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HAROLD VANCE DEPARTMENT OF PETROLEUN ENGINEERING

LETTER FROM THE DEPARTMENT HEAD



The question on many sharp, young minds is whether pursuing a degree in petroleum engineering is still a smart move. The answer is yes.

Fossil fuels in 2020 met 85% of global energy demand, according to the International Energy Agency and the BP Statistical Review of World Energy. Both project that by 2040, this number will drop by a mere 6%. These predictions indicate that petroleum, and petroleum engineers, will continue to play a vital and leading role in meeting the world's future energy needs.

These future petroleum engineers will face difficult but rewarding challenges in continuing to meet our increasing global demand for energy. Whether addressing mature reservoirs in decline or newly found reserves in complex and environmentally sensitive regions, progressive thinking is required. Solutions will come through innovation, cuttingedge science and technology, and collaboration in both fundamental and applied research.

My mission is to ensure that the Harold Vance Department of Petroleum

Engineering at Texas A&M University continues to produce the highest quality, most sought-after engineers at both the undergraduate and graduate levels. We will continue to succeed in this by attracting the world's most qualified students, recruiting and retaining the largest and most accomplished faculty, continuously improving our facilities and increasing our close ties to the local and global petroleum industry in order to grow our resources, define our research efforts and provide jobs to our graduates.

Sincerely,

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Jeff Spath Department Head Director, Crisman Institute for Petroleum Research



TEXAS A&M UNIVERSITY Harold Vance Department of **Petroleum Engineering**

BY THE NUMBERS

RANKINGS (2022)



Undergraduate Program Ranked No. 1 (U.S. News & World Report)

ENROLLMENT* (FALL 2021) *preliminary, 5th class day 333 140Undergraduate Graduate

DEGREES AWARDED*

(AY 2020-21) *preliminary



DIVERSITY (UNDERGRAD & GRAD)

23.5% International Students

76.5% **Domestic Students**

FACULTY

Graduate Program

(U.S. News & World Report)

Ranked No. 2



41 Faculty, including

Society of Petroleum Engineers 19 Distinguished Members

> Society of Petroleum **Engineers Honorary Members**

National Academy of **Engineering Members**

SCHOLARSHIPS (2021-22)

221 Undergraduate Scholarships Awarded

\$930,050 Total Scholarship Amount

FELLOWSHIPS (FALL 2021)

41 Graduate Fellowships Awarded

\$**223,332**

Total Fellowship Amount

ABEDI RECEIVES PRESTIGIOUS NSF CAREER AWARD

Dr. Sara Abedi received the coveted National Science Foundation's (NSF) Faculty Early Career Development (CAREER) Award. She will use funding from the award to support a student outreach program and a five-year research project studying the impact of reactive brine interactions on rock properties.

Rock and salt water interactions are a major concern in several engineering applications, such as carbon sequestration, reservoir stimulation, cliff and slope stability, dam foundation seepage and creep, contaminant transport and enhanced geothermal systems. Rocks may appear solid and stable, but the corrosiveness of brines can erode their mechanical structures and compromise their strength. Characterizing and modeling how rock properties change when exposed to salty fluids remains a challenge because of the complex microstructure of rocks and the intricacy of rock-fluid interactions.

Abedi tailored her research for a broad application that aligned with the civil, mechanical and manufacturing innovation area within the NSF, particularly for advancing infrastructure resilience and sustainability.

"The research results will lead to better efficiency in resource and energy systems, enhanced resiliency in infrastructure systems and improved safety in fluid or gas storage," said Abedi.

Since the integration of research and education is essential for CAREER projects, Abedi will use a collaborative, interdisciplinary outreach plan to broaden the participation of high school students and underrepresented college students in chemical and physical sciences through a program titled "Rocks and Fluids."





INSTRUCTION AN ECONOMIC WIN FOR GEOTHERMAL DRILLING

Drilling a well remains the highest cost for geothermal energy investment. Researchers Dr. Sam Noynaert and Fred Dupriest tackled this problem as part of a \$1.86 million Department of Energy (DOE) project to make the low-margin business of geothermal energy more economically attractive.

The researchers taught a physics-based drilling course to a team preparing a geothermal well for a DOE test site. The team learned the processes involved in drilling, from bit specifics to force application, so they could recognize and reduce performance limiters. Daily online discussions between team members and researchers resolved any issues; drilling improvements solely relied on the team's efforts.

Despite frequent data collection stops, the well was completed in about half the time budgeted, a huge cost reduction for the project.



STUDENTS BUILD ADVANCED RIG FOR SPACE CHALLENGE

Led by petroleum engineering student Mohamed Khaled, an interdisciplinary team of graduate and undergraduate students in the College of Engineering competed in the 2020-21 NASA Moon to Mars Ice and Prospecting Challenge.

