U.S. DEPARTMENT OF
ENERGY

Office of
ENERGY EFFICIENCY &
RENEWABLE ENERGY

Policies to Bolster Critical Mineral and Material Manufacturing in the United States

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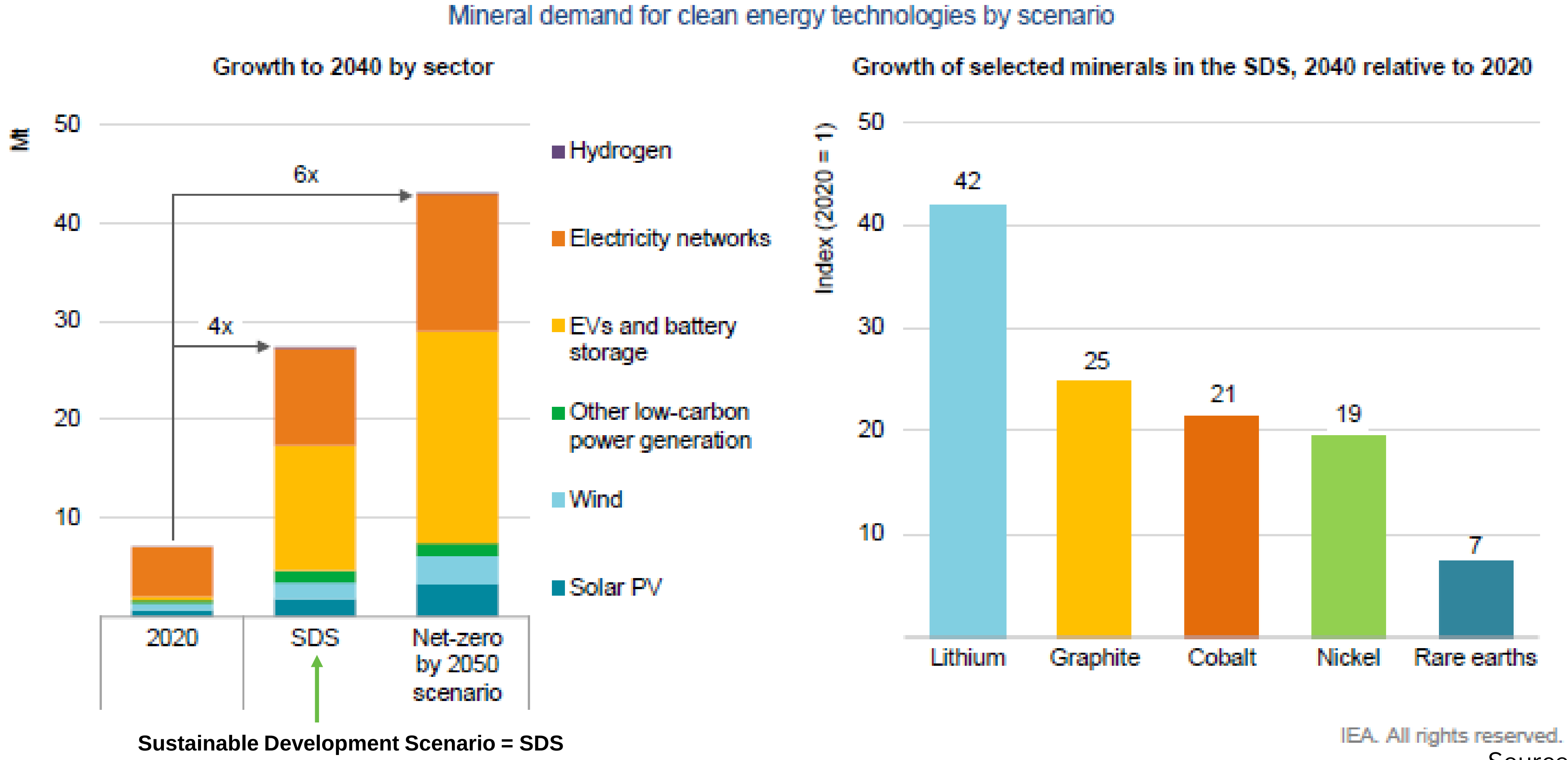
Critical Materials Demand Driven by Decarbonization Goals

