MESC

OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

From Analysis to Pipeline: Fueling the U.S. Hydrogen Manufacturing and Supply Chains

Jesús G. Alvelo Maurosa, Ph.D.

Technology Development Manager

jesus.alvelomaurosa@hq.doe.gov

08 May 2024

MESC is focused on the "how" of the energy transition

PURPOSE

To **deliver the *how* of the energy transition** quickly, securely, and equitably

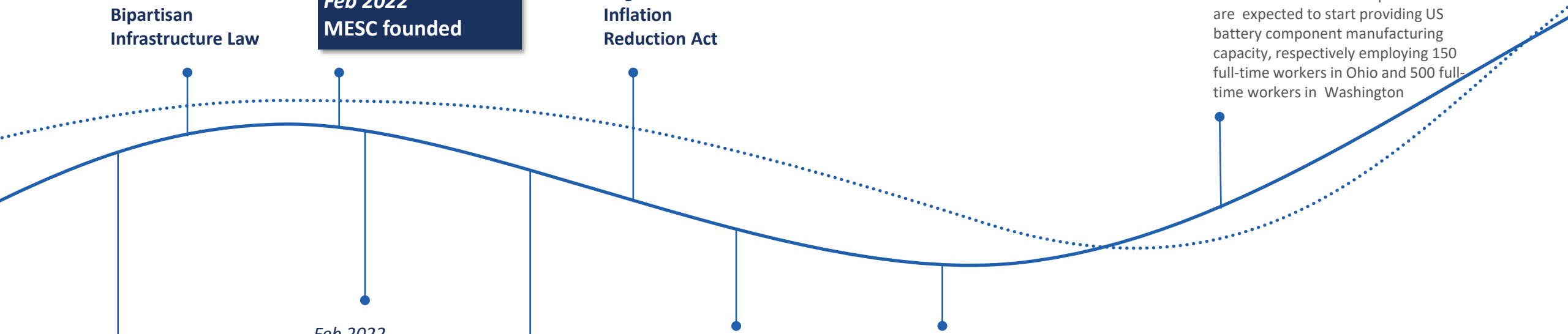
MISSION

The Office of Manufacturing and Energy Supply Chains (MESC) serves as the frontline of clean energy capital deployment to accelerate America's transition to a resilient, equitable energy future via $20B+ of direct investment in manufacturing capacity and workforce development.

VISION

To **eliminate vulnerabilities in US Clean Energy supply chains**, while driving unparalleled social, economic, and environmental impact through our programs & awards

MESC was founded in 2022 to secure and strengthen critical manufacturing and energy supply chains



Feb 2021
E.O. 14017

E.O. directing a whole-of-government approach to assessing vulnerabilities in, and strengthening the resilience of, critical supply chains

Nov 2021
Bipartisan Infrastructure Law

Feb 2022
Securing America's Clean Energy Supply Chain Report

Report in response to E.O. 14017 outlining the USG's plan to build a secure energy sector industrial base

Feb 2022
MESC founded

Jun 2022
Biden invokes DPA

Authorizes DOE to utilize the Defense Production Act to accelerate domestic production of key energy technologies

Aug 2022
Inflation Reduction Act

Oct 2022
First investments announced

MESC selects 20 companies across 12 states, investing $2.8B into the first round of battery manufacturing

Jun 2023
First MESC groundbreaking

Anovion Technologies breaks ground in Georgia on facility supported by MESC investment through BIL funding

2024
First MESC factories expected to come online

Cirba Solutions and Group14 are expected to start providing US battery component manufacturing capacity, respectively employing 150 full-time workers in Ohio and 500 full-time workers in Washington

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

MESC's investment activities are underpinned by robust analytical modeling

MESC's Core Functions

Manufacturing Investing

Strengthening and securing supply chains needed to modernize the nation's energy infrastructure, while supporting a clean and equitable energy transition

Workforce Investing

Supporting workforce education and training through the direct funding of cutting-edge energy manufacturing programs

Manufacturing Analytics Backbone

Robust modeling to guide and support DOE strategy and investments, private sector collaborative investments, and policy recommendations to broader USG

Our **strategic investment in critical materials, workforce, and essential manufacturing** enables DOE's other major project offices (OCED, GDO, etc.) by **de-risking the supply chains** for transmission, hydrogen, carbon capture, and other emerging clean technology projects.

