U.S. Department of ENERGY | Office of Manufacturing & Energy Supply Chains

The Office of Manufacturing & Energy Supply Chains

November 19, 2024

Becca Ward: Chief of Staff

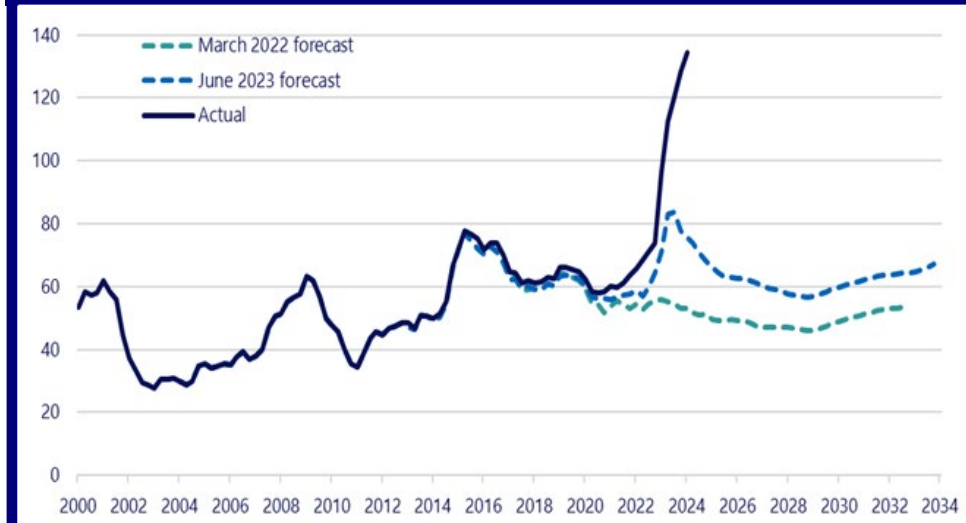
THE OFFICE OF MANUFACTURING & ENERGY SUPPLY CHAINS (MESC): DE-RISKING ENERGY SUPPLY CHAINS SINCE 2022

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

CRITICAL MANUFACTURING INVESTMENT FOR ENERGY SECURITY AND GRID RESILIENCE

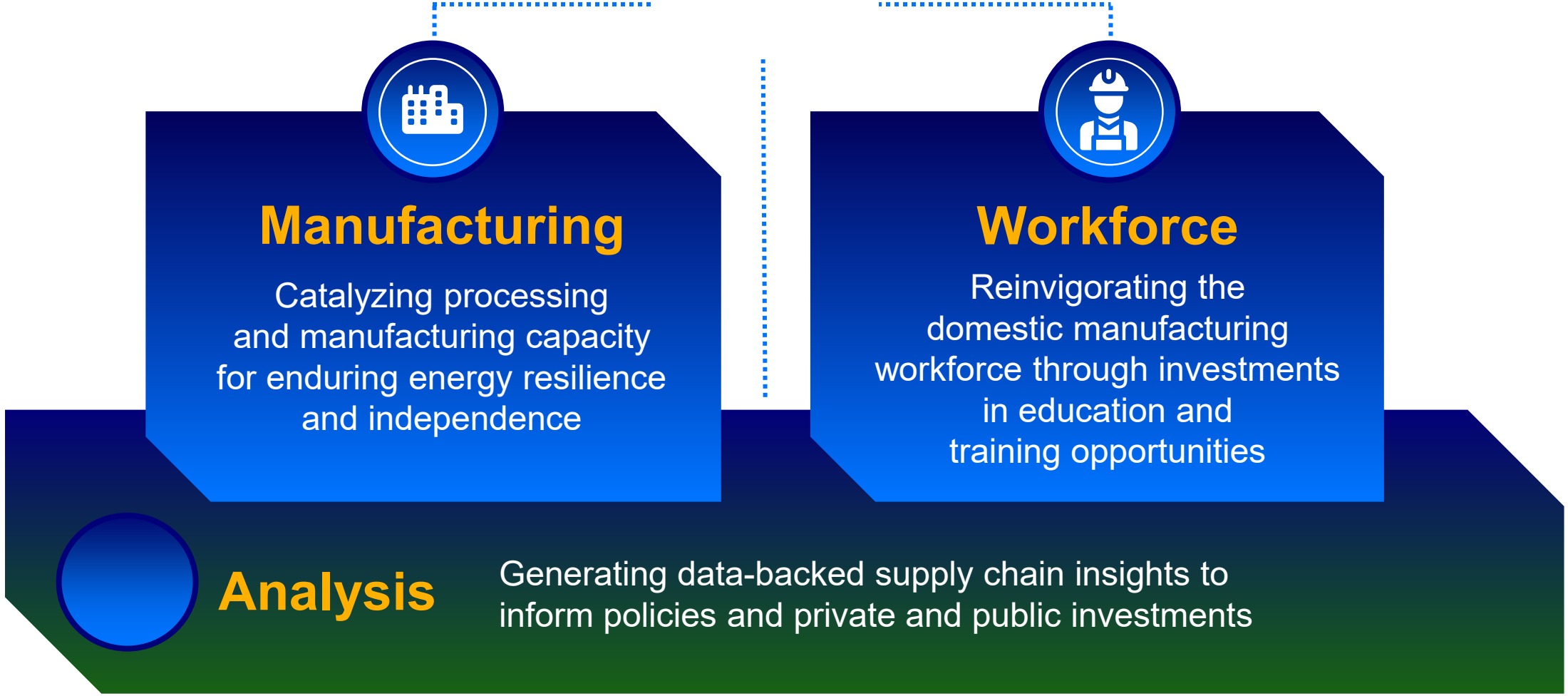
MESC will deploy nearly **$20B** for a modern energy manufacturing sector & workforce.

