# NREL Supply Chain & Circular Economy Capabilities

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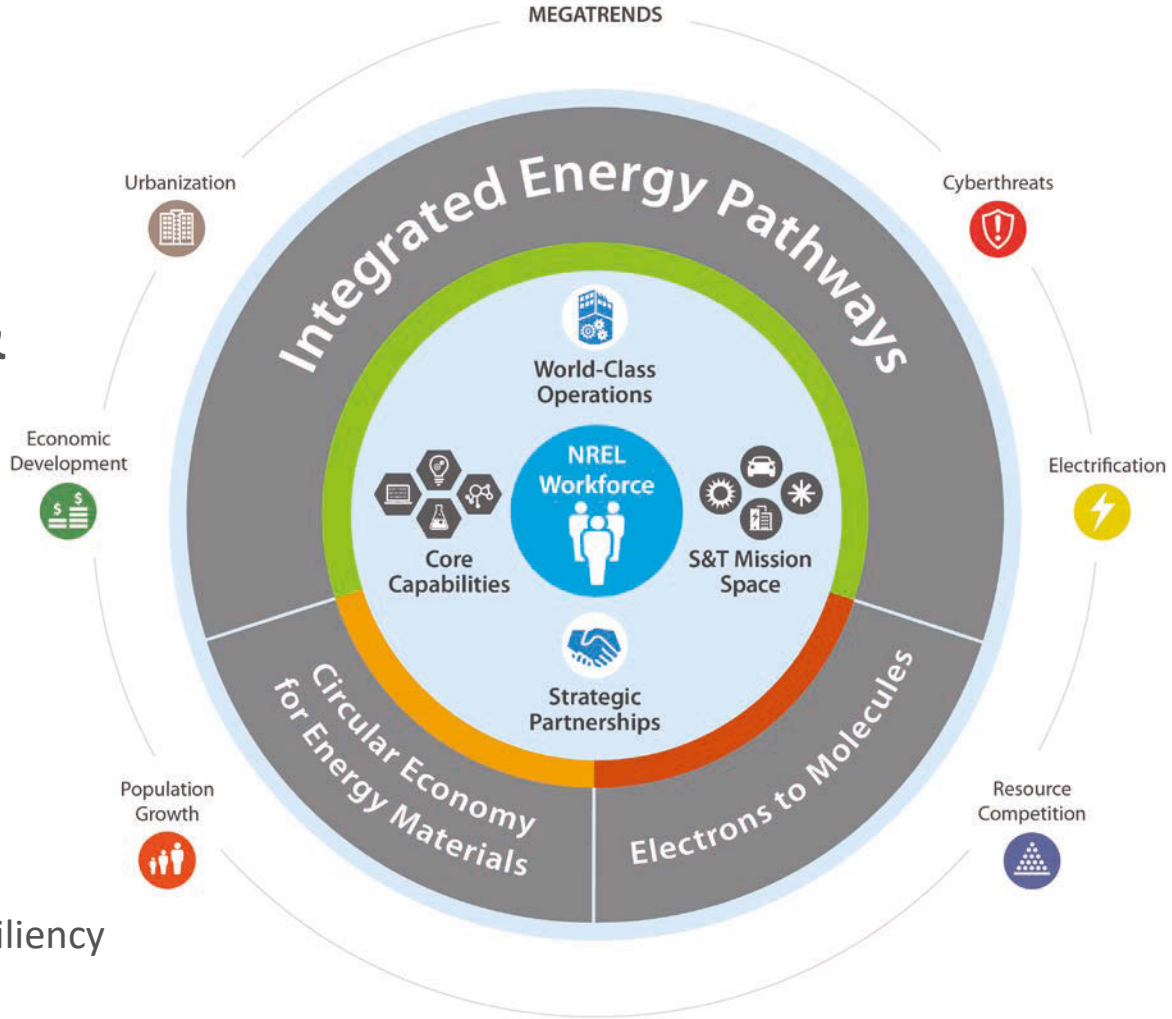
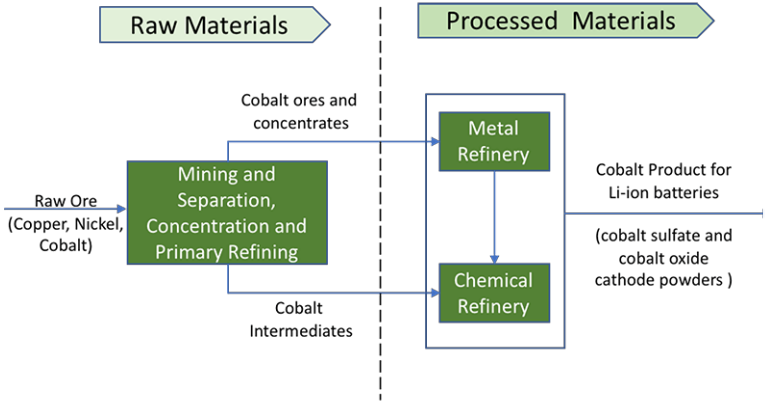


