ABTC
AMERICAN BATTERY
TECHNOLOGY COMPANY

The Future of EV Battery Recycling and the Domestic Supply Chain in the US

Doug Hamilton

Head of Policy

American Battery Technology Company

cieca
Collision Industry Electronic Commerce Association

ABTC
AMERICAN BATTERY
TECHNOLOGY COMPANY

Overview:

- The Battery Boom and Support for Electrification
- Demand for Critical Battery Metals
- Necessity of Battery Recycling
- Securing the U.S. Domestic Supply Chain
- Questions

cieca
Collision Industry Electronic Commerce Association

Lithium-ion Batteries: A Part of Daily Life

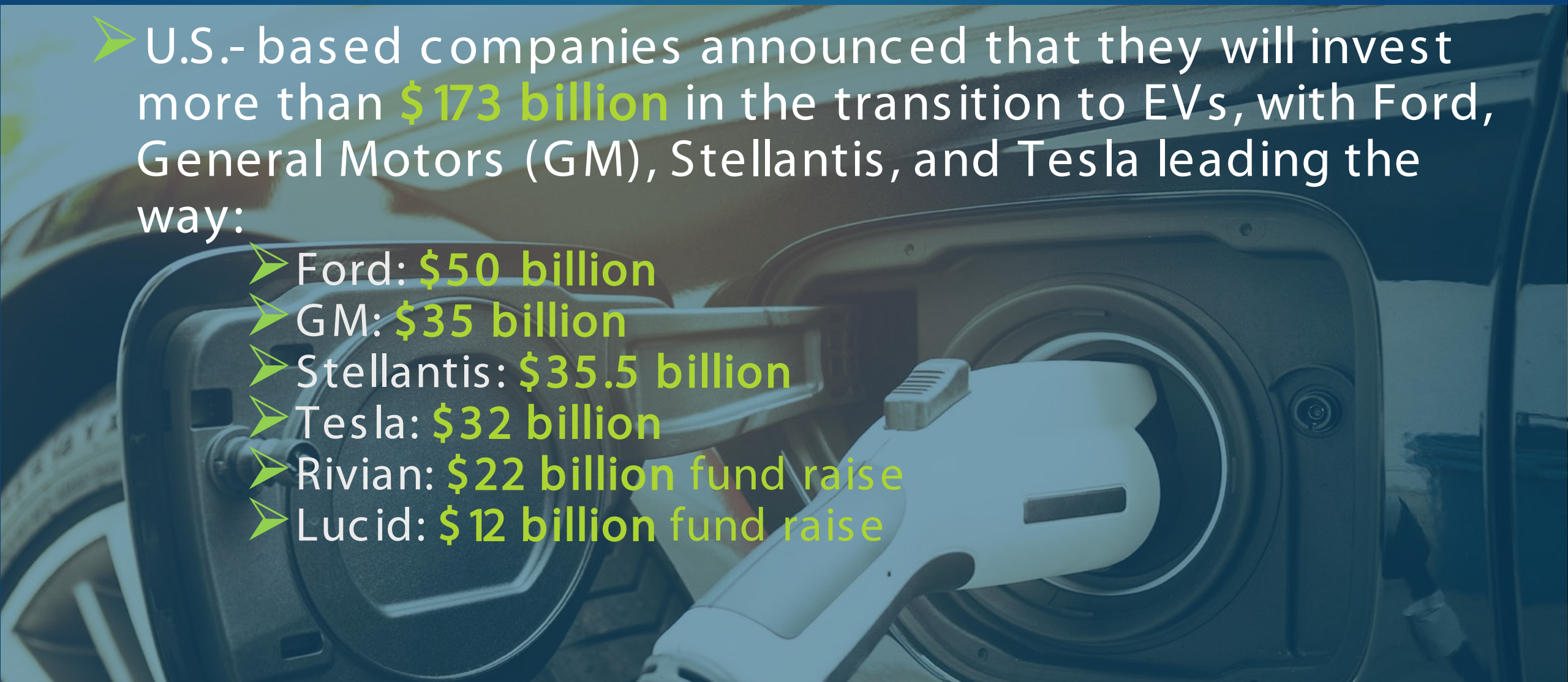
cieca
Collision Industry Electronic Commerce Association

National Push for Electrification of Transportation Grid and Services

- Three main reasons offered:
  - Electric vehicles reduce carbon emissions
  - Cost effectiveness
  - Establishing a domestic supply chain in the clean energy sector increases national security

