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Plastics & Material Flow Analysis

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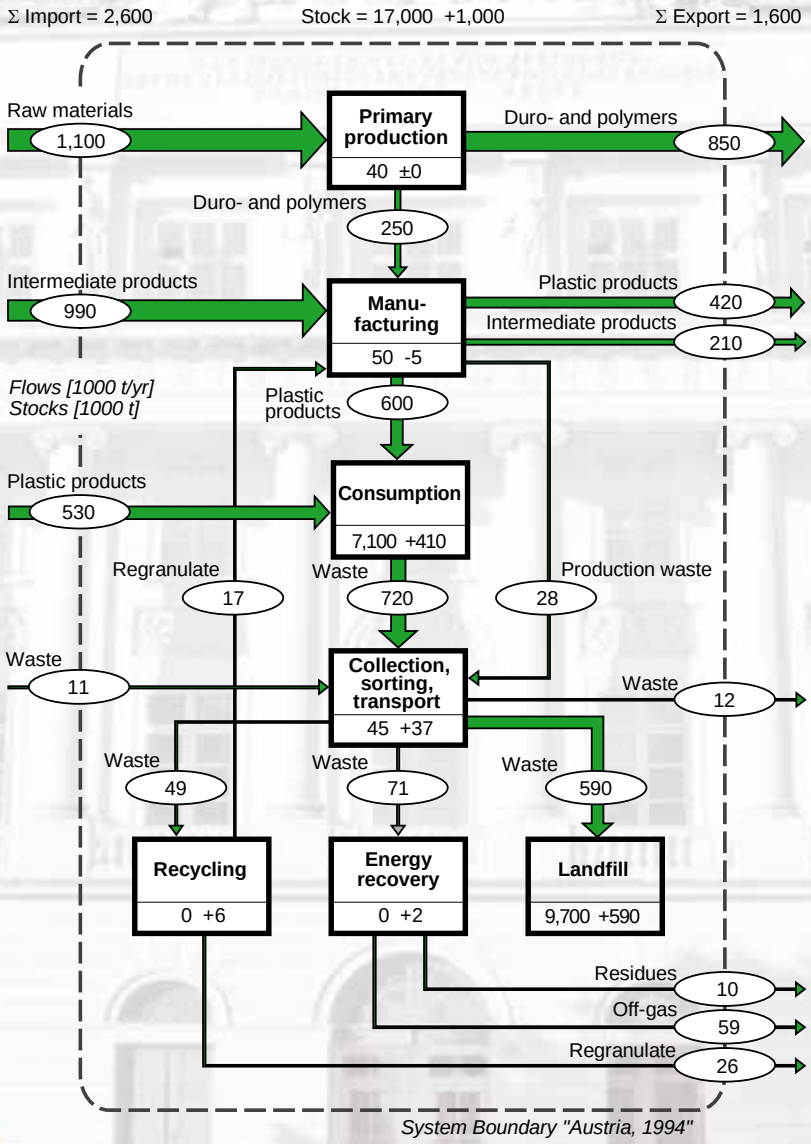
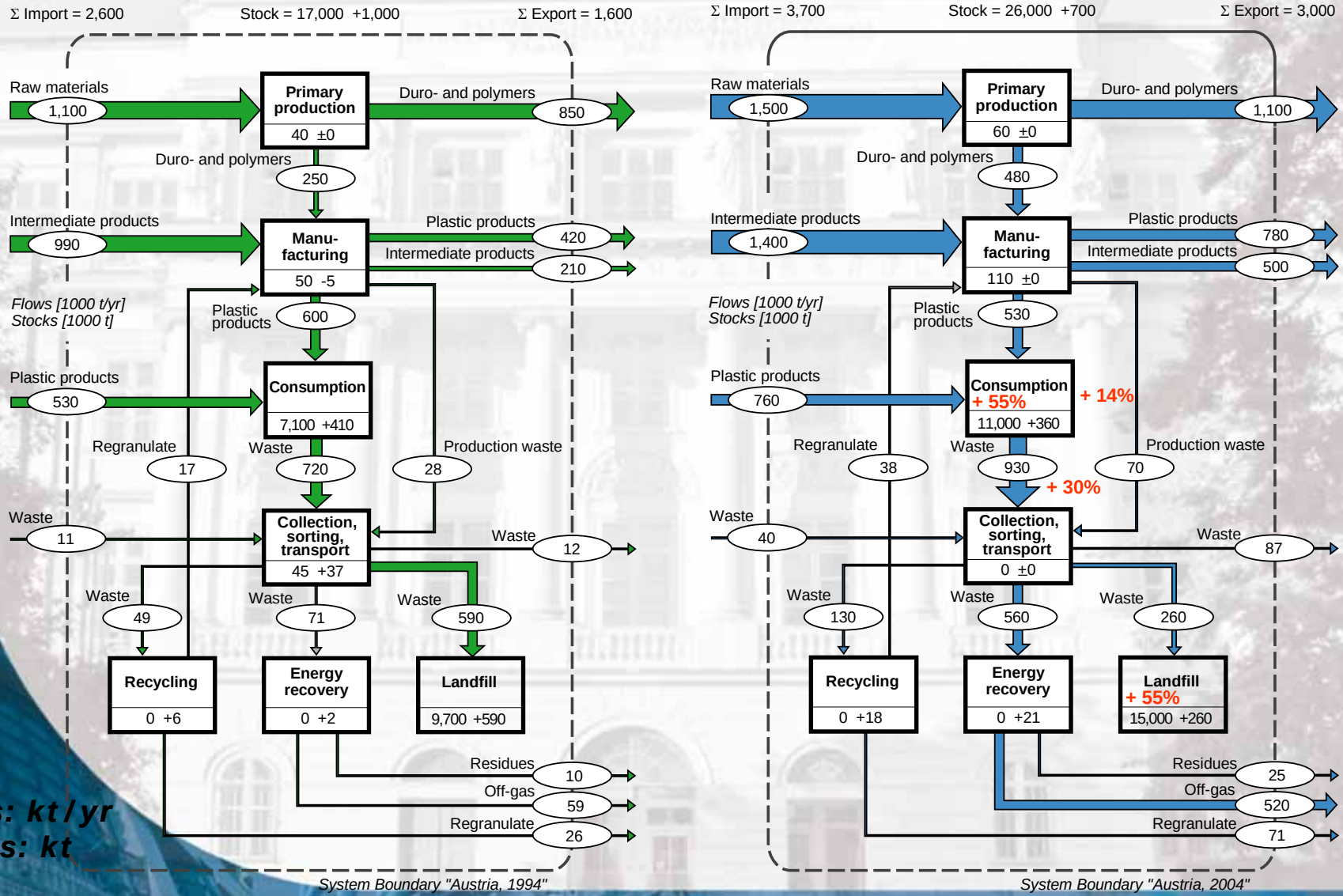
Plastic flows in Austria 1994

