The University of Texas at Austin
Hildebrand Department of Petroleum and Geosystems Engineering
Cockrell School of Engineering

ENERGY ONE

2021 | 2022

PETROLEUM ENGINEERING IN A SUSTAINABLE ENERGY FUTURE

PAGE 12

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ABOUT **ENERGY ONE**

Energy One is published annually for alumni and friends of The University of Texas at Austin Hildebrand Department of Petroleum and Geosystems Engineering. Download and share this issue at **pge.utexas.edu/news**.

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CHAIR'S CORNER

A RESILIENT RETURN

The excitement on the Forty Acres is palpable this fall as we return to campus after more than a year of virtual learning and teaching. This semester, we've welcomed two outstanding faculty members — Dr. Silviu Livescu and Dr. Arvind Ravikumar — and 120 undergraduate and graduate students to the department. We've announced five new Distinguished Alumni honorees, and nine alumni have joined our External Advisory Committee. We're also eagerly anticipating the spring opening of the Gary L. Thomas Energy Engineering building, which will add new state-of-the-art research and teaching space to UT PGE and will mark the southern end of the university's engineering corridor.

As we celebrate these additions and developments, we're mindful of what hasn't changed. US News & World Report once again ranked our graduate and undergraduate petroleum engineering programs No. 1 in the nation. Our students continue to win in national and international competitions, our faculty receive top professional honors, and our graduates make their mark in oil and gas and beyond. In fact, you'll read about many of these successes in this issue.

I'm proud of the resilience our community has shown during the COVID-19 pandemic. This resilience will be tested as we work to adapt to the changing landscape of energy. Yet, I remain confident that oil and gas, petroleum engineering technology, and the Hildebrand Department will continue to play a leading role as the world strives for a more sustainable future. Our cover story will show you why.

Hook 'Em and Enjoy Reading!

JON E. OLSON, DEPARTMENT CHAIR
LOIS K. & RICHARD D. FOLGER LEADERSHIP CHAIR
FRANK W. JESSEN PROFESSOR

4

GONE CAMPING

Two UT PGE students took 34 kids to virtual engineering camp as lead counselors in a new STEM-focused program for underrepresented communities.

7

SURI SUMMER

From data analytics to gas hydrates, 11 students conducted research virtually or on campus over the summer.

9

AND THE WINNER IS ...

Associate Professor Maša Prodanović recently won international recognition from the Society of Petroleum Engineers and the European Association of Geoscientists and Engineers.

16

THE ROCK STAR

UT PGE Petroleum Science and Technology Institute graduate and American Association of Petroleum Geologists Foundation Teacher of the Year Sabrina Ewald offers students — and fellow teachers — hands-on energy education.

TABLE OF CONTENTS

GONE CAMPING

UT PGE students **Judah Baptiste (BSPE '23)** and **Jayvaughn Peter (BSPE '22)** spent the summer as lead counselors for the first Longhorn Engineering Summer Camp. The catch? Instead of pitching tents and making s'mores, the 34 rising 8th and 9th graders who attended spent the week constructing things like a light-up glove, an electrified keyboard and a motion-sensor soccer goal. They also problem-solved scenarios like using those light-up gloves to communicate in the darkness of space and brainstorming energy sources for astronauts stranded on Mars.

Baptiste and Peter designed the activities with Associate Dean for Diversity, Equity and Inclusion (DEI) **Christine Julien**, who is a professor in the Department of Electrical and Computer Engineering, to emphasize the connection between engineering and art, sports, space, health, sustainability and, of course, fun. Since the camp took place virtually due to COVID-19, Baptiste and Peter tested and troubleshot all the activities in advance, and they assembled and mailed each camper a kit containing all the needed materials — a microbit computer, alligator clips, limit switches, motors, LED lights and more. During the week of camp, they oversaw 22 UT student counselors as they guided campers through the activities in Zoom breakout rooms.

"I didn't have the chance to go to a camp like this when I was younger, and there are still so many kids out there who don't know about engineering or don't think it's something they can do," says Baptiste. "Our goal was to show them that it's for anyone. It's not about who you are or what you have."

The camp was a joint initiative of the Cockrell School of Engineering's DEI Office and UT's Youth Engagement Centers. All of the campers live in historically underserved schools across Texas; 41% identify as female, 35% as Black, and 38% as Hispanic. And in surveys after the camp, 100% said they would recommend it to a friend. ■

> "I HOPE WHAT THE KIDS TOOK AWAY FROM EVERYTHING IS THAT THEY HAVE OPTIONS AND THEY DON'T HAVE TO STICK TO THE PATH THEY'RE ALREADY ON, EVEN IF IT FEELS LIKE IT."
>
> —Jayvaughn Peter (BSPE '22)

5 QUESTIONS ? 5 QUESTIONS ? 5 QUESTIONS ? 5 QUESTIONS ?

5

BROOKE FRANKLIN

UT PGE sat down for a conversation with junior petroleum engineering major and Women in Petroleum and Geosystems Engineering president ***Brooke Franklin (BSPE '23)*** *to talk about her podcast, how she mentors fellow students, her take on the future of oil and gas, and more.*

1

SO, YOU HOST A PODCAST?

When I was home during the pandemic, I did create a podcast called "Into the Ordinary" as a way to test myself and see if I could learn some new skills. I focused each show on finding beauty in everyday life — in the first episode, I interviewed my grandmother about losing my grandfather to Alzheimer's and what it's like being ½ Black and ½ Filipino in this country. It was super-healing for both of us.

2

HOW ARE YOU INVOLVED IN UT PGE?

I'm president of Women in Petroleum and Geosystems Engineering, and my goal is to make sure that other PGE women feel the same sense of support that I've felt. I'm also a PEN Pal mentor to new PGE students. I love encouraging them to express their personalities and be all they want to be. It makes the department that much richer and more colorful for all of us.

3

HOW DID YOU SPEND YOUR SUMMER?

I interned for Amazon in Dallas and worked on employee engagement and company culture. We interviewed employees, walked the warehouse floor, compiled and analyzed all the data, and proposed solutions based on what we heard. There's no better feeling than when you have a great team completing a project that really matters. The real-time impact is right in front of you.

