ADVANCED PHYSICAL PORTFOLIO OPTIMIZATION: improving margins in a tight market

As energy companies face tighter profitability, they need to look beyond reducing cost through efficiency and automation. These organizations will need to look for opportunities that create incremental revenue based on their current and future assets. In this article, Rashed Haq, Aditya Gandhi and Sid Bahl discuss key considerations and recommended approaches for harnessing information to improve margins through advanced physical portfolio optimization.

The Challenge
Over the last decade much has changed in the energy industry. First, market conditions are changing at an unprecedented pace. For example, the volatility of commodity prices has increased significantly due to major shifts in supply and demand patterns. Shale gas discoveries have caused a steep decline in basis trading margins of gas trading companies. Power asset managers are rethinking their fuel mix strategy to leverage low natural gas prices to improve margins. Refineries struggling to maintain margins are being forced to explore options to change refinery configurations. Second, the industry has seen the emergence of a number of independent players, such as downstream companies, intermediaries and energy merchants resulting in stronger competition and increased complexity of transactions being executed with more complex pricing structure and contract terms. Third, governments around the world have been looking for tighter regulation, yet there is still ambiguity around regulatory requirements.

In addition to the above challenges, many organizations continue to be hampered in their revenue and margin growth by their organizational structure, which focuses on cost reduction through efficiency. The following issues may prevent organizations from achieving the best utilization of all their assets, contracts and positions, making it difficult to consistently meet earnings expectations:

Should You Be Earning More Money From Your Physical Assets?

This article represents a milestone in a 10-year journey taken by Sapient Global Markets and some of its key partners to better understand how to ensure that any set of physical assets—energy in this case—is being optimized to yield as much profit as possible.

I have spent almost my entire career in energy trading. The first time I stepped on a trading floor I stared in awe at the scheduling desk, the short-term traders and the operations group and wondered how these people could be making real-time decisions about the disposition of physical volumes with the reports and market data they had available to them. What I found then—and still find today in many organizations—is a lot of guesswork.

In these fast-moving markets, there are many ways to manage the same exposure. Do I buy or sell? Do I produce? Do I inject or withdraw? Do I ship? To whom? The decision tree is incredibly complex and the more real or virtual midstream assets you control, the more difficult the problem becomes—or the greater the opportunity.

Oftentimes, traders and schedulers that lack clear visibility into these values make a host of simplifying assumptions and estimations regarding the physical rights and obligations of the assets and contracts and the best way to manage them in a complex and fast-moving market.

But have you ever wondered how much more money you could be making if your traders could really see and use all of the flexibility your physical assets have to offer in the short-term markets? What if they could really see all of the rights and obligations in your portfolio of contracts and where you stand against them in near-real-time? And what if they had tools that could help them understand the most profitable option available for every molecule or electron given all of the midstream and downstream alternatives available?

Read on for an in-depth discussion about advanced physical portfolio optimization. I hope this article sparks some interesting thoughts about how advanced physical portfolio optimization can have an impact in your own organization.

Chip Register
• Heterogeneous organizational structures composed of multiple commercial groups, regionalized production or processing plant management and distributed decision-making teams.
• Commercial teams that are primarily speculative with a limited role in assisting regional asset operations with fuel supply imbalances, e.g. leveraging store vs. sell options on production surpluses or buy vs. produce options to fulfill demand.
• Silo-based physical asset management organizations with localized sales and marketing channels, not fully leveraging market price intelligence gathered by commercial groups.
• Production that may primarily support contractual demand obligations, in turn driving demand for fuel procurement leading to possible erosion of profit in support of non-profitable obligations.

These challenges have put additional pressure on companies already struggling to find innovative ways to sustain current profitability and fuel growth. For energy companies facing some or all of these challenges, cost reduction and efficiency alone will not be enough to take a leadership position in the marketplace. Being able to grow earnings and improve overall margins will be the biggest challenge that firms will face in the coming decade.

A Systematic Approach to Managing the Business
For many firms, advanced physical portfolio optimization can provide ways to grow earnings and improve overall margins. Energy companies, including producers, suppliers or merchant traders of gas, power, oil or chemicals, that are looking to improve revenues should manage their businesses using a systematic market-based approach that treats all assets in the business—physical assets, term contracts, transport or storage leases and positions—as an integrated portfolio. The key concept in advanced physical portfolio optimization is that the value of a business should be denominated by the value of the portfolio as a whole as well as by how the portfolio is managed:

• All transaction decisions should be managed in a manner that allows all contractual obligations to be met while adding the most value to the portfolio as a whole for a given level of risk tolerance. These decisions should be based on considering the optionality within the rights and obligations built into each contract or asset and the current level of utilization of these.
• All asset decisions should be evaluated for the value the assets add to the portfolio at a given risk threshold. This can range from enhancing contract terms to proactively re-shaping the asset portfolio mix with new assets or contracts.

