



Environmental indicators for aluminium products

a lifecycle perspective

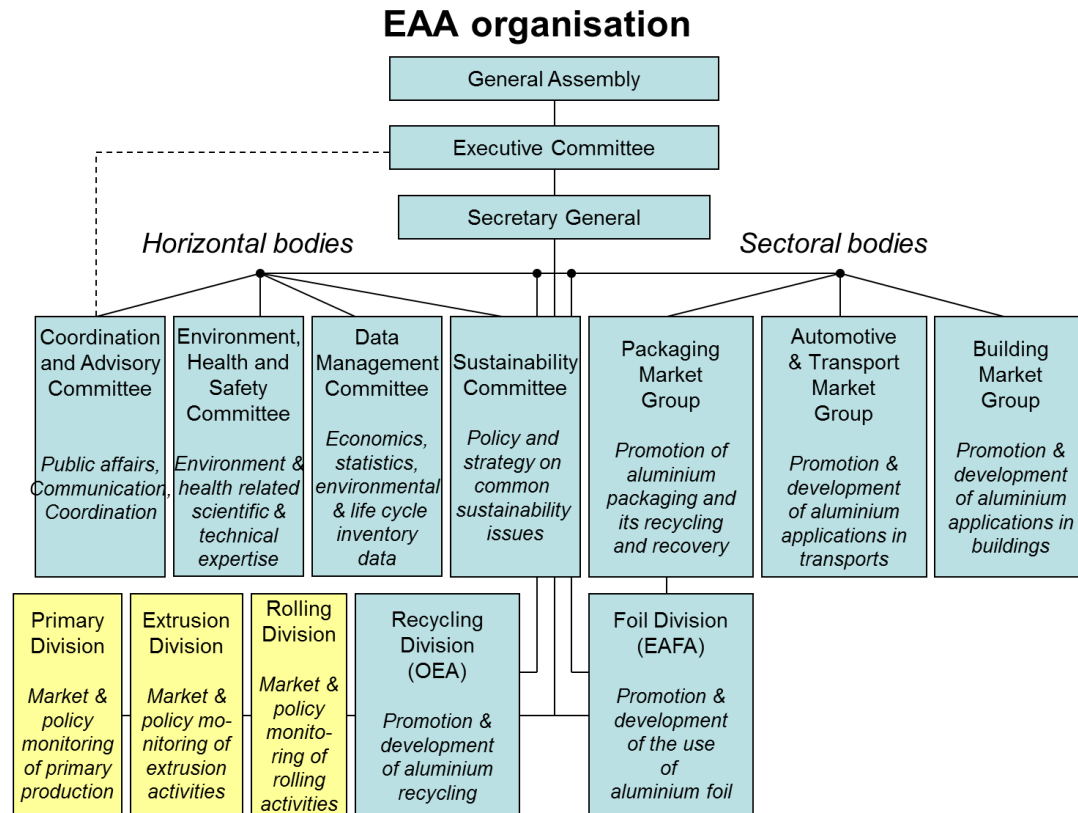
Ana Maria Danila, EAA
APAL meeting,
Aveiro, 28.02.2012

Presentation outline

1. Brief info about EAA
2. What is LCA?
3. The EAA environmental data & LCI indicators for aluminium production and transformation processes
 - Focus on extrusions
4. Environmental indicators for aluminium products
5. Conclusions

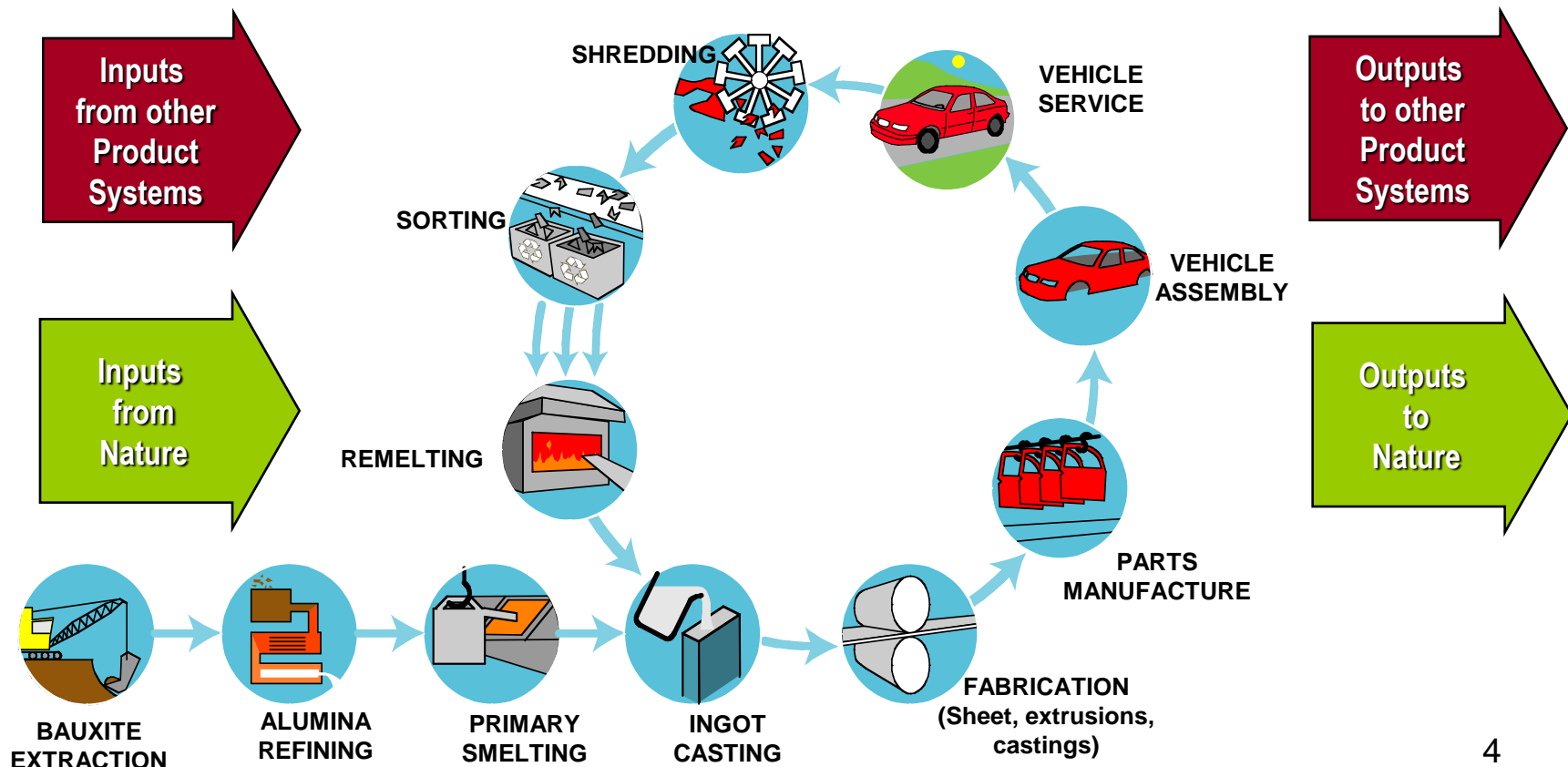
1. What is the European Aluminium Association?