Flows: kt/yr
Stocks: kt



Source: Fehringer & Brunner 1997

Plastic flows in Austria 1994 and 2004



Flows: kt/yr
Stocks: kt

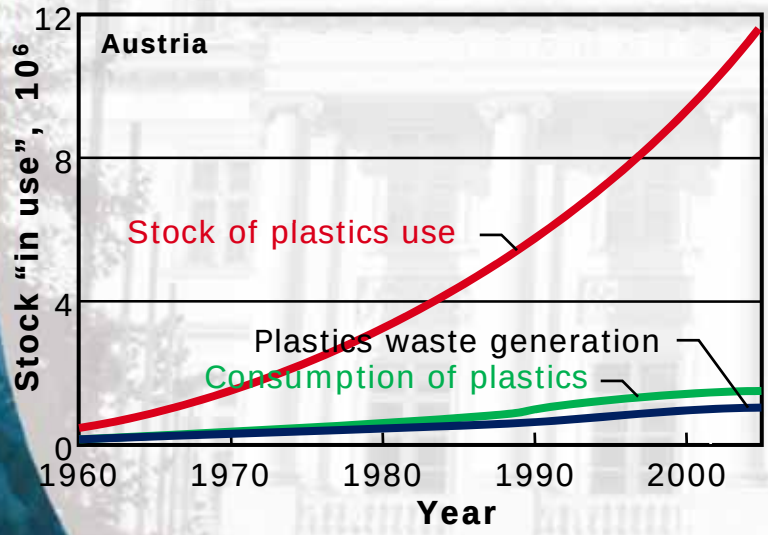
Source: Bogucka et al. 2008

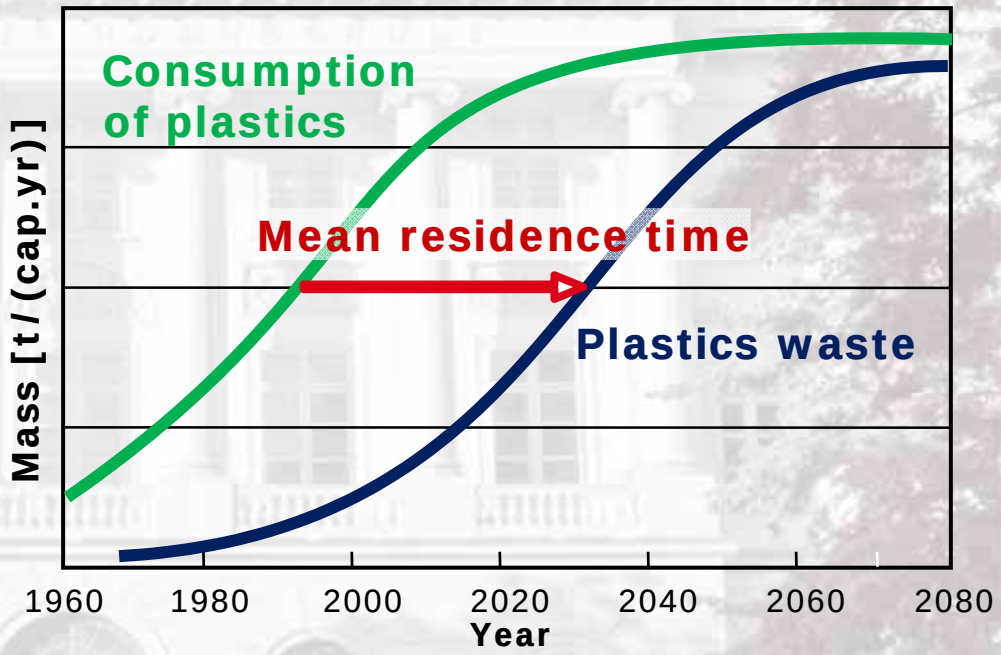
Some figures

Packaging waste separately collected 20 kg/cap.yr

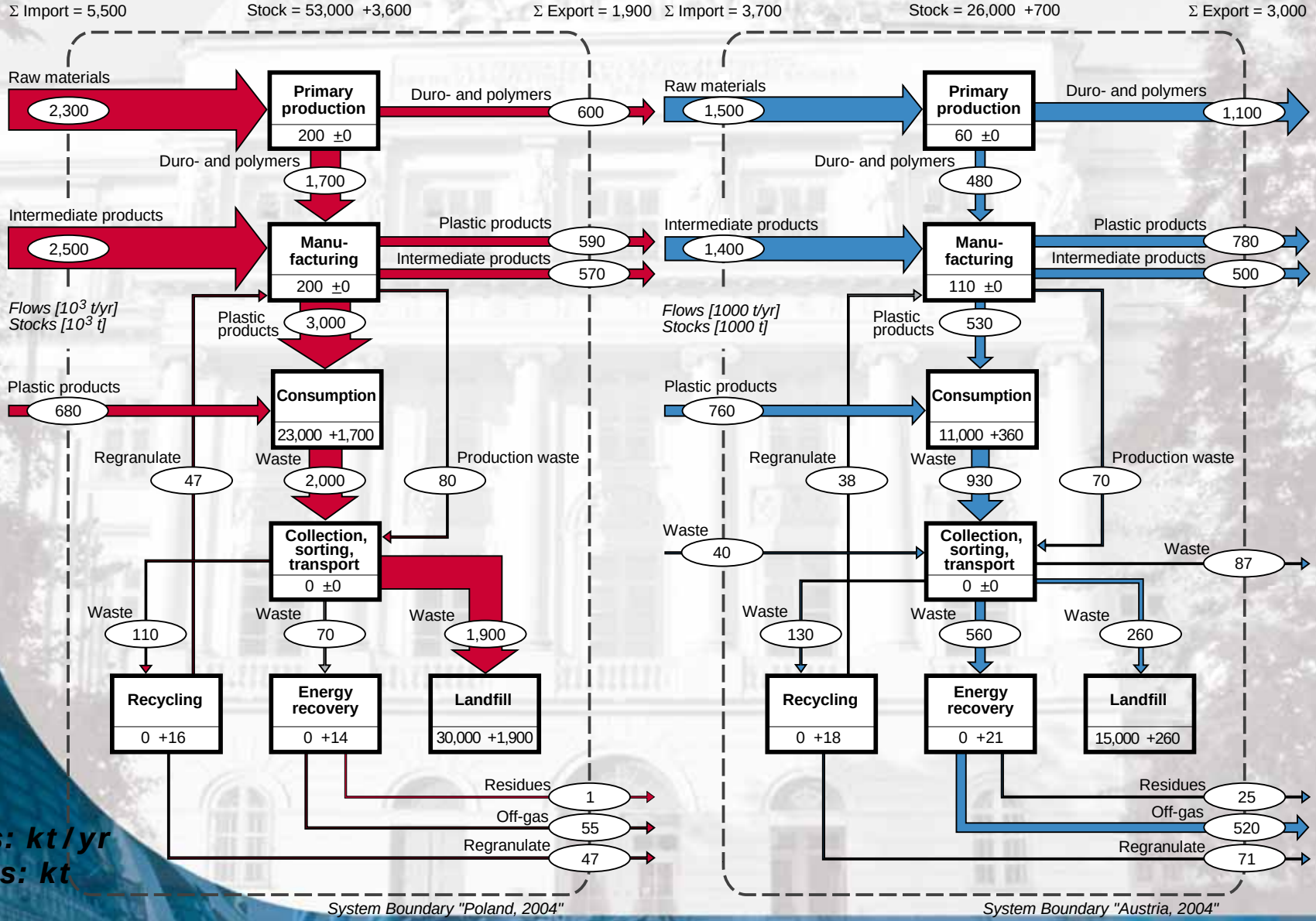
Plastics in use ca. 1.4 t/cap

Growth rate of stock in use ca. 5 %





Plastic flows in Poland and Austria 2004



Flows: kt/yr
Stocks: kt

Source: Bogucka et al. 2008

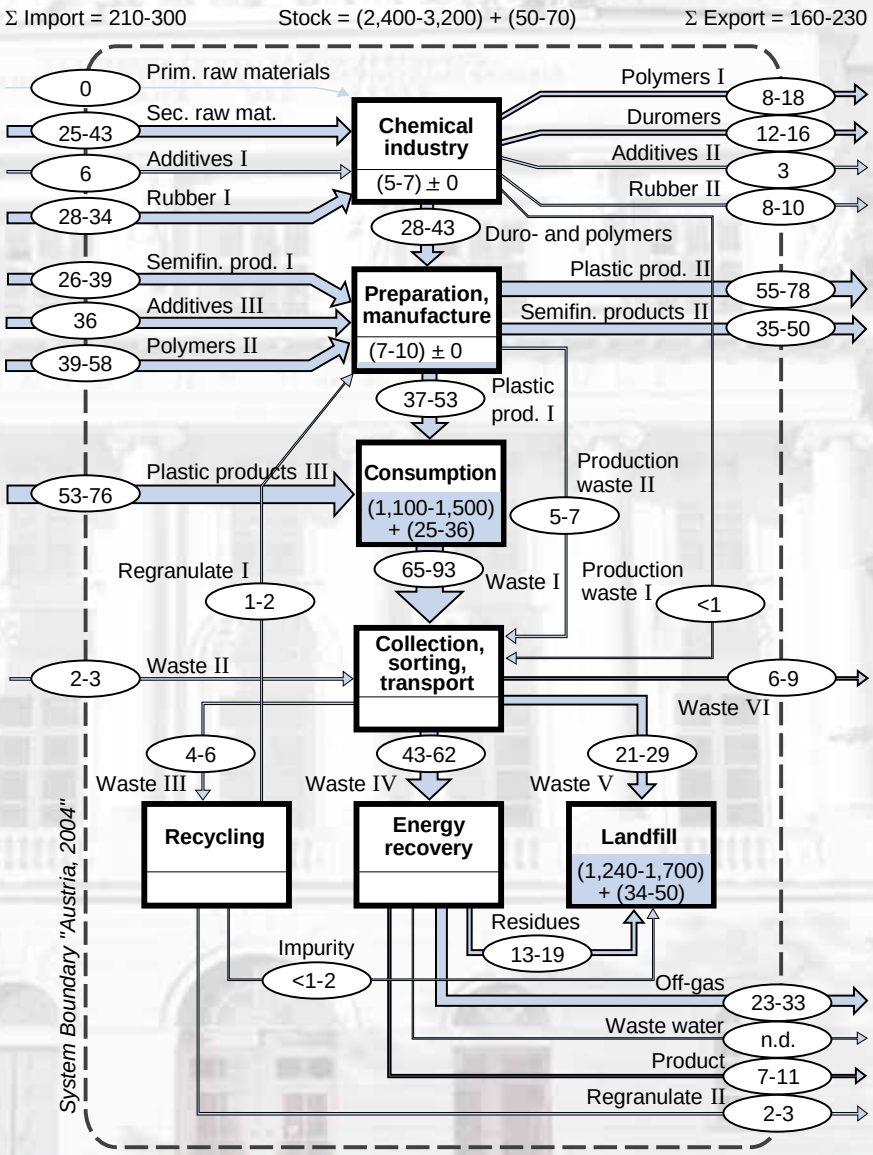
Plastic flows and stocks

	Austria			Poland		
	Total [1,000 t/a]	**kg/cap**	%	Total [1,000 t/a]	**kg/cap**	%
