



umicore
materials for a better life

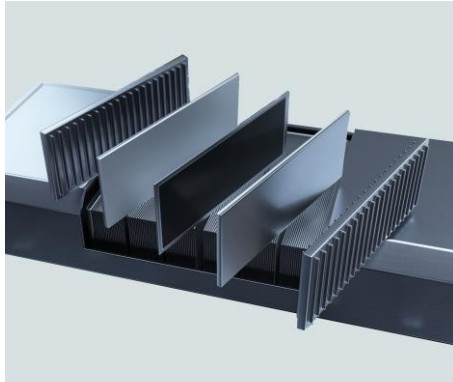
Cathode Supply Chain Considerations with focus on North America

Rob Privette

Center for Research in Extreme Batteries:
2022 Spring Bi-Annual Meeting

We are

A global materials technology and recycling group



A global leader in automotive catalysts for internal combustion engines, hybrids and fuel cell powered vehicles



A leading supplier of key materials for rechargeable batteries used in electrified transportation and portable electronics



The world's leading recycler of complex waste streams containing precious and other valuable metals

A global leader in active materials for rechargeable batteries



Over 20 years
in the market



8 production
sites worldwide



First cathode
producer in
Europe



Carbon neutral
production in Europe



This year Umicore
will produce enough
cathode materials to power
1 million vehicles

From portable
electronics to
automotive



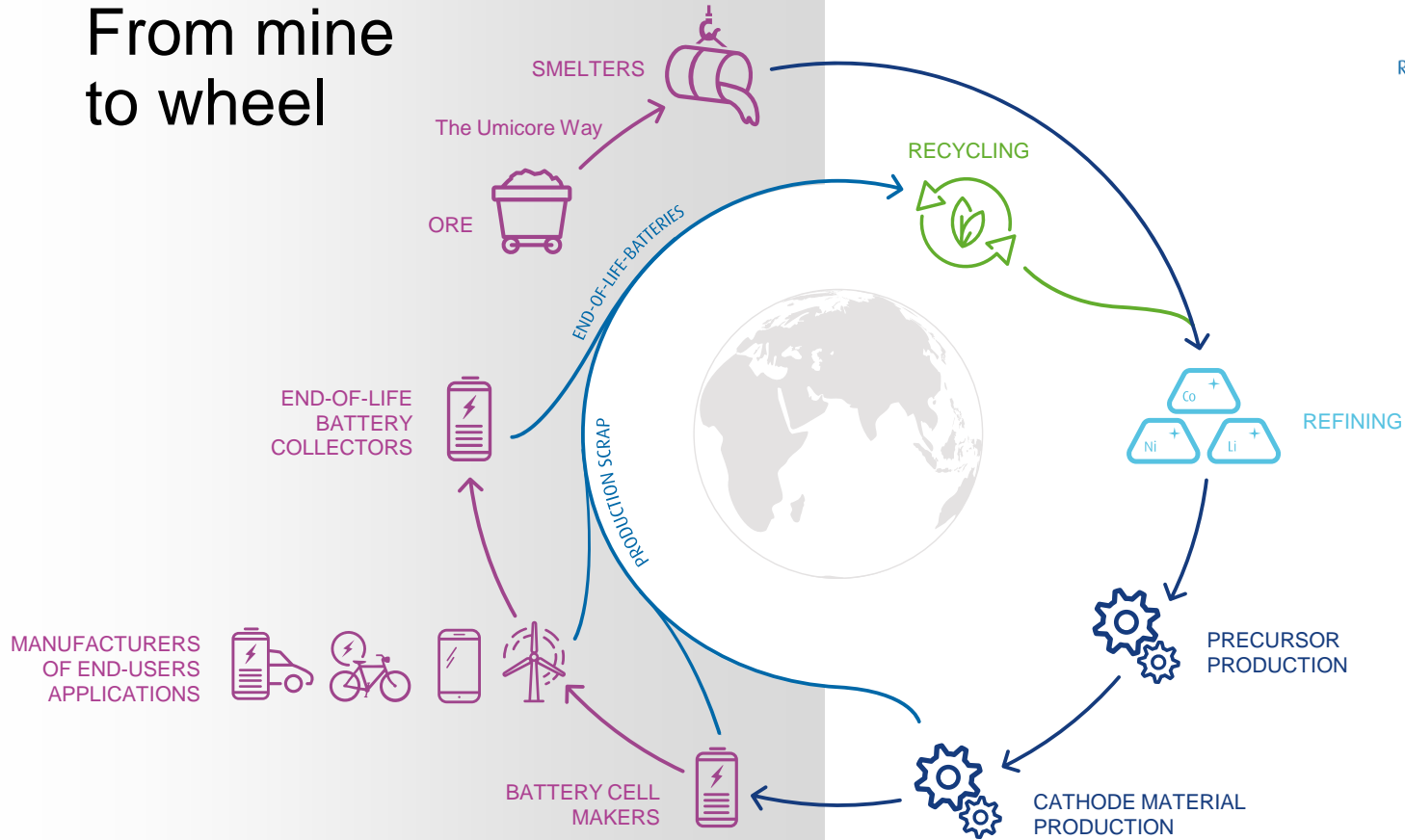
Over 15 years of
sustainable and ethical
sourcing of materials