cieca
Collision Industry Electronic Commerce Association

U.S. Automotive OEMs Investing in Electrification and EV Infrastructure



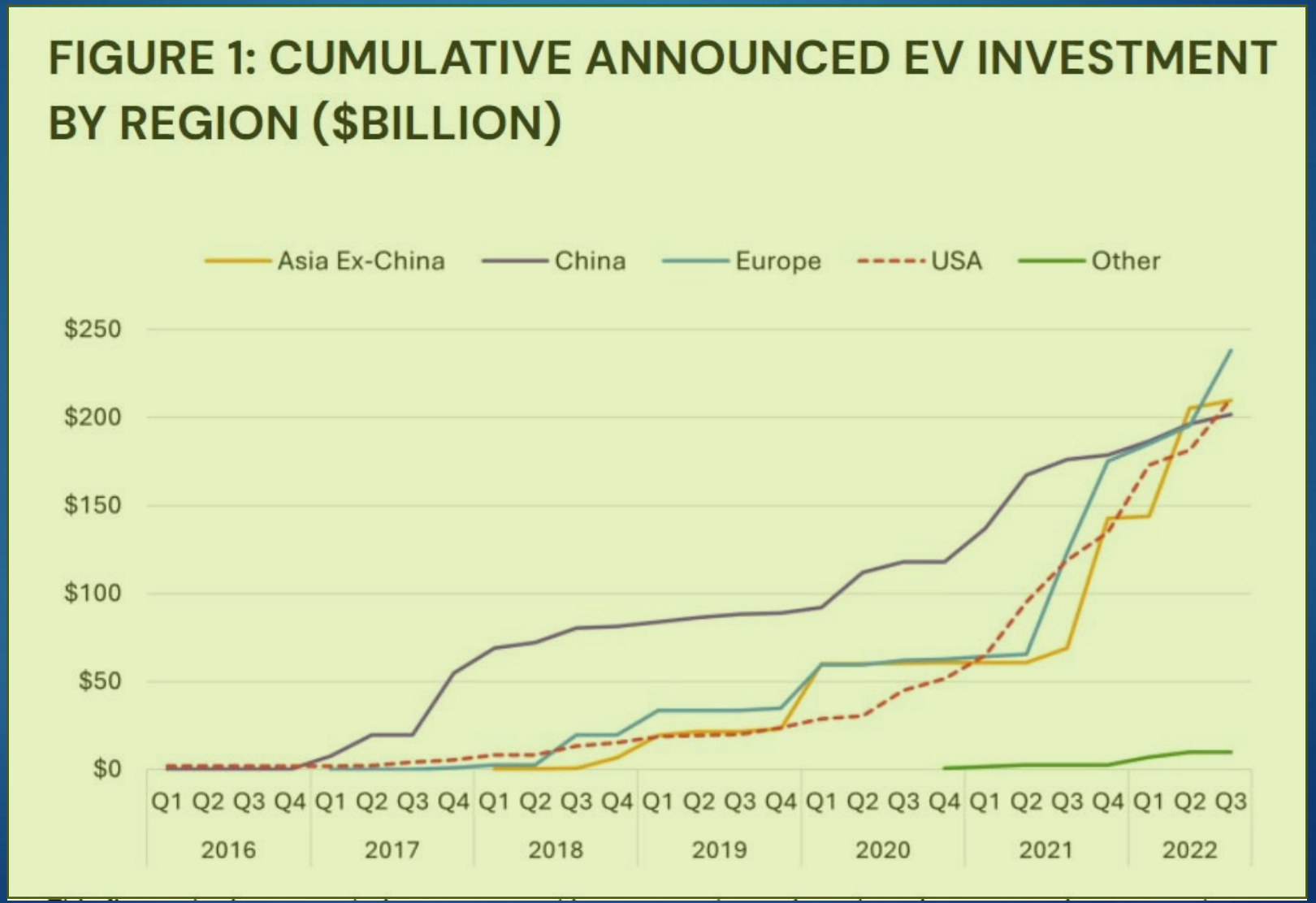
- U.S.-based companies announced that they will invest more than **$173 billion** in the transition to EVs, with Ford, General Motors (GM), Stellantis, and Tesla leading the way:
  - Ford: **$50 billion**
  - GM: **$35 billion**
  - Stellantis: **$35.5 billion**
  - Tesla: **$32 billion**
  - Rivian: **$22 billion** fund raise
  - Lucid: **$12 billion** fund raise

Historic Government Funding In Support of Electrification

- November 2021: The Infrastructure Investments and Jobs Act (IIJA)
- August 2022: Inflation Reduction Act (IRA)
  - Over **$245 billion** EV-Eligible Funding
  - Additional **$7.5 billion** for battery recycling and materials processing

cieca
Collision Industry Electronic Commerce Association

United States poised to become a global leader in the EV transition



cieca
Collision Industry Electronic Commerce Association

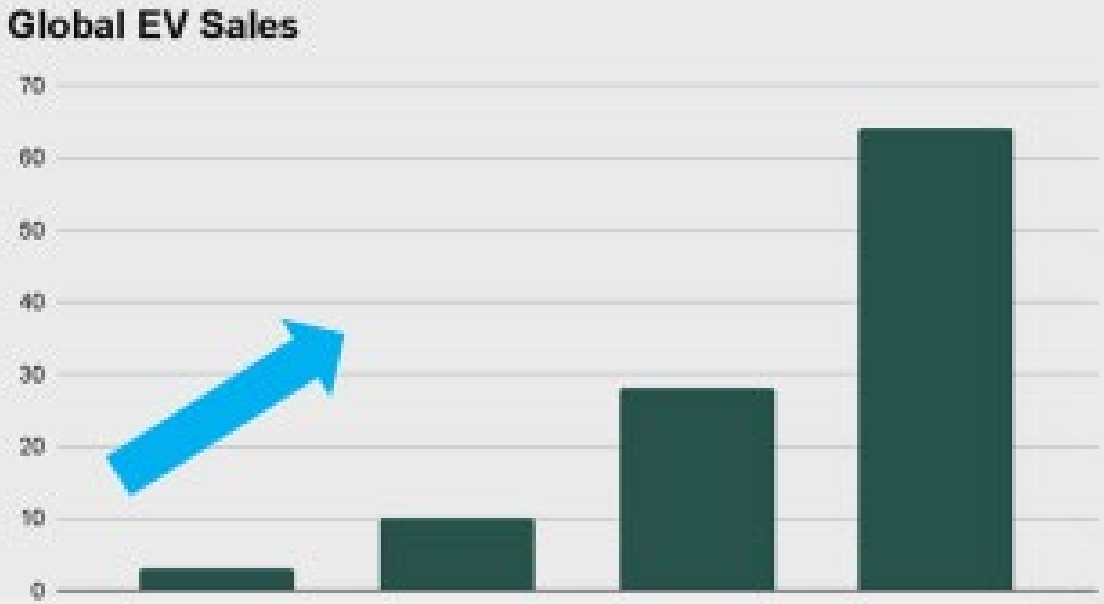
Boom in the EV and EV Battery manufacturing space

- 260 Hybrid & Electric Vehicle Manufacturing businesses in the US as of 2023, an increase of 12.5% from 2022.

