The EFD Technology Integration Program

An opportunity to demonstrate technologies which will reduce environmental impacts.

Interstate Oil & Gas Compact Commission

Awarded October 5, 2009

CHAIRMAN'S STEWARDSHIP AWARDS

IOGCC
Vancouver
June, 2012

EFD

Thomas E. Williams,
Sr. Advisor to the Environmentally Friendly Drilling Program

EFD

NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

RPSEA Research Partnership to Secure Energy for America

Texas A&M University

SH

MONTAN UNIVERSITY

HARC

The EFD Team

Co-funded by RPSEA, US Fish and Wildlife, Industry, Environmental Organizations

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Montan Universität

ENVIRONMENTAL ORGANIZATIONS

The Nature Conservancy
Fort Worth Nature Center Conservancy
NRDC Natural Resources Defense Council — The Earth's Best Defense

COLLABORATORS

HART
Groundwater Protection Council
PTTC Technology Connections
American Association of Petroleum Geologists — An International Geological Organization
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University of Wyoming — New Thinking
UK University of Kentucky
PennState
Clemson University
Rensselaer
USC University of Southern California
Utah State University
UAF University of Alaska Fairbanks
TCAT Texas Center for Applied Technology

Outline of discussion

- **Next Phase – TIP**

  The Environmentally Friendly Drilling Systems (EFD) Program is embarking on a new effort – field testing cost effective technologies that reduce the environmental footprint associated with oil and gas operations (drilling, fracturing, air, water, site, etc.). The Technology Integration Program a joint RPSEA and industry funded initiative, focuses on demonstrating, documenting and reporting results.
- **Plans & Schedule**
- **Relevance to States (IOGCC)**

What is an Environmentally Friendly Drilling System?

The application and integration of a number of incremental improvements, where collectively they can have a significant impact on reducing the environmental impact of E&P activities.

Our research indicates that that the public will accept development provided environmental issues are appropriately addressed.

EFD Program History

- Formed Team in 2005 (7 years)
- Texas A&M University took lead to obtain U.S. Department of Energy Funding
- Formed Joint Industry Partnership to guide and co-fund program
- Engaged Environmental Organizations
- Phase 2 led by HARC with RPSEA funding
- Formed University/National Lab Alliance
- Initiated International outreach program including EFD-EU
- **Phase 3, Technology Integration Program co-funded by RPSEA & Industry**
- Initiated complementary program funded by U.S. Coastal Impact Assistance Program (CIAP) managed by the Texas General Land Office

EFD Program Overview

Focus on technologies for **environmentally sensitive development** of **energy sources** that can be used to maintain our standard of living and preserve our quality of life.

