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Tackling Recycling Aspects in EN15804: the Metal Case

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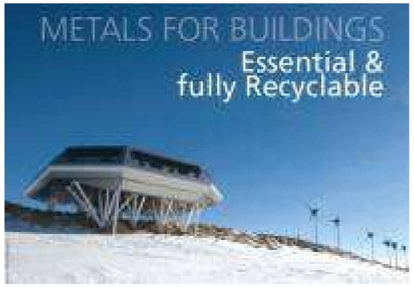

Should we allocate environmental value to secondary/recycled materials?

Square aluminium ceiling plates stacked and ready for transportation

Mixed metal scrap

environmental Value ?

Aluminium ceiling strips in the Pirelli building

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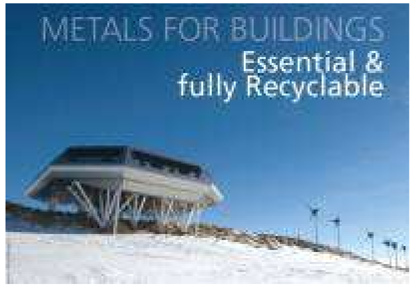

The 2 usual LCA methods for recycling

« Recycled Content »	« End of Life recycling »
Cut-off rule applied on recycled materials exiting the system, i.e. no allocation rule	Allocation rule applied, i.e. as recommended by ISO and ILCD
Recycled materials are « free of environmental burdens/values »	Environmental benefits calculated on basis of the primary material savings resulting from the end of life recycling
Recycled content is the key indicator	EoL recycling rate is the key indicator
Recycling benefits given to the product using recycled materials	Recycling benefits given to the product providing recycled materials
Promote the consumption/use of recycled materials	Promote the production/preservation of recycled materials
Method 100:0	Method 0:100

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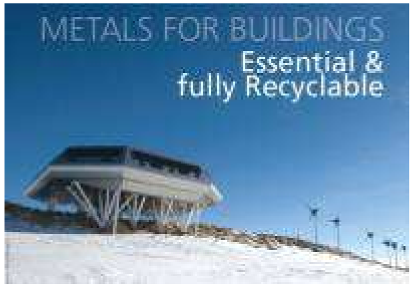
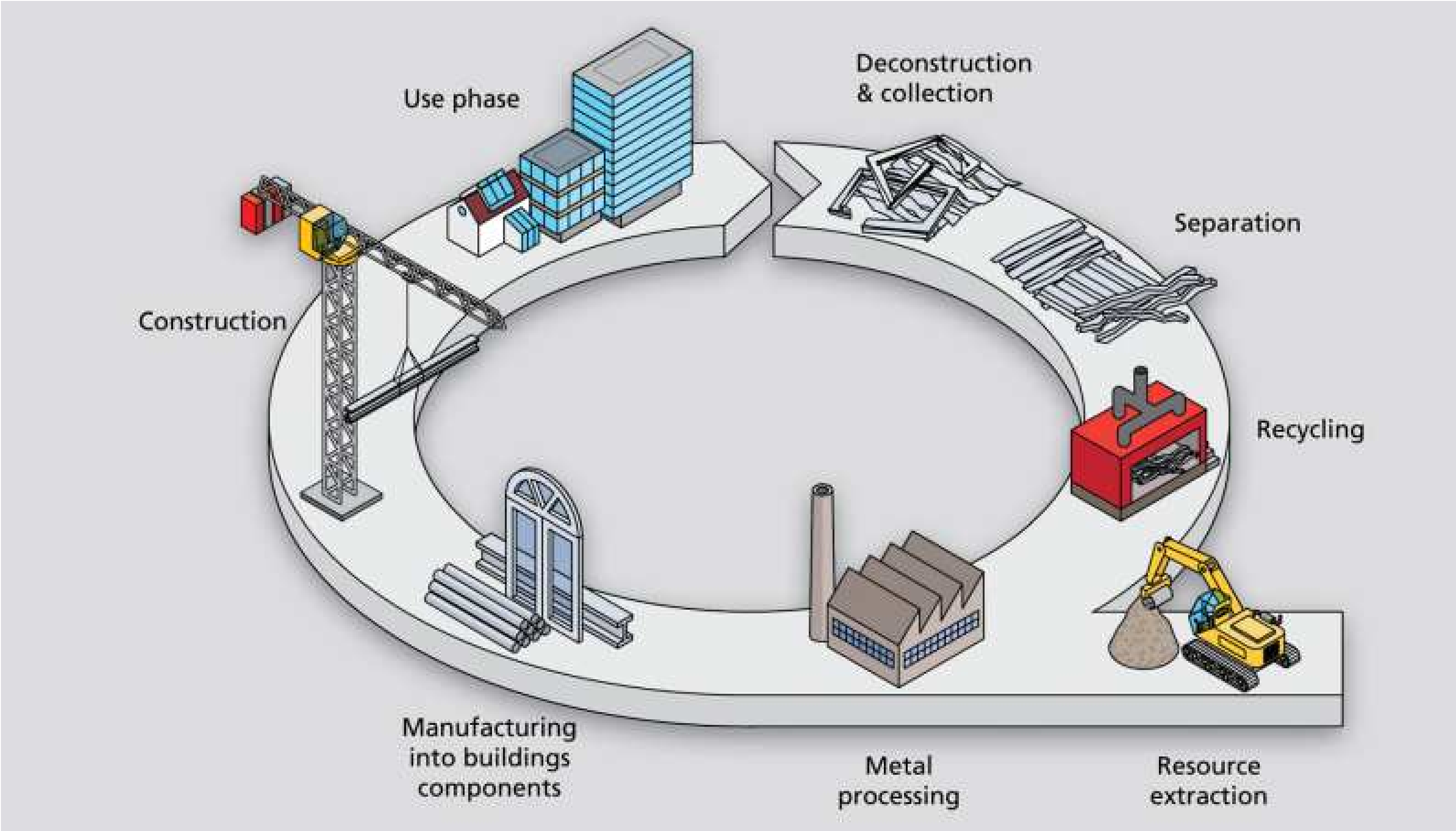


Metal building products:
the « Cradle to Cradle » life cycle



The high economic value of metal scrap is the main driver

Recycling of end-of life metal building products: an efficient business

- Aluminium
  - **Collection rates > 95% showed** by a TUDelft study
  - 9 demolition sites analysed in 6 EU countries
  - Large parts, such as windows, corrugated roof plates, curtain walls and exterior cladding plates collected and dismantled separately for direct remelting
- Steel
  - UK survey showed that 99% of steel section are collected as well as 92% of rebars

