



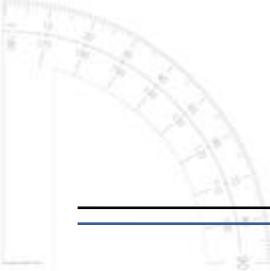
RPSEA Research Project Overview

IOGCC Annual Meeting
October 16-18 Buffalo, NY

Charlotte Schroeder

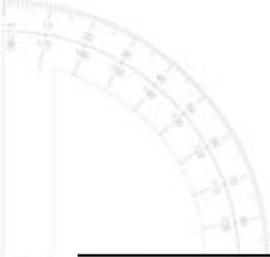
RPSEA

- **A non-profit corporation formed by a consortium of premier U.S. energy research universities, industry and independent research organizations.**
- **Mission is to provide a stewardship role in ensuring the focused research, development and deployment of safe, environmentally sensitive technology that can effectively deliver hydrocarbons from domestic resources to the citizens of the United States.**
- **3 programs**
 - **Ultra-Deepwater**
 - **Unconventional Natural Resources**
 - **Small Producer**



Unconventional Resources Program Advisory Committee

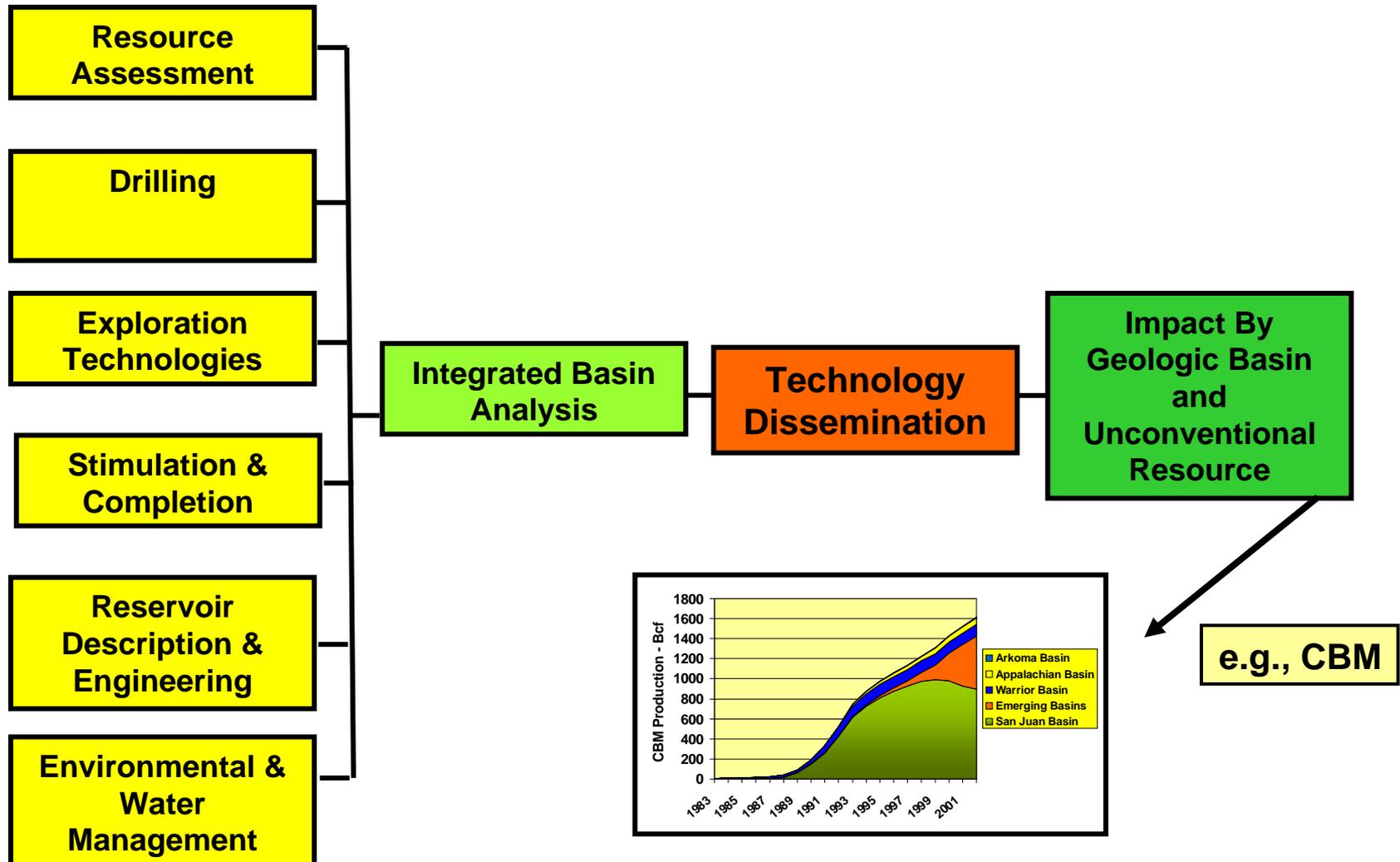
- **15 members from Industry**
 - **Producing Companies,**
 - **Service Companies**
 - **Research Organizations**
- **Provide Direction to the Program**
 - **Solicitation Guidance**
 - **Proposal Evaluations and Selections Recommendations**
 - **Other Guidance**



