MTM CRITICAL METALS

FLASH JOULE HEATING: A NEW ERA OF SUSTAINABLE METAL EXTRACTION

COSM A Technology Summit

PRESENTATION AT COSM 2024, SEATTLE WA

04 November 2024

ASX: MTM

Overview

- **MTM Critical Metals Ltd** is an ASX-listed emerging Industrial Technology Company at the forefront of innovation in the critical minerals and metals sectors.
- We are committed to advancing the commercialisation of our sustainable Flash Joule Heating (FJH) metal recovery and processing technology, and **re-shoring Critical Metals supply back to the USA**.

Core Technology	• **FJH** revolutionises metal extraction from ores & waste, allowing more efficient processing compared to traditional methods • Applications in Minerals Processing & Waste Streams (mine tailings, bauxite residue (red mud), e-waste and battery recycling), significantly contributing to a circular economy • Licenced (worldwide & exclusive) from Rice University, Texas
Commercial Focus	• **Industrial Validation:** Design underway for **1-ton-per-day FJH Demonstration Plant** • **Primary Metal Focus: gallium (Ga)** from waste streams & **lithium** from spodumene concentrate, aligning with current global demand & strategic importance • **Commercial production of Ga** expected by Q4-25, positioning MTM for transformative growth & potentially **re-shoring Ga in the U.S.**, addressing a major national security risk

MTM: Australia & U.S. Presence

KNIGHTHAWK ENGINEERING

ENGINEERING DESIGN & SCALE-UP

Houston, Texas, USA

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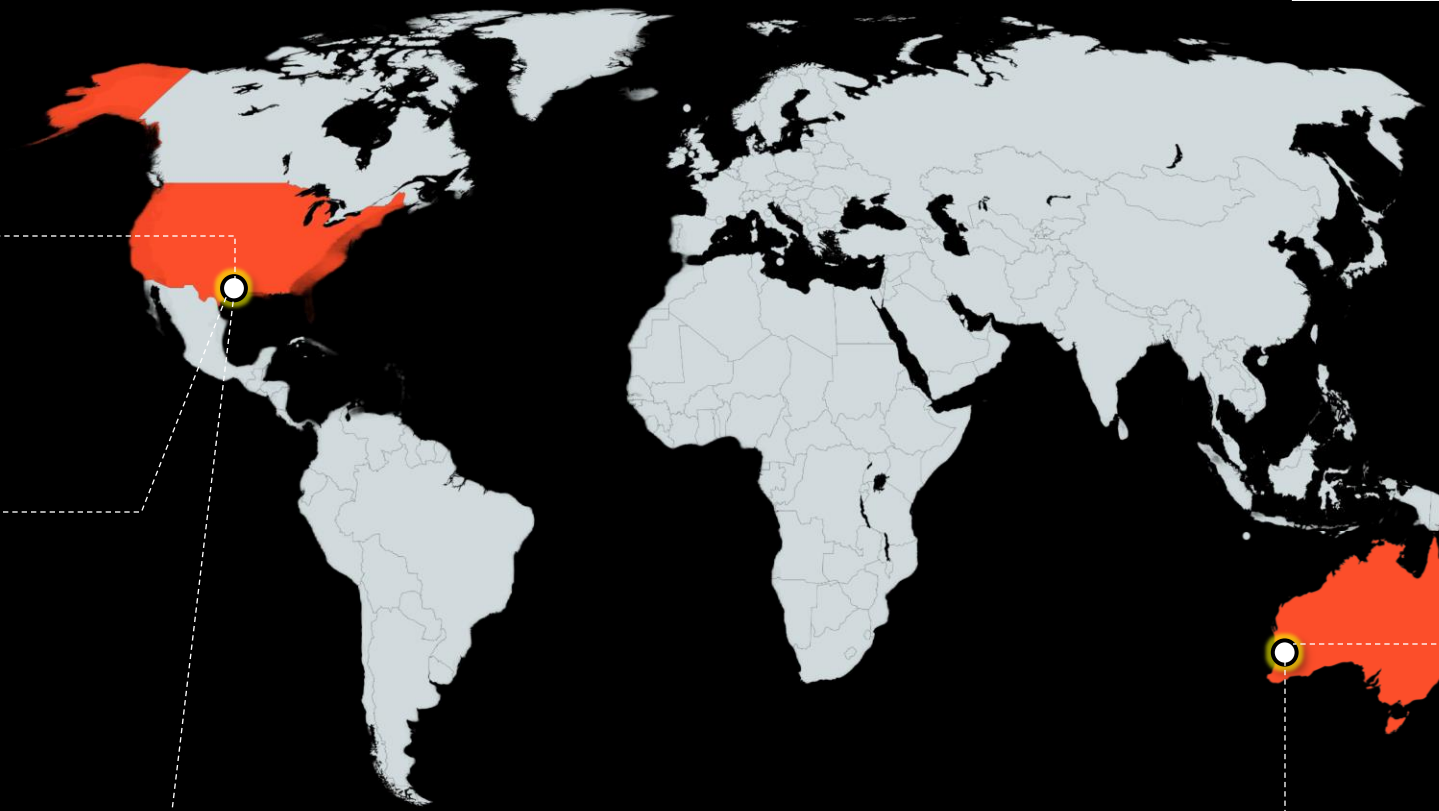
Flash Metals USA HQ (MTM)
Houston, Texas

RICE UNIVERSITY

FJH PIONEERS / R&D

Houston, Texas, USA



Perth Australia

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MTM HQ
Perth Australia

MTM has a Global Licence Agreement for FJH with Rice University

KnightHawk was founded in 1991 and specializes in bespoke engineering design solutions

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MTM: How can I Buy Shares?

- MTM is listed on the Australian Stock Exchange (Ticker ASX: MTM)
- The Company is exploring options to undertake a U.S. listing via the over-the-counter (OTC) markets, operated by OTC Markets Group (OTCQB). This is expected to be finalised in the coming weeks

OTCQB:
Coming Soon

ASX

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Coming Soon: U.S. listing of shares through OTC Market

- In the U.S., there is a substantial pool of capital and strong investor demand for opportunities that integrate **Natural Resources / Metals** with cutting-edge **Technology**.
- The Company is exploring options to undertake a U.S. listing via the over-the-counter (OTC) markets, operated by OTC Markets Group (OTCQB). This is expected to be finalised in the coming weeks.

Advantages:

- Tap into the largest pool of capital, across the full spectrum of U.S. investors including high net worth and investment funds
- Enhanced liquidity with trading volumes settled via ASX
- Leverage ASX listing qualifications to meet OTC listing requirements, enabling U.S. compliance without the high costs associated with full NASDAQ or NYSE listings (at this stage)
- Market information is directly disseminated through U.S. newswire services, providing significant reach to investor platforms.

Example of Other Australian Companies with Dual Australian & U.S. Listings:

- IperionX Ltd
- Silex System Ltd
- Amaero International Ltd

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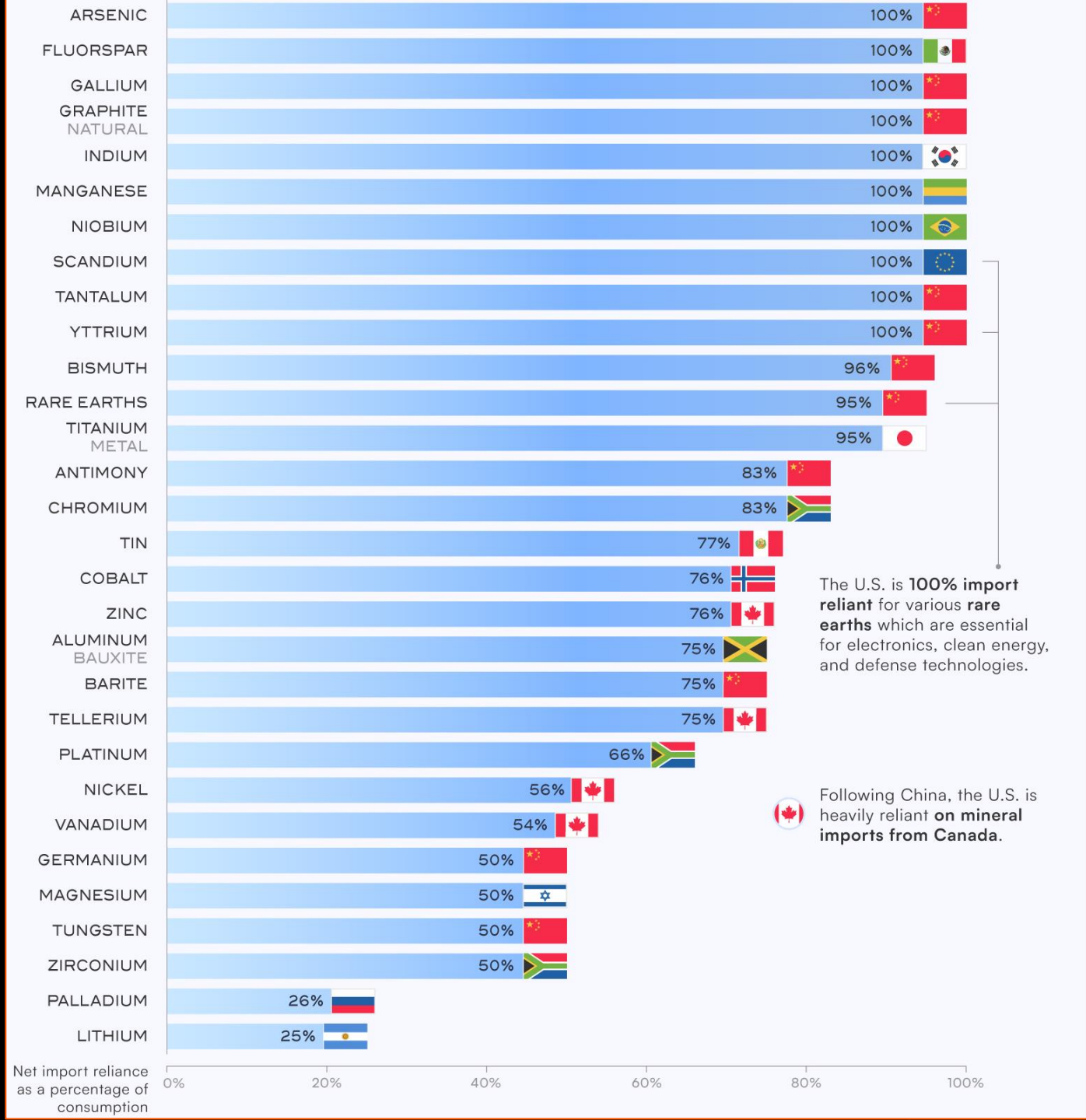
U.S. Dependency on Critical Metals

>95% reliant on imports for the 13 most "critical" metals, with China being the primary import source for > 50% of these.