4

WHERE DO YOU SEE THE OIL AND GAS INDUSTRY IN 10 OR 15 YEARS?

My generation sees the benefit of being environmentally conscious, and we want to work for companies who are part of the energy transition to manage the resources we have on Earth more effectively. If we tighten up our processes and focus on developing new technologies, we can make oil and gas cleaner and more efficient — and we can scale it globally.

5

WHAT'S NEXT FOR YOU?

I'm trying to decide about grad school, maybe getting an MBA or a dual degree in engineering and AI or machine learning. I really love the data analytics side of petroleum engineering. Your data has to tell the whole story — and you have to be able to break it down so people understand it, particularly in energy where so much is at stake. ■

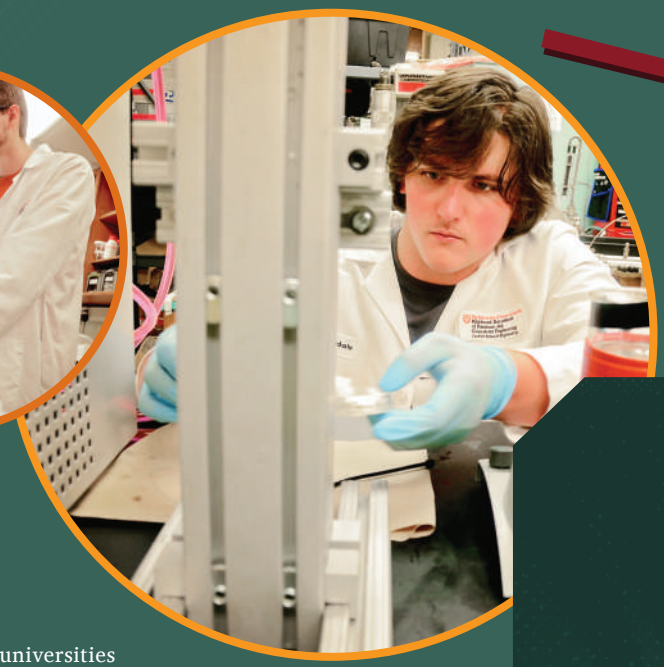
PGE UPDATE

HILDEBRAND DEPARTMENT OF PETROLEUM AND GEOSYSTEMS ENGINEERING

GLT BUILDING NEARS COMPLETION

Construction on the 184,000-square-foot Gary L. Thomas Energy Engineering building (GLT) is wrapping up, with a grand opening planned for the spring semester. Architectural elements like a grand staircase, wall of windows and high ceilings emphasize engineering on display as visitors will be able to see inside classrooms and labs as they enter the building, highlighting UT PGE's hands-on curriculum and emphasizing a sense of collaboration.

The GLT is named in honor of alumnus and retired EOG Resources Inc. President **Gary L. Thomas (BSPE '72)**, who made a transformative $25 million gift to help bring the building to reality. The GLT is the latest of several recent building and renovation projects in the Cockrell School of Engineering and marks the southernmost cap of the engineering campus.



SURI SUMMER

Eleven students from universities across the country — including five from UT Austin — participated in the Hildebrand Department's 10-week Summer Undergraduate Research Internship (SURI) program, held virtually again this year due to COVID-19 concerns. Students and their UT PGE faculty mentors completed projects on topics including subsurface data analytics, gas hydrates in the Arctic, the economic efficiencies of renewable energy sources and pipeline flow assurance. Interns also learned about the diverse opportunities within petroleum and geosystems engineering, attended weekly technical seminars, virtually toured a top energy research facility, and presented their findings via a Zoom conference at the end of the program.

STUDENTS WIN IN PRESTIGIOUS COMPETITIONS

TEXAS

UT PGE undergraduate **Ben Zhong (BSPE '22)** placed first in the BS division of the Society of Petroleum Engineers (SPE) Regional Paper Contest held virtually in May, while graduate students **Mahmood Shakiba (MSPE '14, PhD '21)** and **Leopoldo Ruiz (MSPE '18, PhD '22)** placed first and second, respectively, in the PhD division. In September, Zhong and Shakiba moved on to the international competition, where Shakiba placed third in his division.

Joshua Bautista-Anguiano (MSPE '16, PhD '21) and his research advisor, Professor **Carlos Torres-Verdin**, won the 2020 Best Paper award in GEOPHYSICS, a journal published six times a year by the Society of Exploration Geophysicists. Their paper appeared in the November/December 2020 issue. The pair also won Honorable Mention for a paper co-authored with German petrophysicist Joachim Strobel in the July/August 2020 issue. Both papers are part of the research Bautista-Anguiano conducted for his PhD dissertation. ■

NO. 1 IN THE U.S.

The Hildebrand Department's undergraduate petroleum engineering program is once again No. 1 in the nation according to the 2022 U.S. News & World Report undergraduate program rankings released Sept. 13. UT PGE shares the top spot with Texas A&M University. In the 2022 graduate rankings, released last spring, the graduate program also topped the list, affirming UT PGE's position as the nation's leading petroleum engineering department.

The University of Texas at Austin's Cockrell School of Engineering ranks No. 10 among the nation's engineering schools, with the aerospace, biomedical, chemical, civil, computer, electrical, environmental and mechanical engineering undergraduate programs all ranking in the top 16.

WELCOME BACK

The Hildebrand Department welcomed incoming UT PGE students at a one-day event in August. This year, 110 members of the classes of '24 and '25 toured campus with their upperclassman mentors, played icebreaker games, learned about student organizations, and discussed networking and internships with representatives from event sponsor Chevron. Since last year's welcome retreat was canceled due to COVID-19, both freshmen and sophomores attended.

"The goal of the retreat is to create a smooth transition for new students into the petroleum and geosystems engineering majors through supportive programs that introduce them to their classmates and professors," says Student Program Coordinator **Gabby Banales**.

