

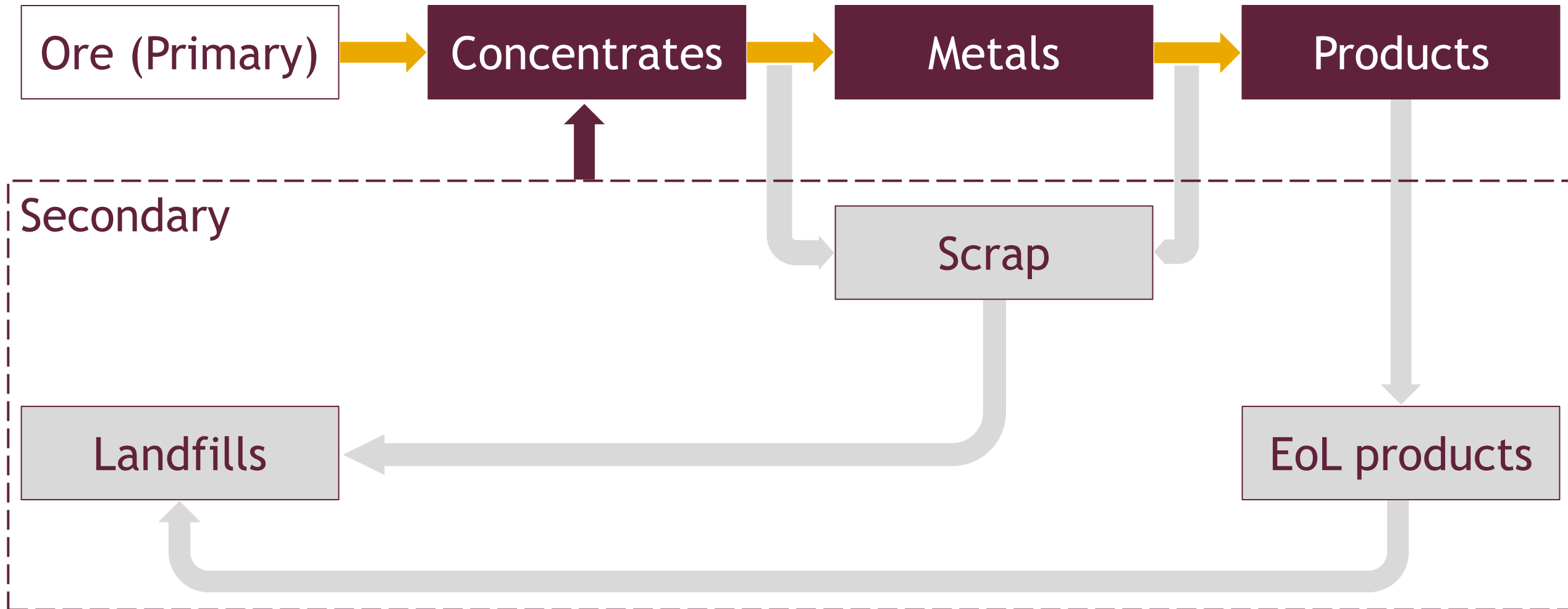


Metal production from secondary  
resources in South Africa

Christie Dorfling

By Stefan Els

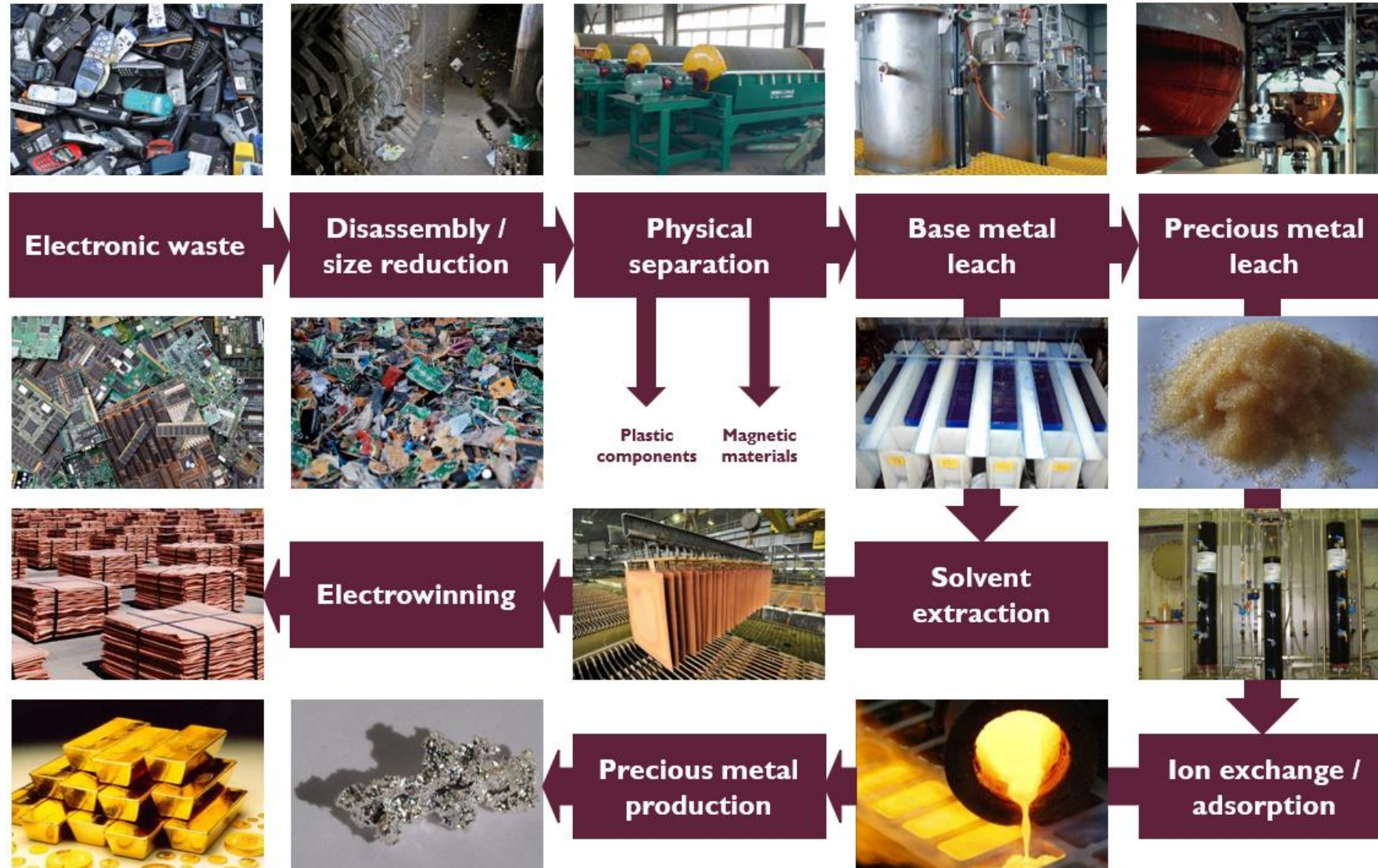
# Primary and secondary resources



# Why secondary resources?

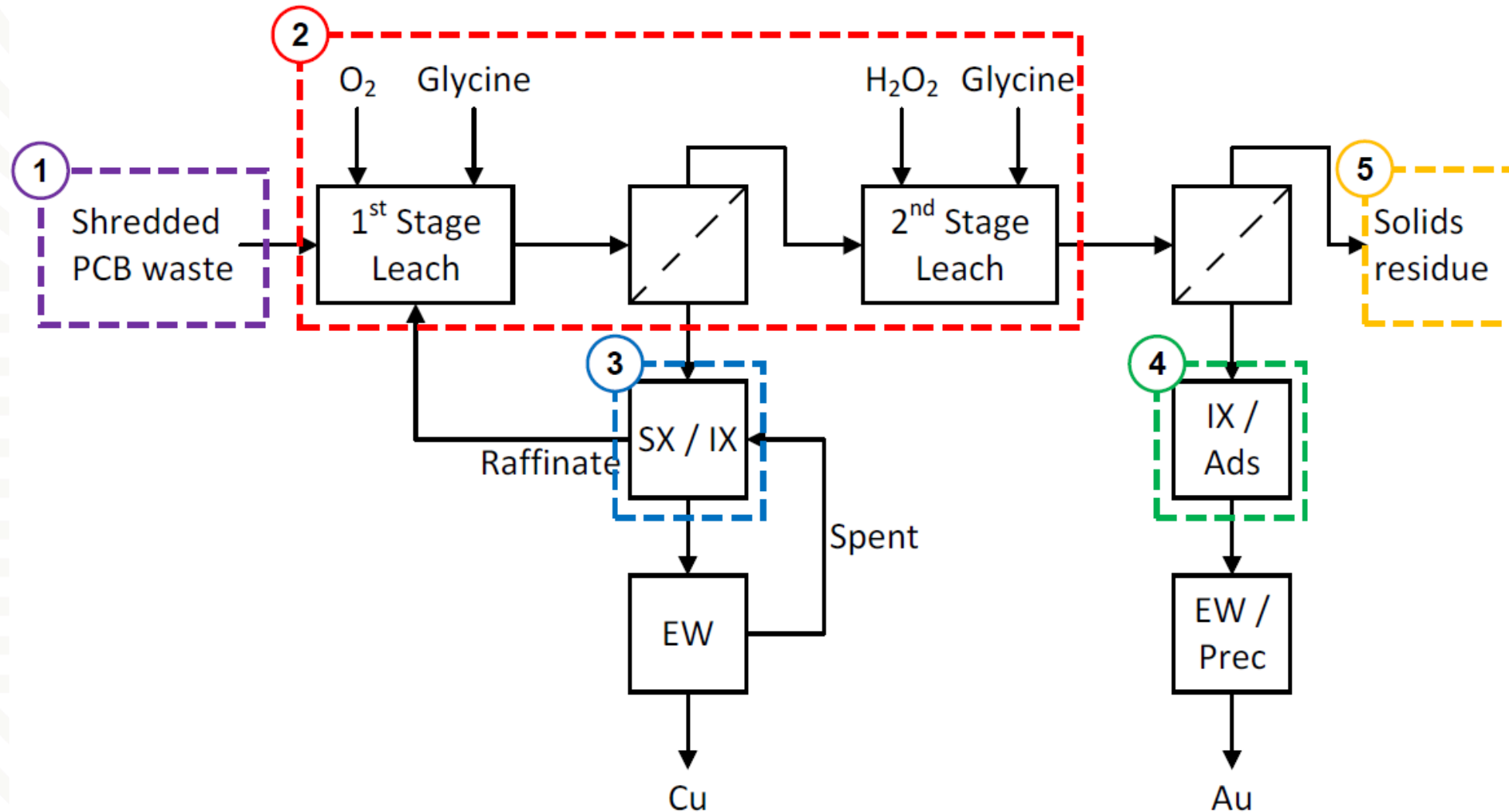
- Financial incentives
  - Value of formal SA waste sector valued at more than R 15 billion
  - Local valorisation vs exporting of waste
  - Cost and availability of primary resources