- EAA Members:
 - Primary aluminium producers, downstream manufacturers, producers of recycled aluminium and national aluminium associations, from 18 European countries
 - Organisation of the European Aluminium Recycling Industry (recycling division - OEA)
 - European association of aluminium foil producers (EAFA)

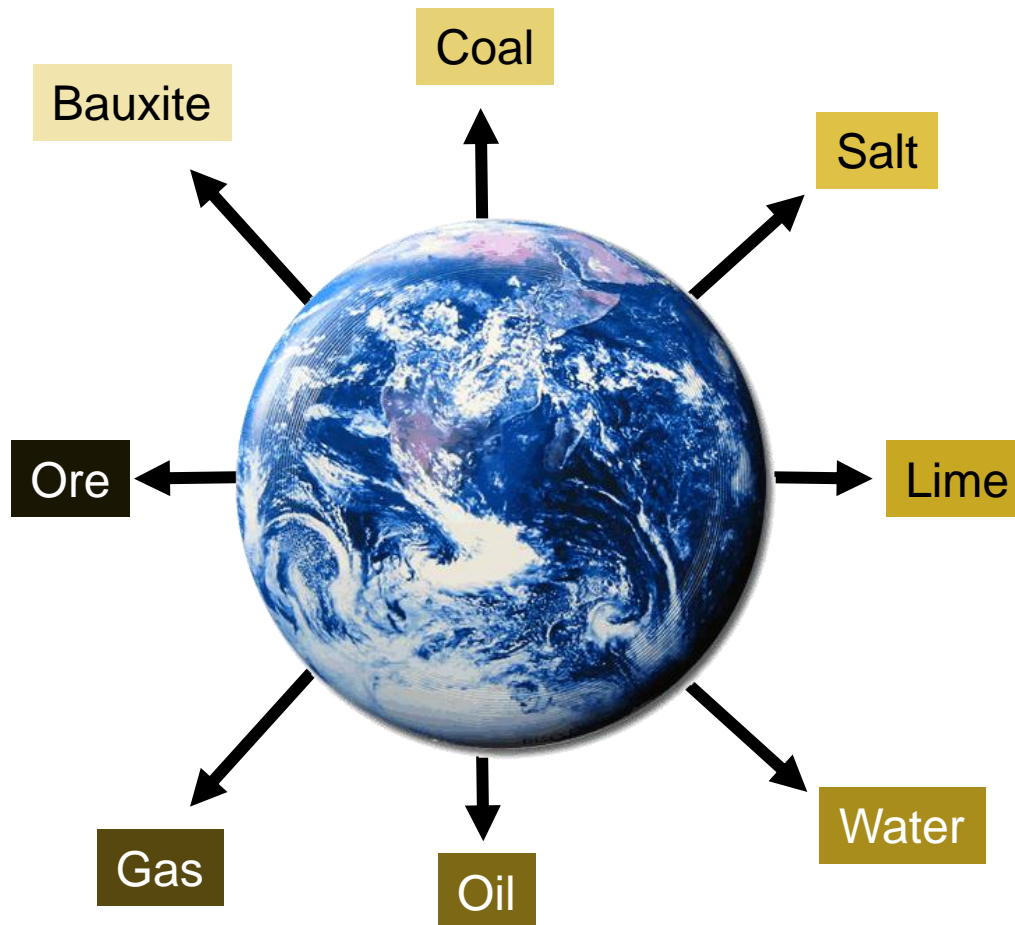


2. What is Life Cycle Assessment?

Evaluation of the inputs, outputs and potential environmental impacts of a product throughout its life cycle



What is included in an LCA of an Aluminium Product?



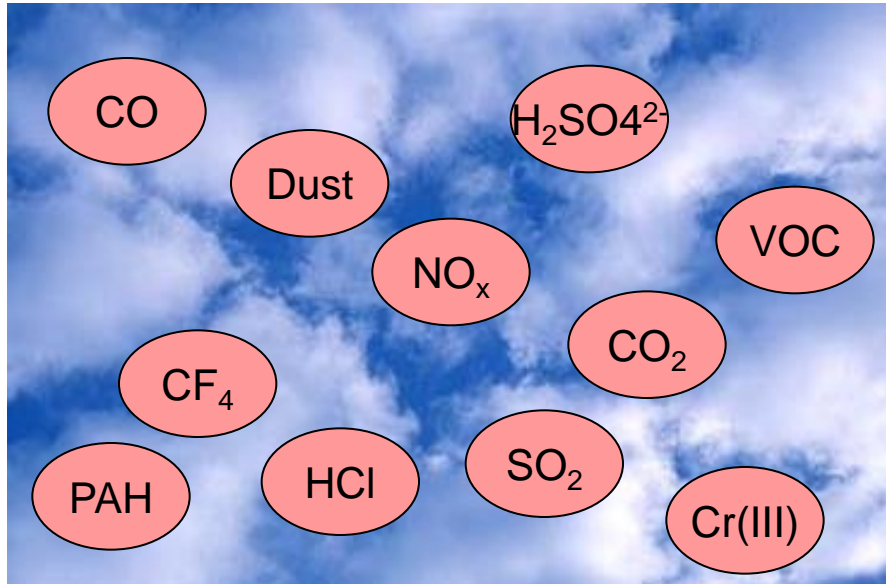
**1. An inventory
of all resources
taken out of the
earth's crust**

or

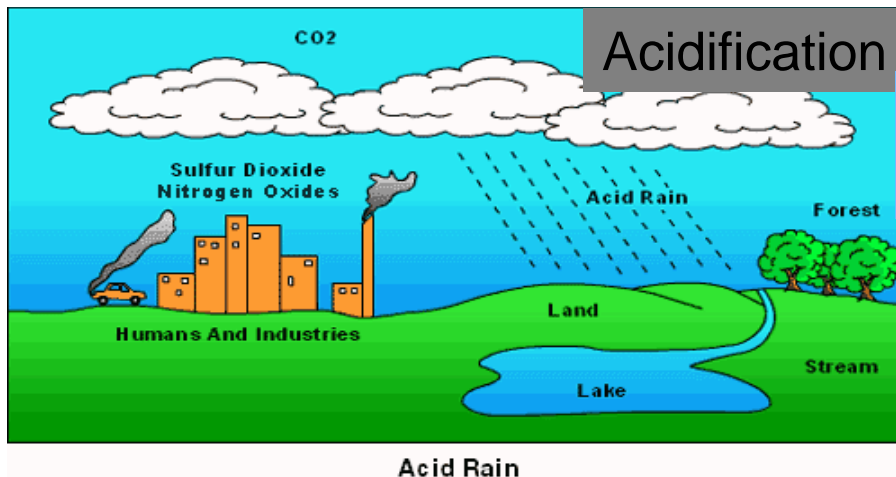
taken from other
product systems

to produce, use and
recycle the specified
product

What is included in an LCA of an Al Product?



