

**NUCLEAR ENERGY AGENCY**

**NUCLEAR DEVELOPMENT COMMITTEE – NDC**

**55th meeting**

## ***Radioactive Waste in Perspective***

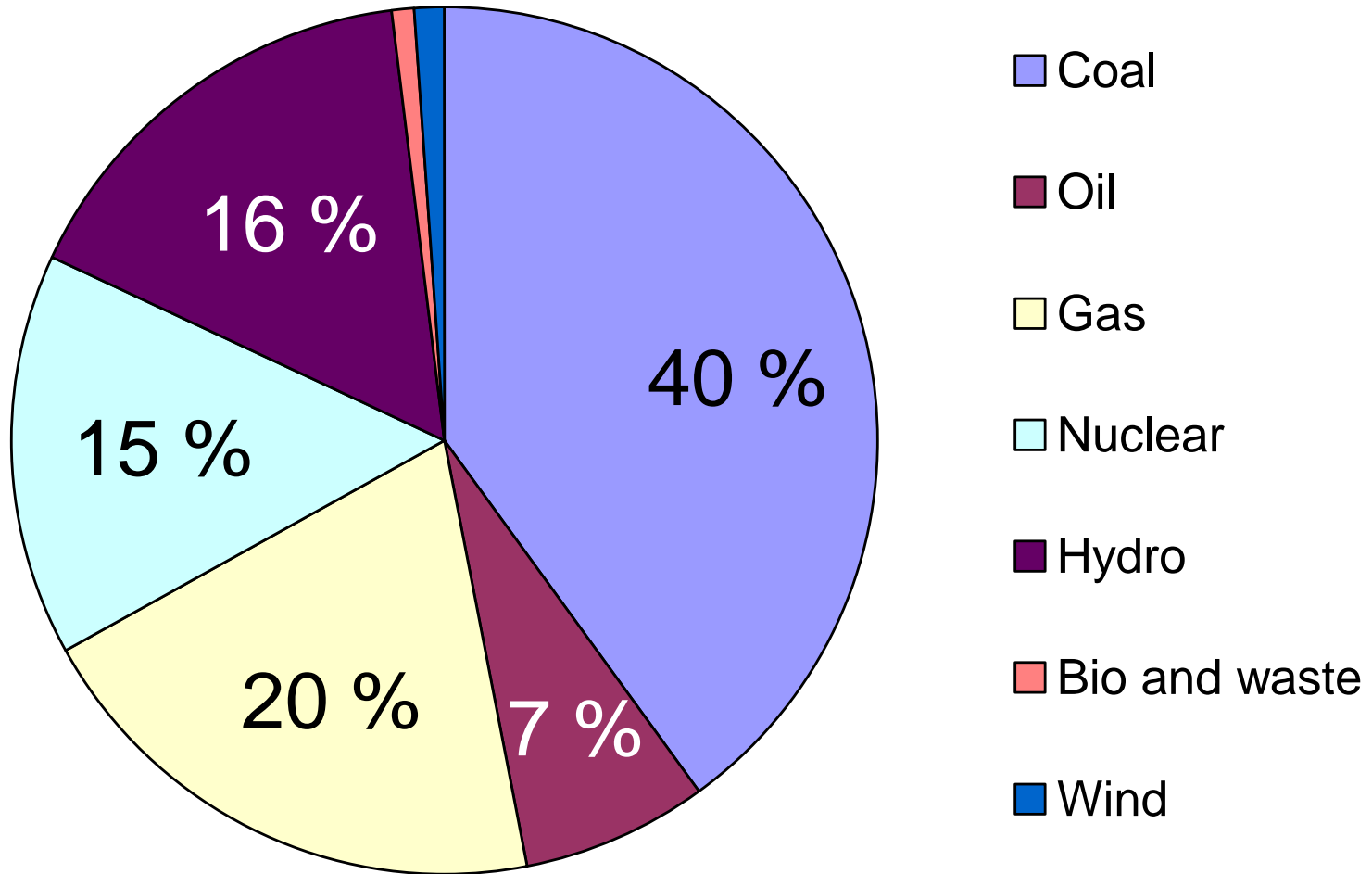
***Case study:***

***Residues from thermochemical  
energy production***

