



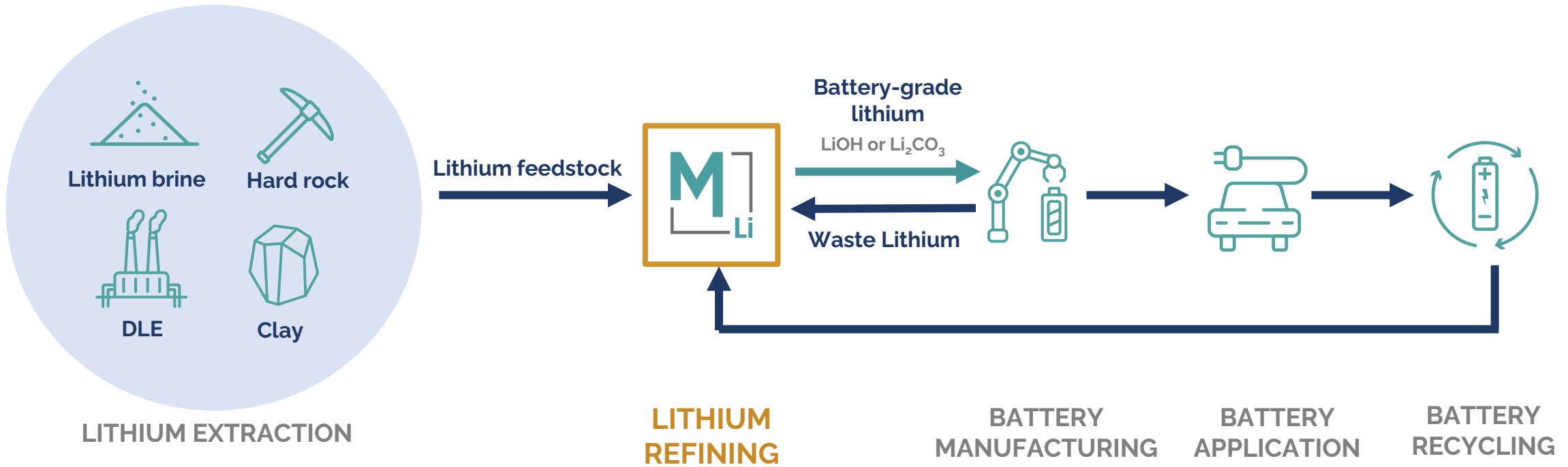
MANGROVE LITHIUM

Unlocking a battery-powered future



MANGROVE UNLOCKS REFINING BOTTLE-NECKS

Enables supply chain security and resiliency through localized refining



PROVEN TRACK RECORD OF FUNDRAISING AND TECHNOLOGY COMMERCIALIZATION

2013

- 1st lab scale demonstration completed.
- Secured \$500k from Round 1 ERA Grand Challenge winners.
- Secured \$450k from Western Economic Diversification



2016

- Completed the 1st commercial pilot scale demonstration.
- Secured \$3M from Round 2 ERA Grand Challenge winners.
- Spun out from Wilkinson Research Group at UBC Chemical Engineering



2019

- Built fully commercial pilot scale demonstration system completed for testing.
- Secured \$5M from Round 3 ERA Grand Challenge winners.



2020

- Secured \$3M financing from BDC Capital's Cleantech Practice



2021

- Completed the series A round of investments with Breakthrough Energy participating as the lead investor.



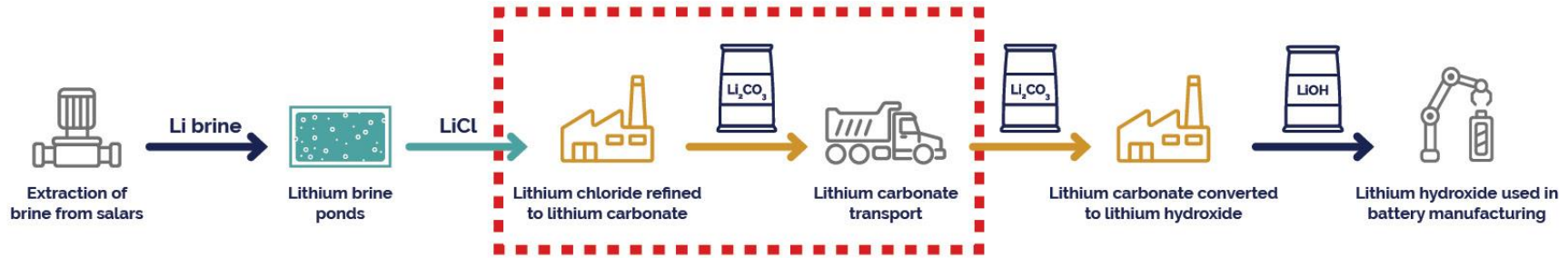
2022

- Completed the series A-1 round of investments with lead investor BMW i Ventures and with returning investors Breakthrough Energy Ventures.