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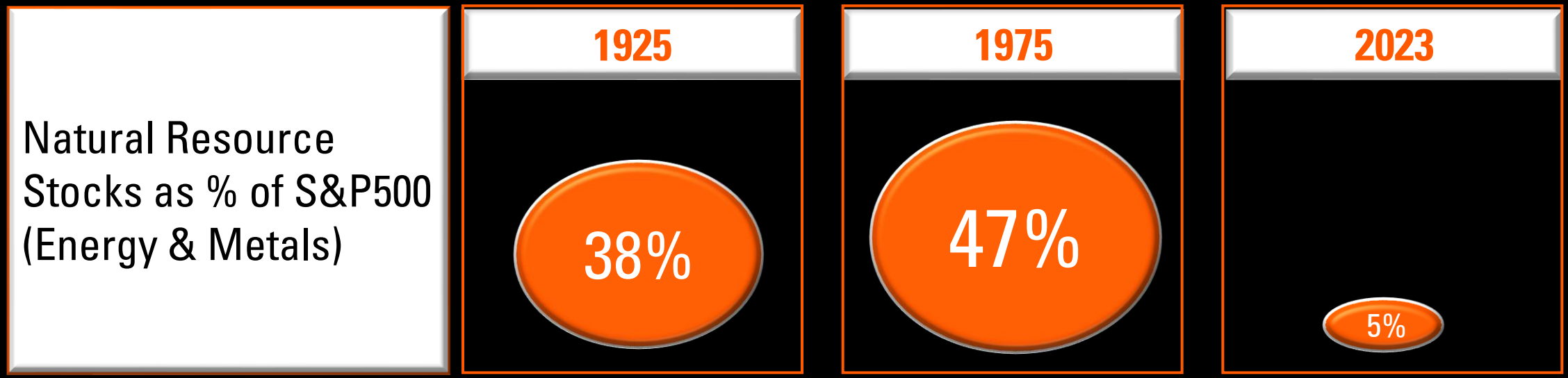
Source: Visual Capitalist (2023)

Disconnect Between Technology and Natural Resources

- Modern technology & civilisation is **underpinned by metals (underappreciated by most of society).**
- Critical technologies, including **Military Defence**, **AI, Robotics, Energy Storage, & quantum computing.**
- **Lithium, cobalt, nickel, and REEs** are the backbone of batteries, semiconductors, and electric grids.
- Despite this, **investment in natural resources is at historic lows, but the cycle is turning.**
    - **ESG / Indexation & Passive Investing ⇒ Growth Stocks / Poor prior cycle performance**



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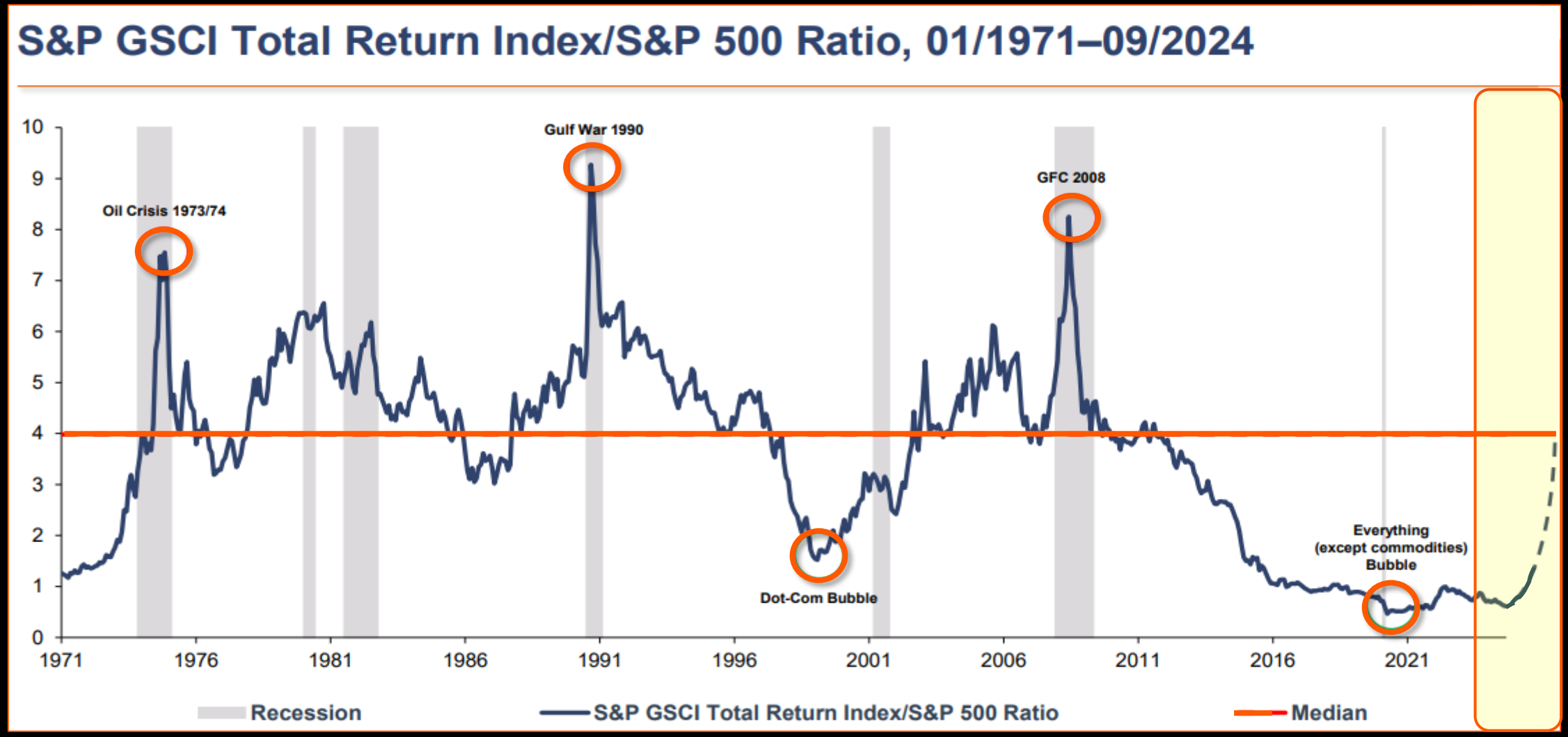
Source: Goehring & Rozencwajg Associates, LLC; Bloomberg (2024)

The Natural Resources Cycle is Turning



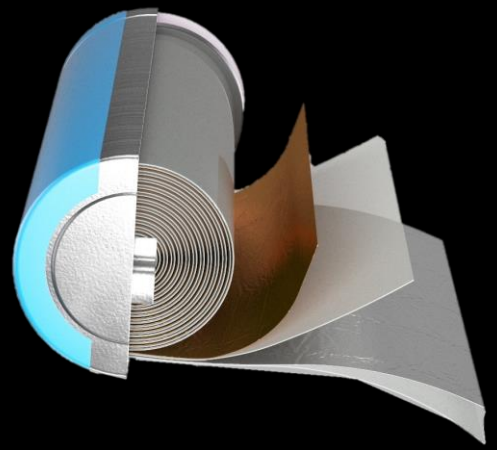
Source: Incrementum AG (2024)

