UND PREEC

Petroleum Research Education and Entrepreneurship Center

Established in 2009

North Dakota Department of Commerce Centers of Excellence Program
Geology and Geophysics of Williston Basin

Environmental and Policy Issues

Enhanced Geothermal Systems

CO₂ Sequestration

Petroleum Engineering Characteristics of Williston Basin

Enhanced Oil Recovery

SIX INITIAL MISSIONS
Initial PREEC SUPPORT

- North Dakota Department of Commerce
  - $3,000,000 CoE Award

- American Petroleum Institute
  - $20,232 Standards subscription

- IHS
  - $641,715 Software license

- Schlumberger
  - $4,171,260 ECLIPSE reservoir simulation software
  - $372,404 PETREL Petroleum geology software
  - $331,560 Petrophysics well logging software
$1,733,961 DOE - Electrical Power from Co-produced fluids

$1,733,961 DOE - Electrical Power from low temperature fluids (90 - 150 C)

$1,500,00 Access Energy LLC Design and Production of High-efficiency ORC

$266,000 DOE - SMU National Geothermal Data Aggregation

$250,000 DOE - AZGS National Geothermal Data System (NE & ND)

$500,000 RPSEA (DOE) Enhanced Oil Recovery from Bakken

$195,000 Noble Energy - Surfactant Formulation Study for Enhancing Wattenberg field Oil Production

$125,000 NDIC Enhanced Oil Recovery from Bakken

$108,808 DOE - U. Minnesota National Geothermal Data System

$13,700 IREE - Heat Flow Map of Minnesota

$10,000 DOE - NREL National Geothermal Student Competition
Petroleum Industry Partnerships

- **AAG (Aqua Advisory Group) Inc., Jacksonville, Fl**
  - Partner in developing water treatment technology for brackish supply, frac water, and produced waters for oil fields

- **Poudre Valley Environmental Sciences, Inc. (consultant)**
  - Partner with AAG in developing water treatment technology for oil field applications

- **Hess Corporation, Houston, TX**
  - Partner in DOE project: Geomechanical Study of Bakken Formation for Improved Oil Recovery. Matching funding for PREEC.
  - Participant in RPSEA DOE/NDIC funded 3-yr $650,000 Bakken EOR project of surfactant imbibition.

- **St. Mary Land & Exploration Co, Denver, CO**
  - Partner in DOE project: Geomechanical Study for Bakken Formation for Improved Oil Recovery. Matching funding for PREEC
Petroleum Industry Partnerships

- **Denbury, Inc Ft. Worth, TX**
  - Partner in DOE project: Geomechanical Study of Bakken Formation for Improved Oil Recovery. Matching funding for PREEC

- **Whiting Petroleum Corp., Denver, CO**
  - Partner in DOE project: Geomechanical Study of Bakken Formation for Improved Oil Recovery. Matching funding for PREEC

- **Marathon Oil Corp., Houston, TX**
  - Partner in DOE project: Geomechanical Study of Bakken Formation for Improved Oil Recovery. Matching funding for PREEC

- **CorsiTech, Houston, TX**
  - Participant in RPSEA DOE/NDIC Enhanced Oil Recovery Project

- **Shell Chemicals, Houston, TX**
  - Chemical supplier for RPSEA DOE/NDIC Enhanced Oil Recovery Project
Petroleum Industry Partnerships

- **Tiorco, Denver, CO**
  - Chemical supplier for RPSEA DOE/NDIC Enhanced Oil Recovery Project

- **Computer Modeling Group, Calgary, AB**
  - Numerical simulator software partner for RPSEA DOE/NDIC Enhanced Oil Recovery Project

- **University of Texas, Austin, TX**
  - Numerical simulator software partner for RPSEA DOE/NDIC Enhanced Oil Recovery Project

- **PRRC of New Mexico Tech**
  - Cooperator on EOR research of tight oil reservoirs

- **North Dakota Geological Survey Core Lab**
  - Core sample provider for RPSEA DOE/NDIC Enhanced Oil Recovery Project

- **Noble Energy**
  - Surfactant formulation study for enhancing Wattenberg field oil production
Geothermal Power Partnerships

- **Access Energy, LLC, Yorba Linda, CA**
  - Partner supplying $1,500,000 in funding for design and production of high-efficiency organic Rankine cycle (ORC) engines

- **Continental Resources, Inc., Oklahoma City, OK**
  - Oil industry partner in oil field geothermal power project

- **Slope Electric Cooperative, Inc., New England, ND**
  - Partner in development of oil field geothermal power

- **InnerGeo, LLC, Corpus Christi, TX**
  - Partnership in research and development of a novel heat-mining process for geothermal power

- **Presco Inc., the Woodlands, TX**
  - Partnership in geophysical data analysis of Rye Patch, NV Geothermal Power plant
Characterization of the diagenesis of the middle member of the Bakken Formation

Enhanced Oil Recovery by surfactant imbibition

Geomechanical study of Bakken formation

Thermal history and thermal maturity analysis of source rocks in the Williston basin

Water treatment technology for brackish supply, frac water, and produced waters for oil fields

Integrated underground coal gasification (UCG) with CO2 enhanced oil recovery
PREEC PROJECTS

- Geothermal power production from low temperature (90 °C - 150°C) oil field fluids – U.S. Dept. Of Energy
- Geothermal power production from co-produced oil field fluids – U.S. Dept. Of Energy
- EGS with CO₂
  - Collaborative with: U MN, Heat Mining Corp.
  - Collaborative with: SMU, UT BEG, Texas Tech, Cornell, MLK and GRC
- Heat flow map of Minnesota - MNRRI
- Post-glacial warming correction for heat flow data
Petroleum Engineering Laboratory

- MTS Uniaxial Testing System
- AutoLab 1500 C Triaxial Testing System
- Geochemical system for surfactant imbibition
- CO₂ injection system
Geothermal Laboratory

- Two divided bar systems for measuring thermal conductivity; capable of 0-69 MPa and -20 C to 150 C
- Two portable electronic divide bars for measuring thermal conductivity in the field and laboratory at ambient conditions
- 96 channel EX-300 Geode exploration seismograph capable of multiple array styles including a linear layout of up to 0.5 km at 5m spacing
- Ballistic Seismic Source system (BOSS)
- Germanium-Lithium gamma ray spectrometer for measuring uranium, thorium, and potassium for radioactive heat production in crushed rock samples
- Hand-held portable gamma-ray spectrometer
- High-precision manual temperature logging system capable of 8500 m depth and +/-0.001 C accuracy
- Two Trimble 5700 GPS receivers
- Three G-856 Memory Mag Proton Precession Magnetometers
Current PREEC Statistics

- 10 Faculty and Staff
- Thirty-three student research assistants
- Ten competitive research grants
- $11,976,601 total external funding and in-kind support
- Fifty-four presentations, publications 2010-2012