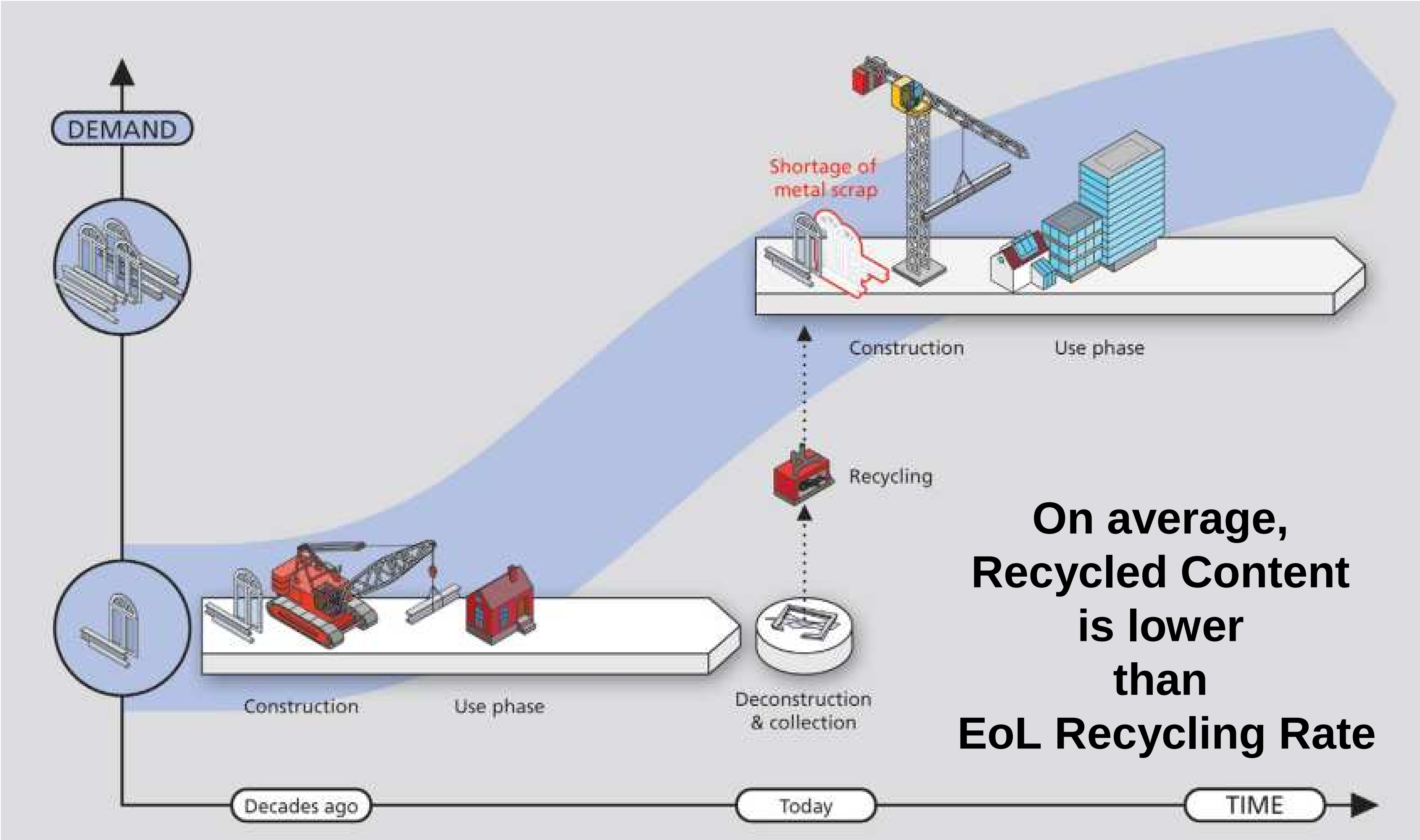
- High value of metal scrap is a key incentive and major economic impetus for recycling
- A **recycling rate of 90-95%** is typically reached for metal products used in buildings, e.g. aluminium window frame or steel section

