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What Is the Impact of 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:

- Produced Water and Sustainability*
- Traditional hydrocarbon research*
- Other Energy – Geothermal and Nuclear*
- Carbon Management and Critical Minerals*

The PRRC has Impact

Jobs: PRRC currently contributes to 106 jobs in the state including 35 staff, 13 supported Faculty at NMT and 58 Students funded on research projects in FY26

To the State: Funded research supports entities across the state with a 5-year average budget of \$ **\$11,950,255** per year including funds allotted to partner universities, national labs, and companies in the state. The PRRC’s research portfolio* has projects positively impacting both San Juan and Permian basin communities. PRRC Researchers enjoy a high profile in a wide range of research areas

University Support: The PRRC supports the university and contributed an average of \$ **\$2,692,872** per year over the last 5 years to NMT including: overhead and direct support and student contracts and faculty Support. We actively train students for careers in sustainable energy development.

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Petroleum Recovery Research Center Economics

PRRC Metrics FY26

- Research portfolio of **\$134,466,422**
- 35 Active projects including:
 - Industry Projects
 - Critical Minerals
 - Geothermal
 - Produced Water Cleanup
- Actively engage with companies
- Active partner’s with the states research universities and National Labs
- Average Annual Expenditures of \$11,950,255
- Over 250 Papers, Reports, and Presentations FY 25
- High ROI, about \$5 external Dollars spent for every \$1 of State funds

PRRC Supports NMT - FY 26

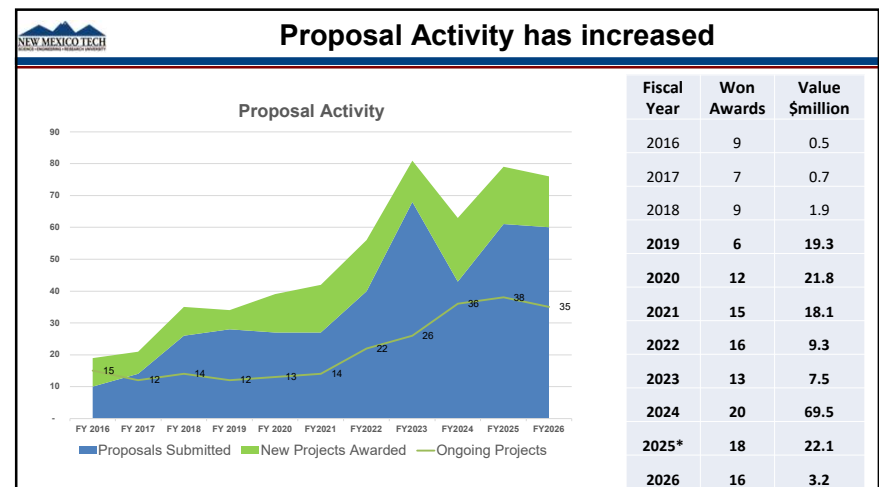
Total Support to NMT of **\$6,591,989.39**

- \$2,848,640 in direct support (Overhead, Institutional Support fees, Students, Faculty)
- Other support - staff salaries and fringe of \$3,743,349.39

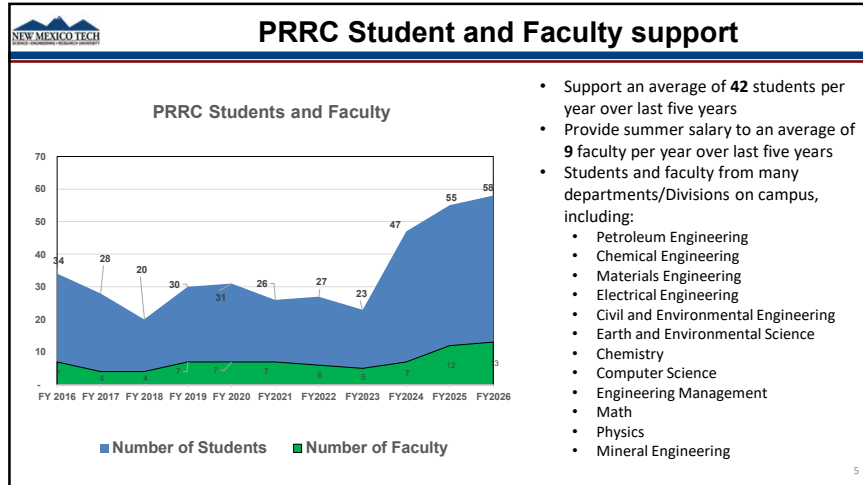
Direct Institutional Support FY26	
Overhead	\$ 1,059,379
Students	\$ 1,037,109
Faculty	\$ 506,707
Institutional Support Fund	\$ 100,000
Physical Plant	\$ 100,000
ISD	\$ 39,967
OnePetro	\$ 5,477
Total	\$ 2,848,640

