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

# ENERGY·ONE

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## ABOUT **ENERGY ONE**

The University of Texas at Austin Hildebrand Department of Petroleum and Geosystems Engineering publishes stories and news about innovative research, student excellence, alumni accomplishments and leadership annually in magazine format.

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# *Creating a* SUSTAINABLE ENERGY FUTURE

Sustainability is the cover story for our issue this year. We live in a world that is going in many different directions with respect to energy. In an attempt to mitigate the negative effects of climate change, states and countries are adopting policies to reduce carbon emissions. Increased usage of wind, solar, and electric vehicles are some of the solutions that are proposed to achieve the "greening" of energy.

At the same time, the United States has experienced an incredible resurgence of oil and gas production (Texas oil production is up by a factor of 5), energy demand worldwide is continually growing (China and India have each averaged annual energy consumption growth rates of four percent or more over the past decade), and there are still many people around the world living in energy poverty. Fossil fuels account for 85 percent of total energy consumption worldwide, with world oil consumption reaching 100 million bbls/day and natural gas 70 million BOE/day.

Reconciling the world's need for oil and gas as a reliable and cost-effective energy source and the desire to minimize the environmental impact of energy consumption presents a grand challenge to society. At UT Austin, the students and faculty are engaging each other in meaningful conversations and research on how to address oil and gas production issues around land, water, and air.

In closing, I want to state how proud I am of the accomplishments of all the Hildebrand Department students, faculty, staff and alumni over this past year. It is an honor and joy to serve the department as chair as I get to visit with alumni and friends all over the world. As a professor, the opportunity to engage with and guide our exceptional students is a great reward. As you will read inside, I love teaching so much that Dr. Hilary Olson and I recently spent a month in Norway, living and studying energy with 20 first-year students.

*Hook 'Em and Enjoy Reading!*

**Jon E. Olson,** *Department Chair*

*Lois K. & Richard D. Folger Leadership Chair*
*Frank W. Jessen Professor*

# *A Deep Dive with* MATTHEW WILLENBRING

*UT PGE sat down for a conversation with first-year petroleum engineering undergraduate student Matthew Willenbring, who transferred into the major this fall after spending a year in undergraduate studies. Originally from Westlake, Texas, home to several Olympic swimmers, Willenbring came to UT Austin for the prestige of the academic and swimming programs.*

*In 2019, he was a Big 12 swimming champion in the 400 free relay and he qualified for the NCAA Championships. He is wise beyond his years in managing his athletic career as well as his petroleum engineering studies. Learn more about what he has discovered when facing hardships and what excites him most about petroleum engineering.*

### *How did you become passionate about swimming?*

Originally, swimming was being able to hang out with friends after school but it quickly turned into a sport that I grew to love. My favorite part about swimming is the ability to race. There is nothing else like putting your whole heart into something all at once. It allowed me to express my competitive side and, at the same time, showed me that hard work really does pay off.

### *How do you balance academics and athletics?*

In the beginning, I was worried about how I would potentially be able to achieve my goals in the pool and the classroom. However, the support that both the athletic and academic departments offer allows me to take full advantage of the opportunities that I have been given. In addition to all the tutors and extra office hours offered, past engineers on my team have taught me how to manage all the missed class days and follow our coach's golden rule: "school is No. 1, swimming is 1a." Finally, this would never be possible without the support from my professors and their commitment to my success in both my studies and swimming.

### *What inspired you to major in petroleum engineering?*

Only recently did I consider internally transferring into petroleum engineering in the Cockrell School of Engineering. My initial inclination of petroleum engineering being a "niche education" was soon changed after researching the subject. I was surprised by the different amount of skills that would be taught in this major — from the actual math and science, all the way to programming and even the business side of energy. I look forward to seeing how all of these different fields fit together in the real market, and how I can play a part in it.

### *Why did you select UT Austin as the place to swim and study?*

For me, I knew that I would be going to UT Austin as soon as I took my first trip here. I fell in love with the culture, not only with my new team and coaches, but also the campus and city as a whole. I was originally worried about being too close to home, but after my first year, I am glad I decided to stay close in Austin. Going to UT Austin has given me the perfect balance between individuality and familiarity.

### *What are the biggest successes of your athletic career?*

It is really hard to pinpoint any specific time or race as one of the standout points in my career. Although swimming is mostly an individual sport, I have felt most accomplished after being a part of a team. I first learned this after I was able to participate in the USA Junior World Team in 2017. I loved the idea of having a whole group who has your back and to be swimming for something more than just myself. This feeling is even more evident when swimming for Texas, and I can't wait for the next three years.

### *What hardships have you faced and what lessons have you learned throughout your athletic and academic journeys?*

Being both an athlete and an aspiring engineer, I have learned how to fail very well. More so than academics, sports have many mountains and valleys that manifest in the forms of best times, injuries, illnesses, and a lot of training questions. Through these experiences, I have learned how to separate the things that are not in my control as well as my identity from my success or failure. Although I love both swimming and learning, I am so much more than just a student-athlete at UT Austin.