**2. An inventory
of all emissions to air,
water and soil
affecting the
environment during
production, use and
recycling of the
specified product**



Global Warming
i.e. Carbon footprint

Summer Smog

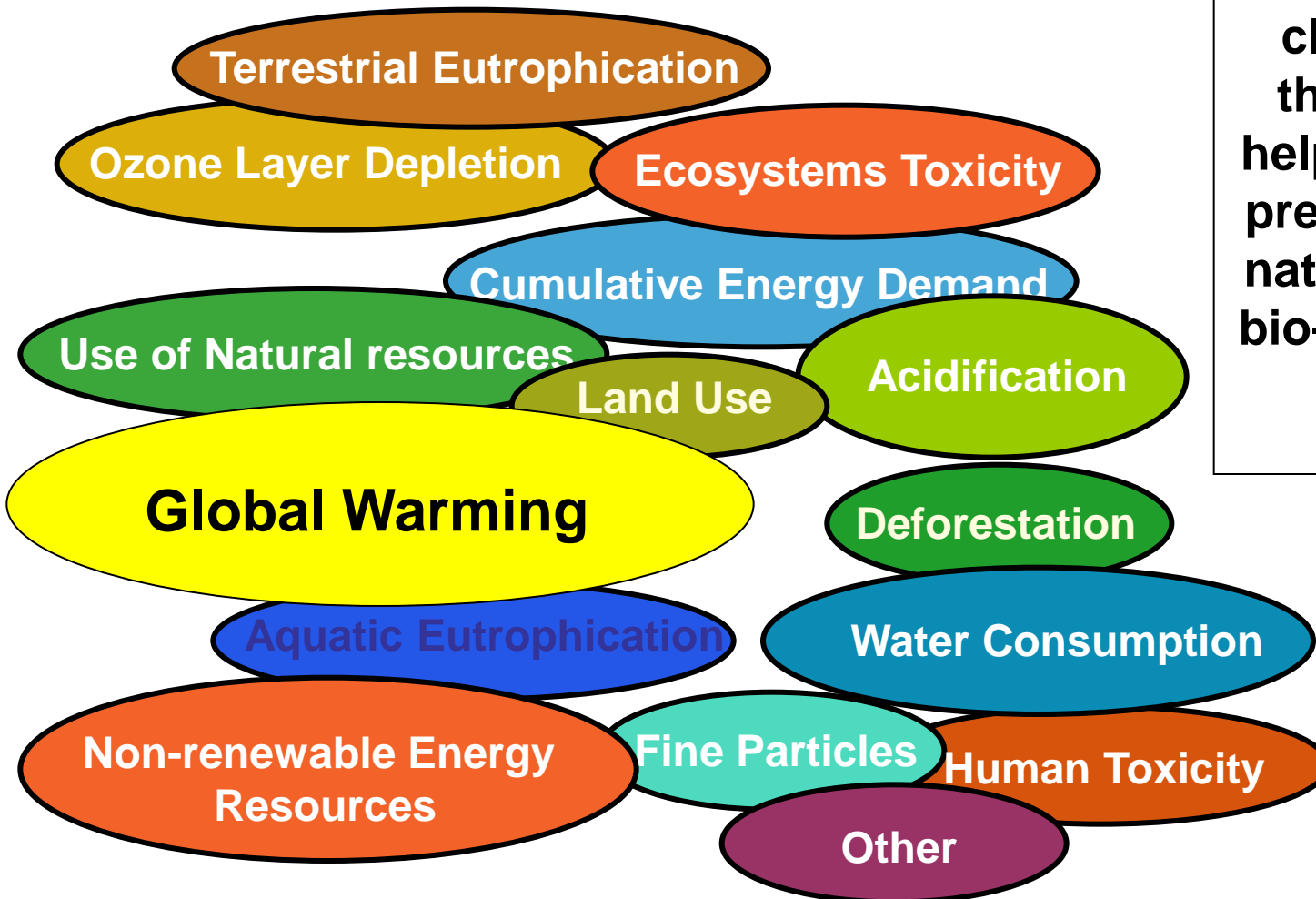
Eutrophication

Health

Waste

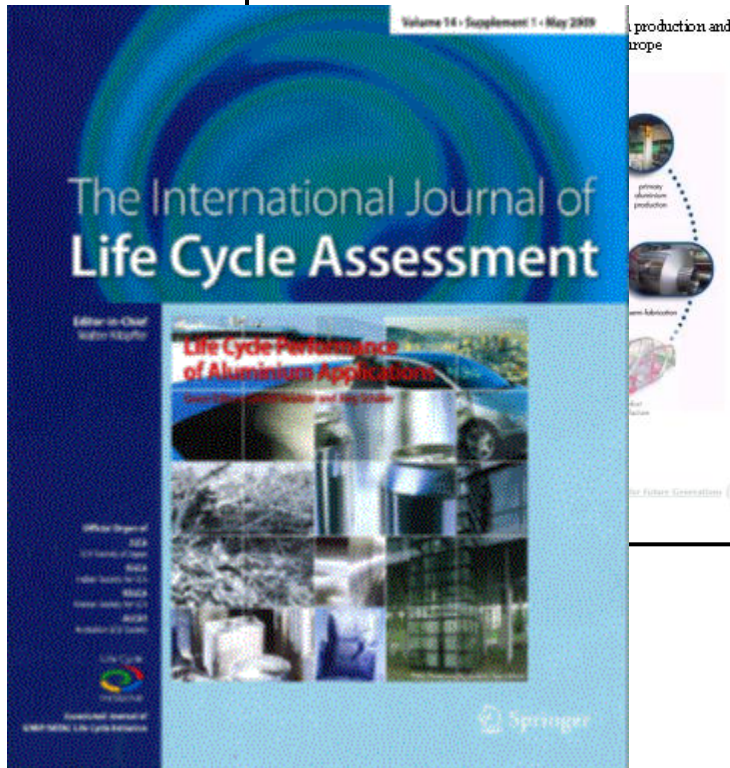
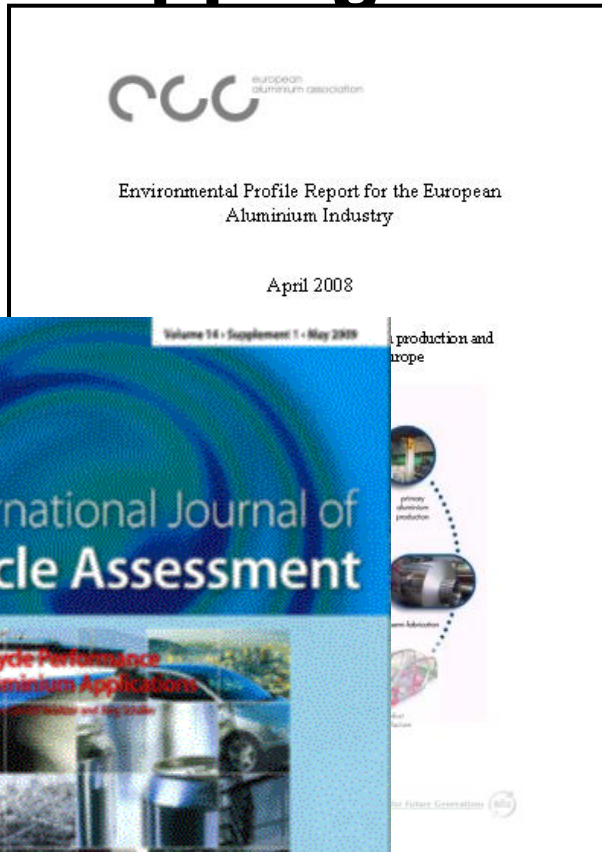
Ozone Depletion⁶

LCA outcome is usually a set of environmental Indicators



In addition to climate change, these indicators help to address the preservation of the natural capital, e.g. bio-diversity, water, air, land, etc.