U.S. Investment in Manufacturing (2000 – 2034)



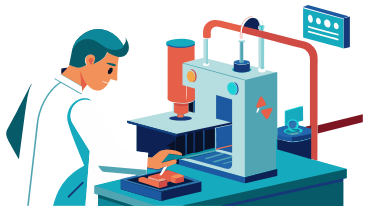
Source: Bureau of Economic Analysis; S&P Global Projections
As of June 27, 2024.

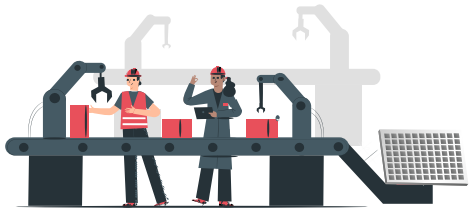
SYSTEMATICALLY SECURING AMERICA'S ENERGY FOUNDATION

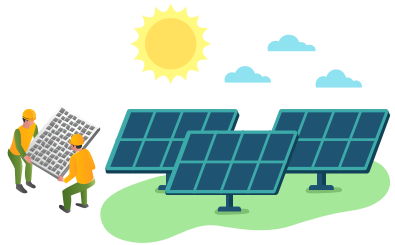


DOE-ENABLED, PRIVATE SECTOR-LED SECURE ENERGY DEPLOYMENT

Research → **Development** → **Demonstration** → **Deployment**







Product Innovation

- Office of Science (SC)
- Office of Electricity (OE)
- Office of Fossil Energy & Carbon Management (FECM)
- Office of Energy Efficiency & Renewable Energy (EERE)
- Advanced Materials & Manufacturing Technologies Office
- Office of Nuclear Energy (NE)
- Advanced Research Projects Agency - Energy (ARPA-E)

Product Installation

- Office of Clean Energy Demonstrations (OCED)
- Grid Deployment Office (GDO)
- Loan Program Office (LPO)

Product Manufacturing

- Office of Manufacturing & Energy Supply Chains (MESC)

MESC HAS DEPLOYED $12B+ TO TRANSFORM ENERGY SUPPLY CHAINS AND CREATE JOBS

46K+
construction and permanent jobs created or retained

40%
of MESC projects have locations of work in a disadvantaged community

3,000+
students trained annually

147 skilling institutions selected
Including non-traditional, community, and vocational institutions

$222M+
in benefits flowing to communities through Community Benefits Plans

65
manufacturing facilities awarded or selected for construction or expansion

MESC'S MANUFACTURING INVESTMENTS

MESC PROGRAM IMPACT TO DATE

$2B Domestic Manufacturing Automotive Conversion Grants

- 19K+ JOBS CREATED OR RETAINED
- 8 STATES IMPACTED
- 9 TOTAL PROJECTS

$4B Qualifying Advanced Energy Project Tax Credit (48C) Program Allocated

- 35 STATES IMPACTED
- 100+ TOTAL PROJECTS

$250M DPA Electric Heat Pump Manufacturing

- 2,400+ JOBS CREATED OR RETAINED
- 19 U.S. FACILITIES
- 12 TOTAL PROJECTS

$24M ITAC Implementation Grant Program (Section 40521 b1)

