AFPM

116th American Fuel & Petrochemical Manufacturers

ANNUAL MEETING

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DAY ONE | #AFPMAM

Sunday/Monday | March 11/12, 2018

The US refining and petrochemical industries as global leaders

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

Welcome to New Orleans and the 116th Annual Meeting of the American Fuel & Petrochemical Manufacturers. It is an exciting time to be in our industries, and in this city as it celebrates its tricentennial.

At last year's event, we were optimistic about the new administration and Congress. We were hopeful for an end to the war on fossil fuels, for steps to address regulatory overreach that stifled America's energy revolution, and for long-overdue tax reform. We have not been disappointed.

In just one year, the President's "America First Energy Plan" has shown real progress through several channels, including executive actions that reduced barriers to energy production and expedited approval of much-needed infrastructure, including the Keystone XL and Dakota Access pipelines. We have also seen historic tax reform, which will be good for US manufacturers and the country at large. I am confident that these changes will further cement the US refining and petrochemical industries as global leaders.

While we do not take this progress for granted, constraints on a free market must be addressed. It has been 13 years since the initial implementation of the Renewable Fuel Standard, and it is more than time for the biofuels industry to stand on its own, unaided by a federal mandate. Similarly, Congress and the administration must reform the CAFE (Corporate Average Fuel Economy) program, as well as end tax subsidies for electric vehicles. Today's vehicles are more efficient than ever, and innovation, not government intrusion, should be the driving force behind fuel policies and consumer choice. The right policies will enable the US refining and petrochemical industries' continued growth and their ability to provide the world with products that elevate our standards of living.

The importance of our industries and the products we supply were on display during last year's unprecedented hurricanes. Although threatened by the worst storms in decades, our resilient and dedicated employees worked to ensure that impacted operations got back up and running as soon as safely possible, causing minimal disruptions to consumers. At the same time, they contributed materials, money and countless labor hours to their communities. We will highlight their impressive work during panel discussions on Monday afternoon.

It seems fitting that we are in New Orleans at a time when the city honors its history and the resilience of its people—something our industries share. I look forward to meeting with many of you during the Annual Meeting, and encourage you to explore the Big Easy.

Laissez les bon temps rouler—that's Cajun for, "Let the good times roll." ●

INSIDE THIS ISSUE

Impact of gasoline and diesel outlook on US refiners

ALAN GELDER, Wood Mackenzie

Globally, the US refining system is one of the most competitive group of assets, when competitiveness is measured in monetary terms. However, each refinery is unique, so a wide range of performance exists across the US, with sites in PADD 2 (Midwest) and PADD 5 (West Coast) dominating the first quartile. This strong performance has been delivered on a sustainable basis over recent years, as US refiners have typically enjoyed both advantaged crude and product pricing relative to their international peers.

The global economic outlook remains positive, but the combined impact of improving vehicle fuel efficiencies and a growing penetration of electric vehicles (EVs) decouples oil demand growth from the economy. Initially, demand declines in the US and Europe have been countered by growth in the developing world, but our outlook for gasoline is ultimately one of global decline. Our conservative view of battery technology improvement results in electrification being focused on the passenger car segment. Therefore, a rise in distillate demand for road trucking is seen as economies grow, requiring more manufacturing and movement of goods. This difference in growth trajectories skews the refining system toward being distillate-led, rather than gasoline-led, which has been the regime since the crude oil price collapse (FIG. 1). The switch away from gasoline undermines the competitive strength of the US refining system.

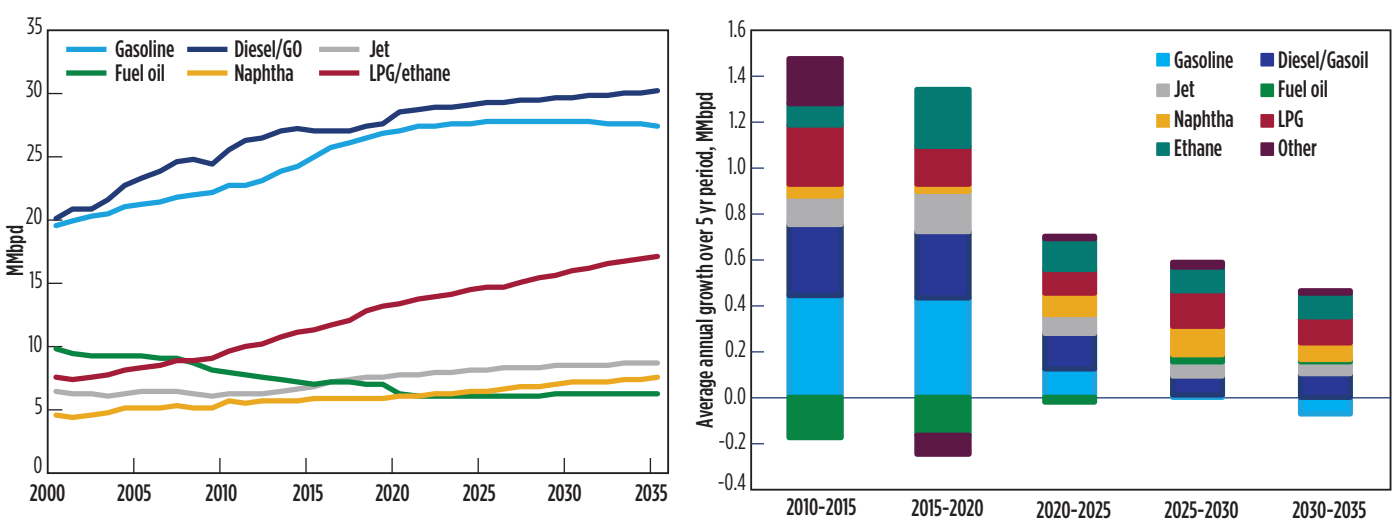

FIG. 1. Global gasoline demand is projected to fall, while distillate growth is predicted to continue. Petrochemical feedstocks are increasingly important to demand growth. Source: IEA Energy Statistics, Local Statistics, Forecast: Wood Mackenzie.

▶ See OUTLOOK, page 3

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OUTLOOK, continued from page 1

The change in US demand outlook is more pronounced and potentially more challenging than the global changes. The projected gasoline demand decline of more than 100 Mbpd per year from 2020 onwards exceeds the opportunity for greater imports from Latin America. This will require the US refining system to extend its geographical reach beyond the Americas to maintain high utilization and profitability. However, these efforts will face increasing headwinds, as Wood Mackenzie's global outlook suggests that the refining environment for Atlantic Basin assets becomes more challenging post-2023. In this timeframe, a strong risk of over-investment in refining capacity in the Middle East and Asia is considered, as the region needs to add, over the next 20 years, half of the capacity that it has added in the past 20 years. Given that new investments tend to be first quartile in terms of competitive performance, the risk of closure of weak assets in the Atlantic Basin returns.

While history tends to rhyme rather than repeat, the impact of declining demand on regional refining systems does have precedents. Japan offers the example of weak coastal sites that are undergoing ongoing capacity rationalization, as they are competitively weak and have poor export logistics. Germany offers the precedent of declining inland markets, showing that vertical integration through ownership of fuels marketing and asset consolidation to rebalance refining supply have value. These are precedents that the US refining sector must consider in its strategic planning for the future.

Alan Gelder will be leading a session exploring the market issues, opportunities and outlook for US refiners on Tuesday, March 13 during the 2 p.m.–5 p.m. session titled, "Global gasoline and diesel outlook, and its implications for US refiners." To discuss US and global market trends, stop by Wood Mackenzie's hospitality suite on Monday in the Bridge suite. ●

Alan Gelder is the Head of Downstream Consulting for Wood Mackenzie, and is responsible for formulating the firm's research outlook and integrated cross-sector perspectives on the global downstream sector. Mr. Gelder joined Wood Mackenzie's Downstream Consulting team in 2005 and became global head in 2009. Prior to joining Wood Mackenzie, he spent 10 years doing industry consulting after working for ExxonMobil in a variety of project planning and technical process design roles. Mr. Gelder earned an MS degree in chemical engineering from Imperial College, London, and an MBA from Henley Management College.

SCHEDULE OF SESSIONS AND SPECIAL EVENTS

SUNDAY, MARCH 11, 2018

9 a.m.–7:30 p.m.	Registration
5:30–7:30 p.m.	Opening reception

MONDAY, MARCH 12, 2018

7 a.m.–5 p.m.	Registration
7:30–9 a.m.	**Government relations breakfast*** *Open to registered attendees only
	Networking breakfast* *Open to registered attendees only
9–11:30 a.m.	**General session featuring:** Dan Nicholson, Vice President, Global Propulsion Systems, General Motors Rich Karlgaard, Editor-at-Large and Global Futurist, Forbes, Economic Leader, Entrepreneur & Author
12–2 p.m.	**Lunch/Tech Talks** Grab a light lunch during this informal networking session that will feature short presentations on emerging technology.
	Women in Industry Luncheon* Dawn Hudson, Chief Marketing Officer at the National Football League and Former President and CEO of Pepsi Cola North America and PepsiCo Foodservice *Open to registered women attendees only. Tickets required.
2–3 p.m.	**General session—Lessons Learned from Hurricane Harvey**
3–3:30 p.m.	**Coffee Break**
3:30–5 p.m.	**Breakout sessions:** Enhancing Resiliency in the Energy Sector through Infrastructure Investment; Flipping the Switch: The Complex Process of Refinery and Petrochemical Facility Shutdowns and Restarts; Critical Communication Awareness
5–6 p.m.	**Operating Company Reception** Join us for this inaugural gathering designed for peer-to-peer networking between operating company personnel only.
6–7 p.m.	**Chairman's Reception*** *By Invitation

TUESDAY, MARCH 13, 2018

7 a.m.–12 p.m.	Registration
7:30–9 a.m.	**Industry Leadership Breakfast*** *Open to registered attendees only
9–11:30 a.m.	**Breakout sessions:** Process Safety, Priority Regulatory Issues, Emerging Technologies
10–10:30 a.m.	**Coffee Break**
11:30 a.m.–2 p.m.	**Annual Luncheon featuring*:** Jay Leno, Comedian and Actor *Open to registered attendees only. Tickets must be purchased by March 2. No tickets or same-day seating will be available onsite.
2–4:30 p.m.	**Breakout sessions:** Economic/Commercial, Big Data, Workforce Development, Community Relations and Diversity, Innovation
3–3:30 p.m.	**Coffee Break**
5–7 p.m.	**Closing Reception** Wrap up a successful few days in the Big Easy with us at Pat O's on the River, atop the Jax Brewery. Enjoy breathtaking views of the French Quarter and the Mighty Mississippi while you unwind with friends, colleagues and a specialty cocktail! Transportation provided. Price: $75

AFPM

116TH ANNUAL MEETING CONFERENCE NEWS

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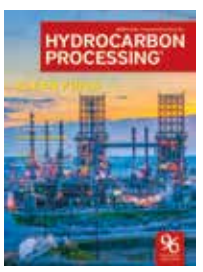


Interesting work and mentoring attract talent and lead to innovation

JAMIE MCDANIELS has been the Southeast and Great Plains Engineering Team Leader at Athlon Solutions since March 2017. She previously served as a Refinery Technical Advisor with a focus on H_2S and desalting projects. Ms. McDaniels is active with AFPM, especially at the Operations and Process Technology Summits, where she has presented papers. She graduated from the University of Alabama with a BS degree in chemical engineering.

KATHLEEN WILLS is a Technical Advisor for Athlon Solutions. As a member of the Engineering and Technical Support team, she has shared responsibility for supporting materials integrity and phase separation processes. Ms. Wills is an active member of AFPM and is engaged as a steering committee member. She is also active in NACE International, where she serves as a task group chair and participates in several other task groups. She graduated from the University of Kansas with a BS degree in chemical engineering.

Attracting and retaining young talent are challenges for many organizations in our industry. AFPM and *Hydrocarbon Processing* welcomed the chance to speak with engineers Jamie McDaniels and Kathleen Wills of Athlon Solutions, both of whom have a strong reputation within the industry and at AFPM.

AFPM/*HP:* Considering the economic cycles and some of the traditional stereotypes, what is the attraction for you to build your career in the energy industry?

McDaniels: We are often presented with challenges, whether it be a change in demand or an imposed regulation. Part of the fun is figuring out how to meet those challenges. The landscape shifts, but as professionals in the industry, we move with it. Skills are developed and fine-tuned in this line of work, including critical thinking and creative problem-solving. Today, we are helping to optimize diesel production with effective pour point depressants, and tomorrow we may be supplying private rocket ships with fuel. No matter what the industry looks like, I am confident we are all here to stay to meet humanity's needs.

Wills: Working in the energy industry is both interesting and challenging. Within this multi-faceted industry, I have had ample opportunities to further develop my career and continuously learn and do new things. It keeps me on my toes, and it is rewarding to challenge myself and make positive contributions to the industry while growing my career.

AFPM/*HP:* Your roles as engineers place you in the field, in the lab, on sales calls and working day-to-day with your leadership. Where do you see the industry going?

McDaniels: Hopefully, most companies, like Athlon Solutions, are investing right now in young talent. Experience is important, but so is growing a workforce of driven learners. If this hiring pattern is consistent across the industry, we will have motivated and experienced employees who will lead their companies and the industry to the next phase of growth. We live in a world where knowledge and communication are at our fingertips. With a surge of fresh ideas coupled with this new level of access, I think we will see major innovations in the future.

