

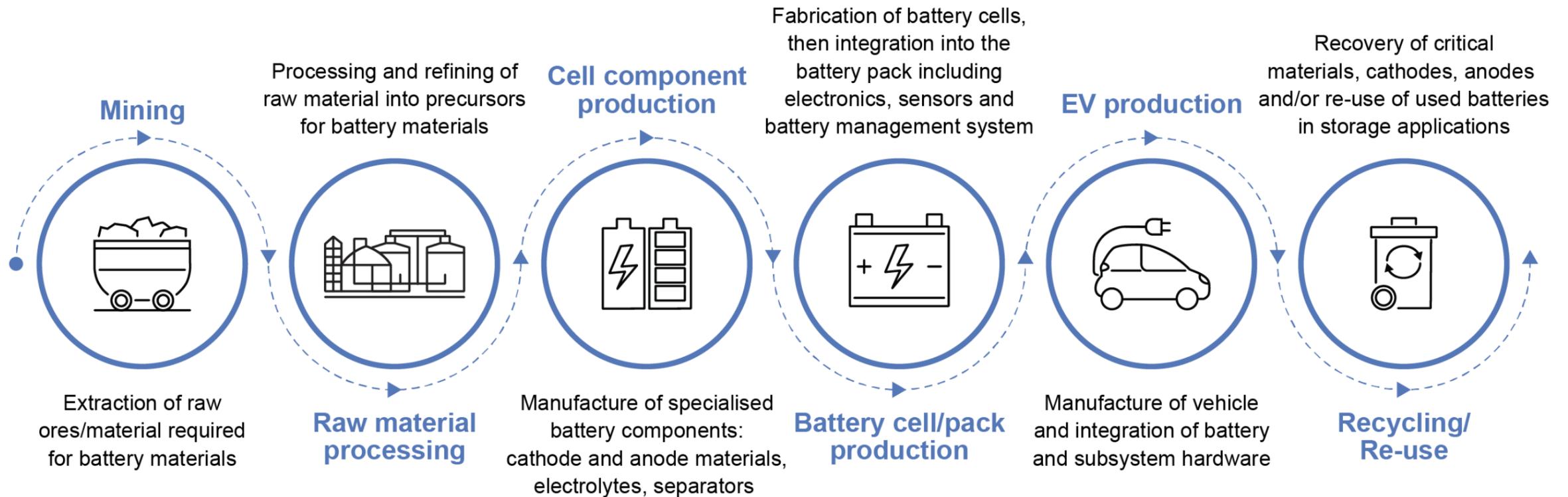
Federal Reserve Bank Energy Summit: Improving Supply Chains to Advance Energy Transition

11.07.23

The Ford logo, rendered in its signature script typeface, is positioned in the bottom right corner of the slide. It is white and stands out against the dark blue background.

The Battery Value Chain is Sprawling, Complex, and Must Grow ~5-10x to Support Electric Vehicle Goals

Battery supply chain was not originally designed for EVs, but rather for more traditional consumer electronics



Lithium and nickel are most critical of the critical minerals

Critical mineral dependence is here to stay. Next-generation technology (solid-state, silicon anode, etc.) will reduce dependence on graphite, but not lithium, nickel, or cobalt

- Lithium-ion will remain dominant for EVs. Grid storage could evolve differently (sodium-ion, flow batteries, etc.)

Critical Mineral	Priority	Used in every EV?	Commentary on geopolitical and supply risks
Lithium	High	Yes	New technologies, resource types, and players entering the market present significant supply volume and price risk.
Nickel	High	No	Chinese influence in Indonesia is key to monitor. Majority of growth will come from Indonesia
Cobalt	Medium	No	Cobalt is a byproduct of nickel and copper production. Increasing demand for these minerals will bring cobalt along
Graphite	Medium	Yes	Can avoid mining altogether with technology choice. For example, LFP uses 100% synthetic graphite, which comes from a petroleum byproduct and is not a critical mineral
Rare Earths	Medium	Yes	China's grip is extremely strong – government can influence pricing. Only successful non-China efforts have heavy government backing
Manganese / phosphorus	Medium	No	Abundant geologically and mined at large scale, but refining to battery-grade purity is expected to bottleneck future manganese-rich chemistries. Phosphate (for LFP chemistry) competes with agriculture

Feasibility of 100% US Battery Supply Chain

US Localization Difficulty

Least Difficult    Most Difficult



Mining



Refining



pCAM



Cathode Processing



Battery Production



Battery Recycling

Degree of Difficulty for US Localization



Key Challenges

- Permitting new mines, especially open pit, is very difficult in US
- Limited resources
- Large (~\$50Bn) investment would be required for fully domestically supplied raw materials

- Little capacity today
- Limited appetite by local stakeholders to build refinery capacity over potential environmental risks
- Sulfate capacity to be built

- Integration with refining and sulphate plant
- Geographic limitations due to water access requirement for sulphate disposal and raw materials
- Significant waste disposal

- Little capacity today
- Feed materials needed

- Significant capital required
- Scaling up production and lowering costs

- No collection network yet developed
- Early days with limited battery supply

Permitting Reform Could Unlock Domestic Supply

Key Ingredients to Development of Raw Materials Supply	Commentary on Domestic Supply Landscape
<p>Mineral Endowment (Attractive Ore Body Characteristics)</p>	<p>✓ Some endowment of Nickel (Minnesota) and Lithium (North Carolina) but not sufficient for whole industry</p>
<p>Availability of Capital (Investor Appetite)</p>	<p>✓ ✓ OEMs, miners, and governments willing to deploy capital</p>
<p>Supportive Regulatory & Social Environment (Ability to Get Permits)</p>	<p>? Multi-year process to receive a permit Significant opposition from local stakeholders & NGOs No major permits issued to new mines that were uncontested in past ~10+ years</p>
<p>Skilled Operators (Ability to Construct & Operate)</p>	<p>✓ Many US, Canadian, and Australian firms have skills to execute mine development Need for skilled mining/metallurgical engineers to operate the new mines that will come online</p>