* Fixed Costs - \$245,444 / year

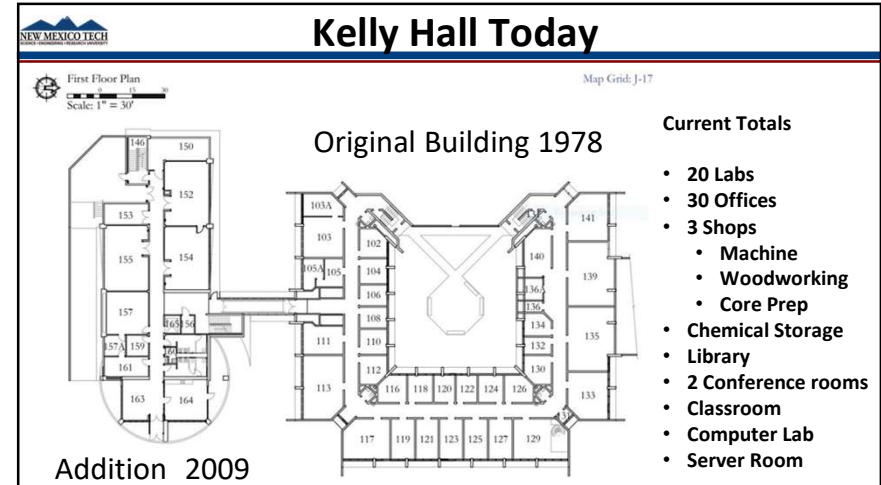
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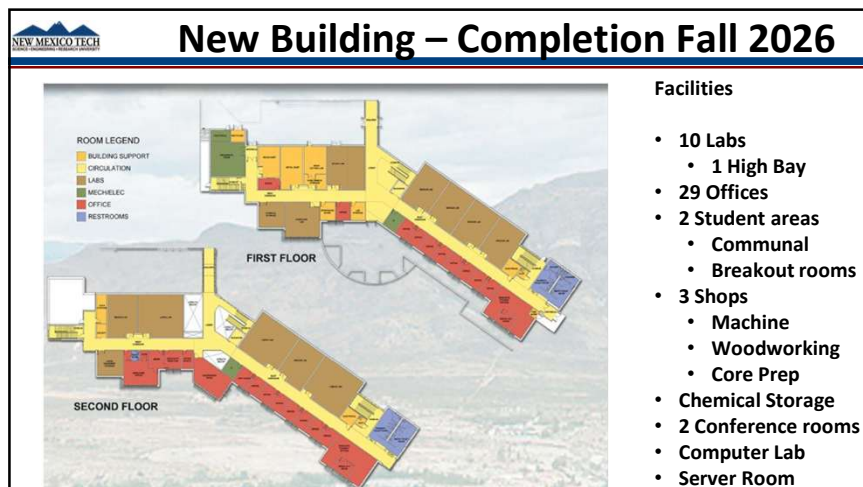
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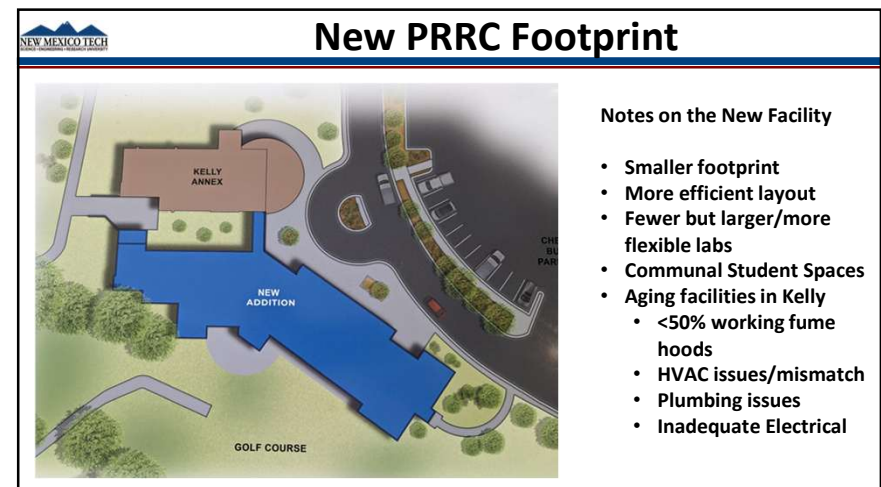
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Research Group Capabilities

