



# **AMERICAN MANGANESE INC.**

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*A Critical Metal Company Focusing on  
Recycling Lithium Ion Electric Vehicle Batteries*

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**TSX-V: AMY | OTC US: AMYZF | FSE: 2AM**

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# LARRY W. REAUGH

**President and CEO of American Manganese Inc.  
1998 – Present**

- ❑ 55+ years of mining industry experience
- ❑ President & CEO of several exploration, development, and production companies
- ❑ 12 years in internet and technology companies listed on the TSX, TSX Venture and NASDAQ exchanges
- ❑ Made several significant resource discoveries, three of which went on to be producing mines
- ❑ Raised \$300 million for junior resource mining companies
- ❑ \$25 million dollars raised for AMY over the past 18 years



# DIRECTORS



Larry W. Reaugh  
President & CEO, Director



Andris Kikauka  
P.Geo, Director



Norman L. Tribe  
B.A.Sc., P.Eng., Director



Kurt Lageschulte  
Director



Ed Skoda  
Director



Jan Eigenhuis  
Director



Shaheem Ali  
BBA, Chief Financial Officer



Teresa Piorun  
Senior Corporate Officer



Zarko Meseldzija  
Chief Technical Officer

# ADVISORS



Shailesh Upreti  
Advisory Board



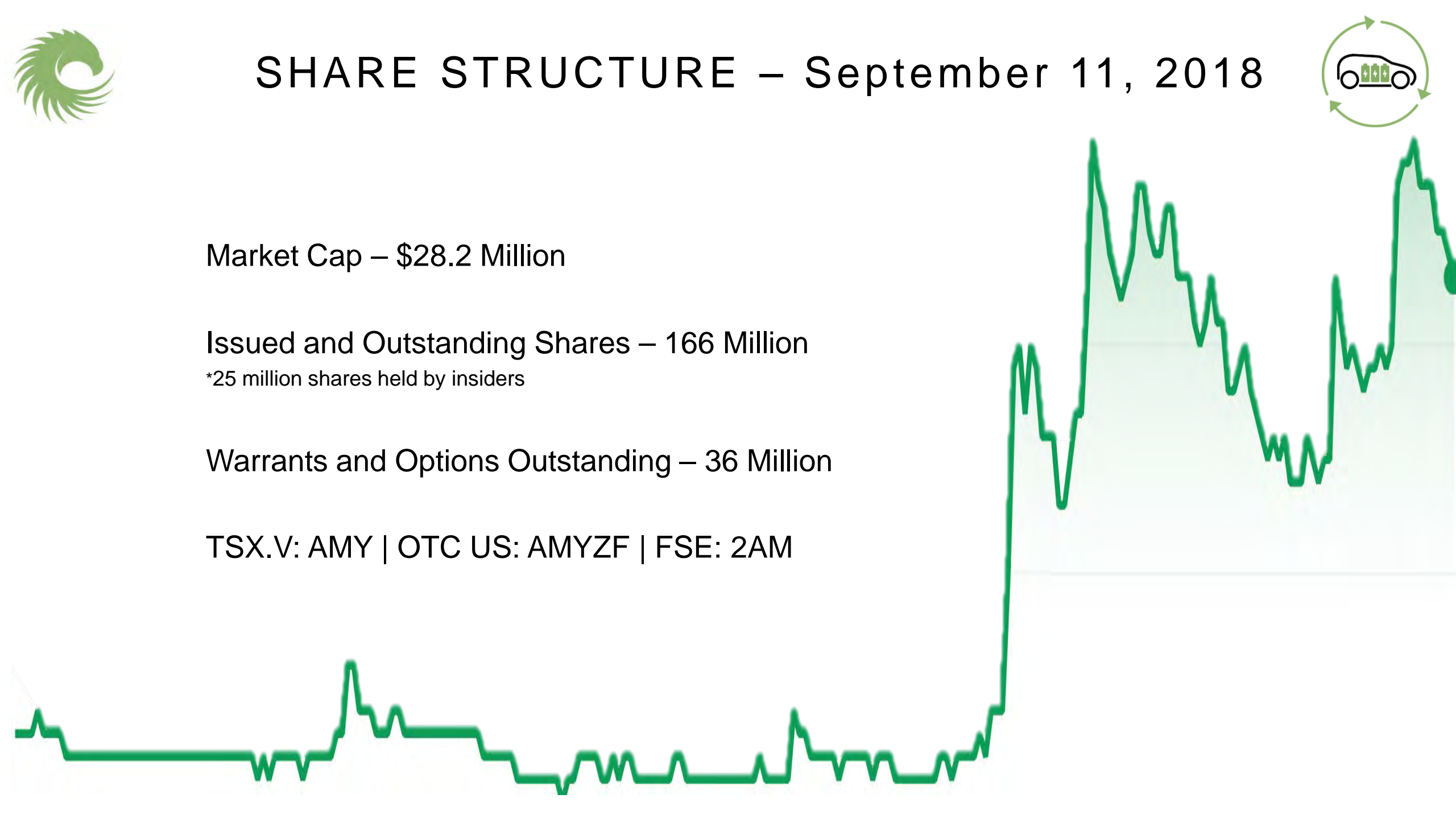
David Langtry  
Technical Advisor



Dan McGroarty  
Strategic Advisor



James J. Hahn  
Strategic Advisor



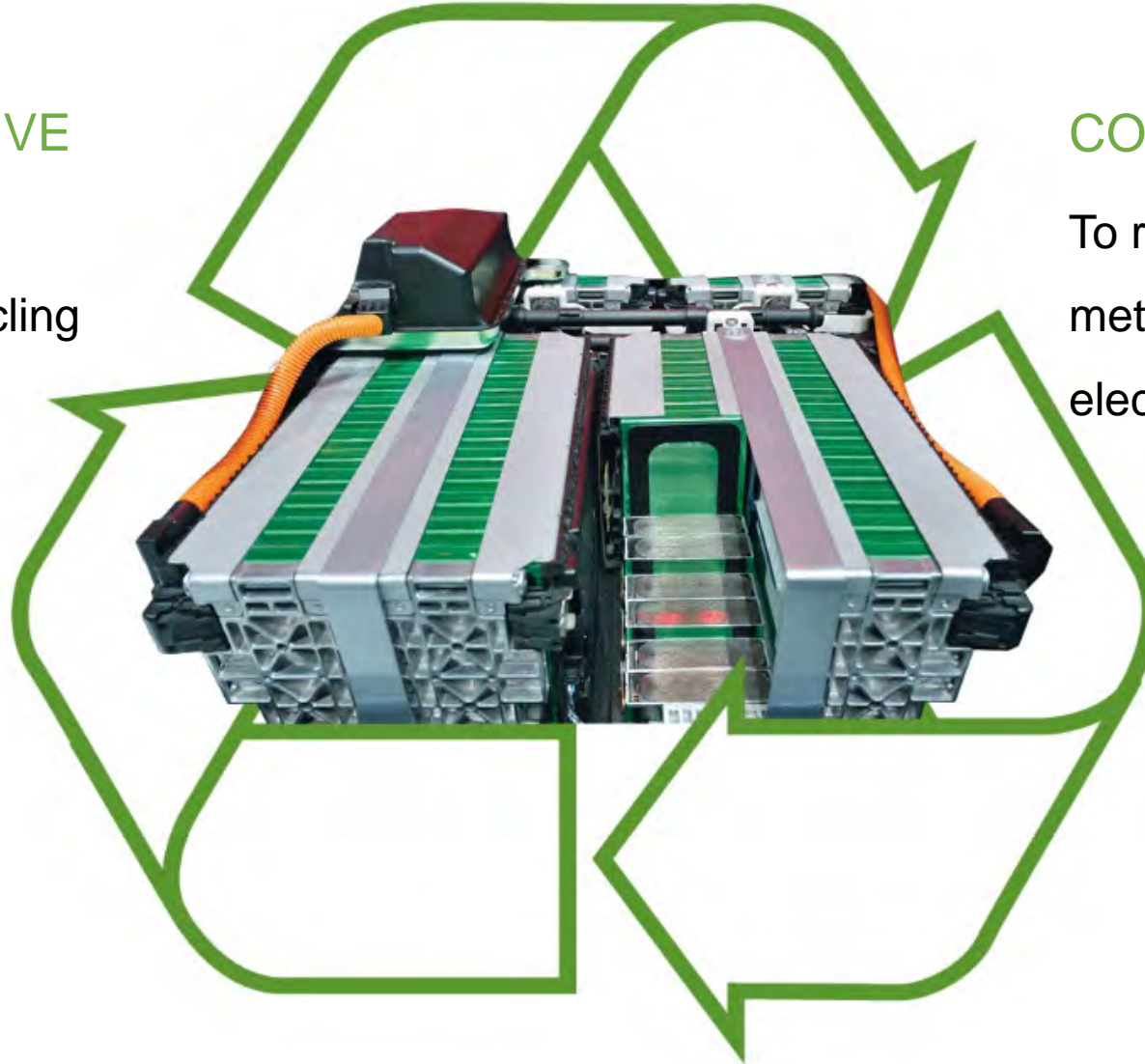


## CORPORATE OBJECTIVE

A diversified critical metals company focusing on recycling lithium-ion electric vehicle batteries