- National and international priorities
  - Sustainable Development Goals
  - South African National Development Plan 2030
    - Reduce the volume of waste disposed to landfill
    - Improve sustainability of resource intensive economy
- South African expertise and infrastructure related to primary metal production

# End-of-life products



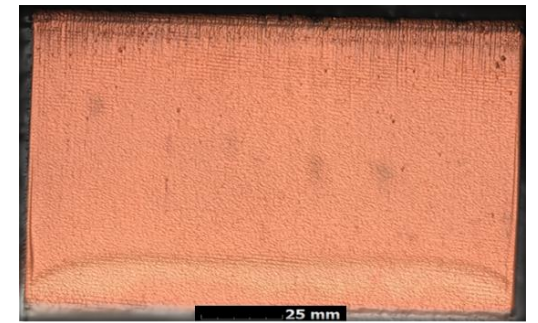
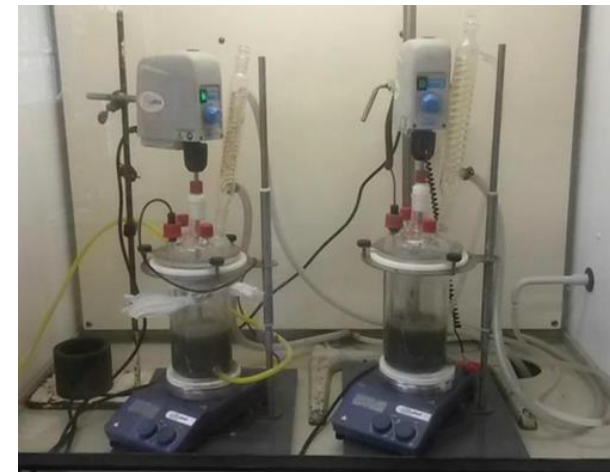
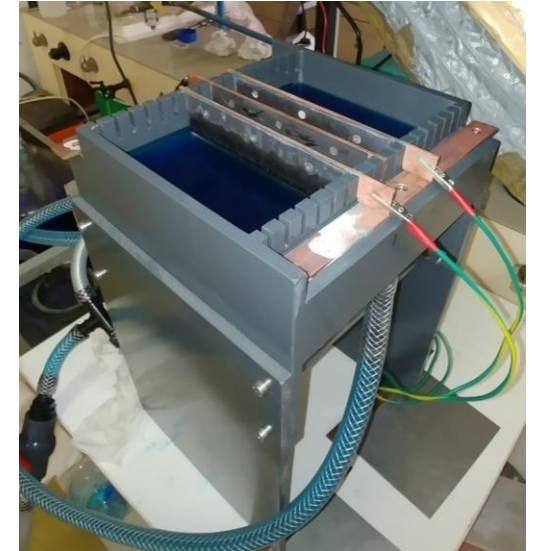
# End-of-life products

