



**Office of Manufacturing  
& Energy Supply Chains**

IN PARTNERSHIP WITH THE

**Modeling, Mapping, &  
Analysis Consortium (MMAC)**

# **Supply Chain Readiness Level Preliminary Analysis: Batteries Summary**

November 2024

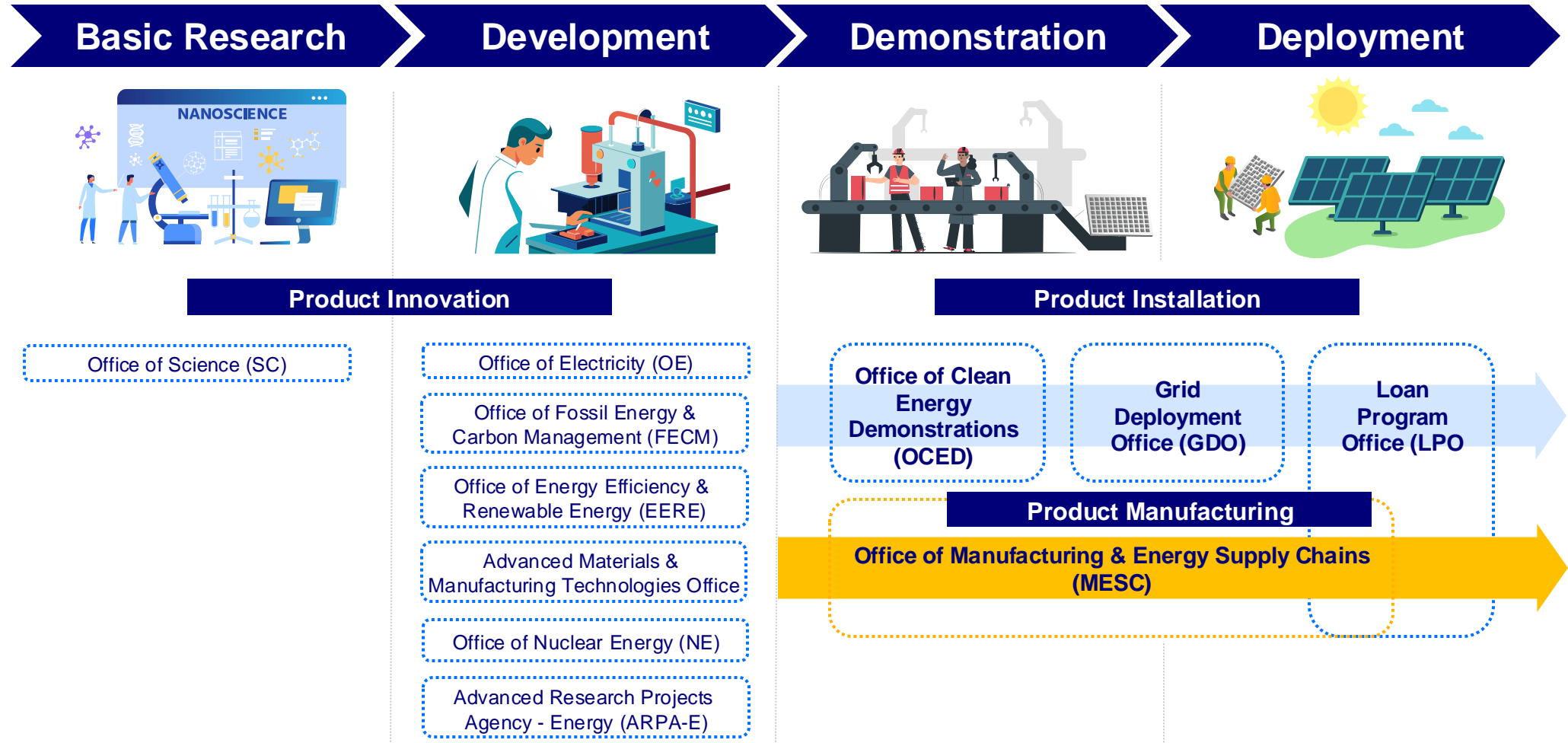


# ABOUT MESC

# THE OFFICE OF MANUFACTURING & ENERGY SUPPLY CHAINS (MESCC): DE-RISKING ENERGY SUPPLY CHAINS SINCE 2022

MESCC's mission is to enhance economic and national security by **eliminating vulnerabilities** in the United States' energy supply chains.

