Optimal Blending Strategy for Coking Coal Given Geological Uncertainty

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ABSTRACT

Coking coal is essential to the large-scale production of steel, and the quality of the coking coal significantly contributes to the quality of the produced steel. High quality coking coal has low ash content and a prescribed range of properties including volatile matter content and predicted coke strength. These measures can be improved by processing the raw coal after it has been mined. To maximise the profit of a mining operation the processing can be varied and coal from multiple sources can be blended.

This paper describes an original mixed integer programming model to maximise the profit of coal blending and processing. The model developed is a general model, which is computationally efficient and can practically be adapted to any modern coal mining and processing operation. In a novel approach, the multi-period blending model explicitly captures the geological variability of coal in the formulation using stochastic constraints. In contrast to standard industry practice of using simulations to model geological variability, this method uses the explicit uncertainty of a block of coal as captured in the kriging variance. This can be used for real time decisions on plant feed to ensure that the output quality will be within a selected tolerance.

A case study is evaluated and demonstrates that explicitly modelling geological variability can add many millions of dollars of value to a typical coking coal mining and processing operation. This approach, in practice, is achievable without additional cost but simply through selecting the order that coal is fed into a processing plant. This approach is equally applicable to all mining and processing operations where material is blended into a processing facility or directly into a saleable product.