# From Waste Management to Resources Management

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# What is the most important resource?

# Tulips?

Tooneel van FLORA.

*Vertonende :*

Grondelijcke Redens-onderſoekinge,

*vanden*

HANDEL DER FLORISTEN.

Ghe ſpeeld/ op de ſpreucke van Anthonius de Guevara :
Een voorſichtich eerlijck man, ſal altijt meer ghedulden,
dan ſtraffen.

T'ſamen geſteld, mits/datter dagelijx :

Uyt haat : ſpruyt ſmaad.

Noch is hier by-gevoegt de Lijſte van eenige *Tulpaen* vercocht aende meeſt-biedende tot Alcmaer op den 15 Februarij 1637. Item 't Loſ-dicht van *Calliope*, over de Goddinne FLORA, &c.

t'AMSTERDAM,

Ghedruckt by Iooſt Broerſz. Boeck-drucker inde Graeve-ſtraet/ inde Druckerye / Anno 1637.

# Price of a tulip in the year 1637:

3000 Gulden, equivalent to:

8 fat pigs + 4 fat oxen + 12 fat sheep

+24 tons wheat+ 48 tons barley

+2 barrels wine+ 4 barrels beer

+2000 kg butter + 500 kg cheese

+1 silver cup +1 bale cloth

+1 bed including sheets and cover

+1 boat worths 500 Gulden!

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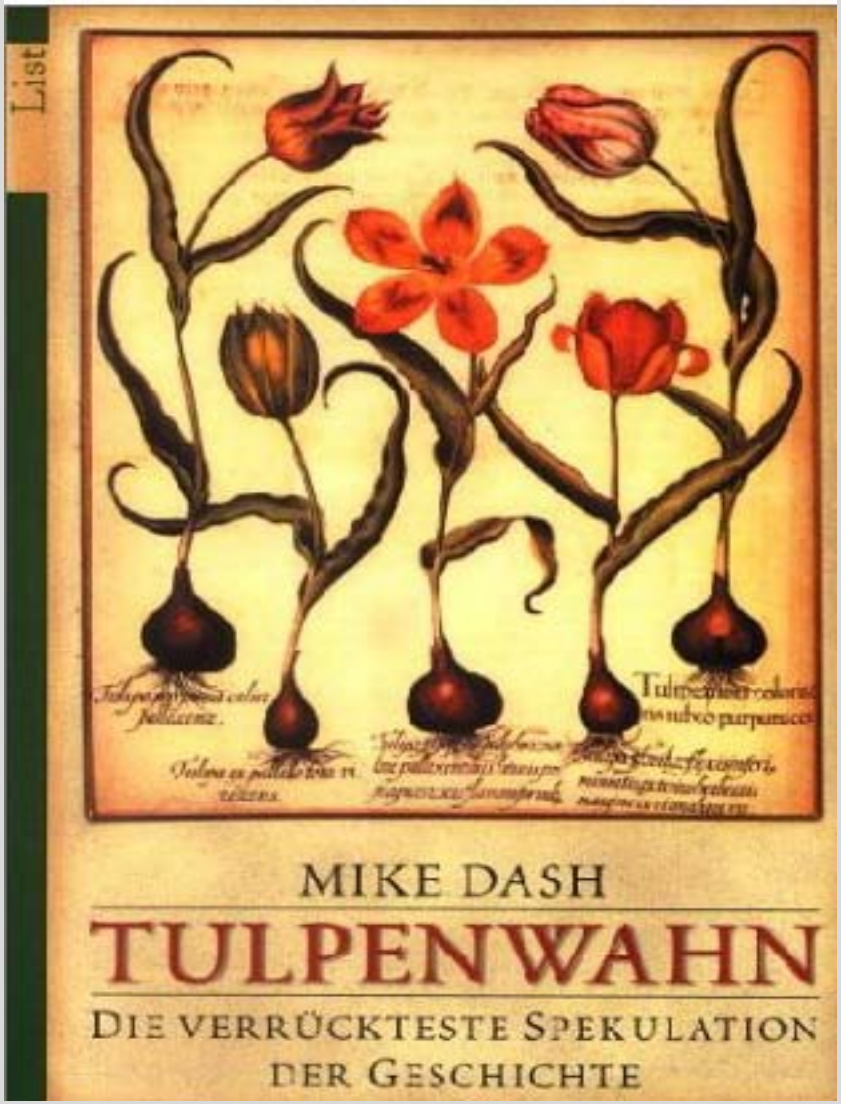
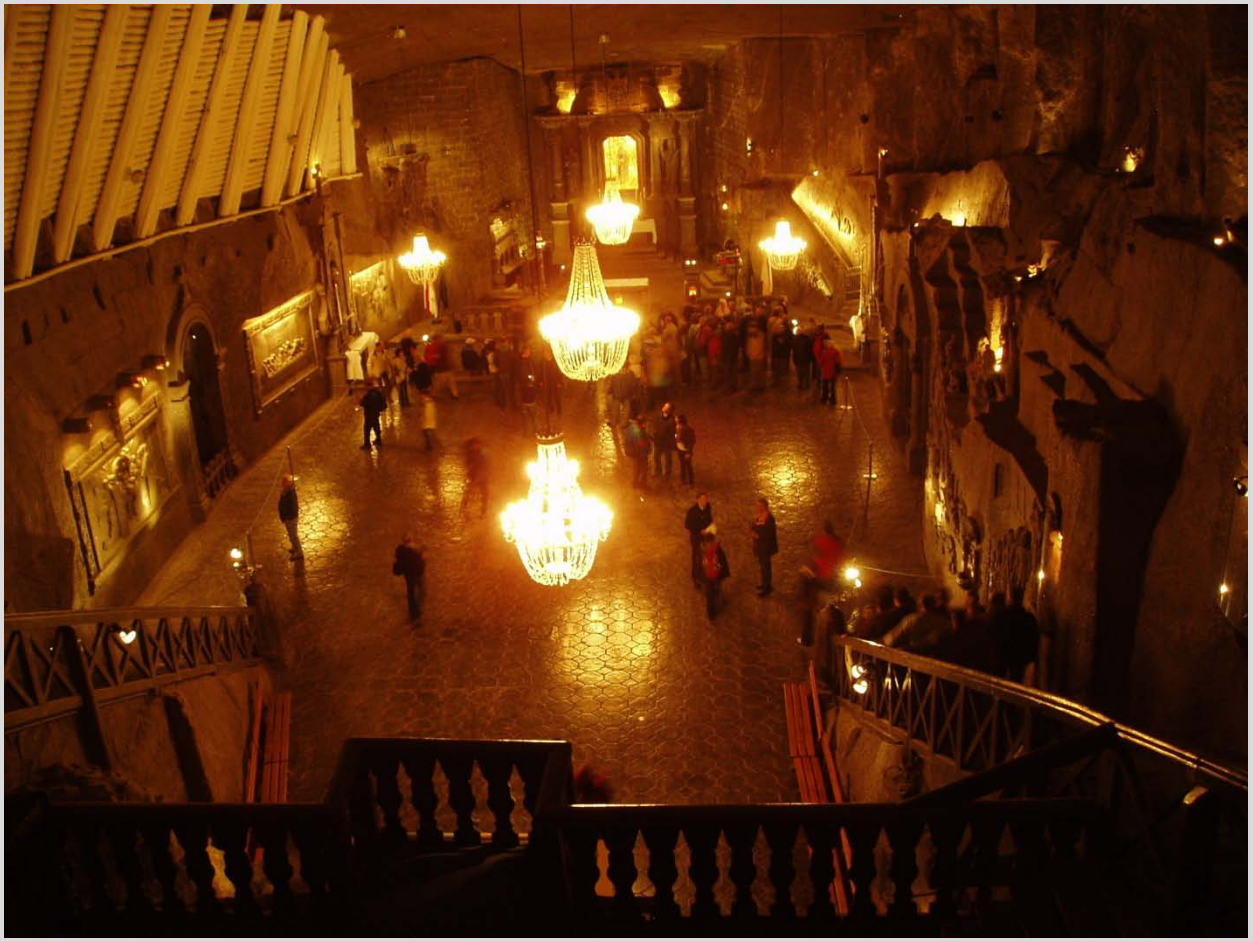
# The „*most crazy speculation in history*“?