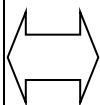
3. EAA has a long experience in devellopping LCI datasets



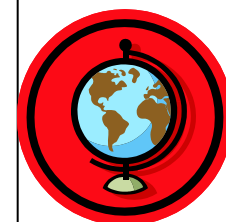
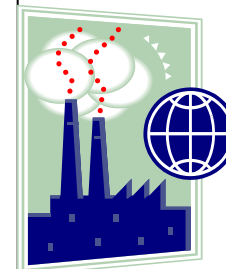
- Extensive environmental survey organised in 2006/2007 (reference year 2005) for developing/modelling updated Life Cycle Inventory (LCI) datasets
- Interactive critical reviewing of the whole LCI project by a renown independent LCA expert, Professor Walter Klöpffer
- Publication of a special « aluminium » edition of the International LCA Journal (May 2009)
- New LCI datasets (year 2010) under development

The three main steps of the generic LCI datasets development

Possibly with external verification



1. Calculation of foreground generic data (i.e. process-level data):
 - Collection, consolidation and averaging of input and output data for the various aluminium processes
 - Data collected through an EAA excel questionnaires
2. Development of LCI models
 - Models principles and hypotheses, determination of material flows, combination of the aluminium processes or sub-processes, integration of supplementary processes (electricity production, ancillary materials, etc.).
 - Use of specific LCA software (e.g. GaBi, Simapro) and database (eco-invent, GaBi, etc.)
3. Calculation of the generic LCI datasets and associated environmental indicators for a pre-set of impact categories



Developing generic LCI datasets

- Requires
 - significant effort at members and association level
 - LCA and technical expertise
 - Use of specific software and databases
 - ISO standards (ISO14044) should guide the processus
- A special focus is needed on the identified hot spots
- External verification reinforces credibility

Generic LCI datasets are not only building blocks for LCA studies but are also strong foundations for the advocacy work of the association.

Example of average foreground data for 1 tonne of profile production

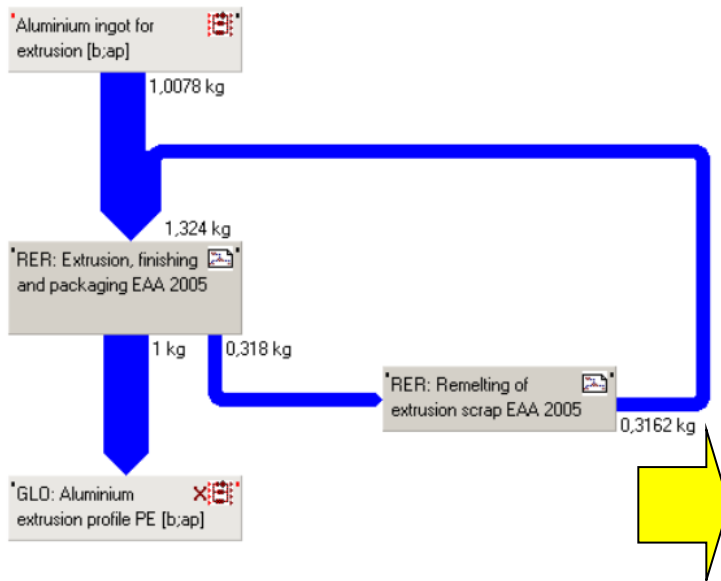
Aluminium extrusion processes - Figures for 1 tonne of extrusion						
	Unit	Extrusion	Scrap Remelting	Total		
Year		2005			2002	1998
Main aluminium inputs						
Extrusion ingot	kg	1008		1008	1013	1013
Clean scrap	kg		324			
Main aluminium outputs						
Dross/skimmings	kg		10		15.3	18.4
Metal content of dross/skimmings	%		60%			
Clean scrap	kg	324				
Finished profile	kg	1000		1000	1000	1000
End use Energy						
Heavy Oil	kg		0.4	0.4		
Diesel and light fuel Oil	kg	1.1	0.3	1.4	1.25	0.65
Natural Gas	kg	47.7	25.6	73.3	81	101
Total thermal energy	MJ	2,402	1,216	3,619	3,904	4,827
Electricity	kWh	758	118	876	913	1321
Ancillaries inputs						
Argon	kg		0.73	0.73		0.53
Chlorine	kg		0.04	0.04	0.011	0.081
Water input (mainly cooling)	m3	2.4	3.5	5.9	11	30
Acids, calculated as 100% H ₂ SO ₄	kg	6.9		6.9		
Alkalis, calculated as 100% NaOH	kg	11.3		11.3	15	28
Water input	m3	1.9	2.8	4.7	9	26
Emissions						
NOX, as nitrogen dioxide	kg	0.15	0.22	0.37		
SO2	kg	0.03	0	0.03		
Dust/particulates, total	kg		0.04	0.04		
Water output	m3	1.83	3.26	5.1		
Total hazardous waste	kg	37.5	0.5	38.1	37.6	32.3
Total non-hazardous waste	kg	12.9	2.07	14.97	19	23

Main LCI data (kg) per tonne of profile

RER: Aluminium extrusion profile EAA 2005 [pl]

GaBi 4 process plan: Mass

The names of the basic processes are shown.



