

THE PETROLEUM RECOVERY RESEARCH CENTER

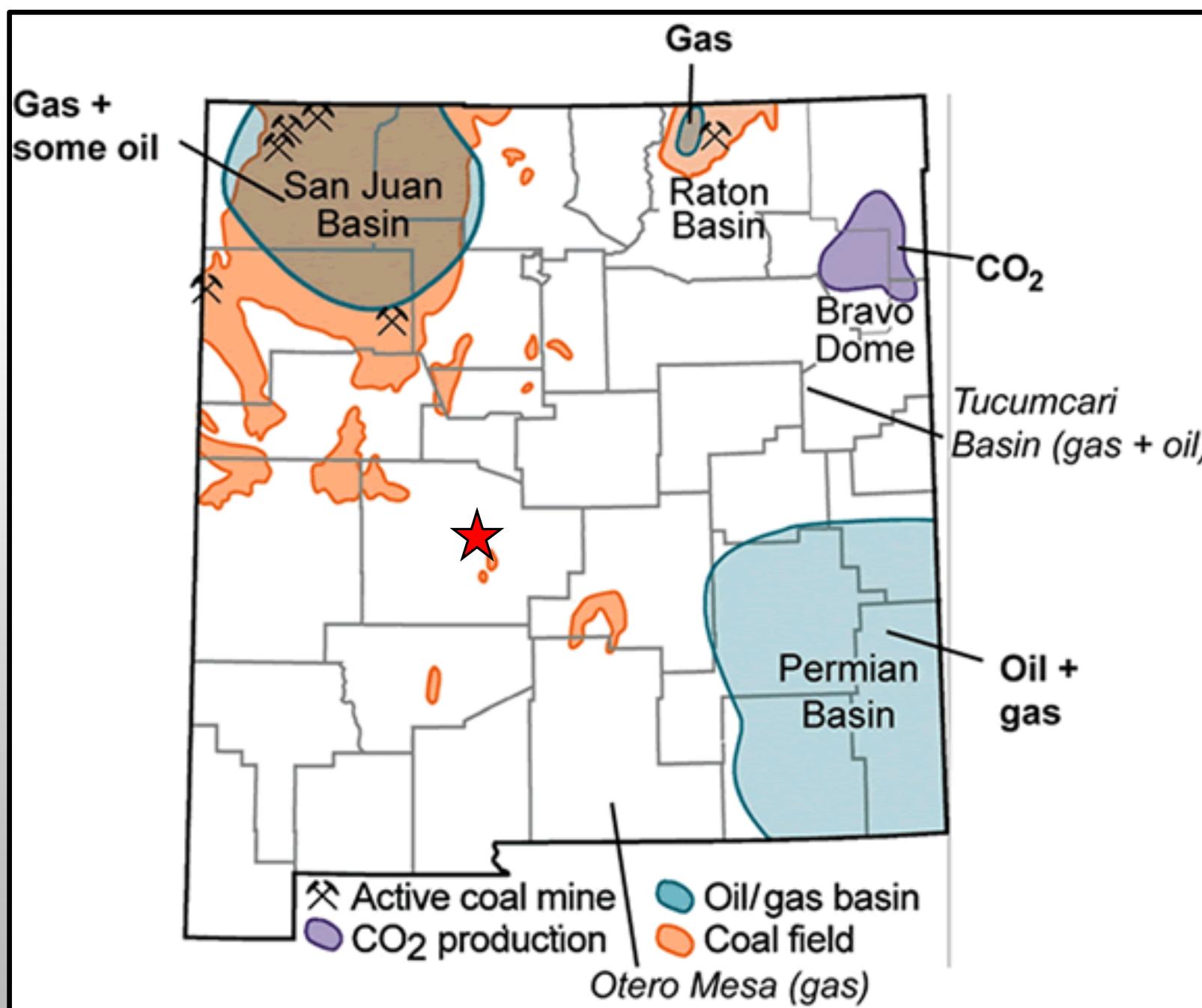
NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

ROBERT BALCH

DIRECTOR

WHERE IS THE PRRC?

- Located in Socorro
- Central location ~3-4 hour drive to all producing areas in the state



NEW MEXICO INSTITUTE OF MINING AND TECHNOLOGY

☰ New Mexico Institute of Mining and Technology 🔍 ✕



New Mexico Institute of Mining and Technology
4.1 ★★★★★ 11 reviews
University

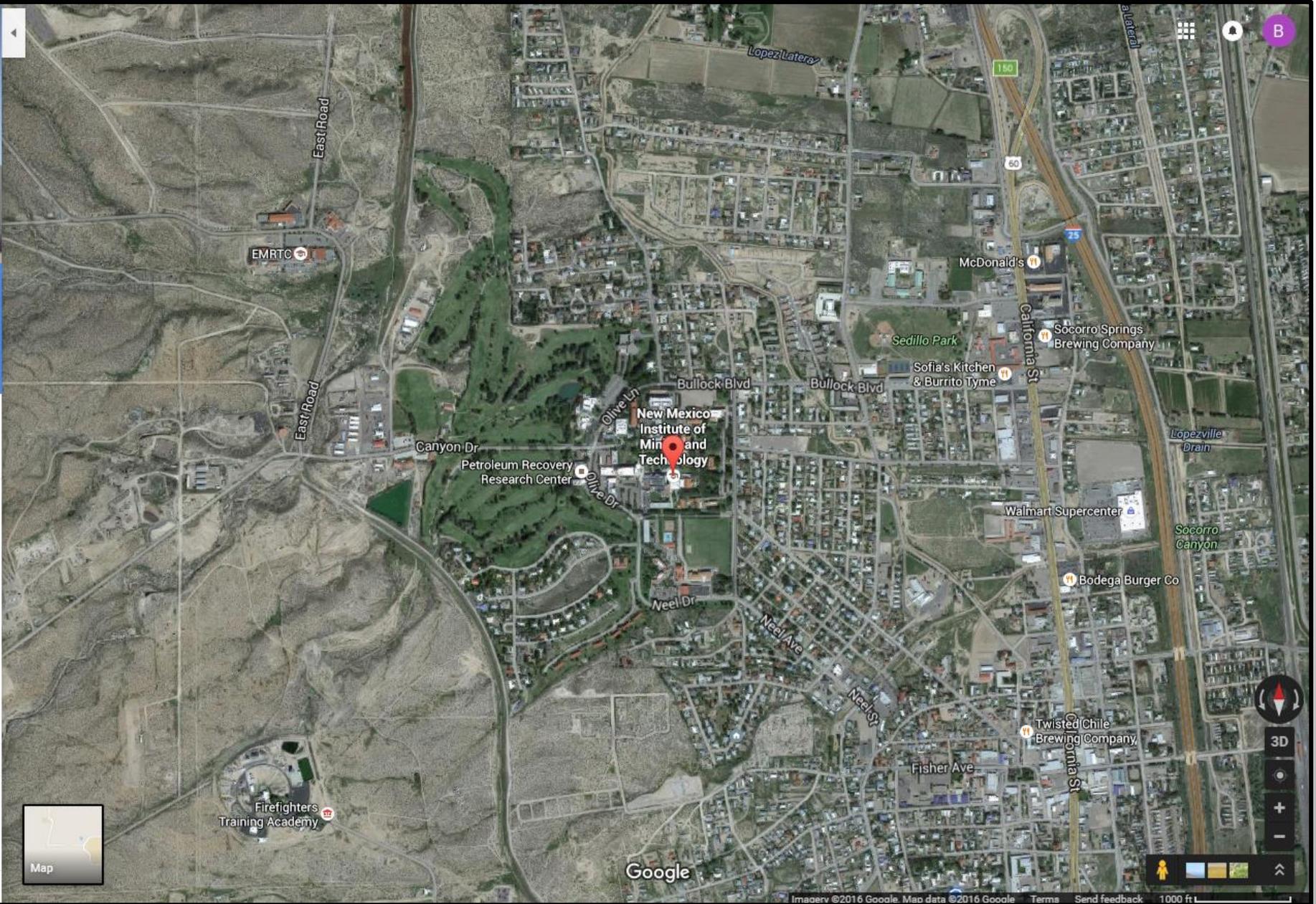
📍 **Directions**

★ SAVE 📍 NEARBY 📱 SEND TO YOUR PHONE 🔄 SHARE

📍 801 Leroy Pl, Socorro, NM 87801
🌐 nmt.edu
📞 (575) 835-5424
🕒 Open now: 8AM-5PM
✎ Suggest an edit
🚩 Add a label

📷 29 Photos
📷 Add a photo

Review summary



KELLY HALL

Addition 2009

Original Building 1978



THE PRRC IN 1978

Created by New Mexico Statute: NMSA 1978, Article 9 as a division of New Mexico Tech

Duties:

“The objectives and duties of the New Mexico Petroleum Recovery Research Center shall be as follows:

