

CASE STUDY

Significant increase in NPV for greenfield potash mine

APEX

Mining Method
Room and Pillar

Module
Strategic

The Customer

The customer owns a large-scale, underground, room and pillar potash mine with multiple seams. The potash will be supplied for fertiliser products and exported to global markets.

The Problem

Creating Life of Mine (LoM) plans is a complex and time-consuming task that requires comparing scenarios to assess the impact of making strategic decisions such as mine design and cut-off grade selections. Each of these scenarios is optimised in software to ensure they meet operational constraints and have a high net present value (NPV).

Prior to using APEX, the existing plans were optimised using software that implements meta-heuristic solution algorithms. This technique is not globally optimal, meaning there is no guarantee of the quality of the solutions produced. This manifests in a semi-manual solution process, in which a starting schedule is iteratively permuted and refined until only marginal gains are possible. This method was time consuming and fraught with uncertainty, as there was no clear indication of when to cease iterations.

About APEX

APEX optimises the LoM / Strategic schedule for complex mining operations. It maximises NPV considering mining tasks, resource consumption and constraints.



Maximise NPV

11% NPV increase over the incumbent mine scheduling tool



Time Saving

Reduce solve times down to 2 hours from 38 hours in a single run



Optimality Guarantee

Achieve a mathematically optimal schedule





The solutions provided by the meta-heuristic were probabilistic in nature, leading to varying outcomes with each iteration. In some cases, these results violated important blending constraints. With no stockpiling, the correct sequencing of mining for blending was required at all times to ensure a marketable product quality over the mine's lifespan. Furthermore, key strategic decisions such as the timing of mining seams varied significantly between solutions, eroding confidence in the quality of the plans.

The Solution

Polymathian used the strategic module of APEX - an Industrial Mathematics based mine planning software tool - to address the LoM planning challenges.

APEX is designed to calculate optimal solutions with minimal manual intervention. It utilises the globally optimal mixed-integer linear programming (MILP) solution technique. Unlike the incumbent technique, this algorithm can quantify the optimality of each solution. With this, users can understand the trade-off between solution quality and runtime for each scenario.

MILP-based software like APEX feature 'run-once' deterministic calculations. This means solutions which respect all constraints (such as blending) to maximise NPV can be produced without the need for iteration.

The Benefits

Maximised NPV

APEX improved the mine's NPV by 11% compared to the incumbent solutions.

Run-once Solver

With its 'run-once' solving capability, APEX was able to generate a mathematically optimal mining sequence, delivering results in just 2 hours. This is a significant reduction from the existing 38-hour manual process using the existing software tools.

Integration

APEX also offers integration with mine design and scheduling products like those offered by Deswik, significantly streamlining workflows and enhancing the mine planning processes.

Decision Support

APEX helped to answer business critical questions such as:

- What is the correct mining sequence to achieve on-spec grades?
- Should the seams be linked in the mine plan?
- What cut-off grades and mine design choices should be selected for the LoM?
- What does the ramp-up profile look like and when should development costs be incurred?