Polymathian: Multi–Utility Asset and Network Optimization

Case Study

Learn how a real-time optimization platform – developed by Polymathian and powered by the Gurobi Optimizer – enabled a leading global utilities company to improve gross margin by 15%.

The Challenge: Satisfying Demand While Safeguarding Profitability

Energy and utility providers strive to satisfy customer demand in the most cost-effective manner possible. To achieve this goal, they need to be able to maximize the utilization of their assets – which can be a mix of generation technologies and fuel sources – and capitalize on real-time supply, demand, and price fluctuations across their operational networks.

This is a hugely challenging task, especially for providers managing multi-resource networks that utilize co-generation technologies and/or shared fuel supplies. To maintain profitability, these companies must be able to attain visibility and control their complex and constantly changing networks and make the best decisions on how to dispatch their assets.

One such company – a leading global utilities player with a strong presence in numerous markets around the world – runs a private, fully-integrated, multi-resource industrial site in Europe where power, steam, and other utilities are supplied direct to customers on-site as well as to the domestic power grid.

This multi-resource site is home to numerous large, energy intensive, process manufacturing companies. All of these companies rely on the utilities provider to deliver the power, steam, and other utilities they need in their day-to-day operations.

To meet customer demand at this multi-resource site, manage its complex steam and power network with numerous generation assets and fuel sources, and maximize gross margin, the global utilities company must be able to make the best possible decisions on:

- Asset dispatch: The operations team must make decisions on how each of their steam and power generation assets should be operating at any given time, and what the input and output of that asset should be. Each asset has its own cost and revenue structure, which must be taken into account when making these decisions.

- Network balance: The operations team and other stakeholders must make decisions on how to configure and operate the site's interconnected steam and power networks – to ensure all customer demand is met, maintain the quality of the steam flows in the networks, and respect physical planning constraints at all times

■ Energy trading: Energy traders must be able to identify opportunities to buy or sell power from the domestic market in advance, taking into account on-site customer demand and fluctuations of fuel costs and power prices in the market.

To manage the site's operations and make asset dispatch, network balance, and trading decisions, the global utilities provider was using an Excel-based heuristic tool, which only allowed them to make a single, daily operational plan. Using this tool, the operators did not have the capability to:

■ Respond rapidly to fluctuating power and fuel prices.

■ Identify the optimal site configuration due to shifting supply and demand dynamics on-site.

■ Exploit the flexibility and optimize the efficiency of various assets across the multi-resource site's network.

■ Capitalize on opportunities to import or export power from the domestic market in the short term to maximize revenue.

Unable to see the real-time impacts of asset dispatch, network flow, and trading decisions on gross margin, the global utilities provider was leaving money on the table – and thus, in 2018, they decided that they wanted to invest in and implement a mathematical optimization solution.

The Solution: Optimizing Operational Efficiency and Capitalizing on Market Opportunities

To develop a mathematical optimization tool that would enable the global utilities giant to make optimal, real-time decisions the company engaged Polymathian – a leading provider of advanced, automated industrial mathematics software solutions for companies across a range of industries.

To meet the global utilities provider's needs (as well as those of other energy and utilities companies facing similar challenges), Polymathian built VOLT – an

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> Jackson Richards, Manager at Polymathian

autonomous, continuous optimization platform that:

- Functions as a digital process twin that encompasses detailed asset, network, and financial models as well as their real-time data feeds

- Integrates these models with the Gurobi Optimizer (the world's fastest and most robust mathematical optimization solver) which is used to continuously process, formulate, and generate optimal solutions to the combined asset dispatch, network flow and trading business problem.

- Empowers users to drive optimal, real-time, data-driven decision making across their operational networks.

Polymathian developed VOLT and implemented it at the global utilities provider's site in 2019, and the solution went live in early 2020. VOLT is managed on-site by a cross-functional working group comprised of representatives from the Operations, Trading, Finance,

and IT departments.

With VOLT, the global utilities provider is able to:

- Continually determine the optimal site configuration (dispatch of assets and network configuration) as demand and prices fluctuate – in order to maximize efficiency, reduce operating costs, and therefore maximize gross margin.

- Rapidly conduct pricing scenarios that capture latent site conditions to identify energy trading opportunities in the short term, and maximize trading revenue.

- Conduct "what-if" type scenarios to explore the value of site modifications such as upgrading assets or installing new network piping.

