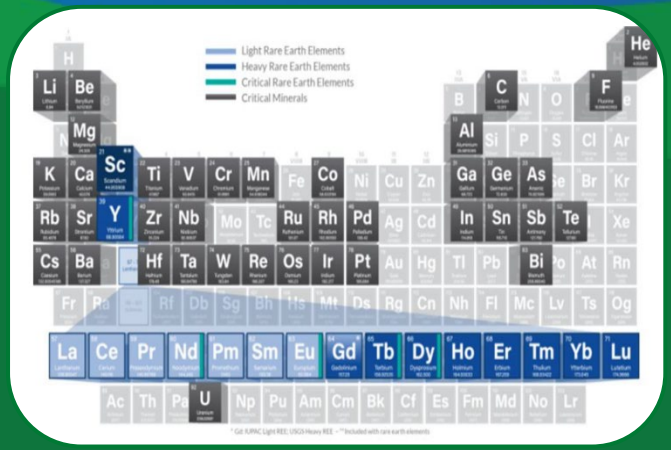
U.S. DEPARTMENT OF ENERGY

Fossil Energy and Carbon Management

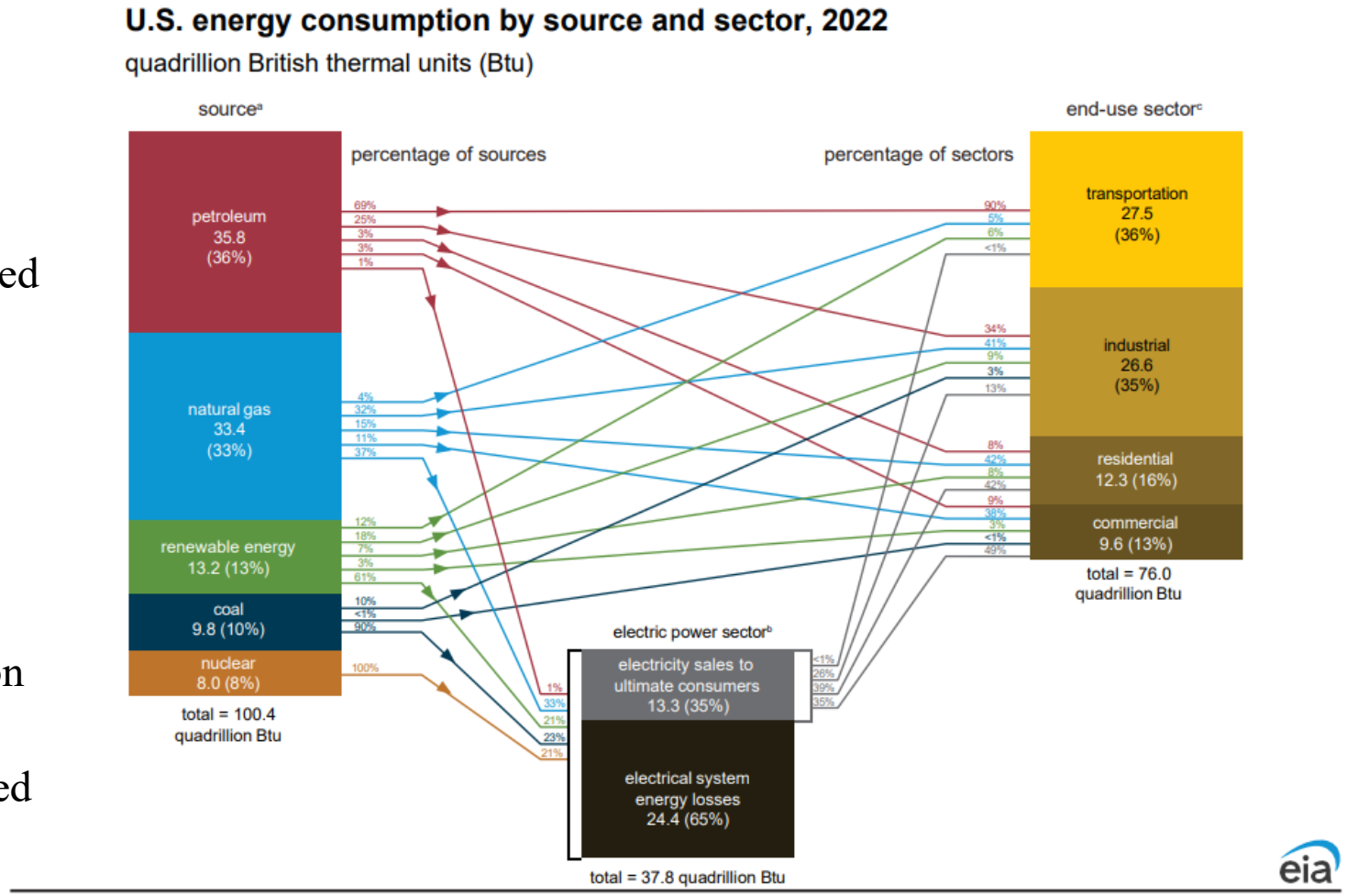
Office of Resource Sustainability

May 9, 2024



Role of Resource Sustainability in the Energy Mix

- The United States continues to produce and use historically high levels of oil and natural gas
- Mounting concern over climate change have increased attention to reducing emissions from fossil energy production and use
- Fossil fuels will continue to provide a significant portion of domestic energy consumption as the U.S. transitions to a clean energy economy
- FECM's Office of Resource Sustainability focuses on developing technologies that will reduce the environmental impacts of our historical and continued dependence on coal, oil, and natural gas



Reducing the environmental impacts associated with the production, transportation, and storage of oil and natural gas is critical to achieving net-zero emissions.