- 142 TOTAL PROJECTS
- 34 STATES IMPACTED

$5B Batteries Materials Processing, Manufacturing, Recycling (Section 40207)

- 47 TOTAL PROJECTS
- 27 STATES IMPACTED
- 22K+ JOBS CREATED OR RETAINED

$351K Transformer & EPS Rebates (Section 40555.1 and 40555.2)

- 53 TOTAL REBATES
- 17 STATES IMPACTED

$81M ITAC Centers of Excellence & Expansion (Sections 40521 b2 and b3)

- 46 TOTAL PROJECTS
- 31 STATES IMPACTED
- 2,400+ AVG. STUDENTS IN TRAINING ANNUALLY

$22M State Manufacturing Leadership (Section 40534)

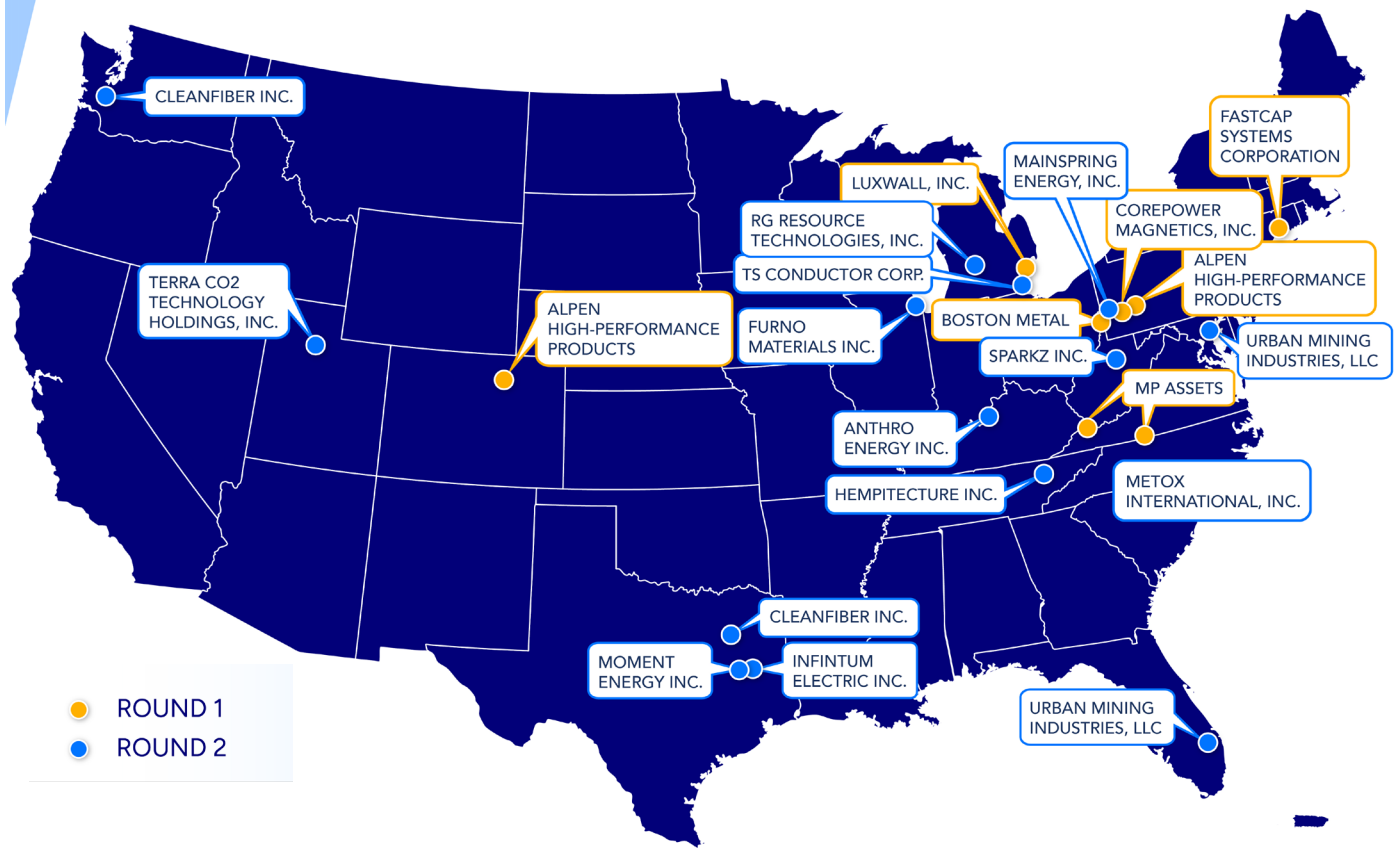
- 12 TOTAL PROJECTS
- 12 STATES IMPACTED

