Research Partnership to Secure Energy for America

RPSEA, Funding Game Changing Technology for the Future of our Industry

CO_2 Flooding Conference

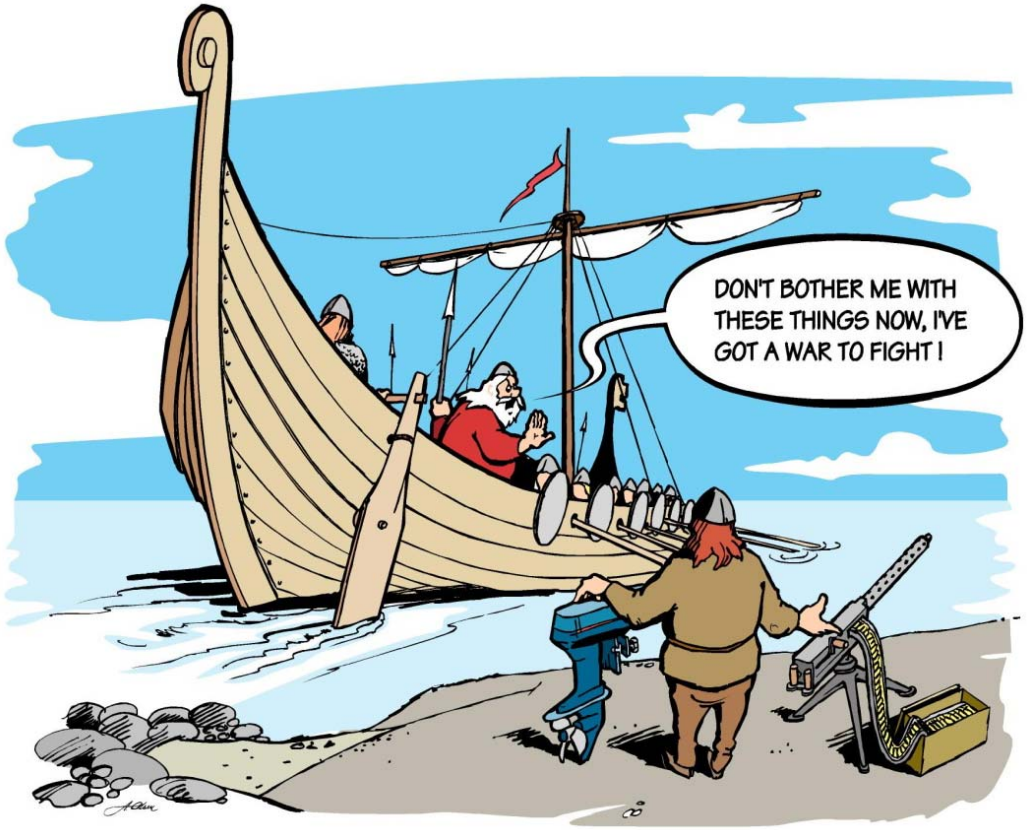
Midland, Texas

Overview

- Who is RPSEA
  - Public/private partnership
- What do we do
  - Research funding
- How RPSEA and Industry interact
  - Advisory Committees
- Focus of Research
  - For CO_2 Conference will focus on our Onshore research
  - Game Changing Research under way

The U. S. Energy Policy Act of 2005 And Section 999:

An Industry led Public/Private Partnership for R&D in the Ultra-Deepwater in the Gulf of Mexico and in Unconventional Onshore Natural Gas and Other Petroleum Resources of the United States.



What is Section 999?