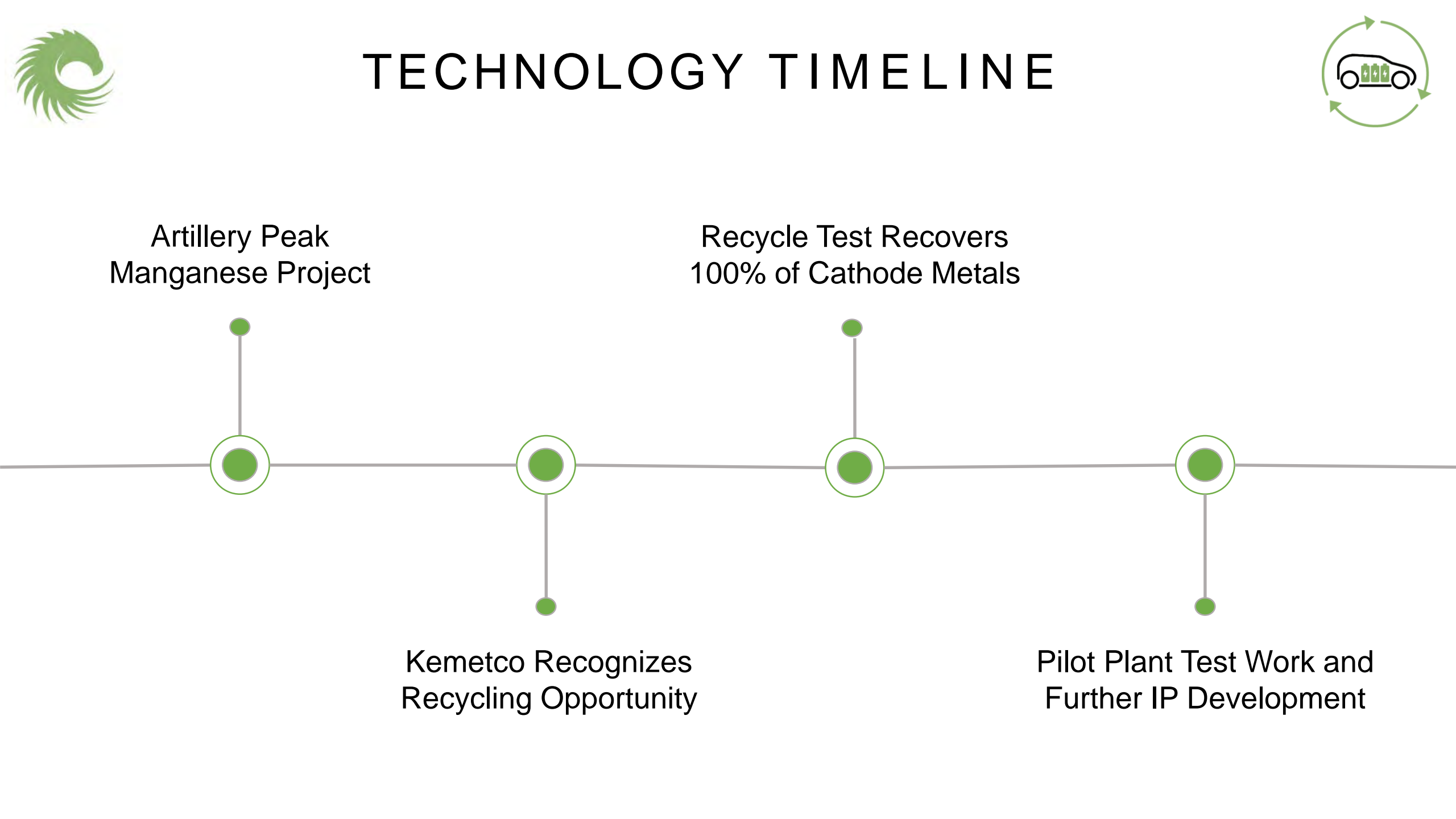
## CORPORATE STRATEGY

To recycle valuable cathode metals for the global lithium electric vehicle battery industry



## THE RESULT

Clean, sustainable, robust and efficient recycling alternative compared to existing methods





# ARTILLERY PEAK PILOT PLANT







# PATENT

✓ November 2017

Patent Application **Submitted** For Lithium-ion Battery Recycling Process and Recovery of Cathode Materials

✓ May 2018

Patent Application **Published** And Still Under Patent Pending Protection in 152 Countries and Jurisdictions (Publication No. WO2018/089595)

✓ July 2018

Received The First Office Action From The US Patent And Trademark Office Indicating That **All Drawings Have Been Accepted** And Claims 1 – 70 (All Claims In The Application) Appear To Be Allowable Over The Cited Prior Art Of Record



**Patent Granted**



# THE OPPORTUNITY

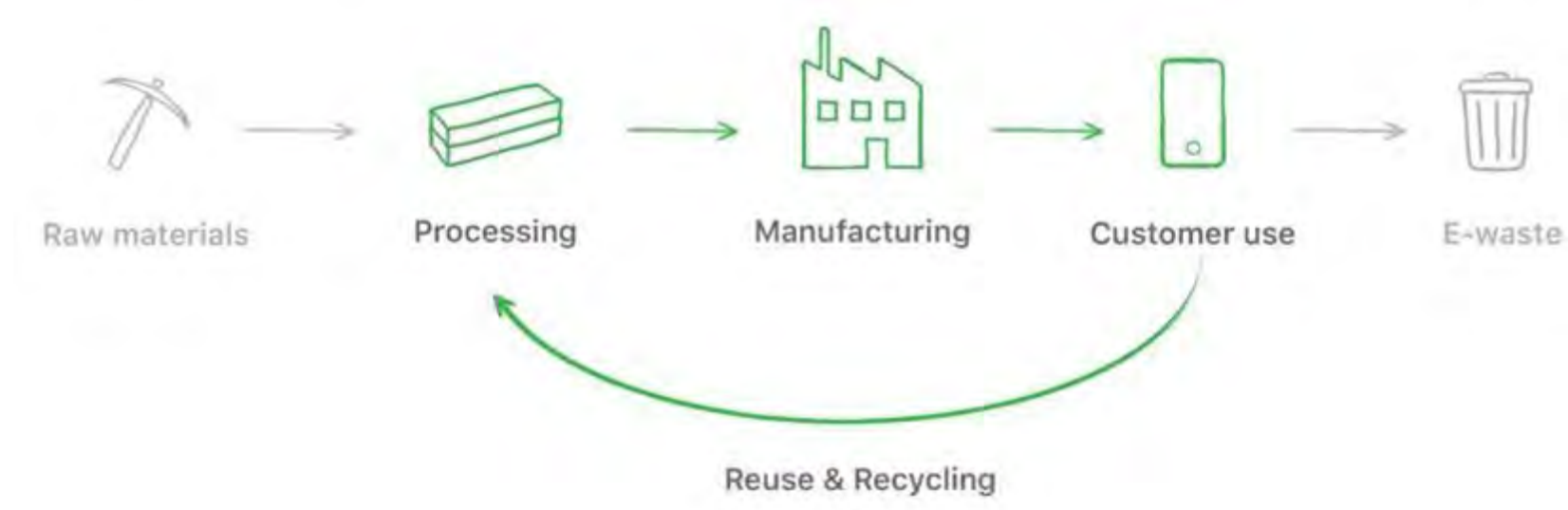


Recycling Of Spent Batteries Is A **Certainty** Thanks To Increasing Regulations Around The World:

**China** Legislated That EV Manufacturers Come Up With Feasible **Recycling Programs**

**European Union** Set Timelines For Battery Manufacturers To **Recycle Spent Lithium Ion Batteries**

**Canada** Has 3 Provinces With **Mandatory Recycling Programs**







# CURRENT OPTIONS



Pyrometallurgy (Burning in Smelter)



Landfill Storage





# UNITED STATES EXECUTIVE ORDER



“Ensure and Secure a Reliable Supply of Critical Minerals”

The United States is currently **import-dependent** for:

More than **50%** of its  
annual **lithium** needs

**74%** of its **cobalt**

**100%** of its **manganese**  
and **graphite**





# ELECTRIC VEHICLE REVOLUTION



A Projected **125 Million EVs** On The  
Roads By **2030**  
- **International Energy Agency**