Office of Resource Sustainability

Design and administer activities associated with technologies and approaches that will reduce the environmental impacts of our historical and continued dependence on coal, oil, and natural gas

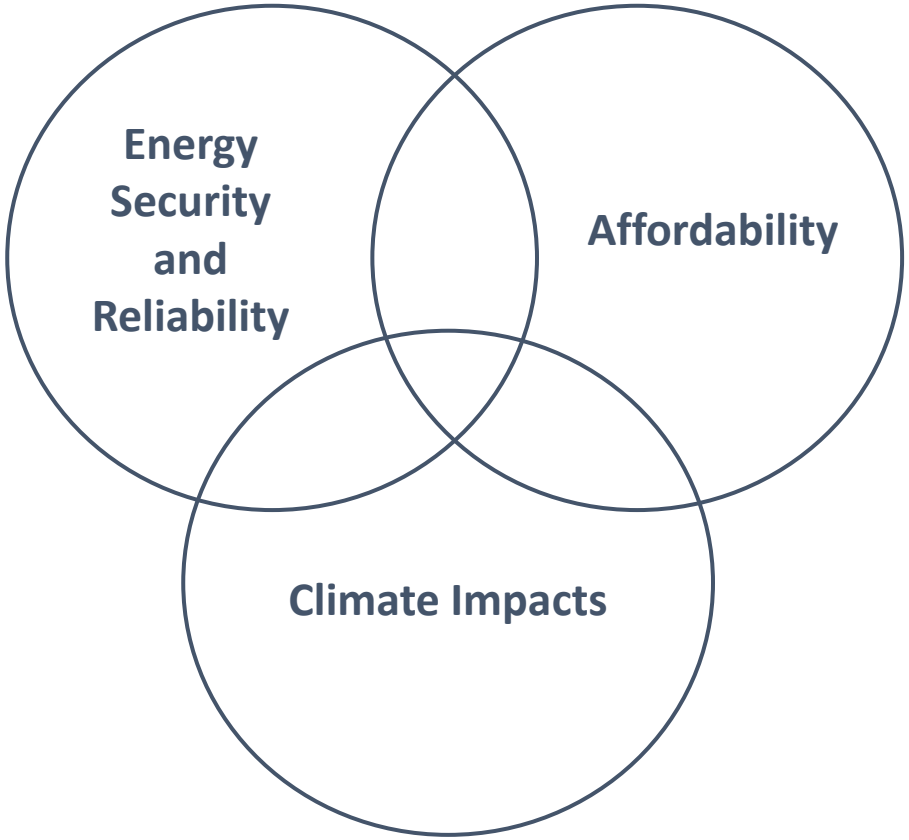
- Reduce environmental impacts and emissions associated with ***fossil energy development, use, transportation and storage*** - produced water, abandoned mine remediation, methane
- Improve the economics and reduce environmental impacts of ***critical minerals extraction, processing, use and disposal***
- Regulate the ***import and export of natural gas***
- Conduct analysis of ***oil and natural gas markets***
- *Assess policy and regulatory frameworks for* ***fossil fuels and critical minerals***
- Accomplish these goals through ***policy, research, innovation, outreach, and stewardship***

