



*2007 CTCI Foundation Environment & Energy Convention  
January 16-25, 2007*

# **Case studies of national-scale material flow assessment: the European experience**

**Paul H. Brunner**

Vienna University of Technology  
Institute for Water Quality, Resources and Waste Management  
[www.iwa.tuwien.ac.at](http://www.iwa.tuwien.ac.at)

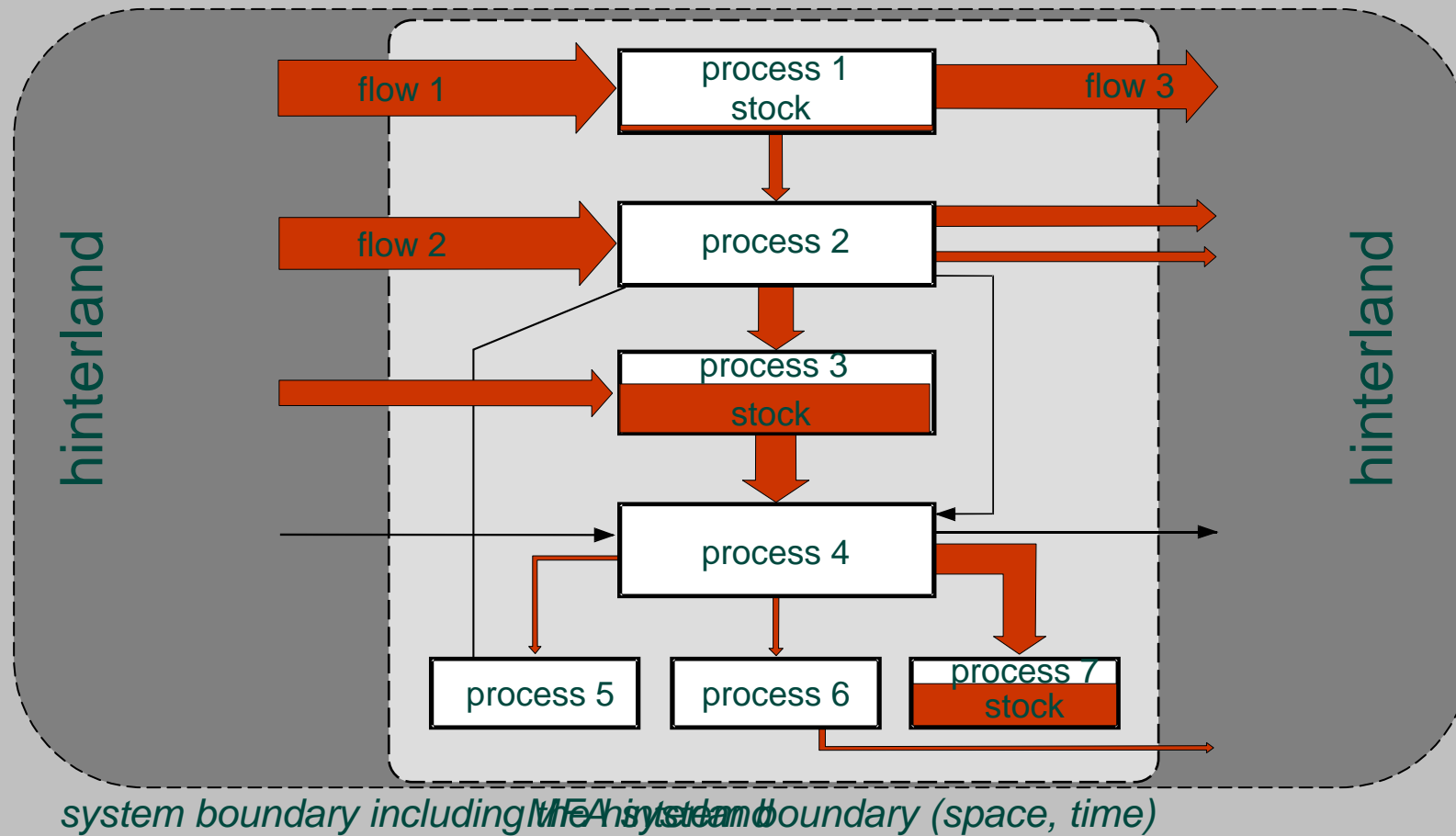
- comparison of economies      -> *resource efficiency, footprint*
- resource management        -> *optimization, conservation, availability,*
- environmental management   -> *early recognition, priorities, design*  
and waste management        *of measures*