Square aluminium ceiling plates stacked and ready for transportation

Aluminium ceiling strips in the Pirelli building

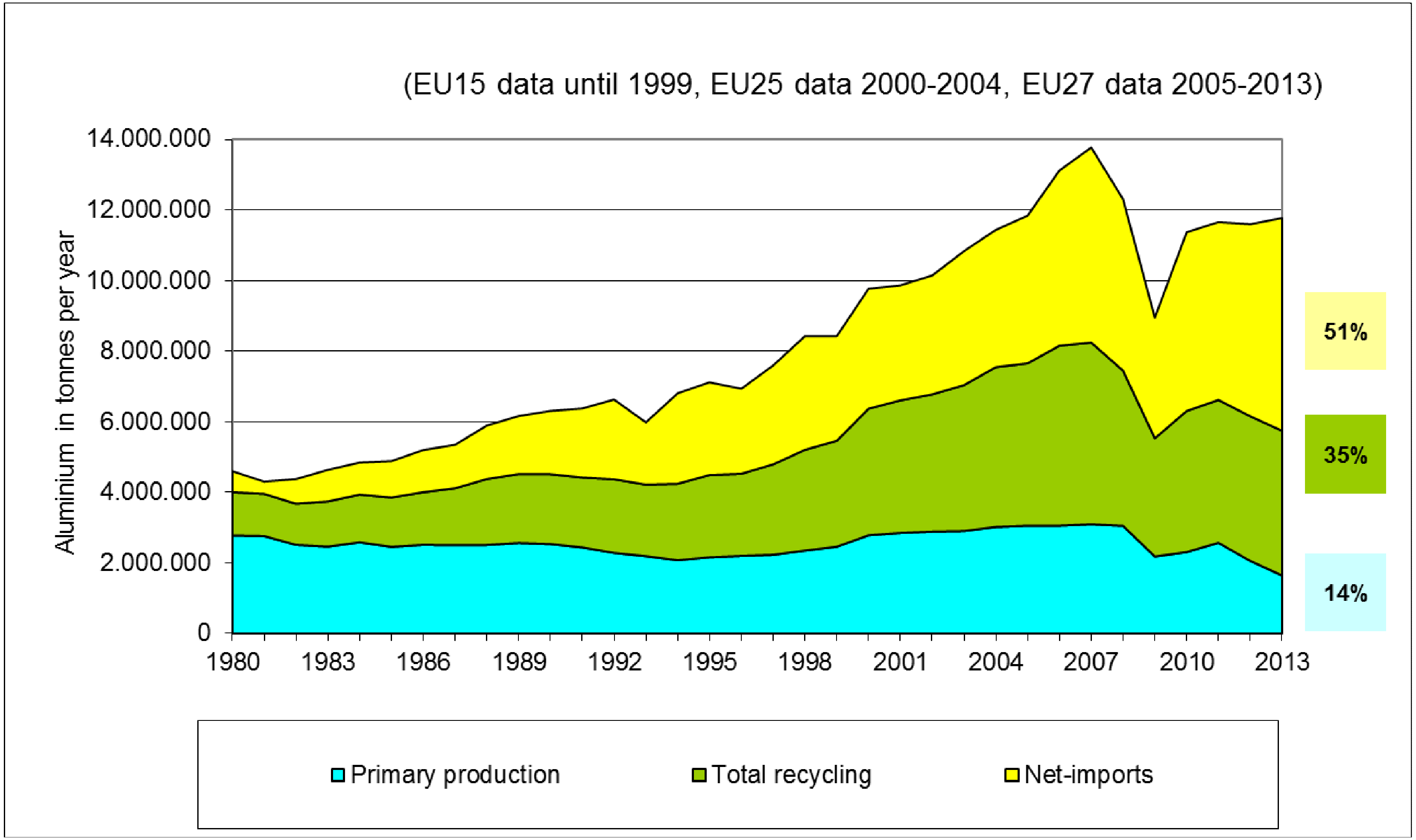
Mixed metal scrap

Due to market growth, « scrap » is missing in spite of a high EoL recycling rate

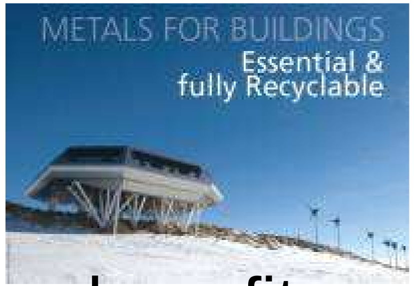


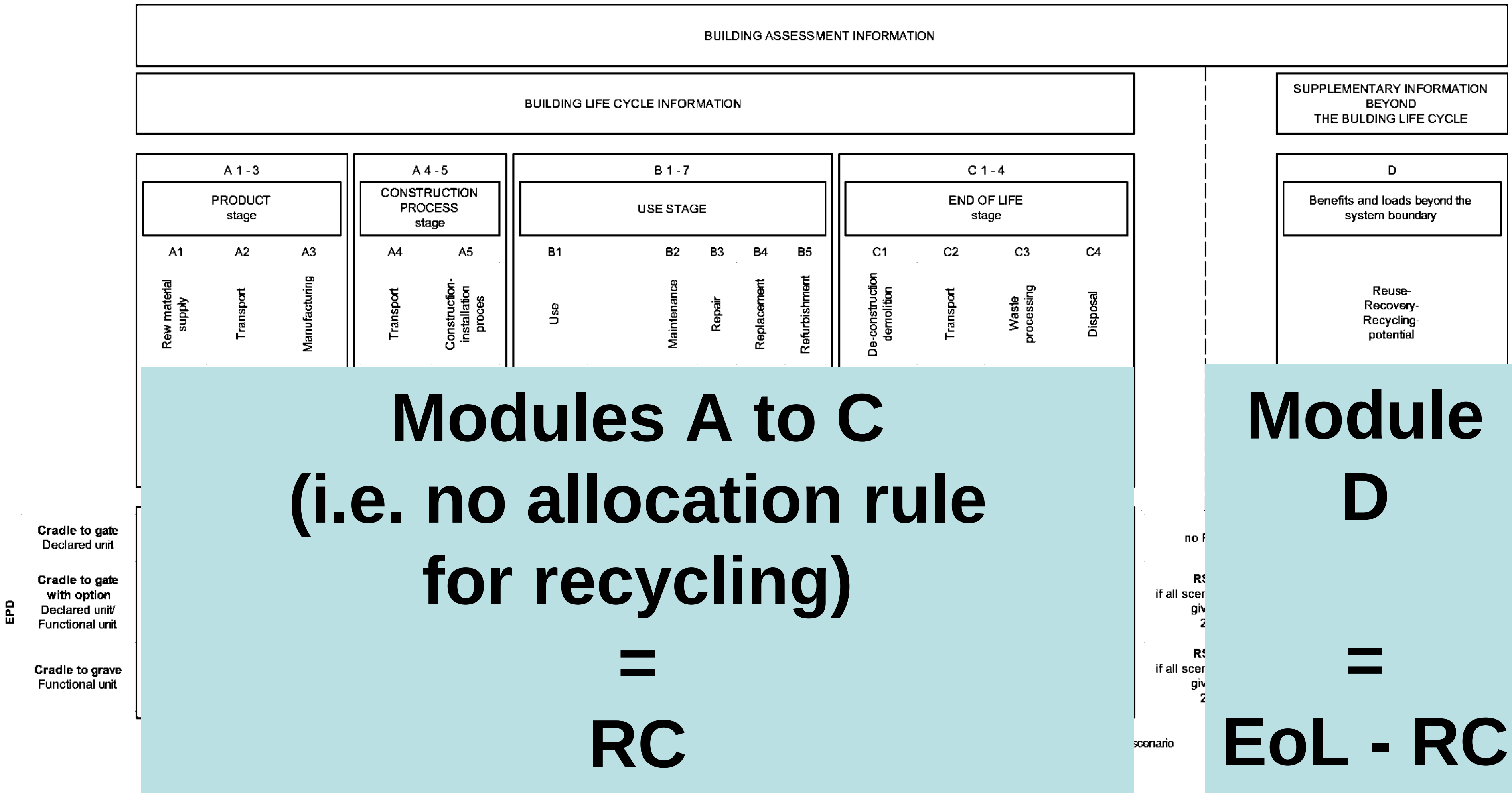
On average, Recycled Content is lower than EoL Recycling Rate

Example: Aluminium supply of the EU market



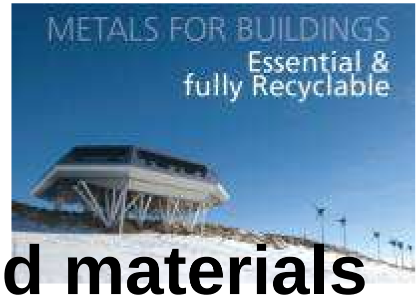
EN 15804: Modularity principle and recycling benefits





