

A photograph of a large, white, rectangular sign with the words "NEW MEXICO TECH" in dark blue, serif capital letters. The sign is set against a blue sky and a building with a blue roof. In the foreground, there are green bushes with pink and purple flowers.

NEW MEXICO TECH

Research Highlights, Partnerships, and Future Directions
NM Science & Technology Committee 8/28/2024

Dr Michael Doyle, Vice President for Research & Economic Development

A UNIQUE RESEARCH UNIVERSITY

Priorities

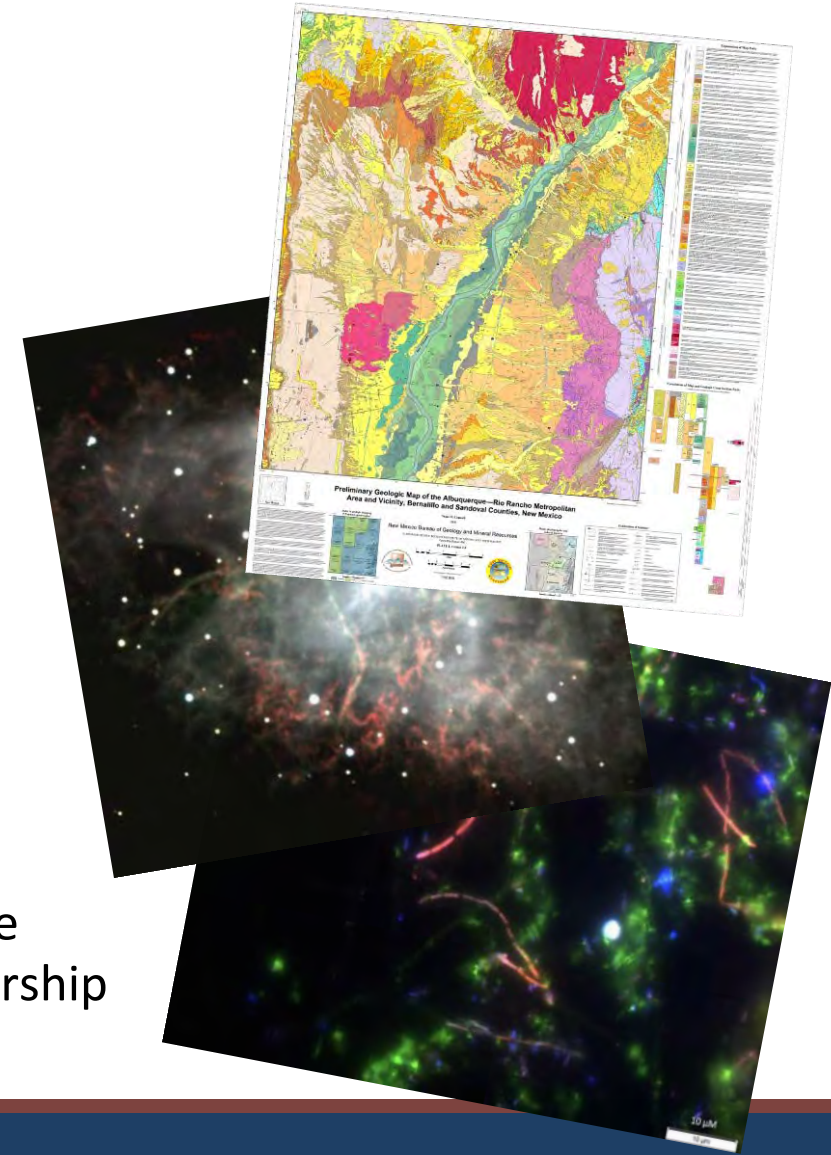
- Applied Research to Address Societal Challenges
- Education Enrichment
- Workforce Development
- Catalyze the Local and State Economy

Some Key Focus Areas

- Water Resources Data, Management, and Education
- Energy Technologies and Carbon Capture
- 5G and Future-G Spectrum Science
- New Advances in Biotechnology
- Next-Gen AI Technologies and AI Security

Highlights

- Game-Changing Technologies Across Multiple Fields
- \$132MM Research Expenditures, with \$120MM of that Non-State
- State-Wide Collaborations Leading to Positions of National Leadership



APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

- Energetic Materials Research & Testing Center
- Hantush-Deju National Center for Hydrologic Innovation
- Geophysical Research Center
- Institute for Complex Additive Systems Analysis
- Langmuir Laboratory for Atmospheric Research
- Magdalena Ridge Observatory
- Mount Erebus Volcano Observatory
- National Cave and Karst Research Institute
- New Mexico Bureau of Geology and Mineral Resources
- New Mexico Cybersecurity Center of Excellence
- Petroleum Recovery Research Center
- Playas Research and Training Center



APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

About the New Mexico Bureau of Geology

J. Michael Timmons – Director and State Geologist

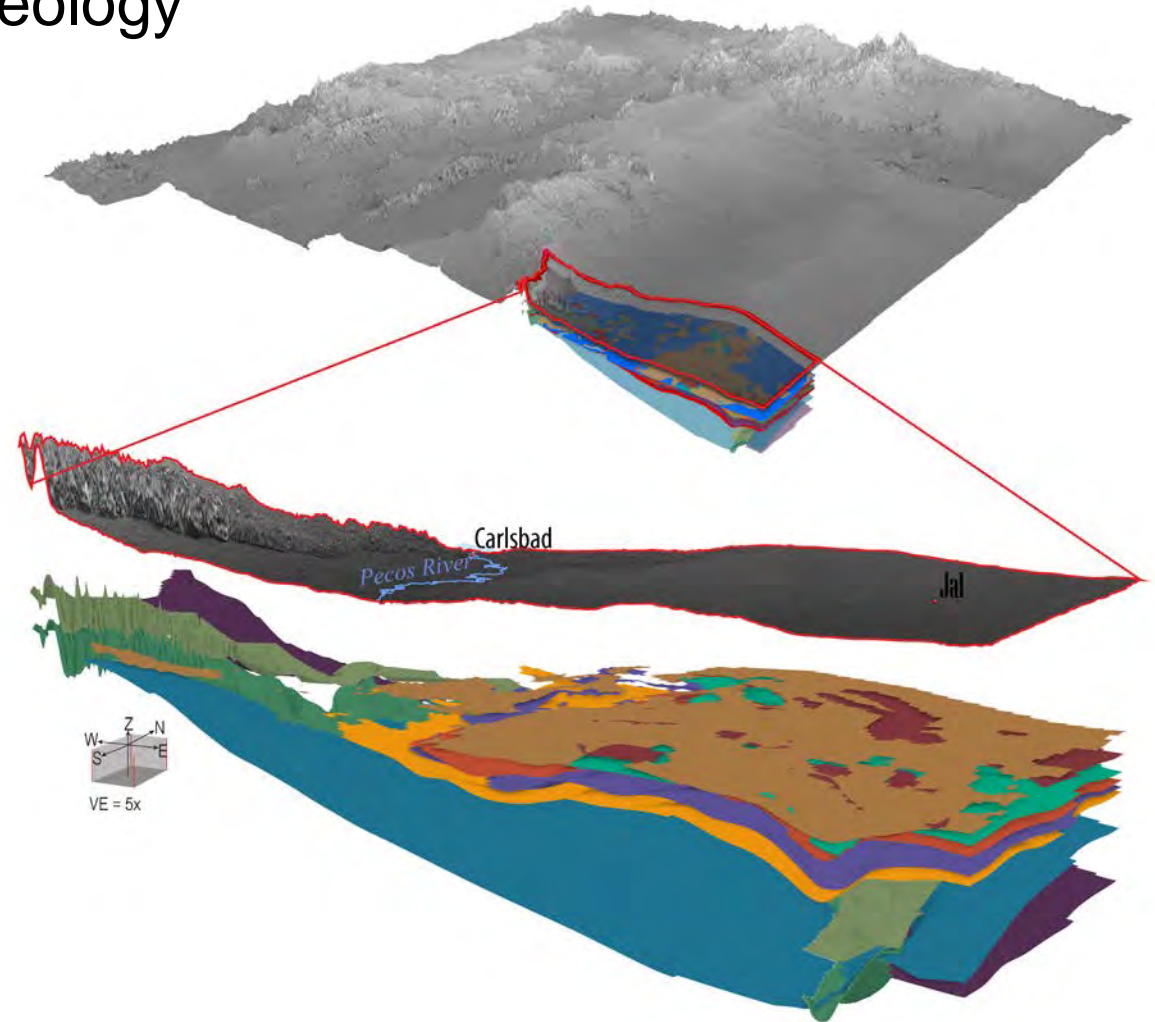
- Established in 1927 through state legislation.
- As a non-regulatory governmental agency (the state's geological survey), we conduct scientific investigations that lead to responsible economic development of the state's mineral, water, and energy resources.
- We currently have 70 staff members at approximately 68 FTEs, consisting of research scientists, professionals, permanent support staff, and emeritus staff. We also mentor and employ students, and in FY24, we hired 69 full- and part-time undergraduate and graduate students.
- Our office is located on the New Mexico Tech Campus in Socorro (65 staff) and remote personnel (5 staff).
- In FY24, our total budget was approximately 48% from state appropriations and 52% from external contract funding.



APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

Programs at the New Mexico Bureau of Geology

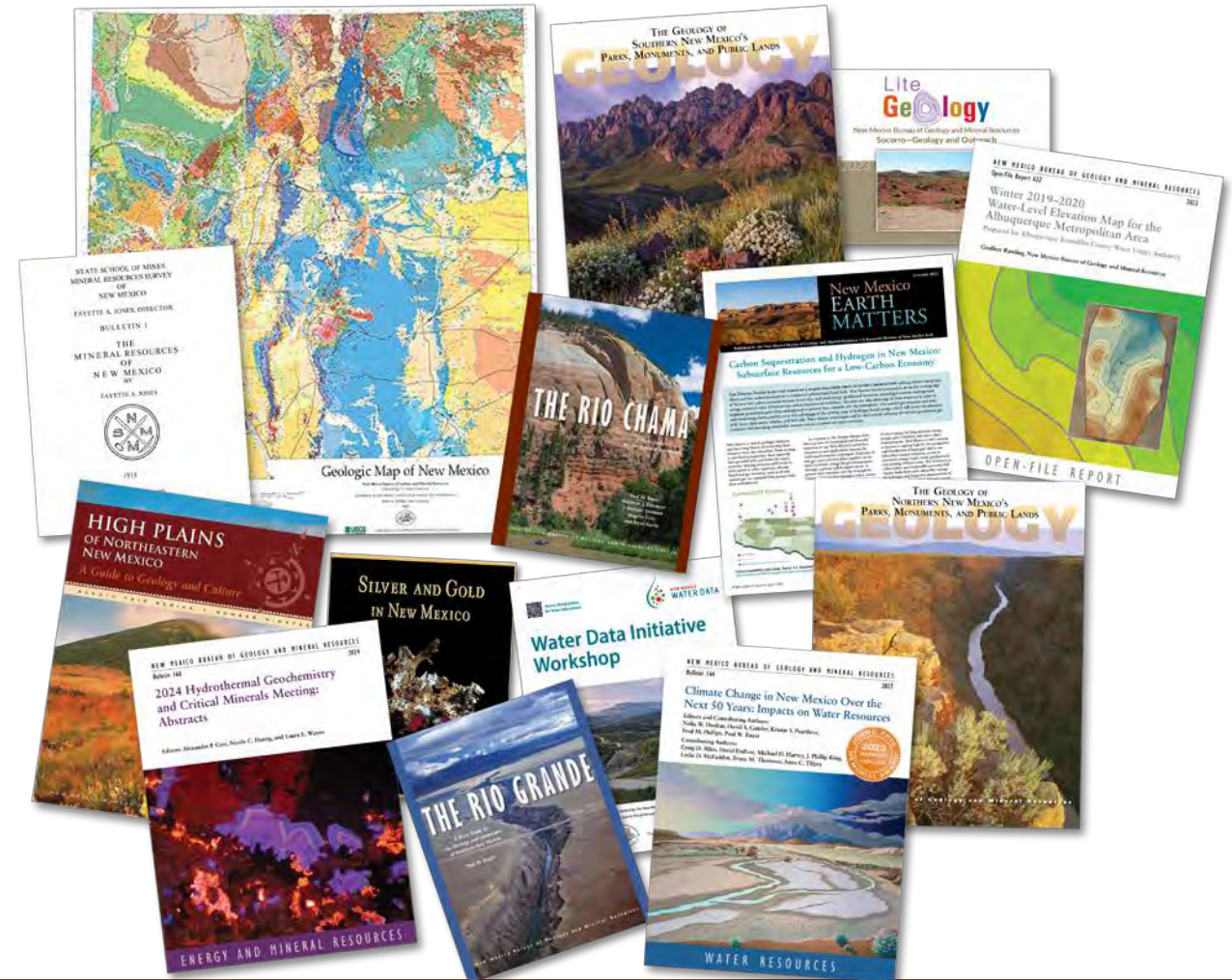
- **Geologic mapping and hazards**
 - STATEMAP program
 - Earthquakes, volcanic activity, landslides, and other hazards
- **Hydrogeology**
 - Aquifer Mapping and Monitoring Program
 - New Mexico Water Data Act
 - Water Leaders Education
- **Analytical laboratories**
 - Chemistry/water quality
 - Electron microprobe
 - Geochronology
 - X-ray diffraction



APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

Other Programs at the New Mexico Bureau of Geology

- **Energy resources**
 - Oil and gas
 - Geothermal
 - Uranium
- **Mineral resources**
 - Critical and strategic minerals
 - Metals
 - Industrial minerals
- **Outreach and education**
 - Mineral Museum
 - Publications
 - Teacher and student training
 - Archives and collections



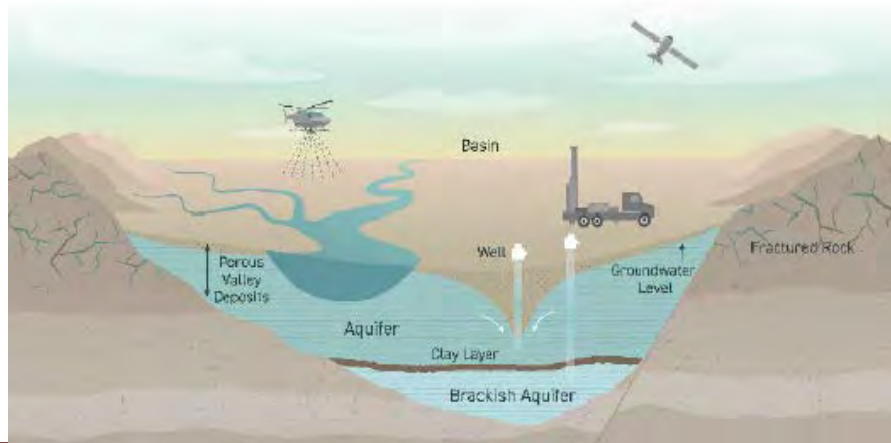
APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

Working toward a sustainable water future in New Mexico

Aquifer Mapping and Monitoring Program

Working to fully characterize our fresh and brackish water aquifers; providing foundation for water planning and alternative water resource considerations.

