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electricity transmission

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24 July 2013

Anthony Bell
Director Network Operations and Development
Australian Energy Regulator
Level 35, 360 Elizabeth Street
MELBOURNE VIC 3000

Dear Anthony

re: Heywood Interconnector Upgrade – AER information request

On 15 July, the AER requested that ElectraNet provide a response on a point raised by Frontier Economics as part of comments provided to the AER by Macquarie Generation, to assist the AER in making its 5.16.6 determination of the Heywood Interconnector Upgrade RIT-T.

The point raised by Frontier Economics was to query the level of congestion apparent in the market modelling as compared to historical outcomes. The AER requested an explanation of why the peak congestion hours forecast in the base case for 2016-17 are so high compared to historical figures. At the same time the AER invited ElectraNet to respond to a range of other issues raised by Macquarie Generation.

ElectraNet and AEMO discussed these issues with the AER on 18 July. At this meeting it was agreed that ElectraNet and AEMO would provide further information on the governance and quality assurance practices employed by the project, particularly in relation to the modelling of future network constraints.

Attachment A is a joint ElectraNet and AEMO response to the issues referred to above.

Please contact Hugo Klingenberg on (08) 8404 7991 for any enquiries in relation to this response.

Yours sincerely

Rainer Korte
Executive Manager Network Strategy and Regulatory Affairs

ATTACHMENT A

1. Response to Frontier Economics comments

1.1 Congestion

Frontier Economics (FE) states that in the base case there is a greater level of congestion than has occurred over the last seven years. In particular FE states that the level of congestion between 350 MW to 400 MW has averaged 400 to 500 hours a year which is lower than the 1300 hours forecast in the base case for 2016-17.

AEMO and ElectraNet consider, however, that the data FE has presented demonstrates an increase in congestion over time. In particular, congestion between 350 MW to 400 MW has steadily increased from less than 50 hours in 2006-07 to more than 600 hours in 2011-12. The consideration of average congestion by FE over this period is less informative than consideration of the growth of congestion over this period, which has grown at an annual rate of more than 50 per cent. A continuation of this growth trend would lead to well in excess of 1300 hours of congestion by 2016-17[1].

ElectraNet and AEMO also note that the period of 2006 to 2013 has demonstrated lower power flows across the interconnector than the period 1998 to 2006. Figure 1 below shows the net imports to South Australia across the Heywood and Murraylink interconnectors. Energy flows are significantly lower from 2006-07 onwards compared to the three years preceding this. From 2006 energy flows steadily increase. This coincides with the increase of congestion apparent in FE's information.

The period from 1998 to 2006 demonstrated significantly higher congestion on the Heywood interconnector along with much higher energy flows. It should be noted that congestion across the interconnector during the period 1998 to 2006 was less in the 350MW to 400 MW range, but much greater in the 450 MW to 500 MW range. And more recently, greater congestion has been occurring at around 200 MW that did not occur in the period to 2006.

Three separate limitations on the Heywood interconnector are causing this congestion, namely: 132 kV South East thermal limitations; voltage stability limitations and limits on the Heywood transformers in Victoria. All three of them will be alleviated by the preferred option.

[1] There has been a significant reduction of congestion in 2012-13. This has been influenced by improvements to constraint formulations and a temporary reduction in the size of the largest generator contingency in South Australia.