Specifically, the law directs –

- Research, development, demonstration, and commercial application of technologies for ultra-deepwater and unconventional natural gas and other petroleum resource
- Maximize the U.S resource value by:
  - Increasing supply
  - Reducing the cost
  - Increasing E&P efficiency
  - Improving safety and minimizing environmental impacts

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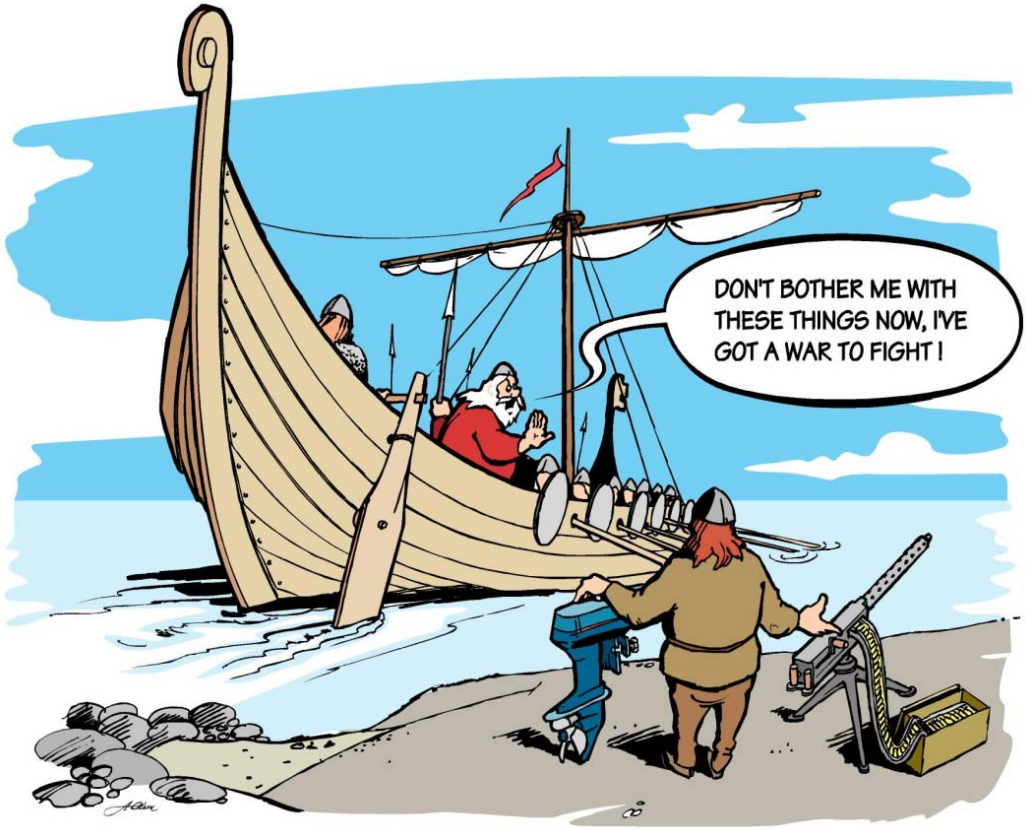
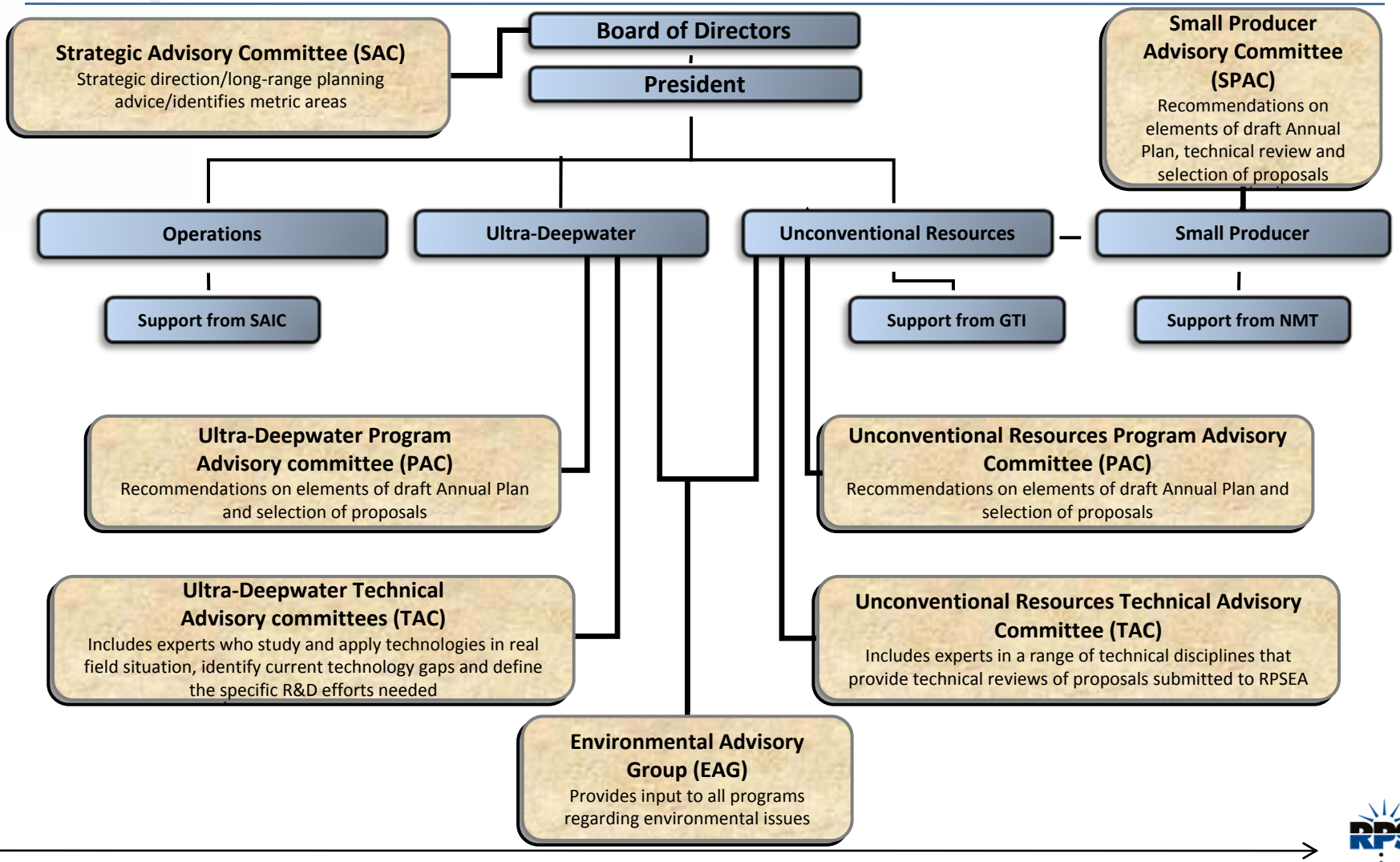