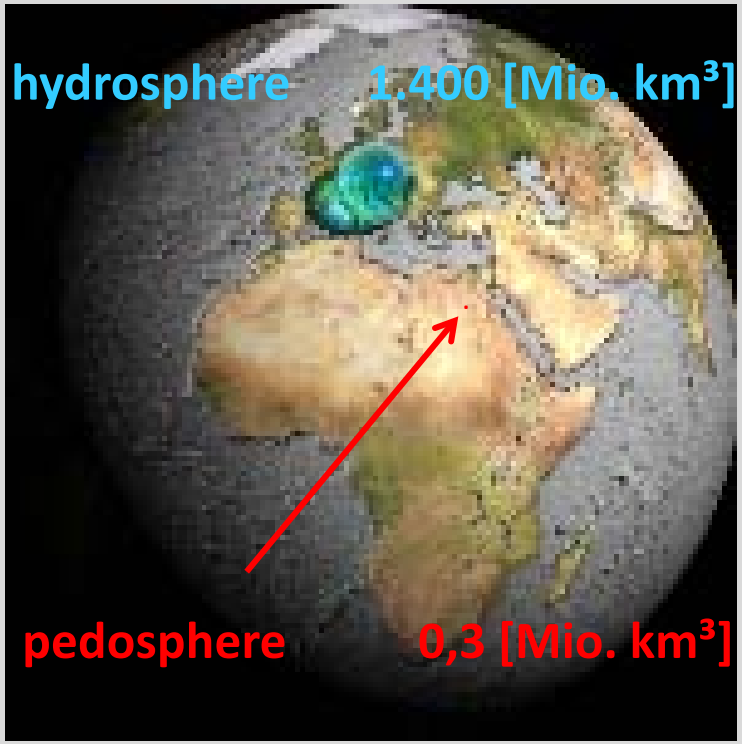


# Salt – the most important resource?



*Salzbergwerk Wielicka, Polen*

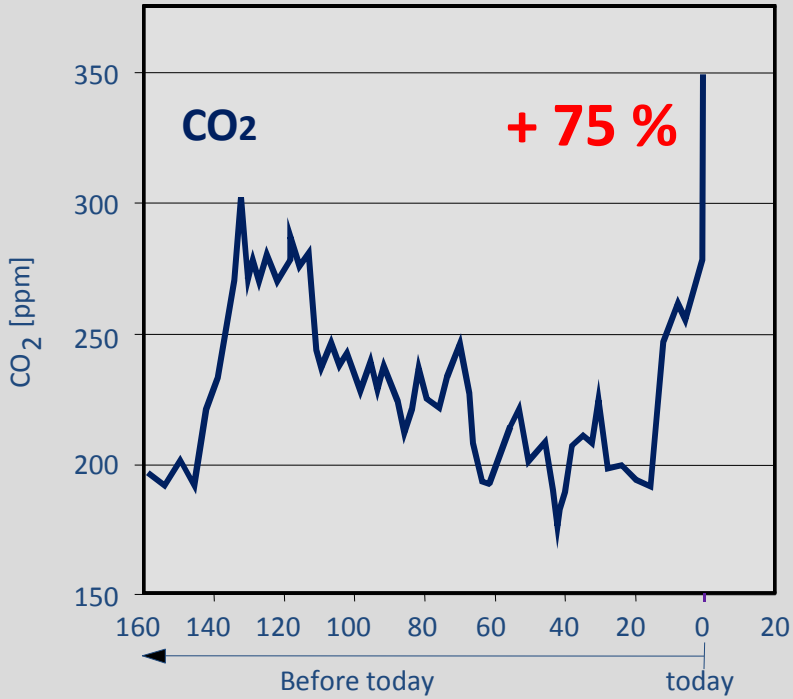
# The environment – most limited resource?