- A. to engage in theoretical and practical research into the recovery of petroleum and other energy resources;
- B. to disseminate the knowledge acquired;
- C. to assist, in all legal ways, persons and entities in the state in their efforts to effect additional recovery of petroleum and other energy resources from the state;

THE PRRC IN 1978

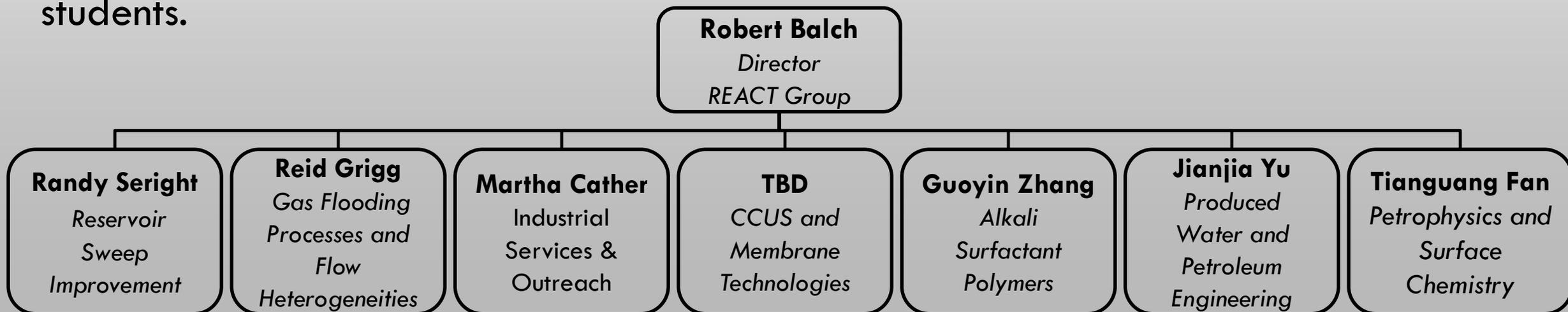
- D. to perform any and all tasks in the area of petroleum recovery and other energy research as directed by the board of regents of the New Mexico Institute of Mining and Technology; and
- E. to cooperate with all other state and federal agencies as may be beneficial in carrying out the work of the New Mexico Petroleum Recovery Research Center.

Sources of income.

- The center may receive appropriations from the state directly or through the board of regents and may receive any or other items of value from public or private sources.”

THE PRRC TODAY

- 21 Regular employees
 - 6 Support staff: Lab assistants, IT, accounting, clerical, technical writing, machine shop
 - 15 Research staff in eight research groups
- 4 Supported Faculty, with summer salary in Hydrology, Geophysics, Petroleum Engineering, and Engineering Management, funded through collaboration with researchers.
- 28 supported students, currently funding 17 graduate students and 11 undergraduate students.



PRRC FACILITIES

- 24 Laboratories with over 10,000 ft² of lab space, including:
 - Core Flooding
 - Materials synthesis
 - Produced water treatment
 - Computing
- Machine shop
- Server Room
- Chemical storage
- Meeting and Seminar rooms
- Field sites in New Mexico and Texas



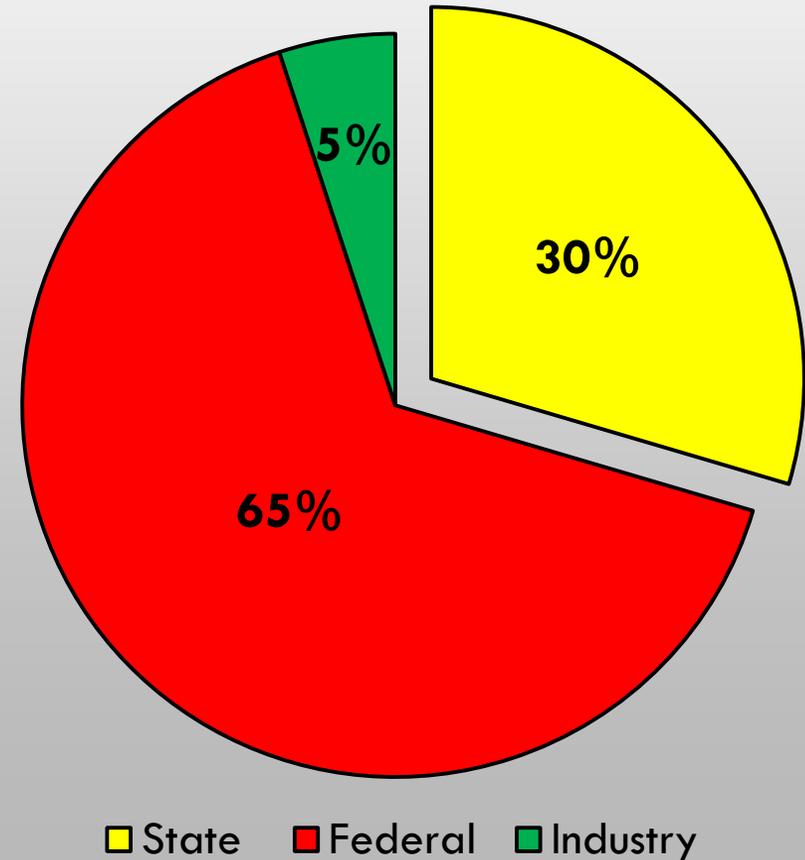
Prototype field desalination unit developed at PRRC

PRRC FINANCES

Funding from multiple sources:

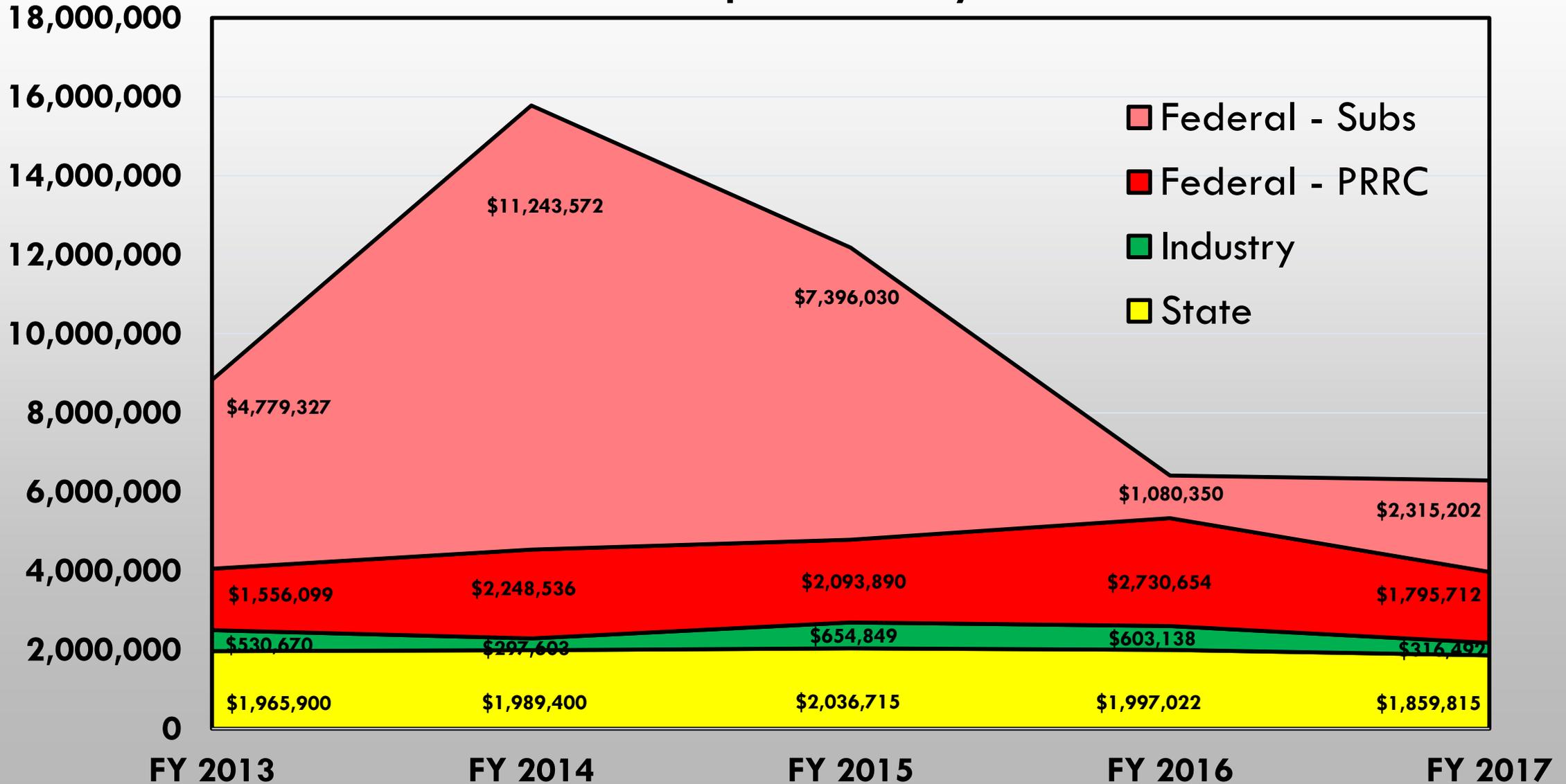
- State Of New Mexico provides a base budget
 - **\$1,859,815**
- Work for other state agencies
 - **\$45,000**
- Federally funded research
 - **\$4,110,914**
- Industry and Industrial consortia
 - **\$316,492**

