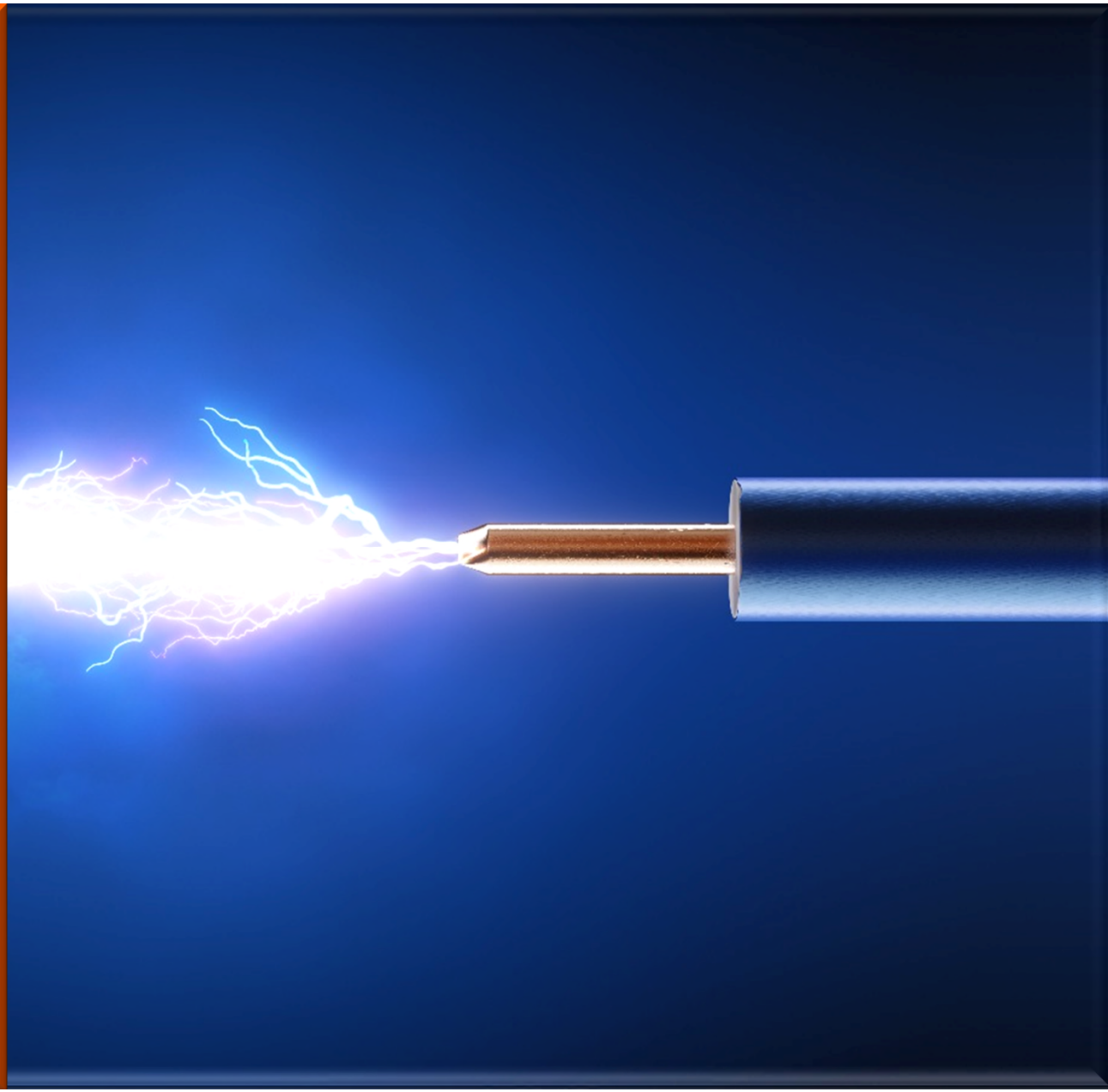
MTM CRITICAL METALS

Revolutionising Metal Recovery and Processing with Breakthrough FJH Technology

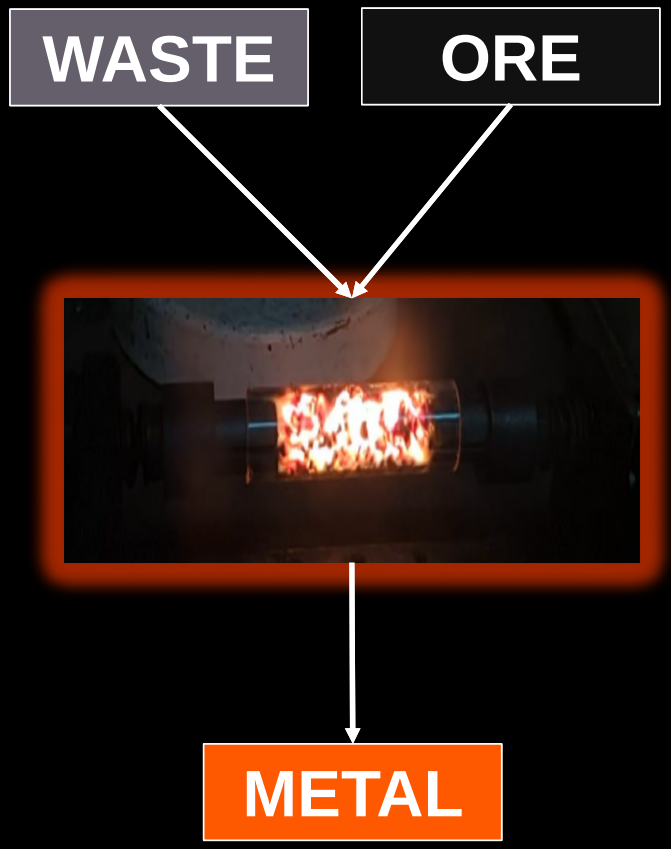


JULY 2024

Our Plan is to Innovate and Disrupt how Critical Metals are Recovered from Ores & Waste

MTM CRITICAL METALS

MTM is focused on commercialising **Flash Joule Heating (FJH)** technology which has **the potential for cheaper metal recovery from ores & waste.**



POSSIBILITIES & POTENTIAL:

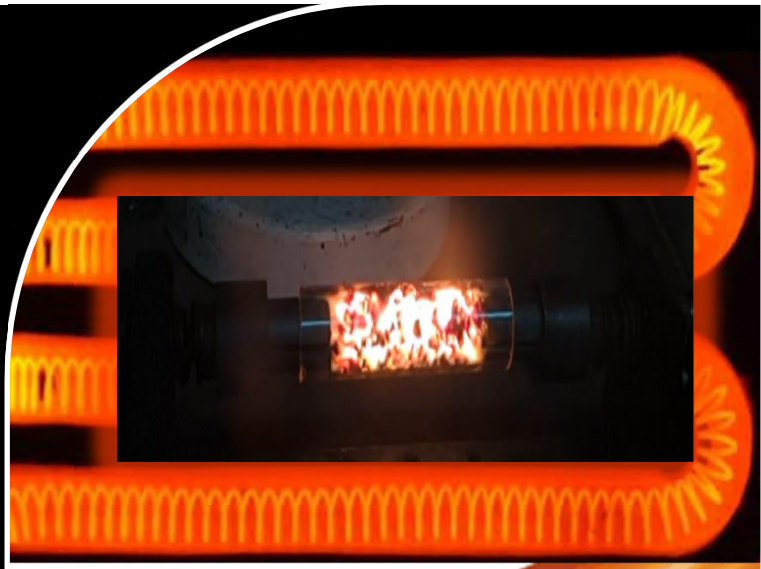
- ⇒ Extract value from waste dumps (red mud and coal fly ash).
- ⇒ Recycling of E-Waste and Li-ion batteries
- ⇒ Extract value from deposits previously considered uneconomic.
- ⇒ Provide low-cost sources of Critical Metals.
- ⇒ Revolutionise process flowsheets using state-of-the-art heating technology.
- ⇒ Help industry to innovate and solve key supply, environmental & recovery challenges.

