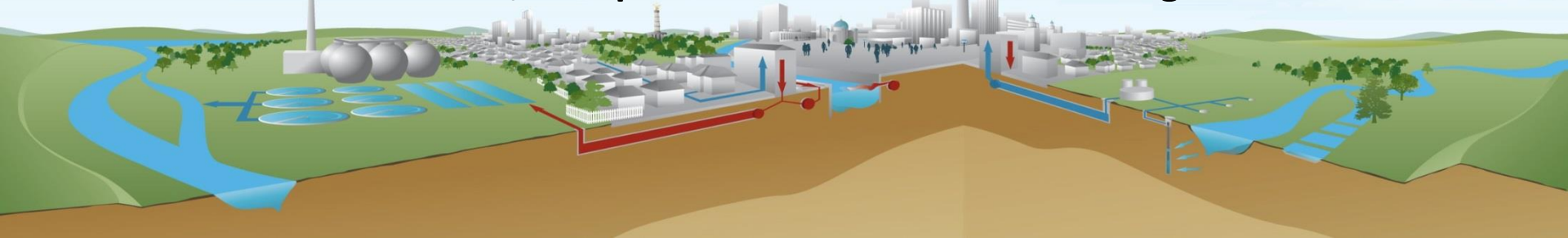


Comparative life-cycle assessment of P-recovery from wastewater path and phosphate rock based fertilizer production