FY 2017 Budget: **\$6,287,221**

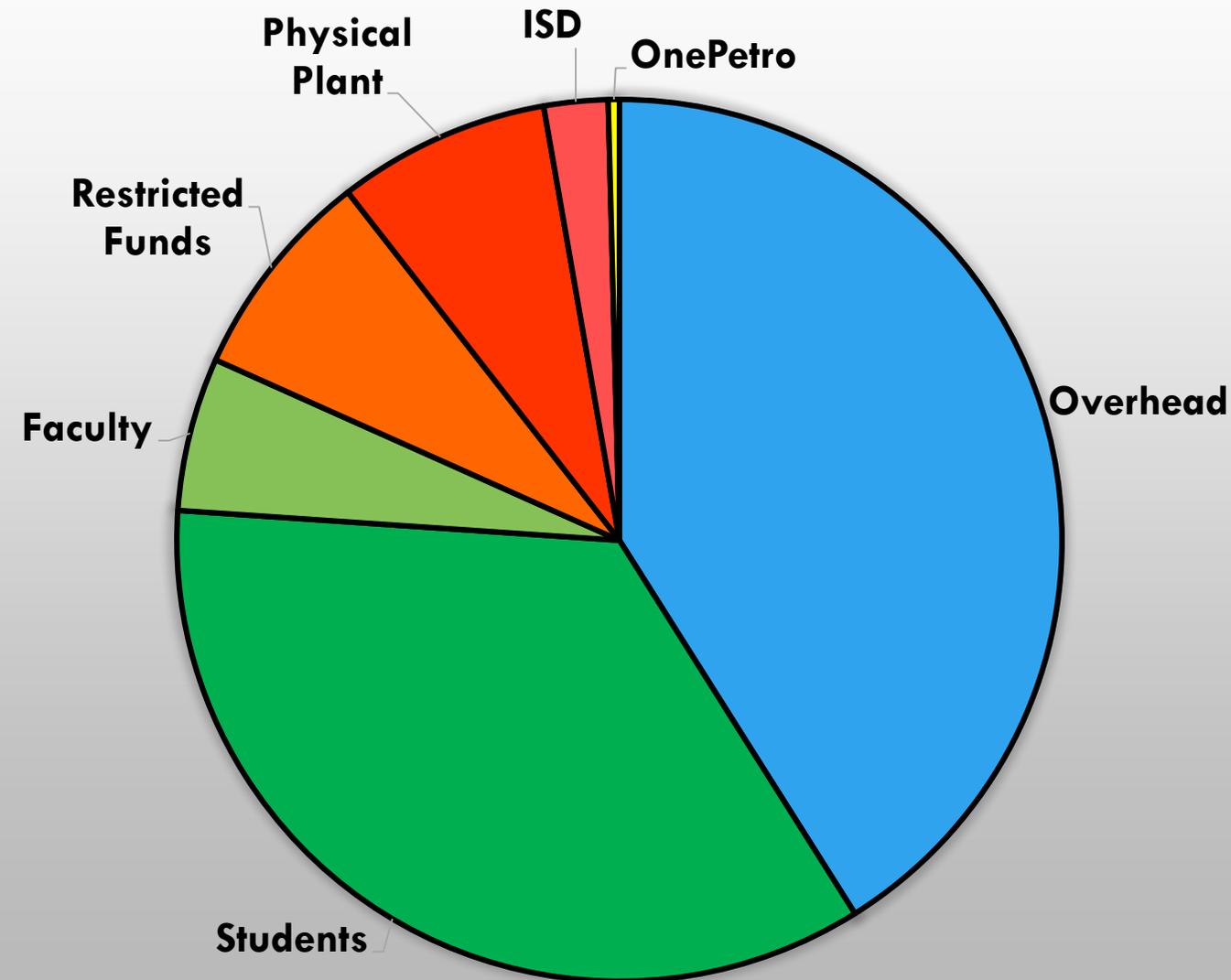


PRRC FINANCES

PRRC Expenditures by Fiscal Year



THE PRRC SUPPORTS NEW MEXICO TECH

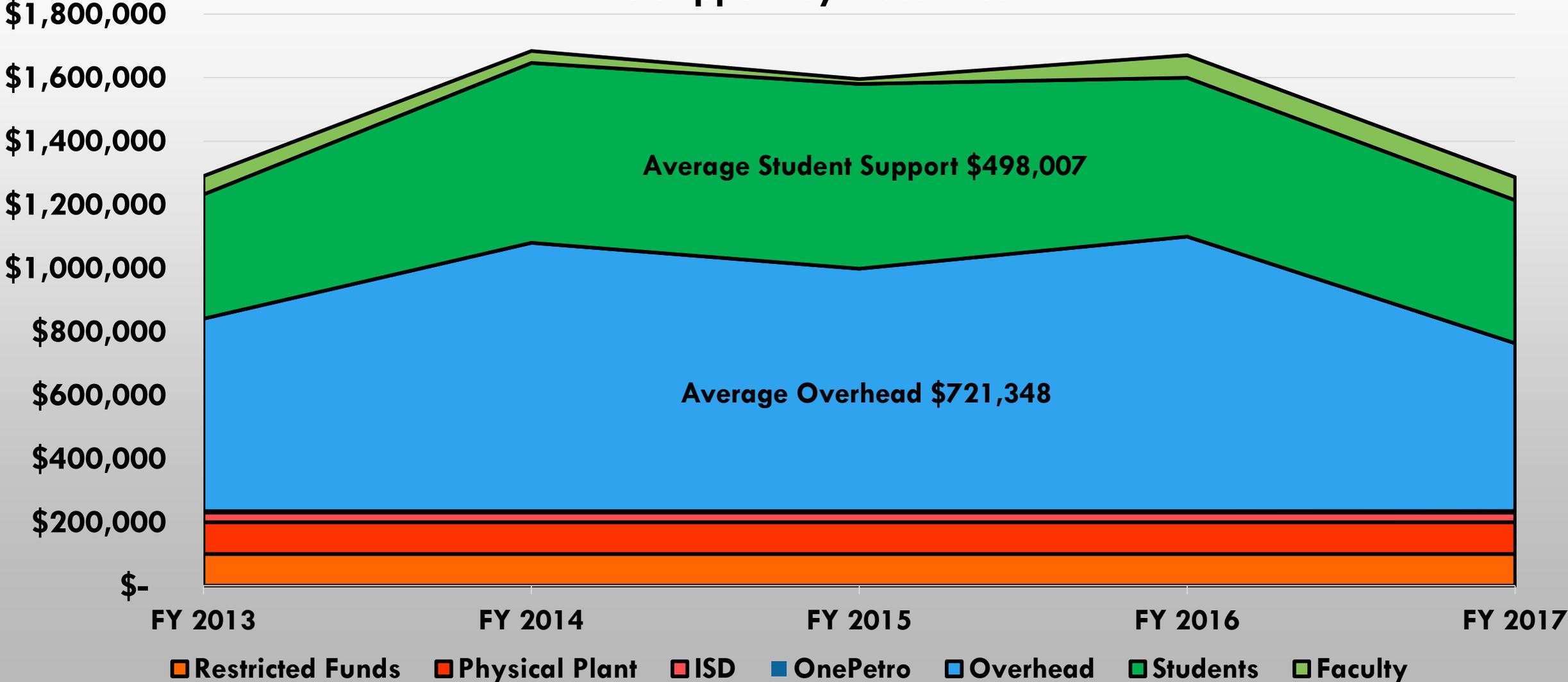


Institutional Support FY 2016	
Overhead	\$ 528,282
Students	\$ 450,401
Faculty	\$ 72,393
Restricted Funds*	\$ 100,000
Physical Plant*	\$ 100,000
ISD*	\$ 30,000
OnePetro*	\$ 5,250
Total	\$ 1,286,326