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

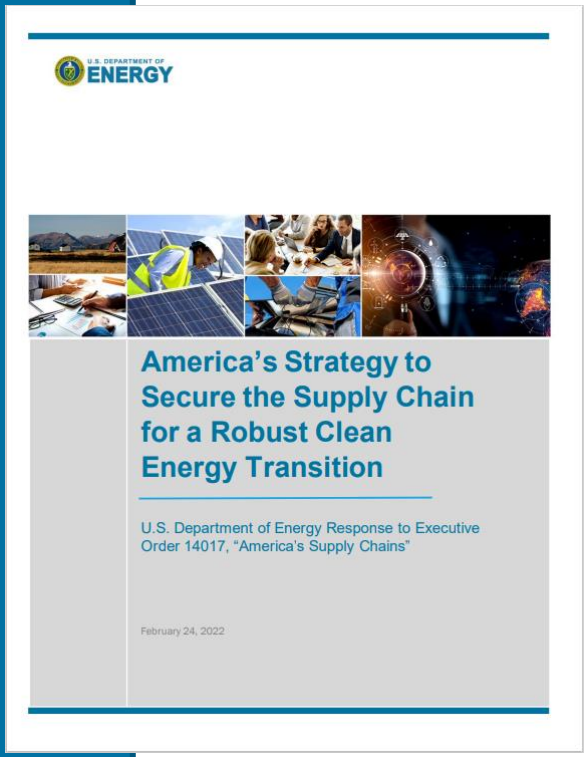
Executive Order 14017: America's Supply Chains

https://www.energy.gov/policy/securing-americas-clean-energy-supply-chain

- DOE released **14 reports on the energy sector supply chains**, including 13 issue-specific deep dive assessments and an overarching strategy report
- "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition" is the **first-ever comprehensive U.S. government strategy to secure our domestic energy supply chains and an Energy Sector Industrial Base**
- Lays out dozens of **critical strategies and actions** to build secure, resilient, and diverse domestic energy supply chains
- Part of a larger **whole-of-government approach** on supply chains

Deep-Dive Assessment Report Topics

- Carbon capture materials
- Electric grid including transformers and high voltage direct current
- Energy storage
- Fuel cells and electrolyzers
- Hydropower including pumped storage hydropower
- Neodymium magnets
- Nuclear energy
- Platinum group metals and other catalyst
- Semiconductors
- Solar photovoltaics
- Wind
- Commercialization and competitiveness
- Cybersecurity and digital components