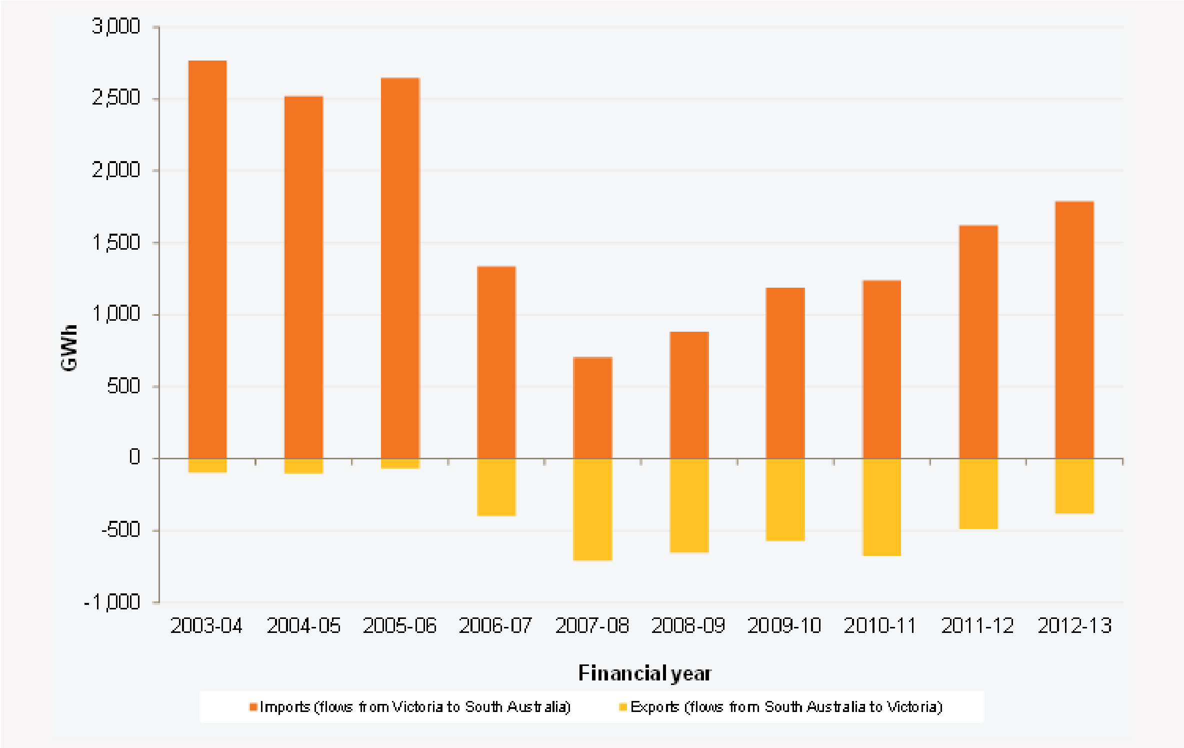

Figure 1: annual energy imports and exports into South Australia from 2003-04

ElectraNet and AEMO note that the drivers of congestion are complex, being derived from an interaction of short term operational decisions, longer term investment decisions by generators and TNSPs and the potential impact investment decisions may then have on the utilisation of the network.

In summary, consideration of past outcomes can be a useful check to ensure that results look reasonable. However, it is expected that future congestion patterns will diverge from historical observation as demonstrated by the growth in congestion over recent years.

1.2 Constraint formulation process

The market modelling performed for each option relies on relevant constraint formulation. The constraint formulation process followed the following three steps. Each of these steps is expanded in the subsequent text.

1. Load flow studies and augmentation design: Start with the existing NEM constraint set and modify to reflect the proposed augmentation options
2. Generation planning: Determine the generation expansion plan subject to major network constraints
3. Market benefit modelling: Iteratively test constraints to ensure reasonable outcomes.

1.2.1 Load flow studies and augmentation design

The modelling process starts with the existing NEM constraint equation set, which is modified to reflect the likely outcome from the augmentation option being modelled. This is an iterative process performed in conjunction with the load flow studies. The proposed augmentation options to solve existing constraints are input into load flow and stability studies to determine which augmentation options have the potential to alleviate constraints. For instance, the 132 kV works in South Australia proposed as a component of the preferred option were designed specifically to alleviate certain thermal constraint equations currently in the system. In this way, the constraint set input into the market modelling for each option has been modified to reflect the most likely resulting constraint equation set following option implementation.