***Rolf Sjöblom***

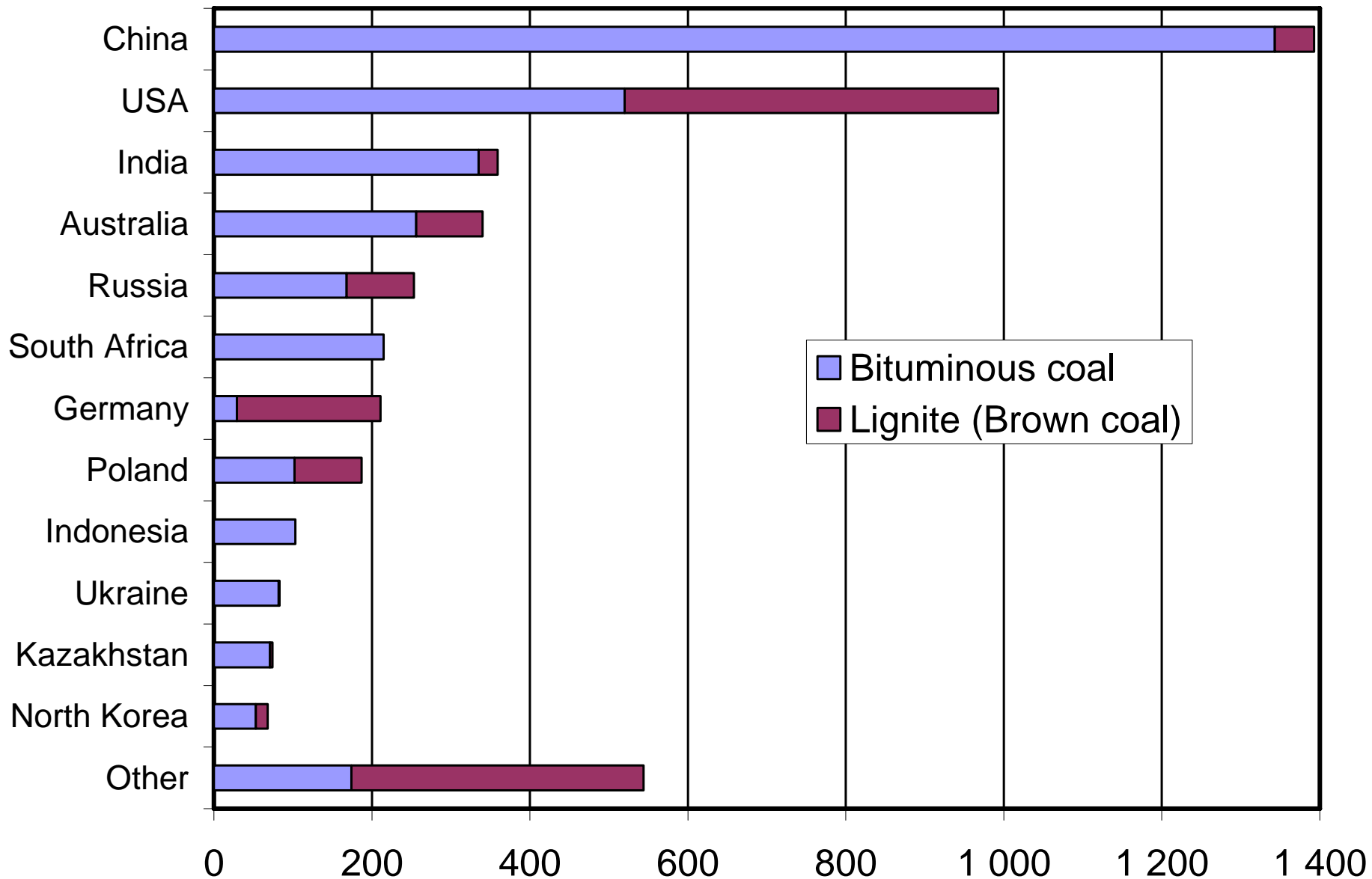


# Electricity generation from different sources, 2005



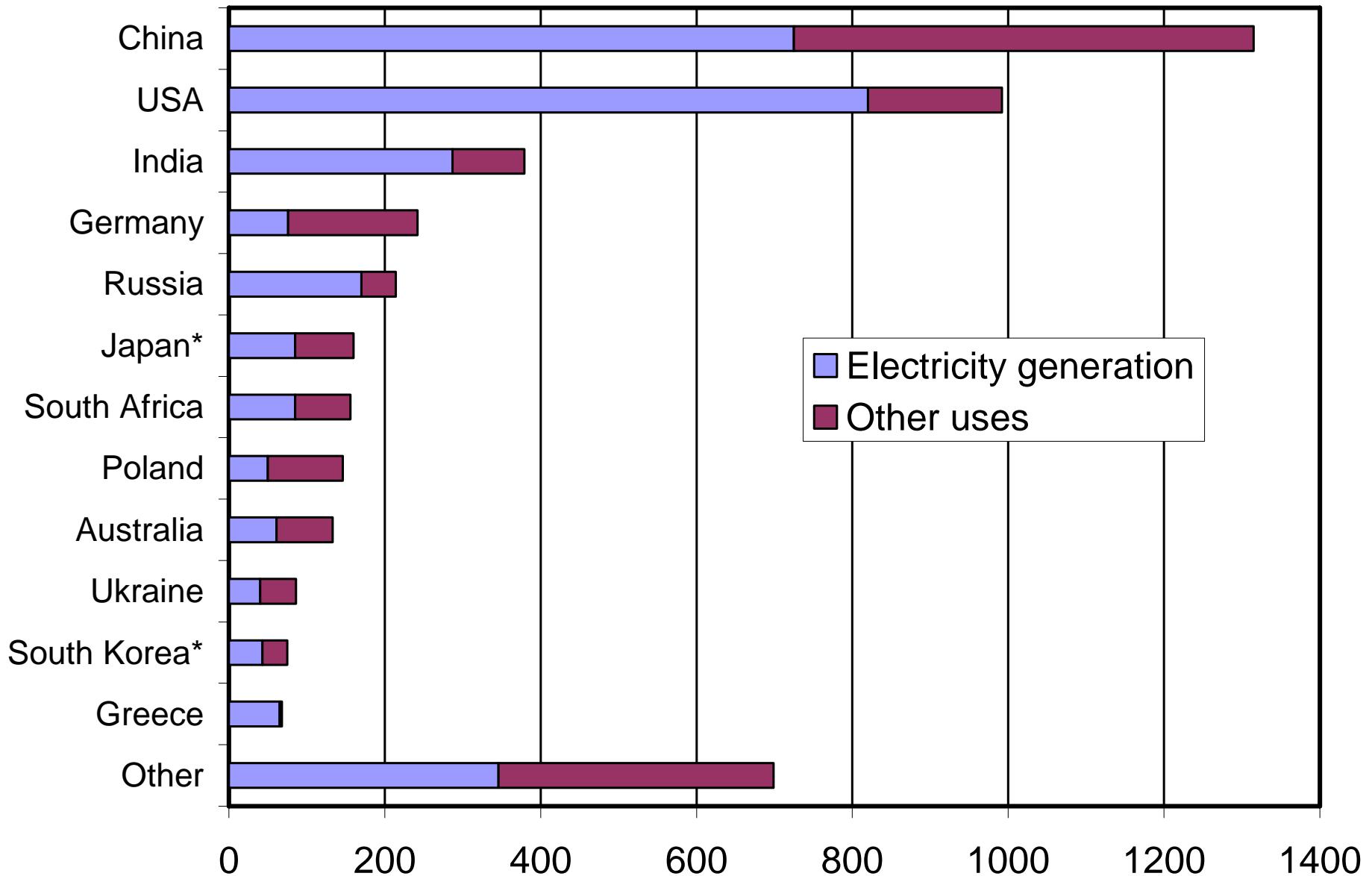
# World production of coal in Mtonnes per year

