the Lamp

An ExxonMobil publication

Focus on the future

- Introducing Darren Woods
- The new biofuels

Plus

- **Meet our newest directors**
- **Stories from Hurricane Harvey**
- **Rotterdam refinery project**

2017 – No. 1

Energy Factor
By ExxonMobil

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Research scientist Kelsey McNeely is part of a team developing oil from algae

the Lamp

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In this issue

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The Lamp bids farewell

Editor's note: With this issue, *The Lamp* will conclude publication, ending a nearly 100-year run. During that time, we published close to 420 issues and more than 12,600 pages. This article chronicles the history of *The Lamp* and highlights the array of other communication choices now available to readers.

ExxonMobil predecessor Standard Oil faced a number of challenges in the early years of the 20th century, including the 1911 breakup, falling oil production, soaring petroleum product demand and growing international competition. But there were also internal issues that demanded the attention of management.

The company recognized the need for better employee relations and major reforms in wages, benefits and job conditions. So it embarked on a major overhaul of personnel policies. A cornerstone of those changes, which set new standards for American industry, was a commitment to greater communication between the company and its employees.

Walter Teagle, who was appointed president of Standard Oil in 1917 at the age of 39, was brought in to oversee these changes. Teagle, at the time one of the youngest men to run a large American corporation, was accessible and caring, but also intense and hard-driving. He immediately set about restructuring Standard Oil and strengthening its employee benefits with enhanced retirement and stock-purchase programs. He elevated the role of public and media relations and, as part of that effort, developed a new in-house magazine in 1918 called *The Lamp*, appointing himself de facto editor.

Lighting the way

As president, Teagle had other critical obligations, primarily expanding the company's worldwide exploration and production programs. He turned the day-to-day editorship of *The Lamp* over to Northrup Clarey, a former financial editor of *The New York Times*. But Teagle kept a hand in directing the publication even from afar, suggesting articles, approving copy and submitting future story ideas.

The first issue of the publication confirmed its mission and reason for its name: "It is hoped that its rays will reach everyone interested directly or indirectly in the fortunes of the company – and that it will light the way to an understanding of one another and that no shadows of misconception nor suspicion will endure in its presence."

From its onset, *The Lamp* contained detailed articles about Standard Oil's operations, financial performance, management viewpoints, corporate milestones, employee activities and accomplishments. It also presented broader educational features about the petroleum industry, such as how explorers find oil and how gasoline prices are determined. There were even "travelogue" stories about the search for oil with titles like "Adventures in the upper Amazon" and "Hunting for oil in Saudi Arabia," which transported readers to new and exciting regions of the world.

Interest in the magazine quickly grew beyond its employee base to include investors, stockbrokers, students, financial writers and other external groups. Requests for the publication grew to such a level that by the early 1920s, the company actually sold subscriptions for $1.00 a year. At that time, *The Lamp* was printed and mailed to subscribers every other month.

Editorial refocus

As Standard's worldwide organization grew, the corporation organized itself along affiliate lines and established stand-alone companies in the various countries where

 Story by Bob Davis Photography by Doug Mangold

it operated. Employee communication – the initial editorial mission of *The Lamp* – became the responsibility of each affiliate. Additional specialized magazines proliferated among the companies highlighting particular aspects of the energy industry. These included *Oilways*, which showcased the company's motor oil and lubricants business; *Search* magazine, highlighting exploration; *Chemsphere* magazine, profiling the company's global chemical business; and numerous affiliate publications such as Esso Australia's *Connection* magazine.

Beginning in the 1940s, *The Lamp* editors retooled the magazine away from its strictly internal focus to include external audiences, particularly shareholders. theLamp

New avenues

Just as *The Lamp* originated nearly 100 years ago due to Standard Oil's understanding of the importance for better communications, ExxonMobil understands that readers today consume news very differently. Most receive their information on laptops and mobile devices, and they want stories and business news faster and more frequently than a print publication can deliver. Digital delivery also offers significant cost efficiencies.

We encourage readers to keep up to date on our corporate news by using a number of news sources available and accessible online:

▸ **Energy Factor** (energyfactor.com) features company news, in-depth reviews of science and technology highlights, employee profiles, and perspectives on the energy industry. You can sign up to receive regular newsletters.

▸ Join us on **Facebook**, **Twitter** and **LinkedIn** to be part of our online community, stay connected to the company, and share content with family and friends.

▸ Our **website** (exxonmobil.com) is an in-depth source for news, publications and important shareholder information. Sign up for email alerts to learn whenever the company issues news releases or announcements.

▸ You can also find ExxonMobil on **YouTube** and in the **App Store** on your mobile devices.

The Lamp brought the stories of ExxonMobil people and places to life for nearly a century. Now, Energy Factor and our other digital tools will continue to highlight the achievements of our corporation, and the many talents and accomplishments of our employees around the world.

Energy Factor By ExxonMobil

A winning attitude

The Lamp profiled Darren Woods when he became senior vice president in 2015. In his earlier interview, he described his upbringing and his experience in the Downstream and Chemical organizations. Now that Woods has been named chairman and CEO, we wanted to check back in and ask what challenges and opportunities he sees in his new role.

Congratulations on your election! How's it going?
It's been an extraordinary first year so far. I'm fortunate to be part of a very talented and capable team. I feel we're off to a strong start. We're building on a legacy of leadership from the many talented people who have made our company great over the past 135 years. It's a real honor to follow in their footsteps. We're very focused on the future, working to grow our competitive advantage, becoming more efficient, running our business even more effectively and creating greater shareholder value.

What experiences do you think prepared you for the top job?
One of ExxonMobil's many strengths is the way we develop our people. We offer them a diversity of career experiences that span the globe. We challenge them with big jobs and significant responsibilities early in their careers. We help people realize that they are capable of more than they think.

During my 25 years with the company, I've really benefited from that approach. I had the chance to work in a variety of roles across the Downstream companies, in Chemical, and at our Dallas headquarters. I've worked for great managers, who challenged me every step of the way. There's no better preparation for a role like this than a career at ExxonMobil.

You often speak of the importance of "winning." What exactly do you mean by that?
It starts with deciding what we're trying to do. Do we want to be among the best – or ***the*** best? Do we race to finish – or to win? Frankly, given the strength of our organization, the quality and capability of our people, and the competitive advantages we've built over decades, I'd be disappointed with anything other than a win. This means creating greater shareholder and stakeholder value than any of our competitors.

This requires more than just continuous improvement. It requires greater improvement, delivered faster, than any of the advances made by our competitors. It requires us to grow competitive advantage and fully leverage it in the areas that create the most value. It requires a clear strategy, owned by every level of the organization, for each sector in which we choose to compete. That is what we're focused on.

Chairman and CEO Darren W. Woods


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March 1, 2017
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Darren Woods visits the Baytown refinery

Photo by Pam Farmer

What challenges do you see ahead?

The world needs affordable energy to grow its economies and advance living standards. The world also needs to manage and protect its environment and natural resources. Society doesn't have the luxury of choosing one over the other. We have to tackle both.

At ExxonMobil, we play a vital role. The work we do every day is focused on these objectives. Lowering cost and improving productivity while minimizing our environmental footprint and the emissions from our operations and products is helping. But we have more to do. I'm confident that further advances will come with the research we're doing across a broad spectrum of technology opportunities.

Of course, we do this to generate greater shareholder and stakeholder value over the long term. In an increasingly competitive environment, with markets currently over-supplied, this is a significant challenge.

So what's the solution?

It starts with our people. I don't think there's any organization in the world with people more talented or capable than those at ExxonMobil. My job, along with the other leaders in the organization, is to empower and fully leverage this capability.

Technology is also critical. Advances in technology are allowing us to do things today that people thought weren't possible a decade ago. The industry has unlocked vast resources of oil and natural gas we had once thought out of reach. Industry innovation led to an energy revolution. This will happen again. Technology will ultimately play a role in unlocking solutions for most, if not all, of our challenges.

What opportunities out there make you the most excited?

I'm excited by opportunities across our entire portfolio. In the Downstream, we're investing in proprietary technology to increase the production of higher-value products and position our refineries as some of the most competitive in the world.

In Chemical, we're leveraging a host of organizational capabilities – from projects to sales – and technology advantages in processes and products to invest strategically in high-value, high-growth businesses.

In the Upstream, I'm excited about several of our new investments in Guyana, Mozambique and the Permian Basin here in the United States to name a few. All are world class. The Permian will enable us to take advantage of our integrated businesses, which span the value chain along the U.S. Gulf Coast.

Earlier this year, I announced our "Growing the Gulf" initiative, which is expanding manufacturing capacity to take advantage of abundant oil and natural gas from shale. All told, it's a $20 billion investment program spanning 11 projects over a 10-year period, and will create 45,000 jobs.

I'm also excited about our research and development program, which is exploring technologies to improve our business performance and help mitigate the risks of climate change. It's an exciting time for our industry and our company.

"Technology will ultimately play a role in unlocking solutions for most, if not all, of our challenges."

Chairman and CEO Darren W. Woods

What are your priorities as chairman and CEO?
My first priority is to ensure that all of us continue to live by and promote our company's values, including safety and integrity. I want us to build on our strong foundation of operational excellence and corporate citizenship. I want us to empower and fully leverage the talents and capabilities of our people.

Another priority of mine is for us to further differentiate the capabilities and performance of our technology organization and functional companies.

Finally, our priority must be to win – to beat our competition in creating shareholder and stakeholder value.

Early on as chairman and CEO, you've spoken out about climate change. Where are you on this issue?
It's an important issue, part of the dual challenge I talked about earlier. ExxonMobil is committed to helping address the challenge – and has been for years. We've been involved in climate research for almost 40 years. We've made significant contributions to the science and partnered with some of the world's leading scientific and research organizations, including the U.N. Intergovernmental Panel on Climate Change, Stanford University, MIT and others. We're reducing emissions in our operations. We're helping consumers reduce their emissions with improvements in our products. And we're investing in breakthrough technologies that could be game-changing, like biofuels and carbon capture and storage.

We recently joined the Climate Leadership Council, which supports a revenue-neutral carbon tax. We also support the Paris agreement. We have a lot of experience in the energy industry and a deep understanding of the available technologies. We can make a significant contribution.