Wills: I expect that we will see many changes as the industry anticipates and adapts to changing market demands. A significant focus on innovation will continue as we try to make better use of existing technologies while developing new technologies. As we are already seeing, the demographics in our industry are changing as many experienced professionals leave the workforce. The industry will continue to strive for more effective knowledge capture and transfer, and leveraging new data-management technology and training tools will play a big role.

AFPM/*HP:* If you had the ear of corporate leaders, what challenges would you say need addressing to attract talent, particularly women?

McDaniels: To retain talent, you should understand what motivates your workforce. We recently conducted a survey within our engineering team and found that "interesting work" was the number one response. If you understand what motivates your people and you give it to them, then retention should improve. I encourage leaders to ask their employees what truly motivates them to stay with your company. They might be surprised by the answers. Specifically, regarding women: company leaders, held accountable by their peers and their management, should take an honest assessment of their own biases for or against hiring women. If a bias does exist, it is possible that the right leadership is not in place. We should be recruiting the best talent out there, regardless of gender. However, only about 20% of engineering students are female, so this tells me that the process to close the workforce gender gap must begin at home. Parents should teach their daughters that they can do anything a man can do. Teachers should encourage women to take more science and mathematics courses. Friends, family and colleagues should change the conversation if they hear a woman say that she "can't do something." We have to challenge young ladies.

Wills: Reflecting on my own career, one of the biggest reasons I have stayed in the industry and with Athlon Solutions is that I have had excellent managers and mentors who have genuinely invested in my career development. Women and men often respond differently to different leadership styles, and leaders need to understand the individuals on their teams, regardless of gender, to be more effective in leading them. A heavy focus on technical training exists, particularly for technical roles, but companies should also invest in soft skills and leadership training. Leadership shapes the culture of a company, and to attract and retain talented women, we need leaders that respect women, mentor women and champion for women in the industry.

AFPM/*HP:* As an industrial process and water treatment provider, Athlon Solutions is a growing company. What makes it such a rewarding place to work?

McDaniels: I was hired with little experience, yet I was still treated as someone who had something important to contribute. Senior employees mentor me. The company leadership understands what motivates me and has never treated me any differently as a female or as a millennial. Athlon Solutions is a privately held, family-owned company, and working for them makes me feel like I not only work for a family, but am part of it. Every day, I get to interface with scientists, businesspeople, engineers, chemists and technicians. Athlon's name says it best: Solutions. As a part of the engineering and technical support group, I see and live this company promise every single day.

Wills: Athlon Solutions has a very positive and team-oriented work environment that is due, in large part, to our family culture. Our team is strong because we have quality people with diverse experience and skillsets that complement and support each other. Our focus on collaboration and "thinking outside the box" to solve our customers' problems makes the job fun.

Join the Athlon Solutions team at their hospitality suite Monday night in the Camp Ballroom for some casino fun and music. ●

CONTANDA SECURES PRIME HOUSTON SHIP CHANNEL ACREAGE

Contanda Terminals LLC, a provider of bulk liquid storage and logistics services in North America, has secured a multi-year commercial agreement with the Port of Houston Authority for 339 acres of prime deepwater access property located on the Houston Ship Channel.

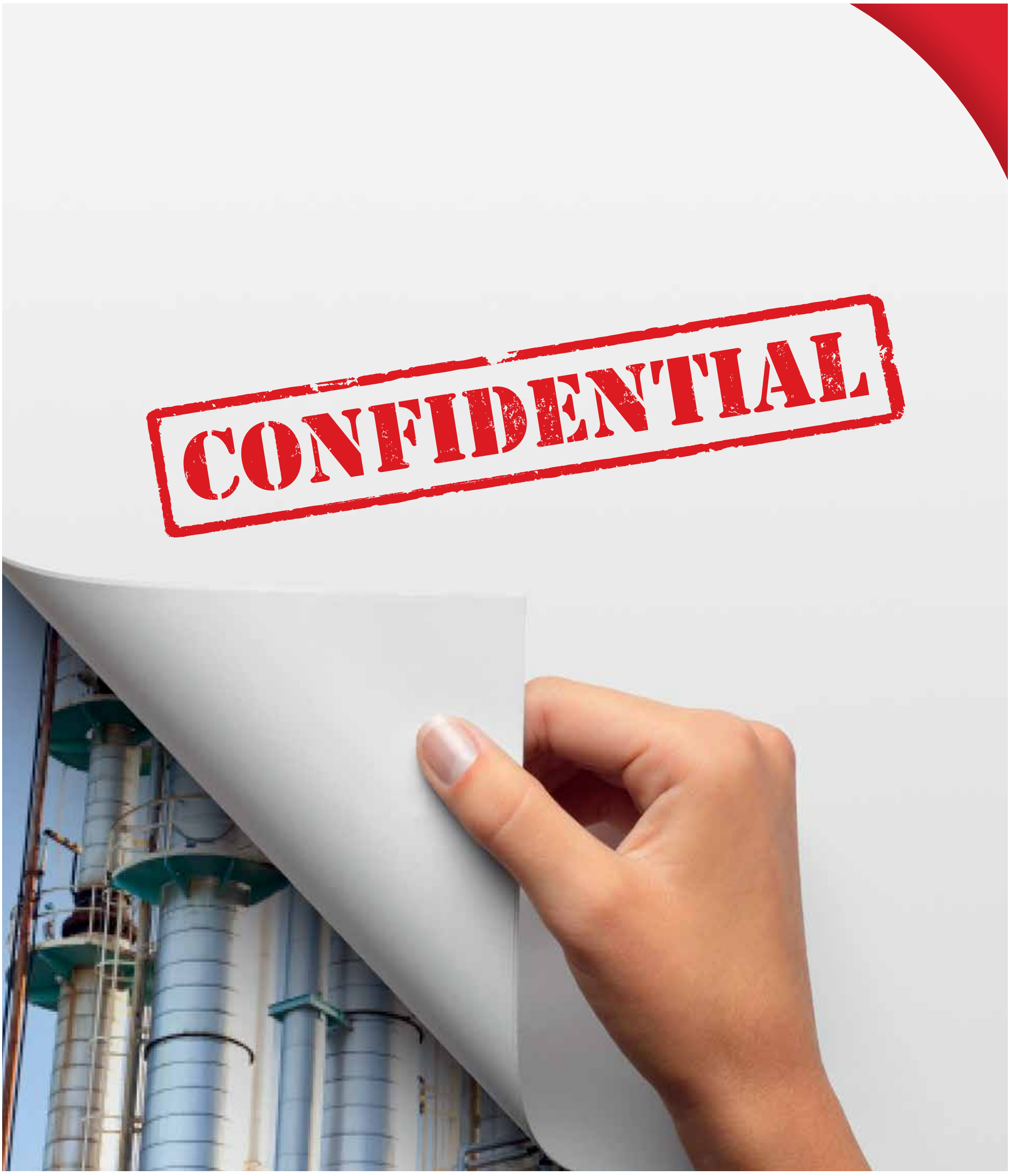
The land acquisition enables Contanda to continue its objective of doubling its terminal storage capability over the next five years, and expanding into the bulk petrochemical and hydrocarbon markets.

"This agreement with the Port of Houston Authority solidifies our long-term commitment to grow with the Port of Houston and the Houston Ship Channel," said G.R. Cardillo, President and CEO of Contanda. "With this project, Contanda has the opportunity to make significant strides in achieving our corporate goals while firmly establishing our position as a leading storage provider in the growing petrochemical and hydrocarbon markets."

"Liquid bulk storage facilities are in high demand along the Houston Ship Channel, and this agreement enables Port Houston to support this vital industry sector," said Port Chairman Janiece Longoria. "This positive development fits in well within our strategic growth plan objective to grow and diversify our business base. In addition, this partnership with Contanda helps us optimize and leverage our real estate assets, while helping the company meet its own strategic objectives."

Contanda's automated terminal facility will be built in phases to provide customers access to onsite processing, multiple ship and barge docks, and convenient tank truck and railcar accessibility. The facility is centrally located for numerous pipeline connections providing support storage services for a variety of commodities, including petrochemicals, clean petroleum products, various blendstocks, ethanol, crude oil, and refinery intermediates and other bulk commodities.

Houston-based Contanda now operates three storage terminals in the Houston area and 13 other bulk terminals across North America. ●



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Eight predictions about industrial cybersecurity in 2018

LEO SIMONOVICH, Siemens Energy

2017 saw the biggest ransomware attack ever when "WannaCry" hit more than 200,000 victims in 150 countries. The UK's National Health Service (NHS) was severely affected, including 40 hospital trusts. Operations and appointments were cancelled and ambulances diverted. Hackers demanded payment to restore access to vital medical records. Other big names infected by this cyberattack include the Spanish telecom giant Telefonica and FedEx. The power sector did not escape damage, with WannaCry attacking computers at the West Bengal State Electricity Distribution Co. Ltd. (WBSEDCL) in India, where officials detected the malicious software (malware) at four of its offices.

Was 2017 the year that the world finally took notice of increasingly frequent and sophisticated industrial cyber threats? Will global companies—from the energy, manufacturing and other industrial sectors—now take all necessary measures to prevent the next attack? Let's hope so. However, before we become too optimistic, we must see clear signs of leadership and commitment by global companies to protect their critical infrastructure and their businesses. The signs are there, but I hope that 2018 is the year we will see more.

1. **Organizations will overcome the fear of connectivity to get visibility and take advantage of digitalization.** The present strategy by many energy companies to keep their networks unconnected in the misguided belief that this makes them more cyber secure will fall victim to more successful attacks, from both inside and outside. Companies will gradually see the value in taking a more sensible approach to connectivity and defense measures. The lesson that greater connectivity equals insight may come at a high price. Once this lesson is learned, we will all become safer.
2. **Attacks against the energy sector will become more frequent and severe.** We know three things: the probability of some sort of breach in today's environment is 100%; the energy sector is undoubtedly the primary target for hackers; and operational technology has become a growing target, now comprising 30% of all cyberattacks. Recent reports indicate that new types of malware attacking critical infrastructure around the world will become regular occurrences. As these cyber weapons become more sophisticated, they will become more successful.
3. **Industrial cyber risk will reach the Board, resulting in strong directives to tackle the issue.** Global companies are already aware that they have been unprepared to combat the growing and increasingly sophisticated cyber threat. WannaCry highlighted this cyber readiness gap in even more stark terms. The call for stricter cyber regulations will get louder with each successful attack. Energy executives will respond by becoming more proactive in developing their own security measures, rather than waiting for changes to be imposed on them from the outside.
4. **New, cross-disciplinary industrial cyber leader roles will be created in many large and medium-size enterprises.** Certain energy companies will demonstrate leadership by dedicating their focus at the highest levels—and with commensurate financial resources—to integrate cyber vigilance throughout the enterprise. They will become role models for the industry by developing an industrial cybersecurity strategy, standing up a cyber-governance model, re-examining their security fundamentals and building smart infrastructure defenses that include extensive cyber training.
5. **More dedicated and comprehensive industrial cyber solutions will be brought to the energy sector.** Energy companies that take a holistic approach will be more prepared for the next attack in what is an escalating threat landscape. Those that adopt solutions leveraging the best available technologies from a variety of providers, from bridging the visibility gap to understanding the entirety of their cyber exposure, will be the most successful in staying safe.
6. **Process security analytics, powered by machine learning and AI, will give energy customers the edge to detect and respond to attacks.** A growing recognition of the OT cyber threat will lead to greater demand for machine-learning technology. Artificial intelligence (AI) will rise in stature, not only for identifying in-progress threats to environments beyond the corporate network, but also for neutralizing them.
7. **Energy customers will make cyber training and basic cyber hygiene mandatory for field personnel, following the path of safety.** The origins of many cyber threats will become more understood. With studies showing that 70% of industrial cyberattacks have been instigated from inside, inadvertent and/or malicious cyber incidents originated by employees will highlight the need for internal cyber training and awareness initiatives (FIG. 1).
8. **Energy customers will demand cyber services and integrated solutions, delivered with technology and clear risk reduction outcomes.** Energy companies will attribute the greatest value to solutions that address their most pressing cyber challenges and reach across the full value chain. The solutions deemed most effective will be those that are comprehensive and integrated, and offer "defense-in-depth" protection encompassing plant, network and system security. Companies will look for partners that can bridge digitalization and automation, allow secure data processing and automation anywhere on the web, and meet the environmental, availability and security requirements of tankers, pipelines, subsea and offshore production rigs. ●

FIG. 1. Since approximately 70% of industrial cyberattacks originate within an organization, the need for internal cyber training and awareness initiatives is growing.

As Vice President and Global Head of Industrial Cyber and Digital Security for Siemens, Leo Simonovich is responsible for setting the strategic direction for Siemens' industrial cybersecurity business worldwide. He identifies emerging market trends, works with customers and Siemens businesses to provide best-in-class cyber offers, and contributes to the company's thought leadership on the topic. He is particularly focused on solving the cybersecurity challenge in the oil and gas and power sectors by bringing unique solutions to customers looking to address a growing and costly operational security risk. He frequently speaks on such topics as cyber governance, risk management and organizational transformation in operational environments.