### *What excites you most about being a petroleum engineering student?*

I am excited to start learning about all of the different skills and fields that go into becoming a petroleum engineer, but I am most looking forward to all of the new people I will meet. After being accepted into the program, I was pleasantly surprised to find the major is actually small and close-knit. I had new friendships start at the First-year Fall Retreat and I can't wait to continue building relationships throughout the rest of the semester. I am extremely close with the swimming community at UT Austin, so I can't wait to do the same with my new engineering family.

### *How has athletics made you a better student?*

The most difficult part about doing a high-level sport while trying to pursue an education is separating the two. Through many years of practice, I have learned to not worry about swimming when I am at school, and not worry about school when I am swimming. This has allowed me to be the best I can be in both endeavors without any distractions. That being said, swimming has taught me the true meaning of hard work. Whether it be a final exam or end-of-the-year meet, the work you put in leading up to that point always determines the end result.

# *The* FULBRIGHT SCHOLARS

Moises Velasco Lozano and Eduardo Maldonado Cruz both grew up in rural regions in the southern part of Mexico near the Pacific Ocean. Not being known for its oil and gas production, the journey to petroleum engineering was unlikely for both Velasco and Maldonado particularly since they did not know each other until college. With a deep passion for learning and a drive to succeed as well as some chance encounters along the way, Velasco and Maldonado were led to each pursue a doctoral degree in petroleum engineering in the Hildebrand Department as prestigious Fulbright-Garcia Robles Scholars.

## *The Early Years*

Living in small cities of Oaxaca in Mexico, Velasco and Maldonado were raised with only the necessities like water and electricity — they did not have access to supermarkets or universities. For Maldonado, being raised in a town of only about 200 people with extreme poverty, he said he quickly learned about what was important in life.

"Being close to family and traditions are what matter most," Maldonado said. "You don't have many opportunities, but you do your best in everything and always try to be better. That philosophy was the premise for all my future decisions."

Velasco did not have a clear path to receiving a college degree as neither of his parents received advanced degrees. They were committed to growing crops on the farm. "Despite not having the higher education experience, both my parents always supported my studies and wanted to give me that opportunity," Velasco said. "I get my work ethic and drive to be successful from them."

Maldonado was fortunate to have his mom and dad be his elementary school teachers, who taught him to read at an early age. Maldonado describes attending elementary school as "magic." He spent many hours in the school library immersed in books on technology. One day, while in the library, he clearly remembers spotting a petroleum engineering book on the shelf.

"The images in the book were impressive because I never imagined a platform could exist in the middle of the sea," Maldonado said. "Beyond seeing astronauts in space, an offshore rig was the coolest thing I had ever seen – at that moment I fell in love with technology and the environment."

Velasco discovered petroleum engineering in a less traditional place – the soccer field. He attended a soccer match in his hometown and began talking with a man on the sidelines who worked as a chemist for an oil and gas company in Mexico. This immediately sparked Velasco's interest so he began an online investigation into the energy field.

"I discovered that Mexico is an important oil country and I found out how we play a strong role in researching petroleum engineering," Velasco said. "The professionals in this discipline are doing something risky but also rewarding. I loved that the topic included a lot of math too as that is my favorite subject."

Despite years of not being able to attend classes due to teacher strikes, Maldonado made a commitment to himself to continue reading and studying. By the time he entered high school he knew he wanted to study either engineering or earth sciences. While in high school he spent a lot of time looking at potential majors and his interests led him to petroleum engineering.

"I remember specifically reading about the petroleum engineering major and I thought 'yes this is definitely for me,'" Maldonado said. "I also recall watching the movie "Armageddon" as a kid and being inspired by the drillers – I later learned that the story is not too accurate, but it was exciting when I was younger."

Both Maldonado and Velasco set their sights on attending the National Autonomous University of Mexico (UNAM), the highest-rated university in the country according to U.S. News & World Report. Maldonado knew he had significant work to do since he did not have a strong educational background. He asked two of his high school teachers for their support, and they agreed. He would go to their offices and practice calculus for two to three hours after school each day. With persistence, they were both accepted into UNAM's petroleum engineering program.

When Maldonado and Velasco first arrived in Mexico City, they did not know each other. They eventually met within their program, but said they were not friends at first. Then an opportunity to participate in a contest sponsored by Schlumberger came up and they figured they would be stronger together. Maldonado and Velasco were right – their team took first place in the competition.

"Working together on this project solidified our passion for petroleum engineering," Maldonado said. "That win was a big motivator for us to continue our studies, and it was important for our overall development."

## *The Fulbright Experience*

After graduating UNAM with BS and MS degrees in petroleum engineering, both Maldonado and Velasco went to work for private companies in the oil and gas sector for about two years before coming to the realization that they wanted to take the next step in furthering their education – pursuing a PhD. Both Velasco and Maldonado applied for the prestigious Fulbright Scholarship in Mexico, which is given to a select number of students each year to participate in an international exchange program to pursue a graduate degree.

In 2018, Maldonado and Velasco both received the scholarship; they were the only two majoring in petroleum engineering. With the scholarship in hand, which covers all college

*Left to right: Eduardo Maldanado Cruz and Moises Velasco Lozano*

> *Beyond seeing astronauts in space, an offshore rig was the coolest thing I had ever seen – at that moment I fell in love with technology and the environment.*

costs, they applied and were accepted into six petroleum engineering programs across the United States. They both chose to be Longhorns due to the program's No. 1 ranking. With the UT PGE graduate population representing more than 20 countries, the program flourishes beyond its academic and research accolades – it also teaches students how to become compassionate global citizens.

