



# UND Petroleum Engineering Update

# Overview

- Introductions- Sven Egenhoff and Brian Tande
- CEM Overview and Priorities
- Vision for Petroleum Engineering
- CEM Support for Petroleum Engineering
- Plans for OGRP Grant



# Sven Egenhoff

- Director, Harold Hamm School of Geology and Geological Engineering
- Previous role: Professor of Geology at Colorado State
- Research Interests: Shale/mudstone depositional environments, Siliciclastic and Carbonate Sedimentology, Hydrocarbon Reservoir Characterization, Sequence Stratigraphy, Basin Analysis



Figure 8. Dr. Sven Egenhoff of Colorado State University presenting at the 2019 Williston Basin Core Workshop.



# Brian Tande, Dean of CEM

- Native of Stanley, ND
- Worked in the polymeric materials and composites industry prior to UND
- Fifteen years at UND
  - Previously served as a faculty member in ChE, Chair of ChE, Associate Dean
- Dean of CEM since 2019
- My goals
  - Fully align our college with the education and research needs of North Dakota and our region
  - Increase collaboration with EERC, state agencies, and industry





- 2,200 Students
- 82 Faculty
- 7 Units
  - Chemical Engineering
  - Civil Engineering
  - Harold Hamm School of Geology & Geological Engineering
  - School of Electrical Engineering and Computer Science
  - Mechanical Engineering
  - Petroleum Engineering
  - CEM Research Institute
- 17 Fields of Study

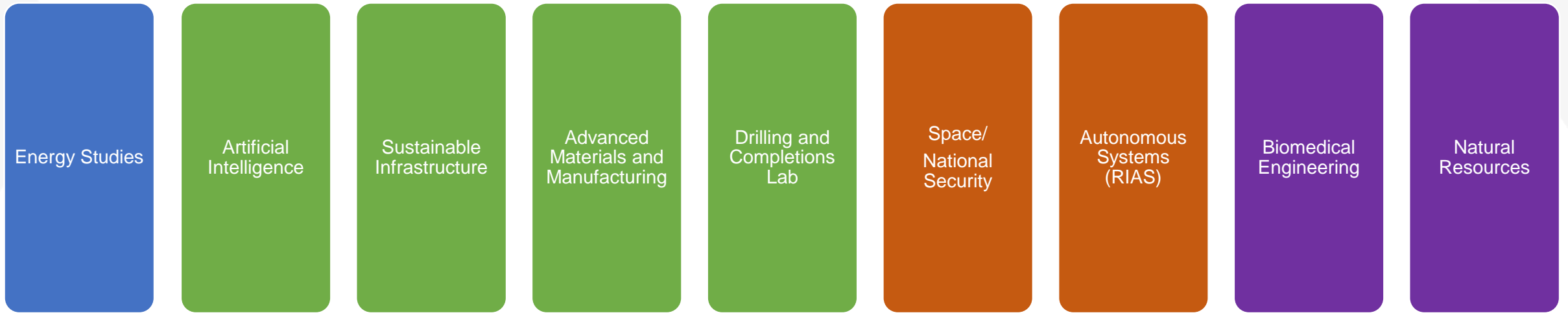
# Academic Programs

On-campus & Online | ABET Accredited

- Artificial Intelligence & Machine Learning (Grad.Cert.)\*
- Biomedical Engineering (Minor/B.S./M.S./Ph.D.)\*
- Chemical Engineering (B.S./M.S./M.Eng./Ph.D.)
- Civil Engineering (B.S./M.S./M.Eng./Ph.D.)
- Computer Science (B.S./M.S./Ph.D.)
- Cybersecurity (Cert./Minor/B.S./M.S.)
- Data Science (B.S./M.S.)
- Earth Science (B.S.)
- Electrical Engineering (B.S./M.S./M.Eng./Ph.D.)
- Energy Engineering (M.S./M.Eng./Ph.D.)
- Environmental Engineering (Cert./M.S./M.Eng./Ph.D.)
- Environmental Geoscience (B.S./M.S./M.Eng.)
- Ethical Hacking (Cert.)\*
- Geological Engineering (B.S./M.S./Ph.D.)
- Geology (Minor/B.S./M.A./M.S./Ph.D.)
- Mechanical Engineering (B.S./M.S./M.Eng./Ph.D.)
- Petroleum Engineering (Cert./B.S./M.S./M.Eng./Ph.D.)
- Petroleum Geology (Cert.)
- Secure Networks (Cert.)\*
- Systems Engineering (M.S./M.Eng.)\*