Previously, Mr. Simonovich led the cyber risk analytics practice area at the management consulting firm, Booz Allen Hamilton. He refined his expertise through his work with large government and commercial customers to improve their cyber risk posture. While at Booz Allen, he created an industry-recognized methodology to evaluate the financial benefits of investment in cybersecurity. Mr. Simonovich holds both an MS degree in global finance and an MBA from the University of Denver.

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Secure refinery control systems against cyberattack

SAM GALPIN, Bedrock Automation

It is 2:00 a.m. in the control room, and suddenly all of the operator's screens go dark, except one. The screen requests $1 MM in Bitcoins for the instructions and decryption key required to restore normal operations.

This is what a targeted ransomware attack might look like. This may seem unlikely, but take a moment and think like a hacker: the attack has a payday, and it is much easier than a serious cyber-physical attack on the process. This scenario requires only a targeted delivery of a Windows ransomware payload, which is something that hackers do every day.

The real nightmare scenario is the attack that uses the control system as a weapon to cause fires, explosions, environmental damage or loss of human life. This more complex attack requires both hacking and process engineering skills. The recent TRISIS/TRITON attack on a safety system in the Middle East was most likely intended to be part of a larger attack with potentially disastrous results.

FIG. 1. The Bedrock Control system has standard functionality that continuously monitors the controller's network and system time to detect intrusions and anomalous behavior.

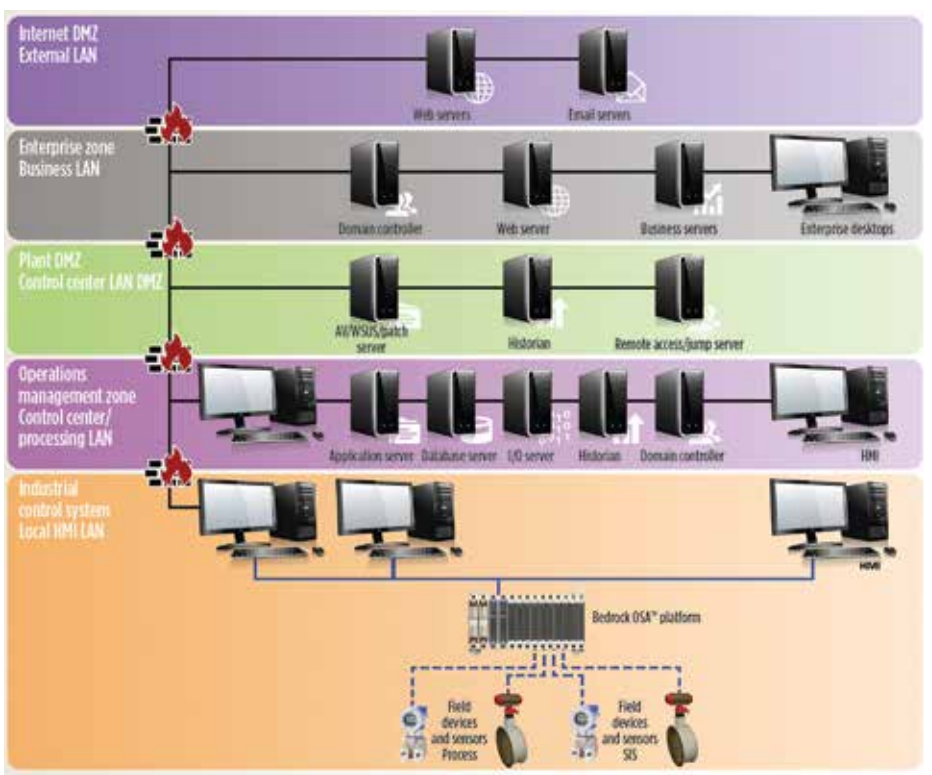

FIG. 2. Large systems can be broken into multiple segments at multiple levels, making life more difficult for an attacker.

Control security basics. The tools and techniques used by cyberattackers are continually evolving, and even the most secure systems are vulnerable. Securing a control system is an iterative process that combines defense in depth with continuous improvement, and comprises three basic components: reducing vulnerability, situational awareness and incident response. Securing the system requires both IT security technology, and the industrial control systems (ICS) and process knowledge of plant operations (OT). Best practices require a partnership of both groups that is supported by top management. In today's world, cyber defense must go beyond barriers to entry. The defensive objective must shift to resilience and the limitation of consequences.

Risk assessment—the cyber PHA. Process hazards analysis (PHA) or hazards and operability (HAZOP) studies are methodologies used to identify the types of malfunctions that might harm personnel, processes or the environment. Today, these basic approaches must be extended by considering the malfunctions that might be created by a cyberattack on one or more system components. These malfunctions are not random hardware failures, but are rather caused by deliberate malice. One critical difference this makes is that the protection normally provided by redundancy is much less effective. To a hacker, triple redundancy simply means carrying out the same hack three times. The most important questions to ask are:

- What would an attacker need to do to inflict maximum damage?
- How might a cyber attacker do it?

In most organizations, OT personnel are responsible for the processes. They know what kinds of malfunctions can potentially become "nightmare" scenarios. However, they normally have little knowledge of cybersecurity, cyberattacks, networks, firewalls and related cyber issues. This has traditionally been the domain of IT personnel, who are most likely officially responsible for defending the organization from cyberattacks, but have little understanding of the process, the control system or the OT world. Conducting an effective cyber PHA will require the skills of both groups.

The cyber PHA should deliver a clearer view of the risks and, ideally, a short list of the most important assets to protect. Available defensive resources are always limited, so mitigation efforts should be focused where they will be most effective.

Reducing vulnerability. Not long ago, the general view of ICS vulnerability could be summarized as, "We are air gapped, so we are not at risk." Development engineers at major ICS vendors shared this mindset, with the result that most ICS protocols assume that all properly formed messages are authentic. This means that a sufficiently knowledgeable malicious actor with access to the control network can open and close valves, change setpoints and generally do whatever he or she pleases. In this scenario, the potential damage depends on the nature of the process and the intent and skill of the attacker. Therefore, vulnerability reduction for ICS components has traditionally focused on network segmentation and firewalls. The concept is simple: restore the air gap, and configure the firewalls at all levels to "deny all," except for critical data.

Vulnerability reduction goes beyond the network to include the hardening of the various devices. This includes best practices like antivirus software and security updates for Windows and Linux systems. These measures, however, still leave the basic vulnerability of the insecure ICS protocols untouched. Given time and motivation, elite hackers can gain access through firewalls.

Adding depth to defense. A more complete solution is to establish a cryptographic root of trust mediated by public key infrastructure (PKI). The basic principles are simple: all parties have unique certificates, issued and managed by a certificate authority (CA), that identify them and define their system roles and privileges. The certificated PKI mechanisms enable all actors to recognize other legitimate actors and exclude imposters, as well as provide secure communication between members.

In the case of an ICS controller module, it is possible to know, at the controller, if an actor is an engineer allowed to change the user programming, or if an operator may change a setpoint. If the actor has the proper certificate and matching private key, the controller allows the action. If not, the controller blocks it. The Bedrock Open Secure Automation (Bedrock OSA™) control system (**FIG. 1**) has standard functionality that continuously monitors the controller's network and system time to detect intrusions and anomalous behavior.

More complex configurations. Segmented networks make life more difficult for an attacker. Large systems can be broken into multiple segments at multiple levels, as shown in **FIG. 2.** For example, critical safety systems can be in their own segment under a control segment. DMZ segments contain stations that must communicate across segment boundaries. A typical example would be a historian server that gets data from the control network and is also accessed by applications on the corporate network. Segments can be isolated by data diodes, a special firewall-like device that allows data to flow in only one direction.

Situational awareness. In today's world, determined attackers *will* get in and they will hide, but even stealthy attackers will leave detectable traces. Ideally, attackers are detected and ejected. Unfortunately, events created by attackers are usually only subtle departures from normal behavior. The good news is that a wide range of monitoring tools, both commercial and open source, are available.

Incident response. Back to 2:00 a.m. in the control room, where the only lit screen is requesting $1 MM in Bitcoins. What happens next?

Ideally, an incident response plan is in place, informed by the cyber PHA. First and second responders have conducted training exercises and know what to do and how to adapt. Worst-case outcomes will be prevented, and a thorough post-incident review will attempt to find the rest of the story: how the attackers gained entry, why they were not detected, and what improvements will need to be made. ●

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Industrial apps simplify data analytics

MARCIO DONNANGELO, Emerson Automation Solutions

Refinery operators must focus on process optimization and blending crudes to achieve the most profitable operations. Asset and equipment failure can lead to downtime, spoiling these and other strategies, so operators are constantly searching for ways to improve uptime. One way to achieve this is through monitoring assets using data analytics. However, data must first be collected before it can be analyzed.

Different from real-time control, monitoring requires a new approach in terms of response time, data collection hardware, databases, analytics and actions. These needs, coupled with cost and time pressures, often make wired instrumentation infeasible for new asset monitoring applications. This is driving a need for different, suitable technologies, and this is where *Wireless*HART® rises to the top.

*Wireless*HART has been one of the industry standards for wireless communications for the past 10 years. It is supported by dozens of vendors and administered by the independent FieldComm Group organization. Emerson alone has nearly 30,000 wireless networks installed, with more than 8 billion hours of operation.

Since wireless networks do not require a wired infrastructure, a wireless instrument can be installed for 20%–33% of the cost of a wired 4-20 mA or Fieldbus instrument, and in a fraction of the time. New non-intrusive instruments technologies—such as inside-of-pipe temperature, corrosion, acoustic and others—eliminate leak points and further reduce the overall cost and time of installation by removing the need for pipe cutting, drilling or welding.

Once a wireless infrastructure is set up to monitor one or more pieces of equipment, additional wireless instruments can be added and joined to the existing network for very little marginal cost.

Simplified software and system integration. Next-generation software applications, or industrial "apps," collect raw data from these wireless and existing wired instruments, and then perform analytics to determine the condition of plant equipment and assets. This provides users with greater visibility into operations, enabling improved reliability and energy efficiency.

FIG. 1. Emerson's Plantweb Insight apps can be securely accessed from any device capable of hosting a web browser, including PCs, tablets and smartphones.

As with apps for smartphones and tablets, these types of industrial apps are becoming a common way for vendors to supply software to end users, supplanting more traditional software products. These industrial software apps are also lightweight and require very little in the way of corporate IT support.

Emerson's Plantweb™ Insight apps utilize pre-built analytics with embedded domain expertise to diagnose the health of plant assets. The resulting information and insights can be accessed and visualized on a web-user interface running on PCs, laptops, tablets or smartphones (**FIG. 1**). Dashboards and charts simplify navigation and interpretation of information, so minimal training is required. The apps include features to ensure security, including role-based access.

Each app addresses specific assets—such as pumps, heat exchangers, pressure relief valves and steam traps, among others—with simple and inexpensive plug-in solutions. These apps run independently of a plant's control system. The app package is provided as a "virtual machine," making it easy to install, simple to manage and available to multiple users simultaneously. No specific hardware is needed.

Each of these apps is purpose-built for a specific asset, making them quick, easy and inexpensive to implement. This contrasts with general-purpose data analytic solutions, which often require extensive configuration or programming by the end user to yield meaningful results.

Wireless gateways, which funnel data from the wireless instruments to the apps, can be accessed. Once the gateways are installed, additional wireless instruments and apps can be added at minimal cost. The additional instrumentation will use the same gateways in most cases, depending on how many instruments are connected, and the apps can connect to multiple gateways.

Besides acquiring data from wireless and wired transmitters, each app can also access data from historians, databases or other sources via industry-standard interfaces such as OPC UA and Modbus TCP/IP.

Emerson's Plantweb Insight apps complement a plant's existing control and monitoring system without interfering with existing operations. This means that equipment diagnostics can be conducted parallel to any legacy control and monitoring system. This is significant because most refineries have very stringent, expensive and time-consuming procedures for adding an input point to an existing control system. In most cases, these monitoring points are not used for control, so they can be installed and commissioned much more quickly and inexpensively than input points used for control.

Wireless instrumentation and accompanying apps simplify the installation, configuration and maintenance of equipment monitoring systems. This allows refineries to protect assets and equipment, improve uptime, comply with regulations and increase profits. ●

Marcio Donnangelo is Global Business Development Manager with Emerson Automation Solutions, and is focused on wireless technologies in refineries. He is an Industrial Electrical Engineer with 25 years of field experience applying industrial automation solutions for customers across multiple business segments and industries, including refining, petrochemical, pulp and paper, food and beverage, automotive and others.

AFPM testifies to DHS subcommittee on cybersecurity, infrastructure protection, CFATS program

On February 15, 2018, AFPM President and CEO Chet Thompson provided testimony to the House Committee on Homeland Security, Subcommittee on Cybersecurity and Infrastructure Protection in a hearing titled, "Industry views of the Chemical Facility Anti-Terrorism Standards (CFATS) program."

Mr. Thompson's verbal testimony is included here.

"Good morning and thank you Chairman Ratcliffe (Rep. John Ratcliffe—R-Texas), Ranking Member Richmond (Rep. Cedric Richmond—D-Louisiana) and members of the subcommittee for the opportunity to testify today.