"Fulbright is an amazing program that promotes the academic and cultural exchange between nations," Velasco said. "I am lucky to be part of a small group of people who have the chance to go abroad and to share my culture and learn new things. I questioned if I was the perfect person to do it and thought 'what if I fail, what if the language barrier is too high,' but in the end I realized this is a once-in-a-lifetime opportunity so I had to take it."

Velasco and Maldonado began attending UT PGE in the fall of 2018. Velasco is currently conducting reservoir simulation research with his supervisor, Dr. Matt Balhoff, and Maldonado is working on data analytics and machine learning with Dr. Michael Pyrcz. They plan to finalize their specific research topic over the next year. So far, the UT PGE academic experience has been positive for both Velasco and Maldonado.

"In addition to our supervisors, it is amazing that I get to work with professors like Drs. Pope and Lake — they are transmitting their wealth of knowledge to us through classes and research and are always happy to meet with us," Velasco said. "We also have great facilities to run our experiments and UT PGE has a demanding, but good, academic program."

Post-graduation Velasco's goal is to become a post-doctoral candidate and then eventually he wants to return to Mexico to become a professor in order to teach the next generation of engineers. Maldonado plans to continue seeing the world through the global industry.

"I want to work for an international company that will allow me to grow in my career, but I also want to support my home country by providing them with ideas on energy sustainability," Maldonado said. "I want to support the energy development of my country."

# LONGHORNS *Going* GLOBAL

This past summer, almost 20 UT PGE students and two faculty members participated in the department's Norway Maymester program - Engineering, Energy and the Environment.

The program, led by Drs. Jon and Hilary Olson, took place along the beautiful coastal city of Grimstad at the University of Agder from June 6 to July 6.

Norway is recognized for its strong history of offshore oil and gas development on the Norwegian Continental Shelf. The country is also a leader in alternative energy development. This course provided a unique experience for students to study energy and global culture amid the stunning natural beauty of the Norwegian fjords and mountains.

"Studying abroad in the beautiful country of Norway was a fantastic experience," said Yajing Lan, who participated in the program as a freshman. "Being in a foreign country challenged me to get out of my comfort zone, which I needed since it is essential for petroleum engineers to be good problem solvers. I feel like the opportunity helped me to grow up quickly and better understand my strengths."

More than 3,000 Longhorns study in 80 countries every year and UT Austin ranks second in the nation for the most students studying abroad, according to the Institute of International Education's latest annual report. With UT PGE's alumni working and living abroad population representing 60 countries, it is important for petroleum engineering students to participate in an international educational program during their time on the Forty Acres to gain experience with global companies.

The PGE 301 course explored the energy and environmental policies that have shaped Norway's development as one of the wealthiest nations as a result of its large oil and gas resources. During the program, students received UT PGE faculty mentorship and a valuable opportunity to network with members of the oil and gas industry and academia while gaining cross-cultural communication skills.

The program included field trips to Stavanger, considered the Houston of Europe, and cultural activities in Oslo. Students also visited several company sites, including Baker Hughes GE, National Oilwell Varco (NOV), and ConocoPhillips, during the course to see state-of-the-art equipment and training facilities.

During the visit to ConocoPhillips, students went to the company's real-time operations center. Entering the room, the students saw a sea of screens that monitor ConocoPhillips' rigs in the North Sea. The faculty and students were able to observe all the data streaming in from the rigs to gain an understanding of the industry's sophisticated technological environment.

"The corporate and university visits highlighted to our students the dedication to building a high-tech oil and gas industry," Jon Olson said. "They worked in mixed and virtual reality settings with gaming technology and had the opportunity to program robots, which will make energy recovery safer and more efficient."

The students were also able to witness the broad application of oil and gas technology. Olson said one company showed him and the students a downhole tool that could possibly be used to convert sea water into fresh water for communities in need.

Since there was strong interest and positive feedback from the inaugural UT PGE Norway study abroad program, the department will host another PGE 301 class in Norway next summer.

"This is a once-in-a-lifetime opportunity for our students," Jon Olson said. "The program provides our students with a leg up on their future careers and I believe it makes them better engineers and citizens."

# *Training* DATA SCIENTISTS

*Dr. Michael Pyrcz*

According to Forbes, the worldwide big data market is projected to grow from $42 billion in 2018 to $103 billion in 2027 and more than 150 zettabytes (150 trillion gigabytes) of data will need analysis by 2025. UT PGE associate professor Michael Pyrcz, who joined UT PGE last year after spending more than a decade in industry, is excited about training the next generation of data scientists who will be able to solve the oil and gas industry's technology challenges. Putting his passion into practice, Pyrcz launched a student program in the fall of 2019 on energy analytics.

The program is a part of the Freshmen Research Initiative (FRI) housed in the UT Austin College of Natural Sciences. Now in its 15th year, about 1,000 first-year students participate in the FRI program with 35 students enrolled specifically in Pyrcz's energy analytics class. It is taught primarily by assistant professor of practice Jesse Pisel, who was previously a data scientist at the Wyoming State Geological Survey.