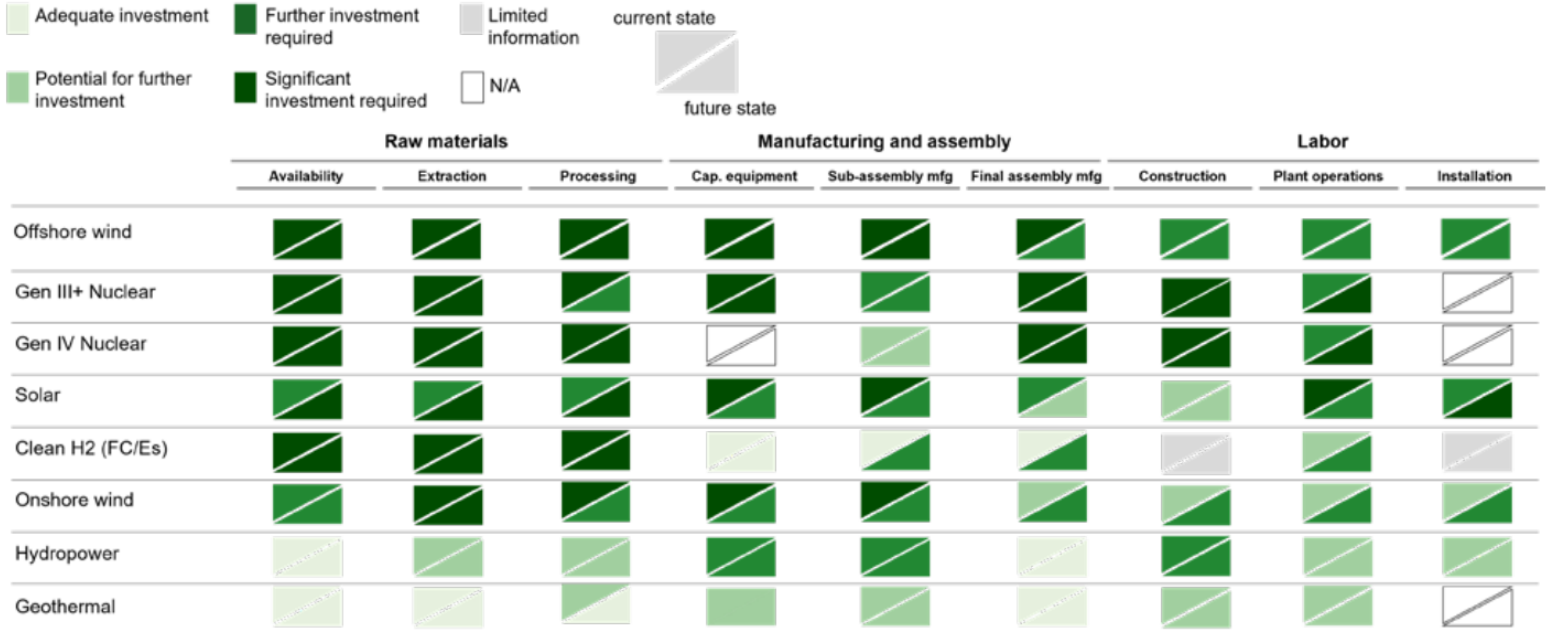
MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

Supply Chain Progress Report (Aug 2023)

https://www.energy.gov/mesc/reports

- Summarizes DOE progress in **building and securing supply chains to support the American energy sector industrial base**:
  - Securing critical materials
  - Expanding energy sector manufacturing
  - Growing the domestic clean energy workforce
  - Building out supply chain capabilities
- Identifying **supply chain vulnerabilities/opportunities to identify priorities and align investments**

Component/Equipment	Relevant Technologies	Vulnerabilities
Large Castings and Forgings	Onshore wind, offshore wind, hydropower, and nuclear	U.S. does not have large-scale domestic castings and forgings capabilities to meet demand; certain technologies, such as nuclear, require higher grade equipment than others.
Rare Earth Magnets	EVs, onshore wind, and offshore wind	U.S. does not have manufacturing capability for Neodymium magnets with China dominating more than 92% of the capacity
Battery Components	EVs and grid energy storage	China maintains a stronghold in mid and downstream battery supply chain. China manufactures most cathodes (89 %), anodes (93 %), separators (89 %), electrolytes (94 %), and cells (75%)