- 13 new battery cell gigafactories coming online in the US by 2025, according to the Department of Energy.

cieca
Collision Industry Electronic Commerce Association

Opportunity: EV Sales Growth



Year	2020	2025	2030	2040
Growth from Current Market	-	488%	1547%	3724%
% of Total Auto Sales	2%	11%	29%	68%

Source: BloombergNEF Electric Vehicle Outlook 2021

cieca
Collision Industry Electronic Commerce Association

Critical Metals a Necessity for Li-ion Battery Production

- Demand is set to exponentially outpace supply without a significant increase in production

- Currently, the U.S. produces just 1% of the global battery metal supply

cieca
Collision Industry Electronic Commerce Association

IRA Provisions Provide Strong Incentives

- The Inflation Reduction Act awards car makers a $7500 tax credit on each car under the following conditions:
  - To qualify for the first $3750, **50% of the value of critical materials** used in new car batteries must be sourced from the U.S. or a free trade agreement country in 2024 climbing steadily **80% from 2027 to 2032**.
  - To qualify for the second $3750, **60% of the value of battery components** be produced or assembled in North America in 2024 to qualify for half of the tax credit, $3,750. That percentage will increase to **100% starting in 2029**.
- **This supercharges the manufacturing industries for EV production/ assembly and the sourcing of critical minerals**

cieca
Collision Industry Electronic Commerce Association

3 Independent Challenges to North American Battery Supply Chain

Security of Supply

<1%

Of global battery materials produced by USA

Less than 1% of the global manufacturing capacity of each of the primary battery metals (lithium, nickel, cobalt, and manganese) is currently within the US.

Cost of Supply

$ ↑↑↑

Cost of battery minerals has soared alongside supply scarcity

The cost of manufacturing and importing these battery metals has grown rapidly over recent years as demand has grown at a far faster pace than new supply can enter the market.

Environmental Impact of Supply

Many conventional recycling and mining practices are harmful to the environment

The mining and recycling of these battery metals through conventional techniques can result in the emission of large amounts of greenhouse gases, criteria pollutants, and contaminated water and soil.

Recycling Addresses All 3 Challenges

1. **Security of Supply-**---Batteries everywhere—A tsunami of EV batteries coming

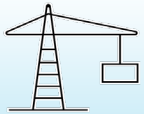
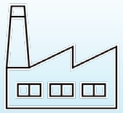
1. **Cost of Supply-**--Recycled batteries can be collected at a much lower cost

1. **Environmental Impact-**--Less batteries in landfills—less toxic waste sites and polluting the ground water

cieca
Collision Industry Electronic Commerce Association

Battery Recycling Problem in the U.S.

Spent batteries are frequently treated as ***waste*** and rather than a **valuable domestic resource**

 Export Market	 Thermal Treatment	 Risk: Reliance on China
The majority of batteries currently **"recycled"** in the United States are **exported** to China, Korea & Japan	The majority of batteries currently **"recycled"** globally are **smelted** in blast furnaces	Every battery **exported** to China exacerbates the domestic U.S. **critical mineral** supply problem

Estimated only 10% of spent batteries are recycled

Battery metals can be recycled and reused *indefinitely*

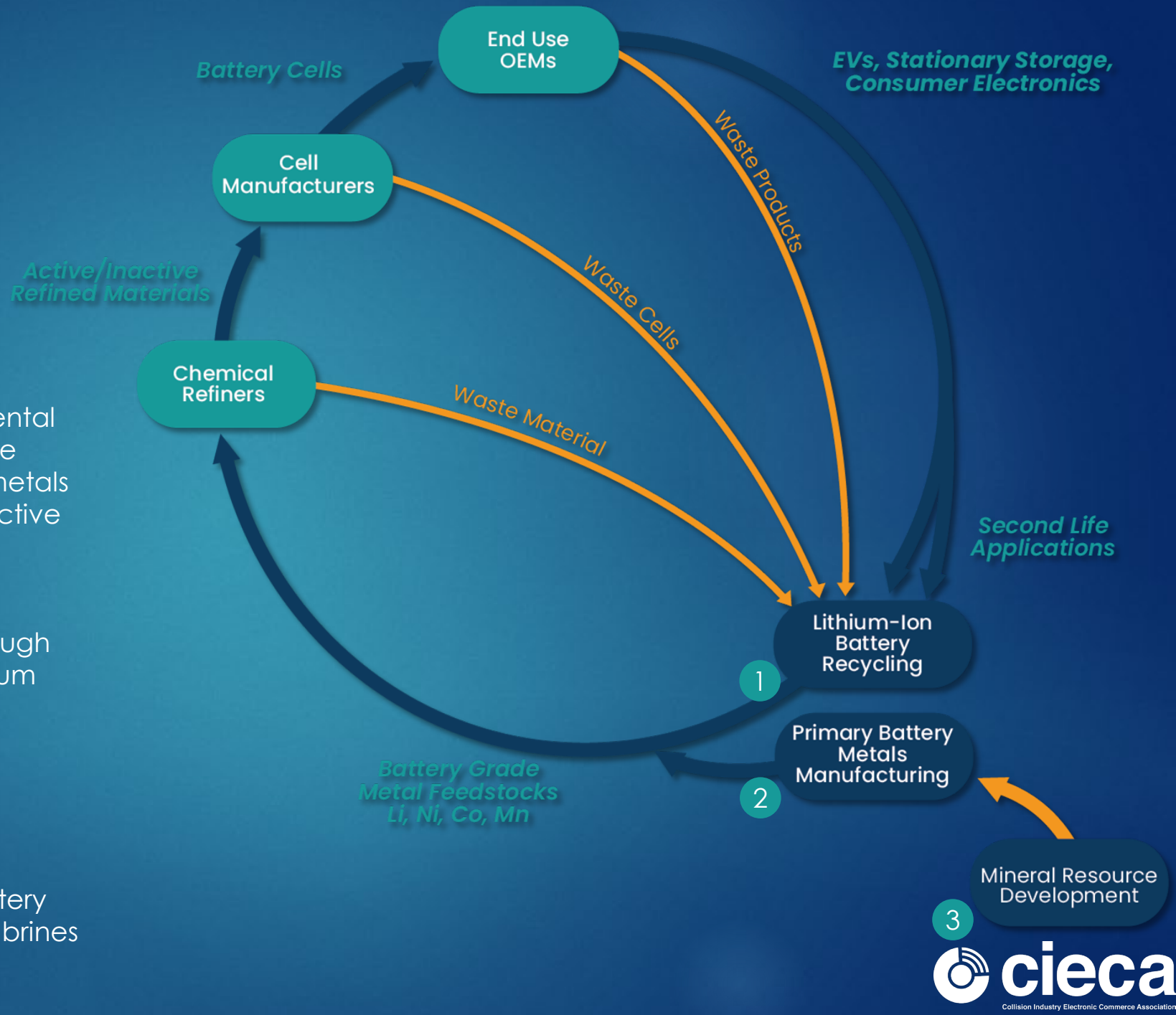
cieca

A Closed Loop Economy

1 **Lithium-Ion Battery Recycling**
An integrated process to ***close-the-loop*** through the low-cost and low-environmental impact recycling of end-of-life and waste lithium-ion batteries into battery grade metals to be further synthesized into cathode active material (CAM)