Unconventional Resources

- **38 projects have been undertaken – solicitation years 2007 – 2009**
 - **\$72 MM total**
 - **\$46 MM RPSEA**
- **8 projects being negotiated from 2010**

RPSEA Unconventional Gas Program Components & Approach – Built Over 2007-2010



	Gas Shales	Tight Sands
Integrated Basin Analysis	New Albany (GTI) \$3.4 Marcellus (GTI) \$3.2 Mancos (UTGS) \$1.1	Piceance (CSM) \$2.9
Stimulation and Completion	Cutters (Carter) \$.09 Frac (UT Austin) \$.69 Refrac (UT Austin) \$.95 Frac Cond (TEES) \$1.6 Stimulation Domains (Higgs-Palmer) \$0.39 Fault Reactivation (WVU) \$0.85	Gel Damage (TEES) \$1.05 Frac Damage (Tulsa) \$.22 Foam Flow (Tulsa) \$0.57 Fracture Complexity (TerraTek) \$0.83
Reservoir Description & Management	Hi Res. Imag. (LBNL) \$1.1 Gas Isotope (Caltech) \$1.2 Marcellus Nat. Frac./Stress (BEG) \$1.0 Frac-Matrix Interaction (UT-Arl) \$0.46 Marcellus Geomechanics (PSU) \$3.1	Tight Gas Exp. System (LBNL) \$1.7 Strat. Controls on Perm. (CSM) \$0.1 Fluid Flow in Tight Fms. (MUST) \$1.2
Reservoir Engineering	Decision Model (TEES) \$.31 Coupled Analysis (LBNL) \$2.9 Shale Simulation (OU) \$1.05	Wamsutter (Tulsa) \$.44 Forecasting (Utah) \$1.1 Condensate (Stanford) \$.52
Exploration Technologies	Multi-Azimuth Seismic (BEG) \$1.1	
Drilling	Drilling Fluids for Shale (UT Austin) \$0.6	
Water Management	Barnett & Appalachian (GTI) \$2.5 Integrated Treatment Framework (CSM) \$1.56	Frac Water Reuse (GE) \$1.1
Environmental	Environmentally Friendly Drilling (HARC)* \$2.2	*
Resource Assessment	Alabama Shales (AL GS) \$.5 Manning Shales (UT GS) \$.43	Rockies Gas Comp. (CSM) \$.67

Coal Related:

Microwave Stimulation (Penn) \$.08

Water Treatment (CSM) \$1.56

Microbial Methanogenesis (CSM) \$.86

2007 Projects

2008 Projects

2009 Projects



Shale Related Projects

Unconventional Onshore Program

Shale Related Projects-2007 Program

1. New Albany Shale Gas
2. Novel Concepts for Unconventional Gas Development of Gas Resources in Gas Shales, Tight Sands and Coalbeds
3. An Integrated Framework for Treatment and Management of Produced Water
4. Geological Foundation for Production of Natural Gas from Diverse Shale Formations
5. Petrophysical studies of unconventional gas reservoirs using high-resolution rock imaging
6. A Self-teaching Expert System for the Analysis, Design and Prediction of Gas Production from Unconventional Gas Resources
7. Optimizing Development Strategies to Increase Reserves in Unconventional Gas Reservoirs
8. Improvement of Fracturing in Gas Shales
9. Improved Reservoir Access Through Refracture Treatments In Tight Gas Sands And Gas Shales
10. Paleozoic Shale-Gas Resources of the Colorado Plateau and Eastern Great Basin, Utah: Multiple Frontier Exploration Opportunities