Petrophysics and Surface Chemistry
Research Chemist: Dr. Sai Wang

- Focuses on surface and interfacial properties of crude oils
- wettability alteration
- crude oil/brine/rock interactions
- the stability of asphaltenes

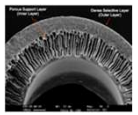


Capabilities

- Asphaltene-Instability-Trend (ASIST) Predictions
- Asphaltene Deposition Tests
- Wettability Measurements
- Crude Oil analyses:
 - Refractive index, density
 - Viscosity as a function of temperature
 - Compositional analyses
- Water Analyses
 - pH, conductivity, alkalinity, major ions, TOC

Produced Water and Petroleum Engineering
Research Scientist: Dr. Jianjia Yu

- Pursues advanced methods in membrane technology for produced water treatment.
- hollow fiber membranes using a two-stage nanofiltration process.



Capabilities

- Analysis of porous media
 - Porosity
 - Surface area
- Nanoparticle generation and quantification
- Organic composition analysis
- Hollow fiber membrane fabrication
- Gas chromatograph
- TOC analysis
- Bench and pilot scale testing

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Research Group Capabilities

Reservoir Sweep Improvement Group
Section Head: Dr. Randall Seright

Develop methods to prevent fluid channeling through reservoirs and to reduce excess water and gas production during oil recovery

Polymer Flooding

- Polymer rheology in viscometers and in porous media over a very wide range of concentrations, salinities, and shear rates/velocities
- Tests in porous media with permeability from 1 to 15000 md, in all wettabilities,

Gel Treatments

- Excess water production problems, especially those involving fractures.
- Placement and sizing procedures for gel treatments.
- Laboratory studies extensively characterizing the flow properties of gels in fractures and porous media

Gas Flooding Processes and Flow Heterogeneities
Section Head: Dr. Sai Wang

The Gas Flooding and Flow Heterogeneities Group pursues CO₂ and EOR related research

- Carbon sequestration or storage in geologic formation, focusing on oil, gas, coal-bed and water aquifer formation.
- Improving conformance control and sweep efficiency in CO₂ flooding.
- Understanding and managing injectivity changes associated with water alternating with gas injection (WAG).
- Improving the modeling capability of CO₂ foam-enhancing processes and WAG injection.

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Research Group Capabilities

Reservoir Evaluation/Advanced Computational Technologies (REACT)
Section Head: Dr. William Ampomah

- Reservoir characterization studies utilizing data at all scales, to support reservoir simulation models
- Field and regional scale geologic modeling using well and seismic data

Capabilities

- Reservoir characterization
- Construction of geologic models
- Reservoir simulation
- Enhanced oil recovery project planning
- Regulatory impacts on site planning
- Produced water management
- Development of computer and web application software and hardware

Alkali Surfactant Polymers (ASP)
Research Scientist: Dr. Guoyin Zhang

Surfactant Flooding

- Develop and formulate high-efficiency surfactants for ASP flooding and SP flooding
- Develop novel surfactant formulations that can be used in low pH environments, such as CO₂ floods
- Develop uses of chemical EOR for soil remediation.

Lab Analyses

- Interfacial tension measurement.
- Fluid rheology measurement in a viscometer and in porous media.
- Surfactant/oil/brine phase behavior tests.
- Chemical retention in porous media.
- Evaluation of oil recovery efficiency by coreflooding.

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Research Group Capabilities

Outreach and Engagement
Section Head: Jennifer Raney

- Go-Tech - Oil and gas production, price, and well activity, provided in a quick, accurate, and easy-to-use format. **15 million page views in FY 25.**
- Water quality data for ~9,400 oil and gas wells in NM, water volume data for over 75,000 wells

Capabilities

- Outreach and Public engagement
 - Work with Legislators, Tribes, Communities
- Student involvement and industry connections
- Provide site-specific information to leaders
- Present basic PRRC research in lay terms
- Identify and engage with affected communities
- Engage with Native American Tribal leaders
- Mapping and data analysis

Industry Services
Section Head: Khadir El-Kaseeh

- Provide support to industry partners and engage with companies on projects of all durations
- Provide regulatory support to operators seeking permits

Capabilities

- Build teams from within PRRC to rapidly respond to projects sought by industry partners
- Serve as a liaison with companies and service companies on a daily basis
- Seek opportunities in private sector
- Support other research groups with staff expertise in:
 - Seismic processing and interpretation
 - Simulation and geologic modeling
 - Permits and regulatory issues