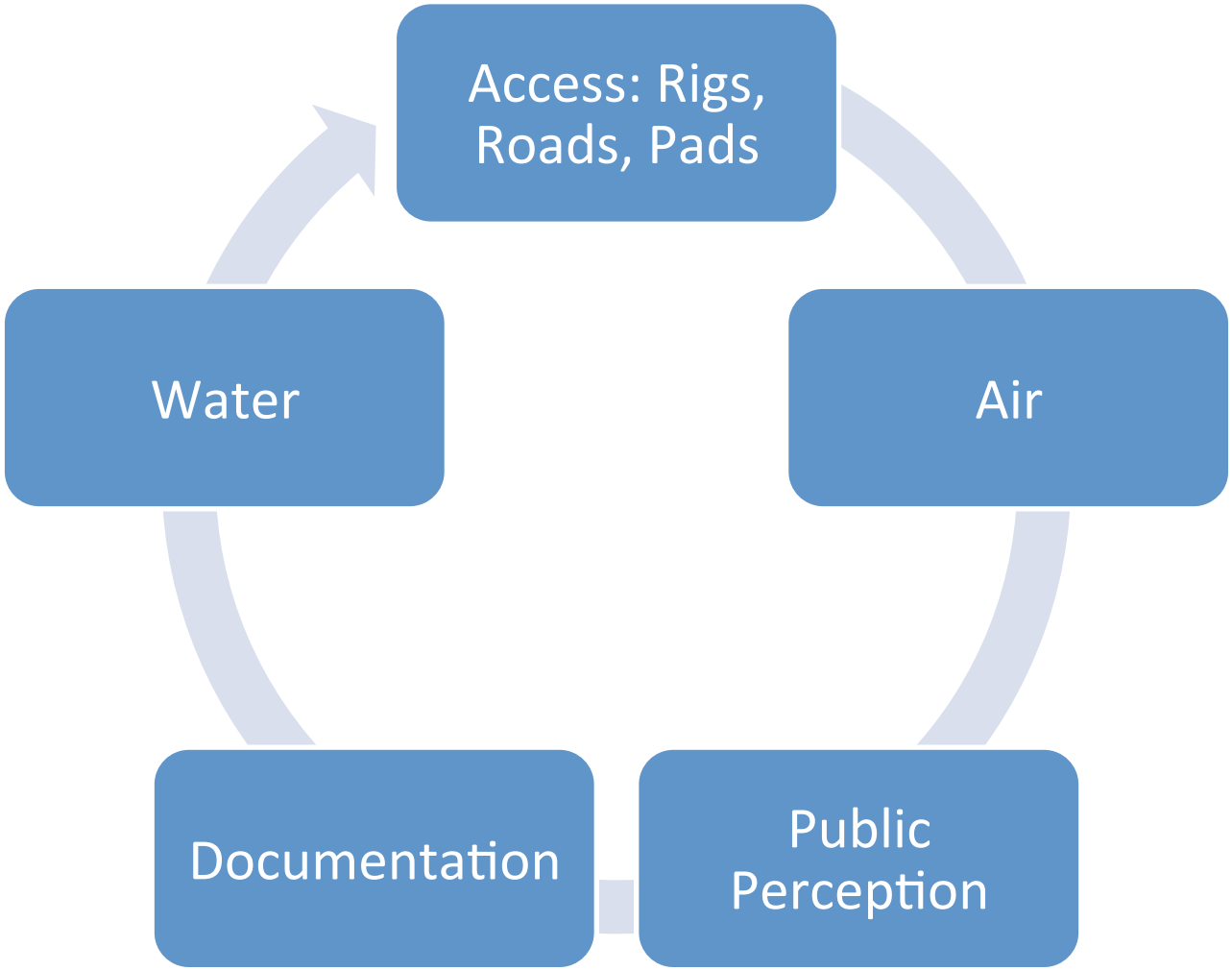
The objective is to **identify**, **develop** and **transfer** critical, **cost effective**, new technologies that can provide policy makers and industry with the ability to develop reserves in a **safe** and **environmentally friendly** manner.