While most energy companies generally follow the basic market principles to some extent, there is usually too much information to make the most effective decisions without the appropriate tools. Advanced physical portfolio optimization cannot be managed manually with pen and paper because there is simply too much information to consider. Doing so would likely lead to simplifying assumptions that ignored the complexity involved in optimizing the overall portfolio value—and would ultimately lead to sub-optimal decisions. One result of this approach is that some companies become focused on cost savings without mapping the costs to revenue growth, and hence leave potential revenue on the table. Often minimizing cost alone or maximizing just revenue independently does not create the most margins (see figure 1 for a simple schematic). There are many information and algorithmic tools for managing physical plans and financial portfolios, such as linear programming or stochastic valuation software, that can be extended to manage the information complexity of physical and paper assets and positions and take back that potential revenue.

Figure 1: Independently Minimizing Costs or Maximizing Revenue Don’t Necessarily Maximize Profits

![Figure 1: Independently Minimizing Costs or Maximizing Revenue Don’t Necessarily Maximize Profits](image-url)
For a business to manage its portfolio along the principles of advanced physical portfolio optimization, all the rights and obligations for each contract need to be available with all physical, contractual or policy-based constraints including the following:

- All term contracts for receiving or delivering commodities
- All leases and contracts for changes in commodity, such as blending or fractionation—or moving the commodity across time or locations
- All production forecasts and demand forecasts and current and forecasted prices

Based on the business model, the optimization process will utilize these inputs to develop the target or recommended transactions (see figure 2). The best set of transactions will meet both all contractual obligations within the physical and policy constraints and create the maximum value within the risk constraints. Users, such as traders or schedulers, will try to execute the target transactions, but will likely run into execution roadblocks, such as not being able to find a counterparty willing to transact the target volume, etc. Based on these types of roadblocks, they will get to an executed transaction set that is close—but not identical—to the expected portfolio. In the meantime, market prices may have evolved throughout the day. As a result, markets and new beginning positions will then become inputs into the next iteration of optimization for the next period. The expected portfolio continuously evolves with market conditions and target transactions that get executed.

The major benefit of advanced physical portfolio optimization is that it improves the management of the overall business at the lowest level of granularity. This is done in an integrated way across lines of business through transparency in the key day-to-day decisions, such as whether to buy or produce for demand, store or sell for supply or transport or exchange for movements. The decision makers have all the contract and asset information at hand, and are able to explicitly view the potential options for execution across all business divisions, including the potential financial and risk impacts of the

Figure 2: Advanced Physical Portfolio Optimization Provides Recommended Transactions to Maximize Profit within Asset and Contractual Constraints
decision before it is made. Additionally, transparency helps with the development of the optimal baseline movement plans, re-routes in case of extreme weather, etc. An additional benefit of this approach is that a large part of the organization’s contract usage and operating knowledgebase is transparently captured in information systems, improving knowledge retention and simplifying the ramp up of new users.

An advanced physical portfolio optimization approach can be leveraged to shape the future of the asset and contract portfolio, enable the creation of what-if contracts and markets, etc. and evaluate how these impact the portfolio in terms of value and risk. This makes portfolio and asset extension or rationalization decisions easier to understand and make. In the same way, advanced physical portfolio optimization can be used to understand the sensitivity and risk around the markets by varying the prices or varying the supply and demand. This can demonstrate to such groups as management, treasury, the board or ratings agencies how the organization is managing assets and contracts effectively, thereby increasing confidence in the business and potentially reducing the cost of capital. Companies that have undertaken this kind of systematic optimization have realized a 5-10% increase in margin across the board and, in some instances, there have been substantially higher breakthrough increases through restructuring of assets in a subset of areas based on the optimization insights.

Example
Consider a hypothetical natural gas Gulf Coast portfolio to demonstrate how the optimization concepts will be put into use.

