



Four-X Hint

Checking For Over Constraint



This hint is part of a semi-regular series 'published' on the Whittle User's Email Discussion Group

I was recently asked about papers on the correct strategy for a mining company, when they know the price is low now but expect it to rise. Well firstly I found there is a big gap in the literature on this topic [in fact I could not find a single paper addressing this problem] but more importantly I realised that it was the framing of the question that makes a solution difficult to find.

If the question had been “What is the optimal plan, if I believe the price will stay low at \$Xxx/tonne gradually rise to \$Yyyy/tonne in the next 5 years” a solution can be easily calculated.

[Believe it or not, The solution is generally cut production till the price rises! However this long-term view will probably not convince management or financiers, who are more likely to be pre-occupied about the vulnerability to takeovers or simply the survival of the mining operation in a very competitive market.]

The two keys to understanding this problem are uncertainty [about confidence in the change in price and when] and the need for strategy [not just an optimal solution to a single case, sure they want a good NPV but are management are likely to be more worried about their upper quartile position on the cost curve]

In the conclusion to his paper “Optimisation: Is it Best?” Ken Lane advises, *“This is the essence of planning in conditions of uncertainty. The plan should incorporate options that can be exercised when and if certain circumstances arise.”*

This is great advice, but how do you do it. Probably one of the biggest secrets in life of mine plans is understanding the differences and overlap between optimum, strategic and tactical. Whilst an optimum solution will target a single criterion and guarantee a maximum for that criteria, and this will define the best tactical plan to suit those conditions. The strategic plan will look for flexibility to be able to adapt, and robustness to avoid risks associated with changes.

HINT – CHECKING FOR OVER CONSTRAINT

It is not uncommon for an optimiser to push a system to the limit, right up hard against one of the constraints. If a slight change (or miscalculation in planned targets) occurs then you may well hit that constraint and consequently be unable to get over the hurdle. The result will then inevitably lower productivity and lead to loss of potential revenue.

In Four-X there are three physical constraints that can be set, Mining Capacity, Milling Capacity and Amount of Metal Produced. **CAN BE** is an important feature, they can be set but do not have to be. Four-X only needs one of these capacities to be set, for it to prepare schedules. If two or three limits are set it is highly likely that the system may hit and become limited by one capacity, with plenty of excess available in the other limits. How can you be sure you haven't hit a hurdle, which introduces risk?

You can not be sure without a bit of analysis. I call this looking for over constraint, and it is a very simply little bit of sensitivity analysis. Just run three separate cases where only one limit is set at a time and see what your resource is capable of.

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Four-X Hint **Checking for Over Constraint**

Try your life of mine schedule again with only one limit set at a time.

- 1) Firstly just set a mining capacity.
- 2) Next just set a milling capacity.
- 3) Finally just set a metal production limit.

You will probably be very surprised how different the results are.

I have prepared a simple worked example, for the marvin copper project, called setting limits, which can be found under the Know How Section of news on my website.

www.users.bigpond.user.com/imageo/imageo_vision.htm

I have been observing the rise of over-constraint for a while now, and have largely blamed it on the new dialogue style interface with lots of boxes to fill, so the natural tendency is to put something in each box. Of course they are probably practical limits but the issue is, are they over constraining what your resource is capable of.

So here is your first strategic question which is the most important limit?

How much potential revenue are you missing out on?

Over the next few weeks I have plans to run through a number of simple exercises, instead of just hints, using the marvin data set from the Four-X demo disk to illustrate why strategic thinking is so vital when prices are low. So please get hold of a Four-X version 2.30 demo disk and set aside about 15-20 minutes each week to investigate this for yourself.

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