Modules A to C
(i.e. no allocation rule for recycling)
=
RC

Module D
=
EoL - RC



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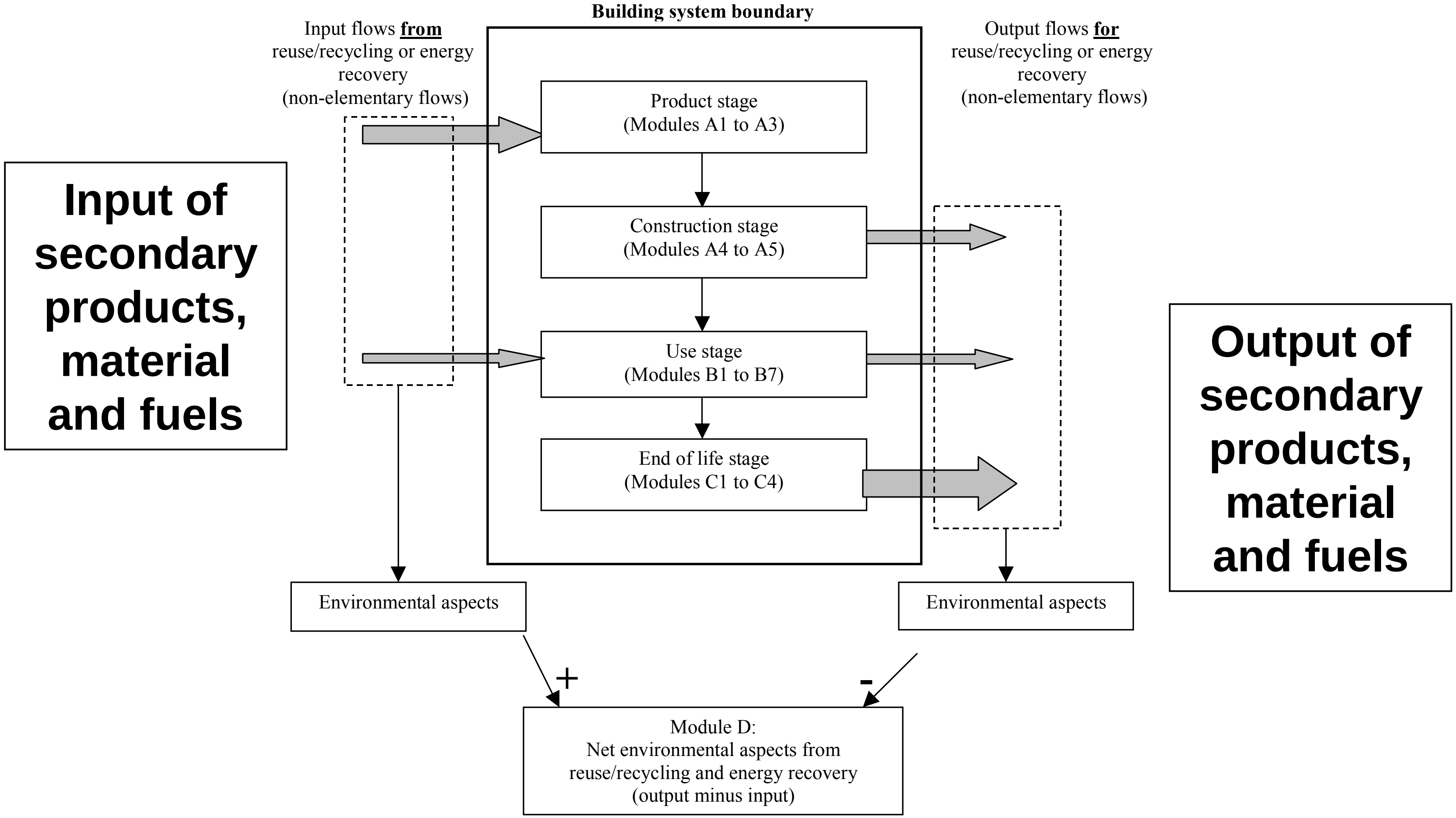
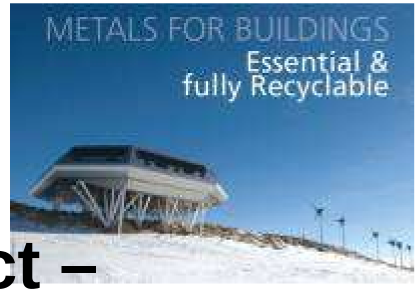
Module D principle: considering recycled materials on life cycle basis in accordance with ISO rules





Module D calculation for a metal product – Flows & system boundary

- System boundary (section 6.3.4.5 of EN15804)
  - After physical prepration (e.g shredding and sorting), metal scrap usually satisfy the « end of waste » criteria
  - Scrap enter and exit the system boundary
  - Secondary material = sorted metal scrap
- Input and ouput flows
  - Metal scrap are used in the metal suppy chain and are generated at the end of life
  - Calculation needs to address the net environmental aspects of scrap flow, i.e. outputs minus inputs
  - Provided the scrap at the input and output of product system have the same properties, the methodology can be applied to the net flow of scrap