Shale Related Projects-2008 Program

1. Barnett and Appalachian Shale Water Management and Reuse Technologies
2. Novel Gas Isotope Interpretation Tools to Optimize Gas Shale Production
3. Environmentally Friendly Drilling
4. Defined Effort to provide Pretreatment and Water Management for Frac Water Reuse and Salt Production.
5. Sustaining Fracture Conductivity of Gas Shale Reservoirs for Enhancing Long-Term Production and Recovery
6. Multi-azimuth Seismic Diffraction Imaging for Fracture Characterization in Low-Permeability Gas Formations
7. Evaluation of Fracture Systems and Stress Fields Within the Marcellus Shale and Utica Shale and Characterization of Associated Water-Disposal Reservoirs: Appalachian Basin.

Shale Related Projects-2009 Program

1. Characterizing Stimulation Domains, for Improved Well Completions in Gas Shales
2. Marcellus Gas Shale Project
3. Prediction of Fault Reactivation in Hydraulic Fracturing of Horizontal Wells in Shale Gas Reservoirs
4. Cretaceous Mancos Shale Uinta Basin, Utah: Resource Potential and Best Practices for an Emerging Shale Gas Play
5. Simulation of Shale Gas Reservoirs Incorporating Appropriate Pore Geometry and the Correct Physics of Capillarity and Fluid Transport
6. Integrated Experimental and Modeling Approaches to Studying the Fracture-Matrix Interaction in Gas Recovery from Barnett Shale
7. Using Single-molecule Imaging System Combined with Nano-fluidic Chips to Understand Fluid Flow in Tight and Shale Gas Formation
8. Improved Drilling and Fracturing Fluids for Shale Gas Reservoirs