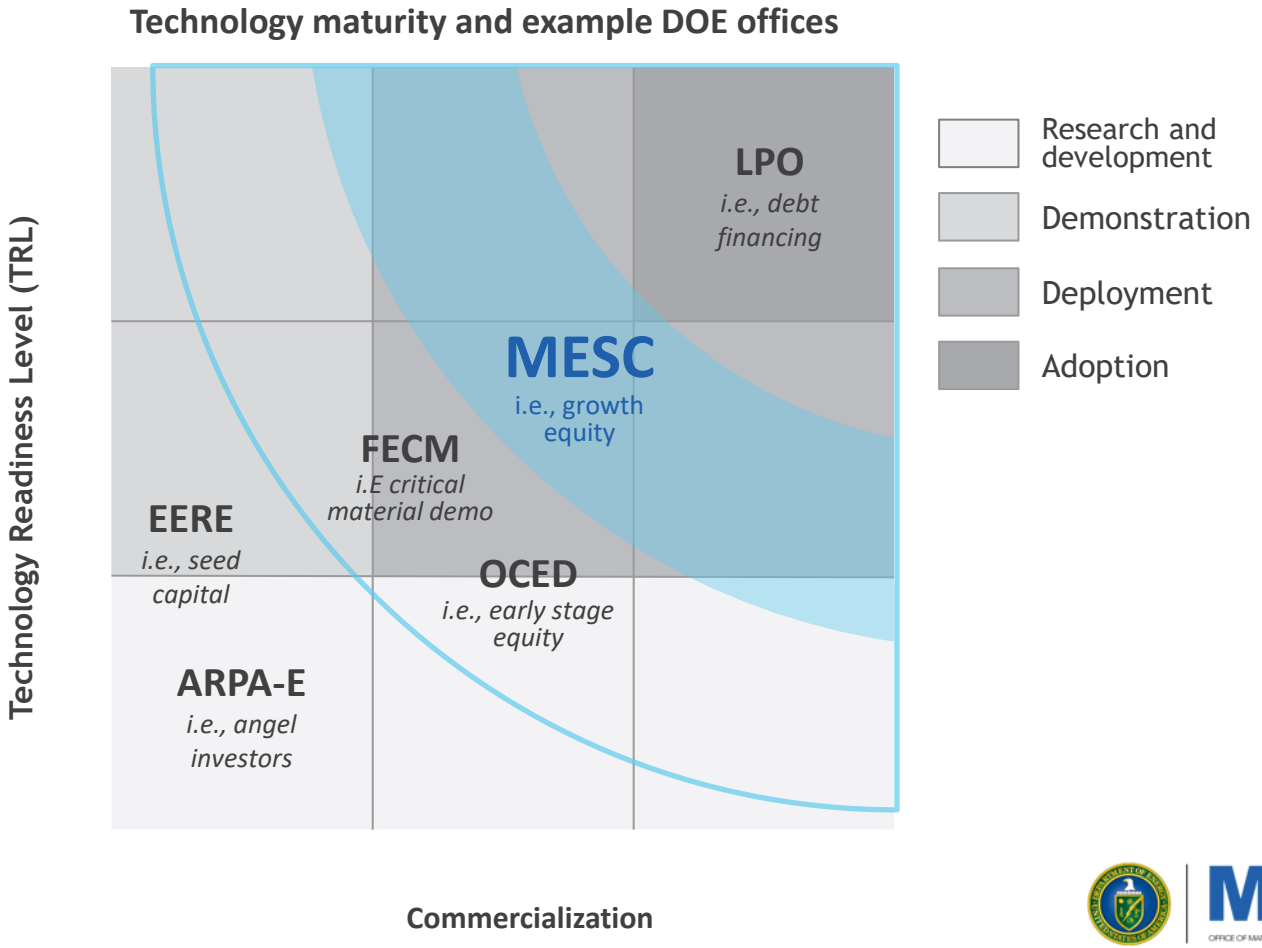


MESC operates in late-stage technology development, driving large-scale deployment of new technologies

