

August 15, 2025

Mr. Jordan Kannianen
Deputy Executive Director
North Dakota Industrial Commission
ATTN: Oil and Gas Research Program
State Capitol – 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Dear Mr. Kannianen:

Subject: Chord Energy Proposal Entitled “Large-Scale Hydrocarbon Gas Injection EOR Pilot to Inform Future CO₂ EOR in the Bakken” in Response to the North Dakota Industrial Commission (NDIC) Oil and Gas Research Program (OGRP) Enhanced Oil Recovery Grant Program

Chord Energy is pleased to submit the subject proposal to the Oil and Gas Research Program. The \$100 application fee is provided through ACH transaction number 8980400226JO. Chord Energy is committed to helping the state improve oil recoveries through EOR and other techniques.

If you have any questions, please contact me by telephone at (281) 404-9500 or by email at arvo.buck@chordenergy.com.

Sincerely,

A handwritten signature in black ink, appearing to read 'A. Buck', with a stylized flourish at the end.

Arvo Buck
Director of New Ventures

AB

Attachments

c/att: Erin Stieg, NDIC OGRP

Oil and Gas Research
Program:
Enhanced Oil Recovery
Grant Program
North Dakota

Industrial Commission

Application

Project Title: Large-Scale Hydrocarbon Gas
Injection EOR Pilot to Inform Future CO₂ EOR in
the Bakken

Applicant: Chord Energy

Principal Investigator: Arvo Buck

Date of Application: August 15, 2025

Amount of Request: \$13,998,200

Total Amount of Proposed Project:
\$38,632,967

Duration of Project: 24 months

Point of Contact (POC): Arvo Buck

POC Telephone: (281) 404-9500

POC E-Mail Address:
arvo.buck@chordenergy.com

POC Address: 1001 Fannin St., Suite 1500
Houston, TX 77002

TABLE OF CONTENTS

Abstract	4
Project Description	5
Standards of Success	11
Background/Qualifications	11
Management	12
Timetable	12
Budget	14
Confidential Information and Patents/Rights to Technical Data	14
Status of Ongoing Projects	14
EERC Letter of Support	Appendix A
Resumes of Key Personnel	Appendix B
Budget Justification	Appendix C

ABSTRACT

Objective: The “Bakken CO₂ EOR and Storage Field Laboratory” (BCO₂EORFL) was established in September 2024, to conduct lab, modeling, and field-based activities to show that CO₂ injected into a Bakken reservoir will result in incremental oil recovery. The center piece of the original BCO₂EORFL work plan is an 18-month CO₂ injection pilot for EOR. This pilot is the first to comprehensively address all technical and operational challenges that limited previous pilots full potential. The objective of this proposal is to provide additional resources that will enable Chord Energy to fully achieve the BCO₂EORFL goal of demonstrating commercial viability of Bakken EOR. This EOR pilot is the fastest and surest path to economic EOR success for North Dakota and its O&G Operators. Unfortunately, to achieve the pilot’s ambitions, Chord had to adjust from a CO₂ injection plan to a mostly a hydrocarbon based injectable solution due to lack of available CO₂ supply. Hydrocarbon injectant and CO₂ are similar enough for EOR to allow for the results from a hydrocarbon-based EOR pilot to be calibrated to predict the effects of CO₂ under the same reservoir conditions. This indicates that the results of an EOR pilot that uses hydrocarbons can be directly applied to predicting the results of future EOR operations that use CO₂. In addition to higher injectable fluid costs, base costs for the project have fundamentally exceeded original expectations. This is largely due to refining/changing scope now that a drilling spacing unit (DSU) has been chosen. Chord is currently working through understanding surface processes and necessary surface facilities to successfully execute this EOR pilot. **Expected Results:** Execution of the pilot test activities will help demonstrate a pathway towards commercial-scale deployment of Bakken EOR for hydrocarbon and CO₂ injectates. **Duration:** 24 months (January 1, 2026 – December 31, 2027). **Total Cost:** The total value of the project is \$38,632,967. The OGRP request is for \$13,998,200. Chord Energy will provide cost-share commitments. **Participants:** Chord Energy and EERC.

PROJECT DESCRIPTION

The passing of Senate Bill 2014 by North Dakota's 69th Legislative Assembly establishes an EOR grant program and appropriates funds to the North Dakota Industrial Commission Oil and Gas Research Program (NDIC OGRP) for projects that demonstrate approaches for commercially viable improved oil recovery that can be deployed throughout the Bakken play, as well as the state's wide variety of conventional reservoirs. In September 2024, with primary funding from an award of \$11,600,000 by the U.S. Department of Energy (DOE), the "Bakken CO₂ EOR and Storage Field Laboratory" (BCO₂EORFL) was established by Chord Energy and the Energy & Environmental Research Center (EERC). The purpose of the BCO₂EORFL is to conduct laboratory, modeling, and long-term, large-scale injection activities to investigate the concept that CO₂ injected into a Bakken reservoir will result in incremental oil recovery. The centerpiece of the original BCO₂EORFL scope of work is an 18-month CO₂ injection program for EOR. However, due to difficulties with cost-competitive CO₂ sourcing at the required scale, Chord intends to pivot from a CO₂-based injectate to a hydrocarbon gas-dominated injectate, which past studies indicate will provide a similar EOR response as CO₂. It is anticipated that the hydrocarbon gas stream used for the pilot will include a minor concentration of CO₂, which will satisfy the contractual obligation to DOE to evaluate the potential effects of CO₂ injection on a Bakken reservoir. Past laboratory testing and modeling exercises indicate that the results of a hydrocarbon-based EOR pilot can be calibrated to inform the successful design and operation of future commercial-scale CO₂-based EOR operations. The EOR pilot will be located in the Indian Butte Area of the Bakken, McKenzie County, North Dakota. The proposed project intends to use pairs of wells for injection, oil production, and reservoir surveillance throughout the project. Additional offset wells will be monitored for production responses after injection commences. The two HnP wells along with the other four wells on the DSU pad are currently drilled and will be completed and put in production prior to the injection project commencing.

A multiwell cyclic gas injection (also referred to as huff 'n' puff [HnP]) design will be employed to perform the EOR pilot test. Hydrocarbon gas will be injected into the reservoir through the two wells, alternating in each HnP cycle: when one well is in injection stage, the other will be in soaking and/or production stage and vice versa. Currently 18 months of injection are planned over a 20-month field test period with a currently planned hydrocarbon gas injection volume of 6,566 MMscf. Initial simulation results indicated that high-pressure HnP through hydrocarbon gas injection could yield 30% more oil than pressure depletion over three years of operation, provided consistent, sufficient gas volume is available. Unconventional EOR analogues from other basins show incremental recoveries of 30 -70% over primary. This is the first EOR pilot in the Bakken that will comprehensively address these operational and technical challenges. Success will have tremendous effect on the economic trajectory of the Bakken and North Dakota supplementing primary production and decreasing drilling inventory in the basin.

The current funding profile for the original BCO₂EORFL budget over the course of a four-year period of performance includes contracted funding from the U.S. DOE (\$11,600,000, of which \$6,750,000 is budgeted to go to Chord), NDIC OGRP funding through the EERC's Bakken Production Optimization Program (\$2,000,000 over four years which is budgeted to pay for EERC activities), and in-kind contributions from Chord (minimum of \$900,000).

In this proposal, Chord Energy and EERC are seeking incremental funding through the NDIC-OGRP Enhanced Oil Recovery Grant Program¹ to incorporate the use of hydrocarbon-based fluids as a primary component of the injectate stream to make up the shortfall in cost-competitive pure CO₂ availability. These funds would be used to offset costs associated with the planning and operational activities of the pilot using a hydrocarbon injectate stream. Specific components of the incremental activities will include

¹ The ND legislature appropriated an additional \$25 million to the NDIC-OGRP specifically for the purpose of advancing EOR (SB 2014).

adapting surface infrastructure to manage the hydrocarbon injectate, and modifying the modeling and simulation, scheme design, operational planning, permitting, and reservoir surveillance activities. A portion of the incremental NDIC-OGRP EOR Grant funding will be used by Chord to purchase equipment and supplies, including the injectate, necessary for the successful execution of the pilot.

Objectives: Complete the necessary modifications to the originally planned EOR modeling and simulations, injection scheme design, operational planning, permitting, and reservoir surveillance to successfully transition from a purely CO₂ injectate stream to a hydrocarbon gas stream for a 20-month multiwell, multicycle EOR pilot as part of the BCO₂EORFL.

Methodology: Chord Energy will work with the EERC to complete the following tasks.

