RECENTLY COMPLETED PROJECTS

Continued from pg 3

Cosmo's recognition and implementation of a corporate culture promoting refinery profit maximization and continuous improvement was equally important to the project. Such characteristics include: high level management support, continually challenging the true profit constraints, improving planning tools, focusing on testing and implementation, and using KPIs to track improvements and achieved benefits.

Final responsibility for a safe, speedy and successful implementation belongs with Cosmo. To meet these requirements, they set up an organization and procedures for opportunity safety reviews, efficient communications and implementation of the PIP methods. Through a corporate culture change and the right models and tools, Cosmo is confident that they can now lead the process of Profit Maximization and Continuous Improvement at the refinery.

(Based on the presentation by Shigetoshi Tamura for the 3rd Bottom Line Improvement Conference, Kuala Lumpur, Malaysia.)

Opportunity Implementation Support

Europe

In 2004 KBC had completed a VGO Maximisation study on the Crude and Vacuum Unit for a North West European Refiner. The client was keen to test and implement the opportunities that had been identified and asked KBC to support these activities. An target profit improvement of $4.5 MM/yr was set for the project.

KBC focused on achieving fast track implementation and sustainability of opportunities by providing a comprehensive test-run service, implementing benefit tracking using KBC's ProfitTracker, and teaching training workshops in KBC Profit Improvement Methodologies and Management Review meetings.

Increasing the crude and vacuum unit heater outlet temperatures improved diesel/residue fractionation, resulting in diesel yield improvements. The agreed implemented benefit for these opportunities was $3.4 MM/yr.

Test runs showed that the vacuum tower operation was highly sensitive at higher pumparound flow rates. Increasing the HVGO pump-around increased internal HVGO wash with a consequent increase in vacuum residue yield.

The LVGO fractionation bed was also found to be a bottleneck. The LVGO draw tray was prone to under-tray condensation constraining LVGO yield and the ability to monitor unit operations effectively.

KBC gave operational guidelines to optimize the tower within the current operating window, worth a further $3 MM/yr. This detailed knowledge of the tower performance and limits is now being exploited by KBC in executing the basic engineering design for a vacuum unit revamp project planned for completion in 2006.

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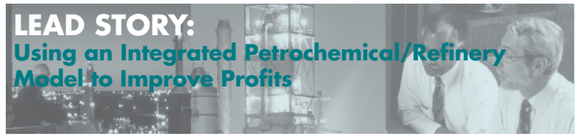


KBC Listed LSE THE LONDON STOCK EXCHANGE

KBC provides independent consulting services and implemented solutions to improve the sustainable profitability of our clients worldwide in the process industries.

Our Services Include:

- Process Improvement
- Linnhoff March® Energy Services
- Reliability, Availability and Maintenance (RAM)
- Planning Services
- PEL Market Services
- PROFIMATICS™ Simulation Software
- Petrochemicals
- Training Services

IN THE NEXT ISSUE:
Site Optimization of GTL Complex in Africa

KBC
PROFIT. ABILITY.

3rd Quarter 2005

DRIVING Competitive Advantage

Helping Clients Improve Profits and Achieve Pacesetter Performance

FEATURE STORY

Using an Integrated Petrochemical/ Refinery Model to Improve Profits

by Paul Haugseth, Principal Consultant, and Gloria Chukman, Product Manager, KBC Advanced Technologies

KBC recently completed a study for an Asian refinery on their "top of the barrel" processes. In the first phase of the project, KBC built a detailed Petro-SIM™ model, with tight integration of crude, naphtha reforming and aromatics units. This model, along with current economic data, was used to evaluate various case studies to improve profits while maintaining high crude throughput.

"Top of the Barrel" Processes

The process contains multiple Crude units, multiple Naphtha Catalytic Reformers, and a complex aromatics facility. These are shown in Figure 1.

