



**CriticalMetals**

**Vanadium Recovery  
and  
LiB Recycling**

**Annual General Meeting**  
September 2020

# ACKNOWLEDGEMENT

- The majority of the content in this presentation has been provided courtesy of Neometals Ltd (ASX:NMT) and has been used with their express permission.
- Neometals innovatively develops opportunities in minerals and advanced materials essential for a sustainable future. With a focus on the energy storage megatrend, the Neometals strategy revolves around de-risking and developing long life projects with strong partners and integrating down the value chain to increase margins and return value to shareholders.
- Neometals is the largest shareholder of Critical Metals (16.4%).
- Critical Metals has entered a co-operation agreement with Neometals to extract vanadium from steel slag in Sweden and Finland using a proprietary hydrometallurgical process.
- Critical Metals has the sole and exclusive right to commercialise Neometals' LiB recycling technology in Sweden, Norway, Denmark and Finland.



**CriticalMetals**

# INTRODUCTION

- Critical Metals aims to supply Europe with metals from Scandinavia via:
  - urban mining (recovering metals from industrial by-product stockpiles); and
  - traditional mining (discovering and extracting metals from the earth).



## VANADIUM RECOVERY PROJECT



**CriticalMetals**

# VANADIUM RECOVERY

- Critical Metals aims to recover vanadium from steel slag and process it into high-grade vanadium products used in the steel alloy, energy storage and aerospace industries.
- Potential for vanadium production in the lowest quartile of production costs globally due to the very high vanadium grade within the stockpiles, the proposed low energy – low emission – low throughput flowsheet and the location of the stockpiles.
- Vanadium products expected to supply ~5% of global demand from 2025.



**CriticalMetals**

# OPPORTUNITY

- To supply European and North American industry with high-purity vanadium products produced in Sweden and Finland without the need to open a new mine.
- To recover metals from by-products in an environmentally friendly manner powered by renewable energy (hydro and wind).
- To supply the European energy storage industry (principally vanadium redox flow batteries) with responsibly sourced vanadium chemicals.
- To decrease Europe's reliance on China, South Africa and Russia for the supply of vanadium.

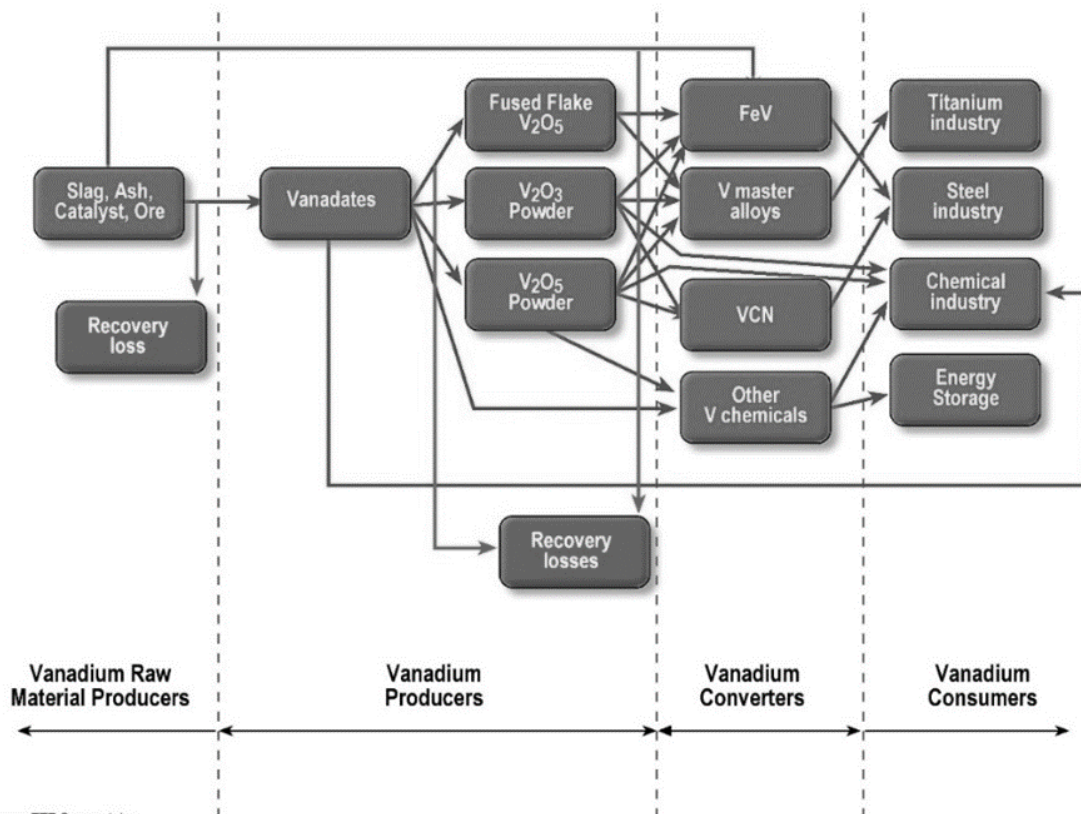


**CriticalMetals**

# TRANSACTION

- 10 year slag supply agreement with SSAB
  - Conditional on meeting project study milestones by due dates and commencing production by December 2024
  - Right to purchase at least 2M dry metric tonnes of slag
- Collaboration agreement with Neometals Ltd
  - Neometals to fund all studies up to final investment decision, which if positive will lead to a 50:50 joint venture
  - Critical Metals will fund location study for plant in Sweden or Finland
  - Neometals entitled to a gross revenue royalty on sales of vanadium products

# THE VANADIUM MARKET

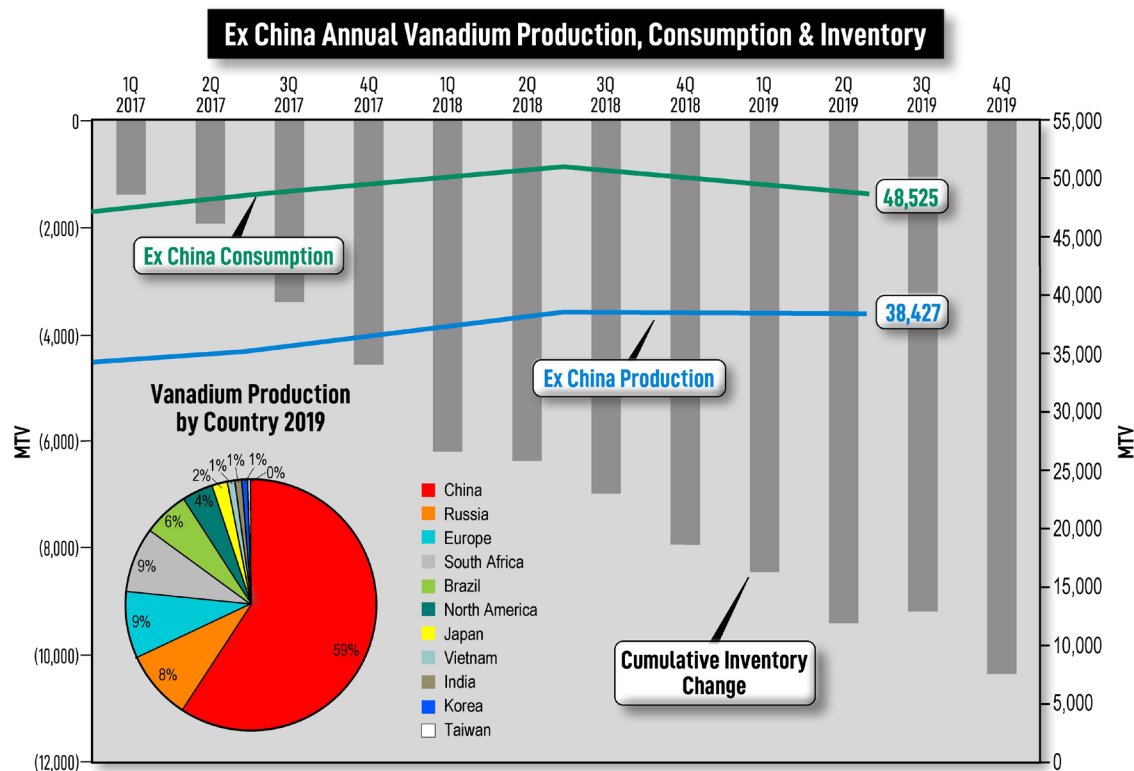


Source: TTP Saured, Inc



# NEED FOR A SECURE EU SUPPLY CHAIN

Vanadium on European Union Critical Metals List since 2017



Source: Vanitec

# THE BACKGROUND

- Scandinavian steel giant SSAB has +2Mt of high-grade vanadium-bearing by-product (“Slag”) stored at 3 steel mills in Sweden and Finland.
- Approx 2Mt of very high-grade vanadium feedstocks secured by Critical Metals Ltd (15.4% NMT) under supply agreement
- Neometals funding evaluation of vanadium recovery using proprietary eco-friendly hydromet process
- Scoping study indicated potential lowest quartile position opex for proposed 50:50 Incorporated JV
- Location study in progress considering Luleå and Boden in Sweden, Raahе and Pori in Finland and Teesside in England.



