

## ECONOMIC ASSESSMENT OF ISR PROJECTS

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### ABSTRACT

In-situ recovery (ISR) transfers hydrometallurgical processing of mineralised bodies to the subsurface to directly obtain solutions of commodities. As a result, there is little surface disturbance. For ISR to be successful, however, deposits need to be permeable. Furthermore, commodities need to be readily amenable to dissolution by leaching solutions over a reasonable period, with an acceptable consumption of leaching reagents.

ISR projects comprise the following components:

- Lixiviant preparation module (or alternatively the use of a pre-prepared lixiviant)
- Wellfield blocks where ISR is occurring
- Processing Plant for processing solutions
- Refinery Plant for production of the final product from the eluate or extractant.

Estimation of Operating Expenditure (OPEX) and Capital Expenditure (CAPEX) for Lixiviant preparation, and Processing Plant and Refinery Plant construction is quite common and carried out in the same manner as conventional mining projects.

OPEX requirements for ISR should be estimated based on Liquid to Solid (L/S) ratio which reflects how much solution (m<sup>3</sup>) is required to reach the target extraction of a specific commodity for one tonne of ore. CAPEX for wellfield construction cost is spread almost over the whole life of mine (LoM) and may also be regarded as OPEX.

The following pregnant solution cut-off grades are defined for ISR projects:

- The breakeven cut-off grade for pregnant solutions is based on OPEX without the cost of operation block construction. Breakeven cut-off grades should be used for termination of the operation of blocks/production wells. If the cost of processing and leaching is higher than the revenue from the useful component in solutions, then the well is terminated.
- The full cut-off grade for pregnant solutions is based on the full cost of mining and processing solutions – wellfield construction cost and OPEX. The full cut-off grade is used for selection of cells/blocks for the LoM Plan.

The best way to estimate the full cut-off grade and therefore the selection of mineralisation for the LoM Plan is to determine the operational cells where the profit is >US\$0 where:

**Profit of Cell = Revenue – OPEX – Cost of Cell Construction**

One of the most significant benefits of ISR mines is the ability to construct the mine in modules, commencing with minimal capacity. OPEX is contingent on the capacity of the ISR operation.

ISR allows the most profitable blocks to be scheduled first, with re-investment of cash flow to further develop the operation and increase capacity.

Keywords: *in-situ recovery, OPEX, CAPEX, revenue*