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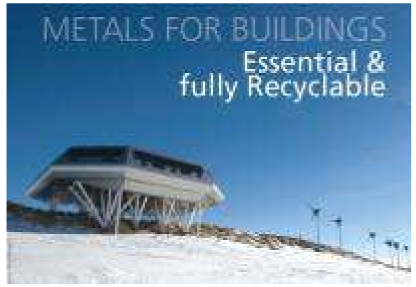
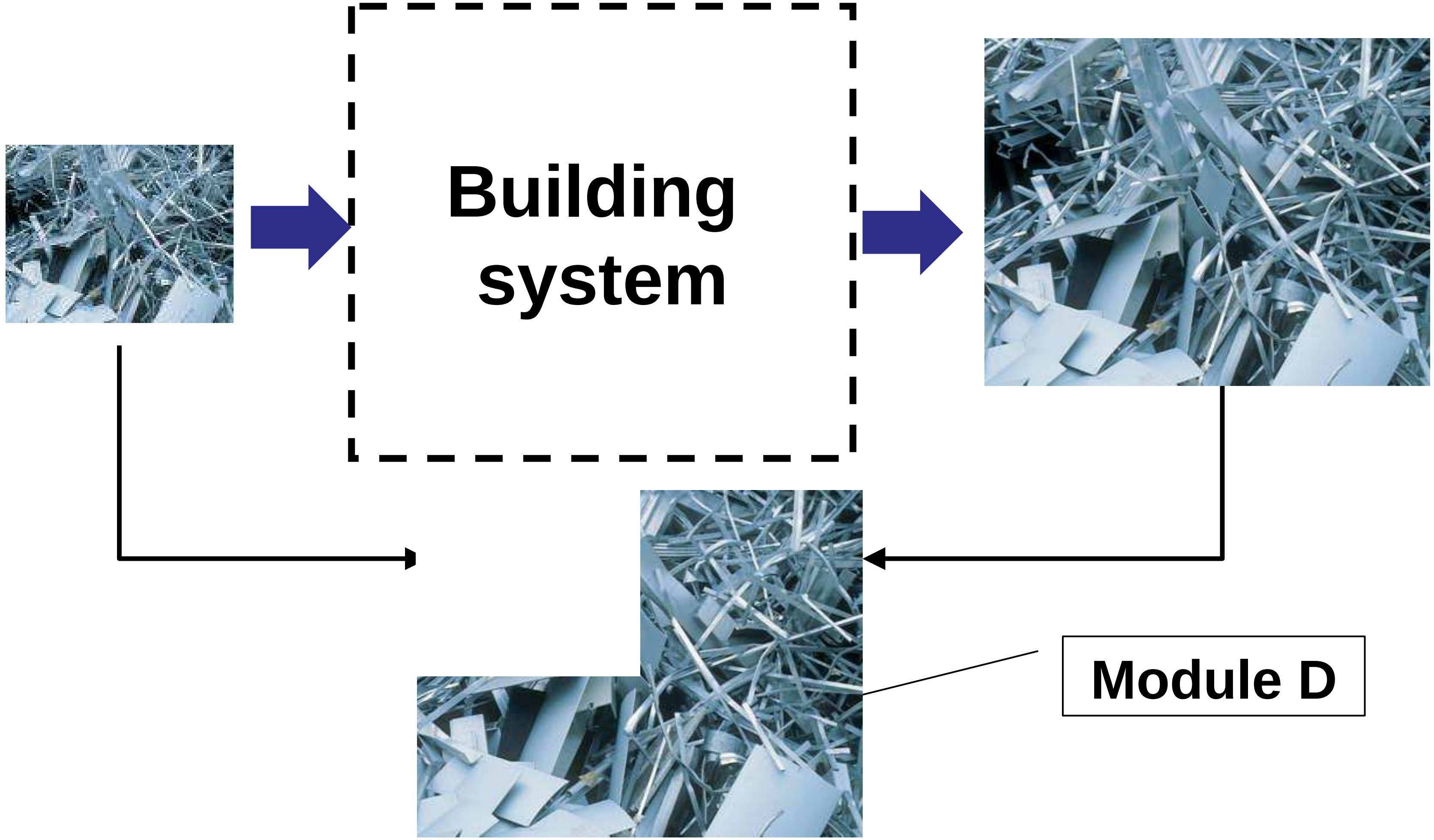
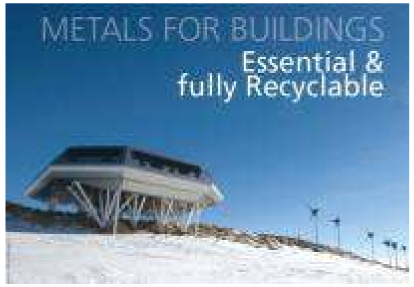


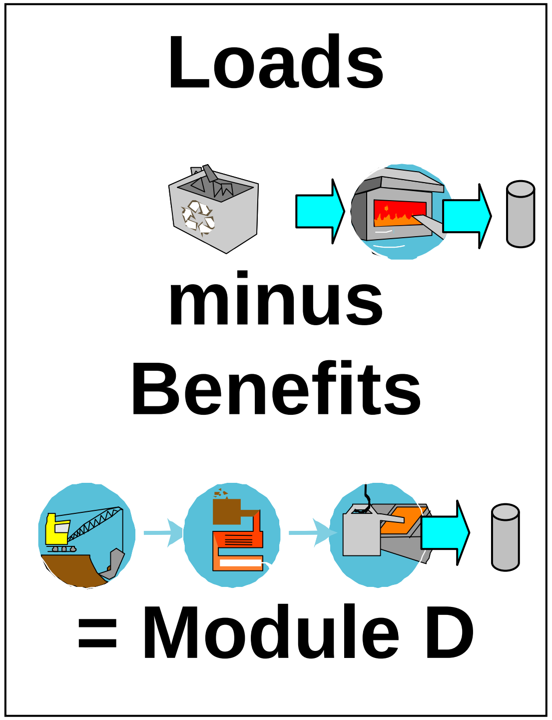
Module D principle – simplification

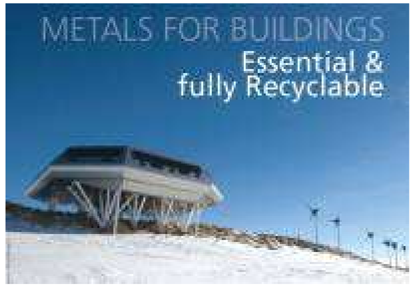




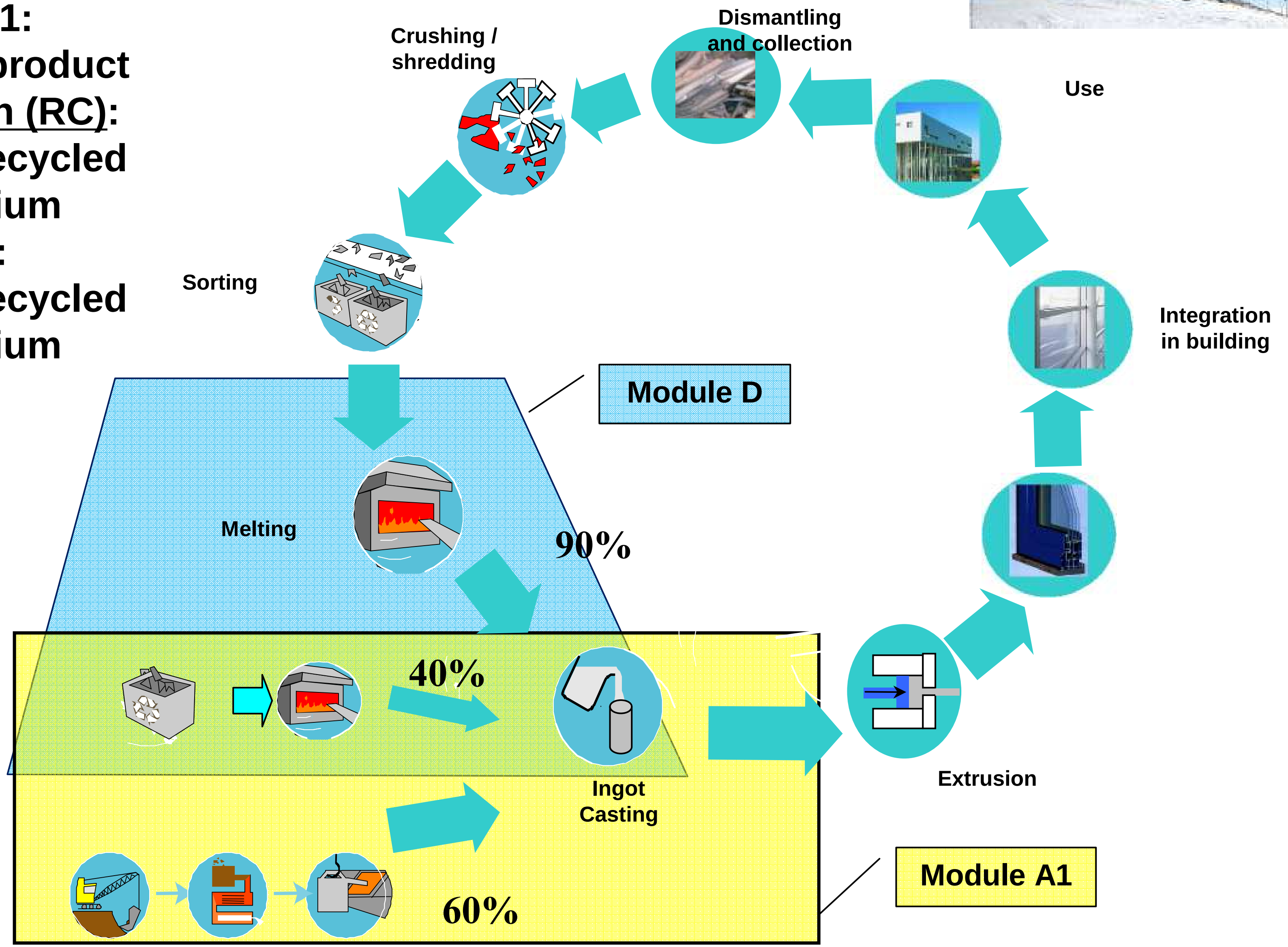
Module D calculation for a metal product – substitution principle (section 6.4.3.3)