"Let's get students doing innovative research from day one," Pyrcz said. "It is important to be developing scientists with a broad range of knowledge in data analytics. We are teaching methods for any type of spatial/environmental problem – students can use it in space, in the subsurface, or on the surface with trees or water."

Pyrcz's program is unique in that he is the first Cockrell School of Engineering faculty member to exclusively lead a FRI program in the College of Natural Sciences and it is the first to be supported by a corporate partner – ConocoPhillips. In addition to the FRI, Pyrcz will also be leading a practicum section of the newly launched Inventor's Program. It is designed to provide entrepreneurial opportunities on the UT Austin campus to students enrolled in STEM majors.

> *"The oil and natural gas industry is rapidly innovating and utilizing leading-edge data science techniques to find, develop and produce hydrocarbon resources more effectively."*
>
> *- ConocoPhillips Chief Technology Officer Gregory P. (Greg) Leveille.*

"The oil and natural gas industry is rapidly innovating and utilizing leading-edge data science techniques to find, develop and produce hydrocarbon resources more effectively," said ConocoPhillips Chief Technology Officer Gregory P. (Greg) Leveille. "ConocoPhillips' relationship with The University of Texas has been a rich source of talent for us and we are delighted to support the data science program. Programs like this one strengthen students' skill sets by preparing them to enter industry already experienced in data science techniques."

To ensure the students are ready to hit the ground running in their careers, the class provides experiential learning opportunities on technical topics such as data analytics, geostatistics, and machine learning. In addition, the plan after the first year is to have the students who participated in the program return to serve as mentors to the next class.

"Our hope for this initiative is to have students who remain engaged in data science research throughout their four years on campus," Pyrcz said. "There is an incredible amount of opportunity in this field right now – data-driven methods are impacting every scientific and engineering field."

# BIG IDEA:

## ENGINEERED WATER *to* IMPROVE EOR

The U.S. Department of Energy (DOE) is investing $8 million in the Hildebrand Department's engineering research at The University of Texas at Austin that aims to create a more efficient process for recovering oil from naturally fractured reservoirs using engineered water. Water flooding is currently the cheapest and safest method, but also one of the least efficient in naturally fractured reservoirs. Finding new ways to make water-based enhanced oil recovery (EOR) more efficient and effective will help safeguard U.S. energy independence into the future.

Led by Kishore Mohanty, a professor in the Hildebrand Department and director of the UT Center for Petroleum and Geosystems Engineering, the research team, which also includes two other Co-PIs from the department, associate professor Michael Pyrcz and assistant professor Wen Song, is investigating the efficiency of EOR techniques in fractured reservoirs that are injected with water engineered with ionic modifications, surfactants, and nanoparticles.

They believe that by making slight changes to water composition, they can improve its capacity to stick to carbonate minerals, thereby helping the water to be absorbed and easing the process of expelling the oil from the matrix. The UT PGE team will field-test the new technology in a West Texas naturally fractured oil-wet carbonate reservoir.

There are a number of different EOR techniques currently used by industry, with gas and thermal recovery being the most common. Injecting water into an oil reservoir remains one of the most economical methods, but it does not yield efficient returns in fractured carbonates, in some cases recovering as little as 20 percent of what is projected to be in place.

"Only around 20 percent of oil can be reached successfully in naturally fractured reservoirs using current water-flooding methods, meaning we leave more than three-quarters behind," Mohanty said. "We believe injecting water that is engineered with ionic and chemical modifications will improve oil recovery efficiencies from fractured carbonates and lead to the discovery of even more energy in West Texas and beyond."

Mohanty is a leading global authority in EOR techniques and is regularly called upon by national and international energy producers for his expertise. The DOE Office of Fossil Energy recruited the Texas Engineer as part of its basin-specific research strategy focused on increasing ultimate recovery and operational efficiency.

This $8 million, four-year investment is part of a wider national DOE program known as the Advanced Technologies for Enhanced Oil Recovery initiative, which will provide federal funding to five research and development projects across the U.S. at a total cost of $39.9 million.

# ENERGY SUSTAINABILITY

*In the five different scenarios presented in the 2019 BP Energy Outlook report, oil and gas account for at least half of the energy mix that will be used in 2040. With the continued global need for oil and gas, Drs. Mukul Sharma, Hugh Daigle and David DiCarlo believe it is critical to continue tackling and finding innovative solutions to current sustainability challenges for water, land, and air.*

*Left to right: Drs. David DiCarlo, Hugh Daigle, Mukul Sharma*

*Being conscious of the environmental impact is part of our social license to operate as responsible stewards of our resources.*

The UT PGE professors' goals are to help protect the environment, while providing industry and society with economic benefits. They are also passionate about providing the next generation of petroleum engineers with the robust skills needed to address the hydrocarbon questions of tomorrow. While the phrase "energy sustainability" is often connected to renewable energy resources, these professors see tremendous opportunities for oil and gas to become a more sustainable resource through conservation and efficiency.

## WATER

With the shale boom taking off a little over a decade ago, the Permian Basin, which is the largest shale play in the U.S., has ramped up both its water usage and the volumes of water produced. According to an article in the San Antonio Express-News, shale wells are each using around 10 million gallons of water or about 15 Olympic-sized swimming pools – more than double the amount a few years ago.