Total plastic import plus domestic production	3 704	463	100	5 556	146	100
Total plastic export	2 417	302	65	1 833	48	33
Plastic consumption	1 287	161	35	3 723	98	67
Plastics to stock “in use”	359	45	10	1 759	46	32
Total plastics in stock “in use”	11 200	1 400	302	23 000	605	414
Plastic waste flow (incl. import-export of waste)	952	119	26	2 044	54	37
Plastic waste flow to recycling	127	16	3	110	3	2
Plastic waste flow to energy recovery	564	71	15	70	2	1
Plastic waste flow to landfills	261	33	7	1 864	49	34
Total plastic stock in landfills	15 500	1 938	418	30 000	789	540

Source: Bogucka & Brunner 2007

Additives in plastics

Additives:
Stabilizers,
Antioxidants,
Lubricants,
Processing aids,
Antifogging and antistatic additives,
Antimicrobials, flame retardants,
Colorants,
Fillers and reinforcement agents



Additives: *Flows [1000 t/yr]*
Stocks [1000 t]

Source: Bogucka & Brunner 2007

Additives in plastics

material (1992)	consumption [1000t/yr]	thereof packaging [1000t/a]	in use stock [1000t]
plastics	1,000	250	6,700
softeners	14	3	180
Ba/Cd-stabilizers	0.250	0.0002	4
Pb- stabilizers	1.6	0.002	27
flame retardants	2	0	34

Source: Fehringer & Brunner 1997

Better data on plastic products required

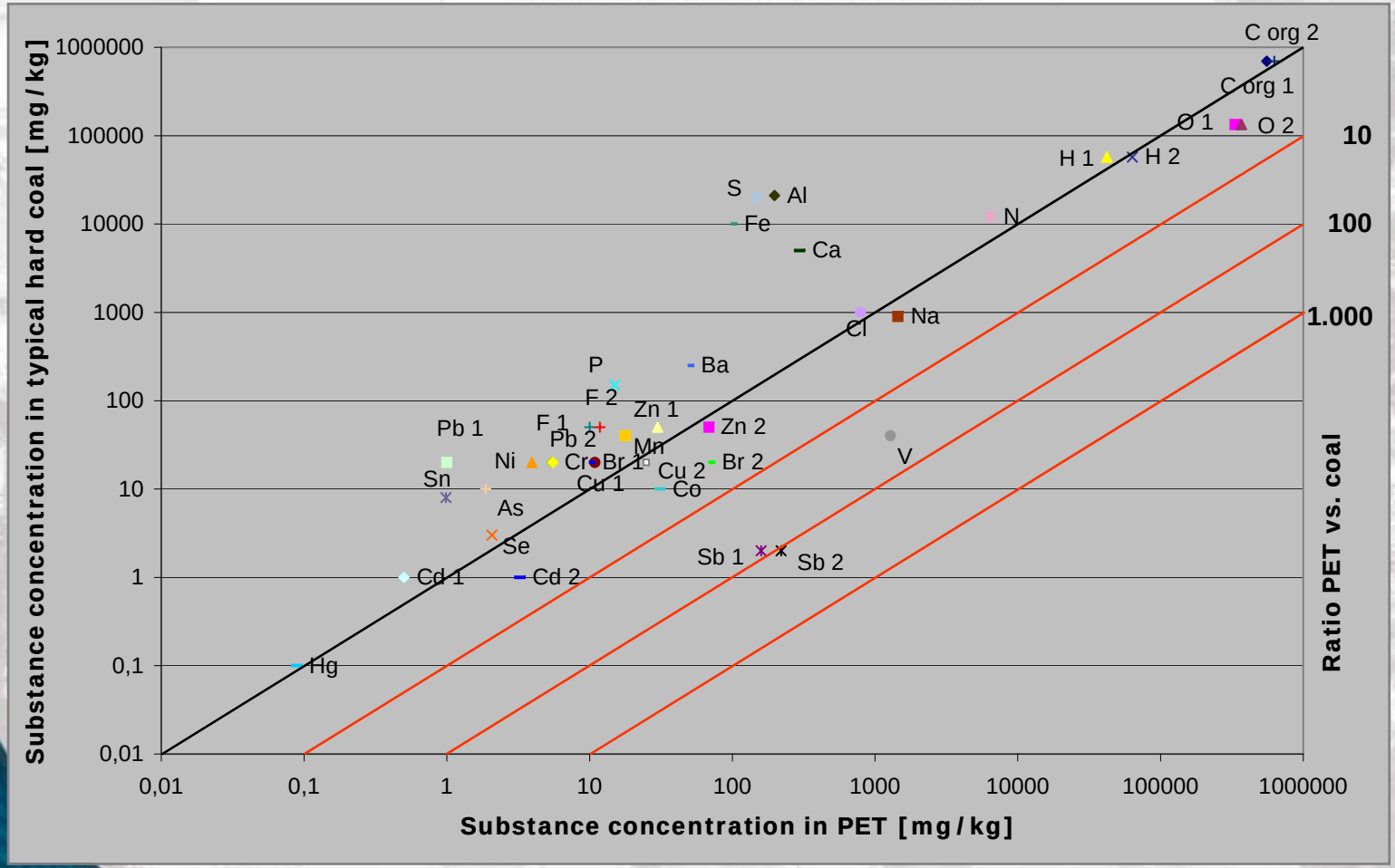
Trim strip

Recycling of PET bottles (LCA study 2004)