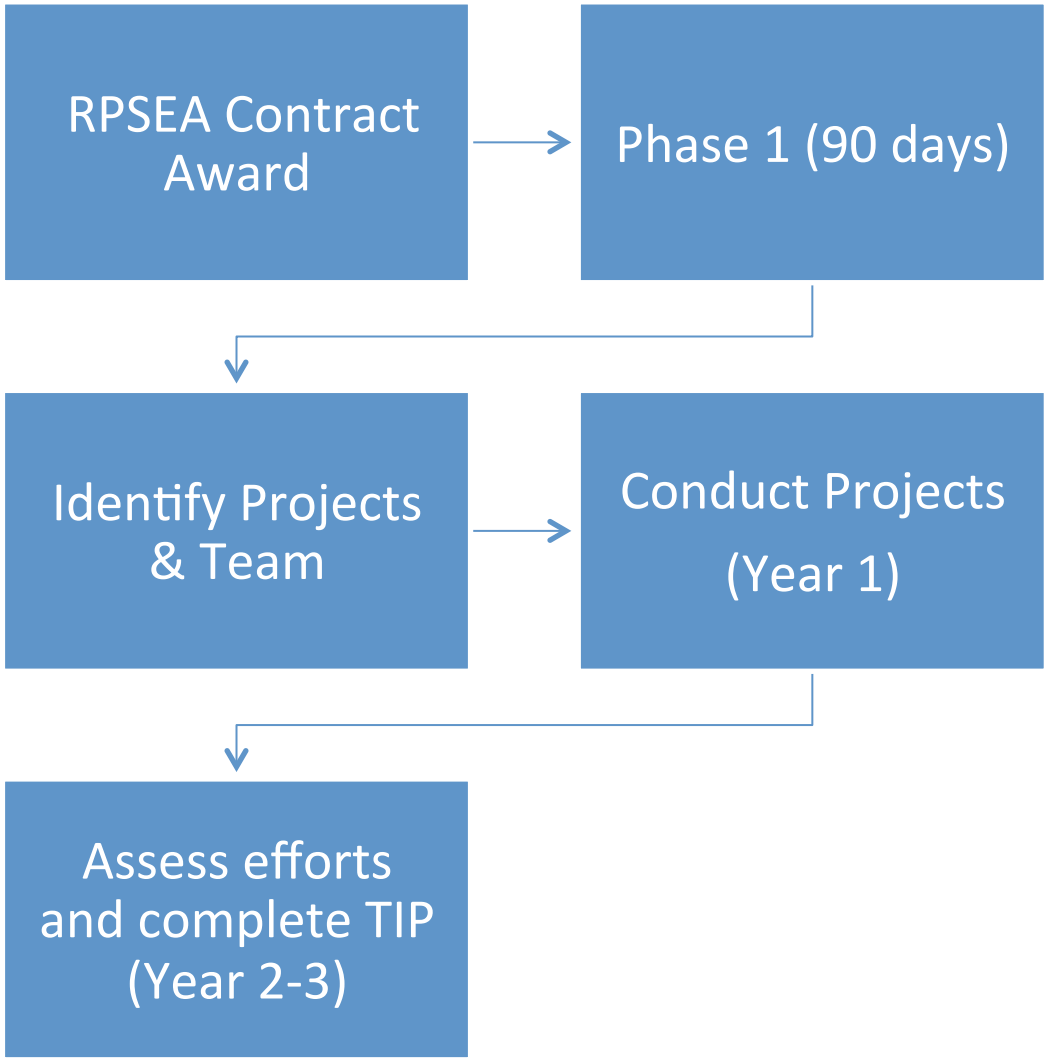
What gets measured, gets done.
What gets identified, gets dealt with.
What gets expected, gets respected.

Technology Integration Program (TIP) Objectives

- ***Speed the commercial development*** of technology
- Create ***regional centers*** that facilitate and coordinate field deployment
- ***Perform field trials***
- ***Document*** and ***provide*** the ***results***
- ***Emphasize programs*** that ***reduce cost*** and ***improve performance***, ***lessen environmental impacts,*** and ***address societal issues***

TIP program will address the E&P System




RPSEA Contract Award
Phase 1 (90 days)
Identify Projects & Team
Conduct Projects (Year 1)
Assess efforts and complete TIP (Year 2-3)