## Total volume 4 823 Mtonnes per year



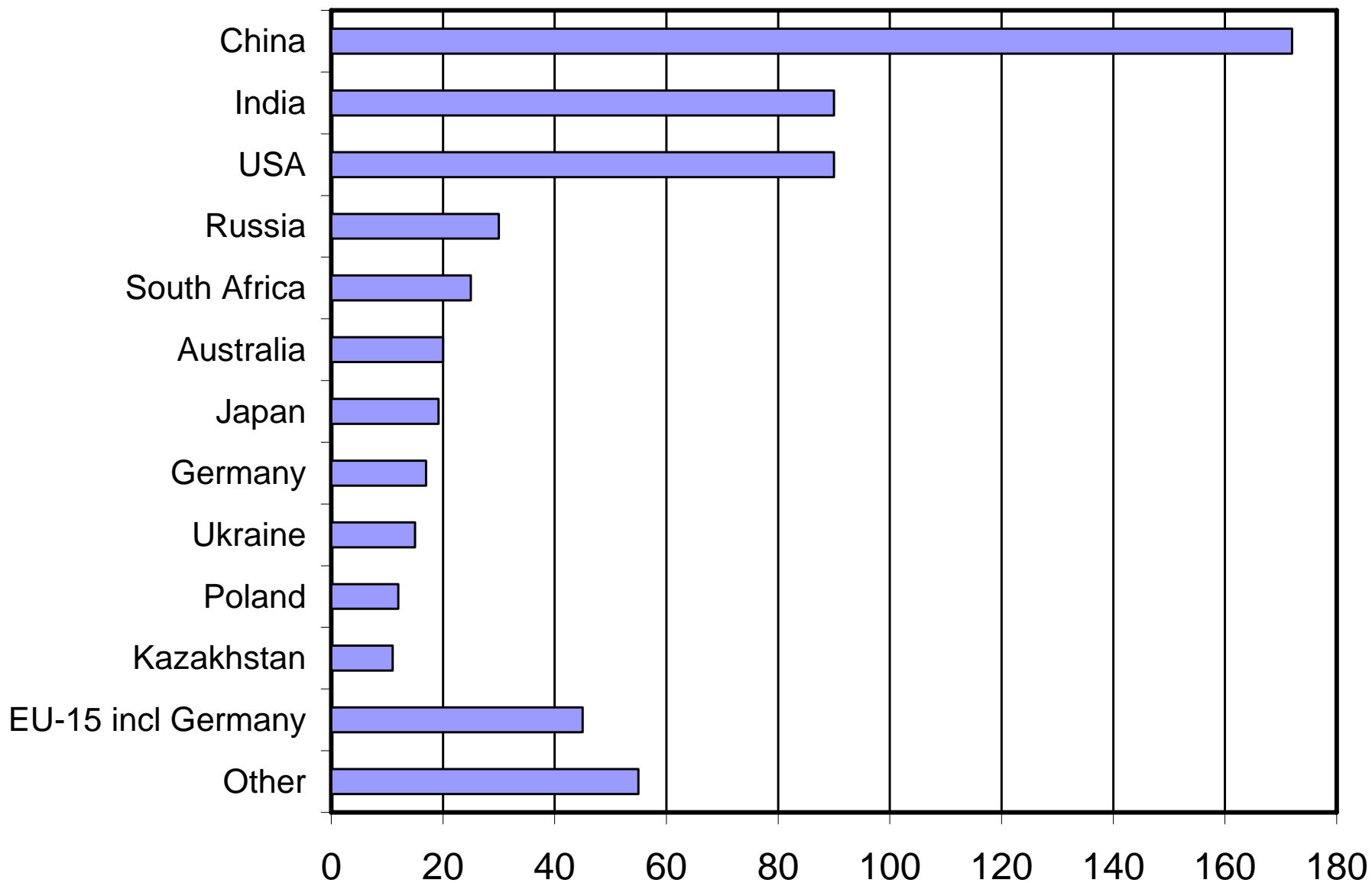
# Worldwide coal consumption in Mtonnes per year

