Mines Welcomes Whole Value Chain Carbon Capture, Utilization, and Storage (CCUS)

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Mines: An inclusive culture of excellence in research and innovation – interdisciplinary and collaborative, creating positive societal impact.

MINES: By the Numbers AY2024-2025

8246 students

(6,210 UG, 1,856 Grad w/729 PhD)

(55% CO, 8% Int; 34%/66% W/M)

374 academic faculty

(234 T/TT, 126 TF, 14 PoP's; 34%/66%W/M)

$37M state investment

(6.7% contribution to FY24 budget)

$21,914 resident UG tuition & fees

"R1" Research Carnegie Classification

(**$136M research awards / $164M research expenditures)

Student Success

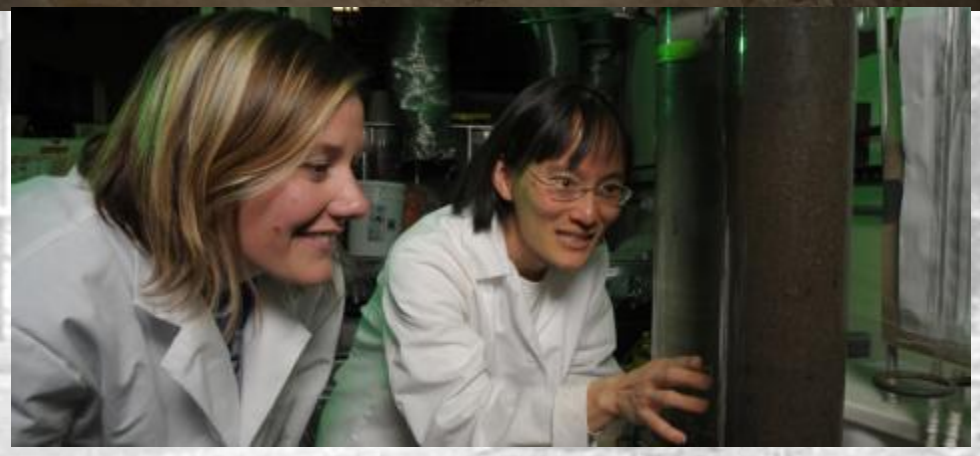
(93.8% FTF Retention; 70%/81% 4/6-year Grad Rate;

94% BS/95% MS/98% PhD six-month Positive Employment Outcomes)

What Matters to Mines

- **Signature Student Experience** –
  - Relevance, leadership, entrepreneurship
  - Mines graduates highly sought after
- **Solving complex problems - earth, energy and environment**
  - Intersecting disciplines working together
  - Cradle-to-cradle / full systems understanding
- Right size: Selective, Deliver globally respected Research, Science & engineering education, Business acumen, Innovation impacts, Pragmatic.
- **Strong partnerships**
  - Industry, federal labs *(e.g., DOE national labs, USGS, NASA, NIST, NOAA, NCAR, DOD labs,…)* government, universities, community, international)


Edgar Mine - Experimental Station



Mines – Internationally Recognized Leadership

- In the **Top 3** of U.S. 'elite' energy programs - Geosciences, Petroleum Engineering - and Hydrology & Water Resources *(2022 US News & World Report, 2020 Hecht, StateUniversity.com)*
- #1 **mineral and mining** engineering program in the world *(2023 QS World University Rankings)*
- #2 U.S. university for combining **research** and **instruction** *(Wall Street Journal, 2020)*
- #2 **Return on Investment** *(Money, 2022)*
- #3 **Best U.S. Engineering** Colleges *(Money, 2022)*
- #4 **Brainiest** Colleges *(Lumosity 2020)*