> "WE WANT TO HELP THEM BUILD LASTING FRIENDSHIPS, EXPLORE OPPORTUNITIES IN THE OIL AND GAS INDUSTRY, AND GIVE THEM TOOLS TO HELP THEM SUCCEED ACADEMICALLY."
> —**Gabby Banales**

FACULTY FOCUS

PRODANOVIĆ RECEIVES SPE AND EAGE AWARDS

Prodanović

Associate Professor **Maša Prodanović** earned two prestigious industry awards in July — Distinguished Member from the Society of Petroleum Engineers (SPE) and the Alfred Wegener Award from the European Association of Geoscientists and Engineers (EAGE).

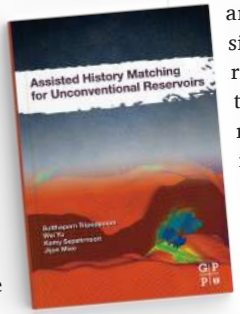
The SPE Distinguished Member Award is given to just 1 percent of members and recognizes those who have attained eminence in the petroleum industry or the academic community, or who have made significant contributions to SPE. Previously, Prodanović received SPE's Regional Formation Evaluation Award in 2019 and its Faculty Innovative Teaching Award in 2014.

The Alfred Wegener Award is presented to an EAGE member who has made an outstanding contribution over time to the scientific and technical advancement of the association's disciplines, particularly petroleum geoscience and engineering. The award citation recognizes Prodanović's work on understanding flow in porous media, including image analysis and topology to quantify pore structure and fluid displacement. "Like Wegener himself," the citation states, "[Prodanović] is a scientist of considerable imagination, unafraid to pursue new ideas."

Olson

OLSON RECOGNIZED BY AAPG

Associate Professor of Instruction **Hilary Olson** received the 2021 Public Service Award from the American Association of Petroleum Geologists in September. The award recognizes contributions in education, policy and thought leadership related to petroleum, land use and resource conservation. Olson directs the Hildebrand Department's Petroleum Science and Technology Institute (*see story, page 16*) and leads the international TOPCORP oil and gas inspector training program at the Center for Subsurface Energy and the Environment.



LU AND PYRCZ HONORED BY SPE

Lu

Pyrcz

Assistant Professor **Yingda Lu** and Associate Professor **Michael Pyrcz** earned recognition from the Society of Petroleum Engineers (SPE) in July. Lu won the SPE Southwestern North America Region's Production and Operations Award, which recognizes outstanding achievements in or contributions to the advancement of petroleum engineering in the area of production and operations technology, while Pyrcz won the SPE Gulf Coast North America Region's Data Science and Engineering Analytics Award for outstanding achievements in or contributions to the advancement of data science and engineering analytics in the industry.

SEPEHRNOORI PUBLISHES NEW BOOK

Sepehrnoori

Professor **Kamy Sepehrnoori** co-authored *Assisted History Matching for Unconventional Reservoirs*, which was released by Gulf Professional Publishing in August. The book gives reservoir engineers a holistic view on how to model today's fractures and unconventional reservoirs. It details simulations for hydraulic fractures, natural fractures and shale reservoirs using the embedded discrete fracture model; reviews automatic and assisted history matching algorithms including visuals on the advantages and limitations of each model; and captures data on uncertainties of fractures and reservoir properties for better probabilistic production forecasting and well placement. ■

LIVESCU AND RAVIKUMAR
JOIN FACULTY

***Silviu Livescu** and **Arvind Ravikumar** joined the UT PGE faculty this fall as associate professor and research associate professor, respectively.*

Livescu brings to UT PGE expertise in research and development, innovation, commercialization, and intellectual property in the petroleum industry. Most recently chief scientist of the pressure pumping product line at Baker Hughes, he has more than 30 US patents granted and pending, and has published more than 60 papers and articles.

Livescu is currently the 2020–2023 data science and engineering analytics technical director on the Society of Petroleum Engineers (SPE) International Board of Directors. He is also an SPE distinguished member and a former SPE distinguished lecturer, an executive editor for the *Journal of Petroleum Science and Engineering*, an associate editor for *SPE Journal*, and a technical reviewer for 19 journals and national science organizations. He earned a PhD in mechanical engineering from the University of Delaware and was a postdoctoral research fellow at Stanford University.

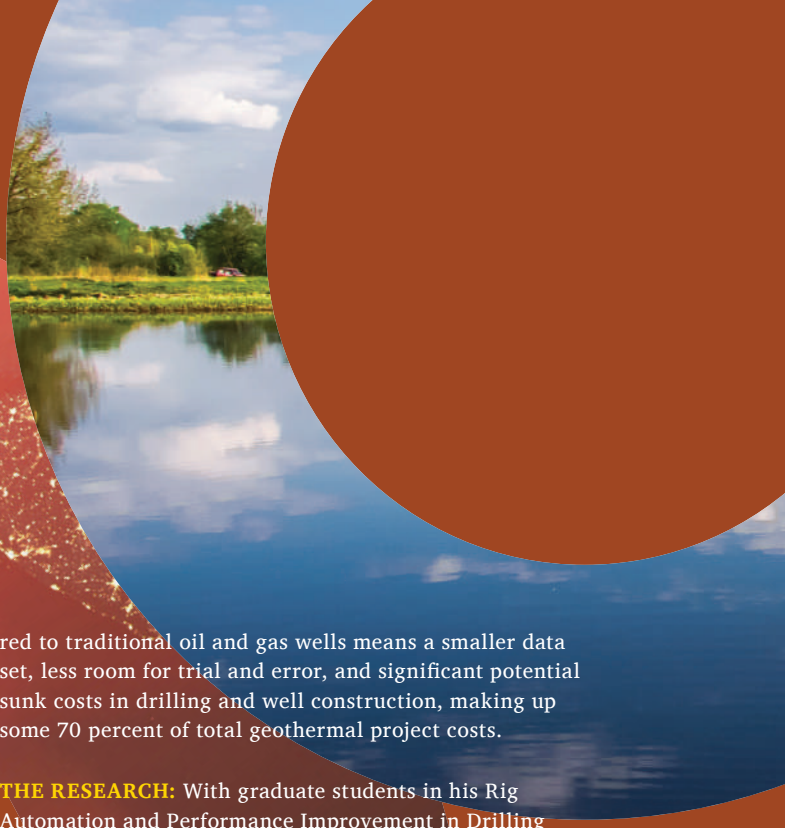
Ravikumar brings to UT PGE a multidisciplinary approach to solving one of science and society's most pressing questions — how global economies can meet growing energy demand while addressing its climate impacts. Through his Sustainable Energy Transition Lab, he will continue his work on sustainability within the oil and gas industry and the dynamics of global energy transition to a low-carbon economy through a combination of field work, model development and policy design.

