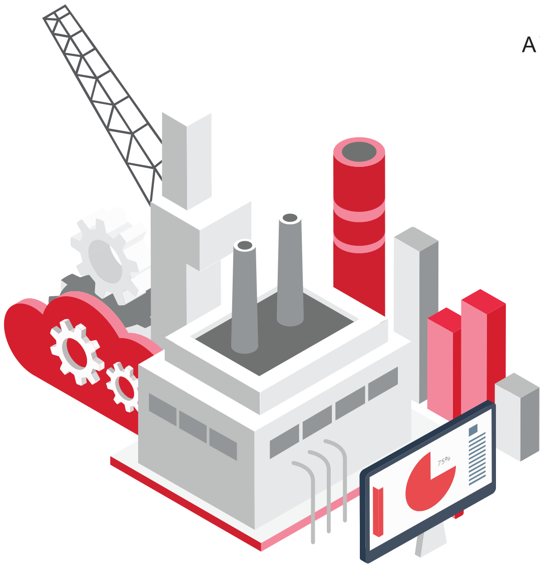
CASE STUDY

KBC
A Yokogawa Company



Refinery Petrochemical Integration saved USD 6 million/year

Petro-SIM reactor suite and COILSIM1D, a powerhouse combination

Key Benefits

- Saved USD 6 million/year
- Improved feedstock selection for steam cracker
- Optimized gasoline pool

Background

- Indian grass-root refinery
- Expanding to an integrated petrochemical facility

KBC Solution and Results

- Petro-SIM process simulator reactor models and COILSIM1D
- Developed a digital twin for an integrated refinery-petrochemical and aromatics complex
- Increased engineer knowledge on model simulation and capability development

Client Challenge

A refinery based in India was building a greenfield refinery-petrochemical complex.

They understood the challenge they would face to expand from a refinery to an integrated petrochemical facility. While price dictates the economics on one hand, molecular characterization of refining streams makes it difficult to optimize the processes for maximum profit and efficiency.

The operator was looking for a methodology where you build once, but use multiple times. For this to work, a process simulation tool is critical. The operator partnered with KBC for technical advice to achieve their goals.

Originally, the operator sent C5 recycle from a cracked gasoline hydrotreater unit in the steam cracker complex to the steam cracker furnace. To meet the production target, raffinate from the aromatic's extraction unit was sent to the gasoline pool first and the remaining to the cracker furnace. KBC challenged this scheme based on rigorous site-wide refinery petrochemicals model optimization.

The Solution

KBC suggested implementing Petro-SIM® process simulator along with COILSIM1D simulation and optimization software. Working with the operator, KBC developed a digital twin of the integrated refinery using high-fidelity process models to drive optimization through molecular management.

KBC reviewed all the available streams in the refinery-wide flowsheet. To meet the production target, the aromatics extraction unit sent raffinate streams to the cracker furnace and the gasoline pool.

The C5 material from a steam cracker is typically an olefinic stream and is hydrogenated to maximize cracking selectivity. When this C5 stream blends into a gasoline pool, it can result in a high research octane number stream, hence boosting gasoline production. However, routing this stream to the gasoline pool can also reduce petrochemical yield, resulting in lower overall margins.

The other constraint is high Reid vapor pressure (RVP) of C5. This can cause issues with the RVP and vapor lock index (VLI) of gasoline.

The raffinate stream, on the other hand, is essentially rich in paraffins with C6-C8 components and is an ideal feedstock for steam crackers.

KBC proposed changing the path for the C5 stream to the gasoline pool and the raffinate stream to the steam cracker.

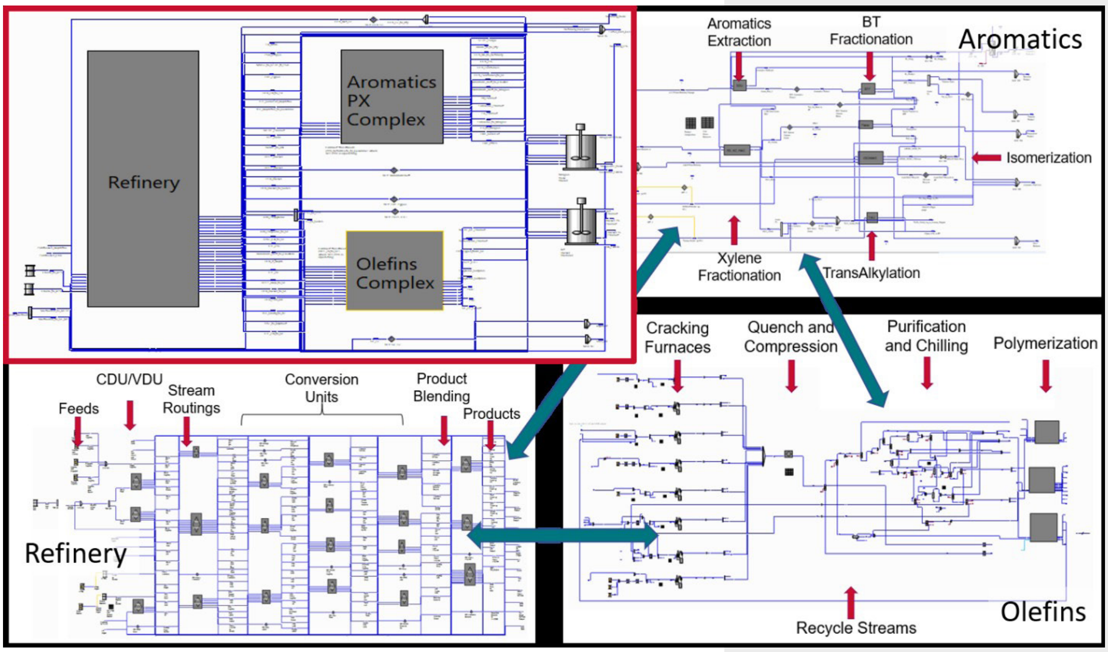
The integrated framework included process level molecular management and carbon level simulation.

Results

The operator used the complex-wide model to run multiple feed sensitivities of processing raffinate in the cracker furnace using COILSIM1D. They analyzed changes in gasoline pool impacting the overall economics.

Engineers considered summer and winter gasoline specifications. They determined that the gasoline pool could absorb the entire C5 stream to meet demand. The stream change led to saving about USD 6 million/year.

They saw similar results for other refinery streams. Feed sensitivity runs from COILSIM1D showed kerosene as potential feed to the steam cracker furnace. The hydrogen network KBC developed for the site-wide model helped to capture reduction in hydrogen consumption as this stream's original routing was to the diesel hydrotreater. The scheme resulted in a huge success.



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