

117th American Fuel & **Petrochemical Manufacturers**

ANNUAL MEETING

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DAY ONE | #AFPMAM Sunday/Monday | March 17/18, 2019

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Changing the narrative and innovating toward a more sustainable future

CHET THOMPSON, President and CEO, American Fuel & Petrochemical Manufacturers



American Fuel & Petrochemical Manufacturers 117th Annual Meeting! We are thrilled to be back in San Antonio and pleased you could join us.

AFPM and its members have accomplished a lot in the last year. We have continued to safe-

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ly and reliably meet increasing consumer demands for our life-enhancing products. US refining and petrochemicals saw record-high production and utilization rates, matched by strong US exports abroad. We engaged on more public policy issues than ever before, including trade and tariffs, IMO 2020, chemical regulations, product bans, the Renewable Fuel Standard, CAFE standards, carbon tax and electric vehicle (EV) subsidies. We testi-

Welcome to the fied several times before Congress on behalf of our industries, and our narrative on key public debates was included in dozens of outlets, including the Wall Street Journal, Financial Times, Forbes, The Hill and the Houston Chronicle, to name just a few. As a result of our efforts, last year we saw the net favorability of the fuel and petrochemical industries rise by more than 10%.

> The new year brought with it a new Congress and a new set of opportunities and challenges, with some policymakers calling for a so-called "green new deal" that ultimately seeks to eliminate our industries. While we face many challenges, we are excited about the future of our industries and the many opportunities that lie ahead.

> The fuel and petrochemical industries are wellpositioned to keep growing and thriving. We continue to innovate and find cleaner, cheaper and more efficient ways to deliver our products to meet increasing consumer demand globally. Petrochemical demand is at a historic peak and looks

to remain high for the foreseeable future as the middle class grows worldwide. While some say that the growth of the internal combustion engine has peaked, consumers continue to demonstrate that they prefer the ever-greater horsepower, performance and efficiency offered by new internal combustion engine vehicles.

We are also enhancing our operations and performance with advanced technologies that are having a positive impact on safety, security and emissions. Our production processes and fuels are cleaner than ever and, despite all the progress we have made together, we are just beginning to scratch the surface of how our industries can be part of a more sustainable future. Ultimately, our goal is to change the narrative about our products and industries by sharing stories that bring to life the many ways we are driving progress and propelling the world forward.

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See WELCOME, page 3

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Condensate is Crude

Ultra-light crudes and condensates are here to stay. These streams have flooded the market in recent years, and many of them are deeply discounted against reference crudes. Refiners have been processing increasing percentages of this light material through their Crude Distillation Units (CDUs) up against unit naphtha handling limits. On the surface, processing condensate and other ultra-light crudes with high API gravity and low sulfur should be easy. In reality, many refiners have experienced significant challenges, some of which are unique to ultra-light crudes and condensate.

Although their bulk properties signal that these crudes should be easy to process, new recovery techniques tend to leave undesirable compounds in the crudes that can adversely affect refinery CDUs or Condensate Splitters. Some of the bad actors are:

- High melt point waxes / high paraffin content
- Tramp amines from production H₂S scavengers
- Filterable solids
- Tramp phosphorous compounds



Severe crude column tray fouling



These undesirable compounds are the source of operating and reliability problems in CDUs and Condensate Splitters worldwide, and the onset and severity of certain problems can often be traced back to the introduction of new ultra-light crudes and condensates.

These supposedly "easy" crudes have been linked the following problems:

- Fouling in the cold preheat train
- Poor desalter performance
- Fouling in the warm and hot preheat trains
- Crude heater fouling and hot spots
- Accelerated overhead system corrosion
- Salting in the top of the crude column
- Plugging of kerosene section trays and exchangers
- Plugging of stripping trays

Despite the impression that new ultra-light crudes and condensates should all be easy to run, they are not. Condensates and ultra-light crudes are crudes, meaning that many of them can be difficult to process and can present unique refining challenges.

Process Consulting Services, Inc. has experience with these crudes and has addressed all of the problems above through process and equipment design features. Contact us today to maximize profitability and minimize headaches while processing these discounted crudes.

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WELCOME, continued from page 1

year's program. It features a star- ligence implications for health and studded lineup of speakers, includ- safety, and what it means to sustain ing former Secretary of State Condoleezza Rice, Fox News anchor Chris Wallace, Pulitzer Prize-win- merous opportunities for networking ning historian Doris Kearns Goodwin and Marathon Petroleum CEO Gary Heminger. You will also hear from industry leaders and innovators about several topics, such as the fu-

9 a.m.–7:30 p.m.

4–5:30 p.m.

5:30-7:30 p.m.

MONDAY, MARCH 18, 2019

7 a.m.–5 p.m. 7:30–9 a.m.

9-11:30 a.m.

12:15–1:30 p.m.

1:30-3:30 p.m. 3:30-3:45 p.m. 3:45-4:45 p.m.

5-6 p.m. 6–7 p.m.

TUESDAY, MARCH 19, 2019

7 a.m.–12 p.m. 7:30–9 a.m.

9–10 a.m.

10-10:30 a.m. 10:30–11:30 a.m.

12–2 p.m.

2–3 p.m.

3–3:15 p.m. 3:15-4:15 p.m.

We hope you are excited for this ture of transportation, artificial intelour industries for the future. As always, the program will include nuthat will allow you to engage and connect with your industry peers.

> I hope you enjoy the conference and find time to explore San Antonio, the Alamo City!

SCHEDULE OF SESSIONS AND SPECIAL EVENTS

SUNDAY, MARCH 17, 2019

Registration

Women in Industry Reception* *Open to registered women attendees only

Opening reception

Registration

Government Relations Breakfast* *Open to registered attendees only

GENERAL SESSION

Opening Remarks

Joe Gorder, Chairman, President & CEO,

Valero Energy Corporation Chet Thompson, President & CEO, AFPM

America Under President Trump: A View from Washington **Chris Wallace**, FOX News

Leadership in Turbulent Times

Doris Kearns Goodwin, Author

11:30 a.m.-1:30 p.m. AFPM Networking Lunch

Lunch/Tech Talks

Grab a light lunch during this informal networking session that will feature short presentations on emerging technology.

GENERAL SESSION: Sustaining the Future

Coffee Break

Concurrent Breakout Sessions: Trade Agenda 2019, Impact of IMO on U.S. Energy Security, The Transportation Climate Initiative

Operating Company Reception

Chairman's Reception

*By Invitation

Registration

Industry Leadership Breakfast featuring* Gary Heminger, CEO, Marathon Petroleum *Open to registered attendees only.

Concurrent Breakout Sessions: Pulling Back the Curtain on Environmental Activism, Global Oil Outlook, Operational Excellence, Tech Sessions

Coffee Break

Concurrent Breakout Sessions: Future of Transportation, Tech Session, Operational Excellence, Tech Sessions

Annual Luncheon (SOLD OUT) featuring*

The Honorable Condoleezza Rice,

Former U.S. Secretary of State

*Open to registered attendees only. No tickets or same-day seating will be available onsite.

Concurrent Breakout Sessions: Pulling Back the Curtain on Environmental Activism, What Lies Ahead for the Renewable Fuel Standard, Operational Excellence, Tech Sessions

Coffee Break

Concurrent Breakout Sessions: EMpower, Tech Session, **Operational Excellence**, Tech Sessions

ADVOCATING FOR THE INDUSTRY

On February 28, AFPM released the following statement about the confirmation of Andrew Wheeler as Administrator of the US Environmental Protection Agency (EPA): "We congratulate Administrator Wheeler on his confirmation and are encouraged by the impressive experience he brings to the position. We look forward to continuing to work with him and EPA staff on issues critical to US refiners and petrochemical producers, and the industries and consumers who depend on our products."

Earlier in February, the organization also released a statement in support of the Fairness for Every Driver Act of 2019, introduced by Senator John Barrasso (R-Wyoming) and Representative Jason Smith (R-Missouri): "AFPM fully supports the Fairness for Every Driver Act, which promotes true competition among vehicle technologies by eliminating ineffective subsidies and ensuring electric vehicles pay their fair share to maintain roads and bridges. American workers simply should not be forced to subsidize the purchase of these cars for the wealthiest among us, and nor should they shoulder the entire burden of maintaining US roads. It is long past time to modernize policies in recognition of the fact that conventional fuels and vehicles have never been cleaner or more efficient." •

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Optimizing DP flow applications in refineries

DAN CYCHOSZ, Emerson Automation Solutions

Differential pressure (DP) flow leviate the problem by significantly meters are common in many process reducing the straight pipe requireplants and particularly in refineries thanks to their versatility, accuracy and scalability. How they work and how they can be configured to optimize operations in refineries are discussed here.