*Fixed Costs - \$235,250/ year

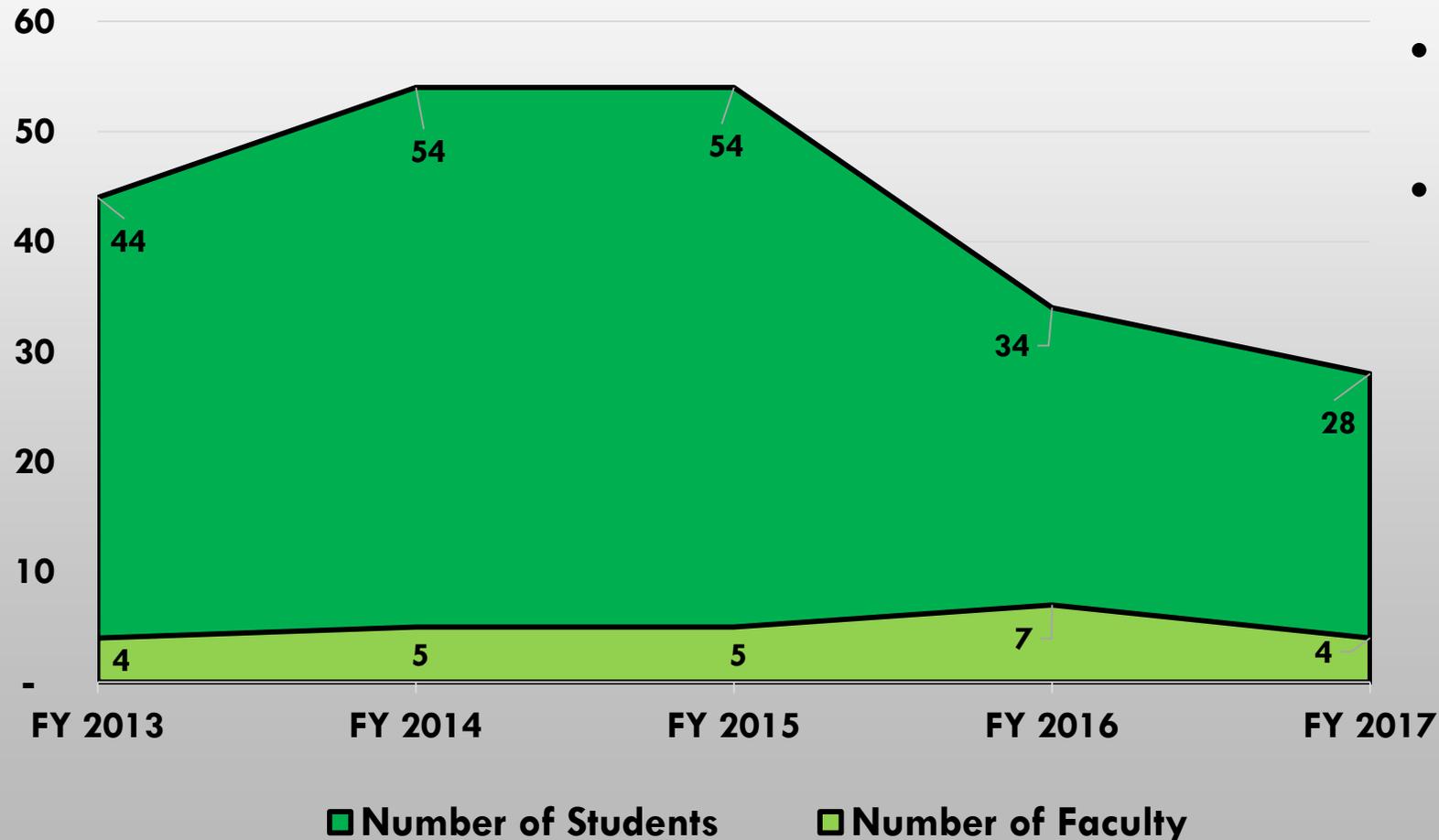
THE PRRC SUPPORTS NEW MEXICO TECH

PRRC Support by Fiscal Year



PRRC STUDENT AND FACULTY SUPPORT

PRRC Students and Faculty



- Support an average of **43** students per year
- Provide summer salary to an average of **5** faculty per year
- Students and faculty from many departments on campus, including:
 - Petroleum Engineering
 - Chemical Engineering
 - Materials Engineering
 - Electrical Engineering
 - Civil and Environmental Engineering
 - Earth and Environmental Science
 - Chemistry
 - Computer Science
 - Engineering Management

FUNDED RESEARCH

- Twelve active projects in 2016
 - Federally funded projects
 - Industry based projects
- Largest project was the “*Southwest Partnership on Carbon Sequestration: Phase III*”
 - 15 year \$90 million Carbon Capture / EOR demonstration project U.S. DOE
- Smallest project was “*Simulation of Impact of Short Radius Laterals*”
 - 1 year \$30,000 for ViperDrill LLC

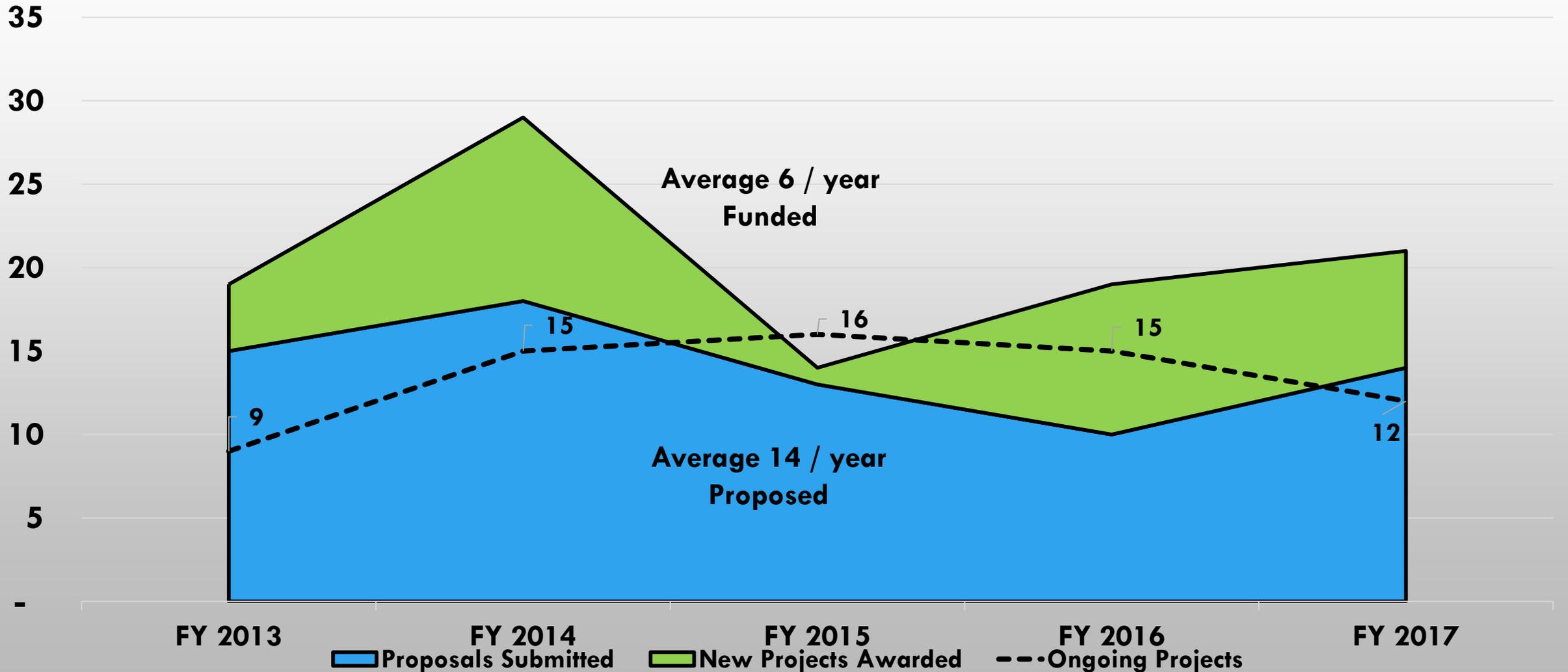
NON-FUNDED RESEARCH

Numerous 2017 non-funded research projects, including:

- *Determination of source of injectivity issues for Queen sand waterfloods*
 - Lab work for Beach Exploration
- *Simulation Study of Acid Gas Injection into the Cherry Canyon Formation, Delaware Basin, New Mexico*
 - MS thesis to study plume extent for an existing acid-gas disposal permit
- *Go-TECH website*
 - ongoing maintenance and software upgrades for free production database which gets 3-5 million hits per year

