The Secretary of Energy
Energy Advisory Board
Natural Gas Subcommittee

June 28, 2011

Statement of
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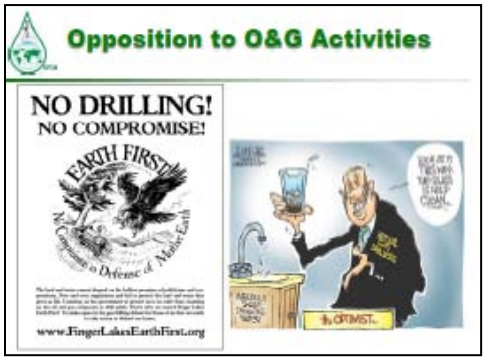
Good afternoon Chairman and members of the subcommittee. My name is Rich Haut. I am currently employed at the Houston Advanced Research Center, a 501(c)3, non-profit organization. (www.harc.edu) At the Center, we use the tools of science, policy and technology to provide new knowledge about the complex balance between environmental, social and economic issues. We are funded on a project-to-project basis by local, state and federal agencies, as well as industry and foundations. The Houston Advanced Research Center is a boundary organization, working with universities, industries, environmental organizations and government entities to take an unbiased, scientific approach to provide scientific based reasoning for policies and to push environmental based technologies to commercialization. Businessman George P. Mitchell, supported by four Texas universities, created the Center in 1982. Today the Center is focused on three areas: 1) clean energy, including the acceleration of alternative energy, 2) air quality research that includes emissions technologies and transportation policies and 3) the interaction between natural and human systems.

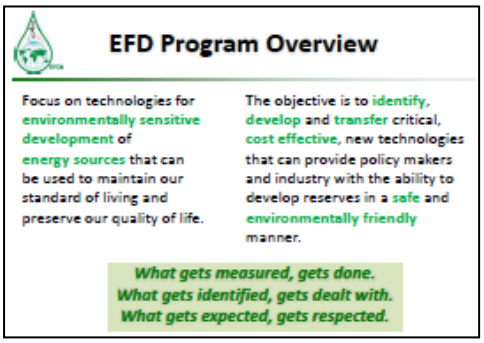
I am also on the board for the Research Partnership to Secure Energy for America (RPSEA: www.rpsea.org) where I chair the Environmental Advisory Group. The Research Partnership has over 160 universities, companies and organizations nationwide and is the research management organization coordinating 37.5 million dollars of research funding per year that was created by section 999 of the Energy Policy Act. This funding is related to deepwater oil and gas development, unconventional natural gas development and technology requirements for small producers. The Environmental Advisory Group consists of members from universities and industry as well as representatives from prominent environmental organizations.

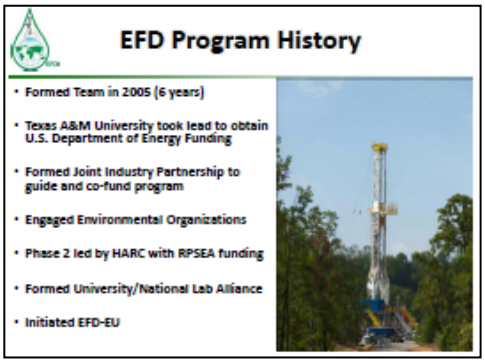
I direct the Environmentally Friendly Drilling Systems (EFD, see: www.efdsystems.org, www.facebook.com/EFDSystems) program, a comprehensive, worldwide effort that focuses on balancing onshore oil and gas operations and environmental tradeoffs. Even though it says drilling in our title, our program works to improve the safety and environmental performance of all natural gas operations, including hydraulic fracturing from shale formations. The program was honored by the Interstate Oil and Gas Compact Commission (IOGCC) with their Chairman's Stewardship Award for Environmental Partnership in 2009. After a brief introduction to the EFD program and a discussion of some complementary efforts, I will focus on the EFD scorecard that we are in the process of developing.



As we all know, shale gas development is ubiquitous across the USA, supplying approximately 25 percent of our current natural gas. All of these wells are hydraulically fractured. In addition, when gas production from coal bed methane (CBM) and tight gas reservoirs, along with some of the other conventional gas production is considered, there is approximately 50 percent of the natural gas that we currently consume that requires hydraulic fracturing. By 2035, taking into consideration the projections by the US

Department of Energy that shale gas will supply 45 percent, tight gas will supply 22 percent and CBM will supply 7 percent, there will be over 75 percent of our natural gas supplied that requires hydraulic fracturing. So, there is, and will be, significant gas shale development across the USA, and, along with the development, there are, and will be, concerns about environmental tradeoffs associated with protecting land, air water, habitat and society. These concerns about the environment and the impact on society need to be appropriately addressed. Our EFD program is a long-term, integrated effort to demonstrate current and new technology in land-based operations for compatibility with environmentally sensitive areas. We also provide the unbiased science to ensure that issues are appropriately investigated.





The EFD program has taken a systems approach to the implementation of low-impact technology in order to develop systems that have very limited environmental impact. Our objective is to identify, develop and transfer critical, cost effective technologies that can provide policy makers and industry with the ability to develop reserves in a safe and environmentally friendly manner. We collaborate with many other programs including those funded by RPSEA, the US Department of Energy, the Ground Water Protection Council, environmental organizations and industry.

