Overview: Critical Minerals & Materials

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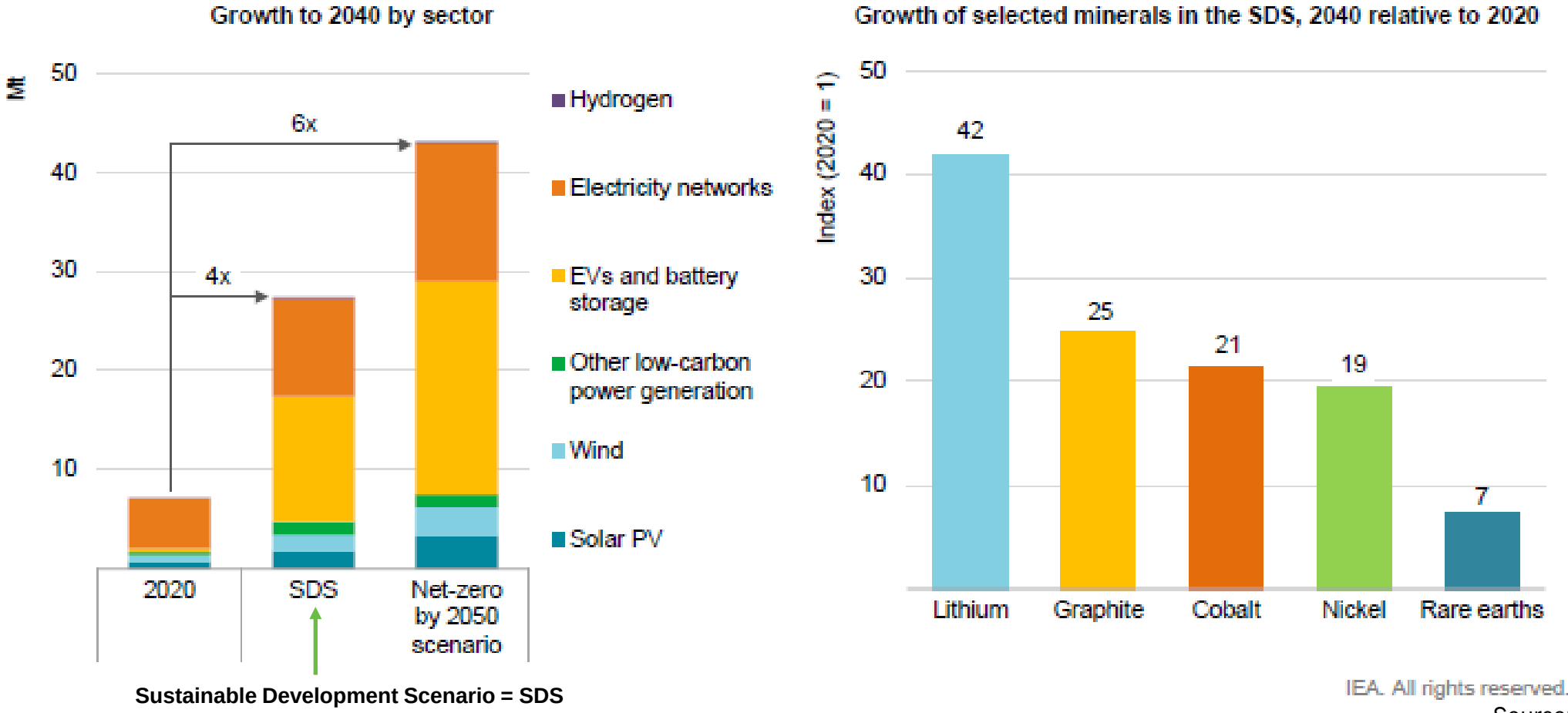
Outline

- Background on Critical Minerals & Materials
- DOE Vision & Strategy
- DOE's Research Portfolio: Now & Future
- Goals for Today's Discussions

Critical Materials Demand Driven by Decarbonization Goals

- Reduce net greenhouse gas (GHG) emissions 50-52% below 2005 levels by 2035
- Achieve net zero emissions economy-wide by 2050

Mineral demand for clean energy technologies by scenario



Sustainable Development Scenario = SDS

Notes: Mt = million tonnes. Includes all minerals in the scope of this report, but does not include steel and aluminium. See Annex for a full list of minerals.

