REFINERY OPERATIONS

Engineering Solutions, Maintenance, Reliability, Automation and Equipment Relevant to Refinery Processing and Operations

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FEATURE: Increasing FCCU Profitability in a Volatile Fuels Market

Maximizing FCC profitability in spite of supply/demand volatility benefits from catalyst formulation "flexibility" to achieve desired LCO and gasoline yield shifts in a relatively short period of time. While enhanced bottoms conversion, gasoline and coke selectivity are important process considerations, emphasis on formulation flexibility is crucial considering the variations in FCC operations.

Formulation flexibility plays a large role in minimizing delays often associated with an FCC catalyst change-out, which is why Grace Davison often prefers to make these adjustments in the unit's fresh hopper. For these rapid adjustments, their GENESIS® catalyst system has been employed by those refiners wanting to take advantage of the shifting economics between gasoline and LCO. GENESIS is based on a two-catalyst system to optimize the zeolite-to-matrix (Z/M) ratio for each individual application.

According to information extracted from several papers previously published by Grace Davison's FCC catalyst product manager, Rosann K. Schiller, the principal component in the GENESIS two-catalyst system is the MIDAS® high matrix activity catalyst to deliver superior coke-to-bottoms capabilities. 20% of the world's FCC capacity has utilized GENESIS across a broad range of feeds, including resid, VGO and hydrotreated feeds.[1-3]

An improved coke-to-bottoms "relationship" ultimately provides refiners with more flexibility to optimize hydrotreating and FCC operations, including more favorable fluidization characteristics and reduced circulation instability in the FCC reactor. There have been at least 80 applications of GENESIS in over 50 refineries, meaning that some facilities have reformulated more than once to capture swings in diesel and gasoline profitability. For these rapid changes, Grace Davison shipped MIDAS catalyst to the refiner to adjust the GENESIS formulation in the fresh hopper.

The Al Shaheem refinery is expected to be onstream by 2011. Photo courtesy of Qatar Petroleum Corp."

At one facility, with adjusted FCCU operating conditions that included reduced reactor operating temperature (ROT) and end point (EP) adjustments, the GENESIS system increased LCO yield without octane reduction and loss of volume expansion. According to published information from Schiller, this provided the refiner with a $0.50/bbl yield benefit.

At another facility, a GENESIS®

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catalyst, formulated for maximum LCO, delivered an additional 3.5 lv% yield for a net increase of 5 lv% LCO and 2.2 lv% reduction in slurry relative to the competitive base catalyst. In the maximum LCO operation, the percentage of MIDAS catalyst was increased in the blend to maximize bottoms cracking and reduce Z/M. When economics became favorable for gasoline, the refiner returned to the original formulation. Overall, these yield shifts were worth between $0.45 and $1.00/bbl, depending on the operating mode and the refining margins at the time.

Other refinery case studies discussed in the Schiller papers detail the performance of the GENESIS system, where the operating severity and the blend ratios of the two-catalyst system are adjusted according to distillate or gasoline operating mode and objectives.

A wider range of feedstocks are being processed in FCCUs. In one case, Schiller reported that a refiner processing resid was seeking additional bottoms cracking without sacrificing coke selectivity or metals tolerance. For this application, GENESIS catalyst delivered an increase of +10 m^2/g in E-cat matrix surface area, 1.5 lv% reduction in bottoms yield, and +2.0 lv% compared to a base IMPACT® catalyst formulated with a high stability zeolite. Even though E-cat metals levels increased almost 10% due to a feed change, GENESIS maintained coke, hydrogen and gas selectivity.

In other words, the synergy imparted by formulating IMPACT catalyst into the GENESIS system exceeded any combined "linear" improvements that could have been derived from merely blending a high zeolite activity catalyst with a high matrix activity catalyst.

Literature Cited

1. Schiller, Rosann K., "Grace Davison's GENESIS® Catalyst Systems Provide Refiners the Flexibility to Capture Economic Opportunities," Catalagram® publication, No. 107, Spring 2010, pp.s 4-12.