The basic measurement concept requires creating a pressure drop in the line. Traditional wisdom used tion. If poorly executed, they can be to be that getting the maximum accuracy and turn-down range meant creating the largest pressure drop. Fortunately, the accuracy of today's DP transmitters is better than in the that specify welding techniques, isopast, making it possible to get good flow readings with less pressure loss.

long, straight and smooth pipe sec- include gate valves on the high and tions upstream and downstream from the primary element. Standards These allow the transmitter to be specify that as much as 44 pipe diameters upstream and five diameters downstream are required to achieve cluded to clear gas slugs trapped in maximum accuracy. This can make the lines. mounting a DP flow meter in complex and congested piping a challenge. On new installations, additional costs can be incurred when should a DP flow meter designed to piping runs longer than otherwise thrive in an unforgiving refinery apneeded must be specified to ensure plication look like? Shown in FIG. 1, accurate measurement. Using multi- Emerson's Rosemount[™] 9295 prople holes rather than just one for the cess flow meter is a case in point. orifice plate primary element can al- Key features include:

ment, while maintaining high measurement accuracy and repeatability.

DP flow meters usually have impulse lines between the transmitter and both sides of the primary element. The design and construction of the impulse lines have a major influence on the success of the installaprone to many problems including clogging, freezing and slugs of gas or liquid. In refineries, they are governed by strict piping requirements lation valves, etc.

In critical applications, impulse Best practices call for relatively lines are normally all welded and low sides to isolate the transmitter. removed without shutting down the process. Bleeding ports are also in-

> Combining design developments. With these points in mind, what

- It is supported by a Rosemount 3051S MultiVariable[™] transmitter on a pre-assembled spool section ready for mounting.
- The impulse lines are kept short to minimize plugging. • A four-hole conditioning
- orifice plate primary element reduces overall length. making it easier to fit into existing piping.
- Overall construction is welded stainless steel in keeping with piping requirements, and the entire unit has been leak-tested.
- The gate-type isolation valves are also selected and welded in keeping with piping requirements.
- Threaded clean-out ports align with the impulse lines so they can be rodded out while the unit is in operation.
- Smaller isolation and bypass valves are built into the manifold, along with impulse line-bleeding ports.
- Smart instrument functions built into the transmitter provide a wide range of basic and advanced diagnostic information.
- Integral temperature

measurement eliminates the need for an additional temperature instrument and pipe penetration.

This product represents a combination of proven technologies optimized for use in harsh environments. It is built to provide a long and reliable life in refineries, and the electronic components can be replaced on the fly without shutting down the line.

Effective process control and safety in a refinery or petrochemical plant depends on effective instrumentation. Instrumentation provides the eyes and ears into a process, letting operators know what is happening inside pipes and vessels. DP transmitters capture much of the data necessary to keep production units working correctly and safely, and with today's technologies, they can do a better job than ever.

DAN CYCHOSZ is a global DP flow product manager for Emerson Automation Solutions in Boulder, Colorado and is responsible for Rosemount DP flow meters. He earned a BS degree in chemical engineering from Iowa State University. Prior to joining Emerson, he spent time in the chemical industry in a technical sales role.

SENATOR TED CRUZ TO RECEIVE **AFPM LEADERSHIP AWARD**



At Monday morning's General Session, Senator Ted Cruz (R-Texas) will be awarded the 2019 AFPM Leadership Award.

Throughout his life, Senator Cruz has proven to be a passionate and effective fighter for limited government, economic growth and the Constitution. His calling to public service has been inspired by his firsthand observation of the pursuit of freedom and opportunity in America. Senator Cruz's mother Eleanor was born to an Irish-Italian working-class family. The first in her family to go to college, she graduated from Rice University with

a degree in mathematics and became a pioneering computer programmer in the 1950s. After being tortured and imprisoned in Cuba, his father, Rafael, fled to the US in 1957, and then started a small business in the oil and gas industry. Senator Cruz has been a tireless fighter for liberty because his family knows what it is like to lose it.

As Solicitor General for the State of Texas and in private practice, he authored more than 80 US Supreme Court briefs and argued 43 oral arguments, including nine before the US Supreme Court. He also won an unprecedented series of landmark national victories that include his defense of US sovereignty against the UN and the World Court in Medellin vs. Texas, our Second Amendment right to keep and bear arms, and the constitutionality of the Ten Commandments monument at the Texas State Capitol and the words "under God" in the Pledge of Allegiance.

In the US Senate, he has led the fight to repeal Obamacare, to secure the border and to confirm Justice Neil Gorsuch to the Supreme Court. He has also led the fight to defend life, marriage, the First Amendment, the Second Amendment and our Bill of Rights.

AFPM is proud to recognize Senator Cruz for his contributions to the US and the petrochemicals and refining industries.



FIG. 1. Emerson's Rosemount 9295 process flowmeter is designed for difficult refinery operations while providing a high degree of precision and reliability.



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SHELL CATALYSTS & TECHNOLOGIES TRANSFORMING ENERGY TOGETHER

Drones are making refineries and petrochemical plants safer, more efficient

A career with the US Army took Russell Lewis all over the US and abroad. Whether he was working as an operations officer in Fort Drum, New York or as a battalion commander in Afghanistan, a particularly memthe job at hand.

me from danger, save me from danger."

Lewis has carried that philosophy to his position as the Corporate, Western Regional Security Supervisor for Marathon Petroleum Corp. From his office in San Antonio, Lewis plays an integral role in ensuring the safety of the integrated downstream company's employees. The need for "persistent surveillance" in this industry is not so different from what Lewis was responsible for while he served in the military.

While the potential for incidents at a refinery pales in comparison to the dangers of a battlefield, an employee may still face some precarious positions in fuel and petrochemical manufacturing. This is where drones come into play.

Drones—less colloquially known as unmanned aerial vehicles (UAVs) are being increasingly used in refinery

and petrochemical operations across the country. Some sites have moved beyond the experimental phase and have fully integrated drones into their daily operations. ExxonMobil's Baton Rouge refinery, for example, has used orable adage was applicable no matter UAVs equipped with remote visual HD cameras to perform comprehen-"There is one thing we say about a sive inspections, which saves maintesoldier," Lewis said. "If you can save nance costs and helps ensure reliability throughout the facility.

> "You avoid risk if you send drones," Lewis said. "Whether in the military or at refineries, using a drone means that I do not have to put an officer or employee out there." UAVs also offer time efficiencies. "A drone can more efficiently fly to some of the remote parts of your facility in areas that are very open. There is a lot of terrain out there."

Marathon Petroleum, which recently acquired refining company Andeavor, is exploring the most effective ways to deploy the technology. Some Marathon Petroleum facilities are using drones to perform flare and tower inspections, eliminating the need for scaffolding and human risk. Additionally, the company is using drones for pipeline right-of-way work and for



FIG. 1. The sheer size of the Shell Deer Park Manufacturing complex in suburban Houston, Texas made it a logical choice for the pilot program for all UAV programs at Shell. Source: Shell Deer Park.



FIG. 2. Following Hurricane Harvey, the DART team worked with Drone Systems Intl. and deployed two drone teams to scan the property. One drone can fly a mission and identify issues with images and video, enabling engineers and maintenance crew workers to make repairs quickly while the other drone scans other areas for trouble. Source: Shell Deer Park.

surveillance during different types of emergencies. It is also partnering with the University of North Dakota to cultivate its aviation program as a training ground for drone pilots at refineries.

If a model refinery exists for drone deployment in the US, it is the Shell Deer Park Manufacturing complex in suburban Houston, Texas (FIG. 1). The al costs, and saving man hours and 1,500-acre facility is located 20 miles time on tools." east of downtown and has operated since 1929. It is the company's largest manufacturing hub in the world some 5,000 people pass through the front doors daily, with up to 17,000 entries and exits to and from the facility.

The sheer size of Deer Park made it a logical choice for the early adoption of drones, and so it became the pilot program for all UAV programs at Shell.

"Everything we do is about protecting personnel in the field," said Gary Scheibe, a longtime Houston police officer and Homeland Security veteran who has been at Shell for eight years. After working with contractors using drones and seeing the benefits of the technology first-hand, Scheibe made a strong case to develop UAV capabilities in-house. "I requested some funding for a drone program, and they gave it to me. We bought some initial birds (drones) and trained ten pilots. A yearand-a-half into our program, we have \$100,000 invested in it."

Efficiencies and improvements. Shell Deer Park's Drone Aerial Response Team (DART) was begun in early 2017. In addition to Scheibe, DART's members also include a former Marine who specializes in logistics and a former Army infantry veteran, Sheriff's deputy and EMT who performs inspections and manages the CCTV and access control. One team member, a former Marine who has since moved to a refinery in Louisiana, wrote Deer Park's policies for drone use and training.

DART has provided the refinery a much quicker response time. Livestream video footage monitored by the DART team allows for action within 15 min–20 min. In the first year of the program, the team logged 477 flights, with each flight eliminating the group of safety experts from refinerneed for personnel to work at heights, ies and petrochemical plants across and resulting in an estimated cost sav- the country. The DART crew gave ings of \$1.2 MM.

UAVs at Shell Deer Park was in the swered questions about the obstacles aftermath of Hurricane Harvey, when they faced getting the drone program the DART team worked with Drone up and running. Systems Intl. and deployed two drone teams to scan the property. An entire not a competition," said Lara Swett, site assessment was completed in Senior Director of health and safety two weeks, an unprecedently quick programs for AFPM, which facilimethod, which required Deer Park proliferation of good safety practices. individual tank. One drone can fly a primary importance. If one company mission and identify issues with im- has a safety approach that is more efages and video, enabling engineers fective than others, they are eager to make repairs quickly while the other eager to apply it."

drone scans other areas for trouble.