This program now leads the effort to address the aquifer characterization needs highlighted in the Governor's 50 Year Water Action Plan.



Water Data Initiative

The 2019 NM Water Data Act requires state agencies to make their water data more accessible and usable to the public and interoperable through common data standards.

The Bureau of Geology is the convening agency for the Water Data Initiative.




Water Education Program

Bringing the science, water management and local issues on WATER to legislators, staff and state water leaders

Collaboration and connections with universities, state and local agencies, NGOs, and many other subject matter experts.

Societal impacts and partnerships including:

- **Regional Soil and Water Conservation Districts, municipalities, counties, Irrigation Districts**
- **State agencies such as OSE, ISC, NMED, EMNRD and SLO**
- **Federal partnerships with Bureau of Reclamation, USGS, BLM, and Sandia National Labs**



The Petroleum Recovery Research Center

New Mexico Institute of Mining and Technology

Robert Balch

Director

What Is the PRRC?

Created by New Mexico Statute: NMSA 1978, Article 9 as a division of New Mexico Tech: Primary Duty: “to engage in theoretical and practical research into the recovery of petroleum and other energy resources”

Primary Focus today is:

- 50% Carbon Storage and Hydrogen**
- 20% Produced Water and Sustainability**
- 30% traditional hydrocarbon research**

The PRRC has Impact

Jobs: PRRC currently creates 65 direct jobs in the state including 27 full-time staff, 6 supported Faculty at NMT and 32 Students funded on research projects in FY22

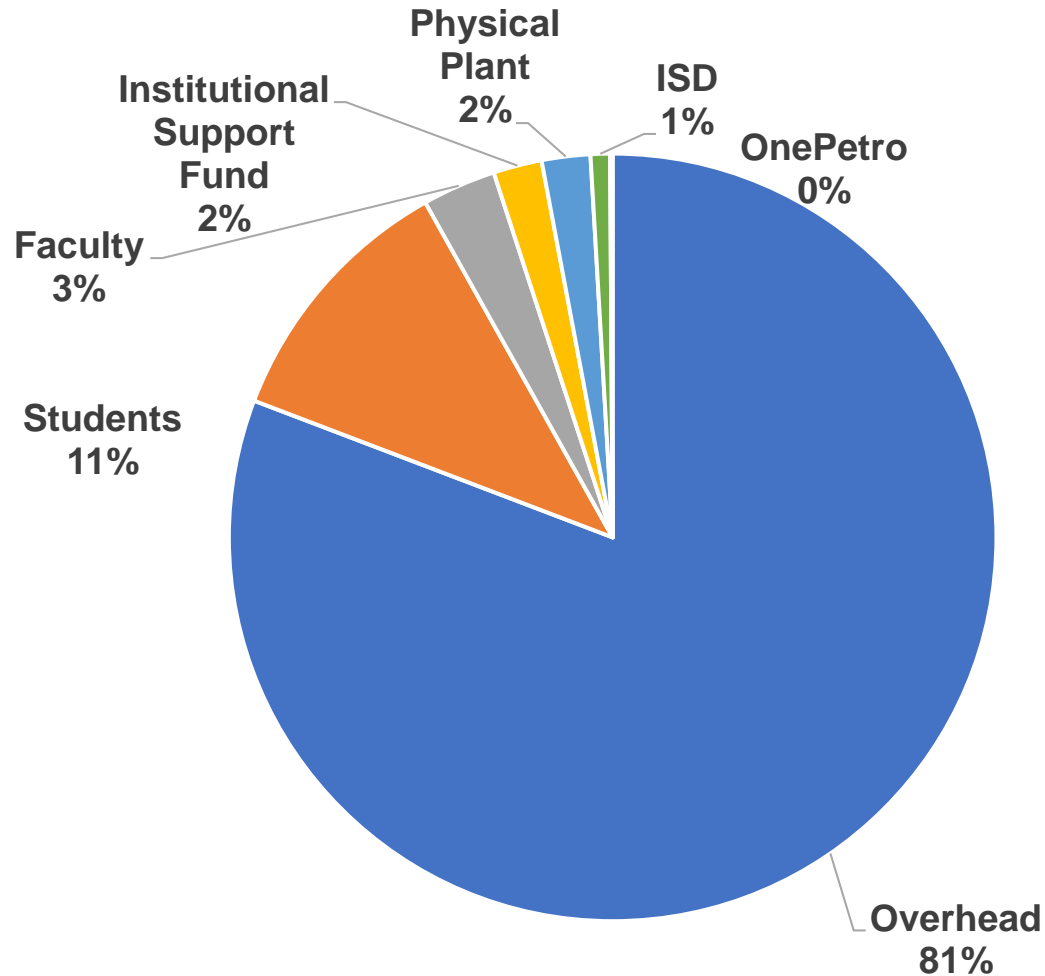
To the State: Funded research supports entities across the state with nearly \$20 Million spent in FY23 including funds allotted to partner universities, national labs, and companies in the state. The PRRC’s carbon storage research portfolio alone exceeds \$130 million, with projects impacting both San Juan and Permian basin communities. PRRC Researchers enjoy a high profile in Carbon Storage research, both nationally and internationally