1.2.2 Generation planning

To the extent possible, key transmission constraints were included within the PLEXOS expansion plan so that plant dispatch was appropriately impacted when determining the most economically efficient locations for new generation investment. The constraint equations were developed with coefficients for all the new generators – this was done by taking the existing NEM pre-dispatch constraints, and including potential new generator terms based on an electrically similar unit nearby. That means – as the model installed new generators across the horizon, the constraints were able to adapt and limit flows accordingly.

Only those key constraints that would result in a material difference between options and/or were considered material to outcomes in the base case were amended. Not all network constraints were modelled at this stage of the project. Estimates of the potential reserve sharing capability under the various options were also made. In this sense, the impact of constraint equations changed over the study period, becoming more or less restrictive based on the generation investment pattern.

The generation expansion plans used for each option were released in conjunction with publication of the PADR/ PACR. These formed the basis for the generation supply assumptions used.

1.2.3 Market modelling

The final constraint set for the Prophet modelling was then developed iteratively, in that all constraints were input into the model, and the resulting binding hours were assessed by the network team to determine if they were reasonable. For instance, the project team looked at constraints that increased over time and removed them from the base case and augmentation options if augmentation to remove the constraint could be reasonably considered routine or reliability-driven. Most importantly, all decisions on the removal of constraints were given due consideration to ensure that the change would not unduly bias any particular outcome, including the “do nothing”, or base-case option.

As with any constraint equation modelling, AEMO and ElectraNet focussed on alleviating the constraints of most relevance to the Heywood Interconnector transfer limit. As the NEM is an interconnected system, the removal of one constraint inevitably leads to the next constraint becoming apparent. Removing all binding constraints is not practical and would require consideration of potential network augmentations across the NEM, some of which are better suited to separate RIT-Ts, or joint projects with other TNSPs.

1.3 Related constraint development assumption information

The determination of the constraint set for future years takes into account future committed and non-committed generators.

As mentioned in the PADR/ PACR, the 'committed projects', 'generation projects' & 'planned generation closures' have been taken into account in this RIT-T and the market simulation has been undertaken for the period 2013/14 to 2039-40. The period selected for the market modelling was sufficiently long to cover for the end of the Large-scale Renewable Energy Target (LRET) scheme.

The four scenarios modelled (refer to PADR section 5) reflect a broad range of different assumptions in relation to factors such as growth in electricity demand, the future carbon price and future gas prices, which were considered to have the potential to affect the market modelling outcomes under this RIT-T.

The demand input into the model was as per either the 2011 ESOO or 2012 NEFR demand forecasts relevant to the scenario being modelled (specified in Section 5.4 and Appendix C, Section C.1 of the PACR).

1.4 Forecast fuel prices

FE has queried the impact of extrapolation of fuel prices beyond 2030 stating that this "has resulted in a very aggressive assumed fuel price trajectory for the period 2030-2050".

Figure 2 below presents the same information as Figure 1 in FE's June report for Macquarie Generation, up to the year 2030. Also included is the present value cost of the preferred option. It is clear that the credible option creates sufficient market benefits well before the extrapolation of fuel costs begins to influence the market benefits calculation.

Specifically, figure 2 demonstrates that by 2030 approximately $200 million in present value gross benefits have been generated by the preferred option. This is significantly greater than the $80 million in present value costs of the project. Given this, and the fact that fuel costs are constant across all credible options, the extrapolation does not impact on the choice of preferred option.