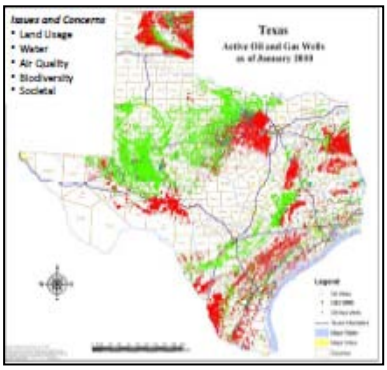
Our program began six years ago when we formed the EFD team. At the time, Dave Burnett from Texas A&M University took the lead and obtained initial funding from the Department of Energy (DoE). As you know for every 80 cents of DoE funding, we had to supply 20 cents. So, we formed a joint industry partnership to co-fund the program and also to provide critical guidance for our efforts. We recognized that we also needed guidance concerning environmental issues and began to engage environmental organizations. Two years ago we were awarded phase two funding by the Research Partnership to Secure Energy for America (RPSEA). The program is now led by HARC as we have multiple universities involved and we also initiated a program in Europe.

When we consider all the various government agencies on a federal and state level, along with the cost share provided by industry and environmental organizations, our total funding is over two million dollars per year. We have a management team consisting of HARC, Texas A&M University, Sam Houston State University and a former Senior Executive Official at the US Department of Energy and Department of Interior, Tom Williams, to oversee our efforts.

Over the years, we have learned the importance of thinking globally and acting locally. Our EFD alliance spans the globe. In the United States, we stretch from coast to coast and from Alaska to Texas. We have already established a presence in Europe and are currently having discussions with a university in Australia. Through our team, we are able to share research findings, identify areas of common interest and apply expertise to regional issues.

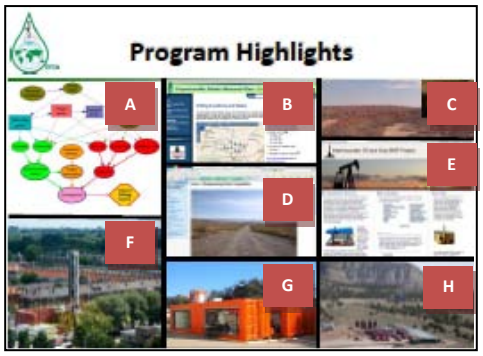
Wherever we are, there appears to be five main categories of issues and concerns that include land, water, air, biodiversity and societal. These five categories of issues are associated with all operations, including hydraulic

fracturing. Our EFD alliance members provide local expertise to address these issues, provide the unbiased science needed for sound policies and accelerate the acceptance of cost effective, environmentally friendly technologies.



Our research program has a variety of projects that investigate issues from site selection through gas gathering and compression. For example:

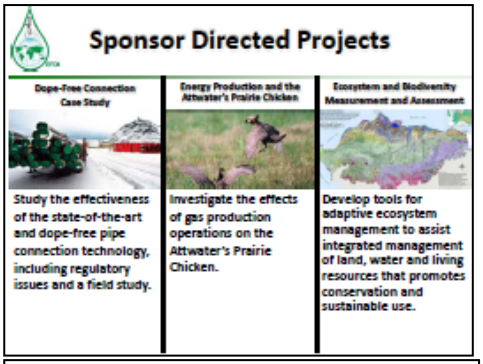
A) At Texas A&M we are developing a computer program to enable operators to select and optimize environmentally friendly systems for drilling operations.
B) At the University of Arkansas we have developed a computer program to assist in site selection and permitting that includes taking into consideration endangered species, topography and other issues.
C) Utah State University and Sam Houston State investigate the public perception of natural gas operations, including hydraulic fracturing, in Eastern Utah as well as in Texas.
D) Texas A&M is working with several of our sponsors to reduce environmental impact associated with logistical support.
E) The University of Colorado has developed and maintains a web site that discusses best management practices and most applicable technologies to address rules and regulations for operations in the Rocky Mountains. (www.oilandgasbmps.org)

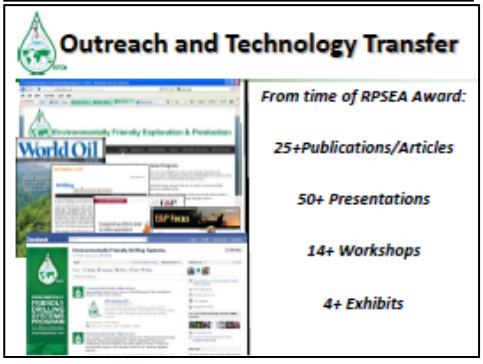


F) In Europe, we performed a case study of a new prototype rig that has lower-cost and lower environmental impact. Two of these rigs have now been imported into the USA where they are operating in the Eagle Ford shale.
G) The handling and treatment of produced water and frac water flowback is being investigated by our team. We have already developed new technologies and have testing underway in the Marcellus Shale. In addition, Texas A&M is planning a test program that will compare the effectiveness of several water treatment systems currently being used.
H) We also have a study underway to identify alternatives that may reduce the hydraulic fracturing footprint including offsite operations and innovative fracturing technologies such as a novel process that involves minimal pumping equipment, low volumes of frac fluid and materials that are environmentally friendly and non-damaging.

In addition, we have various projects that our sponsors have directly funded. These include:

1) Studying the effectiveness of dope-free connection technologies, a means to greatly reduce the environmental impact associated with pipe storage and handling.
2) We worked with the Nature Conservancy to understand the impact that operations have on the habitat for the Attwater's Prairie Chicken.
3) We currently have an ongoing effort to understand the value of ecosystem services on the northern slope of Alaska.





The engagement of all stakeholders is a key part of our program. We devote significant resources to reach out and meet with industry, environmental organizations, concerned citizens, regulators and policy makers. We sponsor quarterly workshops and participate in many others throughout the year. Our workshops include discussions of innovative technologies, best management practices and regulatory issues concerning all operations, including hydraulic fracturing. The outcome of our effort is expected to result in reasonable

regulatory controls, lower development cost and reduction of the environmental footprint associated with operations. Our workshops have been attended by members of the Sierra Club, NRDC, the Environmental Defense Fund, state and federal regulators, operators, service companies, and concerned citizens. Our work has been featured in various newspapers and publications including Discovery Magazine, the Wall Street Journal and industry publications.