# LOCATION AND STOCKPILES

Luleå	
Slag stored	+630kt
Vanadium Grade $V_2O_5$	+4%
Contained $V_2O_5$	+25,000t
Net Slag Added	100ktpa



Raahe	
Slag stored	+360kt
Vanadium Grade $V_2O_5$	+3%
Contained $V_2O_5$	+13,000t
Net Slag Added	80ktpa

Oxelösund	
Slag stored	+890kt
Vanadium Grade $V_2O_5$	+3%
Contained $V_2O_5$	+25,000t
Net Slag Added	90ktpa

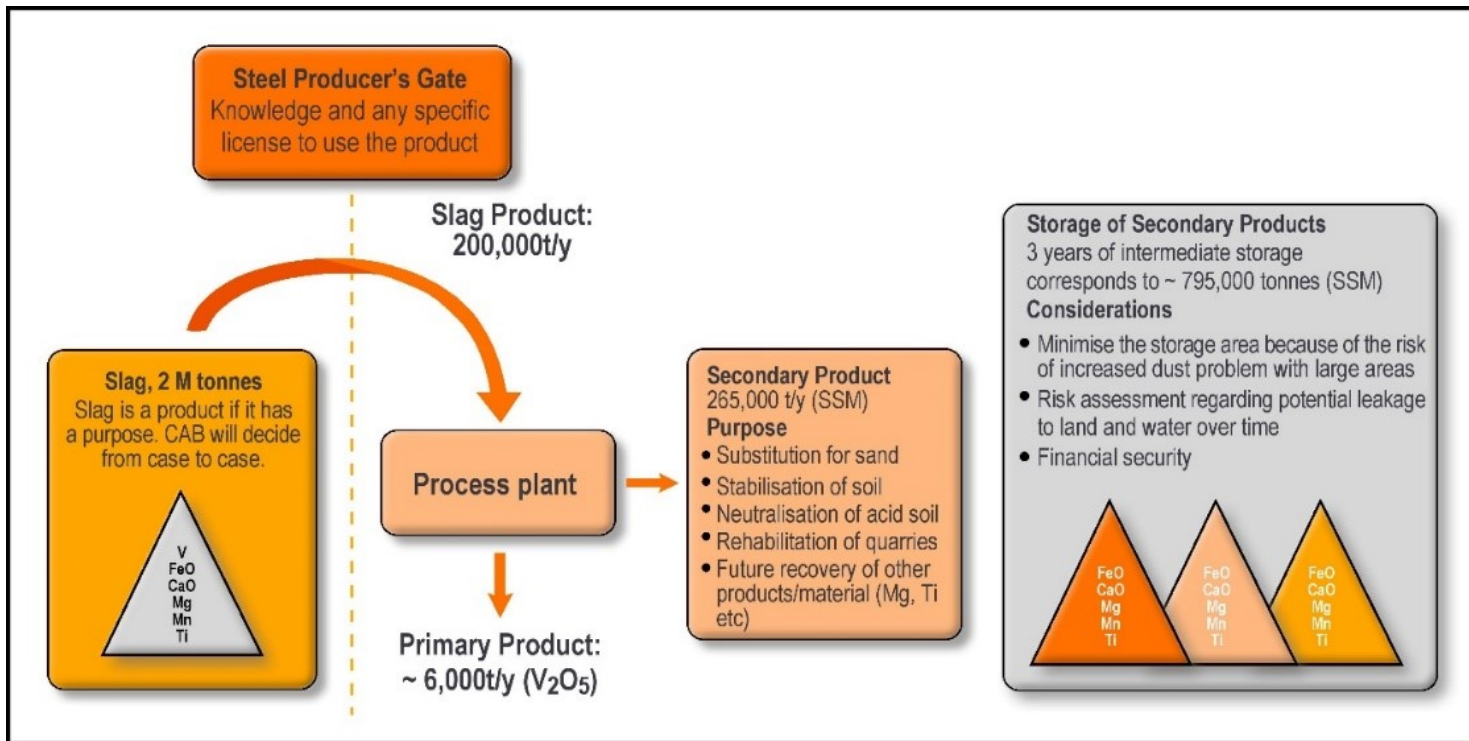
## Agreement Volumes and Price

- Initial purchase of 700kt of Slag from Luleå post FID
- Purchase 200ktpa Slag post commercial production for 10 years
- Price linked to prevailing FeV80 vanadium price and vanadium content (reference grade 2.2%  $V \sim 3.9\% V_2O_5$ )