As the world takes on this challenge, everyone will have to play a part – governments, the industry and consumers. We must also remember that some parts of the world are in desperate need of reliable, affordable energy. We have to meet this need as well.

Any final thoughts for readers of *The Lamp*?
Let me say, whether you're an employee, an annuitant or a shareholder of ExxonMobil, you're part of something big, and something important. The energy we produce is powering progress around the world. It's lifting billions of people out of poverty. It's enabling hundreds of millions to join the middle class. It's helping more people get the medical care, education and jobs they need. Our company has many exciting opportunities to continue to contribute to this progress. We also have exciting opportunities to address energy's impact on the environment. We've made great progress over the years. I'm optimistic that our research efforts will help unlock additional opportunities. I'm proud to be a part of all that we do, and I hope you are too. the Lamp

Darren Woods has held several roles in the Downstream and Chemical businesses, and in Investor Relations

Photo by Robert Seale

In their own words

Relentless winds. Nonstop rain. Epic flooding and destruction. Hurricane Harvey brought it all. ExxonMobil employees responded with resolve, perseverance and selfless inspiration. Here are a few of their stories.

The massive storm roared out of the darkness of the Gulf of Mexico at 10 p.m. on Friday, August 25, and slammed into South Texas with winds of more than 130 miles per hour. The hurricane leveled homes and businesses in Port Aransas and Rockport with a force likened by one resident to "a bomb blast going off."

After a brief foray inland, Harvey weakened, did an about-face, and tracked back over the warm waters of the Gulf. Now a tropical storm, it stalled over Houston for nearly five days, dropping upwards of 50 inches of rain in some areas and causing widespread catastrophic flooding.

Days before impact, ExxonMobil teams were preparing: shutting in production and evacuating crews from offshore platforms; assembling workers at its refining and chemical complexes in Baytown and Beaumont to shut down facilities safely; evaluating the effects of potentially idle pipelines and marketing terminals on gasoline and product supplies; and setting up emergency response and monitoring centers, human resource hotlines and recovery action plans after the storm passed.

When the rains began to fall and the waters began to rise, thousands of people – including hundreds of employees and their families – were forced from their homes, many of them given little time to gather what they could before evacuating.

We could fill the pages of this magazine with their accounts, because when an event like this occurs, it affects everyone, regardless of where you live, the position you have in the company or how long you have worked in your job. The stories here are a small example of the wider impact and response to the storm – the heroism of first responders and volunteers, the taking in of families in need, the rescuing of the suddenly homeless, the delivery of food and water to the hungry, and more.

There's a commonality to these stories that encompasses not only caring for one's immediate family, but also for the wider community. They also show an incredible dedication to helping the company get its operations

Hurricane Harvey dumped an estimated 19 trillion gallons of rain over southeast Texas – enough to fill a cube 2.6 miles wide by 2.6 miles long by 2.6 miles high

Harvey relief by the numbers

ExxonMobil donated much-needed cleaning supplies to help Texas Gulf Coast residents recover from devastating flooding brought on by Hurricane Harvey. Here is a summary of the items the company donated.

safely up and running again in order to supply energy to where it's needed. Pervading each of these accounts is the knowledge that when disaster strikes, none of us has to go it alone.

Steve Hart
Vice president global supply and transportation, Houston
"Throughout the entire organization, there was an urgency and a dedication. We had many employees suffering flood damage. But while the storm was still going on, we were working issues together over the phone. Only later did I learn that this person or that person had his or her house flood. You would have never known it on the phone. Their dedication is so high that there were times you had to tell them, 'Hey, go take care of yourself. We'll get someone else to cover until you get back.'

"Our people are not looking for accolades for what they do. They realize that their work will not be fully seen by the public, and they don't expect it would be. They know what they're doing is helping – helping their community, and helping by getting fuel to customers in a time of need."

Kristy McCarty
Environmental department lead, Beaumont complex
"During a shutdown, you can't skip steps. My role before, during and after the storm was to ensure that we compliantly and safely shut down. Our team was in constant contact with regulatory agencies. It was great to see people coming together as a team to solve problems, and how willing everyone was to make environmental compliance a priority."

Jimmy Smith
Process mechanical supervisor, Baytown complex
"Shutting down a refinery safely during a storm is crucial because with the winds and the rains and potential flooding, if you don't have the proper planning, you could have a significant impact on the environment, and to the safety of our people.

"The toughest part was seeing my fellow employees impacted. There were so many employees out there trying to take care of their homes and families. There was so much devastation out there."

Arce Sambilay
Console supervisor, Baytown complex
"Saturday night, I started my shift, and we were monitoring the radar. At 2 a.m., it started raining, and it never stopped. So we began to shut down the plant, and we went into live-in conditions. I was here for four more days as a live-in.

"I've lived in Baytown for 30 years, and I've never seen as much water on the roads in all that time. At the plant, everybody pitched in. You didn't have to ask people; they were there. There was never just one person working on just one thing.

"It was always at least two people or a team of people responding together. Everybody pitched in."

Reno Castillo
Instrumentation specialist, Baytown complex
"I wasn't able to get to the plant. My house has been here 30 years and has never flooded before. The only way in and out was by boat. But I did a lot of troubleshooting over the phone throughout the storm with my colleagues. A friend and I were helping in the neighborhood, and we came back to my place and tied up his boat in my driveway. I got a call and was actually sitting on my wet couch, and we worked through an issue.

"Every day, someone from the company would call and ask, 'Is your family OK? Do you have food? Do you have a place to stay? Do you need help at your house? Do you need gas, dehumidifiers, supplies?'

"And then, when the storm was over, they sent workers here to help tear out Sheetrock, insulation and flooring. It had been just me, my wife and son trying to get all that work done. Man, what a tremendous difference it made."

Richard Bowen
National account manager, Fuels, Lubes and Specialties Marketing, Houston
"After evacuating our home, I was safe in a relative's home and watching news coverage of the storm when the reporter in a boat turned down a familiar street – my street.

"That's when the reality of the situation began to set in. There was our house, on national television. We could see that we had suffered a devastating loss. We were numb.

"Then, without us even asking, help began to arrive. An ExxonMobil employee came with cleaning supplies. Then a professional remediation crew, arranged and paid for by ExxonMobil, arrived to clean out our house.

"During one of the most difficult times in our lives, the company was there for me. I am truly grateful and thankful for the assistance. It makes me even prouder to say that I work for ExxonMobil."

Steve Garcia
Safety coordinator, Baytown complex
"One of the things I saw personally was the way the community came together. I saw some of our firefighters from the refinery on TV going into a flooded subdivision and taking people out in their personal boats. It was like they were taking care of what had to be done outside the refinery, while we were taking care of what had to be done inside the refinery.

"Later, I personally participated in the transport of 2,000 pounds of food and a whole lot of water. I can't even remember how many loads we did."

Beaumont employees helped with the interior demolition at a co-worker's flood-damaged house

Joey and Laura Hanks spent many hours helping their neighbors and colleagues clean their homes

Dan Misko
Engineer, Beaumont complex
"The city's water-treatment facility was knocked out by the flood. So we got a team together to think through, 'How do we solve this problem?'

"We expanded to about 60 employees and contractors, and we quickly developed a solution: bring in temporary pumps and 600 feet of pipelines, and draw water from the river to the treatment plant. Roads into and out of the city were impassable, so we had to fix this with the people we had in Beaumont. It took all of us working together to secure the resources and materials to actually go out and do this. While we were working to get the treatment plant back,

Ryan Jarvis, exploration geoscientist, and his family assisted ExxonMobil retiree Gerry Lee and his wife Julie with recovery efforts at the couple's Sour Lake, Texas home

David Sistiva, construction area supervisor, received assistance from fellow employees

other teams were bringing in pallets of water and other essentials by helicopter.

"I was working a dual role – doing my job at the refinery while trying to get clean water back up and running to the city, which we did. The other thing the team did was secure the electrical infrastructure for the treatment facility. That was at risk of taking on water, and if it did, all of our efforts would be futile. It took us about eight hours to build a sandbag levee around the infrastructure to stop that from happening."

Byrd Reed
Mechanical craftsman, Baytown complex
"The 'Texas Strong' motto says it all. It means helping other people. Somebody gets a boat, somebody gets this, somebody gets that, and we show up and do what we have to do to get them out of harm's way.

"It's been a wonderful thing in a disastrous situation to see all of these people come together and say, 'Hey, I just want to help. No, it doesn't cost you anything. We just want to help.'"

Joey Hanks
Shift team lead, Baytown Olefins Plant
"When you pull up to the first house to help, and you see the homeowner looking just lost, that's when it becomes personal.

"One lady we helped was a school bus driver all her life who'd saved her money and had paid her mortgage off two months before Harvey struck. She lost everything. She didn't have flood insurance. And she said to me, 'What do I do?' And all you can do is to try to tell her that it will be OK.

"But when you see people at their lowest low, and you help them and see them smile by the end of the day, then you know you're doing your job."

Laura Hanks
Planning and scheduling first line supervisor, Baytown Technology and Engineering complex
"It became personal for me when I arrived at one house and realized that the owner was a retired ExxonMobil employee who'd been my mentor, and had actually helped me get hired by the company. After looking around his house, we both broke down.

"He was trying to be so strong for his wife and kids in the face of all the destruction. He'd held it in. He took me aside and told me everything they'd been through. I was his sounding board. Sometimes, that's all a person needs – a good hug and a good, 'I love you, we've got this.'"

