IMPROVING REFINERY MARGINS KEYNOTE

BIDDING TO INNOVATE

Jim Ondyak, Dorf Ketal, USA, discusses how companies can change suppliers between bidding events, taking advantage of technical innovation and boosting profitability.

Suppliers of speciality chemical solutions play an important role in refinery profitability. There are many crude treatment and process applications within the refinery where chemistry assists in improving refining economics and reliability. If these programmes are not working properly, there is potential for significant adverse impacts including off-specification and derated production, equipment damage, and unplanned shutdowns.

Bidding to award multi-year contracts is the global norm for procuring these products and services. Between bidding events, the potential to change suppliers is normally restricted. Refiners are finding that profitability can be improved when these restrictions are modified and processes are put in place to encourage change between bidding events that takes advantage of technical innovation. This article explores this new trend and offers examples of how bidding and technical innovation are being uncoupled by refiners to improve profitability. Case histories for corrosion control, emulsion breaking, and hydrogen sulfide (H_2S) treatment are presented to illustrate the impact of this new trend in procurement.

Background

The annual cost of speciality chemicals and services for a typical refiner is in the millions of dollars. Collectively, it is one of the largest controllable variable costs in the refinery, but the cost of performance problems can be far higher. Changing chemical suppliers to get the same chemistry at a lower price introduces profit risk if the results are compromised. This creates an interesting negotiating dynamic. The cost of change includes the consideration that there may be an unintended negative consequence in the transition. Incumbent suppliers, aware of these considerations, have a potential advantage in the pricing negotiation.

Procurement efforts have been successful in reducing supplier leverage through increased knowledge of how to create a competitive advantage for their organisation.[1] Around 25 years ago, supplier selection was often made by the superintendent of the unit whose criteria was heavily influenced by their confidence in the technical representatives servicing the business, their knowledge of the operation, how much they valued the working relationship, and their aversion to change. In this environment, there were multiple suppliers in the refinery and gross margins for speciality chemicals were in the range of 60 – 70%. It became obvious to procurement and refinery management that refiners were paying a lot of money for suppliers to make sales calls on each other's business.

Crude oil refinery consolidation and the emergence of more sophisticated supply chain practices were two major factors in changing supplier relationships. The number of refineries in the US declined from 216 in 1986 to 149 in 2004, and the majority of the closures were small, less complex refinery assets.[2] During the same time period, supply chain practices were changing across multiple industries ranging from automotive to pulp and paper to refining.[3] Refinery supply chain leaders, faced with excess refinery capacity and closures, implemented strategies to increase their buying power and reduce costs. They created new negotiating leverage by bundling purchases across multiple applications and locations and changed the buying process by moving decision making away from relationship buyers. The expanded bidding list and winner take-all strategy exposed supplier vulnerabilities. For example, buyers learned that products sold to them as specialities were often not special relative to similar products offered by the competition. This knowledge reduced the risk of change and increased buyer power. Prices dropped as products become more commoditised in the marketplace.

Suppliers cut budgets for R&D and improved efficiencies in all areas to deal with the price reductions. They sought increased volume to counter reduced margins and responded by offering further increases to the size of the bundle while pursuing a bidding process, which reduced innovation leverage and increased barriers for competitor entry. By awarding additional application business to a single supplier, the supplier was often stretched to provide chemistries and service outside of its traditional expertise. This increases the risk for substandard performance for the refinery and reduces the opportunity for innovations to improve margins.

Today, multiple rounds of bidding have significantly reduced supplier gross margins. Bidding continues to serve as a restraint to price increases and, in some cases, can expose new examples of supplier vulnerabilities that lead to significant price reductions. However, the innovation process is not well incorporated into bidding, and there are unmet needs for improved results that require innovation. A new strategy is emerging that uses technical innovation as a method to further reduce costs and increase leverage on suppliers.

Technical innovation procurement strategy

It is difficult to vet technical innovation during a bid. Bidding speciality chemicals is resource intensive for the refiner and the supplier, and is best managed on a relatively short, disciplined timeline. The process of evaluating technical innovation can also be resource intensive, but compared to bidding, the resources are often functionally different. For example, while R&D is not normally needed to a great degree in bidding, it is necessary for evaluating technical innovation.

For best pricing leverage, the bidding process must at some level be perceived by the incumbent as a threat to their business. This perception can be best created when communication processes are tightly controlled to limit information flow to the supplier. The most powerful bids create the perception that multiple suppliers are essentially equivalent in meeting the bid criteria, and price will be a major factor on the final decision. Competitive bidders are motivated to underestimate dosage to show major cost reduction. Experience has shown that the successful bidder is often able to adjust their dosage commitments based upon new observations and performance demands.