"AFPM represents 97% of the nation's refining and petrochemical manufacturing capacity, including 118 refineries and 248 petrochemical facilities in 33 states. We support more than three million US jobs and add approximately $600 B each year to the US economy. Our members make the gasoline, diesel, jet fuel and petrochemicals that power our economy and make modern life possible.

"America's refining and petrochemical companies play an important role in ensuring and maintaining the security of America's energy and petrochemical infrastructure. Nothing is more important to our members than the safety and security of our employees, contractors and surrounding communities. Their safety requires that we protect our facilities and critical infrastructure against potential security threats. Accomplishing this is the shared responsibility of the government and our member companies.

"We have a good partnership with DHS, and believe they have done a great job implementing the program (CFATS). For all these reasons, we fully support the reauthorization of the CFATS program and urge Congress not to let this program lapse.

"I would like to use my limited time this morning to highlight a couple of the points from my written testimony. First, the overall structure of the CFATS program is sound and not in need of a major statutory overhaul. Again, AFPM members support the mission and goals of CFATS, and believe that the US is safer as a result.

"We strongly endorse the program's performance-based approach that allows facilities to develop security plans that fit their specific risk profiles, as opposed to requiring facilities to apply a one-size-fits-all approach. Second, Congress's 2014 CFATS reauthorization improved the program. Some of the larger improvements included revisions to

▶ See **AFPM HEARING,** page 12

Better Adapt To Changing Conditions

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AFPM HEARING, continued from page 10

DHS's risk assessment tools and tiering methodology, the establishment of an Expedited Approval Program for Tier 3 and Tier 4 facilities, and streamlining personnel vetting for Tier 1 and Tier 2 facilities.

"Congress's four-year reauthorization was also important. It provided industry with the certainty needed to make long-term facility security investments and provided DHS with the support and resources needed to improve the program.

"AFPM supports another multi-year reauthorization to continue this positive momentum. In addition to a multi-year reauthorization, we offer the following recommendations as the Committee moves forward:

- First, AFPM urges Congress to continue protecting the confidentiality of CFATS site security information.
- DHS and covered facilities should not be required to publicly disclose or provide site security information to persons who lack the requisite security clearances. CFATS is a security program.
- Mandating the public disclosure of sensitive information—such as security system designs, control system schematics, worst-case scenario discharge data, COI records (chemicals of interest) and tactical response information—could threaten the safety of our facilities and the security of the nation's critical infrastructure.
- Second, AFPM also urges Congress to continue to subject the CFATS program, particularly Appendix A [Chemicals of Interest (COI) List], to the formal notice and comment rulemaking process under the Administrative Procedure Act.
- Revisions to Appendix A would have broad implications for chemical facilities, including whether they are subject to CFATS and, in part, how they are tiered.
- As such, proposed changes to Appendix A should be transparent and subject to public review and comment.
- Finally, we caution against adding new and extraneous provisions that will slow or diminish the progress DHS has made in implementing the CFATS program.
- More specifically, Congress should not mandate or authorize DHS to require facilities to undergo Inherently Safer Technology (IST) review as part of the security planning process. Nor should it mandate additional stakeholder involvement in security plan development.

"Thank you again for the opportunity to testify today. We look forward to working with the Committee and DHS in the months ahead." ●

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 in AFPM Central, located in the Churchill Room of the Hilton New Orleans Riverside. To contact the hotel desk, dial 504-561-0500.

Advanced Refining Technologies (ART)—Sun., Mon.	Suite TBA
Albemarle—Mon.	Commerce
Athlon Solutions—Mon.	Camp
Axens North America, Inc.—Mon.	Jackson
BASF Corporation—Sun.	Suite TBA
Chevron Lummus Global/CB&I, Sun., Mon.	Suite TBA
CRI Catalysts/Criterion Catalysts/Shell Global Solutions—Mon.	Port & Starboard
Dorf Ketal Chemicals LLC—Sun.	Pelican
DuPont Clean Technologies—Sun., Mon.	Quarterdeck, Ballroom A
Emerson Automation Solutions—Sun.	Suite TBA
Haldor Topsoe, Inc.—Sun., Mon.	Fulton
Honeywell UOP—Mon.	Suite TBA
KBC Advanced Technologies (A Yokogawa Company)—Sun., Mon.	Suite TBA
KBR—Mon.	Magazine
Linde Engineering North America—Mon.	Parish
Norton Engineering Consultants, Inc.—Sun., Mon.	Steering
S&P Global Platts—Sun., Mon.	Quarterdeck BC
Sabin Metal Corporation—Sun., Mon.	Royal
Wood—Mon.	Canal
Wood Mackenzie—Mon.	Bridge
W. R. Grace & Co.—Sun., Mon.	Suite TBA

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Air Liquide Large Industries US LP	Suite TBA
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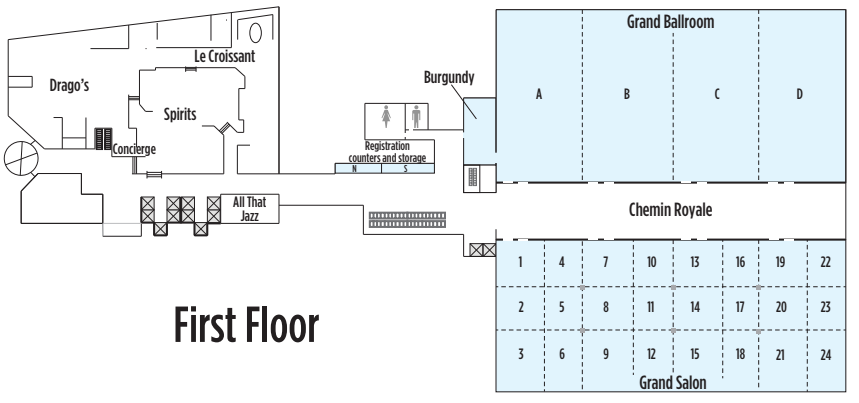
Colonial Terminal Logistics, LLC	Suite TBA
Vopak Americas	Suite TBA

HILTON NEW ORLEANS RIVERSIDE FLOOR PLAN



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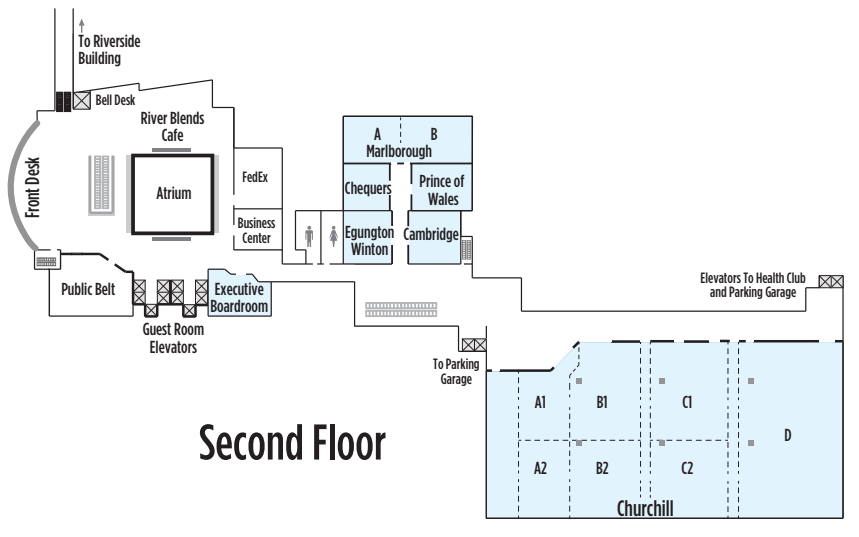
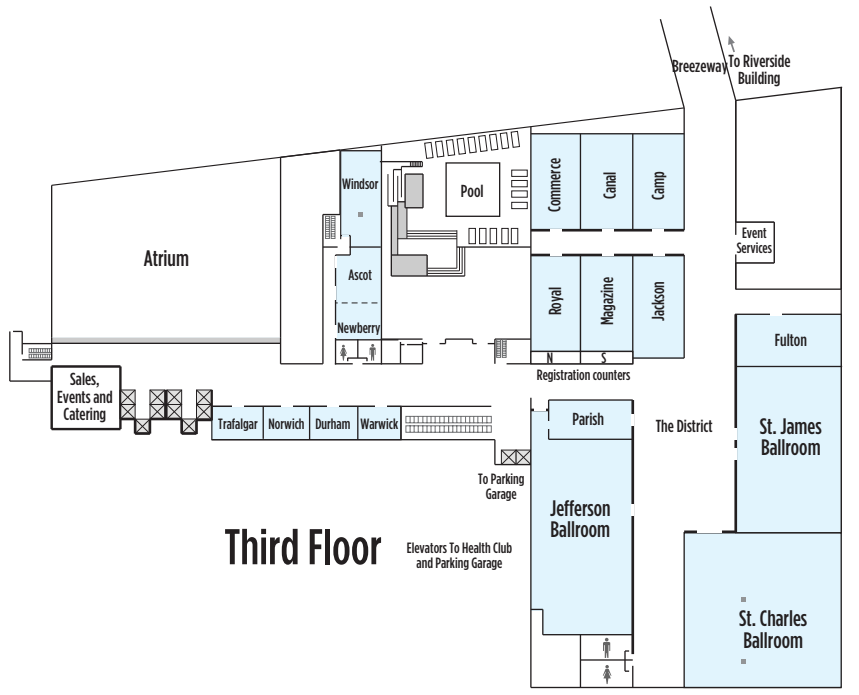
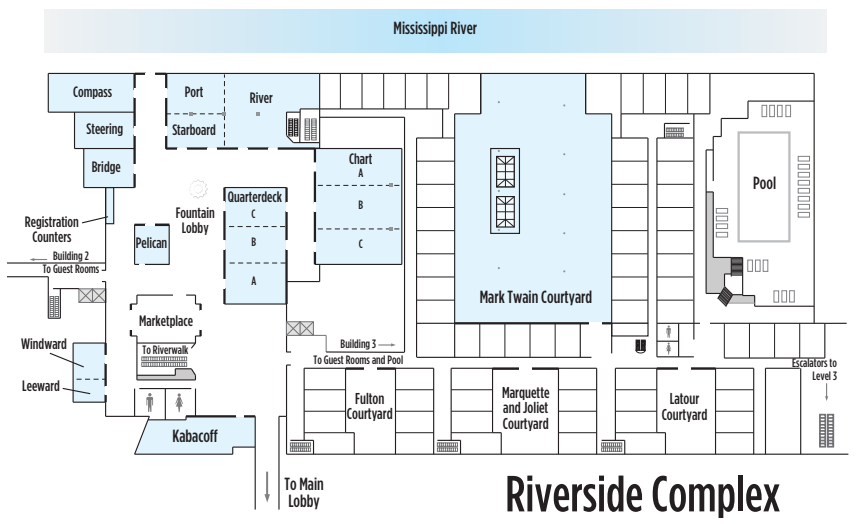


Second Floor



Third Floor



Riverside Complex

UPCOMING AFPM EVENT

Reliability & Maintenance Conference and Exhibition

May 22–25, 2018 / San Antonio, Texas

This three-day program includes keynote addresses, technical and management presentations, discussion groups, structured Q & A sessions, and an exhibition of products and services. Presentations focus on improving reliability in the refining and petrochemical industry, covering topics such as effective maintenance organization, productivity, equipment reliability, health and safety, training, environmental control, predictive/preventive maintenance, maintenance and engineering standards, inspection, procurement and innovative reliability technology.

FOR MORE INFORMATION, VISIT AFPM.ORG

Combine the power of digital twins with cloud-based collaboration

TIM SHIRE, KBC

Increasing oil prices are reducing the relative feedstock and energy cost advantages that refiners and petrochemicals producers have recently enjoyed. With these high costs and a growing scarcity of skilled staff, a fundamental shift in mindset toward plant operations and maintenance is required to ensure organizational resilience. Accordingly, the desire to achieve enhanced cost structures through innovation in operating models and digitalization has intensified.

Historically, refineries annually purchase thousands of hours of professional consulting services for troubleshooting and optimization under technical service agreements. Under these agreements, third-party subject matter experts are made available and charged on a time and material basis, acting as an extended member of the plant's technical team.

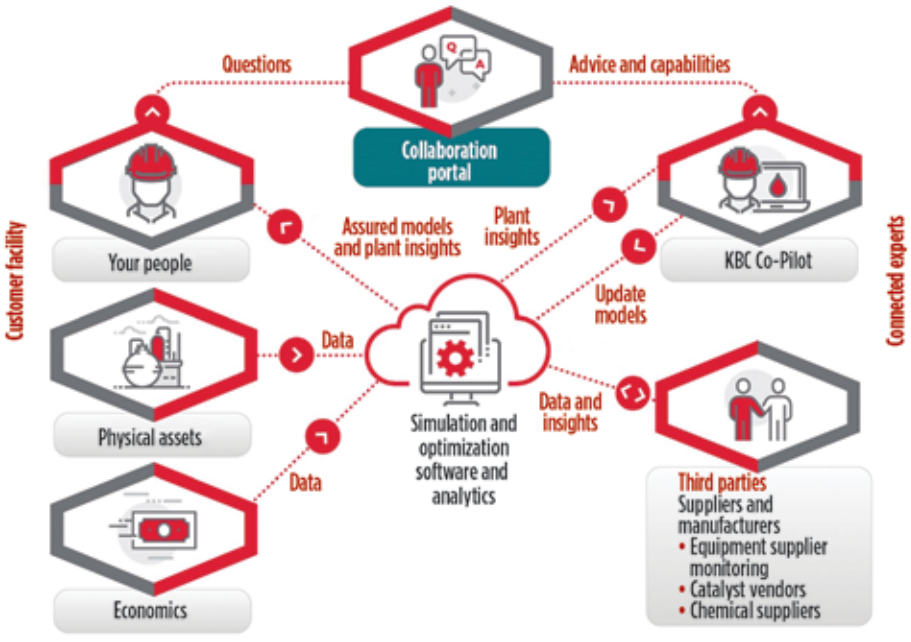


FIG. 1. Digitally replicating live plant operating data and economic data in the cloud allows KBC to provide remote advice and assistance for improving plant operations.