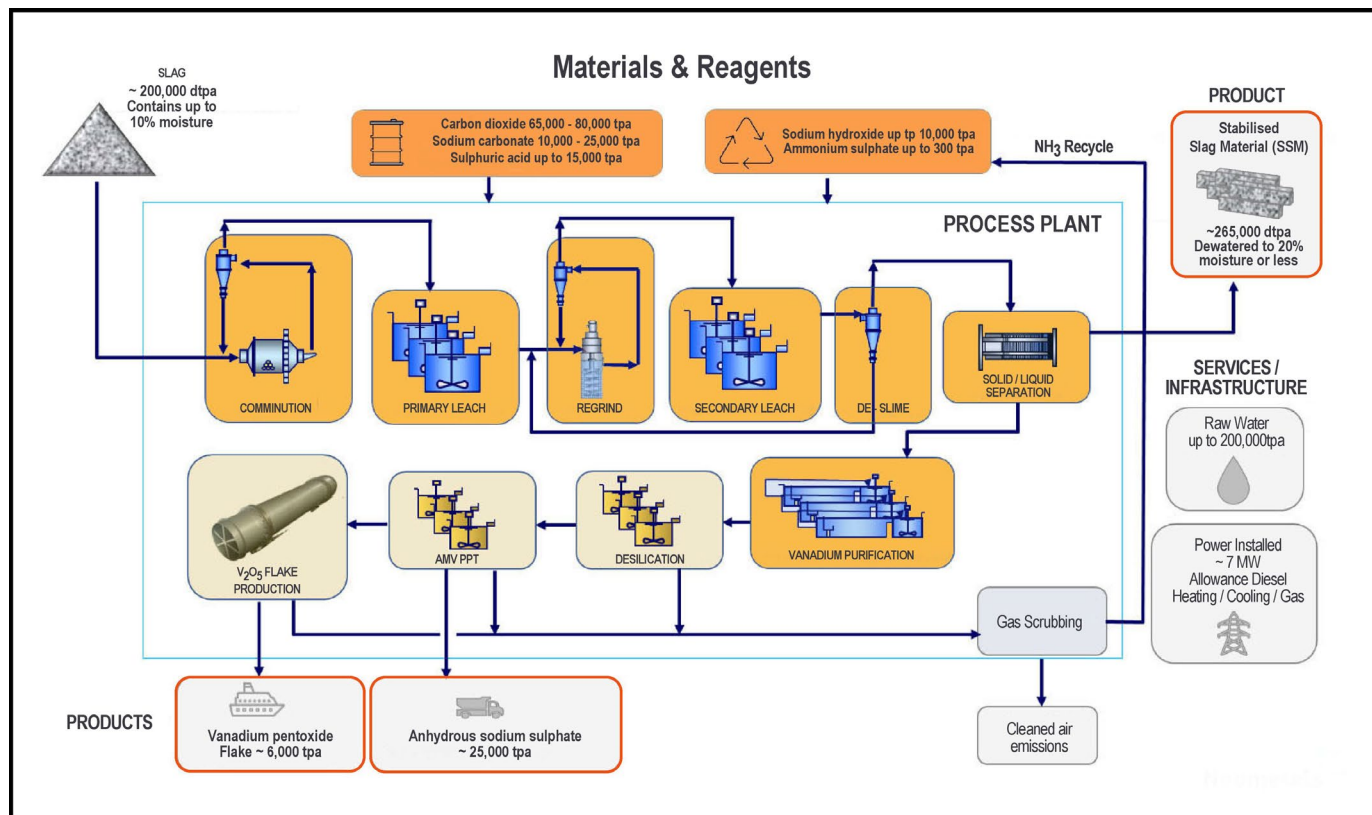


**CriticalMetals**

# MATERIALS FLOW – VANADIUM RECOVERY

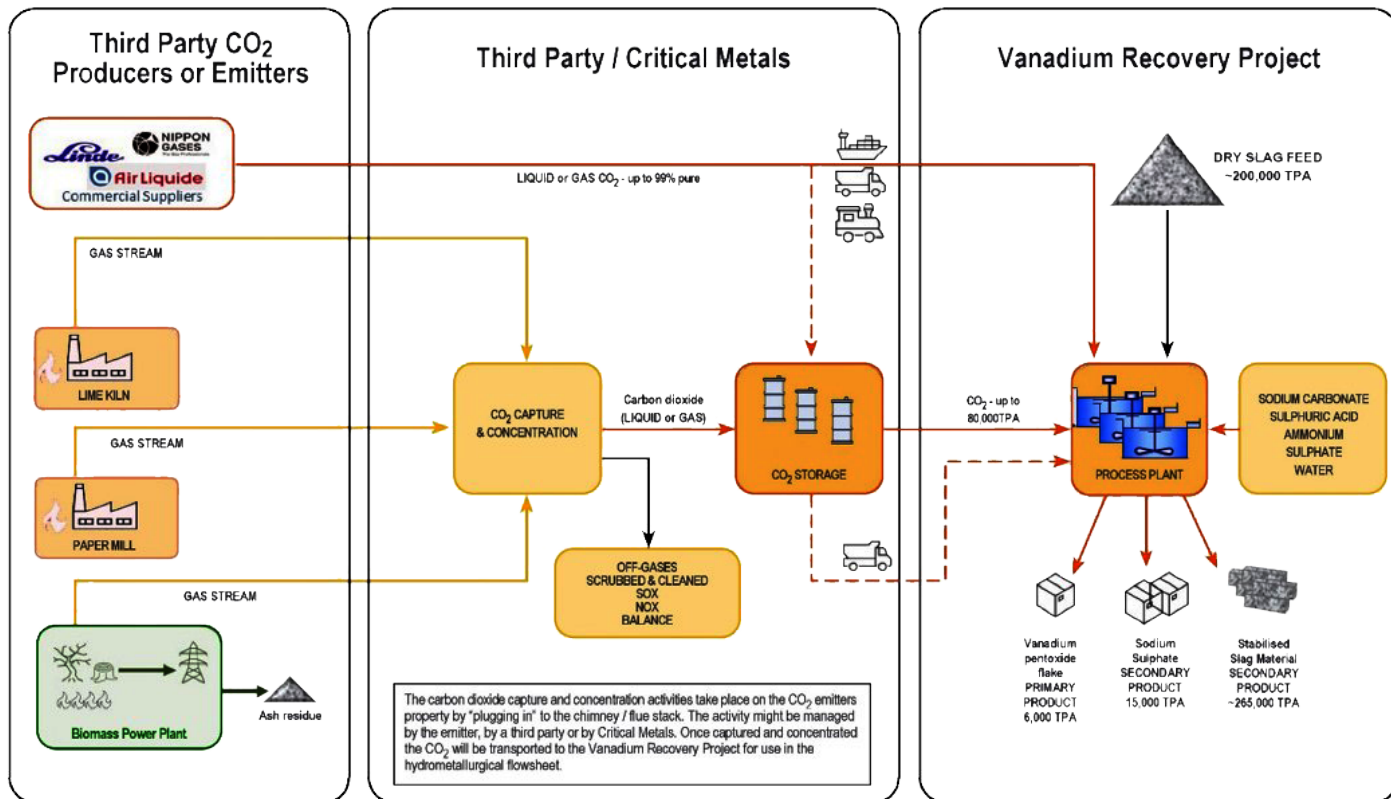


# HIGH LEVEL FLOWSHEET – VANADIUM RECOVERY



CriticalMetals

# CARBON CAPTURE – VANADIUM RECOVERY





# MINI PILOT PLANT – VANADIUM RECOVERY



# MINI PILOT PLANT – SECONDARY PRODUCT

- One of the secondary products is stabilised slag material (SSM)
- SSM is considered inert and non-hazardous.
- SSM product is a filter cake of calcium carbonate rich particles, normally  $<20\mu\text{m}$  and with a water content of about 20% or less (depending on the filtration method and the level at which the material is dried during filtration).
- Annual production of the dried material is estimated at ~265,000 tons / year (291,500 - 307,400 tons / year wet filter cake).
- pH of ~11 and a liquid density of 1.02.
- Chemical composition is estimated to be calcium (~24%), iron (~14%), magnesium (~4%), silica (~3%), manganese (~2%), aluminum (~0.75%), titanium (~0.6%), vanadium (~0.4%), phosphorus (~0.2%) and chromium (0.1%).
- As the test work continues, more accurate information will be obtained.



**CriticalMetals**



# INPUTS – VANADIUM RECOVERY

DESCRIPTION	CHEMICAL SYMBOL	VOLUME / MASS (TONNES/Y)	COMMENT
Slag		200,000	Feedstock currently stockpiled in Luleå, Oxelösund and Raahe.
Raw water	H <sub>2</sub> O	165,000	To be sourced from local supplier. Raw water storage tanks. Used as make-up for cooling tower and reagent mixing. First fill ~1,000m <sup>3</sup> .
Potable water	H <sub>2</sub> O	4,500	To be sourced from local supplier. Used in ablution facilities, safety showers and main buildings. Direct municipal pipeline assumed. No storage. First fill ~150m <sup>3</sup> .
Sodium carbonate	Na <sub>2</sub> CO <sub>3</sub>	25,000	Commercial supply, ~3 trucks per day.
Carbon dioxide	CO <sub>2</sub>	80,000	To be sequestered from industrial site currently emitting gas to atmosphere, delivered via pipeline or truck.
Sulfuric acid	H <sub>2</sub> SO <sub>4</sub>	15,000	Commercial supply, ~2 trucks per day.
Sodium (or potassium) hydroxide	NaOH / KOH	10,000	Commercial supply, ~2 trucks per day
Ammonia	NH <sub>3</sub>	300	Commercial supply, ~2 trucks per month – stored in steel tanks
Heat		250,000,000 MJ/year	Heat for building and plant.



# OUTPUTS – VANADIUM RECOVERY

DESCRIPTION	CHEMICAL SYMBOL	VOLUME (TONNES/Y)	COMMENT
Vanadium pentoxide	V <sub>2</sub> O <sub>5</sub>	6,000 tpa	Produced as a flake and stored in bulker bags and or sealed 44-gallon drums.
Stabilised slag material (SSM)		265,000	To be stored on site or sold.
Sodium (or potassium) sulphate	Na <sub>2</sub> SO <sub>4</sub> / K <sub>2</sub> SO <sub>4</sub>	25,000	Produced as crystallised material (likely anhydrous) ready for sale and distribution. Marketing pending.