Sharma's goal is to reduce the amount of water currently being used per barrel of equivalent oil produced. He and his team of researchers are focusing on four main areas for water sustainability, which include: improved oil recovery from existing horizontal wells, non-aqueous fluids for fracturing (ex. carbon dioxide, foams, etc.), water reuse and recycling, and safe water injection and disposal.

His group has been involved in several field pilot tests for huff-n-puff gas injection for improved oil recovery, using gases with different compositions, pressures, and soak times. "For water reuse and recycling, we are researching methods for making produced water suitable for fracturing through the use of novel friction reducers and membranes," Sharma said.

The intent of Sharma's water injection and disposal research is to discover best practices that would mitigate induced seismicity challenges. While Sharma says the industry has done a good job of reducing the impact of shale oil and gas development, he believes continuing to improve operations will be key for future production.

"Being conscious of the environmental impact is part of our social license to operate as responsible stewards of our resources," Sharma said.

## LAND

With the industry producing more oil, a continued challenge is getting the resource to market. Transporting petroleum by truck or rail are two viable options, but they can have safety concerns such as vehicular fatalities and explosions. The other option is through pipelines, which Daigle says is ideal.

"Pipelines are a lot safer than trucks or trains, but they are not without their problems, so we are looking into how to make pipelines safer for the public and the environment," Daigle said.

His research project is focused on detecting any anomalies in the pipeline that might be indicative of structural integrity issues, including corrosion or someone tampering with the pipelines. The goal of the project is to improve the early detection of those types of events.

"We should be able to detect the leaks before they are actually leaks," Daigle said. "The way it is done now, you can monitor a pipeline with a drone that enables crews to see discoloration on the ground, but by the time you see the issue it is too late."

His project, which is a part of the Hildebrand Grand Challenge Seed Grant program, is still in its infancy. Currently, he is proposing to use fiber optic cables that would be installed in the pipeline to continuously monitor its activity. His team wants to take large continuous streams of data and pass it through a machine learning algorithm that can separate out normal signals from anomalous activity. Daigle says he anticipates the findings will be able to tell him the difference between winds blowing across the pipeline and an actual signal of corrosion that could eventually lead to a leak.

He is also working on getting a sustainability consortium off the ground. He is optimistic that these initial projects will give the initiative positive traction by building its industry and government partners.

"Like EOR, sustainability is an area where we can take the lead among other universities," Daigle said. "It is not an area where we have typically done research, but we have the resources to be successful."

# AIR

DiCarlo, an associate professor, is focusing his research around gas flaring. According to a report from the Norwegian research firm Rystad Energy, the estimated volumes of methane from natural gas burned off or vented into the atmosphere averaged 663 million cubic feet per day in the second quarter of 2019, which is more than triple the amount of emissions from just two years ago. DiCarlo says there is not a simple solution to the problem, but he hopes by reframing challenges and bringing key people together, they will contribute, particularly in West Texas, to minimizing emissions.

DiCarlo says protecting the environment and economic benefits are not mutually exclusive. He cites Prudhoe Bay, which is the largest reservoir in North America, as a notable example of when regulations had a positive impact on both the atmosphere and the industry.

"When production began in Prudhoe Bay, the regulators told the operators that they could not flare," DiCarlo said. "With this knowledge, the industry decided to reinject the gas into the wells. Through the physics of displacement, reinjecting the gas ended up helping the industry significantly by going from producing 30 percent of the oil to about 70 or 80 percent."

However, different engineering is involved, in West Texas. DiCarlo says the reservoirs are not shaped the same way in that region. He says there are several potential solutions for the Permian Basin.

"One option is storing the gas in depleted reservoirs while the pipelines are being built," DiCarlo said. "I am working with an undergraduate research assistant on finding the cost-benefit analysis on gas storage in the Permian."

In addition, DiCarlo is inviting scientific and regulatory experts to the Hildebrand Department this fall for a gas flaring workshop. The goal is to tackle the emissions problem by outlining solutions seen in the research and having a larger discussion with the industry.

"There are significant opportunities to develop better systems that will greatly reduce gas waste," DiCarlo said. "It is a precious resource — we want to add value to it so people can power their homes and we can ship it overseas. I think now is the time to correct gas flaring."

# *The* ENERGY DRIVER

*Gary L. Thomas (B.S. PE 1972) is one of the Hildebrand Department's alumni whose leadership revolutionized the oil and gas industry by helping the U.S. become a top energy producer. Due to his success, he is making a commitment to ensure future engineers will be equipped with the knowledge and skills to power the world. In 2021, the Cockrell School of Engineering will open the Gary L. Thomas Energy Engineering Building, a 183,000-square-foot hub for energy education and research. In this Q&A, Thomas shares the significant moments in his oil and gas career, why he is passionate about collecting cars, and his advice for current students.*

# Q&A

**Q Who has had the most significant impact on your life?**

A I go back to the incredible impact my parents had on me. I had tremendous respect for my dad. He was from a family of 11 during the Great Depression. In order to help feed all the kids, he had to drop out of school in sixth grade and he never had an opportunity to return. He was a WWII veteran, who worked in the oil and gas industry for 42 years. I learned about the value of hard work from my father. My mom taught us the importance of perseverance. She was the valedictorian of her class, but she never had the opportunity to go to college, so it was her dream to see her children go. All three of us attended UT Austin on scholarship.