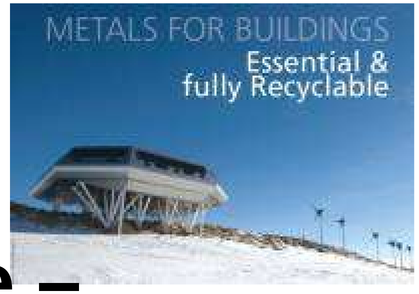
- Point of functional equivalence
  - For metal products, the point of functional equivalence is the ingot, i.e. where recycled metal subsitutes primary metal
- Net impacts calculation: « avoided impact » principle
  - Loads : Recycling loads from « scrap up to ingot » including metal losses
  - Benefits: Primary metal subsituted/saved by the recycled metal scrap enter and exit the system boundary
  - A correction factor should be applied if full substitution cannot take place
  - Results/indicators = Loads – Benefits





Case 1:
1 kg of Al product
<u>Production (RC)</u>:
0,4 kg of recycled aluminium
<u>EoL</u>:
0,9 kg of recycled aluminium





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Case 1 : GHG calculation principle – Aluminium ingot production

Data related to production processes			
Type of production		GHG*	Unit
Primary metal production up to ingot		9,7	kg CO2 equiv/kg metal ingot
Recycling (from end of life product up to ingot)		0,5	kg CO2 equiv/kg metal ingot
*Source: Environmental Profile Report for the European Aluminium Industry, EAA, April 2008			
Data related to the studied product			
Ingot production		GHG	
Metal supply from primary	60%	5,8	kg CO2 equiv/kg metal ingot
Metal supply form recycling	40%	0,2	kg CO2 equiv/kg metal ingot
Total		**6,0**	**kg CO2 equiv/kg metal ingot**

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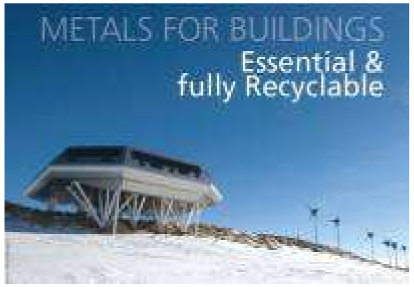

