1) Do you own an electric/plug-in vehicle?

Response options

<table>
<thead>
<tr>
<th>Yes</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>36</td>
<td>18%</td>
</tr>
<tr>
<td>No</td>
<td>160</td>
<td>82%</td>
</tr>
</tbody>
</table>

Engagement 70%

2) In 2030, what percent of US new car sales will be electric? (Note: in 2021 EVs accounted for 3% of new car sales)

Response options

<table>
<thead>
<tr>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20%</td>
<td>39</td>
</tr>
<tr>
<td>20-40%</td>
<td>141</td>
</tr>
<tr>
<td>60-80%</td>
<td>27</td>
</tr>
<tr>
<td>&gt;80%</td>
<td>0</td>
</tr>
</tbody>
</table>

Engagement 73%
3) Rank the elements in a lithium battery in the order of their criticality from maintaining a secure and reliable supply chain.

<table>
<thead>
<tr>
<th>Element</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium</td>
<td>1st</td>
</tr>
<tr>
<td>Nickel</td>
<td>2nd</td>
</tr>
<tr>
<td>Cobalt</td>
<td>3rd</td>
</tr>
<tr>
<td>Graphite</td>
<td>4th</td>
</tr>
<tr>
<td>Manganese</td>
<td>5th</td>
</tr>
<tr>
<td>Silicon</td>
<td>6th</td>
</tr>
</tbody>
</table>

4) Which part of the supply chain represents the biggest challenge for developing a secure domestic battery industry? Click on the image to submit your response.

<table>
<thead>
<tr>
<th>Response options</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>199</td>
<td>100%</td>
<td>199 Responses</td>
</tr>
</tbody>
</table>
5) In 5 words or less: what unconventional sources should we explore to gain access to battery critical materials (e.g., mine tailings, coal ash)?

Responses

- Go to new chemistries
- Development mining capital for strategic minerals
- Stop exporting domestically mined materials out of the country for processing.
- Recycling non-battery devices
- Human waste
- Outer planet
- Asteroid / Lunar mining
- International collaboration
- Brine
- Sand refining
- Asteroids!

Approaches that deliver material in the next 5 years, seawater is a 10-15 years issue

There is a cobalt mine in Idaho, near Salmon (Iron Creek Project). It was run by First Cobalt, now called Electra Battery Materials Corporation

Early stage development capital to derisk strategic mineral mining

People need to allow mining in their backyards, it's reality.

Sea water
Canadian tundra
Mine tailings

Issues: Permitting & access to non-nuclear green energy

"Recycling non-battery devices"

Develop lithium-sulfur cells -- skip nickel, cobalt

Global investments with a 20 year horizon

Mines in Siberia supply 20% of high-grade "class 1" nickel

Sea water deeper into mantle. Canadian tundra
Responses

use low cost rail and waterways to move material

Asteroid Mining  Al and remote sensing

Maximize conventional resources

New formulations with domestically available materials

brine

Talon metals does Nickel-Copper-Cobalt mining; Need to encourage recycling - Redwood Materials, Li-Cycle; TMC the metals co. approach might be interesting

Invest in Africa  Recycling

Remove epa barriers to mining  recycling

US mint for copper and Nickel

Ni from sour crude coke.  Military batteries

environmentally-friendly recycling. not pyrolysis

Recycling

two price surges could significantly increase the costs of EV

design with recycling in mind

Municipal Solid Waste (MSW) to Energy conversion

Recycling!  Faster permitting

global average price of lithium carbonate soared

recycling  mine tailings  Li hard rock and clays

Partnership

importing scrap batteries for recycling from other countries - have Trade.Gov US embassy trade reps help clear the road
Responses

- Use chemistries w/fewer critical minerals
- global collaboration
- Graphite extraction and processing
- Strengthen North and South American partnerships
- don't use lithium batteries for non-transport.

Meanwhile, the global average price of lithium carbonate soared from $12,275 in January 2019 to $52,634 in February, according to data from Benchmark Mineral Intelligence. The trend is unrelated to the crisis in Ukraine, as Russia is not a major lithium supplier. Instead, it stems from strong demand for electric car batteries outstripping supply. The two price surges could significantly increase the costs of electric vehicles. In a note to clients last week, analysts at Morgan Stanley warned that the nickel surge alone could make it $1,000 more expensive to produce an EV.

