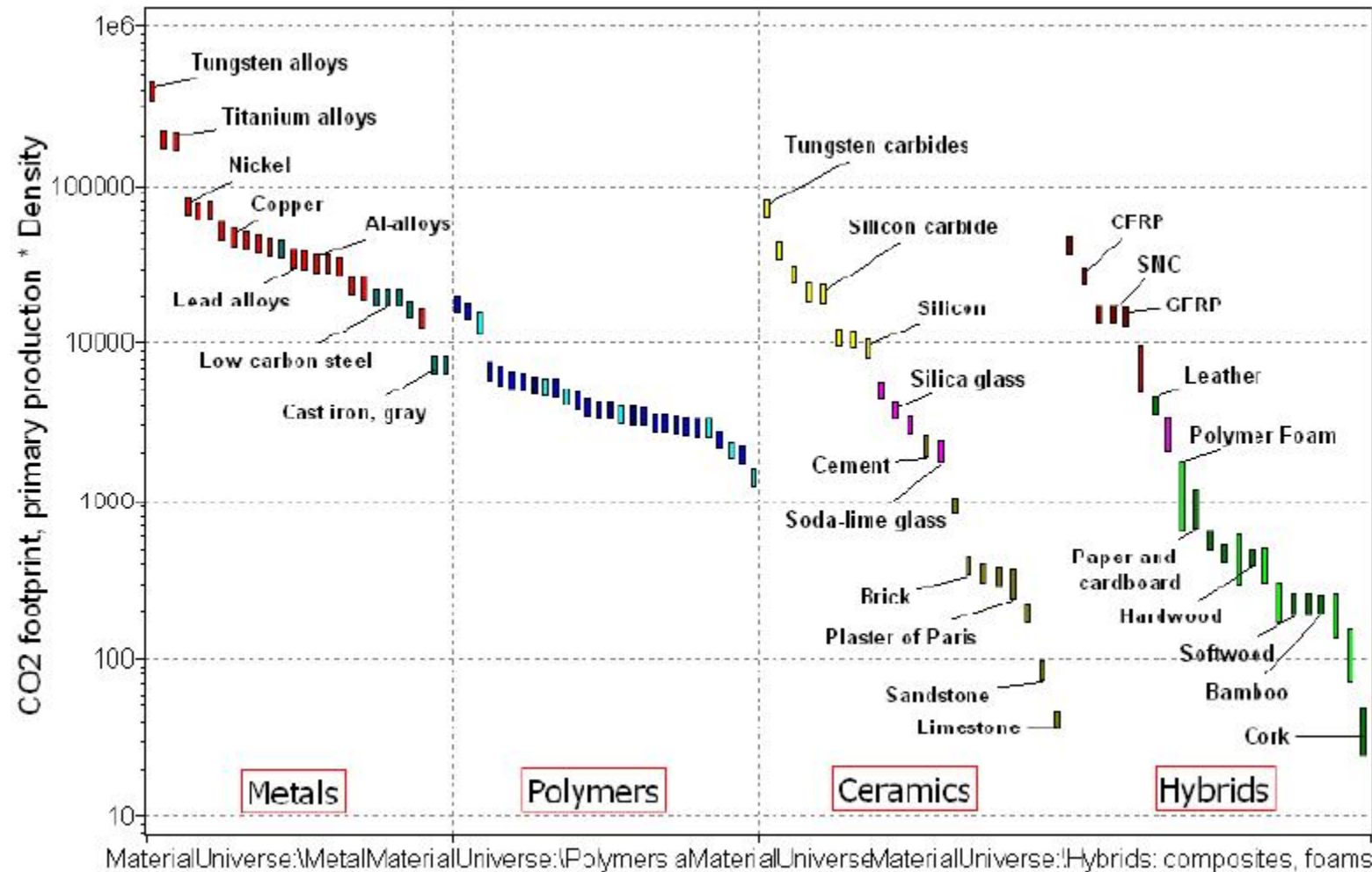


Container type	Material	Mass (grams)	Energy/liter (MJ/liter)	Correction factor	Corrected Energy (MJ/liter)
PET 400ml bottle	PET	25	5.2	0.88	4.6
PE 1 liter milk bottle	High Density PE	38	<u>3.1</u>	0.95	2.9
Glass 750ml bottle	Soda glass	325	6.7	0.87	5.8
Al 440ml can	5000 series Al alloys	20	9.4	0.90	8.5
Steel 440ml can	Plain carbon steel	45	3.3	0.70	<u>2.3</u>

