Optimizing Energy Trading Portfolios

With support from Gurobi, SESCO simulates market dynamics to determine optimal energy pricing.

SESCO Enterprises, LLC is a proprietary energy trading firm trading across deregulated electricity markets in the United States.

Industry: Power & Utilities, Financial Services
Location: Americas
Use Cases: Price Optimization, Portfolio Optimization, Risk Management, Large Model
Website: www.sescollc.com

Results

- With Gurobi, SESCO is now able to solve complex power market problems in a fraction of the time required by other solvers.

- SESCO plans continued expansion of Gurobi into other areas of their operations, including research.

With over 20 years of trading experience, SESCO Enterprises uses innovative energy pricing estimate approaches to participate in the power and congestion markets as a virtual power trader in all major deregulated ISOs in the United States.

As a proprietary trading firm in the energy markets, SESCO's goal is to simulate the condition of the national grid, as well as the consumer demand for the electricity it delivers. Machine learning models facilitate these power demand forecasts; their predictive outputs help determine optimal unit commitment and generator scheduling, and ultimately serve as critical inputs to SESCO's energy price optimization models.

"The unique thing about electricity markets is that prices aren't really determined by people buying and selling in an order book. Next-day prices are determined at the ISO auction, where clearing prices are often set by the outcome of an optimization solve — typically using tools like Gurobi," explains Dylan Modesitt, Chief Investment Officer at SESCO. "So using the partial information we have, we try to determine what the optimal pricing would be."

Because forecasting power demand and simulating the physical state of the US electrical grid involves millions of variables and constraints, SESCO needs a solver powerful enough to handle the job.

Tackling Production-Sized Problems

SESCO's business involves speculating on next-day electricity prices, as well as the longer-term forward markets for trading power.

"Our trading expertise is about the congestion component of price, which is the kind of pricing differential that arises from transmission lines being saturated at their limit," says Modesitt. "And when transmission lines are saturated to some local limit, loss is going to emit as heat. So to avoid any kind of catastrophic failure, price signals are sent on either side of that transmission line. It's a lot of demand speculation, and it requires an understanding of the actual physics of the grid."

SESCO began building out mathematical models and used them to solve toy problems with another commercial solver. And that worked fine in the

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Dylan Modesitt
Chief Investment Officer
SESCO Enterprises

beginning — but when their production-sized mixed-integer problems eclipsed several million constraints and variables, either the incumbent solver was unable to find feasible solutions, or each solve simply took too long to be useful.

Like systematically quantitative hedge funds that may run hundreds of back-testing scenarios in any given day, for SESCO, the speed-to-solve imperative is critical to maximizing the number of scenarios they can test. More scenarios equate to higher confidence in their trading decisions — or, in SESCO's case, higher confidence in their price estimations and bidding strategy at the next day's auction.

To solve their biggest problems with speed and precision, SESCO turned to Gurobi.

Because many SESCO team members used Gurobi as undergraduates, they knew from personal experience that this solver could help them find real solutions.

"I don't think there was ever really a doubt that we would be using [Gurobi] to solve models of this size," says Modesitt.

Making the Most of Imperfect Information

Initially, SESCO used several Gurobi resources to reformulate and tighten their models.

"We did some reformulations to build our problems in a more performant way. So

that was some work, but it was beneficial to what we were doing," explains Modesitt. "And we were able to do much more with some Gurobi resources that helped us make our formulation as tight as possible."

Now that they have Gurobi, SESCO has begun to use the solver in other areas of trading where they had previously used heuristic methods. The heuristic approach was easier to implement, but they needed a solution that could capture the complex effects of the physical grid state as it impacts market outcomes. The advanced optimization techniques used by Gurobi's solver accomplish this by improving the pricing precision and capital efficiency of SESCO's trading approach.

As Modesitt sees it, "Gurobi has become absolutely essential to our operations. If you have large, complicated problems to solve, I really don't think there's any other choice — you should probably use Gurobi."

Gurobi Helps Bring Innovative Solutions to Life

The SESCO team is still in the early stages of using Gurobi to trade in a production context, but they believe that the impact has been transformative — and will continue to be so well into the future.

"[Gurobi] is going to be a central part of how we function as a company moving

forward," says Matt Tunno, COO and Head of Trading at SESCO.

And when any challenges do arise, they find the support they need from the Gurobi team.

"Everyone [from Gurobi] has been great to work with — they've been very, very helpful, and always very responsive," shares Modesitt. "If there is one software or subscription that I would retain, it would be Gurobi over pretty much anything else that we pay for. I think it's become the most important part of our trading."