

## **Enhanced Oil Recovery Commission**

### **Quality of Life Results**

- Wyoming has a diverse economy that provides a livable income and ensures wage equality.
- Wyoming natural resources are managed to maximize the economic, environmental and social prosperity of current and future generations.
- Advanced technologies and workforce allow Wyoming business and communities to adapt and thrive.

### **Contribution to Wyoming Quality of Life:**

Wyoming's oil fields are, in most cases, declining in production, yet most of the oil in these fields remains underground. While unrecoverable by traditional production methods, significant amounts of oil in these fields can be recovered through enhanced oil recovery (EOR) techniques. According to conservative estimates by the Wyoming Geological Survey, approximately 8 billion barrels of oil remain in Wyoming fields and between 5% to 15% of this oil can be recovered with EOR technologies. Therefore, a broad application of EOR could increase the state's ultimate oil production by anywhere from 400 million to 1.2 billion barrels. Given the current high price of each barrel of oil, the revenues from royalties and property and production taxes to Wyoming government, and ultimately the government's ability to support state programs, will be tremendously increased.

### **Commission Facts:**

The EOR Commission was created in 2004 to provide overall direction and oversight of EOR programs conducted by the Enhanced Oil Recovery Institute (EORI) at the University of Wyoming. The legislature appropriated \$2.4 million to fund programs in two overarching areas:

1. Research: CO<sub>2</sub> separation from flue gas and thermodynamic characterization of reservoir fluids
2. Technology Transfer: Making available information about traditional and newly discovered EOR technologies to Wyoming industry

In March 2006 the Wyoming legislature appropriated \$6,107,224 to continue the efforts.

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The EOR Commission consists of eight commissioners appointed by the Governor. The following members served from July 1, 2005 to June 30, 2006:

Senator Bill Hawks, ex-officio

Lynne Boomgaarden, director, Office of State Lands and Investments

Bern Hinckley, geologist

Ambassador Tom Stroock, president, Alpha Development

Hank True, UW trustee and managing member of True Oil, LLC

Peter Wold, president, Wold Oil Properties

Governor Dave Freudenthal, ex-officio

Ron Surdam, state geologist, ex-officio

### **Performance Measure 1:**

The EOR Commission shall facilitate the development of formal agreements between the Institute and the oil and gas industry through which the industry is provided access to the Institute's geologic and engineering reservoir modeling and reservoir characterization work in exchange for providing data access and testing facilities.

### **Story behind the performance:**

In order to benefit the state of Wyoming, cooperative associations (project work agreements) have been formed with industry for reservoir characterization and modeling. These agreements allow EOR scientists to use producer's operations as real-time laboratories. The knowledge gained by working the fields can be transferred to producers state-wide.

### **What has been accomplished?**

Listed below are the active cooperative associations and the specific research question being analyzed at each site.

- Merit Energy Company – Lost Soldier Wertz Field (history matched “Darwin/Madison and Cambrian” reservoir models)
- Nance Petroleum – Mahoney Dome Field (reservoir characterization and simulation)
- Nerd Gas Company – Brooks Ranch Field (geologic characterization and analysis of oil recovery by water flooding)
- Safford Oil – Crooks Gap Field (removal of water block at well bores)

We have entered into negotiations for an additional cooperative association with XTO at their Hartzog Draw site to study the Shannon Sandstone Reservoir.

**Performance Measure 2:**

The EOR Commission shall promote and facilitate the transfer of new technologies developed at the Institute throughout the oil and gas industry in this state.

**Story behind the performance:**

Through its support and oversight of the EOR Institute, the EOR Commission has been instrumental in the sponsorship of workshops and working groups to provide an interactive, noncompetitive forum to promote a better understanding of Wyoming reservoirs.

**What has been accomplished?**

Developing technology transfer workshops has been a challenge due to some difficulty in identifying industry needs. In many cases, producers are not able to articulate their needs due to either time constraints resulting from the increased oil production activity or due to a lack of basic information on the technology assistance available. To that end, a series of EOR Primers are being produced. These briefing memos are being designed to help producers understand various EOR technologies in order to make decisions on investing additional time and resources on a deeper understanding and ultimate implementation of the technology at their site.

