An allocation method based on the relative profit between industrial sectors

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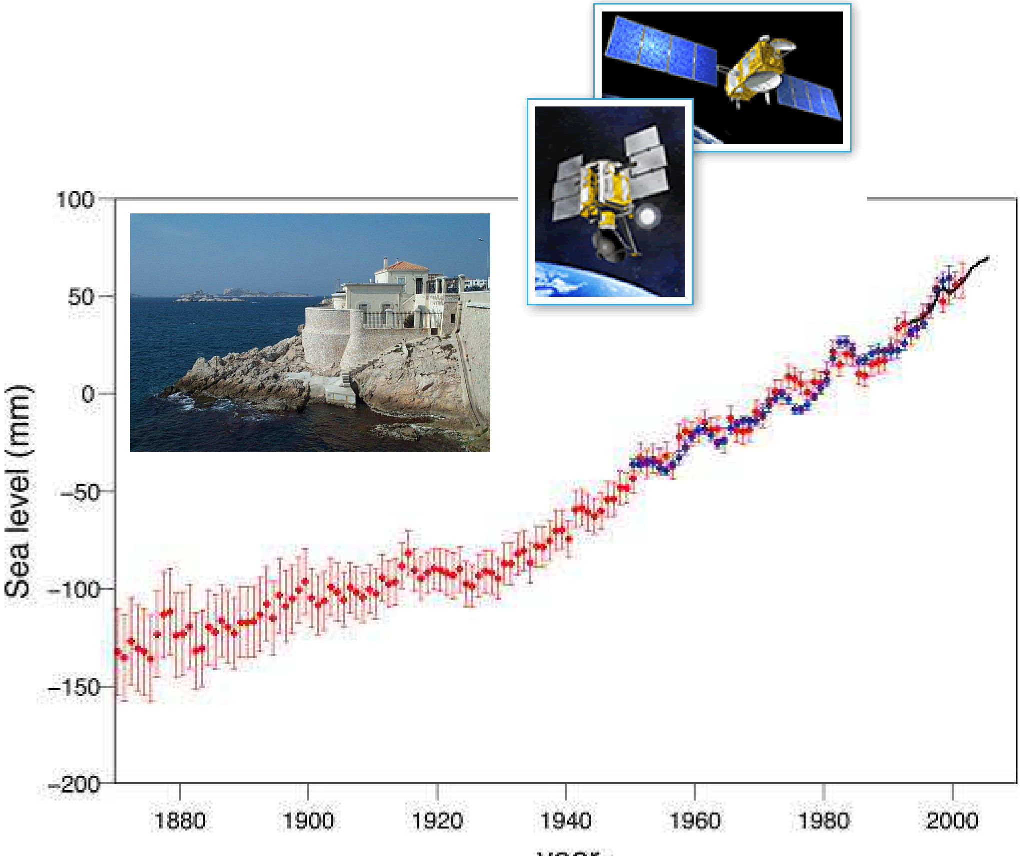
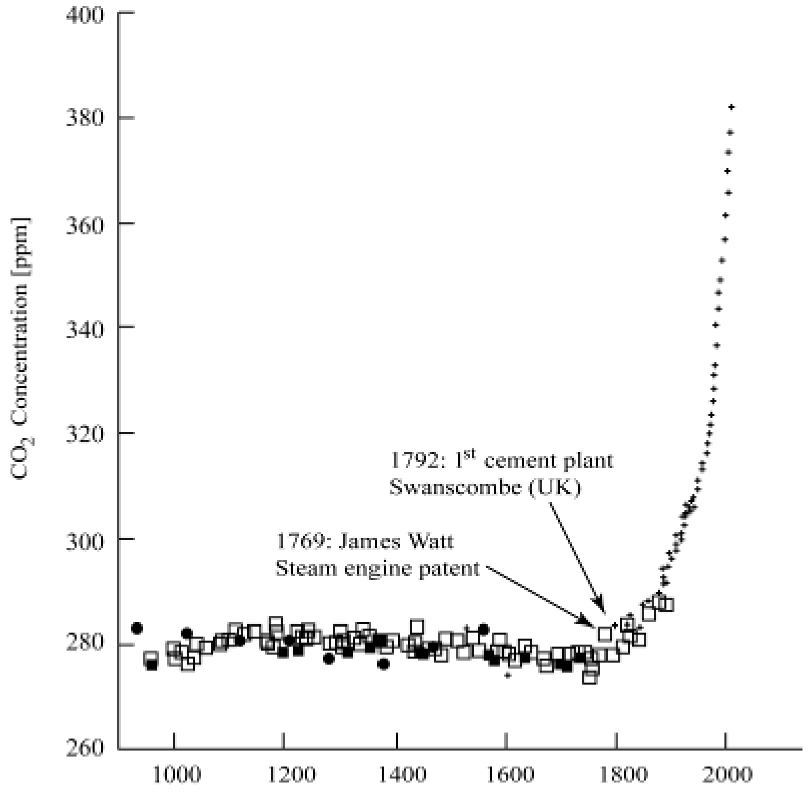
Quantification of the disaster