University Support: The PRRC supports the university, and in FY23 directly contributed nearly \$5 million to NMT including: \$4 million in overhead and direct support and \$700,000 in student contracts and faculty Support. We actively train students for careers in sustainable energy development.

Who Are We?

- **65 Total Staff:**
- 27 Regular employees
 - 7 Support staff: IT, accounting, clerical, technical writing, machine shop
 - 20 Research staff in eight research groups
- 6 Supported Faculty, with summer salary funded through collaboration with researchers:
 - Hydrology
 - Geophysics
 - Petroleum Engineering
 - Math
 - Chemical Engineering
- 32 supported students
 - 18 graduate students
 - 14 undergraduate students

THE PRRC Supports New Mexico Tech



Direct Institutional Support FY 2023*

- Overhead
- Students
- Faculty
- Institutional Support Fund
- Physical Plant
- ISD
- OnePetro

Institutional Support FY23	
Overhead	\$ 3,950,196
Students	\$ 541,992
Faculty	\$ 151,704
Institutional Support Fund	\$ 100,000
Physical Plant	\$ 100,000
ISD	\$ 40,000
OnePetro	\$ 5,157
Total	\$ 4,889,048

* Fixed Costs - \$245,157 / year

*Estimates for FY23 are not be final until June 30

Active Research Portfolio

- **\$226 Million** in active research portfolio (including cost share/partners)
- **31 active projects**
 - 12 Projects in Energy Transition topics
 - 8 Projects in Produced Water
 - 11 Projects directly funded by industry
- Projects span all research areas at the PRRC and include projects for US Federal Government, State of New Mexico and many private companies

