



Large U.S. Gulf Coast Refiner Uses Petro-SIM Flowsheet for Margin Capture

Physics-based model improves decision-making from crude supply through product blending

Key Benefits

- Increased decision-making confidence
- Improved margin capture potential
- Evaluated attractive opportunities
- Validated LP model

Background

- Existing LP model unsuitable for client's needs
- Under-optimized integration between older and newer units
- Called for a higher-fidelity tool to evaluate margin-improvement strategies across facility

Solution

- Assessed and validated existing unit models
- Built new Petro-SIM unit models for remaining units
- Applied innovative catalytic distillation modeling for greater accuracy
- Developed a refinery-wide Petro-SIM flowsheet that integrates all unit models into a data-driven tool for planning and evaluating investments

Client Challenge

A large U.S. Gulf Coast refinery sought a more rigorous and accurate tool than its current linear programming (LP) model to evaluate process optimization and margin improvement scenarios.

Over time, the refinery had evolved into a highly complex configuration to include multiple crude units, hydroprocessing units, cokers, and other processing units. Refinery personnel needed a way to assess specific “what-if” cases—such as stream rerouting options, operating condition changes, and new capital projects—to holistically assess feasibility and economic impact. The refinery team recognized numerous opportunities to optimize the overall facility. However, their LP model could not adequately simulate the dynamic interactions between process units, which limited visibility into potential gains.

The Solution

KBC partnered with the client to build a refinery-wide Petro-SIM® flowsheet that connected every process unit—from crude supply through product blending—into a single, integrated model.

The client had several Petro-SIM models of individual units already developed. KBC combined those existing models with newly developed ones to create the refinery-wide flowsheet. For existing Petro-SIM models, KBC performed high-level validation along with recommended modifications to improve accuracy. For units not previously modeled, kinetic models with rigorous fractionation were developed.

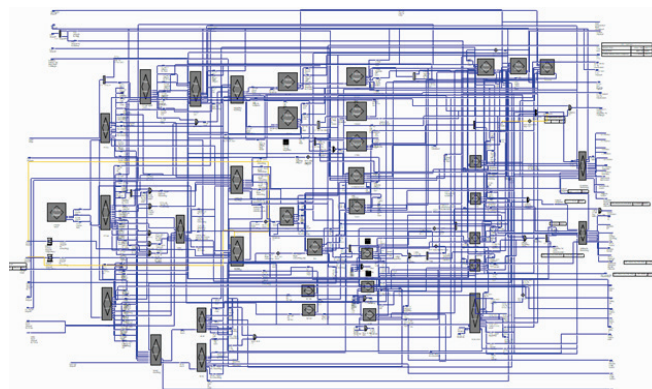
Through a series of collaborative roundtables, a two-day integration workshop, and a series of flowsheet review sessions, the team aligned on key concepts, such as operating parameters, constraints, and stream routings, to ensure the model reflected the refinery's true operating behavior.

In many areas, lab data were limited for developing models. To overcome this challenge, KBC applied its refining expertise and engineering judgment to fill data gaps with reasonable assumptions.

The team reviewed the extensive stream-routing options and designed detailed mechanisms to accurately represent the refinery's routing strategies and constraints.

KBC also took an innovative, first-of-its-kind approach to develop a new model that represented one of the refinery's processing units, which involved catalytic distillation. This advanced approach incorporated kinetics and thermodynamics to capture a more accurate representation of unit operation across varying conditions that would be unavailable in a traditional, simplified model.

Throughout the project, weekly status meetings were held to ensure alignment and maintain communication amongst the team. KBC documented and shared technical details to ensure transparency and traceability as the model evolved.



Detailed Refinery-Wide model developed to improve optimization and investment decision-making.

Results

The refiner now uses a rigorous, refinery-wide flowsheet validated against operating experience to support critical business and strategic investment decisions. It enables engineers and planners to evaluate scenarios, quantify economic impact, and prioritize the most profitable opportunities.

The flowsheet supports margin improvement by:

- Complementing and verifying LP case runs
- Identifying and evaluating "quick-win" opportunities
- Testing single-variable changes (e.g. fractionation, reactor severity)
- Assessing capital investment projects
- Exploring new stream-routing strategies

By complementing the existing LP tool, the new model strengthens confidence via data-driven decision-making across the value chain. Through operational insight and digital intelligence, KBC is Bringing Decarbonization to Life®.