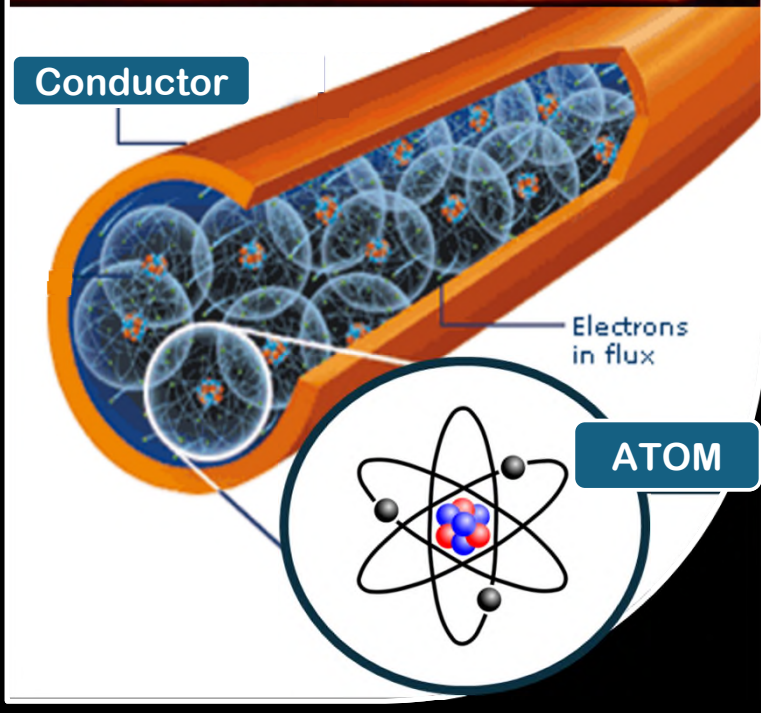
Core Patent Protected Innovation

Joule's Law of Heating: Heat is produced from the collision of electrons in a conductor

Flash Joule Heating (FJH)

1. Direct current rapidly passes through a material.
2. The resistance of the material creates heat.
3. Temperature can reach **>3,000^{O}C** in milliseconds ⇛ **'Flash' heating.**
4. Various physical and chemical transformations, **potentially beneficial for metal recovery**





MTM CRITICAL METALS

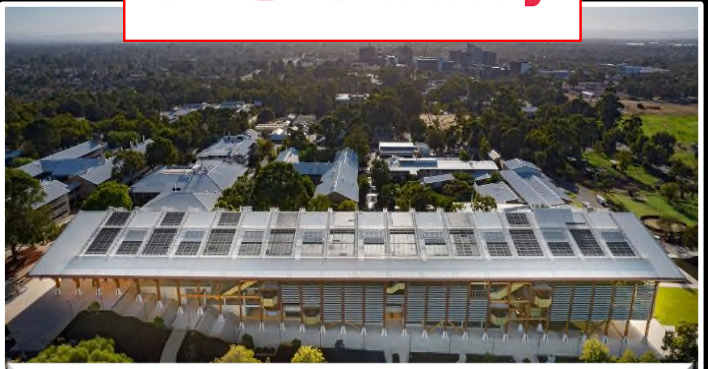
Partners

RICE UNIVERSITY

FJH PIONEERS / R&D

MTM has a Global Licence Agreement for Flash Joule Heating Technology with Rice University

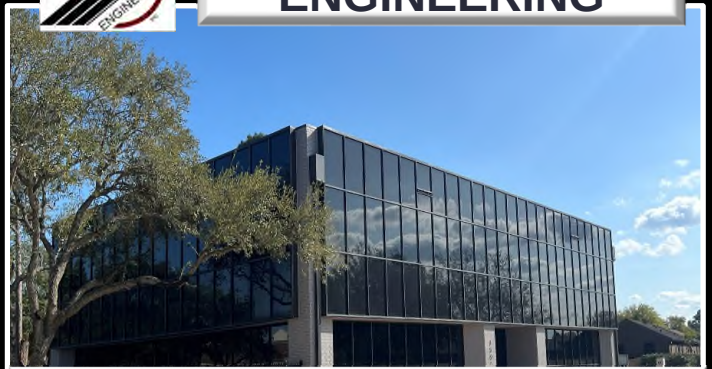
Murdoch University



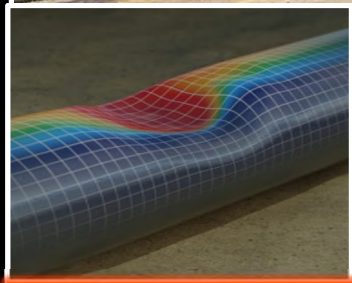
METALLURGY R&D

Murdoch University is one of the leading centres of excellence in Australia for metallurgy

KNIGHTHAWLK ENGINEERING



ENGINEERING DESIGN & SCALE-UP



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

MTM CRITICAL METALS

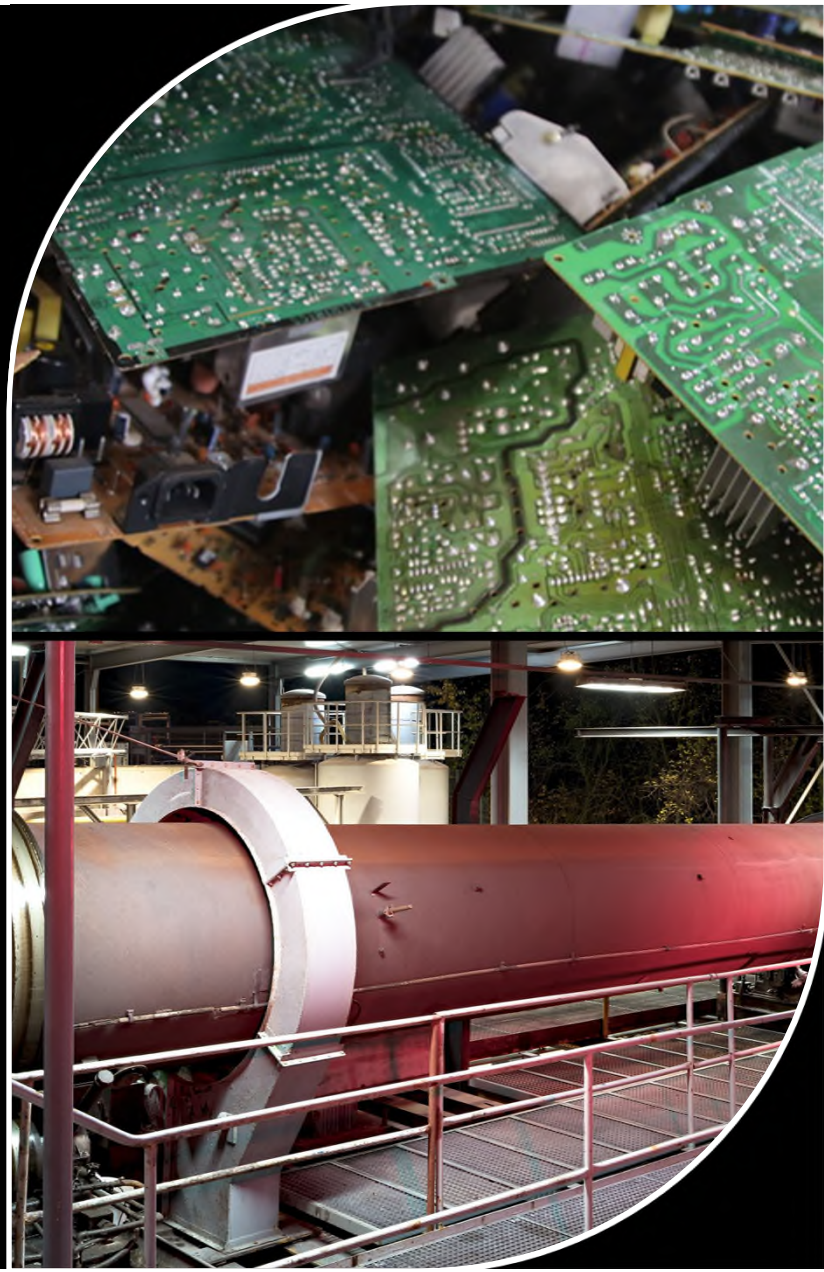
Flash Joule Heating Potential

1. Extract valuable metals from **industrial waste streams**

E-Waste | Spent Li-Ion Batteries | Coal Fly Ash | Bauxite Residue

2. Improve performance of **mineral processing** operations

Lithium | Rare Earths | Gold | Niobium



MTM CRITICAL METALS

Business Model

MTM CRITICAL METALS

MTM BUSINESS UNITS

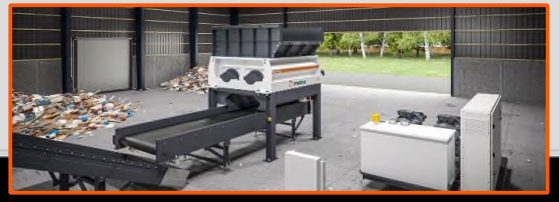
CRITICAL MINERALS EXPLORATION

- Exploring for critical minerals in Australia & Canada
  - West Arunta **niobium** project
  - Pomme **REE** carbonatite project
  - East Laverton clay-hosted **REE** project

FLASH METALS

METALS FROM WASTE

- Extract valuable metals from industrial waste streams
  - Targeting: e-waste, spent lithium batteries, coal fly ash, bauxite “red mud” waste residue etc.
  - Recovery of REEs, tin, precious metals, nickel, cobalt, copper, zinc, aluminium, etc
  - Critical metal recovery from scrap i.e. titanium.