These services are, for the most part, provided to reactively address plant issues. While these arrangements work well in some instances, cost containment of services is often an issue, as are the lack of proactive advice and assurance of outcomes. Customers have historically paid for these inputs in the form of service hour billings, but the outcomes remain uncertain.

However, outcome-as-a-service offerings are becoming prevalent. For example, consumers no longer buy CDs, but instead subscribe to online streaming services with "all you can eat" listening. In the electricity generation segment, major equipment vendors have moved from selling gas turbines to selling "power by the hour." The proliferation of these subscription-based service models has been enabled by significant improvements in technology.

This outcome-as-a-service model is now being applied to ensure plant performance in industrial settings, delivering operational excellence (OpX®) as a service through the cloud. This type of approach provides the ability to achieve plant troubleshooting and optimization objectives more efficiently and effectively.

To confirm the functionality of these types of commercially-advantaged approaches, the service provider must have a high degree of technical expertise with respect to refinery operations, and battle-tested capabilities for online streaming and management of operations and maintenance data. The service provider must also have efficient, automated algorithms and technology to process the information and generate insights.

Digital twins in the cloud. The KBC Co-Pilot Program® accomplishes this by creating high-fidelity, molecular-enabled (kinetic) digital twins of refinery and petrochemical plants in the cloud (**FIG. 1**). The digital twin in the cloud gathers data from the plant's distributed control systems, historians and labs, as well as from other sources such as feedstock and energy pricing. The data is constantly monitored and analyzed by deep subject matter experts (SMEs) with decades of worldwide plant troubleshooting and optimization experience to create insights for improving plant performance in real-time through highly-robust, cloud-based data sharing.

The program also provides predictive capabilities, which improve upon purely reactive approaches. The molecular-enabled, digital twin can calculate equipment health parameters that cannot be directly measured by sensors, enabling the identification and mitigation of potential issues before they constrain or impact performance.

Reactive and proactive advice and recommendations are provided through an online, cyber-secured collaboration portal, allowing for real-time discussion and exchange of ideas among multiple external experts and plant-based engineering, operations, maintenance and planning groups. Advice and recommendations can also be pushed out to plant personnel through emails and texts, and by sending data and information to existing plant control and monitoring systems.

These types of service agreements apply to day-to-day operations and have longer-term positive impacts on maintenance and asset integrity, circling back to production planning and enabling the plant to achieve its full potential at all times, in the most efficient way possible.

To learn more about the KBC Co-Pilot Program and to meet the KBC team, visit the company's hospitality suite Sunday and Monday nights. ●

Tim Shire is the Product Manager for the KBC Co-Pilot Program, cloud-based simulation and expert support to ensure asset performance. He began his career as an engineer in utilities design for an engineering, procurement and construction company before joining KBC in 2006, where he worked initially as an energy efficiency consultant. He has worked on a range of global projects in the oil refining, petrochemicals, gas and LNG segments. Starting in 2014, Mr. Shire led KBC's consulting innovation program, and was Product Manager for KBC's suite of energy software. He holds BS and MS degrees in chemical engineering from the University of Cambridge, UK.

UPCOMING AFPM EVENT

Security Conference

April 24–25, 2018 / New Orleans, Louisiana

As an industry and as a nation, we must keep ourselves informed about the many potentially devastating events that could change the way refiners and petrochemical manufacturers operate. The conference presents current topics of critical importance to assist attendees in keeping themselves up-to-date on security issues.

FOR MORE INFORMATION, VISIT AFPM.ORG

FEATURED EVENTS AND SPEAKERS

WOMEN IN INDUSTRY LUNCHEON

The popular Women in Industry Luncheon on Monday, March 12, provides a distinct opportunity for women to meet and network with one another at the AFPM Annual Meeting. This event is a natural extension of AFPM's growing emphasis on creating a more inclusive and diversified industry.

Attendees will have the pleasure of hearing from **Dawn Hudson,** the Chief Marketing Officer for the National Football League (NFL) and the former President and CEO of Pepsi Cola North America and PepsiCo Foodservice.

One of the most important female marketers in sports, Dawn Hudson has helped revolutionize marketing and tie-ins with sports organizations. During Ms. Hudson's 11 years at Pepsi, the company's sponsorships included NFL and Major League Baseball deals, along with Mountain Dew's support of action sports. Her impact on advertising and communications within the beverage industry is legendary, and under her leadership Pepsi also maintained its status among the most purchased brands in the country. A veteran marketing and advertising executive, Ms. Hudson has more than 20 years of strategic brand-building experience behind some of the world's best-known brands, and she is a champion of smart innovation and growth. She will share insights on turning adversity into an advantage, building a global brand and creating a diverse workplace.

In 2005 and 2007, she was listed among *Fortune* magazine's "50 Most Powerful Women in Business," and she was twice named to *Advertising Age's* list of "Top 50 Marketers." In 2002, she was named "Advertising Woman of the Year" by Advertising Women of New York.

GENERAL SESSION

At Monday morning's general sessions, AFPM attendees will hear from two noted speakers.

Dan Nicholson was appointed General Motors Vice President, Global Propulsion Systems, in December 2014. He previously served as the Executive Director for Global Powertrain Embedded Controls at GM, where he ran the day-to-day operations of the global engineering team responsible for all powertrain controllers and software, as well as all powertrain calibration.

Mr. Nicholson began his career with GM as a co-op student at Buick Motor Division in 1982. He has an extensive background in product engineering and subsequently progressed through a series of leadership positions, including Engineering Group Manager, Director of controller integration, Director of engine calibration, Chief Engineer for V8 engines, Managing Director of GM Powertrain-Germany GmbH, where he led all powertrain operations for the country unit, and Vice President of global quality.

Mr. Nicholson is the President of FISITA, a trustee of the SAE Foundation and a Director of the Engineering Society of Detroit.

Rich Karlgaard, *Forbes* Publisher and Global Futurist, Economic Leader, Entrepreneur and Author, is one of the most influential and respected figures in the technology, economic and business worlds. In Monday morning's general session, he will advise the AFPM audience on how to harness an organization's disruptive spirits to maximize business opportunities in the global marketplace.

As an expert in artificial intelligence, blockchain and the Internet of Things, Mr. Karlgaard is a co-founder of *Upside* magazine, Garage Technology Partners (with Guy Kawasaki) and Silicon Valley's premier public business forum, the 7,500-member Churchill Club, for which he won an Ernst & Young Entrepreneur of the Year Award. His 2015 book, *Team Genius: The New Science of High Performing Organizations,* has been endorsed by Satya Nadella, CEO of Microsoft, and Fred Smith, CEO of FedEx. ●

DAWN HUDSON

DAN NICHOLSON

RICK KARLGAARD

Planning crucial to critical power utilities installation during a plant turnaround

BARNEY SMITH, Aggreko

While critical to the long-term operational efficiency of a plant, turnarounds cost a great deal of money and do not directly generate any revenue. Plant management is under immense pressure to perform turnarounds as efficiently, quickly and safely as possible to get the plant back online.

Turnarounds often prove challenging during repairs or upgrades to the facility's electrical power system. Such work might vary from relatively short-duration (2 days–7 days) production curtailments for power equipment repairs or inspections, to turnaround extensions driven by long-duration, critical-path electrical system work.

Refiners and plant operators continually look for ways to minimize turnaround extensions, or to eliminate the need to curb production only for electrical work. To avoid shutting down a process unit, it becomes necessary to duplicate a unit's electrical infrastructure on a temporary basis.

These projects have consistently demonstrated the importance of early planning to ensure a safe and more efficient turnaround. However, in many instances, crucial aspects of planning temporary power generation are not addressed until just a few months prior to the planned turnaround start date.

To avoid unexpected surprises that might extend the timeframe and cost of a turnaround, or raise safety risks to personnel, a checklist of best practices should be followed when planning critical power utilities for turnarounds is detailed here.

Follow proper safety labeling. Safety is the primary concern of any plant operation, and turnarounds are certainly no exception. Electrical hazards such as ARC flashes are a very real concern, which makes proper labeling of electrical equipment and panels an absolute necessity (**FIG. 1**).

FIG. 1. A representative ARC Flash Decal for a generator circuit breaker panel, which clearly lists the required level of flash and shock protections when working on and around the generator.

FIG. 2. Example of a one-line diagram displaying equipment placement.

Determine electrical needs. Larger refineries and petrochemical plants assemble dedicated teams to design and manage the turnaround, including properly identifying the operating voltage, power and other electrical parameters required prior to selecting the amount and type of equipment needed.

Pre-scoping of the job should commence approximately 12 mos before the turnaround is scheduled to begin. This typically begins with the vendor conducting a thorough walkthrough of the facility with the plant's engineers. This walkthrough is designed to give the vendor a detailed understanding of which equipment the plant needs to keep running during the turnaround, how much load will be required, and the best fueling options based on availability and need.

During a walkthrough ahead of a large-scale turnaround in a 195-Mbpd refinery in the mid-continental US, the refiner sought to limit NO_x emissions coming from diesel generators. The refiner also needed assurances that the selected power source was highly reliable for the high-load needs of heat stress relief applications.

Aggreko proposed switching to natural gas as a fuel source, which would essentially eliminate the refiner's emissions concerns while significantly lowering their fuel costs. Aggreko designed a natural gas solution complete with the necessary one-line diagrams for efficient installation.

The natural gas generators used in this turnaround reduced NO_x emissions by more than 80%, saved $250,000 in diesel fuel costs and avoided the logistical challenges associated with frequent diesel fuel deliveries to the facility. The generators also provided the reliability improvement the refiner was looking for, resulting in 50%–65% fewer service intervals compared to diesel generators.

In another turnaround project, a US West Coast refiner required a significant amount of short-term power for the removal and replacement of their FCC reactor. Historically, generators have been placed quite close to where the power is used during a turnaround. Space was at a premium in this particular turnaround, which made locating the power near the work more challenging.

The generators would have to be periodically refueled, which implies that additional personnel and trucks must be onsite at a time when the facility seeks to minimize personnel and equipment for safety reasons. In addition, a generator's combustion process naturally produces emissions that must be monitored. It is not uncommon for slight changes in ambient conditions to activate a worker's CO alarm, forcing them to curtail work even if they are not in danger.

Aggreko conducted a walkthrough and suggested centrally locating the generators in a vacant tank pad area some distance from the FCCU. The generators would be close enough to run cables, but far enough away that workers would not need to worry about CO emissions from the generators. Centrally locating generators allows for higher kW capacity with fewer units, enabling the generators to run higher on their efficiency curve, saving fuel. These designs also inherently incorporate redundancy, which is more difficult and less cost-effective when generators are scattered. Finally, this design option reduces the number of people required in the plant to refuel the generators, providing safety benefits during the turnaround.

Aggreko installed 17 MW of power at the centralized location. Generator voltage was increased to 4,160 V. Transformers near the equipment then stepped the voltage down to 480 V for use in the plant. This arrangement saved the customer more than $1.4 MM in combined generator rental and fuel costs. In addition, it made worker-related CO emissions a non-issue—total emissions were 18% lower than anticipated.

Pinpointing locations and selecting connections. Approximately 6 mos–9 mos prior to project startup, and with an understanding of the facility's short-term power needs, the next step is to determine the optimal placement of generators and routing of cables in the facility. Depending on the size and scope of the turnaround, localized power at the site may be ideal. Larger turnarounds may call for a distributed, mini-grid-style power configuration.

Detailed equipment layout and cable routing drawings should be developed to assist in these efforts. Cable and electrical layouts are also produced to detail the location of cable routes and how each cable will be connected to the equipment.

These diagrams, commonly reviewed in turnaround planning meetings, help identify potential complications and allow for changes well before any work has begun, ultimately reducing unforeseen installation time and labor costs.

Create one-line diagrams. Approximately 3 mos–6 mos prior to the start of the turnaround, detailed one-line diagrams should be created for the plant's electrical power needs (**FIG. 2**). These diagrams are designed to identify the type, size and location of all generators, circuits, and panel and cable sizes.

Coordinating layout drawings with the one-line diagrams ensures that equipment goes to the right locations and that life-critical systems stay active in case of faults. These drawings can also reduce labor hours, as anyone reviewing the drawing will know exactly where to send equipment when it arrives at the facility.