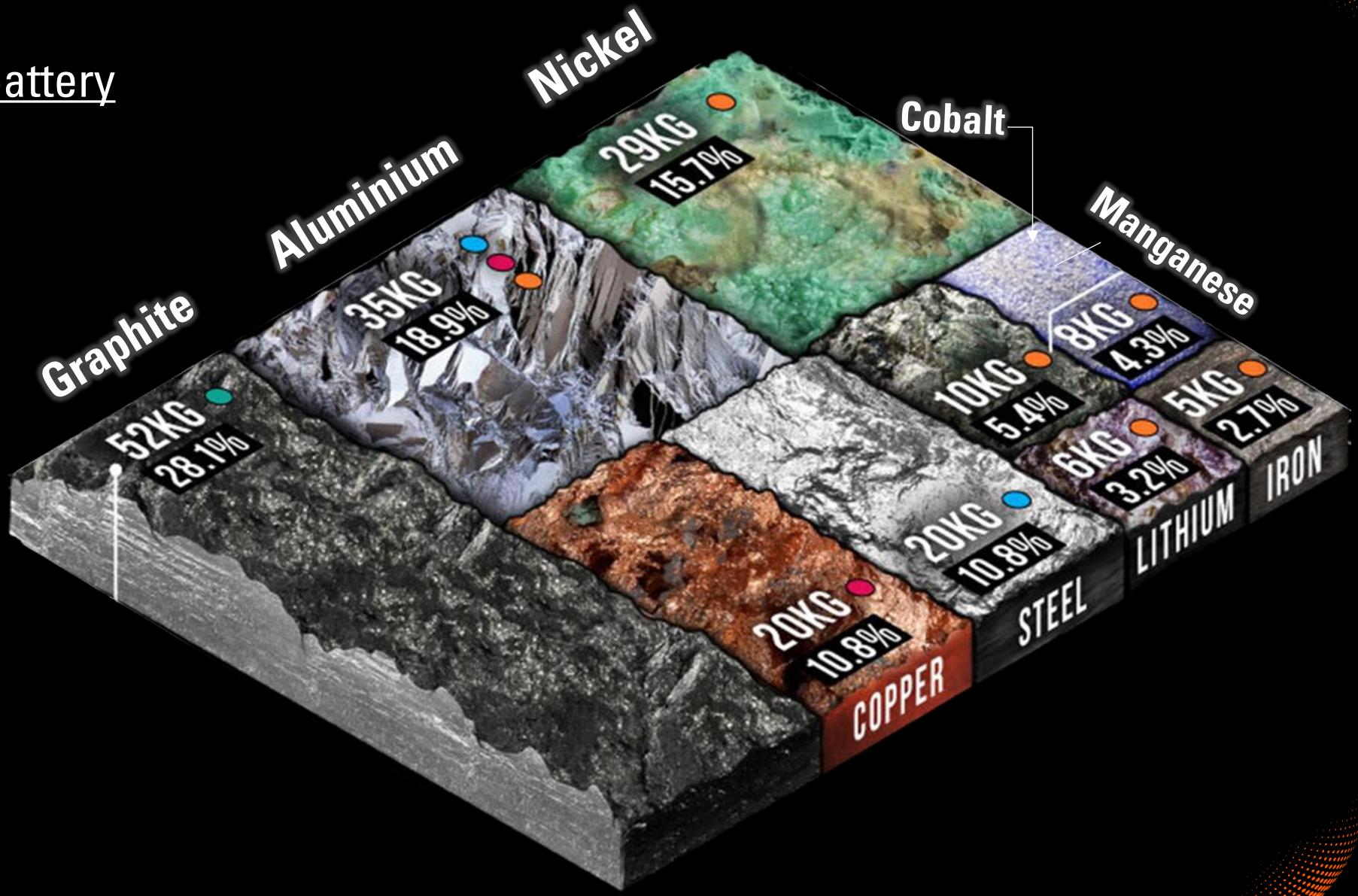
EXAMPLE: Metals in Electric Vehicle Battery

Typical 60 kWh 'NCMA' battery

185 kg metals

- 6 kg lithium
- 29 kg nickel
- 20 kg copper
- 8 kg cobalt





Source: VisualCapitalist (2022)

EXAMPLE: Datacentres– The Silent Giants of Metal Consumption

Metal	Estimated Tonnes per MW
Copper (Cu)	27
Aluminium (Al)	10
Steel	40
Lead (Pb)	4
Lithium (Li)	0.1
Nickel (Ni)	0.5
Cobalt (Co)	0.2
Gallium (Ga)	0.05
Rare Earths	0.05

Source: *Data Center Catalog, 2021. Gallium nitride power systems seek a larger foothold in data centers. https://www.datacentercatalog.com*
Visual Capitalist, 2023. Why copper is critical for data centers. https://elements.visualcapitalist.com

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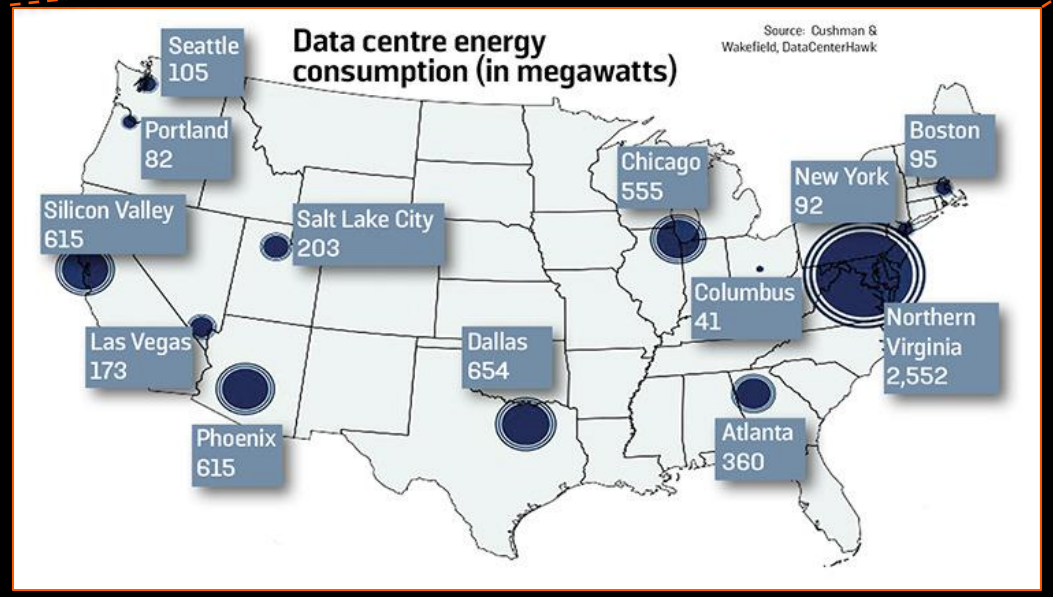
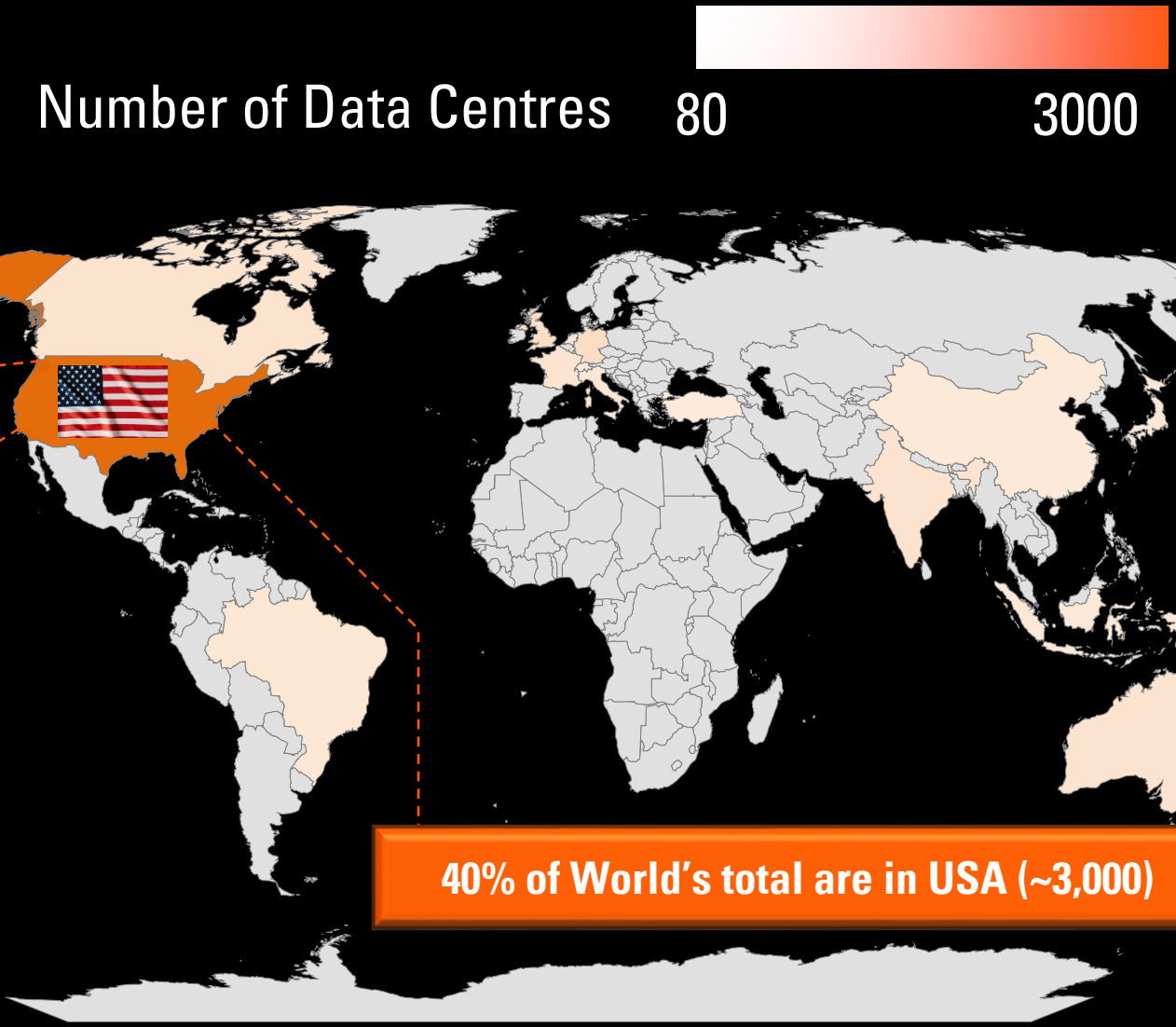
Global Datacentres (~6,000): Majority in USA