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**Q You had an impressive almost 50-year oil and gas career. What were your greatest successes and challenges?**

A monumental moment in my career was leaving Apache and going to work for a small, independent that was quite aggressive — EOG Resources. Another significant time in my career was in 1999, when EOG was facing a lot of turmoil. The stabilizing factor was Forrest E. Hoglund becoming the CEO of the company. He is someone I deeply admire for his integrity and high expectations. He established the strong culture of EOG, which exists today. In the beginning of his leadership, it was challenging because EOG had high debt and it was still a trying time with prices. However, we were able to drill our way out of debt as the industry's most active driller. With that said, we were also able to identify that we would not grow at a rate necessary for Wall Street to recognize us — we knew we had to be innovative.

We understood some horizontal drilling was starting in Canada, so I went there and visited with various operators. In the mid-1990s, we began drilling horizontal wells in West Texas just to learn the techniques and try to advance the completion technology. EOG entered the Barnett Shale in the mid-2000s and from there we were off to the races in the other shale plays. It was great for EOG — the company is now producing 600 million barrels of oil annually and is one of the largest crude oil producers in the country.

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**Q What do you miss most about the industry after retiring in Dec. 2018?**

A I miss the people the most. After working for over 40 years at EOG, and having the close interaction of the senior management and the employees, I have a lot of great contacts. There is not a week that goes by where my former colleagues do not text or call me. Several times a month they will even come see me. I stay in close contact with my EOG family — the caliber of the company's people is what made it so successful.

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**Q How did UT PGE prepare you for your successful career?**

A I would say the remarkable professors. They wanted us to think as problem solvers. This way when you are in the real-world, you are excited about the difficulties because you look at them as opportunities and as challenges. In the oil and gas industry we have had quite a number of challenges and opportunities.

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**Q Why did you make a strong investment now in the new Energy Engineering Building? What impact do you hope it will have on students and the industry?**

A There were three things that influenced me to give back. First, I was so fortunate that I received a scholarship that encouraged me to go to UT Austin. Second, being a petroleum engineer in these times inspires me — it is all about the need for energy, which fuels the world. Lastly, I was blessed to be able to work for a company with tremendous people who were able to advance technology and grow the company and its value. From that, I was rewarded as a shareholder. I thought a lot about the right thing to do, and it felt like the answer was returning a portion of my good fortune to The University of Texas.

In addition, I am very moved by the young engineers that we have been fortunate enough to hire. EOG only started hiring engineers out of college about 10 years ago, but that really took EOG to the next level. A lot of the things we are doing in industry are not in textbooks — it is all new innovation, so they came in without preconceived ideas and with a can-do attitude for experimentation and making change. The first asset in a company is the leadership and the people, and the second is the technology. The way students are taught today is quite different from when I was in school. With the way buildings are designed now, they serve as tools for education and facilitators of interdisciplinary learning.

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**Q You have one of the most significant private collections of Ford cars in the country. What about the cars inspires you? How have they shaped you?**

A It is interesting how it started. Right after graduation, I was at a Unocal training program in Oklahoma. About two weeks into the program, a gentleman at the gas plant told me about a sports car in a barn a few miles down the road. I walked across the field, propped open the barn door and saw a red '57 Thunderbird sitting in the dust. I immediately figured out who owned the farm and I called everyone in the phone book with that last name. I finally got in touch with the owner who said he wanted $1,200 for it. I could not afford that price so he recommended I talk with the president of the local bank, who he went to high school with, and ask for a loan. I secured the loan, making the Thunderbird my first collector car — I bought it only two weeks after college graduation.

Collecting cars is a passion of mine because of the high performance of the Ford vehicles and I think it is important to preserve the history of the early performance cars. I also like the idea of anticipating what people will want in the future — that translates into the oil and gas industry.

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**Q What advice would you give to our current petroleum engineering students?**

A I would say have patience and be willing to volunteer for any challenging problem. Always be looking for how you can improve the operation. Finally, communicate your interests. Your manager may not know you want to go from completions to drilling, so let it be known. That way, when an opportunity comes up, they will think about you.

# *A Decade of Celebrating* DISTINGUISHED ALUMNI

For nearly 90 years, UT PGE has educated leaders who have shaped the oil and gas industry. A decade ago, the department created the Distinguished Alumni Ceremony to honor the best among them — company executives, technological innovators and shrewd entrepreneurs — who display an extraordinary commitment to the industry and the Hildebrand Department community. In the program's 10th year, it recognized five Distinguished Alumni and one Rising Star for their outstanding contributions.