$683M Advanced Energy Manufacturing & Recycling Grants (Section 40209)

- 20 TOTAL PROJECTS
- 15 STATES IMPACTED
- 4,400+ JOBS CREATED OR RETAINED

BOOSTING U.S. MANUFACTURING & STRENGTHENING SUPPLY CHAINS

On October 22, MESC announced selections for the BIL Section 40209 Advanced Manufacturing and Recycling Grants Program (Round 2)



~$690 million
in grant selections for advanced manufacturing and recycling

22
locations with decommissioned coal mines and coal power plants

15
states with recipient businesses

20
projects selected

~$800 million
in private sector investment

3,000
good-paying, high quality jobs

Project Summaries – Round 2 Selections

Company & Location	Product	Supply Chain	Highlights	Federal Share	Total Costs
TS Conductor Corp. Erie, MI	Advanced Carbon Core Conductors and HVDC Conductors	Grid	• Establish U.S.-based manufacturing of High Voltage Direct Current (HVDC) conductors and other advanced conductors that enable a secure and resilient clean grid. • Create 425 construction jobs and 162 operating jobs with above prevailing wages.	$28,248,485	$65,692,337
MetOx International Southeast US	High Temperature Superconductor Tape	Grid	• Establish Project Arch, an advanced superconductor tape manufacturing facility that can be used for cables to transmit renewable energy, hyperscale AI data centers, and large manufacturing loads. • Create 230 jobs, supporting economic revitalization in a coal community.	$80,001,256	$180,716,203
Moment Energy Inc, Taylor, TX	Stationary Battery Energy Storage Systems from Repurposed EV Batteries	Grid	• Establish the first UL1974 Certified manufacturing facility in the United States to repurpose EV batteries to produce safe, reliable, and affordable battery energy storage systems. • Create 50 construction jobs and a total of 200 new jobs within their facility, which will produce an annual output of 1 GWh once fully operational.	$20,329,491	$40,658,982
Mainspring Energy, Inc. Coraopolis, PA	Linear Generators, a net-zero ready power generator	Clean Electricity	• Establish a state- of-the-art manufacturing facility near Pittsburg to produce 1,000 linear generators that can run on any gaseous fuel, and change fuels without any hardware changes. • Create 291 construction-related jobs, at least 80% of which will seek to be unionized and 600 operations positions with above-average pay.	$87,070,493	$174,140,987
Sparkz Inc. Bridgeport, WV	Precursor for Lithium Iron Phosphate CAMs	Batteries	• Create a first-of-its-kind battery-grade iron phosphate (FePO4) plant in the United States. • Create and retain 75 high quality jobs, and has signed a neutrality agreement with the United Mine Workers of America (UMWA) Labor Union and will work with UMWA on providing training to coal workers.	$9,800,000	$20,000,000
Anthro Energy, Inc. Louisville, KY	Advanced Electrolytes for Lithium Ion	Batteries	• Retrofit a facility to enable the domestic production of advanced electrolyte for use in Lithium-ion battery (LIB) cells in electric vehicles (EV), defense applications, and consumer electronics. • Create an estimated 115 permanent high-quality jobs.	$24,980,889	$70,535,121

§ 48C ROUND 1: $4 BILLION IN TAX CREDITS
~$1.5 BILLION FOR PROJECTS IN ENERGY COMMUNITIES

Over 100 projects across 35 states selected to accelerate domestic clean energy manufacturing and reduce greenhouse gas emissions at industrial facilities

Clean Energy Manufacturing and Recycling Projects	Critical Materials Projects	Industrial Decarbonization Projects
$2.7 Billion for projects spanning multiple industries: • Clean hydrogen • Grid Components • EVs & EV batteries • Nuclear • Solar • Wind	**$800 Million for critical materials:** • Electrical steel applications • Lithium-ion battery recycling • Rare earth projects	**$500 Million for diverse industrial decarbonization projects, including:** • Automotive manufacturing • Biofuels • Building materials • Ceramics • Chemicals • Food and beverage • Glass • Iron and steel • Low-carbon fuels and energy sources • Pulp and paper