Source: IEA

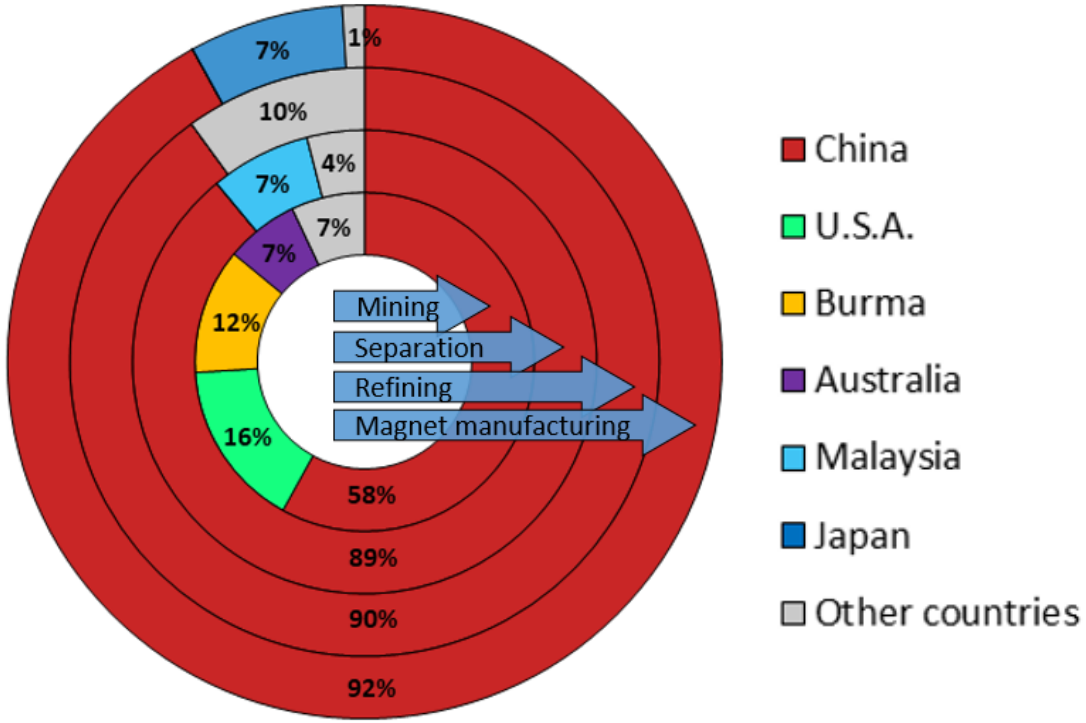
Critical Mineral and Material Supply Chain Vulnerabilities