1 out of 5 batteries
ever made contains
Umicore technology



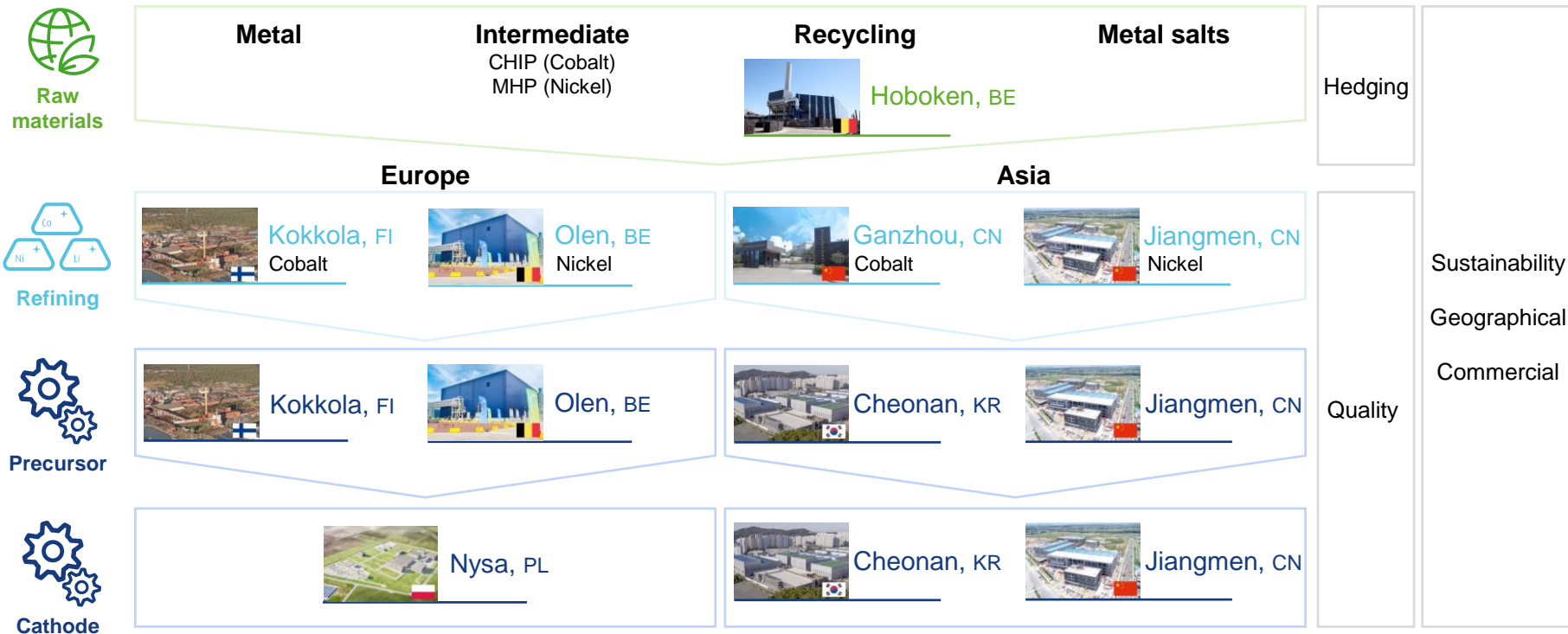
From mine to wheel



Supply security through unique footprint and know-how

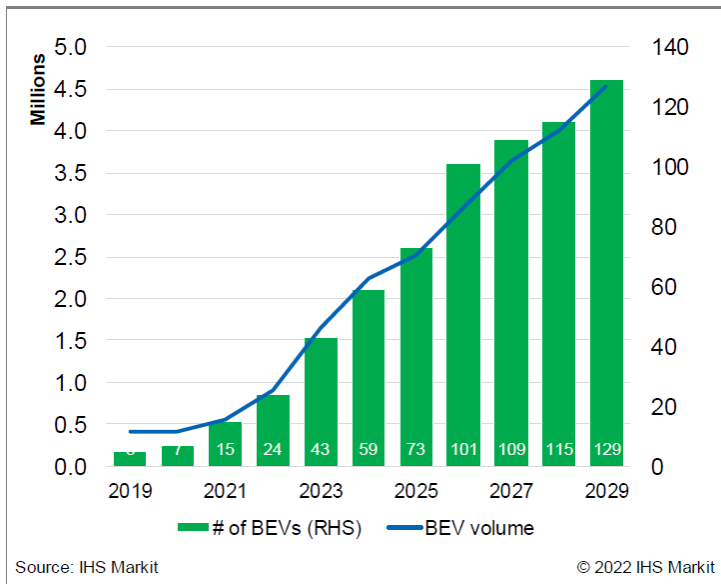
Umicore's unique supply chain set-up

Risks managed 



North American Market Growth

