

DRIVING Competitive Advantage

Helping Clients Improve Profits
and Achieve Pacesetter Performance

At KBC, we focus on improving our clients' competitive position through innovative business solutions, allowing clients to achieve superior returns on their invested capital and achieve pacesetter status within their industries.

Our Services Include:

Yield Optimization
Energy Improvement
Petrochemical Services
Clean Fuels Impact Reviews
Reliability, Availability & Maintenance
Pinch Technology Applications
Planning & Scheduling
Unit-specific & Refinery-wide Process Simulation
Change Leadership
Implementation Services
Technical Services
Upstream & Downstream Risk Management
Integration Services
Benchmarking
Capital Project Review/
Due Diligence
Design Services
Unit-specific Studies
Strategic Planning
Business Risk
Management Consulting
Oil & Gas Market Analysis
Process & Utility Integration



'FAST TRACK' ROUTE TO PROFIT IMPROVEMENT SUCCEEDS WITH TAKREER

In 1999, the Abu Dhabi National Oil Company formed a new company (TAKREER) to be responsible for its oil refining operation. Upon formation, TAKREER's management set out to achieve their vision of becoming a 'World Class' oil refiner using 'Best Practice' technologies and methodologies.

In early 2001, TAKREER selected KBC as their profit improvement partner to realize their aggressive plan to improve the company's bottom line and create a profit-focused, dynamic and target driven organization en route to achieving their vision.

The Program

A ten-month 'Fast Track' KBC Profit Improvement Program®, (PIP™), was seen as an ideal first step in fulfilling TAKREER's mission for the Ruwais and Umm-Al Nar (UAN) refineries and a major power generation facility. The key objectives of the PIP program were:

- Early identification and implementation of high value operational improvements
- Identification, evaluation and implementation of:
 - Refinery yield opportunities
 - Energy efficiency improvements
 - Oil loss reduction opportunities
 - Supply and planning opportunities
- Benchmarking all the organization's activities, particularly the planning, supply and refinery operations functions to form the basis for Phase 2, providing the framework for World Class performance

The PIP has been embraced throughout the TAKREER organization. At the senior management level, the Deputy General Manager chairs a PIP steering committee to

follow progress, identify roadblocks, and address relevant operating, planning and strategic issues facing the corporation.

At each refinery, regular opportunity review sessions were held, consisting of refinery operations, planning, and engineering personnel along with KBC's PIP consultants. The combination of the TAKREER staff's detailed refinery knowledge and experience with the PIP consultants' specialist knowledge, toolkits, and methodology led to the development of solid, high-value refinery profit improvement opportunities. Opportunities were organized into coherent strategies, providing a route-map for implementation.

The KBC PIP home office team in the UK headquarters carried out the complex opportunity evaluation. The 'Fast Track' approach meant that KBC placed two implementation consultants at each refinery site at the end of Month 4 to steward the refinery PIP teams in opportunity implementation and to track progress in terms of bottom line dollar improvements. By the end of Month 5, opportunities generating in excess of \$12 million had been implemented over both sites. Major high-value improvements included an increase in hydrocracker fresh feed at Ruwais and improved CDU gasoil recovery at UAN.

Ruwais Refinery

At the end of the Phase 1 PIP (Month 10), approximately 50 opportunities had been identified for Ruwais with combined annual benefit \$64 million. The majority of these opportunities (70%) required no or very minor investment. The on-site KBC-TAKREER implementation team was actively working on 22 opportunities, capturing improvements worth \$14 million/yr.

Umm Al Nar Refinery

At the UAN refinery, opportunities worth \$17 million/yr had been identified, with \$12.5 million/yr implemented. The UAN PIP team also managed to make a \$7-10 million capital cost savings on a proposed reformer revamp project.

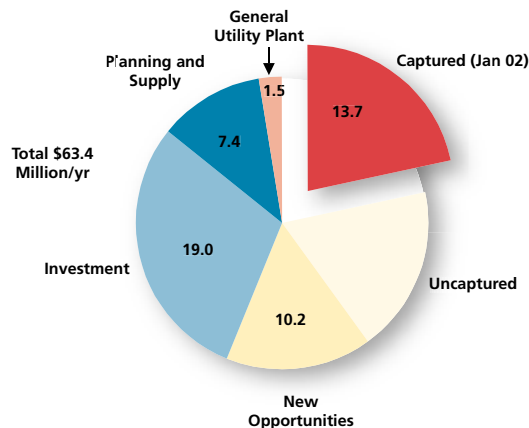
Summary

The 'Fast Track' approach generated \$26.5 million/year benefit within 10 months. This was achieved with minimal investment. In addition, there were substantial benefits through capital deferral and/or elimination.

