Request for further information on TPAG Discussion Paper from Graeme Everett, Norske Skog Tasman, 8 July 2011

E-mail from Graeme Everett to Bruce Smith re HVDC LRMC spreadsheet[1]

HI Bruce

I am trying to make sense of the spreadsheet but since I don't have Excel 2007 on my computer it is not straightforward for me. Since my request for an extension to the July 14th deadline was declined I am hoping that you can help out with some explanations please.

It would be most helpful if you can please send a mathematical formulation of how this thing actually works, or is intended to work.

It seems that the spreadsheet is a deterministic calculation of marginal generation plant that is required. All exogenous inputs (capital costs, exchange rates, fuel prices, demand growth, carbon tax etc) are known with absolute certainty for the next 30 years. Is that true? There is some kind of randomisation but it appears to be simply perturbing exogenous parameters symmetrically about a mean, and if done enough times is the same as solving once using the average.

The only consideration of location seems to be fiddling of location factors - with no evidence of why LFs are chosen. A project like Hayes, which would require a considerable grid investment to get the power out of Southland is treated the same as a CCGT at Otahuhu (no capital required for grid expansion) - except it has a different location factor. Is that correct?

If you can please help me understand the answers to these questions I would appreciate it very much.

Best Regards
Graeme

Response

The spreadsheet implements the methodology outlined in Appendix D.2.2.

The methodology is simple and involves calculating an long run marginal costs (LRMC) 'ranking' measure with or without an HVDC charge for a range of exogenous scenarios, sorting in order, determining the approximate timing of new investment to meet assumed 'energy' demand assuming it is built in 'merit order' and then assessing the impact of the HVDC charge on the NPV of new investments.

The objective is to assess the potential magnitude of the <u>impact</u> of an additional HVDC charge (over and above the marginal costs of losses and constraints in the transmission grid which are already fully reflected in the market prices) on the timing of new base-load and renewable investments and hence the potential impact of the HVDC charge on the NPV of new investments required to meet the demand for 'energy' (not peak).

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[1] This spreadsheet is available at: http://www.ea.govt.nz/document/14249/download/our-work/consultations/advisory-group/transmission-pricing/

It is not aimed at accurately assessing the actual merit order and timing of new investments which is highly uncertain and depends on exchange rates, future fuel prices, local fuel availability, local resource availability (geothermal, wind and hydro) and consenting, individual project capital costs (including generation connection costs), individual project operational characteristics (eg wind/hydro level, volatility and correlation, transmission losses to the grid etc), regional marginal location factors etc.

The analysis treats the actual merit order and timing of new investments as an exogenous random factor – and then assesses the approximate impact of the HVDC charge on this merit order and timing assuming a plausible modelling assumption that new investment projects are constructed in approximate merit order. Other assumptions could be used but would involve much more complicated (and equally arguable) modelling.

1. A simple merit order is established by ranking options according to a measure of LRMC (this is the average base load equivalent real price at Haywards required to cover the full capital and other costs over its lifetime – with approximate adjustments to account for general location (i.e. the expected long run average location factors relative to Haywards and expected long run factors to account for intermittency and correlation of renewable schemes).

2. This merit order and approximate timing of new investment is derived for each of a number of exogenously determined 'deterministic scenarios' specified by assumptions on costs, prices, exchange rates, resource availability etc.

3. A new merit order is derived including HVDC charges. This is compared with the first merit order to derive the impact of the HVDC charge on project timing and on the NPV of total new investment costs.

4. The point of the randomisation in the exogenous 'scenarios' is to determine the potential range and size of the impact of the HVDC charge in each scenario. The impact will vary according to each scenario. For example it will be small if the 'scenario' has a large volume of NI options which are all cheaper than SI options (and hence the impact of an additional HVDC charge on SI options will be small and delayed). Alternatively it will be larger if the 'scenario' has some SI options which have a lower cost than NI options and hence could be significantly delayed by an HVDC charge. The average of the impacts over the different scenarios is thus not the same as the impact that would be calculated with the 'average' scenario.

The approximate regional location factors used in the merit order ranking is simply an average from earlier GEM runs. These are part of the set of exogenous assumptions (along with fuel price, capital cost etc). The cost of connection to the grid for projects such as Hayes etc are part of the capital costs of the individual projects. These, and individual location, capacity and intermittency factors, could be randomly adjusted along with the other scenario parameters. However the random adjustment to individual capital costs is used as a proxy for all of these uncertainties.