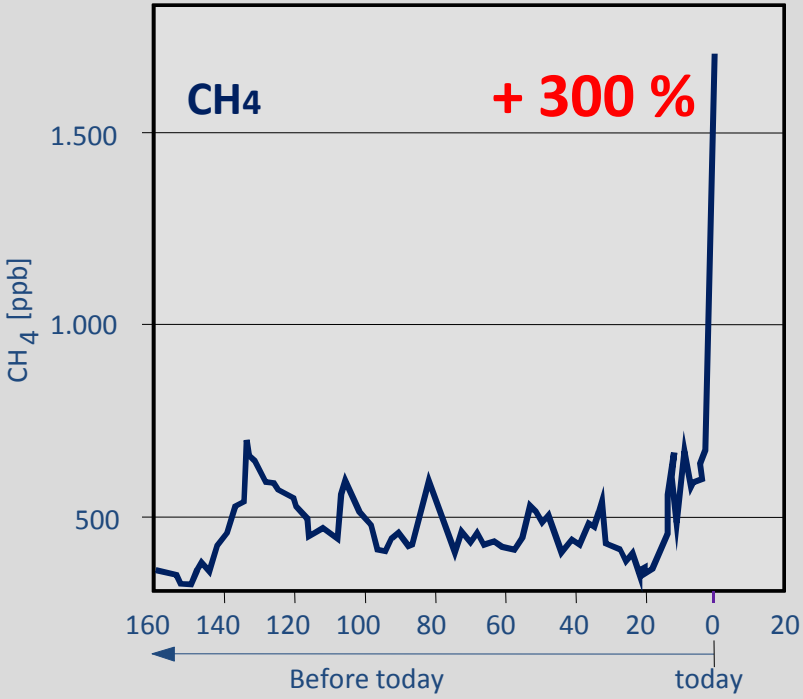




*nach A. Nieman ergänzt durch G. Döberl*

# Limited sinks: where to dispose of carbon?

Concentration of $CO_2$ and $CH_4$ in the atmosphere

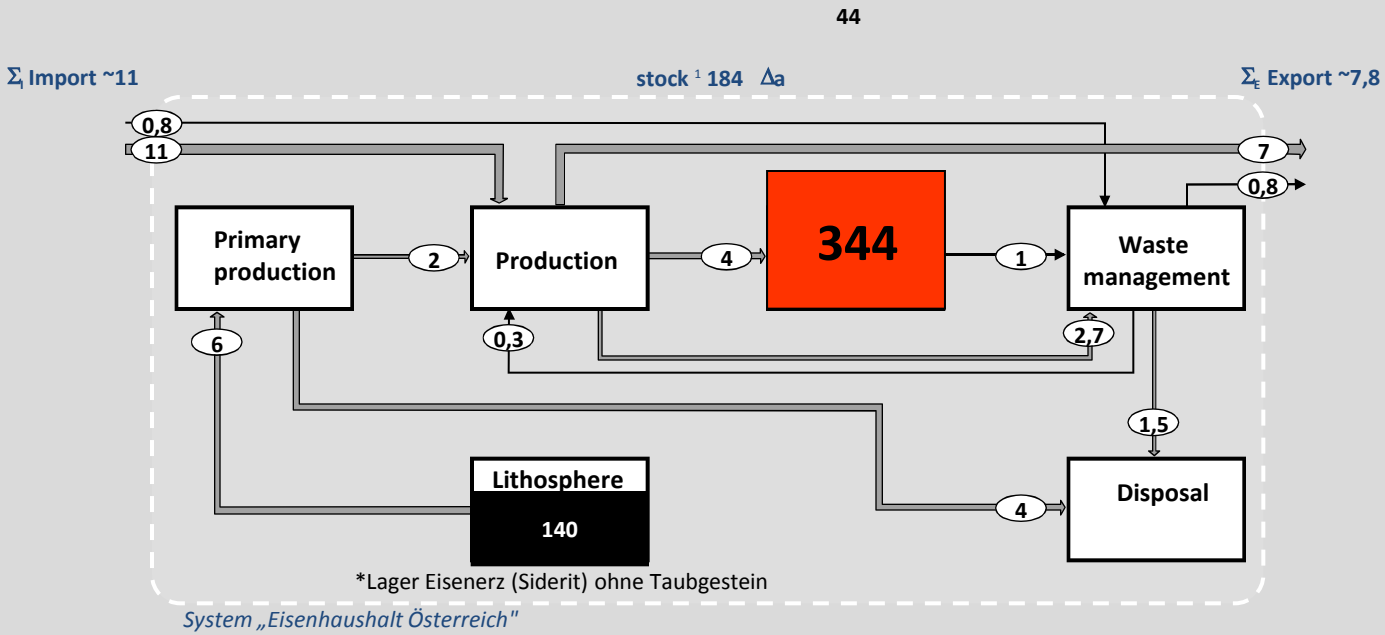



Quelle: Beer, Baumgartner, 1995

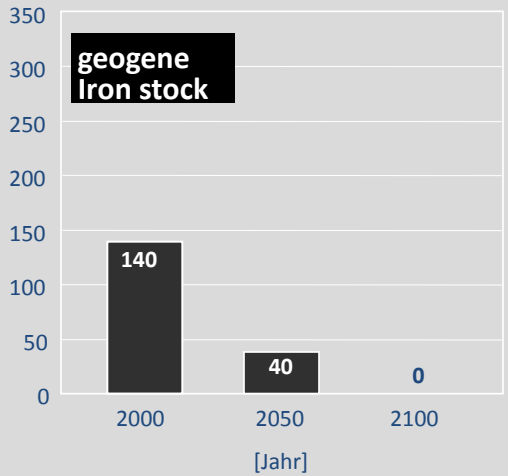
# Iron the most important resource?