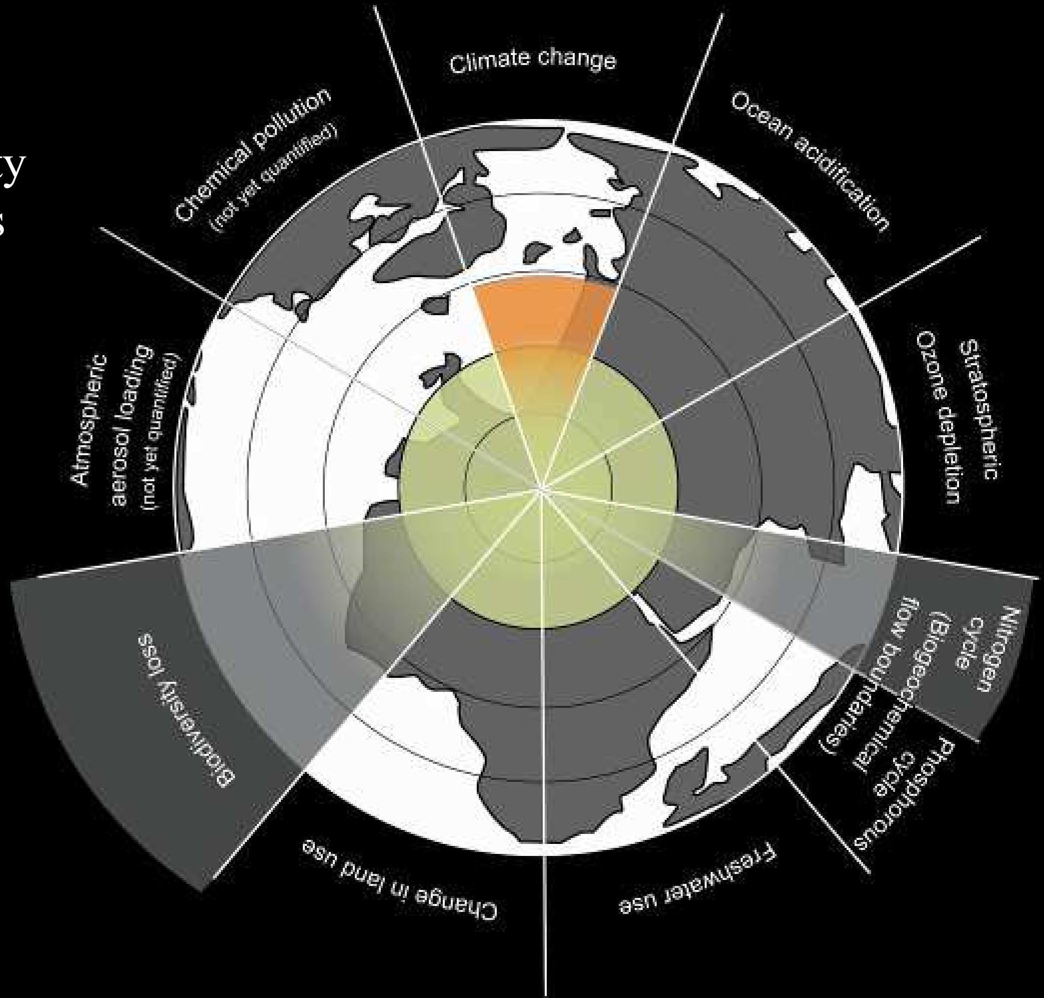
[IPCC, 2007]



[MacKay, 2008]

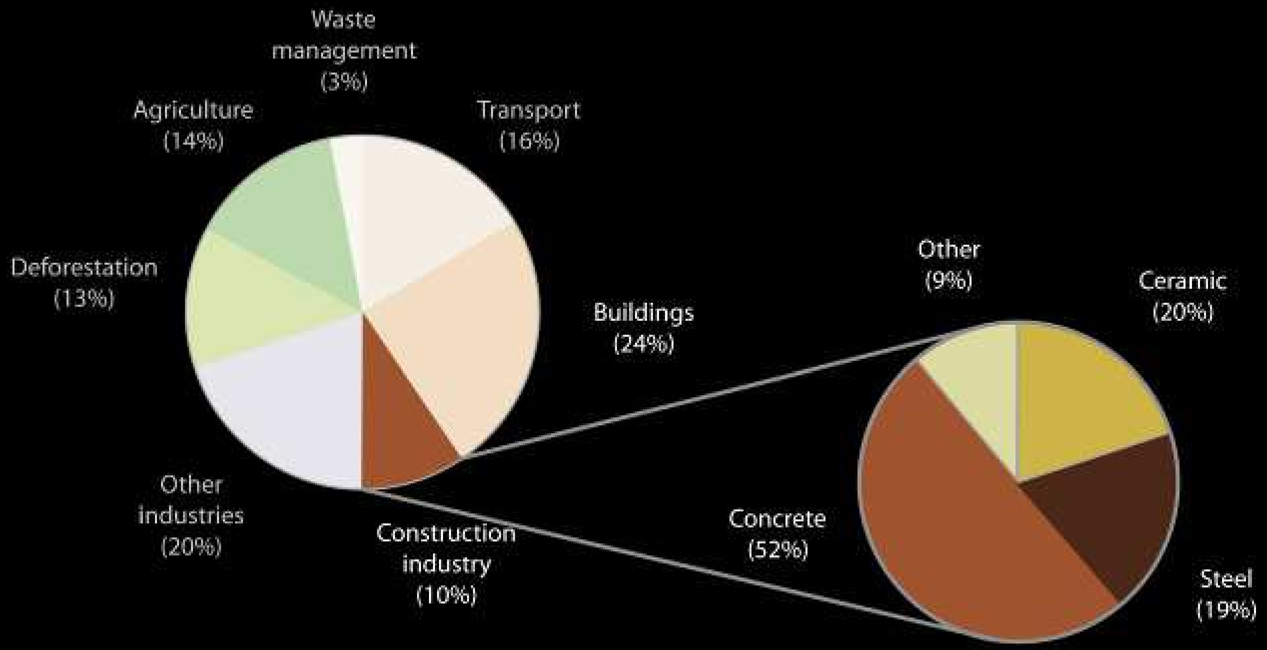
Quantification of the disaster

Impacts of human activity for ten critical thresholds



[Rockström et al., 2009. *Nature*, 461, 472-475]