North America Production of BEVs



2021 US Electrified Vehicle Sales Growth

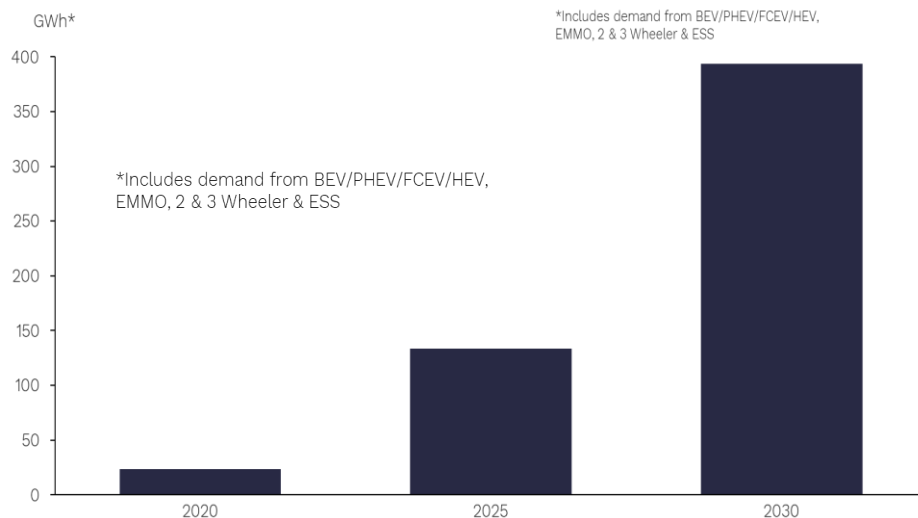
	2021	2020	Y-O-Y
EVs	487,460	257,872	89.0%
HEVs / PHEVs	969,407	525,605	84.4%
Total Electrified	1,456,867	783,477	85.9%
Total Market	15,061,885	14,568,364	3.4%
% Electrified	9.7%	5.4%	79.9%

Cox Automotive Inc.