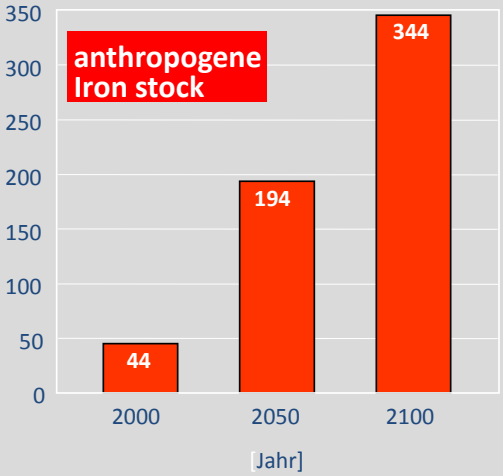
Iron flows and stocks in Austria in Mio t/a




*System „Eisenhaushalt Österreich"*

[Mio. t]



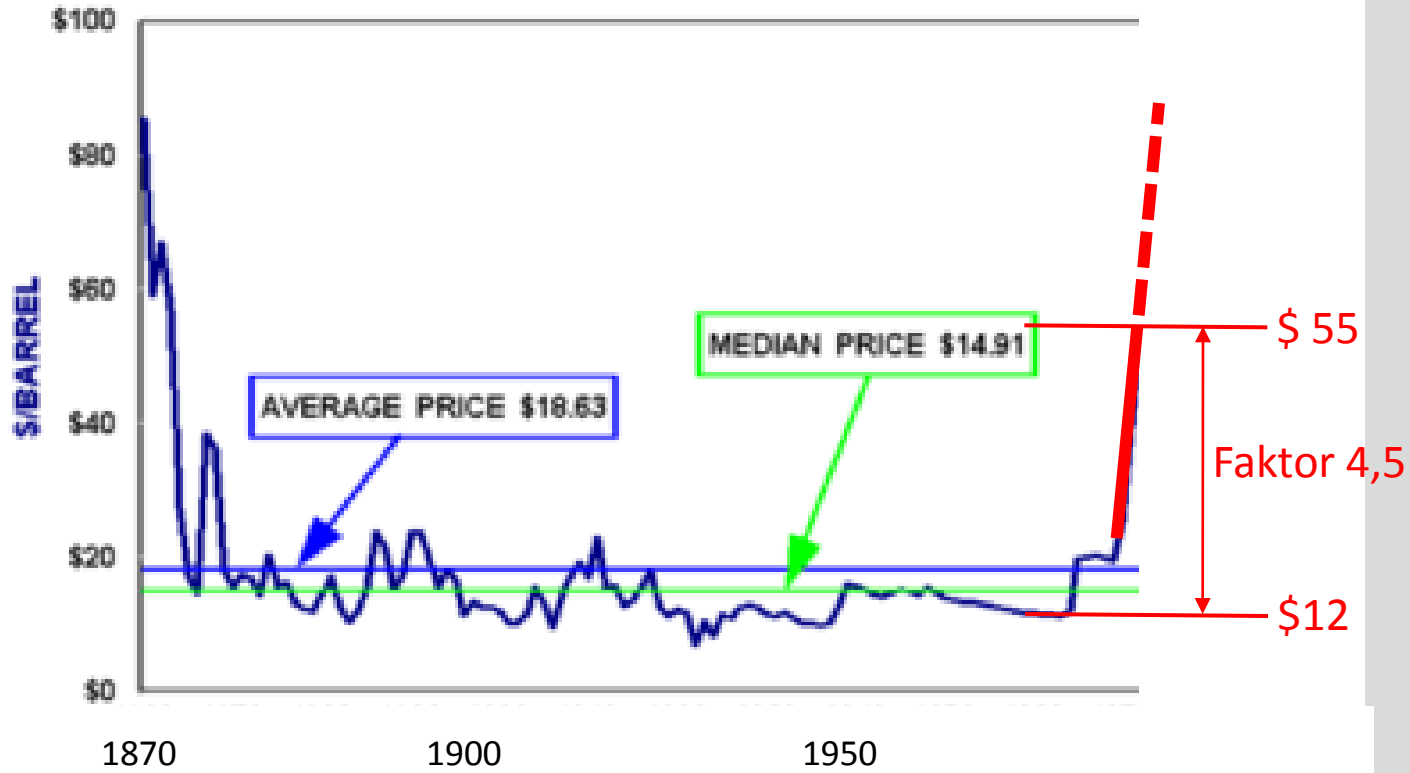
# Fuel – the most important resource?

## Tesla Car

**0-100 kmh in 3,9 sec.  < 2 liter /100 km**

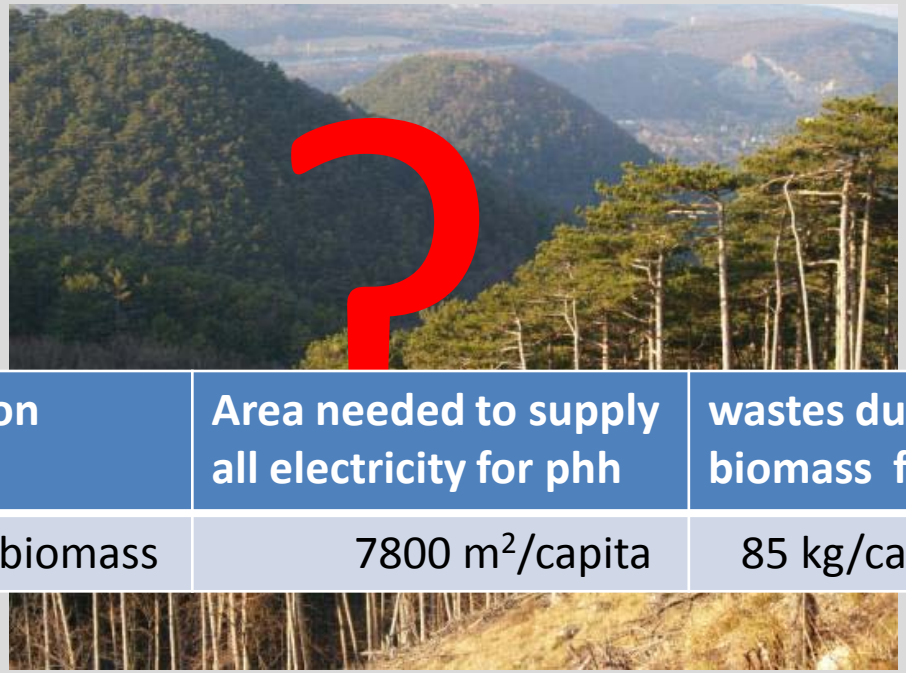
# Oil – the most important resource?