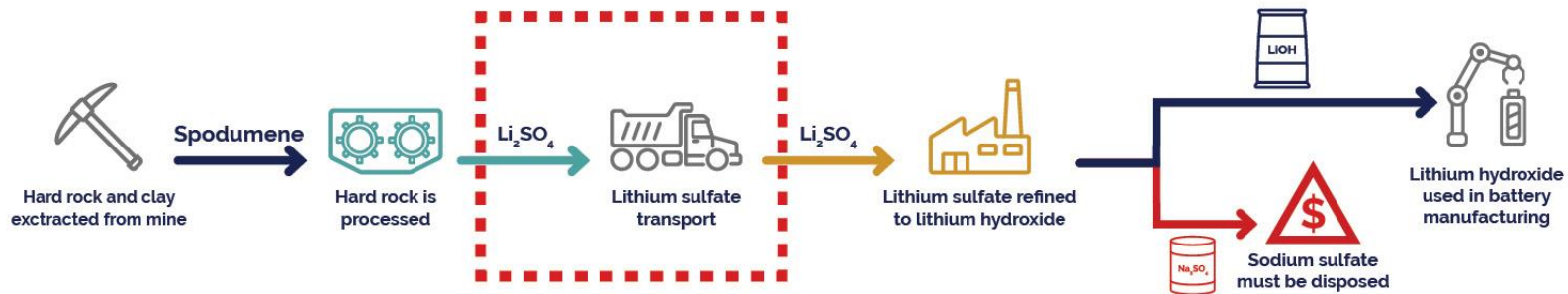
INEFFICIENCIES EXIST IN THE LITHIUM SUPPLY CHAIN

Brine



- Requires multiple chemical inputs to produce lithium hydroxide
- Requires 2 separate facilities, multi-stage process to produce lithium hydroxide

Hard Rock

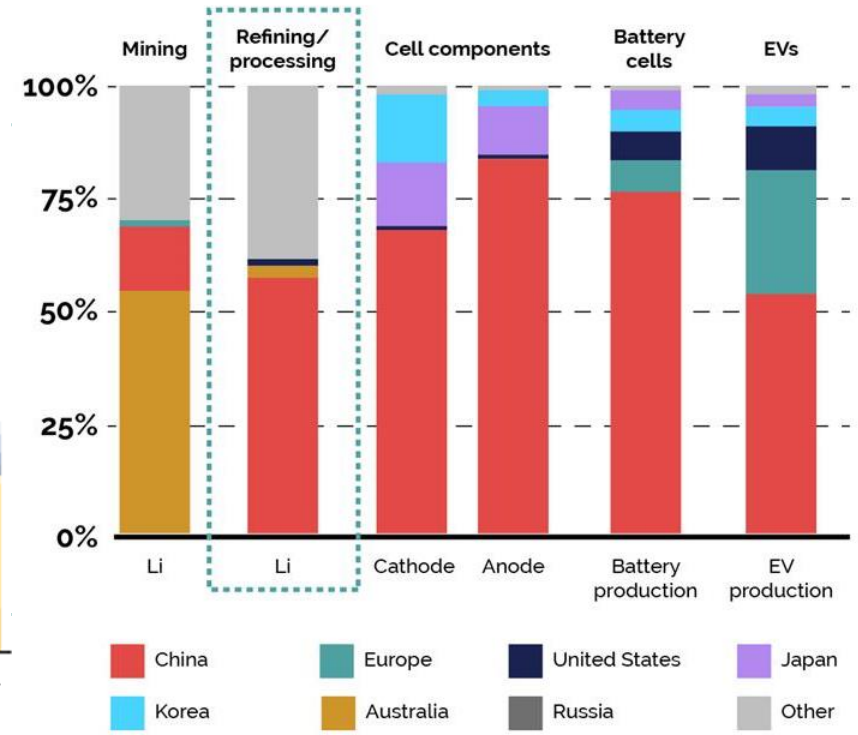
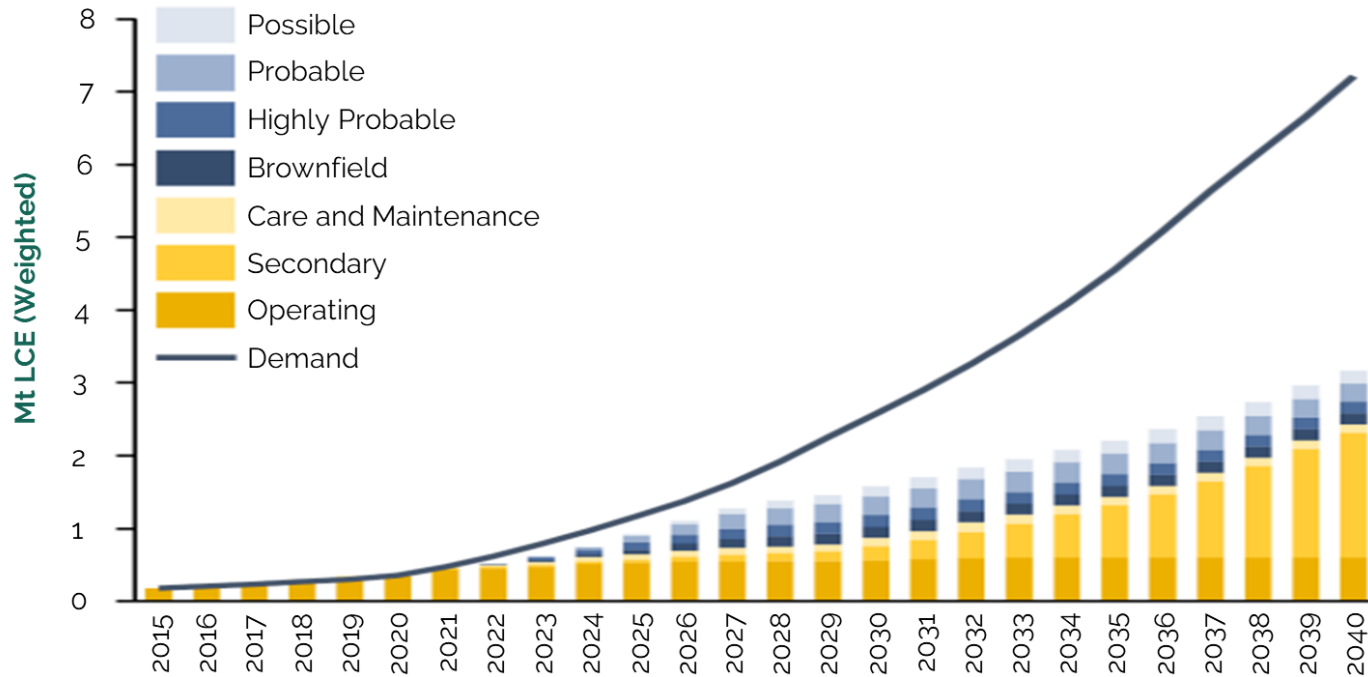