- Academic lead for DOE **Critical Materials** Institute
- Lead university for **Materials Science**
- First-of-its kind U.S. program for **Carbon Capture, Utilization and Storage**
- **Top Nuclear Science and Engineering** program focus includes **radiochemistry, space nuclear, SMRs**
- Principal partner with USGS for **TRIGA reactor**
- **Research expertise** in **Energetic materials** and **Materials in Extreme conditions**
- Leader for U.S. **Robotics** programs
- First U.S. **Quantum engineering** programs
- Earth Observation Group unique satellite **resource-mapping** expertise, emissions tracking, USGS partnership
- **Sustainable materials** stewardship expertise, including **nuclear energy** systems
- **Humanitarian Engineering** programs and global sustainability projects, ESG focus

Earth, Energy, Environment, Foundations, Fundamentals & Frontiers

Mines Pillars of Research and Innovation: focus on solving the world's most critical science and engineering challenges

Earth Exploration

Understanding our planet & responsibly developing its resources

Mines researchers are building a better understanding of Earth's structure, natural processes, and changing environments to predict and mitigate natural hazards, understand environmental cycles, address climate change, and locate and access critical resources with minimal impact on the planet.

Foundations of Responsible Innovation

Building solutions in global context

Mines scientists and engineers integrate social, cultural, ethical, economic, policy, and environmental considerations into their work to improve our world through impactful and responsible research and innovation.

Integrated Energy Solutions

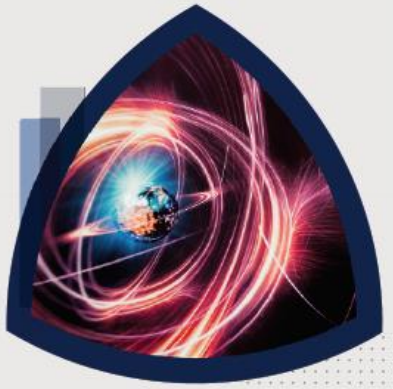
Powering the future

Balancing ever-growing demands for affordable, reliable, and climate-conscious energy, Mines researchers are leaders in finding solutions that reduce emissions, boost energy efficiency and storage, use alternative and renewable sources and fuels, and improve grid reliability.

Fundamentals of Scientific Discovery

Expanding our understanding of the world

Researchers across Mines drive discovery and innovation by using advanced technology and computing to enhance our understanding of the matter, forces, and interactions that govern our universe.



Sustainable Environment & Climate

Protecting our planet

Environmental sustainability and climate change mitigation are central to research at Mines, where scientists advance projects aimed at purifying water, soil, and air while driving cleaner energy production, resource extraction, and manufacturing practices.

Science & Engineering Frontiers

Pushing the boundaries of what's possible

Mines researchers explore the frontiers and push the boundaries of science to accelerate breakthroughs in computing, robotics, space exploration, advanced materials and manufacturing, biotechnology, and beyond.