The Department of Energy and now RPSEA provides our core funding. We have been able to leverage these contributions with other funded efforts, for example, funding from the Coastal Impact Assistance Program for investigating issues on the Texas Gulf Coast and funding from the US Agency for International Development to assist the Ukraine government in reviewing their rules and regulations and developing a strategy to develop their gas shales.

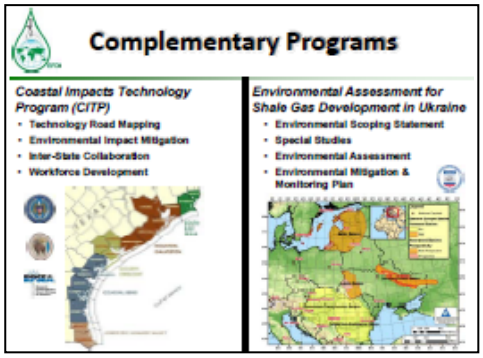
We work to identify better technologies and cleaner approaches to reduce the environmental and health impacts of oil and gas operations, including hydraulic fracturing. We know that we need scientific analysis and data on the full impacts to water supplies, air quality and local communities. To develop an understanding of risks, we need measurement tools. Over the past six years we have come to appreciate that different regions have different requirements. So, we focus on regional issues at the state level, collaborating with local stakeholders and industry. With the right technologies and with the right measurement tools, the industry can have cost-effective operations while minimizing the impact on the environment.

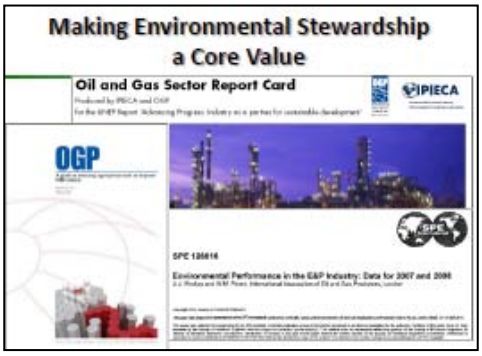
Working with the International Association of Oil & Gas Producers (OGP), the International Petroleum Industry Environmental Conservation Association (IPIECA) develops and promotes solutions to global and social issues pertaining to the oil and gas industry. They provide a forum for encouraging continuous improvement of industry performance.

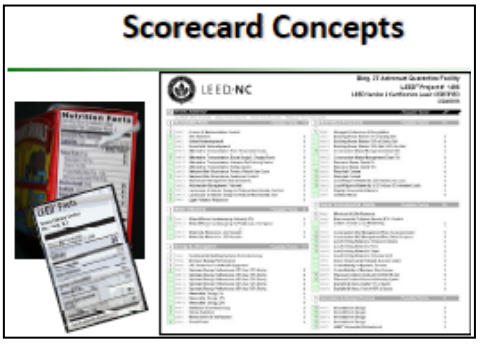
IPIECA strives for ongoing improvement of oil and gas industry performance by encouraging the industry worldwide to adopt key features of impact assessment and mitigation procedures and to continually improve and refine them.

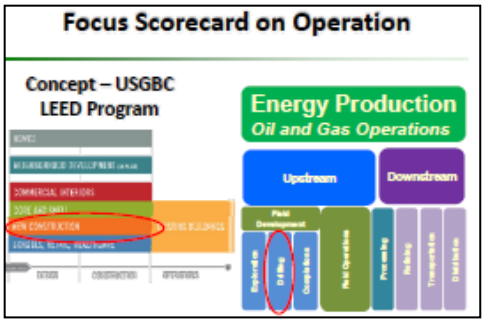
Our EFD Team reviewed what IPIECA was working on and thought about what could be done on a focused, operational level. We wanted a scorecard that could be used to measure the effectiveness of environmental sensitive technologies on a site specific level. We looked at various methodologies being used and decided to try and develop a system similar to what the US Green Building Council (USGBC) developed for the built environment – their Leadership in Energy and Environmental Design (LEED™) program. A comparison of the IPIECA and the EFD Scorecard indicators is given in the attachment.

Just like the USGBC recognizes that one scorecard cannot effectively cover the entire building industry, we know that one scorecard could not possibly cover the entire energy production industry. The USGBC focused first on new





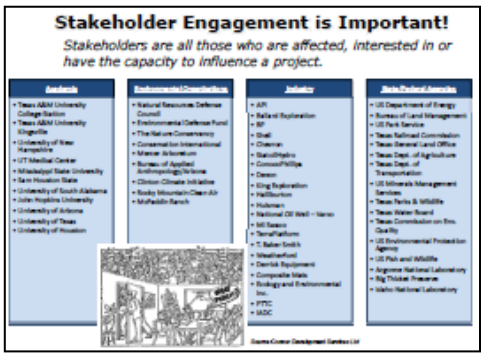




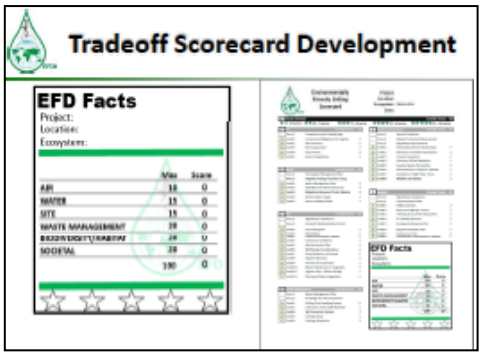
construction and, using the analogy, we decided to first focus on the drilling process – from site selection through site restoration. We have also begun the process to develop a scorecard for hydraulic fracturing operations.