Benchmarking activities that compared TAKREER to a World Class refiner were a key component of Phase 1. With these completed, the PIP management team was best positioned to put together a program to:

- Engrain the PIP methodology and "culture" into the refinery organizations
- Put in place the tools, methodology and best practice to consistently achieve World Class refinery performance

Overview of Ruwais PIP \$ Benefits



KBC is extending the partnership with TAKREER, providing assistance in achieving the project objectives and continuing to further the PIP implementation efforts to capture the majority of the remaining identified benefits.

Linnhoff March Identifies Energy Savings in Venezuelan Oil Production

In December 2001, our pinch specialists completed a successful joint project between Linnhoff March Ltd and PDVSA Intevp in Venezuela. The project involved the modeling of the well head steam generation and distribution systems, as well as the identification of energy saving projects

in a major on-shore oil field. Pinch Analysis was used to provide a rigorous overview of all the field heat and power demands, and several cogeneration opportunities were incorporated into the field utility model. The project was also used as a vehicle for pinch technology transfer to the PDVSA's engineers.

World Class Planning and Performance Monitoring

Improving LP Accuracy for Optimal Planning and Crude Selection at Koa Oil

In today's fiercely competitive environment, improvements in refinery capability, operating performance, catalyst performance, overcoming physical constraints and capital improvements are a regular occurrence. In order to fully benefit from these improvements, the planning model must not only be updated, but the updated LP accuracy must be verified correctly. Otherwise, the improvements will not be exploited in the refinery plans. An inaccurate LP results in an incorrect representation of limitations/constraints in the refinery-planning model that can be as costly as well as a real plant limitation.

KBC has developed and implemented its World Class Planning and Performance Monitoring Solution, which successfully employs non-linear, kinetic simulation and Best Practice Linear Programming (LP) structures.

This World Class Planning and Performance Monitoring Solution was recently implemented at Koa Oil Company's two Japanese refineries, which resulted in finding major discrepancies between LP predictions and actual operation. LP structure redesign, Best Practice LP vector data generation, and the correction of actual process versus LP sub-model discrepancies resulted in profit improvement, estimated by the refinery in excess of 20 ¢/bbl due to improved crude selection.

The Solution follows an ordered Best Practice methodology that comprises more than the following:

- Measuring unit performance through the application of rigorous, non-linear simulation tools
- Redesign of LP process sub-model structures to Best Practice Standards, and the verification of sub-models in a stand-alone environment after data take-on
- Maintenance of LP process sub-models through timely regeneration of vectors that represent true process unit performances and capabilities, scheduled based on a Best Practice threshold guideline
- A technical analysis of unit performance versus LP process sub-model representation with the objective of identifying and correcting planning model inaccuracy
- Implementation of Best Practice Backcasting Methodologies to identify discrepancies in plan versus actual operations and profit improvement opportunities
- World Class Planning and Performance Monitoring training for stakeholders on the use of the Solution to ensure effective and correct use of Best Practice methodologies to gain maximum benefit from the Solution
- Improved communication between planning, technical services and operations

KBC started a Profit Improvement Program at the two Koa refineries in 1998, with the objectives of improving refinery profitability by 50 ¢/bbl through:

- Implementation of PIP identified opportunities
- Creating a profit culture within Koa
- Transforming the organization to achieve continuous improvements

In parallel with the PIP, KBC also worked with Koa on other initiatives in reliability, maintenance and planning, with an LP upgrade project to improve the planning decisions and in particular crude selection by improving the structure of the LP.

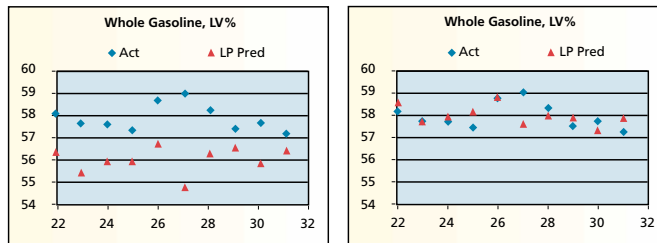
As part of the PIP program, KBC developed software applications using its KBC Profimatics software and Best Practice Key Performance Indicator (KPI) Methodology to monitor and sustain the improvements implemented in earlier phases of the PIP. The combined use of the software tools and a newly structured LP resulted in the deployment of a World Class Planning and Performance Monitoring Solution.

LP sub-models, when applied to a continuous method of process monitoring with KPI's and backcasting, results in a world class accurate LP, taking full advantage of all the profit improvement initiatives at Koa. KPI monitoring highlights if actual operation is following plan.

Koa has attributed over 20 ¢/bbl to the World Class Planning and Performance Monitoring Solution (with the LP Upgrade project being a significant part of the Total Solution) and is enjoying further benefits due to improved inventory management, reduced scheduling problems and better communication between departments.