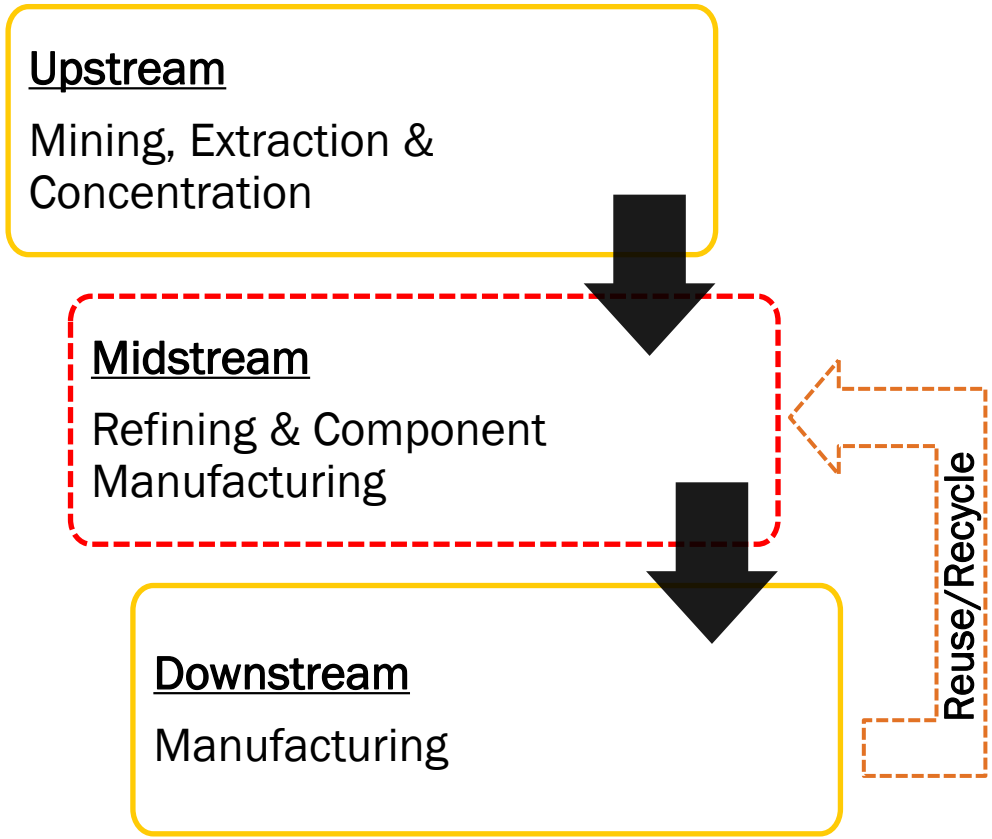
Supply Chain Vulnerabilities

→ *Up-to-mid stream capabilities* ***are concentrated in 1-3 countries***

→ ***Lack of midstream capabilities are a gap*** *that limit growth of upstream supply and downstream value-add manufacturing*

Example: Geographic concentration of supply chain stages for sintered NdFeB magnets

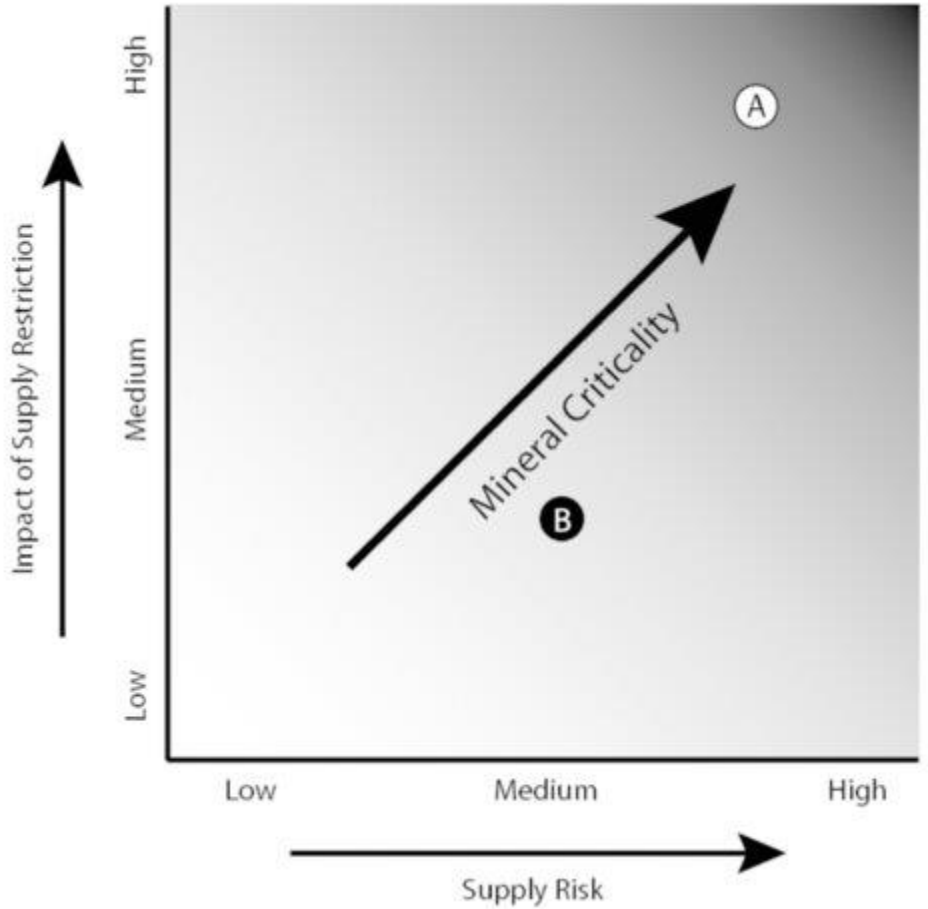




What is a Critical Material or Mineral?

- Critical **Material:**
  - any non-fuel mineral, element, substance, or material that the Secretary of Energy determines—
    - has a **high risk of a supply chain disruption**; and
    - serves an **essential function in one or more energy technologies**, including technologies that produce, transmit, store, and conserve energy; or
  - a critical mineral.
- Critical Mineral:
  - any mineral, element, substance, or material designated as critical by the Secretary of Interior (Federal List of CMs)
  - Exclusions: fuel minerals; water, ice or snow; common varieties of sand, gravel, pumice, cinder and clay
  - USGS 2022 Critical Minerals List
  - USGS 2021 Open File Report (methodology)