Process  
development:  
Waste printed  
circuit boards



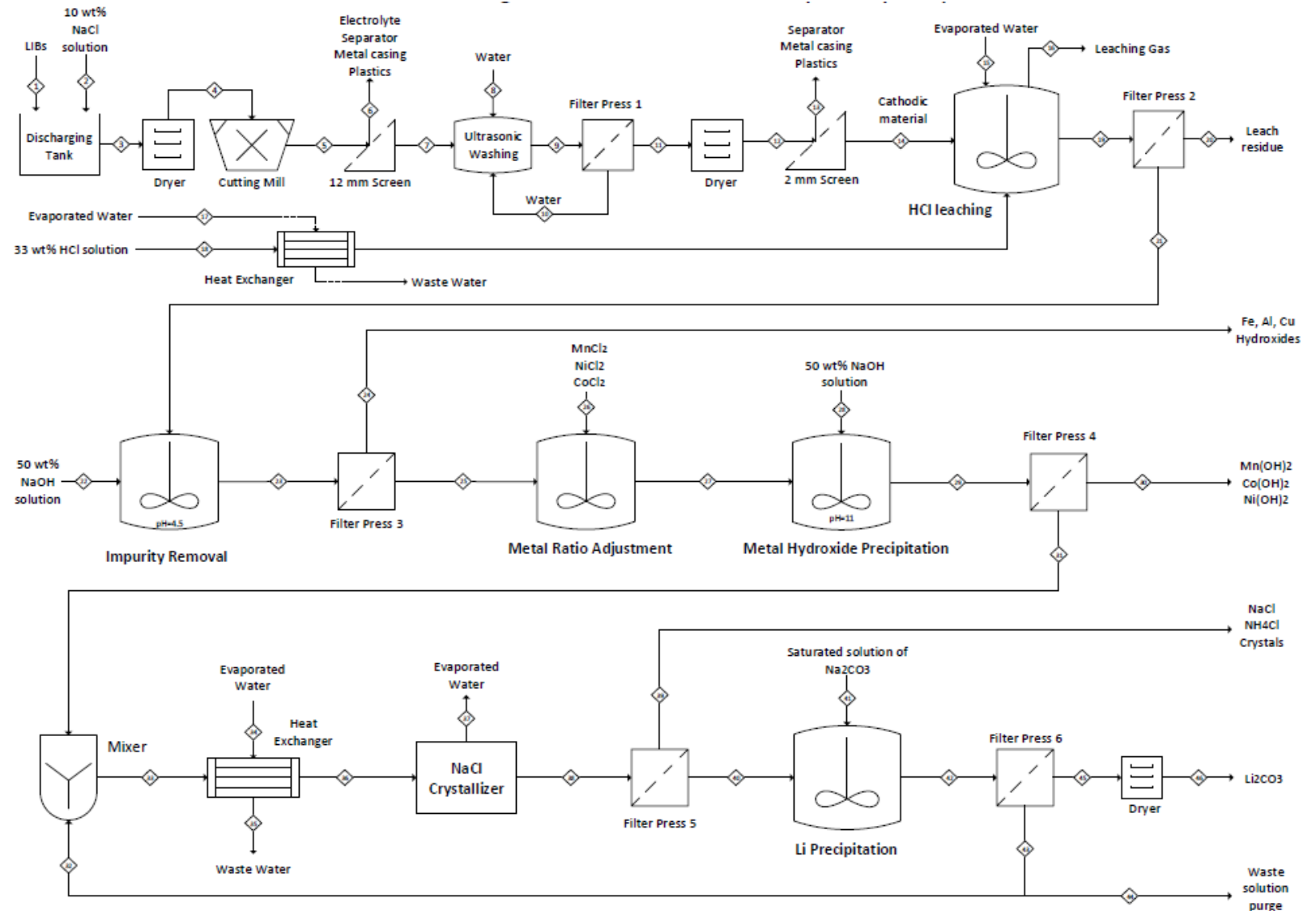
# End-of-life products

Experimental  
facilities



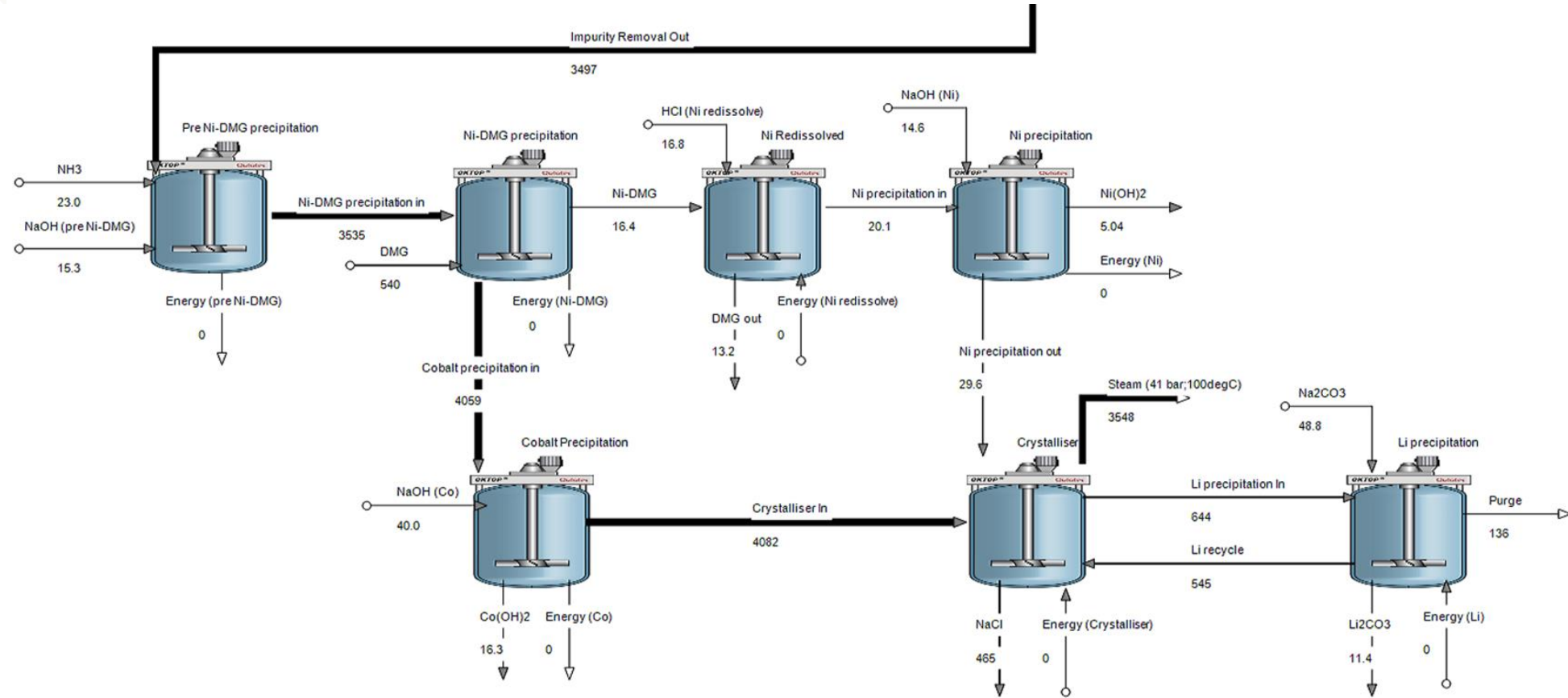
# End-of-life products

Process  
development:  
Lithium-ion  
batteries