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Active Research Portfolio

Large Active Research portfolio (FY 26 including cost share/partners)

- **35 active projects** in:
 - Produced Water
 - Enhanced Oil Recovery (CO₂, Polymers, Alkaline surfactants)
 - Industry Funded Work
 - Geothermal
 - Critical Minerals
 - Federal Priorities
- Projects span all research areas at the PRRC and include projects for US Federal Government, State of New Mexico and many private companies
- Partners include Universities, National Labs, Geologic Surveys, and Private Companies

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FY 2026 Successful Federal Proposals

16 Successful Proposals and Acquired Funding FY 2026 (\$3.3 million)

Agency	Program	Project Title	PI	Funding Request	Acquired Date
Arpa-E	Federal	Adsorptive Vacuum Membrane Distillation for Simultaneous Extraction of Magnesium, Lithium and Ammonia from Produced Water	Jianjia Yu	\$ -	2025/07
Arpa-E	Federal	Selective Extraction of Magnesium, Ammonia and Lithium from Produced Water (SE-MALI)	Jianjia Yu	\$ -	2025/07
TEF Engine development funds	State	NSF Engines: San Juan-Rio Grande Energized Watershed Engine	Lique Coolen/Jianjia Yu	\$ 52,937	2025/07
SNL	Federal	Leaching while fracking for ore bodies using supercritical CO ₂ foam with chelator functionalized nanoparticles	Robert Balch	\$ 189,000	2025/07
EMNRD	State	Data for the Energy Transition, Economy, Climate Change, and Technologies (DETECT)/Comprehensive Energy Transition Strategy (CETS) Phases II and III	Jean-Lucien Fonquergne	\$ 499,999	2025/12
NMED	State	Extraction of high-purity water and lithium from brackish water via integrated membrane processes	Jianjia Yu	\$ 1,580,762	2025/12

6 Federal Proposals funded for a total of \$2,322,698

- **Not including \$17 million** in reinstated federal projects
- **No DOE awards in 2026** while federal program was under review

10 Industry Proposals funded for a total of \$951,852 (next slide)

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FY 2026 Successful Industry Proposals

Agency	Industry	Project Title	PI	Funding Request	Acquired Date
Targa	Industry	Additional Reservoir Simulation to Support Increased Injection Volume Bull Moose AGI #001 Well in Texas	George El-kaseeh	\$ 20,000	2025/08
Chevron	Industry	Laboratory Evaluation of Asphaltene Deposition (LEAD) in Tubing Systems	Sai Wang	\$ 82,000	2025/09
Targa	Industry	Feasibility Analysis to Assess Interference that could be Introduced by Injection in the Bottom of the Cherry Canyon Formation in Red Hills Site, AGI #002	George El-kaseeh	\$ 50,000	2025/09
Targa	Industry	Copperhead AGIR2 MRV	George El-kaseeh	\$ 90,000	2025/12
Targa	Industry	Bull Moose AGIR2 MRV	George El-kaseeh	\$ 90,000	2025/12
MPLX	Industry	Pre-Feasibility Study to Evaluate Location and Subsurface Suitability for Acid Gas Injection for 1. Near Hayfield Ridge Amine, Dagger Lake Amine Treating, Bell Lake Amine and Pelham; 2. Tornado Gas Plant and Secretariat Gas Plant	George El-kaseeh	\$ 30,000	2025/12
General Atomic Uranium Resources (Rio Grande Resources)	Industry	Environmentally Conscious Optimization of In Situ Leaching (ECO-IL) for Uranium Recovery in New Mexico	Jason Simmons	\$ 289,852	2025/12
HyTerra Ltd. and Renaissance Philanthropy	Non-Profit	Estimation of in-situ hydrogen generation rates from pre-Cambrian rock samples extracted from HyTerra and legacy wells in Mid-Continent Rift based on their mineralogy and elemental chemistry	Robert Czarnota	\$ 60,000	2026/04
Targa	Industry	Support "Authorization to Inject" Application for the Grizzly AGI #001 Well (Location: TBD) in Texas	George El-kaseeh	\$ 120,000	2026/04
Targa	Industry	Scope of Work to support "Authorization to Inject" Application for the Camp Viejo AGI #002 Well (Location: TBD) in Yoakum County, Texas	George El-kaseeh	\$ 120,000	2026/05
FY 2026 Total*				\$ 3,274,549	
FY 2025 Total				\$ 22,317,646	
FY 2024 Total				\$ 69,481,512	
FY 2023 Total				\$ 7,471,911	
FY 2022 Total				\$ 9,252,522	
FY 2021 Total*				\$ 18,095,102	
FY 2020 Total **				\$ 21,808,023	
FY 2019 Total **				\$ 19,345,875	
FY 2018 Total				\$ 1,918,301	