***The stone age did not finish because of a scarcity of stones!***



# Biomass - the most important resource?

Solar radiation



electrons

| sun -> electron | Area needed to supply all electricity for phh | wastes due to biomass fuel |
|---|---|---|
| utilization of biomass | 7800 $m^2$/capita | 85 kg/capita&year |

biomass - harvest transport - pre-treatment - incinera-tion - boiler - turbine - generator - grid and transport

# Is the sun the most important resource?

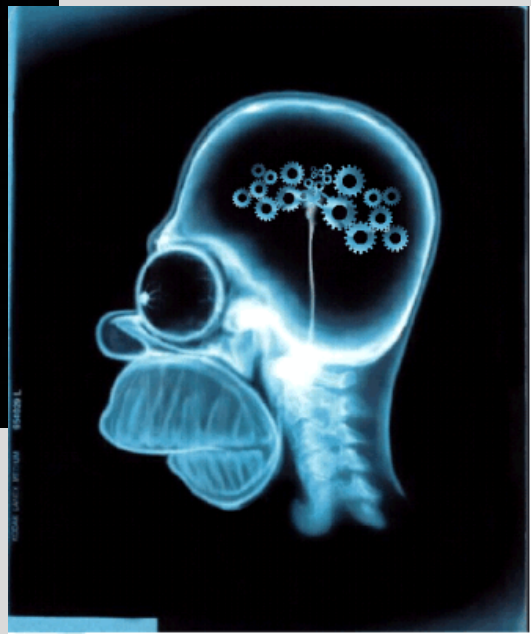
Solar radiation

electrons

| sun -> electron | Area needed to supply all electricity for phh | wastes due to biomass fuel |
|---|---|---|
| utilization of biomass | 7800 $m^2$/capita | 85 kg/capita&year |
| **photovoltaic cells** | **80 $m^2$/capita** | **0 kg/cap&year** |

solar cell → utilization

# The most important resource!



# What is the contribution of waste management to resources management?

***Precautionary principle:***

**Waste of today's generation may not impose any economic or ecological burden on future generations**

***Goals***

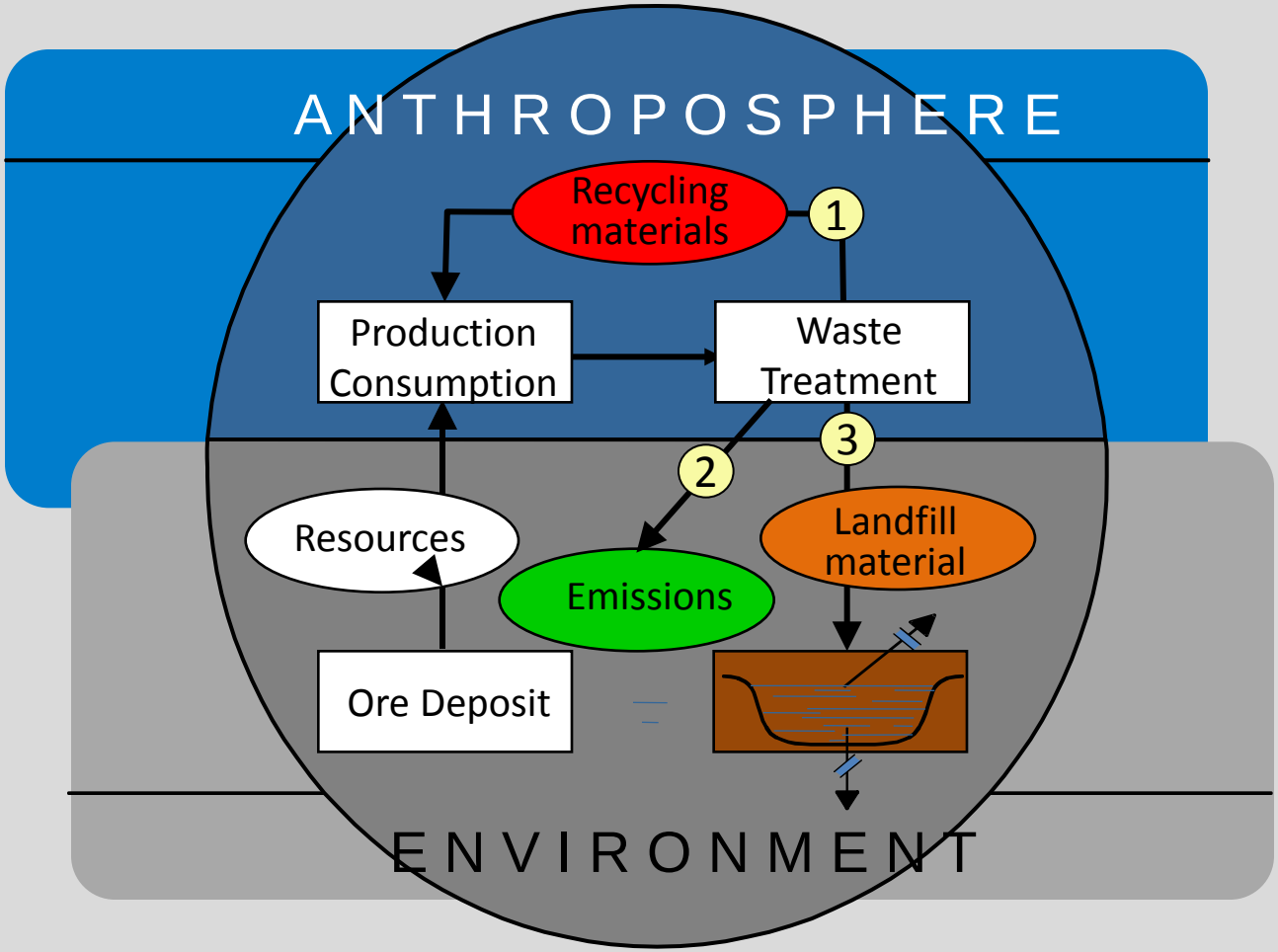
1. **Protection of men and the environment**
2. **Conservation of resources**
3. **After-care-free waste management (landfills)**