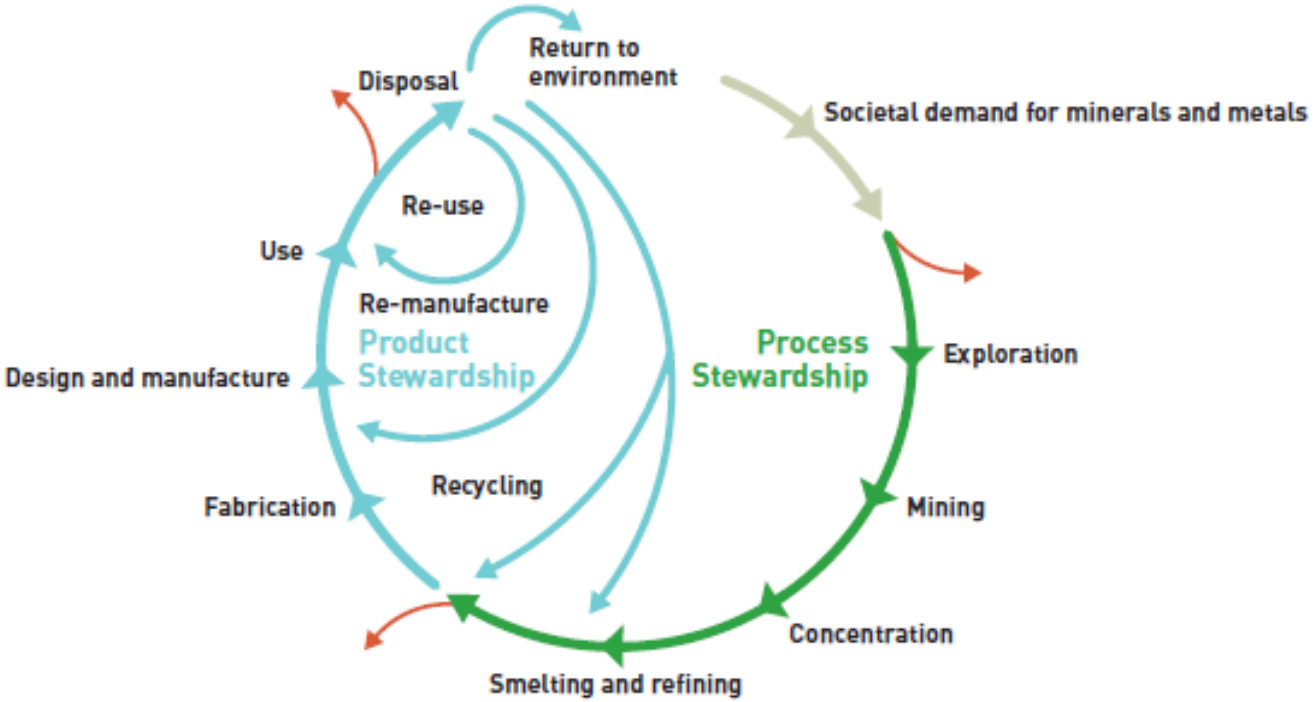
Full Spectrum Energy Portfolio

- Mining, Critical Minerals & Materials
- Advanced manufacturing / decarbonization
- Hydrogen
- Climate & energy nexus
- Carbon capture, utilization & storage
- Geothermal
- Hydrology and Water-energy nexus
- Oil & Gas
- Nuclear
- Wind
- Photovoltaics
- Fuel cells
- Energy storage / Batteries
- Membranes
- Sustainability
- Policy

Comprehensive Mines energy research portfolio, tightly coupled with industry, federal labs and national and international governmental agencies ensure realistic energy perspectives

Leading University for Materials Science

Cradle-to-Cradle Focus



Research themes include:

- Sustainability, mineral exploration, processing, business & economics
- Critical minerals / Mining engineering
- Materials engineering in metals and alloys, ceramics, smart materials, and much more
- Humanitarian engineering, societal benefit, ESG
- Supply chain
- Metrology and Standards
- Advanced manufacturing
- Robotics and automation
- Space resources
- Extraction and recycling

The Payne Institute for Public Policy

COLORADO SCHOOL OF MINES

A SCIENTIFIC, DATA DRIVEN APPROACH TO INFORMING THE GLOBAL ENERGY FUTURE

Leverages Mines' broad technical expertise throughout the energy system to create a comprehensive understanding of future energy opportunities and challenges

- Convening Thought Leaders
- Research
- Education
- Events
- Global partners

Native American Mining & Energy Sovereignty

The Payne Institute for Public Policy AT COLORADO SCHOOL OF MINES

Native American Mining and Energy Sovereignty Symposium
May 20-21, 2025
Sky Ute Casino Resort, Ignacio, Colorado

COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

Mines Global Energy Future presents

The New Map: Energy, Climate and the Clash of Nations

Daniel Yergin, Vice Chairman, IHS Markit
Thursday, Jan. 21 | 9 a.m.

Daniel Yergin, a highly respected authority on energy, international policy and economics and Pulitzer Prize-winning author, will discuss his latest book, "The New Map: Energy, Climate, and the Clash of Nations." Yergin is the proud recipient of an honorary degree from Colorado School of Mines.