Ravikumar is also a Payne Institute for Public Policy fellow at the Colorado School of Mines and an Initiative for Sustainable Energy Policy fellow in the School of Advanced and International Studies at Johns Hopkins University. He earned a PhD and MA in electrical engineering from Princeton University, where he was an Energy and Climate Scholars fellow at the Princeton Environmental Institute. Most recently, Ravikumar was assistant professor of energy engineering at the Harrisburg University of Science and Technology.

Follow Ravikumar on Twitter @arvindpawan1.

TURNING DOWN THE HEAT

IN ITS MAY REPORT, THE INTERNATIONAL ENERGY AGENCY CALLED ON THE SCIENTIFIC COMMUNITY TO FOCUS ON DECARBONIZING THE GLOBAL ECONOMY BY 2050. REACHING NET-ZERO CARBON DIOXIDE EMISSIONS WHILE KEEPING ENERGY PLENTIFUL, EXPANDING ENERGY EQUITY AND FUELING ECONOMIC GROWTH "WILL REQUIRE NOTHING SHORT OF THE COMPLETE TRANSFORMATION OF THE GLOBAL ENERGY SYSTEM," THE AUTHORS WRITE.



Progress in decarbonization depends in large part on how quickly experts can test, refine, deploy and scale fledgling technologies and techniques. And petroleum engineers may be among those best suited to lead the charge, according to the IEA report. With mastery of the subsurface environment and extensive infrastructure knowledge, "the expertise of the oil and natural gas industry fits well with technologies … needed to tackle emissions in sectors where reductions are likely to be most challenging."

In fact, several faculty members in the Hildebrand Department of Petroleum and Geosystems Engineering already have their eyes, equipment and expertise focused on four of these areas — geothermal energy; carbon capture and storage; reduced methane emissions; and hydrogen power. Here, they explain how (and why) they're up for the challenge of creating a sustainable energy future.

GEOTHERMAL

THE POTENTIAL: With a temperature equivalent to the surface of the sun, Earth's core generates about three times more heat flow to the surface than what the world currently consumes. If humans were to extract that heat continuously for a million years, only a fraction of a percent would be used — with minimal emissions and no fossil fuels burned. "Geothermal energy is clean, fully renewable, baseload-capable and a phenomenal opportunity we have ahead of us," says Professor **Eric van Oort**. "There's really nothing we can reasonably do to deplete it."

THE CHALLENGE: To extract enough heat energy to contribute significantly to societal demand, engineers must drill deeper — and through harder igneous and metamorphic rock — to reach higher temperatures. But these higher-pressure, higher-temperature environments wreak havoc on many conventional bit, fluid, casing and cementing materials. Where advanced technologies do exist, economic incentives often don't, so companies are hesitant to pursue mass production. What's more, the relatively small number of active geothermal wells compared to traditional oil and gas wells means a smaller data set, less room for trial and error, and significant potential sunk costs in drilling and well construction, making up some 70 percent of total geothermal project costs.

THE RESEARCH: With graduate students in his Rig Automation and Performance Improvement in Drilling (RAPID) consortium, van Oort is using artificial intelligence (AI) and machine learning to mine existing geothermal well data, search for patterns and call out anomalies that could indicate real-time drilling dysfunction that interferes with efficient hole-making. His team is also using AI to automatically analyze images from drill bits used in the field to quickly identify the root causes of bit damage and failure. What they learn could advance successful geothermal drilling techniques, speed up technology deployment and lead to more geothermal investment as drilling costs come down.

Professor **Mukul Sharma** is also focusing on geothermal applications, heading up a three-year $4 million project funded by the Department of Energy at its Frontier Observatory for Research in Geothermal Energy (FORGE) site in Utah. Sharma and his UT team will use sophisticated models developed for unconventional oil and gas extraction to simulate the performance of various hydraulically fractured horizontal well completions in a geothermal setting. They'll implement the most successful scenarios at the FORGE site and monitor the new wells with fiber-optic sensors. The ultimate goal is to develop best practices to guide engineers in scaling up geothermal energy production. "We need to bring the cost down and the power generation capacity up," Sharma says, "so we can achieve a target cost that makes it viable."

THE OIL AND GAS ADVANTAGE: Geothermal development "offers a particularly compelling case for oil and gas involvement given the domain expertise, technology application experience and transferable skills that can immediately be leveraged in the geothermal domain," says van Oort. "Moreover, it can help oil and gas companies deliver on their sustainable energy transition goals."

"HYDROGEN IS CONSIDERED LIKELY TO REPLACE MUCH OF THE GASOLINE AND NATURAL GAS CURRENTLY USED WITHOUT THE ASSOCIATED CO_2 EMISSIONS."

—**Mojdeh Delshad,** ***Research Professor***

"WE NEED TO BRING THE COST DOWN AND THE POWER GENERATION CAPACITY UP, SO WE CAN ACHIEVE A TARGET COST THAT MAKES IT VIABLE."

—**Mukul Sharma,** ***Professor***

CARBON CAPTURE

THE POTENTIAL: Carbon dioxide (CO_2) can be captured directly from concentrated emissions sites like power generation and industrial plants or from the atmosphere, and stored underground in saline aquifers or depleted oil and gas reservoirs. In fact, much of the needed technology is already proven and viable. Once captured, as much as 55,000 gigatons of CO_2 could be stored worldwide, according to IEA estimates. From a societal standpoint, carbon capture and storage (CCS) can help ameliorate energy poverty in developing countries by allowing them to continue relying on less expensive or already established fossil fuels once technologies like wind and solar become more widespread in developed countries.