total volume 4 665 Mtonnes per year, \*=non-producer

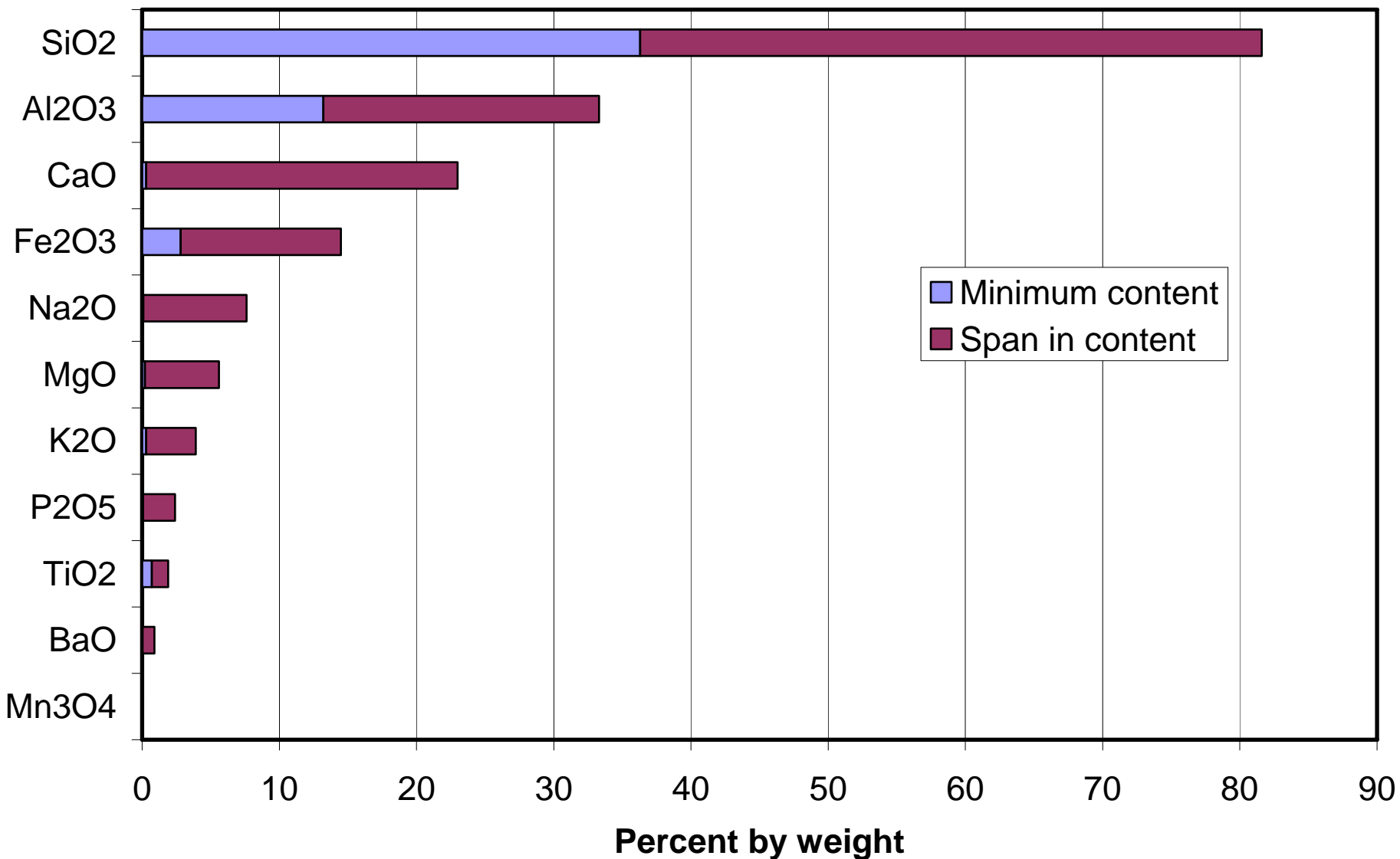


# World coal ash generation in Mtonnes per year

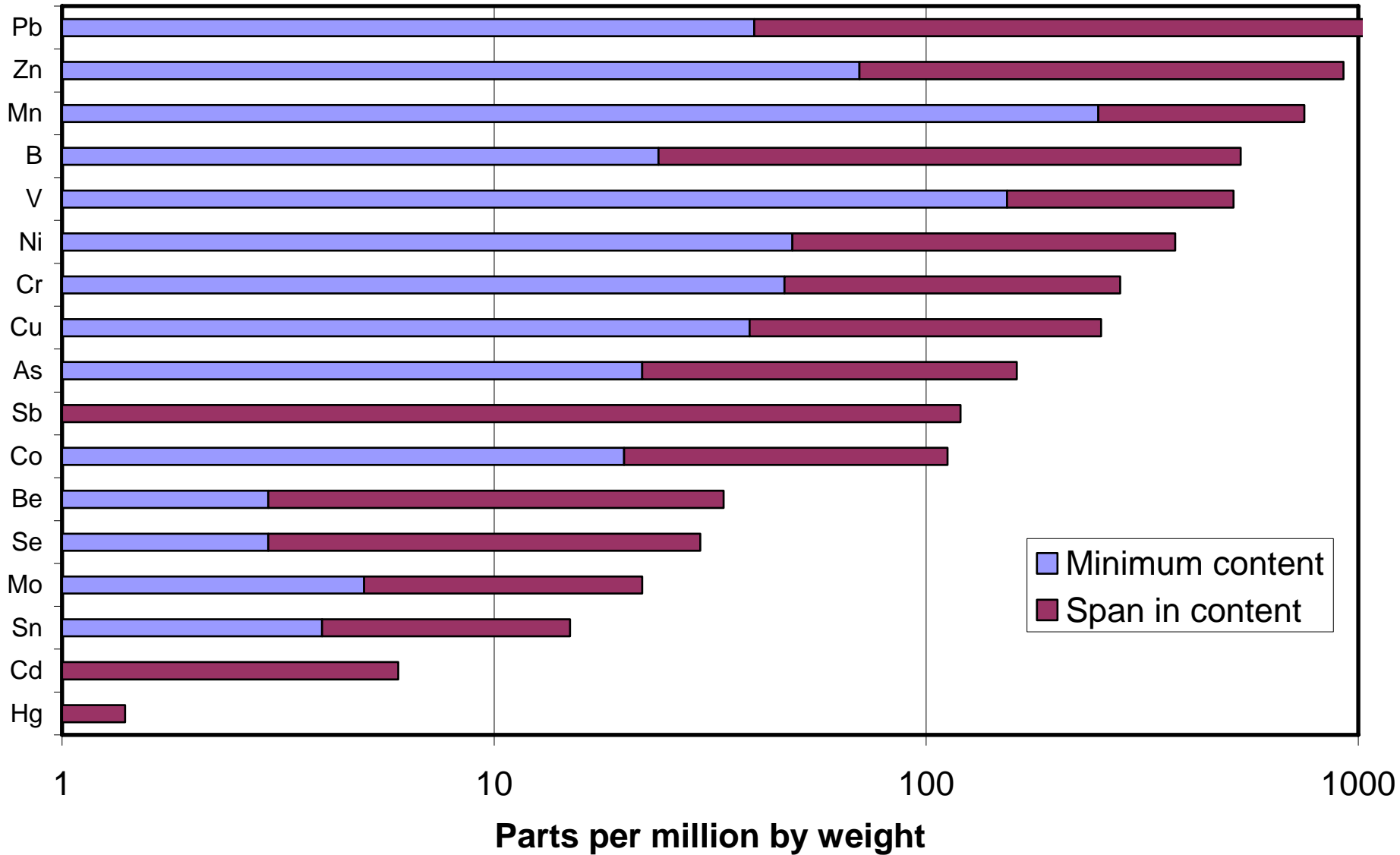
total volume 584 Mtonnes per year



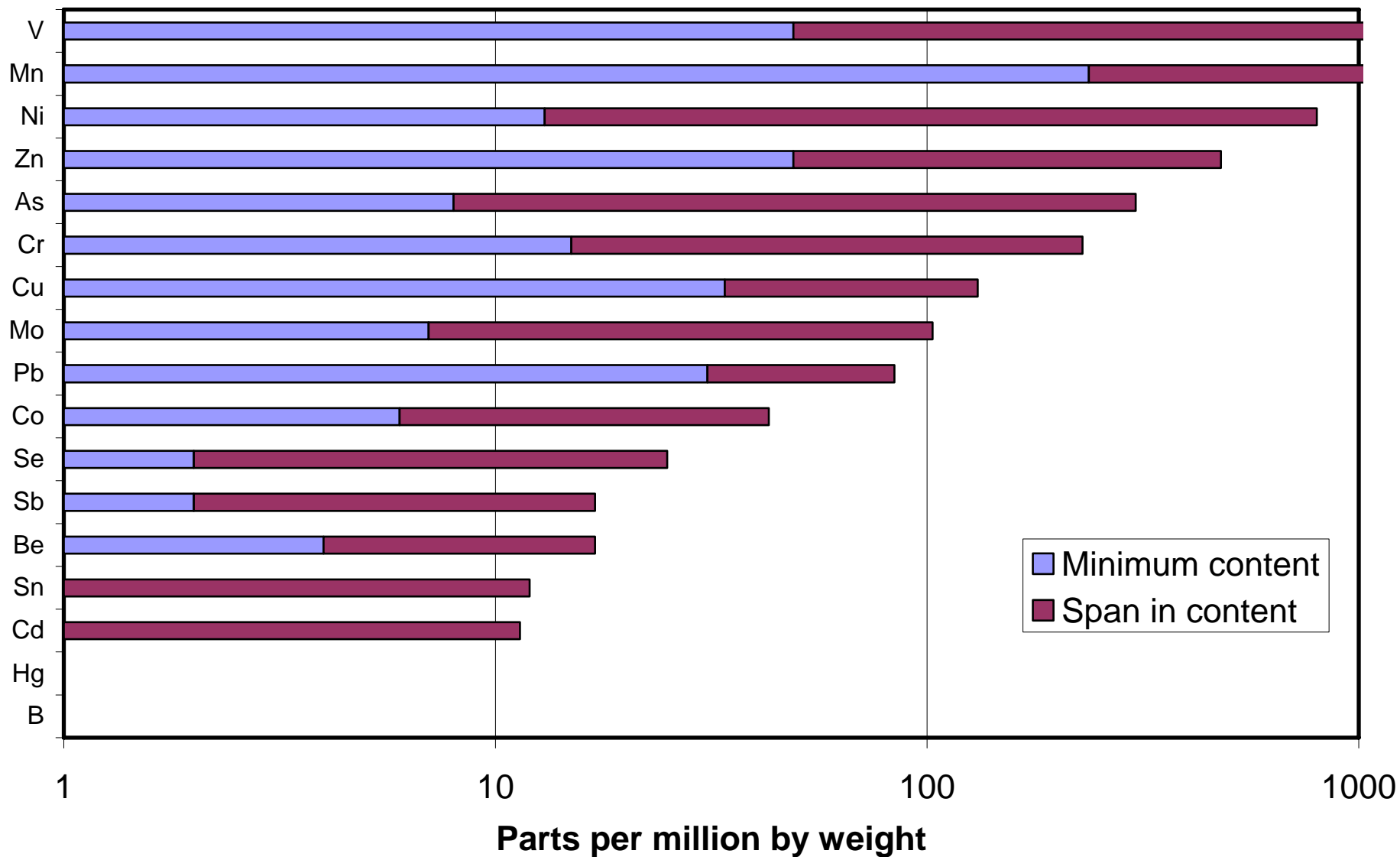
