

EERC EXPERIENCE IN OIL AND GAS

Goal

Design and implement new approaches to efficiently and safely explore, develop, and produce hydrocarbon resources.



THE BRAVE NEW WORLD – UNCONVENTIONAL RESERVOIRS



UNCONVENTIONAL LEADERSHIP FOR AN UNCONVENTIONAL RESOURCE



Bakken Production Optimization Program

- Resource characterization
- Site logistics
- Waste management
- Hydrocarbon utilization
- Water management
- Process optimization and systems analysis



Bakken CO₂ Enhanced Oil Recovery and Storage Project

- Resource maximization
- Innovative reservoir characterization
- Fracture characterization and modeling



BAKKEN PRODUCTION AND OPTIMIZATION PROGRAM GOALS

- Maximize oil production from Bakken and Three Forks wells by employing an “all of the above” approach:
 - Advanced reservoir characterization
 - Improved drilling/stimulation/completion/production techniques and sequences
 - Optimizing wellsite surface operations:
 - ◆ Reduce costs
 - ◆ Reduce development and operation impacts to surrounding landowners
 - ◆ Reduce demands on surrounding infrastructure and water sources

PROGRESS MADE TO DATE

ECONOMIC

- Increased well productivity and economic output of North Dakota's oil and gas resources.
- Increased revenue for the state, royalty owners, and operators.
- Reduced demand for infrastructure construction and maintenance.
- Reduced road maintenance costs, wastewater production, waste disposal costs, and freshwater use.
- Significant increases to estimates of recoverable hydrocarbons.

EDUCATIONAL

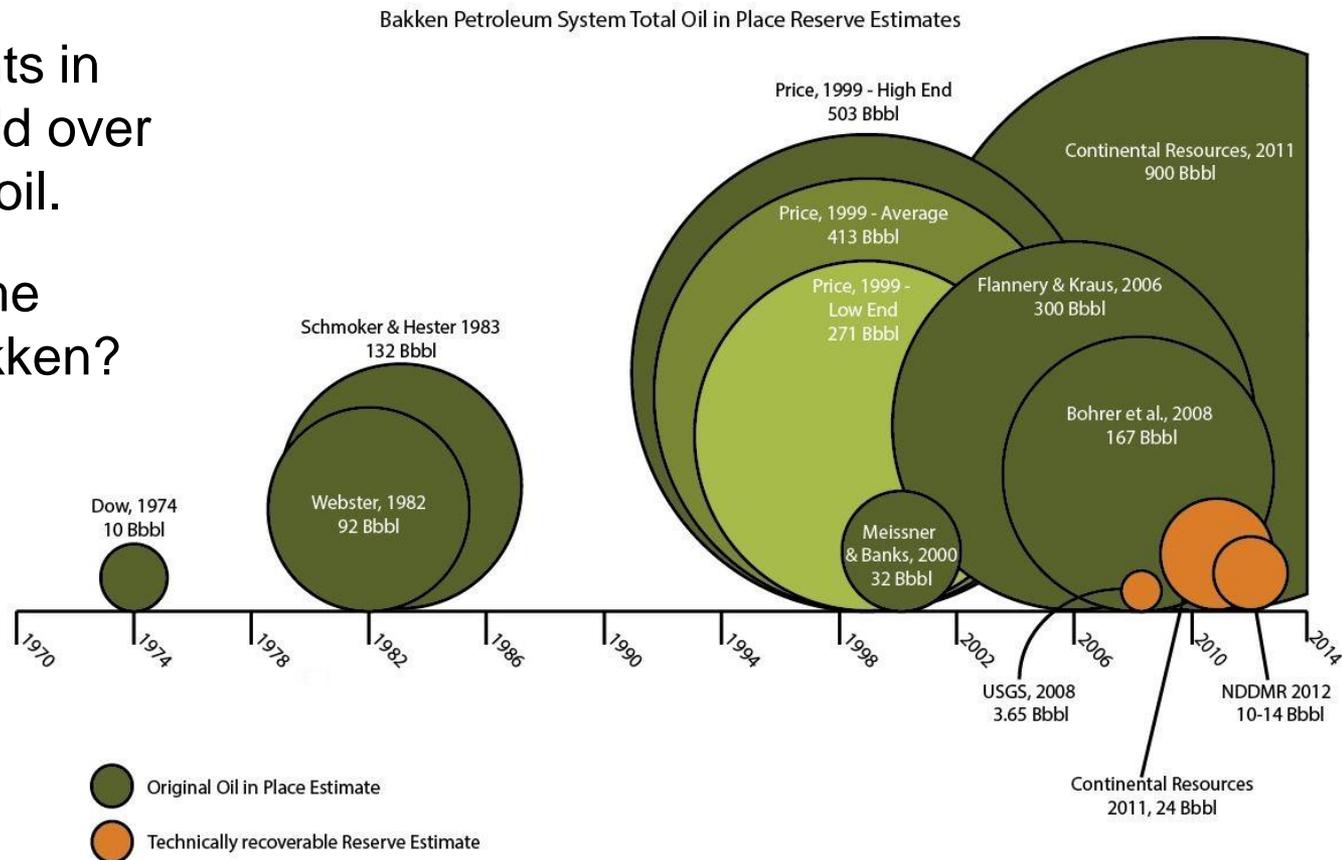
- Greatly increased understanding of Bakken–Three Forks reservoirs.
- Public education and outreach.