# End-of-life products

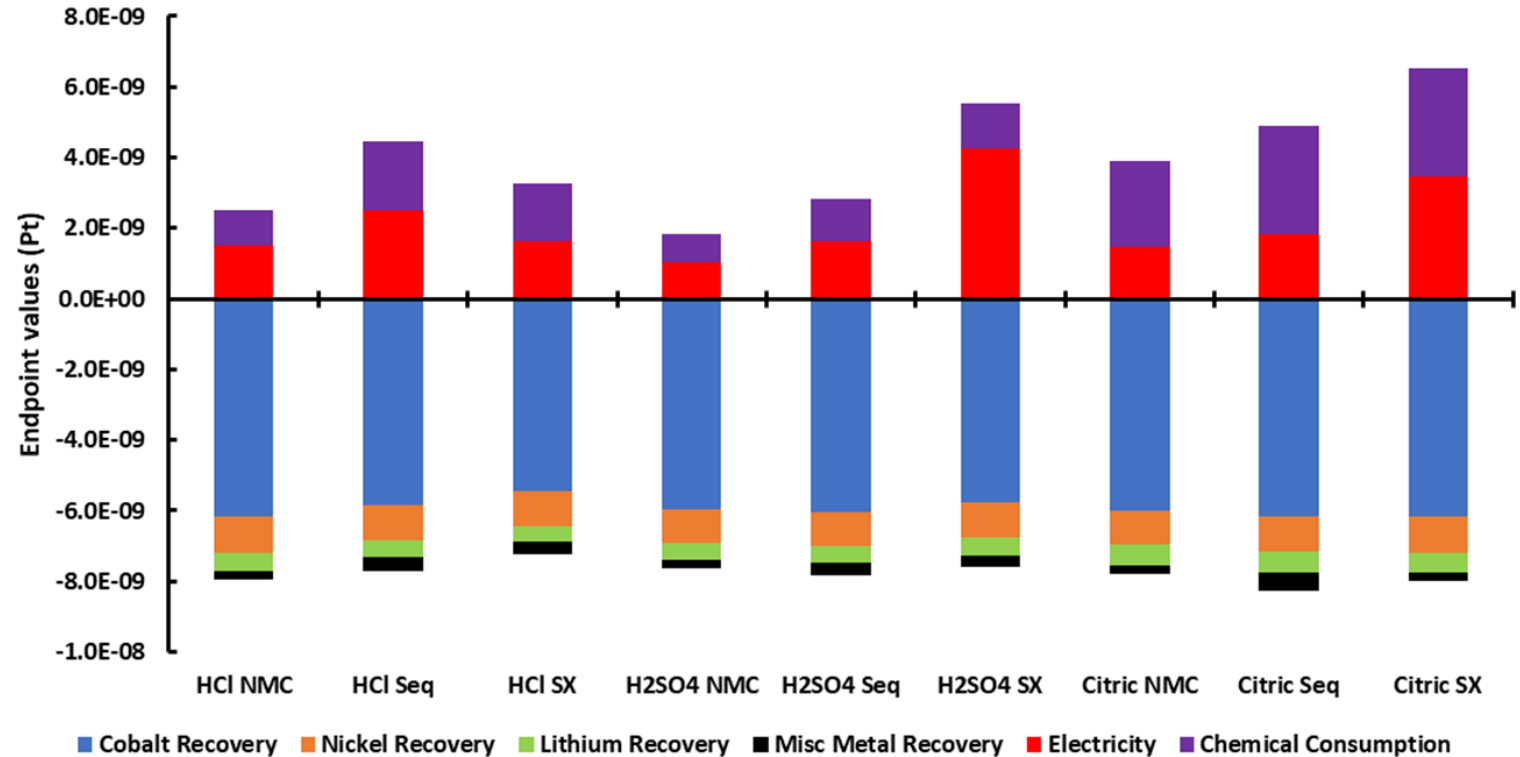
## Process modelling





# End-of-life products

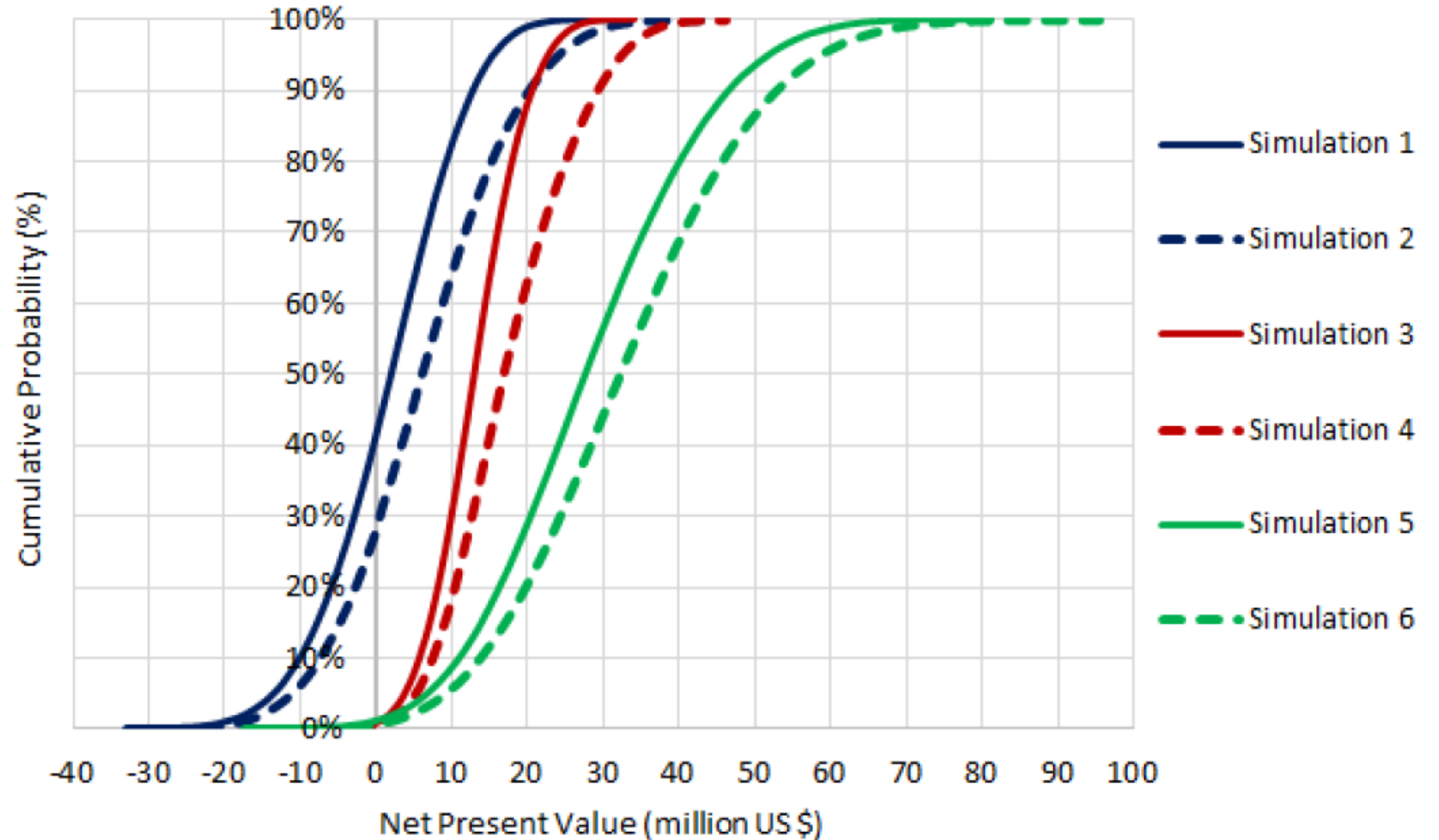
Resource efficiency



	HYDROCHLORIC - 20 g/L			SULPHURIC - 20 g/L + 4v/v% H <sub>2</sub> O <sub>2</sub>			CITRIC - 20 g/L + 4 v/v% H <sub>2</sub> O <sub>2</sub>		
Process Type	NMC	Seq	SX	NMC	Seq	SX	NMC	Seq	SX
Endpoint Value (Pt)	-5.44E-09	-3.22E-09	-3.97E-09	-5.83E-09	-5.01E-09	-2.08E-09	-3.88E-09	-3.35E-09	-1.47E-09
Standardised Value	169%	100%	123%	181%	155%	64%	120%	104%	46%