Case Study: Packaging 2(Metal)



Case Study: Packaging 2(All)

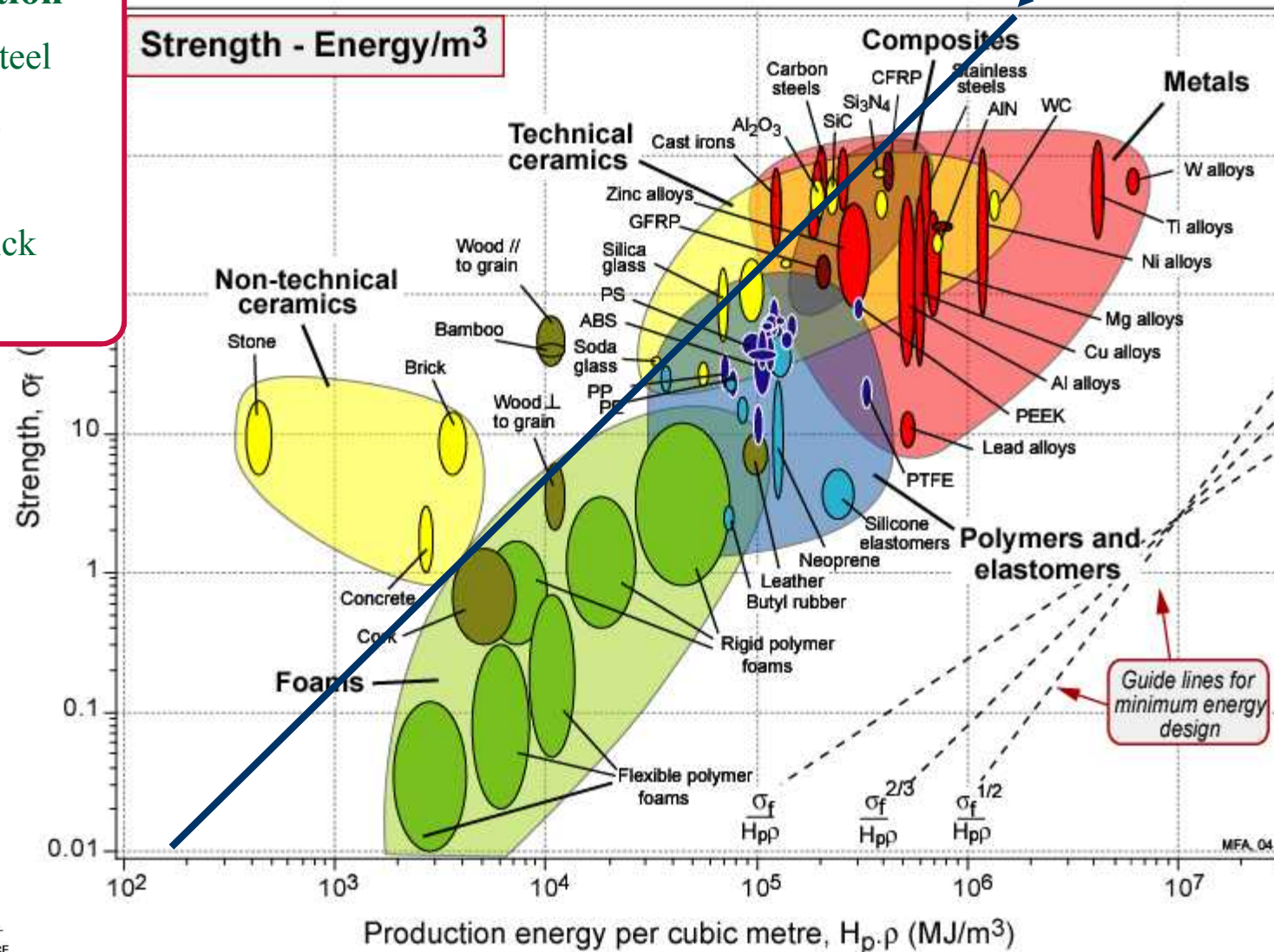


Bending strength per unit energy

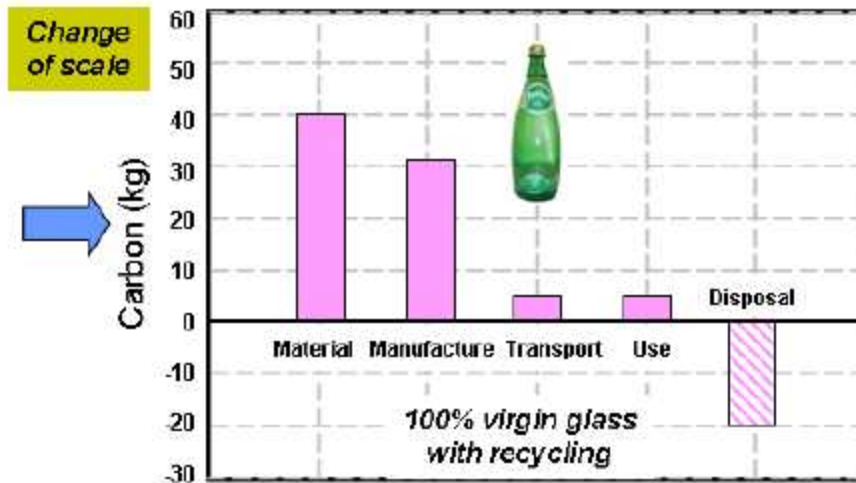