The goal of the EFD scorecard is to enable a dialogue to be established and maintained among all interested, concerned and affected stakeholders. In this manner, the oil and gas industry has a way of seeing itself within the larger network. The scorecard provides the means to demonstrate the connectivity between energy production and the affected ecosystem. Through the development of the scorecard we recognize that what may apply in the Marcellus may not apply in West Texas. The scorecard must be geographically and geologically adaptive.

To begin the development of the scorecard, we held a workshop that was attended by over 80 participants from a wide cross section of stakeholders. These stakeholders included industry producers, service companies, ecologists, botanists, toxicologists, zoologists, wildlife managers, endocrinologists, environmentalists, regulators and others. At the workshop we identified six categories of attributes (air, water, site, waste management, biodiversity/habitat, societal) and began the process to identify the various sub-attributes associated with these categories.



Our EFD team then worked with our advisors from the industry and environmental organizations to reach a consensus on definitions of the sub-attributes and the weighting factors associated with a balanced scorecard.



Minimizing the environmental footprint can reduce environmental liabilities, control operational costs and encourage public acceptance for the development of natural resources. The EFD scorecard can encourage and accelerate the use of environmentally friendly practices through the implementation of a universally understood and accepted tools and performance criteria. Our goal is to have a nationally accepted benchmark for the design, construction and operation of oil and gas production systems, providing a tool to measure performance and impact.

Low impact operations reduce the environmental footprint of operations by the adoption of methods to use in (1) getting materials to and from the rig site (site access), (2) reducing the rig site area, (3) using alternative drilling rig power management systems, and (4) adopting waste management at the rig site. The scorecard enables a dialog to be established and maintained among all interested, concerned and affected stakeholders. In this manner, the industry has a new way of seeing itself within the larger network. The scorecard provides a means to make environmental and societal issues core business values.

Each attribute has several layers or sub-attributes. As an example, within biodiversity, the potential threat to wildlife due to proximity or timing of operations could be assessed and minimized. Drilling activities have the potential risk of temporarily interfering with wildlife. The risk can be mitigated through proper planning and monitoring of operations.

The EFD scorecard has two point levels. For each of the six major attributes there are prerequisites that must be addressed and then credits that may be earned by going beyond the prerequisites. A summary of the key points that are addressed in each attribute follows:

Air – Within this attribute, the prerequisites are related to complying with all regulations. Credit sub-attributes include implementing technologies and processes related to contractual obligations for logistics, site emissions, dust suppression, clean power and green completions.

Water – There are two prerequisites in the water attribute: developing/implementing a stormwater management plan and planning and implementing integrity testing of the surface casing. Credit sub-attributes include technologies and processes related to developing/implementing a water management plan, setbacks from streams/sources, mitigation measures to protect waters, ensure ground water protection, reduce water usage, and reuse of water and fluids.

Site – The site prerequisites include regulatory compliance as well as erosion and sedimentation control. Credit sub-attributes are related to the use of a pre-existing site, pad drilling, protecting/restoring habitat, providing contractor guidelines, site reclamation, well design considerations, living quarters, and other technologies and processes.

Waste Management – There are two prerequisites related to developing/implementing a waste management plan and performing a pre-site assessment of the drill site pad. Credit sub-attributes cover the drilling fluid handling system, handling of rig wastes, spill prevention systems and disposal of drill cuttings.

Biodiversity/Habitat – For this attribute, there are three prerequisites covering species protection, habitat protection/enhancement, and regulatory requirements. Credit sub-attributes include interim reclamation, reduction of surface disturbance, offsite mitigation, invasive species prevention, reintroduction of species/habitat and other issues.

Societal – There are two prerequisites covering regulatory compliance and the development/implementation of a communication plan. Credit sub-attributes are related to public outreach, noise/lighting, monitoring air quality, training local first responders, surface use plans, and programs related to dispute resolution and unintended consequences.

The scorecard is a tool that can help operators measure, learn and improve. The Environmentally Friendly Drilling team is now working with operators to prototype test the scorecard system. Several operators have requested that we implement the scorecard to perform a baseline for regional operations.Once the scorecard has been tested and the appropriate number of points is determined for the various levels, a voluntary certification process will be introduced. Our team is open to adding additional operators to our testing phase. We work with each operator on a confidential basis. Before we finalize the scorecard and make it public, we want to ensure that it is meaningful, effective and will make a difference. Any and all operating companies that are interested in helping us test the scorecard may contact me directly.

Based on the development of our first scorecard that addresses drilling activities, we are now working on a scorecard that addresses hydraulic fracturing operations. In addition, we were recently asked to begin thinking about a scorecard for offshore operations.

In summary, our Environmentally Friendly Drilling Systems program brings all stakeholders together to identify and address issues associated with the development of oil and gas reserves in environmentally sensitive areas, including hydraulic fracturing and all other operations. Although it is broad in scope and encompasses operations across the United States and now in Europe, our program recognizes the importance of addressing issues on a local, regional level. Our EFD Scorecard performs a comprehensive review of operations and was developed through a consensus-building process involving all stakeholders and is now being tested across a variety of geographies and geologies.

We would not be where we are today without that initial funding from the US Department of Energy and the continued funding from the Research Partnership to Secure Energy for America.

Environmentally Friendly Drilling Systems Program

Balancing Environmental Tradeoffs

Awarded October 5, 2009
CHAIRMAN'S STEWARDSHIP AWARDS

EFD

www.efdsystems.org
www.facebook.com/EFDSystems

US Department of Energy
Secretary of Energy Advisory Board
Natural Gas Subcommittee

June 28, 2011

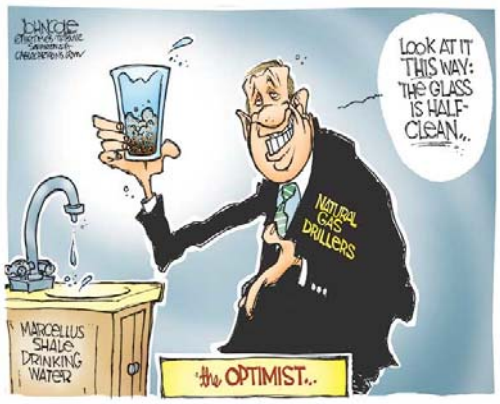
Items to Discuss

1. The Environmentally Friendly Drilling Systems (EFD) Program
   - Incentives and Objectives
   - Background
     - How did it start
     - who are the players
     - Funding
   - Issues being addressed
   - Outreach and Technology Transfer

2. Complementary Programs

3. The EFD Scorecard
   - Measuring Processes
   - Development of the Scorecard
   - Comparison of Processes
   - Status

Opposition to O&G Activities



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.