- Est. Up to 70 % of World's internet traffic flows through a handful of rural counties in the American northeast
- Major growth anticipated over next decade





Source: PlanetTracker.org (2024); Geographical (2024)

EXAMPLE: Rare Earth Elements

Crucial in Defence Applications

F-35

~420 kg REO

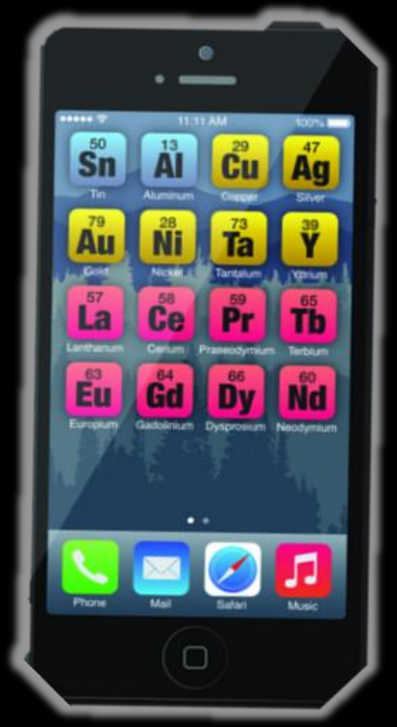
Arleigh Burke-class destroyer

~2,400 kg REO

USS Virginia

~4,200 kg REO

Smartphone (iPhone)



16 REE Elements

0.05 kg REO

Wind Turbine (3 MWh)

4 REE Elements

2,000 kg REO

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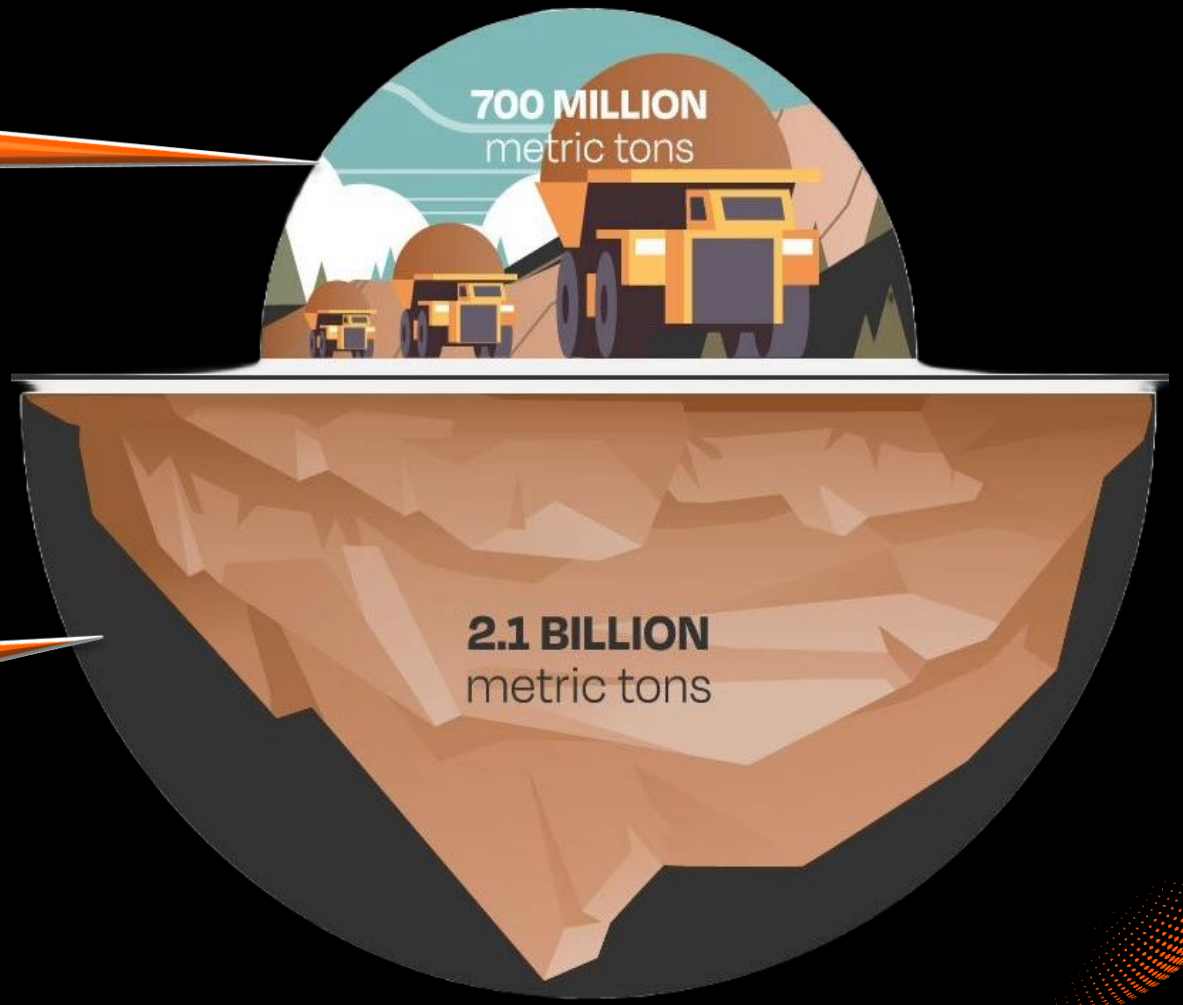
Source: Congressional Research Service (2023)

Growing Demand and Supply Chain Risks

- Demand for critical metals will skyrocket over the next decade driven by Computing & the “Energy Transition”. Example COPPER

Total amount of Copper produced over **human history**

Copper required to achieve “net zero” by 2050



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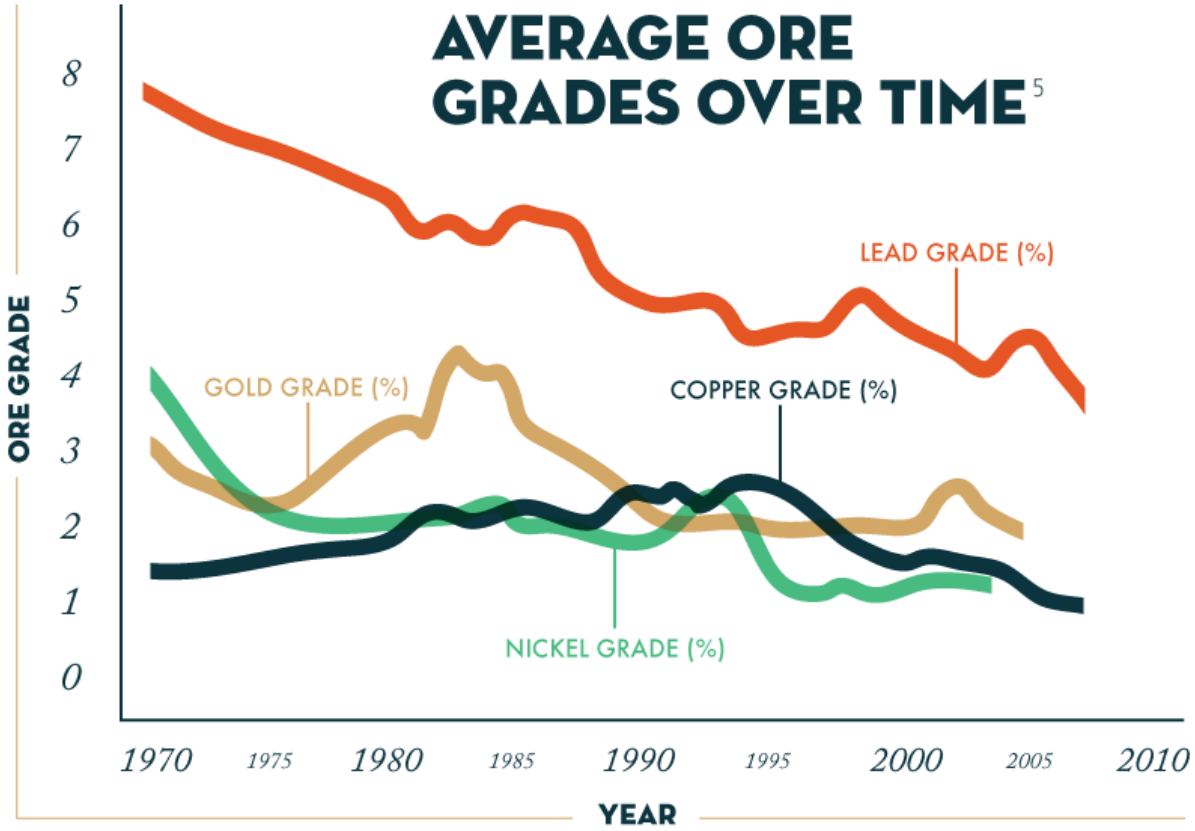
Source: VisualCapitalist (2024)

Global metal supplies are dwindling

- High-grade ore bodies have been depleted. The “easy” stuff has been found
- More waste material must now be processed to extract the same amount of metal.



