The cost of not-knowing: why technical expertise is critical for the security of supply of resources

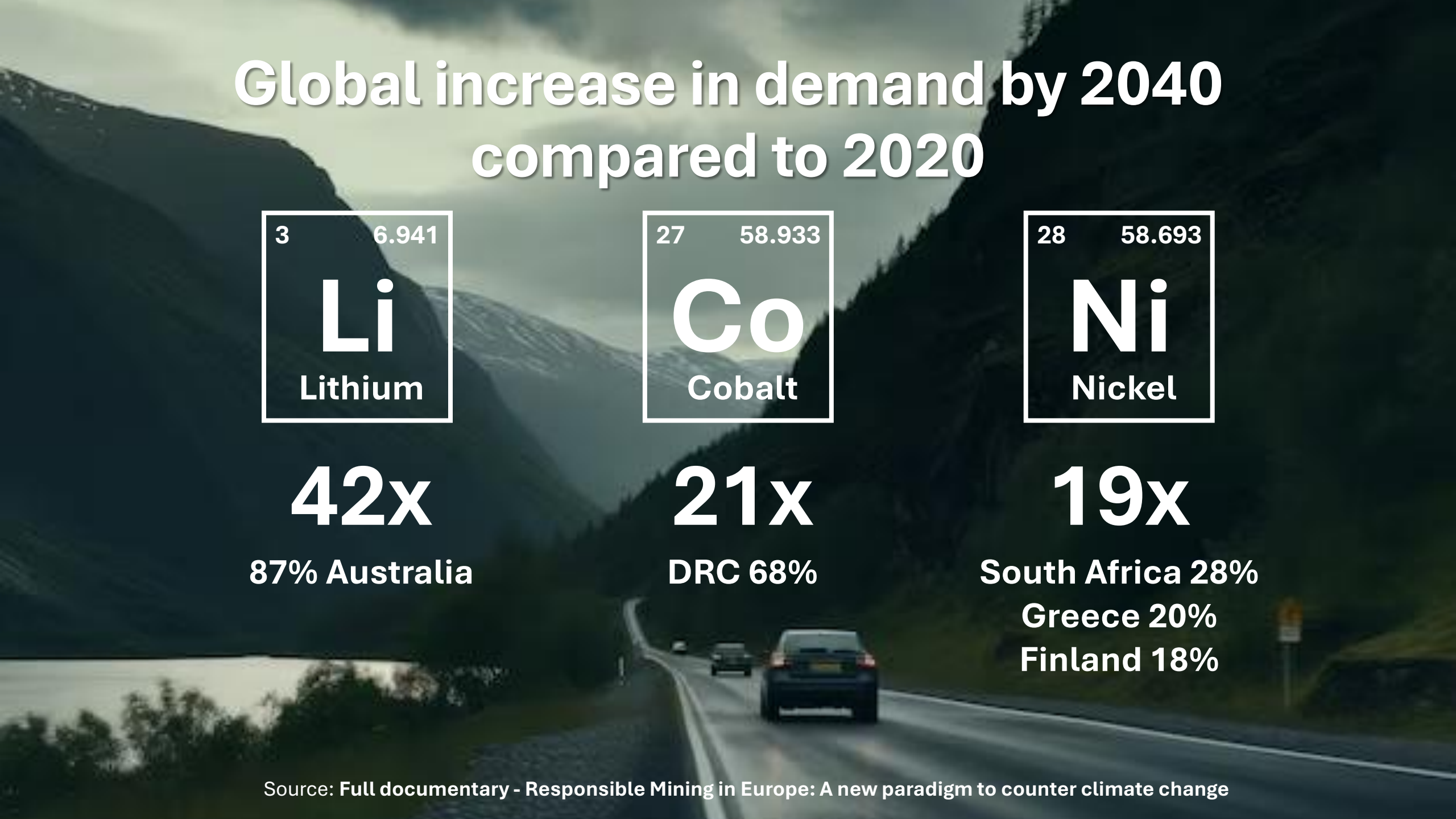
First National Theme Day on Circularity and Security of Supply of Resources

February 21, 2025 - ROMKE KUYVENHOVEN

Overview

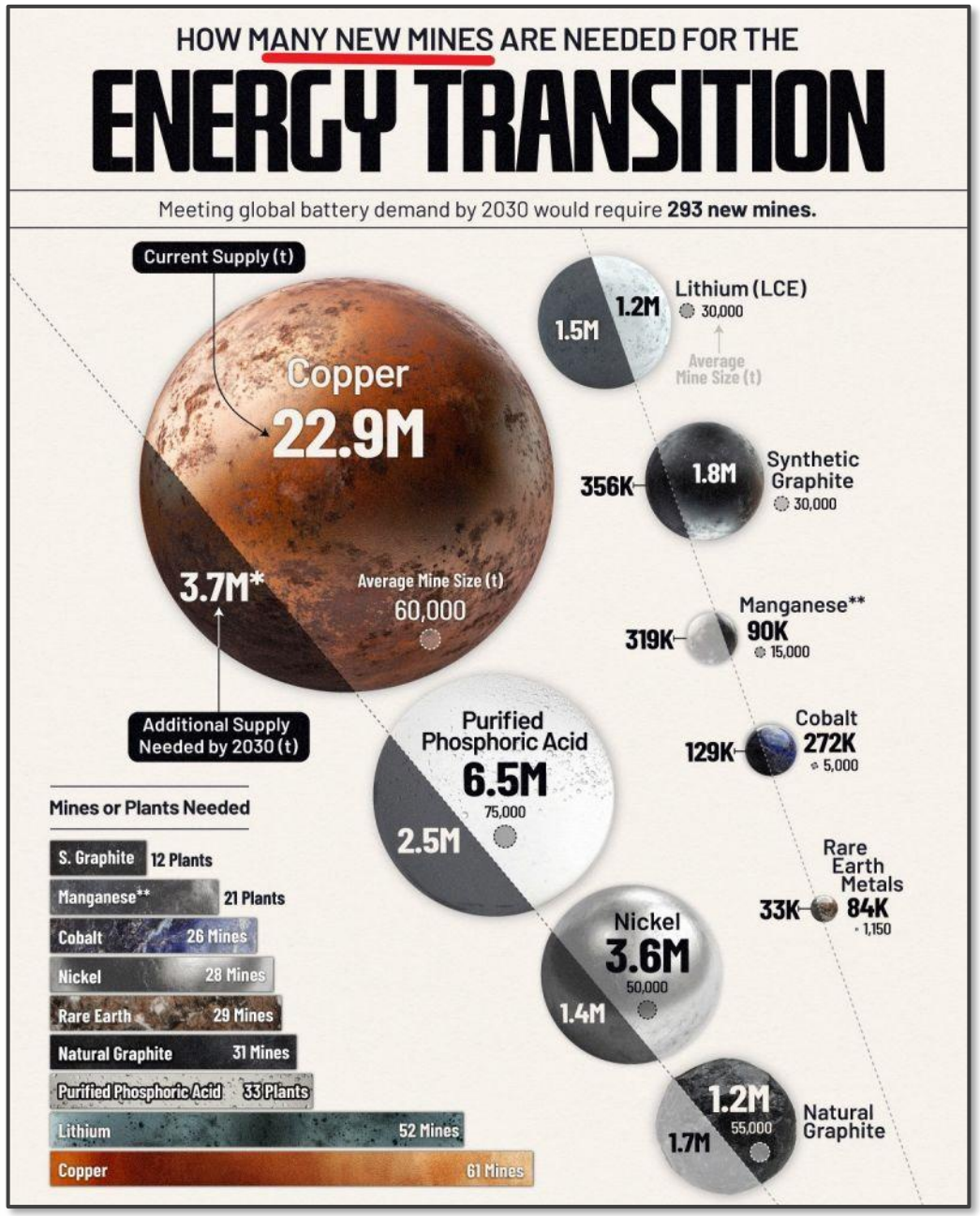
- Where do we stand today in raw materials demand
- Contribution of recycling to mitigate primary demand
- Conflict minerals & cobalt
- The cost of not-knowing
- The power of knowledge
- Opportunities in resource engineering

Global increase in demand by 2040 compared to 2020



3	27	28
6.941	58.933	58.693
Li	**Co**	**Ni**
Lithium	Cobalt	Nickel
42x	**21x**	**19x**
87% Australia	DRC 68%	South Africa 28% Greece 20% Finland 18%

Source: **Full documentary - Responsible Mining in Europe: A new paradigm to counter climate change**