## Major elements in coal ash, 11 samples from different countries



# Minor elements in coal ash from Europe, many samples



# Minor elements in coal ash from Canada & US, many samples





# Content of radionuclides, Bq/kg

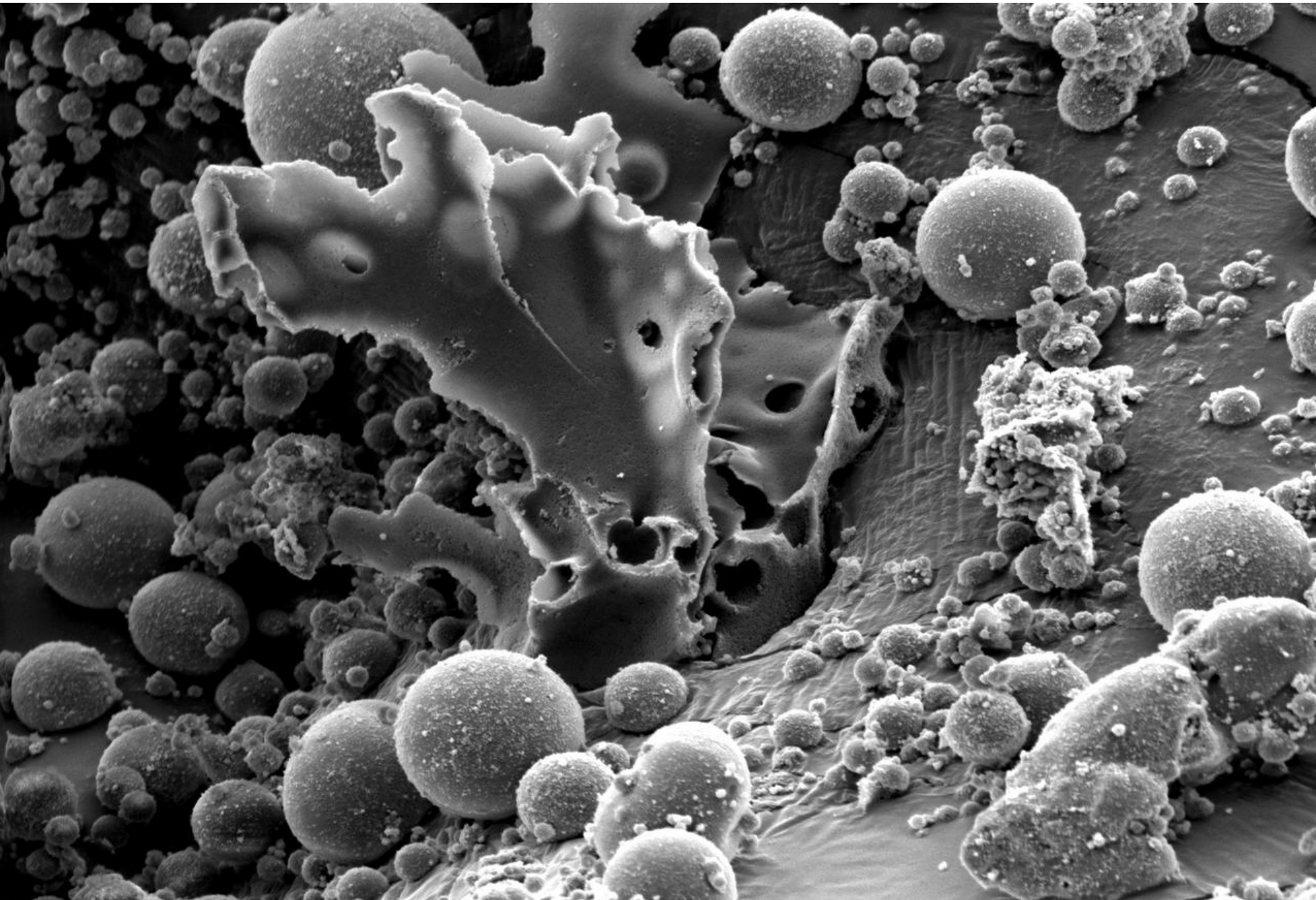
<b>Comparison concrete / coal fly ash</b>	<b>Ra-226</b>	<b>Th-232</b>	<b>K-40</b>
Concrete, typical	40	30	400
Coal fly ash, typical	180	100	650
Concrete, maximum	240	190	1600
Coal fly ash, maximum	1100	300	1500