Source: S&P Global IQ (2012)

World now depends on older mines with declining grades

Top 20 Copper Mines by Production in 2023 - Dominated by by archaic mines

20% started > 100 years ago!

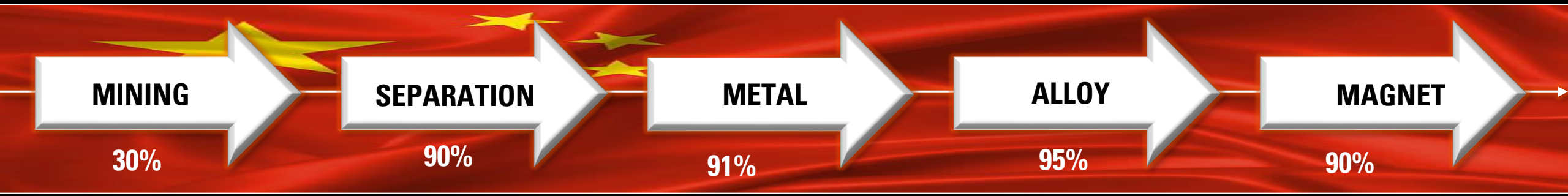
Mine	Country	Mine Commencement	Years in Production	2023 Cu Production
El Teniente	Chile	1819	205	401
Bingham Canyon	USA	1863	161	310
Chuquicamata	Chile	1879	145	400
Buenavista del Cobr	Mexico	1899	125	535
Polar Division	Russia	1935	89	450
Morenci	USA	1937	87	570
Cerro Verde II	Peru	1976	48	500
Escondida	Chile	1990	34	1,350
Grasberg	Indonesia	1990	34	770
Collahuasi	Chile	1999	25	640
Los Pelambres	Chile	1999	25	370
Antamina	Peru	2001	23	450
Kansanshi	Zambia	2005	19	340
Los Bronces	Chile	2007	17	340
Tenke Fungurume	DRC	2009	15	400
Las Barnbas	Peru	2016	8	400
Cobre Panama	Panama	2019	5	380
Kamoa-Kakula	DRC	2021	3	430
Quellaveco	Peru	2022	2	350
Toromocho	Peru	2022	2	320

Source: Merlin Marr-Johnson (Crux Investor, 2024)

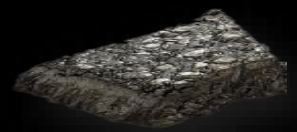
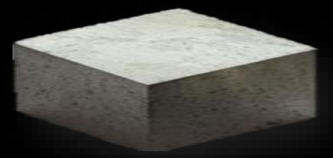
Chinese Dominance in Rare Earths

- China has ~ 30% of worlds REE reserves, YET
- China controls ~100% EV, Wind Turbine, & Military Grade NdFeB Magnet Production
- China undertakes > 90% of the downstream refining & manufacturing of REEs
- Only **one single Western Company with ability to produce NdFeB Magnets**
- Separation IP originally developed in the US post WWII (Ames lab / Manhattan project)

Magnetic REE Value Chain - Complete Dominance by China



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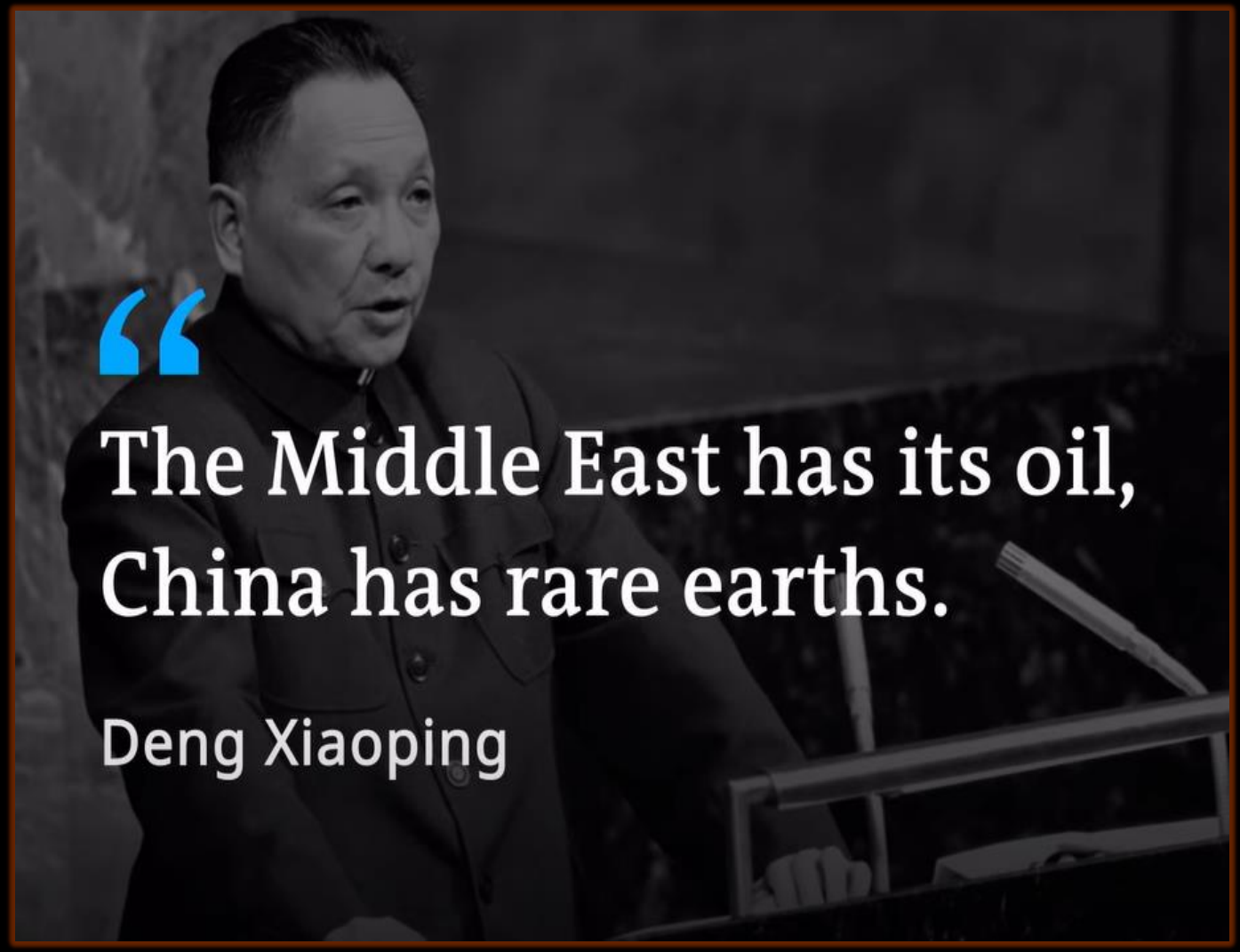
Source: James Kennedy (2023)

Chinese Dominance in Rare Earths

- Early 1980's (Regan / Thatcher era) ⇒
- Major offshoring & Technology Transfer push to China (lower costs & less regulation)
- Massive expansion of Chinese R&D into REE Metallurgy and Processing
- 1992 – Deng Xiaoping
- Magnequench – USA-pioneered developer of REE magnets, acquired by China



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Source: James Kennedy (2023)

Environmental Costs of Extraction - REEs

Baotou, Inner Mongolia

- World's biggest supplier of REEs for last 40 years
- Weikuang Dam: 12km^2 of Tailings Dam (artificial lake)
- Unlined
- Radioactive

Environmental Costs of Extraction - REEs

Myanmar's & China's clay leaching

Major source of cheap REEs since 1970s

Environmental Costs of Electronic Waste

World's largest e-waste dump in Agbogbloshie Ghana, Africa

Flash Joule Heating:

A New Era of Sustainable Metal Extraction

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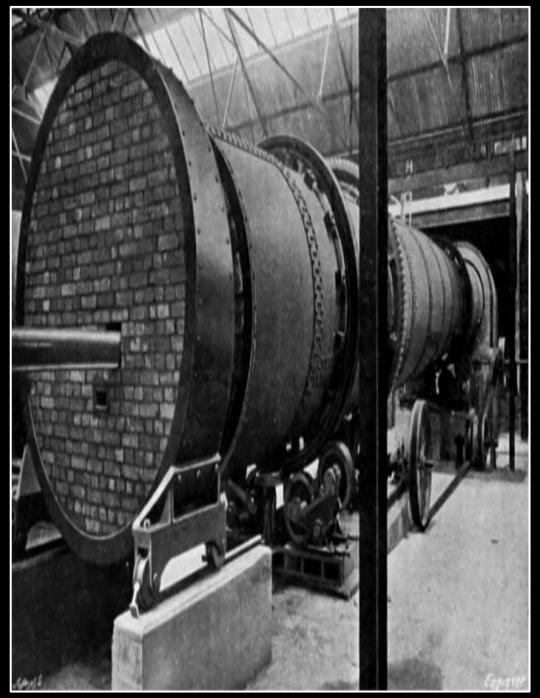
Processing Technology Breakthroughs that Changed History

Bessemer Converter
1856

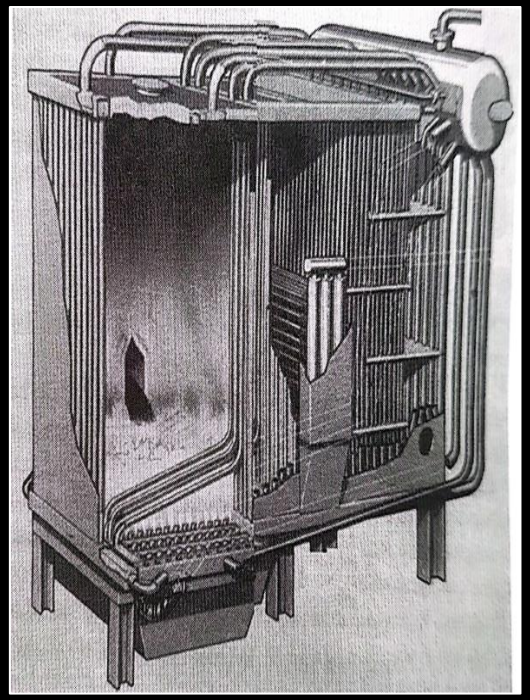
1st Inexpensive method to mass produce steel

Modern Rotary Kiln
1885



Revolutionised Continuous processing

Fluidized Bed
1921



Revolutionised Petroleum cracking

ElecArc Furnace (MiniMill)
1955

Revolutionised scrap metal recovery.
Initially ridiculed

What's Next?.....