European Sustainable Phosphorus Conference #3

11.06.2018, Helsinki

Fabian Kraus, Kompetenzzentrum Wasser Berlin gGmbH



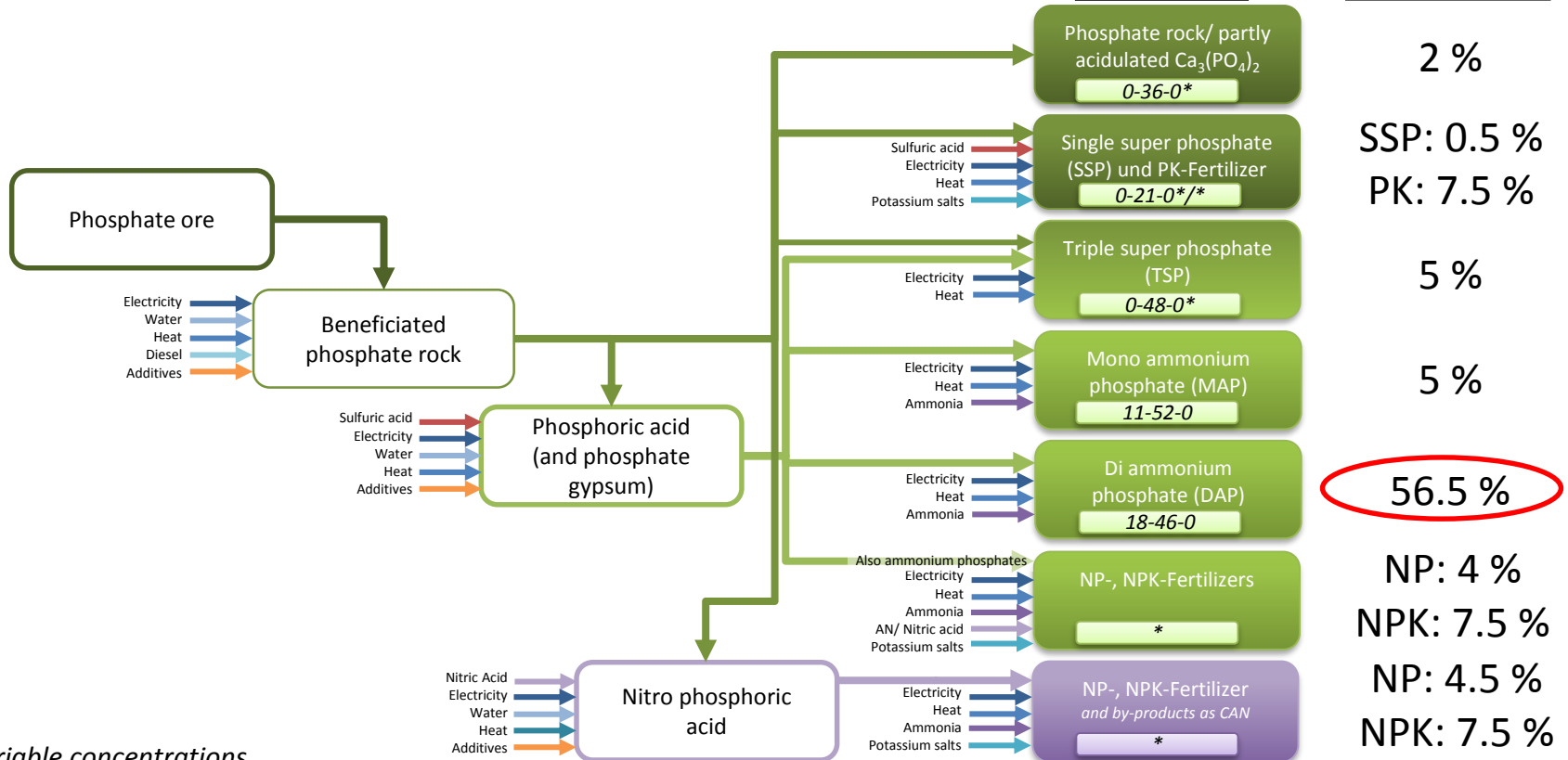
Overview conventional P fertilizers

Raw materials

Intermediates

Fertilizers

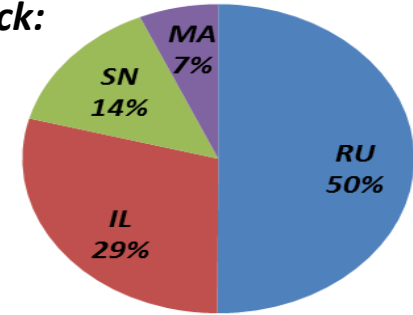
Share in DE



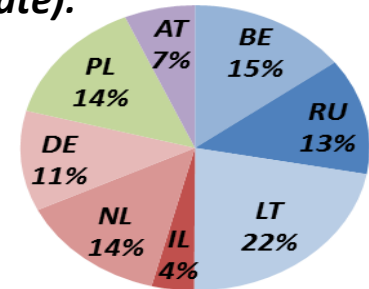
Where does phosphate rock for Germany come from?