ENVIRONMENTAL

- Decreased environmental impacts of wellsite operations.
- Less truck traffic, resulting in decreased diesel emissions, road dust, and spills.
- Reduced land use impacts.
- Reduced gas flaring.
- Evaluation of technologies to recycle wastewater and decrease freshwater demand.

HOW MUCH BIGGER CAN THE BAKKEN GET?

- Currently, only a 3%–10% recovery factor.
- Small improvements in recovery could yield over a billion barrels of oil.
- Can CO₂ be a game changer in the Bakken?



EERC BAKKEN CO₂ STORAGE AND EOR RESEARCH PROGRAM

Laboratory work to evaluate:

- Rock matrix.
- Nature of fractures.
- Effects of CO₂ on oil.
- Ability of CO₂ to remove oil from rock.

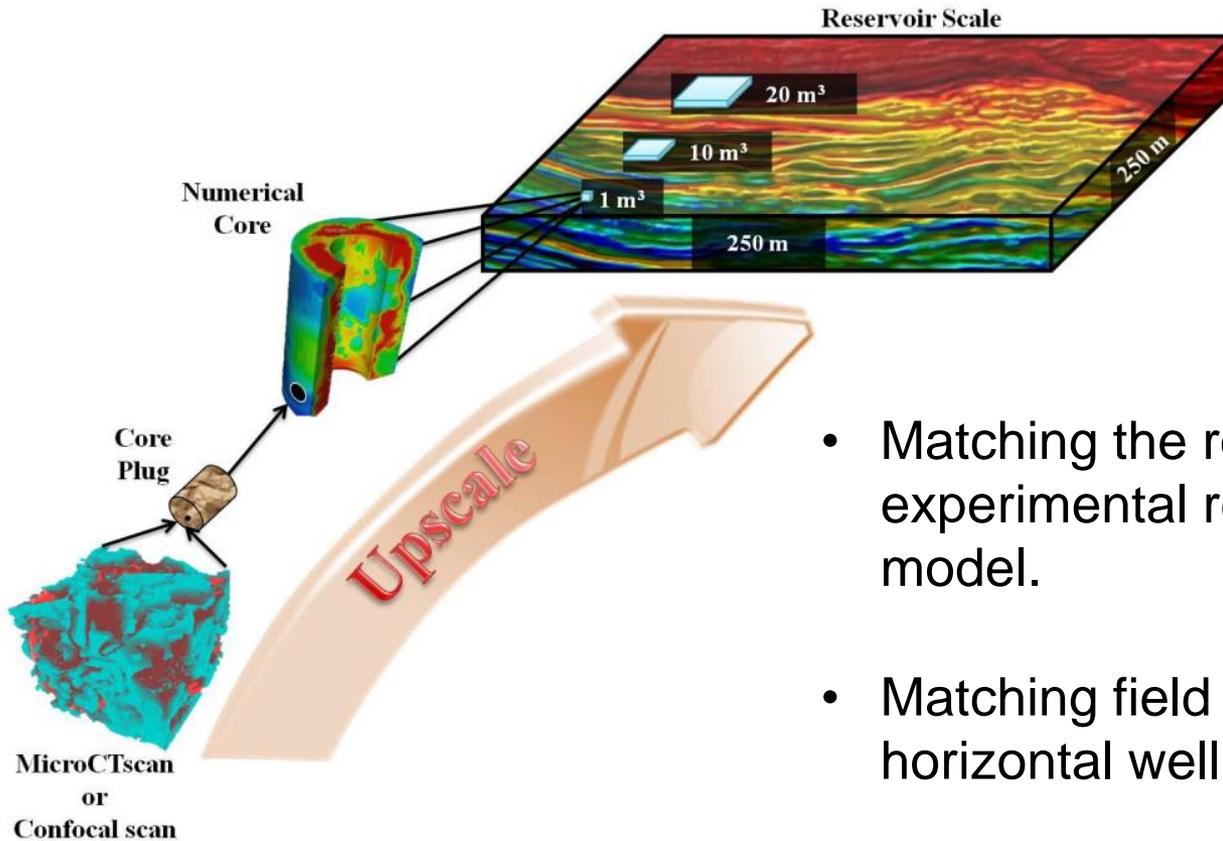
Static and dynamic modeling.

