PRRC Researchers Win Contracts

Two innovative research projects that target more cost-effective EOR for small producers were recently awarded to PRRC researchers.

Radial Jet Drilling

A two-year, $1.5 million field validation project awarded by RPSEA’s Small Producer Program aims to show that lateral-jet drilling can be cost-effective for EOR in low-permeability marginal reserves.

"Field Testing and Diagnostics of Radial-Jet Well-Stimulation for Enhanced Oil Recovery from Marginal Reserves," is headed by Dr. Lianxiong Li, Research Scientist and Section Head of the Membrane Technology Group at PRRC. Co-investigators are Steve Bowen from Well Enhancement Services (WES) of Texas and Jeff Harvard of Harvard Petroleum Company, a NM production company since 1961.

The unique features of this project are its multidisciplinary components and its systematic approach to meshing fundamental research with field demonstration for technology validation. Radial jet enhancement will be specifically tested on marginal wells in low-permeability reservoirs, where it is expected to perform to advantage.

Research will address three questions:

(1) Control and diagnosis of placement and direction of laterals during a radial jet enhancement; (2) Cost-effectiveness of lateral jet enhancement for small producers; (3) Preferred reservoir conditions and lateral patterns for deployment of radial jet technology in an existing wellbore.

Reservoir type, permeability ratios, and reservoir pressure/temperature play crucial roles in lateral jet design and contribute significantly to the economic success of lateral jet enhancement. These factors, as well as the influence of fracture orientation, faulting, and formation deviation, will be investigated by the PRRC research team. All operating fluid will be recycled during the radial jet enhancement operation, so no environmental impact is expected.

Radial Jet Enhancement is WES’s patented method of jet drilling horizontal laterals using a high-pressure water jet, specifically developed for cutting lateral boreholes out to 300 feet in length from existing production casing. It has been used successfully for enhancing well productivity or water injectivity at the injection well.

WES will provide major equipment, including a coiled tubing unit that has already been manufactured and is ready for the proposed research. The PRRC’s researchers will supervise the placement of distributed optical pressure fiber sensors, which will be integrated with the coiled tubing unit for monitoring the direction and lateral placement.

The Harvard Petroleum Company has committed full access to three wells for the field demonstration: two oil wells (cont’d on page 2)
in Eddy County and one gas well in Roosevelt County.

The successful completion of this project will result in a cost-efficient stimulation method that can significantly increase production from the existing marginal wells that are mainly operated by small producers in NM and in other regions of the US.

**Nanoparticles for Foam Stability**

A three-year, $1.2 million DOE-funded project, “Nanoparticle-Stabilized CO₂ Foam for CO₂ EOR Application,” awarded in Fall 2010, will be led by Dr. Ning Liu, with co-PI Dr. Liangxiong Li, researchers at PRRC.

In this project a new type of CO₂ foam for gas flooding will be developed in which nanoparticles of materials such as iron oxide, hydroxides, metal sulfates, silica, clays, and carbon are used for stabilizing CO₂ foam instead of surfactants, to improve sweep efficiency and increase oil recovery.

Although EOR with CO₂ is a well-established means of enhancing production, CO₂ mobility control—that is, the means of keeping the mobility of the displacing fluid (CO₂) equal to or less than that of the displaced fluid (oil)—remains a problem; CO₂ channeling and early breakthrough often occur, resulting in more costs and/or lower oil production.

Surfactant-stabilized CO₂ foams have been reported to successfully control CO₂ mobility and have been even field-tested, but these still have some serious weaknesses, like instability under reservoir conditions and adsorption loss.

Compared to surfactant molecules, nanoparticles can strongly adsorb at the CO₂/brine interface and form stable foams. In addition, nanoparticles are solid and have the potential to withstand high-temperature and/or high-salinity reservoir conditions for extended periods.

This research offers a new CO₂ mobility control technology for EOR. Its success will advance the development of an alternative CO₂ EOR technology that could significantly reduce EOR operation costs and improve economic benefits for US producers.

**Technology Showcase Features PRRC Researchers**

Four New Mexico Tech scientists were featured at a day-long Small Producer Program Showcase sponsored by the Research Partnership to Secure Energy for America (RPSEA) at the University of Texas-Permian Basin in Midland, Texas, on February 4. This showcase is the first of its kind for the Small Producer Program, which funds research focused on technological advances that can be implemented by independent operators to improve efficiency and profitability.