Completed Projects

Unconventional Onshore Program

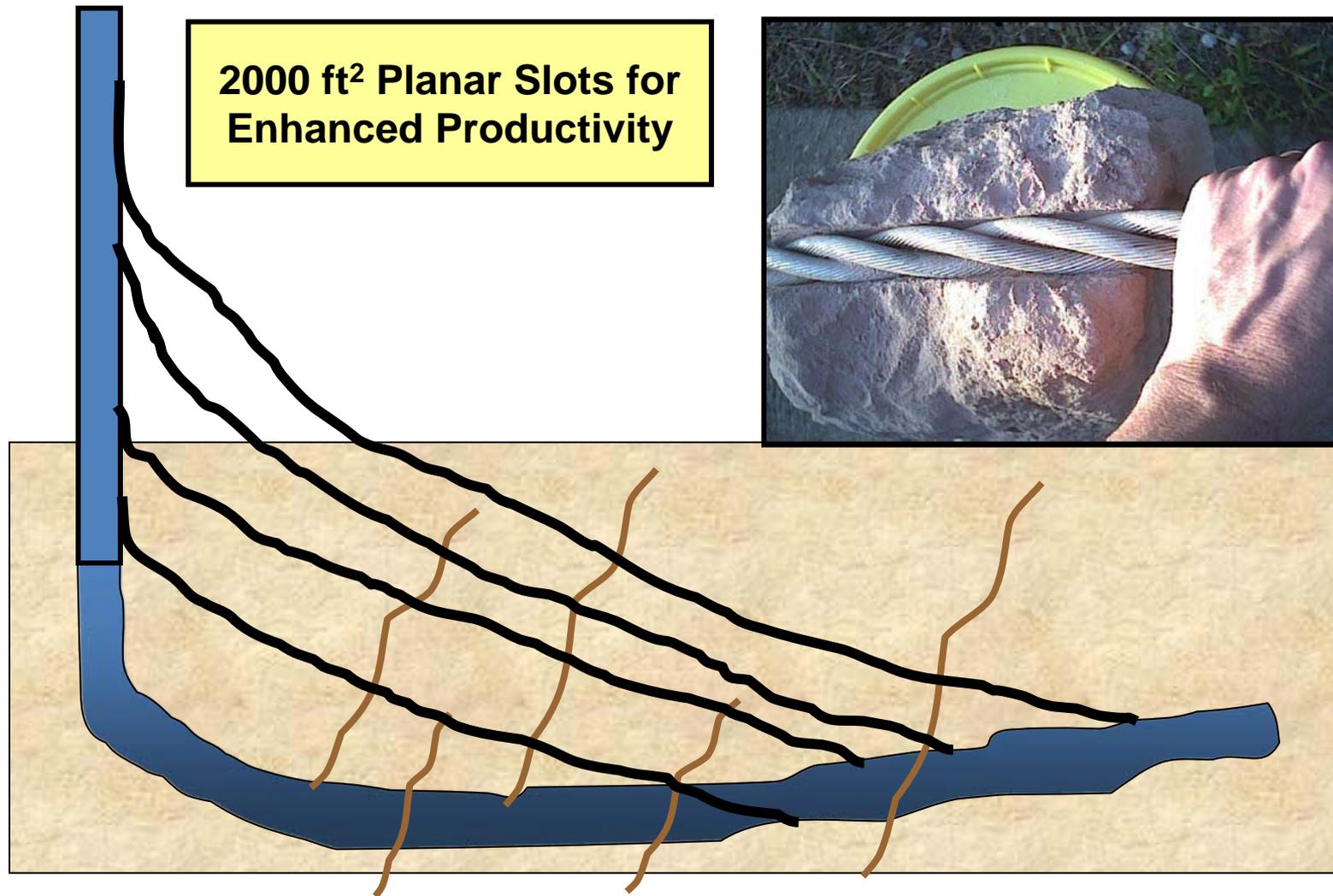
Completed Projects

Unconventional Onshore Program

Final Reports Available on RPSEA website

- Novel Concepts for Unconventional Gas Development in Shales, Tight Sands and Coalbeds
- New Albany Shale Gas
- Geological Foundation for Production of Natural Gas from Diverse Shale Formations
- Enhancing Appalachian Coalbed Methane Extraction by Microwave-Induced Fractures
- Optimization Of Infill Well Locations In Wamsutter Field

Novel Concepts for Unconventional Gas Development in Shales, Tight Sands and Coalbeds



Key Seat Slots Cut in Dogleg Hole

New Albany Shale

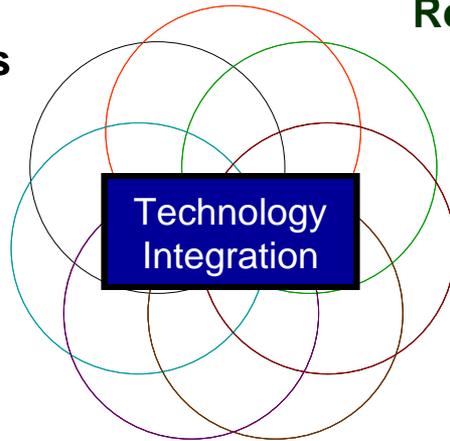
Resource Characterization - Well Stimulation - Well Cost