Quantification of the disaster



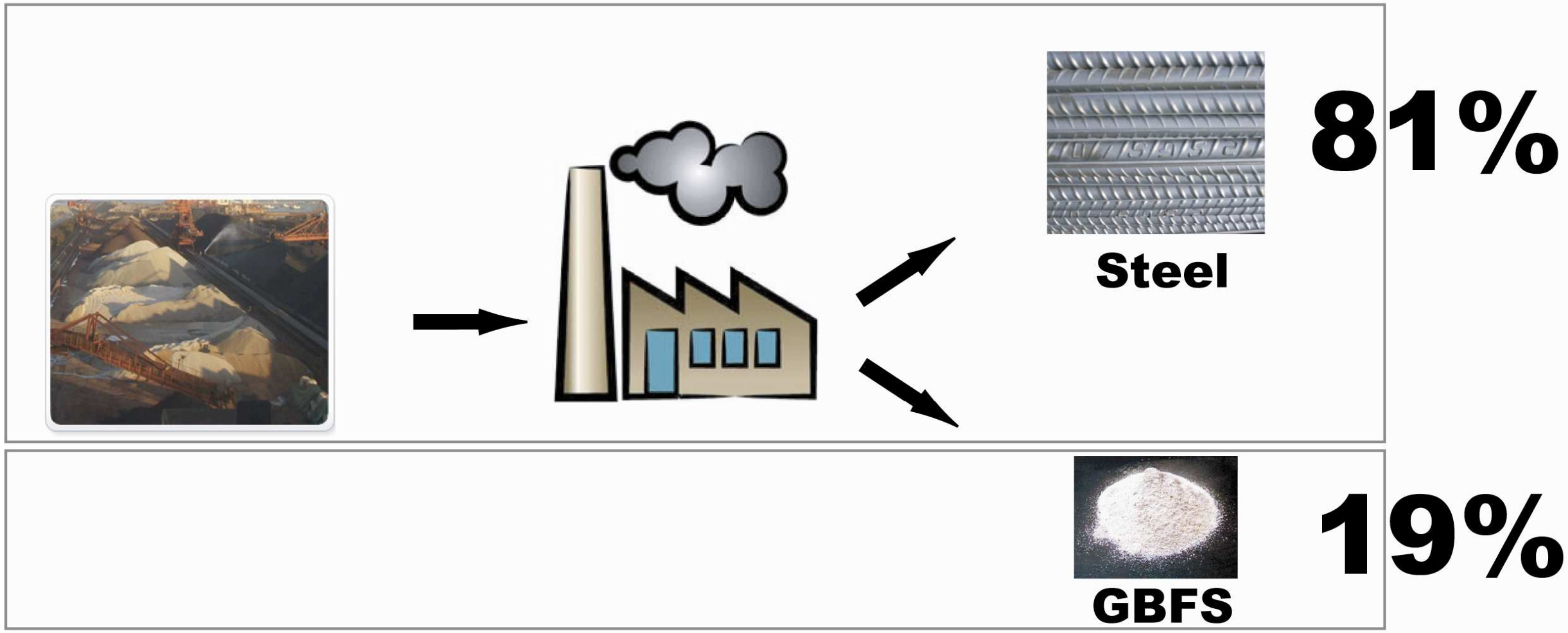
CO_2 emissions from construction sector
=
concrete & steel industry