Role of Resource Sustainability in Addressing the Energy "Trilemma"

The Office of Resource Sustainability is focused on reducing the environmental impacts associated with the production, transportation, and storage of fossil fuels to achieve net-zero emissions.

The Office's work is primarily focused on natural gas, and supports a vision to:

- Meet the energy security and reliability needs of the U.S. and our allies.
- Decarbonize the natural gas value chain and mitigate methane emissions domestically and internationally on a trajectory consistent with achieving net-zero greenhouse gas emissions by midcentury.
- Support American consumers and ensure the competitiveness of U.S. industry and manufacturing.



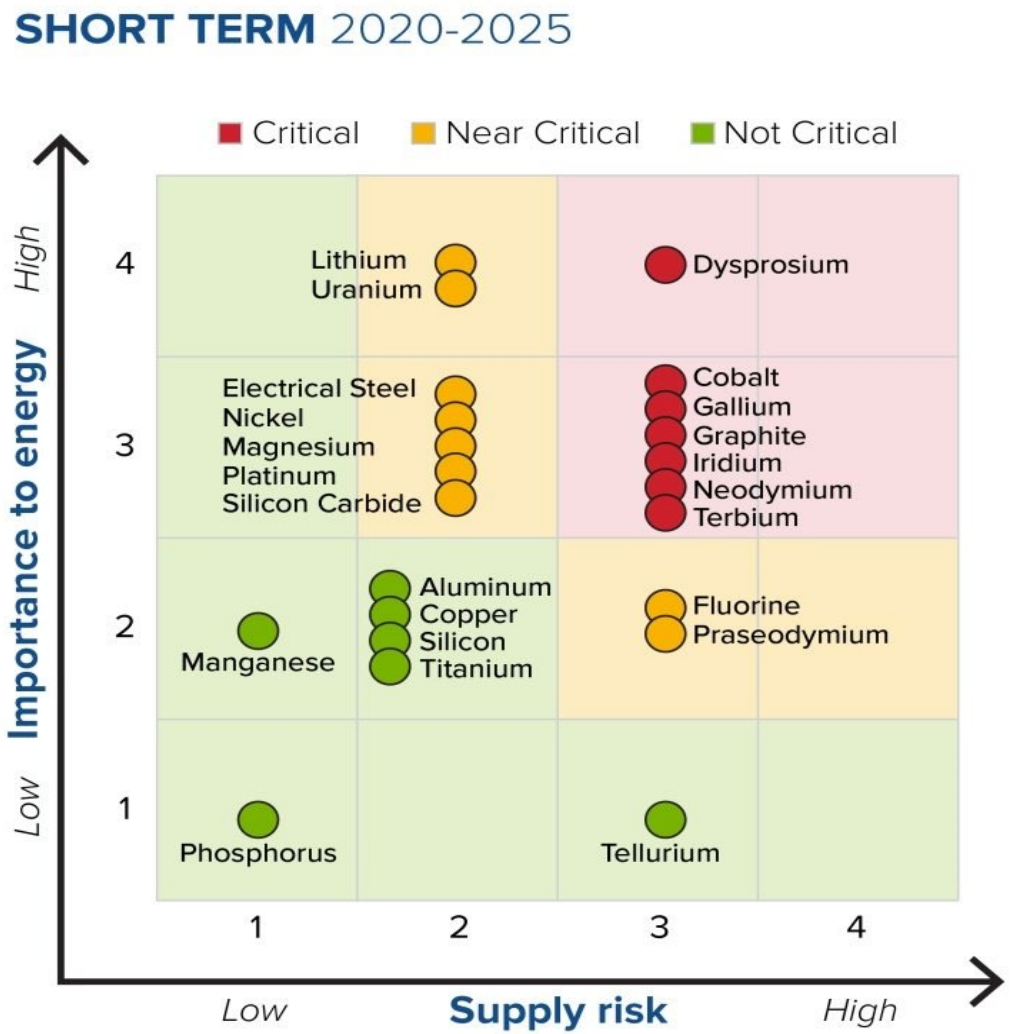
Reduce emissions and environmental impacts from fossil fuels while ensuring energy security for the U.S. and providing affordable and reliable supplies to American consumers and manufacturing.

