GUROBI OPTIMIZATION

Optimizing the Mining Supply Chain

Optimized operational, tactical, and strategic planning and scheduling resulted in a 10-30% increase in efficiency.

Deswik

Deswik empowers businesses with Industrial Mathematics to transform industry with a passionate team of innovators, software engineers and mathematicians. From planning the operations of the largest mines in the world to scheduling sporting competitions, Deswik has successfully helped businesses transform into industry leaders.

Industry: Metals and Mining
Location: Australia / New Zealand
Use Cases: Supply Chain
Website: deswik.com

Results

- 10-30% increase in efficiency
- Optimization tool automatically generates optimal plans and schedules
- Makes optimal decisions across operational, tactical, and strategic time horizons

> "[Our customers] have experienced notable improvements in their supply chain planning, decision-making, and overall operational efficiency and have been able to achieve significant operational and bottom-line benefits."

Dr. Ben Hollis
Director, Deswik

Companies operating within large multi-user mining value chains – from producers to rail haulage providers, terminal operators to track owners, and mining conglomerates to supply chain coordinating bodies – all share the same, simple goal: Move material from train load point through the rail network and terminal infrastructure and onto vessels in the most efficient and profitable manner possible.

Achieving this simple goal, however, is an incredibly difficult undertaking due to the scale, complexity, and dynamic nature of large, multi-user mining value chains.

To ensure that the right material gets to the right place at the right time (and at the lowest cost), these companies must be able to:

- Maximize throughput and utilization of critical resources (such as load points, rolling stock, track, train crew, stacker-reclaimers, stockpile pads, and ship loaders).
- Attain and maintain end-to-end supply chain visibility, alignment, and agility.
- Assemble data from a range of disparate sources and systems to generate optimal strategic, tactical, and operational plans and schedules, which can be used to make optimal decisions.

Unfortunately, manual planning tools and techniques – which have been traditionally used by various stakeholders within these complex multi-user mining value chains – are time consuming to use, require expert domain knowledge to operate, and cannot produce optimal schedules for such a large and complex value chain.

There is an enormous number of interdependent decisions that have to be made simultaneously to ensure the overall system is operating efficiently including:

- Which cycles should each rail unit in each haulage provider fleet undertake in the planning horizon to rail what material from which producer-specific load points to unload points at which export terminals, taking into account track access constraints and other contractual obligations.
- When should maintenance be conducted on rail infrastructure (when this maintenance can flex in time) to minimize the impact on throughput given prevailing value chain conditions.
- How should stockpile space within terminals be allocated over time to store individually assembled cargoes or manage dedicated product stockpiles to ensure maximum velocity of material through the terminal given its available infrastructure.
- When should vessels load, noting they cannot load until all material has been railed and stacked, while making sure enough reclaiming and ship loading capacity is available.

The complexity inherent in ensuring these massive value chains operate efficiently is why a growing number of these companies are investing in and implementing automated, advanced planning and scheduling software tools that are powered by mathematical optimization. With these cutting-edge tools, stakeholders throughout the value chain can optimize their planning and decision making, revolutionize their operations, and conquer their supply chain challenges.

The Solution: Automated and Optimal Planning Within Large, Complex, Multi-User Mining Value Chains

One of the leading providers of advanced, automated planning and scheduling solutions is Deswik. Headquartered in Australia, Deswik produces a suite of products that empower companies across various industries to harness the

power of mathematical optimization to solve their complex business problems and optimize their operations.

One of the key products in Deswik's portfolio is RACE – an online decision support tool for companies operating within complex multi-user mining supply chain networks – which was developed in 2014 and first deployed in 2015.

RACE has proven to be a popular and powerful tool for companies across these complex mining value chains, and Deswik now has a wide variety of customers using RACE including the Hunter Valley Coal Chain Coordinator Limited (HVCCC), Aurizon, Pacific National, and a range of large mining conglomerates.

Although each of these companies faces its own uniquely complex operational challenges, RACE serves as a single solution that enables automated and optimal planning for multiple stakeholders within these multi-user, semi-coordinated or fully-coordinated mining value chains.

For each different customer, RACE delivers:

- **Flexibility:** RACE is a data-driven, web-hosted, cloud-based application that can be configured and customized based on each company's data, business situation and decision-making rights, and seamlessly integrates with existing systems across the enterprise.
- **Robustness:** At the core of RACE is a mathematical optimization solver – the Gurobi Optimizer – which is capable of generating optimal, data-driven plans and schedules in a matter of minutes.

"RACE empowers different stakeholders across the mining value chain to leverage mathematical optimization to solve their complex planning and scheduling problems. With RACE, these companies can transform their planning processes by making them automated, repeatable, auditable, in addition to optimal – in short they can get the best possible answer in the shortest possible time to make better business decisions given their role in the value chain," said Dr. Ben Hollis, Director at Deswik.

"The Gurobi Optimizer is the beating heart of RACE, not to mention other tools in Deswik's product portfolio. For each customer using RACE, we model their real-world, stakeholder-specific, value chain problems using RACE, channel their data through mathematical models to the Gurobi Optimizer, which produces detailed, optimal plans and schedules," Dr. Hollis added. With RACE, different stakeholders within the mining value chain can automatically generate optimal plans and schedules and make optimal decisions across the following time horizons:

- **Operational:** Continuously synchronize detailed rolling stock schedules, intra terminal and vessel loading operations to maximize network throughput and efficiency.
- **Tactical:** Proactively schedule rail and network infrastructure maintenance activities to reduce their impacts on throughput. Inform producer ordering profiles in periods of high demand in multi-terminal, multi-operator value chains.
- **Strategic:** Conduct studies to investigate the impact of large track network capital investment decisions; rolling stock fleet size and deployment decisions; changes to track, terminal, or haulage provider contracts; and assess alternate terminal operating strategies.

The Results: Improved Resource Utilization, Throughput, and Profitability

RACE's customer base includes companies operating across the mining value chain, including primary producers, rail haulage providers, terminal operators, rail track owners, mining conglomerates and coordinating bodies.

Since implementing RACE, all these companies have experienced notable improvements in their supply chain planning, decision making, and overall operational efficiency and have been able to achieve significant operational and bottom-line benefits including:

- 10-30% increase in efficiency (i.e. asset utilization and throughput).
- Dramatically reduced planning cycle times (from days and hours to a few minutes or seconds).
- Improved levels of customer service and satisfaction.
- End-to-end supply chain visibility and control.
- Higher level of coordination with other value chain stakeholders.

Why Gurobi

Deswik decided to embed the Gurobi Optimizer in RACE (as well as the other products in its portfolio) for one reason: It's the state-of-the-art mathematical optimization solver.

"At Deswik, we want to ensure that we have the ability to use the best-of-breed mathematical optimization solver in our products – so that our products can deliver the highest quality solutions for our customers in the shortest amount of time," Dr. Hollis said.