

DRIVING Competitive Advantage

Helping Clients Improve Profits and Achieve Pacesetter Performance

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 NEXT ISSUE

ULSD Problems and Solutions

A brief discussion of the common pitfalls associated with scoping, designing, implementing, and operating ULSD units. The article will offer various solutions to specific hydroprocessing areas that must be addressed, ranging from optimizing hydrogen partial pressures to avoidance of recombination reactions.



PROFIT. ABILITY.

FEATURE STORY

Worldwide Trends in RAM Improvement

A brief review of the improvements in plant reliability, availability and maintenance to ensure better and sustainable results in a competitive market.

by J. Patrick Williams, Senior Staff Consultant

Plant reliability, availability and maintenance (RAM) optimization is one of the principal opportunities for improving the financial performance of a hydrocarbon processing industry (HPI) facility. Therefore, plants are adopting the same best practices that have proven effective to industry leaders in achieving a sustainable balance between the cost of an action and the risk associated with postponing or cancelling such activity.

The first step to a successful RAM program consists in developing an objective, cross-functional strategy that is formulated and carried out avoiding the above mentioned pitfalls and addresses the following elements:

- Turnaround Maintenance
- Routine Maintenance
- Reliability/Availability Improvement

A program that follows the trends discussed below usually closes 50-75% of the performance gap within the first 12-18 months.

The General Trend

The general trend in RAM is to move maintenance and inspection activities from a traditionally reactive to a risk-based approach. The proactive methodologies endorsed by API are becoming increasingly popular amongst the HPI. Industry leaders have been successfully using the risk-based decision making concepts for over a decade.

Risk is defined as the product of consequence and probability. Risk can be acceptable or unacceptable and drawing the line between them can be difficult as the general tendency of people is to focus only on the ultimate consequence. To effectively select and prioritize work consistently across the site requires the use of a single risk-based decision matrix (RBDM) that integrates safety, health, environmental and money. A 5x5 matrix as illustrated in Figure 1 has proven useful for this purpose. This RBDM can be used for optimizing turnaround work scope, selecting and prioritizing routine maintenance work, prioritizing analyzes for defect elimination (DE) and developing optimized asset care policies.

Turnaround Maintenance Optimization (TMO)

TMO is an area where significant quick wins can be readily achieved in most HPI works worldwide. These wins result from optimizing the work list and reducing duration through integration and challenging the status quo. The turnaround planning process consists of five reviews:

1. **Strategic Review** helps optimizing the long-range business strategy. It optimizes the run lengths and timing for individual plants and identifies any organizational deficiencies that could hurt turnaround performance. This review is performed proactively with a two turnaround cycle look ahead.
2. **Work Scope Review** ensures that each line item in the turnaround list is justified in terms of risk and that assets affected by upsets during the last run get the proper attention as to ensure plant safety and reliability. This review should be performed on completion of the work list, 9-12 months before oil-out and usually reduces the turnaround cost by 10-25%.
3. **Execution Planning Review** optimizes the execution of the turnaround by analyzing in detail the mechanical activities (maintenance and project) critical and sub-critical paths by less than 3 days to ensure they are safe. The review should be carried out 6 months prior to oil-out and it usually reduces the turnaround duration by 2-3 days.

Likelihood of Occurrence of Potential Consequence

NEARLY DEFINITE Almost certain it will occur >80% chance in timeframe	1
PROBABLE Expected to occur 10% chance in timeframe	2
POSSIBLE It could occur 1% chance in the timeframe	3
UNLIKELY Not expected to occur 0.1% chance in timeframe	4
NEARLY IMPOSSIBLE Almost certain it will not occur <0.01% chance in timeframe	5

		Potential Consequence (Health / Safety / Environmental / Business Impact)				
		E	D	C	B	A
		NEGLECTIBLE	MODERATE	SERIOUS	MAJOR	CATASTROPHIC
1		Green	Yellow	Yellow	Red	Red
2		White	Green	Yellow	Yellow	Red
3		White	Green	Green	Yellow	Red
4		White	White	Green	Yellow	Yellow
5		White	White	White	Green	Green