1.0 – Project Management and Reporting: In this task, Chord and EERC management will ensure all project activities stay within budget and on schedule and all project objectives are achieved. Chord and EERC staff will meet frequently as necessary throughout the duration of the project. Activities under this task will ensure all technical activities are coordinated effectively between Chord and EERC teams. This task will encompass the development of contractually required project reports to the NDIC as well as periodic project update meetings with members of the Oil and Gas Research Council.

2.0 – Modeling, Simulation, and Design of Hydrocarbon Gas Injection and Production Schemes:

This task includes performing iterative reservoir simulations using industry standard software to support designing optimum hydrocarbon-based injection and production schemes for the pilot DSU. Production history matching and predictive simulations will be conducted throughout the duration of the project to aid in interpretation of EOR pilot performance and guide pilot operation. Activities under this task will support the design and operational planning for the EOR injection and production cycle scheme, as well as engineering support for near-real-time operational performance evaluation and troubleshooting during the execution of the pilot project.

3.0 – Reservoir Surveillance and Evaluation: This task includes the development and implementation of a reservoir surveillance scheme that will gather data necessary to evaluate the response of the Bakken reservoir to hydrocarbon gas injection operations. This task will include the assessment, selection, and installation of reservoir surveillance equipment (i.e. downhole gauges, surface gauges, flowback fluid sampling and analysis) as well as the interpretation of the collected data. Data collected through this task will be incorporated into the iterative reservoir simulations that will be performed through Task 2.0.

4.0 – Surface Facility Planning and Design, Injectate Procurement, and Permitting: Surface infrastructure needs will be evaluated to ensure compatibility to manage the hydrocarbon injectate and anticipated fluid flowback operations during production. Additional surface equipment and surface equipment installation services will be purchased by Chord Energy with project funds. Specific examples of surface equipment include high pressure production separators, automated well manifolds, and compressor installation. Additionally, project funds from this task will be utilized to cover the incremental cost of purchasing hydrocarbon-gas injectate as opposed to CO₂. During the original BCO₂EORFL proposal process the price for CO₂ was assumed to be \$1.50/Mcf (based on publicly available CO₂ price estimates in literature). After the BCO₂EORFL was selected by DOE for award, Chord began the process of seeking to contract a source of CO₂ to supply the planned pilot injection. During that process it became clear that cost-competitive CO₂ in the volumes necessary for a successful pilot were not going to be available in the necessary timeframe. The cost of hydrocarbon gas in quantities necessary to conduct the pilot is \$2.00/Mcf. The incremental cost to purchase the necessary volume of hydrocarbon gas is estimated to be \$3,283,200.

The necessary permits will be developed and submitted to the North Dakota Department of Mineral Resources (DMR) to conduct the EOR pilot. Additionally, this task will include the development and submission of any sundry notices to the DMR that may be associated with the pilot.

Anticipated Results: The data generated from this project and the associated infrastructure changes will allow for the design and execution of a hydrocarbon gas HnP pilot, supporting the successful execution of a long term, large scale Bakken EOR pilot despite the shortfall that exists in available CO₂. Past studies have indicated that injecting hydrocarbon gas will provide a similar EOR response as CO₂ which will enable the results from this pilot to inform the successful design and operation of future commercial-scale CO₂-based and hydrocarbon-based EOR operations in the Bakken.

Facilities, Resources, and Techniques to Be Used and Their Availability and Capability: Chord Energy is the largest Williston Basin operator with approximately 1.3 million net acres in the Bakken Play that currently produces over 250,000 bbl/day gross from over 4500 wells. Chord has a large team of highly trained, qualified, and experienced engineers, geoscientists, and technical field support staff who will be available to work on the project. The design and conduct of all field-based operations will use industry-standard best practices with respect to environmental, safety, and health protocols and performance. All equipment will be procured, installed, and operated according to industry standards and best practices.

The EERC employs a multidisciplinary staff of about 300 and has 254,000 square feet of state-of-the-art offices, laboratories, and technology demonstration facilities, which enable staff to address a wide variety of research topics. The EERC has decades of Bakken-focused geologic modeling, reservoir simulation, EOR facilities design, reservoir surveillance, and data analytics experience.

Environmental and Economic Impacts while the Project is Underway: Environmental impacts will be minimal during the execution of this project. Field-based activities will be conducted on an existing industrial site (well pad with surface facilities). Economic impacts during the project will also be minimal and will not appreciably affect any of the organizations participating apart from regular employment economic effects for those working on the project.

Technological and Future Development Impacts: This project could ultimately increase oil and gas industry operations in North Dakota by increasing estimated ultimate recovery for Bakken DSUs.

Successful EOR operations would extend the lifetime of the Bakken play by multiple decades and could yield billions of barrels of incremental oil and natural gas, which would translate into billions of dollars of economic impact to North Dakota.

Why the Project Is Needed: This project is needed to facilitate the successful adaptation of hydrocarbon-based fluids as the primary injectant in the Bakken CO₂ EORSFL pilot test. This will allow for Chord to leverage the \$10.6 million of DOE funding provided through the Bakken CO₂ EORSFL despite the shortfall that exists in available CO₂. Simulations show that high-pressure HnP through hydrocarbon gas injection could yield +30% more incremental EUR than pressure depletion over several years of operation, provided consistent, sufficient gas volume is available. Unconventional EOR analogues from other basins show incremental recoveries of 30 -70% over primary. Independent studies conducted by the EERC (Sorensen et al., 2015) and Advanced Resources International (Kuuskraa et al., 2020) indicate that estimated ultimate recovery from EOR in the Bakken ranges from 3.2 to 7 billion barrels of incremental oil. Current supplies of hydrocarbon-based injectates (natural gas, rich gas, and natural gas liquids), which are projected by the North Dakota Pipeline Authority (DMR Director's Cut, March 2025) and the U.S. Energy Information Administration (eia.gov, accessed August 1, 2025) to grow over the coming years, could support EOR operations at hundreds of Bakken DSUs. Federal legislation has increased the value of 45Q tax credits for qualifying EOR projects to \$85/tonne of CO₂ stored, which is on par with the value of 45Q tax credits for CO₂ storage in deep saline aquifers. This development is expected to incentivize the capture and availability of CO₂ for use in EOR projects. A combination of currently operating and announced CO₂ capture projects in the region indicate there is the potential to supply over 100 DSUs. The fact that this project is specifically designed to yield results that are applicable to both hydrocarbon gas and CO₂-based EOR means it could provide a path toward

commercial EOR at several hundred DSUs across the Bakken within the decade. Successful EOR pilot projects are crucial for unlocking additional resources in the Bakken of North Dakota, and this is the first EOR pilot in the Bakken that will comprehensively address the operational and technical challenges from prior pilots. Success will have tremendous effect on the economic trajectory of the Bakken and North Dakota supplementing primary production and decreasing drilling inventory in the basin.

STANDARDS OF SUCCESS

Success will be measured in this project's ability to generate key data and insights that will influence the design, planning, and execution of future commercial-scale EOR projects in the Bakken. This project will take essential steps on the path to unlocking the vast potential of EOR in the Bakken and to ensure the continued success of the oil and gas industry in North Dakota. A strong oil and gas industry contributes to a robust state economy, which includes the creation and continuation of jobs that support or are positively impacted by oil and gas development in the state. As a measure of success, the current NDIC OGRP-approved process of reporting will be employed to deliver results. High-level progress updates will be provided in semiannual reports to OGRP for inclusion on the OGRP website for immediate access by the public. A final report summarizing project outcomes will be prepared and delivered to OGRP at the end of the project.

BACKGROUND/QUALIFICATIONS

Chord Energy is the largest Williston Basin operator with approximately 1.3 million net acres in the Bakken play that currently produce over 250,000 bbl/day gross from over 4500 wells. Chord has a large team of highly trained, qualified, and experienced engineers, geoscientists, and technical field support staff who will be available to work on the project. Mr. Arvo Buck, Director New Ventures for Chord Energy, will serve as the project manager. Mr. Buck has over 18 years of oilfield industry experience. Mr. Victor Barcot, Vice President, New Ventures for Chord Energy, will serve as a senior project advisor. Mr. Barcot has over 20 years of advisory and M&A experience, exclusively within the Energy sector. The

EERC is a nonprofit branch of the University of North Dakota and has been intimately involved in the planning and execution of four previous Bakken pilot tests. Mr. James Sorensen, Director of Subsurface R&D, will serve as the leader of the EERC team. Dr. John Harju, Vice President for Strategic Partnerships, will serve as a senior project advisor. Both Mr. Sorensen and Dr. Harju have over 30 years of experience working with the oil and gas industry, with an emphasis on EOR over the last 20 years. Other key EERC personnel will include Mr. Mike Warmack, petroleum engineer, Mr. Darren Schmidt, petroleum engineer, and Dr. Lu Jin, reservoir engineer. Resumes of key personnel are provided in Appendix B.