2. Schiller, R., et al, "The GENESIS Catalyst System," Catalagram publication, No. 102, Fall 2007.

3. Mott, R.W., Wear, C. "FCC Catalyst Design for Optimal Performance," 1998 NPRA, Paper AM-88-73. ■

Refining Technology

Reducing System Pressure Drop to Debottleneck FCC

Considering that some refiners have been reducing FCC run rates this summer due to economic conditions, it is imperative that FCC revamps (www.revamps.com) planned for the near-future take into consideration the practical strategies for reducing revamp costs. Since the early 1990s, chemical engineers at Process Consulting Services (PCS) have reported on a wide range of engineered improvements where FCCU capacity increases of 12 to 40% have been achieved without modifications to major vessels or rotating equipment, including the main fractionator, main air blower (MAB), wet gas compressor (WGC), gas plant and linked process assets.

In an FCC revamp, high-cost options, such as MAB or WGC changeout to larger compressors are options of last resort and should be superseded by first trying to capture opportunities that may initially go unnoticed, such as manipulation of component (or entire unit) pressure balance. The major FCC equipment "components" between the MAB and WGC (including the reactor-regenerator and main fractionators) are linked through a pressure balance, which is where engineers can find opportunities for reducing system pressure drop.

PCS has reported on a variety of instances where FCC unit pressure limits were circumvented with adjustments to major equipment operating pressures, such as replacing main fractionators trays with structured packing to reduce fractionator pressure by as much as 4.0 psi (to debottleneck the WGC or MAB). According to previously published papers by PCS engineers, these opportunities may be overlooked unless accurate field pressure measurements from the MAB discharge to the WGC inlet nozzle are taken to establish individual component losses.

Higher component pressure losses are actually being generated than what is calculated for individual component pressure drops, particularly when taking into consideration the use of higher percentages of heavier and more aromatic feeds. In all cases, the unit mass and energy balance requires detailed adjustments to accomplish control objectives. According to Scott Golden at PCS, "Process designs that simplify the system to ease controllability often are overlooked. Generally, these process design modifications require little capital."

A detailed discussion on strategies for reducing system pressure drop, improving FCCU control, etc. is beyond the scope of this discussion and should be tasked to requesting previously published information available from PCS (info@revamps.com). Some of the FCC related optimization white papers published by PCS since 1993 include the following (chronologically dated):

1. Golden, Scott W., Schmidt, K. D. & Martin, G. R., "Field Data, New Design Correct Faulty FCC Tower Revamp," Oil & Gas Journal, May 31, 1993, pp.s 54-60.

2. Golden, Scott W., Martin, G. R.,

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Sloley, A. W., "FCC Main Fractionator Revamps," Hydrocarbon Processing, March 1993.

3. Golden, Scott W., Lieberman, N., Martin, G. R., "Correcting Design Errors Can Prevent Coking in Main Fractionators," Nov., 21, 1994, Oil & Gas Journal, pp.s 72-82.

4. Golden, Scott W., "Approaching the Revamp," HTI Quarterly, Autumn 1995, pp.s 47-55.

5. Golden, Scott W., "Improved Control Strategies Correct Main Fractionator Operating Problems," Oil & Gas Journal, Aug. 21, 1995.

6. Golden, Scott W., Kowalczyk, D., "FCCU Optimization: A Minimum Capital Approach," Fuel Technology & Management, March/April 1996, pp.s 37-45.

7. Golden, Scott W., "Case Studies Reveal Common Design, Equipment Errors in Revamps," Oil & Gas Journal, Part 1 & Part 2, April 7 & 14, 1997.

8. Nigg, Jason M., Sitton, Kevin D., "Improve the Reliability and Maintenance of FCCU Main Fractionator Internals," Akzo Nobel Australian Seminar, May 13-14, 1999.

9. Hartman, Edward L., Hanson, D. W., Weber, B., "FCCU Main Fractionator Revamp for CARB Gasoline Production," Hydrocarbon Processing, February 1998.

10. Martin, Gary R. and Cheatham, Bryon E., "Keeping Down the Cost of Revamp Investment," Petroleum Technology Quarterly, Summer 1999, pp.s 99-107.

11. Barletta, T., "Revamping FCC Units: Debutanizer Reboiler Fouling," World Refining, January/February 2001.

12. Barletta, T., Nigg, J., Ruoss, S., Mayfield, J. and Landry W., " Diagnose Flooring Columns Efficiently," Hydrocarbon Processing, July 2001.

13. Golden, Scott W., Fulton, S. A. and Hanson, D. W., "Understanding Centrifugal Compressor Performance in a Connected Process System," Petroleum Technology Quarterly, Spring 2002.

14. Barletta, T. and Golden, S. W., "Refiners Must Optimize FCC Feed Hydrotreating When Producing Low-Sulfur Gasoline," Oil & Gas Journal, Oct. 14, 2002.