"Large-area inspections previously took two weeks to complete; the drone can do them in two hours," said John McClain, the Shell Deer Park DART Chief Pilot who manages inspections and the CCTV. "We are saving people from working at heights, saving rent-

These efficiencies and improvements are welcome early results of Shell's innovative approach to using drones, and evidence that similar facilities could benefit from adopting UAVs. However, the use of UAVs remains a delicate proposition.

"Pioneering a new technology at a facility that already observes extensive safety and security measures takes time," said Tom Owen, Senior Director of enterprise sales and business development at San Francisco, California-based KittyHawk, a drone operations management platform. "Operators of major industrial facilities and critical infrastructure often will not incorporate a new technology like UAVs until they fully evaluate it and establish a firm understanding of exactly how it is going to work—and rightly so." Owen partnered with the Shell Deer Park team in the earliest days of the DART program.

Close collaboration. The KittyHawk platform and team help organizations develop and integrate essential elements of a UAV program, from pilot training and log-booking, to mission planning and in-field situational awareness, to data management and sophisticated reporting. They also help pilots (FIG. 2) stay informed of regulations issued by the Federal Aviation Administration (FAA), which classifies drones used for business purposes as commercial aircraft, the same category for planes operated by major airlines.

The close collaboration between Shell Deer Park and KittyHawk has led to DART members serving as initial resources to discuss perceived challenges with organizations that have contacted Owen to explore the possibilities of a UAV program.

Recently, Shell Deer Park hosted a equipment demonstrations, walked Perhaps the most notable use of through drone-use scenarios, and an-

"Safety among our members is amount of time compared to the old tates industry collaboration and the employees to manually inspect each "Ensuring the safety of people is of and maintenance crew workers to share that knowledge, and others are





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Monday's General session: Featured guests

will kick off the 2019 Annual Meeting. Joe Gorder, Chairman, President and CEO of Valero Energy Corp., and Chet Thompson, President and CEO of AFPM, will welcome attendees with their opening remarks before introducing two featured speakers.

America under President Trump: A view from Washington. Chris Wallace, award-winning veteran journalist and host of FOX News Sunday, will break down today's top news issues impacting individuals and industry, leaving the AFPM audience with takeaways that prepare them for impending changes in the political landscape.

Wallace has established himself as a battled-tested media presence,

CHRIS WALLACE

Monday morning's General Session an incisive, thoughtful interviewer, ary Clinton and Donald Trump. and a venerable authority on presidential history and election politics. Over his decades-long journalism career, he has reported from the ABC News desk as a senior correspondent for *Primetime* and 20/20, and as an nology on the presidency. anchor on the longest running show on television, NBC News' Meet the *Press.* The author of the best-seller, Character: Profiles in Presidential Courage, Wallace has won every major broadcast news award, including three Emmys, the Peabody Award and the Dupont-Columbia Silver Baton Award. In 2016, he earned praise from fellow journalists and political operatives on both sides of the aisle for his sterling performance moderating the final presidential debate between Hil-



DORIS KEARNS GOODWIN

With substance, fairness and gravitas, Wallace captivates with seasoned insights on current events and political affairs, including the evolving role Roosevelt: The Home Front in World of the media and the influence of tech- War II. Her book, The Fitzgeralds

Leadership in turbulent times. Doris Kearns Goodwin is a world-renowned presidential historian, public speaker and Pulitzer Prize-winning author. Her 7th book, *Leadership in Turbulent* Times, was published in September 2018 to critical acclaim and became an instant New York Times bestseller. A culmination of Goodwin's five-decade career of studying the American presidents focusing on Presidents Abraham Lincoln, Theodore Roosevelt, Franklin Roosevelt and Lyndon Baines Johnson, the book provides an accessible and essential road map for aspiring and established leaders in every field.

As a 24-year-old graduate student at Harvard University, she was selected to join the White House Fellows, one of America's most prestigious programs for leadership and public service. Dr. Goodwin worked with Johnson in the White House and later assisted him in the writing of his memoirs. Her subsequent book, Lyndon Johnson and the American Dream, received critical acclaim and will be re-released in 2019 with a new foreword highlighting LBJ's accomplish- film, television and digital projects.

ments in domestic affairs that have stood the test of time. Dr. Goodwin was awarded the Pulitzer Prize for No Ordinary Time: Franklin and Eleanor and the Kennedys, was adapted into an award-winning five-part television miniseries.

Her 6th book, The Bully Pulpit: Theodore Roosevelt, William Howard Taft, and the Golden Age of Journal*ism,* won the Carnegie Medal and is being developed into a film.

Goodwin's Team of Rivals: The Political Genius of Abraham Lincoln served as the basis for Steven Spielberg's hit film *Lincoln* and was awarded the prestigious Lincoln Prize, the inaugural Book Prize for American History, and the Lincoln Leadership Prize.

Well known for her appearances and commentary on television, Dr. Goodwin is frequently seen in documentaries, on news and cable networks, and on shows including Meet The Press and The Late Show with Stephen Colbert. Among her many honors and awards, Dr. Goodwin was awarded the Charles Frankel Prize, the Sarah Josepha Hale Medal, the New England Book Award and the Carl Sandburg Literary Award. She recently founded Pastimes Productions with Beth Laski to develop and produce

Session, Sustaining the future: *Leadership perspectives*, THOMPSON, President and CEO of AFPM, will moderate a panel of industry leaders as they look ahead to the future of the refining and petrochemicals industries. The panel includes MICHAEL COYLE, President, Manufacturing, Chevron U.S.A. Inc.; TODD. W. FREDIN, Executive VP Supply, Trading and Logistics, Motiva Enterprises LLC; JOE GORDER, Chairman, President and CEO, Valero Energy Corp.; DAVID LAMP, President and CEO, CVR Energy Inc.; MARK LASHIER, President and CEO, Chevron Phillips Chemical Co. LP; and LOIC **VIVIER**, Senior Vice President, Fuels, ExxonMobil Fuels & Lubricants Co.

MICHAEL COYLE has been President

of Chevron's manufacturing organization since July 2016. He previously served as VP of manufacturing, where his responsibilities included overseeing the safe and reliable operations of Chevron's four niche refineries located Salt Lake City, Utah; Cape Town, South Africa; Kapolei, Hawaii; and Burnaby, British Columbia. He also served as VP of downstream strategy. Coyle began his career with Chevron as a design engineer in the Perth Amboy refinery. He went on to serve in a variety of engineering and operating positions of increasing responsibility





General Session: Sustaining the future

CHET

In Monday afternoon's General at Chevron's Salt Lake, Philadelphia and Pembroke refineries, ultimately returning to the Perth Amboy refinery, where he served as Operations Manager prior to assuming the role of Re- Valero's assets in the UK and Ireland. finery Manager.

> Prior to assuming his role as Executive VP of supply, trading and logistics at Motiva Enterprises LLC, TODD W. FREDIN was VP of Saudi Aramco Products Trading Company based in Dhahran, Saudi Arabia. Before joining Aramco, Fredin was with ConocoPhillips, where he last served as President of Europe, Africa and Middle East, Commercial. He joined Conoco in 1975 and held various positions in the US, Europe, the Middle East and Asia, with diverse assignments in refining, upstream, business development and trading.

> JOE GORDER became Chairman, President and CEO of Valero Energy Corp. in 2014. He previously served as President and Chief Operating Officer (COO), where he was responsible for refining operations and commercial operations in marketing, supply and transportation. He has also served as Chief Commercial Officer and President of Valero Europe. In this role, Gorder oversaw all commercial trading and related activity for the company, including crude and feedstock supply and trading, products supply and trading, wholesale marketing, logistics operations, commercial busi

ness development, transportation and Phillips Petroleum, now Phillips 66, ditionally, he was responsible for all Gorder served as Valero's Executive cial businesses. VP of marketing and supply, followdevelopment and strategic planning.

DAVID LAMP serves as CEO, President and a Director of CVR Energy global fuels value chain, from crude Inc., as well as CEO, President and a to customers, and is accountable for Director of the general partner of CVR its financial performance. Prior to Refining LP, and Executive Chairman of the general partner of CVR Partners LP. Lamp has more than 37 years of ExxonMobil Fuels, Lubricants & of technical, commercial and operational experience in the refining and chemical industries. Prior to his role asphalt, basestocks and specialties as President and COO of Western Refining Co., he was President and CEO of Northern Tier Energy Corp., which merged with Western Refining. Lamp previously served as COO and Execu- will be moderated by JARED HAWES, tive VP of HollyFrontier Corp.-in Director of state and local outreach 2011, Holly Corp. and Frontier Oil for AFPM. Featured panelists completed a merger of equals and changed their name to HollyFrontier & Sustainability, Chevron Phillips Corp. Mr. Lamp joined Holly in 2004 Chemical; JENNIFER FEELEY, Corporate and held various roles, including VP of Program Portfolio Manager, EMRE R refinery operations, Executive VP of & D, Corporate Strategic Research; refining and marketing, and President.