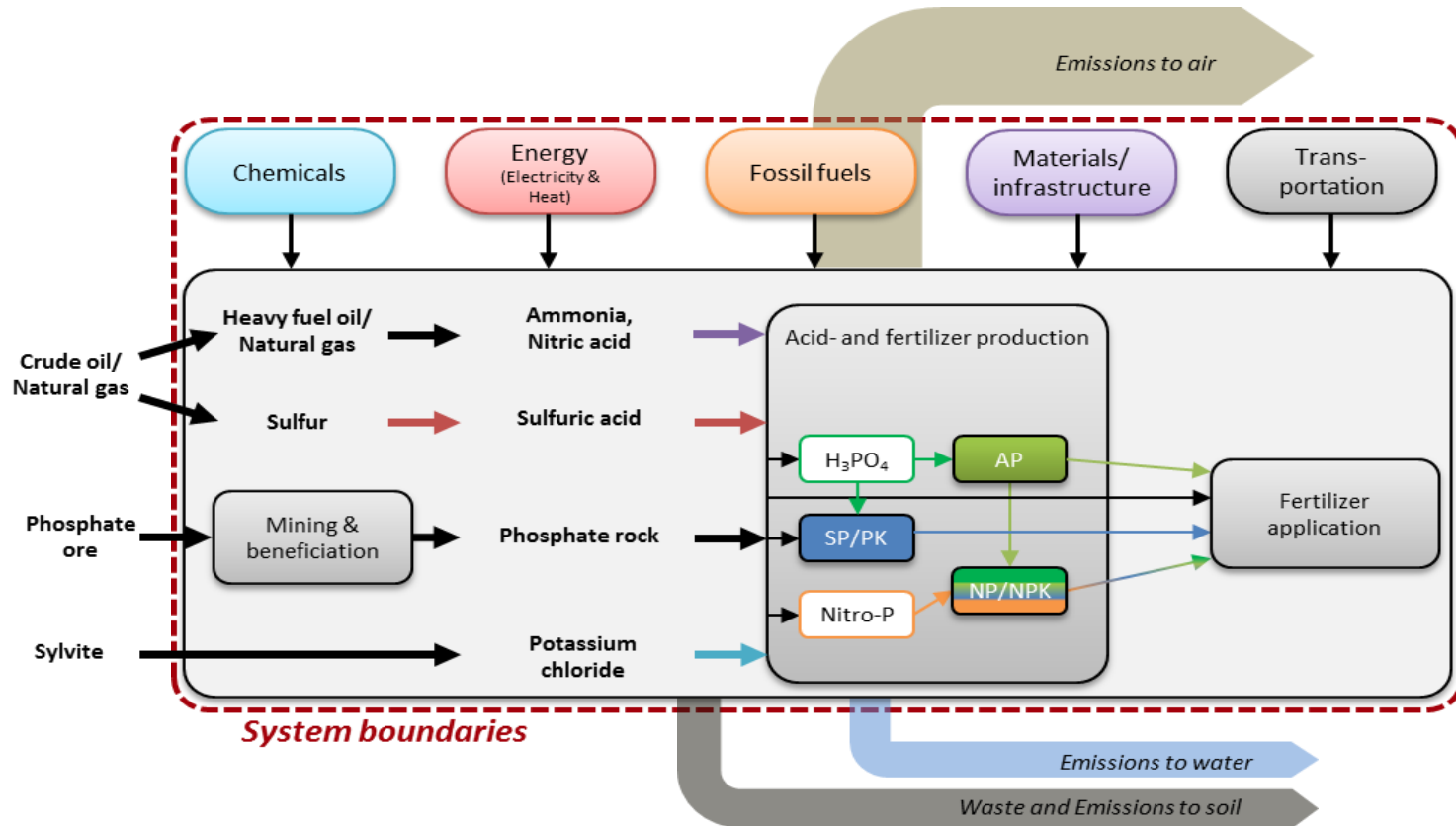
Relevant countries of origin for phosphate rock:



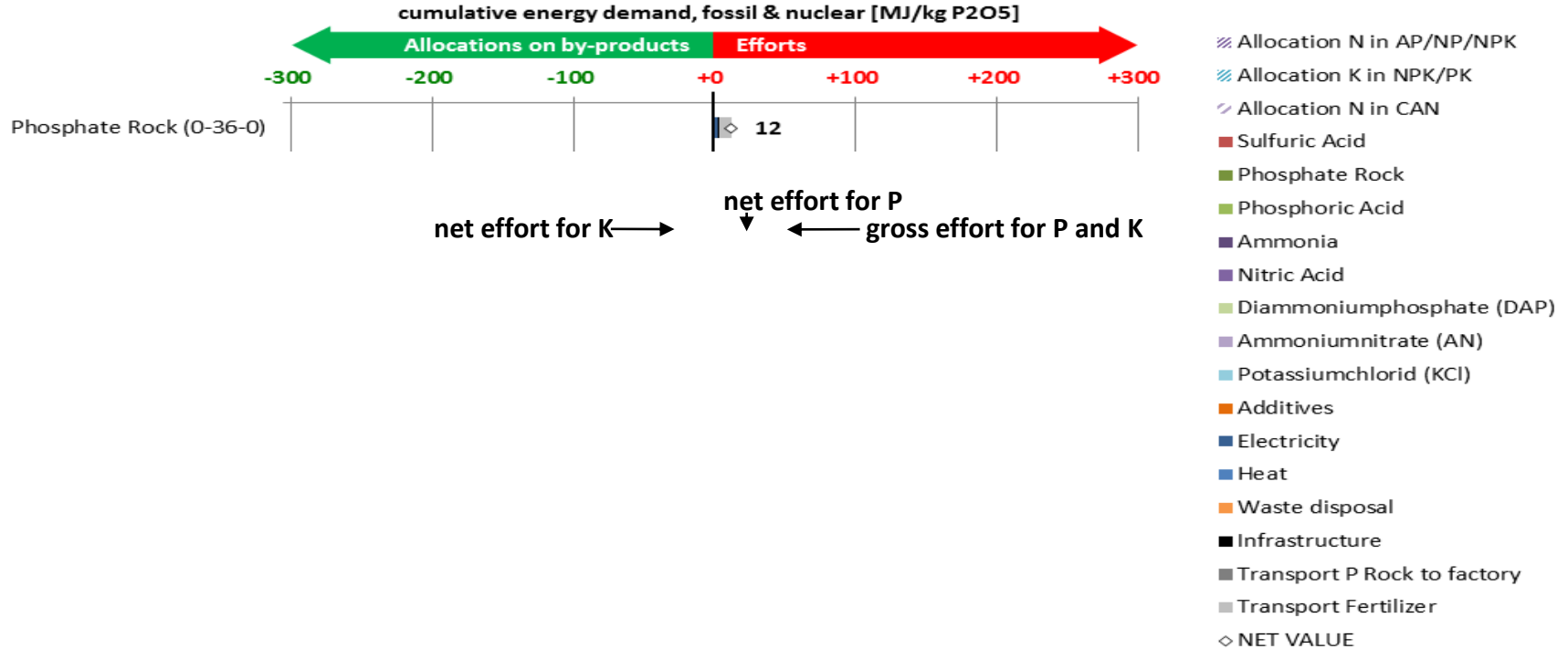
Relevant countries of origin for phosphate fertilizers (related to the amount of phosphate):



Scope of assessment



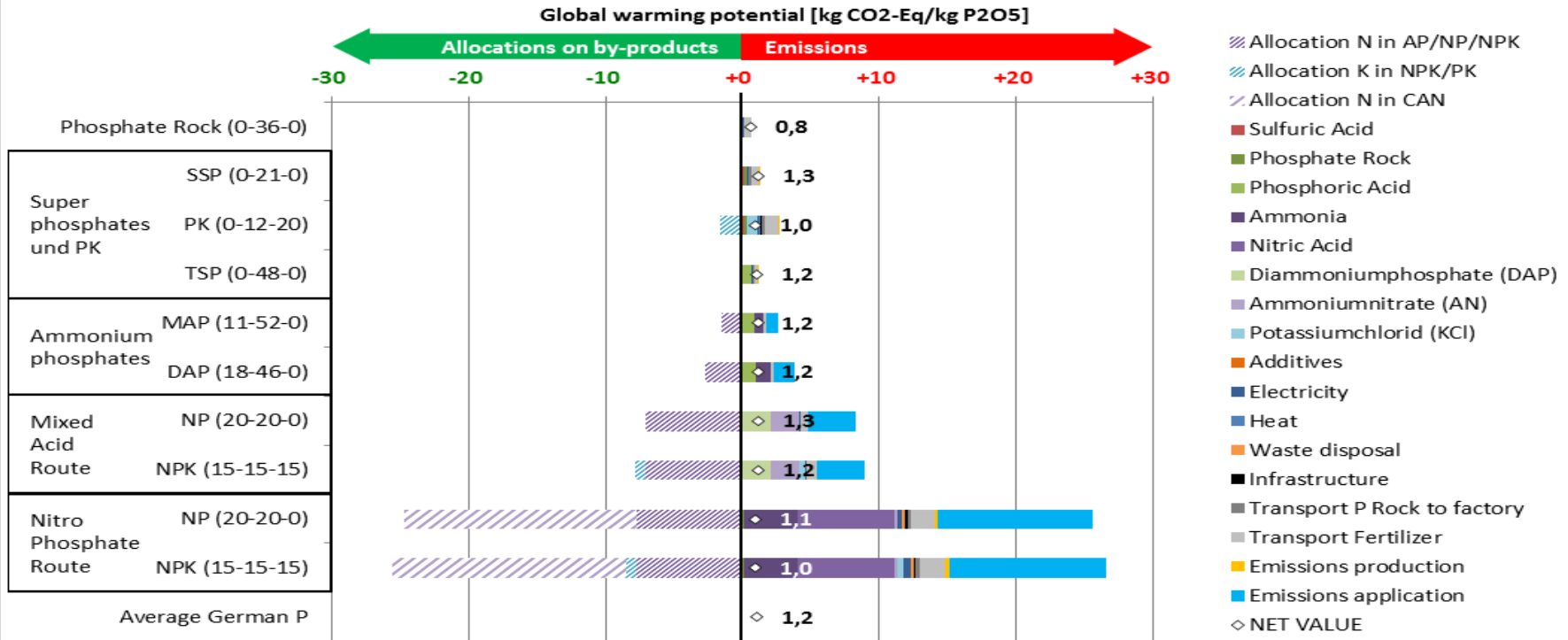
Results – fossil & nuclear energy demand