Table shows examples of types of projects selected in Round 1 – Not exhaustive

48C PROGRAM ROUND 2: UP TO $6 BILLION AVAILABLE

ROUND 2 PRIORITIES (IN ALPHABETICAL ORDER)

- Clean Hydrogen
- Electric Grid
- Electric Heat Pumps
- Electric Vehicles*
- Low carbon energy-intensive materials**
- Nuclear Energy
- Solar Energy*
- Sustainable Aviation Fuels
- Wind Energy*

**The production of some products under this section may be eligible for tax credits under § 45X and receiving an allocation under §48C(e) may preclude an applicant from receiving tax credits under that program. Applicants are encouraged to evaluate which program may be most beneficial to their project before submitting a concept paper for consideration under §48C(e)*

***At least 30% lower when compared to an appropriate industry-specific benchmark*

Refer to Notice 2024-36 Section 2.3 for the complete list of Round 2 Program Priorities

WORKFORCE IMPACT

- MESC has selected nearly **150 skilling institutions across the country.**
- Through these selections MESC is training 3,000+ studen ts annually.
- To date, MESC has deployed **over $100M** for our ITAC implementation and expansion programs, resulting in nearly **200 projects for SMMs across the United States.**

Additional Technical Training Institutes

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)**

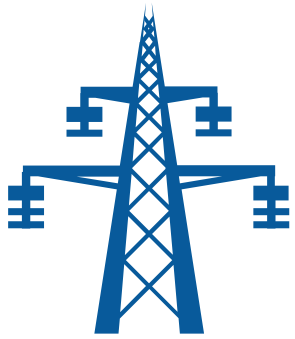
SUPPLY CHAIN READINESS LEVEL EVALUATES SUPPLY RELIABILITY + U.S. COMMERCIAL COMPETITIVENESS

