CORE-CM WILLISTON BASIN

CARBON ORE, RARE EARTH, AND CRITICAL MINERALS

EERC UND UNIVERSITY OF NORTH DAKOTA

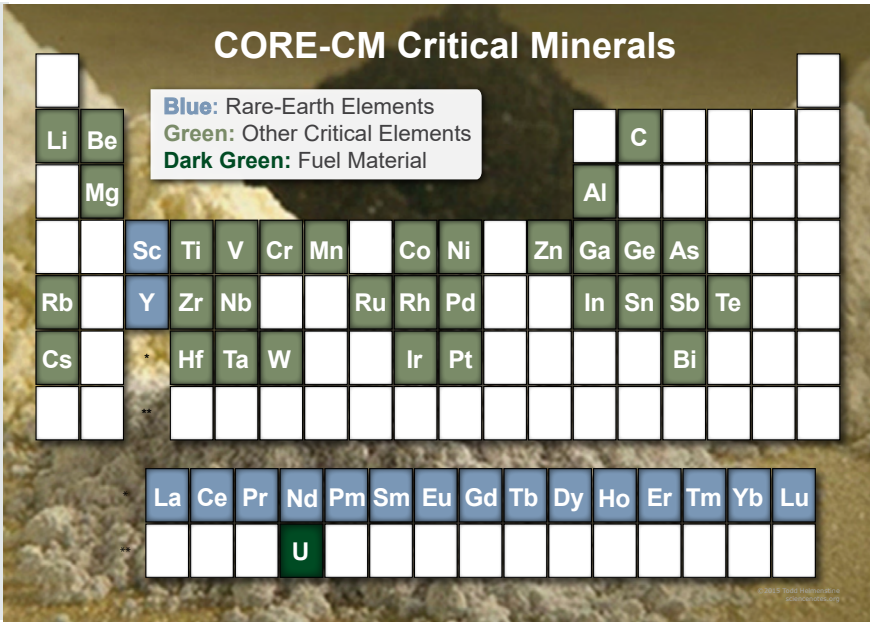
THE WILLISTON BASIN Carbon Ore, Rare Earth, and Critical Minerals (CORE-CM) Initiative is setting the stage for future expansion and transformation of coal use within the Williston Basin for the production of critical minerals (CMs), including rare-earth elements (REEs) and nonfuel carbon-based products.

Current research is focused on building partnerships; assessing resources, markets, and infrastructure; identifying data gaps; and establishing potential technology and business development pathways. Anticipated project outcomes include a database of known CM resources, e.g., coal deposits and waste streams; plans to address infrastructure and supply chain gaps; recommendations for CORE-CM technology development; and technology training and outreach plans.

WHAT MAKES A MINERAL CRITICAL?

With high demand and limited supply, these minerals and their elements are essential for everything from vehicles and mobile phones to food preservation and health care. Most elements are critical because no substitute exists. For example, chromium's unique properties are critical to the formation of stainless steel. REEs, in particular, enable portability, miniaturization, and technological advances; it takes nine different REEs to make an iPhone:

Y – yttrium	*Pr – praseodymium*	*Gd – gadolinium*
La – lanthanum	*Nd – neodymium*	*Tb – terbium*
Ce – cerium	*Eu – europium*	*Dy – dysprosium*



WHAT IS THE BENEFIT OF THE CORE-CM PROJECT?

The overall goal is to secure a domestic supply of materials essential to health care, high technology, national security, and clean energy, which may catalyze economic growth and job creation. The United States currently imports most of the CMs and REEs needed for manufacturing, leaving the nation's economy vulnerable to supply chain disruption and raising concern about future demand for these metals. These imports include both raw materials and finished products. Developing a domestic supply chain would bring about sustainable opportunities for mining communities and extended usefulness for existing infrastructure.