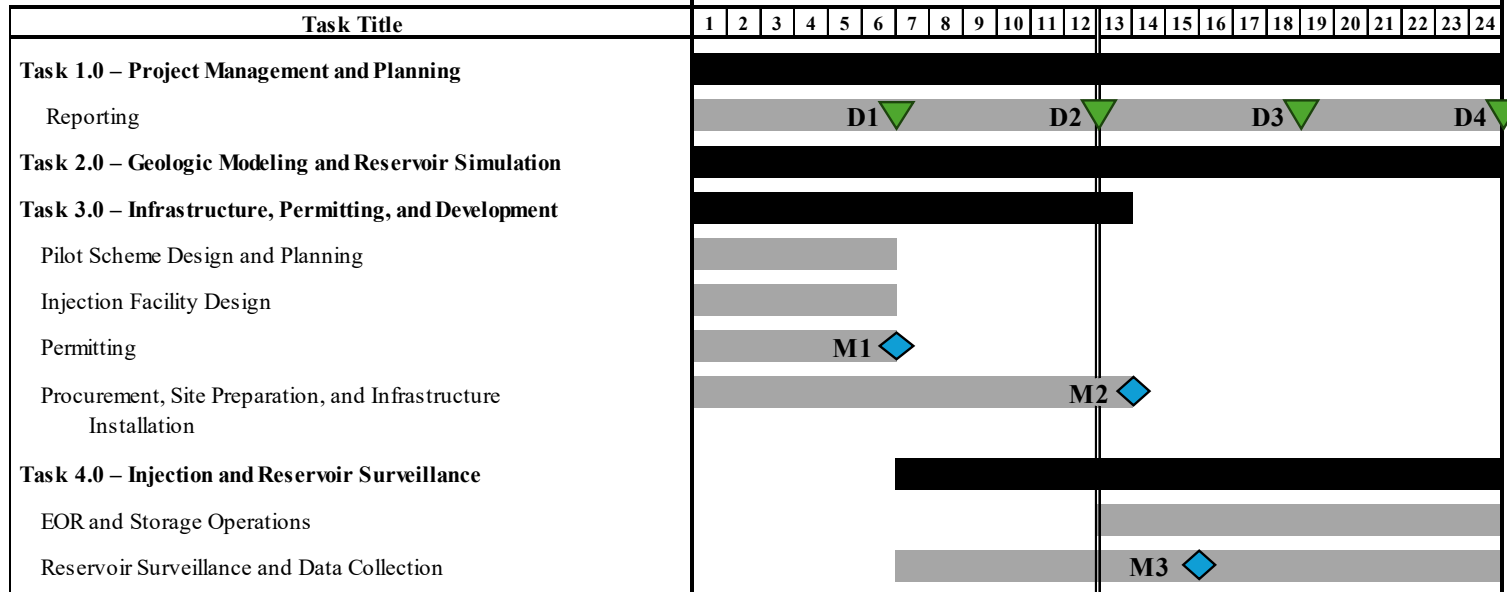
MANAGEMENT

Chord Energy manages approximately 1.3 million net acres in the Bakken play, operating over 4500 wells and associated infrastructure daily. Chord has a large team of highly trained, qualified, and experienced management and support staff who will be focused on project success. Systems are in place to ensure that projects are managed within budget, schedule, and scope. Mr. Buck will oversee the project, with assistance in management of EERC tasks by Mr. Sorensen and Mr. Schmidt. This will involve integration of tasks, project reporting, and collaboration between Chord and EERC personnel. Periodic reports will be submitted to NDIC in accordance with the program requirements.

TIMETABLE

A project term of 24 months is proposed, starting January 1, 2026. The preliminary project timetable is summarized below. Due to the nature of the planned operational period for the pilot being a minimum of 18 months, it is anticipated that the pilot operations will continue beyond June 30, 2027. However, assuming this proposal is selected for award and a contract is negotiated in a timely manner, Chord will make a good faith effort to ensure that any NDIC funding provided under the current OGRP EOR Grant Program will be spent prior to June 30, 2027. Results of the pilot up to that date will be included in the final report deliverable for this project.

**Large-Scale Hydrocarbon Gas Bakken EOR Pilot to Inform Future
CO₂ EOR**



Deliverables

D1 – Biannual Progress Report Submitted
D2 – Biannual Progress Report Submitted
D3 – Biannual Progress Report Submitted
D4 – Final Technical Report Submitted

Milestones

M1 – Injection Permit(s) Submitted to DMR
M2 – Surface Facilities Ready for Injection
M3 – Baseline Monitoring, Reporting, and Verification (MRV) Survey Completed

BUDGET

The total estimated cost for the proposed effort is \$38,500,000. After DOE funding, the remaining exposure to Chord is approximately \$24,600,000. \$13,998,200 is requested from OGRP. This request reflects the scope changes, cost increases, and risk sharing with the state on a project that has basin-wide potential. Cost-share commitments are provided by Chord Energy. The budget breakdown is provided in Table 1. The budget justification can be found in Appendix C.

Table 1. Budget Breakdown

Project-Associated Expense	Chord Share (In- Kind)	NDIC Share (Cash)	Total Project
Subcontractor (EERC)		\$1,510,000	\$1,510,000
Pipeline Costs	\$6,625,000		\$6,625,000
EOR Injectate Costs and Well Preparation			
Gas Injectate Cost	\$9,849,600	\$3,283,200	\$13,132,800
Well Work	\$ –	\$1,600,000	\$1,600,000
Facilities Preparation and Operation			
Power Usage	\$6,662,007	\$ –	\$6,662,007
Facility Installation (Compressor FEED and Install)	\$470,000	\$4,780,000	\$5,250,000
High Pressure Production Separator	\$100,000	\$150,000	\$250,000
Automated Well Manifold	\$ –	\$550,000	\$550,000
Supervisory Control and Data Acquisition (SCADA) System	\$ –	\$100,000	\$100,000
Line Heater	\$ –	\$400,000	\$400,000
Recycle Meter	\$ –	\$50,000	\$50,000
Dehydrator	\$ –	\$1,500,000	\$1,500,000
Power Upgrade	\$ –	\$75,000	\$75,000
Labor			
Technical Staff Labor	\$768,000	\$ –	\$768,000
Field Labor	\$160,160	\$ –	\$160,160
TOTAL:	\$24,634,767	\$13,998,200	\$38,632,967

CONFIDENTIAL INFORMATION AND PATENTS/RIGHTS TO TECHNICAL DATA

This proposal has no confidential information. No patentable technologies are expected to be created.

STATUS OF ONGOING PROJECTS

Chord Energy is actively engaged as a subcontractor to the EERC for the “Injection Testing with Propane to Inform Future Bakken CO₂ EOR Pilot” project (Contract No.: G-061-121).

APPENDIX A

EERC LETTER OF SUPPORT



August 14, 2025

Mr. Arvo Buck
Director, New Ventures
Chord Energy LLC
1001 Fannin St., Suite 1500 Houston, TX 77002

Dear Mr. Buck:

Subject: EERC Services Commitment to Chord Energy Submission to NDIC OGRP

EERC Services confirms its commitment to the team being assembled by Chord Energy (Chord) to demonstrate a Bakken enhanced oil recovery (EOR) pilot using multiwell cyclic gas injection (huff 'n' puff) with hydrocarbon-based fluids to address key technical and operational challenges within EOR. EERC Services is committed to participating as a subcontractor in Chord's proposal entitled "Large-Scale Hydrocarbon Gas Injection EOR Pilot to Inform Future CO₂ EOR in the Bakken" submitted to the North Dakota Industrial Commission (NDIC) Oil and Gas Research Program (OGRP).

EERC Services is committed to providing technical and operational support, which may include project management consultation, data analysis, reservoir characterization, laboratory measurements, numerical simulation, reservoir surveillance, surface facility design, and permitting guidance.

We welcome this opportunity to partner with Chord on this pilot and fully support its inclusion in the NDIC OGRP Enhanced Oil Recovery Grant Program. We understand that this letter is intended to be used as an attachment to the project's OGRP application. We are fully supportive of this intention and agree to be referenced in this context. We look forward to the opportunity to continue our collaborations with Chord on this exciting project in North Dakota. If you have any questions, please contact me by phone at (701) 777-5355 or by email at cgorecki@undeerc.org.

Sincerely,

DocuSigned by:
A blue ink signature of Charlie D. Gorecki.
29499751F2B84D7...