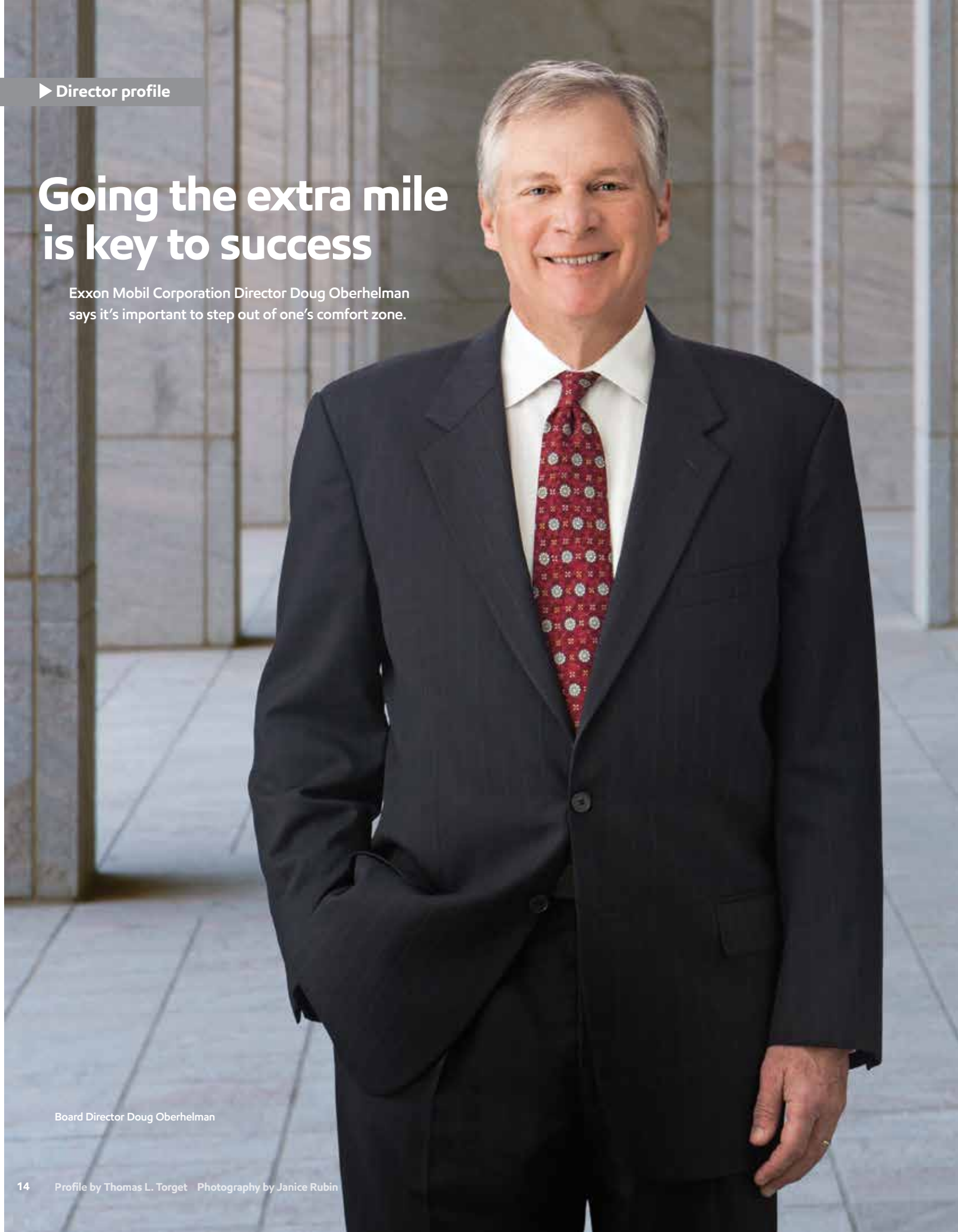
Ashley Alemayehu
Public and government affairs manager, Beaumont complex
"Like many other companies in the area, we were ready to step in to help when the City of Beaumont called. It was a true collaborative effort between the city and private sector to get water back on for residents.

"I was going back and forth between the refinery, the water plant and the city's emergency operations center, helping in whatever way I could. We have a long relationship with Beaumont, and I think it has strengthened even further." the Lamp

For more stories and photos from the storm, visit ExxonMobil's energyfactor.com

Going the extra mile is key to success

Exxon Mobil Corporation Director Doug Oberhelman says it's important to step out of one's comfort zone.



Board Director Doug Oberhelman

 Profile by Thomas L. Torget Photography by Janice Rubin

As a young boy growing up in Woodstock, Illinois, Doug Oberhelman enjoyed climbing onto the John Deere tractors that his father sold to area farmers. "As a kid, I never dreamed I'd spend my adult life working for Dad's competitor," says Oberhelman, retired chairman and chief executive of Illinois-based Caterpillar Inc. "My family didn't farm, but we lived out in the country. Dad would bring tractors home now and then and let me climb around on them, and I would pretend I was in a field somewhere. It was great fun."

Years later, Oberhelman studied finance at Millikin University in Decatur, Illinois, and planned for a career in the banking industry. "In my senior year, Caterpillar was interviewing on campus, and I learned they had an opening in their treasury department. The job sounded intriguing, so I signed on. That was more than 40 years ago, and I've only just recently retired."

Diverse career

It didn't take long for Oberhelman to realize that Caterpillar was where he wanted to build his career. "Each of my early assignments was great fun, and I was constantly learning," he says. "With Caterpillar's diverse and global operations, I knew I could have multiple careers without changing employers. That's an attribute that Caterpillar shares with ExxonMobil, which makes both companies great places to build a career."

Oberhelman's second assignment with Caterpillar had him trading foreign currencies worldwide. "The U.S. dollar had floated for just a few years, so it was an exciting time to be involved in the currency markets," he says. "I lived in Uruguay during the early 1980s, when much of South America had currency and debt troubles. The experience taught me what it takes for a business to survive in very tough economic conditions."

Later postings took Oberhelman to Florida, Canada and Japan. "I worked in Edmonton in 1986 after the oil-price collapse that brought tough times to western Canada," he says. "In Tokyo, I served as chief financial officer for a Caterpillar joint venture with a Japanese company. Every job taught me new skills and gave me great satisfaction. I've been very fortunate."

Positions of increasing responsibility culminated in Oberhelman's election as Caterpillar's chairman of the board and chief executive officer in 2010. He stepped down as CEO on Dec. 31, 2016, and was executive chairman until March 31, 2017.

In addition to serving as a director of Exxon Mobil Corporation, Oberhelman serves on the board of Peter Kiewit Sons Inc. He is a member of The Business Council and former chair of both the Business Roundtable and the National Association of Manufacturers. He serves as vice president of the Wetlands America Trust and is a director on the boards of the Max McGraw Wildlife Foundation and Intersect Illinois. He is also chairman of the board of trustees for the Easterseals Foundation of Central Illinois.

International trade

As a business leader, Oberhelman has seen many of the challenges that stem from several years of slow global economic growth. "The overriding business issue of the past decade has been the weak recovery from a deep recession," he says. "You see the effects worldwide. Government debt is rising to new levels. Some political leaders are now leaning away from trade, and that's worrisome because free trade is critical to a nation's economic growth."

Oberhelman believes restructuring the U.S. tax code is a key step in generating economic vitality. "When I joined Caterpillar in 1975, the U.S. corporate tax rate was lower than most other countries," he says. "Now it's the highest, because other countries have lowered their rates to attract investment and create jobs. We must do the same if we want to continue to be internationally competitive."

Another area that needs improvement is education, Oberhelman says. "This country spends record amounts on education, but it seems like our results don't get any better. Asian countries take a different approach to education, and they're turning out a much higher percentage of engineers and scientists than we are. Because today's economy is so global, the United States cannot be an island separated from the rest of the world. To compete successfully, we must have a workforce that can out-compete all others."

Accelerated change

Oberhelman expects the pace of change brought by new technologies to accelerate in the years ahead. "Today, we have more technology in our cars, homes and businesses than ever before, and the pace of change is going to accelerate," he says. "Our lives are going to become better in ways we can't even imagine. We live in exciting times."

What advice would he offer young professionals entering the workforce today? "Look at any business, and you'll find that the most successful people are those who go the extra mile," he says. "They get out of their comfort zone. They do everything possible to ensure the success of their work group and their company. By helping their team succeed, they ensure their own success." the Lamp

Work hard and know who you are

Angela Braly, ExxonMobil director, says the steps to success are simple but demanding.

Hard-wired for hard work, Angela Braly earned her finance degree at Texas Tech in just three years. Sometimes she wonders if that was a mistake.

"I thought college was fun!" she says. "I may have shortchanged myself by skipping that fourth year."

Mistake or not, Braly's academic achievement was an early indicator of what she would accomplish in the coming years.

After graduation, she attended Southern Methodist University's Dedman School of Law.

"I always knew I wanted a career in business," she says, "but when you study finance, you learn about countless rules and regulations. I wanted to better understand the 'why' behind them, so I decided to study law."

Lessons from a tragedy

One of five children, Braly grew up in Richardson, Texas, a suburb of Dallas. "I had a happy childhood and loving parents," she says. "All of my siblings were active in school activities."

During her first year of college, Braly's father was killed in an automobile accident involving a drunk driver. "We were emotionally devastated," Braly says.

She especially remembers the tragedy's impact on her mother. "When my father died, she was suddenly responsible for every aspect of maintaining a home and raising five children. It made a huge impression on me. I learned the importance of being able to take care of yourself and your family."

After graduating from law school, Braly practiced law in Fort Worth and later accepted an offer to be general counsel of St. Louis-based Anthem Blue Cross Blue Shield of Missouri, where she rose to the office of president and CEO.

WellPoint (now known as Anthem), which owned the Missouri company, called her to Indianapolis to be its general counsel and chief public affairs officer.

She served as WellPoint's president and CEO from 2007 to 2012, assuming the additional title of chairman in 2010.

Braly believes her experience as CEO is valuable for serving on the boards of ExxonMobil and three other major companies: Brookfield Asset Management Inc., Lowe's Companies Inc. and Procter & Gamble Co.

"CEOs and directors have some similar responsibilities," she says. "They must look at large issues such as strategy, risk and succession planning. But directors don't get involved in day-to-day operations. As the saying goes, 'Noses in, fingers out.'"

Joining ExxonMobil

One of the main reasons Braly accepted the invitation to stand for election to ExxonMobil's board was its well-known reputation.

"ExxonMobil is a leader in an industry the whole world depends on," she says. "Energy has been essential throughout history, and developing countries need access to affordable supplies if they are to achieve economic growth."

Braly also noted ExxonMobil's disciplined, consistent approach to safety. "It's such a key part of the culture," she says, "and I've been very impressed."