Source: https://www.benchmarkminerals.com/

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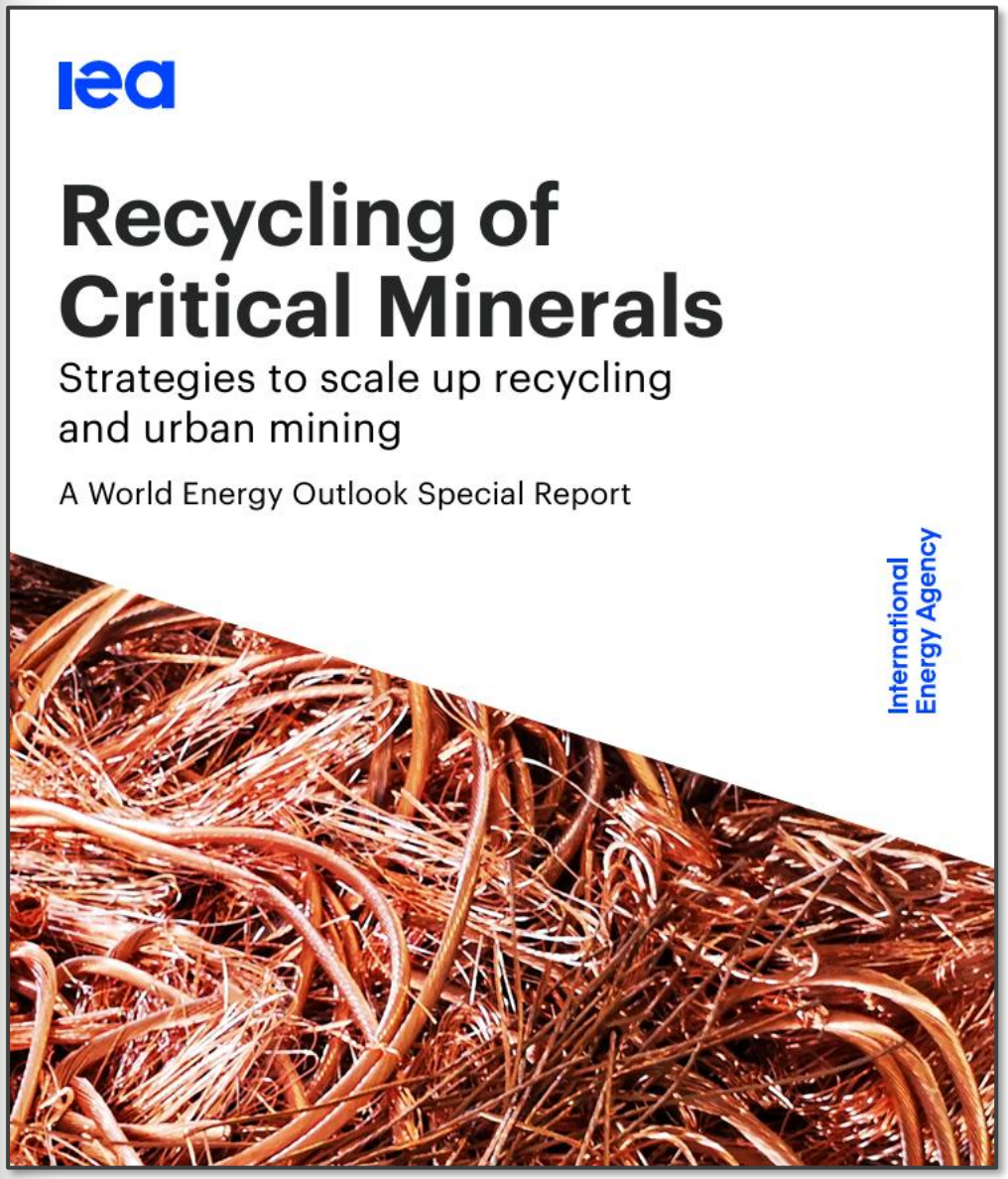
Copper can't be mined fast enough to electrify the US

Pima County Arizona copper mine. Image credit: Joyce Cory, CC BY 2.0, via Wikimedia Commons

https://news.umich.edu/copper-cant-be-mined-fast-enough-to-electrify-the-us

Conclusion #1

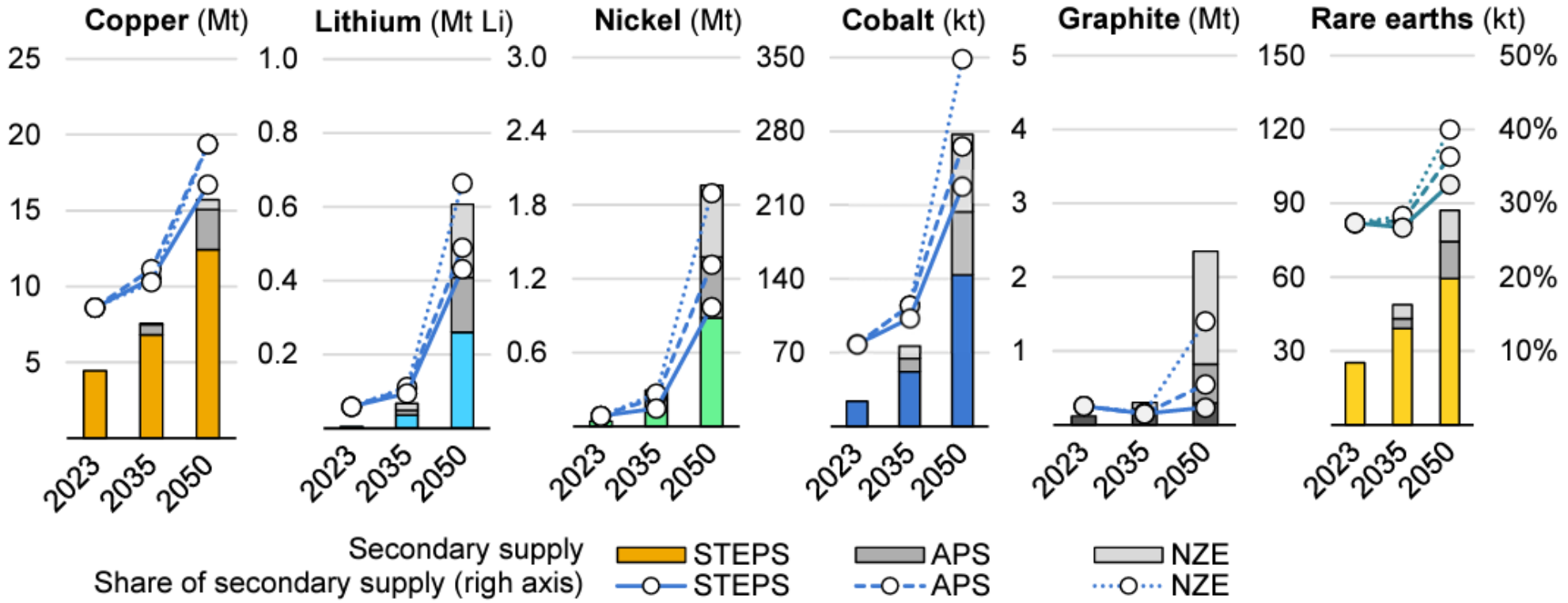
The world will need a lot of raw materials



"Despite growing policy ambitions, the use of recycled materials has so far failed to keep pace with rising material consumption"