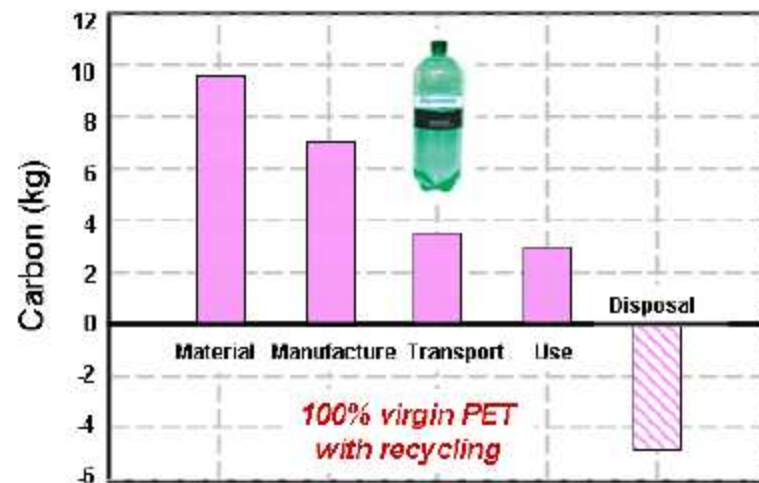
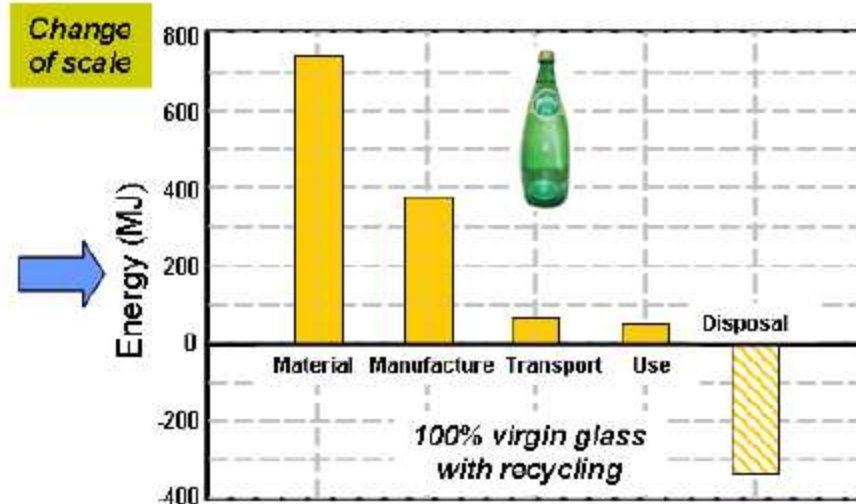
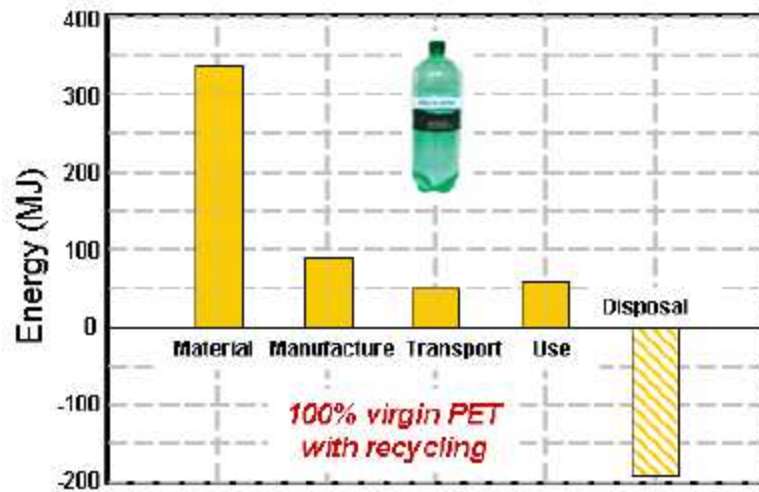
$$\frac{\sigma_y^{2/3}}{H_p \rho}$$