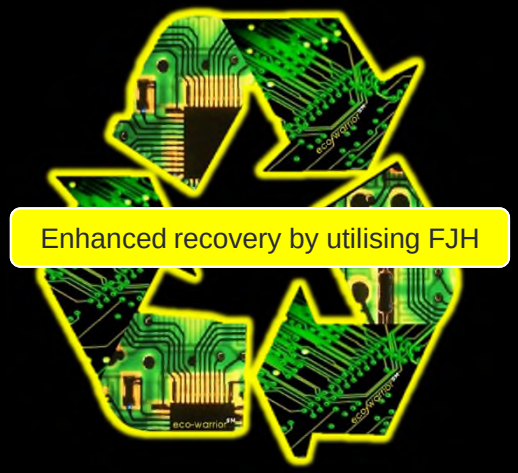


MINERALS PROCESSING

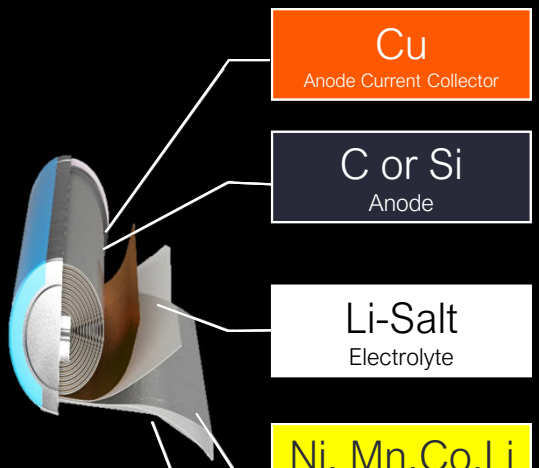
- Improve performance of mineral processing operations
  - Aim to revolutionise process flowsheets that utilise conventional technology like kilns for heat transfer.
  - Targeting: Metallurgical operations that utilise high process heating to extract refractory minerals i.e. lithium refining, REE, niobium etc.
- Licencing model

Huge addressable market & multibillion $ verticals

	E-Waste	Battery Waste	Mineral Processing
Global Market Value (2022)	USD 50B	USD 10B	Lithium: USD 30B REE: USD 20B
Projected Value (2027-2030)	USD 90B	USD 60B	Lithium: USD 60B REE: USD 75B



Gold, Silver, PGEs, Tin, Copper, Aluminium



Typical lithium-ion battery

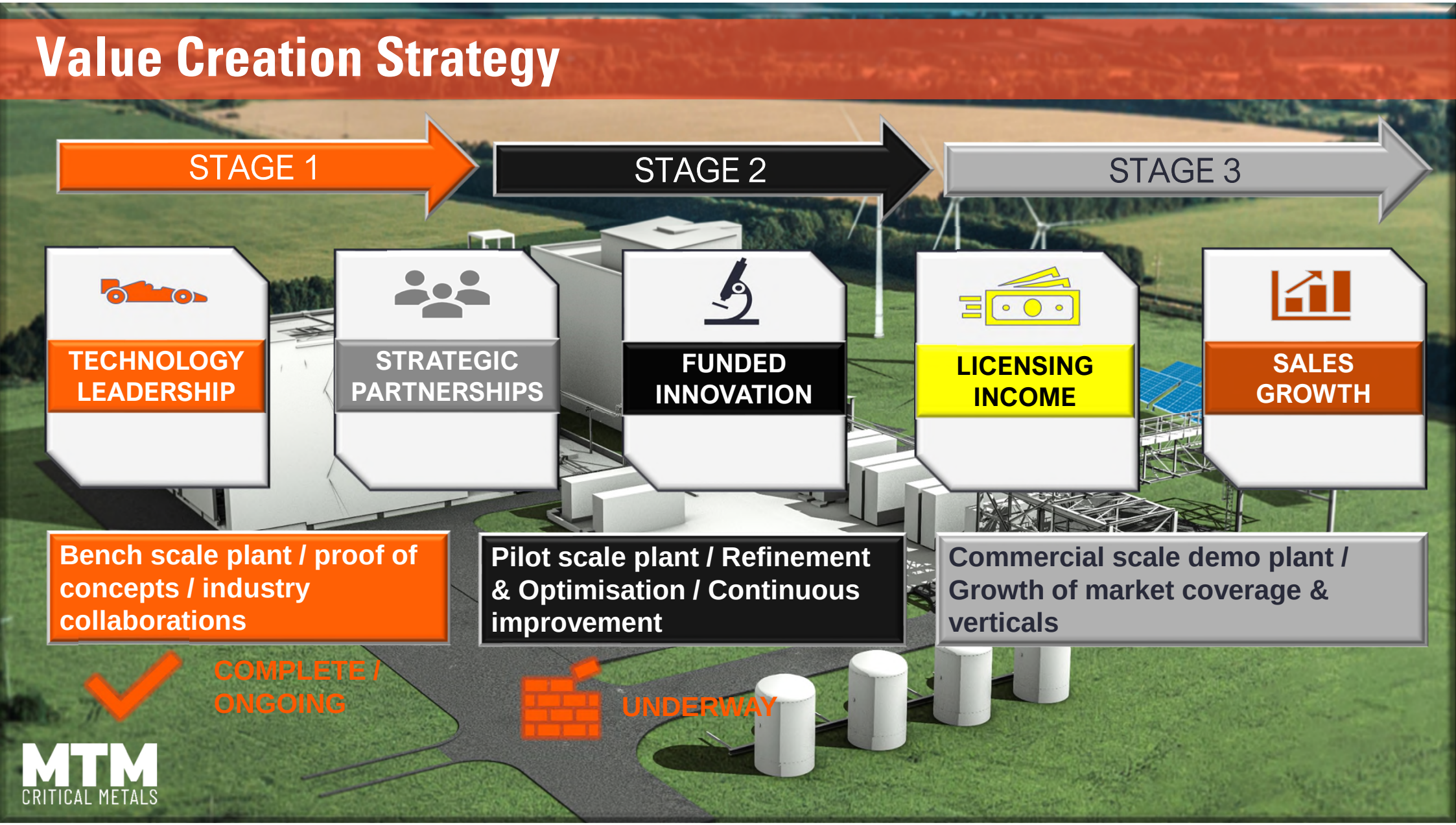
Enhanced recovery and/or decarbonise by utilising FJH

Lithium & Rare Earths shown only for brevity. Several more application for FJH in mineral processing

MTM CRITICAL METALS

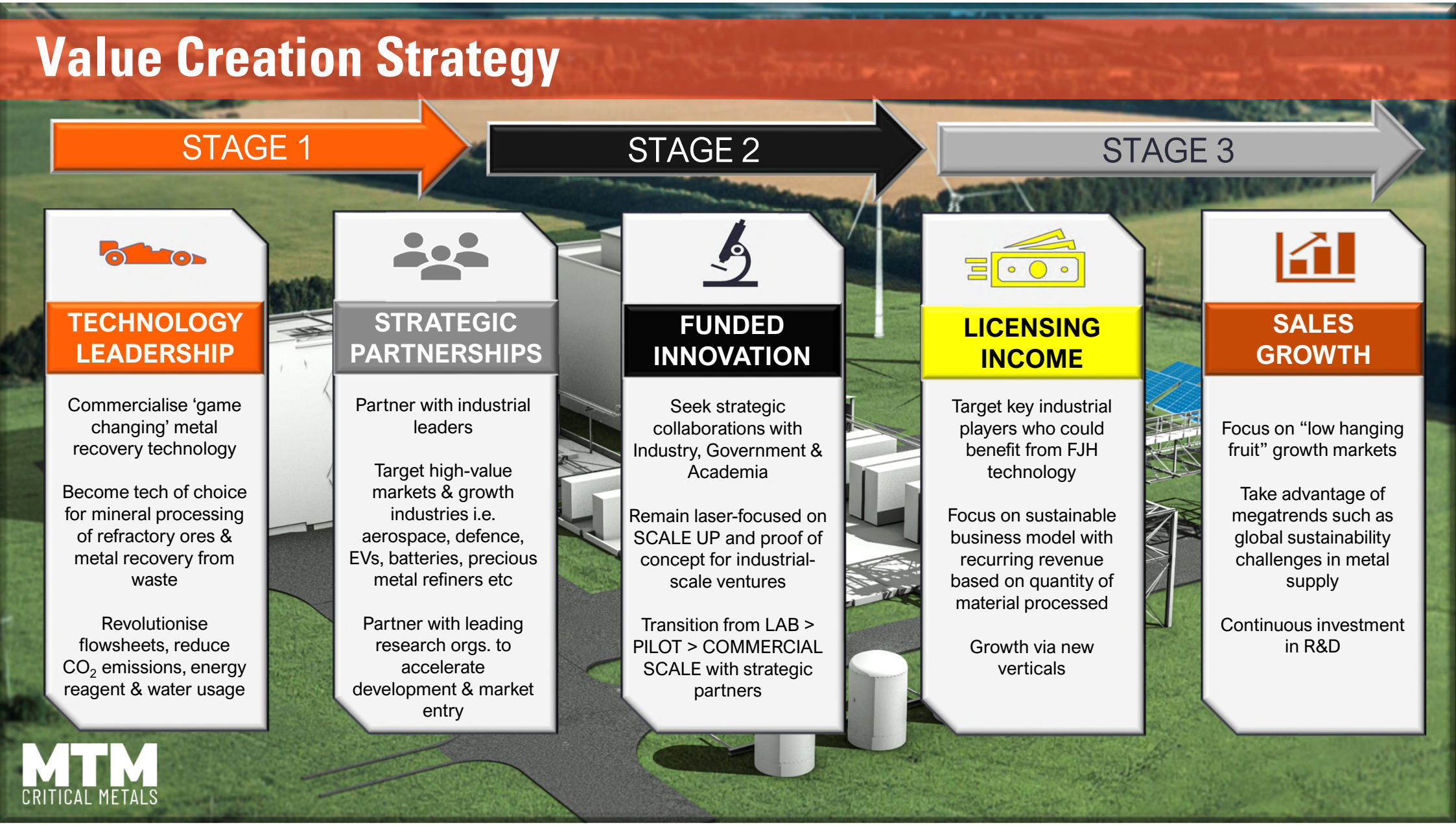
REFERENCE:
Business Research Insights 2022, https://www.businessresearchinsights.com/market-reports/electronic-waste-recycling-market-101423
P&S Intelligence 2022, https://www.psmarketresearch.com/market-analysis/lithium-ion-battery-recycling-market
(Business Research Insights 2023, https://www.businessresearchinsights.com/market-reports/mineral-processing-market-102470

