

Key features how to treat aluminium in LCAs, with special regard to recycling issues

Applicable for the other metals?

Use of LCA

- **Industry:**
 - identify market position
 - identify significant environmental aspects and options for improvement
- **Customers:**
 - material selection within DFE
- **Authorities:**
 - regulations and recommendations
 - role as customers for public buildings

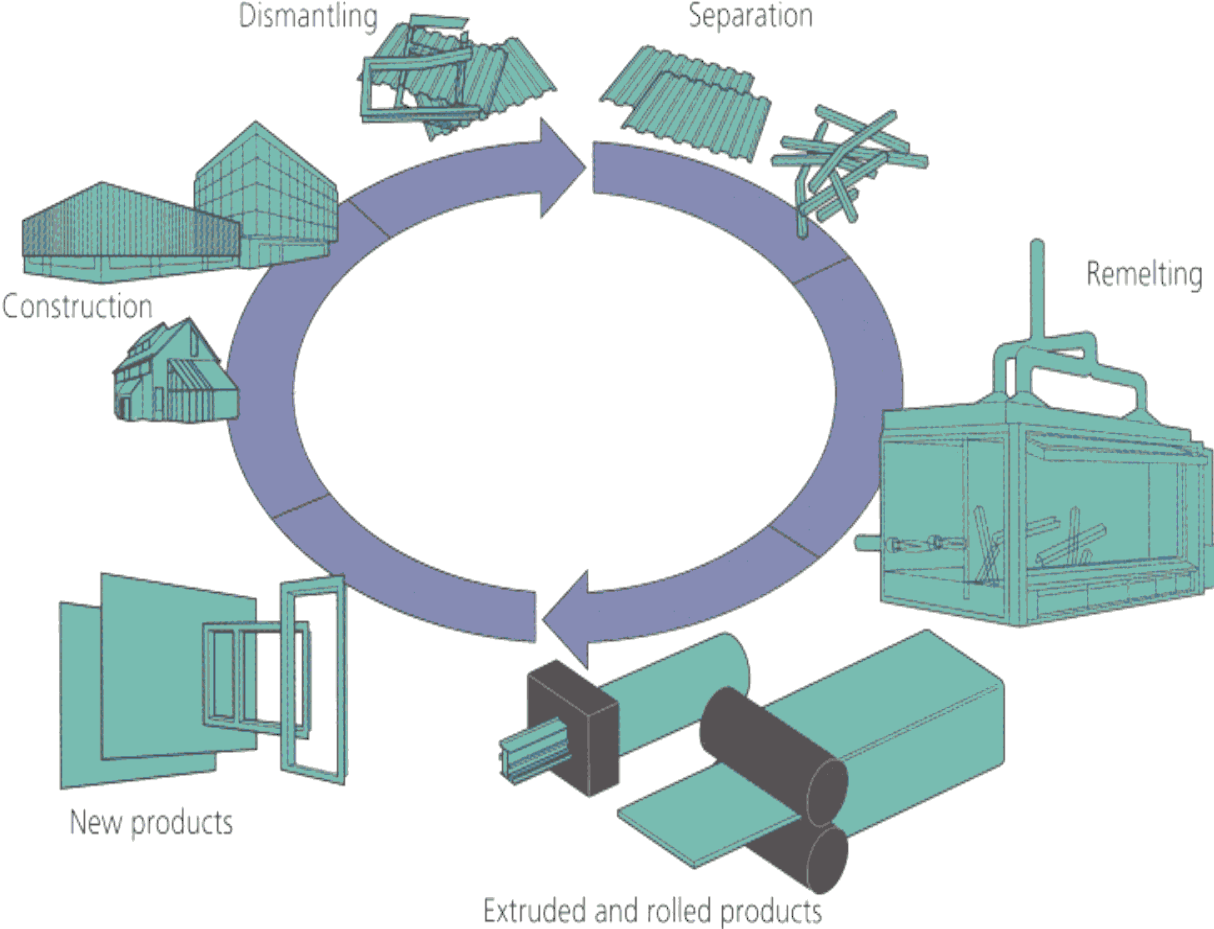
Fundamentals of LCA methodology

- **ISO 14040 Life cycle assessment - Principles and framework**
- **ISO 14041 Life cycle assessment - Goal and scope definition and inventory analysis**
- **ISO 14042 Life cycle assessment - Life cycle impact assessment**
- **ISO 14043 Life cycle assessment - Life cycle interpretation**