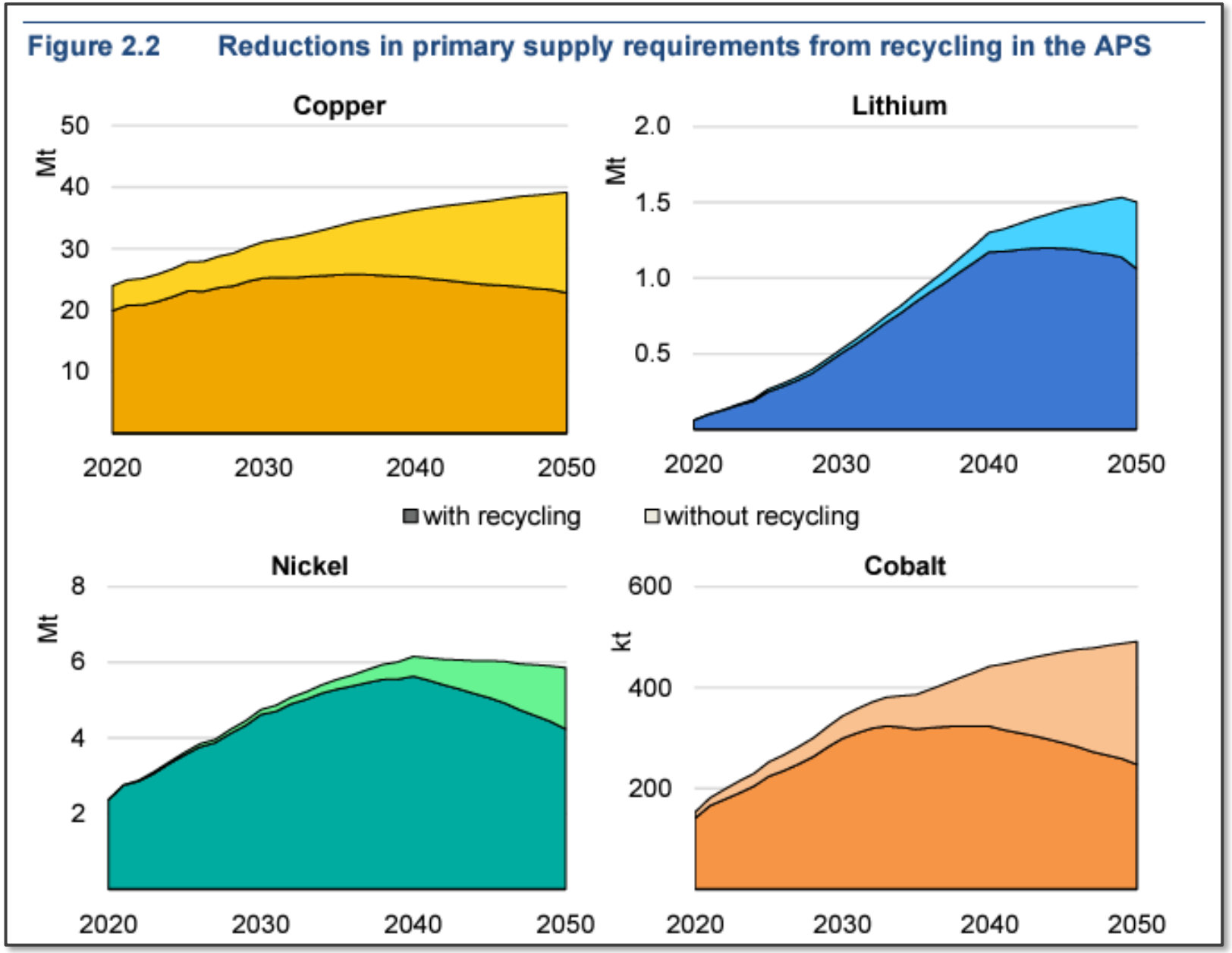
Source: International Energy Agency 2024, Recycling of Critical Minerals Strategies to scale up recycling and urban mining A World Energy Outlook Special Report

Figure 2.1 Secondary supply volumes and share of total demand for key energy transition minerals in the APS and NZE Scenario, 2023-2050



- Stated Policies Scenario (STEPS): This scenario is based on a detailed review of the current policy landscape
- Announced Pledges Scenario (APS): This scenario assumes that governments will meet all of the announced commitments
- Net Zero Emissions by 2050 (NZE) Scenario: : Normative scenario portrays a pathway to limit the global temperature rise to 1.5 °C

Source: International Energy Agency 2024, Recycling of Critical Minerals Strategies to scale up recycling and urban mining A World Energy Outlook Special Report



"A successful scale-up of recycling can lower the need for new mining activity by 25-40% by 2050 in a scenario that meets national climate pledges"

That means that 60-75% of raw materials will have to be obtained through primary mining

Source: International Energy Agency 2024, Recycling of Critical Minerals Strategies to scale up recycling and urban mining A World Energy Outlook Special Report

Conclusion #2

Recycling will only have a limited impact on the supply of raw materials

European Commission

EN

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Conflict Minerals Regulation

Source: https://policy.trade.ec.europa.eu/development-and-sustainability/conflict-minerals-regulation_en

Conflict Minerals Regulation: The regulation explained

On 1 January 2021 a new law came into full force across the EU – the Conflict Minerals Regulation

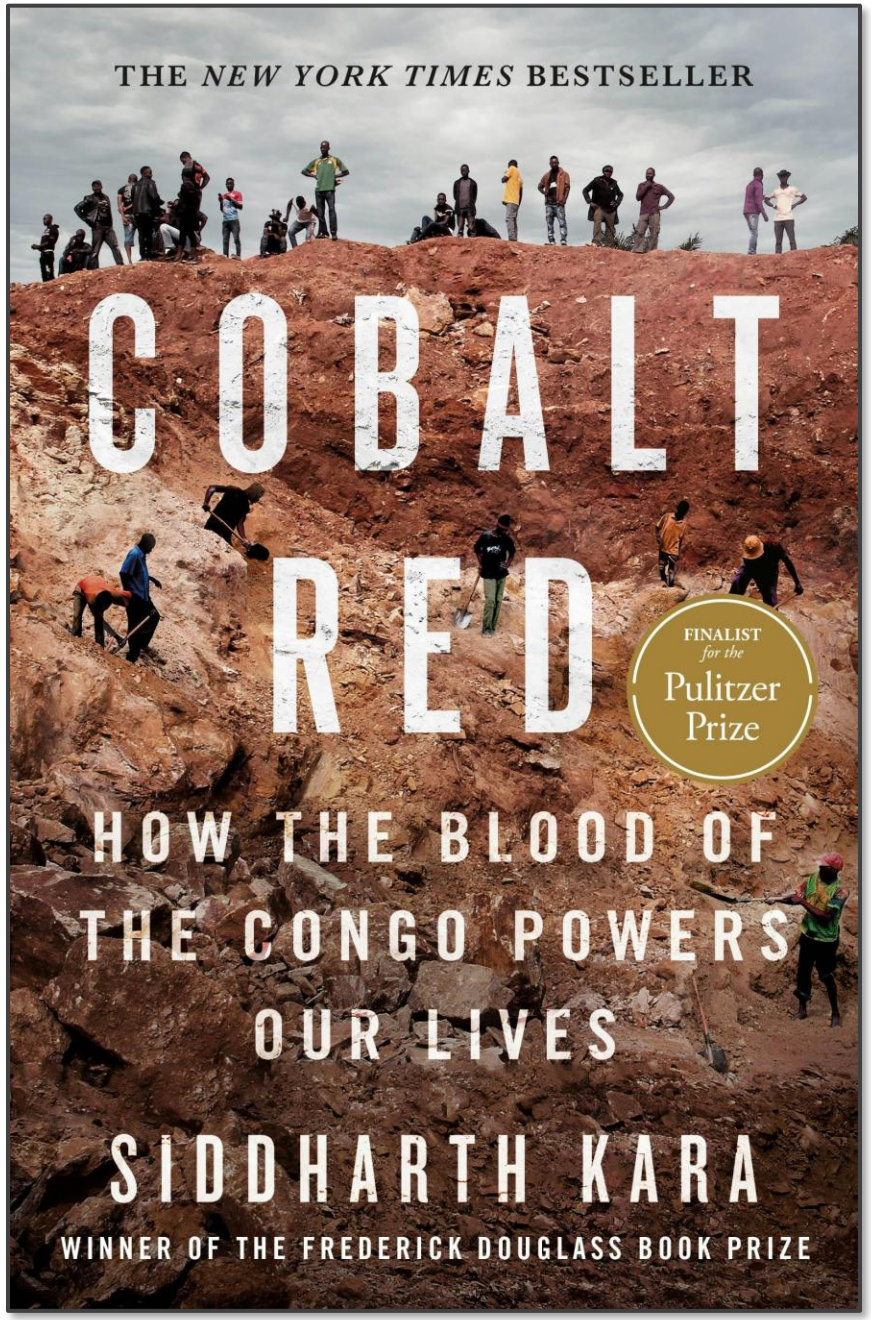
What are 'conflict minerals'?

- In politically unstable areas, the minerals trade can be used to finance armed groups, fuel forced labour and other human rights abuses, and support corruption and money laundering.
- These so-called 'conflict minerals' such as tin, tungsten, tantalum and gold, also referred to as 3TG, can be used in everyday products such as mobile phones and cars or in jewellery.
- It is difficult for consumers to know if a product they have bought is funding violence, human rights abuses or other crimes overseas.