Source: *So lebt der Mensch*

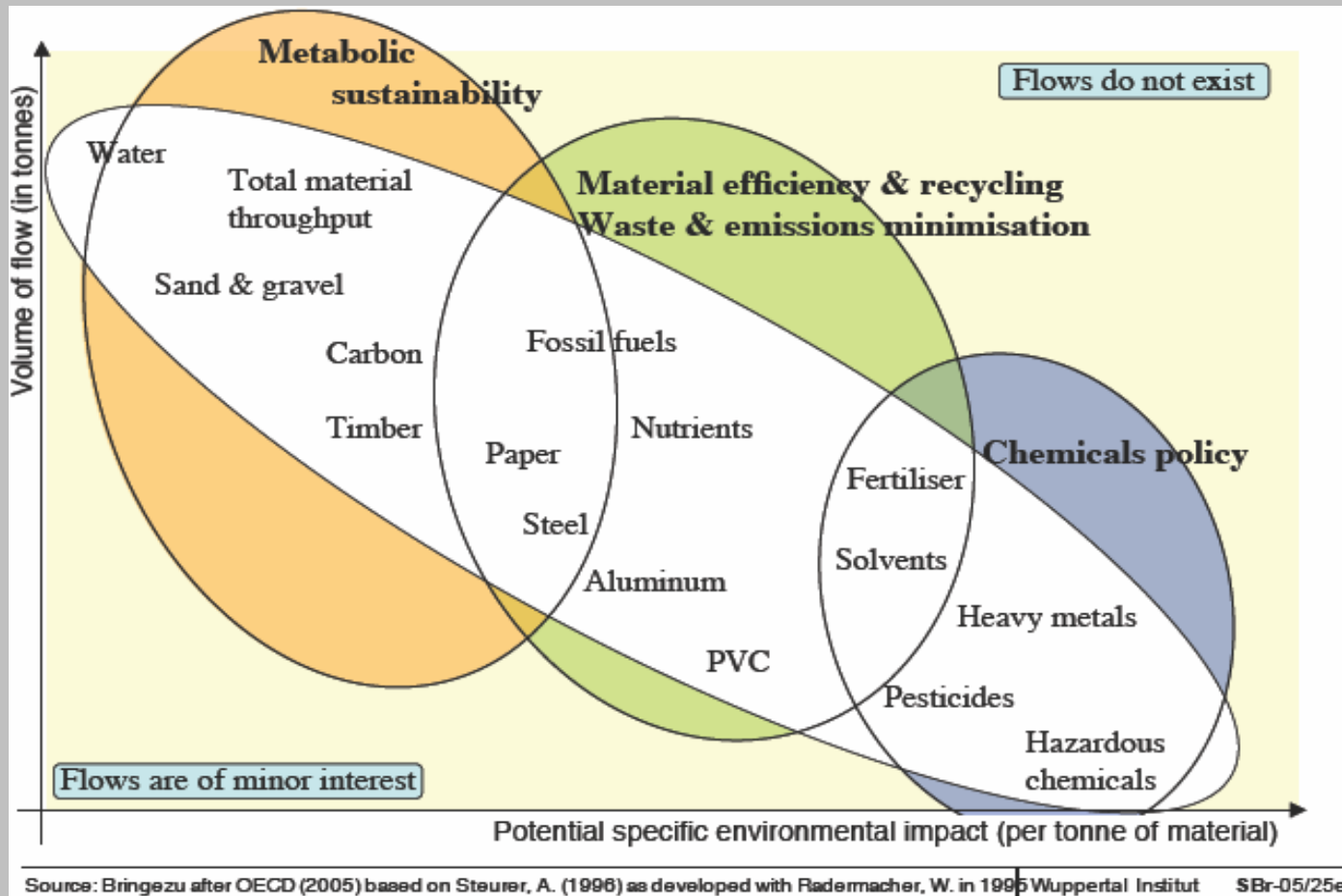


- MFA -> systematic analysis of material flows and stocks
- materials accounting: -> routine MFA based on key flows and stocks



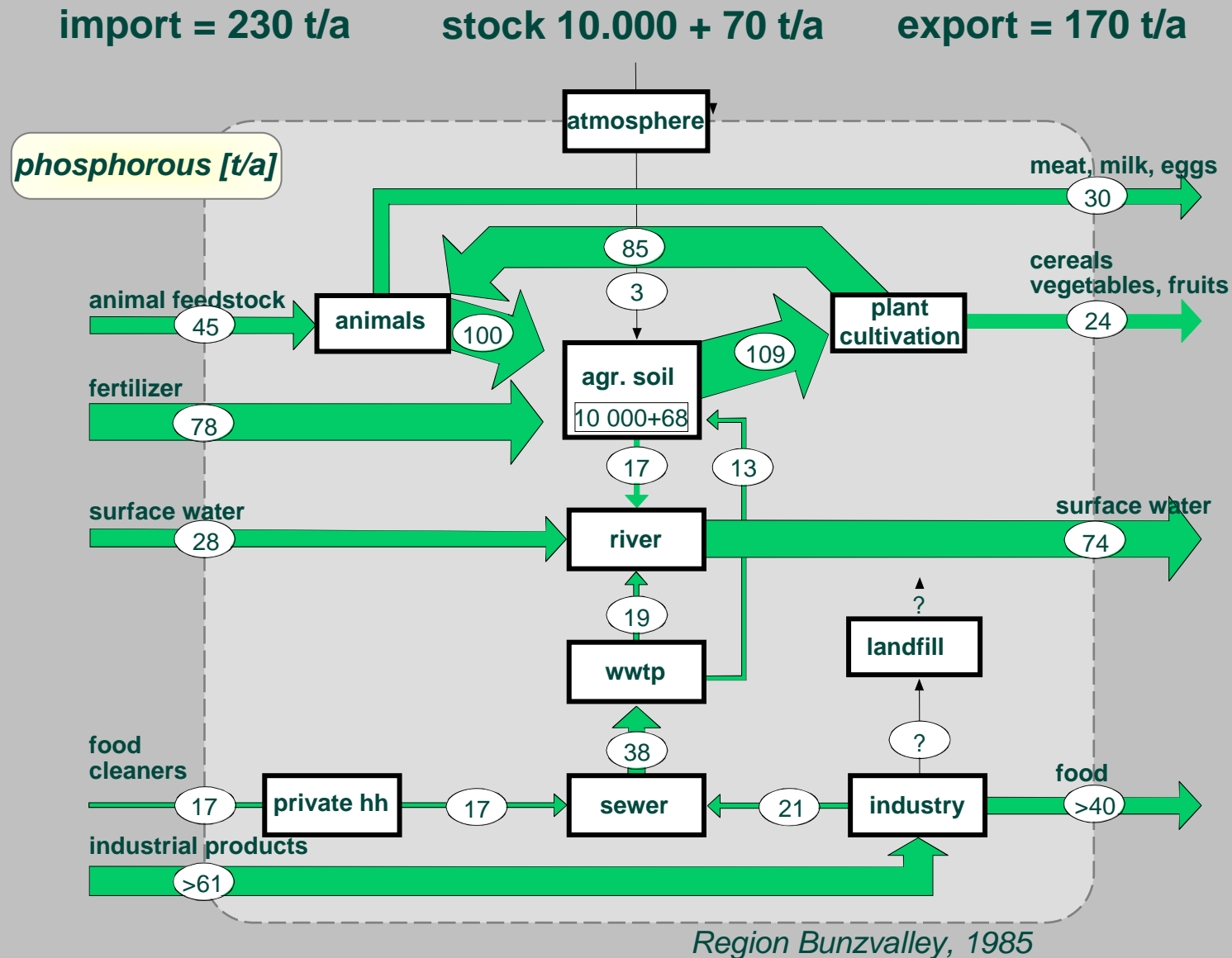
- **“good” (= “product”) as economic entity: car, steel, rice...**  
-> data availability o.k. (national statistics etc.)
- **“substance” (= “element” or “compound” in goods) are relevant for resources and environment: C, N, Cd, Nonylphenol...**
  - > few data, measurement necessary
  - > high uncertainty
  - > expensive
- **“material” stands for both “goods” and “substances”**

(bulk) MFA: Dematerialization, „Factor 4“  
 SFA: analysis and optimization for r-, e-,w- management