Maximum dose for inhabitant in "coal ash house" a few mSv/y

# Ash properties

<b>Powder burners (dominating method)</b>	<b>Fluidized bed combustion</b>
High furnace temperature	Moderate furnace temperature
Quenched molten glass – High reactivity	Limestone bed sand - High alkalinity
Pozzolanic properties	Liming & cementing properties

**Fly ash particles are mostly spherical and  $< 45$  micron**



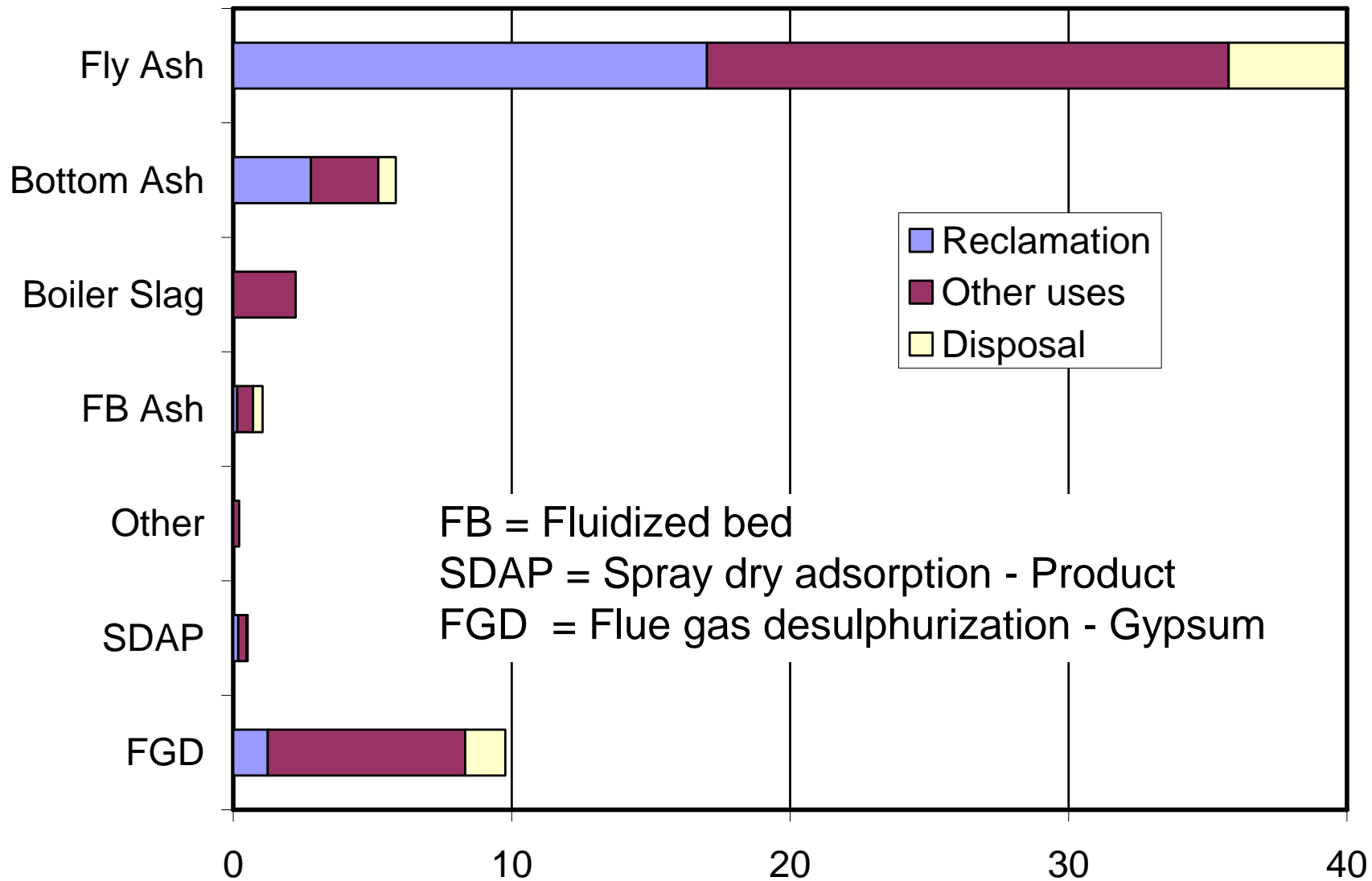
# Ash utilization

- Replaces cement and lime in concrete and mortar – often with superior results
  - Liming reactions
  - Pozzolanic reactions
- Fertilization in agriculture
- Geotechnical applications
- Waste stabilization
- Asphalt filler
- Reclamation