Phase 1

RPSEA Program Assessment, Regional Centers,

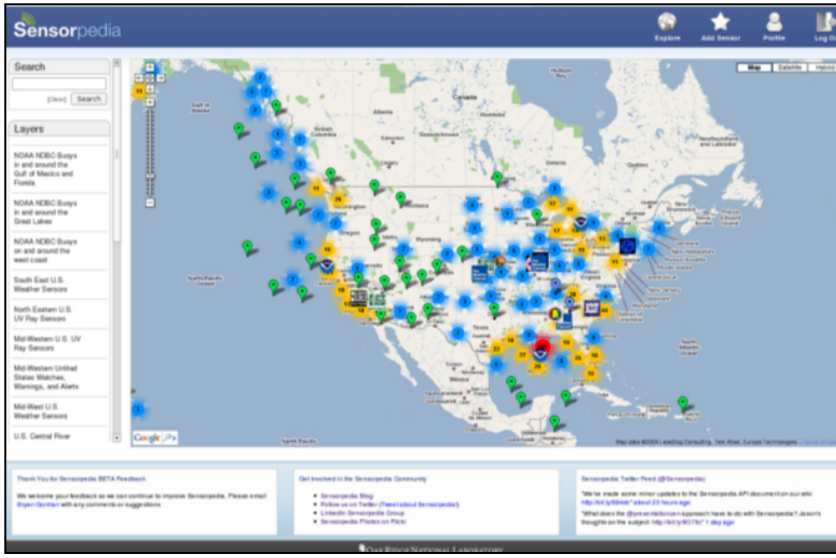
- In the first 90 days = Perform initial assessment of relevant technologies/R&D including RPSEA unconventional and small producers projects.

- Establish a network of regional centers with the goals of:
    - Provide synergistic approach to common issues.
    - Enable local issues to be addressed by local experts.
    - Provide unbiased science concerning local, regional and national policies.
    - Establish field test sites to develop prototype technologies.
    - Perform case studies of applying technologies on a regional level.
    - Provide public, legislators and regulators an opportunity to view technologies being applied in a safe manner.

TIP *West Center – managed by Texas A&M University/Texas Center for Applied Technologies*

Studies will include:

- **Water Management – Test new treatment and re-use**
- **Drilling and Completion Operations**
  - **Road and well siting**
- **Community Issues – Social Impact Assessment**
- **Air Quality/Emissions**
  - **Small, cost effective mobile sensors**



OAK RIDGE NATIONAL LABORATORY
Managed by UT-Battelle for the Department of Energy
Sensorpedia

