



Sustainability standard systems for mineral resources and their applicability for mitigating ESG risks in the rare earth supply chain

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Mining and Sustainability

Federal Institute for Geosciences and Natural Resources (BGR)

Bastnäsit



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Monazit



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Agenda

- Background: Use, demand and production
- ESG aspects along the rare earth value chain
- Approaches for sustainable raw material supply chains
 - Legal environment
 - Voluntary sustainability standard systems
 - General applicability of standard systems for the rare earth supply chain

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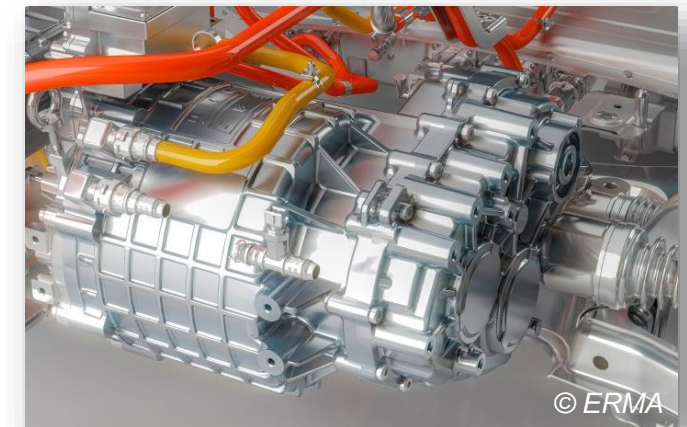
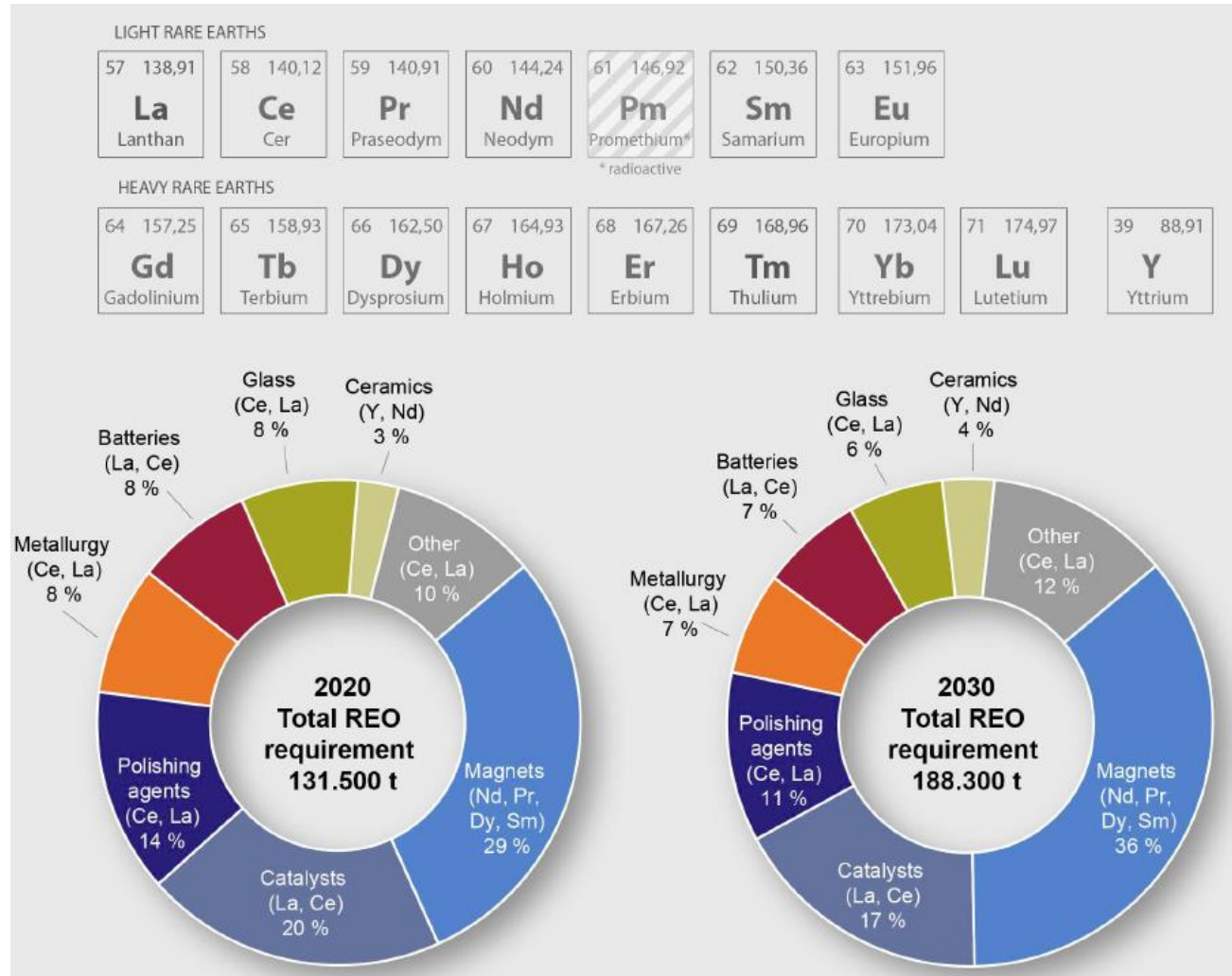
- BGR is the central geoscientific advisory institution of the German Federal Government
- It is part of the portfolio of the Federal Ministry for Economic Affairs and Climate Action (BMWK)
- Locations: Hannover, Berlin, Grubenhagen, soon in Cottbus
- Number of employees: ~ 800
- Budget: ~100 Mio. EUR



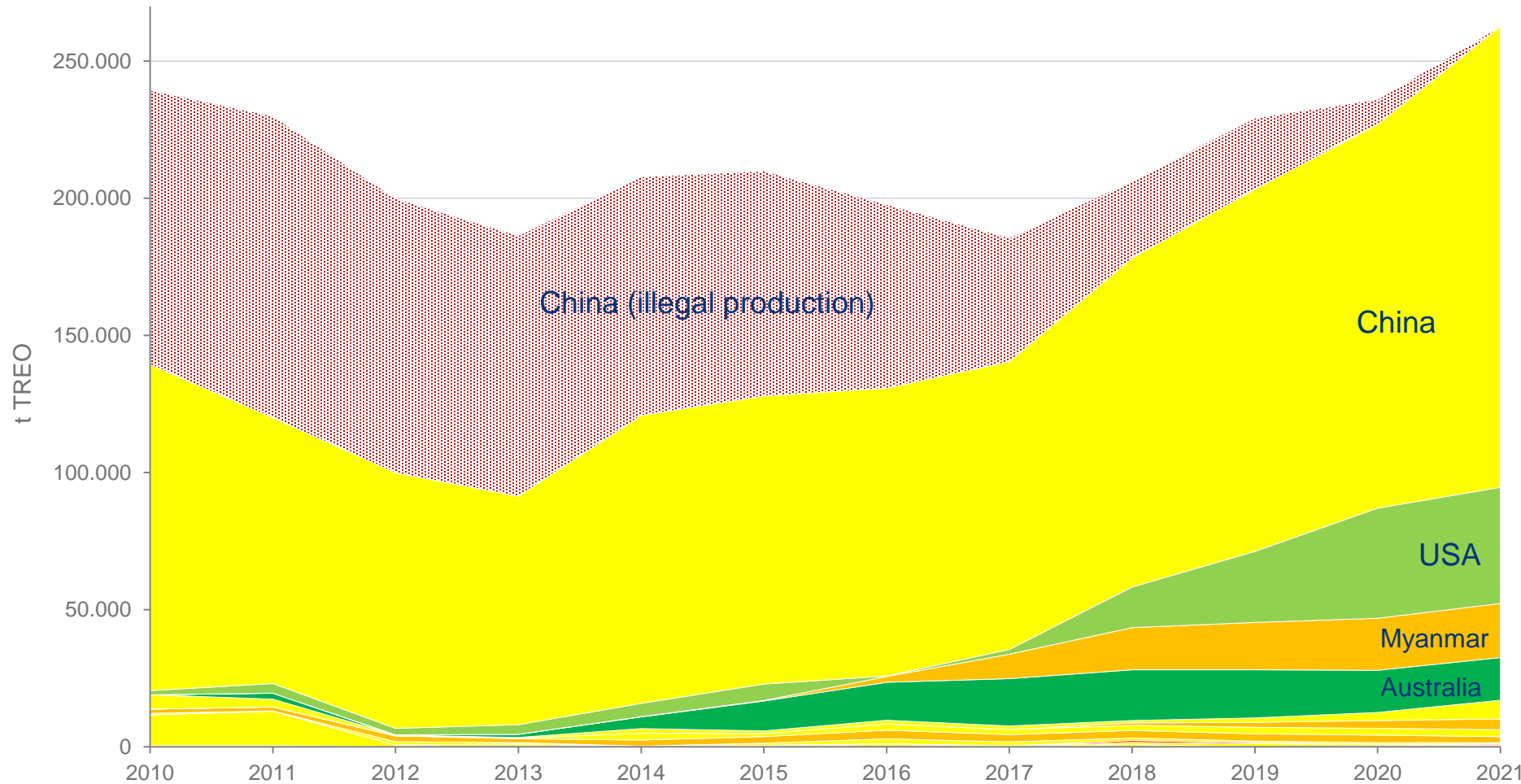
Main tasks:

- As consultants to the federal government and German industry BGR continuously analyses and evaluates global mineral resource potentials and markets for metals, industrial minerals and non-metals
- International geoscientific and technical cooperation, including polar research
- Geoscientific research and development

Use and Demand of Rare Earth Elements



Production of Rare Earths

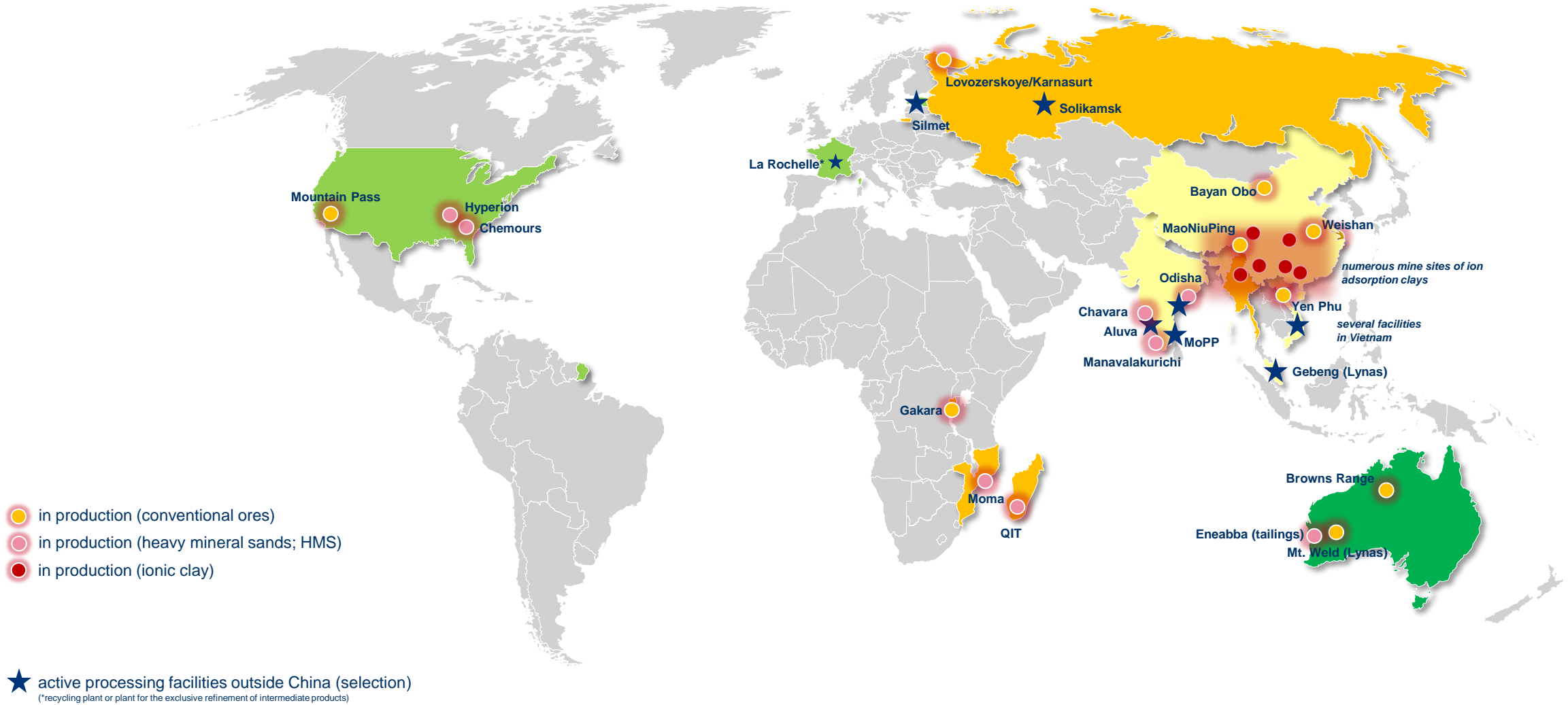


Source: BGR, Roskill (2021)

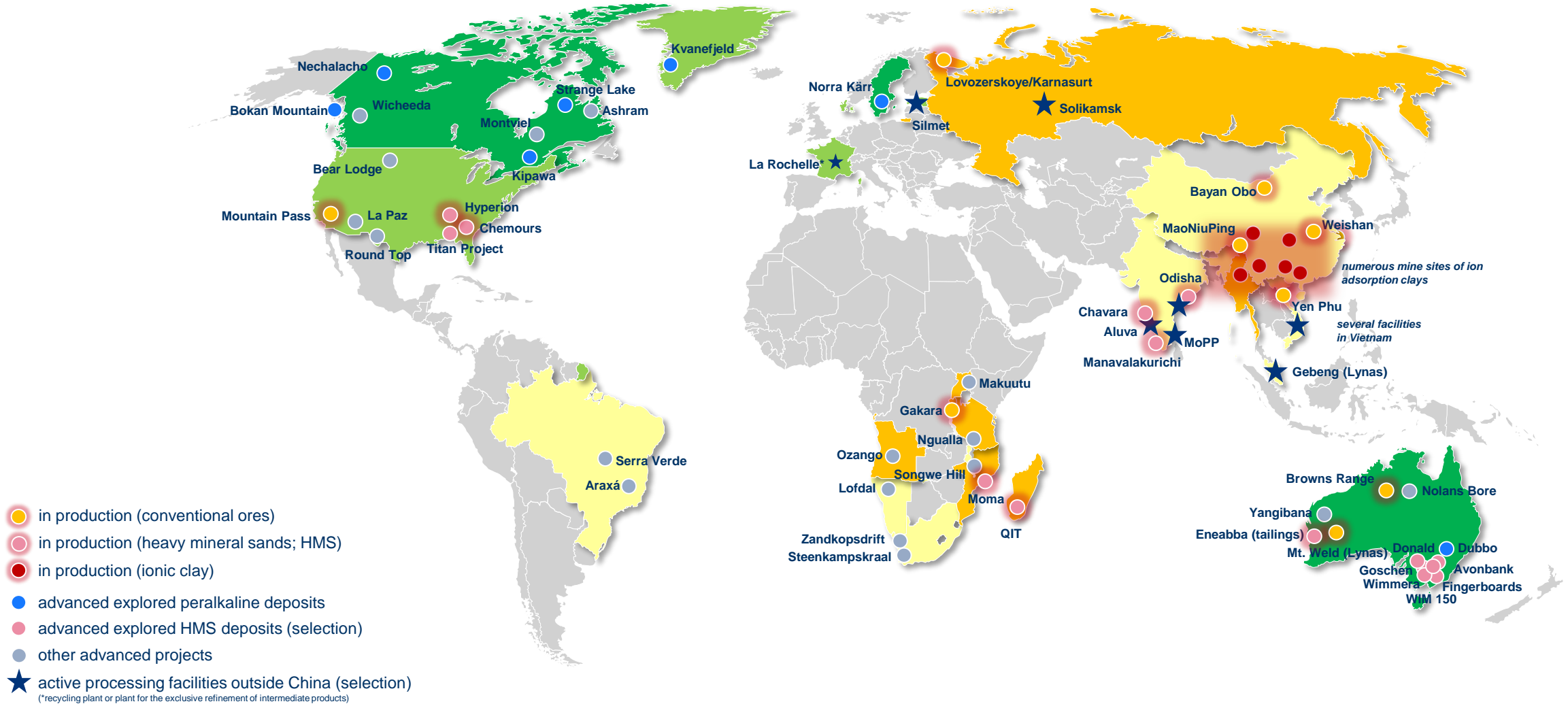
- China remains largest RE producer even if share of mine production declines
 - 64 % in 2021 compared to >90 % before 2013
- Successfully curbed illegal production in China by consolidating the RE market and introducing strict production quotas
- Increasing production in Myanmar and USA
- Increasing extraction of monazite from heavy mineral sand deposits