- Synthetic graphite with domestic assets

Recycling cemented carbide scrap (WC-Co) to produce pure Co chemicals for cathodes. ~ 6% of the world production of Co is consumed by the cemented carbide industry.

- Address US-Based Nanomaterial production deficit

- ocean nodules
- Strategic relationships with US allies

- Thacker pass Nevada

- Exploration for critical metals - you need to look to find these resources

- Landfill Mining
- global partnership
- Salton Sea

- Lithium in brine/produced water
- recycling

- canada
Responses

- Recycling of battery waste stream
- Graphite from biomass
- Urban mining via recycling
- Solution mining landfills, bioaccumulation
- Petroleum for conductive polymers
- Synthetic graphite production using low cost energy and domestic coal and petroleum derivatives and feedstocks, purified natural flake graphite co manufacturing.
- Borax mine
- Expand relation with friendly countries
- For Ni, Co: switch to LFP, with solid electrolyt
- Invest in recycling to mimic lead-acid industry

While Russia supplies only about 7 percent of the world’s total nickel, its mines in Siberia supply about 20 percent of high-grade "class 1" nickel, which is used in most electric car batteries, said Simon Moores, CEO of Benchmark Mineral Intelligence.

- Use non-critical materials
- Seawater
- Mine tailings and clay deposits
- Reverse supply chain battery flow
- Graphite from biomass sources
- International mining/production partnerships
- Reuse of radioactive contaminated nickel
- Mine tailings
- Petroleum products
- Coal ash
- Geothermal brine
- Global collaboration is necessary with friendly countries.
- Synthetic
- Recycling
- Recycle mfg scrap
But these efforts from top Democrats could rankle some climate advocates, who have opposed a proposed lithium mine in Nevada because of its potential environmental impact. It's all part of the "paradox of green growth," according to Chris Berry, an independent energy analyst who tracks mineral markets.

President Biden last month announced new spending on U.S. mineral production, while Senate Finance Chairman Ron Wyden (D-Ore.) last week introduced legislation to spur domestic mining of nickel, lithium and other metals.

For Li: coproduction from geothermal brines
Responses

renewable feedstocks for anodes recycling
diplomacy

synthetic graphite, bio-derived carbon feedstock
global partnerships recycling recycling
large deposits in Canada Recycling

Based purely on geological scarcity, Co is probably the most critical.

International collaboration MINE TAILINGS
Relax mining regulations E-waste
global partnerships recycle Mine landfills
urban mining overseas resources
graphene fabrication Recycling
Seawater and metal recycling recycling
geothermal brines

Strategic collaborations with allies
Streamlining permitting for new mining projects.

what about lithium in brine from geothermal power plant production?

Petroleum coke Geothermal brines
From Sea water Mine Tailings spent catalysts
Recycled NiMH batteries sea bed mining
Recycling sustainable global partnerships
Mine tailings mine tailings seabed mining
6) When considering potential new suppliers, rank the various criteria that are important before signing a contract.

Response options

- Production capacity
- Company track record
- Differentiated performance
- Financial reserves

Rank

- Production capacity: 1st
- Company track record: 2nd
- Differentiated performance: 3rd
- Financial reserves: 4th

Responses

Responses

Engagement

Responses
7) For OEMs and Battery manufacturers: In 5 words or less, what is the rate limiting step for qualifying a new supplier (e.g., calendar life testing)?