US Li-ion battery market and Associated Cathode Supply Chain Requirements

Li-ion GWh demand US



www.RhoMotion.com

www.RhoMotion.com



US Cathode materials (2030)

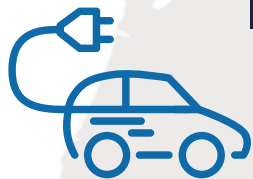
~600 kMT



**US Raw materials (2030)
NMC8xx family**



~300 kMT



May 26, 2022 ...Automotive industry leaders have committed more than **\$500 billion** to shifting to electric propulsion over the course of this decade.

The largest single manufacturing investment in the history of Ford Motor Company

NEW MEGA CAMPUS IN TENNESSEE AND TWIN BATTERY PLANTS IN KENTUCKY; \$11.4B INVESTMENT TO CREATE 11,000 JOBS AND POWER NEW LINEUP OF ADVANCED EVS

SEP 27, 2021 | DEARBORN, MICH.



Blue Oval City



Autos & Transportation

August 5, 2021

Biden seeks to make half of new U.S. auto fleet electric by 2030

GM Will Boost EV and AV Investments to \$35 B Through 2025

GM will pull ahead construction of two new Ultium battery cell plants in the U.S., in addition to plants in Ohio and Tennessee now being built

2021-06-16

October 18, 2021
6:36 AM EDT
Last Updated 40 minutes ago

Technology

Stellantis, LGES strike battery production deal for North America

• New 40 GWh-capacity plant expected to start by Q1 2024

Biden Proposes \$174B for Electrification

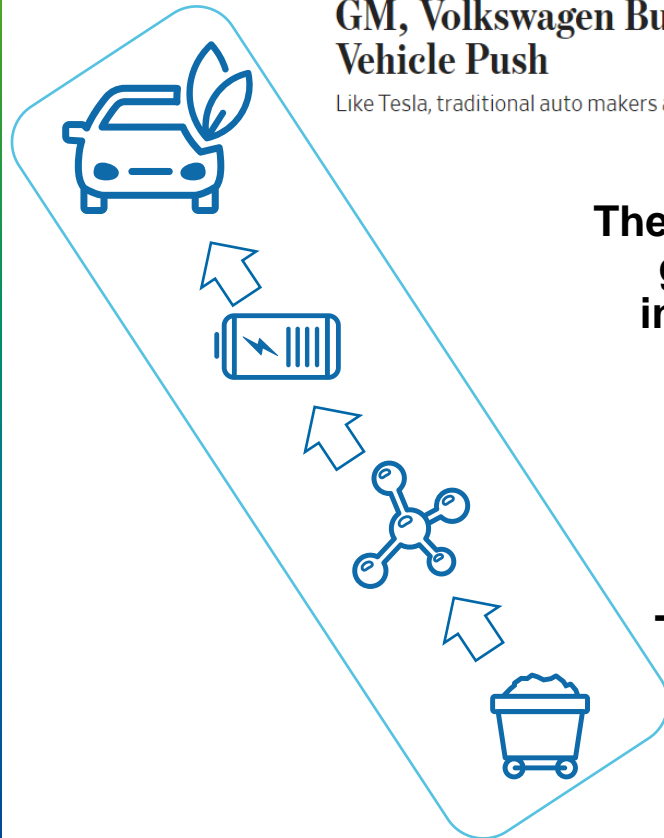
April 7, 2021 • by Government Fleet Staff •