FACTOIDS

Worldwide Trends on Business Process Outsourcing

PricewaterhouseCoopers sponsored a Global Top Decision-Makers Study on Business Process Outsourcing (BPO). The study was conducted by the well known market research firm, Yankelovich Partners, which interviewed senior executives at 304 of the world's largest companies in 14 countries. The worldwide coordinator for the study was the Goldstein Consulting Group. Partial results are summarized below:

STUDY HIGHLIGHTS

Global Experience – Nearly two thirds (63%) of the top decision-makers interviewed said their companies have outsourced one or more business processes to external service providers.

Satisfaction Levels – Four out of five (84%) of the executives with active BPO programs said they are satisfied with the results of their outsourcing initiatives.

Shareholder Value – Two-thirds (66%) of the executives believe that BPO helps their companies become more profitable, leading to improved shareholder value.

Strategic Benefits – In addition to shareholder value, the executives seek the following strategic benefits:

- Achieve cost reductions (79%)
- Focus on company's core business (75%)
- Improve service quality (70%)
- Maintain competitive edge (67%)
- Obtain outside expertise (61%)
- Meet changing customer demands (60%)
- Have access to advanced technology (59%)
- Achieve revenue enhancements (58%)
- Make continuous improvements (58%)
- Achieve world-class standards/benchmarks (53%)
- Gain greater internal flexibility (52%)

Increased Importance – Nearly one-half (46%) of the executives said the importance of BPO has increased at their companies during the past three years; and 23% said that BPO programs are now written into their business plans.

Source: www.PwCglobal.com © 2000 PricewaterhouseCoopers. All rights reserved.

FEATURE STORY

Continued from p. 1

4. Integrated Plan Review assesses the level of preparedness for the turnaround, analyzes the shut down and start-up operations and sequences, and identifies the need for contingency plans. Typically, the turnaround duration can be shortened by another 1-2 days through integration of all plans into a consistent single master plan. This review should be performed at least 3 months prior to oil-out. However, the above reviews can be consolidated, especially the third and fourth.

5. Closeout Review evaluates the turnaround performance and ensures the continuous improvement of the turnaround process.

Other general recommendations to improve turnaround performance are:

- Safety is always first – the safest job will achieve the highest productivity.
- Do only what is needed to run for another cycle and that cannot be done on-stream.
- Manage contractor buy-in and delivery of plant objectives through incentives and bonuses.
- Planning to the last detail eliminates surprises.

Routine Maintenance Optimization (RMO)

The wins in RMO arise from the reduction of work through a structured, cross-functional, risk-based work selection and prioritization process (including backlog analysis) and improved planning and scheduling practices. This is particularly important in a large facility where many competing work orders are received daily from multiple areas. RMO starts with risk-assessing each work request and determining the required completion (hand-back to Operations) date in order to ensure the risk of operating the plant in an abnormal condition is acceptable. However, if the repair will take longer than the required completion date, the risk analysis will flag plant vulnerabilities, or the need for improvement. A typical example of this type of situation is pump repairs, where the completion date will be influenced by the condition of the spare pump. Improve routine maintenance performance by practicing the following:

- Risk assess all work requests with Operations, Maintenance Planning, and others as needed and assign agreed end dates.
- Avoid breaking the weekly work schedule.

- Use Job Packs and international time norms.
- Package as many small jobs as practical into larger work orders.
- Risk assess the backlog on a monthly basis.
- Introduce maintenance by operators.