Current Program Areas

Adv. Remediation Technologies	• Research and solutions for the environmentally sustainable production and use of oil and natural gas resources. • Water management research including for produced water treatment and reuse technologies. • Methane Hydrates characterization and environmental assessments.
Methane Mitigation Technologies	• Develop new technologies to reduce or eliminate methane emissions across the natural gas supply chain in the United States. • Develop advanced technologies that will result in a significant reduction of methane emissions from natural gas production due to venting or flaring activities. • Transformational concepts for decarbonized, clean hydrogen from domestic natural gas resources.
Minerals Sustainability	• Technologies to improve critical mineral economics, and reduce the environmental impacts of mineral extraction, processing, and use. • Geological characterization, sustainable mining, concentration and processing, and separation and metallization technology development.
Engagement	• Provide expertise in support of engagements and initiatives with government, non-profit, academia and industry entities related to fossil fuel mitigation and support energy justice goals associated with legacy fossil fuel production and use.
Policy and Analysis	• Analyze fossil energy market developments and trends in support of the Administration's energy transition and other policy goals.
Regulation	• Review applications for the import and export of natural gas, including liquefied natural gas (LNG).

Critical Minerals and Materials

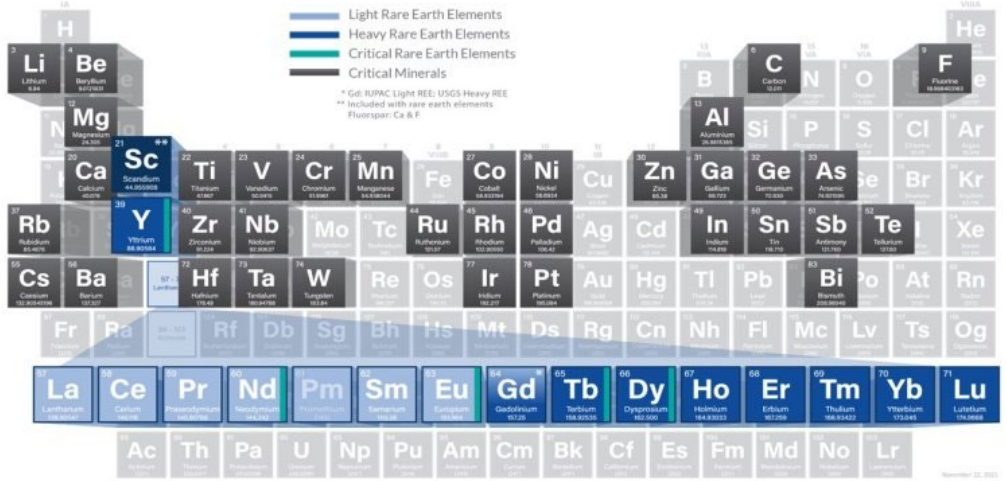
- In 2023, the Department of Energy released its Final 2023 Critical Materials List.
- This list includes critical materials for energy, as determined by the Secretary of Energy, as well as those critical minerals on the 2022 final list published by the Secretary of Interior.
- Based on this and the 2023 DOE Critical Materials Assessment, DOE created short- and medium- term criticality matrices for critical minerals and materials.