During a director visit in 2016, Braly toured ExxonMobil's mammoth Baytown, Texas, refining and petrochemical complex, one of the largest in the world. She met people who reinforced her impression of another ExxonMobil strength – the quality of its employees.

"The people I met were bright, engaged individuals of all ages and different educational backgrounds. I was struck by the fact that very young people are given big responsibilities early in their careers."

Empowering women

Braly refers to her demanding work on four boards as her "day job."

In addition, she is passionate about an innovative program she and two other women founded in 2015. The Policy Circle (www.thepolicycircle.org) aims to create a grassroots network for women to talk about public policy.

"Women are concerned and knowledgeable about policy issues," Braly says. "Unfortunately, they sometimes don't have the information or confidence they

 Profile by Bill Corporon Photography by Janice Rubin

Board Director Angela Braly

need to take an active public role in discussing and shaping those issues. The Policy Circle is designed to change that."

Groups of 10 to 20 women meet in an individual's home every other month. Members read a briefing paper on a selected issue, then get together for a discussion.

"Our ultimate purpose," Braly says, "is to empower women to have influence in their local communities and to promote policies that foster free enterprise and the values of freedom and liberty at all levels of government."

Steps to success

Braly is eager to counsel ambitious women and men seeking to rise in a large corporation. Her advice:

- Be committed to your work, and work hard.
- Take on challenging assignments. You may not always succeed, but you'll create opportunities for yourself.
- Do the right thing, and strive to do it right the first time. If you fall short, think about what you've learned. Put that knowledge to work next time.

Above all, she says: "Know who you are. If you don't, plenty of people will tell you who you should be." theLamp

For climate and energy solutions, it's a matter of scale

Dr. Susan Avery, noted atmospheric physicist, brings her pioneering career to the ExxonMobil board.

High up in the atmosphere, well beyond the reach of regular aircraft, the wind is always blowing.

Dr. Susan Avery, newly elected to the ExxonMobil board of directors, knows this lofty space well. As an atmospheric physicist, she led breakthrough research that continues to aid the world's understanding of the upper atmosphere.

"What goes on in the upper atmosphere 20 to 70 miles above the earth's surface impacts our lives below, and we're still learning about it," Avery says. "A lot of the circulation systems up there are coupled with weather systems in the lower atmosphere. Distortions caused by solar disturbances as well as atmospheric turbulence in the upper atmosphere can also impact satellite, navigation and radio communications, affecting power systems, energy distribution, GPSs and other vital communications."

Kitchen problem-solving

Avery's journey into pioneering atmospheric research began around the kitchen table at home in Michigan with her dad, an electrical engineer for Michigan Consolidated Gas Co.

"Understanding that math is the language of science and engineering, my dad insisted that my brother, sister and I know how to do 'story problems.' So Dad led us through exercises to find a mathematical solution. For example, if a storm is coming, producing a certain pressure change, what will the wind speed be? We each had definitely earned our stripes in disciplined thinking by the time we entered college."

Avery completed her undergraduate studies at Michigan State University, which her mom – one of the first women to receive a degree in bacteriology – dad, aunts and uncles, and sisters and cousins also attended. Upon graduation, she married James Avery, a computer science major, and they entered graduate school together at the University of Illinois. There, she discovered she disliked quantum mechanics but came to appreciate the value of interdisciplinary research and academics.

Science to opera

"I began to explore how I could use physics in another area of study. There was a fledgling atmospheric science program connected to the physics department, but it was also affiliated with the engineering school. Marvin Geller, who has become a leading atmospheric scientist, welcomed me in as my adviser. He encouraged me to think beyond conventional research and academic boundaries and use all of my talents fully."

Those talents included singing – and not just everyday singing. Avery performed in two operas, "Manon" and "The Merry Widow." She also sang in choirs and played the flute.

Bouncing off meteors

Avery's interdisciplinary journey continued after she received her Ph.D. in atmospheric physics. She joined the electrical engineering department at Illinois as an assistant professor. There, she pioneered using radar technology to measure winds in the upper atmosphere, particularly the little-understood transition zone between the ionized and nonionized regions.

"The technology involves bouncing radar signals off the ionized trails of tiny meteors that had burned up, and using the resulting Doppler shift [change in signal frequency] from the transmitter to the return signal to measure wind velocity," she explains.

In 1982, Avery received a fellowship from the National Science Foundation and National Oceanic and Atmospheric Administration (NOAA) to teach and continue her research at the University of Colorado. With seven institutes, the university was (and continues to be) an important center for advances in atmospheric and space science.

"The rich multidisciplinary environment – with atmospheric physicists, chemists, biologists, geologists, engineers and others working together – further shaped my future."

Avery's continuing research into her meteor radar technique and the need to test it at longer distances led to international partnerships with other scientists. She eventually discovered how to measure wind in the upper atmosphere in remote equatorial and polar regions with radar systems that were smaller, less expensive and required less maintenance. She and her team

Board Director Dr. Susan Avery

 Profile by Mike Long Photography by Janice Rubin

also licensed a meteor radar that could measure the lower and upper atmospheres simultaneously.

Social contract shift

In 1994, Avery became director of the Cooperative Institute for Research in Environmental Sciences (CIRES) at the University of Colorado. The institute, the largest of NOAA's cooperative institutes, includes more than 800 scientists, staff and students devoted to improving understanding of the earth and its environment. Its scientists produce an average of 500 peer-reviewed publications annually.

"At the time I became director, science's social contract with society had begun to shift from Cold War military defense to something much broader," she says. "Awareness of how science impacted everyday lives was evolving. Research organizations were beginning to respond accordingly, including greater efforts to expand scientific literacy. Among other efforts, we launched a program to improve K-12 science teaching and expose teachers to the scientific research environment.

"In addition, we developed a new center devoted to the interface of science with policy, as well as a new program on climate variability and change and its impact on western water. I am pleased that all of these initiatives are now part of the ongoing culture of CIRES – one that balances interaction with stakeholders with the need for science information."

From 2008 to 2015, Avery was president and director of the prestigious Woods Hole Oceanographic Institute in Massachusetts, where she continued to build public scientific awareness of the ocean and its connectivity to everyone.

The need for scale

At ExxonMobil, Avery looks forward to lending her science and engineering perspective. She is particularly interested in supporting ExxonMobil's leadership and the work that the company is doing to bring new technology solutions for climate and energy issues to scale, including carbon capture and sequestration and biofuels, so they can do the most good.

"Bringing solutions to scale is what the private sector can do best. Academia and nonprofits can make significant contributions, but they simply don't have the horsepower that the industry does."

Avery adds that there's also a key need for governments to return to funding basic science research, as they have done in the past.

"Governments have the resources that could generate the thousands of ideas from which a few will provide solutions. ExxonMobil is an industry leader in basic science research, but can't do it all," she says.

"There's no doubt that the best and timeliest solutions for climate and energy will come with industry, academia, environmental nonprofits and government all working together." the Lamp

Rotterdam refinery
harnesses technology and opportunity

New unit improves capabilities, creates new marketing channels and positions the Dutch plant for the future.

A "one team, one goal" approach is bringing about the safe, on-time completion of the hydrocracker expansion, according to Harro van de Rhee, refinery manager (right) and Rolando Garcia, project executive

ExxonMobil is advancing construction of a more than $1 billion hydrocracker expansion at its 190,000-barrel-a-day refinery in Rotterdam, Netherlands. To underline the significance of this project to the Dutch economy, Minister of Economic Affairs Henk Kamp broke ground on the project in June 2016. The new unit is on track for startup in late 2018 and for shipping product in early 2019.

The project is significant because it will increase the plant's ability to produce ultra-low sulfur diesel. It will also produce ExxonMobil EHC™ Group II base stocks on a large scale for the first time in Europe. This high-quality base stock is in demand in the lubricants industry, and helps reduce emissions and improve fuel economy and performance, among other benefits.

The Rotterdam activity is part of the company's focused investment to strengthen the global supply of high-quality base stocks, and complements other investments at its integrated facilities in Jurong (Singapore) and Baytown (United States).

"The European refining sector is a mature but highly competitive business," says Harro van de Rhee, Rotterdam refinery manager. "This project will enable us to upgrade lower-margin products to higher-value products. But in addition to greater operational flexibility, the hydrocracker also brings energy-efficiency gains. We are already one of the most energy-efficient plants in Europe. With this new unit and the application of our proprietary technology, we will further boost our energy efficiency by 5 percent."

Van de Rhee started his career at the Rotterdam refinery and has worked within refinery and chemical businesses in Europe and North America during his 26 years with ExxonMobil.

ExxonMobil has a long history of integrated operations in the area, and the refinery, a lubes blending plant and four chemical facilities are all located within the Port of Rotterdam. The refinery is ideally situated for the expansion with its deepwater access and proximity to European markets.

 Story by Bob Davis Photography by Danny Cornelissen

A massive crane lifts a 400-ton, 160-foot vacuum tower into place as part of the Rotterdam hydrocracker expansion project

"It makes a great deal of business sense to situate the expanded hydrocracker here in Rotterdam, and we are very proud of the commitment the company has made to our operations," van de Rhee says.

Milestones

Meanwhile, the site is safely buzzing with activity.

"We've already safely reached a number of major milestones," says Rolando Garcia, project executive for the Rotterdam hydrocracker. "Our heavy lifts are in place, including the positioning of three large reactors totaling 2,000 tons and a 400-ton, 160-foot-tall vacuum tower. We were also able to optimize cost, schedule and safety by pre-assembling pipe racks in Spain and transporting them to the construction site. A total of 19 modules are now stacked and in place, and the work is now transitioning to erection of steel and piping."

Everything about this project is big. The foundations for the unit span 20,000 cubic yards – the equivalent of filling the size of an American football field 12 feet deep with concrete. There are 3,500 tons of structural steel, which equals the weight of eight fully loaded 747 jetliners. Piping alone stretches more than 50 miles.

Garcia, who marks his 30th anniversary with ExxonMobil this year, believes that one of the biggest accomplishments of the project thus far is how the refinery is building a culture to integrate and embrace the lubes business and operation.