- Output sodium sulfate in rough 1:1 ratio to lithium hydroxide is a solid waste that must be managed.

LITHIUM SUPPLY BOTTLENECKS WILL LIMIT EV ADOPTION

Chinese dominance of refining and processing capacity is a further risk

Forecasted Lithium Market Balance



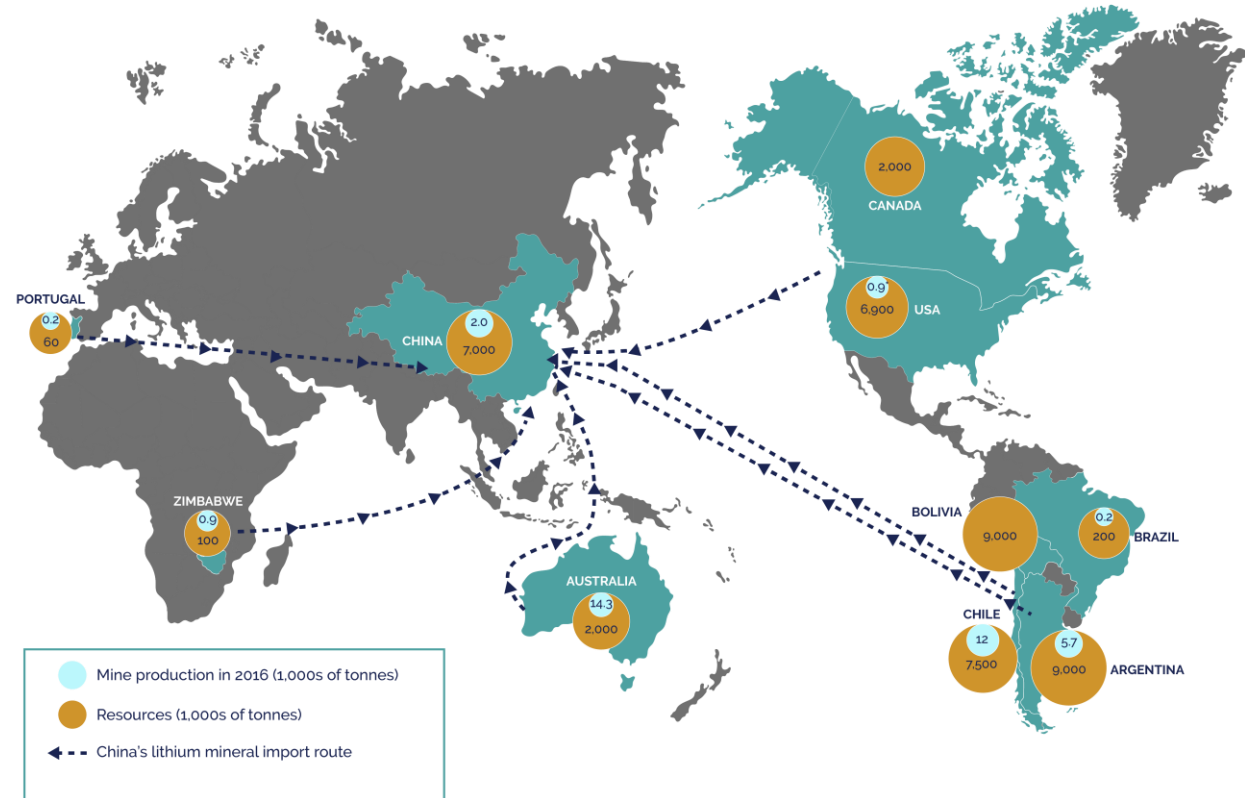
Note: Mt LCE = Million tonnes of lithium carbonate equivalent.