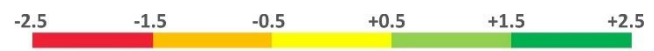
Active Mines and Processing Facilities



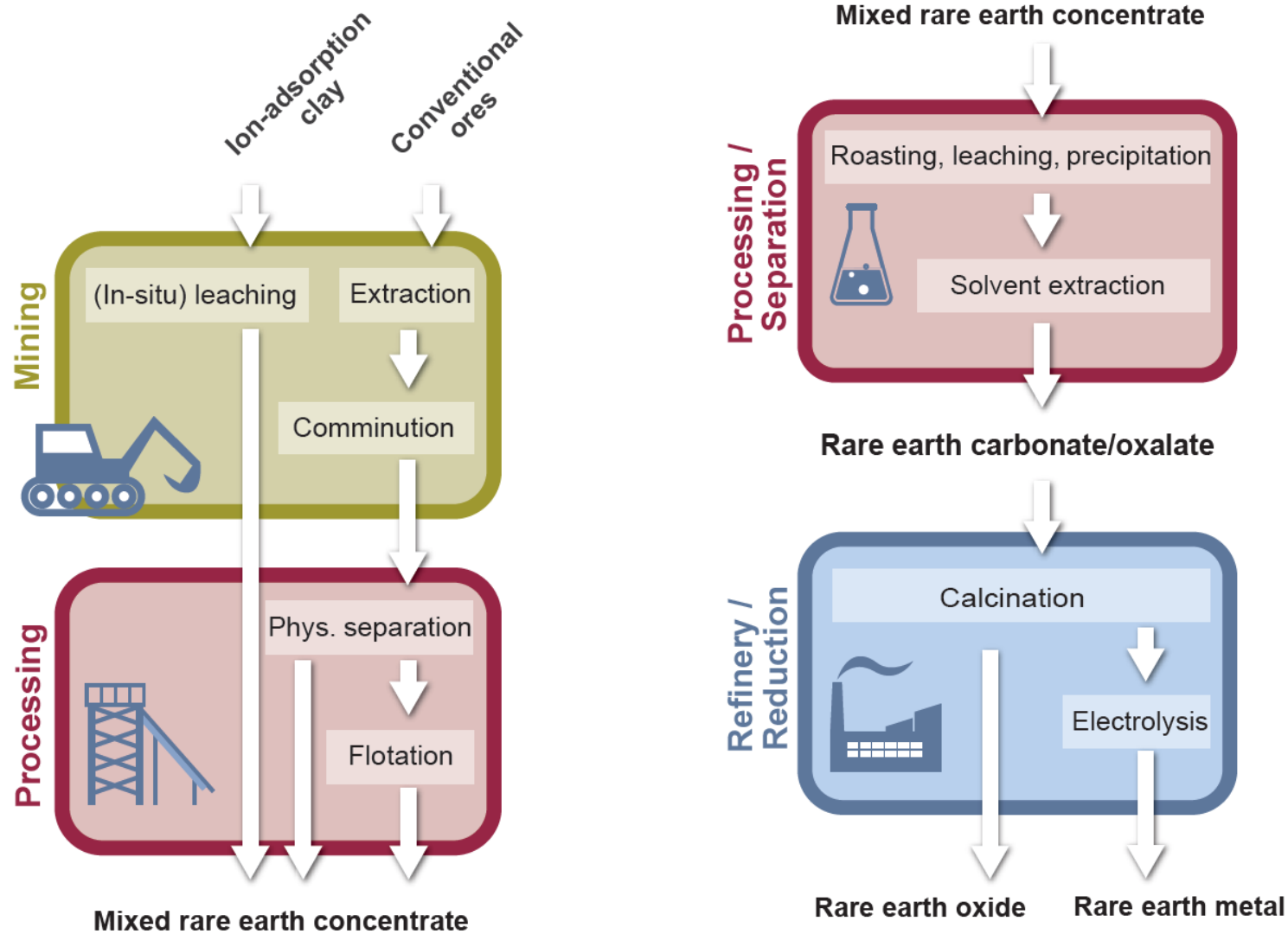
Rare Earth Projects Outside of China



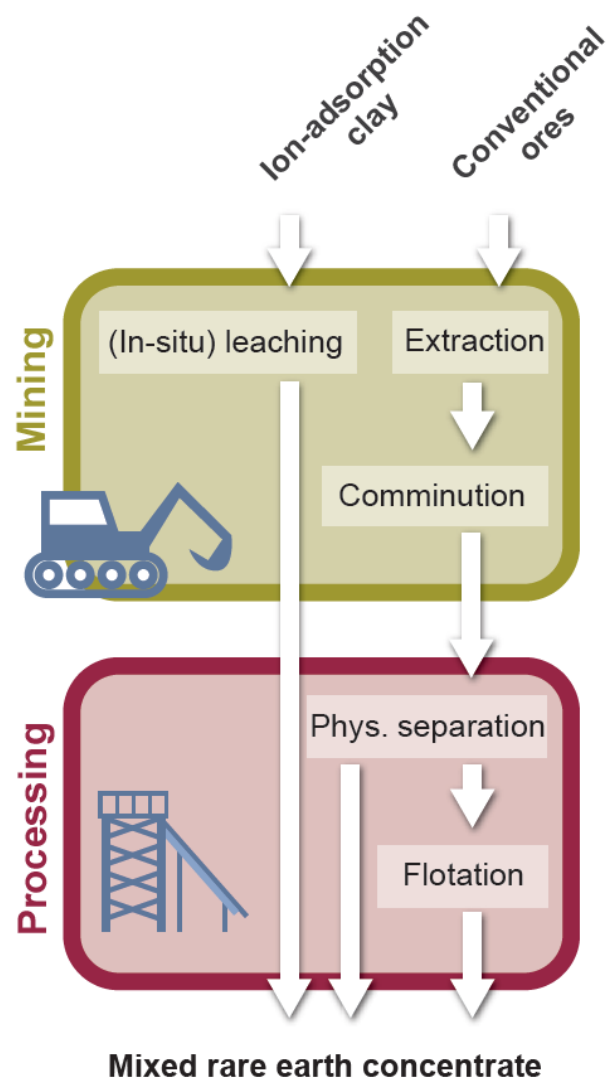
- in production (conventional ores)
- in production (heavy mineral sands; HMS)
- in production (ionic clay)
- advanced explored peralkaline deposits
- advanced explored HMS deposits (selection)
- other advanced projects
- ★ active processing facilities outside China (selection)
(*recycling plant or plant for the exclusive refinement of intermediate products)



Process Diagram for the Production of Rare Earths



ESG Aspects Along the Rare Earth Value Chain



Carbonatite (CHN, AUS, USA)

Ionic clay (CHN, MMR)

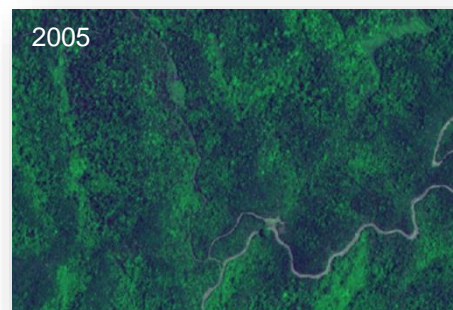
HMS (SE-Asia, IND, MDG,...)