TIP West Project Plans

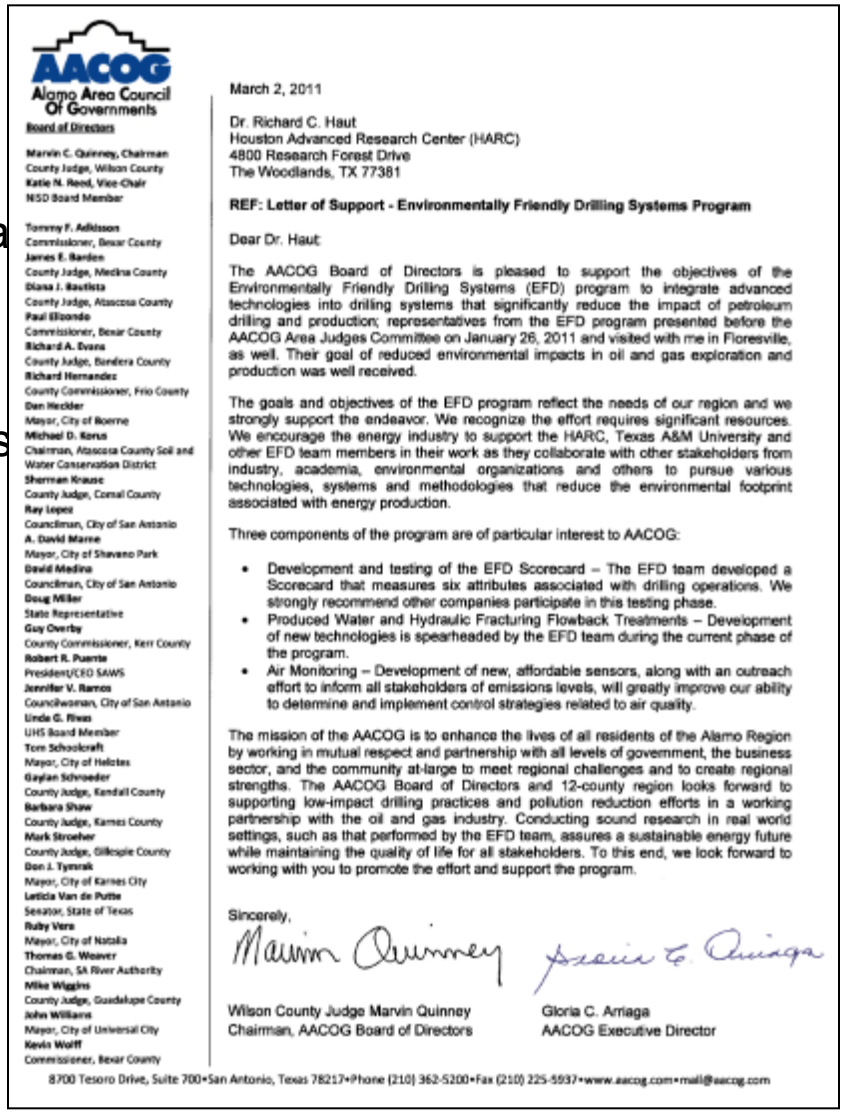
Field Tests

- ***Locating Sites*** – allow new knowledge to influence land use.
- ***Drilling and Completion Operations*** – demonstra what is possible with new technologies.
- ***Community Issues*** – perform social impact assessment to identify/address misconceptions.
- ***Air Quality/Emissions*** – develop/test new sensors systems.
- ***Water Management*** – test full-scale prototype systems.

Technology Transfer/Outreach

Web site that integrates all RPSEA work being performed.

- Access to valid/accurate data related to new knowledge, technologies, practices.
- Work with all RPSEA funded unconventional gas programs.



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March 2, 2011

Dr. Richard C. Haut
Houston Advanced Research Center (HARC)
4800 Research Forest Drive
The Woodlands, TX 77381

REF: Letter of Support - Environmentally Friendly Drilling Systems Program

Dear Dr. Haut:

The AACOG Board of Directors is pleased to support the objectives of the Environmentally Friendly Drilling Systems (EFD) program to integrate advanced technologies into drilling systems that significantly reduce the impact of petroleum drilling and production; representatives from the EFD program presented before the AACOG Area Judges Committee on January 26, 2011 and visited with me in Floresville, as well. Their goal of reduced environmental impacts in oil and gas exploration and production was well received.

The goals and objectives of the EFD program reflect the needs of our region and we strongly support the endeavor. We recognize the effort requires significant resources. We encourage the energy industry to support the HARC, Texas A&M University and other EFD team members in their work as they collaborate with other stakeholders from industry, academia, environmental organizations and others to pursue various technologies, systems and methodologies that reduce the environmental footprint associated with energy production.

Three components of the program are of particular interest to AACOG:

- Development and testing of the EFD Scorecard – The EFD team developed a Scorecard that measures six attributes associated with drilling operations. We strongly recommend other companies participate in this testing phase.
- Produced Water and Hydraulic Fracturing Flowback Treatments – Development of new technologies is spearheaded by the EFD team during the current phase of the program.
- Air Monitoring – Development of new, affordable sensors, along with an outreach effort to inform all stakeholders of emissions levels, will greatly improve our ability to determine and implement control strategies related to air quality.

The mission of the AACOG is to enhance the lives of all residents of the Alamo Region by working in mutual respect and partnership with all levels of government, the business sector, and the community at-large to meet regional challenges and to create regional strengths. The AACOG Board of Directors and 12-county region looks forward to supporting low-impact drilling practices and pollution reduction efforts in a working partnership with the oil and gas industry. Conducting sound research in real world settings, such as that performed by the EFD team, assures a sustainable energy future while maintaining the quality of life for all stakeholders. To this end, we look forward to working with you to promote the effort and support the program.