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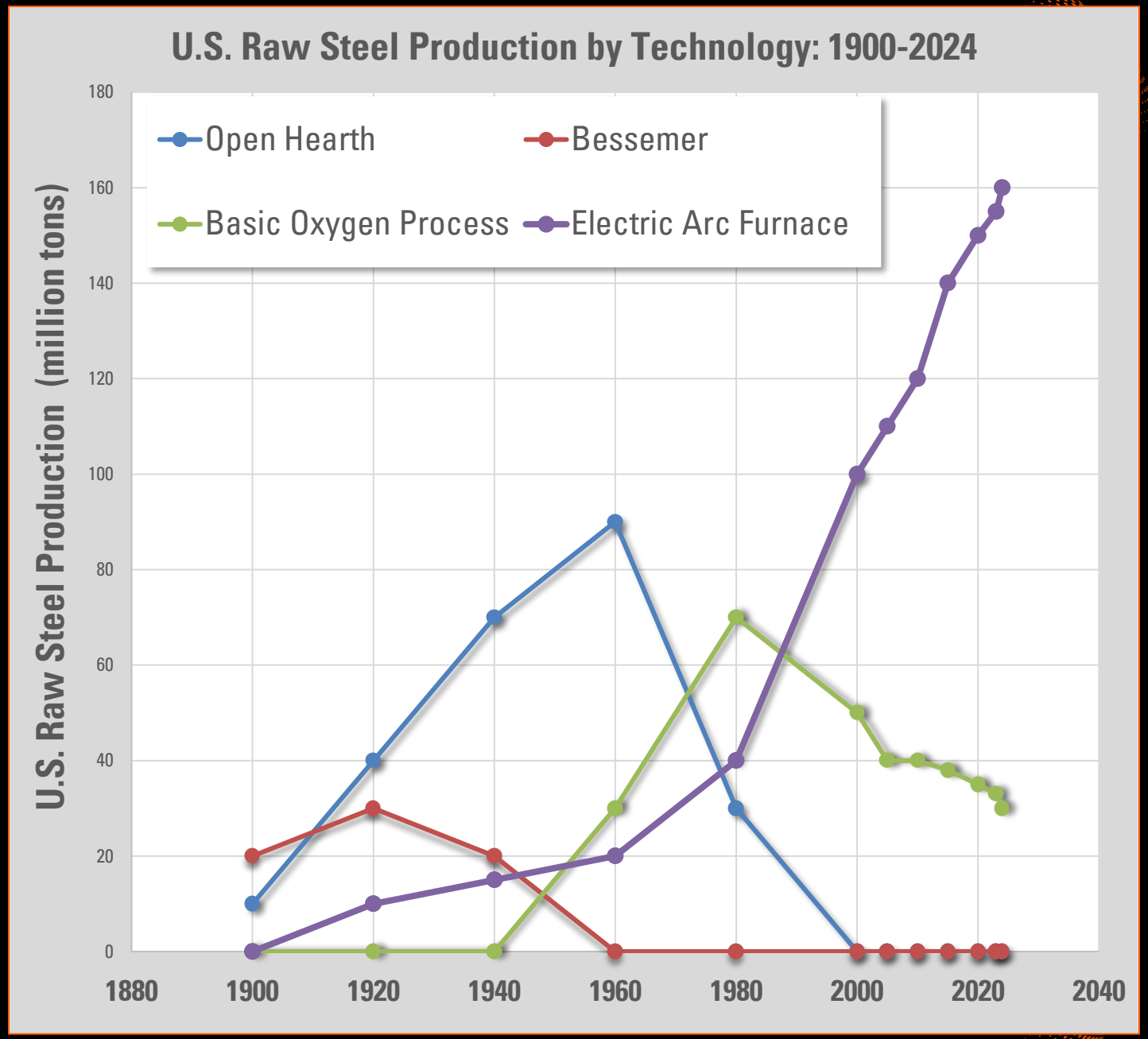
Source: Perrys Chemical Engineer's Handbook (2002)

ElecArc Furnace (MiniMill)

- **Initial Skepticism:** Large steelmakers dismissed MiniMills, doubting their scalability.
- **Nucor's Vision:** adoption of MiniMill operations faced industry ridicule.
- **Breakthrough Success 1980s:** Nucor introduced thin-slab casting, disproving critics.
- **Industry Shift:** MiniMills scaled up challenging traditional steelmaking.
- MiniMills now dominate U.S. steel production



- Canary Media, 2024. *Steelmaking is starting to go electric.* Available at: https://www.canarymedia.com
- Congressional Research Service, 2023. *Domestic Steel Manufacturing: Overview and Prospects.* Available at: https://crsreports.congress.gov
- IRENA, 2023. *Solutions to decarbonise heat in the steel industry.* Available at: https://www.irena.org
- ITAD Daily, 2024. *Funding Secured for U.S. Steel's Big River Expansion Project.* Available at: https://itaddaily.com

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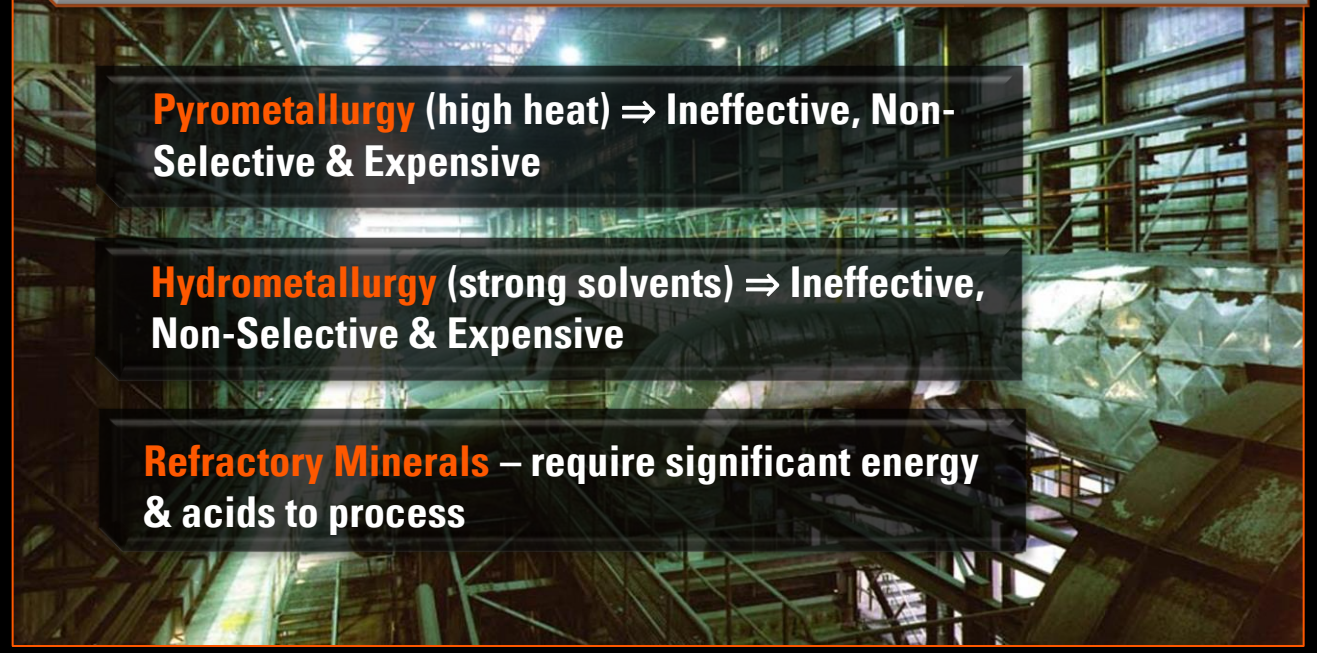
Introducing Flash Joule Heating (FJH)

- Originally developed by Dr James Tour at Rice University to produce graphene, FJH has evolved into a method for efficiently extracting metals from unconventional sources like e-waste & mine tailings.
- Potential to revolutionise metal recovery by reducing energy consumption, reagent use and waste, offering a more economical and environmentally friendly alternative.