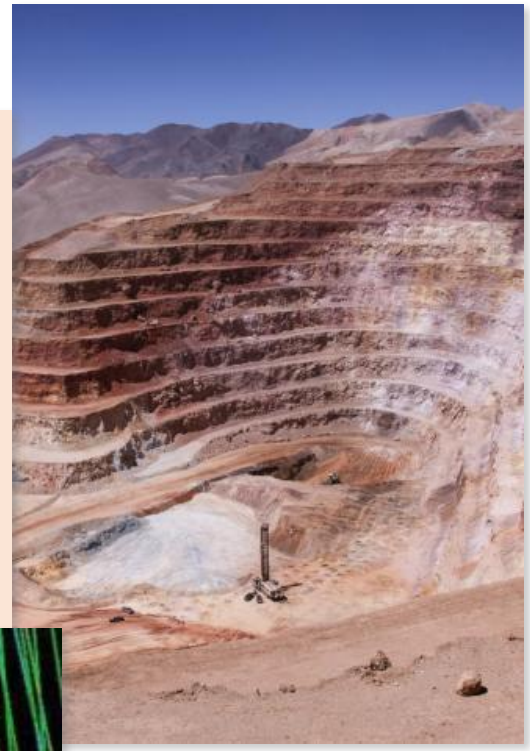
Register for the event at bit.ly/yerginzoomcast
Purchase "The New Map: Energy, Climate, and the Clash of Nations" on Amazon

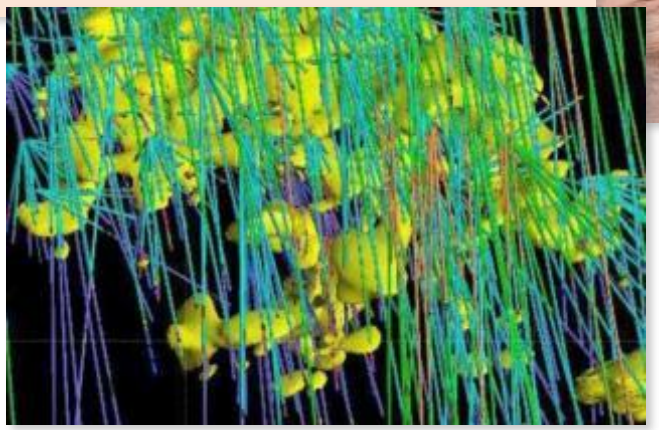
The Payne Institute for Public Policy MINES | Global Energy Future

Mines = Preferred Partner to Industry

- Industry-university consortia currently, connecting 100's of companies, including
  - 11 research centers and industry consortia related to subsurface characterization
  - 5 research centers and industry consortia related to water
- Focus on energy, critical resources, materials, advanced manufacturing
- Industry-friendly research partnerships
- Holistic approach, entrepreneurial, collaborative teams

Example:
Center to Advance the Science of Exploration to Reclamation in Mining (CASERM)
geology + mathematics for locating, characterizing, visualizing mineral resources





Collaborations are in our DNA

USGS-Mines Energy and Mineral Resources Facility on Mines Campus
Authorized and appropriated. Construction underway. Opens 2027