THE PRRC ACTIVELY PURSUES FUNDING

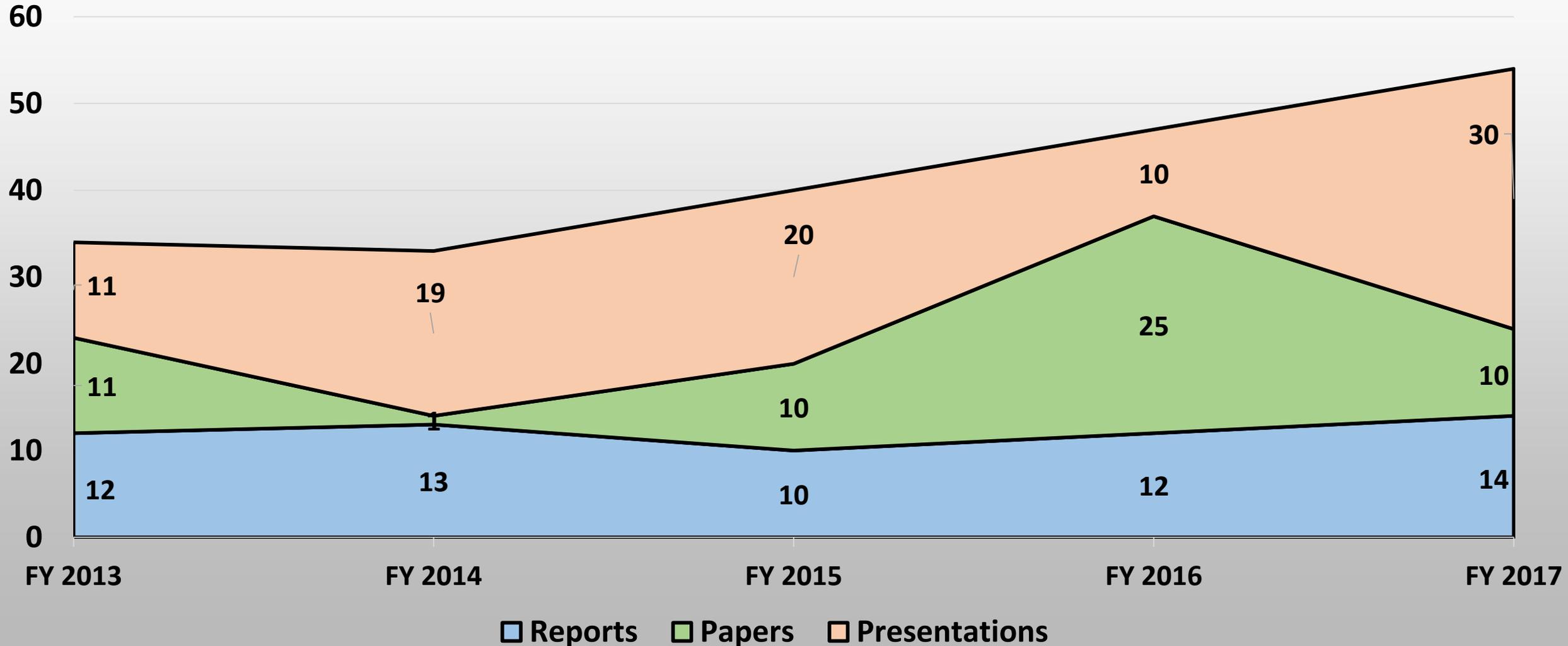
Proposal Activity



Note: Proposals funded may not be awarded in the same fiscal year proposed

TECHNOLOGY TRANSFER

Reports, Papers, Presentations



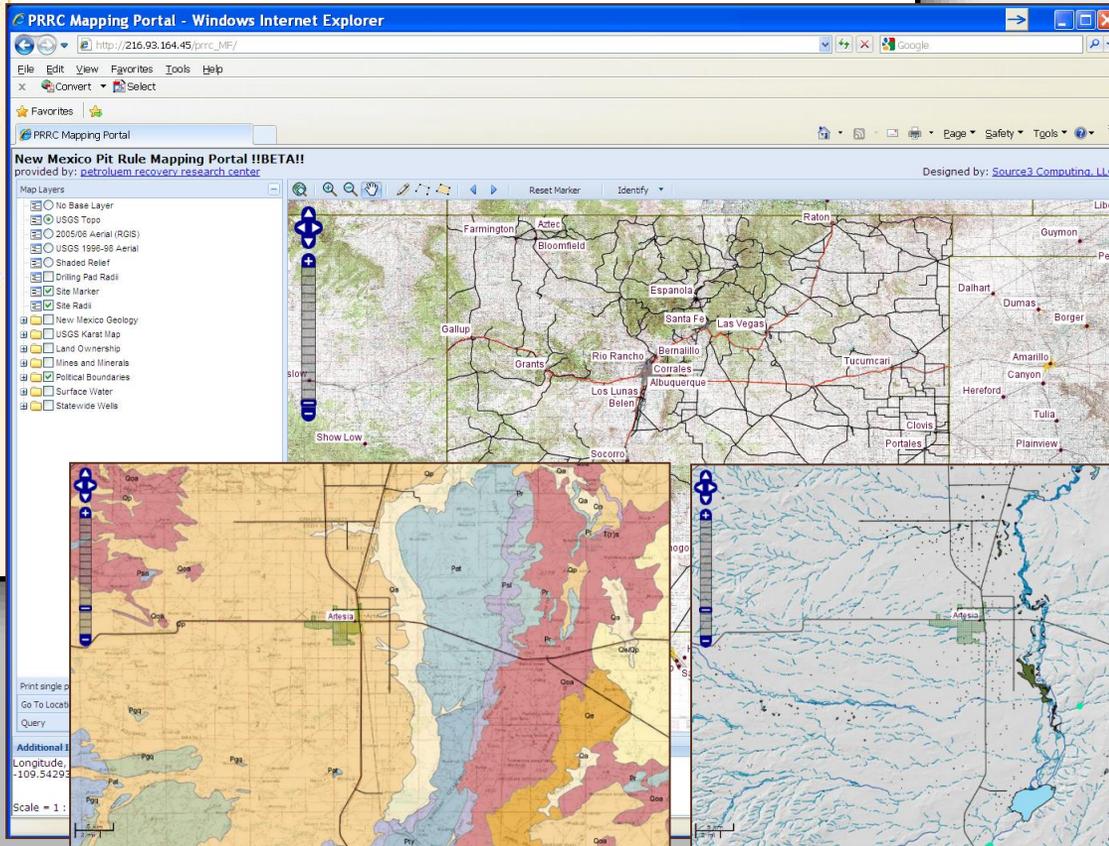
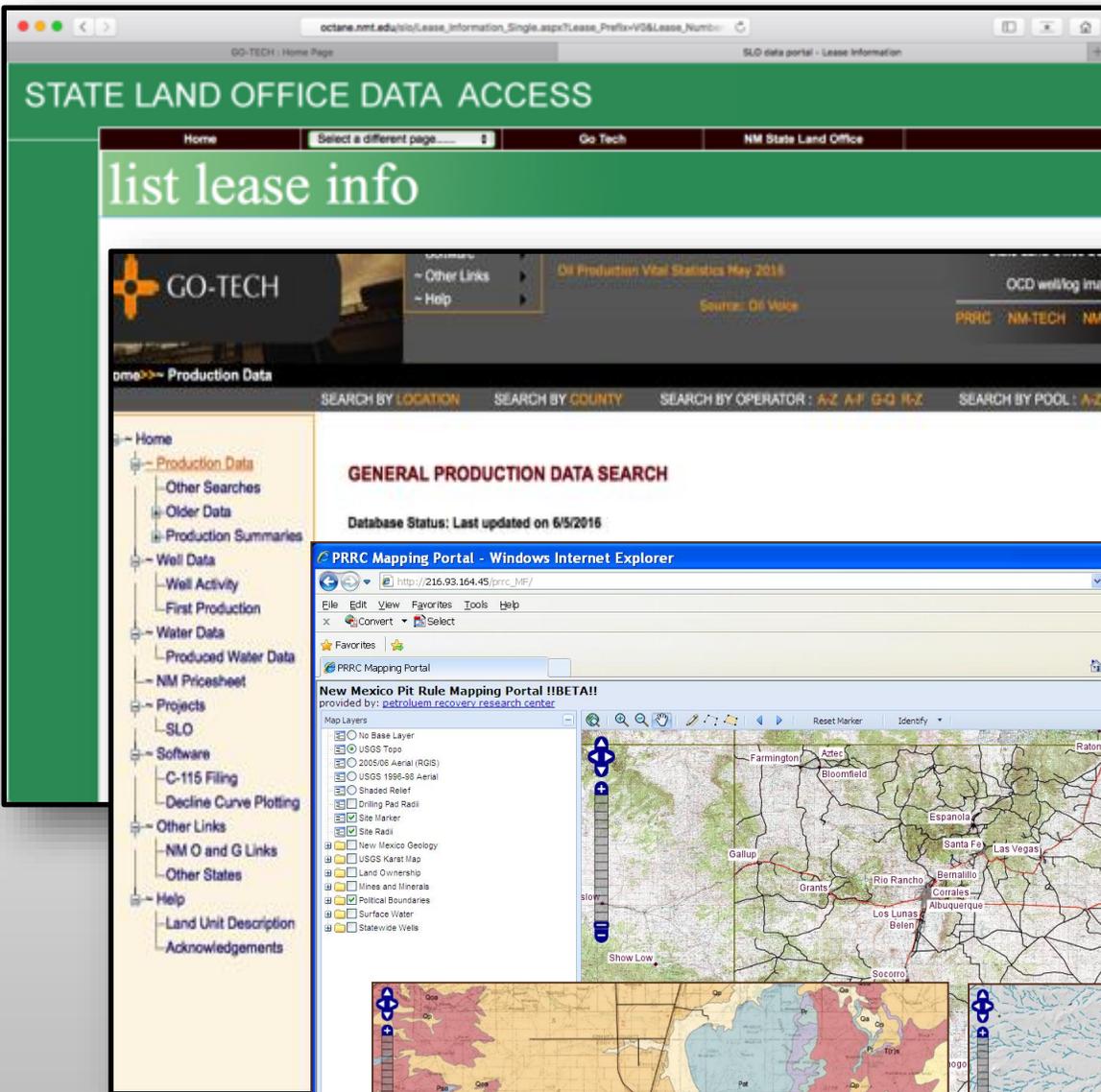
WEB TOOLS