Plan service and refueling access. Whether installing one or multiple generators for the turnaround, service access is a crucial consideration. All generators will require periodic maintenance and service, and will need to be refueled on a scheduled basis.

Not only should each generator be easily accessible to personnel throughout the duration of the turnaround, but additional power options must also be planned out in the event that a generator is taken offline for service. This might mean installing two generators rather than only one, which allows one generator to pick up the load when the other is being serviced. The optimum solution may call for the installation of three to four generators at one location, and utilizing the facility's existing distribution system to transmit power where needed.

Each generator's fueling needs and options should be organized in advance, as well. Unfortunately, some plants overlook this aspect of critical response planning and face power shortages at a particular site, or across the whole plant, while waiting for a refueling truck to arrive.

Securing the site and identifying key contacts. As with any high-voltage electrical equipment, temporary generators and cables in a plant can pose risks of injury. To increase safety, the site should be secured by installing fencing around power generation equipment, anchoring cables in place and securing access rights to qualified and trained workers. This should be done well in advance of the startup of the generators, rather than as an afterthought.

Plant management must prepare a list of key contacts to reach in case of an emergency with the power generation equipment. These contacts include plant personnel who will be responsible for managing onsite electrical equipment, as well as representatives from any contractors or vendors that work with the plant to support their electrical needs.

These best practices for critical power utility installation have been cultivated over many years of successful turnaround project executions. By following them, plants can achieve a higher level of efficiency in their turnaround operations, while realizing enhanced workplace safety, minimal congestion in core work areas, and reduced operating costs and overall emissions. ●

Barney Smith is the Turnaround Services Manager for Aggreko and has more than 20 years of experience working in the petrochemical and refining industries. In this role, Barney provides plants with innovative temporary utility and temperature control solutions designed to increase safety, reduce schedules and cost, and address process bottlenecks and seasonal cooling limitations.

Simplifying data communication during oil loading

Software and consulting company Implico has released a tool enabling its customers to connect legacy field technology with the OpenTAS terminal management system. The new TCP-X-Unit is capable of simultaneously converting signals from three serial-linked field devices for OpenTAS, enabling users to monitor data throughput from anywhere and view the information sent most recently by the field devices.

Older hardware and modern software often do not speak the same language, which makes it impossible for legacy field devices connected via serial links to communicate directly with an OpenTAS terminal management system. This usually requires an additional computer that converts the loading hardware's legacy signals for the OpenTAS software. The compact TCP-X-Unit considerably simplifies the previously required hardware environment.

The complete solution is a suite comprising the Matrix-504 microcomputer and suitable software developed by Implico especially for OpenTAS connectivity. Except for this pocket-sized computer, no further hardware is required for the connection. The TCP-X-Unit converts the field device's RS-232 signal into a TCP/IP signal and transmits it to the OpenTAS automation processes via Ethernet protocol (**FIG. 1**).

Remote access for maintenance, updates and configuration. Since the TCP-X-Unit is equipped with a web service for remote access, the solution represents another step toward the Internet of Things (IoT), making it possible to manage, configure, update or start the microcomputer remotely via a web browser.

Should a TCP-X-Unit fail, it can be easily replaced by a low-cost backup device. Local staff do not require any specific IT knowledge to replace the box. After replacement, the preconfigured backup device is set to the failed unit's IP address and restarted. The unit then automatically receives all the required settings and protocol information from OpenTAS and is available for immediate use, minimizing downtime and ensuring a continuous and stable loading process.

Implico provides consulting services, data services and software solutions for the entire supply chain—from forecasting, order entry, dispatching and tour optimization, to data collation and invoicing. Leading oil and gas companies all over the world utilize Implico's industry expertise and high-performance IT solutions, including OpenTAS and iGOS. OpenTAS automates the storage and transportation of hydrocarbons for refineries, tank farms and service station networks; and iGOS (Implico Global Operation Services) offers innovative downstream solutions out of the cloud.

Additionally, Implico offers consulting expertise surrounding the SAP Secondary Distribution Management (SAP SDM) for oil and gas, and SAP Retail Fuel Network Operations (SAP RFNO) downstream solutions. ●

FIG. 1. The TCP-X-Unit, a suite comprising the Matrix-504 microcomputer and suitable software, translates RS-232-signals from older field devices for the modern terminal management system OpenTAS.

Achieve operational excellence with advanced process control

TUSHAR SINGH, AspenTech

Gaining a higher level of operational excellence maturity with a well-planned advanced process control (APC) implementation program will help sustain a competitive advantage in today's volatile and competitive marketplace. The goal of APC is to maximize margins and meet customer expectations, while managing the complexity associated with operating process plants. APC is a process control and optimization technology that reduces variability by actively controlling key process parameters. Once key variables are stabilized, APC can be used to move the process to a more optimal point. This allows the unit to operate consistently, safely and reliably to achieve maximum profitability (FIG. 1).

Identifying benefit areas to pursue with APC. Chemical producers must understand which process units or unit components will benefit most from an APC program implementation. Examples of how APC can provide potential value by understanding the unit and production process within the broader production value chain include:

- **Increased production**—APC debottlenecks the process, or portions of the process, by reducing variability and operating close to limits, which increases production rates. Typically, APC improves production capacity by 3%–5% with the right technology.
- **Energy savings**—Utilities management is a complex control issue that spans across the site and may impact the electric grid. APC applications can be designed to manage utility systems effectively by matching steam production to the site's demand, and a 3%–15% reduction in energy usage can be achieved. Benefits come from reducing pressure letdowns, and reducing or eliminating vented steam onsite. Many companies report a 60%–90% reduction in vented steam, with additional opportunities in boilers and gas turbines.
- **Quality improvements**—Many companies have reported a reduction in the standard deviation of product qualities of up to 50%.
- **Increased yield**—A yield improvement of 1%–2% can be achieved by optimizing the reactor part of the process and/or the separation portion. Well-controlled reactors can achieve an increased yield of 0.5% per pass at the same throughput rates, while maintaining safe operating temperatures. The online time of a well-controlled polymer reactor can be increased by up to 5% before a shutdown is required, also resulting in improved yields and throughput. For the non-reacting part of the process, maintaining specifications on the final product can increase the yield of the desired product by increasing impurities up to contracted specifications.
- **Polymer production wheel optimization**—Without APC, grade transitions take 20%–50% longer and low-value products are produced. With APC, plants can produce the grades that are in demand while minimizing transition time and reducing off-spec products. Using APC in conjunction with supply chain software, companies can exploit new capabilities to further optimize the production wheel.
- **Emissions control**—It is possible to operate closer to emissions limits without violating them by using APC to model and actively control furnaces, boilers and hydrocarbon emissions.
- **Exploitation of ambient temperature effects**—Ambient temperatures impact compressor performance, condensation capacity, gas turbine operation, cooling water temperature, refrigeration capability, gas volumes and other process-related conditions. Units affected by ambient conditions can benefit from APC applications and anticipate these changes on a minute-by-minute basis.
- **Site-wide optimization opportunities**—Plants should consider optimizing multi-units together, as opportunities can be lost as a result. Facilities should also consider incorporating the use of APC software early in the design stage to derive greater overall site benefits.

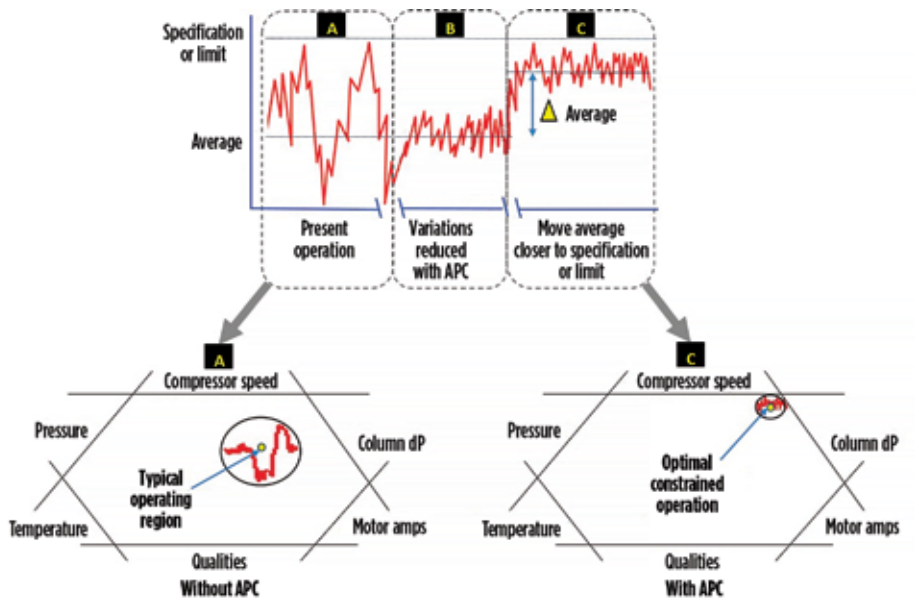


FIG. 1. APC delivers benefits and reduces variability by actively controlling key process parameters.

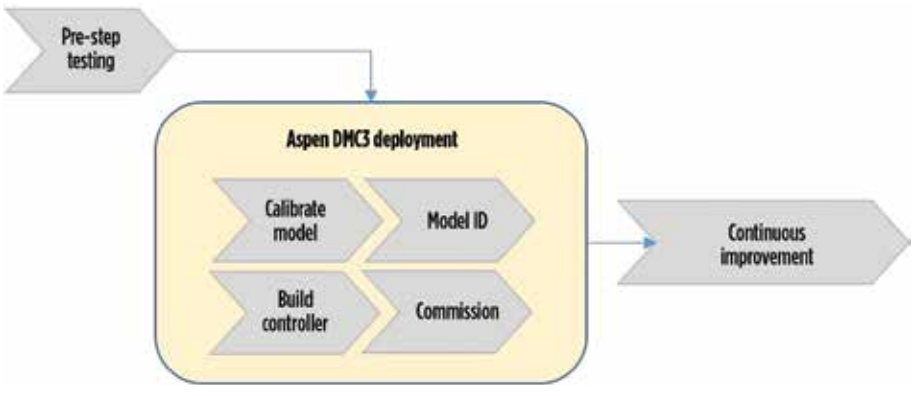


FIG. 2. Advanced APC technology, such as Aspen DMC3 Project Lifecycle.

Today, forward-looking companies have advanced beyond traditional methods to a more innovative and profitable approach by integrating *adaptive* process control with APC software technology. Aspentech's Adaptive Process Control technology has allowed faster deployments and sustained benefits with continuous model updates in the background, and enables less experienced users to deploy and sustain APC controllers.

After identifying the business case for an APC project, the next step is to start building and implementing the APC controller (FIG. 2).

How an ethylene manufacturer benefitted from APC. A leading manufacturer of ethylene and polyethylene adopted Aspen DMC3 with Adaptive Process Control technology, which enabled increased throughput and efficiency while ensuring a consistent supply of high-quality ethylene. The varying ethane feed and underperforming APC controllers had resulted in high variability in the demethanizer column, preventing operations from running lower column pressure. In the past, revamping an APC controller required numerous plant tests, which was problematic and impractical given the nature of the business.

Following the deployment of Aspen DMC3 with Adaptive Process Control technology, the manufacturer experienced enhanced production, yield and energy efficiency, the ability to update APC models with no disruptions to the process, the elimination of tedious workflows, freed resources for more valuable tasks, greater operator acceptance and improved APC utilization. Adaptive Process Control enabled the manufacturer to maximize benefits with very limited available resources. The technology was easily adopted and widely accepted, with increased engagement, and with minimal effort or training required.

Achieving operational excellence. With Adaptive Process Control technology integrated into today's APC solutions, sustaining controllers is no longer handled as a project, but rather as a continuous process. Sustainability tools in these advanced APC solutions include automatic bad-model identification. Models can be calibrated online in a closed loop without any disruption to the process, making sustained benefits easier and cheaper. Maintaining APC controllers requires fewer resources and allows controllers to maintain peak performance, enabling deployment of more controllers and leading to a best-in-class APC program.

For chemical companies, APC software is a key strategic tool in the business quest to reach higher levels of operational excellence. ●

TUESDAY'S WORKFORCE DEVELOPMENT & DIVERSITY PANEL

Join us Tuesday afternoon, as industry leaders discuss an important issue that is impacting our entire industry. This group of panelists will discuss how they are recruiting, engaging and retaining a strong and diverse workforce. The panel will be moderated by Jaime De La Cruz, Diversity, Inclusion and Talent Management Manager, Marathon Petroleum. Panelists include: Julia Rendon Reinhart, Vice President Human Resources, Valero; Natacha Buchanan, Senior Advisor for Inclusion & Diversity, P66; and Justin Steel, Human Resources Manager, Chevron Richmond Refinery. ●

The evolution of FCC additives

MELISSA CLOUGH MASTRY and **JUAN HURTADO,** BASF

Butylenes demand in the US continues to grow, with the vast majority of butylenes from fluid catalytic cracker (FCC) production going into high-octane blending components for fuels, such as alkylate. This demand increase is primarily driven by higher demand for high-octane gasoline, as well as lower-octane potential from tight oil feeds. Measures taken to ensure compliance with Tier 3 gasoline sulfur standards also significantly erode gasoline octane from the refinery.