2 **Primary Battery Metals Manufacturing**
A first-of-kind process to ***fill-the-loop*** through the manufacturing of battery grade lithium hydroxide from domestic-US based unconventional claystone sedimentary resources

3 **Mineral Resource Development**
The low impact ***primary resource development*** of domestic-US based battery mineral containing sediments, ores, and brines to enable high-volume manufacturing



cieca
Collision Industry Electronic Commerce Association

The Makeup of Battery Feedstock

Battery feedstock falls under 3 categories:

1. End-of-life, intact, rechargeable Li-ion batteries

2. Manufacturing waste: material scraps and rejected cells (new scrap)

3. End-of-life, damaged Li-ion batteries

cieca
Collision Industry Electronic Commerce Association

1. Intact Li-ion Batteries

ABTC is focused on initial collection of these materials - considered 'Universal Waste'

- Reduced fire hazard
- Safer to transport and store
- Safer to handle onsite
- Does not require a permit to store
- Can store for up to 1 year in Nevada

cieca
Collision Industry Electronic Commerce Association

2. Manufacturing Waste

This material may eventually become our largest source of feedstock in the future

- Considered Hazardous Waste
- Need a Resource Conservation and Recovery Act (RCRA) Permit for Treatment, Storage and Disposal Facilities (TSDF) / Written Determination

- More expensive and dangerous to ship
- More expensive and dangerous to store

cieca
Collision Industry Electronic Commerce Association

3. End-Of-Life Damaged Batteries

Once we are up and running and properly permitted we can own this market but not now—Fire Hazard

- Considered Hazardous Waste
- Need a Resource Conservation and Recovery Act (RCRA) Permit for Treatment, Storage and Disposal Facilities (TSDF)/Written Determination
- More expensive and dangerous to ship
- More expensive and dangerous to store

cieca
Collision Industry Electronic Commerce Association

Battery Cells Types We Can Collect

Individual Cells

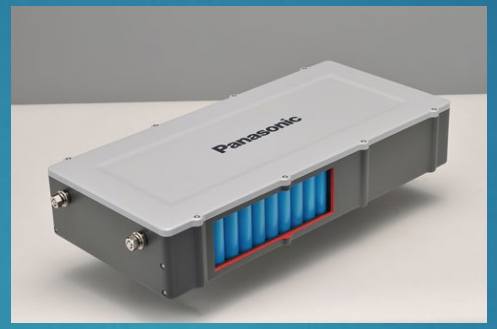
Cylindrical

Button

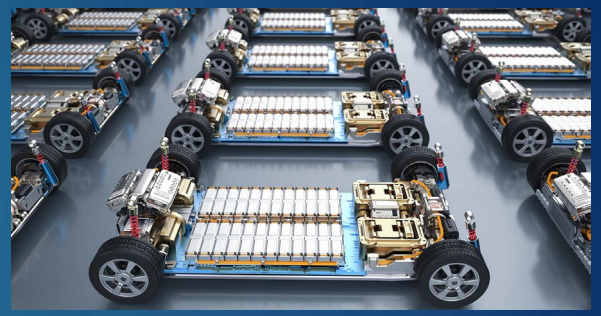
Pouch

Prismatic

Modules



Packs



Collision Industry Electronic Commerce Association

What chemistries can we accept?

LCO Lithium Cobalt Oxide($LiCoO_2$)
Mobile phones, tablets, laptops and digital cameras.

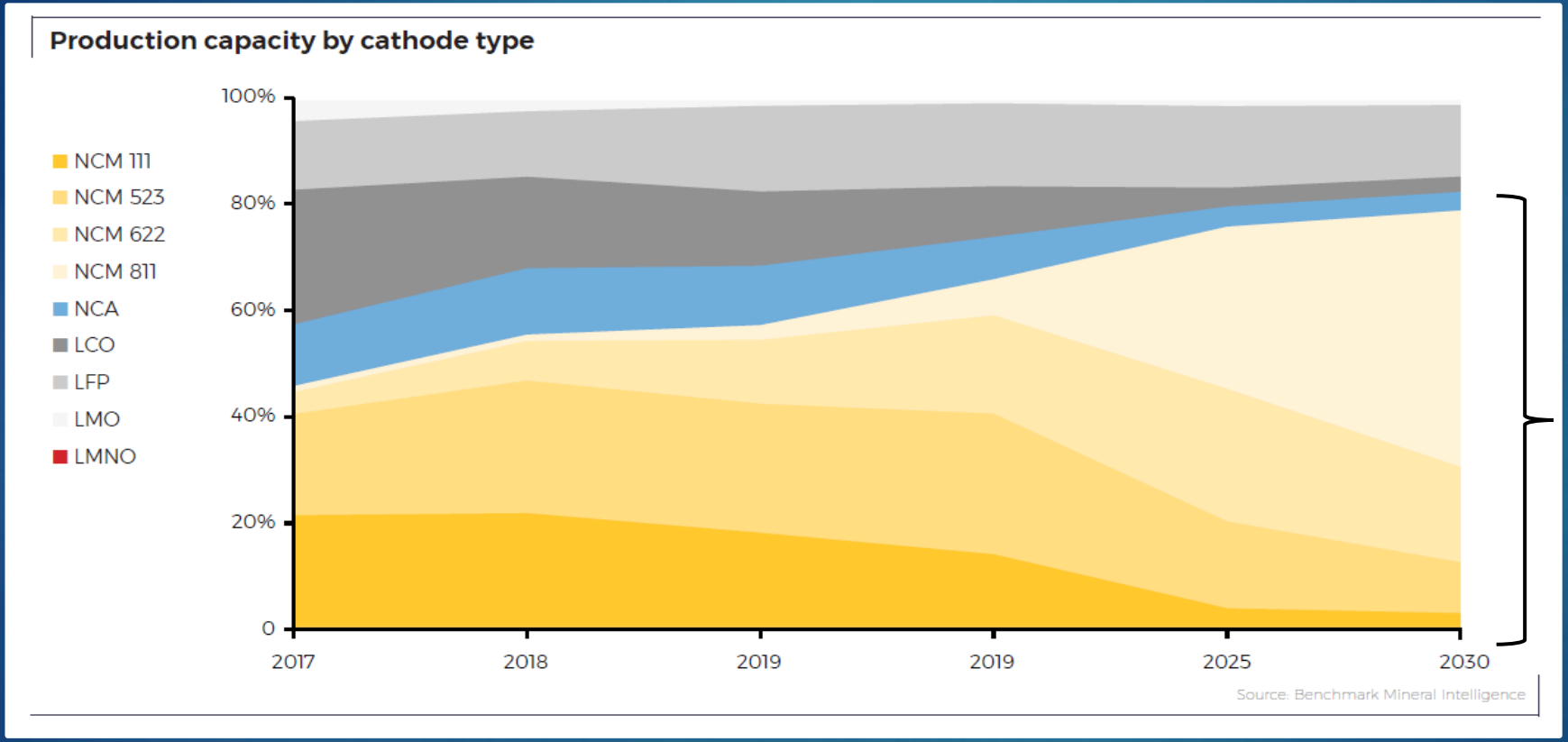
NCA Lithium Nickel Cobalt Aluminum Oxide ($LiNiCoAlO_2$)
Medical devices, industrial, electric powertrain i.e.(Tesla)