Which countries do conflict minerals come from?

- The countries or areas considered to be conflict-affected or high-risk are those:
- Whose natural resources include minerals which are in high demand, either locally, regionally of globally, and, are either suffering from armed-conflict, such as civil war, a state of fragile post-conflict, or witnessing weak or non-existing governance and systematic violations of international law, including human rights abuses.


© Siddharth Kara



"I **never saw or heard of any activities** in DRC linked to the Responsible Minerals Initiative or the Global Battery Alliance **to assure ethical supply chains**."

"The titanic companies that sell products containing Congolese cobalt are worth trillions, yet the people who dig the cobalt out of the ground are characterized by **extreme poverty and immense suffering**."

"The informal and all but untraceable nature of the marketplace makes it **impossible to discriminate the source of cobalt** being processed at industrial facilities."

Conclusion #3

Conflict minerals will eventually even further limit supply

The cost of not-knowing

Impossibility to assure responsible sourcing

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NEWS

Are children mining cobalt for Tesla? Tesla doesn't know

Elon Musk promised to install a webcam to monitor a mine in real time, but that's been walked back to a single blurry satellite image every month

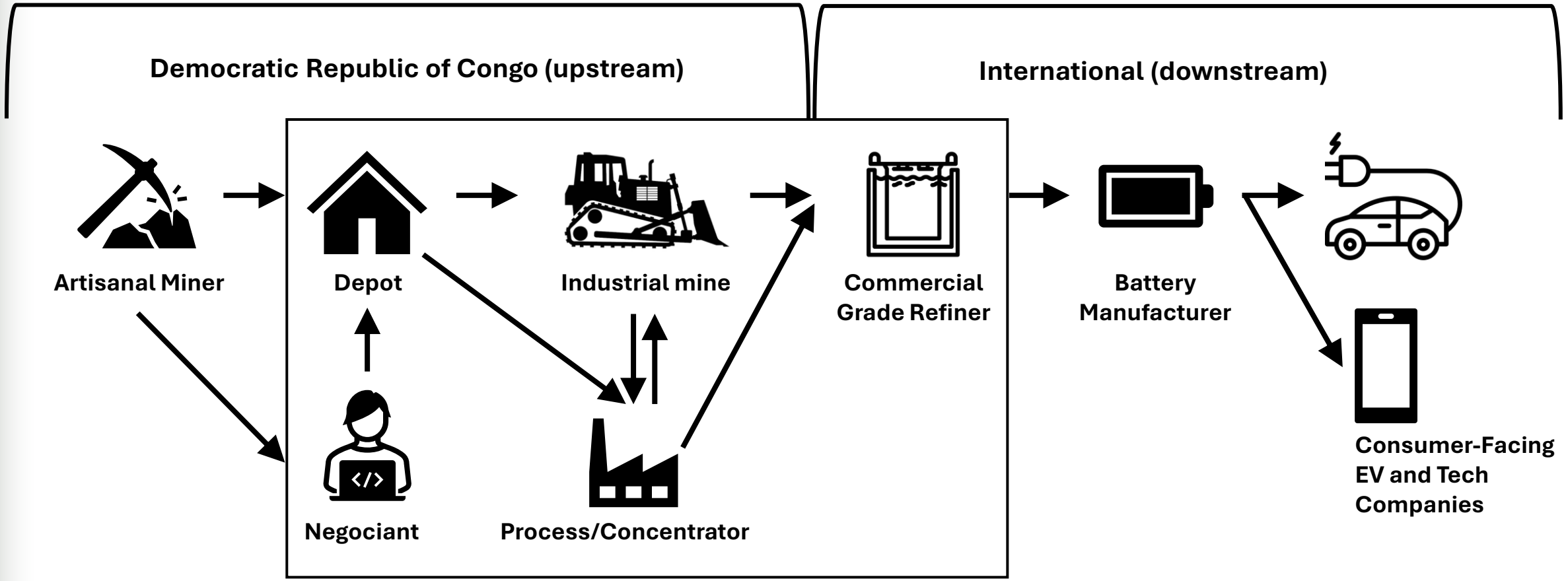
By Bradley Brownell / Jalopnik Published July 2, 2024

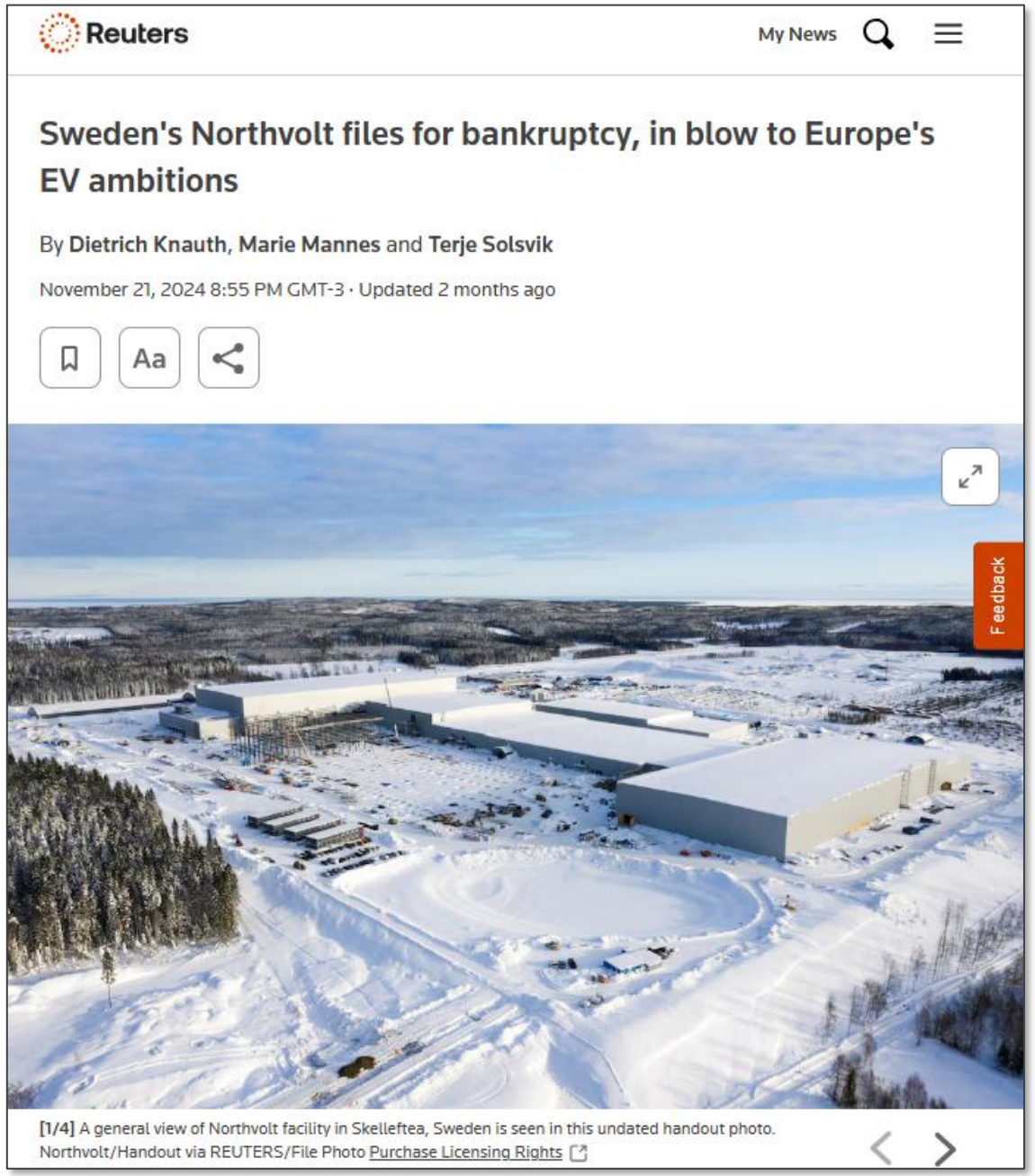
Image: Junior Kannah (Getty Images)

Source: https://qz.com/tesla-cobalt-mining-ev-batteries-child-labor-elon-musk-1851572456

From toxic pit to shiny showroom

Cobalt Red – Siddharth Kara (page 21)





The cost of responsible sourcing…?