*UT PGE's Distinguished Alumni Ceremony Committee announced the 2019 award recipients:*

## DISTINGUISHED ALUMNI

**LAURIE "LARRY" W. FOLMAR*** *(B.S. PE 1947)*
**JAMES "JIM" M. BARNUM** *(B.S. PE 1978)*
**JAMES H. DUPREE** *(M.S. PE 1983)*
**CHARLES "CHIP" JOHN RIMER** *(B.S. PE 1983)*
**MICHAEL J. MINAROVIC** *(B.S. PE 1987)*

## RISING STAR

**JOHN H. CAMPBELL III** *(B.S. PE 2009)*

These honorees exemplify excellence by leading successful production efforts around the world for some of the largest oil and gas corporations or serving as co-founders of thriving energy companies. Collectively, their insights and bold ideas have forever changed the industry. They have also supported the Hildebrand Department, providing UT PGE students with the tools to become the next generation of successful oil and gas leaders. The Distinguished Alumni Class of 2019 joins an elite community of industry legends, including Ernest Cockrell Jr., Jeffery D. Hildebrand, Gary L. Thomas, and W.A. "Tex" Moncrief Jr.

***The 10th annual event took place on Friday, Nov. 8 at the Four Seasons Hotel in Austin. Visit bit.ly/PGEDA19 to learn more about the event and read the honorees' bios.***

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# *Excellence & Accolades*

## *Three Faculty Received Four International Awards*

The Society of Petroleum Engineers (SPE) and the American Institute of Mining, Metallurgical and Petroleum Engineering (AIME) awarded three Hildebrand Department professors with four 2019 international awards for their significant contributions to the field of petroleum engineering.

Professor Carlos Torres-Verdin received the prestigious SPE Anthony F. Lucas Gold Medal, which honors distinguished achievement in the identification and development of new technology and concepts that will enhance the process of finding or producing petroleum.

Associate professor Zoya Heidari garnered two international awards. One accolade was the SPE Distinguished Member Award, which acknowledges members who have attained eminence in the petroleum industry or the academic community, or who have made significant contributions to SPE. In addition, her paper "Directional-Permeability Assessment in Formations with Complex Pore Geometry with a New Nuclear-Magnetic-Resonance-Based Permeability Model" earned the AIME Rossiter W. Raymond Memorial Award. This honor recognizes the best paper published by AIME in a given period where the lead author is a member under 35 years of age.

Jon Olson, chair and professor, is the winner of the SPE International Completions Optimization and Technology Award. The accolade recognizes outstanding achievement or contributions to the advancement of petroleum engineering in the area of completions optimization and technology.

## *Alumna Named a Distinguished Cockrell School Graduate*

Karen Hagedorn (B.S. PE 1986), who is an asset manager at ExxonMobil, won the 2019 Distinguished Engineering Graduate Award, which is the highest honor that the Cockrell School bestows on its alumni. Including this year's five honorees, 286 alumni have been selected for this award. It recognizes the alumni as highly respected professionals, dedicated engineers, and supporters of higher education.

## *Sercan Gul Wins a SPWLA International Award*

The Society of Petrophysics and Well Log Analysts (SPWLA) awarded UT PGE graduate student Sercan Gul, who is supervised by Dr. Eric van Oort, with first place in the oral PhD category of the SPWLA 2019 Student Presentation Contest. The 60th annual symposium was held June 15-19 in The Woodlands, Texas.

## *Zoya Heidari Honored with Arie van Weelden Award*

Associate professor Zoya Heidari won the European Association of Geoscientists and Engineers (EAGE) Arie van Weelden Award. The award is presented to a member of EAGE who has made a highly significant contribution to one or more of the disciplines in the association and qualifies as an EAGE Young Professional.

## *Professor Receives Recognition for his Op-Ed*

The UT Austin Teresa Lozano Long Institute for Latin American Studies (LLILAS) Benson Mexico Center selected professor Carlos Torres-Verdin's op-ed "Texas and Mexico have a perfect partnership opportunity," featured in the Dallas Morning News and the Houston Chronicle, as one of the winners of the Mexico Center Award. This recognition was created by LLILAS to elevate the profile of UT Austin as a leading institution in relation to Mexico-related scholarship, research, and ideas while furthering its international mission.

## *Michael Pyrcz to Serve as AAPG Distinguished Lecturer*

The American Association of Petroleum Geologists (AAPG) Distinguished Lecture Committee chooses lecturers in six topical areas each year. This year, the committee added a new topic, Machine Learning and Artificial Intelligence in Petroleum Geoscience, and extended an invitation to associate professor Michael Pyrcz to serve as the first speaker representing that topic for the 2019-2020 lecture series. Pyrcz will record a lecture and then spend five days touring university departments as well as presenting one to three lectures at regional AAPG conferences.

To read more about the accolades visit: ***pge.utexas.edu/news***

# CAMERON CADE

> *I love the diversity of the department – it has a lot of students and faculty who come from countries all over the globe to study and teach petroleum engineering.*

Petroleum engineering was not in recent UT PGE graduate Cameron Cade's (B.S. PE '19) initial plan. Her intention was to study mechanical engineering, but upon admission into UT Austin she was offered a spot in the UT PGE program. Once she was in, Cade never looked back as she found something irreplaceable that solidified her decision to pursue an education in the Hildebrand Department: community.

"I found such an amazing, inspirational group of people in petroleum engineering," Cade said. "I love the diversity of the department – it has a lot of students and faculty who come from countries all over the globe to study and teach petroleum engineering. It enabled me to learn so many new things not only from my classes, but also from my classmates."

