

WHITE PAPER

Independent Linear Programming Analysis Is Key to Refinery Strategic Planning in an Increasingly Dynamic Marketplace

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The refining industry is defined by relentless change, driven by volatile global markets, evolving regulations, and shifting supply and demand fundamentals. To secure future profitability, refineries need a robust, forward-looking strategic road map. This requires more than just operational adjustments; it demands sound capital planning. Linear programming (LP) is the industry's essential tool for this analysis, but its true power is unlocked when applied with an independent, objective perspective. An independent LP analysis provides the unbiased, data-driven foundation necessary for making sound, multiyear strategic decisions that allocate capital effectively, while maximizing returns and mitigating risk.



Planning for an Uncertain Future Is a Strategic Challenge

While strategic planning cycles — typically every two to four years — have always been a feature of the refining industry, today's environment of accelerated change presents unique challenges. The primary drivers compelling this strategic reevaluation: structural shifts in crude supply and product demand, along with regulatory changes.

- **Evolving crude and feedstock supply:** Many U.S. refineries spent the late 20th and early 21st centuries making significant investments to process heavier, nondomestic crudes. However, the defining story of the past 15 years has been the domestic shale revolution. The massive penetration of lighter crudes from various shale regions created a fundamental mismatch between this new feedstock and the existing processing capacity, a dynamic that continues to drive significant capital investment. This trend is compounded by

the build-out of new pipelines, which continually reshapes access to these crudes and creates new market opportunities and competitive pressures.

- **Shifting product demand:** The long-term outlook for product demand is diverging. On one hand, gasoline demand faces headwinds from increasing EV market penetration and rising vehicle fuel efficiency requirements. On the other, sustained distillate demand, driven by economic activity in trucking, shipping and aviation, remains robust. This divergence continually puts pressure on a refinery's clean product mix, forcing strategic decisions about how to optimize yields and potentially make capital investments to shift production from gasoline to more valuable distillates.
- **Regulatory and market headwinds:** Increasingly stringent environmental regulations, such as ethanol blending and subsequent impacts on Reid Vapor Pressure (RVP) specifications, are not just operational hurdles; they are major financial factors that must be considered in any long-term strategic plan. Furthermore, the ongoing rationalization of refining assets — marked by regional closures and consolidations — creates market-shaping events that present both threats and opportunities requiring careful strategic assessment.

These large-scale trends mean that simply optimizing current operations is not sufficient. Long-term survival and profitability depend on a disciplined and forward-looking strategic planning process.

The Role of Linear Programming in Strategic Decision-Making

An LP is a sophisticated mathematical model that helps refiners determine the most profitable path forward. While routinely used for short-term operational optimization, it also is a powerful application in long-range strategic planning.

In a strategic context, the LP model is used to evaluate complex scenarios by comparing various potential projects to a base case. This process clarifies the differential economics of major capital investments. The modeling approach is methodical:

- **Calibration case.** First, a calibration case is built to reflect actual operations (typically a summer and winter period), ensuring that the model accurately represents the facility's real-world performance.
- **Base case.** This establishes a “do nothing,” or status quo forecast, which introduces strategic constraints like crude slate, throughput and sales. It serves as the benchmark against which all strategic options are measured.
- **Scenario cases.** Finally, multiple scenario cases are developed to model the impact of different capital investments, market conditions or regulatory futures. These could range from unit revamps to entirely new process units.

By analyzing thousands of variables — from crude inputs and process unit configurations to final product slates — the LP helps answer critical strategic questions. For example, given the diverging long-term demand for gasoline and distillates, what is the best strategic use of the refinery's gas oil? Should the refinery continue to crack it into gasoline via the FCC, or does the ROI justify the major capital investment in hydrocracker capacity to shift production toward diesel and jet fuel?

Why Independent Analysis Is Crucial Advantage for Strategy

Engaging an outside consultant to independently develop and run the strategic LP provides an objective evaluation that is difficult to achieve internally.

This need for an external partner is more acute today than ever before. Due to industry consolidation, workforce reductions and retirements, many refineries are being asked to do more with fewer people. The deep, dedicated strategic planning capability that was once common in-house has become a scarce resource. With leaner teams focused on pressing day-to-day demands, the capacity for dedicated, long-range strategic thinking is often constrained. An independent partner fills this critical expertise gap, providing the focused bandwidth and specialized skills required for robust strategic planning.

This independent approach delivers several key advantages for high-stakes strategic decisions:

Objectivity and credibility. An unbiased, third-party validation is essential when developing a major investment strategy for refinery stakeholders. It removes any perception of internal bias toward legacy processes or favored projects and provides a credible, defensible foundation for major capital allocation.

Holistic, external perspective. The independent evaluation process is highly collaborative. It begins with brainstorming sessions involving key refinery stakeholders to generate ideas and understand business objectives. However, an external partner adds value by bringing in a broader market perspective, offering insights from across the industry and introducing novel solutions that may not have been considered internally. By working with an integrated EPC consulting firm, capital cost estimates are grounded in recent, real-world project experience.

Rigorous due diligence through scenario analysis. An independent LP model serves as a critical form of due diligence. By stress-testing a project's core assumptions against different scenarios, the LP can identify flawed logic or “value leaks” before capital is committed. The key objective is to formulate credible upside and downside scenarios concerning the pricing and availability of feedstocks and product demand.

From Tactical Tool to Strategic Imperative

In an era of profound and accelerating change, refineries must elevate the LP model from a tactical, operational tool to the cornerstone of their strategic planning process. The consequences of not performing regular, rigorous evaluations can be a slow erosion of competitiveness, leading to noncompetitive refineries that are eventually forced out of business.

Maintaining a healthy flow of revenue is as vital as maintaining access to adequate supplies of crude. An independent, strategic LP planning approach provides the clarity, confidence and objective validation required to navigate future uncertainties and secure long-term profitability.

A team with integrated capabilities for LP modeling and a deep understanding of refineries provides clients with a realistic, actionable view of the return on investment for each potential

pathway, powerfully bridging the gap between high-level strategic analysis and successful, real-world project execution. By working across the full spectrum of refinery economics — from LP audits that can uncover millions in immediate operational value, to development of complex multirefinery models that optimize assets at an enterprise level — a clear pathway forward may be identified.

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