NCM Nickel Cobalt Oxide Manganese ($LiNiMnCoO_2$)
E-bikes, medical devices, EVs, industrial

LCO Lithium Cobalt Oxide($LiCoO_2$) — LCO
Mobile phones, laptops and digital cameras

cieca
Collision Industry Electronic Commerce Association

Market Percentage of Batteries Accepted



Initially we will accept these chemistries which represent 80% of the market

cieca
Collision Industry Electronic Commerce Association

Chemistries we do not accept currently

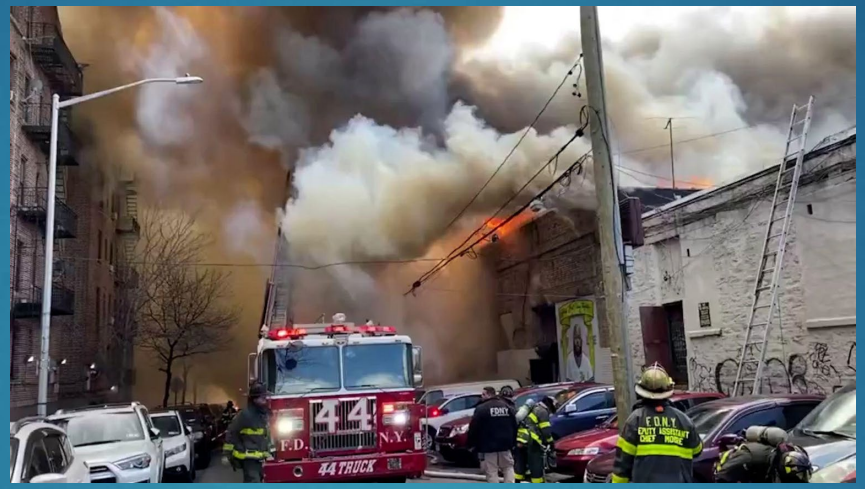
- ***LFP*** Lithium Iron Phosphate($LiFePO_4$)
  energy storage, EVs

- ***LMO*** Lithium Manganese Oxide ($LiMn_2O_4$)
  power tools, medical instruments,
  electric vehicles

- ***LTO*** Lithium Titanate (Li_2TiO_3)
  electric powertrain (Mitsubishi i-MiEV,
  Honda Fit EV),solar-powered street lighting