**Geologic Studies
Bureau of Economic Geology**

**Geochemical Analysis
Amherst & U Mass**

**Formation Evaluation
ResTech**

**Field Data,
Environmental
and Project
Management**



**Reservoir Engineering
Texas A&M**

**Fracture Modeling and
Diagnosis
Pinnacle Technology
and Texas A&M**

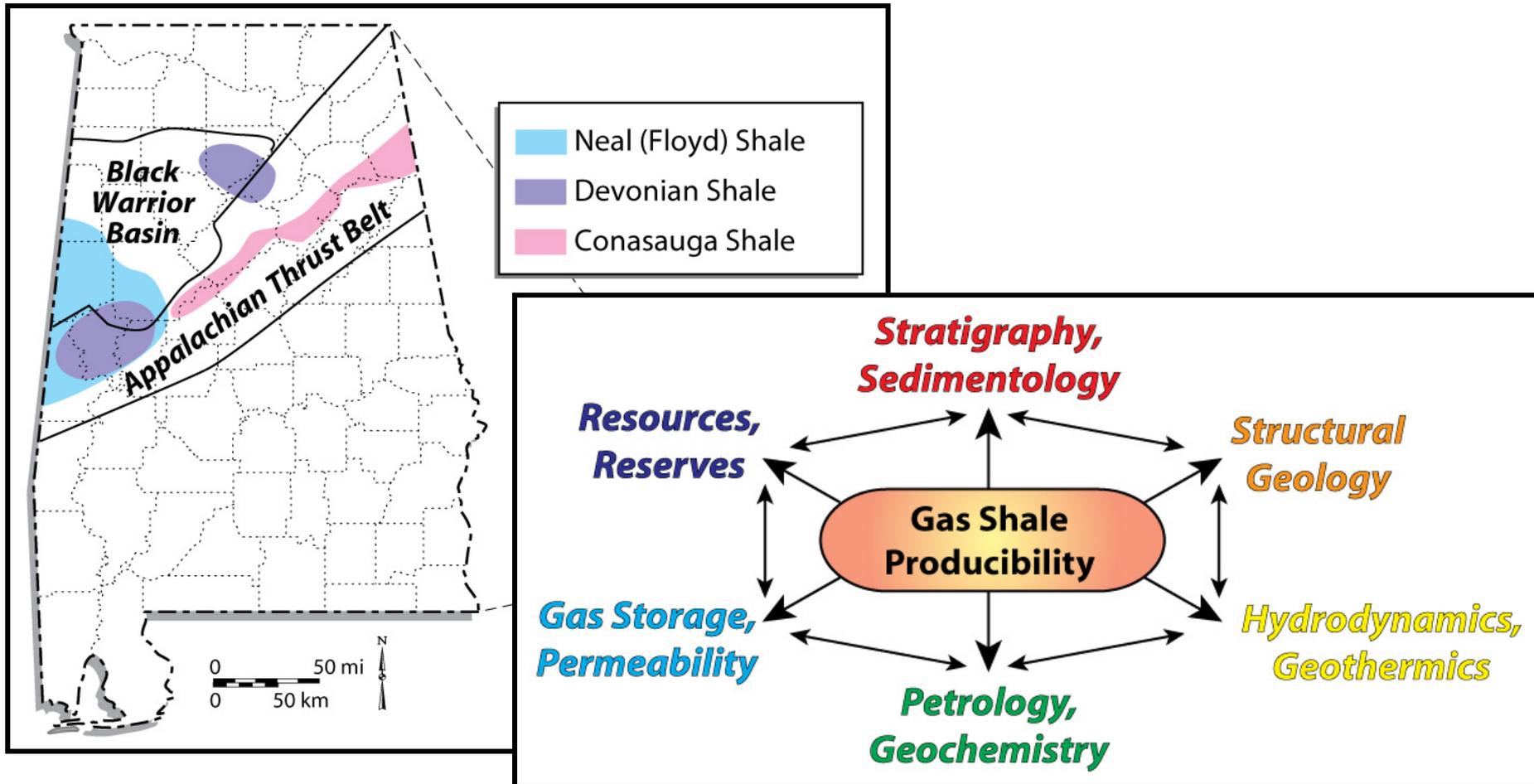
**Best Practice Analysis
West Virginia University**

**New Albany
Consortium**

Producer Participants

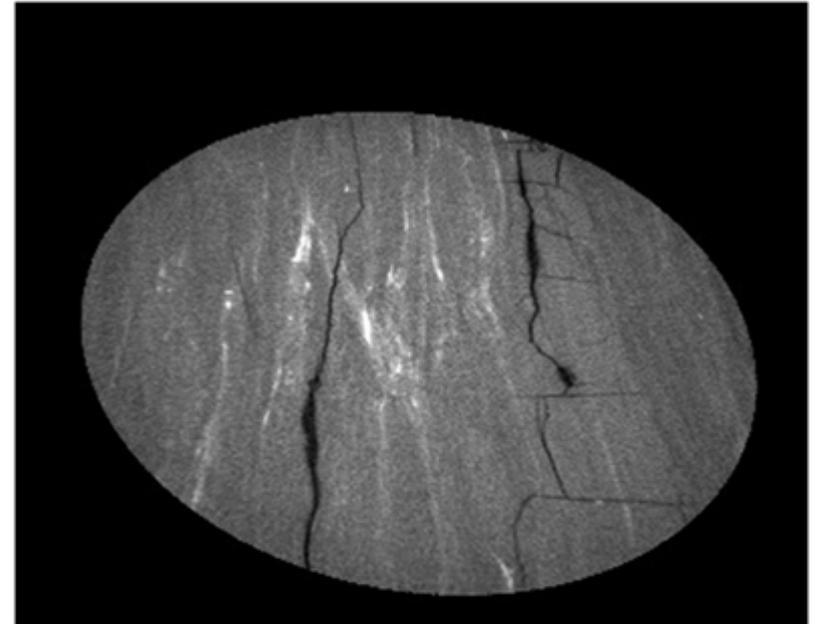
- > NGAS
- > Aurora Oil & Gas
- > Noble Energy
- > CNX Gas
- > Trendwell
- > Breitburn Energy
- > Diversified Operating