Key features of LCA methodology

- Comparisons must be based on the same functional unit
- for impact assessment, elementary flow data should be assigned to impact categories
- cumulative energy figures (including renewable energy) are not permitted

Treatment of Recycling in LCAs

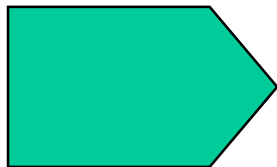


Aluminium Recycling - Key Features

- Aluminium is not consumed but only used by a product life cycle
- „cradle to next user“ instead of „cradle to grave“
- Aluminium usually maintains its *value*
- A priori no value losses by use or remelting: Metallic grid cannot be modified
- Mass losses (recovery) and value losses (impurities) can be avoided

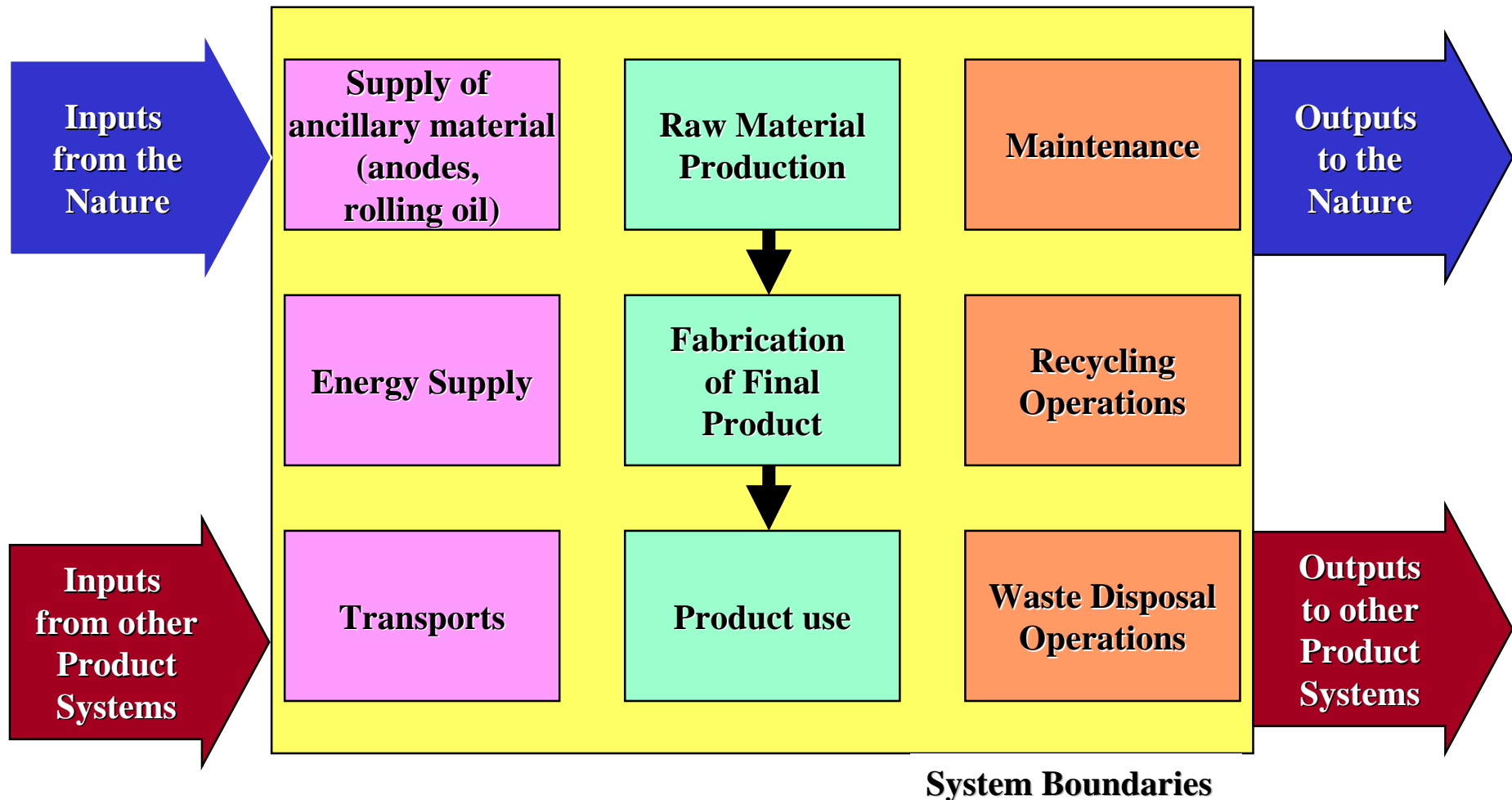
The recycled material content approach

- Often called „cut-off-approach“
- Type I: Any recycling disregarded
- Type II: cut-off, when open loop recycling



Not appropriate for aluminium

Product System according to ISO 14041



Recycled metal content approach - comments