A technology transfer working group meeting for Wyoming producers was held in Casper in July, 2005. Because the Tensleep Sandstone provides the most prolific oil reservoirs and the greatest volume of stranded oil in the State, EORI in cooperation with the Rocky Mountain Oilfield Testing Center (RMOTC), assembled a “Tensleep Reservoir Working Group” whose mission is *“to provide an interactive, noncompetitive forum to promote better understanding of the geology and engineering of Tensleep reservoirs, to share operating experience and science that are relevant to producers, and to develop and promote best practices in the management of these reservoirs.* Twenty producers attended the first Tensleep Working Group meeting. EORI and RMOTC will continue to sponsor technology transfer workshops for producers working in the Tensleep and other oil producing formations within Wyoming.

In its strategic plan, the Commission and the Institute made technical outreach a priority for the biennium. To that end, the Wyoming Legislature appropriated funds to develop a cost sharing program to encourage producers to conduct testing, tracer studies, fracture analyses and other downhole activities that may be necessary to identify appropriate EOR approaches. With the financial support in place, the activities can commence during the 2006-2007 fiscal year.

New technical outreach initiatives required additional scientific and engineering staff at the Institute. The following professionals have been hired and will commence work during the 2006-2007 fiscal year:

- Owen Phillips, Economics
- Lamia Goual, Petroleum Engineering
- Muhammed Piri, Petroleum Engineering
- Carolyn Coolidge, Technical Writer
- Geoff Thyne, Geochemist
- Graduate Students in Economics, Geology, and Petroleum Engineering

One item that was offered in the strategic plan that has not been implemented is the online “knowledge repository” designed to make pertinent information about EOR easily accessible to Wyoming producers and citizens. The project is on hold while we reevaluate the cost of the project compared to its value to industry.

### **Performance Measure 3:**

The EOR Commission will establish a technical advisory task force to evaluate the responsiveness of programs, the effectiveness of technology transfers and funding from non-state sources.

#### **Story behind the performance:**

During its first year, the Commission and Institute focused on the technical outreach and research missions. The Commission members provided the evaluatory feedback.

#### **What has been accomplished?**

The Commission has identified potential technical advisory committee members to oversee reservoir geology, modeling and engineering, and economic and regulatory issues. In addition, the committee will evaluate the responsiveness to the Commission’s and Institute’s programs, the effectiveness of technology transfer, and funding from non-state sources. The first meeting will occur in the 2006-2007 fiscal year.

### **Performance Measure 4:**

The Commission will support basic research on EOR such as CO<sub>2</sub> separation and characterization of reservoir fluids, creation of scoping models, and conducting a decline curve analysis.

#### **Story behind the performance:**

Through the Institute’s CO<sub>2</sub> separation studies, a new CO<sub>2</sub> absorption material with enhanced CO<sub>2</sub> absorption capacity and fast absorption/desorption rates has been developed and tested.

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Work continues in developing theoretical approaches for predicting the thermodynamic properties of reservoir fluids and a model for predicting Minimum Miscibility Pressure (MMP).

A “Wyoming CO2 Scoping Model” is being constructed that will allow operators to better understand potential costs and enhanced production that a CO2 flood might generate for their fields.

Work continues on the characterization of Wyoming reservoirs to assist with the identification of statistical ‘performance groups’.

### **What has been accomplished?**

The basic research on CO2 separation and characterization of reservoir fluids will continue to build on the advances made during the first year of the Commission and Institute. This type of research is time consuming. Answers to EOR questions often take years to develop.

Wyoming CO2 Scoping Model has been completed for the Powder River Basin. It will allow operators to better understand factors that influence project economics and to assist with the decision of proceeding with costly reservoir and engineering studies. The statistical performance groups will be used to (1) help operators compare the performance of their field to the ‘norm’ and (2) model expected CO2 EOR production performance.