Source: National Academies, 2007

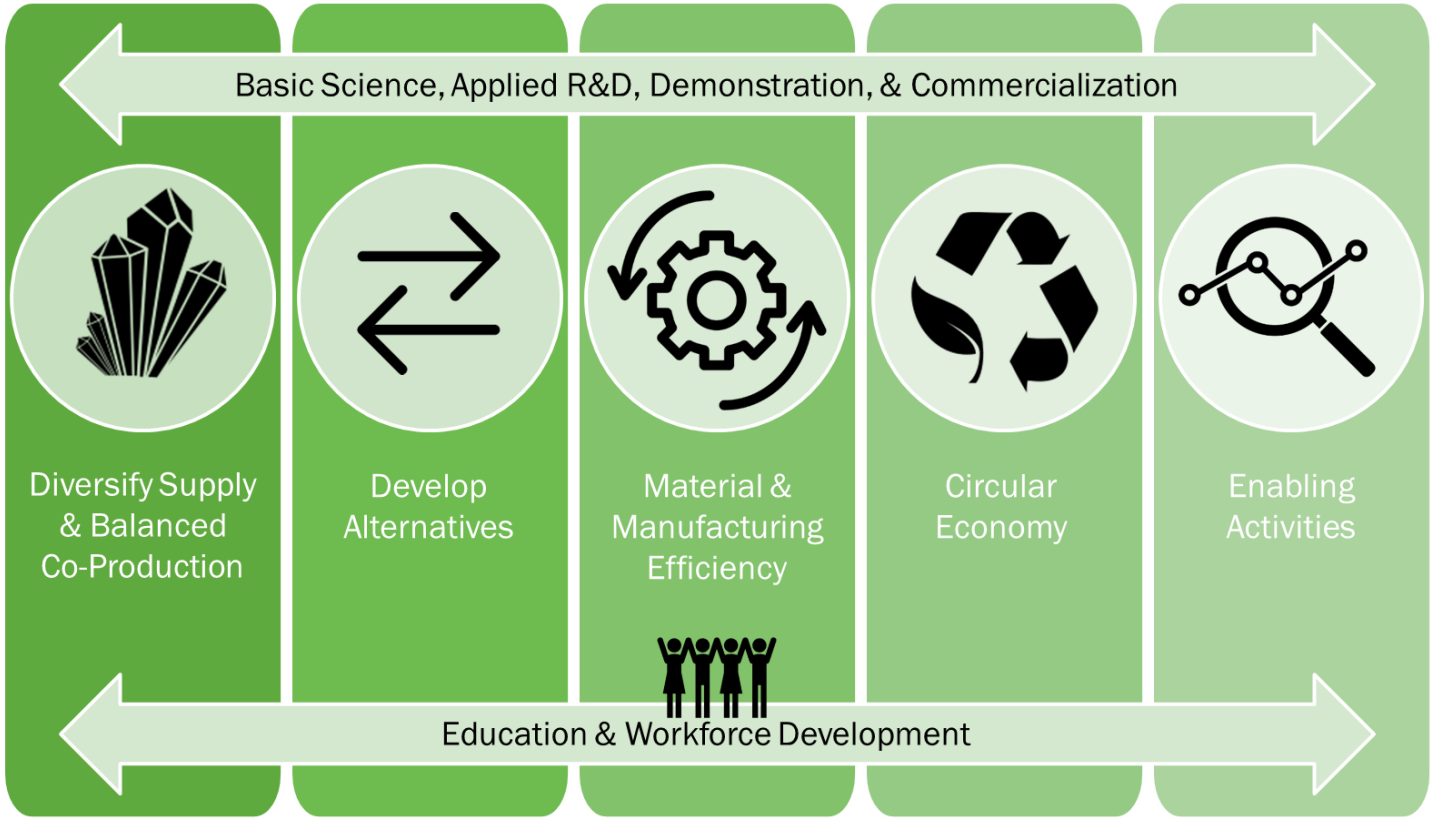


→DOE will be updating criticality assessment to inform future priorities.

DOE Critical Minerals and Materials (CMM) Vision & Strategy

Vision: Resilient, diverse, sustainable, and secure domestic critical mineral and materials supply chains that support the clean energy transition and decarbonization of the energy, manufacturing, and transportation economies while promoting safe, sustainable, economic, and environmentally just solutions to meet current and future needs.