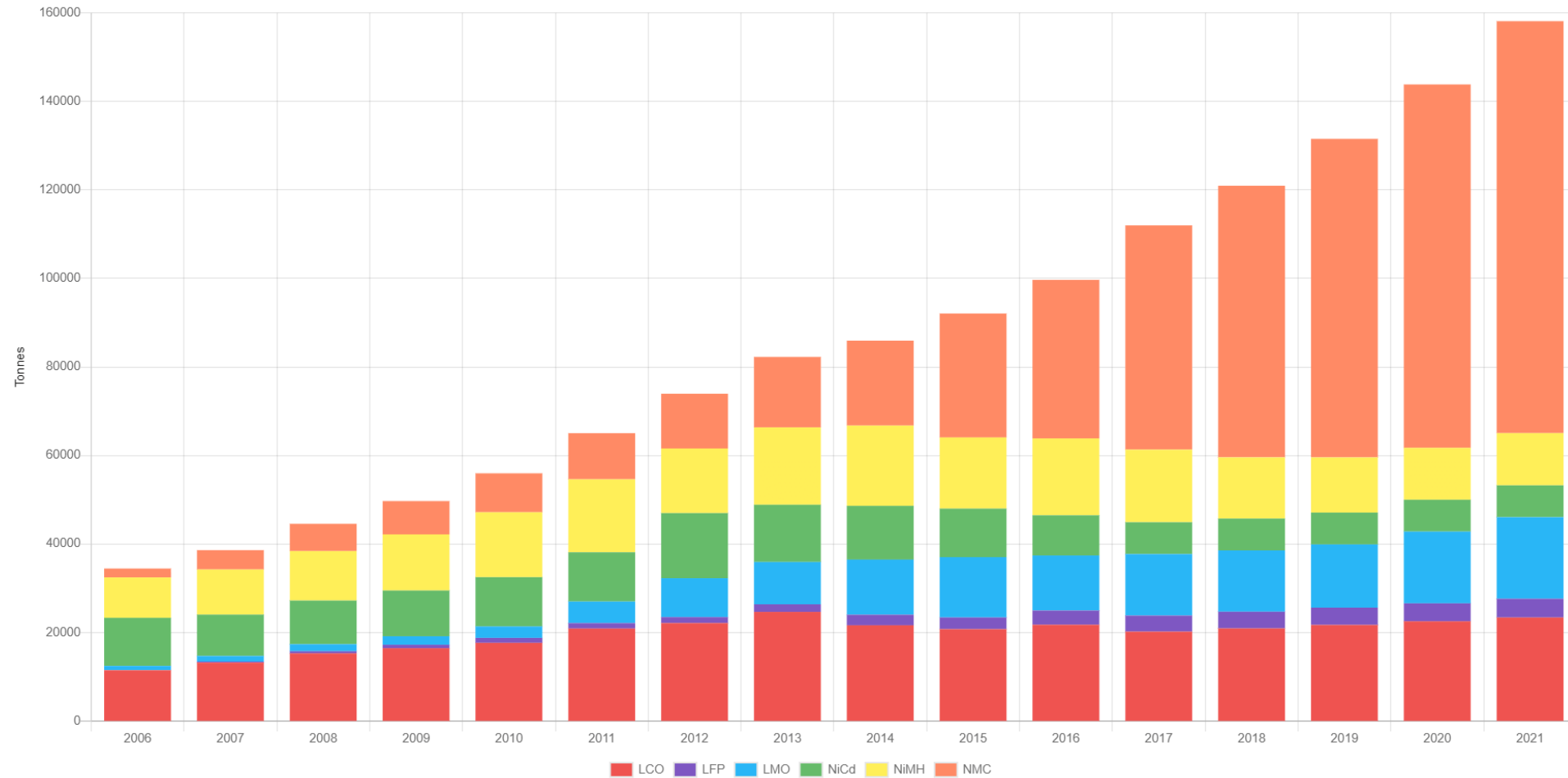
# End-of-life products

Economic  
performance



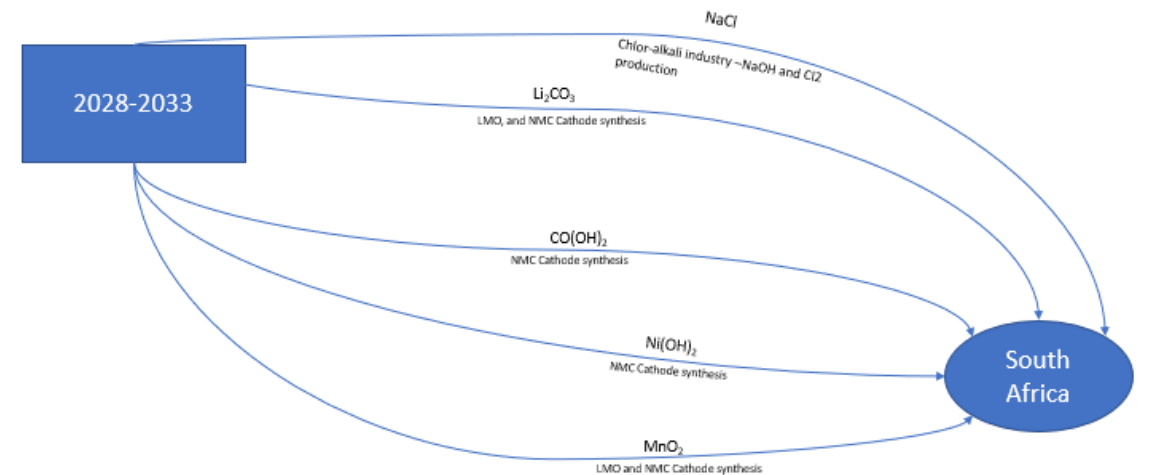
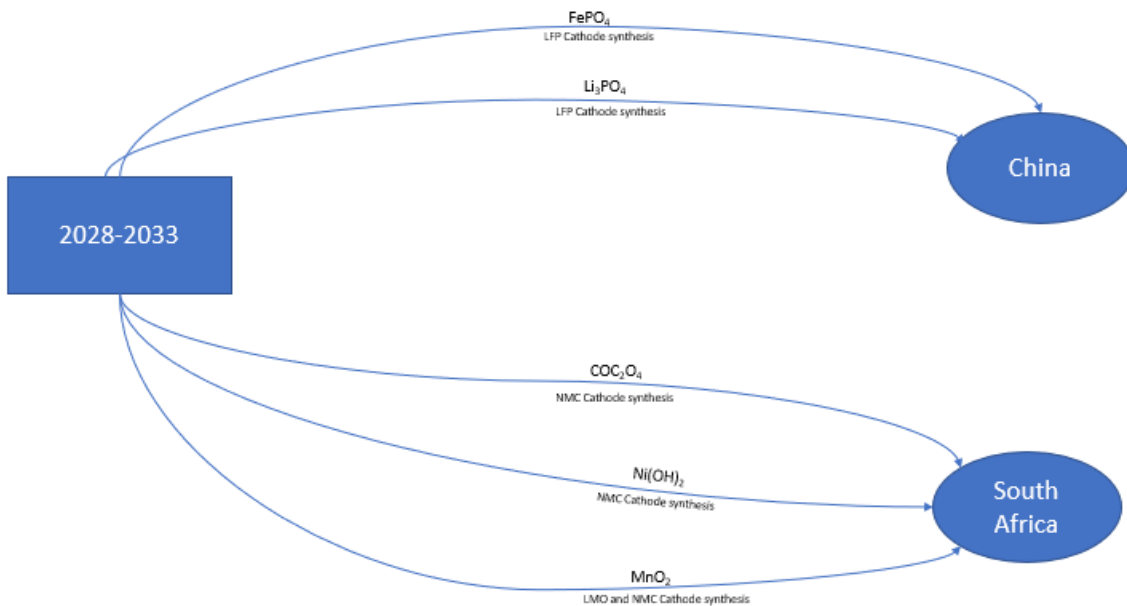
# End-of-life products