Evolution in business models

BUSINESS | AUTOS & TRANSPORTATION | AUTOS INDUSTRY

GM, Volkswagen Build Up Their Battery Supply Chains Amid Electric-Vehicle Push

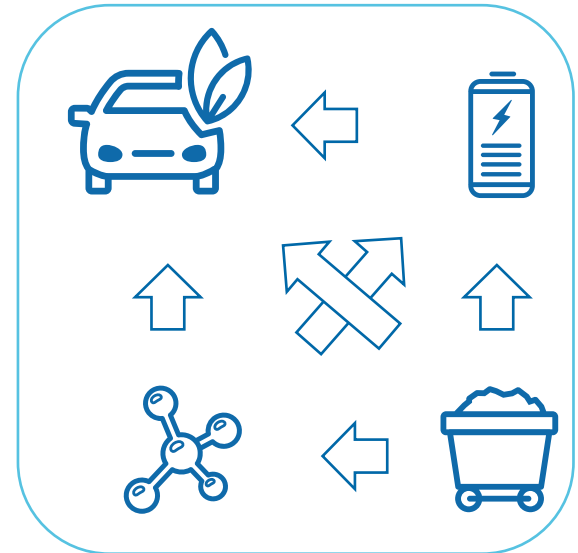
Like Tesla, traditional auto makers are investing more in needed supplies as the industry returns more to vertical integration



**The linear business model
gives way to a more
interconnected model**



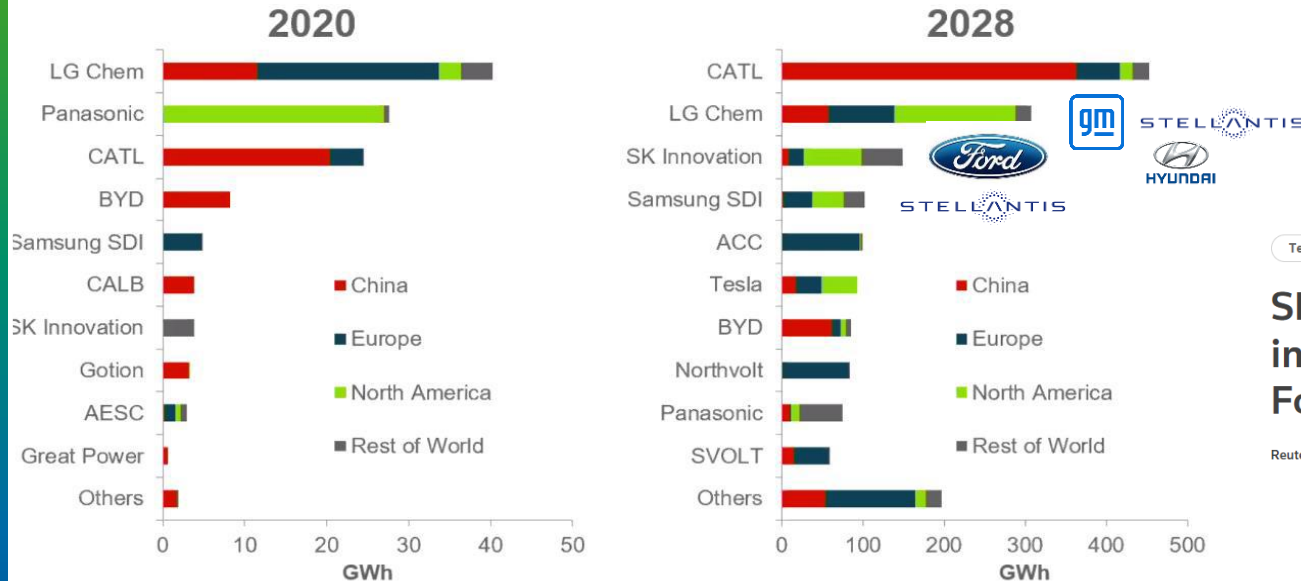
seeking to optimize:
- costs,
- supply security,
- product differentiation.