* This does not include \$17 million in reactivated pending projects that has been credited in other years

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New Focus Areas – Geothermal and Critical Minerals

- Using legacy data and **O&G tech and skills** to identify new prospects
- Industry focus: Attract funding to drill characterization wells

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Industry Projects

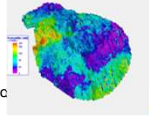
- Hands-on experience for early career staff
- Generate economic activity through hiring subcontractors for drilling and other purposes
 - \$13 million wells drilled in Farmington on Federal \$\$
 - Several \$35 million well drilled in Permian basin by partner, 4 more in process in New Mexico
 - 2 million tonnes/yr CO₂ storage permitted for midstream partners
- Wide network and numerous industry partnerships
 - Major and independent oil companies
 - Tallgrass (Hydrogen)
 - Service Companies
 - Targa Midstream (CO₂)
 - Coolsky Energy Solutions
 - PESCO Produced Water



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A Sample of Industry Projects

- Enhanced Oil Recovery (EOR): CO₂, Surfactants, ASP**
 - Hilcorp Pilot North Slope Alaska – Very successful Polymer flood pilot
 - Alkaline Surfactants – Ongoing work at Daqing Field
 - CO₂: Floods for both CO₂ EOR and depleted Reservoir CO₂ storage in Texas and New Mexico
- Acid Gas Disposal / CO₂ Storage**
 - Involved with midstream companies in New Mexico and Texas on permitting, well design, tax credit applications
 - 8 wells drilled, 3 in progress
 - 2 million tonnes/yr CO₂ storage permitted for midstream partners
- Wettability, water control, Asphaltene control**
 - Regular work with Chevron, ongoing projects last 17 years
- Nano Technology and Water management**
 - Seven projects on nano filters (hollow fiber membranes)
 - Inexpensive produced water cleanup
 - Mining of critical minerals from produced brine




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Energy Transition Leadership

State of New Mexico
Energy, Minerals and Natural Resources Department

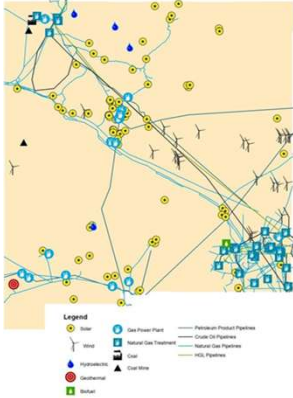
Michelle Lujan Grisham, Governor
Melanie Keeney, Cabinet Secretary
Ben Shelton, Deputy Cabinet Secretary
Erin Tallyor, Deputy Cabinet Secretary

FOR IMMEDIATE RELEASE:
Contact: Salvey Hill
Public Information Officer, EMNRD
salvey.hill@emnrn.dem.nm.gov
May 12, 2025

EMNRD leading Comprehensive Energy Transition Strategy for NM

Supporting the State Energy Transition Strategy roadmap effort:

- Lead contract with EMNRD – Phase I
- Data strategy development
- Partnership with EFI for policy



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Driving the Conversation on Energy

New Mexico Energy Initiatives

Objectives:

- To develop RD&D energy projects
- Increase collaboration and PPPs: Universities, State, Industries, IOUs, NGOs...
- Support education and workforce development

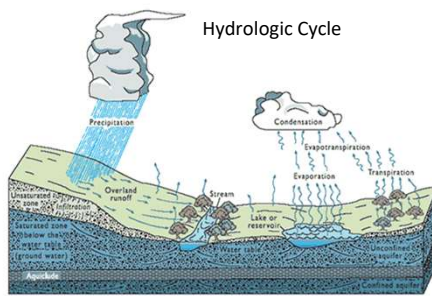



Inaugural Meeting in 2024 with 100 attendees

Charter/MOU for governance and to attract industry funding

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Special Focus - Water



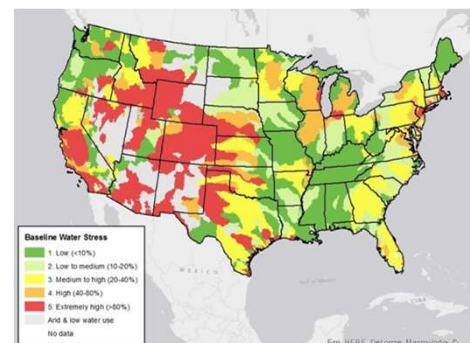
Shari Kelly and Peggy Johnson, NM Bureau of Geology

Water shortage and security is a global AND local challenge

- New Mexico is an arid state, **1.1 million** people are affected by the long periods of drought and inconsistent precipitation.
- **87%** of public water supply comes from ground water in NM.
- The remaining water (13%) comes from rivers

Rapidly depleting aquifers requires exploration of new sustainable water resources...