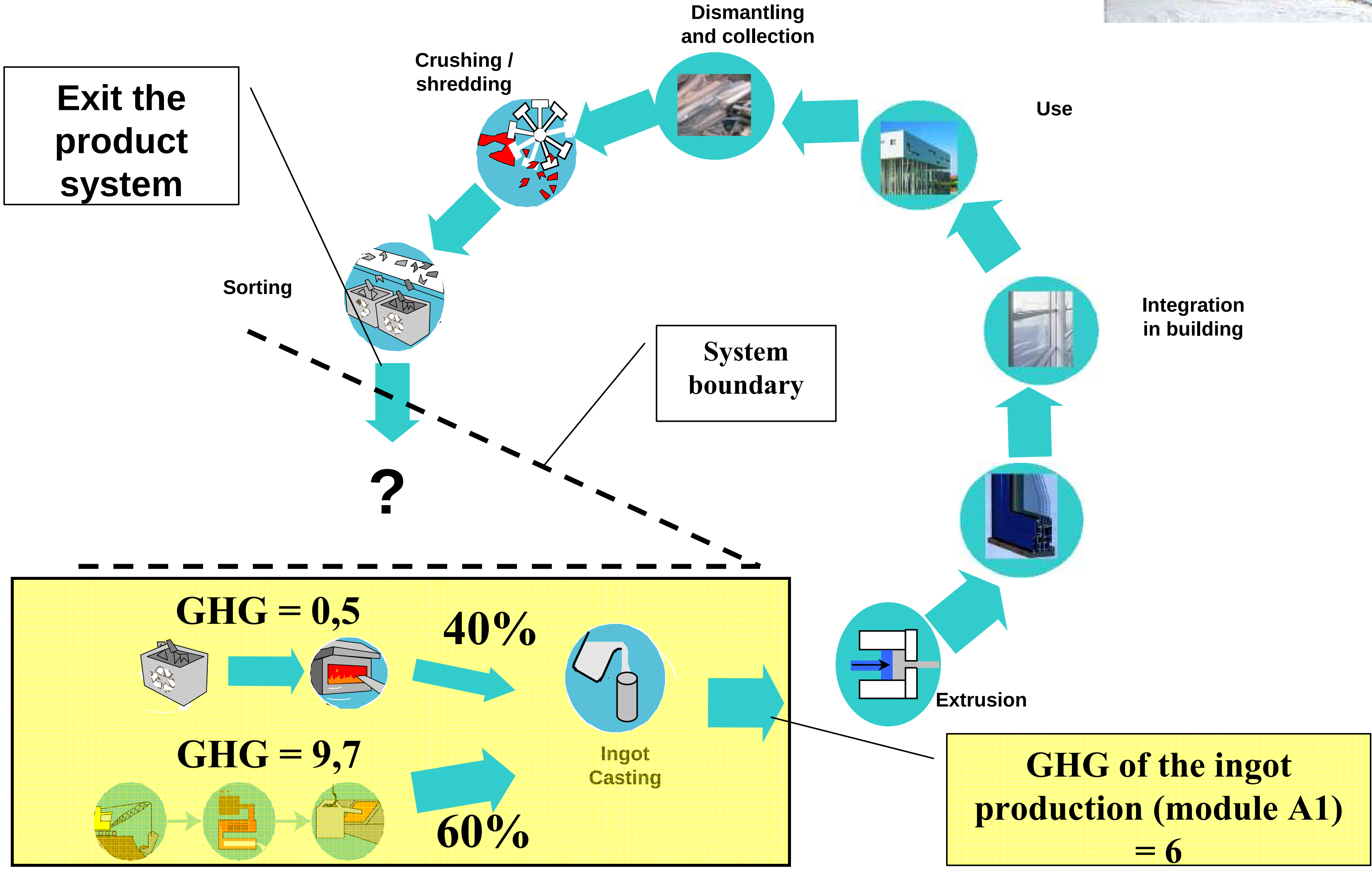

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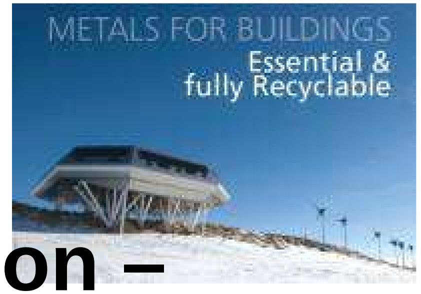
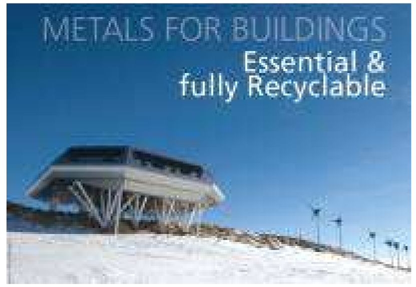
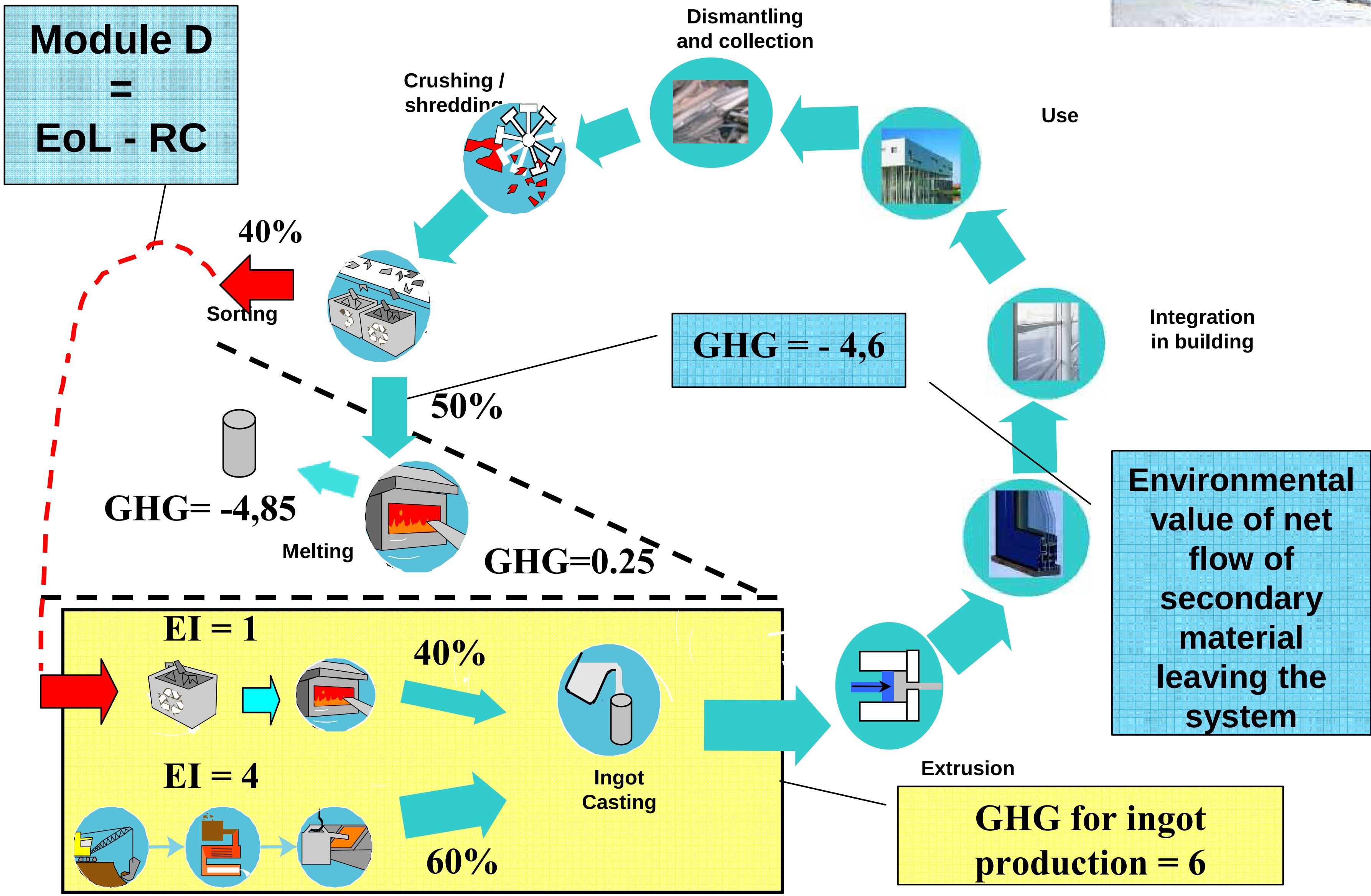
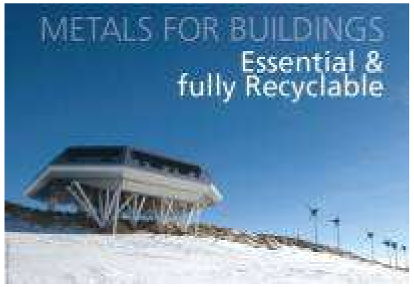