THE CHALLENGE: CCS technologies, including plants to capture the CO_2, pipelines to transport it and wells to store it, are expensive and currently unprofitable without government subsidies. Where the stored carbon can be used for other purposes, like enhanced oil recovery, turning a profit becomes tied to the fluctuating price of oil. Plus, not all theoretical storage sites are equal: "Sedimentary systems are complex and hard to fully map at high resolution," says Associate Professor **Nicolas Espinoza**. "Some sites may end up being the equivalent of drilling a dry hole," creating a vicious cycle of economic infeasibility. Even when a suitable underground storage site is selected, "there's still the potential risk of CO_2 leakage, which would undermine the intended purpose of the site," adds Associate Professor **Ryosuke Okuno**.

THE RESEARCH: Espinoza and Okuno are co–principal investigators of the Hildebrand Department's Carbon UTilization, Storage and Transportation (CarbonUT) industrial affiliate program launched in July. With funding from industry partners, Espinoza and Okuno lead an interdisciplinary research team focused on reducing carbon emissions in the energy industry and accelerating knowledge transfer for worldwide CO_2 capture, storage and utilization. Okuno himself is currently exploring turning CO_2 into formate and formic acid. Formate solution in brine has 200 times greater carbon density than CO_2 at standard conditions and would allow more carbon to be stored underground with better control over its in-situ transport. "Breaking down the formic acid would also create a large, safe hydrogen reserve that could be used for energy," he says. "The whole process can be done in an electrochemical way that is already technologically ready for pilot testing."

THE OIL AND GAS CONNECTION: Petroleum engineers are experts in key areas needed to construct successful carbon storage sites, like determining injection rates and storage capacity, monitoring pressure and seismicity, and ensuring seal integrity. Many also have the data analytics chops needed. "It's practically impossible to run simulations for all possible injector locations and schedules," says Espinoza. "With machine learning, we can optimize storage site selection, find local maximums and get started sooner."

METHANE EMISSIONS

THE POTENTIAL: First, some bad news. The methane leakage rate from natural gas systems in the United States

"WE ARE JUST STARTING TO PEEL BACK THE POWER AND POTENTIAL FOR MACHINE LEARNING TO ADDRESS THESE ISSUES." **—Arvind Ravikumar, *Research Associate Professor***

is about 2.3 percent — with 1.6 percent coming from upstream production and processing. Because methane is a highly potent greenhouse gas, however, "reducing emissions can significantly improve the oil and gas industry's environmental performance," says Research Associate Professor **Arvind Ravikumar**. "It's the low-hanging fruit."

THE CHALLENGE: Methane emissions data provided by the Environmental Protection Agency is outdated, relies on a miniscule sample size and neglects the impact of super-emitters, underestimating total emissions by about 60 percent, according to Ravikumar. Quantifying actual emissions can be costly and time-consuming and depends on myriad factors like location, time of day and year, and facility age. But getting accurate numbers is the key to fixing the problem, says Ravikumar: "You can only address something if you know where it is happening, and you can only know where it is happening if you go measure it."

THE RESEARCH: Through his Sustainable Energy Transition Lab, Ravikumar and his team have tested the efficacy of more than 20 technologies used to measure methane emissions at sites from New York to California using planes, drones, satellites and truck-mounted sensors. Based on that data, the team has begun modeling the most effective and cost-efficient ways to reduce emissions. The ultimate question is, "which technology X, on platform Y, surveying Z times per year, in basin B under these particular weather conditions and repair rules can reduce emissions by 50 percent?" says Ravikumar.

The team has discovered that 25 percent of sites contribute 75 percent of total methane emissions. "But by the time you get to those facilities, you might have already spent a month in the field measuring others that were just fine." Ravikumar hopes that AI can help identify likely super-emitters, saving time and money in the process. "We are just starting to peel back the power and potential for machine learning to address these issues," he says.

THE OIL AND GAS CONNECTION: Since methane leaks happen most often in the upstream sector, petroleum engineers already have the skills to fix them. "You also have to understand how new technologies work and how that fits into the broader socioeconomic systems we have in the world," says Ravikumar. "A PGE background plus that kind of interdisciplinary toolkit leads to effective sustainability solutions."

HYDROGEN

THE POTENTIAL: Hydrogen's appeal lies in its abundance and versatility. Even though it can't be sourced directly from the earth, lots of fuels generate it as a byproduct; it has a high specific energy; and when it's combusted, it produces only water vapor. Today, "hydrogen is considered an energy carrier likely to replace much of the gasoline and natural gas currently used for transportation, heating and electricity generation without the associated CO_2 emissions," says Research Professor **Mojdeh Delshad**.

THE CHALLENGE: Although hydrogen has a high energy mass, its low energy volume means larger reservoirs or tanks are needed to store enough to match the energy volume of more traditional fuels like natural gas. Since hydrogen isn't yet produced as consistently as oil and gas, even more must be stored for production to be ramped up during periods of increased energy demand. These storage requirements, coupled with the need to capture and store CO_2 in the subsurface to meet emissions goals, could mean a shortage of suitable rock formations until engineers can successfully combine the processes.

THE RESEARCH: Delshad, Professor **Kamy Sepehrnoori** and Bureau of Economic Geology Senior Research Scientist **Peter Eichhubl** are working to develop a screening tool to assess which subsurface reservoirs are best suited for hydrogen storage. After modeling how hydrogen behaves compared to CO_2 in different geological settings, they simulated injecting hydrogen into two saline aquifers and a depleted natural gas reservoir to provide data for the screening tool. It's a work in progress, says Eichhubl: "Even more research is needed to develop a fast and robust tool to select, design and execute efficient and safe storage projects. Despite our vast experiences in storing CO_2 and natural gas, H_2 storage has its own unique challenges."