Water Stress Map of the United States



Water Stress Map of the United States Source: USGS.

	2019	2050
Extremely high risk >80% water depleted	2.2B	2.8B
High 40%-80%	870M	
Medium to high 20%-40%	1B	1.3B
Low to medium 10%-20%	800M	1.2B
Low <10%	2.3B	1B
Arid and low water use		2.6B

“Over one quarter of the world’s population face extremely high water stress”.

- World Resources Institute (WRI).

Does New Mexico have enough water?

Not for everything we want to do...

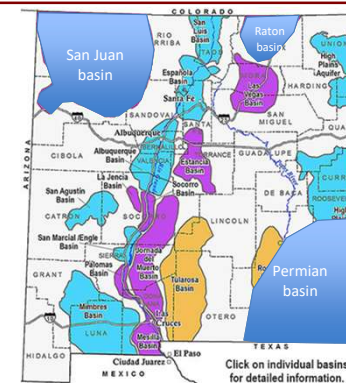
- Farming is already limited by available water, this is difficult to address because of very large volumes needed
- New Industries need more water
 - Chip fabrication
 - Data farms (cooling)
 - Grid-scale batteries (cooling, pump hydro)
 - Hydrogen needs 4-8 gallons of water per kg of hydrogen



So How Do We Come Up With “New” Water?

In New Mexico the answer is going to be:

- New groundwater sources...
 - Resources are already strained
- Improve use from non-traditional water sources
 1. Produced Water from oil and gas
 2. Brackish Water
 3. Better reuse/treatment of wastewater



New Mexico Bureau of Geology and Mineral Resources Brackish water assessment

Produced Water in New Mexico

2,748 MM bbl*

Produced water reported for New Mexico in 2025

128,641 mg/L*

Mean TDS in 46 Permian Basin produced-water samples

NM WaterSTAR

Interactive produced-water quantity and quality mapping portal

Produced water is a big issue

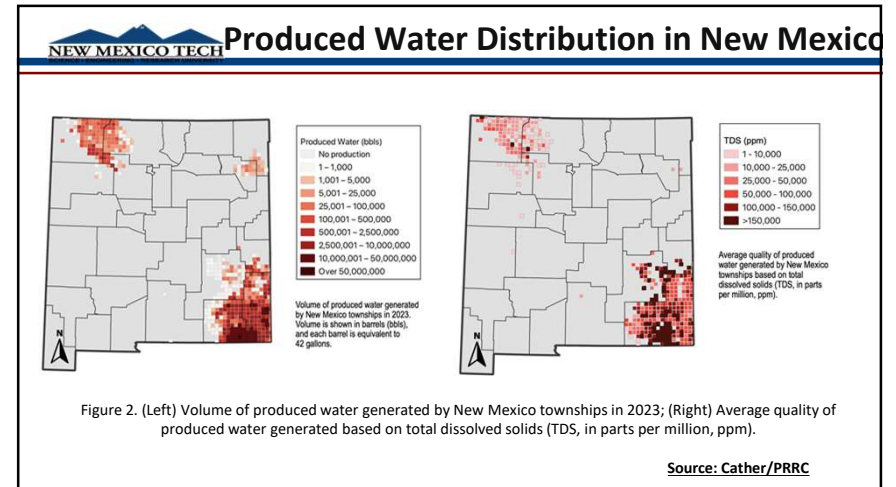
- In 2025, over **113 billion** gallons of produced water was generated in NM, over **310 million** gallons per day, equal to **twice the total daily municipal water consumption** in NM;
- Produced water is currently reinjected underground for use or disposal (the cost can exceed **\$0.11/gallon**);
- Cost of water management can make profitable operations uneconomic for small producers.

Produced water desalination is challenging

- High salinity** (as high as 201,474 mg/L), volatiles, **organics** (as high as 248.1 mg/L), etc.;
- Most commercial desalination processes focus on **brackish water** (<10,000 mg/L) and **sea water** (35,000 mg/L).

Source: * NMOCD.
 **Hightower, Permian Basin Produced Water Quality Drivers, Produced Water Society Permian Basin Summit, 2023.