CEO of Chevron Phillips Chemical USA; JULIA REINHART, VP, HR and Company LLC. Throughout nearly Administration, Valero Energy Corp.; three decades with Chevron Phillips and KRIS TOBERSON, Technology Chemical and its owner company Director, Motiva Enterprises LLC.

specialty products marketing. Ad- Lashier has held several leadership roles. Before his August 2017 apbusiness activities and operations of pointment as head of the company, he served as Executive VP of commer-

LOIC VIVIER is the Senior Vice ing a tenure as Senior VP for corporate President of Fuels for ExxonMobil Fuels & Lubricants in Spring, Texas. In his current role, Vivier oversees the his current position, he served as VP of wholesale and specialties, GBU Specialties. He was responsible for the global wholesale fuels products, product lines.

The second session, Sustaining the future: Meeting the challenges, include JIM BECKER, VP, Polymers **STACEY PUTMAN**, Senior Project MARK LASHIER is President and Director, INEOS Olefins & Polymers

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Pave the way to profitable growth

A key challenge for the North American refining industry is profitable growth in the face of softening fuels demand and ever-changing global trade dynamics. To achieve growth and remain competitive, future-forward refiners will need to rethink their business models.

Together with UOP, refiners can create real, bottom-line value by integrating petrochemicals, ensuring flexibility to meet rapidly changing market needs and optimizing daily performance through state-of-the-art connected technology.

10000 (1)

Today's integrated refining and petrochemical mega-projects are targeting 50-70 percent petrochemicals products. This is also achievable for existing refineries through strategic, step-wise investments in new process technology with advanced molecular management. Honeywell UOP can help refiners develop an integration strategy that profitably unlocks additional value by utilizing the latest bottom-of-the-barrel technology, high-conversion hydrocracking and today's energy-efficient aromatics complexes. Integrating these technologies enables traditional refiners to diversify into petrochemicals and create their own Refinery of the Future.

Unlock new value from every barrel

Honeywell UOP can develop a step-wise approach to increase value capture of every barrel of oil, targeting the lowest value stream for conversion first. A configuration study for a 500kBPD refinery with existing VGO Hydrocracking to diesel and Delayed Coking unit demonstrated a potential pathway that would allow a refiner to profitably maximize bottom-of-the-barrel conversion through Uniflex[™] MC Technology and integrate into petrochemicals with VGO and diesel Hydrocracking to naphtha. (Table 1 below)

Join Stan Carp, Senior Manager of Configurations at Honeywell UOP, on Tuesday, March 19, for more details on this valuable case study.

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HEAR THE REST OF THE STORY

Stan Carp, Senior Manager IPS Configurations & Process Consultancy Honeywell UOP

> **TUESDAY, MARCH 19** 9:30 AM **TECH SESSION**

VGO H Distill Aroma UNII LPG, I

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THE REFINERY OF THE FUTURE IS FLEXIBLE, INTEGRATED AND CONNECTED

Targeting 50–70% petrochemical products

Table 1: Improve Economic Performance with Uniflex™ MC Technology and Hydrocracking to Naptha

| E | BASE | 1 | 2 | | | | |
|---|---------------|--------------------|--------------------|--|--|--|--|
| m Residue Upgrading | Delayed Coker | Uniflex MC Unit | Uniflex MC Unit | | | | |
| ydrocracker | Diesel | Diesel | Naphtha | | | | |
| ate Hydrocracker | None | None | Naphtha | | | | |
| tics Complex | None | None | Included | | | | |
| IELD IMPROVEMENTS VS. BASE CASE | | | | | | | |
| laphtha & Diesel Yield, %t | Base | + 30 | + 30 | | | | |
| ïeld, % | Base | - 30 | - 30 | | | | |
| ERY ECONOMIC PERFORMANCE IMPROVEMENTS VS. PREVIOUS CASE | | | | | | | |
| sh Margin, % | Base | + 21 | + 110 | | | | |
| nental IRR, %t | Base | + 23 | + 16 | | | | |
| nental NPV, % | Base | + 32 | + 16 | | | | |

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95 RON with ETBE: A panacea for the RFS?

ARA BARSAMIAN and **ELISEO CURCIO**, Refinery Automation Institute

the Renewable Fuels Standard (RFS), the refining industry and renewable fuel producers, mainly US ethanol producers, have been at odds with each other: refiners have resented paying significant capital for renewable identification numbers (RINs) to meet their renewable volume obligations (RVO); ethanol producers have been clamoring to increase the gasoline ethanol content to 15 vol% or more; and consumers have been impacted by the enormous subsidies for renewables at the pump.

Is it too good to be true? An obvious solution is to use bio-ETBE, widely used in Europe, Latin America and Japan in concentrations of up to 22 vol% (about 10 vol% ethanol equiva-

Since the US Congress mandated lent). Ethyl tert-butyl ether (ETBE) is an ether made with bio-ethanol, containing about 45 vol% ethanol. When compared with ethanol,

- ETBE advantages include: • It can be blended directly
- at the refineries • It can be shipped via pipelines
- It has low vapor pressure
- (no 1 psi waiver needed) • Low Reid vapor pressure
- (RVP) reduces volatile organic compound (VOC) emissions
- High octane and low RVP promote reduction of aromatics (carcinogenic precursors)
- Less water absorption, less corrosion, no azeotropes
- Proven user of 10 vol% ethanol-equivalent in gasoline without harmful effects



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FIG. 1. Example 1: 95 RON with 22 vol% ETBE.

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CONSTRUCTION



using bio-ETBE

• Upgrades low-octane naphtha

- Higher mileage due to higher energy density.
- After the California-promoted

hysteria against using methyl tertiary-butyl ether (MTBE), potential users were wary of lawsuits, although bio-ETBE is radically different in terms of health hazards. It is interesting (and ironic) to note that while the use of MTBE is prohibited in the US, we do export it to others.

ETBE is produced in the US in minuscule amounts for export. This can be remedied by converting existing MTBE facilities to ETBE by substituting bio-ethanol for methanol.

Blending gasoline with ETBE. In addition to the advantages mentioned here, ETBE uses cheap naphtha that is inexpensive and abundant thanks to shale crude production, in addition to also using cheap butane.

Successful blending tests runs were conducted with 22 vol% ETBE, equivalent to using 10 vol% ethanol. shown in FIG. 1; 33 vol% ETBE, equivalent to using 15 vol% ethanol, shown in FIG. 2; and 44 v% ETBE, equivalent to using 20 vol% ethanol, shown in FIG. 3.

Getting the US Congress, the oil refining industry and ethanol lobbies engineering with honors from the to agree on using more ethanol (in the University of Calabria in Italy.





ARA BARSAMIAN is the President and CEO of Refinery Automation Institute LLC (RAI) and has more than 48 years of experience in gasoline, diesel and biofuels

blending operations and technology. Recently, he has been involved in the IMO 2020 bunker blends, recipes and ISO 8217 specs. Earlier in his career, he was a Group Head with Exxon Research & Engineering Co., President of 3X Corp. and Vice President of ABB Simcon, all in the area of fuels blending. Mr. Barsamian holds BS and MS degrees in electrical engineering from City University of New York.



LEE ELISEO CURCIO is a chemical engineer

blending, ethanol nonlinear property correlations and octane boost, and naphtha and butane blending. He also teaches the gasoline, diesel and bunker blending optimization section of RAI's blending public course. He previously worked at Catholic University of Louvain in advanced modeling and optimization. He holds BS and MS degrees in chemical



FIG. 2. Example 2: 95 RON with 33 vol% ETBE.



FIG. 3. Example 3: 95 RON with 44 vol% ETBE

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The AFPM Operations & Process Technology Summit (formerly the Q & A and Technology Summit) brings together refiners, petrochemical producers, catalyst and chemicals suppliers, plant automation specialists, process licensors, engineering firms, and other industry experts to address the challenges of today's competitive refining environment.

and some are not. classified areas.

for renewable fuels





Hot surfaces and autoignition temperatures in petrochemical facilities

EDDIE GUIDRY, Fluor Enterprises Inc.

For many years, electrical hazardous area classification (HAC) plans have been developed for hazardous (classified) areas in petrochemical facilities. The original intent for these plans was to indicate areas where either flammable materials were present under normal conditions, and/or where flammable materials may be present under abnormal conditions in such quantities that may produce an ignitible mixture. HAC plans have always considered sparking parts and hot surface temperatures of electrical equipment. Some electrical equipment with hot surfaces are marked with temperature codes (T-Codes),

The latest industry trends, both nationally and internationally, are leaning towards using HAC plans to consider autoignition temperatures (AITs) of any equipment with exposed hot surface temperatures found in classified areas (FIG. 1). ISO standards 80079-36 and 80079-37 were recently issued to address hot surface ignition temperatures for equipment other than electrical, although compliance with these documents may prove difficult. US standards do not clearly address the issue of hot surface temperatures associated with non-electrical equipment in

Codes and practices. Papers related to electrical installations in the petrochemical industry are presented each year in global conferences, and leading engineers and parent companies are represented. In 2016, Paper No. PCIC-2016-04, Hot surface ignition temperatures and the impact on electrical area classification

offering a risk-based approach for the consideration of hot equipment surfaces for non-electrical equipment located in classified areas in the US market.

