GUROBI OPTIMIZATION

Creating Optimal Product Mixes for Each Day's Unique Dairy Supply

With help from Gurobi, Fonterra uses their new planning model to sustainably produce nearly a third of the world's dairy exports.

Fonterra™

Fonterra is a global dairy co-operative owned by around 9,000 farmers who produce roughly 30% of the world's dairy exports. The company is committed to sustainable practices.

Industry: Agriculture
Location: Global
Use Cases: Inventory Optimization, Operations, Production, Resource Optimization
Website: www.fonterra.com

Results

- A unified view of key planning problems across the organization that can be addressed with the same solver

- Solve times reduced from 20-40 minutes to roughly one minute

As a dairy co-operative owned by roughly 9,000 farmers, Fonterra is committed to sustainable farming practices. But being responsible for 30% of the world's dairy exports while also trying to do right by the environment comes with its own set of challenges, particularly when it comes to planning.

"The dairy industry is almost like the petroleum industry in that you have a 'natural' product with a composition you can't control, and you have to make choices about how to make best use of the components," explained Geoff Leyland, Principal Data Scientist and Head of the Advanced Analytics team at Fonterra.

"Milk composition changes every day, and if one day the milk has more fat than you forecast, you might end up making more butter than you originally planned," he explained.

Because milk is highly perishable, it must be processed within twenty-four hours. And Fonterra's hardest constraint is that they must process all of the milk in this timeframe.

"That's one of the big challenges of working with a natural product," said Leyland. "We forecast as best we can, but on the day, we don't know exactly how much milk of exactly what composition we will collect, and so we need robust and flexible plans."

Building a Unified System for Optimal Planning

In an effort to address some of those planning problems, Leyland says many teams were using spreadsheets. Also, while they have also used a large-scale product mix model for the last ten years, it no longer suits many of their needs.

"It has become clear that we need to go back to the drawing board and fix things at the foundational level," Leyland noted. "When we were asked to start working on some of the thornier planning problems, that's where Gurobi really managed to do some magic for us."

> " We also tried Xpress and CPLEX, and we found that not only is Gurobi faster, but it always finds a solution, which we couldn't get the other solvers to do reliably. "

Geoff Leyland
Principal Data Scientist and Head of the Advanced Analytics Team, Fonterra

With many different teams using their own siloed spreadsheets—from schedulers to transport teams and manufacturers—Fonterra needed mathematical optimization to help them effectively plan production and make the best use of natural resources, especially when it came to planning for organic milk, which carries a higher value.

"Organic planning is best solved as an integer programming (IP) problem, and we were working that at the time with the open-source CBC solver, but it couldn't solve the organics problem," Leyland explained. "We also tried Xpress and CPLEX, and we found that not only is Gurobi faster, but it always finds a solution, which we couldn't get the other solvers to do reliably."

Whereas teams were previously juggling many different tools and files, Fonterra now only needs to complete one solve. They also have a Power BI dashboard with a page for every team, so everyone can look at the same problem.

Gurobi Makes It Easy to Plan With Confidence

Initially, the goal for Leyland and the Advanced Analytics team was to solve the problem just for the organic planner. But once word got around about what they were able to achieve with their new model and help from Gurobi, more teams wanted to make the model work for them by simply adding on their constraints.

"We were able to solve the organics problem for all the teams involved in the process. Now, teams from other parts of the business are coming to us with planning problems—and we've built models with Gurobi for problems in all sorts of corners. The models can be very informative—in some cases, we've also been able to answer questions that people have been asking for years," said Leyland.

Gurobi also made suggestions to fine-tune a production planning LP model, which brought solve times down from 20-40 minutes to roughly one minute.

"The support from Gurobi has exceeded our expectations," Leyland said. "We don't need to understand how Gurobi works, but we do need to understand how our model works—and when we talk to Gurobi, we get smarter. They can solve problems that other solvers can't, and we can move forward with confidence, knowing that we won't get stuck."