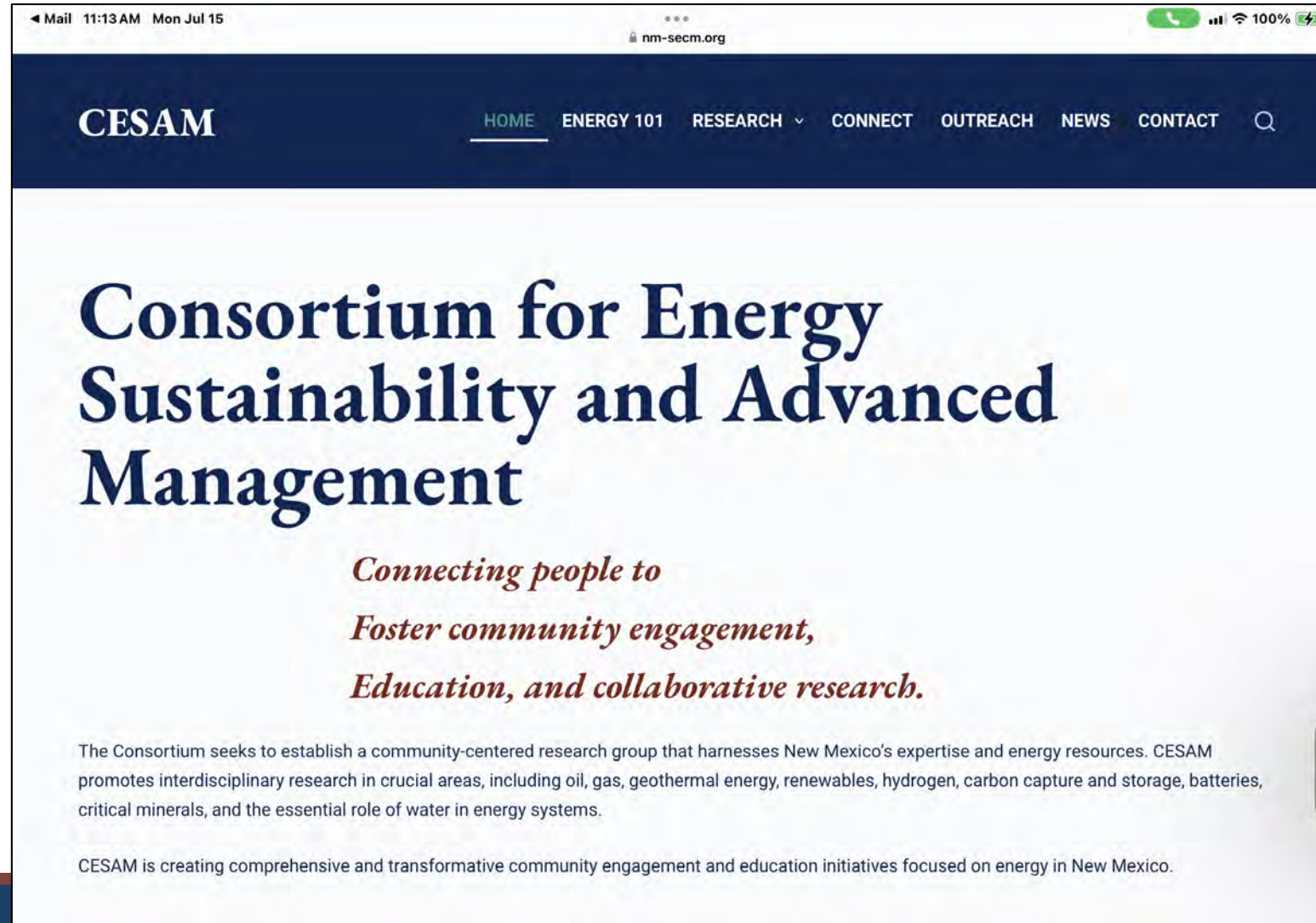
Water Purification Commercial Prototype



5000 gallons per day

APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

Supporting Energy Collaboration Across Disciplines



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CESAM [HOME](#) [ENERGY 101](#) [RESEARCH](#) [CONNECT](#) [OUTREACH](#) [NEWS](#) [CONTACT](#) 🔍

Consortium for Energy Sustainability and Advanced Management

*Connecting people to
Foster community engagement,
Education, and collaborative research.*

The Consortium seeks to establish a community-centered research group that harnesses New Mexico's expertise and energy resources. CESAM promotes interdisciplinary research in crucial areas, including oil, gas, geothermal energy, renewables, hydrogen, carbon capture and storage, batteries, critical minerals, and the essential role of water in energy systems.

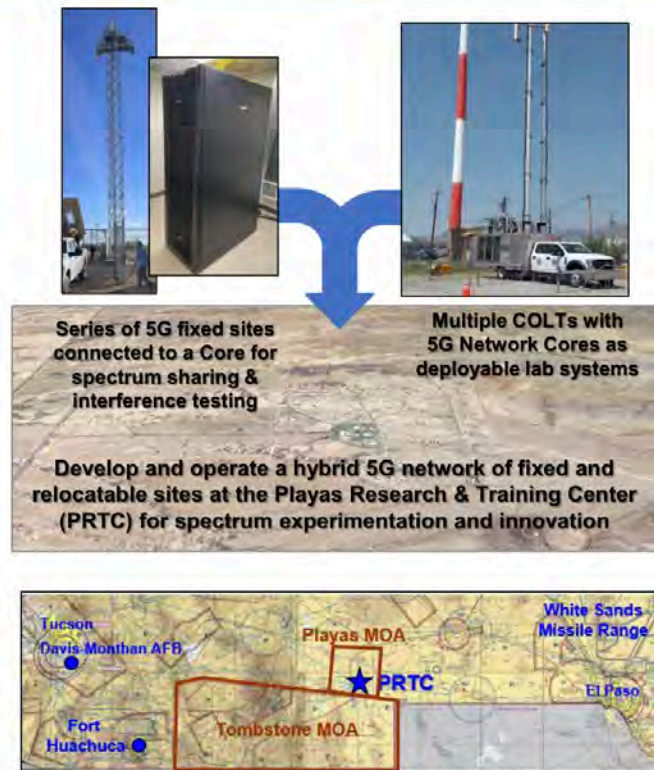
CESAM is creating comprehensive and transformative community engagement and education initiatives focused on energy in New Mexico.

APPLIED RESEARCH ADDRESSING SOCIETAL CHALLENGES

Providing a National Resource for 5G/Future-G Spectrum Science



5G at Playas Research & Training Center (PRTC) Initiative Standup of 5G/FutureG Testbed for Operations & Experimentation



- National 5G Testbed for DoD Training and National Spectrum-sharing Experiments
- FutureG Testbed to Support DoD Warfighter Ops and Training/Experimentation
- Platform for Informing National Spectrum Issues
- National Resource for FutureG Capabilities
- Proving Ground and Living Lab for Dynamic Spectrum Management Technologies and Methods
- Environment for Academic Research in Spectrum Science
- Collaboration Space for DoD, NASA, NSF/ngVLA, Academia

COLLABORATING WITH STATE AND NATIONAL PARTNERS

NM-INBRE - IDeA Networks of Biomedical Research Excellence

Partners: NMT, UNM, NMSU, SJC, ENMU, WNMU, NMHU, DACG, Burrell COM, NCGR, Pueblo of Zuni, Pueblo of Acoma

NM-EPSCoR - Established Program to Stimulate Competitive Research

Partners: NMT, UNM, NMSU, NTU

New Mexico Consortium – Includes all three research institutions and LANL.