Reliability Improvement

Total site reliability is paramount for a safe and productive performance. This is evidenced by a trend in increased availability at the expense of higher maintenance cost in refineries and some petrochemical facilities. Usually the benefit derived from a safer and more reliable operation totally offsets the increased maintenance spend. For quick results, the reliability program needs to adopt the following practices:

- Implement a Defect Elimination program that tracks and prioritizes activities based on the cost of unreliability (CoUR) and addresses root causes including systemic problems.
- Solve 1-2 problems a month rather than tackling 20 at once.
- Audit the mechanical integrity condition of assets and inspection records.
- Update tools and training as needed.
- Implement an evergreen cross-functional, risk-based asset care program consolidating and complementing existing programs as needed.

In summary, the key to success in achieving sustainable RAM improvement is to establish a proactive risk-based culture featuring:

- Full support by senior management.
- Coordinated RAM strategy with meaningful KPIs, roles and responsibilities for each level within the organization.
- Use of a single site-specific RBDM.
- Cross-functional, risk-based decisions using the RBDM.
- Updated work execution techniques.

To receive the unedited version of this article, email tvalach@kbc.com.

NEWS & INNOVATION

KBC NEWS

September is a big month for KBC as it unveils Petro-SIM™, "The New Standard in Refinery Simulation."

Petro-SIM is the most comprehensive and rigorous refinery simulator available. Petro-SIM features KBC's suite of Profimatics® refinery reactor models and proven refinery flowsheet capabilities. It's a full-featured process simulator, including general-purpose unit operations, an extensive component library, and a complete set of thermodynamics packages.

Petro-SIM is expandable. Start with one unit, modeled in detail, to help you improve your daily operations. Or, expand it to a complete refinery-wide model. For more information about Petro-SIM, visit www.kbc.com, or email Gloria Chukman at gchukman@kbc.com.

EVENTS

NPRA Plant Automation and Decision Support Conference, 20-21, September, San Antonio

John Pults of KBC, and Kent Hickenbottom and Ron Gonzales of ConocoPhillips, will jointly present "Application of Rigorous Refinery Process Models for Profit Improvement."

ERTC Reliability, 20-22, September, Berlin
Pat Scullin, Operations Manager, KBC, will present "Routine Maintenance Optimization – A Case Study in Process Change Management."

4th Russian Refining Technology Conference, 23-24, September, Moscow

Join Steve Christy, Senior Staff Consultant, KBC, as he gives the keynote speech on challenges and opportunities for the Russian refinery industry. Andrew Graves, Vice President of FSU, KBC, will also present, "Cogeneration – The Right Choice?"