NM State Land Office Site

GO-TECH Web Site (production data, well info, Data analysis. etc)

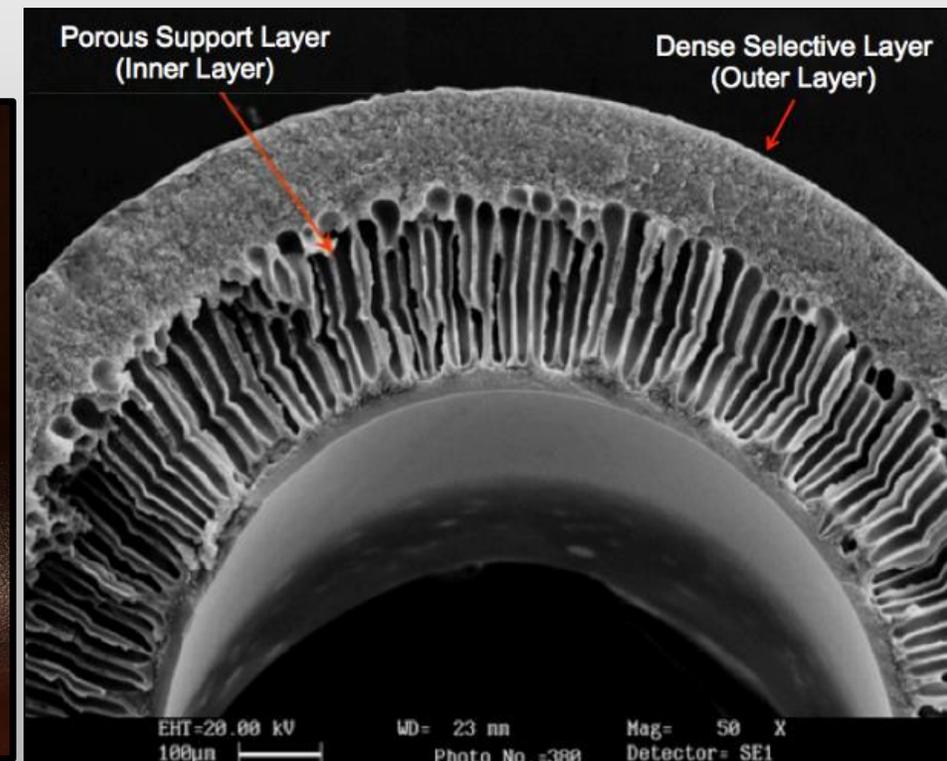
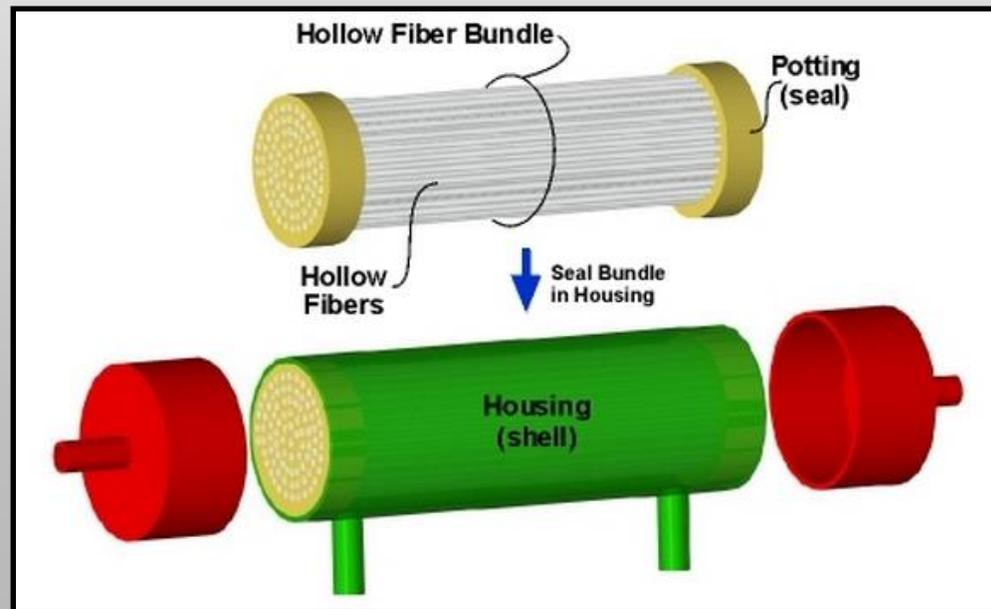
Regulatory Mapping tools
– Pit Rule and other uses

5-6 million page views each year!



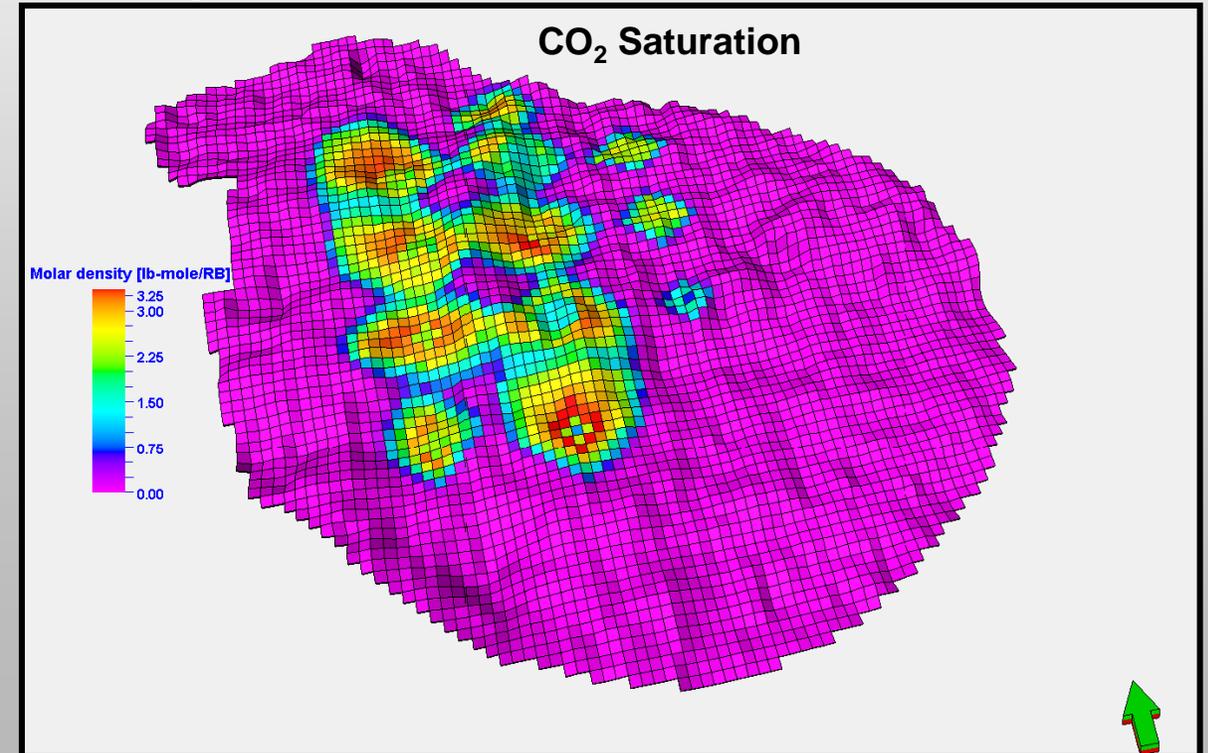
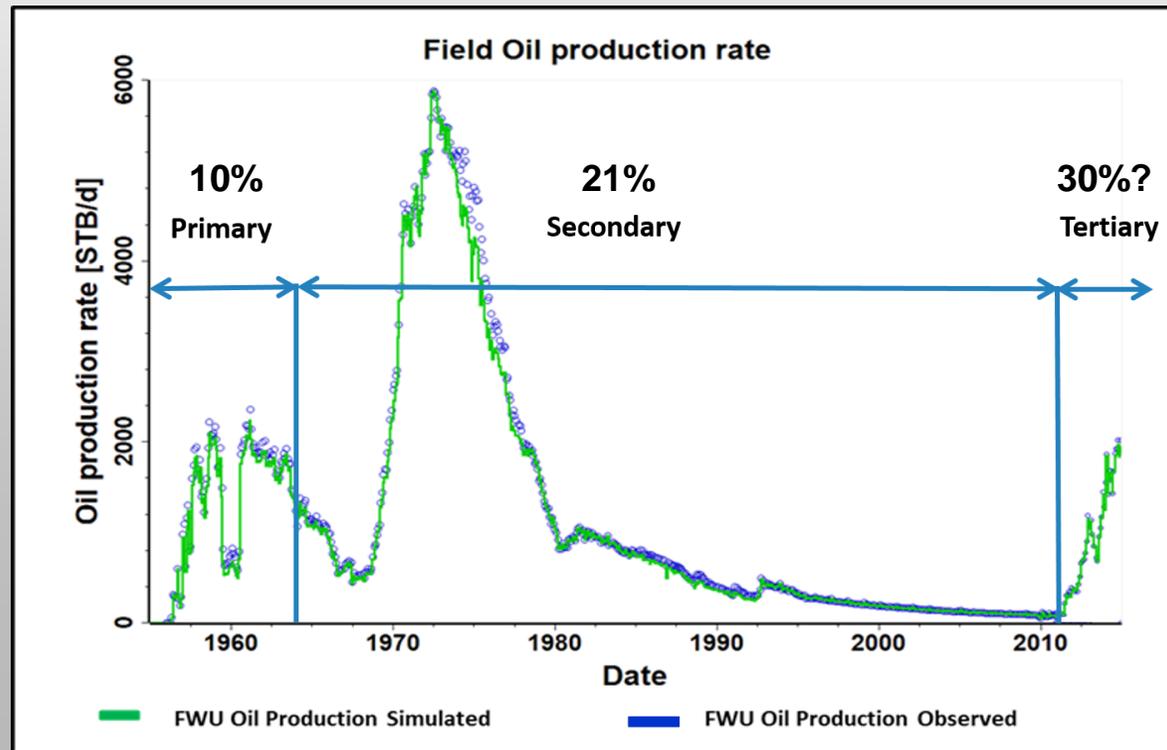
WATER FILTRATION – HOLLOW FIBER MEMBRANES