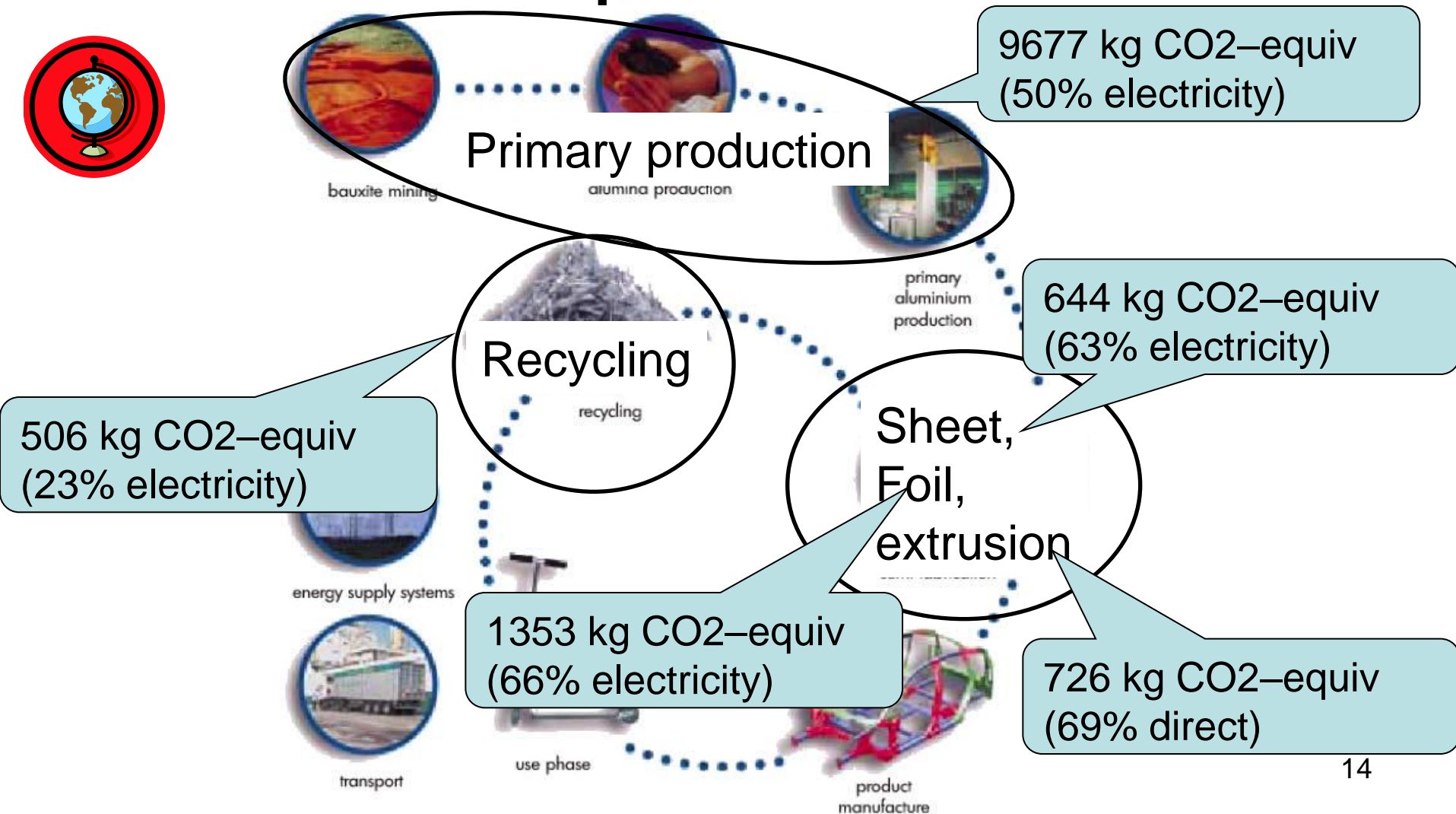
Year	2005		2002	1998
Inputs (kg)	Total	From electricity	Total *	Total *
Aluminium ingot	1008		1013	1013
Fossil energy resources				
Crude oil	22,7	65%	31	43
Hard coal	77,1	95%	104	151
Brown coal	126,2	94%	110	158
Natural gas	123,7	29%	106	135
Outputs (kg)				
Aluminium extrusion	1000		1000	1000
Main air emissions				
CO ₂	683	69%	632	860
NO _x	1,56	56%	1,1	1,5
SO ₂	2,6	92%	3,2	3,2
Dust	0,11	90%	0,47	0,69
Methane	1,58	58%	1,6	2,2

LCI indicators per tonne of profile

- GHG emission: 726 kg CO₂-equiv/tonne
 - 69% from electricity
 - Electricity model plays a very big role
 - Use of EU25 electricity model (ref year 2002)

EAA indicators (per tonne of aluminium profile)	Total	From electricity
Abiotic Depletion (ADP) [kg Sb-Equiv.]	4,70	54%
Acidification Potential (AP) [kg SO ₂ -Equiv.]	3,80	82%
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	0,22	55%
Greenhouse gas emission (GWP 100 years) [kg CO ₂ -Equiv.]	726	69%
Ozone Layer Depletion Potential (ODP, steady state) [kg R11-Equiv.]	1,22E-04	97%
Photo-Oxidant Creation Potential (POCP) [kg Ethene-Equiv.]	0,23	76%
Primary energy from renewable raw materials (net cal. value) [MJ]	1146	65%
Primary energy from non-renewable resources (net cal. value) [MJ]	14311	68%

GHG per tonne of Al for the production & transformation processes



4. Environmental indicators for aluminium products

- Building applications
- Automotive applications
- Packaging applications

Some key aspects in environmental product policies and LCA

- Functional unit and system boundary
 - Especially for comparison or policy purposes



- Use phase
 - Developing robust/realistic scenarios
 - Durability and energy performances