The selection

- Carbon steel
- Cast iron
- Wood
- Stone/brick
- Concrete



Case Study: Packaging 3



Case Study: Packaging 3

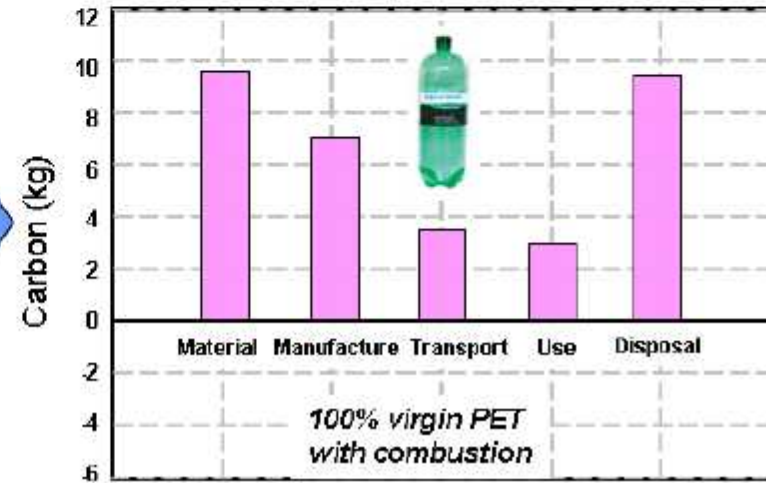
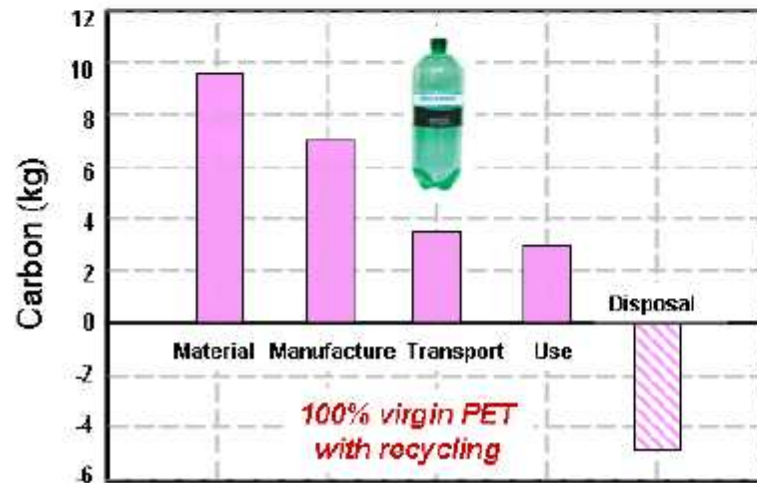
82. Open the Bottled Mineral Water .prd file in the Eco Audit Tool. This file is for 100 PET bottles. If you haven't already noted the total CO₂ and Energy used for this product and exported the report for reference please do that now.