“EVs will outpace gasoline powered vehicles in two decade”  
– Morgan Stanley

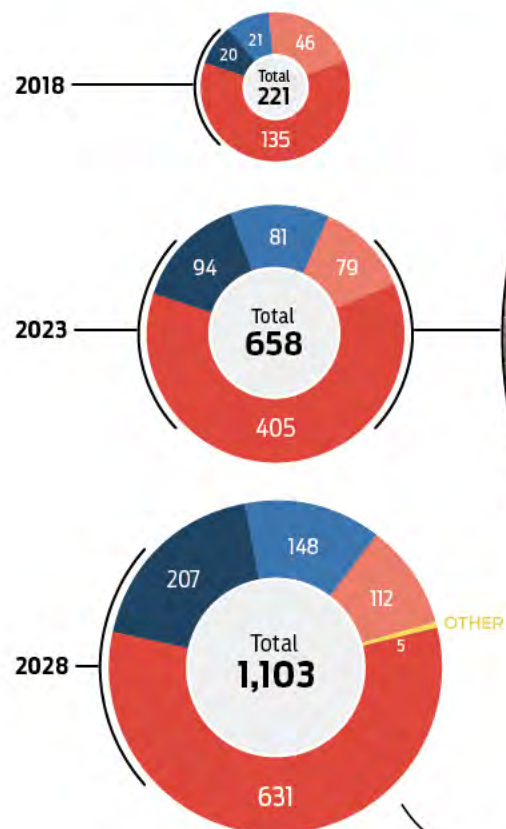
“\$90 Billion in Investments were Pledged into EVs & Batteries by Global Auto Manufacturers”  
– CleanTechnica



# BATTERY PRODUCTION

CAPACITY BY REGION  
GIGAWATT HOURS

EUROPE U.S.A. ASIA (Excluding China) CHINA



TOP 7 PLANTS  
GIGAWATT HOURS (2023)



**1 GWh of NMC-622 Requires a Combined 1200 Tonnes of Cobalt, Lithium, Nickel, and Manganese Valued at \$25 Million**

In just a decade, global lithium-ion battery production capacity will increase **399%** to surpass the **1 TWh** mark.