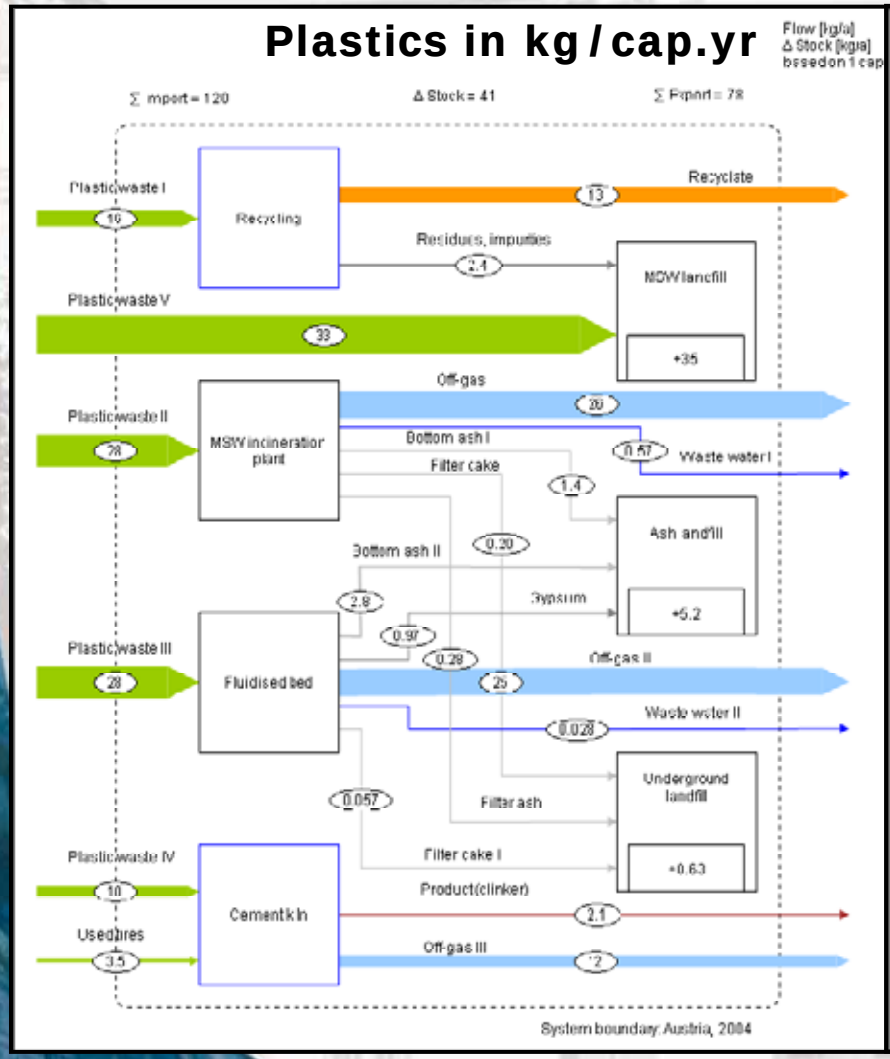
		New Pet bottle		PET-bottle from waste collection	
		Analyse A	Analyse B	IVV 1999 (DSD-Fraktion)	Ecoinvent 2003
Cd	mg/kg		0,20	0,6	3,25
Tl	mg/kg		<0,40	0,3	0,39
Hg	mg/kg		<0,20	1	0,089
Sb	mg/kg	220	220	211	159
As	mg/kg		<1,0	0,4	1,87
Pb	mg/kg		<1,0	2	5,52
Cr	mg/kg		3,8	1	5,42
Co	mg/kg		27	26	31,10
Cu	mg/kg	25	23	12	11,83
Mn	mg/kg		4,2	16	17,74
Ni	mg/kg		1	4	3,94
Vn	mg/kg		<1,0	1	1281
Se	mg/kg			0,5	2,07
Sn	mg/kg			1	0,99
Te	mg/kg			0,5	
Zn	mg/kg			29	68,68