June 2023, Northvolt Supply Chain Officer:

"We are looking for cobalt that does not come from Congo and that is not funded by Chinese capital"

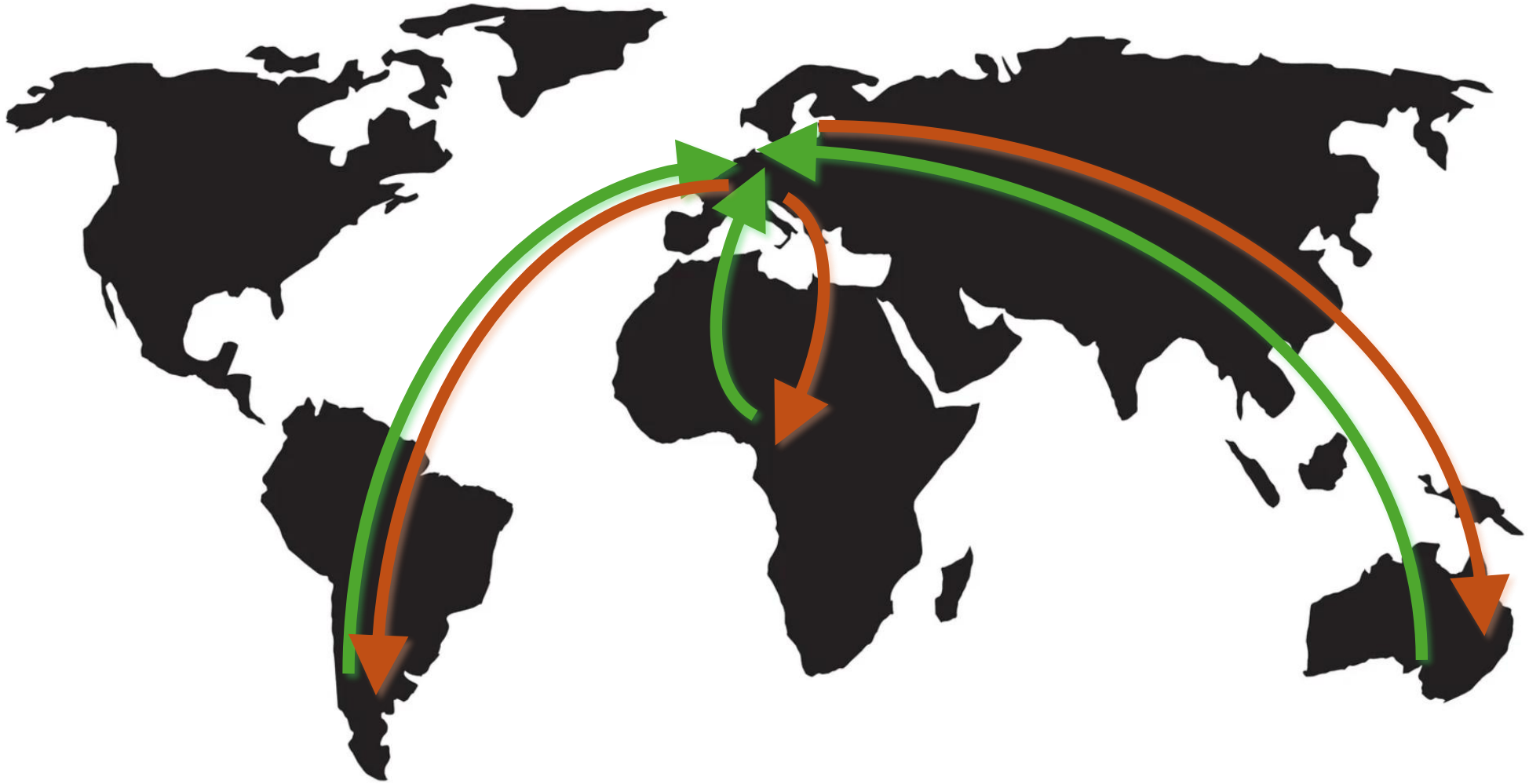
Source: https://www.reuters.com/technology/northvolt-files-chapter-11-bankruptcy-us-2024-11-21/

The risk of missing out on good opportunities

…when you think your country is the center of the world…

The risk of missing out on good opportunities

Import critical knowledge, export (non-mining) Dutch technologies



Conclusion #4

Not-knowing could lead to poor and/or questionable business decisions

Confusion of public opinion…

Embassy of the Kingdom of the Netherlands in Santiago de Chile
3,755 followers
19h •

Ayer la embajadora Elke … de Minería, Aurora Willia… colaboraciones entre Chile y Países Bajos, por ejemplo:

1. La innovación tecnológica y colaboración académica
2. Reprocesamiento de relaves y de la minería circular
3. Desarrollo de prácticas para reducir…
4. Difundir los altos estándares de la minería chilena en cuanto la producción responsable

Muy agradecidos por la instancia y…

Ministerio de Minería, Rodrigo …

"We spoke about shared interests and possible collaboration such as…the reprocessing of tailings and secondary mining…and the development of best practices to reduce water footprint in mining in Chile"

Embassy of the Kingdom of the Netherlands in Santiago de Chile
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La semana pasada nuestros colegas visitaron el pueblo de Andacollo, Coquimbo para conocer más sobre la relación entre el pueblo y la minería. Andacollo ha sido un pueblo minero y hoy en día es el pueblo Latinoamericano con mayor cantidad de relaves inactivos (120), que son un peligro para la comunidad. Hablamos con distintos actores, como las autoridades locales, la minería, la academia y la sociedad civil. En los Países Bajos creemos en un seminario en Andacollo para reflexionar juntos con los diferentes actores los problemas y…

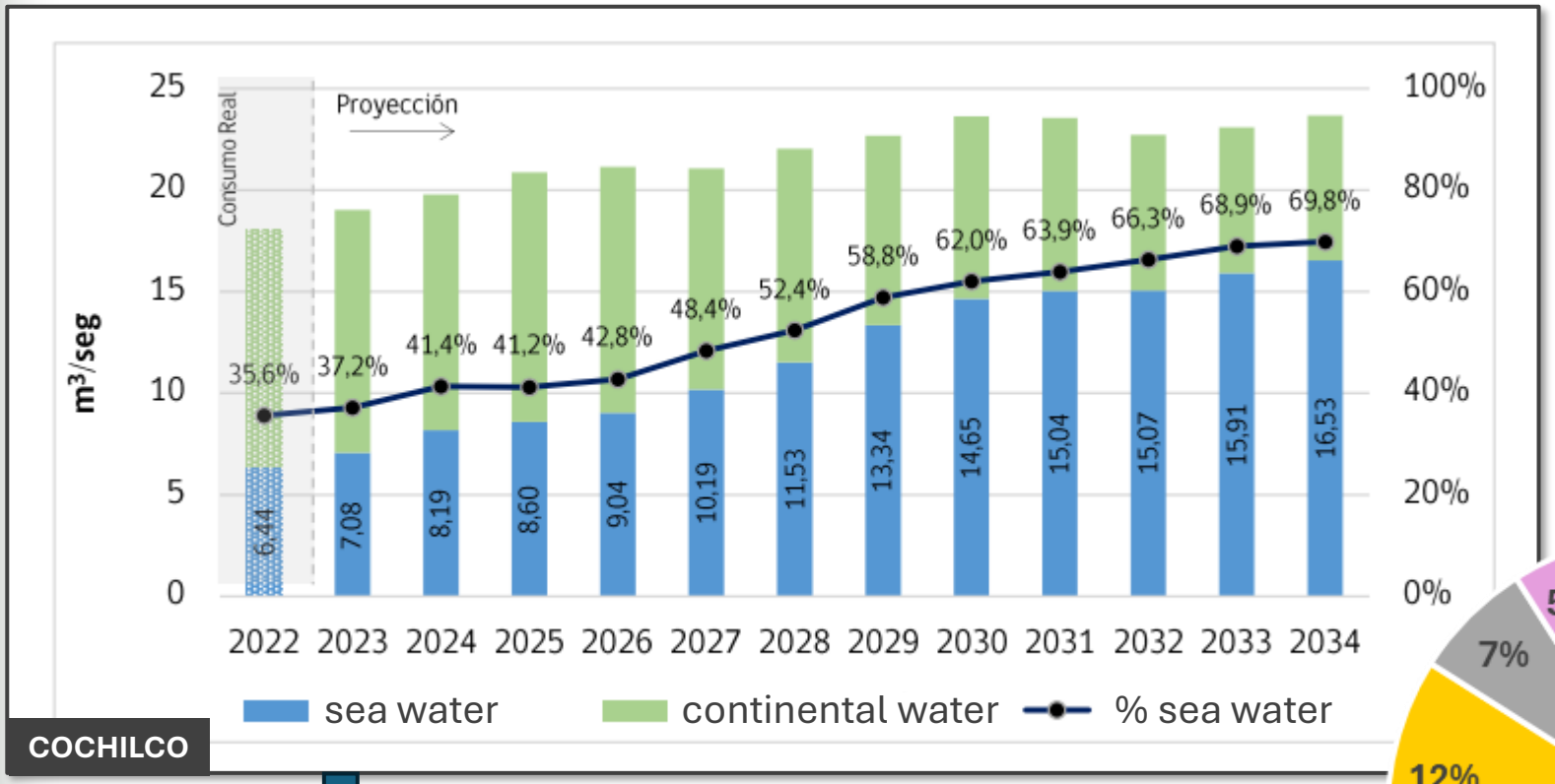
Este viernes siguieran este dialogo en un seminario en Andacollo para reflexionar juntos con los diferentes actores los problemas y…