EFD Program History

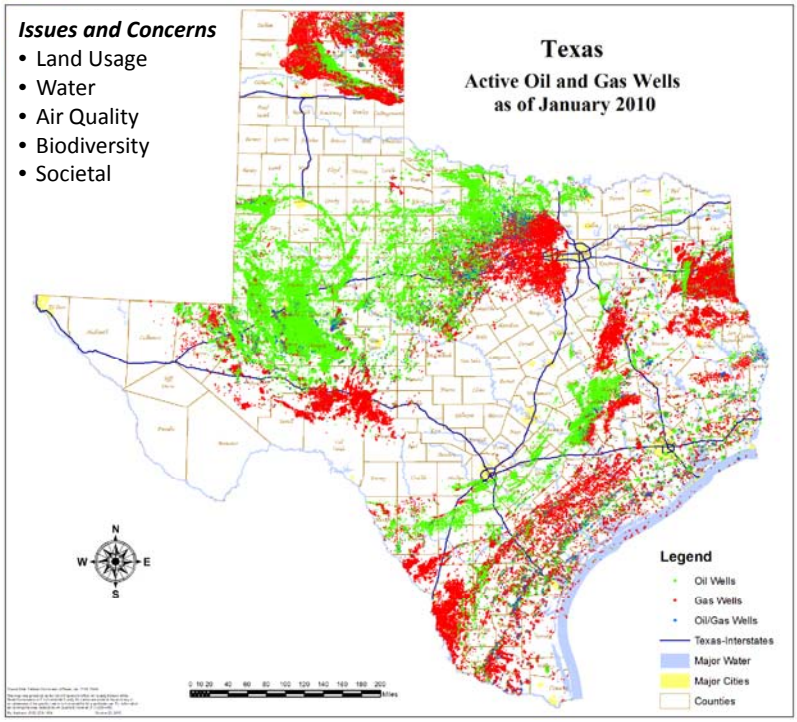
- Formed Team in 2005 (6 years)
- Texas A&M University took lead to obtain U.S. Department of Energy Funding
- Formed Joint Industry Partnership to guide and co-fund program
- Engaged Environmental Organizations
- Phase 2 led by HARC with RPSEA funding
- Formed University/National Lab Alliance
- Initiated EFD-EU

The EFD Team

Co-funded by RPSEA, BOEMRE, Industry, Environmental Organizations

EFD Alliance
responding to local issues

Issues and Concerns
- Land Usage
- Water
- Air Quality
- Biodiversity
- Societal



Program Highlights

Sponsor Directed Projects

Dope-Free Connection Case Study

Study the effectiveness of the state-of-the-art and dope-free pipe connection technology, including regulatory issues and a field study.

Energy Production and the Attwater's Prairie Chicken

Investigate the effects of gas production operations on the Attwater's Prairie Chicken.

Ecosystem and Biodiversity Measurement and Assessment

Develop tools for adaptive ecosystem management to assist integrated management of land, water and living resources that promotes conservation and sustainable use.

Outreach and Technology Transfer

From time of RPSEA Award:

25+Publications/Articles

50+ Presentations

14+ Workshops

4+ Exhibits

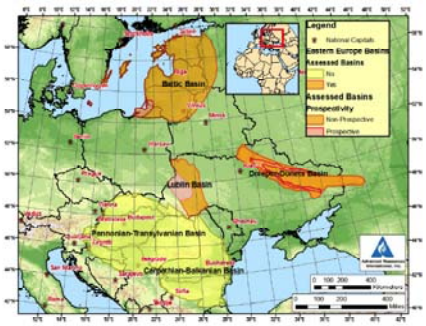
Complementary Programs

Coastal Impacts Technology Program (CITP)

- **Technology Road Mapping**
- **Environmental Impact Mitigation**
- **Inter-State Collaboration**
- **Workforce Development**

Environmental Assessment for Shale Gas Development in Ukraine

- **Environmental Scoping Statement**
- **Special Studies**
- **Environmental Assessment**
- **Environmental Mitigation & Monitoring Plan**



What Will it Take to Do Better?

Making Environmental Stewardship a Core Value

Oil and Gas Sector Report Card

Produced by IPIECA and OGP
for the UNEP Report 'Advancing Progress: Industry as a partner for sustainable development'

SPE 126616

Environmental Performance in the E&P Industry: Data for 2007 and 2008

A.J. Findlay and W.M. Poore, International Association of Oil and Gas Producers, London