In contrast to bidding, evaluations of technical innovations require different resources, more open communication, and a flexible timeline. The trend is to carry out this work between bidding events. When bids are awarded, the contract retains the option for the refiner to use the best available technology from any supplier offering technical innovation that meets the refinery's needs. This motivates incumbent suppliers to continue to invest in R&D or risk losing the application.

The following three case studies explain the benefits of this innovation procurement strategy – high temperature corrosion inhibition, emulsion breaking, and H_2S scavenging.

Case study 1: high temperature corrosion inhibition

High temperature corrosion inhibitors (HTCI) are part of a crude flexibility strategy that utilises crudes contaminated with naphthenic acid. These crudes are sold at a discount that can reduce cost of crude by orders of magnitude greater than the cost of the corrosion inhibitor. The cost of chemical is immaterial relative to the profit improvement results that the corrosion inhibitor can offer, clearly an example where a bidding strategy is not a good fit.

The industry standard for this application is a class of chemistries called phosphate esters. These molecules are surfactants designed to deliver phosphorus, the primary corrosion inhibitor molecule. The phosphorus reacts with existing iron sulfide scale to make it less porous to naphthenic acid penetration to the surface and more resistant to shear stress. Historically, the choice of HTCI has been from partial esters containing an acidic O-H bond that is inherently unstable when exposed to refinery temperatures. This instability degrades the efficiency of the corrosion inhibitor. There are now new tri-ester molecules that address the thermal stability problems with partial esters.

The emerging best practice is to use a third-party laboratory, experienced in autoclave testing of HTCI's, to trial alternative products. Third-party laboratories provide unique

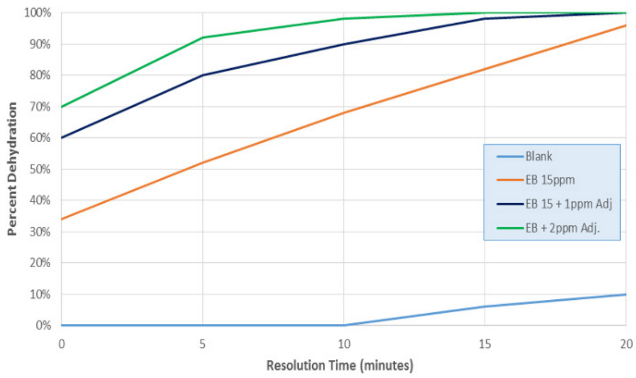

Figure 1. Performance improvement with aldehydes.

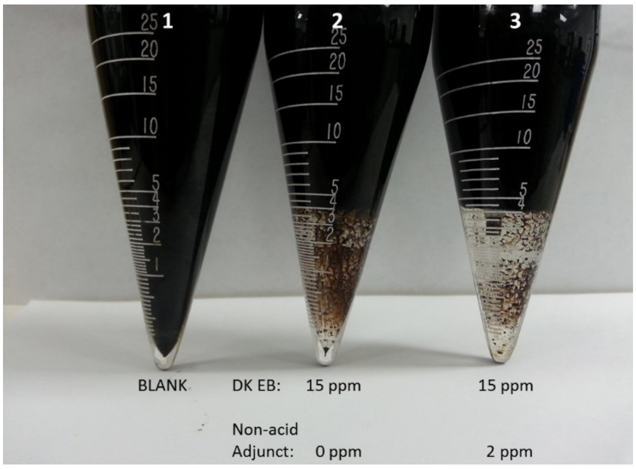

Figure 2. Comparison of portable electric desalter (PED) tests.

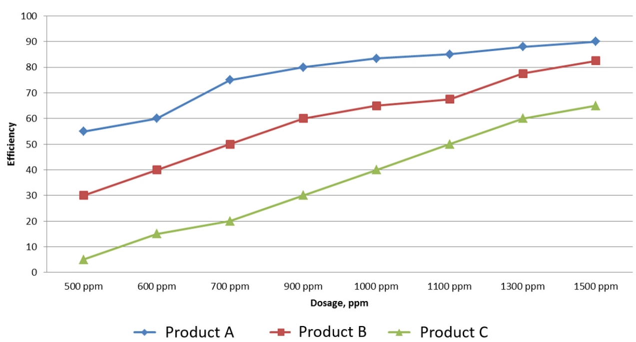

Figure 3. Comparative performance of three products with equal triazine content.

testing expertise, generally have more timing flexibility, and eliminate bias. Refiners who have gone through this exercise have learned that there are significant differences in the phosphorus efficiency of commercially available products. Some products take as much as four times more phosphorus to carry out the same corrosion inhibition as the best-in-class product. This is important because phosphorus is a potential foulant in the crude unit and in hydroprocessing units downstream.