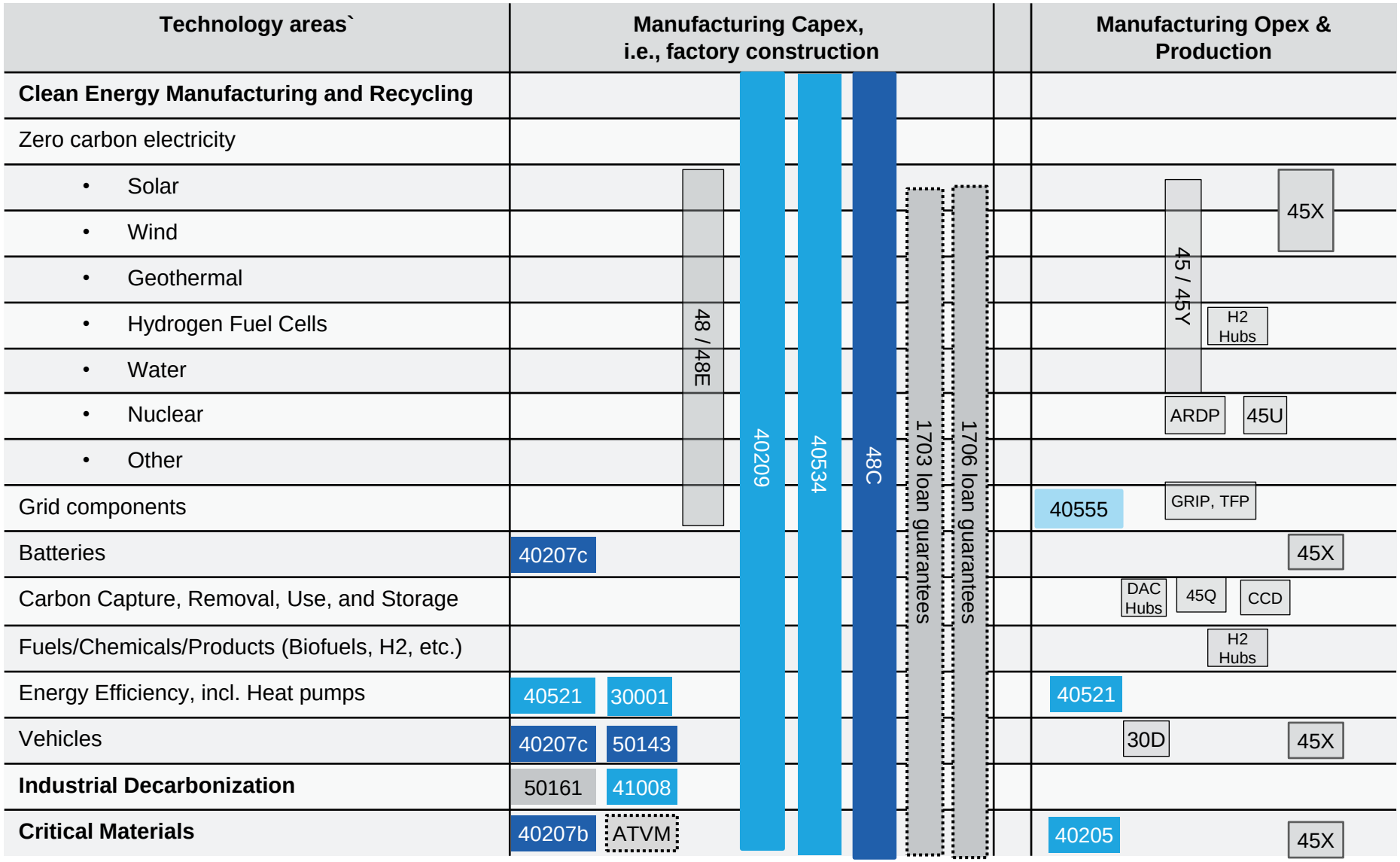
The Office of Manufacturing and Energy Supply Chains is **working alongside private capital** to be a **force multiplier** to **secure American supply chains domestically**.

All DOE and MESC investments follow a **data-driven approach**, building on modeling, mapping, and analysis foundational from MESC experts.

MESC is **supporting workforce** through direct funding of cutting-edge energy manufacturing programs at universities, community college, and trade-schools to proven entry-level and mid-career support.



MESC has a suite of financial instruments to support deployment across the energy sector industrial base