Muchas gracias por realizar nuestra visita Eduardo Duarte Yañez Felix Quartero Frans Janssen Maya Pineda Jacobs

Foto 1: Un relave (la montaña) a lado de un parque
Foto 2: Conociendo cómo funciona una mina abierta
Foto 3: La mina y el pueblo

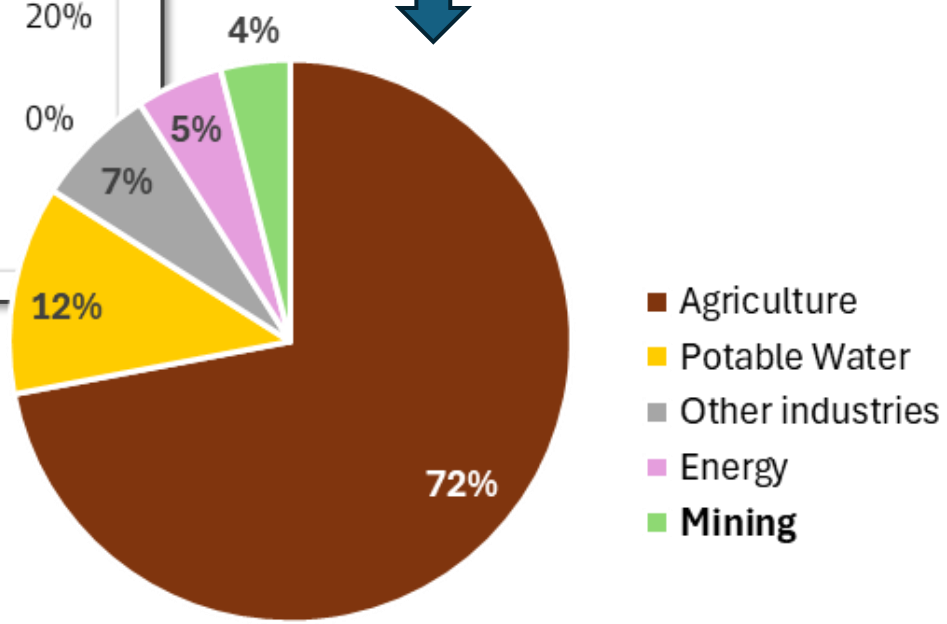
"We spoke to local authorities, the mining, the academia and the civil society. In The Netherlands we believe that it is important to create opportunity for a dialogue between these parties"

...and being misinformed?

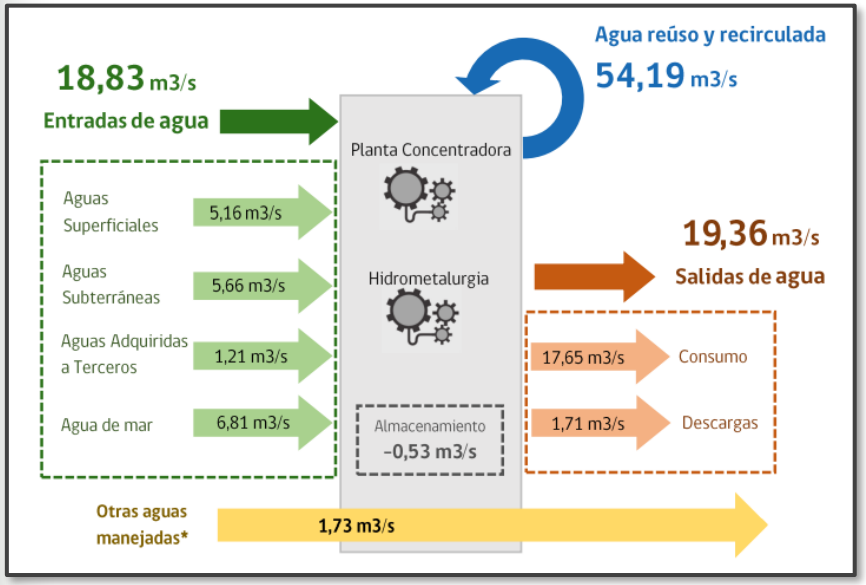


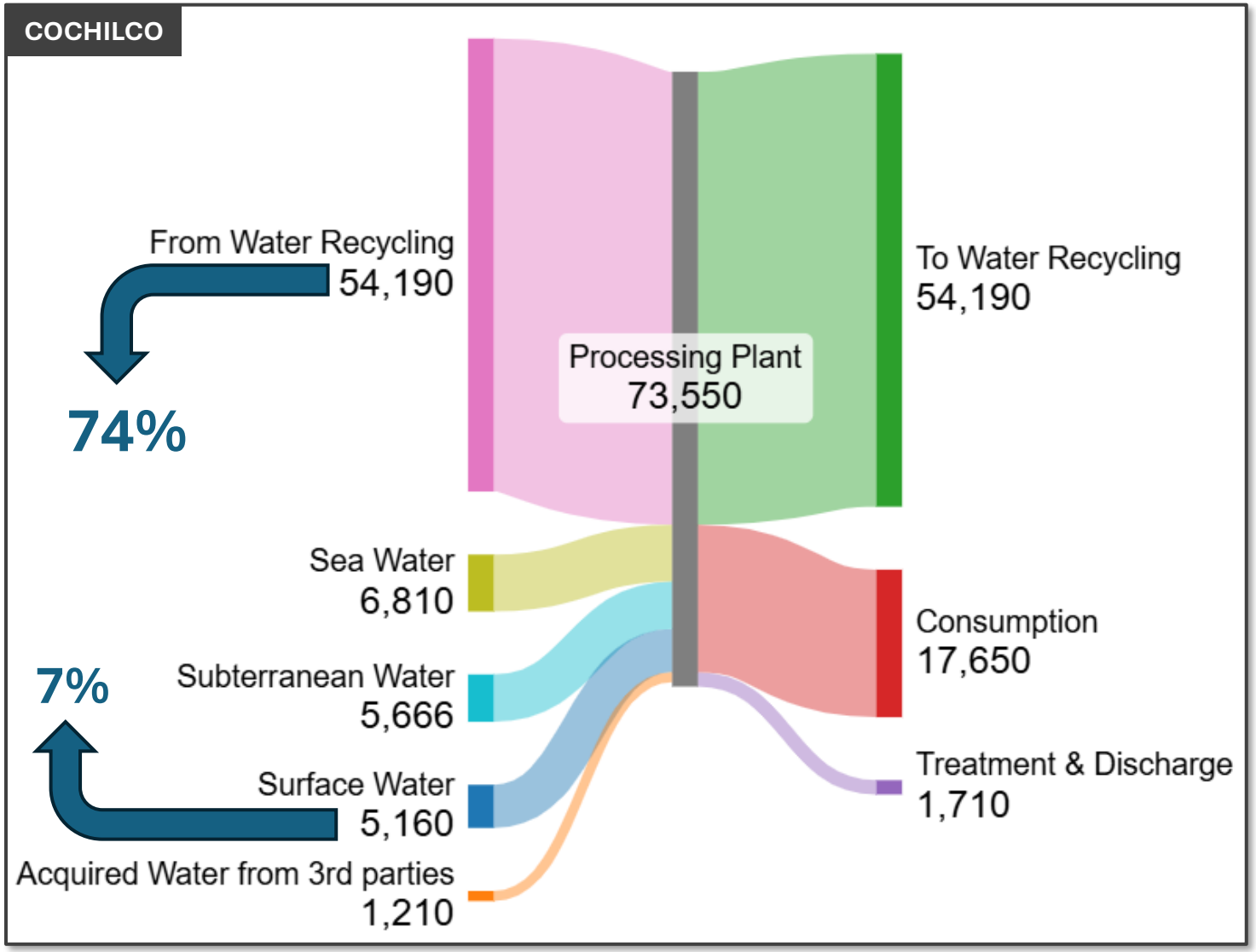
Estimated consumption of sea water vs continental water in mining