Environmental

- Relatively high **land consumption**
- **Radioactively contaminated residues** after flotation
- High potential for **energy and water efficiency**

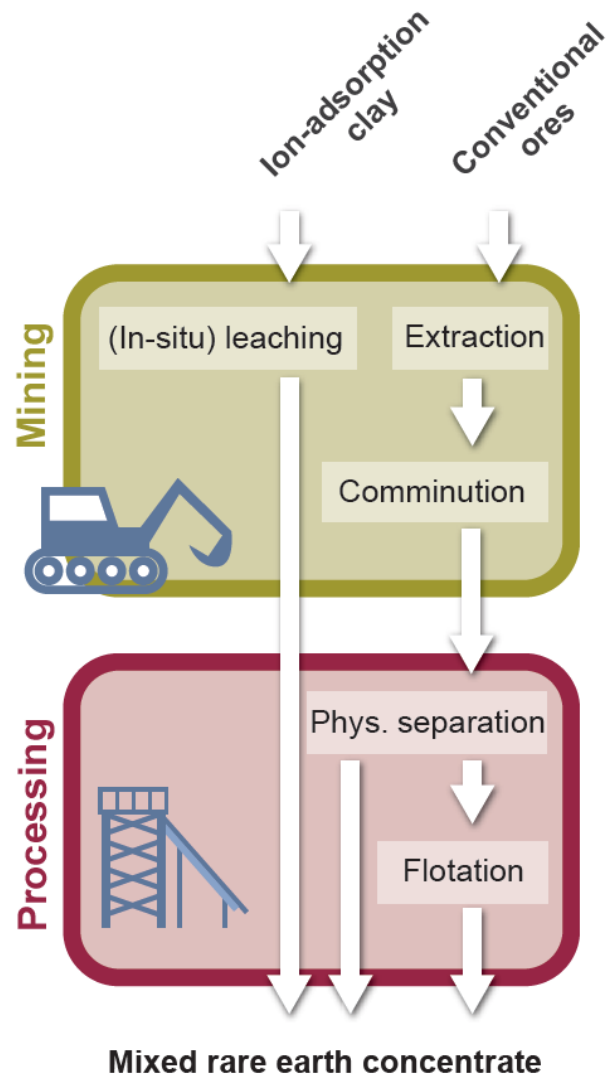
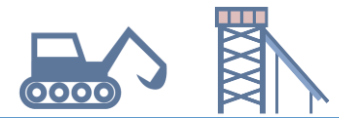
- High **land use** and **water requirements** for heap and tank leaching
- **Soil contamination** by leaching solution
- **Environmentally friendly extraction** theoretically possible with in-situ leaching

- **High radiation exposure** of the residue during monazite extraction
- **High land use demands** of HMS deposits
- **Resource efficiency**, as monazite is obtained as a by-product



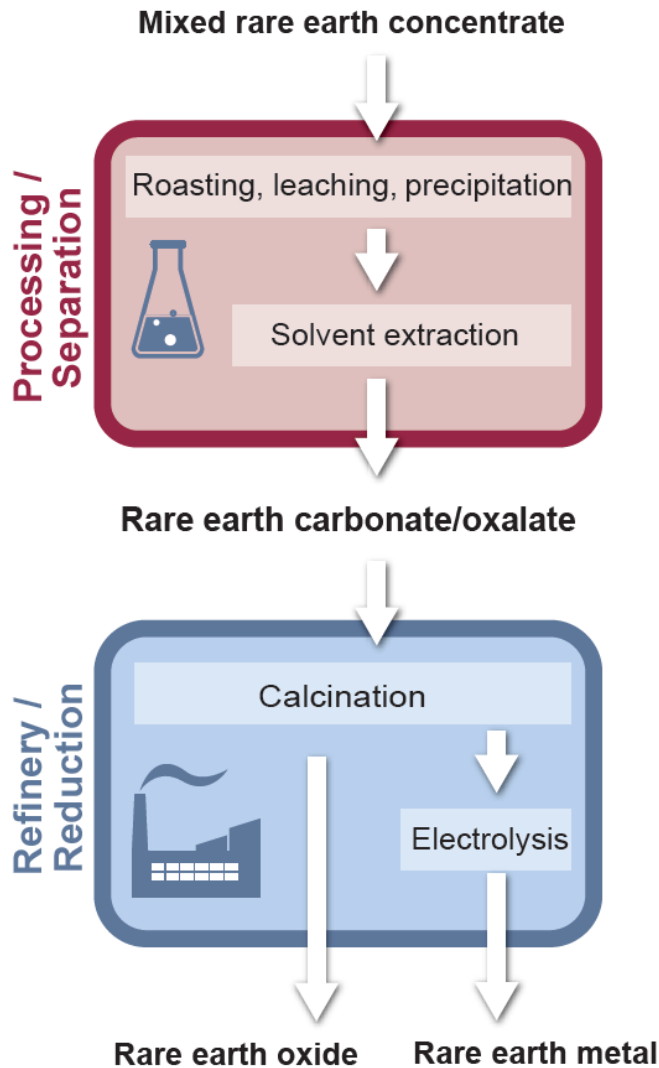
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ESG Aspects Along the Rare Earth Value Chain



	Carbonatite (CHN, AUS, USA)	Ionic clay (CHN, MMR)	HMS (SE-Asia, IND, MDG,...)
Environmental	<ul style="list-style-type: none"> • Relatively high land consumption • Radioactively contaminated residues after flotation • High potential for energy and water efficiency 	<ul style="list-style-type: none"> • High land use and water requirements for heap and tank leaching • Soil contamination by leaching solution • Environmentally friendly extraction theoretically possible with in-situ leaching 	<ul style="list-style-type: none"> • High radiation exposure of the residue during monazite extraction • High land use demands of HMS deposits • Resource efficiency, as monazite is obtained as a by-product
Social	<ul style="list-style-type: none"> • Health hazard for workers due to respirable dusts containing heavy metals, some of which are radioactive 	<p>Myanmar:</p> <ul style="list-style-type: none"> • Illegal mining important source of income for many miners and linked to corruption and mafia structures • Potential financing of armed groups 	<ul style="list-style-type: none"> • Conflict potential due to radioactive residue • Protests (e.g. in Kerala, India)
Governance	<ul style="list-style-type: none"> • No comprehensive international rare earth sustainability standard • Low transparency in chin. RE production even if international ESG requirements increase 		