An example of improvement in LP accuracy by use of the World Class Planning and Performance Monitoring Solution at one of the refineries is shown above.

LP Results (Before and After) [Whole Gasoline, LV%]



The LP showed a marked improvement in overall refinery volume expansion, gasoline blending (due to the correct prediction of FCC Naptha) and distillate/fuel oil blending.

Conclusions

Implementing a World Class Planning and Performance Monitoring Solution at Koa had several benefits:

- An immense improvement in the accuracy of LP, which resulted in better crude selection, minimized inventory costs and reduced scheduling problems; furthermore, an accurate LP enabled Koa to take full advantage of the other profit improvement initiatives at the refineries
- Better backcasting techniques allowed further improvements to be identified
- Improved unit monitoring provided a sound basis for local unit optimization
- Better communication and understanding between the process engineer and the planning engineer in pursuit of better overall refinery decisions

KBC was the partner for Koa in delivering the World Class Planning and Performance Monitoring Solution into Koa's operations culture.



The operating environment for refiners seldom have been so difficult as during the past quarter. There have been three major commercial challenges: intense volatility in crude oil prices; extremely poor margins in the face of weak demand and rising crude prices; and changes in the direction of crude oil flows. These have combined to test the accuracy and efficiency of refiners' crude oil selection and optimization processes, including their hedging capabilities.

In the space of six weeks between late February and early April, the price of benchmark Brent crude increased by \$8/bbl to peak at just above \$28/bbl, then fell back to \$23/bbl in just six working days. The reasons for the rise in prices have been well chronicled, but the major role of speculators, who injected 140 million barrels of buying pressure into the Nymex futures crude contract, may not be so readily appreciated.

Sentiment in the physical market remained distinctly less bullish, but a process of rebalancing oil supply and demand

has begun following OPEC's implementation of successive cutbacks, in particular of Middle East supplies. This has resulted in the movement of substantial volumes of West African and North Sea barrels to Asia, but limited flows of crudes from these regions into the US where the main problem has been sourcing supplies of heavy sour barrels.

PEL Market Services expects oil markets to tighten appreciably by midyear, providing more solid support to renewed strengthening in crude prices. Refiner margins can be expected to improve as excess product stocks are trimmed back. A substantial rise in OPEC output will be required over the second half of the year, partly restoring supplies of heavy sour Middle East barrels and leading to further changes in crude oil flows. Oil price forecasts used in refinery LPs will need to be well informed and, to take advantage of post fixture optimization opportunities, refiners will need to be nimble and commercially skilled.

Our Strategic Plan



Don J. Romano, CEO

The development of our five-year strategic plan in 2001 was a turning point in clearly defining the way forward for KBC. Reinforcing our client-focused strategy, we are providing a comprehensive range of products to develop and maintain clients with new and innovative services for the full term of their needs.

While internally developing some of the products identified in the strategic plan, others have and will be obtained through acquisition. Our recent acquisitions enhance our current offerings with complementary products, while expanding our market reach to offer our expertise outside the hydrocarbon processing industry.

On February 7, KBC acquired Petroleum Economics Limited (PEL) to provide a broadened overview of the key economic, market, and commercial factors driving the current and future industry outlook. The synergistic

combination of KBC's technical consulting services with PEL's recognized commercial and trading knowledge will allow our clients to obtain a unique perspective to optimizing current assets, as well as a truly independent view on future investment options.

KBC acquired Linnhoff March on February 27, strengthening our energy efficiency and clean fuels offerings. The combination of Linnhoff March's engineering expertise and KBC's implementation capabilities offers improvements in energy consumption and emissions, optimization of hydrogen utilization with pinch technology (pioneered by Linnhoff March in 1984), and minimization of water use and effluent production.

We are proud of the acquisitions of these two well known companies. There has been an expression of considerable market interest, and the synergies that the product lines bring will help KBC grow in line with our strategy. World class products and a continued focus on our customers will enable us to fulfill our vision of being the first choice in profit improvement.

DRIVING
**Competitive
Advantage**



"The Refiner's Edge"
has changed to
**"Driving Competitive
Advantage"** to reflect
our expanded
capabilities and
broadened markets. The
new name represents
our commitment to
improving the
competitive position of
our clients worldwide.

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

KBC Process Technology Ltd

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

KBC Advanced Technology Pte Ltd

435 Orchard Road #16-04
Wisma Atria
Singapore 238877
Telephone: +65 6735 5488
Facsimile: +65 6736 4759

KBC Advanced Technologies Inc

580 Westlake Park Boulevard
Suite 1150
Houston, TX 77079
USA
Telephone: +1 281 293 8200
Facsimile: +1 281 293 8290

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