These factors and others contribute to a pricing premium for butylenes over propylene. In the US, maximizing liquefied petroleum gas (LPG) olefins has been the primary objective of refiners for the past two years. Around the globe, increased LPG olefins remains in the top three objectives for refineries (**TABLE 1**).

ZSM-5-based additives have been used in the FCC industry for decades, and they remain the dominant olefins additive technology in the market. Conventional ZSM-5 additives crack naphtha-range olefins into light olefins with preferred selectivity towards propylene. BASF has developed Evolve™, a new butylene-selective FCC additive to meet refinery objectives for higher butylenes. Evolve is effective in generating high LPG olefins, with selectivity towards butylenes over propylene vs. conventional ZSM-5 olefins additives. Evolve is best suited for refineries that aim to maximize alkylate feed, or that run up against LPG constraints. Within a given LPG constraint, Evolve produces a more butylenes-rich LPG product.

Given the economic spread between butylenes and propylene, Evolve provides more benefit than conventional olefins additives. In a refinery heat-balanced kinetic model of an FCCU, the change to Evolve from a conventional olefins additive delivers a $0.22/bbl economic incentive, with annualized profits of more than $3 MM. For a refinery without an LPG constraint, Evolve delivers a higher margin of $0.64/bbl, or an annualized profit of more than $9 MM.

With the butylenes demand from the FCCU expected to grow steadily over the next five years, a butylene-selective additive is a valuable option in bringing higher profitability to refiners, both domestically and abroad. The growing butylenes demand stemming from tight oil processing, Tier 3 regulations and the increased use of premium gasoline has led refiners towards butylenes maximization via base catalyst reformulations and FCC additives. BASF's new Evolve butylene maximization additive provides refineries with the added flexibility of tailoring olefins selectivity during increased seasonal demand. ●

TABLE 1. FCC catalyst needs by region (2016–2017): Top objectives in global request for proposals (RFPs) for FCC catalyst

Objectives	#1	#2	#3	#4
North America	Increase LPG olefins	Lower bottoms	Lower dry gas	Increase octane
Latin America	Increase octane	Increase gasoline	Increase LPG olefins	Lower bottoms
Europe, Middle East, Africa	Lower bottoms	Increase gasoline	Increase LPG olefins	Lower dry gas
Asia	Increase gasoline	Lower delta coke	Increase LPG olefins	Lower bottoms

METROHM USA, ASTM COLLABORATE ON NEW TEST METHOD

Metrohm USA has released a new standard leveraging its combustion ion chromatography (CIC) systems. This new standard, ASTM D8150, provides a test method for the determination of harmful organic chlorides in crude oil.

Organic chlorides do not occur naturally in crude oil—they result from refinery operations—and are harmful, causing corrosion and damage to important catalysts. Using CIC for measurement allows the detection of individual halide species, such as chloride and fluoride, to trace sources of contamination.

As a member of ASTM's largest committee D02, Metrohm USA helps develop test methods that ensure the safety of products across the petroleum industry, including crude oil, gasoline, diesel fuel, motor oil and liquid propane.

In 2017, the partnership between Metrohm and ASTM resulted in two significant method releases: ASTM D8045 for the determination of acid number (AN) in crude oil and petroleum products by thermometric titration; and ASTM D7994, which establishes CIC as a standard test method to determine total fluorine, chlorine and sulfur in liquefied petroleum gas (LPG). ●

Protecting our environment—SO_x emissions abatement from the FCCU

KATE HOVEY and **RICK FISHER,** Johnson Matthey

Sulfur oxide (SO_x) additive chemistry is not straightforward, and "one size fits all" is definitely not the case when it comes to SO_x additives. Multiple vital components make up a SO_x additive, and these components can be altered depending on the unit configuration and operation.

UNDERSTANDING SO_x ADDITIVE FUNCTIONALITIES

SO_3 sorption capacity. The ability to adsorb sulfur trioxide (SO_3) out of regenerator combustion gases is a major function required by the additive, and it is proportional to the amount of magnesium oxide (MgO) contained within the additive. More MgO means more SO_3 "pick up" and, therefore, less additive consumption. Today, the most effective SO_x additives available are based on a hydrotalcite structure, while some still use a spinel-type substrate. Hydrotalcites allow for a much higher (as much as 50% more) MgO content than the spinel alternative. This is of most importance in full-burn regenerators, as the sorption capacity is often the limiting factor.

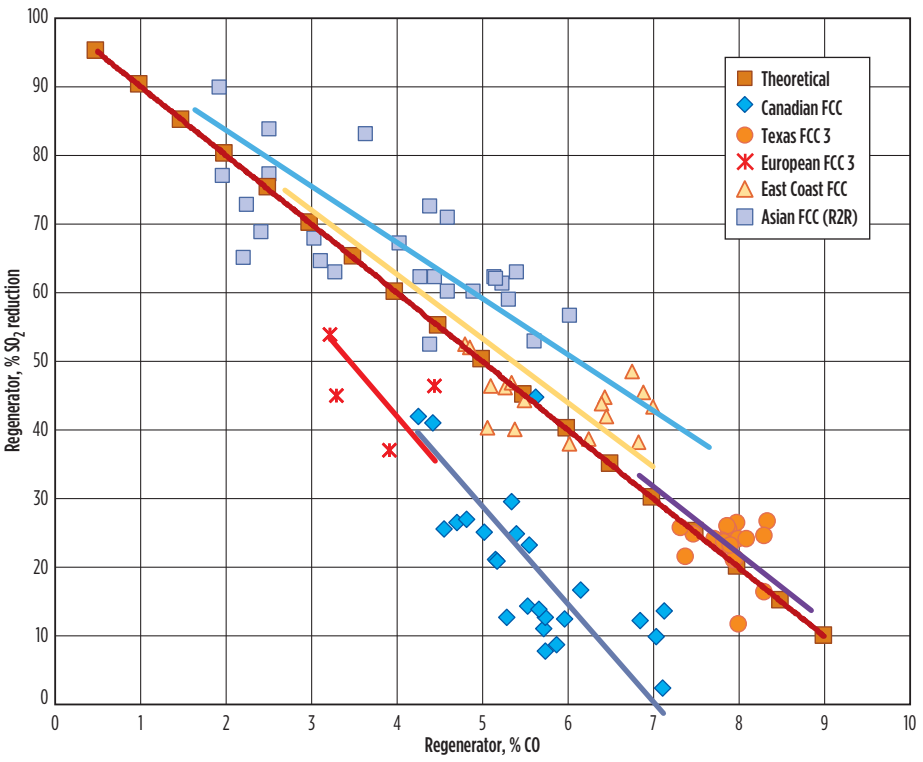


FIG. 1. Maximum SO_x reduction level as a function of flue gas CO.

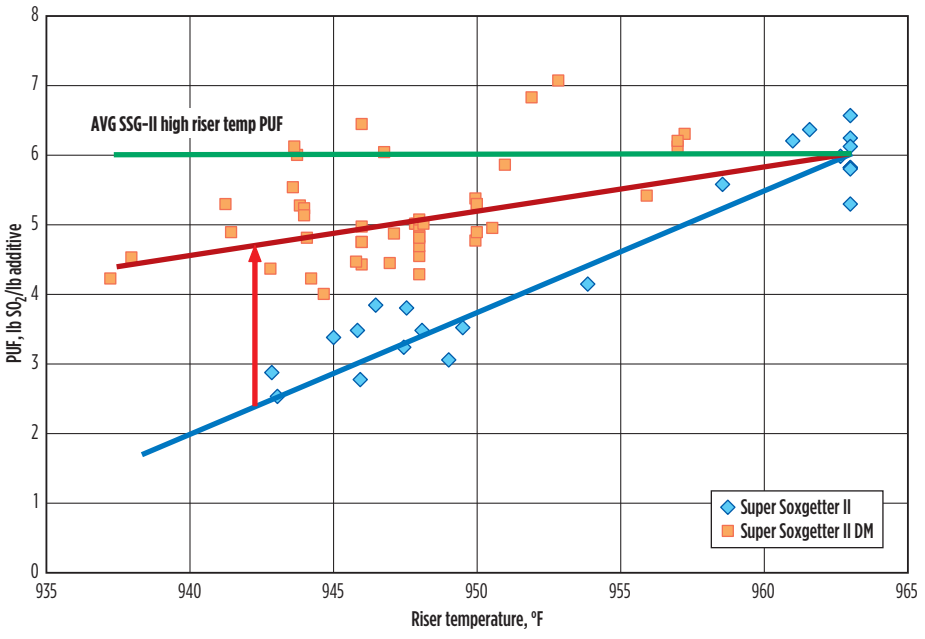


FIG. 2. Improvements realized by switching to the DM grade of Johnson Matthey's SUPER SOXGETTER II.

Oxidation package for SO_2-to-SO_3 conversion. Another important function of the SO_x additive is its ability to oxidize SO_2 to SO_3. Under normal full-burn conditions, only about 10% of the sulfur is in the form of SO_3, while the remainder is mainly SO_2. This means that without any SO_2-to-SO_3 oxidation assistance, SO_x additives can only reduce emissions by about 10%. In full-burn units, the oxidation capability of most SO_x additives is sufficient to enable the forward oxidation. However, in partial-burn applications, the limited oxygen partial pressure can be a hindrance. The reduced sulfur combustion product carbonyl sulfide (COS) is also present, and is very difficult to oxidize in the regenerator once it is formed. It will, however, form SO_x when it reaches the carbon monoxide (CO) boiler.

In most units, the deeper into partial burn the regenerator is operating, the less SO_x reduction is possible. **FIG. 1** shows how the "maximum SO_x reduction level" is related to the amount of CO present in the flue gas, and includes the theoretical relationship between the CO level and SO_x reduction (Eq.1):

$$\textit{Maximum } SO_x \textit{ reduction level} = 100\% - (\%CO \times 10) \quad (1)$$

Special SO_x additives have been developed that are well suited to partial-burn applications. One example is LO-SOX™-PB XL, which is very effective at capturing SO_x up to the maximum SO_x reduction level, and a specific modification to the oxidation package allows for no impact to the CO/CO_2 ratio.

Reactor side H_2S release. SO_x additives release the sulfur in the reactor. This critical step should not be overlooked, as its efficiency dictates how well the additive becomes "regenerated" prior to returning to the regenerator. If this regeneration is insufficient, the sorption capacity of the additive is compromised. The reactions occurring in the reactor are quite complex, but in general they can be summarized by Eq. 2:

$$MSO_4 + 8[H] \rightarrow MO + H_2S + 3H_2O \quad (2)$$

Components in most SO_x additives promote this release functionality, but many refineries suffer from poor sulfur release. The majority of these "regeneration-limited" cases have been linked to distillate-mode operation or FCCUs that are operating with low riser outlet temperatures (ROTs).

Fortunately, solutions are available. The DM grade of Johnson Matthey's standard SO_x additive, SUPER SOXGETTER™II, incorporates specialized catalytic components that aid the sulfur release, and **FIG. 2** shows how one refiner regained approximately 70% of the lost additive performance by switching to the DM grade.

Additional SO_x additive uses. About 50% of US refiners use a wet gas scrubber (WGS) to meet SO_x emissions limits. These can incur quite hefty costs in caustic usage and disposal, let alone the wastewater treatment costs. About 4% of SO_x additive users are successfully offsetting their WGS costs by using additives in conjunction with this hardware. SO_x additive efficiency is initially very high, and only declines at high reduction levels. SO_x additives are highly efficient at low reduction levels (< 50%). The optimum reduction level depends on the caustic price.

A refiner used LO-SOX™ SPECIAL at a very low concentration (< 2 wt%) and was able to reduce the WGS caustic usage by 30% (**FIG. 3**).

While scrubbers are extremely effective at removing SO_2, SO_3 removal can be very challenging for some scrubber designs and can lead to a characteristic "blue plume." In these cases, SO_x additives are used not to remove SO_2, but rather to specifically remove SO_3. This allows FCCUs to operate without the blue/white-colored SO_3 plume. Customized SO_x additive formulations are highly recommended for these operations, as standard additives could actually make things worse. ●

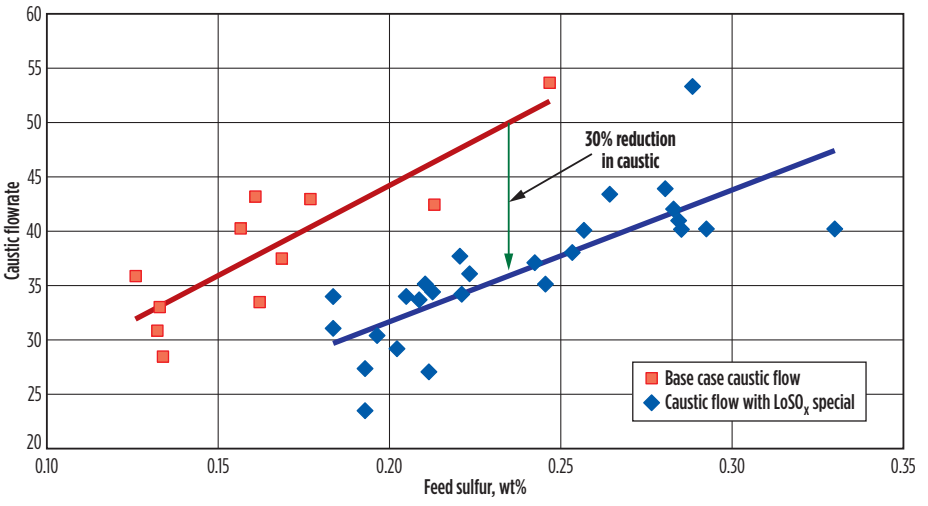


FIG. 3. Commercial data showing the caustic reduction as a result of using a SO_x additive in conjunction with a WGS.