Sincerely,

Wilson County Judge Marvin Quinney
Chairman, AACOG Board of Directors

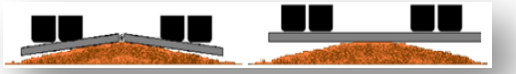
Gloria C. Arriaga
AACOG Executive Director

8700 Tesoro Drive, Suite 700•San Antonio, Texas 78217•Phone (210) 362-5200•Fax (210) 225-5937•www.aacog.com•mail@aacog.com

Site Access

Main Components – Rollout Road

- Conformable

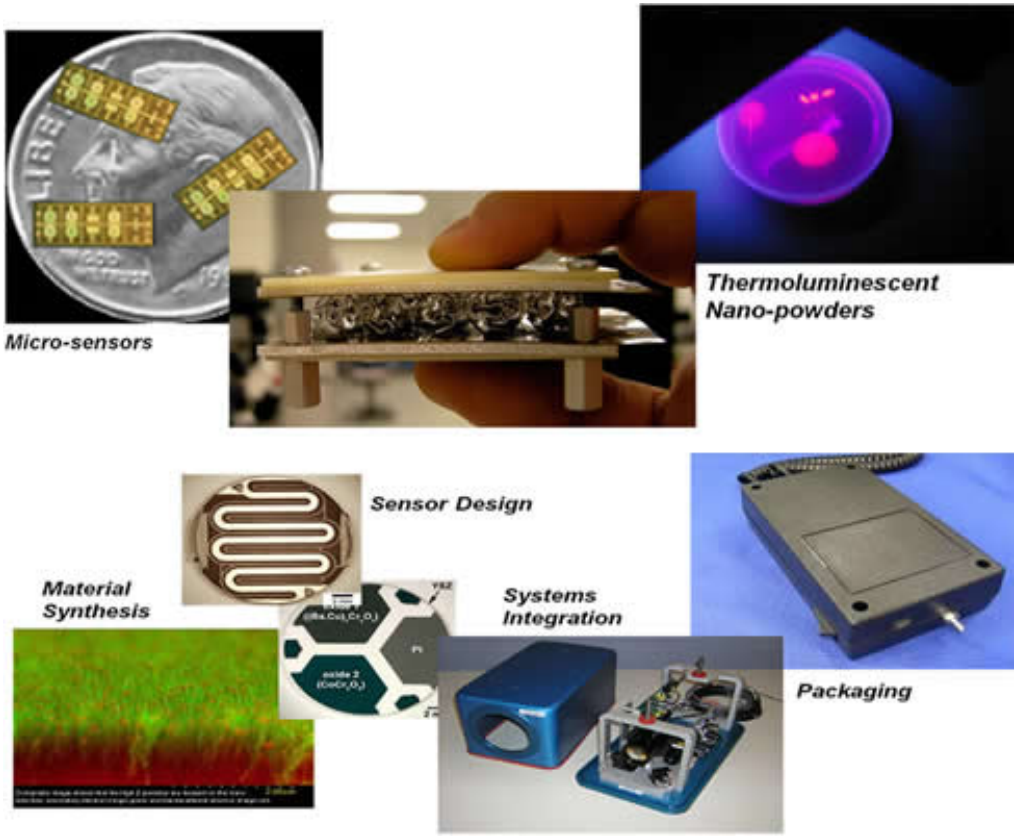


- Hinged board segments

Every site needs a road to link it to the outside world. New technology promises to protect sensitive environments from the damage caused by conventional roads.