THE OIL AND GAS CONNECTION: The options for underground hydrogen storage include manmade caverns, salt domes, aquifers, and depleted oil and gas fields. Petroleum engineers and geoscientists have the expertise to determine which formations will work best; how quickly and in what form the hydrogen can be safely injected; how it will react while stored; and the most effective way to withdraw it for transportation, heating and electricity generation. "The industry has been storing hydrogen in the subsurface with some degree of success since the 1980s," says Sepehrnoori. "It's time to figure out how to scale up what we've learned and help kickstart the hydrogen economy." ■

THE R

CK STAR

THE ROOM WHERE IT HAPPENS
While high school teacher Sabrina Ewald's fun and friendly classroom draws in students like Selin Yavuzcan and Lucas Robinson, her hands-on energy lessons change their worldview.

*When students walk into **Sabrina Ewald**'s high school classroom, it's a toss-up what they notice first. Some focus on the hundreds of rocks — obsidian, quartz, pyrite, geodes — in cases against the back wall. Others spot the rows and rows of Funko Pop toys — Marvel, Dr. Who, Harry Potter, Star Wars — on the bookshelf behind her desk.*

No matter what, though, they all finish her Astronomy, Earth Science or AP Environmental Science class with the same core understanding. "I walked away with a wide-eyed awareness of our energy needs as a planet, a country and as individuals," says former student Lucas Robinson, now a political science major who uses what he learned in Ewald's class to talk energy policy with voters on the campaign trail. "She makes those very important lessons super-relatable."

That's by design. Ewald is a graduate of the Hildebrand Department's Petroleum Science and Technology Institute for high school STEM teachers, which is led by Associate Professor of Instruction **Hilary Olson** and taught by UT PGE faculty members. In the five-day program, participants explore energy topics in hands-on activities, interactive labs, expert-guided discussions and peer breakout sessions.

"I was blown away by how efficient and organized the institute was," says Ewald, who also completed the Hildebrand Teacher Leadership Program and won its Excellence in Leadership Award this year. "I am so very thankful for these experiences and how they have helped me grow as a teacher and as a leader in earth science education."

Ewald routinely incorporates PSTI activities into her lessons, like having students conduct a personal energy audit or calculate the amount of energy it takes to heat water for a shower. "I want my students to be energy literate and see the whole picture," she says. "I want them to see that energy equity and sustainability are very difficult challenges that aren't clear-cut, but are attainable."

Ewald's teaching prowess earned her the 2021 American Association of Petroleum Geologists Foundation Teacher of the Year Award. She regularly presents to teachers at state and national conferences like the Earth Educators Rendezvous and Conference for the Advancement of Science Teaching. "I love being pushed out of my comfort zone," she says, "and I want to help teachers reimagine their roles as ambassadors of earth science."

Ultimately, students across Texas are the ones who benefit most. "Ms. Ewald's model of reading the material, discussing it and doing something hands-on really helped me internalize what she was teaching," says former student Selin Yavuzcan, now a psychology and neuroscience major planning a career in forensic psychology. "She teaches like her students are intelligent thinkers who can understand the complexities — because we are and we do." ■

RE-ENGINEERING A LIFE

***Channy Soeur (BSPE '84)** escaped Cambodian tyrant Pol Pot's killing fields by 24 hours — a blip in geologic time but a life-altering moment in his own history.*

Nearly fatally wounded by a grenade while guarding his high school at age 15, Soeur spent two months in the hospital before enlisting in the Cambodian Navy in the fight against Pot's Khmer Rouge army. On the eve of the Khmer Rouge's declaration of victory, Soeur fled with more than 700 others by ship to Thailand, Malaysia and eventually the Philippines. He was 20.

While Pol Pot and his henchmen began a genocide that would ultimately claim the lives of two million Cambodians, including his family, Soeur immigrated to Fort Indiantown Gap, Pennsylvania, in 1975 as one of the first refugees admitted under the Indochina Migration and Refugee Assistance Act. He brought nothing with him except the clothes on his back and a vocabulary of three English words: yes, no and OK. With assistance from local nonprofits, he settled in Providence, Rhode Island, and got a job scrubbing dishes at a seafood buffet near his boarding house.

> "I REMEMBER CRYING AFTER MY FIRST NIGHT ON THE JOB. I HAD BEEN ON MY FEET FOR OVER 12 HOURS WITHOUT A BREAK. I HAD NO FAMILY OR FRIENDS TO GO HOME TO, AND I REALIZED AT THAT MOMENT JUST HOW HARD IT WOULD BE TO PUT MY LIFE BACK TOGETHER."

But he did it, eventually taking a second job at a coffee factory, earning his GED and enrolling in community college engineering classes before moving to Austin to start work on his BS in petroleum engineering. After graduating, he took a job as a computer graphic technician for the City of Austin and worked his way up over the next decade and a half to assistant director and deputy director of two city departments. In 2001, he left his job with the city and founded CAS Consulting and Services out of his garage.

Today, CAS has more than 30 employees and offices in five cities. The civil engineering firm specializes in the development, rehabilitation and expansion of urban water and wastewater systems, watershed management, and transportation systems. Soeur and his teams have worked on projects including the City of Austin's Waller Creek Tunnel project; San Antonio's largest-ever wastewater tunnel, called the W6 Interceptor; and San Francisco's Biosolids Digester Facilities Project, which will modernize the city's existing treatment plants and help them better withstand earthquakes and sea-level rise.

"Fluid mechanics, physical chemistry, thermodynamics — all those classes made it pretty straightforward to use my petroleum engineering degree to do civil projects," he says. "But my ticket to ride was all the modeling and simulations, the differential equations and linear algebra. Being able to write the programs to develop accurate models gave me a tremendous amount of confidence."

Some sage and time-tested advice from his former professor **Larry Lake** also came in handy: "Think forward, think backwards and never give up until you solve the problem." ■

OLD WORLD, NEW WORLD
From top: Soeur on the balcony of his Providence apartment in 1975; intricate carvings on a Cambodian temple; Soeur at his first City of Austin job as a computer graphic technician.

A LESSON LEARNED AT UT AUSTIN

“Think forward, think backwards and never give up until you solve the problem.”