RPSEA Organization



RPSEA
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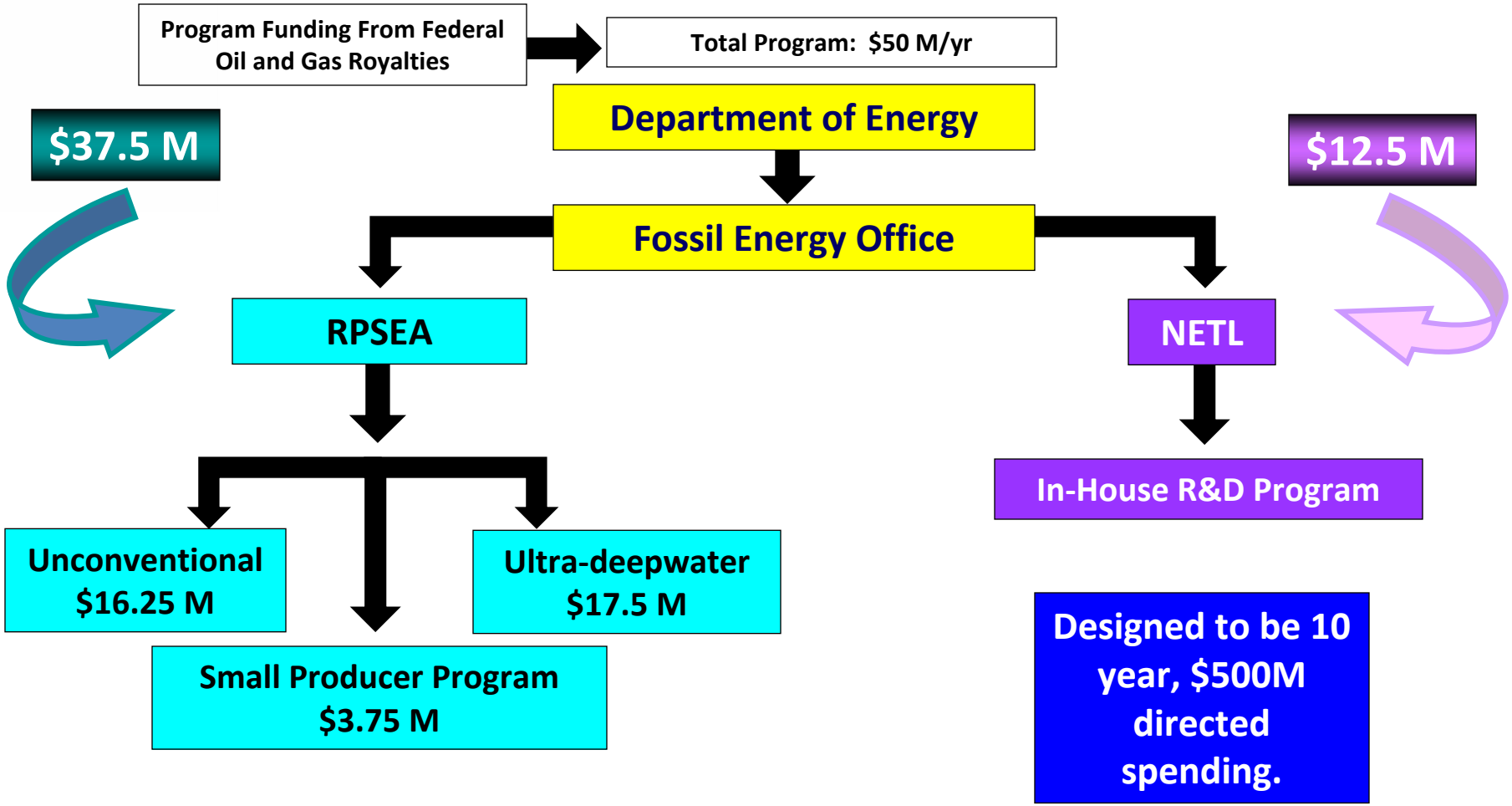
Program Structure/Funding