Source: Benchmark Minerals. <https://www.datocms-assets.com/53992/1638402269-asx-ceo-presentationagm-30-november-21final1.pdf>



CRITICAL MINERALS REQUIRE CREATION OF DOMESTIC SUPPLY CHAINS

- Over 80% of lithium refining is concentrated in China
- Incumbent lithium refining technologies rely on **chemical and energy-intensive processes** that have a big carbon footprint and require the disposal of chemical byproducts.



wp Washington Post

China to restrict graphite exports to United States as tech war escalates - The Washington Post

New controls on graphite exports to the United States could hurt American efforts to create green jobs while weaning the country off fossil...

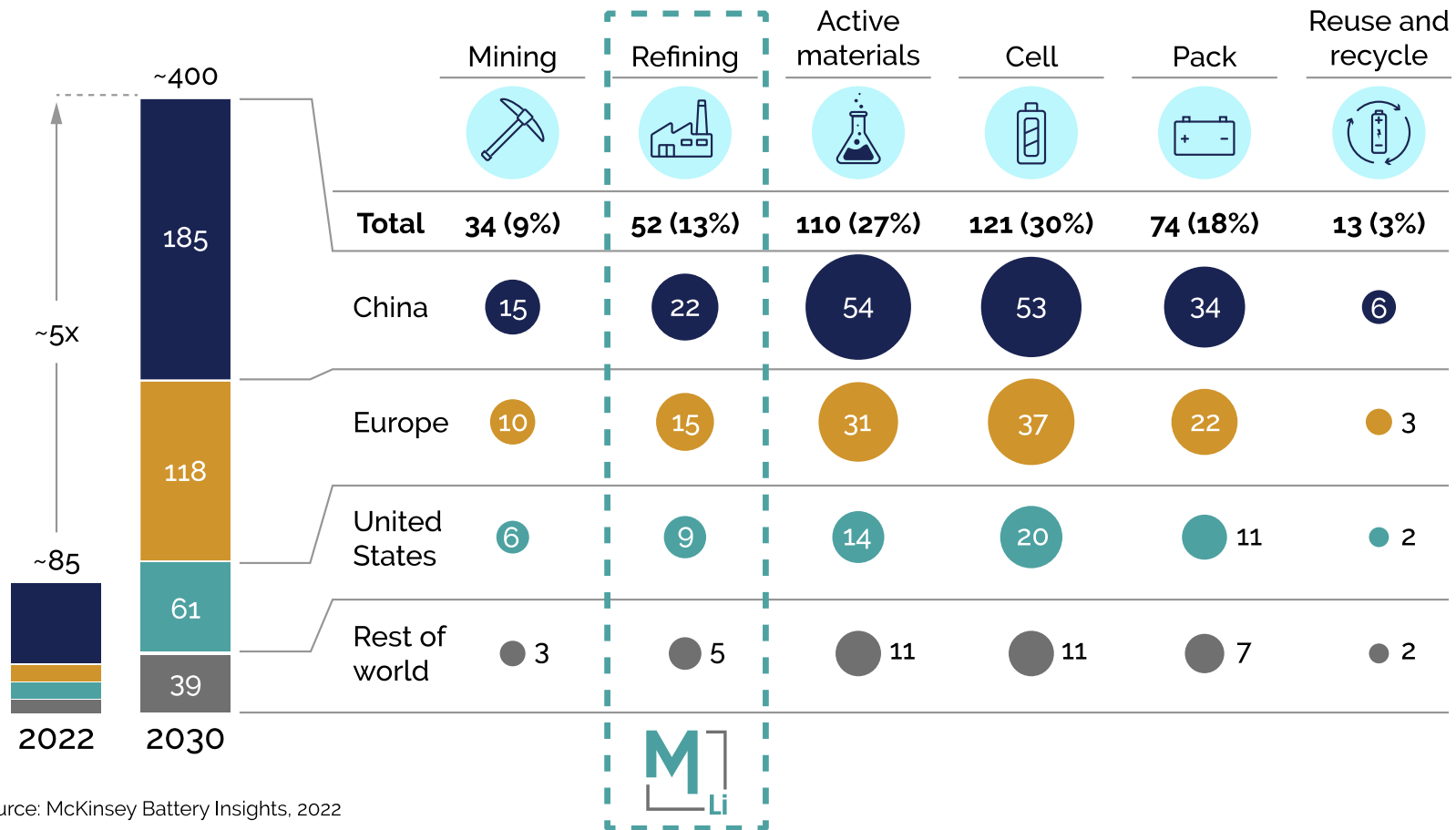
1 month ago



ONCE IN A GENERATION OPPORTUNITY FOR TRANSFORMATION

- Lithium supply chain expected to be **\$400 B opportunity by 2030**
Refining component estimated at **\$52 B**

Revenues, base case 2030, \$ billion



Source: McKinsey Battery Insights, 2022

MANGROVE ENABLES CANADIAN BATTERY SUPPLY CHAIN

Refining technology is a crucial step in developing a high-quality, domestic critical minerals supply chain

- Canada has **51 active projects** in the battery supply chain from mining to battery materials and assembly to recycling
- Only **3 of the projects include lithium refining**. All current announcements show intent to use traditional refining which will have chemical waste and won't contribute to a circular economy in the industry. Most projects remain in pilot stage.
- Need to **de-risk and incentivize novel, circular refining technology** to create a world-class lithium refining supply chain in Canada and capture maximum value for our economy.



Source: Accelerate ZEV Canada's Zero Emission Vehicle Supply Chain Map and Database