For many years, electrical equipment in the US, such as a typical luminaire, has been required to

plans, presented an alternative to the ISO approach by have a T-Code, which indicates the maximum surface temperature that can be reached safely in a given classified location without the possibility of igniting hazardous materials. However, while elec-

HALDOR TOPSØE H

See FLUOR, page 20



FIG. 1. The latest industry trends are leaning towards using HAC plans to consider autoignition temperatures (AITs) of any equipment with exposed hot surface temperatures found in classified areas.

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A new look at integration opportunities

MARION BURLAK, STAN CARP, KEITH COUCH and MATT GRIFFITHS, Honeywell UOP

Changing factors driving the fuels and petrochemicals markets present both challenges and opportunities for refiners. The refinery of the future will be an integrated fuels and petrochemicals producer that consumes less energy, eliminates waste and connects the enterprise for optimal operations. Refiners can begin by making wellplanned investments that have immediate benefits to profitability.

US gasoline demand in 2035 is expected to be 15% lower than in 2018, and diesel demand is expected to be 6% lower. At the same time, growth of global demand for petrochemicals is expected to be three to six times greater than that of fuels. From 2018–2026, the global compound annual growth rate (CAGR) is expected to be < 1% for gasoline, but 4% for propylene and 5% for paraxylene. Furthermore, petrochemicals are the more valuable products with price spreads of \$400/metric t for paraxyfor propylene over propane.

Rise in petrochemical demand. The reasons behind the decline in demand for US fuels include domestic factors such as technological improvements, renewables substitution and changing demographic behaviors. US fuels exports will also decline as more refin-

YDROCARBON

ROCESSING

ing capability comes online locally in those foreign markets and as foreign fuel quality standards continue to bethose locations.

The rise of petrochemical demand, driven by the emerging and rapidly growing middle class around the world, is a phenomenon that will continue through the coming decades and provides rich opportunities for US refiners (FIG. 1). US natural gas is one third the cost of LNG in China, providing an energy cost advantage. The current oversupply of LPG (propane and butane) in the US, due to expanding natural gas field developments, is projected to increase by 40% from 2018 to 2023. These factors favor propylene production via propane dehydrogenation (PDH), and independent producers are already operating

ecule, technology selection, specific gasoline and diesel specifications, and other factors must be considered for come more stringent, precluding the each unique case. In one case study, export of higher sulfur or otherwise a five-step petrochemicals integration lower-quality fuel from the US to plan was developed that included a fluid catalytic cracking unit (FCCU) revamp to increase propylene production, the addition of a world-scale PDH unit for further propylene production, the addition of a world-scale aromatics complex to convert naphtha to aromatics, a new distillate hydrocracker to produce more naphtha for aromatics, and a steam cracker to enable polyethylene production. This series of investments moves the refiner from 100% fuels production, with values of \$15/bbl over crude, to 56% petrochemicals production, with values of \$45/bbl over crude.

Recent integration plans developed from an invitation to bid (ITB) demonstrate that flexibility to optimize ITB process configurations, technology selection and molecule management can allow for solutions with improved economic outcomes over the traditional configurations presented in the ITB. The project is part of a world-scale grassroots refining and petrochemicals complex producing aromatics and polypropylene while making fuels that meet Euro V specifications.

The ITB sought to produce a specified amount of propylene via an FCCU operating at high severity and yielding 14% propylene with a PDH unit producing the remainder. Honeywell UOP used its depth of knowledge and experience in these technologies to find an optimized configuration that increased the propylene margin from \$80/metric t to \$220/metric t and increased the internal rate of return (IRR) by 1%. This was achieved by rebalancing the propylene production between the FCCU and PDH unit based on the incremental propylene cash cost of production in the FCCU.

If high-octane reformate is re-tasked for aromatics production and the gasoline pool needs to be high octane, as is the case in this ITB, an expansion of alkylation capacity is likely a necessity. The ITB configuration, which utilized all available butylenes available from the FCCU and exported light naphtha that has octane too low for the desired gasoline pool, had reasonable economics. However, the new solution that Honeywell UOP found optimized the economics dramatically. It did so by upgrading low-value, readily available butanes in a UOP C₄ OleflexTM butane dehydrogenation (BDH) unit, thus providing additional feed for the alkylation unit. This maximized gasoline production, maintained the target paraxylene production, and allowed the refiner to blend all the naphtha into the gasoline pool. The new configuration increased IRR by 20% and tripled net present value (NPV).

Takeaway. Refiners open to utilizing new technologies and expanding into petrochemical production will find that the changes in demand for fuels and petrochemicals offer very profitable and attainable opportunities. The key to tapping into these opportunities is in the development of an overall investment plan for integration that considers the refiner's unique position and utilizes the optimal combinations of technologies to reach and perhaps exceed their profitability goals. Honeywell UOP's future-forward philosophy is leading the way for refiners to maximize each molecule while responding to market conditions with a wide range of feedstocks and flexible models to integrate fuels and petrochemicals. Partner with Honeywell UOP and create tomorrow, every day.

To learn more and to meet members of our team, visit the Honeywell UOP hospitality suite Monday night in the Marriott Rivercenter.

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and provide rich opportunities for US refiners.

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20 PDH facilities, with more projects lene over naphtha and \$500/metric t in development. Similarly, paraxylene and benzene can be readily produced very profitably from naphtha. **Initiating an integration strategy.** For a US refiner to realize these significant increases in value, the development of a well-planned integration strategy is the starting point. Optimum use of each stream and mol-

FOR MORE INFORMATION, VISIT AFPM.ORG petrochemical markets, economics and politics.

FIG. 1. The rise of petrochemical demand will continue through the coming decades

MICHAEL KANELLOS, OSIsoft

nologies.

The company plans to create an independent subsidiary that will license software applications and other technology developed through its iMOM (integrated manufacturing operations management) program to third parties, said Eyad Buhulaiga, Manufacturing Operations Management Project Management Specialist and Solutions Architect at Aramco. The company will license judiciously-you will not able to build exact replicas of their plants or processes through the software and service they will make available.

Instead, the subsidiary will license solutions for predictive maintenance, pump optimization, i.e., the problems every petrochemical plant and refinery faces (FIG. 1). The new subsidiary will possibly even license technology to other heavy industries.



A new frontier for energy companies: **Selling software**

Saudi Aramco is one of the most successful energy companies in the world, and its success lies, in part, in its ability to create and exploit new tech-

Embracing transformation. Expect to see a version of this story played out over the next several vears. Heavy industry has embraced digital transformation and Internet of Things (IoT) technologies to date largely to reduce costs, such as process energy and maintenance, or to increase productivity out of existing capital. For example, DCP Midstream has publicly discussed how it invested \$20 MM-\$25 MM in transformation and recovered \$20 MM–\$25 MM within one year through lower downtime and other factors. Accenture estimates

that digital transformation overall could have a Japan's largest utilities, have launched initiatives \$14.5-T impact worldwide by 2025.

that their technology is dynamic, and that there is Grid operator PJM is mulling commercialization no reason to confine it to an audience of one. Tokyo Electric Power and Kansai Electric Power, two of

to provide services, consulting and technology Along the way, these companies are discovering for optimizing power plants in other jurisdictions.

See OSIsoft, page 18



FIG. 1. Heavy industry has embraced digital transformation and Internet of Things (IoT) technologies to date largely to reduce costs, such as process energy and maintenance, or to increase productivity out of existing capital

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Turning an IMO 2020 problem into a high-profit solution

BOB RILEY, W. R. Grace & Co.

been as universally discussed by refiners over the last several years as we near the deadline for the imple- refiners do not have multiple options. mentation of IMO 2020.

W. R. Grace, along with our partbeen working for some time to understand the impact of IMO 2020 on refiners, and to identify the most profitable solutions to help refiners adapt to the new environment. While hydrotreating are major components of many refiners' strategies, a key unresolved problem for many refiners remains the fluid catalytic cracking the incentive to upgrade FCC bottoms (FCC) bottoms disposition.

is a reasonably high-sulfur stream (1

Few refining industry issues have high sulfur and the suspended catalyst higher profitability. With the onset of particulates creates a specific challenge new marine regulations, this incenfor marine fuel blending under IMO the upcoming International Maritime 2020. Alternatives that have been dis-Organization (IMO) regulations on cussed include FCC feedstock changes marine fuel quality. Nearly every con- (lower sulfur), routing the FCC botference, meeting or presentation in the toms to a resid hydrotreater/heavy oil industry has a healthy connection to upgrader, or routing the FCC bottoms this issue, and the projected impacts to a coker. Each of these presents their have been evolving at a rapid pace as own set of costs and constraints; many

At the same time, the value of middle distillates, including FCC light ners at ART Hydroprocessing, have cycle oil (LCO), is pushing toward a relative maximum purely based on non-IMO market drivers. Additionally, many economists have predicted that middle distillates will rise in value under the new IMO regulations, as finished marine fuel blend.