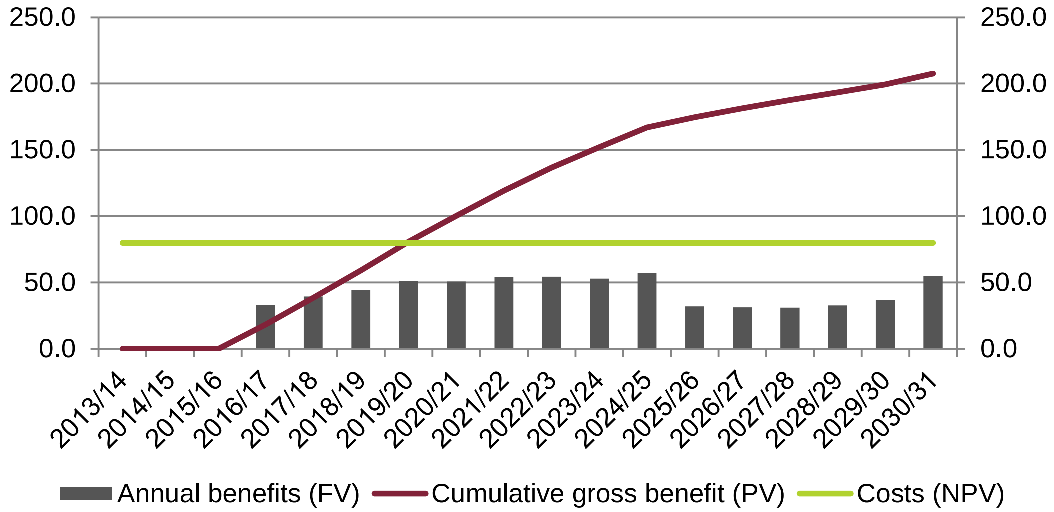

Figure 2: cumulative present value of gross benefits

ElectraNet and AEMO also question the statement that the extrapolation is a "very aggressive" forecast. Figure 3 below shows the central gas scenario of a new entrant Adelaide CCGT in the Heywood Interconnector Upgrade RIT-T. The Adelaide CCGT price has been used as it is reflective of the prices used by a number of existing gas plant in Adelaide when assumptions regarding current fuel contracts expire, as well as potential new entrants.

The avoidance of using this gas has been a significant part of the operating cost benefits. The central gas price had a weighting of 70 per cent as it was used in both the central and revised central scenarios. This price is compared to the three scenarios AEMO has recently published as part of its 2013 Planning Assumptions. These prices extend to 2036 giving a benchmark to compare the extrapolation that commenced in 2030.

It is clear that the central gas price extrapolation beyond 2030 is lower than all three scenarios in AEMO's 2013 Planning Assumptions.