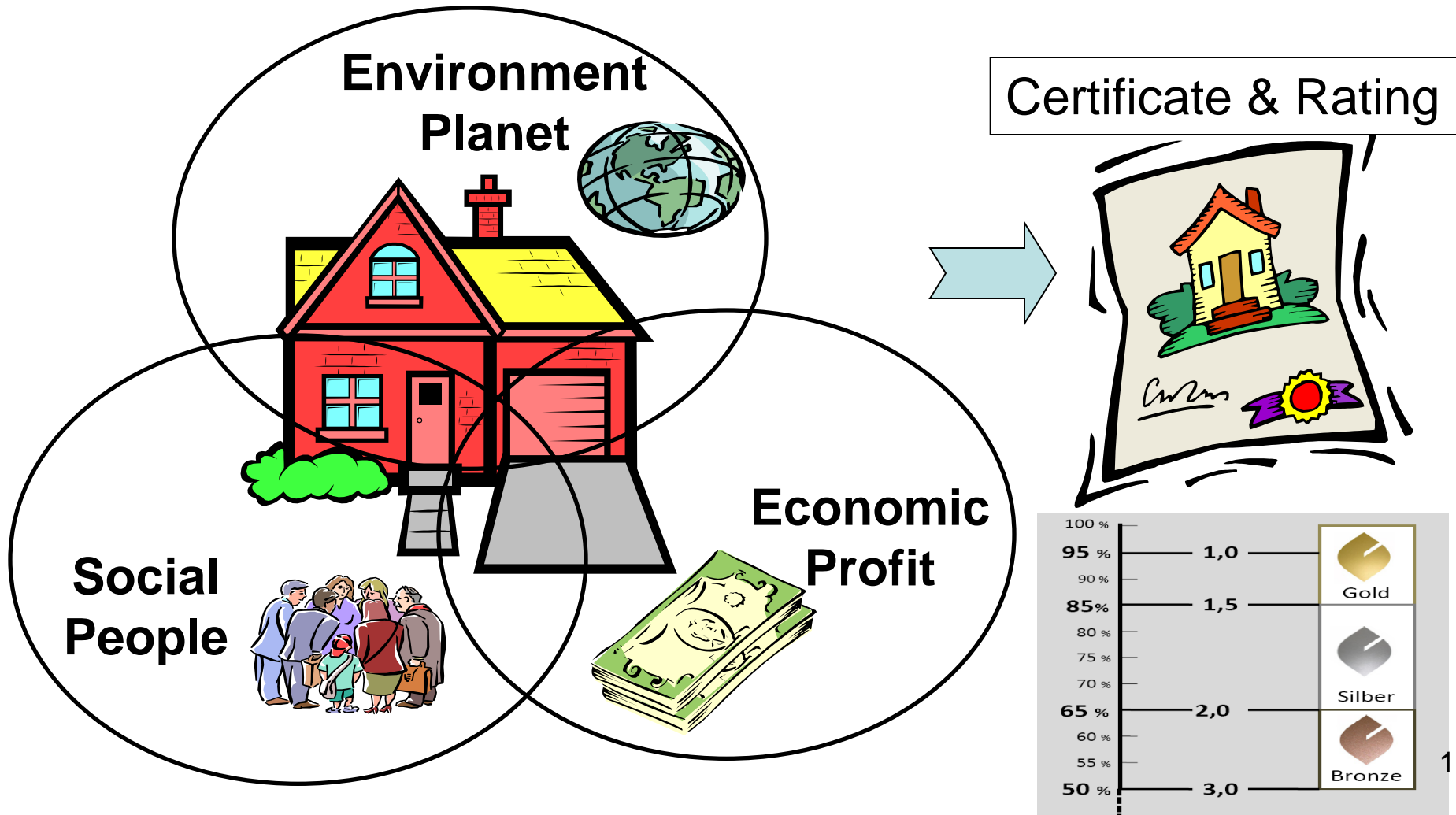


- End of life*
 - Recycling for metals

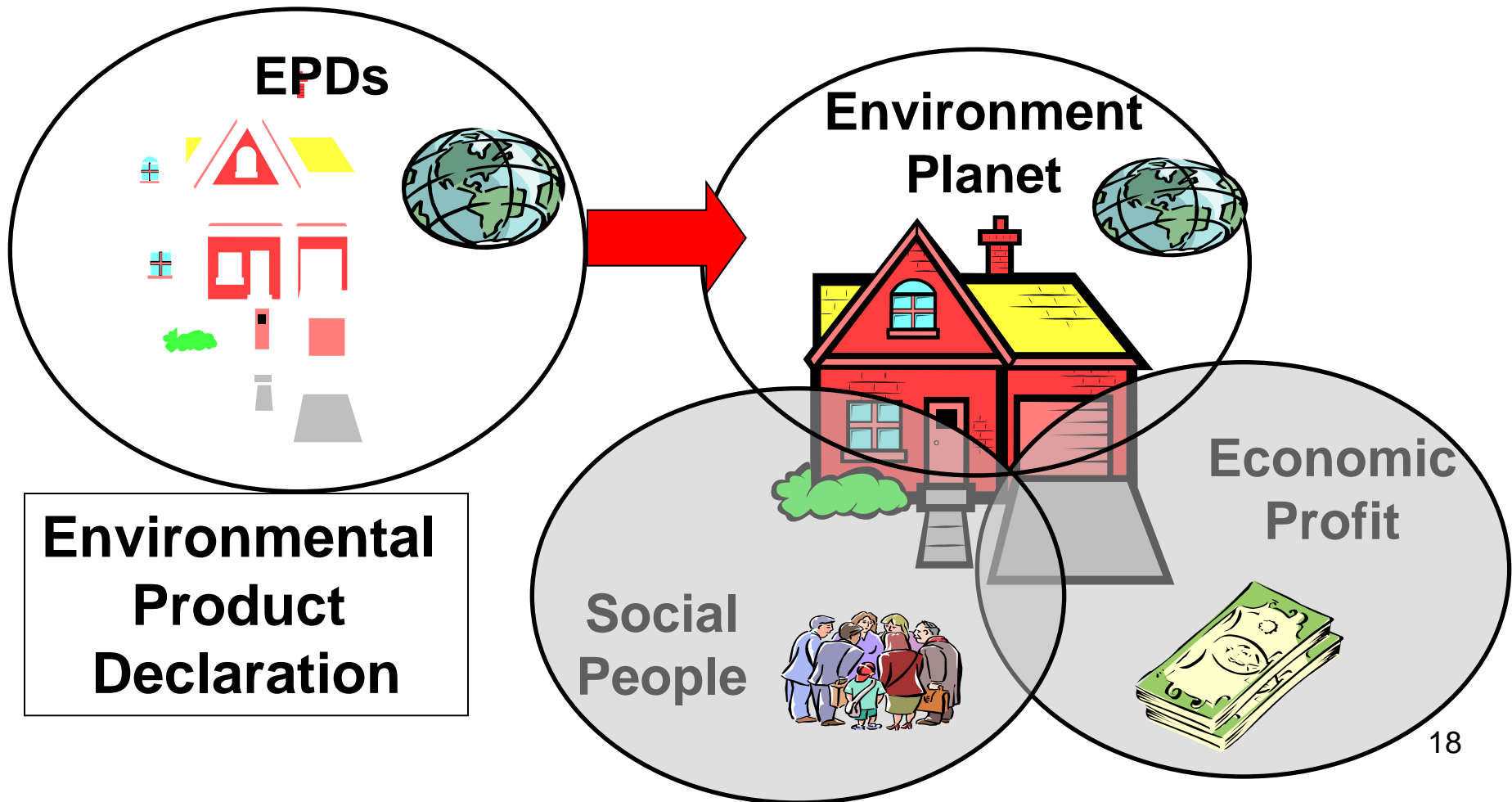


A. BUILDING

Sustainability assessment of buildings/construction is on track



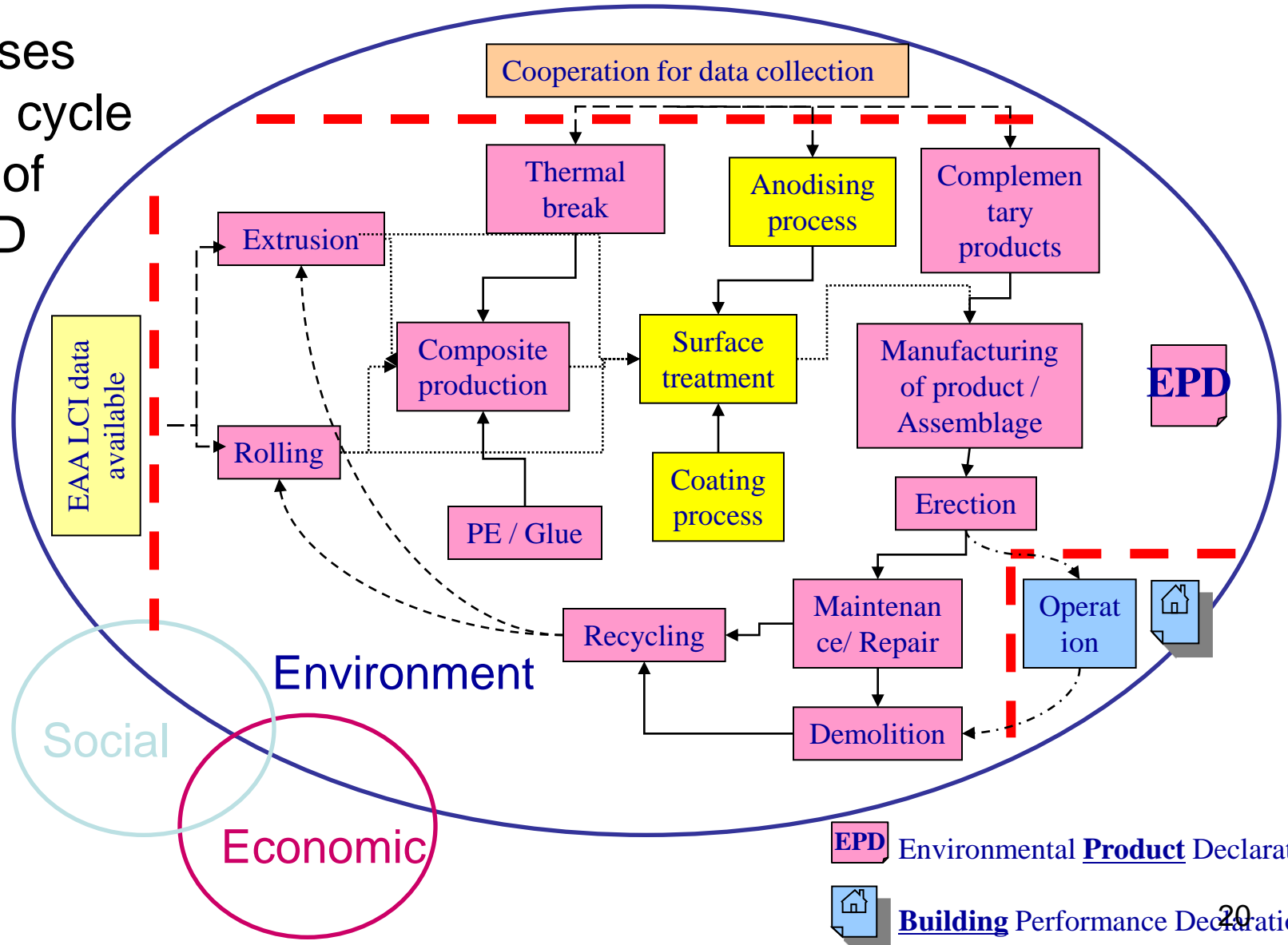
Environmental Product Declarations are essential elements