Air Monitoring Technologies

ORNL Micro-Sensors



NETL Helicopter

- Can carry 12 lb payload

TIP East Center - managed by West Virginia University

Activities will include:

Marcellus Baseline Monitoring Site – Enhance effort managed by NETL

- One year of environmental monitoring will occur before any development takes place
- Two horizontal wells will be drilled in July, 2012
- Monitoring will continue through road and pad construction, drilling, and hydraulic fracturing
- Monitoring will continue for at least one year into production
- ***"Prospective Case Study" for EPA Hydraulic Fracturing Task Force***

Other field tests as defined in first phase which may include:

- Scorecard implementation
- Improved cementing practices to protect groundwater
- Assessment of water based drilling fluids

Tradeoff Scorecard Development

EFD Facts

Project:
Location:
Ecosystem:

	Max	Score
AIR	10	0
WATER	15	0
SITE	15	0
WASTE MANAGEMENT	20	0
BIODIVERSITY/HABITAT	20	0
SOCIETAL	20	0
	100	0

Environmentally Friendly Drilling Scorecard

Project:
Location:
Ecosystem: Semi-Arid
Date:

0	Points Achieved	Possible Points: 100

★ 55 - 64 points ★★ 65 - 74 points ★★★ 75 - 84 points ★★★★ 85 - 94 points ★★★★★ 95 - 100 points

0	Air	Possible Points: 10	
	Prerq 1	Compliance w/Air Quality Regs	
0	Credit 1	Contractual Obligations for Logistics	2
0	Credit 2	Site Emissions	2
0	Credit 3	Dust Suppression	2
0	Credit 4	Clean Power	3
0	Credit 5	Green Completions	1

0	Water	Possible Points: 20	
	Prerq 1	Stormwater Management Plan	
	Prerq 2	Integrity Testing of Surface Casing	
0	Credit 1	Water Management Plan	9
0	Credit 2	Setbacks from Streams/Sources	4
0	Credit 3	Mitigation Measures/Protect Waters	4
0	Credit 4	Reduce Water Usage	2
0	Credit 5	Reuse of Water/Fluids	1

0	Site	Possible Points: 20	
	Prerq 1	Regulatory Compliance	
	Prerq 2	Erosion & Sedimentation Control	
0	Credit 1	Pre-Existing Site	2
0	Credit 2	Pad Drilling	2
0	Credit 3	Protect and Restore Habitat	2
0	Credit 4	Contractor Guidelines	2
0	Credit 5	Site Restoration Plan	2
0	Credit 6	Well Design Considerations	2
0	Credit 7	Living Quarters and People	2
0	Credit 8	Organic Materials	1
0	Credit 9	Pre-Plan for Production	2
0	Credit 10	Match Site/Access to Topgraphy	1
0	Credit 11	Logistics Plan - Offsite Storage	1
0	Credit 12	Planting of Native Vegetation	1

0	Waste Management	Possible Points: 20	
	Prerq 1	Waste Management Plan	
	Prerq 2	Pit Design Pre-site Assessment	
0	Credit 1	Drilling Fluid Handling System	6
0	Credit 2	Lubricants, Fluids, Bulk Materials	5
0	Credit 4	Spill Prevention System	3
0	Credit 5	Cuttings Reuse	3
0	Credit 6	Cuttings Reinjection	3

0	Biodiversity/Habitat	Possible Points: 15	
	Prerq 1	Species Protection	
	Prerq 2	Habitat Protection/Enhancement	
	Prerq 3	Regulatory Requirements	
0	Credit 1	Restoration/Interim Reclamation	4
0	Credit 2	Reduction of Surface Disturbance	3
0	Credit 3	Erosion Prevention	2
0	Credit 4	Voluntary Offsite Mitigation	1
0	Credit 5	Invasive Species Prevention	1
0	Credit 6	Reintroduction of Species, Habitat	1
0	Credit 7	Avoidance of High Value Areas	1
0	Credit 8	Wildlife and Habitat	2

0	Societal	Possible Points: 15	
	Prerq 1	Regulatory Compliance	
	Prerq 2	Communication Plan	
0	Credit 1	Public Outreach	3
0	Credit 2	Noise and Lighting Control	2
0	Credit 3	Training of Local First Responders	2
0	Credit 4	Air Quality Monitors	2
0	Credit 5	Emergency Response Plan	2
0	Credit 6	Dispute Resolution Plan	1
0	Credit 7	Surface Use Plan	2
0	Credit 8	Unintended Consequences Program	1