Sce: Manicore, 2011

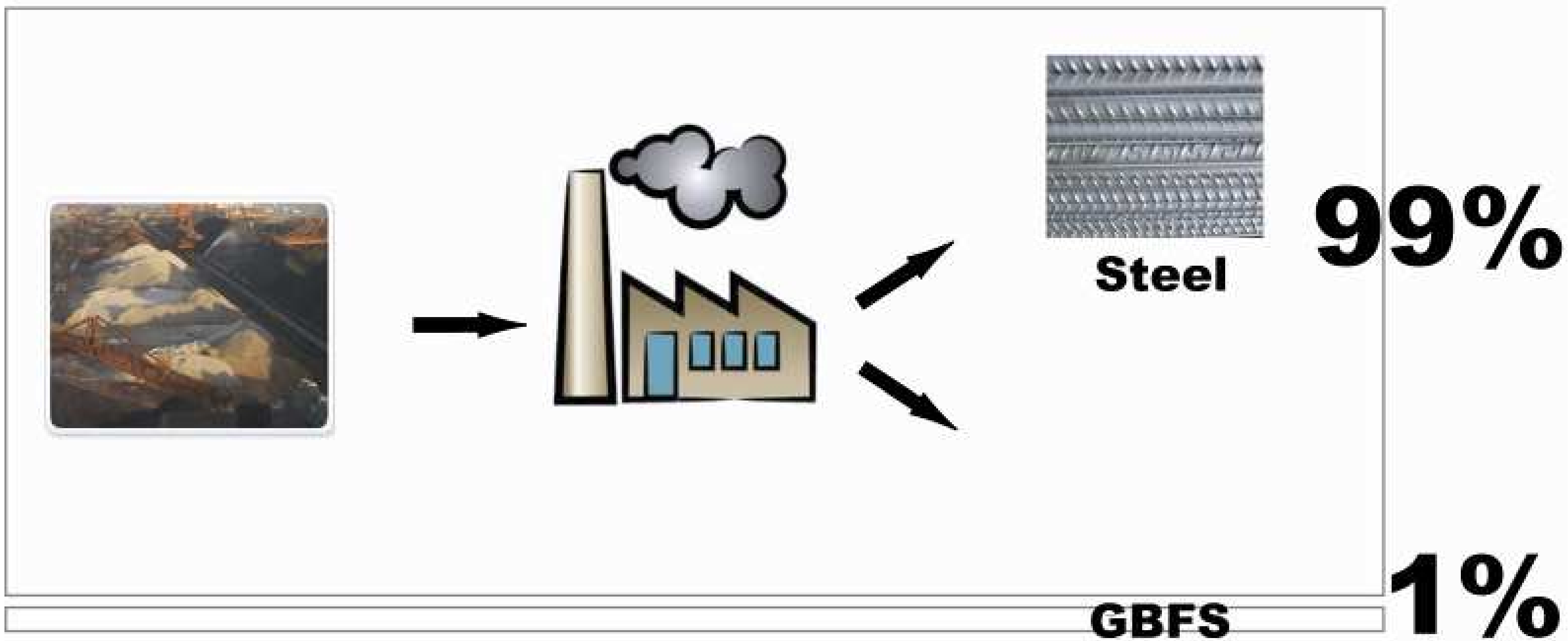
Sce: Bribián et al. 2011. *Building and environment*, 46, 1133-1140.