Tools enabling  
further  
development

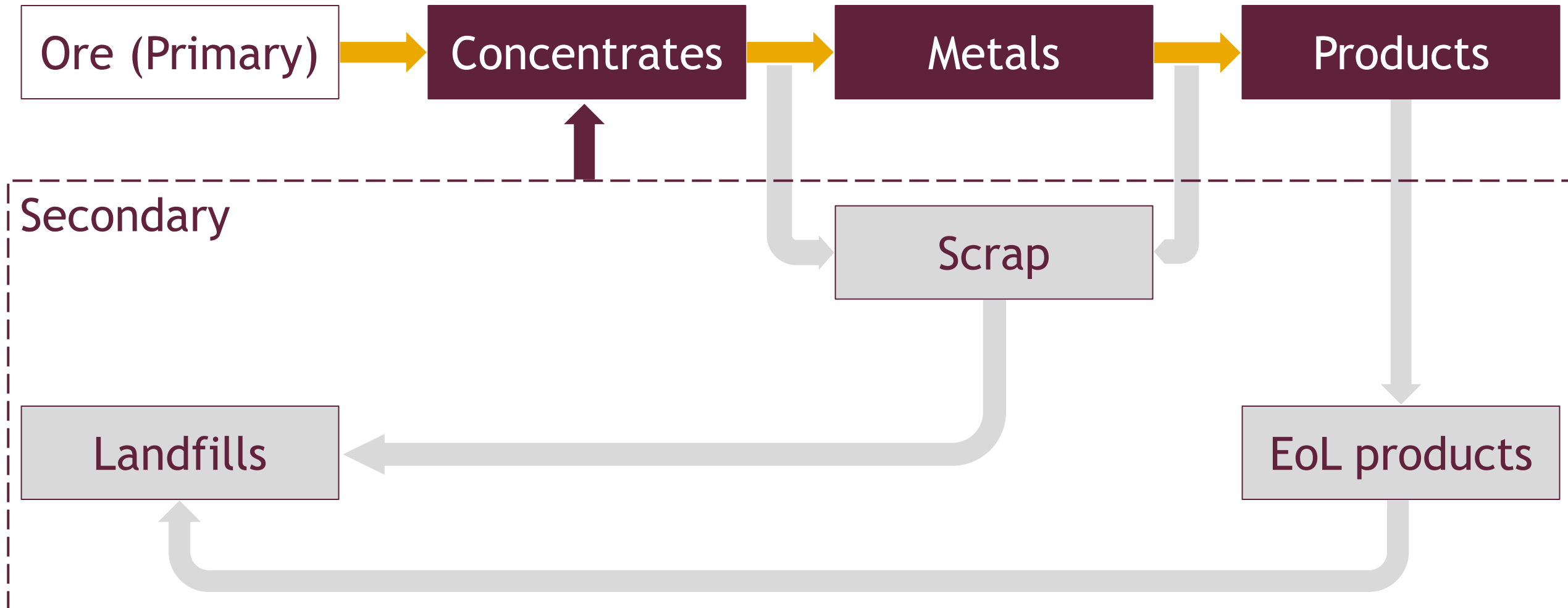


# End-of-life products

Tools enabling further development



# Primary and secondary resources

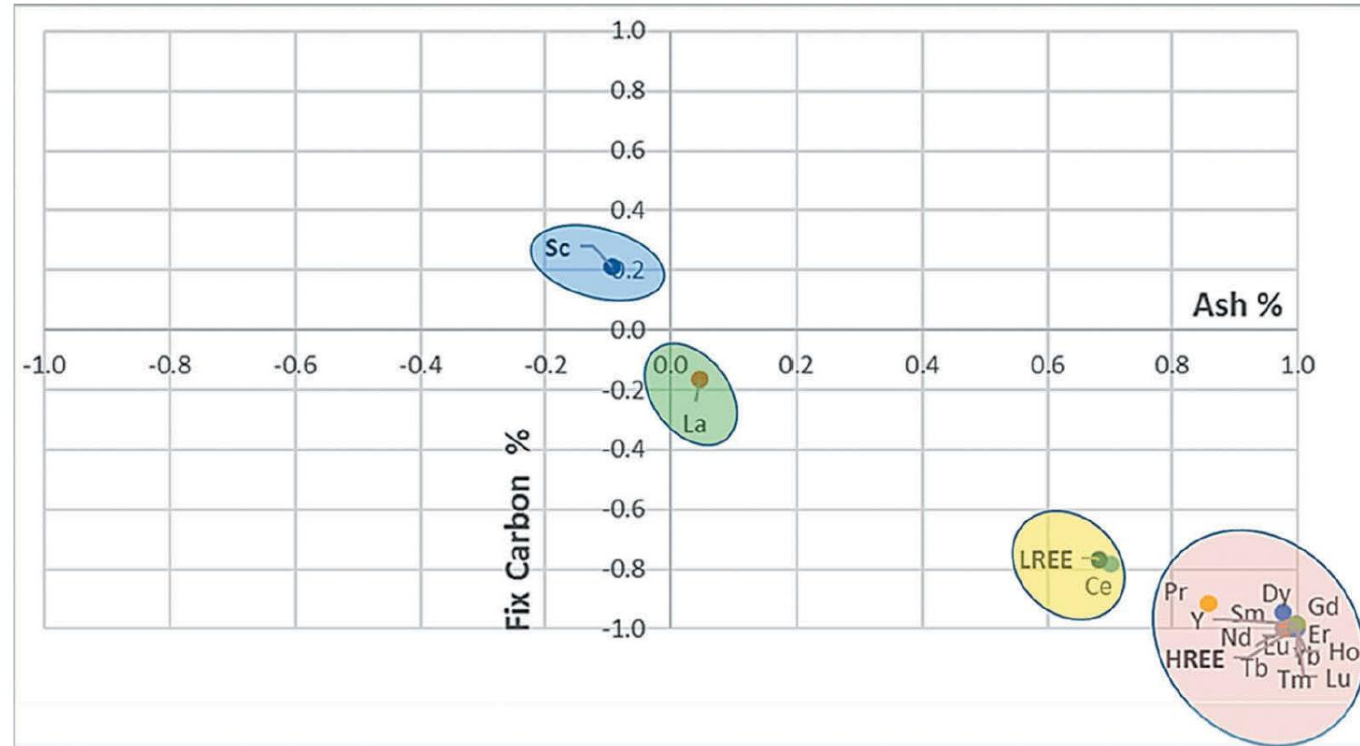


# Residues and scrap: Tailings

- Mine dumps cover ~6000 ha of land
- >440 gold tailings dumps in Johannesburg
- Generally low cost and low risk
- Process development
  - Treatment of refractory materials
  - Novel environmentally benign lixivants