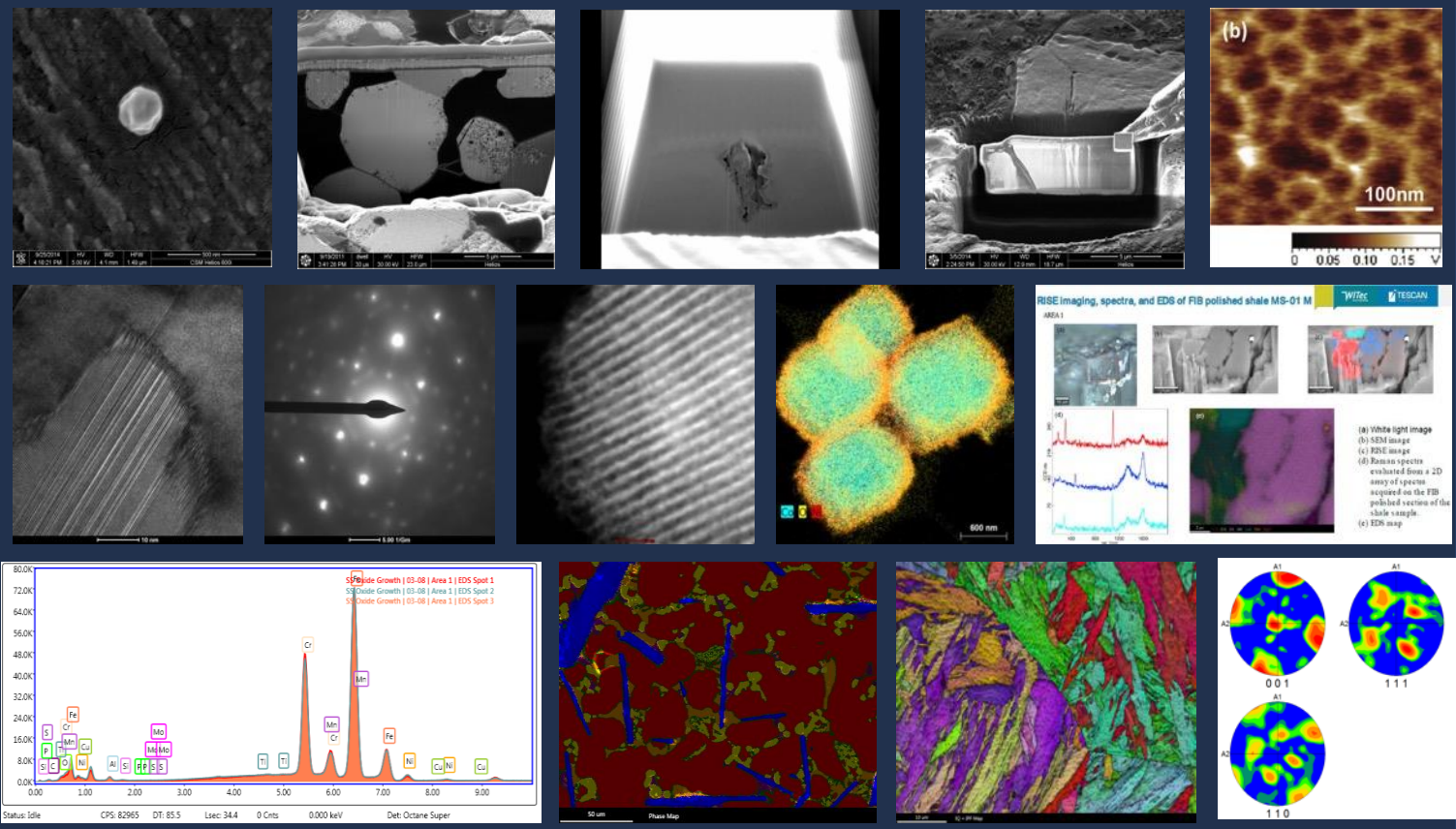
New Entrepreneurship and Innovation Spaces

Mines Shared Instrumentation Facility

Centralized and simplified access to world-class instrumentation

Instrumentation Capabilities

- Electron & Scanning Probe Microscopy
- Mass Spectrometry
- Mechanical Testing
- Nanofabrication and Thin Film Deposition
- X-ray Diffraction & CT
- X-Ray Photoelectron Spectroscopy
- Thermal Analysis (DSC, DTA, TGA, etc.)
- Etc.