Share the responsibility

Mass allocation

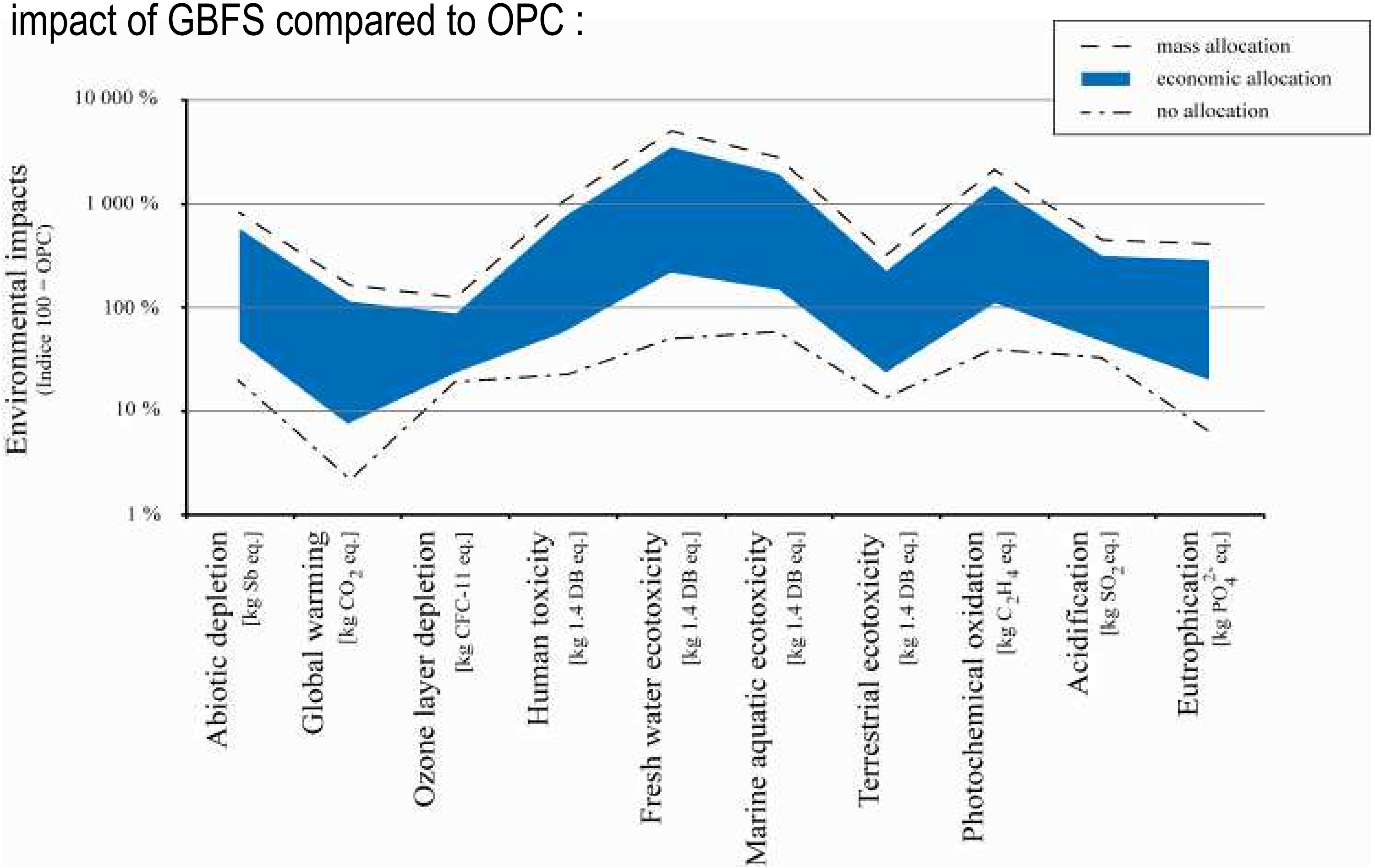


Economic allocation



Share the responsibility

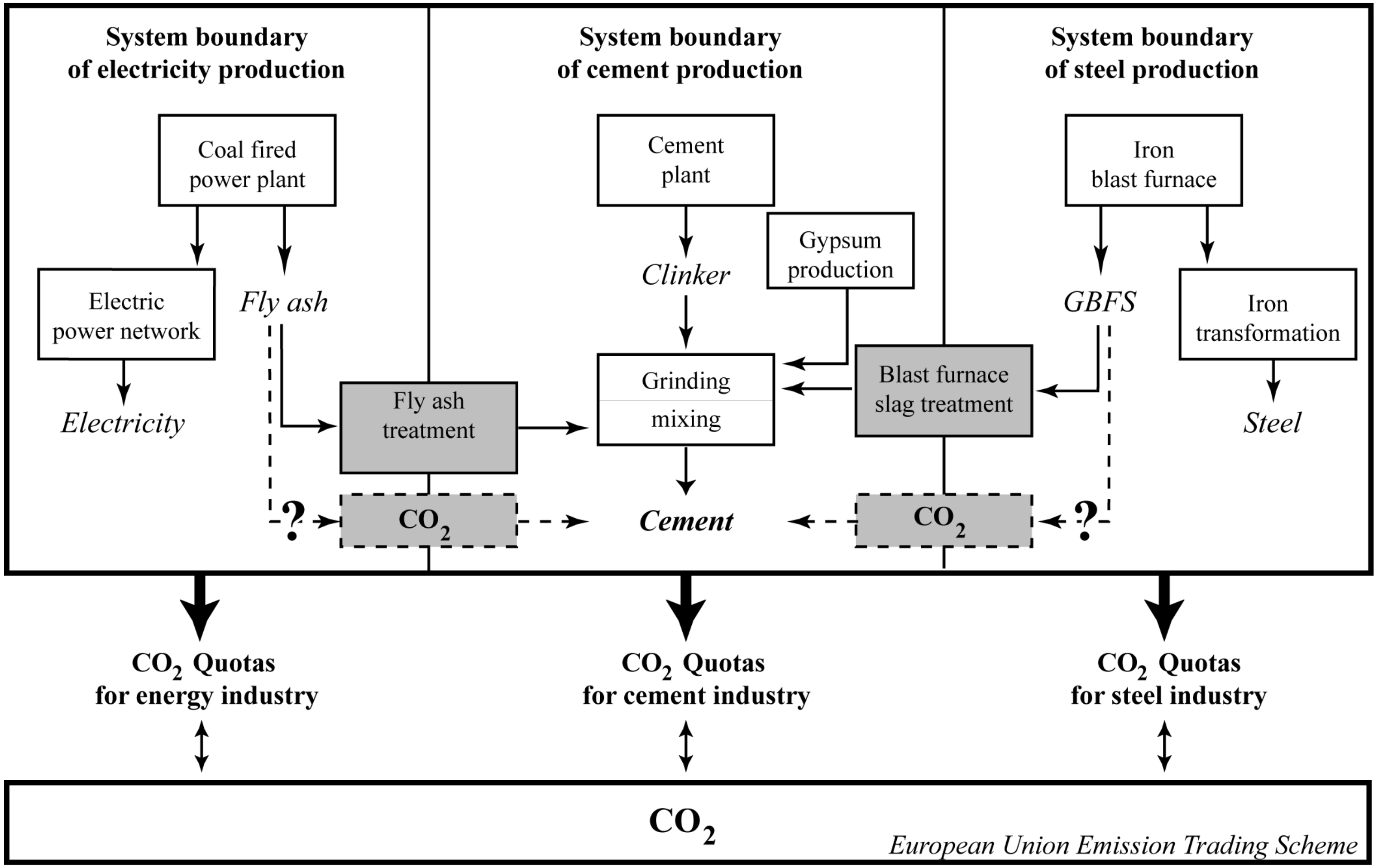
Environmental impact of GBFS compared to OPC :



Allocation of bast furnace impacts on slag and steel has a critical consequences on further use of slags in cement industry

[Chen et al. 2010. *Resources, Conservation and Recycling*, **54**, 1231-1240]