15. Clark, D. and Golden, S. W "Improve FCCU Profitability – Bottoms System Upgrades," Petroleum Technology Quarterly, Summer 2003.

16. Dean, Christopher F. and Golden, S. W., "Understanding Unit Pressure Balance Key to Cost-Effective FCC Revamps," Oil & Gas Journal, May 10, 2004. ■

Use of Emissions Control Additives Increasing

In spite of hesitation in the refining industry concerning the level of investment needed to meet future regulatory requirements for controlling emission, it is expected that there will be an increase in the use of FCC regenerator flue gas emissions control additives to achieve SOx and NOx emission compliance.

For SOx control, about 30% of US refiners currently use SOx transfer additives, like Super DESOX®, to achieve SOx emission compliance, according to a comment by Grace Davison's Michael Zehender at the most recent NPRA Q&A. Zehender noted that SOx additive usage tends to vary by region, and climbs to approximately 70% in parts of the country such as the West Coast, where emission controls are generally more stringent.

Zehender also noted that Super DESOX® can readily reduce SOx emissions to less than 10 ppm in the flue gas. Usage rates range from 50 to 2000 lb/day, with 225 lb/day being about average, typically representing between 5 to 10 wt% of fresh catalyst addition rates. In addition, Zehender noted that the actual addition rates required will vary significantly due to factors like hydrotreating severity, feed sulfur, feed rate, conversion, C/O ratio, oxygen availability, and FCC stripper and regenerator operating conditions.

Zehender also explained that for NOx emission reductions, two general additive solutions are available; low NOx combustion promoters and standalone NOx reduction additives. The amount of NOx reduction achieved with each of these additive solutions varies with unit design and operating conditions, but NOx reductions of 50% are typically achieved, with many refiners achieving substantially larger reductions in NOx.

According to Zehender, factors that have been found to influence NOx emissions are the amount of nitrogen in the feed, excess oxygen levels, recent prior use of platinum formulated CO promoters, and regenerator conditions, including air distribution, catalyst bed level, and temperatures in general. Some regenerator operations have been observed to exhibit rather strong correlations between CO and NOx, while others demonstrate quite weak relationships.

Zehender concluded that "many refiners use combustion promoters designed to mitigate the NOx emissions that usually accompany the use of a conventional platinum formulated combustion promoter.

Low NOx combustion promoters, like Grace's XNOX®, and CP® P are currently used by roughly one third of the US FCC units. These additives are typically used at rates anywhere from ½ to 3 times that of more traditional platinum formulated CO promoters." ■

Unit Automation

Crude Distillation Unit Upgrades: Maximizing Profitability with Automation

Increasing crude distillation unit (CDU) efficiency is a primary objective for refiners as changes in plant-wide processing strategies are implemented to deal with narrow margins and higher process complexity. Beginning at the front-end of the refinery, CDU intermediate product quality can be improved by reducing variability. In addition, operating closer to process or equipment design constraints without exceeding these limits will result in maximum utilization and increased profitability.

In efforts to improve CDU efficiency, Emerson Process Management's Doug White, VP, APC Services, posted (www.emerson.com) an example of a European refiner targeting CDU throughput, maximum intermediate product recovery value, maximum heat recovery and improvement to overall energy efficiency . With the input from Emerson's Chief Blogger, Jim Cahill (www.emersonprocessexperts.com), additional detail concerning other recent CDU projects was discussed. In this case, incorporating technology such as embedded multivariable model predictive control (MPC) within Emerson's DeltaV Control System was an important component of the unit upgrade.

A typical refinery CDU includes fired heaters, atmospheric and vacuum distillation towers, and linked process assets (e.g., heat exchangers, pumps, strippers, etc.). Accurate evaluation of equipment constraints are required to cost effectively achieve required operating objectives. Process changes to downstream conversion units, such as the FCCU, naphtha reformer and hydrocracker typically require adjustments to CDU operations. The CDU also needs to transition smoothly and quickly during crude oil switching to minimize impact to downstream units.

In the case of the European refinery, the Emerson team, led by Project Manager Chibuike Ukeje-Eloagu, worked with the refinery's engineering and operations staff to plan and execute this CDU optimization project. The project implementation plan first involved conducting a site survey to gather data on current performance and perform preliminary step testing to understand the unit's process dynamics.