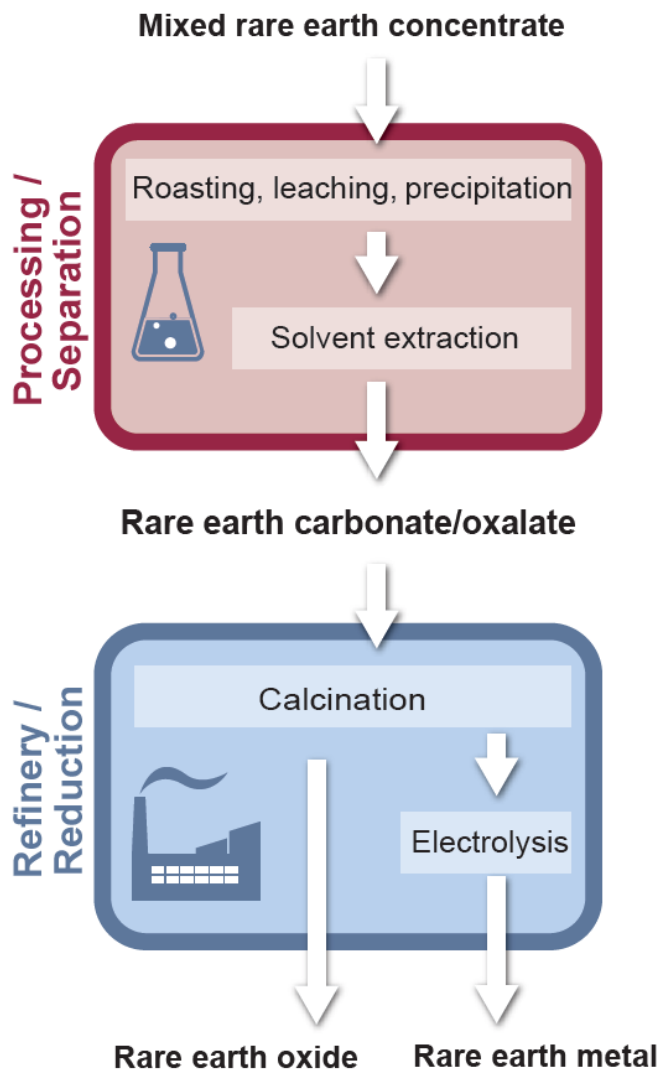
ESG Aspects Along the Rare Earth Value Chain



Environmental

- **High water demand** during washing after roasting
- **Radioactive residues** containing heavy metals, possibly contaminated with chemicals
 - Water-Leach Purification-Waste
- **Leachate** in inadequately sealed residue storage facilities and **risk of flooding** in the monsoon season
- **Inadequate due diligence in the treatment/aftercare of residual materials**, especially in the case of illegally constructed plants (**risk of dam failures**)
- Very **high energy demand** for solvent extraction (16-23 GJ / t SEO) and electrolysis (38-48 GJ / t SEO), associated with high GHG emissions (especially in the case of coal-based power generation)

ESG Aspects Along the Rare Earth Value Chain



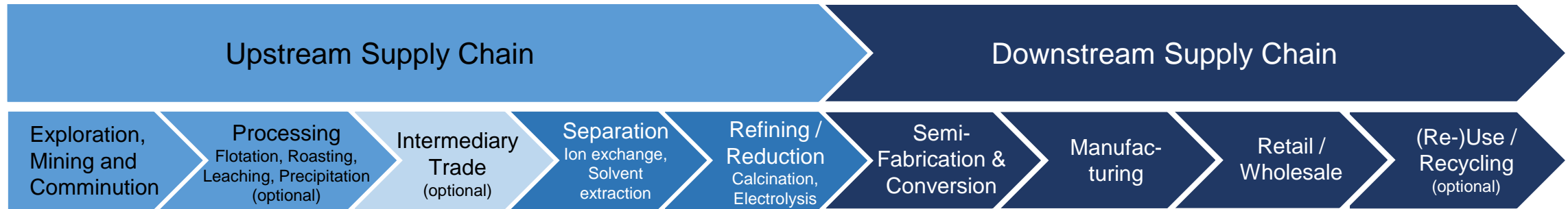
Environmental	<ul style="list-style-type: none"> • High water demand during washing after roasting • Radioactive residues containing heavy metals, possibly contaminated with chemicals <ul style="list-style-type: none"> ➢ Water-Leach Purification-Waste • Leachate in inadequately sealed residue storage facilities and risk of flooding in the monsoon season • Inadequate due diligence in the treatment/aftercare of residual materials, especially in the case of illegally constructed plants (risk of dam failures) • Very high energy demand for solvent extraction (16-23 GJ / t SEO) and electrolysis (38-48 GJ / t SEO), associated with high GHG emissions (especially in the case of coal-based power generation)
Social	<ul style="list-style-type: none"> • Long-lasting social conflicts due to radioactive residues (e.g. Malaysia) • No effective grievance mechanism for affected communities
Governance	<ul style="list-style-type: none"> • Low transparency in chin. RE production even if international ESG requirements increase • Transparency / environmental monitoring and regular sustainability reporting (GRI) in Malaysia • No comprehensive international rare earth sustainability standard

Approaches for Sustainable Raw Material Supply Chains

Sustainability standards in production countries



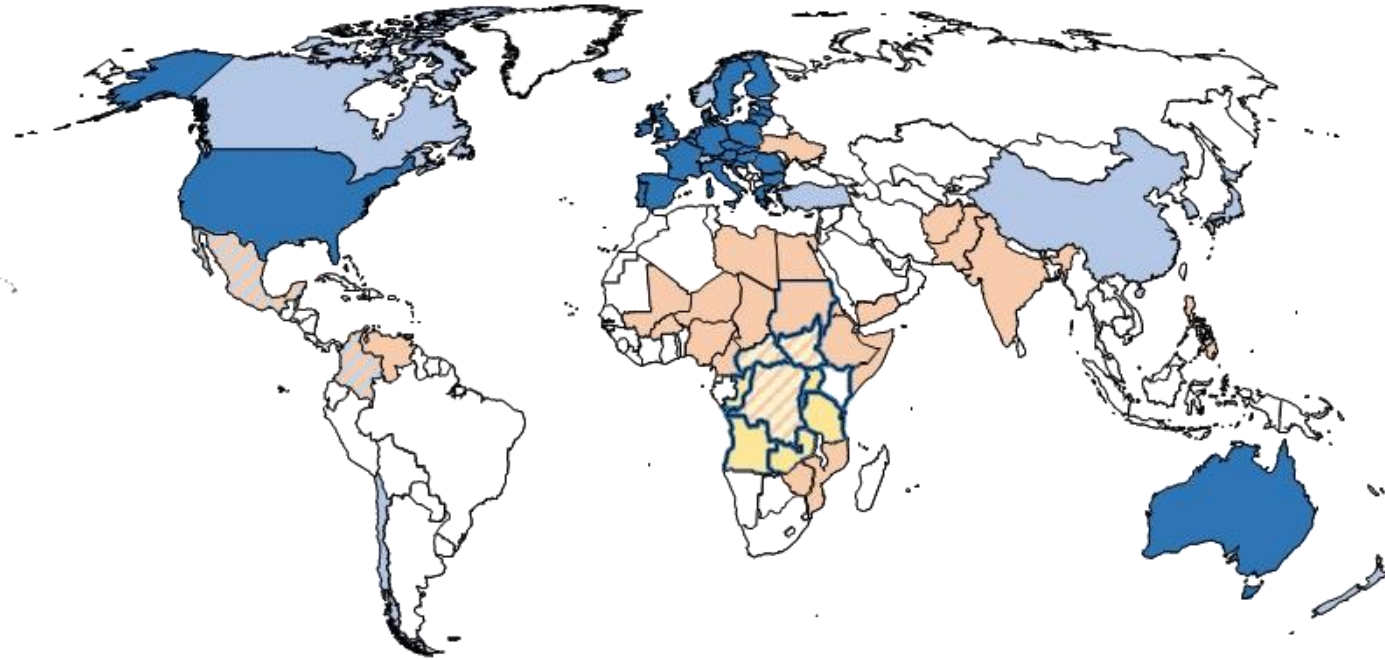
Sustainability requirements for raw material supply chains



- Governance in resource rich countries
- Technological development
- Commitment to international standards
- Business initiatives in the mining industry
- etc.

- Regulations
- Supply chain initiatives
- Pilot projects from OEMs
- etc.