Charlie D. Gorecki
CEO and President

CDG/kal

APPENDIX B

RESUMES OF KEY PERSONNEL

ARVO BUCK, M B A

Cypress, TX 77433 • 432.413.7726
arvoqbuck@gmail.com • linkedin.com/in/arvobuck/

Executive Qualifications

- **Business-centric thought leader with multidisciplinary experience with a \$5B+ CCS group.** Noted for turning around underperforming organizations and energizing stagnant operations.
- **Ensured success of large-scale operations,** re-engineered business processes, tamed operational chaos, and advocated continuous improvement to save time, reduce costs, and enhance efficiencies.
- **Championed capital project design and management** with focus on balancing cost-effectiveness, technical excellence, and operational performance.
- **Inspirational mentor, capability builder, and leader.** Leadership approach is rooted in promoting a culture of ongoing improvement, inspiring teams to question the norm and initiate transformative change.

EXECUTIVE CAREER HISTORY & HIGHLIGHTS

Chord Energy – Houston, TX

December 2024 – Present

Chord Energy (Chord) is an independent energy company that acquires, develops, and explores for crude oil, natural gas, and natural gas liquids in the Williston Basin.

DIRECTOR, NEW VENTURES

Manage the sourcing, valuation, and strategy of early-stage investments with particular emphasis on Unconventional EOR

ExxonMobil – Plano, TX

August 2023 – December 2024

ExxonMobil, on July 13, 2023, confirmed its takeover of Denbury Inc., a leading player in carbon capture, utilization, and storage solutions and enhanced oil recovery. The all-stock deal was valued at \$4.9B.

LEAD INTEGRATION EXECUTIVE

Team: 23 Workstreams Representing the Whole Company | Pre/Post-Acquisition Business Integration

Recruited to stay past the acquisition to integrate people, processes, operations, and systems. Ensured the integration aligned with ExxonMobil's commitment to low-carbon solutions. Made the most of Denbury's CO2 transportation and storage business and enhanced oil recovery operations and CO2 pipeline network to boost ExxonMobil's low-carbon solutions business. Ensured seamless integration process' and presented at town halls with delivery of company-wide updates.

- **Optimized value capture through integration,** identified and realized synergies, and facilitated blending of the 2 companies' cultures, ensuring a seamless transition for all employees.
- **Architected comprehensive integration plans,** encapsulating all workstreams, a communications strategy, and the synergy benefits of ExxonMobil's acquisition of Denbury.
- **Established and managed ExxonMobil/Denbury integration processes,** including functional work plan reviews, cross-functional collaboration, issue management, and executive status updates.

Denbury Resources – Plano, TX

September 2011 – August 2023

A leading energy firm with revenues exceeding \$500MM annually and employing around 1K individuals.

VICE PRESIDENT, BUSINESS SERVICES (November 2019 – August 2023)

Team: 4 Direct & 150+ Total | \$250MM+ OPEX | Digital Transformation | Process Automation | Technology Roadmap Planning

Elevated with an executive charter to overhaul organization, driving stringent cost controls and injecting accountability across departments. Scoured processes, eradicating inefficiencies, and launched comprehensive turnaround strategies to rectify underperformance. Reconstructed the supply chain organization, enabling substantial revenue growth within 2 years. Reclaimed millions in operational spending, previously left unmanaged in the field. Structured digitized, modern organizations that would raise enterprise value. Created digital transformation strategies, multiyear roadmap, and governance for business alignment. Worked with audit/KPMG/PWC to satisfy all annual SOX IT audit requirements.

- **Innovation and Digitization of Denbury**
 - Introduced mobile solutions such as Field Data Gather (FDG) and SAP Asset Manager (SAM). Integrated Cygnet/SAP for automation, work orders, notifications, and measurements
 - Implemented OpenText to capture, store, and track the life cycle of Denbury's electronic records
 - Merged traditional SCADA with scalable IIOT devices, resulting in a cost reduction from \$30M to \$4M per well.

- **Bolstered the organization's defenses by implementing comprehensive cybersecurity measures.** Built a specialized cybersecurity team while enhancing framework compliance and threat management strategy.
 - Improved the organization's cybersecurity posture by consolidating cybersecurity strategy and deploying the National Institute of Standards and Technology (NIST) controls framework.
- **Slashed 2022 budget actuals by 9% compared to 2021** by implementing a zero-based budgeting process (\$31MM+), resulting in key costs being efficiently managed at the vendor level after reviewing over 140 vendors.
- **Built consensus** over deployment of a standard SAP supply chain cycle, a new category team structure, and procurement workflow. Used SAP data to manage supplier performance for delivery, price, and quality.
 - Achieved a 12% cost reduction, saving \$36MM on materials in 2020–2021, surpassing KPIs.
 - Streamlined field operations with a 20% resource cut via PO volume and sourcing optimization.
- **Drove support for dozens of capital projects (\$380MM)** via sourcing and execution of commercial terms.

ASSET MANAGER (December 2012 – November 2019)

Team: 12–15 Direct & 60+ Total | Enhanced Oil Recovery Assets (20M+ Barrels of Oil Per Day, \$80MM Annual Capital Budget)

Brought on board to manage assets in regions with aging resources, extracting maximum value while reducing risk profiles. Demonstrated expertise in bridging the gap between high-level corporate strategy and daily operational tasks. Orchestrated coordination across all groups to align goals, optimize resources, and maximize NPV of assets.

- **Conducted thorough reviews of reservoir management** across all company assets, delivering insightful reports to executives and the board of directors on a monthly basis, leading to improved decision-making efficiency.
- **Development Highlights**
 - Tinsley North Fault Block (3280 BOPD - PV10 - \$62MM), Brookhaven Phase 8 (1230 BOPD - PV10 - \$26MM), Cranfield Phase 8 (860 BOPD - PV10 - \$8MM)
 - Delhi field unit Tuscaloosa infill drilling program (\$15M) took field production from 4800 to 6300 BOPD
 - Through a program of recompletions (\$3.7 MM) increased Delhi field unit from 6300 BOPD to 8000+ BOPD
- **A&D Technical Lead** for Penn Virginia Acquisition (\$1.7B, 2019), Project Bass 1.0/2.0 Divestiture (\$300MM, 2018), Project Coyote Acquisition (\$2B, 2016) and others
- **Concept-to-execution leadership of corporate CO2 technical initiatives** including late life strategies, blowdown, and CCUS resulting in significantly increased NPV.
- **Elevated technical excellence** through comprehensive peer reviews and training sessions, imparting knowledge on reservoir engineering, capital planning, reserves, and more to budding engineers.

EARLY CAREER HISTORY

RESERVOIR ENGINEER, Gulf Coast Assets • Denbury Resources – Plano, TX

RESERVOIR ENGINEER, SACROC Field Unit • Kinder Morgan – Midland, TX

PRODUCTION ENGINEER, Yates Field Unit • Kinder Morgan – Iraan, TX

EDUCATIONAL QUALIFICATIONS & CERTIFICATIONS

MASTER OF BUSINESS ADMINISTRATION (MBA) - EXECUTIVE • Southern Methodist University – Dallas, TX 2016

BACHELOR OF SCIENCE (BS) IN PETROLEUM ENGINEERING • Texas Tech University – Lubbock, TX 2006

- Phi Epsilon Tau Petroleum Engineering Honor Society Member

- **NACD Cyber-Risk Certified**, 2023
- **Harvard Corporate Director Certified**, 2023

KEVIN A. KELLY
Vice President for Sustainability
Chord Energy Corporation
1001 Fannin Street, Suite 1500, Houston, Texas 77002 USA
281.404.9500, kevin.kelly@chordenergy.com

Principal Areas of Expertise

Mr. Kelly has more than 25 years of experience in the oil and gas industry. Prior to the merger between Whiting Petroleum and Oasis Petroleum to create Chord Energy, Mr. Kelly served as Vice President, Business Development and ESG between August 2020 to June 2022 for Whiting Petroleum. Mr. Kelly joined Whiting in November 2018 as Vice President, Marketing and Midstream. Prior to joining Whiting Petroleum, Mr. Kelly spent 20 years with Anadarko Petroleum Corporation in various roles including internal audit, acquisitions and divestitures, international business development and strategy, LNG marketing, fundamental commodity analysis, and gas and NGL marketing.

Education and Training

M.B.A., Oklahoma State University.
Bachelor of Science, Oklahoma State University.

Research and Professional Experience

July 2022–Present: Vice President for Sustainability, Chord Energy Corporation.

August 2020–June 2022: Vice President, Business Development and ESG, Chord Energy Corporation.

November 2018–July 2020: Vice President, Marketing and Midstream, Chord Energy Corporation.

2015–October 2018: General Manager for Gas & NGL Marketing and Vice President of Anadarko Energy Services Corporation.

June 1998–2015: Various positions of increasing responsibility with Anadarko Petroleum Corporation, including internal audit, acquisitions and divestitures, international business development and strategy, LNG marketing, fundamental commodity analysis, and gas and NGL marketing.