SCRL IS THE FIRST AND ONLY TOOL TO ASSESS ENERGY SUPPLY CHAIN NEEDS AND US CAPABILITIES TO MEET THOSE NEEDS

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

BATTERY STORAGE IS CRITICAL TO OUR ENERGY AND TRANSPORTATION FUTURE

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

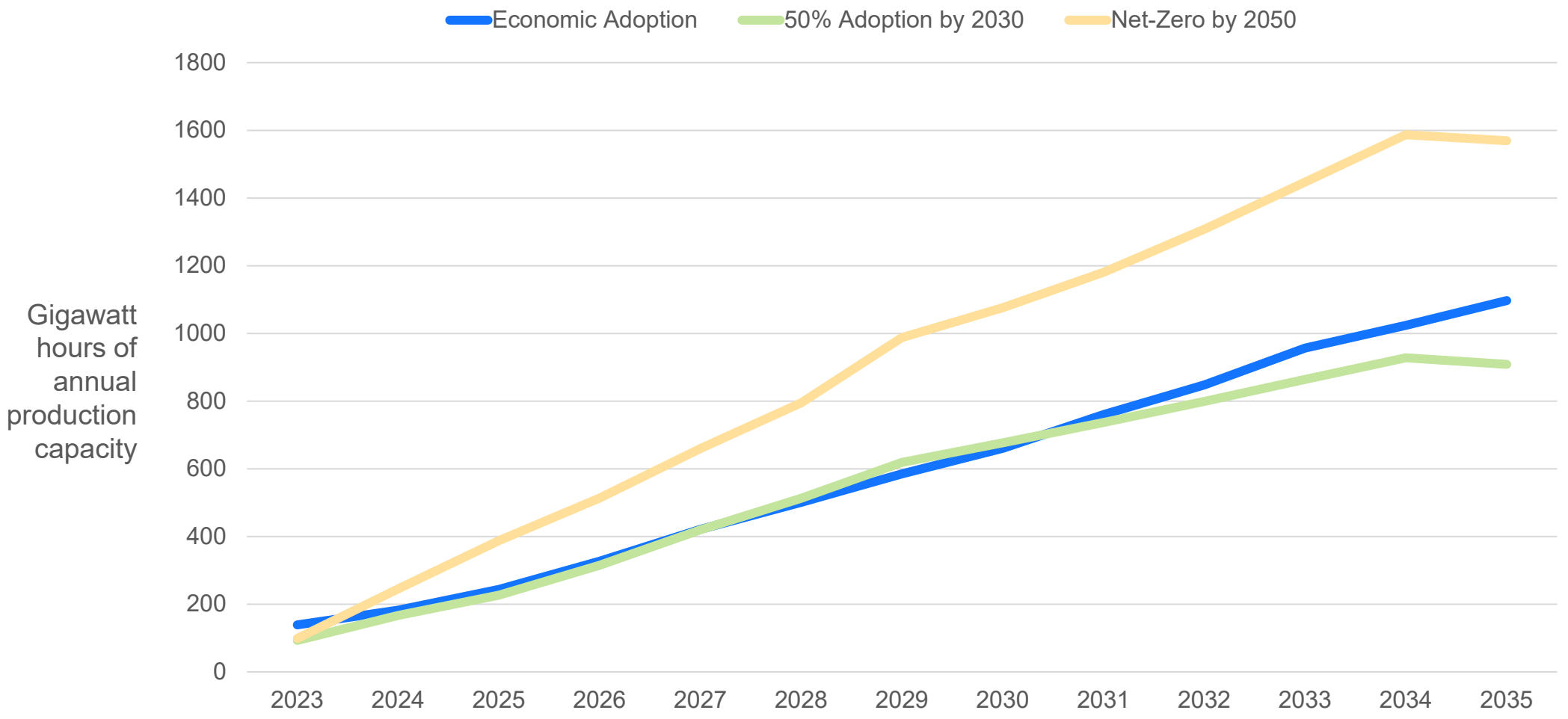


Battery storage will be increasingly essential to maintain system and price stability, bridging energy supply and demand differentials

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



MMAC compilation of data sources

WE'RE MAKING STRATEGIC INVESTMENTS IN OUR DOMESTIC BATTERY SUPPLY CHAINS

DOE's battery supply chain investments de-risked and unleashed private investment, securing our energy future 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

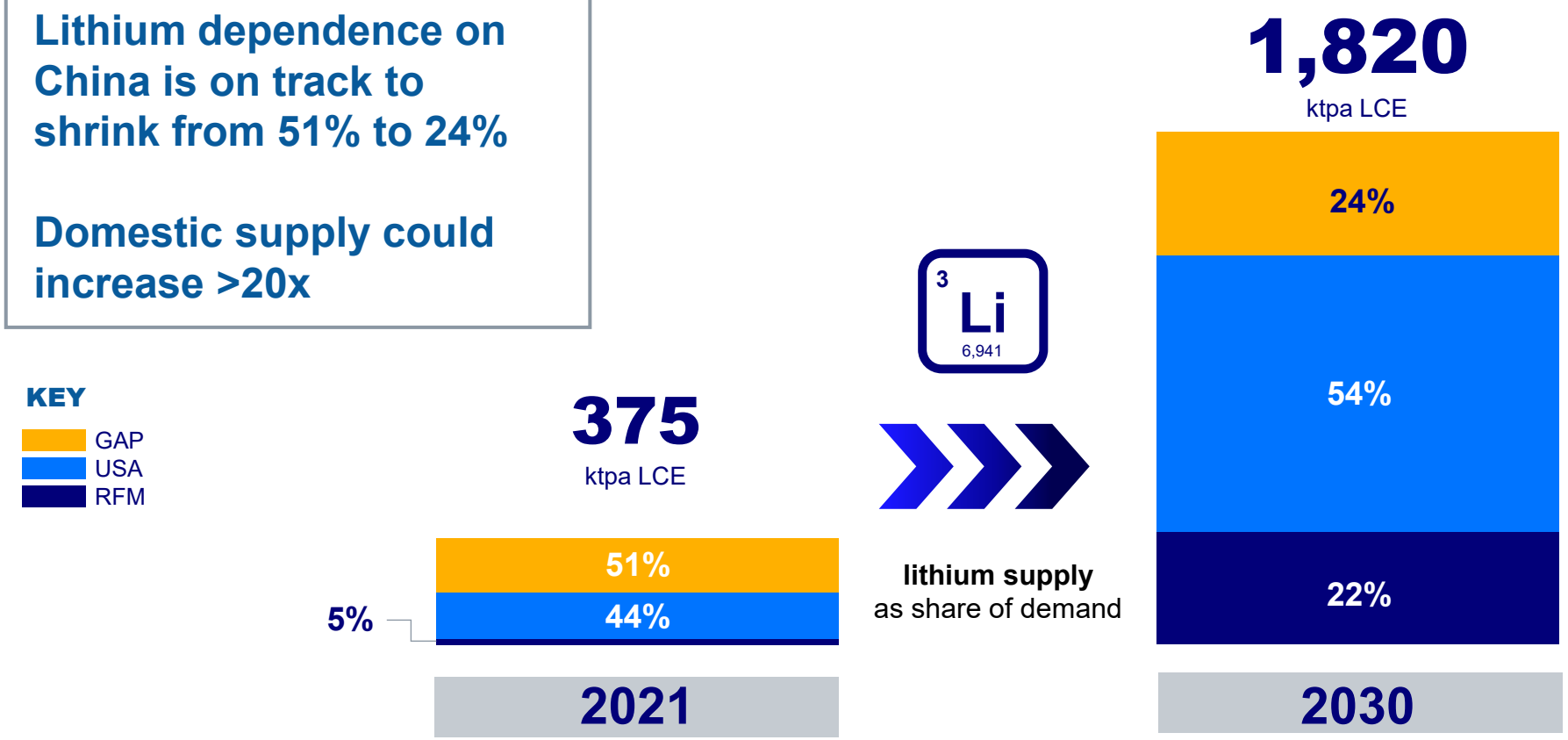
Manufacturing jobs being created across the country