Problems we are trying to solve: Traditional metal recovery methods are expensive, energy & reagent-intensive, and non-selective



The solution:
Breakthrough **Flash Joule Heating** Platform

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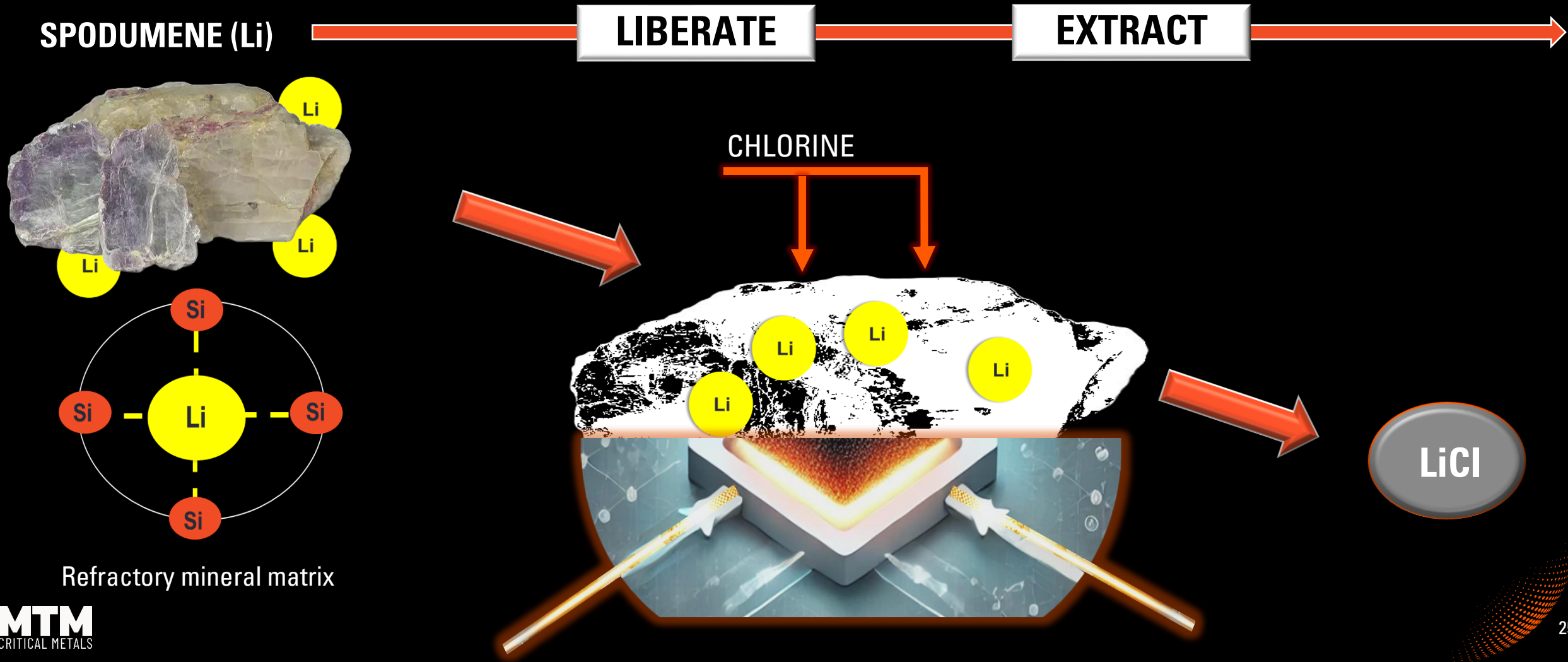
How does it Work? Example Refractory Minerals

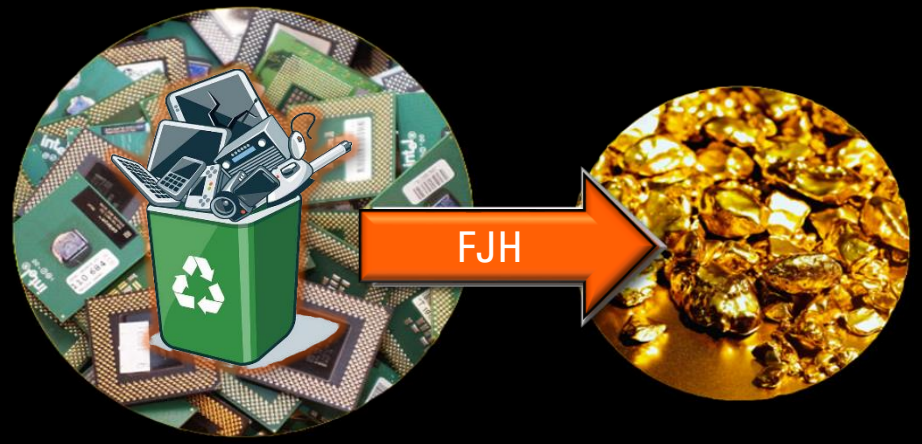
- Target metal of interest “locked” in “glass” jail (tight bond)
- Liberate the target metal of interest by thermal shock. i.e. Li from Spodumene



Real-World Success with FJH

Extract valuable metals from Industrial Waste Streams

- Spent Li-Ion Batteries
- High value E-Waste
- Semiconductor Scrap
- Mine Tailings



Improve performance of refractory Mineral Processing Operations

- Lithium
- Rare Earths
- Niobium
- Antimony

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“Game changer” potential for the Lithium industry

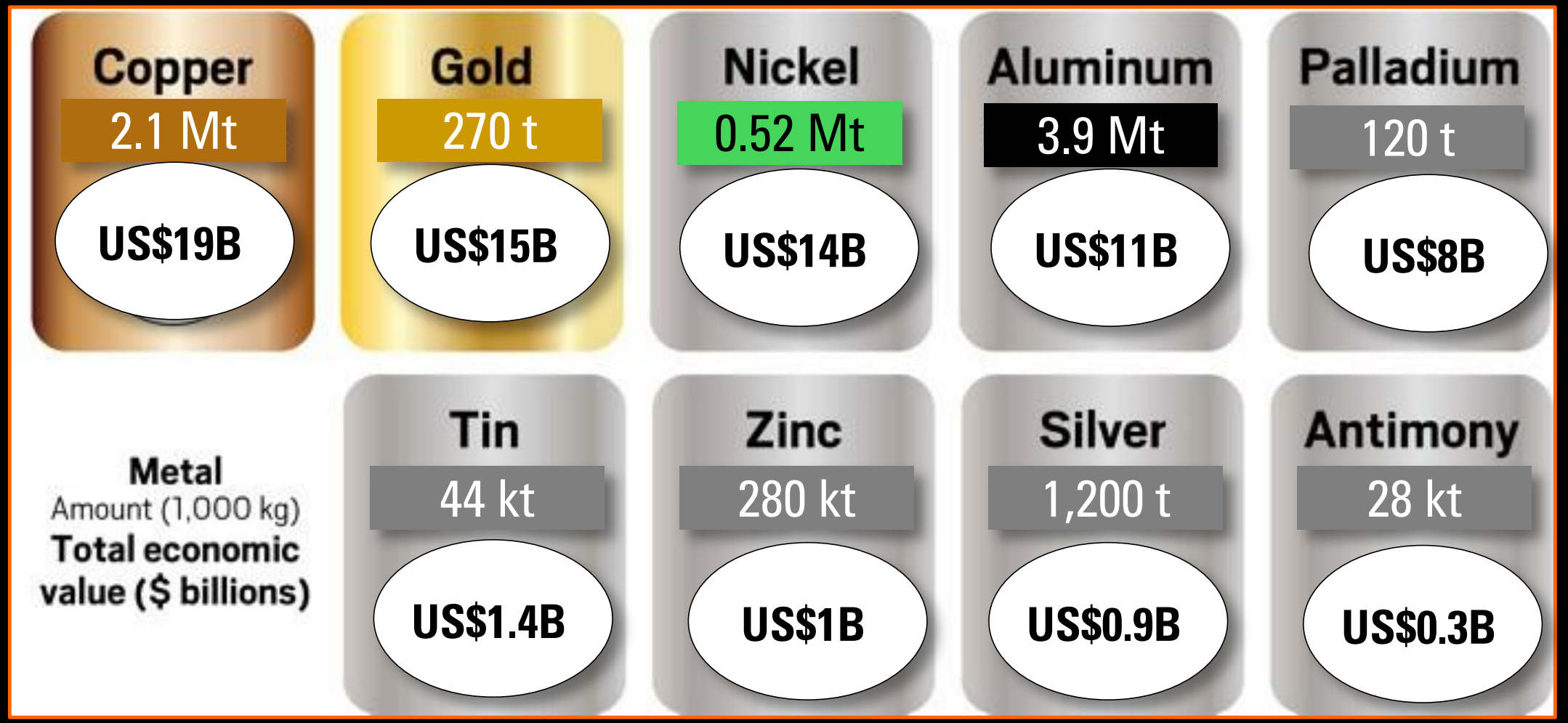
Spodumene is the primary source of Li globally, and the traditional extraction process involves significant energy usage & recovery inefficiencies

3 distinct opportunities

1. Improve Calcination
2. Complete flowsheet revamp using FJH Chlorination
3. Recover unrecoverable material & reprocess tailings