# MESC IS FOCUSED ON GOVERNMENT-ENABLED, PRIVATE SECTOR-LED ENERGY MANUFACTURING



# MESC IS SYSTEMATICALLY SECURING AMERICA'S ENERGY FOUNDATION

## MESC



### Manufacturing

Catalyzing processing and manufacturing capacity for enduring energy resilience and independence



### Workforce

Reinvigorating our domestic manufacturing workforce through education and training opportunities



### Analysis

Generating data-backed supply chain insights to inform policies and private and public investments

# MESC IS SCALING U.S. MANUFACTURING AND CATALYZING U.S. ENERGY PRODUCTION

## Batteries



## Buildings & Energy Efficiency



## Critical Materials & Recycling



## Energy Generation & Fuels



## Grid Equipment



## Materials



## Transport



# **ABOUT THE SUPPLY CHAIN READINESS LEVEL (SCRL) FRAMEWORK**

# SUPPLY CHAIN READINESS LEVEL (SCRL) ANALYSIS

## THREE CORE OBJECTIVES



Assess readiness at two levels: overall technology (e.g., batteries) and individual supply chain segments (e.g., lithium)



Independently assess multiple risk factors, including sourcing concentration, commercial risks, and workforce availability



Enable dynamic analysis of supply chains over time

# SCRL

Scalable, data-driven, and technology-agnostic framework to assess energy supply chain risks

**MESC** conducts the SCRL analyses in partnership with the DOE National Laboratories' **Modeling Mapping & Analysis Consortium (MMAC)**



# SUPPLY CHAIN READINESS LEVEL EVALUATES SUPPLY RELIABILITY + U.S. COMMERCIAL COMPETITIVENESS

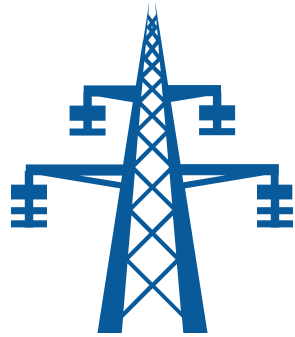
SCRL OFFERS A TOOL TO COMPREHENSIVELY ASSESS NEEDS IN U.S. ENERGY SUPPLY CHAINS

	RISK FACTORS	ASSESSMENT QUESTION
Supply Reliability Factors	Deployment Viability	Projected global demand relative to all known sources of supply
	Sourcing Risk Management	Projected US & partner demand relative to supply from reliable sources
Commercial Competitiveness Factors	Workforce Readiness	Availability of workers with sufficient skills
	Supplier Maturity	Availability of upstream materials/components from established, reliable sources
	Customer Maturity	Strength of demand at sufficient price levels to make US production viable
	Cost Competitiveness	US competitiveness relative to other global producers

**SCRL ANALYSIS  
PRELIMINARY FINDINGS:  
BATTERIES**

# BATTERY STORAGE IS CRITICAL TO OUR ENERGY AND TRANSPORTATION FUTURE

EMERGING GRID, DEFENSE AND TRANSPORTATION NEEDS DEPEND ON SUFFICIENT AND AFFORDABLE BATTERY STORAGE



Battery storage will be increasingly essential to maintain system and price stability, bridging energy supply and demand differentials