Water consumption in Chile per industrial sector



Current water recycling in Chilean mining





ICMM president Rohitesh Dhawan signals Chile as world reference in sustainability in mining: “Chile is probably 10 or 20 years ahead of the rest of the world”

Consejo Minero De Chile A G
38,079 followers

May 10, 2024

Confusion of public opinion

Dutch embassy participating in anti-mining movement

https://investigacolina.org/

Conclusion #5

Not-knowing could mean damaging the image of The Netherlands

“You don’t get a second chance to make a first impression”

Knowledge is critical – for critical raw materials

The Netherlands does not (seem to) have relevant potential for commercial production of critical & strategic raw materials

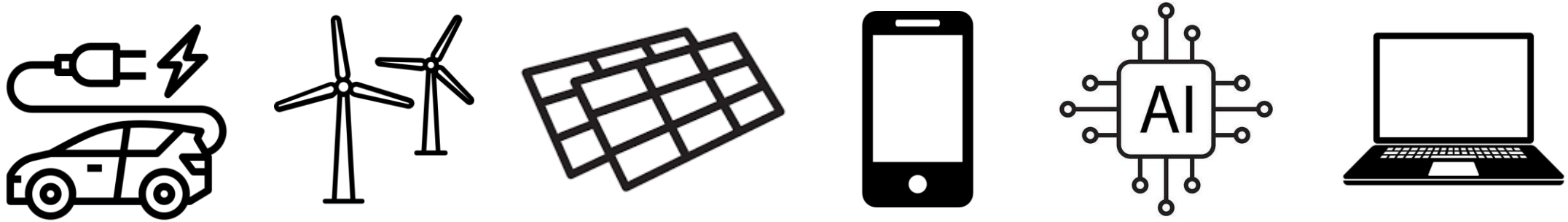
1. Because of the absence of geological resources
2. Because of legal & environmental restrictions
3. Because of the absence of the required skills & knowledge

So, what is actually the issue then?

What should we do?

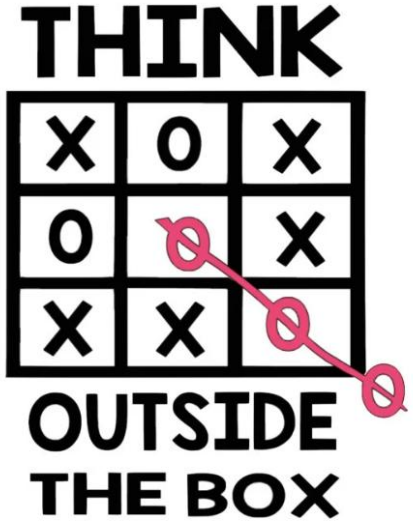
Why would we need knowledge & expertise in resources extraction & processing

Assure responsible sourcing



- Not: from where do we import our consumer goods
- But: where and how were the raw materials obtained that were used to manufacture our consumer goods

Strengthen strategic position of The Netherlands



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How Japan solved its rare earth minerals dependency issue

Oct 13, 2023

A rare earth minerals site in Inner Mongolia.
Image: Reuters

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SUPPLY CHAIN

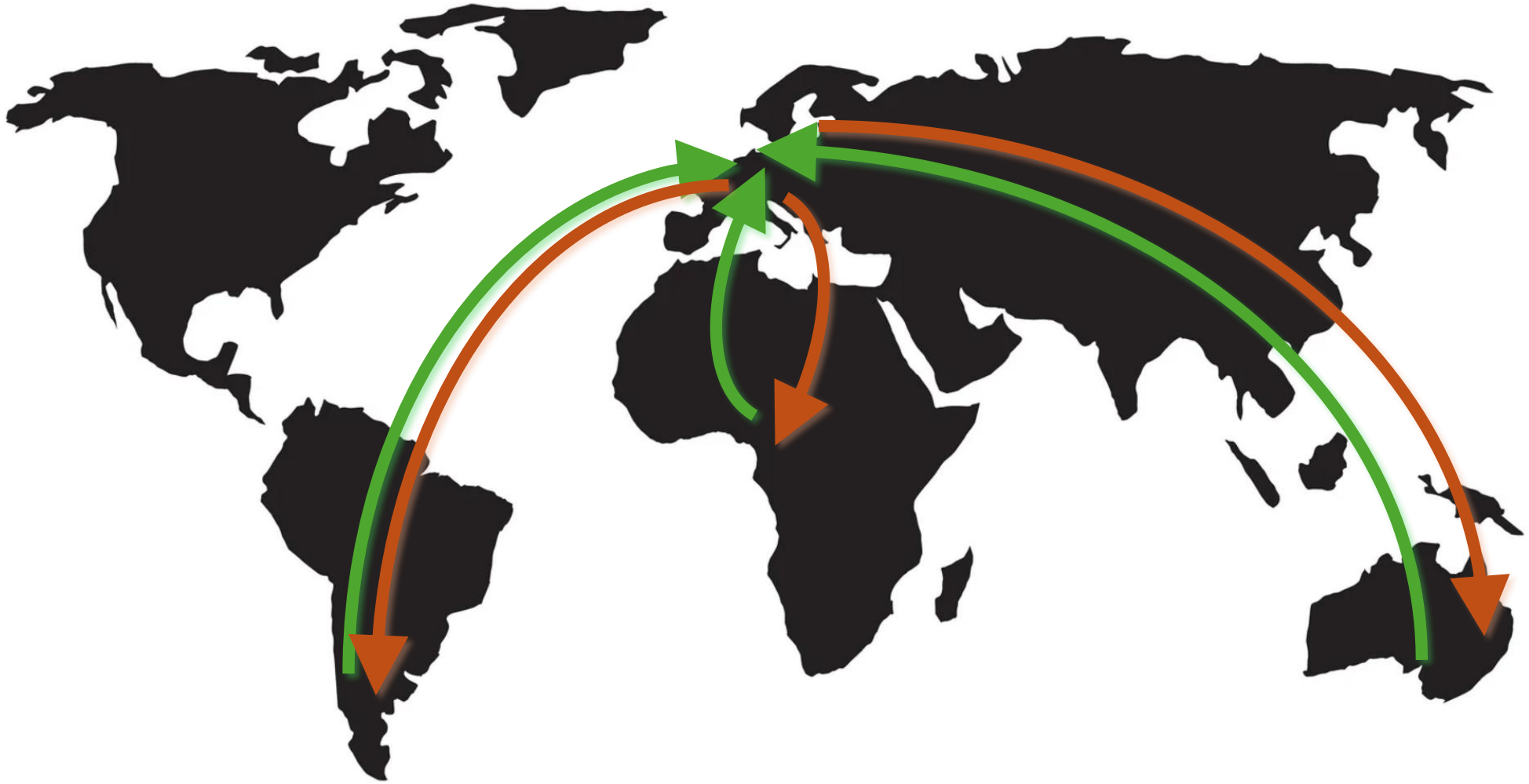
Japan to raise cap on state backing for copper mine stakes to 75%

JOGMEC aims to reduce private sector's risk exposure, secure supplies

Copper is a key resource for building infrastructure, such as transmission wires. © Reuters

DAISHI CHIBA, Nikkei staff writer
June 6, 2024 03:12 JST

Import what's needed & export what's valuable



Conclusion #6

Knowledge is required to become a sustainable society

The role of resource engineering

Step 1: Educate for the future

Top reasons to study Erasmus Mundus Joint Master in Sustainable Mineral and Metal Processing Engineering

- A unique opportunity to study mineral and metal processing in four countries: Finland, Austria, Croatia, and Chile.
- Top-level mineral processing laboratories, pilot plants, analytical equipment and recognized scholars and experts.
- Work-life related studies in close cooperation with the mining industry. Internship and thesis opportunities offered to students.
- Strong ties with the processing industry and a cluster of 31 mining companies.
- Programme coordinated by the University of Oulu, ranked within the top 76-100 universities in Mining & Mineral Engineering in Shanghai Ranking´s Global Ranking of Academic Subjects 2023

https://www.oulu.fi/en/apply/erasmus-mundus-joint-master-sustainable-mineral-and-metal-processing-engineering