take home message:

#1 sulfuric acid production and potential by-product valorisation are crucial

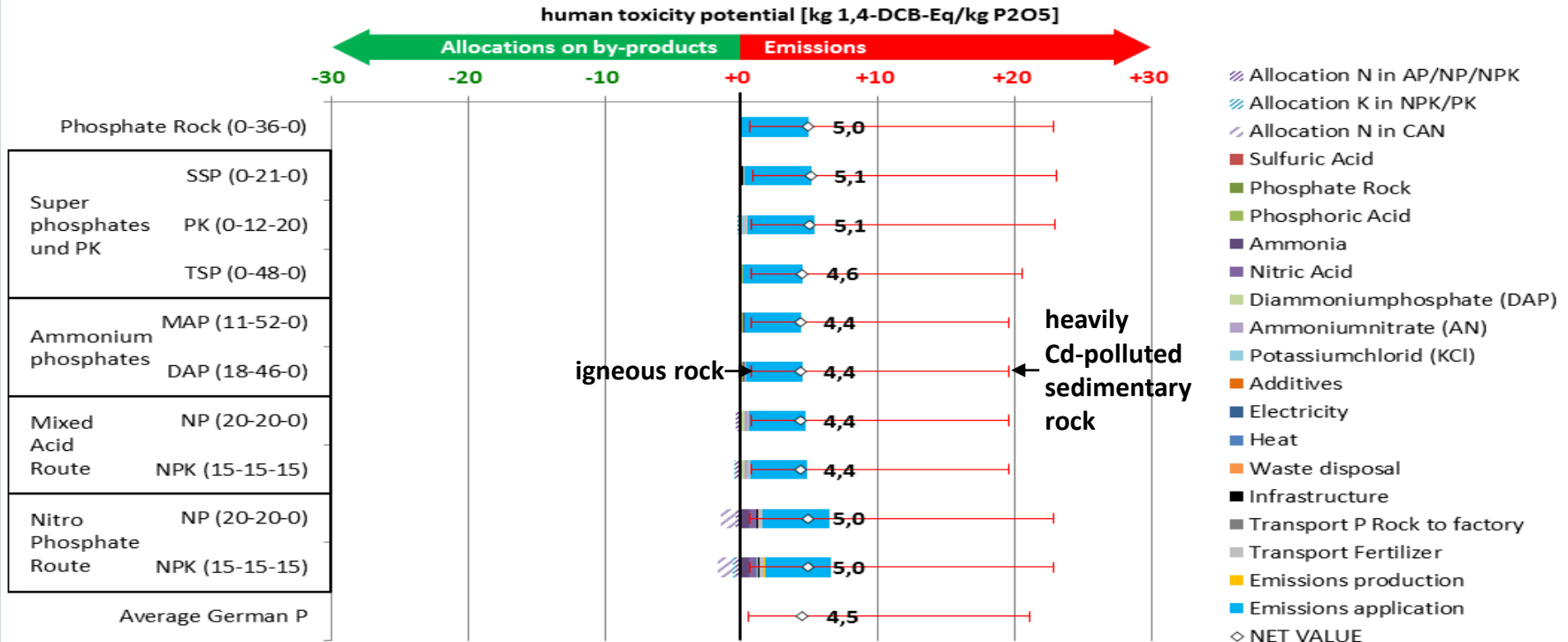
Results – global warming potential



take home message:

#2 GWP of 1 kg N production and application 6-fold higher than for 1 kg P₂O₅

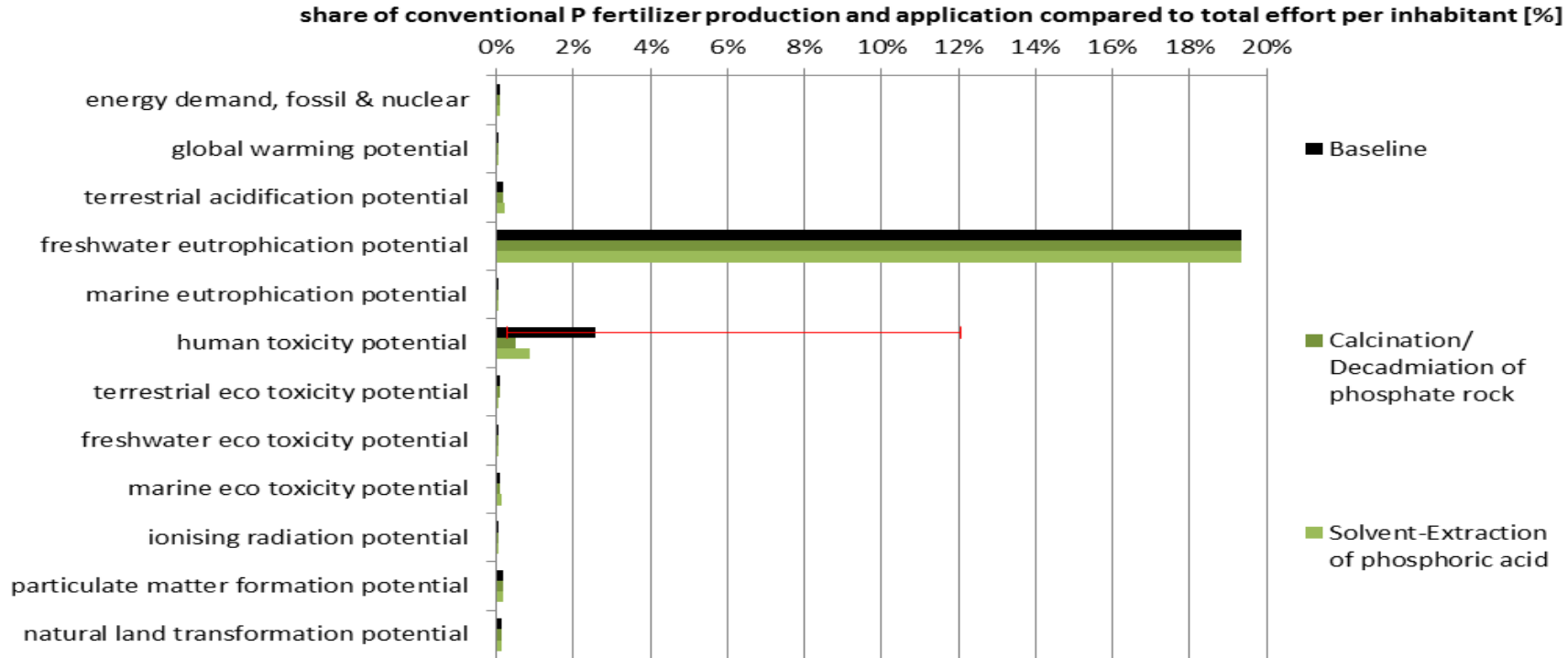
Results – human toxicity potential



take home message:

#3 Extreme variation depending on Cd-content of phosphate rock

Normalised results

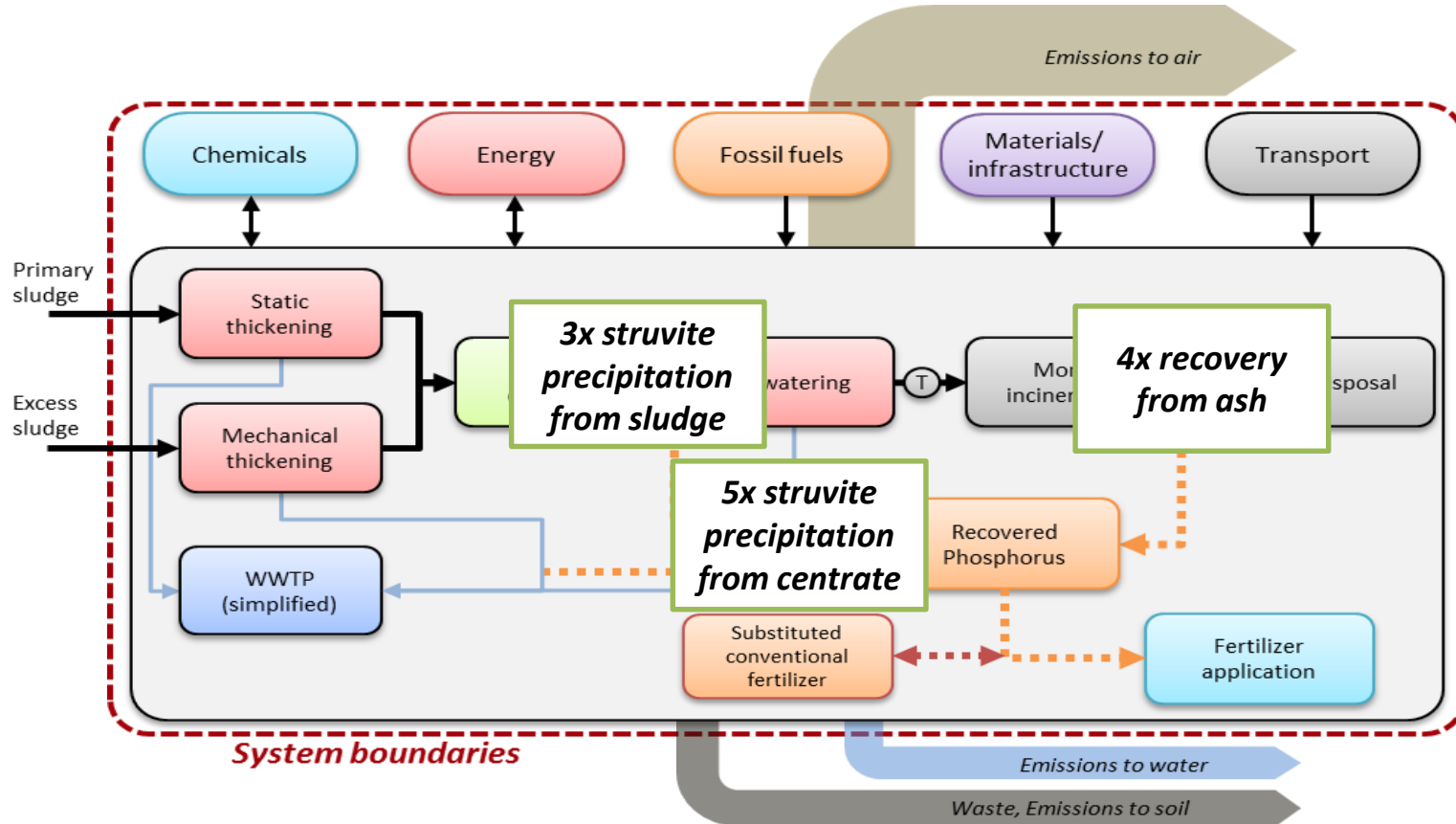


take home messages:

#4 P and HM emissions to environment show a high score in normalisation

#5 Minor energetic efforts for decadmiation technologies compared to benefits

P recovery from wastewater sludge and ash (scope)

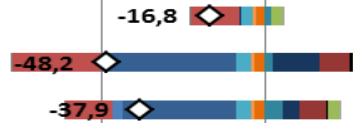


Results – fossil & nuclear energy demand

cumulative energy demand, fossil & nuclear [MJ/(pe a)]



struvite from sludge	-
	Lysogest
	+ Pondus



- Credits for P-Fertilizer
- Credits for N-Fertilizer
- Polymer
- Chemicals
- Electricity demand WWTP
- Electricity credit CHP
- Electricity balance incineration
- Heat balance WWTP
- Credit sludge volume
- By-products
- Infrastructure
- Electricity demand recovery
- Ash disposal
- Transport of product
- ◇ NET VALUE

Considering technical P-acid as product



take home messages:

#6 reduced sludge volume increases energetic and economic profitability