Strategy:



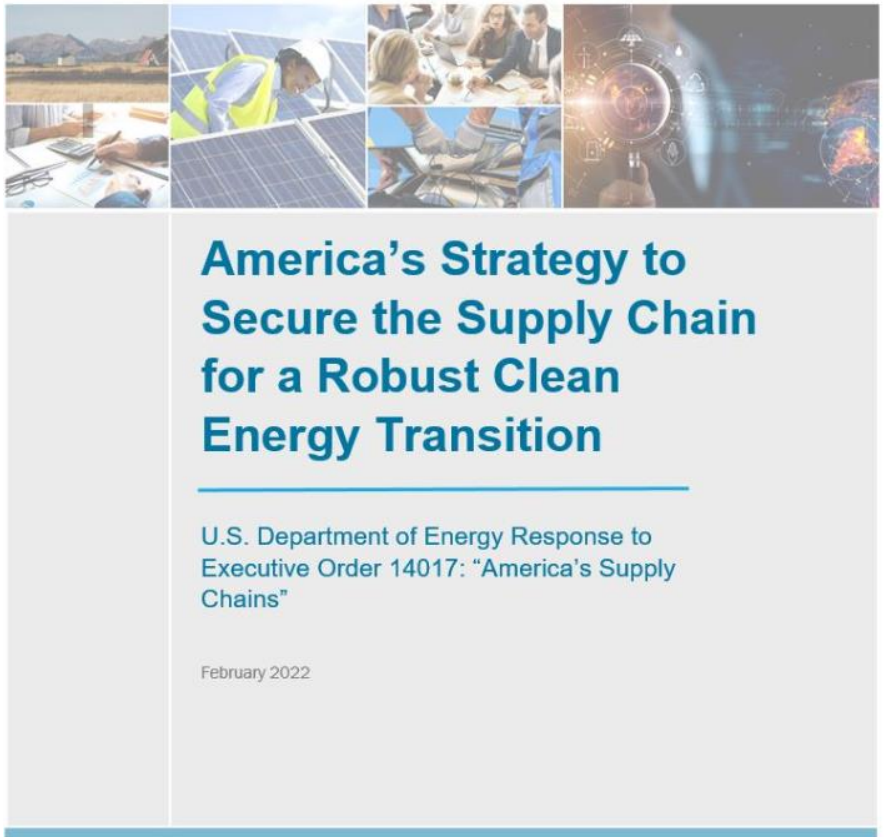
Requires a Material-by-Material Approach as part of an All-of-Government Strategy

Role of DOE in the Federal Landscape

- **DOE's primary role is to advance research, development, demonstration, and deployment spanning basic science to technology innovation.**
  - Supported by analyses, domestic and international standards, and international collaboration with allied countries
- DOE does not have regulatory authority to issue permits for critical minerals or materials activities.
- DOE partners with other federal agencies and departments
  - Implementation of Federal Strategy on Critical Minerals
  - Mining Reform
  - Seabed Mining
  - National Blueprint for Lithium Batteries

DOE CMM Strategy in Action

- DOE is working to secure and strengthen the critical minerals and materials supply chain:
  - Published "America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition"
  - Ongoing basic and applied research, development, and demonstration activities that span the entire supply chain
  - Expansion to commercialization/deployment activities
    - Implementation of the Infrastructure Investment and Jobs Act
  - Critical mineral stockpile for the clean energy economy
  - Bilateral and multilateral cooperation with allied partners
  - Standards to promote supply chain transparency and traceability



DOE Critical Minerals & Materials Activities

DOE's core activities span multiple Program Offices and address the full supply chain and life cycle of critical minerals and materials