***Strategies to reach the goals:***

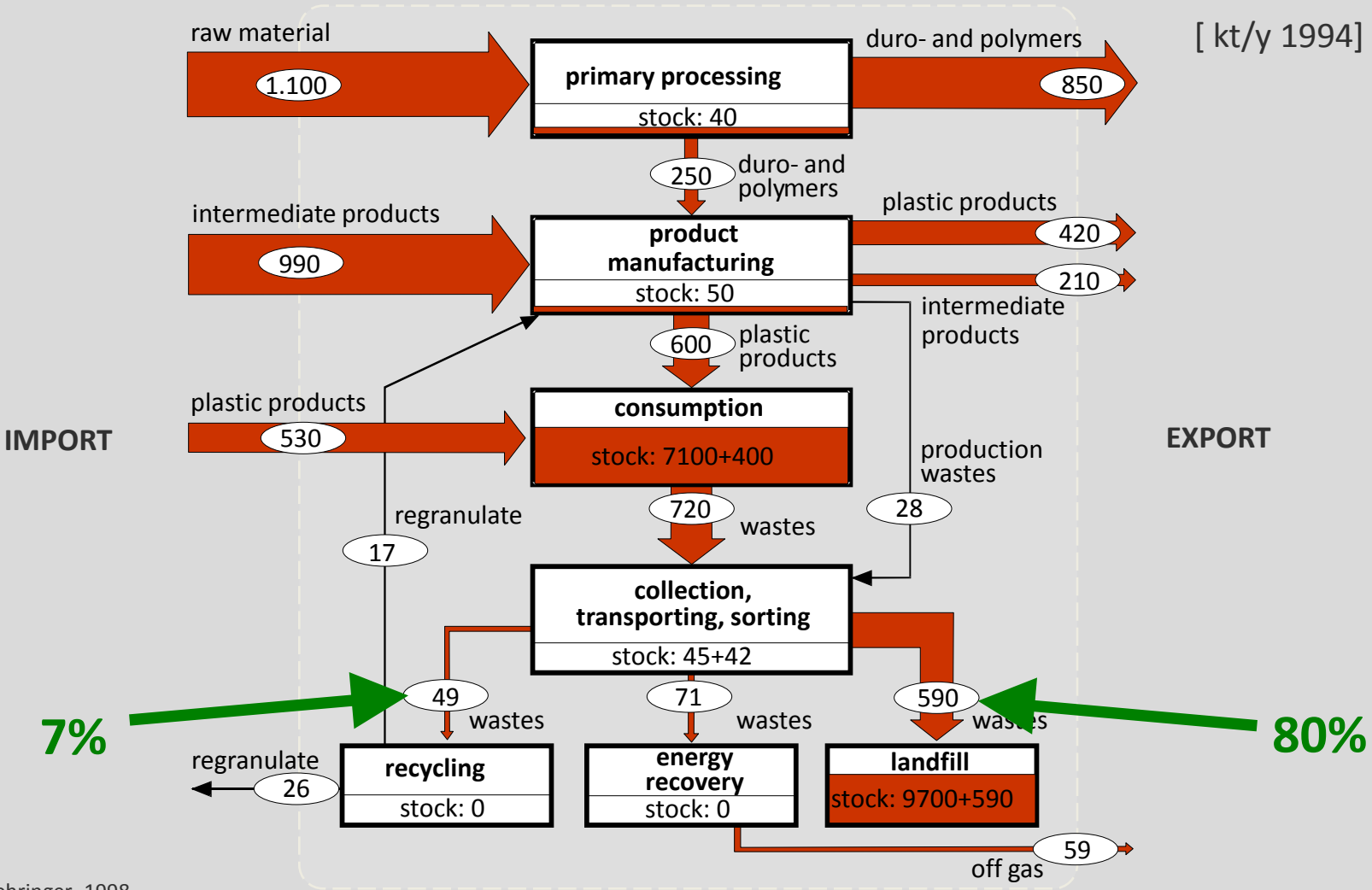
**Prevention, recycling, disposal**

**–> EU: hierarchy!**

# How to reach the goals: 1. clean cycles 2. low emissions 3. safe final sinks



# Plastic waste management in Austria




Source: R. Fehringer, 1998

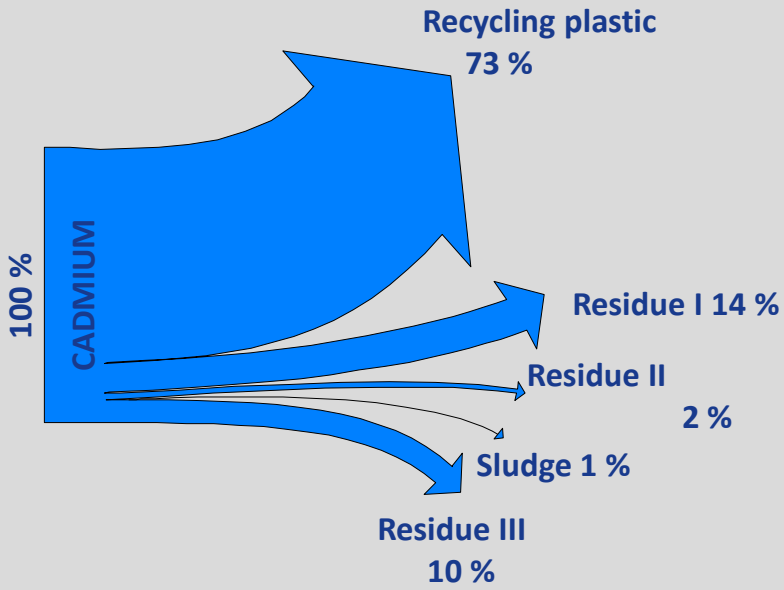
# Additives as the main problem

| Material & additives | Total consumption | % in packaging material | | Total stock |
|---|---|---|---|---|
| | [kt/yr] | [kt/yr] | [%] | [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 |

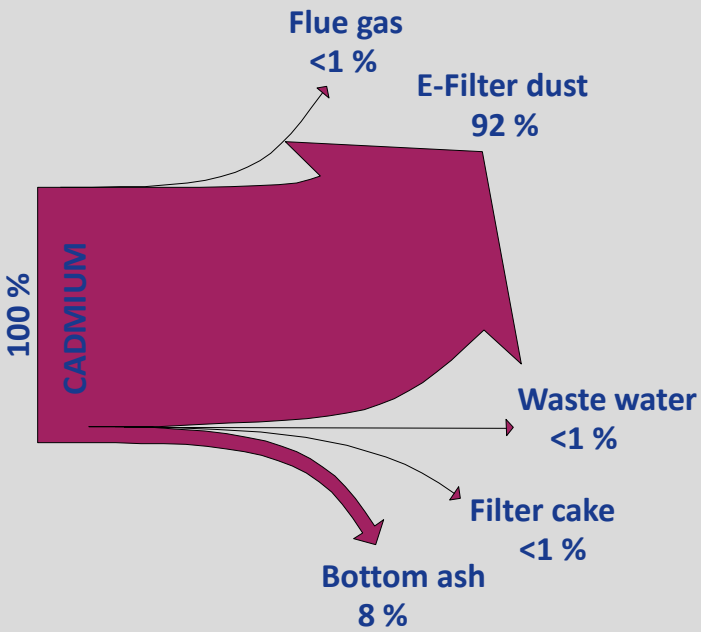
# How to establish clean cycles?