cieca
Collision Industry Electronic Commerce Association

All Lithium-ion Batteries are Hazardous

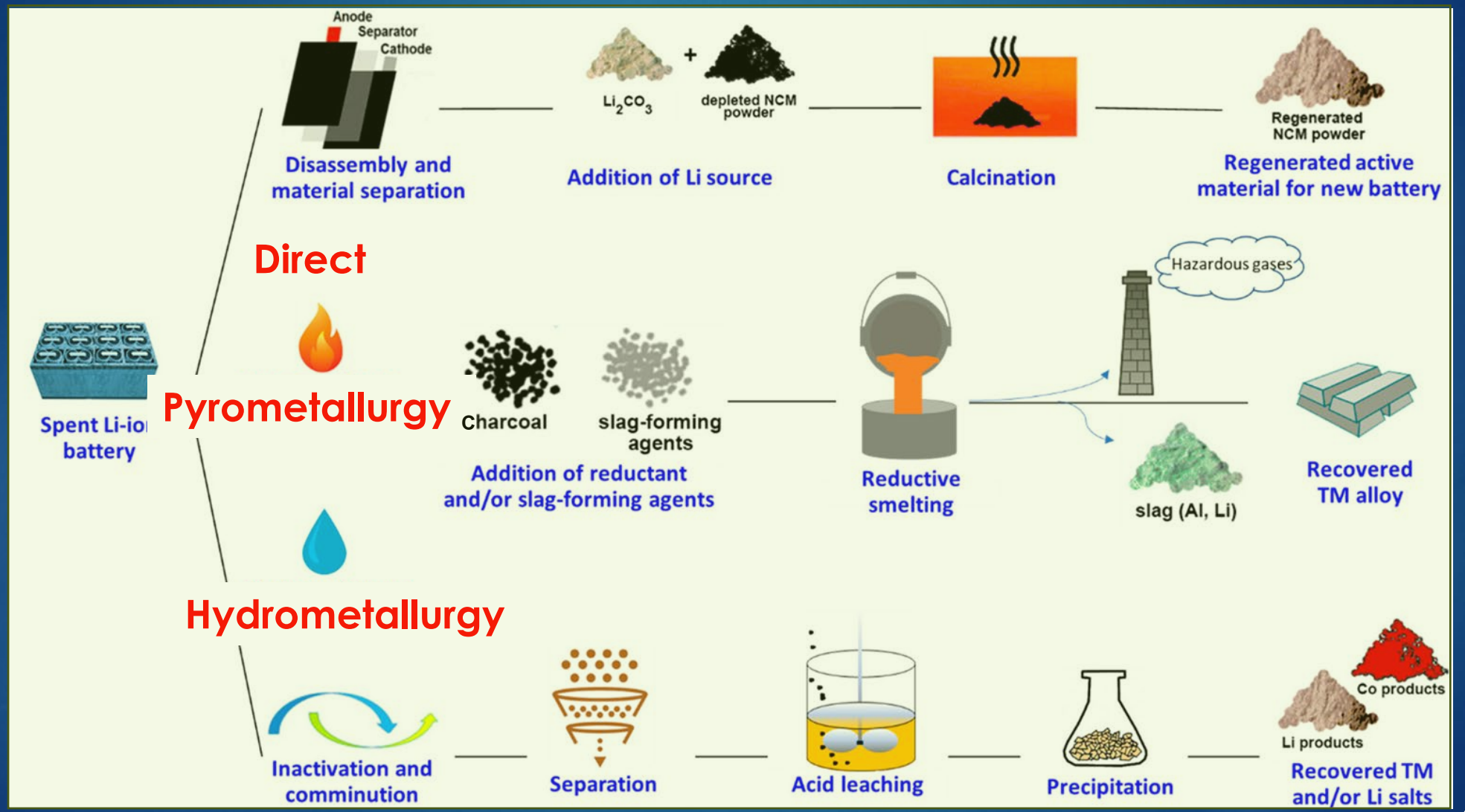


The DOT and EPA have strict regulations for how to transport and store this material

But it is still the Wild West out there.

cieca
Collision Industry Electronic Commerce Association

The Recycling Process: 3 common methods



cieca
Collision Industry Electronic Commerce Association

The Recycling Process: Stage 1 Product

- From each of these three processes you get a product called **Black Mass**

- This black powder or slurry consist of the 4 main metals

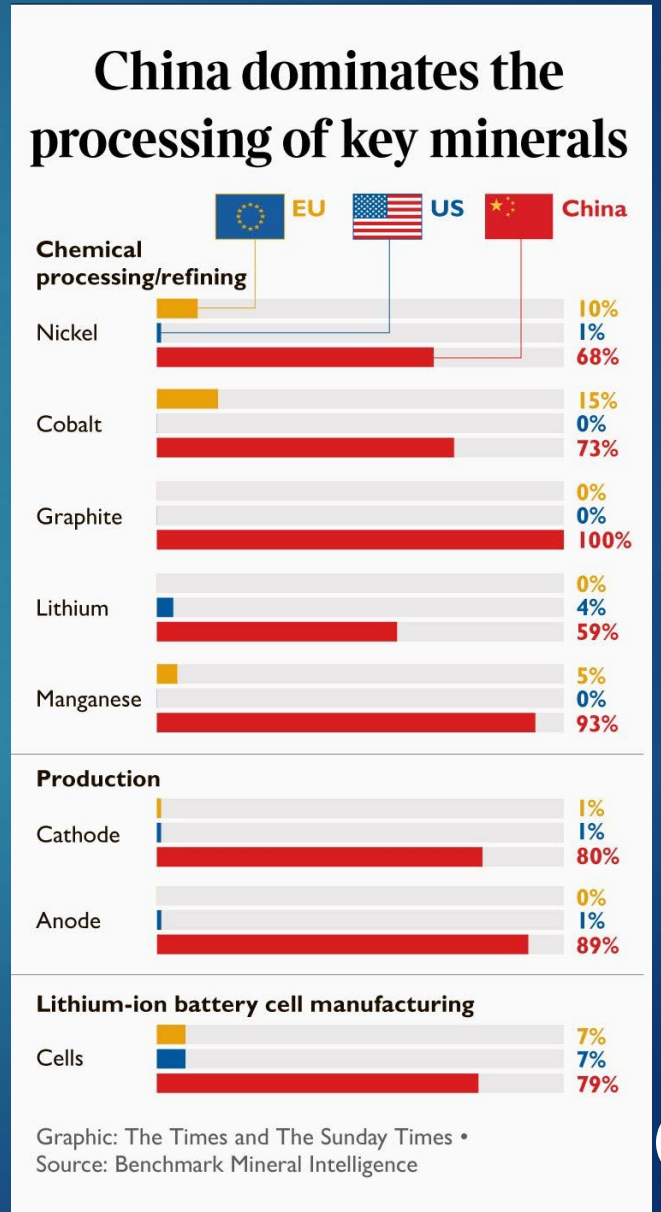
Guesses?

Lithium, Cobalt, Nickle, and Manganese

cieca
Collision Industry Electronic Commerce Association

Recycling Process Stage 2 CAM
(Cathode active material)