- Polymeric hollow fiber membranes have been fabricated at PRRC for produced water treatment. The removal efficiency for organics salt removal is greater than 95% under a relatively low pressure (less than 30 psi).



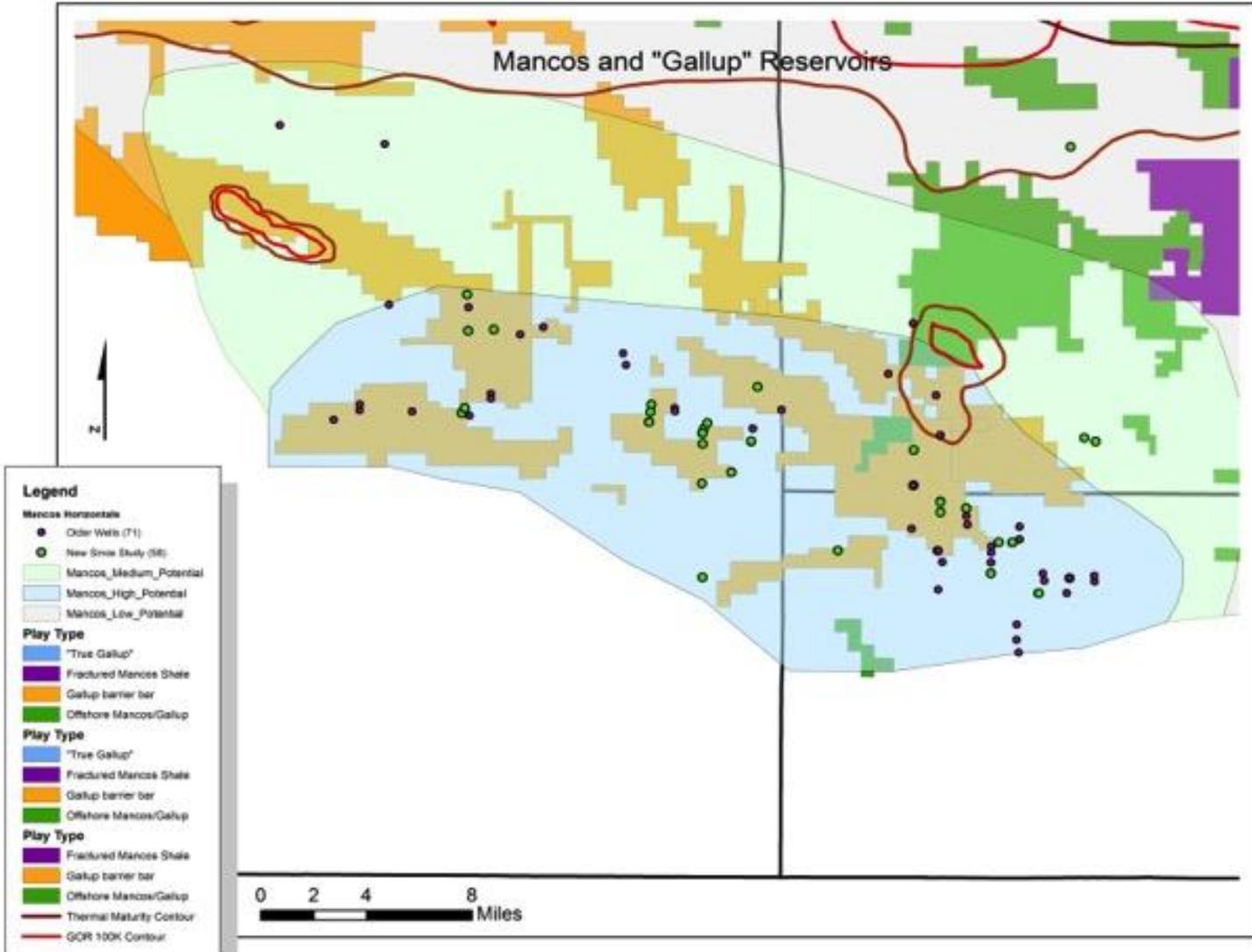
CO₂ EOR

- Southwest Partnership – Co-optimizing CO₂ storage and enhanced oil recovery at Farnsworth Field. Demonstrating benefits of using/storing 1,000,000 tonnes of anthropogenic CO₂ to simultaneously store carbon and improve ultimate oil recovery.