Together, the students designed and built a next-generation drilling and ice-harvesting prototype rig for space sporting several impressive features. Their rigging, a strong but lightweight structure made of rods, cables and rotary motors, can deploy or fold itself. The drill bit self-adjusts its progress through various subsurface materials using their advanced computer-automated system. Their drilling, heating and extraction systems work individually or together as needed to collect water frozen within the soil of other worlds. Finally, everything they created operates in the airless environment of space without any need for direct human assistance.



MODELING RESERVOIRS WITH ALGORITHMS

In a project funded by the U.S. Department of Energy, researchers are using machine learning to teach algorithms to create fast and accurate models of key features in underground environments.

Simple, simulated oil and gas reservoirs were used initially to teach the software to sift through borehole pressure and flowrate data. The algorithms had to make decisions and predictions of the porosity and permeability of subsurface material. Correct answers, judged against known results, were rewarded. Researchers found that the algorithms quickly learned to predict accurately by maximizing their accrued rewards.

This reinforcement-based success should soon allow these algorithms to handle more complex simulations, potentially leading to the automated prediction of oil and gas reserves and even groundwater systems or seismic hazards.

MINERAL STUDY EXPLAINS RESERVOIR STIMULATION ISSUES

Postdoctoral researcher Dr. Igor Ivanishin investigated natural variations of dolomite and calcite minerals to understand why well stimulations in carbonate reservoirs do not always work.

Current modeling methods assume these minerals have ideal chemical compositions and predictably react when acids are injected to stimulate or dissolve channels in reservoir rock for hydrocarbons to travel through. Ivanishin found that extra ions picked up during dolomite formation in nature can modify the mineral's chemical stability. When acids are applied, dissolution rates can vary up to five times greater than expected, meaning the stimulation could dissolve too much in one spot and leave the rest of the reservoir untouched.

He is testing calcite for similar issues and creating computer simulations of his results to share with oil companies while discussing possible solutions.



FACULTY AWARDS AND RECOGNITION



Dr. Ibere Nascentes Alves received the 2021 Distinguished Award in Teaching, University Level, from the Texas A&M University Association of Former Students. This award is presented to instructors judged as superior classroom educators.



Dr. Siddharth Misra received the 2021 European Association of Geoscientists and Engineers Arie van Weelden Award for his research achievements. He also received Texas A&M Triads for Transformation program funding for startup research on an improved subsurface monitoring system.

Dr. J.C. Cunha received the DeGolyer Distinguished Service Medal, a Society of Petroleum Engineers (SPE) international award highlighting exemplary service to the society and the petroleum industry. He received SPE distinguished membership as part of the award.



Dr. George Moridis was awarded the highest honor given by SPE, honorary membership, for a lifetime of technical and service contributions to the industry.



Dr. Eduardo Gildin was awarded SPE distinguished membership for his achievements in the petroleum industry and the academic community.



Dr. Oliver Mullins was awarded the Anthony F. Lucas Gold Medal from SPE for his identification and development of new technology and concepts that will enhance the process of finding or producing petroleum.



Dr. Berna Hascakir was named a 2021-22 ADVANCE Administrative Fellow and will direct a new partnership program for female doctoral students in the College of Engineering who complete part of their academic requirements on the Texas A&M University at Qatar campus.



Dr. Hadi Nasrabadi received funding from the Texas A&M Triads for Transformation program supporting his initial research on an interdisciplinary project finding economic desalination solutions for produced water. ►



TEXAS A&M UNIVERSITY Harold Vance Department of Petroleum Engineering

engineering.tamu.edu/petroleum

HAROLD VANCE DEPARTMENT OF PETROLEUM ENGINEERING AREAS OF FOCUS

Advanced Drilling Technologies

Well Control, Optimized Drilling Performance, Horizontal Drilling, Dual Gradient Drilling, Applied Drilling, Offshore Drilling Risks

Advanced Well Completion Technologies

Downhole Diagnostic Measurements, Intelligent Completions, Wellbore Models, Oil and Gas Recovery, Fluid/Gas/Foam Behavior

Gas Hydrates

Data Investigation, Crystal Growth, Behavior Modeling and Prediction, Gas Hydrate Systems

Predictive Models for Unconventional Reservoirs

Geologic, Fracture Propagation, Reservoir Simulation, Risk Assessment

Reservoir Modeling

Simulator Development, Optimization, Upscaling, Numerical Analysis

Unconventional Reservoir Development and Assessment

Pore-Scale Rock Physics, Diagnostic Technologies, Nanotechnologies

Well Stimulation

Hydraulic Fracturing Methods, Materials, Models, Matrix Acidizing, Acid Fracturing, Injections, Nanotechnology, Thermal Applications, Refracturing, Sand Transport