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Dear Nalin and Greg,

Re: QNI Upgrade Competition Benefits Methodology

Thank you for the opportunity to comment on this key issue relating to assessing competition benefits associated with assessment of development of the Queensland-New South Wales Interconnector (QNI). ROAM Consulting has provided a consolidated response below.

Can Competition Benefits form a significant component of economic benefits?

Powerlink and TransGrid are interested in the views of parties who are experienced in economic and market modelling as to whether they consider competition benefits could form a significant component of economic benefits associated with increasing the transfer capability across interconnectors, and in particular, QNI.

ROAM considers competition benefits to be potentially significant to the outcome of the RIT-T for interconnectors. This is based on our experience in conducting regulatory tests as far back as for SNOVIC 400 and SNI in the early 2000s. All components of market benefits, including competition benefits, contribute to the overall outcome of the RIT-T. It is difficult to judge potential market benefits without detailed modelling.

ROAM has recently conducted several preliminary RIT-Ts for proposed interconnector upgrades in the NEM for interested parties. For this we have applied the Frontier methodology as described in the Powerlink/TransGrid consultation paper. We have found the methodology to be capable of being undertaken in a comprehensive manner using our half hourly time sequential 2-4-C model with dynamic bidding implemented, using an agent-based Nash equilibrium assessment.

Dynamic bidding is implemented by firstly computing starting bids by generation portfolio, and then allowing generators to change their bidding patterns to attempt to gain a competitive advantage. While this approach is computationally intensive, it is capable of yielding valuable information in relation to competition benefits. In particular, we have shown that competition benefits result from a lessening of market power by generation portfolios as a result of transmission upgrades.

We therefore support the inclusion of competition benefits as part of the evaluation of market benefits for potential upgrades, including QNI. Identifying competition benefits explicitly using the Frontier methodology is a reasonable and implementable approach.

Quantifying Competition Benefits

Powerlink and TransGrid are seeking feedback as to whether any particular technical or market characteristic of QNI limits the application of Frontier's methodology for calculating economic benefits associated with alleviating transmission congestion across QNI.

ROAM has conducted several draft and completed regulatory tests for interconnectors since market start, including the SNOVIC400, which was subsequently completed, and SNI, which was ultimately not developed. Furthermore, we have conducted preliminary RIT-T tests for several interconnector upgrades.

We have carefully assessed and applied Frontier's 5-step approach over a lengthy period in various draft RIT-T assessments for clients. We consider that the Frontier approach is appropriate for calculating economic benefits associated with alleviating transmission congestion across QNI.

Realistic Bidding Models

If it is considered that Supply Side Equilibrium is not a suitable framework for modelling generator bidding behaviour within the realistic bidding scenarios, Powerlink and TransGrid are seeking feedback as to why the framework is not considered suitable (including supporting research and documentation).

ROAM has had considerable experience in developing and applying software for assessment of the RIT-T over a period of more than thirteen years. The particular aspect for which Powerlink/TransGrid have requested consideration is the suitability of the Supply Side Equilibrium for modelling generator bidding behaviour within the realistic bidding scenarios. The term Frontier use is supply function equilibrium (SFE), which we will use throughout.

As discussed in many publications[1], a supply function equilibrium is simply an application of the standard concept of Nash equilibrium to a particular, specialised type of model – not an alternative way to define an equilibrium.

As stated in the consultation paper, 'Supply Side Equilibrium involves developing an aggregate supply curve for each region as continuous functions', and for this reason it is an approximation of the discrete price and demand pairs that most markets, including the NEM , apply for dispatch of the electricity market. Equally, as Larson and Salant discuss, by retaining the discrete price and volume pairs, there is a risk that the solution of the Nash equilibrium will be unstable.

[1] Nathan Larson and David Salant, 'Equilibrium in Wholesale Electricity Markets', 13 November 2003 (http://www.hks.harvard.edu/hepg/Papers/Larson.Salant.equil.wholesale.mkts.Nov.03.pdf)

Therefore both dynamic bidding involving potential shifts of bids by generators to alternative pairs of price and volume in search of a competitive benefit and the approximation of discrete steps by a continuous function potentially introduce sources of modelling error.