Network of DWCs in complex process units

MANISH BHARGAVA, ROOMI KALITA and **AMIT KANDA,** GTC Technology US LLC

Dividing wall column (DWC) technology is incorporated in a naphtha hydrotreating (NHT) and isomerization (ISOM) unit to improve profitability. In these units, DWCs combine the operation of two or more sequential columns to generate a leaner and energy-efficient process scheme.

In a conventional NHT and ISOM unit, the stabilizer column removes the lighter gases. The top liquid product goes to a deethanizer column to recover liquefied petroleum gas (LPG). A two-column naphtha splitter sequence then separates light naphtha (C_5–C_6), mid-cut naphtha (C_7) and heavy naphtha (C_8+). Light naphtha is further processed to generate concentrated i-C_5 and n-C_5+ fraction.

Next, the reactor isomerate gets processed in three columns to produce the following products: offgas (C_4-cut), C_5 recycle stream, light isomerate (mainly i-C_6), heavy isomerate (C_7+ cut) and n-C_6 recycle stream. In this scheme, the stabilizers use medium-pressure (MP) steam due to high operating pressure. Additionally, a supplementary deethanizer column is needed to recover the C_3–C_4 lost in the off-gas. Two naphtha splitters are used to prepare the ISOM feed.

FIG. 1 illustrates the DWC process integration. First, a GT-LPG MAX® column removes the off-gas from the feed. The C_3–C_4s losses are minimized by use of absorption on one side of this top DWC. The wall prevents any inter-mixing between the top halves. LPG is recovered on the other side by distillation. Some of the column bottoms or any heavy hydrocarbon stream are used for absorption. Other refinery offgas streams can also be fed to the column to improve LPG recovery. Next, a GT-DWC® naphtha splitter uses a middle wall to generate light naphtha, mid-cut naphtha and heavy naphtha. Finally, a GT-DWC depentanizer/deisohexanizer column is used in the ISOM unit to extract the C_5s recycle stream on one side. C_6 isomerate, C_7+ cut and C_6 recycle stream are removed on the other side. Additionally, the overhead C_6 isomerate vapors heat the upstream deisopentanizer reboiler.

This enables DWCs to successfully merge the operation of two columns in refinery networks to yield better product recoveries. Lower energy costs and capital investment, and better heat integration are also observed. ●

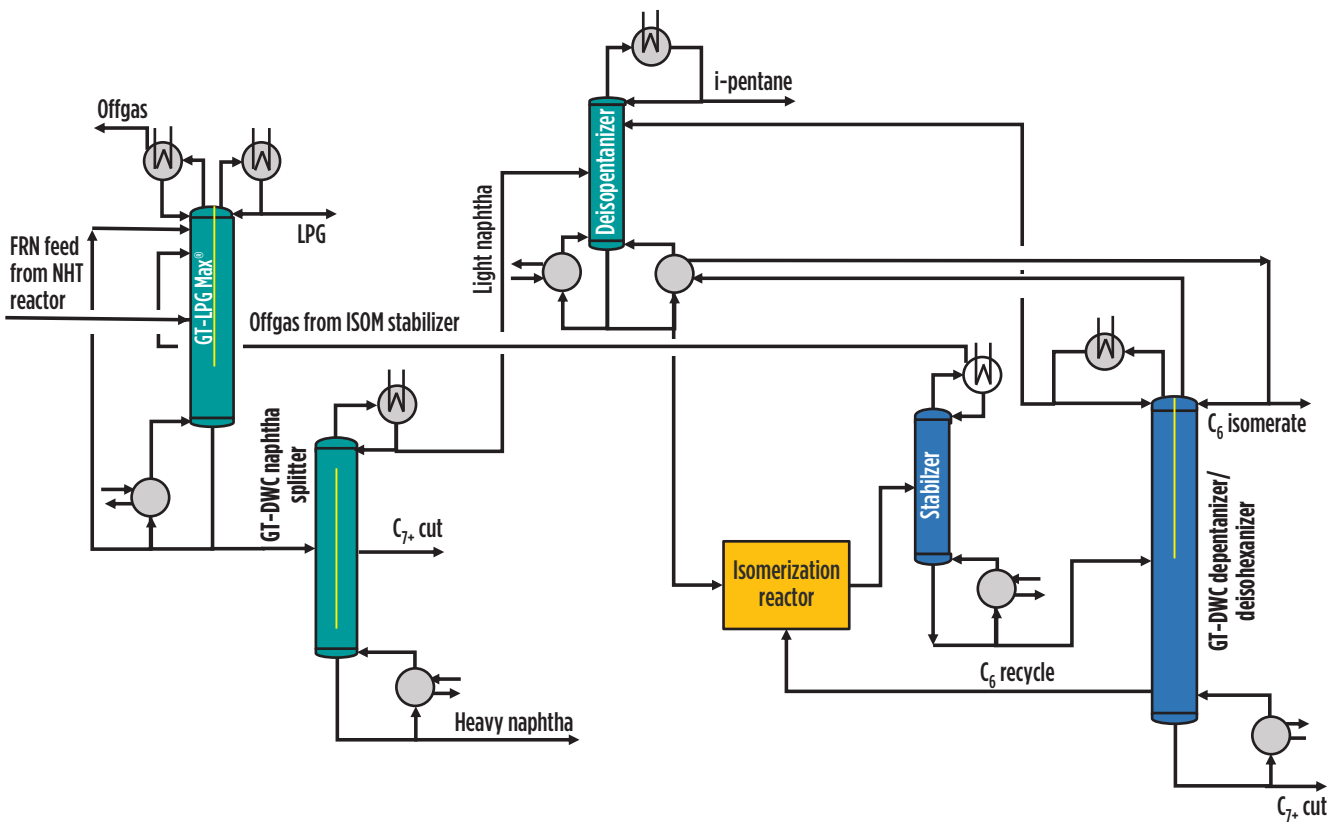


FIG. 1. Heat-integrated GT-DWC process scheme.

A taste of the Big Easy

One of the most historically rich cities in the US, New Orleans is a true melting pot of diverse cultures, art, architecture, music and food. The city straddles the mighty Mississippi River, making it an invaluable port and vital waterway access to the continent's interior.

Originally an outpost of the French and Spanish empires until Napoleon sold it to the US with the rest of the Louisiana Purchase in 1803, the city has always been a distinctive cultural gateway to North America. Its social makeup is complicated; indeed, from 1820 to 1870, New Orleans was one of the main immigrant ports to the nation, second only to New York. The influx of Spanish, French, American, African, Irish, German and Italian people intertwined with the native population of the New World. The city's strength lies in its enduring ability to absorb new influences from its cross-cultural and multilingual heritage.

Welcome to New Orleans, and we hope you will get out to explore what is often referred to as the "most unique city" in the US.

The birthplace of jazz. Perhaps more than any other place in the country, New Orleans' eclectic music scene reflects and is inspired by the deep roots of the people that call it home. On any given night, you will hear the soul of the city—the blues, Cajun, funk, Zydeco and that most original of American art forms: jazz.

New Orleans was once the only place in the New World where Voodoo rituals were openly tolerated and well attended by all, and the mixture of the dark rumble of African drums, European horns and musicians from many cultures created a jubilant new sound. Jazz is a reflection of the city's social and spiritual history. The music that grew from New Orleans natives like Buddy Bolden, Papa Jack Laine, Ferdinand "Jelly Roll" Morton, Louis Armstrong and Ellis Marsalis continues to influence musicians all over the world.

When a variety of influences come together to create something special, and when flavors combine to make a new taste that is greater than the sum of its spices, we have a name for it down here: we call it gumbo. Just like jazz, nobody makes gumbo like we do.

New Orleans cuisine. Ask any resident where to get the best and most authentic food, and each of us will tell you someplace different. But we all agree that there are many must-haves when it comes to dining.

It is difficult to go anywhere in the city without hearing great music.

The city's cuisine is some of the best anywhere. Clockwise from upper left: a traditional crawfish étouffée; a whole muffuletta sandwich…almost; shrimp jambalaya; and last but never least, beignets.

Gumbo is the quintessential New Orleans fare, and we think of it as its own food group. It is a stew served over rice, and most traditional restaurants offer multiple types of this dish—sassafras and bay leaves, okra, seafood instead of chicken or sausage instead of ham; there really is no set recipe, and specialty ingredients can be found in every pot.

Crawfish **étouffée** (pronounced eh-too-fey) comes from the French word "to smother," and is a thicker stew chock full of plump crawfish (or shrimp, depending on the season), also served over rice. Although similar to gumbo, étouffée is made with a "blonde" roux, which gives it a lighter color and different flavor.

Jambalaya is another New Orleans staple, and the ingredients can vary from chicken, sausage and seafood, or any combination of the three. Are you detecting a theme here? Local legend tells the tale of an inn chef that was told to "balayez," or "throw something together" to feed a late traveler. The dish is very popular at family gatherings, as it is easy to alter the recipe to accommodate large numbers of hungry guests.

Red beans and rice is a traditional dish that still appears on most menus and in most homes on Monday evening. It is usually accompanied by a side of sausage or pork chops.

Po-Boys are overstuffed sandwiches served on French bread, and French fry and gravy po-boys are found on many menus. Sicilian immigrants brought the **muffuletta,** a massive and delicious Italian cold-cut sandwich served on an entire round loaf of Italian bread that is piled high with provolone cheese, genoa salami and Cappicola ham, and topped with an olive salad—chopped, green unstuffed olives, pimientos, celery, garlic, cocktail onions, capers, oregano, parsley, olive oil, red-wine vinegar, and salt and pepper. It is perfectly salty and *huge,* so it is best split between two or more people, depending on how hungry you are.

The city's exuberant spirit is hard to resist.

The architecture of New Orleans is a reflection of its multicultural heritage.

New Orleans is not your average city, and **beignets** (pronounced ben-yays) are not your average doughnut. One of the city's most famous staples, this dessert (breakfast?) is made from fried dough covered with mounds of powdered sugar, and is best served hot with café au lait or chocolate milk.

Specialty cocktails. Don't forget to wash down our flavorful food with one of the city's many popular cocktails. Try the sweet and tart Hurricane; America's first cocktail, the Sazerac; a spicy Creole Bloody Mary; a Pimm's Cup, our traditional summer drink that is tasty any time of the year; a Brandy Milk Punch; a Ramos Gin Fizz; a Mimosa with brunch; an Absinthe Frappe; and, of course, a Mint Julep.

Nightlife. As the sun goes down, the city comes alive with vibrant and funky dance, music and jazz clubs, cozy bars and luxe lounges. Take a cab to Uptown, which offers numerous hip bars, great restaurants and hoppin' music clubs. Of course, Bourbon Street in the famous French Quarter is loaded with the best burlesque and cabaret clubs, DJs, bars and celebration opportunities. It is also a center of history, folklore and beauty that dates to the early 18th century. A short walk from the neon lights and boisterous fun of Bourbon Street, Frenchman Street in the Marigny offers a quieter, more laid-back night on the town. The hip and unpretentious bars and clubs are a favorite of locals to hear authentic live music. Try your luck at Harrah's Casino New Orleans, which boasts 113 table games, 20 poker tables that feature no-limit Texas Hold 'Em, 7 Card Stud and Pot-Limit Omaha, and more than 1,800 slot machines.

French Quarter attractions. Locals and visitors alike flock to the city's cultural hub, also known as the Vieux Carré, which sits on a crescent in the Mississippi River. So much more than just Bourbon Street, New Orleans' oldest neighborhood features beautiful architecture, art galleries, museums, shopping, tours, street performers, carriage and trolley rides, and picturesque gardens.

New Orleans is a city where you can dance down the middle of the street in the middle of the day, in the middle of the week, and instead of people wondering why you are not at work, they will be wondering how they can join you. Remember, it requires no prequalification other than the New Orleans "wish to have a great time." ●

POWERING AHEAD IN 2018

AFPM 2018 Meetings

Annual Meeting
March 11 – 13
New Orleans Hilton
New Orleans, LA

International Petrochemical Conference
March 25 – 27
Grand Hyatt
San Antonio, TX

International Base Oils and Waxes Conference
March 25 – 27
Grand Hyatt
San Antonio, TX

Security Conference
April 23 – 25
Omni Royal Orleans
New Orleans, LA

Labor Relations/ Human Resources Conference
April 26, 27
Omni Royal Orleans
New Orleans, LA

National Occupational & Process Safety Conference
May 15, 16
Grand Hyatt
San Antonio, TX

Reliability & Maintenance Conference
May 22 – 25
Henry B. Gonzalez Convention Center
San Antonio, TX

Cat Cracker Seminar
August 21, 22
Royal Sonesta
Houston, TX

Operations & Process Technology Summit
October 1 – 3
Atlanta Marriott Marquis
Atlanta, GA

Environmental Conference
October 14 – 16
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