The two most influential aspects of Cade's four-year tenure in the department were a combination of the university's diverse community and the student organization activities. While on campus, Cade wasted no time participating in many UT Austin student organizations. Most notably, Cade became involved in WPGE, Women in Petroleum and Geosystems Engineering, eventually serving as the president of the chapter.

"Being chosen as president of WPGE was a defining moment for me," Cade said. "It showcased the trust my fellow officers and members had in me to continue making important decisions that would enable the organization to strategically grow and strengthen."

Throughout her time with WPGE, she learned valuable lessons and became closer to her classmates who shared the same passions, including continuing to empower fellow women engineers. One of her favorite WPGE networking events was a tea party at Dr. Hilary Olson's house.


"All the WPGE members had an opportunity to socialize with our female professors and teaching assistants in a more fun and relaxed environment than in the classroom," Cade said.

Along with extracurricular activities, Cade distinguished herself with her motivational drive towards career success. As a participant in the inaugural Alumni-in-Residence program, Cade met Scott Sheffield, the CEO of Pioneer Natural Resources. She describes him as a "genuine individual who inspires the students to see the power of dedication and hard work." This was a unique opportunity for Cade, as she began working with Pioneer Natural Resources in a full-time position this July. She is currently serving as a rotational engineer in Midland, Texas.

Cade has previous field experience from internships, so she is excited to be back out in the field again. Even more so, she is optimistic about the changes that are occurring in the oil and gas industry.

"Many companies are taking initiatives to be more inclusive and diverse, and I have seen firsthand at UT how helpful that is for a forward-thinking work environment," Cade said. "I hope to remain involved in organizations that help women in the oil and gas industry."

Cade advises current petroleum engineering students to stay involved and make sincere friends. "Be as helpful as you can to your classmates, because the oil and gas industry is small — you never know when you will need help in the future."

# UDDHAV MARWAHA

Born in Bangalore, India and raised in Dubai before moving to the U.S. at the age of seven, Uddhav Marwaha (BS PE '19) originally discovered engineering by working with an offshore energy company. He broadly learned about project management and engineering disciplines, but it was not until meeting UT PGE professors during a campus visit that he realized the Hildebrand Department was where he belonged on the Forty Acres. For Marwaha, UT Austin gave him a chance to learn about engineering, the geopolitical landscape, and the role of energy markets.

In his first year at UT Austin, Marwaha joined Texas Undergraduate Computational Finance (UCF), a student-run quantitative finance fund exploring trading strategies, where he later served as its director. Involvement in UCF marked the beginning of his path to exploring market behavior and its impacts on an international scale. At the end of his freshman year, Marwaha participated in an internship with Anadarko. While his work focused on production engineering, it was there that his curiosity about financial markets materialized.

"The big question that first hooked me during that internship was, 'what am I getting for my barrel,'" Marwaha said. "By asking the people around me the simple question of what drives value in a market, I found my interests in geopolitics, physical markets, and emerging market development."

Throughout his undergraduate tenure, his passions only continued to grow particularly through his undergraduate fellowship with UT Austin's Clements Center for National Security. The program hosted prestigous fellows, so students could hear from and engage with influential government and policy leaders, including a former CIA director, a U.S. ambassador, and a European energy minister. They taught Marwaha about understanding the challenges in foreign policy and the beneficial aspects of the market.

During the fellowship, Marwaha worked with Stratfor — an American geopolitical intelligence platform and publisher founded in Austin. He took on projects around geopolitical forecasting for public and private sector clients, which enabled him to learn about a variety of topics including trade sanctions and market-based innovations. Most recently, Marwaha worked on creating political and economic tools to aid Venezuela's approach to resolving its humanitarian crisis following a shift in power.

Now, Marwaha is heading to Chicago to work at BP's trading group, Integrated Supply and Trading, in their Trader Development Program where he will spend his first year on the gasoline trading team. He aims to build knowledge and experience within the global energy trading space and extend that into tackling corruption in emerging nations by making markets more open and competitive.

He leaves his fellow Longhorns and future UT PGE students with this piece of advice, "Be curious; try all the flavors of ice cream." Marwaha first heard this quote from a recruiter during his internship at Anadarko.

"The recruiter said, 'if you only try vanilla ice cream, then it will be your favorite. But until you have experienced chocolate or strawberry, you will not be able to truly know which one you enjoy the most.'" For Marwaha, this meant thinking outside the box when it came to his career. He wanted to take a non-traditional route that tied together his passion of petroleum engineering with international trade and development.

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# *Teaching* TEACHERS

UT Austin's Petroleum Science & Technology Institute, held July 22-26, introduced almost 20 STEM high school teachers from across Texas to the latest technological innovations in the oil and gas industry. An initiative within the Hildebrand Department's strategic plan, the five-day summer institute was led by Dr. Hilary Olson and numerous faculty from the department. They presented hands-on activities, laboratory work, and discussion sessions as well as made visits to an interactive museum and industry. Each teacher is expected to give a half-day workshop on energy to at least 20 more teachers in his or her own school district.

An increased technical understanding of petroleum science, engineering, and technology provides teachers with the foundation needed to better instruct, inspire, and mentor their students for potential future careers in the energy industry.