The difficulty with retaining discrete bid pairs in modelling is the approach to be taken when cycling between alternative pairs of bids either between or within portfolios of generation occurs. One option is to revert to 'starting bids' in this situation and move on to the next time step. The number of times that cycling occurs due to instability caused by bid pairs can be readily monitored to see if the solution outcomes are being compromised.

The difficulty with using a continuous supply function equilibrium is in choosing how to approximate what can be a very complex and non-linear set of price and demand bids by a smooth function. Furthermore, whether the function is chosen to be linear, quadratic or higher order can be an arbitrary decision.

However, ROAM believes there may be further limitations on the applicability of SFE to the NEM. Firstly, a brief literature review has not found examples of SFE being applied in a realistic fashion to a complex such as the NEM, where transmission constraints and the diversity of generation options create non-trivial outcomes. In the studies reviewed by ROAM, significant simplifications of generator behaviour and input parameters were required to achieve a solution to the profit maximising algorithm.

Further, the key advantage of SFE is to model the strategies of generators required to submit supply curves applicable to multiple periods or to future periods where the demand is not known precisely. The expectation is that generators would therefore bid a supply curve to be able respond to unexpected demand "shocks", taking into account the response of other generators. The NEM, however, features short dispatch intervals with the opportunity to rebid capacity (but not prices) very close to dispatch. As such, demand is well known and the SFE methodology reduces to determining the bid price and supply for a single period. Using the SFE curves may not truly capture the strategic bidding options available to generators in the NEM, although ROAM acknowledges this would require further research to confirm. ROAM's modelling of dynamic bidding employs an agent based model employing discrete bid pairs.

For these reasons ROAM would suggest that, for the assessment of competition benefits, both methodologies should be used and the outcomes compared, either within the same software package or using two alternative software packages. This approach of using two alternative methods or software providers has been done for other major studies of aspects of the NEM, for example, by Australian Treasury in the modelling of the Clean Energy Futures package.[2]

Due to the higher computational capacity of computer hardware achieved in recent years, in our view there is no reasonable basis for attempting to simplify modelling approaches due to computing time constraints as these are rarely on the critical path in conducting assessments. More usually, it is data preparation and analysis of findings that are the bottlenecks in undertaking studies. For example, establishing portfolio contract positions is vital and subject to market confidentiality issues, yet still has to be modelled in assessing competition benefits.

Disorderly Bidding

Powerlink and TransGrid are seeking feedback on the modelling of disorderly bidding, and whether alleviating disorderly bidding could form a material component of market benefits.

[2] Commonwealth Treasury, 'Strong Growth, Low Polution: Modelling a Carbon Price', 2011 (http://archive.treasury.gov.au/carbonpricemodelling/content/report.asp)

ROAM has extensive experience in modelling the occurrence and outcomes of disorderly bidding, including our recent modelling report for the AEMC Transmission Frameworks Review (TFR).[3]

For the TFR, we conducted both backcasting and forecasting of the incidence of disorderly bidding. We have developed methodologies for detecting the onset of disorderly bidding in forecasting, and implemented disorderly bidding accordingly.

We have found that, based on our investigation, the market benefits from alleviating disorderly bidding would not be significant.

Demand Elasticity

Powerlink and TransGrid are seeking comments relating to the suitability of the proposed demand elasticity data and models as an input to the Frontier methodology.

ROAM has conducted detailed modelling over several years of forecasting of competition benefits using the elasticity of demand approach proposed by Frontier.

We have found this methodology to be applicable. ROAM's approach has been to apply the methodology using a notional change in demand, e.g. 1%, and then scaling the outcomes according to the elasticity values for each particular region. By adopting this approach, the inaccuracies inherent in modelling very small differences in market simulations for small changes in demand can be reduced.

Yours sincerely,

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Executive Chairman

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Managing Director

Dr Joel Gilmore
Principal - Renewable Energy and Climate Policy

Mr David Yeowart
Senior Software Engineer

[3] ROAM Consulting, 'Modelling Transmission Frameworks Review', 28 February 2013 (http://www.aemc.gov.au/Media/docs/ROAM-Consulting--Modelling-Transmission-Frameworks-Review-c1899e45-6bc0-4c00-a643-1ad7e6a1bdfc-0.pdf)