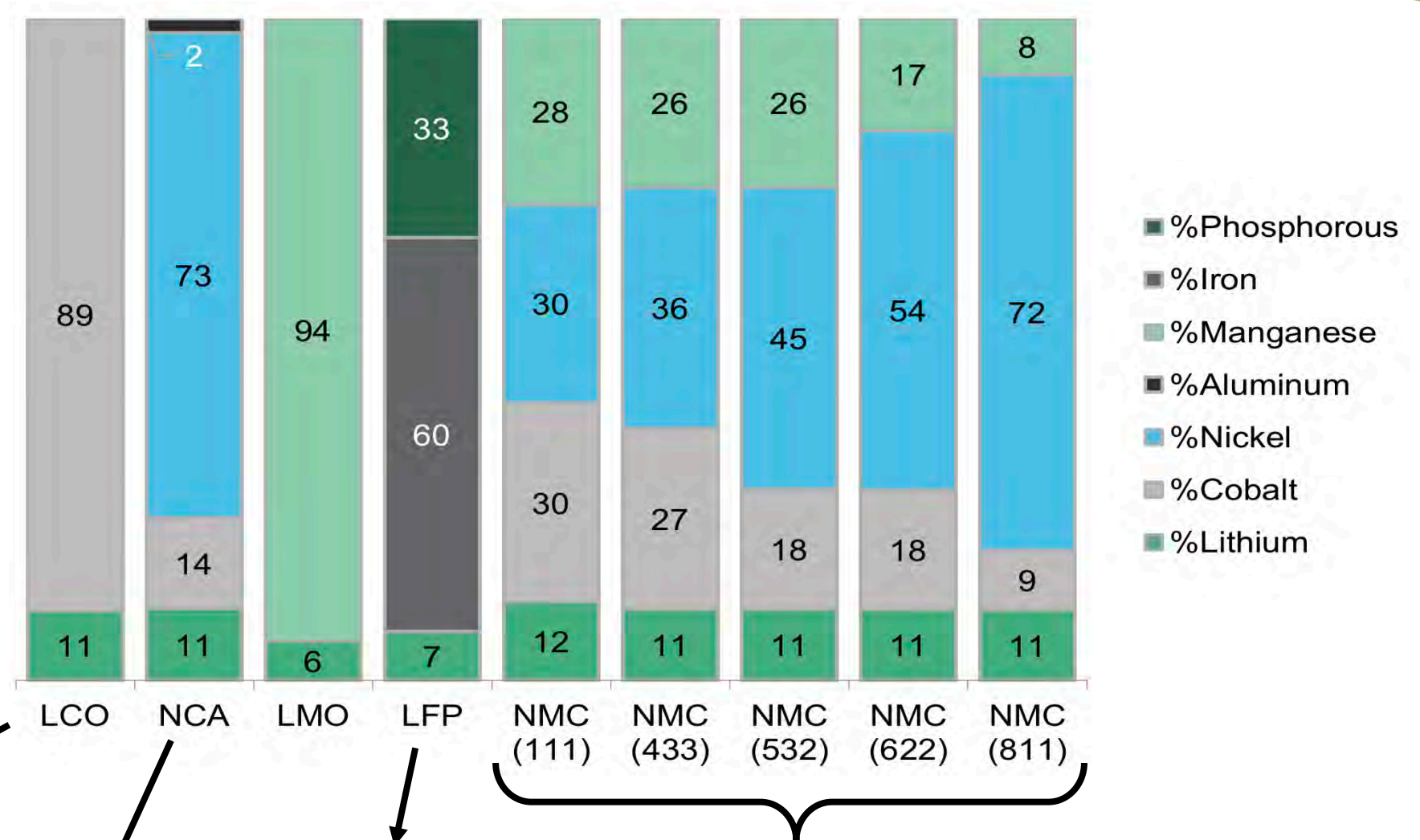




# BATTERY CHEMISTRIES



**TRADE OFF:**  
Specific Energy  
Specific Power  
Safety  
Cost  
Performance



Portable Electronics

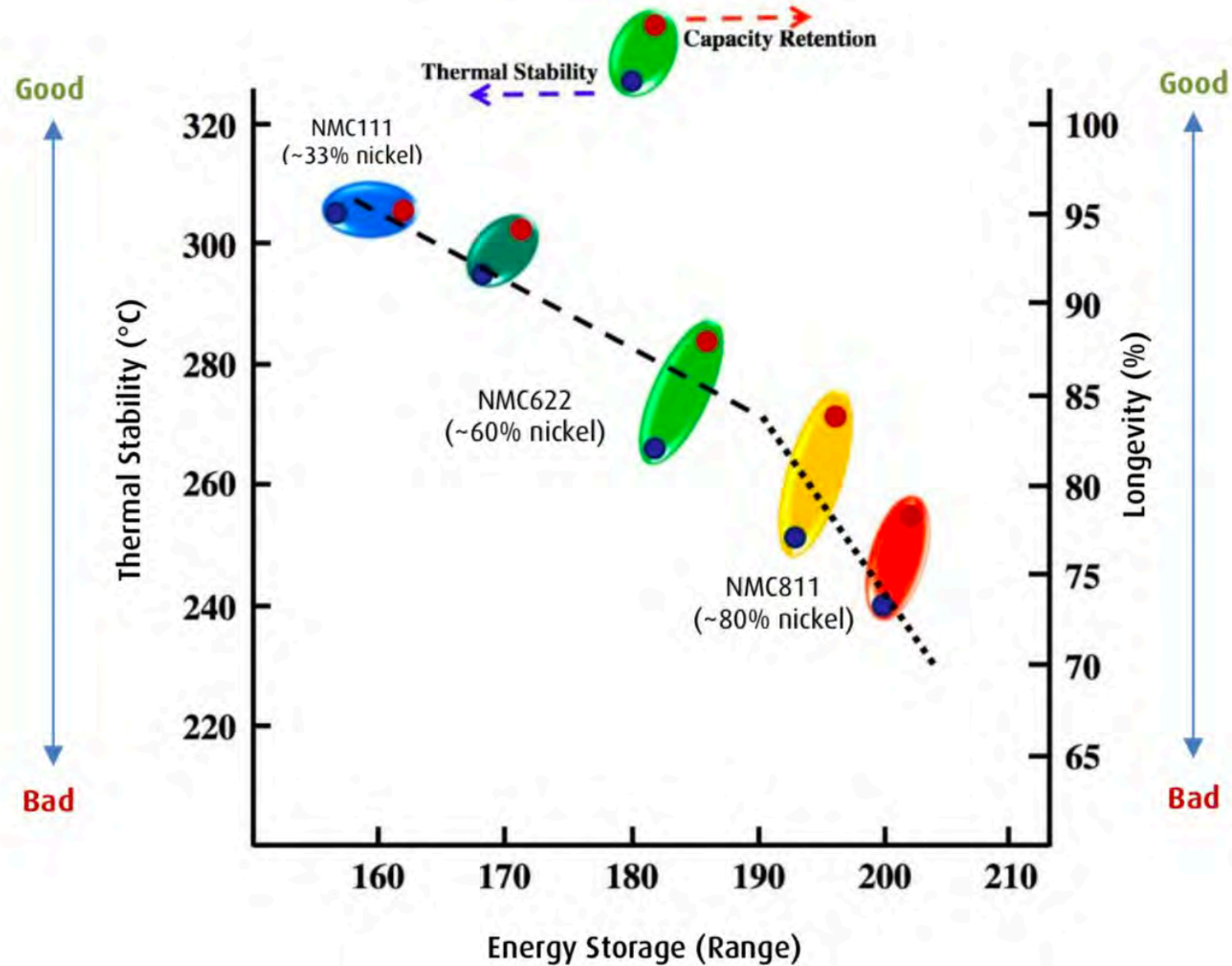
Tesla

Popular in China but  
switching to NMC