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

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

Lithium dependence on China is on track to shrink from 51% to 24%

Domestic supply could increase >20x

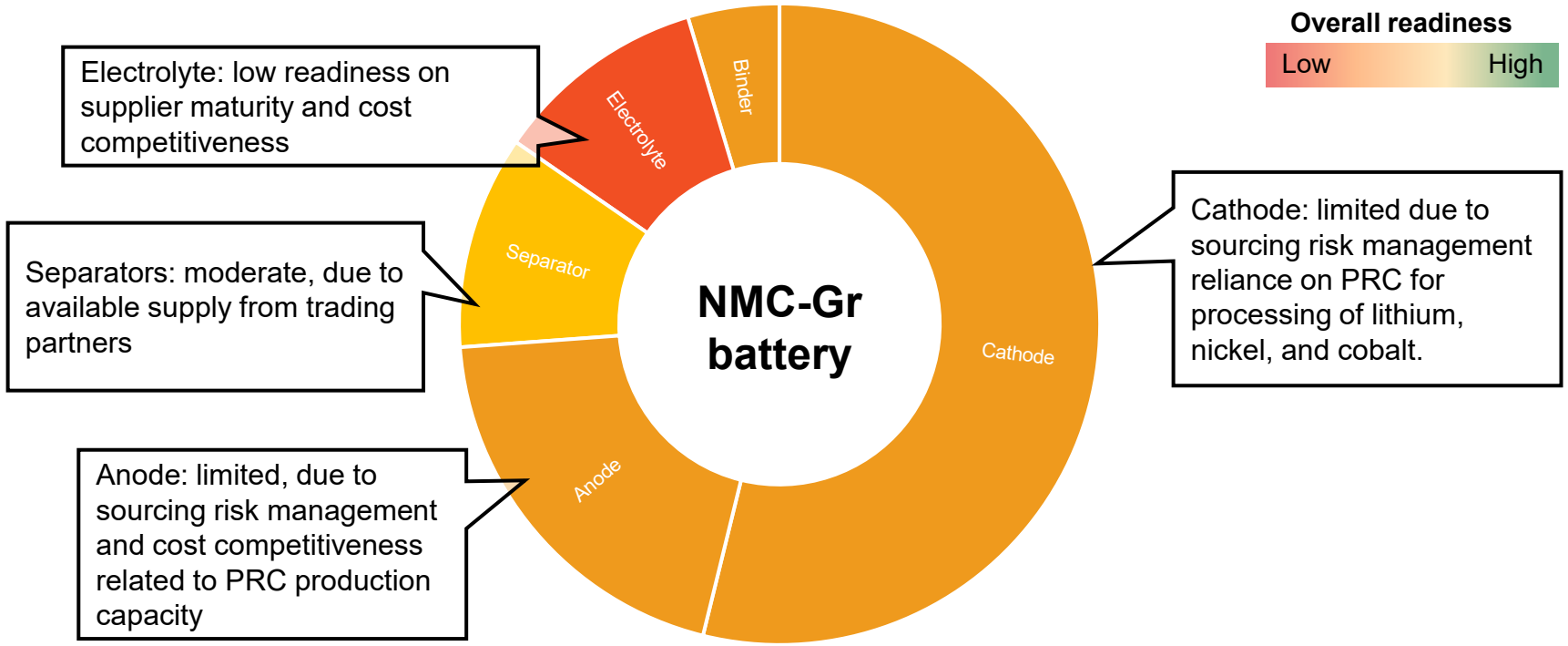


Rest of Free Market (RFM) excludes covered nations

ANALYSIS PRODUCT EXAMPLE: SUPPLY CHAIN READINESS LEVEL (SCRL) FRAMEWORK

NMC-Gr, 2024: MODERATE

- Trading partner relationships add stability, with mature supplier inputs, end customers, and markets
- US production faces cost competitiveness challenges against global price benchmarks (~20% price delta) across upstream materials and manufacturing