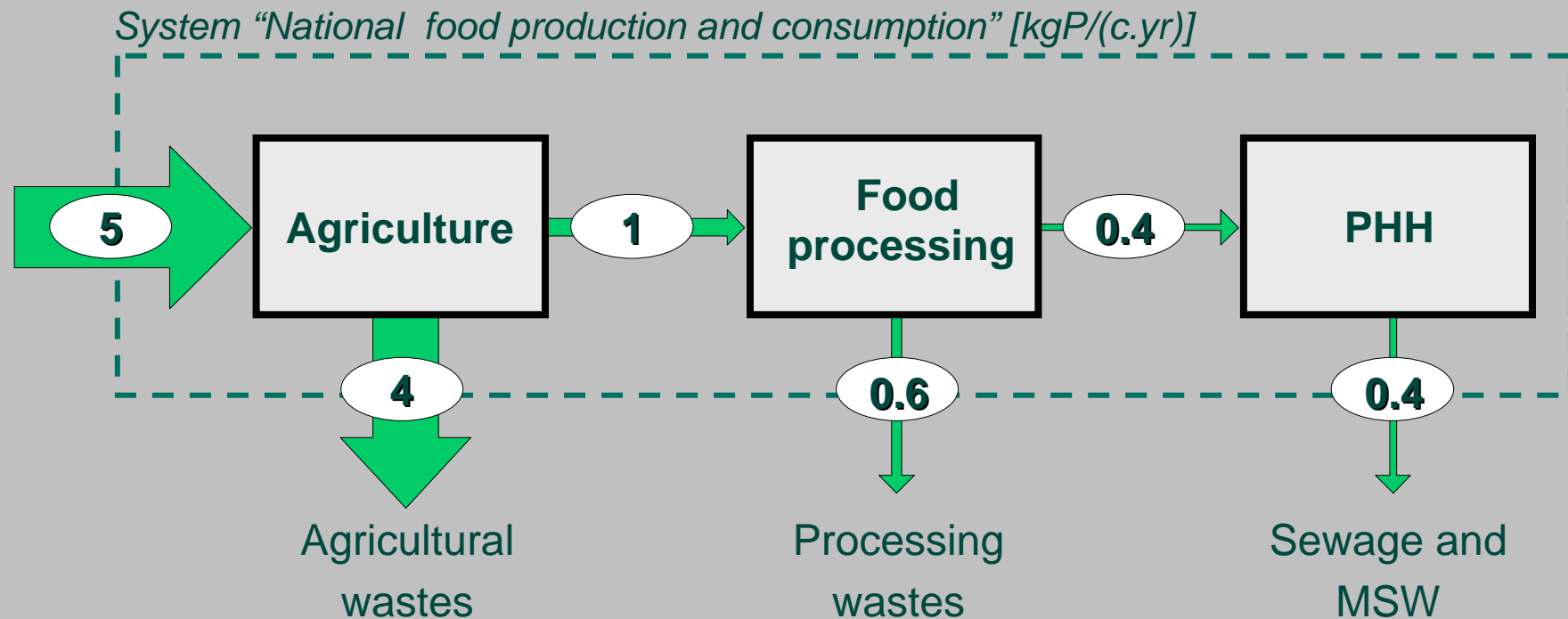




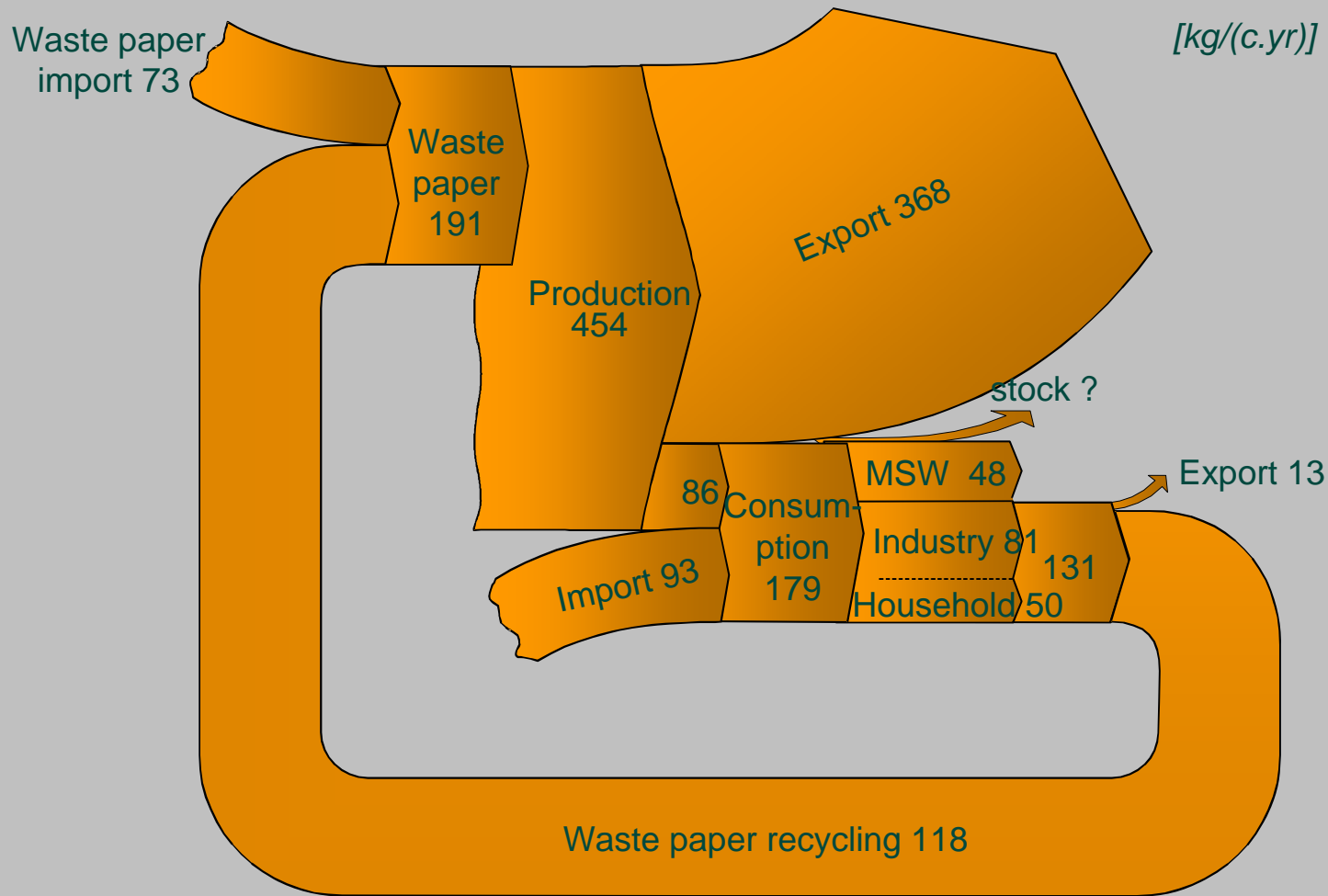
# Case studies - the regional example: phosphorous