#7 high-value products and by-products from ash improve energetic profile

Results – human toxicity potential

human toxicity potential [kg 1,4 DCB-Eq/(EW a)]



take home messages:

#8 struvite and techn. P-acid are products with negligible contaminant-level

#9 sludge ash contains high HM-loads, HM removal recommended

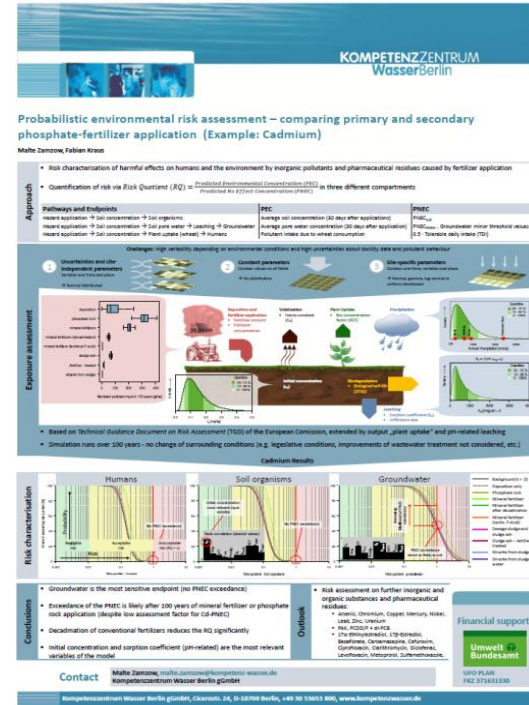
Summary and Outlook

Conventional:

- #1 origin of sulfuric acid is crucial for LCA results
- #2 N has a severely higher environmental impact
- #3 Cd is priority hazard regarding conventional fertilizers
- #4 Invest in research for demand-release-fertilizers
- #5 Decadmiation technologies seem affordable

Recycling:

- #6 Care about „positive side-effects“ in sludge treatment
- #7 Go for industrial products derived from sludge ash
- #8 Produce products with minor contaminant-level
- #9 sludge ash contains high/relevant loads of Cu and Zn



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