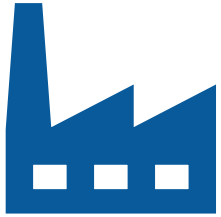


Upstream Materials	Limited due to nascent processing and refining capacity for battery-grade metals and materials
Manufacturing	Moderate due to available supply and customers in domestic and trading partner markets
Workforce	Low due to labor supply and demand gap and hiring difficulty compared to other manufacturing sectors

BATTERY SCRL ASSESSMENT REVEALS 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

EXECUTIVE SUMMARY

- Transformers and grid equipment face surging demand from load growth, electrification, extreme weather, and aging stock
- U.S. has strong manufacturing base for distribution transformers, but relies heavily on imports for power transformers
- Utility spending on storm restoration has significantly increased since 2018 due to the frequency and severity of extreme weather
- Amidst increasing demand and storm recovery needs, lead times and costs for transformers and grid equipment remain high
- Industry engagement highlights structural barriers and key barriers risks to investment in new production capacity
- MESC developed a Supply Chain Readiness Level framework to assess energy industrial base with grid components and conductors currently in development

COMBINATION OF FACTORS DRIVE FUTURE DEMAND FOR TRANSFORMERS AND GRID COMPONENTS

Key demand drivers	Summary	Key insights
Load growth	Electricity demand is projected to grow due to data centers, reshoring of manufacturing and industrial production, and economy-wide electrification, which will increase need for transformers and grid equipment	NREL estimates the overall stock of transformers in the U.S. needs to grow by between 160% and 260% by 2050
Aging stock of equipment and replacement	Utility routine transformer replacements, both due to failure and active resilience investments, will be needed to future-proof the grid	Analysis shows 75% of distribution transformers stock is 33 to 41 years old
Increased demand from electrification	Increased load due to electrification is a result of increased EV, renewables, heat pumps, and appliances drives demand for additional equipment and new specs	Nearly 1.8 TW of step-up transformer capacity will need to be in service by 2050, with sizes ranging from 1-5 MVA
Extreme weather events	Increasing frequency and severity of extreme weather events and longer-term trends in climate expected to increase demand for transformer and grid equipment	One transformer manufacturer produced 21,000 single phase transformers as a direct response to Hurricane Helene and Milton

Sources: National Renewable Energy Laboratory; Bloomberg New Energy Finance; Wood Mackenzie; industry engagement

INDUSTRY PERSPECTIVES: KEY RISKS IN GRID COMPONENTS SUPPLY CHAIN

		Focus area	Key insights from industry engagement
Primary risks	1	**Transformer windings** *(copper & aluminum)*	*"Copper and aluminum have become major bottlenecks due to rising demand and limited supply."*
	2	**Transformer core materials** *(GOES & amorphous steel)*	*"Competitors like Nippon, POSCO, and JFE are ahead in R&D improvements… we're playing catch-up."*
	3	**Transformer final assembly** *(plant capacity, test beds, labor)*	"*These factories are running at least 2 shifts; at times we are running 3 shifts like we are now because demand is so high*."
	4	**Workforce** *(skills and labor shortages)*	"*We can't find enough to qualified workers to add additional shifts, even if we wanted to*."
Secondary risks	5	**HVDC concentration** (Europe & Asia)	*"Production faces challenges due to the geographic concentration of suppliers in Europe and Asia."*
	6	**Insulation materials** (specialty paper & epoxy)	*"Specialty papers and insulation are critical for transformer longevity and performance but are mostly outsourced."*
	7	**Bushings** (porcelain)	*"Challenges with breakages in bushings were significant, reaching up to 11,000 units of broken components / year"*
	8	**HVDC supplier backlog** (existing cap., input constraints)	*"We come from a situation where we had two or three projects as order intake per year. That now has significantly changed, and we're looking at something like eight to 10 projects."*

WANT TO LEARN MORE ABOUT SUPPLY CHAIN SECURITY?

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energy.gov/mesc/analysis

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THANK YOU!