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

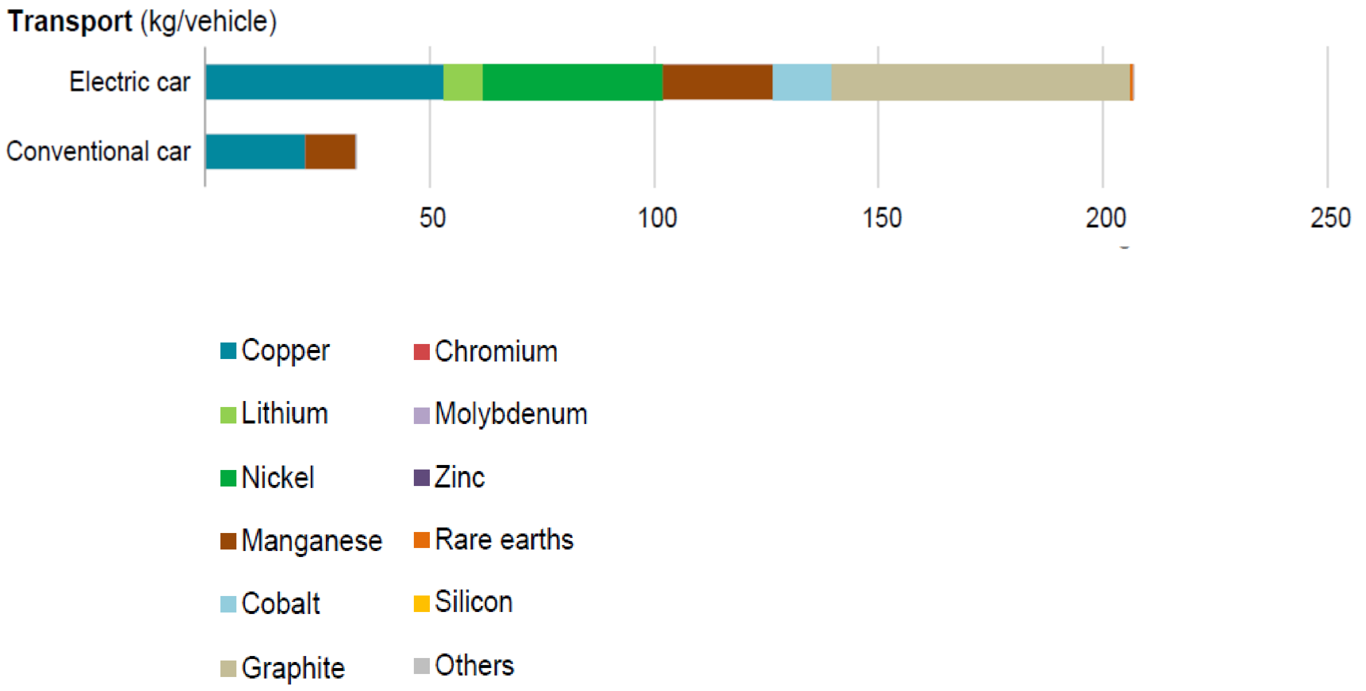


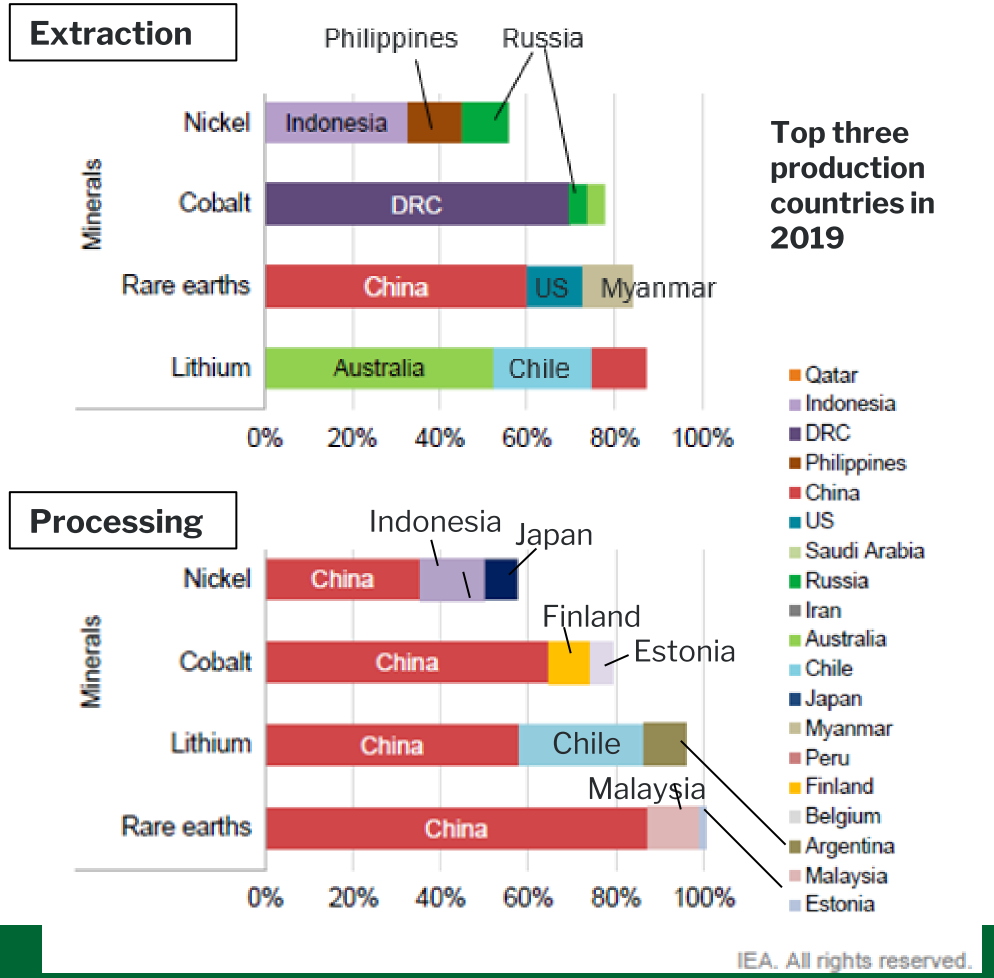
Notes: Mt = million tonnes. Includes all minerals in the scope of this report, but does not include steel and aluminium. See Annex for a full list of minerals.