<table>
<thead>
<tr>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approved Materials</td>
</tr>
<tr>
<td>quality control/product performance</td>
</tr>
<tr>
<td>environmental impact studies</td>
</tr>
<tr>
<td>ability to co locate</td>
</tr>
<tr>
<td>modularity of the batteries for different EV's</td>
</tr>
<tr>
<td>cost, performance</td>
</tr>
<tr>
<td>safety of cells</td>
</tr>
<tr>
<td>Ensuring high quality with minimum variability</td>
</tr>
<tr>
<td>performance assurance</td>
</tr>
<tr>
<td>manufacturing location</td>
</tr>
<tr>
<td>Collaboration track record</td>
</tr>
<tr>
<td>Quality/life validation and familiarity with in-depth testing for product</td>
</tr>
<tr>
<td>Large companies locking up supply</td>
</tr>
<tr>
<td>Documentation and PPAP validation</td>
</tr>
<tr>
<td>geopolitical; domestic source</td>
</tr>
<tr>
<td>Proof of consistent quality</td>
</tr>
<tr>
<td>quality assurance</td>
</tr>
<tr>
<td>Material production location</td>
</tr>
<tr>
<td>technology validation</td>
</tr>
<tr>
<td>trust</td>
</tr>
<tr>
<td>alignment with target specs</td>
</tr>
<tr>
<td>Research spending</td>
</tr>
<tr>
<td>quality control, domestic origin</td>
</tr>
<tr>
<td>ARGONNE1</td>
</tr>
<tr>
<td>quality control/product validation</td>
</tr>
<tr>
<td>Technical skills and Quality</td>
</tr>
<tr>
<td>Environment justice</td>
</tr>
<tr>
<td>variability across multiple batches</td>
</tr>
<tr>
<td>consistency of production from patch to batch</td>
</tr>
<tr>
<td>cost and quality, location</td>
</tr>
<tr>
<td>confirm quality</td>
</tr>
</tbody>
</table>
Responses

Qualification Testing Process

Speed of production to meet demand

quality/delivery/price scalability

Production scale-up Price and flexibility

Quality and capacity

Accelerated aging/performance validation testing

Life testing to ensure quality

Time to production scale cost

Verified, independent testing

ease of startups doing business with govt.

carbon footprint Battery performance and life

Time between order and delivery

Quality and performance consistency

ownership structure - NO Oligarchs

Does not apply to me

product lifetime and design philosophy (no programmed obsolescence)

validation Getting to real data vs data sheet

Qualification Testing Process quality assurance

diversity of supplier's workforce

performance and cost performance demonstration

Time to qualify delivering according to our spec

Elongated OEM "Sample A/B/C" progression

Cost / performance / partnership quality COST
Responses

quality at needed scale

Demonstrated Quality and Certification

fit with ESG goals

ownership structure - NO Russian Oligarchs or other New Dirty Money

Scale Up, Production Validation (PV)

Purchasing stringing suppliers along

quality consistency, life time performance

cycle life with high level of confidence N/A

geopolitical cultural differences

Consistent performance

B-Sample cell characterization

engineering resource shortage

demonstration of growth Supporting data

product/process validation contracting

test standards material validation

quality and capacity Capacity Verification

ITAR certified Quality control

Production design performance/life validation

domestic workforce and supply

Consistent performance over time

diversity of supplier

Rapid performance and life validation

carbon footprint quality, capacity
8) How long does it take to qualify virgin materials (e.g., a new source of lithium or a new cathode chemistry)?

<table>
<thead>
<tr>
<th>Response options</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 months</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td><strong>6-12 months</strong></td>
<td><strong>48</strong></td>
<td><strong>46%</strong></td>
</tr>
<tr>
<td>1-2 years</td>
<td>43</td>
<td>41%</td>
</tr>
<tr>
<td>Longer than I care to admit.</td>
<td>13</td>
<td>12%</td>
</tr>
</tbody>
</table>

9) How long does it take to qualify recycled materials?

<table>
<thead>
<tr>
<th>Response options</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2 months</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td><strong>6-12 months</strong></td>
<td><strong>27</strong></td>
<td><strong>30%</strong></td>
</tr>
<tr>
<td><strong>1-2 years</strong></td>
<td><strong>54</strong></td>
<td><strong>59%</strong></td>
</tr>
<tr>
<td>Longer than I care to admit.</td>
<td>7</td>
<td>8%</td>
</tr>
</tbody>
</table>

Responses
- long time verification
- geopolitical location
- Fundamental Electrochemical properties; CE!
- establishing good quality standards
- historical performance
- design validation
10) In 5 words or less: what issues inhibit you from using recycled materials in your manufacturing line (e.g., batch to batch variation)?