# SCOPING STUDY RESULTS

Plant  
feed rate



**200,000tpa**

Vanadium Output



**12 m lbs p.a.  
high purity V<sub>2</sub>O<sub>5</sub>**

OPEX



**US\$3.92/lb**

Capital costs



**US \$159m**  
(inc 20% contingency)

Payback



**<5 years**

Pre tax NPV<sub>10</sub>



**US \$138m**  
(IRR 24%)

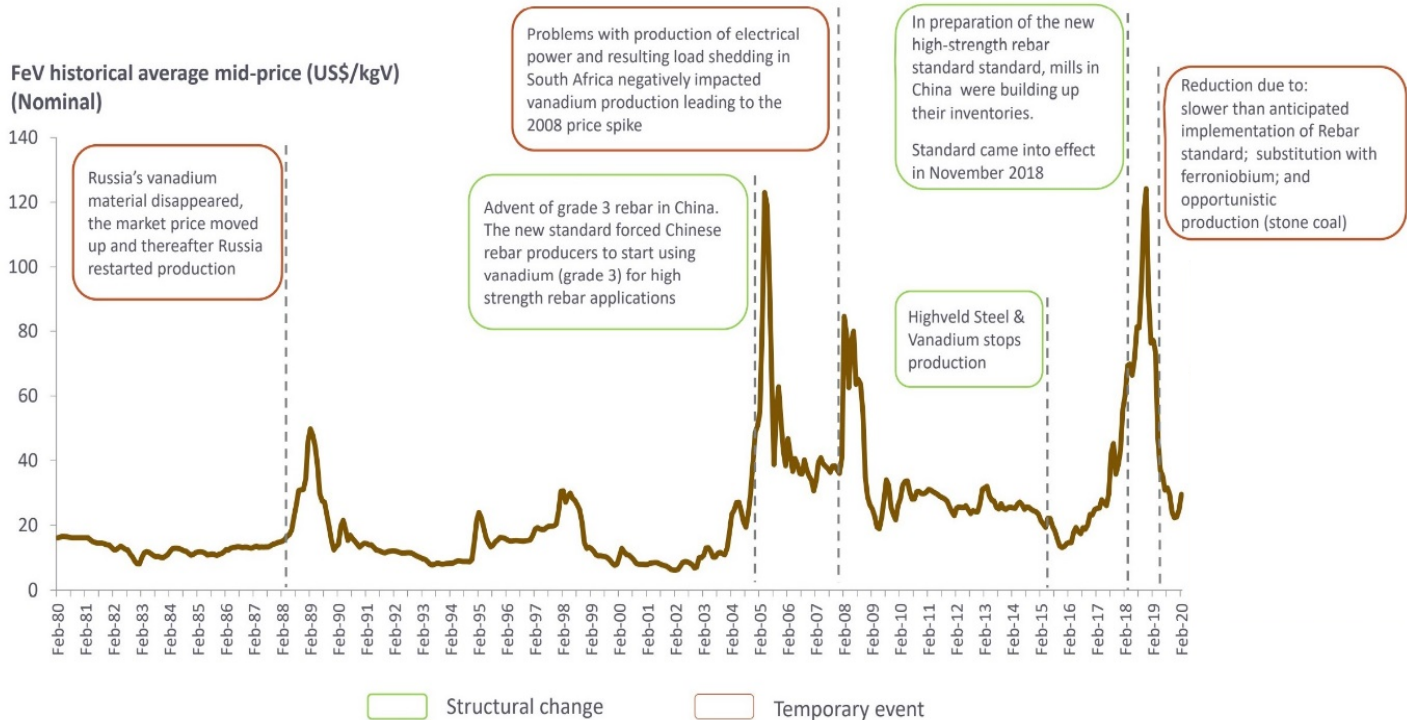


**CriticalMetals**

\*Source: Please refer to ASX announcement 24 June 2020 titled "Vanadium Recovery Project – Scoping Study Results"