Geothermal Lithium Extraction Prize

Unconven-tional and Secondary Material Recovery

Basic Science

CORE-CM Regional Initiatives

Financing

Critical Materials Institute

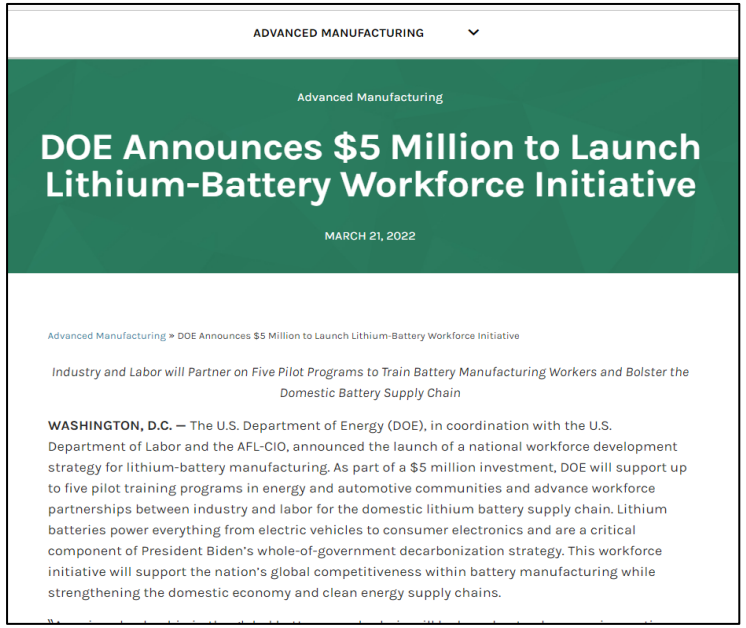
Small Pilots and Demos

Mining Research

Technology Development

ReCell Center

DOE Lithium Battery Workforce Initiative



ADVANCED MANUFACTURING

Advanced Manufacturing

DOE Announces $5 Million to Launch Lithium-Battery Workforce Initiative

MARCH 21, 2022

Advanced Manufacturing » DOE Announces $5 Million to Launch Lithium-Battery Workforce Initiative

Industry and Labor will Partner on Five Pilot Programs to Train Battery Manufacturing Workers and Bolster the Domestic Battery Supply Chain

WASHINGTON, D.C. — The U.S. Department of Energy (DOE), in coordination with the U.S. Department of Labor and the AFL-CIO, announced the launch of a national workforce development strategy for lithium-battery manufacturing. As part of a $5 million investment, DOE will support up to five pilot training programs in energy and automotive communities and advance workforce partnerships between industry and labor for the domestic lithium battery supply chain. Lithium batteries power everything from electric vehicles to consumer electronics and are a critical component of President Biden's whole-of-government decarbonization strategy. This workforce initiative will support the nation's global competitiveness within battery manufacturing while strengthening the domestic economy and clean energy supply chains.

- DOE launched the national workforce development strategy for lithium-battery manufacturing in partnership with the Department of Labor, and AFL-CIO
  - Five pilot training programs in energy and automotive communities
  - Partnerships between industry and labor

DOE Critical Materials Research Program

- **DOE budget request in fiscal year 2023 nearly doubles critical minerals and materials research.**

	Diversify Supply	Develop Substitutes	Material & Mnfg. Efficiency	Circular Economy	Enabling Activities
Basic Science	DOE's existing research program spans 6 Program Offices, totaling $217M in FY2021. DOE's budget request in FY2023 for CMM totals $400M.				
Applied R&D					
Pilots					
Demos					
Commercialization					

DOE Critical Materials Research Program

- **The Infrastructure, Investments and Jobs Act, also commonly known as the Bipartisan Infrastructure Law (BIL), will integrate and expand ongoing activities.**

	Diversify Supply	Develop Substitutes	Material & Mnfg. Efficiency	Circular Economy	Enabling Activities
Basic Science	Critical Materials Research, Development, Demonstration, and Commercialization Program (RDD&CA) BIL 41003c: $600M for Critical Materials Recycling, Innovation, Efficiency, and Alternatives. Energy Act of 2020 authorizes a Critical Materials Consortium. BIL 41003d: $75M for a Critical Material Supply Chain Research Facility				
Applied R&D					
Pilots					
Demos					
Commercialization					