Source: IEA

A Mineral Intensive Energy Economy

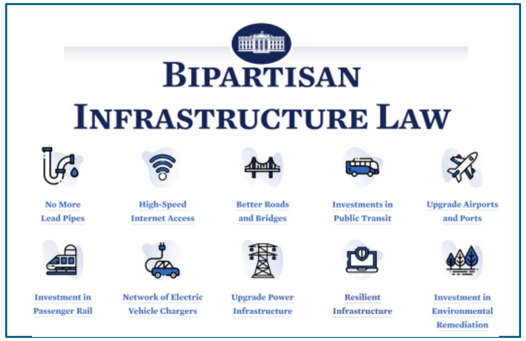
- The transition to a net-zero energy economy may increase mineral demand by up to four times
- A typical electric car requires 6X more mineral inputs than a conventional car
- Mineral extraction and material processing are increasing geographically concentrated





Source: https://www.iea.org/reports/the-role-of-critical-minerals-in-clean-energy-transitions/

Complementary Action to Strengthen U.S. Manufacturing of Critical Materials



February 2021

Executive Order to help create more resilient and secure supply chains for critical and essential goods

- Paired with energy and emission targets set in April

November 2021

BIL establishes a mechanism to mature critical material manufacturing technologies and verify the economics at a scale that allows for de-risking and deployment

- Strategic pillars and material specific approaches

July 2022

IRA incentivizes domestic manufacturing of clean energy technologies through tax credits

- Driving demand for American made components/materials

February 2021: Executive order 14017 to review critical supply chains

April 2021: Energy and emission targets signal shift toward clean energy technology deployment

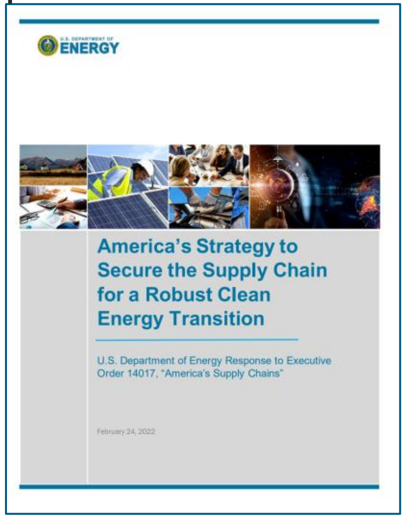
- 100% clean electricity by 2035
  - Supported by 30 GW offshore wind by 2030
- Zero-emission transportation
  - Including 50% EV adoption by 2030

- Supply chain reports contextualize challenges and path forward

June 2021: 100-day critical supply chain review published, one on critical materials, another on large capacity batteries

February 2022: DOE publishes 1-year supply chain reports

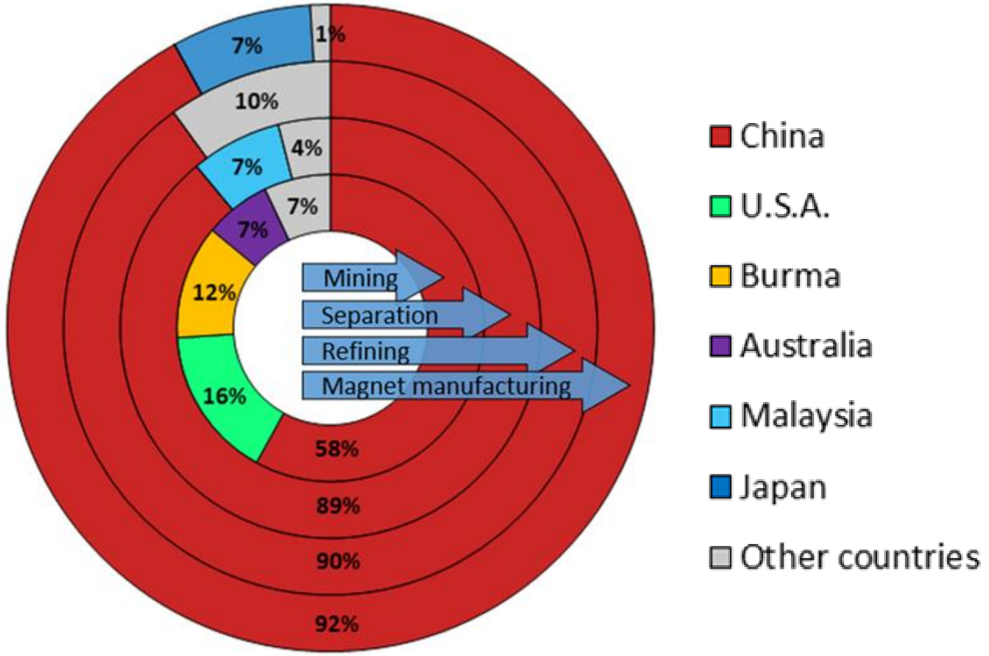
- America's Strategy to Secure the Supply Chain for a Robust Clean Energy Transition
- 13 sectoral deep dives