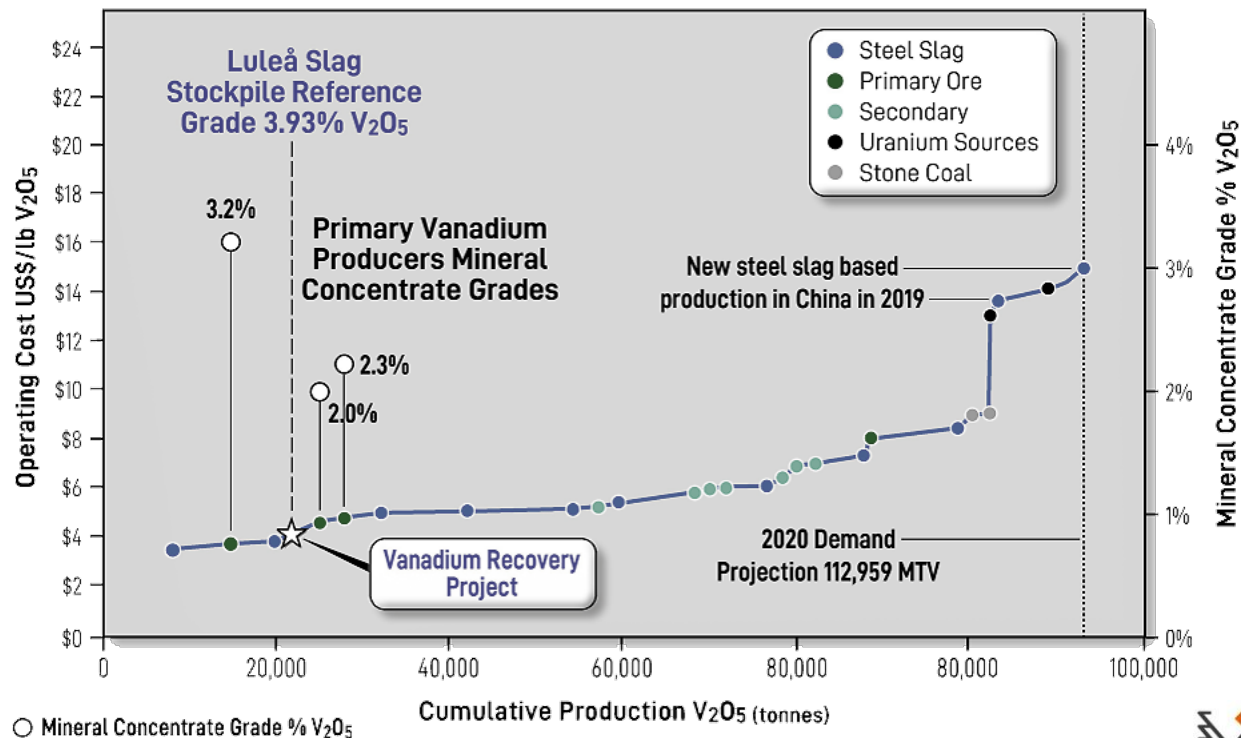
# VANADIUM PRICE CHART

## Ferrovanadium price chart



# HIGH GRADE / PROCESS DELIVERS A SUSTAINABLE COMPETITIVE ADVANTAGE

Vanadium Cost Curve 2020



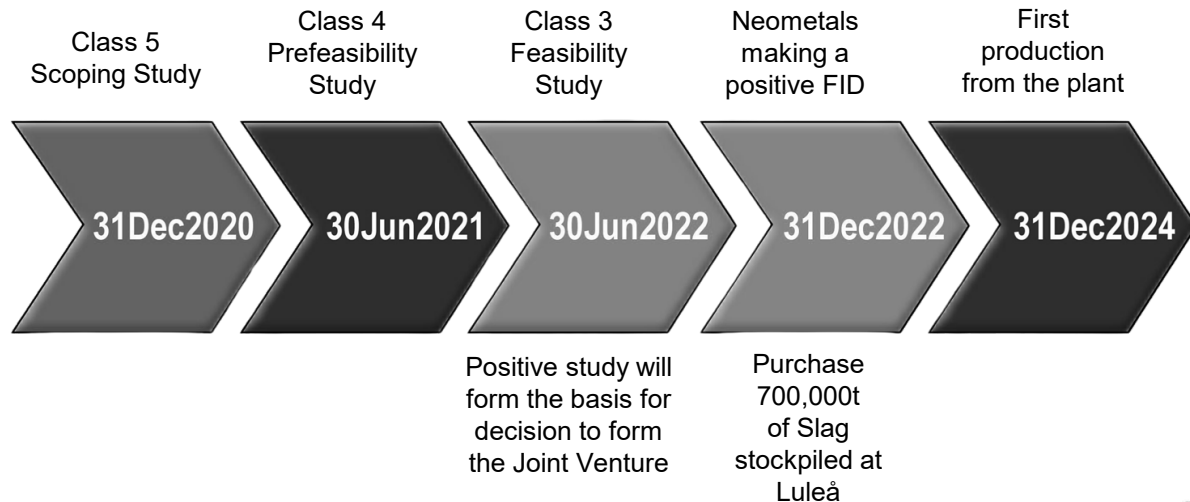
Source: TTP Squared

# FORWARD WORK PROGRAM

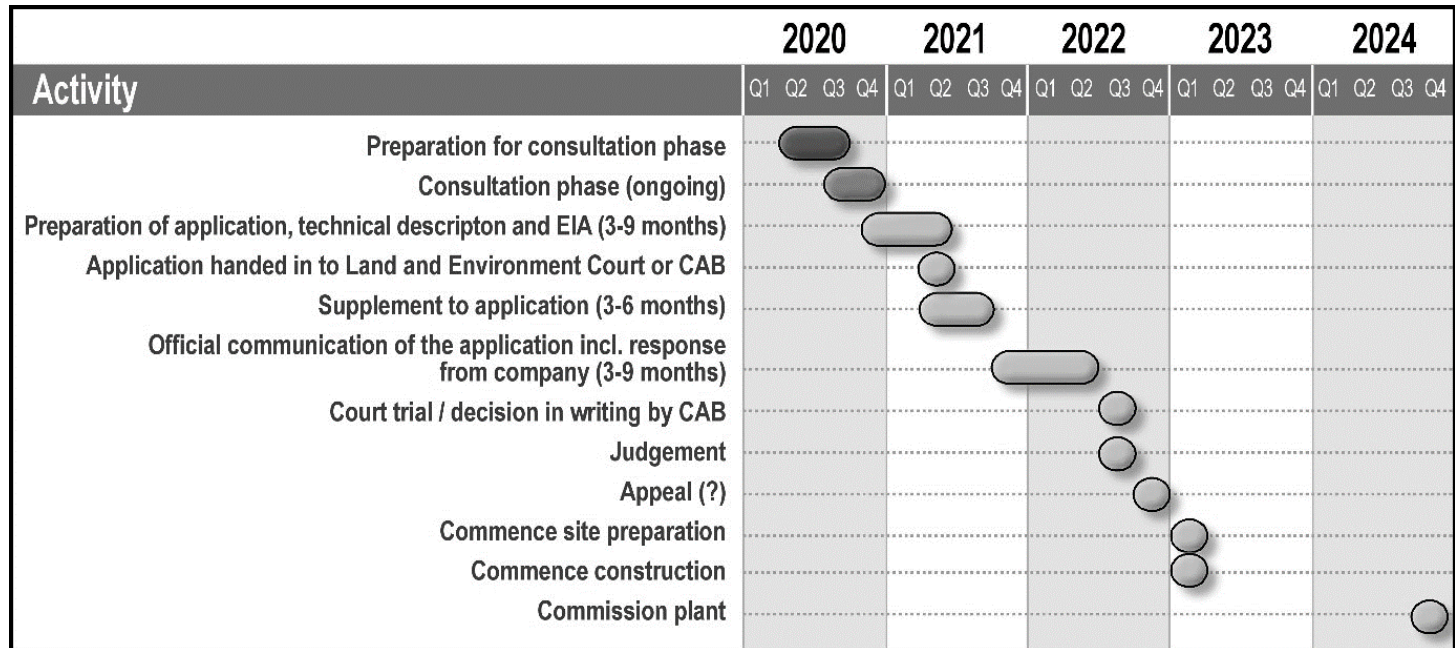
Evaluation studies to be funded and managed by Neometals to timetable below:

- Metallurgical testwork
- Class 5, 4 and 3 AACE (Association for the Advancement of Cost Engineering) Engineering Cost studies

## Indicative Project Timeline – Steel Slag Project



# TIMELINE



**CriticalMetals**

# SHORT TERM MILESTONES

Date	Milestone
October 2020	<ul style="list-style-type: none"><li>• JORC compliant resources for Luleå stockpile</li><li>• Mini Pilot test results</li></ul>
November 2020	<ul style="list-style-type: none"><li>• Completion of Location Study</li><li>• Delivery of Scoping Study to SSAB</li></ul>
December 2020	<ul style="list-style-type: none"><li>• Capital Raise for Critical Metals</li></ul>
January 2021	<ul style="list-style-type: none"><li>• Commencement of PFS</li></ul>
April 2021	<ul style="list-style-type: none"><li>• Operation of Pilot Plant</li></ul>
June 2021	<ul style="list-style-type: none"><li>• Delivery of PFS to SSAB</li></ul>





## LIB RECYCLING PROJECT



**CriticalMetals**

# LITHIUM ION BATTERY RECYCLING

- The EU needs between 10 and 20 Lithium Ion Battery (LiB) Giga factories to meet demand.
- The EU faces intense global competition for critical metals to supply the Giga factories.
- Waste (off-spec and end-of-life) generated from LiBs will be large and must be recycled.
- Forecast growth of EVs using LiBs is massive.
- Substantially more critical metals need to be sourced from within the EU.
- High potential to source feedstock and create a sustainable LiB recycling business with support of both the EU legislation and Scandinavian recycling culture.

# TRANSACTION

- Critical Metals has the sole and exclusive rights to recycle LiBs in Sweden, Norway, Denmark and Finland using Neometals' proprietary technology. Critical Metals is free-carried through the technology development process up to a Final Investment Decision.
- Neometals and SMS Group GmbH ("SMS") have established a recycling joint venture. SMS is a global, leading partner for the metal industry, refer [www.Primobius.com](http://www.Primobius.com).
- Execution of an agreement between Neometals and SMS Group has added significant value to the sole and exclusive license held by Critical Metals.



**CriticalMetals**

# OPPORTUNITY FOR CRITICAL METALS

- Independently process waste (off-spec and end-of-life) LiBs.
  - Revenue from sale of high-purity metals 'produced' from recycling waste LiBs.
- Batch process (toll treat) waste (off-spec and end-of-life) lithium ion batteries on behalf of collectives, existing recycling companies and importers & distributors of electronic and electric equipment.
  - Revenue from providing service to third party.
- Joint venture initiatives with National Government, local Kommuns, recycling companies, collectives and importers & distributors of electronic and electric equipment.
  - Partner with existing actors to generate an optimal solution for the recycling of waste containing critical metals.



**CriticalMetals**

# THE RATIONALE FOR LIB RECYCLING IS CLEAR



## Fire Risk

These risks have led to concerns over the storage, transport, disposal, ethical supply and sustainability of these batteries.



## Pollution (GHG)

As a result, many countries have imposed recycling regulations in order to help reduce these risks.



## Landfill

EU Battery Directive – ‘producers’ must recycle or acquit the same amount.



## Material Shortages

EOL vehicle directive – more than 85% to be reused and recycled.



## Circular Economy

Mandatory recycling in California - no landfill dumping.



**CriticalMetals**

# REDUCING THE LEVEL OF HAZARDOUS MATERIAL

**>15MT** Discarded LiB  
from 2020-30



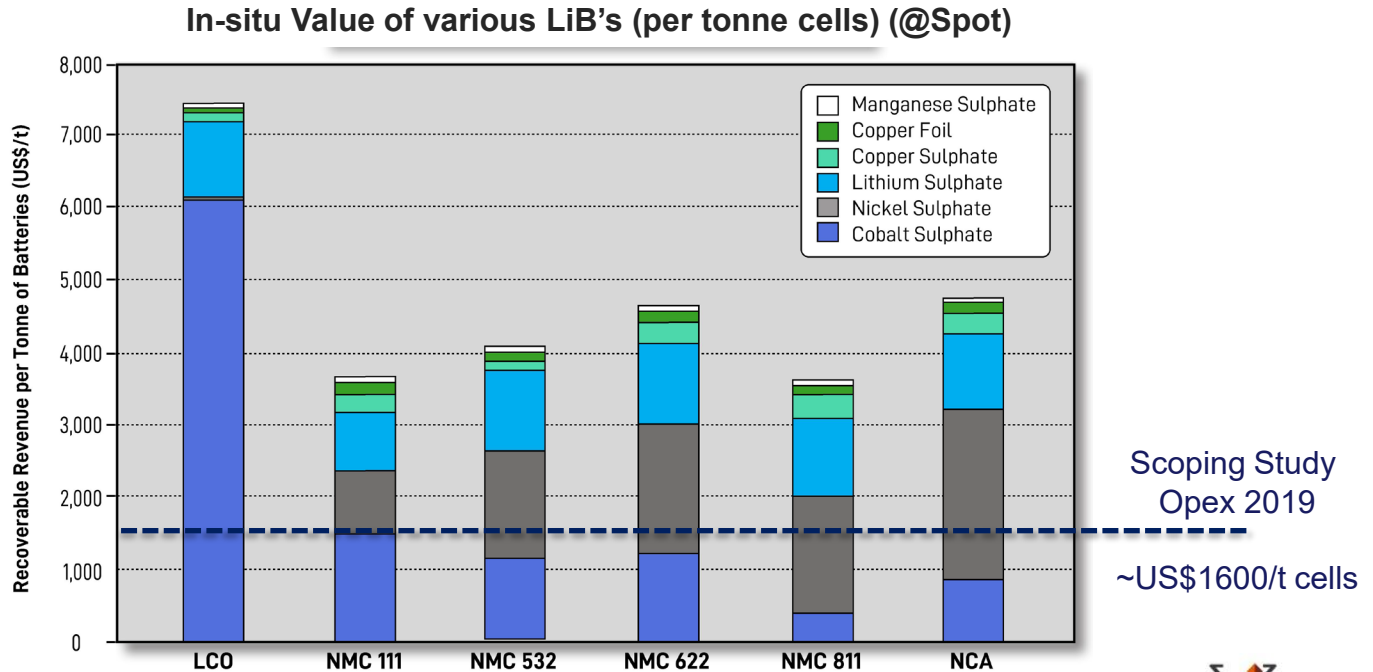
- Expired LiBs are growing in volume.
- Combustible and hazardous content at risk of being dumped into landfill.
- Small % of LiBs are currently being recycled.
- Incumbent recycling technology sees most of the valuable ingredients burnt and released into the atmosphere.