Ms. Martha Cather, Industry Service and Outreach Group Coordinator at PRRC, coordinates RPSEA’s Small Producer Program. Ms. Cather gave a lunch-hour presentation on how to effectively apply for research funding. Dr. Lianxiang Li and Dr. Robert Balch, both PRRC researchers, and Tech professor Dr. Tom Engler, who is also holds a joint appointment as a Research Scientist at PRRC, presented updates on their research projects funded through the Small Producer Program.

Dr. Li is designing a low-temperature distillation unit to treat produced water. He is among several scientists at New Mexico Tech working on developing new low-cost methods of cleaning produced water. Dr. Balch’s project is the development of the New Mexico Pit Rule Mapping Portal, which generates maps of potential site regulatory issues using government recommended data, with the objective of expediting evaluation, form preparation and compliance with the new pit siting criteria. Dr. Engler’s research involves new cost-saving methods of waterflooding small oil reservoirs, designed to extend the productivity of small, mature oil fields.

Other speakers were from Texas A&M, the University of Kansas, Missouri-Rolla and the University of Texas-Permian Basin. Speakers focused on the application of their research and the benefit to industry from scientific findings. About 50 industry engineers and executives attended the showcase.

RPSEA is a nonprofit corporation that aims to maximize domestic hydrocarbon output through supporting research, development and deployment of new, safe technology that enhances production.

The RPSEA Small Producer Program recognizes the importance of the nation’s independent hydrocarbon producers and their role in supplying the nation’s energy. The Small Producer Program was established to support research that will result in technology to assist small producers in developing mature resources.
Publications, Presentations 2010

Akanni, O. 2010. Analysis of Bright Water Reservoir Sandstone Imbibition and Comparison with Polymer Flooding for Improved Oil Recovery. M.S. Thesis, New Mexico Institute of Mining and Technology, Socorro, NM


Balch, R. 2010. The New Mexico Pit Rule Mapping Portal. Presented at the SPE Four Corners Section Meeting, Farmington, NM, 27 January; the RPSEA Small Producer Program Showcase, University of Texas-Permian Basin, Midland, 4 February; the SPE Roswell Section Meeting, Artesia, NM, 23 March, and at the AAPG Rocky Mountain Section Meeting, Durango, 13–16 June.


Seright, R.S. 2010. Potential for Polymer Flooding Reservoirs with Viscous Oils. Paper SPE 129899 presented at the SPE Improved Oil Recovery Symposium, Tulsa, Oklahoma, 24–28 April. (Accepted for publication in SPE.J)


PRRC Students Honored

Two PRRC Students were honored recently with awards for scholarship and leadership.

Petroleum engineering junior Breanne Dunaway won a competitive scholarship from the Texas Alliance of Energy Producers Foundation for Energy Education in April 2010. A native of Holdrege, NE, she is the daughter of Robert and Sandy Dunaway. She is a Petroleum Engineering major, employed at the PRRC.

She is the first New Mexico Tech student to win the Joseph King McMahon Petroleum Engineering Scholarship. Established in 2006, the scholarship helps academically gifted petroleum engineering students who are involved in their campus community.

Shanker Muraleedharan, a graduate student in Petroleum Engineering at the PRRC, was one of five NMT students honored with a Student Appreciation Award, bestowed at a special banquet on May 2, at the Stage Door Grill in Socorro.

All the honorees, though academically gifted, were recognized for contributing to the campus community through volunteerism. Mr. Muraleedharan has shown his leadership within the Petroleum Engineering Department, at PRRC, and in the Indian Student Association. He was nominated for this award by Dr. Tom Engler of NMT’s Petroleum Engineering Department and Ms. Heidi Guerra of the PRRC.

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The PRRC is a state-supported center that conducts research on improving methods of recovering crude oil and natural gas and that transfers petroleum technology to domestic oil producers. Funding for the PRRC comes from three sources: the State of New Mexico, the federal government (Department of Energy), and private industry.

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Oil price data through Nov. 30, 2010 from PRRC's OCTANE website (octane.nmt.edu). Prices are NYMEX.