NSF Regional Innovation Engines (\$160 M/10 year, if awarded)

Awarded Type I planning (\$1M/2 year):

- **RALI-WEST** (water resources)
Partners: UNM, NMT, NMSU, LANL, SNL, SRIC, SFCC, CNM, Area, Creative Startups, ENMU, UTEP
- **Space Valley** (space technologies)
Partners: Space Valley Coalition, NMT, CNM, Newspace Nexus, Spaceport America, Levado, NTU, NM MEP, NMSU, City of Albuquerque
- **PEDL** (water resources in the Permian Basin)
Partners: UT Austin, NMT, NMSU, UTPB, Odessa College, Midland College, UTEP, NREL, SNL, many more

New Proposals (in development)

- **New Mexico Engine for Decentralized AI** (Artificial Intelligence technologies)
Initial Partners: NMT, NMAIC, LANL, SNL, UNM, NMSU, GreenData, others in discussion (NRAD, etc.)
- **New Mexico engine for Spatial Biology** (Next-Generation Biotechnologies)
Initial Partners: NMT, NCGR, UNM, NMSU, NM Bioscience Authority, others in discussion

ENHANCING THE RESEARCH CAPACITY OF THE STATE

Custom AI to Support Research within New Mexico

Uses internal documents such as funding proposals, contracts, patents, papers, and engineering designs

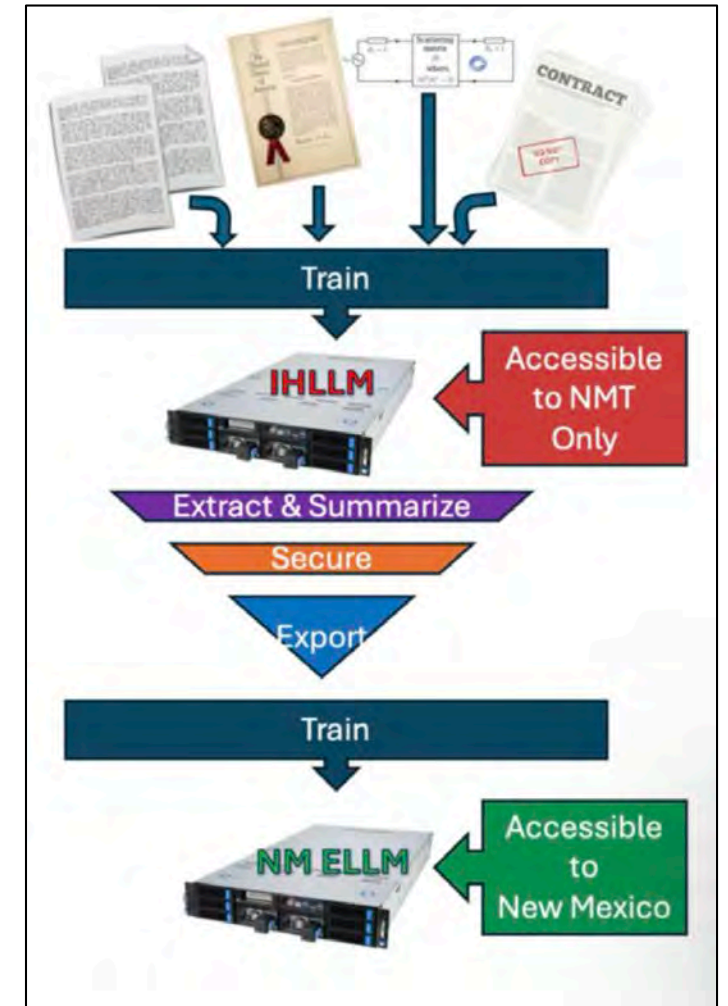
- Create a model for expanding research across New Mexico institutions
- Train an in-house large language model (IHLLM) with research proposals, patents, and technical papers
- Make LLM accessible to NMT faculty and research staff
- Generate data for training an external large language model (ELLM)
- Dual-layered LLM approach ensures that sensitive information remains protected within the IHLLM while allowing the ELLM to provide valuable collaboration insights externally

Three Primary Goals:

- Assist in finding collaborators on specific topics
- Aid in drafting materials for proposals
- Help identify potential interest in specific calls for proposals before distributing information or scheduling collaboration meetings

NMT Pilot will be Rolled Out Statewide

- Completed ELLM will serve as the foundation for the NM ELLM, incorporating data from other state entities to create a **statewide resource for finding research collaborators**



CREATING ENGINES OF INNOVATION

NSF Engine Regional Innovation Hubs

\$160MM each, over 10 years, if awarded

Spatial Biology (NMT led)

- Develop cutting-edge bio-imaging technologies

Quantum Technologies (Elevate Quantum led)

- Develop new game-changing quantum material technologies

Water Resources (UNM led and UT Austin led)

- Helping build an economic ecosystem around NM water technologies

Space Technologies (Colorado led)