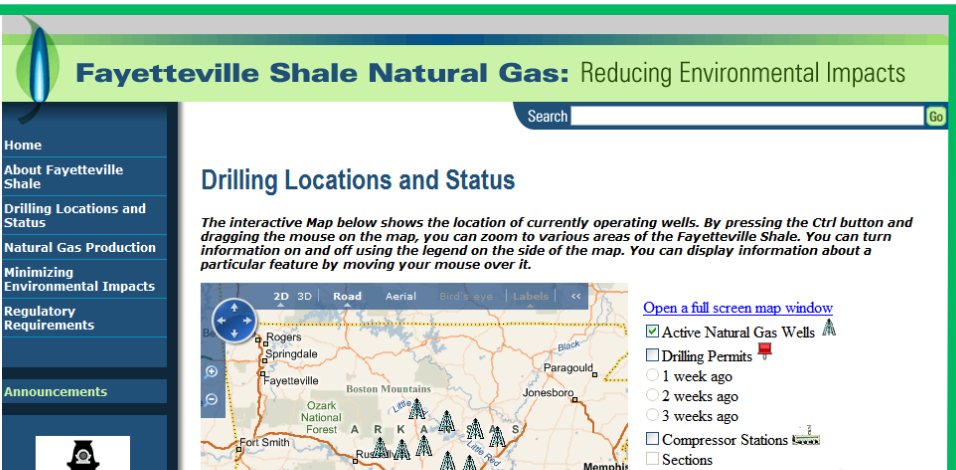
EFD Facts

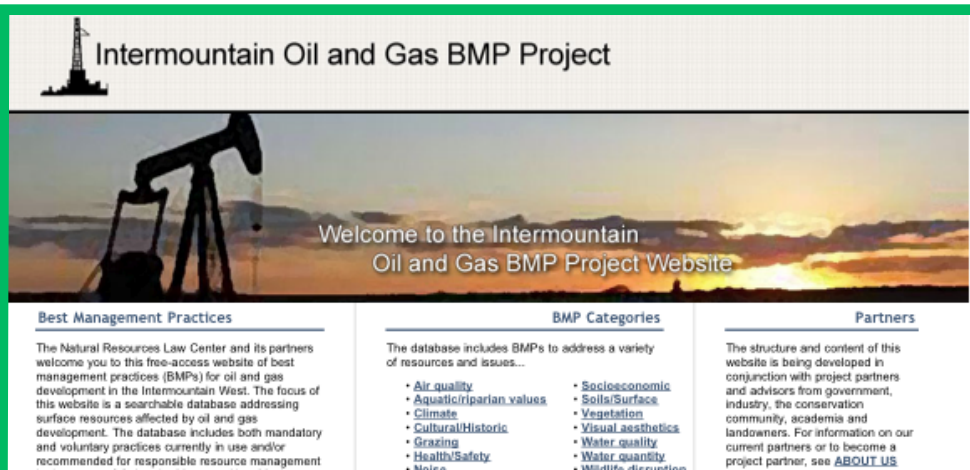
Project:
Location:
Ecosystem:

	Max	Score
AIR	10	0
WATER	20	0
SITE	20	0
WASTE MANAGEMENT	20	0
BIODIVERSITY/HABITAT	15	0
SOCIETAL	15	0
	100	0

Technology Transfer and Dissemination

- Improved EFD Web Site (www.efdsystems.org, www.facebook.com/EFDSystems)
  - Collate information related to field tests (reports, videos, graphics, results)
  - Access to information from other RPSEA funded efforts
- GIS Analytical Tool
- Sensorpedia Network
- Presentations, Exhibits, Technology Outreach





Join us! The EFD team is seeking new sponsors/advisors to partner with us to plan and implement the field test program.

- Sound Science/Objective reporting
- Speeding up commercialization
- Identify sites/operators, technologies, focus priorities
- Measurable improvements in reducing E&P environmental impact

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