Value Creation Strategy



MTM CRITICAL METALS

Value Creation Strategy



STAGE 1

TECHNOLOGY LEADERSHIP

Commercialise 'game changing' metal recovery technology

Become tech of choice for mineral processing of refractory ores & metal recovery from waste

Revolutionise flowsheets, reduce CO_2 emissions, energy reagent & water usage

STAGE 2

STRATEGIC PARTNERSHIPS

Partner with industrial leaders

Target high-value markets & growth industries i.e. aerospace, defence, EVs, batteries, precious metal refiners etc

Partner with leading research orgs. to accelerate development & market entry

FUNDED INNOVATION

Seek strategic collaborations with Industry, Government & Academia

Remain laser-focused on SCALE UP and proof of concept for industrial-scale ventures

Transition from LAB > PILOT > COMMERCIAL SCALE with strategic partners

STAGE 3

LICENSING INCOME

Target key industrial players who could benefit from FJH technology

Focus on sustainable business model with recurring revenue based on quantity of material processed

Growth via new verticals

SALES GROWTH

Focus on "low hanging fruit" growth markets

Take advantage of megatrends such as global sustainability challenges in metal supply

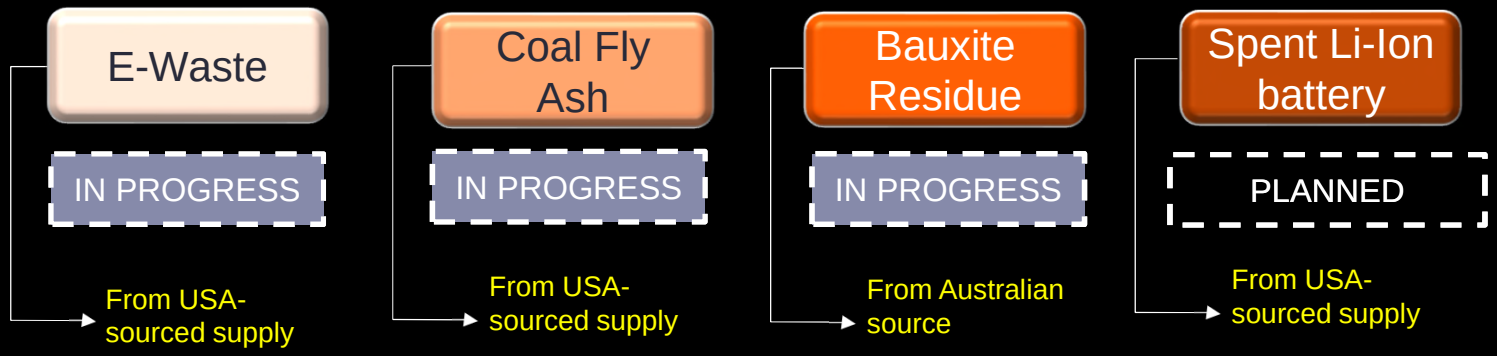
Continuous investment in R&D

MTM CRITICAL METALS

Testing completed and / or in progress

MTM CRITICAL METALS

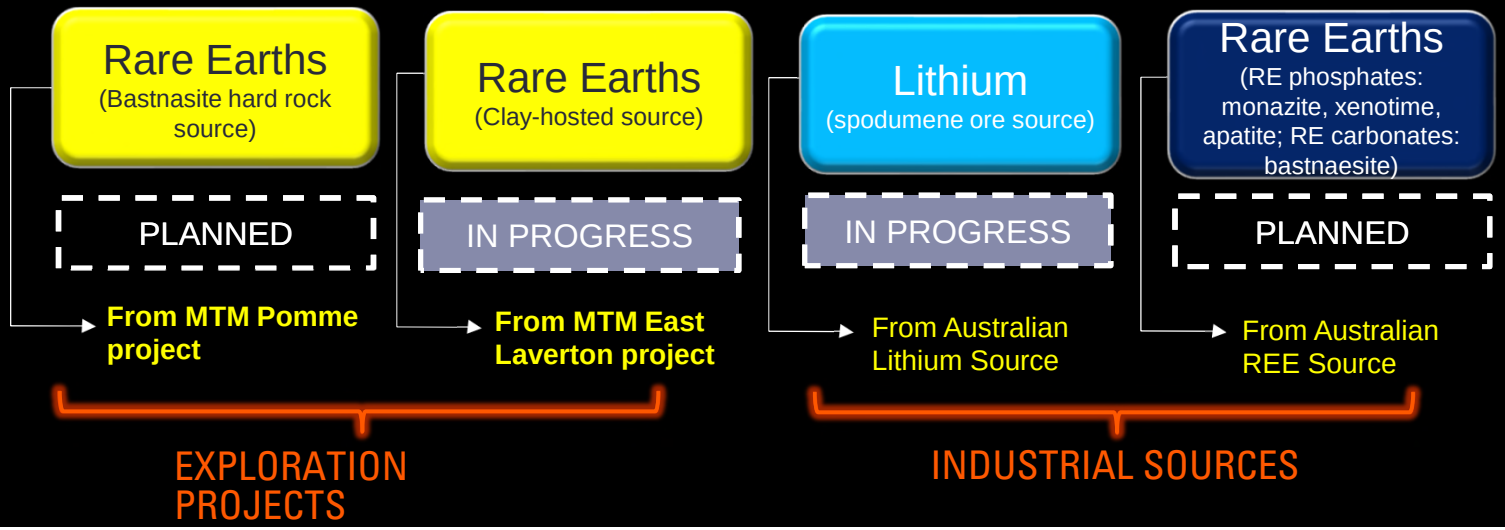
1. Extract metals from industrial waste



PURPOSE

- Recover high value Metals such as **Rare Earths, Rubidium, Gold, Silver, Tin** etc from waste
- Unlock potential sources of domestic supply