"There is a lot of collaboration on this project, ranging from refining and supply, research and engineering, and fuels and lubes in order to begin base stock production and sales. We knew that we had to create a greater awareness of what lubes production and sales involve. We're doing that by setting up a series of technical sessions and presentations by senior ExxonMobil marketing managers, as well as conducting a number of 'information fairs' with displays to introduce, prepare and ultimately make the whole organization ready for the new lubes operation here."

Van de Rhee emphasizes the importance of the close working relationship and alignment of the project construction team and the refining staff. This "one team, one goal" approach is working toward the safe, on-time completion of the hydrocracker project and also the seamless integration of the new lubes value chain into the overall Rotterdam operation.

"We know that our ultimate success, to a great extent, will be defined by how successful we've been at creating and fostering alignment between our various groups," van de Rhee says. "I'm pleased to say that I believe that we are accomplishing this goal, and there is a building excitement that you can feel here as we work together to prepare for the many new opportunities the project will open for us. This is preparing us for the future." the Lamp

Collaborating for success

Sylvie Houry has worked for ExxonMobil for 27 years, primarily in marketing positions in France, Italy and Belgium. For the past two years, she has been the business venture manager for the Rotterdam hydrocracker project.

"This will make us the first large-scale producer of Group II base stocks in Europe," Houry says. "These products are designed to meet evolving industry requirements such as new standards on engine lubricating oils to achieve better mileage and lower emissions. EHC™ products provide enhanced capabilities in a wide range of engine and industrial applications and have the potential to reduce supply-chain complexity. Our customers will be assured of worldwide supply availability, whether it's in the United States, Asia-Pacific or Europe.

"What's exciting for me about this project is working with so many different functions – crude supply, refining, blending, chemicals, the project team, research, marketing and, of course, our customers – to collaborate on the startup of this new endeavor. The communication and collaboration everyone has established are going to make this project a great success."

Excitement and pride surround Guyana development

The Liza discovery is among the largest in the past decade.

Members of the Liza Phase 1 team include (from left) Russell Carter, CT Khoo and Gina Dickerson

ExxonMobil has sanctioned the first phase of the Liza deepwater development 120 miles offshore the South American nation of Guyana. Phase 1 will develop approximately 450 million barrels of oil.

The Liza field is located in the 6.6 million acre Stabroek block, where the company has drilled a number of wells since the initial discovery in 2015 to support Liza field development. With additional discoveries in the Liza area and at Payara, Snoek and Turbot, the block is now estimated to contain between 2.3 billion and 2.8 billion oil-equivalent barrels.

Liza Phase 1 is expected to cost more than $4.4 billion, with startup slated for early 2020. The project involves the conversion of an oil tanker into a floating, production, storage and offloading (FPSO) vessel and four undersea drill centers with 17 wells, including eight production wells producing up to 120,000 barrels of oil a day. Water and gas injection will maximize oil recovery.

The undertaking is a global effort, involving multiple contractors and suppliers worldwide.

"Project activities are underway in more than a dozen countries now," says Gina Dickerson, senior project manager for Liza Phase 1. "I am confident that the team will bring all of the parts of the project together and be ready for the installation campaign offshore Guyana in 2019, before startup."

Pacesetter

"From the start, we set out to strike a balance between understanding the numerous risks and uncertainties and progressing the project quickly," says CT Khoo, Guyana project executive, who has been with the company for 35 years and has managed such major undertakings as liquefied natural gas (LNG) developments in Qatar.

"We decided on a phased, highly cost-efficient approach that targets the highest-quality reservoirs first, thus increasing our chance of success," Khoo says. "This approach will also give us information on the development of the rest of the field. In addition, we can apply our experience offshore Angola, Nigeria and Equatorial Guinea here."

The project team was put together one month after the initial discovery well – unusually fast for a development of this size and complexity. The exploration, development, production and drilling teams fast-tracked the project to a final investment decision within two years of discovery, and the prospect of first oil is in less than five years.

"I'm really proud of the team for accomplishing so much in a short time. We hope this project will be a pacesetter that people will look back on for key lessons on efficient and timely deepwater development, especially in the low-price environment we find ourselves in today," Khoo says.

Partnership and aspiration

ExxonMobil worked closely with partners Hess Guyana Exploration Ltd. and CNOOC Nexen Petroleum Guyana Ltd. to achieve full alignment on the development plan. The in-country team is also building a long-term, trusting relationship with the Guyanese government to gain its continuing confidence and support.

"Without an established oil and gas industry, everything was new to the government," says Rod Henson, Guyana lead country manager. "The intensive effort and due diligence they exercised on the review of our production license application and environmental impact assessment was impressive."

ExxonMobil and the Guyanese government are working together to realize the government's aspiration of maximizing benefit and creating lasting value from its petroleum resources. The company

Photo by Robert Seale

At the recent opening of the Guyana Business Development Centre in Georgetown, Minister of Natural Resources Raphael Trotman (left) and ExxonMobil's CT Khoo, Guyana project executive, discuss how the FPSO *Liza Destiny* will be built, and how it will function offshore Guyana

supports this effort with a three-pronged approach: developing the Guyanese workforce; working with local companies for the competitive supply of in-country goods and services; and making strategic investments to support health, education and infrastructure programs.

More than 400 Guyanese nationals are now employed in marine operations, catering, security, transportation, housing and other project support activities, as well as in the ExxonMobil office in the capital city of Georgetown. ExxonMobil and DAI Global LLC, an international development company, opened the Guyana Business Development Centre in July to promote the establishment and growth of small- and medium-size businesses in Guyana. An online supplier registration website has attracted 300 companies, 100 of which are Guyanese.

Destiny

ExxonMobil's Russell Carter, a 32-year-old operations technical coordinator for the Liza 1 project, was born in Guyana and left the country in 2003 to attend Pennsylvania State University. After graduating with a degree in mechanical engineering, ExxonMobil hired him in 2007. Following several jobs within the company, including a stint as a facilities engineer on offshore platforms in the Gulf of Mexico, he was tapped to become part of the Liza operations readiness team in 2016.

"These are exciting times for Guyana, and for me to be on a project that will potentially help my country gives me a great deal of pride," Carter says. "One of my career goals was to be involved in the startup of a large project in another country that can positively impact the lives of people for generations to come. It feels like destiny that it's now happening, and it's happening in the country where I was born." the Lamp

A wide aperture into the future

Top researchers focus on emerging energy technologies.

When wildcatter Edwin Drake drilled the first commercial oil well in 1859, striking oil some 69 feet below ground in Titusville, Pennsylvania, who could have imagined today's drilling platforms tapping oil 30,000 feet below the surface of the ocean?

But looking into the future is key to meeting the world's energy needs, which are expected to increase 25 percent by 2040. An ExxonMobil team of senior-level scientists, engineers, and research and development executives has dedicated themselves to imagining our energy future, evaluating technology research opportunities that range from improving today's energy efficiency to advancing the alternative energy sources of tomorrow.

"Technology is the lifeblood of this industry," says T.J. Wojnar Jr., vice president, Corporate Strategic Planning. "There have been significant breakthroughs over the entire evolution of energy, and ExxonMobil has been at the forefront of many of those. By 2040, the world will have more than 2 billion additional people who need access to energy, and the developing nations of today will want an efficient, effective and reliable energy supply."

Predicting the future

ExxonMobil looks at the energy landscape up to 2040 and beyond to understand the role resources and products will play, and how the entire energy landscape could evolve.

Wojnar says a key challenge to predicting the future is forecasting future technologies. "Technology developments are one of the key drivers of improvements in our standards of living and economic progress," he says. "So as we look to the future, we want to keep a sharp eye on technology developments that we think will improve lives and help provide new types of energy and improved ways of delivering energy."

A unique in-house team of more than 150 Ph.D.s in the Corporate Strategic Research organization tracks technology trends and alternate energy breakthroughs to assist Wojnar's planning group in its development of ExxonMobil's

Technology photos by Robert Seale

Photo by Janice Rubin

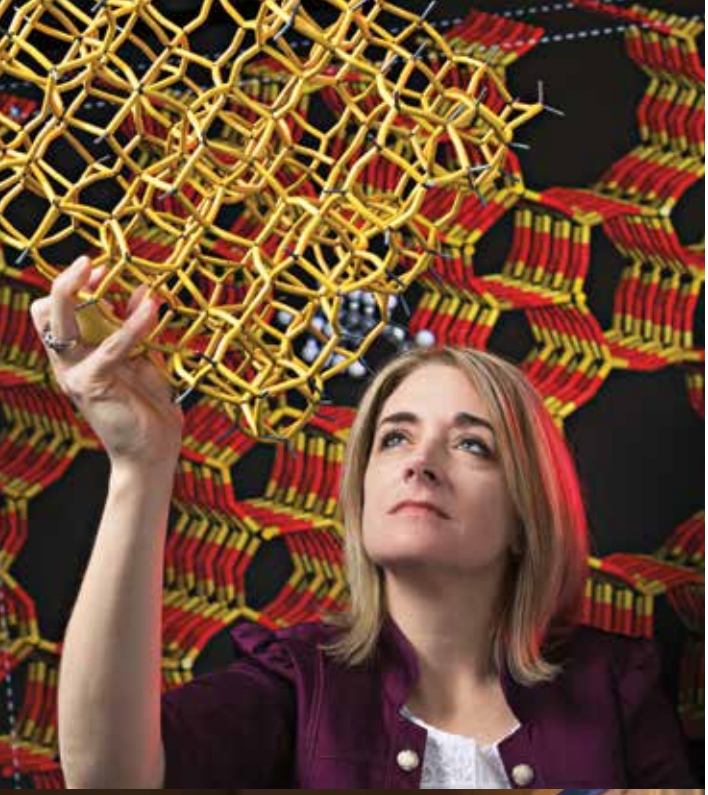


Photo by Keith Wood

Photo by Robert Seale

Photo by Robert Seale

Outlook for Energy. The annual study looks into the future at the evolving landscape.

The most recent *Outlook* forecasts that the world's economy will double by the year 2040. There will be 1.8 billion cars, light trucks and SUVs in the world, up from 1 billion now.

"Our company makes long-term, multibillion dollar investment decisions and needs to have as clear an understanding as possible of what the future may hold," Wojnar says. "The close link between our strategic planning and our research program is vital to the future success of the corporation."