*MFA as a decision support tool for waste and resources management*



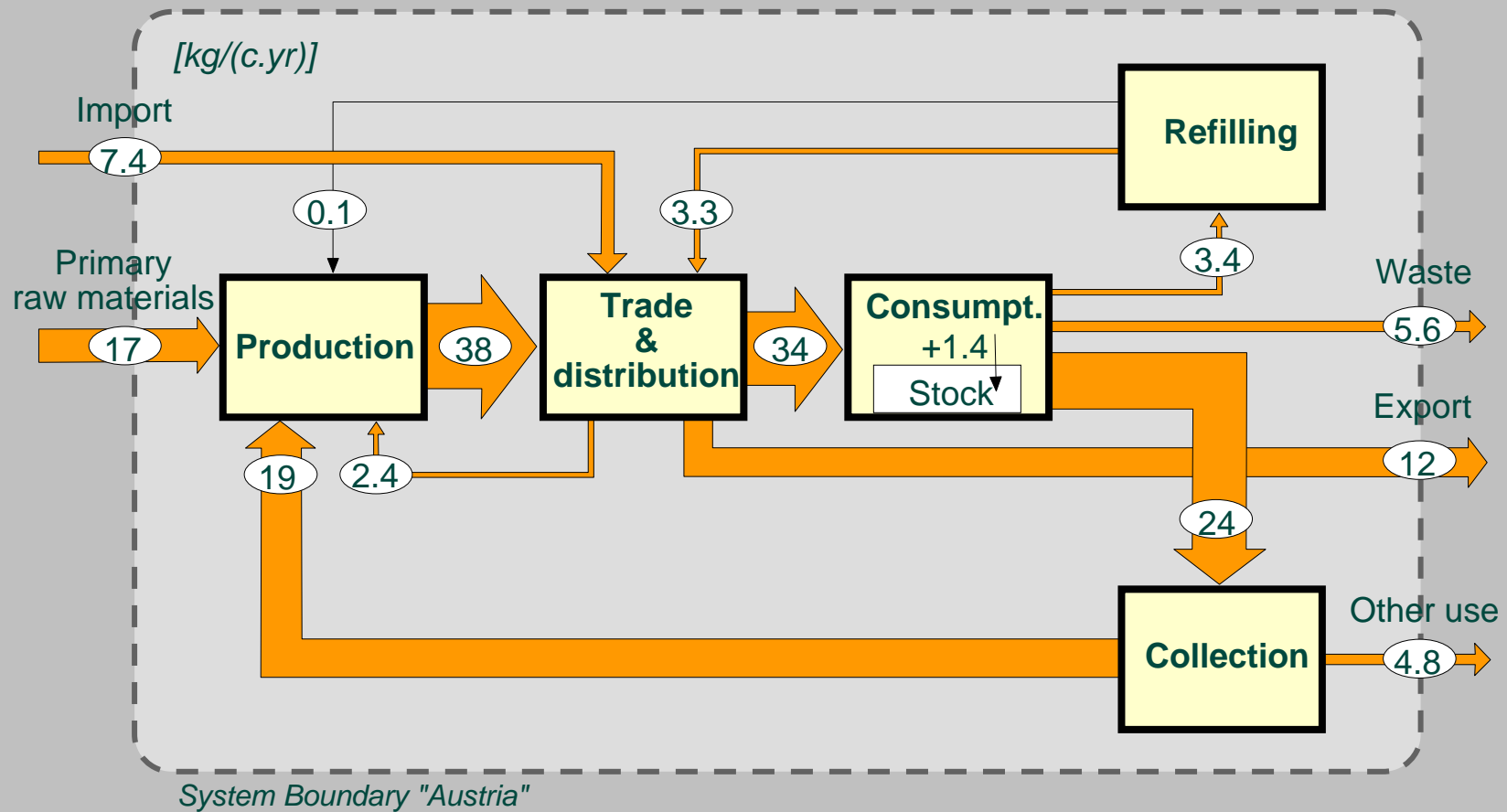
## MFA of paper cycle in Austria



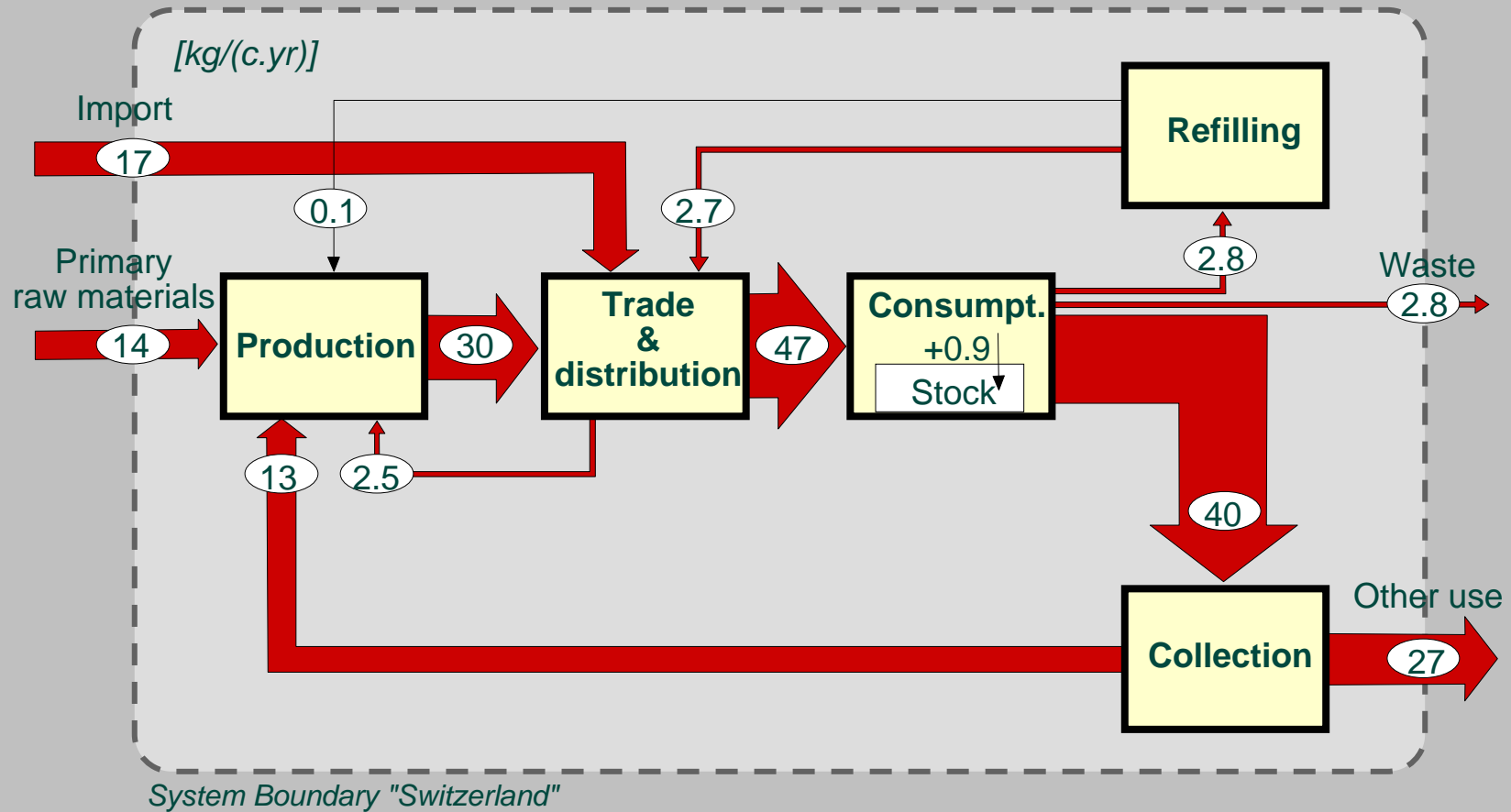