2. Improve performance of mineral processing operations



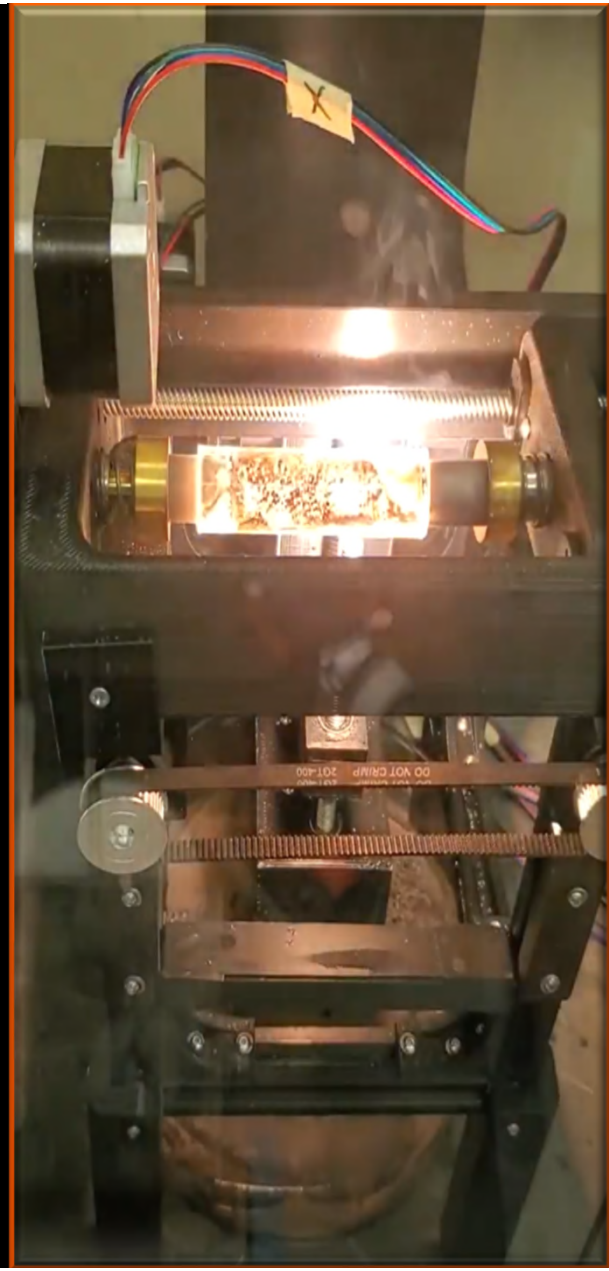
PURPOSE

- Aiming to revolutionise metal recovery flowsheets such as within the Lithium & REE refining industry.
- Opportunity for potential savings in energy, water usage, and emissions.

POTENTIAL INNOVATIONS IN MINERALS PROCESSING

CURRENT FOCUS: LITHIUM & RARE EARTH ELEMENTS

MTM
CRITICAL METALS



The Problem:
Mining & Metal Refining globally is responsible for significant **Energy Usage** & **CO_2 Emissions**

~2% of Global Energy Consumption

~10% of Global CO_2 Emissions

Majority of this energy from **fossil fuels**

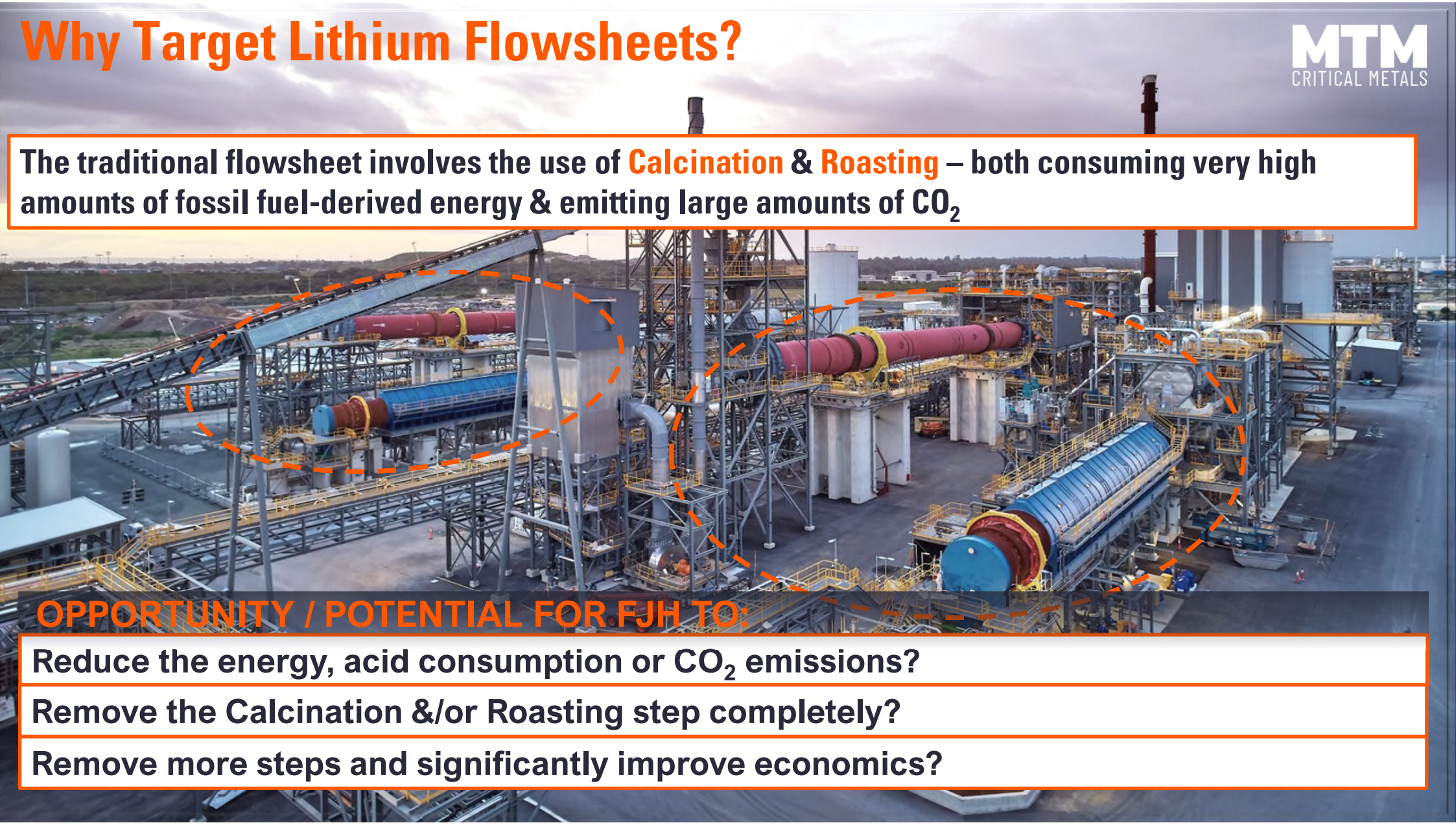
~50% of this energy is for **process heating**

REFERENCE: Aramendia E, Brockway P, Taylor P, & Norman J 2003, 'Global energy consumption of the mineral mining industry: Exploring the historical perspective and future pathways to 2060', Global Environmental Change, vol. 83, https://doi.org/10.1016/j.gloenvcha.2023.102745.
MINING.COM 2022, https://www.mining.com/web/the-carbon-emissions-of-producing-energy-transition-metals-charted/

Why Target Lithium Flowsheets?

MTM CRITICAL METALS

The traditional flowsheet involves the use of Calcination & Roasting – both consuming very high amounts of fossil fuel-derived energy & emitting large amounts of CO_2



OPPORTUNITY / POTENTIAL FOR FJH TO:

- Reduce the energy, acid consumption or CO_2 emissions?
- Remove the Calcination &/or Roasting step completely?
- Remove more steps and significantly improve economics?

Why Target Lithium Flowsheets?

Calcination & Roasting – Allowing lithium to be recovered from refractory spodumene

BACKGROUND

1. Naturally occurring spodumene (‘α-spodumene’) has a monoclinic crystal structure.
2. α-spodumene is “refractory” and is not amenable to leaching using acid.
3. α can be converted into a less dense tetragonal polymorph (β-spodumene) by heating ~ 1,100°C over a defined period.
4. β-spodumene is amenable to acid leaching and the Lithium is typically extracted by reacting the β-spodumene with sulphuric acid (H_2SO_4) at ~ 250degC, generating Lithium Sulphate and alumina silicate waste. The Lithium Sulphate is then converted into Lithium Hydroxide (or carbonate) for use in the cathode of Li-Ion batteries.
5. **The α to β spodumene ‘calcine’ is typically done in a horizontal kiln and could be the most energy and carbon intensive step in the entire process of LiOH production**

MTM
CRITICAL METALS

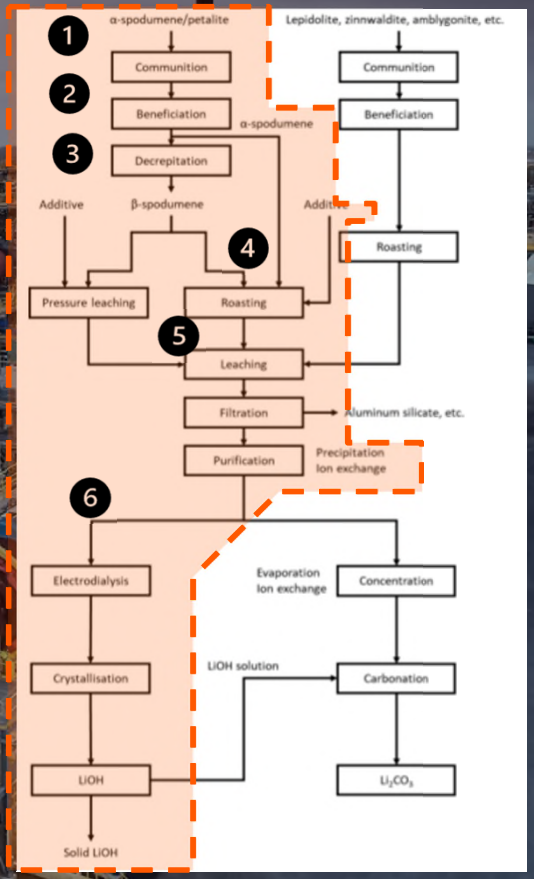
Lithium Hydroxide Flowsheet

Ore to battery-grade product

1. **Mining and Crushing**: Extraction of spodumene ore and crushing it into smaller particles.
2. **Beneficiation**: Separating spodumene from other minerals in the ore.
3. **Calcination**: Converting alpha-spodumene to beta-spodumene.
4. **Acid Roasting**: Reacting beta-spodumene with sulfuric acid.
5. **Leaching**: Dissolving lithium sulfate to extract lithium.
6. **Precipitation and Conversion**: Converting lithium sulfate to lithium hydroxide.