Scale legend

MESC programs by size

- $ Billions
- $100s Millions
- $10s Millions

Other programs

- Other grant / tax
- Loan programs

Program Legend

- **48C:** $10B ITC for energy manufacturing & recycling, critical minerals processing & recycling, and energy efficiency in manufacturing
- **40207b:** $3B, BIL Battery Material Processing Grants
- **40207c:** $6B, BIL Battery Manufacturing Grants
- **50143:** $2B, IRA Domestic Manufacturing Conversion Grants
- **40521:** $400M, BIL Industrial Assessment Centers Implementation Grants
- 40534: $50M State Manufacturing Leadership program
- **41008:** $500M, BIL Industrial Emissions Demonstrations
- **40205:** $140M for Rare Earth Elements deployment from BIL
- **30001 (DPA):** $250M for heat pumps manufacturing from IRA
- **40209:** $750M, BIL Advanced Energy Manufacturing and Recycling Grants
- 40555: $20 M for Energy Efficient Transformer Rebates Program
- **50161:** $5.8B, IRA Advanced Industrial Facilities Deployment
- **ATVM:** LPO Advanced Technology Vehicle Manufacturing Loan Program
- **ARDP**: $2.5 BIL advanced reactor demo program,
- **1703:** Innovative Energy Supply Chain Loan Guarantees
- **1706:** Energy Infrastructure Reinvestment (if replacing power plant/energy infra.)
- **45 / 45Y:** PTC for Renewable Electricity / Clean Electricity
- **48 / 48E:** ITC for Renewable Energy / Clean Electricity
- **45U: $6B** Nuclear Power PTC
- **30D:** Clean Vehicle Credit
- DAC hubs: $3.5B Regional Direct Air Capture
- 45Q: PTC for carbon capture & sequestration
- H2 Hubs: $8B Regional Clean Hydrogen Hubs Program
- CCD: $2.5B Carbon Capture Demonstration Program

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

MESC initiatives support the Energy Sector Industrial Base with a multi-disciplinary approach

Facility and Workforce Assistance

Supporting small and medium manufacturing growth, industrial decarbonization, and workforce for energy and manufacturing industries

Primary Stakeholders

- A Broad Group of Industrial Enterprises and Regional Manufacturers
- Academia: Universities, Community Colleges, Technical Schools
- State/Local Governments

Battery and Critical Materials

Developing a domestic Batteries and Critical Minerals manufacturing supply chain from cradle to grave and recycling.

Primary Stakeholders

- Upstream and Mid-Stream Mineral Processing, Refining, and Materials Production Enterprises
- Recycling Enterprises

Focus Areas

- Battery materials, Rare Earths, Platinum Group Metals, Other Critical Materials

Analysis and Strategic Investment

Analysis and support to build capabilities across energy technologies and throughout the supply chain for critical components, devices, and systems.

Primary Stakeholders

- Mid-/Down-Stream Components, Device, and Systems Manufacturing Enterprises
- Supply Chain Planning and Forecasting Stakeholders

Focus Areas

- Grid/HV/Storage, Solar/Wind, Fuel Cells/Electrolysis, Semiconductors

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

MESC's Facility & Workforce Assistance

Build or retrofit manufacturing facilities to make clean energy products and reduce facility GHG emissions with an emphasis on small and medium sized manufacturers and shoring up the manufacturing workforce.

Manufacturing Assistance

Advanced Energy Manufacturing and Recycling Grants *(BIL 40209):* $750M for SMMs in coal communities to decarbonize local facilities and reequip them for clean energy manufacturing

State Manufacturing Leadership Program *(BIL 40534):* $50M for state-level efforts to accelerate the deployment of smart manufacturing tech and access to high-performance computing

Workforce Development & Industrial Assessments

IAC Program (base): Long-running program, operates 37 university centers that train energy-savvy engineers while providing no-cost energy technical assistance to SMMs

IAC Expansion *(BIL 40521):* $150M to expand IACs to skilled trades training (e.g., community colleges, technical schools, apprenticeships) and strengthen IAC innovation via Centers of Excellence

IAC Implementation Grants *(BIL 40521):* $400M for SMMs to implement the facility improvements recommended by IACs and others

Advanced Industrial Decarbonization

Industrial Technologies Joint Strategy: Chair the DOE-wide effort to identify decarbonization challenges and priority solutions in key industrial sectors (e.g., metals, chemicals) to inform MESC programs like 48C

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

Batteries and Critical Materials

Scale-up & deployment of manufacturing for critical minerals and battery materials

Investment Programs

Battery Material Processing and Battery Manufacturing Grants *(BIL 40207(b)(c)):* $9B in grants for battery materials processing and manufacturing to ensure viable battery materials processing industry