The team then designed functional, detailed test specifications for review, iteration and acceptance by the refinery project staff. After this design phase was completed, next was the build-phase where the advanced process controllers (APC), step tests of manipulated variables (MV) / disturbance variables (DV) and models was developed.

The final commissioning step was to commission the controllers, train the engineering and operations staff, and conduct the site acceptance test per the test specifications. An important final step was to benchmark the process' performance, compare against the original process data collected, and calculate the return on investment (ROI) for this optimization project.

According to the documentation posted (www.emerson.com), MPC embedded in the refinery's DeltaV control system was employed because the process had large interactions . These interactions made single and cascade loop control strategies difficult to implement and maintain over time. The process had a number of disturbances for which the model needed to account. It also took a long time for the process to reach steady state conditions. The solution was to create five APC controllers--one for each fired heater, one for the atmospheric tower, reflux drum, and stripping towers and one for the vacuum tower.

One of the key constraints in the process was the product compositions of the gas, naphtha, kerosene, light diesel, diesel, AGO, LVGO and HVGO. The traditional method had been manual measurements that were drawn and sent to the lab once per day. Chibuike's team developed regression-based inferential sensors or virtual analyzers to predict product compositions (e.g., diesel cloud point) in real time. These virtual analyzers perform inferential analysis using a regression based on product flow rates and distillation column temperatures. Predicted values are updated daily against laboratory results to help keep the virtual analyzers tuned while providing accurate predictions. The MPCs use these predicted values as constraint variables to keep the products within specification limits.

Upon MPC implementation and post-audit, the throughput was increased to a level where the downstream units actually became the bottleneck. The quantifiable results were a payback within three months. This came from increasing production of more valuable intermediate products while reducing desired product giveaway and improving heater efficiency. The non-quantified benefits were reduced operator actions to maintain steady-state operations and improved response to disturbances such as crude oil composition changes.

Over the past several years, the controllers and virtual analyzers have been in continuous use. The refiner and Chibuike's team have ongoing service agreements should immediate help or tweaks to the models need to be made . The models are robust and tolerant of inaccuracies to a certain degree and so long as no major process modifications are made, the models have not required refitting to the process dynamics .

Two other cases directly related to CDU upgrades are downloadable on Emerson Process Management's regularly updated blogs and website. This documentation points out instrument and tuning problems, such as a faulty level transmitter, and the control performance tools to gather and assess the process dynamics around the level control loop . ■