## Partitioning of cadmium contained in waste plastic by:

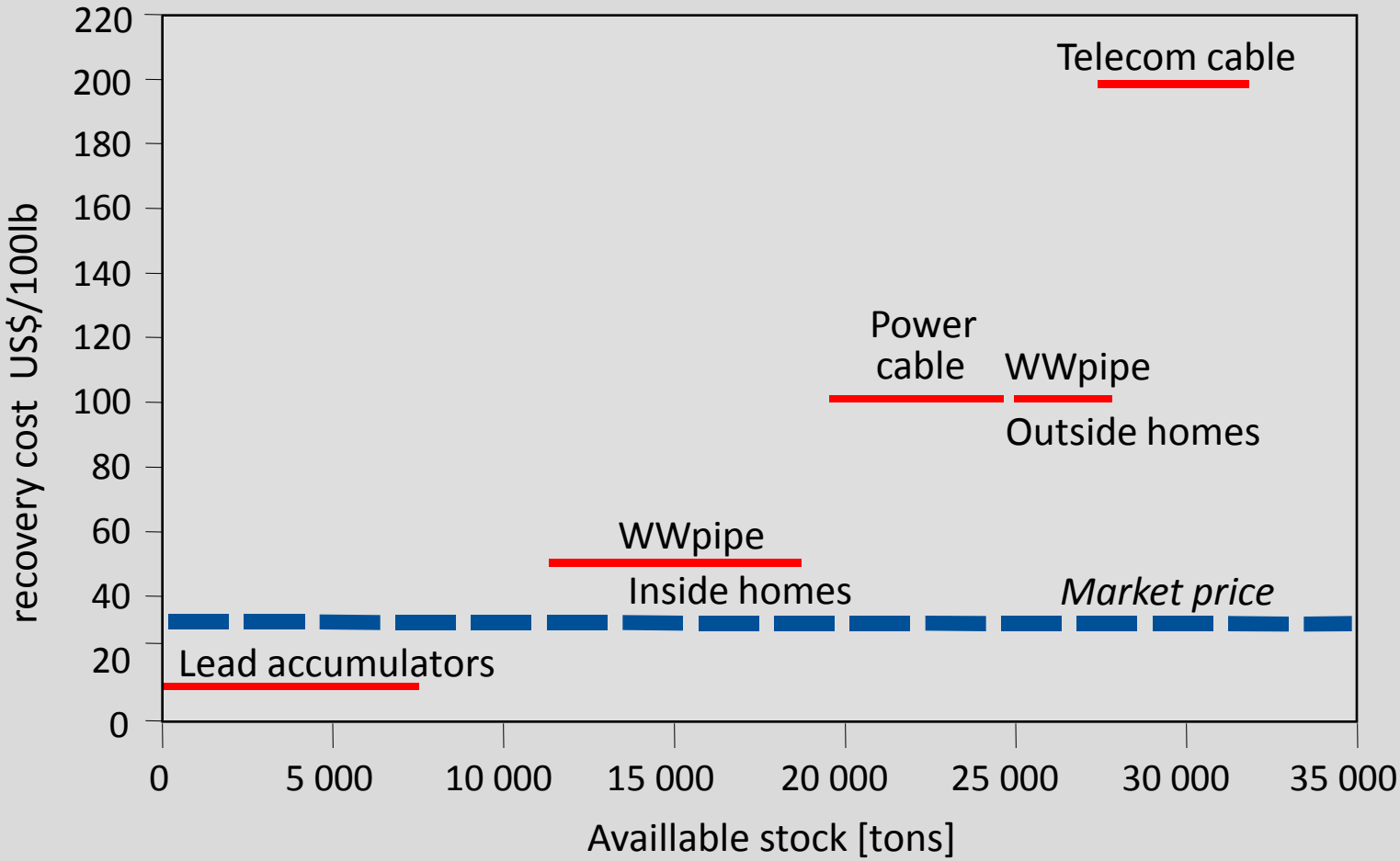
### Plastic recycling




### MSW incineration



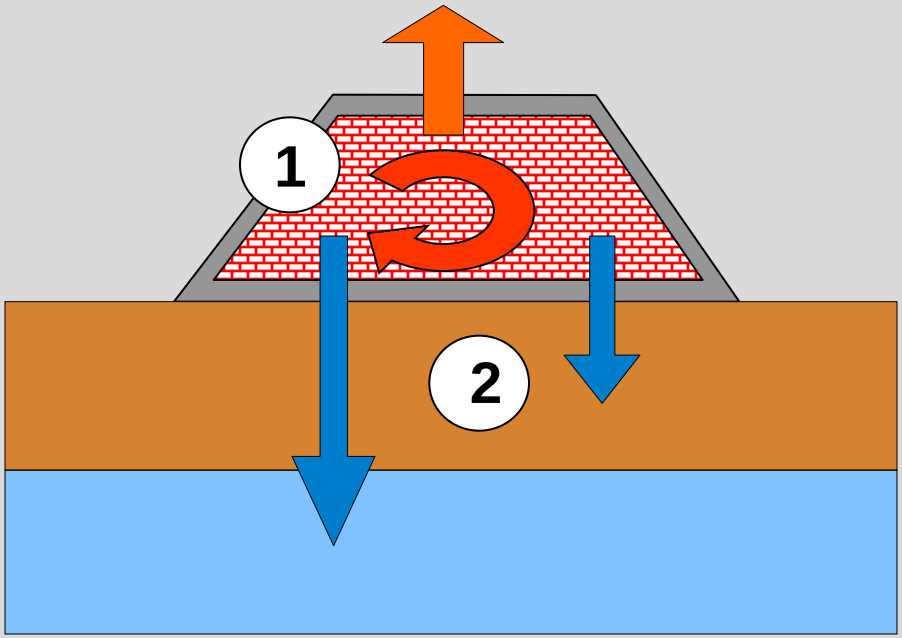
# The market sets limits for recycling! (example lead)