Most Popular in EVs



# NMC BATTERY





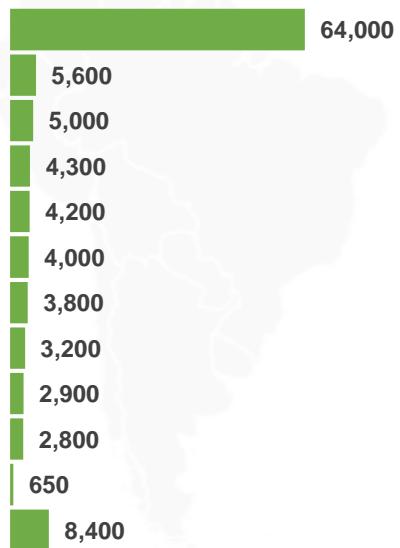


# COBALT

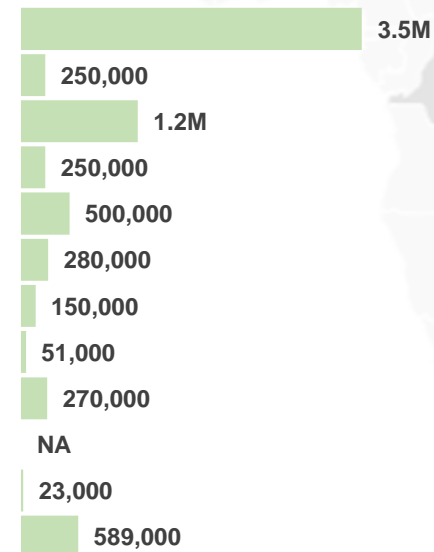


1. Congo
2. Russia
3. Australia
4. Canada
5. Cuba
6. Philippines
7. Madagascar
8. New Guinea
9. Zambia
10. New Caledonia
- United States
- Other