International Partnerships

- Mines: Extensive history of successful partnerships globally
- Collaborations with governments, universities, NGOs, economic development organizations, …
  - Research partnerships
  - Resource assessment
  - Sustainable development
  - Curriculum development
  - Workforce preparation
  - Capacity building

Image Courtesy: NASA

Unique Research Capabilities

Center for Hydrate Research

The CHR is a global leader in hydrate research and recovery, an area that has significant impact on both energy and environmental sustainability. CHR funding and collaborations span across industry, the federal agencies, and non-profit organizations.

Center for Rock & Fluid Multiphysics

CRFM combines simultaneous laboratory experimentation with rock physics modeling to research the multiphysical properties of rocks, fluids and their interactions.

Center for Wave Phenomena

CWP is a research center that collaborates with industry, government agencies, and academic institutions to conduct leading research in seismic exploration, monitoring, and wave propagation.

Colorado Fuel Cell Center

CFCC partners with industry to develop electrochemical devices to address our nation's needs in electricity generation and energy storage.

Colorado Geological Survey

Housed at Mines, CGS is a state government agency that provides geologic advice to the public to help reduce the impact of geologic hazards, promote responsible development of mineral and energy resources, and provide geologic insight into water resources.

Geology Center of Research Excellence

CoRE is an innovative industry-academic partnership between Mines and Chevron that promotes world-class research and education. CoRE focuses on scientific and technical challenges faced by the energy industry.

Colorado Center for Advanced Ceramics

CCAC is a focal point for interdisciplinary research and education on ceramics and related materials, with active industry and government partnerships.

Colorado Energy Research Collaboratory

Mines is a member of the Collaboratory, which is a unique Colorado partnership that brings together energy expertise across the state to address the complex energy and natural resource challenges facing the world.

Critical Materials Innovation Hub

CMI is a DOE Energy Innovation Hub focused on assuring supply chains for materials critical to clean energy technologies. Mines is part of CMI senior leadership and spearheads CMI efforts in education, training, and outreach.

Energy Emissions Modeling and Data Lab

EEMLD is a collaborative initiative focused on developing transparent models and data sets for accurate greenhouse gas emissions accounting across the global oil and gas supply chain. Partners include the University of Texas at Austin and Colorado State University.

Unique Research Capabilities

Mines CCUS Innovation Center

MCIC is an independently sponsored research center that highlights applied research focused on reducing greenhouse gas emissions by millions of metric tons and enabling communities to transition toward zero-emissions energy generation.

Nexus | Mines/NREL

Nexus is a partnership between Mines and the National Renewable Energy Laboratory (NREL) that strengthens, accelerates, and enhances collaborative efforts to address energy challenges.

Nuclear Science and Engineering Center

An interdisciplinary research center focused on nuclear science and engineering, NuSEC also manages the research and educational relationship with the U.S. Geological Survey TRIGA Reactor on the Denver Federal Center in Lakewood, CO.

Reservoir Characterization Project

RCP collaborates with industry partners to conduct applied research using seismic methods across a variety of geologic settings to predict reservoir performance and enhance field development strategies.

Shared Instrumentation Facility

The SIF provides centralized access to world-class scientific equipment and engineering instruments on Mines campus. External partners can consult with technical experts and access the SIF through our website.

Institute for Initiatives in Latin America

IILA builds external connections with partner institutions in Latin America and mobilizes Mines resources to conduct cutting-edge applied science that benefits local communities and builds research capacities at partner institutions.

Colorado-Wyoming Climate Resilience Engine

Mines is a partner in the Colorado-Wyoming Climate Resilience Engine, a NSF Regional Innovation Engine to advance climate resiliency research and commercialization efforts across methane emissions, soil carbon capture, earth sensing, water scarcity, wildfires and extreme weather.

Center for Resource Recovery and Recycling

CR^3 is a multi-university cooperative research center focused on sustainable stewardship of the earth's resources. Mines partners with Worcester Polytechnic Institute and KU Leuven to advance technologies that recover, recycle, and reuse materials across industries.

MINES Research

Innovation with Impact