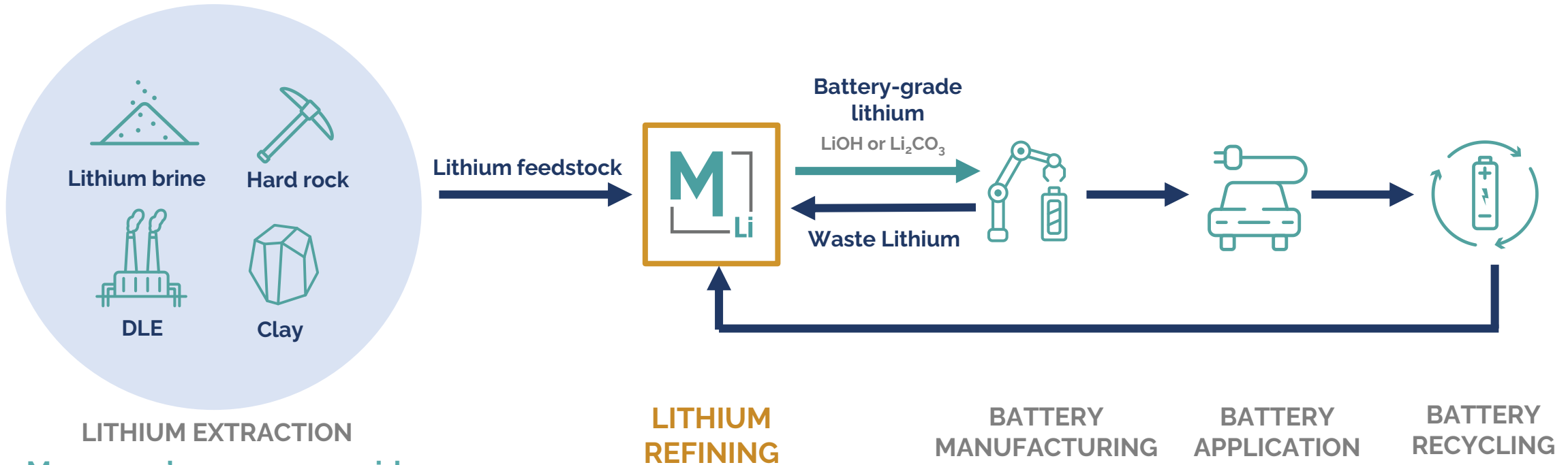


Mangrove's **Li Refining Solution**



MANGROVE UNLOCKS REFINING BOTTLE-NECKS

Enables supply chain security and resiliency through localized refining



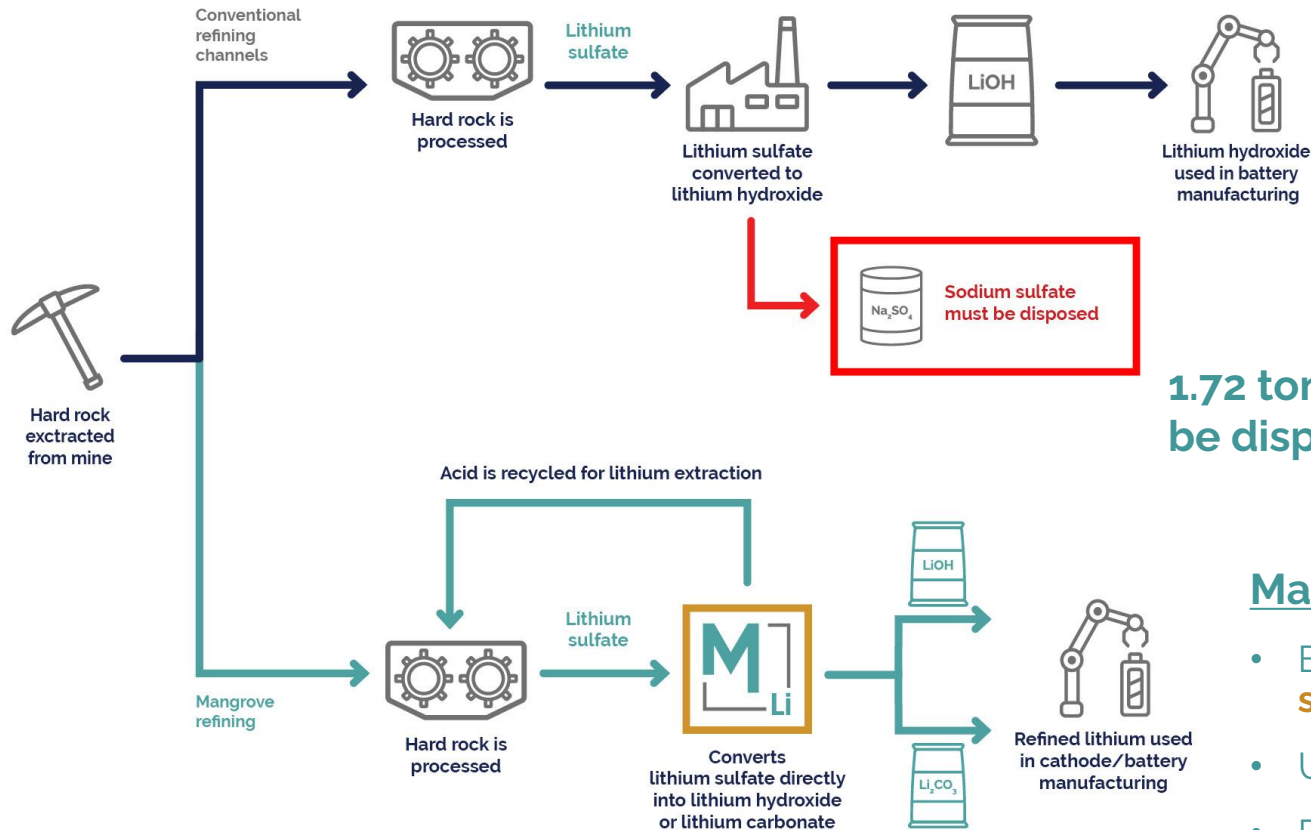
Mangrove's process provides

- **Flexibility:** can refine Li₂SO₄ and LiCl feedstocks in the same system simultaneously into battery-grade LiOH or Li₂CO₃.
- **Independence:** Compared to traditional 2-step process, our all-electric system reduces the supply chain risk of needing to source chemical reagents, and system can be co-located at your facility.
- **Efficiency:** Only byproduct is acid that can be used again, and it enables recovery of lithium from other waste streams in battery manufacturing and recycling processes.
- **Sustainability:** 50% fewer GHG emissions compared to traditional processes.

MANGROVE OPTIMIZES HARD ROCK ASSET ECONOMICS

Mangrove's streamlined process eliminates chemical inputs and waste outputs

1 ton sodium hydroxide
required per ton $\text{LiOH}\cdot\text{H}_2\text{O}$



Incumbent System

- Time and capital intensive
- Widely available hard rock acids are **not cost-effective** to refine
- Requires additional **costly chemical inputs**
- Produces **sodium sulfate waste**

1.72 tons sodium sulfate output to
be disposed per ton $\text{LiOH}\cdot\text{H}_2\text{O}$

Mangrove Lithium

- Eliminates costs/challenges of **disposal for sodium sulfate**
- Unlocks previously **unviable feedstocks**
- Eliminates sulfuric acid consumable cost through **recycling of by-product**
- Eliminates the need for **caustic sodium hydroxide consumable**