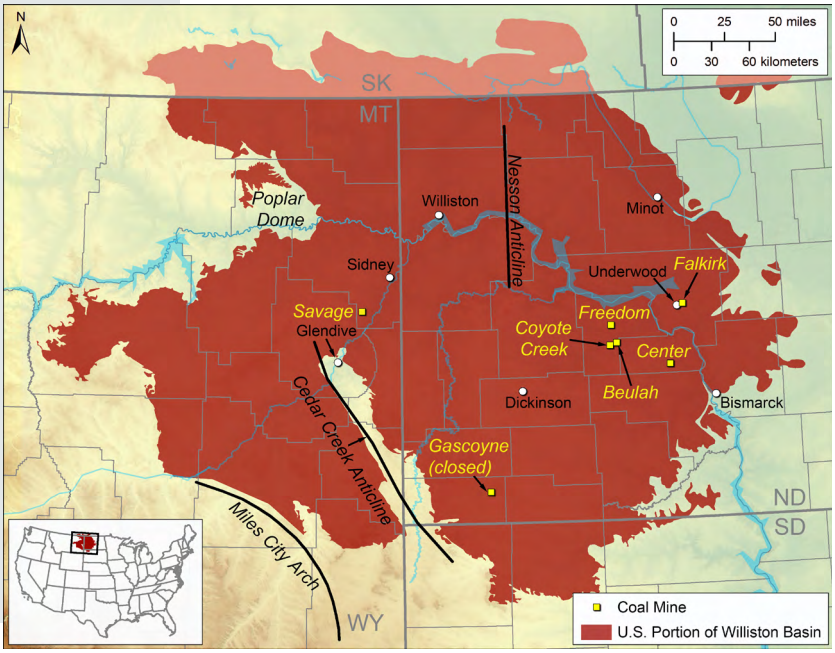
WHY IS CARBON CRITICAL?

Carbon comes in many forms. Although coal is plentiful in the United States, another form of carbon, natural graphite, is not. Graphite is used in heat-resistant materials and is also essential for batteries, brake linings, lubricants, pencils, and steelmaking. Currently, the United States imports 100% of the graphite it needs.[2]

WHY IS THE WILLISTON BASIN IMPORTANT?

The Williston Basin is a large sedimentary basin spanning western North Dakota, eastern Montana, southern Saskatchewan, and northwestern South Dakota. It has a rich and extensive history of producing critical resources for the United States and contains more than 800 years of lignite coal at existing rates of use.

Significant research has characterized REE and CM content in the lignite coals and combustion by-products of the basin, as well as exploration of technologies for extraction of these components. Additionally, the Williston Basin contains extensive infrastructure for mining, transport, and resource processing. The region's energy producers follow established protocols for worker safety and environmental protection. In short, the building blocks of a future industry developing a domestic supply chain of CMs are already present.



WHY LIGNITE COAL?

Recent research has focused on the production of graphene, graphite, and carbon-based building materials from lignite coal. Coal is, however, more than carbon. Its structure includes minerals that are not consumed during combustion. These combustion by-products are promising potential sources of REEs and CMs and a starting point of this project's research and development.

WILLISTON BASIN CORE-CM AND DOE'S CORE-CM INITIATIVE

The Williston Basin project is one of 13 projects funded under the U.S. Department of Energy's (DOE's) CORE-CM Initiative. The Initiative seeks to catalyze regional economic growth and job creation by realizing the full potential value of natural resources, such as coal, across basins throughout the United States. The Williston Basin CORE-CM project was awarded by DOE's Office of Fossil Energy and Carbon Management through a competitive process.

PROJECT TIMELINE

Work began in October 2021 and wil continue to March 2024. The project is expected to continue through a competitive award process based on current project outcomes.

References

[1] National Energy Technology Laboratory, 2021, Critical minerals sustainability program: www.netl.doe.gov/coal/rare-earth-elements/program-overview/background (accessed 2022).

[2] U.S. Geological Survey, 2021, Mineral commodity summaries 2021: U.S. Geological Survey, 200 p., https://doi.org/10.3133/mcs2021, p. 72–73 (accessed 2022).

The Williston Basin CORE-CM Initiative is developing a pathway to critical minerals extraction and processing using existing coal-based resources.

Led by the Energy & Environmental Research Center, research partners include the University of North Dakota's Institute of Energy Studies and Nistler College of Business Administration, North Dakota State University, Pacific Northwest National Laboratory, Montana Technological University, and the Critical Materials Institute. Funding partners include DOE, the North Dakota Industrial Commission Lignite Research Program, North American Coal, BNI Energy, Minnkota Power Cooperative, and Basin Electric Power Cooperative.

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Learn more at **undeerc.org/wb-corecm**.

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