Battery Recycling: State/Local/Retailer Programs *(BIL 40207(f3)(f4)):* $125M in grants for RD&D projects to create innovative and practical approaches to increase the reuse and recycling of batteries

Rare Earth Demonstration (with FECM) *(BIL 40205):* $140M to demonstrate feasibility of a full-scale integrated rare earth extraction and separation facility and refinery

Battery Supply Chains Coordination + Collaboration

Battery Joint Strategy Team: 8 program offices within DOE focused on technology, manufacturing, commercial, and supply chain readiness well as end-use applications

Federal Consortium for Advanced Batteries (FCAB)*:* 91 Agencies over 80 Offices; released National Blueprint for Lithium Batteries, 2021

Li-Bridge Public-Private Partnership: holds Forums and releases reports with recommendations to foster domestic industry growth

Critical Materials Coordination + Collaboration

Critical Materials Collaborative: 9 program offices within DOE focused end-of-life battery recycling and re-use guidance

Rare Earth Elements: working with stakeholders to develop domestic resources for rare earth elements, creating partnerships with allied countries, and exploring alternative resources as feedstock

Working Groups: various public, interagency, and other external coordinating dialogues

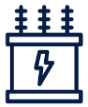
MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

Analysis and Strategic Investment

Targeted investment in critical mid- and down-stream energy technologies (components, devices, and systems), informed by integrated cross-cutting manufacturing and supply chain analysis.

Tax Credits and Rebates

48C Advanced Manufacturing Tax Credit *(IRA 13501):* $10B competitively award credit for clean energy manufacturing & recycling, critical materials, and industrial GHG emissions reduction projects



Rebates for Efficient Distribution Transformers and Extended Product Systems *(BIL 40555):* $20M technology rebates for purchasers of a qualified energy efficient transformer or extended product system

Targeted Investment in Energy Supply Chains

Defense Production Act *(IRA 30001):* $250M to bolster heat pump supply; future investment in four other designated technologies: grid components, clean hydrogen technologies, solar components, and insulation

Manufacturing Conversion Grants for Electrified Vehicles *(IRA 50143):* $2B to renovate and retool vehicle and component manufacturing facilities for electrified vehicles (including hybrids and fuel cells)

Energy Sector Industrial Base Technical Team: new activities to mitigate critical supply chain vulnerabilities and risk in critical industries and supply chains not already enumerated by existing funding authorities

Modeling, Mapping, and Analysis

Sprint Analysis: Synthesize fact base across DOE and private sector expertise to identify acute vulnerabilities cutting across technologies, to single technologies, and specific to each technology to inform DOE cross-cutting investments

Modeling, Mapping, and Analysis Consortium (MMAC): develop analysis research and applied modeling ecosystem across DOE's national labs and supported by academic for integrated insights across manufacturing and energy supply chains

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

Qualifying Advanced Energy Project Credit (48C) Program

- $4 billion of 48C credits over 100 projects
- Clean Energy Manufacturing and Recycling Projects, Industrial Decarbonization Projects and Critical Materials Projects
- Approx. $340 million in electrolyzers and fuel cells components (self disclosed info)
- Applicant Self-Disclosed 48C Projects