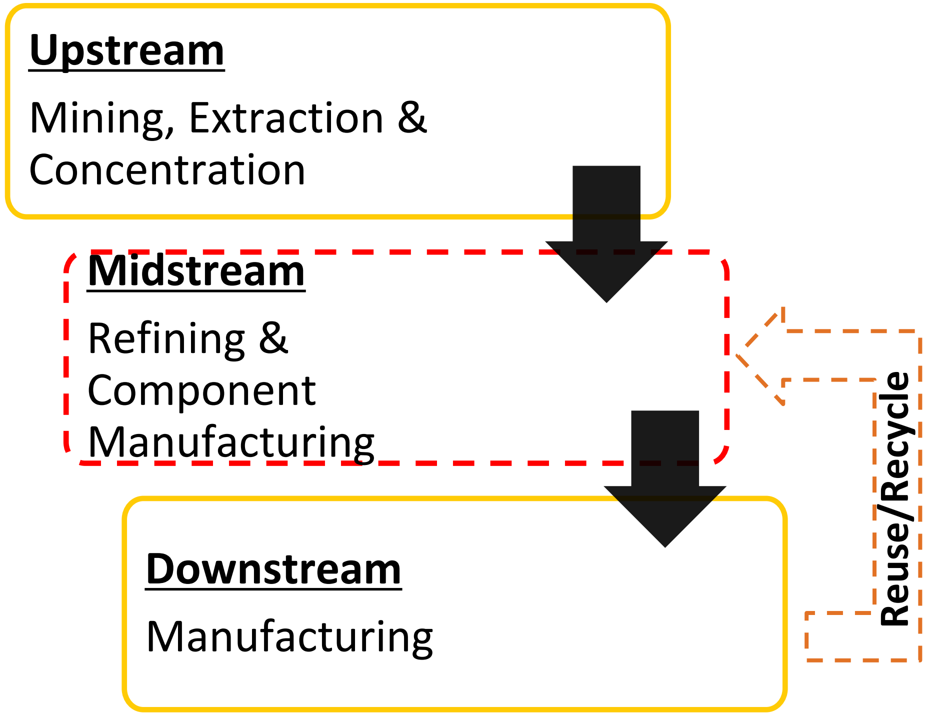


Addressing Critical Material Supply Chain Vulnerabilities

- Supply chain reports contextualize challenges and path forward
  - Gap in midstream processing
    - 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