VICTOR BARCOT

Vice President, New Ventures

Chord Energy Corporation

1001 Fannin Street, Suite 1500, Houston, Texas 77002 USA

281.404.9500, victor.barcot@chordenergy.com

Principal Areas of Expertise

Mr. Barcot has 20+ years of advisory and M&A experience, exclusively within the Energy sector, having advised major U.S. companies, public and private independents, and National Oil Companies (NOCs) on a range of regional and cross-border M&A and capital markets transactions. He most recently served as Managing Director, Global Oil & Gas Group for Mizuho Financial Group.

Mr. Barcot also was the Founding Partner of Exxel Energy Group, an independent E&P firm focused on the U.S. Rocky Mountains, and the Founder and CEO of Archer Petroleum, with operations in Western Canada and Permian Basin.

Education and Training

M.B.A., University of Houston

Bachelor of Business Administration, University of Houston.

Research and Professional Experience

Vice President, New Ventures, Chord Energy Corporation.

Mr. Barcot joined Mizuho Financial Group in 2019 and led the company's global energy transition initiative and managed the bank's 50+ billion energy portfolio across several energy verticals, including: Upstream, Midstream, Renewables, LNG, and Green Hydrogen/Ammonia.

He began his investment banking career at Credit Suisse First Boston in 1997. Mr. Barcot served as a key member of Deutsche Bank's Global Oil & Gas Group, where he was a Managing Director focused on providing capital markets and M&A advisory services for public and private clients worldwide. Prior to Deutsche Bank, he was a Managing Director in HSBC's Resources and Energy Group, working with E&P clients in the U.S., Canada, and Latin America.



JAMES A. SORENSEN

Director of Subsurface Research and Development
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5287, jsorensen@undeerc.org

Education and Training

M.Eng., Petroleum Engineering, University of North Dakota, 2020.
B.S., Geology, University of North Dakota, 1991.

Research and Professional Experience

October 2019–Present: Director of Subsurface Research and Development, EERC, UND.
Responsible for developing and managing programs and projects focused on conventional, unconventional, and enhanced oil and gas production; the geological storage of CO₂; and other energy and environmental research.
Primary areas of interest and expertise are enhanced oil recovery (EOR) in unconventional tight oil formations, CO₂ utilization and storage in geologic formations, and tight oil resource assessment and development.

July 2018–September 2019: Assistant Director for Subsurface Strategies, EERC, UND.
Developed business opportunities, provided technical support and guidance regarding emerging areas of research, and served as a principal investigator (PI) and task manager for projects related to the sequestration of CO₂ in geologic media and the sustainable development of tight oil resources.

1999–July 2018: Principal Geologist, EERC, UND.
Served as manager and co-PI for programs to develop strategies for CO₂ utilization and storage.
Led research focused on EOR in the Bakken.

1997–1999: Program Manager, EERC, UND.
Managed projects focused on produced water management and environmental fate of natural gas-processing chemicals.

1993–1997: Geologist, EERC, UND.
Conducted field-based hydrogeologic investigations focused on natural gas production sites.

1991–1993: Research Specialist, EERC, UND.
Assembled and maintained comprehensive databases related to oil and gas drilling, production, and waste management.

Professional Activities

Member, Society of Petroleum Engineers

Publications

Has coauthored nearly 200 publications.



DR. JOHN A. HARJU

Vice President for Strategic Partnerships

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

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701.777.5157, jharju@undeerc.org

Education and Training

Ph.D., Petroleum Engineering, University of North Dakota, 2022.

M.Eng., Petroleum Engineering, University of North Dakota, 2020.

B.S., Geology, University of North Dakota, 1986.

Research and Professional Experience

2002–Present: EERC, UND.

July 2015–Present: Vice President for Strategic Partnerships.

- Leads efforts to build and grow dynamic working relationships with industry, government, and research entities globally in support of the EERC's mission to provide practical, pioneering solutions to the world's energy and environmental challenges.
- Represents the EERC regionally, nationally, and internationally in advancing its core research priorities: coal utilization and emissions, carbon management, oil and gas, alternative fuels and renewable energy, and energy–water.

Principal areas of interest and expertise include carbon sequestration, enhanced oil recovery, unconventional oil and gas development, waste management, geochemistry, technology development, hydrology, and analytical chemistry, especially as applied to the upstream oil and gas industry.

2003–June 2015: Associate Director for Research.

- Led a team of scientists and engineers building industry–government–academic partnerships to carry out research, development, demonstration, and commercialization of energy and environmental technologies.

2002–2003: Senior Research Advisor.

- Developed, marketed, managed, and disseminated research programs focused on the environmental and health effects of power and natural resource production, contaminant cleanup, water management, and analytical techniques.

2017–Present: Adjunct Lecturer, Department of Petroleum Engineering, UND.

1999–2002: Founder/Vice President, Crystal Solutions, LLC, Laramie, Wyoming.

- Firm was involved in commercial E&P produced water management, regulatory permitting and compliance, and environmental impact monitoring and analysis.

1997–2002: Gas Research Institute (GRI) (now Gas Technology Institute [GTI]), Chicago, Illinois.

2000–2002: Principal Scientist, Produced Water Management.

- Developed and deployed produced water management technologies and methodologies for cost-effective and environmentally responsible management of oil and gas produced water.

1998–2000: Program Team Leader, Soil, Water, and Waste.

- Managed projects and programs related to the development of environmental technologies and informational products related to the North American oil and gas industry.
- Formulated RFPs, reviewed proposals, and formulated contracts.
- Performed technology transfer activities.
- Supervised staff and contractors.
- Served as Manager of the Environmentally Acceptable Endpoints project, a multiyear program focused on rigorous determination of appropriate cleanup levels for hydrocarbons and other energy-derived contaminants in soils.
- Led GRI/GTI involvement with industry environmental consortia and organizations, such as PERF, SPE, AGA, IPEC, and API.

1997–1998: Principal Technology Manager (1997–1998) and Associate Technology Manager (1997), Soil and Water Quality.

1988–1996: EERC, UND.

1994–1996: Senior Research Manager, Oil and Gas Group. Served as:

- Program Manager for assessment of the environmental transport and fate of oil- and gas-derived contaminants, focused on mercury and sweetening and dehydration processes.
- Project Manager for field demonstration of innovative produced water treatment technology using freeze crystallization and evaporation at oil and gas industry site.
- Program Manager for environmental transport and fate assessment of MEA and its degradation compounds at Canadian sour gas-processing site.
- Program Manager for demonstration of unique design for oil and gas surface impoundments.
- Director of the National Mine Land Reclamation Center for the Western Region.
- Co-PI on project exploring feasibility of underground coal gasification in southern Thailand.
- Consultant to an International Atomic Energy Agency program entitled “Solid Wastes and Disposal Methods Associated with Electricity Generation Fuel Chains.”

1988–1994: Research Manager (1994), Hydrogeologist (1990–1994), Research Specialist (1989–1990), and Laboratory Technician (1988–1989).

Professional Activities

Member, National Coal Council (appointed 2018)

Member, National Petroleum Council (appointed 2010)

Member, Mainstream Investors, LLC, Board of Governors (2014–present)

Member, DOE Unconventional Resources Technology Advisory Committee (2012–2014)

Member, Interstate Oil and Gas Compact Commission (appointed 2010)

Member, Rocky Mountain Association of Geologists

Publications

Has authored or coauthored more than 100 professional publications and nearly 300 technical presentations.



DARREN D. SCHMIDT

Assistant Director for Energy, Oil, and Gas
Energy & Environmental Research Center (EERC), University of North Dakota (UND)
15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA
701.777.5201, dschmidt@undeerc.org

Education and Training

B.S., Mechanical Engineering, West Virginia University, 1994.
Registered Professional Engineer (Mechanical and Petroleum).

Research and Professional Experience

February 2021–Present: Assistant Director for Energy, Oil, and Gas, EERC, UND.

- Leads a team focused on research, development, and commercialization related to efficient and clean fossil fuel production, utilization, carbon management, and alternative fuels and renewable energy.

Principal areas of interest and expertise include oil and gas facilities, production, injection, well stimulation, enhanced recovery, power generation, and renewable technologies.

2016–January 2021: Principal Engineer, Research and Technology, Equinor, Williston, North Dakota.

- Provided leadership for Equinor’s research portfolio in Bakken/Williston Basin, with focus on low carbon.
- Developed project focused on reducing flaring in which patent application was filed.
- Earlier work included leading team to develop CO₂ used in well stimulations.
- Through Equinor’s involvement with North Dakota Oil and Gas Research Program, research was completed to address requirements surrounding crude oil vapor pressure.
- Worked closely with Equinor’s Williston office regional manager to support operations, including serving as regulatory liaison for emergency response team.

2013–2016: Completions Engineer, Statoil Completions, Williston, North Dakota.