Mine Production (2017)



Economically Viable Reserves



**Rechargeable Batteries** Constitute  
**55% of Global Cobalt Demand**



# LITHIUM



Lithium demand projected to increase  
by **650%** by 2027

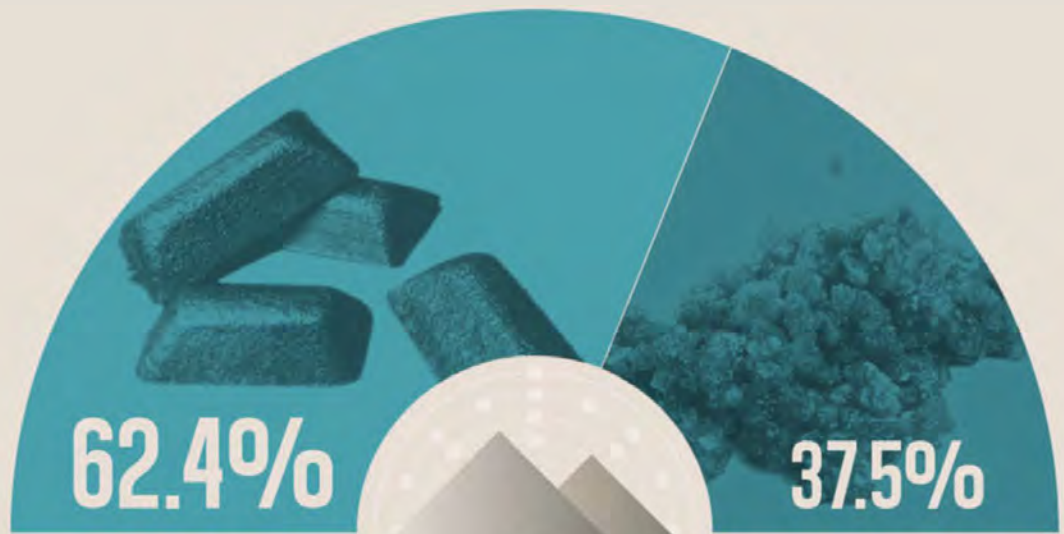
**4 Years** on average to **Develop** a **Lithium Brine  
Deposit** and Another **3-4 Years** to Reach **Full  
Capacity**

Source: Baystreet





# NICKEL



## NICKEL LATERITES

Low grade, bulk-tonnage.  
Found in Indonesia, Cuba,  
Philippines, and New Caledonia.

Typical Products Include  
Nickel pig iron and Ferronickel.

## NICKEL SULPHIDES

High grade, but rare.  
Found in North America, Australia,  
China, Russia, and Greenland.

Typical Products Include  
Nickel metal and Nickel sulfate.



Nickel pig iron and ferronickel are used as cheap inputs mainly to make Chinese stainless steel.

**Steel is the most important market for nickel use.**



Nickel sulfate is a blue salt used primarily for electroplating and lithium-ion cathode material