In addition to evaluating inhibitors, there is also the need to re-evaluate the total acid number (TAN) limits of the existing metallurgy. This process can discover when current assets are underutilised and where there has been significant lost profit by avoiding more high acid crudes in the blend, even without inhibitors.

The breadth and magnitude of the economics and the complexity of evaluating alternative innovative HTCI chemistry demonstrates that relying upon a bidding process bundled with other applications is not resource efficient or cost effective when selecting HTCI.

Case study 2: emulsion breaking

Procurement practices for purchasing emulsion breakers vary worldwide. In Asia, the extent to which the refiner has delegated desalter operation to the supplier is less, the number of suppliers is greater, and competitive trials occur far more frequently. The level of trial frequency is sufficient for procurement decisions to identify technical innovations, especially with difficult metals removal and desalting challenges.

Refiners in North America and Europe have become more dependent on the chemical supplier to monitor and control desalter operation. There are fewer suppliers and bidding practices limit new entrants. In over 80% of the refineries in North America, a competitive trial has not occurred in over five years. As a result, there is far less data for procurement to evaluate technical innovations in desalting.

However, new trends in procuring technical innovation are changing this paradigm. The technical innovation case history in desalting involves a new class of emulsion breaking chemistry using aldehydes. Described as a new class of adjunct chemistry, aldehydes can dramatically improve the ability of the emulsion breaker to remove more water, faster, and with less oil in the brine (see Figures 1 and 2). This synergy is magnified when the emulsion breaker (EB) is designed to take advantage of the aldehyde functionality. Quantification of the technical and economic performance improvement of this new adjunct chemistry in the dynamic operating environment of desalters requires an open innovation evaluation process. Current commercial bidding practices cannot capture the advantages of this new technology.

A new procurement trend is for refiners to conduct more trials and utilise third-party laboratories to conduct desalter solution comparison studies. These comparisons show significant quantifiable improvement differences in the new desalter chemistries, allowing refiners to take better advantage of changing crude economics. Once again, the economic benefit of the innovation is potentially orders of magnitude greater than the cost of chemicals.

Case study 3: H_2S scavenging

H_2S is a toxic gas present in crude and intermediate refinery products that have not been hydrotreated. Transportation of H_2S containing hydrocarbons has been under increased scrutiny to protect personnel involved in shipping of these hydrocarbons and to reduce air emissions from handling and storage. H_2S scavengers are the class of chemicals that react with the H_2S in the hydrocarbon.

Surveys of refiners frequently list H_2S scavengers in the top five in dollar spend for chemicals and growing. Increased demand for these products is evident to suppliers.

The procurement challenge with this class of chemicals is sporadic usage and the material to be treated is inconsistent in chemical demand. As a result, this business is routinely granted to the bid winner as an extra or add-on to the bid scope, however, this is changing. Increased costs are driving more scrutiny on the line item spend. Success with on-site 'can tests' and tests using third-party testing services is leading procurement managers to increase testing of scavenger performance. Figure 3 presents a laboratory test result of three scavengers, each with equal triazine content. The efficiency of these products differs significantly. Researchers have discovered a number of options for improving efficiency of triazines as well as nitrogen free scavengers. For those refiners facing increased cost in H_2S scavenging, it is recommended that they survey the supplier base for technical innovations in this area. The survey will show that efficiency of scavengers is a dynamic subject and the average refiner is missing profit improvement opportunities because they do not recognise the innovation that is happening in this category of speciality chemistry. There is a clear trend to not rely on the actives content, but to carry out performance testing when selecting the scavenger as there are potential savings of 30% or more available.

Conclusion

Time and resource requirements for commercial bidding of established refining process chemicals is significantly different than the assessment of innovative refining process chemistry. Commercial bidding of established chemistry extracts value for the refiner when communication is minimised, the perception of performance similarity is maximised and the evaluation time is compressed. Assessment of the economic value of innovative chemistry requires the opposite refiner/supplier relationship to be established. The valuation of innovation is best carried out through open communication and without time requirements.

Three case studies were used to illustrate that the profit improvement benefits of having a process for technical innovation can be significant. Economic benefits extend far beyond the acquisition cost and are best quantified in the 'cost-in-use'. The resources required to evaluate technical innovation vary depending on the subject matter, the needs of the refinery, and the highly variable change process required to capture the value.

Success with technical innovation is leading a number of refiners to make changes to the terms of supplier contracts to better facilitate changes without causing animosity. On the contrary, these changes can be motivating to improve performance and increase R&D efforts to meet the needs of the refiner.

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