EAA EPD program and tool status

Product	EAA webtool		Others
	Generic - Public	EAA members-restricted	
Windows	2nd verification finished – ready for use	Some company-specific systems already integrated	2 members implementing EPD within CAD software
Curtain walls	Prototype available (based on HBS profiles)	No specific systems implemented	
Coil coated sheet	No	Almost finalised, tool and data verification will start soon	No
Composite panel	No	Prototype under preparation	No

Processes and life cycle stages of the EPD



Result...

Environmental Product Declaration Short Version



EAA - European Aluminium Association
Av. de Broqueville 12
B-1150 Brussels
www.eaa.net

10, rue du Débarcadère
F-75852 Paris Cedex 17

www.stfa.fr



EAA-2008-05-14-4985-ENG

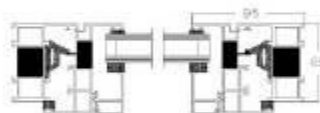
05/14/2008

Project Name:
Product Name:

Test 14/08
Super 11&1um

This EPD applies to a single side-hung casement window using the declared aluminium profile and a standard glazing system in the given dimensions.

generic depth 65



Product characteristics:

Window size:
Width: 1,000.00 mm
Height: 1,000.00 mm

Transparent area:
Transparent Area: 0.74 m²

Surface:
Surface treatment: Powder coating

Total weight of the window:
Mass: 40.43 kg

Thermal transmittance (U_g-value) [W/m²K]: 1.80
Light transmittance value of glass (T_L) [%]: 90.00
Solar factor (g-value) [%]: 90.00
Burglar resistance: npd

Acoustic performance [dB]:
Reaction to fire: F

According EN 14351-1:
npd = no performance determined.
Characteristics provided by producer.



Producer

Validity

Declaration number

Date of Issue

Declared product

Product type

Profile system

Comparability

Verification

Manufacture

Environment

Application

Packaging

and service

Recycling

Element of the

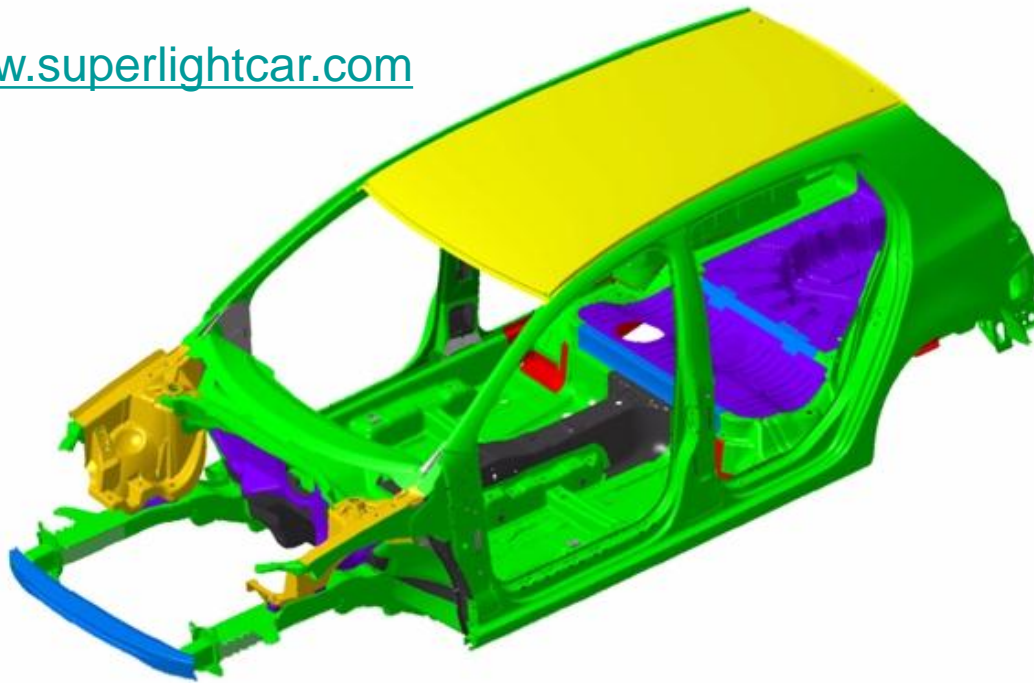
Scope of the LCA

Life Cycle Indicator	Result for declared Life Cycle
Primary energy, non-renewable [MJ]	1,069.26
Primary energy, renewable [MJ]	73.11
Water consumption [kg]	811.38
Depletion of Abiotic Resources (ADP) [kg Sb-Equiv.]	0.41
Greenhouse Gas Emission (GWP) [kg CO2-Equiv.]	56.92
Ozone Depletion Potential (ODP) [kg R11-Equiv.]	7.136e-6
Acidification Potential (AP) [kg SO2-Equiv.]	0.44
Eutrophication Potential (EP) [kg Phosphate-Equiv.]	0.04
Photochemical Ozone Creation Potential (POCP) [kg Ethene-Equiv.]	0.03
Non hazardous waste [kg]	12.81
Hazardous waste [kg]	2.86

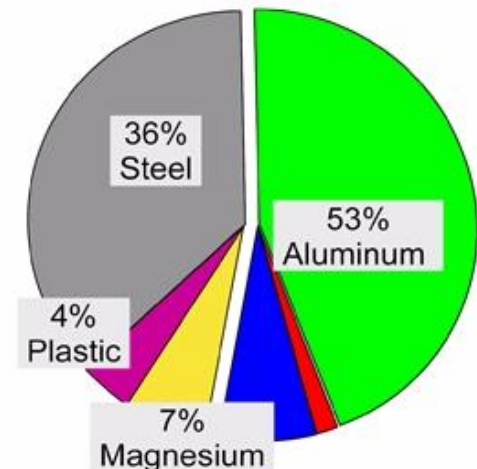
The LCA comprises the manufacture of the primary materials regarding to the applied surface treatment and their assembly to windows. This includes also the transport of the semi-finished products to the

