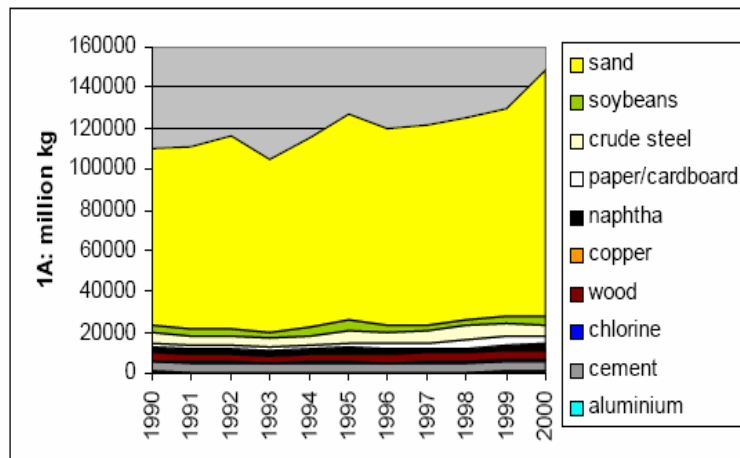


# Dematerialisation and decoupling

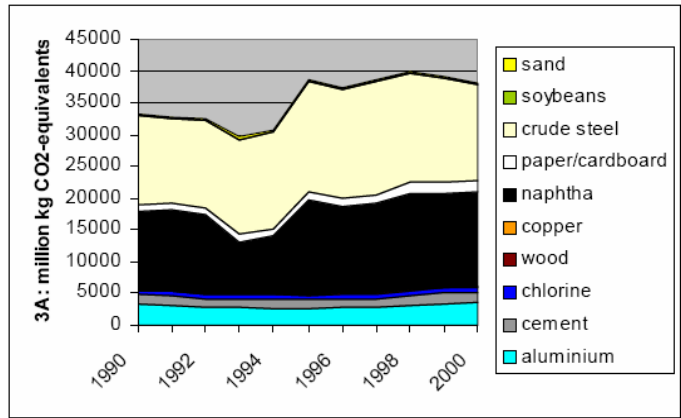
Frans Vollenbroek, DG ENV  
EEB seminar 21 September 2004.

Industrial metabolism, mass-weighted



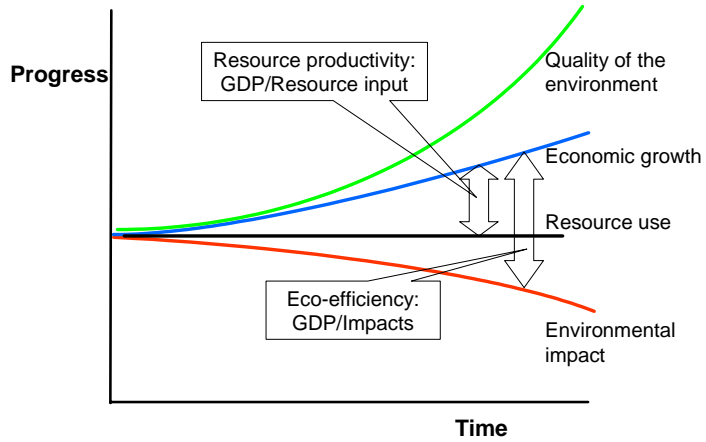
Source: CE Delft [http://www.ce.nl/redirect/publ\\_opin\\_index.html](http://www.ce.nl/redirect/publ_opin_index.html)

Contribution to CO2 emissions



Source: CE Delft [http://www.ce.nl/redirect/publ\\_opin\\_index.html](http://www.ce.nl/redirect/publ_opin_index.html)

Economic growth and progress



## Pro's and con's of indicators

|              | Advantage            | Disadvantage             |
|--------------|----------------------|--------------------------|
| Mass based   | Easy to measure      | Measures the wrong thing |
| Impact based | Difficult to measure | Measures the right thing |

## Basic equations

$$\text{GDP (euro)} = \text{RU (kg)} \times \text{RP (euro/kg)}$$

RP measures how much resources are needed to create wealth (euro per kg).

$$\text{GDP (euro)} = \text{EP (environmental pressure)} \times \text{EE (eco-efficiency)}$$

EE measures how much environmental pressure is needed to create wealth (euro per pressure unit).

$$\text{This means that } \text{EP} = \text{RU} \times \text{RP/EE}$$

This implies that resource use (RU) would be a perfect proxy for environmental pressure (EP) if RP/EE equals 1.

- In case of fossil fuel use **RP/EE** is constant: if the fossil fuel use of an economy doubles, the CO<sub>2</sub> emission will double. One could thus say that resource use is indeed a good proxy for environmental pressure. However, if CO<sub>2</sub> is not emitted, but e.g. sequestered, RP decreases since more energy is needed, while EE increases (no emission of CO<sub>2</sub>).
- If biomass is used as the energy source, RP will decrease compared to fossil fuels (biomass has a lower energy content than fossil fuels). EE can no longer be measured in euro per CO<sub>2</sub>. It could take the form of euro per area of agricultural land use or euro per unit of pesticides use, or euro per unit of lost biodiversity.
- If wind energy is used as the energy sources, RP will increase compared to fossil fuels (wind energy does not involve many kilograms). On the other hand, like biomass, it involves the use of land. EE could be measured as euro per unit of land use (or sea).

## Conclusion

Resource use as a proxy for environmental pressure is only valid if the ratio of resource productivity and eco-efficiency equals 1. In practice this is only the case for some specific situations, such as fossil fuel burning (without CO<sub>2</sub> sequestration).