\*New Programs

# CEM Focused Research Areas



Our most well-established area

Areas established through internal investments over the past two years

UND-wide initiatives in which CEM plays a major role

New initiatives we are beginning to form

# 20/20 by 2030

## \$20 Million/yr in Research

- Increase from ~\$9 million in FY23
- Supports UND's goal of achieving R1 status
- Additional funding used to add faculty, support additional PhD students, and improve our facilities

## 20:1 Student to Faculty Ratio

- In each department, while growing or maintaining enrollment
- Over 40 more faculty needed, in addition to staff
- Supports our student-focused culture
- Allows us to grow our PhD numbers to help UND achieve R1



# Petroleum Engineering

- Six full time faculty positions (incl. Vamegh and Minou)
- Seven adjunct faculty
- ~170 students as of Spring 2022
  - 92 of those are graduate students
- Accomplishments
  - Top 3 largest PE Ph.D. programs in the USA
  - Largest number of journal publications per faculty in PE programs in USA
  - ABET Accreditation renewed
  - Establishment of DRACOLA with state and industry support
  - 2021 API group achievement award and several student prizes
  - Nearly 30 past and current students worked part/full time at EERC



# Immediate plans

- Dr. Sven Egenhoff named interim Chair of PE
- Hire three full time instructors to cover teaching needs
  - Over 20 applicants; positions filled by Aug. 15.
- Launch search for two faculty positions
  - One will be the Continental Resources Distinguished Professor
  - Target technical specialties that support the projects identified in the proposal
  - Positions could be filled as early as January
- Elevate some adjunct positions to help cover PhD advising
- Cover gaps by utilizing faculty from related areas: Geology, Geological Engineering, Energy Engineering



# CEM Support of Petroleum Engineering

- Faculty/staff salaries: ~\$600,000/yr
- Other operating expenses: ~\$60,000/yr
- Grad student tuition waivers: ~\$1,200,000/yr
- Support Unit Costs: ~\$975,000/yr
  
- A new 10-yr lease on the DRACOLA facility was recently signed
  - \$160k per year



# OGRC Funding Approved in March

- Funding from OGRP:
  - \$2,400,000 for 30 PhD students
  - \$280,000 for faculty summer salaries
  - \$300,000 to complete DRACOLA
- Cost share
  - \$3,633,930 from industry partners



# Proposed Projects for PhD Students

1. Big Data Analytics/UAS/Data Mining
2. CO<sub>2</sub>-EOR
3. Sulfate Deposition
4. Machine Learning/Refracking
5. Real-time Leak Detection for Oil and Gas Pipelines in North Dakota
6. Oil and Gas Pipe Blockage Prevention and Detection Based on Operational Parameters
7. Prediction of Gas Hydrate to Improve North Dakota Oil and Gas Production Efficiency
8. Investigation of Multiphase Flow in Undulating Horizontal Wells to Enhance Bakken Oil Production
9. Light Hydrocarbon Injection to Enhance Bakken Tight Oil Recovery
10. Optimization of Multistage Fracturing in Horizontal Wells to Maximize Bakken Oil Recovery
11. Evaluation of Bakken Rock Properties Alternation Caused by CO<sub>2</sub> Enhanced Oil Recovery
12. Feasibility Study of Water-Alternating-Gas Flooding in Bakken Reservoirs
13. Management and Treatment of Oil-Field Produced Water to Reduce Overall Cost, Bakken Case
14. Identification and Shut-off of Water Influx to Reduce Bakken Water Production
15. Frac-Hit Prediction, Prevention, and Mitigation for Bakken Pad Drilling and Stimulation
16. Study of Advanced Technologies to Reduce Gas Flaring in Bakken
17. Miscible EOR (CO<sub>2</sub>, rich gas) and Conformance Control in Miscible EOR
18. Reservoir Modeling and Simulation
19. Wettability Determination and Imbibition Experiments
20. CO<sub>2</sub> Storage
21. Fluid Flow Mechanisms in Tight Formation
22. Saltwater Disposal and Its Optimization

PhD student projects  
already in progress for all  
but two topics

# DRACOLA

- Nearly operational, waiting for variable frequency drives
- Additional \$300k in funding will be used to upgrade automation and data collection systems to current standards
- Several pending proposals, including one to the DOE in collaboration with Oklahoma State
- Will be set up as a cost center so that time can be billed to internal and external clients



# Summary

- We are committed to the success of DRACOLA and the Petroleum Engineering program at UND
- We remain fully capable of completing the approved projects
  - New faculty with the required expertise will be hired as soon as possible
  - 29 PhD students have been admitted for the fall, with financial aid commitments pending
  - 69 PhD applications are in process
- The support of the OGRC is greatly appreciated



**QUESTIONS?**

