



# ENVIRONMENTALLY FRIENDLY DRILLING SYSTEMS PROGRAM

*Cost Effective Technologies for Environmental Protection*

***Industry has made great strides in protecting the environment while increasing oil and natural gas production. Producers, however, still face daunting challenges.***

The **Environmentally Friendly Drilling (EFD)** program, managed by the Houston Advanced Research Center (HARC), integrates advanced technologies into systems that significantly reduce the footprint of petroleum drilling and production in environmentally sensitive areas. 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.

The program continues to add participants from environmental organizations, academia, government agencies, government laboratories, and industry. Currently over 100 organizations support this effort including financial assistance. The partnership identifies new technologies and transfers them to areas that must incorporate new practices to address environmental concerns. Regional partners optimize technologies to fit the needs of their locale. Partners routinely come together to discuss progress with the sponsors/advisors. The program was honored with the Environmental Partnership Chairman's Stewardship Award from the Interstate Oil and Gas Compact Commission at their 2009 annual meeting.



Technology Transfer activities include the human dimension of technology incorporation in societal areas. Educating and informing is directed toward the industry, regulators and the public. The outcome of the program is expected to result in reasonable regulatory controls, lower development cost and reduction of the environmental footprint associated with operations. To date, the program has made over 50 presentations, issued over two dozen publications and has held four significant workshops. The EFD Program has created a University/National Laboratories Alliance to fund and transfer critical new technologies that accelerates development of domestic reserves in a safe and environmentally friendly manner. The research is aimed specifically at identifying and developing safe and environmentally friendly technologies.

## **International Cooperation**

It is important to address environmental tradeoffs associated with energy development worldwide. Innovation knows no geographic boundaries. The EFD program includes a European Chapter with the goal to identify and apply best practices in Europe as well as to identify new innovations and applications. Additional chapters around the world are being considered. Regulatory requirements in countries that have strict regulatory standards (sometimes stricter than in the US) cause innovation and lead to the development of new technologies that could be applied everywhere. Having worldwide programs enables all operators and regulators to learn about technologies being developed and implemented throughout the world, fostering international relationships.

The Environmentally Friendly Drilling (EFD) program integrates several projects and programs that are funded by the Research Partnership to Secure Energy for America (RPSEA), the U.S. Department of Energy through the National Energy Technology Laboratory (NETL), private industry and environmental organizations. Additional funding is from the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) through the Coastal Impact Assistance Program (CIAP) managed by the Texas General Land Office. Example programs and projects include:

- ◆ **Texas A&M University—Systems Engineering Design Methodology: Low Impact Well Design Optimization:** Developing a computer program to enable operators to select and optimize environmentally friendly systems for drilling operations.
- ◆ **Texas A&M University—Produced Water Studies:** Investigating the various issues associated with processing produced water in the Marcellus Shale.
- ◆ **University of Colorado—Best Management Practices Database:** Developing a web site that discusses various best management practices and most applicable technologies to address various rules and regulations for operations in the Rocky Mountains.
- ◆ **University of Arkansas—Dissemination and Decision Support:** Replicating the effort performed under the Low Impact Natural Gas Operations program for the Haynesville Shale. Developing a GIS based information site that includes operational information, permits, endangered species, topography and other information.
- ◆ **University of Wyoming—Western Mountain States Studies:** developing a prototype lay down road system and initial field testing.
- ◆ **Utah State University & Sam Houston State University—Societal Acceptance:** Investigating public perception of unconventional natural gas operations in Eastern Utah.
- ◆ **West Virginia University—Eastern Mountain States Studies:** Identifying barriers associated with unconventional natural gas development in the Marcellus Shale.
- ◆ **Prototype Small Footprint Drilling Rig:** Testing prototype new technologies that have lower-cost and lower environmental impact that can benefit domestic exploration and production.
- ◆ **Application for Semi-Arid Ecosystem:** Holding workshops to identify low impact systems for specific regions.
- ◆ **NOx Air Emissions Studies:** Developing guidelines for reducing emissions from large diesel engines associated with unconventional natural gas operations.
- ◆ **Reduced Hydraulic Fracturing Footprint:** Identifying alternatives to reduce the footprint including offsite operations and innovative fracturing technologies such as a novel process involving: minimal pumping equipment, low volumes of frac fluid and materials that are environmentally green and non-damaging.
- ◆ **Measuring the Effectiveness:** Developing and testing the EFD scorecard and the measurement methodology.
- ◆ **Ecosystem and Biodiversity—Measurement and Assessment:** Developing tools for adaptive ecosystem management to assist integrated management of land, water and living resources that promotes conservation and sustainable use.
- ◆ **Coastal Impacts Technologies Program:** Performing research, demonstration and application of technologies to reduce the environmental footprint of operations in the 18 Texas coastal counties.

The EFD management team is pursuing various sources of long term funding. Industry funding covers specific projects through 2012. The program receives funding from the Coastal Impact Assistance Program (CIAP) through 2015. In addition, the EFD team has submitted a proposal for the Technology Integration Program (EFD-TIP) that will include field trials of environmentally friendly drilling systems technologies.

# Environmentally Friendly Drilling Program

For 20 years, we have worked to reduce our environmental footprint. Remarkable progress has been made.

The program has shown we can **reduce the footprint more than 90%** with a further reduction in the impact on the environment if low impact technologies are combined in a system.

From the past...  
(multiple well sites)



...to the present drill site pad  
**6 times smaller** and able  
to access multiple wells  
from **ONE** location



## System includes:

- Modular small footprint rigs with reduced emissions.
- Pad drilling of multiple wells from one site.
- New downhole logging and steering tools.
- Closed loop drilling fluid systems.

Managed by the Houston Advanced Research Center (HARC), Texas A & M University, Sam Houston State University and TerraPlatforms LLC.  
[www.efdsystems.com](http://www.efdsystems.com)

The project has been co-funded by the DOE National Energy Technology Laboratory, Research Partnership to Secure Energy for America (RPSEA), industry and environmental organizations.

### SPONSORS



### MANAGEMENT TEAM



### ENVIRONMENTAL ORGANIZATIONS



### COLLABORATORS



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