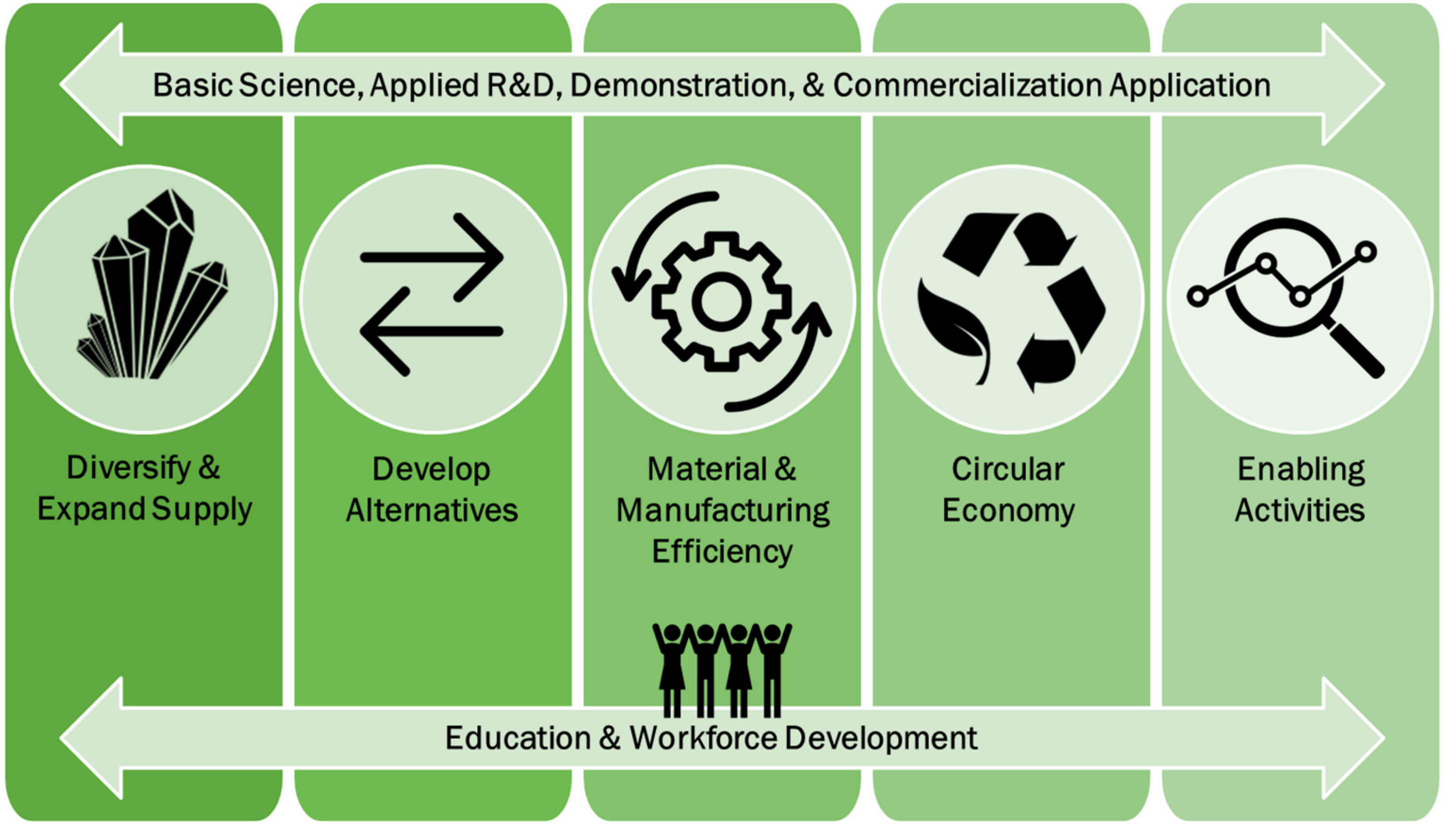


Source: https://www.energy.gov/policy/securing-americas-clean-energy-supply-chain

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.

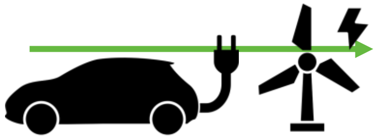
Strategy:



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

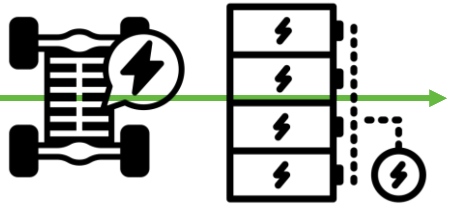
Material by Material Approach

- Neodymium and Dysprosium for magnets



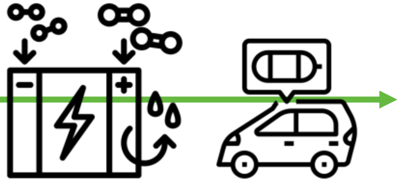
Magnets enable efficient electric machines including wind generators, electric and fuel cell vehicle motors, industrial motors

- 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 for electrolyzers; Platinum for fuel cells

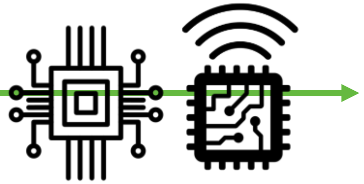


Ir for electrolyzers are needed for green hydrogen production and Pt for fuel cells used in transportation and stationary energy storage

- Gallium for wide bandgap semiconductors

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)

Icons from The Noun

Priorities for Critical Materials RD&D

Material Priorities

Cross-cut | Basic Science | Applied R&D | Small Scale Pilots | Large Scale Demos | Deployment

REE Magnets

Improved co-production
Next-generation mining, substitution, circular economy, manufacturing
Demo. across supply chain, including alternatives