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Produced Water Purification

Challenges and Opportunities:

- ❑ New Mexico is the **second-largest** oil-producing state and among top natural-gas producers.
- ❑ Produced water can be up to **6 times saltier than seawater**, can also carry:
 - TDS often reaching 200,000 mg/L,
 - hydrocarbons such as oil and grease (2-565 mg/L),
 - suspended solids (1.2-1,000 mg/L),
 - dissolved organic compounds up to 1,500 mg/L,
 - and metals or major ions including Ba, Fe, Ca, Mg, and Li across basin-specific concentration ranges.
- ❑ Reuse discussions: **disposal-only** >>>> **fit-for-purpose treatment, oilfield recycling, and potential closed loop new industrial water supplies.**

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Current Produced Water Management

In New Mexico:

59.9%

Deep-well disposal / SWD

40.1%

Enhanced oil recovery injection/Pressure maintenance injection

0%

Beneficial reuse outside oil and gas

PRRC Research Goal: develop **affordable, portable and scalable robust membrane-based** desalination technologies to convert **produced water** as a **sustainable water resource**.

Sources: NMOCD
<https://wwwapps.emnrd.nm.gov/ocd/ocdpermitting/Reporting/Production/ExpandedProductionInjectionSummaryReport>

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PRRC Produced Water Research Program

Hollow Fiber Membrane Research: **Affordable, portable and scalable** desalination technologies

Hollow fiber membranes

Organics removal

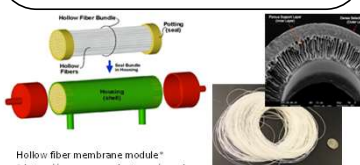
- Ultrafiltration
- Microfiltration
- Membrane adsorption
- Hybrid process

Desalination

- Nanofiltration
- Reverse/Forward osmosis
- Membrane distillation
- Hybrid process

Compared to flat sheet membrane:

- ✓ **higher productivity per unit volume** (high packing density and large surface area)
 - For a 0.04 m³ membrane device:
 - HF membrane: 575 m² (90 mm in diameter);
 - Spiral wound flat-sheet membrane: 30 m²;
 - Tubular configuration: 5 m².
- ✓ **self-supporting**
- ✓ **small footprint, easily scalable**

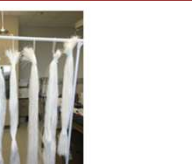


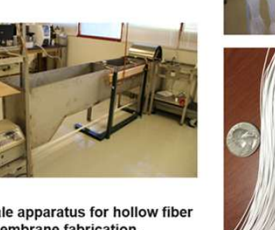
Hollow fiber membrane module*
* <http://www.pemselect.com/membranes>

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Laboratory and Bench Scale

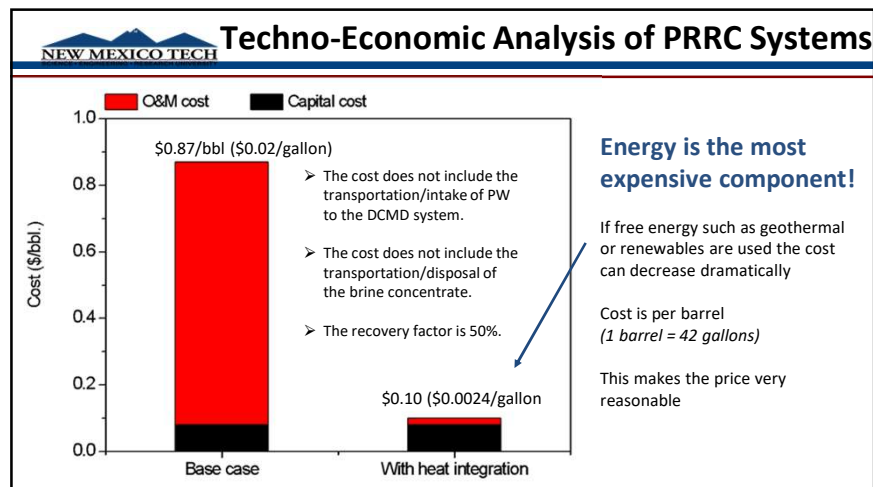





Large scale apparatus for hollow fiber membrane fabrication.