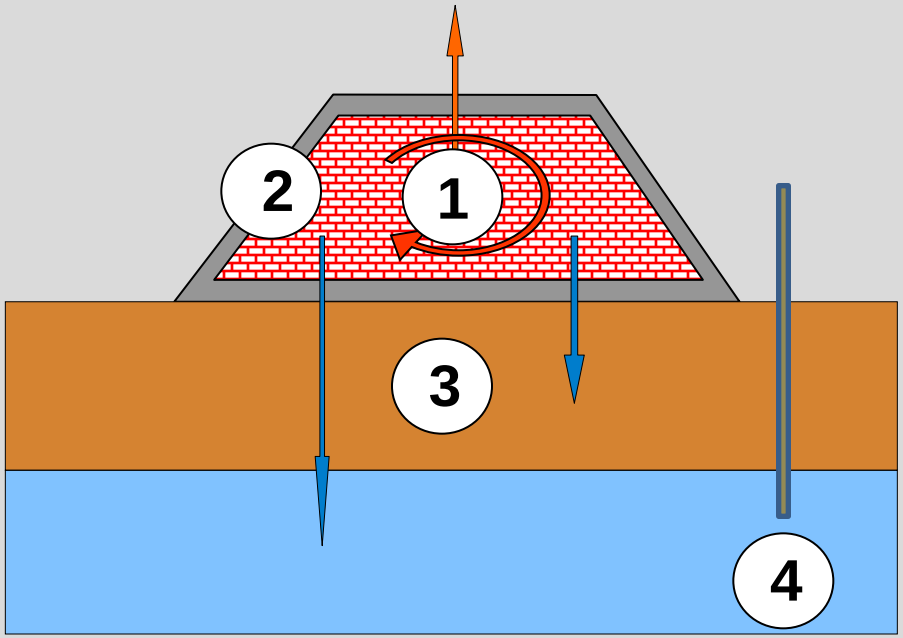



Source: Lohm et al., 1998

# We need landfills

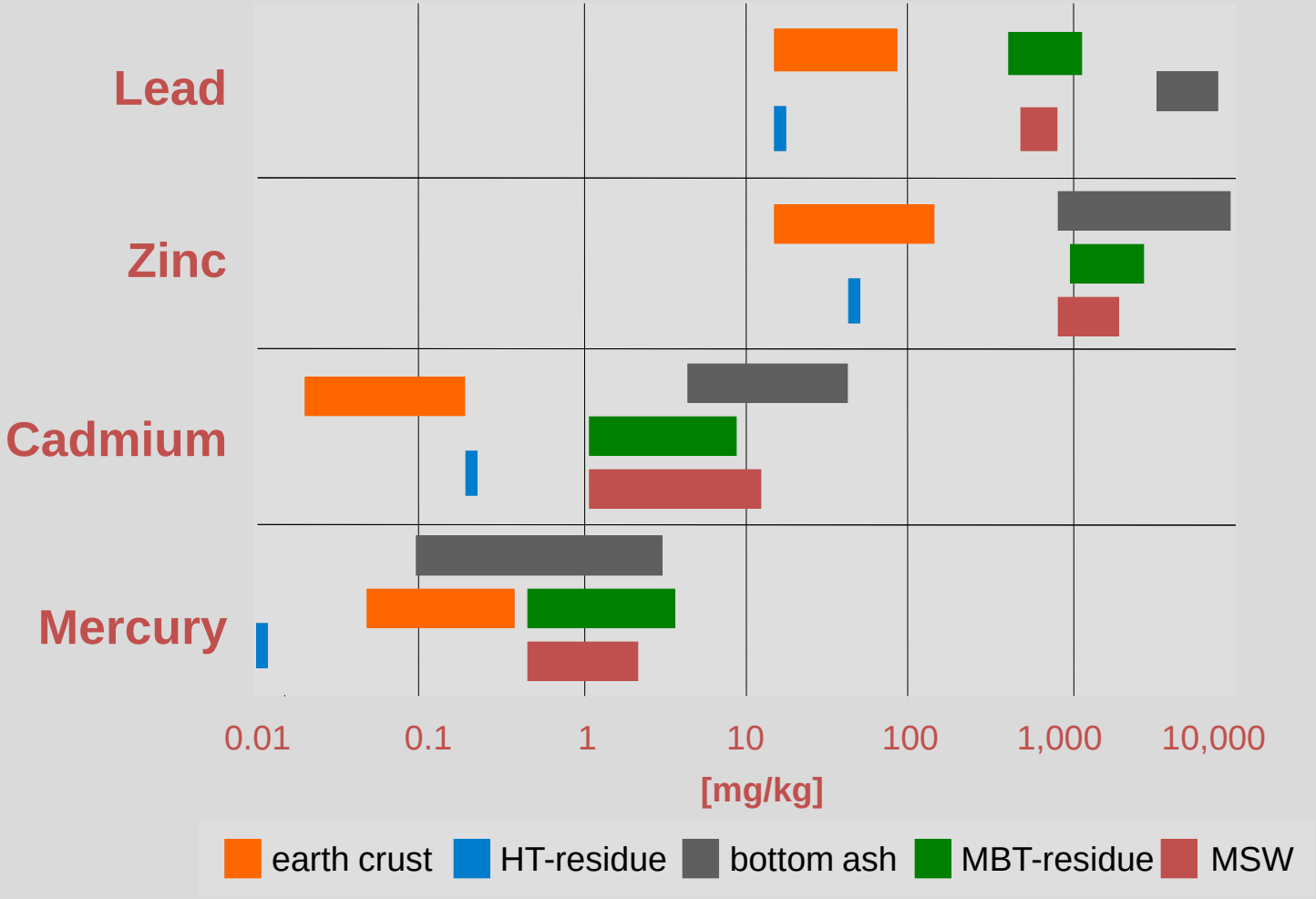
## Reactor landfills versus final sinks




***We need „final storage quality“***

# Final storage quality -> making „stones“




Döberl et al. (2001)


Thank you