A rich portfolio

Based on this forward thinking, researchers at ExxonMobil Research and Engineering Company (EMRE) are exploring the science behind next-generation fuels and vehicles, and developing new technologies to support the energy needs of the future.

EMRE's Emerging Technologies research organization has a rich portfolio of projects in five areas of endeavor: increasing energy supply, improving efficiency, promoting good science for sound policy, mitigating emissions and expanding energy access.

"We want to have our aperture as wide open as possible to understand the fundamentals behind various energy options being pursued today in academia, at national labs and within the industry," says Vijay Swarup, EMRE's vice president of research and development. "This allows us to understand which technologies are fundamentally different and technically viable to progress over a period of decades."

What makes an energy option attractive? "It should be scalable, reliable, affordable and sustainable," he says.

Currently, in the mitigating emissions area, ExxonMobil has multiple research programs and partnerships involving carbon capture and sequestration, with researchers studying the capture of carbon dioxide emissions. One program involves researching and testing whether carbonate fuel-cell carbon-capture technology is feasible on a commercial scale.

ExxonMobil researchers are also looking at ways to increase supply by converting natural gas to higher-value products and creating alternative fuels such as biofuels. "We're studying the fundamental ways in which algae absorb light, and through normal biological processes, generate the types of oil we need to convert into transportation fuel," Swarup says. *(See story on page 23.)*

He adds that one of the greatest sources for energy tomorrow is being more efficient with what the world has today. "Our researchers are looking at

Photo by Robert Seale

improved efficiency of internal combustion engines and understanding how we can make advanced polymers that are lighter weight.

“In the expanding energy access area, we’re studying energy options for developing nations, including power-generation technologies and power distribution.

“As part of our good science and sound policy studies, we conduct what’s called wells-to-wheels analysis to determine the environmental impacts of various energy types and technologies over a complete life cycle.”

A long-term focus

Understanding the energy landscape decades from now is important because of the nature of energy development.

“The infrastructure needed to move an energy source and the types of capital projects required to extract or convert resources all take significant amounts of time and funding to implement on a commercial scale,” Swarup says. “Therefore, we must have a big-picture focus and future view for determining which technologies to place our research behind, with a line of sight to develop them ultimately into commercial projects or products.”

Emerging technologies can influence the energy landscape. “One of the great uncertainties is the rate and pace of technology evolution and development. We couldn’t have imagined 50 years ago the types of deepwater and directional drilling techniques that are available today,” Swarup says.

“As the energy landscape continues to evolve, our job is to understand the fundamental science behind the various energy options so that we can continue to advance our contribution to energy and energy solutions,” he adds.

The entire corporation plays a role in technology evolution, from the upstream in finding and developing new opportunities for energy access, to the downstream in converting energy resources to fuels, lubricants and chemical products that are more efficient, affordable and better for the environment.

“This is an exciting time to be in technology,” Wojnar notes. “The integrated alignment across the ExxonMobil value chain is in great shape, and we look forward to what we will deliver.” theLamp

The new biofuels

ExxonMobil continues work on advanced lower-emissions energy technologies.

In its most recent *Outlook for Energy*, ExxonMobil projected that carbon-related emissions will peak in the 2030s and then decline. Driving this anticipated drop is increased energy efficiency coupled with a shift to lower-emission fuels for both power and transportation.

As a global energy company, ExxonMobil is laying the groundwork to meet this energy transition. It has grown its production of natural gas to meet an ever-increasing demand for this clean and reliable fuel. It's also investing in research to develop biofuels from several innovative feedstocks.

Since 2009, the company has worked with Synthetic Genomics Inc. (SGI) to develop fuels from algae. Underpinning this joint research is a goal as simple as it is challenging: develop scalable, energy-rich algae oil that conventional refineries can process and convert into products such as diesel and jet fuel to meet growing demand.

One of the challenges ExxonMobil and SGI faced was finding a strain of algae that not only grew the energy-rich fatty lipids required to convert the algae into low-emission fuel, but how to do so without impacting its growth. Maintaining the algae's productivity is essential for the feedstock to eventually scale into a commercial-grade fuel.

This year, the two companies announced they had developed a strain of algae that did just that.

"It was a true eureka moment when we knew what we had," says Rob Brown, SGI's senior director and the lead scientist on the algae project. "After years of research, we've managed to move the needle in a substantial way."

"This research is part of our ongoing work to make scalable, affordable and reliable energy accessible to the world," says Jennifer Feeley, biofuels research portfolio manager for ExxonMobil Research and Engineering (EMRE). "While there is still work ahead, low-emission renewable diesel refined from algae could be one part of the solution."

A researcher monitoring algae growth at the SGI laboratory in La Jolla, California

The rewards of "fat" algae

To boost fat production, SGI and ExxonMobil scientists tweaked the part of the algae genome responsible for the assimilation of nitrogen, an essential nutrient. This genetic modification more than doubled its oil content, from 20 percent to 40 percent, with little or no impact to the algae's growth cycle.

When it comes to algae, the potential rewards are worth the challenges to be expected when developing an entirely new energy resource.

The fuel offers several tangible benefits poised to strengthen the ongoing transition to low-emission energy resources. It emits fewer greenhouse gases than most conventional energy sources. In 2012, ExxonMobil and the Massachusetts Institute of Technology (MIT) concluded that on a life-cycle assessment basis, algae biofuels released half as many greenhouse gas emissions as petroleum-derived fuels.

Compared to other biofuel feedstocks, algae yields are also more productive. An acre of palm-oil trees will produce about 650 gallons (2,460 liters) of palm oil in one year, compared to more than 2,000 gallons (7,570 liters) of oil from algae. Finally, once refined, algae-derived diesel is "engine-ready," which means that if scaled to commercial levels, it could be pumped into diesel automobiles without major overhauls to car engines.

"While there is still a lot of research to do," explains Vijay Swarup, vice president of research and development for EMRE, "the breakthrough does bring ExxonMobil and SGI a step closer to potentially turning algae into a scalable commercial product."

Leaving no stone unturned

Algae research is just one of the opportunities explored by the company when it comes to biofuels.

Although natural gas and oil will continue to supply a majority of the world's energy needs for the foreseeable future, demand for renewables, including biofuels, will grow significantly, accounting for about 15 percent of world energy demand by 2040.

To meet this anticipated demand, ExxonMobil is leaving no stone unturned. In addition to the partnership with SGI, ExxonMobil is working with other leading companies and academics *(see page 30)* to develop ways to convert cellulosic biomass resources, such as corncobs, switchgrass and wood chips, into low-emission diesel and jet fuels. In addition to their ability to produce low-emission fuels, these feedstocks do not compete with food supplies or for fresh water sources.

Fruitful partnerships

ExxonMobil is exploring the potential of bio-refining cellulosic biomass feedstocks with the Renewable Energy Group (REG) using their proprietary fermentation technology. The goal of the program is to modify and improve REG's patented microbe-based technology so it can be used to convert cellulosic non-food, biomass-sourced sugars into biodiesel.

ExxonMobil is taking a different approach to converting cellulosic biomass into biofuels with the University of Wisconsin. The goal of this program is to discover novel catalytic routes to convert cellulosic biomass into renewable diesel and jet fuel.

ExxonMobil's biofuels research – whether focused on algae or cellulosic resources – is driven by a single goal: to build a portfolio of low-emission fuels that support tomorrow's energy realities. theLamp

Learn more about our research by visiting energyfactor.com.

Oxygenating algae samples to spur growth

A new approach to fundamental research

ExxonMobil collaborates with university energy centers for new solutions to energy challenges.

It's been more than 25 years since David Dankworth walked the halls of Princeton University, where he received a Ph.D. in chemical engineering in 1991. Today, the ExxonMobil distinguished scientific adviser is back on campus, collaborating once again with the faculty and staff.

Dankworth is coordinating a portfolio of academic research projects with Princeton faculty and graduate students as part of collaborative relationships with energy centers at four of the nation's top universities.

"It helps to have a connection to Princeton as I make appointments and go talk to faculty members involved in various research programs," Dankworth says. "I am able to bridge across corporate and academic culture, having experience in both."

Besides Princeton, ExxonMobil is working with the Massachusetts Institute of Technology (MIT), the University of Texas at Austin (UT) and Stanford University to pursue technologies that can help meet the dual challenge of growing energy demand while also reducing emissions.

"We want to have a wider view of emerging energy research and be fully engaged in accessing the best science and technology relevant for our corporation," says Mike Matturro, director, Hydrocarbon and Emerging Energy Sciences Laboratory at ExxonMobil.

Mike Matturro, director, Hydrocarbon and Emerging Energy Sciences Laboratory at ExxonMobil Research and Engineering (EMRE)

Story by Tracy Torma Photography by Chris New

"Understanding the evolving world of energy helps ExxonMobil improve efficiency, mitigate emissions and gain a clear vision of the strongest, best science that supports policy decisions globally," he says. "We also want to be aware of developments in alternative energy and new frontiers in science."

A new approach

While ExxonMobil has been engaged for years in research with more than 80 universities across the globe, these new relationships go beyond traditional support.

"We have long-established relationships with universities, conducting proprietary research and participating in industry consortia," explains Michele Thomas, ExxonMobil's scientific portfolio adviser for the University of Texas. "That work will continue, but this is different. The findings will be published, and ExxonMobil researchers work directly with the faculty and their graduate and postdoctoral students on those projects. Faculty members are excited about both the long-range focus of the work and the opportunity to collaborate with our in-house scientists."

The new strategy evolved from a long-standing relationship with Stanford University's Global Climate and Energy Project (GCEP), which ExxonMobil joined as a founding member in 2002, committing $100 million for research.

In 2012, ExxonMobil began looking at a different strategy to increase access to emerging research. "There was great diversification in the world of emerging energy research, far beyond what we could manage ourselves," Matturro notes. "Our work with university energy centers is about creating new science capabilities for the company and a new awareness of where emerging energy technologies will go."

Crossroads for discovery

After reviewing the capabilities of university energy centers around the world, four emerged as major crossroads for energy research, providing access to eminent scientists who could improve the company's line of sight for leading-edge science and technology.