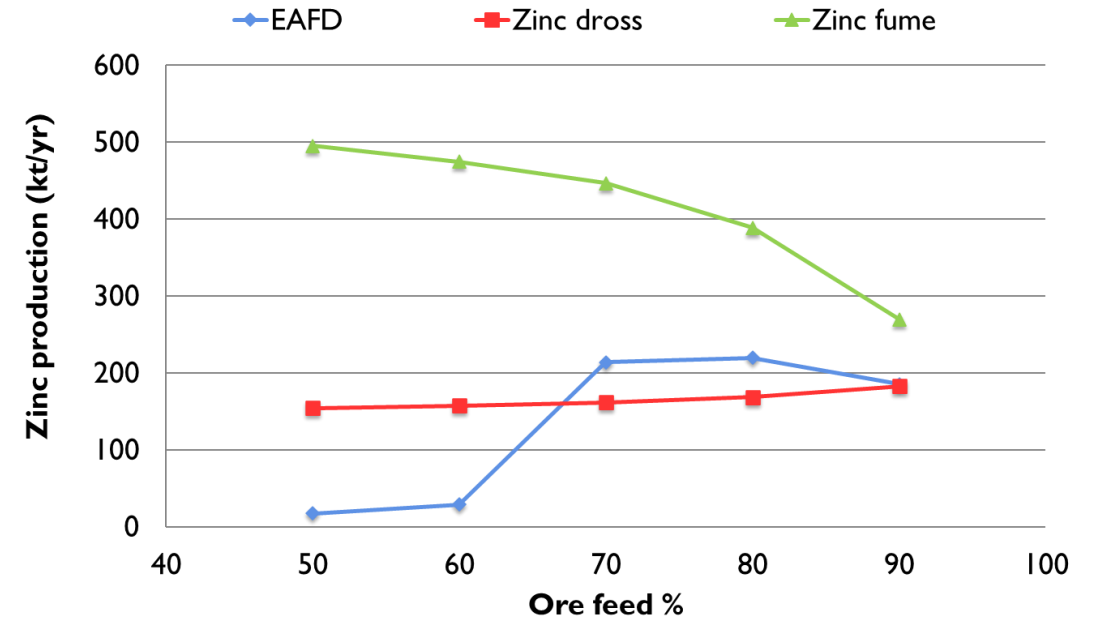
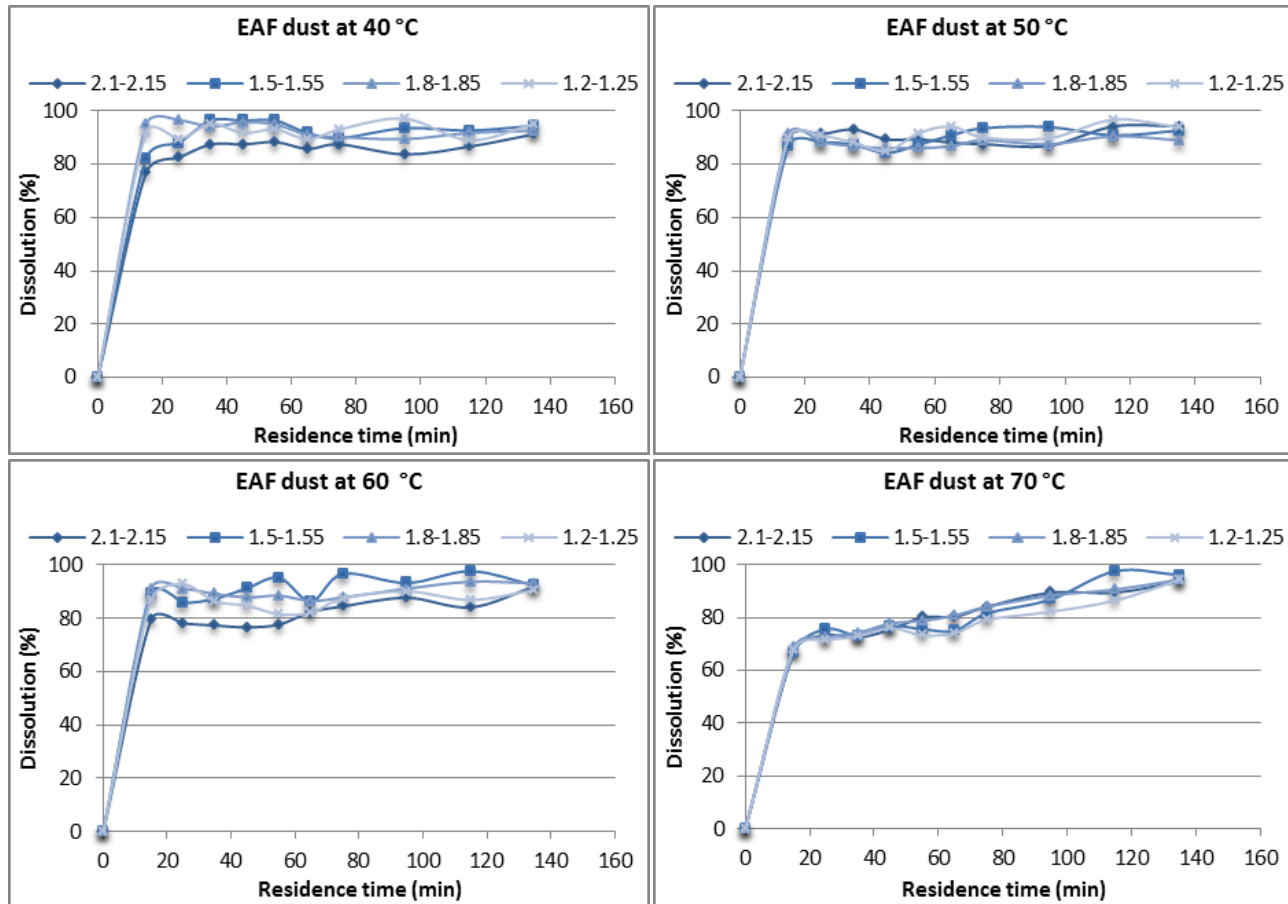
# Residues and scrap: REEs from coal

- REEs of strategic importance
  - High technology applications
  - Supply risks
- High ash discard coal > 60 Mt/year
- Characterisation of coal fractions
- Process development
  - REE extraction using different lixiviants



# Residues and scrap: Furnace dust

- Hydrometallurgical treatment of alternative zinc oxides (e.g. EAFD, Zn dross, Zn fume)





# Concluding remarks

- Continuously changing end-of-life product landscape
- Site-specific requirements for residues and scraps
- Future areas of interest
  - Exploration for mining of landfill sites
  - Integrated, multi-use waste processing facilities
  - Interdisciplinary research critical
    - Holistic approach to process selection, including environmental economics
    - Provide inputs to design for recycling
    - Provide inputs to legislative frameworks on recycling



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Dankie | Thank you | Enkosi