**Less than 10% of nickel supply is in sulfate form, and not all of that is battery grade.**

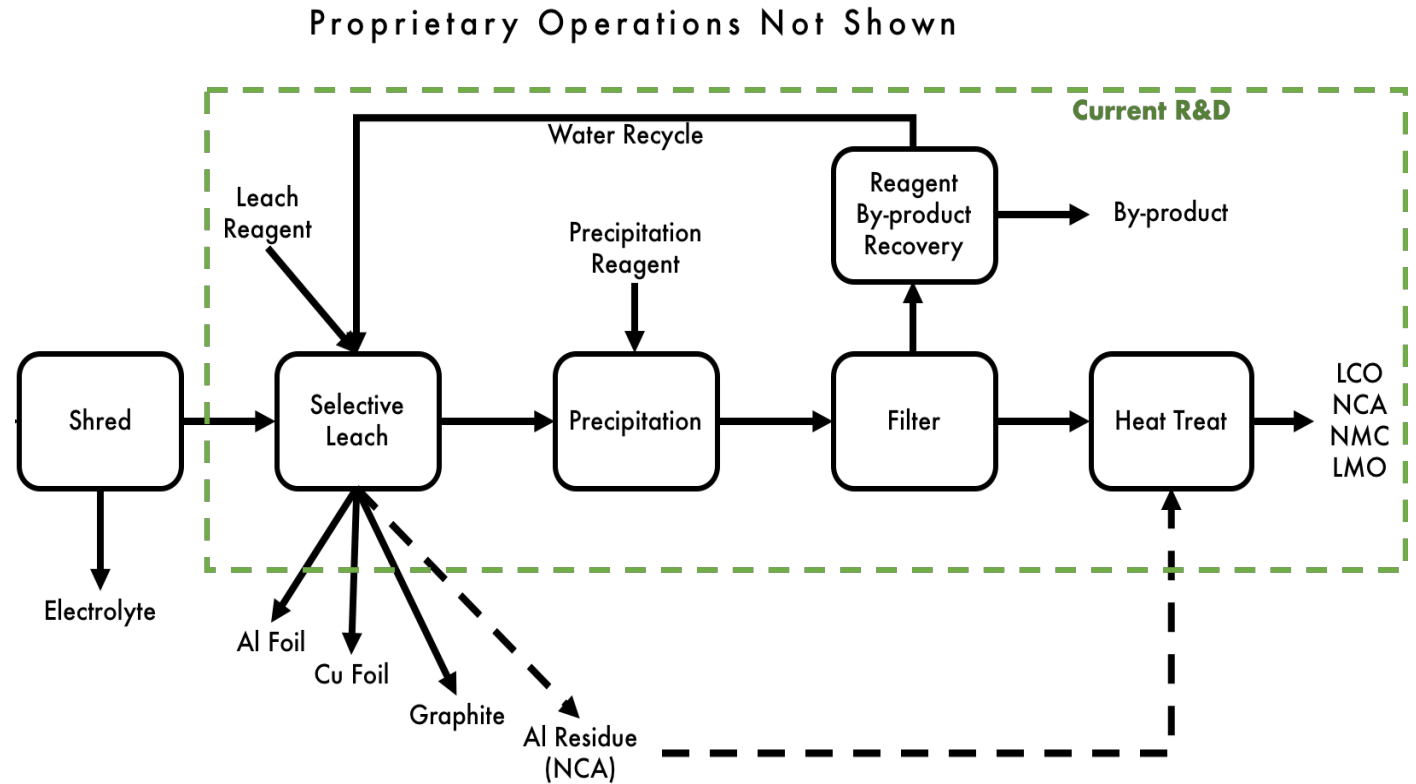


# DEMONSTRATION PLANT FINANCIAL MODEL

(AS OF COMMODITY PRICES ON AUGUST 21, 2018)



**3 Tonnes**  
of Cathode  
Scrap Per  
Day



Potential Battery Chemistries:

LCO  
NMC-111  
NMC-622  
NMC-811  
NCA

Demonstration Plant  
(Estimated CAPEX = US\$ 10M)





# PRO FORMA DEMONSTRATION PLANT FOR NMC-622

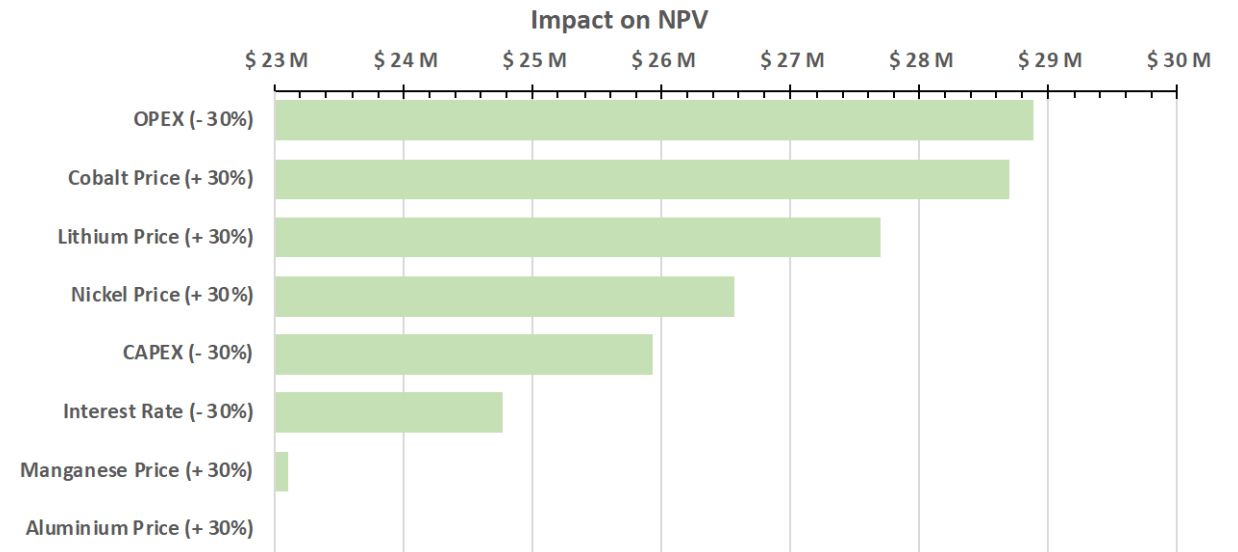
(AS OF COMMODITY PRICES ON AUGUST 21, 2018)



Metal	Market Price (USD/kg)	NMC622 (kg)	Total (USD)
Lithium Carbonate	\$17.00	1,143	\$7.1 M
Cobalt	\$64.50	365	\$8.59 M
Nickel	\$13.60	1,090	\$5.41 M
Manganese	\$2.03	340	\$.25 M
Aluminium	\$2.02	0	\$.0 M
<b>Total Annual Revenue</b>			<b>\$21.35 M</b>

Annual Operating Expenses	
Reagents	\$1.07 M
Labour and G&A	\$3.26 M
Utilities	\$0.13 M
Feed Material Delivere	\$2.13 M
Maintenance	\$0.53 M
Building Rent	\$0.18 M
Shipping & Packaging	\$0.68 M
<b>Total Annual Operating</b>	<b>\$7.98 M</b>
<b>Annual Operating Profi</b>	<b>\$13.36 M</b>
<b>Operating Margin</b>	<b>63%</b>

Interest Rate 10%		
Period	Cashflow	Balance
Year 0	\$ (10.0)M	\$ (10.0)M
Year 1	\$ 13.4 M	\$ 3.4 M
Year 2	\$ 13.4 M	\$ 16.7 M
Year 3	\$ 13.4 M	\$ 30.1 M
<b>NPV</b>	<b>Payback</b>	<b>IRR</b>
\$23.23 M	9 Months	121%