- Change the end of life of the PET bottle to Combust.

View the report and describe what has happened to the Carbon footprint and why.

Answer

Combusting the bottle creates energy but also CO₂



Eco Audit Project

Product Definition | Report

Product name: New Open Save

Product life: years

1. Material and manufacture

Component name	Material	Primary process	Mass (kg)
Tower structure	Low carbon steel	Forging, rolling	1.64E+05
Tower, cathodic protection	Zinc alloys	Casting	203
▶ Nacelle, gears	Stainless steel	Forging, rolling	1.9E+04
Nacelle, generator core	Low carbon steel	Forging, rolling	9000
Nacelle, generator conductors	Copper alloys	Forging, rolling	1000
Nacelle, transformer core	Cast iron, ductile (nodular)	Forging, rolling	6000

2. Transport

Stage name	Transport type	Distance (km)
▶ Transit large components to site	32 tonne truck	300
Transit small components to site	14 tonne truck	100
*		

3. Use

Static mode

Product uses the following energy:

Energy input and output:

Power rating:

Usage: days per year

Usage: hours per day

Mobile mode

Product is part of or carried in a vehicle:

Fuel and mobility type:

Usage: days per year

Distance: km per day

4. Report

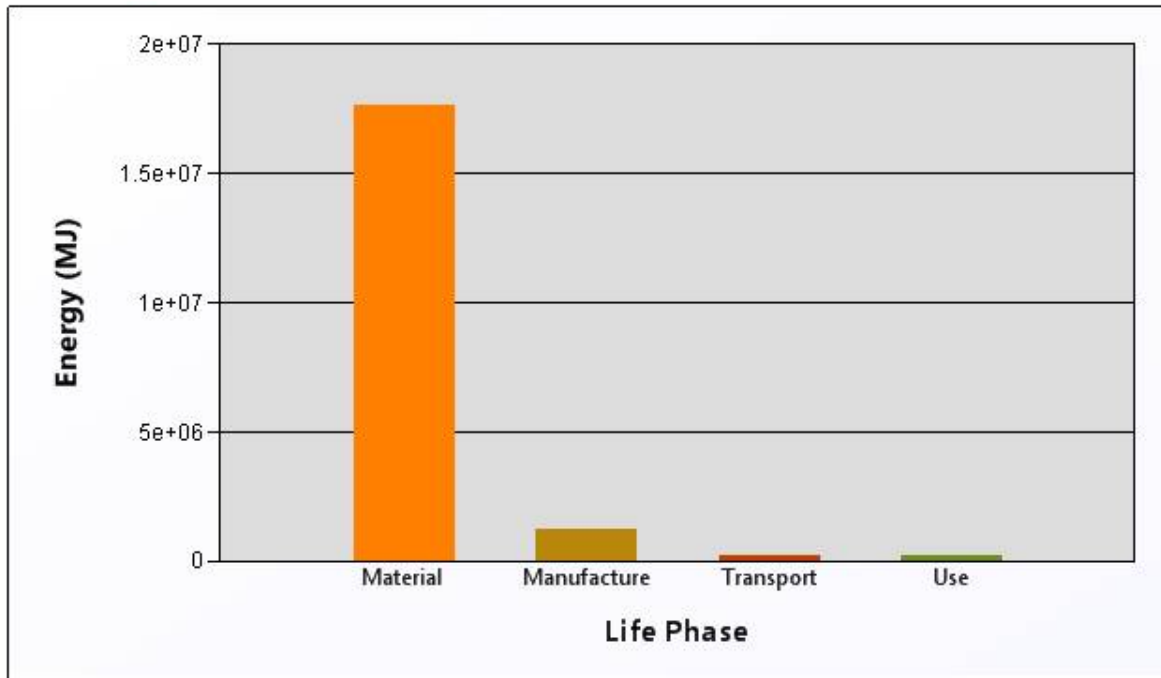
Eco Audit Project

Product Definition Report

1 of 2 100%

Summary of Life Phases:

[Detailed Breakdown](#)



Phase	Energy (MJ)	Energy (%)
Material	1.8e+07	91.2
Manufacture	1.2e+06	6.4
Transport	2.4e+05	1.3
Use	2.3e+05	1.2
Total	1.9e+07	100



감사합니다.