**CriticalMetals**

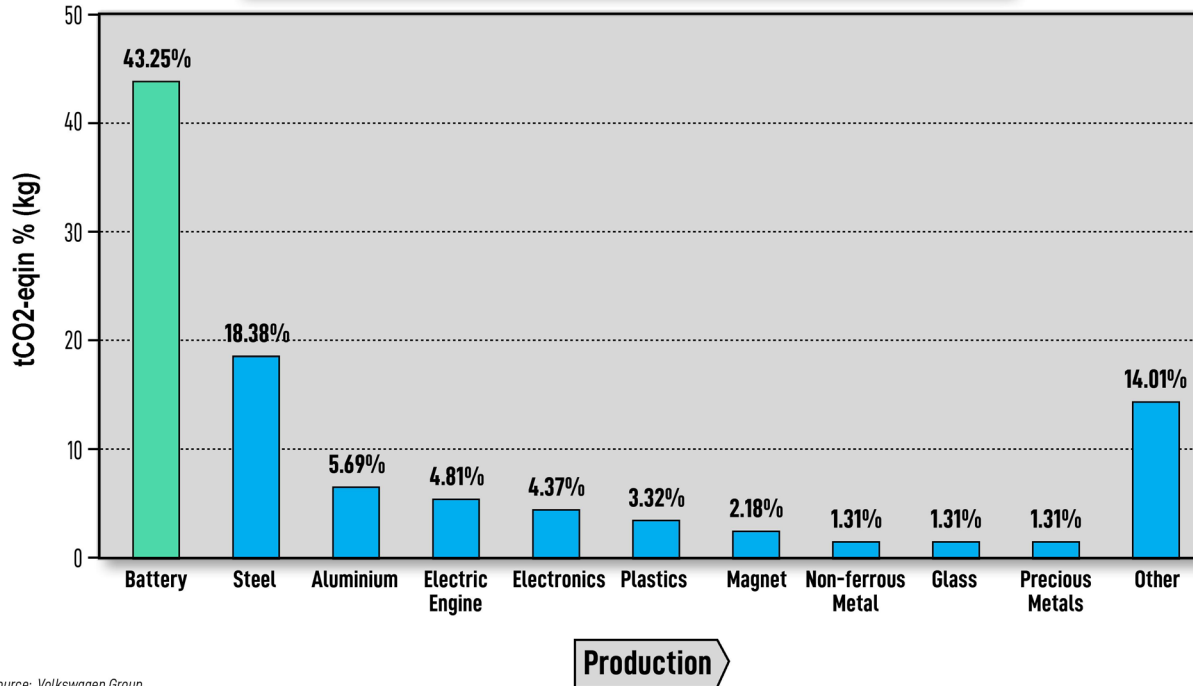
# SPENT LIBS ARE ECONOMICALLY VALUABLE

NEOMETALS' STUDIES INDICATE ROBUST ECONOMICS IRRESPECTIVE OF FEEDSTOCK



Source : Benchmark Mineral Intelligence (pricing assumptions for nickel, cobalt and lithium products)  
NMT Management (battery cell composition, pricing assumptions for copper and manganese products)