Evaluation of data from pilot field injection tests.



Ultimate goal is to apply lessons learned from experiments and modeling to a pilot-scale injection test in at least one well.

MODELING EFFORTS



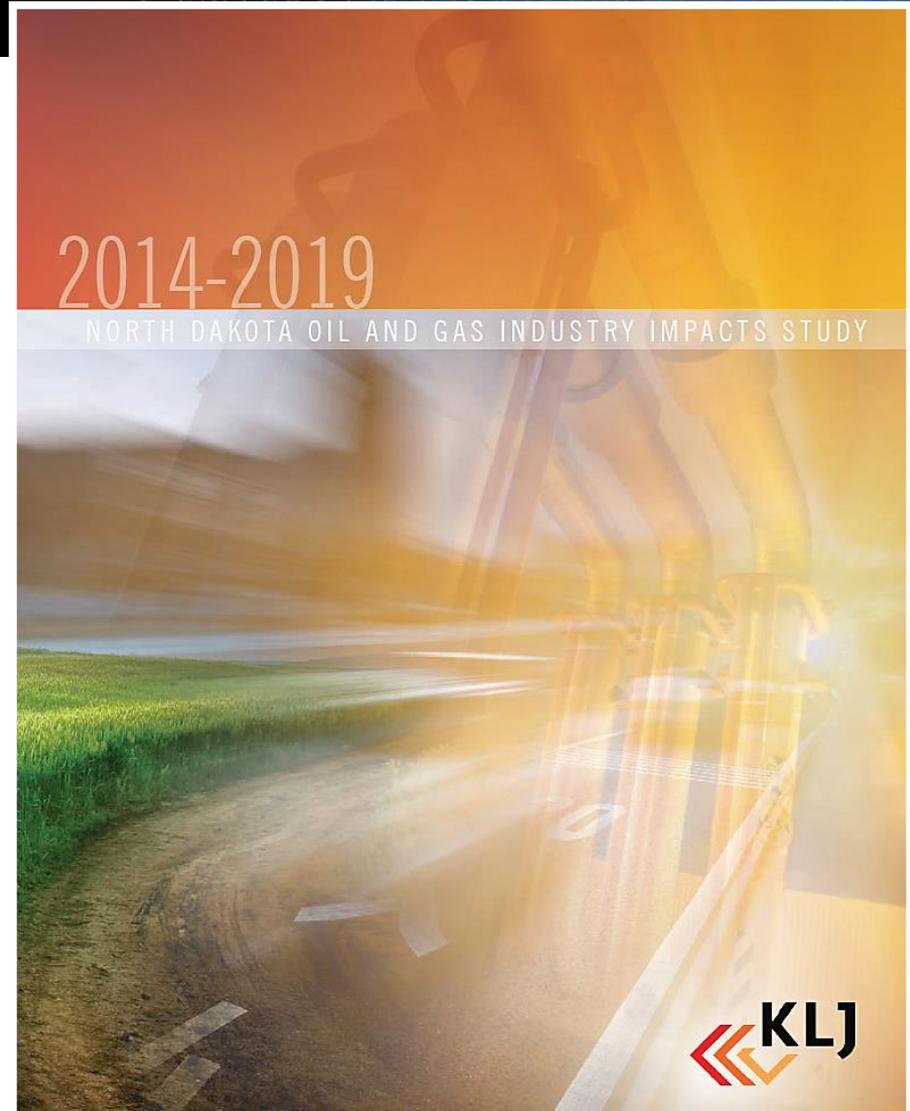
The goal is to close the gaps between modeling and reality in the field.

- Matching the rock extraction experimental results to a small-scale model.
- Matching field production data to a single horizontal well model.
- **New algorithms for phase behavior in tight, organic-rich rocks.**

Hurley et. al. 2012

OIL AND GAS INDUSTRY IMPACTS STUDY

- As part of the North Dakota Oil and Gas Industry Impacts Study, the EERC conducted an evaluation of the near-term potential for future oil production from CO₂ enhanced oil recovery (EOR) operations in the conventional oil fields of North Dakota.



PIPELINE STUDY

- 23 recommendations made to NDIC and EDTC ... many now evident in new proposed DMR rule making, currently open to public comment.
- Pilot demonstrations will provide information on the performance of those technologies with greatest potential to lessen the severity of *future* spills and leaks.

