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Criterion, Shell Global Solutions Address Key Clean Fuels Issue: Cost-Effectiveness

By Carol Cole, Editor, Octane Week

If your goal is cleaner fuels, almost any vendor can help. But if your goal is cleaner fuels, maximum reliability and minimum capital expenditure, then you need an alliance of companies - the alliance of Shell Global Solutions and Criterion Catalysts & Technologies, LP. Together, they have already provides cost-effective, clean-fuels solutions to numerous refineries around the world. And as U.S. refiners gear up to manufacture Tier 2 gasoline and ultra-low sulfur diesel (ULSD), the companies' combined expertise will get their North American clients off to a good start, operationally and financially.

"We define our mission within the refining industry as providing refiners with options to make clean fuels with minimal capital outlay," said Gary Yepsen, vice president, Criterion Catalysts & Technologies. To do this, the Shell Global Solutions/Criterion alliance always consider the best use of existing assets, assess a projects' impact on operating costs and evaluate its reliability.

Together, Criterion Catalysts & Technologies and Shell Global Solutions cover the world in terms of catalyst expertise and knowledge of refinery operations and processes. Criterion is the world's largest hydroprocessing catalyst supplier. The company's global role has produced an extensive database covering a wide range of feeds, product properties and operating conditions. Criterion Catalysts & Technology Co. maintains multiple development laboratories to improve catalyst performance.

Shell Global Solutions has been a force in the industry long before the focus on fuel sulfur levels emerged. The company has a tremendous knowledge base of refining processes. For almost every problem, they offer a proven, cost-effective solution. They also budget ongoing R&D investments to develop new solutions in the areas of process technology, equipment design and catalysis.

Together the companies approach the clean fuels problem from all angles. Gary Yepsen explained, "A company that is solely a catalyst vendor is naturally going to approach clean fuels by looking at the catalysts in the hydrotreater, a mind-set that usually produces one or two options -either to change catalysts or build a second reactor." Yepsen continued, "Because of our alliance with Shell Global Solutions, we look well beyond the hydrotreating reactor."

That's where Shell's global experience is invaluable. "We are operating in many places where clean fuels have long been established," said Michel Houte, senior vice president, Corporate Accounts, Shell Global Solutions (US), Inc. "Northwest European refiners, particularly in Sweden and Germany, have been producing low-sulfur diesel for years. We have been a large part of those efforts. In addition to this, our broad knowledge of refining enables us to look beyond the reactor and find real cost and performance advantages."

There's a lot to be gained from looking outside the reactor itself, Bob Hennekes, vice president, Technology Marketing, Shell Global Solutions (US) Inc. explained. "For example, before we even analyze the reactor, we look upstream at how best to fractionate the feed." he said. "There are many equally important issues, such as how clean the hydrogen must be."

"Take the case of a refiner who needs additional desulfurization. Some vendors might suggest more reactor volume and more catalyst. The specialists in the Criterion and Shell Global Solutions alliance know that improving the hydrogen partial pressure will get deeper desulfurization in the same reactor. We also know how to accomplish this. The best first step might be to do a hydrogen study across the entire refinery to see where the hydrogen can be captured and better utilized," Hennekes said.

Before getting to the reactor itself are things such as pumps, furnaces and compressors that the partners evaluate for their potential to contribute to a quick project payout. There's also the potential integration of other hydroprocessing units - naphtha hydrotreating/reforming, paraffin isom, diesel

hydrotreating, FCC pretreat, hydrocracking, FCC gasoline post-treat and sulfur recovery. Who other than the Criterion/Shell Global Solutions alliance can manage all that?

Finally, a thorough scrutiny of the reactor is in order, with a hard look at the feed distribution. Tighter internals can free up important room to process more feed and catalyst without requiring the construction of a new reactor.

Internals really make a difference in the manufacture of ULSD. “In some cases, you can double the effective volume in the reactor, Yepsen said. “By making better use of the reactor bed and applying more effective catalysts, we can get twice as much use out of the reactor volume.”

That’s very important, considering the disparity between the quality of intermediates and the final fuels, said Houte. “In Europe, the goal is 5 ppm sulfur diesel. Imagine a feed with 1,000 ppm sulfur,” he said. “If there’s any maldistribution of that 1,000 ppm feed, and just 1% of the sulfur gets into the fuel, the refiner has overshot his fuel quality goal. Hence distribution trays are a key factor the Criterion/Shell Global Solutions alliance takes into consideration.”

Shell Global Solutions’ expertise in the construction of intervals is invaluable. Criterion Catalysts & Technologies LP knows the alliance’s capabilities and can secure them for their clients. By the same token, Shell Global Solution’s clients also have the benefit of bouncing possible catalyst solutions off Criterion’s experts.

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>
> - Bob Hennekes, Shell Global Solutions (US) Inc.

“We can be a one-stop shop so clients also have to research and sign multiple vendors. Shell’s operational skills dovetail with with Criterion’s catalyst selections, making a package that can reduce refiners’ headaches and downtime,” said Yepsen. “And through our alliance with other affiliates, such as CDTech, we have a large number of pieces we can bring to solve the puzzle. It’s that breadth of view, and we are certain it does create value for the customer.”

“That value is unique,” said Michel Houte. “We offer truly different types of solutions. After all, if current technology isn’t producing the required fuel sulfur specification, then we need to look for new solutions. Shell Global Solutions and Criterion combine to provide a holistic view of the refinery. We think upstream and downstream, because we’re not just one single catalyst, we’re not just one single technology. Many vendors have only one solution to offer, while we have a range of solutions. We work as partners with our customers and join their clean fuels team. Together, we define customized solutions to fit within site-specific constraints and provide the best return.”

One of those constraints can be regulatory uncertainty, which makes refiner’s want to wait as long as possible to begin a project. A short lead-time is one accommodation Shell Global Solutions/Criterion can make with its many low-cost solutions.

However, fuel specifications are never stagnant, Bob Hennekes pointed out. “With that in mind, we tend to provide solutions that can grow with the requirements. Our clients can’t sit idle while regulators and automakers figure out what they want next, or they would risk waiting too late to start a project. Clients can be confident that our solutions provide flexibility, so investments won’t get stranded. Just expect fuel specifications to be moving targets, and rely on Shell Global Solutions/Criterion to craft in as much flexibility as possible.”

Hennekes points to the alliances’ efforts on behalf of refiner’s in Europe. “There, the ULSD sulfur spec went from 50 ppm to 10 ppm, and the next round of rules could be aromatics,” he said. “We believe near-term solutions that offer long-term flexibility are best for refiners, and that’s what our customers get.”

Internal Revamp Reactor Performance Summary

	Existing Reactor		Revamped Reactor
Reactor Volume	150 m^3		150 m^3
Reactor Utilization	67%		86%
Catalyst Volume	100 m^3		129 m^3
Catalyst Utilization	80%		100%
Catalyst In use	80 m^3		129 m^3
Catalyst Activity (RVA)	100%	New Generation Catalysts ----------→	125%
Effective Volume	80 m^3	= **2X** >>	160 m^3