

# Refiners Reap Big Benefits in Comparative Tests of ULSD, Hydrocracking Catalyst

By Jack Peckham. Published April 8, 2014

At a recent presentation to the American Fuels & Petrochemical Manufacturers (AFPM) annual meeting in Orlando, Fla., Illinois-based George Hoekstra of Hoekstra Trading touted the benefits of independent, side-by-side testing of new refinery catalysts enabling wiser refiner decisions.

Some refiners spend more than \$100 million annually on catalysts, according to Hoekstra, a 35-year-veteran refinery process researcher at BP plc, who retired in 2009 and subsequently launched Hoekstra Trading.

Refiners can realize savings of up to \$5 million per year if they choose an optimal catalyst for a “typical” ultra-low sulfur diesel (ULSD) hydroprocessing unit and more than \$10 million per year for a hydrocracking unit, he said here.

“You can get 20% lower catalyst cost by opening your business to more suppliers and newer catalysts,” Hoekstra said. “With independent testing, you gain confidence in your decisions, and you can be more flexible in catalyst supply.”

In his presentation, Hoekstra cited the independent catalyst test work at C Solutions Limited in Thessaloniki, Greece. Side-by-side tests of catalysts are carried out over a period of days, rather than months or years, he explained.

Following his AFPM presentation, Hart Energy’s Downstream Business (DB) asked Hoekstra to explain the significance and value of such short-term test:



**DB: How can a refiner know whether a supposedly ‘good’ catalyst (higher activity/higher conversion for example) as indicated by the results in the test program later turns out to be a ‘bad’ catalyst (slashes run length or causes other problems in the refinery)?**

*Hoekstra: You are correct. The economic value of a catalyst depends on both its activity and its long term stability.*

*Our standardized test is a 15-day test that includes a ‘torture test’—days 10 to 12—during which the catalyst is exposed to high temperature on difficult feed, conditions that promote coke deactivation.*

*To get a high performance rating, a catalyst must stand out in activity on days 1 through 9 compared to the benchmarks, survive the torture test, and then maintain its high rating through day 15.*

*Some catalysts break down during the torture test. They are classified as unstable and are excluded from our ratings. This approach has been proven fit for purpose and avoids the need to run tests of months duration, which are cost prohibitive and do not produce better ratings.*

**DB: Is it possible that some refiners don’t bother with this testing program and instead ‘stick-with’ a known catalyst supplier because of certain performance guarantees or price discounts that they get from certain catalyst suppliers?**

Hoekstra: *Yes. Performance guarantees and price discounts are very common ways to encourage refiners to stick with the incumbent.*

**DB: Perhaps this explains why some refiners don't bother to do these tests, and why some catalyst suppliers don't supply their catalysts to you for side-by-side comparison testing?**

Hoekstra: *Yes. Performance guarantees and price discounts are effective for incumbent suppliers. But I think a bigger factor is that sticking with the incumbent is the 'simple, safe, sure, the path of least resistance,' as I stated in my presentation.*

*Our clients have proven they can get much better economic value by exposing their incumbent [catalyst supplier] to true market competition using our performance ratings.*

*This gives much faster access to the best new catalysts and yields a true market price that is lower than the discounted incumbent's quote. And our program, for the first time, makes it easy for any refiner to use this strategy.*

*About the suppliers: most of our test samples do come from catalyst suppliers. Those who still opt out [from competitive testing] are a shrinking minority. And we have proven the reason they opt out is they don't like the transparency our program brings.*

### **Hundreds of choices**

In his AFPM presentation, Hoekstra showed that refiners face a mind-boggling array of catalyst choices, vendors and brands. Not only do refiners face choices among cobalt-molybdenum (CoMo) or nickel-molybdenum (NiMo) types, but also "high-density or low-density, high-metals or low-metals, trilobes or quadrilobes and stacked bed" varieties," he said.

"When you take all the brands and multiply by all the flavors, you have 200 options," he said. "If you were a busy process engineer needing to select catalyst, how would you deal with 200 options that are presented to you with conflicting claims?"

To help refiners sort through this blizzard of options, "C Solutions does lots of site-specific, proprietary projects for refiners," he said.

"Each site-specific project is sponsored by a single client, usually for a specific VGO [vacuum gas oil] or hydrocracking unit that requires a tailored test program.

"With a site specific proprietary project, you send two drums of your unit's feed and four candidate catalysts to C Solutions. One of your people will work with C Solutions to plan and oversee the tests. C Solutions will run the program on your feed and you will draw your conclusions.

“The pilot plant test itself typically lasts 30 days, and you’ll need about six-month’s lead time to plan the program, deliver the feed and catalysts, and complete a 30-day pilot plant test on four catalysts.

“A new approach is standardized multi-client testing. This is used for ULSD units. You don’t need to run your own site specific proprietary project for diesel units. We have standard feeds and a standardized pilot plant test for this.

“Five years ago, Hoekstra Trading sponsored the industry’s first standardized multi-client catalyst testing program for ULSD catalysts, working with a group of independent refiners. Since then, we have tested eight more catalysts each year at C Solutions using the same standardized test. So we’ve now tested 32 catalyst samples over four years in this program.

“This is an open market program, meaning all our test results are available, now, to anyone. The cost per client for 30days/year of testing is one-fifth the cost of doing your own proprietary program because the test is standardized, it is limited to ULSD, and the cost is shared across multiple clients.

“We have seen big differences among the many competitive ‘Type II’ catalysts tested in this program, and some results have been surprising. Research in the 1980’s showed that placing a cobalt atom at the right spot in the Type II nanostructure increases the activity per cobalt atom by a factor of 50, and more recent development has multiplied that factor further.

“So there is lots of leverage in getting a higher percentage of the promoter on the sweet spot, which is why catalysts keep getting better as suppliers develop better catalyst preparation technology.

“From the refiner’s perspective, these competitive product rankings are powerful in your catalyst selection process. Now you have some reliable hard data, from side-by-side tests on a reliable, independent test track, with different competitors’ products, apples-to-apples. You can consider putting something new in your unit without feeling like you’re ‘rolling the dice,’” he concluded.

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