EU and German Legal Environment

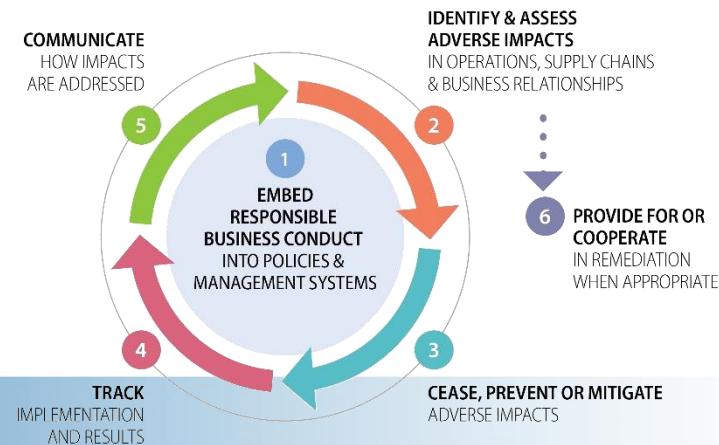


- Countries with mandatory due diligence regulations (cross-sectoral or raw materials)
- OECD members or countries that committed to OECD due diligence implementation
- Countries that include conflict-affected or high-risk areas (indicative EU list)
- Countries referenced in the US Dodd-Frank act (conflict minerals provisions)
- Member states of the International Conference on the Great Lakes Region (ICGLR) that committed to due diligence implementation for conflict minerals at the regional level

Due diligence obligations increasingly framed into EU / German legislation

- EU conflict minerals regulation (2018)
- **German supply chain act (LkSG) (2021)**
- EU Battery Directive (will be introduced gradually from 2024 onwards)
- **EU Corporate Sustainability Due Diligence Directive (draft from 2022)**

DUE DILIGENCE PROCESS & SUPPORTING MEASURES



Developments in Legislation, Policies and Industry Initiatives

- Supply chain due diligence as new international benchmark, extension to sectors and commodities
- From supply chains to product-related requirements in the sense of circular economy?
- Linking security of supply with responsible sourcing



Voluntary Sustainability Standard Systems for Mineral Resources

Example: Responsible Minerals Assurance Process (RMAP) of the Responsible Minerals Initiative (RMI)

- Independent, risk-based audits of smelters/refiners worldwide for tantalum, tin, tungsten, gold and cobalt with regard to compliance with the OECD Guidelines, recognition by EU Regulation
- More than 350 member companies worldwide (including numerous German companies)
- Extension of certification of smelters / refineries to copper, nickel, zinc and lead

Tantalum Smelter List



Active	0
Conformant	35
Eligible	36

Tungsten Smelter List



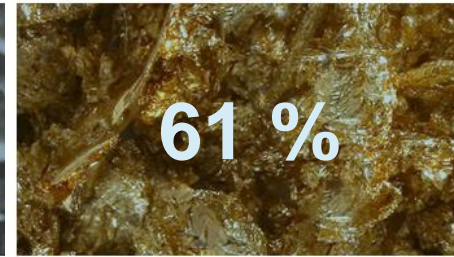
Active	4
Conformant	41
Eligible	52

Tin Smelter List



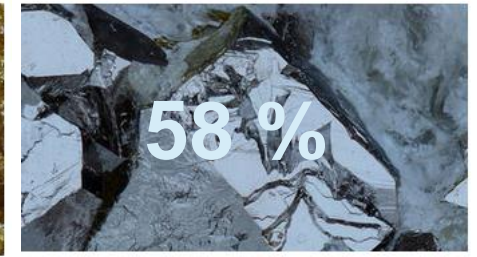
Active	8
Conformant	54
Eligible	80

Gold Refiners List



Active	8
Conformant	99
Eligible	176

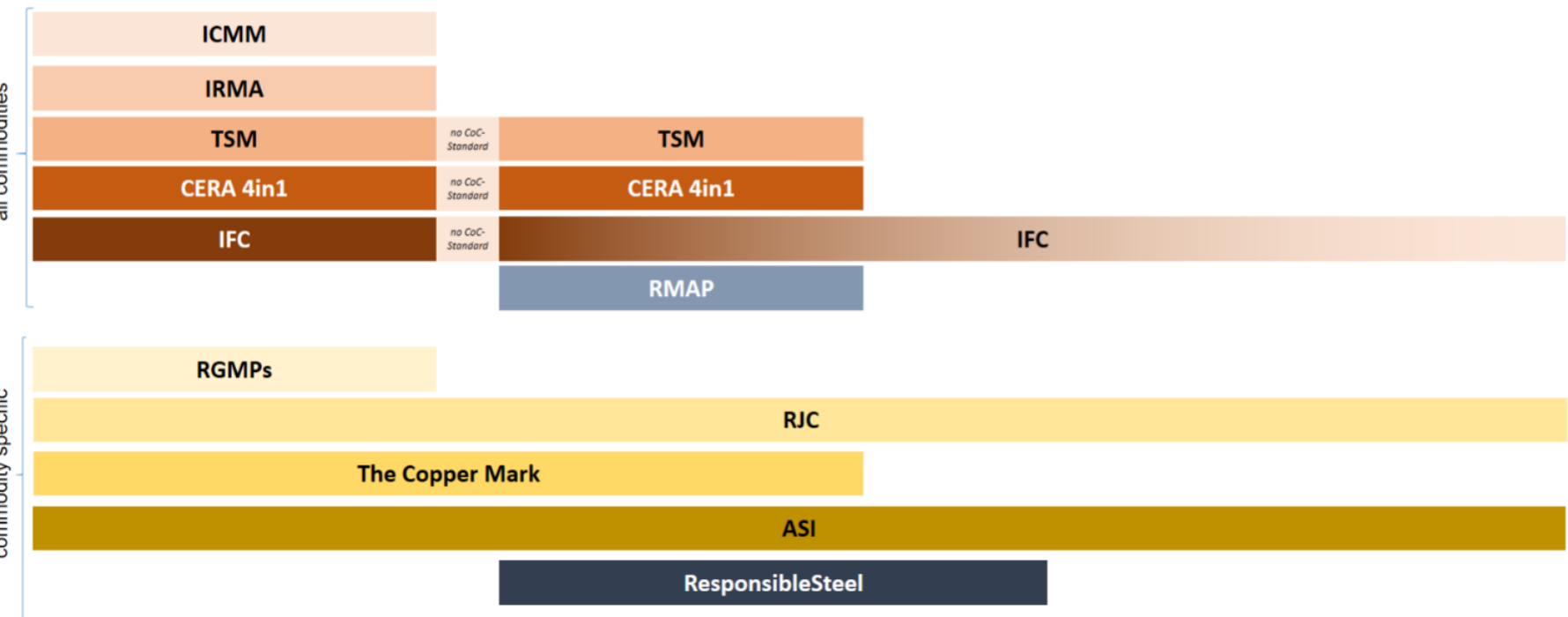
Cobalt Refiners List



Active	11
Conformant	31
Eligible	73

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Voluntary Sustainability Standard Systems for Mineral Resources