Together, these forces align to drive catalyst solutions. to LCO to an all-time high. Luckily, In most refineries, the FCC bottoms prior to the new IMO regulations, upgrading FCC bottoms to higher-value wt%+), and the combination of the products was often the fastest route to

tive is expected to become the most significant economic driver for even more FCCUs globally. However, many refiners have not yet built this additional incentive into their current plans, and it remains one of the most important near-term opportunities that will evolve as we approach the implementation of the new rule.

Because upgrading bottoms has always been an important part of FCC, Grace has deployed FCC catalysts to address this need at hundreds of refineries. Our newest innovations, including our MIDAS[®] Gold technology, allow for the inclusion of a high degree of our signature mesoporosdesulfurization via hydrocracking and low-sulfur cutter stock is proposed as ity, as well as an increased amount of value could be significantly magnified an option to manage the sulfur in the macroporosity to extend the range of in the future as the IMO 2020 rule is benefits that can be delivered by our implemented.

one such application, where the use R. Grace & Co./ART Hydroprocessof MIDAS increased FCC LCO by ing hospitality suite on Sunday and destroying FCC bottoms. In this case, Monday evenings in the Marriott the refiner's primary target was to up-

grade bottoms into LCO, and the catalyst employed was designed for this specific purpose. The baseline catalyst was a high Z/M formulation from Grace, which had previously been used to maximize gasoline + liquefied petroleum gas (LPG) make.

Based on typical FCC yield profiles, a reduction in FCC bottoms of 1 vol% of fresh feed (as an example) can reduce the amount of FCC bottoms produced by 20%-30% overall, significantly reducing the issues associated with blending this difficult stream. Couple that with an increase in FCC LCO production (while managing to ensure volume swell is maintained), and the refiner can realize significant value today. In addition, this

For more information, or to meet FIGS. 1 and 2 show the results of a member of our team, visit the W. Rivercenter.





OSIsoft, continued from page 17

for DIMA, an in-house software application that gives remote maintenance technicians a control of data a day. Shell tracks more than 7.5 MM live licensing be enough, or will it have to be linked to room view on their cell phones and laptops.

In the chemical segment, Air Liquide has already spun off Alizent, a technology services unit diagnostic services when the OEM is receiving all that provides plant management and optimization the data for his R&D?" asked Petronas' Gavin Halls services to Air Liquide, as well as third-party com- at a 2017 conference. "The OEM should be paying panies that buy Air Liquide gases.

these companies a new revenue stream (albeit a Protean for predicting rotating equipment failures. small one in the beginning) that often moves in the opposite direction of their core business. When **Co-opetition.** Success, of course, cannot be foreorcommodity prices dip, software investments often climb.

wealth of operational data to train their algorithms. One of the reasons IBM bought the Weather Co. was to get their hands on data to fine-tune their agricultural offerings, according to Scott Lundstrom, as well as get comfortable with "co-opetition." Group Vice President of IDC. Lundstrom, among and oil and gas companies have no shortage of data.

One facility can easily generate a terabyte or more with business model innovation. Will technology data streams.

"Why pay the OEM for remote monitoring and cense? Software is a very different culture. the operator-us-for the data." Petronas, mean-A successful digital initiative would also give while, has developed an in-house application called

dained. As software and technology services companies, these new independent subsidiaries will find These companies have another asset, as well: a themselves competing with traditional partners like Schlumberger as well as behemoths like Google, Amazon and Microsoft. The new entrants will have to identify specific market niches they can occupy

The effort will also require steady and persistent others, predicts that anonymized data will become a investment in recruiting. Data scientists can be a lot saleable product. Of course, refining, petrochemical more difficult to find than process engineers. Additionally, companies will have to get comfortable at OSIsoft.

consulting services? Subscription or perpetual li-

Most importantly, energy companies will have to be patient and take a somewhat hands-off approach. Often, new initiatives like this can flounder. During the 1990s and 2000s, Intel spent billions trying to move into hot markets like data center management, consumer electronics and communications technologies, and failed almost every single time. After a while, the mothership would simply lose interest

Still, energy companies should at least examine ways to monetize their technology. They invariably will have to increase their investments in digital over the next decade to improve their existing operations anyway. Trying to productize these same breakthroughs will represent a low-risk way to explore a new, potentially high-return opportunity.

Michael Kanellos is the IoT Analyst

The road to successful plant modernization HYONSOOK KANG, Yokogawa

Anyone working in a refinery or heavy petroproduction costs, reduced energy consumption, A process automation system installed today chemical plant with "vintage" automation equipimproved regulatory compliance, greater feedthat fully embraces concepts of modern technology stock handling flexibility or some combination of should never require a complete replacement. Old ment is painfully aware of the effects a distributed control system (DCS) from the 1990s, 1980s these. One way or another, it is about profitabil-DCS platforms must often be replaced completely because they are so monolithic. Today's systems or even earlier can have on operations. These ity for the plant driven by operational excellence. old control platforms are built on long-obsolete Safety also enters the discussion because incidents are far more modular, which means that they can be improved incrementally. More functionality is technology, which means that replacement parts cause production disruptions. defined by software rather than hardware, so it can and people who understand how they work are in The capabilities of modernized automation technologies are designed around three factors be updated far more easily. Smart I/O, where it is short supply. Unscheduled outages caused by failures of old (FIG. 1):

components threaten plant efficiency and even operational viability, yet plants are still postponing upgrades to current platforms. Those that do launch projects often do not go nearly far enough with the kinds of improvements possible, with huge opportunities lost as a result. Why is this the case, and what can be done to alleviate the situation?

Process manufacturing plants have little incentive to replace something that is operating well. Age alone is rarely a primary consideration, which is why so many plants have such old automation equipment and infrastructure. However, the two main arguments for migration—reliability problems caused by obsolescence and functionality limitations-are inescapable.



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PETROLEUM ECONOMIST

The new DCS should be considered a platform to improve production and efficiency by removing the impediments caused by the old, unreliable platform, while providing new tools to achieve better performance. Improved performance might

- Improved advanced process control (APC) concepts
- Engagement with the changing workforce
- Operation in a secure environment with minimal cyber risks.

In refineries, production gains of 2%, 3% and even 5% have been routinely realized after APC implementation as processes are optimized.

Embracing modern technology. Clearly, nobody needs to be convinced of the value of APC considering these points, but achieving these gains requires careful planning and intentionality. One aspect that cannot be ignored is automation infrastructure. Field instrumentation and actuators must perform flawlessly to realize the ultimate benefits. Trying to implement APC on top of a crumbling foundation of legacy field networks is asking for trouble. Operators simply cannot compensate for unreliable or missing measurements in this environment, and this may be the most compelling arbe defined as higher production volumes, lower gument for re-instrumentation and smart I/O.

See YOKOGAWA, page 20







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A solution for FCC propylene production and purification

CARL KEELEY, LOTHAR KARRER and MODESTO MIRANDA, BASF

which is used to produce a large variety of petrochemicals. Over the last five years, global propylene demand growth rate was sustained at about 4% per year. After steam cracking, fluid catalytic cracking (FCC) is the second-largest producer of propylene. The use of FCC catalysts can improve a unit's flexibility to process a wide range of feeds and maximize propylene selectivity. Purification adsorbents are used to upgrade (LPG) and FCC gasoline yields. the raw propylene to chemical-grade quality. The chemical-grade propylene is combined with benzene to make cumene (isopropyl benzene), an important building block for the synthesis of other organic compounds, such as phenol, acetone, bisphenol-A, phenolic resins and methyl methacrylate.

Demand is strong for propylene, FCC propylene production. The potential to produce propylene at the FCCU depends on variables such as feed quality, operating conditions by a variety of factors, many refineries and catalyst technology. Historically, propylene was produced by processing a very good and clean feed; using a high reactor outlet temperature, **FCC propylene maximization.** Using usually more than 995°F (535°C); selecting a very high activity FCC

This arrangement produces 6 wt%–11 wt% propylene at the exit of the FCC reactor, but dry gas and coke vields were usually high because increasing the reactor temperature produces propylene by thermal cracking. In FCCUs with a wet gas compressor (WGC) constraint, one mole of dry gas

TABLE 1. Results of the first trial of BASF's Maximum Propylene Solution. The propylene yield exceeded 10 wt%

| | Incumbent | BASF Maximum Propylene Solution trial |
|-------------------------|-----------|---------------------------------------|
| Reactor Temperature, °F | 1,000 | 1,000 |
| C/O ratio | 7.17 | 7.37 |
| Dry gas, wt% | 3.9 | 3.85 |
| Propane, wt% | 2.71 | 2.91 |
| Propylene, wt% | 9.61 | 10.46 |
| Butane, wt% | 8.47 | 8.3 |
| Butylene, wt% | 8.24 | 9.14 |
| Total LPG, wt% | 29.03 | 30.81 |
| C5+ LCN, wt% | 32.2 | 32.34 |
| HCN, wt% | 8.21 | 8.07 |
| LCO, wt% | 14.34 | 13.38 |
| Slurry, wt% | 7.51 | 6.77 |
| Coke, wt% | 4.81 | 4.78 |

of propylene. Therefore, it is desirable to produce propylene selectively via a catalytic route. Furthermore, driven now need to produce propylene from heavier, less desirable feeds.

new FCC catalysts, more propylene can be catalytically produced from catalyst; and using ZSM-5 additive to any quality feed, at much lower reacfine-tune the liquefied petroleum gas tor outlet temperature than previously possible. At one FCCU designed to maximize propylene selectivity and yield, the refinery C_3 stream is sent to a petrochemical site for cumene production. The refinery used BASF's Maximum Propylene Solution to increase propylene yield. The advantage of this solution is the increase in propylene without dilution of catalyst occupies the same volume as one mole activity. The BASF Maximum Propylene Solution, at same riser outlet temperature, increased propylene vield to 10.5 wt% and improved bot- and with phosphine, another common toms upgrading (TABLE 1).