# LIB RAW MATERIALS ARE LARGEST SOURCE OF CO<sub>2</sub> IN ELECTRIC VEHICLES



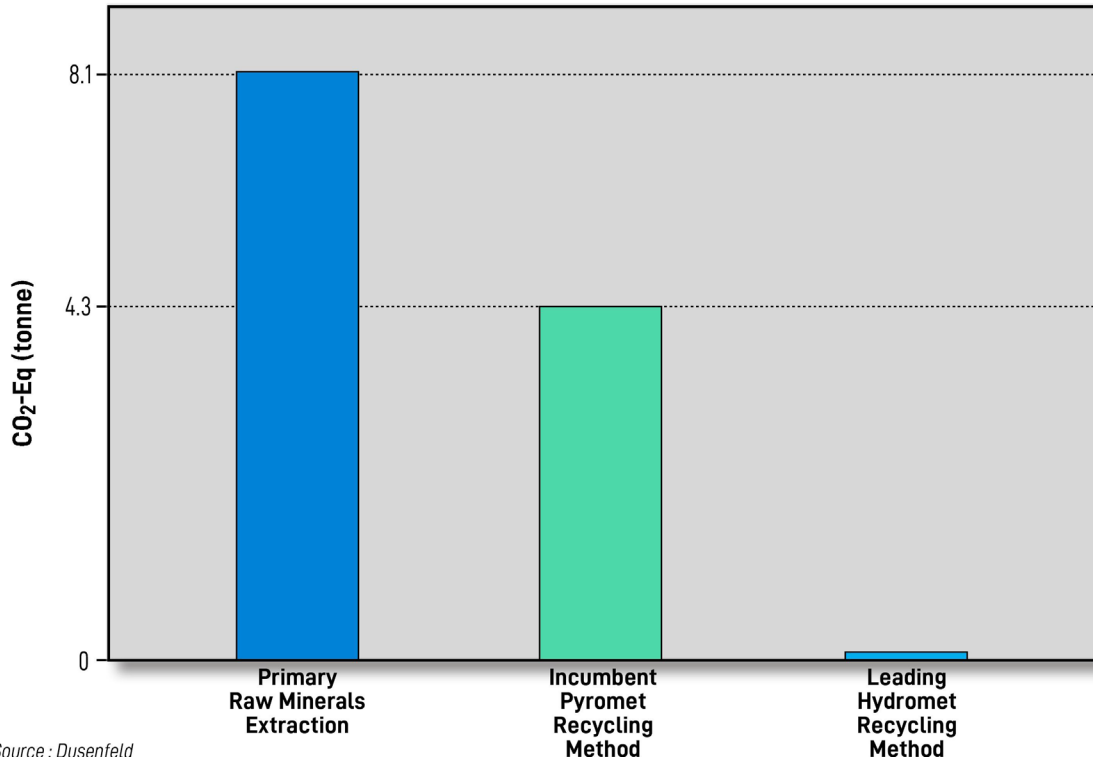
Source: Volkswagen Group



# HYDROMETALLURGICAL RECYCLING HAS THE LOWEST CARBON FOOTPRINT



**Raw Material CO<sub>2</sub> Savings - Traditional Mining vs Battery Recycling**



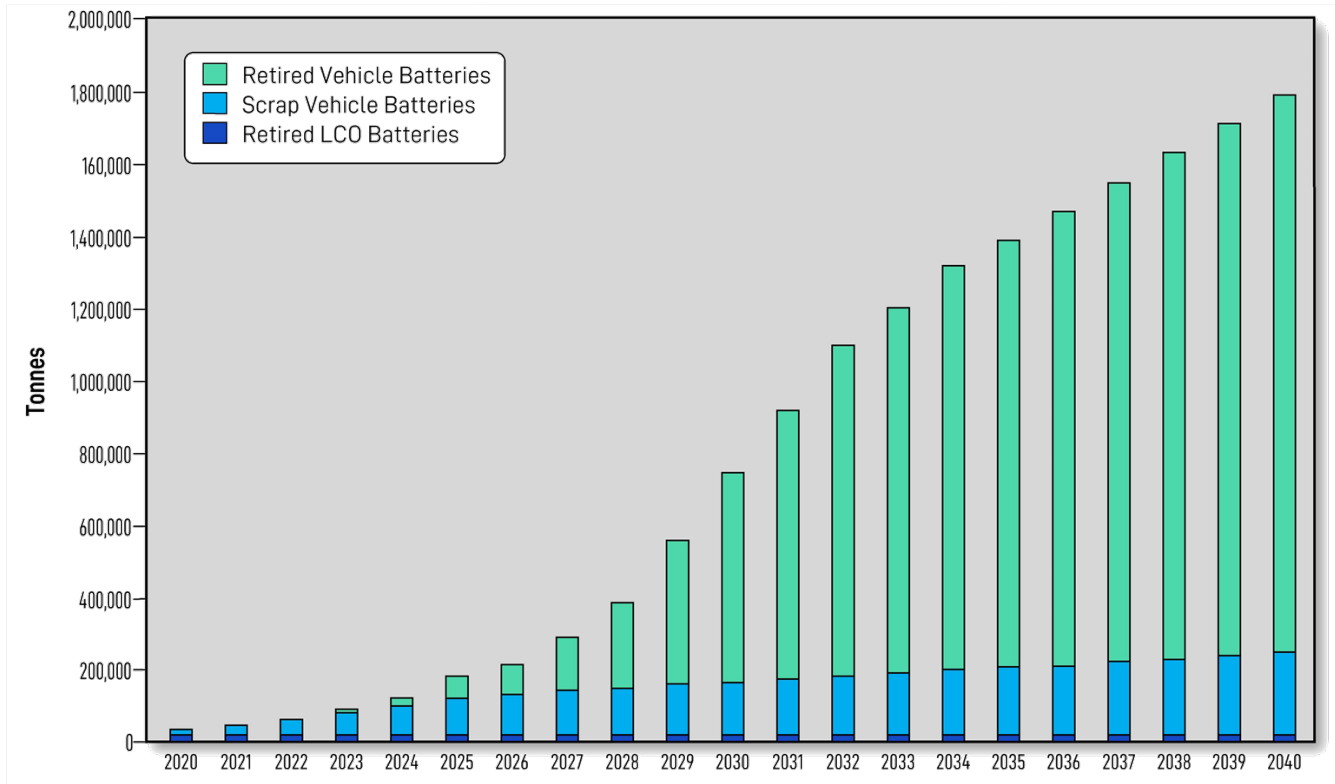
Source : Dusenfeld



**CriticalMetals**

# EU NEEDS DOMESTIC RECYCLING...

## European Lithium Ion Battery Recycling Feed



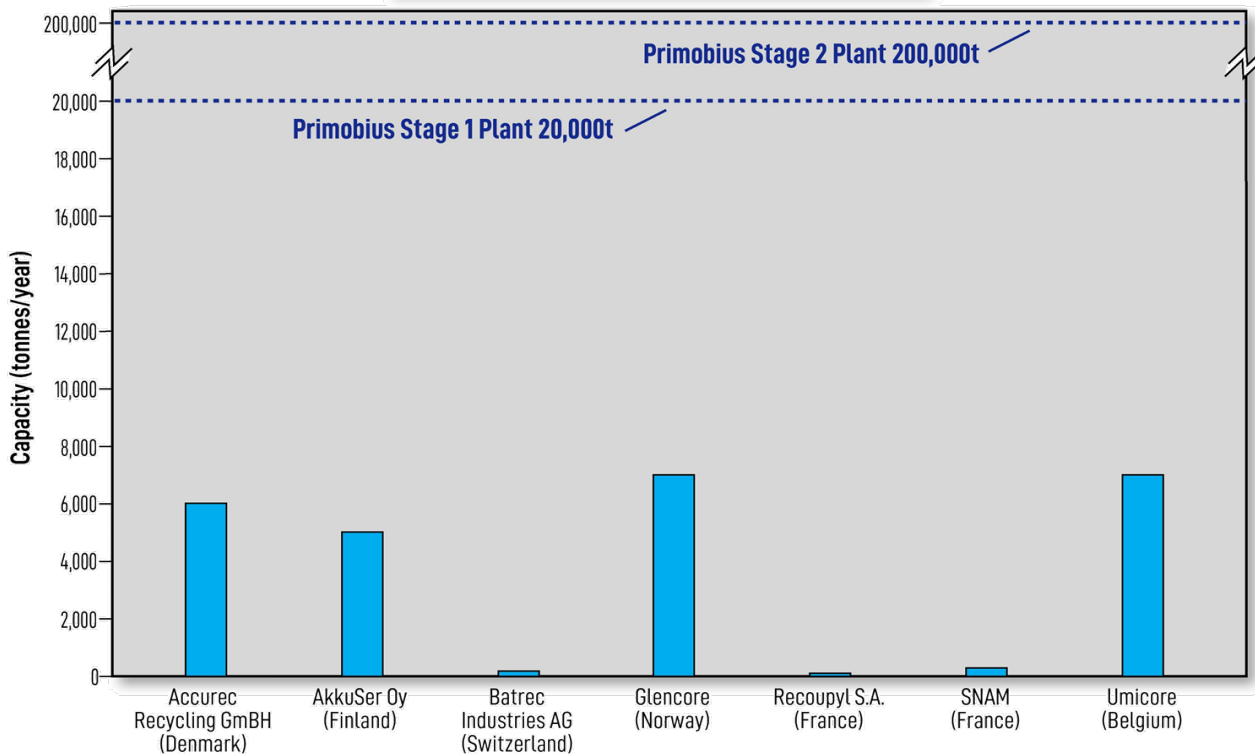
Source: Benchmark Minerals Intelligence (Battery Cell Capacity) and Neometals Management (Utilisation rate 75%, Scrap Rate 10% and Cell Weight 45g/Wh)