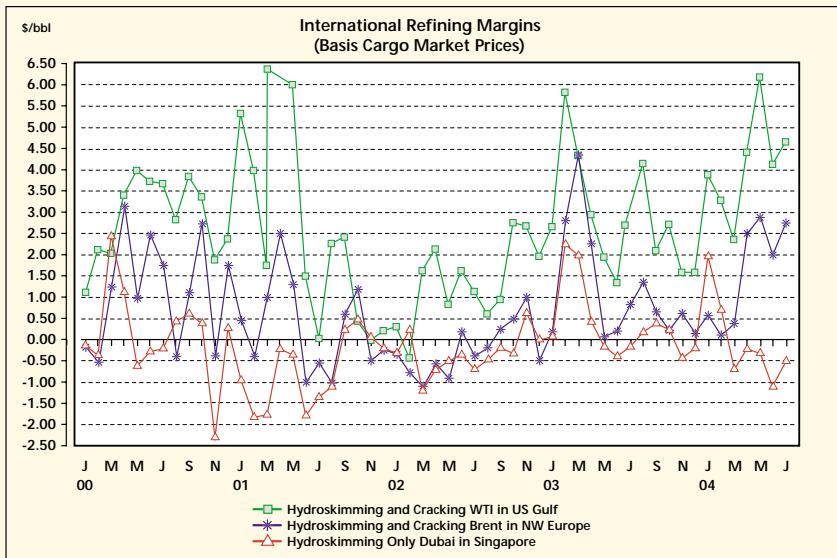
Refining Margins

by Olan O'Sullivan

Refining margins in the Atlantic Basin returned to its upward trend in July after a brief blip in June. Although gasoline weakened slightly in June, undermining margins somewhat, it rebounded to offer fundamental support through mid-July as concerns over the refiners' ability to meet demand in August resurfaced. This was due in part to the tightness of the European market, which had exported large amounts of product to the US where it was left short of gasoline during its peak summer demand. The gasoline crack in both regions returned to levels observed in May, consistently staying around \$15/bbl. Middle distillates also began to offer support to margins during this period as the need to build heating oil inventories ahead of winter became apparent. This was reflected in the strength of the gas-oil crack spread, which has fluctuated around \$9/bbl in Europe.

Early July margins averaged close to \$5/bbl and \$7/bbl in Europe and the US respectively, before much of the fear surrounding gasoline availabilities tapered in the middle of the month. Crude prices rose on the back of terrorism fears in the US and the escalation of the 'Yukos affair' in Russia. This resulted in margins coming off their high levels at the beginning of July to average under \$3/bbl in NW Europe and just over \$5/bbl in the US for the month. By month's end, European hydroskimming and cracking margins were barely above breakeven levels and have struggled throughout August in the face of weaker gasoline prices and rising crude oil prices.

Margins East of Suez on a hydroskimming-only basis have continued to fluctuate around breakeven or below breakeven. The weakness of residual fuel oil has weighed down on margins on this basis, particularly during the current period of high refinery runs. However, margins on a hydroskimming and cracking basis have been substantially stronger and more reflective of Atlantic Basin markets.



Multi-billion Dollar Strategic Planning Project using KBC's Simulation and LP Data Generation Technologies

Latin America

A large petroleum company needed to prepare strategic studies to focus on future upgrades to its downstream system including crude supply, multiple refineries and petrochemical plants, and product distribution. The main tool needed for this study was a large, global, multi-refinery LP model with a detailed crude supply system, refining process representations, petrochemical plants, and product distribution systems including pipelines, barges, rail and trucks to individual product terminals.

The first project task was to upgrade the accuracy of the global refining system's LP model. KBC's process consultants visited each site for data collection and process reviews. Process simulation models were calibrated to match existing individual process unit performance characteristics. KBC's simulation models were used to generate robust base-delta LP representations from the calibrated simulation models. Using the client's laboratory assay data, the crude and vacuum unit representations included predictions of commercial distillation performances. Combining these efforts resulted in downstream process unit LP models that optimized the process units based on optimal feed property shifts and changes in operating variables.

Following the LP upgrade, the Global LP model was successfully used to study a large number of strategic planning scenarios involving major refinery reconfiguration projects and other strategic initiatives.

One attractive multi-billion dollar refinery reconfiguration project has moved from the strategic planning phase towards the project phase. A detailed flowsheet simulation model using KBC's Petrofine® modeling system was built and used to rigorously study the planned processing changes to confirm the technology and the processing benefits. The detailed flowsheet simulation model and the Global LP were compatible since they were both based on the same underlying simulation technology.

The Global LP model provided inter-refinery and system-wide synergies. The simulation

Process Engineering Technical Exchange Meeting (PETEM), 4-6, October, Saudi Arabia

Simon Rogers, Vice President of Software, KBC, will present "Improving LP Accuracy for Optimal Planning Decision Making and Profit Improvement."

ERTC Petrochemical, 11-13, October, Vienna

Darren C. Le Geyt, Petrochemical Consultant, KBC, will discuss "Unlocking Profit Potential - Cost Effective Optimization for Olefins Plants," while Zoran Milosevic, Senior Staff Consultant, will jointly present "Benchmarking and Improving the Energy Efficiency of Ethylene Crackers" with Fina Antwerp Olefins.

European Ethylene Product Conference, 13-15, October, Vienna

Richard Arey, Principal Consultant, will discuss Defect Elimination at this year's annual conference.