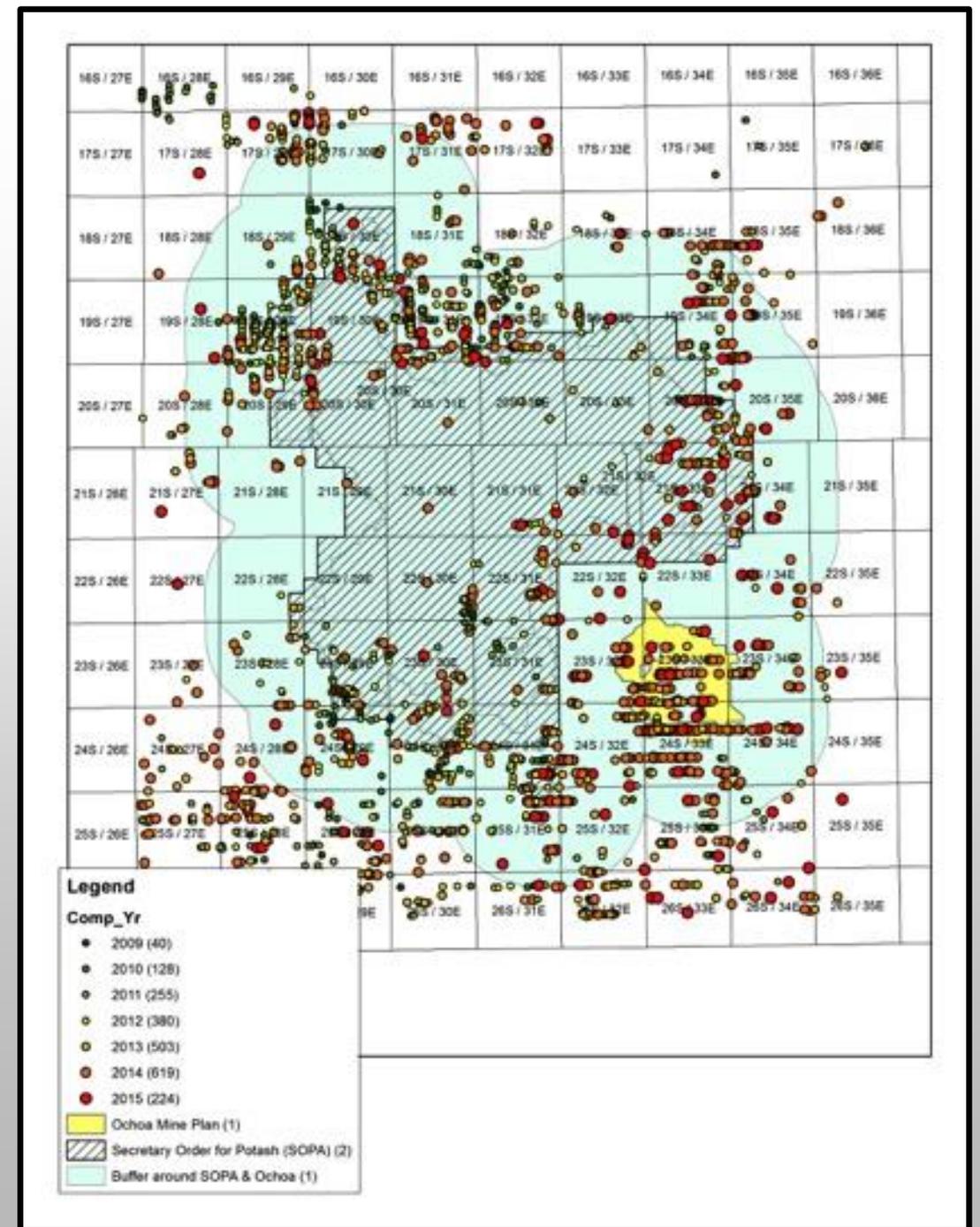
HIGH GRADING THE MANCOS SHALE

- Mancos shale development in San Juan Basin – compiled well data, production data, and geological information to help predict areas of highest potential for Mancos oil play development



POTASH CONSORTIA

- Potash area evaluation – compile well, production and economic data to determine impact of oil and gas development in the area
- 10 COMPANIES
 - BOPCO, CHEVRON, DEVON, XTO, OXY, EOG, CONCHO, STRATA, CIMAREX, YATES



NEW: SHALE OIL/GAS CONSORTIUM

Purpose – to conduct an industry-directed research program that will provide useful information that will increase and enable more cost-efficient and environmentally-sound recovery from shale resources.

- Looking for members/stakeholders (NW Mancos, SE Var. Formations)

- Technical/Academic

- Industry

- Legal

- Public

- Regulatory bodies

US shale oil output to rise by 100,000 barrels a day in August

www.cnbc.com/.../us-shale-oil-output-to-rise-by-100000-barrels-a-day-in-august.html ▼

Jul 17, 2017 - Oil production in several U.S. shale oil regions will grow by 113,000 barrels a day, the Energy Information Administration forecast on Monday.

US shale oil output to rise by 127,000 barrels a day in July: EIA

<https://www.cnbc.com/.../us-shale-oil-output-to-rise-by-127000-barrels-a-day-in-july-...> ▼

Jun 12, 2017 - US shale oil output projected to rise by more than 100,000 barrels a day for a ... Forecast for oil production from U.S. shale basins, thousands of ...

US shale oil output to rise by 122,000 barrels per day in June: EIA

<https://www.cnbc.com/.../us-shale-oil-output-to-rise-by-122000-barrels-per-day-in-ju...> ▼

May 15, 2017 - American shale oil drillers are expected to raise output again in June, ... Forecast for oil production from U.S. shale basins, thousands of barrels ...

- Contact: Martha Cather – martha.cather@nmt.edu – (575) 835-5685

NEW: PRODUCED WATER CONSORTIUM

Purpose – to explore regulatory changes and technical/engineering challenges to overcome to allow beneficial use of produced water

- Looking for members/stakeholders
 - Technical/Academic
 - Industry
 - Legal
 - Public
 - Regulatory bodies



In 2016 NM produced nearly 36 billion gallons of water!

- Contact: Robert Balch – robert.balch@nmt.edu – (575) 835-5305

SERVICE TO NEW MEXICO PRODUCERS

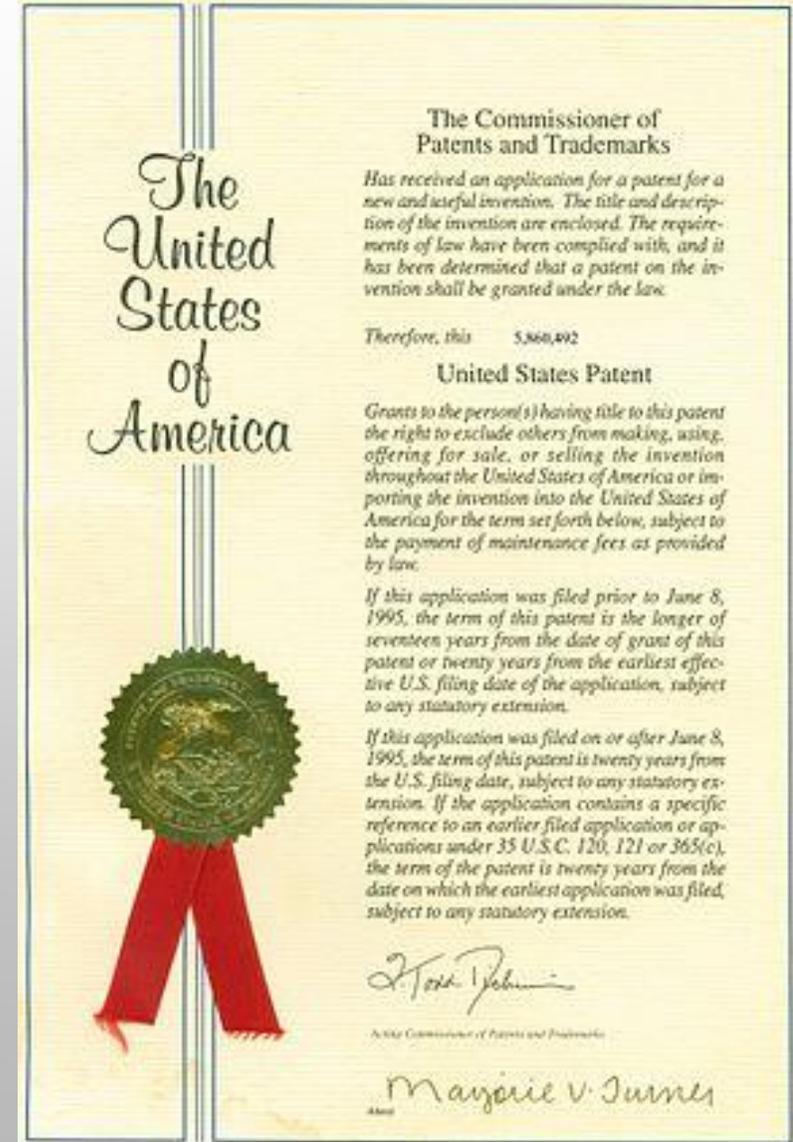
- Service to New Mexico producers is an integral part of the PRRC mission
- Low oil and gas price environment challenges producers and development decisions have more weight
- PRRC can add specialized expertise to operations and help reduce risk while enhancing production
- PRRC can perform no, or at-cost lab analyses and other services to jumpstart projects



**WHAT CAN THE PRRC DO FOR
YOUR COMPANY?**

ACTIVE PATENTS

- Six active patents
- Focused in two areas:
 - **Produced water purification (4)**
 - Instrumentation (2)
- Additional opportunities in:
 - Nanotechnology
 - Gas sampling
 - Sensors



RESEARCH GROUP CAPABILITIES

Advanced Materials in Hydrocarbon Production

Section Head: TBD

Nanoparticle-stabilized CO₂ foams for enhanced oil recovery

- Formulation of nanoparticle-stabilized CO₂ foams for enhanced oil recovery
 - Advantages of nanoparticle-stabilized CO₂ foams include excellent chemical stability, low retention on mineral surfaces, and long-term CO₂ foam stability.
 - Decrease in CO₂ mobility.
 - Improvement of CO₂ sweep efficiency.

Development of chemical sensors for downhole monitoring

- Fabrication and development of chemical CO₂ sensors
- Simulation of CO₂ storage process.

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.

RESEARCH GROUP CAPABILITIES

Petrophysics and Surface Chemistry

Research Chemist: Tianguang Fan

- 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

RESEARCH GROUP CAPABILITIES

Reservoir Evaluation/Advanced Computational Technologies (REACT)

Section Head: Dr. Robert Balch

- 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

Industry Service and Outreach Group

Section Head: Martha Cather

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

Capabilities

- Geological characterization at core and microscope scale
 - Study deposition and diagenesis to determine porosity and permeability.
- Core studies
- Basic petrographic studies
- Detailed thin section analysis
- Microprobe analysis
- Play and resource evaluation
- Mapping and data analysis

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. Reid Grigg

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.