PATENTED TECHNOLOGY ENABLES A STEP-CHANGE IN Li REFINING

Best in class technology with fundamental advantages over incumbents

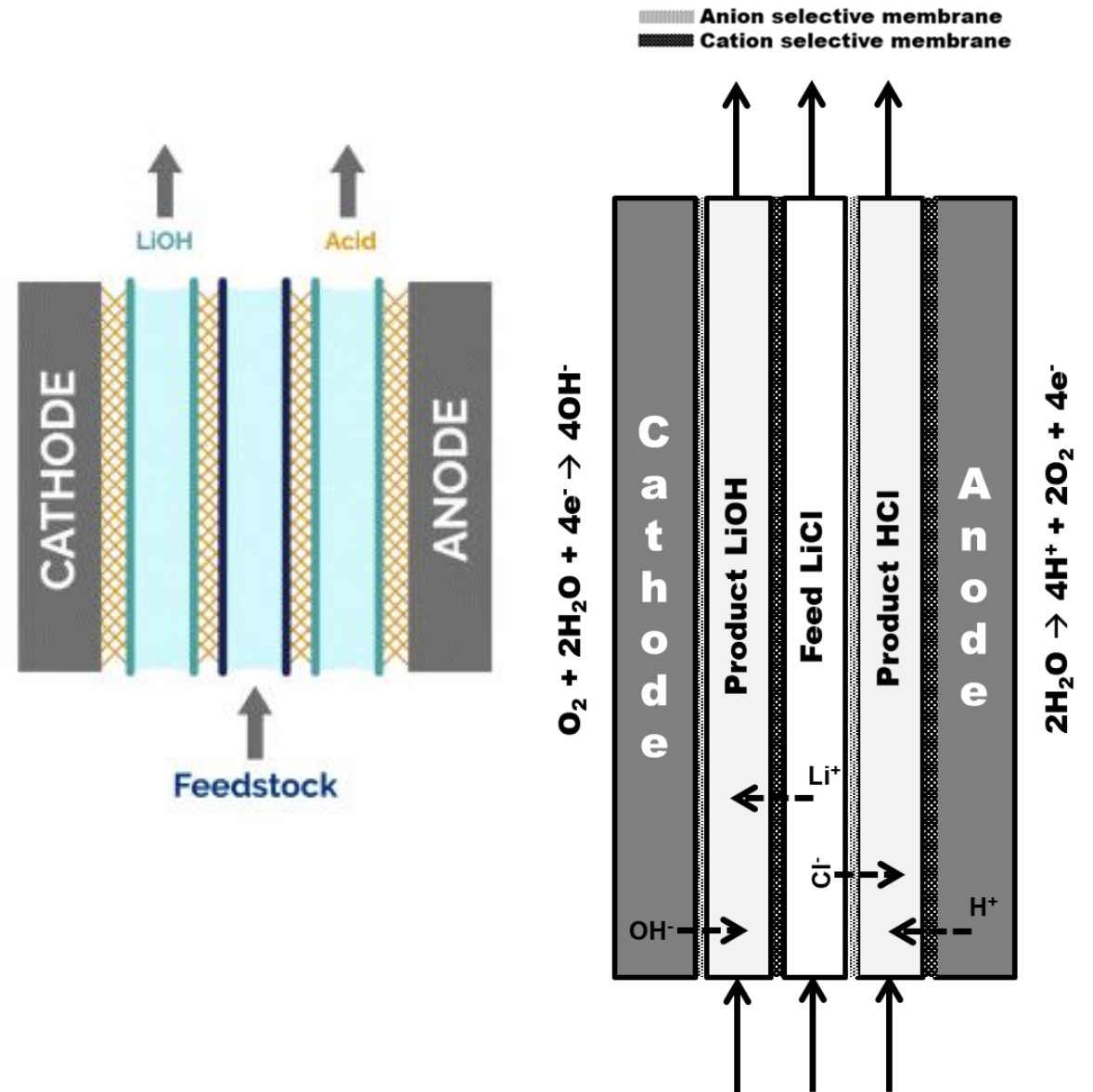
Mangrove's process utilizes electricity to do the work in place of chemicals and requires >30% less energy than incumbent technology

How it works:

- Electricity moves cations towards the cathode and anions towards the anode
- Strategic placement of ion-exchange membranes to build-up acid and base
- Oxygen/air cathode is used to produce hydroxide ions and reduce energy consumption
- Protons generated at the anode

Why it is unique & differentiated:

- Oxygen/air cathode fundamentally reduces voltage & energy consumption
- Multi-compartment cell design allows flexible feed concentrations and compositions



MANGROVE'S MODULAR TECHNOLOGY ENABLES SIMPLE SCALING

Modular electrochemical stack means flexibility of scaling to meet customer's needs on the same "frame"