- Black Mass is then refined to battery grade cathode active material
- However, the U.S. has almost no capacity to refine and process Black Mass
- China dominates the field



cieca
Collision Industry Electronic Commerce Association

ABTC Integrated Battery Recycling Process

Battery Packs/Modules

Battery Cells

Electrode Powders/Slurries

Automated DeManufacturing

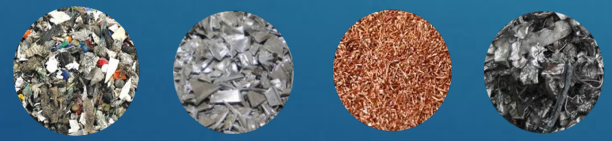
Structural Materials

Dissection

Separation/ Sorting

Inline Water Treatment

Solids Removal



Plastics, Steel, Copper, Aluminum

Selective Leaching

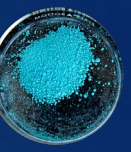
Selective Impurity Removal

Selective Transition Metal Recovery

Selective LiOH Recovery

Inline Water Treatment

Solids Removal



Nickel Sulfate

Cobalt Sulfate

Manganese Sulfate

Lithium Hydroxide

CAM

Feedstock Materials

Product Streams

Impurity Removal

cieca

Collision Industry Electronic Commerce Association

Integrated Li-ion Recycling Facility to Commence Operations in October

cieca
Collision Industry Electronic Commerce Association

Goal: A Secure Domestic Critical Minerals Supply Chain

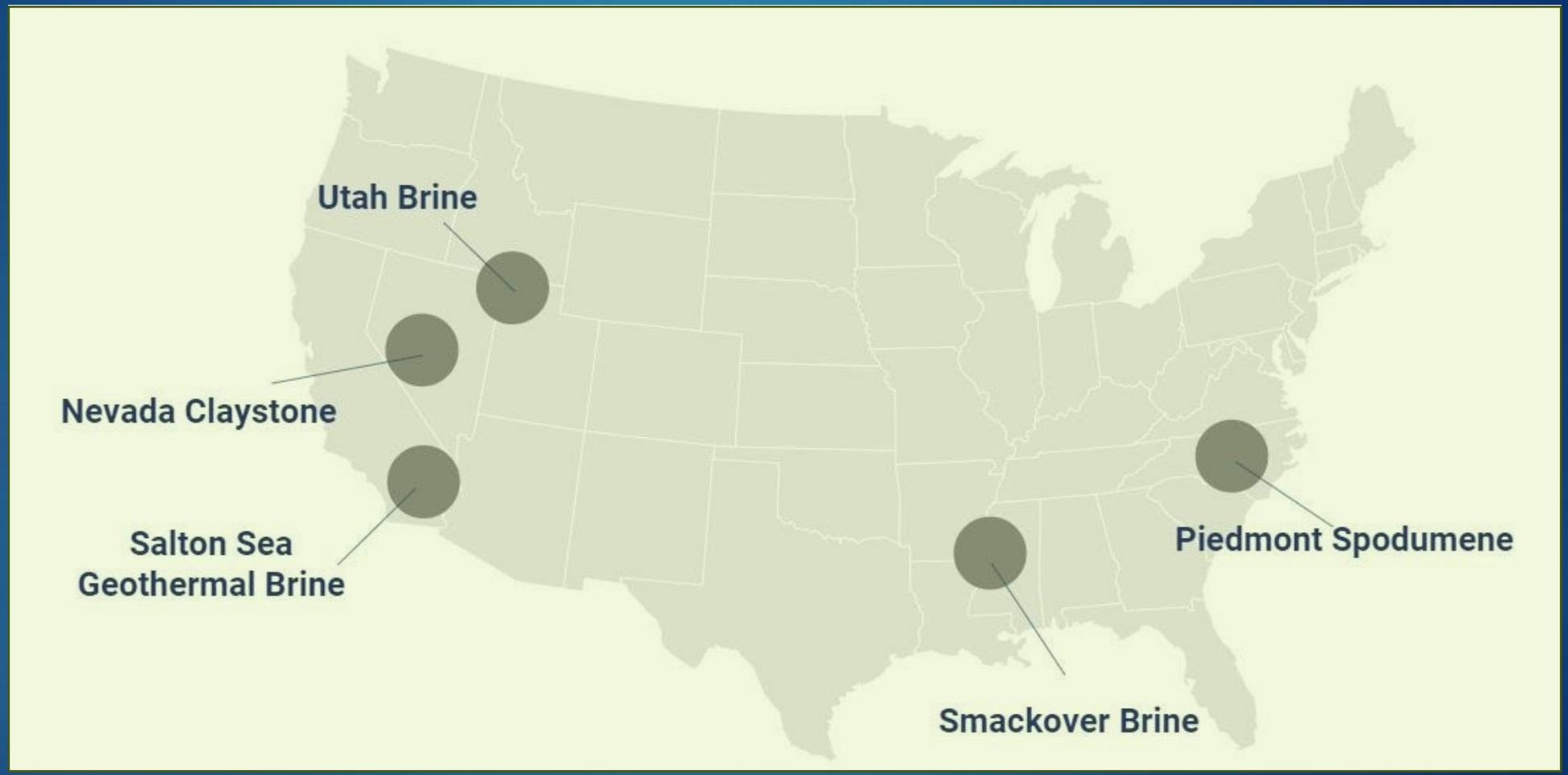
- Recycling Lithium-ion Batteries can help the U.S. achieve:
  - Economic Security
  - Environmental Security
  - National Security

- However, recycling is only **part** of the solution

- Where else can we get critical metals needed to build our EVs?

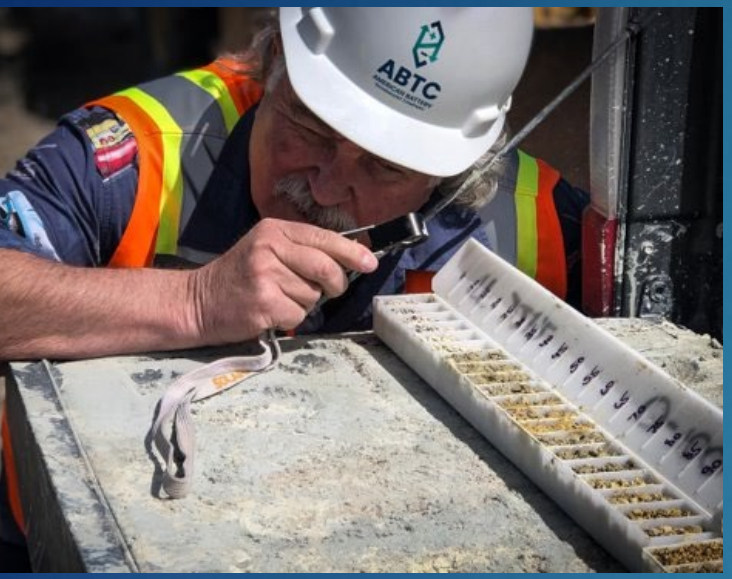
cieca
Collision Industry Electronic Commerce Association

The U.S. Has the Resources Available



cieca
Collision Industry Electronic Commerce Association

Primary Minerals Resource Development:
The Tonopah Flats Lithium Project



- ABTC has been designing and optimizing its internally developed processing train for the manufacturing of battery cathode grade lithium hydroxide from Nevada-based sedimentary claystone resources.