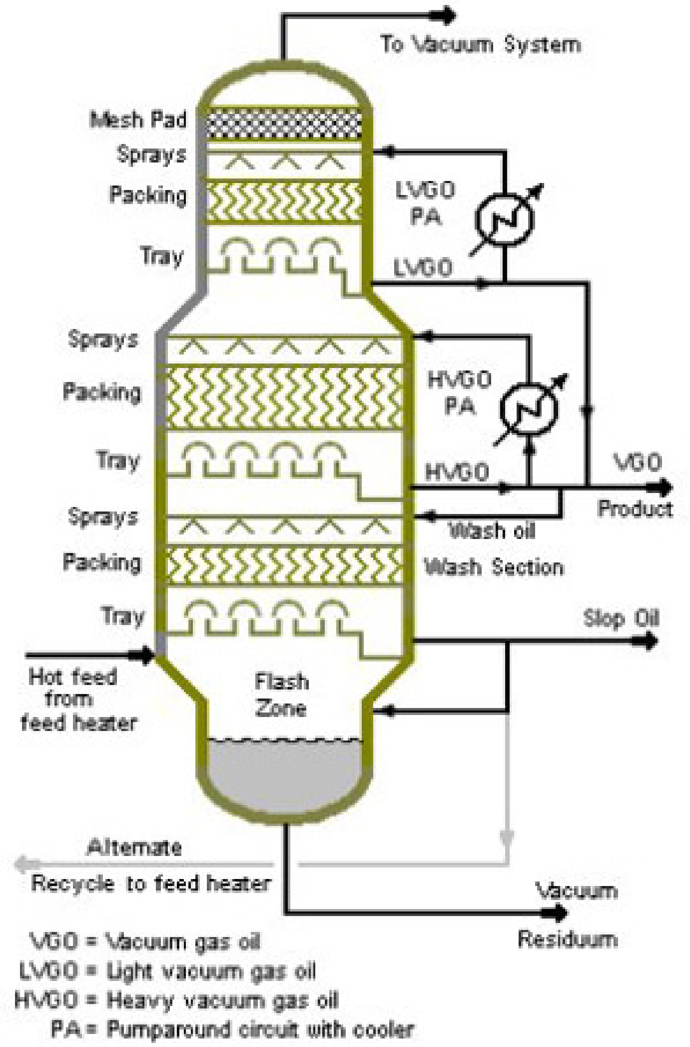
Modeling and Optimizing Process Units

Invensys Operations Management recently announced that it has entered into an agreement with ExxonMobil Research and Engineering Company (EMRE) that allows Invensys to sub-license a suite of EMRE's refinery process models to third parties. The suite of models will be delivered through Invensys Operations Management's SimSci-Esscor® optimization software, using its ROMeo® solution to enable clients to model and optimize process units.

"With depressed demand, decreased margins and increased environmental mandates, refiners no longer have the option to simply operate at maximum throughput," said Sudipta Bhattacharya, president and chief executive of Invensys Operations Management. "Over the course of the coming decade, we will see a drastic shift in the oil industry as refiners constantly optimize their operations in the face of changing feedstock and energy costs, product specs and margins. Refiners will increasingly rely on accurate modeling technologies to construct a refinery-wide picture and assess the financial impact of different operating scenarios. Our SimSci-Esscor optimization software and ROMeo solution, combined with EMRE process models, enables refiners to make improved economic decisions throughout the refinery, from crude feed to final product blending."

While traditional modeling solutions can only simulate individual process units or provide point solutions to solve a specific problem, Invensys Operations Management's SimSci-Esscor solution provides a scalable software environment that enables companies to optimize refinery-wide performance, as well as other aspects of refinery profitability, such as utilities and instrument/equipment health monitoring. Additional benefits are derived from leveraging the data generated by rigorous models to enhance planning and scheduling decisions, leading to increased refinery margins.

"These modeling improvements allow refiners to better optimize their operations," said Charles Darnell, global manager for optimization at ExxonMobil Research and Engineering Company. "We use ROMeo technology in our plants for multiple applications and continue to work with Invensys to develop improvements in this technology." ■



"The Al Shaheem refinery includes special control systems for the vacuum column used to upgrade bottom-of-the-barrel feedstocks. Photo courtesy of Qatar Petroleum."

Industry News

Regional Trends in Energy Consumption Benefits New Mega-Refineries

This has been undoubtedly one of the toughest years for the refining business globally. Refining margins dropped to their lowest in a decade. Weak demand, high inventory levels and high crude prices led to weakening of refining margins across regions. This summer, many refiners are running their major conversion units at reduced run-rates due to weak gasoline and diesel economics. These reduced run rates further exacerbate operating efficiency. More so, prolonged maintenance shutdowns and permanent closures are projected in mature refining markets.

For some regions, improved economic outlook, positive industrial data and higher demand have led to an improvement in refining margins. For

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example, the $620 billion per year Turkish economy has been growing steadily since 2007 at 6% annual growth rate. At this rate, it will surpass Germany's economy by 2050. This is a country where 25% of the population's 73 million people are under the age of 15, which means that very soon the demand for transportation fuels and other refined products will increase significantly. Young workers in a vibrant economy not only produce, they also buy homes and vehicles, and start families --- a big boost to energy consumption.

With only four refineries in Turkey, other refiners in the Mediterranean region are planning to upgrade their facilities to export diesel and gasoline to the expanding Turkish market.

While the previously mentioned run rates in many North American and European refineries are closer to 85%, other refiners in developing countries, such as Reliance Industries Ltd. (RIL) in India, are operating close to 100% run rates. For example, the complexity of RIL's two refineries in Jamnagar (over 12.0 on the Nelson Complexity Index), among the world's largest, allow for highly competitive operating costs. RIL is among the top 10 private refining companies globally and owns 25% of the world's most complex refining capacity. RIL has also become the world's largest producer of ultra-clean fuels at a single location. This resulted in RIL delivering the best refining margin and achieving the highest operating rate of any large refining system globally. ■

New Hydrocracker at Haifa Refinery

Oil Refineries Ltd. (ORL) in Israel and the syndicate of local banks led by Bank Hapoalim, has signed an agreement for a loan of US$600 million, as part of a financing program of US$900 million, to continue the implementation of ORL's strategic plan and its additional credit needs until the end of 2012. The financing plan has been approved by ORL's Board of Directors for ORL's general funding needs until the end of 2012, which includes the hydrocracker project at ORL's Haifa refinery. This project is expected to cost around US$500 million and is expected to be operational in early 2012.