Material-by-Material Approach Driven by Decarbonization Goals

GOALS

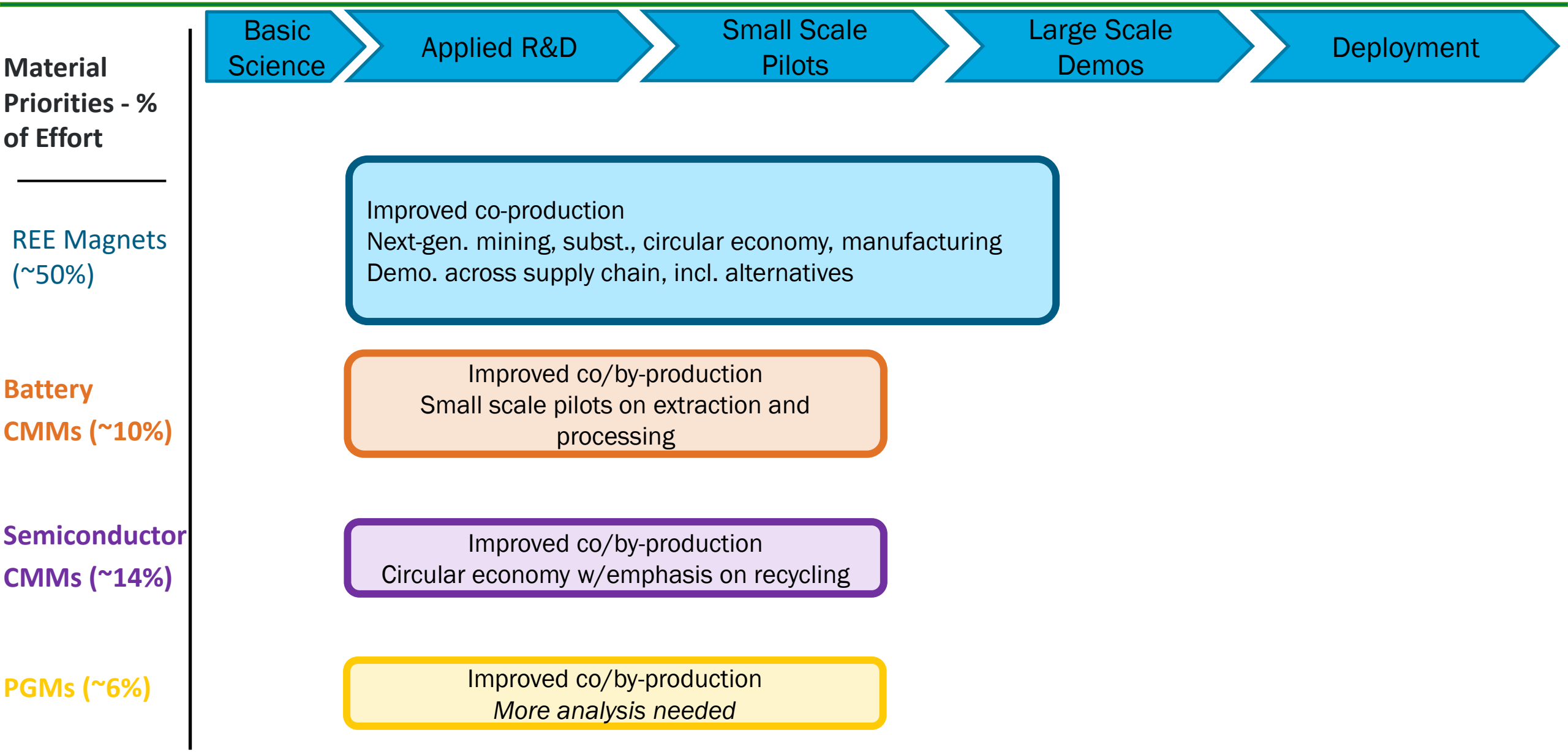
● 100% clean electricity by 2035: 30 GW offshore wind by 2030 ●