Battery CMMs

Improved co/by-production
Small scale pilots on extraction and processing

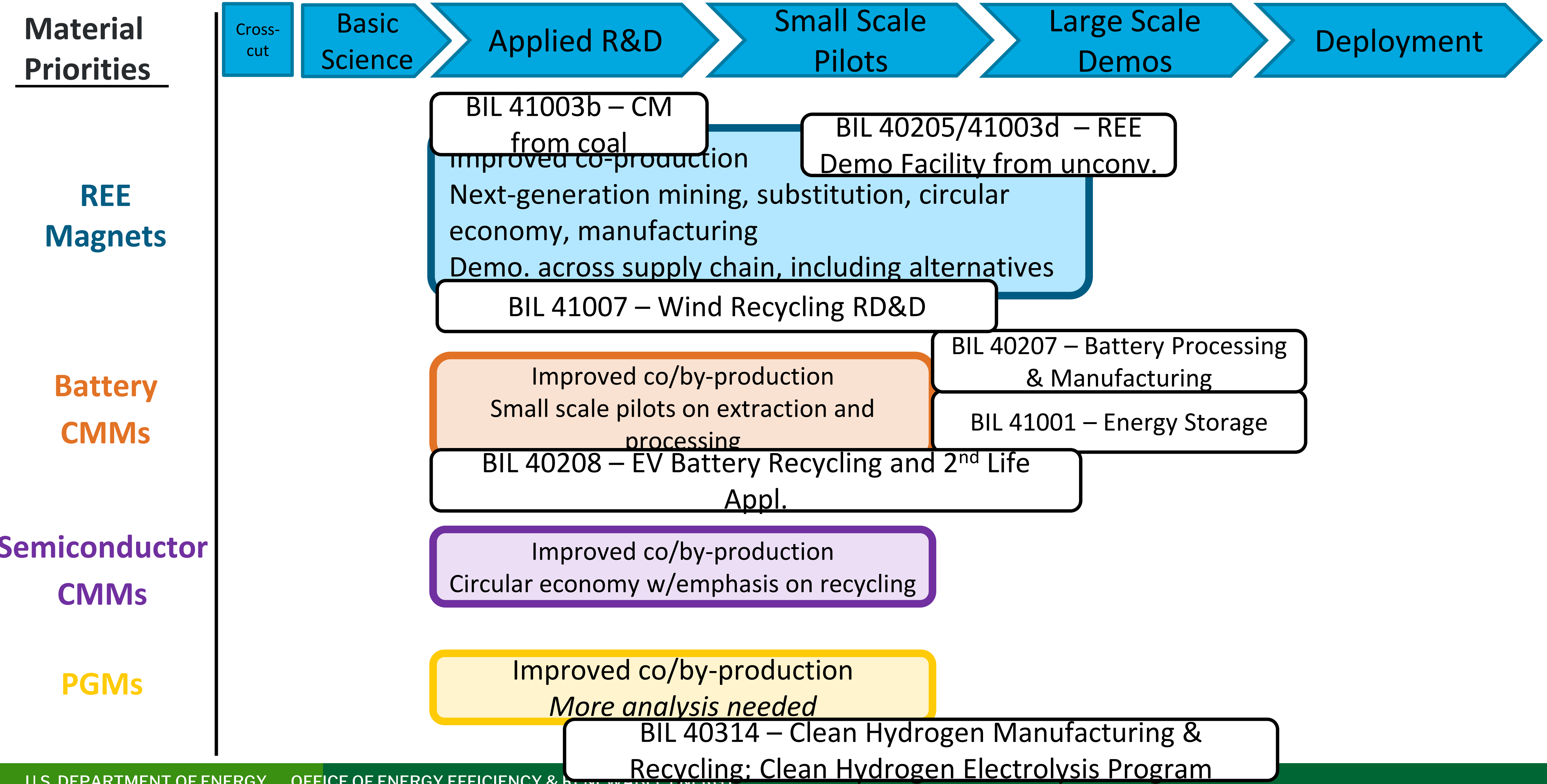
Semiconductor CMMs

Improved co/by-production
Circular economy w/emphasis on recycling

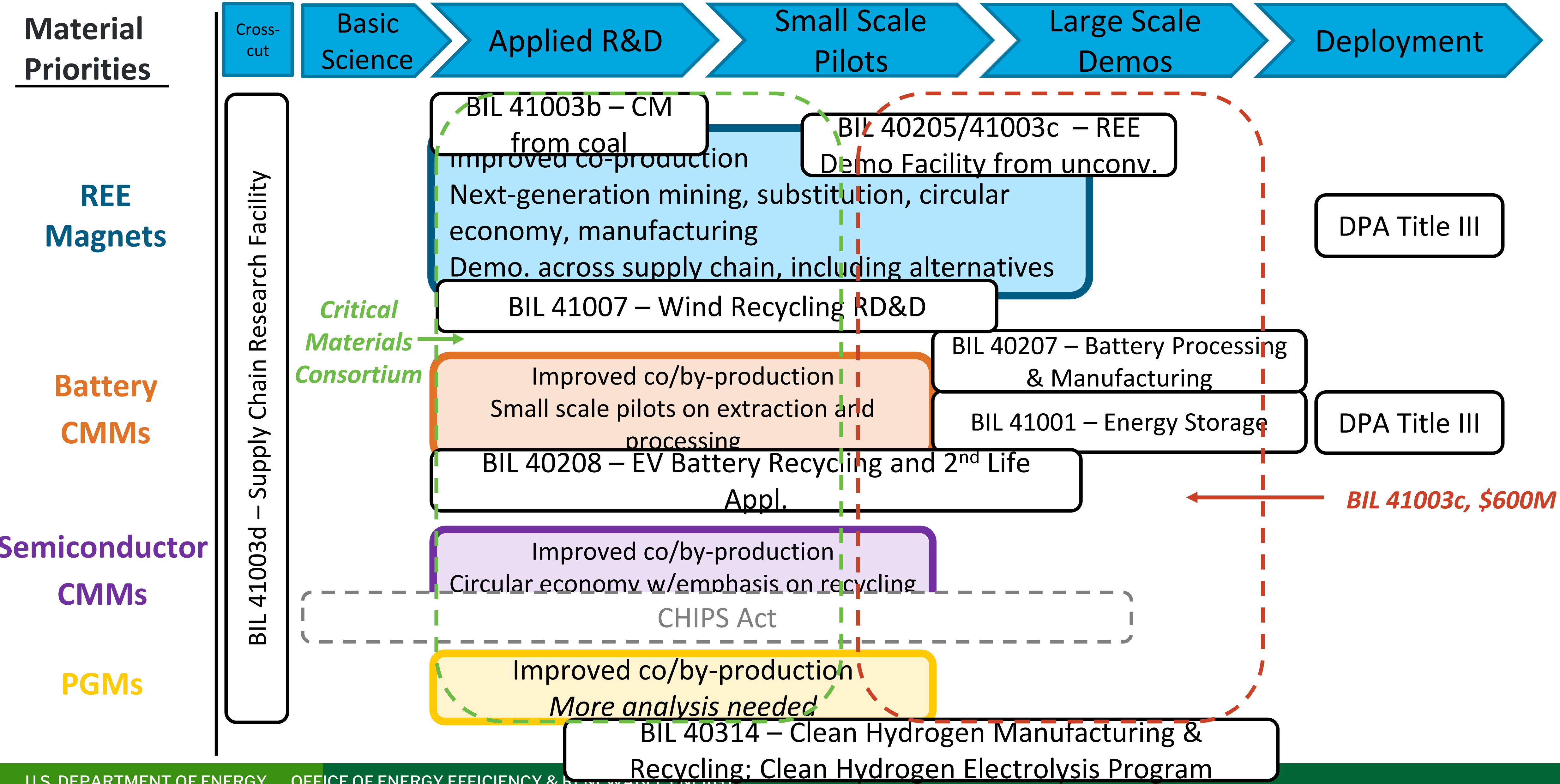
PGMs

Improved co/by-production
More analysis needed

November 2021: BIL Aims Mature & De-risk Manufacturing Tech.

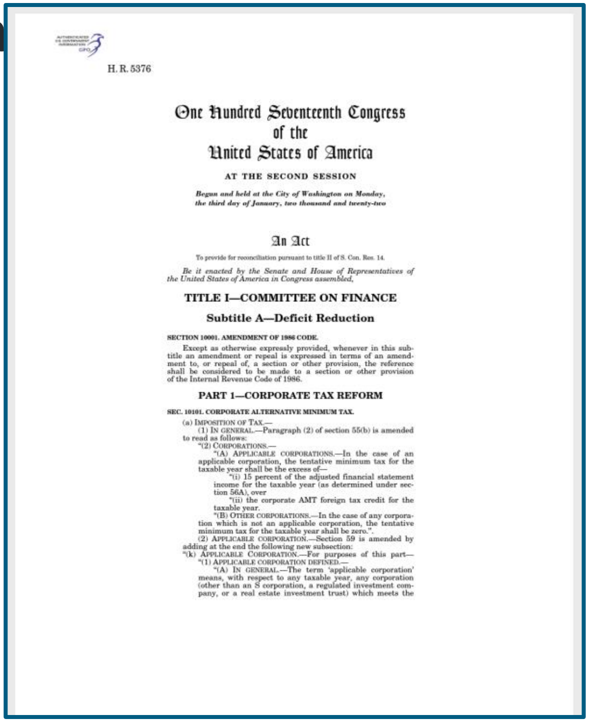


Crosscutting Critical Materials RD&D



July 2022: IRA Incentivizes Domestic Manufacturing of Clean Energy Tech.

- Leverage the purchasing power of our energy and transportation sectors to incentivize domestic manufacturing of clean energy technologies through tax credits
- Drives demand for American made components/m
- Creates jobs



H. R. 5376

One Hundred Seventeenth Congress of the United States of America

AT THE SECOND SESSION

Begun and held at the City of Washington on Monday, the third day of January, two thousand and twenty-two

An Act

To provide for reconciliation pursuant to title II of S. Con. Res. 14.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

TITLE I—COMMITTEE ON FINANCE

Subtitle A—Deficit Reduction

SECTION 10001. AMENDMENT OF 1986 CODE.

