INDUSTRIAL COMMISSION OF NORTH DAKOTA

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Taxation Committee
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North Dakota Industrial Commission
Karlene Fine, Executive Director

Thank you for the opportunity to appear before your Committee. For the record, I am Karlene Fine, Executive Director and Secretary for the North Dakota Industrial Commission. I was asked to speak today about one of the research programs that the Industrial Commission oversees -- the Oil and Gas Research Program (Program).

A few comments about the Program in general -- funding for the Program comes from a percentage of the oil taxes; since the Legislature authorized the Program in 2005 the Commission has awarded funding for over 70 contracts, every dollar that is awarded must be matched dollar for dollar from other funds -- industry dollars or federal dollars. All projects that are funded must be recommended by the Oil and Gas Research Council consisting of 9 members with 2 of those members serving as ex-officio members. The Board members represent the oil and gas counties and industry.

The Oil and Gas Research Program has six ongoing contracts with the Energy and Environmental Research Center -- one of the premier research facilities in North Dakota. They are:

- Plains CO_2 Reduction Partnership - Phase III of this research began in 2008. (Phase I began in 2003). Substantial understanding of EOR as a carbon management vehicle has been developed through this effort, largely focused on conventional (non-Bakken) oil fields.
- Program to Determine the Uniqueness of Three Forks Bench Reserves, Determine Optimal Well Density in the Bakken Pool and Optimize Bakken Production. This program is also known as the Bakken Production Optimization Program (BPOP).
- Improved Characterization and Modeling Tight Oil Formations for CO_2 Enhanced Oil Recovery (EOR) Potential and Storage
- North Dakota Industrial Commission Resource Characterization which is being conducted with Sandia National Laboratories and the Department of Energy.
- Produced Water Pipeline Study* - The Legislature directed in House Bill 1358 that the EERC complete a study regarding construction standards and monitoring systems for gathering lines (Phase I) and demonstrate best practices in a pilot gathering pipeline project (Phase 2). The second phase will require technical engagement and support from one or more industrial stakeholders in the state.
- Pilot Program to Determine Best Techniques for Remediating Contaminates from Soil Surrounding Legacy (1951-1984) Waste Pits in North Central North Dakota - The Legislature again directed that this study be done in House Bill 1358.

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*No matching funds were required on this study although it is anticipated that in order for the second phase of this study to be completed industry will be providing technical support.

The Commission has previously partially funded one project that is closely related to this most recent award - Bakken CO_2 Storage and EOR Consortium Phase 1 - 2012-2014. The goal of this study was to generate data and insight regarding the use of CO_2 for Bakken EOR and CO_2 storage. A vast majority of the characterization efforts and all of the modeling efforts were focused on the Middle Bakken. The hydrocarbon extraction work was roughly split between Middle Bakken and shales.

Although we did not provide funding for the Bakken CO_2 Storage and EOR Consortium Phase 2 - 2014-2016, the Commission's Department of Mineral Resources oil and gas technical experts are familiar with the work that is being conducted during Phase II, and this project dovetails closely with and complements the Bakken CO_2 Storage and Enhanced Recovery Research Program -- Improved Characterization and Modeling Tight Oil Formations for CO_2 EOR Potential and Storage.

You asked that I specifically speak about the Bakken CO_2 Storage and Enhanced Recovery Research Program -- Improved Characterization and Modeling Tight Oil Formations for CO_2EOR Potential and Storage. The total funding for this project is over $2,500,000 with the majority of the funding coming from the Department of Energy. The total award made by the Industrial Commission through the Oil and Gas Research Program is $400,000. The purpose of the project is to develop improved tools and techniques to evaluate fluid flow in the tight rocks of the Bakken Formation, including the shales, resulting in an ability to better determine the enhanced oil recovery potential of the Bakken. The objective is to generate improved reservoir characterization data and integrate those data with reservoir modeling to develop previously unavailable insight regarding the use of CO_2 for EOR in the Bakken Formation. To further elaborate on how EERC will do this here are 6 bullets that further identify the work they will be doing:

- Assess and validate CO_2 transport and fluid flow in fractured tight oil reservoirs
- Determine the effects of the wetting fluid on EOR and CO_2 storage. Illuminate the roles that the shale members may play with respect to CO_2 storage, containment, EOR, or possibly even all three.
- Advanced scanning electron microscopy (SEM) and computerized tomography (CT) scanning techniques that are not part of other efforts will be used to characterize fractures and pore networks at scales ranging from macro-to nanoscale.
- Geomechanical testing will be conducted to support development of improved hydraulic fracture models.
- Determine CO_2 permeation and oil extraction rates in tight reservoir rocks and organic-rich shales. Integrate the laboratory-based CO_2 permeation and oil extraction data and the characterization data into geologic models and dynamic simulations to predict CO_2 storage capacity and EOR in the Bakken.
- Use new reservoir characterization and laboratory analytical data and state-of-the-art modeling to determine the viability of using carbon dioxide for enhanced oil recovery in the Bakken.

Attached to my testimony is the summary page from the EERC's application to the Commission requesting funding from the Oil and Gas Research Program.

ABSTRACT

Objective: Total oil-in-place estimates for the Bakken Petroleum System range from 300 billion barrels (Bbbl) to over 900 Bbbl. Most estimates for primary recovery range from 3% to 5%. With such low primary recovery factors and such a large resource, small improvements in productivity could increase North Dakota's technically recoverable oil by billions of barrels. Previous Energy & Environmental Research Center (EERC) research indicates that as much as 4 to 7 Bbbl of incremental oil may be produced through the use of carbon dioxide (CO_2). However, pilot-scale CO_2 injection tests in the Bakken have had limited success, and there is no clear, straightforward answer regarding the most effective approach for improving oil productivity in the Bakken. A better understanding of the fundamental mechanisms controlling the interactions between CO_2, oil, and the tight rocks of the Bakken Formation is necessary to develop the knowledge necessary to make informed decisions regarding the development of effective injection and production schemes. The EERC seeks funding for a research project to develop improved tools and techniques to evaluate fluid flow in the tight rocks of the Bakken Formation, including the shales, resulting in an ability to better determine the enhanced oil recovery (EOR) potential of the Bakken. The objective is to generate improved reservoir characterization data and integrate those data with reservoir modeling to develop previously unavailable insight regarding the use of CO_2 for EOR in the Bakken Formation. The proposed project has already received funding from the U.S. Department of Energy (DOE) and the North Dakota Lignite Energy Council (LEC). This project complements the EERC's Phase II Bakken CO_2 Storage and Enhanced Recovery Program, and the results of both efforts will be made available to the North Dakota Industrial Commission (NDIC). Additional detail on this complementary effort can be found in Appendixes A and B to the EERC proposal.

Expected Results: The results of the proposed work will provide insight regarding relationships between Bakken oil, key reservoir attributes (particularly the nature of micro- and nanoscale pore networks), and CO_2 under reservoir conditions toward the efficient use of CO_2 for EOR.

Duration: The duration of the proposed project is 36 months (November 1, 2014, to October 31, 2017).