# DEMONSTRATION PLANT OPERATING EXPENSES



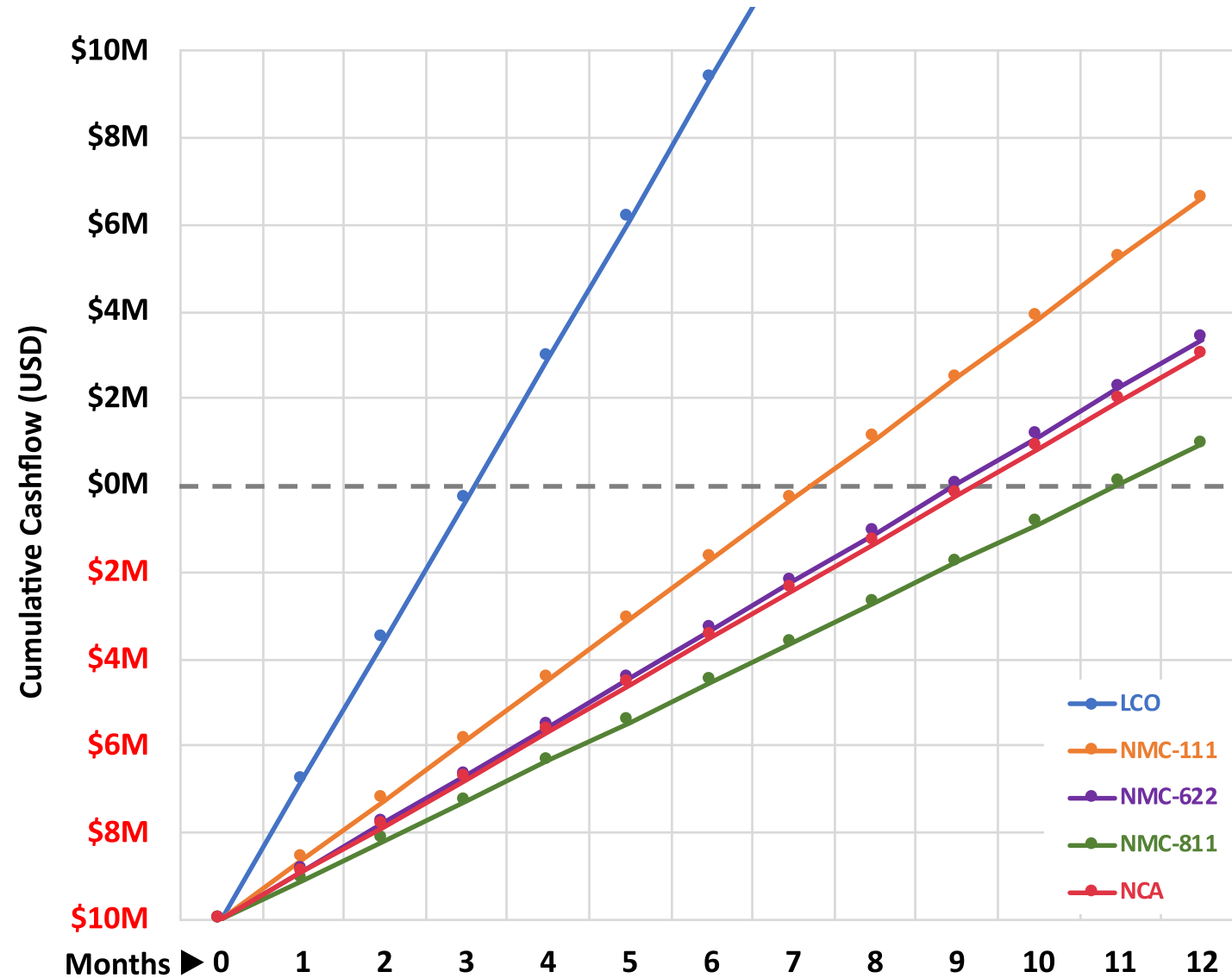
Expense	Estimation
Reagents	<p>Derived from the quantity of reagents used to process 3 tonnes of cathode material multiplied by the cost of the reagents.</p> <p>The same composition of reagents is used for all battery chemistries shown.</p>
Labour and Maintenance	<p>Three shifts of four plant operators working an 8-hour shift and operating 24 hours/day at a rate of \$45/hour.</p> <p>An office administrator, an accountant, shipping and receiving, an assistant manager, and a manager working an 8-hour shift at a rate of \$45/hour. Plus an additional \$3,168 for G&amp;A.</p> <p>Maintenance includes three 8-hour shifts of one maintenance personnel at a rate of \$60/hr.</p>
Feed Material Delivered	<p>10% of the total cathode value.</p>
Building and Utilities	<p>The building rent and utility costs were estimated for a 15,000 ft<sup>2</sup> facility, that would be located in the greater Vancouver area.</p> <p>Utility costs are extrapolated from current rates being used in the lab testing.</p>
Shipping and Packaging	<p>Received a quote for shipping and packaging two 20-tonne loads of the processed cathode material across Canada every week.</p>

NOTE: The third party and contract company, Kemetco Research, is experienced in successfully designing and installing dozens of similar sized facilities and using similar reagents. They have helped provide most of the estimates for CAPEX and OPEX.



# DEMONSTRATION PLANT PAYBACK PERIOD

(AS OF COMMODITY PRICES ON AUGUST 21, 2018)





# COMPETITORS

	PROOF OF CONCEPT	PATENTS	RECOVERIES		*RECOVERY METHOD
AMERICAN MANGANESE INC. SURREY, B.C. CANADA	Completed	Patent Published May 17, 2018 Publication No. W02018/089595	COBALT	LITHIUM	Hydro Metallurgy
			100%	100%	
RETRIEVE TECHNOLOGIES	Completed	Not Found	Small Amount Not Recovered	Not Recovered	Hydro Metallurgy
WORCESTER POLYTECHNIC INSTITUTE (BATTERY RESOURCES)	Completed	US Patent Application Applied for: November 22, 2016	Not Reported	Not Reported	Hydro Metallurgy
INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA	Completed	Not Found	< 25%	< 50%	Hydro Metallurgy Plus High Cost Calcining
NEOMETALS LTD.	Completed	Patent Pending	99.2%	Not Reported	Hydro Metallurgy
UNIVERSITY OF CALIFORNIA SAN DIEGO	Completed	Not found	Not Reported	Not Reported	Heat Treating
UMICORE	Current Method of Disposal of Most Batteries	Not Patentable	40 - 70% Not Reusable in Batteries	Nil	High Cost of Smelting 'Not Environmentally Responsible'

*\*Management & Kemetco's Examination of recycling and Hydro Metallurgy of our competitors has shown no overlapping chemistries with our Technology.  
American Manganese's process strongly suggests leadership in the Competing Technologies*





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