- **Amount of aluminium scrap is limited**
 - Increase of RMC in one product will cause a decrease in other products
- **Aluminium with expanding use and long life-time is discriminated**
- **RMC approach causes "green competition" between primary industry and remelters**
- **Customers and governments may require high RMCs**
 - This raises costs for production and logistics
- **RMC for different products is difficult to report**
 - RMC for in-house production scrap may vary from batch to batch
 - Purchased scrap is a mix of new scrap and old scrap

Treatment of recycling - guidance from by ISO 14041

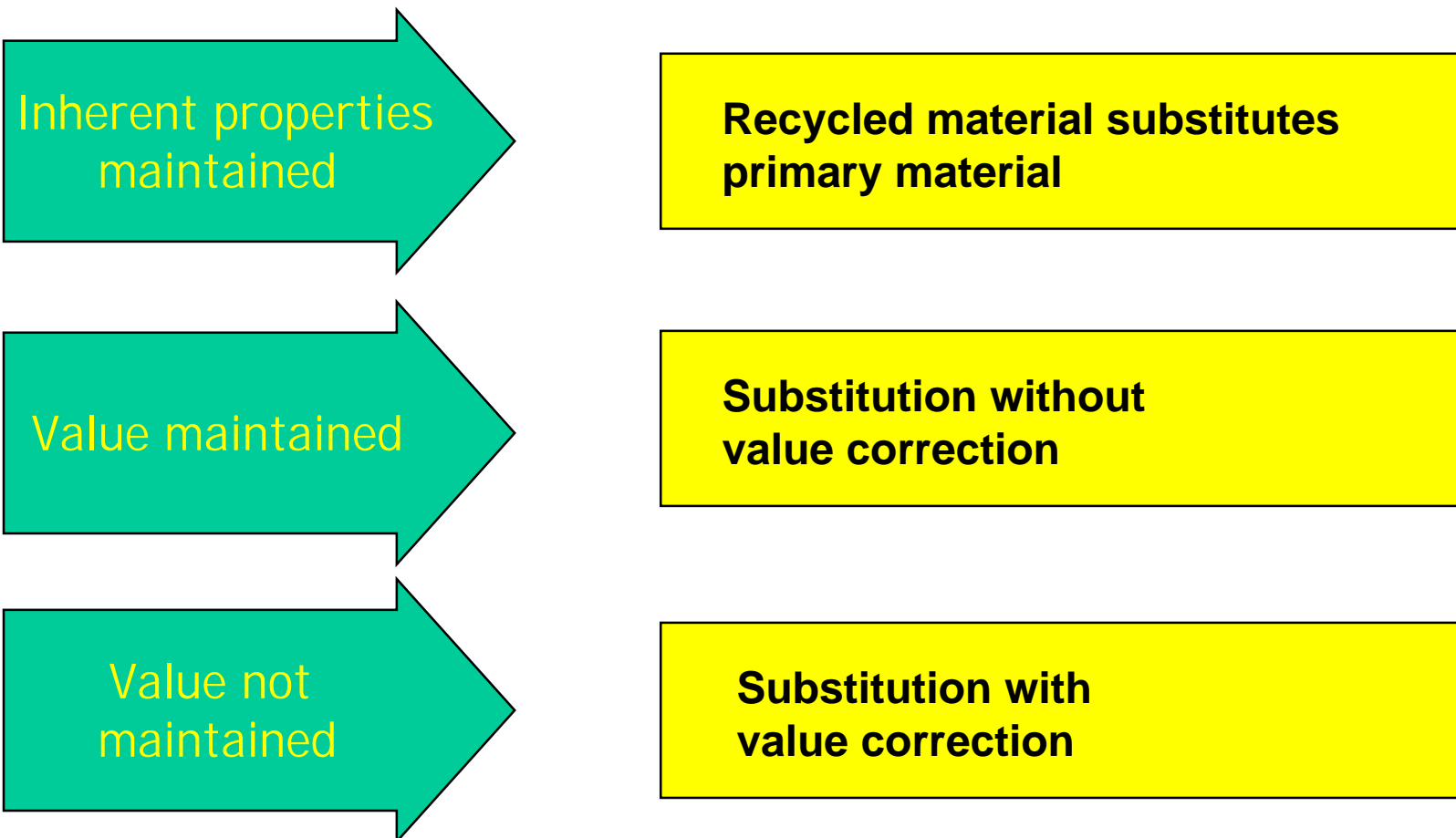
- Recycling operations are part of the product system
- Recycling scenarios needed (even if 100 years ahead)
- Metal recycled from the product to be compared with raw metal used for the product
- “Recycling credits” are given according to substitution method
- Value of recycled material taken as criterion