Data: Austrian Paper Industry, 1996



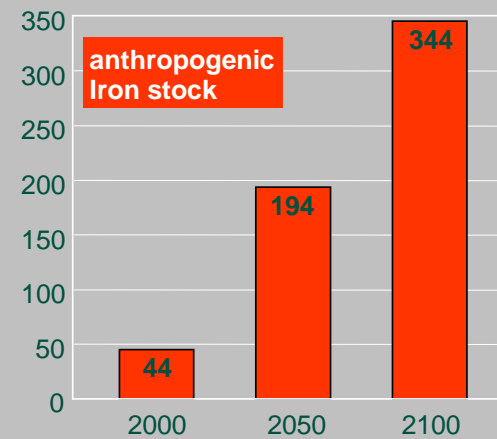
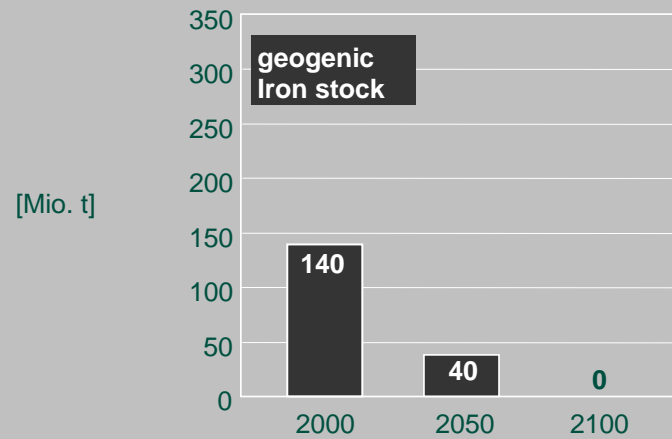
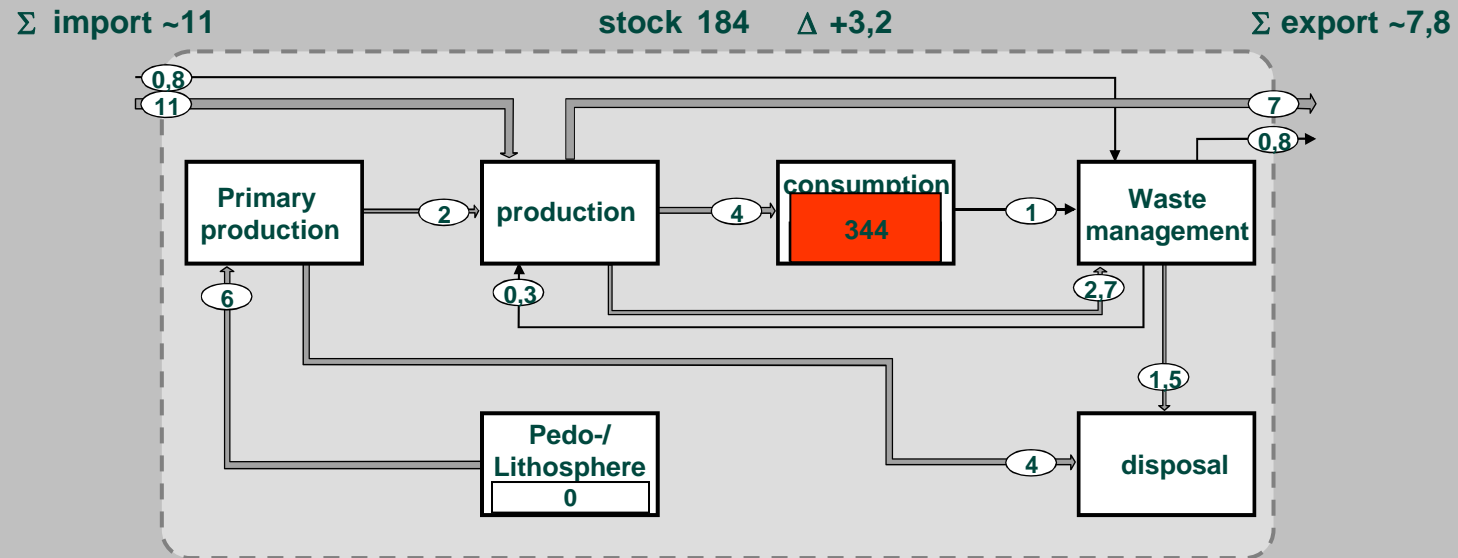
## MFA of glass use in Austria