CURRENT FOCUS AREAS

Focus on the Acid-Roast sulphation route

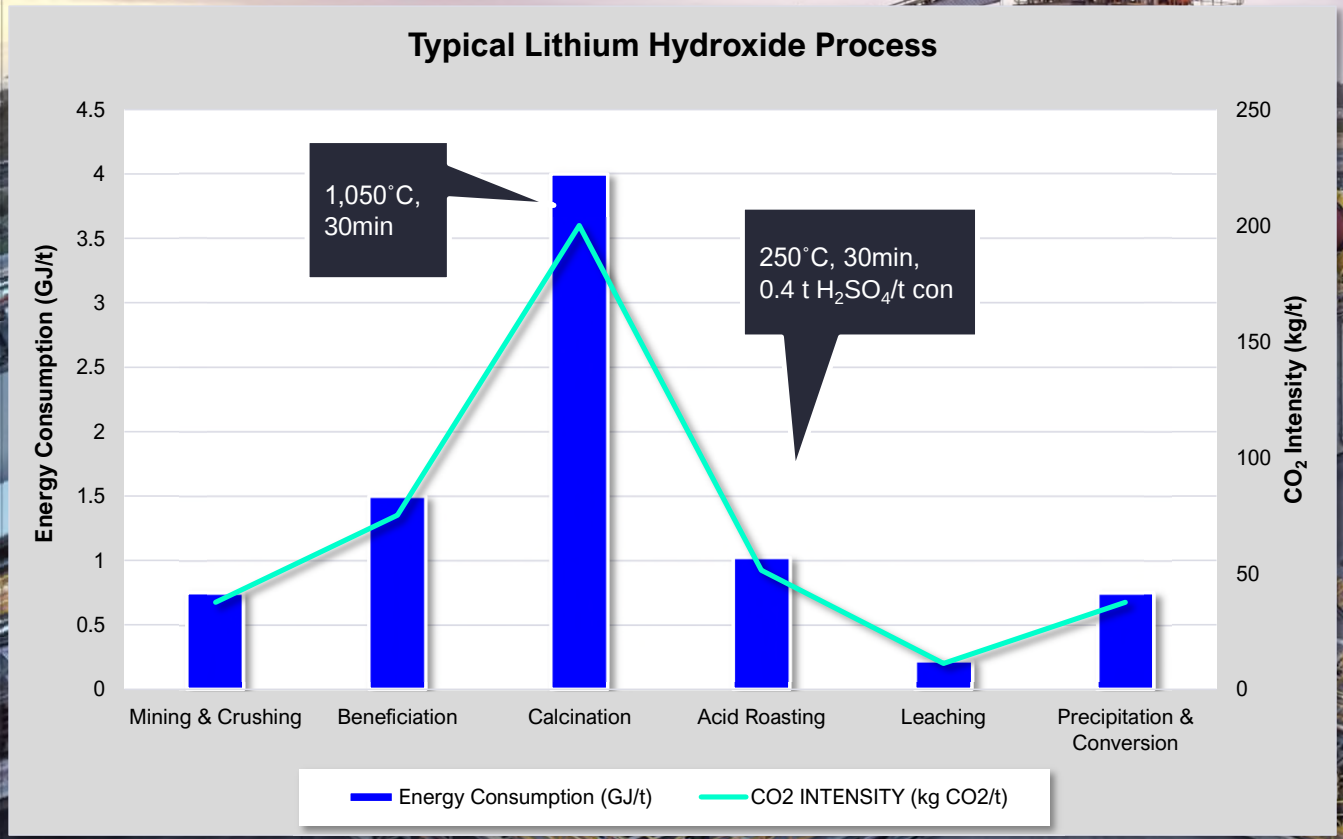


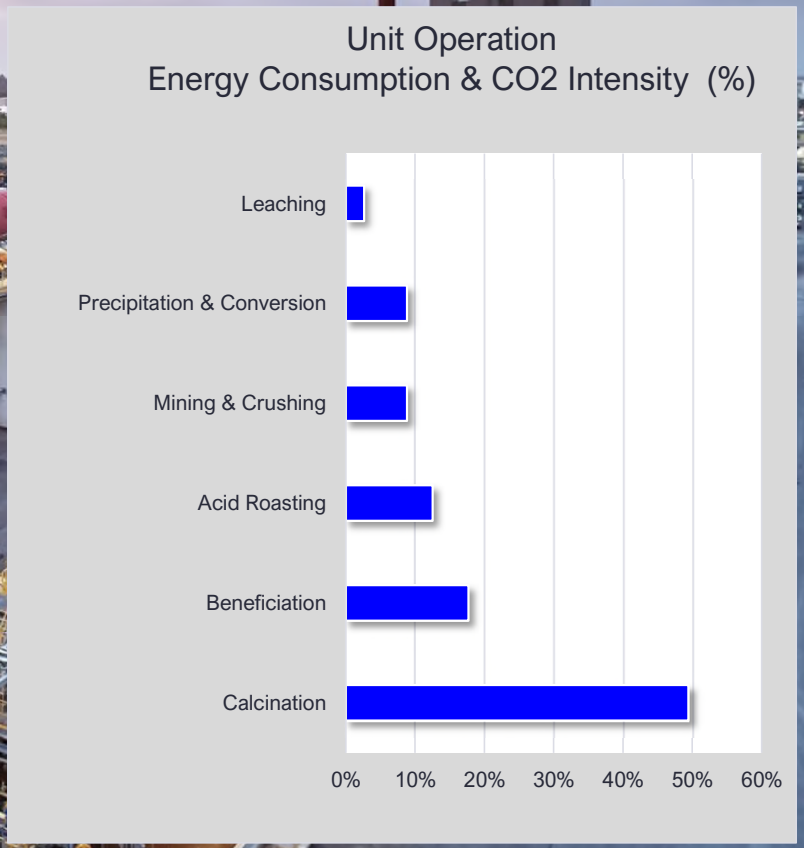
MTM CRITICAL METALS

Why Target Lithium Flowsheets?

MTM CRITICAL METALS

The traditional flowsheet involves the use of Calcination & Roasting – both consuming very high amounts of fossil fuel-derived energy & emitting large amounts of CO_2