- Served as completions engineer for Williams County, with strong focus on safe operations.
- Led successful program in 2015 to use 10% produced water in Statoil hydraulic fracturing operations.
- Oversaw hydraulic fracture designs, quality of operations, implementing new procedures, enforcing standard operating procedures, and approving fieldwork.
- Mentored interns and completions-related research projects to improve performance.

2012–2013: Technical Advisor, Weatherford Fracturing Technologies, Williston, North Dakota.

- Provided leadership to Williston district to ensure job quality, safety, personnel management, education, and training.
- Supported revenue; provided intelligence; conducted marketing; provided urgent response to customers, field services, and client-based technical assistance; and ensured quality reporting.
- Provided technical guidance to district stimulation fluids laboratory.

2008–2012: Senior Research Advisor, EERC, UND.

- Oversaw procurement and execution of research projects related to Bakken Formation in Williston Basin. Projects included utilization of associated gas in drilling operations, laboratory investigation of conductivity associated with proppants, fracturing fluids, and rock formations, enhanced production from coal bed methane, geologic storage of CO₂, and oil-field drilling, production, and workover operations.
- Served as advisor to distributed biomass gasification development and contributed to organization's revenue through research proposals, publications, and intellectual property.

1998–2008: Research Manager, EERC, UND.

- Secured research contracts, managed projects, and performed engineering tasks in the areas of cofiring and biomass power systems, including combustion, fluidized-bed, gasification, microturbine, and internal combustion engine generators; energy efficiency; ground-source heat pumps; hydrogen production from biomass; and researching the behavior of biomass in combustion systems relative to ash fouling and trace elements.

1994–1998: Mechanical Engineer, Research Triangle Institute (RTI), Research Triangle Park, North Carolina.

- Served as project leader for \$3M Cooperative Agreement with U.S. Environmental Protection Agency (EPA) to demonstrate electricity production using 1-MW wood gasification technology.
- Significant experience included permit, design, installation, operations, and reporting.
- Other activities included support of marketing activities and coauthoring publications.

Summer 1993: Internship, EERC, UND, Grand Forks, ND.

- Supported combustion and coal ash studies.

Summer 1992: Internship, Foster Wheeler Development Corporation, Livingston, New Jersey.

- Supported gasification research and development.

Professional Activities

Appointed Member, North Dakota Oil and Gas Research Council
Cochair, North Dakota Petroleum Council Technology Solutions Group
Section Chair, Williston Basin Society of Petroleum Engineers

Publications

Has authored or coauthored over 80 peer-reviewed and other professional publications.

Patents

Method and Apparatus for Supply of Low-Btu Gas to an Engine Generator. U.S. Patent 8,460,413, June 11, 2013.

Application of Microturbines to Control Emissions from Associated Gas. U.S. Patent 8,418,457, April 16, 2013.

Hydrocarbon Gas Recovery Methods. U.K. Application No. 2009516.2, filed June 22, 2020.



MICHAEL P. WARMACK

Distinguished Oil and Gas Facilities Engineer

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA

701.777.5004, mwarmack@undeerc.org

Education and Training

B.S., Chemical and Petroleum Refining Engineering, Colorado School of Mines, 1981.

Research and Professional Experience

2022–Present: Distinguished Oil and Gas Facilities Engineer, EERC, UND.

- Serves on EERC project teams and works with EERC clients by providing technical leadership/oversight on industrial and governmental projects relating to enhanced oil recovery (EOR) and carbon capture, utilization, and sequestration (CCUS) projects to improve development and production of domestic energy.
- Supports planning, design, selection of materials/treatment programs, costing, reporting, and/or upgrade/retrofit efforts related to production facilities optimization for unconventional oil plays; injection, production, and recycle infrastructure associated with EOR/incremental oil recovery (IOR) in conventional and unconventional oil and gas plays; infrastructure associated with capture and injection of CO₂ for geologic storage; and other emerging challenges associated with oil and gas injection/production processes.
- Has more than 40 years of experience in oil and gas production and operations, facilities design and installation, chemical treatment and optimization, and hands-on experience in multiple engineering disciplines.

2021–2022: Principal Oil and Gas Facilities Engineer, EERC, UND.

- Served on EERC project teams and worked with EERC clients to improve development and production of domestic energy.
- Supported planning, design, selection of materials/treatment programs, costing, reporting, and/or upgrade/retrofit efforts related to production facilities optimization for unconventional oil plays; injection, production, and recycle infrastructure associated with EOR/IOR in conventional and unconventional oil and gas plays; infrastructure associated with capture and injection of CO₂ for geologic storage; and other emerging challenges associated with oil and gas injection/production processes.

2015–2020: Denbury Resources, Plano, Texas.

Was directly involved with Denbury's CO₂ operations within Delhi EOR and natural gas liquids (NGL) facilities (Delhi, Louisiana) and Tinsley EOR unit (Tinsley, Mississippi). Positions held included the following:

Facilities and Optimization Engineer – Delhi EOR Unit

- Provided engineering support on operations for Delhi EOR and NGL facilities.

- Provided recommendations and designs for facility upgrades (EOR facility), new equipment installation (EOR and NGL facilities), programming changes to plant operations, and operational changes within facilities. Efforts resulted in increased operational run time of plant and field operations while providing more efficient separation through plant.
- Worked with vendor on operations of NGL plant, resulting in equipment upgrades and increasing run time of plant from 85% in 2018 to 95% in 2019.
- Initiated monthly mechanical integrity and chemical reviews of plant and field operations.
- Designed and installed oil line to third-party crude blending facility, resulting in additional revenues without costs to unit.

Facilities and Optimization Engineer – Tinsley EOR Facility

- Provided detailed engineering review and recommendations for reducing chemical treatments on injection wells and improving operations of Tinsley EOR facility. Recommendations reflected development of maximum operating rate of EOR facility in terms of momentum, culminating in \$9.2 million investment to upgrade plant. After completion of plant upgrades, injection well treatments were reduced from 40+ treatments/month to ~1 per month while reducing treating chemical expenses by approximately \$2.4 million per year.
- Led engineering review on reduced injection occurring in field. Provided detailed analysis on injection system resulting in recommendation to improve flow in two major distribution lines.
- Instituted monthly mechanical integrity and chemical treating reviews on field operations.

2001–2015: Chaparral Energy, Oklahoma City, Oklahoma.

Directly involved with Chaparral's EOR operations in Texas and Oklahoma Panhandle areas, northeast Oklahoma area, and primary production activities in Oklahoma and Texas Panhandle areas. Positions held included the following:

Facilities Advisor/Facilities Manager (2011–2015)

- Provided project management and engineering oversight for Chaparral's largest CO₂ development that included grassroots 68-mile CO₂ pipeline and grassroots CO₂ capture facility to serve new EOR project in northeast Oklahoma.
- Directly responsible for facility design and integration within all of Chaparral's ongoing and developing EOR projects, resulting in alternative design of field facilities to replace underperforming equipment.
- Initiated standardization of facility designs within EOR projects for compression, water facilities, CO₂ pumps, and cooling facilities.
- Directly involved with developing and maintaining Chaparral's EOR budget, including full field project development costs.
- Recognized as key contributing team member by leading Chaparral in achieving its initial and highest monthly oil production level of 1 MMBO in May 2014.

Operations Manager/Operations Engineer (2001–2011)

- Directly responsible for development of Chaparral's CO₂ expansion programs within active and three new EOR projects within Oklahoma and Texas Panhandle areas. Development work included well intervention, facilities design and installation, chemical reviews on ongoing operations, drilling, and completion programs, WAG design and implementation, and land work support. Chaparral's CO₂ expansion programs realized increase in gross production of over 5100 BOPD from units involved.

- Directly responsible for securing CO₂ sourcing from Arkalon ethanol plant in Liberal, Kansas, resulting in development of grassroots CO₂ capture facility adjacent to ethanol plant.
- Directly responsible for development, installation, and monitoring of three pipeline projects in southwest Kansas and Oklahoma and Texas Panhandle areas to service new CO₂ projects.
- Instituted chemical squeeze treatment on submersible pump installations to stem scaling of downhole equipment. Treatments resulted in increasing run time of submersible pumps from less than 3 months to 18 months.
- Recognized by Chaparral as key personnel asset within its EOR operations during Chaparral's financial presentations.

1999–2001: WoodGroup ESP, Oklahoma City and Purcell, Oklahoma.

Alliance Manager (2000–2001)

- Directly responsible for alliance with Kerr McGee for submersible pump installation and operation.
- Instituted new design parameters on submersible pump installations that dramatically increased run time of installed equipment. This design resulted in savings of over \$1 million per year to Kerr McGee. Recognized by Kerr McGee for savings to its operations.
- Developed plan for continuous improvement concerning submersible pump installations based upon review of equipment installations and cooperation of WoodGroup's personnel and Kerr McGee's Failure Analysis Team.