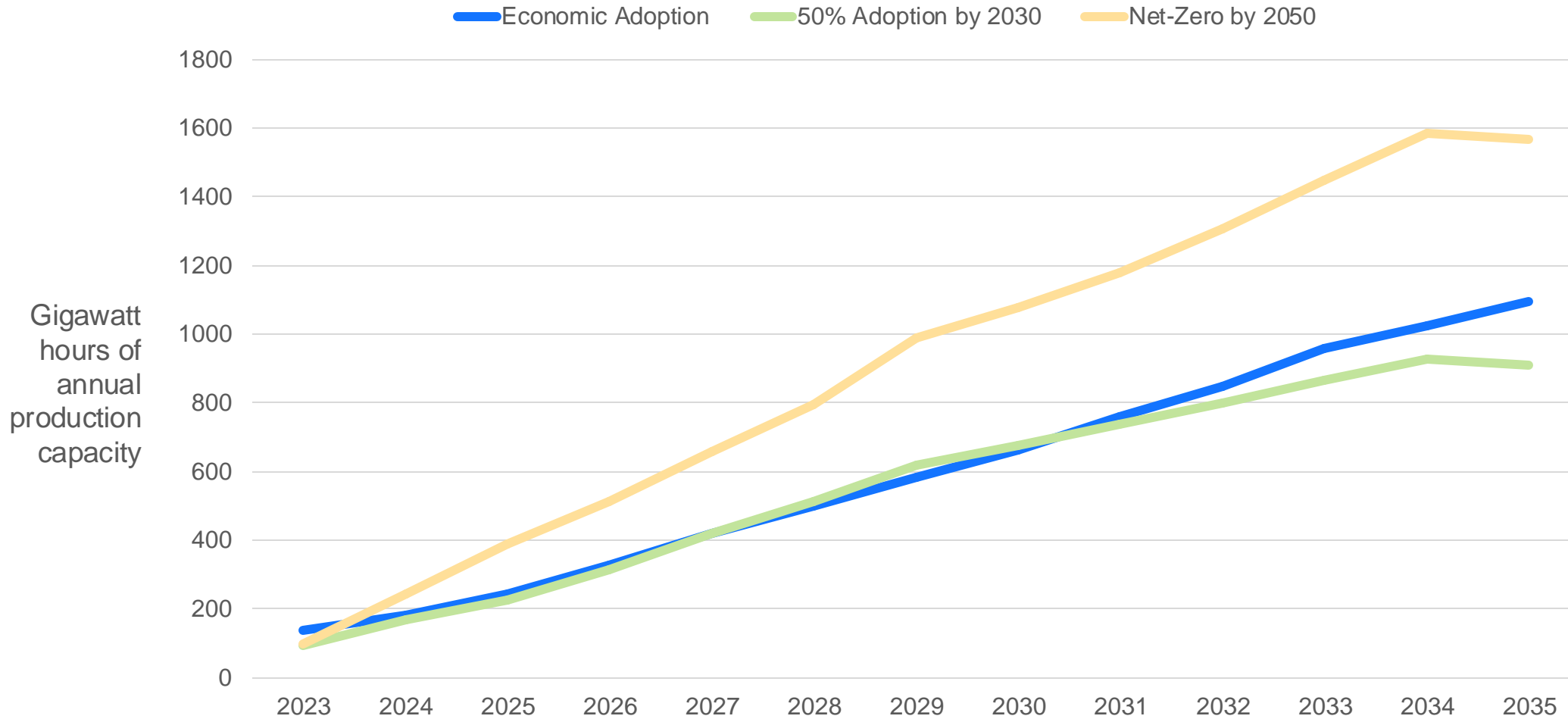


Batteries provide reliable, portable power essential for military operations, from powering equipment and vehicles to ensuring resilient energy supply in remote and combat environments