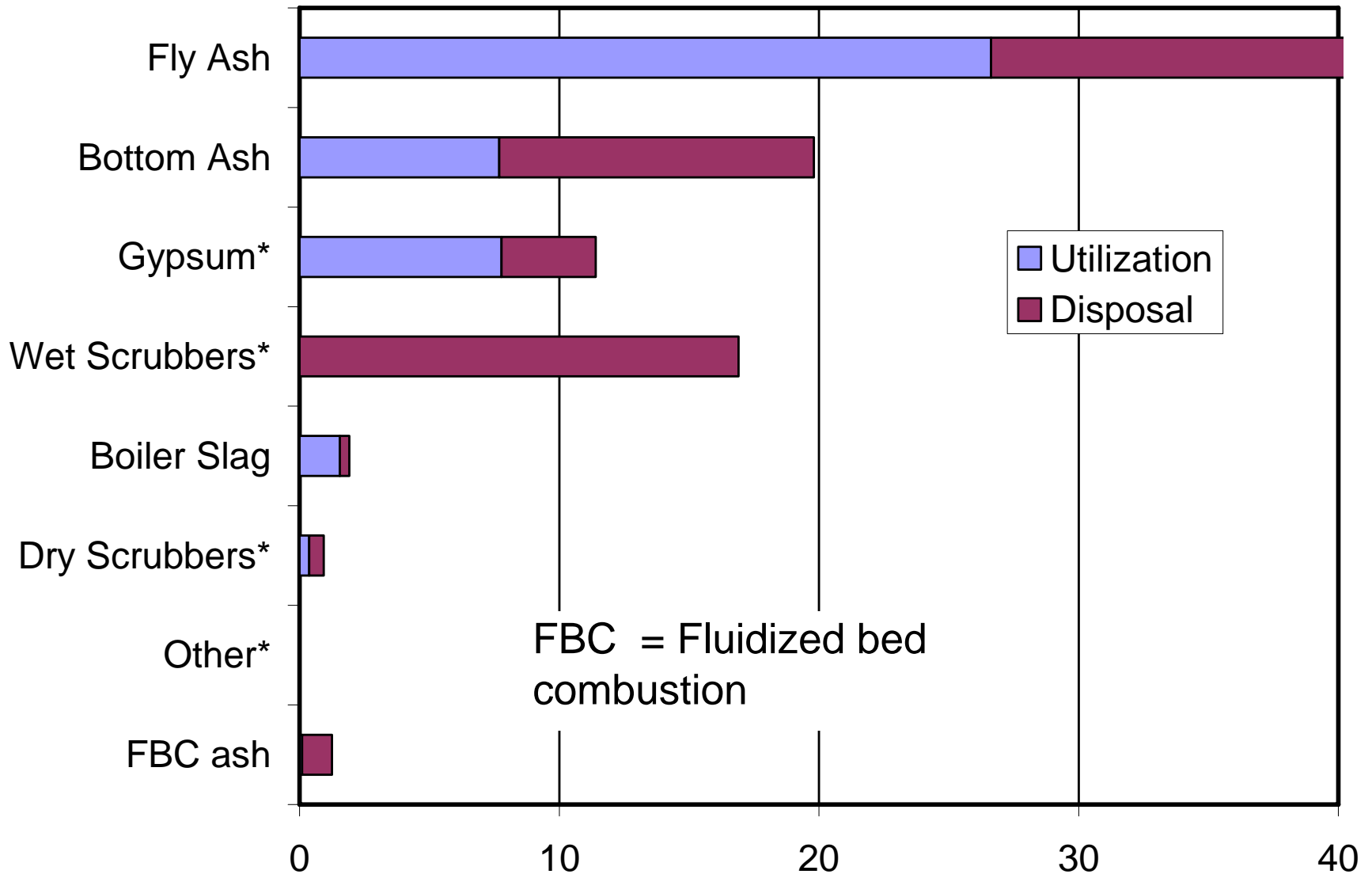


**Pont du Gard** – an almost 2000 years old construction in stone & Roman cement. Aqueduct and bridge in south of France

# Utilization of various coal combustion residues in Europe (EU 15), Mtonnes per year



# Utilization of various coal combustion residues in the United States, Mtonnes per year



# Health and environment aspects

- Levels of species that can have a detrimental effect on human health and the environment are generally low in coal ash (in relation to e.g. the EU criteria for hazardous waste)
- Coal ash is generated in large volumes and reaches a diversity of destinations while the volumes radioactive waste are much lower and reach fewer destinations
- The major impact of coal combustion is from outside the area of coal ash, namely ...



# CCS – Carbon Capturing and Storage

## CO<sub>2</sub>-FREE ELECTRICITY AND HYDROGEN FROM FOSSIL FUELS