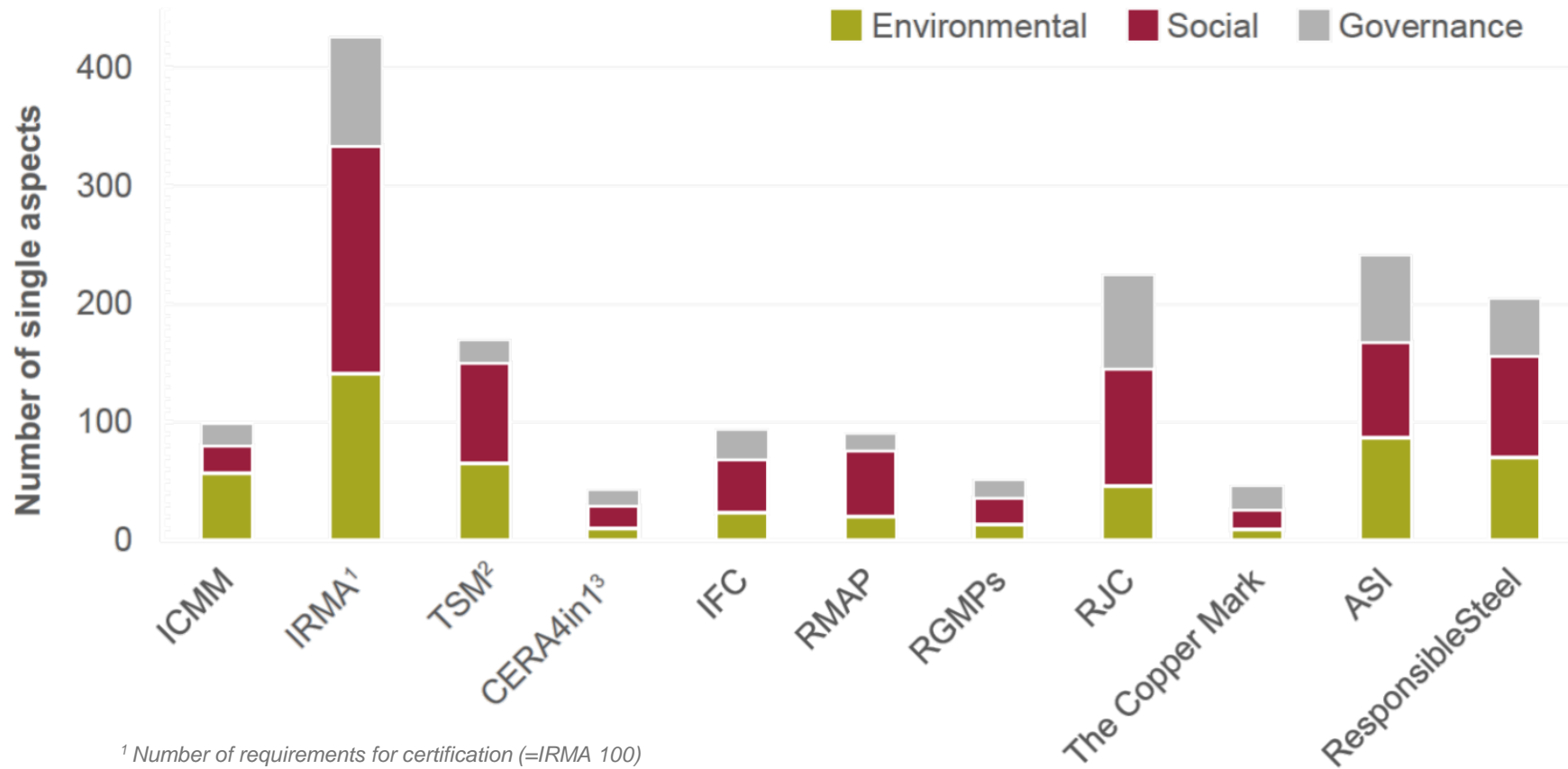


Logos of the organizations associated with the standards shown in the figure:

- ICMM: International Council on Mining & Metals
- IRMA: Initiative for Responsible Mining Assurance
- The Mining Association of Canada: ADVOCACY STEWARDSHIP COLLABORATION
- IFC: International Finance Corporation, WORLD BANK GROUP
- CERA 4in1: CERTIFICATION OF RAW MATERIALS
- Responsible Minerals Initiative
- WORLD GOLD COUNCIL
- RJC: RESPONSIBLE JEWELLERY COUNCIL
- THE COPPER MARK: RESPONSIBLY PRODUCED COPPER
- asi: Aluminium Stewardship Initiative
- Responsible Steel: standards & certification

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Voluntary Sustainability Standard Systems for Mineral Resources



¹ Number of requirements for certification (=IRMA 100)

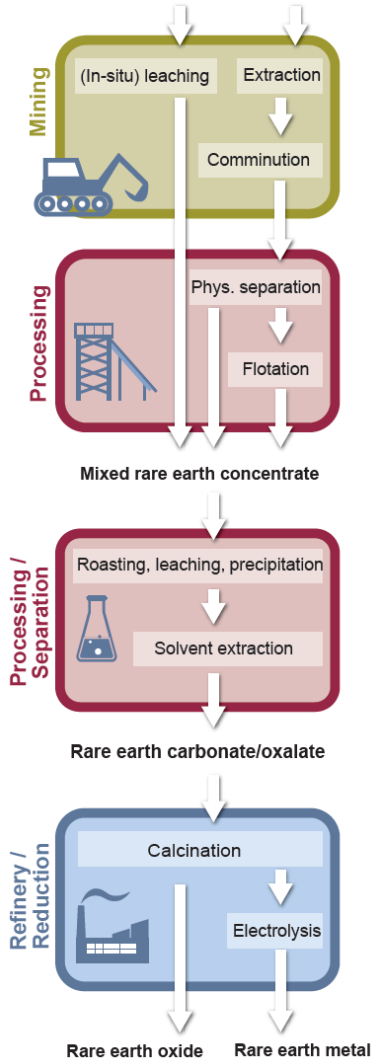
² Number of criteria for level A performance in MAC's TSM

³ More requirements in CERA 4in1 Audit Check List

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General Applicability of Standard Systems* for the Rare Earth Supply Chain



ICMM
International Council on Mining and Metals
- Sustainable Development Framework

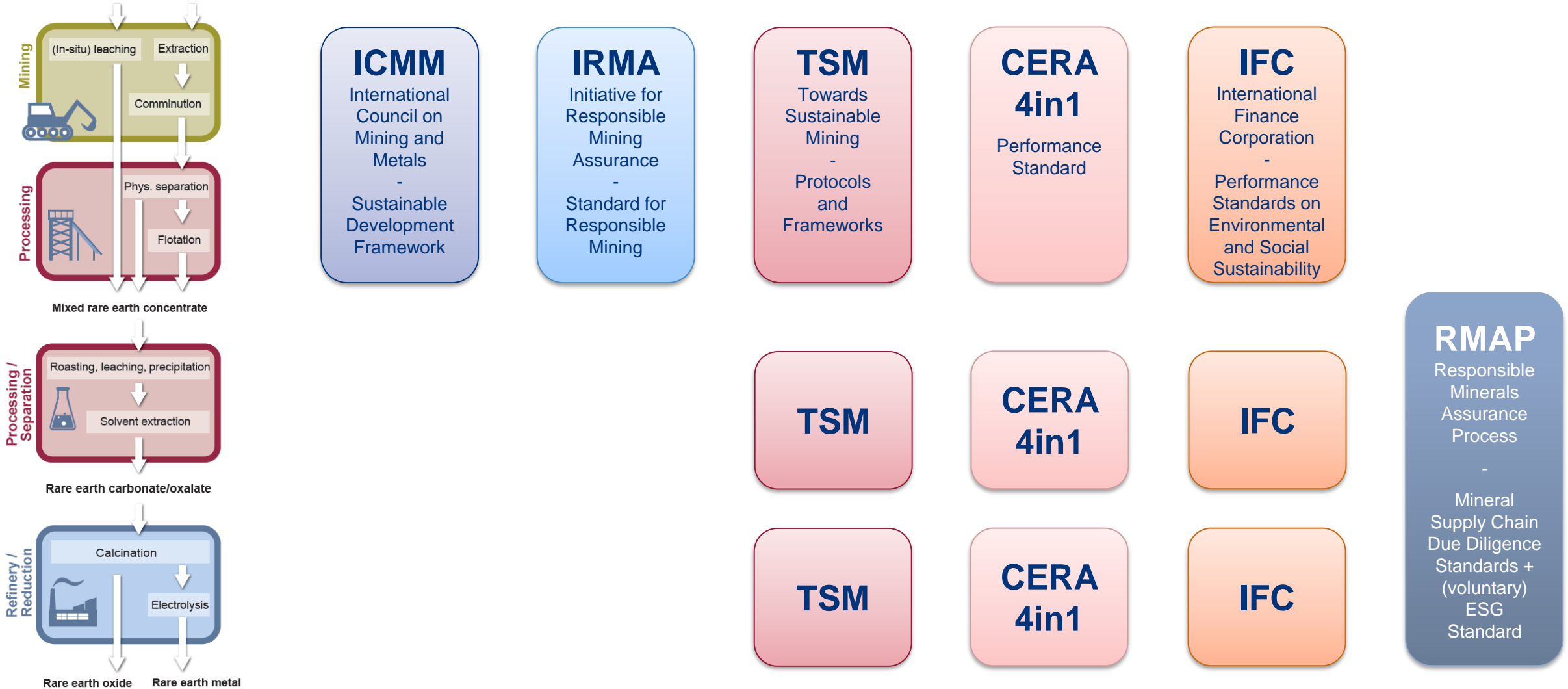
IRMA
Initiative for Responsible Mining Assurance
- Standard for Responsible Mining