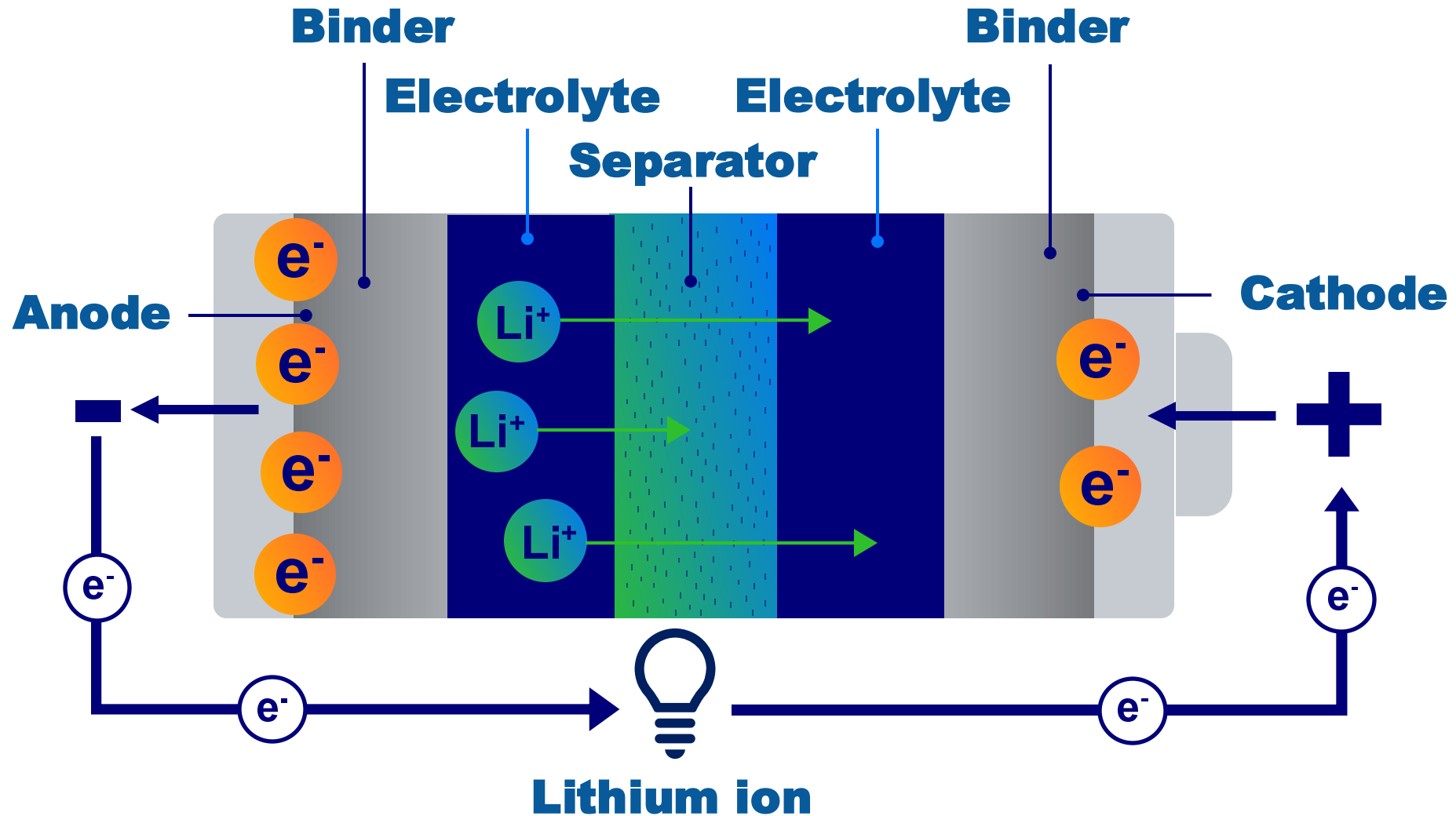


Battery cell and pack manufacturing are key to American OEM competitiveness as other nations seek to dominate the growing electric and hybrid transportation market