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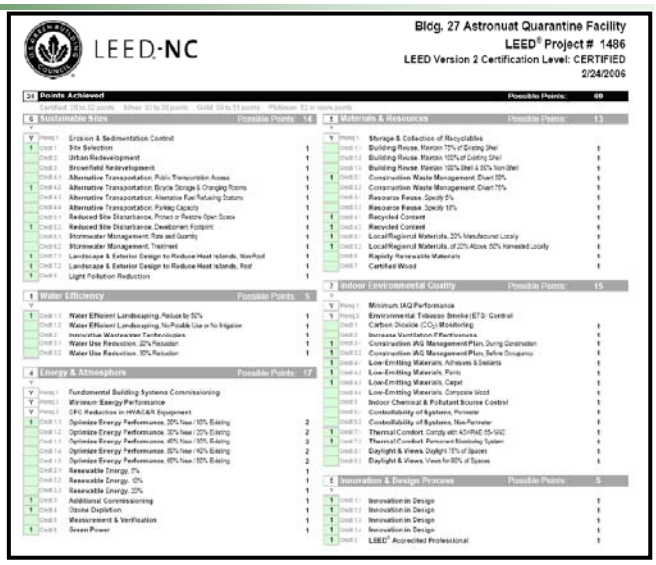
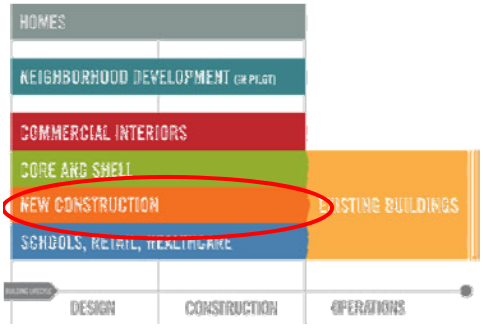
Scorecard Concepts

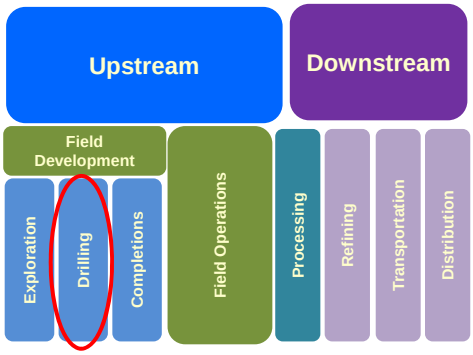


Focus Scorecard on Operation

Concept – USGBC LEED Program



Energy Production
Oil and Gas Operations



Stakeholder Engagement is Important!

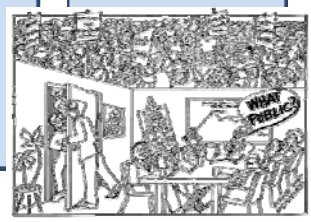
Stakeholders are all those who are affected, interested in or have the capacity to influence a project.

Academia

- Texas A&M University College Station
- Texas A&M University Kingsville
- University of New Hampshire
- UT Medical Center
- Mississippi State University
- Sam Houston State
- University of South Alabama
- John Hopkins University
- University of Arizona
- University of Texas
- University of Houston

Environmental Organizations

- Natural Resources Defense Council
- Environmental Defense Fund
- The Nature Conservancy
- Conservation International
- Mercer Arboretum
- Bureau of Applied Anthropology/Arizona
- Clinton Climate Initiative
- Rocky Mountain Clean Air
- McFaddin Ranch



Industry

- API
- Ballard Exploration
- BP
- Shell
- Chevron
- StatoilHydro
- ConocoPhillips
- Devon
- King Exploration
- Halliburton
- Huisman
- National Oil Well – Varco
- MI Swaco
- TerraPlatform
- T. Baker Smith
- Weatherford
- Derrick Equipment
- Composite Mats
- Ecology and Environmental Inc.
- PTTC
- IADC

State/Federal Agencies

- US Department of Energy
- Bureau of Land Management
- US Park Service
- Texas Railroad Commission
- Texas General Land Office
- Texas Dept. of Agriculture
- Texas Dept. of Transportation
- US Minerals Management Services
- Texas Parks & Wildlife
- Texas Water Board
- Texas Commission on Env. Quality
- US Environmental Protection Agency
- US Fish and Wildlife
- Argonne National Laboratory
- Big Thicket Preserve
- Idaho National Laboratory

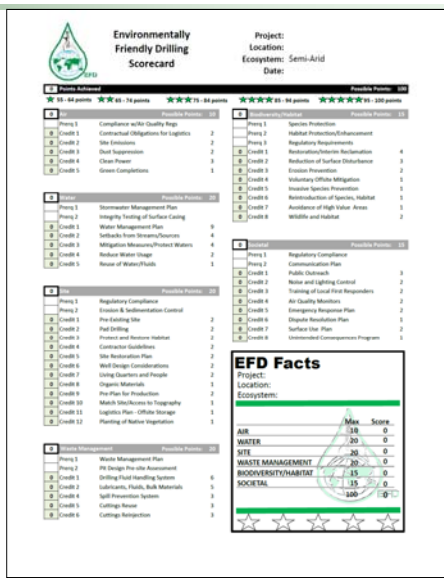
Source:Connor Development Services Ltd

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



Comparison of IPIECA and EFD Scorecard Indicators

Note: the highlighted colors indicate potentially comparable indicators/data points
BLUE = air quality/GHG emissions
PURPLE = energy/power use
YELLOW = wildlife/plant life/biodiversity
GREEN = water
RED = waste
GREY = spill prevention
GOLD = community engagement
*Indicators not color-coded do not share a category with indicators in the other reporting system

IPIECA Indicators

Environmental Indicators	- Climate change and energy o Greenhouse gas (GHG) emissions o Energy use o Alternative energy sources o Flared gas - Ecosystem services o Biodiversity and ecosystem services o Fresh water - Local environmental impact o Other air emissions o Spills to the environment o Discharges to water o Waste
Health and safety indicators	- Workforce protection o Workforce participation o Workforce health o Occupational injury and illness incidents - Product health, safety and environmental risks o Product stewardship - Process safety and asset integrity o Process safety
Social and economic indicators	- Community and society o Local community impacts and engagement o Indigenous peoples o Involuntary resettlement o Social investment - Local content o Local content practices o Local hiring practices o Local procurement and supplier development - Human rights o Human rights due diligence o Human rights and suppliers o Security and human rights - Business ethics and transparency o Preventing corruption o Preventing corruption involving business partners o Transparency of payments to host governments o Public advocacy and lobbying - Labor practices o Workforce diversity and inclusion o Workforce engagement o Workforce training and development o Non-retaliation and grievance system