<table>
<thead>
<tr>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>supply of consistent feed stock to the recycling facility</td>
</tr>
<tr>
<td>supplier reliability</td>
</tr>
<tr>
<td>fully validated in new active materials</td>
</tr>
<tr>
<td>accuracy</td>
</tr>
<tr>
<td>cost and certification</td>
</tr>
<tr>
<td>may not be electrochemically optimized</td>
</tr>
<tr>
<td>material certification</td>
</tr>
<tr>
<td>no government incentives</td>
</tr>
<tr>
<td>None</td>
</tr>
<tr>
<td>unknown quality consistency; validation timing</td>
</tr>
<tr>
<td>reliable material properties</td>
</tr>
<tr>
<td>dealing with waste</td>
</tr>
<tr>
<td>Not sufficient production capacity</td>
</tr>
<tr>
<td>batch to batch variation</td>
</tr>
<tr>
<td>mixed cathodes</td>
</tr>
<tr>
<td>defects/variation in material properties, inconsistent supply</td>
</tr>
<tr>
<td>inconsistency processing (slurry)</td>
</tr>
<tr>
<td>level of other impurities</td>
</tr>
<tr>
<td>quality, consistency, contamination</td>
</tr>
<tr>
<td>Inconsistent supply</td>
</tr>
<tr>
<td>Availability</td>
</tr>
</tbody>
</table>
Responses

- Material consistency changes over time
- No good standards for qualification
- Quality, diversity of impurities, risk, inconsistency
- Availability Availability and consistency
- Feedstock availability and consistency
- How to get the battery quality need?
- Variation of chemistry
- Impurity, performance consistency impurities
- Cost purifying volume
- Cost of transportation - cost/kg have skyrocketed
- Contamination
- Aluminum and/or copper contamination
- Consistent availability
- Variation in properties, potential contamination.
- Quality availability depreciation
- From a good supplier, nothing Recycling Process
- Consistent quality quality quality Quality
- Purity level Consistency of quality
- Performance reliability yield, reduced performance
- Consistency Not enough material currently.
- Consistent material lack of significant volume
- Confidence in consistency of properties
- Nothing - we use recycled materials routinely!
11) What challenges stop you from expanding production domestically? Rank them in order.

Response options

- Lack of skilled workforce 1st
- Lack of access to suppliers 2nd
- Lack of access to finance 3rd
- Permitting delays 4th
- Environmental regulations 4th
- Limited market size 6th

Rank

Engagement

23% Responses

66
### 12) In 5 words or less: What is the single most important thing the U.S. government can do to make it possible for U.S. companies to compete with the companies that currently dominate the lithium-ion supply chain?

| Responses                                                                                     |
|                                                                                             |
| permits Create a better Charging infrastructure                                            |
| protect IP Encourage second use applications                                                  |
| Prioritize manufacturing - scale and speed                                                    |
| Tax incentives for green energy production and recycling                                      |
| Reuse second life batteries - reduced CO2                                                    |
| Have great technology - incentivize mfg. supply chain                                        |
| Collaboration across supply chain to ensure viability                                       |
| avoid monopoles Fund Materials Manufacturing R&D                                             |
| Partnership with China                                                                       |
| Create an EV market through regulation; like China did.                                      |
| develop workforce ensure access to capital                                                   |
| capital and speed to scale create a roadmap                                                  |
| Overseas suppliers such as China and Russia can produce inputs at a significant discount.     |
| Adjusting tariffs would help to stop their dumping practices.                               |
| support university R&D                                                                      |
| Increase in Recycling capability                                                             |
| Domestic manufacturing to scale new technologies                                            |
| Novel green technology                                                                       |
| Get WH out of strategic energy process.                                                      |
| regulate exports of raw materials, scrap, EOL                                                |
| Permitting and Subsidies                                                                     |
Responses

Consortium of US companies like MANTech

Education and manufacturing fund research and development

Execute a national strategy for regulation and permitting assistance

Create basins, hubs of battery manufacturing
devlop tech to eliminate minerals from countries of concern

Consistent support over many years

workforce development

create true gov collaborations instead of coordinating

Open Source Patent Bi-partisan funding and policy

Funding inventive to domestic manufacturing
open doors to favorable business partnerships with China

Cost of carbon and inequity research and renovation

Put a tariff regulation Funding
easier permitting process Streamline permitting

encourage data sharing NA

Consistency beyond election cycles Unsure

initial capital & ongoing tariffs

access to EV telemetry to get BMS history for second life - show stopper - applies to 1st life and resale of used EVs too -