Process Industry Maintenance, 20-21, October, Brussels

Patrick Scullin, Senior Operations Manager, will present "Optimizing Shutdowns Using RBDM Combined with Industry Expertise," while Bill Tetreault, Vice President of RAM, will present "Reducing the Cost of Unreliability with a Structured Defect Elimination Program."

Coming Soon: 6th Annual European Fuels Conference, 14, March 2005

Participate in KBC's pre-conference seminar, "Achieving Competitive Advantage." Join us as we present strategies to maximize your ROCE. Email Claudia Matthews at cmatthews@kbc.com for more information about this seminar.

Continued on p. 4

COMPLETED PROJECTS

Continued from p. 3

model provided detailed refinery processing streams (yields and properties), and confirmed the integrity and accuracy of the proposed refinery upgrade. The accurate Global LP provided confidence in economic benefits achieved through system-wide optimization. The simulation technology provided confidence in the expected results of the processing technology.

TPT Paves the Way for \$2 MM in RAM Improvements

Asia Pacific

Tuntex Petrochemical Thailand (TPT) signed its first Reliability, Availability, and Maintenance (RAM) program with KBC. TPT is the second largest PTA producer in Thailand. KBC's three-phase approach was designed specifically to assist TPT in meeting their goal of \$2 million (US) in profit improvement by 2005. This article will mainly focus on the second phase of our program.

The first phase of the program was the RAM Assessment, aimed at establishing a detailed definition and understanding of TPT's maintenance practices and work flows in order to identify any missed

opportunities. KBC identified potential opportunities that could be realized by implementing RAM practices that could improve plant reliability from 93 percent in 2003 to 95.4 percent in 2004, while recognizing a 10 percent maintenance cost reduction throughout the program.

The second phase of the program began in March 2004. RAM modules were selected to develop a plant-wide change management process in reliability; work selection, materials managements, and turnaround execution, were implemented to change the plant mindset from firefighting to reliability-oriented maintenance. One focal area was the introduction of our Risk Based Work Selection (RBWS) methodology that utilizes a cross-functional team to evaluate each work request to determine whether the work needed to be performed and of its time frame. This process requires an evaluation of both the consequences, as well as the probability of the event happening. By implementing the RBWS methodology, the percentages of emergency work dropped significantly from 88 percent in March 2004 to 14 percent in May 2004, respectively. This improvement empowered TPT to focus on project management development and

inspection programs, while allowing them to perform work when it was most beneficial to the company. Additional programs instituted during this stage were:

- Risk Based Spare Part Selection (RBSS) and materials management programs supported repair needs by reducing the inventory levels and assuring higher critical spare part availability.
- Defect Elimination program identified the causes of plant unreliability and developed solutions to eradicate them.
- Turnaround Strategy determined the reasons for executing plant outages, frequency, and needed repairs to ensure run time goals were met.

The third phase of this program is scheduled in Fall of 2004. This phase will include the creation of a systematic equipment care policy, while optimizing maintenance resources.

To date, the program's success shows the value of the "team" approach by combining TPT's determination and dedication to work process improvement and KBC's extensive RAM experience. Look for an update on phase three in a future issue of Driving Competitive Advantage.

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Worldwide Trends
in RAM
Improvement.



Web site: www.kbcat.com
E-mail: kbc@kbcat.com

KBC Advanced Technologies Inc.

14701 St. Mary's Lane
Suite 300
Houston, TX 77079
USA
Telephone: +1 281 293 8200
Facsimile: +1 281 293 8290

KBC Process Technology Ltd

KBC House
42-50 Hershaw Road
Walton on Thames
Surrey KT12 1RZ
UK
Telephone: +44 1932 242424
Facsimile: +44 1932 224214

KBC Process Technology Ltd

5th Floor Yokohama Miki Bldg.
1-1-3 Hiranuma, Nishi-Ku
Yokohama, Kanagawa 220-0023
Japan
Telephone: +81 45 290 6380
Facsimile: +81 45 290 6382

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