**CriticalMetals**

# ...WITH SIZE AND SCALE

## Major European EV Battery Recycling Facility Capacities



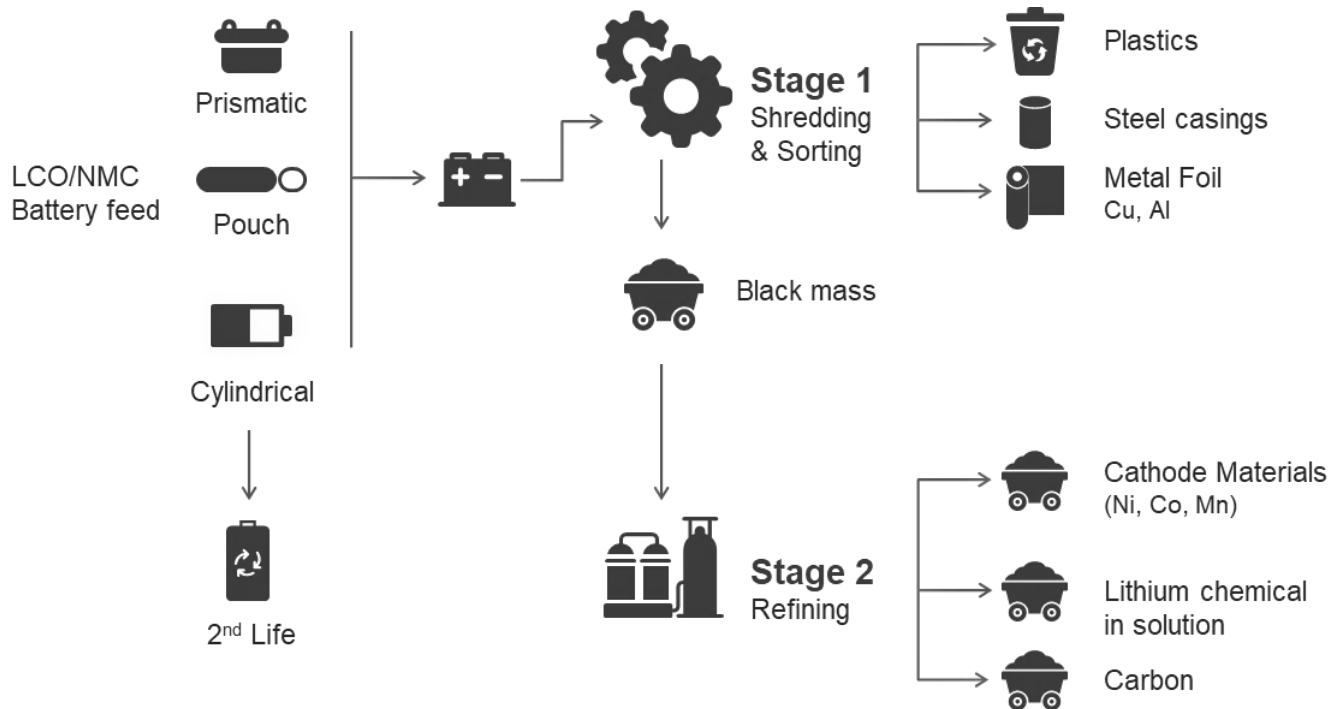
Source: Benchmark Minerals Intelligence



**CriticalMetals**

# RECYCLING TECHNOLOGY

## NEOMETALS HIGH-LEVEL FLOWSHEET



**CriticalMetals**

# INDICATIVE TIMELINE

## Indicative Project Timeline – LiB Recycling



**Commenced**  
Procurement phase  
for demonstration  
plant

**Complete**  
Construction of  
demonstration plant

**Complete**  
Demonstration  
Plant Trial

**Complete**  
Class 3 ECS  
Capex & Opex

**Complete**  
Feasibility study and  
FID\*

**Commence**  
Commercial scale  
integrated operations

**JUNQ20**

**DEC 20**

**MAR 21**

**SEPQ21**

**MARQ22**

**~12 months**

**Running Feedstock, Offtake, Product Evaluation in parallel**

*(\*) Subject to NMT and JV Board Approval*

# VALUE PROPOSITION

~20KTPA STAGE 1 PLANT

Expect significant economies of scale for 200ktpa stage 2

Recycling plant  
feed rate



**50TPD**  
**18,236TPA**

EV & Consumer  
battery feed



**Products**  
Inc. high purity Co,  
Ni, Cu, Li

OPEX



**US<\$7/lb\***  
contained cobalt  
excluding co-products

Capital costs



**US \$66m\***  
(A\$92M)

Payback



**<2 years**

Pre tax NPV<sub>12</sub>



**IRR 72%**  
(US\$220M A\$308M)



**CriticalMetals**

\*1 USD: 1.4 AUD at US\$6.15/kg Cobalt Sulphate (~20% cobalt contained in CoSO<sub>4</sub>), US\$5/kg Lithium Sulphate, US\$3.30/kg Nickel Sulphate, US\$2/kg Copper Sulphate

Source: Please refer to ASX announcement 4 June 2019 titled "Battery Recycling – Scoping Study Results"



## MINERALS EXPLORATION



**CriticalMetals**

# MINERALS EXPLORATION

- Soidinvaara Vanadium Project, Finland – ready for drill testing optimised targets, completing additional metallurgy and assessing economic potential.
- Lapland Cu-Ni-PGE / Fe-V-Ti / IOCG Project, Sweden – aiming to confirm the camp scale nature of this highly prospective “hot-spot”.
- Pahtohavare Copper-Gold Project – free-carried by joint venture partner (Lovisagruvan AB) through to Decision to Mine.
- Paljasjärvi Iron Projects – refer to [www.kirauniron.se](http://www.kirauniron.se) (a wholly owned subsidiary of Critical Metals Ltd)



**CriticalMetals**



# DIRECTORS

---

**Jonathan Murray – Independent Non-Executive Chairman**

Resides in Perth, Australia

20 years experience as a corporate lawyer; Senior Partner of Steinepreis Paganin. Principal legal practice areas include equity capital markets, takeovers, project acquisitions and divestments, corporate governance, commercial law and strategy.

**Kris Gram – Non-Executive Director**

Resides in Oslo, Norway

5 years Management Consultant and 10 years Investment Banking experience. Currently COO of Norwegian investment bank.

**Amanda Scott – Non-Executive Director of Swedish Subsidiary Companies**

Resides in Malå, Sweden

Geologist with 15 years experience (8 years in Sweden). Extensive experience in Western Australia and northern Scandinavia generating new projects and exploring for lithium, gold, copper, nickel, PGEs, iron and manganese.

**Olof Forslund – Non-Executive Director**

Resides in Malå, Sweden

Geophysicist with extensive international experience in the mineral exploration industry. Founder of Malå Geoscience. Commenced with Geological Survey of Sweden (SGU) in 1966 and during the period 2003 – 2007 was Regional Manager of the Mineral Resources Information Office in Mala, Sweden.

**Markus Bachmann – Non-Executive Director**

Resides in Johannesburg, South Africa

Corporate finance professional with 20 years experience. Founder of Craton Capital. Craton Capital awarded Fund Manager of the Year at the Mining Journal's "Outstanding Achievement Awards" during December 2010.

**Damian Hicks – Executive Director**

Resides in Perth, Australia

15 years experience as Founder of resources companies in Western Australia (since 2002) and Sweden (since 2007). Financial, legal and compliance qualifications with principal responsibilities including strategy formulation, team development, deal origination & execution and capital raising. Director of all companies within the Group.



**CriticalMetals**

# DIRECTORS & MANAGEMENT

---

**Per-Olof Renling – Non-Executive Director of Swedish Subsidiary Company**

Resides in Malå, Sweden

Experienced in Power Generation and Power Distribution, particularly construction of power lines and operation and maintenance at thermal power generation and heat distribution plants. Currently Mr Renling is the site manager for several wind farms.

**Mindy Ku – Company Secretary**

Resides in Perth, Australia

Accountant. Diverse experience in finance, compliance, information technology, marketing and management, both in Australia and internationally ([www.corpbservices.com](http://www.corpbservices.com)).

---

**Pernilla Renberg – Chief Administrator**

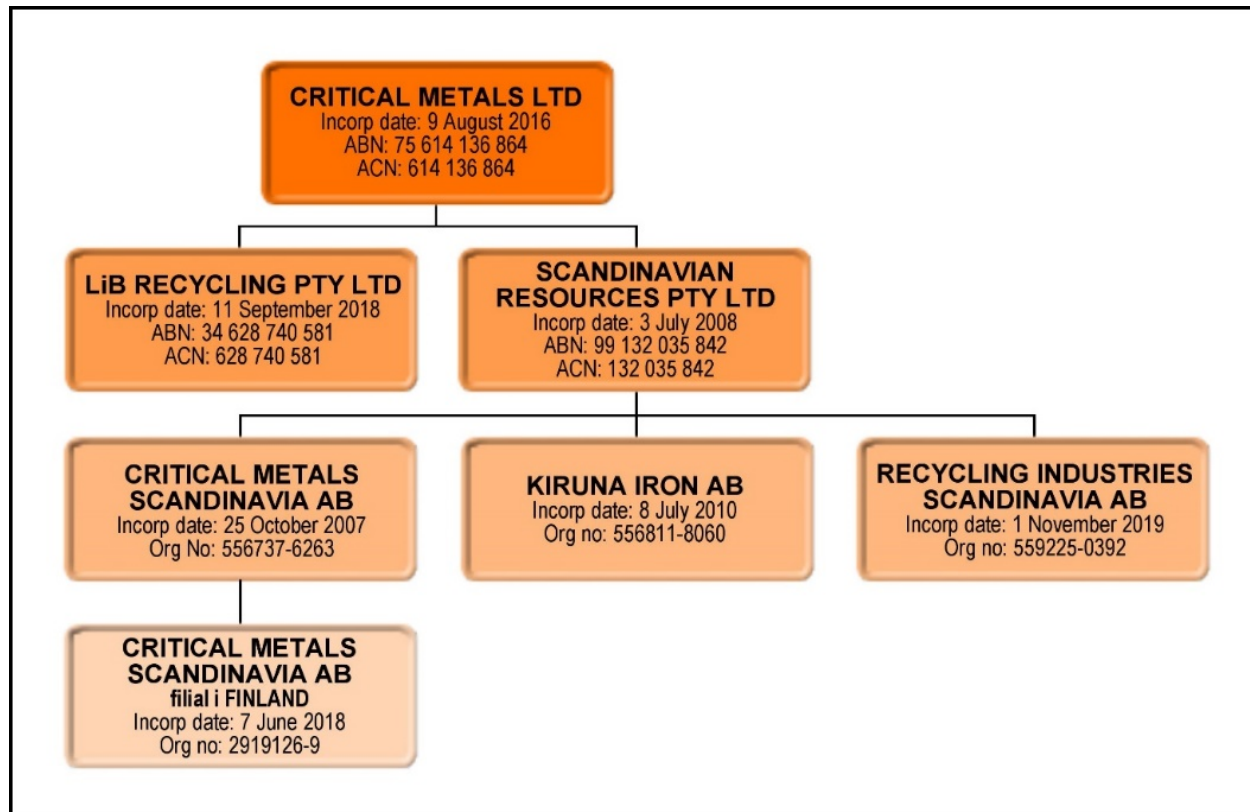
Resides in Malå, Sweden

Responsible for the day-to-day operations, management and administration of all companies within the Group.



**CriticalMetals**

# CORPORATE STRUCTURE



All companies within the Group are wholly owned.

# CONTACT DETAILS

For further information please contact:

<p>Damian Hicks Executive Director M: +61 419 930 087 E: <a href="mailto:dhicks@criticalmetals.eu">dhicks@criticalmetals.eu</a></p>	<p>Pernilla Renberg Chief Administrator M: +46 703 225 133 E: <a href="mailto:prenberg@criticalmetals.eu">prenberg@criticalmetals.eu</a></p>
<p><a href="http://www.criticalmetals.eu">www.criticalmetals.eu</a></p>	<p>@CuAuNiFeLiCoC</p>