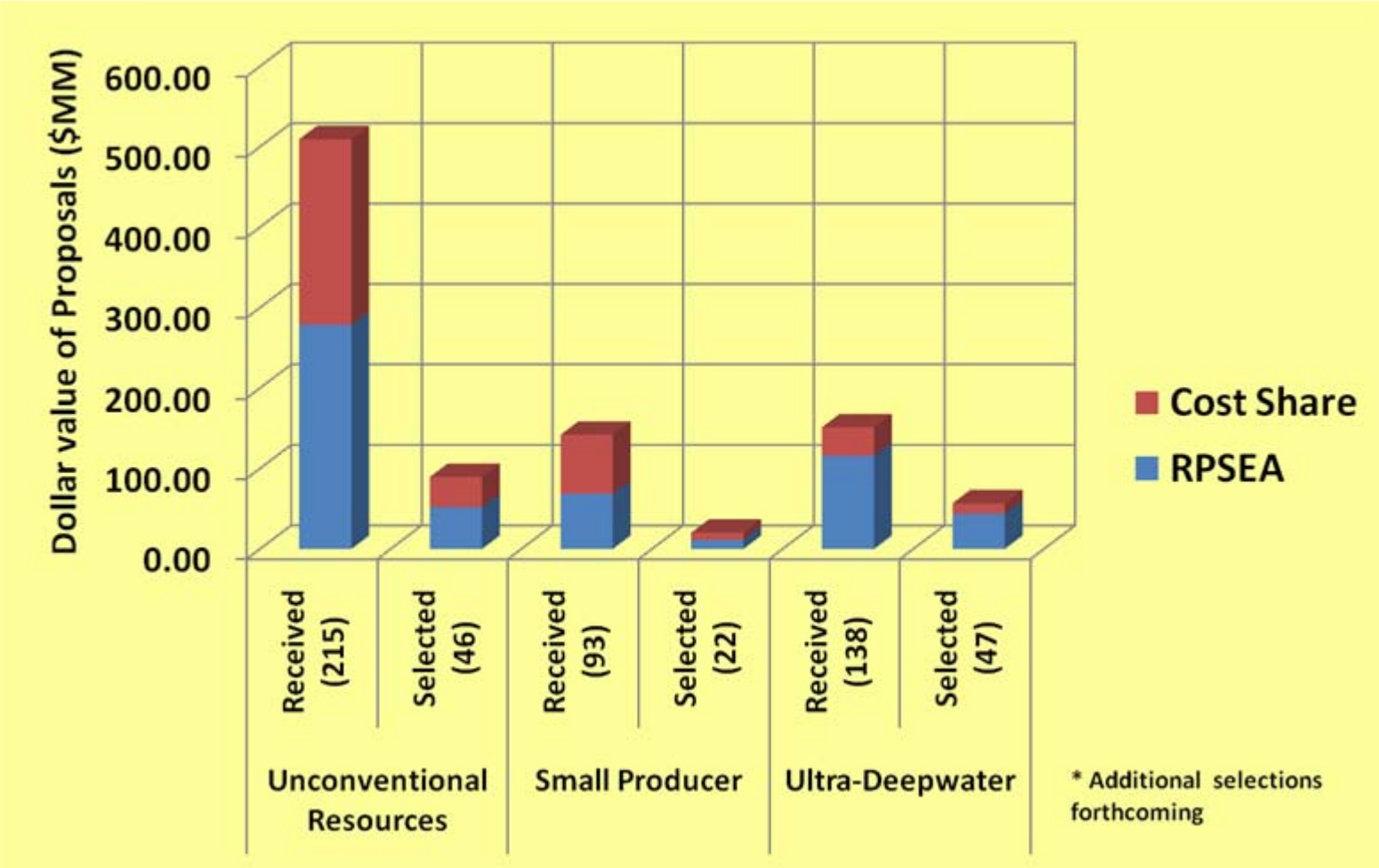


Portfolio Overview

RPSEA Program Selections 2007-2010				
	Small Producer	Unconventional Resources	Ultra-Deepwater*	Total
Universities	15	30	10	55
For Profits	5	5	30	40
Non-Profits	1	5	6	12
National Labs	1	3	1	5
State Agencies	0	3	0	3
Total Selected	22	46	47	115

* Additional selections to be made

2007-2010 Proposals*



RPSEA Unconventional Onshore Program

- **Mission & Goal**
  - ***Economically viable*** **technologies to allow** ***environmentally acceptable*** **development of unconventional gas resources**
    - **Gas Shales**
    - **Tight Sands**
    - **Coalbed Methane**
- **Objectives**
  - **Near Term**
    - **Increase production & recovery from established unconventional gas resources, accelerate development of existing & emerging plays**
    - **Decrease environmental impact of unconventional gas development**
    - **Integrate project results & deliverables and engage in technology transfer to ensure application of program results**
  - **Longer Term**
    - **Technologies for high-priority emerging & frontier resources**

Unconventional Resources

- **Challenges**
  - **Cost**
  - **Environmental impact of development**
  - **These challenges are closely related**
  - **Concern over safety and unplanned environmental impact**
- **Technical Issues**
  - **Low porosity and permeability**
  - **Heterogeneous reservoirs**
  - **Many wells required**
  - **Aggressive well treatment**
  - **Variability in well productivity**

Unconventional Resources – Addressing the Challenges

- Decrease the environmental footprint of unconventional gas operations
- Understand variations in subsurface properties to avoid drilling marginal wells
- Scientifically characterize risks and inform stakeholders

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Unconventional Resources – Decrease the Footprint

- **Expanded use of pad drilling**
- **Cuttings re-use**

Unconventional Resources – Decrease the Footprint

- Water treatment and recycling
- Water storage

Unconventional Resources – Decrease the Footprint

- **Determination of the chemical interactions between fracturing fluids and different shale rocks – both experimental and predictive**
  - **Increase efficiency of hydraulic fracturing operations**
  - **Reduce the need for refracture treatments**
- **Development of "green" drilling and fracturing fluids**
  - **Reduce potential for contamination**
  - **Reduce need for trucking wastewater to disposal wells**
- **Development of improved cement evaluation and pressure testing wireline tools assuring casing and cement integrity**
  - **Ensure isolation between gas wells and shallower aquifers**
    - **During hydraulic fracturing operations**
    - **During the life of the well**