HAPPY HOUR SUMMER

After more than a yearlong hiatus due to COVID-19, UT PGE alumni in Austin, Dallas and Houston reconnected at happy hours hosted by each city's young alumni chapter in June and July. Though the spread of the Delta variant derailed further summer gatherings, more events are in the works. Bookmark pge.utexas.edu/connect/alumni-events for the latest schedule.

DISTINGUISHED ALUMNI HONORED ON CAMPUS

The Hildebrand Department recognized five alumni at its annual Distinguished Alumni ceremony and dinner held on campus Nov. 12 in the Engineering Education and Research Center atrium. The event, which began in 2010, recognizes educators, company executives, technological innovators and astute entrepreneurs with unmatched industry expertise and a continued commitment to the UT PGE community.

CONGRATULATIONS TO THIS YEAR'S RECIPIENTS!

DISTINGUISHED ALUMNI

WILLIAM FINDLEY
BSPE '47
(1922–2018)

PAUL BOMMER
BSPE '76, MSPE '77,
PHD '79

GENE SHEPHERD
BSPE '81, MBA '86

NICK STEINSBERGER
BSPE '87

RISING STAR

MARIYA TOWNSWICK
BSPE '08

Visit bit.ly/da2021pge
TO READ MORE ABOUT THE HONOREES AND SEE PICTURES FROM THE EVENT.

ALUMNI JOIN ADVISORY COMMITTEE

Nine alumni began terms in August on UT PGE's External Advisory Committee (EAC), which is made up of oil and gas industry leaders who consult with faculty and staff to enhance teaching excellence and recruitment efforts. In turn, faculty members inform the EAC about current industry-related thinking in academia.

> "WE ARE THRILLED TO HAVE THESE INDIVIDUALS JOIN THE COMMITTEE. WE KNOW THEY WILL BRING INVALUABLE EXPERTISE AND ADVOCACY TO THE DEPARTMENT."
>
> **—Sara Hernando, Senior Alumni and Constituent Relations Coordinator**

WELCOME TO THE NEWEST UT PGE EAC MEMBERS:

JASON BROWN
Upstream Recruiting Advisor, ExxonMobil

ERIC DAVIS
Global Completions Chief, ConocoPhillips

JOSEPH FU
Senior Reservoir Engineer, Pioneer Natural Resources

DUNCAN FORD
General Manager, Occidental

RE KENEBREW
Global Account Manager, Reservoir Performance, Schlumberger

SCOTT LISTIAK
Chief Production Engineer, EOG

GORDON POSPISIL
Development Advisor, Liberty Resources

YOSHI PRADHAN
Senior Reservoir Engineer, Endeavor Energy Resources

PEGGY RIJKEN
Chapter Manager, Geomechanics, Chevron

FAMILY TIES

NINA STAVISKI (BSPE '21)

Native Floridian **Nina Staviski (BSPE '21)** came to UT PGE thanks to a little sibling rivalry. She first visited the Forty Acres after her older brother, **Nick Staviski (BSPE '18)**, enrolled as a petroleum engineer. After falling in love with Austin and the campus and sitting in on one of his engineering classes, she decided the close-knit UT PGE community was a good fit for her, too. "I figured, if he could do it, I could, too — and probably better," she laughs.

These days, Nina and Nick work just a few miles apart in Houston. She's at Lambda Energy and he's at ConocoPhillips. She got the job at Lambda after a hiring manager there found her through the "Hire a UT PE" section of the department's website. With three Chevron internships and a slew of student organization leadership positions on her resume, she was a prime candidate.

> "THE DEPARTMENT TOLD US FROM DAY ONE EXACTLY HOW TO SET OURSELVES UP FOR SUCCESS. GO TO EXPO EVERY YEAR, GET AN INTERNSHIP EVERY SUMMER AND GET INVOLVED IN STUDENT ORGS. I KNEW EXACTLY WHAT TO DO."

Even learning virtually for the last three months of her junior year and almost the entirety of her senior year thanks to the COVID-19 pandemic didn't slow her down. The intro videos Professor **Carlos Torres-Verdin** filmed to music in his backyard before his recorded lectures, the thoughtful questions Professor of Practice **Brian Sullivan** asked to engage students in oil and gas law, Associate Professor **David DiCarlo**'s thermodynamics jokes — "the faculty really tried to connect with us and make sure we understood the material," Staviski says.

As special events coordinator for Women in Petroleum and Geosystems Engineering, she, too, had to pivot to a virtual environment. Instead of in-person picnics and faculty teas, she organized Zoom workouts, a candle-making class, a painting demo, Netflix movie nights, Valentine care packages and more throughout the year. Now, she's reaping the rewards of the connections she helped foster. "I knew all 70 of the students I graduated with," she says. "Before the pandemic, we studied in the Caudle Lounge together, served on student boards and traded interview tips; now, we're still in touch, still networking and trying to help each other. As big as the industry is, it feels pretty small." ■

LA STORY

HAMZAH MOIN (BSPE '20) & DEVIKA MANISH KUMAR (BSPE '20)

When Hurricane Ida smashed through Louisiana in August, it left a million people without power. As they tended to felled trees and destroyed homes, a new problem emerged — no more fuel to power vehicles and generators. That's when **Hamzah Moin (BSPE '20)** and fellow volunteers with the nonprofit Fuel Relief Fund (FRF) deployed to the state.

Over the next 12 days, Moin and FRF volunteers delivered more than 30,000 gallons of fuel. They filled 100-gallon bladders and drove street by street looking for those who needed gas. Once large tankers arrived — four in total — they worked long days topping off the tanks of anyone who could get to their base camp.

"As we drove around, we saw huge trees that the winds had ripped the leaves right off of, and piles of wood instead of houses," says Moin, who is currently working on his master's degree in computer science. "Some of the houses that did make it through still had tarps on their roofs from Hurricane Laura last year. It was surreal."

Moin got involved with FRF thanks to **Devika Manish Kumar (BSPE '20)**, who discovered the nonprofit online and has been a volunteer since February. "As a petroleum engineer, I know all about upstream production," she says, "but I wanted to know more about the downstream part of the cycle, where oil and gas gets to the customer."