EFD Scorecard Indicators

Air	• Prerequisites o Regulatory compliance • Credits o Contractual obligations for logistics ▪ 1 point: require all contractors and subcontractors associated with any logistical support or well site operations to use retrofit technology on all on-road vehicles that have Tier I or lower engines ▪ 1 point: require all contractors and subcontractors associated with any logistical support to use clean Tier II (or higher) engines for on-road vehicles o Site emissions ▪ 1 point: use clean Tier III/Type III engines for all non-road vehicles or ensuring application of retrofit technology to non-road vehicles that are Tier II or lower ▪ 1 point: use Tier IV engines for all applications o Dust suppression ▪ 2 points: submit a dust suppression plan and implementing/documenting the plan o Clean power ▪ 1 point: use tier IV diesel engines or natural gas from the field to power electric motors to run the drill rig ▪ 1 point: connect the drill rig to the electric grid ▪ 1 point: connect the drill rig to the electric grid and certify that the electricity is generated by solar or wind o Green completions ▪ 1 point: submit and implement a plan to use green completion practices
Water	• Prerequisites o Develop and implement a stormwater management plan that prevents or mitigates discharge of stormwater runoff. Use acceptable best management practices to reduce sources of contaminants from stormwater runoff. o Integrity testing of surface casing • Credits o Water cycle management plan ▪ 3 points: develop and implement a water management plan ▪ 2 points: develop and implement the segregation of liquid effluents principally along industrial, utility, sanitary, and storm water categories ▪ 2 points: identify opportunities and implementing a program to prevent or reduce wastewater pollution through such measures as recycle/reuse within the development area ▪ 1 point: assess the possibility of treating wastewater discharges for reuse ▪ 1 point: perform baseline hydrology studies, mapping and hydrochemistry studies and documenting water quality in the nearby area prior to operations. o Setbacks from streams/sources ▪ 2 points: contact all stakeholders that have water wells, streams, wetlands, or other water sources within 1,000 feed of the proposed operation ▪ 1 point: contact all stakeholders within 500 feet of 5,000 feet downstream of the operation of any stream that is within 1,000 feed of the proposed operation ▪ 1 point: hold a stakeholder meeting to discuss the operation, any risk to the fresh water sources and all risk mitigation efforts that are planned o Mitigation measures to protect ground water ▪ 2 points: develop and implement a detailed monitoring program to ensure that mitigation measures are in place, functional and adequate ▪ 2 points: include monitoring the non-contact runoff to ensure contamination does not occur o Reduce water usage ▪ 1 point: develop and implement a water use efficiency program ▪ 1 point: develop and implement a process to reduce the use of hazardous materials that could increase water treatment requirements o Reuse of water/fluids ▪ 1 point: develop and implement a plan to use water/fluids from nonpotable sources that are located within 50 miles of the sites

Site	• Prerequisites o Regulatory compliance o Erosion and sedimentation control • Credits o Pre-existing site ▪ 2 points: fully evaluate the possibility of the reuse of an existing drill site, determine the financial impact on the drilling budget, and select/use a pre-existing drill site o Pad drilling ▪ 1 point: employ pad drilling to more than a single well from the drill site ▪ 1 point: have a minimum of eight wells on the drill site o Protect and restore habitat ▪ 1 point: perform a site survey to identify site elements and adopting a plan concerning use and restoration of the site ▪ 1 point: use a spill control system and mats to limit surface disturbance o Contractor guidelines ▪ 1 point: publish an illustrated document that provides contractors with information on how to reduce their environmental footprint related to the drill site ▪ 1 point: hold training sessions with all contractors to review the document and the strategies listed in the document. Provide supervision on-site to ensure implementation o Site restoration ▪ 1 point: reclaim the site to its original elevations using the stockpiled topsoil and replanting the entire area with native grasses or other vegetation as directed ▪ 1 point: use topography to hide structure locations and using low profile structures o Well design considerations ▪ 1 point: document how the environmental sensitivities were taken into consideration when developing the well design ▪ 1 point: review the reservoir development plan to maximize production from each well and minimize the number of wells that need to be drilled o Living quarters and people ▪ 2 points: develop and implement a recycling program to minimize household waste o Organic materials ▪ 1 point: harvest organic materials during site preparation, mulch organic materials to be used on-site during site restoration, and bury remaining organic materials o Preplan and production ▪ 2 points: pre-plan for production by including the layout of flowlines, planning for stock tanks and other production equipment during the well site preparation o Match site/access to topography ▪ 1 point: use, whenever possible, previously impacted terrain for access routes and build irregularly shaped drill pads to conform to natural topography o Logistics plan—offsite storage ▪ 1 point: develop and implement a logistics plan that considers a centralized location for storage of equipment and supplies for various frill pads o Planting of native vegetation ▪ 1 point: develop and implement a plan that includes planting of native vegetation at the appropriate time of year for the plants to become established