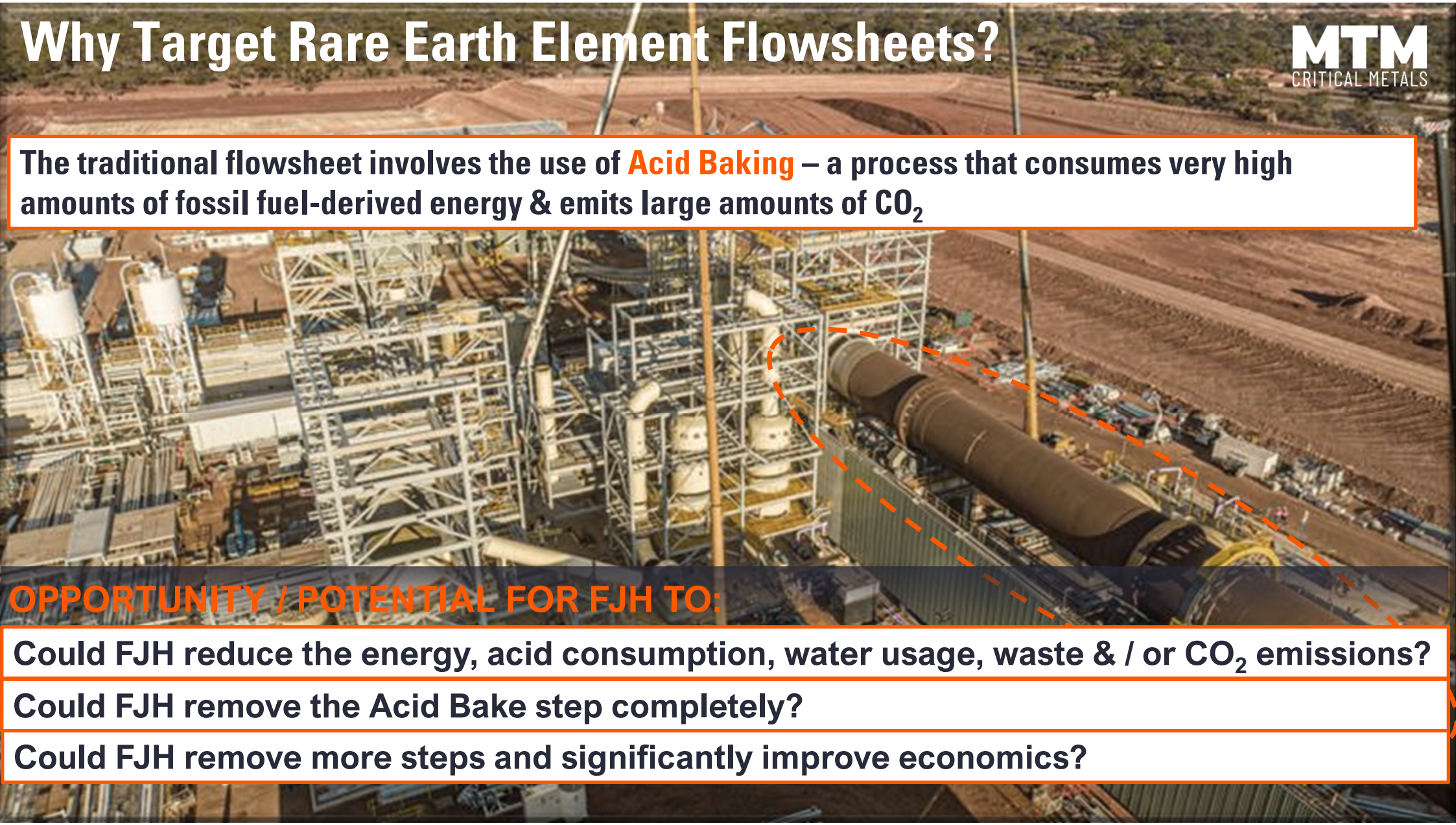




REFERENCE: Ellis, M., & Hayes, J. (2020). "The Energy Consumption in Mining and Beneficiation."; Habashi, F. (1997). "Handbook of Extractive Metallurgy."; Xu, W., & Li, C. (2019). "Energy Consumption in Acid Roasting of Spodumene."

Why Target Rare Earth Element Flowsheets?

MTM CRITICAL METALS



The traditional flowsheet involves the use of Acid Baking – a process that consumes very high amounts of fossil fuel-derived energy & emits large amounts of CO_2

OPPORTUNITY / POTENTIAL FOR FJH TO:

- Could FJH reduce the energy, acid consumption, water usage, waste & / or CO_2 emissions?
- Could FJH remove the Acid Bake step completely?
- Could FJH remove more steps and significantly improve economics?

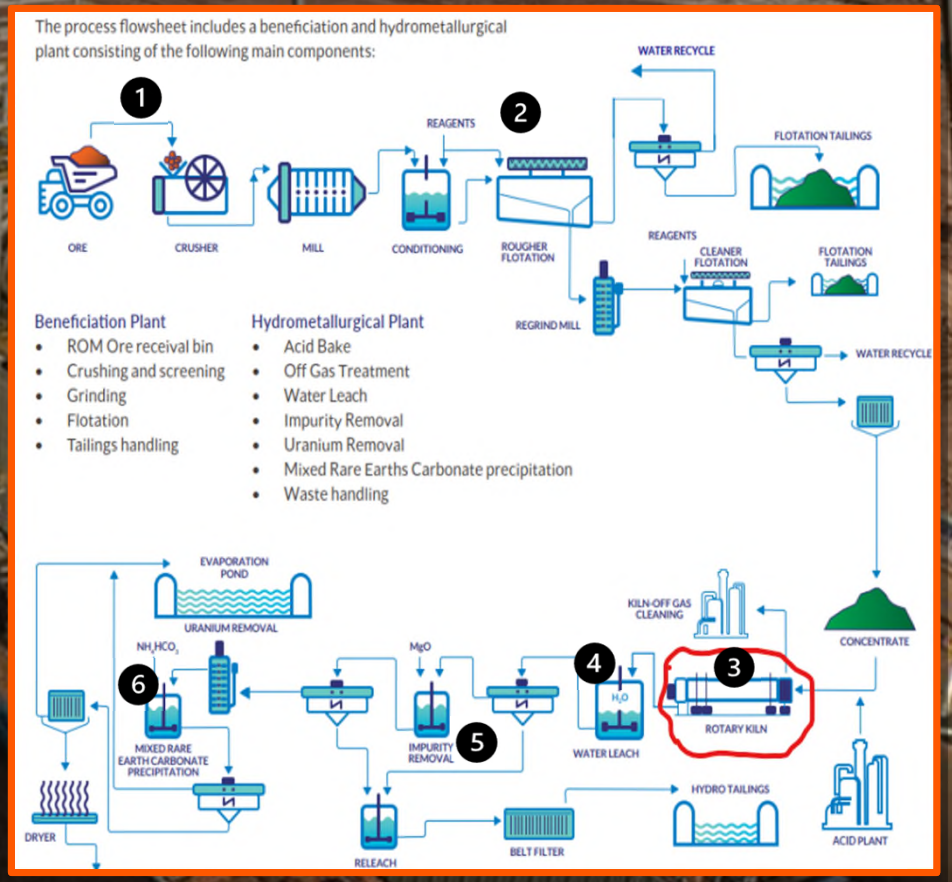
Rare Earth Element Process Flowsheet

MTM CRITICAL METALS

Ore to separated RE oxides with a focus on the acid bake step

1. **Mining and Crushing** : Extraction of MONAZITE ore and crushing it into smaller particles.
2. **Beneficiation**: Separating MONAZITE from other minerals in the ore, e.g. flotation or gravity separation
3. **Acid Bake**: Converting RE phosphates to RE sulfates.
4. **Water Leach**: Dissolve water soluble RE sulfates.
5. **Impurity removal:** Raise the pH with alkali slurry, e.g. MgO to remove undesirable contaminants Al, Fe, Th, U
6. **Carbonation:** Precipitate the rare earths using sodium carbonate to make an MREC
7. **Solvent Extraction (SX):** separate the rare oxides into high purity powders, NdPrOx, SEG/HRE carbonate, La_2O_3, CeO_2, Ce carbonate, LaCe oxide or carbonate

CURRENT FOCUS AREAS



REFERENCE: Hastings Technology Metals Limited, Definitive Feasibility Study, November 2017

Investment Thesis

MTM has multiple pathways to value creation for shareholders

DISRUPTIVE TECH WITH BROAD APPLICATIONS

- Game-Changing Innovation in metal recovery and mineral processing
- Not limited to a single type of metal or waste stream, or industrial application

INDUSTRY COLLABORATIONS & JOINT VENTURES

- Ongoing discussions with top-tier industrial firms & partnerships with major research institutions
- Enhancing development and industry adoption

STRATEGIC POSITIONING & FUNDING

- Actively pursuing strategic grant funding from US Government for critical minerals supply security*
- Several potential strategic applications for US