Geological Foundation for Production of Natural Gas from Diverse Shale Formations



Enhancing Appalachian Coalbed Methane Extraction by Microwave-Induced Fractures

- Microwave energy have been shown to induce fractures.
- Can we *in situ* generate new macro and micro fractures with a microwave burst?
- What is the influence of these changes on methane permeability?
- Lab experiments will scan coal core, establish fracture/permeability baseline.
- A burst of microwave energy will be tested for permeability enhancement



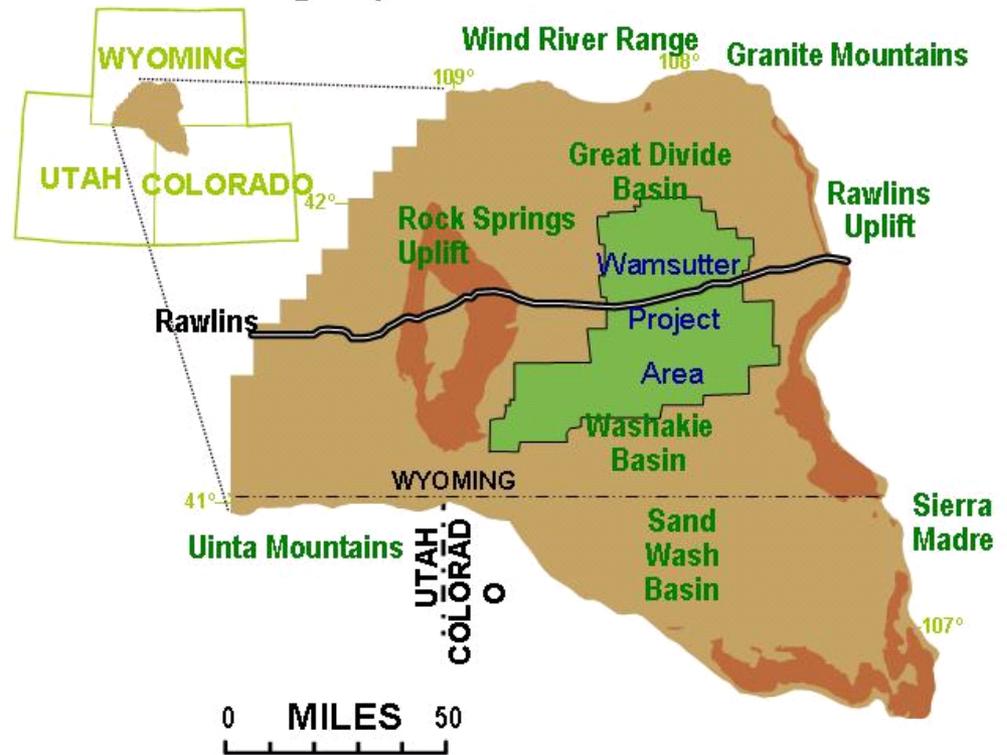
**Microwave Induced Fractures
in Bituminous Coal**

Optimizing Infill Drilling at Wamsutter

- Over 2,000 square miles
- $k < 0.1$ md
- 80 acre spacing

- Generate static reservoir descriptions of sands using geostatistical procedures
- History match 80 & 160 acre spaced wells
- Project the future performance of 40 acre spaced wells & Identify Best Locations

Wamsutter Area Geographic Location



Questions?