● Zero-emission transportation: 50% EV adoption by 2030 ●

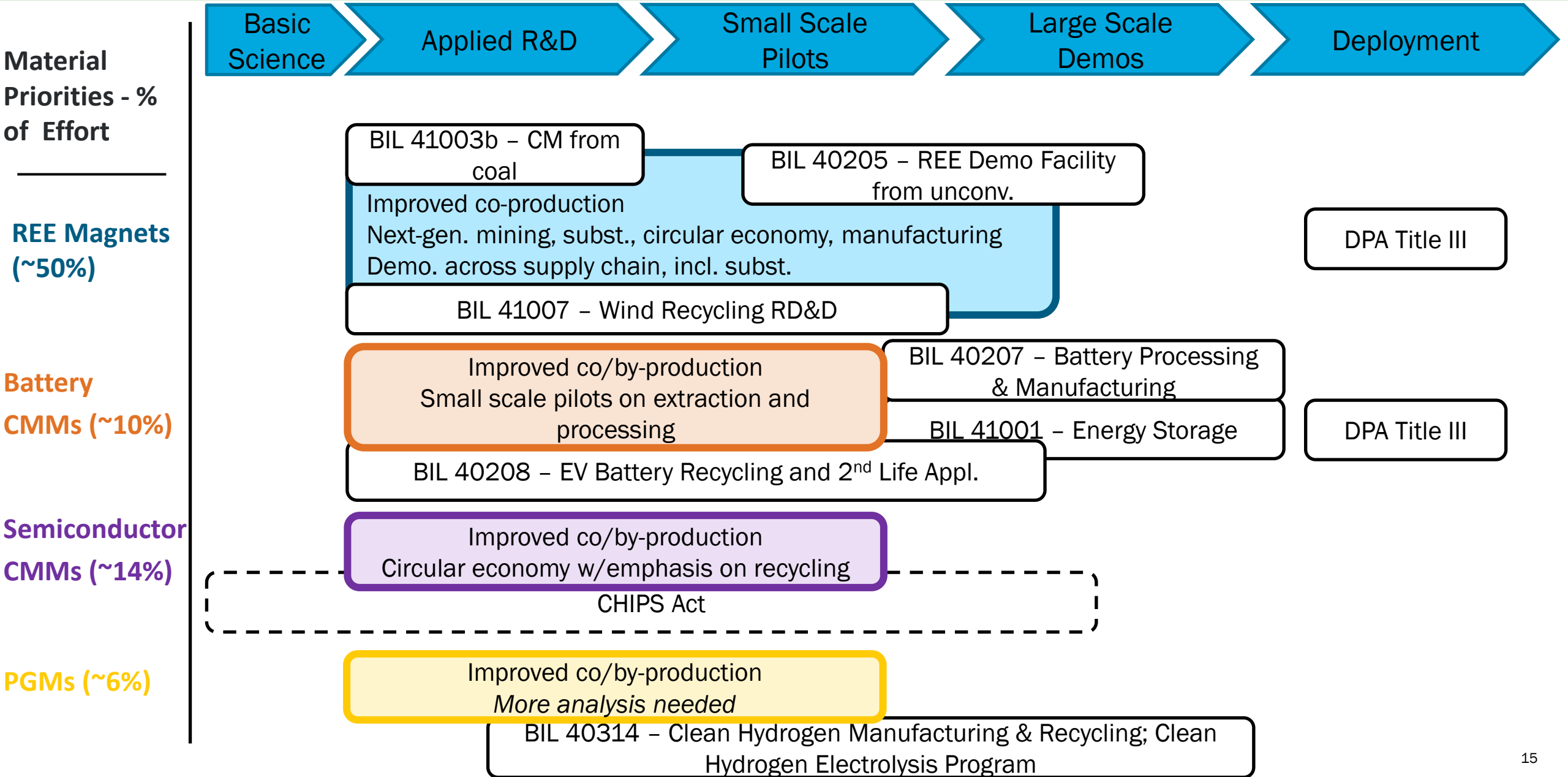
• Neodymium and Dysprosium for magnets	→ Magnets enable efficient electric machines including wind generators, electric and fuel cell vehicle motors, industrial motors
• Lithium, Cobalt, and Nickel for energy storage	→ Batteries are needed for electric vehicles and grid storage to enable high penetration of zero-emission transportation and intermittent clean power generation
• Iridium & Platinum for electrolyzers; Platinum for fuel cells	→ Iridium and platinum for electrolyzers are needed for green hydrogen production and platinum for fuel cells used in transportation and stationary energy storage
• Gallium for wide bandgap semiconductors, LEDs	→ Wide bandgap power electronics enable high voltage power generation (like wind) to connect to the grid
• Germanium for microchips (semiconductors)	→ Microchips for sensors, data, and control play an important role in SMART manufacturing, which will be needed to increase efficiency and minimize waste (inclusion GHGs); Fiber and infrared optics

America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition

Priorities for Critical Materials RD&D



RDD&CA Program Integrated with other USG Efforts



Justice40 Initiative and Environmental & Energy Justice



- **Justice40 Initiative** – Created by E.O. 14008, establishes a goal that **40% of the overall benefits of certain federal investments flow to disadvantaged communities** (DACs).
  - Investments in climate change
  - Clean energy and energy efficiency
  - Clean transit; affordable and sustainable housing
  - Training and workforce development
  - Remediation and reduction of legacy pollution
  - Development of critical clean water infrastructure
- **Environmental Justice** – The fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.
- **Energy Justice** – Refers to the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those disproportionately harmed by the energy system.

Implementation & Community Engagement

- DOE's Program of research, development, demonstration, and commercialization seeks to:
  - Drive innovation and adoption of science and technology to create responsible material extraction, processing and manufacturing
  - Reduce environmental impacts
- DOE is looking for your feedback on:
  - Achieving Justice40 in a meaningful way for communities such as creating economic opportunities
  - Creating benefit and opportunities for communities that holds up principles of equity, environmental and energy justice
  - Develop education and workforce training
  - Understanding concerns and pathways to address them
  - Initiating and maintaining community engagement

Goals for Today

- DOE is in listening mode! We want to hear your ideas and concerns.
- Three breakout discussions:
  1. Equity, Environmental and Energy Justice
  2. Partnering and Engagement with DOE and Awardees
  3. Considerations for Implementation
- Initiate long-term engagement throughout the process of development and implementation
  - Workshops on July 14 and 19 to inform Critical Materials Research Program
  - A Request for Information (RFI) is planned for release mid-to-late July
  - Your input *may* used for DOE planning purposes and funding opportunities

Thank you for your attention!