Reliability Engineer (1999–2000)

- Directly responsible for investigation into failures on domestic and international customer equipment. Provided summary reports of findings with proposed solutions to prevent future reoccurrence.
- Directly responsible for investigative review on WoodGroup's operating standards, equipment upgrades, and modifications.
- Provided engineering support to in-house quality control on procured and manufactured equipment.

1997–1998: Lead Field Engineer, Occidental Petroleum, Maracaibo, Venezuela.

- Supervised staff of up to 15 field personnel engaged in completions, nondrilling workovers, and downhole operations.
- Coordinated fieldwork with Maracaibo office and camp personnel for workover and production operations, submersible equipment design and installation, and workover rig movements.
- Recognized as key asset in ongoing operations through sale of operations from Occidental to Union Texas Petroleum to Arco and British Petroleum.

1981–1997: Occidental Petroleum and prior subsidiaries, Oklahoma City, Oklahoma.

- Directly involved with ongoing EOR projects in central Oklahoma area that included design of grassroots EOR project in acquired unit for plant and field facilities. Instituted new design for CO₂ distribution system within field.
- Implemented Failure Analysis Team (FAT Team) to extend run time of submersible pump installations within company's EOR operations. FAT Team consisted of operating personnel, a chemical supplier, and a submersible pump supplier. Work from FAT Team resulted in extending run times of submersible pumps from 15 months to over 24 months within 2 years, resulting in reduced operating and equipment costs.
- Led successful acquisition efforts on two producing properties valued at \$3.0 million.

- Continuously enhanced production base from wells ranging in depths from 3000 to 15,000 feet through workover programs, recompletions, stimulations, and changes in artificial lift equipment. Developed and instituted program for having pipeline connection installed prior to frac treatments, resulting in better completions and higher production from wells.
- Developed multistage frac design in vertical wells using bullet perforations, reducing frac time by 50% and resulting in savings of over \$250,000 per job.
- Selected by Oxy to serve on worldwide ESP team to enhance run time and use of ESP equipment.

Publications

Has coauthored numerous professional publications.



D. MICHAEL HILLIX, PG

Principal Geoscientist and Energy Advisor

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

15 North 23rd Street, Stop 9018, Grand Forks, North Dakota 58202-9018 USA

303.589.1965, mhillix@undeerc.org

Education and Training

Master's of Petroleum Reservoir Systems, Colorado School of Mines, Golden, Colorado, 2020.

B.S., Geology, University of Kansas, Lawrence, Kansas, 2007.

Professional Geologist (Wyoming) – License Number PG-4318

Research and Professional Experience

February 2023–Present: Principal Geoscientist and Energy Advisor, EERC, UND.

- Works closely with directors and program/project managers in the areas of oil and gas production optimization and geologic CO₂ capture and storage (CCS) to assist in managing research tasks within a multidisciplinary team of scientists, engineers, and business professionals.
- Notable projects and activities include the following:
 - Provided technical and regulatory oversight for multiple underground injection control (UIC) Class VI permit applications for both state (North Dakota) and federally (U.S. Environmental Protection Agency) regulated CCS projects.
 - Provided consultation and recommendations for proposed geologic and reservoir characterization efforts from a technical and regulatory perspective for multiple international offshore CCS projects.
 - Led the development of a fully probabilistic risk/leakage model for evaluating the potential for CO₂ loss from permitted CO₂ storage complexes to be used for voluntary carbon market (VCM) risk of reversal assessments.
 - Provided technical and regulatory oversight for California Air Resource Board (CARB) Low Carbon Fuel Standard CCS permanence applications.
 - Provided regulatory review and permitting guidance for geophysical survey and stratigraphic test well drilling for CCS site characterization.
 - Coauthored several technical papers on topics including CCS project risk assessment, maximum allowable injection pressure (MAIP) implications for CCS projects, and the feasibility of developing salt caverns for hydrocarbon storage in North Dakota.

December 2014–October 2022: Lead Asset Geologist, Chord Energy (Whiting Petroleum), Denver, Colorado.

- Responsible for geologic evaluation and development planning in Sanish Field, North Dakota, including oversight of operations geology for active drilling program.
- Developed workflow that incorporates geologic, reservoir, and production data to better predict infill well productivity in Bakken and Three Forks intervals, used to create infill development program for Sanish Field.
- Worked closely with reservoir engineering team to identifying key geologic and reservoir parameters linked to well productivity across Williston Basin.

- Led geologic and development evaluation on successful 2021 acquisition evaluation valued at \$270MM (Kraken Oil & Gas).
- Experience working on multiple additional acquisition evaluations, divestment packages, and other business development projects.
- Provided guidance and management of wellsite geologic and geosteering operations along with continual coordination with drilling group on permitting, directional drilling planning, and geohazard assessment and mitigation.
- Provided recommendations on evaluation programs including wireline logs, mudlogging, coring, and other data collection methods.
- Successfully guided implementation of “backbuilds” or highly deviated wells into Whiting’s well-planning process.
- Close collaboration with reserves and planning groups to ensure accurate forecasting and program management.
- Provided geologic testimony and created exhibits for state Oil & Gas Commission hearings.
- Evaluated up-hole and downhole targets in Williston Basin across company’s leasehold.
- Investigations included detailed sequence stratigraphy, log and core analysis, reservoir characterization, characterizing risk and uncertainty, and detailed economic analysis.

June 2011–December 2014: Geologist, Kodiak Oil and Gas Corp. (acquired by Whiting Petroleum), Denver, Colorado.

- Responsible for 24/7 operations geology and geosteering for four-rig program developing Bakken/Three Forks play.
- Created full-field development plans for company’s acreage position.
- Involved in planning and permitting of horizontal wells on state, federal, and Indian lands including pad location selection, geologic prognosis creation, directional planning, and AFE creation.

August 2009–June 2011: Geologist, El Paso Exploration and Production, Denver, Colorado.

- Conducted reservoir characterization studies to identified multiple infill and recompletion opportunities in conventional House Creek North Field.
- Integrated geologic, reservoir, production, and injection data into assessment for improving horizontal waterflood performance in Parkman Unit of Savageton Field.

Professional Activities

Member, American Association of Petroleum Geologists

Member, Society of Petroleum Engineers



DR. LU JIN

Distinguished Reservoir Engineer

Energy & Environmental Research Center (EERC), University of North Dakota (UND)

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Education and Training

Ph.D., Petroleum Engineering, Louisiana State University, 2013.

M.S., Petroleum Engineering, Louisiana State University, 2009.

B.S., Petroleum Engineering, Northeast Petroleum University, 2005.

Research and Professional Experience

October 2022–Present: Distinguished Reservoir Engineer, EERC, UND.

- Develops novel methods for renewable energy development in Williston Basin, including geothermal development in Bakken Formation and hydrogen conversion in oil reservoirs.
- Leads scientific research activities on machine learning applications, enhanced oil recovery (EOR) technologies, database development for EOR operations, effective simulation methods for unconventional reservoirs, etc.
- Serves as task lead and key reservoir engineer for U.S. Department of Energy (DOE)-sponsored project, “Williston Basin Resource Study for Commercial-Scale Subsurface Hydrogen Storage.”
- Serves as principal investigator (PI) for North Dakota Industrial Commission (NDIC)-sponsored project, “Extending the Shale Revolution from Oil and Gas to Geothermal Development in North Dakota.”
- Serves as PI for NDIC-sponsored project, “Examination of In Situ Hydrogen Conversion in Oil Reservoirs.”
- Serves as task lead and key reservoir engineer for U.S. Department of Energy (DOE)-sponsored project, “CO₂ Enhanced Oil Recovery Improvement in Conventional Fields Using Rich Gas.”
- Serves as task lead and key reservoir engineer for DOE-sponsored project, “Improving Enhanced Oil Recovery Performance Through Data Analytics and Next-Generation Controllable Completions.”
- Serves as task lead and key reservoir engineer for NDIC-sponsored project, “Unitized Legacy Oil Fields: Prototypes for Revitalizing Conventional Oil Fields in North Dakota.”

Principal areas of interest and expertise include reservoir modeling and simulation, CO₂/rich gas EOR and associated CO₂ storage in both conventional and unconventional reservoirs, engineering optimization, water coning control, and multiphase flow in porous media, with particular interest in subsurface oil–water–gas interactions, EOR techniques and development of old oil fields/unconventional resources.

January 2020–October 2022: Principal Reservoir Engineer, EERC, UND.

- Developed dynamic numerical models for CO₂/rich gas enhanced oil recovery in different reservoirs.
- Oversaw technical areas in reservoir engineering, including conventional, unconventional and enhanced oil and gas production, geologic storage of CO₂ and natural gas, natural resource development, geocellular modeling, numerical simulation.