"The key question that this global utilities provider needed to answer was: How can we fulfill customer demand while exploiting all the flexibility of our power generation assets and capitalizing on opportunities to sell power to the domestic grid? On a 24/7, real-time basis, VOLT provides the answer to that question by telling the Operations and Trading departments and other stakeholders throughout the organization exactly how to operate their site to guarantee customer supply and maximize operational efficiency, and gross margins," said Jackson Richards, Manager at Polymathian.

"The Gurobi Optimizer is the engine that drives VOLT, as well as the other state-of-the-art industry solutions in Polymathian's product portfolio. In the energy and utilities industry, the business environment is in a constant state of flux – with demand, prices, and costs fluctuating every minute of every day – and energy and utilities providers must be able to react and respond to those real-time changes and make the best decisions on how to manage their assets and networks. VOLT gives them the power to do exactly that," Richards added.

The Results: Shrinking Operating Costs, Improving Gross Margins

The deployment of VOLT in early 2020 has transformed the operations of the global utilities provider's multi-

resource site in Europe, resulting in a measurable improvement in overall efficiency and profitability.
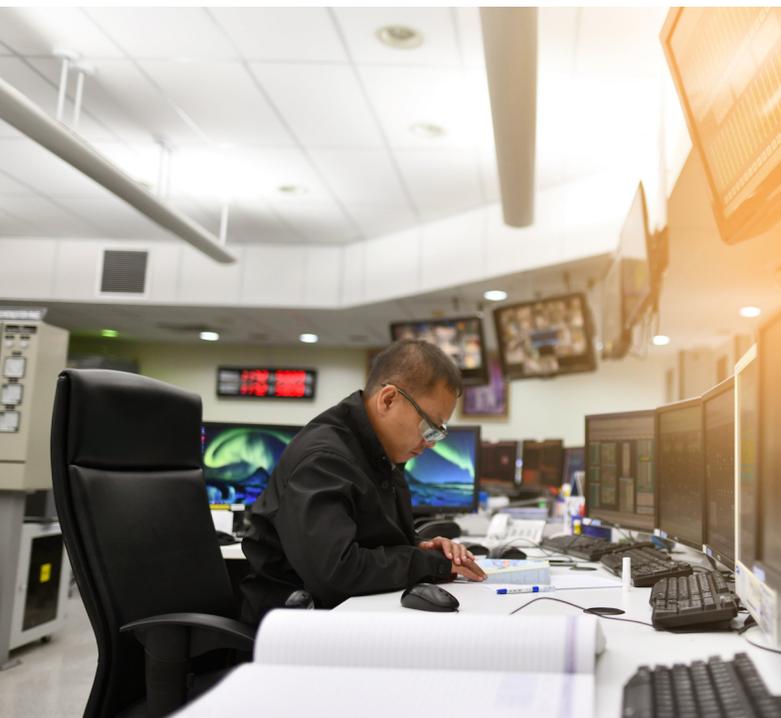
With VOLT, key stakeholders from various departments across the multi-resource site can all attain real-time, network-wide visibility and agility and optimize their asset dispatch, network flow, and trading and investment decisions. The VOLT platform serves as a single source of truth through which all business teams can exchange information, ensuring the actions of each team is visible to the others.

With VOLT, the global utilities provider has been able to achieve:

- 15% increase in gross margins, arising from:
  - 7% reduction in operating costs by coordinating the behavior of assets in real time.
  - 8% increase in revenues by better quantifying trading opportunities.

By minimizing costs and maximizing revenues, VOLT has been able to generate tremendous business value for the global utilities provider.

Why Gurobi

Polymathian chose to embed the Gurobi Optimizer in VOLT – as well as the other products in its portfolio – because it is the fastest and most powerful mathematical optimization solver out there.

"In a real-time, continuous optimization tool like VOLT, speed is absolutely critical. The Gurobi Optimizer is capable of handling the complex, real-world problems of the energy industry (and other industries as well) and delivering optimal solutions extremely rapidly. Additionally, Gurobi's multi-objective optimization capability makes it possible for users of VOLT to optimally balance the tradeoffs between various (and often competing) business objectives – so that they can make the best possible business decisions. In terms of both speed and functionality, the Gurobi Optimizer is an industry-leading mathematical optimization solver," Richards said.

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