Except as otherwise expressly provided, whenever in this subtitle an amendment or repeal is expressed in terms of an amendment to, or repeal of, a section or other provision, the reference shall be considered to be made to a section or other provision of the Internal Revenue Code of 1986.

PART 1—CORPORATE TAX REFORM

SEC. 10101. CORPORATE ALTERNATIVE MINIMUM TAX.

(a) IMPOSITION OF TAX.—

(1) IN GENERAL.—Paragraph (2) of section 55(b) is amended to read as follows:

"(2) CORPORATIONS.—

"(A) APPLICABLE CORPORATIONS.—In the case of an applicable corporation, the tentative minimum tax for the taxable year shall be the excess of—

"(i) 15 percent of the adjusted financial statement income for the taxable year (as determined under section 56A), over

"(ii) the corporate AMT foreign tax credit for the taxable year.

"(B) OTHER CORPORATIONS.—In the case of any corporation which is not an applicable corporation, the tentative minimum tax for the taxable year shall be zero.".

(2) APPLICABLE CORPORATION.—Section 59 is amended by adding at the end the following new subsection:

"(k) APPLICABLE CORPORATION.—For purposes of this part—

"(1) APPLICABLE CORPORATION DEFINED.—

"(A) IN GENERAL.—The term 'applicable corporation' means, with respect to any taxable year, any corporation (other than an S corporation, a regulated investment company, or a real estate investment trust) which meets the

$30B

Production tax credits to accelerate U.S. manufacturing of solar panels, wind turbines, batteries, and critical minerals processing

$10B

Investment tax credit to build clean technology manufacturing facilities, like facilities that make electric vehicles, wind turbines and

$0.5B

In the Defense Production Act for heat pumps and critical minerals processing

$2B

In grants to retool existing auto manufacturing facilities to manufacture clean vehicles

July 2022: IRA Incentivizes Domestic Manufacturing of Clean Energy Tech.

IRA 45X - Advanced Manufacturing Credit

Eligible components under section 45X include photovoltaic cells and wafers, solar grade polysilicon, polymeric backsheets, solar modules, wind energy components, torque tubes, structural fasteners, electrode active materials, battery cells, battery modules, and certain critical minerals. Subject to certain additional calculations, the amount of the total credit is the sum of the amounts corresponding to each eligible component.

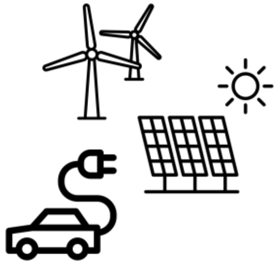
IRA 48C - Advanced Energy Project Credit

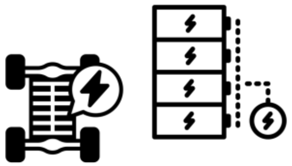
The are expansions to the list of manufactured products that will qualify for the advanced energy project credit **to include facilities that also recycle qualifying property** in addition to facilities that manufacture certain renewable energy components Second, qualifying property and components will include products designed to be used to produce energy from water, along with those designed to be used to produce energy from the sun, wind, geothermal deposits, and other renewable resources.

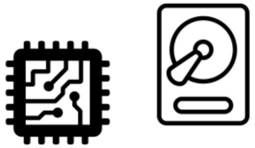
Critical Material Sources

- Mining and separation from virgin feedstocks
- Byproducts and coproducts
- Geothermal Brine

- Coal ash, tailings, and acid waste from decommissioned coal mines
- Decommissioned oil and gas wells and clays





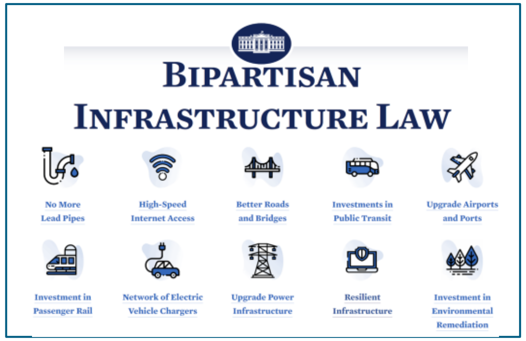


- Recycling end of life energy technologies
  - Wind turbines
  - Solar cells
  - Vehicle and mobility motors
- Recycling of end of life batteries
  - EV Batteries
  - Mobile devices
- Recycling of electronics
  - Hard disk drives
  - Microelectronics

- Greatest barriers to development and deployment is technoeconomic feasibility
- Technoeconomics closely tied to critical material concentration in a feedstock

- Collection, separation, traceability, and transparent standards and operation can help create more concentrated waste streams for more efficient CM production

Complementary Action to Strengthen U.S. Manufacturing of Critical Materials



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Thank You