## MFA of glass use in Switzerland

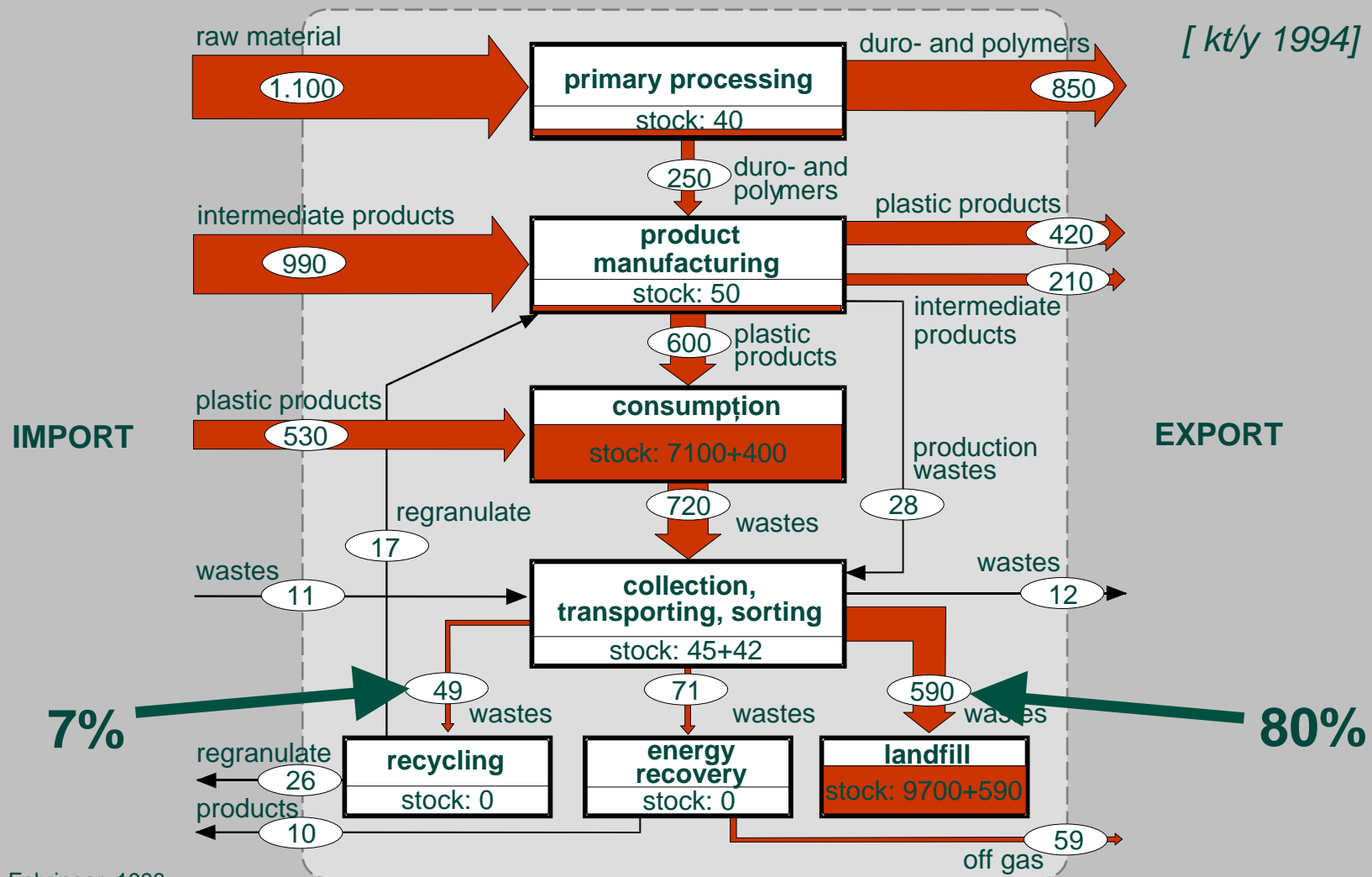


## MFA of iron use in Austria





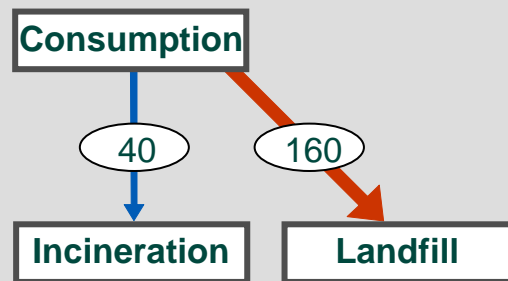
## MFA of plastic materials in Austria



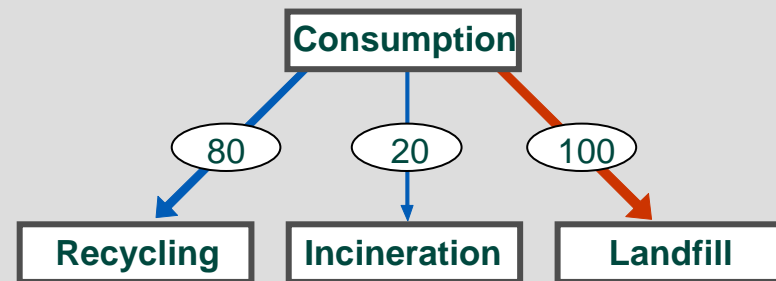
Source: R. Fehring, 1998

## Goal oriented plastic waste management based on MFA

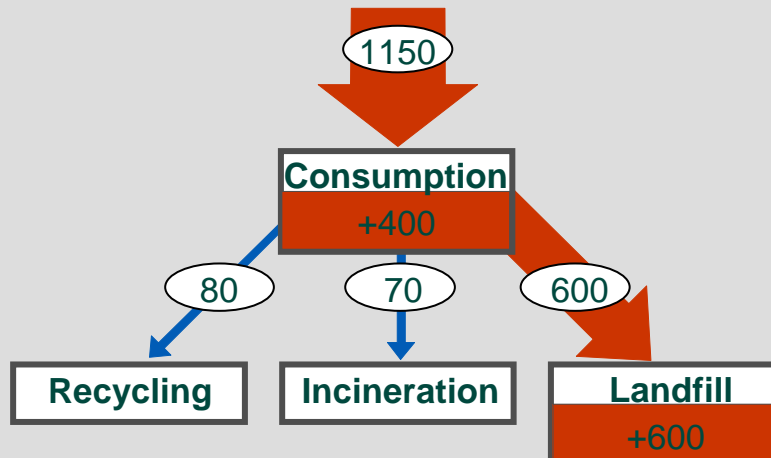
### Packaging waste view



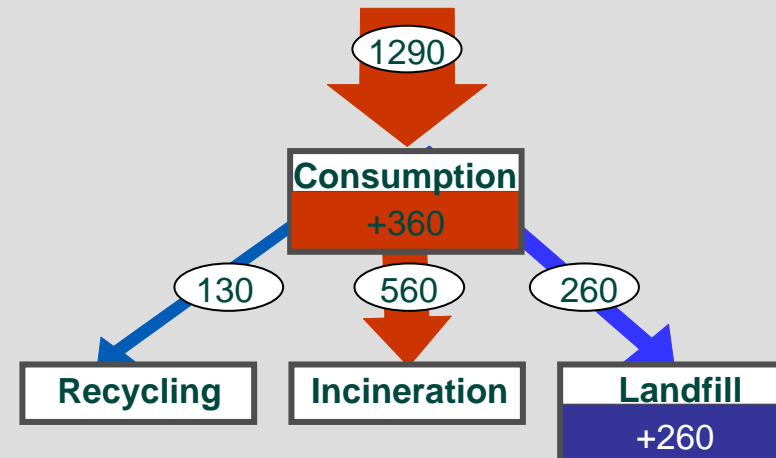
### Impact of Packaging Waste Ordinance



### Materials management view



### Impact of Landfill Ordinance

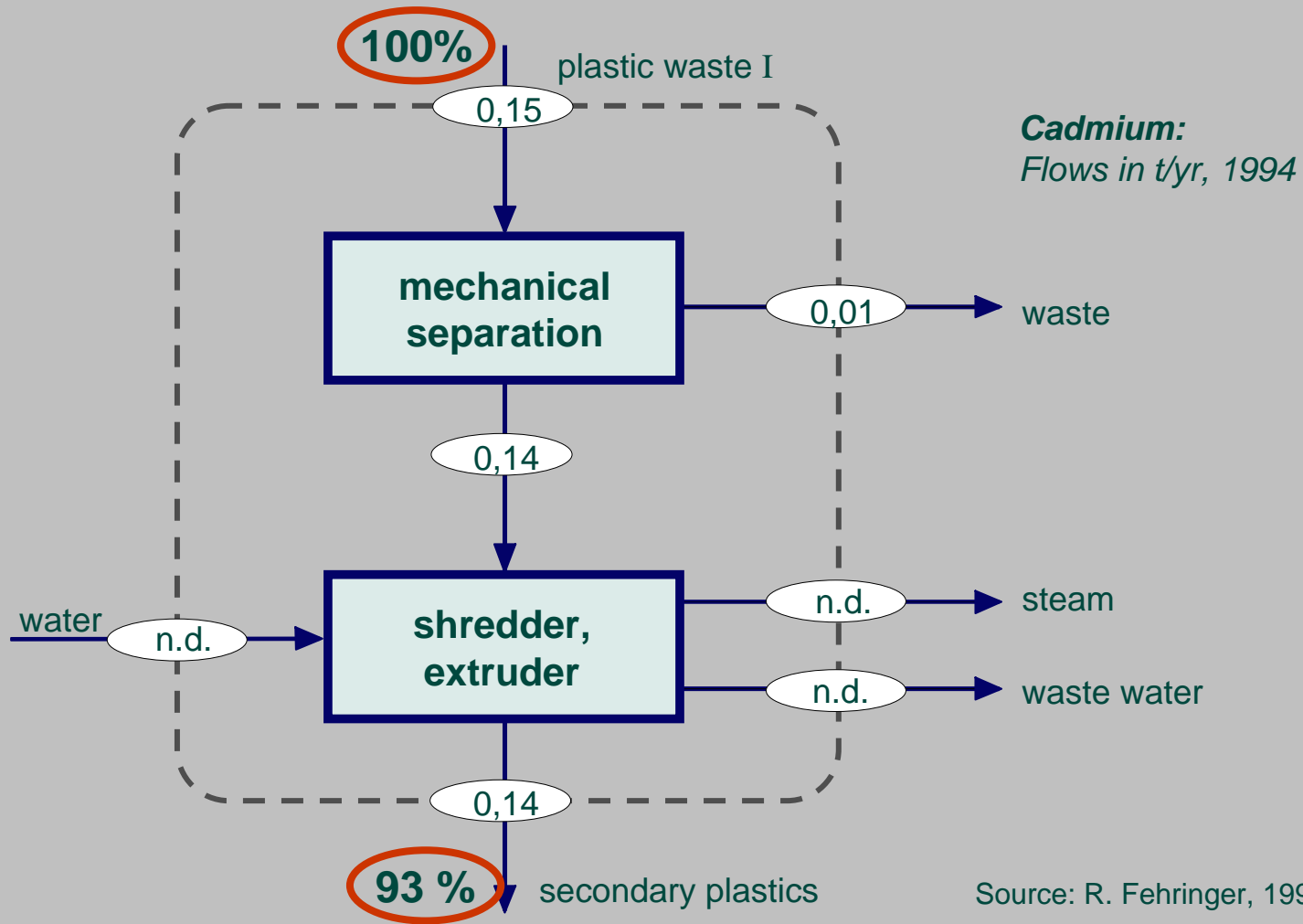


## *Additives in plastic materials used in Austria*

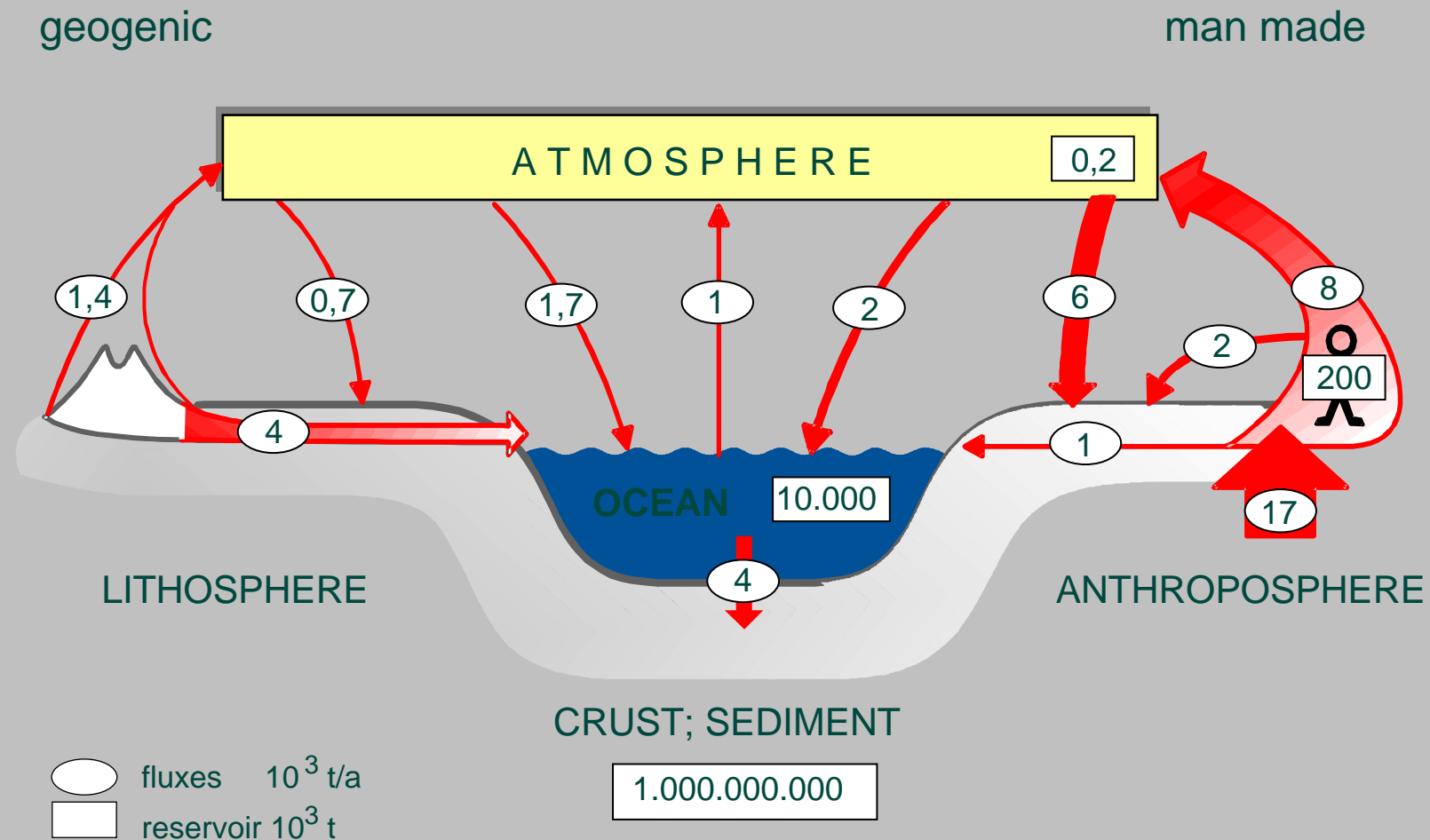
| Material           | Total consumption | Packaging material |       | Total stock |
|--------------------|-------------------|--------------------|-------|-------------|
|                    | in kt/yr          | in kt/yr           | in %* | in kt       |
| Plastics           | 1,100             | 200                | 18    | 7,100       |
| Softeners          | 14                | 0.2                | 2     | 140         |
| Ba/Cd- stabilizers | 0.27              | 0.0002             | <1    | 2.6         |
| Pb-stabilizers     | 1.8               | 0.002              | <1    | 18          |
| Fire retardants    | 2.3               | 0                  | ~0    | 22          |