48C Round 2: $6 billion announcement

48C Updates: Round 2 Announced

Informational Webinar – 5/16/2024, 12 p.m. ET

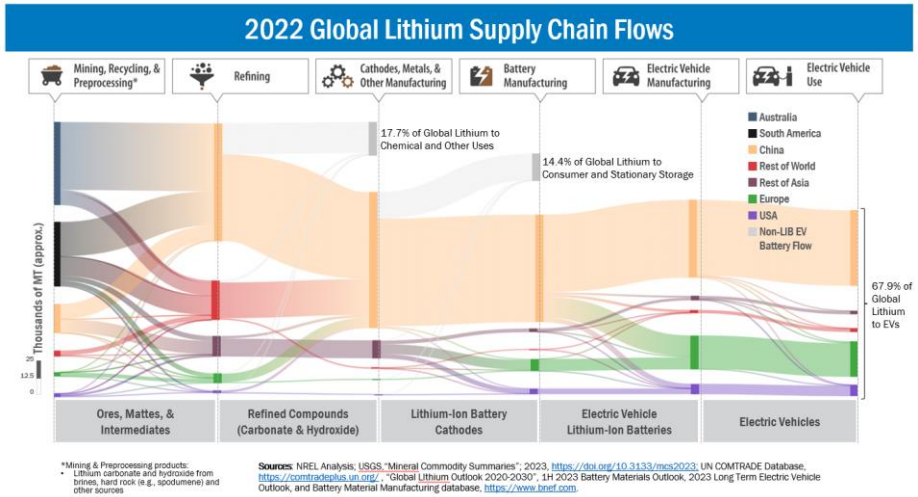
registration link

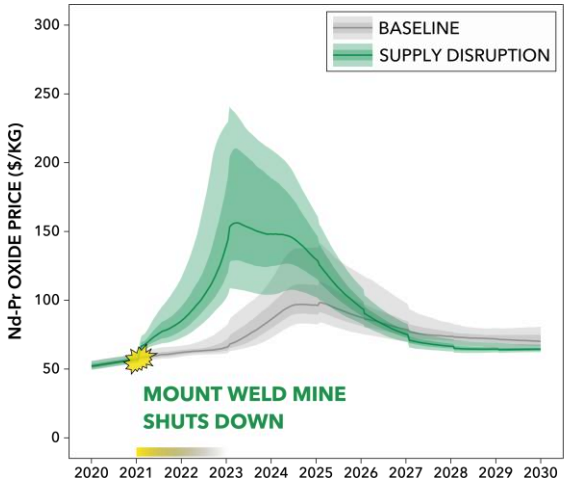
DOE 48C ECO Portal opens for Concept Paper Submission – no later than 5/28/2024

Submission Deadline for Concept Papers – 30 days after 48C ECO Portal opens for submission at 5:00 pm ET

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

Mapping, Modeling, and Analysis Consortium





Supply Chain Readiness Level (SCRL) *[scale of 1–9]*

Raw Materials
+
Manufacturing and Assembly
+
Workforce/Labor
+
Logistics

- **Global installed manufacturing**
- **Material prices**
- **Minerals mapping**
- Supply chain mapping
- Threat/intelligence

- **Supply chain bottleneck assessment**
- **System dynamics modeling**
- **Agent based modeling**
- **Deployment projections**
- Spatial modeling
- Discrete event modeling
- Material flow equations

- **Global trade flows**
- **Life cycle analysis (LCA)**
- **Manufacturing techno-economic analysis**
- Workforce
- End-of-life disposal and recycling
- Diversity, equity, inclusion, and accessibility

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

Wednesday, May 8 Poster Presentations, 5:30–7:00 p.m.

MESC001 - Supercharging Critical Hydrogen Supply Chains with MMAC

Diane Graziano, ANL & Justin Bracci, NREL

Request for Information:

- Domestic Manufacturing Conversion Grants for Electrified Vehicles
- State Partnerships for Small- and Medium-Sized Manufacturers (SMMs)
- ICEV to EV including hybrid and hydrogen fuel cell
- Deadline for RFI input: May 20, 2024
- Access to RFI link HERE

RFI seeks input on:

Anticipated Program Scope and Details

Worker and Community Benefits

Equity, Environmental, and Energy Justice (EEEJ) Priorities, including implementation of the Justice40 Initiative

MESC's impact to-date

- $7B+ private sector investment catalyzed
- 8,000+ jobs created
- 34% of investments in energy justice communities
- 500+ students trained annually
- 10M+ EVs enabled annually

Source: DOE BIL Battery FOA Fact Sheets, MESC IAC Website

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS

https://www.energy.gov/mesc/reports

Thank you

energy.gov/mesc

MESC@hq.doe.gov

Office of Manufacturing and Energy Supply Chains, U.S. Department of Energy

MESC
OFFICE OF MANUFACTURING AND ENERGY SUPPLY CHAINS