# U.S. BATTERY DEMAND IS EXPECTED TO GROW NEARLY 7X

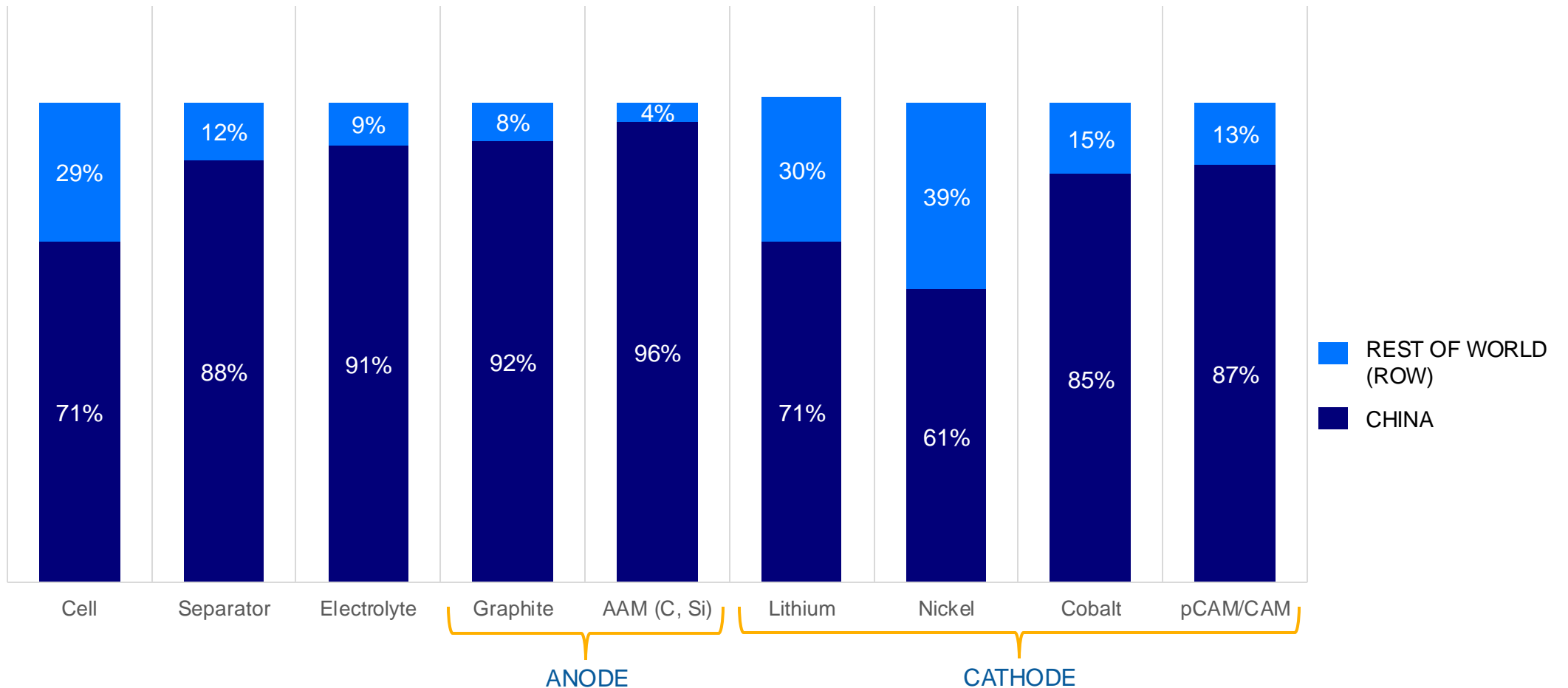


# WHAT'S IN A BATTERY CELL?



# CHINESE PRODUCTION DOMINATES GLOBAL