The sample portfolio [see figure 3] consists of production assets in northeast Texas and offshore production assets in the Gulf of Mexico, storage assets near Henry Hub and in Texas, multiple term purchase and sales contracts at different locations in Texas and Louisiana area, demand from residential customers in Texas and Louisiana, demand from C&I customers in northeast US and multiple capacity contracts with multiple pipelines in the region. The descriptions of the assets are captured in the table in figure 4.
Optimization should account for a set of constraints while maximizing profit. For example:

- All gas production must be utilized
- All demand commitments must be met
- Each location in the portfolio must be balanced daily
- The proposed transactions should not breach the risk thresholds

There will be multiple ways—often in the hundreds or thousands—to meet all the constraints, with each way producing a different level of profit. The optimization process involves evaluating all the possibilities and identifying the one that will result in maximum value. For example, to satisfy the constraint of utilizing all gas production from the Gulf Coast, there are number of options, including:

- Sell gas from the Gulf of Mexico offshore production assets at Henry Hub
  - The market price of gas at Henry Hub and the transportation cost are two of the factors that must be accounted for in the evaluation of this option
- Store the gas at Henry Hub
  - The cost of injecting into storage, the cost incurred in carrying inventory and the potential profits that can be made in future months by withdrawing from storage and selling the gas at future market prices are some of the factors to consider

- Use the gas to meet demand for residential and C&I customers in TX and LA
  - The cost to transport gas from production facilities to demand centers needs to be considered. This option must be evaluated against other possible ways of meeting customer demand, such as buying gas from the market hubs or withdrawing gas from storage or using the term supply contracts or cutting deliveries to interruptible customers
- Export gas to the northeast US
  - The market price of gas in the northeast and the possibility of importing gas from Canada are factors that will influence the selection of this option

From this simple example, it is evident that just to meet one of the constraints, multiple options must be explored and each one of these options must be evaluated against multiple factors that affect profitability and risk level. Most companies today manage extremely complex portfolios comprised of asset and contract types, each with high counts of contract rights and obligations. These portfolios span multiple regions throughout the world with each region having different operational conditions, multiple commodities grades and specifications.

To achieve the maximum possible profit from such portfolios, firms must account for hundreds of constraints. Each of these constraints can be met through hundreds of possible
options and each of these options needs to be evaluated against hundreds of factors that impact value. This requires assessing millions of variables and then selecting the ones that result in an optimal portfolio. This is only possible through systematic, information-based optimization tools and processes. Companies will need to move away from traditional approaches to decision making and focus on systematically integrating advanced physical portfolio optimization into their decision-making processes to make the most out of their current asset base.

Implications
As an organization moves towards optimization, it will have to overcome two hurdles. The first is change management. Most organizations have defined organizational boundaries or policies around different commercial and asset groups that prevent these groups from operating in ways that best leverages the optionality embedded in the portfolio. To truly leverage the entire portfolio of assets, the business needs to be thought of and organized in an integrated way. This will lead to new structures and roles within the company for which there is often significant resistance. Overcoming this resistance is often the biggest challenge and, if it cannot be overcome, then an optimization program within the company will likely fail or at best be significantly suboptimal. In addition to the organizational structure, if the employees who operate the day-to-day business are not engaged and supportive, then the business cannot move in this direction. Often their first concern is the perception that their work is being replaced by systems. In reality, they will now have powerful tools to help with decisions and operations but will likely need some retraining. Some organizations feel that their assets are already highly optimized and cannot be further optimized. Often, however, users do not have sufficient visibility into all the execution options around contracts or their utilization level, let alone whether that utilization level is at maximal value.

The second hurdle is information transparency. Firms will need to systematically capture all the rights, obligations and optionality in each of the organization’s contracts and similarly model all the assets and related forecasts. They will then need to integrate the disparate transactional systems that provide current positions, exposures and inventory and use this information for running the optimization processes. But the outputs of the optimization process are no less complex than the inputs; there will be a large volume of data to parse through to understand the recommendations that are being made and the drivers used to make them. Generally, both of these traditional information transparency challenges are satisfactorily handled through modern day integrated information systems and user-centric visualization designs for large data volumes.

For energy companies or organizations that want to maintain or grow their competitive advantage and utilize their contracts and assets to outperform their competition, they must not only focus on efficiency and cost savings but also on growing revenue by advanced physical portfolio optimization using systematic information tools and processes.

Rashed Haq
is a Vice President of Energy Services at Sapient Global Markets. Based in Houston, Rashed specializes in trading, supply logistics and risk management. He works with oil and gas companies to create innovative processes and solutions for their most complex challenges in business operations.
rashed@sapient.com

Aditya Gandhi
is a Director at Sapient Global Markets based in Gurgaon, India. He is an expert at implementing sophisticated trading and logistics solutions for leading global asset managers and large-scale energy organizations for both physical and financial asset classes.
agandhi@sapient.com

Sid Bahl
is a Senior Manager at Sapient Global Markets based in Houston, Texas. He specializes in asset valuation and portfolio optimization. Sid has helped financial and energy companies implement and adopt complex optimization and risk management solutions and tightly integrate these into their decision-making processes.
sibahl@sapient.com