Waste management	• Prerequisites o Waste management plan o Pit design pre-site assessment • Credits o Drilling fluid handling system ▪ 2 points: use cuttings management plan ▪ 2 points: use environmentally friendly drilling fluids ▪ 1 point: use a modified closed loop system by using additional drilling fluids handling equipment in addition to what is supplied by the rig ▪ 1 point: use a full closed loop system in addition to rig system that includes a cuttings dryer o Handling of rig wastes ▪ 2 points: use biodegradable lubricants and including a recycle/salvage plan for disposal ▪ 1 point: use environmentally friendly pipe dope for both drill pipe and casing ▪ 1 point: use an electric top drive system to minimize use of hydraulic fluids ▪ 1 point: maximize the use of bulk materials o Spill prevention system ▪ 1 point: to minimize the risk of any spillage, including drilling fluids, oil/fuel, lubricants, drip pans and other devices/systems should be used ▪ 1 point: ensure that all equipment installed on the site is designed so that any effluent is caught and not discharged directly into the environment ▪ 1 point: develop and implement plan for bioremediation of spills and use of landfarming o Cuttings reuse ▪ 3 points: develop and implement a drill cutting recovery and reuse plan o Cuttings reinjection ▪ 3 points: develop and implement a cuttings reinjection plan
Biodiversity/ habitat	• Prerequisites o Species protection o Habitat protection/enhancement o Regulatory requirements • Credits o Restoration/interim reclamation ▪ 4 points: develop a well abandonment plan before the well is drilled to ensure that the plan is updated during the well's life whenever the well's configuration is changed o Reduction of surface disturbance ▪ 1 point: during construction and drilling, shuttle workers to site ▪ 1 point: establish centralized location for hydraulic fracturing and water delivery ▪ 1 point: install systems to enable remote monitoring o Erosion prevention ▪ 1 point: plan and install access roads to avoid erosion ▪ 1 point: armor roadway ditches and leadoff ditches with rock riprap o Voluntary offsite mitigation ▪ 1 point: establish and implement a plan that includes passive techniques that encourage biodiversity and ecosystem health o Invasive species prevention ▪ 1 point: perform three (3) of the following: site restoration, identify and establish no impact zones, clean equipment that is moved between sites to prevent transport of invasive species, ensure that materials (soils, mulch, etc.) brought in to site are certified to be invasive free, identify and remove invasive species on site o Reintroduction of species, habitat ▪ 1 point: ensure that a botanical expert is on-site when clearing vegetation occurs. The expert should develop a pre-disturbance species composition list. Then, a restoration/revegetation plan should be developed and implemented based on the pre-disturbance species composition list. Also, ensure that a wildlife expert is consulted and on-site, if necessary, when site construction activities occur. The expert should document various topographical and other features that are conducive to wildlife habitat(s). Then, a restoration plan should be developed and implemented that would encourage the return of native wildlife o Avoidance of high value areas ▪ 1 point: include input from on-site land manager(s) to preserve agricultural land when selecting locations for facilities o Wildlife and habitat: ▪ 1 point: Scout the sensitive areas and plan routes likely to cause least disruption, stay clear of wildlife areas marked on the planning map to avoid sensitive areas, ban hunting and fishing at all times, instruct crews not to intentionally harass or feed wildlife, ban pets on all crew facilities, report incidents and any significant problems with wildlife, train crews to identify wildlife ▪ 1 point: develop and implement a habitat mitigation plan that includes enhancements to the area that encourages biodiversity and improves wildlife mortality rates

Societal	• Prerequisites o Regulatory compliance o Communication plan (an agreement in writing from land managers and landowners concerning plans to construct new facilities. Also develop and implement a transparent process concerning making decisions about) • Credits o Public outreach ▪ 1 point: engage community early and often in discussions concerning energy development, reach a consensus with community leaders concerning location of facilities that may potentially be visible from public places, work with local law enforcement to develop and implement measures to reduce traffic safety hazards, engage local and regional officials to advise on health and safety concerns associated with operations ▪ 1 point: develop and implement a logistics plan to transport all consumables for the project to and from the location in the least disruptive way and how to store and use them on location in the safest possible manner ▪ 1 point: develop and implement a public interaction plan, including a communication process that keeps the public informed of planned activities and progress o Noise and lighting control ▪ 1 point: work with community leaders to identify noise management guidelines ▪ 1 point: minimize residual lighting effects o Training of local first responders ▪ 1 point: develop and implement a plan to train local emergency medical service personnel on issues that may arise during operations ▪ 1 point: provide support to local public health service providers that could address key public health issues o Air quality monitors ▪ 1 point: install air quality monitors to ensure the following values are not exceeded: VOCs (including benzene): 20 milligrams per normal cubic meter, hydrogen sulfide: 30 milligrams per normal cubic meter, odor: not offensive at the receptor end ▪ 1 point: provide website that has links to data from sensors o Emergency response plan ▪ 2 points: develop and implement an Emergency Response Plan that goes beyond requirements and engages the community. The plan should be a set of scenario-based procedures to assist emergency responders during real life emergencies as well as training exercises. The plan should include an assessment of local support capabilities o Dispute resolution plan ▪ 1 point: develop a dispute resolution plan that is agreed to with landowners. Include in the plan a process that would handle any dispute and agree on how the costs would be split among the affected parties o Surface use plan ▪ 1 point: develop and implement a Surface Use Plan that ensures environmental expectations exceed regulatory requirements concerning exploration and production activities ▪ 1 point: (1) organize and hold a workshop to inform all landowners and the surrounding community about the operational commitment to environmental stewardship and (2) routinely (suggested weekly, but at least monthly) inform landowners and community about environmental stewardship related to surface use. This may be done through a website, electronic newsletters, mailings, or other means o Unintended consequences program ▪ 1 point: develop and implement a company polity that addresses unintended consequences that may arise during development. Communicate the company policy to all stakeholders. In addition, ensure that all stakeholders are aware of whom to contact if/when an issue arises

Summary

1. The Environmentally Friendly Drilling Systems (EFD) Program
   - Brings all stakeholders together
   - Broad program that takes a systems approach to issues
   - Strong, worldwide program

2. Complementary Programs
   - Coastal Impacts Technology Program
   - Ukraine efforts

3. The EFD Scorecard
   - Comprehensive review of operations
   - Consensus of stakeholders developed scorecard
   - Currently testing ‘alpha prototype’

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Thank you

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