> FCC propylene purification. In general, raw FCC propylene is purified using several technologies: amine treating, mercaptan oxidation and often purification adsorbents. Amine treating and mercaptan oxidation improve the raw FCC propylene to improve the propylene production refinery-grade quality.

The propylene purity must be improved before it is used to make cumene because trace impurities spoil the cumene catalyst performance and shorten its lifetime. By increasing the cumene catalyst lifetime and productivity, the purification adsorbent cost is paid for many times over.

At this refinery, BASF Selexsorb[®] activated alumina adsorbents are used

in a regenerative treater system to remove water, oxygenates, ammonia, COS and mercaptans. Bed regeneration using FCC dry gas is typically fast. The desorbed contaminants together with the regeneration gas are sent to the refinery fuel gas system to remove trace sulfur species after this process. After the regenerative treater system, the propylene still contains traces of sulfur species, arsine and phosphine that must be removed. The propylene is sent to an adsorber with two stacked beds. The first bed removes remaining sulfur species (H_2S and COS), using BASF Selexsorb COS, and the second bed removed arsine and phosphine. The first bed is regenerated with hot gas, while the second bed is a sacrificial guard bed that is packed with a reactive copperzinc based catalyst (BASF Puristar[®] R3-12). The metal oxides react with arsine (A_3H_3) to form metal arsenides, contaminant, to form metal phosphides. If any traces of H₂S or COS remain, this guard bed will remove these, as well. The lifetime of the guard bed is typically several years.

The strong demand for FCC propylene continues to increase. BASF has collaborated with a refinery to from the FCCU using the Maximum Propylene Solution, resulting in an elevated propylene selectivity and yield. The refinery also used purification adsorbents to improve the efficiency and integration of refining and chemicals installations.

To learn more and to meet members of our team, visit the BASF hospitality suite on Monday night in the Marriott Rivercenter.

YOKOGAWA, continued from page 19

possible to change the device type or communication method from an engineering station, is just one example.

Major gains stemming from plant modernization do not happen by accident, and they do not occur from a DCS upgrade project where the primary concern is cost. Such projects can produce a like-forlike result, and possibly some modest improvement in capability, but such successes are usually shortlived. Within a few years, another project will have to be launched to compensate for the lost opportunities. Modernization is not a time for half measures, so a best practice is to incorporate as many advances as possible as part of the upgrade project.



As an Industry Consultant for Yokogawa Corp. of America, HYONSOOK KANG brings the voice of the customer to Yokogawa's internal personnel. She has more than 35 years of experience in the oil and gas and

chemical industries, working as an Engineering Manager/ Project Manager for major LNG, ethylene, polyethylene and subsea projects. Ms. Kang worked for Shell for the bulk of her career before joining Yokogawa, and she holds a BS degree in chemical engineering from The University of Illinois at Urbana-Champaign.

EIA: CHANGES IN MARINE FUEL SULFUR LIMITS WILL PUT TEMPORARY PRESSURE **ON DIESEL MARGINS**

The US Energy Information Administration's January 2019 Short-Term Energy Outlook (STEO) includes analysis of the effect that upcoming changes to marine fuel sulfur specifications will have on crude oil and petroleum product markets. Beginning January 1, 2020, the International Maritime Organization's (IMO) new regulations limit the sulfur content in marine fuels used by ocean-going vessels to 0.5% by volume, a reduction from the previous limit of 3.5%. The change in fuel specification is expected to put upward pressure on diesel margins and modest upward pressure on crude oil prices in late 2019 and early 2020. EIA analysis indicates that the price effects that result from implementing this new standard will be most acute in 2020 and will di- to higher demand for light-sweet garding the forecast outcomes of the Sasol announced the beneficial opminish over time.

Residual oil-the long-chain hydrocarbons remaining after lighter and shorter hydrocarbons such as gasoline and diesel have been separated from crude oil—comprises the largest component of marine fuels used by large ocean-going vessels, 2020. Motor gasoline margins averalso known as bunker fuel. Marine aged \$0.28/gal in 2018 and are ex-



FLUOR, continued from page 15

trical equipment surface temperatures have been ad- of any gas or vapor under controlled laboratory condressed, other process equipment has seemingly been ditions is relatively easy. However, when applying ignored. For instance, it is very typical to have an ex- these AITs to real-world conditions, simply too many posed 600-psig steam line with a surface temperature variables exist for the published AITs to be accurate. in the range of 600°F–700°F (316°C–371°C) near a The best we can do is to use the published AITs for luminaire that carries a T-Code of T3 [a maximum gases and leave a generous safety margin between surface temperature not to exceed 392°F (200°C)]. the AIT and the hot equipment surface temperature. Logically, this does not make sense, as neither gas nor vapor discern between electrical equipment and boundaries and the corresponding electrical equipnon-electrical equipment.

American Petroleum Industry Recommended Practice 2216 (API RP 2216), "Ignition risk of hydrocarbon liquids and vapors by hot surfaces in the in paper PCIC-2016-04 or assessing an approach for open air," discusses issues with hot surface temperatures of non-electrical equipment, but does not offer a and specifications. definitive approach for assessing the associated risks. The conclusions reached in API RP 2216 may erroneously lead one to believe that the current approach for the classification of electrical equipment in classi- 2016-04, all hot surfaces should be considered a fied locations may be too conservative. However, the source for potential ignition in classified areas. ISO approach will probably prove to be very difficult to implement, given that essentially every piece of equipment will need a T-Code for hazardous areas.

the issue of autoignition of gases/vapors and hot sur- and international codes and standards and has been a faces was thoroughly analyzed. Determining the AIT

The current US approach for determining HAC ment should be maintained, as it has a long, proven history of being safe. A few parent companies are either adopting the risk-based methodology offered adopting said methodology into their work practices

Whatever the ultimate outcome over the next few years, whether it is the use of the ISO standards or a risk-based approach as described by paper PCIC-

EDDIE GUIDRY is a Senior Fellow in electrical engineering, specializing in codes and standards for Fluor Corp. He is During the development of paper PCIC-2016-04, very active in the development of many US national (ANSI) principal member of the NEC Panel 11 since 1999.

INDUSTRY NEWS AND TRENDS

vessels account for about 4% of global oil demand.

Removing sulfur from residual oils or upgrading them to more valuable lighter products, such as diesel and gasoline, can be an expensive and capital-intensive process. Refineries have two options regarding residual oils: invest in more downstream units to upgrade residual oils into more valuable products, or process lighter and sweeter crude oils to minimize the production of residual oils and the sulfur content therein.

The EIA forecasts that the implementation of the new IMO fuel specification will widen discounts between light-sweet crude oil and heavy-sour crude oil, while also widening the price spreads between high- and low-sulfur petroleum products. In the January STEO forecast, Brent crude oil spot prices increase from an average of \$61/bbl in 2019 to \$65/bbl in 2020, with about \$2.50/ bbl of this increase being attributable crude oils priced from Brent.

The expected increased premium on low-sulfur fuels will likely mean higher diesel fuel refining margins, which the EIA forecasts will increase from an average of \$0.43/gal in 2018 to \$0.48/gal in 2019 and \$0.65/gal in

pected to increase slightly to an aver- ed its engineering, procurement and age of \$0.29/gal in 2019 and \$0.33/ gal in 2020.

of diesel fuel, distillate fuel refinery yields are forecast to increase from Fluor resources will assist the Sasol an average of 29.5% in 2018 to 29.9 % in 2019 and 31.5% in 2020, while motor gasoline yields fall from an ing activities, working with Sasol in average of 46.9% in 2018 to aver- parallel on the transition plans for ages of 46.5% in 2019 and 45.6% in 2020. Residual fuel yields decrease FMC/Fluor will also assist in perforfrom an average of 2.4% in 2018 to an average of 2.2% in 2020. Refinery an average of 17.2 MMbpd in 2018 to a record level of 17.9 MMbpd on (FID) in 2014. The complex features average in 2020, so small changes in a 1.5-MMtpy ethane cracker based refinery yields can have large impli- on TechnipFMC's proprietary ethylcations for the volumes of petroleum ene technology, which has been seproducts produced.

set of decision-makers involved in complying with the regulations and the global nature of the regulation, regulation.