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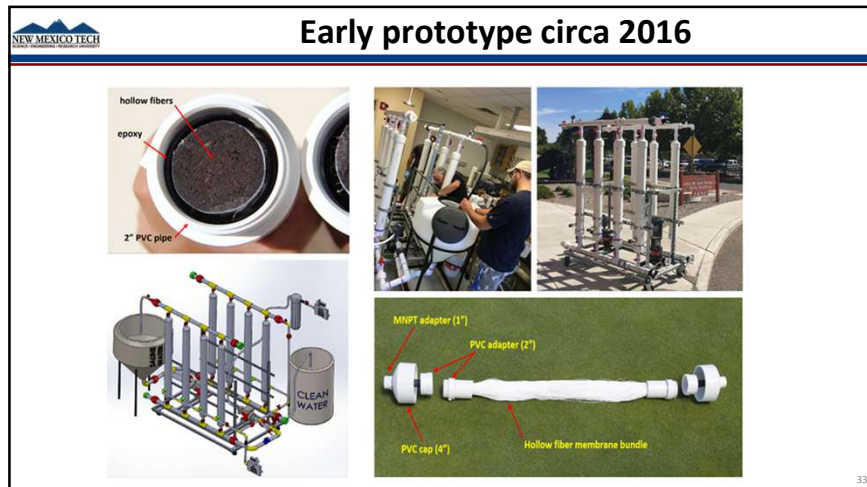
Water Filtration – Hollow Fiber Membranes

30 years of produced water research with dozens of funded projects

- Polymeric hollow fiber membranes have been fabricated at PRRC for produced water treatment. The removal efficiency for organics salt removal is greater than 95% in a single pass, under a relatively low pressure (less than 30 psi).
- Working with PESCO to manufacture and distribute systems for domestic and industrial uses
 - PESCO has licensed our technology and is preparing to mass produce units
- Committed to building six 500 gpd systems for rural Native American communities
 - Partnership with Navajo Technical University
- Have projects to extract critical minerals from produced water
 - Successfully isolating and extracting Lithium from Permian basin water



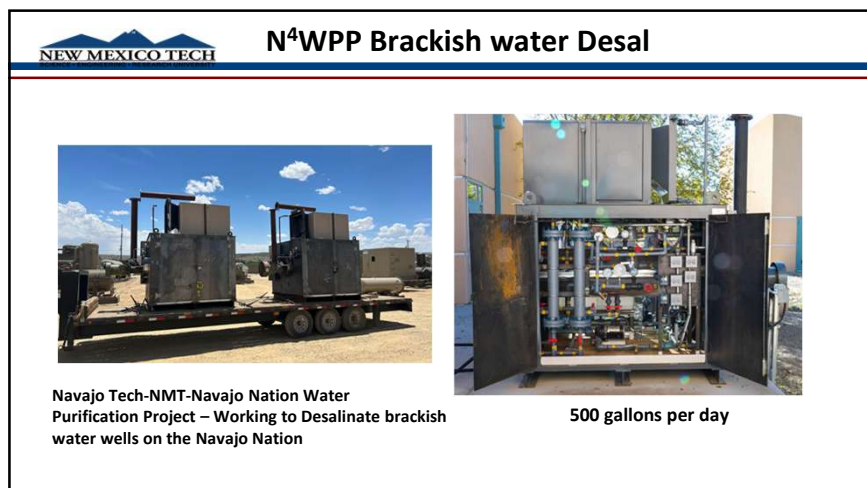
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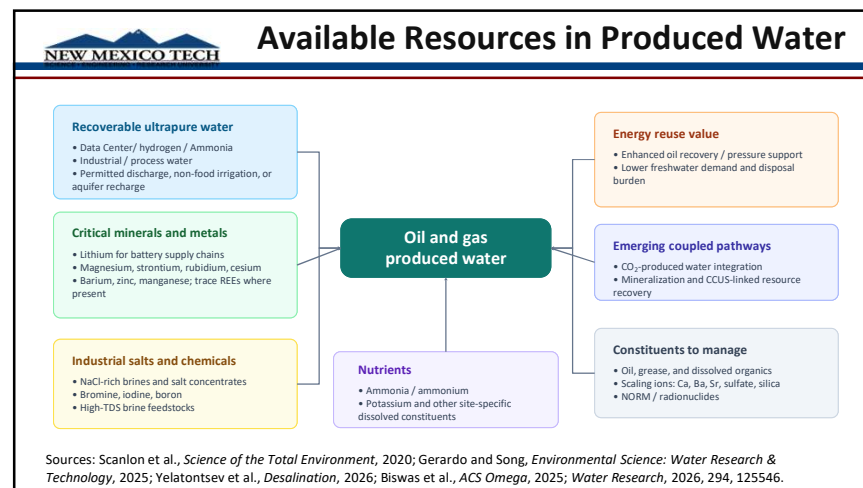
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Thank you