- Securing space-based systems against future attacks

Next-generation AI (NMT RPC led)

- Make NM the epicenter of the next wave of the sustainable AI economy



Engine: New Mexico Engine for Spatial Biology (NMESB)

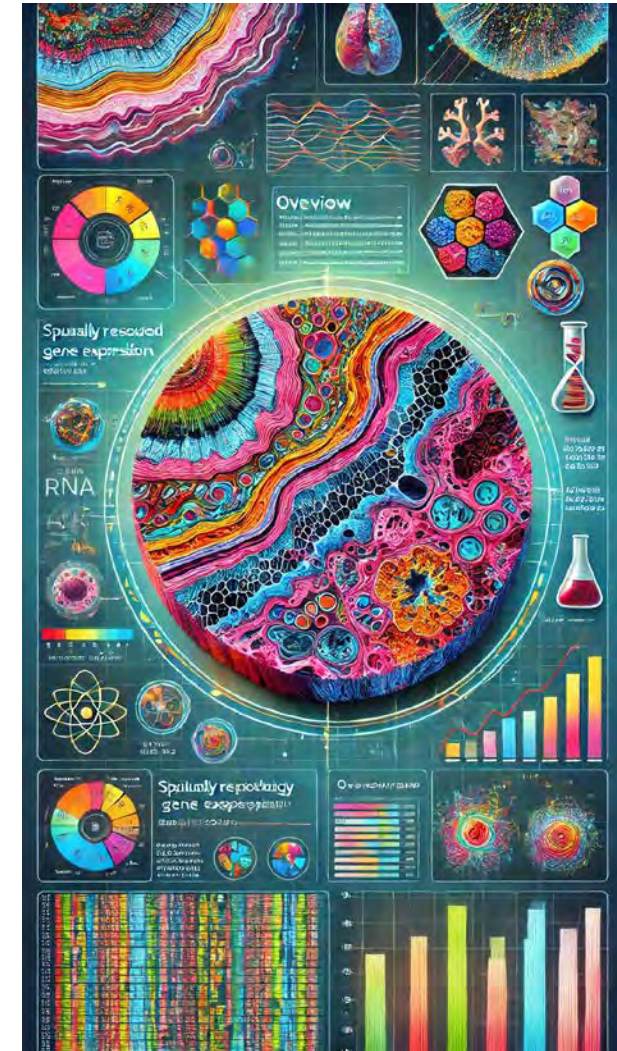
NSF Engine Regional Innovation Hub (\$160MM over 10 years, if awarded)

- Develop and deploy cutting-edge imaging technologies to capture intricate biological data
- Enhance computational tools and algorithms for efficient data analysis
- Apply spatial biology insights to improve plant biology and agricultural productivity
- Establish comprehensive workforce development programs to train researchers and technicians in spatial biology
- Create an economic ecosystem for technology translation to foster the development of new startups in the field

Poised to transform New Mexico into a hub for spatial biology technologies, significantly impacting economic growth, enhancing data security, and creating high-value jobs.

- Bridging the gap between advanced spatial imaging and practical agricultural applications.
- Addressing the shortage of skilled spatial biology technicians
- Enhancing the computational capacity to manage and analyze vast spatial datasets
- Providing workforce pathways for students from under-represented and indigenous communities to enter high-paying biotechnology careers

Core Partners: NMT, NCGR, UNM, NMSU, LANL, SNL, Emory, Mizzou



Engine: New Mexico Engine for Decentralized AI (NMED.AI)

NSF Engine Regional Innovation Hub (\$160MM over 10 years, if awarded)

- Leverages new decentralized AI platform technology and AI security technology
- Establishes a vibrant technological ecosystem
- Focused on the development, deployment, and commercialization of decentralized AI across diverse sectors
- Aims to catalyze the formation of startups, promote AI security innovation, and spur workforce development within the state
- Exploit use of alternative energies for sustainable AI computation

Poised to transform New Mexico into a hub for decentralized AI technologies, significantly impacting economic growth, enhancing data security, and creating high-value jobs.

- Aims to position New Mexico as a leader in AI-driven solutions
- Attract further investment and partnership opportunities.

Addresses critical challenges for both New Mexico and the nation

- enhancing AI security
- fostering economic development through technological innovation
- addressing the skilled workforce gap in the rapidly evolving AI sector

This project presents a unique opportunity to leverage New Mexico's growing capabilities in technology and innovation, significantly advancing the state's and the nation's technological and economic landscape

Core Partners: NMURPC, NMT, NMAIC, UNM, NMSU, LANL, NMC SNL



NEW MEXICO TECH

A Unique Research University

- Applied Research Addressing Societal Challenges
- Collaborating with State and National Partners
- Enhancing the Research Capacity of the State
- Creating Engines of Innovation

Leveraging State Investment to yield over 10:1 ROI

- \$132MM NSF HERD Research Expenditures, with \$120MM of that Non-State
- Programs like the Technology Enhancement Fund (TEF) have been invaluable in enabling this success
- But we can do So Much More





Questions