A common carbon market



A common carbon market

Activities	Waste used in cement industry
Combustion of fuels in installations with a total rated thermal input exceeding 20 MW	Fly ash + refused derived fuel ashes
Refining of mineral oil	refused derived fuels
Production of coke	coke combustion + fly ash
Metal ore (including sulphide ore) roasting or sintering, including pelletisation	Tailings
Production of pig iron or steel (primary or secondary fusion)	Granulated Blast furnace slag, steel slags
Production or processing of ferrous metals (including ferro-alloys)	SiMn slag and Mn oxide filter cakes
Production of primary aluminium	Dross / sludge / red mud
Production of secondary aluminium	non metallic products and salts
Production or processing of non-ferrous metals	slags
Production of cement clinker	Cement industry
Production of lime or calcination of dolomite	Cement industry
Manufacture of glass	waste glass
Manufacture of ceramic products	fired bricks waste, waste gypsum
Manufacture of mineral wool insulation material	rock wool waste
Drying or calcination of gypsum or production gypsum products	Cement industry
Production of pulp from timber or other fibrous materials	Wood saw dust, wood fibres
Production of paper or cardboard	Paper sludge
Production of carbon black	carbon black
Production of nitric acid	No known use in cement industry
Production of adipic acid	No known use in cement industry
Production of glyoxal and glyoxylic acid	No known use in cement industry
Production of ammonia	No known use in cement industry
Production of bulk organic chemicals	No known use in cement industry
Production of hydrogen (H2)	No known use in cement industry
Production of soda ash (Na2CO3) and sodium bicarbonate (NaHCO3)	No known use in cement industry
Capture of greenhouse gases and geological storage in a storage site	linked to cement industry
Transport of greenhouse gases by pipelines for geological storage	linked to cement industry
Geological storage of CO_2 in a storage site permitted under Directive 2009/31/EC	linked to cement industry
Aviation	No known use in cement industry

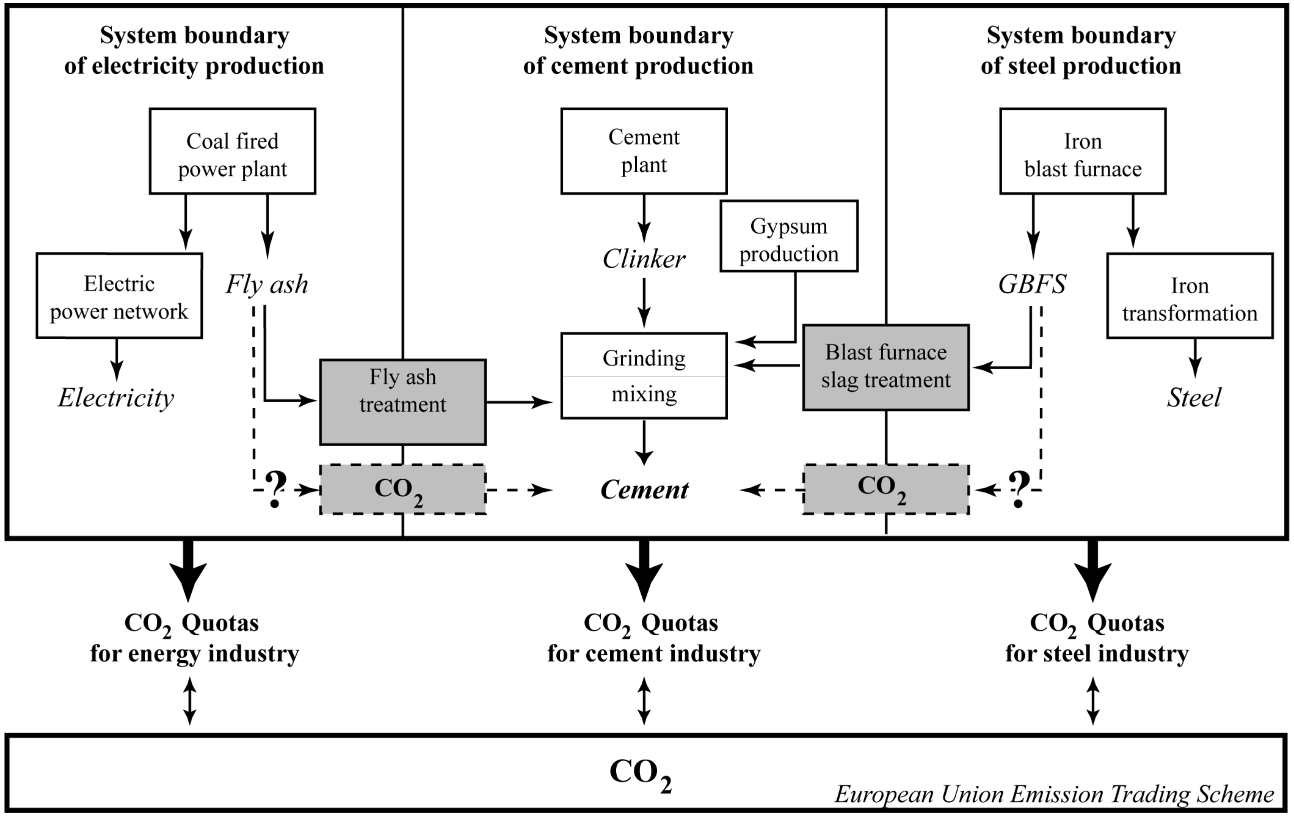
Chemistry sector

Airplanes emissions

[European Union, Directive 2009/29/EC, Annex I]

Looking at the relative economic benefit

$$\overline{I}_{SCM} = c \cdot \overline{I}_{primary\_process} + \overline{I}_{treatment}$$



Looking at the relative economic benefit

$$\overline{I}_{SCM} = c \cdot \overline{I}_{primary\_process} + \overline{I}_{treatment}$$

Binding efficiency of the SCM (from EN 206-1)**:**
1 kg of SCM = *k* . kg of OPC

The cement benefit =
relative benefit of selling a cement composed of GBFS (CEM III) compared to selling an Ordinary Portland Cement (CEM I).

$$Cement_{benefit} = \left(€_{CEMIII} - k.€_{CEMI}\right) + \left(k.€_{stone} - €_{GBFS}\right) + \left(k.€_{kiln} - €_{treatment}\right) + \left(k.I_{CEMI}.€_{CO_2} - C_{GBFS}.I_{Iron}.€_{CO_2}\right)$$