The overhead net liquid from each CDU is routed to a Naphtha Splitter and then split into Light Straight Run (LSR) and Heavy Straight Run (HSR) streams. The LSR stream is debutanized after the Naphtha Splitter, and that stream is then sent to an Olefin producing facility for processing into ethylene and propylene. The HSR is sent to the Naphtha Reformer units for conversion into feed to the Aromatics complex.

The refinery has three Naphtha Catalytic Reformers that are used to produce the feedstock to the downstream aromatic units: two Continuous Catalytic Reformers (CCRs) and one semi-regen catalytic reformer unit.

The Aromatics complex contains processes to recover and separate benzene, toluene, and xylenes. The petrochemicals facility included multiple Sulfolane™, Isomar, Tatoray™, Parex units, and many fractionators. The first part of the process separates the aromatics from the reformate. The non-aromatics are routed to either gasoline blending and/or mixed with the CDU LSR for Petrochemical feedstock. The aromatics are then separated into benzene, toluene, C8 aromatics, C9 aromatics, and C10+ aromatics. The toluene and C9 streams are converted to benzene and xylenes; some of the benzene is further processed into cyclohexane. The C8 aromatics are isomerized into para-xylene.

The Simulation

Each unit model was created and calibrated as an individual Petro-SIM case. The crude units were modeled using a rigorous tray-to-tray model. The Reformers use REF-SIM technology incorporated into Petro-SIM, and the Aromatics complex used specialized reactor and extraction models created by KBC.

Each individual model was incorporated and connected into a single flowsheet for case studies. Fluid packages were selected appropriate to each section of the model to accommodate all processes and automatically mapped onto each section accordingly. The model consisted of over 2000 streams and over 1000 individ-

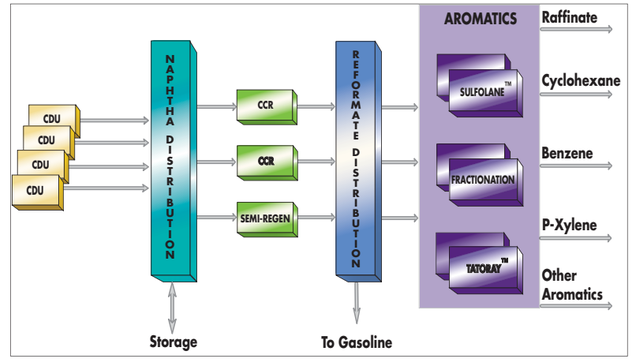


Figure 1

Continued on pg 2

FEATURE STORY

Continued from pg 1

ual process units. Thirty-eight recycle loops were used within the final model.

The refinery has the ability to route the different CDU HSR streams to the different reformers, but it has plant constraints for naphthenes content and routing options. The simulation could import naphtha or route excess naphtha volume to storage as required to meet these specifications.

The aromatic units have flow rate limitations based on extraction limits, fractionation capacity, and heat input; these limitations were incorporated into the simulation. This was very important as the aromatics content in the reformate changed with changes in the CDU's operation. These adjustments allowed the model to solve quickly with proper stream routings. The products from the aromatic complex were routed to sales so that the value of each stream could be calculated.

Economics were assigned based on current market pricing to the feeds and products to determine the economic impact on the plant.

Case Studies to Evaluate Profit Improvement Ideas

After the model was verified as representative of a base case operation, areas for profit improvement were identified and several case studies were performed for each study. Based on the case study results, the most dramatic changes and increased profitability were the results of a study to change the Naphtha cutpoint. This case examined the effects of changing the current targets on the Crude Unit LSR and HSR distillation specifications. The columns were run with specifications on the ASTM D86 cutpoints for the LSR and HSR. The flowsheet was used to evaluate each case. Based on the study pricing, the most profitable case was to increase the LSR D86 95% cutpoint to 100ºC and minimize the HSR D86 95% cutpoint to 140ºC.

The Reformers had a constraint of constant throughput. As the LSR 95% point was increased, additional HSR from storage was available for the model to maintain the Reformer charge rate. This case requires a large import of HSR to maintain the reformer's charge rate.