TSM
Towards Sustainable Mining
- Protocols and Frameworks

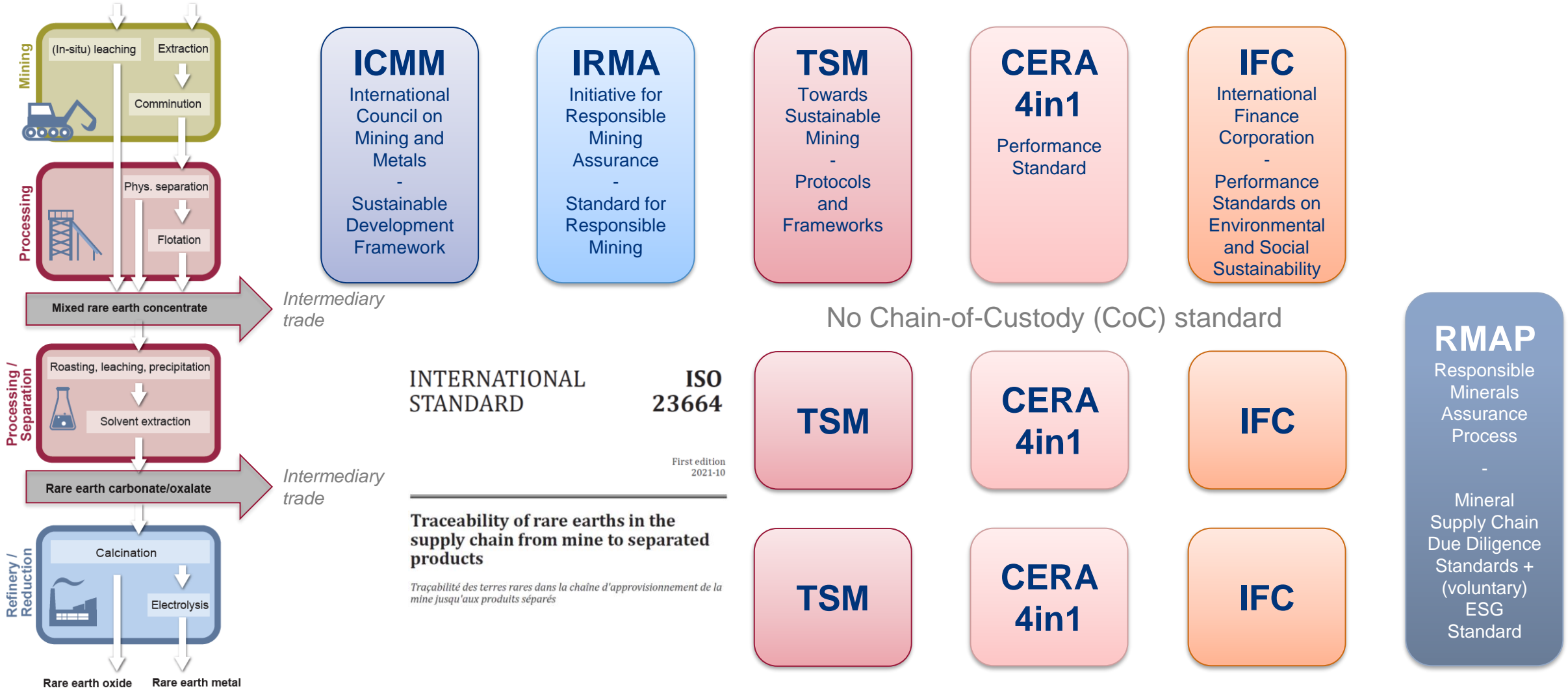
CERA 4in1
Performance Standard

IFC
International Finance Corporation
- Performance Standards on Environmental and Social Sustainability

General Applicability of Standard Systems* for the Rare Earth Supply Chain



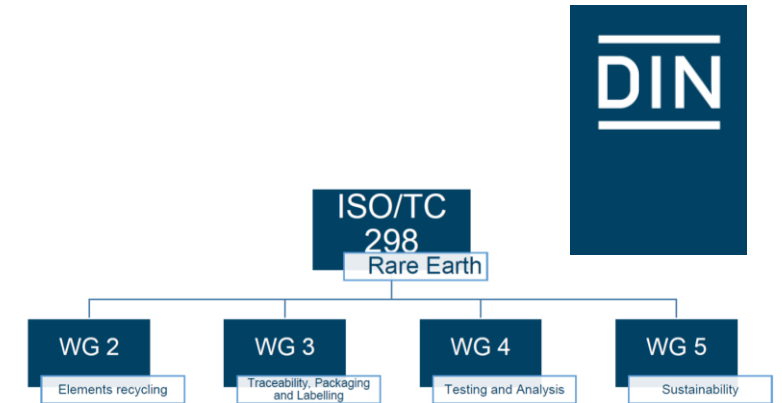
General Applicability of Standard Systems* for the Rare Earth Supply Chain



Current BGR Measures in the Field of Mining and Sustainability of Rare Earths

Participation in the DIN Rare Earths Working Committee

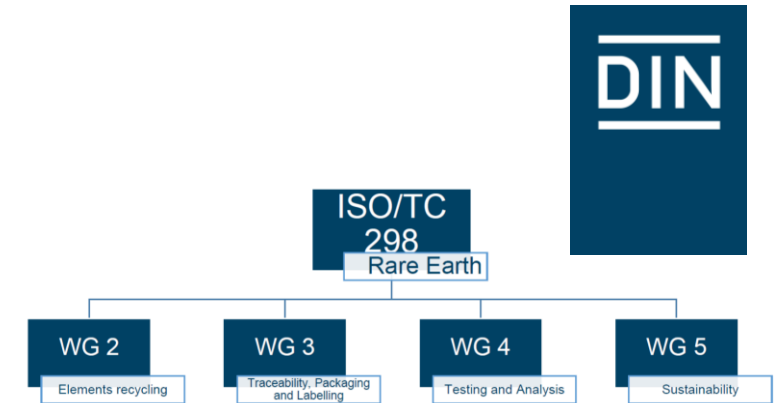
- Mirroring the work of the China-led ISO/TC 298 „Rare Earth“
- The topics of sustainability as well as traceability are the focus of the German mirror committee
- Contribution of German positions to international standard setting



Current BGR Measures in the Field of Mining and Sustainability of Rare Earths

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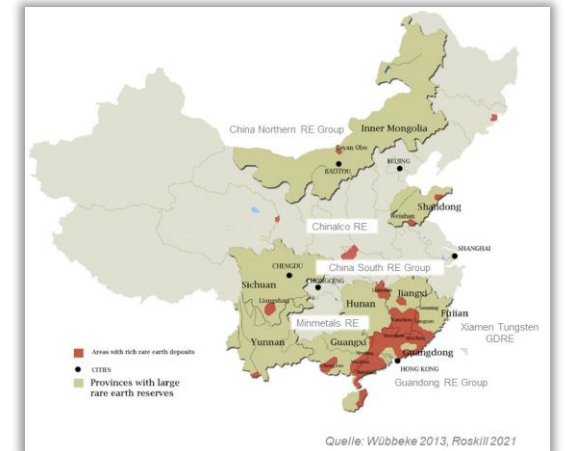
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Pilot measure on sustainability requirements in the rare earth supply chain

- A dialogue moderated by BGR and CCCMC* with the support of Berners Consulting between German companies and Chinese rare earth producers on sustainability criteria in the rare earth supply chain.
- Workshops with stakeholders to develop a common understanding of responsible supply chains and agree on a set of criteria based on legal requirements and standards of international sustainability initiatives.

*China Chamber of Commerce of Metals, Minerals & Chemicals Importers & Exporters





Thank you for your attention!

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