In 2014, ExxonMobil became a founding member of the MIT Energy Initiative, investing $25 million, which supports students, postdoctoral fellows and 10 graduate energy fellowship appointments each year.

In 2015, the company joined the Princeton E-filliates Partnership, which is administered by Princeton's Andlinger Center for Energy and the Environment. The program fosters collaboration between the university and industry in the pursuit of energy and environmental innovation. ExxonMobil committed $5 million, the largest financial commitment the program has received.

Yueh-Lin "Lynn" Loo, director of the Andlinger Center at Princeton University

Photo courtesy of Princeton University

And in August 2016, ExxonMobil announced its investment of $15 million in the UT Energy Institute.

"All of these projects support future work and build capabilities and knowledge in areas that are adjacent to our core science and business," notes Hans Thomann, who serves as scientific portfolio adviser for ExxonMobil's projects at MIT. Currently, ExxonMobil is working with MIT researchers on a variety of projects, including the areas of carbon capture and sequestration, photovoltaic devices, fundamentals of steel corrosion, data analytics and machine learning, to name a few.

"At MIT, we find that working closely with the industry helps us identify problems with the greatest opportunity for impact at scale," says MIT Energy Initiative Director Robert Armstrong. "In addition, this work facilitates the ultimate successful commercialization of any new technologies we develop. We are collaborating with ExxonMobil and a consortium of other companies engaged in our Low-Carbon Energy Centers to

David Dankworth, distinguished scientific adviser, EMRE

advance technologies that will power our future while addressing the global challenges of climate change and energy access."

"By working across universities, where innovation is inherently occurring at a very rapid pace involving multiple disciplines, we can see how research in one field can have an impact on another," Thomann notes.

Princeton's Andlinger Center, 35 miles from the ExxonMobil Research and Engineering (EMRE) research center in Clinton, New Jersey, is looking at alternative energies for the future. Current research projects include the development of organic photovoltaic materials, extending battery lifetime and cycle efficiency, using low-temperature plasmas to convert methane into other products and the impact of carbon dioxide on oceans.

"We need close collaborations between academics and industrial practitioners in order to catalyze emerging energy technologies and implement them for the wider world," says Yueh-Lin "Lynn" Loo, director of the Andlinger Center. "At the center, ExxonMobil can gain insight to leading-edge research. Faculty, research scholars and students can explore how ideas make the leap from lab to market."

Research at the UT Energy Institute will capitalize on the university's expertise in carbon capture and storage (CCS) and strengths in geoscience and petroleum engineering. ExxonMobil is an industry leader in CCS, with a working interest in about one-fourth of the world's capacity.

"By partnering with UT, the company can tap into trends and cutting-edge research across academic disciplines," says Tom Edgar, director of UT's Energy Institute. "The goal is to get people together and start learning from each other, identifying opportunities across the energy spectrum, across disciplines, and let cross-fertilization start to generate new and better ideas for the future."

The company will develop a similar collaborative relationship with Stanford's GCEP, whose program has significantly impacted the research world over the past decade.

"Our initial investment at Stanford led to increasing the size of the research community in energy," says Nazeer Bhore, ExxonMobil manager, lead generation and downstream breakthrough research. "In the past 10 years, the program has impacted more than 900 graduate and postdoctoral students. They authored more than 850 papers in leading journals and received more than 35,000 citations of GCEP research. This research enabled the creation of many new startups. The impact is phenomenal," Bhore notes.

Advantage of adjacency

ExxonMobil hopes that its energy center engagements will have a similar impact to expand fundamental research applicable to the industry.

"For example, at MIT, we're working with the artificial intelligence researchers who planned the Mars Rover mission," Thomann says. "We're developing self-learning, submersible robots that can monitor the depths of the oceans: mapping and analyzing them, and gauging their health. The MIT team is also looking at technology developed for the far reaches of our solar system. Our collaboration allows us to apply technological advances in adjacent areas.

"We also joined the MIT Energy Initiative's Carbon Capture, Utilization and Storage Center, which is one of eight Low-Carbon Energy Centers," he adds. "We want to broaden the portfolio of technical options to reduce carbon dioxide emissions."

By working through universities' energy centers, ExxonMobil can broaden the scope of research opportunities and provide greater access to faculty members. "In the past, we might have developed an individual relationship with one institute at the university," Matturro notes. "Now, through each university's energy center, we have a portal for working across all institutions on campus."

At Princeton, Dankworth plans to take advantage of the university's strong liberal arts program, working with public affairs, economics, psychology and social science experts in diverse fields to understand how people make decisions and how societies change, which can impact the deployment speed of energy solutions.

To launch its programs at universities, ExxonMobil conducts one- to two-day workshops with the faculty and leadership of the energy centers. "Our scientists get a chance to listen to faculty members and their areas of research to see where their capabilities and our interests overlap," Matturro says.

"Having an umbrella agreement in place fosters collaboration

Nazeer Bhore, manager, lead generation and downstream breakthrough research at the Clinton EMRE facility

between ExxonMobil and our faculty very quickly, allowing researchers to focus on what they do best, which is the science and discovery," Princeton's Loo notes.

The collaborative relationship enables student researchers to work with scientists in the field to solve real problems.

Long-term, experienced researchers and engineers like Dankworth spend at least 20 percent of their time facilitating and working with faculty and student researchers on campus. ExxonMobil scientists are joint program leaders, and collaborate closely with faculty leads at the universities.

"We are not just providing funds as a sponsor, but are active participants in the research," Matturro notes.

For Dankworth, it's exciting to make connections between faculty members and ExxonMobil researchers. "Because of our research center's close proximity to campus, there are two or three ExxonMobil researchers collaborating with students and faculty on campus every week. These types of partnerships help ExxonMobil broaden its bandwidth and connect with cutting-edge research in areas such as electronics, geophysical dynamics and plasmas – capabilities that we don't have in-house. The partnerships are instrumental as we look to provide energy for the future." theLamp

Read more at exxonmobil.com/technology.

Excellence achieved across global

The current *Corporate Citizenship Report* highlights progress in safety, emissions reduction, environmental and other operational performance.

If you were to travel by helicopter to ExxonMobil's Hoover Diana platform 160 miles south of Galveston Island, Texas, one of the first things you would notice is how blue the water is that far out in the Gulf of Mexico. If your helicopter set down on the platform's giant helipad and you spent the night, you would see schools of fish jumping among the waves at dusk, and later on, millions of stars spanning the pitch-black sky.

Since production startup in 2000, work crews have made thousands of trips back and forth between the mainland and the platform, which is suspended in 4,800 feet of water. While the crews work many types of jobs onboard Hoover Diana, safety is paramount – so much so that workers have successfully completed more than 950 work-years of safe operations at the platform.

In fact, in 2016 the corporation achieved its best-ever safety performance worldwide, reducing workforce lost-time incidents more than 80 percent since 2000.

"I am proud of our performance last year," says Lynne Lachenmyer, vice president of safety, security, health and environment. "Even so, there is still room for improvement, and we will never stop working toward our goal of Nobody Gets Hurt."

Breakthrough technologies

In the area of emissions reduction, ExxonMobil and FuelCell Energy Inc. of Danbury, Connecticut, are pursuing a novel technology in power plant carbon dioxide capture through a new use of carbonate

Story by Bob Davis

scope of the corporation

fuel cells. What's significant about the research and field testing the companies are conducting is that the approach they have developed allows the capture of carbon dioxide more efficiently than conventional technology.

"The fuel cell carbon capture solution we're advancing with ExxonMobil could be a game changer in affordably reducing carbon dioxide emissions from coal- and gas-fired power plants globally," says Chip Bottone, president and chief executive officer of FuelCell Energy Inc.

This collaboration is part of a broad suite of research and technology partnerships with private companies and universities to develop solutions to emissions reductions. For example, ExxonMobil has formed an association with Renewable Energy Group Inc. to research the use of sugars from agricultural waste to produce biofuels. The work could revolutionize the production of ultra-low carbon biodiesel fuel, increasing energy supplies, lowering emissions and improving operational efficiencies.

Report available

The full 2016 *Corporate Citizenship Report* showcases these and numerous other examples and statistics encompassing the corporation's activities in health and safety, management of climate change risks, environmental performance, community engagement and investments, local development and supply-chain management, and corporate governance. The report also presents detailed performance data from 2007 to 2016.

"For 135 years, ExxonMobil has been built on strong business fundamentals, including operational excellence, technology leadership, financial discipline and a world-class workforce," says Darren Woods, ExxonMobil chairman and CEO. "These strengths have enabled us to safely and reliably deliver energy to our customers and value to our shareholders, even in the low-priced environment our industry has experienced recently." the Lamp

For more information, please visit exxonmobil.com/citizenship.

Mobil Jet Oil takes off from new Port Allen lubricants plant

ExxonMobil's recently opened Port Allen, Louisiana, aviation lubricants plant has achieved full production for the entire line of Mobil Jet™ engine lubricants and is now shipping product worldwide.

The 90,000-square-foot facility is part of a $200 million investment to expand ExxonMobil's integrated chemical and lubricants complex in Baton Rouge, which is already one of the largest petrochemical hubs in the world.

"We anticipate that demand for advanced aviation fuels and lubricants will increase 55 percent by 2040," said Nancy Carlson, vice president of aviation and marine at ExxonMobil Fuels and Lubricants. "The Port Allen plant will position ExxonMobil for growth, enabling the company to meet the emerging needs of the industry while integrating modern technologies to manufacture aviation engine oils for many years to come."

The facility uses the latest advanced manufacturing technology, including in-line blending, a high-speed quart line and flow-through racking. It has a range of sustainable features to increase electrical energy efficiency, such as natural day-lighting panels, a comprehensive recycling program and dedicated water-treatment facilities.

Singapore acquisition delivers advantaged growth and synergies

ExxonMobil's growth in the strategic aromatics business will be strengthened with the recent cost-competitive acquisition of Jurong Aromatics Corporation Pte. Ltd.'s plant, located on Jurong Island in Singapore.

The plant, one of the largest in the world with an annual production capacity of 1.4 million tons of aromatics and 2.5 million tons of transportation fuels, presents operational and logistical synergies with ExxonMobil's integrated refining and petrochemical complex nearby.