BATTERY SUPPLY CHAINS

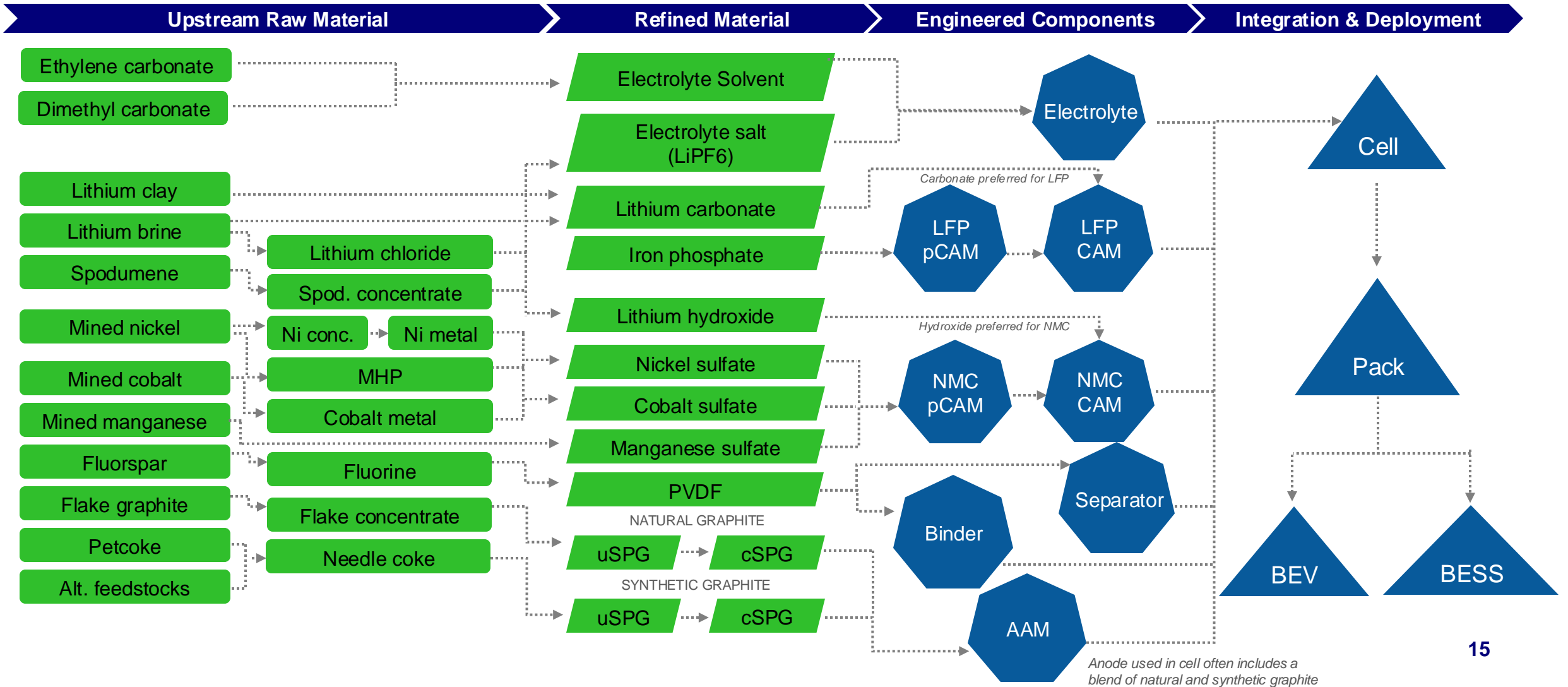
CHINA HAS >60-90% MARKET SHARE OF CRITICAL MIDSTREAM PRODUCTION, POSING ENERGY SECURITY RISKS