Looking at the relative economic benefit

$$\overline{I}_{SCM} = c \cdot \overline{I}_{primary\_process} + \overline{I}_{treatment}$$

Binding efficiency of the SCM (from EN 206-1)**:**
1 kg of SCM = *k* . kg of OPC

The iron benefit =
relative benefit of selling GBFS compared to send it to final disposal.

$$Iron_{benefit} = €_{GBFS} + €_{disposal} + C_{GBFS} . I_{Iron} . €_{CO_2}$$

A "fair" distribution of economic gain and losses

A "fair" distribution of responsibilities ?

$$Cement_{benefit} = Iron_{benefit}$$

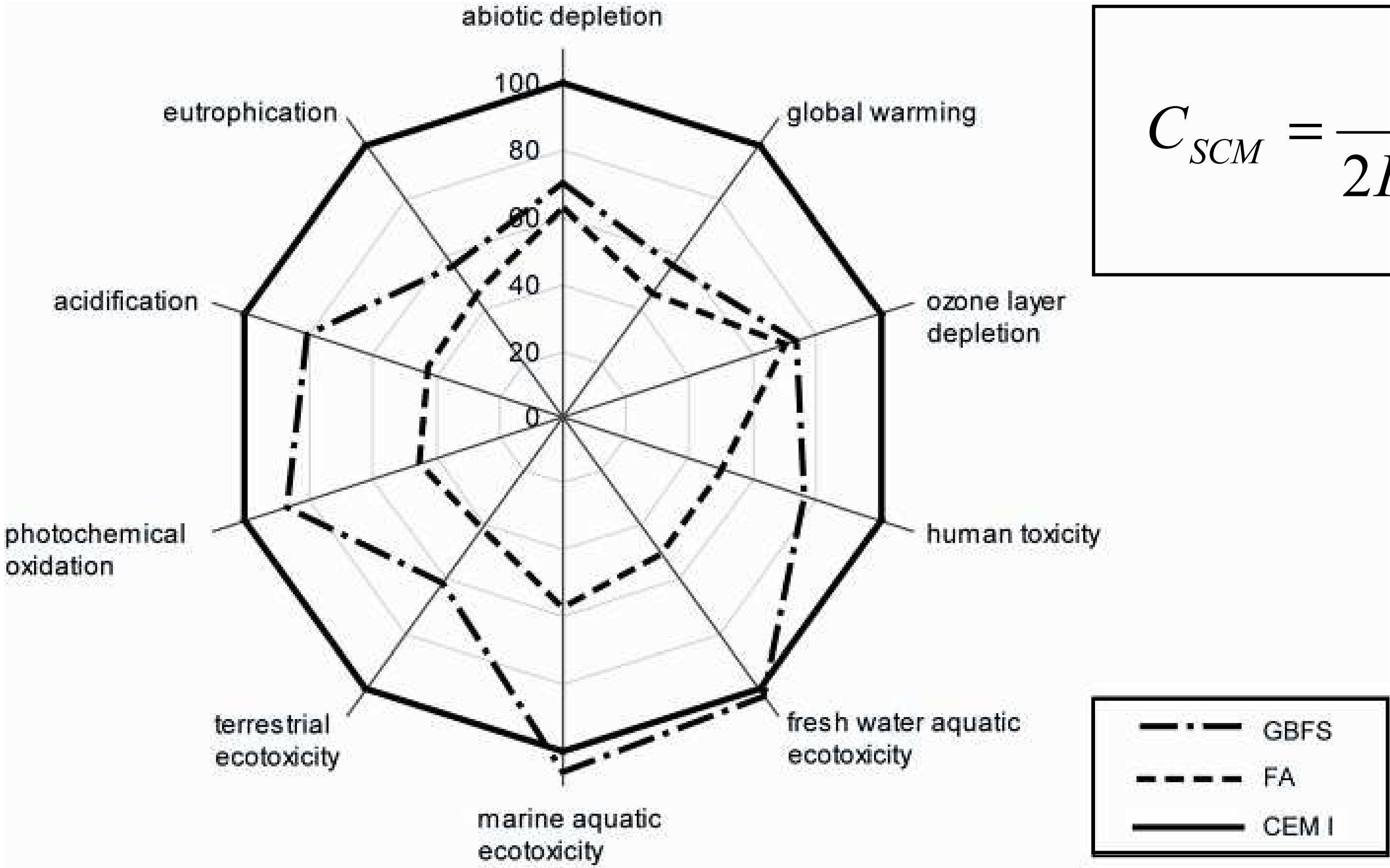
$$C_{BFSG} = \frac{k.I_{CEMI}}{2I_{Iron}} + \frac{€_{CEMIII} - €_{disposal} - 2€_{GBFS} - €_{treatment} + k.(€_{stone} + €_{ki\ln} - €_{CEMI})}{2I_{Iron}€_{CO_2}}$$

$$\lim_{€_{CO2}\to\infty}(C_{BFSG}) = \frac{k.I_{CEMI}}{2I_{Iron}}$$

$$\boxed{C_{SCM} = \frac{k.I_{CEMI}}{2I_{primary\_production}}}$$

A “fair” allocation method

A “fair” distribution of responsibilities ?