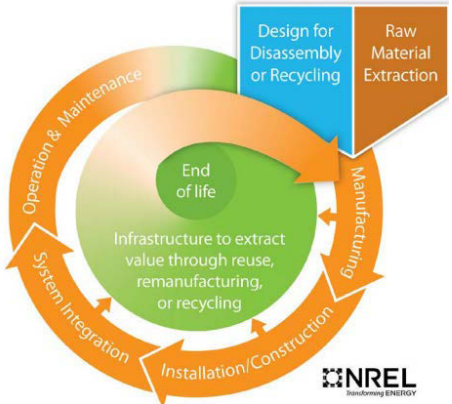

COVID-19 Rethinking Supply Chain Resiliency
November 4-5, 2020

# Overview

## Sustainable Mining Industry



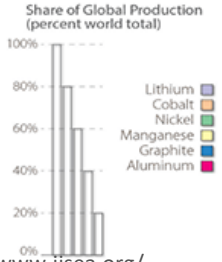

## Circular Economy Tech, Costs, Policy




- PV
- Wind turbines
- Batteries
- Refrigerants
- Etc.

## Supply Chain and Value-add TEA


## Global Trade and Supply Risks


In 2017, 32 countries accounted for all global production of key NMC materials

- **60 million tons aluminum (smelters):** 54% China, 6% Russia, 5% Canada
- **16 million tons manganese**: 33% South Africa, 16% China, 14% Australia
- **2.1 million tons nickel**: 11% Philippines, 10% Canada, 9% Russia, 9% Australia
- **1.2 million tons natural graphite** : 67% China, 13% India, 8% Brazil
- **110,000 tons cobalt**: 59% Democratic Republic of Congo, 5% Russia, 5% Australia
- **43,000 tons lithium**: 44% Australia, 34% Chile, 13% Argentina

Sources: JISEA/CEMAC, https://www.jisea.org/

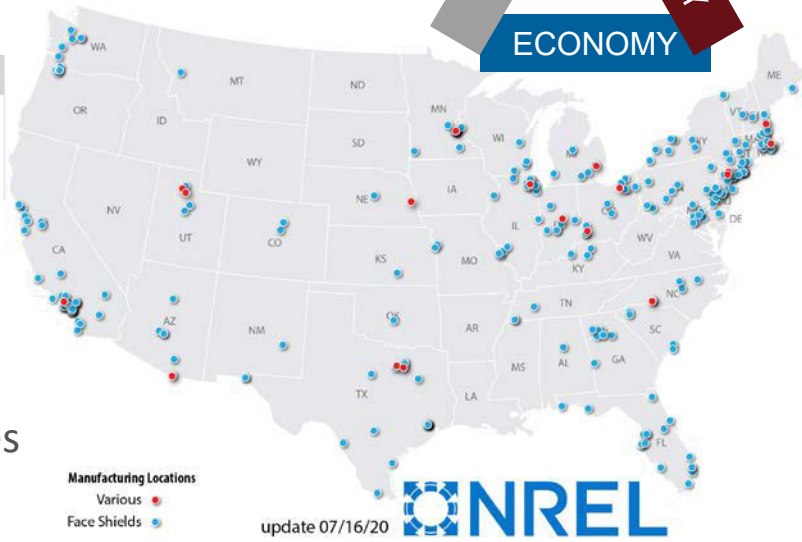
# Supply Chain Critical Competencies and Capabilities

- **Technology Assessment:** Assessment of renewable and other energy technologies and understanding of their components and materials in their supply chains
- **Modeling and Analysis**: Models and datasets on economics, environment, and policies related to energy technologies
  - Understanding the transition of technology from prototype to commodity
  - Understanding end of life (EOL) and circular economy
  - Lifecycle assessment
- **Strategy Development:** Identification of global regulatory, economic, societal, and societal trends affecting corporate strategy on supply chains and energy technology deployment
- **Impact assessment**: Assessment of energy, carbon and material utilization in the supply chain

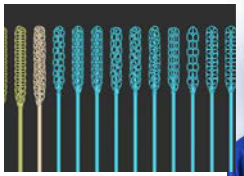
# Example Case Study: COVID PPE Supply Chain


- Identify supply chain pinch-points
  - N95 Respirators
  - Face Shields
  - Testing


- Results
  - Respirators are supply limited due to melt-blown material
  - Face Shield were initial limited but US manufactures have quickly pivoted to fill the gap
  - Testing was initially limited due to a swab shortage




- Conclusion- US Manufacturers are agile in responding to critical needs and the National lab complex can use science to address issues where the manufacturing challenge is greater



Credit: Henkel (Source)

*Credit: Sinclair & Rush*

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# Future Challenges and Opportunities

**Challenges:**

- Providing substitutes for critical materials
- Enabling separation and processing of heterogeneous wastes
- Increasing life-cycle efficiency of embedded energy
- Supply chains that are vulnerable to natural disasters or other events without pathways to pivot (was apparent in food supply chain and availability of paper products as well as the energy supply over capacity early in the COVID disruption)
- Identifying comparable material substitution

**Opportunities:**

- Identify vulnerabilities and domestic resources that can be leveraged during disruptions
- Understanding the potential supply chain hurdles if identified substitutions become mainstream
- Identifying automation or digitalization to address human resource constraints
- Identifying how to make the energy supply more flexible

# Thank you

**www.nrel.gov**
**www.jisea.org**

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