If the price of the HSR imports is high, the best case would be to increase the HSR D86 95% cutpoint to 145ºC; this case does not require any imports.

Analysis

Naphthene content in the feed was a critical parameter in this study; higher naphthene feed HSR will typically produce more aromatics in the reformate at constant unit octane. As the naphthene content of the feed is reduced, the unit has to operate at a higher severity to produce the same octane. Higher severity will reduce the overall recovery of C5+ feed to the downstream aromatics section. Lowering the LSR 95% cutpoint causes the model to import additional LSR to satisfy the Olefins Complex flow and to maintain xylene sales. These effects drastically reduced the profitability of the overall facility.

As the LSR 95% cutpoint is increased, the CDU HSR quantity of Naphthenes increased This allows the reformer's severity to be reduced, at constant octane, which increases the reformate yield from each unit. The additional reformate is sold as additional gasoline blendstock. Since the production of HSR from the CDUs is reduced in these cases, additional kerosene is also sold. The overall effect is to import low cost HSR and convert this into reformate and kerosene.

Summary

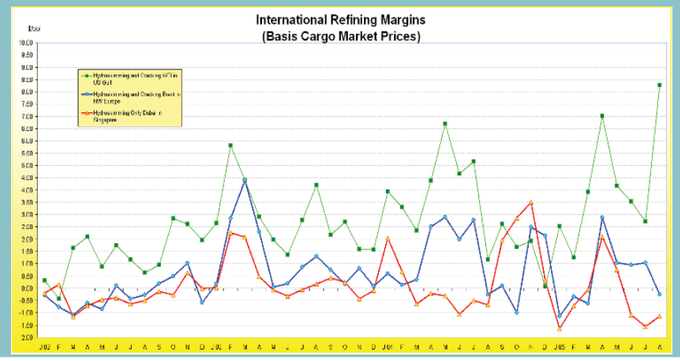
The use of the Petro-SIM flowsheet allowed us to compare the economics of the overall facility as individual unit changes were evaluated. The refinery flowsheet changes based on the preset constraints allowed the model to solve quickly and allow easy comparison between cases. Overall, the refinery now has a working simulation that closely matches actual operation and the tool can be used for additional case studies. We are now expanding the flowsheet to include the "bottom of the barrel" processes and will be using the entire flowsheet for case studies.

PEL MARKET SERVICES

Refining Margins

by Olan O'Sullivan

The strength of crude prices ensured margins were relatively constrained for much of the past three months, particularly in NW Europe and Singapore. Moreover, in NW Europe the relative stability during May, June and July was in sharp contrast to August, which saw margins fall to almost $1/bbl below breakeven. Concerns of a winter heating supply crunch in the fourth quarter kept distillate prices well supported through June. A switch to maximizing distillate output resulted in consistent stock builds in the US, alleviating some of the anxiety over supplies. This period of high refinery throughput had a dampening effect on margins as larger volumes of fuel oil depressed profitability. However, gasoline demand in the US and to a lesser extent in Asia remained robust despite high retail prices in the US. The effect on gasoline inventories was considerable; they moved from a comfortable position above the five year mean at the end of June, to below the five year low toward the end of August - their lowest position since November 2003. Gasoline prices boosted US margins; moreover, the arrival of Hurricane Katrina at the end of August sent prices to astonishing levels. Gasoline crack spreads were in excess of $50/bbl in the US Gulf, which sent margins above $20/bbl and pushed the monthly average for August above $8/bbl. In Singapore, margins on a hydroskimming basis were less resilient. Fuel oil prices weakened during June due to oversupply, consequently undermining margins. The end of turnaround programs and increased throughputs pressured margins further. Therefore, crude prices, in combination with weak fuel oil prices, continued to depress margins on a hydroskimming only basis, with margins at Singapore around $1.50 below breakeven.



COMPLETED PROJECTS

Profit Improvement Success

Japan

Cosmo Oil operates four refineries in Japan. The Yokkaichi refinery, near Nagoya in central Japan, has a capacity of 155 kbpd and a conversion configuration with Reformer, Mild Hydrocracker and FCC. There is also a Lubes production facility at this location.