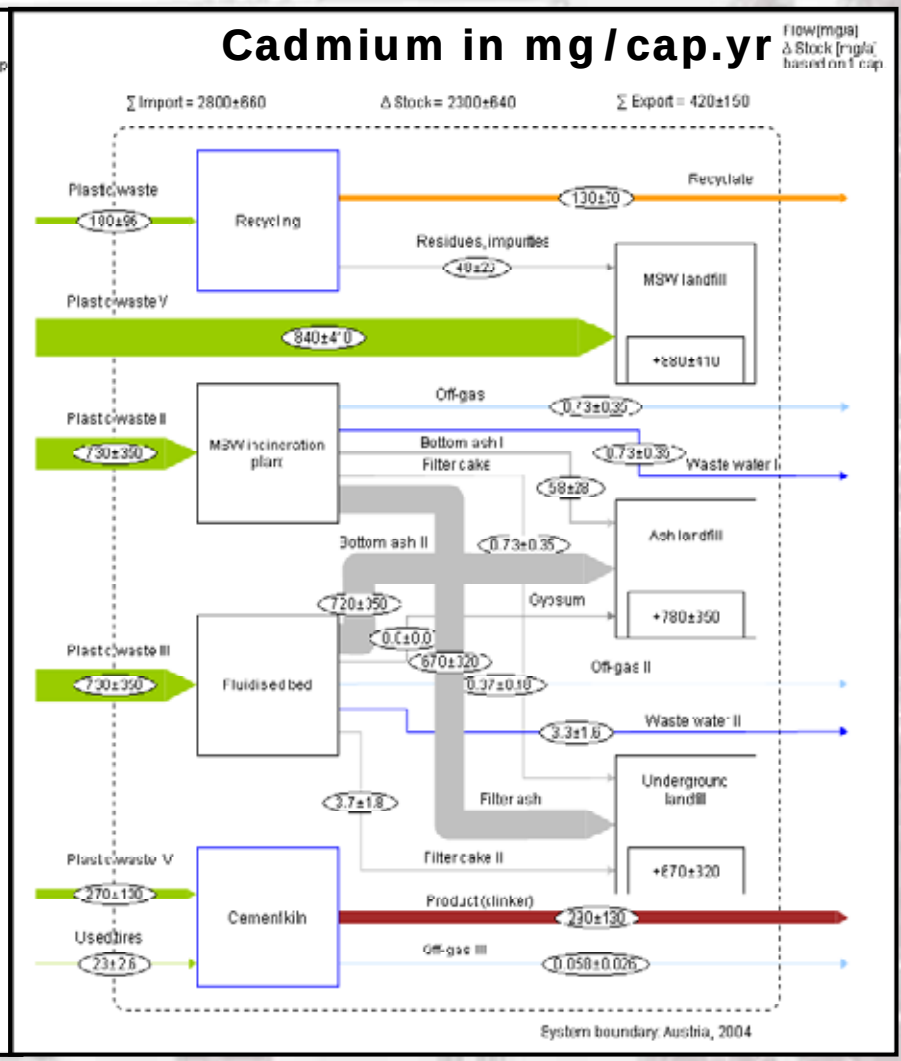
Source: Detzel et al. 2004

Assessing the quality of PET as a fuel



Flows of plastics and cadmium in Austrian waste management

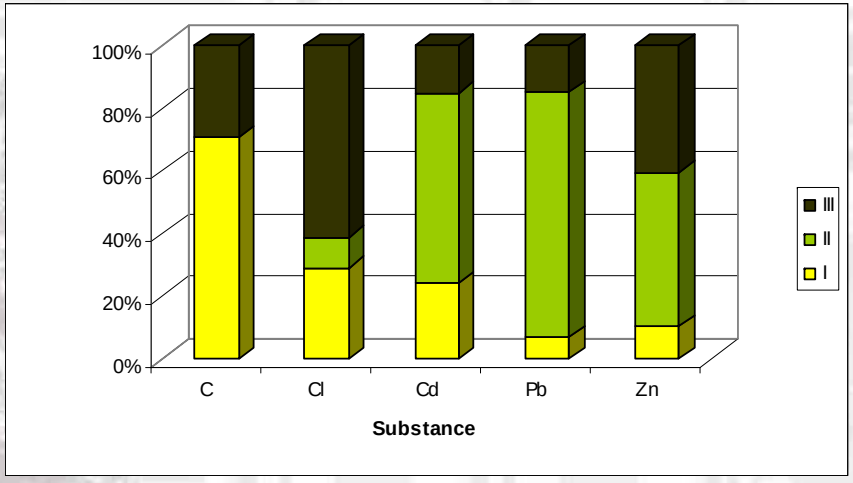




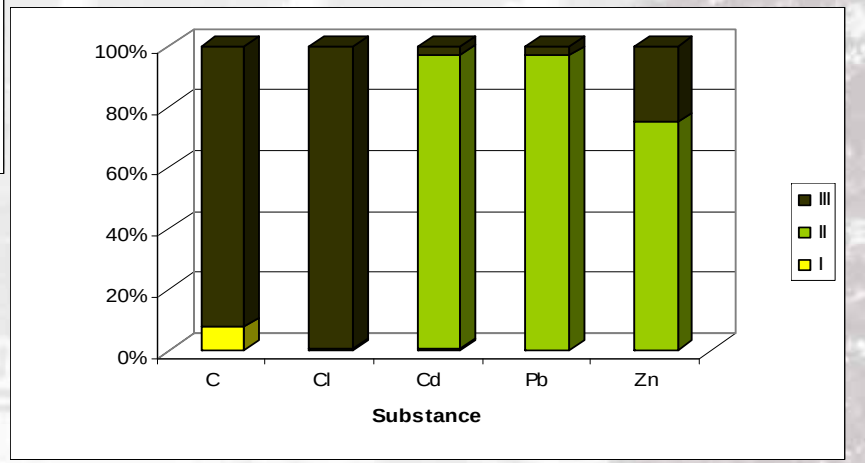
Source: Bogucka & Brunner 2007

Selected substances reaching appropriate target processes

Austria



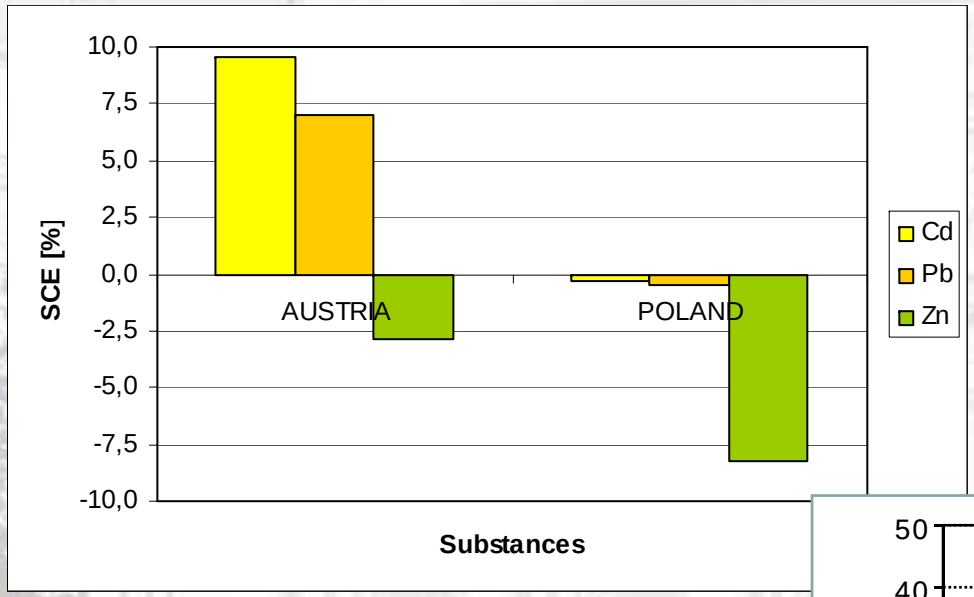
Poland



I appropriate target process
II mean/conditionally appropriate target process
III inappropriate target process

