



# Conquer Mount Everest in planning and scheduling

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**L**ike experienced mountaineers, planners and schedulers need to navigate volatile and risky environments. The recent crude oil price volatility exemplifies how increased market volatility is the new normal with fluctuating feedstock pricing, incessant commodities trading, rampant currency movements, rapid demand and supply shifts. To ensure optimal performance, companies need to focus on operational excellence and pursue long term business sustainability. Global shale plays have increased the range of options for refiners. According to Rystad Energy, the US is home to more oil reserves than Saudi Arabia or Russia now. Depending on the source, new feedstocks can be lighter or heavier than crudes traditionally used. This intensifies the need to change configurations in a refinery. Fortunately, planners and schedulers can now access the best technology to maximize the use of existing assets. With advanced software, very complex decisions can be better navigated, as accurate planning and advanced scheduling tools protect against declining profitability.

## Production planning is like mapping out a climb

When the stakes are high, the challenge presented is comparable to climbing Mount Everest. As such, you want to secure the best map possible. Most refineries operate within relatively thin margins and large

errors can be detrimental to profitability. This means that decisions need to be made with a mathematical optimizer as the only way to adequately represent reality. Planners need to adopt industry best practices to achieve optimal results.

First, planners need to plan with sustained profitability in mind. This includes selecting the correct modeling parameters from hundreds of variables to create an ideal map. Typically, this map would be a linear program model (also known as a planning model) to represent the complexity of real refinery and olefins operations. It is necessary to select the right parameters that take into consideration factors, such as yield, energy consumption and other economic drivers.

Second, planners need to solve the optimization problem reliably. Once the model is built to the right level of accuracy, including non-linear relationships, the tool needs to be tested well. New features in some advanced optimization programs allow planners to detect false positives (local optima) by solving cases from any number of starting conditions. This greatly increases confidence in the results and prevents lost profits by avoiding local optima. Borealis, an olefins producer, has implemented non-linear advanced optimization tools in their plants. Initially, their complex models had convergence and local optima problems.



With the implementation of advanced optimization software, the cases could converge with virtually no local optima. In using non-linear equations to model key plant constraints, Borealis could improve the fidelity of their models and plan closer to actual plant limits.

Third, planners need to analyze the solution for robustness. The biggest challenge is to ensure that production plans remain profitable within a range of operating conditions. The largest barrier to implementing contingency planning lies in running the vast number of cases it requires. The best companies in the industry are investigating the use of cloud computing to reduce resolution time. For example, an Asian refining company could resolve 800 routine cases in 90 minutes with advanced optimization and multi-core processing. Previously, this process took a whopping 36 hours. With the ability to capture market opportunities faster than the competition, this company gained an advantage.

### Scheduling is like the climb itself

The scheduler must now execute the plan created by the planner. As the refining industry is relatively unpredictable by nature, refiners need a schedule that is safe, operational efficient and feasible. Schedulers will also need to comply with stricter product specifications, market and regulatory requirements that can impact profit margins. As new feedstocks become available, complexity increases. This makes having a comprehensive, refinery wide view of the schedule vital.

First, it is necessary to schedule in a collaborative environment. By bringing all scheduling activities under a single platform, refiners can streamline their workflow and achieve a greater view of the entire petroleum supply chain. Scheduling automation software enables crude and product schedulers to work from the same schedule. This eliminates any disconnect between the functions and improves visibility into the refinery's activities. Schedulers can now optimize the process units and increase profitability by maximizing operational constraints and throughput. For example, PETRONAS

Melaka used a collaborative scheduling environment to minimize human error and increase profitability by \$0.10 USD/bbl of crude processed with an advanced refinery scheduling solution.

Second, operational disruptions need to be managed. Best-in-class scheduling technology enables schedulers to streamline their workflow by allowing more time for analysis and determine the best decisions to run the refinery during disruption. Planning and scheduling software enables refiners to run different scenarios, make the best decisions and return to ideal operations quickly. Schedulers can also compare plan and schedule versus actual results to better understand where production gaps exist.

Third, product blends need to be optimized. The purpose of any refinery is to refine crude into different

blend stocks that are eventually blended into saleable products, such as distillates, gasoline or fuel oils. As blend complexity increases and additional constraints are introduced, a scheduler's responsiveness is crucial to create an optimal blend recipe. With a blending solution, schedulers can accurately model the blending operation to maximize margins and reduce product quality giveaway.

### A tall order but not impossible to fulfill

With change as a constant, the shortage of experienced workers in the refining and petrochemical industries is a growing concern. A crucial need for leaders with diverse business experience drives many companies to rotate new engineers and managers through planning and scheduling roles. Best-in-class planning and scheduling technologies are mandatory for refiners to be competitive. With the right innovation, refiners can now improve visibility across the entire petroleum supply chain and increase profitability. Indeed, technology has helped leading refiners secure the highest peak in the world today – Mount Everest has never been easier to conquer, figuratively speaking!



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