The hydrocracker unit will allow production of more distillates with higher added value per barrel, and will increase the flexibility of the refinery in its selection of raw materials and product mix, to suit changing market conditions. With the establishment of the hydrocracker facility, it is expected that the Nelson Complexity Index of ORL, which currently stands at 7.4, will increase to the 9 mark. The implication of the increased index complexity is the ability to produce higher value added from each a barrel of oil. The new unit is expected to improve ORL's competitive positioning in the Mediterranean fuel markets, including the rapidly expanding Turkish fuel market. ■

Indian Refining Output Continues to Grow

Recent data made available from the Indian government indicates that India's annual refinery output grew 7.7% in May, its highest jump since July 2008, driven by positive margins and growing local demand for auto fuels. Annual oil product demand in Asia's third largest oil consumer rose 6.3% in May.

Indian refiners processed 3.252 million barrels per day (bpd) of crude in May, when margins for simple Asian refiners turned positive to 0.37 cents a barrel. The International Energy Agency expects India's annual demand to rise 1.9 percent in 2010 compared to the last year.

India's Reliance Industries Ltd, which runs the world's biggest refining complex at Jamnagar in the western state of Gujarat, imported nearly 1.09 million bpd, down from 1.42 million bpd in April and up from about 721,900 bpd in May last year, according to the data.

Reliance shut a 100,000 bpd vacuum gas oil hydrotreater at its older 660,000 bpd refinery in early May to change a catalyst. Trade sources say the unit is still off-line. The company's two complex refineries at Jamnagar can together process 1.24 million bpd crude. ■

EPA Voids Air Quality Permits

The U.S. Environmental Protection Agency (EPA) invalidated the air quality permits in late June of 122 plants across the state of Texas, affecting numerous petrochemical facilities and oil refineries. The actions sparked complaints from representatives of the refining and petrochemical industry who called the move a "back-door" attempt to bring the facilities under federal green-house gas regulation. ■

July Planned and Unplanned Maintenance Schedules

The following summaries list production outages at several refineries in the U.S. and Europe as reported by Dow Jones Newswires, compiled from both official and unofficial refining sources and is not meant to be a comprehensive list:

ConocoPhillips (COP) has cut crude runs at its 210,000 bpd Bayway refinery in Linden, N.J., due to extreme heat, according to a person familiar with the plant's operations. The run rate of the facility's crude distillation unit (CDU) is now at around 207,000 bpd amid the heat wave sweeping the U.S. East Coast.

Chevron Corp. (CVX) will complete a $500 million expansion project at its Pascagoula, Mississippi refinery by late summer, market information provider Industrial Info Resources said in a statement in early July. The project comprises replacement of two 30-year-old catalytic reformers and construction of a 55,000 bpd continuous catalytic reformer unit, it said.

Motiva Enterprises LLC's Port Arthur Texas refinery began repairing one of its boilers around July 11 to prevent an unplanned shut down of a key gasoline-producing unit, according to a filing with environmental regulators. A leaky tube was found in the waste heat boiler located at FCCU #3, the company said in a report to the Texas Commission on Environmental Quality. "In order to prevent an emergency shut down with subsequent emissions, a plan is in pace to conduct an orderly shut down," the report said. ■

Over 500 Delegates Expected for Cat Cracking Conference

The 2010 NPRA Cat Cracking Conference scheduled for August 24 & 25 in Houston is expected to draw over 500 professionals from the traditional fields of refinery processing, operations, maintenance, as well as technology suppliers. The topic tracks for 2010 are include mechanical, prrocess/operations and rotating equipment. The 2010 Seminar will also have a Question & Answer session with industry

experts who will address questions on process safety, rotating equipment, refractory, process technology, emissions controls, maintenance work processes, turnarounds, inspections, technology choices, and operations. Additional registration information is available on the NPRA website (www.npra.org). ■

Editorial Comments

Re-Scoping Postponed Projects

Aside from poor market conditions, there is noticeable hesitation in the refining industry with the restart of postponed projects. In many cases, this hesitation is due to regulatory or monetization related concerns, partially driven by perceived lack of support for the refining industry by financial entities and governments. In addition, uncertainty regarding CO2 regulations is currently weighing heavily on facility investments.