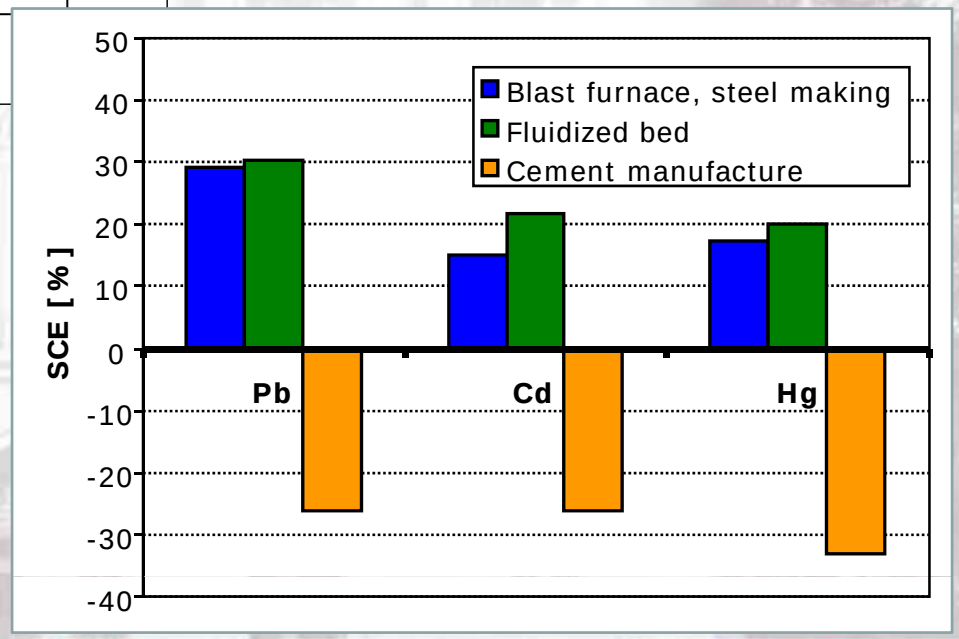
Source: Bogucka & Brunner 2007

Substance concentrating efficiency of plastics management

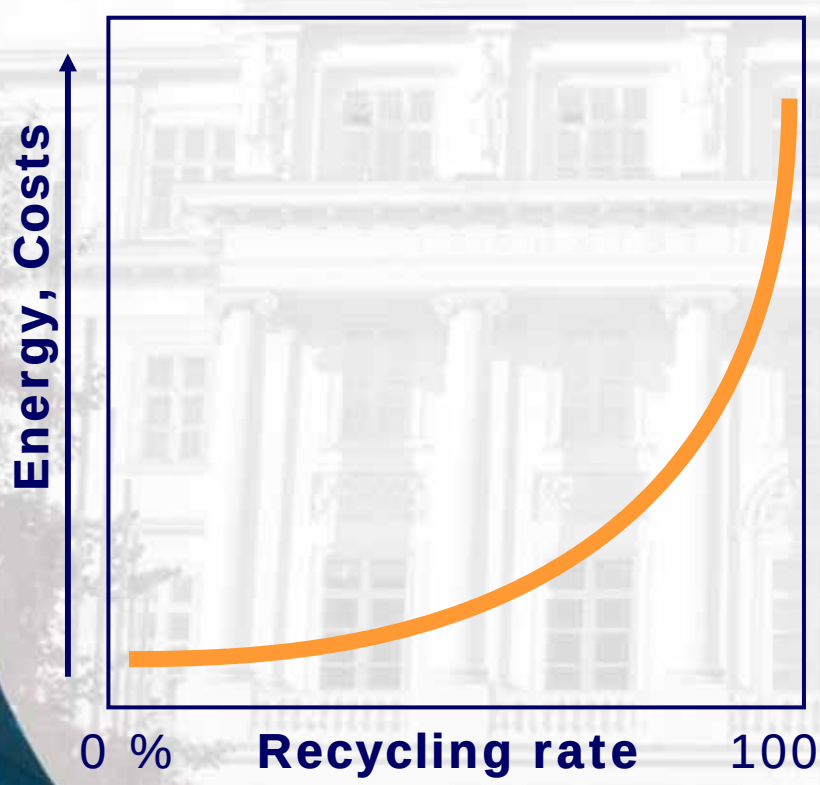


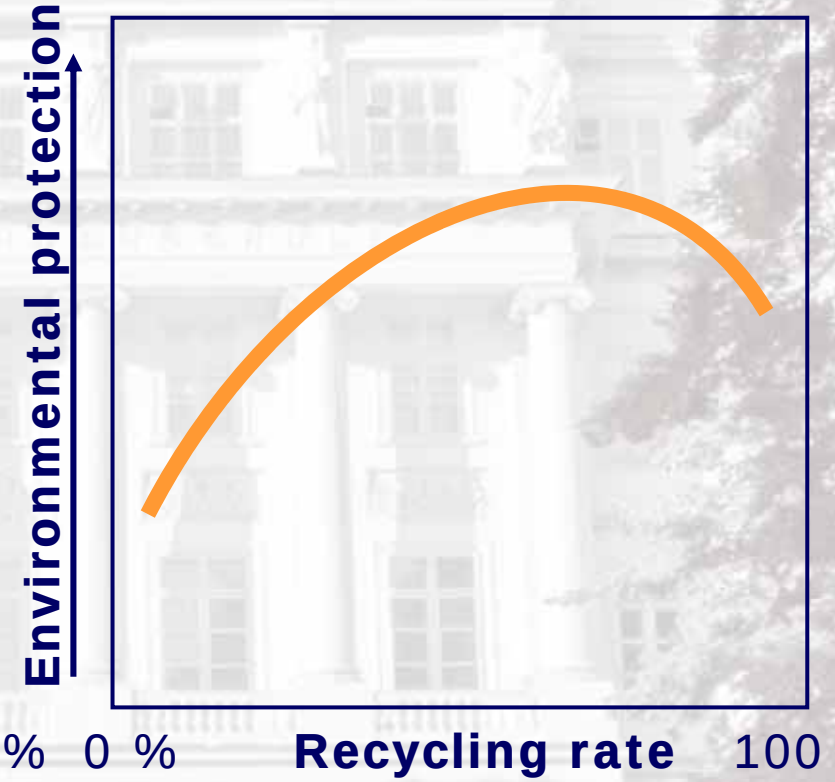
Source: Bogucka & Brunner 2007

Source: Pilz 2007

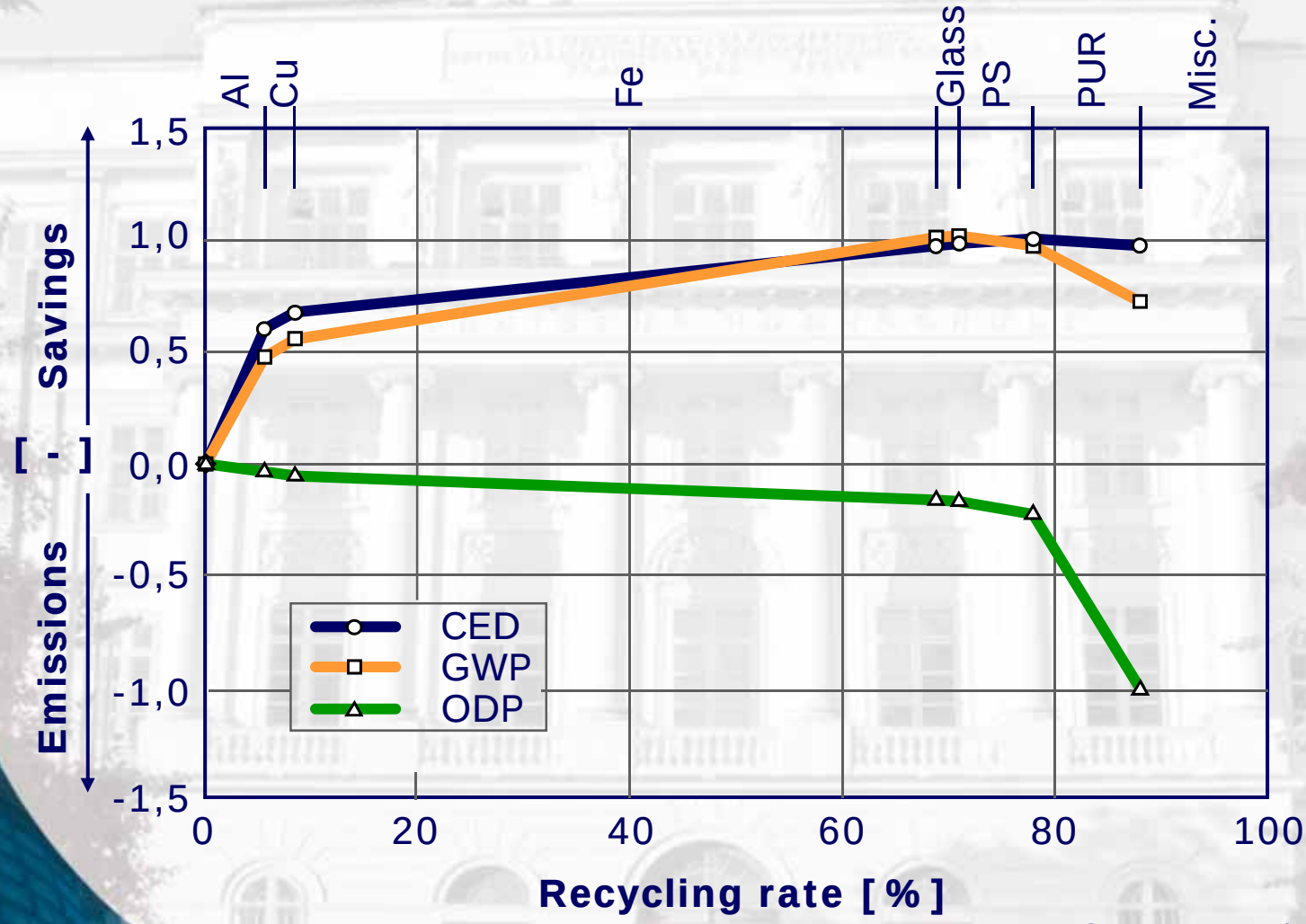


Difference between maximum and optimum recycling





Difference between maximum and optimum recycling



Source: Laner & Rechberger 2007

What to do?

Short-living products: near optimum

Solve problems with long-living products

- **Find environmentally compatible substitutes for problematic additives**
- **Design for recycling (easy dismantling)**
- **Producer and recycler should be the same (producer responsibility)**
- **Remove plastics from construction and demolition waste**