End-of life recycling approach in LCAs

- Include the end-of life recycling processes in the product system
- Compare the recycled product with the primary product (quantity and value)

Only the consumed material has to be charged to the product

The substitution method - the new accounting rule



Aluminium windows



LCA studies on window frames - GHG



emissions

	Alternative 1
Study	1996
Window type	type 1
recycling yield	not known
recycled metal value	not known
treatment of recycling in LCA	cut-off method
recycled metal content (%)	35

LCA studies on window frames - GHG



emissions

	Alternative 1
Study	1996
Window type	type 1
recycling yield	not known
recycled metal value	not known
treatment of recycling in LCA	cut-off method
recycled metal content (%)	35
primary aluminium production *)	425
production of other materials *)	84
frame material fabrication *)	25
Tota frame without credits *)	534
credit by cut-off *)	149
credit by VCS *)	0
Frame Material *)	385
Recycling operations, old scrap *)	0
TOTAL	385

*) GHG potential, measured in kg CO₂ equivalents

LCA studies on window frames - GHG



emissions

	Alternative 1	Alternative 2
Study	1996	1996
Window type	type 1	type 1
recycling yield	not known	not known
recycled metal value	not known	not known
treatment of recycling in LCA	cut-off method	cut-off method
recycled metal content (%)	35	85
primary aluminium production *)	425	425
production of other materials *)	84	84
frame material fabrication *)	25	25
Tota frame without credits *)	534	534
credit by cut-off *)	149	362
credit by VCS *)	0	0
Frame Material *)	385	172
Recycling operations, old scrap *)	0	0
TOTAL	385	172

*) GHG potential, measured in kg CO₂ equivalents

Message from cut-off approach:

**Increase recycled aluminium content from
35 % to 85 %**

LCA studies on window frames - GHG

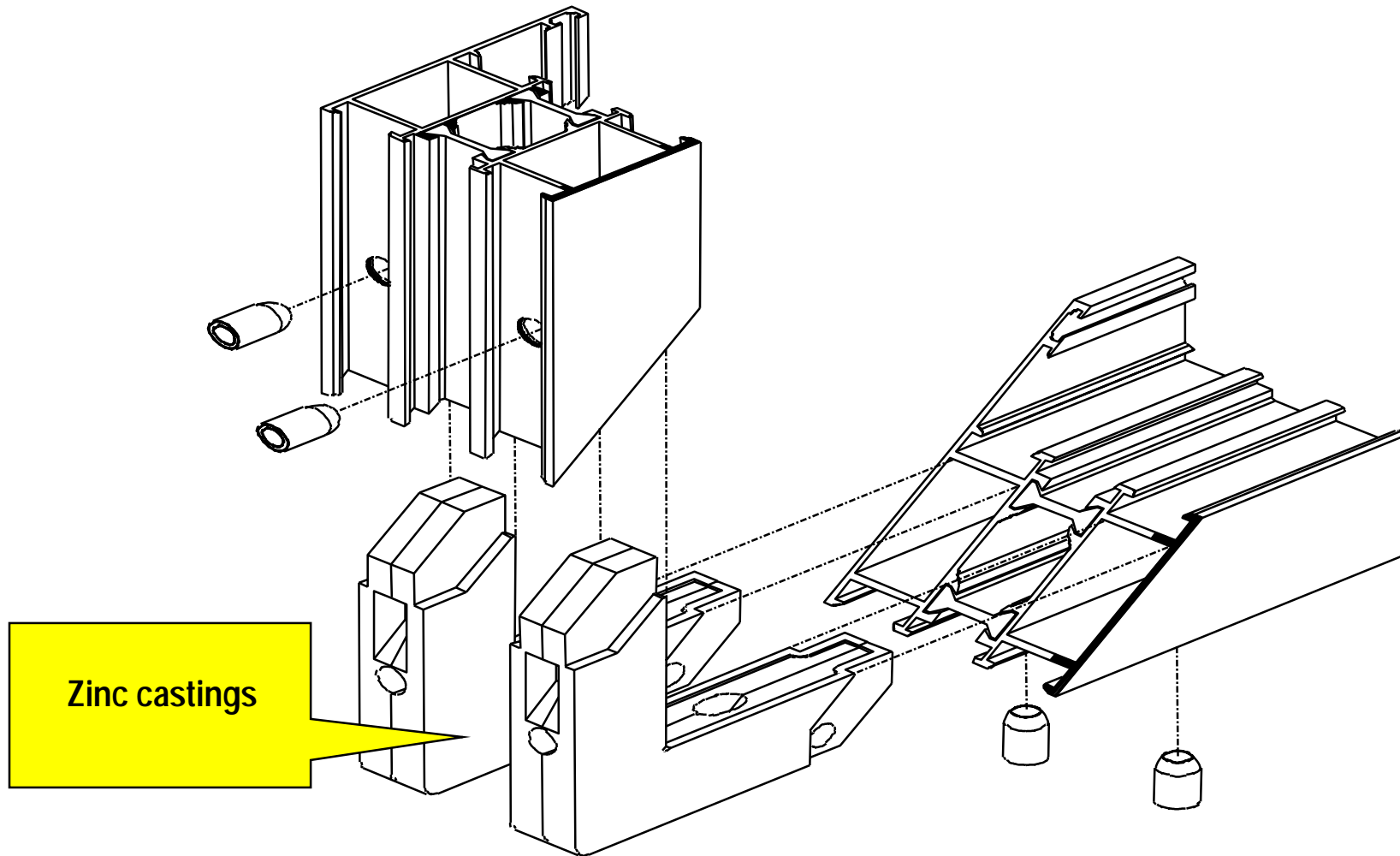


emissions

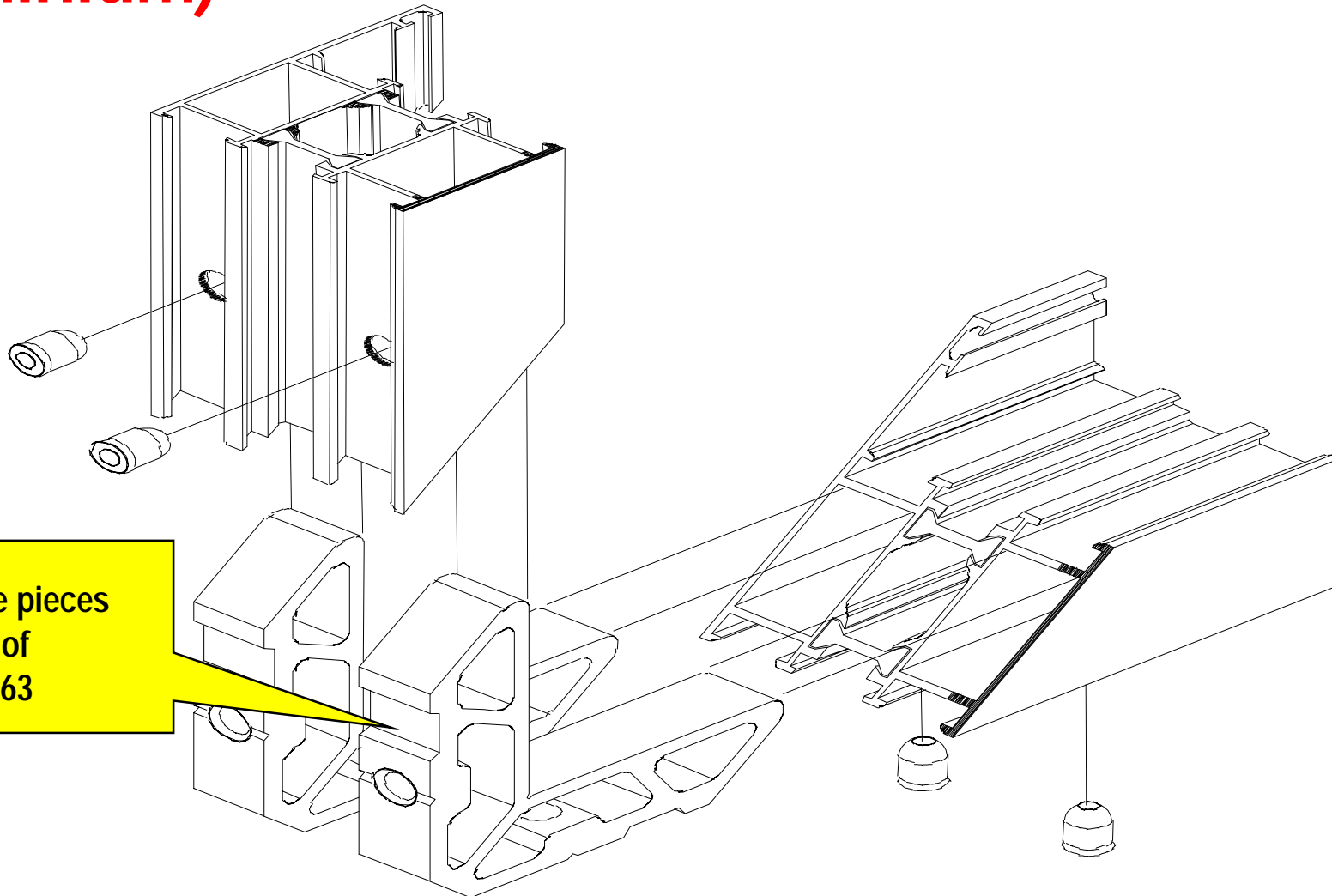
	Alternative 1	Alternative 2	Alternative 3
Study	1996	1996	2000
Window type	type 1	type 1	type 1
recycling yield	not known	not known	90 %
recycled metal value	not known	not known	reduced by 10 %
treatment of recycling in LCA	cut-off method	cut-off method	value corrected substitution
recycled metal content (%)	35	85	not known
primary aluminium production *)	425	425	425
production of other materials *)	84	84	84
frame material fabrication *)	25	25	25
Tota frame without credits *)	534	534	534
credit by cut-off *)	149	362	0
credit by VCS *)	0	0	344
Frame Material *)	385	172	190
Recycling operations, old scrap *)	0	0	45
TOTAL	385	172	235

*) GHG potential, measured in kg CO₂ equivalents

Window type 1, typical corner stiffening



Window type 2, improved corner stiffening (Hydro Aluminium)



Profile pieces
made of
AA 6063

LCA studies on window frames - GHG emissions

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Study	1996	1996	2000	2000
Window type	type 1	type 1	type 1	type 2
recycling yield	not known	not known	90 %	90 %
recycled metal value	not known	not known	reduced by 10 %	maintained
treatment of recycling in LCA	cut-off method	cut-off method	value corrected substitution	substitution method
recycled metal content (%)	35	85	not known	not known
primary aluminium production *)	425	425	425	464
production of other materials *)	84	84	84	64
frame material fabrication *)	25	25	25	25
Tota frame without credits *)	534	534	534	553
credit by cut-off *)	149	362	0	0
credit by VCS *)	0	0	344	418
Frame Material *)	385	172	190	135
Recycling operations, old scrap *)	0	0	45	44
TOTAL	385	172	235	179

*) GHG potential, measured in kg CO₂ equivalents

Message from VCS approach:

Apply design for recycling