# SUPPLY CHAIN READINESS LEVELS ASSESS RISKS AT EVERY SUPPLY CHAIN SEGMENT

REPRESENTATIVE VIEW OF THE LITHIUM IRON PHOSPHATE (LFP) AND NICKEL MANGANESE COBALT (NMC) BATTERY SUPPLY CHAINS

■ Upstream and refined materials
 ■ Downstream and manufacturing



# U.S. STRATEGIC INVESTMENTS IN DOMESTIC BATTERY SUPPLY CHAINS

DOE's battery supply chain investments de-risked and unleashed private investment, enhancing energy security and decreasing reliance on China.

**\$120B**

Total public and private investment in battery and EV supply chains:  
80% of total cleantech manufacturing investment

**\$33B**

U.S. government investment share from MESC battery grants program, LPO loans, and the 48C tax credit

**>154K**

Manufacturing jobs being created across the country



# DOE INVESTMENT IS DRIVING U.S. STRENGTH IN THE GLOBAL BATTERY SUPPLY CHAIN

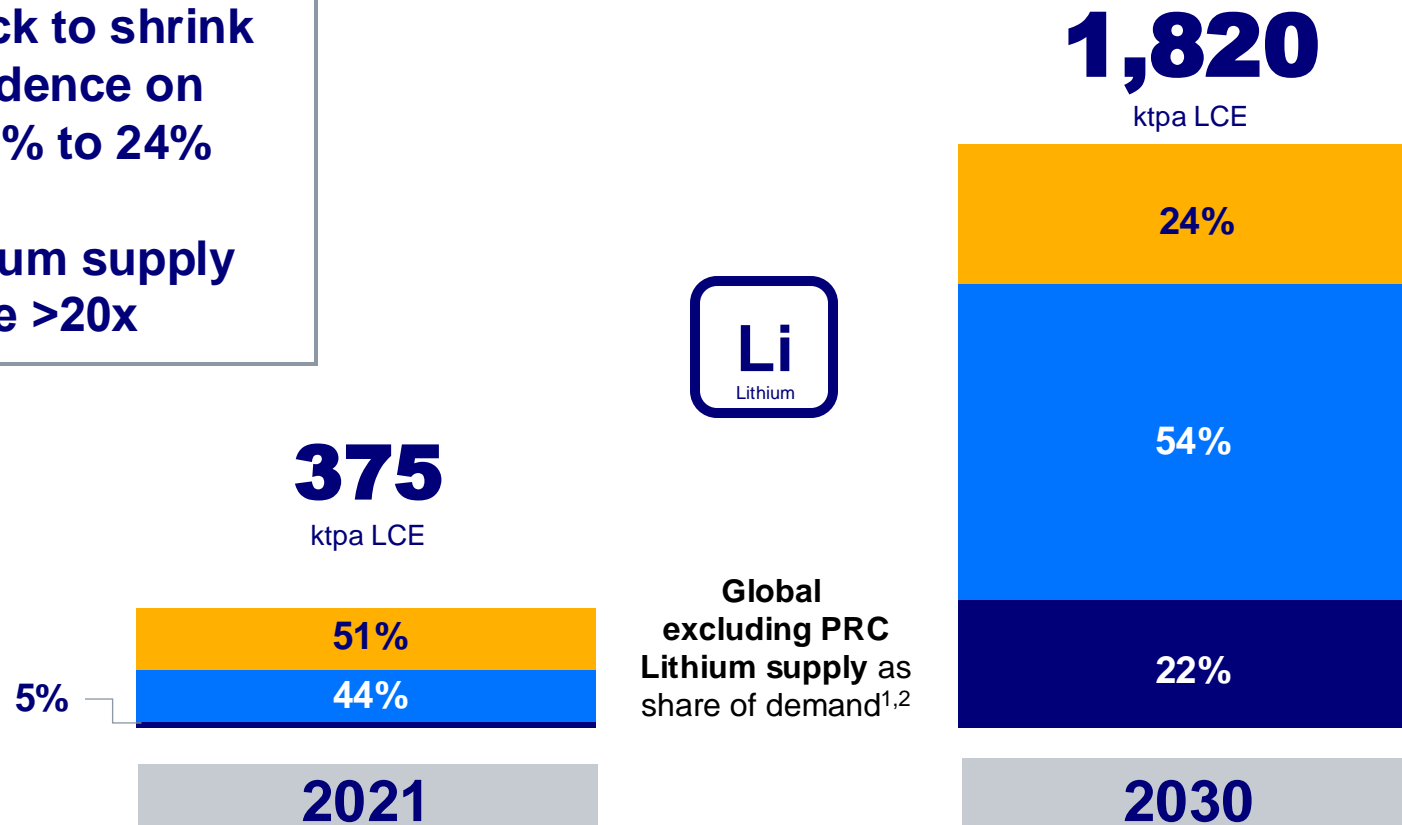
CHINA DOMINATES TODAY'S BATTERY SUPPLY CHAIN, RISKING OUR ENERGY SECURITY

We are on track to shrink lithium dependence on China from 51% to 24%

Domestic lithium supply could increase >20x

**KEY**

- GAP
- RFM
- USA



1. Supply and demand includes US demand and Rest of Free Market (RFM) and excludes Covered Nations
2. Supply projections include all announced projects