Step 2: Educate for the future **at TU Delft**

- TUDelft covers (practically) all relevant fields of engineering to enhance **Circularity and Security of Supply of Resources**
- Current technological developments in the world require cross-disciplinary approaches
  - Resource engineering
    - Primary, from mining operations, and secondary, from tailings or waste
  - Chemical, materials & metallurgical engineering
    - To sustainably extract metals from primary, secondary or tertiary (urban waste) sources
  - Life Cycle Assessment & Circular Engineering
    - To assess carbon footprint and thermodynamical limitations to recycling processes

Actively participate in collaborative RDi

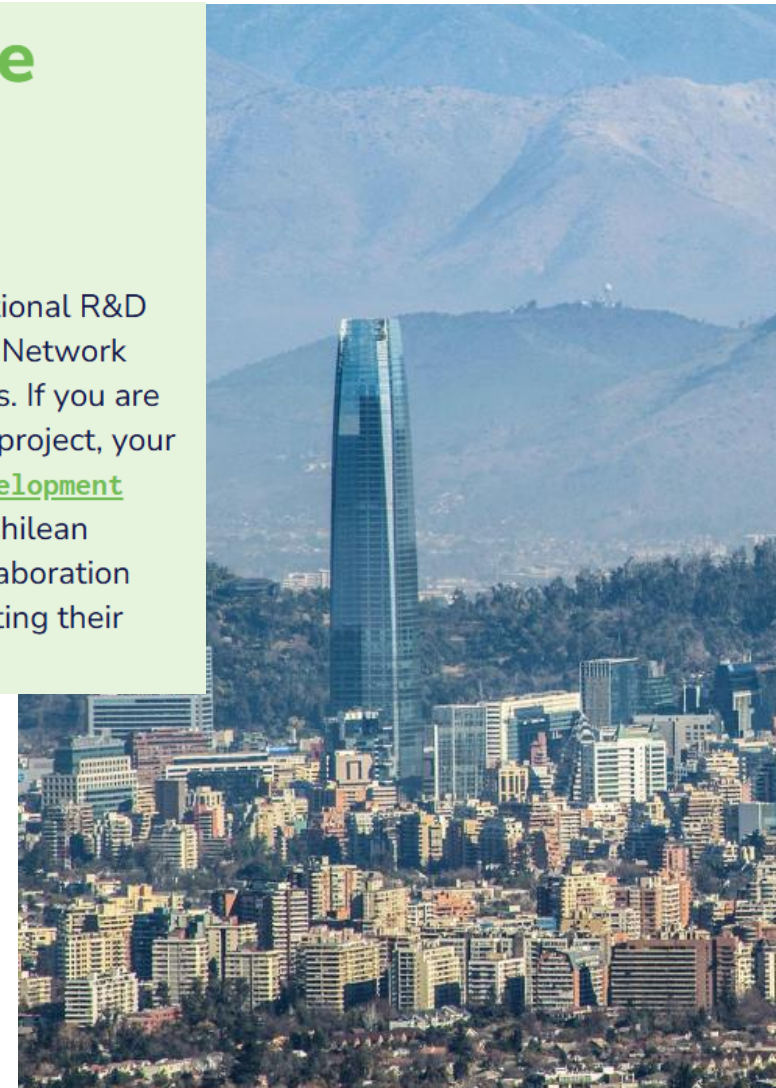
https://www.sernageomin.cl/plataforma-publica-de-relaves/

Eureka and Chile

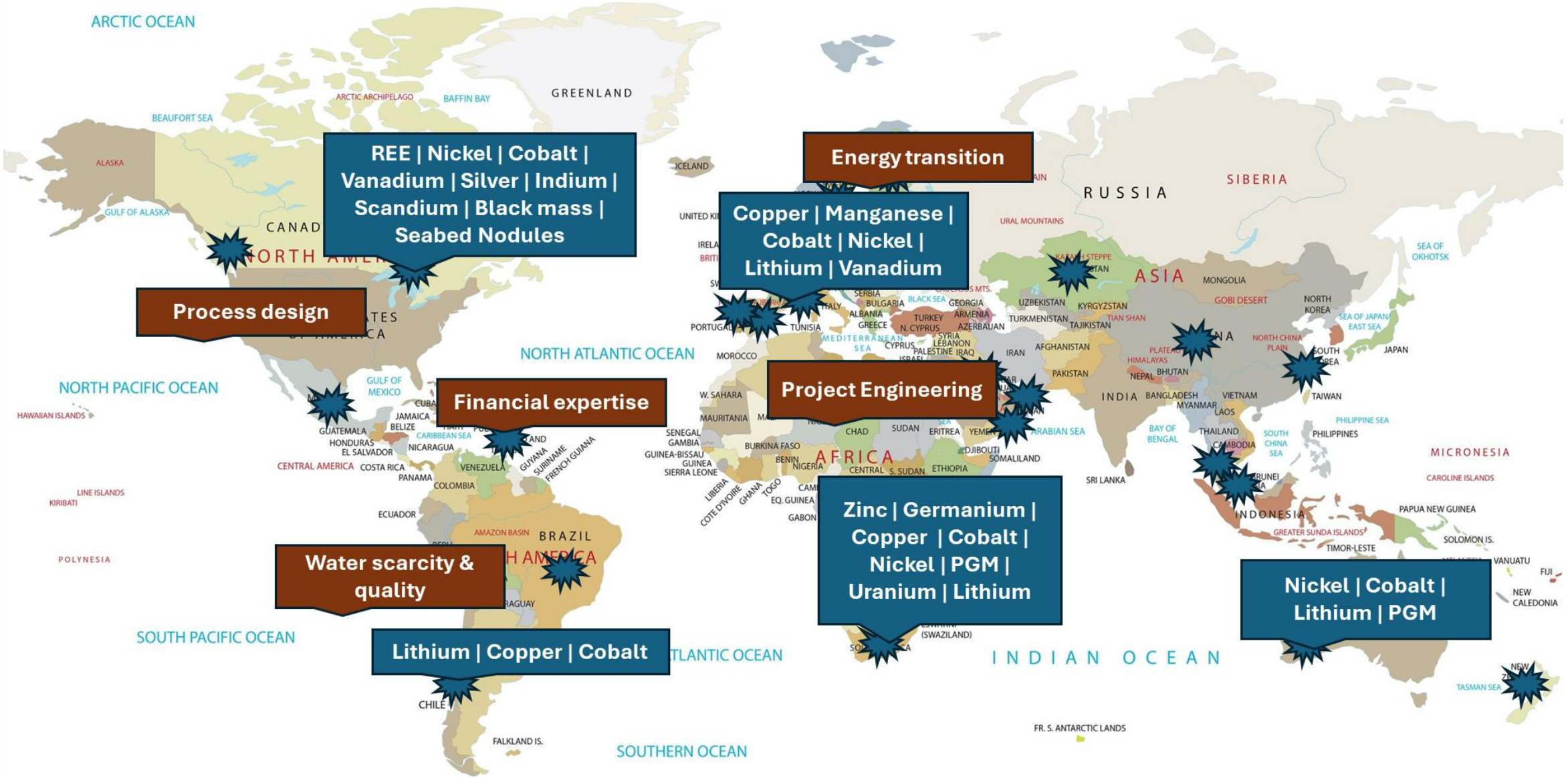
Change country

Chilean organisations participating in international R&D projects are eligible for funding through our Network projects, Globalstars and Clusters programmes. If you are based in Chile and seeking funding for an R&D project, your first point of contact is with Production Development Corporation (CORFO). CORFO supports Chilean organisations interested in international collaboration giving them access to expertise and supporting their growth.

https://eurekanetwork.org/



Current TUDelft engineers active in resource industry



Actively use the TU Delft alumni network around the world

- …and in The Netherlands!
  - Who are the mining & metallurgical engineers that are currently assisting the Dutch government?
- To identify internships and research opportunities in “mining” countries
  - Canada, Australia, Chile, Peru, South Africa, and many more
- Involve “local” TUD alumni on the ground when exploring export opportunities for new businesses…and also involve Dutch students in those efforts!
- To give feedback on “beyond mining” activities that could benefit from Dutch knowledge & expertise

Final Conclusion

The right time is now.
Invest in education and research.

“Stop talking and start doing”