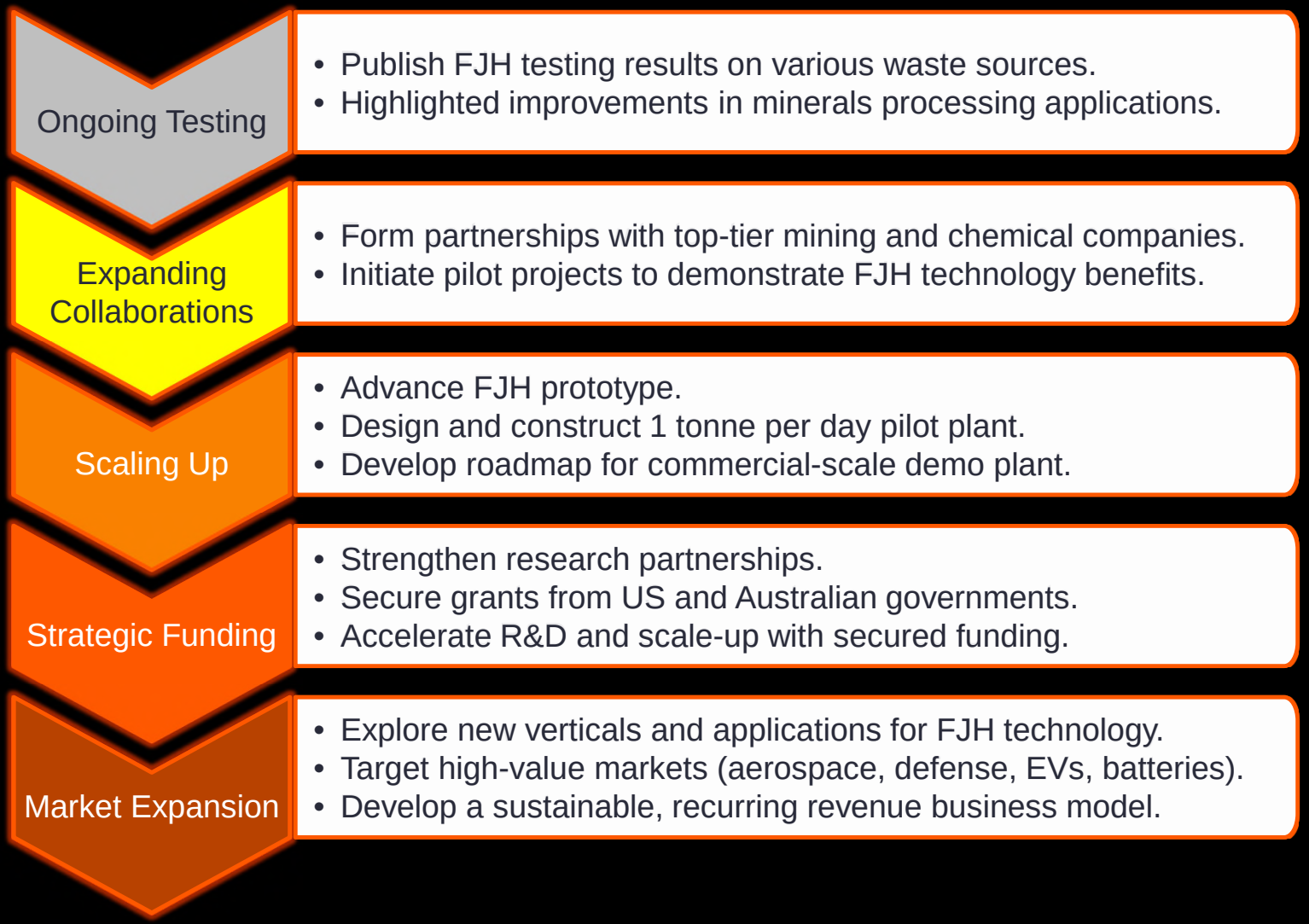
EXPLORATION UPSIDE FOR NIOBIUM & REE

- 2 projects with proven REE mineralisation that may be unlocked by FJH
- Highly prospective niobium project in Australia's most exciting exploration hotspot

MTM CRITICAL METALS

* There are no guarantees that grant funding will be made available on terms satisfactory to MTM, or at all.

Newsflow & Major Catalysts 2024 and Beyond



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APPENDICES

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Recent Success Extracting REE From Coal Fly Ash

MTM CRITICAL METALS

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ABN 27 645 885 463

ASX: MTM

mtmcriticalmetals.com.au

ASX RELEASE

6 May 2024

FLASH JOULE HEATING PROTOTYPE TEST SIGNIFICANTLY INCREASES REE RECOVERY (Amended)

Initial FJH prototype testing shows material improvement in metal recovery from coal fly ash

Highlights:

- Flash Joule Heating (FJH) prototype testing has produced significant increases in the acid leachability of Rare Earth Elements (REE) and target Critical Metals from Coal Fly Ash (CFA) samples.
- CFA samples treated by the FJH prototype delivered a +50% increase in the recovery of REE and Critical Metals.
- Initial testing successfully conducted at 50x scale up from Rice University's proof of concept.
- Ongoing testing will provide technical and performance data for MTM to progress the design of the Pilot FJH Plant.
- MTM will conduct additional Prototype FJH testing on waste sources of REE and Critical Metals including Bauxite Residue, E-Waste and end of life Lithium-Ion Batteries

MTM Critical Metals Limited (ASX:MTM) (MTM or the Company) has received results from testing of coal fly ash (CFA) samples using Flash Joule Heating (FJH). FJH processes improve the acid leachability of rare earth elements (REE) by over 50% and a range of critical metals by between 50% and 514% when compared to traditional acid leach methods.

Table 1: Selected CFA leaching results showing the positive effect on metal recovery using FJH technology.

Element		Head Grade (SGS - ppm)	Leach Recovery Results (Pre FJH) (µg/L)	Leach Recovery Results (Post FJH) (µg/L)	% Change in Recovery
Rare Earth Elements (REE)	Nd - Neodymium	72	637	1,095	72
	Pr - Praseodymium	18	188	285	52
	Dy - Dysprosium	14	367	444	21
	Tb - Terbium	2	41	62	50
	TOTAL MREE	**106**	**1,233**	**1,886**	**53**
	Ce - Cerium	153	1,482	2,377	60
	Er - Erbium	8	277	350	26
	Eu - Europium	3	37	56	50
	Gd - Gadolinium	16	256	367	44
	Ho - Holmium	3	86	121	40
	La - Lanthanum	74	752	1,197	59
	Lu - Lutetium	1	65	79	22
	Sm - Samarium	15	149	232	55
	Tm - Thulium	1	44	58	31
	Y - Yttrium	81	1,346	1,961	46
	Yb - Ytterbium	7	319	381	20
	TOTAL REE	468	6,046	9,065	50
Other Elements of Interest	*Al – Aluminium (%)**	*10	5,814,146	9,497,618	63
	Ba - Barium	978	4,777	3,499	-27
	Co - Cobalt	45	558	964	73
	Cs - Cesium	7	120	333	176
	Li - Lithium	125	3,248	4,857	50
	Ni - Nickel	102	1,214	2,412	99
	Rb - Rubidium	93	1,141	2,427	113
	Sc - Scandium	27	694	1,409	103
	Ti - Titanium	5,900	1,626	9,990	514
	V - Vanadium	205	6,052	1,320	-78

Notes:

- Results are preliminary and un-optimised.

Board & Management

John Hannaford

Non-Executive Chairman

An experienced corporate executive with extensive experience in the ASX Resources sector as Corporate Advisor, Executive, Chairman, Company promoter and investor. A qualified Chartered Accountant and Fellow of the Securities Institute of Australia, he is a founder and director of Rockford Partners, a financial services company in Perth, WA.

David Izzard

Non-Executive Director

A highly experienced Executive and Non-Executive Director with extensive skills in all aspects of financial and commercial management at a senior executive level in both listed and unlisted companies. Strong knowledge and experience of mining operations and instrumental in the formulation of a number of junior exploration companies.

Tony Hadley

Non-Executive Director

A senior metallurgist with over 30 years of experience within the mining industry. Broad technical knowledge in mineral processing covering flowsheets, project design, engineering and process plant commissioning, flotation, comminution, cracking, leaching, gravity and magnetic separartion, and neutralisation of REE concentrates.

Paul Niardone

Non-Executive Director

Experienced director and executive in a range of roles for ASX-listed companies, private entities and not-for-profit organisations. Has establish and expand several prominent Australian businesses, including the Agency Group Ltd where he has been an Director since 2013. Founder and Executive Director of Professional Public Relations, the largest PR and communications firm in Western Australia.

Steve Ragiel

CEO – US Operations

Extensive experience as a CEO and board level executive over more than thirty years in industrial services, environmental services, renewable energy, solid waste recycling and manufacturing. A strong track record of commercialising technologies and executing business strategy with a customer-centric mindset to create significant shareholder value.

Michael Walshe

Technical Advisor

Chemical Engineer & MBA with over 15 years of international experience in engineering, operations, technology commercialisation, & project development across the minerals, chemicals, and energy sectors.

Spent 10 years with process technology company Metso Outotec, in various technical and senior management roles, covering all major commodities.

Corporate Overview

Share price

A$0.039

As at 28 June 2024
(52 week high $0.21, low $0.021)

Market capitalisation

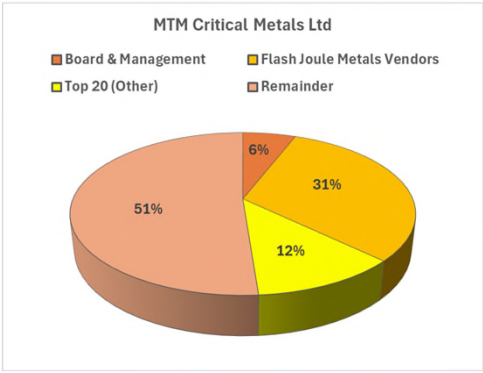
A$11.0m

As at 28 June 2024

Board & Management ownership

5.9%

As at 28 June 2024



Shares on issue

281.1m

As at 28 June2024

Cash

A$3.8m

As at 31 March 2024

Listed options (MTMO)

153.9m

As at 17 June 2024

Debt

Nil

ASX Share price performance ($A)

12 months to 28 June 2024

Disclaimers

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