Creating a Consortium
### Responses

| UL certification and NFPA 855 effects on cost of conversation EV to stationary storage |
| removing regulation for 5 years | protect IP |
| Reward domestic manufacturing vs. imported products |
| sustained govt commitment | tariffs |
| Closed loop battery |
| require environmentally responsible lifecycle/production |
| streamlining regulations |
| Public Private Partnership Support | Incentive |
| promoting collaboration among domestic partners |
| require proof of concept | Get an answer for NIMBY |
| pathway for integrating new materials |
| Recognize US's higher emission requirements and penalize countries of origin that have poor standards - China |
| Incentivize markets to buy U.S.A |
| Learn from China. Pick winners. |
| Working with Canada |
| Limit legal liability supply chain for second-life - |
| Innovation clusters | no cost share |
| Grant to more parties |
| Environmental Impact standards for imports |
| A US supply chain doesn't require US-based companies throughout. Trying to make supply chain purely US company based will fail. |
Responses

More smaller grants rather than fewer large ones so there are more opportunities for innovation and research

more funding with fewer strings attached

Financial Incentives

Support indigenous domestic OEM's

incentivize foreign investment in US

invest in advanced electrode manufacturing

reduce policy volatility encouraging consortiums

Invest in Free world and don't support communist countries

Move to hydrogen fuel cells

Building new processing facilities

Regulation to guarantee the demand for EVs. Regulation has created the demand in China.

Stop subsidizing oil Domestic workforce

Battery Form factor, recycling regulations, and standardization

agility in standard framework development to account for new technology

Reduce regulations Corporate

counter china moves Enhance global collaboration

local content requirements

invest in alternative battery chemistry

support domestic suppliers

Streamline permitting and regulations
Responses

- Incentivize domestic supply and collaboration
- Eliminate need for critical minerals
- Dominate the production regions
- Invest in advanced manufacturing facilities
- Diverse battery systems
- Demand US-produced materials
- Relax regulations
- Capital and speed to scale
- Invest in R&D
- Mining permits
- Secure critical raw materials
- Tax incentives
- Less bureaucracy
- Invest in education
- Drop political infighting
- Streamline mining and refining permitting
- Support upstream supply chain
- Pave the way for business focused relationships with China and Europe
- More competition / diversified supply sources
- Look at real scientific data rather than trying to push political agendas
- Paradox of green growth
- Facilitate and expedite standup of upstream, notably precursor manufacturing.
- Approve permits quickly for new Li mining in US
- Invest in USA
- More funding
- Funding for technology development
- Support Skill Development
- Increase diplomatic relations w/ allies
Responses

- promoting domestic suppliers
- permitting and precursor chemicals mtg
- Get beyond NMC chemistry
- more funding in research
- focus on grid-scale
- Minimize time to permit
- Stop allowing material mined here to leave the country.
- Identify weakest links / biggest technology or mfg. gaps
- Tariff on foreign supply on the entire value chain
- Create trade schools
- minimize permit requirements
- tax credit
- Subsidies, streamline permitting
- Mining regulations
- Collaboration not competing
- Continue to support EV adoption
- Policy creating equitable market
- Increase in Recycling capability
- Support cell manufacturing process innovation
- no cost share
- funding of small businesses
- new spending on U.S. mineral production
- incentives
- source of startup funding
- Streamline the grant application process
- protectionist measures
- promote collaboration
- tax credits after grants to sustain
- cost cutting
- secure demand
- invest in raw material processing
- avoid monopoly
- invest in education for batteries
- provide subsidies or tax holidays
13) In 2030, what percent of the US manufacturing capacity will focus on LFP cells? (Note: today's percent is trivially small)

<table>
<thead>
<tr>
<th>Response options</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-20%</td>
<td>19</td>
<td>25%</td>
</tr>
<tr>
<td>20-40%</td>
<td>35</td>
<td>45%</td>
</tr>
<tr>
<td>40-60%</td>
<td>20</td>
<td>26%</td>
</tr>
<tr>
<td>60-80%</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td>&gt;80%</td>
<td>1</td>
<td>1%</td>
</tr>
</tbody>
</table>

14) When will non-lithium-based batteries (e.g., sodium ion, flow batteries…) become widespread (i.e., 10's of GWh yearly production capacity) for vehicle or grid applications in the US?

<table>
<thead>
<tr>
<th>Response options</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5 years</td>
<td>3</td>
<td>3%</td>
</tr>
<tr>
<td>5-10 years</td>
<td>31</td>
<td>36%</td>
</tr>
<tr>
<td>More than 10 years</td>
<td>52</td>
<td>60%</td>
</tr>
</tbody>
</table>