Critical Minerals and Materials Pillars and CMC

Critical Mineral and Material Pillars

1. Diversify and Expand Supply
2. Develop Alternatives
3. Materials and Manufacturing Efficiency
4. Circular Economy



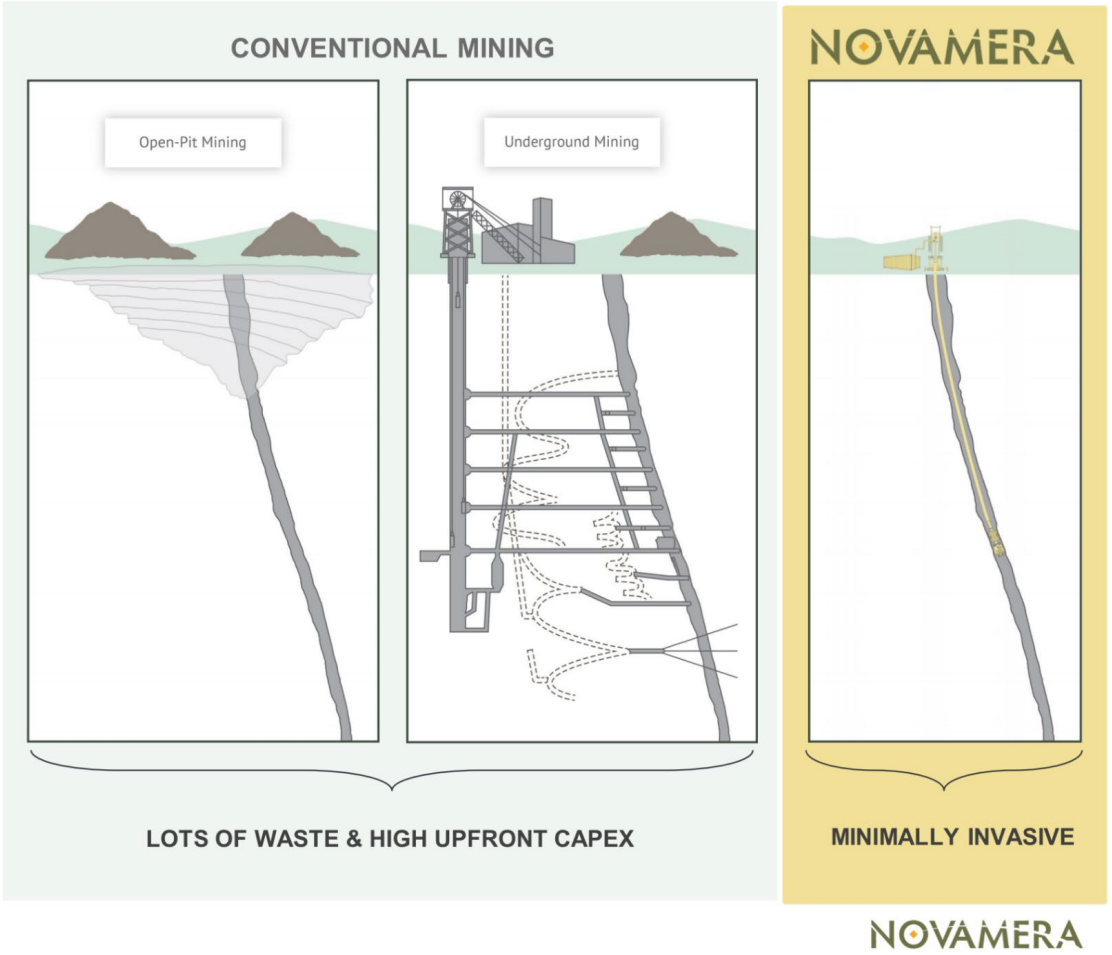
The Critical Materials Collaborative (CMC)

- Accelerates critical materials applied RDD&D.
- Coordinates across the U.S. government interagency.

Advanced Critical Material Recovery

Opportunity to capitalize on recent efforts to revolutionize mining technology

- Take a “laparoscopic” approach
  - No removal of overburden
  - No big hole to be filled
  - No workers underground
  - Minimized impact on water (aquifers, rivers, streams)



Novamera is a gold mining/drilling company that is applying a similar approach now

Future Mining Expected Outcomes

- Acceleration of exploration-to-production timeline – cutting target time in half
- Achieving the “Mine of the Future” vision
  - Low to zero emission mining technologies and practices
  - New technologies for getting “everything” out of a mineral deposit
  - Small “footprint” mining
  - A low-impact national strategy for tailings management, re-use and extraction
- Ensuring a trained workforce concurrent with activity increase
- Improved image of sector – combination of clean technologies and public engagement
- Key support to regulatory agencies – ensuring regulatory adoption of innovation and tested new approaches

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