\* % of total consumption

## Fate of Cadmium during plastic recycling



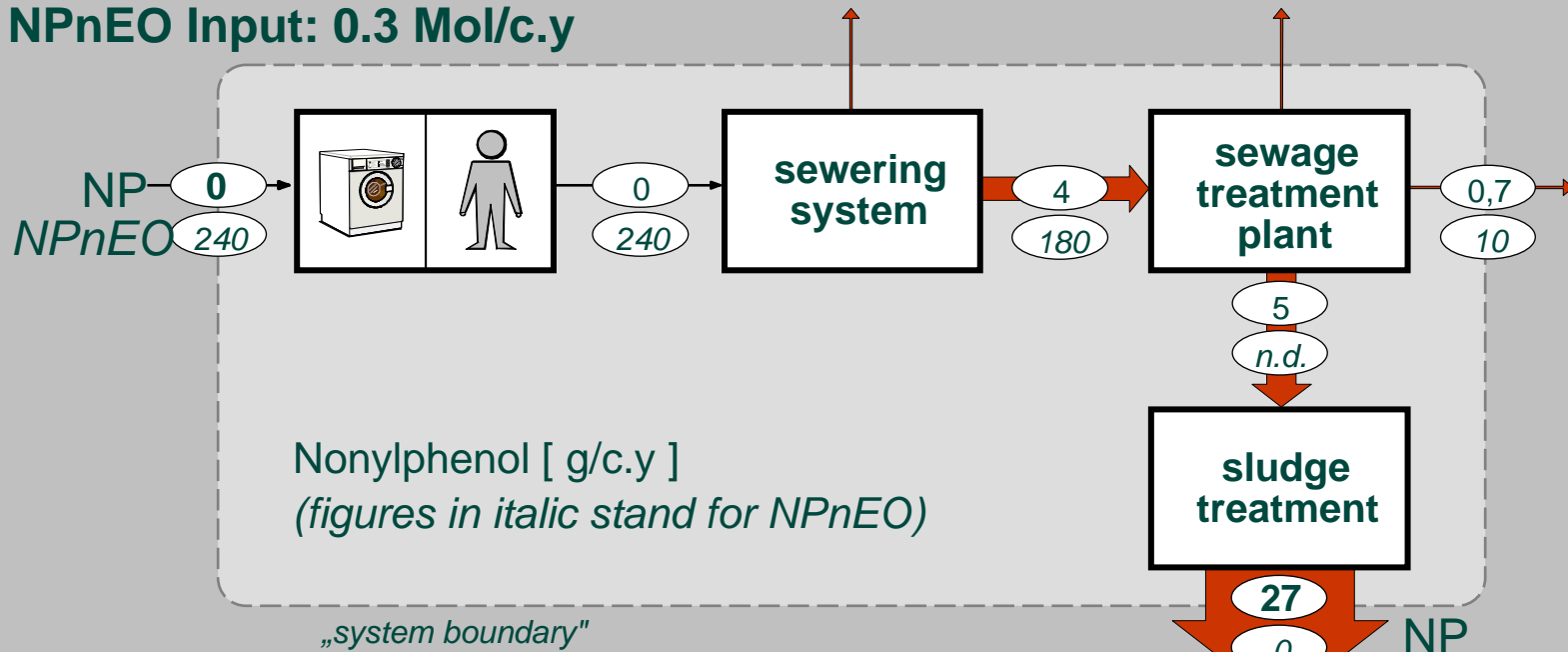
## Global cadmium flows and stocks



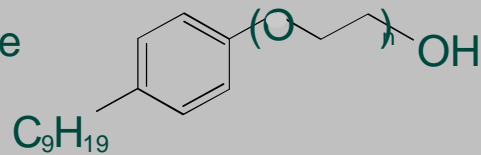


## MFA of Nonylphenol Polyethoxylate in Switzerland

NPnEO Input: 0.3 Mol/c.y



Nonylphenol Polyethoxylate  
(= NPnEO)



NP Output: 0.12 Mol/c.y

MFA important for

- Resource management:
  - EU resources strategy (new resource information base)
  - Dematerialization/factor 4 (Germany, Japan)
  - Accumulation/depletion of stocks (Sweden, Austria, USA)
- Environmental management
  - Early recognition (nutrient accounting CH, global and regional Cd )
  - Priority setting (Austria NEP)
  - Filter strategy -> „life cycle thinking“ (EU, *NOT necessarily LCA*)
- Waste management
  - transparency ( $I=O + \text{change in stock}$ )
  - EIS (NRWF Germany)
  - Priority setting (WMP Austria);
  - Waste analysis (Switzerland, Austria)
  - FP7 (EU)

Thank you



Freeware, available from:

<http://www.iwa.tuwien.ac.at>