- This work has evolved into our Tonopah Flats Lithium Exploration Project, which encompasses four primary focuses:

1. Extraction Technology Optimization with Partner Companies
2. Development of a Domestic Field Demonstration Site
3. Commercial-Scale Lithium Hydroxide Manufacturing Demonstration Grant
4. ABTC Tonopah Flats Resource Exploration Drilling Program

cieca
Collision Industry Electronic Commerce Association

Tonopah Flats Lithium Deposit

ABTC's third party contractor, RESPEC, acted as Qualified Person and published an SK-1300 compliant Inferred Resource Report to quantify this lithium-bearing resource. The report classifies these resources as Inferred and indicates that the project contains 15.8 million tons of economically accessible lithium carbonate equivalent (LCE).

Classification	Cut-off (ppm Li)	Total Ktons	Ave. ppm Li	Li KTons	LCE KTons
Inferred	*300*	*5,289,000*	*561*	*2,970*	*15,800*

- **One of the Largest Known Lithium Deposits in the U.S. Identified at ABTC's Tonopah Flats Property**

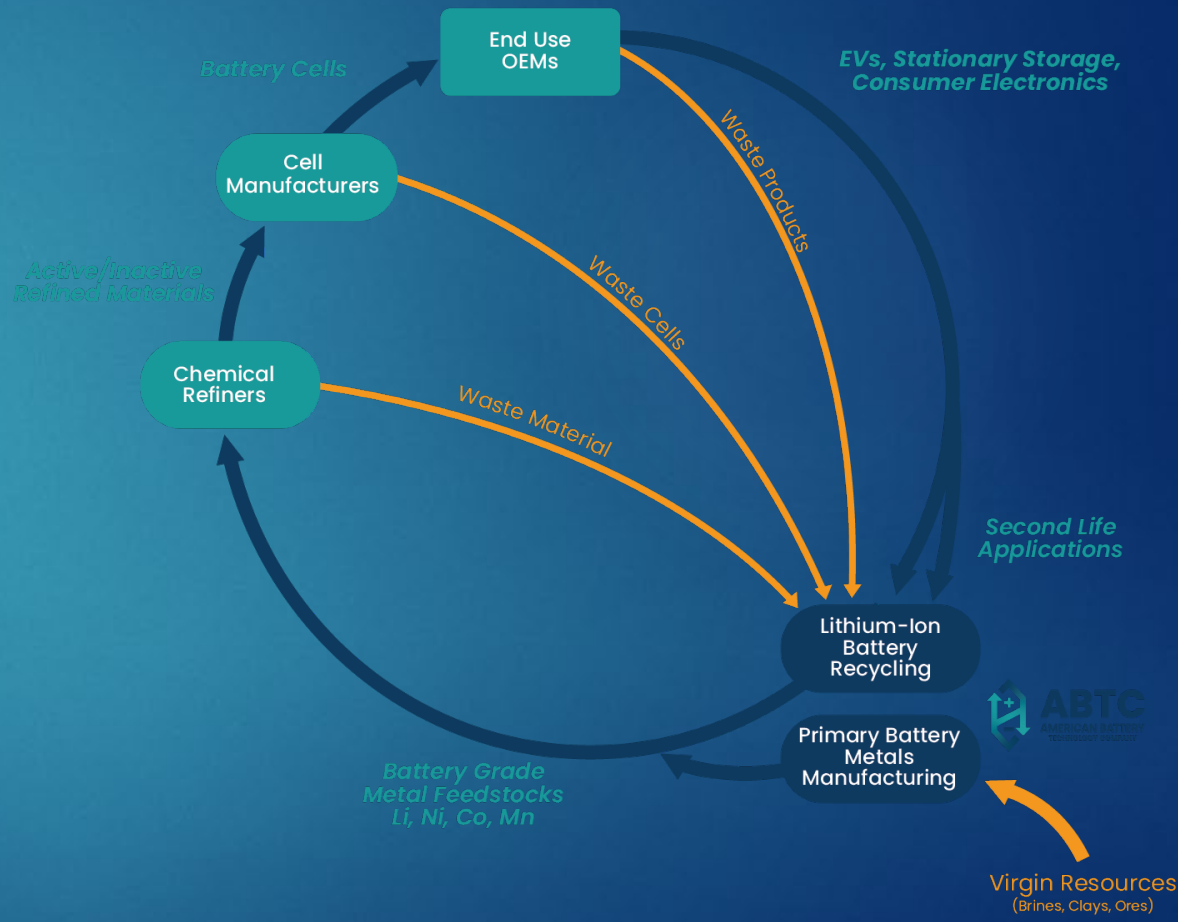
https://americanbatterytechnology.com/wp-content/uploads/ABTC-TonopahFlats_InferredResourceReport_SK1300.pdf

cieca
Collision Industry Electronic Commerce Association

American Battery Technology Company

Addressing the Domestic Battery Metals Shortage through Sustainable, First-Of-Kind Innovations

- Lithium-ion Battery Recycling
  - Processing spent lithium-ion batteries to recover and reuse battery metals domestically
- Primary Metals Resource Development
  - Developing mineral resources to enable extraction of critical materials
- Primary Metals Extraction
  - Manufacturing battery metals from primary resources with new scalable technologies



cieca
Collision Industry Electronic Commerce Association

Questions?

cieca
Collision Industry Electronic Commerce Association

ABTC
AMERICAN BATTERY
TECHNOLOGY COMPANY

Thank you!

Doug Hamilton

dhamilton@batterymetals.com

cieca
Collision Industry Electronic Commerce Association