This is because process facilities bear the brunt of potential CO2 emissions regulations --- as this is the source where crude oil derivatives are actually combusted by industrial, commercial and consumer off-takers. For example, proposed CO2 regulations are how Wall Street financial entities working in conjunction with the U.S. government will gather revenues and fees from "allowing CO2 emissions." This type of cohesion among government and financial entities has been expected elsewhere, such as in Europe and Japan.

In addition, lack of investment, at least in North America, may also be driven by a sense of denial regarding the continued plentiful availability to U.S. refineries of high API/waxy or waxy-aromatic crude oils at competitive prices relative to worldwide crude oil benchmarks (e.g., U.S. $ per bbl or Euro per metric ton market prices for North Sea Brent, WTI, OPEC Light Basket).

Regional refining market dynamics also weigh heavily on investment strategies. For example, Japan's Ministry of Economy, Trade & Industry's (METI) new ordinance known as "Sophisticated Methods of Energy Supply Structures" states that the cracking/CDU ratio of refineries in Japan must be 13% or higher

Rene Gonzalez, Editor, Refinery Operations

by the first quarter of 2014. Considering the current stagnation in the

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Japanese refining industry, this law will probably lead to facility rationalization for those refiners and oil companies that cannot invest in the process complexity to meet this 13% cracking/CDU ratio. Perhaps Chinese oil companies will "step in" to upgrade select shuttered Japanese refinery facilities to provide additional sources of intermediates or finished products for the Chinese transportation fuel market.

Another example of regional refining market dynamics weighing heavily on future investment can be seen with the Canadian bitumen feedstock/US processor relationship. According to comments from one industry expert, who wished to remain anonymous, it is quite possible that the Government of Canada, the Government of the Province Of Alberta, and the Western Canadian Bitumen industry will increasingly encourage existing and new bitumen upgrader plants to shift operations away from either (a) low-sulfur non-premium bottomless synthetic crude oil or (b) low-sulfur premium bottomless synthetic crude oils, and more towards sale of low-sulfur naphtha (especially for use in making dilbits and dil-syn-bits for export to U.S.); ultra-low sulfur 2-D on-road diesel fuels (with actual CI [D4737-A] ≥ 42.5 neat and CI [D976] ≥ 40 neat); and sales of low-sulfur cat feed vacuum gas oil (VGO).

Inclusion of more powerful light distillate hydrotreater units (HTUs) and addition of high-pressure kerosene HTUs to bitumen upgrader plants can permit such bitumen upgrader plants to make a diesel gas oil [nominal 160°C/175°C to 350°C or 320°F/347°F to 662°F], which meets US/Canada specifications for 2-D diesel fuels.

New or upgraded light distillate HTUs may perhaps become double-loop/two-stage configurations with HTU reactor pressure inlet greater than or equal to (≥) 125 bara, and some kerosene HTUs may also need to incorporate capabilities for significant hydrogenation of mono-aromatics into cycloparaffins of similar carbon number at residual sulfur less than or equal to (≤) 5 wppm when working with small amounts of straight-run kerosene + coker kerosene + EB/dispersed slurry kerosene.

The bitumen upgrader plant thus enters partly into the refining business with better potential to enhance sales revenues and thus leverage gross profits. However, the bitumen upgrader plant still does not incorporate catalytic reforming; or C5/C6 isomerization; or an FCC unit combined with a butylene alkylation unit. These configurations are left to more traditional refineries in Canada and US. Regardless, it will take at least three quarters of improved profitability before there are sufficient to consider expanding the scope of projects that are currently at risk of being postponed or cancelled altogether. ■

Calendar of Events

JULY

18-22 ASME Pressure Vessels and Piping, Bellevue, Washington, +1 800 843 2763, www.asme.org.

AUGUST

8-12 ASME International Heat Transfer Conference, Washington, DC, +1 800 843 2763, www.asme.org.

*24-25 NPRA Cat Cracking Conference, Houston, +1 202 457 0480, www.npra.org.

SEPTEMBER

22-24 Euro Petroleum Consultants Ltd 10th Russia & CIS Refining Technology Conference, +44 (0)20 7357 8394, www.europetro.com.

* Refinery Operations is sponsoring the 48-page special report, "Innovations in Fluid Catalytic Cracking," to be published in advance of the August 24-25 NPRA Cat Cracking Conference in Houston. Please feel free to contact the editor for submission of articles at +1 713 449 5817 editor@refineryoperations.com.

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