The Yokkaichi Refinery has made good progress in improving profitability through cost reduction; however, despite their success, the refinery remained below Japan's average refining margin. Cosmo contracted with KBC for a Profit Improvement Program (PIP) to improve their margin by increasing revenue from improved product yields.

KBC was selected due to their worldwide experience in refinery profit improvement for non- and small investment work, ability to lead the implementation process, sophisticated methodology and tools, and experienced specialists. From the beginning, the focus was on implementation of the identified yield improvement opportunities. This refinery PIP implemented 13 opportunities worth 28.0 c/bbl in the first year, and an additional 14 opportunities worth 16 c/bbl in the extension to a second year. These figures met the financial targets for the program.

Continued on pg 4

NEWS & EVENTS

EVENTS

Asia Pacific Refining Conference
Sept 13-14,Sheraton Grande Suhumvit Bankok, Thailand
Zoran Milosevic, Senior Staff Consultant with KBC, will present a paper entitled "Use of Energy Metrics to Sustain Refinery Energy and Environmental Performance."

13th Annual Asia Petrochemicals Summit
Sept 15-16,
Bankok, Thailand
John Philpot, KBC's Petrochemical Practice Leader, will present "Profit Improvement in Olefin Complexes."

Defect Elimination
Sept 27-28, Mandarin Oriental
Kuala Lumpur, Malaysia
KBC will participate with a tabletop booth, and Richard Arey, Senior Staff Consultant with KBC, will serve on the panel.

NPRA Q&A and Technology Forum
Oct 18-21, Gaylord Texan Resort
Grapevine, TX, USA
Q&A, Principles and Practices and Plant Automation sessions address real-world facility problems. KBC will attend.

RPBC - 2nd International Refining & Petrochemicals Business Conference & Exhibition
October 19-20, Antwerp
"The Next Step in Refining Profitability - Profit Manager™", will be presented by Simon Rogers, KBC's VP of Software Solutions.

KBC ATTENDS FLOATING PRODUCTION SUMMIT

On June 28-29, KBC's Haije Stigter, Greg Gustafson and David Turner attended the Floating Production Summit in Kuala Lumpur, Malaysia. This conference kicked-off KBC's re-entry into the offshore and upstream arenas. *(Photo left)*

Pictured (left-right): Haije Stigter *(Senior Consultant; KBC)*, Nazya Ayaz *(Conference Manager; Oil and Gas IQ)*, David Turner *(VP, Business Devel., Asia; KBC)*, Greg Gustafson *(Senior Consultant; KBC)*

Pictured (standing left-right): HH Huh *(AIM - KBC Agent)*, Paul Haugseth *(Principal Consultant; KBC)*, Other SK Project Team Members, ***(sitting left-right):*** SR Park *(SK Corp)*, David Turner *(VP, Business Devel., Asia; KBC)*

SK SIGNING CEREMONY

SK Corp. and KBC sign documents to kick-off Phase II "bottom of the barrel" Petro-SIM project. *(Photo left)*

KBC PARTICIPATES IN PANEL

KBC's Ramon Loureiro participated in the 63rd National Congress of the Association of Petroleum Engineers of Mexico on 16 April 2005 in Puebla, Mexico. The main topic of discussion at this event was "Refinery Reconfiguration and Upgrades in the Face of Heavier Crude Prospects." KBC's expertise in this field was highlighted through Ramon's responses. *(Photo right)*

Pictured (left-right): Ing. Nicolás Rodríguez Martínez, Ing. Heberto Ramos Rodríguez *(VP, Nacional de AIPM)*, Ricardo Rocha, Ing. Ramon Loureiro *(EVP, Americas; KBC)*, Ing. Daniel Aiken *(Representative from Latin America; UOP)*, Ing. Fermín Villegas García *(President, AIPM de la Delegación Veracruz)*