Permitting Reform Policy Proposals & Initiatives

Enhanced Community Engagement: It is possible to accelerate permitting while maintaining the high environmental standards that have protected American communities and enhancing the ability of those communities to have a voice in matters that affect them by:

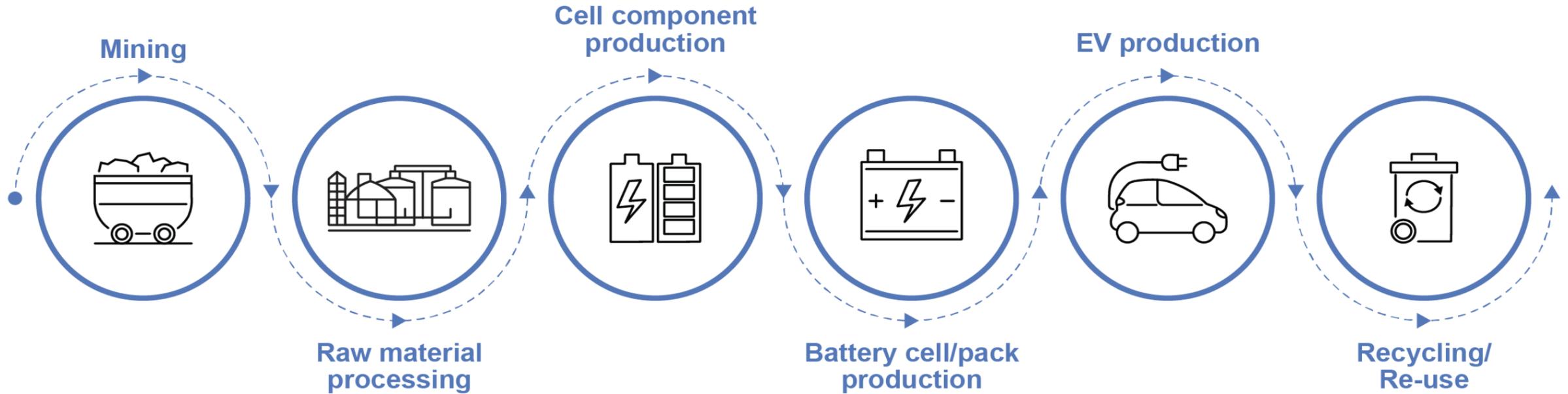
- Early and regular community engagement in the environmental review process that helps foster trust and increases the likelihood of a project's success; and
- Regular consultation which provides a forum that empowers communities to play a pivotal role in decision-making processes during project development.

Ensuring Appropriate Timelines: Congress should work to ensure appropriate timelines for permit review and subsequent judicial review. Applicable agencies and regulations should ensure timelines are appropriate but do not cause unnecessary delays on projects.

Designation of a Lead Agency: The Fiscal responsibility Act designated a lead agency to supervise the preparation of an environmental impact statement or environmental assessment if more than one Federal agency proposes or is involved in the same action; or is involved in a group of actions directly related to each other.

Building a Responsible EV Supply Chain

Ford is committed to respecting human rights everywhere we operate and throughout our supply chain. We are building an EV supply chain that upholds our ESG commitments.



Application of Ford's responsible sourcing standards to our value chain

Aspire to Only Source Raw Materials Responsibly Produced

The critical minerals supply chain has several challenges that can be managed by:

- Engaging directly with mining and processing companies
- Working to get full transparency and traceability of supply chain
- Partnering with third-party organizations such as IRMA, RMI and Copper Mark
- Conducting responsible sourcing due diligence throughout the sourcing process and value chain of battery materials
- Requesting suppliers conduct third-party audits to independent standards like IRMA
- Commitment from stakeholders to ethical, sustainable principles and standards, including in the permitting process
- Government assistance to mitigate environmental issues with application of standards and permitting
- Early and consistent stakeholder engagement in the permitting application process for domestic extraction and processing

Automotive industry's future vision: closed loop battery supply chain in United States with innovative processes and materials

- Recycling will be integral in helping meet the demand for battery raw materials – levels the geographic playing field for resources
- The US can develop a technical edge across the value chain to deliver lowest cost in environmentally conscience way



Government Incentives: Inflation Reduction Act

Supply Chain Investments

Extension of the Advanced Energy Project Credit: Expanded the qualifications for, and allocation of, advanced energy project credits. The provision allowed the Secretary to allocate an additional \$10 billion in tax credits to qualifying projects. Eligibility was expanded to include projects to establish, expand or re-equip facilities for advanced light, medium, and heavy-duty vehicles and related components and infrastructure.

Advanced Manufacturing Production Credit: Provided an outline of credits available to those entities that produce materials used for clean energy production. Materials eligible for credits include the production of electrode active materials, battery cells, battery modules and applicable critical minerals. Credit phase outs do not apply to the production of critical minerals.

Advanced Technology Vehicle Manufacturing: Appropriated \$3 billion for the Secretary of Energy to make direct loans for the cost of establishing or expanding U.S. manufacturing facilities that produce advanced technology vehicles or components with low or zero greenhouse gas emissions.

Domestic Manufacturing Conversion Grants: Appropriated \$2 billion for grants for electric hybrid, plug-in electric hybrid, plug-in electric drive and hydrogen fuel cell electric vehicles.

Defense Production Act Funding: Included \$500 million (available until September 2024) for additional incentives to spur onshoring for critical minerals.