# FLIPPING THE SCRIPT: ON TRACK FOR A RESILIENT SUPPLY FOR BATTERY CELLS

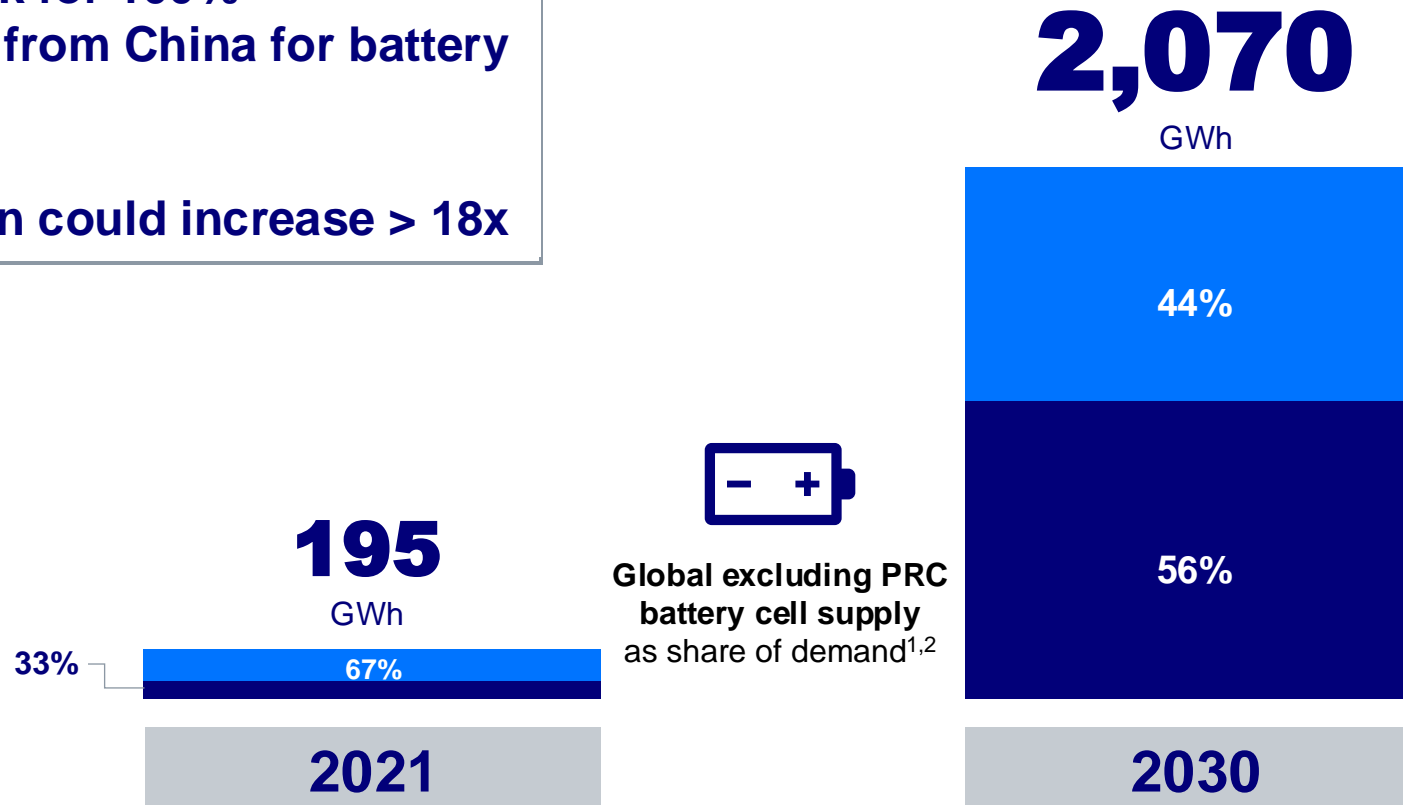
DOE DOWN PAYMENTS ARE CROWDING IN PRIVATE SECTOR INVESTMENT AND TURNING THE TIDE FOR BATTERY CELL MANUFACTURING

We are on track for 100% independence from China for battery cells by 2030

U.S. production could increase > 18x

**KEY**

 RFM  
 USA



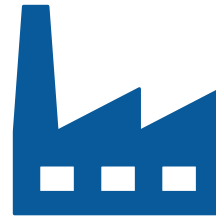
1. Supply and demand includes US demand and Rest of Free Market (RFM) and excludes Covered Nations for nickel-based and iron-based lithium-ion batteries and other batteries.
2. Supply projections include all announced projects

# BATTERY SCRL ASSESSMENTS REVEAL KEY INSIGHTS



## Raw Materials

- Readiness improves as lithium projects reach full-scale commercial production
- Processing and refining remain bottlenecks for other minerals



## Manufacturing

- Cost competitiveness improvements are key to long-term viability
- Demand outpaces projected supply across multiple manufactured components



## Workforce

- Demand for workers likely to exceed supply in 2030
- Battery supply chain faces comparatively greater hiring difficulty (limited electrical assemblers and testers familiar with batteries manufacturing)

# THE SCRL FRAMEWORK: UPCOMING ANALYSES

THE SCRL FRAMEWORK SPOTLIGHTS VULNERABILITIES ACROSS OUR ENERGY SUPPLY CHAINS



**Grid:** Transformers, Conductors & Other Key Grid Components



**Nuclear:** Fuel Supply, Existing Fleet, and Advanced Reactors



**Electrolyzers:** Proton Exchange Membrane (PEM), Liquid Alkaline, & Solid Oxide Electrolysis Cells (SOECs)



**Solar:** Polysilicon, Ingots/Wafers, Solar Glass, & Next-Generation Solar Technologies

WANT TO LEARN MORE  
ABOUT SUPPLY CHAIN  
SECURITY?

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[energy.gov/mesc/analysis](https://energy.gov/mesc/analysis)



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