Case 1 : Example of GHG calculation – Module D

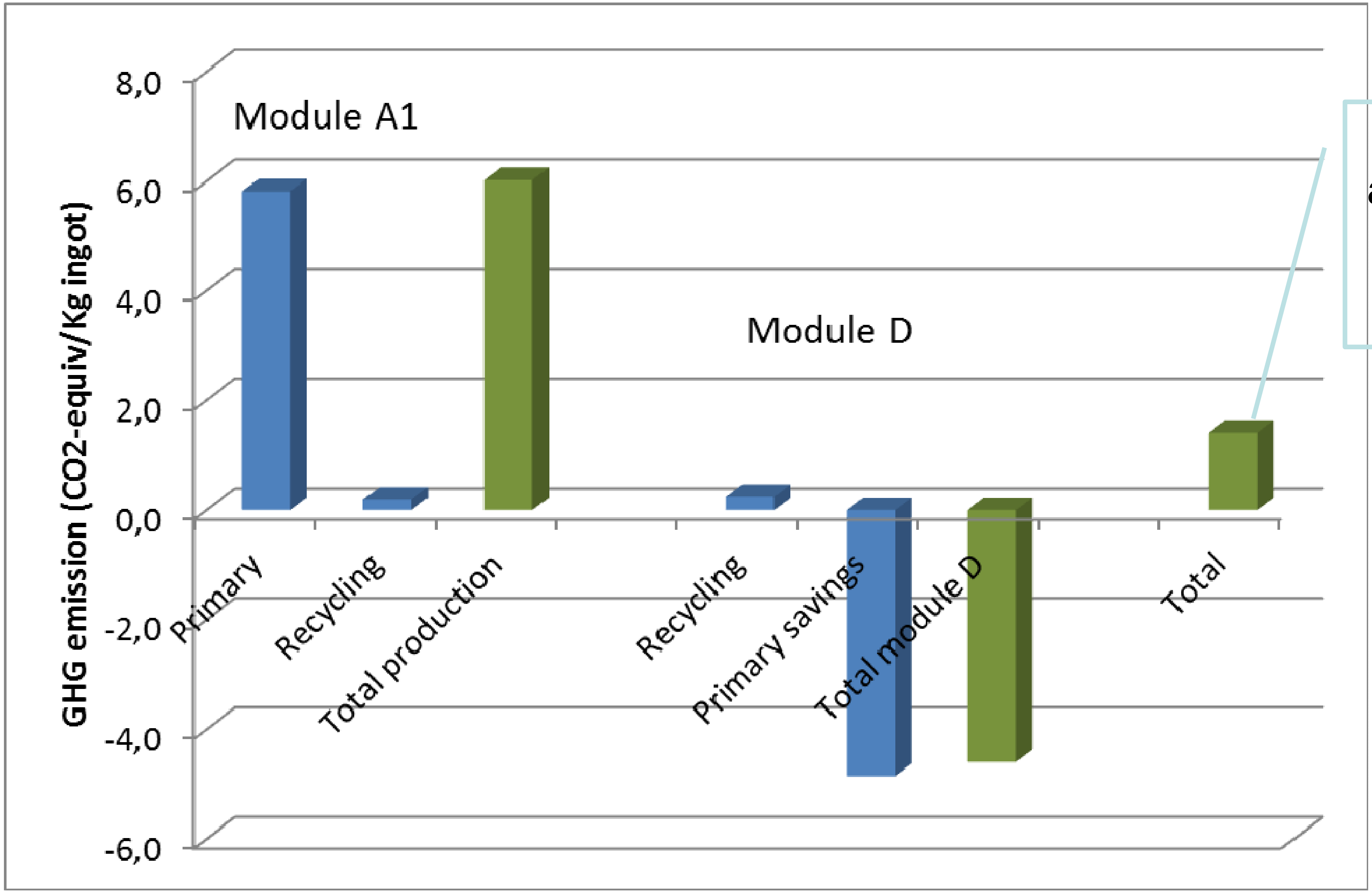
Data for the calculation			Comments
EoL recycling rate (considering all losses)		90%	
Factor reflecting the ability of substitution		100%	
% of recycled metal to be considered in module D		50%	= 90% (output) - 40% (input) Assuming the same properties for the scrap used at the input and output sides
Module D Calculation		GHG emissions	Comments
Recycling burdens	kg CO2-equiv /kg ingot	0,25	These additional benefits are calculated from the primary metal which is saved by 50% of additional recycling at EoL
Benefits from substitution	kg CO2-equiv /kg ingot	-4,85	
Total module D	kg CO2-equiv /kg ingot	**-4,6**	


METALS FOR BUILDINGS
Essential &
fully Recyclable


Module D
=
EoL - RC
Dismantling
and collection
Crushing /
shredding
Use
40%
Sorting
Integration
in building
GHG = - 4,6
50%
GHG= -4,85
Melting
GHG=0.25
Environmental
value of net
flow of
secondary
material
leaving the
system
EI = 1
40%
Ingot
Casting
EI = 4
60%
Extrusion
GHG for ingot
production = 6



Case 1: Aluminium frame



Not according to EN15804

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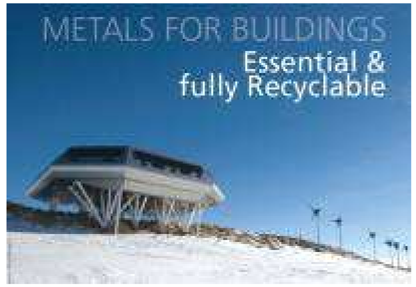

Case 2: steel sections

Module A= mix production = 1,15 tCO2eq

Source: worldsteel, european data, 2010

Module D = (RR-RC)*Y*(Ev-Er) = (0,95-0,85)*1,6 = 0,15 tCO2eq

Ref: worldsteel data 2010

GWP section = 1,15 – 0,15 = 1,00 tCO2eq

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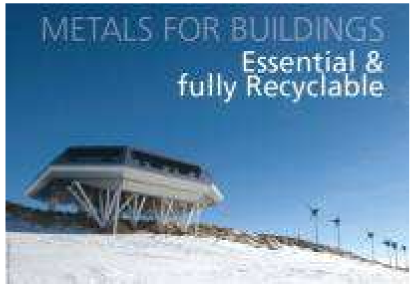

Conclusions

- Properly considering recycling aspects into LCA/EPD is crucial
- Recycled content approach is surely not enough, especially for metal products
- Hence, complementing the information through the Module D concept as used in EN15804 is essential for transparently reporting the full benefits of recycling, in a “cradle to grave” or “cradle to cradle” LCA as recommended by ISO or ILCD while avoiding any double crediting or counting issue.
- Ultimately, module D is intended to be used to promote
  - design for reuse, recycling and recovery of all building materials, including metals.
  - sound end of life treatment strategies for all types of building products

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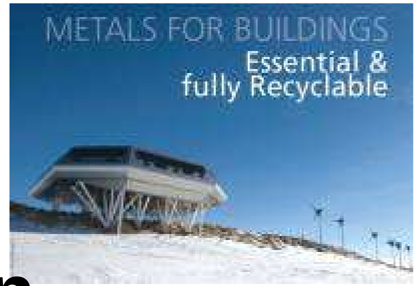

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