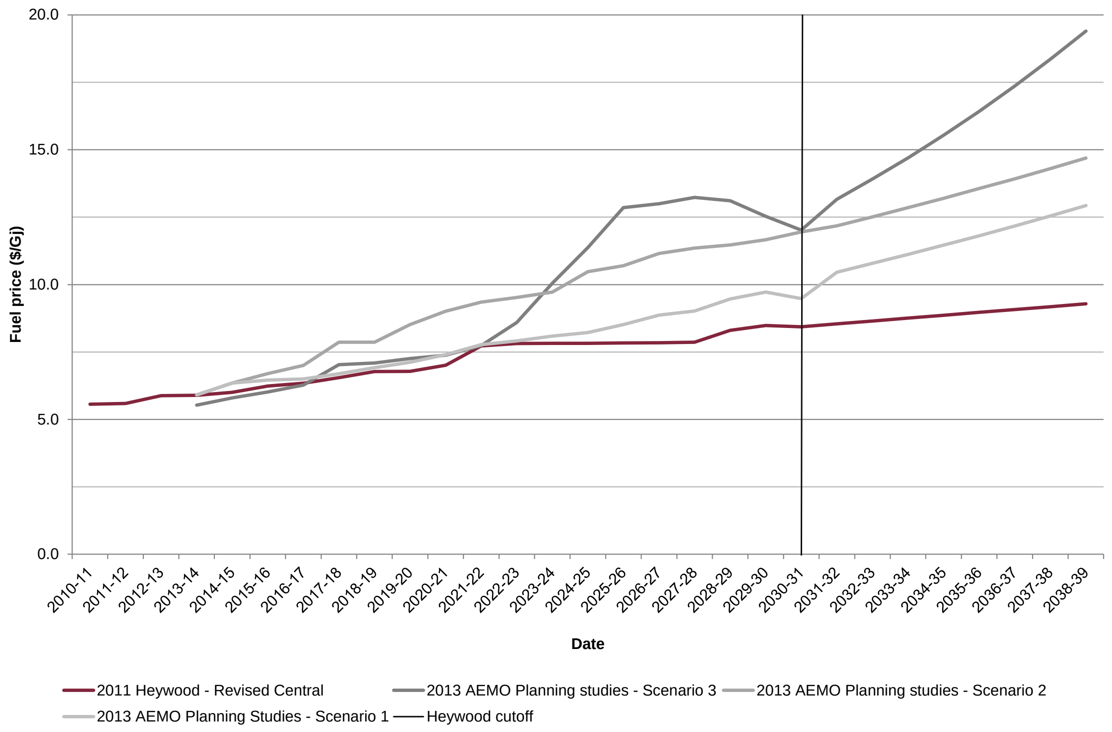

Figure 3: Heywood central gas price and 2013 Planning assumptions

2. Response to Macquarie Generation comments

2.1 Issue A1: Safety factors in constraint equations

AEMO employs the following margins in South Australia in five-minute dispatch constraint equations.

Network element	Operating margin (MW)
SA 275 kV	20
SA 132 kV – South East	10
SA 132 kV – North and Metropolitan	5
SA 132 kV – Riverland	10
SA 66 kV	5
Stability constraints	25

Operating margins have been accounted for in the constraint formulation and hence modelling in the Heywood interconnector upgrade RIT-T (Heywood RIT-T). Operating margins have been incorporated in a manner consistent with the formulation of pre-dispatch constraints. Consistent modelling methods have been applied for the base case and all credible network options.

The inclusion or otherwise of operating margins does not materially impact on the outcome of the Heywood RIT-T, including the selection of the preferred option.

2.2 Issue A2: Summary of ratings of selected circuits

The cost of alleviating all plant and protection limits, on both 275 kV and 132 kV lines, on the network between Tungkillo and Heywood, has been included in the preferred option.

2.3 Issue A3: Victoria – South Morang F2 Transformer

All 2010 NTNDP constraints for this part of the network were included; this includes constraints for the South Morang F2 transformer in Victoria.

2.4 Issue A4: Heywood to South East Transmission line

The transmission line ratings on the AEMO website show the current operational ratings, which may not reflect the conductor rating.

The continuous and post-contingency ratings shown in the PACR Appendix D are the conductor ratings as advised by SP AusNet and ElectraNet. It is acknowledged that the interconnector will not be capable of 650 MW transfers at all times. The Heywood Interconnector Upgrade RIT-T has accurately modelled the capability of the transmission network.

ElectraNet is currently investigating the potential for application of short term and dynamic rating of the network, and all lines in the Heywood to Tungkillo corridor will be included in this investigation.

2.5 Issue A5: Tailem Bend to Keith No2 Transmission line

See Issue A2 above.

2.6 Issue A6: Kincraig to Keith and Kincraig to Penola West Transmission lines

See Issue A2 above.

2.7 Issue A7: Tailem Bend to Adelaide

See Issue A2 above.

Note that this section of line is likely to be next bottleneck on the Heywood interconnector. It will at times prevent imports and exports from reaching 650 MW. The capability of this section of the interconnector has been accurately modelled in the Heywood Interconnector Upgrade RIT-T.

2.8 Issue A8: South west Victoria Voltage Support

All relevant system-normal network limitations have been modelled in the Heywood Interconnector Upgrade RIT-T. Voltage stability limits for this part of the network were assessed. Table 3-11 of the Victorian APR notes that these limits are for a prior outage of the Heywood – Alcoa – Portland 500 kV network. Flows between South Australia and Victoria will be less than the nominal 650 MW from time to time, particularly during outage conditions and this has been taken into account in the modelling.