TECHNIPFMC JV COMPLETES CONSTRUCTION SCOPE OF WORK ON SASOL LOUISIANA PROJECT

(JV) with Fluor, has safely complet- each unit or system.

construction management (EPCM) services on Sasol's world-scale pet-As refiners maximize production rochemical complex in Westlake, Louisiana. As planned, TechnipFMC/ team at the Lake Charles Chemical's Project (LCCP) site for the remaineach unit and workstream. Technipmance testing for the LCCP.

The TechnipFMC and Fluor JV runs are expected to increase from has provided EPCM services since the project final investment decision lected for more than 60% of all new Due to the numerous and diverse ethylene crackers installed worldwide in the last decade. The LCCP complex also includes six downstream chemical units and associated significant uncertainty exists re- utilities, infrastructure and offsites. eration on the 470,000-tpy polyethylene unit on February 13, which is one of the two polyethylene derivative units at the LCCP.

Beginning in November 2018, TechnipFMC/Fluor commenced incremental transitions of assets to Sa-TechnipFMC, in joint venture sol upon mechanical completion of

HOSPITALITY SUITES

Many affiliate companies host hospitality suites/rooms and hold meetings during the Annual Meeting. Open hours are determined by the individual host in compliance with AFPM's policy not to conflict with regularly scheduled Association sessions and activities and to close by 1 a.m.

To find the exact room number of a hospitality suite, please refer to the daily event board in the lobby of the hotel or the information wall located in the AFPM registration area, Marriott Rivercenter Salons I&J. To contact the hotel desk, dial 210-223-1000 (Marriott Rivercenter) and 210-224-4555 (Marriott Riverwalk).

Note: The hospitality suites are spread across two hotels. In the listings, MRC indicates the Marriott Rivercenter, and MRW signifies the Marriott Riverwalk.

| Albemarle—Mon. Travis Room, MRW Athlon, a Halliburton Service—Mon. Salons E&F, MRW Axens North America—Mon. Bowie Room, MRW BASF Corporation—Mon. Suite TBA, MRC Chevron Lummus Global—Sun., Mon. Suite TBA, MRC DuPont Clean Technologies—Sun., Mon. Suite 3829, MRC Emerson Automation Services—Sun. Suite TBA, MRC Haldor Topsoe Inc.—Sun., Mon. Salon C, MRW Honeywell UOP—Mon. Suite TBA, MRC IHS Markit—Sun., Mon. Salon C, MRW KBR—Sun., Mon. Salon C, MRW Honeywell UOP—Mon. Suite TBA, MRC IHS Markit—Sun., Mon. Salon D, MRW KBC (A Yokogawa Company)—Sun., Mon. Suite TBA, MRC KBR—Sun., Mon. Salon D, MRW Linde Engineering North America—Mon. Riverview, MRW Pall Corporation—Sun., Mon. Salon B, MRW Sabin Metal Corporation—Sun., Mon. Suite TBA, MRC W.R. Grace & Co./ART Hydroprocessing—Sun., Mon. Suite TBA, MRC Wilam Room Milam Room Maw |
|---|
| Wood—Won |
| BY INVITATION ONLY |
| Air Liquide Suite TBA, MRC Buckeye Partners L.P. Valero Room, MRW Colonial Pipeline Company Suite TBA, MRC Colonial Terminal Logistics Suite TBA, MRC hte—the high throughput experimentation company Salon A, MRW Kinder Morgan Terminals MR 15, MRC McDermott Suite TBA, MRC Platts River Terrace Room, MRW Stancil & Co. Suite TBA, MRC Vopak Americas Suite TBA, MRC W.R. Grace & Co. Sazo Banquet Room, MRC |

Deep in the heart of Texas

independent spirit and varied culture make it an ideal gateway to the region's scenic beauty, restful retreats and historic legacy. First settled as a colony of Spain, the city has grown up as a territory of Mexico, part of the independent (well, that's what we Texans think).

The Old World charm of San Aners, is apparent in culturally significant art, museums, architecture, cuisine and music. Even some of the street signs are written in three languages. With such a variety of attractions, it is little wonder why San Antonio is the most popular tourist destination in Texas.

The Texas Hill Country. Settled by and Mexico. In 1836, decades after Hill Country has a culture all its own. was the site of one of the most noto-Storybook farms and ranches dot the countryside, and you may still hear long-time residents speaking German in Fredericksburg, Boerne and For 13 days, 150 "Texians" died de-New Braunfels. You'll also find quaint B&Bs, antique shops on old-fashioned main streets and celebrations with roots in the Old World, like Wurstfest (a sausage festival) and Weihnachten Crockett. The Alamo is open daily, (a Christmas festival). Floating down cool rivers, strolling quaint main streets Battle of the Alamo can be seen at the in search of unique bargains, playing a IMAX movie theater. round at one of many championshipquality golf courses, or hiking and bik- **Attractions.** The **San Antonio Zoo** is ing through rolling, scenic terrain are one of the largest in the nation, housing Walk, a verdant oasis of cypress-lined all within driving distance. Outside of over 3,500 animals. Take the Zoo Train Boerne, the Cascade Caverns offer a for a relaxing tour of the grounds and

Welcome to San Antonio! The city's 68° break from the Texas heat, including a 100-ft, underground waterfall.

18th century, Franciscan priests from Spain established five Catholic mis-Republic of Texas, and finally a key primarily to extend Spain's dominion city in the greatest of the United States northward from Mexico, but also to convert and educate the native population. Today, the five missions (San look. The influence of Spanish, Mexi- Mission Concepción, Mission San can and German cultures, among oth- Juan and Mission Espada) represent the largest concentration of Spanish colonial missions in North America, World Heritage status.

The Alamo (Mission San Antonio first mission in San Antonio, serving rious battles in American history, becoming an inspirational symbol for liberty during the Texas Revolution. fending the Alamo against more than 1,000 of Mexican General Santa Anna's troops, including state folk heroes William Travis, Jim Bowie and Davy and the most accurate depiction of the

Marine life shows and displays, adventure camps, exciting rides and one of viding millions of visitors each year **The Missions and the Alamo.** In the the coolest water parks anywhere await you at SeaWorld San Antonio. Sample one of over 100 rides, including the shops, nightclubs and historic sites. sions along the San Antonio River, only "floorless" roller coaster in the Visitors and locals dine aboard river southwest, at San Antonio's Six Flags Fiesta Texas. Since it was opened dur- echo from above. This is the river that ing the 1968 World's Fair, the 15-acre originally inspired the settlement of HemisFair Park has remained one of San Antonio, and it still flourishes totonio is represented everywhere you Antonio de Valero, Mission San José, the city's top draws, anchored by the day as the city's center. 750-ft. Tower of the Americas. Hit a two-for-one special under one roof: the **Dining.** Perhaps nowhere is the city's Plaza Wax Museum and Ripley's Believe It or Not! Museum are fun for and they have been nominated for visitors of all ages. Shop at Market Square, known as the largest Mexican market north of the Rio Grande, and de Valero) was founded in 1718 as the find unique local and imported pieces ety of options, including the famed of art, pottery, jewelry and textiles. Visas a way station between east Texas it the lavish homes of the historic King and fresh cilantro, are unmatched in William District; immerse yourself in the state and accompanied perfectly Germans and Eastern Europeans, the the mission had closed, the Alamo local art at the McNay Art Msuseum; by local wines, beers and tequilas. shop in the Traders Village; cruise Many of our acclaimed chefs who throughout town on a Segue; get your studied elsewhere bring their world-"cultured cowboy" on at the Briscoe the Natural Bridge Wildlife Ranch; stroll through the **Botanical Gardens**; and visit La Villita, one of the original neighborhoods in old San Antonio, to see the artisan studios, shops and restaurants. Are you getting the drift? The list goes on and on.

> complete without strolling or riding a boat along the San Antonio River lush landscapes. Steps away from you enjoy it as much as we do.

nearly a dozen naturalistic exhibits. the MRC and MRW hotels, it gently winds through the city center, prowith easy access to the city's cultural hot spots, authentic restaurants, local cruisers while the sounds of mariachis

diverse culture more evident than in its cuisine. San Antonio's culinary palette and cooking styles reflect the heritage and innovation of European and Mexican influence. The vari-Tex-Mex with its aromas of spices class training back to our culinary Western Art Museum; experience landscape. And the barbeque? This is Texas, partner. Enough said.

Music flourishes here: countrywestern, mariachis, rock, blues and folk can be heard throughout the city. Art comes alive in outdoor murals, gardens, parks and sculptures. The confluence of cultures is everywhere and in everything, especially the **The River Walk.** No visit to Texas is open, friendly faces of the people who call San Antonio home. Our city has deep roots in its past, but we are forever mindful of its future. Thank you paved paths, arched stone bridges and for visiting San Antonio, and we hope







WE MAKE THE MARINE FUEL, **THAT POWERS** THE CARGO SHIPS, **THAT PROPEL GLOBAL TRADE AND A CLEANER GLOBE**.



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We Make Progress

Let's do the math.

Grace custom catalyst solutions, co-developed with you, are about more than performance—and more than chemistry. They're designed to add to your bottom line.

In some cases, the difference between our refinery customers' financial return on Grace technologies versus the alternative has reached into eight figures.

If you're ready to put Grace chemistry to work to strengthen your business, we're ready to show you how we can help. Call us to get started with the calculations.

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