Umicore and Volkswagen AG to create European EV battery materials Joint Venture

Cell makers global footprint

And (largely captured) growth in North America



**SK Innovation to invest \$4.3 bln
in U.S. battery production with
Ford Motor**

Reuters

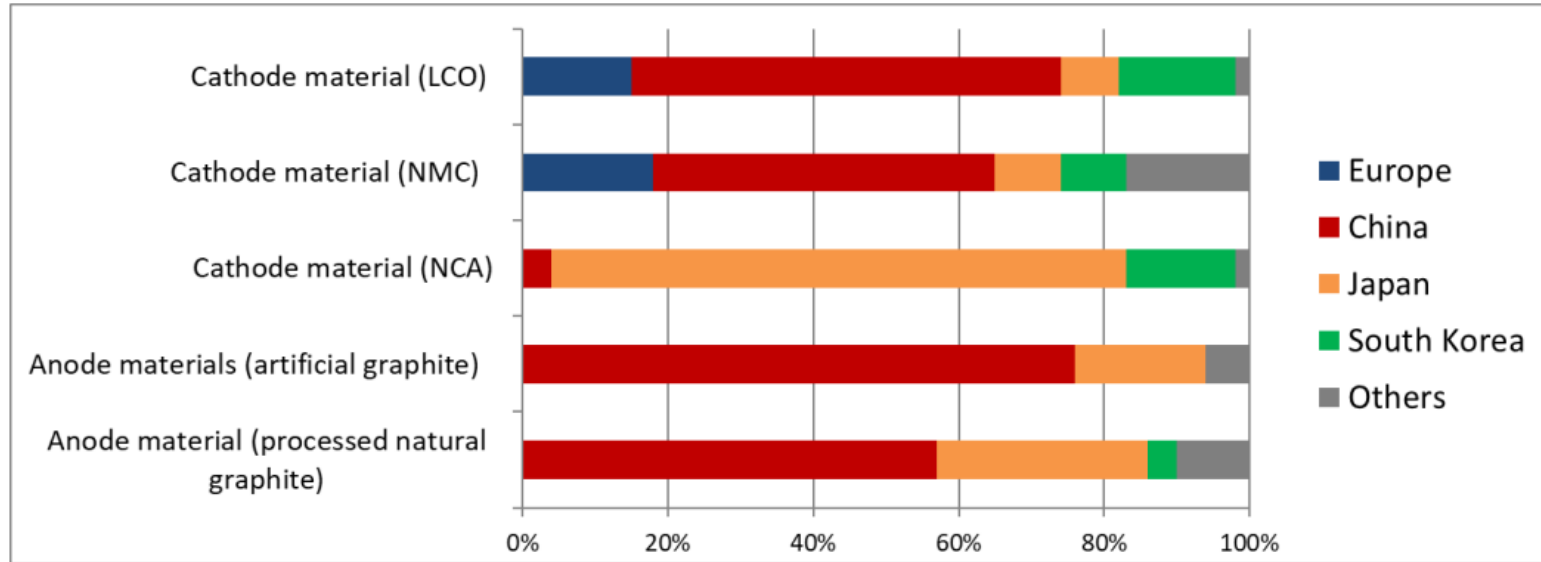
Source: LMC Automotive

LG announces a \$1.7B ramp-up, 1,200 new jobs, at its Michigan EV battery factory

**Samsung SDI, Stellantis Invest \$2.5
Billion in US Battery Plant**

Current active materials production

Currently dominated by overseas supply



Source: JRC, BNEF, 2019.

... with announced plans for cathode production in NA mid-decade

NA Cathode production

Considerations

- Financial
 - Access to high capital employed
 - Short-term contracting terms
 - Market uncertainty
- Siting
 - Sustainability - Availability of renewable energy
 - Logistics & Footprint for expected expansion
 - Regulatory
- Raw material supply & Closed loop recycling
 - Limited domestic Ni and Co resources, Li processing early TRL
 - Some potential global production – demand imbalances, especially for premium sources
 - Nascent battery scrap/ End-of-Life market



Takeaways

- The Li-ion battery market in North American is poised for significant growth this decade driven mobility electrification
- Automotive OEMs are investing \$100's B to enable vehicle electrification through the creation of a domestic supply chain
- The automotive supply chain is evolving to create security and economies
- Leading suppliers are locating to North America led by automotive investment with 2025+ timing
- Cathode production capacity, largely initially captured for automotive will grow rapidly through the end of the decade
- Raw material markets are expected to be tight

materials for a better life