Or doesn't, as the case may be. "It's easy to take it for granted — you assume your tank of gas is going to be full," says Manish Kumar, a former reservoir engineer at Shell who now works at EDF Renewables in San Diego. "But infrastructure is often damaged in disasters. Ordinary people can't get fuel, and agencies trying to help can't get fuel either."

Last April, she helped create an informational video about FRF for other humanitarian organizations attending a virtual event hosted by the World Food Programme's Logistics Cluster. Then, she and Moin spent the summer working on a deployment rubric to guide FRF leaders as they made decisions about which disasters they could respond to most effectively and safely.

Enter Ida. As Manish Kumar and Moin learned of flooded refineries, destroyed gas stations and widespread power outages, they knew FRF could help. "Those of us from the Gulf Coast, we have oil and gas in our backyard and assume it's always going to be there," says Manish Kumar. "It's easy to forget that our infrastructure can be vulnerable and fragile."

> THAT'S A LESSON MOIN, WHO EMIGRATED FROM PAKISTAN IN 2014, UNDERSTANDS WELL. "I'VE ALWAYS WANTED A CAREER IN ENERGY BECAUSE I KNOW FIRSTHAND WHAT HAPPENS WHEN YOU DON'T HAVE IT."

To learn more about FRF, visit fuelrelieffund.org

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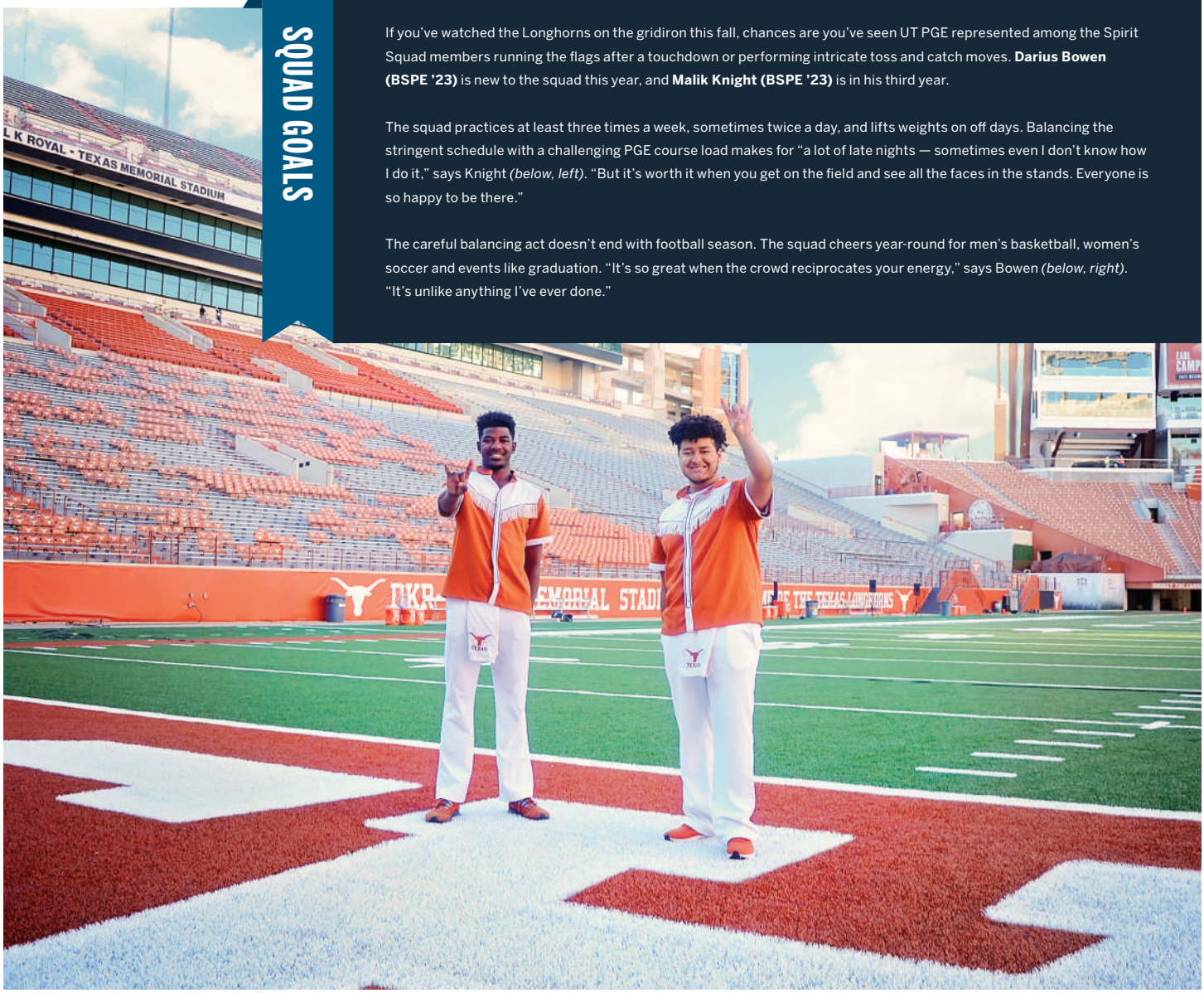
SQUAD GOALS

If you've watched the Longhorns on the gridiron this fall, chances are you've seen UT PGE represented among the Spirit Squad members running the flags after a touchdown or performing intricate toss and catch moves. **Darius Bowen (BSPE '23)** is new to the squad this year, and **Malik Knight (BSPE '23)** is in his third year.

The squad practices at least three times a week, sometimes twice a day, and lifts weights on off days. Balancing the stringent schedule with a challenging PGE course load makes for "a lot of late nights — sometimes even I don't know how I do it," says Knight *(below, left)*. "But it's worth it when you get on the field and see all the faces in the stands. Everyone is so happy to be there."

The careful balancing act doesn't end with football season. The squad cheers year-round for men's basketball, women's soccer and events like graduation. "It's so great when the crowd reciprocates your energy," says Bowen *(below, right)*. "It's unlike anything I've ever done."



STAY CONNECTED @UT_PGE