- Served as task lead and key reservoir engineer for DOE-sponsored project, "CO₂ Enhanced Oil Recovery Improvement in Conventional Fields Using Rich Gas."
- Served as task lead and key reservoir engineer for DOE-sponsored project, "Improving Enhanced Oil Recovery Performance Through Data Analytics and Next-Generation Controllable Completions."
- Served as key reservoir engineer for DOE-sponsored project, "Bakken Rich Gas Enhanced Oil Recovery Project."
- Served as co-PI for NDIC-sponsored project, "Exploration of Opportunities and Challenges for a North Dakota Petrochemical Industry."

July 2018–January 2020: Senior Reservoir Engineer, EERC, UND.

- Developed dynamic numerical models for CO₂ flow monitoring and prediction in different reservoirs; designed well testing plans for both producers and injectors to support long-term success of field operations; developed innovative fractured reservoir models for Bakken unconventional petroleum system; and served as simulation task lead for variety of seismic projects.
- Served as task lead and key reservoir engineer for DOE-sponsored project, "Joint Inversion of Time-Lapse Seismic Data."
- Served as key reservoir engineer for DOE-sponsored project, "Scalable, Automated, Semi-permanent Seismic Method for Detecting CO₂ Plume Extent During Geological CO₂ Injection – Phase II."

February 2015–July 2018: Reservoir Engineer, Reservoir Modeling and Simulation, EERC, UND.

- Developed geophysical models of subsurface and ran dynamic simulations to determine long-term fate of produced/injected fluids, including hydrocarbons, CO₂ storage, and brine, using oil and gas industry simulation software.
- Served as task lead and key reservoir engineer for DOE-sponsored project, "Plains CO₂ Reduction (PCOR) Partnership Phase III – Bell Creek Test Site."
- Served as Co-PI and key reservoir engineer for DOE-sponsored project, "Improved Characterization and Modeling of Tight Oil Formations for CO₂ Enhanced Oil Recovery Potential and Storage Capacity Estimation."
- Served as key reservoir engineer for DOE-sponsored project, "Scalable, Automated, Semi-permanent Seismic Method for Detecting CO₂ Plume Extent During Geological CO₂ Injection – Phase I."

January 2014–February 2015: Reservoir Engineer, InPetro Technologies, Inc., Houston, Texas.

- Developed simulation and analytical models for unconventional reservoir development, especially for shale oil reservoirs; analyzing fluid PVT (pressure, volume, temperature) change during depletion and considering pore-size distribution (PSD) in simulations. Application of new model in Eagle Ford and Bakken Formations shows that oil reserves could be improved as much as 30% by integrating PVT and PSD effects.

August 2007–December 2013: Research Assistant and Reservoir Consultant, Department of Petroleum Engineering, Louisiana State University (LSU), Baton Rouge, Louisiana.

- Modeled and evaluated performance of downhole water loop (DWL) well system in different oil fields, developed economical models for evaluation of DWL system in various reservoir and market conditions, and identified best reservoir candidates for system; oil production rate could be improved as much as 200%. Constructed software (toolbox) using ECLIPSE and VBA for complex well system simulation, applied batch processing technology in simulation, achieved automatic task queuing, and reduced simulation time 67%.

January 2013–December 2013: Reservoir Consultant, Joint Industrial Program (JIP), LSU, and Pluspetrol, Baton Rouge, Louisiana. Simulated cold production of heavy oil in Massambala Field, Angola, identifying mechanisms of high water cut in current wells, optimizing perforation length for conventional wells, and proposing two well systems, which could improve cumulative oil up to 80% or reduce produced water 75%, respectively.

May 2012–August 2012: Internship, High Plains Operating Company, LLC (HPOC), San Francisco, California. Simulated and analyzed extra water production problems in Ojo Encino Field, New Mexico, designing DWS well system to produce oil from thick transition zone, which could improve oil production rate by up to 20%.

May 2011–August 2011: Internship, JIP, LSU, and HPOC, Baton Rouge, Louisiana. Simulated performance of vertical and horizontal wells in Ojo Encino Field, New Mexico, diagnosing water coning/cresting problems in thick transition zone, determining best location for water injection to minimize pressure interference, and suggesting well type to develop field, which saved costs up to 30%.

January 2011–January 2013: Senior Teaching Assistant, Drilling Fluids Laboratory, LSU, Baton Rouge, Louisiana. Served as lecturer and oversaw four teaching assistants and 80–100 students each year as well as supervised three senior students completing their senior design projects.

September 2005–August 2007: Production Consultant, JIP, China University of Petroleum, and CNPC.

- Optimized a large gas pipeline network in China, proposed new optimization algorithm, and programmed software package for best operation in different conditions, reducing operational cost up to 23% (more than \$20,000/day).

Professional Activities

Member, Society of Petroleum Engineers

Publications

Has authored or coauthored numerous peer-reviewed and other professional publications.

APPENDIX C

BUDGET JUSTIFICATION

BUDGET JUSTIFICATION

Subcontractor – Energy & Environmental Research Center (EERC): The EERC will be providing engineering support for surface facility planning and design, injection and production scheme design, and reservoir surveillance design and data interpretation. This includes engineering support for near-real-time operational performance evaluation and troubleshooting during the execution of the pilot. The EERC will also be providing modeling and simulation services, permitting support, and assistance with report preparation. This cost was determined from a cost quote provided by the EERC based on its past experiences performing similar activities for Bakken enhanced oil recovery (EOR) pilot projects.

Pipeline: This expense is for the installation of 8 miles of pipeline that is necessary to deliver hydrocarbon gas to the EOR pilot injection site. The estimated cost was determined through professional engineering judgment on the part of Chord Energy.

EOR Injectate Costs and Well Preparation:

Injectate Cost: The expense that's budgeted is for the purchase of hydrocarbon gas to be used as the injectate (also known as working fluid) for the EOR pilot. The North Dakota Industrial Commission (NDIC) share is to be utilized by Chord Energy to cover the incremental cost associated with purchasing hydrocarbon gas to be used as the injectate instead of CO₂, as CO₂ was determined to not be available in sufficient enough quantities to meet the objectives of the project. An injectate in sufficient quantities is critical to conduct an EOR pilot as it is the medium that is physically injected into the reservoir to improve the displacement of oil and increase recovery efficiency. The estimated cost of the injectate was determined through multiplying the expected volume of gas that will be required for the EOR pilot (6566 MMscf) by the midpoint of quoted third-party cost estimates (\$2.00/Mcf) for hydrocarbon gas that were received.

Well Work: This expense is for the preparation of six wells within the EOR pilot drilling spacing unit (DSU) for injection operations. This may include cleanouts, installation of downhole sensors, and other downhole and wellhead equipment necessary for injection operations. The estimated cost was determined through professional engineering judgment on the part of Chord Energy.

Facilities Preparation and Operation

Power Usage: This expense is for the cost of the electrical power that will be required during the 18-month injection period. The estimated cost was determined through professional engineering judgment on the part of Chord Energy and assumes a power cost of \$0.10 per kilowatt/hour.

Compressor Front-End Engineering and Design (FEED) Study and Installation: This expense is for the cost of a FEED study (\$250,000) for the surface equipment that will be necessary to perform the EOR pilot and the cost of installing the compressor (\$5,250,000) that is required to inject the hydrocarbon gas. These estimated costs were determined from conversations with third parties and professional engineering judgement on the part of Chord Energy.

High Pressure Production Separator, Automated Well Manifold, and Supervisory Control and Data Acquisition (SCADA) System: These expenses are for equipment that will be required to perform the EOR pilot. The surface equipment used to flowback the wells will be designed to handle the extreme pressures and phase changes necessary to perform the pilot. The automated well manifold will allow the necessary operational flexibility to move produced fluids and injectant from well to well to test which

cyclic scheme gives the best performance. The estimated costs for these items were determined through professional engineering judgment on the part of Chord Energy.

Line Heater, Recycle Meter, Dehydrator: These expenses are for surface equipment that will be required to perform injection operations for the EOR pilot. A line heater is necessary to heat the hydrocarbon gas to prevent freezing in lines, valves, and separators. The recycle meter is necessary to determine the amount of gas that is being reinjected, and the dehydrator is required to remove any water from the gas stream. The estimated costs for these items were determined through professional engineering judgment on the part of Chord Energy.

Power Upgrade: This expense is for the electrical power upgrades that will be necessary at the EOR pilot site to accommodate the additional electrical load that will be required to power the compressors and other surface necessary for injection. The estimated cost was determined through professional engineering judgment on the part of Chord Energy.

Labor: This expense is for the cost of the Chord Energy technical and field staff labor that will be required to coordinate the design, implementation, operation, and evaluation of the EOR pilot. Estimates are based on the scope of work and prior experience on projects of similar scope.