B. Automotive – Lightweighting benefits needs to be fully considered

www.superlightcar.com



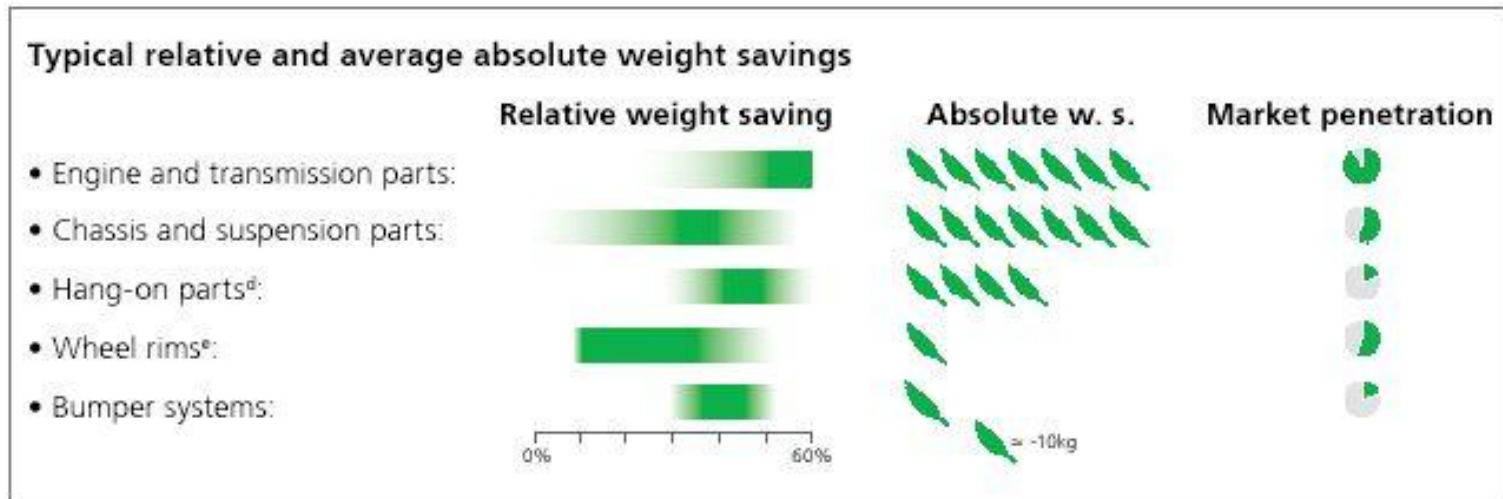
- Aluminium sheet
- Aluminium cast
- Aluminium extrusion
- Steel
- Magnesium
- Fibre reinforced plastic



SLC BIW: weight 180kg (-35%, Δm -101kg)

Lightweighting with aluminium – today

- Primary weight savings, typical values:

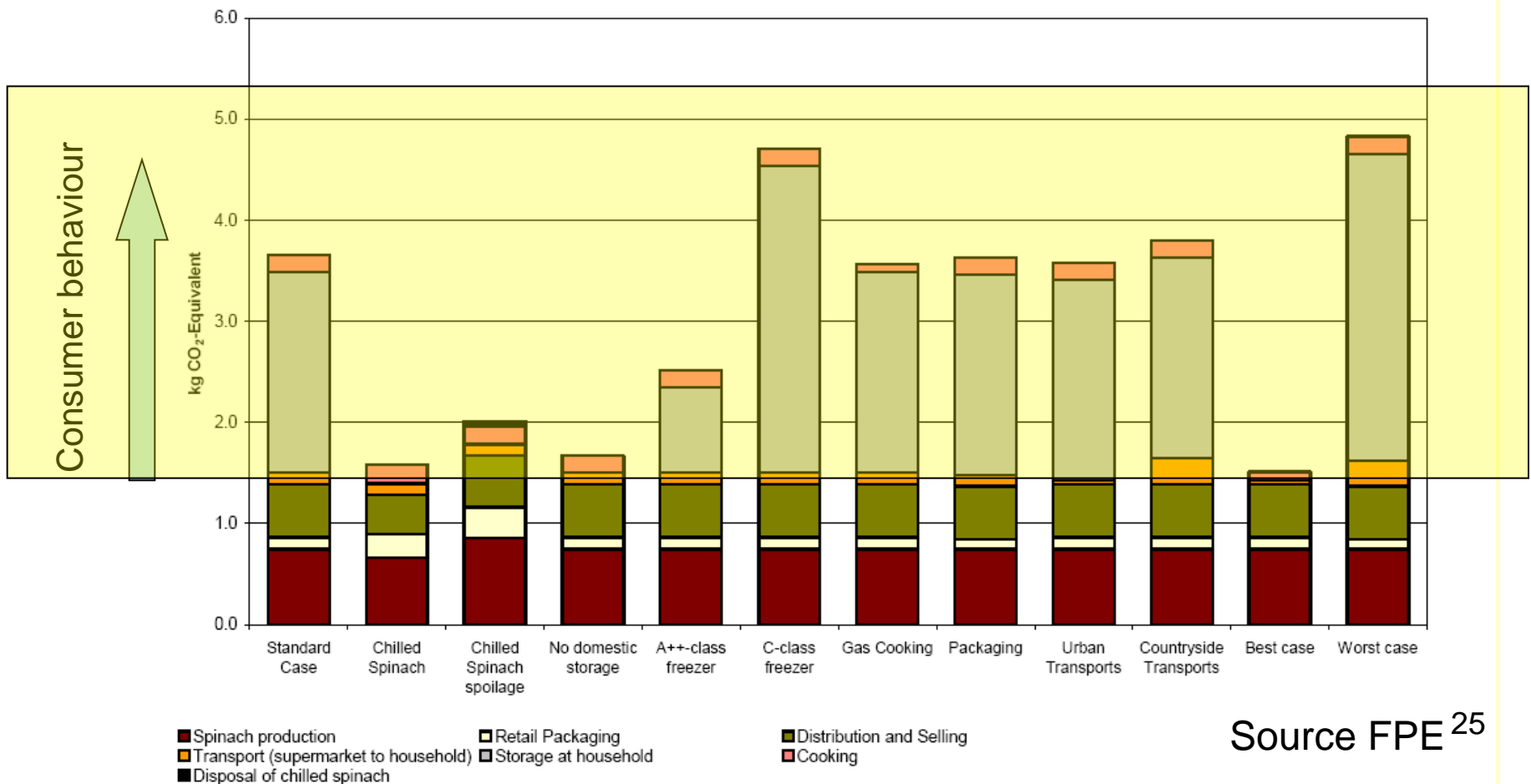


Secondary weight savings typically 0 – 50% extra

- Significant growth is expected from aluminium sheet and extrusions:
 - Car body applications, particularly hang-on parts: doors, hoods etc...
 - Crash management systems

C. Packaging

Food - Modelling the use phase is challenging but crucial – Deep frozen spinach – Carbon footprint



Source FPE²⁵

5. Conclusions

- Life cycle thinking is key for aluminium
- LCA is the scientific tool to support the lifecycle approach for evaluating the environmental impact of processes/products.
- Most of the aluminium benefits appear during the use or recycling phases of aluminium products.
- End-of-life recycling needs to be properly credited

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