"We have operated in Singapore for more than 120 years and remain one of the country's largest investors," said Karen McKee, senior vice president of basic chemicals, intermediates and synthetics for ExxonMobil Chemical Company. "The integration of the aromatics plant with our existing manufacturing facility will help us better serve our customers in key Asian growth markets."

"Our growth in Singapore is driven by the expected increase in global demand for chemical products over the next decade of nearly 45 percent, or about 4 percent per year, which is a faster pace than energy demand and economic growth," said Neil Chapman, president of ExxonMobil Chemical Company. "Nearly three-quarters of the increased demand is expected to be in the Asia-Pacific as a result of its rising prosperity and growing middle class."

ExxonMobil continues to increase Permian Basin acreage

ExxonMobil has acquired companies previously owned by the Bass family of Fort Worth, Texas, more than doubling its Permian Basin resource to 6 billion oil-equivalent barrels.

The assets acquired in February 2017 include an estimated resource of 3.4 billion oil-equivalent barrels in New Mexico's Delaware Basin, a highly prolific oil-prone section of the Permian Basin.

ExxonMobil Chairman and CEO Darren Woods said the high-quality properties are a major addition to ExxonMobil's XTO Energy-managed unconventional liquids portfolio.

"This acquisition strengthens ExxonMobil's significant presence in the dominant U.S. growth area for onshore oil production," Woods said. "This investment gives us an exceptional Delaware Basin position in a proven multistacked play that can generate attractive returns in a low-price environment."

The company also added another 22,000 acres to its Permian Basin portfolio through a series of acquisitions and acreage trades completed throughout mid-2017. This new acreage is located in the highly prolific, stacked oil pay zones of the Delaware and Midland Basins.

ExxonMobil is currently producing more than 165,000 net oil-equivalent barrels per day across its Permian Basin leasehold. The company is one of the most active operators in the Permian Basin, and recently drilled its first 12,500-foot horizontal lateral length well in the Delaware Basin.

Agreement signed to explore offshore Cyprus

Affiliates of Exxon Mobil Corporation and Qatar Petroleum have signed an exploration and production sharing contract with the Republic of Cyprus for offshore Block 10, located southwest of Cyprus.

"ExxonMobil and our partner, Qatar Petroleum, have a long and successful history of developing gas resources," said Andrew Swiger, senior vice president of Exxon Mobil Corporation. "We appreciate our strong working relationship with the Ministry of Energy, Commerce, Industry and Tourism, and look forward to working with the government of Cyprus to evaluate and realize the country's hydrocarbon potential."

"This agreement expands our international upstream footprint into the eastern Mediterranean for what we hope is one of the most promising opportunities in the area," added Saad Sherida al-Kaabi, president and CEO of Qatar Petroleum.

The contract includes a commitment from the ExxonMobil-Qatar Petroleum consortium to acquire 3-D seismic data (now completed), drill two exploration wells in the first license period, and work with the government of Cyprus to build skills and strengthen understanding of the petroleum business through focused training programs. The companies have begun planning for drilling operations and intend to drill a first exploration well in 2018.

ExxonMobil partners with Red Bull Racing for Formula One

The new Fuels and Lubricants partnership with the F1 Red Bull Racing team is underway. Driver Daniel Ricciardo kicked off the partnership by racing along the ring road of the Houston campus in front of thousands of ExxonMobil employees. The Red Bull Racing team has seen a solid start to the F1 season, with a win at the Azerbaijan Grand Prix and strong finishes at the Silverstone, Austrian, Montreal and Monaco Grand Prix races.

The first half of 2017 focused on The New Fast campaign, setting the tone for the new partnership and the added speed that ExxonMobil products give the Red Bull Racing team. New campaigns will demonstrate how Mobil 1 motor oil and Esso fuel help the Red Bull Racing team maximize performance (and wins).

Company and government representatives at the signing ceremony for the production sharing contracts. From left to right: Marny Daal-Vogelland, manager petroleum contracts, Staatsolie; Minister Regilio J. Dodson, Suriname minister of natural resources; Rudolph Elias, CEO, Staatsolie; Erik Oswald, vice president Americas, ExxonMobil Exploration Company; Timothy J. Chisholm, vice president exploration Atlantic Basins, Hess; and Martijn Smit, country representative for Suriname, Statoil

Acreage expanded with offshore Suriname acquisition

ExxonMobil recently signed an agreement that adds significant acreage to the company's operated portfolio in the Guyana-Suriname Basin.

ExxonMobil Exploration and Production Suriname B.V., along with co-venturers Hess and Statoil, signed the production sharing contract for Block 59 with Staatsolie Maatschappij Suriname N.V., the national oil company of Suriname, in July.

Deepwater Block 59 is in water depths ranging from nearly 2,000 meters to 3,600 meters, located approximately 190 miles (305 kilometers) offshore Suriname's capital city, Paramaribo. The block is 2.8 million acres, or 4,430 square miles, and shares a maritime border with Guyana, where ExxonMobil is the operator of three offshore blocks, including the world-class Liza field.

"We look forward to working with Staatsolie and our co-venturers to evaluate the potential of this new acreage," said Steve Greenlee, president of ExxonMobil Exploration Company. "Adding this block enhances our leading global deepwater portfolio."

Suriname represents a new country for ExxonMobil's upstream business. The company has investments throughout South America. Following contract signing, the co-venturers are preparing to begin exploration activities, including the acquisition and analysis of seismic data.

ExxonMobil expands Africa footprint

ExxonMobil has signed an agreement to enable the acquisition of a 25 percent indirect interest in the natural gas-rich Area 4 block offshore Mozambique.

Darren Woods, chairman and CEO of ExxonMobil, said the asset is a major addition to the company's global development portfolio.

"This strategic investment will enable ExxonMobil's LNG leadership and experience to support development of Mozambique's abundant natural gas resources," Woods said. "Our industry-leading project execution, advanced technologies, financial strength and marketing capabilities will help deliver reliable, affordable energy to customers and create long-term economic value for the people of Mozambique, project partners and ExxonMobil shareholders."

The deepwater Area 4 block contains an estimated 85 trillion cubic feet of natural gas, which will provide resources for a world-class liquefied natural gas project.

The acquisition will be completed following clearance from Mozambican and other regulatory authorities.

the Lamp

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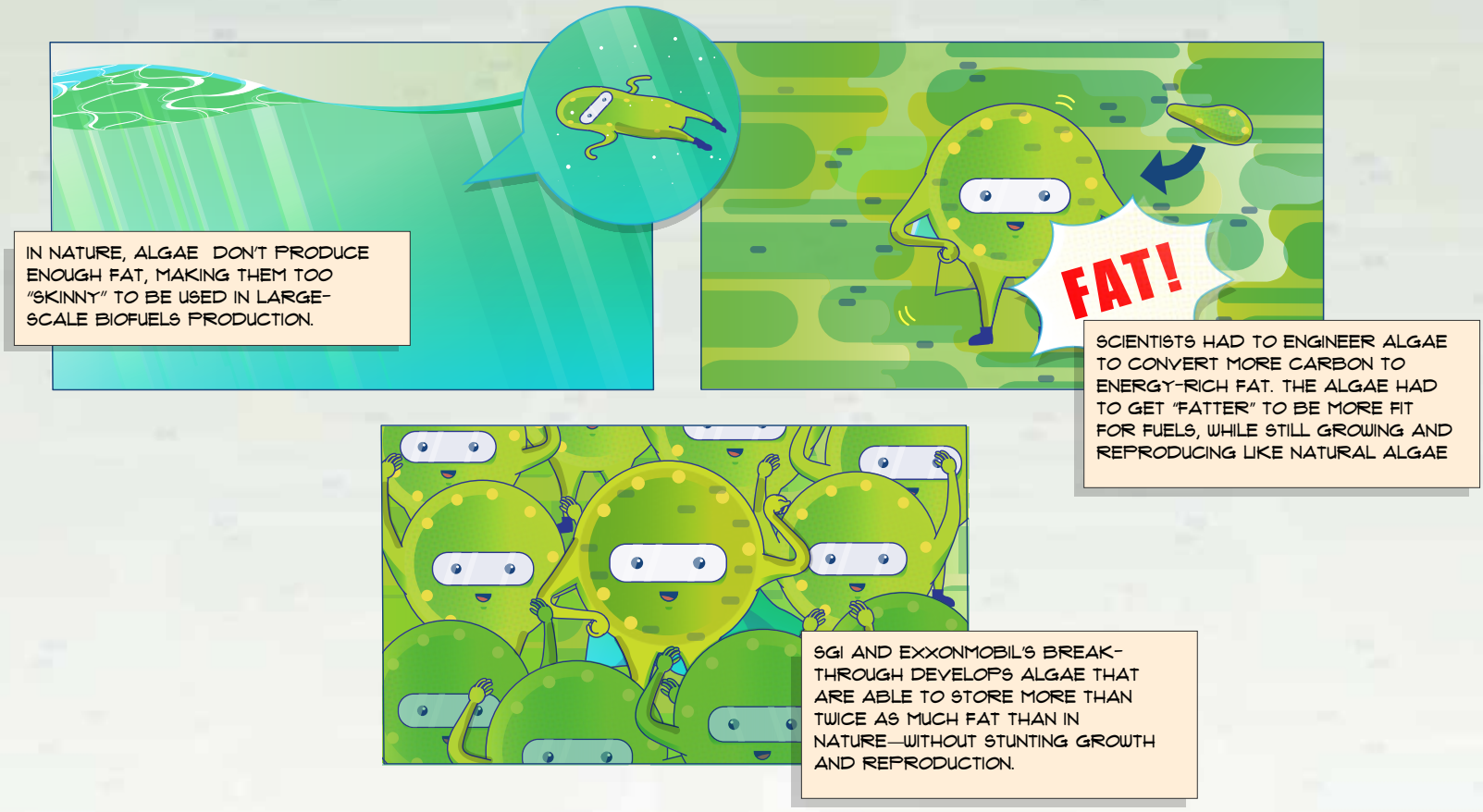
Fat, fit, fantastic fuel

Algae are a great potential source of biofuel. ExxonMobil and SGI scientists may have taken a critical first step in making algae a real part of our future energy mix...



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