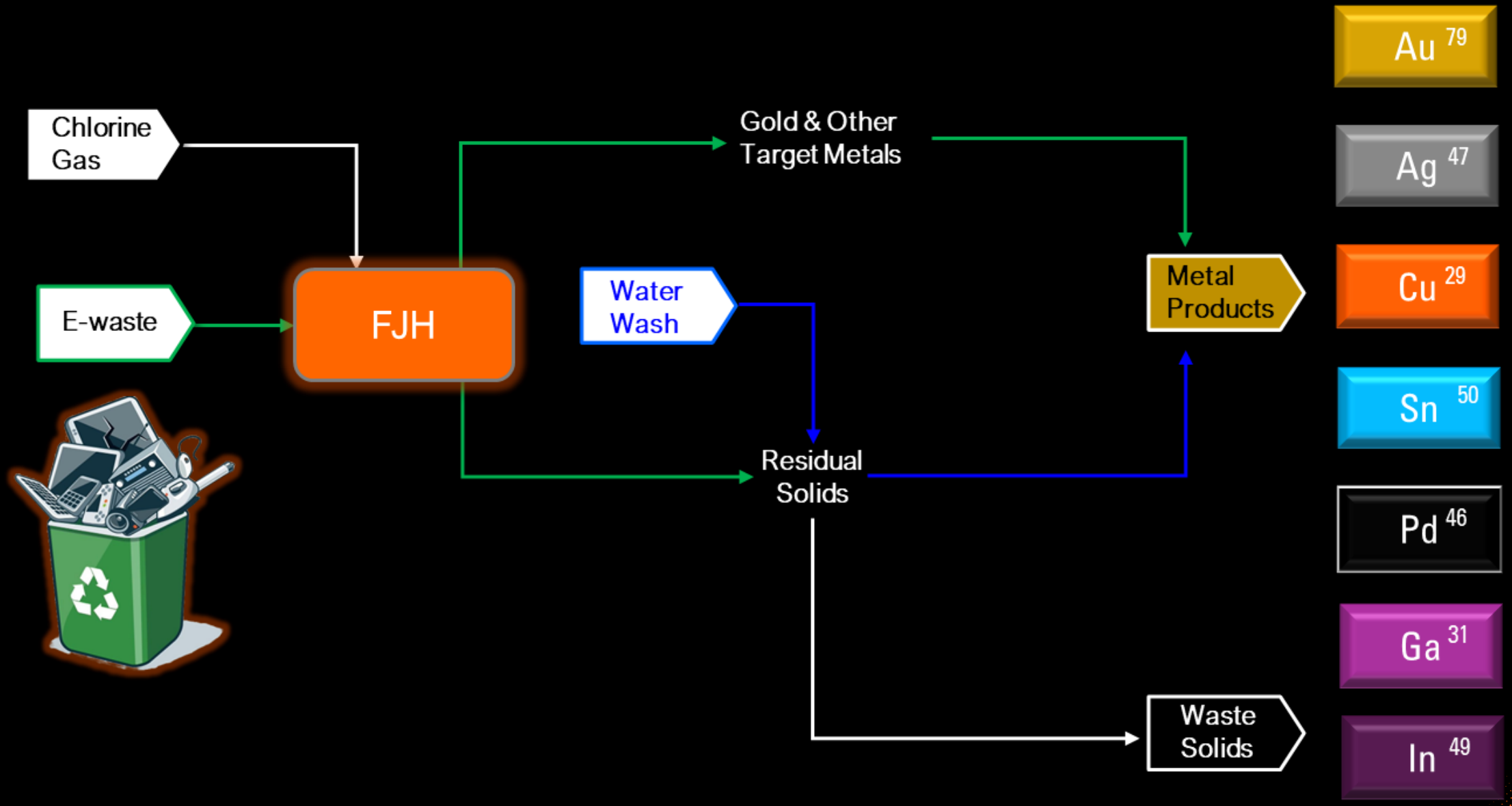
E-Waste – a rich source of metals

Weight and value of metals contained in the 62 Mt of e-waste generated globally in 2022



Source: Forti et.al 2024; Patel,2024.

Real-World Success – E-Waste & Gallium / Indium Scrap



Source: See previous ASX:MTM announcements.

We are preparing for commercial scale-up with our FJH Demonstration Plant (“FDP”)

Initial plant to be located in Texas

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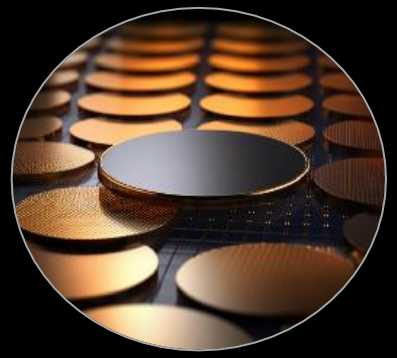
Onshoring Critical Metal Supply Chains - GOLD

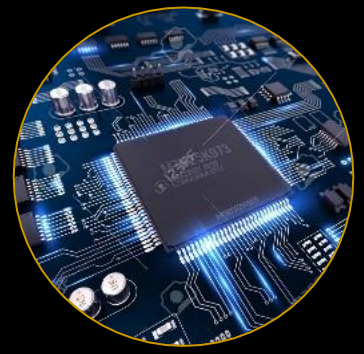
- Strong demand project over next decade due to monetary debasement & worsening geopolitics
- **iPhone / Gold Ratio**
  - In “fiat” dollars – the iPhone has increased in price by ~150% since 2007 (5.5% CAGR)
  - In ounces of Gold, it has decreased by ~ 50%

Source: Incrementum AG (2024)

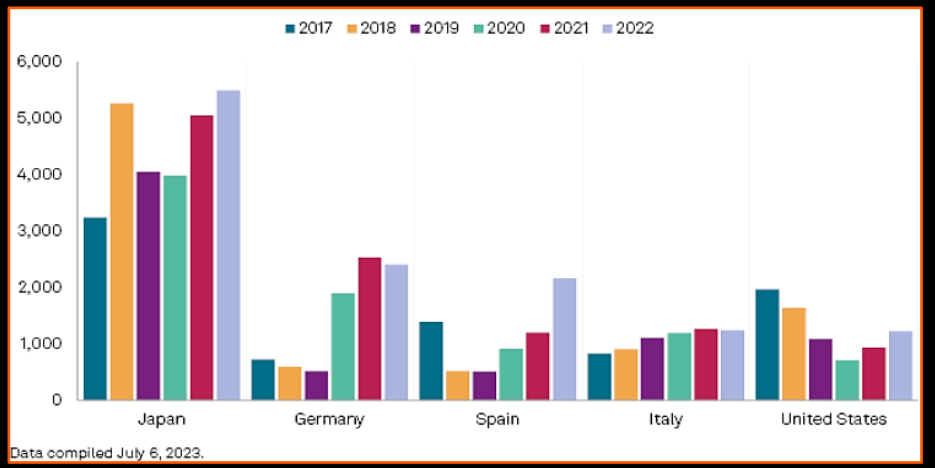
Onshoring Critical Metal Supply Chains - GALLIUM

- **Market Supply Issues:** The global gallium market has been severely impacted by China's export restrictions, leading to dramatic price increase.
- **Crucial for various applications**, including semiconductors, LEDs, solar panels and defence technologies like radar systems.
- **Domestic USA stockpile** = 0 tons



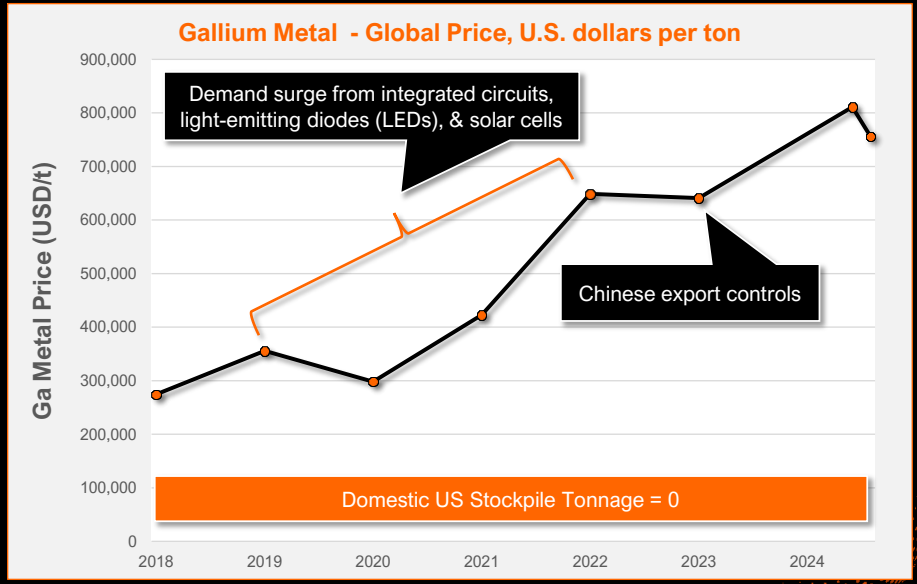


Major Gallium & Germanium Importers from China



Source: S&P Global (2023)

Global Gallium Metal Price Trend since 2018



Source: Statista (2024), USGS (2024)

- **Statista 2024,** Gallium price worldwide from January 2018 to January 2024, https://www.statista.com/statistics/1443942/gallium-global-price/
- **United States Geological Survey (USGS) 2024**, Gallium Mineral Commodity Summaries 2024, https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-gallium.pdf

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Onshoring & Localising Critical Metal Supply Chains

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Conclusion – FJH = New Era in Sustainable Metal Extraction

ASX: MTM

U.S. Listing Coming Soon

- The next generation of metal recovery technology
- Enhances national security by reducing reliance on imports.
- Sustainable solution for by converting waste into value
- Empowers industries with local access to critical metals for tech
- Scalable solution for growing demand
- Investment tailwinds: Right time in the investment cycle for n. resources

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