Example of single electrochemical cell

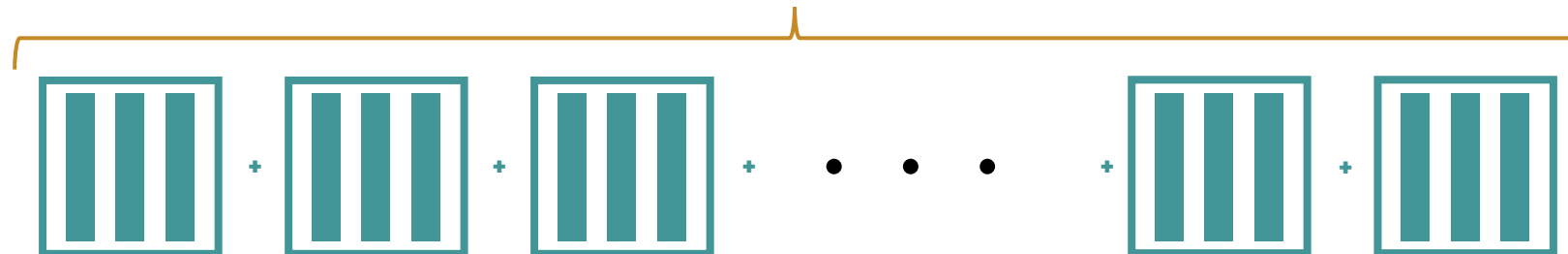


Cells are duplicated into a single stack



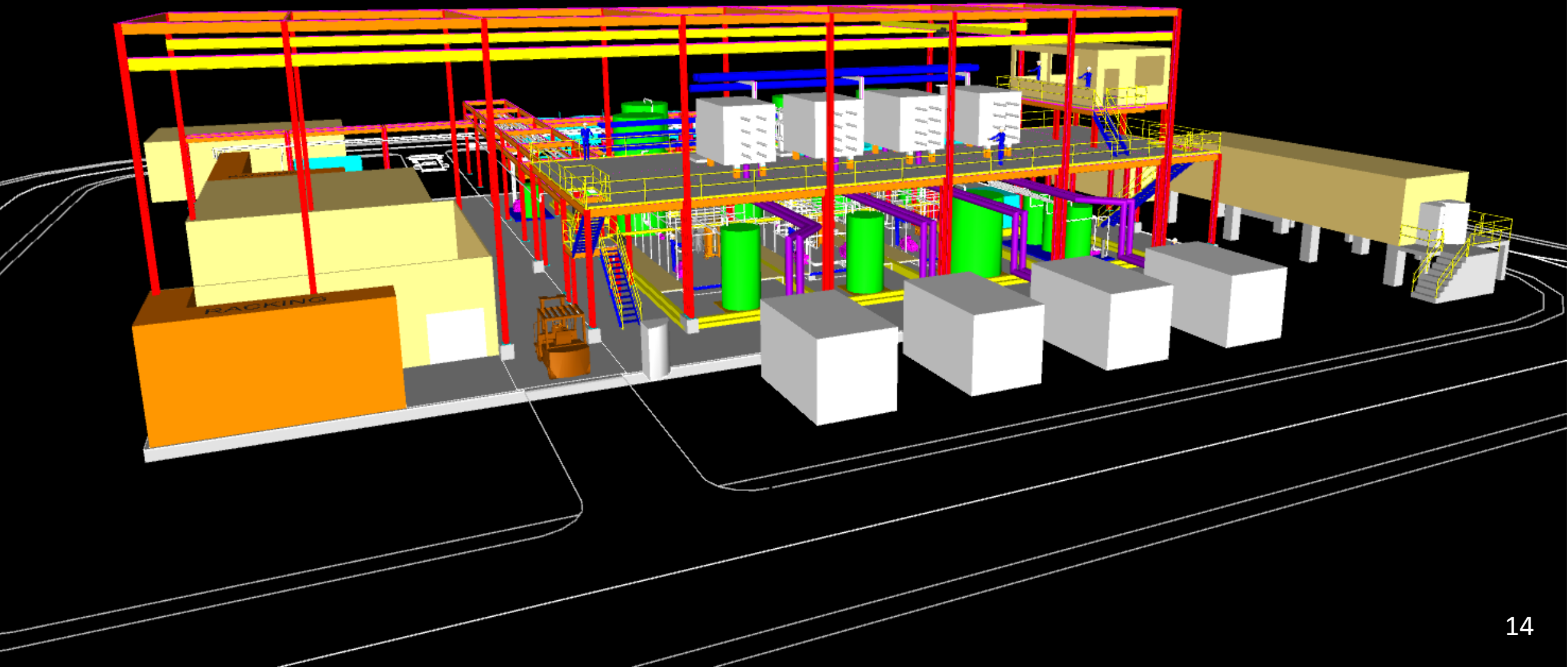
Stacks work together in a module

Replicate modules to meet customer capacity



COMMERCIAL SYSTEMS BASED ON SAME ELECTROCHEMICAL STACK

Expand capacity using a modular approach to accelerate customer qualification



TRUSTED, EXPERIENCED AND STRATEGIC INVESTORS





Thank you

M
Li