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Unconventional Resources – Subsurface Properties

- Avoid drilling the marginal wells
- Understand controls on reservoir productivity
- Subsurface imaging to predict productive zones
- Fewer wells means less impact
  - Surface disturbance
  - Truck traffic
  - Water use
  - Waste disposal
  - Air emissions

Unconventional Resources – Subsurface Properties - *Understanding the Rocks*

- **What controls production**
  - **Large-scale fracture systems?**
  - **Which fracture systems?**
  - **Microfractures?**
  - **Mineralogy?**
  - **Rock-fluid interaction?**
- **What controls response to stimulation**
  - **Mineralogy?**
  - **Microstructure?**
- **How to detect key parameters?**
  - **Pre-drill**
  - **Borehole measurements**
  - **During production**

Unconventional Gas – Addressing the Challenges

- Decrease the environmental footprint of unconventional gas operations
- Understand variations in subsurface properties to avoid drilling marginal wells
- Scientifically characterize risks and inform stakeholders

RPSEA Funded Marcellus Gas Shale Project

- Marcellus is an emerging resource that covers an area of 54,000 square miles across four states with estimates of 63 tcf of producible gas
- A recent Penn State study of the Marcellus shale concluded that development of these gas resources will pump $14 billion into the state's economy in one year alone, growing to $25 billion by 2020
- This activity would create 98,000 new jobs and generate close to $1 billion in state and local tax revenues.

RPSEA Funded Marcellus Gas Shale Project

- **Objective**
- **Study the influence of natural fractures on propagation and growth of hydraulic fractures**
- **Determination of optimal well and fracture stimulation spacing**
- **Participants**
  - **Gas Technology Institute, the University of Texas at Austin, Bureau of Economic Geology, Lawrence Berkeley National Laboratory, Pennsylvania State University, Stanford University, West Virginia University, Schlumberger, Range Resources. Also includes the 33 producing members of the Marcellus Shale Committee**
  - **Accomplishments**
  - **Over ninety fracturing stages in six horizontal wells have been mapped using surface and downhole microseismic imaging followed up by production logging**

RPSEA Funded Marcellus Gas Shale Project

- **Significant Findings to Date**
  - **Detailed fracture stimulation pressure has the potential of indicating the presence of natural fractures near the wellbore**
  - **Comparison of surface & downhole microseismic techniques showed good agreement on fracture azimuth**
  - **High density microseismic clusters are not necessarily indicators of higher production rates**

RPSEA Funded Piceance Basin Project

- Piceance Basin is a hot spot for E&P of natural gas from tight-gas sandstones in the Rocky Mountain region
  - Estimated to contain more than 400 tcf of in-place
  - A study to "Understand the Rocks"
    - What controls production, what controls response to stimulation
    - Uses regional outcrop data to understand the subsurface data
    - Outcrop data will be integrated with detailed reservoir characterization and modeling, fracture analysis and subsurface-based stratigraphic correlations
  - A holistic approach to basin analysis
    - Structural, stratigraphic, diagenetic controls
    - Multiple projects with significant participation from the producer community

RPSEA Funded Residual Oil Zones Project

- Project is to develop a methodology for determining the presence and distribution of ROZ's
  - build a regional hydrological model that ties into sulfur deposits, water salinity observations, and tilted oil/water contacts in reservoirs
- ROZ's appear to be common in the Permian Basin
- Exploitation of thick ROZ's associated with several major fields has begun with CO_2 projects underway at Wasson, Seminole, Vacuum, Means, Goldsmith, and Hanford Fields
- Production from ROZ's coupled with the model of ROZ development, has led to the belief that there are potentially billions of barrels of additional producible reserves in the Permian Basin

“To do something, you have to do something.”

Jeff Immelt, General Electric