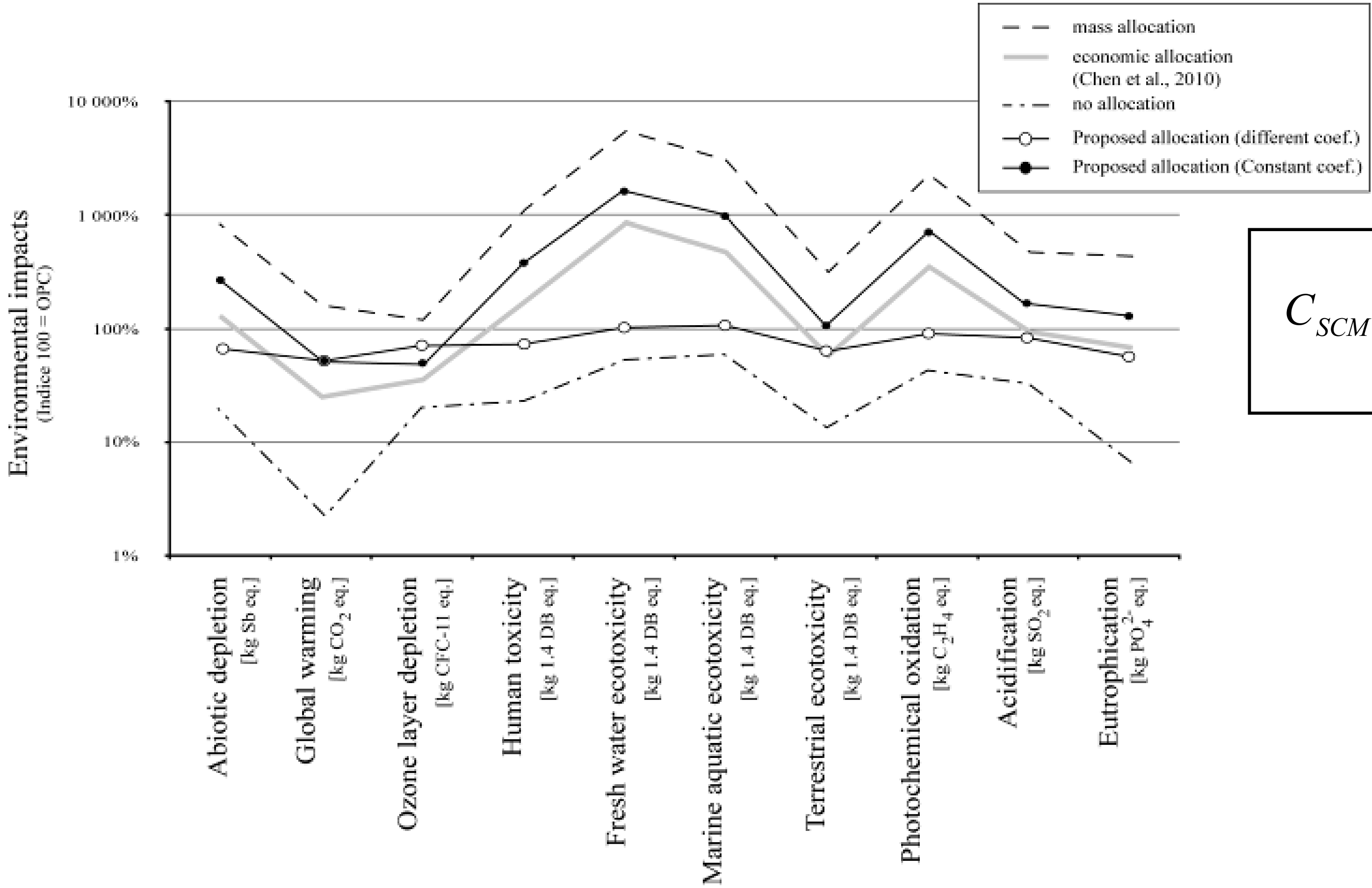


$$C_{SCM} = \frac{k.I_{CEMI}}{2I_{primary\_production}}$$

Comparison is done for products providing
the same binding capacity: 1kg CEM I = 1kg SCM / k

Discussion

1) Allocation with same coefficient as GWP for all impacts or a specific coefficient for each category?

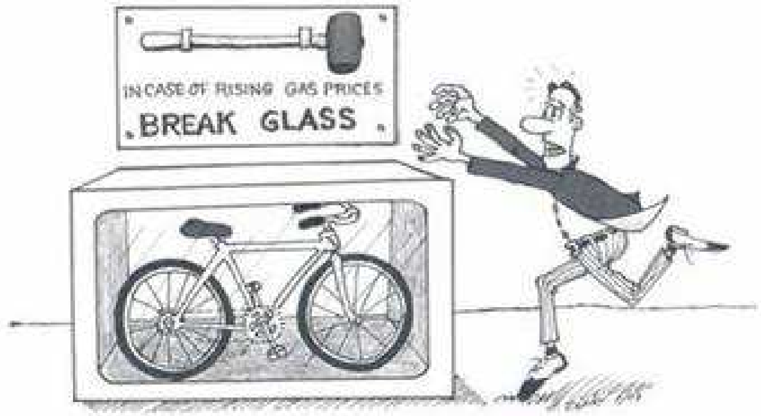


$$C_{SCM} = \frac{k.I_{CEMI}}{2I_{primary\_production}}$$

2) Comparison is done for products providing the same binding capacity: 1kg CEM I = 1kg SCM / k

→ Impacts are equal to 50% of the cement + specific treatment

Can be used to develop an efficient industrial ecology system…



Thank you for your attention